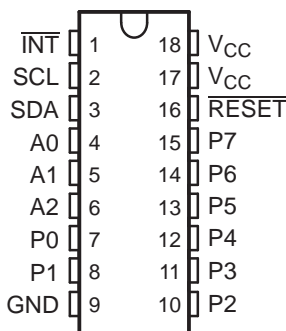


## FEATURES

- Low Standby Current Consumption of 1  $\mu$ A Max
- I<sup>2</sup>C to Parallel Port Expander
- Open-Drain Active-Low Interrupt Output
- Active-Low Reset Input
- Operating Power-Supply Voltage Range of 2.3 V to 5.5 V
- 5-V Tolerant I/O Ports
- 400-kHz Fast I<sup>2</sup>C Bus
- Three Hardware Address Pins Allow for Use of up to Eight Devices on the I<sup>2</sup>C/SMBus
- Input/Output Configuration Register
- Polarity Inversion Register
- Internal Power-On Reset
- High-Impedance Open Drain on P0
- Power Up With All Channels Configured as Inputs
- No Glitch On Power Up
- Noise Filter on SCL/SDA Inputs
- Latched Outputs With High-Current Drive Maximum Capability for Directly Driving LEDs
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

DW PACKAGE  
(TOP VIEW)



## DESCRIPTION/ORDERING INFORMATION

This 8-bit I/O expander for the two-line bidirectional bus (I<sup>2</sup>C) is designed for 2.3-V to 5.5-V V<sub>CC</sub> operation. It provides general-purpose remote I/O expansion for most microcontroller families via the I<sup>2</sup>C interface [serial clock (SCL) and serial data (SDA)].

### ORDERING INFORMATION

T <sub>A</sub>	PACKAGE <sup>(1)</sup>	ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	SOIC – DW	PCA6107DW	PCA6107
		PCA6107DWG4	
		PCA6107DWR	
		PCA6107DWRG4	
	Reel of 250	PCA6107DWT	

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

**PCA6107**  
**REMOTE 8-BIT I<sup>2</sup>C AND SMBus LOW-POWER I/O EXPANDER**  
**WITH INTERRUPT OUTPUT, RESET, AND CONFIGURATION REGISTERS**



SCPS139B–JANUARY 2006–REVISED OCTOBER 2006

**DESCRIPTION/ORDERING INFORMATION (CONTINUED)**

The PCA6107 consists of one 8-bit Configuration (input or output selection), Input Port, Output Port, and Polarity Inversion (active high) registers. At power on, the I/Os are configured as inputs. However, the system master can enable the I/Os as either inputs or outputs by writing to the I/O configuration bits. The data for each input or output is kept in the corresponding input or output register. The polarity of the Input Port register can be inverted with the Polarity Inversion register. All registers can be read by the system master.

The system master can reset the PCA6107 in the event of a timeout or other improper operation by asserting a low in the active-low reset ( $\overline{\text{RESET}}$ ) input. The power-on reset puts the registers in their default states and initializes the I<sup>2</sup>C/SMBus state machine. Asserting  $\overline{\text{RESET}}$  causes the same reset/initialization to occur without depowering the part.

The PCA6107 open-drain interrupt ( $\overline{\text{INT}}$ ) output is activated when any input state differs from its corresponding Input Port register state and is used to indicate to the system master that an input state has changed.

$\overline{\text{INT}}$  can be connected to the interrupt input of a microcontroller. By sending an interrupt signal on this line, the remote I/O can inform the microcontroller if there is incoming data on its ports without having to communicate via the I<sup>2</sup>C bus. Thus, the PCA6107 can remain a simple slave device.

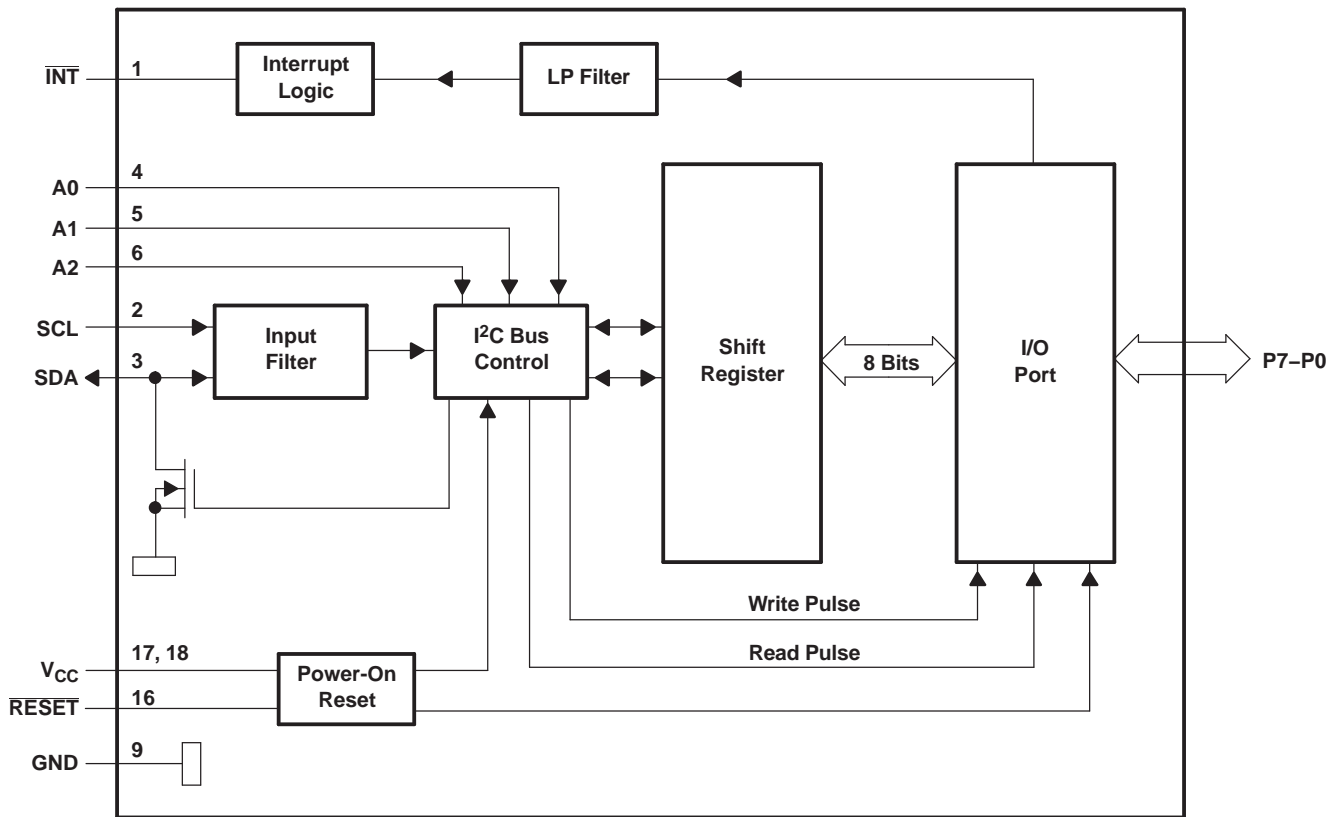
The device outputs (latched) have high-current drive capability for directly driving LEDs. The device has low current consumption and a high-impedance open-drain output pin, P0.

Three hardware pins (A0, A1, and A2) are used to program and vary the fixed I<sup>2</sup>C address, allowing up to eight devices to share the same I<sup>2</sup>C bus or SMBus.

