



## NXP 8/16-bit I<sup>2</sup>C/SMBus GPIO expanders PCA9534/35/35C for low-power applications

# Low-power GPIO expanders for portable applications

These I<sup>2</sup>C/SMBus-compatible devices offer an extremely low standby current (<1.0  $\mu$ A max) and make it easy to add programmable I/O ports to battery-powered applications.

### Key features

- ▶ Compatible with I<sup>2</sup>C-bus and SMBus
- ▶ 8 or 16 programmable GPIO compatible with most processors
  - Input or output
  - Push-pull or open-drain outputs
  - True bidirectional operation
- ▶ Outputs can drive LEDs directly
  - 25-mA (max) sink and 10-mA (max) source per bit
  - 100-mA (max) capacity per 8-bit register
- ▶ Open-drain interrupt output activates when input changes state
- ▶ Low standby current ( $I_{DD}$ ): <1.0  $\mu$ A (max)
- ▶ Operating voltage: 2.3 to 5.5 V
- ▶ All I/O tolerant to 5.5 V
- ▶ Temperature range: -40 to +85 °C
- ▶ I<sup>2</sup>C-bus clock frequency: 0 to 400 kHz
- ▶ High-volume CMOS process
- ▶ Package options: SO, TSSOP, HVQFN, HWQFN

### Applications

- ▶ GPIO expansion to support ACPI power switches, sensors, push-buttons, LEDs, fans, and more

These general-purpose I/O (GPIO) expanders provide a simple way to add I/O for ACPI power switches, sensors, push-buttons, LEDs, fans, and functions, in battery-powered I<sup>2</sup>C/SMBus applications.

The NXP PCA9534 is a 16-pin CMOS device that provides eight bits of parallel GPIO expansion. It has an 8-bit configuration register for I/O selection, an 8-bit input register, an 8-bit output register, and an 8-bit polarity-inversion register that lets the system master use the I<sup>2</sup>C/SMBus program and configure the GPIO.

The PCA9535/35C is a 24-pin CMOS device that provides 16 bits of parallel GPIO expansion. It has two sets of the same 8-bit registers: configuration, input, output, and polarity-inversion.

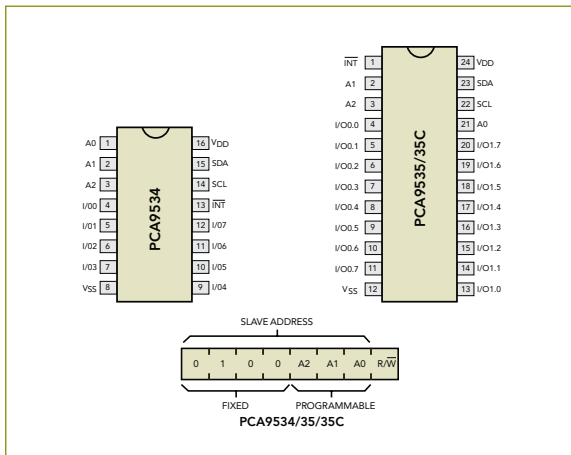
The PCA9534 and PCA9535 are low-power versions of the NXP PCA9554, PCA9554A, and PCA9555. The I/O 100-k $\Omega$  pull-up resistor has been removed, creating a very low standby current (less than 1  $\mu$ A) that maximizes battery life in portable applications.

The PCA9535C an open-drain version of the PCA9535, used to drive LEDs without sourcing current. The system master can enable the I/O as inputs or outputs by writing to the I/O configuration bits. Data for each input or output is kept in the corresponding input or output register. The polarity of the read register can be inverted using the polarity-inversion register. All registers can be read by the system master.

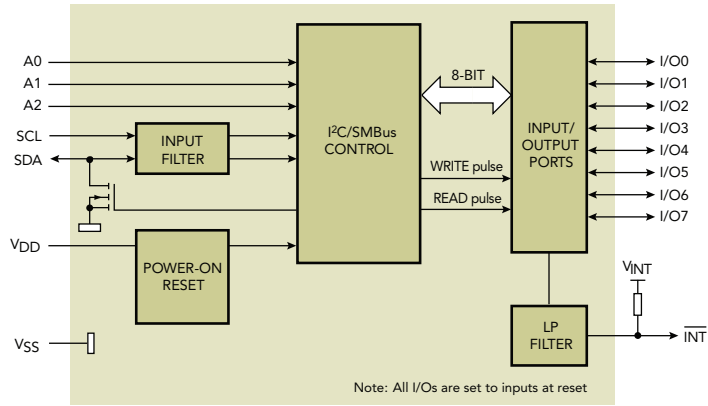
All the devices are pin-to-pin and I<sup>2</sup>C-address compatible with the NXP PCF857X series, but various enhancements make software changes necessary (see application note AN469).

The open-drain interrupt output is activated when any input state differs from its corresponding input port register state. The output notifies the system master than an input state has changed.

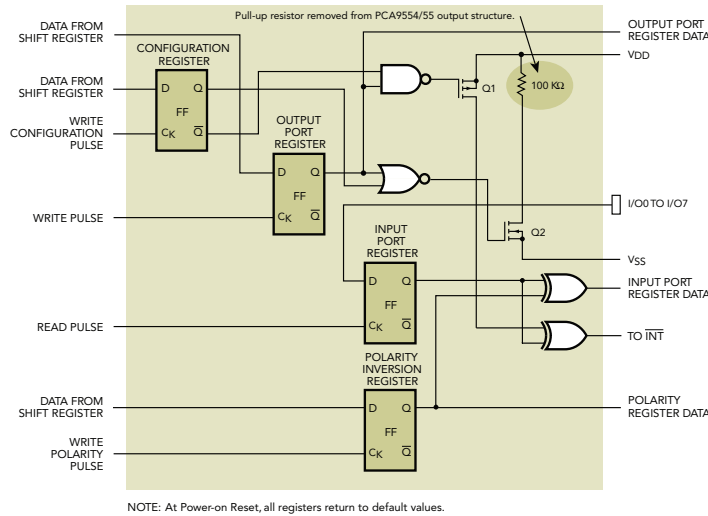
Three hardware pins (A0, A1, A2) vary the fixed I<sup>2</sup>C-bus address and allow up to eight of these devices, in any combination, to share the same I<sup>2</sup>C/SMBus.



Pin configurations and I<sup>2</sup>C address



Block diagram



Simplified schematic of I/O0 to I/O7

The outputs on the PCA9534/35 sink 25 mA and source 10 mA. The open-drain outputs on the PCA9535C sink 25 mA, but don't provide any source current.

The functional diagrams and I/O schematics for all the devices are the same, except the PCA9535 has two 8-bit blocks of I/O and the PCA9535C has the upper transistor (Q1) disconnected.

### Order information

Package	Container	PCA9534	PCA9535	PCA9535C
SO	Tube T & R	PCA9534D PCA9534D-T	PCA9535D PCA9535D-T	PCA9535CD PCA9535CD-T
TSSOP	Tube T & R	PCA9534PW PCA9534PW-T	PCA9535PW PCA9535PW-T	PCA9535CPW PCA9535CPW-T
HVQFN	T & R	PCA9534BS-T	PCA9535BS-T	
HWQFN	T & R		PCA9535HF-T	PCA9535CHF-T

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