Your complete choice for I²C-bus peripherals

Our invention, your solution
to everyday design challenges

founded by Philips

Broad-based solutions from the

Benefits of the I²C-bus

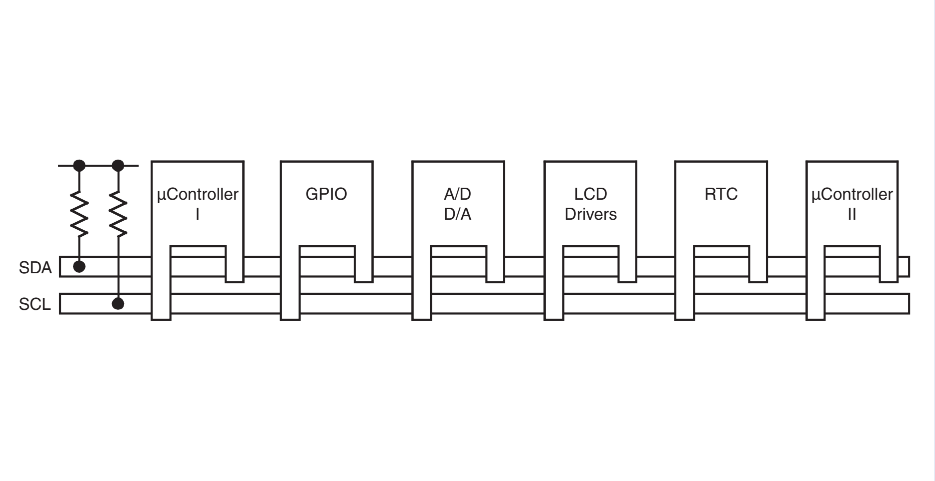
- De facto world standard
- Fast time-to-market
- Proven, robust performance
- Very wide range of functions
- Easy to design in
- Simple to debug
- Fast to test and assemble
- Reduces overall cost

NXP Semiconductors is the world's leading supplier of I²C-bus products. We invented the technology more than 20 years ago and never looked back. Since then, we've taken performance to new levels, introduced a wide variety of vital functions, and continue to offer the most flexible options for the most important applications.

We offer the industry's broadest portfolio of I²C-bus logic, providing essential components like GPIO, LED blinkers/ dimmers, Hot Swap bus buffers, bus expanders, bus hubs/ repeaters, DIP switches, muxes and switches, EEPROMs, data converters, LCD segment drives, and more.

To meet the needs of today's high-performance systems, our Fast-mode Plus (Fm+) devices operate at up to 1 MHz and drive up to 30 mA, so they work with long buses and support applications of up to 1,500 pF. They also use the Fast-mode software protocol (400 kHz), so you can upgrade speed without having to change your design software.

To overcome the limits of interfacing a host bus to its peripheral, we've introduced a new series of bridge ICs that manage the connection between the I²C-bus and other protocols. The bridges make it possible for legacy I²C-bus structures to connect to new systems, too, so you can retain your original design investment while extending the lifespan of older I²C-bus systems.



I²C-bus structure

inventor of the technology

Online support for the I²C-bus

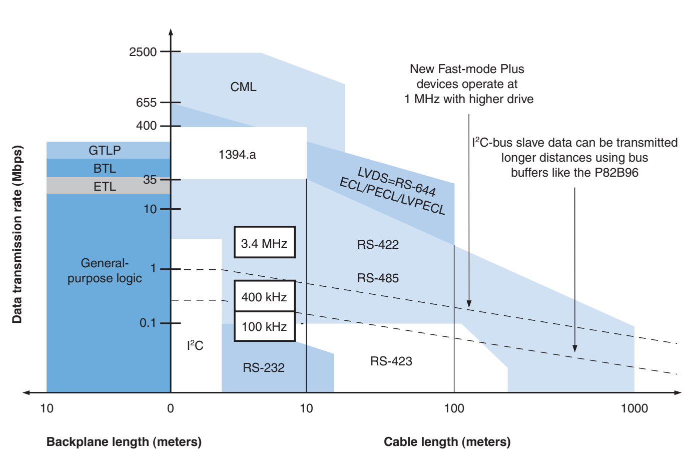
I²C-bus home page	: www.nxp.com/i2c
I²C-bus logic home page	: www.nxp.com/i2clogic
Boards and samples	: i2c.support@nxp.com

Performance, simplicity, and ease of use

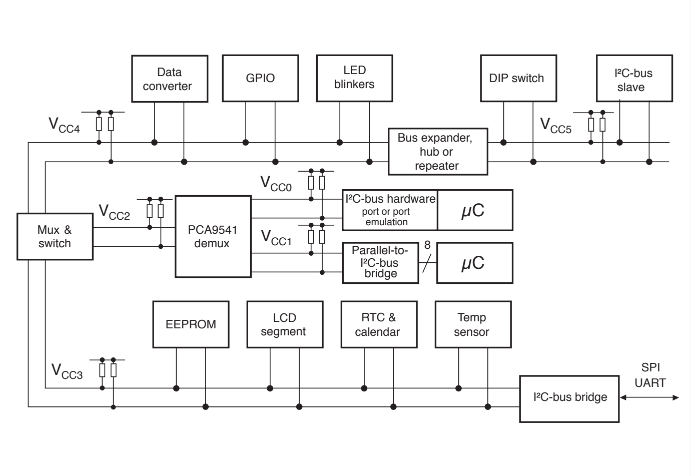
There are plenty of reasons why the I²C-bus has endured for more than two decades. First, there's performance. The technology has continued to evolve and today supports several speed grades. Bus capacitance has also increased, with hubs, bus repeaters, bidirectional switches, and multiplexers that support more devices over longer distances – off the card, out of the cabinet, or even across the room.

Beyond performance, though, there's ease of use. All it takes it two simple lines to connect every IC in the system. Any I²C-bus device can be attached to a common I²C-bus, and any master device can exchange information with any slave device. The software-controlled addressing scheme eliminates address-decoding hardware, and there's no need to design and debug external control logic because it's already provided by the I²C-bus protocol. That means you can move quickly from block diagram to final hardware, simply clipping new devices and functions to an existing bus.

The I²C-bus also saves space and lowers overall cost. The two-line structure means fewer trace lines, so the PCB can be that much smaller. Having fewer trace lines simplifies debug and test, too, since there are fewer lines to check and fewer information sources to verify. What's more, as the system evolves over several generations, new I²C-bus devices can be added or removed easily, without impacting the rest of the system.