**TERMINAL FUNCTIONS**

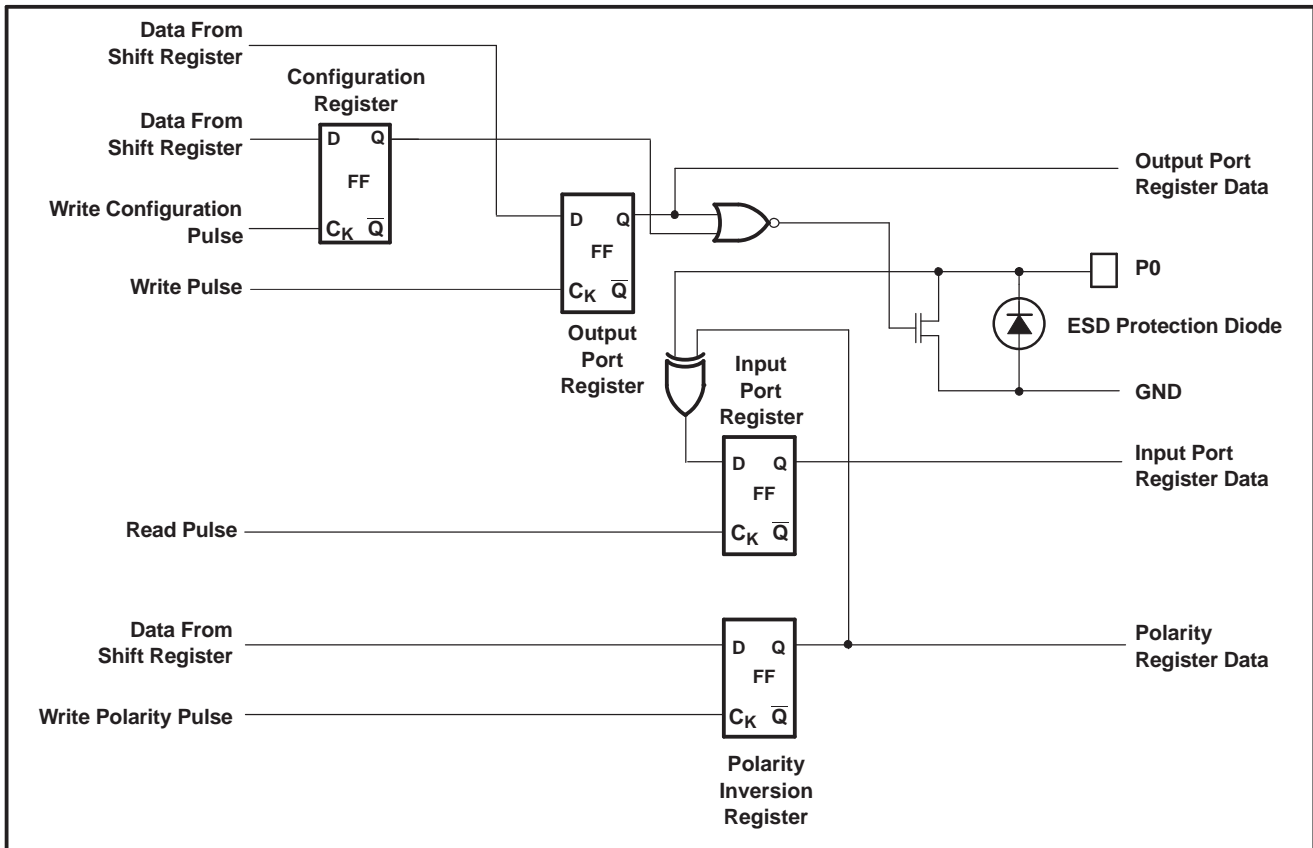
TERMINAL		DESCRIPTION
NO.	NAME	
1	$\overline{\text{INT}}$	Interrupt output. Connect to $V_{\text{CC}}$ through a pullup resistor.
2	SCL	Serial clock bus. Connect to $V_{\text{CC}}$ through a pullup resistor.
3	SDA	Serial data bus. Connect to $V_{\text{CC}}$ through a pullup resistor.
4	A0	Address input. Connect directly to $V_{\text{CC}}$ or ground.
5	A1	Address input. Connect directly to $V_{\text{CC}}$ or ground.
6	A2	Address input. Connect directly to $V_{\text{CC}}$ or ground.
7	P0	P-port input/output. Open-drain design structure. Connect to $V_{\text{CC}}$ through a pullup resistor.
8	P1	P-port input/output. Push-pull design structure.
9	GND	Ground
10	P2	P-port input/output. Push-pull design structure.
11	P3	P-port input/output. Push-pull design structure.
12	P4	P-port input/output. Push-pull design structure.
13	P5	P-port input/output. Push-pull design structure.
14	P6	P-port input/output. Push-pull design structure.
15	P7	P-port input/output. Push-pull design structure.
16	$\overline{\text{RESET}}$	Active-low reset input. Connect to $V_{\text{CC}}$ through a pullup resistor if no active connection is used.
17	$V_{\text{CC}}$	Supply voltage
18	$V_{\text{CC}}$	Supply voltage

**LOGIC DIAGRAM (POSITIVE LOGIC)**



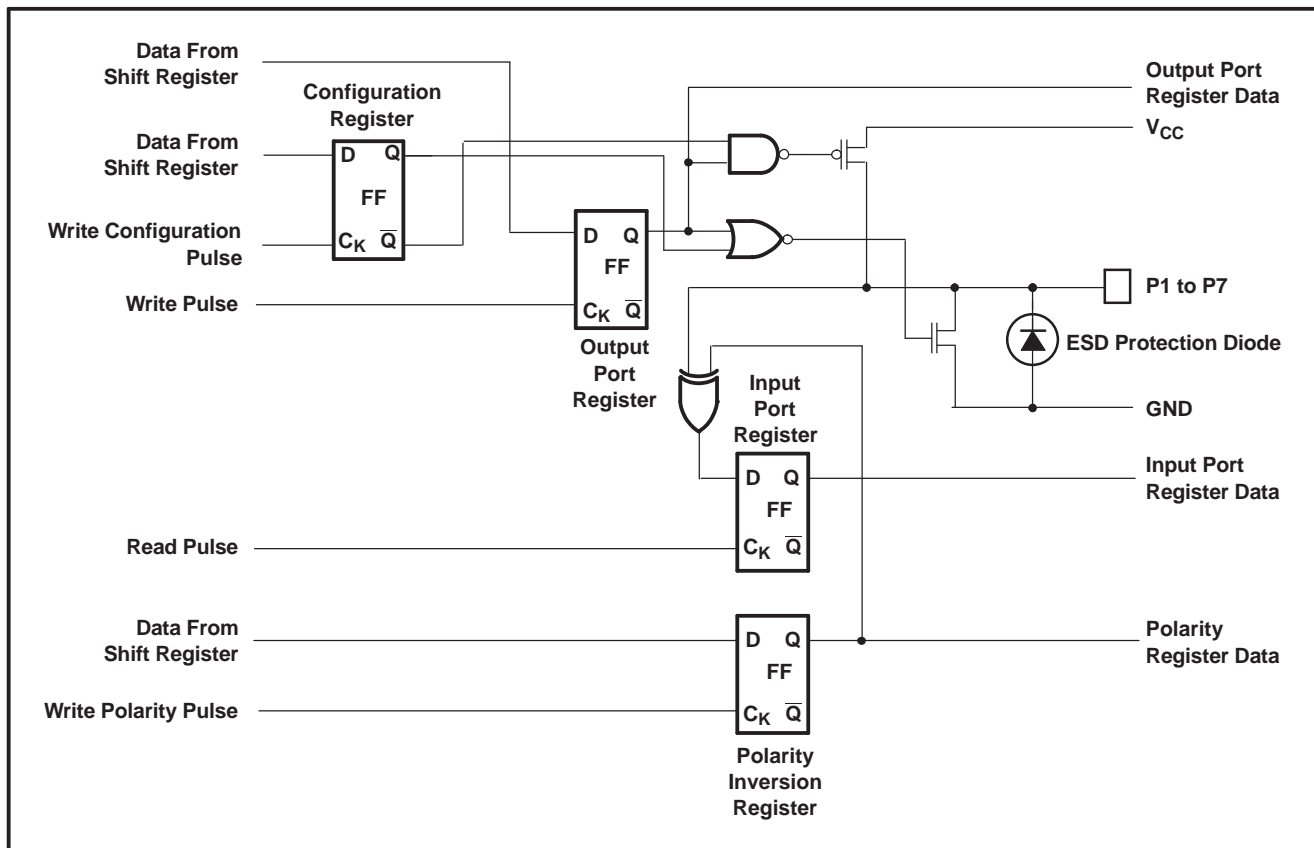
A. All I/Os are set to inputs at reset.

SIMPLIFIED SCHEMATIC OF P0



A. On power up or reset, all registers return to default values.

**SIMPLIFIED SCHEMATIC OF P1 TO P7**



A. On power up or reset, all registers return to default values.

## I<sup>2</sup>C Interface

The bidirectional I<sup>2</sup>C bus consists of the serial clock (SCL) and serial data (SDA) lines. Both lines must be connected to a positive supply through a pullup resistor when connected to the output stages of a device. Data transfer may be initiated only when the bus is not busy.

I<sup>2</sup>C communication with this device is initiated by a master sending a Start condition, a high-to-low transition on the SDA input/output while the SCL input is high (see Figure 1). After the Start condition, the device address byte is sent, MSB first, including the data direction bit (R/W).

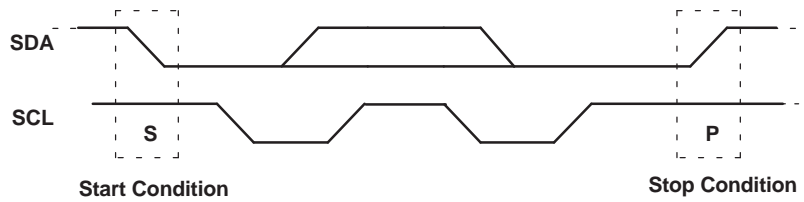
After receiving the valid address byte, this device responds with an acknowledge (ACK), a low on the SDA input/output during the high of the ACK-related clock pulse. The address inputs (A0–A2) of the slave device must not be changed between the Start and the Stop conditions.

On the I<sup>2</sup>C bus, only one data bit is transferred during each clock pulse. The data on the SDA line must remain stable during the high pulse of the clock period, as changes in the data line at this time are interpreted as control commands (Start or Stop) (see Figure 2).

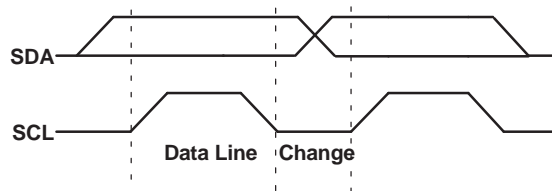
A Stop condition, a low-to-high transition on the SDA input/output while the SCL input is high, is sent by the master (see Figure 1).

Any number of data bytes can be transferred from the transmitter to the receiver between the Start and the Stop conditions. Each byte of eight bits is followed by one ACK bit. The transmitter must release the SDA line before the receiver can send an ACK bit. The device that acknowledges must pull down the SDA line during the ACK clock pulse, so that the SDA line is stable low during the high pulse of the ACK-related clock period (see Figure 3). When a slave receiver is addressed, it must generate an ACK after each byte is received. Similarly, the master must generate an ACK after each byte that it receives from the slave transmitter. Setup and hold times must be met to ensure proper operation.

