

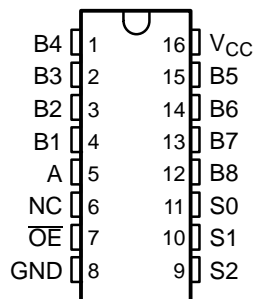
## FEATURES

- High-Bandwidth Data Path (up to 500 MHz <sup>(1)</sup>)
- Equivalent to IDTQS3VH251 Device
- 5-V Tolerant I/Os With Device Powered Up or Powered Down
- Low and Flat ON-State Resistance ( $r_{on}$ ) Characteristics Over Operating Range ( $r_{on} = 4 \Omega$  Typ)
- Rail-to-Rail Switching on Data I/O Ports
  - 0- to 5-V Switching With 3.3-V  $V_{CC}$
  - 0- to 3.3-V Switching With 2.5-V  $V_{CC}$
- Bidirectional Data Flow With Near-Zero Propagation Delay
- Low Input/Output Capacitance Minimizes Loading and Signal Distortion ( $C_{io(OFF)} = 3.5 \text{ pF}$  Typ)
- Fast Switching Frequency ( $f_{OE}$  or  $f_S = 20 \text{ MHz}$  Max)

(1) For additional information regarding the performance characteristics of the CB3Q family, refer to the TI application report, *CBT-C, CB3T, and CB3Q Signal-Switch Families*, literature number SCDA008.

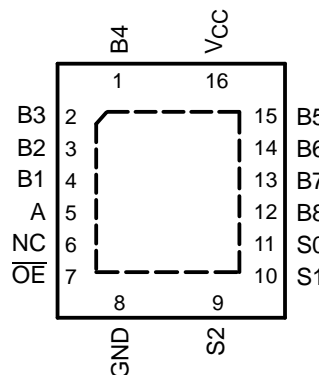
- Data and Control Inputs Provide Undershoot Clamp Diodes
- Low Power Consumption ( $I_{CC} = 1 \text{ mA}$  Typ)
- $V_{CC}$  Operating Range From 2.3 V to 3.6 V
- Data I/Os Support 0- to 5-V Signaling Levels (0.8 V, 1.2 V, 1.5 V, 1.8 V, 2.5 V, 3.3 V, 5 V)
- Control Inputs Can Be Driven by TTL or 5-V/3.3-V CMOS Outputs
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Performance Tested Per JESD 22
  - 2000-V Human-Body Model (A114-B, Class II)
  - 1000-V Charged-Device Model (C101)
- Supports Both Digital and Analog Applications: PCI Interface, Differential Signal Interface, Memory Interleaving, Bus Isolation, Low-Distortion Signal Gating

DBQ, DGV, OR PW PACKAGE  
(TOP VIEW)



NC - No internal connection

RGY PACKAGE  
(TOP VIEW)



NC - No internal connection

## DESCRIPTION/ORDERING INFORMATION

The SN74CB3Q3251 is a high-bandwidth FET bus switch utilizing a charge pump to elevate the gate voltage of the pass transistor, providing a low and flat ON-state resistance ( $r_{on}$ ). The low and flat ON-state resistance allows for minimal propagation delay and supports rail-to-rail switching on the data input/output (I/O) ports. The device also features low data I/O capacitance to minimize capacitive loading and signal distortion on the data bus. Specifically designed to support high-bandwidth applications, the SN74CB3Q3251 provides an optimized interface solution ideally suited for broadband communications, networking, and data-intensive computing systems.



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.

**SN74CB3Q3251**  
**1-OF-8 FET MULTIPLEXER/DEMULTIPLEXER**  
**2.5-V/3.3-V LOW-VOLTAGE HIGH-BANDWIDTH BUS SWITCH**

SCDS173A–AUGUST 2004–REVISED MARCH 2005

## DESCRIPTION/ORDERING INFORMATION (CONTINUED)

The SN74CB3Q3251 is a 1-of-8 multiplexer/demultiplexer with a single output-enable ( $\overline{OE}$ ) input. The select (S0, S1, S2) inputs control the data path of the multiplexer/demultiplexer. When  $\overline{OE}$  is low, the multiplexer/demultiplexer is enabled, and the A port is connected to the B port, allowing bidirectional data flow between ports. When  $\overline{OE}$  is high, the multiplexer/demultiplexer is disabled, and a high-impedance state exists between the A and B ports.

This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry prevents damaging current backflow through the device when it is powered down. The device has isolation during power off.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

