MICROCHIP®

Interface Products Design Guide

Using CAN, LIN, Ethernet, Infrared Connectivity and General Purpose I/O Expanders

Design ideas in this guide are based on many of the interface devices available from Microchip Technology. A complete device list and corresponding data sheets for these products can be found at: **www.microchip.com**

Stand-alone CAN Controller
MCP2515

CAN Transceiver
MCP2551

CAN I/O Expander
MCP250XX

LIN Transceiver
MCP201

Ethernet Controller
ENC28J60

General Purpose I/O Expander
MCP23X08
MCP23X17

IrDA® Encoder/Decoder
MCP2120
MCP2122

IrDA® Protocol Handler
MCP2140
MCP2150
MCP2155

Controller Area Network (CAN)

CAN DESIGN EXAMPLE: SIMPLE SENSOR NODE

The CAN bus (Controller Area Network) protocol was designed to be a high-speed, reliable communication protocol for command and control network applications. Microchip offers a complete line of products to meet the needs of high-performance embedded applications using the CAN protocol, including 8- and 16-bit microcontrollers (MCUs) with integrated CAN, stand-alone CAN controllers, CAN I/O expanders and CAN transceivers.

As CAN continues to grow and proliferate into other markets, the need to add CAN to simple sensor circuits increases. In some applications, a simple CAN sensor node can be cost prohibitive due to the higher cost of using a microcontroller with integrated CAN modules. Often the microcontrollers with integrated CAN have extra peripherals, program memory, RAM, etc. which the simple sensor application does not need.

In addition to MCUs with integrated CAN, Microchip offers a low cost stand-alone CAN controller with SPI™ interface (MCP2515) which can be paired up with the desired MCU to create an optimized CAN node. The designer does not have to *settle* for the peripherals offered by an MCU with integrated CAN, but rather the designer can choose the MCU which *best* matches the application.

Additionally, the four pins used by the MCU for SPI can be regained by using the general purpose inputs and outputs on the MCP2515.

The schematic shown below represents a very simple, low cost CAN solution.

MCP2515 Stand-alone CAN Controller Features:

- Implements CAN V2.0B at 1Mb/s
- Masks and filters to filter out unwanted messages
- Two receive buffers
- Three transmit buffers
- High speed SPI interface (10 MHz)
- Low voltage operation (2.7-5.5 V)
- One shot mode to ensure a message transmission is only attempted once
- Start-Of-Frame (SOF) signal pin to detect CAN start-of-frame
- Data byte filtering of the first two data bytes
- Clock out pin with prescaler can be used as a clock source
- Interrupt output pin with selectable interrupt enables
- Two buffer full pins (can be used as general purpose outputs)
- Three request-to-send pins (can be used as general purpose inputs)
- 18-pin PDIP and SOIC, 20-pin TSSOP

Development Tool Support:

- MCP2510/2515 CAN Developer's Kit (DV251001)
- MCP2515 CAN Controller PICtail™ Demonstration Board (MCP2515DM-PCTL)

**Simple Sensor Node Using MCP2515 Stand-alone CAN Controller**
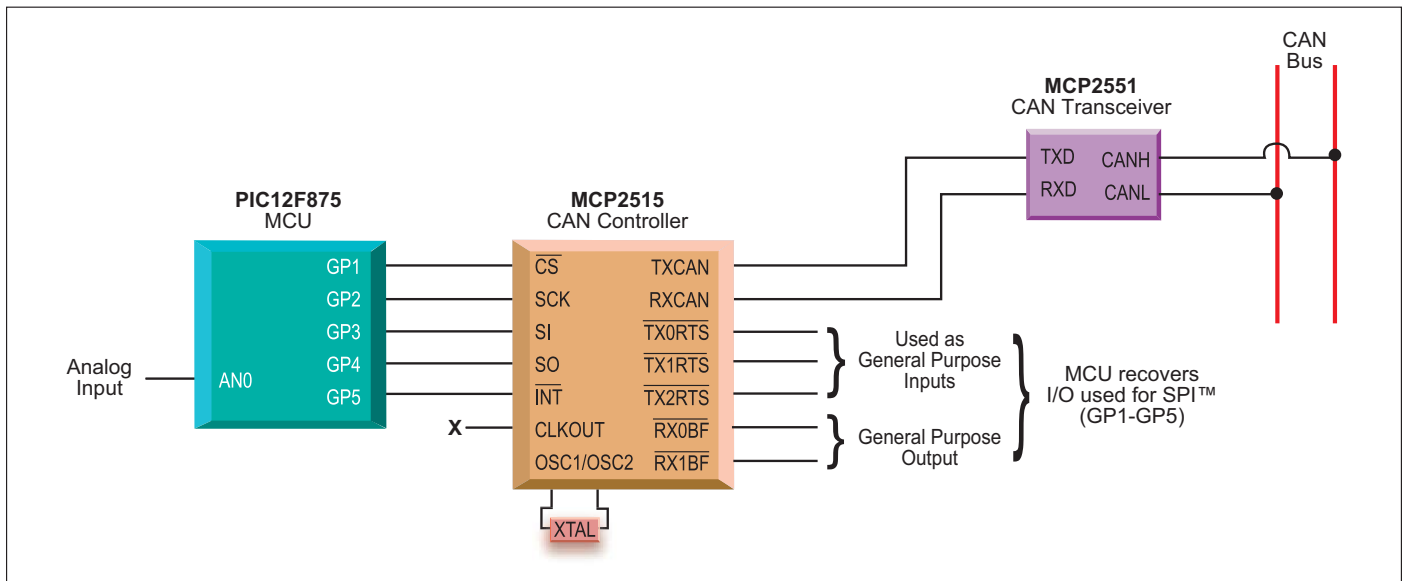
Product specifications can be found on page 13.
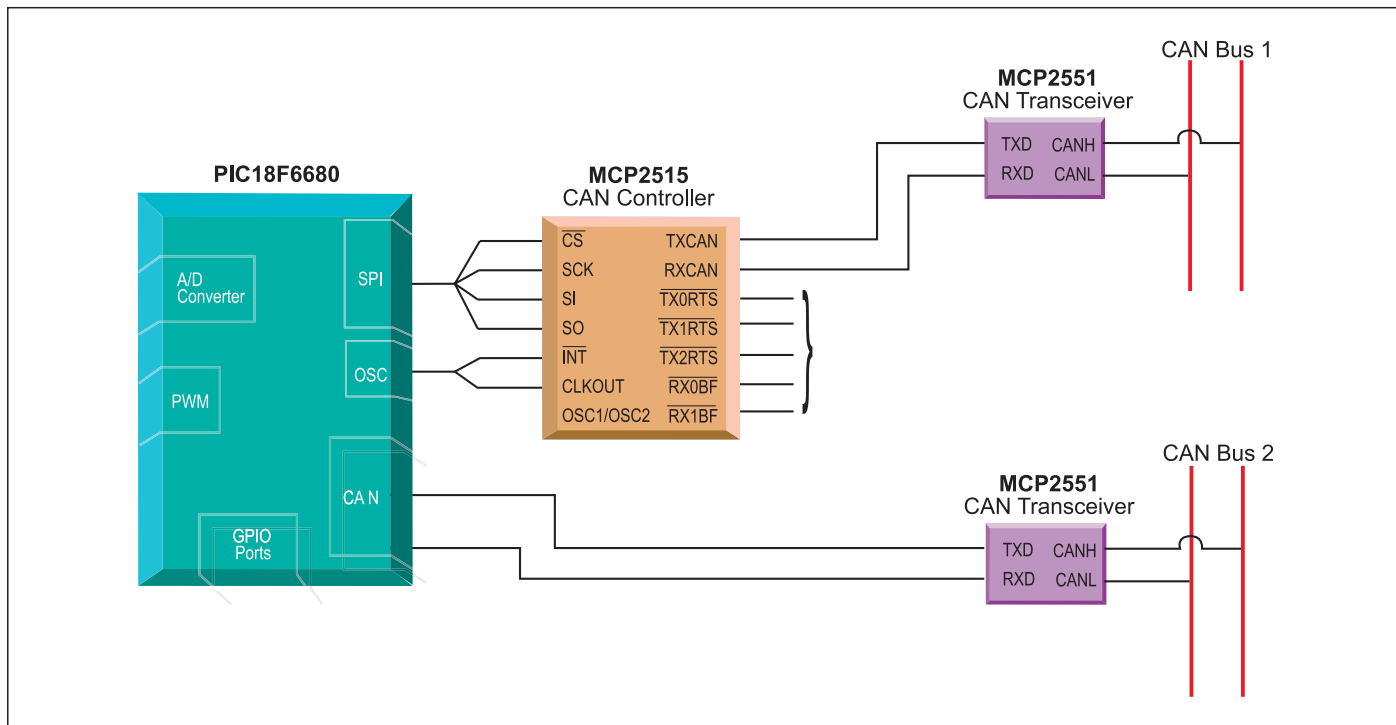
Controller Area Network (CAN)

Existing applications that require the addition of CAN will find that the MCP2515 can be used to add CAN connectivity to any application ranging from low-end simple sensor applications, to high-end DSP, 32-bit MCU, ASIC, etc.

