

Put the Power of Industry 4.0 in Your Pocket

MEET THE POCKET IO

INTRODUCTION

The fourth revolution in manufacturing and process automation, often referred to as Industry 4.0, will advance on the backbone of connected systems: sensors, actuators, and control systems, all linked through networks via the internet protocol. Sensor data will be analyzed to optimize manufacturing, predict failures, schedule maintenance and automatically replenish inventory. This poses a considerable challenge for programmable logic controller (PLC) design engineers who are required to pack more functionality into enclosures that keep getting smaller. Higher input/output (I/O) density and smaller form factors also add to the design challenge in another basic way: the system must be more power efficient than ever to prevent the PLC from overheating, especially in an application where fans and vents are generally not acceptable.

ADDRESSING THE CHALLENGE

Fortunately, a new solution is available which leverages the latest chip integration technology. Combining multiple discrete functions in a single IC provides system designers with significant advantages in size, power consumption and cost. Maxim Integrated's groundbreaking **MAXREFDES150 Pocket IO™ PLC Development Platform** (Figure 1) uses analog integration to enable lower heat dissipation and faster throughput than ever before, in an extremely compact footprint of less than ten cubic inches.

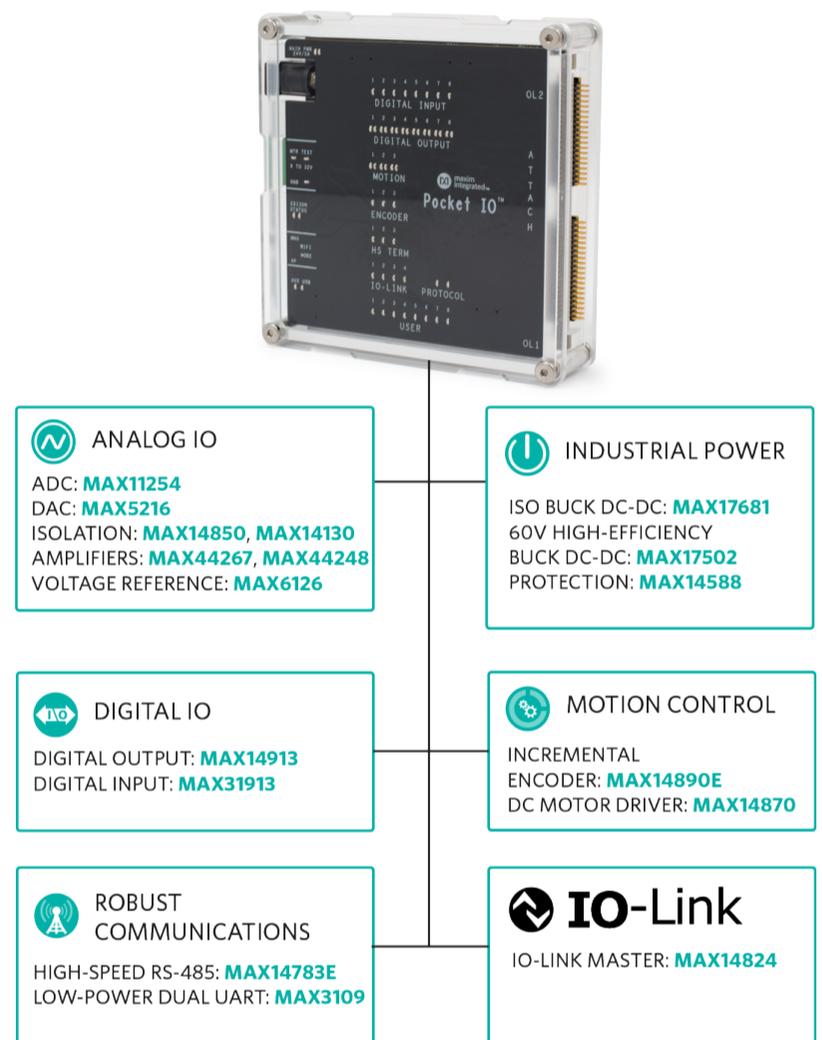


Figure 1. Pocket IO Functional Blocks

ANALOG IO

Pocket IO features a complete analog input signal chain consisting of a multi-channel 24-Bit sigma-delta ADC (**MAX11254**), a 36V precision, low-power operational amplifier (**MAX44248**), and an ultra-precision voltage reference (**MAX6126**). The analog output signal chain consists of a 16-bit, low-power, buffered output, rail-to-rail DAC with SPI Interface (**MAX5216**).

