


## System Board 6782

# Go-IO INDUSTRIAL IoT REFERENCE DESIGN

 Active: In Production.

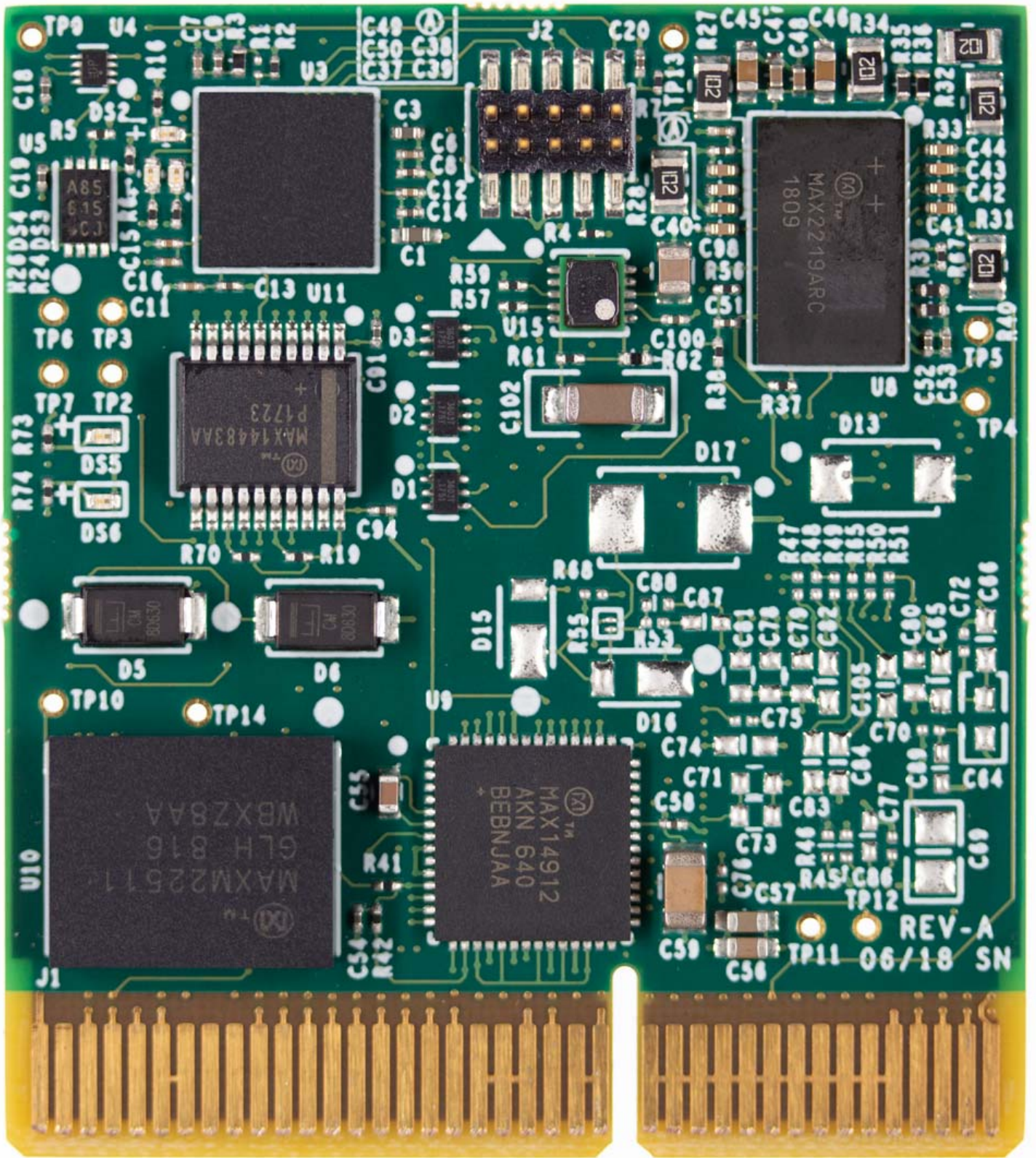
### Details

Go-IO is the brand name for a modular Industrial IoT reference design (see **Figure 1**) based on a carrier card (or backplane) (MAXREFDES215#), an application processor card (MAXREFDES211#), and an I/O card which can vary depending upon the target application (MAXREFDES200#, MAXREFDES201#). The MAXREFDES200# targets factory automation and features a mix of I/O types including analog inputs, analog output, digital input, digital output, IO-Link and a RS-485 COM port. The MAXREFDES201# targets motion control and features a mix of I/O types including digital inputs, DC motor drivers, encoders, and a RS-485 COM port.

All field connectors are on the MAXREFDES215# carrier card for easy connectivity to sensors, actuators, and communication ports. All cards are powered from a single 24V wall adapter, which connects to the carrier card. Circuitry on the carrier card generates various power rails including an isolated supply for the application processor card (MAXREFDES211#). Additional local on-card DC-DC converters and LDO regulators are used to create lower voltage rails specific to each card.

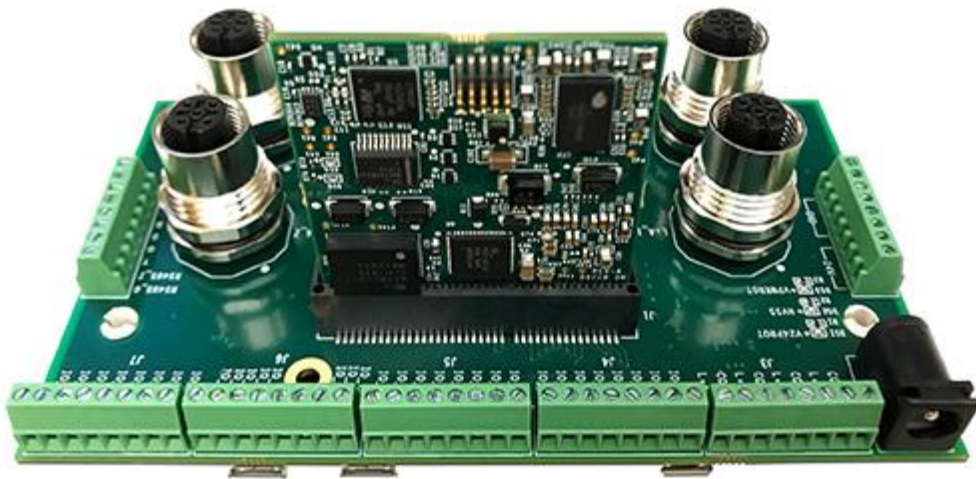
Order the MAXREFDES212# to receive a kit that contains the MAXREFDES215#, MAXREFDES211#, MAXREFDES200#, and a 24V wall adapter. The kit allows the Go-IO system to be used out-of-the-box.

Go-IO System Board



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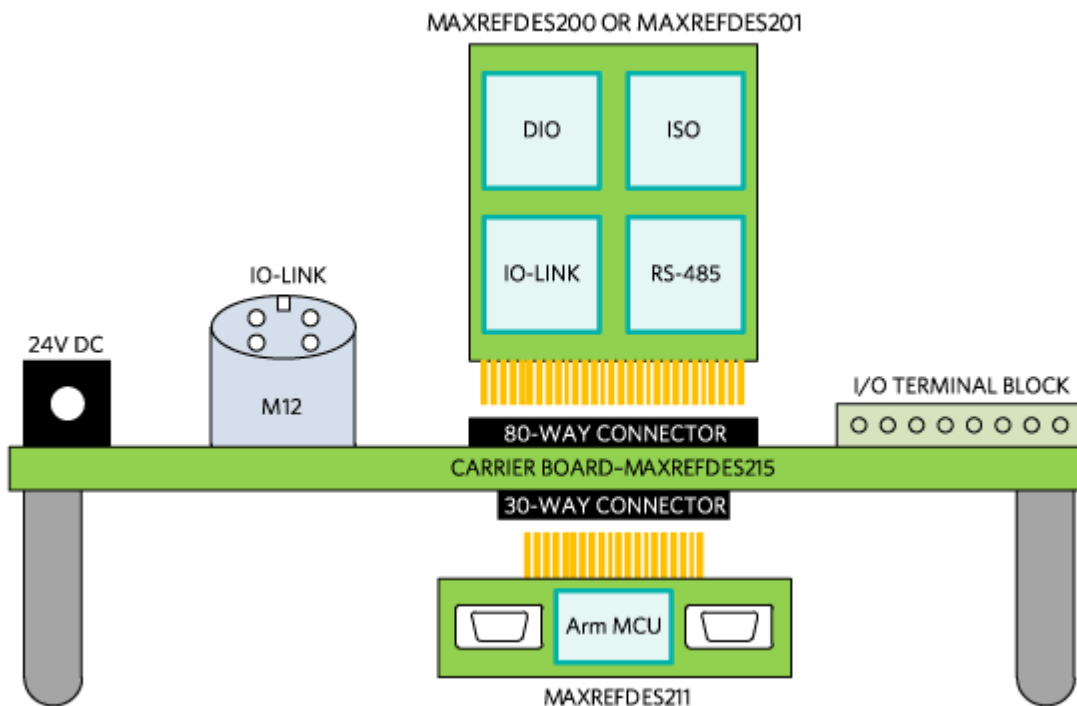
Diagram



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## System Diagram

When plugged together, the Go-IO boards form a configurable development reference design for industrial IOT applications. The system provides a robust, flexible architecture which leverages leading edge industrial technologies for Universal I/O, isolation, power management, and Arm®-based microcontrollers. Featuring highly integrated solutions, these boards support over 20 I/Os in a tiny footprint of less than three square inches. The compact footprint and high reliability are achieved by using highly efficient power management and low power dissipation devices, which are available in tiny packages.



