

FEATURES

- 1-of-4 Bidirectional Translating Switches
- I²C Bus and SMBus Compatible
- Four Active-Low Interrupt Inputs
- Active-Low Interrupt Output
- Three Address Pins, Allowing up to Eight Devices on the I²C Bus
- Channel Selection Via I²C Bus
- Power Up With All Switch Channels Deselected
- Low R_{ON} Switches
- Allows Voltage-Level Translation Between 1.8-V, 2.5-V, 3.3-V, and 5-V Buses
- No Glitch on Power Up
- Supports Hot Insertion
- Low Standby Current
- Operating Power-Supply Voltage Range of 2.3 V to 5.5 V
- 5.5-V Tolerant Inputs
- 0 to 400-kHz Clock Frequency
- Latch-Up Performance Exceeds 100 mA Per JESD 78
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

DESCRIPTION/ORDERING INFORMATION

The PCA9544A is a quad bidirectional translating switch controlled via the I²C bus. The SCL/SDA upstream pair fans out to four downstream pairs, or channels. One SCL/SDA pair can be selected at a time, and this is determined by the contents of the programmable control register. Four interrupt inputs (INT3–INT0), one for each of the downstream pairs, are provided. One interrupt output (INT) acts as an AND of the four interrupt inputs.

A power-on reset function puts the registers in their default state and initializes the I²C state machine, with no channel selected.

The pass gates of the switches are constructed such that the V_{CC} pin can be used to limit the maximum high voltage, which will be passed by the PCA9544A. This allows the use of different bus voltages on each pair, so that 1.8-V, 2.5-V, or 3.3-V parts can communicate with 5-V parts, without any additional protection. External pullup resistors pull the bus up to the desired voltage level for each channel. All I/O pins are 5-V tolerant.

ORDERING INFORMATION

T _A	PACKAGE ⁽¹⁾⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QFN – RGW	Reel of 3000	PCA9544ARGWR	PREVIEW
	QFN – RGY	Reel of 1000	PCA9544ARGYR	PD544A
	SOIC – DW	Tube of 25	PCA9544ADW	PCA9544A
		Reel of 2000	PCA9544ADWR	
	TSSOP – PW	Tube of 70	PCA9544APW	PD544A
		Reel of 2000	PCA9544APWR	
		Reel of 250	PCA9544APWT	
	TVSOP – DGV	Reel of 2000	PCA9544ADGVR	PD544A
	VFBGA – GQN	Reel of 1000	PCA9544AGQNR	PD544A
	VFBGA – ZQN (Pb-free)	Reel of 1000	PCA9544AZQNR	PD544A

(1) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

(2) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.



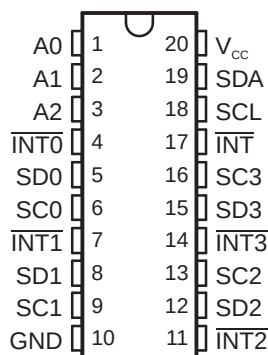
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PCA9544A

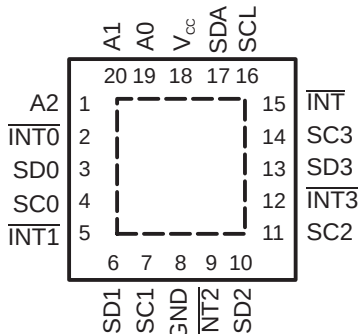
4-CHANNEL I²C AND SMBus MULTIPLEXER WITH INTERRUPT LOGIC

SCPS146D—OCTOBER 2005—REVISED FEBRUARY 2008

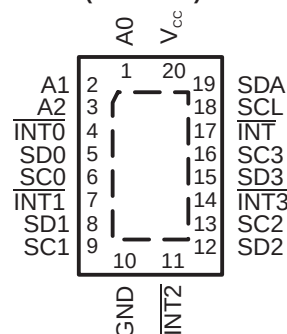
**DGV, DW, OR PW PACKAGE
(TOP VIEW)**



**RGW PACKAGE
(TOP VIEW)**



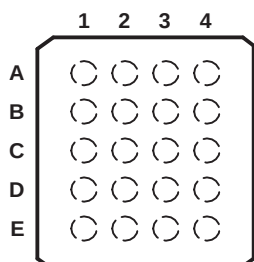
**RGY PACKAGE
(TOP VIEW)**



TERMINAL FUNCTIONS

PIN NO.		NAME	FUNCTION
DGV, DW, PW, AND RGY	RGW		
1	19	A0	Address input 0. Connect directly to V _{CC} or ground.
2	20	A1	Address input 1. Connect directly to V _{CC} or ground.
3	1	A2	Address input 2. Connect directly to V _{CC} or ground.
4	2	INT0	Active-low interrupt input 0. Connect to V _{CC} through a pullup resistor.
5	3	SD0	Serial data 0. Connect to V _{CC} through a pullup resistor.
6	4	SC0	Serial clock 0. Connect to V _{CC} through a pullup resistor.
7	5	INT1	Active-low interrupt input 1. Connect to V _{CC} through a pullup resistor.
8	6	SD1	Serial data 1. Connect to V _{CC} through a pullup resistor.
9	7	SC1	Serial clock 1. Connect to V _{CC} through a pullup resistor.
10	8	GND	Ground
11	9	INT2	Active-low interrupt input 2. Connect to V _{CC} through a pullup resistor.
12	10	SD2	Serial data 2. Connect to V _{CC} through a pullup resistor.
13	11	SC2	Serial clock 2. Connect to V _{CC} through a pullup resistor.
14	12	INT3	Active-low interrupt input 3. Connect to V _{CC} through a pullup resistor.
15	13	SD3	Serial data 3. Connect to V _{CC} through a pullup resistor.
16	14	SC3	Serial clock 3. Connect to V _{CC} through a pullup resistor.
17	15	INT	Active-low interrupt output. Connect to V _{CC} through a pullup resistor.
18	16	SCL	Serial clock line. Connect to V _{CC} through a pullup resistor.
19	17	SDA	Serial data line. Connect to V _{CC} through a pullup resistor.
20	18	V _{CC}	Supply power

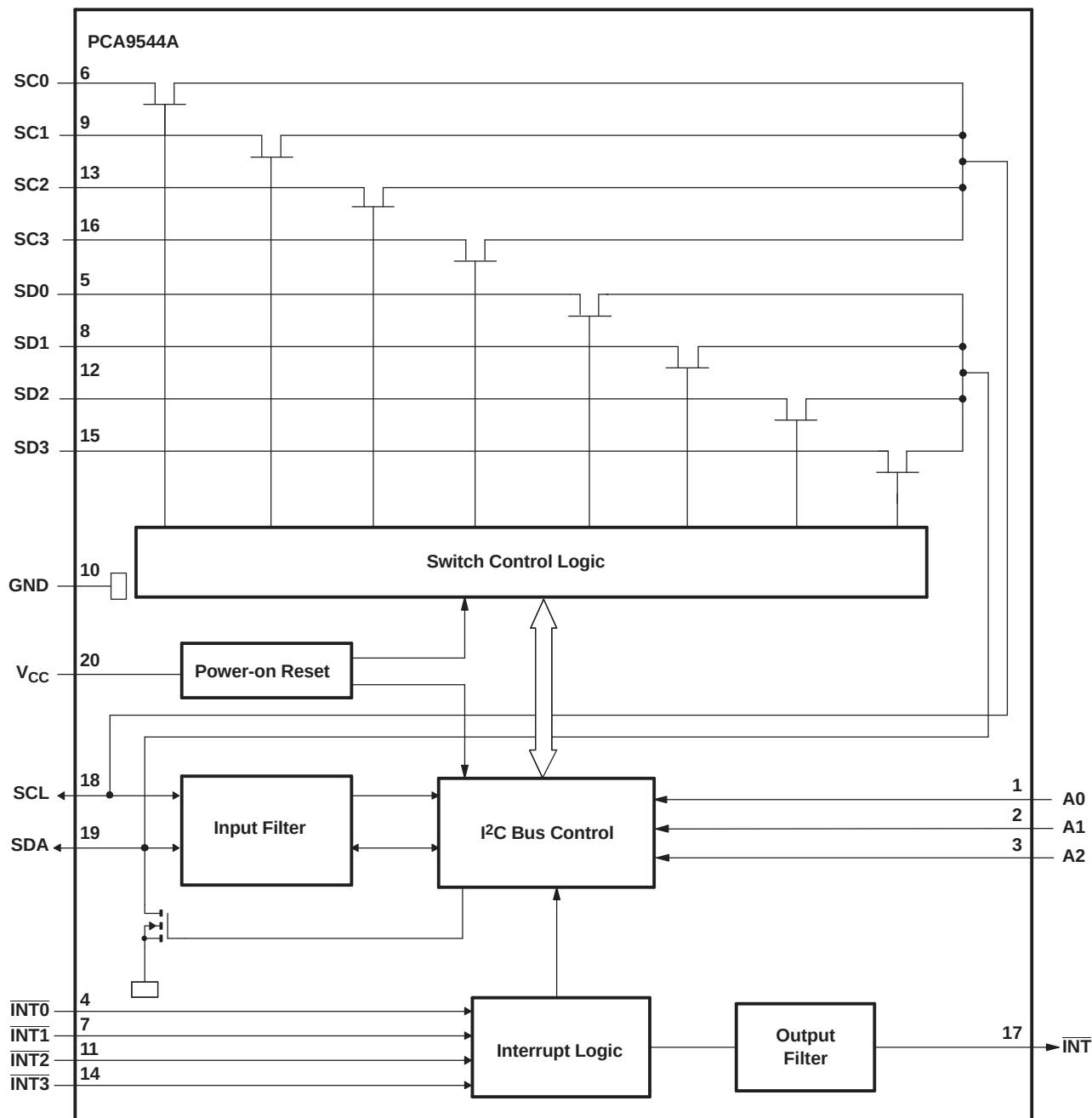
**GQN OR ZQN PACKAGE
(TOP VIEW)**



TERMINAL ASSIGNMENTS

	1	2	3	4
A	A1	A0	V _{CC}	SDA
B	INT0	INT	A2	SCL
C	SC0	SD0	SD3	SC3
D	SD1	SC2	INT1	INT3
E	GND	SC1	INT2	SD2

BLOCK DIAGRAM



Pin numbers shown are for DGV, DW, PW, and RGY packages.

PCA9544A

4-CHANNEL I²C AND SMBus MULTIPLEXER WITH INTERRUPT LOGIC

SCPS146D—OCTOBER 2005—REVISED FEBRUARY 2008

Device Address

Following a start condition, the bus master must output the address of the slave it is accessing. The address of the PCA9544A is shown in Figure 1. To conserve power, no internal pullup resistors are incorporated on the hardware-selectable address pins, and they must be pulled high or low.

