



I²C-bus Components Selection Guide

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Overview

By replacing complex parallel interfaces with a straightforward yet powerful serial structure, the Inter-Integrated Circuit (I²C) bus revolutionized chip-to-chip communications. The I²C-bus shrinks integrated circuit (IC) footprints by reducing connection count, leading to lower IC costs, which in turn simplifies printed circuit board (PCB) design complexity and reduces system cost. This bus components selection guide provides an overview of NXP's deep I²C-bus solutions portfolio.

History

As electronic designs grew in complexity, a need developed for an easy and more cost effective way to connect peripheral devices to their controlling microprocessors. To meet this need, Philips Semiconductors (now NXP Semiconductors) invented a simple bidirectional 2-wire bus. Originally created over thirty years ago for television applications, the I²C-bus has since become a de facto industry standard supported by many companies.

I²C Features

The I²C-bus requires only two lines: a serial data line (SDA) and a serial clock line (SCL). Each device connected to the bus is software addressable by a unique address, and simple master/slave relationships exist at all times.

Operation

Serial 8-bit bidirectional data transfers occur at up to 100kbit/s in the Standard mode, up to 400kbit/s in Fast-mode (Fm), up to 1Mbit/sec in Fast-mode plus (Fm+), up to 3.4 Mbit/s in high-speed mode (Hs), and up to 5 Mbits/s (unidirectional) in the new Ultra-Fast-mode (UFm).

I²C Applications

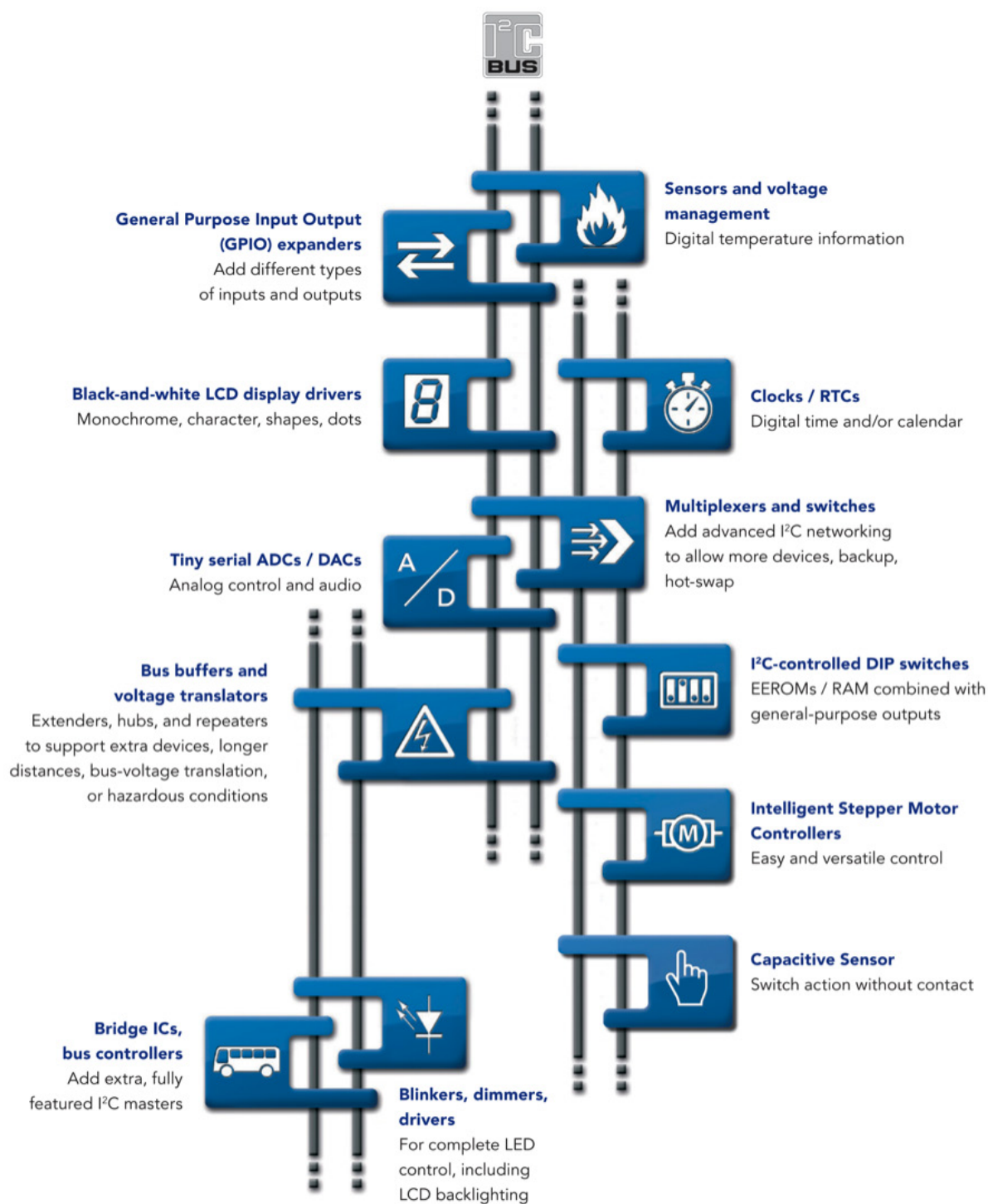
Although originally designed to link a small number of devices locally, improvements to bus speed options and the introduction of bus extension devices has allowed the use of the I²C-bus to grow from applications such as cell phones and car radios to systems spanning rooms and even buildings.

I²C Specification

For the I²C-bus specification and user manual, please visit:
http://www.nxp.com/documents/user_manual/UM10204.pdf

I²C-bus System Diagram

NXP divides the I²C peripherals portfolio into twelve families, one for each of the most common, everyday design concerns.



General Purpose Input Output (GPIO) Expanders

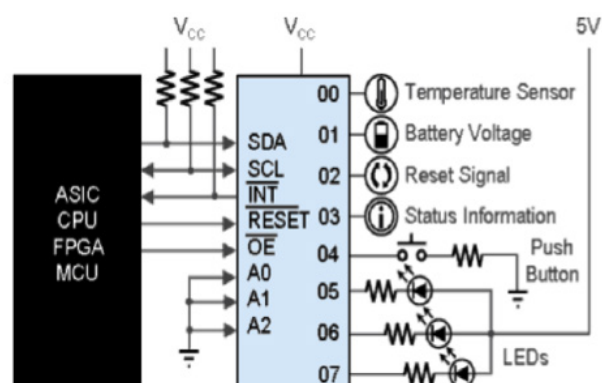
As applications demand more control and monitoring features, the General Purpose I/O (GPIO) ports on microprocessors become more valuable. GPIO expanders provide expansion capability for most microprocessor families, allowing designers to save the microprocessor GPIO for other important functions.

Features

All of NXP's I²C GPIO expanders offer similar functionality, and most have an /INT output, but several also have a /RESET input or /RESET and /OE input.

Applications

- LED control
- Hardware control monitors
- Humidity sensors
- System monitoring
- ACPI power switches
- Push buttons
- Fans



GPIO Expanders Selection Guide

Device	# of Outputs	Quasi Output	Push-Pull Output	Internal Pull-up Resistor/ Current Source	Vcc Range (V)	I ² C Max Frequency (kHz)	/OE	Hardware Reset	Interrupt Output	2kbit EEPROM	5-bit Multiplex/ 1-bit Latch EEPROM
PCA9570	4		Output Only		1.1 to 3.6	1000					
PCA9536	4		✓	✓	2.3 to 5.5	400					
PCA9537	4		✓		2.3 to 5.5	400		✓	✓		
PCA9571	8		Output Only		1.1 to 3.6	1000					
PCA6408A	8				1.65 to 5.5	400		✓	✓		
PCA9538A	8		✓		1.65 to 5.5	400		✓	✓		
PCA9554B(C)	8		✓	✓	1.65 to 5.5	400			✓		
PCA9500	8	✓		✓	2.3 to 3.6	400				✓	
PCA9501	8	✓		✓	2.3 to 3.6	400			✓	✓	
PCA9502	8		✓		2.3 to 3.6	400		✓	✓		
PCA9557	8		✓		2.3 to 5.5	400		✓			
PCA9558	8	Open Drain			2.3 to 5.5	400				✓	✓
PCA9670	8	✓		✓	2.3 to 5.5	1000		✓			
PCA8574(A)	8	✓		✓	2.3 to 5.5	400			✓		
PCA9534	8		✓		2.3 to 5.5	400			✓		
PCA9538	8		✓		2.3 to 5.5	400		✓	✓		
PCA9554(A)	8		✓	✓	2.3 to 5.5	400			✓		
PCA9672	8	✓		✓	2.3 to 5.5	1000		✓	✓		
PCA9674(A)	8	✓		✓	2.3 to 5.5	1000			✓		
PCF8574(A)	8	✓		✓	2.5 to 6.0	100			✓		