*Figure 1. Go-IO modular block diagram.*

## Detailed Description of the MAXREFDES215# Carrier Card

### **Introduction**

**Figure 2** shows the system block diagram for the MAXREFDES215#.

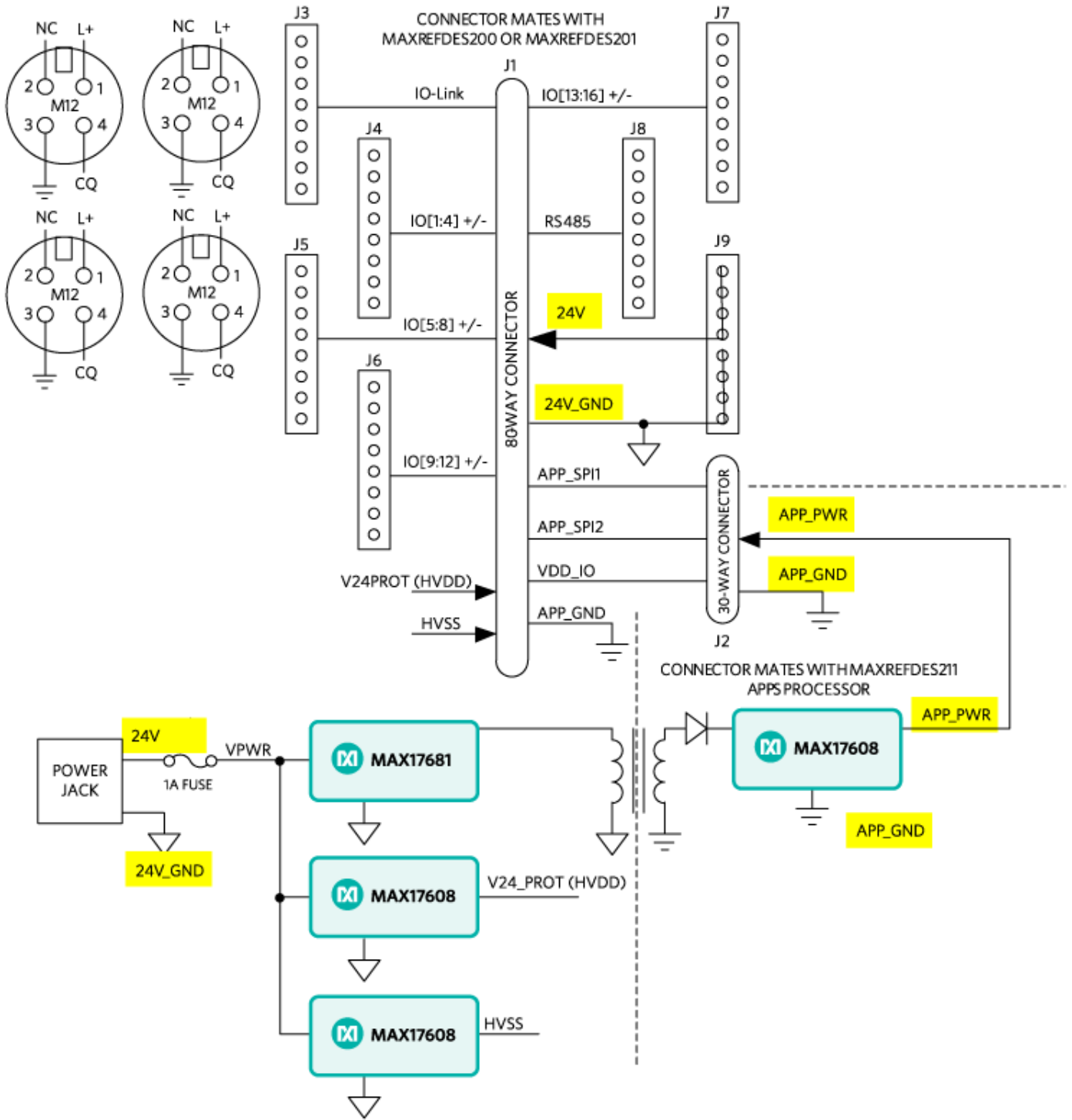


Figure 2. MAXREFDES215# block diagram.

Figure 3 shows the top view of the MAXREFDES215#.



Figure 3. MAXREFDES215# top view.

### Connections

Two connectors are used for board-to-board interfaces: J1 and J2. J1 is an 80-way female connector that mates with a male connector on an I/O card, which can be either the MAXREFDES200# or the MAXREFDES201# depending upon the end application. J2 is a 30-way male connector that mates with a female connector on the MAXREFDES211# application processor card. Both connectors are keyed to prevent incorrect insertion of the respective cards.

Four M12 type female connectors are used to connect to industry-standard IO-Link sensors and actuators that use equivalent M12 male connectors and cables. Multiple screw terminal blocks are used for easy connection to the analog I/O, digital I/O and RS-485 ports.

### Galvanic Isolation

The Go-IO uses two different domains, which are separated using the Maxim digital isolator products. The field domain uses the 24V input supply and 24V GND for reference. The logic domain uses APP\_PWR and APP\_GND for reference and is found on the application processor card, MAXREFDES211#.

### Power Supplies

Power is supplied to the MAXREFDES215# using a standard 24V, 1A wall adapter that connects to the on-board barrel connector. Alternatively, a higher current power supply of up to 5A can be connected using screw terminals on block J9.

The 24V input rail is protected from overcurrent with a 1A fuse. If the MAXREFDES200# is used and if a higher current operation is required (i.e., digital output loads greater than 1A), an external 24V supply can be connected to the input terminal on connector J9. If the MAXREFDES201# is used with the DC motor drivers, the VMTR supply must be connected to the input terminal J3. The power supply must match the DC motor selected for voltage and current specifications.

With the 24V input, different DC-DC converters are used to generate different voltage rails. The MAX17681 is a high-efficiency iso-buck DC-DC converter used to provide isolated power up to 5W. In the MAXREFDES215#, the input is 24V and the MAX17681 uses primary-side feedback to regulate the output voltage while reducing the external components and saving total cost, no optocoupler required. After the transformer output and rectification, the MAX17608 current limiter provides the isolated power rails APP\_PWR and APP\_GND. The MAX17608 is the industry's smallest and most robust integrated system protection solution, providing 1A current limiting along with OV, UV, and reverse protection.

On the field domain, two regulators generate the higher positive and negative voltage rails, HVDD and HVSS, to be used by the analog IO products. The MAX17608 provides a protected 24V rail, V24\_PROT, which in turn becomes the HVDD rail. The MAX15062 high-efficiency step-down DC-DC converter converts the +24V input to a negative voltage rail for use as the HVSS supply to be used by the analog IO products.