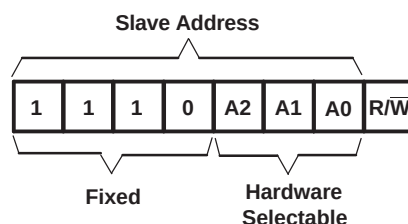


Figure 1. PCA9544A Address

The last bit of the slave address defines the operation to be performed. When set to a logic 1, a read is selected, while a logic 0 selects a write operation.

Control Register

Following the successful acknowledgment of the slave address, the bus master sends a byte to the PCA9544A, which is stored in the control register. If multiple bytes are received by the PCA9544A, it saves the last byte received. This register can be written and read via the I²C bus.

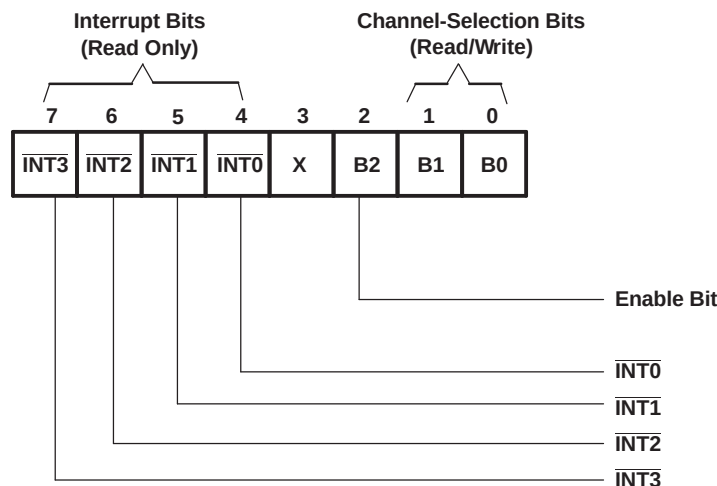


Figure 2. Control Register

Control Register Definition

One or several SCn/SDn downstream pairs, or channels, are selected by the contents of the control register (see Table 1). This register is written after the PCA9544A has been addressed. The three LSBs of the control byte are used to determine which channel (or channels) is to be selected. When a channel is selected, the channel becomes active after a stop condition has been placed on the I²C bus. This ensures that all SCn/SDn lines are in a high state when the channel is made active, so that no false conditions are generated at the time of connection. A stop condition always must occur right after the acknowledge cycle.

Table 1. Control Register Write (Channel Selection), Control Register Read (Channel Status)⁽¹⁾

INT3	INT2	INT1	INT0	D3	B2	B1	B0	COMMAND
X	X	X	X	X	0	X	X	No channel selected
X	X	X	X	X	1	0	0	Channel 0 enabled
X	X	X	X	X	1	0	1	Channel 1 enabled
X	X	X	X	X	1	1	0	Channel 2 enabled
X	X	X	X	X	1	1	1	Channel 3 enabled
0	0	0	0	0	0	0	0	No channel selected, power-up default state

(1) Only one channel may be selected at a time.

Interrupt Handling

The PCA9544A provides four interrupt inputs (one for each channel) and one open-drain interrupt output. When an interrupt is generated by any device, it is detected by the PCA9544A, and the interrupt output is driven low. The channel does not need to be active for detection of the interrupt. A bit also is set in the control register (see [Table 2](#)).

Bits 4–7 of the control register correspond to channels 0–3 of the PCA9544A, respectively. Therefore, if an interrupt is generated by any device connected to channel 1, the state of the interrupt inputs is loaded into the control register when a read is accomplished. Likewise, an interrupt on any device connected to channel 0 causes bit 4 of the control register to be set on the read. The master then can address the PCA9544A and read the contents of the control register to determine which channel contains the device generating the interrupt. The master can reconfigure the PCA9544A to select this channel and locate the device generating the interrupt and clear it. Once the device responsible for the interrupt clears, the interrupt clears.

It should be noted that more than one device can provide an interrupt on a channel, so it is up to the master to ensure that all devices on a channel are interrogated for an interrupt.

The interrupt inputs can be used as general-purpose inputs if the interrupt function is not required.

If unused, interrupt input(s) must be connected to V_{CC}.

Table 2. Control Register Read (Interrupt)⁽¹⁾

INT3	INT2	INT1	INT0	D3	B2	B1	B0	COMMAND
X	X	X	0	X	X	X	X	No interrupt on channel 0
			1					Interrupt on channel 0
X	X	0	X	X	X	X	X	No interrupt on channel 1
		1						Interrupt on channel 1
X	0	X	X	X	X	X	X	No interrupt on channel 2
	1							Interrupt on channel 2
0	X	X	X	X	X	X	X	No interrupt on channel 3
1								Interrupt on channel 3

(1) Several interrupts can be active at the same time. For example, INT3 = 0, INT2 = 1, INT1 = 1, INT0 = 0 means that there is no interrupt on channels 0 and 3, and there is interrupt on channels 1 and 2.

PCA9544A

4-CHANNEL I²C AND SMBus MULTIPLEXER WITH INTERRUPT LOGIC

SCPS146D—OCTOBER 2005—REVISED FEBRUARY 2008

Power-On Reset

When power is applied to V_{CC} , an internal power-on reset holds the PCA9544A in a reset condition until V_{CC} has reached V_{POR} . At this point, the reset condition is released, and the PCA9544A registers and I²C state machine are initialized to their default states, all zeroes, causing all the channels to be deselected. Thereafter, V_{CC} must be lowered below 0.2 V to reset the device.

Voltage Translation

The pass-gate transistors of the PCA9544A are constructed such that the V_{CC} voltage can be used to limit the maximum voltage that is passed from one I²C bus to another.

Figure 3 shows the voltage characteristics of the pass-gate transistors (note that the graph was generated using data specified in the electrical characteristics section of this data sheet). In order for the PCA9544A to act as a voltage translator, the V_{pass} voltage must be equal to or lower than the lowest bus voltage. For example, if the main bus is running at 5 V and the downstream buses are 3.3 V and 2.7 V, V_{pass} must be equal to or below 2.7 V to effectively clamp the downstream bus voltages. As shown in Figure 3, V_{pass} (max) is at 2.7 V when the PCA9544A supply voltage is 3.5 V or lower, so the PCA9544A supply voltage could be set to 3.3 V. Pullup resistors then can be used to bring the bus voltages to their appropriate levels (see Figure 12).

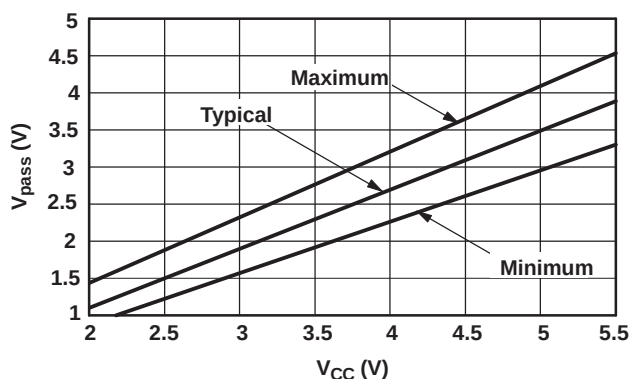


Figure 3. V_{pass} Voltage vs V_{CC}

I²C Interface

The I²C bus is for two-way two-line communication between different ICs or modules. The two lines are a serial data line (SDA) and a serial clock line (SCL). Both lines must be connected to a positive supply via a pullup resistor when connected to the output stages of a device. Data transfer can be initiated only when the bus is not busy.

One data bit is transferred during each clock pulse. The data on the SDA line must remain stable during the high period of the clock pulse, as changes in the data line at this time are interpreted as control signals (see Figure 4).

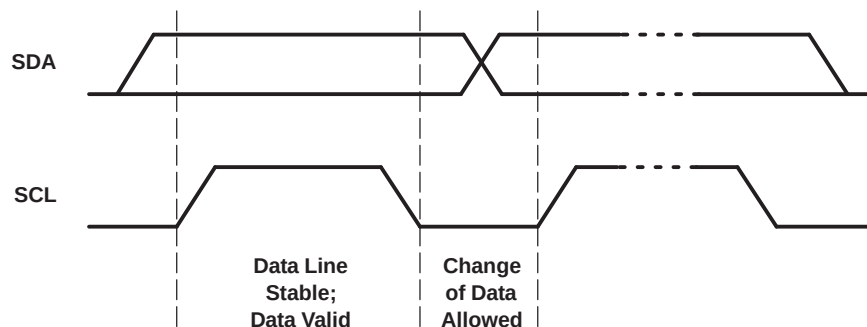


Figure 4. Bit Transfer

Both data and clock lines remain high when the bus is not busy. A high-to-low transition of the data line while the clock is high is defined as the start condition (S). A low-to-high transition of the data line while the clock is high is defined as the stop condition (P) (see Figure 5).

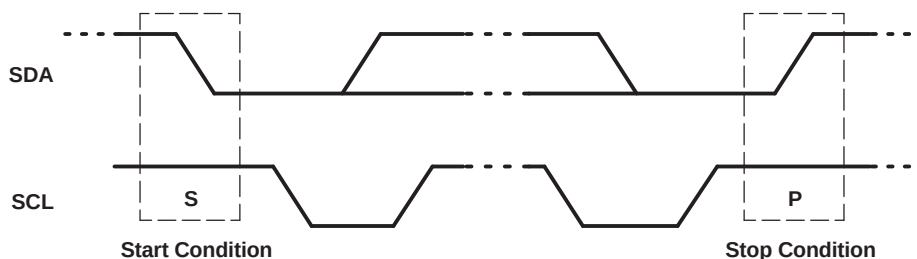


Figure 5. Definition of Start and Stop Conditions

A device generating a message is a transmitter; a device receiving a message is the receiver. The device that controls the message is the master, and the devices that are controlled by the master are the slaves (see Figure 6).