Device	# of Outputs	Quasi Output	Push-Pull Output	Internal Pull-up Resistor/ Current Source	Vcc Range (V)	I ² C Max Frequency (kHz)	/OE	Hardware Reset	Interrupt Output	2kbit EEPROM	5-bit Multiplex/ 1-bit Latch EEPROM
PCA6416A	16		✓		1.65 to 5.5	400		✓	✓		
PCA9535A	16		✓		1.65 to 5.5	400			✓		
PCA9539A	16		✓		1.65 to 5.5	400		✓	✓		
PCA9555A	16		✓	✓	1.65 to 5.5	400			✓		
PCA9671	16	✓		✓	2.3 to 5.5	1000		✓			
PCA8575	16	✓		✓	2.3 to 5.5	400			✓		
PCA9535C	16	Open Drain			2.3 to 5.5	400			✓		
PCA9535	16		✓		2.3 to 5.5	400			✓		
PCA9539	16		✓		2.3 to 5.5	400		✓	✓		
PCA9673	16	✓		✓	2.3 to 5.5	1000		✓	✓		
PCA9675	16	✓		✓	2.3 to 5.5	1000			✓		
PCA9555	16		✓	✓	2.3 to 5.5	400			✓		
PCF8575	16	✓		✓	2.5 to 5.5	400			✓		
PCF8575C	16	Open Drain			4.5 to 5.5	400			✓		
PCA9505	40		✓	✓	2.3 to 5.5	400	✓	✓	✓		
PCA9506	40		✓		2.3 to 5.5	400	✓	✓	✓		
PCA9698	40	Open Drain	✓		2.3 to 5.5	1000	✓	✓	✓		

GPIO Expanders Agile I/O Selection Guide

Device	# of Outputs	Quasi Output	Push-Pull Output	Internal Pull-up Resistor/ Current Source	Vcc Range (V)	I ² C Max Frequency (kHz)	Hardware Reset	Interrupt Status	Interrupt Output	Voltage Translating Capability
PCAL6408A	8	Open Drain	✓	✓	1.65 to 5.5	400	✓	✓	✓	✓
PCAL9538A	8	Open Drain	✓	✓	1.65 to 5.5	400	✓	✓	✓	
PCAL9554B(C)	8	Open Drain	✓	✓	1.65 to 5.5	400		✓	✓	
PCAL6416A	16	Open Drain	✓	✓	1.65 to 5.5	400	✓	✓	✓	✓
PCAL9535A	16	Open Drain	✓	✓	1.65 to 5.5	400		✓	✓	
PCAL9539A	16	Open Drain	✓	✓	1.65 to 5.5	400	✓	✓	✓	
PCAL9555A	16	Open Drain	✓	✓	1.65 to 5.5	400		✓	✓	

Unique “Agile I/O” Features

Incorporating many highly useful functions commonly added in system applications, the new I²C Agile I/O expanders offer the following standard integrated hardware features:

- An interrupt pin that reports back to the control processor when an input has changed state
- A hardware reset pin to return the device to its default state without powering down the part
- Two power-supply pins to enable simple level-shifting between different voltage domains (PCA(L)64XX only)

In addition, the Agile I/O expanders include important software-programmable features, including:

- A latched input to retain the input state
- Internal pull-up and pull-down resistors (PCA9554B(C) and PCA9555A default pull-up ON)
- An interrupt mask which reduces interrupt traffic to the microcontroller and improves interrupt service response
- Interrupt register reports to identify which input actually caused an interrupt
- An output drive strength control to minimize system noise when multiple outputs switch simultaneously

Need a Simple, Low-cost Way to Add I/O and Voltage Level Shifting to your I²C Design?

NXP's low-voltage translating I/O expander is the solution.

This part provides additional I/O while keeping interconnections to a minimum.

It also simplifies interconnection of processors running at one voltage level to I/O devices operating at a different voltage level.



PCA6416A GPIO FEATURES

- ▶ 16-bit general purpose I/O expansion
- ▶ 400 MHz Fast mode I²C-bus
- ▶ Independent operating supply voltage of 1.65 V to 5.5 V for both I/O and I²C-bus interface
- ▶ Bidirectional voltage-level translation and GPIO expansion
- ▶ Schmitt trigger action for slow input transition and better switching noise immunity at SCL/SDA inputs
- ▶ Latched outputs for directly driving LEDs
- ▶ Low standby current consumption

Thermal Sensors and Voltage Management

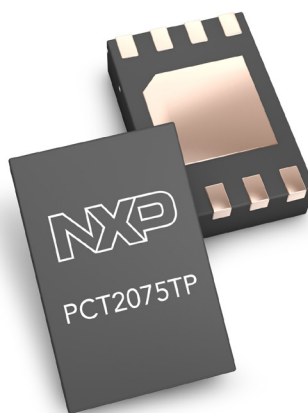
NXP offers a wide range of temperature sensors to support system reliability and enhance performance. Sensor options include: local-only, local and remote, and serial presence detect (SPD).

Features

- Wide supply range coverage (1.7 to 5.5V)
- Wide operating temperature range (-55 to 125 °C)
- Low power and standby current
- Programmable temperature set points
- Standby mode and one-shot conversion
- Programmable fault queue
- One remote channel
- One thermal alarm output

Applications

- Desktop and notebook computers
- Servers
- Power supplies
- Enterprise communication



Thermal Sensors and Voltage Management Selection Guide

Device	Fan Control Output	Local Sensing Accuracy (°C)	Remote Sensing Accuracy (°C)	A/D Resolution (°C/#bits)	Supply Range (V)	Supply Operating Current (μA)	Supply Operating Current (μA) (typical 25° C/max 125° C)	Package Options
PCT1075		±0.5		0.0625/12	2.7 to 5.5	400	< 0.1/20	SO-8 TSSOP-8 HWSON-8 TSOP6
SE98A		±1		0.125/11	1.7 to 3.6	400	< 0.1/5	TSSOP-8 HWSON-8
PCT2075		±1		0.125/11	2.7 to 5.5	400	< 0.1/20	SO-8 TSSOP-8 HWSON-8 TSOP6
SE95		±1		0.03125/13	2.8 to 5.5	1000	< 7.5/NA	SO-8 TSSOP-8 WAFER
SE97B		±1		0.125/11	3.0 to 3.6	400	< 0.1/10	HWSON-8
LM75A*		±2		0.125/11	2.8 to 5.5	1000	< 3.5/NA	SO-8 TSSOP-8
LM75B		±2		0.125/11	2.8 to 5.5	300	< 0.2/1	SO-8 TSSOP-8 XSON-8 HWSON-8
SA56004	1	±2	±1	0.125/11	3.0 to 3.6	500	10/NA	SO-8 TSSOP-8 HWSON-8
NE1617A		±2	±3	1.0/8	3.0 to 5.5	70	3/10	QSOP-8

*Not recommended for new designs, use LM75B or PCT2075 instead.

Precise Temperature Monitoring Made Simple

NXP's I²C-bus controlled temperature sensors offer high-resolution solutions for your thermal management needs.

Ideally suited for personal computers, industrial controllers, and other electronic equipment.



PCT2075 THERMAL SENSOR FEATURES

- ▶ Pin-for-pin replacement for industry standard part LM75
- ▶ 11-bit ADC with enhanced temperature resolution of 0.125 °C
- ▶ Temperature accuracy of ±1 °C from -25 °C to +100 and ±2 from -55 °C to +125 °C
- ▶ Power supply input range of 2.7–5.5 V
- ▶ Programmable temperature threshold and hysteresis set points
- ▶ Shutdown mode for power conservation
- ▶ Small form factor packages

LCD Display Drivers

NXP offers a wide range of LCD Segment, Character and Graphic Drivers for the most challenging applications in automotive, industrial, and consumer. All latest NXP LCD drivers are specifically designed for — but not limited to — driving high-contrast, true black background Vertical Alignment (VA) displays which offer a very wide viewing angle. Automotive AEC-Q100 compliant qualification on a wide range of devices ensures highest robustness and reliability under harshest conditions. Available as cased devices in a package for Surface Mount Device (SMD) application or as bare die with gold bumps for Chip-On-Glass (COG) application.