## ORDERING INFORMATION

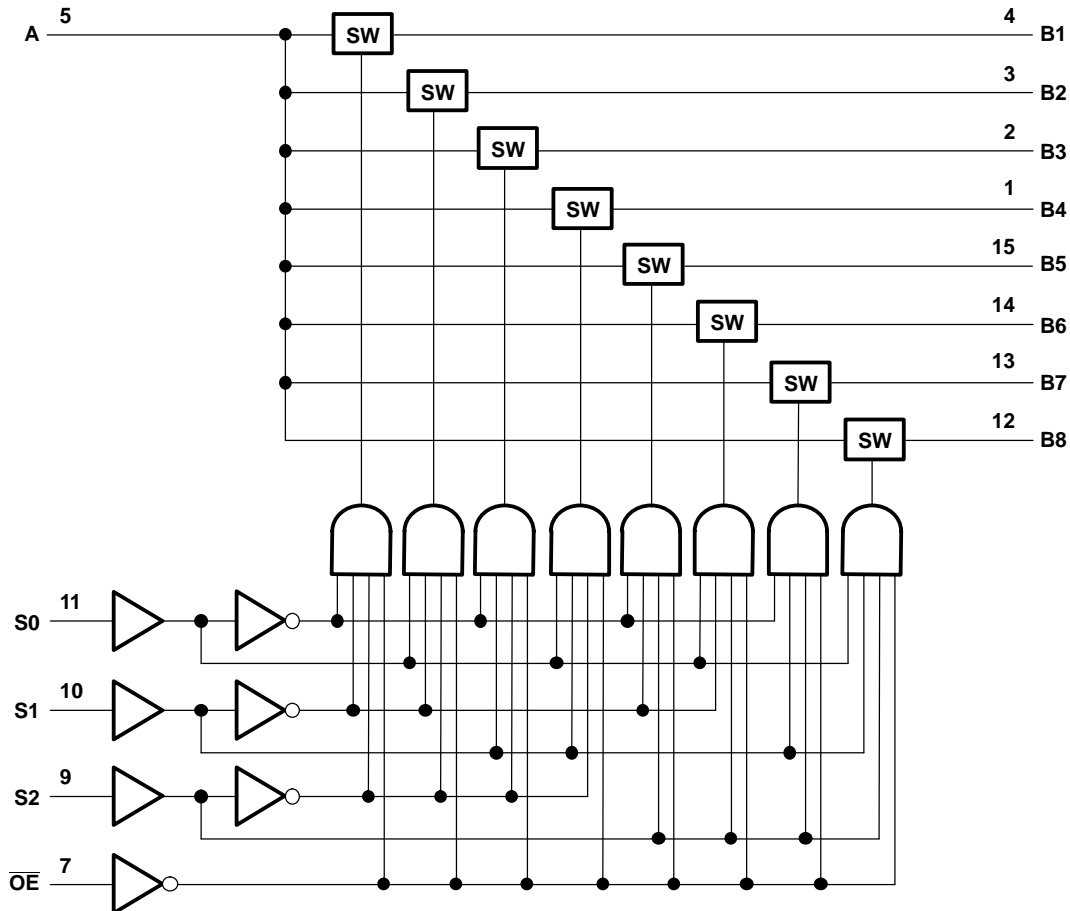
$T_A$	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QFN – RGY	Tape and reel	SN74CB3Q3251RGYR	BU251
	SSOP (QSOP) – DBQ	Tape and reel	SN74CB3Q3251DBQR	BU251
	TSSOP – PW	Tube	SN74CB3Q3251PW	BU251
		Tape and reel	SN74CB3Q3251PWR	
	TVSOP – DGV	Tape and reel	SN74CB3Q3251DGVR	BU251

(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).

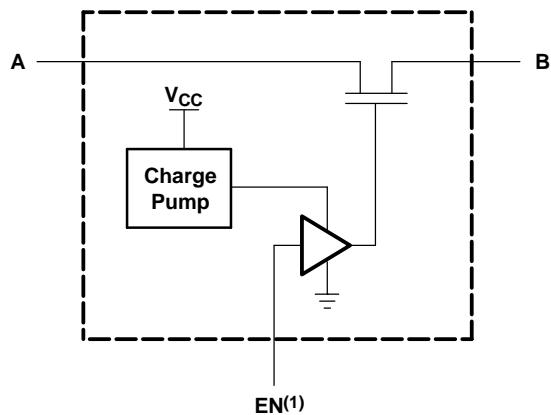
## FUNCTION TABLE

INPUTS				INPUT/OUTPUT A	FUNCTION
$\overline{OE}$	S2	S1	S0		
L	L	L	L	B1	A port = B1 port
L	L	L	H	B2	A port = B2 port
L	L	H	L	B3	A port = B3 port
L	L	H	H	B4	A port = B4 port
L	H	L	L	B5	A port = B5 port
L	H	L	H	B6	A port = B6 port
L	H	H	L	B7	A port = B7 port
L	H	H	H	B8	A port = B8 port
H	X	X	X	Z	Disconnect

### LOGIC DIAGRAM (POSITIVE LOGIC)



### SIMPLIFIED SCHEMATIC, EACH FET SWITCH (SW)



(1) EN is the internal enable signal applied to the switch.

**SN74CB3Q3251**  
**1-OF-8 FET MULTIPLEXER/DEMULTIPLEXER**  
**2.5-V/3.3-V LOW-VOLTAGE HIGH-BANDWIDTH BUS SWITCH**

SCDS173A–AUGUST 2004–REVISED MARCH 2005

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

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

			MIN	MAX	UNIT
$V_{CC}$	Supply voltage range		–0.5	4.6	V
$V_{IN}$	Control input voltage range <sup>(2)(3)</sup>		–0.5	7	V
$V_{I/O}$	Switch I/O voltage range <sup>(2)(3)(4)</sup>		–0.5	7	V
$I_{IK}$	Control input clamp current	$V_{IN} < 0$		–50	mA
$I_{I/O}$	I/O port clamp current	$V_{I/O} < 0$		–50	mA
$I_{I/O}$	ON-state switch current <sup>(5)</sup>			±64	mA
	Continuous current through $V_{CC}$ or GND			±100	mA
$\theta_{JA}$	Package thermal impedance	DBQ package <sup>(6)</sup>		90	°C/W
		DGV package <sup>(6)</sup>		120	
		PW package <sup>(6)</sup>		108	
		RGY package <sup>(7)</sup>		39	
$T_{stg}$	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) All voltages are with respect to ground unless otherwise specified.
- (3) The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (4)  $V_I$  and  $V_O$  are used to denote specific conditions for  $V_{I/O}$ .
- (5)  $I_I$  and  $I_O$  are used to denote specific conditions for  $I_{I/O}$ .
- (6) The package thermal impedance is calculated in accordance with JESD 51-7.
- (7) The package thermal impedance is calculated in accordance with JESD 51-5.