The diagram below shows CAN added to a high-end application, as many high-end processors do not have embedded CAN peripherals.
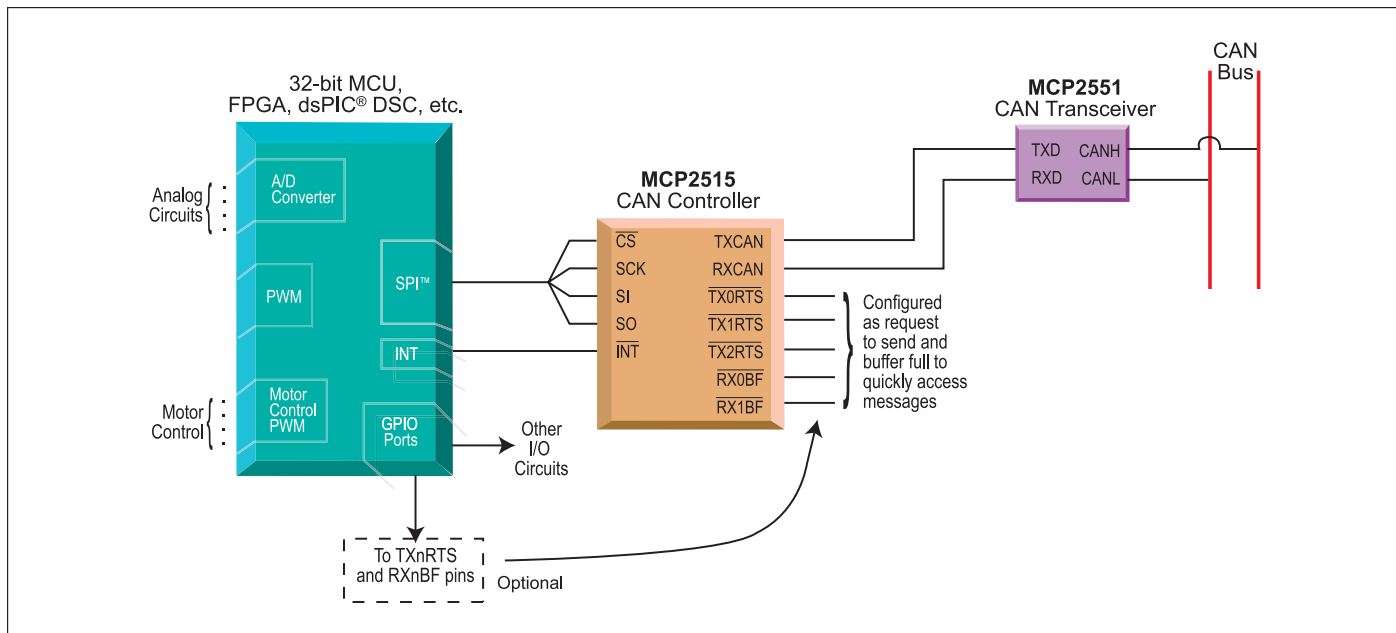
Dual CAN Node – The MCP2515 can be used to easily add dual CAN capabilities for a given node.

Product specifications can be found on page 13.

Controller Area Network (CAN)

CAN DESIGN EXAMPLE: SIMPLE SENSOR NETWORK USING CAN I/O EXPANDER

MCP250XX CAN I/O Expander

The MCP250XX devices operate as I/O expanders for a CAN system. These devices feature several peripherals including eight digital I/O, four 10-bit A/D converters and two 10-bit PWM channels. In addition, the MCP250XX can automatically send messages when an input changes state, including when an analog channel exceeds a preset threshold. The device can also be configured to send A/D and digital I/O messages at regular intervals.

Three bits (plus the RTR bit or one more ID bit for direction) are reserved in the identifier/arbitration field of the CAN message to communicate with the MCP250XX. This allows a master CAN node to communicate/control the CAN I/O Expanders via the CAN bus.

Simple Sensor Network

The MCP250XX is ideal for simple, low cost sensor networks. Particularly where the higher layers are proprietary so the system designer can maximize the MCP250XX features. The diagram below shows a four-node sensor network using only one MCU.

MCP250XX CAN I/O Expander Features:

■ Implements CAN 2.0 B
■ Masks and filters to filter out unwanted messages
■ Two receive buffers
■ Three auto transmit buffers for sending messages automatically
■ Non-volatile memory for user configuration
■ Configuration can be modified via the CAN bus
■ Message scheduling capability
  – Sends GPIO and analog data
■ Eight general purpose I/O pins individually selectable as inputs or outputs
  – Individually selectable transmit-on-change for each input
■ Four 10-bit analog channels with programmable conversion clock and V_{REF} sources
■ Individually selectable threshold detection
■ Two 10-bit PWM outputs
■ Low voltage operation (2.7-5.5V)
■ 14-pin PDIP and SOIC

Development Tools Support:

■ MCP250XX CAN I/O Expander's Developer's Kit (DV250501)
■ MCP2515 CAN Controller PICtail™ Demonstration Board (MCP2515DM-PCTL)
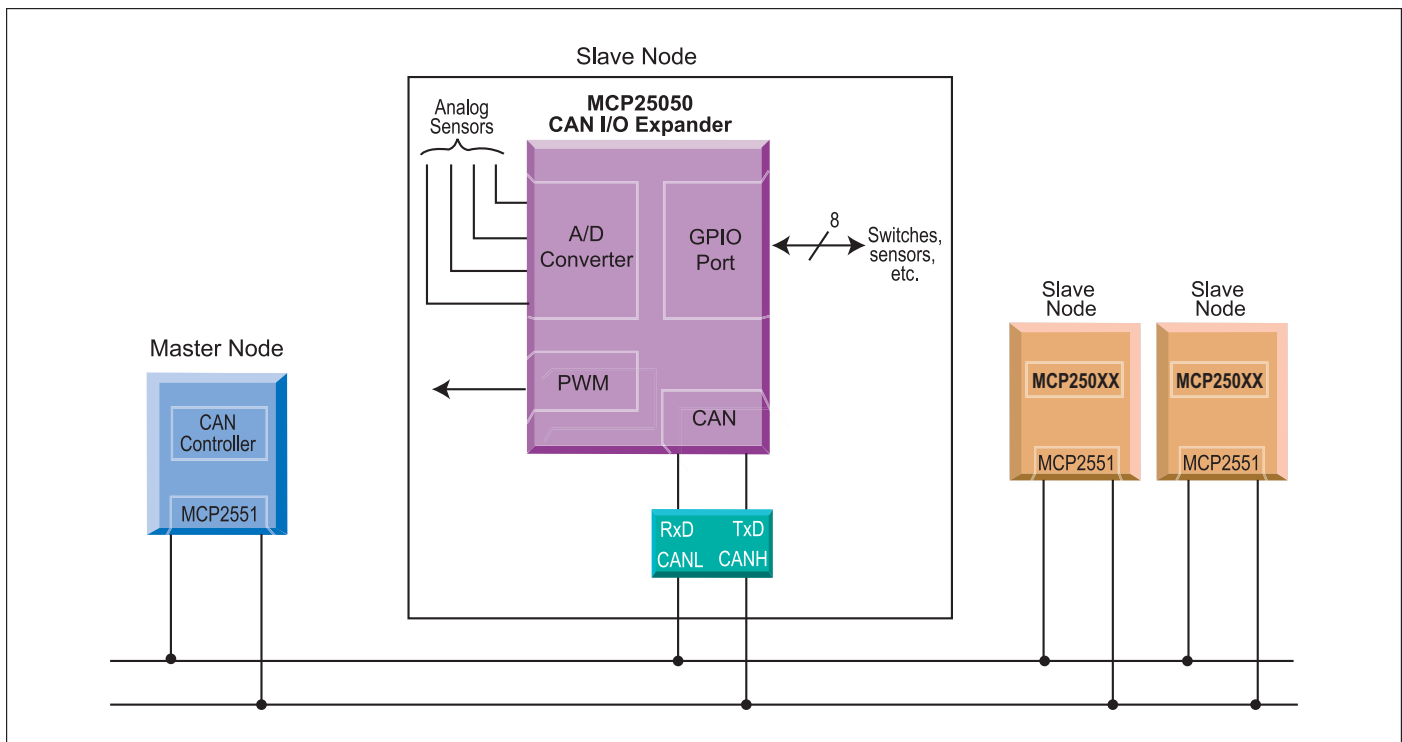
Product specifications can be found on page 13.

Controller Area Network (CAN)

MCP2551 CAN Transceiver

The MCP2551 is a high speed CAN transceiver which serves as an interface between the CAN bus and the CAN controller. The MCP2551 implements the ISO 11898-2 physical layer requirements which is by far the most common physical layer for CAN.

The MCP2551 converts between logic levels generated by the CAN controller and differential signal levels on the bus. The differential signal is less prone to electrical disturbances. The MCP2551 protects the CAN controller from electrical anomalies such as voltage spikes, short circuits and other electrical transients on the bus.

The diagram below shows the basic connections for connecting the MCP2551.