Features

- Wide supply voltage range
- Wide VLCD voltage range
- Low power consumption
- Programmable multiplex rates
- Wide operating temperature range up to +105 °C (selected devices)
- On-chip VLCD generation (charge pump) (selected devices)
- On-chip VLCD temperature compensation (selected devices)
- Programmable frame frequency (selected devices)
- AEC-Q100 compliant automotive qualification (selected devices)

Applications

- Industrial
 - e-meter (electricity, gas, water)
 - White goods
 - Home appliance
 - Test & measurement systems
 - Machine control systems
 - Point of Sales (POS) terminals
- Automotive
 - Instrument cluster
 - Climate control unit
 - Car radio
 - Tachographs
- Consumer
 - Handheld electronics
 - Battery operated equipment
 - General purpose display modules
- Medical and health care

LCD Segment Drivers

Device	Max number of elements	Number of elements at Multiplex Rate							VDD		VLCD		Frame Frequency (Hz)	On-Chip VLCD Generation (Charge Pump)	On Chip VLCD Temperature Compensation	Tamb		Package	AEC-Q100 compliant
		MUX 1:1	MUX 1:2	MUX 1:3	MUX 1:4	MUX 1:6	MUX 1:8	MUX 1:9	[min] (V)	[max] (V)	[min] (V)	[max] (V)				[min] (°C)	[max] (°C)		
PCF85162T	128	32	64	96	128				1.8	5.5	2.5	6.5	82	N	N	-40	85	TSSOP48	N
PCA85162T	128	32	64	96	128				1.8	5.5	2.5	8	110	N	N	-40	95	TSSOP48	Y
PCF85176T	160	40	80	120	160				1.8	5.5	2.5	6.5	82	N	N	-40	85	TSSOP56	N
PCA85176T	160	40	80	120	160				1.8	5.5	2.5	8	82	N	N	-40	95	TSSOP56	Y
PCF85176H	160	40	80	120	160				1.8	5.5	2.5	6.5	82	N	N	-40	85	TQFP64	N
PCA85176H	160	40	80	120	160				1.8	5.5	2.5	8	82	N	N	-40	95	TQFP64	Y
PCF85134HL	240	60	120	180	240				1.8	5.5	2.5	6.5	82	N	N	-40	85	LQFP80	N
PCA85134H	240	60	120	180	240				1.8	5.5	2.5	8	82	N	N	-40	95	LQFP80	Y
PCF8536AT	320				176	252	320		1.8	5.5	2.5	9	60-300 ¹	N	N	-40	85	TSSOP56	N
PCA8536AT	320				176	252	320		1.8	5.5	2.5	9	60-300 ¹	N	N	-40	95	TSSOP56	Y
PCF8537AH	352	44	88		176	276	352		1.8	5.5	2.5	9	60-300 ¹	Y	Y	-40	85	TQFP64	N
PCA8537AH	352	44	88		176	276	352		1.8	5.5	2.5	9	60-300 ¹	Y	Y	-40	95	TQFP64	Y
PCA9620H	480	60	120		240	320	480		2.5	5.5	2.5	9	60-300 ¹	Y	Y	-40	105	LQFP80	Y
PCA9620U	480	60	120		240	320	480		2.5	5.5	2.5	9	60-300 ¹	Y	Y	-40	105	Bare die	Y
PCF8576DU	160	40	80	120	160				1.8	5.5	2.5	6.5	77	N	N	-40	85	Gold-bumped die, bare die	N
PCA8576DU	160	40	80	120	160				1.8	5.5	2.5	6.5	77	N	N	-40	85	Gold-bumped die	Y

1. SW programmable. 2. HW selectable. 3. Release H1 2013. 4. Release H2 2013.

Device	Max number of elements	Number of elements at Multiplex Rate							VDD		VLCD		Frame Frequency (Hz)	On-Chip VLCD Generation (Charge Pump)	On Chip VLCD Temperature Compensation	Tamb		Package	AEC-Q100 compliant
		MUX 1:1	MUX 1:2	MUX 1:3	MUX 1:4	MUX 1:6	MUX 1:8	MUX 1:9	[min] (V)	[max] (V)	[min] (V)	[max] (V)				[min] (°C)	[max] (°C)		
PCA8576FU ⁴	160	40	80	120	160				1.8	5.5	2.5	6.5	200	N	N	-40	95	Gold-bumped die	Y
PCF85133U	320	80	160	240	320				1.8	5.5	2.5	6.5	82/110 ²	N	N	-40	85	Gold-bumped die	N
PCA85133U	320	80	160	240	320				1.8	5.5	2.5	8	82/110 ²	N	N	-40	95	Gold-bumped die	Y
PCA85233U ⁴	320	80	160	240	320				1.8	5.5	2.5	8	150/220 ²	N	N	-40	95	Gold-bumped die	Y
PCF85132U	640	160	320	480	640				1.8	5.5	1.8	8	60-90 ¹	N	N	-40	85	Gold-bumped die	N
PCA85132U	640	160	320	480	640				1.8	5.5	1.8	8	60-90 ¹	N	N	-40	95	Gold-bumped die	Y
PCA85232U	640	160	320	480	640				1.8	5.5	1.8	8	117-176 ¹	N	N	-40	95	Gold-bumped die	Y
PCF8538U ³	918	102	204		408	612	816	918	2.5	5.5	4	12	45-300 ¹	Y	Y	-40	85	Gold-bumped die	N
PCA8538U ³	918	102	204		408	612	816	918	2.5	5.5	4	12	45-300 ¹	Y	Y	-40	105	Gold-bumped die	Y

1. SW programmable. 2. HW selectable. 3. Release H1 2013. 4. Release H2 2013.

LCD Character Drivers

Device	Number of Lines x Number of Characters			Number of Icons	Character Set	VDD1		VDD2		VLCD		Frame Frequency (Hz)	On-Chip VLCD Generation (Charge Pump)	On Chip VLCD Temperature Compensation	Tamb		Package	AEC-Q100 compliant
						[min] (V)	[max] (V)	[min] (V)	[max] (V)	[min] (V)	[max] (V)				[min] (°C)	[max] (°C)		
PCF2113AU	1 x 24	2 x 12		120	A	1.8	5.5	2.2	4	2.2	6.5	95	Y	Y	-40	85	Gold-bumped die	N
PCF2113DU	1 x 24	2 x 12		120	D	1.8	5.5	2.2	4	2.2	6.5	95	Y	Y	-40	85	Gold-bumped die	N
PCF2113EU	1 x 24	2 x 12		120	E	1.8	5.5	2.2	4	2.2	6.5	95	Y	Y	-40	85	Gold-bumped die	N
PCF2113WU	1 x 24	2 x 12		120	W	1.8	5.5	2.2	4	2.2	6.5	95	Y	Y	-40	85	Gold-bumped die	N
PCF2116AU	1 x 24	2 x 24	4 x 12		A	2.5	6	2.5	6	3.5	9	65	Y	N	-40	85	Gold-bumped die	N
PCF2116CU	1 x 24	2 x 24	4 x 12		C	2.5	6	2.5	6	3.5	9	65	Y	N	-40	85	Gold-bumped die	N
PCF2119AU	1 x 32	2 x 16		160	A	1.5	5.5	2.2	4	2.2	6.5	95	Y	Y	-40	85	Gold-bumped die	N
PCF2119DU	1 x 32	2 x 16		160	D	1.5	5.5	2.2	4	2.2	6.5	95	Y	Y	-40	85	Gold-bumped die	N
PCF2119FU	1 x 32	2 x 16		160	F	1.5	5.5	2.2	4	2.2	6.5	95	Y	Y	-40	85	Gold-bumped die	N
PCF2119IU	1 x 32	2 x 16		160	I	1.5	5.5	2.2	4	2.2	6.5	95	Y	Y	-40	85	Gold-bumped die	N
PCF2119RU	1 x 32	2 x 16		160	R	1.5	5.5	2.2	4	2.2	6.5	95	Y	Y	-40	85	Gold-bumped die	N
PCF2119SU	1 x 32	2 x 16		160	S	1.5	5.5	2.2	4	2.2	6.5	95	Y	Y	-40	85	Gold-bumped die	N
PCF2117RU ²	1 x 40	2 x 20		200	R	2.5	5.5	2.5	5.5	4	16	45-300 ¹	Y	Y	-40	85	Gold-bumped die	N
PCA2117RU ²	1 x 40	2 x 20		200	R	2.5	5.5	2.5	5.5	4	16	45-300 ¹	Y	Y	-40	105	Gold-bumped die	Y
PCF2117SU ²	1 x 40	2 x 20		200	S	2.5	5.5	2.5	5.5	4	16	45-300 ¹	Y	Y	-40	85	Gold-bumped die	N
PCA2117SU ²	1 x 40	2 x 20		200	S	2.5	5.5	2.5	5.5	4	16	45-300 ¹	Y	Y	-40	105	Gold-bumped die	Y

1. SW programmable. 2. Release H2 2013.

LCD Graphic Drivers

Device	Max Display Resolution Rows x Cols	Multiplex Rates	VDD1		VDD2		VLCD		Frame Frequency (Hz)	On-Chip VLCD Generation (Charge Pump)	On Chip VLCD Temperature Compensation	Tamb		Package	AEC-Q100 compliant
			[min] (V)	[max] (V)	[min] (V)	[max] (V)	[min] (V)	[max] (V)				[min] (°C)	[max] (°C)		
PCF8539U ²	18 x 100	Mux 1:12; Mux 1:18	2.5	5.5	2.5	5.5	4	16	45-300 ¹	Y	Y	-40	85	Gold-bumped die	N
PCA8539U ²	18 x 100	Mux 1:12; Mux 1:18	2.5	5.5	2.5	5.5	4	16	45-300 ¹	Y	Y	-40	105	Gold-bumped die	Y
PCF8531U	34 x 128 or 33 x 128 + 128 icons	Mux 1:17, Mux 1:26, Mux 1:34	1.8	5.5	2.5	4.5	4	9	66	Y	Y	-40	85	Gold-bumped die	N
PCF8811U	80 x 128 or 79 x 129 + 128 icons	Mux 1:16 to Mux 1:80 in steps of 8	2	3.3	1.8	3.3	3	9	30-60 ¹	Y	Y	-40	85	Gold-bumped die	N

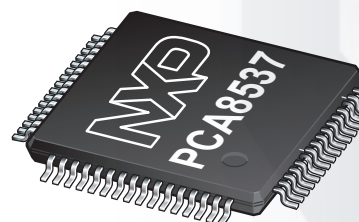
1. SW programmable. 2. Release H2 2013.

