

SN74CB3Q3244

8-BIT FET BUS SWITCH

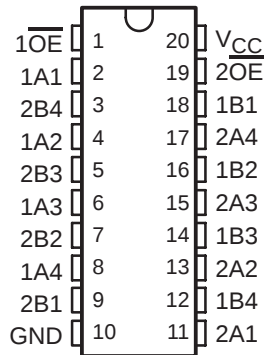
2.5-V/3.3-V LOW-VOLTAGE HIGH-BANDWIDTH BUS SWITCH

SCDS154B – OCTOBER 2003 – REVISED DECEMBER 2004

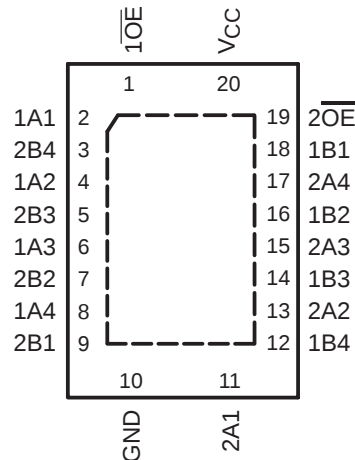
- High-Bandwidth Data Path (Up To 500 MHz[†])
- 5-V-Tolerant I/Os with Device Powered Up or Powered Down
- Low and Flat ON-State Resistance (r_{on}) Characteristics Over Operating Range ($r_{on} = 4\ \Omega$ Typical)
- Rail-to-Rail Switching on Data I/O Ports
 - 0- to 5-V Switching With 3.3-V V_{CC}
 - 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 ($C_{io(OFF)} = 3.5\text{ pF}$ Typical)
- Fast Switching Frequency ($f_{OE} = 20\text{ MHz}$ Max)
- Data and Control Inputs Provide Undershoot Clamp Diodes
- Low Power Consumption ($I_{CC} = 0.7\text{ mA}$ Typical)
- 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: Differential Signal Interface, Memory Interleaving, Bus Isolation, Low-Distortion Signal Gating

[†] 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.

DB, DBQ, DGV, DW, OR PW PACKAGE
(TOP VIEW)



RGY PACKAGE
(TOP VIEW)



description/ordering information

The SN74CB3Q3244 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 SN74CB3Q3244 provides an optimized interface solution ideally suited for broadband communications, networking, and data-intensive computing systems.



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SN74CB3Q3244

8-BIT FET BUS SWITCH

2.5-V/3.3-V LOW-VOLTAGE HIGH-BANDWIDTH BUS SWITCH

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description/ordering information (continued)

The SN74CB3Q3244 is organized as two 4-bit bus switches with separate output-enable ($\overline{1OE}$, $\overline{2OE}$) inputs. It can be used as two 4-bit bus switches or as one 8-bit bus switch. When $\overline{OE}$ is low, the associated 4-bit bus switch is ON, and the A port is connected to the B port, allowing bidirectional data flow between ports. When $\overline{OE}$ is high, the associated 4-bit bus switch is OFF, and the 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.

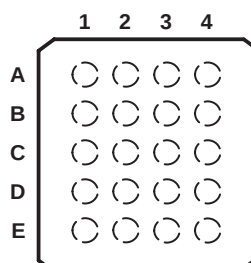
To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

ORDERING INFORMATION

TA	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	QFN – RGY	Tape and reel	SN74CB3Q3244RGYR	BU244
	SOIC – DW	Tube	SN74CB3Q3244DW	CB3Q3244
		Tape and reel	SN74CB3Q3244DWR	
	SSOP – DB	Tape and reel	SN74CB3Q3244DBR	BU244
	SSOP (QSOP) – DBQ	Tape and reel	SN74CB3Q3244DBQR	CB3Q3244
	TSSOP – PW	Tube	SN74CB3Q3244PW	BU244
		Tape and reel	SN74CB3Q3244PWR	
	TVSOP – DGV	Tape and reel	SN74CB3Q3244DGVR	BU244
	VFBGA – GQN	Tape and reel	SN74CB3Q3244GQNR	BU244

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

GQN PACKAGE (TOP VIEW)



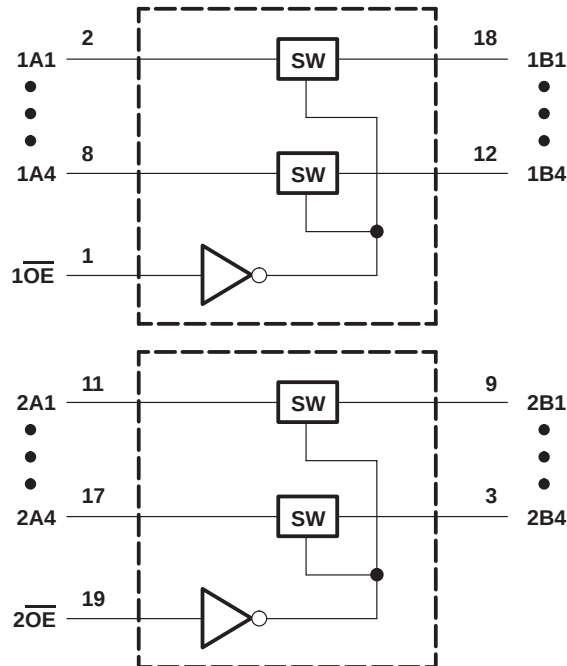
terminal assignments

	1	2	3	4
A	1A1	$\overline{1OE}$	V_{CC}	$\overline{2OE}$
B	1A2	2A4	2B4	1B1
C	1A3	2B3	2A3	1B2
D	1A4	2A2	2B2	1B3
E	GND	2B1	2A1	1B4

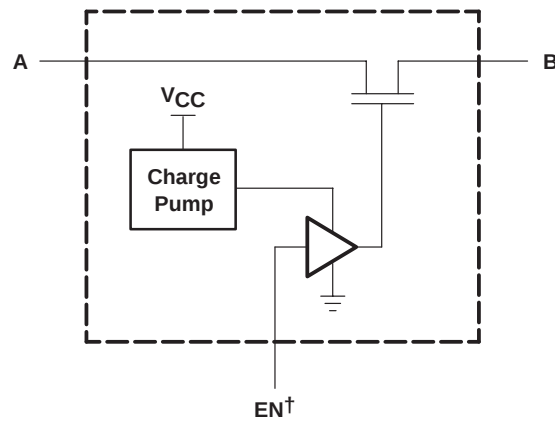
FUNCTION TABLE (each 4-bit bus switch)

INPUT $\overline{OE}$	INPUT/OUTPUT A	FUNCTION
L	B	A port = B port
H	Z	Disconnect

logic diagram (positive logic)



simplified schematic, each FET switch (SW)