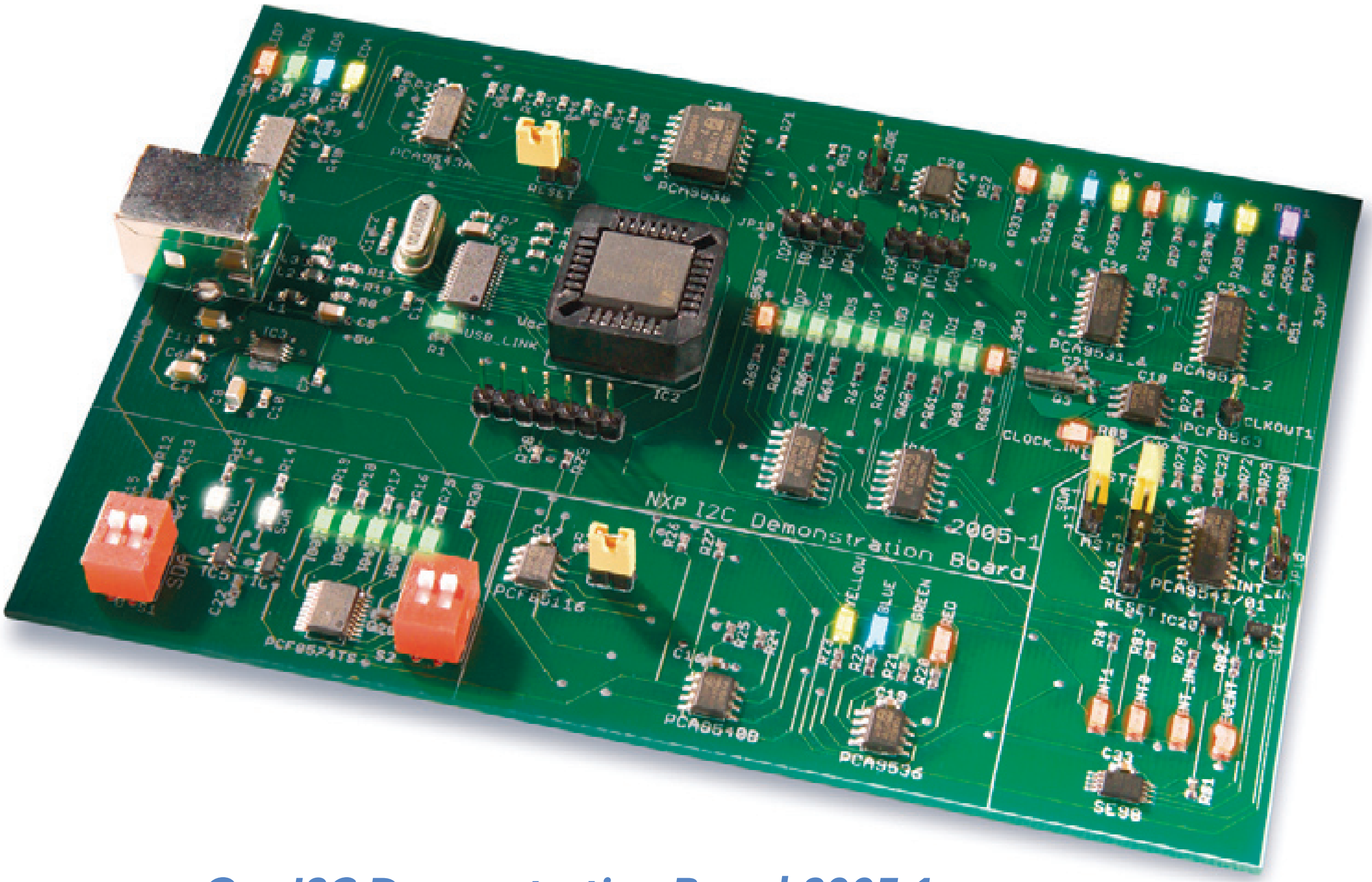


By supporting a range of performance levels, our I²C-bus devices deliver maximum design flexibility

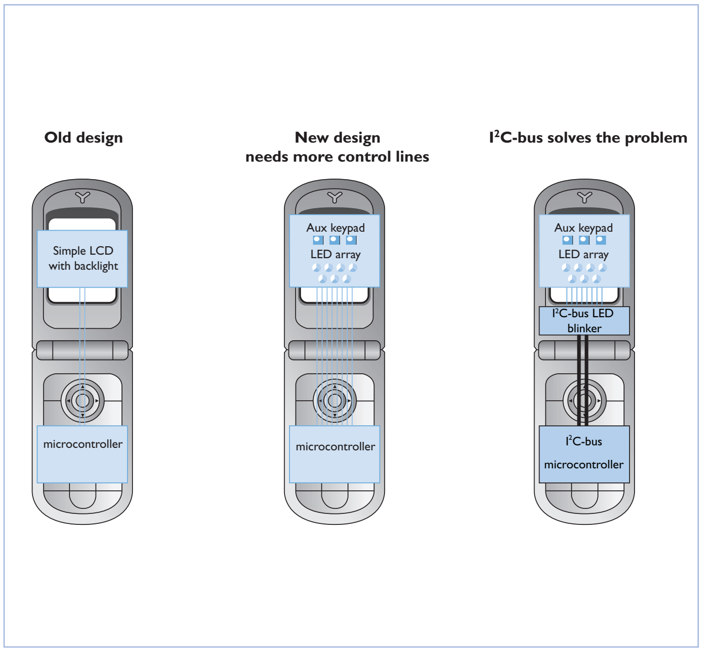


We offer the widest range I²C-bus logic

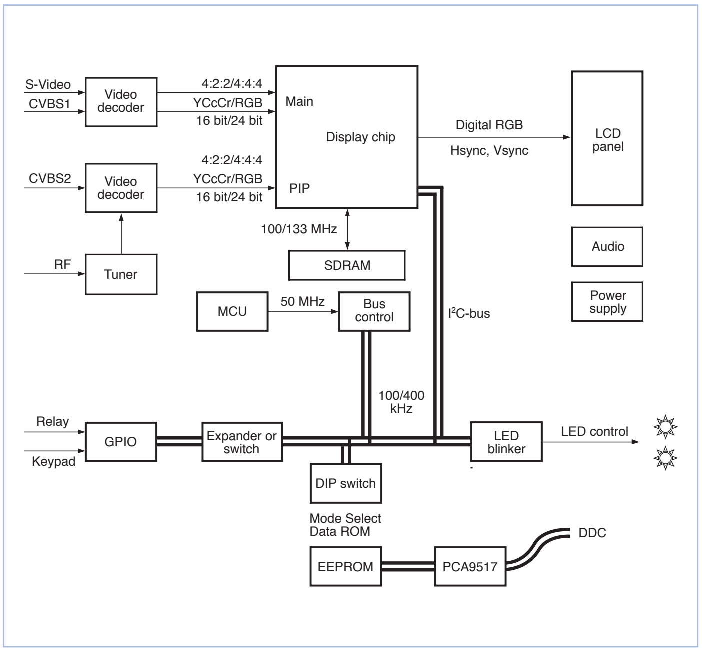
Taking I^{2}C-bus to the next level



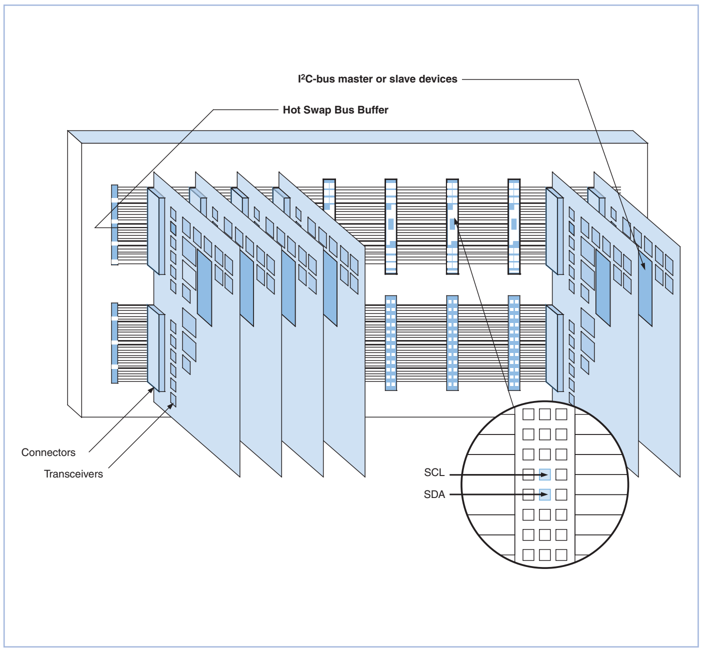
Our I2C Demonstration Board 2005-1 makes it easy to demo I^{2}C-bus devices and learn about the I^{2}C-bus



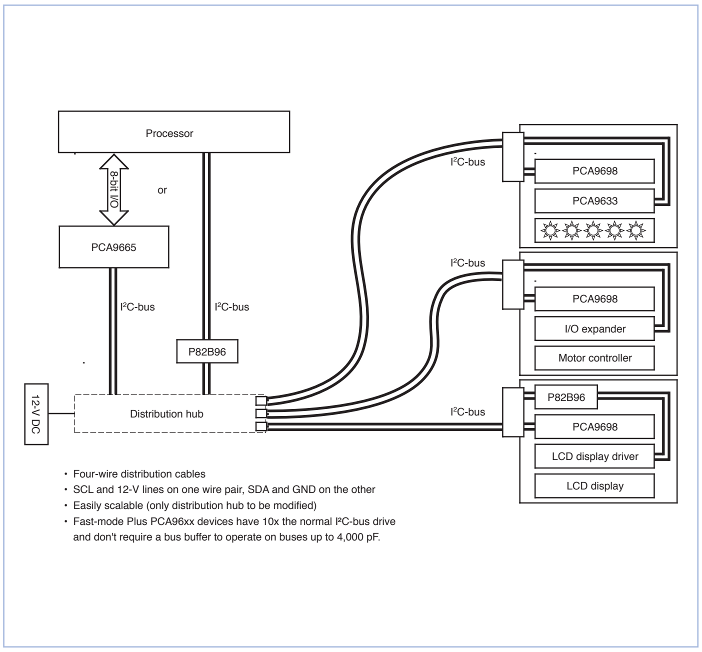
Portable device applications



LCD TV



Hot Swap applications including cPCI, VME, and advanced TCA



- Four-wire distribution cables
- SCL and 12-V lines on one wire pair, SDA and GND on the other
- Easily scalable (only distribution hub to be modified)
- Fast-mode Plus PCA96xx devices have 10x the normal I²C-bus drive and don't require a bus buffer to operate on buses up to 4,000 pF.