Fully Featured LCD Drivers for High-Contrast Vertical Alignment (VA) Displays

Specifically designed for high-contrast, true black background Vertical Alignment (VA) displays which offer a very wide viewing angle.

Automotive AEC-Q100 compliant qualification for highest robustness and reliability under harshest conditions.

Fully featured with on-chip VLCD generation and on-chip VLCD temperature compensation.



PCA8537 LCD DRIVER FEATURES

- ▶ 352-segment driver (44, 88, 176, 276 or 352 segments)
- ▶ Programmable frame frequency from 60 to 300Hz
- ▶ Extended VLCD supply voltage range to 9V
- ▶ On-chip VLCD generation (charge pump)
- ▶ On-chip VLCD temperature compensation
- ▶ Extended temperature range to +95 °C
- ▶ AEC-Q100 compliant
- ▶ TQFP64 package

Clocks and Real Time Clocks

NXP offers a variety of real-time clocks to suit the many applications requiring accurate time keeping. Options include ultra-low power, high-temperature tolerant, temperature compensated, and high-accuracy versions.

Features

- All addresses and data transferred serially via I²C-bus

Applications

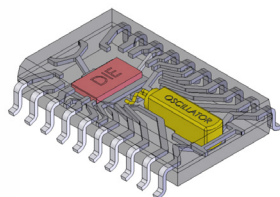
- Mobile telephones
- Electronic metering
- Portable instruments
- Battery-powered products



Clocks and Real Time Clocks Selection Guide

Device	Bus	Feature
PCA8802	I ² C Fm	Ultra low power Smartcard; integrated counter for initiating one time password generation
PCF8523	I ² C Fm+	Ultra low power with loss of main power detect and auto battery switch over
PCF8563	I ² C Fm	Ultra low power clock/calendar
PCF85063	I ² C Fm	Tiny RTC with 30s, 60s interrupt
PCF85063A	I ² C Fm	Tiny RTC with alarm and 30s, 60s interrupt
PCA8565	I ² C Fm	High temperature (-40°C – +125°C) clock/calendar
PCF8583	I ² C	Clock/calendar resolution 0.01 s with 256x8 SRAM
PCF2127A	I ² C Fm	High-accuracy, low-voltage with 512x8 RAM; temperature compensated
PCA/PCF2129(A)	I ² C Fm	High accuracy; temperature compensated

Precision Timekeeping Doesn't Have to Consume Lots of Power



NXP's PCA2129 Real Time Clock provides precision timekeeping for automotive, electronic metering, GPS equipment, or any other application that requires accurate process timing.

PCA2129 REAL TIME CLOCK FEATURES

- ▶ AEC-Q100 compliance for automotive applications
- ▶ Typical accuracy of ± 3 ppm from -30 °C to +80 °C
- ▶ 32.768 kHz quartz crystal and oscillator integrated into one convenient package
- ▶ Battery backed output voltage and low battery detection
- ▶ Temperature compensated crystal oscillator with integrated capacitors
- ▶ Year, month, day, weekday, hours, minutes, seconds, and leap year correction
- ▶ Programmable interrupts and watchdog timer
- ▶ Clock operating voltage of 1.8 V to 4.2 V



Tiny Serial Analog-to-Digital and Digital-to-Analog Converters

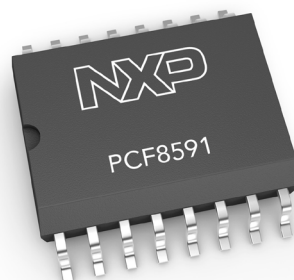
I²C Analog-to-Digital (A/D) and Digital-to-Analog (D/A) converters provide a way to convert between digital and analog signals and send the information via the I²C-bus.

Features

- Convert four different analog voltages to digital values
- Transmit converted data on an I²C-bus for processing by microprocessor/controller
- Generate one analog voltage output from 8-bit digital value

Applications

- Record analog information such as temperature, pressure, battery level, signal strength
- Convert from digital signals to analog voltages for LCD contrast or buzzer control

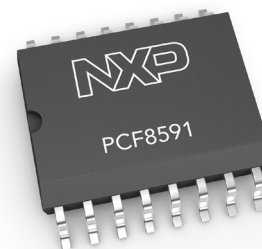


Tiny Serial ADC and DAC Selection Guide

Device	A/D	D/A	# Bits	I ² C-bus Frequency	Maximum Conversion Rate (kHz)
PCF8591	✓	✓	8	100 kHz	11

Add Data Conversion Functionality with Minimal Impact

NXP's PCF8591 provides 8-bit digital-to-analog and analog-to-digital conversion in a single chip, single supply, low-power device.



PCF8591 A/D AND D/A CONVERTER FEATURES

- ▶ 8-bit CMOS data acquisition device using successive approximation A/D conversion and multiplying D/A conversion
- ▶ 4 analog inputs programmable as single-ended or differential
- ▶ 1 analog output
- ▶ Serial input/output via I²C-bus
- ▶ Addressable via 3 hardware address pins
- ▶ Sampling rate given by I²C-bus speed
- ▶ Auto-incremented channel selection
- ▶ On-chip track and hold circuit
- ▶ Single operating supply voltage of 2.5 V to 6 V



Multiplexers and Switches

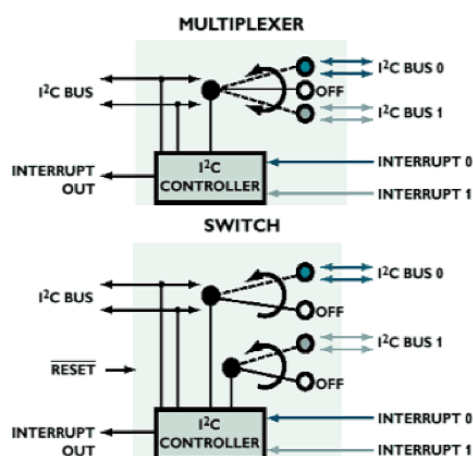
I²C-bus multiplexers and switches provide capacitive isolation when connecting an upstream I²C-bus to a desired combination of downstream buses. The software-controlled multiplexers and switches break the I²C-bus into two, four, or eight sub-branches. Multiplexers allow selection of only one downstream branch at a time, while switches allow selection of any individual downstream sub-branch or combination of downstream sub-branches.

Features

- Interrupt
- Hardware reset
- 2.3–5.5 V operating voltage
- 5 V tolerant input/outputs
- -40–85 °C operating temperature range
- 0–400 kHz operating frequency
- I²C and SMBus compatible

Applications

- Connection of I²C devices that operate at different voltage levels but share a common bus
- Expanded ability to use multiple devices that share a common I²C address
- Providing voltage level shifting
- Isolating devices when not in use to reduce overall system capacitive loading



Multiplexers and Switches Selection Guide

Device	Multiplexer (In/Out)	Switch (In/Out)	I ² C-bus # of Addresses	Interrupt (IN-OUT)	Hardware Reset	Packages				
						Pin Count	SO (Narrow)	SO (Wide)	TSSOP	XSON or HVQFN
PCA9540B	1-2		1			8	D		DP	GD
PCA9541A	2-1		16	1-2	✓	16	D		PW	BS
PCA9542A	1-2		8	2-1		14	D		PW	
PCA9543A/B ¹		1-2	4	2-1	✓	14	D		PW	
PCA9544A	1-4		8	4-1		20		D	PW	BS
PCA9545A/B ²		1-4	4	4-1	✓	20		D	PW	BS
PCA9546A		1-4	8		✓	16	D		PW	BS
PCA9547	1-8		8		✓	24		D	PW	BS
PCA9548A		1-8	8		✓	24		D	PW	BS
PCA9646 ³		1-4	8		✓	16	D		PW	

1. PCA9543A and PCA9543B are identical except for the fixed addresses allowing four of each version on the same bus

2. PCA9545A and PCA9545B are identical except for the fixed addresses allowing four of each version on the same bus

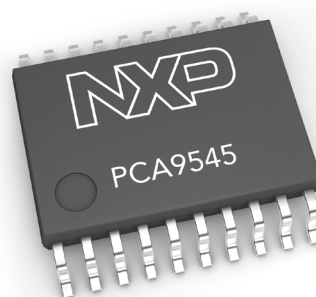
3. No offset bus buffer isolates capacitance to each channel, operates to 1 MHz on Fm+ bus

Expand the Reach of your I²C-based Application

Avoid complete system redesign: address capacity via bus switches.

