

# TRAVEO™ T2G 32-bit Automotive MCU

Based on Arm® Cortex®-M4F single

## General description

CYT2CL is a family of TRAVEO™ T2G microcontrollers targeted at automotive systems such as cluster entry units. CYT2CL has an Arm® Cortex®-M4 CPU for primary processing, and an Arm® Cortex®-M0+ CPU for peripheral and security processing. These devices contain embedded peripherals supporting controller area network with flexible data rate (CAN FD), local interconnect network (LIN), clock extension peripheral interface (CXPI), LCD controller. TRAVEO™ T2G devices are manufactured on an advanced 40-nm process. CYT2CL incorporates Infineon' low-power flash memory, multiple high-performance analog and digital peripherals, and enables the creation of a secure computing platform.

## Features

### • Dual CPU subsystem

- 160-MHz (max) 32-bit Arm® Cortex®-M4F CPU with
  - Single-cycle multiply
  - Single-precision floating point unit (FPU)
  - Memory protection unit (MPU)
- 100-MHz (max) 32-bit Arm® Cortex®-M0+ CPU with
  - Single-cycle multiply
  - Memory protection unit
- Inter-processor communication in hardware
- Three DMA controllers
  - Peripheral DMA controller #0 (P-DMA0) with 76 channels
  - Peripheral DMA controller #1 (P-DMA1) with 84 channels
  - Memory DMA controller #0 (M-DMA0) with 4 channels

### • Integrated memories

- Up to 4160 KB of code-flash with an additional 128 KB of work-flash
  - Read-While-Write (RWW) allows updating the code-flash/work-flash while executing code from it
  - Single- and dual-bank modes (specifically for Firmware update Over The Air [FOTA])
  - Flash programming through SWD/JTAG interface
- Up to 512 KB of SRAM with selectable retention granularity

### • Crypto engine<sup>[1]</sup>

- Supports Enhanced Secure Hardware Extension (eSHE) and Hardware Security Module (HSM)
- Secure boot and authentication
  - Using digital signature verification
  - Using fast secure boot
- AES: 128-bit blocks, 128-/192-/256-bit keys
- 3DES: 64-bit blocks, 64-bit key
- Vector unit supporting asymmetric key cryptography such as Rivest-Shamir-Adleman (RSA) and Elliptic Curve (ECC)
- SHA-1/2/3: SHA-512, SHA-256, SHA-160 with variable length input data
- CRC: supports CCITT CRC16 and IEEE-802.3 CRC32
- True random number generator (TRNG) and pseudo random number generator (PRNG)
- Galois/Counter Mode (GCM)

#### Note

1. Crypto engine features are available on select MPNs.

### Features

- **Functional safety for ASIL-B**
  - Memory protection unit (MPU)
  - Shared memory protection unit (SMPU)
  - Peripheral protection unit (PPU)
  - Watchdog timer (WDT)
  - Multi-counter watchdog timer (MCWDT)
  - Low-voltage detector (LVD)
  - Brown-out detector (BOD)
  - Overvoltage detection (OVD)
  - Clock supervisor (CSV)
    - Supported in all power modes
  - Hardware error correction (SECDED ECC) on all safety-critical memories (SRAM, flash)
- **Low-power 2.7-V to 5.5-V operation**
  - Low-power Active, Sleep, Low-power Sleep, DeepSleep, and Hibernate modes for fine-grained power management
  - Configurable options for robust BOD
    - Two threshold levels (2.7 V and 3.0 V) for BOD on  $V_{DDD}$  and  $V_{DDA\_ADC}$
    - One threshold level (1.1 V) for BOD on  $V_{CCD}$
- **Wakeup support**
  - Up to four pins to wakeup from Hibernate mode
  - Wakeup recognition bit for each wakeup source
  - Up to 128 GPIO pins to wakeup from Sleep modes
  - Event Generator, SCB, Watchdog Timer, RTC alarms to wake from DeepSleep modes
- **Clock sources**
  - Internal main oscillator (IMO)
  - Internal low-speed oscillator (ILO)
  - External crystal oscillator (ECO)
  - Watch crystal oscillator (WCO)
  - Phase-locked loop (PLL)
  - Frequency-locked loop (FLL)
  - Low-power external crystal oscillator (LPECO)
- **LCD controller**
  - Up to four LCD controllers, with 32 segments (SEG) and four commons (COM)
  - Supports both Type A (standard) and Type B (low-power) drive waveforms
  - Three drive modes
    - PWM drive at 1/2 bias
    - PWM drive at 1/3 bias
    - Digital correlation
  - Operates in ACTIVE, SLEEP, and DeepSleep power modes
  - Digital contrast control
- **Sound subsystem**
  - Two time-division multiplexing (TDM) interfaces
  - Two pulse-code modulation-pulse width modulation (PCM-PWM) interfaces
  - Up to five sound generator (SG) interfaces
  - One PCM Audio stream mixer with five input streams

### Features

#### • Communication interfaces

- Up to four CAN FD channels
  - Increased data rate (up to 8 Mbps) compared to classic CAN, limited by physical layer topology and transceivers
  - Compliant to ISO 11898-1:2015
  - Supports all the requirements of Bosch CAN FD Specification V1.0 for non-ISO CAN FD
  - ISO 16845:2015 certificate available
- Up to 12 runtime-reconfigurable SCB (serial communication block) channels, each configurable as I<sup>2</sup>C, SPI, or UART
- Up to two independent LIN channels
  - LIN protocol compliant with ISO 17987
- Up to two CXPI channels with data rate up to 20 kbps

#### • Serial memory interface (SMIF)

- One SPI (single, dual, quad, or octal), xSPI interface
- On-the-fly encryption and decryption
- Execute-In-Place (XIP) from external memory

#### • Timers

- Up to 46 16-bit and 16 32-bit timer/counter pulse-width modulator (TCPWM) blocks for regular operations
  - Up to 12 16-bit counters optimized for motor-control operations (Equivalent to 6 stepper motor-control [SMC] channels with ZPD and slew rate control capability)
  - Supports timer, capture, quadrature decoding, pulse-width modulation (PWM), PWM with dead time (PWM\_DT), pseudo-random PWM (PWM\_PR), and shift-register (SR) modes
- Up to 16 Event Generation (EVTGEN) timers supporting cyclic wakeup from DeepSleep
  - Events trigger a specific device operation (such as execution of an interrupt handler, a SAR ADC conversion, and so on)

#### • Real time clock (RTC)

- Year/Month/Date, Day-of-week, Hour:Minute:Second fields
- Supports both 12- and 24-hour formats
- Automatic leap-year correction

#### • I/O

- Up to 140 Programmable I/Os
- Two I/O types
  - GPIO Standard (GPIO\_STD)
  - GPIO Enhanced (GPIO\_ENH)
  - GPIO Stepper Motor Control (GPIO\_SMC)
  - High-Speed I/O Standard with Low Noise (HSIO\_STDLN)

#### • Regulators

- Generates 1.1-V nominal core supply from a 2.7-V to 5.5-V input supply
- Two types of regulators
  - DeepSleep
  - Core internal

#### • Programmable analog

- One SAR A/D converter
  - Each ADC supports 32 logical channels, with 48 external channels. Any external channel can be connected to any logical channel in the SAR.
  - 12-bit resolution and sampling rates up to 1 Msps
- The ADC also supports six internal analog inputs like:
  - Bandgap reference to establish absolute voltage levels
  - Calibrated diode for junction temperature calculations
  - Two AMUXBUS inputs and two direct connections to monitor supply levels
- ADC supports addressing of external multiplexers
- ADC has a sequencer supporting autonomous scanning of configured channels

### Features

- **Smart I/O**

- One smart I/O block, which can perform Boolean operations on signals going to and from I/Os
- Up to eight I/Os (GPIO\_STD) supported

- **Debug interface**

- JTAG controller and interface compliant to IEEE-1149.1-2001
- Arm® SWD (serial wire debug) port
- Supports Arm® Embedded Trace Macrocell (ETM) Trace
  - Data trace using SWD
  - Instruction and data trace using JTAG

- **Compatible with industry-standard tools**

- GHS/MULTI or IAR EWARM for code development and debugging

- **Packages**

- 144-LQFP, 16 × 16 × 1.7 mm (max), 0.4-mm lead pitch
- 144-LQFP, 20 × 20 × 1.7 mm (max), 0.5-mm lead pitch
- 176-LQFP, 24 × 24 × 1.7 mm (max), 0.5-mm lead pitch

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## 1 Features list

**Table 1-1** CYT2CL feature list for all packages

Features	Package	
	144-LQFP	176-LQFP
<b>CPU</b>		
Core	32-bit Arm® Cortex®-M4F CPU and 32-bit Arm® Cortex®-M0+ CPU	
Functional safety	ASIL-B	
Operation voltage for GPIO_STD	2.7 V to 5.5 V	
Operation voltage for GPIO_ENH	2.7 V to 5.5 V	
Operation voltage for GPIO_SMC	2.7 V to 5.5 V	
Operation voltage for HSIO_STDLN	3.0 V to 3.6 V	
Core voltage	1.05 V to 1.15 V	
Operating frequency	Arm® Cortex®-M4 160 MHz (max) and Arm® Cortex®-M0+ 100 MHz (max), related by integer frequency ratio (that is, 1:1, 1:2, 1:3, and so on)	
MPU, PPU	Supported	
FPU	Single precision (32-bit)	
DSP-MUL/DIV/MAC	Supported by Arm® Cortex®-M4F CPU	
<b>Memory</b>		
Code-flash	4160 KB (4032 KB/Large Sectors + 128 KB/Small Sectors)	
Work-flash	128 KB (96 KB/Large Sectors + 32 KB/Small Sectors)	
SRAM (configurable for retention)	512 KB (SRAM0/256 KB + SRAM1/256 KB)	
ROM	32 KB	
<b>Communication interfaces</b>		
CAN0 (CAN-FD: Up to 8 Mbps)	2 ch	
CAN1 (CAN-FD: Up to 8 Mbps)	2 ch	
CAN RAM	16 KB per instance (2 ch), 32 KB in total	
Serial communication block (SCB)	12 ch	
LIN/UART master support	2 ch	
CXPI controller	2 ch	
<b>Memory interfaces</b>		
SMIF (Single SPI/Dual SPI/Quad SPI/Octal SPI/xSPI)	1 ch (HSIO_STDLN at 100 MHz)	
<b>Timers</b>		
RTC	1 ch	
TCPWM (16-bit)	34 ch	
TCPWM (16-bit) SMC	12 ch	
TCPWM (32-bit)	16 ch	
<b>External interrupts</b>	108	140
<b>Analog</b>		
12-bit, 1 Msps SAR ADC	1 Unit (SAR0, 32 logical channels)	
	48 external channels	
	6 ch for Internal sampling	

## Features list

**Table 1-1** CYT2CL feature list for all packages (continued)

Features	Package	
	144-LQFP	176-LQFP
<b>Security</b>		
Flash security (program/work read protection)	Supported	
Flash chip erase enable	Configurable	
eSHE/HSM	By separate firmware <sup>[2]</sup>	
<b>Sound</b>		
Mixer	1 ch (5 mixer sources)	
PCM-PWM	2 ch	
TDM	2 TDM structures (TDM0/1 with up to 16 ch)	
Sound generator (SG)	5 ch	
<b>LCD controller</b>		
Common	4	
Segments	Up to 32 segments	
Type	Type A and Type B	
<b>System</b>		
DMA controller	P-DMA0 with 76 channels (32 general purpose), P-DMA1 with 84 channels (16 general purpose), and M-DMA0 with 4 channels	
Internal main oscillator	8 MHz	
Internal low-speed oscillator	32.768 kHz (nominal)	
PLL	Input frequency: 3.988 to 33.34 MHz, PLL output frequency: up to 160 MHz	
FLL	Input frequency: 0.25 to 80 MHz, FLL output frequency: up to 100 MHz	
Watchdog timer and multi-counter Watchdog timer	Supported	
Clock supervisor	Supported	
Cyclic wakeup	Supported	
GPIO standard (GPIO_STD)	66	96
GPIO enhanced (GPIO_ENH)	6	8
GPIO SMC (GPIO_SMC)	24	
HSIO standard low noise (HSIO_ST-DLN)	12	
Smart I/O (Blocks)	1 block, mapped through 8 I/Os	
Low-voltage detect	Two, 26 selectable levels	
Maximum ambient temperature	105°C for S-grade	
Debug interface	SWD/JTAG	
Debug trace	Arm® Cortex®-M4 ETB size of 8 KB, Arm® Cortex®-M0+ MTB size of 4 KB	

**Note**

2. Enhanced Secure Hardware Extension (eSHE) and Hardware Security Module (HSM) support are enabled by third-party firmware.



## 1.1 Peripheral instance list

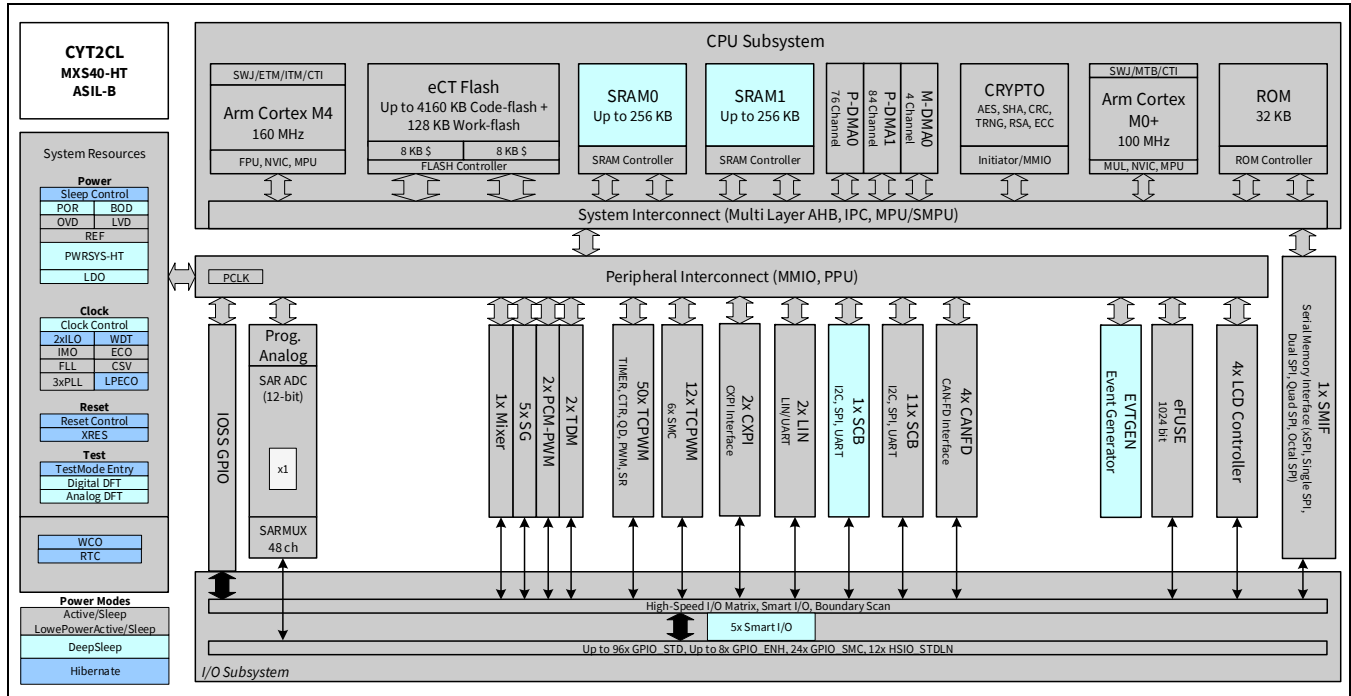
The following table lists the instances supported under each package for communication peripherals, based on the minimum pins needed for the functionality.

**Table 1-2 Peripheral instance list**

Module	144-LQFP	176-LQFP	Minimum pin function set
CXPI	0/1	0/1	TX, RX
CAN0	0/1	0/1	TX, RX
CAN1	0/1	0/1	TX, RX
LIN0	0/1	0/1	TX, RX
SCB/UART	0 to 11	0 to 11	TX, RX
SCB/I2C	0 to 11	0 to 11	SCL, SDA
SCB/SPI	0 to 11	0 to 11	MISO, MOSI, CLK, SELECT0
TDM/RX	0/1	0/1	MCK, FSYNC, SCK, SD
TDM/TX	0/1	0/1	MCK, FSYNC, SCK, SD
SG	0 to 4	0 to 4	TONE, AMPL
PWM	0/1	0/1	LINE1/2_P/N

## 2 Blocks and functionality

### Block diagram



The **Block diagram** gives a simplified view of the interconnection between subsystems and blocks. CYT2CL has four major subsystems: CPU, system resources, peripherals, and I/O<sup>[3,4]</sup>. The color-coding shows the lowest power mode where the particular block is still functional.

CYT2CL provides extensive support for programming, testing, debugging, and tracing of both hardware and firmware.

Debug-on-chip functionality enables in-system debugging using the production device. It does not require special interfaces, debugging pods, simulators, or emulators.

The JTAG interface is fully compatible with industry-standard third-party probes such as I-jet, J-Link, and GHS.

The debug circuits are enabled by default.

CYT2CL provides a high level of security with robust flash protection and the ability to disable features such as debug.

Additionally, each device interface can be permanently disabled for applications concerned with phishing attacks from a maliciously reprogrammed device or attempts to defeat security by starting and interrupting flash programming sequences. All programming, debug, and test interfaces are disabled when maximum device security is enabled.

#### Notes

- GPIO\_STD supporting 2.7 V to 5.5 V  $V_{DDIO}$  range.
- GPIO\_ENH supporting 2.7 V to 5.5 V  $V_{DDIO}$  range with higher currents at lower voltages.
- GPIO\_SMC supporting 2.7 V to 5.5 V  $V_{DDIO}$  range with currents higher than GPIO\_ENH.
- HSIO\_STD/LN supporting 3.0 V to 3.6 V  $V_{DDIO}$  range with high-speed signaling and programmable drive strength.

## **3 Functional description**

### **3.1 CPU subsystem**

#### **3.1.1 CPU**

The CYT2CL CPU subsystem contains a 32-bit Arm® Cortex®-M0+ CPU with MPU, and a 32-bit Arm® Cortex®-M4F CPU with MPU, and single-precision FPU. This subsystem also includes P-/M-DMA controllers, a cryptographic accelerator, code-flash of up to 4160 KB, 128 KB of work-flash, SRAM of up to 512 KB, and 32 KB of ROM.

The Cortex®-M0+ CPU provides a secure, un-interruptible boot function. This guarantees that, following completion of the boot function, system integrity is valid and privileges are enforced. Shared resources (flash, SRAM, peripherals, and so on) can be accessed through bus arbitration, and exclusive accesses are supported by an inter-processor communication (IPC) mechanism using hardware semaphores.

#### **3.1.2 DMA controllers**

CYT2CL has three DMA controllers: P-DMA0 with 32 general-purpose and 44 dedicated channels, P-DMA1 with 16 general-purpose and 68 dedicated channels, and M-DMA0 with four channels. P-DMA is used for peripheral-to-memory and memory-to-peripheral data transfers and provides low latency for a large number of channels. Each P-DMA controller uses a single data-transfer engine that is shared by the associated channels. General purpose channels have a rich interconnect matrix including P-DMA cross triggering which enables demanding data-transfer scenarios. Dedicated channels have a single triggering input (such as an ADC channel) to handle common transfer needs. M-DMA is used for memory-to-memory data transfers and provides high memory bandwidth for a small number of channels. M-DMA uses a dedicated data-transfer engine for each channel. They support independent accesses to peripherals using the AHB multi-layer bus.

#### **3.1.3 Flash**

CYT2CL has up to 4160 KB (4032 KB with a 32-KB sector size, and 128 KB with an 8-KB sector size) of code-flash with an additional work-flash of up to 128 KB (96 KB with 2-KB sector size, and 32 KB with 128-B sectors size). Work-flash is optimized for reprogramming many more times than code-flash. Code-flash supports Read-While-Write (RWW) operation allowing flash to be updated while the CPU is active. Both the code-flash and work-flash areas support dual-bank operation for over-the-air (OTA) programming.

#### **3.1.4 SRAM**

CYT2CL has up to 512 KB of SRAM (512 KB) with two independent controllers. The first controller SRAM0 provides DeepSleep retention in 32-KB increments while SRAM1 is selectable between fully retained and not retained.

#### **3.1.5 ROM**

CYT2CL has 32-KB ROM that contains boot and configuration routines. This ROM enables secure boot and authentication of user flash to guarantee a secure system.

#### **3.1.6 Cryptography accelerator for security**

The cryptography accelerator implements (3)DES block cipher, AES block cipher, SHA hash, cyclic redundancy check, pseudo random number generation, true random number generation, galois/counter mode, and a vector unit to support asymmetric key cryptography such as RSA and ECC.

Depending on the part number, this block is either completely or partially available or not available at all. See [Ordering information](#) for more details.

## 3.2 System resources

### 3.2.1 Power system

The power system ensures that the supply voltage levels meet the requirements of each power mode, and provides a full-system reset when these levels are not valid. Internal power-on reset (POR) guarantees full-chip reset during the initial power ramp.

Three Brown-Out Detection (BOD) circuits monitor the external supply voltages ( $V_{DD}$ ,  $V_{DDA\_ADC}$ ,  $V_{CCD}$ ). The BOD on  $V_{DD}$  and  $V_{CCD}$  are initially enabled and cannot be disabled. The BOD on  $V_{DDA\_ADC}$  is initially disabled and can be enabled by the user. For the external supplies  $V_{DD}$  and  $V_{DDA\_ADC}$ , BOD circuits are software configurable with two settings; a 2.7-V minimum voltage that is robust for all internal signaling, and a 3.0-V minimum voltage, which is also robust for all I/O specifications (which are guaranteed at 2.7 V). The BOD on  $V_{CCD}$  is provided as a safety measure and is not a robust detector.

Three overvoltage detection (OVD) circuits are provided for monitoring external supplies ( $V_{DD}$ ,  $V_{DDA\_ADC}$ ,  $V_{CCD}$ ), and overcurrent detection circuits (OCD) for monitoring internal and external regulators. OVD thresholds on  $V_{DD}$  and  $V_{DDA\_ADC}$  are configurable with two settings; a 5.0-V and 5.5-V maximum voltage.

Two voltage detection circuits are provided to monitor the external supply voltage ( $V_{DD}$ ) for falling and rising levels, each configurable for one of the 26 selectable levels.

All BOD, OVD, and OCD circuits on  $V_{DD}$  and  $V_{CCD}$  generate a reset, because these protect the CPUs and fault logic. The BOD and OVD circuits on  $V_{DDA\_ADC}$  can be configured to generate either a reset, or a fault.

### 3.2.2 Regulators

CYT2CL contains two regulators that provide power to the low-voltage core transistors: DeepSleep and core internal. These regulators accept a 2.7–5.5-V  $V_{DD}$  supply and provide a low-noise 1.1-V supply to various parts of the device. These regulators are automatically enabled and disabled by hardware and firmware when switching between power modes. The core internal regulators operate in Active mode, and provide power to the CPU subsystem and associated peripherals.

#### 3.2.2.1 DeepSleep

The DeepSleep regulator is used to maintain power to a small number of blocks when in DeepSleep mode. These blocks include the ILO and WDT timers, BOD detector, SCB0, SRAM memories, Smart I/O, and other configuration memories. The DeepSleep regulator is enabled when in DeepSleep mode, and the core internal regulator is disabled. It is disabled when XRES\_L is asserted (LOW) and when the core internal regulator is disabled.

#### 3.2.2.2 Core internal

The core internal regulator supports load currents up to 150 mA, and is operational during device startup (boot process), and in Active/Sleep modes.

### 3.2.3 Clock system

The CYT2CL clock system provides clocks to all subsystems that require them, and glitch-free switching between different clock sources. In addition, the clock system ensures that no metastable conditions occur.

The clock system for CYT2CL consists of the 8-MHz IMO, two ILOs, three watchdog timers, three PLLs, an FLL, five clock supervisors (CSV), a 7.2- to 33.34-MHz ECO, a 4- to 8-MHz LPECO, and a 32.768-kHz WCO.

The clock system supports two main clock domains: CLK\_HF and CLK\_LF.

- CLK\_HF<sub>x</sub> are the active domain clocks. Each can use any of the high-frequency clock sources including IMO, EXT\_CLK, ECO, LPECO, FLL, or PLL.
- CLK\_LF is a DeepSleep domain clock and provides source for MCWDT or RTC modules. The reference clock for the CLK\_LF domain is selectable from ILO0, ILO1, WCO, or disabled.

**Table 3-1 CLK\_HF destinations**

Name	Description
CLK_HF0	CPUSS clocks, PERI, and AHB infrastructure
CLK_HF1	Event Generator, also available in HSIOM as an output
CLK_HF2	Sound Subsystem #0
CLK_HF3	Sound Subsystem #1
CLK_HF4	Sound Subsystem #2
CLK_HF5	SMIF #0

### 3.2.3.1 IMO clock source

The IMO is the frequency reference in CYT2CL when no external reference is available or enabled. The IMO operates at a frequency of around 8 MHz.

### 3.2.3.2 ILO clock source

An ILO is a low-power oscillator, nominally 32.768 kHz, which generates clocks for a watchdog timer when in DeepSleep mode. There are two ILOs to ensure CSV (clock supervisor) capability in DeepSleep mode. ILO-driven counters can be calibrated to the IMO, WCO, or ECO to improve their accuracy. ILO1 is also used for clock supervision.

### 3.2.3.3 PLL and FLL

A PLL (two 200 MHz and one 400 MHz) or FLL may be used to generate high-speed clocks from the IMO, ECO, or an EXT\_CLK. The FLL provides a much faster lock than the PLL (5  $\mu$ s instead of 35  $\mu$ s) in exchange for a small amount ( $\pm 2\%$ ) of frequency error<sup>[7]</sup> and a lower max output frequency (100 MHz instead of up to 400 MHz). 400-MHz PLLs supports spread spectrum clock generation (SSCG) with down spreading.

### 3.2.3.4 Clock supervisor

Each clock supervisor (CSV) allows one clock (reference) to supervise the behavior of another clock (monitored). Each CSV has counters for both the monitored and reference clocks. Parameters for each counter determine the frequency of the reference clock as well as the upper and lower frequency limits of the monitored clock. If the frequency range comparator detects a stopped clock or a clock outside the specified frequency range, an abnormal state is signaled and either a reset or an interrupt is generated.

### 3.2.3.5 EXT\_CLK

One of two I/Os can be used to provide an external clock input of up to 100 MHz. This clock can be used as the source clock for either the PLL or FLL, or can be used directly by the CLK\_HF domain.

### 3.2.3.6 ECO

The ECO provides high-frequency clocking using an external crystal connected to the ECO\_IN and ECO\_OUT pins. It supports fundamental mode (non-overtone) quartz crystals, in the range of 7.2 to 33.34 MHz. When used in conjunction with the PLL, it generates CPU and peripheral clocks up to device's maximum frequency. ECO accuracy depends on the selected crystal. If the ECO is disabled, the associated pins can be used for any of the available I/O functions.

**Note**

7. Operation of reference-timed peripherals (such as a UART) with an FLL-based reference is not recommended due to the allowed frequency error.

### 3.2.3.7 LPECO

The LPECO provides high-frequency clocking using an external crystal connected to the LPECO\_IN and LPECO\_OUT pins. It supports fundamental mode (non-overtone) quartz crystals, in the range of 3.99 to 8.01 MHz. LPECO can operate during DeepSleep, and Hibernate modes with significant lower current consumptions. It can also be used for real-time-clock applications. When used in conjunction with the PLL, it generates CPU and peripheral clocks up to device's maximum frequency.

### 3.2.3.8 WCO

The WCO is a low-power, watch-crystal oscillator intended for real-time-clock applications. It requires an external 32.768-kHz crystal connected to the WCO\_IN and WCO\_OUT pins. The WCO can also be configured as a clock reference for CLK\_LF, which is the clock source for the MCWDT and RTC.

### 3.2.4 Reset

CYT2CL can be reset from a variety of sources, including software. Reset events are asynchronous and guarantee reversion to a known state. The reset cause (POR, BOD, OVD, overcurrent, XRES\_L, WDT, MCWDT, software reset, fault, CSV, Hibernate wakeup, debug) is recorded in a register, which is sticky through reset and allows software to determine the cause of the reset. An XRES\_L pin is available for external reset.

### 3.2.5 Watchdog timers

CYT2CL has one watchdog timer (WDT) and two multi-counter watchdog timers (MCWDT).

The WDT is a free-running counter clocked only by ILO0, which allows it to be used as a wakeup source from Hibernate. This allows watchdog operation during all power modes and needs to be serviced during a configured window, otherwise generates a watchdog reset, if not serviced before the timeout occurs. A watchdog reset is recorded in the Reset Cause register.

An MCWDT is available for each of the CPU cores. These timers provide more capabilities than the WDT, and are only available in the Active, Sleep, and DeepSleep modes. These timers have multiple counters that can be used separately or cascaded to trigger interrupts and/or resets. They are clocked from ILO0 or the WCO.

### 3.2.6 Power modes

CYT2CL has six different power modes:

- Active – All peripherals are available
- Low-Power Active (LPACTIVE) – Low-power profile of Active mode where all peripherals and the CPUs are available, but with limited capability
- Sleep – All peripherals except the CPUs are available
- Low-Power Sleep (LPSLEEP) – Low-power profile of Sleep mode where all peripherals except the CPUs are available, but with limited capability
- DeepSleep – Only peripherals which work with CLK\_LF are available
- Hibernate – The device and I/O states are frozen; the device resets on wakeup

### 3.3 Peripherals

#### 3.3.1 Peripheral clock dividers

Integer and fractional clock dividers are provided for peripheral and timing purposes.

**Table 3-2 Clock dividers**

Divider	Count	Description
div_8	11	Integer divider, 8 bits
div_16	16	Integer divider, 16 bits
div_16_5	4	Fractional divider, 16.5 bits (16 integer bits, 5 fractional bits)
div_24_5	11	Fractional divider, 24.5 bits (24 integer bits, 5 fractional bits)

#### 3.3.2 Peripheral protection unit

The Peripheral protection unit (PPU) controls and monitors unauthorized access from all masters (CPU, P-/M-DMA, Crypto, and any enabled debug interface) to the peripherals. It allows or restricts data transfers on the bus infrastructure. The access rules are enforced based on specific properties of a transfer, such as an address range for the transfer and access attributes (such as read/write, user/privilege, and secure/non-secure).

#### 3.3.3 12-bit SAR ADC

CYT2CL contains one 1-Msps SAR ADCs. This ADC can be clocked at up to 26.67 MHz and provide a 12-bit result in 26 clock cycles.

The references for the SAR ADC comes from a dedicated pair of inputs: VREFH and VREFL<sup>[8]</sup>.

CYT2CL supports 32 logical ADC channels which can select one of 54 input sources. Sources include 48 external inputs from I/Os, and six internal connections for diagnostic and monitoring purposes.

The number of ADC channels (per ADC and package type) are listed in [Table 1-1](#).

SAR ADC has a sequencer, which autonomously cycles through the configured channels (sequencer scan) with zero-switching overhead (that is, the aggregate sampling bandwidth, when clocked at 26.67 MHz, is equal to 1 Msps whether it is for a single channel or distributed over several channels). The sequencer switching is controlled through a state machine or firmware. The sequencer prioritizes trigger requests, enables the appropriate analog channel, controls ADC sampling, initiates ADC data conversion, manages results, and initiates subsequent conversions for repetitive or group conversions without CPU intervention.

SAR ADC has two analog multiplexers used to connect the signals to be measured to the ADC. One is SARMUX0 which has 24 GPIO\_STD inputs (ADC[0]\_0 to ADC[0]\_23), and six additional inputs to measure internal signals such as a band-gap reference, a temperature sensor,  $V_{CCD}$ ,  $V_{DDA\_ADC}$  power supplies and AMUXBUSA/B signals. The other multiplexer is SARMUX1 which has 24 GPIO\_SMC inputs (ADC[1]\_0 to ADC[1]\_23).

CYT2CL has a temperature sensor. Software post processing is required to convert the temperature sensor reading into kelvin or Celsius values.

To accommodate signals with varying source impedances and frequencies, it is possible to have different sample times programmed for each channel. ADC also supports range comparison, which allows fast detection of out-of-range values without having to wait for a sequencer scan to complete and for the CPU firmware to evaluate the measurement for out-of-range values.

The ADC is not usable in DeepSleep and Hibernate modes as they require a high-speed clock. The ADC input reference voltage VREFH range is 2.7 V to  $V_{DDA\_ADC}$  and VREFL is  $V_{SSA\_ADC}$ .

#### Note

- VREF\_L prevents IR drops in the VSSIO and VSSA\_ADC paths from impacting the measurements. VREF\_L, when properly connected, reduces or removes the impact of IR drops in the VSSIO and VSSA\_ADC paths from measurements.

### 3.3.4 Timer/counter/PWM block (TCPWM)

The TCPWM block consists of 16-bit (46 channels) and 32-bit (16 channels) counters with user-programmable period. Twelve of the 16-bit counters are optimized for DC and stepper motor-control operations. Each TCPWM counter contains a capture register to record the count at the time of an event, a period register (used to either stop or auto-reload the counter when its count is equal to the period register), and compare registers to generate signals that are used as PWM duty-cycle outputs.

Each counter within the TCPWM block supports several functional modes such as timer, capture, quadrature, PWM, PWM with dead-time insertion (PWM\_DT, 8-bit), pseudo-random PWM (PWM\_PR), and shift-register.

The TCPWM block also provides true and complement outputs, with programmable offset between them, to allow their use as deadband complementary PWM outputs. The TCPWM block also has a kill input (only for the PWM mode) to force outputs to a predetermined state; for example, this may be used in motor-drive systems when an overcurrent state is detected and the PWMs driving the FETs need to be shut off immediately (no time for software intervention).

Twelve of the 16-bit counters are optimized for DC and stepper motor-control operations, these also have ZPD (Zero Point detection) and slew rate control capabilities. Two of these TCPWM channels constitute one SMC channel.

### 3.3.5 Serial Communication Blocks (SCB)

CYT2CL contains 12 serial communication blocks, each configurable to support I<sup>2</sup>C, UART, or SPI.

#### 3.3.5.1 I<sup>2</sup>C interface

An SCB can be configured to implement a full I<sup>2</sup>C master (capable of multi-master arbitration) or slave interface. Each SCB configured for I<sup>2</sup>C can operate at speeds of up to 1 Mbps (Fast-mode Plus<sup>[9]</sup>) and has flexible buffering options to reduce the interrupt overhead and latency of the CPU. In addition, each SCB supports FIFO buffering for receive and transmit data, which, by increasing the time for the CPU to read the data, reduces the need for clock stretching. The I<sup>2</sup>C interface is compatible with Standard, Fast-mode, and Fast-mode Plus devices as specified in the NXP I<sup>2</sup>C-bus specification and user manual (UM10204). The I<sup>2</sup>C-bus I/O is implemented with GPIO in open-drain modes<sup>[10, 11]</sup>.

#### 3.3.5.2 UART interface

When configured as a UART, each SCB provides a full-featured UART with maximum signaling rate determined by the configured peripheral-clock frequency and over-sampling rate. It supports infrared interface (IrDA) and SmartCard (ISO 7816) protocols, which are minor variants of the UART protocol. It also supports the 9-bit multi-processor mode that allows the addressing of peripherals connected over common Rx and Tx lines. Common UART functions such as parity, number of stop bits, break detect, and frame error are supported. FIFO buffering of transmit and receive data allows greater CPU service latencies to be tolerated.

The LIN protocol is supported by the UART. LIN is based on a single-master multi-slave topology. There is one master node and multiple slave nodes on the LIN bus. The SCB UART supports only LIN slave functionality. Compared to the dedicated LIN blocks, an SCB/UART used for LIN requires a higher level of software interaction and increased CPU load.

#### Notes

9. I/Os drive level does not support the full bus capacitance in Fast-mode Plus speeds.

10. This is not 100 percent compliant with the I<sup>2</sup>C-bus specification; I/Os are not high-voltage compliant, do not support the 20-mA sink requirement of Fast-mode Plus, and violate the leakage specification when no power is applied.

11. See [Table 27-10](#) 'Serial Communication Block (SCB) specifications' for supported IO-cells and I<sup>2</sup>C modes.



### 3.3.5.3 SPI interface

The SPI configuration supports full Motorola SPI, TI Synchronous Serial Protocol (SSP, essentially adds a start pulse that is used to synchronize SPI-based codecs), and National Microwire (a half-duplex form of SPI). The SPI interface can use the FIFO and operates with up to a 12.5-MHz SPI Clock. SCB also supports EZSPI<sup>[12]</sup> mode.

SCB0 supports the following additional features:

- Operable as a slave in DeepSleep mode
- I<sup>2</sup>C slave EZ (EZI2C<sup>[13]</sup>) mode with up to 256-B data buffer for multi-byte communication without CPU intervention
- I<sup>2</sup>C slave externally-clocked operations
- Command/response mode with a 512-B data buffer for multi-byte communication without CPU intervention

### 3.3.6 CAN FD

CYT2CL supports two CAN FD controller blocks, each supporting two CAN FD channel. All CAN FD controllers are compliant with the ISO 11898-1:2015 standard; an ISO 16845:2015 certificate is available. It also implements the time-triggered CAN (TTCAN) protocol specified in ISO 11898-4 (TTCAN protocol levels 1 and 2) completely in hardware. All functions concerning the handling of messages are implemented by the Rx and Tx handlers. The Rx handler manages message acceptance filtering, transfer of received messages from the CAN core to a message RAM, and provides receive-message status. The Tx handler is responsible for the transfer of transmit messages from the message RAM, to the CAN core, and provides transmit-message status.

### 3.3.7 Local interconnect network (LIN)

CYT2CL contains up to two LIN channels. Each channel supports transmission/reception of data following the LIN protocol according to ISO standard 17987. Each LIN channel connects to an external transceiver through a 3-pin interface (including an enable function) and supports master and slave functionality. Each channel also supports classic and enhanced checksum, along with break detection during message reception and wake-up signaling. Break detection, sync field, checksum calculations, and error interrupts are handled in hardware.

### 3.3.8 Clock extension peripheral interface (CXPI)

CYT2CL contains up to two CXPI channels compliant with JASO D015 and ISO standard 20794 including the controller specification.

Each channel supports:

- Master and slave functionality
- Polling and event trigger method for both normal and long frames
- Non-return to zero (NRZ) and PWM signaling modes
- Collision resolution and carries sense multiple access
- Wakeup pulse generation and detection
- CRC8 and CRC16 for both normal and long frames
- Error detection
- Dedicated FIFO (16 B) for transmit and receive

#### Notes

12. The Easy SPI (EZSPI) protocol is based on the Motorola SPI operating in any mode (0, 1, 2, or 3). It allows communication between master and slave, and reduces the need for CPU intervention.

13. The Easy I<sup>2</sup>C (EZI2C) protocol is a unique communication scheme built on top of the I<sup>2</sup>C protocol by Infineon. It uses a meta protocol around the standard I<sup>2</sup>C protocol to communicate to an I<sup>2</sup>C slave using indexed memory transfers. This reduces the need for CPU intervention.

### 3.3.9 Serial memory interface

In addition to the internal flash memory, CYT2CL supports direct connection to 128 MB of external flash or RAM memory. This connection is made through either a xSPI or serial peripheral interface (SPI). xSPI allows connection to HYPERFLASH™ and HYPERRAM™ devices, while SPI (single, dual, quad, or octal SPI) can connect with serial flash memory. Code stored in memory connected through this interface allows execute-in-place (XIP) operation, which does not require the instructions to be first copied to internal memory, and on-the-fly encryption and decryption for environments requiring secure external data and code.

### 3.3.10 Sound subsystem

CYT2CL supports the following,

- Up to two time-division multiplexing (TDM) interfaces
  - Full-duplex transmitter and receiver operation
  - Independent transmitter or receiver operation, each in master or slave mode
  - Up to 16 channels, each channel can be individually enabled or disabled
- Up to two pulse code modulation-pulse width modulation (PCM-PWM) interface
  - Conversion of PCM audio streaming to PWM signals
  - Up to 32-bit output sample resolution
  - Supports E- and H-bridge formats
  - Dead time insertion
- Up to five sound generator (SG) interfaces
  - PWM modulated (amplitude, tone) sound generation
  - Separate volume and frequency control (two signals) and combined volume-frequency control (one signal) formats
- One mixer supporting five input sources
  - Combines multiple PCM source streams into a single PCM destination stream
  - PCM source stream can be gain/volume controlled
  - Fixed PCM sample formatting (16-bit pairs)
  - LPF support by FIR filter
  - Fade-in and Fade-out control for both source and destination PCM streams

### 3.3.11 One-time-programmable (OTP) eFuse

CYT2CL devices contain a 1024-bit OTP eFuse memory that can be used to store and access a unique and unalterable identifier or serial number for each device. eFuses are also used to control the device life-cycle (manufacturing, programming, normal operation, end-of-life, and so on) and the security state. Of the 1024 bits, 192 are available for user purposes.

### 3.3.12 Event generator

The event generator supports generation of interrupts and triggers in the Active mode and interrupts in the DeepSleep mode. The event generators are used to trigger a specific device function (execution of an interrupt handler, a SAR ADC conversion, and so on) and to provide a cyclic wakeup mechanism from the DeepSleep mode. They provide CPU-free triggers for device functions, and reduce CPU involvement in triggering device functions, thus reducing overall power consumption and processing overhead.

### 3.3.13 Trigger multiplexer

CYT2CL supports connecting various peripherals using trigger signals. Triggers are used to inform a peripheral of the occurrence of an event or change of state. These triggers are used to affect or initiate some action in other peripherals. The trigger multiplexer is used to route triggers from a source peripheral to a destination. Triggers provide active logic functionality and are typically supported in the Active mode.

### 3.4 I/Os

CYT2CL has up to 140 programmable I/Os.

The I/Os are organized as logical entities called ports, which are a maximum of 8 bits wide. During power-on and reset, the I/Os are forced to the High-Z state. During the Hibernate mode, the I/Os are frozen.

Every I/O can generate an interrupt (if enabled) and each port has an interrupt request (IRQ) and interrupt service routine (ISR) associated with it.

The I/O port power source mapping is listed in [Table 3-3](#). The associated supply determines the  $V_{OH}$ ,  $V_{OL}$ ,  $V_{IH}$ , and  $V_{IL}$  levels when configured for CMOS and Automotive thresholds.

**Table 3-3 I/O port power source**

Supply	Ports
VDDD	P0, P10, P11, P12, P13, P14, P15, P16, P17, P18, P19
VDDIO_GPIO	P1, P2, P3, P4
VDDIO_HSIO	P8, P9
VDDIO_SMC	P5, P6, P7

Each I/O implements the following:

- Programmable drive mode
  - High impedance
  - Resistive pull-up
  - Resistive pull-down
  - Open drain with strong pull-down
  - Open drain with strong pull-up
  - Strong pull-up or pull-down
  - Weak pull-up or pull-down

CYT2CL has four types of programmable GPIOs: GPIO Standard, GPIO Enhanced, GPIO SMC, HSIO Standard with Low noise. Only GPIO\_STD, GPIO\_ENH, and GPIO\_SMC have the capability to wakeup the device from DeepSleep mode.

#### 3.4.1 GPIO

Three types of GPIOs are supported:

- GPIO\_STD, GPIO\_ENH, and GPIO\_SMC

These implement the following:

- Configurable input threshold (CMOS, TTL, or Automotive)
- Hold mode for latching previous state (used for retaining the I/O state in DeepSleep mode)
- Analog input mode (input and output buffers disabled)
- Edge-triggered interrupts on rising edge, falling edge, or on both the edges, on pin basis

##### 3.4.1.1 GPIO standard (GPIO\_STD)

Supports standard automotive signaling across the 2.7-V to 5.5-V  $V_{DDIO}$  range. GPIO Standard I/Os have multiple configurable drive levels, drive modes, and selectable input levels.

##### 3.4.1.2 GPIO enhanced (GPIO\_ENH)

Supports extended functionality automotive signaling across the 2.7-V to 5.5-V  $V_{DDIO}$  range with higher currents at lower voltages (full I<sup>2</sup>C timing support, slew-rate control).

### **3.4.1.3 GPIO SMC (GPIO\_SMC)**

Provides significant drive strength than GPIO\_STD and GPIO\_ENH (Supports 30-mA drive).

### **3.4.2 HSIO**

These I/Os are optimized exclusively for high-speed signaling and do not support slew-rate control, DeepSleep operation, POR mode control, analog connections, or non-CMOS signaling levels. HSIOs support programmable drive strength. They are available only in Active mode.

#### **3.4.2.1 HSIO standard low noise (HSIO\_STDLN)**

Supports clocking and signaling up to 100 MHz. Also supports holding state during DeepSleep mode. Low noise version optimizes the noise generated by having specific modes for each interface support.

### **3.4.3 Port nomenclature**

Px.y describes a particular bit “y” available within an I/O port “x.”

- For example, P4.2 reads “port 4, bit 2”.

### **3.4.4 Smart I/O**

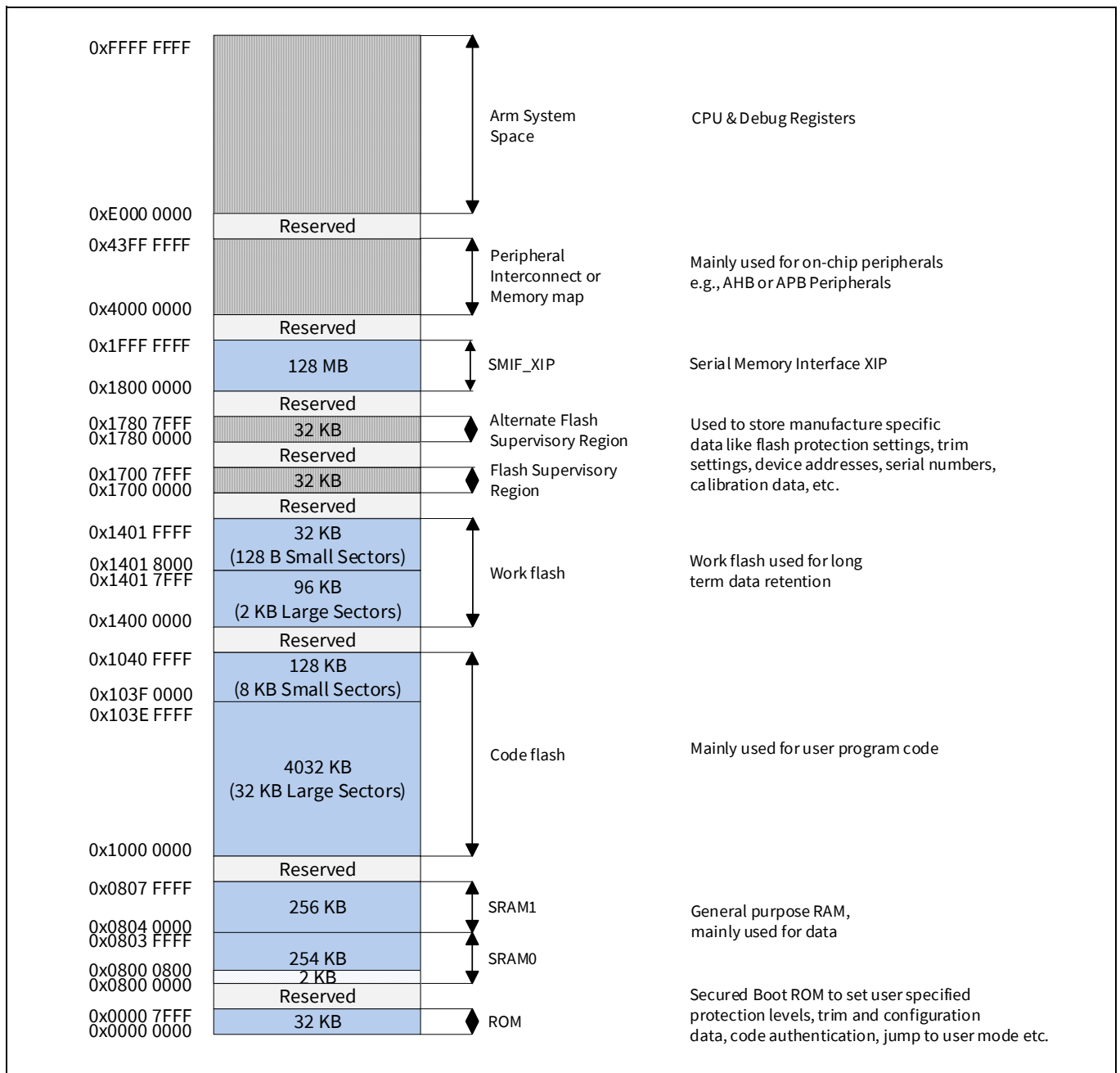
Smart I/O allows Boolean operations on signals going to the I/O from the subsystems of the chip or on signals coming into the chip. CYT2CL has one Smart I/O block. Operation can be synchronous or asynchronous and the blocks operate in all device power modes except for the Hibernate mode.

## 4 CYT2CL address map

The CYT2CL microcontroller supports the memory spaces shown in [Figure 4-1](#):

- Code-flash
  - 4160 KB (4032 KB + 128 KB) of code-flash, used in the single- or dual-bank mode based on the associated bit in the flash control register
    - Single-bank mode - 4160 KB
    - Dual-bank mode - 2080 KB per bank
- Work-flash
  - 128 KB (96 KB + 32 KB) of work-flash, used in the single- or dual-bank mode based on the associated bit in the flash control register
    - Single-bank mode - 128 KB
    - Dual-bank mode - 64 KB per bank
- 32 KB of secure ROM
- 512 KB of SRAM (First 2 KB is reserved for internal usage)
- 128 MB SMIF XIP

CYT2CL address map



**Figure 4-1** CYT2CL address map<sup>[14, 15]</sup>

**Notes**

- 14. The size representation is not up to scale.
- 15. First 2KB of SRAM is reserved, not available for users. User must keep the power of first 32KB block of SRAM0 in enabled or retained in all Active, LP Active, Sleep, LP Sleep, DeepSleep modes.

## 5 Flash base address map

**Table 5-1** through **Table 5-6** give information about the sector mapping of the code- and work-flash regions along with their respective base addresses.

**Table 5-1 Code-flash address mapping in single bank mode**

Code-flash Size (KB)	Large Sectors (LS)	Small Sectors (SS)	Large Sector Base Address	Small Sector Base Address
4160	32 KB × 126	8 KB × 16	0x1000 0000	0x103F 0000

**Table 5-2 Work-flash address mapping in single bank mode**

Work-flash Size (KB)	Large Sectors	Small Sectors	Large Sector Base Address	Small Sector Base Address
128	2 KB × 48	128 B × 256	0x1400 0000	0x1401 8000

**Table 5-3 Code-flash address mapping in dual bank mode (Mapping A)**

Code-flash Size (KB)	First Half LS	First Half SS	Second Half LS	Second Half SS	First Half LS Base Address	First Half SS Base Address	Second Half LS Base Address	Second Half SS Base Address
4160	32 KB × 63	8KB × 8	32 KB × 63	8 KB × 8	0x1000 0000	0x101F 8000	0x1200 0000	0x121F 8000

**Table 5-4 Code-flash address mapping in dual bank mode (Mapping B)**

Code-flash Size (KB)	First Half LS	First Half SS	Second Half LS	Second Half SS	First Half LS Base Address	First Half SS Base Address	Second Half LS Base Address	Second Half SS Base Address
4160	32 KB × 63	8 KB × 8	32 KB × 63	8 KB × 8	0x1200 0000	0x121F 8000	0x1000 0000	0x101F 8000

**Table 5-5 Work-flash address mapping in dual bank mode (Mapping A)**

Work-flash Size (KB)	First Half LS	First Half SS	Second Half LS	Second Half SS	First Half LS Base Address	First Half SS Base Address	Second Half LS Base Address	Second Half SS Base Address
128	2 KB × 24	128 B × 128	2 KB × 24	128 B × 128	0x1400 0000	0x1400 C000	0x1500 0000	0x1500 C000

**Table 5-6 Work-flash address mapping in dual bank mode (Mapping B)**

Work-flash Size (KB)	First Half LS	First Half SS	Second Half LS	Second Half SS	First Half LS Base Address	First Half SS Base Address	Second Half LS Base Address	Second Half SS Base Address
128	2 KB × 24	128 B × 128	2 KB × 24	128 B × 128	0x1500 0000	0x1500 C000	0x1400 0000	0x1400 C000

## 6 Peripheral I/O map

**Table 6-1** CYT2CL peripheral I/O map

Section	Description	Base address	Instances	Instance size	Group	Slave
PERI	Peripheral interconnect	0x4000 0000			0	0
	Peripheral group (0, 1, 2, 3, 4, 5, 6, 8, 9)	0x4000 4000	9	0x20		
	Peripheral trigger group	0x4000 8000	13	0x400		
	Peripheral 1:1 trigger group	0x4000 C000	13	0x400		
PERI_MS	Peripheral interconnect, master interface	0x4001 0000			0	1
	PERI Programmable PPU	0x4001 0000	6 <sup>[16]</sup>	0x40		
	PERI Fixed PPU	0x4001 0800	450	0x40		
Crypto	Cryptography component	0x4010 0000			1	0
CPUSS	CPU subsystem (CPUSS)	0x4020 0000			2	0
FAULT	Fault structure subsystem	0x4021 0000			2	1
	Fault structures	0x4021 0000	4	0x100		
IPC	Inter process communication	0x4022 0000			2	2
	IPC structures	0x4022 0000	8	0x20		
	IPC interrupt structures	0x4022 1000	8	0x20		
PROT	Protection	0x4023 0000			2	3
	Shared memory protection unit structures	0x4023 2000	16	0x40		
	Memory protection unit structures	0x4023 4000	16	0x400		
FLASHC	Flash controller	0x4024 0000			2	4
SRSS	System Resources Sub-System Core Registers	0x4026 0000			2	5
	Clock Supervision High Frequency	0x4026 1400	3	0x10		
	Clock Supervision Reference Frequency	0x4026 1710	1			
	Clock Supervision Low Frequency	0x4026 1720	1			
	Clock Supervision Internal Low Frequency	0x4026 1730	1			
	Multi Counter WDT	0x4026 8000	2	0x100		
	Free Running WDT	0x4026 C000	1			
BACKUP	SRSS Backup Domain/RTC	0x4027 0000			2	6
	Backup Register	0x4027 1000	4	0x04		
P-DMA	P-DMA0 Controller	0x4028 0000			2	7
	P-DMA0 channel structures	0x4028 8000	76	0x40		
	P-DMA1 Controller	0x4029 0000			2	8
	P-DMA1 channel structures	0x4029 8000	84	0x40		
M-DMA	M-DMA0 Controller	0x402A 0000			2	9
	M-DMA0 channels	0x402A 1000	4	0x100		
eFUSE	eFUSE Customer Data (192 bits)	0x402C 0868	6	0x04	2	10
HSIOM	High-Speed I/O Matrix (HSIOM)	0x4030 0000	20	0x10	3	0
GPIO	GPIO port control/configuration	0x4031 0000	20	0x80	3	1

**Note**

16. These six Programmable PPU are configured by the Boot ROM and are available for the user based on the access rights. Refer to the device specific TRM to know more about the configuration of these programmable PPU.

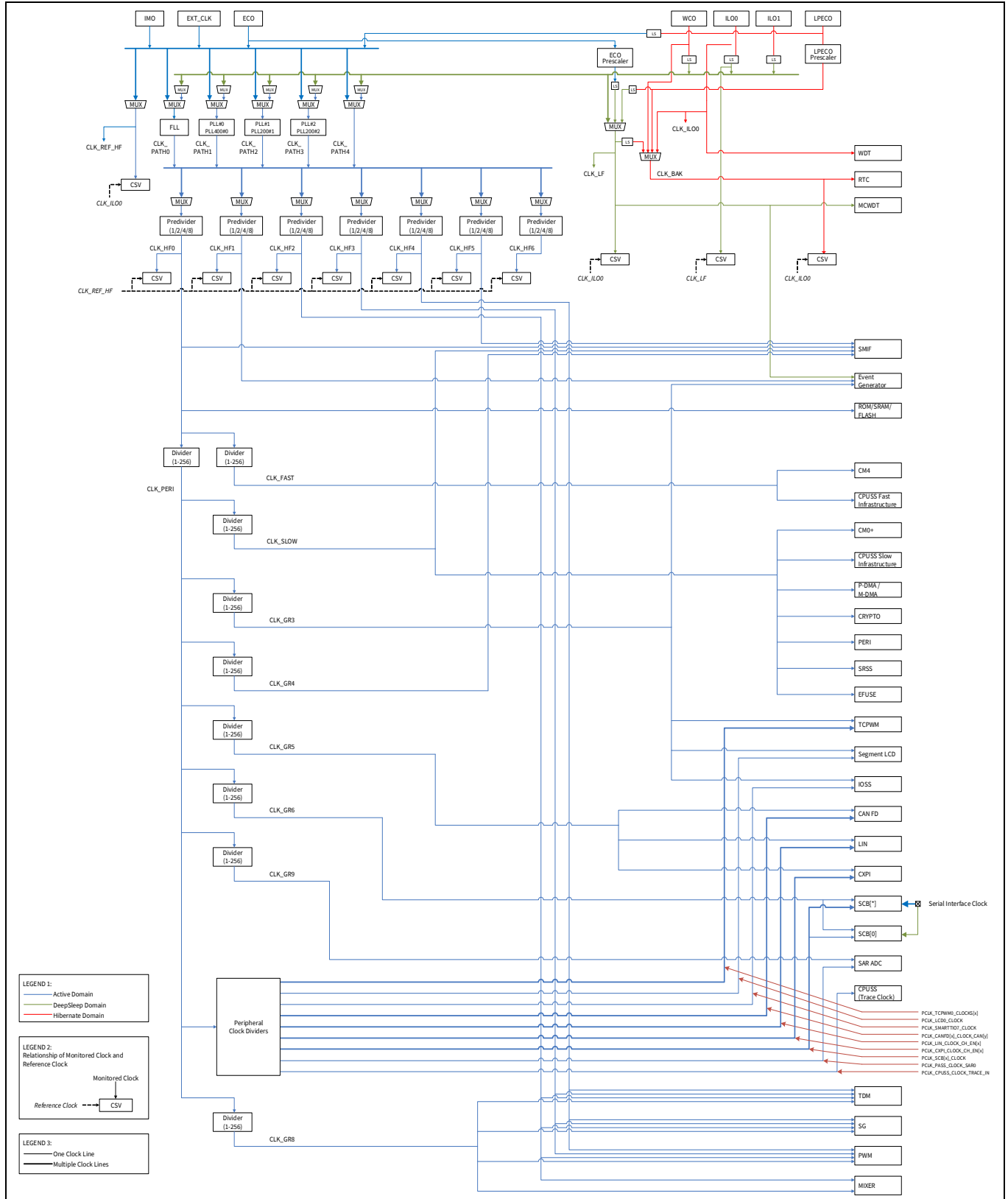


**Table 6-1** CYT2CL peripheral I/O map (continued)

Section	Description	Base address	Instances	Instance size	Group	Slave
SMARTIO	Programmable I/O configuration	0x4032 0000			3	2
	SMART I/O port configuration	0x4032 0C00	1	0x100		
TCPWM	Timer/Counter/PWM 0 (TCPWM0)	0x4038 0000			3	3
	TCPWM0 Group #0 (16-bit)	0x4038 0000	34	0x80		
	TCPWM0 Group #1 (16-bit, Motor control)	0x4038 8000	12	0x80		
	TCPWM0 Group #2 (32-bit)	0x4039 0000	16	0x80		
LCD	LCD Controller	0x403B 0000			3	4
	LCD Data	0x403B 0100	4	0x100		
EVTGEN	Event generator 0 (EVTGEN0)	0x403F 0000			3	5
	Event generator 0 comparator structures	0x403F 0800	16	0x20		
SMIF	Serial Memory Interface 0 (SMIF0)	0x4042 0000			4	0
	SMIF0 Devices	0x4042 0800	2	0x80		
LIN	Local Interconnect Network 0 (LIN0)	0x4050 0000			5	0
	LIN0 Channels	0x4050 8000	2	0x100		
CXPI	Clock Extension Peripheral Interface 0 (CXPI0)	0x4051 0000			5	1
	CXPI0 Channels	0x4051 8000	2	0x100		
TTCANFD	CAN0 controller	0x4052 0000	2	0x200	5	2
	Message RAM CAN0	0x4053 0000		0x1FFF		
	CAN1 controller	0x4054 0000	2	0x200	5	3
	Message RAM CAN1	0x4055 0000		0x1FFF		
SCB	Serial Communications Block (SPI/UART/I <sup>2</sup> C)	0x4060 0000	12	0x10000	6	0-11
Sound	Time Division Multiplexer 0 (TDM0)	0x4081 0000			8	0
	TDM0 Structures	0x4081 8000	2	0x200		
	Sound Generator 0 (SG0)	0x4082 0000			8	1
	SG0 Structures	0x4082 8000	5	0x100		
	Pulse Width Modulation 0 (PWM0)	0x4083 0000			8	2
	PWM0 Structures	0x4083 8000	2	0x100		
	Mixer0	0x4088 0000			8	4
	Mixer0 Source Structures	0x4088 8000	5	0x100		
	Mixer0 Destination Structures	0x4088 C000	1			
SAR PASS	Programmable Analog Subsystem (PASS0)	0x4090 0000			9	0
	SAR0 channel controller	0x4090 0000				
	SAR0 channel structures	0x4090 0800	24	0x40		
	SAR1 channel structures	0x4090 1800	24	0x40		

CYT2CL clock diagram

# 7 CYT2CL clock diagram



**Figure 7-1** CYT2CL clock diagram

## 8 CYT2CL CPU start-up sequence

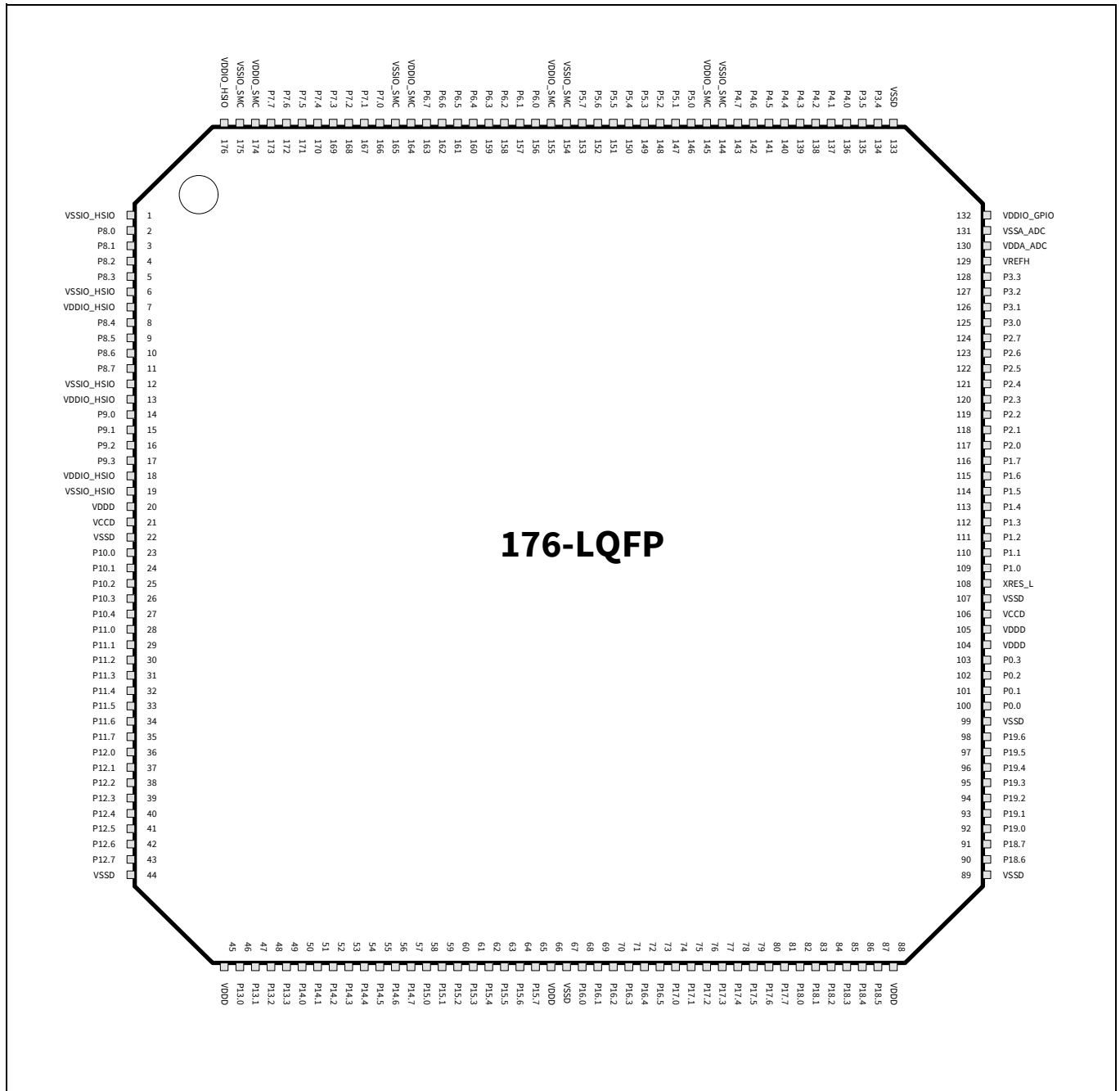
The following steps describe the start-up sequence:

1. System Reset (@0x0000 0000)
2. CM0+ executes ROM boot (@0x0000 0004)
  - i. Applies trims
  - ii. Applies Debug Access port (DAP) access restrictions and system protection from eFuse and supervisory flash
  - iii. Authenticates flash boot (only in SECURE life-cycle stage) and transfers control to it
3. CM0+ executes flash boot (from Supervisory flash @0x1700 2000)
  - i. Debug pins are configured as per the SWD/JTAG spec<sup>[17]</sup>
  - ii. Sets CM0+ vector offset register (CM0\_VTOR part of the Arm® system space) to the beginning of flash (@0x1000 0000)
  - iii. CM0+ branches to its Reset handler
4. CM0+ starts execution
  - i. Moves CM0+ vector table to SRAM (updates CM0+ vector table base)
  - ii. Sets CM4\_VECTOR\_TABLE\_BASE (@0x0000 0200) to the location of CM4 vector table mentioned in flash (specified in CM4 linker definition file)
  - iii. Releases CM4 from reset
  - iv. Continues execution of CM0+ user application
5. CM4 executes directly from either code-flash or SRAM
  - i. CM4 branches to its Reset handler
  - ii. Continues execution of CM4 user application

**Note**

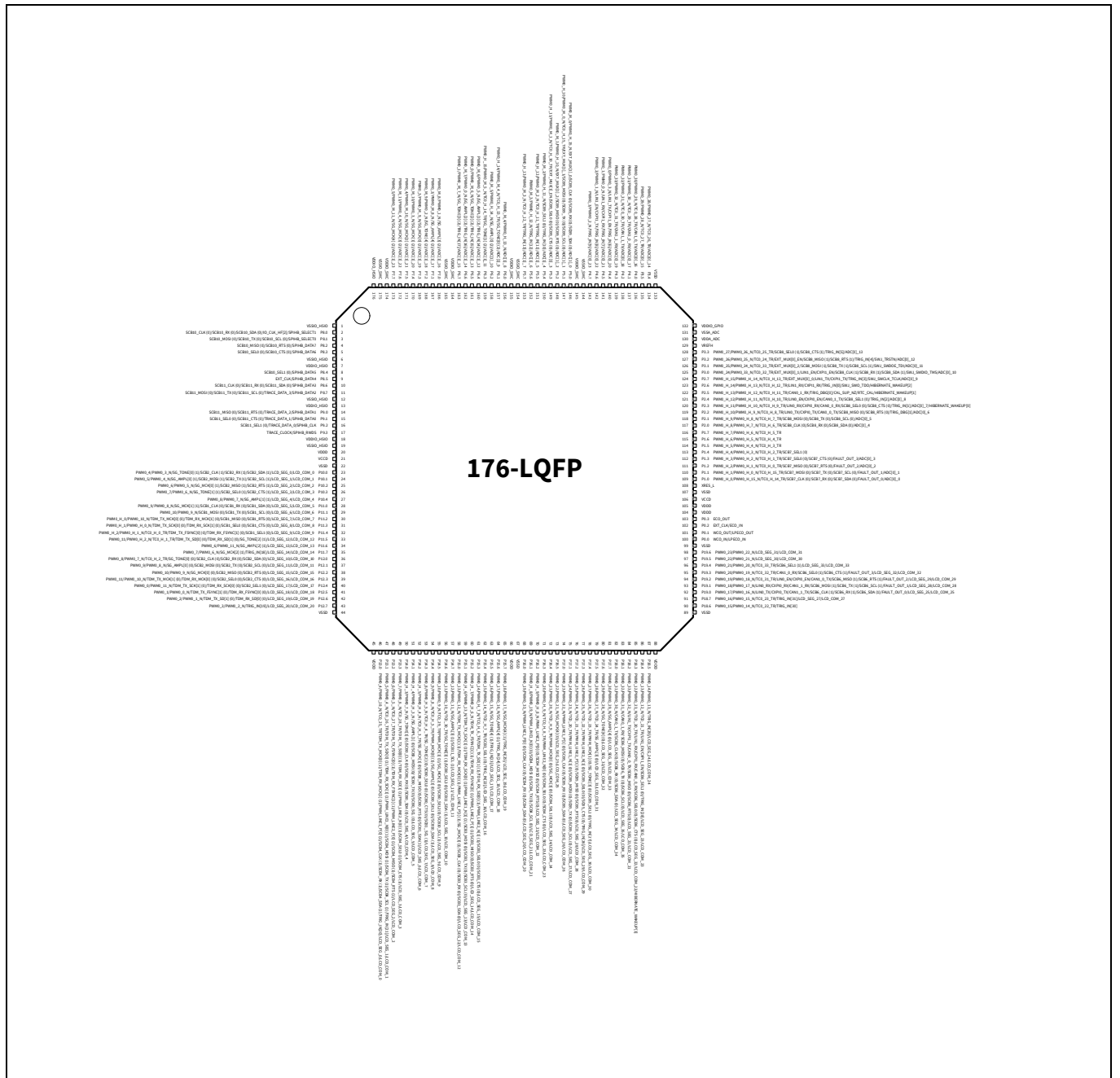
17. Port configuration of SWD/JTAG pins will be changed from the default GPIO mode to support debugging after the boot process, see [Table 11-1](#) for pin assignments.

