

Si53258/Si53254 Data Sheet

8/4-Output PCIe Gen1/2/3/4/5 Clock Buffer

The Si53258/54 are the industry's highest performance and lowest power automotive grade PCI Express fanout buffers for PCIe Gen1/2/3/4/5 common clock and/or SRIS applications. The Si53258 and Si53254 source eight and four 100 MHz PCIe differential clock outputs, respectively. All clock outputs are compliant to PCIe Gen1/2/3/4/5 common clock and separate reference clock architecture specifications.

Hardware control pins are available for enabling and disabling the outputs, as well as input selection for devices that include dual-input functionality.

For more information about PCI Express, Silicon Labs' complete PCIe portfolio, application notes, and design tools, including the Silicon Labs PCIe Clock Jitter Tool for PCI Express compliance, please visit the Silicon Labs PCI Express Learning Center.

Applications:

- Infotainment
- ADAS ECU
- Radar Sensors
- LiDar Sensors

KEY FEATURES

- 8/4-outputs with internal termination
- PCIe Gen 1/2/3/4/5 compliant
- Automotive grade 2: -40 to +105 °C
- Internal 100 Ω or 85 Ω line matching
- Excellent additive jitter performance
 - 0.05 ps RMS (Gen3/4)
 - 0.025 ps RMS (Gen5)
- Spread spectrum tolerant to pass through a spread input clock for EMI reduction
- Individual hardware control pins for Output Enable
- Optional dual input capability with MUX
- 1.8–3.3 V power supply
- Pb-free, RoHS-6 compliant

1. Features List

- 8/4-HCSL outputs with internal termination
- PCIe Gen1/2/3/4/5 compliant
- Automotive grade 2: -40 to +105 °C
- Internal 100 Ω or 85 Ω line matching
- Excellent additive jitter performance
 - 0.05 ps RMS (Gen3/4)
 - 0.025 ps RMS (Gen5)
- Spread spectrum tolerant to pass through a spread input clock for EMI reduction
- Loss of Signal (LOS) output pin
- Individual hardware control pins for Output Enable
- Optional dual input capability with MUX
- 1.8–3.3 V power supply
- Pb-free, RoHS-6 compliant

2. Ordering Guide

| Number of Outputs | Number of Inputs | Part Number | Package Type | Temperature |
|-------------------|------------------|-----------------|-----------------------|---------------------------|
| 8 | 1 | Si53258A-D01AM | 40-QFN | Automotive, -40 to 105 °C |
| | | Si53258A-D01AMR | 40-QFN, Tape and Reel | |
| | 2 | Si53258A-D02AM | 40-QFN | |
| | | Si53258A-D02AMR | 40-QFN, Tape and Reel | |
| 4 | 1 | Si53254A-D01AM | 32-QFN | |
| | | Si53254A-D01AMR | 32-QFN, Tape and Reel | |
| | 2 | Si53254A-D02AM | 40-QFN | |
| | | Si53254A-D02AMR | 40-QFN, Tape and Reel | |