## Detailed Description of the MAXREFDES211# Application Processor

### Introduction

**Figure 4** shows the system block diagram for the MAXREFDES211#.

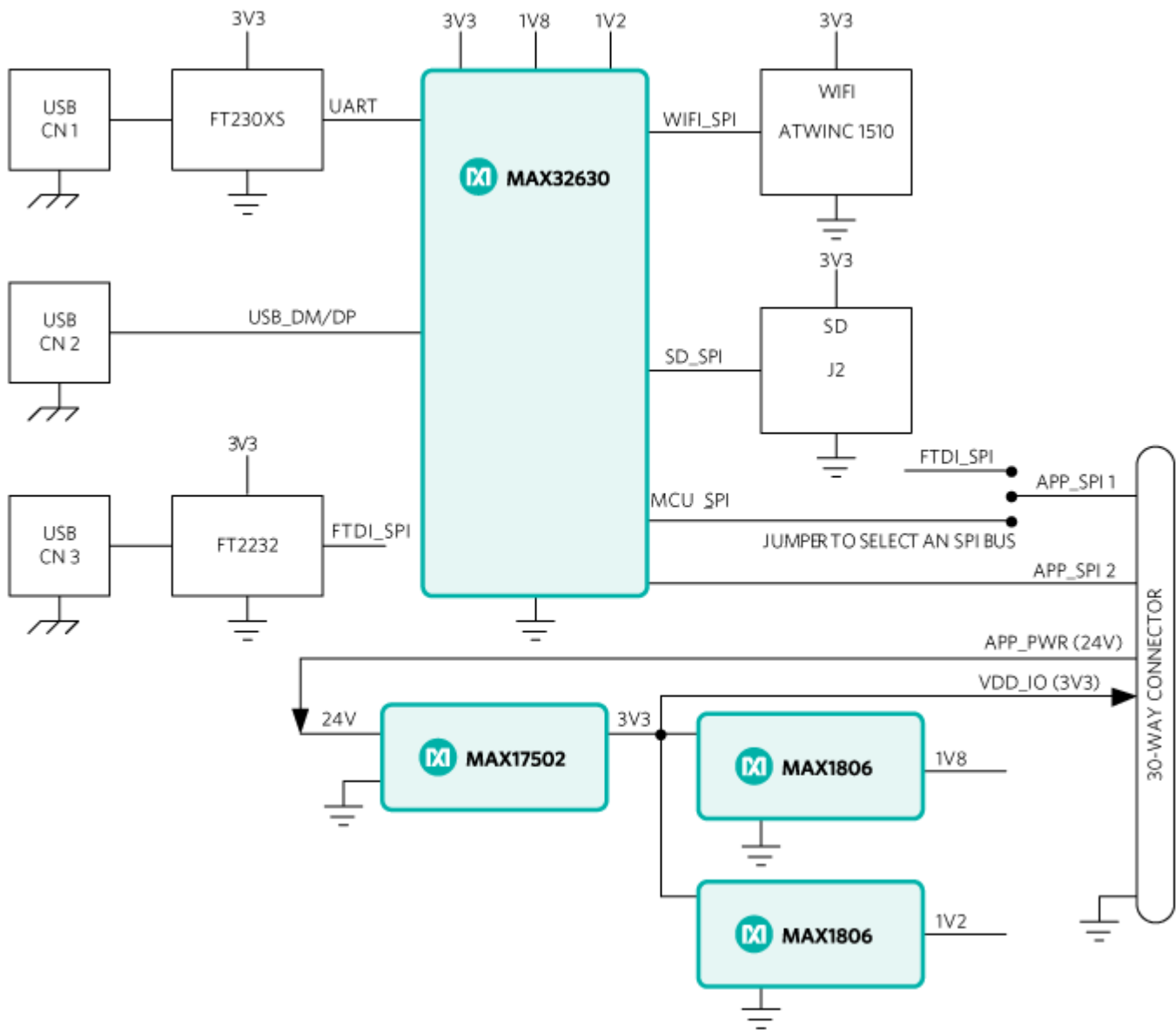


Figure 4. MAXREFDES211# block diagram.

Figure 5 shows a picture of the top view of the MAXREFDES211#.



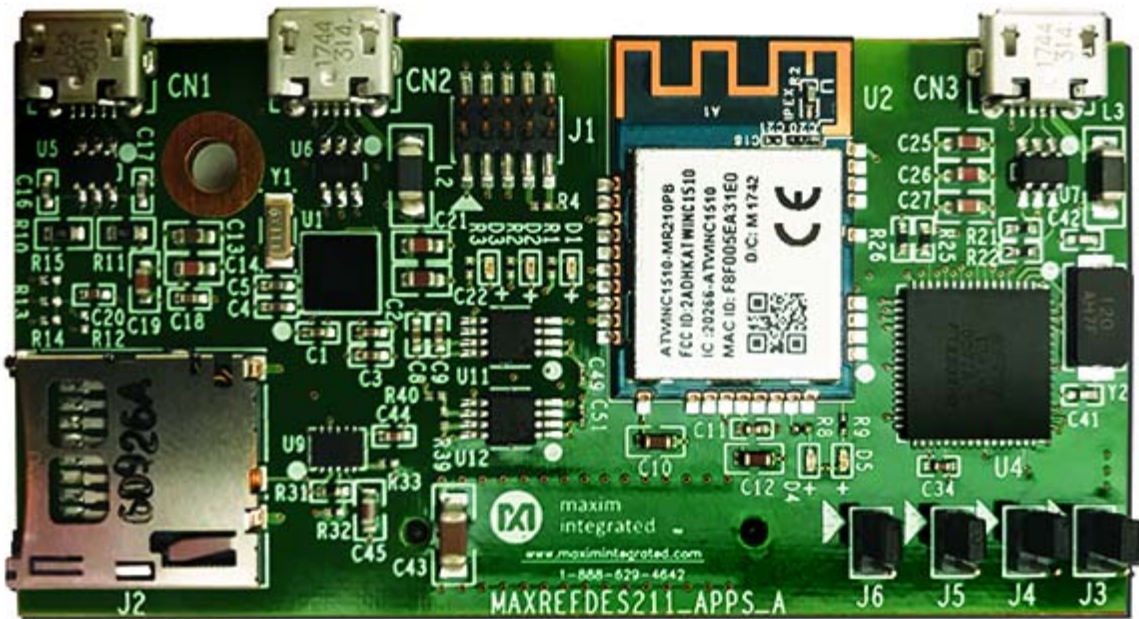


Figure 5. MAXREFDES211# top view.

### Connections

The MAXREFDES211# connects to the underside of the MAXREFDES215# through a 30-way female connector that mates with a male connector on the MAXREFDES215# carrier card. Both connectors are keyed to prevent incorrect insertion of the respective cards. Three USB connectors are included for interfacing to the MAX32630 microcontroller.

### Galvanic Isolation

The Go-IO uses two different domains, which are separated using the Maxim digital isolator products. The field domain uses the 24V input supply and 24V GND for reference. The logic domain uses APP\_PWR and APP\_GND for reference and is found on the application processor card, MAXREFDES211#. The digital isolators on the I/O control card, either MAXREFDES200# or MAXREFDES201#, perform the galvanic isolation function.

### Power Supplies

Power is supplied to the MAXREFDES211# from the MAXREFDES215# (APP\_PWR (24V) and APP\_GND). On board regulators do a multi-level step down to provide the different voltage rails required by the microcontroller.

The MAX17502 DC-DC converter steps the 24V input down to 3.3V to use as the input to the two MAX1806 linear regulators. The MAX17502 high-efficiency, high-voltage, synchronous step-down DC-DC converter with integrated MOSFETs operates over a 4.5V to 60V input voltage range. This device is offered in a fixed 3.3V output voltage while delivering up to 1A of current. The output voltage is accurate to within  $\pm 1.7\%$  over  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

The MAX1806 low-dropout linear regulator operates from a +2.25V to +5.5V supply and delivers a guaranteed 500mA load current with low 175mV dropout. The high-accuracy ( $\pm 1\%$ ) output voltage has different preset values, and for the MAXREFDES211#, two MAX1806 linear regulators generate the 1.8V and 1.2V rails required by the MAX32630 microcontroller.

### **Microcontroller**

The MAX32630 features an Arm Cortex®-M4 with FPU CPU that delivers ultra-low power, high-efficiency signal processing functionality with significantly reduced power consumption and ease of use. Multiple SPI, UART, I<sup>2</sup>C, 1-Wire® master, and USB interfaces are provided. The USB interfaces are made using industry standard FTDI USB chips.

The MAXREFDES211# uses four SPI buses to interface to the different peripherals:

- **MCU\_SPI:** Use the 2:1 jumper to select the target SPI bus, either a secondary FTDI-USB interface or the more commonly used APP\_SPI1 bus. The APP\_SPI1 bus connects to the 80-way connector to plug-in modules such as the MAXREFDES200# or MAXREFDES201#. This SPI bus is galvanically isolated on those cards and used to control I/O peripherals such as the MAX14819 IO-Link master IC.
- **APP\_SPI2:** The APP\_SPI2 bus connects to the 80-way connector to plug-in modules such as the MAXREFDES200# or MAXREFDES201#. On the MAXREFDES200# or MAXREFDES201#, this SPI bus connects to the MAX22192, which is a galvanically isolated digital input device. The integrated isolation within the MAX22192 shares the isolated SPI bus with other field domain devices on the modules, saving the need for more external isolators.
- **WIFI\_SPI:** The WIFI\_SPI bus connects to the Wi-Fi chipset and is unused in the initial product release.
- **SD\_SPI:** The SD\_SPI bus connects to the SD card controller and is unused in initial product release.