## 9 Pin assignment



**Figure 9-1 176-LQFP pin assignment**

Pin assignment



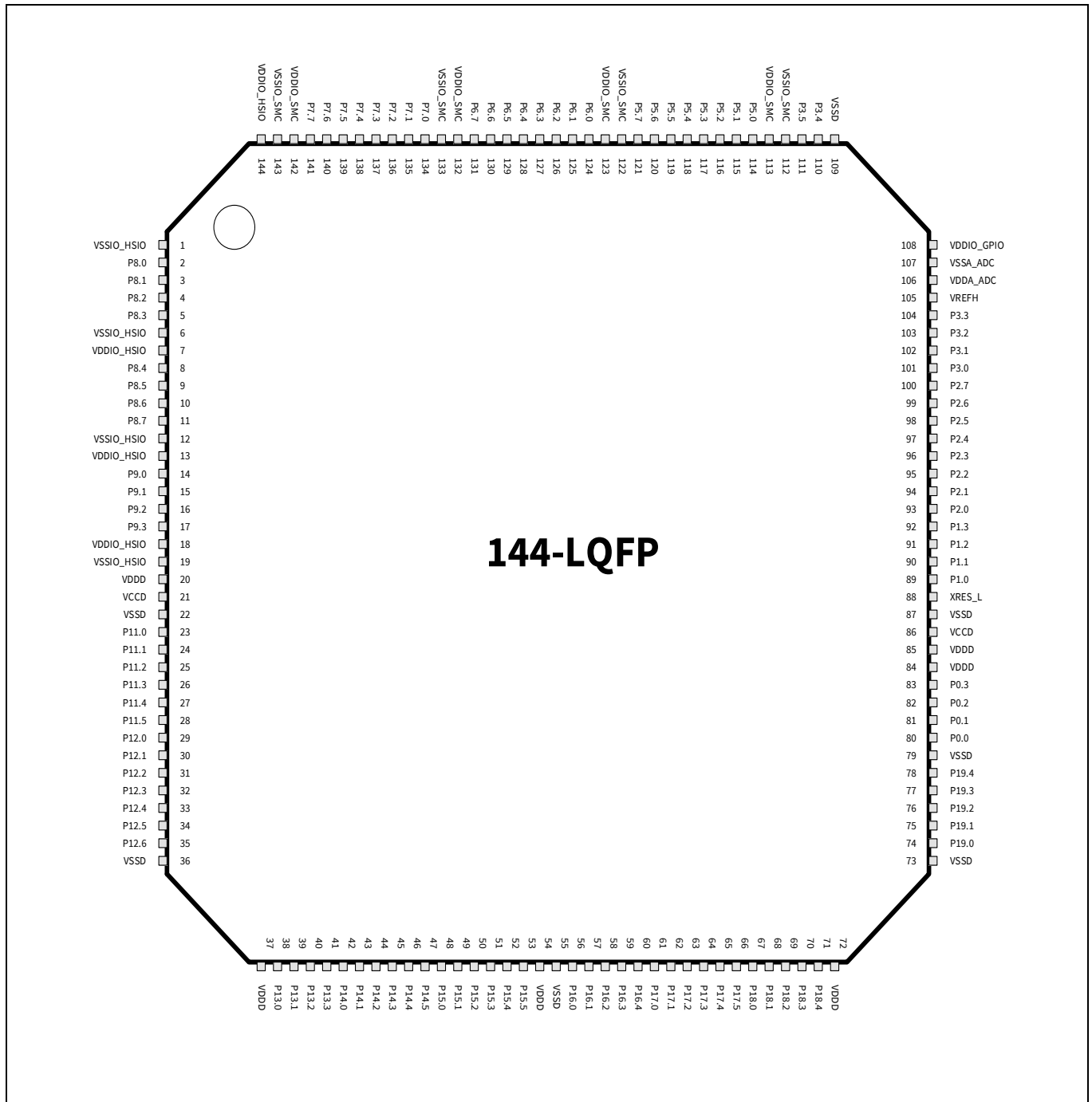
**Figure 9-2 176-LQFP pin assignment with alternate functions**

# TRAVEO™ T2G 32-bit Automotive MCU

## Based on Arm® Cortex®-M4F single



### Pin assignment



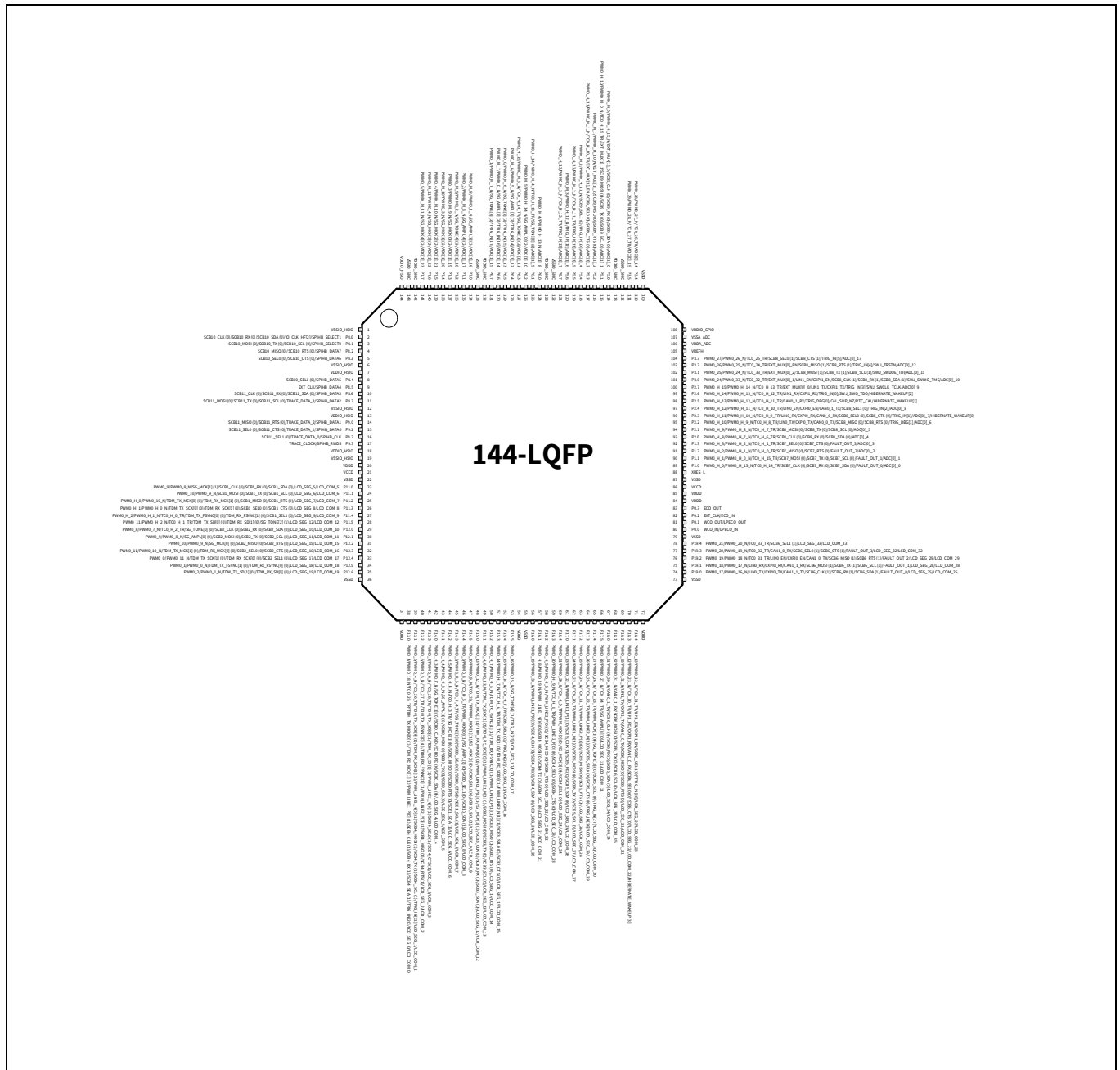
**Figure 9-3 144-LQFP pin assignment**

# TRAVEO™ T2G 32-bit Automotive MCU

## Based on Arm® Cortex®-M4F single



### Pin assignment



**Figure 9-4 144-LQFP pin assignment with alternate functions**

## 10 High-speed I/O matrix connections

**Table 10-1 HSIOM connections reference**

Name	Number	Description
HSIOM_SEL_GPIO	0	GPIO controls 'out'
HSIOM_SEL_GPIO_DSI	1	Reserved
HSIOM_SEL_DSI_DSI	2	
HSIOM_SEL_DSI_GPIO	3	
HSIOM_SEL_AMUXA	4	
HSIOM_SEL_AMUXB	5	
HSIOM_SEL_AMUXA_DSI	6	
HSIOM_SEL_AMUXB_DSI	7	
HSIOM_SEL_ACT_0	8	Active functionality 0
HSIOM_SEL_ACT_1	9	Active functionality 1
HSIOM_SEL_ACT_2	10	Active functionality 2
HSIOM_SEL_ACT_3	11	Active functionality 3
HSIOM_SEL_DS_0	12	DeepSleep functionality 0
HSIOM_SEL_DS_1	13	DeepSleep functionality 1
HSIOM_SEL_DS_2	14	DeepSleep functionality 2
HSIOM_SEL_DS_3	15	DeepSleep functionality 3
HSIOM_SEL_ACT_4	16	Active functionality 4
HSIOM_SEL_ACT_5	17	Active functionality 5
HSIOM_SEL_ACT_6	18	Active functionality 6
HSIOM_SEL_ACT_7	19	Active functionality 7
HSIOM_SEL_ACT_8	20	Active functionality 8
HSIOM_SEL_ACT_9	21	Active functionality 9
HSIOM_SEL_ACT_10	22	Active functionality 10
HSIOM_SEL_ACT_11	23	Active functionality 11
HSIOM_SEL_ACT_12	24	Active functionality 12
HSIOM_SEL_ACT_13	25	Active functionality 13
HSIOM_SEL_ACT_14	26	Active functionality 14
HSIOM_SEL_ACT_15	27	Active functionality 15
HSIOM_SEL_DS_4	28	DeepSleep functionality 4
HSIOM_SEL_DS_5	29	DeepSleep functionality 5
HSIOM_SEL_DS_6	30	DeepSleep functionality 6
HSIOM_SEL_DS_7	31	DeepSleep functionality 7



# 11 Package pin list and alternate functions

Most pins have alternate functionality, as specified in [Table 11-1](#).

Port 11 has the following additional features:

- Ability to pass full-level analog signals to the SAR without clipping to  $V_{DD}$  in cases where  $V_{DD} < V_{DDA\_ADC}$
- Ability to simultaneously capture all three ADC signals with highest priority (ADC[0:2]\_M)
- Lower noise for the most sensitive sensors

**Table 11-1 Pin selector and alternate pin functions in DeepSleep (DS) Mode, Analog, Smart I/O** <sup>[23]</sup>

Name	Package		I/O Type	DeepSleep Mapping					Analog/HV	Smart I/O
	176-LQFP	144-LQFP		HCon#12 <sup>[18]</sup>	HCon#13	HCon#14	HCon#15	HCon#29		
	Pin	Pin		DS#0 <sup>[19,20]</sup>	DS#1	DS#2	DS#3	DS#5		
P0.0	100	80	GPIO_STD						WCO_IN, LPECO_IN <sup>[21]</sup>	
P0.1	101	81	GPIO_STD						WCO_OUT, LPECO_OUT <sup>[21]</sup>	
P0.2	102	82	GPIO_STD						ECO_IN <sup>[21]</sup>	
P0.3	103	83	GPIO_STD						ECO_OUT <sup>[21]</sup>	
P1.0	109	89	GPIO_STD						ADC[0]_0	
P1.1	110	90	GPIO_STD						ADC[0]_1	
P1.2	111	91	GPIO_STD						ADC[0]_2	
P1.3	112	92	GPIO_STD						ADC[0]_3	
P1.4	113	NA	GPIO_STD							
P1.5	114	NA	GPIO_STD							
P1.6	115	NA	GPIO_STD							
P1.7	116	NA	GPIO_STD							
P2.0	117	93	GPIO_STD						ADC[0]_4	
P2.1	118	94	GPIO_STD						ADC[0]_5	
P2.2	119	95	GPIO_STD						ADC[0]_6	
P2.3	120	96	GPIO_STD						ADC[0]_7 HIBERNATE_WAKEUP[0]	

**Notes**

- 18.High Speed I/O matrix connection (HCon) reference as per [Table 10-1](#).
- 19.DeepSleep ordering (DS#0, DS#1, DS#2) does not have any impact on choosing any alternate functions; the HSIOM module handles the individual alternate function assignment.
- 20.All port pin functions available in DeepSleep mode are also available in Active mode.
- 21.I/O pins that support an oscillator function (WCO or ECO) must be configured for high-impedance if the oscillator is enabled.
- 22.This I/O will have increased leakage to ground when VDD is below the POR threshold.
- 23.For any function marked with an identifier (n), the AC timing is only guaranteed within the respective group “n”.





**Table 11-1 Pin selector and alternate pin functions in DeepSleep (DS) Mode, Analog, Smart I/O (continued)<sup>[23]</sup>**

Name	Package		I/O Type	DeepSleep Mapping					Analog/HV	Smart I/O
	176-LQFP	144-LQFP		HCon#12 <sup>[18]</sup>	HCon#13	HCon#14	HCon#15	HCon#29		
	Pin	Pin		DS#0 <sup>[19, 20]</sup>	DS#1	DS#2	DS#3	DS#5		
P2.4	121	97	GPIO_STD						ADC[0]_8	
P2.5	122	98	GPIO_STD					RTC_CAL	HIBERNATE_WAKEUP[1]	
P2.6	123	99	GPIO_STD					SWJ_SWO_TDO	HIBERNATE_WAKEUP[2]	
P2.7	124	100	GPIO_STD					SWJ_SWCLK_TCLK	ADC[0]_9	
P3.0	125	101	GPIO_STD					SWJ_SWDIO_TMS	ADC[0]_10	
P3.1	126	102	GPIO_STD					SWJ_SWDOE_TDI	ADC[0]_11	
P3.2	127	103	GPIO_STD					SWJ_TRSTN	ADC[0]_12	
P3.3	128	104	GPIO_STD						ADC[0]_13	
P3.4	134	110	GPIO_STD						ADC[0]_14	
P3.5	135	111	GPIO_STD						ADC[0]_15	
P4.0	136	NA	GPIO_STD						ADC[0]_16	
P4.1	137	NA	GPIO_STD						ADC[0]_17	
P4.2	138	NA	GPIO_STD						ADC[0]_18	
P4.3	139	NA	GPIO_STD						ADC[0]_19	
P4.4	140	NA	GPIO_STD						ADC[0]_20	
P4.5	141	NA	GPIO_STD						ADC[0]_21	
P4.6	142	NA	GPIO_STD						ADC[0]_22	
P4.7	143	NA	GPIO_STD						ADC[0]_23	
P5.0	146	114	GPIO_SMC						ADC[1]_0	
P5.1	147	115	GPIO_SMC						ADC[1]_1	
P5.2	148	116	GPIO_SMC						ADC[1]_2	
P5.3	149	117	GPIO_SMC						ADC[1]_3	
P5.4	150	118	GPIO_SMC						ADC[1]_4	
P5.5	151	119	GPIO_SMC						ADC[1]_5	
P5.6	152	120	GPIO_SMC						ADC[1]_6	
P5.7	153	121	GPIO_SMC						ADC[1]_7	
P6.0	156	124	GPIO_SMC						ADC[1]_8	
P6.1	157	125	GPIO_SMC						ADC[1]_9	
P6.2	158	126	GPIO_SMC						ADC[1]_10	
P6.3	159	127	GPIO_SMC						ADC[1]_11	
P6.4	160	128	GPIO_SMC						ADC[1]_12	

**Table 11-1 Pin selector and alternate pin functions in DeepSleep (DS) Mode, Analog, Smart I/O (continued)<sup>[23]</sup>**

Name	Package		I/O Type	DeepSleep Mapping					Analog/HV	Smart I/O
	176-LQFP	144-LQFP		HCon#12 <sup>[18]</sup>	HCon#13	HCon#14	HCon#15	HCon#29		
	Pin	Pin		DS#0 <sup>[19, 20]</sup>	DS#1	DS#2	DS#3	DS#5		
P6.5	161	129	GPIO_SMC						ADC[1]_13	
P6.6	162	130	GPIO_SMC						ADC[1]_14	
P6.7	163	131	GPIO_SMC						ADC[1]_15	
P7.0	166	134	GPIO_SMC						ADC[1]_16	SMARTIO7_0
P7.1	167	135	GPIO_SMC						ADC[1]_17	SMARTIO7_1
P7.2	168	136	GPIO_SMC						ADC[1]_18	SMARTIO7_2
P7.3	169	137	GPIO_SMC						ADC[1]_19	SMARTIO7_3
P7.4	170	138	GPIO_SMC						ADC[1]_20	SMARTIO7_4
P7.5	171	139	GPIO_SMC						ADC[1]_21	SMARTIO7_5
P7.6	172	140	GPIO_SMC						ADC[1]_22	SMARTIO7_6
P7.7	173	141	GPIO_SMC						ADC[1]_23	SMARTIO7_7
P8.0	2	2	HSIO_STDLN							
P8.1	3	3	HSIO_STDLN							
P8.2	4	4	HSIO_STDLN							
P8.3	5	5	HSIO_STDLN							
P8.4	8	8	HSIO_STDLN							
P8.5	9	9	HSIO_STDLN							
P8.6	10	10	HSIO_STDLN							
P8.7	11	11	HSIO_STDLN							
P9.0	14	14	HSIO_STDLN							
P9.1	15	15	HSIO_STDLN							
P9.2	16	16	HSIO_STDLN							
P9.3	17	17	HSIO_STDLN							
P10.0	23	NA	GPIO_STD	LCD_SEG_0	LCD_COM_0					
P10.1	24	NA	GPIO_STD	LCD_SEG_1	LCD_COM_1					
P10.2	25	NA	GPIO_STD	LCD_SEG_2	LCD_COM_2					
P10.3	26	NA	GPIO_STD	LCD_SEG_3	LCD_COM_3					
P10.4	27	NA	GPIO_STD	LCD_SEG_4	LCD_COM_4					
P11.0	28	23	GPIO_STD	LCD_SEG_5	LCD_COM_5					
P11.1	29	24	GPIO_STD	LCD_SEG_6	LCD_COM_6					
P11.2	30	25	GPIO_STD	LCD_SEG_7	LCD_COM_7					



**Table 11-1 Pin selector and alternate pin functions in DeepSleep (DS) Mode, Analog, Smart I/O** (continued)<sup>[23]</sup>

Name	Package		I/O Type	DeepSleep Mapping					Analog/HV	Smart I/O
	176-LQFP	144-LQFP		HCon#12 <sup>[18]</sup>	HCon#13	HCon#14	HCon#15	HCon#29		
	Pin	Pin		DS#0 <sup>[19, 20]</sup>	DS#1	DS#2	DS#3	DS#5		
P11.3	31	26	GPIO_STD	LCD_SEG_8	LCD_COM_8					
P11.4	32	27	GPIO_STD	LCD_SEG_9	LCD_COM_9					
P11.5	33	28	GPIO_STD	LCD_SEG_12	LCD_COM_12					
P11.6	34	NA	GPIO_STD	LCD_SEG_13	LCD_COM_13					
P11.7	35	NA	GPIO_STD	LCD_SEG_14	LCD_COM_14					
P12.0	36	29	GPIO_STD	LCD_SEG_10	LCD_COM_10					
P12.1	37	30	GPIO_STD	LCD_SEG_11	LCD_COM_11					
P12.2	38	31	GPIO_STD	LCD_SEG_15	LCD_COM_15					
P12.3	39	32	GPIO_STD	LCD_SEG_16	LCD_COM_16					
P12.4	40	33	GPIO_STD	LCD_SEG_17	LCD_COM_17					
P12.5	41	34	GPIO_STD	LCD_SEG_18	LCD_COM_18					
P12.6	42	35	GPIO_STD	LCD_SEG_19	LCD_COM_19					
P12.7	43	NA	GPIO_STD	LCD_SEG_20	LCD_COM_20					
P13.0	46	38	GPIO_STD	LCD_SEG_0	LCD_COM_0					
P13.1	47	39	GPIO_STD	LCD_SEG_1	LCD_COM_1					
P13.2	48	40	GPIO_STD	LCD_SEG_2	LCD_COM_2					
P13.3	49	41	GPIO_STD	LCD_SEG_3	LCD_COM_3					
P14.0	50	42	GPIO_ENH	LCD_SEG_4	LCD_COM_4	SCB0_CLK (0)	SCB0_SDA (0)			
P14.1	51	43	GPIO_ENH	LCD_SEG_5	LCD_COM_5	SCB0_MOSI (0)	SCB0_SCL (0)			
P14.2	52	44	GPIO_ENH	LCD_SEG_6	LCD_COM_6	SCB0_MISO (0)				
P14.3	53	45	GPIO_ENH	LCD_SEG_7	LCD_COM_7	SCB0_SEL0 (0)				
P14.4	54	46	GPIO_ENH	LCD_SEG_8	LCD_COM_8	SCB0_SEL1 (0)				
P14.5	55	47	GPIO_ENH	LCD_SEG_9	LCD_COM_9	SCB0_SEL2 (0)				
P14.6	56	NA	GPIO_ENH	LCD_SEG_10	LCD_COM_10	SCB0_SEL3 (0)				
P14.7	57	NA	GPIO_ENH	LCD_SEG_11	LCD_COM_11					
P15.0	58	48	GPIO_STD	LCD_SEG_12	LCD_COM_12					
P15.1	59	49	GPIO_STD	LCD_SEG_13	LCD_COM_13					
P15.2	60	50	GPIO_STD	LCD_SEG_14	LCD_COM_14					
P15.3	61	51	GPIO_STD	LCD_SEG_15	LCD_COM_15					
P15.4	62	52	GPIO_STD	LCD_SEG_16	LCD_COM_16					



**Table 11-1 Pin selector and alternate pin functions in DeepSleep (DS) Mode, Analog, Smart I/O (continued)<sup>[23]</sup>**

Name	Package		I/O Type	DeepSleep Mapping					Analog/HV	Smart I/O
	176-LQFP	144-LQFP		HCon#12 <sup>[18]</sup>	HCon#13	HCon#14	HCon#15	HCon#29		
	Pin	Pin		DS#0 <sup>[19, 20]</sup>	DS#1	DS#2	DS#3	DS#5		
P15.5	63	53	GPIO_STD	LCD_SEG_17	LCD_COM_17					
P15.6	64	NA	GPIO_STD	LCD_SEG_18	LCD_COM_18					
P15.7	65	NA	GPIO_STD	LCD_SEG_19	LCD_COM_19					
P16.0	68	56	GPIO_STD	LCD_SEG_20	LCD_COM_20					
P16.1	69	57	GPIO_STD	LCD_SEG_21	LCD_COM_21					
P16.2	70	58	GPIO_STD	LCD_SEG_22	LCD_COM_22					
P16.3	71	59	GPIO_STD	LCD_SEG_23	LCD_COM_23					
P16.4	72	60	GPIO_STD	LCD_SEG_24	LCD_COM_24					
P16.5	73	NA	GPIO_STD	LCD_SEG_25	LCD_COM_25					
P17.0	74	61	GPIO_STD	LCD_SEG_26	LCD_COM_26					
P17.1	75	62	GPIO_STD	LCD_SEG_27	LCD_COM_27					
P17.2	76	63	GPIO_STD	LCD_SEG_28	LCD_COM_28					
P17.3	77	64	GPIO_STD	LCD_SEG_29	LCD_COM_29					
P17.4	78	65	GPIO_STD	LCD_SEG_30	LCD_COM_30					
P17.5	79	66	GPIO_STD	LCD_SEG_31	LCD_COM_31					
P17.6	80	NA	GPIO_STD	LCD_SEG_32	LCD_COM_32					
P17.7	81	NA	GPIO_STD	LCD_SEG_33	LCD_COM_33					
P18.0	82	67	GPIO_STD	LCD_SEG_34	LCD_COM_34					
P18.1	83	68	GPIO_STD	LCD_SEG_35	LCD_COM_35					
P18.2	84	69	GPIO_STD	LCD_SEG_21	LCD_COM_21					
P18.3	85	70	GPIO_STD	LCD_SEG_22	LCD_COM_22				HIBERNATE_WAKEUP[3]	
P18.4	86	71	GPIO_STD	LCD_SEG_23	LCD_COM_23					
P18.5	87	NA	GPIO_STD	LCD_SEG_24	LCD_COM_24					
P18.6 <sup>[22]</sup>	90	NA	GPIO_STD							
P18.7	91	NA	GPIO_STD	LCD_SEG_27	LCD_COM_27					
P19.0	92	74	GPIO_STD	LCD_SEG_25	LCD_COM_25					
P19.1	93	75	GPIO_STD	LCD_SEG_28	LCD_COM_28					
P19.2	94	76	GPIO_STD	LCD_SEG_29	LCD_COM_29					
P19.3	95	77	GPIO_STD	LCD_SEG_32	LCD_COM_32					
P19.4	96	78	GPIO_STD	LCD_SEG_33	LCD_COM_33					

**Table 11-1 Pin selector and alternate pin functions in DeepSleep (DS) Mode, Analog, Smart I/O** *(continued)*<sup>[23]</sup>

Name	Package		I/O Type	DeepSleep Mapping					Analog/HV	Smart I/O
	176-LQFP	144-LQFP		HCon#12 <sup>[18]</sup>	HCon#13	HCon#14	HCon#15	HCon#29		
	Pin	Pin		DS#0 <sup>[19, 20]</sup>	DS#1	DS#2	DS#3	DS#5		
P19.5	97	NA	GPIO_STD	LCD_SEG_30	LCD_COM_30					
P19.6	98	NA	GPIO_STD	LCD_SEG_31	LCD_COM_31					

## 12 Power pin assignments

**Table 12-1** Power pin assignments

Name	Package		Remarks
	176-LQFP	144-LQFP	
VDDD	105, 104, 88, 66, 45, 20	85, 84, 72, 54, 37, 20	Main digital supply
VSS	133, 107, 99, 89, 67, 44, 22	109, 87, 79, 73, 55, 36, 22	Main digital ground
VDDIO_GPIO	132	108	Supply for GPIO_STD (2.7 - 5.5 V)
VDDIO_HSIO	176, 18, 13, 7	144, 18, 13, 7	Supply for HSIO_STDLN (3.0 - 3.6 V)
VSSIO_HSIO	19, 12, 6, 1	19, 12, 6, 1	HSIO_STDLN ground
VDDIO_SMC	174, 164, 155, 145	142, 132, 123, 113	Supply for GPIO_SMC (2.7 - 5.5 V)
VSSIO_SMC	175, 165, 154, 144	143, 133, 122, 112	GPIO_SMC ground
VCCD <sup>[24]</sup>	106, 21	86, 21	Main regulated supply. Driven by LDO regulator
VREFH	129	105	High reference voltage for SAR
VDDA_ADC	130	106	Main analog supply (for PASS/SAR)
VSSA_ADC	131	107	Main analog ground (VREFL is shared with VSSA_ADC)
XRES_L	108	88	Active low external reset input

**Note**

24. The  $V_{CCD}$  pins must be connected together to ensure a low-impedance connection. (see the requirement in [Figure 27-2](#))



# 13 Alternate function pin assignments

**Table 13-1** Alternate pin functions in active power mode [20, 27, 28]

Name	Active Mapping														
	HCon#8 <sup>[25]</sup>	HCon#9	HCon#10	HCon#11	HCon#16	HCon#17	HCon#18	HCon#20	HCon#21	HCon#22	HCon#23	HCon#24	HCon#25	HCon#26	HCon#27
	ACT#0 <sup>[26]</sup>	ACT#1	ACT#2	ACT#3	ACT#4	ACT#5	ACT#6	ACT#8	ACT#9	ACT#10	ACT#11	ACT#12	ACT#13	ACT#14	ACT#15
P0.0															
P0.1															
P0.2														EXT_CLK	
P0.3															
P1.0	PWM0_H_0	PWM0_H_15_N	TC0_H_14_TR							SCB7_CLK (0)	SCB7_RX (0)	SCB7_SDA (0) <sup>[29]</sup>			FAULT_OUT_0
P1.1	PWM0_H_1	PWM0_H_0_N	TC0_H_15_TR							SCB7_MOSI (0)	SCB7_TX (0)	SCB7_SCL (0) <sup>[29]</sup>			FAULT_OUT_1
P1.2	PWM0_H_2	PWM0_H_1_N	TC0_H_0_TR							SCB7_MISO (0)	SCB7_RTS (0)				FAULT_OUT_2
P1.3	PWM0_H_3	PWM0_H_2_N	TC0_H_1_TR							SCB7_SEL0 (0)	SCB7_CTS (0)				FAULT_OUT_3
P1.4	PWM0_H_4	PWM0_H_3_N	TC0_H_2_TR							SCB7_SEL1 (0)					
P1.5	PWM0_H_5	PWM0_H_4_N	TC0_H_3_TR												
P1.6	PWM0_H_6	PWM0_H_5_N	TC0_H_4_TR												
P1.7	PWM0_H_7	PWM0_H_6_N	TC0_H_5_TR												
P2.0	PWM0_H_8	PWM0_H_7_N	TC0_H_6_TR							SCB8_CLK (0)	SCB8_RX (0)	SCB8_SDA (0) <sup>[29]</sup>			
P2.1	PWM0_H_9	PWM0_H_8_N	TC0_H_7_TR							SCB8_MOSI (0)	SCB8_TX (0)	SCB8_SCL (0) <sup>[29]</sup>			
P2.2	PWM0_H_10	PWM0_H_9_N	TC0_H_8_TR		LIN0_TX	CXPI0_TX	CAN0_0_TX			SCB8_MISO (0)	SCB8_RTS (0)		TRIG_DBG[1]		
P2.3	PWM0_H_11	PWM0_H_10_N	TC0_H_9_TR		LIN0_RX	CXPI0_RX	CAN0_0_RX			SCB8_SEL0 (0)	SCB8_CTS (0)		TRIG_IN[1]		
P2.4	PWM0_H_12	PWM0_H_11_N	TC0_H_10_TR		LIN0_EN	CXPI0_EN	CAN0_1_TX			SCB8_SEL1 (0)			TRIG_IN[2]		
P2.5	PWM0_H_13	PWM0_H_12_N	TC0_H_11_TR				CAN0_1_RX						TRIG_DBG[0]		CAL_SUP_NZ
P2.6	PWM0_H_14	PWM0_H_13_N	TC0_H_12_TR		LIN1_RX	CXPI1_RX							TRIG_IN[0]		
P2.7	PWM0_H_15	PWM0_H_14_N	TC0_H_13_TR	EXT_MUX[0]_0	LIN1_TX	CXPI1_TX							TRIG_IN[3]		
P3.0	PWM0_24	PWM0_33_N	TC0_32_TR	EXT_MUX[0]_1	LIN1_EN	CXPI1_EN				SCB8_CLK (1)	SCB8_RX (1)	SCB8_SDA (1) <sup>[29]</sup>			
P3.1	PWM0_25	PWM0_24_N	TC0_33_TR	EXT_MUX[0]_2						SCB8_MOSI (1)	SCB8_TX (1)	SCB8_SCL (1) <sup>[29]</sup>			
P3.2	PWM0_26	PWM0_25_N	TC0_24_TR	EXT_MUX[0]_EN						SCB8_MISO (1)	SCB8_RTS (1)		TRIG_IN[4]		
P3.3	PWM0_27	PWM0_26_N	TC0_25_TR							SCB8_SEL0 (1)	SCB8_CTS (1)		TRIG_IN[5]		

**Notes**

- 25.High Speed I/O matrix connection (HCon) reference as per [Table 10-1](#).
- 26.Active Mode ordering (ACT#0, ACT#1, and so on) does not have any impact on choosing any alternate functions; HSIOM module will handle the individual alternate function assignments.
- 27.Refer to [Table 14-1](#) for more information on pin multiplexer abbreviations used.
- 28.For any function marked with an identifier (n), the AC timing is only guaranteed within the respective group “n”.
- 29.See [Table 27-10](#) 'Serial Communication Block (SCB) specifications' for supported IO-cells and I2C modes.





**Table 13-1** Alternate pin functions in active power mode (continued) [20, 27, 28]

Name	Active Mapping														
	HCon#8 <sup>[25]</sup>	HCon#9	HCon#10	HCon#11	HCon#16	HCon#17	HCon#18	HCon#20	HCon#21	HCon#22	HCon#23	HCon#24	HCon#25	HCon#26	HCon#27
	ACT#0 <sup>[26]</sup>	ACT#1	ACT#2	ACT#3	ACT#4	ACT#5	ACT#6	ACT#8	ACT#9	ACT#10	ACT#11	ACT#12	ACT#13	ACT#14	ACT#15
P3.4	PWM0_28	PWM0_27_N	TC0_26_TR												
P3.5	PWM0_29	PWM0_28_N	TC0_27_TR												
P4.0	PWM0_30	PWM0_29_N	TC0_28_TR				CAN1_0_TX								
P4.1	PWM0_31	PWM0_30_N	TC0_29_TR				CAN1_0_RX								
P4.2	PWM0_32	PWM0_31_N	TC0_30_TR				CAN1_1_TX								
P4.3	PWM0_33	PWM0_32_N	TC0_31_TR				CAN1_1_RX								
P4.4	PWM0_0	PWM0_3_N			LIN1_TX	CXPI1_EN							TRIG_IN[6]		
P4.5	PWM0_1	PWM0_0_N			LIN1_RX	CXPI1_RX							TRIG_IN[7]		
P4.6	PWM0_2	PWM0_1_N			LIN1_EN	CXPI1_TX							TRIG_IN[8]		
P4.7	PWM0_3	PWM0_2_N											TRIG_IN[9]		
P5.0	PWM0_M_0	PWM0_H_15_N		EXT_MUX[1]_0						SCB9_CLK (0)	SCB9_RX (0)	SCB9_SDA (0) <sup>[29]</sup>			
P5.1	PWM0_H_10	PWM0_M_0_N	TC0_H_15_TR	EXT_MUX[1]_1						SCB9_MOSI (0)	SCB9_TX (0)	SCB9_SCL (0) <sup>[29]</sup>			
P5.2	PWM0_M_1	PWM0_H_10_N		EXT_MUX[1]_2						SCB9_MISO (0)	SCB9_RTS (0)				
P5.3	PWM0_H_11	PWM0_M_1_N	TC0_H_10_TR	EXT_MUX[1]_EN						SCB9_SEL0 (0)	SCB9_CTS (0)				
P5.4	PWM0_M_2	PWM0_H_11_N								SCB9_SEL1 (0)			TRIG_IN[10]		
P5.5	PWM0_H_12	PWM0_M_2_N	TC0_H_11_TR										TRIG_IN[11]		
P5.6	PWM0_M_3	PWM0_H_12_N											TRIG_IN[12]		
P5.7	PWM0_H_13	PWM0_M_3_N	TC0_H_12_TR										TRIG_IN[13]		
P6.0	PWM0_M_4	PWM0_H_13_N													
P6.1	PWM0_H_14	PWM0_M_4_N	TC0_H_13_TR							SG_TONE[0] (2)					
P6.2	PWM0_M_5	PWM0_H_14_N								SG_AMPL[0] (2)					
P6.3	PWM0_H_15	PWM0_M_5_N	TC0_H_14_TR							SG_TONE[1] (2)					
P6.4	PWM0_M_6	PWM0_5_N								SG_AMPL[1] (2)			TRIG_IN[14]		
P6.5	PWM0_0	PWM0_M_6_N								SG_TONE[2] (2)			TRIG_IN[15]		
P6.6	PWM0_M_7	PWM0_0_N								SG_AMPL[2] (2)			TRIG_IN[16]		
P6.7	PWM0_1	PWM0_M_7_N								SG_TONE[3] (2)			TRIG_IN[17]		
P7.0	PWM0_M_8	PWM0_1_N								SG_AMPL[3] (2)					
P7.1	PWM0_2	PWM0_M_8_N								SG_AMPL[4] (2)					
P7.2	PWM0_M_9	PWM0_2_N								SG_TONE[4] (2)					
P7.3	PWM0_3	PWM0_M_9_N								SG_MCK[0] (2)					
P7.4	PWM0_M_10	PWM0_3_N								SG_MCK[1] (2)					



Alternate function pin assignments

**Table 13-1** Alternate pin functions in active power mode (continued) [20, 27, 28]

Name	Active Mapping														
	HCon#8 <sup>[25]</sup>	HCon#9	HCon#10	HCon#11	HCon#16	HCon#17	HCon#18	HCon#20	HCon#21	HCon#22	HCon#23	HCon#24	HCon#25	HCon#26	HCon#27
	ACT#0 <sup>[26]</sup>	ACT#1	ACT#2	ACT#3	ACT#4	ACT#5	ACT#6	ACT#8	ACT#9	ACT#10	ACT#11	ACT#12	ACT#13	ACT#14	ACT#15
P7.5	PWM0_4	PWM0_M10_N							SG_MCK[2] (2)						
P7.6	PWM0_M11	PWM0_4_N							SG_MCK[3] (2)						
P7.7	PWM0_5	PWM0_M11_N							SG_MCK[4] (2)						
P8.0										SCB10_CLK (0)	SCB10_RX (0)	SCB10_SDA (0) <sup>[29]</sup>		IO_CLK_HF[2]	SPIHB_SELECT1
P8.1										SCB10_MOSI (0)	SCB10_TX (0)	SCB10_SCL (0) <sup>[29]</sup>			SPIHB_SELECT0
P8.2										SCB10_MISO (0)	SCB10_RTS (0)				SPIHB_DATA7
P8.3										SCB10_SELO (0)	SCB10_CTS (0)				SPIHB_DATA6
P8.4										SCB10_SEL1 (0)					SPIHB_DATA5
P8.5														EXT_CLK	SPIHB_DATA4
P8.6										SCB11_CLK (0)	SCB11_RX (0)	SCB11_SDA (0) <sup>[29]</sup>			SPIHB_DATA3
P8.7										SCB11_MOSI (0)	SCB11_TX (0)	SCB11_SCL (0) <sup>[29]</sup>		TRACE_DATA_3	SPIHB_DATA2
P9.0										SCB11_MISO (0)	SCB11_RTS (0)			TRACE_DATA_2	SPIHB_DATA1
P9.1										SCB11_SELO (0)	SCB11_CTS (0)			TRACE_DATA_1	SPIHB_DATA0
P9.2										SCB11_SEL1 (0)				TRACE_DATA_0	SPIHB_CLK
P9.3														TRACE_CLOCK	SPIHB_RWDS
P10.0	PWM0_4	PWM0_3_N							SG_TONE[0] (1)	SCB2_CLK (1)	SCB2_RX (1)	SCB2_SDA (1) <sup>[29]</sup>			
P10.1	PWM0_5	PWM0_4_N							SG_AMPL[0] (1)	SCB2_MOSI (1)	SCB2_TX (1)	SCB2_SCL (1) <sup>[29]</sup>			
P10.2	PWM0_6	PWM0_5_N							SG_MCK[0] (1)	SCB2_MISO (1)	SCB2_RTS (1)				
P10.3	PWM0_7	PWM0_6_N							SG_TONE[1] (1)	SCB2_SELO (1)	SCB2_CTS (1)				
P10.4	PWM0_8	PWM0_7_N							SG_AMPL[1] (1)						
P11.0	PWM0_9	PWM0_8_N							SG_MCK[1] (1)	SCB1_CLK (0)	SCB1_RX (0)	SCB1_SDA (0) <sup>[29]</sup>			
P11.1	PWM0_10	PWM0_9_N								SCB1_MOSI (0)	SCB1_TX (0)	SCB1_SCL (0) <sup>[29]</sup>			
P11.2	PWM0_H_0	PWM0_10_N			TDM_TX_MCK[0] (0)	TDM_RX_MCK[1] (0)				SCB1_MISO (0)	SCB1_RTS (0)				
P11.3	PWM0_H_1	PWM0_H_0_N			TDM_TX_SCK[0] (0)	TDM_RX_SCK[1] (0)				SCB1_SELO (0)	SCB1_CTS (0)				
P11.4	PWM0_H_2	PWM0_H_1_N	TC0_H_0_TR		TDM_TX_FSYNC[0] (0)	TDM_RX_FSYNC[1] (0)				SCB1_SEL1 (0)					
P11.5	PWM0_11	PWM0_H_2_N	TC0_H_1_TR		TDM_TX_SD[0] (0)	TDM_RX_SD[1] (0)				SG_TONE[2] (1)					
P11.6	PWM0_6	PWM0_11_N								SG_AMPL[2] (1)					



**Table 13-1** Alternate pin functions in active power mode (continued) [20, 27, 28]

Name	Active Mapping														
	HCon#8 <sup>[25]</sup>	HCon#9	HCon#10	HCon#11	HCon#16	HCon#17	HCon#18	HCon#20	HCon#21	HCon#22	HCon#23	HCon#24	HCon#25	HCon#26	HCon#27
	ACT#0 <sup>[26]</sup>	ACT#1	ACT#2	ACT#3	ACT#4	ACT#5	ACT#6	ACT#8	ACT#9	ACT#10	ACT#11	ACT#12	ACT#13	ACT#14	ACT#15
P11.7	PWM0_7	PWM0_6_N							SG_MCK[2] (1)				TRIG_IN[18]		
P12.0	PWM0_8	PWM0_7_N	TC0_H_2_TR						SG_TONE[0] (0)	SCB2_CLK (0)	SCB2_RX (0)	SCB2_SDA (0) <sup>[29]</sup>			
P12.1	PWM0_9	PWM0_8_N							SG_AMPL[0] (0)	SCB2_MOSI (0)	SCB2_TX (0)	SCB2_SCL (0) <sup>[29]</sup>			
P12.2	PWM0_10	PWM0_9_N							SG_MCK[0] (0)	SCB2_MISO (0)	SCB2_RTS (0)				
P12.3	PWM0_11	PWM0_10_N			TDM_TX_MCK[1] (0)	TDM_RX_MCK[0] (0)				SCB2_SEL0 (0)	SCB2_CTS (0)				
P12.4	PWM0_0	PWM0_11_N			TDM_TX_SCK[1] (0)	TDM_RX_SCK[0] (0)				SCB2_SEL1 (0)					
P12.5	PWM0_1	PWM0_0_N			TDM_TX_FSYNC[1] (0)	TDM_RX_FSYNC[0] (0)									
P12.6	PWM0_2	PWM0_1_N			TDM_TX_SD[1] (0)	TDM_RX_SD[0] (0)									
P12.7	PWM0_3	PWM0_2_N											TRIG_IN[19]		
P13.0	PWM0_4	PWM0_18_N	TC0_25_TR		TDM_TX_MCK[0] (1)	TDM_RX_MCK[1] (1)	PWM_LINE1_P[0] (1)			SCB4_CLK (1)	SCB4_RX (1)	SCB4_SDA (1) <sup>[29]</sup>	TRIG_IN[20]		
P13.1	PWM0_5	PWM0_4_N	TC0_26_TR		TDM_TX_SCK[0] (1)	TDM_RX_SCK[1] (1)	PWM_LINE1_N[0] (1)			SCB4_MOSI (1)	SCB4_TX (1)	SCB4_SCL (1) <sup>[29]</sup>	TRIG_IN[21]		
P13.2	PWM0_6	PWM0_5_N	TC0_27_TR		TDM_TX_FSYNC[0] (1)	TDM_RX_FSYNC[1] (1)	PWM_LINE2_P[0] (1)			SCB4_MISO (1)	SCB4_RTS (1)				
P13.3	PWM0_7	PWM0_6_N	TC0_28_TR		TDM_TX_SD[0] (1)	TDM_RX_SD[1] (1)	PWM_LINE2_N[0] (1)			SCB4_SEL0 (1)	SCB4_CTS (1)				
P14.0	PWM0_H_3	PWM0_7_N							SG_TONE[1] (0)		SCB0_RX (0)				
P14.1	PWM0_H_4	PWM0_H_3_N							SG_AMPL[1] (0)		SCB0_TX (0)				
P14.2	PWM0_H_5	PWM0_H_4_N	TC0_H_3_TR						SG_MCK[1] (0)		SCB0_RTS (0)	SCB1_SDA (1)			
P14.3	PWM0_8	PWM0_H_5_N	TC0_H_4_TR						SG_TONE[2] (0)		SCB0_CTS (0)	SCB1_SCL (1)			
P14.4	PWM0_9	PWM0_8_N	TC0_H_5_TR					PWM_MCK[0] (1)	SG_AMPL[2] (0)			SCB10_SDA (1)			
P14.5	PWM0_10	PWM0_9_N	TC0_29_TR					PWM_MCK[1] (1)	SG_MCK[2] (0)			SCB10_SCL (1)			
P14.6	PWM0_11	PWM0_10_N	TC0_30_TR						SG_TONE[3] (1)			SCB11_SDA (1)			
P14.7	PWM0_12	PWM0_11_N							SG_AMPL[3] (1)			SCB11_SCL (1)			
P15.0	PWM0_13	PWM0_12_N			TDM_TX_MCK[1] (1)	TDM_RX_MCK[0] (1)	PWM_LINE1_P[1] (1)		SG_MCK[3] (1)	SCB3_CLK (0)	SCB3_RX (0)	SCB3_SDA (0) <sup>[29]</sup>			
P15.1	PWM0_H_6	PWM0_13_N			TDM_TX_SCK[1] (1)	TDM_RX_SCK[0] (1)	PWM_LINE1_N[1] (1)			SCB3_MOSI (0)	SCB3_TX (0)	SCB3_SCL (0) <sup>[29]</sup>			
P15.2	PWM0_H_7	PWM0_H_6_N			TDM_TX_FSYNC[1] (1)	TDM_RX_FSYNC[0] (1)	PWM_LINE2_P[1] (1)			SCB3_MISO (0)	SCB3_RTS (0)				
P15.3	PWM0_14	PWM0_H_7_N	TC0_H_6_TR		TDM_TX_SD[1] (1)	TDM_RX_SD[0] (1)	PWM_LINE2_N[1] (1)			SCB3_SEL0 (0)	SCB3_CTS (0)				
P15.4	PWM0_15	PWM0_14_N	TC0_H_7_TR							SCB3_SEL1 (0)			TRIG_IN[22]		
P15.5	PWM0_16	PWM0_15_N							SG_TONE[4] (1)				TRIG_IN[23]		



**Table 13-1** Alternate pin functions in active power mode (continued) [20, 27, 28]

Name	Active Mapping														
	HCon#8 <sup>[25]</sup>	HCon#9	HCon#10	HCon#11	HCon#16	HCon#17	HCon#18	HCon#20	HCon#21	HCon#22	HCon#23	HCon#24	HCon#25	HCon#26	HCon#27
	ACT#0 <sup>[26]</sup>	ACT#1	ACT#2	ACT#3	ACT#4	ACT#5	ACT#6	ACT#8	ACT#9	ACT#10	ACT#11	ACT#12	ACT#13	ACT#14	ACT#15
P15.6	PWM0_17	PWM0_16_N							SG_AMPL[4] (1)				TRIG_IN[24]		
P15.7	PWM0_18	PWM0_17_N							SG_MCK[4] (1)				TRIG_IN[25]		
P16.0	PWM0_19	PWM0_33_N						PWM_LINE1_P[0] (0)		SCB4_CLK (0)	SCB4_RX (0)	SCB4_SDA (0) <sup>[29]</sup>			
P16.1	PWM0_H_8	PWM0_19_N						PWM_LINE1_N[0] (0)		SCB4_MOSI (0)	SCB4_TX (0)	SCB4_SCL (0) <sup>[29]</sup>			
P16.2	PWM0_H_9	PWM0_H_8_N						PWM_LINE2_P[0] (0)		SCB4_MISO (0)	SCB4_RTS (0)				
P16.3	PWM0_20	PWM0_H_9_N	TC0_H_8_TR					PWM_LINE2_N[0] (0)		SCB4_SEL0 (0)	SCB4_CTS (0)				
P16.4	PWM0_21	PWM0_20_N	TC0_H_9_TR					PWM_MCK[0] (0)	SG_MCK[3] (0)	SCB4_SEL1 (0)					
P16.5	PWM0_22	PWM0_21_N							SG_MCK[4] (0)						
P17.0	PWM0_23	PWM0_22_N						PWM_LINE1_P[1] (0)		SCB5_CLK (0)	SCB5_RX (0)	SCB5_SDA (0) <sup>[29]</sup>			
P17.1	PWM0_24	PWM0_23_N	TC0_20_TR					PWM_LINE1_N[1] (0)		SCB5_MOSI (0)	SCB5_TX (0)	SCB5_SCL (0) <sup>[29]</sup>			
P17.2	PWM0_25	PWM0_24_N	TC0_21_TR					PWM_LINE2_P[1] (0)		SCB5_MISO (0)	SCB5_RTS (0)				
P17.3	PWM0_26	PWM0_25_N	TC0_22_TR					PWM_LINE2_N[1] (0)		SCB5_SEL0 (0)	SCB5_CTS (0)		TRIG_IN[26]		
P17.4	PWM0_27	PWM0_26_N	TC0_23_TR					PWM_MCK[1] (0)	SG_TONE[3] (0)	SCB5_SEL1 (0)			TRIG_IN[27]		
P17.5	PWM0_28	PWM0_27_N	TC0_24_TR						SG_AMPL[3] (0)						
P17.6	PWM0_29	PWM0_28_N							SG_TONE[4] (0)						
P17.7	PWM0_30	PWM0_29_N							SG_AMPL[4] (0)						
P18.0	PWM0_31	PWM0_30_N					CAN0_1_TX			SCB6_CLK (0)	SCB6_RX (0)	SCB6_SDA (0) <sup>[29]</sup>			
P18.1	PWM0_32	PWM0_31_N					CAN0_1_RX			SCB6_MOSI (0)	SCB6_TX (0)	SCB6_SCL (0) <sup>[29]</sup>			
P18.2	PWM0_33	PWM0_32_N			LIN1_TX	CXPI1_TX	CAN0_0_TX			SCB6_MISO (0)	SCB6_RTS (0)				
P18.3	PWM0_12	PWM0_23_N	TC0_20_TR		LIN1_RX	CXPI1_RX	CAN0_0_RX			SCB6_SEL0 (0)	SCB6_CTS (0)				
P18.4	PWM0_13	PWM0_12_N	TC0_21_TR		LIN1_EN	CXPI1_EN				SCB6_SEL1 (0)			TRIG_IN[28]		
P18.5	PWM0_14	PWM0_13_N											TRIG_IN[29]		
P18.6	PWM0_15	PWM0_14_N	TC0_22_TR										TRIG_IN[30]		
P18.7	PWM0_16	PWM0_15_N	TC0_23_TR										TRIG_IN[31]		
P19.0	PWM0_17	PWM0_16_N			LIN0_TX	CXPI0_TX	CAN1_1_TX			SCB6_CLK (1)	SCB6_RX (1)	SCB6_SDA (1) <sup>[29]</sup>			FAULT_OUT_0
P19.1	PWM0_18	PWM0_17_N			LIN0_RX	CXPI0_RX	CAN1_1_RX			SCB6_MOSI (1)	SCB6_TX (1)	SCB6_SCL (1) <sup>[29]</sup>			FAULT_OUT_1
P19.2	PWM0_19	PWM0_18_N	TC0_31_TR		LIN0_EN	CXPI0_EN	CAN1_0_TX			SCB6_MISO (1)	SCB6_RTS (1)				FAULT_OUT_2
P19.3	PWM0_20	PWM0_19_N	TC0_32_TR				CAN1_0_RX			SCB6_SEL0 (1)	SCB6_CTS (1)				FAULT_OUT_3



Alternate function pin assignments

**Table 13-1** Alternate pin functions in active power mode (continued) [20, 27, 28]

Name	Active Mapping														
	HCon#8 <sup>[25]</sup>	HCon#9	HCon#10	HCon#11	HCon#16	HCon#17	HCon#18	HCon#20	HCon#21	HCon#22	HCon#23	HCon#24	HCon#25	HCon#26	HCon#27
	ACT#0 <sup>[26]</sup>	ACT#1	ACT#2	ACT#3	ACT#4	ACT#5	ACT#6	ACT#8	ACT#9	ACT#10	ACT#11	ACT#12	ACT#13	ACT#14	ACT#15
P19.4	PWM0_21	PWM0_20_N	TC0_33_TR							SCB6_SEL1 (1)					
P19.5	PWM0_22	PWM0_21_N													
P19.6	PWM0_23	PWM0_22_N													

## 14 Pin function description

**Table 14-1 Pin function description**

Sl. No.	Pin	Module	Description
1	PWMx_y	TCPWM	TCPWM 16-bit PWM (no motor control), PWM_DT and PWM_PR line out, x-TCPWM block, y-counter number
2	PWMx_y_N	TCPWM	TCPWM 16-bit PWM (no motor control), PWM_DT and PWM_PR complementary line out (N), x-TCPWM block, y-counter number
3	PWMx_M_y	TCPWM	TCPWM 16-bit PWM with motor control line out, x-TCPWM block, y-counter number
4	PWMx_M_y_N	TCPWM	TCPWM 16-bit PWM with motor control complementary line out (N), x-TCPWM block, y-counter number
5	PWMx_H_y	TCPWM	TCPWM 32-bit PWM, PWM_DT and PWM_PR line out, x-TCPWM block, y-counter number
6	PWMx_H_y_N	TCPWM	TCPWM 32-bit PWM, PWM_DT and PWM_PR complementary line out (N), x-TCPWM block, y-counter number
7	TCx_y_TRz	TCPWM	TCPWM 16-bit dedicated counter input triggers, x-TCPWM block, y-counter number, z-trigger number
8	TCx_M_y_TRz	TCPWM	TCPWM 16-bit dedicated counter input triggers with motor control, x-TCPWM block, y-counter number, z-trigger number
9	TCx_H_y_TRz	TCPWM	TCPWM 32-bit dedicated counter input triggers, x-TCPWM block, y-counter number, z-trigger number
10	SCBx_RX	SCB	UART Receive, x-SCB block
11	SCBx_TX	SCB	UART Transmit, x-SCB block
12	SCBx_RTS	SCB	UART Request to Send (Handshake), x-SCB block
13	SCBx_CTS	SCB	UART Clear to Send (Handshake), x-SCB block
14	SCBx_SDA	SCB	I <sup>2</sup> C Data line, x-SCB block
15	SCBx_SCL	SCB	I <sup>2</sup> C Clock line, x-SCB block
16	SCBx_MISO	SCB	SPI Master Input Slave Output, x-SCB block
17	SCBx_MOSI	SCB	SPI Master Output Slave Input, x-SCB block
18	SCBx_CLK	SCB	SPI Serial Clock, x-SCB block
19	SCBx_SELY	SCB	SPI Slave Select, x-SCB block, y-select line
20	LINx_RX	LIN	LIN Receive line, x-LIN block
21	LINx_TX	LIN	LIN Transmit line, x-LIN block
22	LINx_EN	LIN	LIN Enable line, x-LIN block
23	CXPIx_RX	CXPI	CXPI Receive line, x-CXPI block
24	CXPIx_TX	CXPI	CXPI Transmit line, x-CXPI block
25	CXPIx_EN	CXPI	CXPI Enable line, x-CXPI block
26	CANx_y_TX	CAN FD	CAN Transmit line, x-CAN block, y-channel number
27	CANx_y_RX	CAN FD	CAN Receive line, x-CAN block, y-channel number
28	CAL_SUP_NZ	CPUSS	ETAS Calibration support line
29	FAULT_OUT_x	SRSS	Fault output line x-0 to 3
30	TRACE_DATA_x	SRSS	Trace dataout line x-0 to 3
31	TRACE_CLOCK	SRSS	Trace clock line
32	RTC_CAL	SRSS RTC	RTC calibration clock input

## Pin function description

**Table 14-1 Pin function description** (continued)

Sl. No.	Pin	Module	Description
33	SWJ_TRSTN	SRSS	JTAG Test reset line (Active low)
34	SWJ_SWO_TDO	SRSS	JTAG Test data output/SWO (Serial Wire Output)
35	SWJ_SWCLK_TCLK	SRSS	JTAG Test clock/SWD clock (Serial Wire Clock)
36	SWJ_SWDIO_TMS	SRSS	JTAG Test mode select/SWD data (Serial Wire Data Input/Output)
37	SWJ_SWDOE_TDI	SRSS	JTAG Test data input
38	HIBER-NATE_WAKEUP[x]	SRSS	Hibernate wakeup line x-0 to 1
39	ADC[x]_y	PASS SAR	SAR, channel, x-SAR number, y-channel number
40	ADC[x]_M	PASS SAR	SAR motor control input, x-SAR number
41	EXT_MUX[x]_y	PASS SAR	External SAR MUX inputs, x-MUX number, y-MUX input 0 to 2
42	EXT_MUX[x]_EN	PASS SAR	External SAR MUX enable line
43	EXT_CLK	SRSS	External clock input
44	SG_AMPL[x]	SG	Sound generator (SG) amplitude output, x-SG module number
45	SG_MCK[x]	SG	Sound generator (SG) master clock input, x-SG module number
46	SG_TONE[x]	SG	Sound generator (SG) tone output, x-SG module number
47	PWM_LINEx_N[y]	PCM PWM	Audio PWM complementary output line, x-PWM module instance
48	PWM_LINEx_P[y]	PCM PWM	Audio PWM output line, x-PWM module instance
49	PWM_MCK[x]	PCM PWM	Audio PWM master clock input, x-PWM module instance
50	TDM_RX_FSYNC[x]	TDM	TDM receive frame sync, x-TDM module number
51	TDM_RX_MCK[x]	TDM	TDM receive master clock input, x-TDM module number
52	TDM_RX_SCK[x]	TDM	TDM receive bit clock, x-TDM module number
53	TDM_RX_SD[x]	TDM	TDM receive serial data, x-TDM module number
54	TDM_TX_FSYNC[x]	TDM	TDM transmit frame sync, x-TDM module number
55	TDM_TX_MCK[x]	TDM	TDM transmit master clock input, x-TDM module number
56	TDM_TX_SCK[x]	TDM	TDM transmit bit clock, x-TDM module number
57	TDM_TX_SD[x]	TDM	TDM transmit serial data, x-TDM module number
58	SPIHB_CLK	SMIF	SMIF interface clock
59	SPIHB_RWDS	SMIF	SMIF (SPI/xSPI) read-write-data-strobe line
60	SPIHB_SELx	SMIF	SMIF (SPI/xSPI) memory select line, x-select line number
61	SPIHB_DATAx	SMIF	SMIF (SPI/xSPI) memory data read and write line, x-0 to 7 data lines
62	LCD_SEG_x	LCD	LCD segment lines x-0 to 35
63	LCD_COM_x	LCD	LCD common lines x-0 to 35
64	IO_CLK_HF[2]	SRSS	CLK_HF2 clock output

## 15 Interrupts and wake-up assignments

**Table 15-1 Peripheral interrupt assignments and wake-up sources**

Interrupt	Source	Power Mode	Description
0	cpuss_interrupts_ipc_0_IRQn	DeepSleep	CPUSS Inter Process Communication Interrupt #0
1	cpuss_interrupts_ipc_1_IRQn	DeepSleep	CPUSS Inter Process Communication Interrupt #1
2	cpuss_interrupts_ipc_2_IRQn	DeepSleep	CPUSS Inter Process Communication Interrupt #2
3	cpuss_interrupts_ipc_3_IRQn	DeepSleep	CPUSS Inter Process Communication Interrupt #3
4	cpuss_interrupts_ipc_4_IRQn	DeepSleep	CPUSS Inter Process Communication Interrupt #4
5	cpuss_interrupts_ipc_5_IRQn	DeepSleep	CPUSS Inter Process Communication Interrupt #5
6	cpuss_interrupts_ipc_6_IRQn	DeepSleep	CPUSS Inter Process Communication Interrupt #6
7	cpuss_interrupts_ipc_7_IRQn	DeepSleep	CPUSS Inter Process Communication Interrupt #7
8	cpuss_interrupts_fault_0_IRQn	DeepSleep	CPUSS Fault Structure #0 Interrupt
9	cpuss_interrupts_fault_1_IRQn	DeepSleep	CPUSS Fault Structure #1 Interrupt
10	cpuss_interrupts_fault_2_IRQn	DeepSleep	CPUSS Fault Structure #2 Interrupt
11	cpuss_interrupts_fault_3_IRQn	DeepSleep	CPUSS Fault Structure #3 Interrupt
12	srss_interrupt_backup_IRQn	DeepSleep	BACKUP domain Interrupt
13	srss_interrupt_mcwdt_0_IRQn	DeepSleep	Multi Counter Watchdog Timer #0 interrupt
14	srss_interrupt_mcwdt_1_IRQn	DeepSleep	Multi Counter Watchdog Timer #1 interrupt
17	srss_interrupt_wdt_IRQn	DeepSleep	Hardware Watchdog Timer interrupt
18	srss_interrupt_IRQn	DeepSleep	Other combined Interrupts for SRSS (LVD, CLK_CAL)
19	evtgen_0_interrupt_dpslp_IRQn	DeepSleep	Event generator timer DeepSleep domain interrupt
20	scb_0_interrupt_IRQn	DeepSleep	Serial Communication Block#0 (DeepSleep capable)
22	ioss_interrupt_vdd_IRQn	DeepSleep	I/O Supply ( $V_{DDIO}$ , $V_{DDA\_ADC}$ , $V_{DDD}$ ) state change Interrupt
23	ioss_interrupt_gpio_dpslp_IRQn	DeepSleep	Consolidated interrupt for DeepSleep ports
24	ioss_interrupts_gpio_0_IRQn	DeepSleep	GPIO_STD Port #0 Interrupt
25	ioss_interrupts_gpio_1_IRQn	DeepSleep	GPIO_STD Port #1 Interrupt
26	ioss_interrupts_gpio_2_IRQn	DeepSleep	GPIO_STD Port #2 Interrupt
27	ioss_interrupts_gpio_3_IRQn	DeepSleep	GPIO_STD Port #3 Interrupt
28	ioss_interrupts_gpio_4_IRQn	DeepSleep	GPIO_STD Port #4 Interrupt
29	ioss_interrupts_gpio_5_IRQn	DeepSleep	GPIO_SMC Port #5 Interrupt
30	ioss_interrupts_gpio_6_IRQn	DeepSleep	GPIO_SMC Port #6 Interrupt
31	ioss_interrupts_gpio_7_IRQn	DeepSleep	GPIO_SMC Port #7 Interrupt
34	ioss_interrupts_gpio_10_IRQn	DeepSleep	GPIO_STD Port #10 Interrupt
35	ioss_interrupts_gpio_11_IRQn	DeepSleep	GPIO_STD Port #11 Interrupt
36	ioss_interrupts_gpio_12_IRQn	DeepSleep	GPIO_STD Port #12 Interrupt
37	ioss_interrupts_gpio_13_IRQn	DeepSleep	GPIO_STD Port #13 Interrupt
38	ioss_interrupts_gpio_14_IRQn	DeepSleep	GPIO_ENH Port #14 Interrupt
39	ioss_interrupts_gpio_15_IRQn	DeepSleep	GPIO_STD Port #15 Interrupt
40	ioss_interrupts_gpio_16_IRQn	DeepSleep	GPIO_STD Port #16 Interrupt
41	ioss_interrupts_gpio_17_IRQn	DeepSleep	GPIO_STD Port #17 Interrupt
42	ioss_interrupts_gpio_18_IRQn	DeepSleep	GPIO_STD Port #18 Interrupt
43	ioss_interrupts_gpio_19_IRQn	DeepSleep	GPIO_STD Port #19 Interrupt
50	ioss_interrupt_gpio_act_IRQn	Active	Consolidated interrupt for active I/O ports
52	ioss_interrupts_gpio_8_IRQn	Active	HSIO_STDLN Port #8 Interrupt
53	ioss_interrupts_gpio_9_IRQn	Active	HSIO_STDLN Port #9 Interrupt



## Interrupts and wake-up assignments

**Table 15-1 Peripheral interrupt assignments and wake-up sources** (continued)

Interrupt	Source	Power Mode	Description
70	cpuss_interrupt_crypto_IRQn	Active	Crypto Accelerator Interrupt
71	cpuss_interrupt_fm_IRQn	Active	FLASH Macro Interrupt
72	cpuss_interrupts_cm4_fp_IRQn	Active	CM4 Floating Point operation fault
74	cpuss_interrupts_cm0_cti_0_IRQn	Active	CM0+ CTI (Cross Trigger Interface) #0
75	cpuss_interrupts_cm0_cti_1_IRQn	Active	CM0+ CTI#1
76	cpuss_interrupts_cm4_cti_0_IRQn	Active	CM4 CTI#0
77	cpuss_interrupts_cm4_cti_1_IRQn	Active	CM4 CTI#1
80	evtgen_0_interrupt_IRQn	Active	Event Generator Active domain interrupt
81	smif_0_interrupt_IRQn	Active	SMIF#0 Interrupt
86	canfd_0_interrupt0_IRQn	Active	CAN#0, Consolidated Interrupt #0 for all three channels
87	canfd_0_interrupt1_IRQn	Active	CAN#0, Consolidated Interrupt #1 for all three channels
88	canfd_1_interrupt0_IRQn	Active	CAN#1, Consolidated Interrupt #0 for all three channels
89	canfd_1_interrupt1_IRQn	Active	CAN#1, Consolidated Interrupt #1 for all three channels
90	canfd_0_interrupts0_0_IRQn	Active	CAN#0, Interrupt #0, Channel #0
91	canfd_0_interrupts0_1_IRQn	Active	CAN#0, Interrupt #0, Channel #1
96	canfd_0_interrupts1_0_IRQn	Active	CAN#0, Interrupt #1, Channel #0
97	canfd_0_interrupts1_1_IRQn	Active	CAN#0, Interrupt #1, Channel #1
102	canfd_1_interrupts0_0_IRQn	Active	CAN#1, Interrupt #0, Channel #0
103	canfd_1_interrupts0_1_IRQn	Active	CAN#1, Interrupt #0, Channel #1
108	canfd_1_interrupts1_0_IRQn	Active	CAN#1, Interrupt #1, Channel #0
109	canfd_1_interrupts1_1_IRQn	Active	CAN#1, Interrupt #1, Channel #1
114	lin_0_interrupts_0_IRQn	Active	LIN#0, Channel #0 Interrupt
115	lin_0_interrupts_1_IRQn	Active	LIN#0, Channel #1 Interrupt
130	cxpi_0_interrupts_0_IRQn	Active	CXPI#0 Channel #0 Interrupt
131	cxpi_0_interrupts_1_IRQn	Active	CXPI#0 Channel #1 Interrupt
135	scb_1_interrupt_IRQn	Active	SCB#1 Interrupt
136	scb_2_interrupt_IRQn	Active	SCB#2 Interrupt
137	scb_3_interrupt_IRQn	Active	SCB#3 Interrupt
138	scb_4_interrupt_IRQn	Active	SCB#4 Interrupt
139	scb_5_interrupt_IRQn	Active	SCB#5 Interrupt
140	scb_6_interrupt_IRQn	Active	SCB#6 Interrupt
141	scb_7_interrupt_IRQn	Active	SCB#7 Interrupt
142	scb_8_interrupt_IRQn	Active	SCB#8 Interrupt
143	scb_9_interrupt_IRQn	Active	SCB#9 Interrupt
144	scb_10_interrupt_IRQn	Active	SCB#10 Interrupt
145	scb_11_interrupt_IRQn	Active	SCB#11 Interrupt
160	pass_0_interrupts_sar_0_IRQn	Active	SAR#0, Logical Channel#0 Interrupt
161	pass_0_interrupts_sar_1_IRQn	Active	SAR#0, Logical Channel#1 Interrupt
162	pass_0_interrupts_sar_2_IRQn	Active	SAR#0, Logical Channel#2 Interrupt
163	pass_0_interrupts_sar_3_IRQn	Active	SAR#0, Logical Channel#3 Interrupt
164	pass_0_interrupts_sar_4_IRQn	Active	SAR#0, Logical Channel#4 Interrupt
165	pass_0_interrupts_sar_5_IRQn	Active	SAR#0, Logical Channel#5 Interrupt
166	pass_0_interrupts_sar_6_IRQn	Active	SAR#0, Logical Channel#6 Interrupt
167	pass_0_interrupts_sar_7_IRQn	Active	SAR#0, Logical Channel#7 Interrupt

## Interrupts and wake-up assignments

**Table 15-1 Peripheral interrupt assignments and wake-up sources** (continued)

Interrupt	Source	Power Mode	Description
168	pass_0_interrupts_sar_8_IRQn	Active	SAR#0, Logical Channel#8 Interrupt
169	pass_0_interrupts_sar_9_IRQn	Active	SAR#0, Logical Channel#9 Interrupt
170	pass_0_interrupts_sar_10_IRQn	Active	SAR#0, Logical Channel#10 Interrupt
171	pass_0_interrupts_sar_11_IRQn	Active	SAR#0, Logical Channel#11 Interrupt
172	pass_0_interrupts_sar_12_IRQn	Active	SAR#0, Logical Channel#12 Interrupt
173	pass_0_interrupts_sar_13_IRQn	Active	SAR#0, Logical Channel#13 Interrupt
174	pass_0_interrupts_sar_14_IRQn	Active	SAR#0, Logical Channel#14 Interrupt
175	pass_0_interrupts_sar_15_IRQn	Active	SAR#0, Logical Channel#15 Interrupt
176	pass_0_interrupts_sar_16_IRQn	Active	SAR#0, Logical Channel#16 Interrupt
177	pass_0_interrupts_sar_17_IRQn	Active	SAR#0, Logical Channel#17 Interrupt
178	pass_0_interrupts_sar_18_IRQn	Active	SAR#0, Logical Channel#18 Interrupt
179	pass_0_interrupts_sar_19_IRQn	Active	SAR#0, Logical Channel#19 Interrupt
180	pass_0_interrupts_sar_20_IRQn	Active	SAR#0, Logical Channel#20 Interrupt
181	pass_0_interrupts_sar_21_IRQn	Active	SAR#0, Logical Channel#21 Interrupt
182	pass_0_interrupts_sar_22_IRQn	Active	SAR#0, Logical Channel#22 Interrupt
183	pass_0_interrupts_sar_23_IRQn	Active	SAR#0, Logical Channel#23 Interrupt
184	pass_0_interrupts_sar_24_IRQn	Active	SAR#0, Logical Channel#24 Interrupt
185	pass_0_interrupts_sar_25_IRQn	Active	SAR#0, Logical Channel#25 Interrupt
186	pass_0_interrupts_sar_26_IRQn	Active	SAR#0, Logical Channel#26 Interrupt
187	pass_0_interrupts_sar_27_IRQn	Active	SAR#0, Logical Channel#27 Interrupt
188	pass_0_interrupts_sar_28_IRQn	Active	SAR#0, Logical Channel#28 Interrupt
189	pass_0_interrupts_sar_29_IRQn	Active	SAR#0, Logical Channel#29 Interrupt
190	pass_0_interrupts_sar_30_IRQn	Active	SAR#0, Logical Channel#30 Interrupt
191	pass_0_interrupts_sar_31_IRQn	Active	SAR#0, Logical Channel#31 Interrupt
288	cpuss_interrupts_dmac_0_IRQn	Active	CPUSS M-DMA#0, Channel#0 Interrupt
289	cpuss_interrupts_dmac_1_IRQn	Active	CPUSS M-DMA#0, Channel#1 Interrupt
290	cpuss_interrupts_dmac_2_IRQn	Active	CPUSS M-DMA#0, Channel#2 Interrupt
291	cpuss_interrupts_dmac_3_IRQn	Active	CPUSS M-DMA#0, Channel#3 Interrupt
296	cpuss_interrupts_dw0_0_IRQn	Active	CPUSS P-DMA#0, Channel#0 Interrupt
297	cpuss_interrupts_dw0_1_IRQn	Active	CPUSS P-DMA#0, Channel#1 Interrupt
298	cpuss_interrupts_dw0_2_IRQn	Active	CPUSS P-DMA#0, Channel#2 Interrupt
299	cpuss_interrupts_dw0_3_IRQn	Active	CPUSS P-DMA#0, Channel#3 Interrupt
300	cpuss_interrupts_dw0_4_IRQn	Active	CPUSS P-DMA#0, Channel#4 Interrupt
301	cpuss_interrupts_dw0_5_IRQn	Active	CPUSS P-DMA#0, Channel#5 Interrupt
302	cpuss_interrupts_dw0_6_IRQn	Active	CPUSS P-DMA#0, Channel#6 Interrupt
303	cpuss_interrupts_dw0_7_IRQn	Active	CPUSS P-DMA#0, Channel#7 Interrupt
304	cpuss_interrupts_dw0_8_IRQn	Active	CPUSS P-DMA#0, Channel#8 Interrupt
305	cpuss_interrupts_dw0_9_IRQn	Active	CPUSS P-DMA#0, Channel#9 Interrupt
306	cpuss_interrupts_dw0_10_IRQn	Active	CPUSS P-DMA#0, Channel#10 Interrupt
307	cpuss_interrupts_dw0_11_IRQn	Active	CPUSS P-DMA#0, Channel#11 Interrupt
308	cpuss_interrupts_dw0_12_IRQn	Active	CPUSS P-DMA#0, Channel#12 Interrupt
309	cpuss_interrupts_dw0_13_IRQn	Active	CPUSS P-DMA#0, Channel#13 Interrupt
310	cpuss_interrupts_dw0_14_IRQn	Active	CPUSS P-DMA#0, Channel#14 Interrupt
311	cpuss_interrupts_dw0_15_IRQn	Active	CPUSS P-DMA#0, Channel#15 Interrupt

**Table 15-1 Peripheral interrupt assignments and wake-up sources** (continued)

Interrupt	Source	Power Mode	Description
312	cpuss_interrupts_dw0_16_IRQn	Active	CPUSS P-DMA#0, Channel#16 Interrupt
313	cpuss_interrupts_dw0_17_IRQn	Active	CPUSS P-DMA#0, Channel#17 Interrupt
314	cpuss_interrupts_dw0_18_IRQn	Active	CPUSS P-DMA#0, Channel#18 Interrupt
315	cpuss_interrupts_dw0_19_IRQn	Active	CPUSS P-DMA#0, Channel#19 Interrupt
316	cpuss_interrupts_dw0_20_IRQn	Active	CPUSS P-DMA#0, Channel#20 Interrupt
317	cpuss_interrupts_dw0_21_IRQn	Active	CPUSS P-DMA#0, Channel#21 Interrupt
318	cpuss_interrupts_dw0_22_IRQn	Active	CPUSS P-DMA#0, Channel#22 Interrupt
319	cpuss_interrupts_dw0_23_IRQn	Active	CPUSS P-DMA#0, Channel#23 Interrupt
320	cpuss_interrupts_dw0_24_IRQn	Active	CPUSS P-DMA#0, Channel#24 Interrupt
321	cpuss_interrupts_dw0_25_IRQn	Active	CPUSS P-DMA#0, Channel#25 Interrupt
322	cpuss_interrupts_dw0_26_IRQn	Active	CPUSS P-DMA#0, Channel#26 Interrupt
323	cpuss_interrupts_dw0_27_IRQn	Active	CPUSS P-DMA#0, Channel#27 Interrupt
324	cpuss_interrupts_dw0_28_IRQn	Active	CPUSS P-DMA#0, Channel#28 Interrupt
325	cpuss_interrupts_dw0_29_IRQn	Active	CPUSS P-DMA#0, Channel#29 Interrupt
326	cpuss_interrupts_dw0_30_IRQn	Active	CPUSS P-DMA#0, Channel#30 Interrupt
327	cpuss_interrupts_dw0_31_IRQn	Active	CPUSS P-DMA#0, Channel#31 Interrupt
328	cpuss_interrupts_dw0_32_IRQn	Active	CPUSS P-DMA#0, Channel#32 Interrupt
329	cpuss_interrupts_dw0_33_IRQn	Active	CPUSS P-DMA#0, Channel#33 Interrupt
330	cpuss_interrupts_dw0_34_IRQn	Active	CPUSS P-DMA#0, Channel#34 Interrupt
331	cpuss_interrupts_dw0_35_IRQn	Active	CPUSS P-DMA#0, Channel#35 Interrupt
332	cpuss_interrupts_dw0_36_IRQn	Active	CPUSS P-DMA#0, Channel#36 Interrupt
333	cpuss_interrupts_dw0_37_IRQn	Active	CPUSS P-DMA#0, Channel#37 Interrupt
334	cpuss_interrupts_dw0_38_IRQn	Active	CPUSS P-DMA#0, Channel#38 Interrupt
335	cpuss_interrupts_dw0_39_IRQn	Active	CPUSS P-DMA#0, Channel#39 Interrupt
336	cpuss_interrupts_dw0_40_IRQn	Active	CPUSS P-DMA#0, Channel#40 Interrupt
337	cpuss_interrupts_dw0_41_IRQn	Active	CPUSS P-DMA#0, Channel#41 Interrupt
338	cpuss_interrupts_dw0_42_IRQn	Active	CPUSS P-DMA#0, Channel#42 Interrupt
339	cpuss_interrupts_dw0_43_IRQn	Active	CPUSS P-DMA#0, Channel#43 Interrupt
340	cpuss_interrupts_dw0_44_IRQn	Active	CPUSS P-DMA#0, Channel#44 Interrupt
341	cpuss_interrupts_dw0_45_IRQn	Active	CPUSS P-DMA#0, Channel#45 Interrupt
342	cpuss_interrupts_dw0_46_IRQn	Active	CPUSS P-DMA#0, Channel#46 Interrupt
343	cpuss_interrupts_dw0_47_IRQn	Active	CPUSS P-DMA#0, Channel#47 Interrupt
344	cpuss_interrupts_dw0_48_IRQn	Active	CPUSS P-DMA#0, Channel#48 Interrupt
345	cpuss_interrupts_dw0_49_IRQn	Active	CPUSS P-DMA#0, Channel#49 Interrupt
346	cpuss_interrupts_dw0_50_IRQn	Active	CPUSS P-DMA#0, Channel#50 Interrupt
347	cpuss_interrupts_dw0_51_IRQn	Active	CPUSS P-DMA#0, Channel#51 Interrupt
348	cpuss_interrupts_dw0_52_IRQn	Active	CPUSS P-DMA#0, Channel#52 Interrupt
349	cpuss_interrupts_dw0_53_IRQn	Active	CPUSS P-DMA#0, Channel#53 Interrupt
350	cpuss_interrupts_dw0_54_IRQn	Active	CPUSS P-DMA#0, Channel#54 Interrupt
351	cpuss_interrupts_dw0_55_IRQn	Active	CPUSS P-DMA#0, Channel#55 Interrupt
352	cpuss_interrupts_dw0_56_IRQn	Active	CPUSS P-DMA#0, Channel#56 Interrupt
353	cpuss_interrupts_dw0_57_IRQn	Active	CPUSS P-DMA#0, Channel#57 Interrupt
354	cpuss_interrupts_dw0_58_IRQn	Active	CPUSS P-DMA#0, Channel#58 Interrupt
355	cpuss_interrupts_dw0_59_IRQn	Active	CPUSS P-DMA#0, Channel#59 Interrupt