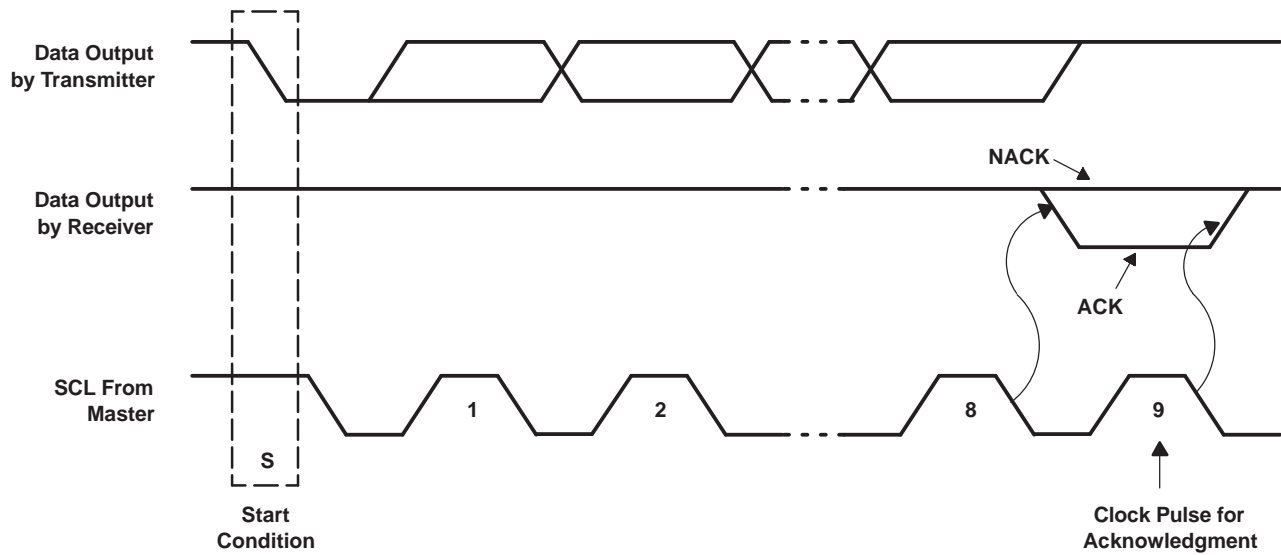
A master receiver signals an end of data to the slave transmitter by not generating an acknowledge (NACK) after the last byte has been clocked out of the slave. This is done by the master receiver by holding the SDA line high. In this event, the transmitter must release the data line to enable the master to generate a Stop condition.



**Figure 1. Definition of Start and Stop Conditions**



**Figure 2. Bit Transfer**



**Figure 3. Acknowledgment on the I<sup>2</sup>C Bus**

**Interface Definition**

BYTE	BIT							
	7 (MSB)	6	5	4	3	2	1	0 (LSB)
I <sup>2</sup> C slave address	L	L	H	H	A2	A1	A0	R/W
Px I/O data bus	P7	P6	P5	P4	P3	P2	P1	P0

## Device Address

The address of the PCA6107 is shown in Figure 4.

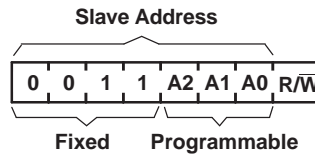


Figure 4. PCA6107 Address

## Address Reference

INPUTS			I <sup>2</sup> C BUS SLAVE ADDRESS
A2	A1	A0	
L	L	L	24 (decimal), 18 (hexadecimal)
L	L	H	25 (decimal), 19 (hexadecimal)
L	H	L	26 (decimal), 1A (hexadecimal)
L	H	H	27 (decimal), 1B (hexadecimal)
H	L	L	28 (decimal), 1C (hexadecimal)
H	L	H	29 (decimal), 1D (hexadecimal)
H	H	L	30 (decimal), 1E (hexadecimal)
H	H	H	31 (decimal), 1F (hexadecimal)

The last bit of the slave address defines the operation (read or write) to be performed. A high (1) selects a read operation, while a low (0) selects a write operation.

## Control Register and Command Byte

Following the successful acknowledgment of the address byte, the bus master sends a command byte that is stored in the control register in the PCA6107. Two bits of this data byte state the operation (read or write) and the internal registers (input, output, polarity inversion or configuration) that will be affected. This register can be written or read through the I<sup>2</sup>C bus. The command byte is sent only during a write transmission.

Once a new command byte has been sent, the register that was addressed continues to be accessed by reads until a new command byte has been sent.

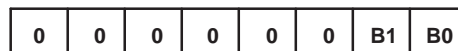


Figure 5. Control Register Bits

## Command Byte

CONTROL REGISTER BITS		COMMAND BYTE (HEX)	REGISTER	PROTOCOL	POWER-UP DEFAULT
B1	B0				
0	0	0x00	Input Port	Read byte	xxxx xxxx
0	1	0x01	Output Port	Read/write byte	0000 0000
1	0	0x02	Polarity Inversion	Read/write byte	1111 0000
1	1	0x03	Configuration	Read/write byte	1111 1111

**PCA6107**  
**REMOTE 8-BIT I<sup>2</sup>C AND SMBus LOW-POWER I/O EXPANDER**  
**WITH INTERRUPT OUTPUT, RESET, AND CONFIGURATION REGISTERS**



SCPS139B–JANUARY 2006–REVISED OCTOBER 2006

**Register Descriptions**

The Input Port register (register 0) reflects the incoming logic levels of the pins, regardless of whether the pin is defined as an input or an output by the Configuration register. It acts only on read operation. Writes to these registers have no effect. The default value, X, is determined by the externally applied logic level. Before a read operation, a write transmission is sent with the command byte to indicate to the I<sup>2</sup>C device that the Input Port register will be accessed next.

**Register 0 (Input Port Register)**

BIT	I7	I6	I5	I4	I3	I2	I1	I0
DEFAULT	X	X	X	X	X	X	X	X

The Output Port register (register 1) shows the outgoing logic levels of the pins defined as outputs by the Configuration register. Bit values in this register have no effect on pins defined as inputs. In turn, reads from this register reflect the value that is in the flip-flop controlling the output selection, not the actual pin value.

**Register 1 (Output Port Register)**

BIT	O7	O6	O5	O4	O3	O2	O1	O0
DEFAULT	0	0	0	0	0	0	0	0

The Polarity Inversion register (register 2) allows polarity inversion of pins defined as inputs by the Configuration register. If a bit in this register is set (written with 1), the corresponding port pin's polarity is inverted. If a bit in this register is cleared (written with a 0), the corresponding port pin's original polarity is retained.

**Register 2 (Polarity Inversion Register)**

BIT	N7	N6	N5	N4	N3	N2	N1	N0
DEFAULT	1	1	1	1	0	0	0	0

The Configuration register (register 3) configures the directions of the I/O pins. If a bit in this register is set to 1, the corresponding port pin is enabled as an input with high-impedance output driver. If a bit in this register is cleared to 0, the corresponding port pin is enabled as an output.

**Register 3 (Configuration Register)**

BIT	C7	C6	C5	C4	C3	C2	C1	C0
DEFAULT	1	1	1	1	1	1	1	1

**Power-On Reset**

When power (from 0 V) is applied to V<sub>CC</sub>, an internal power-on reset holds the PCA6107 in a reset condition until V<sub>CC</sub> has reached V<sub>POR</sub>. At that time, the reset condition is released, and the PCA6107 registers and I<sup>2</sup>C/SMBus state machine initializes to their default states. After that, V<sub>CC</sub> must be lowered to below 0.2 V and back up to the operating voltage for a power-reset cycle. The  $\overline{\text{RESET}}$  input can be asserted to reset the system, while keeping the V<sub>CC</sub> at its operating level.

**RESET Input**

A reset can be accomplished by holding the  $\overline{\text{RESET}}$  pin low for a minimum of t<sub>w</sub>. The PCA6107 registers and I<sup>2</sup>C/SMBus state machine are held in their default states until the  $\overline{\text{RESET}}$  input is again high. This input requires a pullup resistor to V<sub>CC</sub>, if no active connection is used.



## Interrupt ( $\overline{\text{INT}}$ ) Output

An interrupt is generated by any rising or falling edge of the port inputs in the input mode. After time,  $t_{iv}$ , the signal  $\overline{\text{INT}}$  is valid. Resetting the interrupt circuit is achieved when data on the port is changed to the original setting, data is read from the port that generated the interrupt or in a Stop event. Resetting occurs in the read mode at the acknowledge (ACK) or not acknowledge (NACK) bit after the rising edge of the SCL signal. In a Stop event,  $\overline{\text{INT}}$  is cleared after the rising edge of SDA. Interrupts that occur during the ACK or NACK clock pulse can be lost (or be very short) due to the resetting of the interrupt during this pulse. Each change of the I/Os after resetting is detected and is transmitted as  $\overline{\text{INT}}$ .

Reading from or writing to another device does not affect the interrupt circuit, and a pin configured as an output cannot cause an interrupt. Changing an I/O from an output to an input may cause a false interrupt to occur, if the state of the pin does not match the contents of the Input Port Register.

The  $\overline{\text{INT}}$  output has an open-drain structure and requires pullup resistor to  $V_{CC}$ .

## Bus Transactions

Data is exchanged between the master and PCA6107 through write and read commands.

### Writes

Data is transmitted to the PCA6107 by sending the device address and setting the least-significant bit to a logic 0 (see Figure 4 for device address). The command byte is sent after the address and determines which register receives the data that follows the command byte. There is no limitation on the number of data bytes sent in one write transmission.