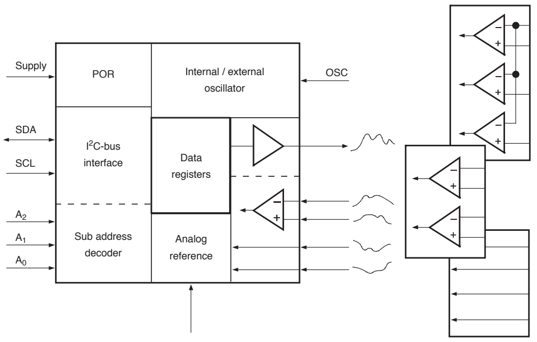
Modular and medical applications and gaming

I²C-bus product families

I²C-bus analog-to-digital converters

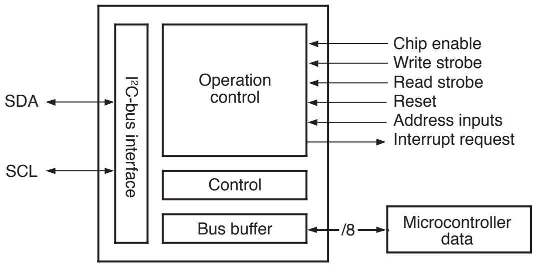
- Convert signals from digital to analog, analog to digital
- Internal oscillator
- Power On Reset (POR)

PCA9691	Fm+ 1-MHz 4-channel 8-bit A/D and D/A converter
PCF8591	100-kHz 4-channel 8-bit A/D and D/A converter
TDA8444	8-channel 6-bit D/A converter



Parallel-bus-to-I²C-bus controllers

- Interface most 8-bit parallel-bus microcontrollers and microprocessors to I²C-bus
- Parallel bus system communicates bidirectionally with I²C-bus
- Provides master and slave functions
- I²C-bus communications carried out on byte-wise basis, using interrupt or polled handshakes
- Multi-master capable
- 68-byte buffer (PCA9665)
- See page 10 for SPI or UART to I²C-bus bridges

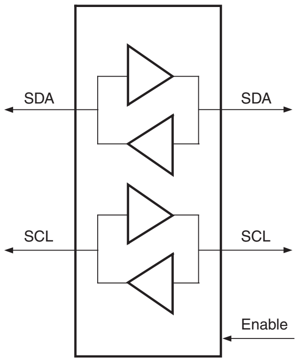


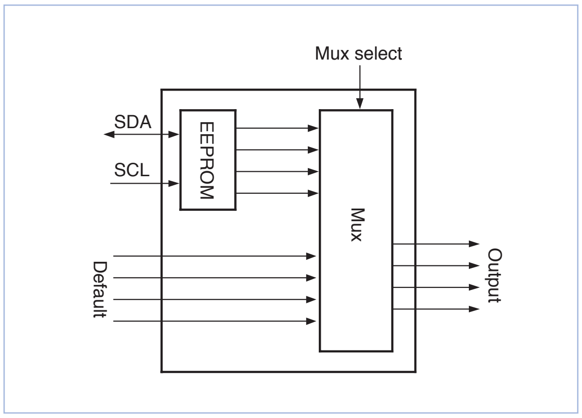
PCA9564	400-kHz 2.3-to-3.6-V I²C-bus controller
PCA9665	Fm+ 2.3-to-3.6-V I²C bus controller
PCF8584	100-kHz 4.5-to-5.5-V I²C-bus controller

I²C-bus repeaters, hubs, and extenders

- Bidirectional I²C-bus drivers isolate I²C-bus capacitance, accommodating more I²C-bus devices and longer bus length
- Up to 400-pF load on each segment, 4000-pF for P82B devices and PCA9600
- Different voltages (3.3 or 5 V) on each segment
- Devices transparent to bus arbitration and contention protocols in multi-master environment
- Twisted-pair differential transmission or opto-electrical isolation of I²C-bus (P82B96 or PCA9600)

P82B715	I²C-bus extender
P82B96	Dual bidirectional I²C-bus buffer
P82B485	Differentail dual bidirectional I²C-bus buffer
P82B486	Differential triple bidirectional I²C-bus buffer
PCA9507	I²C-bus repeater with rise time accellerator
PCA9508	Level translating I²C-bus repeater for cable applications
PCA9509	Low-voltage I²C-bus repeater
PCA9510A/11A/12A/13A/14A	I²C-bus Hot Swap bus buffers
PCA9515/15A	I²C-bus repeater
PCA9516/16A	5-channel I²C-bus hub
PCA9517/17A	Low-voltage I²C-bus repeater
PCA9518A	Expandable 5-channel I²C-bus hub
PCA9519	4-channel low-voltage I²C-bus repeater
PCA9600	Fm+ dual bidirectional I²C-bus buffer

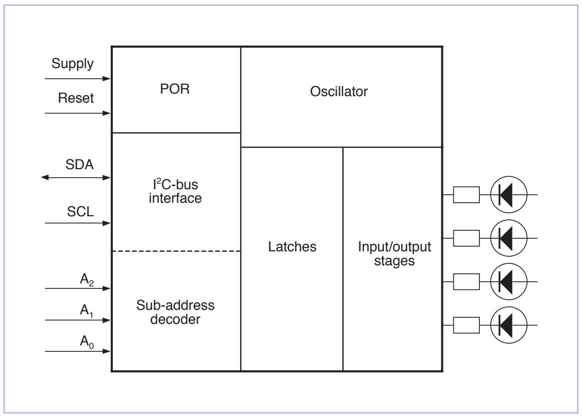




I^{2}C-bus EEPROM-based DIP switches

- Replace jumpers and DIP switches
- Hands-free manipulation via integrated, I^{2}C-bus-controlled EEPROM and multiplexer
- Program and store settings in I^{2}C-bus-controlled EEPROM register
- Multiplex between default values and stored settings
- Non-volatile memory retains register values, even on power-down

PCA8550	4-bit multiplexed / 1-bit latched 5-bit I^{2}C-bus EEPROM
PCA9559	5-bit multiplexed / 1-bit latched 6-bit I^{2}C-bus EEPROM
PCA9560	Dual 5-bit multiplexed / 1-bit latched I^{2}C-bus EEPROM
PCA9561	Quad 6-bit multiplexed I^{2}C-bus EEPROM



I^{2}C-bus LED dimmers/blinkers

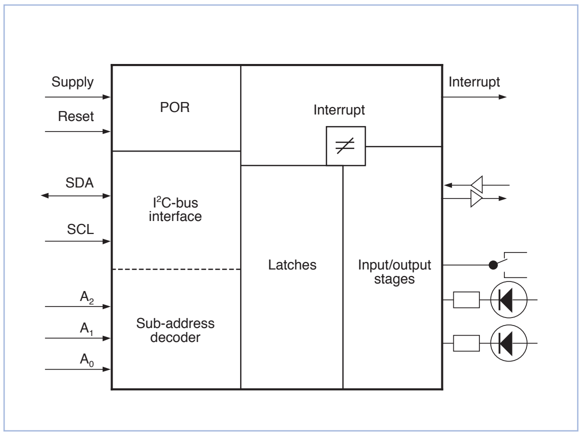
- General-purpose I/O and LED control
- No external components required: internal oscillator provides two (256-step, user- definable) frequency and duty cycles
- Two programmable blink rates
- On/off/blink or dim LED
- LED brightness controlled by setting frequency to 152 Hz and changing duty cycle to vary LED's average current
- Extra pins can be used as inputs or outputs
- Hardware reset pin for state machine
- Open-drain outputs capable of 25-mA sink