Interrupts and wake-up assignments

**Table 15-1 Peripheral interrupt assignments and wake-up sources** (continued)

Interrupt	Source	Power Mode	Description
356	cpuss_interrupts_dw0_60_IRQn	Active	CPUSS P-DMA#0, Channel#60 Interrupt
357	cpuss_interrupts_dw0_61_IRQn	Active	CPUSS P-DMA#0, Channel#61 Interrupt
358	cpuss_interrupts_dw0_62_IRQn	Active	CPUSS P-DMA#0, Channel#62 Interrupt
359	cpuss_interrupts_dw0_63_IRQn	Active	CPUSS P-DMA#0, Channel#63 Interrupt
360	cpuss_interrupts_dw0_64_IRQn	Active	CPUSS P-DMA#0, Channel#64 Interrupt
361	cpuss_interrupts_dw0_65_IRQn	Active	CPUSS P-DMA#0, Channel#65 Interrupt
362	cpuss_interrupts_dw0_66_IRQn	Active	CPUSS P-DMA#0, Channel#66 Interrupt
363	cpuss_interrupts_dw0_67_IRQn	Active	CPUSS P-DMA#0, Channel#67 Interrupt
364	cpuss_interrupts_dw0_68_IRQn	Active	CPUSS P-DMA#0, Channel#68 Interrupt
365	cpuss_interrupts_dw0_69_IRQn	Active	CPUSS P-DMA#0, Channel#69 Interrupt
366	cpuss_interrupts_dw0_70_IRQn	Active	CPUSS P-DMA#0, Channel#70 Interrupt
367	cpuss_interrupts_dw0_71_IRQn	Active	CPUSS P-DMA#0, Channel#71 Interrupt
368	cpuss_interrupts_dw0_72_IRQn	Active	CPUSS P-DMA#0, Channel#72 Interrupt
369	cpuss_interrupts_dw0_73_IRQn	Active	CPUSS P-DMA#0, Channel#73 Interrupt
370	cpuss_interrupts_dw0_74_IRQn	Active	CPUSS P-DMA#0, Channel#74 Interrupt
371	cpuss_interrupts_dw0_75_IRQn	Active	CPUSS P-DMA#0, Channel#75 Interrupt
424	cpuss_interrupts_dw1_0_IRQn	Active	CPUSS P-DMA#1, Channel#0 Interrupt
425	cpuss_interrupts_dw1_1_IRQn	Active	CPUSS P-DMA#1, Channel#1 Interrupt
426	cpuss_interrupts_dw1_2_IRQn	Active	CPUSS P-DMA#1, Channel#2 Interrupt
427	cpuss_interrupts_dw1_3_IRQn	Active	CPUSS P-DMA#1, Channel#3 Interrupt
428	cpuss_interrupts_dw1_4_IRQn	Active	CPUSS P-DMA#1, Channel#4 Interrupt
429	cpuss_interrupts_dw1_5_IRQn	Active	CPUSS P-DMA#1, Channel#5 Interrupt
430	cpuss_interrupts_dw1_6_IRQn	Active	CPUSS P-DMA#1, Channel#6 Interrupt
431	cpuss_interrupts_dw1_7_IRQn	Active	CPUSS P-DMA#1, Channel#7 Interrupt
432	cpuss_interrupts_dw1_8_IRQn	Active	CPUSS P-DMA#1, Channel#8 Interrupt
433	cpuss_interrupts_dw1_9_IRQn	Active	CPUSS P-DMA#1, Channel#9 Interrupt
434	cpuss_interrupts_dw1_10_IRQn	Active	CPUSS P-DMA#1, Channel#10 Interrupt
435	cpuss_interrupts_dw1_11_IRQn	Active	CPUSS P-DMA#1, Channel#11 Interrupt
436	cpuss_interrupts_dw1_12_IRQn	Active	CPUSS P-DMA#1, Channel#12 Interrupt
437	cpuss_interrupts_dw1_13_IRQn	Active	CPUSS P-DMA#1, Channel#13 Interrupt
438	cpuss_interrupts_dw1_14_IRQn	Active	CPUSS P-DMA#1, Channel#14 Interrupt
439	cpuss_interrupts_dw1_15_IRQn	Active	CPUSS P-DMA#1, Channel#15 Interrupt
440	cpuss_interrupts_dw1_16_IRQn	Active	CPUSS P-DMA#1, Channel#16 Interrupt
441	cpuss_interrupts_dw1_17_IRQn	Active	CPUSS P-DMA#1, Channel#17 Interrupt
442	cpuss_interrupts_dw1_18_IRQn	Active	CPUSS P-DMA#1, Channel#18 Interrupt
443	cpuss_interrupts_dw1_19_IRQn	Active	CPUSS P-DMA#1, Channel#19 Interrupt
444	cpuss_interrupts_dw1_20_IRQn	Active	CPUSS P-DMA#1, Channel#20 Interrupt
445	cpuss_interrupts_dw1_21_IRQn	Active	CPUSS P-DMA#1, Channel#21 Interrupt
446	cpuss_interrupts_dw1_22_IRQn	Active	CPUSS P-DMA#1, Channel#22 Interrupt
447	cpuss_interrupts_dw1_23_IRQn	Active	CPUSS P-DMA#1, Channel#23 Interrupt
448	cpuss_interrupts_dw1_24_IRQn	Active	CPUSS P-DMA#1, Channel#24 Interrupt
449	cpuss_interrupts_dw1_25_IRQn	Active	CPUSS P-DMA#1, Channel#25 Interrupt
450	cpuss_interrupts_dw1_26_IRQn	Active	CPUSS P-DMA#1, Channel#26 Interrupt
451	cpuss_interrupts_dw1_27_IRQn	Active	CPUSS P-DMA#1, Channel#27 Interrupt

## Interrupts and wake-up assignments

**Table 15-1 Peripheral interrupt assignments and wake-up sources** (continued)

Interrupt	Source	Power Mode	Description
452	cpuss_interrupts_dw1_28_IRQn	Active	CPUSS P-DMA#1, Channel#28 Interrupt
453	cpuss_interrupts_dw1_29_IRQn	Active	CPUSS P-DMA#1, Channel#29 Interrupt
454	cpuss_interrupts_dw1_30_IRQn	Active	CPUSS P-DMA#1, Channel#30 Interrupt
455	cpuss_interrupts_dw1_31_IRQn	Active	CPUSS P-DMA#1, Channel#31 Interrupt
456	cpuss_interrupts_dw1_32_IRQn	Active	CPUSS P-DMA#1, Channel#32 Interrupt
457	cpuss_interrupts_dw1_33_IRQn	Active	CPUSS P-DMA#1, Channel#33 Interrupt
458	cpuss_interrupts_dw1_34_IRQn	Active	CPUSS P-DMA#1, Channel#34 Interrupt
459	cpuss_interrupts_dw1_35_IRQn	Active	CPUSS P-DMA#1, Channel#35 Interrupt
460	cpuss_interrupts_dw1_36_IRQn	Active	CPUSS P-DMA#1, Channel#36 Interrupt
461	cpuss_interrupts_dw1_37_IRQn	Active	CPUSS P-DMA#1, Channel#37 Interrupt
462	cpuss_interrupts_dw1_38_IRQn	Active	CPUSS P-DMA#1, Channel#38 Interrupt
463	cpuss_interrupts_dw1_39_IRQn	Active	CPUSS P-DMA#1, Channel#39 Interrupt
464	cpuss_interrupts_dw1_40_IRQn	Active	CPUSS P-DMA#1, Channel#40 Interrupt
465	cpuss_interrupts_dw1_41_IRQn	Active	CPUSS P-DMA#1, Channel#41 Interrupt
466	cpuss_interrupts_dw1_42_IRQn	Active	CPUSS P-DMA#1, Channel#42 Interrupt
467	cpuss_interrupts_dw1_43_IRQn	Active	CPUSS P-DMA#1, Channel#43 Interrupt
468	cpuss_interrupts_dw1_44_IRQn	Active	CPUSS P-DMA#1, Channel#44 Interrupt
469	cpuss_interrupts_dw1_45_IRQn	Active	CPUSS P-DMA#1, Channel#45 Interrupt
470	cpuss_interrupts_dw1_46_IRQn	Active	CPUSS P-DMA#1, Channel#46 Interrupt
471	cpuss_interrupts_dw1_47_IRQn	Active	CPUSS P-DMA#1, Channel#47 Interrupt
472	cpuss_interrupts_dw1_48_IRQn	Active	CPUSS P-DMA#1, Channel#48 Interrupt
473	cpuss_interrupts_dw1_49_IRQn	Active	CPUSS P-DMA#1, Channel#49 Interrupt
474	cpuss_interrupts_dw1_50_IRQn	Active	CPUSS P-DMA#1, Channel#50 Interrupt
475	cpuss_interrupts_dw1_51_IRQn	Active	CPUSS P-DMA#1, Channel#51 Interrupt
476	cpuss_interrupts_dw1_52_IRQn	Active	CPUSS P-DMA#1, Channel#52 Interrupt
477	cpuss_interrupts_dw1_53_IRQn	Active	CPUSS P-DMA#1, Channel#53 Interrupt
478	cpuss_interrupts_dw1_54_IRQn	Active	CPUSS P-DMA#1, Channel#54 Interrupt
479	cpuss_interrupts_dw1_55_IRQn	Active	CPUSS P-DMA#1, Channel#55 Interrupt
480	cpuss_interrupts_dw1_56_IRQn	Active	CPUSS P-DMA#1, Channel#56 Interrupt
481	cpuss_interrupts_dw1_57_IRQn	Active	CPUSS P-DMA#1, Channel#57 Interrupt
482	cpuss_interrupts_dw1_58_IRQn	Active	CPUSS P-DMA#1, Channel#58 Interrupt
483	cpuss_interrupts_dw1_59_IRQn	Active	CPUSS P-DMA#1, Channel#59 Interrupt
484	cpuss_interrupts_dw1_60_IRQn	Active	CPUSS P-DMA#1, Channel#60 Interrupt
485	cpuss_interrupts_dw1_61_IRQn	Active	CPUSS P-DMA#1, Channel#61 Interrupt
486	cpuss_interrupts_dw1_62_IRQn	Active	CPUSS P-DMA#1, Channel#62 Interrupt
487	cpuss_interrupts_dw1_63_IRQn	Active	CPUSS P-DMA#1, Channel#63 Interrupt
488	cpuss_interrupts_dw1_64_IRQn	Active	CPUSS P-DMA#1, Channel#64 Interrupt
489	cpuss_interrupts_dw1_65_IRQn	Active	CPUSS P-DMA#1, Channel#65 Interrupt
490	cpuss_interrupts_dw1_66_IRQn	Active	CPUSS P-DMA#1, Channel#66 Interrupt
491	cpuss_interrupts_dw1_67_IRQn	Active	CPUSS P-DMA#1, Channel#67 Interrupt
492	cpuss_interrupts_dw1_68_IRQn	Active	CPUSS P-DMA#1, Channel#68 Interrupt
493	cpuss_interrupts_dw1_69_IRQn	Active	CPUSS P-DMA#1, Channel#69 Interrupt
494	cpuss_interrupts_dw1_70_IRQn	Active	CPUSS P-DMA#1, Channel#70 Interrupt
495	cpuss_interrupts_dw1_71_IRQn	Active	CPUSS P-DMA#1, Channel#71 Interrupt

Interrupts and wake-up assignments

**Table 15-1 Peripheral interrupt assignments and wake-up sources** (continued)

Interrupt	Source	Power Mode	Description
496	cpuss_interrupts_dw1_72_IRQn	Active	CPUSS P-DMA#1, Channel#72 Interrupt
497	cpuss_interrupts_dw1_73_IRQn	Active	CPUSS P-DMA#1, Channel#73 Interrupt
498	cpuss_interrupts_dw1_74_IRQn	Active	CPUSS P-DMA#1, Channel#74 Interrupt
499	cpuss_interrupts_dw1_75_IRQn	Active	CPUSS P-DMA#1, Channel#75 Interrupt
500	cpuss_interrupts_dw1_76_IRQn	Active	CPUSS P-DMA#1, Channel#76 Interrupt
501	cpuss_interrupts_dw1_77_IRQn	Active	CPUSS P-DMA#1, Channel#77 Interrupt
502	cpuss_interrupts_dw1_78_IRQn	Active	CPUSS P-DMA#1, Channel#78 Interrupt
503	cpuss_interrupts_dw1_79_IRQn	Active	CPUSS P-DMA#1, Channel#79 Interrupt
504	cpuss_interrupts_dw1_80_IRQn	Active	CPUSS P-DMA#1, Channel#80 Interrupt
505	cpuss_interrupts_dw1_81_IRQn	Active	CPUSS P-DMA#1, Channel#81 Interrupt
506	cpuss_interrupts_dw1_82_IRQn	Active	CPUSS P-DMA#1, Channel#82 Interrupt
507	cpuss_interrupts_dw1_83_IRQn	Active	CPUSS P-DMA#1, Channel#83 Interrupt
552	tcpwm_0_interrupts_0_IRQn	Active	TCPWM0 Group#0, Counter#0 Interrupt
553	tcpwm_0_interrupts_1_IRQn	Active	TCPWM0 Group#0, Counter#1 Interrupt
554	tcpwm_0_interrupts_2_IRQn	Active	TCPWM0 Group#0, Counter#2 Interrupt
555	tcpwm_0_interrupts_3_IRQn	Active	TCPWM0 Group#0, Counter#3 Interrupt
556	tcpwm_0_interrupts_4_IRQn	Active	TCPWM0 Group#0, Counter#4 Interrupt
557	tcpwm_0_interrupts_5_IRQn	Active	TCPWM0 Group#0, Counter#5 Interrupt
558	tcpwm_0_interrupts_6_IRQn	Active	TCPWM0 Group#0, Counter#6 Interrupt
559	tcpwm_0_interrupts_7_IRQn	Active	TCPWM0 Group#0, Counter#7 Interrupt
560	tcpwm_0_interrupts_8_IRQn	Active	TCPWM0 Group#0, Counter#8 Interrupt
561	tcpwm_0_interrupts_9_IRQn	Active	TCPWM0 Group#0, Counter#9 Interrupt
562	tcpwm_0_interrupts_10_IRQn	Active	TCPWM0 Group#0, Counter#10 Interrupt
563	tcpwm_0_interrupts_11_IRQn	Active	TCPWM0 Group#0, Counter#11 Interrupt
564	tcpwm_0_interrupts_12_IRQn	Active	TCPWM0 Group#0, Counter#12 Interrupt
565	tcpwm_0_interrupts_13_IRQn	Active	TCPWM0 Group#0, Counter#13 Interrupt
566	tcpwm_0_interrupts_14_IRQn	Active	TCPWM0 Group#0, Counter#14 Interrupt
567	tcpwm_0_interrupts_15_IRQn	Active	TCPWM0 Group#0, Counter#15 Interrupt
568	tcpwm_0_interrupts_16_IRQn	Active	TCPWM0 Group#0, Counter#16 Interrupt
569	tcpwm_0_interrupts_17_IRQn	Active	TCPWM0 Group#0, Counter#17 Interrupt
570	tcpwm_0_interrupts_18_IRQn	Active	TCPWM0 Group#0, Counter#18 Interrupt
571	tcpwm_0_interrupts_19_IRQn	Active	TCPWM0 Group#0, Counter#19 Interrupt
572	tcpwm_0_interrupts_20_IRQn	Active	TCPWM0 Group#0, Counter#20 Interrupt
573	tcpwm_0_interrupts_21_IRQn	Active	TCPWM0 Group#0, Counter#21 Interrupt
574	tcpwm_0_interrupts_22_IRQn	Active	TCPWM0 Group#0, Counter#22 Interrupt
575	tcpwm_0_interrupts_23_IRQn	Active	TCPWM0 Group#0, Counter#23 Interrupt
576	tcpwm_0_interrupts_24_IRQn	Active	TCPWM0 Group#0, Counter#24 Interrupt
577	tcpwm_0_interrupts_25_IRQn	Active	TCPWM0 Group#0, Counter#25 Interrupt
578	tcpwm_0_interrupts_26_IRQn	Active	TCPWM0 Group#0, Counter#26 Interrupt
579	tcpwm_0_interrupts_27_IRQn	Active	TCPWM0 Group#0, Counter#27 Interrupt
580	tcpwm_0_interrupts_28_IRQn	Active	TCPWM0 Group#0, Counter#28 Interrupt
581	tcpwm_0_interrupts_29_IRQn	Active	TCPWM0 Group#0, Counter#29 Interrupt
582	tcpwm_0_interrupts_30_IRQn	Active	TCPWM0 Group#0, Counter#30 Interrupt
583	tcpwm_0_interrupts_31_IRQn	Active	TCPWM0 Group#0, Counter#31 Interrupt

## Interrupts and wake-up assignments

**Table 15-1 Peripheral interrupt assignments and wake-up sources** *(continued)*

Interrupt	Source	Power Mode	Description
584	tcpwm_0_interrupts_32_IRQn	Active	TCPWM0 Group#0, Counter#32 Interrupt
585	tcpwm_0_interrupts_33_IRQn	Active	TCPWM0 Group#0, Counter#33 Interrupt
616	tcpwm_0_interrupts_256_IRQn	Active	TCPWM0 Group#1, Counter#0 Interrupt
617	tcpwm_0_interrupts_257_IRQn	Active	TCPWM0 Group#1, Counter#1 Interrupt
618	tcpwm_0_interrupts_258_IRQn	Active	TCPWM0 Group#1, Counter#2 Interrupt
619	tcpwm_0_interrupts_259_IRQn	Active	TCPWM0 Group#1, Counter#3 Interrupt
620	tcpwm_0_interrupts_260_IRQn	Active	TCPWM0 Group#1, Counter#4 Interrupt
621	tcpwm_0_interrupts_261_IRQn	Active	TCPWM0 Group#1, Counter#5 Interrupt
622	tcpwm_0_interrupts_262_IRQn	Active	TCPWM0 Group#1, Counter#6 Interrupt
623	tcpwm_0_interrupts_263_IRQn	Active	TCPWM0 Group#1, Counter#7 Interrupt
624	tcpwm_0_interrupts_264_IRQn	Active	TCPWM0 Group#1, Counter#8 Interrupt
625	tcpwm_0_interrupts_265_IRQn	Active	TCPWM0 Group#1, Counter#9 Interrupt
626	tcpwm_0_interrupts_266_IRQn	Active	TCPWM0 Group#1, Counter#10 Interrupt
627	tcpwm_0_interrupts_267_IRQn	Active	TCPWM0 Group#1, Counter#11 Interrupt
680	tcpwm_0_interrupts_512_IRQn	Active	TCPWM0 Group#2, Counter#0 Interrupt
681	tcpwm_0_interrupts_513_IRQn	Active	TCPWM0 Group#2, Counter#1 Interrupt
682	tcpwm_0_interrupts_514_IRQn	Active	TCPWM0 Group#2, Counter#2 Interrupt
683	tcpwm_0_interrupts_515_IRQn	Active	TCPWM0 Group#2, Counter#3 Interrupt
684	tcpwm_0_interrupts_516_IRQn	Active	TCPWM0 Group#2, Counter#4 Interrupt
685	tcpwm_0_interrupts_517_IRQn	Active	TCPWM0 Group#2, Counter#5 Interrupt
686	tcpwm_0_interrupts_518_IRQn	Active	TCPWM0 Group#2, Counter#6 Interrupt
687	tcpwm_0_interrupts_519_IRQn	Active	TCPWM0 Group#2, Counter#7 Interrupt
688	tcpwm_0_interrupts_520_IRQn	Active	TCPWM0 Group#2, Counter#8 Interrupt
689	tcpwm_0_interrupts_521_IRQn	Active	TCPWM0 Group#2, Counter#9 Interrupt
690	tcpwm_0_interrupts_522_IRQn	Active	TCPWM0 Group#2, Counter#10 Interrupt
691	tcpwm_0_interrupts_523_IRQn	Active	TCPWM0 Group#2, Counter#11 Interrupt
692	tcpwm_0_interrupts_524_IRQn	Active	TCPWM0 Group#2, Counter#12 Interrupt
693	tcpwm_0_interrupts_525_IRQn	Active	TCPWM0 Group#2, Counter#13 Interrupt
694	tcpwm_0_interrupts_526_IRQn	Active	TCPWM0 Group#2, Counter#14 Interrupt
695	tcpwm_0_interrupts_527_IRQn	Active	TCPWM0 Group#2, Counter#15 Interrupt
752	tdm_0_interrupts_tx_0_IRQn	Active	TDM0 TX #0 Interrupt
753	tdm_0_interrupts_rx_0_IRQn	Active	TDM0 RX #0 Interrupt
754	tdm_0_interrupts_tx_1_IRQn	Active	TDM0 TX #1 Interrupt
755	tdm_0_interrupts_rx_1_IRQn	Active	TDM0 RX #1 Interrupt
760	sg_0_interrupts_0_IRQn	Active	SG0 #0 Interrupt
761	sg_0_interrupts_1_IRQn	Active	SG0 #1 Interrupt
762	sg_0_interrupts_2_IRQn	Active	SG0 #2 Interrupt
763	sg_0_interrupts_3_IRQn	Active	SG0 #3 Interrupt
764	sg_0_interrupts_4_IRQn	Active	SG0 #4 Interrupt
768	pwm_0_interrupts_0_IRQn	Active	PCM-PWM0 #0 Interrupt
769	pwm_0_interrupts_1_IRQn	Active	PCM-PWM0 #1 Interrupt
780	mixer_0_interrupt_dst_IRQn	Active	MIXER0 Destination interrupt
781	mixer_0_interrupts_src_0_IRQn	Active	MIXER0 Source #0 Interrupt
782	mixer_0_interrupts_src_1_IRQn	Active	MIXER0 Source #1 Interrupt

**Table 15-1** Peripheral interrupt assignments and wake-up sources *(continued)*

<b>Interrupt</b>	<b>Source</b>	<b>Power Mode</b>	<b>Description</b>
783	mixer_0_interrupts_src_2_IRQn	Active	MIXER0 Source #2 Interrupt
784	mixer_0_interrupts_src_3_IRQn	Active	MIXER0 Source #3 Interrupt
785	mixer_0_interrupts_src_4_IRQn	Active	MIXER0 Source #4 Interrupt



Core interrupt types

## 16 Core interrupt types

**Table 16-1 Core interrupt types**

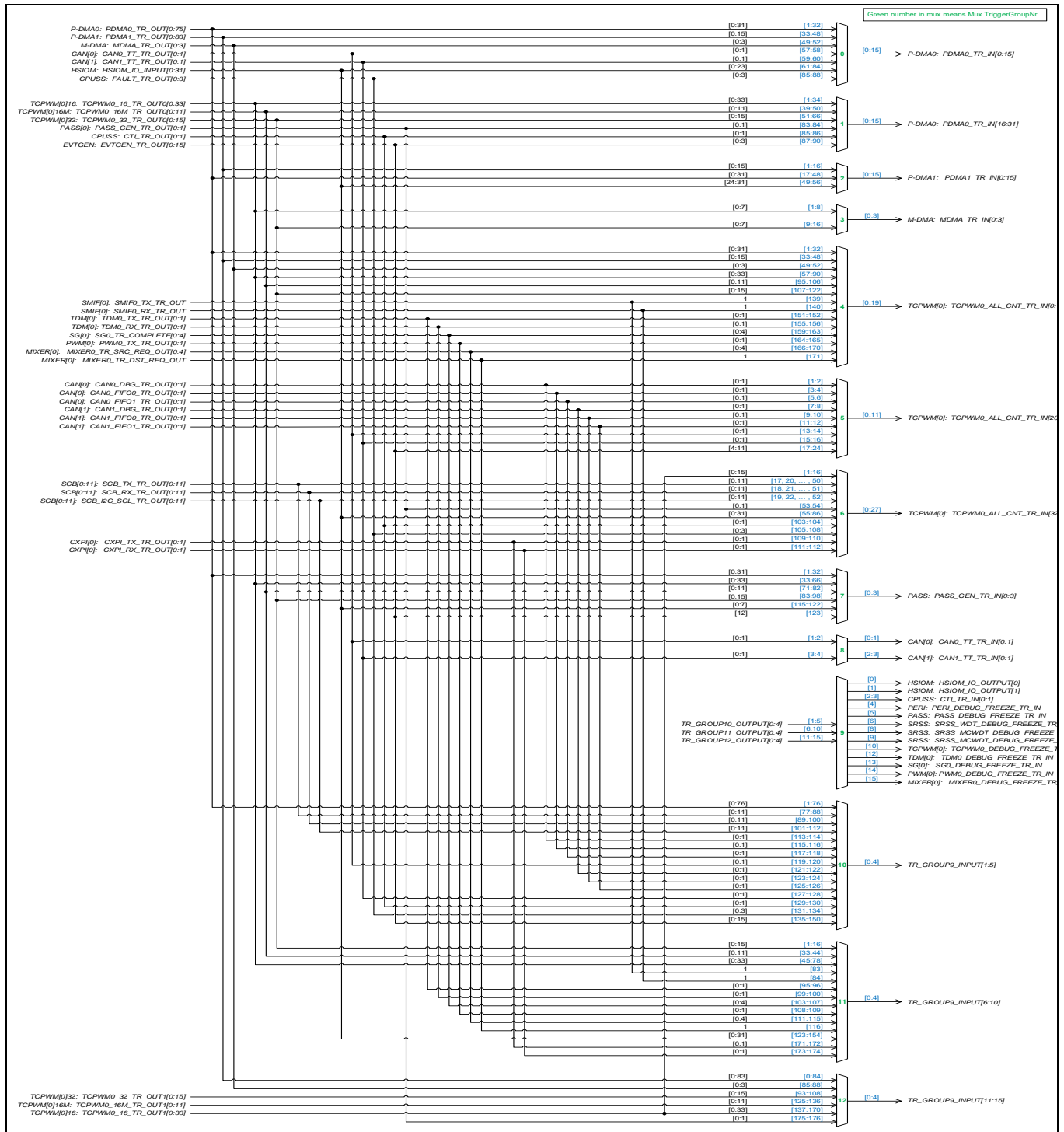
Interrupt	Source	Power Mode	Description
0	CPUIntIdx0_IRQn <sup>[30]</sup>	DeepSleep	CPU User Interrupt #0
1	CPUIntIdx1_IRQn <sup>[30]</sup>	DeepSleep	CPU User Interrupt #1
2	CPUIntIdx2_IRQn	DeepSleep	CPU User Interrupt #2
3	CPUIntIdx3_IRQn	DeepSleep	CPU User Interrupt #3
4	CPUIntIdx4_IRQn	DeepSleep	CPU User Interrupt #4
5	CPUIntIdx5_IRQn	DeepSleep	CPU User Interrupt #5
6	CPUIntIdx6_IRQn	DeepSleep	CPU User Interrupt #6
7	CPUIntIdx7_IRQn	DeepSleep	CPU User Interrupt #7
8	Internal0_IRQn	Active	Internal Software Interrupt #0
9	Internal1_IRQn	Active	Internal Software Interrupt #1
10	Internal2_IRQn	Active	Internal Software Interrupt #2
11	Internal3_IRQn	Active	Internal Software Interrupt #3
12	Internal4_IRQn	Active	Internal Software Interrupt #4
13	Internal5_IRQn	Active	Internal Software Interrupt #5
14	Internal6_IRQn	Active	Internal Software Interrupt #6
15	Internal7_IRQn	Active	Internal Software Interrupt #7

**Note**

30. User interrupt cannot be used for CM0+ application, as it is used internally by system calls. Note, this does not impact CM4 application.

Trigger multiplexer

# 17 Trigger multiplexer

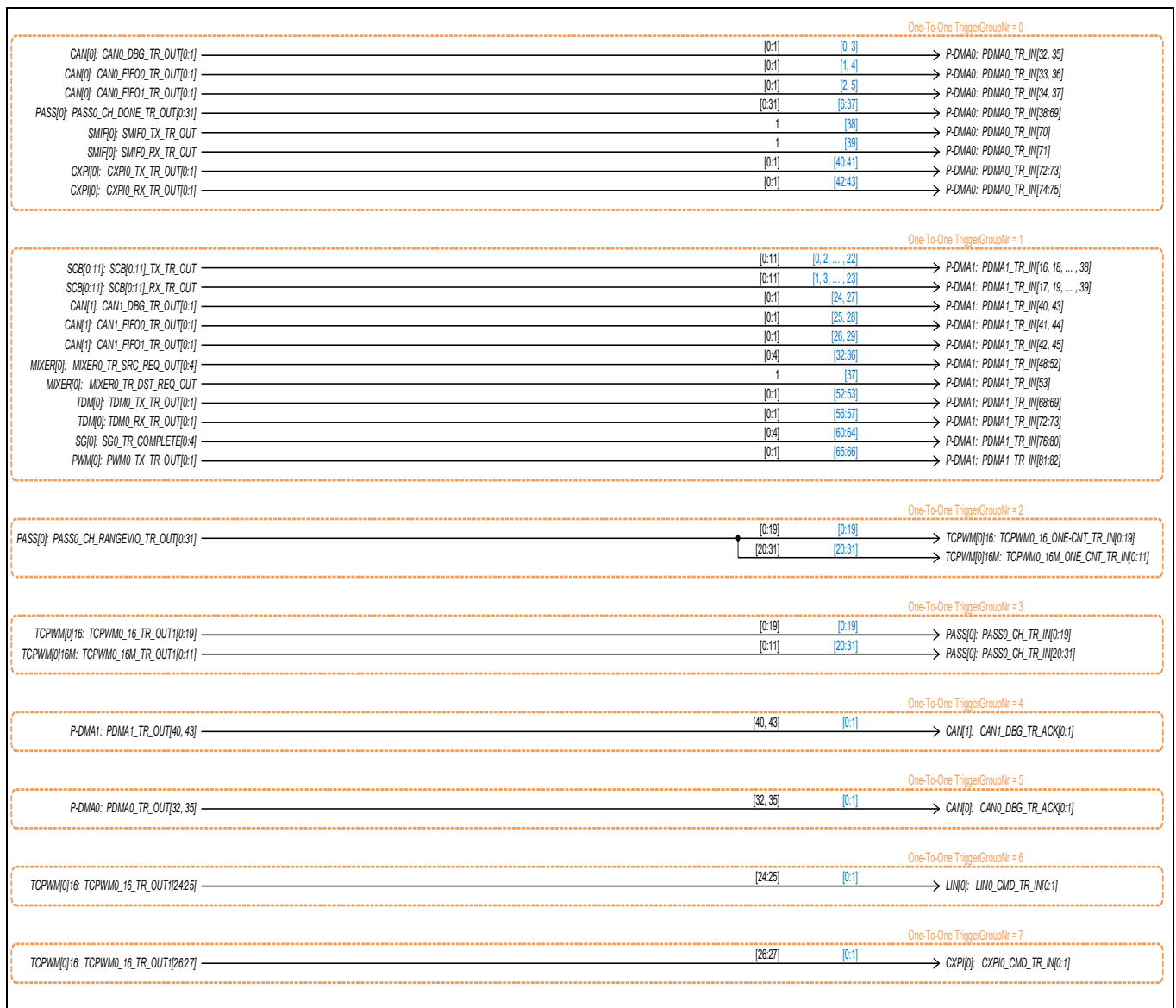


**Figure 17-1** Trigger multiplexer<sup>[31]</sup>

**Note**

31. The diagram shows only the TRIG\_LABEL, final trigger formation based on the formula TRIG\_{PREFIX(IN/OUT)}\_{MUX\_x}\_{TRIG\_LABEL} / TRIG\_{PREFIX(IN\_1TO1/OUT\_1TO1)}\_{x}\_{TRIG\_LABEL} (see [Table 18-1](#), [Table 19-1](#), and [Table 20-1](#).)

Trigger multiplexer



**Figure 17-2 Triggers one-to-one**<sup>[31]</sup>

Triggers group inputs

## 18 Triggers group inputs

**Table 18-1 Trigger inputs**

Input	Trigger	Description
<b>MUX Group 0: P-DMA0_0_15 trigger multiplexer</b>		
1:32	PDMA0_TR_OUT[0:31]	Allow P-DMA#0 to chain to itself. Channels 0 - 32 are general purpose channels available for chaining <sup>[32]</sup>
33:48	PDMA1_TR_OUT[0:15]	Cross connections from P-DMA#1 to P-DMA#0, Channels 0-15 are used
49:52	MDMA_TR_OUT[0:3]	Cross connections from M-DMA#0 to P-DMA#0
57:58	CAN0_TT_TR_OUT[0:1]	CAN#0 TT Sync Outputs
59:60	CAN1_TT_TR_OUT[0:1]	CAN#1 TT Sync Outputs
61:84	HSIOM_IO_INPUT[0:23]	I/O Inputs
85:88	FAULT_TR_OUT[0:3]	Fault events
<b>MUX Group 1: P-DMA0_16_31 trigger multiplexer</b>		
1:34	TCPWM0_16_TR_OUT0[0:33]	16-bit TCPWM#0 counters
39:50	TCPWM0_16M_TR_OUT0[0:11]	16-bit Motor enhanced TCPWM#0 counters
51:66	TCPWM0_32_TR_OUT0[0:15]	32-bit TCPWM#0 counters
83:84	PASS_GEN_TR_OUT[0:1]	PASS#0 SAR events
85:86	CTI_TR_OUT[0:1]	Trace events
87:90	EVTGEN_TR_OUT[0:3]	Event generator triggers
<b>MUX Group 2: P-DMA1_0_15 trigger multiplexer</b>		
1:16	PDMA1_TR_OUT[0:15]	Allow P-DMA#1 to chain to itself. Channels 0–15 are dedicated for chaining
17:48	PDMA0_TR_OUT[0:31]	Cross connections from P-DMA#0 to P-DMA#1, channels 0-31 are used.
49:56	HSIOM_IO_INPUT[24:31]	I/O Inputs
<b>MUX Group 3: M-DMA0 trigger multiplexer</b>		
1:8	TCPWM0_16_TR_OUT0[0:7]	16-bit TCPWM#0 counters
9:16	TCPWM0_32_TR_OUT0[0:7]	32-bit TCPWM#0 counters
<b>MUX Group 4: TCPWM0 Trigger multiplexer</b>		
1:32	PDMA0_TR_OUT[0:31]	General purpose P-DMA#0 triggers
33:48	PDMA1_TR_OUT[0:15]	General purpose P-DMA#1 triggers
49:52	MDMA_TR_OUT[0:3]	AHB M-DMA#0 triggers
57:90	TCPWM0_16_TR_OUT0[0:33]	16-bit TCPWM#0 counters
95:106	TCPWM0_16M_TR_OUT0[0:11]	16-bit Motor enhanced TCPWM#0 counters
107:122	TCPWM0_32_TR_OUT0[0:15]	32-bit TCPWM#0 counters
139	SMIF0_TX_TR_OUT	SMIF#0 TX trigger
140	SMIF0_RX_TR_OUT	SMIF#0 RX trigger
151:152	TDM0_TX_TR_OUT[0:1]	TDM#0 TX trigger
155:156	TDM0_RX_TR_OUT[0:1]	TDM#0 RX trigger
159:163	SG0_TX_TR_OUT[0:4]	SG#0 TX trigger
164:165	PWM0_TX_TR_OUT[0:1]	PWM#0 TX trigger
166:170	MIXER0_TR_SRC_REQ_OUT[0:4]	MIXER#0 SRC trigger
171	MIXER0_TR_DST_REQ_OUT	MIXER#0 DST trigger
<b>MUX Group 5: TCPWM0_20_31 Trigger multiplexer</b>		
1:2	CAN0_DBG_TR_OUT[0:1]	CAN#0 DMA events
3:4	CAN0_FIFO0_TR_OUT[0:1]	CAN#0 FIFO0 events

**Note**

32. “x:y” depicts a range starting from ‘x’ through ‘y’.

## Triggers group inputs

**Table 18-1 Trigger inputs (continued)**

Input	Trigger	Description
5:6	CAN0_FIFO1_TR_OUT[0:1]	CAN#0 FIFO1 events
7:8	CAN1_DBG_TR_OUT[0:1]	CAN#1 DMA events
9:10	CAN1_FIFO0_TR_OUT[0:1]	CAN#1 FIFO0 events
11:12	CAN1_FIFO1_TR_OUT[0:1]	CAN#1 FIFO1 events
13:14	CAN0_TT_TR_OUT[0:1]	CAN#0 TT Sync Outputs
15:16	CAN1_TT_TR_OUT[0:1]	CAN#1 TT Sync Outputs
17:24	EVTGEN_TR_OUT[4:11]	Event generator triggers
<b>MUX Group 6: TCPWM0_32_59 Trigger Multiplexer</b>		
1:16	TCPWM0_16_TR_OUT1[0:15]	16-bit TCPWM#0 counters
17	SCB_TX_TR_OUT[0]	SCB#0 TX trigger
18	SCB_RX_TR_OUT[0]	SCB#0 RX trigger
19	SCB_I2C_SCL_TR_OUT[0]	SCB#0 I <sup>2</sup> C trigger
20	SCB_TX_TR_OUT[1]	SCB#1 TX trigger
21	SCB_RX_TR_OUT[1]	SCB#1 RX trigger
22	SCB_I2C_SCL_TR_OUT[1]	SCB#1 I <sup>2</sup> C trigger
23	SCB_TX_TR_OUT[2]	SCB#2 TX trigger
24	SCB_RX_TR_OUT[2]	SCB#2 RX trigger
25	SCB_I2C_SCL_TR_OUT[2]	SCB#2 I <sup>2</sup> C trigger
26	SCB_TX_TR_OUT[3]	SCB#3 TX trigger
27	SCB_RX_TR_OUT[3]	SCB#3 RX trigger
28	SCB_I2C_SCL_TR_OUT[3]	SCB#3 I <sup>2</sup> C trigger
29	SCB_TX_TR_OUT[4]	SCB#4 TX trigger
30	SCB_RX_TR_OUT[4]	SCB#4 RX trigger
31	SCB_I2C_SCL_TR_OUT[4]	SCB#4 I <sup>2</sup> C trigger
32	SCB_TX_TR_OUT[5]	SCB#5 TX trigger
33	SCB_RX_TR_OUT[5]	SCB#5 RX trigger
34	SCB_I2C_SCL_TR_OUT[5]	SCB#5 I <sup>2</sup> C trigger
35	SCB_TX_TR_OUT[6]	SCB#6 TX trigger
36	SCB_RX_TR_OUT[6]	SCB#6 RX trigger
37	SCB_I2C_SCL_TR_OUT[6]	SCB#6 I <sup>2</sup> C trigger
38	SCB_TX_TR_OUT[7]	SCB#7 TX trigger
39	SCB_RX_TR_OUT[7]	SCB#7 RX trigger
40	SCB_I2C_SCL_TR_OUT[7]	SCB#7 I <sup>2</sup> C trigger
41	SCB_TX_TR_OUT[8]	SCB#8 TX trigger
42	SCB_RX_TR_OUT[8]	SCB#8 RX trigger
43	SCB_I2C_SCL_TR_OUT[8]	SCB#8 I <sup>2</sup> C trigger
44	SCB_TX_TR_OUT[9]	SCB#9 TX trigger
45	CB_RX_TR_OUT[9]	SCB#9 RX trigger
46	SCB_I2C_SCL_TR_OUT[9]	SCB#9 I <sup>2</sup> C trigger
47	SCB_TX_TR_OUT[10]	SCB#10 TX trigger
48	SCB_RX_TR_OUT[10]	SCB#10 RX trigger
49	SCB_I2C_SCL_TR_OUT[10]	SCB#10 I <sup>2</sup> C trigger
50	SCB_TX_TR_OUT[11]	SCB#11 TX trigger
51	SCB_RX_TR_OUT[11]	SCB#11 RX trigger
52	SCB_I2C_SCL_TR_OUT[11]	SCB#11 I <sup>2</sup> C trigger

Triggers group inputs

**Table 18-1 Trigger inputs (continued)**

Input	Trigger	Description
53:54	PASS_GEN_TR_OUT[0:1]	PASS#0 SAR events
55:86	HSIOM_IO_INPUT[0:31]	I/O inputs
103:104	CTI_TR_IN[0:1]	Trace events
105:108	FAULT_TR_OUT[0:3]	Fault events
109:110	CXPI_TX_TR_OUT[0:1]	CXPI#0 transmit events
111:112	CXPI_RX_TR_OUT[0:1]	CXPI#0 receive events
<b>MUX Group 7: PASS0 SAR trigger multiplexer</b>		
1:32	PDMA0_TR_OUT[0:31]	General purpose P-DMA#0 triggers
33:66	TCPWM0_16_TR_OUT0[0:33]	16-bit TCPWM#0 counters
71:82	TCPWM0_16M_TR_OUT0[0:11]	16-bit Motor enhanced TCPWM#0 counters
83:98	TCPWM0_32_TR_OUT0[0:15]	32-bit TCPWM#0 counters
115:122	HSIOM_IO_INPUT[0:7]	I/O Inputs
123	EVTGEN_TR_OUT[12]	Event generator triggers
<b>MUX Group 8: CAN TT Sync</b>		
1:2	CAN0_TT_TR_OUT[0:1]	CAN#0 TT Sync Outputs
3:4	CAN1_TT_TR_OUT[0:1]	CAN#1 TT Sync Outputs
<b>MUX Group 9: Debug MUX</b>		
1:5	TR_GROUP10_OUTPUT[0:4]	Output from debug reduction multiplexer #1
6:10	TR_GROUP11_OUTPUT[0:4]	Output from debug reduction multiplexer #2
11:15	TR_GROUP12_OUTPUT[0:4]	Output from debug reduction multiplexer #3
<b>MUX Group 10: Debug Reduction #1</b>		
1:76	PDMA0_TR_OUT[0:75]	General purpose P-DMA#0 triggers
77:88	SCB_TX_TR_OUT[0:11]	SCB TX triggers
89:100	SCB_RX_TR_OUT[0:11]	SCB RX triggers
101:112	SCB_I2C_SCL_TR_OUT[0:11]	SCB I <sup>2</sup> C triggers
113:114	CAN0_DBG_TR_OUT[0:1]	CAN#0 DMA
115:116	CAN0_FIFO0_TR_OUT[0:1]	CAN#0 FIFO0
117:118	CAN0_FIFO1_TR_OUT[0:1]	CAN#0 FIFO1
119:120	CAN0_TT_TR_OUT[0:1]	CAN#0 TT Sync Outputs
121:122	CAN1_DBG_TR_OUT[0:1]	CAN#1 DMA
123:124	CAN1_FIFO0_TR_OUT[0:1]	CAN#1 FIFO0
125:126	CAN1_FIFO1_TR_OUT[0:1]	CAN#1 FIFO1
127:128	CAN1_TT_TR_OUT[0:1]	CAN#1 TT Sync Outputs
129:130	CTI_TR_OUT[0:1]	Trace events
131:134	FAULT_TR_OUT[0:3]	Fault events
135:150	EVTGEN_TR_OUT[0:15]	EVTGEN Triggers
<b>MUX Group 11: Debug Reduction #2</b>		
1:16	TCPWM0_32_TR_OUT0[0:15]	32-bit TCPWM#0 counters
33:44	TCPWM0_16M_TR_OUT0[0:11]	16-bit Motor enhanced TCPWM#0 counters
45:78	TCPWM0_16_TR_OUT0[0:33]	16-bit TCPWM#0 counters
83	SMIF0_TX_TR_OUT	SMIF#0 TX trigger
84	SMIF0_RX_TR_OUT	SMIF#0 RX trigger
95:96	TDM0_TX_TR_OUT[0:1]	TDM#0 TX trigger
99:100	TDM0_RX_TR_OUT[0:1]	TDM#0 RX trigger
103:107	SG0_TX_TR_OUT[0:4]	SG#0 TX trigger

Triggers group inputs

**Table 18-1** Trigger inputs (continued)

Input	Trigger	Description
108:109	PWM0_TX_TR_OUT[0:1]	PWM#0 TX trigger
111:115	MIXER0_TR_SRC_REQ_OUT[0:4]	MIXER#0 SRC trigger
116	MIXER0_TR_DST_REQ_OUT	MIXER#0 DST trigger
123:154	HSIOM_IO_INPUT[0:31]	I/O inputs
171:172	CXPI_TX_TR_OUT[0:1]	CXPI#0 TX trigger
173:174	CXPI_RX_TR_OUT[0:1]	CXPI#0 RX trigger
<b>MUX Group 12: Debug Reduction #3</b>		
1:84	PDMA1_TR_OUT[0:83]	General purpose P-DMA#1 triggers
85:88	MDMA_TR_OUT[0:3]	M-DMA#0 triggers
93:108	TCPWM0_32_TR_OUT1[0:15]	32-bit TCPWM#0 counters
125:136	TCPWM0_16M_TR_OUT1[0:11]	16-bit Motor enhanced TCPWM#0 counters
137:170	TCPWM0_16_TR_OUT1[0:33]	16-bit TCPWM#0 counters
175:176	PASS_GEN_TR_OUT[0:1]	PASS#0 SAR events

Triggers group outputs

## 19 Triggers group outputs

**Table 19-1 Trigger outputs**

Output	Trigger	Description
<b>MUX Group 0: P-DMA0_0_15 trigger multiplexer</b>		
0:15	PDMA0_TR_IN[0:15]	Triggers to P-DMA#0[0:15]
<b>MUX Group 1: P-DMA0_16_31 trigger multiplexer</b>		
0:15	PDMA0_TR_IN[16:31]	Triggers to P-DMA#0[16:31]
<b>MUX Group 2: P-DMA1_0_15 trigger multiplexer</b>		
0:15	PDMA1_TR_IN[0:15]	Triggers to P-DMA#1
<b>MUX Group 3: M-DMA0 trigger multiplexer</b>		
0:3	MDMA_TR_IN[0:3]	Triggers to M-DMA#0
<b>MUX Group 4: TCPWM0 Trigger multiplexer</b>		
0:19	TCPWM0_ALL_CNT_TR_IN[0:19]	Triggers to TCPWM#0
<b>MUX Group 5: TCPWM0_20_31 Trigger multiplexer</b>		
0:11	TCPWM0_ALL_CNT_TR_IN[20:31]	Triggers to TCPWM#0
<b>MUX Group 6: TCPWM0_32_59 Trigger multiplexer</b>		
0:27	TCPWM0_ALL_CNT_TR_IN[32:59]	Triggers to TCPWM#0
<b>MUX Group 7: PASS0 SAR trigger multiplexer</b>		
0:3	PASS_GEN_TR_IN[0:3]	Triggers to PASS#0 SAR
<b>MUX Group 8: CAN TT Sync</b>		
0:1	CAN0_TT_TR_IN[0:1]	CAN#0 TT Sync Inputs
2:3	CAN1_TT_TR_IN[0:1]	CAN#1 TT Sync Inputs
<b>MUX Group 9: Debug MUX</b>		
0	HSIOM_IO_OUTPUT[0]	To HSIOM as an output
1	HSIOM_IO_OUTPUT[1]	To HSIOM as an output
2:3	CTI_TR_IN[0:1]	To the Cross Trigger system
4	PERI_DEBUG_FREEZE_TR_IN	Signal to Freeze PERI operation
5	PASS_DEBUG_FREEZE_TR_IN	Signal to Freeze PASS#0 SAR operation
6	SRSS_WDT_DEBUG_FREEZE_TR_IN	Signal to Freeze WDT operation
8	SRSS_MCWDT_DEBUG_FREEZE_TR_IN[1]	Signal to Freeze MCWDT#1 operation
9	SRSS_MCWDT_DEBUG_FREEZE_TR_IN[0]	Signal to Freeze MCWDT#0 operation
10	TCPWM0_DEBUG_FREEZE_TR_IN	Signal to Freeze TCPWM#0 operation
12	TDM0_DEBUG_FREEZE_TR_IN	Signal to Freeze TDM#0 operation
13	SG0_DEBUG_FREEZE_TR_IN	Signal to Freeze SG0# operation
14	PWM0_DEBUG_FREEZE_TR_IN	Signal to Freeze PWM#0 operation
15	MIXER0_DEBUG_FREEZE_TR_IN	Signal to Freeze MIXER#0 operation
<b>MUX Group 10: Debug Reduction #1</b>		
0:4	TR_GROUP9_INPUT[1:5]	To main debug multiplexer
<b>MUX Group 11: Debug Reduction #2</b>		
0:4	TR_GROUP9_INPUT[6:10]	To main debug multiplexer
<b>MUX Group 12: Debug Reduction #3</b>		
0:4	TR_GROUP9_INPUT[11:15]	To main debug multiplexer



Triggers one-to-one

## 20 Triggers one-to-one

**Table 20-1 Triggers 1:1**

Input	Trigger In	Trigger Out	Description
<b>MUX Group 0: CAN0 to P-DMA0 Triggers</b>			
0	CAN0_DBG_TR_OUT[0]	PDMA0_TR_IN[32]	CAN0, Channel #0 P-DMA0 trigger
1	CAN0_FIFO0_TR_OUT[0]	PDMA0_TR_IN[33]	CAN0, Channel #0 FIFO0 trigger
2	CAN0_FIFO1_TR_OUT[0]	PDMA0_TR_IN[34]	CAN0, Channel #0 FIFO1 trigger
3	CAN0_DBG_TR_OUT[1]	PDMA0_TR_IN[35]	CAN0, Channel #1 P-DMA0 trigger
4	CAN0_FIFO0_TR_OUT[1]	PDMA0_TR_IN[36]	CAN0, Channel #1 FIFO0 trigger
5	CAN0_FIFO1_TR_OUT[1]	PDMA0_TR_IN[37]	CAN0, Channel #1 FIFO1 trigger
6:37	PASS0_CH_DONE_TR_OUT[0:31]	PDMA0_TR_IN[38:69]	PASS0 SAR0 to P-DMA0 direct connect
38	SMIF0_TX_TR_OUT	PDMA0_TR_IN[70]	SMIF TX to P-DMA0 Trigger
39	SMIF0_RX_TR_OUT	PDMA0_TR_IN[71]	SMIF RX to P-DMA0 Trigger
40:41	CXPI0_TX_TR_OUT[0:1]	PDMA0_TR_IN[72:73]	CXPI 0 TX P-DMA0 Triggers
42:43	CXPI0_RX_TR_OUT[0:1]	PDMA0_TR_IN[74:75]	CXPI 0 RX P-DMA0 Triggers
<b>MUX Group 1: SCBx to P-DMA1 Triggers</b>			
0	SCB0_TX_TR_OUT	PDMA1_TR_IN[16]	SCB0 to P-DMA1 Trigger
1	SCB0_RX_TR_OUT	PDMA1_TR_IN[17]	SCB0 to P-DMA1 Trigger
2	SCB1_TX_TR_OUT	PDMA1_TR_IN[18]	SCB1 to P-DMA1 Trigger
3	SCB1_RX_TR_OUT	PDMA1_TR_IN[19]	SCB1 to P-DMA1 Trigger
4	SCB2_TX_TR_OUT	PDMA1_TR_IN[20]	SCB2 to P-DMA1 Trigger
5	SCB2_RX_TR_OUT	PDMA1_TR_IN[21]	SCB2 to P-DMA1 Trigger
6	SCB3_TX_TR_OUT	PDMA1_TR_IN[22]	SCB3 to P-DMA1 Trigger
7	SCB3_RX_TR_OUT	PDMA1_TR_IN[23]	SCB3 to P-DMA1 Trigger
8	SCB4_TX_TR_OUT	PDMA1_TR_IN[24]	SCB4 to P-DMA1 Trigger
9	SCB4_RX_TR_OUT	PDMA1_TR_IN[25]	SCB4 to P-DMA1 Trigger
10	SCB5_TX_TR_OUT	PDMA1_TR_IN[26]	SCB5 to P-DMA1 Trigger
11	SCB5_RX_TR_OUT	PDMA1_TR_IN[27]	SCB5 to P-DMA1 Trigger
12	SCB6_TX_TR_OUT	PDMA1_TR_IN[28]	SCB6 to P-DMA1 Trigger
13	SCB6_RX_TR_OUT	PDMA1_TR_IN[29]	SCB6 to P-DMA1 Trigger
14	SCB7_TX_TR_OUT	PDMA1_TR_IN[30]	SCB7 to P-DMA1 Trigger
15	SCB7_RX_TR_OUT	PDMA1_TR_IN[31]	SCB7 to P-DMA1 Trigger
16	SCB8_TX_TR_OUT	PDMA1_TR_IN[32]	SCB8 to P-DMA1 Trigger
17	SCB8_RX_TR_OUT	PDMA1_TR_IN[33]	SCB8 to P-DMA1 Trigger
18	SCB9_TX_TR_OUT	PDMA1_TR_IN[34]	SCB9 to P-DMA1 Trigger
19	SCB9_RX_TR_OUT	PDMA1_TR_IN[35]	SCB9 to P-DMA1 Trigger
20	SCB10_TX_TR_OUT	PDMA1_TR_IN[36]	SCB10 to P-DMA1 Trigger
21	SCB10_RX_TR_OUT	PDMA1_TR_IN[37]	SCB10 to P-DMA1 Trigger
22	SCB11_TX_TR_OUT	PDMA1_TR_IN[38]	SCB11 to P-DMA1 Trigger
23	SCB11_RX_TR_OUT	PDMA1_TR_IN[39]	SCB11 to P-DMA1 Trigger
24	CAN1_DBG_TR_OUT[0]	PDMA1_TR_IN[40]	CAN1 Channel #0 P-DMA1 trigger
25	CAN1_FIFO0_TR_OUT[0]	PDMA1_TR_IN[41]	CAN1 Channel #0 FIFO0 trigger
26	CAN1_FIFO1_TR_OUT[0]	PDMA1_TR_IN[42]	CAN1 Channel #0 FIFO1 trigger
27	CAN1_DBG_TR_OUT[1]	PDMA1_TR_IN[43]	CAN1 Channel #1 P-DMA1 trigger
28	CAN1_FIFO0_TR_OUT[1]	PDMA1_TR_IN[44]	CAN1 Channel #1 FIFO0 trigger
29	CAN1_FIFO1_TR_OUT[1]	PDMA1_TR_IN[45]	CAN1 Channel #1 FIFO1 trigger

Triggers one-to-one

**Table 20-1 Triggers 1:1 (continued)**

Input	Trigger In	Trigger Out	Description
32:36	MIXER0_TR_SRC_REQ_OUT[0:4]	PDMA1_TR_IN[48:52]	MIXER0 to P-DMA1 trigger
37	MIXER0_TR_DST_REQ_OUT	PDMA1_TR_IN[53]	MIXER0 to P-DMA1 trigger
52:53	TDM0_TX_TR_OUT[0:1]	PDMA1_TR_IN[68:69]	TDM0 TX to P-DMA1 trigger
56:57	TDM0_RX_TR_OUT[0:1]	PDMA1_TR_IN[72:73]	TDM0 RX to P-DMA1 trigger
60:64	SG0_TX_TR_OUT[0:4]	PDMA1_TR_IN[76:80]	SG0 TX to P-DMA1 trigger
65:66	PWM0_TX_TR_OUT[0:1]	PDMA1_TR_IN[81:82]	PWM0 TX to P-DMA1 trigger
<b>MUX Group 2: PASS SARx to TCPWM1 direct connect</b>			
0	PASS0_CH_RANGEVIO_TR_OUT[0]	TCPWM0_16_ONE_CNT_TR_IN[0]	SAR0 ch#0 <sup>[33]</sup> , range violation to TCPWM0 Group#0 Counter#00 trig=0
1	PASS0_CH_RANGEVIO_TR_OUT[1]	TCPWM0_16_ONE_CNT_TR_IN[1]	SAR0 ch#1, range violation to TCPWM0 Group#0 Counter#01 trig=0
2	PASS0_CH_RANGEVIO_TR_OUT[2]	TCPWM0_16_ONE_CNT_TR_IN[2]	SAR0 ch#2, range violation to TCPWM0 Group#0 Counter#02 trig=0
3	PASS0_CH_RANGEVIO_TR_OUT[3]	TCPWM0_16_ONE_CNT_TR_IN[3]	SAR0 ch#3, range violation to TCPWM0 Group#0 Counter#03 trig=0
4	PASS0_CH_RANGEVIO_TR_OUT[4]	TCPWM0_16_ONE_CNT_TR_IN[4]	SAR0 ch#4, range violation to TCPWM0 Group#0 Counter#04 trig=0
5	PASS0_CH_RANGEVIO_TR_OUT[5]	TCPWM0_16_ONE_CNT_TR_IN[5]	SAR0 ch#5, range violation to TCPWM0 Group#0 Counter#05 trig=0
6	PASS0_CH_RANGEVIO_TR_OUT[6]	TCPWM0_16_ONE_CNT_TR_IN[6]	SAR0 ch#6, range violation to TCPWM0 Group#0 Counter#06 trig=0
7	PASS0_CH_RANGEVIO_TR_OUT[7]	TCPWM0_16_ONE_CNT_TR_IN[7]	SAR0 ch#7, range violation to TCPWM0 Group#0 Counter#07 trig=0
8	PASS0_CH_RANGEVIO_TR_OUT[8]	TCPWM0_16_ONE_CNT_TR_IN[8]	SAR0 ch#8, range violation to TCPWM0 Group#0 Counter#08 trig=0
9	PASS0_CH_RANGEVIO_TR_OUT[9]	TCPWM0_16_ONE_CNT_TR_IN[9]	SAR0 ch#9, range violation to TCPWM0 Group#0 Counter#09 trig=0
10	PASS0_CH_RANGEVIO_TR_OUT[10]	TCPWM0_16_ONE_CNT_TR_IN[10]	SAR0 ch#10, range violation to TCPWM0 Group#0 Counter#10 trig=0
11	PASS0_CH_RANGEVIO_TR_OUT[11]	TCPWM0_16_ONE_CNT_TR_IN[11]	SAR0 ch#11, range violation to TCPWM0 Group#0 Counter#11 trig=0
12	PASS0_CH_RANGEVIO_TR_OUT[12]	TCPWM0_16_ONE_CNT_TR_IN[12]	SAR0 ch#12, range violation to TCPWM0 Group#0 Counter#12 trig=0
13	PASS0_CH_RANGEVIO_TR_OUT[13]	TCPWM0_16_ONE_CNT_TR_IN[13]	SAR0 ch#13, range violation to TCPWM0 Group#0 Counter#13 trig=0
14	PASS0_CH_RANGEVIO_TR_OUT[14]	TCPWM0_16_ONE_CNT_TR_IN[14]	SAR0 ch#14, range violation to TCPWM0 Group#0 Counter#14 trig=0
15	PASS0_CH_RANGEVIO_TR_OUT[15]	TCPWM0_16_ONE_CNT_TR_IN[15]	SAR0 ch#15, range violation to TCPWM0 Group#0 Counter#15 trig=0
16	PASS0_CH_RANGEVIO_TR_OUT[16]	TCPWM0_16_ONE_CNT_TR_IN[16]	SAR0 ch#16, range violation to TCPWM0 Group#0 Counter#16 trig=0
17	PASS0_CH_RANGEVIO_TR_OUT[17]	TCPWM0_16_ONE_CNT_TR_IN[17]	SAR0 ch#17, range violation to TCPWM0 Group#0 Counter#17 trig=0
18	PASS0_CH_RANGEVIO_TR_OUT[18]	TCPWM0_16_ONE_CNT_TR_IN[18]	SAR0 ch#18, range violation to TCPWM0 Group#0 Counter#18 trig=0
19	PASS0_CH_RANGEVIO_TR_OUT[19]	TCPWM0_16_ONE_CNT_TR_IN[19]	SAR0 ch#19, range violation to TCPWM0 Group#0 Counter#19 trig=0
20	PASS0_CH_RANGEVIO_TR_OUT[20]	TCPWM0_16M_ONE_CNT_TR_IN[0]	SAR0 ch#20, range violation to TCPWM0 Group#1 Counter#00 trig=0
21	PASS0_CH_RANGEVIO_TR_OUT[21]	TCPWM0_16M_ONE_CNT_TR_IN[1]	SAR0 ch#21, range violation to TCPWM0 Group#1 Counter#01 trig=0
22	PASS0_CH_RANGEVIO_TR_OUT[22]	TCPWM0_16M_ONE_CNT_TR_IN[2]	SAR0 ch#22, range violation to TCPWM0 Group#1 Counter#02 trig=0
23	PASS0_CH_RANGEVIO_TR_OUT[23]	TCPWM0_16M_ONE_CNT_TR_IN[3]	SAR0 ch#23, range violation to TCPWM0 Group#1 Counter#03 trig=0
24	PASS0_CH_RANGEVIO_TR_OUT[24]	TCPWM0_16M_ONE_CNT_TR_IN[4]	SAR0 ch#24, range violation to TCPWM0 Group#1 Counter#04 trig=0
25	PASS0_CH_RANGEVIO_TR_OUT[25]	TCPWM0_16M_ONE_CNT_TR_IN[5]	SAR0 ch#25, range violation to TCPWM0 Group#1 Counter#05 trig=0
26	PASS0_CH_RANGEVIO_TR_OUT[26]	TCPWM0_16M_ONE_CNT_TR_IN[6]	SAR0 ch#26, range violation to TCPWM0 Group#1 Counter#06 trig=0
27	PASS0_CH_RANGEVIO_TR_OUT[27]	TCPWM0_16M_ONE_CNT_TR_IN[7]	SAR0 ch#27, range violation to TCPWM0 Group#1 Counter#07 trig=0
28	PASS0_CH_RANGEVIO_TR_OUT[28]	TCPWM0_16M_ONE_CNT_TR_IN[8]	SAR0 ch#28, range violation to TCPWM0 Group#1 Counter#08 trig=0
29	PASS0_CH_RANGEVIO_TR_OUT[29]	TCPWM0_16M_ONE_CNT_TR_IN[9]	SAR0 ch#29, range violation to TCPWM0 Group#1 Counter#09 trig=0
30	PASS0_CH_RANGEVIO_TR_OUT[30]	TCPWM0_16M_ONE_CNT_TR_IN[10]	SAR0 ch#30, range violation to TCPWM0 Group#1 Counter#10 trig=0
31	PASS0_CH_RANGEVIO_TR_OUT[31]	TCPWM0_16M_ONE_CNT_TR_IN[11]	SAR0 ch#31, range violation to TCPWM0 Group#1 Counter#11 trig=0
<b>MUX Group 3: TCPWM0 to PASS SARx</b>			
0:19	TCPWM0_16_TR_OUT[0:19]	PASS0_CH_TR_IN[0:19]	TCPWM0 Group #0 Counter #00 through 19 (PWM0_0 to PWM0_19) to SAR0 ch#0 through SAR0 ch#19

**Note**

33.Each logical channel of SAR ADC[x] can be connected to any of the SAR ADC[x]\_y external pin. (x = 0, or 1, or 2 and y=0 to max 31)

Triggers one-to-one

**Table 20-1 Triggers 1:1 (continued)**

Input	Trigger In	Trigger Out	Description
20:31	TCPWM0_16M_TR_OUT1[0:11]	PASS0_CH_TR_IN[20:31]	TCPWM0 Group #1 Counter #00 through 11 (PWM0_M_0 to PWM0_M_11) to SAR0 ch#20 through SAR0 ch#31
<b>MUX Group 4: Acknowledge triggers from P-DMA1 to CAN1</b>			
0	PDMA1_TR_OUT[40]	CAN1_DBG_TR_ACK[0]	CAN1 Channel#0 P-DMA1 acknowledge
1	PDMA1_TR_OUT[43]	CAN1_DBG_TR_ACK[1]	CAN1 Channel#1 P-DMA1 acknowledge
<b>MUX Group 5: Acknowledge triggers from P-DMA0 to CAN0</b>			
0	PDMA0_TR_OUT[32]	CAN0_DBG_TR_ACK[0]	CAN0 Channel#0 P-DMA0 acknowledge
1	PDMA0_TR_OUT[35]	CAN0_DBG_TR_ACK[1]	CAN0 Channel#1 P-DMA0 acknowledge
<b>MUX Group 6: TCPWM0 to LIN0 triggers</b>			
0:1	TCPWM0_16_TR_OUT1[24:25]	LIN0_CMD_TR_IN[0:1]	TCPWM0 (Group #0 Counter #24 to #25) to LIN0
<b>MUX Group 7: TCPWM0_TO_CXPI (TCPWM0 to CXPI)</b>			
0:1	TCPWM0_16_TR_OUT1[26:27]	CXPI0_CMD_TR_IN[0:1]	TCPWM0 (Group #0 Counter #24 to #25) to CXPI0

Peripheral clocks

## 21 Peripheral clocks

**Table 21-1 Peripheral clock assignments**

Output	Destination	Description
0	PCLK_CPUSS_CLOCK_TRACE_IN	Trace clock
1	PCLK_SMARTIO7_CLOCK	SMART I/O#7
2	PCLK_CANFD0_CLOCK_CAN0	CAN#0, Channel#0
3	PCLK_CANFD0_CLOCK_CAN1	CAN#0, Channel#1
4	PCLK_CANFD1_CLOCK_CAN0	CAN#1, Channel#0
5	PCLK_CANFD1_CLOCK_CAN1	CAN#1, Channel#1
6	PCLK_LIN0_CLOCK_CH_EN0	LIN#0, Channel#0
7	PCLK_LIN0_CLOCK_CH_EN1	LIN#0, Channel#1
8	PCLK_CXPI0_CLOCK_CH_EN0	CXPI#0 Channel#0
9	PCLK_CXPI0_CLOCK_CH_EN1	CXPI#0 Channel#1
10	PCLK_SCB0_CLOCK	SCB#0
11	PCLK_SCB1_CLOCK	SCB#1
12	PCLK_SCB2_CLOCK	SCB#2
13	PCLK_SCB3_CLOCK	SCB#3
14	PCLK_SCB4_CLOCK	SCB#4
15	PCLK_SCB5_CLOCK	SCB#5
16	PCLK_SCB6_CLOCK	SCB#6
17	PCLK_SCB7_CLOCK	SCB#7
18	PCLK_SCB8_CLOCK	SCB#8
19	PCLK_SCB9_CLOCK	SCB#9
20	PCLK_SCB10_CLOCK	SCB#10
21	PCLK_SCB11_CLOCK	SCB#11
22	PCLK_PASS0_CLOCK_SAR0	SAR#0
23	PCLK_LCD0_CLOCK	LCD Controller
24	PCLK_TCPWM0_CLOCKS0	TCPWM#0 Group #0, Counter #0
25	PCLK_TCPWM0_CLOCKS1	TCPWM#0 Group #0, Counter #1
26	PCLK_TCPWM0_CLOCKS2	TCPWM#0 Group #0, Counter #2
27	PCLK_TCPWM0_CLOCKS3	TCPWM#0 Group #0, Counter #3
28	PCLK_TCPWM0_CLOCKS4	TCPWM#0 Group #0, Counter #4
29	PCLK_TCPWM0_CLOCKS5	TCPWM#0 Group #0, Counter #5
30	PCLK_TCPWM0_CLOCKS6	TCPWM#0 Group #0, Counter #6
31	PCLK_TCPWM0_CLOCKS7	TCPWM#0 Group #0, Counter #7
32	PCLK_TCPWM0_CLOCKS8	TCPWM#0 Group #0, Counter #8
33	PCLK_TCPWM0_CLOCKS9	TCPWM#0 Group #0, Counter #9
34	PCLK_TCPWM0_CLOCKS10	TCPWM#0 Group #0, Counter #10
35	PCLK_TCPWM0_CLOCKS11	TCPWM#0 Group #0, Counter #11
36	PCLK_TCPWM0_CLOCKS12	TCPWM#0 Group #0, Counter #12
37	PCLK_TCPWM0_CLOCKS13	TCPWM#0 Group #0, Counter #13
38	PCLK_TCPWM0_CLOCKS14	TCPWM#0 Group #0, Counter #14
39	PCLK_TCPWM0_CLOCKS15	TCPWM#0 Group #0, Counter #15
40	PCLK_TCPWM0_CLOCKS16	TCPWM#0 Group #0, Counter #16
41	PCLK_TCPWM0_CLOCKS17	TCPWM#0 Group #0, Counter #17
42	PCLK_TCPWM0_CLOCKS18	TCPWM#0 Group #0, Counter #18
43	PCLK_TCPWM0_CLOCKS19	TCPWM#0 Group #0, Counter #19
44	PCLK_TCPWM0_CLOCKS20	TCPWM#0 Group #0, Counter #20
45	PCLK_TCPWM0_CLOCKS21	TCPWM#0 Group #0, Counter #21
46	PCLK_TCPWM0_CLOCKS22	TCPWM#0 Group #0, Counter #22
47	PCLK_TCPWM0_CLOCKS23	TCPWM#0 Group #0, Counter #23
48	PCLK_TCPWM0_CLOCKS24	TCPWM#0 Group #0, Counter #24
49	PCLK_TCPWM0_CLOCKS25	TCPWM#0 Group #0, Counter #25
50	PCLK_TCPWM0_CLOCKS26	TCPWM#0 Group #0, Counter #26
51	PCLK_TCPWM0_CLOCKS27	TCPWM#0 Group #0, Counter #27

Peripheral clocks

**Table 21-1** Peripheral clock assignments (continued)

Output	Destination	Description
52	PCLK_TCPWM0_CLOCKS28	TCPWM#0 Group #0, Counter #28
53	PCLK_TCPWM0_CLOCKS29	TCPWM#0 Group #0, Counter #29
54	PCLK_TCPWM0_CLOCKS30	TCPWM#0 Group #0, Counter #30
55	PCLK_TCPWM0_CLOCKS31	TCPWM#0 Group #0, Counter #31
56	PCLK_TCPWM0_CLOCKS32	TCPWM#0 Group #0, Counter #32
57	PCLK_TCPWM0_CLOCKS33	TCPWM#0 Group #0, Counter #33
58	PCLK_TCPWM0_CLOCKS256	TCPWM#0 Group #1, Counter #0
59	PCLK_TCPWM0_CLOCKS257	TCPWM#0 Group #1, Counter #1
60	PCLK_TCPWM0_CLOCKS258	TCPWM#0 Group #1, Counter #2
61	PCLK_TCPWM0_CLOCKS259	TCPWM#0 Group #1, Counter #3
62	PCLK_TCPWM0_CLOCKS260	TCPWM#0 Group #1, Counter #4
63	PCLK_TCPWM0_CLOCKS261	TCPWM#0 Group #1, Counter #5
64	PCLK_TCPWM0_CLOCKS262	TCPWM#0 Group #1, Counter #6
65	PCLK_TCPWM0_CLOCKS263	TCPWM#0 Group #1, Counter #7
66	PCLK_TCPWM0_CLOCKS264	TCPWM#0 Group #1, Counter #8
67	PCLK_TCPWM0_CLOCKS265	TCPWM#0 Group #1, Counter #9
68	PCLK_TCPWM0_CLOCKS266	TCPWM#0 Group #1, Counter #10
69	PCLK_TCPWM0_CLOCKS267	TCPWM#0 Group #1, Counter #11
70	PCLK_TCPWM0_CLOCKS512	TCPWM#0 Group #2, Counter #0
71	PCLK_TCPWM0_CLOCKS513	TCPWM#0 Group #2, Counter #1
72	PCLK_TCPWM0_CLOCKS514	TCPWM#0 Group #2, Counter #2
73	PCLK_TCPWM0_CLOCKS515	TCPWM#0 Group #2, Counter #3
74	PCLK_TCPWM0_CLOCKS516	TCPWM#0 Group #2, Counter #4
75	PCLK_TCPWM0_CLOCKS517	TCPWM#0 Group #2, Counter #5
76	PCLK_TCPWM0_CLOCKS518	TCPWM#0 Group #2, Counter #6
77	PCLK_TCPWM0_CLOCKS519	TCPWM#0 Group #2, Counter #7
78	PCLK_TCPWM0_CLOCKS520	TCPWM#0 Group #2, Counter #8
79	PCLK_TCPWM0_CLOCKS521	TCPWM#0 Group #2, Counter #9
80	PCLK_TCPWM0_CLOCKS522	TCPWM#0 Group #2, Counter #10
81	PCLK_TCPWM0_CLOCKS523	TCPWM#0 Group #2, Counter #11
82	PCLK_TCPWM0_CLOCKS524	TCPWM#0 Group #2, Counter #12
83	PCLK_TCPWM0_CLOCKS525	TCPWM#0 Group #2, Counter #13
84	PCLK_TCPWM0_CLOCKS526	TCPWM#0 Group #2, Counter #14
85	PCLK_TCPWM0_CLOCKS527	TCPWM#0 Group #2, Counter #15

## 22 Faults

**Table 22-1 Fault assignments**

Fault	Source	Description
0	CPUSS_MPU_VIO_0	CM0+ MPU/SMPU violation. DATA0[31:0]: Violating address. DATA1[0]: User read. DATA1[1]: User write. DATA1[2]: User execute. DATA1[3]: Privileged read. DATA1[4]: Privileged write. DATA1[5]: Privileged execute. DATA1[6]: Non-secure. DATA1[11:8]: Master identifier. DATA1[15:12]: Protection context identifier. DATA1[31]: '0' MPU violation; '1': SMPU violation.
1	CPUSS_MPU_VIO_1	CRYPTO SMPU violation. See CPUSS_MPU_VIO_0 description.
2	CPUSS_MPU_VIO_2	P-DMA#0 MPU/SMPU violation. See CPUSS_MPU_VIO_0 description.
3	CPUSS_MPU_VIO_3	P-DMA#1 MPU/SMPU violation. See CPUSS_MPU_VIO_0 description.
4	CPUSS_MPU_VIO_4	M-DMA#0 MPU/SMPU violation. See CPUSS_MPU_VIO_0 description.
15	CPUSS_MPU_VIO_15	Test Controller MPU/SMPU violation. See CPUSS_MPU_VIO_0 description.
16	CPUSS_MPU_VIO_16	CM4 system bus AHB-Lite interface MPU violation. See CPUSS_MPU_VIO_0 description.
17	CPUSS_MPU_VIO_17	CM4 code bus AHB-Lite interface MPU violation for non flash controller accesses. See CPUSS_MPU_VIO_0 description.
18	CPUSS_MPU_VIO_18	CM4 code bus AHB-Lite interface MPU violation for flash controller accesses. See CPUSS_MPU_VIO_0 description.
26	PERI_PERI_C_ECC	Peripheral protection SRAM correctable ECC violation DATA0[10:0]: Violating address. DATA1[7:0]: Syndrome of SRAM word.
27	PERI_PERI_NC_ECC	Peripheral protection SRAM non-correctable ECC violation
28	PERI_MS_VIO_0	CM0+ Peripheral Master Interface PPU violation DATA0[31:0]: Violating address. DATA1[0]: User read. DATA1[1]: User write. DATA1[2]: User execute. DATA1[3]: Privileged read. DATA1[4]: Privileged write. DATA1[5]: Privileged execute. DATA1[6]: Non-secure. DATA1[11:8]: Master identifier. DATA1[15:12]: Protection context identifier. DATA1[31:28]: "0": master interface, PPU violation, "1": timeout detected, "2": bus error, other: undefined.
29	PERI_MS_VIO_1	CM4 Peripheral Master Interface PPU violation. See PERI_MS_VIO_0 description.
30	PERI_MS_VIO_2	P-DMA0 Peripheral Master Interface PPU violation. See PERI_MS_VIO_0 description.
31	PERI_MS_VIO_3	P-DMA1 Peripheral Master Interface PPU violation. See PERI_MS_VIO_0 description.
32	PERI_GROUP_VIO_0	Peripheral group #0 violation DATA0[31:0]: Violating address. DATA1[0]: User read. DATA1[1]: User write. DATA1[2]: User execute. DATA1[3]: Privileged read. DATA1[4]: Privileged write. DATA1[5]: Privileged execute. DATA1[6]: Non-secure. DATA1[11:8]: Master identifier. DATA1[15:12]: Protection context identifier. DATA1[31:28]: "0": decoder or peripheral bus error, other: undefined.
33	PERI_GROUP_VIO_1	Peripheral Group #1 violation. See PERI_GROUP_VIO_0 description.
34	PERI_GROUP_VIO_2	Peripheral Group #2 violation. See PERI_GROUP_VIO_0 description.
35	PERI_GROUP_VIO_3	Peripheral Group #3 violation. See PERI_GROUP_VIO_0 description.
36	PERI_GROUP_VIO_4	Peripheral Group #4 violation. See PERI_GROUP_VIO_0 description.
37	PERI_GROUP_VIO_5	Peripheral Group #5 violation. See PERI_GROUP_VIO_0 description.
38	PERI_GROUP_VIO_6	Peripheral Group #6 violation. See PERI_GROUP_VIO_0 description.