MCP2551 CAN Transceiver Features:

- Implements ISO 11898-2 physical layer requirements
- Suitable for 12V and 24V systems
- ±40V short circuit protection on the bus pins
 – Automatic thermal shutdown protection

MCP2551 CAN Transceiver Features (Cont.):

- ±250V transient protection on the bus pins
- Ground fault (permanent dominant) detection on the transmit input pin
  – Keeps faulty transmitters from bringing down the bus due to a permanent dominant condition
- Externally controlled slope on the bus pins to reduce RFI emissions
- Power on reset and brown out detection
- Unpowered nodes will not disturb the bus
- Up to 112 nodes can be connected

Development Tools Support:

- MCP2510/2515 CAN Developer's Kit (DV251001)
- MCP2515 CAN Controller PICtail™ Demonstration Board (MCP2515DM-PCTL)
- MCP250XX CAN I/O Expander Developer's Kit (DV250501)
- SOIC 8-Lead Evaluation Board (SOIC8EV)

Basic Connections for Connecting the MCP2551
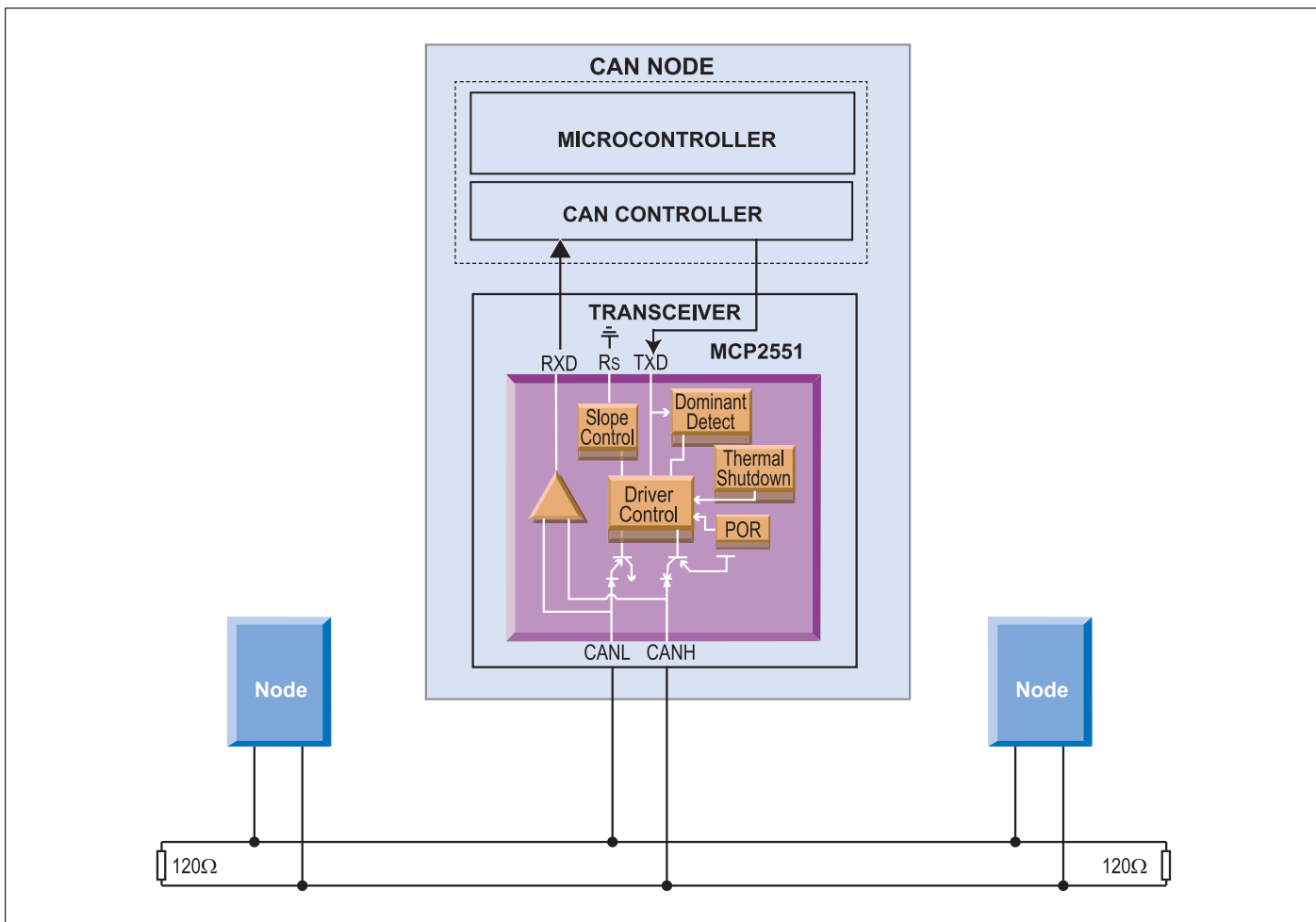
Product specifications can be found on page 13.

Local Interconnect Network (LIN)

MCP201 LIN Transceiver

LIN is a low speed network (20 kbaud) intended for automotive and industrial applications where the speed and robustness of CAN is not needed and where low cost is essential. The MCP201 is a LIN transceiver which provides the interface between the LIN bus and the LIN controller. The MCP201 converts between CMOS/TTL levels and LIN levels.

The diagram shows a typical implementation of a LIN node using the MCP201.

MCP201 LIN Transceiver Features:

- Supports LIN rates up to 20 kbaud
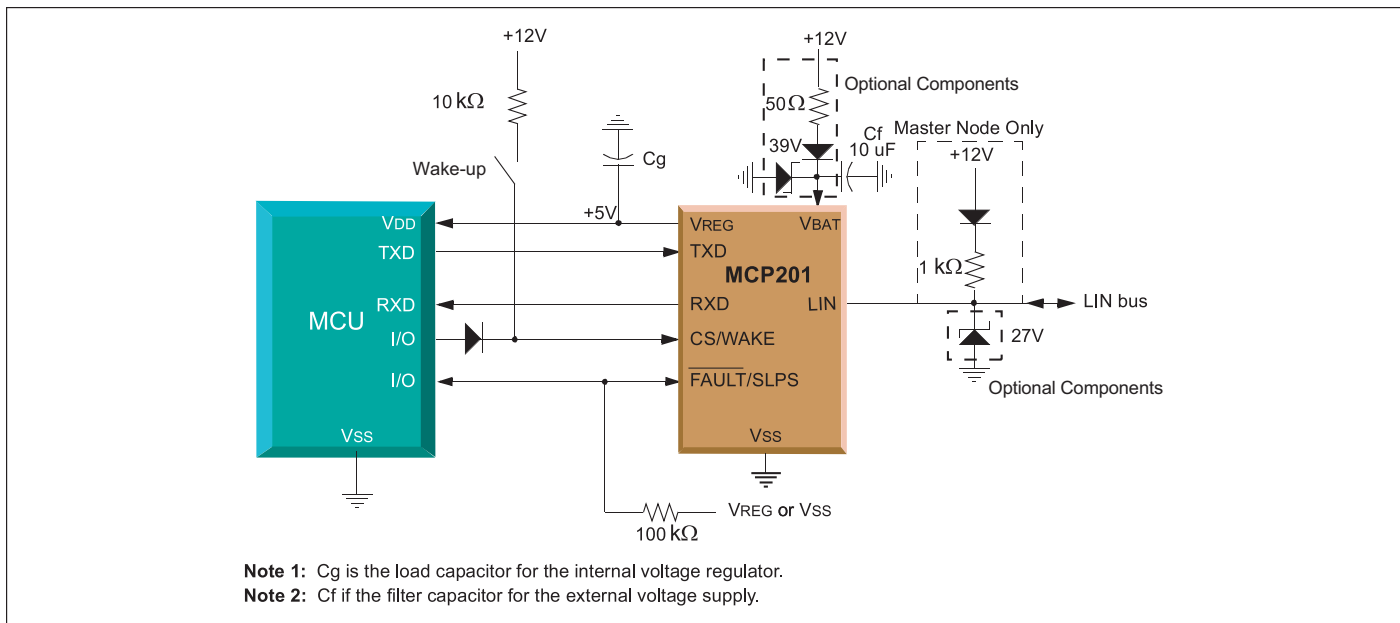- 40V load dump protected
- Operates from 6V to 18V

MCP201 LIN Transceiver Features (Cont.):

- Robust LIN bus pin
  – Protected against ground shorts
  – Protected against loss of ground
  – Automatic thermal shutdown
  – High current drive (40 mA to 200 mA)
- Built in voltage regulator (LDO)
  – 5V output (±5 % tolerance)
  – 50 mA maximum output current
- Internal thermal overload protection
- Internal short circuit protection

Development Tools Support:

- PICDEM™ CAN-LIN 1, 2 and 3 Demonstration Boards (DM163007, DM163011, DM163015)
- PICDEM LIN Demonstration Board (DM163005)
- SOIC 8-Lead Evaluation Board (SOIC8EV)

Typical MCP201 Application

Note 1: Cg is the load capacitor for the internal voltage regulator.
Note 2: Cf if the filter capacitor for the external voltage supply.