† EN is the internal enable signal applied to the switch.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage range, V_{CC}	–0.5 V to 4.6 V
Control input voltage range, V_{IN} (see Notes 1 and 2)	–0.5 V to 7 V
Switch I/O voltage range, $V_{I/O}$ (see Notes 1, 2, and 3)	–0.5 V to 7 V
Control input clamp current, I_{IK} ($V_{IN} < 0$)	–50 mA
I/O port clamp current, $I_{I/OK}$ ($V_{I/O} < 0$)	–50 mA
ON-state switch current, $I_{I/O}$ (see Note 4)	±64 mA
Continuous current through V_{CC} or GND terminals	±100 mA
Package thermal impedance, θ_{JA} (see Note 5): DB package	70°C/W
(see Note 5): DBQ package	68°C/W
(see Note 5): DGV package	92°C/W
(see Note 5): DW package	58°C/W
(see Note 5): GQN package	78°C/W
(see Note 5): PW package	83°C/W
(see Note 6): RGY package	37°C/W
Storage temperature range, T_{stg}	–65°C to 150°C

[†] 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.

- NOTES:
1. All voltages are with respect to ground unless otherwise specified.
 2. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
 3. V_I and V_O are used to denote specific conditions for $V_{I/O}$.
 4. I_I and I_O are used to denote specific conditions for $I_{I/O}$.
 5. The package thermal impedance is calculated in accordance with JESD 51-7.
 6. The package thermal impedance is calculated in accordance with JESD 51-5.

recommended operating conditions (see Note 7)

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

NOTE 7: 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.

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

PARAMETER		TEST CONDITIONS		MIN	TYP [†]	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
$I_{OZ}^{\ddagger}$		$V_{CC} = 3.6\text{ V}$,	$V_O = 0\text{ to }5.5\text{ V}$, $V_I = 0$, 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}		$V_{CC} = 3.6\text{ V}$,	$I_{I/O} = 0$, Switch ON or OFF, $V_{IN} = V_{CC}\text{ or GND}$		0.7	2	mA
$\Delta I_{CC}^{\S}$	Control inputs	$V_{CC} = 3.6\text{ V}$,	One input at 3 V, Other inputs at $V_{CC}\text{ or GND}$			30	μA
$I_{CCD}^{\parallel}$	Per control input	$V_{CC} = 3.6\text{ V}$,	A and B ports open, Control input switching at 50% duty cycle		0.14	0.15	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	3.5	pF
$C_{io(OFF)}$		$V_{CC} = 3.3\text{ V}$,	Switch OFF, $V_{IN} = V_{CC}\text{ or GND}$, $V_{I/O} = 5.5\text{ V}$, 3.3 V, or 0		3.5	5	pF
$C_{io(ON)}$		$V_{CC} = 3.3\text{ V}$,	Switch ON, $V_{IN} = V_{CC}\text{ or GND}$, $V_{I/O} = 5.5\text{ V}$, 3.3 V, or 0		9	11	pF
$r_{on}^{\#}$	$V_{CC} = 2.3\text{ V}$, TYP at $V_{CC} = 2.5\text{ V}$	$V_I = 0$,	$I_O = 30\text{ mA}$		4	8	Ω
		$V_I = 1.7\text{ V}$,	$I_O = -15\text{ mA}$		5	9	
	$V_{CC} = 3\text{ V}$	$V_I = 0$,	$I_O = 30\text{ mA}$		4	6	
		$V_I = 2.4\text{ V}$,	$I_O = -15\text{ mA}$		5	8	

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

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

[‡] For I/O ports, the parameter I_{OZ} includes the input leakage current.

[§] This is the increase in supply current for each input that is at the specified TTL voltage level, rather than V_{CC} or GND.

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

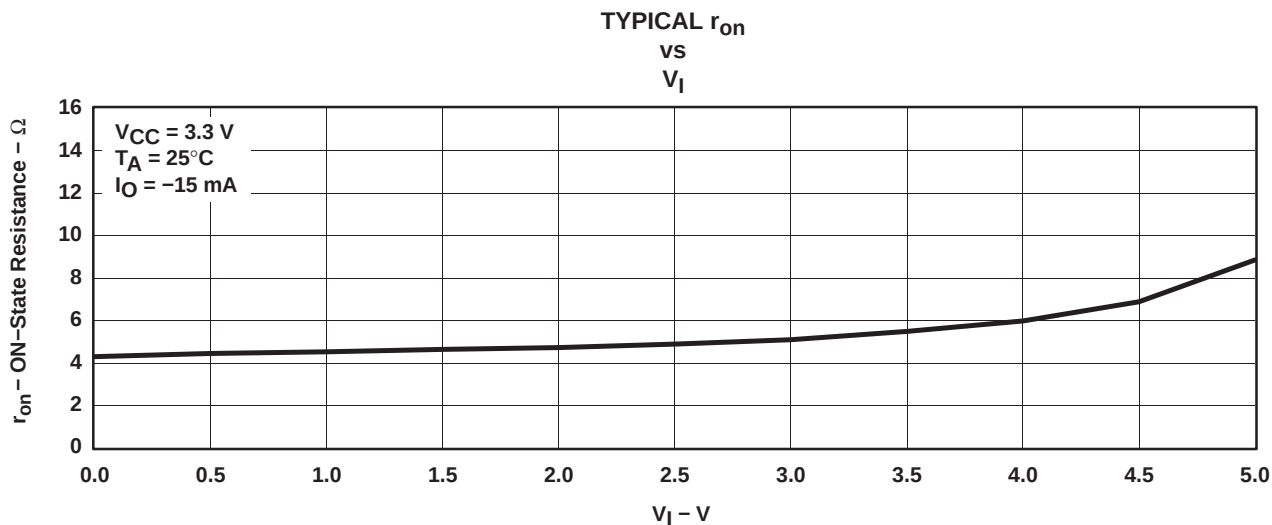
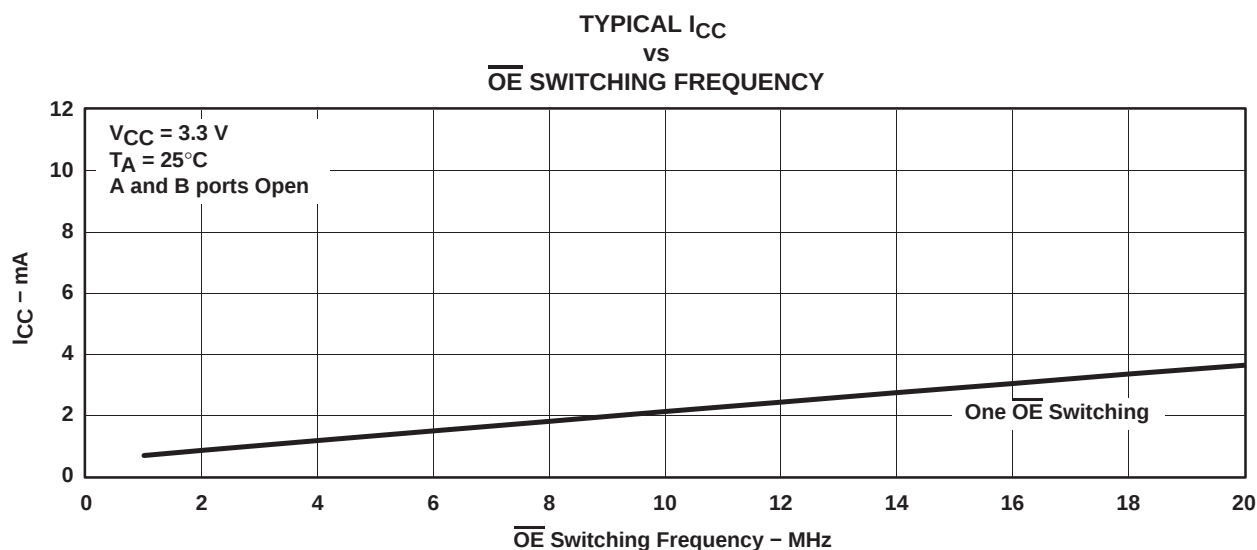
[#] Measured by the voltage drop between the A and B terminals at the indicated current through the switch. ON-state resistance is determined by the lower of the voltages of the two (A or B) terminals.