Faults

**Table 22-1** Fault assignments (continued)

Fault	Source	Description
40	PERI_GROUP_VIO_8	Peripheral Group #8 violation. See PERI_GROUP_VIO_0 description.
41	PERI_GROUP_VIO_9	Peripheral Group #9 violation. See PERI_GROUP_VIO_0 description.
48	CPUSS_FLASHC_MAIN_BUS_ERROR	Flash controller main flash bus error FAULT_DATA0[26:0]: Violating address. Append 5'b00010 as most significant bits to derive 32-bit system address. FAULT_DATA1[11:8]: Master identifier.
49	CPUSS_FLASHC_MAIN_C_ECC	Flash controller main flash correctable ECC violation DATA[26:0]: Violating address. Append 5'b00010 as most significant bits to derive 32-bit system address. DATA1[7:0]: Syndrome of 64-bit word (at address offset 0x00). DATA1[15:8]: Syndrome of 64-bit word (at address offset 0x08). DATA1[23:16]: Syndrome of 64-bit word (at address offset 0x10). DATA1[31:24]: Syndrome of 64-bit word (at address offset 0x18).
50	CPUSS_FLASHC_MAIN_NC_ECC	Flash controller main flash non-correctable ECC violation. See CPUSS_FLASHC_MAIN_C_ECC description.
51	CPUSS_FLASHC_WORK_BUS_ERROR	Flash controller work flash bus error FAULT_DATA0[26:0]: Violating address. Append 5'b00010 as most significant bits to derive 32-bit system address. FAULT_DATA1[11:8]: Master identifier.
52	CPUSS_FLASHC_WORK_C_ECC	Flash controller work flash correctable ECC violation DATA0[26:0]: Violating address. Append 5'b00010 as most significant bits to derive 32-bit system address. DATA1[6:0]: Syndrome of 32-bit word.
53	CPUSS_FLASHC_WORK_NC_ECC	Flash controller work-flash non-correctable ECC violation. See CPUSS_FLASHC_WORK_C_ECC description.
54	CPUSS_FLASHC_CM0_CA_C_ECC	Flash controller CM0+ cache correctable ECC violation DATA0[26:0]: Violating address. DATA1[6:0]: Syndrome of 32-bit SRAM word (at address offset 0x0). DATA1[14:8]: Syndrome of 32-bit SRAM word (at address offset 0x4). DATA1[22:16]: Syndrome of 32-bit SRAM word (at address offset 0x8). DATA1[30:24]: Syndrome of 32-bit SRAM word (at address offset 0xC).
55	CPUSS_FLASHC_CM0_CA_NC_ECC	Flash controller CM0+ cache non-correctable ECC violation. See CPUSS_FLASHC_CM0_CA_C_ECC description.
56	CPUSS_FLASHC_CM4_CA_C_ECC	Flash controller CM4 cache correctable ECC violation. See CPUSS_FLASHC_CM0_CA_C_ECC description.
57	CPUSS_FLASHC_CM4_CA_NC_ECC	Flash controller CM4 cache non-correctable ECC violation. See CPUSS_FLASHC_CM0_CA_C_ECC description.
58	CPUSS_RAMC0_C_ECC	System memory controller 0 correctable ECC violation DATA0[31:0]: Violating address. DATA1[6:0]: Syndrome of 32-bit SRAM code word.
59	CPUSS_RAMC0_NC_ECC	System memory controller 0 non-correctable ECC violation. See CPUSS_RAMC0_C_ECC description.
60	CPUSS_RAMC1_C_ECC	System memory controller 1 correctable ECC violation. See CPUSS_RAMC0_C_ECC description.
61	CPUSS_RAMC1_NC_ECC	System memory controller 1 non-correctable ECC violation. See CPUSS_RAMC0_C_ECC description.
64	CPUSS_CRYPT0_C_ECC	Crypto memory correctable ECC violation DATA0[31:0]: Violating address. DATA1[6:0]: Syndrome of Least Significant 32-bit SRAM. DATA1[14:8]: Syndrome of Most Significant 32-bit SRAM.
65	CPUSS_CRYPT0_NC_ECC	CRYPT0 memory non-correctable ECC violation. See CPUSS_CRYPT0_C_ECC description.
70	CPUSS_DW0_C_ECC	Datawire0 memory correctable ECC violation DATA0[11:0]: Violating DW SRAM address (word address, assuming byte addressable). DATA1[6:0]: Syndrome of 32-bit SRAM code word.
71	CPUSS_DW0_NC_ECC	P-DMA#0 memory non-correctable ECC violation. See CPUSS_DW0_C_ECC description.
72	CPUSS_DW1_C_ECC	P-DMA#1 memory correctable ECC violation. See CPUSS_DW0_C_ECC description.
73	CPUSS_DW1_NC_ECC	P-DMA#1 memory non-correctable ECC violation. See CPUSS_DW0_C_ECC description.
74	CPUSS_FM_SRAM_C_ECC	Flash code storage SRAM memory correctable ECC violation DATA0[15:0]: Address location in the eCT Flash SRAM. DATA1[6:0]: Syndrome of 32-bit SRAM word.
75	CPUSS_FM_SRAM_NC_ECC	Flash code storage SRAM memory non-correctable ECC violation: See CPUSS_FM_SRAMC_C_ECC description.

Faults

**Table 22-1** Fault assignments (continued)

Fault	Source	Description
80	CANFD_0_CAN_C_ECC	CAN#0 message buffer correctable ECC violation DATA0[15:0]: Violating address. DATA0[22:16]: ECC violating data[38:32] from MRAM. DATA0[27:24]: Master ID: 0-7 = CAN channel ID within cluster, 8 = AHB I/F DATA1[31:0]: ECC violating data[31:0] from MRAM.
81	CANFD_0_CAN_NC_ECC	CAN#0 message buffer non-correctable ECC violation DATA0[15:0]: Violating address. DATA0[22:16]: ECC violating data[38:32] from MRAM (not for Address Error). DATA0[27:24]: Master ID: 0-7 = CAN channel ID within cluster, 8 = AHB I/F DATA0[30]: Write access, only possible for Address Error DATA0[31]: Address Error: a CAN channel did an MRAM access above MRAM_SIZE DATA1[31:0]: ECC violating data[31:0] from MRAM (not for Address Error).
82	CANFD_1_CAN_C_ECC	CAN#1 message buffer correctable ECC violation. See CANFD_0_CAN_C_ECC description.
83	CANFD_1_CAN_NC_ECC	CAN#1 message buffer non-correctable ECC violation. See CANFD_0_CAN_NC_ECC description.
90	SRSS_FAULT_CSV	Consolidated fault output for clock supervisors. Multiple CSV can detect a violation at the same time. DATA0[15:0]: CSV violation occurred on corresponding CLK_HF* root clock DATA0[24]: CSV violation occurred on reference clock for CLK_HF CSVs DATA0[25]: CSV violation occurred on CLK_LF DATA0[26]: CSV violation occurred on CLK_ILO0 DATA0[27]: CSV violation occurred on CLK_BAK
91	SRSS_FAULT_SSV	Consolidated fault output for supply supervisors. Multiple counters can detect a violation at the same time. DATA0[0]: BOD detected on VDDA_ADC DATA0[1]: OVD detected on VDDA_ADC DATA0[16]: violation detected on LVD/HVD #1 DATA0[17]: violation detected on LVD/HVD #2
92	SRSS_FAULT_MCWDT0	Fault output for MCWDT#0 (all sub-counters). Multiple counters can detect a violation at the same time. DATA0[0]: MCWDT sub counter 0 LOWER_LIMIT DATA0[1]: MCWDT sub counter 0 UPPER_LIMIT DATA0[2]: MCWDT sub counter 1 LOWER_LIMIT DATA0[3]: MCWDT sub counter 1 UPPER_LIMIT
93	SRSS_FAULT_MCWDT1	Fault output for MCWDT#1 (all sub-counters). See SRSS_FAULT_MCWDT#0 description.



## 23 Peripheral protection unit fixed structure pairs

Protection pair is a pair PPU structures, a master and a slave structure. The master structure protects the slave structure, and the slave structure protects resources such as peripheral registers, or the peripheral itself.

**Table 23-1 PPU fixed structure pairs**

Pair No.	PPU fixed structure pair	Address	Size	Description
0	PERI_MAIN	0x40000000	0x00002000	Peripheral Interconnect main
1	PERI_SECURE	0x40002000	0x00000004	Peripheral interconnect secure
2	PERI_GR0_GROUP	0x40004010	0x00000004	Peripheral Group #0 main
3	PERI_GR1_GROUP	0x40004030	0x00000004	Peripheral Group #1 main
4	PERI_GR2_GROUP	0x40004050	0x00000004	Peripheral Group #2 main
5	PERI_GR3_GROUP	0x40004060	0x00000020	Peripheral Group #3 main
6	PERI_GR4_GROUP	0x40004080	0x00000020	Peripheral Group #4 main
7	PERI_GR5_GROUP	0x400040A0	0x00000020	Peripheral Group #5 main
8	PERI_GR6_GROUP	0x400040C0	0x00000020	Peripheral Group #6 main
9	PERI_GR8_GROUP	0x40004100	0x00000020	Peripheral Group #8 main
10	PERI_GR9_GROUP	0x40004120	0x00000020	Peripheral Group #9 main
11	PERI_TR	0x40008000	0x00008000	Peripheral trigger multiplexer
12	CRYPTO_MAIN	0x40100000	0x00000400	Crypto main
13	CRYPTO_CRYPT0	0x40101000	0x00000800	Crypto MMIO (Memory Mapped I/O)
14	CRYPTO_BOOT	0x40102000	0x00000100	Crypto boot
15	CRYPTO_KEY0	0x40102100	0x00000004	Crypto Key #0
16	CRYPTO_KEY1	0x40102120	0x00000004	Crypto Key #1
17	CRYPTO_BUF	0x40108000	0x00002000	Crypto buffer
18	CPUSS_CM4	0x40200000	0x00000400	CM4 CPU core
19	CPUSS_CM0	0x40201000	0x00001000	CM0+ CPU core
20	CPUSS_BOOT <sup>[34]</sup>	0x40202000	0x00000200	CPUSS boot
21	CPUSS_CM0_INTR	0x40208000	0x00001000	CPUSS CM0+ interrupts
22	CPUSS_CM4_INTR	0x4020A000	0x00001000	CPUSS CM4 interrupts
23	FAULT_STRUCTURE0_MAIN	0x40210000	0x00000100	CPUSS Fault Structure #0 main
24	FAULT_STRUCTURE1_MAIN	0x40210100	0x00000100	CPUSS Fault Structure #1 main
25	FAULT_STRUCTURE2_MAIN	0x40210200	0x00000100	CPUSS Fault Structure #2 main
26	FAULT_STRUCTURE3_MAIN	0x40210300	0x00000100	CPUSS Fault Structure #3 main
27	IPC_STRUCTURE0_IPC	0x40220000	0x00000020	CPUSS IPC Structure #0
28	IPC_STRUCTURE1_IPC	0x40220020	0x00000020	CPUSS IPC Structure #1
29	IPC_STRUCTURE2_IPC	0x40220040	0x00000020	CPUSS IPC Structure #2
30	IPC_STRUCTURE3_IPC	0x40220060	0x00000020	CPUSS IPC Structure #3
31	IPC_STRUCTURE4_IPC	0x40220080	0x00000020	CPUSS IPC Structure #4
32	IPC_STRUCTURE5_IPC	0x402200A0	0x00000020	CPUSS IPC Structure #5
33	IPC_STRUCTURE6_IPC	0x402200C0	0x00000020	CPUSS IPC Structure #6
34	IPC_STRUCTURE7_IPC	0x402200E0	0x00000020	CPUSS IPC Structure #7
35	IPC_INTR_STRUCTURE0_INTR	0x40221000	0x00000010	CPUSS IPC Interrupt Structure #0
36	IPC_INTR_STRUCTURE1_INTR	0x40221020	0x00000010	CPUSS IPC Interrupt Structure #1
37	IPC_INTR_STRUCTURE2_INTR	0x40221040	0x00000010	CPUSS IPC Interrupt Structure #2
38	IPC_INTR_STRUCTURE3_INTR	0x40221060	0x00000010	CPUSS IPC Interrupt Structure #3

**Note**

34.Fixed PPU is configured inside the Boot and user is not allowed to change the attributes of this PPU.

Peripheral protection unit fixed structure pairs

**Table 23-1 PPU fixed structure pairs** (continued)

Pair No.	PPU fixed structure pair	Address	Size	Description
39	IPC_INTR_STRUCT4_INTR	0x40221080	0x00000010	CPUSS IPC Interrupt Structure #4
40	IPC_INTR_STRUCT5_INTR	0x402210A0	0x00000010	CPUSS IPC Interrupt Structure #5
41	IPC_INTR_STRUCT6_INTR	0x402210C0	0x00000010	CPUSS IPC Interrupt Structure #6
42	IPC_INTR_STRUCT7_INTR	0x402210E0	0x00000010	CPUSS IPC Interrupt Structure #7
43	PROT_SMPU_MAIN	0x40230000	0x00000040	Peripheral protection S MPU main
44	PROT_MPU0_MAIN	0x40234000	0x00000004	Peripheral protection MPU #0 main
45	PROT_MPU14_MAIN	0x40237800	0x00000004	Peripheral protection MPU #14 main
46	PROT_MPU15_MAIN	0x40237C00	0x00000400	Peripheral protection MPU #15 main
47	FLASHC_MAIN	0x40240000	0x00000008	Flash controller main
48	FLASHC_CMD	0x40240008	0x00000004	Flash controller command
49	FLASHC_DFT	0x40240200	0x00000100	Flash controller tests
50	FLASHC_CM0	0x40240400	0x00000080	Flash controller CM0+
51	FLASHC_CM4	0x40240480	0x00000080	Flash controller CM4
52	FLASHC_CRYPT0	0x40240500	0x00000004	Flash controller Crypto
53	FLASHC_DW0	0x40240580	0x00000004	Flash controller P-DMA#0
54	FLASHC_DW1	0x40240600	0x00000004	Flash controller P-DMA#1
55	FLASHC_DM4C	0x40240680	0x00000004	Flash controller M-DMA#0
56	FLASHC_FlashMgmt <sup>[34]</sup>	0x4024F000	0x00000080	Flash management
57	FLASHC_MainSafety	0x4024F400	0x00000008	Flash controller main safety
58	FLASHC_WorkSafety	0x4024F500	0x00000004	Flash controller work safety
59	SRSS_GENERAL	0x40260000	0x00000400	SRSS General
60	SRSS_MAIN	0x40261000	0x00001000	SRSS main
61	SRSS_SECURE	0x40262000	0x00002000	SRSS secure
62	MCWDT0_CONFIG	0x40268000	0x00000080	MCWDT #0 configuration
63	MCWDT1_CONFIG	0x40268100	0x00000080	MCWDT #1 configuration
64	MCWDT0_MAIN	0x40268080	0x00000040	MCWDT #0 main
65	MCWDT1_MAIN	0x40268180	0x00000040	MCWDT #1 main
66	WDT_CONFIG	0x4026C000	0x00000020	System WDT configuration
67	WDT_MAIN	0x4026C040	0x00000020	System WDT main
68	BACKUP_BACKUP	0x40270000	0x00010000	SRSS backup
69	DW0_DW	0x40280000	0x00000100	P-DMA#0 main
70	DW1_DW	0x40290000	0x00000100	P-DMA#1 main
71	DW0_DW_CRC	0x40280100	0x00000080	P-DMA#0 CRC
72	DW1_DW_CRC	0x40290100	0x00000080	P-DMA#1 CRC
73	DW0_CH_STRUCT0_CH	0x40288000	0x00000040	P-DMA#0 Channel #0
74	DW0_CH_STRUCT1_CH	0x40288040	0x00000040	P-DMA#0 Channel #1
75	DW0_CH_STRUCT2_CH	0x40288080	0x00000040	P-DMA#0 Channel #2
76	DW0_CH_STRUCT3_CH	0x402880C0	0x00000040	P-DMA#0 Channel #3
77	DW0_CH_STRUCT4_CH	0x40288100	0x00000040	P-DMA#0 Channel #4
78	DW0_CH_STRUCT5_CH	0x40288140	0x00000040	P-DMA#0 Channel #5
79	DW0_CH_STRUCT6_CH	0x40288180	0x00000040	P-DMA#0 Channel #6
80	DW0_CH_STRUCT7_CH	0x402881C0	0x00000040	P-DMA#0 Channel #7
81	DW0_CH_STRUCT8_CH	0x40288200	0x00000040	P-DMA#0 Channel #8
82	DW0_CH_STRUCT9_CH	0x40288240	0x00000040	P-DMA#0 Channel #9
83	DW0_CH_STRUCT10_CH	0x40288280	0x00000040	P-DMA#0 Channel #10

Peripheral protection unit fixed structure pairs

**Table 23-1 PPU fixed structure pairs** (continued)

Pair No.	PPU fixed structure pair	Address	Size	Description
84	DW0_CH_STRUCT11_CH	0x402882C0	0x00000040	P-DMA#0 Channel #11
85	DW0_CH_STRUCT12_CH	0x40288300	0x00000040	P-DMA#0 Channel #12
86	DW0_CH_STRUCT13_CH	0x40288340	0x00000040	P-DMA#0 Channel #13
87	DW0_CH_STRUCT14_CH	0x40288380	0x00000040	P-DMA#0 Channel #14
88	DW0_CH_STRUCT15_CH	0x402883C0	0x00000040	P-DMA#0 Channel #15
89	DW0_CH_STRUCT16_CH	0x40288400	0x00000040	P-DMA#0 Channel #16
90	DW0_CH_STRUCT17_CH	0x40288440	0x00000040	P-DMA#0 Channel #17
91	DW0_CH_STRUCT18_CH	0x40288480	0x00000040	P-DMA#0 Channel #18
92	DW0_CH_STRUCT19_CH	0x402884C0	0x00000040	P-DMA#0 Channel #19
93	DW0_CH_STRUCT20_CH	0x40288500	0x00000040	P-DMA#0 Channel #20
94	DW0_CH_STRUCT21_CH	0x40288540	0x00000040	P-DMA#0 Channel #21
95	DW0_CH_STRUCT22_CH	0x40288580	0x00000040	P-DMA#0 Channel #22
96	DW0_CH_STRUCT23_CH	0x402885C0	0x00000040	P-DMA#0 Channel #23
97	DW0_CH_STRUCT24_CH	0x40288600	0x00000040	P-DMA#0 Channel #24
98	DW0_CH_STRUCT25_CH	0x40288640	0x00000040	P-DMA#0 Channel #25
99	DW0_CH_STRUCT26_CH	0x40288680	0x00000040	P-DMA#0 Channel #26
100	DW0_CH_STRUCT27_CH	0x402886C0	0x00000040	P-DMA#0 Channel #27
101	DW0_CH_STRUCT28_CH	0x40288700	0x00000040	P-DMA#0 Channel #28
102	DW0_CH_STRUCT29_CH	0x40288740	0x00000040	P-DMA#0 Channel #29
103	DW0_CH_STRUCT30_CH	0x40288780	0x00000040	P-DMA#0 Channel #30
104	DW0_CH_STRUCT31_CH	0x402887C0	0x00000040	P-DMA#0 Channel #31
105	DW0_CH_STRUCT32_CH	0x40288800	0x00000040	P-DMA#0 Channel #32
106	DW0_CH_STRUCT33_CH	0x40288840	0x00000040	P-DMA#0 Channel #33
107	DW0_CH_STRUCT34_CH	0x40288880	0x00000040	P-DMA#0 Channel #34
108	DW0_CH_STRUCT35_CH	0x402888C0	0x00000040	P-DMA#0 Channel #35
109	DW0_CH_STRUCT36_CH	0x40288900	0x00000040	P-DMA#0 Channel #36
110	DW0_CH_STRUCT37_CH	0x40288940	0x00000040	P-DMA#0 Channel #37
111	DW0_CH_STRUCT38_CH	0x40288980	0x00000040	P-DMA#0 Channel #38
112	DW0_CH_STRUCT39_CH	0x402889C0	0x00000040	P-DMA#0 Channel #39
113	DW0_CH_STRUCT40_CH	0x40288A00	0x00000040	P-DMA#0 Channel #40
114	DW0_CH_STRUCT41_CH	0x40288A40	0x00000040	P-DMA#0 Channel #41
115	DW0_CH_STRUCT42_CH	0x40288A80	0x00000040	P-DMA#0 Channel #42
116	DW0_CH_STRUCT43_CH	0x40288AC0	0x00000040	P-DMA#0 Channel #43
117	DW0_CH_STRUCT44_CH	0x40288B00	0x00000040	P-DMA#0 Channel #44
118	DW0_CH_STRUCT45_CH	0x40288B40	0x00000040	P-DMA#0 Channel #45
119	DW0_CH_STRUCT46_CH	0x40288B80	0x00000040	P-DMA#0 Channel #46
120	DW0_CH_STRUCT47_CH	0x40288BC0	0x00000040	P-DMA#0 Channel #47
121	DW0_CH_STRUCT48_CH	0x40288C00	0x00000040	P-DMA#0 Channel #48
122	DW0_CH_STRUCT49_CH	0x40288C40	0x00000040	P-DMA#0 Channel #49
123	DW0_CH_STRUCT50_CH	0x40288C80	0x00000040	P-DMA#0 Channel #50
124	DW0_CH_STRUCT51_CH	0x40288CC0	0x00000040	P-DMA#0 Channel #51
125	DW0_CH_STRUCT52_CH	0x40288D00	0x00000040	P-DMA#0 Channel #52
126	DW0_CH_STRUCT53_CH	0x40288D40	0x00000040	P-DMA#0 Channel #53
127	DW0_CH_STRUCT54_CH	0x40288D80	0x00000040	P-DMA#0 Channel #54
128	DW0_CH_STRUCT55_CH	0x40288DC0	0x00000040	P-DMA#0 Channel #55

Peripheral protection unit fixed structure pairs

**Table 23-1 PPU fixed structure pairs** (continued)

Pair No.	PPU fixed structure pair	Address	Size	Description
129	DW0_CH_STRUCT56_CH	0x40288E00	0x00000040	P-DMA#0 Channel #56
130	DW0_CH_STRUCT57_CH	0x40288E40	0x00000040	P-DMA#0 Channel #57
131	DW0_CH_STRUCT58_CH	0x40288E80	0x00000040	P-DMA#0 Channel #58
132	DW0_CH_STRUCT59_CH	0x40288EC0	0x00000040	P-DMA#0 Channel #59
133	DW0_CH_STRUCT60_CH	0x40288F00	0x00000040	P-DMA#0 Channel #60
134	DW0_CH_STRUCT61_CH	0x40288F40	0x00000040	P-DMA#0 Channel #61
135	DW0_CH_STRUCT62_CH	0x40288F80	0x00000040	P-DMA#0 Channel #62
136	DW0_CH_STRUCT63_CH	0x40288FC0	0x00000040	P-DMA#0 Channel #63
137	DW0_CH_STRUCT64_CH	0x40289000	0x00000040	P-DMA#0 Channel #64
138	DW0_CH_STRUCT65_CH	0x40289040	0x00000040	P-DMA#0 Channel #65
139	DW0_CH_STRUCT66_CH	0x40289080	0x00000040	P-DMA#0 Channel #66
140	DW0_CH_STRUCT67_CH	0x402890C0	0x00000040	P-DMA#0 Channel #67
141	DW0_CH_STRUCT68_CH	0x40289100	0x00000040	P-DMA#0 Channel #68
142	DW0_CH_STRUCT69_CH	0x40289140	0x00000040	P-DMA#0 Channel #69
143	DW0_CH_STRUCT70_CH	0x40289180	0x00000040	P-DMA#0 Channel #70
144	DW0_CH_STRUCT71_CH	0x402891C0	0x00000040	P-DMA#0 Channel #71
145	DW0_CH_STRUCT72_CH	0x40289200	0x00000040	P-DMA#0 Channel #72
146	DW0_CH_STRUCT73_CH	0x40289240	0x00000040	P-DMA#0 Channel #73
147	DW0_CH_STRUCT74_CH	0x40289280	0x00000040	P-DMA#0 Channel #74
148	DW0_CH_STRUCT75_CH	0x402892C0	0x00000040	P-DMA#0 Channel #75
149	DW1_CH_STRUCT0_CH	0x40298000	0x00000040	P-DMA#1 Channel #0
150	DW1_CH_STRUCT1_CH	0x40298040	0x00000040	P-DMA#1 Channel #1
151	DW1_CH_STRUCT2_CH	0x40298080	0x00000040	P-DMA#1 Channel #2
152	DW1_CH_STRUCT3_CH	0x402980C0	0x00000040	P-DMA#1 Channel #3
153	DW1_CH_STRUCT4_CH	0x40298100	0x00000040	P-DMA#1 Channel #4
154	DW1_CH_STRUCT5_CH	0x40298140	0x00000040	P-DMA#1 Channel #5
155	DW1_CH_STRUCT6_CH	0x40298180	0x00000040	P-DMA#1 Channel #6
156	DW1_CH_STRUCT7_CH	0x402981C0	0x00000040	P-DMA#1 Channel #7
157	DW1_CH_STRUCT8_CH	0x40298200	0x00000040	P-DMA#1 Channel #8
158	DW1_CH_STRUCT9_CH	0x40298240	0x00000040	P-DMA#1 Channel #9
159	DW1_CH_STRUCT10_CH	0x40298280	0x00000040	P-DMA#1 Channel #10
160	DW1_CH_STRUCT11_CH	0x402982C0	0x00000040	P-DMA#1 Channel #11
161	DW1_CH_STRUCT12_CH	0x40298300	0x00000040	P-DMA#1 Channel #12
162	DW1_CH_STRUCT13_CH	0x40298340	0x00000040	P-DMA#1 Channel #13
163	DW1_CH_STRUCT14_CH	0x40298380	0x00000040	P-DMA#1 Channel #14
164	DW1_CH_STRUCT15_CH	0x402983C0	0x00000040	P-DMA#1 Channel #15
165	DW1_CH_STRUCT16_CH	0x40298400	0x00000040	P-DMA#1 Channel #16
166	DW1_CH_STRUCT17_CH	0x40298440	0x00000040	P-DMA#1 Channel #17
167	DW1_CH_STRUCT18_CH	0x40298480	0x00000040	P-DMA#1 Channel #18
168	DW1_CH_STRUCT19_CH	0x402984C0	0x00000040	P-DMA#1 Channel #19
169	DW1_CH_STRUCT20_CH	0x40298500	0x00000040	P-DMA#1 Channel #20
170	DW1_CH_STRUCT21_CH	0x40298540	0x00000040	P-DMA#1 Channel #21
171	DW1_CH_STRUCT22_CH	0x40298580	0x00000040	P-DMA#1 Channel #22
172	DW1_CH_STRUCT23_CH	0x402985C0	0x00000040	P-DMA#1 Channel #23
173	DW1_CH_STRUCT24_CH	0x40298600	0x00000040	P-DMA#1 Channel #24

Peripheral protection unit fixed structure pairs

**Table 23-1 PPU fixed structure pairs** (continued)

Pair No.	PPU fixed structure pair	Address	Size	Description
174	DW1_CH_STRUCT25_CH	0x40298640	0x00000040	P-DMA#1 Channel #25
175	DW1_CH_STRUCT26_CH	0x40298680	0x00000040	P-DMA#1 Channel #26
176	DW1_CH_STRUCT27_CH	0x402986C0	0x00000040	P-DMA#1 Channel #27
177	DW1_CH_STRUCT28_CH	0x40298700	0x00000040	P-DMA#1 Channel #28
178	DW1_CH_STRUCT29_CH	0x40298740	0x00000040	P-DMA#1 Channel #29
179	DW1_CH_STRUCT30_CH	0x40298780	0x00000040	P-DMA#1 Channel #30
180	DW1_CH_STRUCT31_CH	0x402987C0	0x00000040	P-DMA#1 Channel #31
181	DW1_CH_STRUCT32_CH	0x40298800	0x00000040	P-DMA#1 Channel #32
182	DW1_CH_STRUCT33_CH	0x40298840	0x00000040	P-DMA#1 Channel #33
183	DW1_CH_STRUCT34_CH	0x40298880	0x00000040	P-DMA#1 Channel #34
184	DW1_CH_STRUCT35_CH	0x402988C0	0x00000040	P-DMA#1 Channel #35
185	DW1_CH_STRUCT36_CH	0x40298900	0x00000040	P-DMA#1 Channel #36
186	DW1_CH_STRUCT37_CH	0x40298940	0x00000040	P-DMA#1 Channel #37
187	DW1_CH_STRUCT38_CH	0x40298980	0x00000040	P-DMA#1 Channel #38
188	DW1_CH_STRUCT39_CH	0x402989C0	0x00000040	P-DMA#1 Channel #39
189	DW1_CH_STRUCT40_CH	0x40298A00	0x00000040	P-DMA#1 Channel #40
190	DW1_CH_STRUCT41_CH	0x40298A40	0x00000040	P-DMA#1 Channel #41
191	DW1_CH_STRUCT42_CH	0x40298A80	0x00000040	P-DMA#1 Channel #42
192	DW1_CH_STRUCT43_CH	0x40298AC0	0x00000040	P-DMA#1 Channel #43
193	DW1_CH_STRUCT44_CH	0x40298B00	0x00000040	P-DMA#1 Channel #44
194	DW1_CH_STRUCT45_CH	0x40298B40	0x00000040	P-DMA#1 Channel #45
195	DW1_CH_STRUCT46_CH	0x40298B80	0x00000040	P-DMA#1 Channel #46
196	DW1_CH_STRUCT47_CH	0x40298BC0	0x00000040	P-DMA#1 Channel #47
197	DW1_CH_STRUCT48_CH	0x40298C00	0x00000040	P-DMA#1 Channel #48
198	DW1_CH_STRUCT49_CH	0x40298C40	0x00000040	P-DMA#1 Channel #49
199	DW1_CH_STRUCT50_CH	0x40298C80	0x00000040	P-DMA#1 Channel #50
200	DW1_CH_STRUCT51_CH	0x40298CC0	0x00000040	P-DMA#1 Channel #51
201	DW1_CH_STRUCT52_CH	0x40298D00	0x00000040	P-DMA#1 Channel #52
202	DW1_CH_STRUCT53_CH	0x40298D40	0x00000040	P-DMA#1 Channel #53
203	DW1_CH_STRUCT54_CH	0x40298D80	0x00000040	P-DMA#1 Channel #54
204	DW1_CH_STRUCT55_CH	0x40298DC0	0x00000040	P-DMA#1 Channel #55
205	DW1_CH_STRUCT56_CH	0x40298E00	0x00000040	P-DMA#1 Channel #56
206	DW1_CH_STRUCT57_CH	0x40298E40	0x00000040	P-DMA#1 Channel #57
207	DW1_CH_STRUCT58_CH	0x40298E80	0x00000040	P-DMA#1 Channel #58
208	DW1_CH_STRUCT59_CH	0x40298EC0	0x00000040	P-DMA#1 Channel #59
209	DW1_CH_STRUCT60_CH	0x40298F00	0x00000040	P-DMA#1 Channel #60
210	DW1_CH_STRUCT61_CH	0x40298F40	0x00000040	P-DMA#1 Channel #61
211	DW1_CH_STRUCT62_CH	0x40298F80	0x00000040	P-DMA#1 Channel #62
212	DW1_CH_STRUCT63_CH	0x40298FC0	0x00000040	P-DMA#1 Channel #63
213	DW1_CH_STRUCT64_CH	0x40299000	0x00000040	P-DMA#1 Channel #64
214	DW1_CH_STRUCT65_CH	0x40299040	0x00000040	P-DMA#1 Channel #65
215	DW1_CH_STRUCT66_CH	0x40299080	0x00000040	P-DMA#1 Channel #66
216	DW1_CH_STRUCT67_CH	0x402990C0	0x00000040	P-DMA#1 Channel #67
217	DW1_CH_STRUCT68_CH	0x40299100	0x00000040	P-DMA#1 Channel #68
218	DW1_CH_STRUCT69_CH	0x40299140	0x00000040	P-DMA#1 Channel #69

Peripheral protection unit fixed structure pairs

**Table 23-1 PPU fixed structure pairs** (continued)

Pair No.	PPU fixed structure pair	Address	Size	Description
219	DW1_CH_STRUCT70_CH	0x40299180	0x00000040	P-DMA#1 Channel #70
220	DW1_CH_STRUCT71_CH	0x402991C0	0x00000040	P-DMA#1 Channel #71
221	DW1_CH_STRUCT72_CH	0x40299200	0x00000040	P-DMA#1 Channel #72
222	DW1_CH_STRUCT73_CH	0x40299240	0x00000040	P-DMA#1 Channel #73
223	DW1_CH_STRUCT74_CH	0x40299280	0x00000040	P-DMA#1 Channel #74
224	DW1_CH_STRUCT75_CH	0x402992C0	0x00000040	P-DMA#1 Channel #75
225	DW1_CH_STRUCT76_CH	0x40299300	0x00000040	P-DMA#1 Channel #76
226	DW1_CH_STRUCT77_CH	0x40299340	0x00000040	P-DMA#1 Channel #77
227	DW1_CH_STRUCT78_CH	0x40299380	0x00000040	P-DMA#1 Channel #78
228	DW1_CH_STRUCT79_CH	0x402993C0	0x00000040	P-DMA#1 Channel #79
229	DW1_CH_STRUCT80_CH	0x40299400	0x00000040	P-DMA#1 Channel #80
230	DW1_CH_STRUCT81_CH	0x40299440	0x00000040	P-DMA#1 Channel #81
231	DW1_CH_STRUCT82_CH	0x40299480	0x00000040	P-DMA#1 Channel #82
232	DW1_CH_STRUCT83_CH	0x402994C0	0x00000040	P-DMA#1 Channel #83
233	DMAC_TOP	0x402A0000	0x00000010	M-DMA#0 main
234	DMAC_CH0_CH	0x402A1000	0x00000100	M-DMA#0 Channel #0
235	DMAC_CH1_CH	0x402A1100	0x00000100	M-DMA#0 Channel #1
236	DMAC_CH2_CH	0x402A1200	0x00000100	M-DMA#0 Channel #2
237	DMAC_CH3_CH	0x402A1300	0x00000100	M-DMA#0 Channel #3
238	EFUSE_CTL	0x402C0000	0x00000200	EFUSE control
239	EFUSE_DATA	0x402C0800	0x00000200	EFUSE data
240	BIST	0x402F0000	0x00001000	Built-in self test
241	HSIOM_PRT0_PRT	0x40300000	0x00000008	HSIOM Port #0
242	HSIOM_PRT1_PRT	0x40300010	0x00000008	HSIOM Port #1
243	HSIOM_PRT2_PRT	0x40300020	0x00000008	HSIOM Port #2
244	HSIOM_PRT3_PRT	0x40300030	0x00000008	HSIOM Port #3
245	HSIOM_PRT4_PRT	0x40300040	0x00000008	HSIOM Port #4
246	HSIOM_PRT5_PRT	0x40300050	0x00000008	HSIOM Port #5
247	HSIOM_PRT6_PRT	0x40300060	0x00000008	HSIOM Port #6
248	HSIOM_PRT7_PRT	0x40300070	0x00000008	HSIOM Port #7
249	HSIOM_PRT8_PRT	0x40300080	0x00000008	HSIOM Port #8
250	HSIOM_PRT9_PRT	0x40300090	0x00000008	HSIOM Port #9
251	HSIOM_PRT10_PRT	0x403000A0	0x00000008	HSIOM Port #10
252	HSIOM_PRT11_PRT	0x403000B0	0x00000008	HSIOM Port #11
253	HSIOM_PRT12_PRT	0x403000C0	0x00000008	HSIOM Port #12
254	HSIOM_PRT13_PRT	0x403000D0	0x00000008	HSIOM Port #13
255	HSIOM_PRT14_PRT	0x403000E0	0x00000008	HSIOM Port #14
256	HSIOM_PRT15_PRT	0x403000F0	0x00000008	HSIOM Port #15
257	HSIOM_PRT16_PRT	0x40300100	0x00000008	HSIOM Port #16
258	HSIOM_PRT17_PRT	0x40300110	0x00000008	HSIOM Port #17
259	HSIOM_PRT18_PRT	0x40300120	0x00000008	HSIOM Port #18
260	HSIOM_PRT19_PRT	0x40300130	0x00000008	HSIOM Port #19
261	HSIOM_AMUX	0x40302000	0x00000010	HSIOM Analog multiplexer
262	HSIOM_MON	0x40302200	0x00000010	HSIOM monitor
263	GPIO_PRT0_PRT	0x40310000	0x00000040	GPIO_STD Port #0

Peripheral protection unit fixed structure pairs

**Table 23-1 PPU fixed structure pairs** (continued)

Pair No.	PPU fixed structure pair	Address	Size	Description
264	GPIO_PRT1_PRT	0x40310080	0x00000040	GPIO_STD Port #1
265	GPIO_PRT2_PRT	0x40310100	0x00000040	GPIO_STD Port #2
266	GPIO_PRT3_PRT	0x40310180	0x00000040	GPIO_STD Port #3
267	GPIO_PRT4_PRT	0x40310200	0x00000040	GPIO_STD Port #4
268	GPIO_PRT5_PRT	0x40310280	0x00000040	GPIO_SMC Port #5
269	GPIO_PRT6_PRT	0x40310300	0x00000040	GPIO_SMC Port #6
270	GPIO_PRT7_PRT	0x40310380	0x00000040	GPIO_SMC Port #7
271	GPIO_PRT8_PRT	0x40310400	0x00000040	HSIO_STDLN Port #8
272	GPIO_PRT9_PRT	0x40310480	0x00000040	HSIO_STDLN Port #9
273	GPIO_PRT10_PRT	0x40310500	0x00000040	GPIO_STD Port #10
274	GPIO_PRT11_PRT	0x40310580	0x00000040	GPIO_STD Port #11
275	GPIO_PRT12_PRT	0x40310600	0x00000040	GPIO_STD Port #12
276	GPIO_PRT13_PRT	0x40310680	0x00000040	GPIO_STD Port #13
277	GPIO_PRT14_PRT	0x40310700	0x00000040	GPIO_ENH Port #14
278	GPIO_PRT15_PRT	0x40310780	0x00000040	GPIO_STD Port #15
279	GPIO_PRT16_PRT	0x40310800	0x00000040	GPIO_STD Port #16
280	GPIO_PRT17_PRT	0x40310880	0x00000040	GPIO_STD Port #17
281	GPIO_PRT18_PRT	0x40310900	0x00000040	GPIO_STD Port #18
282	GPIO_PRT19_PRT	0x40310980	0x00000040	GPIO_STD Port #19
283	GPIO_PRT0_CFG	0x40310040	0x00000020	GPIO_STD Port #0 configuration
284	GPIO_PRT1_CFG	0x403100C0	0x00000020	GPIO_STD Port #1 configuration
285	GPIO_PRT2_CFG	0x40310140	0x00000020	GPIO_STD Port #2 configuration
286	GPIO_PRT3_CFG	0x403101C0	0x00000020	GPIO_STD Port #3 configuration
287	GPIO_PRT4_CFG	0x40310240	0x00000020	GPIO_STD Port #4 configuration
288	GPIO_PRT5_CFG	0x403102C0	0x00000020	GPIO_SMC Port #5 configuration
289	GPIO_PRT6_CFG	0x40310340	0x00000020	GPIO_SMC Port #6 configuration
290	GPIO_PRT7_CFG	0x403103C0	0x00000020	GPIO_SMC Port #7 configuration
291	GPIO_PRT8_CFG	0x40310440	0x00000040	HSIO_STDLN Port #8 configuration
292	GPIO_PRT9_CFG	0x403104C0	0x00000040	HSIO_STDLN Port #9 configuration
293	GPIO_PRT10_CFG	0x40310540	0x00000020	GPIO_STD Port #10 configuration
294	GPIO_PRT11_CFG	0x403105C0	0x00000020	GPIO_STD Port #11 configuration
295	GPIO_PRT12_CFG	0x40310640	0x00000020	GPIO_STD Port #12 configuration
296	GPIO_PRT13_CFG	0x403106C0	0x00000020	GPIO_STD Port #13 configuration
297	GPIO_PRT14_CFG	0x40310740	0x00000020	GPIO_ENH Port #14 configuration
298	GPIO_PRT15_CFG	0x403107C0	0x00000020	GPIO_STD Port #15 configuration
299	GPIO_PRT16_CFG	0x40310840	0x00000020	GPIO_STD Port #16 configuration
300	GPIO_PRT17_CFG	0x403108C0	0x00000020	GPIO_STD Port #17 configuration
301	GPIO_PRT18_CFG	0x40310940	0x00000020	GPIO_STD Port #18 configuration
302	GPIO_PRT19_CFG	0x403109C0	0x00000020	GPIO_STD Port #19 configuration
303	GPIO_GPIO	0x40314000	0x00000040	GPIO main
304	GPIO_TEST	0x40315000	0x00000008	GPIO test
305	SMARTIO_PRT7_PRT	0x40320700	0x00000100	SMART I/O #7
306	TCPWM0_GRP0_CNT0_CNT	0x40380000	0x00000080	TCPWM#0 Group #0, Counter #0
307	TCPWM0_GRP0_CNT1_CNT	0x40380080	0x00000080	TCPWM#0 Group #0, Counter #1
308	TCPWM0_GRP0_CNT2_CNT	0x40380100	0x00000080	TCPWM#0 Group #0, Counter #2

Peripheral protection unit fixed structure pairs

**Table 23-1 PPU fixed structure pairs** (continued)

Pair No.	PPU fixed structure pair	Address	Size	Description
309	TCPWM0_GRP0_CNT3_CNT	0x40380180	0x00000080	TCPWM#0 Group #0, Counter #3
310	TCPWM0_GRP0_CNT4_CNT	0x40380200	0x00000080	TCPWM#0 Group #0, Counter #4
311	TCPWM0_GRP0_CNT5_CNT	0x40380280	0x00000080	TCPWM#0 Group #0, Counter #5
312	TCPWM0_GRP0_CNT6_CNT	0x40380300	0x00000080	TCPWM#0 Group #0, Counter #6
313	TCPWM0_GRP0_CNT7_CNT	0x40380380	0x00000080	TCPWM#0 Group #0, Counter #7
314	TCPWM0_GRP0_CNT8_CNT	0x40380400	0x00000080	TCPWM#0 Group #0, Counter #8
315	TCPWM0_GRP0_CNT9_CNT	0x40380480	0x00000080	TCPWM#0 Group #0, Counter #9
316	TCPWM0_GRP0_CNT10_CNT	0x40380500	0x00000080	TCPWM#0 Group #0, Counter #10
317	TCPWM0_GRP0_CNT11_CNT	0x40380580	0x00000080	TCPWM#0 Group #0, Counter #11
318	TCPWM0_GRP0_CNT12_CNT	0x40380600	0x00000080	TCPWM#0 Group #0, Counter #12
319	TCPWM0_GRP0_CNT13_CNT	0x40380680	0x00000080	TCPWM#0 Group #0, Counter #13
320	TCPWM0_GRP0_CNT14_CNT	0x40380700	0x00000080	TCPWM#0 Group #0, Counter #14
321	TCPWM0_GRP0_CNT15_CNT	0x40380780	0x00000080	TCPWM#0 Group #0, Counter #15
322	TCPWM0_GRP0_CNT16_CNT	0x40380800	0x00000080	TCPWM#0 Group #0, Counter #16
323	TCPWM0_GRP0_CNT17_CNT	0x40380880	0x00000080	TCPWM#0 Group #0, Counter #17
324	TCPWM0_GRP0_CNT18_CNT	0x40380900	0x00000080	TCPWM#0 Group #0, Counter #18
325	TCPWM0_GRP0_CNT19_CNT	0x40380980	0x00000080	TCPWM#0 Group #0, Counter #19
326	TCPWM0_GRP0_CNT20_CNT	0x40380A00	0x00000080	TCPWM#0 Group #0, Counter #20
327	TCPWM0_GRP0_CNT21_CNT	0x40380A80	0x00000080	TCPWM#0 Group #0, Counter #21
328	TCPWM0_GRP0_CNT22_CNT	0x40380B00	0x00000080	TCPWM#0 Group #0, Counter #22
329	TCPWM0_GRP0_CNT23_CNT	0x40380B80	0x00000080	TCPWM#0 Group #0, Counter #23
330	TCPWM0_GRP0_CNT24_CNT	0x40380C00	0x00000080	TCPWM#0 Group #0, Counter #24
331	TCPWM0_GRP0_CNT25_CNT	0x40380C80	0x00000080	TCPWM#0 Group #0, Counter #25
332	TCPWM0_GRP0_CNT26_CNT	0x40380D00	0x00000080	TCPWM#0 Group #0, Counter #26
333	TCPWM0_GRP0_CNT27_CNT	0x40380D80	0x00000080	TCPWM#0 Group #0, Counter #27
334	TCPWM0_GRP0_CNT28_CNT	0x40380E00	0x00000080	TCPWM#0 Group #0, Counter #28
335	TCPWM0_GRP0_CNT29_CNT	0x40380E80	0x00000080	TCPWM#0 Group #0, Counter #29
336	TCPWM0_GRP0_CNT30_CNT	0x40380F00	0x00000080	TCPWM#0 Group #0, Counter #30
337	TCPWM0_GRP0_CNT31_CNT	0x40380F80	0x00000080	TCPWM#0 Group #0, Counter #31
338	TCPWM0_GRP0_CNT32_CNT	0x40381000	0x00000080	TCPWM#0 Group #0, Counter #32
339	TCPWM0_GRP0_CNT33_CNT	0x40381080	0x00000080	TCPWM#0 Group #0, Counter #33
340	TCPWM0_GRP1_CNT0_CNT	0x40388000	0x00000080	TCPWM#0 Group #1, Counter #0
341	TCPWM0_GRP1_CNT1_CNT	0x40388080	0x00000080	TCPWM#0 Group #1, Counter #1
342	TCPWM0_GRP1_CNT2_CNT	0x40388100	0x00000080	TCPWM#0 Group #1, Counter #2
343	TCPWM0_GRP1_CNT3_CNT	0x40388180	0x00000080	TCPWM#0 Group #1, Counter #3
344	TCPWM0_GRP1_CNT4_CNT	0x40388200	0x00000080	TCPWM#0 Group #1, Counter #4
345	TCPWM0_GRP1_CNT5_CNT	0x40388280	0x00000080	TCPWM#0 Group #1, Counter #5
346	TCPWM0_GRP1_CNT6_CNT	0x40388300	0x00000080	TCPWM#0 Group #1, Counter #6
347	TCPWM0_GRP1_CNT7_CNT	0x40388380	0x00000080	TCPWM#0 Group #1, Counter #7
348	TCPWM0_GRP1_CNT8_CNT	0x40388400	0x00000080	TCPWM#0 Group #1, Counter #8
349	TCPWM0_GRP1_CNT9_CNT	0x40388480	0x00000080	TCPWM#0 Group #1, Counter #9
350	TCPWM0_GRP1_CNT10_CNT	0x40388500	0x00000080	TCPWM#0 Group #1, Counter #10
351	TCPWM0_GRP1_CNT11_CNT	0x40388580	0x00000080	TCPWM#0 Group #1, Counter #11
352	TCPWM0_GRP2_CNT0_CNT	0x40390000	0x00000080	TCPWM#0 Group #2, Counter #0
353	TCPWM0_GRP2_CNT1_CNT	0x40390080	0x00000080	TCPWM#0 Group #2, Counter #1



Peripheral protection unit fixed structure pairs

**Table 23-1 PPU fixed structure pairs** (continued)

Pair No.	PPU fixed structure pair	Address	Size	Description
354	TCPWM0_GRP2_CNT2_CNT	0x40390100	0x00000080	TCPWM#0 Group #2, Counter #2
355	TCPWM0_GRP2_CNT3_CNT	0x40390180	0x00000080	TCPWM#0 Group #2, Counter #3
356	TCPWM0_GRP2_CNT4_CNT	0x40390200	0x00000080	TCPWM#0 Group #2, Counter #4
357	TCPWM0_GRP2_CNT5_CNT	0x40390280	0x00000080	TCPWM#0 Group #2, Counter #5
358	TCPWM0_GRP2_CNT6_CNT	0x40390300	0x00000080	TCPWM#0 Group #2, Counter #6
359	TCPWM0_GRP2_CNT7_CNT	0x40390380	0x00000080	TCPWM#0 Group #2, Counter #7
360	TCPWM0_GRP2_CNT8_CNT	0x40390400	0x00000080	TCPWM#0 Group #2, Counter #8
361	TCPWM0_GRP2_CNT9_CNT	0x40390480	0x00000080	TCPWM#0 Group #2, Counter #9
362	TCPWM0_GRP2_CNT10_CNT	0x40390500	0x00000080	TCPWM#0 Group #2, Counter #10
363	TCPWM0_GRP2_CNT11_CNT	0x40390580	0x00000080	TCPWM#0 Group #2, Counter #11
364	TCPWM0_GRP2_CNT12_CNT	0x40390600	0x00000080	TCPWM#0 Group #2, Counter #12
365	TCPWM0_GRP2_CNT13_CNT	0x40390680	0x00000080	TCPWM#0 Group #2, Counter #13
366	TCPWM0_GRP2_CNT14_CNT	0x40390700	0x00000080	TCPWM#0 Group #2, Counter #14
367	TCPWM0_GRP2_CNT15_CNT	0x40390780	0x00000080	TCPWM#0 Group #2, Counter #15
368	LCD0	0x403B0000	0x00010000	Segment LCD Controller#0
369	EVTGEN0	0x403F0000	0x00001000	Event generator #0
370	SMIF0_MAIN	0x40420000	0x00001000	Serial Memory Interface #0
371	LIN0_MAIN	0x40500000	0x00000008	LIN#0, main
372	LIN0_CH0_CH	0x40508000	0x00000100	LIN#0, Channel #0
373	LIN0_CH1_CH	0x40508100	0x00000100	LIN#0, Channel #1
374	CXPI0_MAIN	0x40510000	0x00000008	CXPI#0, main
375	CXPI0_CH0_CH	0x40518000	0x00000100	CXPI#0, Channel #0
376	CXPI0_CH1_CH	0x40518100	0x00000100	CXPI#0, Channel #1
377	CANFD0_CH0_CH	0x40520000	0x00000200	CAN#0, Channel #0
378	CANFD0_CH1_CH	0x40520200	0x00000200	CAN#0, Channel #1
379	CANFD1_CH0_CH	0x40540000	0x00000200	CAN#1, Channel #0
380	CANFD1_CH1_CH	0x40540200	0x00000200	CAN#1, Channel #1
381	CANFD0_MAIN	0x40521000	0x00000100	CAN#0 main
382	CANFD1_MAIN	0x40541000	0x00000100	CAN#1 main
383	CANFD0_BUF	0x40530000	0x00010000	CAN#0 buffer
384	CANFD1_BUF	0x40550000	0x00010000	CAN#1 buffer
385	SCB0	0x40600000	0x00010000	Serial Communication Block#0
386	SCB1	0x40610000	0x00010000	Serial Communication Block#1
387	SCB2	0x40620000	0x00010000	Serial Communication Block#2
388	SCB3	0x40630000	0x00010000	Serial Communication Block#3
389	SCB4	0x40640000	0x00010000	Serial Communication Block#4
390	SCB5	0x40650000	0x00010000	Serial Communication Block#5
391	SCB6	0x40660000	0x00010000	Serial Communication Block#6
392	SCB7	0x40670000	0x00010000	Serial Communication Block#7
393	SCB8	0x40680000	0x00010000	Serial Communication Block#8
394	SCB9	0x40690000	0x00010000	Serial Communication Block#9
395	SCB10	0x406A0000	0x00010000	Serial Communication Block#10
396	SCB11	0x406B0000	0x00010000	Serial Communication Block#11
397	TDM0_TDM_STRUCT0_TDM_TX_STRUCT_TX	0x40818000	0x00000100	TDM#0 TX Structure #0
398	TDM0_TDM_STRUCT1_TDM_TX_STRUCT_TX	0x40818200	0x00000100	TDM#0 TX Structure #1

Peripheral protection unit fixed structure pairs

**Table 23-1 PPU fixed structure pairs** (continued)

Pair No.	PPU fixed structure pair	Address	Size	Description
399	TDM0_TDM_STRUCT0_TDM_RX_STRUCT_RX	0x40818100	0x00000100	TDM#0 RX Structure #0
400	TDM0_TDM_STRUCT1_TDM_RX_STRUCT_RX	0x40818300	0x00000100	TDM#0 RX Structure #1
401	SG0_SG_STRUCT0_TX	0x40828000	0x00000100	SG#0 TX Structure #0
402	SG0_SG_STRUCT1_TX	0x40828100	0x00000100	SG#0 TX Structure #1
403	SG0_SG_STRUCT2_TX	0x40828200	0x00000100	SG#0 TX Structure #2
404	SG0_SG_STRUCT3_TX	0x40828300	0x00000100	SG#0 TX Structure #3
405	SG0_SG_STRUCT4_TX	0x40828400	0x00000100	SG#0 TX Structure #4
406	PWM0_MAIN	0x40830000	0x00000010	PWM#0 Main
407	PWM0_TX0_TX	0x40838000	0x00000100	PWM#0 TX0
408	PWM0_TX1_TX	0x40838100	0x00000100	PWM#0 TX1
409	MIXER0_MIXER_SRC_STRUCT0_SRC	0x40888000	0x00000100	MIXER#0 Source Structure #0
410	MIXER0_MIXER_SRC_STRUCT1_SRC	0x40888100	0x00000100	MIXER#0 Source Structure #1
411	MIXER0_MIXER_SRC_STRUCT2_SRC	0x40888200	0x00000100	MIXER#0 Source Structure #2
412	MIXER0_MIXER_SRC_STRUCT3_SRC	0x40888300	0x00000100	MIXER#0 Source Structure #3
413	MIXER0_MIXER_SRC_STRUCT4_SRC	0x40888400	0x00000100	MIXER#0 Source Structure #4
414	MIXER0_MIXER_DST_STRUCT_DST	0x4088C000	0x00000100	MIXER#0 Destination Structure
415	PASS0_SAR0_SAR	0x40900000	0x00000400	PASS SAR#0
416	PASS0_SAR1_SAR	0x40901000	0x00000008	PASS SAR#1
417	PASS0_SAR0_CH0_CH	0x40900800	0x00000040	SAR#0, Channel #0
418	PASS0_SAR0_CH1_CH	0x40900840	0x00000040	SAR#0, Channel #1
419	PASS0_SAR0_CH2_CH	0x40900880	0x00000040	SAR#0, Channel #2
420	PASS0_SAR0_CH3_CH	0x409008C0	0x00000040	SAR#0, Channel #3
421	PASS0_SAR0_CH4_CH	0x40900900	0x00000040	SAR#0, Channel #4
422	PASS0_SAR0_CH5_CH	0x40900940	0x00000040	SAR#0, Channel #5
423	PASS0_SAR0_CH6_CH	0x40900980	0x00000040	SAR#0, Channel #6
424	PASS0_SAR0_CH7_CH	0x409009C0	0x00000040	SAR#0, Channel #7
425	PASS0_SAR0_CH8_CH	0x40900A00	0x00000040	SAR#0, Channel #8
426	PASS0_SAR0_CH9_CH	0x40900A40	0x00000040	SAR#0, Channel #9
427	PASS0_SAR0_CH10_CH	0x40900A80	0x00000040	SAR#0, Channel #10
428	PASS0_SAR0_CH11_CH	0x40900AC0	0x00000040	SAR#0, Channel #11
429	PASS0_SAR0_CH12_CH	0x40900B00	0x00000040	SAR#0, Channel #12
430	PASS0_SAR0_CH13_CH	0x40900B40	0x00000040	SAR#0, Channel #13
431	PASS0_SAR0_CH14_CH	0x40900B80	0x00000040	SAR#0, Channel #14
432	PASS0_SAR0_CH15_CH	0x40900BC0	0x00000040	SAR#0, Channel #15
433	PASS0_SAR0_CH16_CH	0x40900C00	0x00000040	SAR#0, Channel #16
434	PASS0_SAR0_CH17_CH	0x40900C40	0x00000040	SAR#0, Channel #17
435	PASS0_SAR0_CH18_CH	0x40900C80	0x00000040	SAR#0, Channel #18
436	PASS0_SAR0_CH19_CH	0x40900CC0	0x00000040	SAR#0, Channel #19
437	PASS0_SAR0_CH20_CH	0x40900D00	0x00000040	SAR#0, Channel #20
438	PASS0_SAR0_CH21_CH	0x40900D40	0x00000040	SAR#0, Channel #21
439	PASS0_SAR0_CH22_CH	0x40900D80	0x00000040	SAR#0, Channel #22
440	PASS0_SAR0_CH23_CH	0x40900DC0	0x00000040	SAR#0, Channel #23
441	PASS0_SAR0_CH24_CH	0x40900E00	0x00000040	SAR#0, Channel #24
442	PASS0_SAR0_CH25_CH	0x40900E40	0x00000040	SAR#0, Channel #25
443	PASS0_SAR0_CH26_CH	0x40900E80	0x00000040	SAR#0, Channel #26

Peripheral protection unit fixed structure pairs

**Table 23-1 PPU fixed structure pairs** (continued)

Pair No.	PPU fixed structure pair	Address	Size	Description
444	PASS0_SAR0_CH27_CH	0x40900EC0	0x00000040	SAR#0, Channel #27
445	PASS0_SAR0_CH28_CH	0x40900F00	0x00000040	SAR#0, Channel #28
446	PASS0_SAR0_CH29_CH	0x40900F40	0x00000040	SAR#0, Channel #29
447	PASS0_SAR0_CH30_CH	0x40900F80	0x00000040	SAR#0, Channel #30
448	PASS0_SAR0_CH31_CH	0x40900FC0	0x00000040	SAR#0, Channel #31
449	PASS0_TOP	0x409F0000	0x00001000	PASS0 SAR main

## 24 Bus masters

The Arbiter (part of flash controller) performs priority-based arbitration based on the master identifier. Each bus master has a dedicated 4-bit master identifier. This master identifier is used for bus arbitration and IPC functionality.

**Table 24-1 Bus masters for access and protection control**

<b>ID No.</b>	<b>Master ID</b>	<b>Description</b>
0	CPUSS_MS_ID_CM0	Master ID for Cortex®-M0+ CPU
1	CPUSS_MS_ID_CRYPT0	Master ID for Crypto
2	CPUSS_MS_ID_DW0	Master ID for P-DMA#0
3	CPUSS_MS_ID_DW1	Master ID for P-DMA#1
4	CPUSS_MS_ID_DMAC	Master ID for M-DMA#0
14	CPUSS_MS_ID_CM4	Master ID for Cortex®-M4 CPU
15	CPUSS_MS_ID_TC	Master ID for DAP Tap Controller

## 25 Miscellaneous configuration

**Table 25-1 Miscellaneous configuration for CYT2CL devices**

Sl. No.	Configuration	Number/instances	Description
0	SRSS_NUM_CLKPATH	6	Number of clock paths. One for each of FLL, PLL, Direct and CSV
1	SRSS_NUM_HFROOT	6	Number of CLK_HFs roots present
2	PERI_PC_NR	8	Number of protection contexts
3	PERI_CLOCK_NR	85	Number of programmable clocks (outputs)
4	PERI_DIV_8_NR	11	Number of divide-by-8 clock dividers
5	PERI_DIV_16_NR	16	Number of divide-by-16 clock dividers
	PERI_DIV_16_5_NR	4	Number of divide-by-16.5 clock dividers
6	PERI_DIV_24_5_NR	11	Number of divide-by-24.5 clock dividers
7	CPUSS_CM0P_MPU_NR	8	Number of MPU regions in CM0+
8	CPUSS_CM4_MPU_NR	8	Number of MPU regions in CM4
9	CPUSS_CRYPT0_BUFF_SIZE	2048	Number of 32-bit words in the IP internal memory buffer (to allow for a 256-B, 512-B, 1-KB, 2-KB, 4-KB, 8-KB, 16-KB, and 32-KB memory buffer)
10	CPUSS_FAULT_FAULT_NR	4	Number of fault structures
11	CPUSS_IPC_IPC_NR	8	Number of IPC structures 0 - Reserved for CM0+ access 1 - Reserved for CM4 access 2 - Reserved for DAP access Remaining for user purposes
12	SCB0_EZ_DATA_NR	256	Number of EZ memory bytes. This memory is used in EZ mode, CMD_RESP mode and FIFO mode. Note: Only SCB0 supports EZ mode
13	CPUSS_PROT_SMPU_STRUCT_NR	16	Number of S MPU protection structures
14	TCPWM_TR_ONE_CNT_NR	1	Number of input triggers per counter, routed to one counter
15	TCPWM_TR_ALL_CNT_NR	60	Number of input triggers routed to all counters, based on the pin package
16	TCPWM_GRP_NR	3	Number of TCPWM#0 counter groups
17	TCPWM_GRP_NR0_GRP_GRP_CNT_NR	34	Number of counters per TCPWM#0 Group #0
18	TCPWM_GRP_NR0_CNT_GRP_CNT_WIDTH	16	Counter width in number of bits per TCPWM#0 Group #0
19	TCPWM_GRP_NR1_GRP_GRP_CNT_NR	12	Number of counters per TCPWM#0 Group #1
20	TCPWM_GRP_NR1_CNT_GRP_CNT_WIDTH	16	Counter width in number of bits per TCPWM#0 Group #1
21	TCPWM_GRP_NR2_GRP_GRP_CNT_NR	16	Number of counters per TCPWM#0 Group #2
22	TCPWM_GRP_NR2_CNT_GRP_CNT_WIDTH	32	Counter width in number of bits per TCPWM#0 Group #2
23	CANFD0_MRAM_SIZE / CANFD1_MRAM_SIZE	16	Message RAM size in kB shared by all the channels
24	EVTGEN_COMP_STRUCT_NR	16	Number of Event Generator comparator structures

## **26 Development support**

CYT2CL has a rich set of documentation, programming tools, and online resources to assist during the development process. Visit [www.infineon.com](http://www.infineon.com) to find out more.

### **26.1 Documentation**

A suite of documentation supports CYT2CL to ensure that you can find answers to your questions quickly. This section contains a list of some of the key documents.

#### **26.1.1 Software user guide**

A step-by-step guide for using the sample driver library along with third-party IDEs such as IAR EWARM and GHS Multi.

#### **26.1.2 Technical reference manual**

The technical reference manual (TRM) contains all the technical detail needed to use a CYT2CL device, including a complete description of all registers. The TRM is available in the documentation section at [www.infineon.com](http://www.infineon.com).

### **26.2 Tools**

CYT2CL is supported on third-party development tool ecosystems such as IAR and GHS. CYT2CL is also supported by Infineon programming utilities for programming, erasing, or reading using Infineon's MiniProg4 or Segger J-link. More details are available in the documentation section at [www.infineon.com](http://www.infineon.com).

## 27 Electrical specifications

### 27.1 Absolute maximum ratings

Use of this device under conditions outside the Min and Max limits listed in [Table 27-1](#) may cause permanent damage to the device. Exposure to conditions within the limits of [Table 27-1](#) but beyond those of normal operation for extended periods of time may affect device reliability. The maximum storage temperature is 150°C in compliance with JEDEC Standard JESD22-A103, High Temperature Storage Life. When operated under conditions within the limits of [Table 27-1](#) but beyond those of normal operation, the device may not operate to specification.

#### Power considerations

The average chip-junction temperature,  $T_J$ , in °C, may be calculated using Equation 1:

$$T_J = T_A + (P_D \times \theta_{JA})$$

Equation. 1

Where:

$T_A$  is the ambient temperature in °C.

$\theta_{JA}$  is the package junction-to-ambient thermal resistance, in °C/W.

$P_D$  is the sum of  $P_{INT}$  and  $P_{IO}$  ( $P_D = P_{INT} + P_{IO}$ ).

$P_{INT}$  is the chip internal power. ( $P_{INT} = V_{DDD} \times I_{DD} + V_{DDA\_ADC} \times I_{VDDA}$ )

$P_{IO}$  represents the power dissipation on input and output pins; user determined.

For most applications,  $P_{IO} < P_{INT}$  and may be neglected.

On the other hand,  $P_{IO}$  may be significant if the device is configured to continuously drive external modules and/or memories.

Electrical specifications

**Table 27-1 Absolute maximum ratings**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/ conditions
SID10	V <sub>DDD_ABS</sub>	Power supply voltage (V <sub>DD</sub> ) <sup>[35]</sup>	V <sub>SS</sub> - 0.3	-	V <sub>SS</sub> + 6.0	V	See <b>Table 3-3</b> for assignment of ports to supply domains
SID10A	V <sub>DDIO_GPIO_ABS</sub>	Power supply voltage (V <sub>DDIO_GPIO</sub> ) <sup>[35]</sup>	V <sub>SS</sub> - 0.3	-	V <sub>SS</sub> + 6.0	V	See <b>Table 3-3</b> for assignment of ports to supply domains
SID10B	V <sub>DDIO_SMC_ABS</sub>	Power supply voltage (V <sub>DDIO_SMC</sub> ) <sup>[35]</sup>	V <sub>SS</sub> - 0.3	-	V <sub>SS</sub> + 6.0	V	See <b>Table 3-3</b> for assignment of ports to supply domains
SID10C	V <sub>DDIO_HSIO_ABS</sub>	Power supply voltage (V <sub>DDIO_HSIO</sub> ) <sup>[35]</sup>	V <sub>SS</sub> - 0.3	-	V <sub>SS</sub> + 6.0	V	See <b>Table 3-3</b> for assignment of ports to supply domains
SID11	V <sub>DDA_ADC_ABS</sub>	Analog power supply voltage (V <sub>DDA_ADC</sub> ) <sup>[35]</sup> Supply for SAR ADC	V <sub>SSA_ADC</sub> - 0.3	-	V <sub>SSA_ADC</sub> + 6.0	V	
SID12	V <sub>REFH_ABS</sub>	SAR Analog reference voltage, HIGH <sup>[35]</sup>	V <sub>SSA_ADC</sub> - 0.3	-	V <sub>SSA_ADC</sub> + 6.0	V	V <sub>REFH</sub> ≤ V <sub>DDA_ADC</sub> + 0.3 V
SID12A	V <sub>REFL_ABS</sub>	SAR Analog reference voltage, LOW <sup>[35]</sup>	V <sub>SSA_ADC</sub> - 0.3	-	V <sub>SSA_ADC</sub> + 0.3	V	
SID13	V <sub>CCD_ABS</sub>	Power supply voltage (V <sub>CCD</sub> )	V <sub>SS</sub> - 0.3	-	V <sub>SS</sub> + 1.21	V	
SID15A	V <sub>I_GPIO_ABS</sub>	Input voltage <sup>[35]</sup>	V <sub>SS</sub> - 0.5	-	V <sub>DDIO_GPIO</sub> + 0.5	V	See <b>Table 3-3</b> for assignment of ports to supply domains
SID15B	V <sub>I_SMC_ABS</sub>	Input voltage <sup>[35]</sup>	V <sub>SS</sub> - 0.5	-	V <sub>DDIO_SMC</sub> + 0.5	V	See <b>Table 3-3</b> for assignment of ports to supply domains
SID15C	V <sub>I_HSIO_ABS</sub>	Input voltage <sup>[35]</sup>	V <sub>SS</sub> - 0.5	-	V <sub>DDIO_HSIO</sub> + 0.5	V	See <b>Table 3-3</b> for assignment of ports to supply domains
SID16	V <sub>I_ADC_ABS</sub>	Analog input voltage <sup>[35]</sup>	V <sub>SSA_ADC</sub> - 0.3	-	V <sub>DDA_ADC</sub> + 0.3	V	See <b>Table 3-3</b> for assignment of ports to supply domains
SID17A	V <sub>O_GPIO_ABS</sub>	Output voltage <sup>[35]</sup>	V <sub>SS</sub> - 0.3	-	V <sub>DDIO_GPIO</sub> + 0.3	V	See <b>Table 3-3</b> for assignment of ports to supply domains
SID17B	V <sub>O_SMC_ABS</sub>	Output voltage <sup>[35]</sup>	V <sub>SS</sub> - 0.3	-	V <sub>DDIO_SMC</sub> + 0.3	V	See <b>Table 3-3</b> for assignment of ports to supply domains
SID17C	V <sub>O_HSIO_ABS</sub>	Output voltage <sup>[35]</sup>	V <sub>SS</sub> - 0.3	-	V <sub>DDIO_HSIO</sub> + 0.3	V	See <b>Table 3-3</b> for assignment of ports to supply domains
SID18	I <sub>CLAMP_ABS</sub>	Maximum clamp current <sup>[36, 37, 38, 39]</sup>	-5	-	5	mA	Applicable to GPIO pins
SID18A	ΣI <sub>CLAMP_ABS</sub>	Total maximum clamp current	-25	-	25	mA	Applicable to GPIO pins in total for V <sub>DDIO_GPIO</sub>
SID18B	I <sub>CLAMP_ABS</sub>	Maximum clamp current <sup>[36, 37, 38, 39]</sup>	-52	-	52	mA	Applicable to SMC I/O pins
SID18C	ΣI <sub>CLAMP_ABS</sub>	Total maximum clamp current	-624	-	624	mA	Applicable to SMC I/O pins clamping current occurred by sudden switching-off of inductive load (stepper motor coil) in total for V <sub>DDIO_SMC</sub>
SID18D	I <sub>CLAMP_ABS</sub>	Maximum clamp current <sup>[36, 37, 38, 39]</sup>	-5	-	5	mA	Applicable to HSIO_STDLN
SID18E	ΣI <sub>CLAMP_ABS</sub>	Total maximum clamp current	-25	-	25	mA	Applicable to I/O pins in total for V <sub>DDIO_HSIO</sub>

**Notes**

35. These parameters are based on the condition that V<sub>SS</sub> = V<sub>SSA\_ADC</sub> = 0.0 V.

36. A current-limiting resistor must be provided such that the current at the I/O pin does not exceed rated values at any time, including during power transients. See **Figure 27-4** for more information on the recommended circuit.

37. V<sub>DDIO</sub> must be sufficiently loaded or protected to prevent the clamp current from pulling it above the normal operating range.

38. Clamp current can be applied only when the part is powered, and for ports between each pair of V<sub>DDIO</sub>/V<sub>SSIO</sub> pins (excluding ADC pins, ECO\_IN/OUT, LPECO\_IN/LPECO\_OUT, WCO\_IN/OUT and XRES\_L).

39. When the conditions of [36], [37], [38] and SID18A/B/C/D/E are met, |I<sub>CLAMP\_ABS</sub>| supersedes V<sub>I\_ABS</sub>.



