SYSTEM MANAGEMENT I²C, I3C AND SPI SELECTOR GUIDE

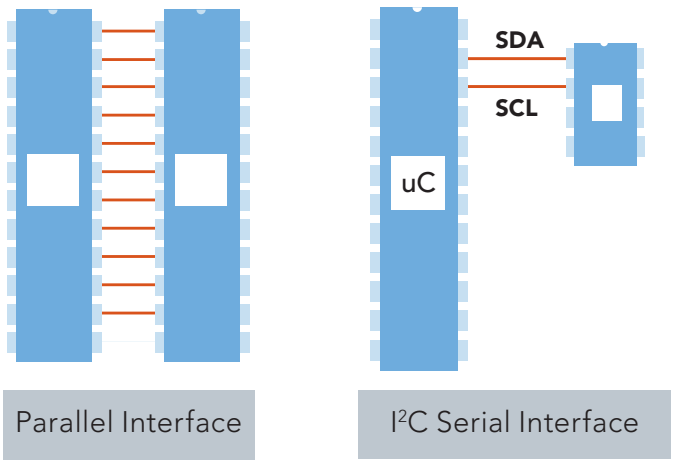
A BROAD CATALOG OF INTERFACE COMPONENTS FOR ALL YOUR DESIGN NEEDS

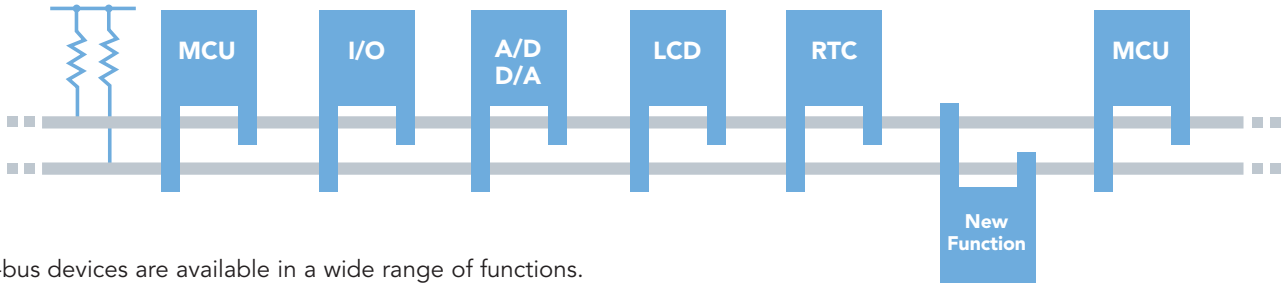
I²C-BUS: THE SERIAL REVOLUTION

By replacing complex parallel interfaces with a straightforward yet powerful serial structure, the I²C-bus revolutionized chip-to-chip communications.

Invented by NXP (Philips) more than 30 years ago, the I²C-bus uses a simple two-wire format to carry data one bit at a time. It performs inter-chip addressing, selection, control and data transfer. Speeds are up to 400 kHz (fast mode), 1 MHz (fast mode plus), 3.4 MHz (high-speed mode), or 5 MHz (ultra-fast mode). New 12.5 MHz I3C controllers with backwards compatibility to I²C are starting to hit the market which compete with the higher speeds of the SPI bus.

The I²C-bus shrinks the IC footprint and leads to lower IC costs. Additionally, since far fewer copper traces are needed, it enables a smaller PCB, reduces design complexity and lowers system cost.

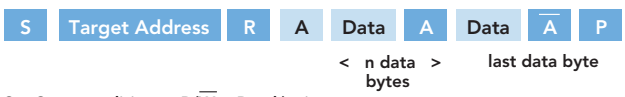




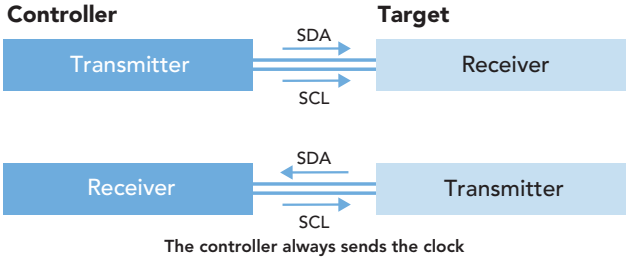
I²C-bus devices are available in a wide range of functions. Each target device has its own I²C-bus address, selectable using address pins set high (1) or low (0). Information is transmitted byte by byte, and each byte is acknowledged by the receiver. There can be multiple devices on the same bus, and more than one IC can act as controller. The controller role is typically played by a microcontroller.

Write data

Read data



S = Start condition R/$\overline{W}$ = Read/write
A = Acknowledge $\overline{A}$ = Not acknowledge P = Stop condition



OVERVIEW OF MIPI I3C

MIPI I3C (and the publicly available MIPI I3C Basic) provide a scalable, medium-speed, utility and control bus for connecting peripherals to an application processor. Its design incorporates key attributes from both I²C-bus and SPI interfaces to provide a unified, high-performance, low-power interface solution that delivers a flexible upgrade path for I²C-bus and SPI implementers. Originally introduced in 2017, I3C was the culmination of a multi-year development project based on extensive collaboration with the MEMS and Sensors Industry Group and across the broader electronics ecosystem.

As shown in Figure 1, I²C-bus targets (with 50 ns filter) can coexist with I3C controllers operating at 12.5 MHz, enabling the migration of existing I²C-bus designs to the I3C specification. Conversely, I3C targets operating at typical 400 kHz or 1 MHz I²C-bus speeds can coexist with existing I²C-bus controllers.

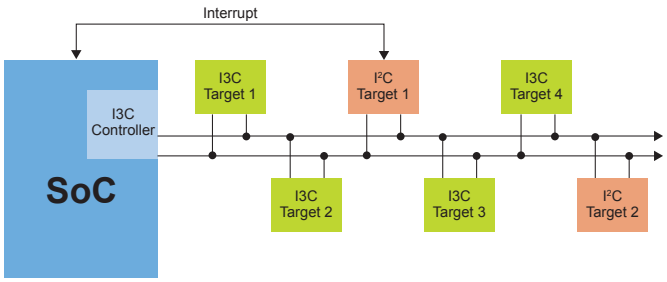


Figure 1 – I²C and I3C targets coexisting with I3C controller

Just like I²C, I3C is implemented with standard CMOS I/O pins using a two-wire interface, but unlike I²C it supports in-band interrupts enabling target devices to notify controllers of interrupts, a design feature that eliminates the need for a separate general-purpose input/output (GPIO) interrupt for each target, reducing system cost and complexity. Support for dynamic address assignments help minimize pin counts, which is key for accommodating space-constrained form factors.