**Recommended Operating Conditions<sup>(1)</sup>**

			MIN	MAX	UNIT
$V_{CC}$	Supply voltage		2.3	3.6	V
$V_{IH}$	High-level control input voltage	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.7	5.5	V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	2	5.5	
$V_{IL}$	Low-level control input voltage	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	0	0.7	V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	0	0.8	
$V_{I/O}$	Data input/output voltage		0	5.5	V
$T_A$	Operating free-air temperature		–40	85	°C

- (1) All unused control 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.

## Electrical Characteristics<sup>(1)</sup>

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

PARAMETER		TEST CONDITIONS		MIN	TYP <sup>(2)</sup>	MAX	UNIT
$V_{IK}$		$V_{CC} = 3.6\text{ V}$ ,	$I_I = -18\text{ mA}$			-1.8	V
$I_{IN}$	Control inputs	$V_{CC} = 3.6\text{ V}$ ,	$V_{IN} = 0\text{ to }5.5\text{ V}$			±1	μA
$I_{OZ}$ <sup>(3)</sup>		$V_{CC} = 3.6\text{ V}$ ,	$V_O = 0\text{ to }5.5\text{ V}$ , $V_I = 0$ , Switch OFF, $V_{IN} = V_{CC}\text{ or GND}$			±1	μA
$I_{off}$		$V_{CC} = 0$ ,	$V_O = 0\text{ to }5.5\text{ V}$ , $V_I = 0$			1	μA
$I_{CC}$		$V_{CC} = 3.6\text{ V}$ ,	$I_{IO} = 0$ , Switch ON or OFF, $V_{IN} = V_{CC}\text{ or GND}$		1	4	mA
$\Delta I_{CC}$ <sup>(4)</sup>	Control inputs	$V_{CC} = 3.6\text{ V}$ ,	One input at 3 V, Other inputs at $V_{CC}\text{ or GND}$			30	μA
$I_{CCD}$ <sup>(5)</sup>	Per control input	$V_{CC} = 3.6\text{ V}$ ,	A and B ports open, Control input switching at 50% duty cycle		0.03	0.1	mA/ MHz
$C_{in}$	Control inputs	$V_{CC} = 3.3\text{ V}$ ,	$V_{IN} = 5.5\text{ V}$ , 3.3 V, or 0		2.5	4.5	pF
$C_{io(OFF)}$	A port	$V_{CC} = 3.3\text{ V}$ ,	Switch OFF, $V_{IN} = V_{CC}\text{ or GND}$ , $V_{IO} = 5.5\text{ V}$ , 3.3 V, or 0		19.5	25	pF
	B port	$V_{CC} = 3.3\text{ V}$ ,	Switch OFF, $V_{IN} = V_{CC}\text{ or GND}$ , $V_{IO} = 5.5\text{ V}$ , 3.3 V, or 0		3.5	4.5	
$C_{io(ON)}$		$V_{CC} = 3.3\text{ V}$ ,	Switch ON, $V_{IN} = V_{CC}\text{ or GND}$ , $V_{IO} = 5.5\text{ V}$ , 3.3 V, or 0		15	19	pF
$r_{on}$ <sup>(6)</sup>		$V_{CC} = 2.3\text{ V}$ , TYP at $V_{CC} = 2.5\text{ V}$	$V_I = 0$ , $I_O = 30\text{ mA}$		4	10	Ω
			$V_I = 1.7\text{ V}$ , $I_O = -15\text{ mA}$		4.5	11	
		$V_{CC} = 3\text{ V}$	$V_I = 0$ , $I_O = 30\text{ mA}$		3.5	8	
			$V_I = 2.4\text{ V}$ , $I_O = -15\text{ mA}$		4	10	

(1)  $V_{IN}$  and  $I_{IN}$  refer to control inputs.  $V_I$ ,  $V_O$ ,  $I_I$ , and  $I_O$  refer to data pins.

(2) All typical values are at  $V_{CC} = 3.3\text{ V}$  (unless otherwise noted),  $T_A = 25^\circ\text{C}$ .

(3) For I/O ports, the parameter  $I_{OZ}$  includes the input leakage current.

(4) This is the increase in supply current for each input that is at the specified TTL voltage level, rather than  $V_{CC}$  or GND.

(5) This parameter specifies the dynamic power-supply current associated with the operating frequency of a single control input (see Figure 2).

(6) Measured by the voltage drop between the A and B terminals at the indicated current through the switch. ON-state resistance is determined by the lower of the voltages of the two (A or B) terminals.

## Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$		$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		UNIT
			MIN	MAX	MIN	MAX	
$f_{OE}\text{ or }f_S$ <sup>(1)</sup>	$\overline{OE}$ or S	A or B		10		20	MHz
$t_{pd}$ <sup>(2)</sup>	A or B	B or A		0.12		0.18	ns
$t_{pd(s)}$	S	A	1.5	6.7	1.5	5.9	ns
$t_{en}$	S	B	1.5	6.7	1.5	5.9	ns
	$\overline{OE}$	A or B	1.5	6.7	1.5	5.9	
$t_{dis}$	S	B	0.5	6.1	0.5	6.1	ns
	$\overline{OE}$	A or B	0.5	6.1	0.5	6.1	

(1) Maximum switching frequency for control input ( $V_O > V_{CC}$ ,  $V_I = 5\text{ V}$ ,  $R_L \geq 1\text{ M}\Omega$ ,  $C_L = 0$ ).

(2) 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).

