

# Ultra-Portable IO on the Go



Smart factories (often referred to as Industry 4.0) are made possible through the convergence of industrial IoT, adaptive manufacturing, cloud computing, and artificial intelligence. Together, these four elements increase productivity by providing the flexibility to adapt manufacturing lines. This allows the production of multiple products without the need to stop production or schedule a technician to reconfigure equipment. Increasingly, this new level of intelligence is being moved to the very edge of the factory floor.

The **MAXREFDES212** Go-IO (Figure 1) consists of multiple software configurable IOs in a compact form factor (less than 1 cubic inch) to address the needs of industrial automation, building automation, and industrial robotics.

## CONFIGURABLE ANALOG

The **MAX22000** Configurable Analog IC (Figure 2) offers best in class ADC and DAC performance with the flexibility to change its operational modes and to connect different types of sensors and devices to the same universal four pin connector. This includes implementation of temperature measurements with the resistive temperature detector (RTD) and thermocouples (TC).

### Key Benefits:

- Software configurable as analog input or output, voltage or current
- $\pm 12.5V$  input/output range and  $\pm 25mA$  current input/output
- Integrated analog front end (AFE) and voltage reference
- Robust  $\pm 36V$  protection on all analog I/O ports
- Seamless operation with **MAX14914A** to implement true universal IO (analog + digital) while increasing accuracy compared to traditional inputs

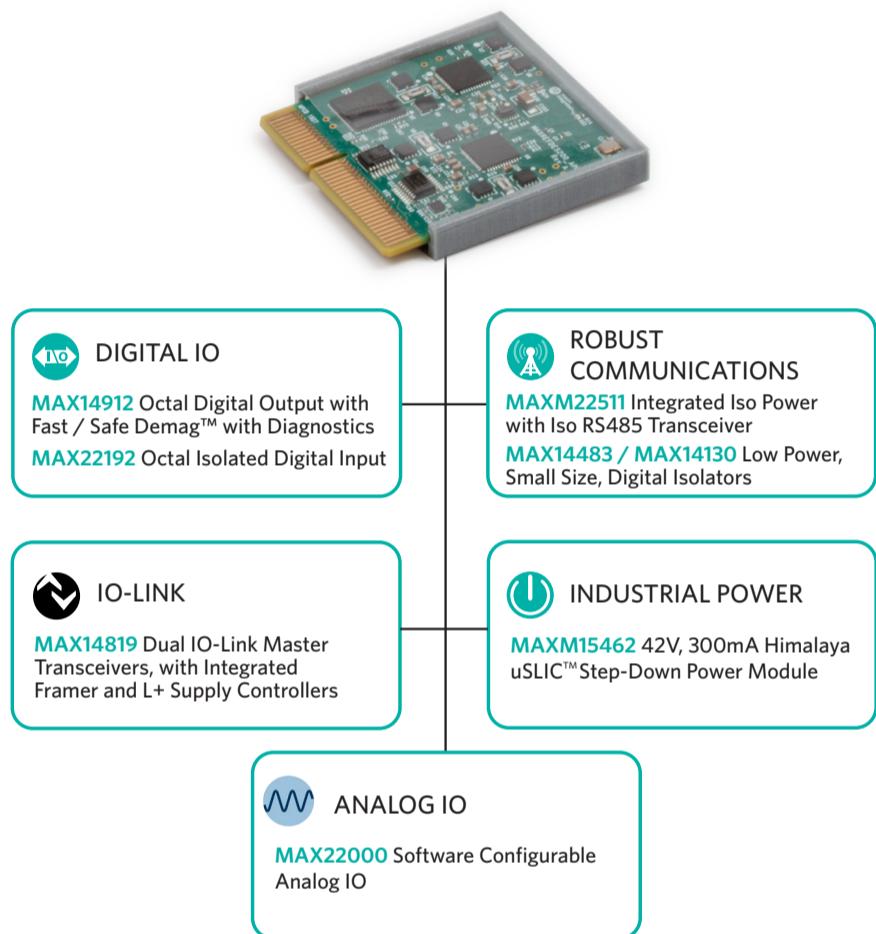


Figure 1. Go-IO Key Enabling Technologies

## ISOLATED DIGITAL INPUT

The **MAX22192** octal isolated digital input (Figure 3) translates eight, 24V, current-sinking industrial inputs to an isolated, SPI-compatible output.