I3C supports a multi-drop bus that, at 12.5MHz, supports standard data rate (SDR) of 10 Mbps with options for high-data-rate (HDR) modes. The net result is that I3C offers a leap in performance and power efficiency compared with I²C as shown in Figure 2.

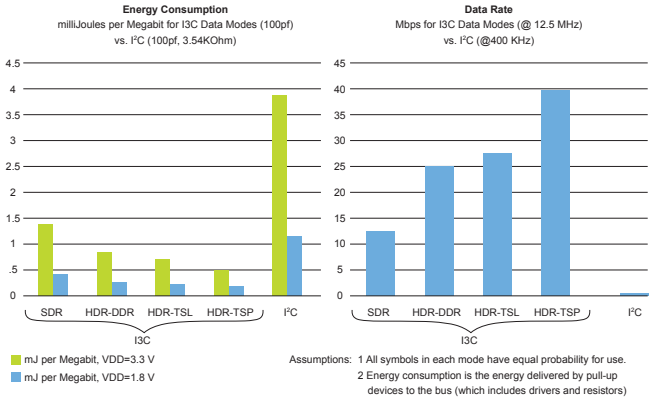


Figure 2 – Comparison of Energy Consumption and Data Rates: I3C vs I²C

Additional technical highlights for I3C include multi-controller support, dynamic addressing, command-code compatibility and a uniform approach for advanced power management features, such as sleep mode. It provides synchronous and asynchronous timestamping to improve the accuracy of applications that fuse signals from various peripherals. It can also batch and transmit data quickly to minimize energy consumption of the host processor.

COMPARISON OF FEATURES

Feature	I3C v1.0	I3C Basic	I3C v1.1	I3C Basic v1.1
12.5 MHz SDR (Controller, Target and Legacy I²C Target Compatibility)	√	√	√	√
Target can operate as I²C device on I²C bus and on I3C bus using HDR modes	√	√	√	√
Target Reset	√	√	√	√
Specified 1.2V-3.3V Operation for 50pf C load	√	√	√	√
In-Band Interrupt (w/MDB)	√	√	√	√
Dynamic Address Assignment	√	√	√	√
Error Detection and Recovery	√	√	√	√
Secondary Controller	√	√	√	√
Hot-Join Mechanism	√	√	√	√
Common Command Codes (Required/Optional)	√	√ √	√	√ √
Specified 1.0V Operation for 100pf C load	√	√	√	√
Set Static Address as Dynamic Address CCC (SETAASA)	√	√	√	√
Synchronous Timing Control	√	√	√	√
Asynchronous Timing Control (Mode 0)	√	√	√	√
Asynchronous Timing Control (Mode 1-3)	√	√	√	√
HDR-DDR	√	√	√	√
HDR-TSL/TSP	√	√	√	
HDR-BT (Multi-Lane Bulk Transport)	√	√	√	√
Grouped Addressing	√	√	√	√
Device to Device(s) Tunneling	√	√	√	√
Multi-Lane for Speed (Dual/Quad for SDR and HDR-DDR)	√	√	√	√
Monitoring Device Early Termination	√	√	√	√

Figure 3 – Comparison of I3C and I3C Basic Features

While the full version of I3C is available only to MIPI Alliance members, MIPI has released a public version called I3C Basic that bundles the most commonly needed I3C features for use by developers and other standards organizations. I3C Basic is available for implementation without MIPI membership and is intended to facilitate a royalty-free licensing environment for all implementers. Figure 3 summarizes the key features supported by I3C and I3C Basic.

To support developers, compatibility between different I3C implementations has been confirmed through multiple interoperability workshops, and several supporting MIPI resources are available. These include:

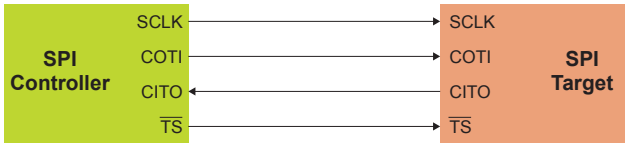
- I3C Host Controller Interface – MIPI I3C HCI℠
- I3C HCI Driver for Linux
- I3C Discovery and Configuration Specification – DisCo for I3C℠
- I3C Debug and Test Interface – MIPI Debug for I3C℠

I3C intellectual property (IP) is available from multiple vendors, including a licence free version for I3C Basic. I3C conformance testing and verification IP test suites are also available from multiple vendors.

More information on I3C and I3C Basic is available via the MIPI Alliance website.

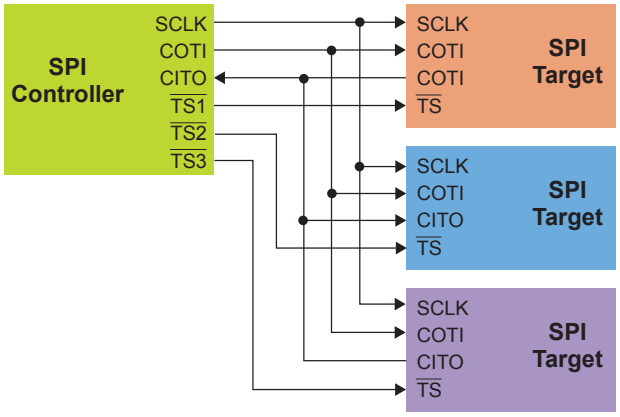
OVERVIEW OF THE SPI BUS

SPI is the full duplex synchronous serial interface consisting of four signals: SCLK (serial clock), COTI (controller out, target in), CITO (controller in, target out) and TS (target select). SPI bus operates with a single controller device and one or more target devices. Data rate ranges from 5 to 20 Mbps which is much higher than the I²C-bus rate but like the new I3C-bus.