Typical LIN Network Configuration
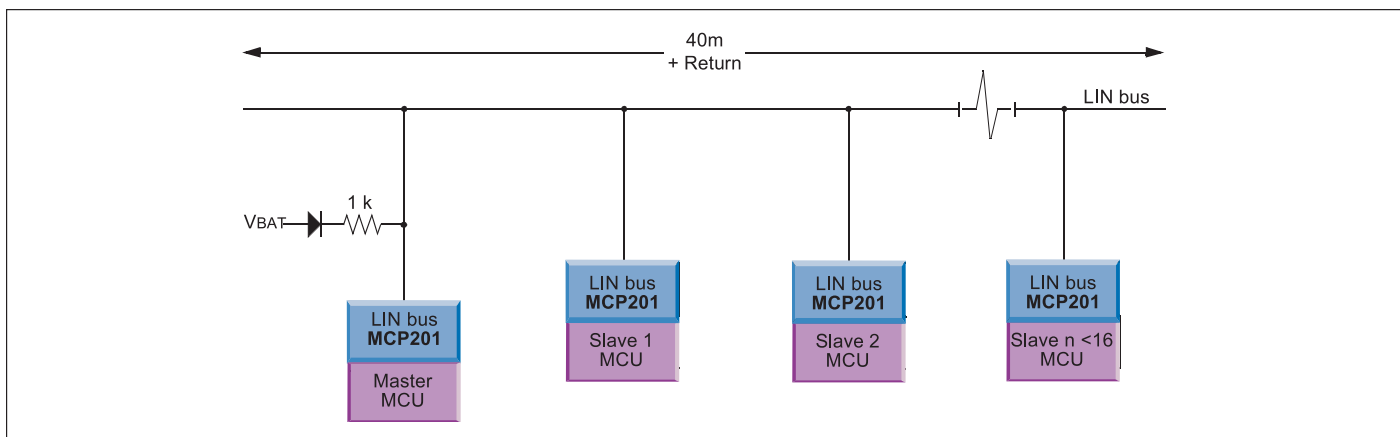
Product specifications can be found on page 13.

ETHERNET DESIGN EXAMPLE: ENC28J60 ETHERNET CONTROLLER

ENC28J60 Ethernet Controller

The ENC28J60 is a 28-pin, IEEE 802.3 compliant stand-alone Ethernet controller with on board MAC and PHY, 8 Kbytes of Buffer RAM and SPI™ interface. These features, combined with Microchip's free TCP/IP software stack for PIC18 microcontrollers, provide the smallest whole-product Ethernet solution for embedded applications. With a small package size including a 6x6 mm QFN, the ENC28J60 provides a low-pin count, cost-effective and easy-to-use solution for remote communication with embedded applications.

ENC28J60 Ethernet Controller Features:

General
- IEEE 802.3 compatible Ethernet Controller
- Integrated MAC and 10BASE-T PHY
- 8 Kbyte Transmit/Receive Packet Dual Port Buffer SRAM
- Receiver and Collision Squelch Circuit
- Automatic Polarity Detection and Correction
- Programmable Automatic Retransmit on Collision
- Programmable Padding and CRC Generation
- Programmable Automatic Rejection of Erroneous Packets

ENC28J60 Ethernet Controller Features (Cont.):

Buffer
- Configurable transmit/receive buffer size
- Hardware managed circular receive FIFO
- Byte-wide random and sequential access
- Internal DMA for fast memory copying
- Hardware assisted IP checksum calculation
- Operates from 6V to 18V

PHY
- Wave shaping output filter
- Loopback mode

MAC
- Support for Unicast, Multicast and Broadcast packets
- Programmable pattern matching of up to 64 bytes within packet at user defined offset
- Programmable wake-up on multiple packet formats, including Magic Packet® , Unicast, Multicast, Broadcast, specific packet match or any packet
- Loopback mode

Development Tools Support:
- Ethernet PICtail Daughter Board (AC164121)
- Microchip TCP/IP software stack (AN833, AN870)

Typical Ethernet Application
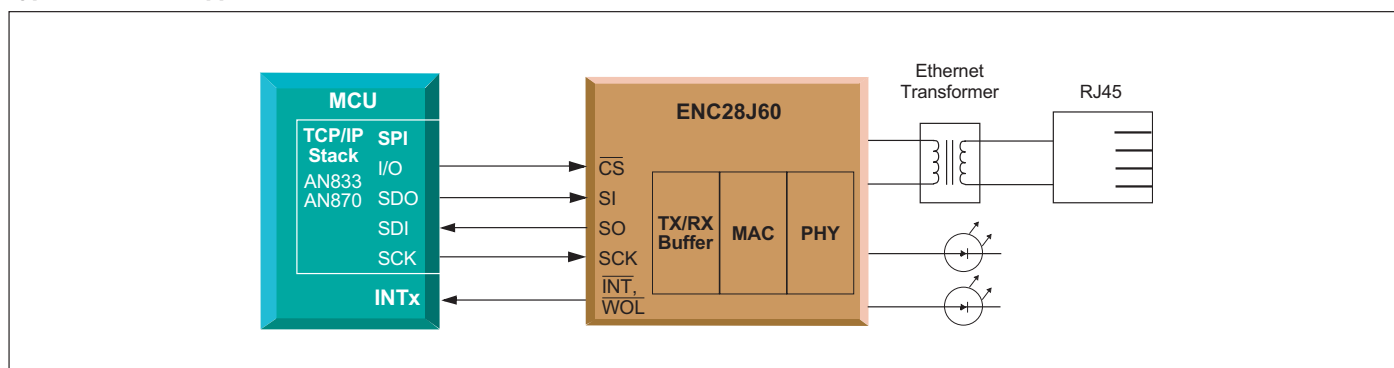
DESIGN EXAMPLE: INFRARED DATA APPLICATIONS

MCP2150 and MCP2155 IrDA® Protocol Stack Controller

The MCP215X devices allow an embedded systems designer to interface to popular IrDA® standard devices (such as PDAs and PCs) using the embedded systems host controller UART and some I/O pins.

The MCP215X implements the IrDA standard stack. At the application layer, the IrCOMM protocol (9-wire "cooked" service class) is the IrDA standard replacement for the serial cable. Thus the embedded systems designer will interface to the MCP215X as if it was a serial cable. The MCP215X does not implement the IR transceiver of the physical layer.

MCP215X Features:

- Implements the IrDA standard including:
    - IrLAP
    - IrLMP
    - IAS
    - TinyTP
    - rCOMM (9-wire "cooked" service class)
- UART to IrDA standard encoder/decoder
    - Interfaces with UARTs and infrared transceivers
- UART support to Data Terminal Equipment (DTE) interfaces (MCP2150) or Data Communication Equipment (DCE) interfaces (MCP2155)
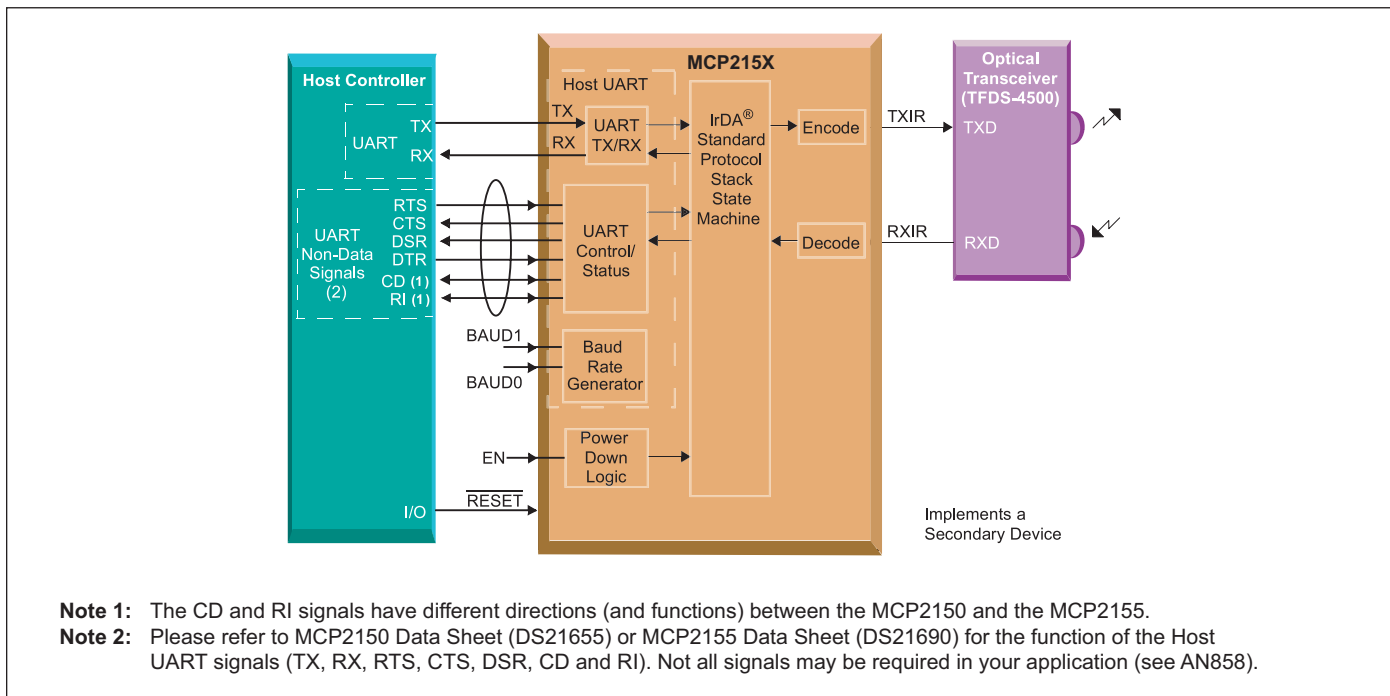
MCP215X Features (Cont.):