## **Detailed Description of the MAXREFDES200# Factory Automation Module**

### **Introduction**

**Figure 6** shows the system block diagram for the MAXREFDES200#.

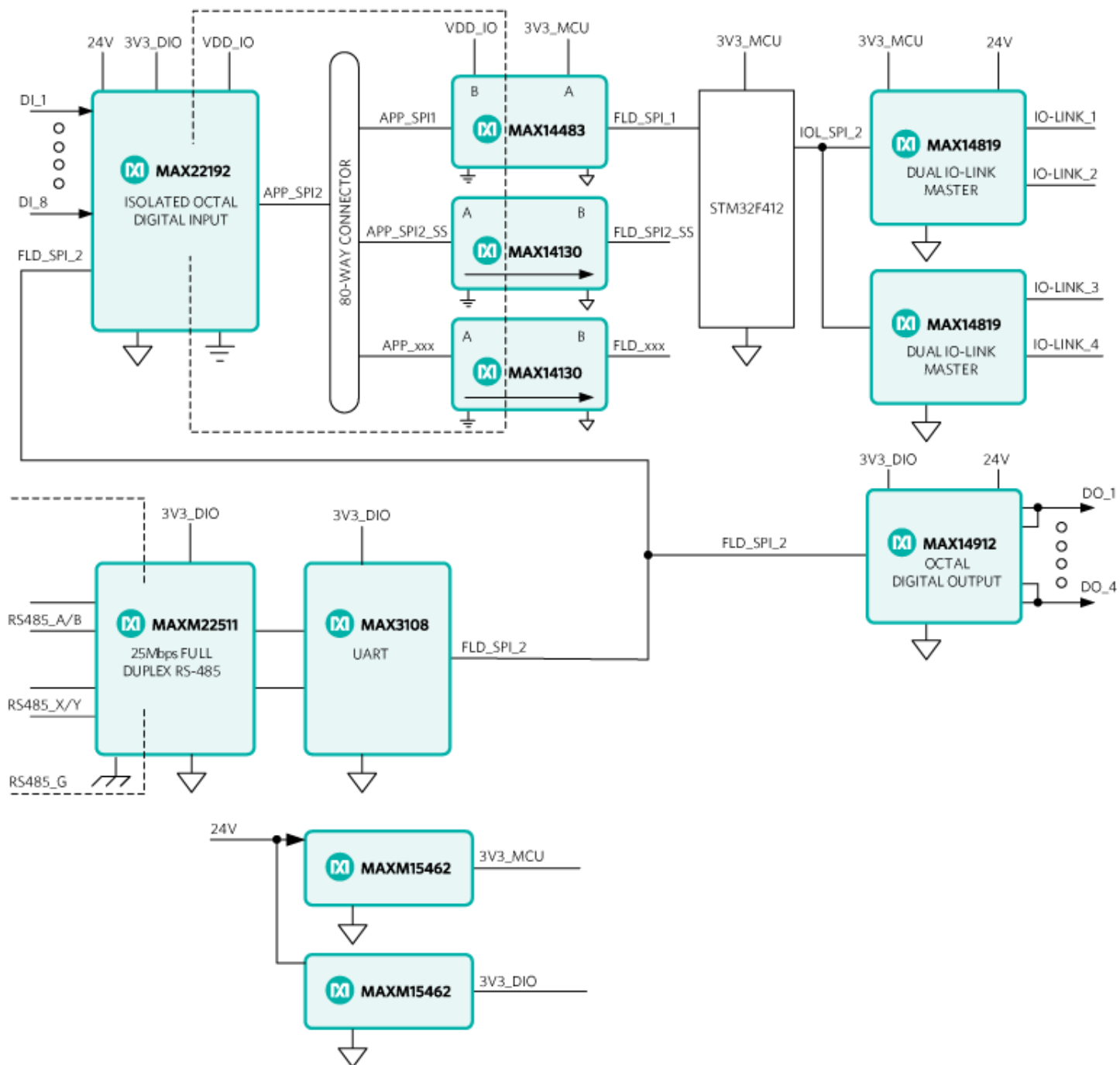


Figure 6. MAXREFDES200# block diagram.

Figure 7 shows the top view of the MAXREFDES200#.

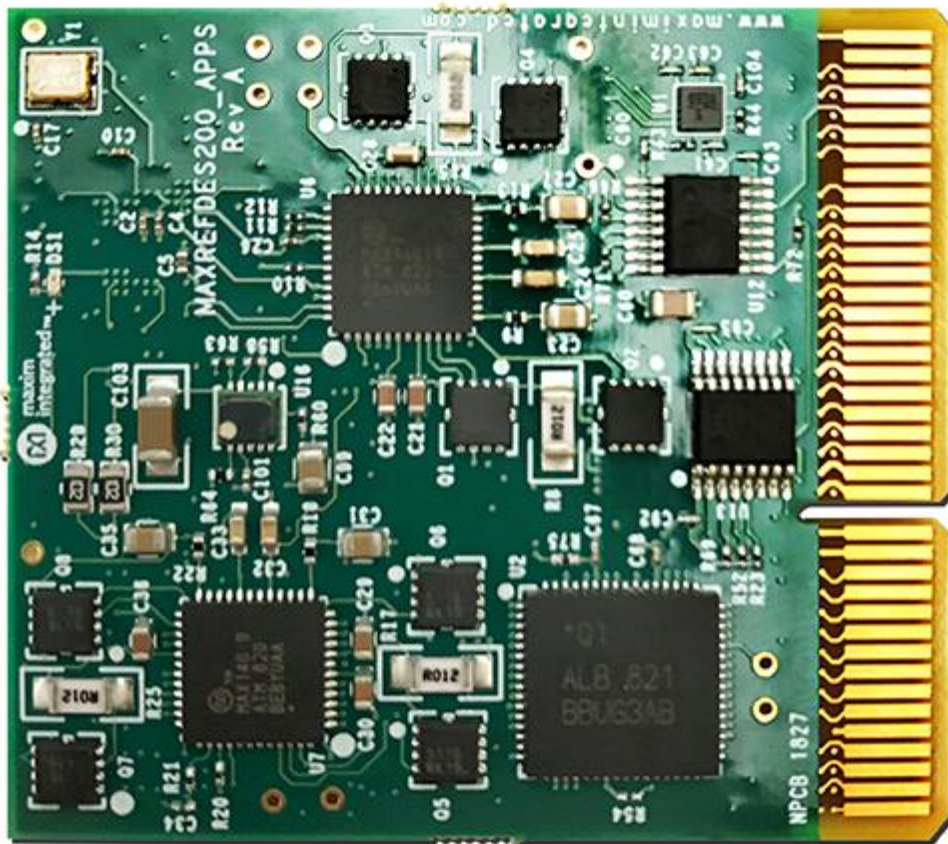


Figure 7. MAXREFDES200# top view.

### Connections

The MAXREFDES200# connects to the top side of the MAXREFDES215# through an 80-way male connector that mates with a female connector on the MAXREFDES215# carrier card. Both connectors are keyed to prevent incorrect insertion of the respective cards.

### Galvanic Isolation

The Go-IO uses two different domains, which are separated using the Maxim digital isolator products. The field domain uses the 24V input supply and 24V GND for reference. The logic domain uses APP\_PWR and APP\_GND for reference and is found on the application processor card, MAXREFDES211#. Three Maxim digital isolators perform the galvanic isolation function on the MAXREFDES200# I/O control card. The MAX14483 and two MAX14130 isolate the SPI buses and control signals (i.e., chip selects, R/W lines).

The MAX14483 is a 6-channel, 3.75kV<sub>RMS</sub> digital galvanic isolator using Maxim's proprietary process technology. The six signal channels are individually optimized for SPI applications and include very low propagation delay on the SDI, SDO, and SCLK channels. For the MAXREFDES200#, the MAX14483 isolates the APP\_SPI1 bus to form the FLD\_SPI1 bus that interfaces to the local MCU used for IO-Link master functionality.

The MAX14130 is a 4-channel,  $1\text{kV}_{\text{RMS}}$  digital isolator utilizing Maxim's proprietary process technology in smaller footprint QSOP packages. This product has four unidirectional channels making it ideal for isolating control signals.

The MAX14130 and MAX14483 transfer digital signals between circuits with different power domains at ambient temperatures up to  $+125^{\circ}\text{C}$ . Independent 1.71V to 5.5V supplies on each side of the isolator also make the device suitable for use as a level translator, although this functionality is not used on the MAXREFDES200#. VDD\_IO provides logic domain power for the isolators, which is generated by using the integrated LDO within the MAX22192. 3V3\_MCU provides the field domain power for the isolators, which is generated on the MAXREFDES200#.

The MAX22192 provides additional isolation as an industrial, octal, digital input device with integrated isolation.

### **Power Supplies**

Power is supplied to the MAXREFDES200# from the MAXREFDES215# (24V) and on-board regulators that step down to provide the different voltage rails required by the I/O devices and digital isolators.

The MAXM15462 is a high-efficiency, synchronous step-down DC-DC module with integrated controller, MOSFETs, compensation components, and inductor that operates over a wide input-voltage range. The module operates from 4.5V to 42V input and delivers up to 300mA output current over a programmable output voltage from 0.9V to 5V. The module significantly reduces design complexity, manufacturing risks, and offers a true plug and play power/supply solution, reducing time-to-market.

Two modules generate 3.3V outputs, 3V3\_DIO for powering the I/O interfaces, and 3V3\_MCU for powering the local MCU, the IO-Link masters, and the field supply for the digital isolators.

The MAX22191 has an integrated LDO which generates a 3.3V output from the 24V supply, to provide the rail VDD\_IO.

### **IO Interfaces**

The MAXREFDES200# has a range of digital I/O (DIO) and analog I/O as well as communication interfaces to represent the functionality commonly found within an industrial system, such as a Programmable Logic Controller (PLC) and its associated I/O modules.

### **Digital Inputs (DI)**

The MAX22192 is an IEC 61131-2 compliant industrial digital input device with integrated isolation. The MAX22192 translates eight 24V current-sinking, industrial inputs to an isolated serialized SPI-compatible output that interfaces with 1.71V to 5.5V logic voltage. A current setting resistor allows the MAX22192 to be configured for Type 1, Type 2, or Type 3 inputs. In the MAXREFDES200#, the inputs are configured at Type 1 or Type 3. For proximity switches, the field wiring is verified using the wire break feature.

The MAX22192 has an isolated 4-pin SPI interface and the field-side accepts a single 7V to 65V supply to the VDD24F pin. When powered by the 24V field supply, the MAX22192 generates a 3.3V output on the VDD3F pin from an integrated LDO regulator, which can provide up to 25mA of current for external loads in addition to powering the MAX22192. In MAXREFDES200#, this output is the VDD\_IO rail and is used to power the field domain of the standalone digital isolators, MAX14430 and MAX14483.

The MAX22192 isolates the SPI bus and provides field domain signals that allow other field domain SPI devices to be shared with the MAX22192 and to share its isolation channels. In the MAXREFDES200#, the daisy chained SPI bus is called FLD\_SPI2 and connects to the digital output, analog I/O, and UART devices.