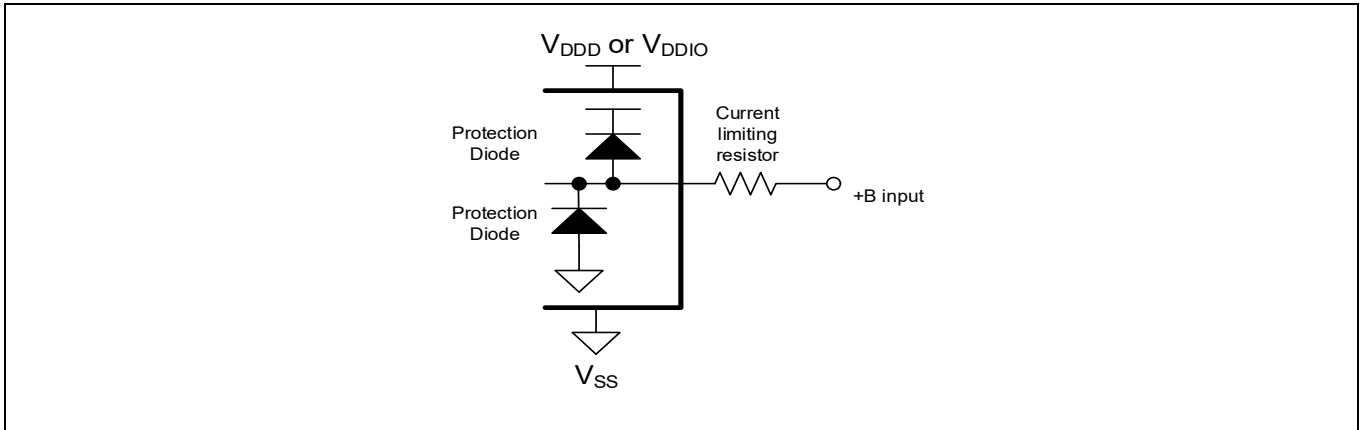
Electrical specifications

**Table 27-1 Absolute maximum ratings (continued)**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID20	I <sub>OL1_GPIO_ABS</sub>	LOW-level maximum output current for GPIO <sup>[40]</sup>	-	-	3.5	mA	Setting is 1 mA
SID21	I <sub>OL2_GPIO_ABS</sub>	LOW-level maximum output current for GPIO <sup>[40]</sup>	-	-	7	mA	Setting is 2 mA
SID22	I <sub>OL3_GPIO_ABS</sub>	LOW-level maximum output current for GPIO <sup>[40]</sup>	-	-	10	mA	Setting is 5 mA
SID22A	I <sub>OL4_GPIO_ABS</sub>	LOW-level maximum output current for GPIO <sup>[40]</sup>	-	-	10	mA	Setting is 6 mA
SID26	ΣI <sub>OL_GPIO_ABS</sub>	LOW-level total output current for GPIO <sup>[41]</sup>	-	-	50	mA	
SID26A	I <sub>OL_SMC_ABS</sub>	LOW-level maximum output current for SMC <sup>[42]</sup>	-	-	52	mA	Setting is 30 mA at -40°C
SID26B	ΣI <sub>OL_SMC_ABS</sub>	LOW-level total output current for SMC <sup>[43]</sup>	-	-	300	mA	25°C < T <sub>A</sub> ≤ 105°C
SID26I	ΣI <sub>OL_SMC_ABS</sub>	LOW-level total output current for GPIO_SMC <sup>[43]</sup>	-	-	450	mA	-40°C ≤ T <sub>A</sub> ≤ 25°C
SID26G	I <sub>OL_HSIO_ABS</sub>	LOW-level maximum output current for HSIO <sup>[44]</sup>	-	-	15	mA	
SID26H	ΣI <sub>OL_HSIO_ABS</sub>	LOW-level total output current for HSIO <sup>[45]</sup>	-	-	150	mA	
SID27	I <sub>OH1_GPIO_ABS</sub>	HIGH-level maximum output current for GPIO <sup>[40]</sup>	-	-	-3.5	mA	Setting is 1 mA
SID28	I <sub>OH2_GPIO_ABS</sub>	HIGH-level maximum output current for GPIO <sup>[40]</sup>	-	-	-7	mA	Setting is 2 mA
SID29	I <sub>OH3_GPIO_ABS</sub>	HIGH-level maximum output current for GPIO <sup>[40]</sup>	-	-	-10	mA	Setting is 5 mA
SID29A	I <sub>OH3_GPIO_ABS</sub>	HIGH-level maximum output current for GPIO <sup>[40]</sup>	-	-	-10	mA	Setting is 6 mA
SID33	ΣI <sub>OH1_GPIO_ABS</sub>	HIGH-level total output current for GPIO <sup>[41]</sup>	-	-	-50	mA	
SID33A	I <sub>OH_SMC_ABS</sub>	HIGH-level maximum output current for SMC <sup>[42]</sup>	-	-	-52	mA	Setting is 30 mA at -40 °C
SID33B	ΣI <sub>OH_SMC_ABS</sub>	HIGH-level total output current for SMC <sup>[43]</sup>	-	-	-300	mA	
SID33G	I <sub>OH_HSIO_ABS</sub>	HIGH-level maximum output current for HSIO <sup>[44]</sup>	-	-	-15	mA	
SID33H	ΣI <sub>OH_HSIO_ABS</sub>	HIGH-level total output current for HSIO <sup>[45]</sup>	-	-	-150	mA	
SID34_3	P <sub>D</sub>	Power dissipation	-	-	1800	mW	
SID36	T <sub>A</sub>	Operating ambient temperature	-40	-	105	°C	For S-grade devices
SID38	T <sub>STG</sub>	Storage temperature	-55	-	150	°C	
SID39	T <sub>J</sub>	Operating junction temperature	-40	-	150	°C	
SID39A	V <sub>ESD_HBM</sub>	Electrostatic discharge human body model	2000	-	-	V	
SID39B1	V <sub>ESD_CDM1</sub>	Electrostatic discharge charged device model for corner pins	750	-	-	V	
SID39B2	V <sub>ESD_CDM2</sub>	Electrostatic discharge charged device model for all other pins	500	-	-	V	
SID39C	I <sub>LU</sub>	The maximum pin current the device can tolerate before triggering a latch-up	-100	-	100	mA	

**Notes**

- 40. The maximum output current is the peak current flowing through any one GPIO I/O.
- 41. The total output current is the maximum current flowing through all GPIO I/Os (GPIO\_STD, and GPIO\_ENH).
- 42. The maximum output current is the peak current flowing through any one SMC I/O.
- 43. The total output current is the maximum current flowing through all SMC I/Os (GPIO\_SMC).
- 44. The maximum output current is the peak current flowing through any one HSIO I/O.
- 45. The total output current is the maximum current flowing through all HSIO I/Os (HSIO\_STDLN).



**Figure 27-1** Example of a recommended circuit<sup>[46]</sup>

**WARNING:**

Semiconductor devices may be permanently damaged by application of stress (including, without limitation, voltage, current, or temperature) in excess of absolute maximum ratings. Do not exceed any of these ratings.

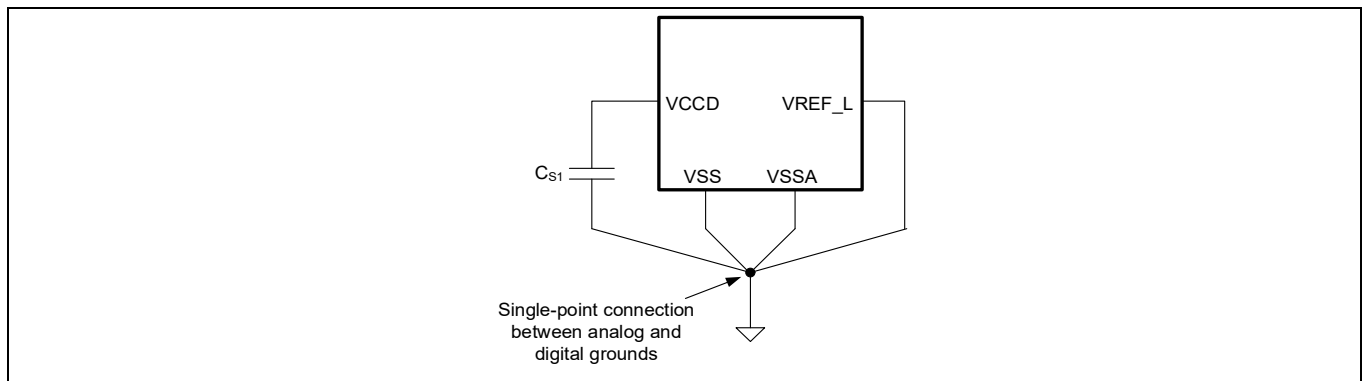
**Note**

46.+B is the positive battery voltage around 45 V.

## 27.2 Device-level specifications

**Table 27-2 Recommended operating conditions**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
<b>Recommended operating conditions</b>							
SID40	V <sub>DDD</sub> , V <sub>DDA_ADC</sub> , V <sub>DDIO_GPIO</sub> , V <sub>DDIO_SMC</sub>	Power supply voltage <sup>[47]</sup>	2.7 <sup>[48]</sup>	–	5.5 <sup>[49]</sup>	V	
SID40M	V <sub>DDD</sub>	Power supply voltage	2.7 <sup>[48]</sup>	–	3.6	V	When using I <sup>2</sup> S or TDM or (PCM)PWM
SID40A	V <sub>DDIO_EFP</sub>	Power supply voltage for eFuse programming <sup>[50]</sup>	3	–	5.5	V	V <sub>DDD</sub> for this product, when programming eFuses
SID40B	V <sub>DDIO_HSIO</sub>	Power supply voltage	3.0	3.3	3.6	V	
SID41A	C <sub>S1</sub>	Smoothing capacitor <sup>[51, 52]</sup>	3.76	10	11	μF	



**Figure 27-2 Smoothing capacitor**

### Notes

47. Ensure  $V_{DDIO\_GPIO} \geq 0.8 \times V_{DDA\_ADC}$  when SARMUX0 is enabled.
48. 3.0 V  $\pm 10\%$  is supported with a lower BOD setting option. This setting provides robust protection for internal timing but BOD reset occurs at a voltage below the specified operating conditions. A higher BOD setting option is available (consistent with down to 3.0 V) and guarantees that all operating conditions are met.
49. 5.0 V  $\pm 10\%$  is supported with a higher OVD setting option. This setting provides robust protection for internal and interface timing, but OVD reset occurs at a voltage above the specified operating conditions. A lower OVD setting option is available (consistent with up to 5.0 V) and guarantees that all operating conditions are met. Voltage overshoot to a higher OVD setting range for V<sub>DDD</sub> and V<sub>DDA\_ADC</sub> is permissible, provided the duration is less than 2 hours cumulated. Note that during overshoot voltage condition electrical parameters are not guaranteed.
50. eFuse programming must be executed with the part in a “quiet” state, with minimal activity (preferably only JTAG or a single LIN/CAN channel on V<sub>DDD</sub> domain).
51. Smoothing capacitor, C<sub>S1</sub> is required per chip (not per V<sub>CCD</sub> pin). The V<sub>CCD</sub> pins must be connected together to ensure a low-impedance connection (see the requirement in [Figure 27-2](#)).
52. Capacitors used for power supply decoupling or filtering are operated under a continuous DC-bias. Many capacitors used with DC power across them provide less than their target capacitance, and their capacitance is not constant across their working voltage range. When selecting capacitors for use with this device, ensure that the selected components provide the required capacitance under the specific operating conditions of temperature and voltage used in your design. While the temperature coefficient is normally found within a parts catalog (such as, X7R, C0G, Y5V), the matching voltage coefficient may only be available on the component datasheet or direct from the manufacturer. Use of components that do not provide the required capacitance under the actual operating conditions may cause the device to operate to less than datasheet specifications.

## Electrical specifications

**27.3 DC specifications**
**Table 27-3 DC specifications, CPU current and transition time specifications**

 All specifications are valid for  $-40^{\circ}\text{C} \leq T_A \leq 105^{\circ}\text{C}$  and for 2.7 V to 5.5 V except where noted.

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID56_2	I <sub>DD1</sub>	Execute from flash; Cortex®-M4 CPU in Active mode, all peripherals enabled	–	52	140	mA	Typ: T <sub>A</sub> = 25°C, V <sub>DDD</sub> = 5.0 V, process typ (TT) Max: T <sub>A</sub> = 105°C, T <sub>J</sub> = 150°C, V <sub>DDD</sub> = 5.5 V, process worst (FF) (Maximum expected V <sub>DDD</sub> when T <sub>J</sub> = 150°C is reached due to self-heating)
SID50A_2	I <sub>DD1</sub>	Cortex®-M4/M0+ CPUs in Sleep mode	–	7	26	mA	Clocks running at max frequency, All CPUs in Sleep mode. All peripherals, peripheral clocks, interrupts, CSV, DMA, ECO are disabled. No IO toggling. Typ: T <sub>A</sub> = 25°C, V <sub>DDD</sub> = 5.0 V, process typ (TT) Max: T <sub>A</sub> = 85°C, V <sub>DDD</sub> = 5.5 V, process worst (FF)
SID50C_2	I <sub>DD1</sub>	Cortex®-M4/M0+ CPUs in Sleep mode (room temp)	–	–	12	mA	Clocks running at max frequency, All CPUs in Sleep mode. All peripherals, peripheral clocks, interrupts, CSV, DMA, ECO are disabled. No I/O toggling. Max: T <sub>A</sub> = 25°C, V <sub>DDD</sub> = 5.5 V, process worst (FF)
SID59_2	I <sub>DD_DS32A</sub>	32 KB SRAM retention, LPECO(4 MHz) operation in DeepSleep mode	–	140	–	μA	Deep Sleep Mode (RTC at 32 kHz and EVTGEN operating, all other peripherals off, CAN MRAM disabled), Typ: T <sub>A</sub> = 25°C, V <sub>DDD</sub> = 5.0 V, process typ (TT)
SID59A_2	I <sub>DD_DS32A</sub>	32 KB SRAM retention, LPECO(4 MHz) operation in DeepSleep mode (room temp)	–	–	240	μA	Deep Sleep Mode (RTC at 32 kHz and EVTGEN operating, all other peripherals off, CAN MRAM disabled), Max: V <sub>DDD</sub> = 5.5 V, T <sub>A</sub> = 25°C, process worst (FF)
SID60_2	I <sub>DD_DS32B</sub>	32 KB SRAM retention, LPECO(4 MHz) operation in DeepSleep mode	–	–	920	μA	DeepSleep Mode (RTC at 32 kHz and Event generator operating, all other peripherals off, CAN MRAM disabled), Max: V <sub>DDD</sub> = 5.5 V, T <sub>A</sub> = 85°C, process worst (FF)
SID64_2	I <sub>DD_DS32C</sub>	32 KB SRAM retention, ILO operation in DeepSleep mode	–	40	750	μA	DeepSleep Mode (RTC at 32 kHz and Event generator operating, all other peripherals off, CAN MRAM disabled) Typ: T <sub>A</sub> = 25°C, V <sub>DDD</sub> = 5.0 V, process typ (TT) Max: T <sub>A</sub> = 85°C, V <sub>DDD</sub> = 5.5 V, process worst (FF)
SID64A_2	I <sub>DD_DS32D</sub>	32 KB SRAM retention, ILO operation in DeepSleep mode (room temp)	–	–	140	μA	DeepSleep Mode (RTC at 32kHz and Event generator operating, all other peripherals off, CAN MRAM disabled) Max: T <sub>A</sub> = 25°C, V <sub>DDD</sub> = 5.5 V, process worst (FF)
<b>Hibernate Mode</b>							
SID66	I <sub>DD_HIB1</sub>	V <sub>DDD</sub> current, Hibernate Mode + RTC at 32.768 KHz	–	–	20	μA	T <sub>A</sub> = 25°C using ILO, V <sub>DDD</sub> = 5.0 V
SID66A	I <sub>DD_HIB2</sub>	V <sub>DDD</sub> current, Hibernate Mode + RTC at 32.768 KHz	–	–	40	μA	T <sub>A</sub> = 25°C, using WCO, V <sub>DDD</sub> = 5.0 V

## Electrical specifications

**Table 27-3 DC specifications, CPU current and transition time specifications** (continued)

 All specifications are valid for  $-40^{\circ}\text{C} \leq T_A \leq 105^{\circ}\text{C}$  and for 2.7 V to 5.5 V except where noted.

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID66B	$I_{DD\_HIB3}$	$V_{DD}$ current, Hibernate Mode + RTC at 32.768 KHz	–	–	75	$\mu\text{A}$	$T_A = 85^{\circ}\text{C}$ , using WCO, $V_{DD} = 5.5\text{ V}$
SID66C	$I_{DD\_HIB4}$	$V_{DD}$ current, Hibernate Mode + RTC at 32.768 KHz	–	–	150	$\mu\text{A}$	$T_A = 25^{\circ}\text{C}$ using LPECO 4 MHz, 20-pF load of LPECO, $V_{DD} = 5.0\text{ V}$
SID66D	$I_{DD\_HIB5}$	$V_{DD}$ current, Hibernate Mode + RTC at 32.768 KHz	–	–	215	$\mu\text{A}$	$T_A = 85^{\circ}\text{C}$ , using LPECO 4 MHz, 20-pF load of LPECO, $V_{DD} = 5.5\text{ V}$
<b>Power Mode Transition Times</b>							
SID69	$t_{ACT\_DS}$	Power down time from ACTIVE to DEEPSLEEP (using the internal regulator)	–	–	2.5	$\mu\text{s}$	When IMO is already running and all HFCLK roots are at least 8 MHz. HFCLK roots that are slower than this will require additional time to turn off.
SID67	$t_{DS\_ACT}$	DeepSleep to Active transition time (IMO clock, flash execution)	–	–	26	$\mu\text{s}$	When using 8 MHz IMO. Measured from wakeup interrupt during DeepSleep until Flash execution. $T_A \geq -5^{\circ}\text{C}$ Note: At temperatures below $-5^{\circ}\text{C}$ the DeepSleep to Active transition time can be higher than the max time indicated by as much as 20 $\mu\text{s}$
SID67A	$t_{DS\_ACT\_FLL}$	DeepSleep to Active transition time (FLL clock, flash execution)	–	–	26	$\mu\text{s}$	When using FLL to generate 96 MHz from the 8-MHz IMO. Measured from wakeup interrupt during DeepSleep until Flash execution. $T_A \geq -5^{\circ}\text{C}$ Note: At temperatures below $-5^{\circ}\text{C}$ the DeepSleep to Active transition time can be higher than the max time indicated by as much as 20 $\mu\text{s}$
SID67B	$t_{DS\_ACT\_PLL}$	DeepSleep to Active transition time (PLL clock)	–	–	60	$\mu\text{s}$	When using PLL to generate 96 MHz from the 8-MHz IMO. Measured from wakeup interrupt during DeepSleep until PLL locks. $T_A \geq -5^{\circ}\text{C}$ Note: At temperatures below $-5^{\circ}\text{C}$ the DeepSleep to Active transition time can be higher than the max time indicated by as much as 20 $\mu\text{s}$
SID68	$t_{HIB\_ACT}$	Release time from HV reset (POR, BOD, OVD, OCD, WDT, Hibernate wakeup, or XRES_L) until CM0+ begins executing ROM boot	–	–	265	$\mu\text{s}$	Without boot runtime. Guaranteed by design
SID68A	$t_{LVR\_ACT}$	Release time from LV reset (Fault, Internal system reset, MCWDT, or CSV) during Active/Sleep until CM0+ begins executing ROM boot	8	–	10	$\mu\text{s}$	Without boot runtime. Guaranteed by design
SID68B	$t_{LVR\_DS}$	Release time from LV reset (Fault, or MCWDT) during DeepSleep until CM0+ begins executing ROM boot	–	–	15	$\mu\text{s}$	Without boot runtime. Guaranteed by design

Electrical specifications

**Table 27-3 DC specifications, CPU current and transition time specifications** (continued)

All specifications are valid for  $-40^{\circ}\text{C} \leq T_A \leq 105^{\circ}\text{C}$  and for 2.7 V to 5.5 V except where noted.

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID79	t <sub>HIBWAKE-UP_PW</sub>	Pulse width for wakeup from Hibernate mode on HIBERANTE_WAKEUP pins	90	–	–	ns	Guaranteed by design
SID80A	t <sub>RB_N</sub>	ROM boot startup time or wakeup time from hibernate in NORMAL protection state	–	–	1700	μs	FAST_BOOT = 1, CM0+ clocked at 100 MHz
SID80B	t <sub>RB_S</sub>	ROM boot startup time or wakeup time from hibernate in SECURE protection state	–	–	2300	μs	FAST_BOOT = 1, CM0+ clocked at 100 MHz
SID81A	t <sub>FB</sub>	Flash boot startup time or wakeup time from hibernate in NORMAL/SECURE protection state	–	–	190	μs	FAST_BOOT = 1, TOC2_FLAGS=0x2CF, CM0+ clocked at 100 MHz, Listen window = 0 ms
SID81B	t <sub>FB_A</sub>	Flash boot with app authentication time in NORMAL/SECURE protection state	–	–	5000	μs	FAST_BOOT = 1, TOC2_FLAGS = 0x24F, CM0+ clocked at 100 MHz, Listen window = 0 ms, Public key exponent e = 0x010001, App size is 64 KB with the last 256 bytes being a digital signature in RSASSA-PKCS1-v1.5 Valid for RSA2K.
SID81C	t <sub>FB_B</sub>	Flash boot with app authentication time in NORMAL/SECURE protection state	–	–	8150	μs	FAST_BOOT = 1, TOC2_FLAGS = 0x24F, CM0+ clocked at 100 MHz, Listen window = 0 ms, Public key exponent e = 0x010001, App size is 64 KB with the last 384 bytes being a digital signature in RSASSA-PKCS1-v1.5 Valid for RSA3K.

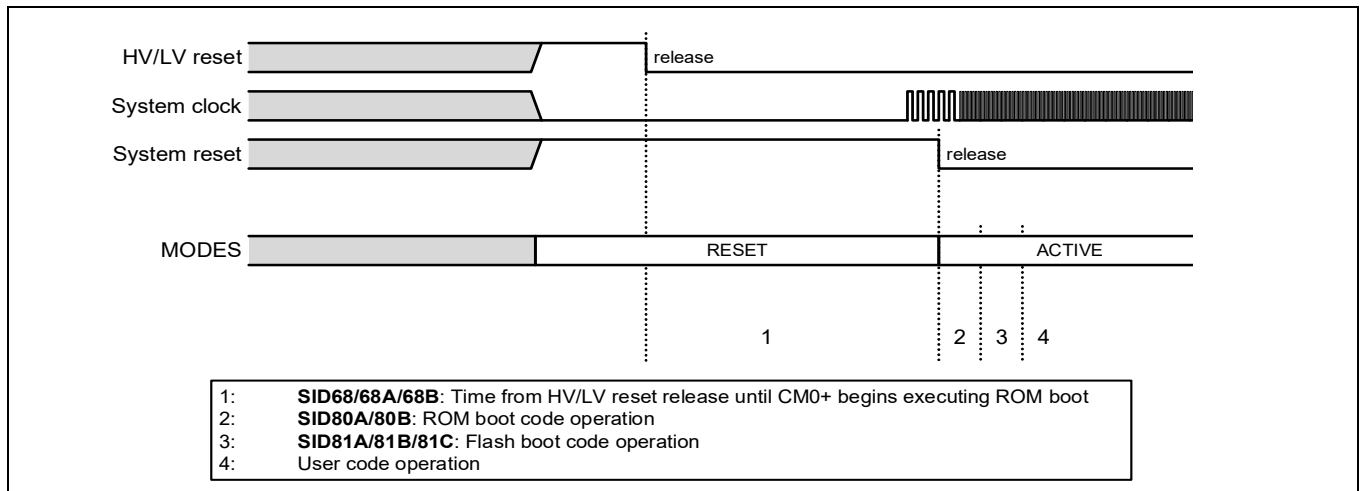
**Regulator Specifications**

SID600	V <sub>CCD</sub>	Internal regulator core supply voltage (transient range)	1.05	1.1	1.15	V	
SID601_2	I <sub>DDD_ACT</sub>	Regulator operating current in Active/Sleep mode	–	80	150	μA	Guaranteed by design
SID602	I <sub>DDD_DPSLP</sub>	Regulator operating current in DeepSleep mode	–	1.5	20	μA	Guaranteed by design
SID603_2	I <sub>RUSH</sub>	In-rush current	–	–	375	mA	Average V <sub>DD</sub> current until C <sub>S1</sub> (connected to V <sub>CCD</sub> pin) is charged after Active regulator is turned on.
SID604_2	I <sub>OUT</sub>	Internal regulator output current for operation	–	–	150	mA	Without triggering OVD

**27.4 Reset specifications**

**Table 27-4 XRES\_L Reset**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
<b>XRES_L DC specifications</b>							
SID73	I <sub>DD_XRES</sub>	I <sub>DD</sub> when XRES_L asserted	-	-	1.7	mA	Typ: T <sub>A</sub> = 25°C, V <sub>DD</sub> = 5 V, process typ (TT) Max: T <sub>A</sub> = 105°C, V <sub>DD</sub> = 5.5 V, process worst (FF)
SID74	V <sub>IH</sub>	Input voltage HIGH threshold	0.7 × V <sub>DD</sub>	-	-	V	CMOS input
SID75	V <sub>IL</sub>	Input voltage LOW threshold	-	-	0.3 × V <sub>DD</sub>	V	CMOS input
SID76	R <sub>PULLUP</sub>	Pull-up resistor	7	-	20	kΩ	
SID77	C <sub>IN</sub>	Input capacitance	-	-	5	pF	
SID78	V <sub>HYSXRES</sub>	Input voltage hysteresis	0.05 × V <sub>DD</sub>	-	-	V	
<b>XRES_L AC specifications</b>							
SID70	t <sub>XRES_ACT</sub>	XRES_L release to Active transition time	-	-	265	μs	Without boot runtime. Guaranteed by design
SID71	t <sub>XRES_PW</sub>	XRES_L pulse width	5	-	-	μs	
SID72	t <sub>XRES_FT</sub>	Pulse suppression width	100	-	-	ns	



**Figure 27-3 Reset sequence**

Electrical specifications

## 27.5 I/O Specifications

**Table 27-5 I/O specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
<b>V<sub>DDIO_GPIO</sub> (standard 5 V I/O) Specifications for GPIO_STD ports except GPIO_ENH</b>							
SID650	V <sub>OL1</sub>	Output voltage LOW level	-	-	0.6	V	I <sub>OL</sub> = 6 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b00, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID651	V <sub>OL2</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 5 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b0X, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID651D	V <sub>OL2</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 2 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b0X, 2.7 V ≤ V <sub>DDIO_GPIO</sub> < 4.5 V
SID652	V <sub>OL3</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 2 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b10, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID652D	V <sub>OL3</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 1 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b10, 2.7 V ≤ V <sub>DDIO_GPIO</sub> < 4.5 V
SID653	V <sub>OL4</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 1 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b11, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID653D	V <sub>OL4</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 0.5 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b11, 2.7 V ≤ V <sub>DDIO_GPIO</sub> < 4.5 V
SID654	V <sub>OH1</sub>	Output voltage HIGH level	V <sub>DDIO_GPIO</sub> - 0.5	-	-	V	I <sub>OH</sub> = -5 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b00, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID654D	V <sub>OH1</sub>	Output voltage HIGH level	V <sub>DDIO_GPIO</sub> - 0.5	-	-	V	I <sub>OH</sub> = -2 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b00, 2.7 V ≤ V <sub>DDIO_GPIO</sub> < 4.5 V
SID655	V <sub>OH2</sub>	Output voltage HIGH level	V <sub>DDIO_GPIO</sub> - 0.5	-	-	V	I <sub>OH</sub> = -5 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b01, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID655D	V <sub>OH2</sub>	Output voltage HIGH level	V <sub>DDIO_GPIO</sub> - 0.5	-	-	V	I <sub>OH</sub> = -2 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b01, 2.7 V ≤ V <sub>DDIO_GPIO</sub> < 4.5 V
SID656	V <sub>OH3</sub>	Output voltage HIGH level	V <sub>DDIO_GPIO</sub> - 0.5	-	-	V	I <sub>OH</sub> = -2 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b10, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID656D	V <sub>OH3</sub>	Output voltage HIGH level	V <sub>DDIO_GPIO</sub> - 0.5	-	-	V	I <sub>OH</sub> = -1 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b10, 2.7 V ≤ V <sub>DDIO_GPIO</sub> < 4.5 V
SID657	V <sub>OH4</sub>	Output voltage HIGH level	V <sub>DDIO_GPIO</sub> - 0.5	-	-	V	I <sub>OH</sub> = -1 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b11, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID657D	V <sub>OH4</sub>	Output voltage HIGH level	V <sub>DDIO_GPIO</sub> - 0.5	-	-	V	I <sub>OH</sub> = -0.5 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b11, 2.7 V ≤ V <sub>DDIO_GPIO</sub> < 4.5 V
SID658	R <sub>PD</sub>	Pull-down resistance	25	50	100	kΩ	
SID659	R <sub>PU</sub>	Pull-up resistance	25	50	100	kΩ	
SID660	V <sub>IH_CMOS</sub>	Input voltage HIGH threshold in CMOS mode	0.7 × V <sub>DDIO_GPIO</sub>	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b0
SID661	V <sub>IH_TTL</sub>	Input voltage HIGH threshold in TTL mode	2	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b1
SID662	V <sub>IH_AUTO</sub>	Input voltage HIGH threshold in AUTO mode	0.8 × V <sub>DDIO_GPIO</sub>	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b1 CFG_IN/VTRIP_SEL<0:0> = 0b0 4.5 V ≤ V <sub>DDIO_GPIO</sub> ≤ 5.5 V
SID663	V <sub>IL_CMOS</sub>	Input voltage LOW threshold in CMOS mode	-	-	0.3 × V <sub>DDIO_GPIO</sub>	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b0
SID664	V <sub>IL_TTL</sub>	Input voltage LOW threshold in TTL mode	-	-	0.8	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b1
SID665	V <sub>IL_AUTO</sub>	Input voltage LOW threshold in AUTO mode	-	-	0.5 × V <sub>DDIO_GPIO</sub>	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b1 CFG_IN/VTRIP_SEL<0:0> = 0b0 4.5 V ≤ V <sub>DDIO_GPIO</sub> ≤ 5.5 V
SID666	V <sub>HYST_CMOS</sub>	Hysteresis in CMOS mode	0.05 × V <sub>DDIO_GPIO</sub>	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b0



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**Table 27-5 I/O specifications (continued)**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID668	V <sub>HYST_AUTO</sub>	Hysteresis in AUTO mode	0.05 × V <sub>DDIO_GPIO</sub>	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0>= 0b1 CFG_IN/VTRIP_SEL<0:0>= 0b0 4.5 V ≤ V <sub>DDIO_GPIO</sub> ≤ 5.5 V
SID669	C <sub>in</sub>	Input pin capacitance	-	-	5	pF	Test condition: 10/100MHz
SID670	I <sub>IL</sub>	Input leakage current	-1	-	1	μA	V <sub>DDIO_GPIO</sub> = V <sub>DDD</sub> = V <sub>DDA_ADC</sub> = 5.5 V, V <sub>SS</sub> < V <sub>I</sub> < V <sub>DDIO_GPIO</sub> -40°C ≤ T <sub>A</sub> ≤ 105°C This is valid for the pin which do not have ADC input functionality.
SID671	t <sub>R_F_FAST</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_GPIO</sub> )	1	-	10	ns	CFG_OUT/DRIVE_SEL<1:0>= 0b00, 20-pF load, entire V <sub>DDIO_GPIO</sub> range
SID672	t <sub>R_F_FAST</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_GPIO</sub> )	1	-	20	ns	CFG_OUT/DRIVE_SEL<1:0>= 0b00, 50-pF load, entire V <sub>DDIO_GPIO</sub> range, Guaranteed by design
SID673	t <sub>R_F_FAST</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_GPIO</sub> )	1	-	20	ns	CFG_OUT/DRIVE_SEL<1:0>= 0b01, 20-pF load, entire V <sub>DDIO_GPIO</sub> range, Guaranteed by design
SID674	t <sub>R_F_FAST</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_GPIO</sub> )	1	-	20	ns	CFG_OUT/DRIVE_SEL<1:0>= 0b10, 10-pF load, entire V <sub>DDIO_GPIO</sub> range, Guaranteed by design
SID675	t <sub>R_F_FAST</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_GPIO</sub> )	1	-	20	ns	CFG_OUT/DRIVE_SEL<1:0>= 0b11, 6-pF load, entire V <sub>DDIO_GPIO</sub> range, Guaranteed by design
<b>GPIO_SMC Specifications (Stepper Motor Control, 5 VI/Os)</b>							
SID650A	V <sub>OL2</sub>	Output voltage LOW level	-	-	0.6	V	I <sub>OL</sub> = 6 mA, CFG_OUT/DRIVE_SEL<1:0>= 0b01, V <sub>DDIO_SMC</sub> ≥ 4.5 V
SID651A	V <sub>OL2</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 5 mA, CFG_OUT/DRIVE_SEL<1:0>= 0b01, V <sub>DDIO_SMC</sub> ≥ 4.5 V
SID651E	V <sub>OL2</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 2 mA, CFG_OUT/DRIVE_SEL<1:0>= 0b01, 2.7 V ≤ V <sub>DDIO_SMC</sub> < 4.5 V
SID652A	V <sub>OL3</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 2 mA, CFG_OUT/DRIVE_SEL<1:0>= 0b10, V <sub>DDIO_SMC</sub> ≥ 4.5 V
SID652E	V <sub>OL3</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 1 mA, CFG_OUT/DRIVE_SEL<1:0>= 0b10, 2.7 V ≤ V <sub>DDIO_SMC</sub> < 4.5 V
SID653A	V <sub>OL4</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 1 mA, CFG_OUT/DRIVE_SEL<1:0>= 0b11, V <sub>DDIO_SMC</sub> ≥ 4.5 V
SID653E	V <sub>OL4</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 0.5 mA, CFG_OUT/DRIVE_SEL<1:0>= 0b11, 2.7 V ≤ V <sub>DDIO_SMC</sub> < 4.5 V
SID653B	V <sub>OL5</sub>	Output voltage LOW level	-	-	0.5	V	I <sub>OL</sub> = 30 mA, CFG_OUT/DRIVE_SEL<1:0>= 0b00, CFG_OUT/SLOW<0:0>= 0b1, 25°C < T <sub>A</sub> ≤ 105°C, V <sub>DDIO_SMC</sub> ≥ 4.5 V
SID653C	V <sub>OL5</sub>	Output voltage LOW level	-	-	0.5	V	I <sub>OL</sub> = 40 mA, CFG_OUT/DRIVE_SEL<1:0>= 0b00, CFG_OUT/SLOW<0:0>= 0b1, -30°C < T <sub>A</sub> ≤ 25°C, V <sub>DDIO_SMC</sub> ≥ 4.5 V
SID653H	V <sub>OL5</sub>	Output voltage LOW level	-	-	0.5	V	I <sub>OL</sub> = 52 mA, CFG_OUT/DRIVE_SEL<1:0>= 0b00, CFG_OUT/SLOW<0:0>= 0b1, -40°C ≤ T <sub>A</sub> ≤ -30°C, V <sub>DDIO_SMC</sub> ≥ 4.5 V
SID654A	V <sub>OH2</sub>	Output voltage HIGH level	V <sub>DDIO_SMC</sub> - 0.5	-	-	V	I <sub>OH</sub> = -5 mA, CFG_OUT/DRIVE_SEL<1:0>= 0b01, V <sub>DDIO_SMC</sub> ≥ 4.5 V
SID654E	V <sub>OH2</sub>	Output voltage HIGH level	V <sub>DDIO_SMC</sub> - 0.5	-	-	V	I <sub>OH</sub> = -2 mA, CFG_OUT/DRIVE_SEL<1:0>= 0b01, 2.7 V ≤ V <sub>DDIO_SMC</sub> < 4.5 V

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**Table 27-5 I/O specifications (continued)**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID656A	V <sub>OH3</sub>	Output voltage HIGH level	V <sub>DDIO_SMC</sub> - 0.5	-	-	V	I <sub>OH</sub> = -2 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b10, V <sub>DDIO_SMC</sub> ≥ 4.5 V
SID656E	V <sub>OH3</sub>	Output voltage HIGH level	V <sub>DDIO_SMC</sub> - 0.5	-	-	V	I <sub>OH</sub> = -1 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b10, 2.7 V ≤ V <sub>DDIO_SMC</sub> < 4.5 V
SID657A	V <sub>OH4</sub>	Output voltage HIGH level	V <sub>DDIO_SMC</sub> - 0.5	-	-	V	I <sub>OH</sub> = -1 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b11, V <sub>DDIO_SMC</sub> ≥ 4.5 V
SID657E	V <sub>OH4</sub>	Output voltage HIGH level	V <sub>DDIO_SMC</sub> - 0.5	-	-	V	I <sub>OH</sub> = -0.5 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b11, 2.7 V ≤ V <sub>DDIO_SMC</sub> < 4.5 V
SID657B	V <sub>OH5</sub>	Output voltage HIGH level	V <sub>DDIO_SMC</sub> - 0.5	-	-	V	I <sub>OH</sub> = -30 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b00, CFG_OUT/SLOW<0:0> = 0b1, 25°C < T <sub>A</sub> ≤ 105°C, V <sub>DDIO_SMC</sub> ≥ 4.5 V
SID657C	V <sub>OH5</sub>	Output voltage HIGH level	V <sub>DDIO_SMC</sub> - 0.5	-	-	V	I <sub>OL</sub> = -40 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b00, CFG_OUT/SLOW<0:0> = 0b1, -30°C < T <sub>A</sub> ≤ 25°C, V <sub>DDIO_SMC</sub> ≥ 4.5 V
SID657I	V <sub>OH5</sub>	Output voltage HIGH level	V <sub>DDIO_SMC</sub> - 0.5	-	-	V	I <sub>OL</sub> = -52 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b00, CFG_OUT/SLOW<0:0> = 0b1, -40°C < T <sub>A</sub> ≤ -30°C, V <sub>DDIO_SMC</sub> ≥ 4.5 V
SID658A	R <sub>PD</sub>	Pull-down resistance	25	50	100	kΩ	
SID659A	R <sub>PU</sub>	Pull-up resistance	25	50	100	kΩ	
SID659B	V <sub>OUT</sub>	Mid range voltage level	2.45	-	2.55	V	CFG/DRIVE_MODE<2:0> = 0b001
SID660A	V <sub>IH_CMOS</sub>	Input voltage HIGH threshold in CMOS mode	0.7 × V <sub>DDIO_SMC</sub>	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b0
SID661A	V <sub>IH_TTL</sub>	Input voltage HIGH threshold in TTL mode	2.0	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b1
SID662A	V <sub>IH_AUTO</sub>	Input voltage HIGH threshold in AUTO mode	0.8 × V <sub>DDIO_SMC</sub>	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b1 CFG_IN/VTRIP_SEL<0:0> = 0b0 4.5 V ≤ V <sub>DDIO_SMC</sub> ≤ 5.5 V
SID663A	V <sub>IL_CMOS</sub>	Input voltage LOW threshold in CMOS mode	-	-	0.3 × V <sub>DDIO_SMC</sub>	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b0
SID664A	V <sub>IL_TTL</sub>	Input voltage LOW threshold in TTL mode	-	-	0.8	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b1
SID665A	V <sub>IL_AUTO</sub>	Input voltage LOW threshold in AUTO mode	-	-	0.5 × V <sub>DDIO_SMC</sub>	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b1 CFG_IN/VTRIP_SEL<0:0> = 0b0 4.5 V ≤ V <sub>DDIO_SMC</sub> ≤ 5.5 V
SID666A	V <sub>HYST_CMOS</sub>	Hysteresis in CMOS mode	0.05 × V <sub>DDIO_SMC</sub>	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b0
SID668A	V <sub>HYST_AUTO</sub>	Hysteresis in AUTO mode	0.05 × V <sub>DDIO_SMC</sub>	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b1 CFG_IN/VTRIP_SEL<0:0> = 0b0 4.5 V ≤ V <sub>DDIO_SMC</sub> ≤ 5.5 V
SID669A	C <sub>IN</sub>	Input pin capacitance	-	-	7	pF	For 10 MHz and 100 MHz
SID670A	I <sub>IL</sub>	Input leakage current	-2	-	2	μA	V <sub>DDIO_SMC</sub> = V <sub>DD</sub> = 5.5 V, V <sub>SS</sub> < V <sub>I</sub> < V <sub>DDIO_SMC</sub> -40°C ≤ T <sub>A</sub> ≤ 105°C This is valid for the pin which do not have ADC input functionality.
SID673A	t <sub>R_F_FAST</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_SMC</sub> )	1	-	20	ns	5-mA drive strength 20-pF load, CFG_OUT/DRIVE_SEL<1:0> = 0b01, CFG_OUT/SLOW<0:0> = 0b0, guaranteed by design
SID674A	t <sub>R_F_FAST</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_SMC</sub> )	1	-	20	ns	2-mA drive strength 10-pF load, CFG_OUT/DRIVE_SEL<1:0> = 0b10, CFG_OUT/SLOW<0:0> = 0b0, guaranteed by design

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**Table 27-5 I/O specifications (continued)**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID675A	t <sub>R_F_FAST</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_SMC</sub> )	1	-	20	ns	1-mA drive strength 6-pF load, CFG_OUT/DRIVE_SEL<1:0> = 0b11, CFG_OUT/SLOW<0:0> = 0b0, guaranteed by design
SID676A	t <sub>R_F_SMC_SLOW</sub>	Fall time (10% to 90% of V <sub>DDIO_SMC</sub> )	15	-	80	ns	30-mA drive strength No load, CFG_OUT/DRIVE_SEL<1:0> = 0b00, CFG_OUT/SLOW<0:0> = 0b1
SID676B	t <sub>R_F_SMC_SLOW</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_SMC</sub> )	25	-	100	ns	30-mA drive strength 85-pF load, CFG_OUT/DRIVE_SEL<1:0> = 0b00, CFG_OUT/SLOW<0:0> = 0b1
SID676C	t <sub>R_F_SMC_SLOW</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_SMC</sub> )	100	-	200	ns	30-mA drive strength 2.7-nF load, CFG_OUT/DRIVE_SEL<1:0> = 0b00, CFG_OUT/SLOW<0:0> = 0b1
<b>GPIO_ENH Specifications</b>							
SID650C	V <sub>OL1</sub>	Output voltage LOW level	-	-	0.6	V	I <sub>OL</sub> = 6 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b0X, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID650D	V <sub>OL1</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 5 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b0X, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID651C	V <sub>OL1</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 2 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b0X, 2.7 V ≤ V <sub>DDIO_GPIO</sub> < 4.5 V
SID652C	V <sub>OL3</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 2 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b10, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID652F	V <sub>OL3</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 1 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b10, 2.7 V ≤ V <sub>DDIO_GPIO</sub> < 4.5 V
SID653F	V <sub>OL4</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 1 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b11, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID653G	V <sub>OL4</sub>	Output voltage LOW level	-	-	0.4	V	I <sub>OL</sub> = 0.5 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b11, 2.7 V ≤ V <sub>DDIO_GPIO</sub> < 4.5 V
SID654C	V <sub>OH1</sub>	Output voltage HIGH level	V <sub>DDIO_GPIO</sub> - 0.5	-	-	V	I <sub>OH</sub> = -5 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b0X, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID654G	V <sub>OH1</sub>	Output voltage HIGH level	V <sub>DDIO_GPIO</sub> - 0.5	-	-	V	I <sub>OH</sub> = -2 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b0X, 2.7 V ≤ V <sub>DDIO_GPIO</sub> < 4.5 V
SID655C	V <sub>OH3</sub>	Output voltage HIGH level	V <sub>DDIO_GPIO</sub> - 0.5	-	-	V	I <sub>OH</sub> = -2 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b10, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID656C	V <sub>OH3</sub>	Output voltage HIGH level	V <sub>DDIO_GPIO</sub> - 0.5	-	-	V	I <sub>OH</sub> = -1 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b10, 2.7 V ≤ V <sub>DDIO_GPIO</sub> < 4.5 V
SID657G	V <sub>OH4</sub>	Output voltage HIGH level	V <sub>DDIO_GPIO</sub> - 0.5	-	-	V	I <sub>OH</sub> = -1 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b11, V <sub>DDIO_GPIO</sub> ≥ 4.5 V
SID657H	V <sub>OH4</sub>	Output voltage HIGH level	V <sub>DDIO_GPIO</sub> - 0.5	-	-	V	I <sub>OH</sub> = -0.5 mA, CFG_OUT/DRIVE_SEL<1:0> = 0b11, 2.7 V ≤ V <sub>DDIO_GPIO</sub> < 4.5 V
SID658C	R <sub>PD</sub>	Pull-down resistance	25	50	100	kΩ	
SID659C	R <sub>PU</sub>	Pull-up resistance	25	50	100	kΩ	
SID660C	V <sub>IH_CMOS</sub>	Input voltage HIGH threshold in CMOS mode	0.7 × V <sub>DDIO_GPIO</sub>	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b0
SID661C	V <sub>IH_TTL</sub>	Input voltage HIGH threshold in TTL mode	2	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b1
SID662C	V <sub>IH_AUTO</sub>	Input voltage HIGH threshold in AUTO mode	0.8 × V <sub>DDIO_GPIO</sub>	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b1 CFG_IN/VTRIP_SEL<0:0> = 0b0 4.5 V ≤ V <sub>DDIO_GPIO</sub> ≤ 5.5 V
SID663C	V <sub>IL_CMOS</sub>	Input voltage LOW threshold in CMOS mode	-	-	0.3 × V <sub>DDIO_GPIO</sub>	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b0

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**Table 27-5 I/O specifications (continued)**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID664C	V <sub>IL_TTL</sub>	Input voltage LOW threshold in TTL mode	-	-	0.8	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0>= 0b0 CFG_IN/VTRIP_SEL<0:0>= 0b1
SID665C	V <sub>IL_AUTO</sub>	Input voltage LOW threshold in AUTO mode	-	-	0.5 × V <sub>DDIO_GPIO</sub>	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0>= 0b1 CFG_IN/VTRIP_SEL<0:0>= 0b0 4.5 V ≤ V <sub>DDIO_GPIO</sub> ≤ 5.5 V
SID666C	V <sub>HYST_CMOS</sub>	Hysteresis in CMOS mode	0.05 × V <sub>DDIO_GPIO</sub>	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0>= 0b0 CFG_IN/VTRIP_SEL<0:0>= 0b0
SID668C	V <sub>HYST_AUTO</sub>	Hysteresis in AUTO mode	0.05 × V <sub>DDIO_GPIO</sub>	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0>= 0b1 CFG_IN/VTRIP_SEL<0:0>= 0b0 4.5 V ≤ V <sub>DDIO_GPIO</sub> ≤ 5.5 V
SID669C	C <sub>IN</sub>	Input pin capacitance	-	-	5	pF	Test condition: 10/100MHz
SID670C	I <sub>IL</sub>	Input leakage current	-1	-	1	μA	V <sub>DDIO_GPIO</sub> = V <sub>DD</sub> = 5.5 V, V <sub>SS</sub> < V <sub>I</sub> < V <sub>DDIO_GPIO</sub> -40 °C ≤ T <sub>A</sub> ≤ 105 °C
SID671C	t <sub>R_F_FAST</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_GPIO</sub> )	1	-	10	ns	20-pF load, CFG_OUT/DRIVE_SEL<1:0>= 0b00, CFG_OUT/SLOW<0:0>= 0b0, entire V <sub>DDIO_GPIO</sub> range
SID672C	t <sub>R_F_FAST</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_GPIO</sub> )	1	-	20	ns	50-pF load, CFG_OUT/DRIVE_SEL<1:0>= 0b00, CFG_OUT/SLOW<0:0>= 0b0, entire V <sub>DDIO_GPIO</sub> range, Guaranteed by design
SID673C	t <sub>R_F_FAST</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_GPIO</sub> )	1	-	20	ns	20-pF load, CFG_OUT/DRIVE_SEL<1:0>= 0b01, CFG_OUT/SLOW<0:0>= 0b0, entire V <sub>DDIO_GPIO</sub> range, Guaranteed by design
SID674C	t <sub>R_F_FAST</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_GPIO</sub> )	1	-	20	ns	10-pF load, CFG_OUT/DRIVE_SEL<1:0>= 0b10, CFG_OUT/SLOW<0:0>= 0b0, entire V <sub>DDIO_GPIO</sub> range, Guaranteed by design
SID675C	t <sub>R_F_FAST</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_GPIO</sub> )	1	-	20	ns	6-pF load, CFG_OUT/DRIVE_SEL<1:0>= 0b11, CFG_OUT/SLOW<0:0>= 0b0, entire V <sub>DDIO_GPIO</sub> range, Guaranteed by design
SID676E	t <sub>F_I2C_SLOW</sub>	Fall time (30% to 70% of V <sub>DDIO_GPIO</sub> )	20 × (V <sub>DDIO_GPIO</sub> / 5.5)	-	250	ns	10-pF to 400-pF load, CFG_OUT/DRIVE_SEL<1:0>= 0b00, CFG_OUT/SLOW<0:0>= 0b1, minimum external R <sub>PU</sub> = 400 Ω
SID677C	t <sub>R_F_SLOW</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_GPIO</sub> )	20 × (V <sub>DDIO_GPIO</sub> / 5.5)	-	160	ns	20-pF load, CFG_OUT/DRIVE_SEL<1:0>= 0b00, CFG_OUT/SLOW<0:0>= 0b1, output frequency = 1 MHz
SID678C	t <sub>R_F_SLOW</sub>	Rise time or fall time (10% to 90% of V <sub>DDIO_GPIO</sub> )	20 × (V <sub>DDIO_GPIO</sub> / 5.5)	-	250	ns	400-pF load, CFG_OUT/DRIVE_SEL<1:0>= 0b00, CFG_OUT/SLOW<0:0>= 0b1, output frequency = 400 kHz, Guaranteed by design

**HSIO\_STDLN Specifications (3 V I/Os)**

SID651F	V <sub>OL0</sub>	Output LOW voltage level	-	-	0.2	V	I <sub>OL</sub> = 0.1 mA, CFG_DRIVE_EXT<1:0>/DRIVE_SEL_EXT<4:0>= 0b0000
SID654I	V <sub>OL1</sub>	Output LOW voltage level	-	-	0.4	V	I <sub>OL</sub> = 10 mA, CFG_DRIVE_EXT<1:0>/DRIVE_SEL_EXT<4:0>= 0b0001, 3.0 V ≤ V <sub>DDIO_HSIO</sub> ≤ 3.6 V
SID655G	V <sub>OL2</sub>	Output LOW voltage level	-	-	0.4	V	I <sub>OL</sub> = 2 mA, CFG_DRIVE_EXT<1:0>/DRIVE_SEL_EXT<4:0>= 0b0010, 3.0 V ≤ V <sub>DDIO_HSIO</sub> ≤ 3.6 V
SID656G	V <sub>OL3</sub>	Output LOW voltage level	-	-	0.4	V	I <sub>OL</sub> = 1 mA, CFG_DRIVE_EXT<1:0>/DRIVE_SEL_EXT<4:0>= 0b0011, 3.0 V ≤ V <sub>DDIO_HSIO</sub> ≤ 3.6 V
SID656H	V <sub>OL4</sub>	Output LOW voltage level	-	-	0.4	V	I <sub>OL</sub> = 0.5 mA, CFG_DRIVE_EXT<1:0>/DRIVE_SEL_EXT<4:0>= 0b0100, 3.0 V ≤ V <sub>DDIO_HSIO</sub> ≤ 3.6 V

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**Table 27-5 I/O specifications (continued)**

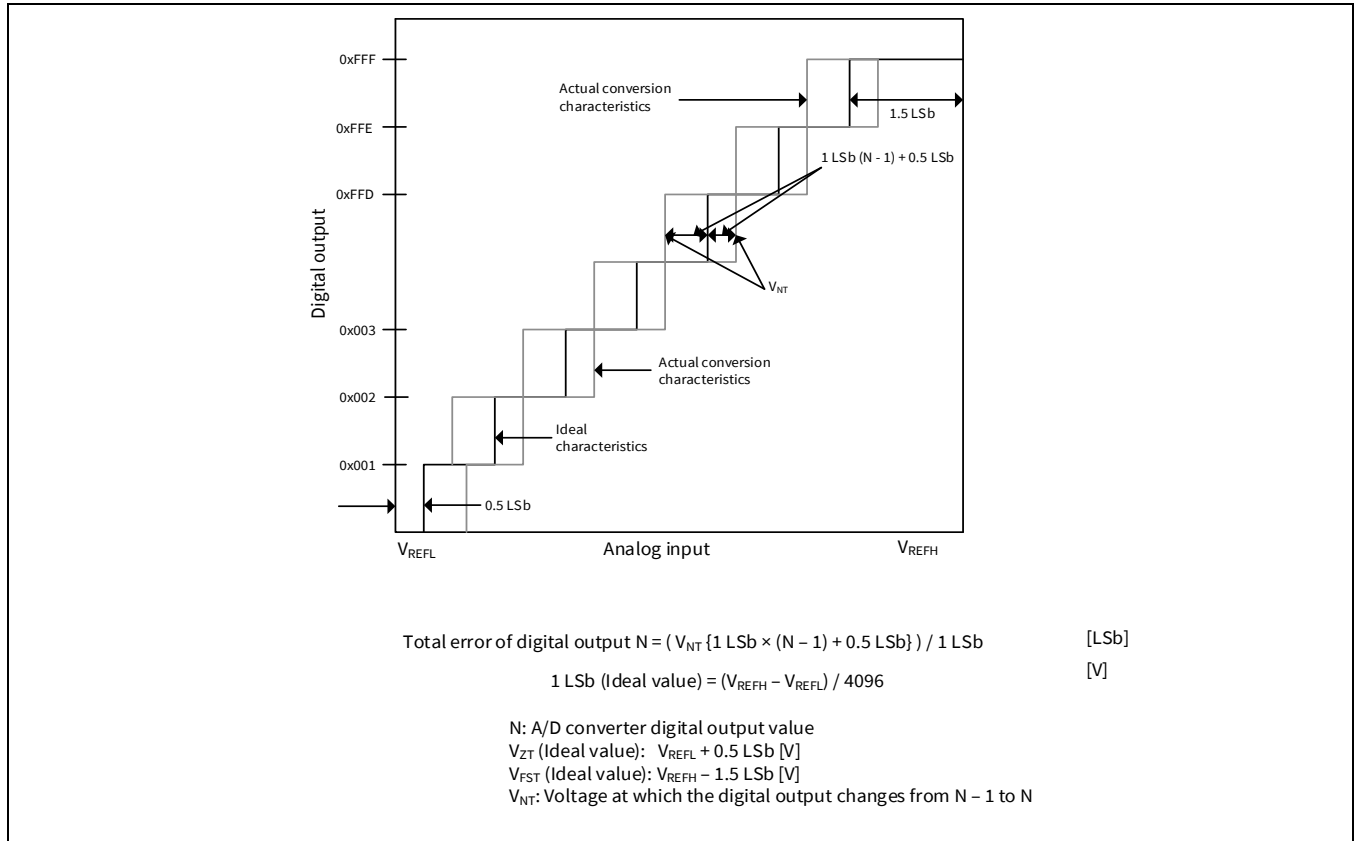
Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID658D	V <sub>OH0</sub>	Output HIGH voltage level	V <sub>DDIO_HSIO</sub> - 0.2	-	-	V	I <sub>OH</sub> = -0.1 mA, CFG_DRIVE_EXT<1:0>/DRIVE_SEL_EXT<4:0> = 0b0000
SID661F	V <sub>OH1</sub>	Output HIGH voltage level	V <sub>DDIO_HSIO</sub> - 0.4	-	-	V	I <sub>OH</sub> = -10 mA, CFG_DRIVE_EXT<1:0>/DRIVE_SEL_EXT<4:0> = 0b0001, 3.0 V ≤ V <sub>DDIO_HSIO</sub> ≤ 3.6 V
SID662F	V <sub>OH2</sub>	Output HIGH voltage level	V <sub>DDIO_HSIO</sub> - 0.4	-	-	V	I <sub>OH</sub> = -2 mA, CFG_DRIVE_EXT<1:0>/DRIVE_SEL_EXT<4:0> = 0b0010, 3.0 V ≤ V <sub>DDIO_HSIO</sub> ≤ 3.6 V
SID663E	V <sub>OH3</sub>	Output HIGH voltage level	V <sub>DDIO_HSIO</sub> - 0.4	-	-	V	I <sub>OH</sub> = -1 mA, CFG_DRIVE_EXT<1:0>/DRIVE_SEL_EXT<4:0> = 0b0011, 3.0 V ≤ V <sub>DDIO_HSIO</sub> ≤ 3.6 V
SID663F	V <sub>OH4</sub>	Output HIGH voltage level	V <sub>DDIO_HSIO</sub> - 0.4	-	-	V	I <sub>OH</sub> = -0.5 mA, CFG_DRIVE_EXT<1:0>/DRIVE_SEL_EXT<4:0> = 0b0100, 3.0 V ≤ V <sub>DDIO_HSIO</sub> ≤ 3.6 V
SID664D	R <sub>PD</sub>	Pull-down resistance	25	50	100	kΩ	
SID665F	R <sub>PU</sub>	Pull-up resistance	25	50	100	kΩ	
SID667G	V <sub>IH0</sub>	Input Voltage HIGH threshold	0.7 × V <sub>DDIO_HSIO</sub>	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b0
SID667I	V <sub>IH1</sub>	Input Voltage HIGH threshold	2	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b1
SID671F	V <sub>IL0</sub>	Input Voltage LOW threshold	-	-	0.3 × V <sub>DDIO_HSIO</sub>	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b0
SID671G	V <sub>IL1</sub>	Input Voltage LOW threshold	-	-	0.8	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b1
SID674D	V <sub>HYST_CMOS</sub>	Hysteresis in CMOS mode	0.05 × V <sub>DDIO_HSIO</sub>	-	-	V	CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0 CFG_IN/VTRIP_SEL<0:0> = 0b0
SID675D	C <sub>IN</sub>	Input pin capacitance	-	-	5	pF	Test condition: 10/100MHz
SID676H	I <sub>IL12</sub>	Input leakage current	-1	-	1	μA	V <sub>DDIO_HSIO</sub> = 3.6 V, V <sub>SS</sub> < V <sub>I</sub> < V <sub>DDIO_HSIO</sub> -40°C ≤ T <sub>A</sub> ≤ 105°C
<b>GPIO Input Specifications</b>							
SID98	t <sub>FT</sub>	Analog glitch filter (pulse suppression width)	-	-	50 <sup>[53]</sup>	ns	One filter per port group (required for some I <sup>2</sup> C speeds)
SID99	t <sub>INT</sub>	Minimum pulse width for GPIO interrupt	160	-	-	ns	

**Note**

53.If longer pulse suppression width is required, use Smart I/O.

## 27.6 Analog peripherals

### 27.6.1 SAR ADC

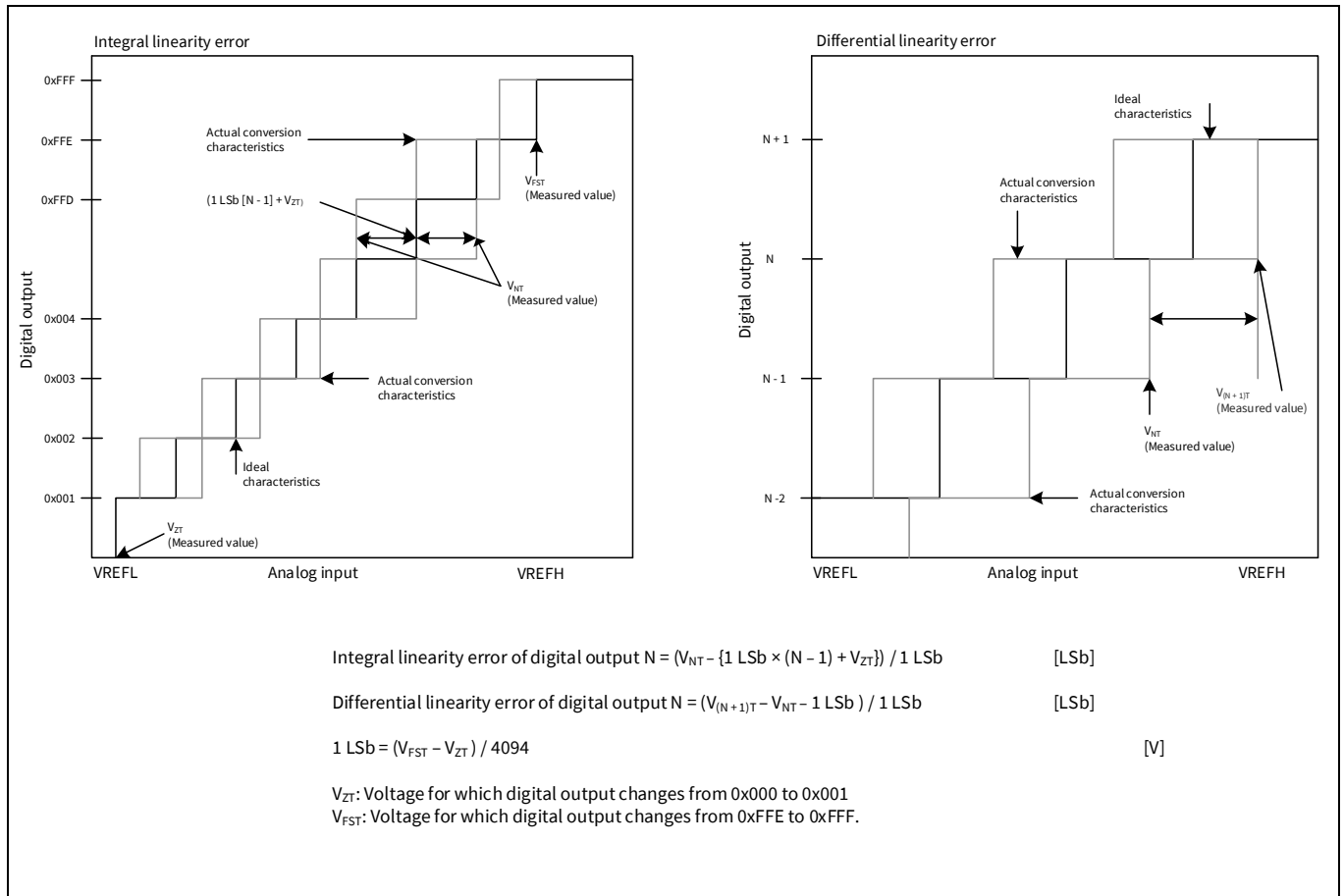


**Figure 27-4 ADC characteristics and error definitions**

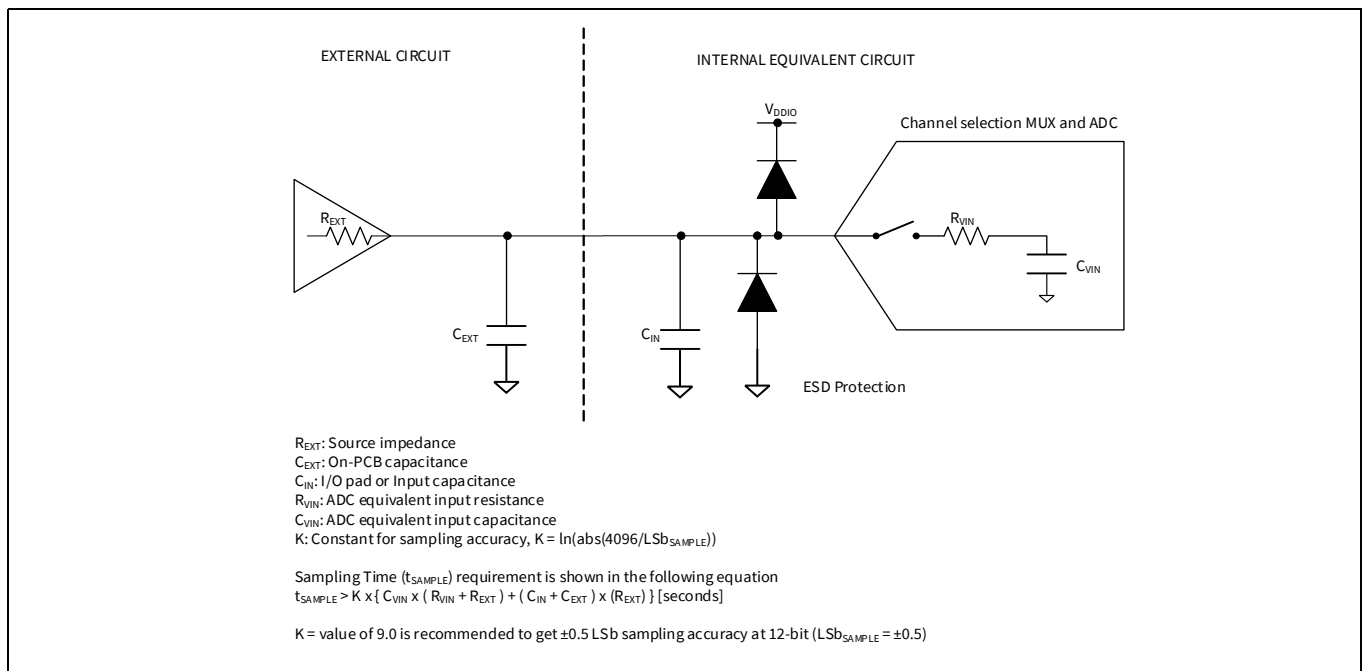
**Table 27-6 12-Bit SAR ADC DC specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID100	A_RES	SAR ADC resolution	-	-	12	bits	
SID101	V_A_INV	Input voltage range	V <sub>REFL</sub>	-	V <sub>REFH</sub>	V	
SID102	V <sub>REFH</sub>	SAR ADC HIGH reference voltage range	2.7	-	V <sub>D<sub>DDA</sub>_ADC</sub>	V	ADC performance degrades when high reference is higher than supply
SID103	V <sub>REFL</sub>	SAR ADC LOW reference voltage range	V <sub>SSA_ADC</sub>	-	V <sub>SSA_ADC</sub>	V	ADC performance degrades when low reference is lower than ground
SID103A	V <sub>BAND_GAP</sub>	Internal band gap reference voltage	0.882	0.9	0.918	V	

Electrical specifications



**Figure 27-5 Integral and differential linearity errors**



**Figure 27-6 ADC equivalent circuit for analog input**

Electrical specifications

**Table 27-7 SAR ADC AC specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID104	V <sub>ZT</sub>	Zero transition voltage	-20	-	20	mV	V <sub>DDA_ADC</sub> = 2.7 V to 5.5 V, -40°C ≤ T <sub>A</sub> ≤ 105°C before offset adjustment
SID105	V <sub>FST</sub>	Full-scale transition voltage	-20	-	20	mV	V <sub>DDA_ADC</sub> = 2.7 V to 5.5 V, -40°C ≤ T <sub>A</sub> ≤ 105°C before offset adjustment
SID114	f <sub>ADC</sub>	ADC operating frequency	2	-	26.67	MHz	
SID113	t <sub>S_4P5</sub>	Analog input sample time (4.5 V ≤ V <sub>DDA_ADC</sub> ) for channels of SARMUX0	412	-	-	ns	SARMUX0 inputs are direct into the ADC Guaranteed by design
SID113A	t <sub>S_2P7</sub>	Analog input sample time (2.7 V ≤ V <sub>DDA_ADC</sub> ) for channels of SARMUX0	824	-	-	ns	SARMUX0 inputs are direct into the ADC Guaranteed by design
SID113B	t <sub>S_DR_4P5</sub>	Analog input sample time when input is from diagnostic reference (4.5 V ≤ V <sub>DDA_ADC</sub> )	2	-	-	μs	Guaranteed by design
SID113C	t <sub>S_DR_2P7</sub>	Analog input sample time when input is from diagnostic reference (2.7 V ≤ V <sub>DDA_ADC</sub> )	2.5	-	-	μs	Guaranteed by design
SID113D	t <sub>S_TS</sub>	Analog input sample time for temperature sensor	7	-	-	μs	Guaranteed by design
SID106	t <sub>ST1</sub>	Max throughput (sample per second) for channels of SARMUX0	-	-	1	Msp/s	4.5 V ≤ V <sub>DDA_ADC</sub> ≤ 5.5 V, 80 MHz / 3 = 26.67 MHz, 11 sampling cycles, 15 conversion cycles
SID106A	t <sub>ST2</sub>	Max throughput (sample per second) for channels of SARMUX0	-	-	0.5	Msp/s	2.7 V ≤ V <sub>DDA_ADC</sub> < 4.5 V, 80 MHz / 6 = 13.3 MHz, 11 sampling cycles, 15 conversion cycles
SID107	C <sub>VIN</sub>	ADC input sampling capacitance	-	-	4.8	pF	Guaranteed by design
SID108	R <sub>VIN1</sub>	Input path ON resistance (4.5 V to 5.5 V)	-	-	9.4	kΩ	Guaranteed by design
SID108A	R <sub>VIN2</sub>	Input path ON resistance (2.7 V to 4.5 V)	-	-	13.9	kΩ	Guaranteed by design
SID108B	R <sub>DREF1</sub>	Diagnostic path ON resistance (4.5 V to 5.5 V)	-	-	40	kΩ	Guaranteed by design
SID108C	R <sub>DREF2</sub>	Diagnostic path ON resistance (2.7 V to 4.5 V)	-	-	50	kΩ	Guaranteed by design
SID119	ACC_RLAD	Diagnostic reference resistor ladder accuracy	-4	-	4	%	



Electrical specifications

**Table 27-7 SAR ADC AC specifications** (continued)

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID109	A_TE	Total error	-5	-	5	LSb	$V_{DDA\_ADC} = V_{REFH} = 2.7\text{ V}$ to 5.5 V, $V_{REFL} = V_{SSA\_ADC}$ $-40^\circ\text{C} \leq T_A \leq 105^\circ\text{C}$ Total Error after offset and gain adjustment at 12-bit resolution mode
SID110	A_INL	Integral nonlinearity	-2.5	-	2.5	LSb	$V_{DDA\_ADC} = 2.7\text{ V}$ to 5.5 V, $-40^\circ\text{C} \leq T_A \leq 105^\circ\text{C}$
SID111	A_DNL	Differential nonlinearity	-0.99	-	1.9	LSb	$V_{DDA\_ADC} = 2.7\text{ V}$ to 5.5 V, $-40^\circ\text{C} \leq T_A \leq 105^\circ\text{C}$
SID112	A_GE	Measure the ADC output with input switching through all input channels of one ADC	-7	-	7	LSb	$V_{DDA\_ADC} = 2.7\text{ V}$ to 5.5 V, $-40^\circ\text{C} \leq T_A \leq 105^\circ\text{C}$
SID115	I <sub>AIC</sub>	Analog input leakage current (GPIO_STD)	-350	-	350	nA	When input pad is selected for conversion, $V_{DDA\_ADC} = V_{REFH} = 2.7\text{ V}$ to 5.5 V, $-40^\circ\text{C} \leq T_A \leq 105^\circ\text{C}$
SID115D	I <sub>AIC</sub>	Analog input leakage current (GPIO_SMC)	-1075	-	1075	nA	When input pad is selected for conversion, $V_{DDA\_ADC} = V_{REFH} = 2.7\text{ V}$ to 5.5 V, $-40^\circ\text{C} \leq T_A \leq 105^\circ\text{C}$
SID115A	I <sub>AIC2</sub>	Analog input leakage current (GPIO_STD)	-	-	165	nA	When input pad is not selected for conversion, $V_{DDA\_ADC} = V_{REFH} = 2.7\text{ V}$ to 5.5 V, $-40^\circ\text{C} \leq T_A \leq 105^\circ\text{C}$
SID115E	I <sub>AIC2</sub>	Analog input leakage current (GPIO_SMC)	-	-	1015	nA	When input pad is not selected for conversion, $V_{DDA\_ADC} = V_{REFH} = 2.7\text{ V}$ to 5.5 V, $-40^\circ\text{C} \leq T_A \leq 105^\circ\text{C}$
SID116	I <sub>DIAGREF</sub>	Diagnostic reference current	-	-	70	μA	
SID117	I <sub>VDDA</sub>	Analog power supply current while ADC is operating	-	360	550	μA	Per enabled ADC, without diagnosis
SID117A	I <sub>VDDA_DS</sub>	Analog power supply current while ADC is not operating	-	1	21	μA	Per enabled ADC

**Table 27-7 SAR ADC AC specifications** (continued)

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID118	$I_{VREF}$	Analog reference voltage current while ADC is operating	–	360	550	μA	Per enabled ADC, without diagnosis
SID118A	$I_{VREF\_LEAK}$	Analog reference voltage current while ADC is not operating	–	1.8	5	μA	Per enabled ADC
SID118B	$t_{S\_4P5\_1}$	Analog input sample time ( $4.5\text{ V} \leq V_{DDA\_ADC}$ ) for channels of SARMUX1	824	–	–	ns	Additional delay for SARMUX1 due to additional switches in the path to the ADC Guaranteed by Design
SID118C	$t_{S\_2P7\_1}$	Analog input sample time ( $2.7\text{ V} \leq V_{DDA\_ADC}$ ) for channels of SARMUX1	1648	–	–	ns	Additional delay for SARMUX1 due to additional switches in the path to the ADC Guaranteed by Design
SID119A	$t_{ST3}$	Max throughput (sample per second) for channels of SARMUX1	–	–	0.5	Msp/s	$4.5\text{ V} \leq V_{DDA\_ADC} \leq 5.5\text{ V}$ , 80 MHz / 6 = 13.3 MHz, 11 sampling cycles, 15 conversion cycles
SID119B	$t_{ST4}$	Max throughput (sample per second) for channels of SARMUX1	–	–	0.25	Msp/s	$2.7\text{ V} \leq V_{DDA\_ADC} < 4.5\text{ V}$ , 80 MHz / 12 = 6.67 MHz, 11 sampling cycles, 15 conversion cycles

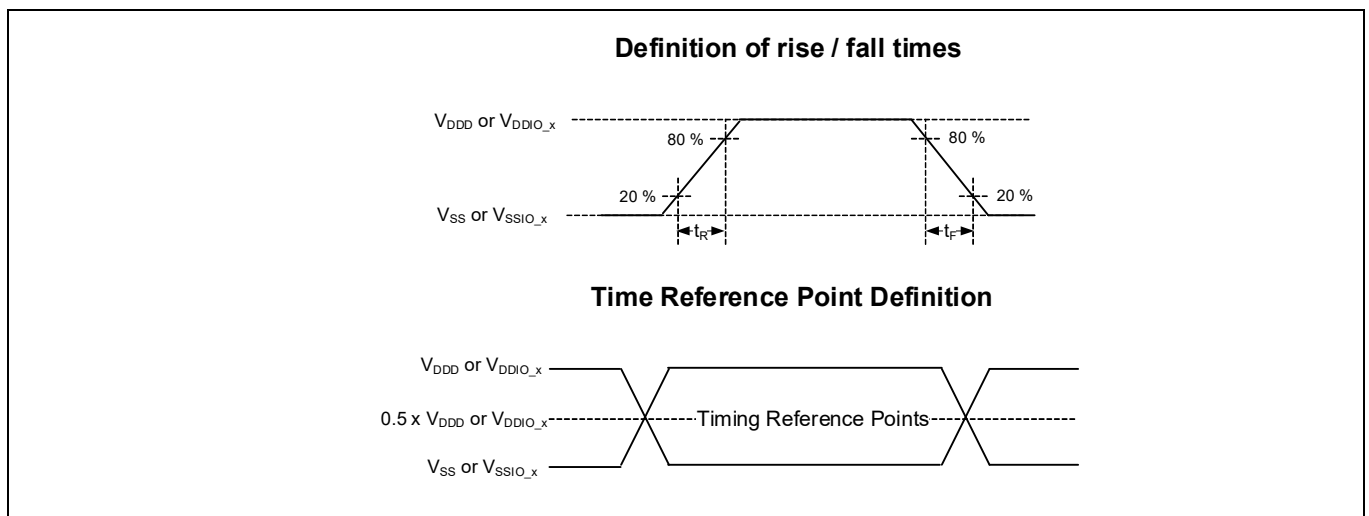
## 27.6.2 Temperature sensor

**Table 27-8 Temperature sensor specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID201	T <sub>SENSACC_TR</sub>	Temperature sensor accuracy trimmed	-5	-	5	°C	This spec is valid for the following two conditions: 1. $3.0\text{ V} \leq V_{\text{DDA\_ADC}}=V_{\text{REFH}} \leq 3.6\text{ V}$ and $3.0\text{ V} \leq V_{\text{DDD}} \leq 3.6\text{ V}$ 2. $4.5\text{ V} \leq V_{\text{DDA\_ADC}}=V_{\text{REFH}} \leq 5.5\text{ V}$ and $4.5\text{ V} \leq V_{\text{DDD}} \leq 5.5\text{ V}$ (Calibrated accuracy by factory trimming)
SID202	T <sub>SENSACC_STD</sub>	Temperature sensor accuracy standard	-10	-	10	°C	This spec applies to all valid combinations for $V_{\text{DDA\_ADC}}=V_{\text{REFH}}$ and $V_{\text{DDD}}$ , which are not covered by SID201 (Uncalibrated accuracy)

## 27.7 AC specifications

Unless otherwise noted, the timings are defined with the guidelines mentioned in the [Figure 27-7](#)

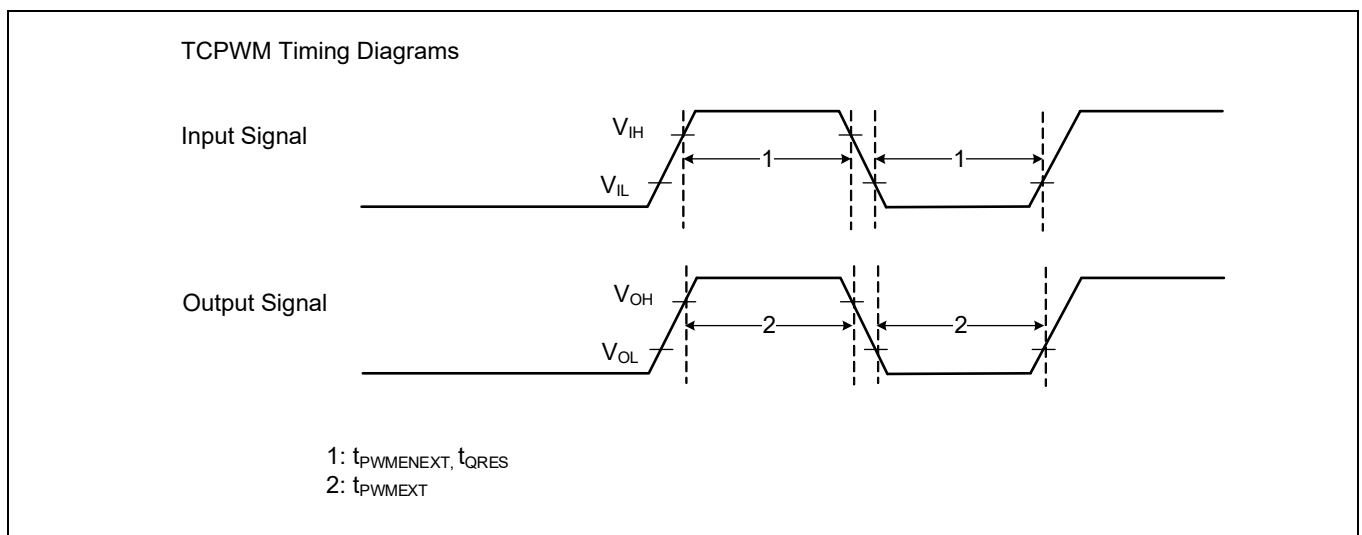


**Figure 27-7 AC timings specifications**

## 27.8 Digital peripherals

**Table 27-9 Timer/Counter/PWM (TCPWM) specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID120	$f_C$	TCPWM operating frequency	–	–	100	MHz	$f_C$ = peripheral clock
SID121	$t_{PWMENEXT}$	Input trigger pulse width for all trigger events	$2 / f_C$	–	–	ns	Trigger Events can be Stop, Start, Reload, Count, Capture, or Kill depending on which mode of operation is selected.
SID122	$t_{PWMEXT}$	Output trigger pulse widths	$2 / f_C$	–	–	ns	Minimum possible width of Overflow, Underflow, and CC (Counter equals Compare value) trigger outputs
SID123	$t_{CRES}$	Resolution of counter	$1 / f_C$	–	–	ns	Minimum time between successive counts
SID124	$t_{PWMRES}$	PWM resolution	$1 / f_C$	–	–	ns	Minimum pulse width of PWM output
SID125	$t_{QRES}$	Quadrature inputs resolution	$2 / f_C$	–	–	ns	Minimum pulse width between Quadrature phase inputs.