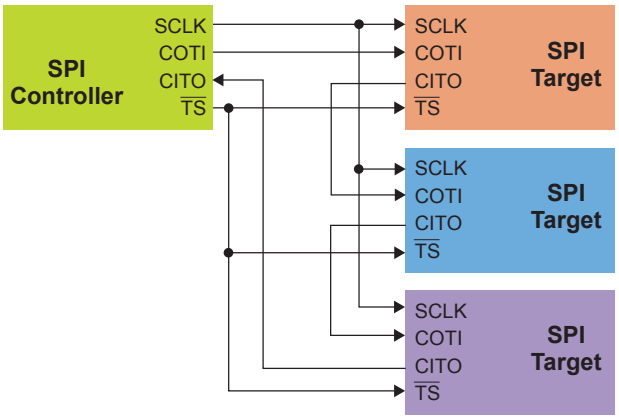


Though target devices might operate in one polarity or phase only, clock polarity and phase of the SPI bus could be configured with respect to the data to establish the valid communication link by the controller. CPOL determines the polarity of the clock. When CPOL = 0, clock is low when idle. The leading edge is the rising edge and the trailing edge is the falling edge. When CPOL = 1, clock is high when idle. The leading edge is the failing edge and the trailing edge is the rising edge.

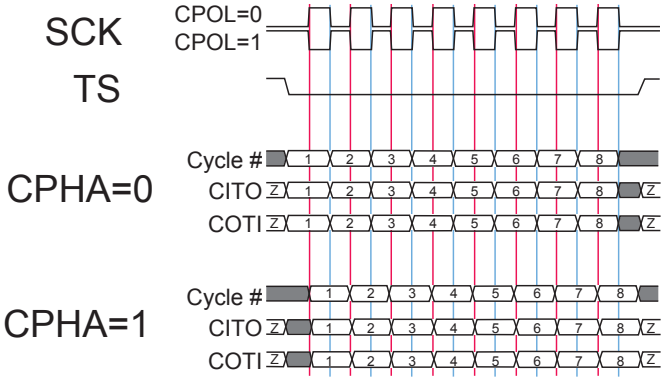
CPHA determines the timing of the data bits relative to the clock pulse. When CPHA = 1, the transmitting side changes data on the leading edge of the clock and the receiving side captures data on the trailing edge of the clock. When CPHA = 0, the transmitting side changes data on the trailing edge of the clock and the receiving side captures data on the leading edge of the clock.



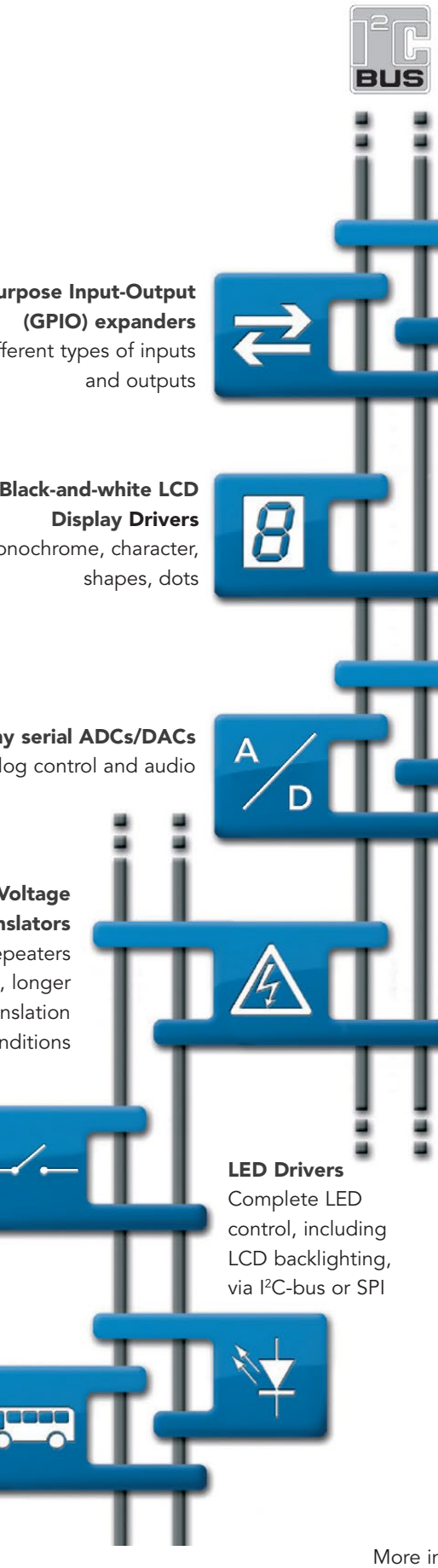
The controller could connect with multiple independent targets in parallel. Each target is controlled with the separate TS signal. When TS = 0, only the corresponding target will response to the controller. Outputs of all others with TS = 1 remain in high impedance.



Alternatively, targets could be connected in a daisy chain configuration to reduce number of the target select signals. The controller output is connected to the first target input. The first target output is connected to the second target input and so on. Then the last target output is connected back to the controller input. Each target is designed to send out during the second group of the clock pulses the exact copy of the data it received during the first group of clock pulses. The controller receives data from the last target first then data from the first target last during the same clock group. It requires two clock groups to complete each operation which would be only one clock group in the parallel configuration



NXP I²C, I3C AND SPI PRODUCT LINES



General-Purpose Input-Output (GPIO) expanders
Add different types of inputs and outputs

Temperature Sensor
Digital temperature information

Black-and-white LCD Display Drivers
Monochrome, character, shapes, dots

Clocks / RTCs
Digital time, watchdog and/or calendar

Tiny serial ADCs/DACs
Analog control and audio

Multiplexers and Switches
Add advanced I²C networking to allow more devices, backup, hot-swap

Bus Buffers and Voltage Translators
Extenders, hubs and repeaters to support extra devices, longer distances, bus-voltage translation or hazardous conditions

I²C-controlled DIP Switches
EEPROMs combined with general-purpose outputs

Load Switch
Easy-to-read power status and feature control via I²C-bus

Intelligent stepper motor controllers
Easy and versatile control

LED Drivers
Complete LED control, including LCD backlighting, via I²C-bus or SPI

Power Management
Integrated circuits

Bridge ICs Bus Controllers add extra, fully featured I²C controller

High Speed Interface
CC Logic/PD Phy, Redrivers, DP++ level shifter and MUX with I²C-bus control

More information: **www.nxp.com/i2c**.