NXP's I²C-bus switches allow selection of any downstream branch, even those operating at different voltage levels.

Plus, they reduce overall system capacitive loading by isolating devices not currently in use.



PCA9545A BUS SWITCH FEATURES

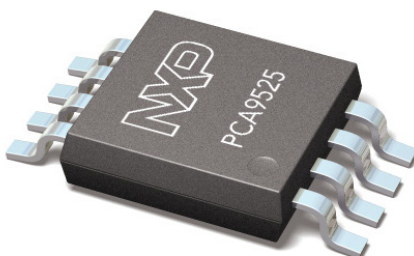
- ▶ Voltage level translation between 1.8 V, 2.5 V, 3.3 V, and 5 V buses
- ▶ 1-of-4 bidirectional translating switches
- ▶ 0-400 kHz clock frequency
- ▶ 5 V tolerant inputs
- ▶ Channel selection via I²C-bus, in any combination
- ▶ No glitch power-up
- ▶ Hot insertion support
- ▶ Power supply operating voltage range of 2.3 V to 5.5 V

Bus Buffers and Voltage Translators

Bus buffers allow designers to expand use of the I²C-bus beyond the 400 pF maximum capacitive loading allowed by the I²C specification, allowing bidirectional communication without a direction pin.

Features

- Voltage translation
- Opto-electrical isolation
- Bus buffering
- Bus isolation/multiplexing



Applications

- Add more I²C or SMBus devices in the same system
- Extend the reach of I²C or SMBus over longer distances
- Isolate an I²C or SMBus segment
- Translate voltage levels to allow devices with different voltage requirements to work on the same bus
- Electrically isolate the I²C-bus
- Support multi-point distribution of the I²C-bus

Bus Buffers and Voltage Translators Selection Guide

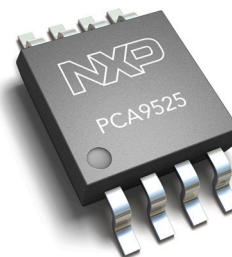
Device	Type of Capacitance Isolation Buffer	Description	I ² C-bus (V) (Left)	I _{OL} (mA) (Left)	I ² C-bus (V) (Right)	I _{OL} (mA) (Right)	# of Pins	Typical Distance	Level Translation Capability
P82B715	None - Amplifier	Fm HV bus extender	0 to 12V	3	0 to 12V	30	8	> 20 m	None
PCA9510A	Incremental Offset	Fm hot-swap bus buffer (no RTA)	2.7 to 5.5V	3	2.7 to 5.5V	3	8	On Card	None
PCA9511A	Incremental Offset	Fm hot swap-bus buffer	2.7 to 5.5V	3	2.7 to 5.5V	3	8	On Card	None
PCA9512A	Incremental Offset	Fm VLT hot swap bus buffer	2.7 to 5.5V	3	2.7 to 5.5V	3	8	On Card	2 Supplies
PCA9513A	Incremental Offset	Fm hot-swap bus buffer (92 uA CS)	2.7 to 5.5V	3	2.7 to 5.5V	3	8	On Card	None
PCA9514A	Incremental Offset	Fm hot-swap bus buffer (0.8 V offset)	2.7 to 5.5V	3	2.7 to 5.5V	3	8	On Card	None
PCA9521	Incremental Offset	1 MHz HV Incremental Offset bus buffer	1.3 to 10V	6	1.3 to 10V	6	8	< 3 m	Over voltage tolerant
PCA9522	Incremental Offset	1 MHz HV hot-swap bus buffer	1.3 to 10V	6	1.3 to 10V	6	8	< 3 m	Over voltage tolerant
PCA9525	No offset Buffer	1 MHz bus repeater	1.4 to 5.5V	4	1.4 to 5.5V	4	8	< 3 m	None
PCA9605	No offset Buffer	Fm+ bus repeater	1.4 to 5.5V	30	1.4 to 5.5V	30	8	< 20 m	None
PCA9646	No offset Buffer	4-channel Fm+ buffer/switch with RST	1.4 to 5.5V	30	1.4 to 5.5V	30	16	< 20 m	None
P82B96	Static Offset	Fm HV for long distance and opto-isolation	3.2 to 15V	3	1.4 to 15V	30	8	> 20 m	Over voltage tolerant
PCA9507	Static Offset	Fm VLT DDC buffer with accelerator	2.7 to 5.5V	6	2.7 to 5.5V	6	8	< 20 m	2 Supplies
PCA9508	Static Offset	Fm VLT hot-swap bus repeater	0.9 to 5.5V	6	2.7 to 5.5V	6	8	< 3 m	2 Supplies
PCA9509	Static Offset	Fm 1.0V LV VLT with current source	1 to 4V	6	3 to 5.5V	6	8	< 3 m	2 Supplies
PCA9509A	Static Offset	Fm 0.8V LV VLT with current source	0.8 to 1.5V	6	2.3 to 5.5V	6	8	< 3 m	2 Supplies
PCA9509P	Static Offset	Fm 0.8V LV VLT bus buffer	0.8 to 1.5V	6	2.3 to 5.5V	6	8	< 3 m	2 Supplies
PCA9515A	Static Offset	Fm bus repeater	2.3 to 5.5V	6	2.3 to 5.5V	6	8	On Card	Over voltage tolerant
PCA9516A	Static Offset	Fm 5-channel hub	2.3 to 5.5V	6	2.3 to 5.5V	6	16	On Card	Over voltage tolerant
PCA9517A	Static Offset	Fm 0.9V LV VLT bus repeater	0.9 to 5.5V	6	2.7 to 5.5V	6	8	< 3 m	2 Supplies

Device	Type of Capacitance Isolation Buffer	Description	I ² C-bus (V) (Left)	I _{OL} (mA) (Left)	I ² C-bus (V) (Right)	I _{OL} (mA) (Right)	# of Pins	Typical Distance	Level Translation Capability
PCA9518A	Static Offset	Fm expandable 5-channel hub	2.3 to 5.5V	6	2.3 to 5.5V	6	20	On Card	Over voltage tolerant
PCA9519	Static Offset	4-channel version of PCA9509	1 to 4V	6	3 to 5.5V	6	20	< 3 m	2 Supplies
PCA9527	Static Offset	Fm DDC VLT with accelerator and CEC	2.7 to 5.5V	6	2.7 to 3.6V	6	14	< 20 m	2 Supplies
PCA9600	Static Offset	Fm+ HV for long distance and opto-isolation	2.6 to 15V	3	1.6 to 15V	30	8	> 20 m	Over voltage tolerant
PCA9601	Static Offset	Fm+ HV with stronger 15 mA local side drive	2.6 to 15V	15	1.6 to 15V	30	8	> 20 m	Over voltage tolerant
PCA9617A	Static Offset	Fm+ 0.8V LV VLT bus repeater	0.8 to 5.5V	6	2.2 to 5.5V	6	8	< 3 m	2 Supplies
GTL2000	None - FET	22-bit Fm+ Voltage Level Translator	1 to 5.5V	64	1 to 5.5V	64	48	On Card	Voltage Clamp
GTL2002	None - FET	2-bit Fm+ Voltage Level Translator	1 to 5.5V	64	1 to 5.5V	64	8	On Card	Voltage Clamp
GTL2003	None - FET	8-bit Fm+ Voltage Level Translator	1 to 5.5V	64	1 to 5.5V	64	20	On Card	Voltage Clamp
GTL2010	None - FET	10-bit Fm+ Voltage Level Translator	1 to 5.5V	64	1 to 5.5V	64	24	On Card	Voltage Clamp
NVT2001	None - FET	1-bit Fm+ Voltage Level Translator	1 to 5.5V	64	1 to 5.5V	64	6	On Card	Voltage Clamp
NVT2002	None - FET	2-bit Fm+ Voltage Level Translator	1 to 5.5V	64	1 to 5.5V	64	8	On Card	Voltage Clamp
NVT2003	None - FET	3-bit Fm+ Level Translator for two power supply	1 to 5.5V	64	1 to 5.5V	64	10	On Card	Voltage Clamp
NVT2004	None - FET	4-bit Fm+ Voltage Level Translator	1 to 5.5V	64	1 to 5.5V	64	12	On Card	Voltage Clamp
NVT2006	None - FET	6-bit Fm+ Voltage Level Translator	1 to 5.5V	64	1 to 5.5V	64	16	On Card	Voltage Clamp
NVT2008	None - FET	8-bit Fm+ Voltage Level Translator	1 to 5.5V	64	1 to 5.5V	64	20	On Card	Voltage Clamp
NVT2010	None - FET	10-bit Fm+ Voltage Level Translator	1 to 5.5V	64	1 to 5.5V	64	24	On Card	Voltage Clamp
PCA9306	None - FET	Dual I ² C/SMBus Fm+ Voltage Level Translator	1 to 5.5V	64	1 to 5.5V	64	8	On Card	Voltage Clamp

Got More Needs than Capability on your I²C-bus-based System?