### **Digital Outputs (DO)**

The MAX14912 is a digital-output, octal, high-speed, high-side switch/push-pull 24V driver capable of 200kHz switching rate. The MAX14912 has eight 640mA smart high-side switches that can also be configured as push-pull drivers for high-speed switching. The device is configured and controlled through the SPI interface. Care needs to be taken when selecting the output loads to ensure they do not exceed the 1A capability of the power adapter supplied. For higher currents, a different external 24V supply is required.

In the MAXREFDES200#, the MAX14912 is configured to operate in high-side mode and the outputs are connected in pairs (1-2, 3-4, 5-6, 7-8), giving four outputs providing higher current capabilities. This configuration still supports internal safe demagnetization when switching inductive loads and does not require external diodes to dissipate the stored energy.

### **Communication Ports**

The MAXM22511 isolated RS-485/422 module with transceiver and power features a full-duplex isolated RS-485 interface. This full-duplex isolated RS-485/422 transceiver provides 2500V<sub>RMS</sub> of galvanic isolation between the cable-side (RS-485 driver/receiver side) and the UART side of the device. An integrated DC-DC powers the cable side of the module that requires no external components and removes the need for a separate field domain supply.

The MAXM22511 operates from a single 3.3V supply (3V3\_DIO) and the integrated DC-DC converter generates the 3.3V operating voltage for the cable side of the module. The MAXM22511 connects to a MAX3108 UART and has a high  $\pm 15$ kV ESD performance and up to 25Mbps data rate.

### **UART**

The MAXM22511 RS-485 transceiver TX and RX pins connect to a MAX3108 advanced universal asynchronous receiver-transmitter (UART), which has 128 words of receive and transmit first-in/first-out (FIFO) and connects using a high-speed SPI interface to the isolated field SPI bus and, thereafter, the application processor MCU.

## IO Link Master

The MAXREFDES200# uses two MAX14819 dual-channel IO-Link master transceivers with a STM32F412 MCU that supports TMG's stack for implementing a 4-channel IO-Link master.

The MAX14819 low-power, dual-channel, IO-Link master transceiver with sensor/actuator power-supply controllers is fully compliant with the latest IO-Link and binary input standards and test specifications, IEC 61131-2, IEC 61131-9 SDCI, and IO-Link 1.1.2. This master transceiver also includes two auxiliary digital input (DI\_) channels. The MAX14819 also features autonomous cycle timers, reducing the need for accurate controller timing. Integrated establish-communication sequencers also simplify wake-up management. The MAX14819 integrates two low-power sensor supply controllers with advanced current limiting, reverse current blocking, and reverse polarity protection capability to enable low-power robust solutions.

The 4-port IO-Link master uses TMG's IO-Link master stack, with the software running on a STM32F412 Arm Cortex-M4 microcontroller. Each of the two MAX14819 transceivers connect to a UART in the STM32F412 as well as through a local SPI bus for configuration. The MAXREFDES200# ships with the master stack preprogrammed inside with an indefinite time license.

For further information about TMG and their software, contact Technologie Management Gruppe, Technologie und Engineering GmbH:

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## Detailed Description of the MAXREFDES201# Motion Control Module

**Figure 8** shows the system block diagram for the MAXREFDES201#.

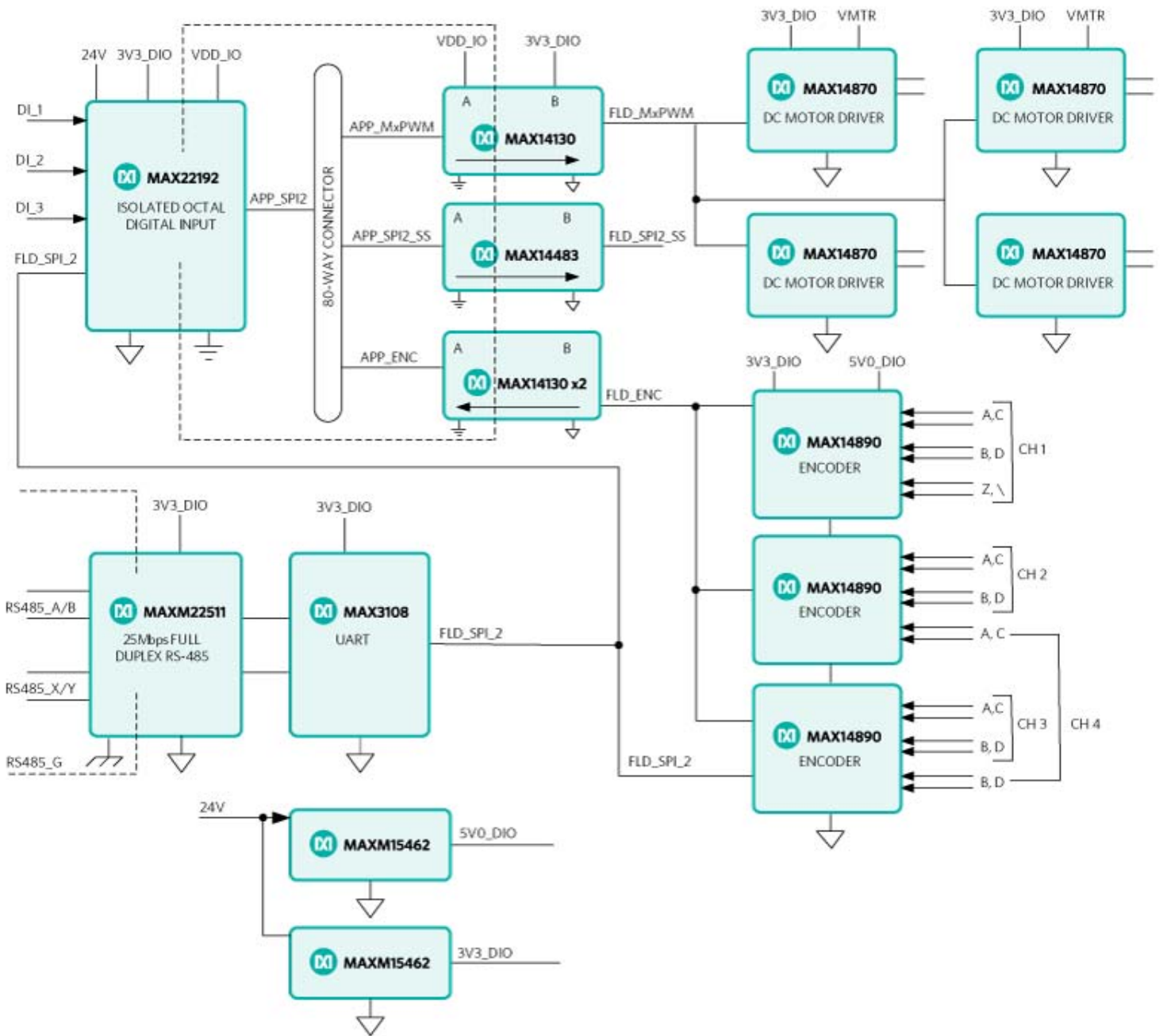


Figure 8. MAXREFDES201# block diagram.

Figure 9 shows the top view of the MAXREFDES201#.



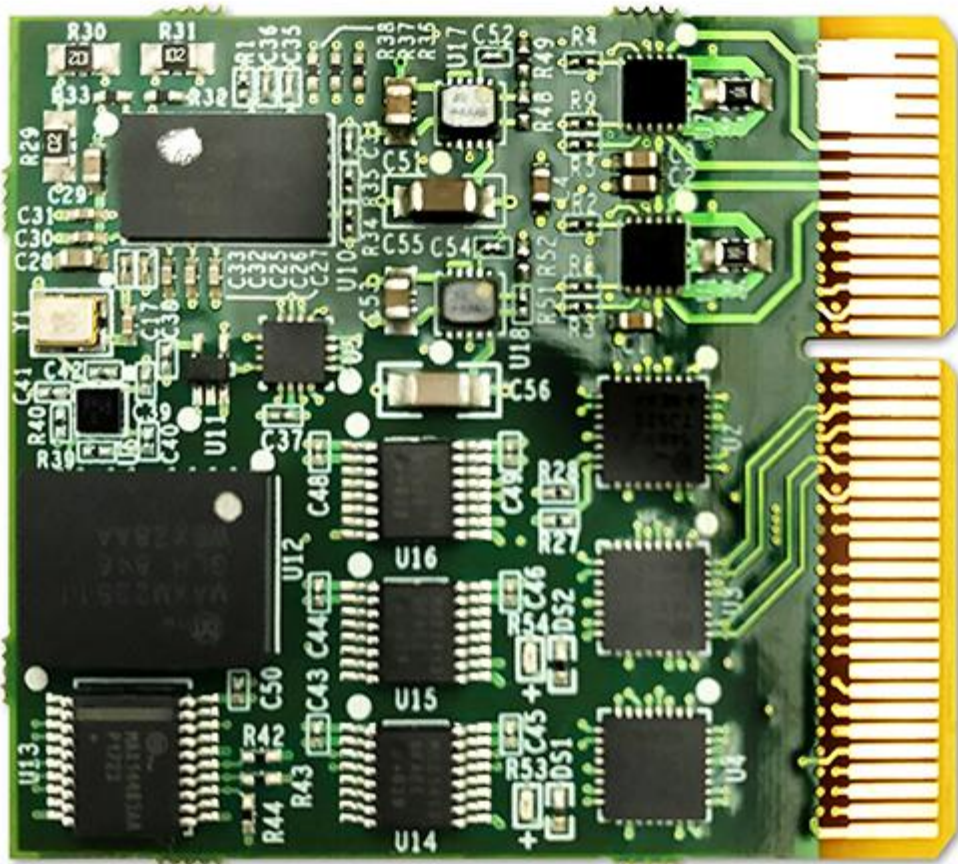


Figure 9. MAXREFDES201# top view.