I²C-BUS,I3C-BUS AND SPI PRODUCT SUMMARY

GPIO Expander

4-bit	PCA9536	4-bit I²C Fm TP GPIO with PU
	PCA9537	4-bit I²C Fm TP GPIO with INT and RST
	PCA9570	4-bit 1 MHz LV TP GPO
8-bit	PCA8574	8-bit I²C Sm QB GPIO with INT and PU
	PCF8574	8-bit I²C Fm QB GPIO with INT and PU
	PCA8574A	8-bit I²C Fm QB GPIO with INT and PU (alternate address)
	PCF8574A	8-bit I²C Sm QB GPIO with INT and PU (alternate address)
	PCA9500	8-bit I²C Fm QB GPIO with PU and 2-K EEPROM
	PCA9501	8-bit I²C Fm QB GPIO with INT, PU and 2-K EEPROM
	PCA9502	8-bit I²C Fm/SPI TP GPIO with INT and RST
	PCA9534	8-bit I²C Fm TP GPIO with INT
	+ PCA9538	8-bit I²C Fm TP GPIO with INT and RST
	PCA9538A	8-bit I²C Fm LV TP GPIO with INT and RST
	PCAL9538A	8-bit I²C Fm LV TP/OD GPIO with INT, RST, latch and PU/PD
	PCA6408A	8-bit I²C Fm LV VLT TP GPIO with INT and RST
	PCAL6408A	8-bit I²C Fm LV VLT TP/OD GPIO with INT, RST, latch and PU/ PD
	PCA9554	8-bit I²C Fm TP GPIO with INT and PU
	PCA9554A	8-bit I²C Fm TP GPIO with INT and PU (alternate address for PCA9554)
	PCA9554B	8-bit I²C Fm LV TP GPIO with INT and PU
	PCAL9554B	8-bit I²C Fm LV TP/OD GPIO with INT, latch and PU/PD (PU default)
	PCA9554C	8-bit I²C Fm LV TP GPIO with INT and PU (alternate address for PCA9554B)
	PCAL9554C	8-bit I²C Fm LV TP/OD GPIO with INT, latch and PU/PD (PU default) (alternate address for PCAL9554B)
	PCA9557	8-bit I²C Fm TP GPIO with RST
	PCA9571	8-bit 1 MHz LV TP GPO
	PCA9574	8-bit I²C Fm LV VLT TP/OD GPIO with INT, RST, latch and PU/PD
	PCA9670	8-bit I²C Fm+ QB GPIO with RST and PU
	PCA9672	8-bit I²C Fm+ QB GPIO with INT, RST and PU
	PCA9674	8-bit I²C Fm+ QB GPIO with INT and PU
	PCA9674A	8-bit I²C Fm+ QB GPIO with INT and PU (alternate address)
	PCA9702	8-bit SPI 18 V GPI with INT
	+ PCA9704	8-bit SPI 18 V GPI with maskable INT
14-bit	+ PCAL9714	14-bit SPI LV VLT TP/OD GPIO with INT, RST, latch and PU/PD
16-bit	PCA8575	16-bit I²C Fm QB GPIO with INT and PU
	PCF8575	16-bit I²C Fm QB GPIO with INT and PU
	PCF8575C	16-bit I²C Fm OD GPIO with INT
	PCA9535	16-bit I²C Fm TP GPIO with INT
	PCA9535C	16-bit I²C Fm OD GPIO with INT
	PCA9535A	16-bit I²C Fm LV TP GPIO with INT
	PCAL9535A	16-bit I²C Fm LV TP/OD GPIO with INT, latch and PU/PD
	+ PCA9539	16-bit I²C Fm TP GPIO with INT and RST
	+ PCA9539R	16-bit I²C Fm TP GPIO with INT and RST (state machine only)
	PCA9539A	16-bit I²C Fm LV TP GPIO with INT and RST
	PCAL9539A	16-bit I²C Fm LV TP/OD GPIO with INT, RST, latch and PU/PD
	PCA6416A	16-bit I²C Fm LV VLT TP GPIO with INT and RST
	PCAL6416A	16-bit I²C Fm LV VLT TP/OD GPIO with INT, RST, latch and PU/PD
	PCA9555	16-bit I²C Fm TP GPIO with INT and PU
	PCA9555A	16-bit I²C Fm LV TP GPIO with INT and PU
	PCAL9555A	16-bit I²C Fm LV TP/OD GPIO with INT, latch and PU/PD (PU default)
	PCA9575	16-bit I²C Fm LV VLT TP/OD GPIO with INT, RST, latch and PU/PD
	PCA9671	16-bit I²C Fm+ QB GPIO with RST and PU
	PCA9673	16-bit I²C Fm+ QB GPIO with INT, RST and PU
	PCA9675	16-bit I²C Fm+ QB GPIO with INT and PU
	PCA9701	16-bit SPI 18 V GPI with INT
	+ PCA9703	16-bit SPI 18 V GPI with maskable INT
22-bit	+ PCAL9722	22-bit SPI LV VLT TP/OD GPIO with INT, RST, latch and PU/PD
24-bit	PCAL6524	24 bit I²C Fm+ ULV VLT TP/OD GPIO with INT, RST, latch and PU/PD
34-bit	PCAL6534	34 bit I²C Fm+ ULV VLT TP/OD GPIO with INT, RST, latch and PU/PD
40-bit	PCA9505	40-bit I²C Fm TP GPIO with INT, RST, OE and PU
	PCA9506	40-bit I²C Fm TP GPIO with INT, RST and OE
	PCA9698	40-bit I²C Fm+ TP/OD GPIO with INT, RST, OE and PU

Stepper Motor Controller

1 motor controller	PCA9629A	Improved I²C Fm+ stepper motor controller with TP GPIO with INT and RSTC

Temp Sensors

Local	LM75B	I²C Fm TS local with ± 2 °C accuracy and SMBus timeout
	SE98A	I²C Fm JEDEC DDR3 TS, no SPD, +/- 1 °C accuracy and SMBus timeout
	PCT2075	I²C Fm+ TS with +/- 1 °C accuracy and SMBus timeout Default interrupt trip is + 85 °C
	PCT2075GV/ N005	Default interrupt trip -5 °C — for freezer alarm
	PCT2075GV/ P110	Default interrupt trip + 110 °C — prevent spurious alarm in high temp environment
	P3T1085UK	I3C and I²C HsM TS with +/- 0.5 °C accuracy and SMBus timeout
	+ P3T1755DP	I3C and I²C HsM TS with +/- 0.5 °C accuracy and SMBus timeout
Local and EEPROM	SE97B	I²C Fm JEDEC DDR3 TS local with ± 1 °C accuracy, 2K SPD and SMBus timeout
Local and remote	SA56004	I²C HSmTS, 1.8 V, + 1 °C accuracy and SMBus timeout