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3. Functional Description

3.1 Functional Block Diagrams

3.1.1 Si53258A-D01AM Functional Block Diagram

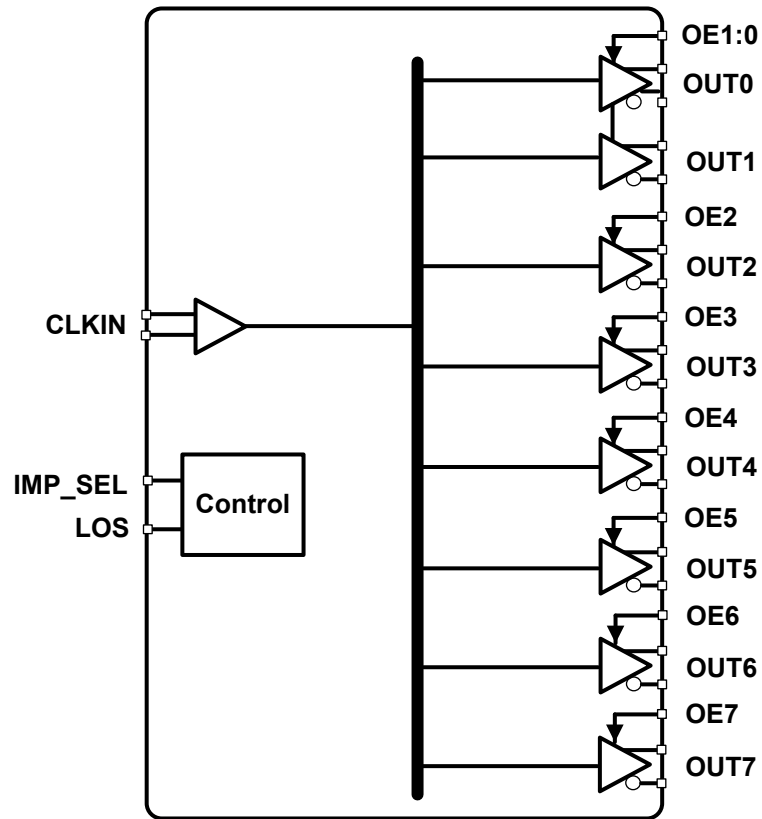


Figure 3.1. Si53258A-D01AM Functional Block Diagram

3.1.2 Si53254A-D01AM Functional Block Diagram

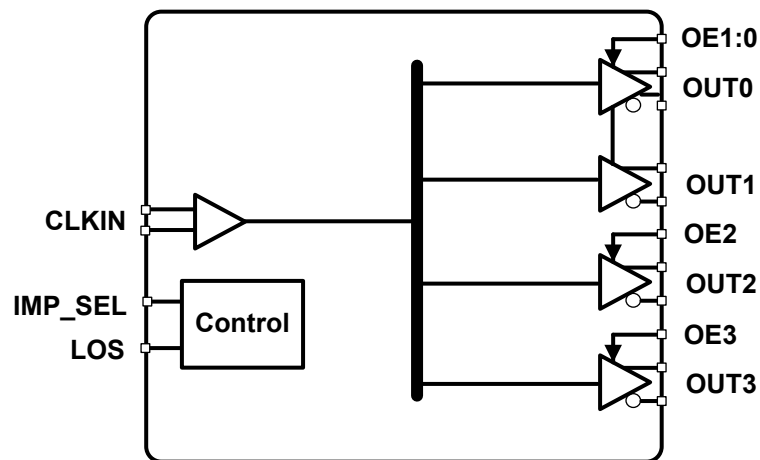


Figure 3.2. Si53254A-D01AM Functional Block Diagram

3.1.3 Si53258A-D02AM Functional Block Diagram

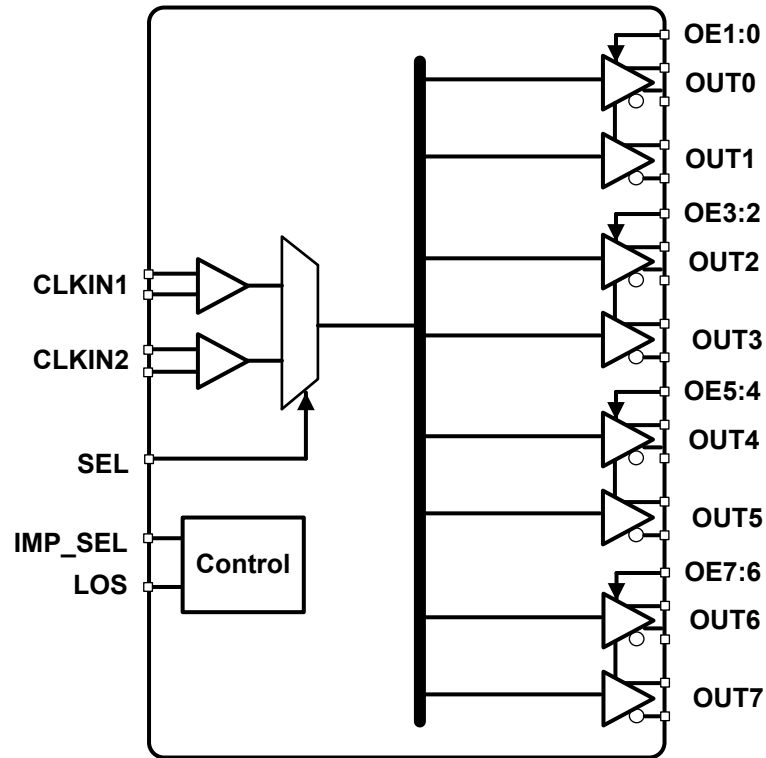


Figure 3.3. Si53258A-D02AM Functional Block Diagram

3.1.4 Si53254A-D02AM Functional Block Diagram

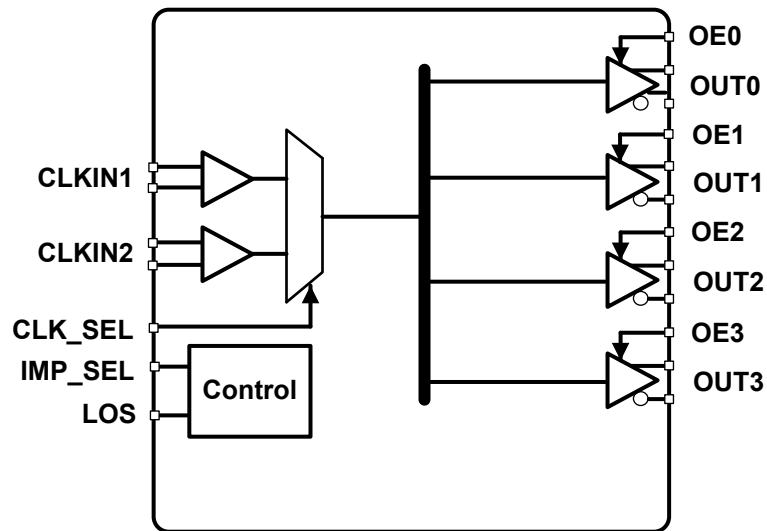


Figure 3.4. Si53254A-D02AM Functional Block Diagram

3.2 HCSL Differential Output Terminations

Termination for HCSL Outputs

The Si52254/8 HCSL driver features integrated termination resistors to simplify interfacing to an HCSL receiver. The HCSL driver supports both 100 Ω and 85 Ω transmission line options, and can be selected using the IMP_SEL hardware input pin.

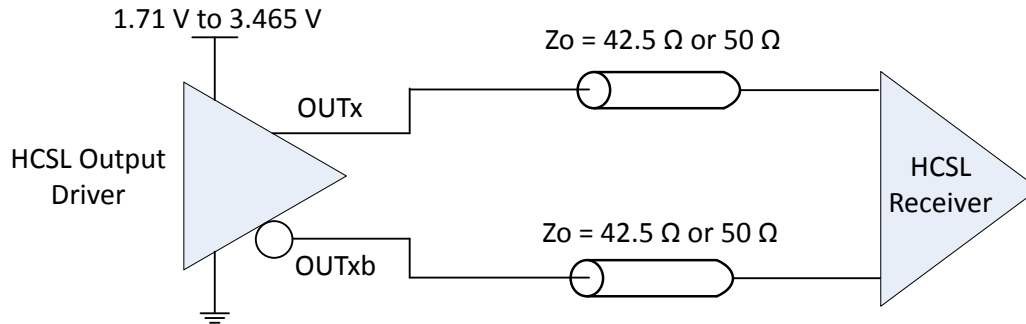


Figure 3.5. HCSL Internal Termination Mode

3.3 Output Enable/Disable

An output enable pin provides a convenient method of disabling or enabling the output drivers. When the output enable pin is held high, all designated outputs will be disabled. When held low, the designated outputs will be enabled.

3.4 Loss of Signal (LOS)

The LOS indicator is used to check for the presence of an input reference source (crystal or clock). LOS will assert when the reference source frequency drops below approximately 10 MHz.

The LOS pin must be checked prior to selecting the clock input or should be polled to check for the presence of the currently selected input clock. In the event that a reference source is not present, the associated LOS pin will assume a logic low (LOS = 0) state. When a reference source is present at the associated input clock pin, the LOS pin will assume a logic high (LOS = 1) state.

4. Power Supply Filtering Recommendations

The Si53258/4 features internal LDOs on each power supply pin, providing excellent power supply noise rejection. As a guideline, each power supply pin should use a parallel combination of a 1 μ f and a 0.1 μ F bypass capacitor placed as close to the supply pin as possible.

5. Electrical Specifications

Table 5.1. Recommended Operating Conditions
 $(V_{DD} = V_{DDA} = V_{DD_DIG} = 1.8\text{ V to }3.3\text{ V }+5\%/ -5\%, V_{DDO} = 1.8\text{ V } \pm 5\%, 2.5\text{ V } \pm 5\%, \text{ or } 3.3\text{ V } \pm 5\%, T_A = -40\text{ to }105\text{ }^\circ\text{C})$

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units |
|------------------------------|--------------------------------|----------------|-------------------|-----|------|------------------|
| Ambient Temperature | T_A | | -40 | 25 | 105 | $^\circ\text{C}$ |
| Junction Temperature | T_{JMAX} | | — | — | 125 | $^\circ\text{C}$ |
| Core Supply Voltage | $V_{DDA}, V_{DD_DIG}, V_{DD}$ | | 1.71 | — | 3.46 | V |
| Output Driver Supply Voltage | V_{DDO} | | 1.42 ² | — | 3.46 | V |

Note:

- All minimum and maximum specifications are guaranteed and apply across the recommended operating conditions. Typical values apply at nominal supply voltages and an operating temperature of 25 $^\circ\text{C}$ unless otherwise noted.
- LVC MOS outputs only.

Table 5.2. DC Characteristics
 $(V_{DD} = V_{DDA} = V_{DD_DIG} = 1.8\text{ V to }3.3\text{ V }+5\%/ -5\%, V_{DDO} = 1.8\text{ V } \pm 5\%, 2.5\text{ V } \pm 5\%, \text{ or } 3.3\text{ V } \pm 5\%, T_A = -40\text{ to }105\text{ }^\circ\text{C})$

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units |
|------------------------------|------------|------------------------------------|-----|-----|-----|-------|
| Core Supply Current | I_{DD} | | — | 11 | 18 | mA |
| Output Buffer Supply Current | I_{DDOx} | HCSL Output ¹ @ 100 MHz | — | 20 | 22 | mA |
| Total Power Dissipation | P_d | 40-pin | | 530 | 670 | mW |
| | | 32-pin | — | 145 | 215 | mW |

Notes:

- Differential outputs terminated into a 100 Ω load at 3.3 V.

Table 5.3. Clock Input Specifications
 $(V_{DD} = V_{DDA} = V_{DD_DIG} = 1.8\text{ V to }3.3\text{ V }+5\%/ -5\%, V_{DDO} = 1.8\text{ V } \pm 5\%, 2.5\text{ V } \pm 5\%, \text{ or } 3.3\text{ V } \pm 5\%, T_A = -40\text{ to }105\text{ }^\circ\text{C})$

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units |
|--|-----------------------------|----------------|------|-----|-----|----------------|
| Input Clock (AC-coupled Differential Input Clock on CLKIN_2/CLKIN_2# or CLKIN_3/CLKIN_3#) | | | | | | |
| Frequency | F_{IN} | Differential | — | 100 | — | MHz |
| Voltage Swing | V_{PP_DIFF} ³ | | 0.5 | — | 1.8 | V_{PP_diff} |
| Slew Rate | SR/SF | 20-80% | 0.75 | — | — | V/ns |
| Duty Cycle | DC | | 40 | — | 60 | % |
| Input Impedance | R_{IN} | | 10 | — | — | k Ω |
| Input Capacitance | C_{IN} | | 2 | 3.5 | 6 | pF |

Notes:

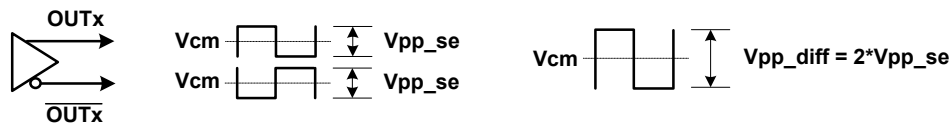
- Imposed for jitter performance.
- Rise and fall times can be estimated using the following simplified equation: $tr/tf_{80-20} = ((0.8 - 0.2) * V_{IN_Vpp_se}) / SR$.
- $V_{PP_DIFF} = 2 * V_{PP_SINGLE-ENDED}$