### Key Benefits:

- **Power Savings:** Current limiters on each digital input greatly reduce power dissipation while increasing accuracy compared to traditional resistive inputs
- **Flexible Configuration:** Can be configured for Type 1, 3 or Type 2 inputs

- **"Energy-less" LEDs:** Current from the input signals is routed through LEDs, meeting the IEC 61131-2 requirements with no additional power dissipation
- **Wire Break Detection:** Provided by a second threshold detector on each input

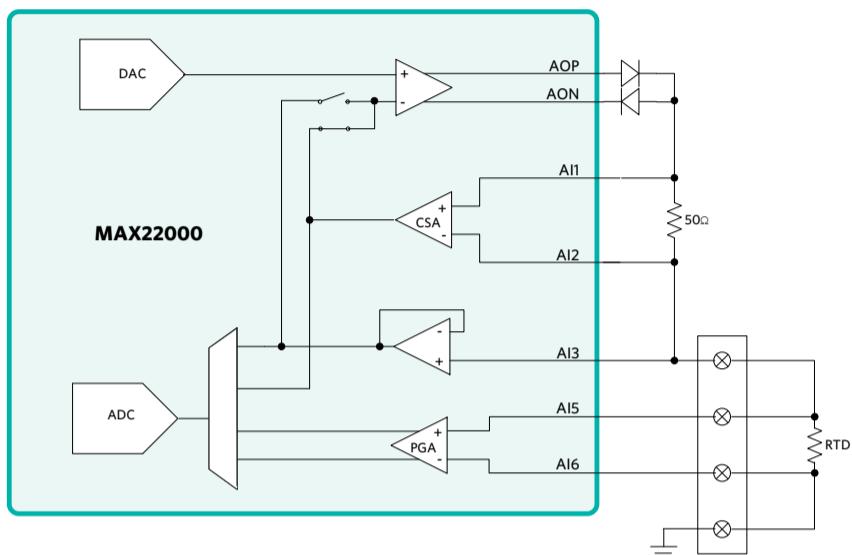


Figure 2. MAX22000 Configurable Analog IO

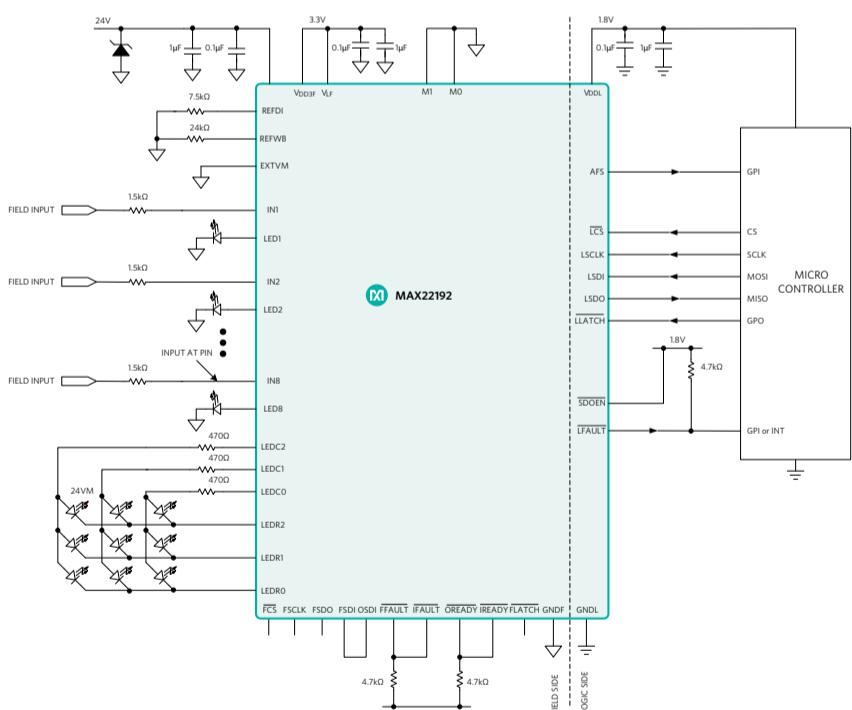


Figure 3. MAX22192 Octal Isolated Digital Input

## ISOLATION

The **MAX14483** (Figure 4) 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.