LED Drivers

Open Drain or Totem Pole Voltage Source

Dimmer (2 PWM, 25 mA/ 5 V)	PCA9530	2-channel I²C Fm OD LED dimmer with RST
	PCA9531	8-channel I²C Fm OD LED dimmer with RST
	PCA9532	16-channel I²C Fm OD LED dimmer with RST
	PCA9533	4-channel I²C Fm OD LED dimmer
Blinker (2 PWM, 25 mA/5 V)	PCA9550	2-channel I²C Fm OD LED blinker with RST
	PCA9551	8-channel I²C Fm OD LED blinker with RST
	PCA9552	16-channel I²C Fm OD LED blinker with RST
	PCA9553	4-channel I²C Fm OD LED blinker
Controller (PWM/Ch, 25 mA/ 5 V)	PCA9632	4-channel I²C Fm+ low-power TP LED controller
	PCA9633	4-channel I²C Fm+ TP LED controller with OE
	PCA9634	8-channel I²C Fm+ TP LED controller with OE
	+ PCA9635	16-channel I²C Fm+ TP LED controller with OE
	+ PCA9685	16-channel I²C Fm+ TP LED controller with 12-bit PWMs and OE

Open Drain Constant Current

Driver (PWM/Ch, 57 mA/ 40 V)	+ PCA9952	16-channel I²C Fm+ HV CS LED driver with OE
	+ PCA9955	16-channel I²C Fm+ HV CS LED driver
Driver (PWM/Ch, 57 mA/ 20 V)	+ PCA9955B	16-channel I²C Fm+ CC LED driver
	+ PCA9745B	16-channel SPI CC LED driver
	PCA9956B	24-channel I²C Fm+ CC LED driver
Driver (PWM, 5 V)	PCA9957	24-channel SPI CC LED driver — 32 mA per ch
	+ PCA9958	24-channel SPI CC LED driver — 63 mA per ch
	PCA9959	24-channel SPI CC LED driver — 63 mA per ch — 64 grids

Power management integrated circuits (PMIC)

PCA942X	i.MX RT5/600 including battery charger
PCA9450	i.MX 8M family with 12 power rails
PCA9460	i.MX 8ULP with 13 power rails
PCA9451	i.MX 93 with 12 power rails

Real-time Clocks

Low-power	PCF2123	SPI lower power RTC with alarm, timer and interrupt
	PCF85053A	Bootable CPU I²C Fm RTC with two I2C controllers, 128 Byte SRAM and alarm function
	PCF85063	I²C Fm/Tiny RTC with 30s, 60s interrupt
	PCF85063A/B	I²C Fm or SPI/Tiny RTC with alarm and 30s, 60s interrupt
	PCF85263A	I²C Fm/Tiny RTC with alarms, time stamp and battery backup +1-byte RAM 0.25 mm pitch WLCSP12 for cellular modem
	PCF85363A	I²C Fm/Tiny RTC with alarms, time stamp and battery back-up switch + 64-byte RAM
	PCF8523	I²C Fm+ ultra-low-power RTC with loss of main power detection and automatic battery backup
	PCF8563	I²C Fm low-power clock/calendar
	PCF8583	I²C Sm Clock and calendar with 240 x 8-bit RAM and alarm
	PCF8593	I²C Sm Low power clock and calendar with alarm
Automotive high temperature	+ PCA21125	SPI lower power RTC with alarm, timer and interrupt to 125 °C
	+ PCA85073A	I²C Fm/Tiny RTC with alarm and 30s, 60s interrupt -40 °C to 105 °C
	+ PCA8565	I²C Fm high-temperature clock/calendar -40 °C to +125 °C
	+ PCA2131	I²C Fm or SPI high accuracy, low voltage 100 mA RTC with embedded crystal, time stamp, tamper pins -40 °C to 105 °C
Temperature compensated high accuracy with embedded crystal	PCF2131	I²C Fm or SPI high accuracy, low voltage 64 nA RTC time stamp, tamper pins -40 °C to 85 °C

Muxes and Switches

2-channel	+ PCA9540B	2-channel I²C Fm mux
	P3S0200GM	2:1 and 1:2 I3C 12.5 MHz mux with select pin
	PCA9542A	2-channel I²C Fm mux with INT
	PCA9543A	2-channel I²C Fm switch with INT and RST
2-to-1 demux	PCA9541A/01	2-to-1 I²C Fm demux with INT and RST (channel 0 default)
	PCA9541A/03	2-to-1 I²C Fm demux with INT and RST (no channel default)
4-channel	PCA9544A	4-channel I²C Fm mux with INT
	PCA9545A	4-channel I²C Fm switch with INT and RST
	PCA9546A	4-channel I²C Fm switch with RST
	PCA9646	4-channel I²C Fm+ no offset buffer/switch with RST
	PCA9846	4-channel ULV VLT I²C Fm+ switch with RST
	PCA9849	4-channel ULV VLT I²C Fm+ mux with RST
8-channel	PCA9547	8-channel I²C Fm mux with RST (channel 0 default)
	PCA9847	8-channel ULV VLT I²C Fm+ mux with RST
	PCA9548A	8-channel I²C Fm switch with RST
	PCA9848	8-channel ULV VLT I²C Fm+ switch with RST
Arbiter	PCA9641	2 controllers to shared target I²C Fm+ arbiter with INT and RST (no channels selected at default)

Load Switch

Load Switch	NX3P2902BUK	500 mA / 3.6 V load switch
	NX3P1108UK	1.5 A / 3.6 V load switch
	NX5P3363UK	3 A / 5 V source load switch
	NX20P5090UK	5 A / 20 V sink load switch
	NX30P6093UK	I²C-controlled OVP load switch