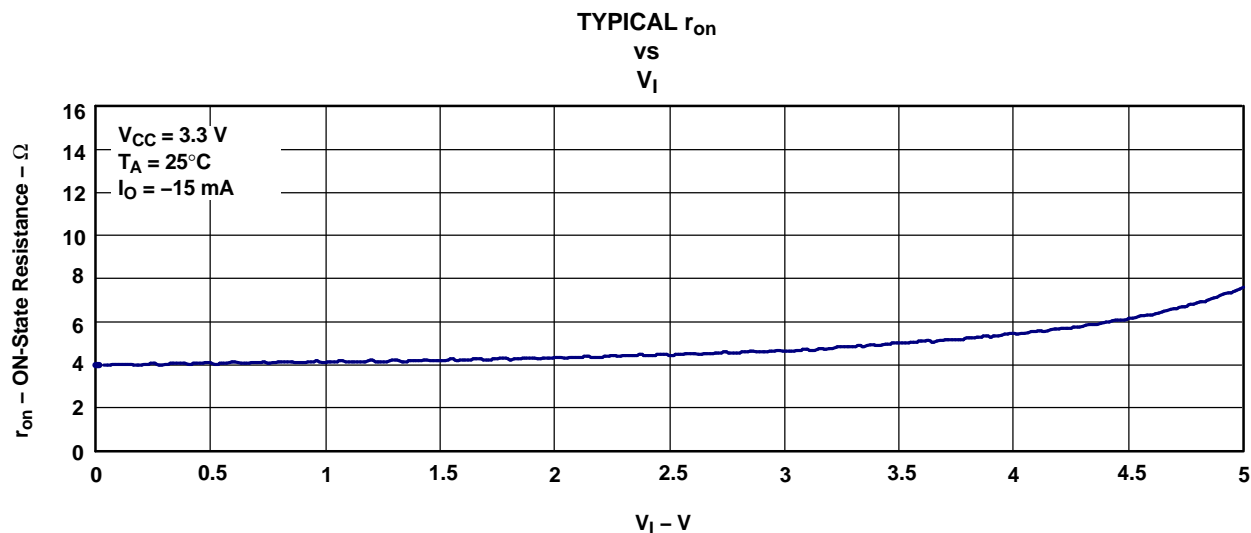


Figure 1. Typical  $r_{on}$  vs  $V_I$ ,  $V_{CC} = 3.3\text{ V}$  and  $I_O = -15\text{ mA}$

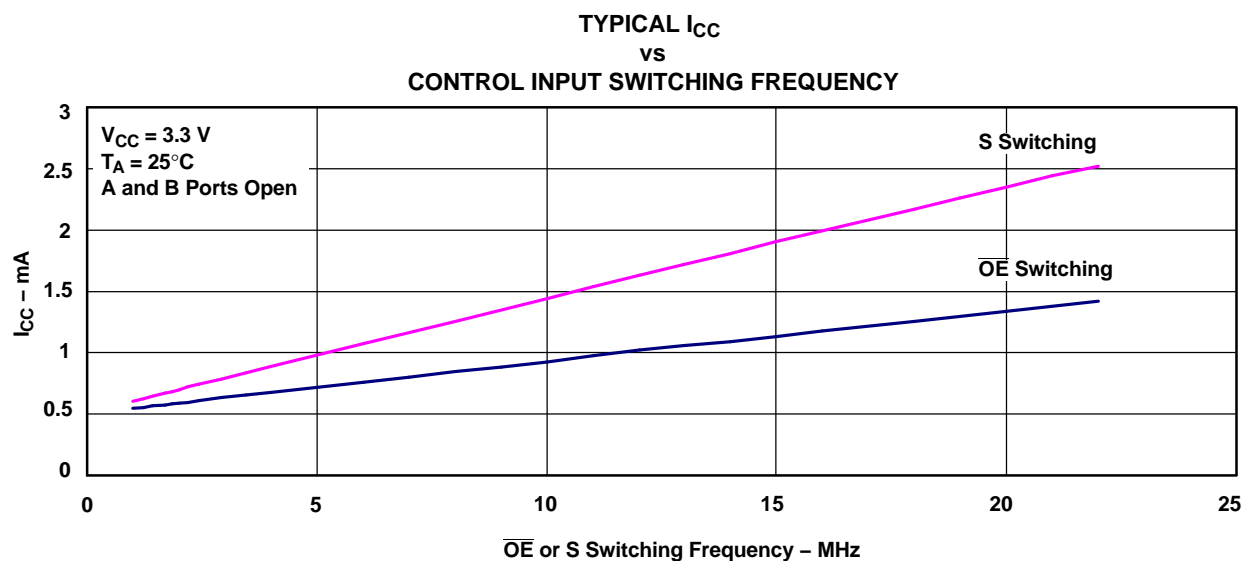
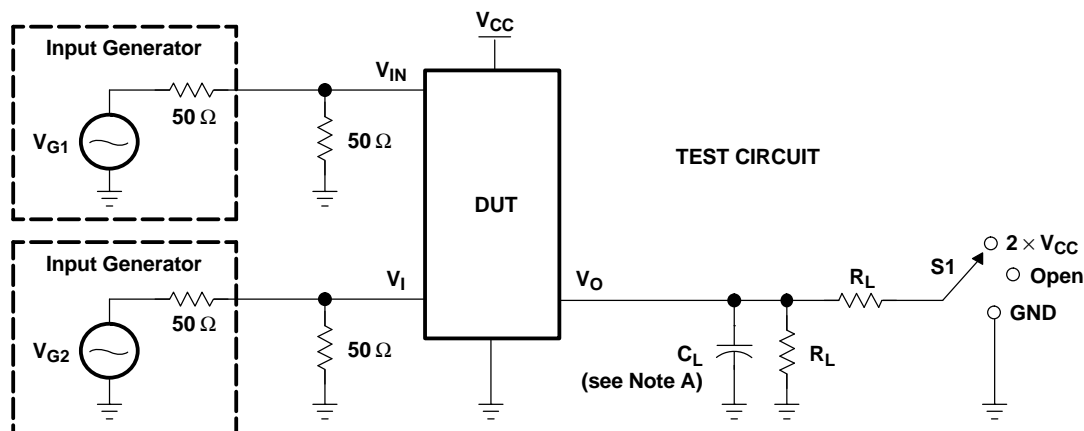
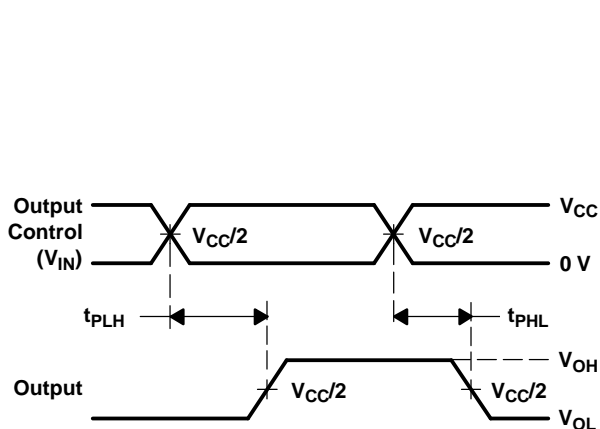