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

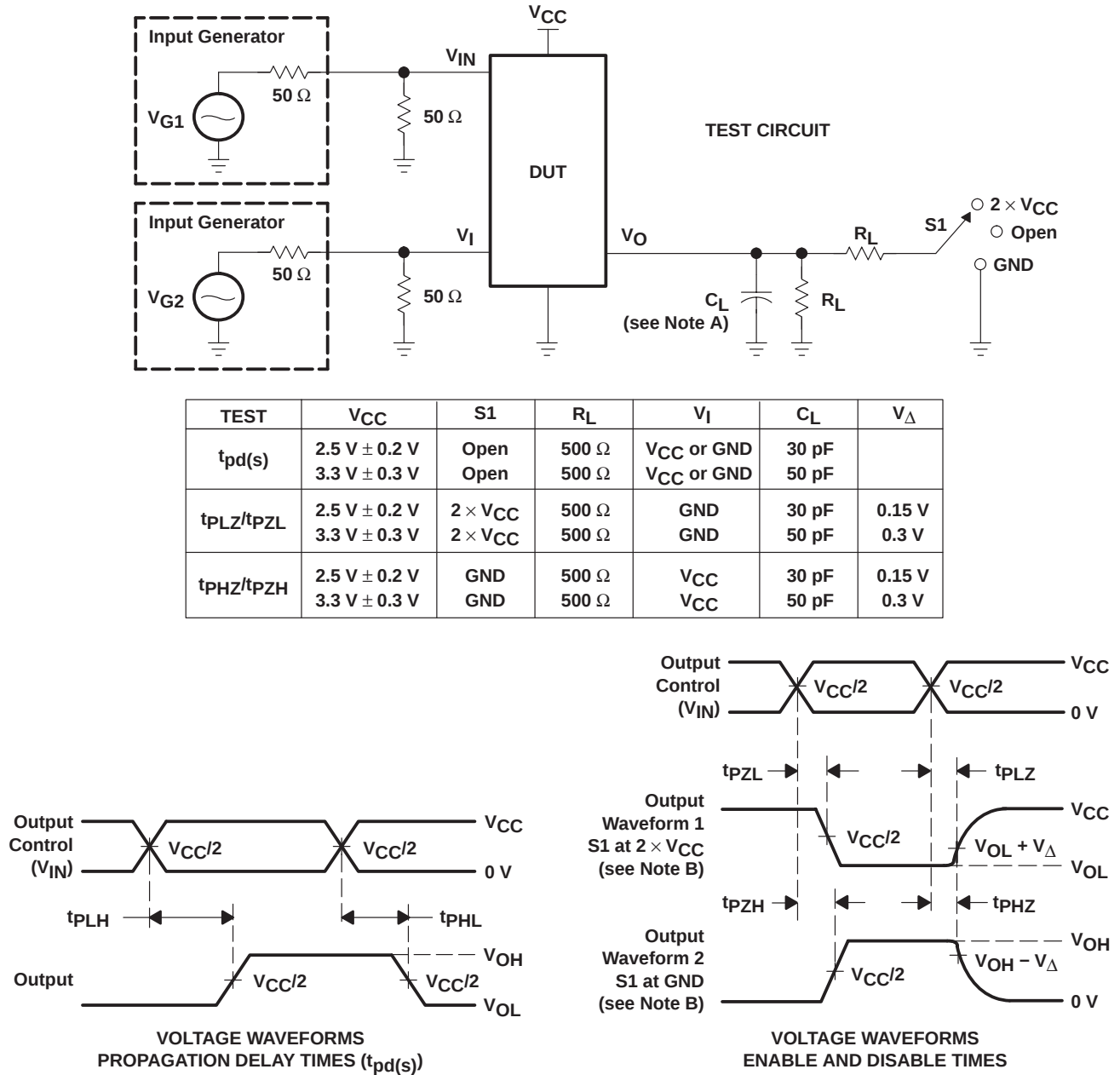
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$		UNIT
			MIN	MAX	MIN	MAX	
$f_{OE}^{\parallel\parallel}$	$\overline{OE}$	A or B		10		20	MHz
$t_{pd}^{\star}$	A or B	B or A		0.12		0.2	ns
t_{en}	$\overline{OE}$	A or B	2.8	7.1	2.5	5.9	ns
t_{dis}	$\overline{OE}$	A or B	1	5.8	1.5	5.8	ns

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

[☆] 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 $\overline{OE}$ Switching Frequency, $V_{CC} = 3.3 \text{ V}$

PARAMETER MEASUREMENT INFORMATION



- NOTES:
- A. C_L includes probe and jig capacitance.
 - B. 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.
 - C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r \leq 2.5\text{ ns}$, $t_f \leq 2.5\text{ ns}$.
 - D. The outputs are measured one at a time, with one transition per measurement.
 - E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - F. t_{PZL} and t_{PZH} are the same as t_{en} .
 - G. t_{PLH} and t_{PHL} are the same as $t_{pd}(s)$. The t_{pd} 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).
 - H. 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)
SN74CB3Q3244DBQR	Active	Production	SSOP (DBQ) 20	2500 LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	CB3Q3244
SN74CB3Q3244DGVR	Active	Production	TVSOP (DGV) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BU244
SN74CB3Q3244PW	Obsolete	Production	TSSOP (PW) 20	-	-	Call TI	Call TI	-40 to 85	BU244
SN74CB3Q3244PWR	Active	Production	TSSOP (PW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BU244
SN74CB3Q3244RGYR	Active	Production	VQFN (RGY) 20	3000 LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	BU244

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

⁽²⁾ **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.