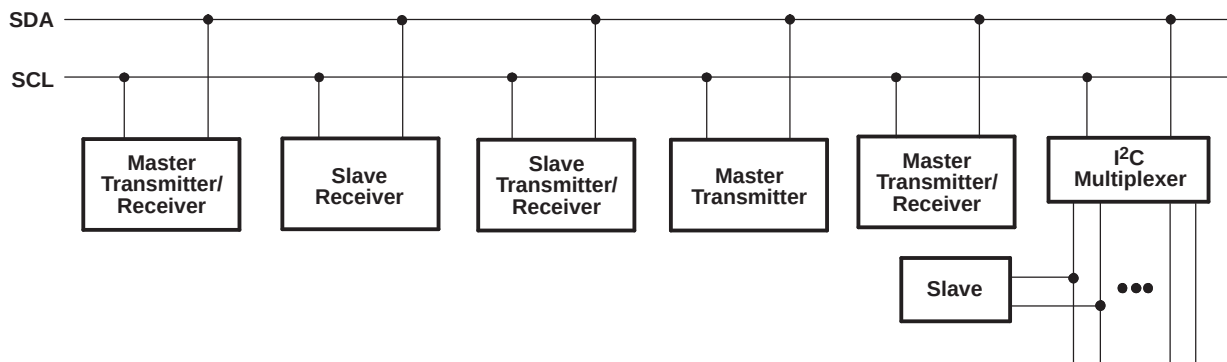


Figure 6. System Configuration

The number of data bytes transferred between the start and the stop conditions from transmitter to receiver is not limited. 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.

PCA9544A

4-CHANNEL I²C AND SMBus MULTIPLEXER

WITH INTERRUPT LOGIC

SCPS146D—OCTOBER 2005—REVISED FEBRUARY 2008

When a slave receiver is addressed, it must generate an acknowledge (ACK) after the reception of each byte. Also, a master must generate an ACK after the reception of each byte that has been clocked out of the slave transmitter. 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 7). Setup and hold times must be taken into account.

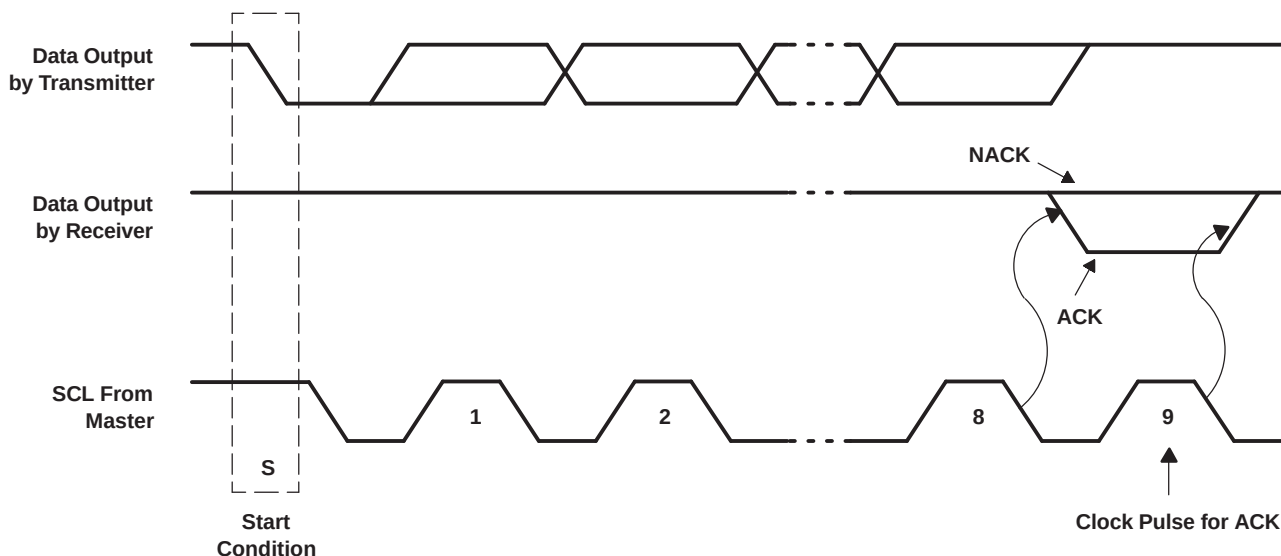


Figure 7. Acknowledgment on the I²C Bus

A master receiver must signal an end of data to the 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.

Data is transmitted to the PCA9544A control register using the write mode shown in Figure 8.

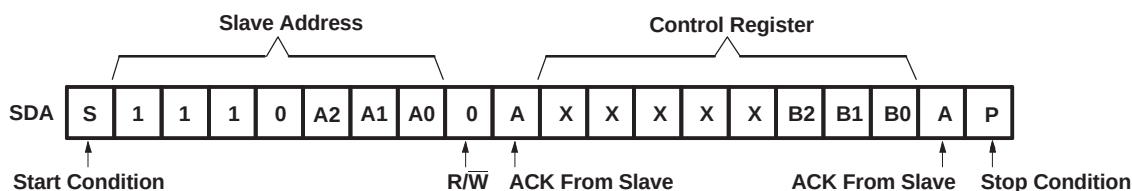


Figure 8. Write Control Register

Data is read from the PCA9544A control register using the read mode shown in Figure 9.

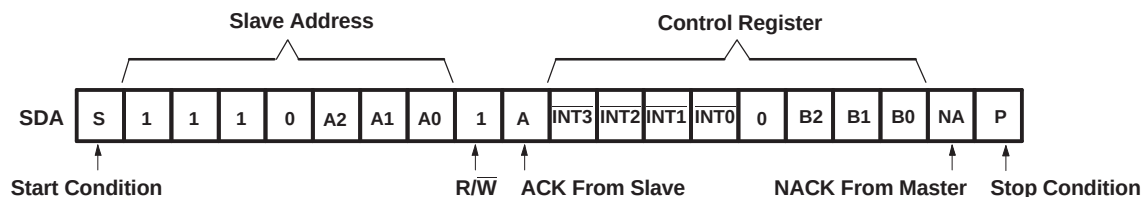


Figure 9. Read Control Register

Absolute Maximum Ratings⁽¹⁾

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

		MIN	MAX	UNIT
V _{CC}	Supply voltage range	–0.5	7	V
V _I	Input voltage range ⁽²⁾	–0.5	7	V
I _I	Input current		±20	mA
I _O	Output current		±25	mA
	Continuous current through V _{CC}		±100	mA
	Continuous current through GND		±100	mA
θ _{JA}	Package thermal impedance	DGW package ⁽³⁾	92	°C/W
		DW package ⁽³⁾	58	
		GQN package ⁽³⁾	78	
		PW package ⁽³⁾	83	
		RGW package ⁽⁴⁾	TBD	
		RGY package ⁽⁴⁾	37	
P _{tot}	Total power dissipation		400	mW
T _{stg}	Storage temperature range	–65	150	°C
T _A	Operating free-air temperature range	–40	85	°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.
- (4) The package thermal impedance is calculated in accordance with JESD 51-5.

Recommended Operating Conditions⁽¹⁾

		MIN	MAX	UNIT
V _{CC}	Supply voltage	2.3	5.5	V
V _{IH}	High-level input voltage	SCL, SDA	0.7 × V _{CC}	6
		A2–A0, $\overline{\text{INT3}}$ – $\overline{\text{INT0}}$	0.7 × V _{CC}	V _{CC} + 0.5
V _{IL}	Low-level input voltage	SCL, SDA	–0.5	0.3 × V _{CC}
		A2–A0, $\overline{\text{INT3}}$ – $\overline{\text{INT0}}$	–0.5	0.3 × V _{CC}
T _A	Operating free-air temperature	–40	85	°C

- (1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

PCA9544A

4-CHANNEL I²C AND SMBus MULTIPLEXER WITH INTERRUPT LOGIC

SCPS146D—OCTOBER 2005—REVISED FEBRUARY 2008

Electrical Characteristics

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

PARAMETER			TEST CONDITIONS		V _{CC}		MIN TYP ⁽¹⁾ MAX		UNIT
V _{POR}	Power-on reset voltage ⁽²⁾		No load, V _I = V _{CC} or GND		V _{POR}	1.7 2.1		V	
V _{pass}	Switch output voltage		V _{SWin} = V _{CC} , I _{SWout} = −100 μA		5 V	3.6		V	
					4.5 V to 5.5 V	2.6 4.5			
					3.3 V	1.9			
					3 V to 3.6 V	1.6 2.8			
					2.5 V	1.5			
					2.3 V to 2.7 V	1.1 2			
I _{OH}	INT		V _O = V _{CC}		2.3 V to 5.5 V		10	μA	
I _{OL}	SCL, SDA		V _{OL} = 0.4 V		2.3 V to 5.5 V	3 7	mA		
			V _{OL} = 0.6 V			6 10			
	INT		V _{OL} = 0.4 V			3 7			
I _I	SCL, SDA		V _I = V _{CC} or GND		2.3 V to 5.5 V	±1		μA	
	SC3–SC0, SD3–SD0					±1			
	A2–A0					±1			
	INT3–INT0					±1			
I _{CC}	Operating mode	f _{SCL} = 100 kHz	V _I = V _{CC} or GND, I _O = 0		5.5 V	3 12	μA		
					3.6 V	3 11			
					2.7 V	3 10			
	Standby mode	Low inputs	V _I = GND, I _O = 0		5.5 V	0.3 1			
					3.6 V	0.1 1			
					2.7 V	0.1 1			
		High inputs	V _I = V _{CC} , I _O = 0		5.5 V	0.3 1			
					3.6 V	0.1 1			
					2.7 V	0.1 1			
ΔI _{CC}	Supply-current change	INT3–INT0	One INT3–INT0 input at 0.6 V, Other inputs at V _{CC} or GND		2.3 V to 5.5 V	8 15	μA		
			One INT3–INT0 input at V _{CC} − 0.6 V, Other inputs at V _{CC} or GND			8 15			
		SCL, SDA	SCL or SDA input at 0.6 V, Other inputs at V _{CC} or GND			8 15			
			SCL or SDA inputs at V _{CC} − 0.6 V, Other inputs at V _{CC} or GND			8 15			
C _i	A2–A0		V _I = V _{CC} or GND		2.3 V to 5.5 V	4.5 6	pF		
	INT3–INT0					4.5 6			
C _{io(OFF)} ⁽³⁾	SCL, SDA		V _I = V _{CC} or GND, Switch OFF		2.3 V to 5.5 V	15 19	pF		
	SC3–SC0, SD3–SD0					6 8			
R _{ON}	Switch-on resistance		V _O = 0.4 V, I _O = 15 mA		4.5 V to 5.5 V	4 9 16	Ω		
					3 V to 3.6 V	5 11 20			
			V _O = 0.4 V, I _O = 10 mA		2.3 V to 2.7 V	7 16 45			

(1) All typical values are at nominal supply voltage (2.5-V, 3.3-V, or 5-V V_{CC}), T_A = 25°C.

(2) The power-on reset circuit resets the I²C bus logic with V_{CC} < V_{POR}. V_{CC} must be lowered to 0.2 V to reset the device.

(3) C_{io(ON)} depends on internal capacitance and external capacitance added to the SCn lines when channels(s) are ON.