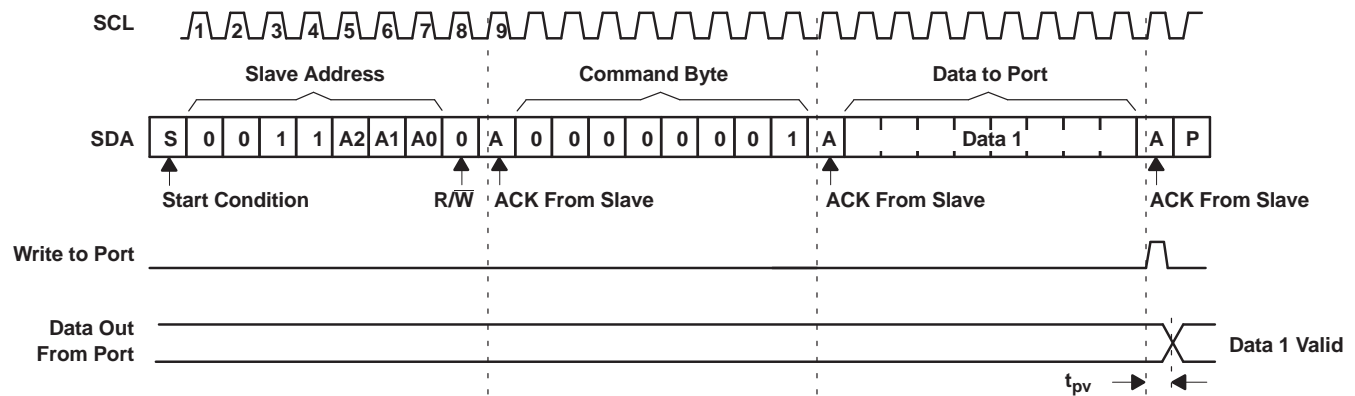


Figure 6. Write to Output Port Register

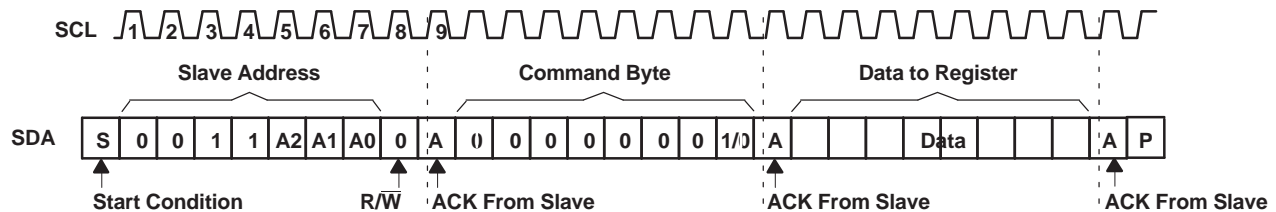
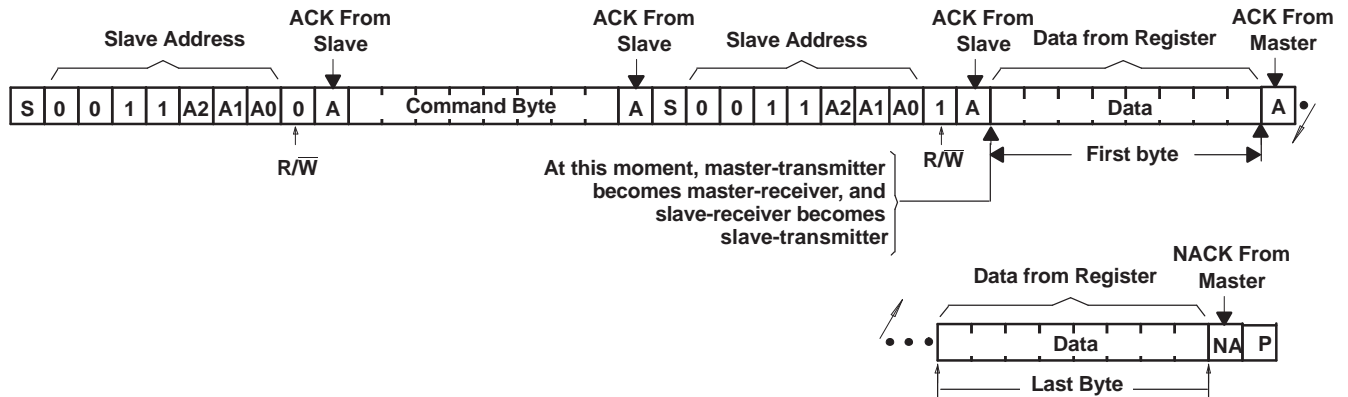


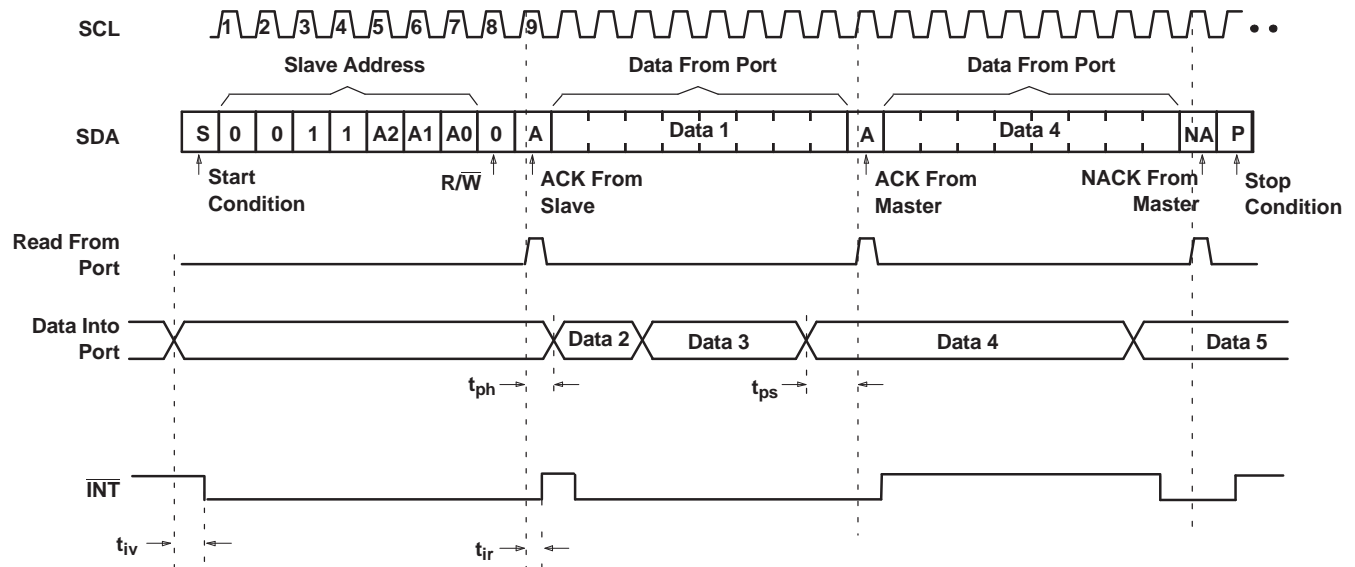
Figure 7. Write to Configuration or Polarity Inversion Registers

**Reads**

The bus master first must send the PCA6107 address with the least-significant bit set to a logic 0 (see Figure 4 for device address). The command byte is sent after the address and determines which register is accessed. After a restart, the device address is sent again, but this time, the least-significant bit is set to a logic 1. Data from the register defined by the command byte then is sent by the PCA6107 (see Figure 8 and Figure 9). After a restart, the value of the register defined by the command byte matches the register being accessed when the restart occurred. Data is clocked into the register on the rising edge of the ACK clock pulse. There is no limitation on the number of data bytes received in one read transmission, but when the final byte is received, the bus master must not acknowledge the data.



**Figure 8. Read From Register**



- A. This figure assumes the command byte has been programmed previously with 00h.
- B. Transfer of data can be stopped at any moment by a Stop condition. When this occurs, data present at the last acknowledge phase is valid (output mode). Input data is lost.
- C. This figure eliminates the command byte transfer, a restart and slave address call between the initial slave address call and actual data transfer from the P port (see Figure 8 for these details).

**Figure 9. Read Input Port Register**

### Absolute Maximum Ratings<sup>(1)</sup>

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage range	-0.5	6	V
V <sub>I</sub>	Input voltage range <sup>(2)</sup>	-0.5	6	V
V <sub>O</sub>	Output voltage range <sup>(2)</sup>	-0.5	6	V
I <sub>IK</sub>	Input clamp current	V <sub>I</sub> < 0		-20 mA
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> < 0		-20 mA
I <sub>IOK</sub>	Input/output clamp current	V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>CC</sub>		±20 mA
I <sub>OL</sub>	Continuous output low current	V <sub>O</sub> = 0 to V <sub>CC</sub>		50 mA
I <sub>OH</sub>	Continuous output high current, P7–P1	V <sub>O</sub> = 0 to V <sub>CC</sub>		-50 mA
I <sub>CC</sub>	Continuous current through GND			-200 mA
	Continuous current through V <sub>CC</sub>			160 mA
θ <sub>JA</sub>	Package thermal impedance <sup>(3)</sup>			73 °C/W
T <sub>stg</sub>	Storage temperature range	-65	150	°C

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The package thermal impedance is calculated in accordance with JESD 51-7.