- Supports 1.63 µs bit width for transmit/receive
- Independent UART and IR baud rates
- UART baud rates:
    - 906 kbaud
    - 19.2 kbaud
    - 57.6 kbaud
    - 115.2 kbaud
- IrDA baud rates:
    - 906 kbaud
    - 19.2 kbaud
    - 38.4 kbaud
    - 57.6 kbaud
    - 115.2 kbaud
- 64 byte data packet
- Programmable device ID
- Operates as a Slave Device
- Hardware pin for low power mode

Development Tools Support:

- MCP2120/MCP2150 Developer's Kit (DM163008)
- MCP215X Data Logger Demonstration Board (MCP215XDM)
- MCP215X/40 Developer's Daughter Board (MCP215XEV-DB)

MCP215X Typical System Block Diagram

Note 1: The CD and RI signals have different directions (and functions) between the MCP2150 and the MCP2155.
Note 2: Please refer to MCP2150 Data Sheet (DS21655) or MCP2155 Data Sheet (DS21690) for the function of the Host UART signals (TX, RX, RTS, CTS, DSR, CD and RI). Not all signals may be required in your application (see AN858).

Product specifications can be found on page 13.

IrDA® Protocol Stack Controller

MCP2140 IrDA® Protocol Stack Controller

MCP2140 has all of the same features as the MCP2150 except:

- Supports discrete IR circuitry instead of integrated infrared transceivers
- Host UART and IR interface fixed at 9600 baud
- Fixed device ID
- Wake-up on IR detect

The diagram below shows a typical system block diagram and typical discreet IR transceiver.

Development Tools Support:

- MCP2140 Wireless Temperature Sensor Demonstration Board (MCP2140DM-TMPSNS)
- MCP215X/40 Developer's Daughter Board (MCP215XEV-DB)

MCP2140 Typical System Block Diagram
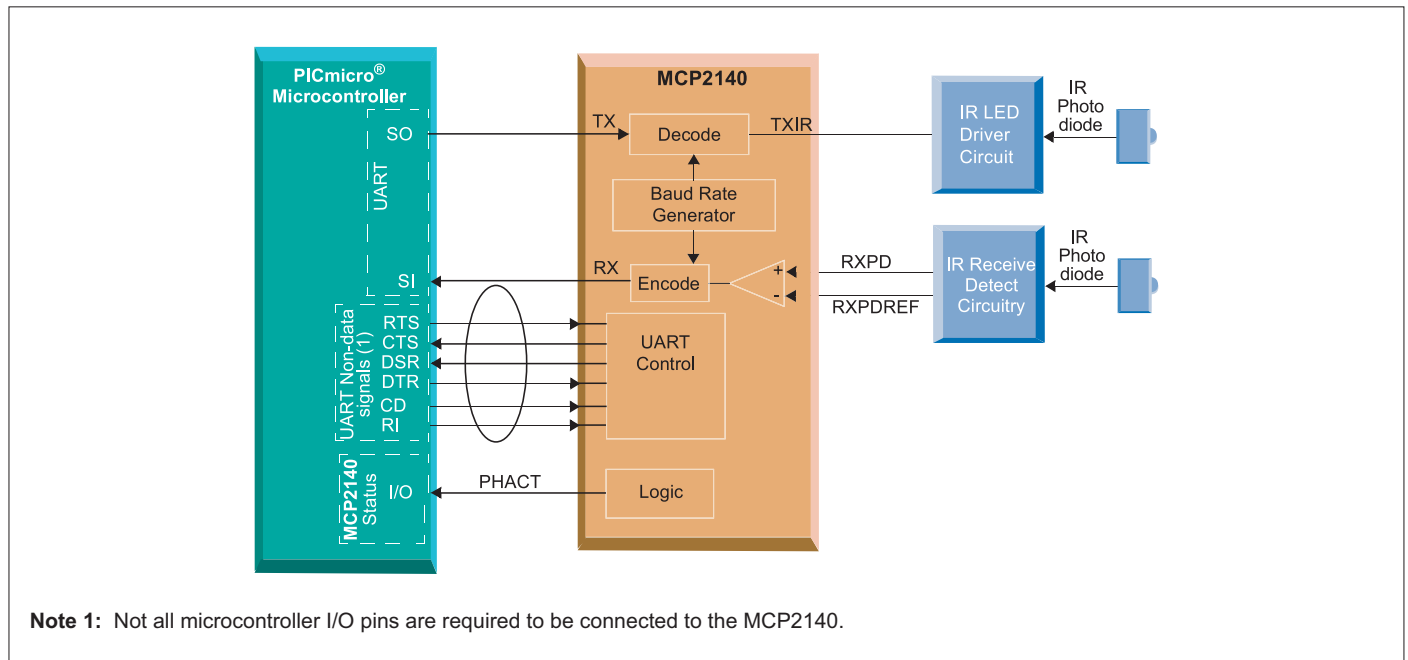
Note 1: Not all microcontroller I/O pins are required to be connected to the MCP2140.

Product specifications can be found on page 13.

IrDA® Protocol Stack Controller

MCP2120 Infrared Encoder/Decoder

Unlike the MCP2150 and MCP2140 which implement the IrDA® stack, the MCP2120 is simply an encoder/decoder. This allows the application processor to implement all or part of the IrDA stack, or implement a custom protocol using IR.

MCP2120 Features:
- UART to IrDA encoder/decoder
- Supports IrDA physical layer specification (v.1.3)
- Interfaces with IrDA compliant transceivers
- Interfaces to standard UARTs

MCP2120 Features (Cont.):
- Operates up to the full standard IrDA data rate (115.2 kbaud)
  – 312.5 kbaud maximum
- Low power mode
- Hardware and software baud control

Development Tools Support:
- MCP2120/MCP2150 Developer's Kit (DM163008)
- MCP212X Developer's Daughter Board (MCP212XEV-DB)

MCP2122 Infrared Encoder/Decoder

The MCP2122 is a stand-alone IrDA standard encoder/decoder device. The MCP2122 has two interfaces: the host UART interface and the IR interface. The host UART interfaces to the UART of the host controller. The IR interface connects to an infrared (IR) optical transceiver circuit, which converts electrical pulses into IR light (encode) and converts IR light into electrical pulses (decode).

MCP2122 Features:
- UART to IrDA encoder/decoder
- Supports IrDA physical layer specification (v.1.3)
- Interfaces with IrDA compliant transceivers
- Interfaces to standard UARTs
- Operates up to the full standard IrDA data rate (115.2 kbaud)
- Low power mode
- 16X clock input

Development Tools Support:
- MCP212X Developer's Daughter Board (MCP212XEV-DB)
- SOIC 8-Lead Evaluation Board (SOIC8EV)

MCP2120 Typical System Block Diagram
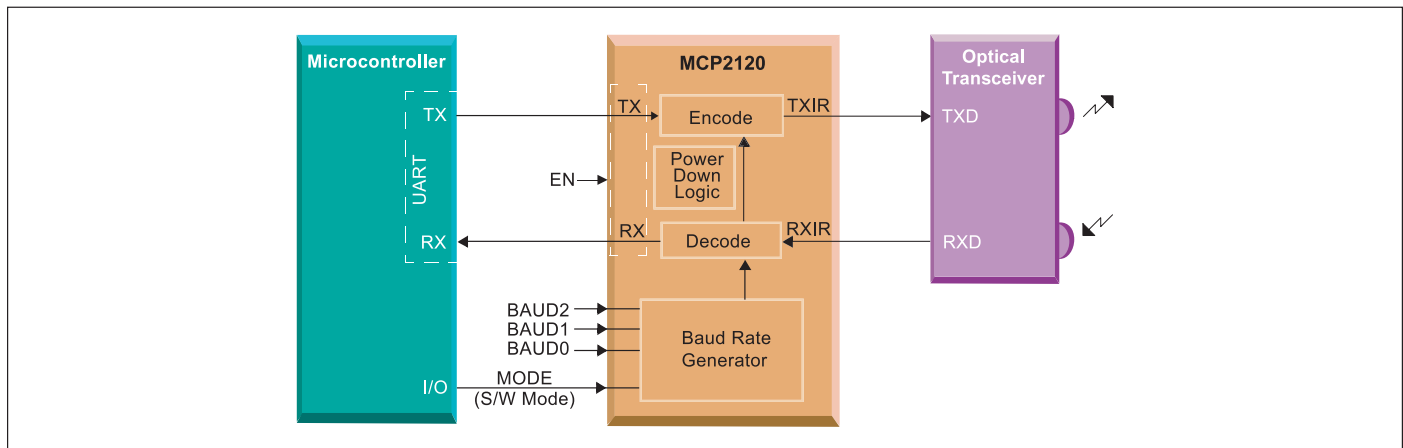
MCP2122 Typical System Block Diagram

Product specifications can be found on page 13.