**Figure 27-8 TCPWM timing diagrams**

Electrical specifications

**Table 27-10 Serial communication block (SCB) specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID129	f <sub>SCB</sub>	SCB operating frequency	–	–	100	MHz	
SID129_2	t <sub>SPI_TRANS</sub>	SCB transition in SPI mode	–	–	4	ns	

**I<sup>2</sup>C Interface-Standard-mode**

**Recommended I/O Configuration:**

**GPIO\_STD:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b01, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG/DRIVE\_MODE<2:0> = 0b100  
**GPIO\_ENH:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b00, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG/DRIVE\_MODE<2:0> = 0b100, CFG\_OUT/SLOW<0:0> = 0b1  
**GPIO\_SMC:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b01, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG/DRIVE\_MODE<2:0> = 0b100, CFG\_OUT/SLOW<0:0> = 0b0  
**HSIO\_STDLN:** CFG\_DRIVE\_EXT<1:0>/DRIVE\_SEL\_EXT<4:0> = 0b00010, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG/DRIVE\_MODE<2:0> = 0b100  
**(Note:** SID138 is not valid for *HSIO\_STDLN*)

SID130	f <sub>SCL</sub>	SCL clock frequency	–	–	100	kHz	
SID131	t <sub>HD;STA</sub>	Hold time, START condition	4000	–	–	ns	
SID132	t <sub>LOW</sub>	Low period of SCL	4700	–	–	ns	
SID133	t <sub>HIGH</sub>	High period of SCL	4000	–	–	ns	
SID134	t <sub>SU;STA</sub>	Setup time for a repeated START	4700	–	–	ns	
SID135	t <sub>HD;DAT</sub>	Data hold time, for receiver	0	–	–	ns	
SID136	t <sub>SU;DAT</sub>	Data setup time	250	–	–	ns	
SID138	t <sub>F</sub>	Fall time of SCL and SDA	–	–	300	ns	Input and output Output: Only valid for GPIO_ENH, GPIO_SMC, GPIO_STD
SID139	t <sub>SU;STO</sub>	Setup time for STOP	4000	–	–	ns	
SID140	t <sub>BUF</sub>	Bus-free time between START and STOP	4700	–	–	ns	
SID141	C <sub>B</sub>	Capacitive load for each bus line	–	–	400	pF	
SID142	t <sub>VD;DAT</sub>	Time for data signal from SCL LOW to SDA output	–	–	3450	ns	
SID143	t <sub>VD;ACK</sub>	Data valid acknowledge time	–	–	3450	ns	

**I<sup>2</sup>C Interface-Fast-mode**

**Recommended I/O Configuration:**

**GPIO\_STD:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b01, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG/DRIVE\_MODE<2:0> = 0b100  
**(Note:** SID158 is not valid for *GPIO\_STD*)  
**GPIO\_ENH:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b00, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG/DRIVE\_MODE<2:0> = 0b100, CFG\_OUT/SLOW<0:0> = 0b1  
**GPIO\_SMC:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b01, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG/DRIVE\_MODE<2:0> = 0b100, CFG\_OUT/SLOW<0:0> = 0b1  
**HSIO\_STDLN:** CFG\_DRIVE\_EXT<1:0>/DRIVE\_SEL\_EXT<4:0> = 0b00010, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG/DRIVE\_MODE<2:0> = 0b100  
**(Note:** SID158 is not valid for *HSIO\_STDLN*)

SID150	f <sub>SCL_F</sub>	SCL clock frequency	–	–	400 <sup>[54]</sup>	kHz	
SID151	t <sub>HD;STA_F</sub>	Hold time, START condition	600	–	–	ns	
SID152	t <sub>LOW_F</sub>	Low period of SCL	1300	–	–	ns	
SID153	t <sub>HIGH_F</sub>	High period of SCL	600	–	–	ns	
SID154	t <sub>SU;STA</sub>	Setup time for a repeated START	600	–	–	ns	
SID155	t <sub>HD;DAT</sub>	Data hold time, for receiver	0	–	–	ns	
SID156	t <sub>SU;DAT</sub>	Data setup time	100	–	–	ns	
SID158	t <sub>F</sub>	Fall time of SCL and SDA	20 × (V <sub>DDIO_GPI0</sub> / 5.5)	–	300	ns	Input and output Output: Only valid for GPIO_ENH, GPIO_SMC
SID159	t <sub>SU;STO</sub>	Setup time for STOP	600	–	–	ns	
SID160	t <sub>BUF</sub>	Bus free time between START and STOP	1300	–	–	ns	
SID161	C <sub>B</sub>	Capacitive load for each bus line	–	–	400	pF	

**Notes**

- 54.To drive full bus load at 400 kHz, 6 mA I<sub>OL</sub> is required at 0.6 V V<sub>OL</sub>.
- 55.To drive full bus load at 1 MHz, 20 mA I<sub>OL</sub> is required at 0.4 V V<sub>OL</sub>. However, this device does not support it.

**Table 27-10 Serial communication block (SCB) specifications (continued)**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID162	$t_{VD;DAT}$	Time for data signal from SCL LOW to SDA output	-	-	900	ns	
SID163	$t_{VD;ACK}$	Data valid acknowledge time	-	-	900	ns	
SID164	$t_{SP}$	Pulse width of spikes that must be suppressed by the input filter	-	-	50	ns	

#### I<sup>2</sup>C Interface-Fast-Plus mode

##### Recommended I/O Configuration:

**GPIO\_STD:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b01, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG/DRIVE\_MODE<2:0> = 0b100

(Note: SID178 is not valid for GPIO\_STD)

**GPIO\_ENH:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b00, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG/DRIVE\_MODE<2:0> = 0b100, CFG\_OUT/SLOW<0:0> = 0b1

**GPIO\_SMC:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b01, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG/DRIVE\_MODE<2:0> = 0b100, CFG\_OUT/SLOW<0:0> = 0b0 (Note: SID178 is not valid for GPIO\_SMC)

**HSIO\_STDLN:** CFG\_DRIVE\_EXT<1:0>/DRIVE\_SEL\_EXT<4:0> = 0b00010, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG/DRIVE\_MODE<2:0> = 0b100 (Note: SID178 is not valid for HSIO\_STDLN)

SID170	$f_{SCL\_FP}$	SCL clock frequency	-	-	1 <sup>[55]</sup>	MHz	
SID171	$t_{HD;STA\_FP}$	Hold time, START condition	260	-	-	ns	
SID172	$t_{LOW\_FP}$	Low period of SCL	500	-	-	ns	
SID173	$t_{HIGH\_FP}$	High period of SCL	260	-	-	ns	
SID174	$t_{SU;STA}$	Setup time for a repeated START	260	-	-	ns	
SID175	$t_{HD;DAT}$	Data hold time, for receiver	0	-	-	ns	
SID176	$t_{SU;DAT}$	Data setup time	50	-	-	ns	
SID178	$t_F$	Fall time of SCL and SDA	20 × ( $V_{DDIO\_GPIO}$ /5.5)	-	160	ns	Input and output, 20pF load Output: Only for GPIO_ENH
SID179	$t_{SU;STO}$	Setup time for STOP	260	-	-	ns	
SID180	$t_{BUF}$	Bus free time between START and STOP	500	-	-	ns	
SID181	$C_B$	Capacitive load for each bus line	-	-	20	pF	
SID182	$t_{VD;DAT}$	Time for data signal from SCL LOW to SDA output	-	-	450	ns	
SID183	$t_{VD;ACK}$	Data valid acknowledge time	-	-	450	ns	
SID184	$t_{SP}$	Pulse width of spikes that must be suppressed by the input filter	-	-	50	ns	

#### SPI Interface

##### Recommended I/O Configuration: (Applicable to all below SPI modes)

**HSIO\_STDLN:** CFG\_DRIVE\_EXT<1:0>/DRIVE\_SEL\_EXT<4:0> = 0b00010, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG\_SLEW\_EXT/SLEW<2:0> = 0b000

##### For SPI speeds ≤ 12.5 MHz

**GPIO\_STD:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b01, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0

**GPIO\_ENH:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b01, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG\_OUT/SLOW<0:0> = 0b0

**GPIO\_SMC:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b01, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG\_OUT/SLOW<0:0> = 0b0

##### SPI Interface Master (Full-clock mode: LATE\_MISO\_SAMPLE = 1, GPIO)

SID190	$f_{SPI}$	SPI operating frequency	-	-	12.5	MHz	Do not use half-clock mode: LATE_MISO_SAMPLE = 0 SPI Master (Full-clock mode): LATE_MISO_SAMPLE = 1) - 12.5 Mbps for instances on GPIO_STD, GPIO_ENH, GPIO_SMC
SID191	$t_{DMO}$	SPI Master: MOSI valid after SCLK driving edge	-	-	15	ns	SPI Master (Full-clock mode): LATE_MISO_SAMPLE = 1) - 12.5 Mbps for instances on GPIO_STD, GPIO_ENH, GPIO_SMC

Electrical specifications

**Table 27-10 Serial communication block (SCB) specifications** (continued)

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID192	t <sub>DSI</sub>	SPI Master: MISO valid before SCLK capturing edge	40	-	-	ns	SPI Master (Full-clock mode: LATE_MISO_SAMPLE = 1) - 12.5 Mbps for instances on GPIO_STD, GPIO_ENH, GPIO_SMC
SID193	t <sub>HMO</sub>	SPI Master: Previous MOSI data hold time	0	-	-	ns	SPI Master (Full-clock mode: LATE_MISO_SAMPLE = 1) - 12.5 Mbps for instances on GPIO_STD, GPIO_ENH, GPIO_SMC
SID194	t <sub>W_SCLK_H_L</sub>	SPI SCLK pulse width HIGH or LOW	0.4 × (1 / f <sub>SPI</sub> )	0.5 × (1 / f <sub>SPI</sub> )	0.6 × (1 / f <sub>SPI</sub> )	ns	SPI Master (Full-clock mode: LATE_MISO_SAMPLE = 1) - 12.5 Mbps for instances on GPIO_STD, GPIO_ENH, GPIO_SMC
SID195	t <sub>VSS</sub>	SPI Master: MOSI valid after SSEL falling edge (CPHA=0)	-	-	12	ns	SPI Master (Full-clock mode: LATE_MISO_SAMPLE = 1) - 12.5 Mbps for instances on GPIO_STD, GPIO_ENH, GPIO_SMC
SID196	t <sub>DHI</sub>	SPI Master: MISO hold time after SCLK capturing edge	0	-	-	ns	SPI Master (Full-clock mode: LATE_MISO_SAMPLE = 1) - 12.5 Mbps for instances on GPIO_STD, GPIO_ENH, GPIO_SMC
SID198	t <sub>EN_SETUP</sub>	SSEL valid, before the first SCK capturing edge	0.5 × (1 / f <sub>SPI</sub> )	-	-	ns	Min is half clock period
SID199	t <sub>EN_HOLD</sub>	SSEL hold, after the last SCK capturing edge	0.5 × (1 / f <sub>SPI</sub> )	-	-	ns	Min is half clock period
SID197	C <sub>SPI_MMS</sub>	SPI Capacitive Load	-	-	20	pF	
<b>SPI Interface Master (Full-clock mode: LATE_MISO_SAMPLE = 1, HSIO)</b>							
SID190A	f <sub>SPI</sub>	SPI operating frequency	-	-	20	MHz	Do not use half-clock mode: LATE_MISO_SAMPLE = 0 SPI Master (Full-clock mode: LATE_MISO_SAMPLE = 1) - 20 Mbps For 20 Mbps, SCB operating frequency (f <sub>SCB</sub> ) must be configured to 80 MHz. for instances on HSIO_STDLN
SID191A	t <sub>DMO</sub>	SPI Master: MOSI valid after SCLK driving edge	-	-	9	ns	SPI Master (Full-clock mode: LATE_MISO_SAMPLE = 1) - 20 Mbps For 20 Mbps, SCB operating frequency (f <sub>SCB</sub> ) must be configured to 80 MHz for instances on HSIO_STDLN

**Table 27-10 Serial communication block (SCB) specifications** (continued)

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID192A	t <sub>DSI</sub>	SPI Master: MISO valid before SCLK capturing edge	25	-	-	ns	SPI Master (Full-clock mode): LATE_MISO_SAMPLE = 1) - 20 Mbps For 20 Mbps, SCB operating frequency (f <sub>SCB</sub> ) must be configured to 80 MHz for instances on HSIO_STDLN
SID193A	t <sub>HMO</sub>	SPI Master: Previous MOSI data hold time	0	-	-	ns	SPI Master (Full-clock mode): LATE_MISO_SAMPLE = 1) - 20 Mbps For 20 Mbps, SCB operating frequency (f <sub>SCB</sub> ) must be configured to 80 MHz for instances on HSIO_STDLN
SID194A	t <sub>W_SCLK_H_L</sub>	SPI SCLK pulse width HIGH or LOW	0.4 × (1 / f <sub>SPI</sub> )	0.5 × (1 / f <sub>SPI</sub> )	0.6 × (1 / f <sub>SPI</sub> )	ns	SPI Master (Full-clock mode): LATE_MISO_SAMPLE = 1) - 20 Mbps For 20 Mbps, SCB operating frequency (f <sub>SCB</sub> ) must be configured to 80 MHz for instances on HSIO_STDLN
SID195A	t <sub>VSS</sub>	SPI Master: MOSI valid after SSEL falling edge (CPHA=0)	-	-	12	ns	SPI Master (Full-clock mode): LATE_MISO_SAMPLE = 1) - 20 Mbps For 20 Mbps, SCB operating frequency (f <sub>SCB</sub> ) must be configured to 80 MHz for instances on HSIO_STDLN
SID196A	t <sub>DHI</sub>	SPI Master: MISO hold time after SCLK capturing edge	0	-	-	ns	SPI Master (Full-clock mode): LATE_MISO_SAMPLE = 1) - 20 Mbps For 20 Mbps, SCB operating frequency (f <sub>SCB</sub> ) must be configured to 80 MHz for instances on HSIO_STDLN
SID197A	C <sub>SPIM_MS</sub>	SPI Capacitive Load	-	-	20	pF	
SID198A	t <sub>EN_SETUP</sub>	SSEL valid, before the first SCK capturing edge	0.5 × (1 / f <sub>SPI</sub> )	-	-	ns	Min is half clock period
SID199A	t <sub>EN_HOLD</sub>	SSEL hold, after the last SCK capturing edge	0.5 × (1 / f <sub>SPI</sub> )	-	-	ns	Min is half clock period
<b>SPI Interface Slave (internally clocked, GPIO and HSIO)</b>							
SID205	f <sub>SPI_INT</sub>	SPI operating frequency	-	-	12.5	MHz	SPI Slave, internally clocked
SID206	t <sub>DMI_INT</sub>	SPI Slave: MOSI Valid before Scklock capturing edge	5	-	-	ns	SPI Slave, internally clocked
SID207	t <sub>DSO_INT</sub>	SPI Slave: MISO Valid after Scklock driving edge, in the internal-clocked mode	-	-	60	ns	SPI Slave, internally clocked
SID208	t <sub>HSO_INT</sub>	SPI Slave: Previous MISO data hold time	3	-	-	ns	SPI Slave, internally clocked
SID209	t <sub>EN_SETUP_INT</sub>	SPI Slave: SSEL valid to first SCK valid edge	33	-	-	ns	SPI Slave, internally clocked
SID210	t <sub>EN_HOLD_INT</sub>	SPI Slave Select active (LOW) from last SCLK hold	33	-	-	ns	SPI Slave, internally clocked



Electrical specifications

**Table 27-10 Serial communication block (SCB) specifications** (continued)

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID211	t <sub>EN_SETUP_PRE</sub>	SPI Slave: from SSEL valid, to SCK falling edge before the first data bit	20	–	–	ns	SPI Slave, internally clocked
SID212	t <sub>EN_HOLD_PRE</sub>	SPI Slave: from SCK falling edge before the first data bit, to SSEL invalid	20	–	–	ns	SPI Slave, internally clocked
SID213	t <sub>EN_SETUP_CO</sub>	SPI Slave: from SSEL valid, to SCK falling edge in the first data bit	20	–	–	ns	SPI Slave, internally clocked
SID214	t <sub>EN_HOLD_CO</sub>	SPI Slave: from SCK falling edge in the first data bit, to SSEL invalid	20	–	–	ns	SPI Slave, internally clocked
SID215	t <sub>W_DIS_INT</sub>	SPI Slave Select inactive time	40	–	–	ns	SPI Slave, internally clocked
SID216	t <sub>W_SCLKH_INT</sub>	SPI SCLK pulse width HIGH	32	–	–	ns	SPI Slave, internally clocked
SID217	t <sub>W_SCLKL_INT</sub>	SPI SCLK pulse width LOW	32	–	–	ns	SPI Slave, internally clocked
SID218	t <sub>SIH_INT</sub>	SPI MOSI hold from SCLK	20	–	–	ns	SPI Slave, internally clocked
SID219	C <sub>SPI_INT</sub>	SPI Capacitive Load	–	–	20	pF	SPI Slave, internally clocked
<b>SPI Interface Slave (externally clocked, GPIO and HSIO)</b>							
SID220	f <sub>SPI_EXT</sub>	SPI operating frequency	–	–	12.5	MHz	SPI Slave, externally clocked: 12.5 Mbps
SID221	t <sub>DMI_EXT</sub>	SPI Slave: MOSI Valid before Scklock capturing edge	8	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID222	t <sub>DSO_EXT</sub>	SPI Slave: MISO Valid after Scklock driving edge, in the external-clocked mode	–	–	30	ns	SPI Slave, externally clocked: 12.5 Mbps
SID223	t <sub>HSO_EXT</sub>	SPI Slave: Previous MISO data hold time	5	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID224	t <sub>EN_SETUP_EXT</sub>	SPI Slave: SSEL valid to first SCK valid edge	20	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID225	t <sub>EN_HOLD_EXT</sub>	SPI Slave Select active (LOW) from last SCLK hold	20	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID226	t <sub>W_DIS_EXT</sub>	SPI Slave Select inactive time	20	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID227	t <sub>W_SCLKH_EXT</sub>	SPI SCLK pulse width HIGH	32	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID228	t <sub>W_SCLKL_EXT</sub>	SPI SCLK pulse width LOW	32	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID229	t <sub>SIH_EXT</sub>	SPI MOSI hold from SCLK	5	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID230	C <sub>SPI_EXT</sub>	SPI Capacitive Load	–	–	20	pF	SPI Slave, externally clocked: 12.5 Mbps
SID231	t <sub>VSS_EXT</sub>	SPI Slave: MISO valid after SSEL falling edge (CPHA = 0)	–	–	33	ns	SPI Slave, externally clocked: 12.5 Mbps
<b>SPI Interface Slave (internally clocked, SMC I/O)</b>							
SID205_2	f <sub>SPI_INT</sub>	SPI operating frequency	–	–	12.5	MHz	SPI Slave, internally clocked
SID206_2	t <sub>DMI_INT</sub>	SPI Slave: MOSI Valid before Scklock capturing edge	5	–	–	ns	SPI Slave, internally clocked
SID207_2	t <sub>DSO_INT</sub>	SPI Slave: MISO Valid after Scklock driving edge, in the internal-clocked mode	–	–	64	ns	SPI Slave, internally clocked
SID208_2	t <sub>HSO_INT</sub>	SPI Slave: Previous MISO data hold time	3	–	–	ns	SPI Slave, internally clocked
SID209_2	t <sub>EN_SETUP_INT</sub>	SPI Slave: SSEL valid to first SCK valid edge	33	–	–	ns	SPI Slave, internally clocked
SID210_2	t <sub>EN_HOLD_INT</sub>	SPI Slave Select active (LOW) from last SCLK hold	33	–	–	ns	SPI Slave, internally clocked
SID211_2	t <sub>EN_SETUP_PRE</sub>	SPI Slave: from SSEL valid, to SCK falling edge before the first data bit	20	–	–	ns	SPI Slave, internally clocked

Electrical specifications

**Table 27-10 Serial communication block (SCB) specifications** (continued)

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID212_2	t <sub>EN_HOLD_PRE</sub>	SPI Slave: from SCK falling edge before the first data bit, to SSEL invalid	20	–	–	ns	SPI Slave, internally clocked
SID213_2	t <sub>EN_SETUP_CO</sub>	SPI Slave: from SSEL valid, to SCK falling edge in the first data bit	20	–	–	ns	SPI Slave, internally clocked
SID214_2	t <sub>EN_HOLD_CO</sub>	SPI Slave: from SCK falling edge in the first data bit, to SSEL invalid	20	–	–	ns	SPI Slave, internally clocked
SID215_2	t <sub>W_DIS_INT</sub>	SPI Slave Select inactive time	40	–	–	ns	SPI Slave, internally clocked
SID216_2	t <sub>W_SCLKH_INT</sub>	SPI SCLK pulse width HIGH	36	–	–	ns	SPI Slave, internally clocked
SID217_2	t <sub>W_SCLKL_INT</sub>	SPI SCLK pulse width LOW	36	–	–	ns	SPI Slave, internally clocked
SID218_2	t <sub>SIH_INT</sub>	SPI MOSI hold from SCLK	20	–	–	ns	SPI Slave, internally clocked
SID219_2	C <sub>SPI_INT</sub>	SPI Capacitive Load	–	–	20	pF	SPI Slave, internally clocked
<b>SPI Interface Slave (externally clocked, SMC I/O)</b>							
SID220_2	f <sub>SPI_EXT</sub>	SPI operating frequency	–	–	12.5	MHz	SPI Slave, externally clocked: 12.5 Mbps
SID221_2	t <sub>DMI_EXT</sub>	SPI Slave: MOSI Valid before Scklock capturing edge	8	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID222_2	t <sub>DSO_EXT</sub>	SPI Slave: MISO Valid after Scklock driving edge, in the external-clocked mode	–	–	34	ns	SPI Slave, externally clocked: 12.5 Mbps
SID223_2	t <sub>HSO_EXT</sub>	SPI Slave: Previous MISO data hold time	5	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID224_2	t <sub>EN_SETUP_EXT</sub>	SPI Slave: SSEL valid to first SCK valid edge	20	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID225_2	t <sub>EN_HOLD_EXT</sub>	SPI Slave Select active (LOW) from last SCLK hold	20	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID226_2	t <sub>W_DIS_EXT</sub>	SPI Slave Select inactive time	20	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID227_2	t <sub>W_SCLKH_EXT</sub>	SPI SCLK pulse width HIGH	36	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID228_2	t <sub>W_SCLKL_EXT</sub>	SPI SCLK pulse width LOW	36	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID229_2	t <sub>SIH_EXT</sub>	SPI MOSI hold from SCLK	5	–	–	ns	SPI Slave, externally clocked: 12.5 Mbps
SID230_2	C <sub>SPI_EXT</sub>	SPI Capacitive Load	–	–	20	pF	SPI Slave, externally clocked: 12.5 Mbps
SID231_2	t <sub>VSS_EXT</sub>	SPI Slave: MISO valid after SSEL falling edge (CPHA = 0)	–	–	37	ns	SPI Slave, externally clocked: 12.5 Mbps
<b>SPI Interface Slave (externally clocked, 20 MHz)</b>							
SID220A	f <sub>SPI_EXT</sub>	SPI operating frequency	–	–	20	MHz	SPI Slave, externally clocked: 20 Mbps
SID221A	t <sub>DMI_EXT</sub>	SPI Slave: MOSI Valid before Scklock capturing edge	5	–	–	ns	SPI Slave, externally clocked: 20 Mbps
SID222A	t <sub>DSO_EXT</sub>	SPI Slave: MISO Valid after Scklock driving edge, in the external-clocked mode	–	–	18	ns	SPI Slave, externally clocked: 20 Mbps
SID223A	t <sub>HSO_EXT</sub>	SPI Slave: Previous MISO data hold time	5	–	–	ns	SPI Slave, externally clocked: 20 Mbps
SID224A	t <sub>EN_SETUP_EXT</sub>	SPI Slave: SSEL valid to first SCK valid edge	20	–	–	ns	SPI Slave, externally clocked: 20 Mbps
SID225A	t <sub>EN_HOLD_EXT</sub>	SPI Slave Select active (LOW) from last SCLK hold	20	–	–	ns	SPI Slave, externally clocked: 20 Mbps
SID226A	t <sub>W_DIS_EXT</sub>	SPI Slave Select inactive time	20	–	–	ns	SPI Slave, externally clocked: 20 Mbps
SID227A	t <sub>W_SCLKH_EXT</sub>	SPI SCLK pulse width HIGH	20	–	–	ns	SPI Slave, externally clocked: 20 Mbps

Electrical specifications

**Table 27-10 Serial communication block (SCB) specifications (continued)**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID228A	$t_{W\_SCLK\_EXT}$	SPI SCLK pulse width LOW	20	-	-	ns	SPI Slave, externally clocked: 20 Mbps
SID229A	$t_{SIH\_EXT}$	SPI MOSI hold from SCLK	5	-	-	ns	SPI Slave, externally clocked: 20 Mbps
SID230A	$C_{SPIS\_EXT}$	SPI Capacitive Load	-	-	20	pF	SPI Slave, externally clocked: 20 Mbps
SID231A	$t_{VSS\_EXT}$	SPI Slave: MISO valid after SSEL falling edge (CPHA = 0)	-	-	23	ns	SPI Slave, externally clocked: 20 Mbps

**UART Interface**

**Recommended I/O Configuration:**

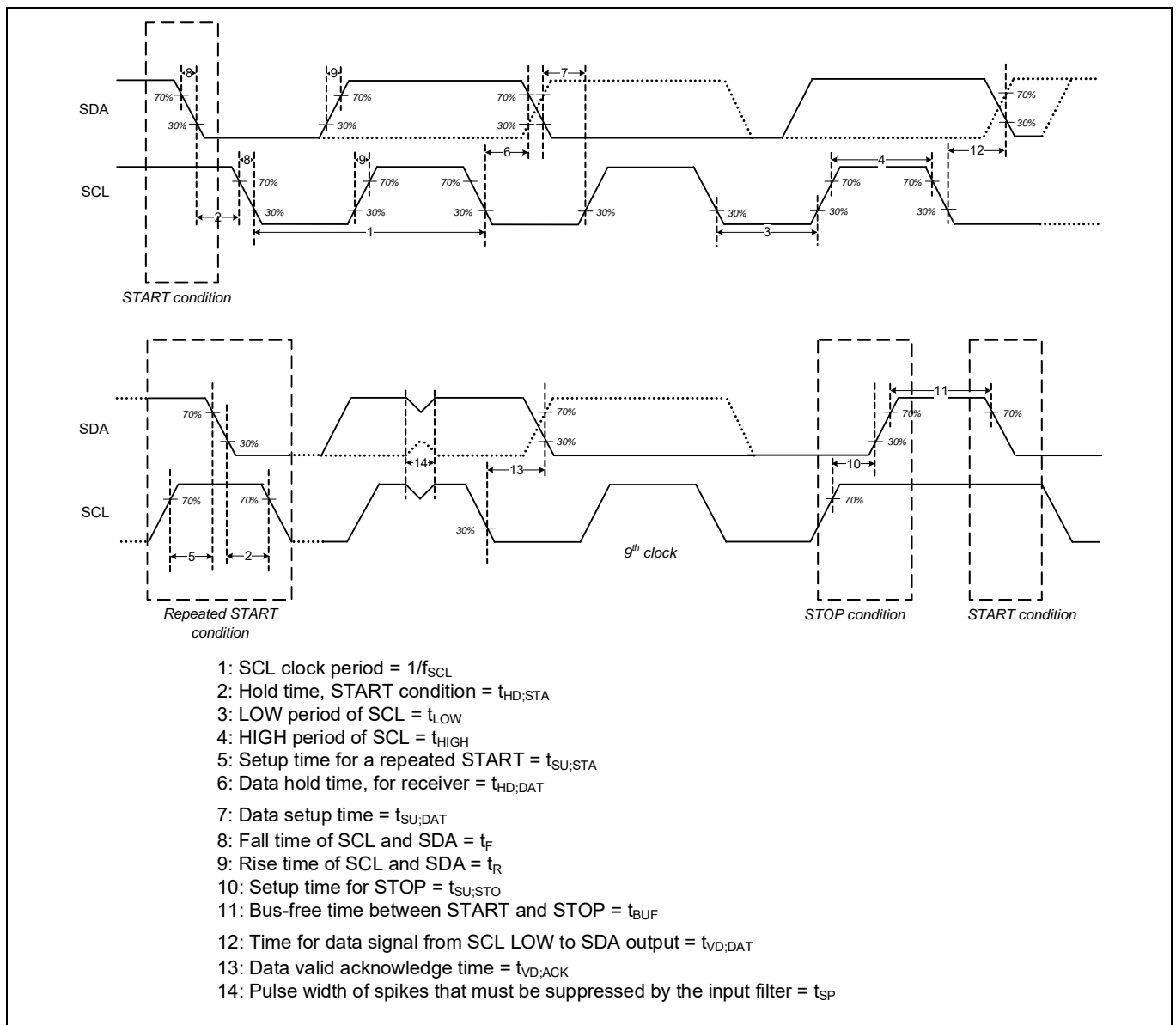
**GPIO\_STD:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b01, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0

**GPIO\_ENH:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b01, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG\_OUT/SLOW<0:0> = 0b0

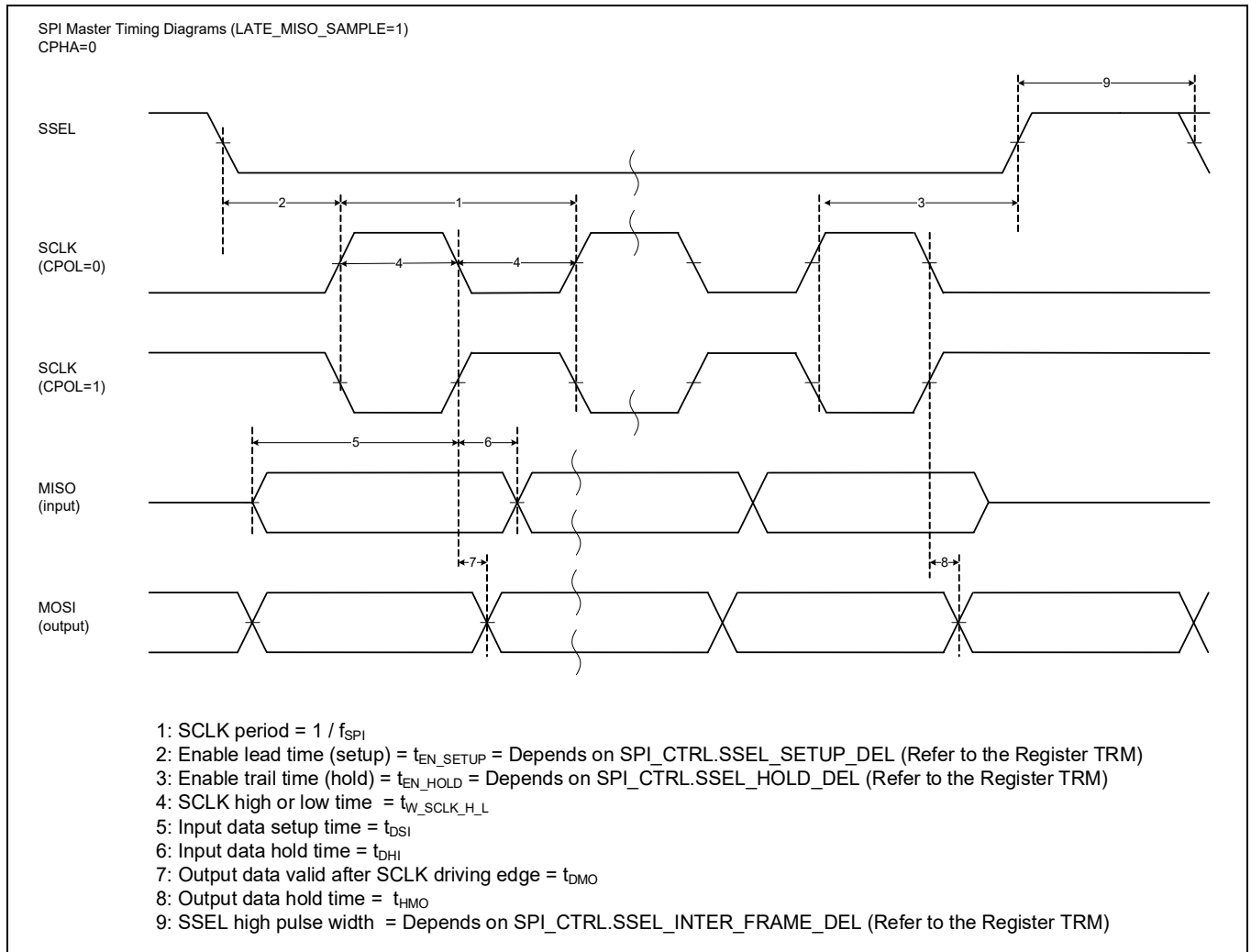
**GPIO\_SMC:** CFG\_OUT/DRIVE\_SEL<1:0> = 0b01, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG\_OUT/SLOW<0:0> = 0b0

**HSIO\_STDLN:** CFG\_DRIVE\_EXT<1:0>/DRIVE\_SEL\_EXT<4:0> = 0b00010, CFG\_IN\_AUTOLVL/VTRIP\_SEL<0:0> = 0b0, CFG\_IN/VTRIP\_SEL<0:0> = 0b0, CFG\_SLEW\_EXT/SLEW<2:0> = 0b000

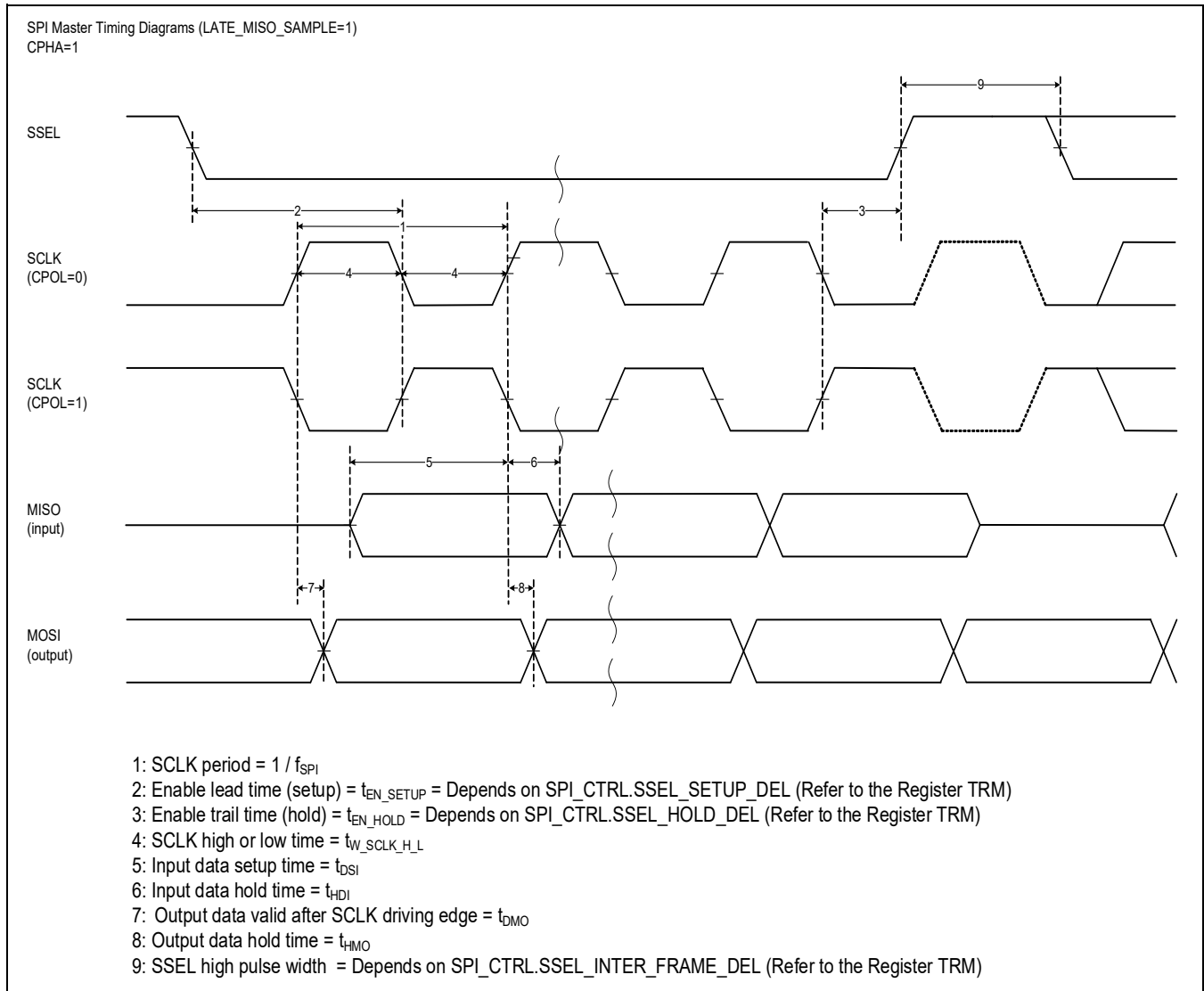
SID240	$f_{BPS}$	Signaling rate	-	-	10	Mbps	
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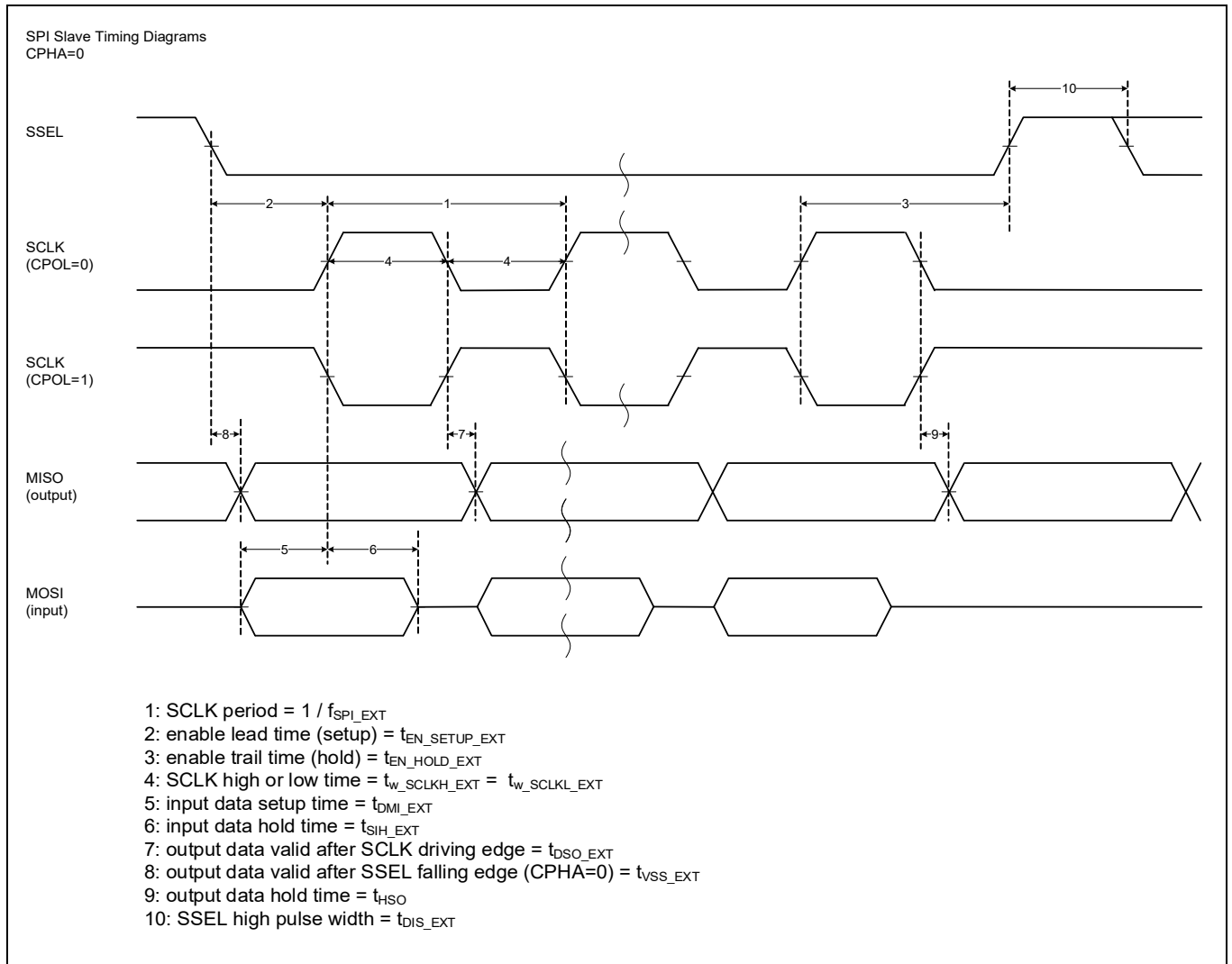
**Figure 27-9 I<sup>2</sup>C timing diagrams**



**Figure 27-10 SPI master timing diagrams with LOW clock phase**

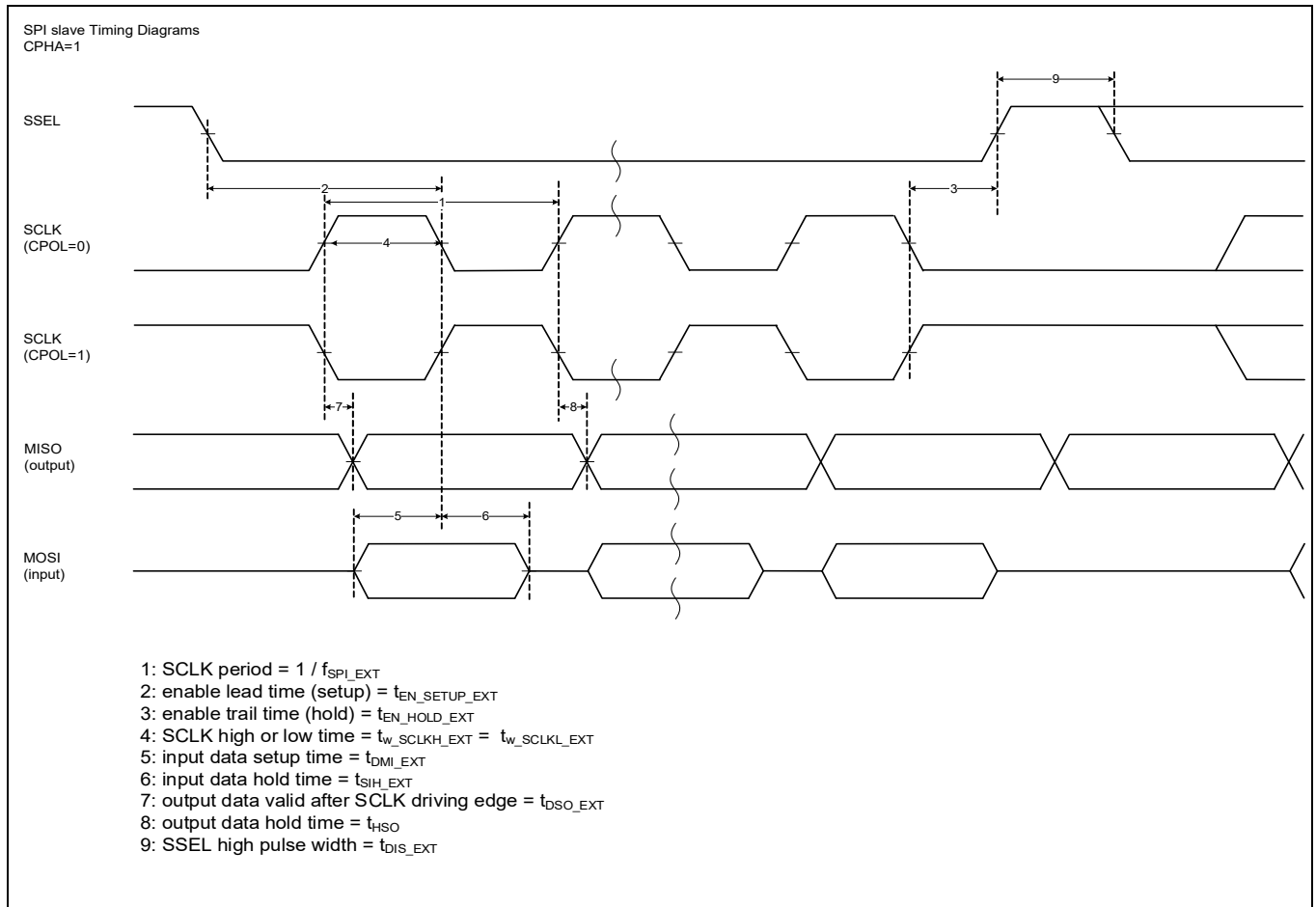


**Figure 27-11 SPI master timing diagrams with HIGH clock phase**



**Figure 27-12 SPI slave timing diagrams with LOW clock phase**

Electrical specifications



**Figure 27-13 SPI slave timing diagrams with HIGH clock phase**

## 27.8.1 LIN specifications

**Table 27-11 LIN specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID249	$f_{LIN}$	Internal clock frequency to the LIN block	–	–	100	MHz	
SID250	BR_NOM	Bit rate on the LIN bus	1	–	20	kbps	Guaranteed by design
SID250A	BR_REF	Bit rate on the LIN bus (not in standard LIN specification) for re-flashing in LIN slave mode	1	–	115.2	kbps	Guaranteed by design

## 27.8.2 CAN FD specifications

**Table 27-12 CAN FD specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID630	$f_{HCLK}$	System clock (HCLK) frequency	–	–	100	MHz	$f_{CCLK} \leq f_{HCLK}$ , guaranteed by design
SID631	$f_{CCLK}$	CAN clock (CCLK) frequency	–	–	100	MHz	$f_{CCLK} \leq f_{HCLK}$ , guaranteed by design

## 27.9 Memory

**Table 27-13 Flash DC specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID257A	$V_{PE}$	Erase and program voltage	2.7	–	5.5	V	

**Table 27-14 Flash AC specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID257	$f_{FO}$	Maximum operation frequency	–	–	100	MHz	Zero wait access to code-flash memory up to 100 MHz Zero wait access with cache hit up to 320 MHz
SID254	$t_{ERS\_SUS}$	Maximum time from erase suspend command till erase is indeed suspend	–	–	37.5	$\mu$ s	
SID255	$t_{ERS\_RES\_SUS}$	Minimum time allowed from erase resume to erase suspend	250	–	–	$\mu$ s	Guaranteed by design
SID258	$t_{BC\_WF}$	Blank Check time for Work Flash N-byte	–	–	$10 + 0.3 \times N$	$\mu$ s	At 100 MHz, $N \geq 4$ and multiple of 4, excludes system overhead time
SID258A	$t_{AA\_BC\_ENTRY}$	Time to enter Blank Check mode	–	5	–	$\mu$ s	
SID258B	$t_{AA\_BC\_EXIT}$	Time to exit Blank Check mode	–	5	–	$\mu$ s	
SID259	$t_{SECTORE-RASE1}$	Sector erase time (code-flash: 32 KB)	–	45	90	ms	Includes internal preprogramming time
SID260	$t_{SECTORE-RASE2}$	Sector erase time (code-flash: 8 KB)	–	15	30	ms	Includes internal preprogramming time



Electrical specifications

**Table 27-14 Flash AC specifications** (continued)

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID261	t <sub>SECTORE-RASE3</sub>	Sector erase time (work-flash, 2 KB)	–	80	160	ms	Includes internal preprogramming time
SID262	t <sub>SECTORE-RASE4</sub>	Sector erase time (work-flash, 128 B)	–	5	15	ms	Includes internal preprogramming time
SID263	t <sub>WRITE1</sub>	64-bit write time (code-flash)	–	30	60	μs	Excludes system overhead time
SID264	t <sub>WRITE2</sub>	256-bit write time (code-flash)	–	40	70	μs	Excludes system overhead time
SID265	t <sub>WRITE3</sub>	4096-bit write time (code-flash)	–	320	1200	μs	Excludes system overhead time
SID266	t <sub>WRITE4</sub>	32-bit write time (work-flash)	–	30	60	μs	Excludes system overhead time
SID267	t <sub>FRET1</sub>	Code-flash retention. 1000 program/erase cycles	20	–	–	years	Temperature at write/erase time. T <sub>A</sub> ≤ +85°C average
SID182T1	t <sub>FRET2</sub>	Code-flash retention. 100 program/erase cycles	50	–	–	years	Temperature at write/erase time. T <sub>A</sub> ≤ +30°C average
SID268	t <sub>FRET3</sub>	Work-flash retention. 125,000 program/erase cycles	20	–	–	years	Temperature at write/erase time. T <sub>A</sub> ≤ +85°C average
SID269	t <sub>FRET4</sub>	Work-flash retention. 250,000 program/erase cycles	10	–	–	years	Temperature at write/erase time. T <sub>A</sub> ≤ +85°C average
SID182T2	t <sub>FRET5</sub>	Work-flash retention. 1000 program/erase cycles	50	–	–	years	Temperature at write/erase time. T <sub>A</sub> ≤ +30°C average
SID612	I <sub>CC_ACT2</sub>	Program operating current (code or work-flash)	–	15	62	mA	V <sub>DDD</sub> = 5 V, V <sub>CCD</sub> = 1.1 V Guaranteed by design
SID613	I <sub>CC_ACT3</sub>	Erase operating current (code- or work-flash)	–	15	62	mA	V <sub>DDD</sub> = 5 V, V <sub>CCD</sub> = 1.1 V Guaranteed by design

## 27.10 System resources

**Table 27-15 System resources**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/ conditions
<b>Power-on-reset specifications</b>							
SID270	V <sub>POR_R</sub>	POR rising trip voltage	1.5	–	2.35	V	Guaranteed by design
SID276	V <sub>POR_F</sub>	POR falling trip voltage	1.45	–	2.1	V	
SID271	V <sub>POR_H</sub>	Level detection hysteresis	20	–	300	mV	
SID272	t <sub>DLY_POR</sub>	Delay between V <sub>DD</sub> rising through 2.3 V and POR reset output rising through V <sub>DD</sub> / 2	–	–	3	μs	Guaranteed by design
SID273	t <sub>POFF</sub>	Power off time	350	–	–	μs	V <sub>DD</sub> < 1.45 V Does not apply to SID274A and SID274B
SID274A	POR_RR1	V <sub>DD</sub> power ramp rate with robust BOD - XRES_L asserted (BOD operation is guaranteed)	–	–	100	mV/μs	Applies to ramp up and ramp down
SID274B	POR_RR1	V <sub>DD</sub> power ramp rate with robust BOD - XRES_L de-asserted (BOD operation is guaranteed)	1	–	100	mV/μs	Applies to ramp up and ramp down
SID275	POR_RR2	V <sub>DD</sub> power ramp rate without robust BOD	100	–	1000	mV/μs	This ramp does not support robust BOD t <sub>POFF</sub> must be satisfied. Applies to ramp up and ramp down
<b>High-voltage BOD (HV BOD) specifications</b>							
SID500	V <sub>TR_2P7_R</sub>	HV BOD 2.7 V trimmed rising trip point for V <sub>DD</sub> and V <sub>D</sub> A <sub>ADC</sub> (default)	2.474	2.55	2.627	V	
SID501	V <sub>TR_2P7_F</sub>	HV BOD 2.7 V trimmed falling trip point for V <sub>DD</sub> and V <sub>D</sub> A <sub>ADC</sub> (default)	2.449	2.525	2.601	V	
SID502	V <sub>TR_3P0_R</sub>	HV BOD 3.0 V trimmed rising trip point for V <sub>DD</sub> and V <sub>D</sub> A <sub>ADC</sub>	2.765	2.85	2.936	V	
SID503	V <sub>TR_3P0_F</sub>	HV BOD 3.0 V trimmed falling trip point for V <sub>DD</sub> and V <sub>D</sub> A <sub>ADC</sub>	2.74	2.825	2.91	V	
SID505	HVBOD_RR_A	Power ramp rate: V <sub>DD</sub> and V <sub>D</sub> A <sub>ADC</sub> (Active)	–	–	100	mV/μs	
SID506	HVBOD_RR_DS	Power ramp rate: V <sub>DD</sub> and V <sub>D</sub> A <sub>ADC</sub> (DeepSleep)	–	–	10	mV/μs	
SID507	t <sub>DLY_ACT_HVBOD</sub>	Active mode delay between V <sub>DD</sub> falling/rising through V <sub>TR_2P7_F/R</sub> or V <sub>TR_3P0_F/R</sub> and an internal HV BOD output transitioning through V <sub>DD</sub> / 2	–	–	0.5	μs	Guaranteed by design

**Table 27-15 System resources** (continued)

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID507A	t <sub>DLY_ACT_H-VBOD_A</sub>	Active mode delay between V <sub>DDA_ADC</sub> falling/rising through V <sub>TR_2P7_F/R</sub> or V <sub>TR_3P0_F/R</sub> and internal HV BOD output transitioning through V <sub>DD</sub> / 2	–	–	1	μs	Guaranteed by design
SID507B	t <sub>DLY_DS_HVBOD</sub>	DeepSleep mode delay between V <sub>DDD</sub> /V <sub>DDA_ADC</sub> falling/rising through V <sub>TR_2P7_F/R</sub> or V <sub>TR_3P0_F/R</sub> and an internal HV BOD output transitioning through V <sub>DD</sub> / 2	–	–	4	μs	Guaranteed by design
SID508	t <sub>RES_HVBOD</sub>	Response time of HV BOD, V <sub>DDD</sub> /V <sub>DDA_ADC</sub> supply. HVBOD guaranteed to generate pulse for V <sub>DDD</sub> /V <sub>DDA_ADC</sub> pulse width greater than this. (For falling-then-rising supply at max ramp rate; pulse width is time below V <sub>TR_2P7_F</sub> or V <sub>TR_3P0_F</sub> )	100	–	–	ns	Guaranteed by design

**Low-voltage BOD (LV BOD) specifications**

SID510	V <sub>TR_R_LVBOD</sub>	LV BOD trimmed rising trip point for V <sub>CCD</sub>	0.917	0.945	0.973	V	
SID511	V <sub>TR_F_LVBOD</sub>	LV BOD trimmed falling trip point for V <sub>CCD</sub>	0.892	0.92	0.948	V	
SID515	t <sub>DLY_ACT_LVBOD</sub>	Active delay between V <sub>CCD</sub> falling/rising through V <sub>TR_R/F_LVBOD</sub> and an internal LV BOD output transitioning through V <sub>DD</sub> / 2	–	–	1	μs	Guaranteed by design
SID515A	t <sub>DLY_DS_LVBOD</sub>	DeepSleep mode delay between V <sub>CCD</sub> falling/rising through V <sub>TR_R/F_LVBOD</sub> and an internal LV BOD output transitioning through V <sub>DD</sub> / 2	–	–	12	μs	Guaranteed by design
SID516	t <sub>RES_LVBOD</sub>	Response time of LV BOD. LV BOD guaranteed to generate pulse for V <sub>CCD</sub> pulse width greater than this. (For falling-then-rising supply at max ramp rate; pulse width is time below V <sub>TR_F_LVBOD</sub> )	100	–	–	ns	Guaranteed by design

**Low-voltage detector (LVD) DC specifications**

SID520	V <sub>TR_2P8_F</sub>	LVD 2.8 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	2800	Typ + 4%	mV	
SID521	V <sub>TR_2P9_F</sub>	LVD 2.9 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	2900	Typ + 4%	mV	
SID522	V <sub>TR_3P0_F</sub>	LVD 3.0 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	3000	Typ + 4%	mV	

Electrical specifications

**Table 27-15 System resources** (continued)

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/ conditions
SID523	V <sub>TR_3P1_F</sub>	LVD 3.1 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	3100	Typ + 4%	mV	
SID524	V <sub>TR_3P2_F</sub>	LVD 3.2 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	3200	Typ + 4%	mV	
SID525	V <sub>TR_3P3_F</sub>	LVD 3.3 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	3300	Typ + 4%	mV	
SID526	V <sub>TR_3P4_F</sub>	LVD 3.4 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	3400	Typ + 4%	mV	
SID527	V <sub>TR_3P5_F</sub>	LVD 3.5 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	3500	Typ + 4%	mV	
SID528	V <sub>TR_3P6_F</sub>	LVD 3.6 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	3600	Typ + 4%	mV	
SID529	V <sub>TR_3P7_F</sub>	LVD 3.7 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	3700	Typ + 4%	mV	
SID530	V <sub>TR_3P8_F</sub>	LVD 3.8 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	3800	Typ + 4%	mV	
SID531	V <sub>TR_3P9_F</sub>	LVD 3.9 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	3900	Typ + 4%	mV	
SID532	V <sub>TR_4P0_F</sub>	LVD 4.0 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	4000	Typ + 4%	mV	
SID533	V <sub>TR_4P1_F</sub>	LVD 4.1 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	4100	Typ + 4%	mV	
SID534	V <sub>TR_4P2_F</sub>	LVD 4.2 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	4200	Typ + 4%	mV	
SID535	V <sub>TR_4P3_F</sub>	LVD 4.3 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	4300	Typ + 4%	mV	
SID536	V <sub>TR_4P4_F</sub>	LVD 4.4 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	4400	Typ + 4%	mV	
SID537	V <sub>TR_4P5_F</sub>	LVD 4.5 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	4500	Typ + 4%	mV	
SID538	V <sub>TR_4P6_F</sub>	LVD 4.6 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	4600	Typ + 4%	mV	
SID539	V <sub>TR_4P7_F</sub>	LVD 4.7 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	4700	Typ + 4%	mV	
SID540	V <sub>TR_4P8_F</sub>	LVD 4.8 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	4800	Typ + 4%	mV	
SID541	V <sub>TR_4P9_F</sub>	LVD 4.9 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	4900	Typ + 4%	mV	
SID542	V <sub>TR_5P0_F</sub>	LVD 5.0 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	5000	Typ + 4%	mV	
SID543	V <sub>TR_5P1_F</sub>	LVD 5.1 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	5100	Typ + 4%	mV	
SID544	V <sub>TR_5P2_F</sub>	LVD 5.2 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	5200	Typ + 4%	mV	
SID545	V <sub>TR_5P3_F</sub>	LVD 5.3 V trimmed falling trip point for V <sub>DDD</sub>	Typ – 4%	5300	Typ + 4%	mV	

Electrical specifications

**Table 27-15 System resources** (continued)

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/ conditions
SID546	V <sub>TR_2P8_R</sub>	LVD 2.8 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	2825	Typ + 4%	mV	Same as V <sub>TR_2P8_F</sub> + 25 mV
SID547	V <sub>TR_2P9_R</sub>	LVD 2.9 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	2925	Typ + 4%	mV	Same as V <sub>TR_2P9_F</sub> + 25 mV
SID548	V <sub>TR_3P0_R</sub>	LVD 3.0 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	3025	Typ + 4%	mV	Same as V <sub>TR_3P0_F</sub> + 25 mV
SID549	V <sub>TR_3P1_R</sub>	LVD 3.1 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	3125	Typ + 4%	mV	Same as V <sub>TR_3P1_F</sub> + 25 mV
SID550	V <sub>TR_3P2_R</sub>	LVD 3.2 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	3225	Typ + 4%	mV	Same as V <sub>TR_3P2_F</sub> + 25 mV
SID551	V <sub>TR_3P3_R</sub>	LVD 3.3 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	3325	Typ + 4%	mV	Same as V <sub>TR_3P3_F</sub> + 25 mV
SID552	V <sub>TR_3P4_R</sub>	LVD 3.4 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	3425	Typ + 4%	mV	Same as V <sub>TR_3P4_F</sub> + 25 mV
SID553	V <sub>TR_3P5_R</sub>	LVD 3.5 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	3525	Typ + 4%	mV	Same as V <sub>TR_3P5_F</sub> + 25 mV
SID554	V <sub>TR_3P6_R</sub>	LVD 3.6 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	3625	Typ + 4%	mV	Same as V <sub>TR_3P6_F</sub> + 25 mV
SID555	V <sub>TR_3P7_R</sub>	LVD 3.7 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	3725	Typ + 4%	mV	Same as V <sub>TR_3P7_F</sub> + 25 mV
SID556	V <sub>TR_3P8_R</sub>	LVD 3.8 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	3825	Typ + 4%	mV	Same as V <sub>TR_3P8_F</sub> + 25 mV
SID557	V <sub>TR_3P9_R</sub>	LVD 3.9 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	3925	Typ + 4%	mV	Same as V <sub>TR_3P9_F</sub> + 25 mV
SID558	V <sub>TR_4P0_R</sub>	LVD 4.0 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	4025	Typ + 4%	mV	Same as V <sub>TR_4P0_F</sub> + 25 mV
SID559	V <sub>TR_4P1_R</sub>	LVD 4.1 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	4125	Typ + 4%	mV	Same as V <sub>TR_4P1_F</sub> + 25 mV
SID560	V <sub>TR_4P2_R</sub>	LVD 4.2 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	4225	Typ + 4%	mV	Same as V <sub>TR_4P2_F</sub> + 25 mV
SID561	V <sub>TR_4P3_R</sub>	LVD 4.3 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	4325	Typ + 4%	mV	Same as V <sub>TR_4P3_F</sub> + 25 mV
SID562	V <sub>TR_4P4_R</sub>	LVD 4.4 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	4425	Typ + 4%	mV	Same as V <sub>TR_4P4_F</sub> + 25 mV
SID563	V <sub>TR_4P5_R</sub>	LVD 4.5 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	4525	Typ + 4%	mV	Same as V <sub>TR_4P5_F</sub> + 25 mV
SID564	V <sub>TR_4P6_R</sub>	LVD 4.6 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	4625	Typ + 4%	mV	Same as V <sub>TR_4P6_F</sub> + 25 mV
SID565	V <sub>TR_4P7_R</sub>	LVD 4.7 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	4725	Typ + 4%	mV	Same as V <sub>TR_4P7_F</sub> + 25 mV
SID566	V <sub>TR_4P8_R</sub>	LVD 4.8 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	4825	Typ + 4%	mV	Same as V <sub>TR_4P8_F</sub> + 25 mV
SID567	V <sub>TR_4P9_R</sub>	LVD 4.9 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	4925	Typ + 4%	mV	Same as V <sub>TR_4P9_F</sub> + 25 mV
SID568	V <sub>TR_5P0_R</sub>	LVD 5.0 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	5025	Typ + 4%	mV	Same as V <sub>TR_5P0_F</sub> + 25 mV

## Electrical specifications

**Table 27-15 System resources** (continued)

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/ conditions
SID569	V <sub>TR_5P1_R</sub>	LVD 5.1 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	5125	Typ + 4%	mV	Same as V <sub>TR_5P1_F</sub> + 25 mV
SID570	V <sub>TR_5P2_R</sub>	LVD 5.2 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	5225	Typ + 4%	mV	Same as V <sub>TR_5P2_F</sub> + 25 mV
SID571	V <sub>TR_5P3_R</sub>	LVD 5.3 V trimmed rising trip point for V <sub>DDD</sub>	Typ – 4%	5325	Typ + 4%	mV	Same as V <sub>TR_5P3_F</sub> + 25 mV
SID573	LVD_RR_A	Power ramp rate: V <sub>DDD</sub> (Active)	–	–	100	mV/μs	
SID574	LVD_RR_DS	Power ramp rate: V <sub>DDD</sub> (DeepSleep)	–	–	10	mV/μs	
SID575	t <sub>DLY_ACT_LVD</sub>	Active mode delay between V <sub>DDD</sub> falling/rising through LVD rising/falling point and an internal LVD output transitioning through V <sub>DDD</sub> / 2	–	–	1	μs	Guaranteed by design
SID575A	t <sub>DLY_DS_LVD</sub>	DeepSleep mode delay between V <sub>DDD</sub> falling/rising through LVD rising/falling point and an internal LVD output transitioning through V <sub>DDD</sub> / 2	–	–	4	μs	Guaranteed by design
SID576	t <sub>RES_LVD</sub>	Response time of LVD, V <sub>DDD</sub> supply. LVD guaranteed to generate pulse for V <sub>DDD</sub> pulse width greater than this. (For falling-then-rising supply at max ramp rate; pulse width is time below LVD falling trip point.)	100	–	–	ns	Guaranteed by design

**High-voltage OVD (HV OVD) specifications**

SID580	V <sub>TR_5P0_R</sub>	HV OVD 5.0-V trimmed rising trip point for V <sub>DDD</sub> and V <sub>DDA_ADC</sub>	5.049	5.205	5.361	V	
SID581	V <sub>TR_5P0_F</sub>	HV OVD 5.0-V trimmed falling trip point for V <sub>DDD</sub> and V <sub>DDA_ADC</sub>	5.025	5.18	5.335	V	
SID582	V <sub>TR_5P5_R</sub>	HV OVD 5.5-V trimmed rising trip point for V <sub>DDD</sub> and V <sub>DDA_ADC</sub> (default)	5.548	5.72	5.892	V	
SID583	V <sub>TR_5P5_F</sub>	HV OVD 5.5-V trimmed falling trip point for V <sub>DDD</sub> and V <sub>DDA_ADC</sub> (default)	5.524	5.695	5.866	V	
SID585	HVOVD_RR_A	Power ramp rate: V <sub>DDD</sub> and V <sub>DDA_ADC</sub> (Active)	–	–	100	mV/μs	
SID586	HVOVD_RR_DS	Power ramp rate: V <sub>DDD</sub> and V <sub>DDA_ADC</sub> (DeepSleep)	–	–	10	mV/μs	
SID587	t <sub>DLY_ACT_HVOVD</sub>	Active mode delay between V <sub>DDD</sub> falling/rising through V <sub>TR_5P0_F/R</sub> or V <sub>TR_5P5_F/R</sub> and an internal HV OVD output transitioning through V <sub>DDD</sub> / 2	–	–	1	μs	Guaranteed by design

**Table 27-15 System resources** (continued)

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/ conditions
SID587A	t <sub>DLY_ACT_H-VOVD_A</sub>	Active mode delay between V <sub>DDA_ADC</sub> falling/rising through V <sub>TR_5P0_F/R</sub> or V <sub>TR_5P5_F/R</sub> and an internal HV OVD output transitioning through V <sub>DD</sub> / 2	–	–	1.5	µs	Guaranteed by design
SID587B	t <sub>DLY_DS_HVOVD</sub>	DeepSleep mode delay between V <sub>DDD</sub> /V <sub>DDA_ADC</sub> falling/rising through V <sub>TR_5P0_F/R</sub> or V <sub>TR_5P5_F/R</sub> and an internal HV OVD output transitioning through V <sub>DD</sub> / 2	–	–	4	µs	Guaranteed by design
SID588	t <sub>RES_HVOVD</sub>	Response time of HV OVD HV OVD guaranteed to generate pulse for V <sub>DDD</sub> /V <sub>DDA_ADC</sub> pulse width greater than this. (For rising-then-falling supply at max ramp rate; pulse width is time above V <sub>TR_5P0_R</sub> or V <sub>TR_5P5_R</sub> )	100	–	–	ns	Guaranteed by design