DIGITAL INPUT

Pocket IO uses the **MAX31913** multichannel serializer (Figure 2) to translate, condition, and serialize the 24V digital outputs of sensors and switches to the 5V, CMOS-compatible levels required by system microcontrollers.

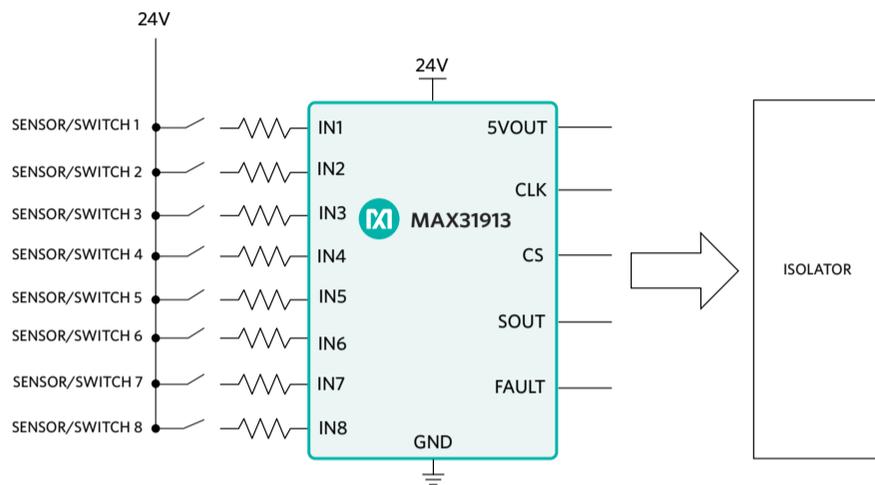


Figure 2. MAX31913 8-Channel Serializer

Benefits of MAX31913 include:

- Higher density I/O boards are possible
- Lowest power/heat dissipation available
- Isolation is required on only three channels
- SPI ports can share the same three isolated channels by daisy chaining multiple serializers

DIGITAL OUTPUT

Further space and power savings are achieved in the digital output drivers through the use of the **MAX14912/MAX14913** (Figure 4) octal high speed, high-side switch and push-pull driver.

Benefits include:

- Best-in-class R_{ON} , to reduce heat dissipation
- Safe discharge of any inductive loads through the use of Maxim's "Safe DeMag" technology.
- High speed switching up to 200kHz

ISOLATION

The **MAX14130** CMOS digital isolator (Figure 3) isolates the input channels, negating the need for inefficient optocouplers.

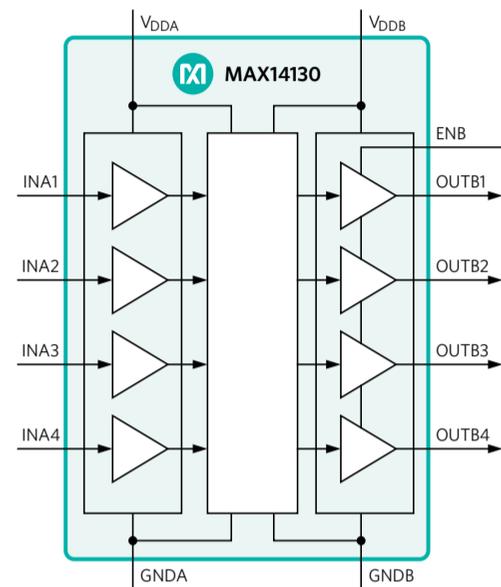


Figure 3. MAX14130 Digital Isolator

Other benefits of this isolator include:

- Ideal for use in electrically noisy applications
- Enables direct interfacing to low voltage ASIC's and micros, from 1.8V to 5.5V
- Small form factor (6mm x 5mm QSOP) with $1kV_{RMS}$ isolation

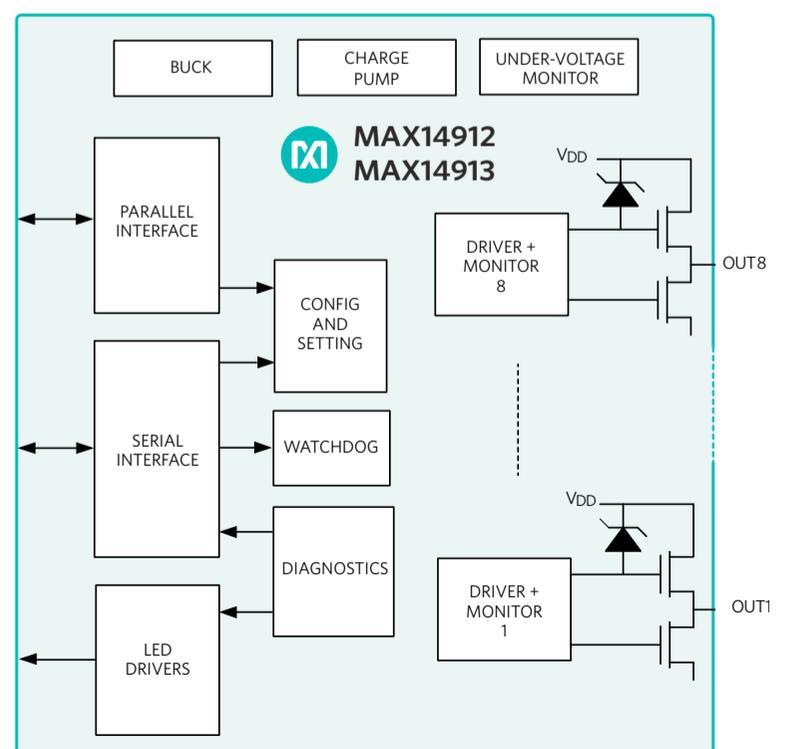


Figure 4. MAX14912/MAX14913

IO-LINK

Four IO-Link® ports allow two-way communication with smart sensors, via the **MAX14824** master transceiver (Figure 5).

Key benefits include:

- Scalable up to 16 master devices on a single bus, reducing component count
- Eases host controller processing by checking C/Q data line polarity and inverting
- Two integrated LDO's save board space

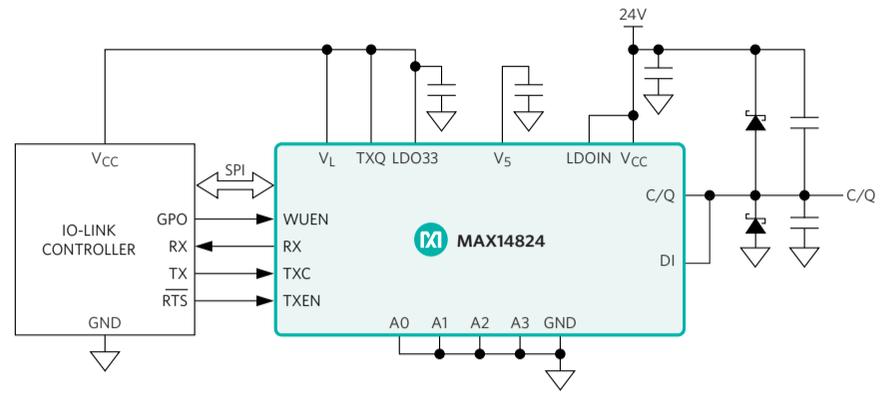


Figure 5. MAX14824 IO-Link Master Transceiver

MOTOR DRIVER

The **MAX14870** DC motor driver (Figure 6) provides a small, low-power, simple solution for driving and controlling brushed DC motors and relays with voltages between 4.5V and 36V.