LED dimmers (Freq. range: 152 Hz to 1.69 sec.)	
PCA9530	2-bit LED dimmer
PCA9531	8-bit LED dimmer
PCA9532	16-bit LED dimmer
PCA9533	4-bit LED dimmer
PCA9632/33	Fm+ 4-bit 5-PWM LED controller
PCA9634	Fm+ 8-bit 9-PWM LED controller
PCA9635	Fm+ 16-bit 17-PWM LED controller
PCA9685	Fm+ 16-bit 4Kstep LED controller

LED blinkers (Freq. range: 152 Hz to 1.69 sec.)	
PCA9550	2-bit LED blinker
PCA9551	8-bit LED blinker
PCA9552	16-bit LED blinker
PCA9553	4-bit LED blinker
PCA9625	Fm+ LED controller (24 V, 100 mA)
SAA1064	4 x 7 I^{2}C-bus LED driver with decimal

I^{2}C-bus general-purpose I/O (GPIO) expanders

- Connect parallel I/O to serial I^{2}C-bus or SMBus and provide I/O expansion
- Quasi output: upper transistor is on for half a clock cycle and then held up by a weak current source (25-mA sink)
- Extend GPIO from I^{2}C-bus or SMBus
- True Output: configurable as input or output with polarity inversion (push/ pull with 25-mA sink and 10-mA source)



Quasi output (weak current source)	
PCA8574/74A	8-bit with interrupt
PCA8575	16-bit with interrupt
PCA9500	8-bit with 2-kbit EEPROM
PCA9501	8-bit with 2-kbit EEPROM, interrupt
PCA9558	8-bit w/ 5-bit DIP, 2-kbit EEPROM
PCA9670	Fm+ 8-bit with reset
PCA9671	Fm+ 16-bit with reset
PCA9672	Fm+ 8-bit with interrupt, reset
PCA9673	Fm+ 16-bit with interrupt, reset
PCA9674/74A	Fm+ 8-bit with interrupt
PCA9675	Fm+ 16-bit with interrupt
PCF8574/74A	8-bit with interrupt
PCF8575/75C	16-bit with interrupt

True output (configur able push/pull)	
PCA9502	8-bit SPI/I^{2}C with interrupt, reset
PCA9505/06	40-bit with interrupt, reset, $\overline{\text{OE}}$
PCA9534/54/54A	8-bit with interrupt
PCA9535/35C/55	16-bit with interrupt
PCA9536	4-bit
PCA9537	4-bit with interrupt, reset
PCA9538	8-bit with interrupt, reset
PCA9539	16-bit with interrupt, reset
PCA9557	8-bit with reset
PCA9698	Fm+ 40-bit with interrupt, reset, $\overline{\text{OE}}$

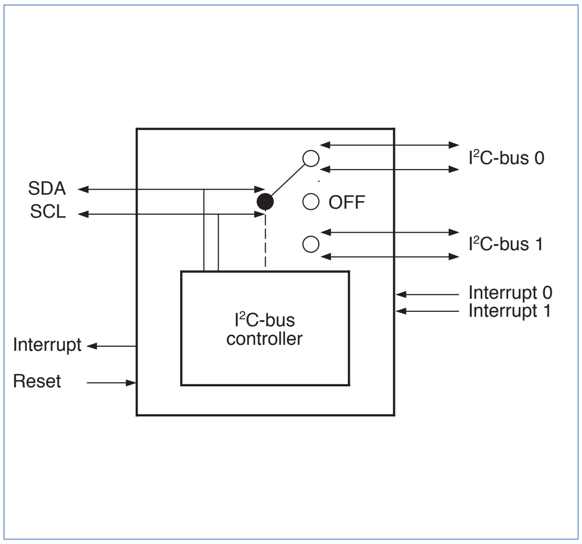
I²C-bus product families

I²C-bus multiplexers and switches

- Fans I²C-bus out to multiple I²C-buses
- Buses selected via I²C-bus commands from master
- Multiplexers and switches select one downstream I²C-bus at a time
- Switches can, in broadcast mode, turn on all channels simultaneously
- Interrupts are collected and sent to master
- Reset pin deselects all channels, so master can regain control if bus hangs up
- Designed for address conflict resolution, I²C-bus sub-branch isolation, I²C-bus level shifting, etc.

PCA9540B	1-to-2 multiplexer
PCA9541	2-to-1 master select w/int, reset
PCA9542A	1-to-2 multiplexer with interrupt
PCA9543 A/B/C	1-to-2 switch w/interrupt, reset
PCA9544A	1-to-4 multiplexer w/interrupt

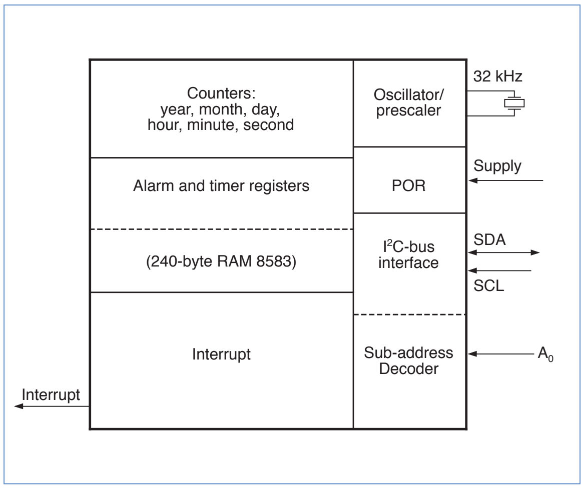
PCA9545 A/B/C	1-to-4 switch w/interrupt, reset
PCA9546A	1-to-8 switch with reset
PCA9547	1-to-8 multiplexer with reset
PCA9548A	1-to-8 switch with reset
PCA9549	8-bit bus switch with reset



I²C-bus real-time clocks

- 32.768-kHz quartz oscillator
- Year, month, day, hour, minute, second (1/100-sec resolution)
- Alarm and timer functions
- Wide operating supply voltage range (1.0 to 5.5 V)
- Open drain interrupt pin
- Low back-up current (0.25 μA at 3 V)
- Low-voltage detection
- Temperature compensation, integrated quartz

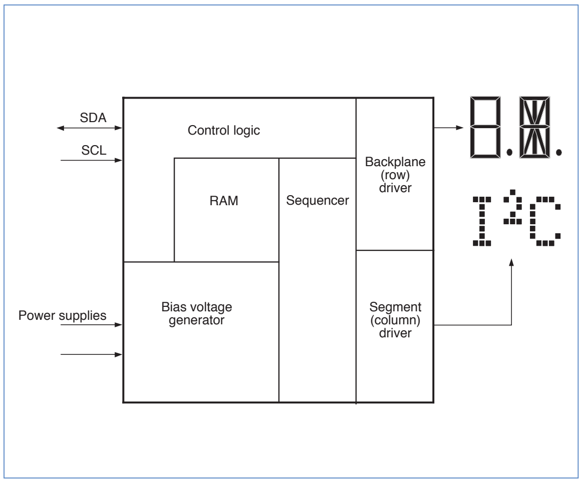
PCA8565	High-temperature (125 °C) I²C-bus real-time clock
PCF8563	Low-power I²C-bus real-time clock
PCF8583	I²C real-time clock with 240-byte RAM
PCF8593	I²C real-time clockwith 1/100-second resolution
PCF2128	RTC with integrated temperature compensated quartz oscillator

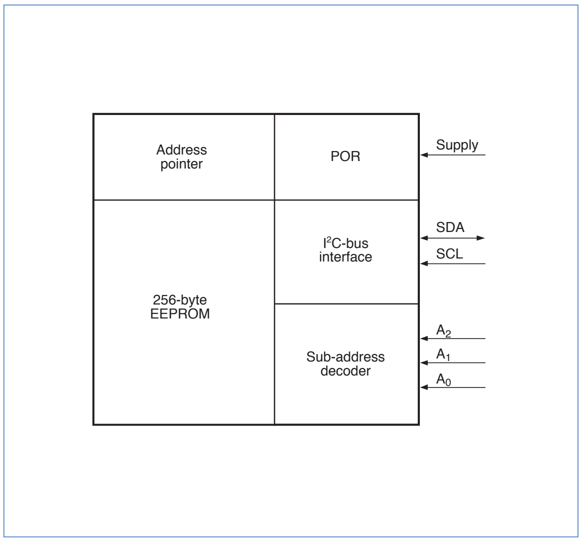


I²C-bus LCD drivers

- Low power
- On-chip bias
- Temperature compensation
- Blinking
- No external parts required