Table 5.4. Differential Clock Output Specifications(V_{DD} = V_{DDA} = V_{DD_DIG} = 1.8 V to 3.3 V +5%/-5%, V_{DDO} = 1.8 V ±5%, 2.5 V ±5%, or 3.3 V ±5%, T_A = -40 to 105 °C)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units |
|-------------------------------------|--------------------------------|----------------------------|------------------------|-----|------------------------|-----------------|
| Output Frequency | f _{OUT} | | | 100 | | MHz |
| Duty Cycle | DC | With 50% duty cycle input. | 48 | — | 52 | % |
| Output-Output Skew | T _{SK} | | — | — | 80 | ps |
| Output Voltage Swing | V _{SEPP} | HCSL | 0.7 | 0.8 | 0.9 | V _{PP} |
| Common Mode Voltage | V _{CM} | HCSL | 0.35 | 0.4 | 0.45 | V |
| HCSL Edge Rate | Edgr | Notes 1, 2, 3 | 1 | — | 4.5 | V/ns |
| HCSL Delta Tr | D _{tr} | Notes 2, 4, 5 | — | — | 155 | ps |
| HCSL Delta Tf | D _{tf} | Notes 2, 4, 5 | — | — | 155 | ps |
| HCSL Vcross Abs | V _{xa} | Notes 6, 7, 2, 4 | 250 | — | 550 | mV |
| HCSL Delta Vcross | D _{vcrs} | Notes 2, 4, 8 | — | — | 140 | mV |
| HCSL Vovs | V _{ovs} | Notes 2, 4, 9 | — | — | V _{HIGH} +300 | mV |
| HCSL Vuds | V _{uds} | Notes 2, 4, 10 | — | — | V _{LOW} -300 | mV |
| HCSL Vrng | V _{rng} | Notes 2, 4 | V _{HIGH} -200 | — | V _{LOW} +200 | mV |
| Rise and Fall Times (20% to 80%) | t _R /t _F | HCSL | — | — | 420 | ps |

Notes:

1. Measure taken from differential waveform on a component test board. The edge (slew) rate is measured from -150 mV to +150 mV on the differential waveform. Scope is set to average because the scope sample clock is making most of the dynamic wiggles along the clock edge Only valid for Rising clock and Falling Clock#. Signal must be monotonic through the Vol to Voh region for Trise and Tfall.
2. Applies to a 2 pf load with both internal or external 50 Ω or 42.5 Ω Rp.
3. Measurement taken from differential waveform.
4. Measurement taken from Single Ended waveform.
5. Measured with oscilloscope, averaging off, using min max statistics. Variation is the delta between min and max.



6. Measured at crossing point where the instantaneous voltage value of the rising edge of CLK equals the falling edge of CLK#.
7. This measurement refers to the total variation from the lowest crossing point to the highest, regardless of which edge is crossing.
8. ΔVcross is defined as the total variation of all crossing voltages of Rising CLOCK and Falling CLOCK#. This is the maximum allowed variance in Vcross for any particular system.
9. Overshoot is defined as the absolute value of the maximum voltage.
10. Undershoot is defined as the absolute value of the minimum voltage.

Table 5.5. Performance Characteristics(V_{DD} = V_{DDA} = V_{DD_DIG} = 1.8 V to 3.3 V +5%/-5%, V_{DDO} = 1.8 V ±5%, 2.5 V ±5%, or 3.3 V ±5%, T_A = -40 to 105 °C)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units |
|-----------------------------------|---------------------|--|-----|-----|-----|-------|
| Power Ramp | t _{VDD} | 0 V to V _{DDmin} | 0.1 | — | 10 | ms |
| Clock Stabilization from Power-up | t _{STABLE} | Time for clock outputs to appear after POR | — | 15 | 25 | ms |

Table 5.6. PCI-Express Clock Output Additive Phase Jitter (100 MHz)(V_{DD} = V_{DDA} = V_{DD_DIG} = 1.8 V to 3.3 V +5%/-5%, V_{DDO} = 1.8 V ±5%, 2.5 V ±5%, or 3.3 V ±5%, T_A = -40 to 85 °C)

| Parameter | Test Condition | Typ | Max | Units |
|--------------|--|-------|-------|--------|
| PCIe Gen 1.1 | Includes PLL BW 1.5–22 MHz, Peaking = 3 dB, T _d = 10 ns, F _{trk} = 1.5 MHz with BER = 1E-12 ¹ | 11 | 19 | ps RMS |
| PCIe Gen 2.1 | Includes PLL BW 5MHz and 8–16 MHz, Jitter Peaking = 0.01–1 dB and 3 dB, T _d =12ns, Low Band, F < 1.5 MHz | 0.02 | 0.026 | ps RMS |
| | Includes PLL BW 5 MHz and 8–16 MHz, Jitter Peaking = 0.01–1 dB and 3 dB, T _d = 12 ns, High Band, 1.5 MHz < F < Nyquist ¹ | 0.2 | 0.31 | ps RMS |
| PCIe Gen 3.0 | Includes PLL BW 2–4 MHz and 5 MHz, Peaking = 0.01–2 dB and 1 dB, T _d = 12 ns, CDR = 10 MHz ^{1, 2} | 0.06 | 0.1 | ps RMS |
| PCIe Gen 4.0 | Includes PLL BW 2–4 MHz and 5 MHz, Peaking = 0.01–2 dB and 1dB, T _d = 12 ns, CDR = 10 MHz ^{1, 2} | 0.05 | 0.1 | ps RMS |
| PCIe Gen5.0 | | 0.025 | 0.04 | ps RMS |

Note:

1. All output clocks 100 MHz HCSL format. Jitter data taken from Clock Jitter Tool v.1.3.
2. Excludes oscilloscope sampling noise.

Table 5.7. Thermal Characteristics

| Parameter | Symbol | Test Condition ¹ | Value | Units |
|---|---------------|-----------------------------|-------|-------|
| 40 QFN | | | | |
| Thermal Resistance, Junction to Ambient | θ_{JA} | Still Air | 23.1 | °C/W |
| | | Air Flow 1 m/s | 17.5 | |
| | | Air Flow 2 m/s | 16.5 | |
| Thermal Resistance, Junction to Case | θ_{JC} | | 13.4 | |
| Thermal Resistance, Junction to Board | θ_{JB} | | 8.7 | |
| | Ψ_{JB} | | 8.4 | |
| 32 QFN | | | | |
| Thermal Resistance, Junction to Ambient | θ_{JA} | Still Air | 28.4 | °C/W |
| | | Air Flow 1 m/s | 24 | |
| | | Air Flow 2 m/s | 23 | |
| Thermal Resistance, Junction to Case | θ_{JC} | | 15.9 | |
| Thermal Resistance, Junction to Board | θ_{JB} | | 11.5 | |
| | Ψ_{JB} | | 11.2 | |
| Note: | | | | |
| 1. Based on JEDEC standard 4-layer PCB. | | | | |

Table 5.8. Absolute Maximum Ratings^{1,2,3}

| Parameter | Symbol | Test Condition | Value | Units |
|--|-----------------|------------------------|------------------|-------|
| Storage Temperature Range | T_{STG} | | -55 to +150 | °C |
| DC Supply Voltage | V_{DD} | | -0.5 to 3.8 | V |
| | V_{DDA} | | -0.5 to 3.8 | V |
| | $V_{DD_{xtal}}$ | | -0.5 to 3.8 | V |
| | V_{DDO} | | -0.5 to 3.8 | V |
| Input Voltage Range | V_I | | -0.3 to 1.3 | V |
| Latch-up Tolerance | LU | | JESD78 Compliant | |
| ESD Tolerance | HBM | 100 pF, 1.5 k Ω | 2.0 | kV |
| Junction Temperature | T_{JCT} | | -55 to 125 | °C |
| Soldering Temperature | T_{PEAK} | | 260 | °C |
| Soldering Temperature Time at T_{PEAK} | T_P | | 20 to 40 | sec |

Notes:

1. Permanent device damage may occur if the absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions as specified in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
2. For more packaging information, go to www.silabs.com/support/quality/pages/RoHSInformation.aspx.
3. The device is compliant with JEDEC J-STD-020.