### Key Benefits:

- **High-Speed SPI:** Low propagation delay on SCLK, SDI, and SDO with up to 200Mbps data rate
- **Robust Operation:** Galvanic isolation of digital signals
  - Withstands 3.75kV<sub>RMS</sub> for 60s (V<sub>ISO</sub>)
  - Continuously withstands 450V<sub>RMS</sub> (V<sub>IOWM</sub>)
  - Withstands  $\pm 10\text{kV}$  surge between GNDA and GNDB with 1.2/50 $\mu\text{s}$  waveform

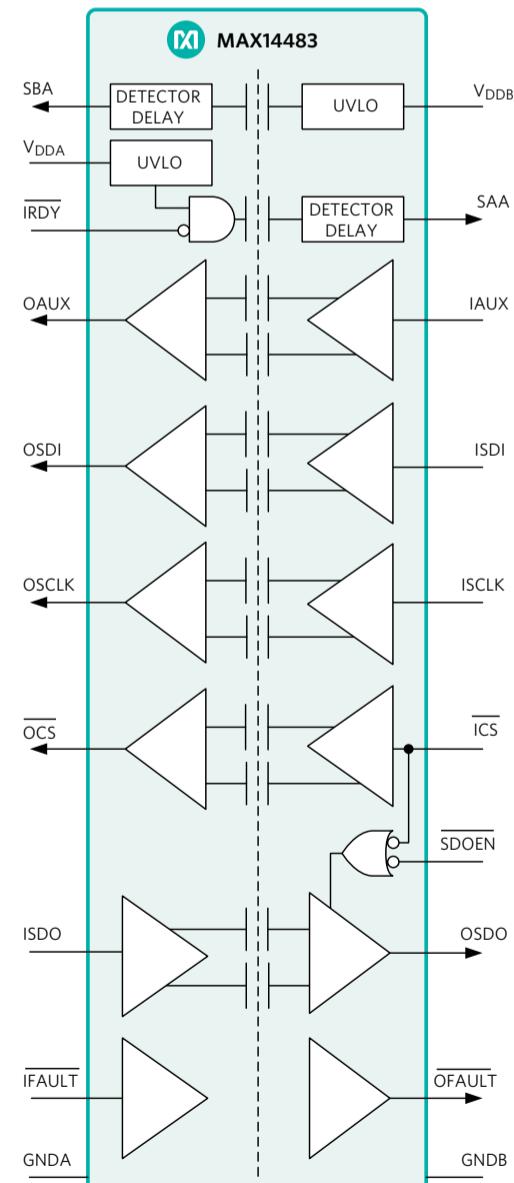


Figure 4. MAX14483 Digital Isolator

## Industrial Digital I/O Interface Product Selector Table

Device Type	Device Evaluated	Device Description	Evaluation Kit	Peripheral Module Board
Digital Input	<a href="#">MAX22190</a>	8-Channel Industrial Digital Input with Diagnostics	<a href="#">MAX22190EVKIT</a>	<a href="#">MAX22190PMB</a>
Digital Input	<a href="#">MAX22191</a>	Single-Channel Parasitically Powered Digital Input	<a href="#">MAX22191EVKIT</a>	<a href="#">MAX22191PMB</a>
Digital Input	<a href="#">MAX22192</a>	Octal Industrial Digital Input with Diagnostics and Digital Isolation	<a href="#">MAX22192EVKIT</a>	
Digital Input	<a href="#">MAX22195</a>	High-Speed, Octal, Industrial Digital Input with Parallel Output	<a href="#">MAX22195EVKIT</a>	
Digital Output	<a href="#">MAX14912</a>	8-Channel High-Speed, Digital Output Driver	<a href="#">MAX14912EVKIT</a>	<a href="#">MAX14912PMB</a>
Digital IO	<a href="#">MAX14914</a>	Single-Channel Driver, Configurable as DI or DO	<a href="#">MAX14914EVKIT</a>	<a href="#">MAX14914PMB</a>
Digital IO	<a href="#">MAX14906</a>	Quad-Channel Driver, Configurable as DI or DO	<a href="#">MAX14906EVKIT</a>	
Digital Output	<a href="#">MAX14915</a>	8-Channel Industrial Digital Outputs with Diagnostics	<a href="#">MAX14915EVKIT</a>	
Digital Output	<a href="#">MAX14916</a>	8-Channel 1A/4-Channel 2A Industrial Digital Outputs with Diagnostics	<a href="#">MAX14916EVKIT</a>	
Digital Output	<a href="#">MAX14917</a>	8-Channel Industrial Digital Outputs	<a href="#">MAX14917EVKIT</a>	
Digital Output	<a href="#">MAX14922</a>	High Side Switch Controller	<a href="#">MAX14922EVKIT</a>	