Expand your reach with Bus Buffers from NXP.

Add more devices on the same system bus, extend the bus over longer distances, or isolate segments of the bus if necessary.



PCA9525 BUS BUFFER FEATURES

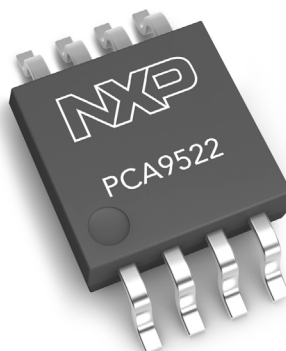


- ▶ No offset allows communication with any other device and multiple devices in series.
- ▶ Impedance isolating buffer function for 2-wire buses
- ▶ Fast switching times for operation > 1MHz
- ▶ 4 mA maximum static open-drain, pull-down capability
- ▶ Input hysteresis for noise immunity
- ▶ Power supply operating voltage range of 2.7 V to 5.5 V

Have Hot Insertion Needs for Your Backplane?

Plug NXP's PCA9522 Bus Buffer into live backplanes without causing data corruption.

Bring individual parts of your system on-line successively using the enable function, which supports bus section isolation.



PCA9522 BUS BUFFER FEATURES

- ▶ Dual, bidirectional, unity gain, isolating buffering
- ▶ Hot insertion logic to prevent data and clock bus corruption in live backplane applications, specifically designed to support Advanced TCA applications
- ▶ Support for I²C-bus Standard- and Fast-modes
- ▶ Enable function to allow bus segments to be disconnected
- ▶ Low noise susceptibility
- ▶ Support for connection of several buffers in series
- ▶ Voltage level shift capability from 1.8 V to 10 V

I²C-Controlled EEPROM, RAM and DIP Switches (multiplexed/latched EEPROMS)

Small-size serial memories (RAM and EEPROM) are common and have wide applicability for data storage.

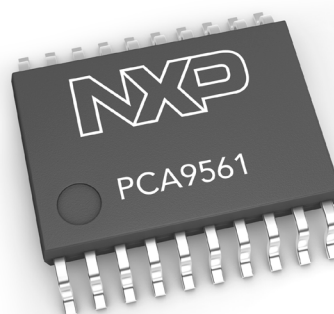
The multiplexed/latched EEPROMs may be used as replacements for DIP switches or jumpers because the settings can be easily changed via the I²C-bus without having to power down equipment and open cabinets.

Features

- Retain data during power-off (except RAM)
- Address and data transferred serially via the I²C-bus
- Built-in word address register automatically increments after each byte written or read (EEPROM)
- All bytes may be read in single operation (EEPROM)
- Up to 8 bytes can be written in one operation (EEPROM)

Applications

- Meter readings
- Electronic key
- Product identification numbers
- Serial presence detect
- DIP Switches



I²C-Controlled RAM Selection Guide

Device	Power Supply	Address Pins	# of Blocks (256 bytes)	# of Bits	Temperature Range (°C)	Clock Frequency (kHz)
PCF8570	2.5–6 V	3	1	2K	-40 to +85	100

I²C-Controlled EEPROM Selection Guide

Device	Power Supply	Address Pins	# of Blocks (256 bytes)	# of Bits	Data Retention (Years)	Temperature Range (°C)	Clock Frequency (kHz)
PCF8582C-2	2.5–6 V	3	1	2K	10	-40 to +85	100
PCF85103C-2	2.5–6 V	3	1	2K	10	-40 to +85	100
PCF8594C-2	2.5–6 V	2	2	4K	10	-40 to +85	100
PCA24508A	2.5–3.6 V	0	8 (128 Bytes)	8K	10	-40 to +85	400
PCA9500	2.5–3.6 V	3	1	2K	10	-40 to +85	400
PCA9501	2.5–3.6 V	6	1	2K	10	-40 to +85	400

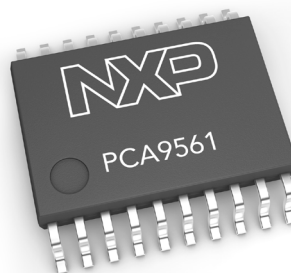
I²C-Controlled DIP Switches (Multiplexed/latched EEPROM) Selection Guide

Device	# of Pins	# of Non-volatile Registers	# of Register Bits	# of Hardware Input Pins	# of Multiplexed Outputs	Non-Multiplexed Inputs	Data Retention	Temperature Range (°C)	Clock Frequency (kHz)
PCF8550	15	1	5	4	4	Yes	10	0 to 70	400
PCA9558	28	1	6	5	5	Yes	10	0 to 70	400
PCA9559	20	1	6	5	5	Yes	10	0 to 70	400
PCA9560	20	2	6	5	5	Yes	10	0 to 70	400
PCA9561	20	4	6	6	6	No	10	0 to 70	400

Still Opening Cabinets and Powering Down Equipment to Change Manual Switches?

Move to I²C configurable, non-volatile memory controlled settings with NXP's EEPROM DIP switches.

Set these switches easily via the I²C-bus, controlled by the system microprocessor.



PCA9561 EEPROM DIP SWITCH FEATURES

- ▶ 6-bit 5-to-1 multiplexer DIP switch
- ▶ 400 kHz maximum clock frequency
- ▶ Operating supply voltage of 3.0 V to 3.6 V
- ▶ 5 V and 2.5 V tolerant inputs/outputs
- ▶ Selection of non-volatile registers via I²C-bus

Intelligent Stepper Motor Controller

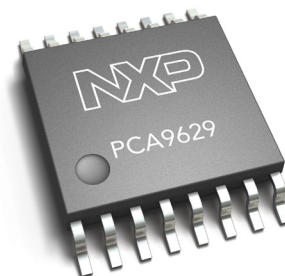
The PCA9629 provides all the logic and control required to drive a four-phase stepper motor via the I²C-bus.

Features

- Generate motor coil drive phase sequence signals with four outputs for use with external high current drivers to off-load CPU
- Four balanced push-pull type outputs capable of sinking 25 mA or sourcing 25 mA for glueless connection to external high current drivers needed to drive motor coils
- Up to 1000 pF loads with 100 ns rise and fall times
- Sensor enabled drive control: linked to interrupt from I/O pins
- Direction control of motor shaft
- Selectable active hold, power off or released states for motor shaft
- Four general purpose I/Os:
 - Configured to sense logic level outputs from optical interrupter photo transistor circuit
 - Configured as outputs to drive (source/sink) LEDs or other loads up to 25 mA
 - Programmable interrupt Mask Control for input pins
- Package offered: TSSOP16

Applications

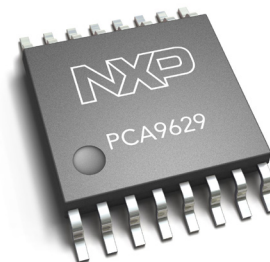
- Car mirror control
- Automated door windows
- Printers
- Scanners
- Toys
- Robotics



Stepper Motor Control Doesn't Have to Consume Valuable Microprocessor Cycles.

NXP's I²C-bus controlled, low-power-consumption stepper motor controller provides highly flexible operation.

Control step size, number of steps per command, number of rotations, direction of rotation and more, all via I²C programmable control registers.



PCA9629 STEPPER MOTOR FEATURES



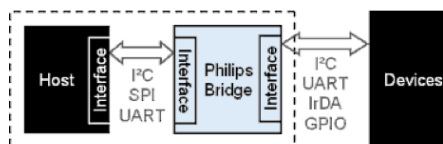
- ▶ 1 MHz Fast-mode Plus (Fm+) I²C-bus operation
- ▶ Built-in oscillator requires no external components
- ▶ Four balanced push-pull type outputs capable of sinking or sourcing 25 mA
- ▶ Drive capability of up to 1000 pF loads with 100 ns rise and fall times
- ▶ Programmable step rate of 344.8 kpps to 0.3 pps with ±5% accuracy
- ▶ Programmable rotation control
- ▶ Programmable watchdog timer
- ▶ Four general purpose I/O for sensing and signaling functions
- ▶ -40 °C to +85 °C operation

Bridge Integrated Circuits and Bus Controllers

Bridge integrated circuits allow designers to connect together devices that use different serial buses. Bus controllers serve as interfaces between most standard parallel bus microcontrollers/microprocessors and the serial I²C-bus, and allow bidirectional communication between the parallel bus and the I²C-bus.