6. Pin Descriptions

6.1 Si53258A-D01AM Pin Descriptions (40-QFN)

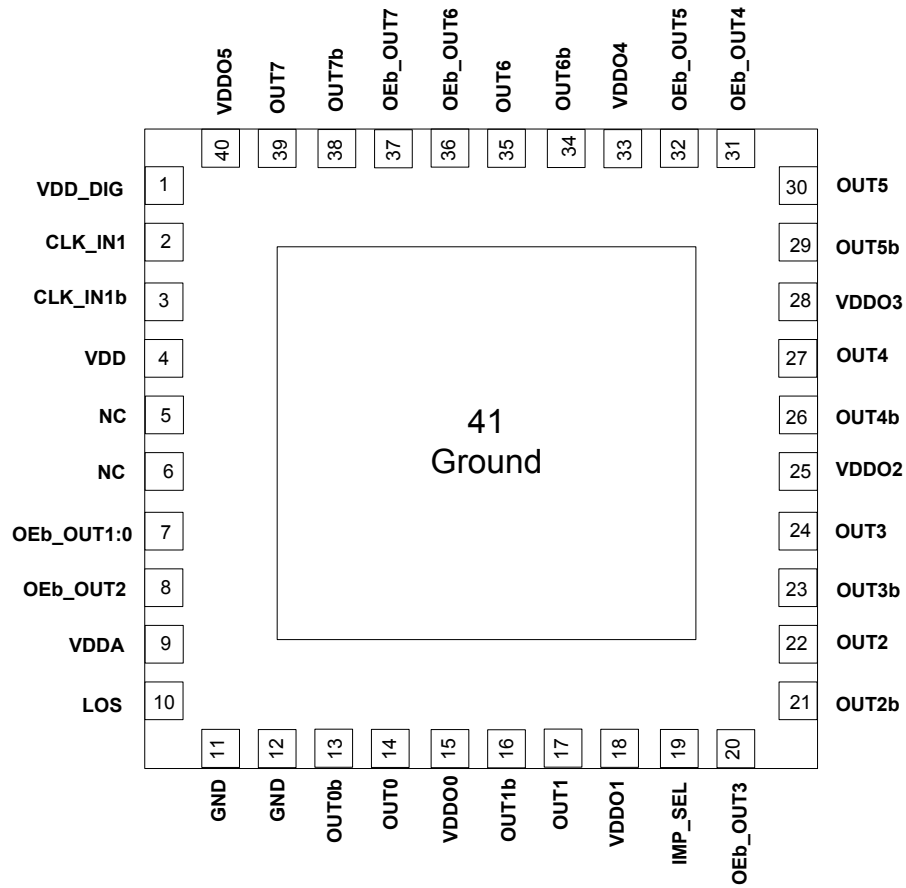


Figure 6.1. Si53258A-D01AM 40-QFN

Table 6.1. Si53258A-D01AM Pin Descriptions (40-QFN)

| Pin Number | Pin Name | Pin Type | Function |
|------------|------------|----------|---|
| 1 | VDD_DIG | P | Voltage supply for digital functions. Connect to 1.8–3.3 V. Part of internal core VDD voltage. Must be connected to same voltage as VDDA and VDD. |
| 2 | CLK_IN1 | I | 100 MHz HCSL Clock1 input. These pins are high-impedance and must be terminated externally. |
| 3 | CLK_IN1b | I | |
| 4 | VDD | P | Voltage supply. Connect to 1.8–3.3 V. Part of internal core VDD voltage. Must be connected to same voltage as VDDA and VDD_DIG. |
| 5 | NC | I | Do not connect these pins to anything. |
| 6 | NC | I | |
| 7 | OEb_OUT1:0 | I | Output enable pin for OUT1 and OUT0. Low = output enabled High = output disabled |
| 8 | OEb_OUT2 | I | Output enable pin for OUT2. Low = output enabled High = output disabled |
| 9 | VDDA | P | Core Supply Voltage. Connect to 1.8–3.3 V. Must be connected to same voltage as VDD_DIG and VDD. |
| 10 | LOS | O | The LOS status pin indicates whether the reference input has dropped below approximately 10 MHz. LOS is active low, open drain output and requires an external pull-up resistor of 1 to 10 kΩ for proper operation. If LOS is not required, this pin can be left unconnected. 0 = reference input has dropped below approx. 10 MHz 1 = reference input is present (>10 MHz) |
| 11 | GND | P | Connect these pins to ground. |
| 12 | GND | P | |
| 13 | OUT0b | O | Output Clock |
| 14 | OUT0 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 15 | VDDO0 | P | Supply Voltage (1.8–3.3 V) for OUT0 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |
| 16 | OUT1b | O | Output Clock |
| 17 | OUT1 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 18 | VDDO1 | P | Supply Voltage (1.8–3.3 V) for OUT1 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |

| Pin Number | Pin Name | Pin Type | Function |
|------------|----------|----------|--|
| 19 | IMP_SEL | I | Impedance select pin for output drivers. IMP_SEL pin is sampled at power-up only. Low = 100 Ω High = 85 Ω |
| 20 | OEb_OUT3 | I | Output enable pin for OUT3. Low = output enabled High = output disabled |
| 21 | OUT2b | O | Output Clock |
| 22 | OUT2 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 23 | OUT3b | O | Output Clock |
| 24 | OUT3 | O | Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 25 | VDDO2 | P | Supply Voltage (1.8–3.3 V) for OUT2 and OUT3 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |
| 26 | OUT4b | O | Output Clock |
| 27 | OUT4 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 28 | VDDO3 | P | Supply Voltage (1.8–3.3 V) for OUT4 and OUT5 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |
| 29 | OUT5b | O | Output Clock |
| 30 | OUT5 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 31 | OEb_OUT4 | I | Output enable pin for OUT4. Low = output enabled High = output disabled |
| 32 | OEb_OUT5 | I | Output enable pin for OUT5. Low = output enabled High = output disabled |
| 33 | VDDO4 | P | Supply Voltage (1.8–3.3 V) for OUT6 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |

| Pin Number | Pin Name | Pin Type | Function |
|------------|----------|----------|---|
| 34 | OUT6b | O | Output Clock |
| 35 | OUT6 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 36 | OEb_OUT6 | I | Output enable pin for OUT6. Low = output enabled High = output disabled |
| 37 | OEb_OUT7 | I | Output enable pin for OUT7. Low = output enabled High = output disabled |
| 38 | OUT7b | O | Output Clock |
| 39 | OUT7 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 40 | VDDO5 | P | Supply Voltage (1.8–3.3 V) for OUT7 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |
| 41 | GND PAD | P | Ground Pad This pad provides electrical and thermal connection to ground and must be connected for proper operation. |