Advantages include:

- Very low driver on-resistance reduces power dissipation
- Charge-pump-less design reduces complexity and solution size

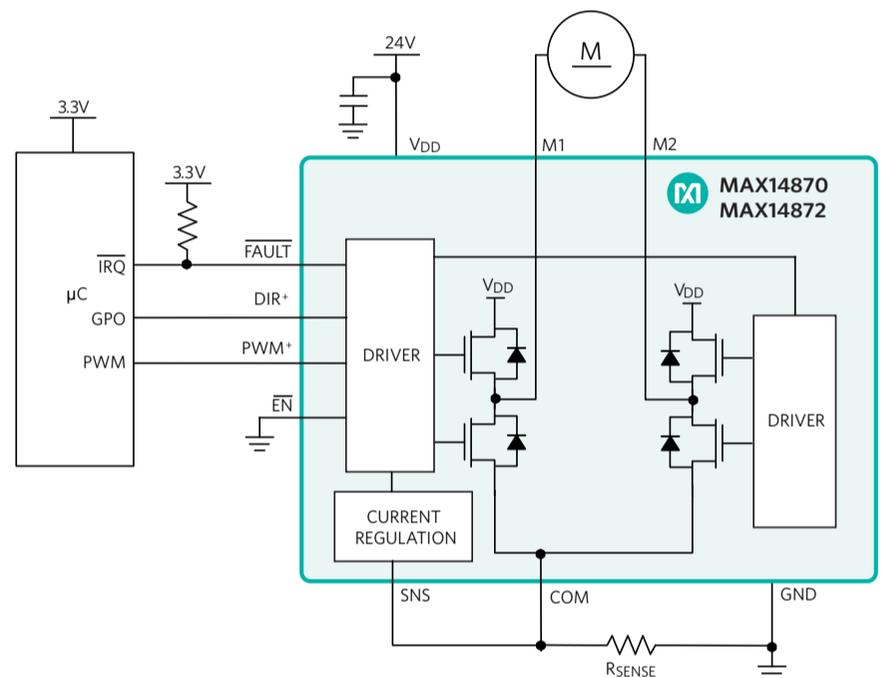


Figure 6. MAX14870 Motor Controller

RS-485 ROBUST COMMUNICATIONS

Robust communication is provided by the **MAX14783E** (Figure 7), the industry's first dual voltage (3.3V and 5V), high speed RS-485/RS-422 transceiver with the highest $\pm 35\text{kV}$ ESD protection available, in small package sizes.

CONNECTIVITY

Connectivity with Pocket IO is accomplished via USB or its own Wi-Fi® network. Code can be developed to run on the Intel Edison® using the popular and easy to use open-source Arduino® software IDE.