PCF2113/2116/2119	I²C-bus LCD character display
PCF8531/8535/8811	I²C-bus LCD graphic drivers
PCF8533	80-to-320 segment I²C-bus LCD segment driver
PCF8534A	60-to-240 segment I²C-bus LCD segment driver
PCF8562	32-to-128 segment I²C-bus LCD segment driver
PCF8566	24-to-96 segment I²C-bus LCD segment driver
PCF8576D	40-to-160 segment I²C-bus LCD segment driver
PCF8577C	32-to-64 segment I²C-bus LCD segment driver
PCF8578/79	>384 segment I²C-bus LCD segment/dot driver

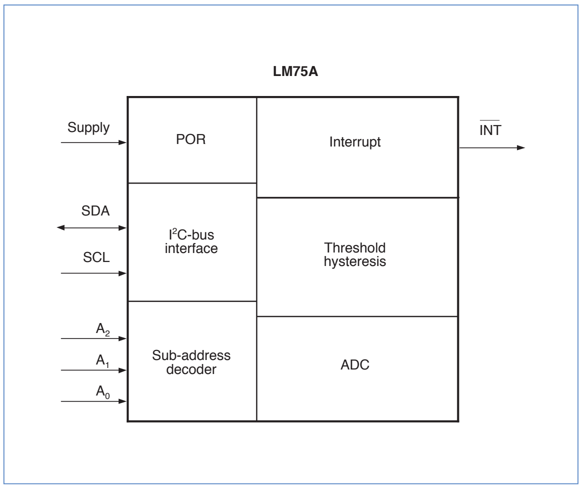




I^{2}C-bus Serial EEPROMs

- Wide voltage range minimizes EEPROM inventory
- I^{2}C-bus reads/writes information to/from memory
- Wide voltage range (2.5 to 5.5 V)
- 1,000,000 read/write cycles
- 10-year data retention

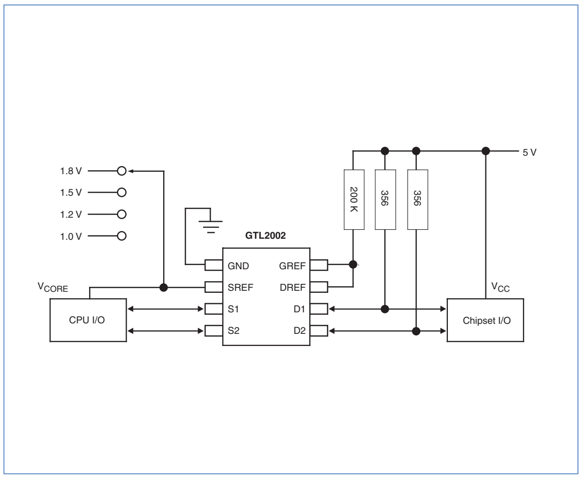
PCA24S08	1024 x 8-bit (8-kbit) I^{2}C-bus serial EEPROM with security features
PCF8570	256 x 8-bit (2-kbit) I^{2}C-bus static low-voltage RAM
PCF8581(C)	128 x 8-bit (1-kbit) I^{2}C-bus serial EEPROM
PCF8582C-2	256 x 8-bit (2-kbit) I^{2}C-bus serial EEPROM
PCF8594C-2	512 x 8-bit (4-kbit) I^{2}C-bus serial EEPROM
PCF8598C-2	1024 x 8-bit (8-kbit) I^{2}C-bus serial EEPROM
PCF85102C-2	256 x 8-bit (2-kbit) I^{2}C-bus serial EEPROM
PCF85103C-2	256 x 8-bit (2-kbit) I^{2}C-bus serial EEPROM with alternate I^{2}C address
PCF85116-3	2048 x 8-bit (16-kbit) I^{2}C-bus serial EEPROM



I^{2}C-bus temperature and voltage sensors

- Hardware monitors use I^{2}C-bus to report temperature and/or voltage
- Remote sensor is more accurate than package-mounted sensors (analog input pins let external transistors and diodes – in a processor, for example – perform very precise temperature sensing)
- SE97/98 per JEDEC specification for RDIMM and SO-DIMM applications

LM75A/B	±2 °C local I^{2}C-bus temperature sensor and thermal watchdog™
NE1617A	±2 °C local / remote I^{2}C-bus temperature monitor
NE1619	±2 °C local / remote I^{2}C-bus temperature and voltage monitor
SA56004	±1 °C local / remote digital temp sensor with over-temp alarms
SE95	±1 °C high accuracy local I^{2}C-bus temperature sensor and thermal Watchdog
SE97	±1 °C local I^{2}C-bus temperature sensor with 2-Kbit EEPROM SPD
SE98	±1 °C local I^{2}C-bus temperature sensor



I^{2}C-bus voltage-level translators

- Voltage translation between any voltage from 1.0 to 5.0 V
- Open drain on both sides with no drive
- Bidirectional voltage translation with no direction pin
- Reference voltage clamps input voltage with low propagation delay
- Supports bidirectional translation of normal 3.3- and/or 5.0-V I^{2}C-bus signals to low-voltage I^{2}C-bus processor ports
- BiCMOS process for excellent ESD performance (except PCA9306)

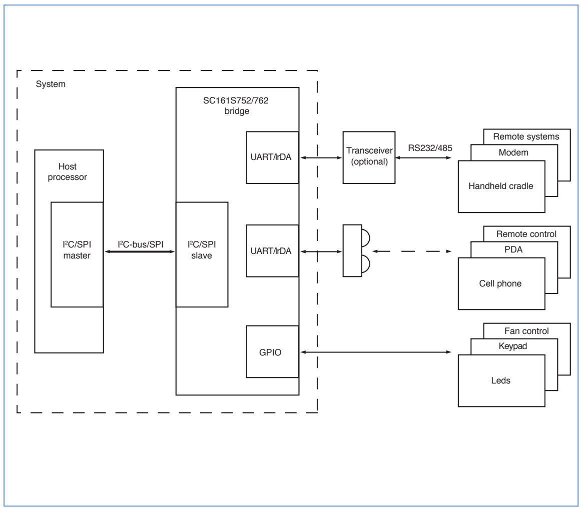
GTL2000	22-bit bidirectional I^{2}C-bus voltage-level translator
GTL2002	2-bit bidirectional I^{2}C-bus voltage-level translator
GTL2003	8-bit bidirectional I^{2}C-bus voltage-level translator
GTL2010	10-bit bidirectional I^{2}C-bus voltage-level translator
PCA9306	Bidirectional I^{2}C-bus and SMBus voltage-level translator

I^{2}C-bus product families

High-speed I^{2}C-bus / SPI-slave bridge to UART / IrDA / GPIO

- Communication between SPI / I^{2}C-bus slave and high-speed UART
- Low power, low voltage
- Minimal host connection
- Broadband UART (5 Mbps)
- Enable communication between I^{2}C-bus or SPI and RS232 or RS485
- IrDA interface for wireless links
- Configurable GPIO
- SPI speed: 4 to 15 Mbps
- I^{2}C-bus speed: 400 kbps
- High data throughput and integrity

SC16IS750	I^{2}C-bus / SPI-slave bridge to single UART with 64-byte FIFOs, 115.2-kbps IrDA SIR, 8 GPIO
SC16IS752	I^{2}C-bus / SPI-slave bridge to dual UARTs with 64-byte FIFOs, 115.2-kbps IrDA SIR, 8 GPIO
SC16IS760	I^{2}C-bus / SPI-slave bridge to single UART with 64-byte FIFOs, 1.152-Mbps IrDA SIR, 8 GPIO
SC16IS762	I^{2}C-bus / SPI-slave bridge to dual UARTs with 64-byte FIFOs, 1.152-Mbps IrDA SIR, 8 GPIO
SC16IS740	I^{2}C-bus /SPI-slave bridge to single UART with 64-byte FIFOs, 115.2-kbps IrDA SIR
SC16IS850	I^{2}C-bus /SPI-slave bridge to single UART with 128-byte FIFOs, 115.2-kbps IrDA SIR
SC16IS852	I^{2}C-bus /SPI-slave bridge to dual UART with 64-byte FIFOs, 115.2-kbps IrDA SIR