6.2 Si53258A-D02AM Pin Descriptions (40-QFN)

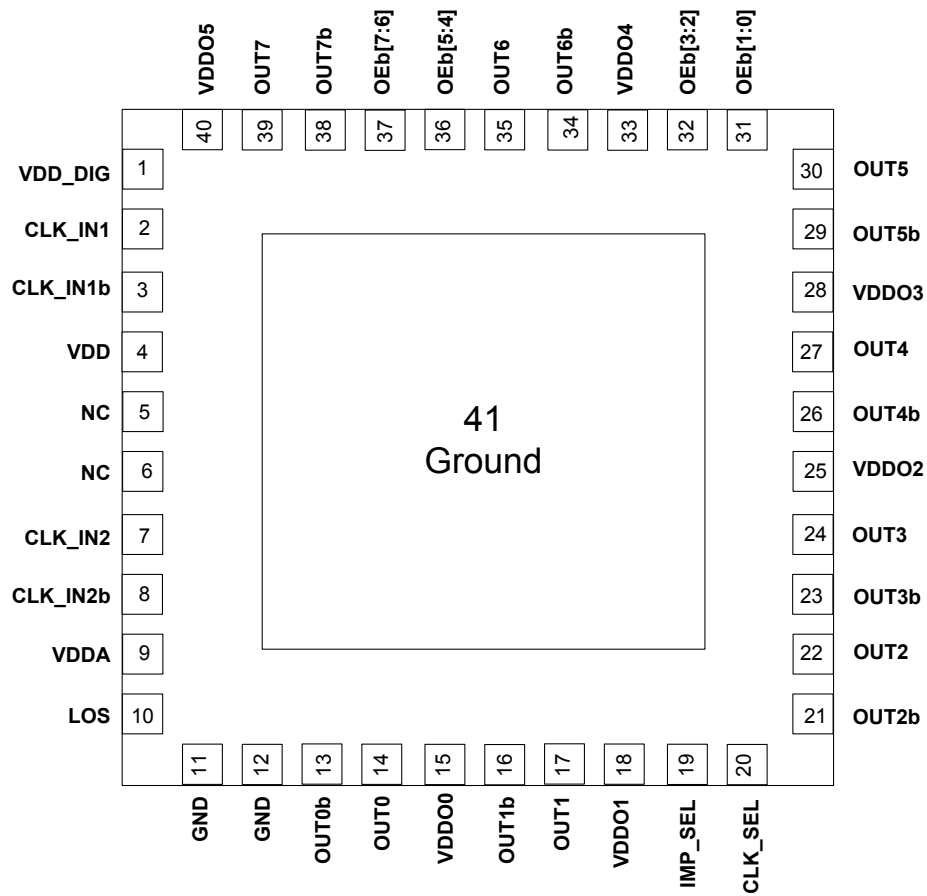


Figure 6.2. Si53258A-D02-AM 40-QFN

Table 6.2. Si53258A-D02AM Pin Descriptions (40-QFN)

| Pin Number | Pin Name | Pin Type | Function |
|------------|----------|----------|---|
| 1 | VDD_DIG | P | Voltage supply for digital functions. Connect to 1.8–3.3 V. Part of internal core VDD voltage. Must be connected to same voltage as VDDA. |
| 2 | CLK_IN1 | I | 100 MHz HCSL Clock1 input. These pins are high-impedance and must be terminated externally. If both the CLK_IN1 and CLK_IN1b inputs are unused and deselected, then both inputs can be left floating. |
| 3 | CLK_IN1b | I | |
| 4 | VDD | P | Voltage supply. Connect to 1.8–3.3 V. Part of internal core VDD voltage. Must be connected to same voltage as VDDA and VDD_DIG. |
| 5 | NC | I | Do not connect these pins to anything. |
| 6 | NC | I | |
| 7 | CLK_IN2 | I | 100 MHz HCSL Clock2 input. These pins are high-impedance and must be terminated externally. If both the CLK_IN2 and CLK_IN2b inputs are unused and deselected, then both inputs can be left floating. |
| 8 | CLK_IN2b | I | |
| 9 | VDDA | P | Core Supply Voltage. Connect to 1.8–3.3 V. Must be connected to same voltage as VDD_DIG and VDD. |
| 10 | LOS | O | The LOS status pin indicates whether the reference input has dropped below approximately 10 MHz. LOS is active low, open drain output and requires an external pull-up resistor of 1 to 10 k Ω for proper operation. If LOS is not required, this pin can be left unconnected. 0 = reference input has dropped below approx. 10 MHz 1 = reference input is present (>10 MHz) |
| 11 | GND | P | Connect this pin to ground. |
| 12 | GND | P | Connect this pin to ground. |
| 13 | OUT0b | O | Output Clock |
| 14 | OUT0 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 15 | VDDO0 | P | Supply Voltage (1.8–3.3 V) for OUT0 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |
| 16 | OUT1b | O | Output Clock |
| 17 | OUT1 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 18 | VDDO1 | P | Supply Voltage (1.8–3.3 V) for OUT1 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |
| 19 | IMP_SEL | I | Impedance select pin for output drivers. IMP_SEL pin is sampled at power-up only. Low = 100 Ω High = 85 Ω |

| Pin Number | Pin Name | Pin Type | Function |
|------------|----------|----------|--|
| 20 | CLK_SEL | I | Input clock select. Low = CLK_IN1 High = CLK_IN2 |
| 21 | OUT2b | O | Output Clock |
| 22 | OUT2 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 23 | OUT3b | O | Output Clock |
| 24 | OUT3 | O | Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 25 | VDDO2 | P | Supply Voltage (1.8–3.3 V) for OUT2 and OUT3 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |
| 26 | OUT4b | O | Output Clock |
| 27 | OUT4 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 28 | VDDO3 | P | Supply Voltage (1.8–3.3 V) for OUT4 and OUT5 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |
| 29 | OUT5b | O | Output Clock |
| 30 | OUT5 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 31 | OEB[1:0] | I | Output enable pin for OUT1 and OUT0. Low = output enabled High = output disabled |
| 32 | OEB[3:2] | I | Output enable pin for OUT2 and OUT3. Low = output enabled High = output disabled |
| 33 | VDDO4 | P | Supply Voltage (1.8–3.3 V) for OUT6 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |
| 34 | OUT6b | O | Output Clock |
| 35 | OUT6 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 36 | OEB[5:4] | I | Output enable pin for OUT1 and OUT0. Low = output enabled High = output disabled |

| Pin Number | Pin Name | Pin Type | Function |
|------------|----------|----------|---|
| 37 | OEb[7:6] | I | Output enable pin for OUT6 and OUT7. Low = output enabled High = output disabled |
| 38 | OUT7b | O | Output Clock |
| 39 | OUT7 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 40 | VDDO5 | P | Supply Voltage (1.8–3.3 V) for OUT7 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |
| 41 | GND PAD | P | Ground Pad This pad provides electrical and thermal connection to ground and must be connected for proper operation. |

6.3 Si53254A-D01AM Pin Descriptions (32-QFN)

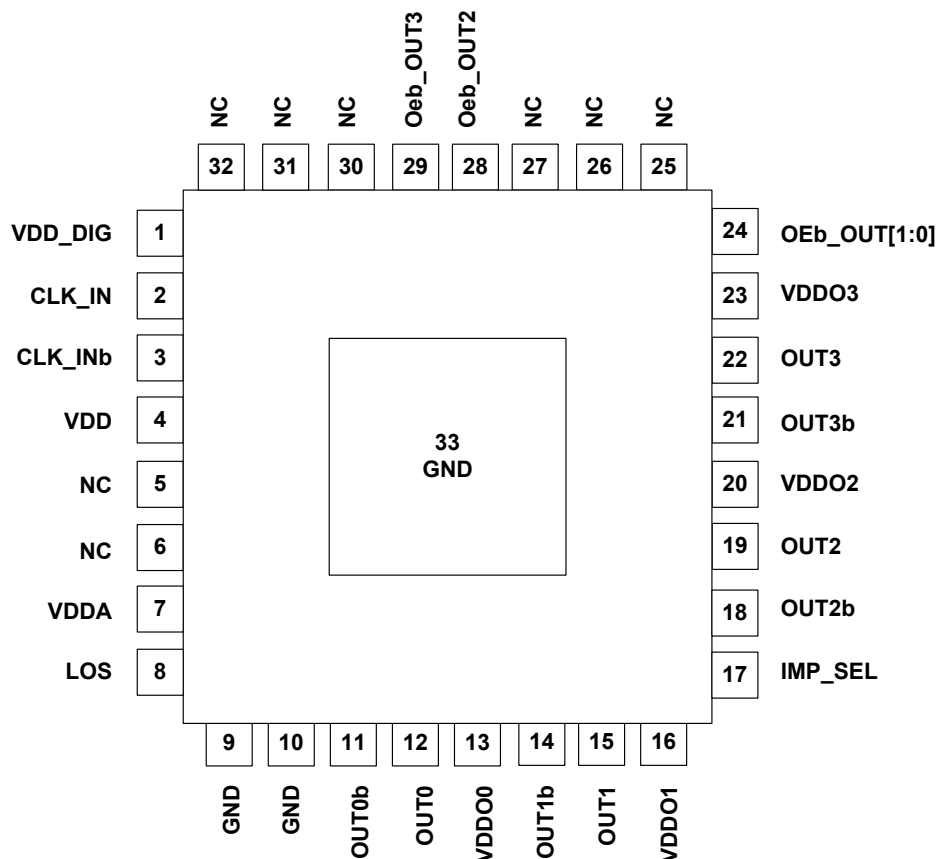


Figure 6.3. Si53254A-D01AM 32-QFN

Table 6.3. Si53254A-D01AM Pin Descriptions, (32-QFN)