I²C Interface Timing Requirements

over recommended operating free-air temperature range (unless otherwise noted) (see [Figure 12](#))

			STANDARD-MODE I ² C BUS		FAST-MODE I ² C BUS		UNIT
			MIN	MAX	MIN	MAX	
f_{scl}	I ² C clock frequency		0	100	0	400	kHz
t_{sch}	I ² C clock high time		4		0.6		μs
t_{scl}	I ² C clock low time		4.7		1.3		μs
t_{sp}	I ² C spike time			50		50	ns
t_{sds}	I ² C serial-data setup time		250		100		ns
t_{sdh}	I ² C serial-data hold time		0 ⁽¹⁾		0 ⁽¹⁾		μs
t_{icr}	I ² C input rise time			1000	$20 + 0.1C_b$ ⁽²⁾	300	ns
t_{icf}	I ² C input fall time			300	$20 + 0.1C_b$ ⁽²⁾	300	ns
t_{ocf}	I ² C output fall time (10-pF to 400-pF bus)			300	$20 + 0.1C_b$ ⁽²⁾	300	ns
t_{buf}	I ² C bus free time between stop and start		4.7		1.3		μs
t_{sts}	I ² C start or repeated start condition setup		4.7		0.6		μs
t_{sth}	I ² C start or repeated start condition hold		4		0.6		μs
t_{sps}	I ² C stop condition setup		4		0.6		μs
$t_{vL(Data)}$	Valid-data time (high to low) ⁽³⁾	SCL low to SDA output low valid		1		1	μs
$t_{vH(Data)}$	Valid-data time (low to high) ⁽³⁾	SCL low to SDA output high valid		0.6		0.6	μs
$t_{vd(ack)}$	Valid-data time of ACK condition	ACK signal from SCL low to SDA output low		1		1	μs
C_b	I ² C bus capacitive load			400		400	pF

- (1) A device internally must provide a hold time of at least 300 ns for the SDA signal (referred to as the V_{IH} min of the SCL signal), in order to bridge the undefined region of the falling edge of SCL.
(2) C_b = total bus capacitance of one bus line in pF
(3) Data taken using a 1-kΩ pullup resistor and 50-pF load (see [Figure 10](#)).

Switching Characteristics

over recommended operating free-air temperature range, $C_L \leq 100$ pF (unless otherwise noted) (see [Figure 10](#))

PARAMETER			FROM (INPUT)	TO (OUTPUT)	MIN	MAX	UNIT
t _{pd} ⁽¹⁾	Propagation delay time	R _{ON} = 20 Ω, C _L = 15 pF	SDA or SCL	SDn or SCn	0.3		ns
		R _{ON} = 20 Ω, C _L = 50 pF			1		
t _{iv}	Interrupt valid time ⁽²⁾		$\overline{INTn}$	$\overline{INT}$	4		μs
t _{ir}	Interrupt reset delay time ⁽²⁾		$\overline{INTn}$	$\overline{INT}$	2		μs

- (1) The propagation delay is the calculated RC time constant of the typical ON-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).
(2) Data taken using a 4.7-kΩ pullup resistor and 100-pF load (see [Figure 11](#)).

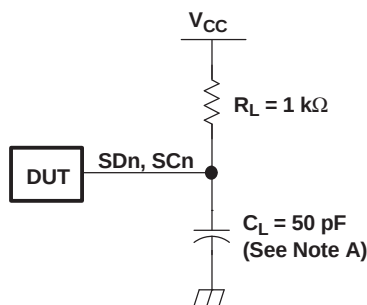
Interrupt Timing Requirements

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

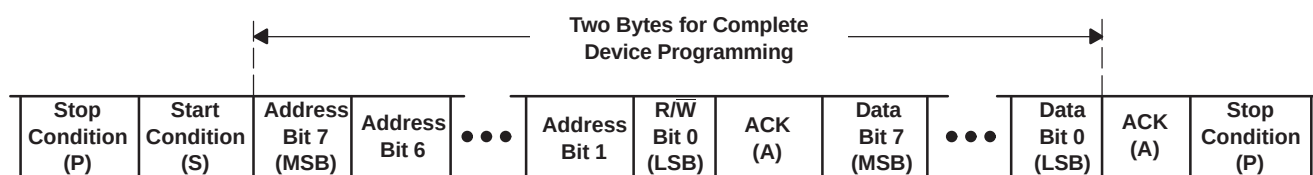
PARAMETER			MIN	MAX	UNIT
t_{PWRL}	Low-level pulse duration rejection of $\overline{INTn}$ inputs ⁽¹⁾		1		μs
t_{PWRH}	High-level pulse duration rejection of $\overline{INTn}$ inputs ⁽¹⁾		0.5		μs

- (1) Data taken using a 4.7-kΩ pullup resistor and 100-pF load (see [Figure 11](#)).

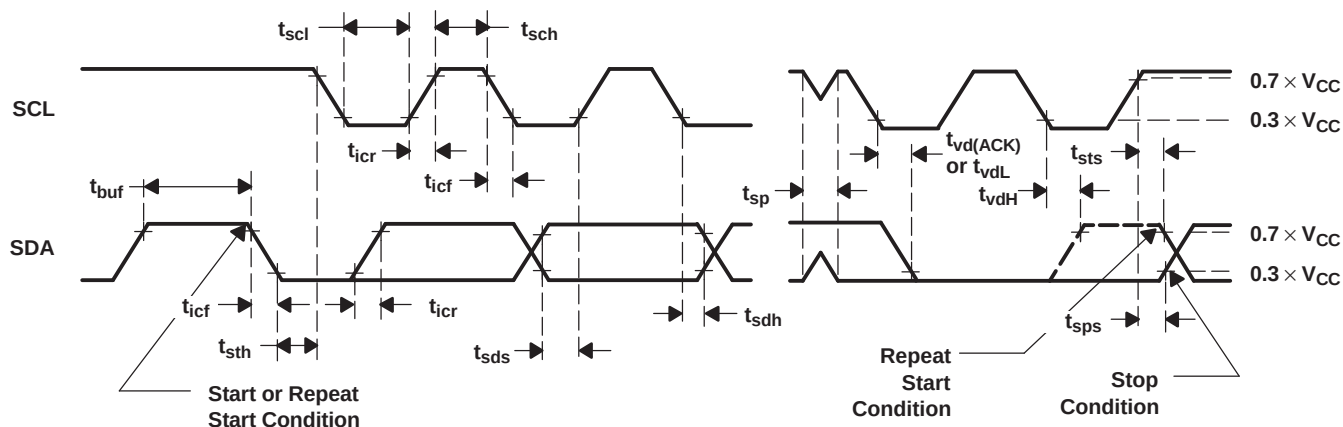
PARAMETER MEASUREMENT INFORMATION



I²C-PORT LOAD CONFIGURATION



BYTE	DESCRIPTION
1	I ² C address + R/W
2	Control register data

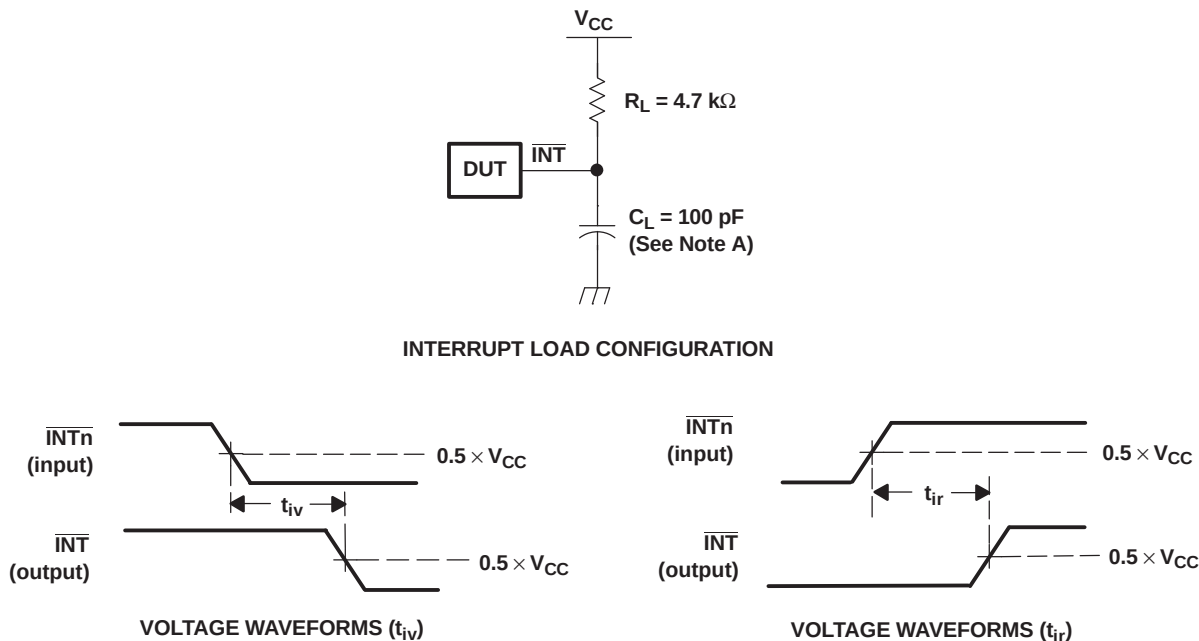


VOLTAGE WAVEFORMS

NOTES: A. C_L includes probe and jig capacitance.
 B. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10$ MHz, $Z_0 = 50 \Omega$, $t_r/t_f \leq 30$ ns.
 C. The outputs are measured one at a time, with one transition per measurement.

Figure 10. I²C Interface Load Circuit, Byte Descriptions, and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION (continued)



- NOTES: A. C_L includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR $\leq$ 10 MHz, $Z_O = 50 \Omega$, $t_r/t_f \leq 30$ ns.