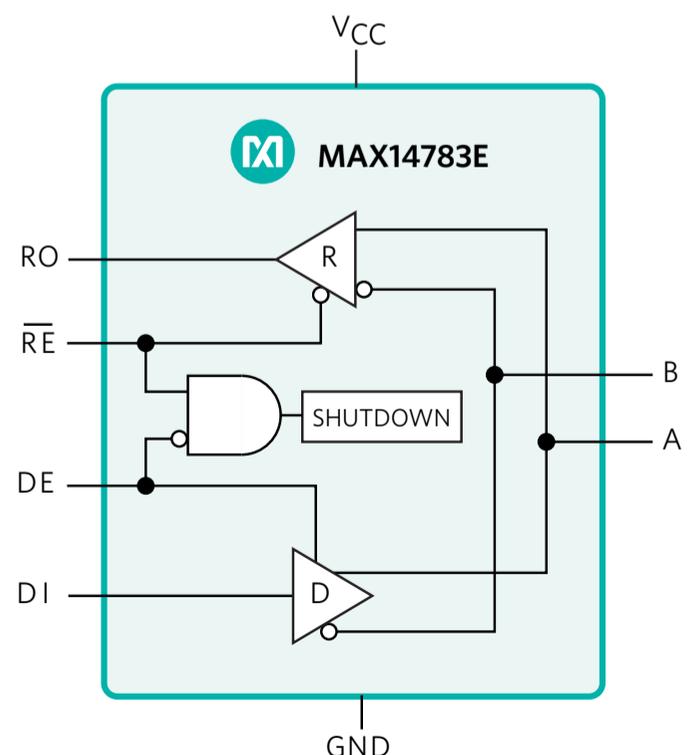


Figure 7. MAX14783E RS-485 Robust Communications

POWER CONVERSION

The DC-DC voltage conversion stage of the Pocket IO 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 **MAX17502** (Figure 8) high-efficiency, high-voltage, synchronous step-down DC-DC converter with integrated MOSFETs operates over a 4.5V to 60V input voltage range.

Advantages include:

- Low $R_{DS(ON)}$ and power-MOSFET synchronous rectification increase efficiency by as much as 10% over asynchronous solutions (> 90% peak efficiency)
- Small, 3mm × 2mm, TDFN package integrates high-side and low-side power MOSFETs to considerably reduce overall solution size by eliminating bulky Schottky diodes
- Internal power MOSFETs, built-in compensation, and preprogrammed output options significantly reduce solution cost by requiring as few as five external components.

CONCLUSION

Maxim's Pocket IO PLC Development Platform provides designers and industrial engineers the flexibility to experiment, to find the best solution for reduced power dissipation and small form factors in PLC designs.

LEARN MORE

- **MAXREFDES150** Pocket IO PLC Development Platform
- **MAX14870** DC Motor Driver
- **MAX14913** Digital Output Driver
- **MAX31913** 8-Channel Serializer
- **MAX14130** Digital Isolator
- **MAX14783E** RS-485 Transceiver
- **MAX17502** Iso-Buck DC-DC Converter
- **MAX17681** Step Down DC-DC Converter
- **MAX14824** IO-Link Master Transceiver
- **MAX11254** ADC with SPI Interface
- **MAX44248** 36V Single/Quad/Dual Op Amps
- **MAX6126** Ultra-High-Precision Voltage Reference
- **MAX5216** 14-/16-Bit DACs with SPI Interface

Need Design Support? Call **800 MAXIM-IC (888 629-4642)**

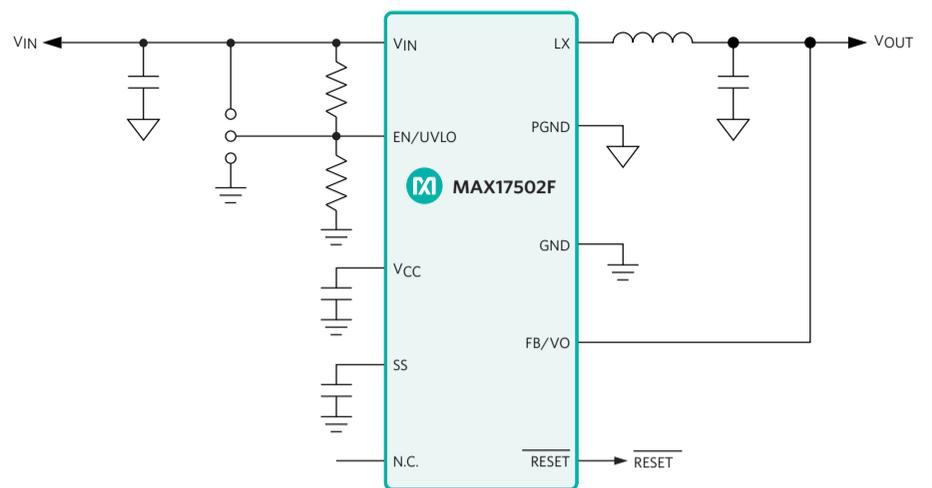


Figure 8. MAX17502 DC-DC Converter