| Pin Number | Pin Name | Pin Type | Function |
|------------|----------|----------|---|
| 1 | VDD_DIG | P | Voltage supply for digital functions. Connect to 1.8–3.3 V. Part of internal core VDD voltage. Must be connected to same voltage as VDDA and VDD. |
| 2 | CLK_IN | I | 100 MHz HCSL Clock Input |
| 3 | CLK_INb | I | These pins are high-impedance and must be terminated externally. |
| 4 | VDD | | Voltage supply. Connect to 1.8–3.3 V. Part of internal core VDD voltage. Must be connected to same voltage as VDDA and VDD_DIG. |
| 5 | NC | — | Do not connect these pins to anything. |
| 6 | NC | — | |
| 7 | VDDA | P | Core Supply Voltage. Connect to 1.8–3.3 V. See the Si5332-AM1/2/3 Family Reference Manual for power supply filtering recommendations. Must be connected to same voltage as VDD_DIG and VDD. |

| Pin Number | Pin Name | Pin Type | Function |
|------------|----------|----------|--|
| 8 | LOS | O | <p>The LOS status pin indicates whether the reference clock input is above 10 MHz. LOS is active low, open drain output and requires an external pull-up resistor of 1 to 10 kΩ for proper operation. If LOS is not required, this pin can be left unconnected.</p> <p>0 = reference input has dropped below 10 MHz 1 = reference present (>10 MHz)</p> |
| 9 | GND | P | Connect these pins to ground. |
| 10 | GND | P | |
| 11 | OUT0b | O | Output Clock |
| 12 | OUT0 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 13 | VDDO0 | P | <p>Supply Voltage (1.8–3.3 V) for OUT0</p> <p>See the Si5332-AM1/2/3 Family Reference Manual for power supply filtering recommendations.</p> <p>Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption.</p> |
| 14 | OUT1b | O | Output Clock |
| 15 | OUT1 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 16 | VDDO1 | P | <p>Supply Voltage (1.8–3.3 V) for OUT1</p> <p>Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption.</p> |
| 17 | IMP_SEL | I | <p>Impedance select pin for output drivers. IMP_SEL pin is sampled at power-up only.</p> <p>Low = 100 Ω High = 85 Ω</p> |
| 18 | OUT2b | O | Output Clock |
| 19 | OUT2 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 20 | VDDO2 | P | <p>Supply Voltage (1.8–3.3 V) for OUT2</p> <p>Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption.</p> |
| 21 | OUT3b | O | Output Clock |
| 22 | OUT3 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 23 | VDDO3 | P | <p>Supply Voltage (1.8–3.3 V) for OUT3</p> <p>Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption.</p> |

| Pin Number | Pin Name | Pin Type | Function |
|------------|--------------|----------|--|
| 24 | OEb_OUT[1:0] | I | Output enable for OUT1 and OUT0. Low = output enabled High = output disabled |
| 25 | NC | — | Do not connect these pins to anything. |
| 26 | NC | — | |
| 27 | NC | — | |
| 28 | OEb_OUT2 | I | Output enable for OUT2. Low = output enabled High = output disabled |
| 29 | OEb_OUT3 | I | Output enable for OUT3. Low = output enabled High = output disabled |
| 30 | NC | — | Do not connect these pins to anything. |
| 31 | NC | — | |
| 32 | NC | — | |
| 33 | GND PAD | P | Ground Pad This pad provides electrical and thermal connection to ground and must be connected for proper operation. |

6.4 Si53254A-D02AM Pin Descriptions (40-QFN)

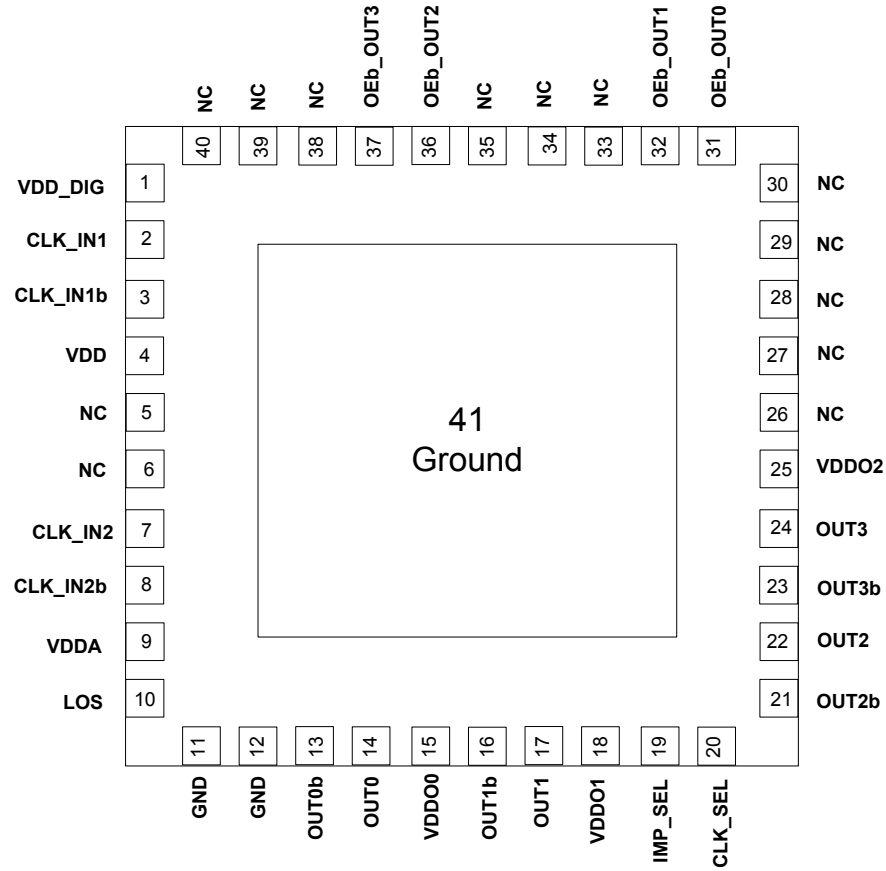


Figure 6.4. Si53254A-D02AM 40-QFN

Table 6.4. Si53254A-D02AM Pin Descriptions (40-QFN)

| Pin Number | Pin Name | Pin Type | Function |
|------------|----------|----------|--|
| 1 | VDD_DIG | P | Voltage supply for digital functions. Connect to 1.8–3.3 V. Part of internal core VDD voltage. Must be connected to same voltage as VDDA and VDD. |
| 2 | CLK_IN | I | 100MHz HCSL clock input. These pins are high-impedance and must be terminated externally. |
| 3 | CLK_INb | I | |
| 4 | VDD | P | Voltage supply. Connect to 1.8–3.3 V. Part of internal core VDD voltage. Must be connected to same voltage as VDDA. |
| 5 | NC | I | Do not connect these pins to anything. |
| 6 | NC | I | |
| 7 | CLK_IN2 | I | 100 MHz HCSL clock input. These pins are high-impedance and terminated externally. |
| 8 | CLK_IN2b | I | |
| 9 | VDDA | P | Core Supply Voltage. Connect to 1.8–3.3 V. Must be connected to same voltage as VDD_DIG and VDD. |
| 10 | LOS | O | The LOS status pin indicates if the reference clock input is above 10 MHz. LOS is active low, open drain output and requires an external pull-up resistor of 1 to 10 k Ω for proper operation. If LOS is not required, this pin can be left unconnected. 0 = reference input has dropped below 10 MHz 1 = reference present (>10 MHz) |
| 11 | GND | P | Connect these pins to ground. |
| 12 | GND | P | |
| 13 | OUT0b | O | Output Clock |
| 14 | OUT0 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 15 | VDDO0 | P | Supply Voltage (1.8–3.3 V) for OUT0 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |
| 16 | OUT1b | O | Output Clock |
| 17 | OUT1 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 18 | VDDO1 | P | Supply Voltage (1.8–3.3 V) for OUT1 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |
| 19 | IMP_SEL | I | Impedance select pin for output drivers. IMP_SEL pin is sampled at power-up only. Low = 100 Ω High = 85 Ω |