### Recommended Operating Conditions

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage	2.3	5.5	V
V <sub>IH</sub>	High-level input voltage	SCL, SDA		0.7 × V <sub>CC</sub>
		A2–A0, P7–P0, RESET		2
V <sub>IL</sub>	Low-level input voltage	SCL, SDA		-0.5
		A2–A0, P7–P0, RESET		0.3 × V <sub>CC</sub>
I <sub>OH</sub>	High-level output current	P7–P1		-10 mA
I <sub>OL</sub>	Low-level output current	P7–P0		25 mA
T <sub>A</sub>	Operating free-air temperature	-40	85	°C

**PCA6107**  
**REMOTE 8-BIT I<sup>2</sup>C AND SMBus LOW-POWER I/O EXPANDER**  
**WITH INTERRUPT OUTPUT, RESET, AND CONFIGURATION REGISTERS**



SCPS139B–JANUARY 2006–REVISED OCTOBER 2006

**Electrical Characteristics**

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	V <sub>CC</sub>	MIN	TYP <sup>(1)</sup>	MAX	UNIT
V <sub>IK</sub>	Input diode clamp voltage	I <sub>I</sub> = -18 mA	2.3 V to 5.5 V	-1.2			V
V <sub>POR</sub>	Power-on reset voltage	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	V <sub>POR</sub>		1.65	2.1	V
V <sub>OH</sub>	P-port high-level output voltage <sup>(2)</sup>	I <sub>OH</sub> = -8 mA	2.3 V	1.8			V
			3 V	2.6			
			4.5 V	3			
			4.75 V	4.1			
		I <sub>OH</sub> = -10 mA	2.3 V	1.5			
			3 V	2.5			
			4.5 V	3			
			4.75 V	4			
I <sub>OL</sub>	SDA	V <sub>OL</sub> = 0.4 V	2.3 V to 5.5 V	3			mA
	P port <sup>(3)</sup>	V <sub>OL</sub> = 0.5 V	2.3 V to 5.5 V	8	20		
		V <sub>OL</sub> = 0.55 V		8	20		
		V <sub>OL</sub> = 0.7 V		10	24		
	INT	V <sub>OL</sub> = 0.4 V	2.3 V to 5.5 V	3			
I <sub>OH</sub>	P port, except for P0 <sup>(3)</sup>	V <sub>OH</sub> = V <sub>CC</sub> - 0.4 V	2.3 V to 5.5 V	-4			mA
	P0 <sup>(3)</sup>	V <sub>OH</sub> = 4.6 V	4.6 V to 5.5 V			1	μA
		V <sub>OH</sub> = 3.3 V	3.3 V to 5.5 V			1	μA
I <sub>I</sub>	SCL, SDA	V <sub>I</sub> = V <sub>CC</sub> or GND	2.3 V to 5.5 V			±1	μA
	A2–A0, RESET					±1	
I <sub>IH</sub>	P port	V <sub>I</sub> = V <sub>CC</sub>	2.3 V to 5.5 V			1	μA
I <sub>IL</sub>	P port	V <sub>I</sub> = GND	2.3 V to 5.5 V			1	μA
I <sub>CC</sub>	Operating mode	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0, I/O = inputs, f <sub>SCL</sub> = 400 kHz	5.5 V		19	25	μA
			3.6 V		12	22	
			2.7 V		8	20	
			5.5 V		1.5	5	
			3.6 V		1	4	
			2.7 V		0.6	3	
	Standby mode	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0, I/O = inputs, f <sub>SCL</sub> = 0 kHz	5.5 V		0.25	1	
			3.6 V		0.25	0.9	
			2.7 V		0.2	0.8	
ΔI <sub>CC</sub>	Additional current in Standby mode	One input at V <sub>CC</sub> - 0.6 V, Other inputs at V <sub>CC</sub> or GND	2.3 V to 5.5 V			0.2	mA
		Every LED I/O at V <sub>I</sub> = 4.3 V, f <sub>SCL</sub> = 0 kHz	5.5 V			0.4	
C <sub>I</sub>	SCL	V <sub>I</sub> = V <sub>CC</sub> or GND	2.3 V to 5.5 V		4	6	pF
C <sub>io</sub>	SDA	V <sub>IO</sub> = V <sub>CC</sub> or GND	2.3 V to 5.5 V		5.5	8	pF
	P port				7.5	9.5	

(1) All typical values are at nominal supply voltage (2.5-V, 3.3-V, or 5-V V<sub>CC</sub>) and T<sub>A</sub> = 25°C.

(2) Each I/O must be externally limited to a maximum of 25 mA, and the P port (P7–P1) must be limited to a maximum current of 100 mA.

(3) The total current sourced by all I/Os must be limited to 85 mA per bit.

## I<sup>2</sup>C Interface Timing Requirements

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 10)

		STANDARD MODE I <sup>2</sup> C BUS		FAST MODE I <sup>2</sup> C BUS		UNIT
		MIN	MAX	MIN	MAX	
f <sub>scl</sub>	I <sup>2</sup> C clock frequency	0	100	0	400	kHz
t <sub>sch</sub>	I <sup>2</sup> C clock high time	4		0.6		μs
t <sub>scl</sub>	I <sup>2</sup> C clock low time	4.7		1.3		μs
t <sub>sp</sub>	I <sup>2</sup> C spike time		50		50	ns
t <sub>sds</sub>	I <sup>2</sup> C serial data setup time	250		100		ns
t <sub>sdh</sub>	I <sup>2</sup> C serial data hold time	0		0		ns
t <sub>icr</sub>	I <sup>2</sup> C input rise time		1000	20 + 0.1C <sub>b</sub> <sup>(1)</sup>	300	ns
t <sub>icf</sub>	I <sup>2</sup> C input fall time		300	20 + 0.1C <sub>b</sub> <sup>(1)</sup>	300	ns
t <sub>ocf</sub>	I <sup>2</sup> C output fall time (10-pF to 400-pF bus)		300	20 + 0.1C <sub>b</sub> <sup>(1)</sup>	300	ns
t <sub>buf</sub>	I <sup>2</sup> C bus free time between Stop and Start	4.7		1.3		μs
t <sub>sts</sub>	I <sup>2</sup> C Start or repeater Start condition setup time	4.7		0.6		μs
t <sub>sth</sub>	I <sup>2</sup> C Start or repeater Start condition hold time	4		0.6		μs
t <sub>sps</sub>	I <sup>2</sup> C Stop condition setup time	4		0.6		μs
t <sub>vd(data)</sub>	Valid data time; SCL low to SDA output valid		1		0.9	μs
t <sub>vd(ack)</sub>	Valid data time of ACK condition; ACK signal from SCL low to SDA (out) low		1		0.9	μs
C <sub>b</sub>	I <sup>2</sup> C bus capacitive load		400		400	pF

(1) C<sub>b</sub> = total capacitance of one bus line in pF

## Reset Timing Requirements

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 13)

		STANDARD MODE I <sup>2</sup> C BUS		FAST MODE I <sup>2</sup> C BUS		UNIT
		MIN	MAX	MIN	MAX	
t <sub>w</sub>	Reset pulse duration	16		16		ns
t <sub>REC</sub>	Reset recovery time	0		0		ns
t <sub>RESET</sub>	Time to reset <sup>(1)</sup>	400		400		ns

(1) The PCA6107 requires a minimum of 400 ns to be reset.

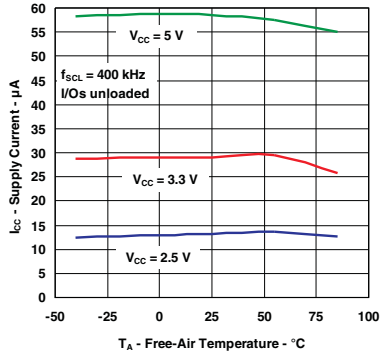
## Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 10)

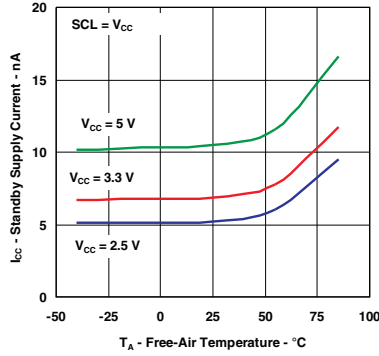
PARAMETER	FROM	TO	STANDARD MODE I <sup>2</sup> C BUS		FAST MODE I <sup>2</sup> C BUS		UNIT
			MIN	MAX	MIN	MAX	
t <sub>iv</sub>	Interrupt valid time	P port		4		4	μs
t <sub>ir</sub>	Interrupt reset delay time	SCL		4		4	μs
t <sub>pv</sub>	Output data valid	SCL		250		250	ns
		SCL	P1–P7		200		
t <sub>ps</sub>	Input data setup time	P port	0		0		ns
t <sub>ph</sub>	Input data hold time	P port	200		200		ns

**TYPICAL CHARACTERISTICS**

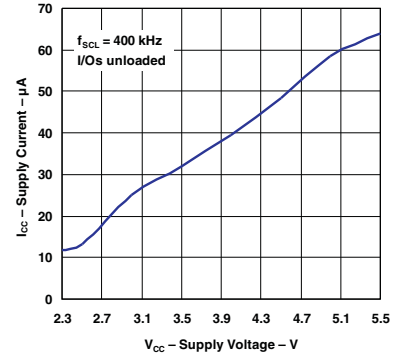
**SUPPLY CURRENT  
 VS  
 TEMPERATURE**



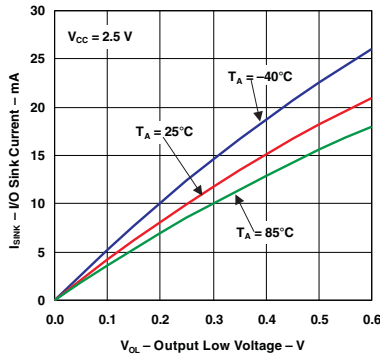
**STANDBY SUPPLY CURRENT  
 VS  
 TEMPERATURE**



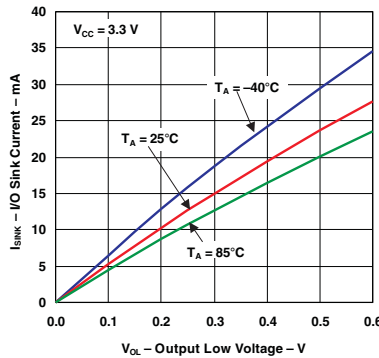
**SUPPLY CURRENT  
 VS  
 SUPPLY VOLTAGE**



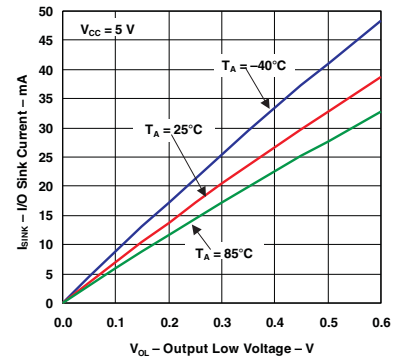
**I/O SINK CURRENT  
 VS  
 OUTPUT LOW VOLTAGE**