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

⁽⁴⁾ **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.

⁽⁵⁾ **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.

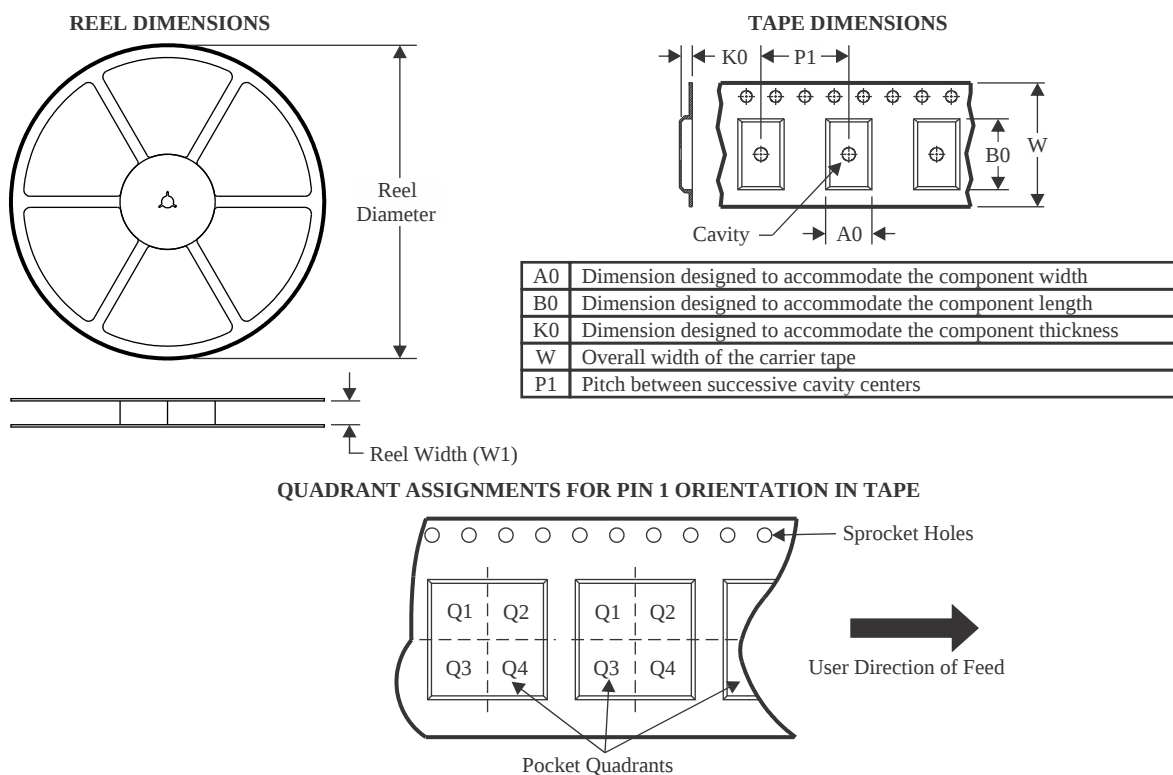
⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

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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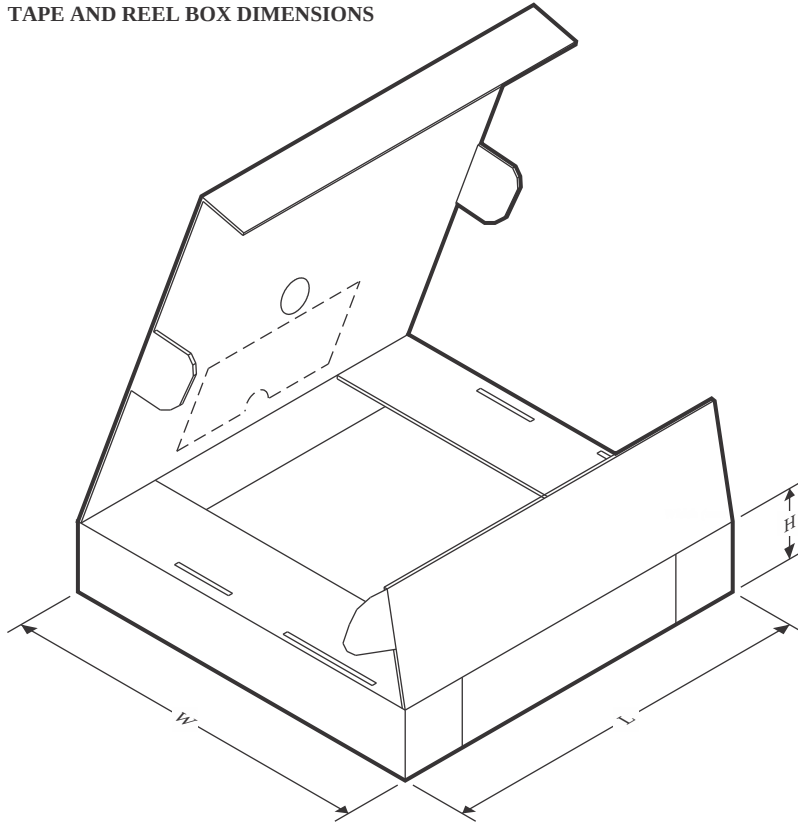
TAPE AND REEL INFORMATION



*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
SN74CB3Q3244DBQR	SSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74CB3Q3244DGVR	TVSOP	DGV	20	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74CB3Q3244PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	16.0	Q1
SN74CB3Q3244RGYR	VQFN	RGY	20	3000	330.0	12.4	3.8	4.8	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