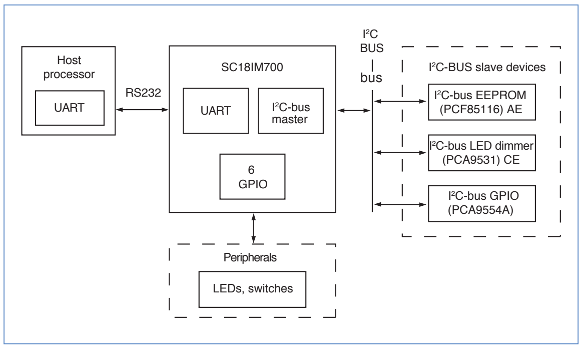


SC16is7xx usage scenarios

UART bridge to I^{2}C-bus master with GPIO

- Control connection between UART host and I^{2}C-bus
- Low power, low voltage
- Fast-mode 400 kHz I^{2}C-bus device interface
- Programmable GPIO and baud rate
- Enables UART connectivity to the I^{2}C-bus
- High data throughput and integrity
- Multi master capable

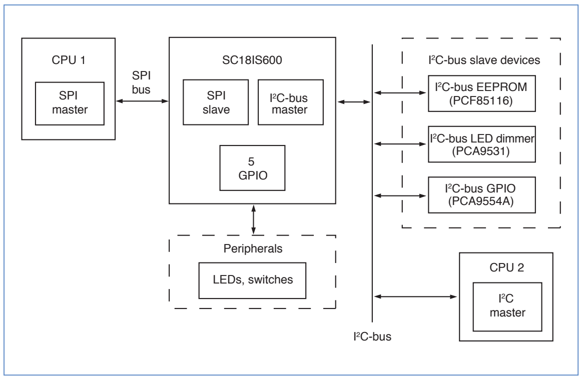
SC18IM700	UART bridge to I^{2}C-bus master with GPIO



SPI-slave bridge to I^{2}C-bus master / GPIO

- Control connection between SPI host and I^{2}C-bus
- Low power, low voltage
- Full-duplex high-speed SPI interface
- SPI speed: 1 to 3 Mbps
- Fast I^{2}C-bus device interface
- Enables communication between SPI and I^{2}C-bus
- Programmable GPIO
- High data throughput and integrity

SC18IS600	SPI-slave bridge to I^{2}C master with GPIO, internal clock
SC18IS601	SPI-slave bridge to I^{2}C master with GPIO, external clock
SC18IS602	I^{2}C-bus-slave bridge to SPI master with GPIO, external clock



Development kits for bridge ICs

I^{2}C-bus / SPI to UART (SC16IS7xx)	Easy interface between an I^{2}C-bus / SPI host and IrDA, RS232 / RS485, and GPIO devices. The bus interface is selectable for I^{2}C-bus or SPI. Kit includes sample code with device initialization (UART, RS485) and IrDA communications, plus user manual.
UART to I^{2}C-bus (SC18IM700)	Easy interface between a UART host and various I^{2}C-bus and GPIO devices. Kit includes sample code with SC18IM700 UART messages and commands for NXP I^{2}C-bus slave devices, plus user manual.
SPI to I^{2}C-bus (SC18IS60x)	Easy interface between an SPI host and various I^{2}C-bus and GPIO devices. The board also includes an I^{2}C-bus EEPROM and an LED dimmer. Kit includes sample code with SC18IS80x SPI messages and commands for NXP I^{2}C-bus slave, plus user manual.

I^{2}C-bus FAQs

Problem	Solution	Suggested parts
Putting too many of the same devices on the bus causes an address conflict.	Use a multiplexer to break address space into sub-branches. Master selects which sub-branch to address under I^{2}C-BUS control. Two to eight sub-branches are available per multiplexer.	PCA9540B, 41, 42A, 43A/B/C, 44A, 45A/B/C, 46A, 47, 48A, 49
I need more devices than the 400-pF lead allows.	Use a multiplexer to break up the capacitance by sub-branch. Sub-branches are addressed individually.	PCA9540B, 41, 42A, 43A/B/C, 44A, 45A/B/C, 46A, 47, 48A,49
	Use a repeater or hub to address all devices at the same time (be careful of address conflicts).	PCA9507, 08, 09, 15, 15A, 16, 16A, 17, 17A 18A, 19
	Use Fast-mode Plus devices.	PCA9632, 33, 34, 35, 70, 71, 72, 73, 74, 74A, 75, 98, with PCA9600 from master or PCA9665
I have to send I^{2}C-bus signals through a really long cable.	Use an I^{2}C-bus extender to add high drive to any I^{2}C-bus. Guidelines (80 pF per meter) for 400 kHz are at least 20 m and for 30 kHz are at least 1000 m.	P82B715, P82B96, and PCA9600 with 30-mA drive PCA9507, 08, 17, 17A with 6-mA drive
I have a mixed-voltage environment that causes conflicts on the open-drain I^{2}C-bus.	Use a switch to dynamically split the bus by pulling downstream channels to different voltages.	PCA9543A/B/C, 45A/B/C, 46A, 48A GTL2002, 2010, 2000, PCA9306 PCA9507, 08, 09, 12A, 17, 17A, 19
I have slow (100-kHz) and fast (400-kHz) parts on the same bus. How can I isolate them to get the most performance from the 400-kHz devices?	Use a bus repeater and have the master disable the 100-kHz segment during 400-kHz communication.	PCA9508, 15, 15A, 16, 16A, 17, 17A, 18A PCA9540B, 42A, 43A/B/C
I have two masters in my fault-tolerant system, one active at a time. How do I select one master over the other?	Use an I^{2}C-bus master selector to switch from a failing master to its backup. The selector also provides isolation.	PCA9541
I support Hot Swap in my fault-tolerant system. How can I keep I^{2}C-bus traffic undisturbed during a swap?	Use an I^{2}C-bus Hot Swap bus buffer to detect bus-idle condition, isolate capacitance, and prevent bus glitches.	PCA9510A, 11A, 12A, 13A, 14A PCA9508
I need to add a new I^{2}C-bus port to a host.	Use a bus controller to create a new I^{2}C-bus port. You may not need a new port. A multiplexer or a switch may give you the features you need.	PCA9564, PCF8584, PCA9665 PCA954x
The I^{2}C-bus is "multi-drop" and any device can hang the bus. How can I make this bus more fault-tolerant?	Break the bus into different branches to create a "star" configuration. Multi-cast is allowed. The master sets the configuration via I^{2}C-bus.	PCA9543A/B/C, 45A/B/C, 46A, 48A Simple discrete circuitry with any buffer can detect and isolate failed sections.