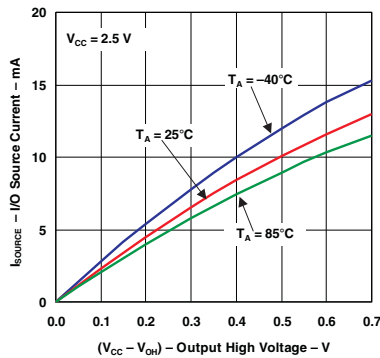
**I/O SINK CURRENT  
 VS  
 OUTPUT LOW VOLTAGE**



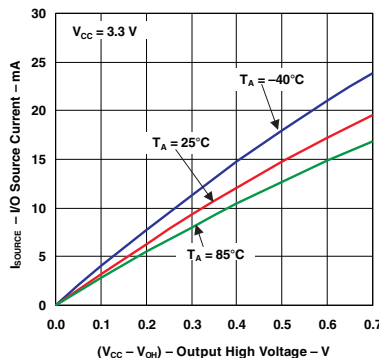
**I/O SINK CURRENT  
 VS  
 OUTPUT LOW VOLTAGE**



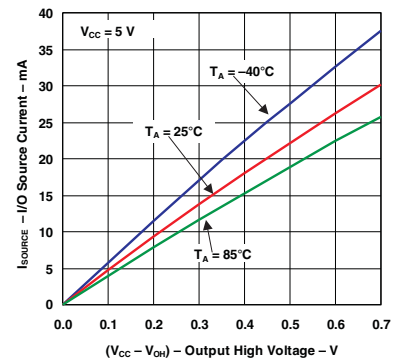
**I/O SOURCE CURRENT  
 VS  
 OUTPUT HIGH VOLTAGE  
 (P7-P1)**



**I/O SOURCE CURRENT  
 VS  
 OUTPUT HIGH VOLTAGE  
 (P7-P1)**

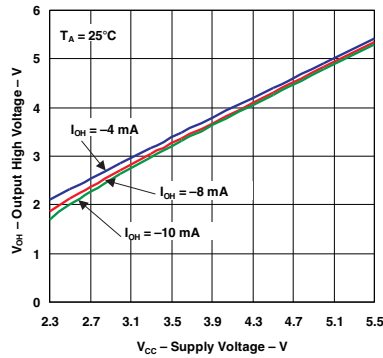


**I/O SOURCE CURRENT  
 VS  
 OUTPUT HIGH VOLTAGE  
 (P7-P1)**

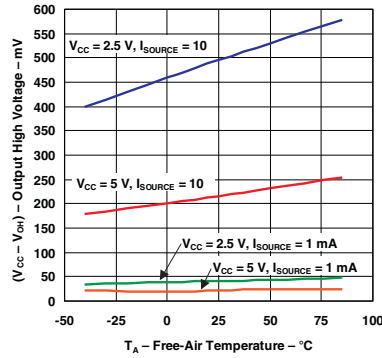


### TYPICAL CHARACTERISTICS (continued)

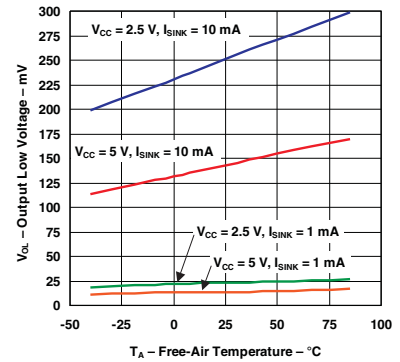
**OUTPUT HIGH VOLTAGE  
VS  
SUPPLY VOLTAGE  
(P7–P1)**



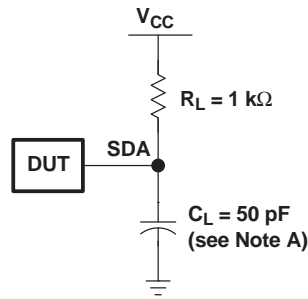
**OUTPUT HIGH VOLTAGE  
VS  
TEMPERATURE  
(P7–P1)**



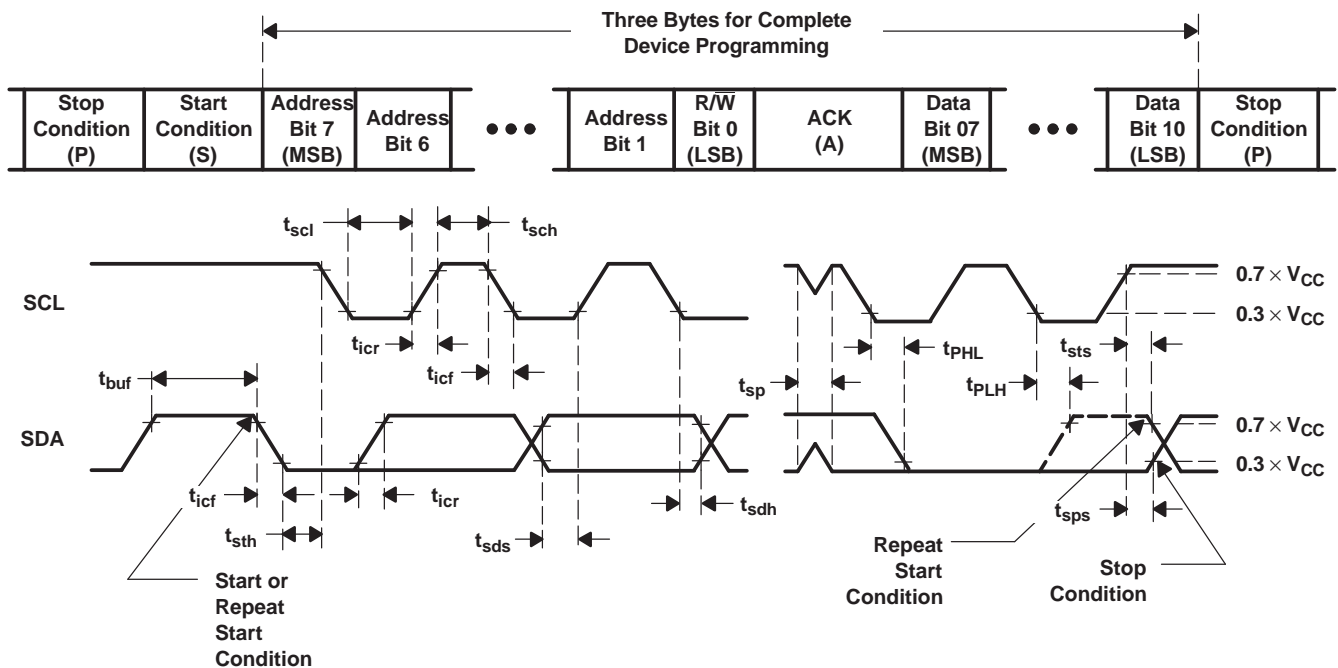
**OUTPUT LOW VOLTAGE  
VS  
TEMPERATURE**



PARAMETER MEASUREMENT INFORMATION



SDA LOAD CONFIGURATION



VOLTAGE WAVEFORMS

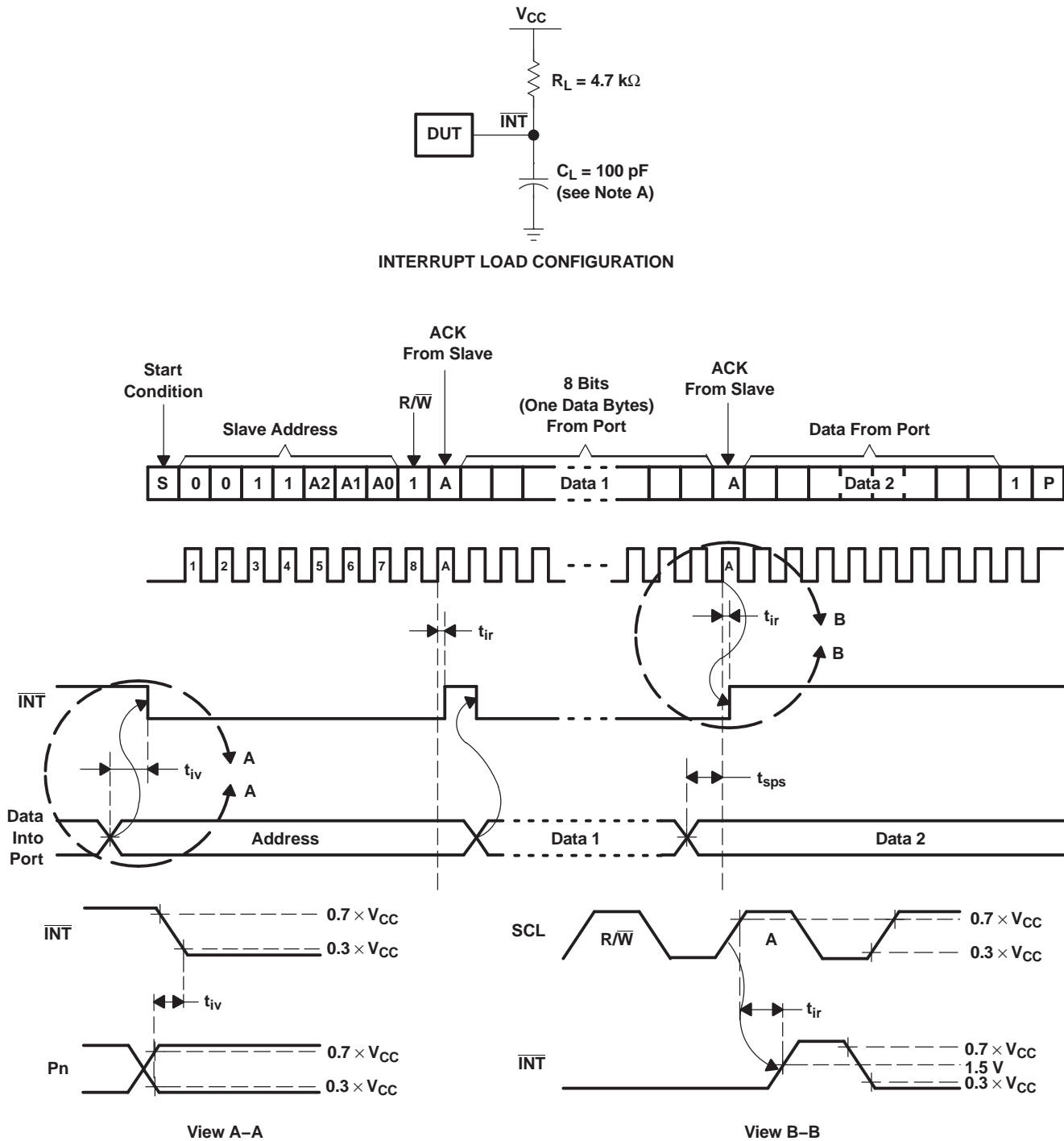
BYTE	DESCRIPTION
1	I <sup>2</sup> C address
2, 3	P-port data