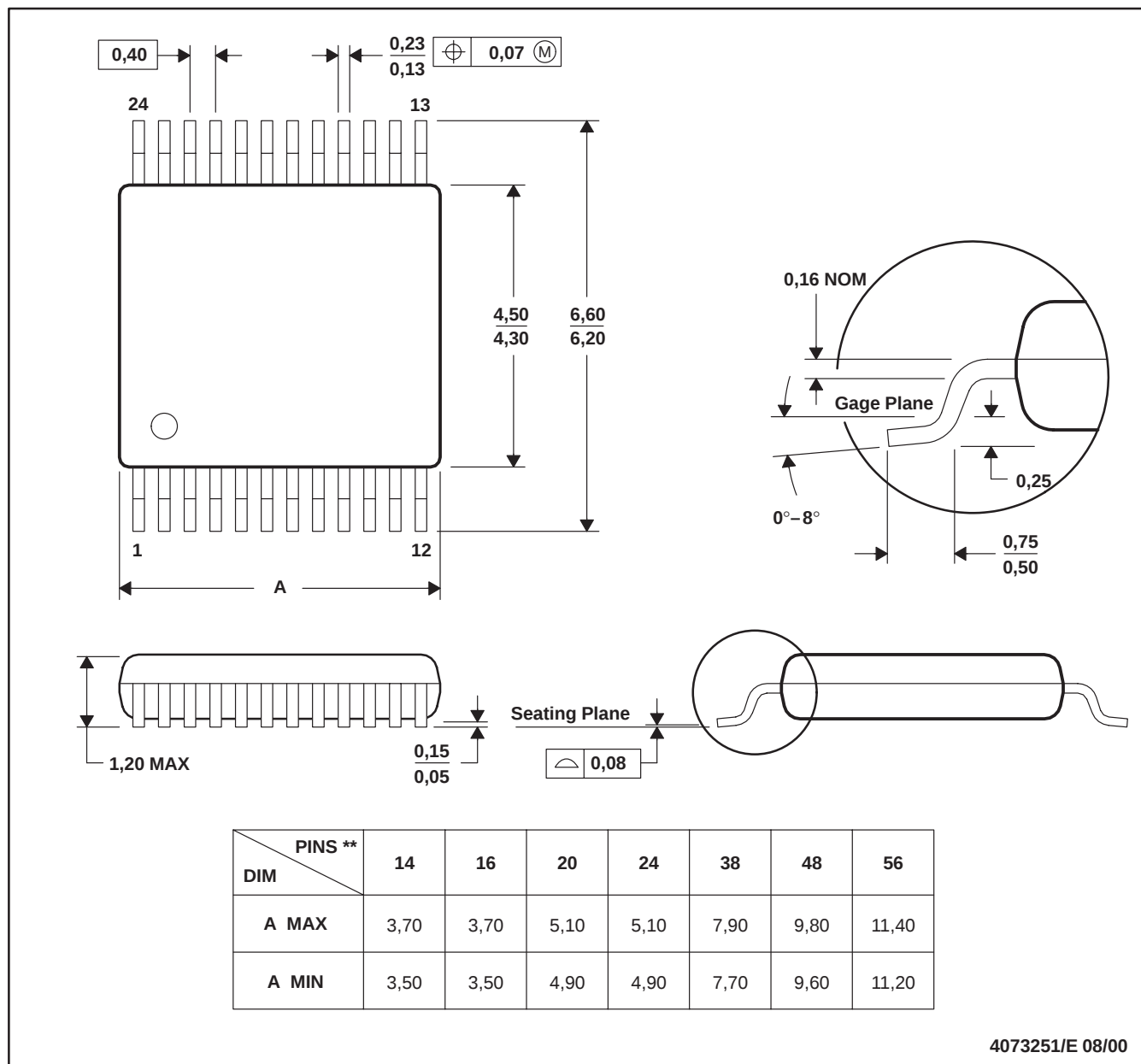
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74CB3Q3244DBQR	SSOP	DBQ	20	2500	356.0	356.0	35.0
SN74CB3Q3244DGVR	TVSOP	DGV	20	2000	367.0	367.0	35.0
SN74CB3Q3244PWR	TSSOP	PW	20	2000	356.0	356.0	35.0
SN74CB3Q3244RGYR	VQFN	RGY	20	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