## DIGITAL OUTPUT

Additional space and power savings are achieved in the digital output drivers using the **MAX14912**/**MAX14913** octal high-speed, high-side switch and push-pull driver.

## Key Benefits:

- **Reduced Heat Dissipation:** Best-in-class  $R_{ON}$  of 230m $\Omega$  (max)
- **“SafeDemag”:** Safe discharge of any inductive loads using Maxim’s proprietary technology

## IO-LINK

Two-way communication with up to four IO-Link® smart sensors is made possible via the two dual-channel **MAX14819** IO-Link master transceivers (Figure 5).

## Key Benefits:

- **Low-Power Architecture:** Low driver on-resistance ( $1\Omega$ )
- **Integrated IO-Link Framer:** Eliminates the need for external UARTs and relieves microcontroller from timing-critical task
- **Flexible Configuration:**
  - Two auxiliary Type 1/Type 3 digital inputs
  - Supports NPN sensors
  - Dual 24V sensor supply controller
- **Robust Performance:** Integrated protection with overvoltage and reverse-polarity protection on all interface pins

## RS-485 ROBUST COMMUNICATIONS

Robust communication is provided by the **MAXM22511** (Figure 6) RS-485 transceiver. Data and power isolation are provided in a single integrated package which needs no external components, saving space and design costs.

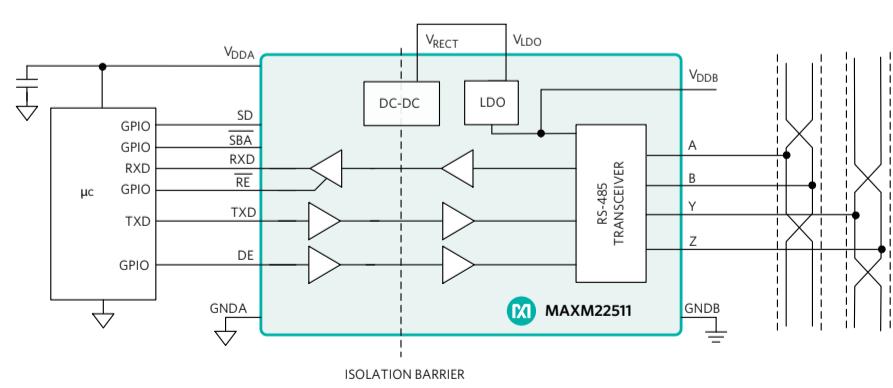
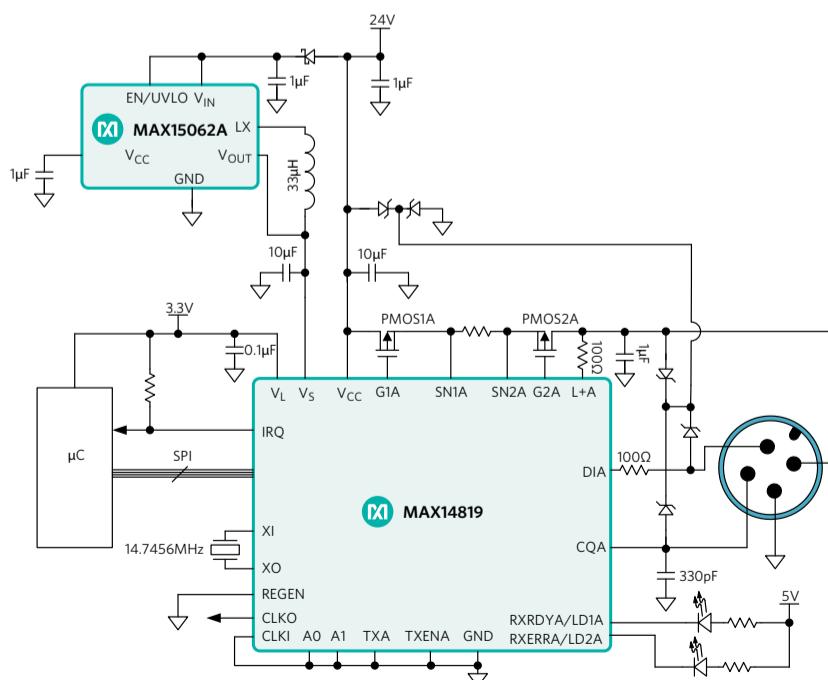