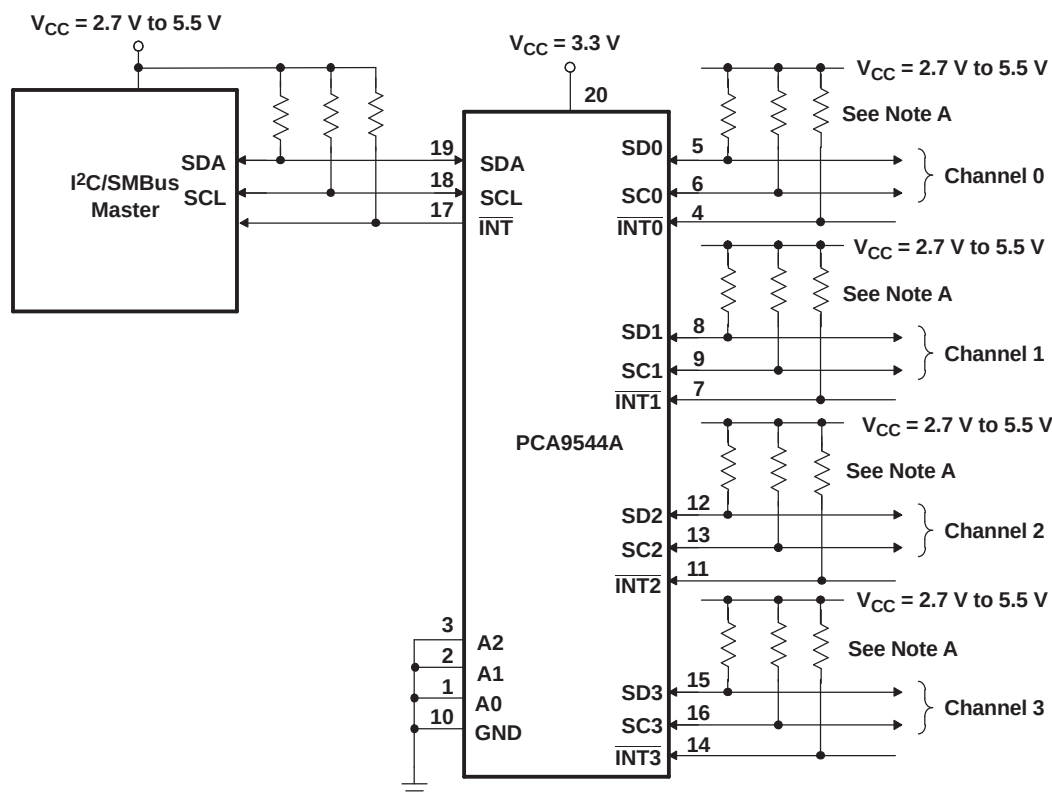
Figure 11. Interrupt Load Circuit and Voltage Waveforms

PCA9544A

4-CHANNEL I²C AND SMBus MULTIPLEXER WITH INTERRUPT LOGIC

SCPS146D–OCTOBER 2005–REVISED FEBRUARY 2008

APPLICATION INFORMATION



- NOTES: A. If the device generating the interrupt has an open-drain output structure or can be 3-stated, a pullup resistor is required. If the device generating the interrupt has a totem-pole output structure and cannot be 3-stated, a pullup resistor is not required. The interrupt inputs should not be left floating.
- B. Pin numbers shown are for DGV, DW, PW, and RGY packages.

Figure 12. Typical Application

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
PCA9544ADGVR	ACTIVE	TVSOP	DGV	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544ADGVRG4	ACTIVE	TVSOP	DGV	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544ADW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544ADWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544ADWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544ADWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544AGQNR	NRND	BGA MICROSTAR JUNIOR	GQN	20	1000	TBD	SNPB	Level-1-240C-UNLIM
PCA9544APW	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544APWE4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544APWG4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544APWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544APWRE4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544APWRG4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544APWT	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544APWTE4	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544APWTG4	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
PCA9544ARGYR	ACTIVE	VQFN	RGY	20	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
PCA9544ARGYRG4	ACTIVE	VQFN	RGY	20	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
PCA9544AZQNR	ACTIVE	BGA MICROSTAR JUNIOR	ZQN	20	1000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM

⁽¹⁾ 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.

OBSELETE: TI has discontinued the production of the device.

⁽²⁾ 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.

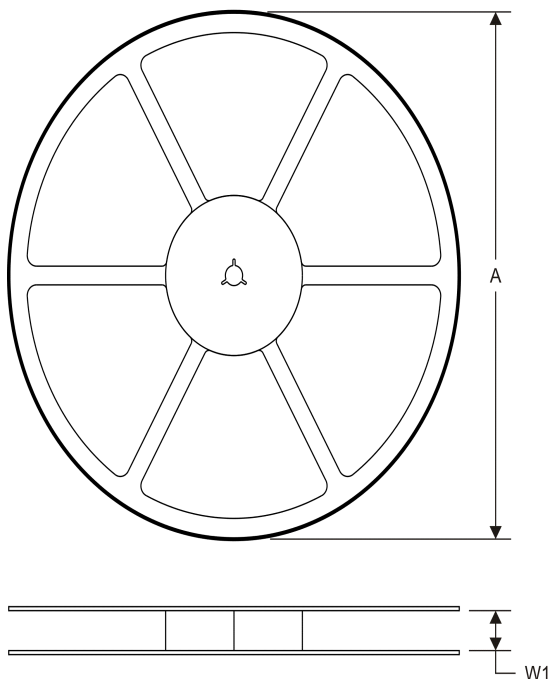
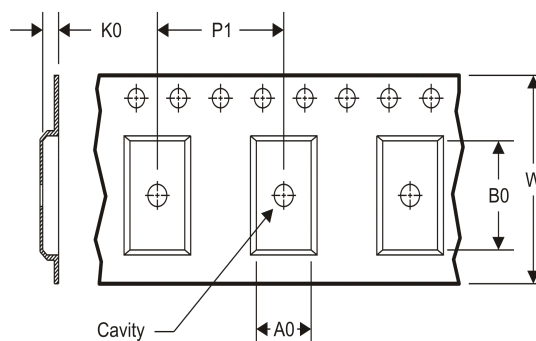
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

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)

⁽³⁾ 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.

TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


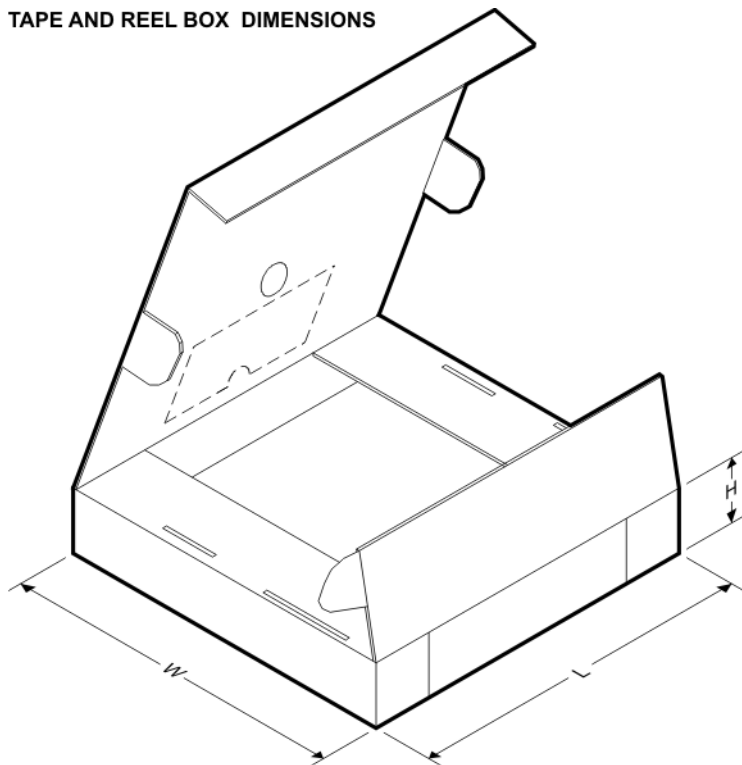
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

TAPE AND REEL INFORMATION

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
PCA9544ADGVR	TVSOP	DGV	20	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
PCA9544ADWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
PCA9544AGQNR	BGA MICROSTAR JUNIOR	GQN	20	1000	330.0	12.4	3.3	4.3	1.6	8.0	12.0	Q1
PCA9544APWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
PCA9544APWT	TSSOP	PW	20	250	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
PCA9544ARGYR	VQFN	RGY	20	3000	330.0	12.4	3.8	4.8	1.6	8.0	12.0	Q1
PCA9544AZQNR	BGA MICROSTAR JUNIOR	ZQN	20	1000	330.0	12.4	3.3	4.3	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS