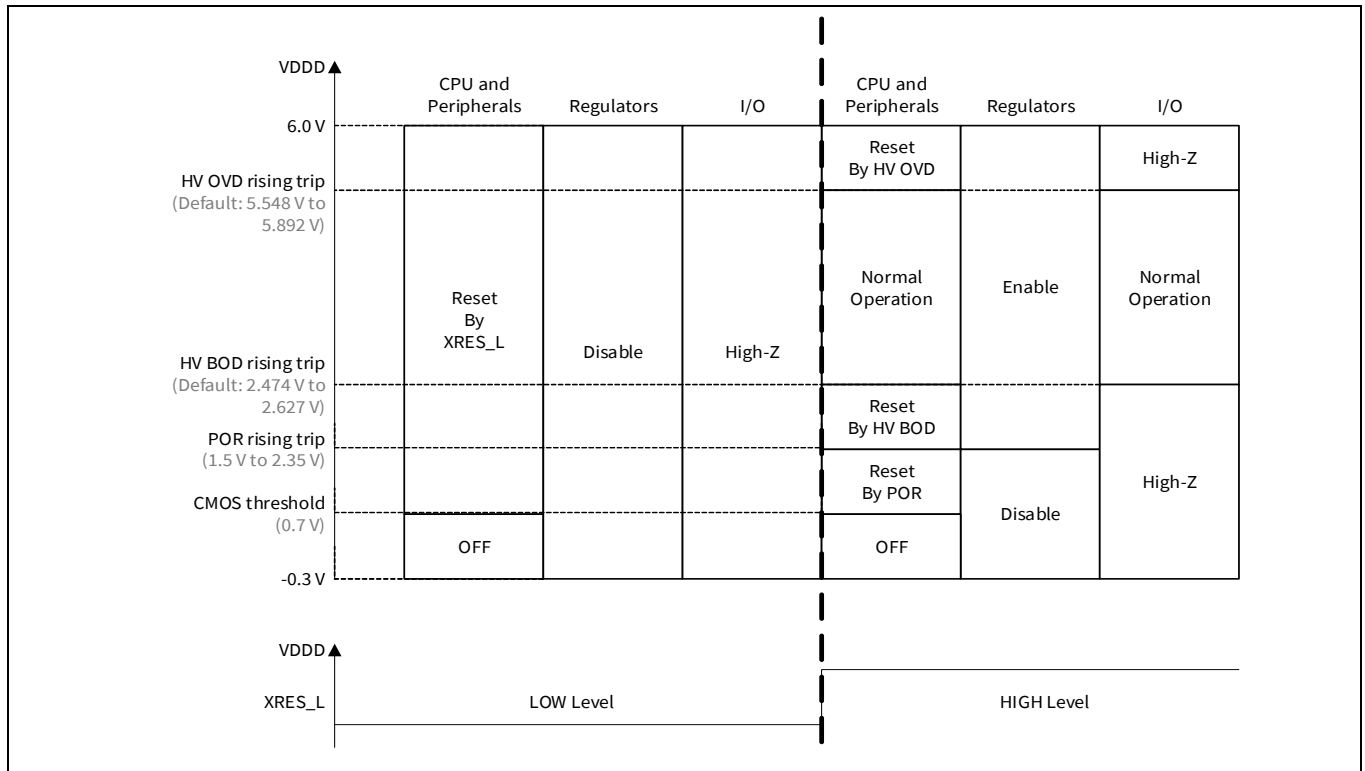
**Low-voltage OVD (LV OVD) specifications**

SID590	V <sub>TR_R_LVOVD</sub>	LV OVD trimmed rising trip point for V <sub>CCD</sub>	Typ – 3%	1300	Typ + 3%	mV	
SID591	V <sub>TR_F_LVOVD</sub>	LV OVD trimmed falling trip point for V <sub>CCD</sub>	Typ – 3%	1275	Typ + 3%	mV	Same as V <sub>TR_R_LVOVD</sub> – 25 mV
SID595	t <sub>DLY_ACT_LVOVD</sub>	Active mode delay between V <sub>CCD</sub> falling/rising through V <sub>TR_F/R_LVOVD</sub> and an internal LV OVD output transitioning through V <sub>DD</sub> / 2	–	–	1	µs	Guaranteed by design
SID595A	t <sub>DLY_DS_LVOVD</sub>	DeepSleep mode delay between V <sub>CCD</sub> falling/rising through V <sub>TR_F/R_LVOVD</sub> and an internal LV OVD output transitioning through V <sub>DD</sub> / 2	–	–	12	µs	Guaranteed by design
SID596	t <sub>RES_LVOVD</sub>	Response time of LV OVD. LV OVD guaranteed to generate pulse for V <sub>CCD</sub> pulse width greater than this. (For rising-then-falling supply at max ramp rate; pulse width is time above V <sub>TR_R_LVOVD</sub> )	100	–	–	ns	Guaranteed by design

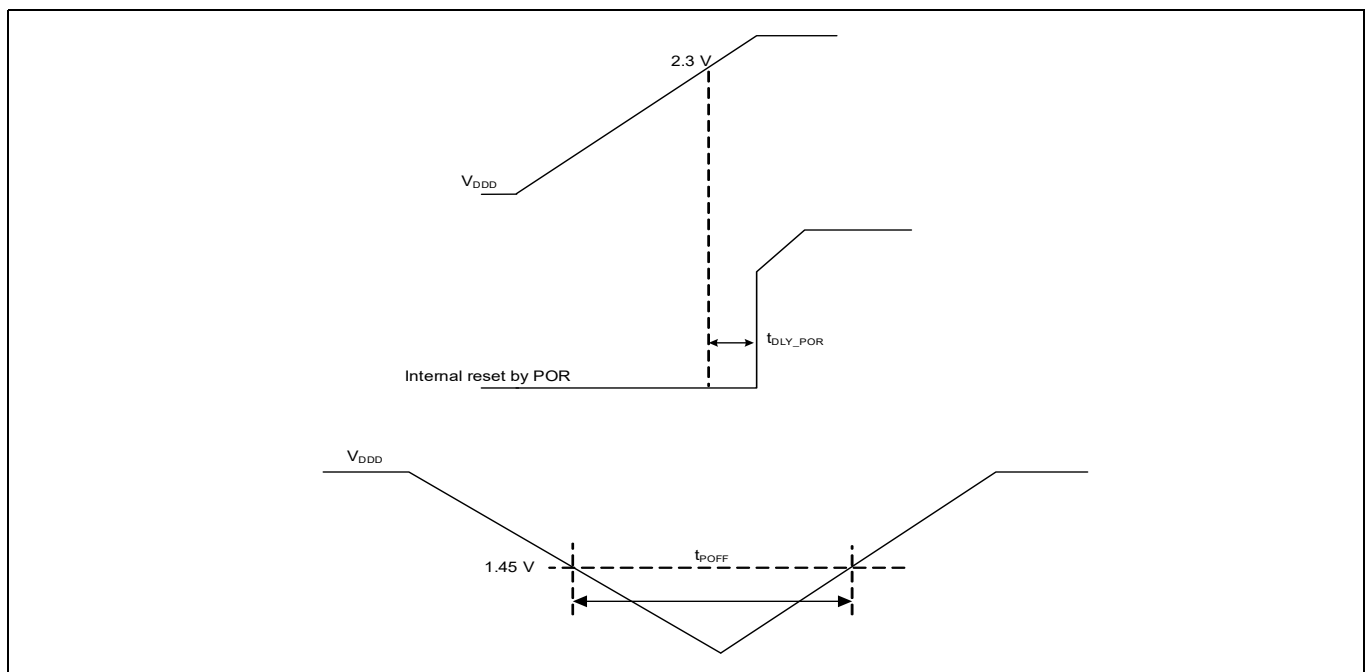
**Over current detection (OCD) specifications**

SID598_A	I <sub>OCD</sub>	Over current detection range for internal Active regulator	156	–	315	mA	
SID599	I <sub>OCD_DPSLP</sub>	Over current detection range for internal DeepSleep regulator	18	–	72	mA	

Electrical specifications

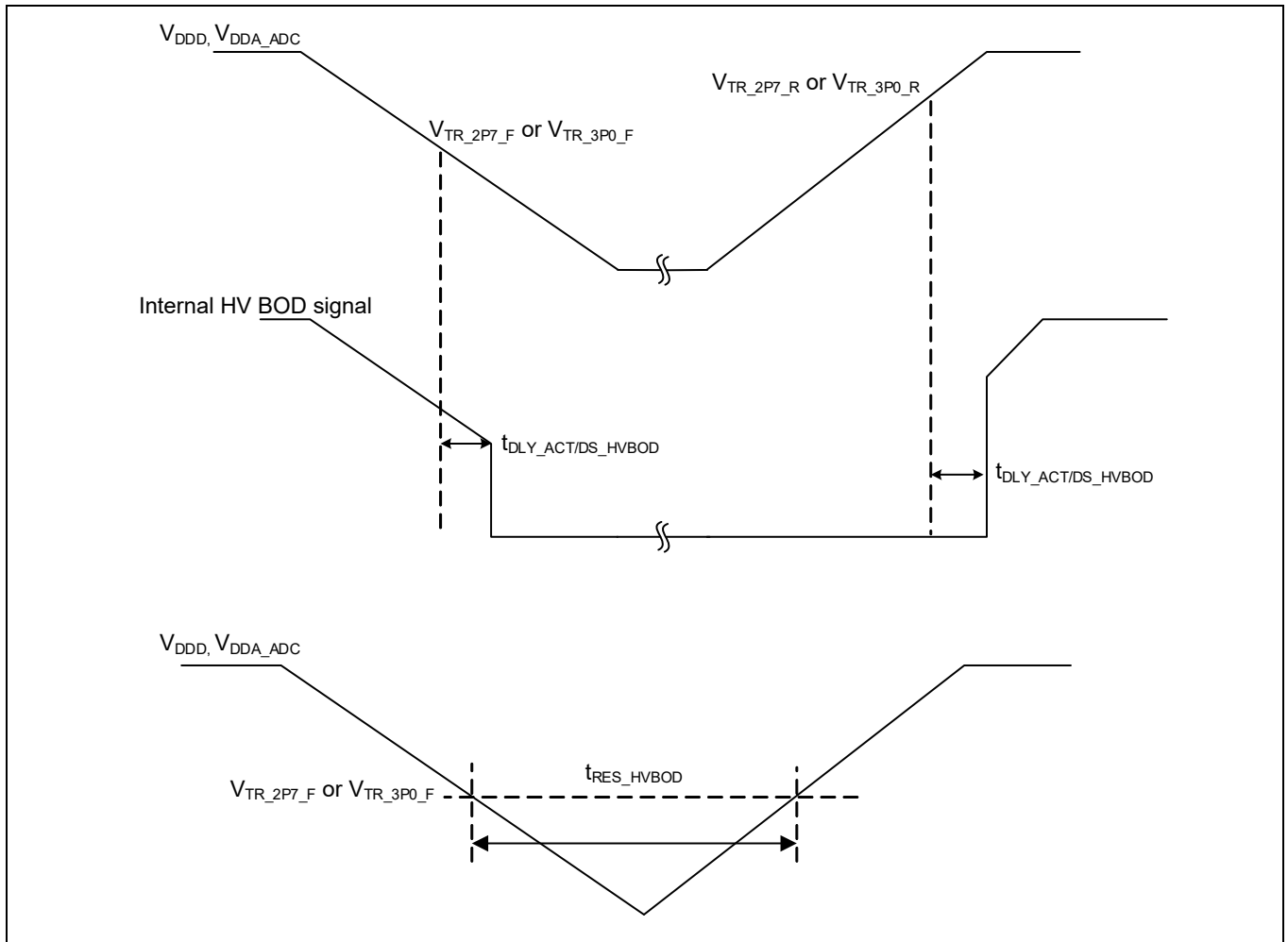


**Figure 27-14 Device operations supply range**

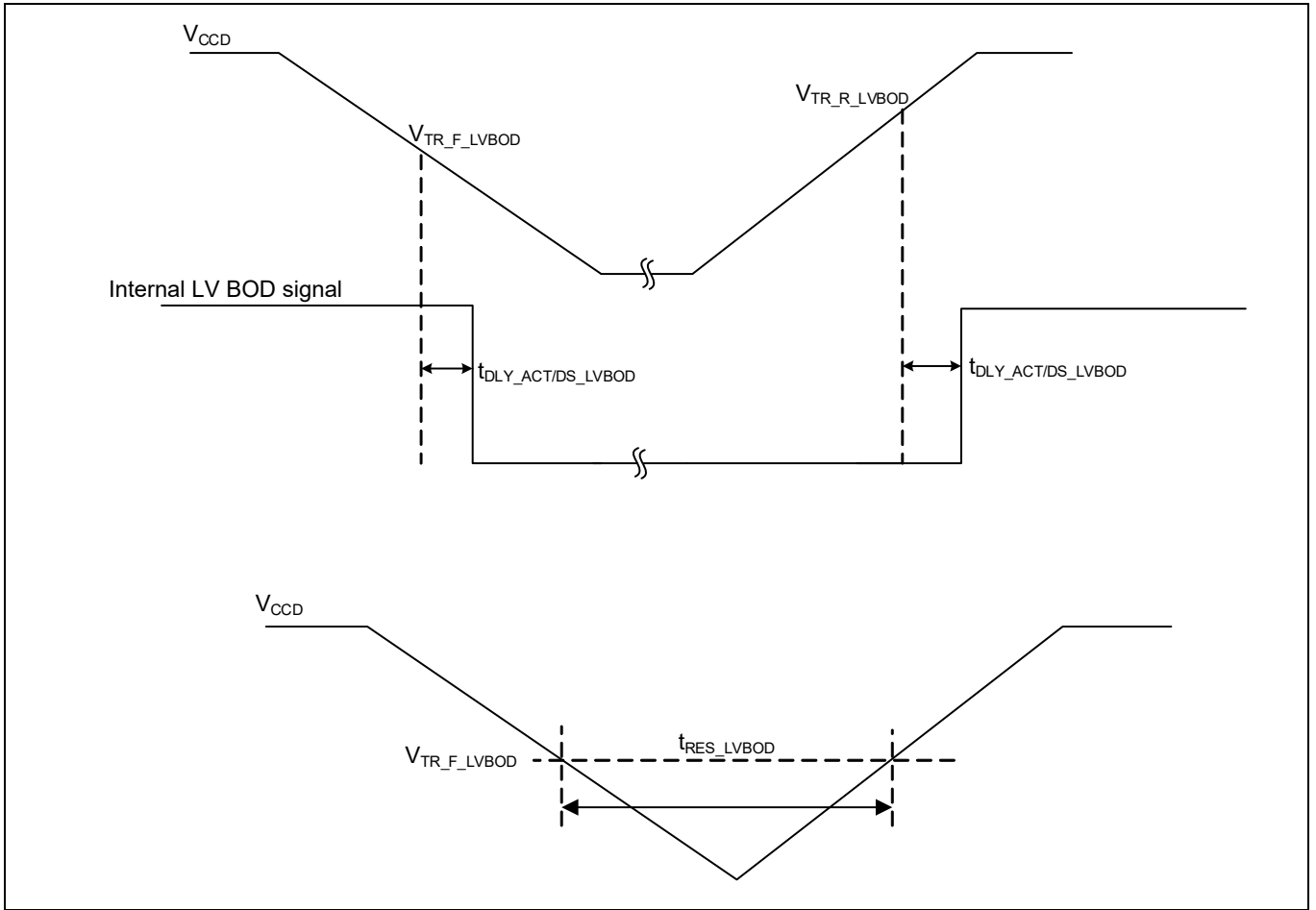


**Figure 27-15 POR specifications**

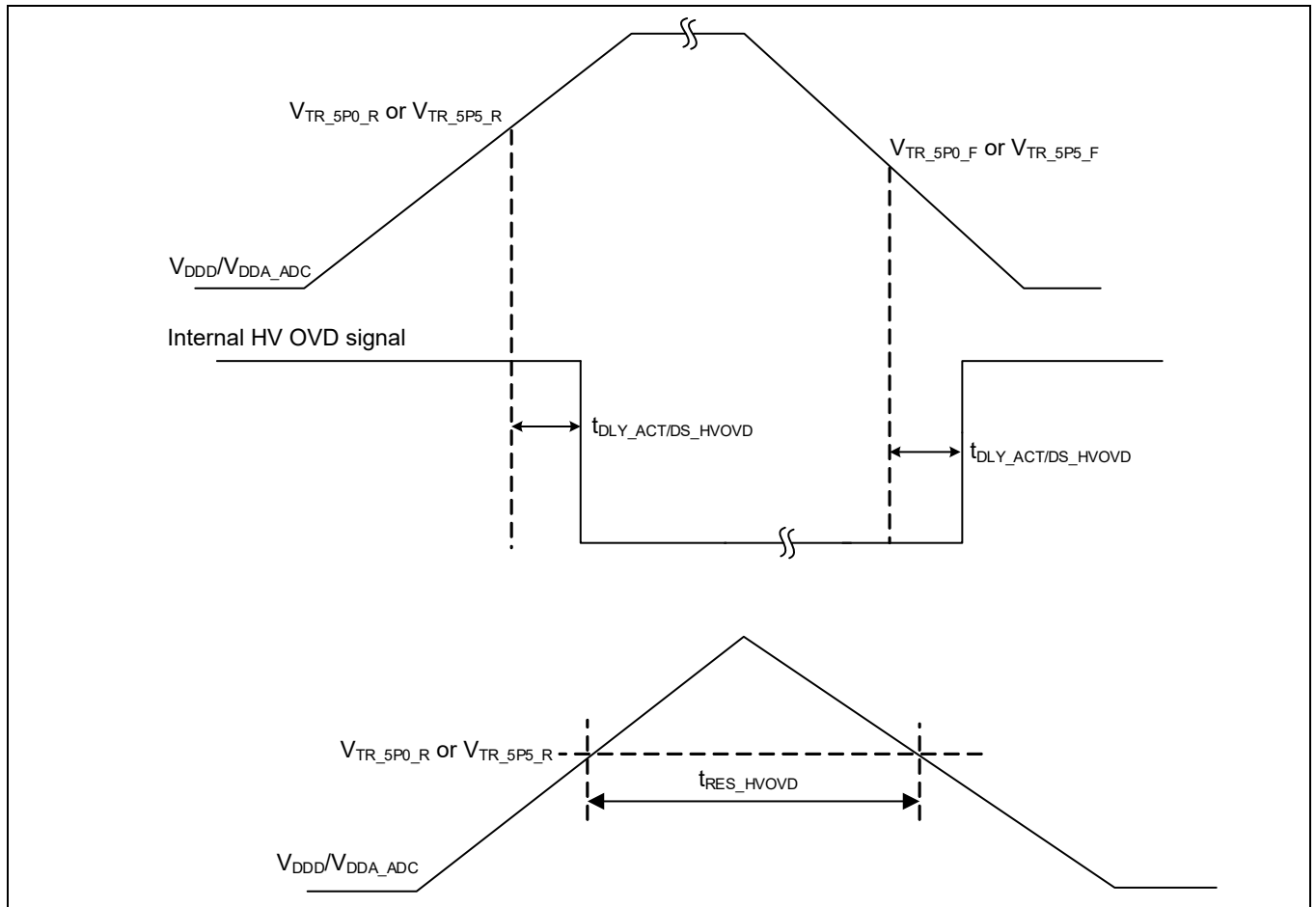




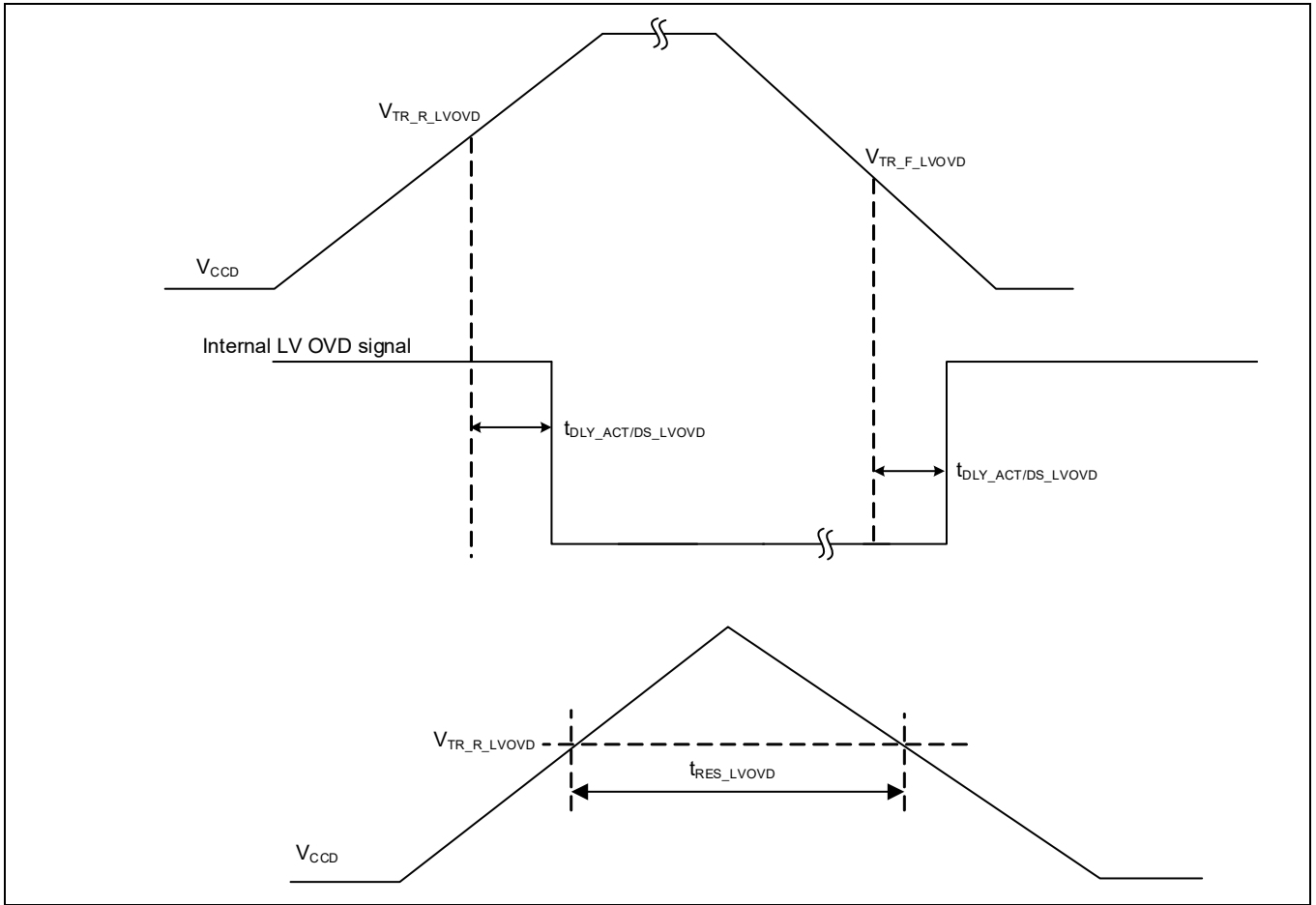
**Figure 27-16 High-voltage BOD specifications**



**Figure 27-17 Low-voltage BOD specifications**

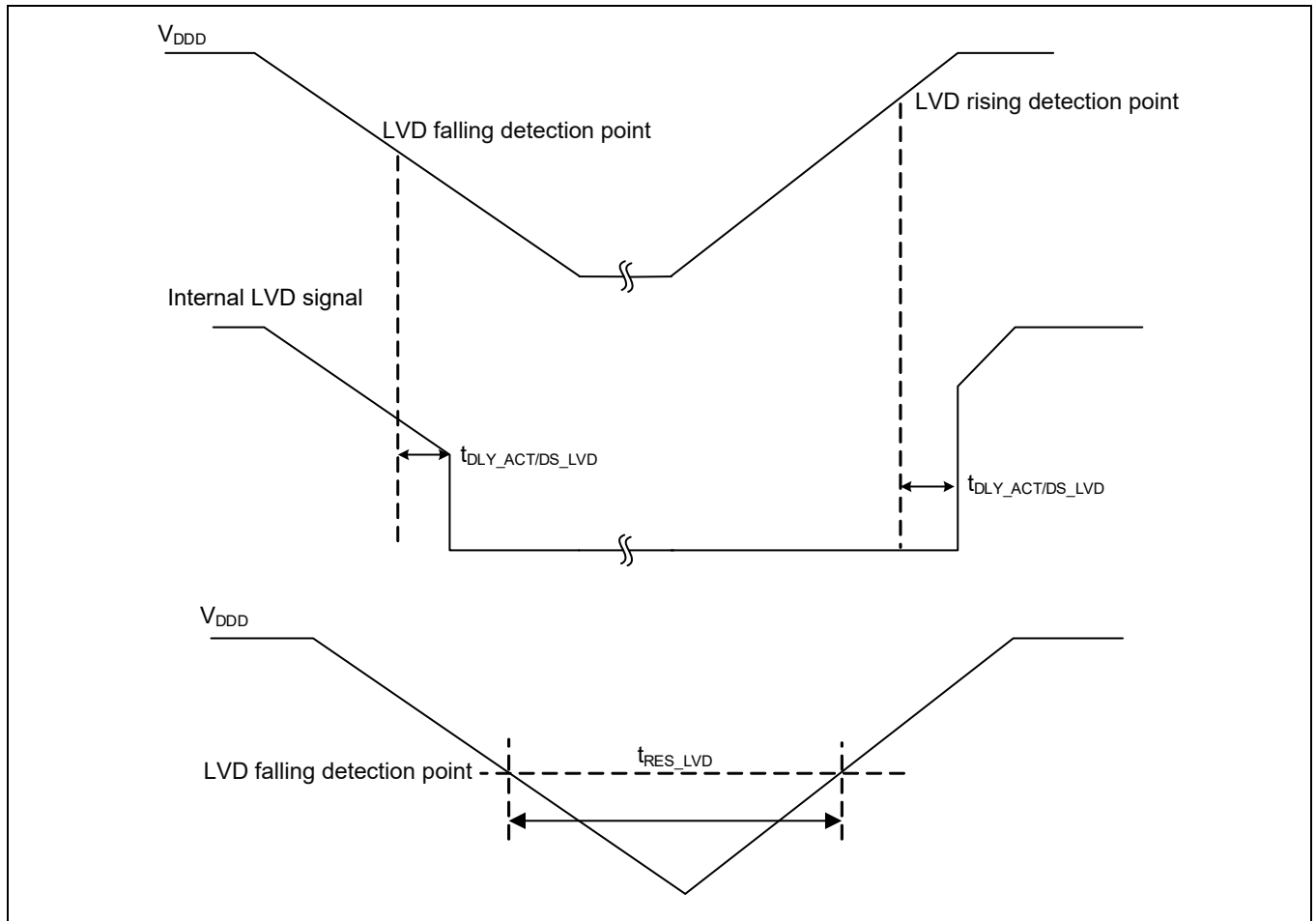


**Figure 27-18 High-voltage OVD specifications**



**Figure 27-19 Low-voltage OVD specifications**

Electrical specifications



**Figure 27-20 LVD specifications**

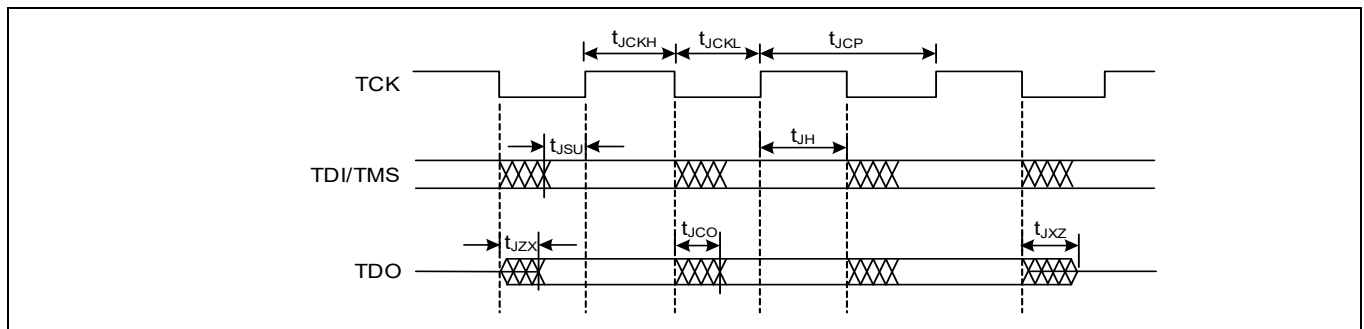
**Table 27-16 SWD interface specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
<b>Recommended I/O Configuration:</b> GPIO_STD: CFG_OUT/DRIVE_SEL<1:0> = 0b00, CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0, CFG_IN/VTRIP_SEL<0:0> = 0b1							
SID300	f <sub>SWDCLK</sub>	SWD clock input frequency	-	-	10	MHz	2.7 V ≤ V <sub>DDIO_GPIO</sub> ≤ 5.5 V
SID301	t <sub>SWDI_SETUP</sub>	SWDI setup time	0.25 × T	-	-	ns	T = 1 / f <sub>SWDCLK</sub>
SID302	t <sub>SWDI_HOLD</sub>	SWDI hold time	0.25 × T	-	-	ns	T = 1 / f <sub>SWDCLK</sub>
SID303	t <sub>SWDO_VALID</sub>	SWDO valid time	-	-	0.5 × T	ns	T = 1 / f <sub>SWDCLK</sub>
SID304	t <sub>SWDO_HOLD</sub>	SWDO hold time	1	-	-	ns	T = 1 / f <sub>SWDCLK</sub>

Electrical specifications

**Table 27-17 JTAG AC specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
<b>Recommended I/O Configuration:</b> GPIO_STD: CFG_OUT/DRIVE_SEL<1:0> = 0b00, CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0, CFG_IN/VTRIP_SEL<0:0> = 0b1							
SID620	t <sub>JCKH</sub>	TCK HIGH time	25	–	–	ns	30-pF load on TDO
SID621	t <sub>JCKL</sub>	TCK LOW time	25	–	–	ns	30-pF load on TDO
SID622	t <sub>JCP</sub>	TCK clock period	62.5	–	–	ns	30-pF load on TDO
SID623	t <sub>JSU</sub>	TDI/TMS setup time	6.25	–	–	ns	30-pF load on TDO
SID624	t <sub>JH</sub>	TDI/TMS hold time	6.25	–	–	ns	30-pF load on TDO
SID625	t <sub>JZX</sub>	TDO High-Z to active	–	–	25	ns	30-pF load on TDO
SID626	t <sub>JXZ</sub>	TDO active to High-Z	–	–	25	ns	30-pF load on TDO
SID627	t <sub>JCO</sub>	TDO clock to output	–	–	25	ns	30-pF load on TDO



**Figure 27-21 JTAG specifications**

**Table 27-18 Trace specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
<b>Recommended I/O Configuration:</b> HSIO_STDLN: CFG_DRIVE_EXT<1:0>/DRIVE_SEL_EXT<4:0> = 0b000000, CFG_SLEW_EXT/SLEW<0:0> = 0b0							
SID1412A	C <sub>TRACE</sub>	Trace Capacitive Load	–	–	30	pF	
SID1412	t <sub>TRACE_CYC</sub>	Trace clock period	20	–	–	ns	Trace clock cycle time for 50 MHz
SID1413	t <sub>TRACE_CLKL</sub>	Trace clock LOW pulse width	2	–	–	ns	Clock low pulse width
SID1414	t <sub>TRACE_CLKH</sub>	Trace clock HIGH pulse width	2	–	–	ns	Clock high pulse width
SID1415	t <sub>TRACE_SETUP</sub>	Trace data setup time	2	–	–	ns	Trace data setup time, CLK_PERI ≥ 75 MHz
SID1416	t <sub>TRACE_HOLD</sub>	Trace data hold time	1	–	–	ns	Trace data hold time, CLK_PERI ≥ 75 MHz
SID1415A	t <sub>TRACE_SETUP</sub>	Trace data setup time	3	–	–	ns	Trace data setup time, CLK_PERI < 75 MHz
SID1416A	t <sub>TRACE_HOLD</sub>	Trace data hold time	2	–	–	ns	Trace data hold time, CLK_PERI < 75 MHz

## 27.11 Clock specifications

The basic requirement on the clock frequency dependency of the cores is that the Cortex®-M0+ core should run at an integer divider from the Cortex®-M4 core clock. Example combinations are listed in the [Table 27-19](#).

**Table 27-19 Clock requirements**

Core Cortex®-M4 Clock (MHz)	Core Cortex®-CM0+ Clock (MHz)
160	80
100	100
80	80

**Table 27-20 Root and intermediate clocks**<sup>[56, 57]</sup>

Root Clock	Maximum permitted clock frequency (MHz) <sup>[58]</sup>	Source	Maximum permitted clock frequency (MHz) <sup>[58]</sup>						Description
			PLL/FLL Clock source: ECO/LPECO <sup>[59]</sup>			PLL/FLL Clock source: IMO <sup>[60, 61]</sup>			
			Integer	SSCG	Fractional	Integer	SSCG	Fractional	
CLK_HF0	160	PLL200#1	160	NA	NA	153	NA	NA	Root clock for CPUSS (CM0+, CM4), PERI (CLK_SLOW, CLK_PERI)
		FLL	100	NA	NA	100	NA	NA	
	100	PLL200#1	100	NA	NA	95	NA	NA	
		FLL	100	NA	NA	97	NA	NA	
CLK_HF1	100	PLL200#1	100	NA	NA	95	NA	NA	Event generator (CLK_REF), clock output on EXT_CLK pins (when used as output)
		FLL	100	NA	NA	97	NA	NA	
CLK_HF2	200	PLL400#0 / PLL200#2 / EXT_CLK	200	196	198	191	189	191	Sound Subsystem #0 root clock, (CLK_IF_SRSS0)
		FLL	100	NA	NA	100	NA	NA	
CLK_HF3	200	PLL400#0 / PLL200#2 / EXT_CLK	200	196	198	191	189	191	Sound Subsystem #1 root clock (CLK_IF_SRSS1)
		FLL	100	NA	NA	100	NA	NA	
CLK_HF4	200	PLL400#0 / PLL200#2 / EXT_CLK	200	196	198	191	189	191	Sound Subsystem #2 root clock (CLK_IF_SRSS2)
		FLL	100	NA	NA	100	NA	NA	

### Notes

56. Intermediate clocks that are not listed have the same limitations as that of their parent clock.

57. Table indicates guaranteed mapping between a root clock (CLK\_HFx) and the PLL.

58. Maximum clock frequency after the corresponding clock source (PLL/FLL + dividers). All internal tolerances and affects are covered by these frequencies.

59. For ECO, LPECO: up to ±150 ppm uncertainty of the external clock source are tolerated by design.

60. The IMO operation frequency tolerance is included.

61. ROM and flash boot execution with IMO/FLL at 100 MHz is guaranteed by design.



**Table 27-20 Root and intermediate clocks**<sup>[56, 57]</sup> (continued)

Root Clock	Maximum permitted clock frequency (MHz) <sup>[58]</sup>	Source	Maximum permitted clock frequency (MHz) <sup>[58]</sup>						Description
			PLL/FLL Clock source: ECO/LPECO <sup>[59]</sup>			PLL/FLL Clock source: IMO <sup>[60, 61]</sup>			
			Integer	SSCG	Fractional	Integer	SSCG	Fractional	
CLK_HF5	200	PLL200#2	200	NA	NA	191	NA	NA	SMIF#0 root clock
		FLL	100	NA	NA	100	NA	NA	
CLK_HF6		ILO	NA						CSV Dedicated (< 1MHz)
CLK_FAST	160	CLK_HF0	160	NA	NA	153	NA	NA	Generated by dividing CLK_HF0, intermediate clock for CM4
		FLL	100	NA	NA	100	NA	NA	
CLK_SLOW	100	CLK_HF0	100	NA	NA	95	NA	NA	Generated by clock gating CLK_PERI, intermediate clock for CM0+, Crypto, P-DMA, M-DMA
		FLL	100	NA	NA	97	NA	NA	
CLK_PERI	100	CLK_HF0	100	NA	NA	95	NA	NA	Generated by clock gating CLK_HF0, intermediate clock for LIN, SCB, PASS, CAN, TCPWM, CXPI, IOSS, CPU trace
		FLL	100	NA	NA	97	NA	NA	



Electrical specifications

**Table 27-21 IMO AC specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID310	f <sub>IMO</sub>	IMO operating frequency	7.632	8	8.368	MHz	Accuracy after factory trimming
SID311	t <sub>STARTIMO</sub>	IMO startup time	-	-	7.5	μs	Startup time to 90% of final frequency
SID312	I <sub>IMO_ACT</sub>	IMO current	-	13.5	22	μA	Guaranteed by design

**Table 27-22 ILO AC specifications**

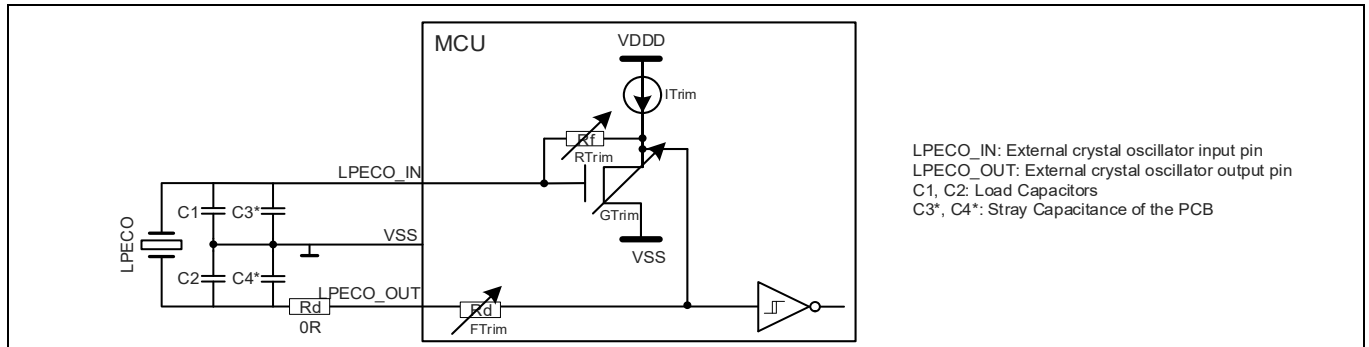
Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID320	f <sub>ILOTRIM</sub>	ILO operating frequency	30.965	32.768	34.57	kHz	5.5% accuracy after factory trimming
SID321	t <sub>STARTILO</sub>	ILO startup time	-	8	12	μs	Startup time to 90% of final frequency
SID323	I <sub>ILO</sub>	ILO current	-	500	2800	nA	Guaranteed by design

**Table 27-23 LPECO specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID325	f <sub>LPECO</sub>	LPECO operating frequency	3.99	-	8.01	MHz	Drive level protection DL ≥ 100 μW, ESR ≤ 200 Ω Crystal load capacitance (C <sub>L</sub> ) 5 pF to 25 pF
SID329	I <sub>LPECO_4M</sub>	LPECO current at 4 MHz	-	93	110	μA	Shared with GPIO, Load: 10 pF BACKUP_LPECO_CTL/LPECO_AMPDET_EN<0:0>=0b0
SID354	I <sub>LPECO_4M</sub>	LPECO current at 4 MHz	-	97	125	μA	Shared with GPIO, Load: 15 pF BACKUP_LPECO_CTL/LPECO_AMPDET_EN<0:0>=0b0
SID326	I <sub>LPECO_4M</sub>	LPECO current at 4 MHz	-	106	145	μA	Shared with GPIO, Load: 20 pF BACKUP_LPECO_CTL/LPECO_AMPDET_EN<0:0>=0b0
SID355	I <sub>LPECO_4M</sub>	LPECO current at 4 MHz	-	115	155	μA	Shared with GPIO, Load: 25 pF BACKUP_LPECO_CTL/LPECO_AMPDET_EN<0:0>=0b0
SID356	I <sub>LPECO_8M</sub>	LPECO current at 8 MHz	-	140	165	μA	Shared with GPIO, Load: 10 pF BACKUP_LPECO_CTL/LPECO_AMPDET_EN<0:0>=0b0
SID357	I <sub>LPECO_8M</sub>	LPECO current at 8 MHz	-	149	175	μA	Shared with GPIO, Load: 15 pF BACKUP_LPECO_CTL/LPECO_AMPDET_EN<0:0>=0b0
SID327	I <sub>LPECO_8M</sub>	LPECO current at 8 MHz	-	165	190	μA	Shared with GPIO, Load: 20 pF BACKUP_LPECO_CTL/LPECO_AMPDET_EN<0:0>=0b0

**Table 27-23 LPECO specifications** (continued)

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID358	$I_{LPECO\_8M}$	LPECO current at 8 MHz	-	183	220	$\mu A$	Shared with GPIO, Load: 25 pF BACKUP_LPECO_CTL/LPECO_AMPDET_EN<0:0>=0b0
SID328	$t_{START\_LPECO}$	LPECO startup time <sup>[62]</sup>	-	-	10	ms	Startup time to 90% of final frequency



**Figure 27-22 LPECO connection scheme**<sup>[63]</sup>

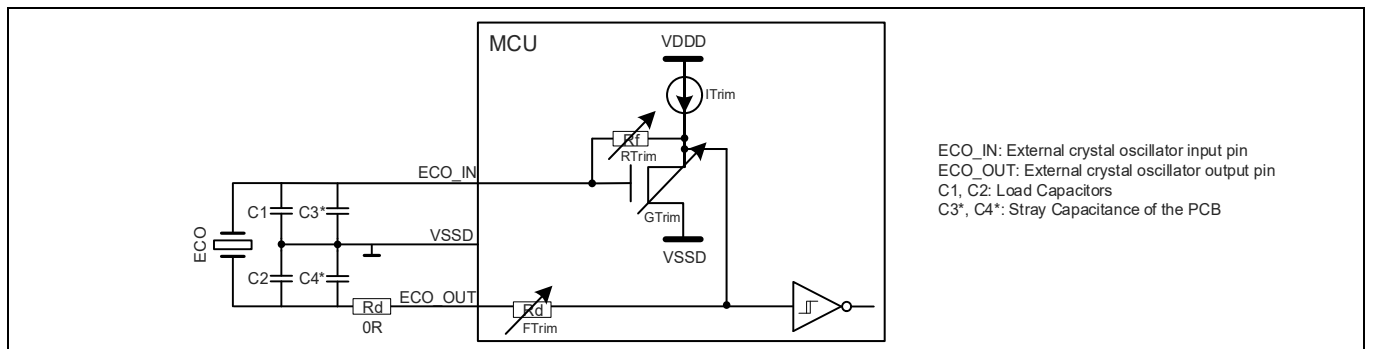
**Notes**

62. Mainly depending on the chosen external crystal.

63. See the family-specific Architecture TRM for more information on crystal requirements (002-19314, TRAVEO™ T2G Automotive Body Controller Entry Family Architecture Technical Reference Manual (TRM)).

**Table 27-24 ECO specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID330	$f_{ECO}$	Crystal frequency range	7.2	–	33.34	MHz	
SID332	$R_{FDBK}$	Feedback resistor value. Min: RTRIM = 3; Max: RTRIM = 0 with 100 kΩ step size on RTRIM	100	–	400	kΩ	Guaranteed by design
SID333	$I_{ECO3}$	ECO current at $T_J = 150\text{ °C}$	–	1200	2000	μA	Maximum operation current at 33 MHz crystal, up to 18 pF load
SID334	$t_{START\_7M}$	7.2 MHz ECO startup time <sup>[64]</sup>	–	–	10	ms	Startup time to 90% of final frequency
SID335	$t_{START\_33M}$	33 MHz ECO startup time <sup>[64]</sup>	–	–	1	ms	Startup time to 90% of final frequency



**Figure 27-23 ECO connection scheme<sup>[65]</sup>**

**Notes**

- 64. Mainly depending on the chosen external crystal.
- 65. See the family-specific Architecture TRM for more information on crystal requirements (002-33175, TRAVEO™ T2G Automotive MCU cluster entry architecture technical reference manual).

**Table 27-25 PLL specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
<b>PLL Specifications for “PLL without SSCG and Fractional Operation” (PLL200)</b>							
SID340	t <sub>PLL200_LOCK</sub>	Time to achieve PLL lock	–	–	35	µs	Time from stable reference clock until PLL frequency is within 0.1% of final value and lock indicator is set
SID341	f <sub>OUT</sub>	Output frequency from PLL block (PLL_OUT)	10.998	–	200.03	MHz	
SID346	f <sub>IN</sub>	PLL input frequency (Reference Clock f <sub>REF</sub> )	3.988	–	33.34	MHz	
SID347	I <sub>PLL_200M</sub>	PLL operating current	–	0.87	1.85	mA	f <sub>OUT</sub> = 200 MHz
SID348C	f <sub>PLL_VCO</sub>	VCO frequency, clock output of 'Voltage Control Oscillator (VCO)'	169.9745	–	400.06	MHz	
SID349C	f <sub>PLL_PFD</sub>	Phase Detector Frequency, clock output of the Reference Divider (Q) and Feedback Divider (P)	3.988	–	8.0012	MHz	
SID342	PLL_LJIT1	Long term jitter	–0.25	–	0.25	ns	For 125 ns Guaranteed by design f <sub>PLL_VCO</sub> : 320 MHz or 400 MHz f <sub>PLL_OUT</sub> : 40 MHz to 200 MHz f <sub>PLL_PFD</sub> : 8 MHz f <sub>PLL_IN</sub> : ECO
SID343	PLL_LJIT2	Long term jitter	–0.5	–	0.5	ns	For 500 ns Guaranteed by design f <sub>PLL_VCO</sub> : 320 MHz or 400 MHz f <sub>PLL_OUT</sub> : 40 MHz to 200 MHz f <sub>PLL_PFD</sub> : 8 MHz f <sub>PLL_IN</sub> : ECO
SID344	PLL_LJIT3	Long term jitter	–0.5	–	0.5	ns	For 1000 ns Guaranteed by design f <sub>PLL_VCO</sub> : 320 MHz or 400 MHz f <sub>PLL_OUT</sub> : 40 MHz to 200 MHz f <sub>PLL_PFD</sub> : 8 MHz f <sub>PLL_IN</sub> : ECO
SID345A1	PLL_LJIT5	Long term jitter	–0.75	–	0.75	ns	For 10000 ns Guaranteed by design f <sub>PLL_VCO</sub> : 320 MHz or 400 MHz f <sub>PLL_OUT</sub> : 40 MHz to 200 MHz f <sub>PLL_PFD</sub> : 8 MHz f <sub>PLL_IN</sub> : ECO
<b>PLL Specifications for “PLL with SSCG and Fractional Operation” (PLL400)</b>							
SID340A	t <sub>PLL400_LOCK</sub>	Time to achieve PLL lock	–	–	50	µs	
SID341A	f <sub>OUT</sub>	Output frequency from PLL block (PLL_OUT)	24.996	–	400.06	MHz	
SID343A	SPREAD_D	Spread spectrum modulation depth	0.5	–	3	%	Downspread only, triangle modulation
SID343B	f <sub>SPREAD_MR</sub>	Spread spectrum modulation rate	–	–	32	kHz	Selected by modulation divider from f <sub>PFD</sub>
SID346A	f <sub>IN</sub>	PLL input frequency (Reference Clock f <sub>REF</sub> )	3.988	–	33.34	MHz	
SID347A	I <sub>PLL_400M</sub>	PLL operating current	–	1.4	2.2	mA	f <sub>OUT</sub> = 400 MHz

## Electrical specifications

**Table 27-25 PLL specifications (continued)**

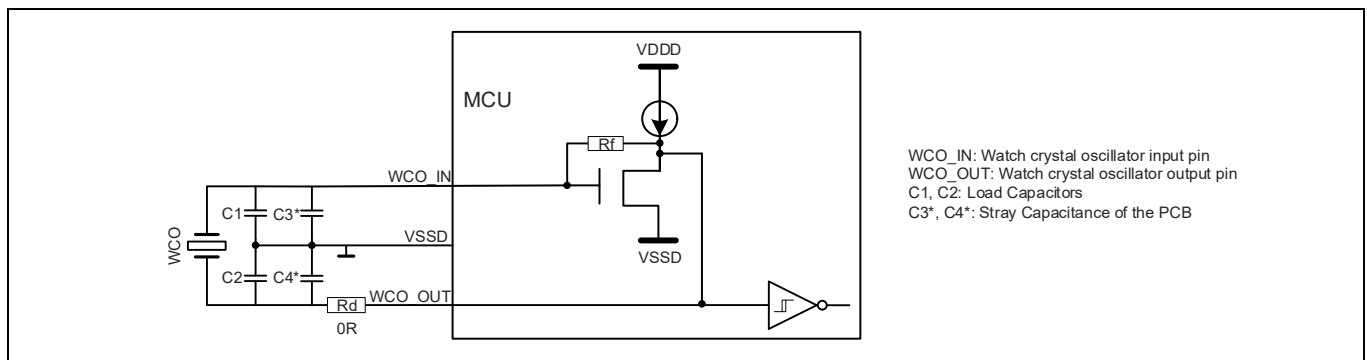
Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID348A	$f_{\text{PFD\_S}}$	Phase Detector Frequency, clock output of the Reference Divider (Q) and Feedback Divider (P)	3.988	-	20.003	MHz	Fractional operation OFF
SID349A	$f_{\text{PFD\_F}}$	Phase Detector Frequency, clock output of the Reference Divider (Q) and Feedback Divider (P)	7.9988	-	20.003	MHz	Fractional operation ON
SID345A	$f_{\text{VCO}}$	VCO frequency, Clock output of 'Voltage Control Oscillator (VCO)'	399.94	-	800.12	MHz	
SID342D1	PLL400_LJIT1	Long term jitter	-0.25	-	0.25	ns	For 125 ns Guaranteed by Design $f_{\text{VCO}}$ : 800 MHz (spreading is off) $f_{\text{IN}}$ : ECO $f_{\text{PFD}}$ : 4 MHz $f_{\text{OUT}}$ : 100 MHz to 400 MHz
SID343D1	PLL400_LJIT2	Long term jitter	-0.5	-	0.5	ns	For 500 ns Guaranteed by Design $f_{\text{VCO}}$ : 800 MHz (spreading is off) $f_{\text{IN}}$ : ECO $f_{\text{PFD}}$ : 4 MHz $f_{\text{OUT}}$ : 100 MHz to 400 MHz
SID344D1	PLL400_LJIT3	Long term jitter	-1	-	1	ns	For 1000 ns Guaranteed by Design $f_{\text{VCO}}$ : 800 MHz (spreading is off) $f_{\text{IN}}$ : ECO $f_{\text{PFD}}$ : 4 MHz $f_{\text{OUT}}$ : 100 MHz to 400 MHz
SID345E1	PLL400_LJIT5	Long term jitter	-1.5	-	1.5	ns	For 10000 ns Guaranteed by Design $f_{\text{VCO}}$ : 800 MHz (spreading is off) $f_{\text{IN}}$ : ECO $f_{\text{PFD}}$ : 4 MHz $f_{\text{OUT}}$ : 100 MHz to 400 MHz

**Table 27-26 FLL specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID350	$t_{\text{FLL\_WAKE}}$	FLL wake up time	-	-	5	$\mu\text{s}$	Wakeup with < 10°C temperature change while in DeepSleep. $f_{\text{FLL\_IN}}$ = 8 MHz, $f_{\text{FLL\_OUT}}$ = 100 MHz, Time from stable reference clock until FLL frequency is within 5% of final value
SID351	$f_{\text{FLL\_OUT}}$	Output frequency from FLL block	24	-	100	MHz	Output range of FLL divided-by-2 output
SID352	FLL_CJIT	FLL frequency accuracy	-1	-	1	%	This is added to the error of the source
SID353	$f_{\text{FLL\_IN}}$	Input frequency	0.25	-	100	MHz	

**Table 27-27 WCO specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID360	$f_{WCO}$	Watch crystal frequency	–	32.768	–	kHz	Tuning Fork Crystal with following parameters: DL (drive level) $\geq 0.5 \mu W$ , ESR $\leq 130 k\Omega$
SID361	WCO_DC	WCO duty cycle	10	–	90	%	
SID362	$t_{START\_WCO}$	WCO start up time <sup>[66]</sup>	–	–	1000	ms	
SID363	$I_{WCO}$	WCO current	–	1.4	–	$\mu A$	AGC = OFF



**Figure 27-24 WCO connection scheme<sup>[67]</sup>**

**Table 27-28 External clock input specifications**

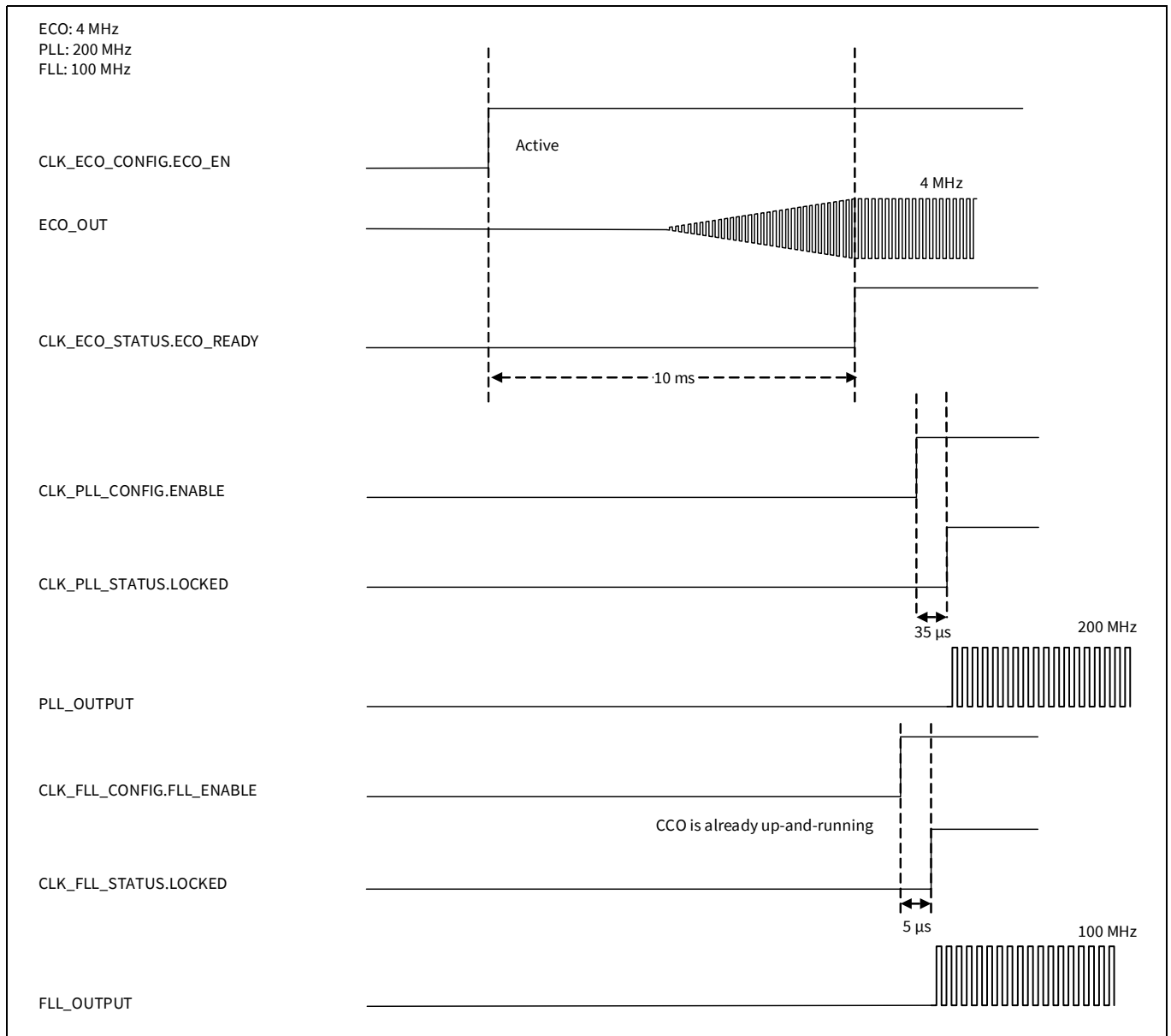
Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID366	$f_{EXT}$	External clock input frequency	0.25	–	100	MHz	For EXT_CLK pin (all input level settings: CMOS, TTL, Automotive)
SID367	EXT_DC	Duty cycle	45	–	55	%	

**Notes**

66. Mainly depending on the chosen external crystal.

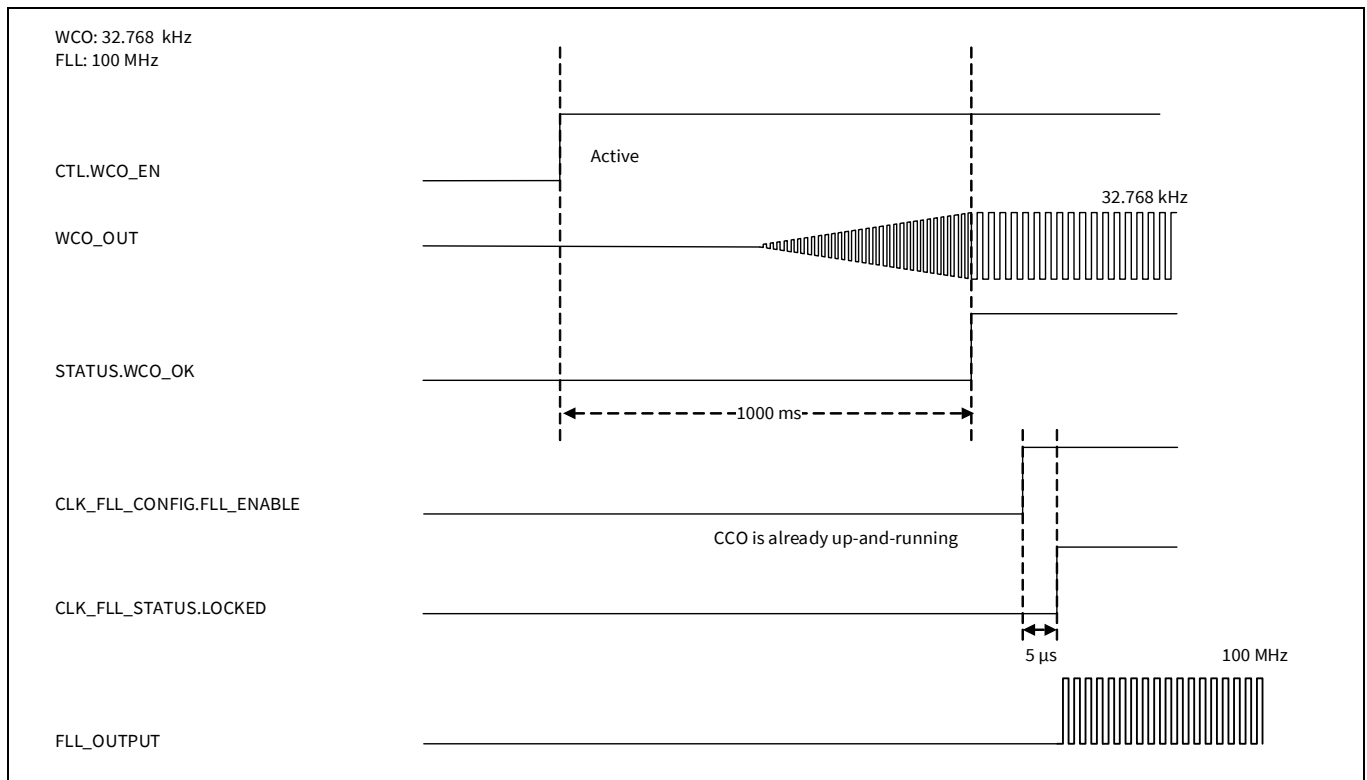
67. See the family-specific Architecture TRM for more information on crystal requirements (002-33175, TRAVEO™ T2G Automotive MCU cluster entry architecture technical reference manual).

## 27.12 Clock timing diagrams



**Figure 27-25 ECO to PLL or FLL diagram**

Electrical specifications



**Figure 27-26 WCO to FLL diagram**

**Table 27-29 MCWDT timeout specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID410	t <sub>MCWDT1</sub>	Minimum MCWDT timeout	57.85	-	-	μs	When using the ILO (32 kHz + 5.5%) and 16-bit MCWDT counter Guaranteed by design
SID411	t <sub>MCWDT2</sub>	Maximum MCWDT timeout	-	-	2.12	s	When using the ILO (32 kHz - 5.5%) and 16-bit MCWDT counter Guaranteed by design

**Table 27-30 WDT timeout specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID412	t <sub>WDT1</sub>	Minimum WDT timeout	57.85	-	-	μs	When using the ILO (32 kHz + 5.5%) and 32-bit WDT counter Guaranteed by design
SID413	t <sub>WDT2</sub>	Maximum WDT timeout	-	-	38.53	h	When using the ILO (32 kHz - 5.5%) and 32-bit WDT counter Guaranteed by design
SID414	t <sub>WDT3</sub>	Default WDT timeout	-	1000	-	ms	When using the ILO and 32-bit WDT counter at 0x8000 (default value), guaranteed by design



## 27.13 Sound subsystem specifications

**Table 27-31 Sound subsystem specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
<b>I<sup>2</sup>S I/O Settings</b>							
<b>Recommended I/O configuration:</b> <b>GPIO_STD:</b> CFG_OUT/DRIVE_SEL<1:0> = 0b01, CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0, CFG_IN/VTRIP_SEL<0:0> = 0b1							
<b>I<sup>2</sup>S Serial Clock Frequency</b>							
SID796	t <sub>SCLK</sub>	Serial clock period	162	-	-	ns	Guaranteed by design No feature is used for low frequency I <sup>2</sup> S operation: DUT RX Master: * RX_IF_CTL.LATE_SAMPLE = 0 * RX_IF_CTL.LATE_CAPTURE = 0b00 DUT TX Slave: No special configuration DUT RX Slave: * RX_IF_CTL.LATE_SAMPLE = 0  I <sup>2</sup> S can only be used at 2.7 V ≤ V <sub>DD</sub> ≤ 3.6 V
SID797	t <sub>HC</sub>	Serial clock high time	0.35 × t <sub>SCLK</sub>	-	-	ns	Guaranteed by design
SID798	t <sub>LC</sub>	Serial clock low time	0.35 × t <sub>SCLK</sub>	-	-	ns	Guaranteed by design
SID799	t <sub>MCLK</sub>	Master clock period	20	-	-	ns	Guaranteed by design  I <sup>2</sup> S can only be used at 2.7 V ≤ V <sub>DD</sub> ≤ 3.6 V
<b>I<sup>2</sup>S Transmitter Timing</b>							
SID740	t <sub>DTR</sub>	Delay from rising edge of TX_CLK to transition on TX_SD/TX_FSYNC (WS)	-	-	0.8 × t <sub>SCLK</sub>	ns	Guaranteed by design
SID741	t <sub>HTR</sub>	Delay from rising edge of TX_CLK to transition on TX_SD/TX_FSYNC (WS)	0	-	-	ns	Guaranteed by design
SID743	t <sub>HR_WS_POL_0</sub>	TX Slave: Hold on TX_FSYNC (WS) after the 1st edge following the driving edge of TX_CLK (SCK_POLARITY = 0, half-cycle hold)	1.8	-	-	ns	
<b>I<sup>2</sup>S Receiver Timing</b>							
SID751	t <sub>SR</sub>	Setup on RX_SD/RX_FSYNC (WS) before the rising edge to RX_CLK	0.2 × t <sub>SCLK</sub>	-	-	ns	Guaranteed by Design Setup time is independent from RX_IF_CTL.LATE_SAMPLE, RX_IF_CTL.LATE_CAPTURE or SCK_POLARITY setting
SID752A	t <sub>HR</sub>	Hold on RX_SD/RX_FSYNC (WS) after the rising edge to RX_CLK	1.8	-	-	ns	Guaranteed by Design Sampling edge w.r.t driving edge of RX_SCLK: 1st edge (0.5 × t <sub>SCLK</sub> ) RX-Master: RX_IF_CTL.LATE_SAMPLE = 0, RX_IF_CTL.LATE_CAPTURE = 0b00 RX-Slave: SCK_POLARITY = 0
SID753	t <sub>SCLK_TRANS</sub>	SCLK transition timing	1	-	8	ns	20% to 80%
SID754	t <sub>MCLK_TRANS</sub>	MCLK transition timing	1	-	8	ns	20% to 80%
SID755	t <sub>DATA_TRANS</sub>	DATA transition timing	1	-	8	ns	20% to 80%

Electrical specifications

**Table 27-31 Sound subsystem specifications (continued)**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
<b>TDM I/O Settings</b>							
Recommended I/O configuration:							
For serial clock up to 25 MHz <b>GPIO_STD:</b> CFG_OUT/DRIVE_SEL<1:0> = 0b01, CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0, CFG_IN/VTRIP_SEL<0:0> = 0b1							
<b>TDM Serial Clock</b>							
SID1000B	t <sub>SCLK</sub>	Serial clock period, TDM[x] (x=0 through 1)	40	-	-	ns	Guaranteed by Design TX Master: TX_IF_CTL.SCK_POLARITY = 0  RX Master: RX_IF_CTL.LATE_SAMPLE = 1 RX_IF_CTL.LATE_CAPTURE = 0b00  TX Slave: Set TX_IF_CTL.SCK_POLARITY = 1  RX Slave: RX_IF_CTL.SCK_POLARITY = 0  TDM can only be used at 2.7 V ≤ V <sub>DD</sub> ≤ 3.6 V
SID1000D	t <sub>SCLK</sub>	Serial clock period, TDM[x] (x=0 through 1)	80	-	-	ns	Guaranteed by Design TX Master: TX_IF_CTL.SCK_POLARITY = 0  RX Master: RX_IF_CTL.LATE_SAMPLE = 1 RX_IF_CTL.LATE_CAPTURE = 0b00  TX Slave: Set TX_IF_CTL.SCK_POLARITY = 1  RX Slave: RX_IF_CTL.SCK_POLARITY = 0  TDM can only be used at 2.7 V ≤ V <sub>DD</sub> ≤ 3.6 V
SID1001	t <sub>HC</sub>	Serial clock high time	0.35 × t <sub>SCLK</sub>	-	-	ns	Guaranteed by design
SID1002	t <sub>LC</sub>	Serial clock low time	0.35 × t <sub>SCLK</sub>	-	-	ns	Guaranteed by design
SID1010A	t <sub>MCLK</sub>	Master clock input period	20	-	-	ns	MCLK must be SCLK*2; The maximum output frequency of the TDM depends on the used I/O type.
SID1002B	t <sub>MCLK</sub>	Master clock output period	40	-	-	ns	
SID1002D	t <sub>MCLK_IH</sub>	Master clock input HIGH time	0.45 × t <sub>MCLK</sub>	-	-	ns	
SID1002E	t <sub>MCLK_IL</sub>	Master clock input LOW time	0.45 × t <sub>MCLK</sub>	-	-	ns	
<b>TDM Transmit Timing</b>							
SID1003	t <sub>DTR</sub>	Delay from rising edge of TX_CLK to transition on TX_SD/TX_FSYNC (WS)	-	-	0.8 × t <sub>SCLK</sub>	ns	Guaranteed by design
SID1004	t <sub>HTR</sub>	Delay from rising edge of TX_CLK to transition on TX_SD/TX_FSYNC (WS)	0	-	-	ns	Guaranteed by design
SID1011	t <sub>HR_WS_POL_0</sub>	TX Slave: Hold on TX_FSYNC (WS) after the 1st edge following the driving edge of TX_CLK (SCK_POLARITY = 0, half-cycle hold)	1.8	-	-	ns	

## Electrical specifications

**Table 27-31 Sound subsystem specifications (continued)**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID1012	t <sub>HR_WS_POL_1</sub>	TX Slave: Hold on TX_FSYNC (WS) after the 2nd edge following the driving edge of TX_CLK (SCK_POLARITY = 1, zero-cycle hold)	1.8	–	–	ns	
<b>TDM Receive Timing</b>							
SID1005	t <sub>SR</sub>	Setup on RX_SD/RX_FSYNC (WS) before the 1st edge following the driving edge of RX_CLK	0.2 × t <sub>SCLK</sub>	–	–	ns	Guaranteed by Design Setup time is independent from RX_IF_CTL.LATE_SAMPLE, RX_IF_CTL.LATE_CAPTURE and SCK_POLARITY setting
SID1006C	t <sub>HR</sub>	Hold on RX_SD/RX_FSYNC (WS) after the 1st edge following the driving edge of RX_CLK	1.8	–	–	ns	Guaranteed by Design Sampling edge w.r.t driving edge of RX_SCLK: 1st edge (0.5 × t <sub>SCLK</sub> ) RX-Master: RX_IF_CTL.LATE_SAMPLE = 0, RX_IF_CTL.LATE_CAPTURE = 0b00 RX-Slave: SCK_POLARITY = 0
SID1006D	t <sub>HR</sub>	Hold on RX_SD/RX_FSYNC (WS) after the 2nd edge following the driving edge of RX_CLK	1.8	–	–	ns	Guaranteed by Design Sampling edge w.r.t driving edge of RX_SCLK: 2nd edge (1 × t <sub>SCLK</sub> ) RX-Master: RX_IF_CTL.LATE_SAMPLE = 1, RX_IF_CTL.LATE_CAPTURE = 0b00 RX-Slave: SCK_POLARITY = 1
SID1006E	t <sub>HR</sub>	Hold on RX_SD/RX_FSYNC (WS) after the 3rd edge following the driving edge of RX_CLK	1.8	–	–	ns	Guaranteed by Design Sampling edge w.r.t driving edge of RX_SCLK: 3rd edge (1.5 × t <sub>SCLK</sub> ) RX-Master: RX_IF_CTL.LATE_SAMPLE = 0, RX_IF_CTL.LATE_CAPTURE = 0b01 RX Slave: Not Applicable
<b>TDM Transition Timing</b>							
SID1007B	t <sub>SCLK_TRANS</sub>	SCLK transition timing	1	–	0.15 × t <sub>SCLK</sub>	ns	Guaranteed by design
SID1008	t <sub>MCLK_TRANS</sub>	MCLK transition timing	–	–	0.15 × t <sub>SCLK</sub>	ns	Guaranteed by design
SID1009B	t <sub>DATA_TRANS</sub>	DATA transition timing	1	–	0.15 × t <sub>SCLK</sub>	ns	Guaranteed by design
<b>(PCM) PWM</b>							
<b>Recommended I/O configuration:</b>							
GPIO_STD: CFG_OUT/DRIVE_SEL<1:0> = 0b01							
GPIO_ENH: CFG_OUT/DRIVE_SEL<1:0> = 0b01							
GPIO_SMC: CFG_OUT/DRIVE_SEL<1:0> = 0b01							
SID1100_2	t <sub>PW_2</sub>	Pulse width on CH1_P, CH1_N, CH2_P, CH2_N for GPIO	20	–	–	ns	PWM clock ≤ 40 MHz, min pulse width nom. 25 ns – 20% max distortion (PCM) PWM can only be used at 2.7 V ≤ V <sub>DD</sub> ≤ 3.6 V Guaranteed by design
SID1101	f <sub>PWM</sub>	PWM sample frequency	15	–	60	kHz	Guaranteed by design
SID1110	t <sub>MCLK</sub>	Master clock input period	10	–	–	ns	Guaranteed by design
SID1111	t <sub>MCLKI_DUTY</sub>	Master clock input duty cycle	40	–	50	%	Guaranteed by design
<b>Sound Generator</b>							
<b>Recommended I/O configuration:</b>							
GPIO_STD: CFG_OUT/DRIVE_SEL<1:0> = 0b01							
GPIO_ENH: CFG_OUT/DRIVE_SEL<1:0> = 0b01							
GPIO_SMC: CFG_OUT/DRIVE_SEL<1:0> = 0b01							
SID1102	f <sub>PWM</sub>	PWM sample frequency	15	–	60	kHz	Guaranteed by design
SID1103	t <sub>MCLK</sub>	Master clock input period	10	–	–	ns	Guaranteed by design
SID1104	t <sub>MCLKI_DUTY</sub>	Master clock input duty cycle	40	–	50	%	Guaranteed by design

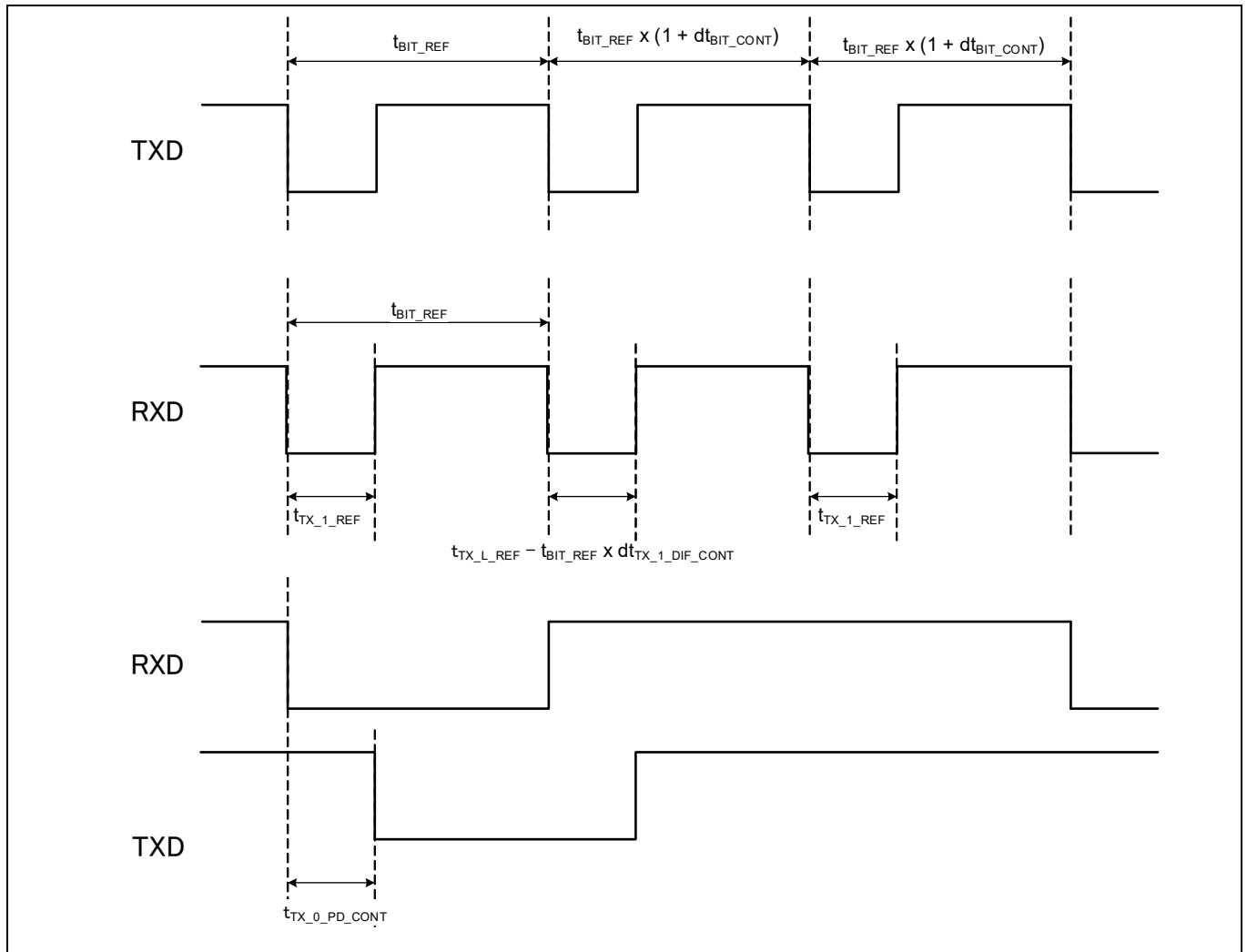
## 27.14 CXPI specifications

**Table 27-32 CXPI specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/ conditions
SID1400	f <sub>CLK_AHB</sub>	CLK_PERI clock frequency	–	–	100	MHz	Guaranteed by design, AHB Interface clock
SID1402	t <sub>BIT_CONT</sub>	Width of clock disparity against the bit width t <sub>BIT_REF</sub> of nominal signaling rate	–0.5	–	+0.5	%	Guaranteed by design
SID1403	t <sub>RX_0_HI_CONT</sub>	The time that should be detected the receiving node is HIGH level.	0.02	–	–	t <sub>BIT</sub>	t <sub>BIT</sub> = 1 / f <sub>BRC</sub> , Guaranteed by design
SID1404	t <sub>TX_DIF_CONT</sub>	Difference of width of LOW-level at the constant threshold that receiving node should discriminate logic '1' and logic '0'	0.05	–	–	t <sub>BIT</sub>	t <sub>BIT</sub> = 1 / f <sub>BRC</sub> , Guaranteed by design t <sub>TX_DIF_CONT</sub> = t <sub>TX_0_LO</sub> – t <sub>TX_1_LO</sub>
SID1405	t <sub>TX_0_P-D_CONT</sub> <sup>[68]</sup>	At the time of logical value '0' outputs, time from the LOW level detection of the communication bus unit falling the voltage "TH_dom".	–	–	0.01	t <sub>BIT</sub>	t <sub>BIT</sub> = 1 / f <sub>BRC</sub> , CTL0.FILTER_EN bit = '0', Guaranteed by design
SID1406	t <sub>TX_0_P-D_CONT</sub> <sup>[68]</sup>	At the time of logical value '0' outputs, time from the LOW-level detection of the communication bus unit falling the voltage "TH_dom".	–	–	0.0125	t <sub>BIT</sub>	t <sub>BIT</sub> = 1 / f <sub>BRC</sub> , CTL0.FILTER_EN bit = '1', Guaranteed by design
SID1407	t <sub>RX_0_FF_CONST</sub>	Delay from external serial data input pin to a flop. This is a standard to satisfy AC.11.	–	–	20	ns	Guaranteed by design
SID1408	t <sub>TX_0_FF_CONST</sub>	Delay from a flop to external serial data output pin. This is a standard to satisfy AC.11.	–	–	80	ns	Guaranteed by design
SID1409	BR	Bit rate	–	–	20	kbps	
SID1411	OS	Oversampling factor	–	–	400		

**Note**

68.The AC spec, according to the CXPI controller specification, is maximum 0.01 t<sub>BIT</sub>. The AC spec, according to the CXPI system specification, including transceiver or driver/receiver is maximum 0.1 t<sub>BIT</sub>.