| Pin Number | Pin Name | Pin Type | Function |
|------------|----------|----------|--|
| 20 | CLK_SEL | I | Mux input select pin: When CLK_SEL is high, CLK_IN1 is selected. When CLK_SEL is low, CLK_IN2 is selected. CLK_SEL contains an internal pull-down resistor. |
| 21 | OUT2b | O | Output Clock |
| 22 | OUT2 | O | 100 MHz HCSL output. Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 23 | OUT3b | O | Output Clock |
| 24 | OUT3 | O | Termination recommendations are provided in 3.2 HCSL Differential Output Terminations . Unused outputs should be left unconnected. |
| 25 | VDDO2 | P | Supply Voltage (1.8–3.3 V) for OUT2 and OUT3 Leave VDDOx pins of unused output drivers unconnected. An alternate option is to connect the VDDOx pin to a power supply and disable the output driver to minimize current consumption. |
| 26 | NC | — | Do not connect these pins to anything. |
| 27 | NC | — | |
| 28 | NC | — | |
| 29 | NC | — | |
| 30 | NC | — | |
| 31 | OEb_OUT0 | I | Output enable pin for OUT0. Low = output enabled High = output disabled |
| 32 | OEb_OUT1 | I | Output enable pin for OUT1. Low = output enabled High = output disabled |
| 33 | NC | — | Do not connect these pins to anything. |
| 34 | NC | — | |
| 35 | NC | — | |
| 36 | OEb_OUT2 | I | Output enable pin for OUT2. Low = output enabled High = output disabled |
| 37 | OEb_OUT3 | I | Output enable pin for OUT3. Low = output enabled High = output disabled |
| 38 | NC | — | Do not connect these pins to anything. |
| 39 | NC | — | |
| 40 | NC | — | |

| Pin Number | Pin Name | Pin Type | Function |
|------------|----------|----------|--|
| 41 | GND PAD | P | Ground Pad This pad provides electrical and thermal connection to ground and must be connected for proper operation. |

7. Package Outline

7.1 6x6 mm 40-QFN Package Diagram

The figure below illustrates the package details for 40-QFN. The table below lists the values for the dimensions shown in the illustration.

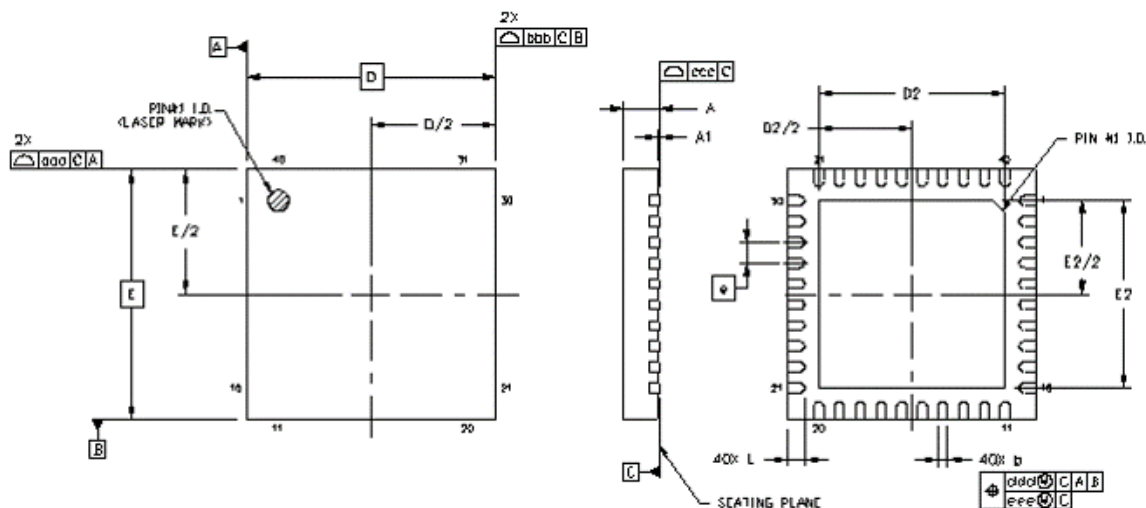


Figure 7.1. 40-Pin Quad Flat No-Lead (QFN)

Table 7.1. Package Dimensions

| Dimension | Min | Nom | Max |
|-----------|----------|------|------|
| A | 0.80 | 0.85 | 0.90 |
| A1 | 0.00 | 0.02 | 0.05 |
| b | 0.18 | 0.25 | 0.30 |
| D | 6.00 BSC | | |
| D2 | 4.35 | 4.50 | 4.65 |
| e | 0.50 BSC | | |
| E | 6.00 BSC | | |
| E2 | 4.35 | 4.50 | 4.65 |
| L | 0.30 | 0.40 | 0.50 |
| aaa | — | — | 0.15 |
| bbb | — | — | 0.15 |
| ccc | — | — | 0.08 |
| ddd | — | — | 0.10 |
| eee | — | — | 0.05 |

| Dimension | Min | Nom | Max |
|--|-----|-----|-----|
| Notes: <ol style="list-style-type: none">1. All dimensions shown are in millimeters (mm) unless otherwise noted.2. Dimensioning and Tolerancing per ANSI Y14.5M-1994.3. This drawing conforms to the JEDEC Solid State Outline MO-220.4. Recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components. | | | |

7.2 5x5 mm 32-QFN Package Diagram

The figure below illustrates the package details for 32-QFN option. The table below lists the values for the dimensions shown in the illustration.



Figure 7.2. 32-Pin Quad Flat No-Lead (QFN)

Table 7.2. Package Dimensions

| Dimension | MIN | NOM | MAX |
|-----------|----------|------|------|
| A | 0.80 | 0.85 | 0.90 |
| A1 | 0.00 | 0.02 | 0.05 |
| A3 | 0.20 REF | | |
| b | 0.18 | 0.25 | 0.30 |
| D/E | 4.90 | 5.00 | 5.10 |
| D2/E2 | 3.40 | 3.50 | 3.60 |
| e | 0.50 BSC | | |
| L | 0.30 | 0.40 | 0.50 |
| K | 0.20 | --- | --- |
| R | 0.09 | --- | 0.14 |
| aaa | 0.15 | | |
| bbb | 0.10 | | |
| ccc | 0.10 | | |

| Dimension | MIN | NOM | MAX |
|-----------|-----|------|-----|
| ddd | | 0.05 | |
| eee | | 0.08 | |
| fff | | 0.10 | |

Notes:

1. All dimensions shown are in millimeters (mm) unless otherwise noted.
2. Dimensioning and Tolerancing per ANSI Y14.5M-1994.
3. This drawing conforms to the JEDEC Solid State Outline MO-220, Variation VKKD-4.
4. Recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components.

8. PCB Land Pattern

8.1 40-QFN Land Pattern

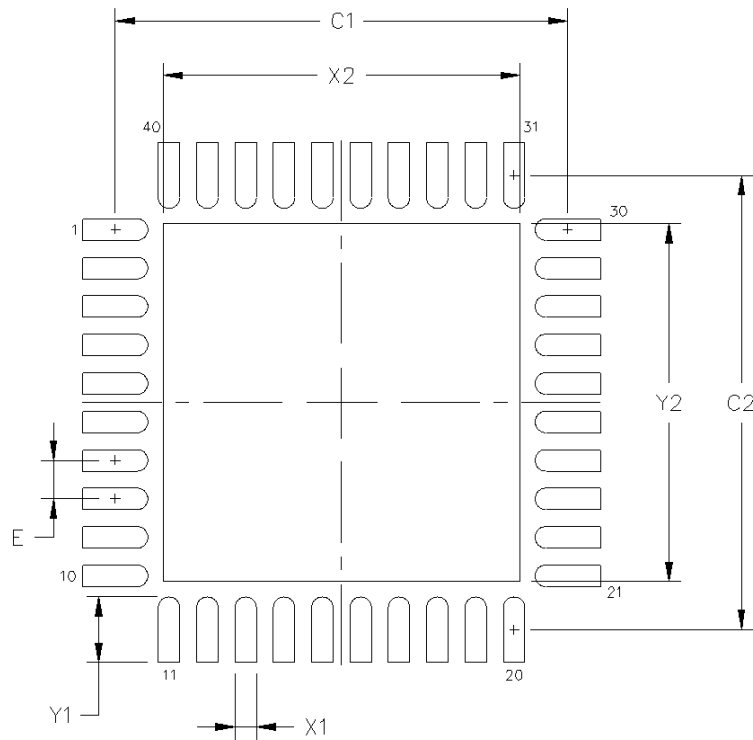


Figure 8.1. 40-QFN Land Pattern

Table 8.1. PCB Land Pattern Dimensions

| Dimension | mm |
|-----------|----------|
| C1 | 5.90 |
| C2 | 5.90 |
| e | 0.50 BSC |
| X1 | 0.30 |
| Y1 | 0.85 |
| X2 | 4.65 |
| Y2 | 4.65 |