### Connections

The MAXREFDES201# connects to the top side of the MAXREFDES215# through an 80-way male connector that mates with a female connector on the MAXREFDES215# carrier card. Both connectors are keyed to prevent incorrect insertion of the respective cards.

### Galvanic Isolation

The Go-IO uses two different domains, which are separated using the Maxim digital isolator products. The field domain uses the 24V input supply and 24V GND for reference. The logic domain uses APP\_PWR and APP\_GND for reference and is found on the application processor card, MAXREFDES211#. Four Maxim digital isolators perform the galvanic isolation function on the MAXREFDES201# I/O control card. The MAX14130 (3 off) and MAX14483 isolate the SPI bus chip selects and other control signals (i.e., PWM, encoder lines). VDD\_IO provides the logic domain power for the isolators and is generated using the integrated LDO within the MAX22192. 3V3\_DIO provides field domain power for the isolators and is generated on the MAXREFDES201# card. The MAX22192 provides additional isolation and is an industrial octal digital input device with integrated isolation.

## Power Supplies

Power is supplied to the MAXREFDES201# from the MAXREFDES215# (24V), and on-board regulators step down to provide the different voltage rails required by the I/O devices and digital isolators.

The MAXM15462 is a high-efficiency, synchronous step-down DC-DC module with integrated controller, MOSFETs, compensation components, and inductor that operates over a wide input-voltage range. The module operates from 4.5V to 42V input and delivers up to 300mA output current over a programmable output voltage from 0.9V to 5V. The module significantly reduces design complexity, manufacturing risks, and offers a true plug and play power/supply solution, reducing time-to-market.

One module generates a 3.3V output (3V3\_DIO) used for powering the I/O interfaces and the field supply for the digital isolators. A second module generates a 5.0V output (5v0\_DIO) used as one of the supplies for the MAX14890 encoders.

The MAX22192 has an integrated LDO which generates a 3.3V output from the 24V supply to provide the rail VDD\_IO.

## IO Interfaces

The MAXREFDES201# has a range of digital input and motor control interfaces as well as communication interfaces.

## Digital Inputs

The MAX22192 is an IEC 61131-2 compliant industrial digital input device with integrated isolation. In the MAXREFDES211# three of the eight inputs are used to provide Type 1 or Type 3 interfaces. The MAX22192 has an isolated 4-pin SPI interface.

The MAX22192 isolates the APP\_SPI2 bus and provides field domain signals to allow other field-side SPI devices to be shared with the MAX22192 and to share its isolation channels. In the MAXREFDES201#, the shared SPI bus is called FLD\_SPI2 and connects to the encoder and UART devices. The MAX22192 is powered by a 24V field supply and generates a 3.3V output on the VDD3F pin from an integrated LDO regulator, which is used to power the MAX22192 and the field domain (VDD\_IO) of the standalone digital isolators, MAX14430, and MAX14483.

## DC Motor Drivers

The MAX14870 motor drivers provide a small, low-power and simple solution for driving and controlling the brushed DC motors and relays with voltages between 9V and 35V. Very low driver on-resistance reduces power dissipation. Input power for these circuits is supplied by the green connector. In the MAXREFDES201#, four motor drivers are included, each supporting peak loads up to 2A. All motor driver control signals (i.e., EN, DIR, PWM) are connected to the application processor, MAXREFDES211#, through the digital isolators.

## Encoders

The MAX14890E incremental encoder receiver contains four differential receivers and two single-ended receivers. The differential receivers can be operated in RS-422 or differential high-threshold logic (HTL) modes and are optionally configurable for single-ended TTL/HTL operation. The MAXREFDES201# uses three encoders. Each encoder has A, B, and Z differential inputs and an SPI interface that provides diagnostics and individual configurations for each receiver. The three MAX14890E encoders are daisy chained and connected to the isolated field domain SPI bus, FLD\_SPI2.

## Communication Ports

The MAXM22511 isolated RS-485/422 module with transceiver and power features a full-duplex isolated RS-485 interface. This full-duplex isolated RS-485/422 transceiver provides 2500V<sub>RMS</sub> of galvanic isolation between the cable-side (RS-485 driver/receiver side) and the UART side of the device. An integrated DC-DC powers the cable side of the module that requires no external components and removes the need for a separate field domain supply.

The MAXM22511 operates from a single 3.3V supply (3V3\_DIO) and the integrated DC-DC converter generates the 3.3V operating voltage for the cable side of the module. The MAXM22511 connects to a MAX3108 UART and has a high  $\pm 15$ kV ESD performance and up to 25Mbps data rate.

## UART

The MAXM22511 RS-485 transceiver TX and RX pins connect to a MAX3108 advanced universal asynchronous receiver-transmitter (UART), which has 128 words of receive and transmit first-in/first-out (FIFO) and connects using a high-speed SPI interface to the isolated field SPI bus and, thereafter, the application processor MCU.

## Quick Start Guide

The Go-IO industrial IoT reference design can be used to control IO-Link, digital input (DI), digital output (DO), and RS-485 devices. This quick start guide shows how to get the system up and running to exercise these IO peripherals.

### Required Equipment:

Maxim Supplied:

- MAXREFDES200# Go-IO Factory Automation Board
- MAXREFDES211# Application Processor Board
- MAXREFDES215# Carrier Board
- 24V 1A DC Wall Adapter

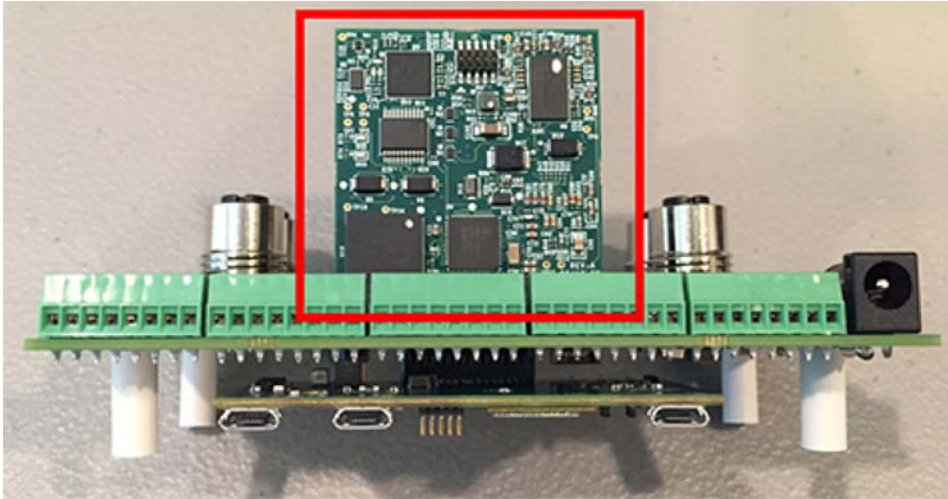
User supplied:

- Windows<sup>®</sup> 7, Windows 8, Windows 10 PC with USB port
- Micro USB 2.0 cable
- Devices (IO-Link device, RS-485 device, DI device, DO device)

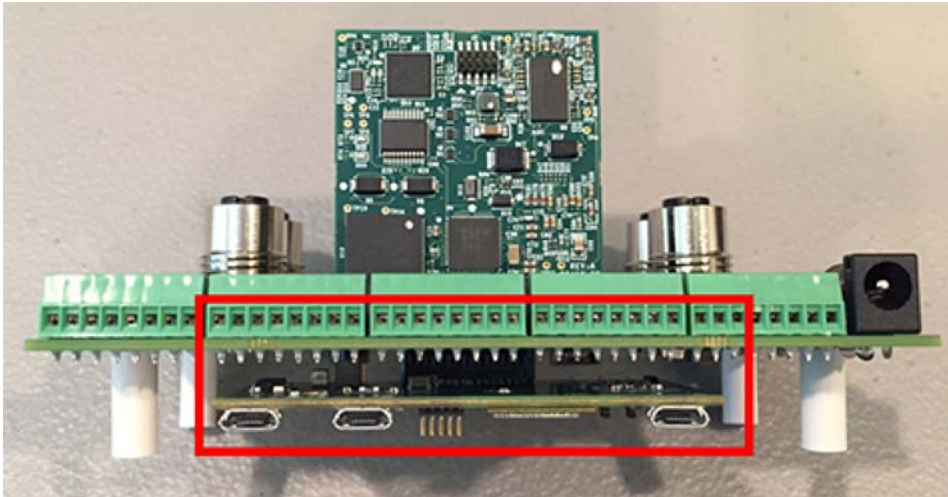
- Cables to connect devices (M12 or wires)
- Terminal program such as PuTTY
- FTDI COM port drivers

## Initial Setup Procedure

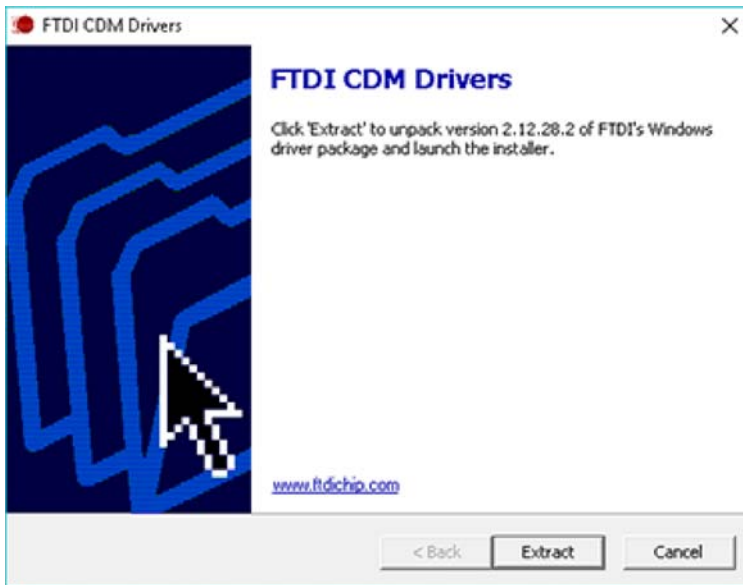
1. Connect the MAXREFDES200# to the carrier board MAXREFDES215#.