I²C-bus product summary

	Type of function in device																									Features										
																	Vcc range (V)						Freq (kHz)			Temp(°C)			Packages							
	I/O expander (bits)	LED blinker (bits)	MUX/latch/EEPROM (bits-lahed bits-register)	MUX/switch (in/out channels)	Repeater hub (in/out segment)	Bus controller	Temperature sensor	Voltage measument	RAM/EEPROM (kbits)	Real time clock/calender	Analog/digital converter	LCD driver	Number of addresses	Interrupt (I/O)	Hardware reset	Current (per bit/total mA)	1.0	1.8	2.5	3.3	5	5-V tolerant	100	400	1000	0 to 70	-40 to 85	-55 to 125	Pin count	DIP	SO (narrow)	SO (wide)	SSOP	QSOP	TSSOP	HVQFN
GTL2000													NA				•	•	•	•	•	•	•	•	•		•		48				DL		DGG	
GTL2002													NA				•	•	•	•	•	•	•	•	•		•		8						DP	DC/GM
GTL2010													NA				•	•	•	•	•	•	•	•	•		•		24		D				PW	BS
LM75A/B							2 °C						8	0/1					2.8	•	•	•	•	•				•	8		D				DP	
NE1617A							2 °C						9	0/1						•	•	•	•			0 to 125			16					DS		
NE1619							2 °C	•					2							•	•	•	•	•		0 to 125			16					DS		
P82B485			1-1																•	•	•	•	•	•			•		10						DP	
P82B486			1-1																•	•	•	•	•	•			•		14/16		D				PW	
P82B715					1-1								NA								•	•	•	•			•		8	PN	TD					
P82B96					1-1								NA						•	•	•	•	•	•		-40 to 125			8	PN	TD				DP	
PCA24S08									8				1						•	•			•	•			•		8		D				DP	
PCA8550			4-1-1										1							•		•	•	•		•			16		D		DB		PW	
PCA8565										•			1	0/1			•	•	•	•	•	•	•	•		-40 to 125			8						DP	
PCA8574	8												8	0/1		25-200		•	•	•	•	•	•	•			•		16			D	TS		PW	
PCA8575	16												8	0/1		25-400		•	•	•	•	•	•	•			•		24			D	DB	DK	PW	BS/BQ
PCA8581/81C									1				8						•	•	•	•	•			-25 to 85			8	PN	TD					
PCA9306													NA				•	•	•	•	•	•	•	•	•		•		8		D				DP	DC/GM
PCA9500	8								2				2-8			25-100				•		•	•	•			•		16			D			PW	BS
PCA9501	8								2				2-64	0/1		25-100				•		•	•	•			•		20			D			PW	BS
PCA9502	8												8	0/1	•	10-80				•		•	•	•			•		16							BS
PCA9505/06	40												8	0/1	•	15-600			•	•	•	•	•	•			•		56						DGG	BS
PCA9507			1-1																•	•	•	•	•	•			•		8		D				DP	
PCA9508					1-1								NA				•	•	•	•	•	•	•	•			•		8		D				DP	
PCA9509					1-1								NA				•	•	•	•	•	•	•	•			•		8		D				DP	
PCA9510A, 11A, 12A, 13A, 14A					1-1								NA							•			•	•			•		8		D				DP	
PCA9515/15A					1-1								NA						•	•		•	•	•			•		8		D				DP	
PCA9516/16A					1-4								NA						•	•		•	•	•			•		16		D				DP	
PCA9517/17A					1-1								NA				•	•	•	•		•	•	•					8		D				DP	
PCA9518A					1-4								NA						•	•		•	•	•			•		20			D			PW	
PCA9519					4-4								NA				•	•	•	•	•	•	•	•			•		20/24						PW	BS
PCA9530		2											2		•	25-50			•	•	•	•	•	•			•		8		D				DP	
PCA9531		8											8		•	25-100			•	•	•	•	•	•			•		16		D				PW	BS/BS3
PCA9532		16											8		•	25-200			•	•	•	•	•	•			•		24			D			PW	BS
PCA9533		4											2			25-100			•	•	•	•	•	•			•		8		D				DP	
PCA9534	8												8	0/1		25-100			•	•	•	•	•	•			•		16			D			PW	BS/BS3
PCA9535/35C	16												8	0/1		25-200			•	•	•	•	•	•			•		24			D			PW	BS
PCA9536	4												1			25-50			•	•	•	•	•	•			•		8		D				DP	
PCA9537	4												1	0/1	•	25-50			•	•	•	•	•	•			•		10						DP	
PCA9538	8												4	0/1	•	25-100			•	•	•	•	•	•			•		16			D			PW	BS
PCA9539	16												4	0/1	•	25-200			•	•	•	•	•	•			•		24			D			PW	BS
PCA9540B				1-2									1						•	•	•	•	•	•			•		8		D				DP	
PCA9541				2-1									16	1/2	•				•	•	•	•	•	•			•		16		D				PW	BS
PCA9542A				1-2									8	2/1					•	•	•	•	•	•			•		14		D				PW	
PCA9543A/B/C				1-2									4	2/1	•				•	•	•	•	•	•			•		14		D				PW	
PCA9544A				1-4									8	4/1					•	•	•	•	•	•			•		20			D			PW	BS
PCA9545A/B/C				1-4									4	4/1	•				•	•	•	•	•	•			•		20			D			PW	BS
PCA9546A				1-4									8		•				•	•	•	•	•	•			•		16		D				PW	BS
PCA9547/48A/49				1-8									8		•				•	•	•	•	•	•			•		24			D			PW	BS
PCA9550		2											2		•	25-50			•	•	•	•	•	•			•		8		D				DP	
PCA9551		8											8		•	25-100			•	•	•	•	•	•			•		16		D				PW	BS/BS3
PCA9552		16											8		•	25-200			•	•	•	•	•	•			•		24			D			PW	BS
PCA9553		4											2			25-100			•	•	•	•	•	•			•		8		D				DP	TK
PCA9554/54A	8												8	0/1		25-100			•	•	•	•	•	•			•		16	N		D	TS		PW	BS/BS3
PCA9555	16												8	0/1		25-200			•	•	•	•	•	•			•		24	N		D	DB		PW	BS
PCA9557	8												8		•	25-100			•	•	•	•	•	•			•		16		D				PW	BS
PCA9558	8		5-1-1						2				2			25-100				•		•	•	•		•			28						PW	
PCA9559			5-1-1										4			20-80				•		•	•	•		•			20						PW	
PCA9560			5-1-2										4			25-100				•		•	•	•			•		20			D			PW	
PCA9561			6-0-4										4			25-100				•		•	•	•			•		20			D			PW	
PCA9564						•							128	0/1	•				•	•		•	•	•			•		20	N		D			PW	BS

	Type of function in device																									Features										
																	Vcc range (V)						Freq (kHz)			Temp(°C)			Packages							
	I/O expander (bits)	LED blinker (bits)	MUX/latch/EEPROM (bits-lahed bits-register)	MUX/switch (in/out channels)	Repeater hub (in/out segment)	Bus controller	Temperature sensor	Voltage measument	RAM/EEPROM (kbits)	Real time clock/calender	Analog/digital converter	LCD driver	Number of addresses	Interrupt(I/O)	Hardware reset	Current (per bit/total mA)	1.0	1.8	2.5	3.3	5	5-V tolerant	100	400	1000	0 to 70	-40 to 85	-55 to 125	Pin count	DIP	SO (narrow)	SO (wide)	SSOP	QSOP	TSSOP	HVQFN
PCA9600			1-1																•	•	•	•	•	•			•		8		D				DP	
PCA9625		16											126			100-1600			•	•	•	•	•	•	•		•		32			D			PW	
PCA9632/33		4											126			25-100			•	•	•	•	•	•	•		•		8/10/16		D				DP/PW	TK/BS
PCA9634		8											126			25-200			•	•	•	•	•	•	•		•		20			D			PW	BS
PCA9635		16											126			25-400			•	•	•	•	•	•	•		•		28			D			PW	BS
PCA9665						•							128	0/1	•				•	•		•	•	•	•		•		20	N		D			PW	BS
PCA9670	8												64		•	25-200			•	•	•	•	•	•	•		•		16			D			PW	BS
PCA9671	16												64		•	25-400			•	•	•	•	•	•	•		•		24			D	DB	DK	PW	BS/BQ
PCA9672	8												64	0/1	•	25-200			•	•	•	•	•	•	•		•		16			D			PW	BS
PCA9673	16												64	0/1	•	25-400			•	•	•	•	•	•	•		•		24			D	DB	DK	PW	BS/BQ
PCA9674/74A	8												64	0/1		25-200			•	•	•	•	•		•		•		16/20			D	TS		PW	BS
PCA9675	16												64	0/1		25-400			•	•	•	•	•		•		•		24			D	DB	DK	PW	BS/BQ
PCA9685	16												126			24-400			•	•	•	•	•	•			•		28						PW	BS
PCA9691											8		64						•	•	•	•	•	•	•		•		16	PN		TD				BS
PCA9698	40												64	0/1	•	25-1000			•	•	•	•	•		•		•		56						DGG	BS
PCF2113												24ch	2						•	•	•	•	•	•			•		100			LQFP100				
PCF2116												48-ch	2						•	•	•	•	•				•					DIE				
PCF2119												32ch	2						•	•	•	•	•	•			•					DIE				
PCF2128										•			2	1				•	•	•	•	•	•	•			•		20			TD				
PCF85116-3									16				1								•	•	•	•			•		8	N	D					
PCF8531												graphic	8					•	•	•	•	•	•	•			•					DIE				
PCF8533												graphic	8					•	•	•	•	•	•	•			•					DIE				
PCF8534A												320	8					•	•	•	•	•	•	•			•					LQFP80				
PCF8535												240	4						•	•	•	•	•				•					DIE				
PCF8562												128	3							•	•	•	•	•			•		48			LQFP48				
PCF8563										•			1	0/1			•	•	•	•	•	•	•	•			•		8	PN		TD			DP	
PCF8566												96	16						•	•	•	•	•				•		40	PN		VSO40				
PCF8570									2				8						•	•	•	•	•				•		8	PN	TD					
PCF8574/74A	8												4	0/1		20-100			•	•	•	•	•				•		16	PN		TD	TS			
PCF8575/75C	16												8	0/1		20-100			•	•	•	•	•	•			•		24				TSDB			
PCF8576C/D												160	16					•	•	•	•	•	•				•		56/64			VSO56/LQFP64				
PCF8577C												64	16						•	•	•	•	•				•		40	PN		VSO40				
PCF8578/79									2			384+	2						•	•	•	•	•				•		56/64			VSO56/LQFP64				
PCF8582C-2/102C-2/103C-2									2				8						•	•	•	•	•				•		8	N	D					
PCF8583										•			2	0/1			•	•	•	•	•	•	•				•		8	PN	TD					
PCF8584							•						128	0/1	•						•	•	•				•		20	PN		TD				
PCF8591											8		8						•	•	•	•	•				•		16	PN		TD				
PCF8593										•			1	0/1	•		•	•	•	•	•	•	•				•		8	N		TD				
PCF8594C-2									4				4						•	•	•	•	•				•		8	N	D					
PCF8598C-2									8				2						•	•	•	•	•				•		8	N		D				
PCF8811												G	4					•	•	•			•	•			•					DIE				
SA56004							1 °C						8	0/2						•	•		•	•		-40 to 125			24		D				DP	
SAA1064												4x8	4			21-mA					•	•	•				•		24	P	T					
SC16IS750	8												1		•	10-80			•	•	•	•	•	•			•		28/32						PW	BS
SC16IS752	8												1		•	10-80			•	•	•	•	•	•			•		24						PW	BS
SC16IS760	8												1		•	10-80			•	•	•	•	•	•			•		28/32						PW	BS
SC16IS762	8												1		•	10-80			•	•	•	•	•	•			•		24						PW	BS
SC18IM700						•							1	0/1	•				•	•	•	•	•	•			•		16						PW	
SC18IS600	5												1		•	10-50			•	•	•	•	•	•			•		16						PW	
SC18IS601	5														•	10-50			•	•	•	•	•	•			•		16						PW	
SCIBIS602	5														•	10-50		•	•	•	•	•	•	•			•		16						PW	
SE95							1 °C						8	0/1					2.8	•	•		•	•				•	8		D				DP	
SE97							1 °C		2				8	0/1				•	•	•			•	•		-20 to 125			8						PW	TK/TL
SE98							1 °C						8	0/1						•			•	•		-20 to 125			8						PW	TK
TDA8444											6		8								12 V		•	•		-20 to 70			16	P		T				

