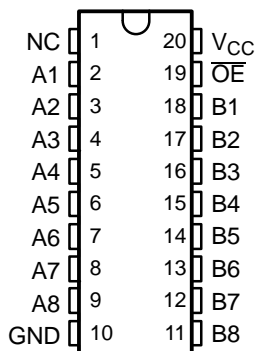


## FEATURES

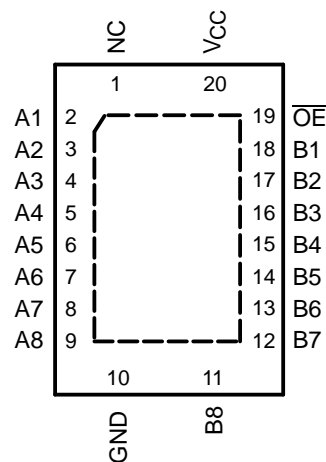
- Standard '245-Type Pinout
- 5-Ω Switch Connection Between Two Ports
- Rail-to-Rail Switching on Data I/O Ports
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)

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



NC - No internal connection

RGY PACKAGE  
(TOP VIEW)



NC - No internal connection

## DESCRIPTION/ORDERING INFORMATION

The SN74CBTLV3245A provides eight bits of high-speed bus switching in a standard '245 device pinout. The low on-state resistance of the switch allows connections to be made with minimal propagation delay.

The device is organized as one 8-bit switch. When output enable ( $\overline{OE}$ ) is low, the 8-bit bus switch is on, and port A is connected to port B. When  $\overline{OE}$  is high, the switch is open, and the high-impedance state exists between the two ports.

This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  feature ensures that damaging current will not 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	SN74CBTLV3245ARGYR	CL245A
	SOIC – DW	Tube	SN74CBTLV3245ADW	CBTLV3245A
		Tape and reel	SN74CBTLV3245ADWR	
	SSOP (QSOP) – DBQ	Tape and reel	SN74CBTLV3245ADBQR	CBTLV3245A
	TSSOP – PW	Tape and reel	SN74CBTLV3245APWR	CL245A
	TVSOP – DGV	Tape and reel	SN74CBTLV3245ADGVR	CL245A
	VFBGA – GQN	Tape and reel	SN74CBTLV3245AGQNR	CL245A
VFBGA – ZQN	Tape and reel	SN74CBTLV3245AZQNR	CL245A	

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

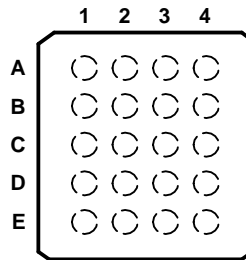


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

# SN74CBTLV3245A LOW-VOLTAGE OCTAL FET BUS SWITCH

SCDS034M—JULY 1997—REVISED AUGUST 2005

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



**TERMINAL ASSIGNMENTS<sup>(1)</sup>**

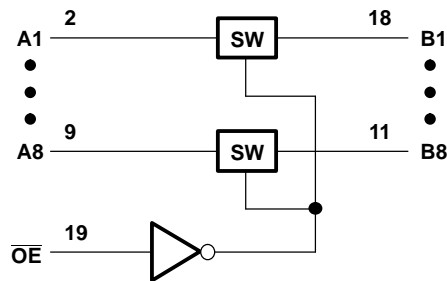
	1	2	3	4
<b>A</b>	A1	NC	V <sub>CC</sub>	$\overline{OE}$
<b>B</b>	A3	B2	A2	B1
<b>C</b>	A5	A4	B4	B3
<b>D</b>	A7	B6	A6	B5
<b>E</b>	GND	A8	B8	B7

(1) NC - No internal connection

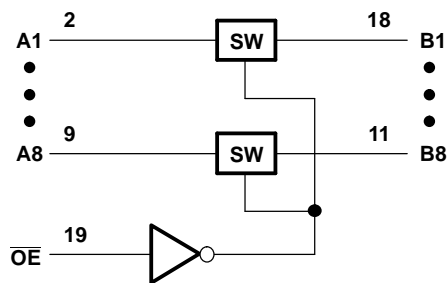
**FUNCTION TABLE**

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

**LOGIC DIAGRAM (POSITIVE LOGIC)**



**SIMPLIFIED SCHEMATIC, EACH FET SWITCH**



### 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
$V_I$	Input voltage range <sup>(2)</sup>	–0.5	4.6	V
	Continuous channel current		128	mA
$I_{IK}$	Input clamp current	$V_{I/O} < 0$		–50 mA
$\theta_{JA}$	Package thermal impedance	DBQ package <sup>(3)</sup>		68
		DGV package <sup>(3)</sup>		92
		DW package <sup>(3)</sup>		58
		PW package <sup>(3)</sup>		83
		RGY package <sup>(4)</sup>		37
$T_{stg}$	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) The input and output negative-voltage ratings may be exceeded if the input and output clamp-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<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	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	2	
$V_{IL}$	Low-level control input voltage	$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	0.7	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	0.8	
$T_A$	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.