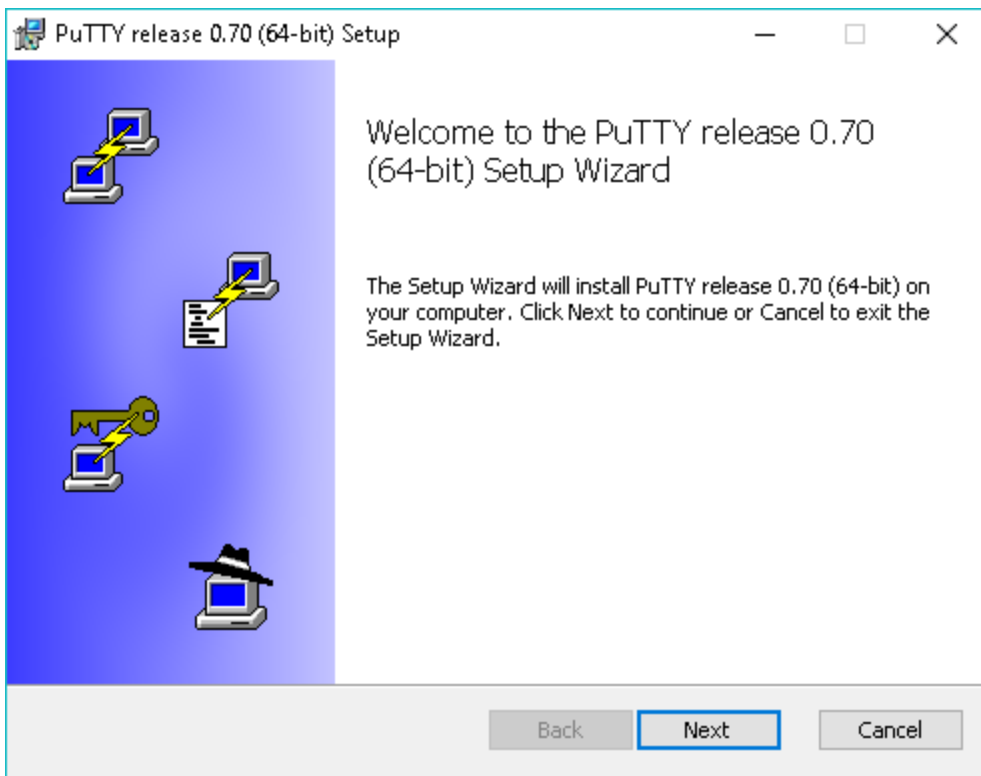
2. Connect the MAXREFDES211# to the carrier board MAXREFDES215#.



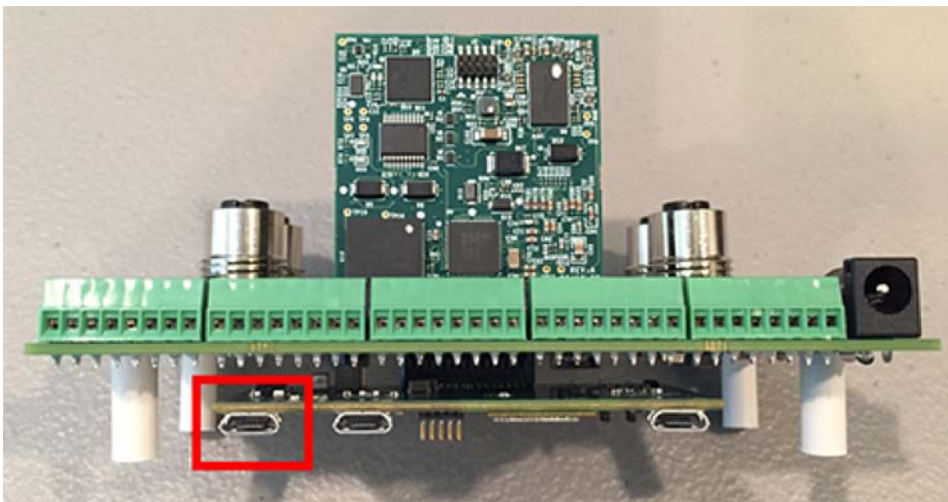
3. Connect any other I/O devices to the respective I/O connectors.
4. Power boards by connecting the 24V DC power adapter into an outlet and into the barrel connector on the MAXREFDES215# carrier board.
5. Download and install the FTDI drivers for COM port functionality. Go to [https://www.ftdichip.com/Drivers/CDM/CDM21228\\_Setup.zip](https://www.ftdichip.com/Drivers/CDM/CDM21228_Setup.zip).
  - Unzip the folder and double click the executable file to install the drivers.



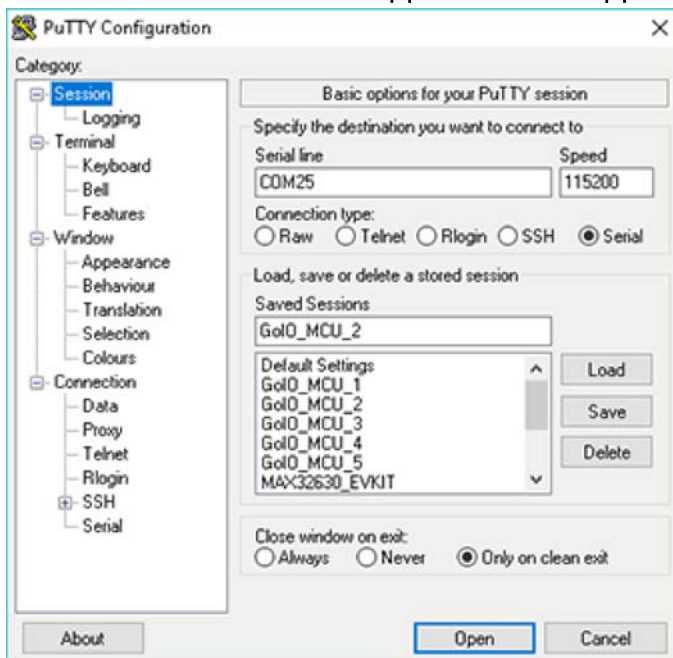
6. If not already installed, download a terminal program such as PuTTY.
  - o For Windows 32-bit, go to <https://the.earth.li/~sgtatham/putty/latest/w32/putty-0.70-installer.msi>.
  - o For Windows 64-bit, go to <https://the.earth.li/~sgtatham/putty/latest/w64/putty-64bit-0.70-installer.msi>.
  - o Double click the msi file to install.



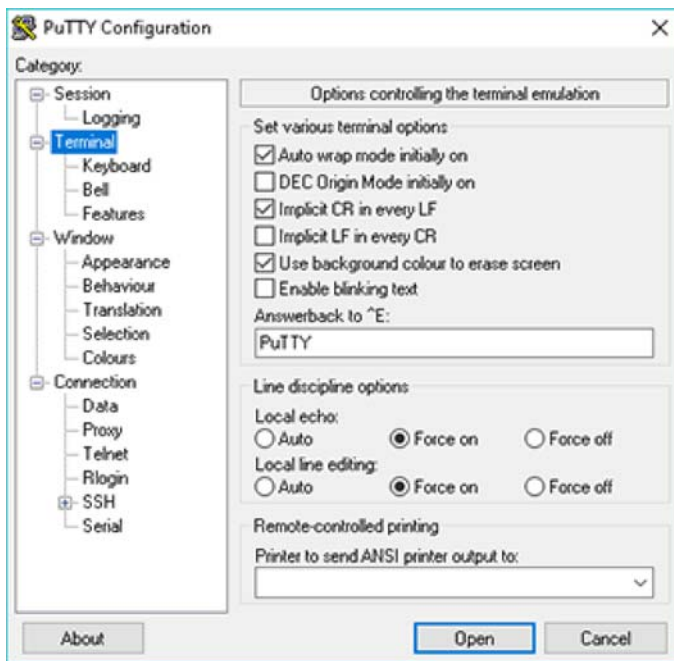
7. Connect the micro USB cable to the PC and to CN1 on the MAXREFDES211#.