Figure 2. Typical  $I_{CC}$  vs  $\overline{\text{OE}}$  or S Switching Frequency,  $V_{CC} = 3.3\text{ V}$

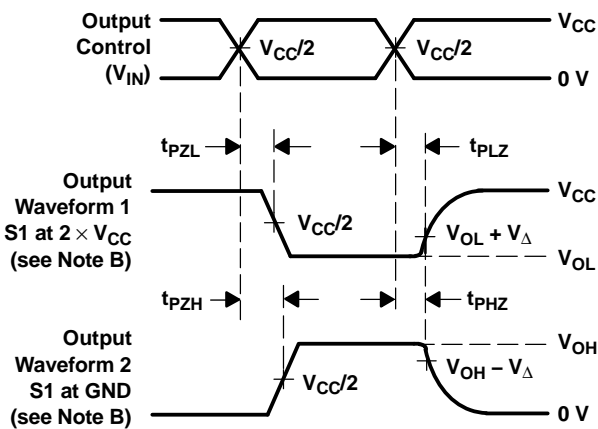
## PARAMETER MEASUREMENT INFORMATION



TEST	V <sub>CC</sub>	S1	R <sub>L</sub>	V <sub>I</sub>	C <sub>L</sub>	V <sub>Δ</sub>
t <sub>pd(s)</sub>	2.5 V ± 0.2 V 3.3 V ± 0.3 V	Open Open	500 Ω 500 Ω	V <sub>CC</sub> or GND V <sub>CC</sub> or GND	30 pF 50 pF	
t <sub>PLZ</sub> /t <sub>PZL</sub>	2.5 V ± 0.2 V 3.3 V ± 0.3 V	2 × V <sub>CC</sub> 2 × V <sub>CC</sub>	500 Ω 500 Ω	GND GND	30 pF 50 pF	0.15 V 0.3 V
t <sub>PHZ</sub> /t <sub>PZH</sub>	2.5 V ± 0.2 V 3.3 V ± 0.3 V	GND GND	500 Ω 500 Ω	V <sub>CC</sub> V <sub>CC</sub>	30 pF 50 pF	0.15 V 0.3 V



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES (t<sub>pd(s)</sub>)



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES

- NOTES:
- C<sub>L</sub> includes probe and jig capacitance.
  - Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
  - All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z<sub>O</sub> = 50 Ω, t<sub>r</sub> ≤ 2.5 ns, t<sub>f</sub> ≤ 2.5 ns.
  - The outputs are measured one at a time, with one transition per measurement.
  - t<sub>PLZ</sub> and t<sub>PZH</sub> are the same as t<sub>dis</sub>.
  - t<sub>PZL</sub> and t<sub>PZH</sub> are the same as t<sub>en</sub>.
  - t<sub>PLH</sub> and t<sub>PHL</sub> are the same as t<sub>pd(s)</sub>. The t<sub>pd</sub> 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).
  - All parameters and waveforms are not applicable to all devices.

Figure 3. Test Circuit and Voltage Waveforms

## PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">SN74CB3Q3251DBQR</a>	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	BU251
SN74CB3Q3251DBQR.A	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	BU251
SN74CB3Q3251DBQR.B	Active	Production	SSOP (DBQ)   16	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	BU251
<a href="#">SN74CB3Q3251DGVR</a>	Active	Production	TVSOP (DGV)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BU251
SN74CB3Q3251DGVR.B	Active	Production	TVSOP (DGV)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BU251
<a href="#">SN74CB3Q3251PW</a>	Obsolete	Production	TSSOP (PW)   16	-	-	Call TI	Call TI	-40 to 85	BU251
<a href="#">SN74CB3Q3251PWR</a>	Active	Production	TSSOP (PW)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BU251
SN74CB3Q3251PWR.A	Active	Production	TSSOP (PW)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BU251
SN74CB3Q3251PWR.B	Active	Production	TSSOP (PW)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BU251
SN74CB3Q3251PWRG4	Active	Production	TSSOP (PW)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BU251
SN74CB3Q3251PWRG4.A	Active	Production	TSSOP (PW)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BU251
SN74CB3Q3251PWRG4.B	Active	Production	TSSOP (PW)   16	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BU251
<a href="#">SN74CB3Q3251RGYR</a>	Active	Production	VQFN (RGY)   16	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	BZ51
SN74CB3Q3251RGYR.A	Active	Production	VQFN (RGY)   16	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	BZ51
SN74CB3Q3251RGYR.B	Active	Production	VQFN (RGY)   16	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	BZ51
SN74CB3Q3251RGYRG4	Active	Production	VQFN (RGY)   16	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	BZ51
SN74CB3Q3251RGYRG4.A	Active	Production	VQFN (RGY)   16	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	BZ51
SN74CB3Q3251RGYRG4.B	Active	Production	VQFN (RGY)   16	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	BZ51

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.