General Purpose I/O Expanders

MCP23008/MCP23S08 8-bit I/O Expander

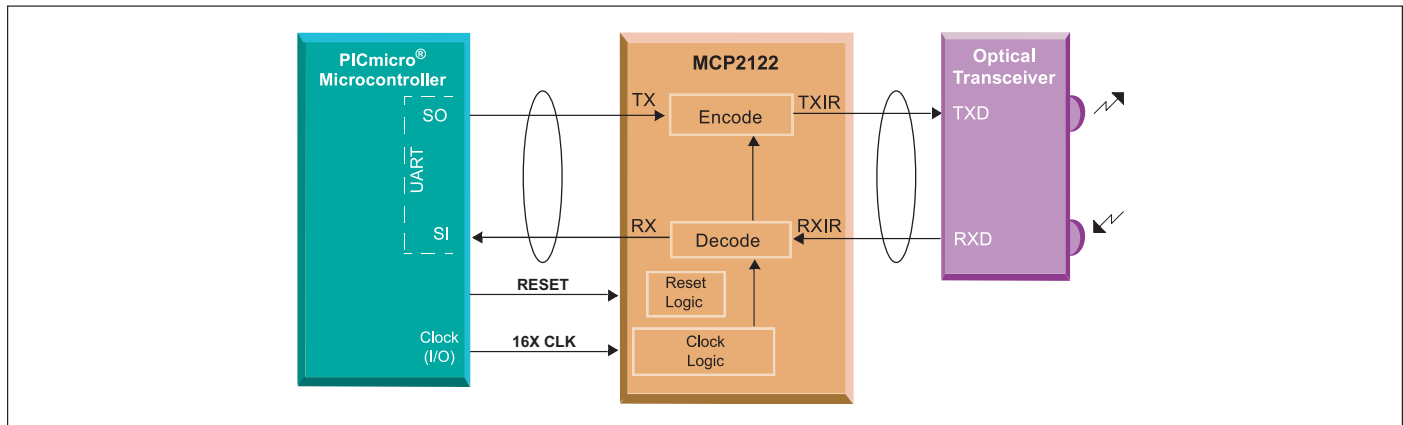The MCP23X08 device provides 8-bit, general purpose, parallel I/O expansion for I2C™ bus or SPI™ applications. The two devices differ in the number of hardware address pins and the serial interface:

MCP23008 – I2C interface; three address pins
MCP23S08 – SPI interface; two address pins

The MCP23X08 consists of multiple 8-bit configuration registers for input, output and polarity selection.

MCP23008 Features:

- High speed I2C interface:
  – 100 kHz
  – 400 kHz
  – 1.7 MHz
- Three hardware address pins for up to eight devices on the bus
- Configurable interrupt output pin
- Configurable interrupt source
- High current drive for each output (25 mA)
- Eight individually selectable I/O pins
- Low standby current (1 µA max)

MCP23S08 Features:

- High speed SPI interface:
  – 10 MHz
- Two hardware address pins for up to four devices on the bus
- Configurable interrupt output pin
- Configurable interrupt source
- High current output drive for each pin (25 mA)
- Eight individually selectable I/O pins
- Low standby current (1 µA max)

Development Tools Support:

- MCP23X08 Evaluation Board (MCP23X08EV)

MCP23008/MCP23S08 Typical System Block Diagram
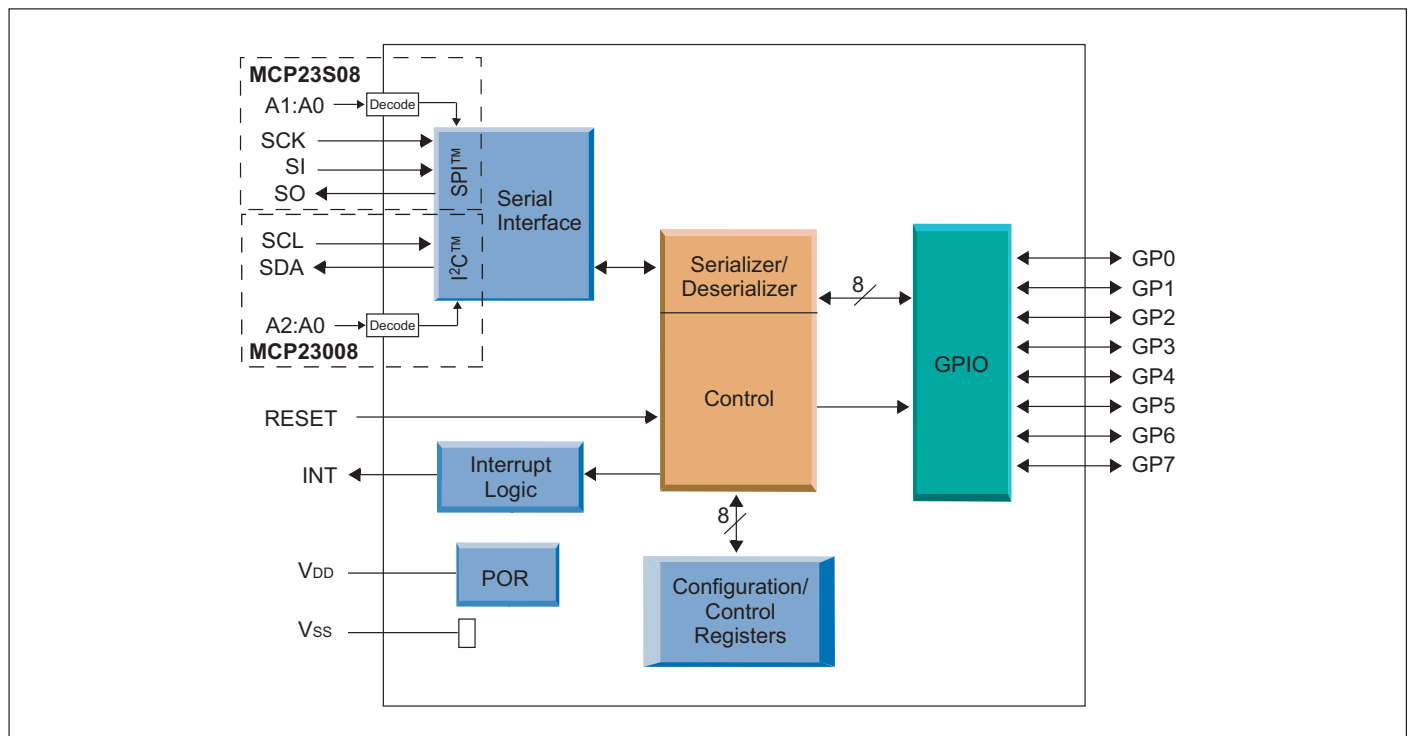
Product specifications can be found on page 14.

General Purpose I/O Expanders

DESIGN EXAMPLE: USING A GENERAL PURPOSE PARALLEL 16-BIT I/O PORT EXPANDER

MCP23017/MCP23S17 16-bit I/O Expander

The MCP23017/MCP23S17 (MCP23X17) device family provides 16-bit, general purpose parallel I/O expansion for I^{2}C™ bus or SPI™ applications. The two devices differ only in the serial interface.

MCP23017 – I^{2}C interface
MCP23S17 – SPI interface

The MCP23X17 consists of multiple 8-bit configuration registers for input, output and polarity selection.