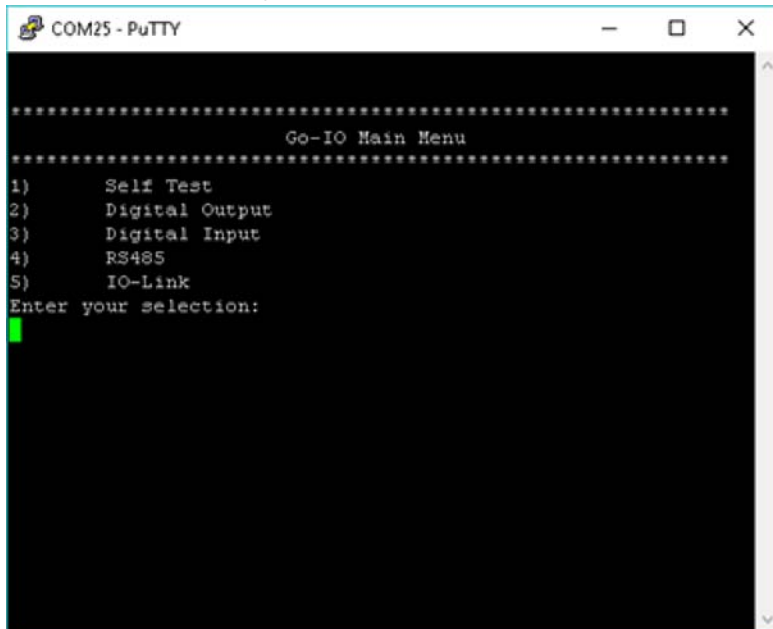
8. When the device is powered and connected, open PuTTY and select "Session" in the left panel.
  - Select the connection type to "Serial."
  - In the "Speed" field, enter 115200.
  - In the "Serial line" field, enter the COM port "COMxxx," where xxx is replaced with the port number. To check the port number, open the Device Manager and unplug and re-plug to see which USB Serial Port disappears and reappears.



9. Select "Terminal" in the left panel.
  - Mark the check box for "Implicit CR in every LF."
  - For local echo, select the radio button "Force on."
  - For local line editing, select the radio button "Force on."



10. It is recommended to go back to "Session" in the left panel and save the session so that the settings can be easily reopened.
11. Once saved, click "Open."
12. If there is an empty terminal window, press "a" and "Enter" to display the main menu.



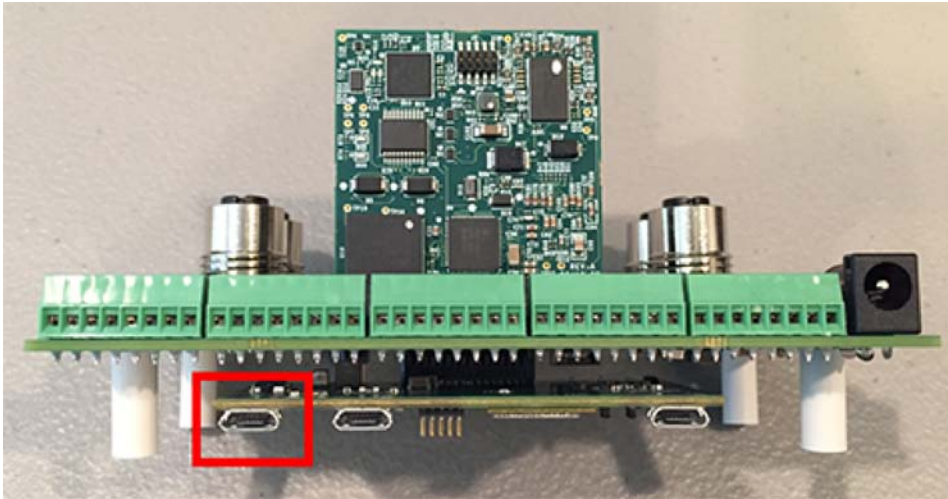
13. Follow the terminal prompts to exercise the desired I/O.

### Self-test Procedure

The self-test can help ensure that the Go-IO is operating as expected.

1. Complete the Initial Setup Procedure.
2. Remove power from the MAXREFDES215# before making new connections.

3. To run the full self-test, connect the following on the MAXREFDES215#:
  - DO1 → DI1 (IO\_09+ → IO\_01+)
  - DO2 → DI3 (IO\_10+ → IO\_03+)
  - DO3 → DI5 (IO\_11+ → IO\_05+)
  - DO4 → DI3 (IO\_12+ → IO\_07+)
  - Connect each of the four IO-Link ports to a MAXREFDES27# (not supplied) or four other user-supplied IO-Link sensors
4. Reconnect power to the MAXREFDES215#.
5. Connect the USB cable to the PC and CN1 of the MAXREFDES211#.



6. Open the PuTTY program and load the previously saved settings to connect.
7. Press "a" and then press "Enter" to show the main menu.
8. Press "1" and "Enter" to run the self-test.



```
*****
                          Self Tests
*****
FW Version:      0.1
Variant:         Industrial Automation-MAXREFDES200#
System freq:     96000000 Hz
*****

                          MAX14912 Tests
                          HW
Test- MAX14912_write_mode(0, 0): 0           pass
Test- MAX14912_read_mode(0): 0             pass
Test- MAX14912_write_mode(1, 1): 0         pass
Test- MAX14912_read_mode(1): 1            pass
Test- MAX14912_write_mode(2, 0): 0         pass
Test- MAX14912_read_mode(2): 0            pass
Test- MAX14912_write_mode(3, 1): 0         pass
Test- MAX14912_read_mode(3): 1            pass
Test- MAX14912_write_mode_all(0x01): 0     pass
Test- MAX14912_read_mode_all(): 0xff      pass
Test- MAX14912_write_mode_all(0x00): 0     pass
Test- MAX14912_read_mode_all(): 0x00      pass
Test- MAX14912_write_output(0, 1): 0       pass
Test- MAX14912_read_output(0): 1          pass
Test- MAX14912_write_output(1, 0): 0       pass
Test- MAX14912_read_output(1): 0          pass
Test- MAX14912_write_output(2, 1): 0       pass
Test- MAX14912_read_output(2): 1          pass
Test- MAX14912_write_output(3, 0): 0       pass
Test- MAX14912_read_output(3): 0          pass
Test- MAX14912_write_output_all(0x00): 0   pass
Test- MAX14912_read_output_all(): 0x00    pass
Test- MAX14912_write_output_all(0xff): 0   pass
Test- MAX14912_read_output_all(): 0xff    pass
Test- MAX14912_write_output_all(0x00): 0   pass
Test- MAX14912_read_output_all(): 0x00    pass
*****

                          MAX22192 Tests
                          HW
Test- MAX22192_read_input(0): 1           pass
Test- MAX22192_read_input(1): 0          pass
Test- MAX22192_read_input(2): 1          pass
Test- MAX22192_read_input(3): 0          pass
Test- MAX22192_read_input(4): 1          pass
Test- MAX22192_read_input(5): 0          pass
Test- MAX22192_read_input(6): 1          pass
Test- MAX22192_read_input(7): 0          pass
Test- MAX22192_read_input_all(): 0x55    pass
Test- MAX22192_read_input_all(): 0x55    pass
*****

                          MAX3108 Tests
                          HW
Test- MAX3108_write(txbuf, 12): 0         pass
Test- MAX3108_read_rx_fifo_level(): 12    pass
Test- MAX3108_read(rxbuf, 12): 0         pass
*****

                          IO-Link Tests
                          HW
Test- IO-Link Dev Connect Ch1: 0         pass
Test- IO-Link ISDU Read Ch1 VendorID: 0x01DE pass
Test- IO-Link ISDU Read Ch1 DeviceID: 0x00000002 pass
Test- IO-Link Dev Connect Ch2: 0         pass
Test- IO-Link ISDU Read Ch2 VendorID: 0x01DE pass
Test- IO-Link ISDU Read Ch2 DeviceID: 0x00000002 pass
Test- IO-Link Dev Connect Ch3: 0         pass
Test- IO-Link ISDU Read Ch3 VendorID: 0x01DE pass
Test- IO-Link ISDU Read Ch3 DeviceID: 0x00000002 pass
Test- IO-Link Dev Connect Ch4: 0         pass
Test- IO-Link ISDU Read Ch4 VendorID: 0x01DE pass
Test- IO-Link ISDU Read Ch4 DeviceID: 0x00000002 pass
*****

                          Failure Totals
MAX14912 Fails- 0
MAX3108 Fails- 0
```

```
MAXREFDES Fails- 0
MAX3108 Fails- 0
IO-Link Fails- 0

                                PASS

*****
                                End of Tests
*****
```

9. The self-test program runs three tests for each IO-Link port.
  - o Initial test establishes a connection.
    - If all connections are made, you should see 0 failure totals, and a final PASS result.
    - If all connections are not made, a connection error has occurred, and the module is unusable.
  - o Vendor ID and device ID tests. The test program assumes the IO-Link sensor on each IO-Link port is the MAXREFDES27# and looks for the vendor ID and device ID. If an alternative sensor is used and a non-zero value is returned for each ID, the test does not provide a FAIL result.
10. The user must manually check that the reported values for the vendor ID and device ID (reported in the GUI) are correct and match the values for the IO-Link sensor IODD file.

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**MAXREFDES200# is not sold as a standalone reference design. It is only available through the purchase of the MAXREFDES212#.**

#### Resources

 PARTS USED

 TRAININGS & VIDEOS