Bus Buffers

Incremental offset	PCA9510A	I²C Fm incremental offset hot-swap bus buffer (no RTA)
	PCA9511A	I²C Fm incremental offset hot-swap bus buffer
	PCA9512A	I²C Fm incremental offset VLT hot-swap bus buffer
	PCA9513A	I²C Fm incremental offset hot-swap bus buffer (92 µA CS)
	PCA9514A	I²C Fm incremental offset hot-swap bus buffer (0.8 V offset)
Differential driver with static offset (1 side)	PCA9614	I²C Fm+ VLT differential (4-wire) bus buffer
	PCA9615	I²C Fm+ VLT differential (4-wire) hot-swap bus buffer
	PCA9616	I²C Fm+ 0.8 V LV VLT differential (4-wire) hot-swap bus buffer with INT (2-wire)
No offset	PCA9646	4-channel I²C Fm+ no offset buffer/switch with RST
Static offset (1 side)	P82B96	I²C Fm HV bus buffer
	PCA9507	I²C Fm VLT DDC buffer with accelerator
	PCA9508	I²C Fm VLT hot-swap bus repeater
	PCA9509	I²C Fm 1.0 V VLV VLT bus buffer with current source
	PCA9509P	I²C Fm 0.8 V ULV VLT bus buffer
	PCA9517A	I²C Fm 0.9 V ULV VLT bus repeater
	PCA9519	4-channel version of PCA9509
	PCA9527	I²C Fm DDC VLT buffer with accelerator and CEC
	PCA9600	I²C Fm+ HV bus buffer
	PCA9601	I²C Fm+ HV bus buffer with stronger 15 mA local side drive to support multiple Fm+ followers
	PCA9617A	I²C Fm+ 0.8 V ULV VLT bus repeater
Static offset (All sides)	PCA9515A	I²C Fm bus repeater
	PCA9516A	I²C Fm 5-channel hub
	PCA9518A	I²C Fm expandable 5-channel hub

Level Translators

FET No Direction Pin	NVT2001	1-bit I²C Fm+ VLT 1.0 V to 5.5 V
	NVT2002	2-bit I²C Fm+ VLT 1.0 V to 5.5 V
	PCA9306	Dual I²C/SMBus Fm+ VLT 1.0 V to 5.5 V
	NVT2003	3-bit I²C Fm+ VLT for two power supplies in same bus application 1.0 V to 5.5 V
	NVT2006	6-bit I²C Fm+ VLT 1.0 V to 5.5 V
	NVT2008	8-bit I²C Fm+ VLT 1.0 V to 5.5 V
	NVT2010	10-bit I²C Fm+ VLT 1.0 V to 5.5 V
FET One Shot No Direction Pin	NTS0101	1-bit I²C Fm+ VLT 1.65 V to 3.6 V A side and 2.3 V to 5.5 V B side
	NTS0102	2-bit I²C Fm+ VLT 1.65 V to 3.6 V A side and 2.3 V to 5.5V B side
	P3A9606	Dual I3C 12.5 MHz and I²C/SMBus Fm+ VLT 0.72 V to 1.98 V
	P3S0200	Dual bidirectional I3C 12.5 MHz 1:2 and 2:1 switch and voltage level translator 0.72 V to 3.6 V
	NTS0104	4-bit I²C Fm+ VLT 1.65 V to 3.6 V A side and 2.3 V to 5.5 V B side
	NTS0302	2-bit improved smart one shot I²C Fm+ VLT 0.95 V to 3.6 V A side and 1.65 V to 5.5 V B side
	NTS0304E	4-bit improved smart one shot I²C Fm+ VLT 0.95 V to 3.6 V A side and 1.65 V to 5.5 V B side with IEC 61000-4-2 Class 4, 8 kV contact on B side
	NTS0308E	8-bit improved smart one shot I²C Fm+ VLT 0.95 V to 3.6 V A side and 1.65 V to 5.5V B side with IEC 61000-4-2 Class 4, 8 kV contact on B side
	NTSX0102	2-bit I²C Fm+ VLT 1.65 V to 5.5 V A side and 1.65 V to 5.5 V B side
Buffer One Shot No Direction Pin	NTB0101	1-bit SPI VLT 1.2 V to 3.6 V A side and 1.65 V to 5.5 V B side
	NTB0102	2-bit SPI VLT 1.2 V to 3.6 V A side and 1.65 V to 5.5 V B side
	NTB0104	4-bit SPI VLT 1.2 V to 3.6 V A side and 1.65 V to 5.5 V B side

Code	Description
Sm	100 kHz Standard-mode I²C-bus
Fm	400 kHz Fast-mode I²C-bus
Fm+	1 MHz Fast-mode Plus I²C-bus
HSm	3.4 MHz High-speed Mode I²C-bus
+	AEC-Q100 Compliance
GPIO	General-purpose I/O Expander
TS	Thermal Sensor
RTC	Real-time Clock
LCD	Liquid Crystal Display
DAC	Digital Analog Converter

Code	Description
ADC	Analog Digital Converter
LV	Supply Voltage < 2.3 V
VLV	Supply Voltage < 1.65 V
ULV	Supply Voltage < 1.0 V
HV	Outputs >10 V
VLT	Voltage Level Translator — 2 Supplies
TP	Totem-pole (push-pull)
QB	Quasi-bidirectional
OD	Open Drain
CC	Constant current

Code	Description
INT	Interrupt
RST	Reset
OE	Output enable
Latch	Input latch
PU	Pull-up resistors
PU/PD	Pull-up/pull-down resistors
COG	Chip on glass
SPI	Serial peripheral interface
SPMI	System power management interface
P3A, P3T, P3S	3 indicates I3C Bus capable