<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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## 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
SN74CB3Q3251DBQR	SSOP	DBQ	16	2500	330.0	12.5	6.4	5.2	2.1	8.0	12.0	Q1
SN74CB3Q3251DGVR	TVSOP	DGV	16	2000	330.0	12.4	6.8	4.0	1.6	8.0	12.0	Q1
SN74CB3Q3251PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74CB3Q3251PWRG4	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74CB3Q3251RGYR	VQFN	RGY	16	3000	330.0	12.4	3.8	4.3	1.5	8.0	12.0	Q1
SN74CB3Q3251RGYRG4	VQFN	RGY	16	3000	330.0	12.4	3.8	4.3	1.5	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)
SN74CB3Q3251DBQR	SSOP	DBQ	16	2500	353.0	353.0	32.0
SN74CB3Q3251DGVR	TVSOP	DGV	16	2000	367.0	367.0	35.0
SN74CB3Q3251PWR	TSSOP	PW	16	2000	367.0	367.0	35.0
SN74CB3Q3251PWRG4	TSSOP	PW	16	2000	367.0	367.0	35.0
SN74CB3Q3251RGYR	VQFN	RGY	16	3000	367.0	367.0	35.0
SN74CB3Q3251RGYRG4	VQFN	RGY	16	3000	367.0	367.0	35.0

## DGV (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

24 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194



**DBQ0016A**

# PACKAGE OUTLINE

**SSOP - 1.75 mm max height**

SHRINK SMALL-OUTLINE PACKAGE



4214846/A 03/2014

## NOTES:

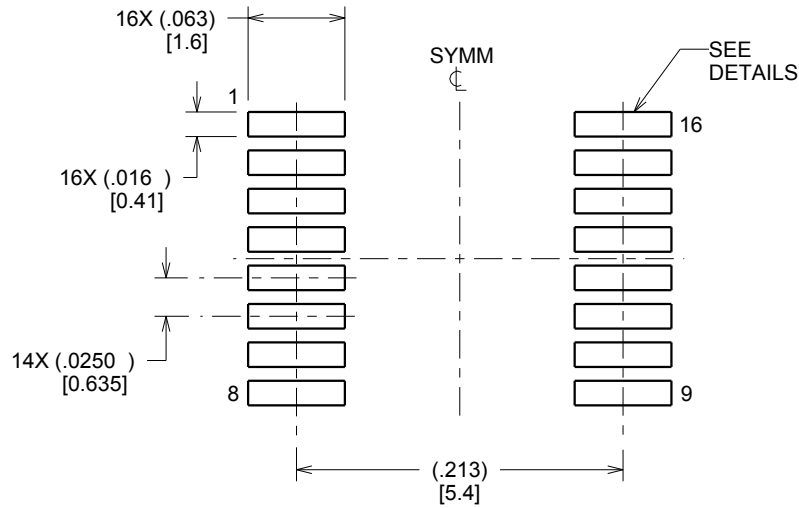
- Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 inch, per side.
- This dimension does not include interlead flash.
- Reference JEDEC registration MO-137, variation AB.

# EXAMPLE BOARD LAYOUT

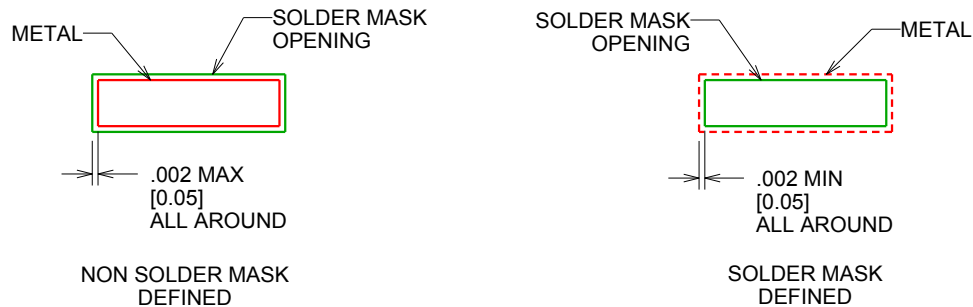
DBQ0016A

SSOP - 1.75 mm max height

SHRINK SMALL-OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
SCALE:8X



SOLDER MASK DETAILS

4214846/A 03/2014

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

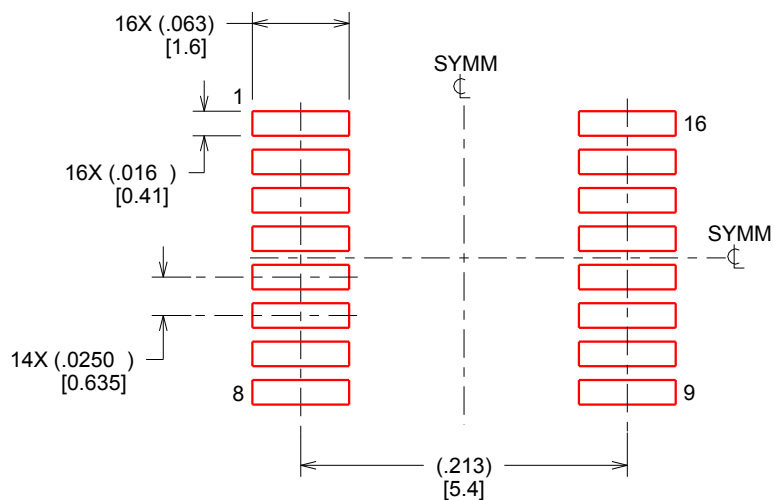
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DBQ0016A