Figure 6. MAXM22511 RS-485 Transceiver

Figure 5. MAX14819 Dual IO-Link Master Transceiver

## POWER CONVERSION

The DC-DC voltage conversion stage of the Go-IO reference design further demonstrates potential power and space savings.

The **MAX17681** high-voltage, high-efficiency, iso-buck DC-DC converter provides isolated power up to 3W. The device operates over a wide 4.5V to 42V input and uses primary-side feedback to regulate the output voltage. The MAX17681 uses peak-current-mode control. The low-resistance, on-chip MOSFETs ensure high efficiency at full load while simplifying the PCB layout.

The **MAXM15462** (Figure 7) 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 a 4.5V to 42V input and delivers up to 300mA output current over a programmable output voltage from 0.9V to 5V.

Additional Benefits:

- **Robust Operation:**

- Hiccup overcurrent protection
- Overtemperature protection
- -40°C to +125°C ambient operating temperature
- -40°C to +150°C junction temperature

- **Rugged and Reliable:**

- Complies with CISPR22 (EN55022) Class B conducted and radiated emissions
- Passes drop, shock, and vibration standards: JESD22-B103, B104, B111

- **Space-Saving:**

- Available in a low-profile, compact 10-pin, 2.6mm × 3mm × 1.5mm, uSLIC™ package

## CONCLUSION

The Go-IO PLC reference design provides designers and industrial engineers with the flexibility to find the best solution for software configurable IOs low power dissipation, robust performance, and improved diagnostics, all in the smallest possible form factor.

## LEARN MORE

- **MAXREFDES212** Go-IO Industrial IoT Reference Design
- **MAX22000** Software Configurable Analog IO
- **MAX14870** Motor Driver
- **MAX14912** Digital Output Driver
- **MAX22192** Octal Isolated Digital Input
- **MAX14483** Digital Isolator
- **MAXM22511** RS-485 Transceiver
- **MAXM15462** Step Down DC-DC Power Module
- **MAX17681** Step Down DC-DC Converter
- **MAX14819** IO-Link Master Transceiver
- **MAX32630** Microcontroller

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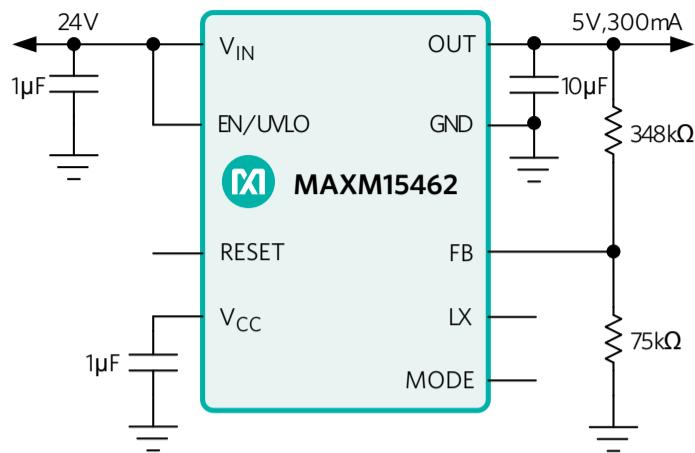


Figure 7. MAXM15462 DC-DC Module