LCD Drivers

Segment driver	+ PCA8561A/B	I²C Fm or SPI 72-segment low-power LCD driver in HVQFN32 package
	+ PCA/ PCF85162	I²C Fm 128-segment LCD driver in TSSOP48 package
	+ PCA85262	I²C Fm 128-segment LCD driver with higher frame frequency in TSSOP48 package
	+ PCA/ PCF8551A/B	I²C Fm or SPI 144-segment low-power LCD driver with programmable frame frequency in TSSOP48 package
	+ PCA/PCE/ PCF85176	I²C Fm 160-segment LCD driver in TSSOP56 or TQFP64 package
	+ PCA85276	I²C Fm 160-segment LCD driver with higher frame frequency in TSSOP56 package
	+ PCA/ PCF8553A/B	I²C Fm or SPI 160-segment low-power LCD driver with programmable frame frequency in TSSOP56 package
	+ PCA8546A/B	I²C Fm or SPI 176-segment LCD driver with programmable frame frequency in TSSOP56 package
	+ PCA8547A/B	I²C Fm or SPI 176-segment LCD driver with programmable frame frequency, charge pump, VLCD temperature compensation in TQFP64 package
	+ PCA/ PCF85134	I²C Fm 240-segment LCD driver in LQFP80 package
	PCF8545A/B	I²C Fm orSPI 320-segment LCD driver with programmable frame frequency in TSSOP56 package
	+ PCA/ PCF8536A/B	I²C Fm or SPI 320-segment LCD driver with programmable frame frequency and LED backlight PWM control in TSSOP56 package
	+ PCA/ PCF8537A/B	I²C Fm or SPI 352-segment LCD driver with programmableframe frequency, charge pump, VLCD temperature compensation in TQFP64 package
	+ PCA9620	I²C Fm 480-segment LCD driver with programmable frame frequency, charge pump, VLCD temperature compensation in LQFP80 package
	+ PCA/ PCF8576D/E	I²C Fm 160-segment COG LCD driver
	+ PCA8576F	I²C Fm 160-segment COG LCD driver with higher frame frequency and higher VLCD
	+ PCA/PCE/ PCF85133	I²C Fm 320-segment COG LCD driver with selectable frame frequency
	+ PCA85233	I²C Fm 320-segment COG LCD driver with higher selectable frame frequency
	+ PCA85232	I²C Fm 640-segment COG LCD driver with higher programmable frame frequency
Character drivers	PCF2119	I²C Fm or parallel bus 2 x 16 characters + 160-icon COG LCD driver with charge pump,VLCD temperature compensation
Graphic driver	PCF8531	I²C Fm 34 x 128-pixel COG LCD driver with charge pump, VLCD temperature compensation

High Speed Interface

CC Logic/ PD Phy	PTN5150	USB Type-C Rev 1.1 CC-Logic, Pin to control NXP redriver
	PTN5110	USB Type-C Rev 3.0 PD PHY, TCPC Rev 2.0 version 1.0. Laptop/tablet applications
Redrivers	PTN36502	USB and DP Combo Redriver, SuperSpeed USB 3.1 Gen1, DP V 1.2
	PTN38007	Multi-protocol USB4 20 Gbps linear redriver
	PTN38003A	Multi-protocol USB3.2 and DisplayPort linear redriver
	PTN3944	Multi-channel PCIe 4.0 linear equalizer
Mux	CBTL08GP053	USB Type-C High performance Crossbar Switch IC
DP++ Level Shifter	PTN3360	Enhanced performance HDMI/DVI level shifter with active DDC buffer, supporting 3 Gbi t/s operation
	PTN3361B	HDMI/DVI level shifter with dongle detect support and active DDC buffer
	PTN3361C	Enhanced performance HDMI DVI level shifter with active DDC buffer, supporting 1.65 Gbit/s operation
	PTN3363	Low power HDMI/DVI level shifter with active DDC buffer, supporting 3.4 Gbit/s operation
	PTN3365	Enhanced performance HDMI/DVI level shifter with active DDC buffer, supporting 3 Gbit/s operation
	PTN3366	Low power HDMI/DVI level shifter with active DDC buffer, supporting 3 Gbit/s operation
	PTN3381	(DOD) Enhanced performance HDMI/DVI level shifter with voltage regulator, dongle detect support and active DDC buffer

A/D-D/A Converters

8-bit ADC	PCF8591	I²C Fm 4-channel ADC and 1-channel DAC

DIP Switch

2-kbit EE	PCA9500	8-bit I²C Fm QB GPIO with PU and 2-K EEPROM
	PCA9501	8-bit I²C Fm QB GPIO with INT, PU and 2-K EEPROM
DIP switch	PCA8550	I²C Fm 4-bit 1-of-2 mux and 5-bit EEPROM
	PCA9559	I²C Fm 5-bit mux/1-bit latch and 6-bit EEPROM
	PCA9560	I²C Fm 2 x 5-bit mux/1-bit latch and 6-bit EEPROM
	PCA9561	I²C Fm 4 x 6-bit mux and 6-bit EEPROM

Bridge and Bus Controllers

Bridge	+ SC16IS740	I²C Fm/SPI-to-UART bridge with IrDA
	SC16IS741A	I²C Fm/SPI-to-UART bridge with IrDA
	SC16IS750	I²C Fm/SPI-to-UART bridge with IrDA and GPIO
	SC16IS752	I²C Fm/SPI-to-DUART bridge with IrDA and GPIO
	SC16IS760	I²C Fm/SPI-to-UART bridge with IrDA and GPIO
	SC16IS762	I²C Fm/SPI-to-DUART bridge with IrDA and GPIO
	SC18IM704	UART-to-I²C Fm controller bridge with GPIO (Replacement for SCI18IM700)
	SC18IS604	SPI-to-I²C Fm controller bridge with GPIO (Replacement for SC18IS600)
	SC18IS606	I²C Fm target-to-SPI controller bridge (Replacement for SC18IS602B)
Controller	PCF8584	I²C Sm bus controller with bus snoop
	PCA9564	I²C Fm bus controller
	PCA9665A	I²C Fm+ bus controller with 68-byte buffer and restart condition fix

Level Transceivers

GTL to LVTTL Translators with Direction Pin	GTL2012	2-bit LVTTL to GTL transceiver
	GTL2014	4-bit LVTTL to GTL transceiver
	GTL2018	8-bit LVTTL to GTL transceiver
	GTL2034	4-bit GTL to GTL buffer

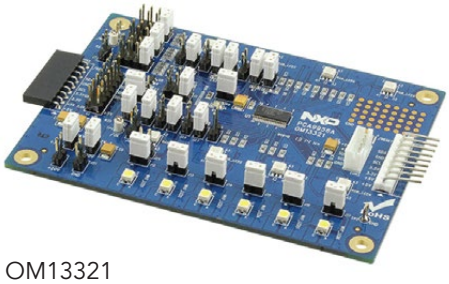
Level Translator

SIM Card Translator	NVT4555	SIM card VLT level translator and LDO
	NVT4557	SIM card VLT level translator for 1.8 V node
	NVT4558	SIM card VLT level translator for 1.2 V and 1.8 V node
SD Card Translator	NVT4857	SD 3.0 - SDR104 auto-direction control memory card level translator and LDO — also support SIM card for combo socket
	NVT4858	SD 3.0 — SDR104 auto-direction control memory card level translator for both 1.2 V and 1.8 V node — also supports SIM card for combo socket
eUSB2 Repeater and Level Shifter	PTN3222	1-port eUSB2 to USB2 redriver functionality