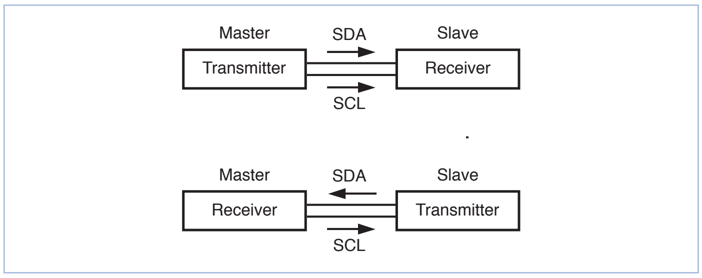
Data sheets can be downloaded at www.nxp.com/i2clogic or www.nxp.com/i2c

How the I²C-bus works

I²C-bus terminology

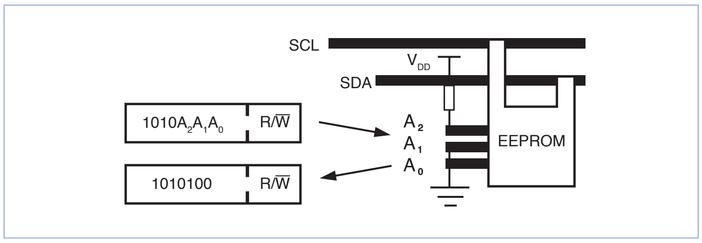
All the ICs along an I²C-bus are either masters or slaves.
A master is an IC that initiates a data transfer, provides the serial clock signal (SCL) during the transfer, and then terminates the transfer. There can be more than one master on the bus at a time – the I²C software protocol uses arbitration and synchronization to prevent collisions and data loss.
A slave is any device addressed by the master.

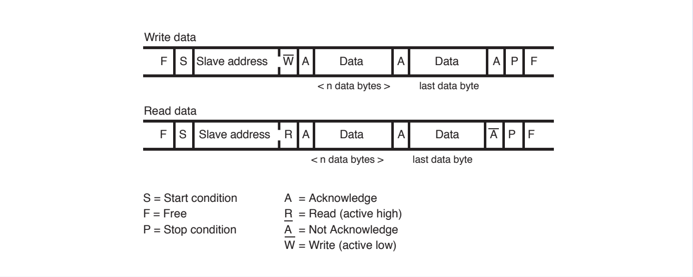
While the master or slave is sending data over the serial data line (SDA), it is referred to as a transmitter. While accepting data from the SDA data line, it's called a receiver.
A master transmitter can put data onto the SDA data line at any time; a slave transmitter can do so only by request.



Device addresses

Each device along the I²C-bus has a unique, 7-bit I²C-bus address. The first four bits in the address are typically fixed, indicating device category (e.g. 1010 is assigned to EEPROMs). The last three bits (A2, A1, A0) are set by hardware address pins on the IC package. In this case, there are up to eight different address combinations available for each device, so up to eight identical devices can operate on the same I²C-bus.
The address pins are held high (1) to Vcc or held low (0) to GND.





The data-transfer bitstream

"F" indicates the bus is Free, or available for use.
During the Free state the serial data line (SDA) is transferring no data and both the SDA data line and the SCL clock line are high.

To take control of the bus and initiate a transaction, the master sends out a Start (S) condition. If the master already controls the bus and wants to initiate an additional transaction, it sends out a Repeat Start (Sr) condition. For the start condition, the SDA data line goes from high to low while the SCL clock remains high.

The Start condition is followed by the desired slave address and the instruction to write ($\overline{W}$) or read (R) data.

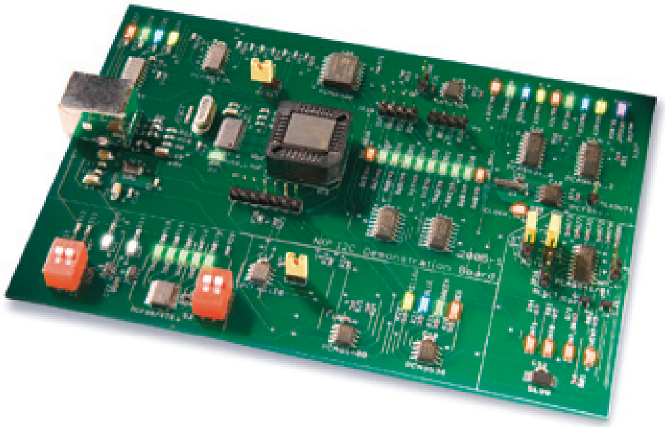
The slave responds to the master by sending an Acknowledge (A) bit and the transfer begins. During data transfer, the SCL clock line is brought and held low; the SDA data line can be either high or low. The SDA data line only changes state when the SCL clock line is low.

After each byte is sent, the receiver will Acknowledge (A) the transmitter. When the master is the receiver, it will Not Acknowledge ($\overline{A}$) the last byte so it can regain control of the bus to terminate the communication. When the master has completed the transmission, it sends the Stop (P) condition to free the bus. For the Stop condition, the SDA data line goes from low to high while the SCL clock line remains high.

With the data transfer complete, the bus returns to the Free state, with both lines high.

I²C vs. SMBus

Developed by Intel in the mid-1990s, the System Management Bus, also as the SMBus, is a popular derivative of the I²C-bus that is, in most cases, compatible with I²C-bus. Both buses use a two-wire communication scheme and have addressable slaves. The SMBus is limited to a maximum data transfer rate of only 100 kbps, requiring special handling in systems that also use the higher transfer rates available with I²C-bus. Other differences include timeout and minimum clock speed, voltage levels, pull-up resistor values, and current levels.



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