- A.  $C_L$  includes probe and jig capacitance.
- B. All inputs are supplied by generators having the following characteristics:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r/t_f \leq 30\text{ ns}$ .
- C. All parameters and waveforms are not applicable to all devices.

Figure 10. I<sup>2</sup>C Interface Load Circuit and Voltage Waveforms



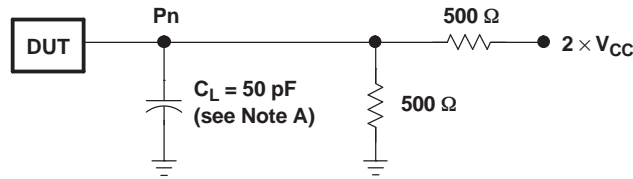
PARAMETER MEASUREMENT INFORMATION (continued)



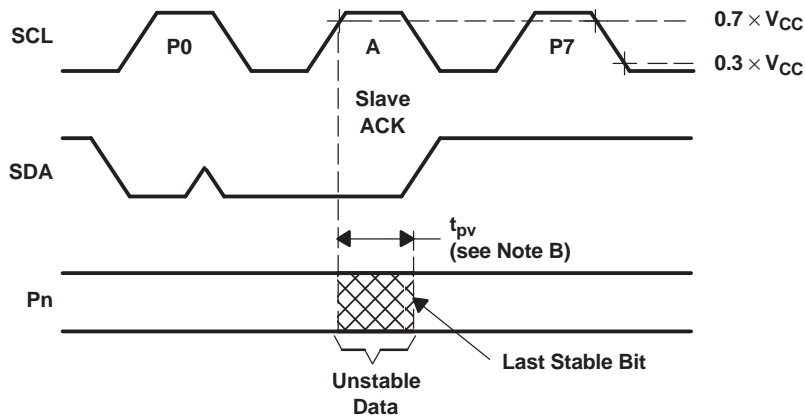
- A.  $C_L$  includes probe and jig capacitance.
- B. All inputs are supplied by generators having the following characteristics: PRR = 10 MHz,  $Z_O = 50 \Omega$ ,  $t_r/t_f \leq 30$  ns.
- C. All parameters and waveforms are not applicable to all devices.

Figure 11. Interrupt Load Circuit and Voltage Waveforms

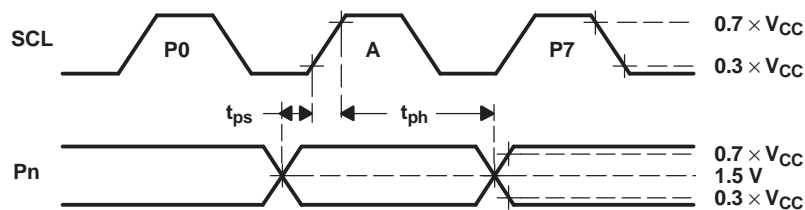
PARAMETER MEASUREMENT INFORMATION (continued)



P-PORT LOAD CONFIGURATION



WRITE MODE ( $R/\bar{W} = 0$ )

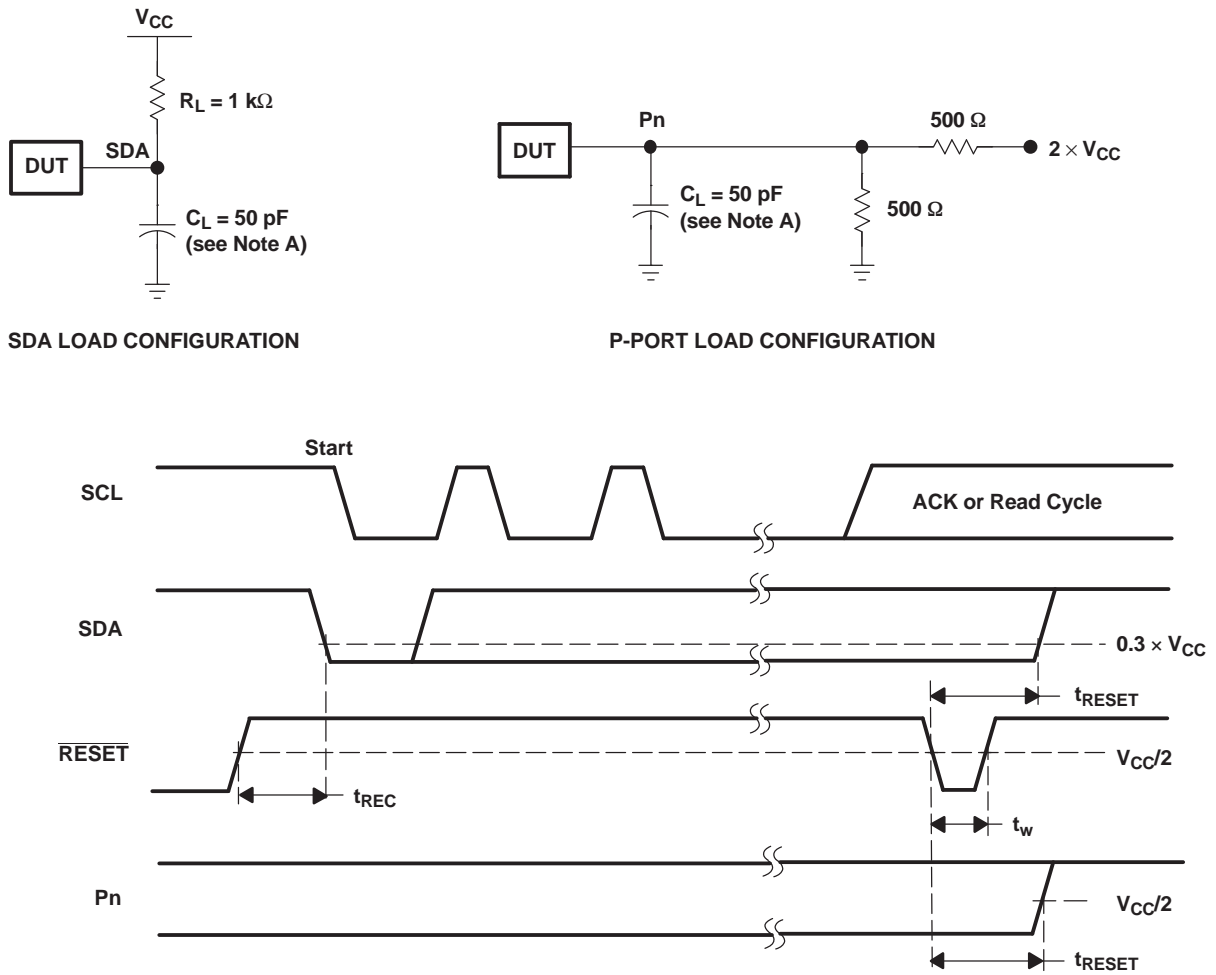


READ MODE ( $R/\bar{W} = 1$ )

- A.  $C_L$  includes probe and jig capacitance.
- B.  $t_{pv}$  is measured from  $0.7 \times V_{CC}$  on SCL to 50% I/O ( $P_n$ ) output.
- C. All inputs are supplied by generators having the following characteristics:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $t_r/t_f \leq 30$  ns.
- D. The outputs are measured one at a time, with one transition per measurement.
- E. All parameters and waveforms are not applicable to all devices.