MCP23017 Features:

- High speed I^{2}C interface:
  – 100 kHz
  – 400 kHz
  – 1.7 MHz
- Three hardware address pins for up to eight devices on the bus
- Configurable interrupt output pin
- Configurable interrupt source
- High current drive for each output (25 mA)
- Sixteen individually selectable I/O pins
- Low standby current (1 µA max)

MCP23S17 Features:

- High speed SPI interface
- Three hardware address pins for up to eight devices on the bus
- Configurable interrupt output pin
- Configurable interrupt source
- High current drive for each output (25 mA)
- Sixteen individually selectable I/O pins
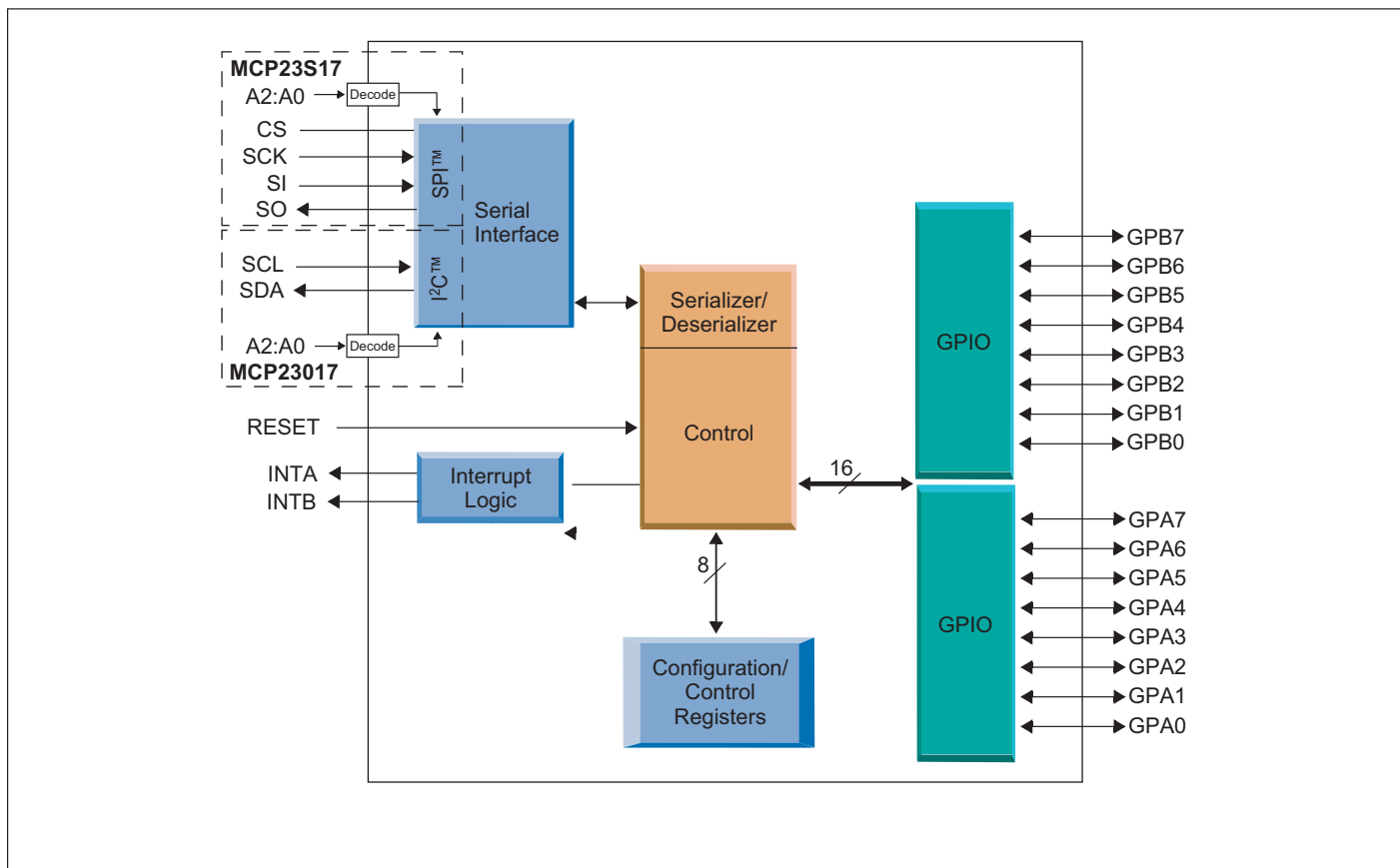- Low standby current (1 µA max)

Development Tools Support:

None available at this time.

MCP23017/MCP23S17 Typical System Block Diagram

Product specifications can be found on page 14.

Interface Products

See the Microchip Product Selector Guide for complete product selection and specifications

			Stand-alone Controller Area Network (CAN) Products		
Device	**Operating Voltage (V)**	**Operating Temp. Range (°C)**	**Unique Features**	**Packages**
MCP2510[1]	2.7 to 5.5	-40 to +125	CAN 2.0B Active controller with SPI™ interface to MCU, 3 transmit buffers, 2 receive buffers, HW and SW message triggers	18 PDIP, SOIC, 20 TSSOP
MCP2515	2.7 to 5.5	-40 to +125	MCP2510 pin-compatible upgrade with enhanced features including higher throughput and data byte filtering	18 PDIP, SOIC, 20 TSSOP
MCP25020	2.7 to 5.5	-40 to +125	CAN 2.0B Active I/O Expander, Configurable I/O, 2 PWM outputs	14 PDIP, SOIC
MCP25025	2.7 to 5.5	-40 to +85	CAN 2.0B Active I/O Expander, Configurable I/O, 2 PWM outputs, one-wire CAN option	14 PDIP, SOIC
MCP25050	2.7 to 5.5	-40 to +125	Mixed-Signal CAN 2.0B Active I/O Expander, Configurable I/O, 4 10-bit ADCs, 2 PWM outputs	14 PDIP, SOIC
MCP25055	2.7 to 5.5	-40 to +85	Mixed-Signal CAN 2.0B Active I/O Expander, Configurable I/O, 4 10-bit ADCs, 2 PWM outputs, One-wire CAN option	14 PDIP, SOIC
MCP2551	4.5 to 5.5	-40 to +125	High-Speed CAN Transceiver (1 Mbps max. CAN bus speed), ISO 11898 compatible, Industry standard pinout	8 PDIP, SOIC

[1] Not recommended for new designs, use MCP2515.

				LIN Bus Transceiver				
Device	**Description**	**V$_{REG}$ Output Voltage (V)**	**Operating Temp. Range (°C)**	**V$_{REG}$ Output Current (mA)**	**Vcc Range (V)**	**Max Baud Rate**	**LIN Specification Supported**	**Packages**
MCP201	LIN transceiver with integrated V$_{REG}$	4.75 to 5.25	-40 to +125	50[1]	6.0 to 18[2]	20 Kbaud	Revision 1.2	8 PDIP, SOIC

[1] Output current can be increased with external pass transistor.
[2] Can withstand 40V load dump.

											Ethernet Controller
Device	**MAC**	**PHY**	**TX/RX RAM Buffer**	**Interrupts**	**LEDs**	**Operating Voltage**	**Temp. Range (°C)**	**Max Speed MHz**	**Serial**	**Ethernet Specification Supported**	**Packages**
ENC28J60[1]	Yes	Yes	8 KB	2	2	3.3	0 to +70	25	SPI™	IEEE 802.3	28 SDIP, SOIC, SSOP, MLF

[1] Contact marketing for availability.

				Infrared Products	
Device	**Operating Voltage (V)**	**Operating Temp. Range (°C)**	**Min./Max. Baud Rate (Kbaud)**	**Unique Features**	**Packages**
MCP2120	2.5 to 5.5	-40 to +85	0/325	UART to IR encoder/decoder with both hardware and software baud rate selection	14 PDIP, SOIC
MCP2122	1.8 to 5.5	-40 to +125	-/115,200	UART to IR encoder/decoder with 16x clock input	8 PDIP, SOIC
MCP2140	2.7 to 5.5	-40 to +85	-/9.6	IrDA® protocol handler plus bit encoder/decoder, fixed baud rate, low power, low cost	18 PDIP, SOIC, 20 TSSOP
MCP2150	3.0 to 5.5	-40 to +85	9.6/115.2	IrDA® Standard protocol handler plus bit encoder/decoder on one chip for DTE applications, programmable device ID	18 PDIP, SOIC, 20 TSSOP
MCP2155	3.0 to 5.5	-40 to +85	9.6/115.2	IrDA® Standard protocol handler plus bit encoder/decoder on one chip for DCE applications, programmable device ID	18 PDIP, SOIC, 20 TSSOP

Interface Products

Serial Peripherals

Device	Description	Operating Voltage (V)	Operating Temp. Range (°C)	Bus Type	Max. Bus Frequency (kBits/s)	Features	Packages
MCP23008 MCP23S08	8-bit I/O Port Expander	1.8 to 5.5	-40 to +125	I2C™	1.7 MHz	3 HW address inputs, HW interrupt, 25 mA source/sink capability per I/O	18 PDIP, SOIC, 20 TSSOP
				SPI™	10 MHz	3 HW address inputs, 2 HW interrupt, 25 mA source/sink capability per I/O	
MCP23016[1]	16-bit I/O Port Expander	2.0 to 5.5	-40 to +85	I2C™	400	3 HW address inputs, HW interrupt, 25 mA source/sink capability per I/O	28 PDIP, SOIC, SSOP
MCP23017 MCP23S17	16-bit I/O Port Expander	1.8 to 5.5	-40 to +125	I2C™	1.7 MHz	3 HW address inputs, 2 HW interrupt, 25 mA source/sink capability per I/O	28 PDIP, SOIC, SSOP, QFN
				SPI™	10 MHz		

[1] Not recommended for new designs.

Related Support Material

The following Application Notes and Tech Briefs are available on the Microchip web site: **www.microchip.com.**

Application Notes

CAN Communications

AN212: Smart Sensor CAN Node Using the MCP2510 and PIC16F876

Demonstrates a way to implement a simple input pressure switch connected to a node board, along with a visual light source to display the value in terms of brightness. Several uses for different types of inputs and outputs can be implemented by using the basic techniques from this design.