SSOP - 1.75 mm max height

SHRINK SMALL-OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON .005 INCH [0.127 MM] THICK STENCIL  
SCALE:8X

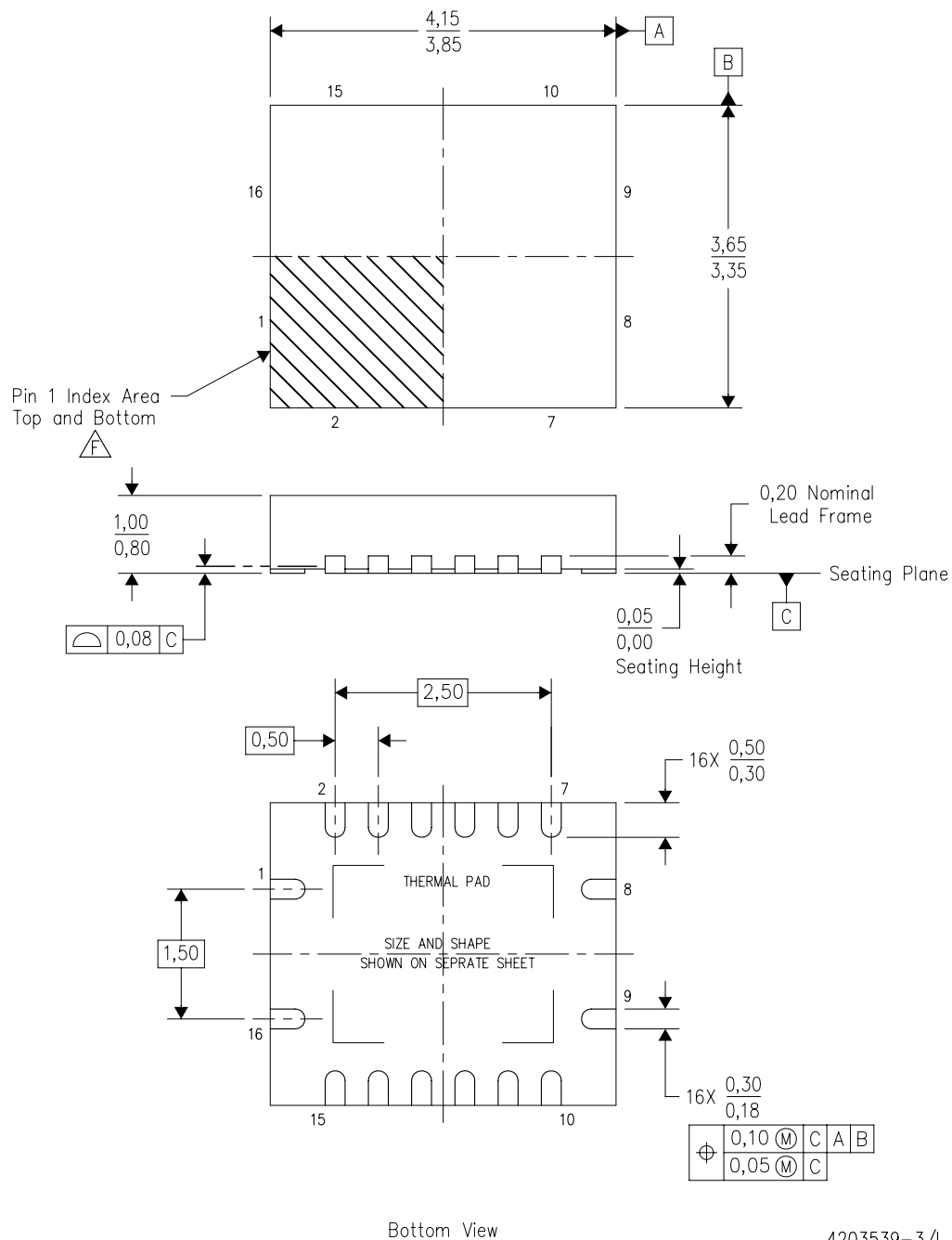
4214846/A 03/2014

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

RGY (R-PVQFN-N16)

PLASTIC QUAD FLATPACK NO-LEAD



4203539-3/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.
- F** 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-N16)