Figure 12. P-Port Load Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION (continued)

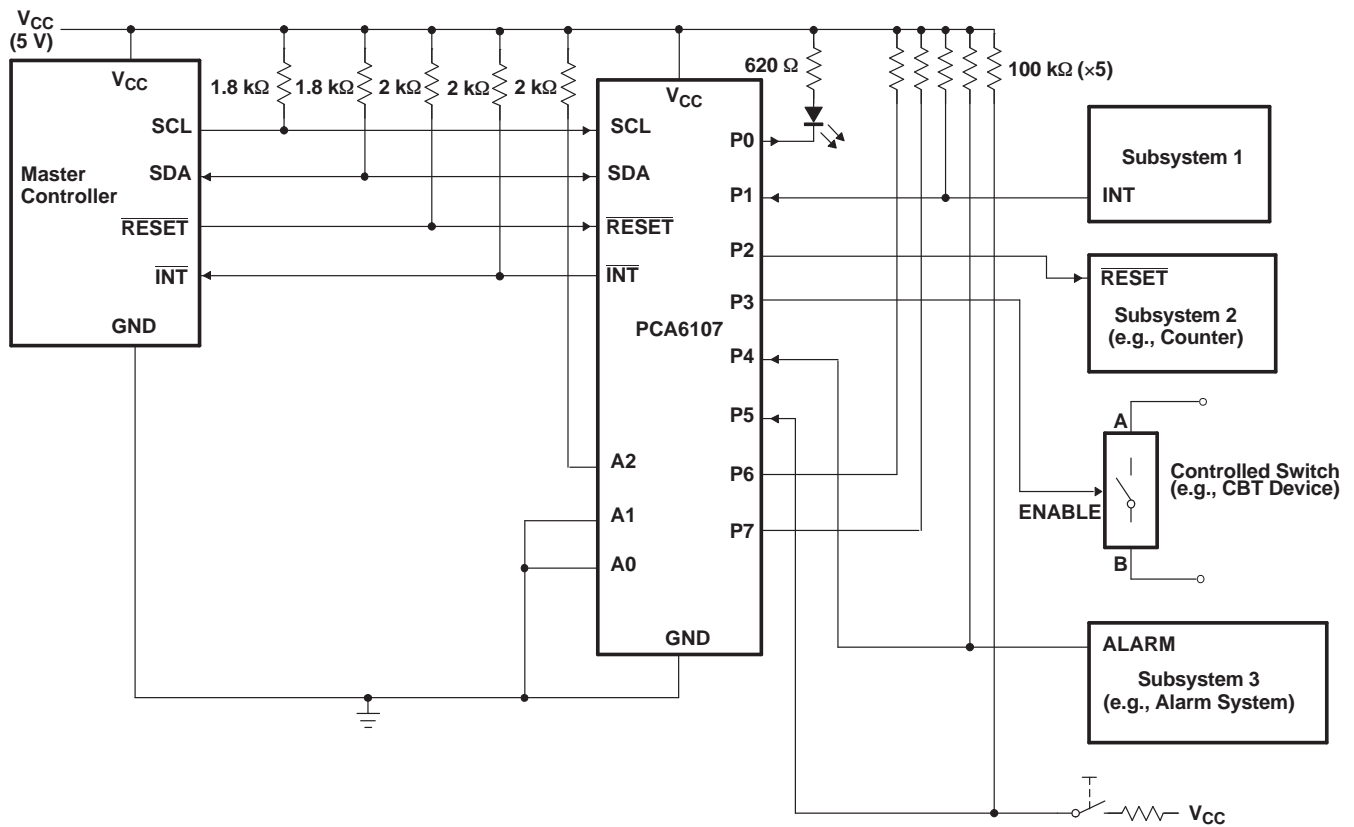


- A.  $C_L$  includes probe and jig capacitance.
- B. All inputs are supplied by generators having the following characteristics:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $t_r/t_f \leq 30$  ns.
- C. I/Os are configured as inputs.
- D. All parameters and waveforms are not applicable to all devices.

Figure 13. Reset Load Circuits and Voltage Waveforms

APPLICATION INFORMATION

Figure 14 shows an application where the PCA6107 can be used.



- A. Device address is configured as 0011100 for this example.
- B. P1, P4, and P5 are configured as inputs.
- C. P0, P2, and P3 are configured as outputs.
- D. P6 and P7 are not used and must be configured as outputs.

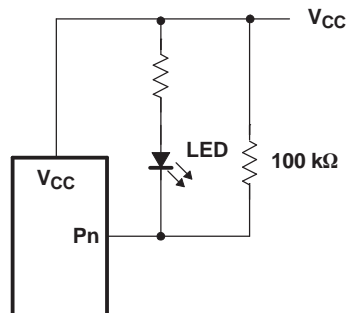
Figure 14. Typical Application

### APPLICATION INFORMATION (continued)

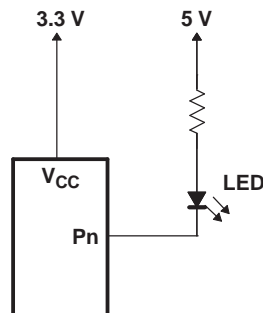
#### Minimizing I<sub>CC</sub> When I/O Is Used to Control LED

When an I/O is used to control an LED, normally it is connected to V<sub>CC</sub> through a resistor as shown in Figure 14. The LED acts as a diode so, when the LED is off, the I/O V<sub>IN</sub> is about 1.2 V less than V<sub>CC</sub>. The ΔI<sub>CC</sub> parameter in *Electrical Characteristics* shows how I<sub>CC</sub> increases as V<sub>IN</sub> becomes lower than V<sub>CC</sub>. Designs needing to minimize current consumption, such as battery power applications, should consider maintaining the I/O pin greater than or equal to V<sub>CC</sub> when the LED is off.

Figure 15 shows a high-value resistor in parallel with the LED. Figure 16 shows V<sub>CC</sub> less than the LED supply voltage by at least 1.2 V. Both of these methods maintain the I/O V<sub>IN</sub> at or above V<sub>CC</sub> and prevent additional supply-current consumption when the LED is off.



**Figure 15. High-Value Resistor in Parallel With the LED**



**Figure 16. Device Supplied by a Low Voltage**

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
PCA6107DW	ACTIVE	SOIC	DW	18	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
PCA6107DWG4	ACTIVE	SOIC	DW	18	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
PCA6107DWR	ACTIVE	SOIC	DW	18	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
PCA6107DWRG4	ACTIVE	SOIC	DW	18	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

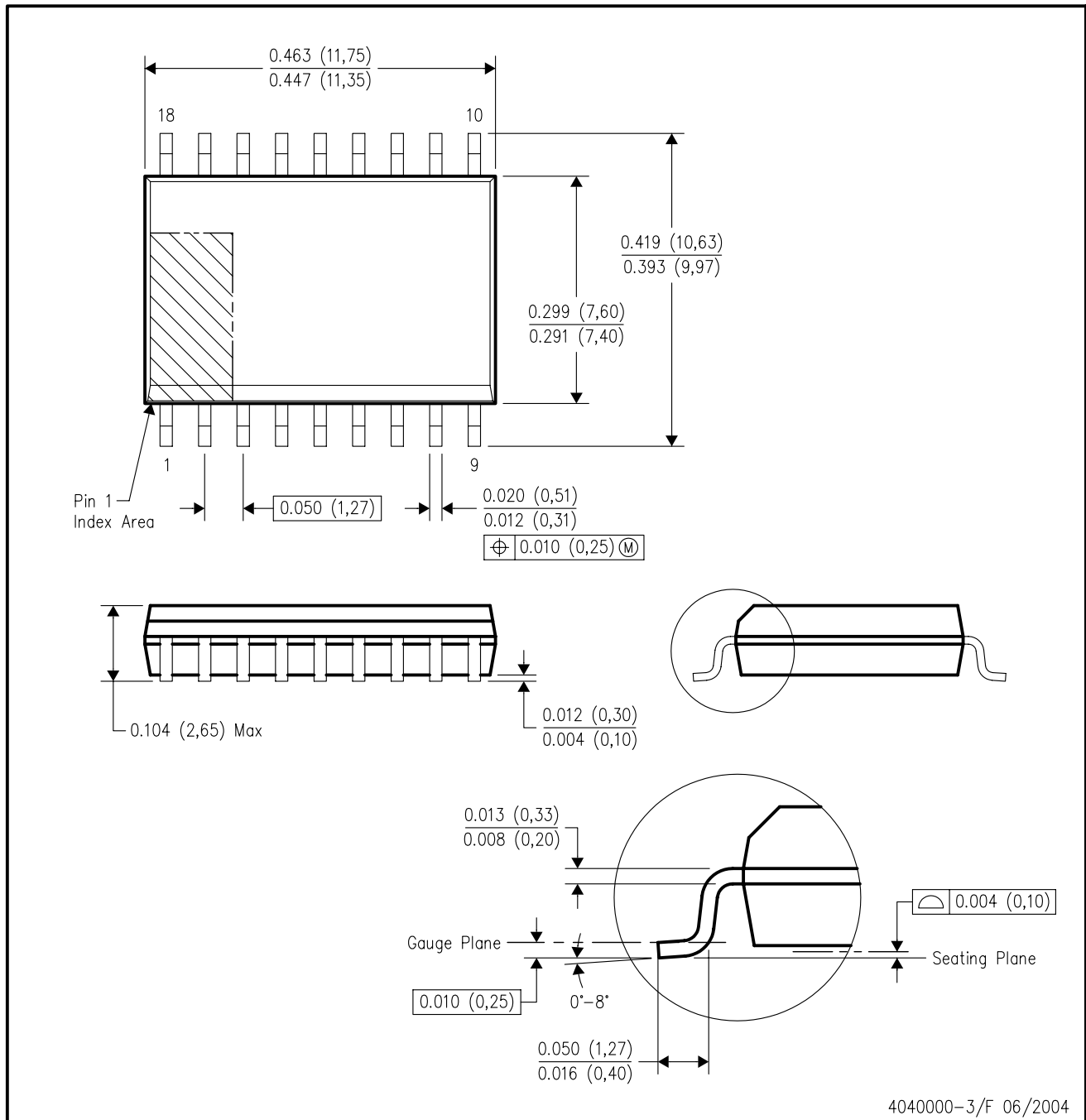
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

**Important Information and Disclaimer:**The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

DW (R-PDSO-G18)

PLASTIC SMALL-OUTLINE PACKAGE



4040000-3/F 06/2004

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-013 variation AB.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

<b>Products</b>		<b>Applications</b>	
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>	Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>	Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>	Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>	Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>	Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Low Power Wireless	<a href="http://www.ti.com/lpw">www.ti.com/lpw</a>	Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
		Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
		Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

Mailing Address: Texas Instruments  
Post Office Box 655303 Dallas, Texas 75265