GENERIC PACKAGE VIEW

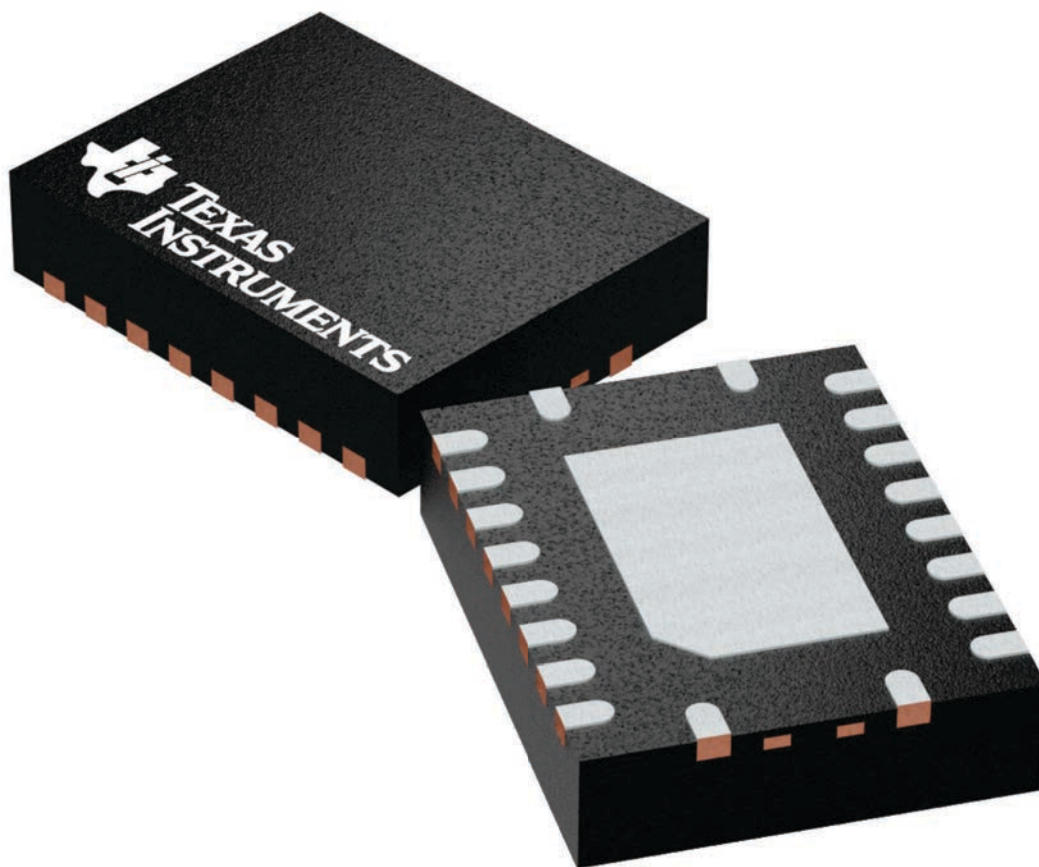
RGY 20

VQFN - 1 mm max height

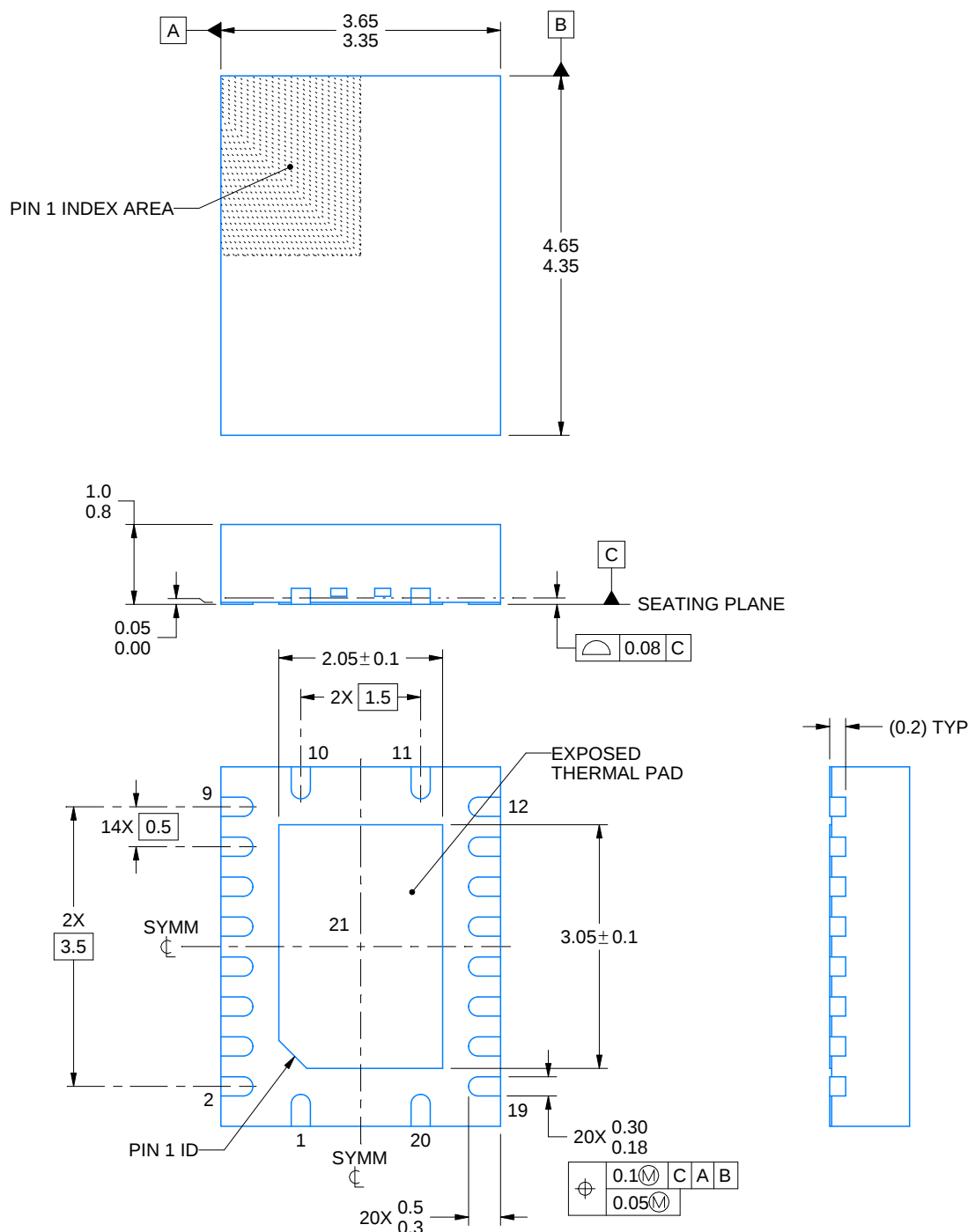
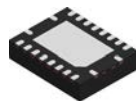
3.5 x 4.5, 0.5 mm pitch

PLASTIC QUAD FGLATPACK - NO LEAD

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



4225264/A



4225320/A 09/2019

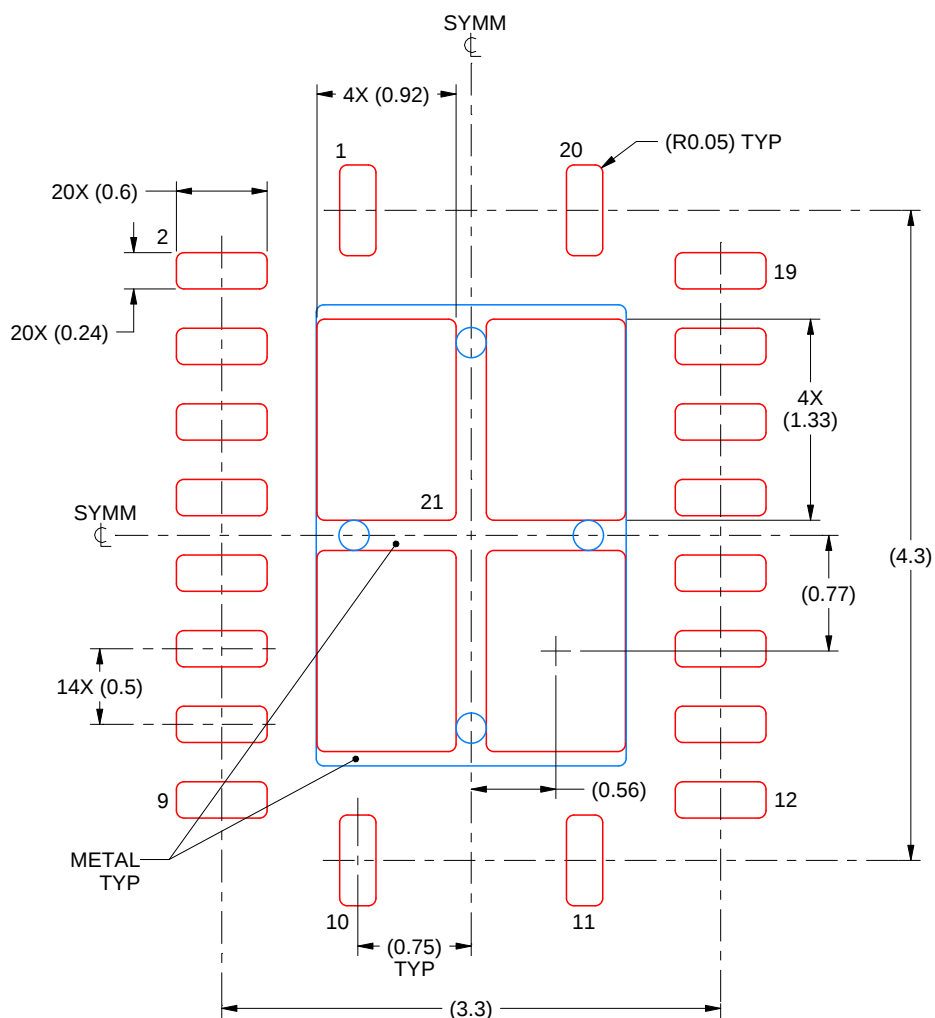
NOTES:

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. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

RGY0020A

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



SOLDER PASTE EXAMPLE

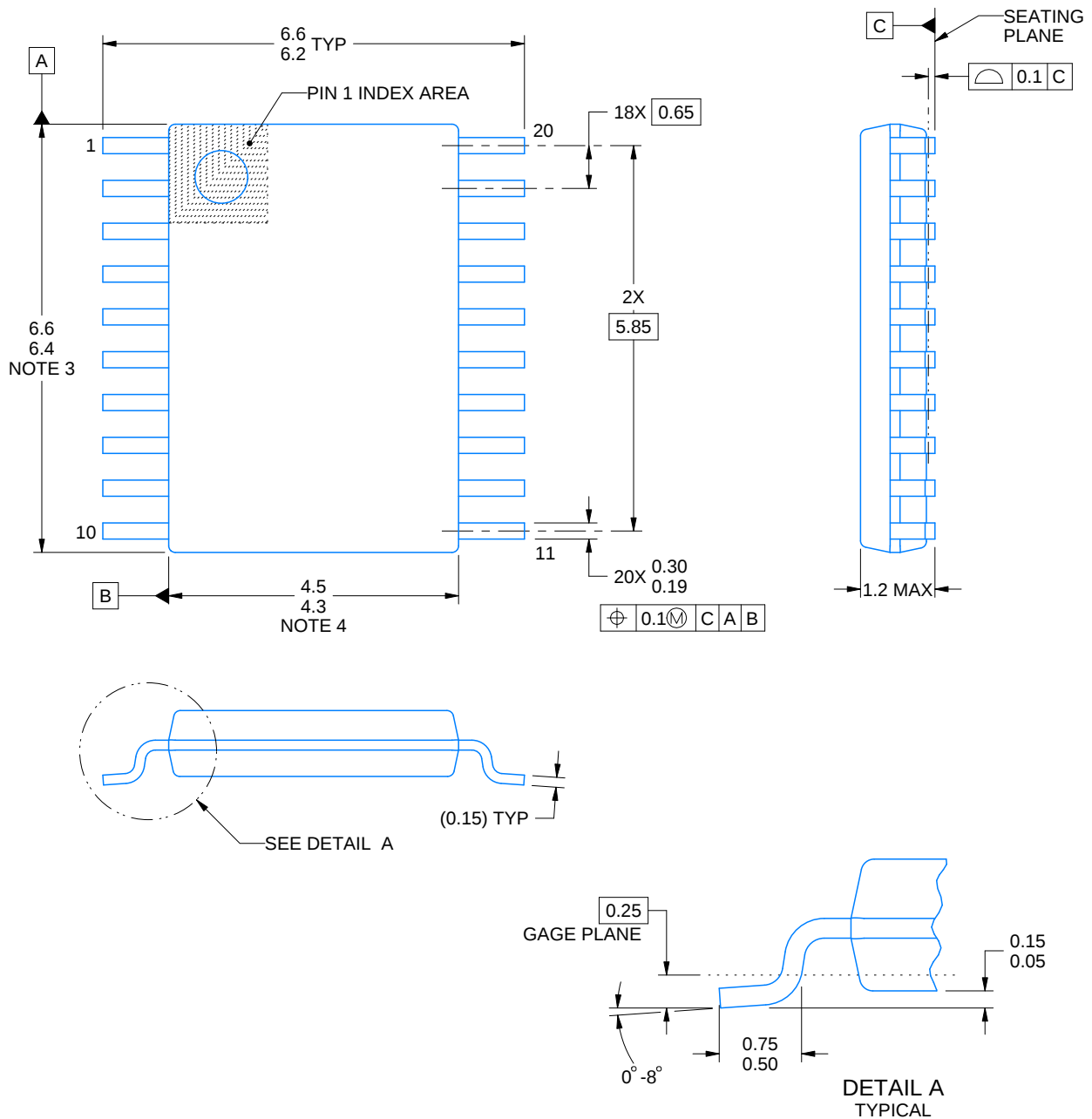
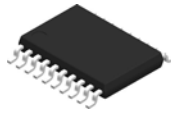
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 21
78% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:20X

4225320/A 09/2019

NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.



4220206/A 02/2017

NOTES:

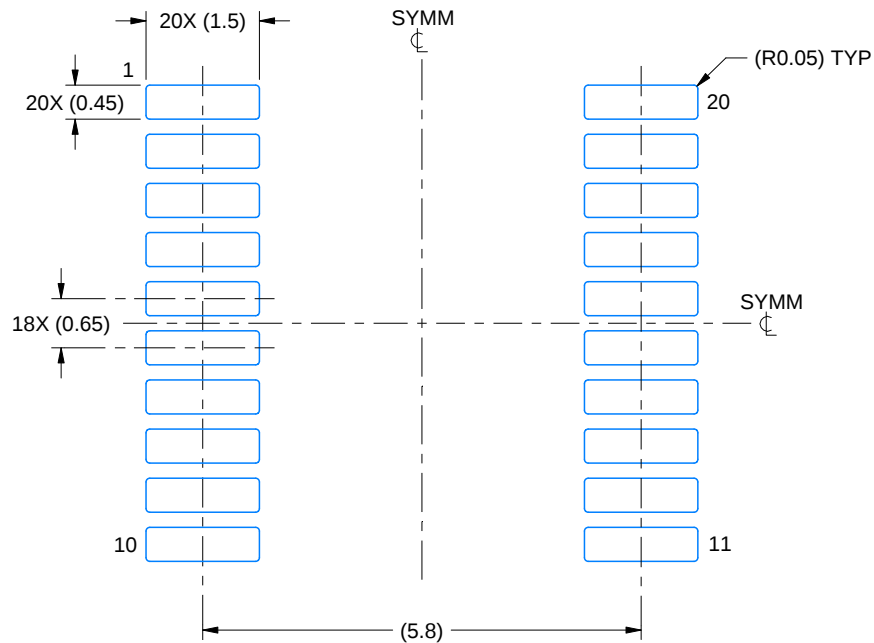
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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