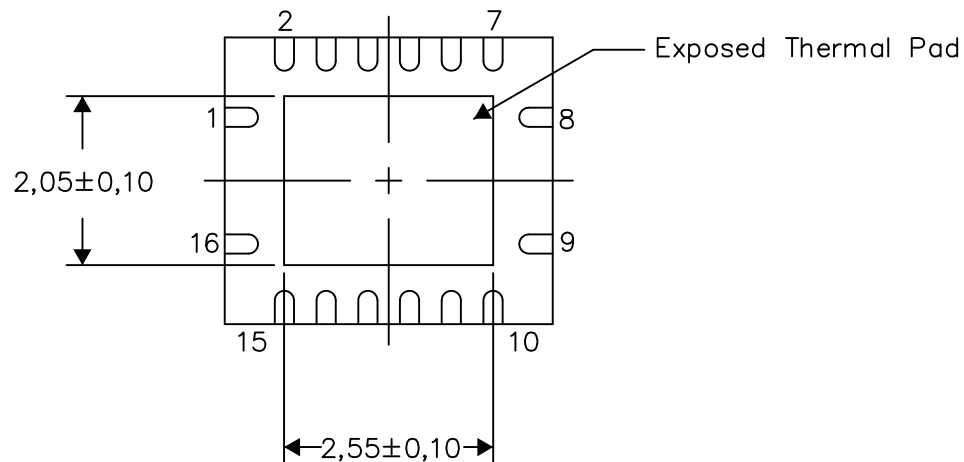
PLASTIC QUAD FLATPACK NO-LEAD

## 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](http://www.ti.com).

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



Bottom View

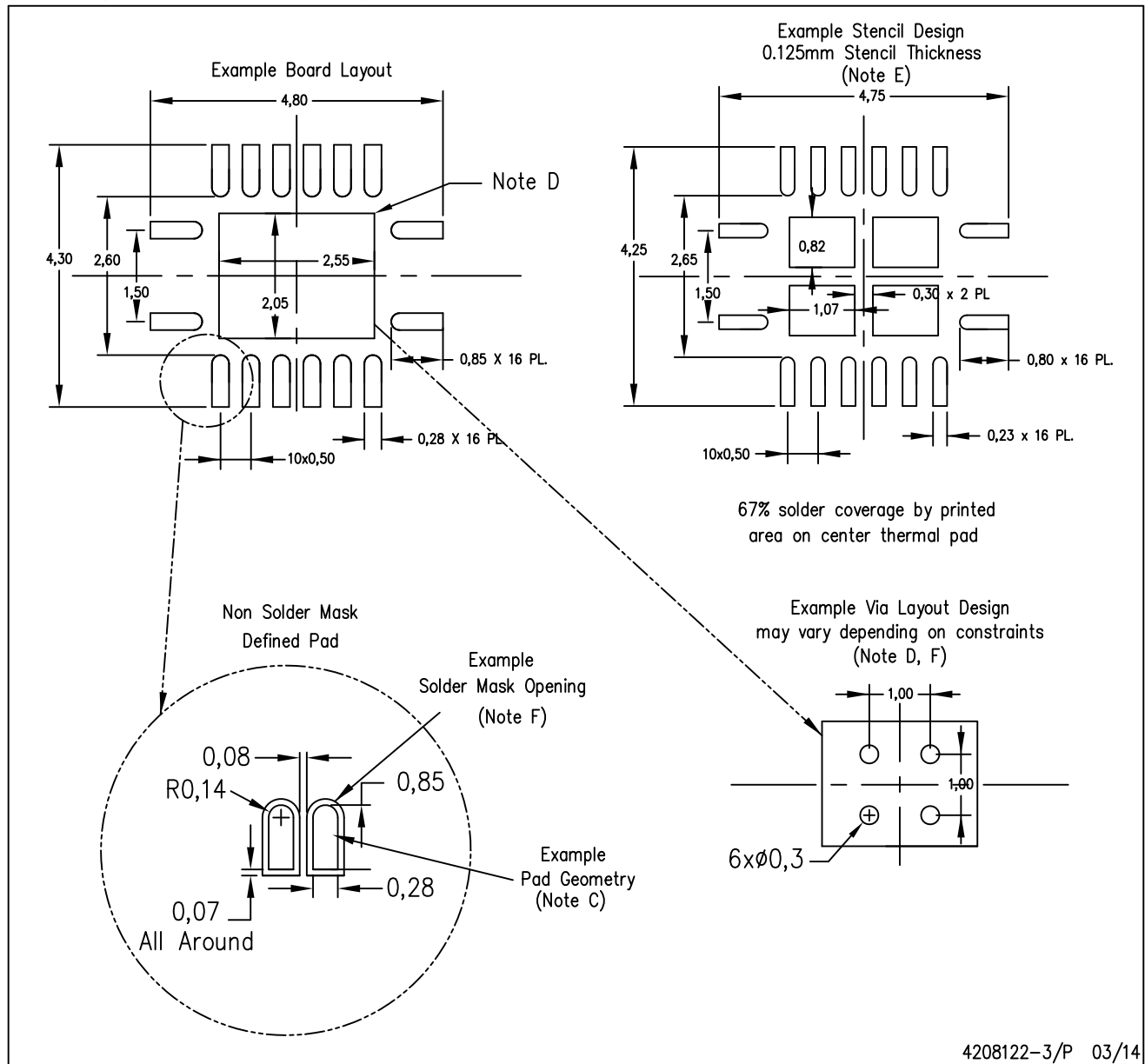
Exposed Thermal Pad Dimensions

4206353-3/P 03/14

NOTE: All linear dimensions are in millimeters

RGY (R-PVQFN-N16)

PLASTIC QUAD FLATPACK NO-LEAD



4208122-3/P 03/14

- 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) <<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.



4220204/A 02/2017

## NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

# EXAMPLE BOARD LAYOUT

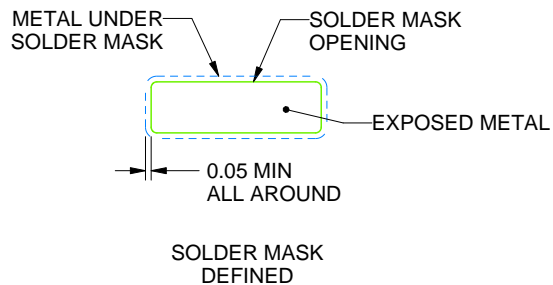
PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220204/A 02/2017

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

4220204/A 02/2017

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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