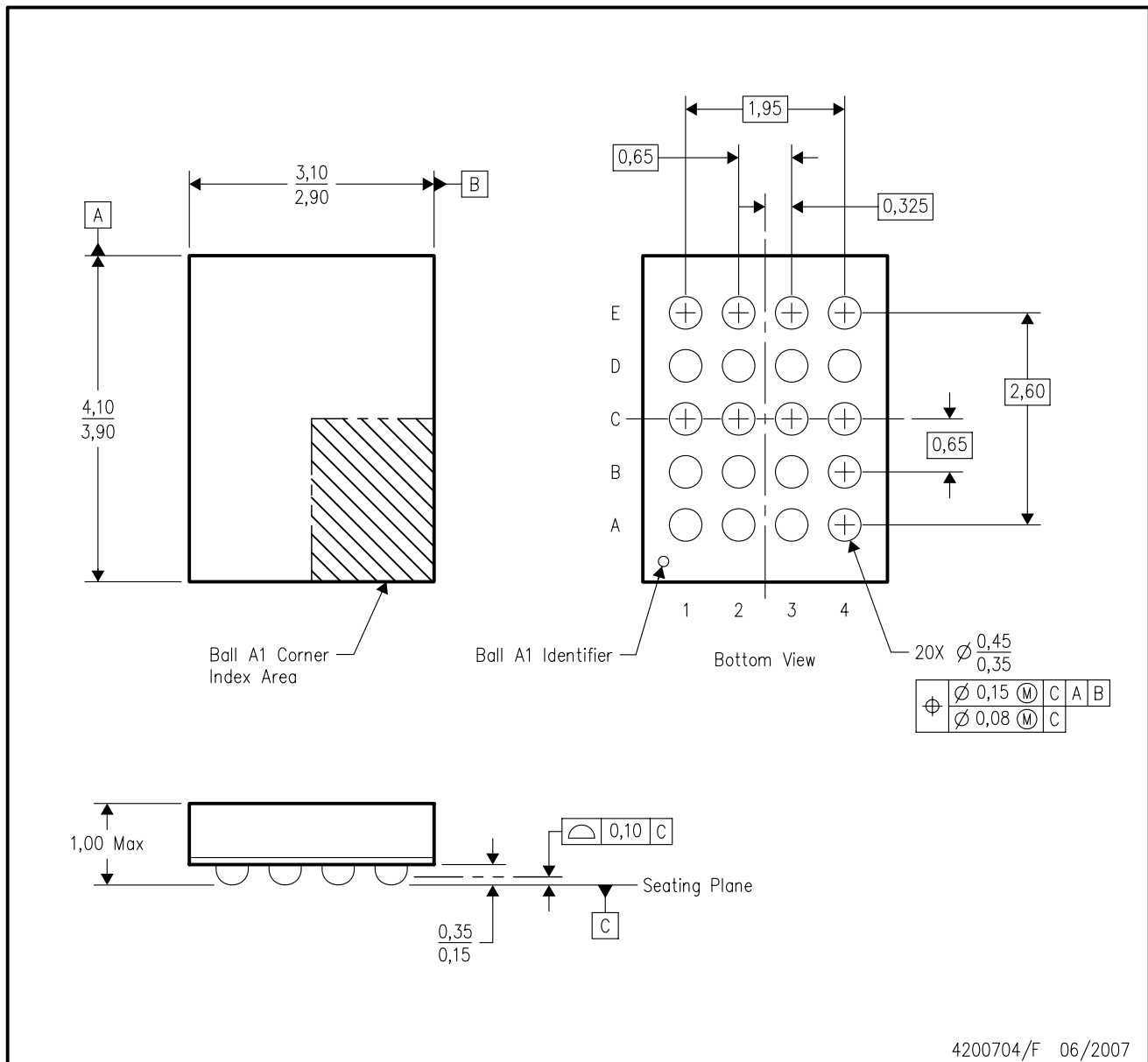


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
PCA9544ADGVR	TVSOP	DGV	20	2000	346.0	346.0	29.0
PCA9544ADWR	SOIC	DW	20	2000	346.0	346.0	41.0
PCA9544AGQNR	BGA MICROSTAR JUNIOR	GQN	20	1000	340.5	338.1	20.6
PCA9544APWR	TSSOP	PW	20	2000	346.0	346.0	33.0
PCA9544APWT	TSSOP	PW	20	250	346.0	346.0	33.0
PCA9544ARGYR	VQFN	RGY	20	3000	346.0	346.0	29.0
PCA9544AZQNR	BGA MICROSTAR JUNIOR	ZQN	20	1000	340.5	338.1	20.6

GQN (R-PBGA-N20)

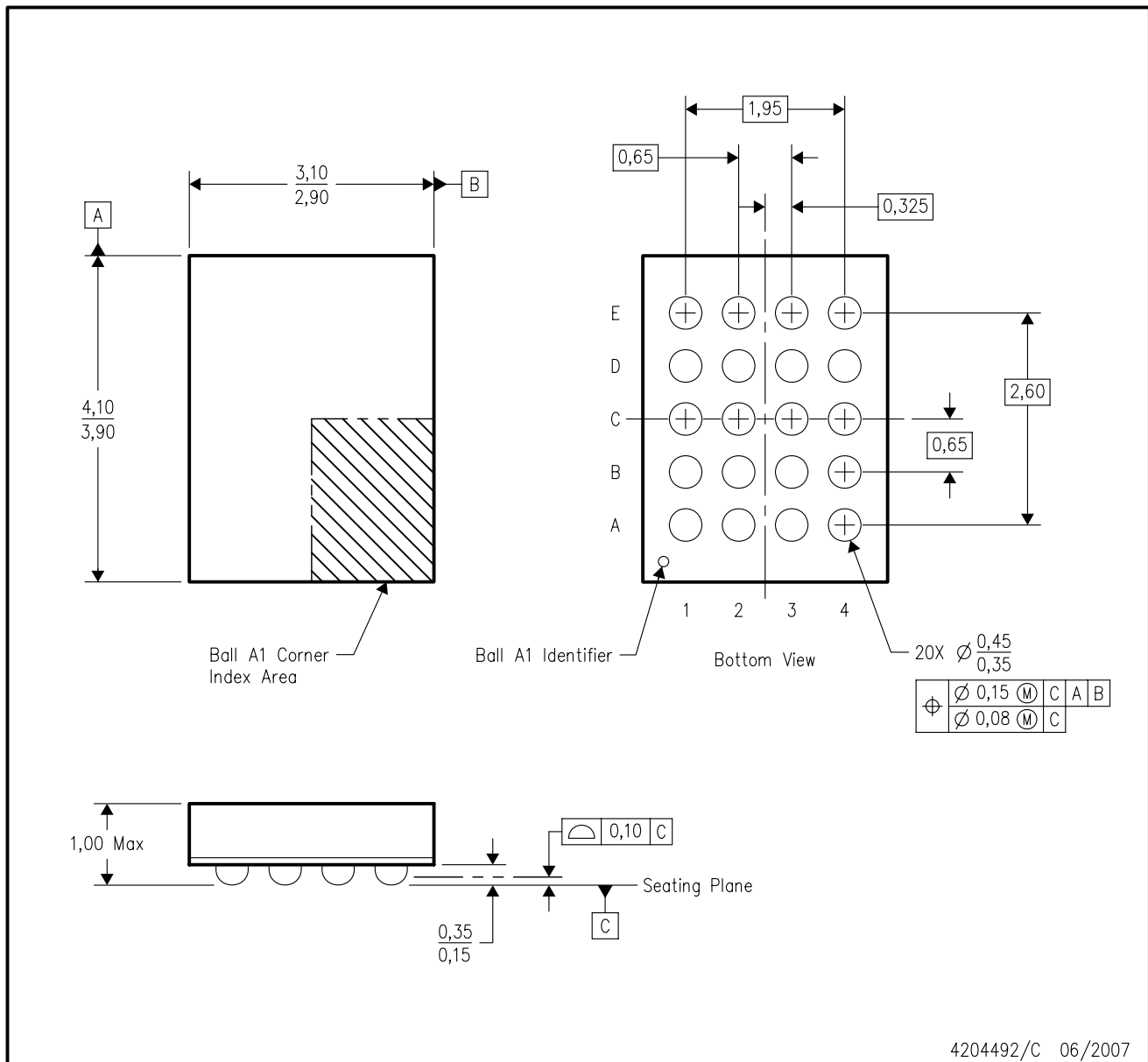
PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Falls within JEDEC MO-285 variation BC-2.
 - D. This package is tin-lead (SnPb). Refer to the 20 ZQN package (drawing 4204492) for lead-free.

ZQN (R-PBGA-N20)

PLASTIC BALL GRID ARRAY

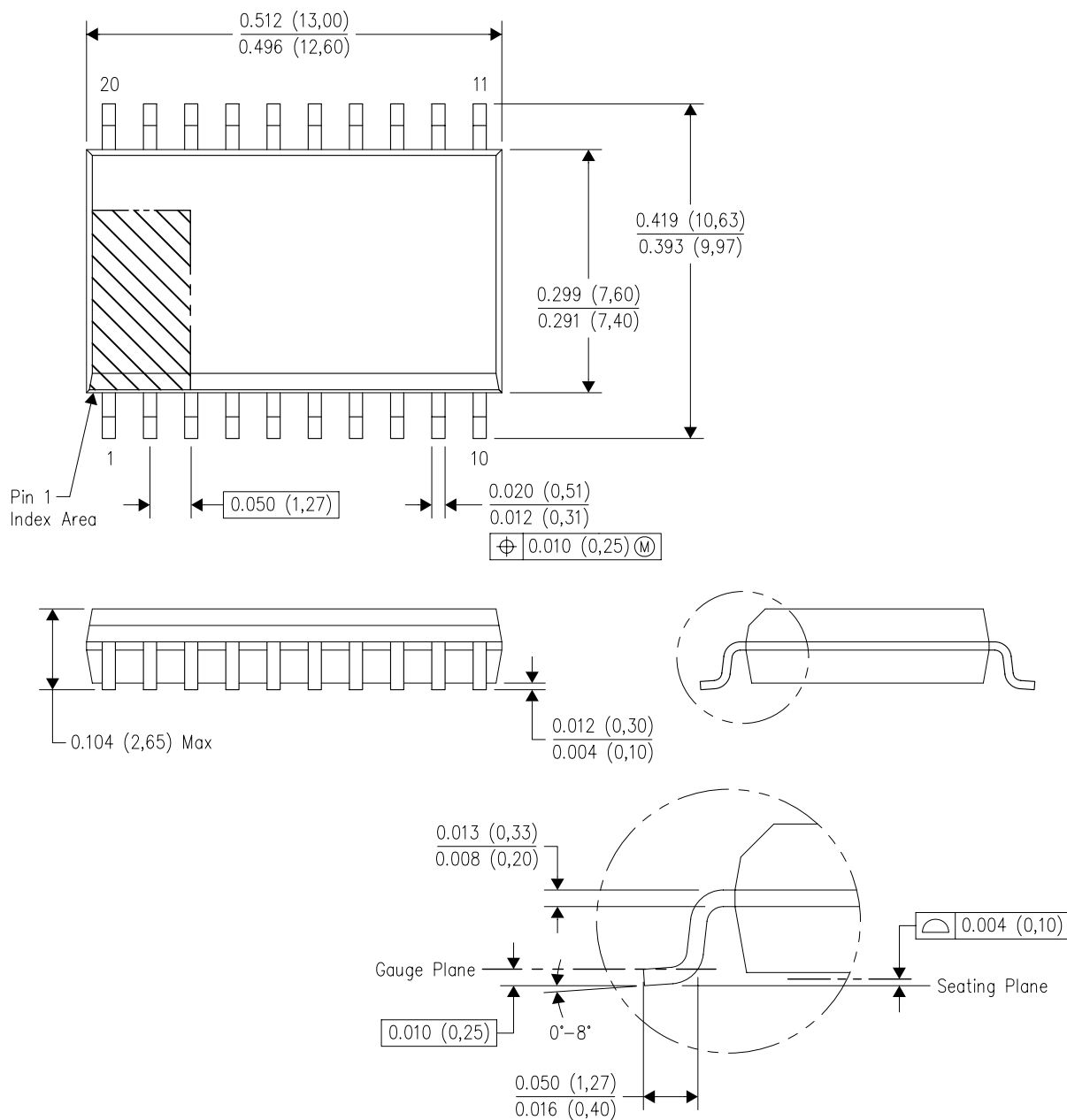


4204492/C 06/2007

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Falls within JEDEC MO-285 variation BC-2.
 - D. This package is lead-free. Refer to the 20 GQN package (drawing 4200704) for tin-lead (SnPb).

DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE

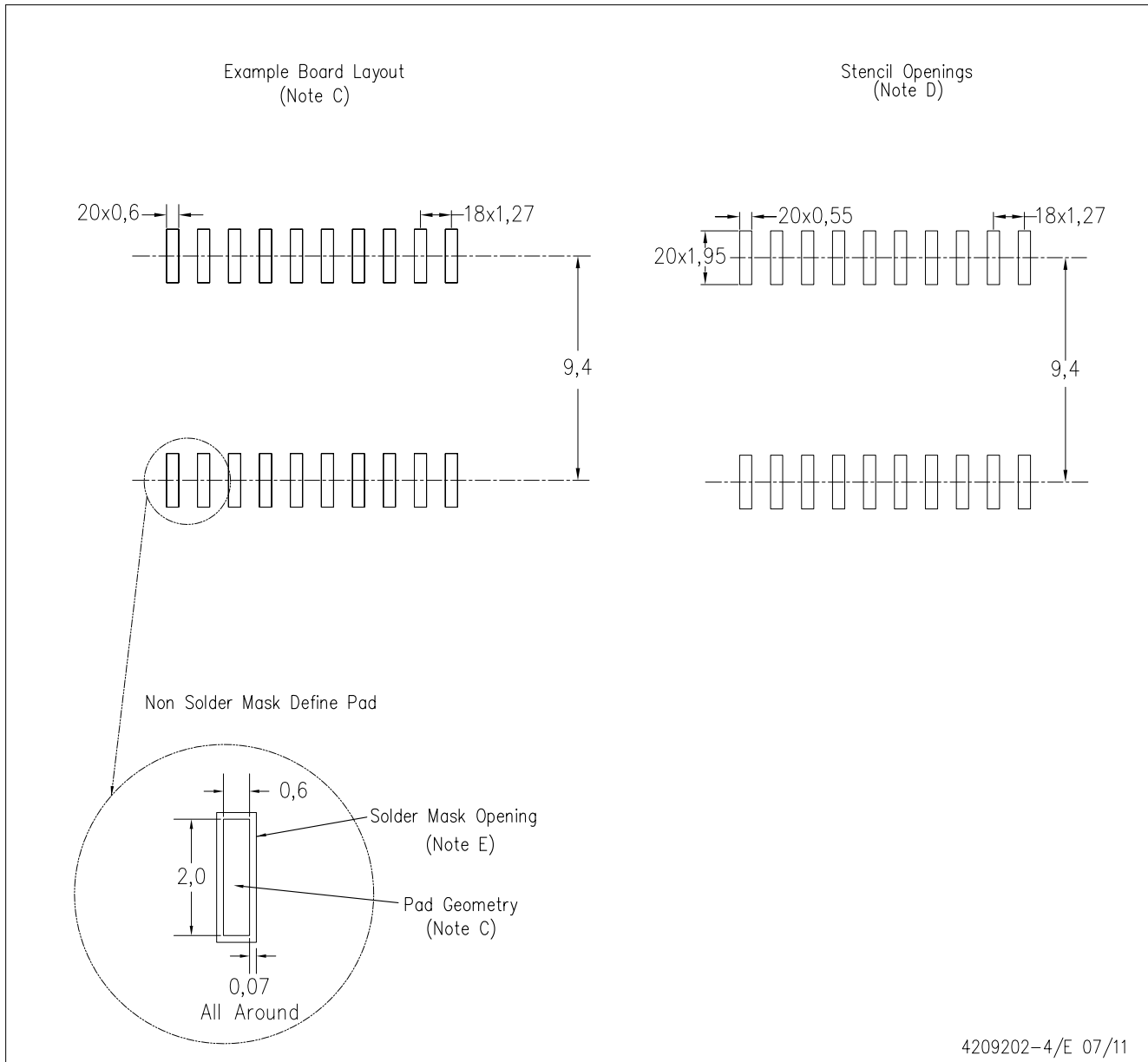


4040000-4/G 01/11

- NOTES: A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
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 AC.

DW (R-PDSO-G20)

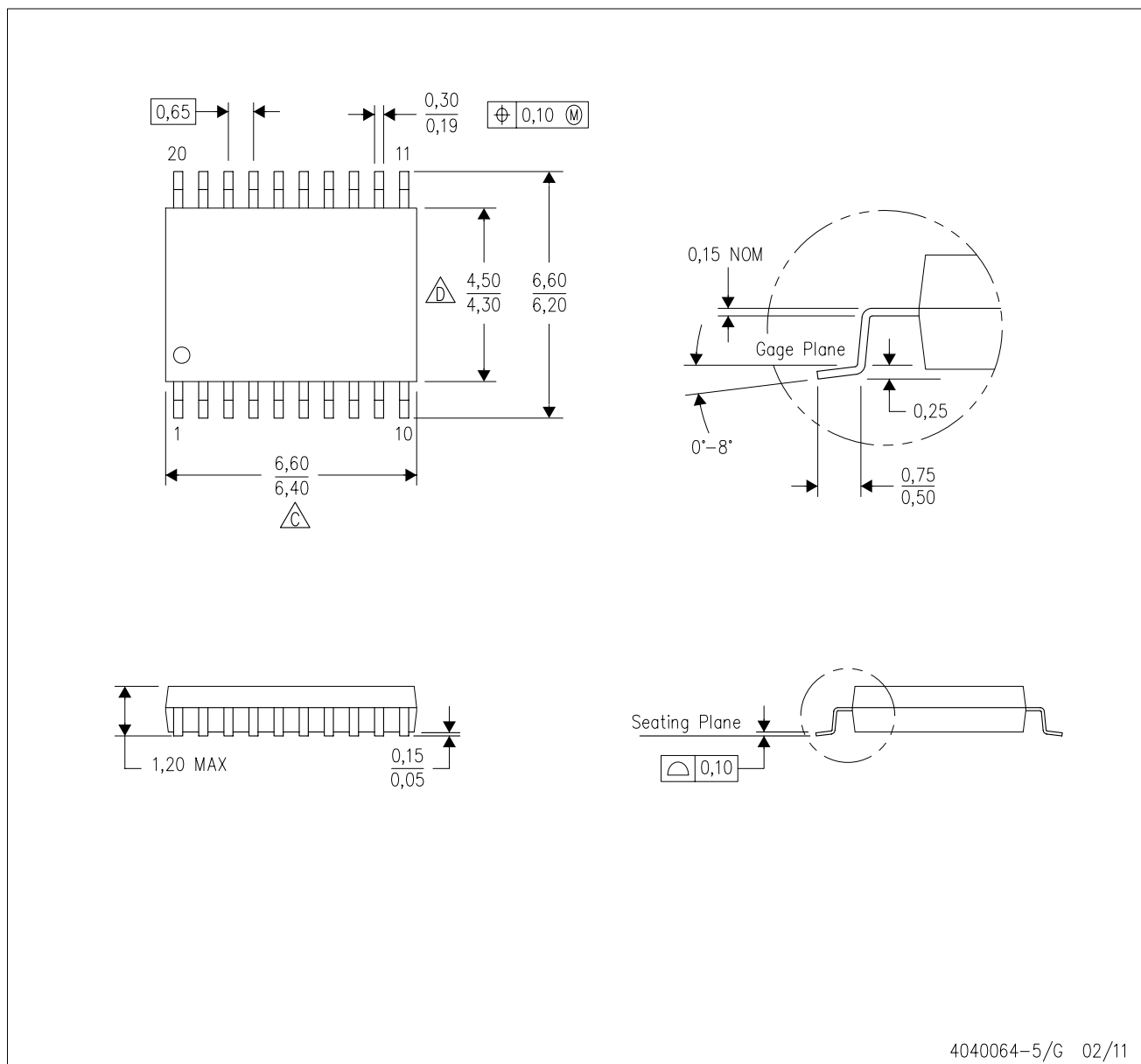
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Refer to IPC7351 for alternate board design.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G20)

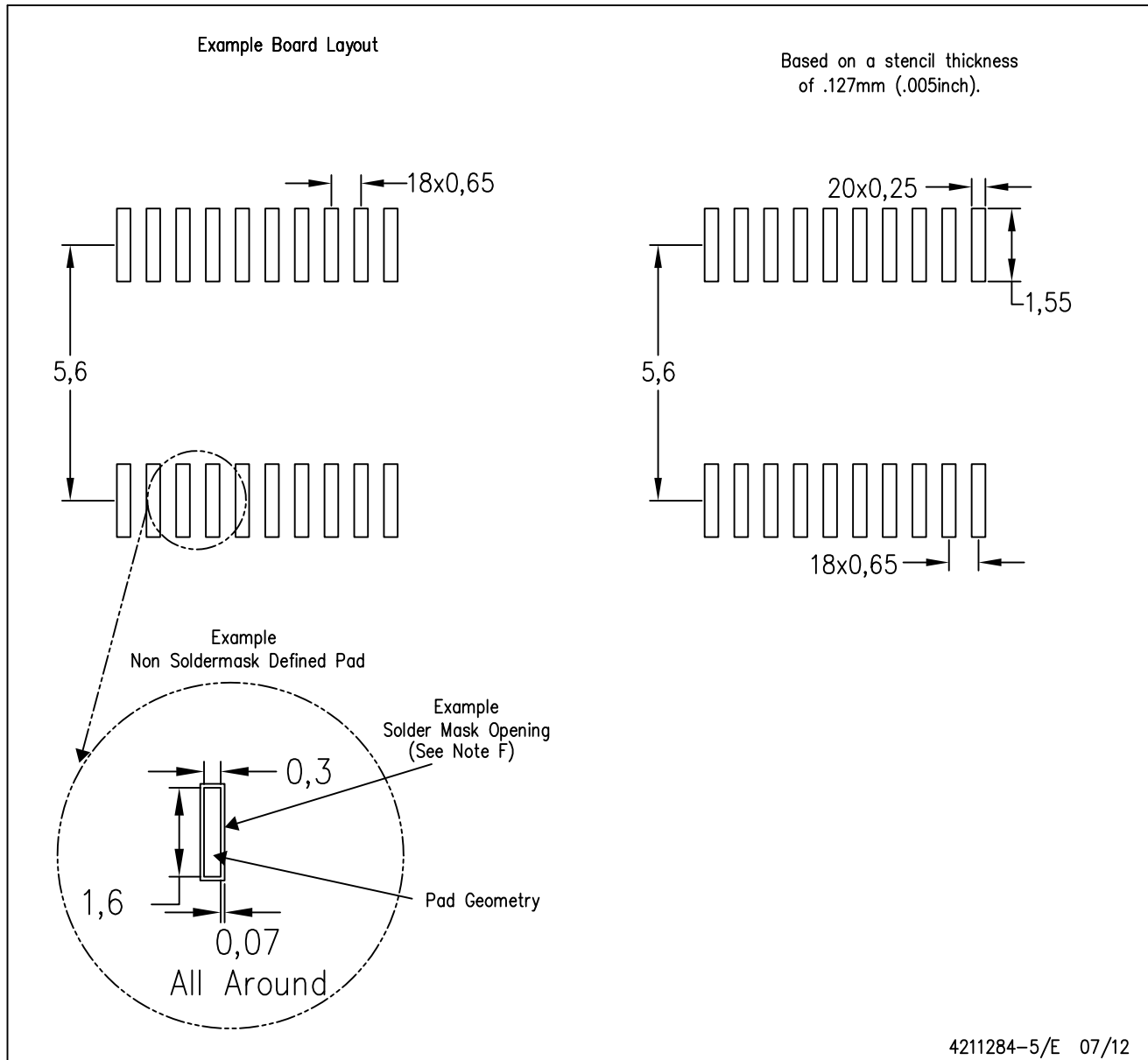
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
 - E. Falls within JEDEC MO-153