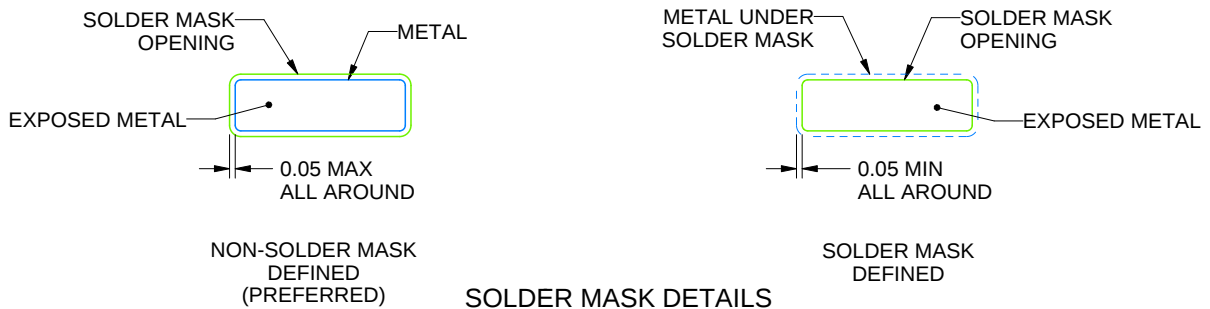
PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220206/A 02/2017

NOTES: (continued)

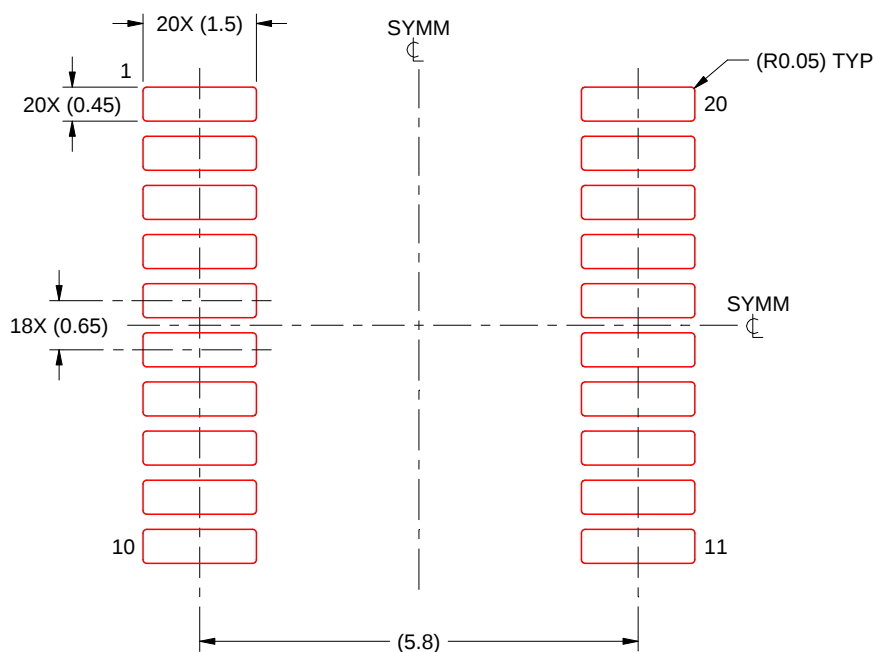
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

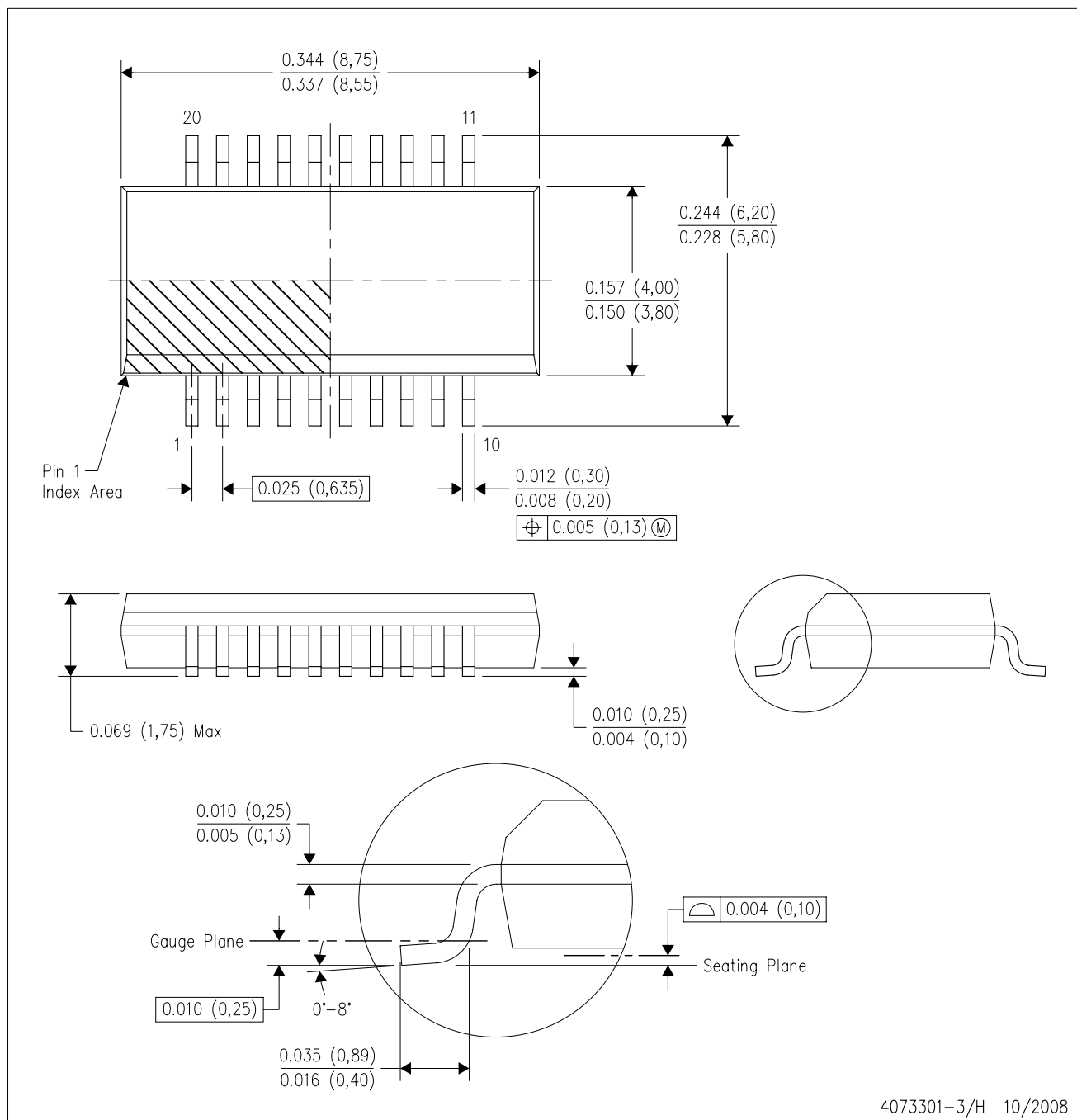
4220206/A 02/2017

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.

DBQ (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



4073301-3/H 10/2008

- 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) per side.
 - D. Falls within JEDEC MO-137 variation AD.

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