Features

- Operate at low voltages
- Consume little power
- Come in a variety of ultra-small package types



Applications

- Host processor communication with disparate serial, wireless, and GPIO interfaces

Bridge Integrated Circuits Selection Guide

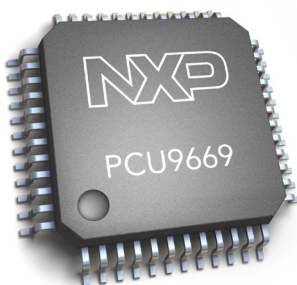
Device	Bridge Type	UARTs	GPIO	IrDA SIR Speed (Maximum)	SPI Speed (Maximum)	FIFO (Bytes)	Oscillator
SC16IS740	I ² C/SPI Slave to UART	1	0	115.2 Kbps	4	64	
SC16IS741	I ² C/SPI Slave to UART	1		115.2 Kbps		64	
SC16IS750	I ² C/SPI Slave to UART	1	8	115.2 Kbps	4	64	
SC16IS752	I ² C/SPI Slave to UART	2	8	115.2 Kbps	4	64	
SC16IS760	I ² C/SPI Slave to UART	1	8	1.152 Mbps	15	64	
SC16IS762	I ² C/SPI Slave to UART	2	8	1.152 Mbps	15	64	
SC16IS850L	1.8V I ² C/SPI Slave to UART	1		115.2 Kbps		128	
SC18IS600	SPI Slave to I ² C Master		4		1		Internal
SC18IS601	SPI Slave to I ² C Master		3		3		External
SC18IS602B	I ² C/SPI Slave to SPI Master		4		1.8 Mbps		Internal
SC18IM700	UART to I ² C Master		8				

Bus Controllers Selection Guide

Device	Type	Voltage Range (V)	Maximum I ² C Frequency (kHz)	Clock Source	Parallel Interface	Package
PCA9564	Parallel bus to I ² C-bus controller	2.3 to 3.6 with 5V tolerance	360	Internal	Fast	DIL-20 SO-20 TSSOP-20 HVQFN-20
PCA9661	Parallel bus to 1 channel Fm+ I ² C-bus controller	3 to 3.6V core 3 to 5.5V I/O	1000	Internal (trimmed)	Fast with 4k Byte Buffer	LQFP48
PCA9663	Parallel bus to 3 channel Fm+ I ² C-bus controller	3 to 3.6V core 3 to 5.5V I/O	1000	Internal (trimmed)	Fast with 4k Byte Buffer	LQFP48
PCA9665	Fm+ parallel bus to I ² C-bus controller	2.3 to 3.6 with 5V tolerance	1000	Internal (trimmed)	Fast with 68 Byte Buffer	SO-20 TSSOP-20 HVQFN-20
PCA9665A	Fm+ parallel bus to I ² C-bus controller	2.3 to 3.6 with 5V tolerance	1000	Internal (trimmed)	Fast with 68 Byte Buffer	TSSOP-20
PCF8584	I ² C-bus controller	4.5 to 5.5	90	External	Slow	DIP-20 SO-20
PCU9661	Parallel bus to 1 channel UFm I ² C-bus controller	3 to 3.6V core 3 to 5.5V I/O	5000	Internal (trimmed)	Fast with 4k Byte Buffer	LQFP48

Device	Type	Voltage Range (V)	Maximum I ² C Frequency (kHz)	Clock Source	Parallel Interface	Package
PCU9668	Parallel bus to 2 channel Fm+ and 1 channel UFm I ² C-bus controller	3 to 3.6V core 3 to 5.5 V I/O	5000	Internal (trimmed)	Fast with 4k Byte Buffer	LQFP48
PCU9669	Parallel bus to 1 channel Fm+ and 2 channel UFm I ² C-bus controller	3 to 3.6V core 3 to 5.5V I/O	5000	Internal (trimmed)	Fast with 4k Byte Buffer	LQFP48

Transmitting Large Amounts of Serial Data?



NXP's advanced single master mode I²C-bus controller supports 8-bit parallel bus to I²C-bus protocol conversion.

Designed specifically for data intensive I²C-bus transfers.

PCU9669 BUS CONTROLLER FEATURES

- ▶ Parallel bus to I²C-bus protocol conversion
- ▶ 5 Mbit/s unidirectional data transfer on Ultra Fast-mode (UFm) channel (push-pull driver)
- ▶ 1 Mbit/s and up to 30 mA SCL/SDA I_{OL} Fast-mode Plus (Fm+) capability
- ▶ Individual 4352-byte buffers for the Fm+ and UFm channels for a total of 13056 bytes of buffer space
- ▶ Internal oscillator trimmed to 1% accuracy to reduce external component requirements
- ▶ SCL clock stretching support (Fm+ only)
- ▶ Operating supply voltage of 3.0 V to 3.6 V
- ▶ I²C-bus I/O supply voltage of 3.0 V to 5.5 V

Blinkers, Dimmers, Drivers (LED Controllers)

Designers commonly use LED controllers/drivers for blinking, dimming, and color mixing LEDs in I²C, SMBus, IPMI and PMbus applications. Using separate I²C LED controllers limits bus traffic and frees the I²C master for other purposes.

Features

- Any bits not used to drive an LED can be used as normal GPIO (Dimmers/Blinkers)
- Industrial operating temperature range
- Low standby current
- Offered in a variety of package types

Applications

- Operating number displays such as 7-segment block
- Driving photo flash LED in mobile phones and PDAs



LED Dimmers/Blinkers Selection Guide

Device	# bits	Type	Feature	Bus
PCA9530	2	LED Dimmer	Programmable brightness	I ² C
PCA9531	8	LED Dimmer	Programmable brightness	I ² C
PCA9532	16	LED Dimmer	Programmable brightness	I ² C
PCA9533	4	LED Dimmer	Programmable brightness	I ² C
PCA9550	2	LED Driver	Programmable blink rates	I ² C
PCA9551	8	LED Driver	Programmable blink rates	I ² C
PCA9552	16	LED Driver	Programmable blink rates	I ² C
PCA9553	4	LED Driver	Programmable blink rates	I ² C

LED Segment Drivers Selection Guide

Device	Feature
SAA1064	4-digit LED driver

LED Flash Drivers Selection Guide

Device	Feature
SSL3250A	Dual LED 500mA Flash driver with Torch and Indicator Modes
SSL3252	Dual LED 500mA Flash driver with Torch and Indicator Modes

LED RGB Color Mixers Selection Guide

Device	# channels	Feature	Bus
PCA9622	16	100mA 40V	Fm+ I ² C
PCA9624	8	100mA 40V	Fm+ I ² C
PCA9626	24	100mA 40V	Fm+ I ² C
PCA9632	4	Low power	Fm+ I ² C
PCA9633	4	Optimized for RGBA color mixing	Fm+ I ² C
PCA9634	8	Optimized for RGBA color mixing	Fm+ I ² C
PCA9635	16	Optimized for RGBA color mixing	Fm+ I ² C
PCA9685	16	PWM LED controller	Fm+ I ² C
PCU9654	8	100mA 40V	UFm I ² C
PCU9655	16	100mA 40V	UFm I ² C
PCU9656	24	100mA 40V	UFm I ² C
PCU9955	16	57 mA constant current	UFm I ² C
PCA9952	16	57 mA constant current	Fm+ I ² C
PCA9955	16	57 mA constant current	Fm+ I ² C

Add Pizzazz to Your Product with NXP's Highly Configurable LED Drivers



Control blinking and dimming of RGBA LEDs to support status, display, backlight, or amusement functions.

PCA9955 LED DRIVER FEATURES

- ▶ 16 LED drivers, each programmable for brightness, dimming/blinking modes, and on/off states
- ▶ 1 MHz Fast-mode Plus (Fm+) compatible I²C-bus interface
- ▶ Four hardware addressable pins to support 16 devices connected to the same I²C-bus
- ▶ 8 MHz internal oscillator requiring no external components
- ▶ 256-step programmable brightness, group brightness, and group blinking
- ▶ Operating supply voltage of 3 V to 5.5 V
- ▶ -20 °C to +85 °C operation

Capacitive Sensors

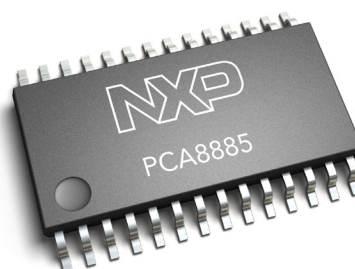
The PCA8885 and PCF8885 integrated circuits are capacitive 8-channel proximity switches that use a patented method to detect a change in capacitance on remote sensing plates.