PW (R-PDSO-G20)

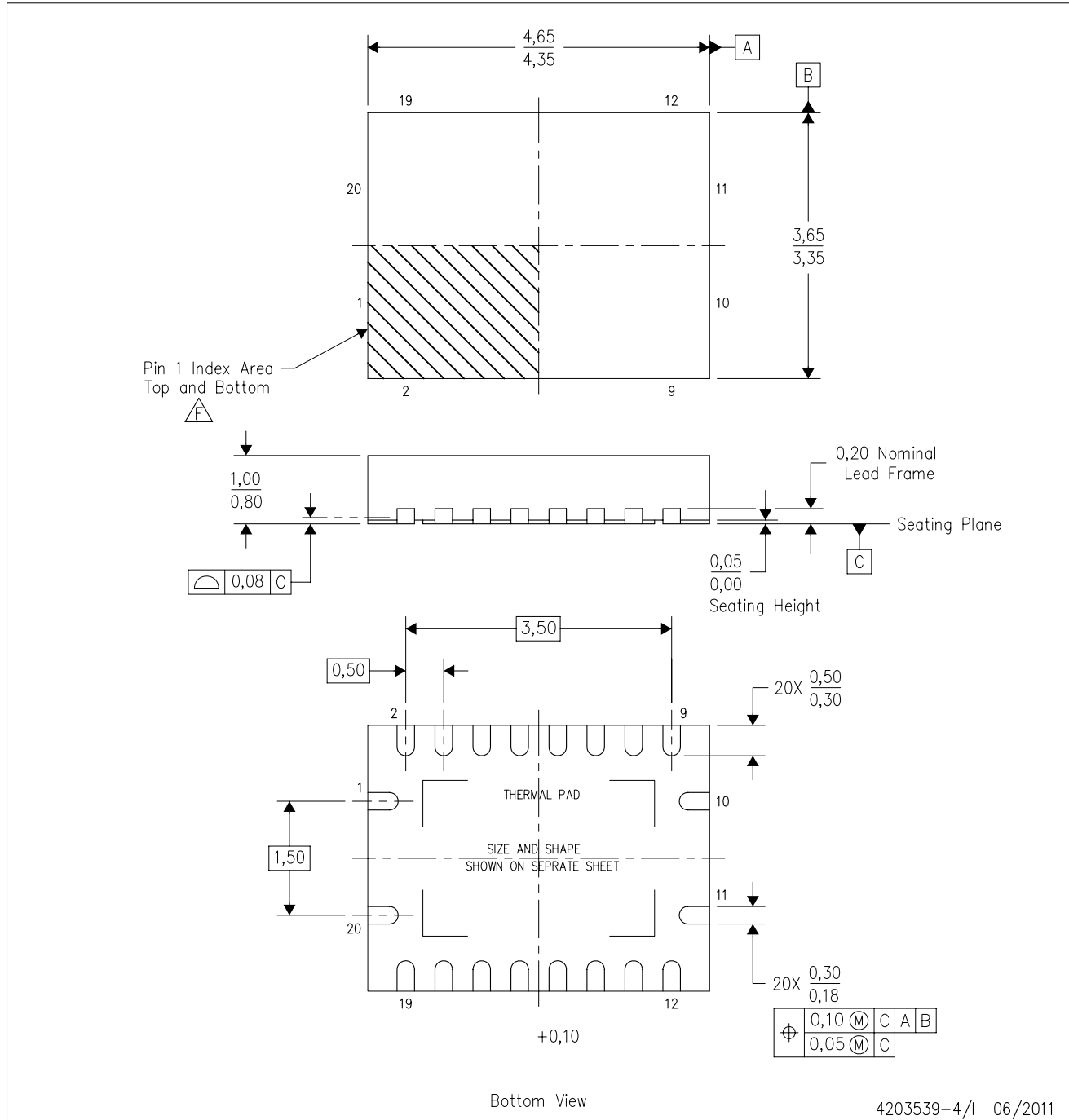
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate design.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

RGY (R-PVQFN-N20)

PLASTIC QUAD FLATPACK NO-LEAD



4203539-4/I 06/2011

- NOTES:
- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - This drawing is subject to change without notice.
 - QFN (Quad Flatpack No-Lead) package configuration.
 - The package thermal pad must be soldered to the board for thermal and mechanical performance.
 - See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
 - Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.
 - Package complies to JEDEC MO-241 variation BA.

RGY (R-PVQFN-N20)

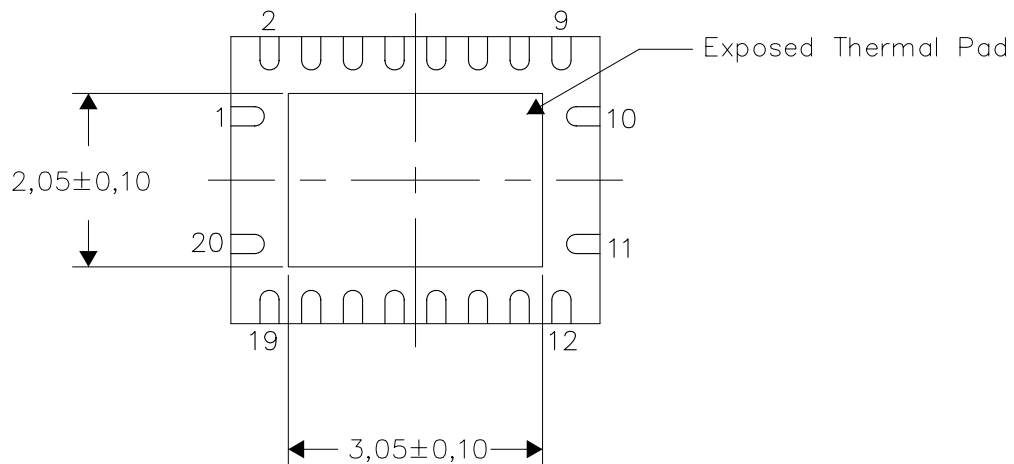
PLASTIC QUAD FLATPACK NO-LEAD

THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at www.ti.com.

The exposed thermal pad dimensions for this package are shown in the following illustration.



Bottom View

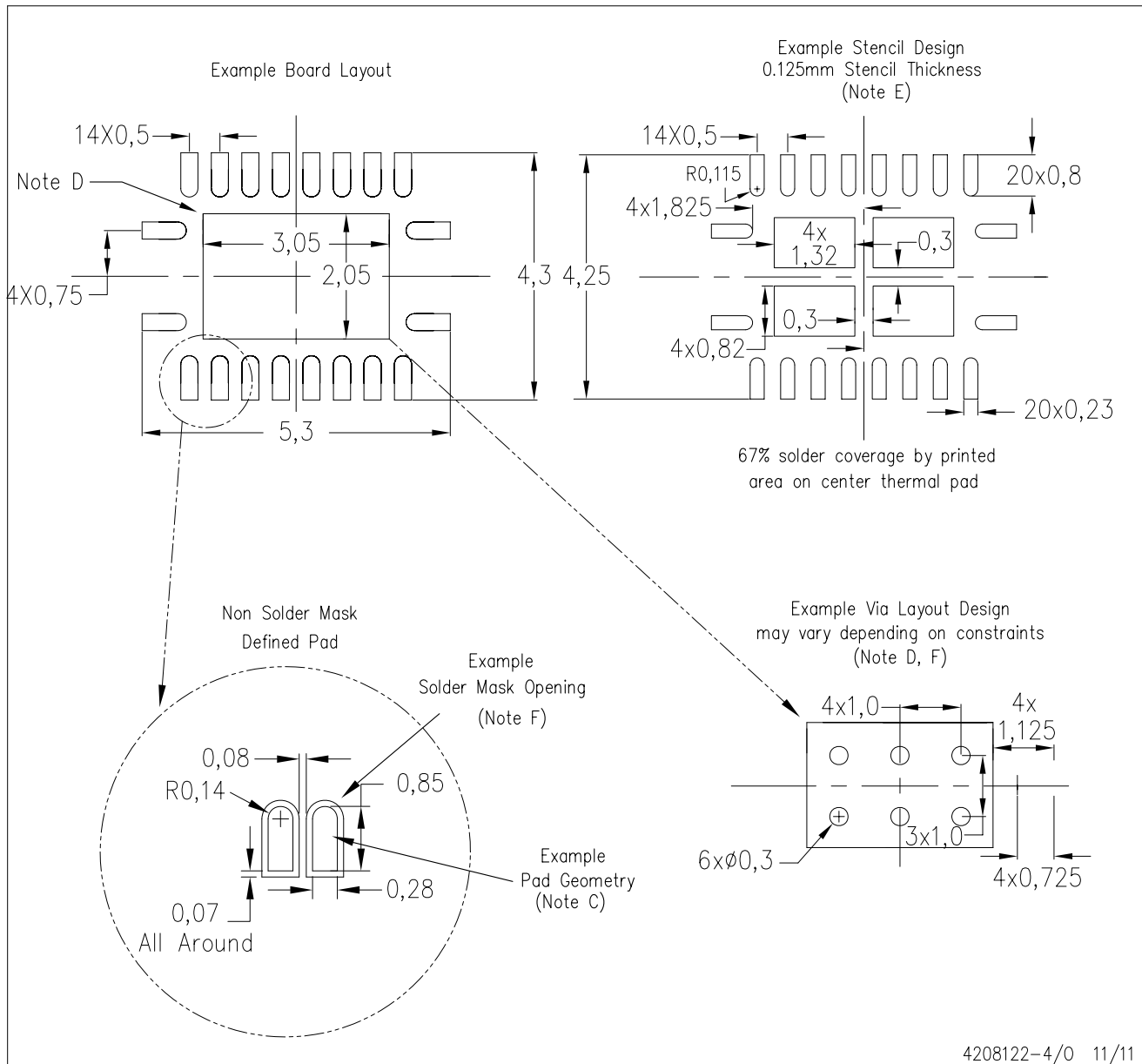
Exposed Thermal Pad Dimensions

4206353-4/0 11/11

NOTE: All linear dimensions are in millimeters

RGY (R-PVQFN-N20)

PLASTIC QUAD FLATPACK NO-LEAD



4208122-4/0 11/11

- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat-Pack QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at www.ti.com <<http://www.ti.com>>.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations.
 - Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

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 TI 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. Information of third parties may be subject to additional restrictions.

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.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

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

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Mobile Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community Home Page

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2012, Texas Instruments Incorporated