**Figure 27-27 CXPI specifications**

## 27.15 Serial memory interface specifications

**Table 27-33 xSPI specifications**

Spec ID	Parameter	Description	Min	Max	Units
<b>xSPI (JEDEC JESD251 xSPI200)</b>			<b>xSPI200</b>		
<b>Recommended I/O configuration:</b> <b>xSPI200: HSIO_STDLN:</b> CFG_DRIVE_EXT<1:0>/DRIVE_SEL_EXT<4:0> = 0b00001, CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0, CFG_IN/VTRIP_SEL<0:0> = 0b0, CFG_SLEW_EXT/SLEW<0:0> = 0b0					
SID1500_3	t <sub>CK</sub>	Interface clock period (JEDEC)	10	–	ns
SID1500_3CM	t <sub>CK</sub>	Interface clock period (CMOS)	10	–	ns
SID1501_3	t <sub>CKDCD</sub>	Allowable clock distortion <sup>[69]</sup>	–	0.05×t <sub>CK</sub>	ns
SID1502_3	t <sub>CKMPW</sub>	Minimum clock pulse width (JEDEC)	4.5	–	ns
SID1502_3CM	t <sub>CKMPW</sub>	Minimum clock pulse width (CMOS)	4.5	–	ns
SID1503_3HV	OUT_SR	Output slew rate with respect to V <sub>OH</sub> /V <sub>OL</sub>	1.03	–	V/ns
SID1504_3	t <sub>OSU</sub>	Output setup time of DS and I/O[7:0] to CK	1.1	–	ns
SID1505_3	t <sub>OH</sub>	Output hold time of DS and I/O[7:0] to CK	1.1	–	ns
SID1506_3HV	IN_SR	Input slew rate with respect to V <sub>IH</sub> /V <sub>IL</sub>	1.03	–	V/ns
SID1507_3	t <sub>DSMPW</sub>	Input min pulse width of DS (JEDEC)	4.1	–	ns
SID1507_3CM	t <sub>DSMPW</sub>	Input min pulse width of DS (CMOS)	4.1	–	ns
SID1508_3	t <sub>RQ</sub>	Input DS to I/O[7:0] valid time (JEDEC)	–	0.9	ns
SID1508_3CM	t <sub>RQ</sub>	Input DS to I/O[7:0] valid time (CMOS)	–	0.9	ns
SID1509_3	t <sub>RQH</sub>	Input I/O[7:0] invalid to DS time (JEDEC)	–	0.9	ns
SID1509_3CM	t <sub>RQH</sub>	Input I/O[7:0] invalid to DS time (CMOS)	–	0.9	ns
SID1511_3	t <sub>CKLCSL</sub>	CK LOW to CS LOW	8	–	ns
SID1512_3	t <sub>CSLCKH</sub>	CS LOW to CK HIGH	8	–	ns
SID1513_3	t <sub>CKLCSH</sub>	CK LOW to CS HIGH	8	–	ns
SID1514_3	t <sub>CSHCKH</sub>	CS HIGH to CK HIGH	8	–	ns
SID1515_3	t <sub>DSLCSH</sub>	DS LOW to CS HIGH	8	–	ns
SID1516_3	t <sub>CSHDST</sub>	CS HIGH to DS High-Z	–	10	ns
SID1517_3	t <sub>CSLDSL</sub>	CS LOW to DS LOW	0	–	ns
SID1518_3	t <sub>DSTCSL</sub>	DS High-Z to CS LOW	0	–	ns

**Table 27-34 xSPI (JEDEC JESD251) Delay tap recommended configuration**

Feature	xSPI200	
	Rx	Rx
Delay Tap Selection (DELAY_TAP_SEL/DELAY_TAPS_NR_LOG2<7:0>)	2	6
Delay Line Selection (CTL/DELAY_LINE_SEL<2:0>)	0	0

**Note**

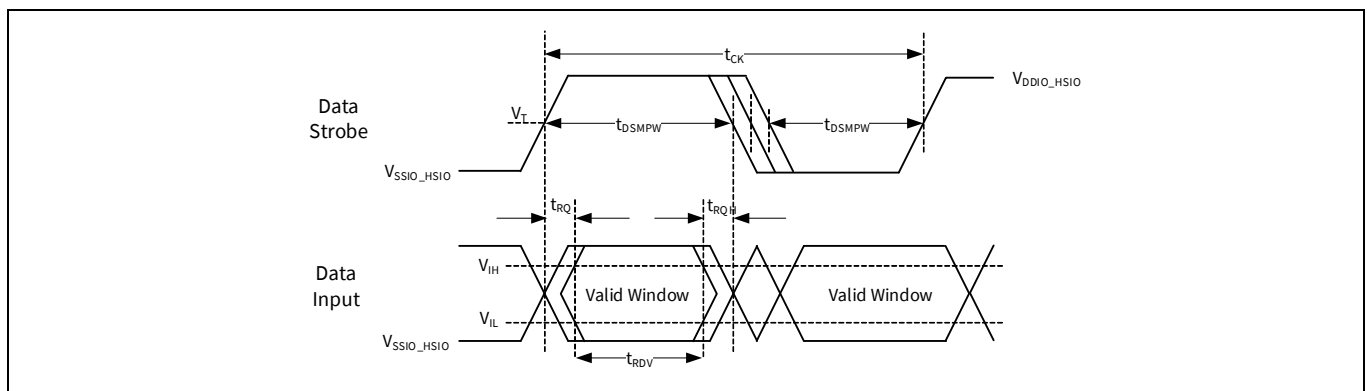
69.PLL#400 with SSCG = 0, fractional divider = off.

**Table 27-35 Input, output supported voltage reference levels**

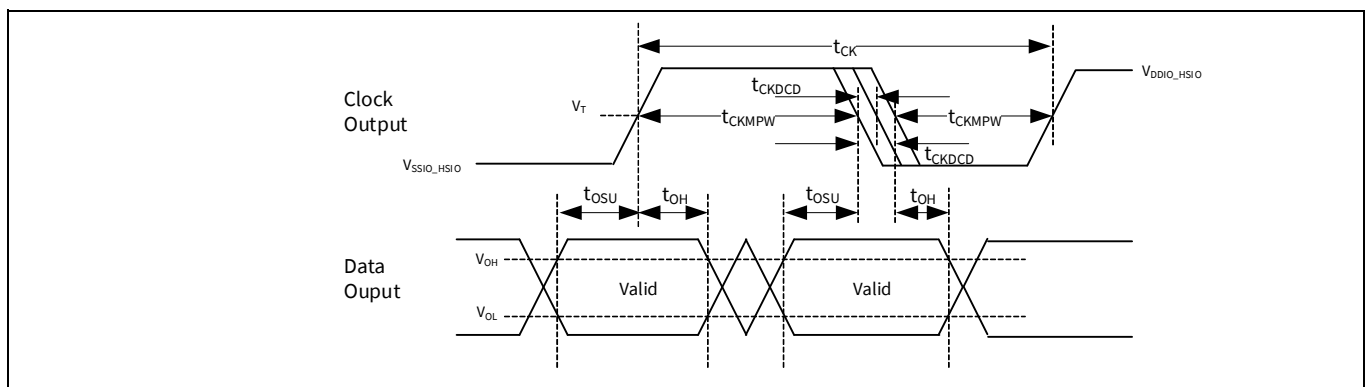
Signal	Supported modes for voltage reference levels	
	CMOS	JEDEC
<i>Clock</i>	$V_T = (50\% \times V_{DDIO\_HSIO})$	
<i>RWDS (output)</i>	$V_T = (50\% \times V_{DDIO\_HSIO})$	$V_{OH}/V_{OL} = 70\% / 30\% \times V_{DDIO\_HSIO}$
<i>DQ[7:0] (output)</i>	$V_T = (50\% \times V_{DDIO\_HSIO})$	$V_{OH}/V_{OL} = 70\% / 30\% \times V_{DDIO\_HSIO}$
<i>RWDS (input)</i>	$V_T = (50\% \times V_{DDIO\_HSIO})$	
<i>DQ[7:0] (input)</i>	$V_T = (50\% \times V_{DDIO\_HSIO})$	$V_{IH}/V_{IL} = 70\% / 30\% \times V_{DDIO\_HSIO}$

**Notes**

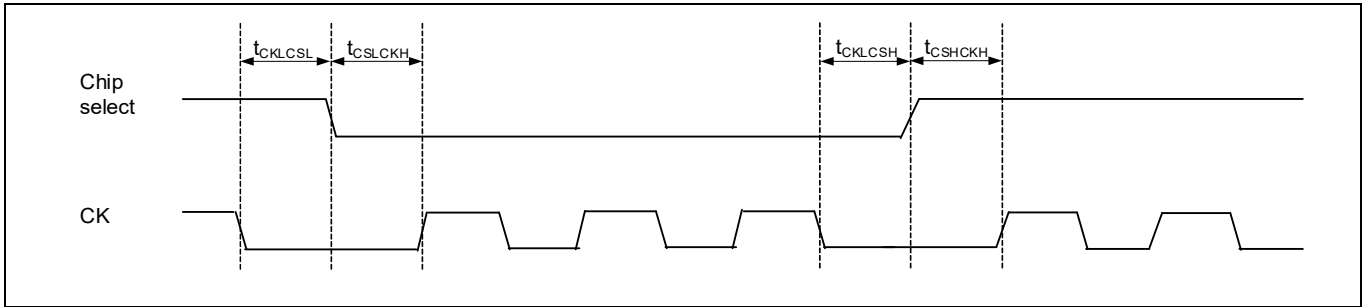
- One of the modes (“CMOS”, “JEDEC”) needs to be selected depending on the requirements of the actual memory.
- Some parameters may be available and listed separately for the individual modes. The corresponding mode will be mentioned in the parameter description.
- Parameters without explicit mode description (e.g.  $t_{OSU}$ ) are applicable for all modes but the voltage reference level as per the table still applies.



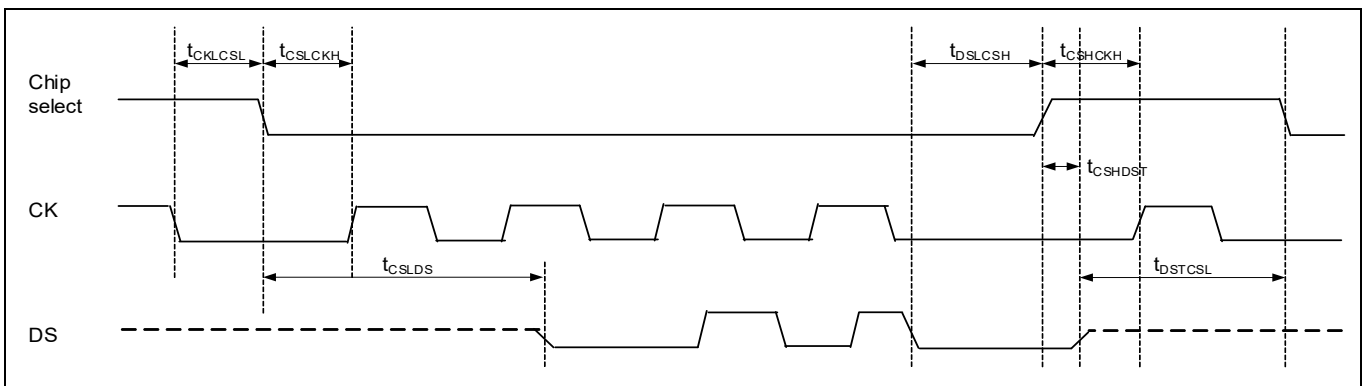
**Figure 27-28 xSPI master data input timing reference level (JEDEC)**



**Figure 27-29 xSPI master data output timing reference level (JEDEC)**



**Figure 27-30 xSPI clock to chip select timing diagram**



**Figure 27-31 xSPI data strobe to chip select timing diagram**



Electrical specifications

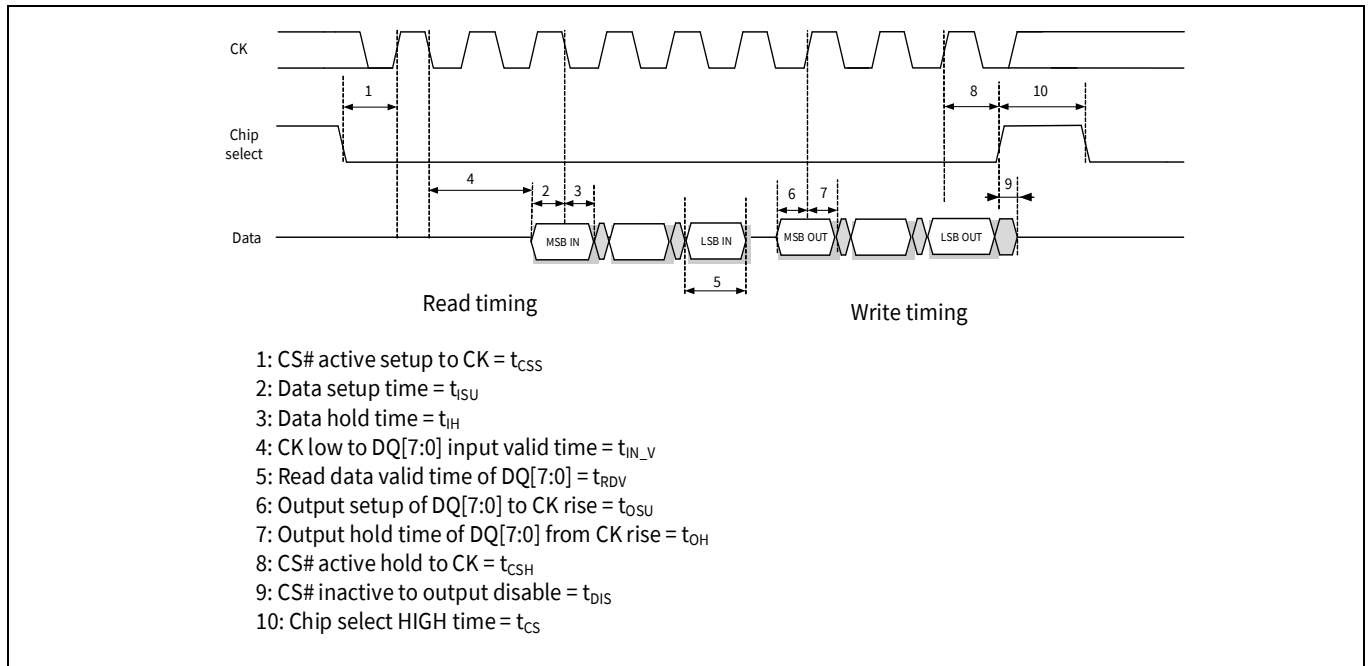
**Table 27-36 Standard SPI specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
<b>Standard SPI SDR</b>							
<b>Recommended I/O configuration:</b> HSIO_STDLN: CFG_DRIVE_EXT<1:0>/DRIVE_SEL_EXT<4:0> = 0b00001, CFG_IN_AUTOLVL/VTRIP_SEL<0:0>= 0b0, CFG_IN/VTRIP_SEL<0:0> = 0b0, CFG_SLEW_EXT/SLEW<2:0> = 0b000 <b>DLL Tap settings for RX:</b> CTL/DELAY_LINE_SEL<2:0> = 0, DELAY_TAP_SEL/DELAY_TAPS_NR_LOG2<7:0> = 2 All timings aligned with respect to VT = (50% × VDDIO_HSI0).							
SID1600_2	t <sub>CK</sub>	Interface clock period	10	–	–	ns	15-pF output loads, 3.3 V
SID1601	t <sub>CKPW</sub>	Clock pulse width	0.45 × t <sub>CK</sub>	–	0.55 × t <sub>CK</sub>	ns	15-pF output loads
SID1602_HS	t <sub>CSS</sub>	CS# active setup to CK (f <sub>CK</sub> > 50 MHz)	4	–	–	ns	15-pF output loads, f <sub>CK</sub> > 50 MHz Guaranteed by design
SID1602_LS	t <sub>CSS</sub>	CS# active setup to CK (f <sub>CK</sub> ≤ 50 MHz)	5	–	–	ns	15-pF output loads, f <sub>CK</sub> ≤ 50 MHz Guaranteed by design
SID1603	t <sub>CSH0</sub>	CS# active hold to CK (mode 0)	4	–	–	ns	15-pF output loads Guaranteed by design
SID1604	t <sub>CSH3</sub>	CS# active hold to CK (mode 3)	6	–	–	ns	15-pF output loads Guaranteed by design
SID1605_2	t <sub>OSU</sub>	Output setup time of DQ[7:0] to CK high (f <sub>CK</sub> = 100 MHz)	2.1	–	–	ns	15-pF output loads  For other frequencies: t <sub>OSU</sub> = t <sub>OSU_min</sub> + 0.45 × (t <sub>CK</sub> - t <sub>CK_min</sub> ) t <sub>OSU_min</sub> = value at MIN of SID1605_2 t <sub>CK_min</sub> = value at MIN of SID1600_2 t <sub>CK</sub> = actual clock period
SID1606_2	t <sub>OH</sub>	Output hold time of DQ[7:0] to CK high (f <sub>CK</sub> = 100 MHz)	2.1	–	–	ns	15-pF output loads  For other frequencies: t <sub>OH</sub> = t <sub>OH_min</sub> + 0.45 × (t <sub>CK</sub> - t <sub>CK_min</sub> ) t <sub>OH_min</sub> = value at MIN of SID1606_2 t <sub>CK_min</sub> = value at MIN of SID1600_2 t <sub>CK</sub> = actual clock period
SID1607	t <sub>IN_V</sub>	CK low to DQ[7:0] input valid time	1	–	6.7	ns	Delay line is enabled
SID1607A	t <sub>ISU</sub>	DQ[7:0] input setup time	1.25	–	–	ns	Delay line is disabled (bypassed)
SID1608	t <sub>IH</sub>	DQ[7:0] input hold time	1.5	–	–	ns	Delay line is disabled (bypassed)
SID1609	t <sub>RDV</sub>	Input data valid time of DQ[7:0]	3.8	–	–	ns	Delay line is enabled
SID1610	t <sub>CS</sub>	CS# HIGH time (Read)	10	–	–	ns	15-pF output loads Guaranteed by design
SID1610A	t <sub>CS</sub>	CS# High time (Read when Reset feature and Quad mode are both enabled and aborted transaction)	20	–	–	ns	15-pF output loads Guaranteed by design
SID1610B	t <sub>CS</sub>	CS# High time (Program / Erase)	50	–	–	ns	15-pF output loads Guaranteed by design
SID1611	t <sub>DIS</sub>	CS# inactive to output disable time	–	–	8	ns	15-pF output loads Guaranteed by design

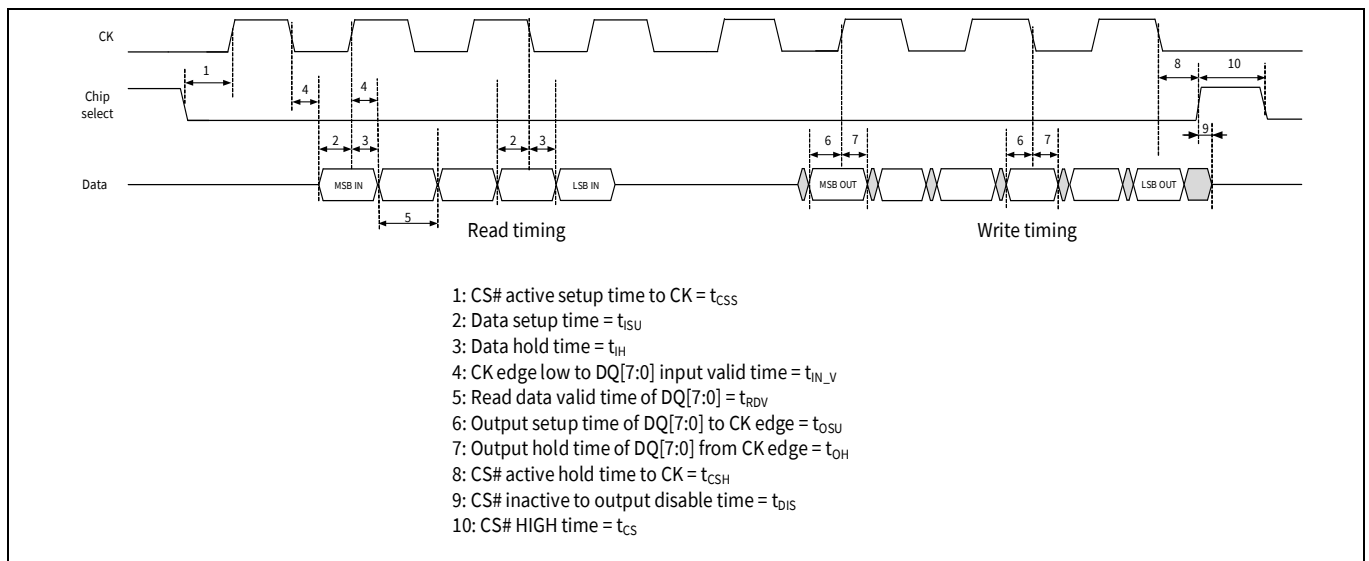
Electrical specifications

**Table 27-36 Standard SPI specifications** (continued)

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
<b>Standard SPI DDR</b>							
<b>Recommended I/O configuration:</b> <b>HSIO_STDLN:</b> CFG_DRIVE_EXT<1:0>/DRIVE_SEL_EXT<4:0> = 0b00001, CFG_IN_AUTOLVL/VTRIP_SEL<0:0> = 0b0, CFG_IN/VTRIP_SEL<0:0> = 0b0, CFG_SLEW_EXT/SLEW<2:0> = 0b000 <b>DLL Tap settings for RX:</b> CTL/DELAY_LINE_SEL<2:0> = 0, DELAY_TAP_SEL/DELAY_TAPS_NR_LOG2<7:0> = 2 All timings aligned with respect to VT = (50% × VDDIO_HSI0).							
SID1700_2	t <sub>CK</sub>	Interface clock period	12.5	–	–	ns	15-pF output loads, 3.3 V
SID1701	t <sub>CKPW</sub>	Clock pulse width	0.45 × t <sub>CK</sub>	–	0.55 × t <sub>CK</sub>	ns	15-pF output loads
SID1702_HS	t <sub>CSS</sub>	CS# active setup to CK (f <sub>CK</sub> > 50 MHz)	4	–	–	ns	15-pF output loads, f <sub>CK</sub> > 50 MHz Guaranteed by design
SID1702_LS	t <sub>CSS</sub>	CS# active setup to CK (f <sub>CK</sub> ≤ 50 MHz)	5	–	–	ns	15-pF output loads, f <sub>CK</sub> ≤ 50 MHz Guaranteed by design
SID1703	t <sub>CSH0</sub>	CS# active hold to CK (mode 0)	4	–	–	ns	15-pF output loads Guaranteed by design
SID1705_2	t <sub>OSU</sub>	Output setup time of DQ[7:0] to CK edge (f <sub>CK</sub> = 80MHz)	2.1	–	–	ns	15-pF output loads  For other frequencies: t <sub>OSU</sub> = t <sub>OSU_min</sub> + 0.225 × (t <sub>CK</sub> – t <sub>CK_min</sub> ) t <sub>OSU_min</sub> = value at MIN of SID1705_2 t <sub>CK_min</sub> = value at MIN of SID1700_2 t <sub>CK</sub> = actual clock period
SID1706_2	t <sub>OH</sub>	Output hold time of DQ[7:0] to CK edge (f <sub>CK</sub> = 80MHz)	1.6	–	–	ns	15-pF output loads  For other frequencies: t <sub>OH</sub> = t <sub>OH_min</sub> + 0.225 × (t <sub>CK</sub> – t <sub>CK_min</sub> ) t <sub>OH_min</sub> = value at MIN of SID1706_2 t <sub>CK_min</sub> = value at MIN of SID1700_2 t <sub>CK</sub> = actual clock period
SID1707	t <sub>IN_V</sub>	CK edge to DQ[7:0] input valid time	1	–	6.7	ns	Delay line is enabled
SID1707A	t <sub>ISU</sub>	DQ[7:0] input setup time	1.25	–	–	ns	Delay line is disabled (bypassed)
SID1708	t <sub>IH</sub>	DQ[7:0] input hold time	1.5	–	–	ns	Delay line is disabled (bypassed)
SID1709_2	t <sub>RDV</sub>	Input data valid time of DQ[7:0] (f <sub>CK</sub> ≤ 80 MHz)	3.5	–	–	ns	Delay line is enabled
SID1710	t <sub>CS</sub>	CS# High time (Read)	10	–	–	ns	15-pF output loads Guaranteed by design
SID1710A	t <sub>CS</sub>	CS# High time (Read when Reset feature and Quad mode are both enabled and aborted transaction)	20	–	–	ns	15-pF output loads Guaranteed by design
SID1710B	t <sub>CS</sub>	CS# High time (Program / Erase)	50	–	–	ns	15-pF output loads Guaranteed by design
SID1711	t <sub>DIS</sub>	CS# inactive to output disable time	–	–	8	ns	15-pF output loads Guaranteed by design



**Figure 27-32 SDR write and read timing diagram**



**Figure 27-33 DDR write and read timing diagram**

## 27.16 LCD controller specifications

**Table 27-37 LCD controller specifications**

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/conditions
SID1243	$f_{LCD\_FR}$	LCD frame rate	10	–	150	Hz	

## 28 Ordering information

The CYT2CL microcontroller part numbers and features are listed in [Table 28-1](#). The Arm® TAP JTAG ID is 0x6BA0 0477.

**Table 28-1** CYT2CL Ordering information<sup>[70]</sup>

Device Code	Ordering code	Package	Code-flash (KB)	Work-flash (KB)	SRAM (KB)	ADC Channels	SCB Channels	LIN Channels	CANFD Channels	CXPI Channels	LCD	SMIF	Mixer	PCM-PWM	TDM	Temperature Grade	JTAG ID CODE
CYT2CL7BAS	CYT2CL7BAAQ0AZSGS	144-LQFP <sup>[76]</sup>	4160 <sup>[71]</sup>	128 <sup>[72]</sup>	512	48	12	2	4	2	32 S x 4 C <sup>[73]</sup>	1x	1x	1x	2x	S <sup>[74]</sup>	0x1EC03069 <sup>[75]</sup>
CYT2CLHBAS	CYT2CLHBAAQ0AZSGS	144-LQFP <sup>[77]</sup>	4160	128	512	48	12	2	4	2	32 S x 4 C	1x	1x	1x	2x	S	0x1EC05069
CYT2CL8BAS	CYT2CL8BAAQ0AZSGS	176-LQFP	4160	128	512	48	12	2	4	2	32 S x 4 C	1x	1x	1x	2x	S	0x1EC01069

### Notes

70. Supported shipment types are “Tray” (default) and “Tape and Reel”. Add the character ‘T’ at the end to get the ordering code for “Tape and Reel” shipment type.

71. Code-flash size 4160 KB = 32 KB × 126 (Large Sectors) + 8 KB × 16 (Small Sectors).

72. Work-flash size 128 KB = 2 KB × 48 (Large Sectors) + 128 B × 256 (Small Sectors).

73. 32 Segments and 4 Commons.

74. S-grade Temperature (–40°C to 105°C).

75. JTAG ID CODE bits 12 through 27, represents the Silicon ID of the device.

76. Package pin pitch is 0.5 mm.

77. Package pin pitch is 0.4 mm.

Ordering information

## 28.1 Part number nomenclature

**Table 28-2 Device code nomenclature**

Field	Description	Value	Meaning
CY	Cypress Prefix	CY	
T	Category	T	TRAVEO™
2	Family	2	TRAVEO™ T2G (Core M4)
B	Application	C	Cluster Entry
D	Code-flash/Work-flash/SRAM quantity	L	4160 KB / 128 KB / 512 KB
P	Packages	8	176-LQFP
		7	144-LQFP (0.5 mm Pitch)
		H	144-LQFP (0.4 mm Pitch)
H	Hardware option	B	Security on (HSM), RSA - 3K
I	Marketing option	A	No options
C	Temperature grade	S	S-grade (-40°C to 105°C)

**Table 28-3 Ordering code nomenclature**

Field	Description	Value	Meaning
CY	Cypress Prefix	CY	
T	Category	T	TRAVEO™
2	Family name	2	TRAVEO™ T2G (Core M4)
B	Application	C	Cluster Entry
D	Code-flash/Work-flash/SRAM quantity	L	4160 KB / 128 KB / 512 KB
P	Packages	8	176-LQFP
		7	144-LQFP (0.5 mm Pitch)
		H	144-LQFP (0.4 mm Pitch)
H	Hardware option	B	Security on (HSM), RSA - 3K
I	Marketing option	A	No options
R	Revision	A	First revision
F	Fab location	Q	UMC (Fab 12i) Singapore
X	Reserved	0	Reserved
K	Package code	AZ	LQFP
C	Temperature grade	S	S-grade (-40°C to 105°C)
Q	Quality grade	ES	Engineering samples
		GS	Standard grade of automotive
S	Shipment type	Blank	Tray shipment
		T	Tape and reel shipment

## 29 Packaging

CYT2CL is offered in the packages listed in the [Table 29-1](#).

**Table 29-1 Package information**

Package	Dimensions <sup>[78]</sup>	Contact/ Lead Pitch	Coefficient of Thermal Expansion <sup>[82]</sup>	I/O pins
176-LQFP	24 × 24 × 1.7 mm (max)	0.5 mm	a1 <sup>[79]</sup> = 8.5 ppm/°C, a2 <sup>[80]</sup> = 33.8 ppm/°C	140
144-LQFP	20 × 20 × 1.7 mm (max)	0.5 mm	a1 <sup>[79]</sup> = 8.5 ppm/°C, a2 <sup>[80]</sup> = 33.7 ppm/°C	108
144-LQFP	16 × 16 × 1.7 mm (max)	0.4 mm	a1 <sup>[79]</sup> = 8.5 ppm/°C, a2 <sup>[80]</sup> = 33.65 ppm/°C	108

**Table 29-2 Package characteristics<sup>[81]</sup>**

Parameter	Description	Conditions	Min	Typ	Max	Units
T <sub>A</sub>	Operating ambient temperature	S-grade	-40	-	105	°C
T <sub>J</sub>	Operating junction temperature	-	-	-	150	°C
R <sub>θJA</sub>	Package thermal resistance, junction to ambient θ <sub>JA</sub> <sup>[78]</sup>	144 LQFP (0.4 mm)	-	-	23.0	°C/Watt
		144 LQFP (0.5 mm)	-	-	23.1	°C/Watt
		176 LQFP	-	-	21.8	°C/Watt
R <sub>θJB</sub>	Package θ <sub>JB</sub>	144 LQFP (0.4 mm)	-	-	15.3	°C/Watt
		144 LQFP (0.5 mm)	-	-	15.0	°C/Watt
		176 LQFP	-	-	14.8	°C/Watt
R <sub>θJC</sub>	Package thermal resistance, junction to case θ <sub>JC</sub>	144 LQFP (0.4 mm)	-	-	5.2	°C/Watt
		144 LQFP (0.5 mm)	-	-	5.3	°C/Watt
		176 LQFP	-	-	4.5	°C/Watt

**Table 29-3 Solder reflow peak temperature, package moisture sensitivity level (MSL), IPC/JEDEC J-STD-2**

Package	Maximum peak temperature (°C)	Maximum time at peak temperature (seconds)	MSL
144 LQFP (0.4 mm)	260	30	3
144 LQFP (0.5 mm)	260	30	3
176 LQFP	260	30	3

### Notes

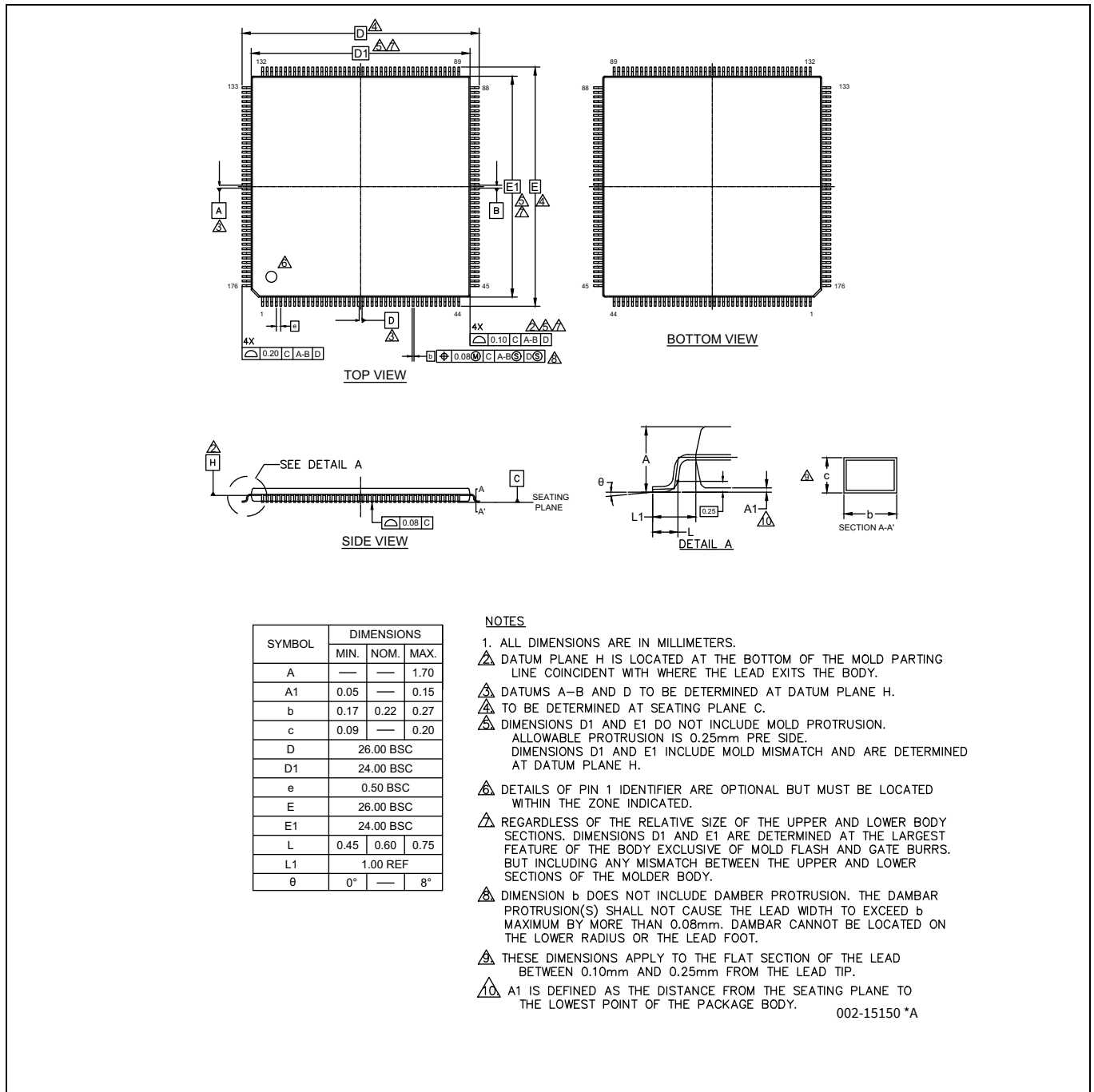
78. The dimensions (column 2) are valid for room temperature.

79. a1 = CTE (Coefficient of Thermal Expansion) value below T<sub>g</sub> (ppm/°C) (T<sub>g</sub> is glass transition temperature which is 131°C).

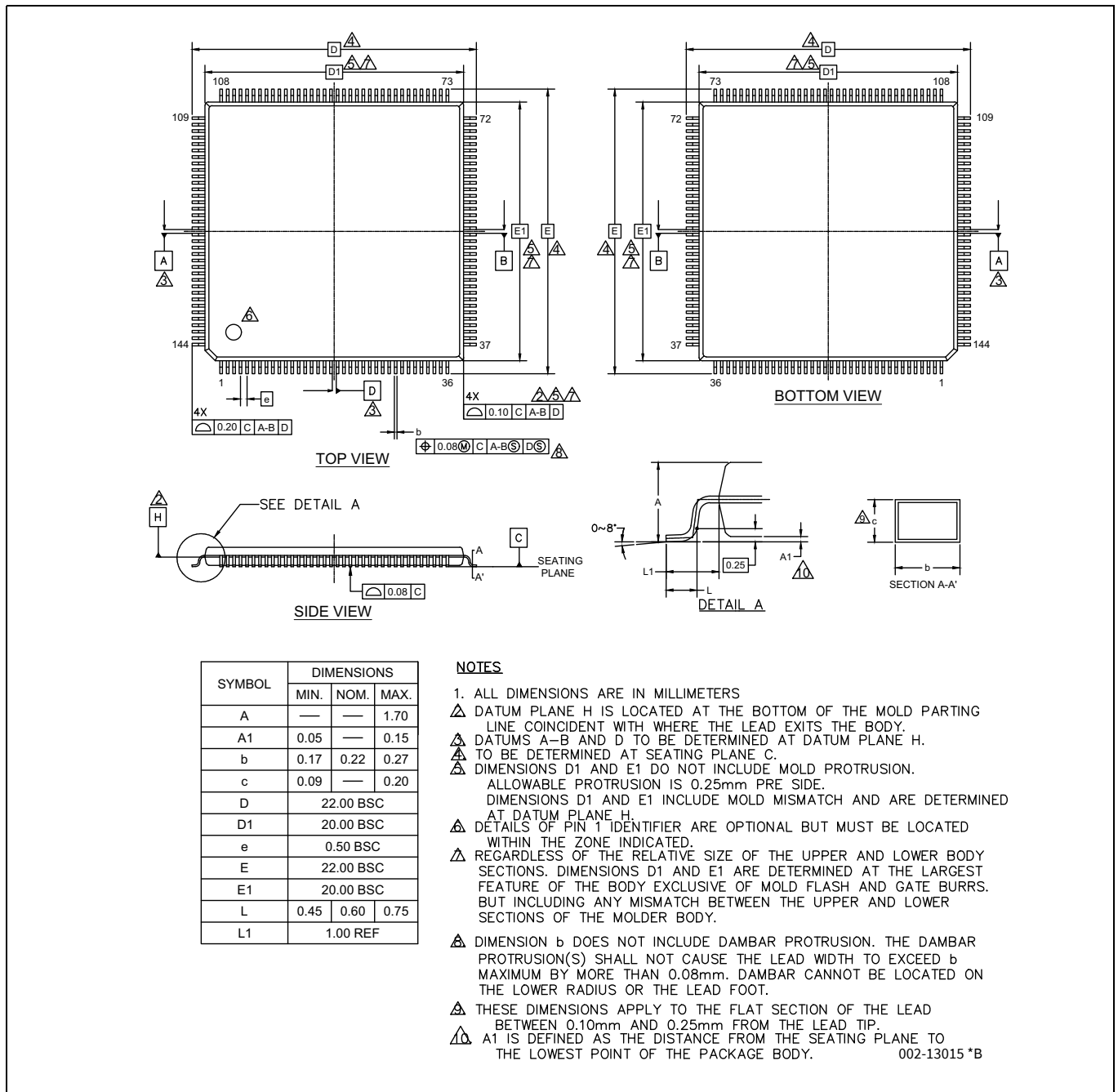
80. a2 = CTE value above T<sub>g</sub> (ppm/°C).

81. Board condition complies to JESD51-7 (4 Layers).

82. The numbers are estimated values based simulation only and are based on a single bill of material combination per package type.



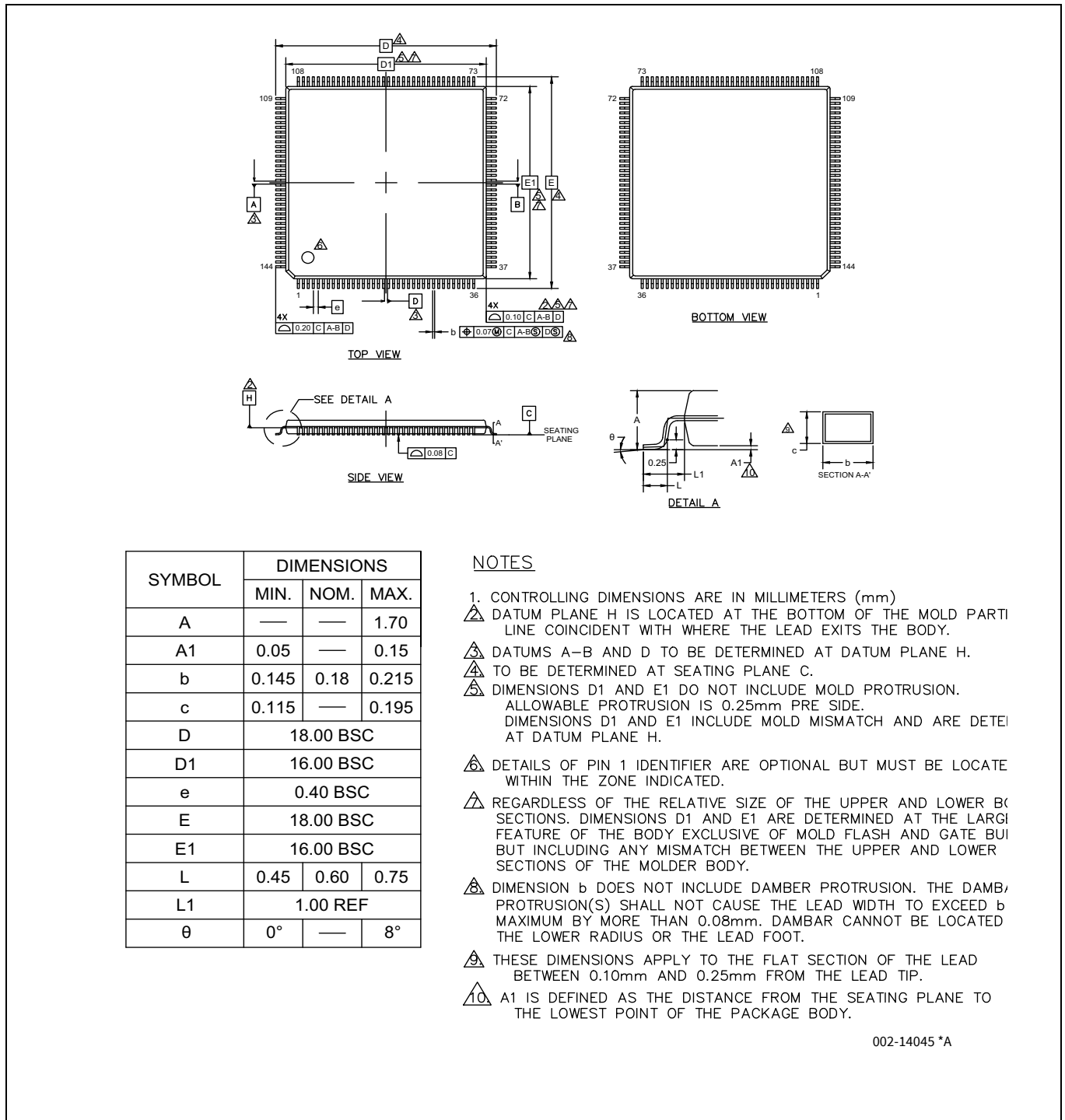
**Figure 29-1 Package outline - 176-LQFP**



**Figure 29-2 Package outline - 144-LQFP (0.5 mm)**



Packaging

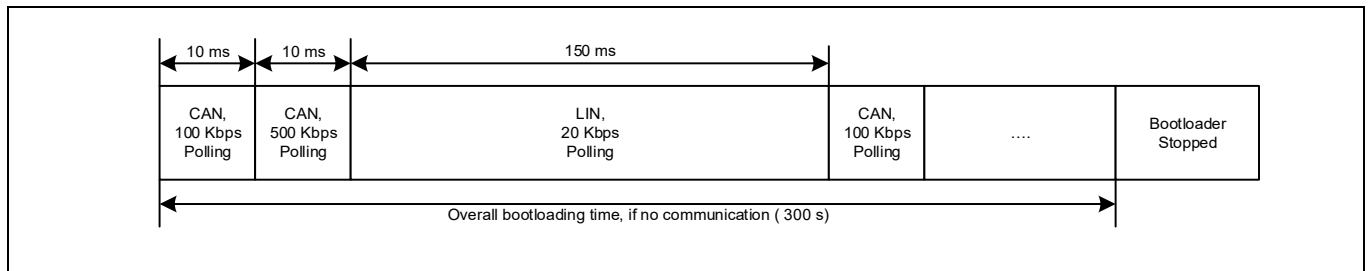


**Figure 29-3 Package outline – 144-LQFP (0.4 mm)**

## 30 Appendix

### 30.1 Bootloading or End-of-line programming

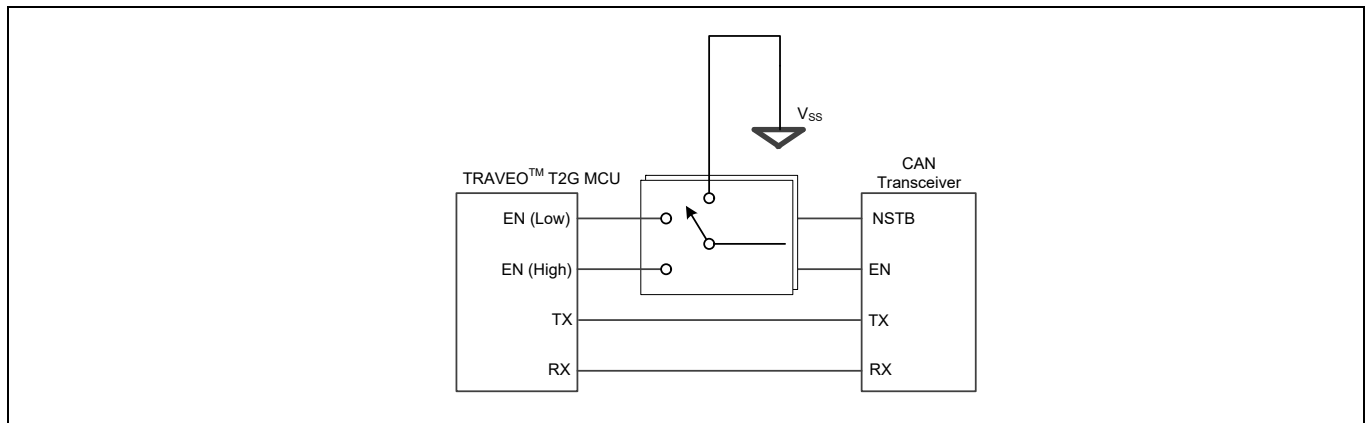
- Triggered at device startup, if a trigger condition is applied
- Either CAN or LIN communication may be used
- Bootloader polls for the communication on CAN or LIN at separate time frames, until the overall 300-second timeout is reached
- If a boot loader command is received on either communication interface, the polling stops and boot loader starts using this interface



**Figure 30-1 Bootloading sequence**

**Table 30-1 CAN interface details**

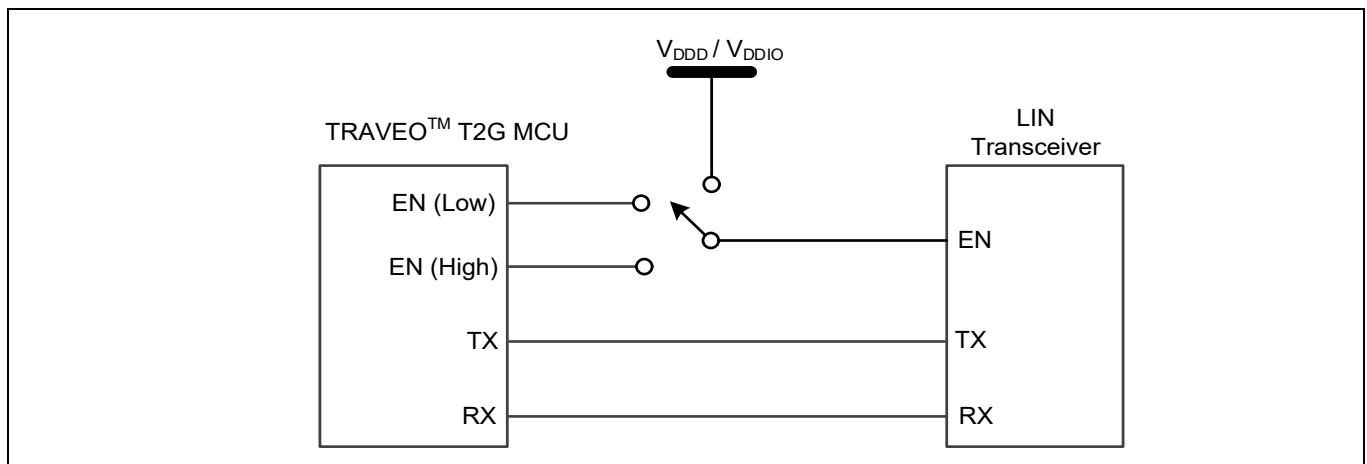
Sl. No.	CAN interface	Configuration
1	CAN Mode	Classic CAN
2	CAN Instance	CAN0, Channel#0
3	CAN TX	P18.2 / CAN0_0_TX
4	CAN RX	P18.3 / CAN0_0_RX
5	CAN Transceiver EN (High)	P19.2
6	CAN Transceiver EN (Low)	P19.3
7	CAN RX Message ID	0x1A1
8	CAN TX Message ID	0x1B1
9	Baud	100 or 500 kbps alternating



**Figure 30-2 MCU to CAN transceiver connections**

**Table 30-2 LIN interface details**

Sl. No.	LIN interface	Configuration
1	LIN type	LIN0, Channel#0
2	LIN mode	Slave
3	LIN checksum type	Classic
4	LIN TX	P19.0 / LIN0_0_TX
5	LIN RX	P19.1 / LIN0_0_RX
6	LIN EN / EN (High)	P19.2
7	LIN EN (Low)	P19.3
8	LIN TX PID	0x46
9	LIN RX PID	0x45
10	Baud	20 or 115.2 kbps
11	Break field length	11
12	Break delimiter length	1 bit



**Figure 30-3 MCU to LIN transceiver connections**

## 30.2 External IP revisions

**Table 30-3 External IP revisions**

Module	IP	Revision	Vendor
CAN FD	mxttcanfd	M_TTCAN IP revision: Rev.3.2.3	Bosch
Arm® Cortex®-M0+	armcm0p	Cortex®-M0+-r0p1	Arm®
Arm® Cortex®-M4	armcm4	Cortex®-M4-r0p1	Arm®
Arm® Coresight	armcoresighttk	CoreSight-SoC-TM100-r3p2	Arm®

## 30.3 Internal IP revisions

**Table 30-4 Internal IP revisions**

Module	Revision
SMIF	SMIF version 3.0 (Variant v3.1)

## 31 Acronyms

**Table 31-1 Acronyms used in the document**

Acronym	Description	Acronym	Description
A/D	Analog to Digital	IRQ	Interrupt request
ABS	Absolute	JTAG	Joint test action group
ADC	Analog to Digital converter	LDO	Low drop out regulators
AES	Advanced encryption standard	LIN	Local Interconnect Network, a communications protocol
AHB	AMBA (advanced microcontroller bus architecture) high-performance bus, Arm® data transfer bus	LVD	Low voltage detection
Arm®	Advanced RISC machine, a CPU architecture	OTA	Over-the-air programming
ASIL	Automotive safety integrity level	OTP	One-time programmable
BOD	Brown-out detection	OVD	Overvoltage detection
CAN FD	Controller Area Network with Flexible Data rate	P-DMA	Peripheral-Direct Memory Access same as DW
CMOS	Complementary metal-oxide-semiconductor	PLL	Phase Locked Loop
CPU	Central Processing Unit	POR	Power-on reset
CRC	Cyclic redundancy check, an error-checking protocol	PPU	Peripheral protection unit
CSV	Clock supervisor	PRNG	Pseudorandom number generator
CTI	Cross trigger interface	PWM	Pulse-width modulation
CXPI	Clock Extension Peripheral Interface	MCU	Microcontroller Unit
DES	Data encryption standard	MCWDT	Multi-counter watchdog timer
DFT	Design-For-Test	M-DMA	Memory-Direct Memory Access
DW	Datawire same as P-DMA	MISO	SPI Master-in slave-out
ECC	Error correcting code/Elliptical curve cryptography	MMIO	Memory mapped I/O
ECO	External crystal oscillator	MOSI	SPI Master-out slave-in
ETM	Embedded Trace Macrocell	MPU	Memory protection unit
EVTGEN	Event Generator	MTB	Micro trace buffer
FLL	Frequency Locked Loop	MUL	Multiplier
FPU	Floating point unit	MUX	Multiplexer
GHS	Green Hills tool chain with Multi IDE	NVIC	Nested vectored interrupt controller
GPIO	General purpose input/output	RAM	Random access memory
HSM	Hardware security module	RISC	Reduced-instruction-set computing
I/O	Input/output	ROM	Read only memory
I <sup>2</sup> C	Inter-Integrated Circuit, a communications protocol	RSA	Rivest-Shamir-Adleman Public Key Encryption Algorithm
ILO	Internal low-speed oscillator	RTC	Real-time clock
IMO	Internal main oscillator	SAR	Successive approximation register

Acronyms

**Table 31-1** Acronyms used in the document *(continued)*

<b>Acronym</b>	<b>Description</b>	<b>Acronym</b>	<b>Description</b>
IOSS	Input/output sub-system	SCB	Serial communication block
IPC	Inter-processor communication	SCL	I <sup>2</sup> C serial clock
IrDA	Infrared interface	SDA	I <sup>2</sup> C serial data
SECCED	Single error correction, double error detection	TCPWM	Timer/Counter Pulse-width modulator
SHA	Secure hash algorithm	TTL	Transistor-transistor logic
SHE	Secure hardware extension	TRNG	True random number generator
SMPU	Shared memory protection unit	UART	Universal Asynchronous Transmitter Receiver
SPI	Serial peripheral interface, a communications protocol	WCO	Watch crystal oscillator
SRAM	Static random access memory	WDT	Watchdog timer reset
SWD	Serial wire debug	XRES_L	External reset I/O pin
SWJ	Serial wire JTAG		

## 32 Errata

This section describes the errata for the CYT2CL product family. Details include errata trigger conditions, scope of impact, available workaround, and silicon revision applicability. Contact your local Infineon Sales Representative if you have questions.

### Part Numbers Affected

Part Number
All CYT2CL parts

### CYT2CL Qualification Status

Production samples

### CYT2CL Errata Summary

The following table defines the errata applicability to available CYT2CL family devices.

Items	Errata ID	CYT2CL	Silicon Rev.	Fix Status
[1.] CAN FD RX FIFO top pointer feature does not function as expected	96	CYT2CL7BAAQ0AZSGS CYT2CLHBAAQ0AZSGS CYT2CL8BAAQ0AZSGS	A	No silicon fix planned. Use workaround.
[2] CAN FD debug message handling state machine not get reset to Idle state when CANFD_CH_CCCR.INIT is set	97			No silicon fix planned. Use workaround.
[3] TPIU peripheral ID mismatch	98			No silicon fix planned.
[4] CAN FD controller message order inversion when transmitting from dedicated Tx Buffers configured with same Message ID	147			No silicon fix planned. Use workaround.
[5] CAN FD incomplete description of Dedicated Tx Buffers and Tx Queue related to transmission from multiple buffers configured with the same Message ID	167			No silicon fix planned. TRM was updated.
[6] Misleading status is returned for Flash and eFuse system calls if there are pending NC ECC faults in SRAM controller #0	175			No silicon fix planned. TRM was updated.
[7] WDT reset causes loss of SRAM retention	176			No silicon fix planned. TRM was updated.
[8] Crypto ECC errors may be set after boot with application authentication	185			No silicon fix planned. TRM was updated.
[9] Incomplete erase of Code Flash cells could happen Erase Suspend / Erase Resume is used along with Erase Sector operation in Non-Blocking mode	198			Will be fixed to update the Flash settings, via Manufacturing Test Program Update for Code Flash setting; this fix is transferred to TRAVEO™ T2G devices during Infineon Factory Test Flow. Fixed devices will be identified by Device Date Code, which is marked on every TRAVEO™ T2G device.
[10] Limitation for keeping the port state from peripheral IP after wakeup from DeepSleep	199			No silicon fix planned. TRM will be updated.

<b>1. CAN FD RX FIFO top pointer feature does not function as expected</b>	
<b>Problem Definition</b>	RX FIFO top pointer function calculates the address for received messages in Message RAM by hardware. This address should be re-start back from the start address after reading all messages of RX FIFO n size (n: 0 or 1). However, the address does not re-start back from the start address when RX FIFO n size is set to 1 (CANFD_CH_RXFnC.FnS = 0x01). This results in CPU/DMA to read messages from the wrong address in Message RAM.
<b>Parameters Affected</b>	N/A
<b>Trigger Condition(s)</b>	RX FIFO top pointer function is used when RX FIFO n size set to 1 element (CANFD_CH_RXFnC.FnS = 0x01).
<b>Scope of Impact</b>	Received message cannot be correctly read by using RX FIFO top pointer function, when RX FIFO n size set to 1 element.
<b>Workaround</b>	Any of the following. 1) Set RX FIFO n size to 2 or more when using RX FIFO top pointer function. 2) Do not use RX FIFO top pointer function when RX FIFO n size set to 1 element. Instead of RX FIFO top pointer, read received messages from the Message RAM directly.
<b>Fix Status</b>	No silicon fix planned. Use workaround.
<b>2. CAN FD debug message handling state machine not get reset to Idle state when CANFD_CH_CCCR.INIT is set</b>	
<b>Problem Definition</b>	If either CANFD_CH_CCCR.INIT bit is set by the Host or when the M_TTCAN module enters Bus-off state, the debug message handling state machine stays in its current state instead of being reset to Idle state. Configuring the bit CANFD_CH_CCCR.CCE does not change CANFD_CH_RXF1S.DMS.
<b>Parameters Affected</b>	N/A
<b>Trigger Condition(s)</b>	Either CANFD_CH_CCCR.INIT bit is set by the Host or when the M_TTCAN module enters Bus-off state.
<b>Scope of Impact</b>	The errata is limited to the use case when the Debug on CAN functionality is active. Normal operation of CAN module is not affected, in which case the debug message handling state machine always remains in Idle state. In the described use case, the debug message handling state machine is stopped and remains in the current state signaled by the bit CANFD_CH_RXF1S.DMS. In case CANFD_CH_RXF1S.DMS is set to 0b11, DMA request remains active.  Bosch classifies this as non-critical error with low severity, there is no fix for the IP. Bosch recommends the workaround listed also here.
<b>Workaround</b>	In case the debug message handling state machine has stopped while CANFD_CH_RXF1S.DMS is 0b01 or 0b10, it can be reset to Idle state by hardware reset or by reception of debug messages after CANFD_CH_CCCR.INIT is reset to zero.
<b>Fix Status</b>	No silicon fix planned. Use workaround.
<b>3. TPIU peripheral ID mismatch</b>	
<b>Problem Definition</b>	TPIU peripheral ID indicates that it is M3-TPIU instead of M4-TPIU.
<b>Parameters Affected</b>	N/A
<b>Trigger Condition(s)</b>	When debugger reads PID registers for component identification.
<b>Scope of Impact</b>	The debuggers read the TPIU as M3-TPIU and no other impact other than this.
<b>Workaround</b>	No specific workaround required. Debuggers can use trace features.
<b>Fix Status</b>	No silicon fix planned.

**4. CAN FD controller message order inversion when transmitting from dedicated Tx Buffers configured with same Message ID**

<p><b>Problem Definition</b></p>	<p>Configuration:                  Several Tx Buffers are configured with same Message ID. Transmission of these Tx Buffers is requested sequentially with a delay between the individual Tx requests.</p> <p>Expected behavior:                  When multiple Tx Buffers that are configured with the same Message ID have pending Tx requests, they shall be transmitted in ascending order of their Tx Buffer numbers. The Tx Buffer with lowest buffer number and pending Tx request is transmitted first.</p> <p>Observed behavior:                  It may happen, depending on the delay between the individual Tx requests, that in the case where multiple Tx Buffers are configured with the same Message ID the Tx Buffers are not transmitted in order of the Tx Buffer number (lowest number first).</p>
<p><b>Parameters Affected</b></p>	<p>N/A</p>
<p><b>Trigger Condition(s)</b></p>	<p>When multiple Tx Buffers that are configured with the same Message ID have pending Tx requests.</p>
<p><b>Scope of Impact</b></p>	<p>In the case described it may happen, that Tx Buffers configured with the same Message ID and pending Tx request are not transmitted with lowest Tx Buffer number first (message order inversion).</p>
<p><b>Workaround</b></p>	<p>Any of the following:</p> <ol style="list-style-type: none"> <li>1) First write the group of Tx message with the same Message ID to the Message RAM and then afterwards request transmission of all these messages concurrently by a single write access to CANFDx_CHy_TXBAR. Before requesting a group of Tx messages with this Message ID ensure that no message with this Message ID has a pending Tx request.</li> <li>2) Use the Tx FIFO instead of dedicated Tx Buffers for the transmission of several messages with the same Message ID in a specific order.</li> </ol> <p>Applications not able to use workaround #1 or #2 can implement a counter within the data section of their messages sent with same ID in order to allow the recipients to determine the correct sending sequence.</p>
<p><b>Fix Status</b></p>	<p>No silicon fix planned. Use workaround.</p>



**5. CAN FD incomplete description of Dedicated Tx Buffers and Tx Queue related to transmission from multiple buffers configured with the same Message ID**

<b>Problem Definition</b>	<p>The following is the updated description in Section 3.5.2 Dedicated Tx Buffers and 3.5.4 Tx Queue of the Architecture TRM related to transmission from multiple buffers configured with the same Message ID.</p> <p><b>3.5.2 Dedicated Tx Buffers</b>          - Wording TRM:          If multiple Tx Buffers are configured with the same Message ID, the Tx Buffer with the lowest buffer number is transmitted first.          - Enhancement:          These Tx buffers shall be requested in ascending order with lowest buffer number first. Alternatively all Tx buffers configured with the same Message ID can be requested simultaneously by a single write access to CANFDx_CHy_TXBAR.</p> <p><b>3.5.4 Tx Queue</b>          - Wording TRM:          If multiple queue buffers are configured with the same Message ID, the queue buffer with the lowest buffer number is transmitted first.          - Replacement:          In case that multiple Tx Queue buffers are configured with the same Message ID, the transmission order depends on numbers of the buffers where the messages were stored for transmission. As these buffer numbers depend on the then current states of the PUT Index, a prediction of the transmission order is not possible.          - Wording TRM:          An Add Request cyclically increments the Put Index to the next free Tx Buffer.          - Replacement:          The PUT Index always points to that free buffer of the Tx Queue with the lowest number.</p>
<b>Parameters Affected</b>	N/A
<b>Trigger Condition(s)</b>	Using multiple dedicated Tx Buffers or Tx Queue Buffers configured with the same Message ID.
<b>Scope of Impact</b>	In the case the dedicated Tx Buffers with the same Message ID are not requested in ascending order or at the same time or in case of multiple Tx Queue Buffers with the same Message ID, it cannot be guaranteed, that these messages are transmitted in ascending order with lowest buffer number first.
<b>Workaround</b>	In case a defined order of transmission is required the Tx FIFO shall be used for transmission of messages with the same Message ID. Alternatively dedicated Tx Buffers with the same Message ID shall be requested in ascending order with lowest buffer number first or by a single write access to CANFDx_CHy_TXBAR. Alternatively a single Tx Buffer can be used to transmit those messages one after the other.
<b>Fix Status</b>	No silicon fix planned. Use workaround. TRM will be updated accordingly.

**6. Misleading status is returned for Flash and eFuse system calls if there are pending NC ECC faults in SRAM controller #0**

<b>Problem Definition</b>	Flash and eFuse system calls will return misleading status of 0xf0000005 (“Page is write protected”) even for non-protected row or 0xf0000002 (“Invalid eFuse address”) for valid eFuse address in case of pending NC ECC faults in SRAM controller #0.
<b>Parameters Affected</b>	Return status of Flash and eFuse system calls
<b>Trigger Condition(s)</b>	NC ECC fault(s) pending in SRAM controller #0 and SWPUs are populated in the design.
<b>Scope of Impact</b>	Flash and eFuse system calls will not work until the NC ECC fault(s) pending in SRAM controller #0 is properly handled.
<b>Workaround</b>	If the NC ECC fault(s) are not due to HW malfunction (i.e., if the faults are due to usage of non-initialized SRAM or improper SRAM initialization), then clearing of these pending faults will resolve the issue.
<b>Fix Status</b>	No silicon fix planned. TRM will be updated.

**7. WDT reset causes loss of SRAM retention**

<b>Problem Definition</b>	Architecture TRM Table 19-1 shows WDT reset can retain SRAM if there is an orderly shutdown of the SRAM only during a warning interrupt. However, this is wrong. WDT reset causes loss of SRAM retention.
<b>Parameters Affected</b>	N/A
<b>Trigger Condition(s)</b>	WDT reset
<b>Scope of Impact</b>	WDT reset causes loss of SRAM retention.
<b>Workaround</b>	None
<b>Fix Status</b>	No silicon fix planned. TRM will be updated.

**8. Crypto ECC errors may be set after boot with application authentication**

<b>Problem Definition</b>	Due to the improper initialization of the Crypto memory buffer, Crypto ECC errors may be set after boot with application authentication.
<b>Parameters Affected</b>	N/A
<b>Trigger Condition(s)</b>	Boot device with application authentication.
<b>Scope of Impact</b>	Crypto ECC errors may be set after boot with application authentication.
<b>Workaround</b>	Clear or ignore Crypto ECC errors which generated during boot with application authentication.
<b>Fix Status</b>	No silicon fix planned. TRM will be updated.

**9. Incomplete erase of Code Flash cells could happen Erase Suspend / Erase Resume is used along with Erase Sector operation in Non-Blocking mode**

<b>Problem Definition</b>	Code Flash memory can be erased in “Non-Blocking” mode; a Non-Blocking mode supported option allows users to suspend an ongoing erase sector operation. When an ongoing erase operation is interrupted using “Erase Suspend” and “Erase Resume”, Flash cells may not have been erased completely, even after the erase operation complete is indicated by FLASHC_STATUS register. Only Code Flash is impacted by this issue, Work Flash and Supervisory Flash (SFlash) are not impacted.
<b>Parameters Affected</b>	N/A
<b>Trigger Condition(s)</b>	Using EraseSector System Call in Non-Blocking mode for CM0+ to erase Code Flash and the ongoing erase operation is interrupted using EraseSuspend and EraseResume System calls.

<b>Scope of Impact</b>	When Code Flash sectors are erased in Non-Blocking mode and the ongoing erase operation is interrupted by Erase Suspend / Erase Resume, it cannot be guaranteed that the Code Flash cells are fully erased. Any read on the Code Flash area after the erase is complete or read on the programmed data after ProgramRow is complete can trigger ECC errors.
<b>Workaround</b>	Use any of the following: 1) Use Non-Blocking mode for EraseSector, but do not interrupt the erase operation using Erase Suspend / Erase Resume. 2) If a Code Flash sector erase operation is interrupted using Erase Suspend / Erase Resume, then erase the same sector again without Erase Suspend / Erase Resume before reading the sector or programming the sector.
<b>Fix Status</b>	Will be fixed to update the Flash settings, via Manufacturing Test Program Update for Code Flash setting; this fix is transferred to TRAVEO™ T2G devices during Infineon Factory Test Flow. Fixed devices will be identified by Device Date Code, which is marked on every TRAVEO™ T2G device.

<b>10.Limitation for keeping the port state from peripheral IP after wakeup from DeepSleep</b>	
<b>Problem Definition</b>	The port state is not retained when the port selects peripheral IP (except for LIN or CAN FD) and MCU wakes up from DeepSleep.
<b>Parameters Affected</b>	N/A
<b>Trigger Condition(s)</b>	The port selects peripherals (except for LIN or CAN-FD) and MCU wakes up from DeepSleep.
<b>Scope of Impact</b>	Unexpected port output change might affect user system.
<b>Workaround</b>	If the port selects peripherals (except for LIN or CAN FD), and the port output value needs to be maintained after wakeup from DeepSleep, set HSIOM_PRTx_PORT_SEL.IOy_SEL = 0 (GPIO) before DeepSleep and set the required output value in GPIO configuration registers. After wakeup, change HSIOM_PRTx-PORT_SEL.IOy_SEL back to the peripheral module as needed.
<b>Fix Status</b>	No silicon fix planned. TRM will be updated to add above workaround.

## Revision history

Document version	Date of release	Description of changes
**	2021-03-11	New datasheet
*A	2021-05-13	Correction in the package dimensions for 144-LQFP (0.4 mm) Updated <b>Features list</b> . Corrected <b>Power modes</b> description. Updated <b>Table 3-3</b> . Added Trigger MUX diagrams and subsequent tables in <b>Trigger multiplexer</b> . Added Peripheral Protection Unit Fixed Structure Pairs Table in <b>Peripheral protection unit fixed structure pairs</b> . Updated <b>Electrical specifications</b> . Updated SCB/SPI Diagrams. Added “AC Specifications”. Added <b>Table 27-20</b> . Updated <b>Table 29-1</b> and <b>Figure 29-3</b> Added <b>Table 30-4</b> .
*B	2021-09-17	Renamed Traveo™ II to TRAVEO™ T2G. Updated <b>Features list</b> . Added <b>Peripheral instance list</b> . Updated <b>Pin assignment</b> diagrams. Updated <b>Package pin list and alternate functions</b> . Updated <b>Alternate function pin assignments</b> . Updated <b>Pin function description</b> . Updated <b>Electrical specifications</b> . Updated <b>Packaging</b> . Updated <b>Package outline – 176-LQFP, Package outline – 144-LQFP (0.5 mm), and Package outline – 144-LQFP (0.4 mm)</b> Updated <b>CAN interface details, LIN interface details</b>
*C	2022-07-15	Migrated to IFX template. Updated <b>Features</b> . Updated <b>CPU subsystem, System resources, Peripherals, I/Os</b> . Updated <b>CYT2CL address map</b> . Updated <b>Alternate function pin assignments</b> . Updated <b>Interrupts and wake-up assignments</b> . Updated <b>Faults</b> . Updated <b>Electrical specifications</b> . Updated <b>Ordering information</b> . Updated <b>Errata</b> .
*D	2022-09-15	Changed datasheet status to Final. Updated <b>Electrical specifications</b> .
*E	2022-10-07	Added note 84. Updated <b>Errata</b> .
*F	2022-10-20	Updated <b>Ordering information</b> .

## Revision history change log

### Rev. \*F Section updates

Section	Change description	Current spec (Rev. *E)	New spec (Rev. *F)	Reason for change
Note 2 on page 1	Not needed and removed, referred under "Crypto engine"	This feature is not available in "eSHE only" parts. For more information, see Ordering information.	(None)	Not needed
Table 28-2/28-3	Packages meaning updated	Hardware option meaning: Security on (HSM), RSA - 2K	Hardware option meaning: Security on (HSM), RSA - 3K	Enhancement
Note 72 on page 156	Not needed and removed, referred under "Table 28-1"	This part is available as an engineering sample.	(None)	Not needed

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**Document reference**  
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