DEMO BOARD

Bridges	OM6270	SC16IS750_760 SPI_I²C-UART EV
	OM6273	SC16IS752_762 SPI_I²C-UART EV
	SC18IS604-EVB	SPI-to-I²C Fm controller bridge Eval Board
	SC18IS606-EVB	I²C Fm target-to-SPI controller bridge Eval Board
	SC18IM704-EVB	UART-to-I²C Fm controller bridge Eval Board
LCD display	OM13506	PCF8553 LCD Demo
RTC	OM11059	PCF85063B RTC Eval - SPI
	OM11059A	PCF85063A RTC Eval - 1²C
	OM13510	PCF85263 RTC Eval
	OM13511	PCF8523 RTC Eval
	OM13512	PCF2123 SPI-bus RTC Eval
	OM13514	PCF85363 RTC Eval
	OM13515	PCF85063A RTC Eval
	OM13517	PCA21125 RTC Eval 9 pin
	OM13519	PCA8565 RTC Eval
Voltage-Level Translator	OM13315	NVT2001GM VLT Eval
	OM13317	NVT2008PW VLT Eval
	OM13318	NVT2002DP VLT Eval
	OM13319	NVT2003DP VLT Eval
	OM13323	NVT2006PW VLT Eval
	OM13324	NVT2010PW VLT Eval
	OM13480	NVT4555UK SIM Card Eval
	OM13543	NTS0304EPW VLT Test
	NVT4858-4557-EVB	NVT4858 SD and NVT4557 SIM Card Eval
	P3A9606JK-EVB	P3A9606JK VLT Eval

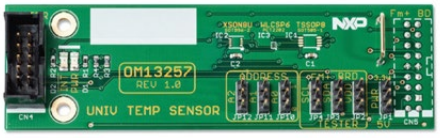
OM13318
NVT2002DP LED Demo Board



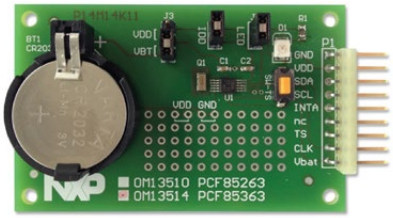
OM13321
PCA9956A 24, Non-Isolated Output
LED Driver Demo Board

LED driver	OM13269	PCA9632 LED Eval
	OM13321	PCA9956B LED Eval Fm_Plus
	OM13327	PCA9634 LED Eval
	OM13329	PCA9952 LED Eval 2005-1
	OM13330	PCA9955 LED EVB - 2005-1
	OM13332	PCA9685 demo board, 16-channel voltage source with 12-bit PWM demo board I²C Fm+
	OM13333	PCA9635 LED Eval
	OM13483	PCA9955B LED Eval
	OM13524	PCA9745B LED SPI Eval
	OM13528	PCA9532BS LED Eval
	OMPCA9957-LEDEV	PCA9957 LED Eval Socket — MCU
	OMPCA9959-LEDEV	PCA9959 LED Eval Socket — MCU
Universal	OM13491	Panel A-VSSOP_XQFN_HWSON_MSOP8
	OM13492	Panel B — 6_8_10 pin pkgs
	OM13493	Panel C — DHVQFN 24_20_16_14
	OM13494	Panel D — HVQFN 14_16_20_24
	OM13495	Panel E — TSSOP 14_16_20_24
	OM13496	Panel F — Surface Mount-DIP EV
	OM13497	Panel G — HTSSOP28_VFBGA XFBGA24
Temperature Sensors	OM13257	Universal TS DC Fm_Plus
Bus Buffers	OM13523	PCA9616PW dI²C Buffer Eval
GPIO	OM13488	Universal 8-bit GPIO DC — Fm
	OM13489	Universal 16-bit GPIO DC — Fm
	OM13526	PCAL6524 GPIO Eval
	OM13529	PCAL6524EV GPIO Eval Fm_Plus
	OM13541	PCAL6534EV GPIO Eval
Arduino Board	PCF85063AT-ARD	Industry Standard RTC
	PCT2075DP-ARD	Temp Sensor
	PCA9957HN-ARD	24-channel LED controller
	PCA9959HN-ARD	24-channel LED controller with 64-grid
	PCF85063TP-ARD	RTC
	IMX8MMINI-IARD	Interposer Board for i.MX8 EVB
	NTS0304EUK-ARD	4cch Voltage Level Translator
	PCAL6534EV-ARD	34-bit GPIO
	PCAL6524EV-ARD	24-bit GPIO
	PCF85263ATL-ARD	Full Function RTC
	PCA9955BTW-ARD	16 ch LED Controller
	PCA8561AHN-ARD	LCD Display
	PCAL6408A-ARD	8-bit GPIO
	PCAL6416AEV-ARD	16-bit GPIO
	PCA9617ADP-ARD	I²C Bus Buffer
	PCA9846PW-ARD	I²C Low Voltage Switch
	PCT2131-ARD	Low Power Temperature Compensated RTC
	PCF85053ATK-ARD	Dual Controller RTC with RAM
	P3T1085UK-ARD	Temp Sensor - 6 pin 0.5 °C accuracy
	P3T1755DP-ARD	Temp Sensor - 8 pin 0.5 °C accuracy

OM13512
PCF2123 SPI-bus RTC Demo Board



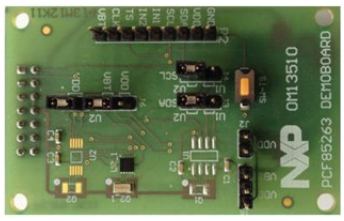
OM13257
Temp Sensor Daughter Card



OM13514
PCF85363A I²C-bus RTC PCF85263/363 Interface

OM13489
Universal 16-bit GPIO Daughter Card

OM13528
PCA9532BS 16-CH LED Demo Board



OM13515
PCF85063A RTC Timing Demo Board

Our I²C-bus website (**www.nxp.com/i2c**), SPI website (**www.nxp.com/SPI**) and I3C-bus website (**www.nxp.com/i3c**) are a valuable resource for device information and training programs. It gives you direct access to a comprehensive handbook, application notes, information about evaluation kits and training materials, links to application and design support and more. The development boards and daughter card make it easy to program new peripherals and are a quick way to learn about the I²C-bus and I3C-bus protocol.

Samples and demo boards are available on request; contact a local NXP distributor.

www.nxp.com/i3c **www.nxp.com/spi** **www.nxp.com/I²C**

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