Features

- Dynamic proximity switch with 8 sensor channels
- Support for matrix arrangement of sensors
- Sensing plates can be connected remotely
- Adjustable response time
- Adjustable sensitivity
- Continuous auto-calibration
- Digital processing method
- Direct and latching switch modes
- AEC-Q100 compliant version available for automotive applications
- I²C Fast-mode Plus (Fm+) compatible interface
- Two I²C-bus addresses
- Cascading of two ICs possible
- Interrupt signaling over I²C-bus
- Interrupt output
- Wide voltage operating range ($V_{DD} = 2.5\text{ V to }5.5\text{ V}$)
- Sleep mode ($I_{DD} < 100\text{ nA}$)
- Low-power battery operation possible ($I_{DD} \sim 10\text{ }\mu\text{A}$)
- Operating temperature range ($T_{amb} = -40\text{ }^{\circ}\text{C to }+85\text{ }^{\circ}\text{C}$)
- Available in TSSOP28 and SOIC28 package

Applications

- Replacing mechanical switches
- Hermetically sealed keys on a keyboard
- Switches for medical applications
- Touch switch in front of LCD display
- Audio control: on/off, channel, and volume
- User interface and vandal-proof switches
- Switches in or under upholstery, leather, handles, mats, carpets, tiles and glass
- Use of standard metal sanitary parts (for example, a tap) as switch
- Portable communication and entertainment units
- White goods control panel



Capacitive Sensor Selection Guide

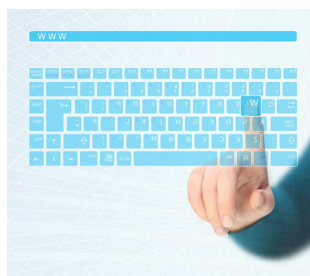
Device	Voltage Range (V)	Input Capacitive Range (pF)	Sensor Channels	Temperature Range (°C)	I ² C Interface	AEC-Q100 Compliant	Package
PCA8885	2.5–5.5	10–40	8	-40 to +85	Fm+	✓	TSSOP28, SOIC28
PCF8885	2.5–5.5	10–40	8	-40 to +85	Fm+		TSSOP28, SOIC28
PCF8883	3–9	10–60	1	-40 to +85	1 interrupt		SO8, CSP
PCA8886	3–9	10–60	2	-40 to +85	2 interrupts	✓	TSSOP16

Up Your Product's "Cool" Factor

Replace mechanical switches with NXP's capacitive touch and proximity sensors.

Add switches in or under upholstery, leather, handles, mats, carpets, tiles, and glass.

Ideal for use in hermetically sealed keyboard keys, medical applications switches, hazardous environment switches, white goods control, and more.



PCA8885 CAPACITIVE TOUCH AND PROXIMITY SENSOR FEATURES

- ▶ AEC-Q100 compliance for automotive applications
- ▶ Dynamic touch and proximity sensor with 8 sensor channels
- ▶ Support for remote connectivity to sensing plates
- ▶ Adjustable sensitivity with continuous auto-calibration
- ▶ I²C Fast-mode Plus (Fm+) compatible interface
- ▶ Operating voltage range of 2.5 V to 5.5 V
- ▶ -40 °C to +85 °C operations

Demo Boards

NXP offers a wide variety of supporting demonstration and evaluation boards, making it easy to program new peripherals and learn about the I²C-bus protocol.

Product	Description
OM6270	SPI/ I ² C-to-UART bridge demonstration board (SC16IS750)
OM6271	SPI-to-I ² C-master bridge demonstration board (SC18IS600)
OM6272	UART-to-I ² C-master bridge demonstration board (SC18IM700)
OM6273	SPI/ I ² C-to-DUART/IrDA/GPIO demonstration board (SC16IS752)
OM6274	I ² C-to-SPI-master bridge demonstration board (SC18IS602)
OM6275	I ² C 2005-1 evaluation board
OM6276	PCA9633 demonstration board
OM6277	PCA9564 evaluation board
OM6278	I ² C 2002-1A evaluation board
OM6281	PCA9698 daughter card for I ² C 2005-1
OM6282	PCA9633 daughter card for I ² C 2005-1
OM6285	I ² C 2002-1A evaluation board without PC controller board
OM6290	LCD driver evaluation board: PCF8576D, PCF2119, PCF8531, PCA9633
OM6292	PCA21125, PCF8562 demonstration board
OM6293	PCA9600 daughter card for I ² C 2005-1
OM6297	PCF2123, PCF8562 demonstration board
OM11051	PCF2127A demonstration board
OM11056	PCA8885/PCF8885 evaluation board
OM11057 OM11057A	PCF8885/86 capacitive sensor and PCF8536 LCD/ LED driver OM11057A with high sensitivity slider
OM13260	I ² C Fm+ development board (RoHS)
OM13285	PCA9629 demonstration board
OM13303	GPIO target board (RoHS)
OM13320	I ² C Fm+ development kit (RoHS)
OM13398	PCA9617A bus buffer board
OM13399	Bridge board

OM6275
I²C 2005-1 evaluation board



OM6278
I²C 2002-1A evaluation board



OM6277
PCA9564 evaluation board



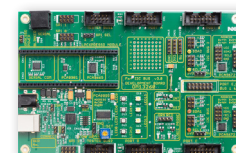
OM6293
PCA9600 daughter card for I²C 2005-1



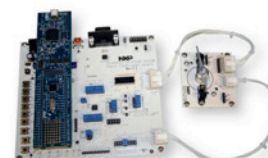
OM6276
PCA9633 demo board



OM13320 Fm+ Demonstration Kit which includes the OM13260 Fm+ Development Board with two OM13303 GPIO Target Boards and one each of the OM13398 PCA9617A bus buffer and OM13399 bridge board



OM13285 PCA9629 stepper motor demonstration board



OM11057 PCF8885/86 touch switch with PCF8536 LCD/LED driver



Resources

Frequently Asked Questions

Question: Does the presence of Standard Mode devices preclude 1Mbps transfers between Fm+ devices?

Answer: NXP's Fm+ parts are backward compatible, but a system containing a mix of Standard Mode, Fm, and Fm+ parts can only be operated at the speed of the slowest part, so if maximum speed is desired, it is necessary to segregate different speed grade functions onto different I²C-buses.

Question: If an I²C slave device isn't responding, what are the possible reasons?

Answer: If an I²C slave device doesn't respond properly, it may be because there was an I²C protocol violation, or fewer than 8 bits were written to the slave. Also consider that the address could be wrong, the device isn't powered up or it is in reset mode.

Question: What does quasi-bidirectional data pins mean? Why do you use quasi?

Answer: Port pins may be described as "quasi-" bidirectional because they are not ALWAYS bidirectional. The "quasi" means "sometimes" bidirectional. They are bidirectional only when in their default or reset state, or when they are written as HIGH. In this situation, they are internally pulled high by a weak pull-up current and they can be pulled LOW by an external signal when they are being used as an input. Port pins may also be driven high by an external signal. If any port pins are written as LOW, then those pins become unidirectional outputs and they cannot be used as inputs. The quasi bi-directional devices are very easy to program.

Question: Can we create a protocol-based bus recovery mechanism using signal toggles for our host I²C path if the I²C state machine gets hung in the middle of transmitting a byte of data back to the host?

Answer: Bit toggling should work to recover a hung I²C-bus, especially if the design uses NXP microprocessors and I²C devices. Send out nine clock pulses rather than examining the SDA pin. This approach should guarantee that the slave removes itself from the bus.

Question: What does remote I/O expander mean?

Answer: Remote I/O expander means the I/O expander is an external chip. It is like any I/O expander in terms of its application and function.

Question: Can I place masters on either side of an I²C multiplexer?

Answer: I²C multiplexer/switches are very simple devices that are controlled by a master located on the upstream side. If all of the masters in the system (upstream and downstream of the multiplexer/switches) are multi-master capable, then it is safe to place them on either side of a multiplexer/switches, but the downstream masters are isolated when the channel is open since they have no access to the multiplexer/switch state machine.

Question: How should an unused /RESET pin be terminated?

Answer: An unused /RESET pin needs to be connected to Vcc either directly or through a resistor to limit current if there is a fault.

Question: How should an unused /INT pin be terminated?

Answer: An unused /INT pin may be connected to GND or left unconnected since it is an open drain output.

Website Product Information

I²C-bus websites: www.nxp.com/interface and http://www.nxp.com/products/interface_and_connectivity/i2c
NXP's I²C-bus websites are a valuable resource for device information and support. They provide direct access to comprehensive product literature, such as brochures, datasheets, application notes, presentations, packaging information, and more.

I²C-bus support: <http://ics.nxp.com/support/>

Visit the I²C-bus support page for manuals, FAQs, information about evaluation kits, tools and training materials, links to application and design support, and more.

Packaging Information: <http://ics.nxp.com/packaging/>

Visit the I²C-bus packaging page for technical information about NXP package options.

Videos

www.youtube.com/nxpinterface

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