AN215: A Simple CAN Node Using the MCP2510 and PIC12C67X

Describes the design, development and implementation of a smart, low cost, stand-alone Controller Area Network (CAN) node. Combines the 8-pin PIC12C672 with the 18-pin MCP2510 stand-alone CAN controller to create a fully autonomous CAN node, which supports both "time-based" and "event driven" message transmission.

AN228: A CAN Physical Layer Discussion

A discussion of the many network protocols which are described using the seven layer Open System Interconnection (OSI) mode.

AN739: An In-Depth Look at the MCP2510

Focuses on "using" the MCP2510 including the minimal configuration necessary to enable the CAN node, features and implementation, a detailed discussion of many of the registers and potential pitfalls during implementation.

AN754: Understanding Microchip's CAN Module Bit Timing

Investigates the relationships between bit timing parameters, the physical bus propagation delays and oscillator tolerances throughout the system as they pertain to Microchip's CAN module and assists in optimizing the bit timing for given physical system attributes.

AN816: A CAN System Using Multiple MCP25025 I/O Expanders

Describes a control system for a scissor-lift, which is essentially a mobile work platform enabling the user to reach relatively high places. All of the operations and movements use one Master Node and three I/O Expander Nodes.

AN872: Upgrading from the MCP2510 to the MCP2515

This application note discusses the differences between the MCP2510 and MCP2515 (and possible impact of these differences) in an effort to assist with the upgrade process.

AN873: Using the MCP2515 CAN Developer's Kit

Serves as a three-part tutorial for the MCP2515/2510 developer's kit and discusses the three software templates in detail as well as the important menu items.

Infrared Communications

AN858: Interfacing The MCP215X to a Host Controller

Discusses the operation of the MCP215X Host UART interface, implements an embedded system (as an IrDA® Standard Secondary device), and describes the setup of PDA devices to operate as the IrDA Standard Primary device.

AN888: Programming the Palm OS™ for Embedded IR Applications

Strives to impart core, fundamental programming concepts and design considerations for the development of Palm OS application programs. Attention is given to each of the fundamental areas of Palm OS application development in the "C" programming language.

AN926: Programming the Pocket PC™ OS for Embedded IR Applications

This application note details the tools, supporting technologies and procedures for the development of infrared applications on Windows Mobile™ based devices.

AN941: Programming Windows XP® for Embedded IR Applications

This application note details the tools, supporting technologies and procedures for the development of infrared applications on a Windows XP® based PC.

Interface Products

AN927: Data Throughput and the MCP215X

Discusses techniques that will improve the data transfer throughput between IrDA standard Primary Device and embedded system.

AN946: Interfacing the MCP2122 to the Host Controller

This application note discusses methods with which to interface the MCP2122 to a Host Controller and how to use the PICmicro MCU's CCP and Timer 2 modules to generate the 16XCLK signal.

AN243: Fundamentals of the Infrared Physical Layer

Describes the fundamentals of the infrared physical layer, the IrDA standard and selecting the proper discrete emitter and photodiode components for circuit implementation.

TB073: Selecting an MCP21XX Device for IrDA® Applications

This document will help you select which MCP21XX family device is a good fit for your application.

AN923: Using the MCP2120 Developer's Board for "IR Sniffing"

Discusses the implementation of an "IR Sniffer" using the MCP2120 Developer's board connect to a PC running a program call "Listen32."

AN756: Using the MCP2120 for Infrared Communications

A discussion regarding the encoding/decoding function in the MCP2120 which is performed as specified in the physical layer component of the IrDA® standard known as the "IrPHY."

TB059: Using The MCP2150 Developer's Board With the MCP2155

This technical brief describes how the MCP2150 Developer's Board can be used for development of MCP2155 applications, and focuses on the Host UART signals from the U2 socket (MCP2150/MCP2155) to the MAX3238 device (U1) and the Header (J1).

AN758: Using the MCP2150 To Add IrDA® Standard Wireless Connectivity

Microchip's MCP2150 provides support for the IrDA standard protocol stack plus bit encoding/ decoding. This application note discusses the encoding/decoding functionality of this device.

TB046: Connecting the MCP2150 To The Psion Operating System

Since the MCP2150 is a protocol handler supporting IrDA® standards plus an encoder/decoder, it can be used as a "Virtual Connector," a wireless link between an embedded application and an IrDA standard host. This host can be a handheld device using the Psion OS. The Psion OS is generally used for small Personal Digital Assistants (PDA) devices.

TB047: Connecting the MCP2150 to the Windows CE® Operating System

Similar to TB046 but using a Microsoft® Windows® CE Operating System (OS). Windows CE is an excellent host platform for use with the MCP2150 because of the light weight, low cost, ease of use and portability of these devices. Microsoft Windows includes a terminal client that can easily be used to demonstrate this capability.

TB048: Connecting the MCP2150 to the Windows® Operating System

This technical brief is similar to TB046, however, in this application the host is a Personal Computer (PC) using Microsoft Windows which includes a terminal client that can easily be used to demonstrate the capabilities of the MCP2150.

TB049: Connecting the MCP2150 to the Palm™ Operating System

Similar to TB046 but using the Palm Operating System (OS) Personal Digital Assistants (PDA) devices are an excellent host platform for use with the MCP2150 because of the light weight, low cost, ease of use and portability of these devices.

I/O Expander

AN972: I/O Expansion Using the MCP23X08 and PIC10F202

This application note discusses using the MCP23008 and MCP23S08 GPIO Expanders with a 6-pin PIC10F202 microcontroller unit (MCU). The discussion is based on the MCP23X08 Evaluation Board, P/N: MCP23008DM.

LIN Bus Communications

AN729: LIN Protocol Implementation Using PICmicro® MCUs

This application note is intended to provide a broad overview of the LIN bus and provide a high level look at how it works, how to implement a Slave node on a PICmicro device and what it's designed to do.

AN829: LightKeeper Automotive Lighting Control Module

This application note describes an automotive exterior lighting control module using a PIC16C433.

Ethernet Communications

AN833: The Microchip TCP/IP Stack

This application note details Microchip's own freely available implementation of the TCP/IP Stack. This TCP/IP Stack is a suite of programs that provide services to standard TCP/IP-based applications (HTTP Server, Mail Client, etc.), or can be used in a custom TCP/IP or UDP/IP-based application.

AN870: An SNMP Agent for the Microchip TCP/IP Stack

This application note provides one of the key components of the SNMP Management system: the SNMP Agent that runs on the managed device. The simple agent presented here is designed to run on Microchip's PICmicro® microcontrollers and is implemented using services provided by the free Microchp TCP/IP stack.

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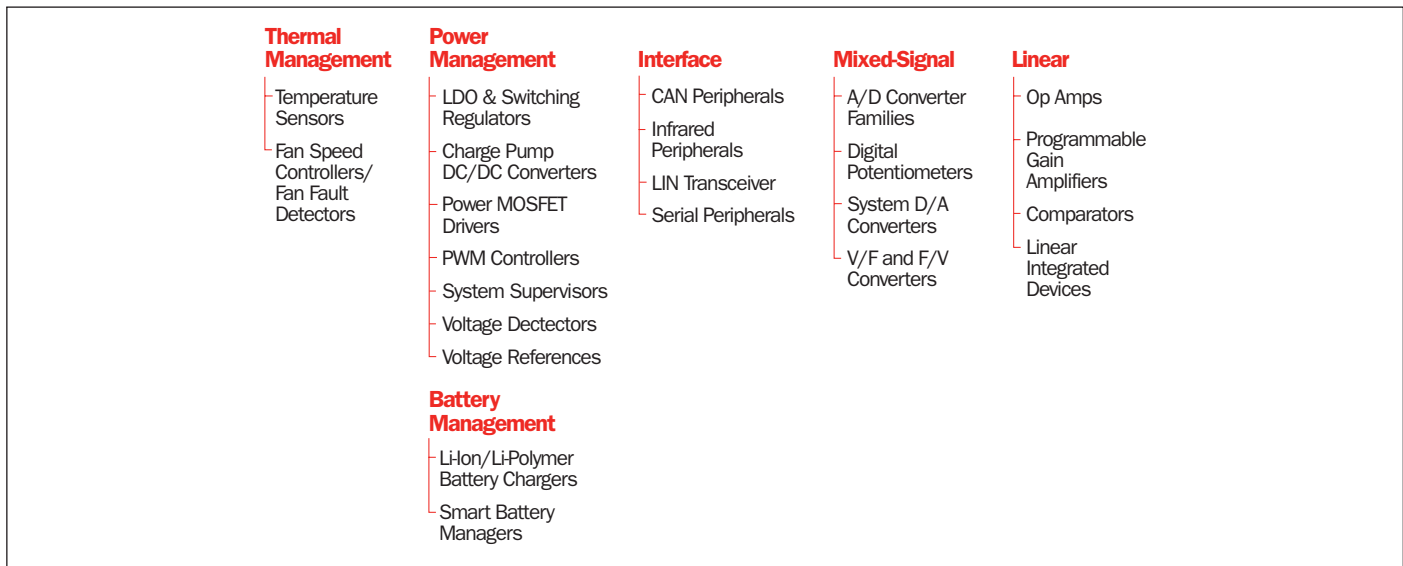
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