| Dimension | mm |
|--|----|
| <p>Notes:</p> <p>General</p> <ol style="list-style-type: none">1. All dimensions shown are in millimeters (mm) unless otherwise noted.2. This Land Pattern Design is based on the IPC-7351 guidelines. <p>Solder Mask Design</p> <ol style="list-style-type: none">1. All metal pads are to be non-solder mask defined (NSMD). Clearance between the solder mask and the metal pad is to be 60 μm minimum, all the way around the pad. <p>Stencil Design</p> <ol style="list-style-type: none">1. A stainless steel, laser-cut and electro-polished stencil with trapezoidal walls should be used to assure good solder paste release.2. The stencil thickness should be 0.125 mm (5 mils).3. The ratio of stencil aperture to land pad size can be 1:1 for all perimeter pads.4. A 3\times3 array of 0.85 mm square openings on a 1.00 mm pitch can be used for the center ground pad. <p>Card Assembly</p> <ol style="list-style-type: none">1. A No-Clean, Type-3 solder paste is recommended.2. The recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components. | |

8.2 32-QFN Land Pattern

The figure below illustrates the PCB land pattern details for 32-QFN package. The table below lists the values for the dimensions shown in the illustration.

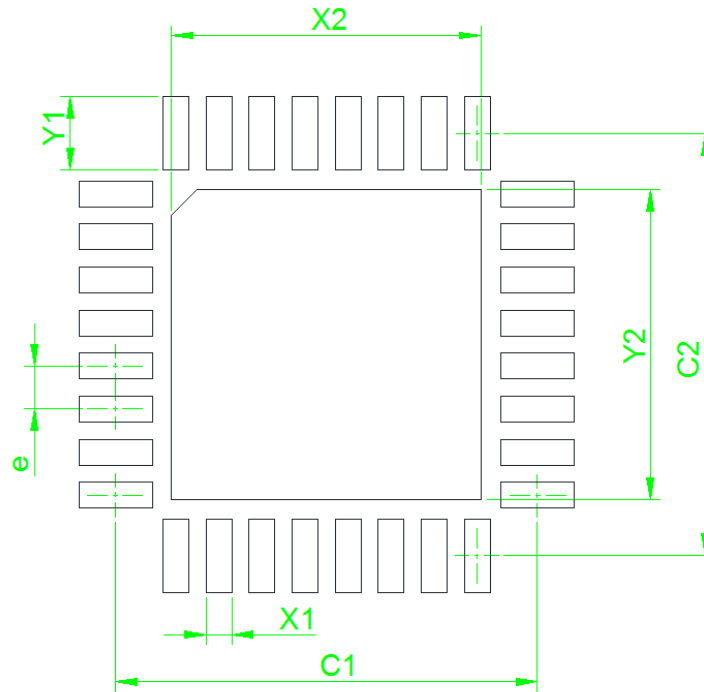


Figure 8.2. 32-QFN Land Pattern

Table 8.2. PCB Land Pattern Dimensions

| Dimension | mm |
|-----------|----------|
| C1 | 4.90 |
| C2 | 4.90 |
| e | 0.50 BSC |
| X1 | 0.30 |
| Y1 | 0.85 |
| X2 | 3.60 |
| Y2 | 3.60 |

| Dimension | mm |
|--|----|
| <p>Notes:</p> <p>General</p> <ol style="list-style-type: none">1. All dimensions shown are in millimeters (mm) unless otherwise noted.2. This Land Pattern Design is based on the IPC-7351 guidelines. <p>Solder Mask Design</p> <ol style="list-style-type: none">1. All metal pads are to be non-solder mask defined (NSMD). Clearance between the solder mask and the metal pad is to be 60 μm minimum, all the way around the pad. <p>Stencil Design</p> <ol style="list-style-type: none">1. A stainless steel, laser-cut and electro-polished stencil with trapezoidal walls should be used to assure good solder paste release.2. The stencil thickness should be 0.125 mm (5 mils).3. The ratio of stencil aperture to land pad size can be 1:1 for all perimeter pads.4. A 3\times3 array of 0.85 mm square openings on a 1.00 mm pitch can be used for the center ground pad. <p>Card Assembly</p> <ol style="list-style-type: none">1. A No-Clean, Type-3 solder paste is recommended.2. The recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components. | |

9. Top Marking

Standard Factory Default Configuration

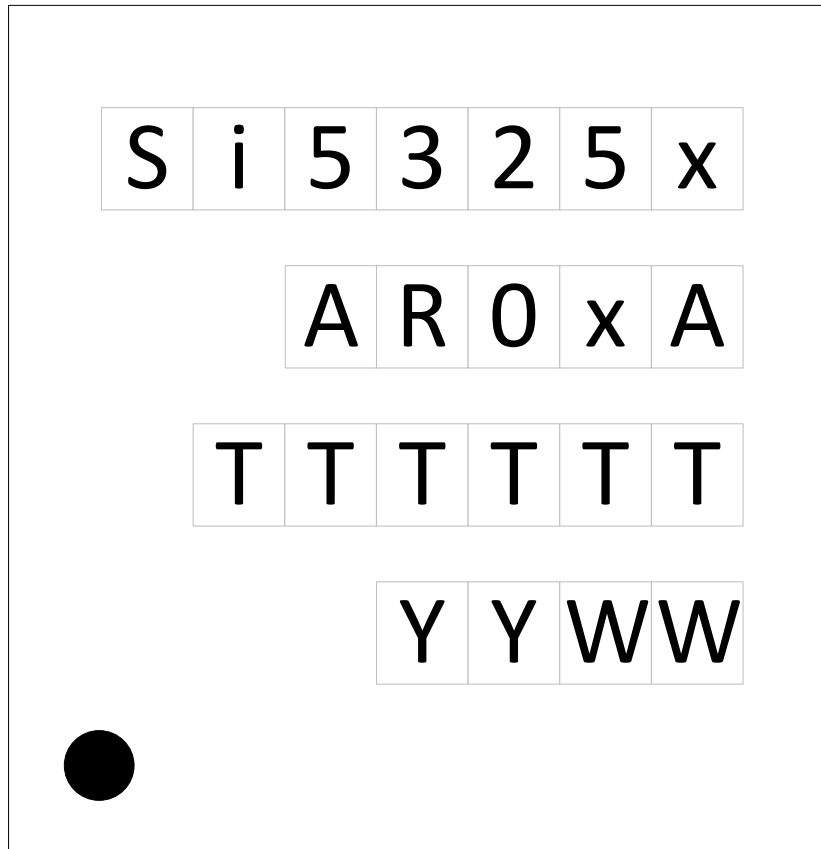


Figure 9.1. Top Marking

Table 9.1. Top Marking Explanation

| Line | Characters | Description |
|------|--------------------|--|
| 1 | Si53258 Si53254 | Base part number |
| 2 | A-D0xA | A = Grade R = Product revision (reference ordering section for latest revision) 0x = Product identification, single input: <ul style="list-style-type: none"> • 01 = Single input • 02 = Dual input A = Automotive grade temperature range |
| 3 | TTTTTT | Manufacturing trace code |
| 4 | YYWW | Year (YY) and work week (WW) of package assembly |

10. Revision History

Revision 1.0

January, 2021

- Updated notes in [Table 5.4 Differential Clock Output Specifications](#) on page 10.
- Removed “default low” from OEb pin descriptions.

Revision 0.7

September, 2019

- Initial release.



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