# SN74CBTLV3245A LOW-VOLTAGE OCTAL FET BUS SWITCH

SCDS034M–JULY 1997–REVISED AUGUST 2005

## Electrical Characteristics

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

PARAMETER		TEST CONDITIONS		MIN	TYP <sup>(1)</sup>	MAX	UNIT
$V_{IK}$	Control inputs	$V_{CC} = 3\text{ V}$ ,	$I_I = -18\text{ mA}$			-1.2	V
	Data inputs					-0.8	
$I_I$		$V_{CC} = 3.6\text{ V}$ ,	$V_I = V_{CC}$ or GND			$\pm 60$	$\mu\text{A}$
$I_{off}$		$V_{CC} = 0$ ,	$V_I$ or $V_O = 0$ to 3.6 V			40	$\mu\text{A}$
$I_{CC}$		$V_{CC} = 3.6\text{ V}$ ,	$I_O = 0$ , $V_I = V_{CC}$ or GND			20	$\mu\text{A}$
$\Delta I_{CC}$ <sup>(2)</sup>	Control inputs	$V_{CC} = 3.6\text{ V}$ ,	One input at 3 V, Other inputs at $V_{CC}$ or GND			300	$\mu\text{A}$
$C_i$	Control inputs	$V_I = 3\text{ V}$ or 0				4	pF
$C_{iO(OFF)}$		$V_O = 3\text{ V}$ or 0,	$\overline{OE} = V_{CC}$			9	pF
$r_{on}$ <sup>(3)</sup>	$V_{CC} = 2.3\text{ V}$ , TYP at $V_{CC} = 2.5\text{ V}$	$V_I = 0$	$I_O = 64\text{ mA}$	5	8	$\Omega$	
			$I_O = 24\text{ mA}$	5	8		
		$V_I = 1.7\text{ V}$ ,	$I_O = 15\text{ mA}$	27	40		
	$V_{CC} = 3\text{ V}$	$V_I = 0$	$I_O = 64\text{ mA}$	5	7		
			$I_O = 24\text{ mA}$	5	7		
		$V_I = 2.4\text{ V}$ ,	$I_O = 15\text{ mA}$	10	15		

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

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

(3) 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.

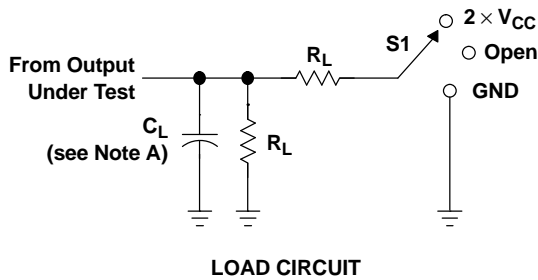
## Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see [Figure 1](#))

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	
$t_{pd}$ <sup>(1)</sup>	A or B	B or A		0.15		0.25	ns
$t_{en}$	$\overline{OE}$	A or B	1	6	1	4.7	ns
$t_{dis}$	$\overline{OE}$	A or B	1	6.1	1	6.4	ns

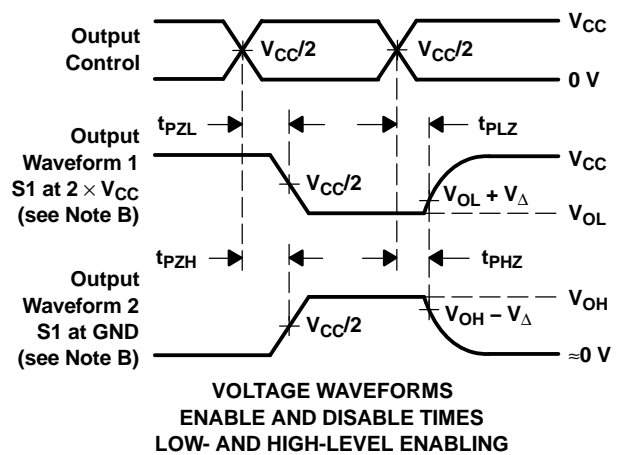
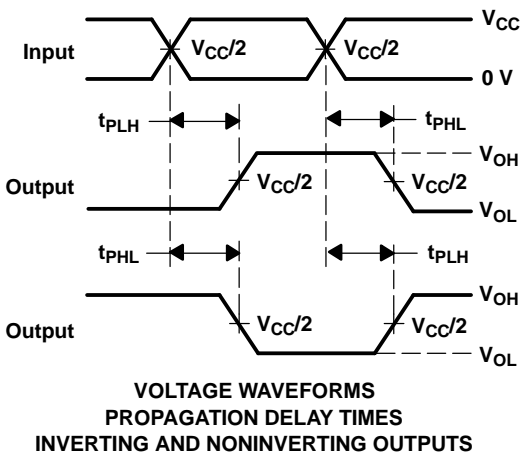
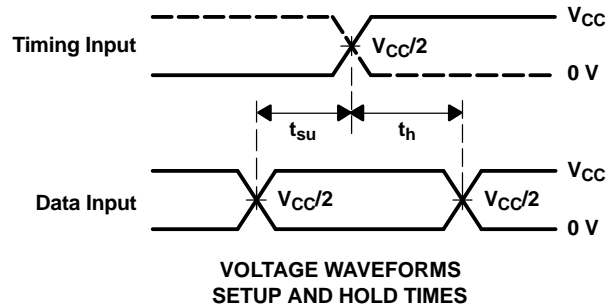
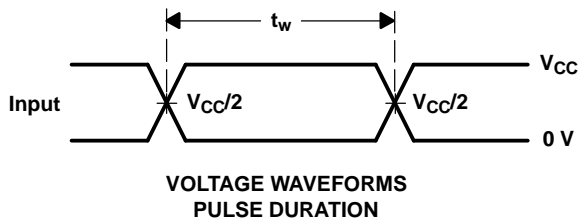
(1) The propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).

PARAMETER MEASUREMENT INFORMATION



TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$2 \times V_{CC}$
$t_{PHZ}/t_{PZH}$	GND

$V_{CC}$	$C_L$	$R_L$	$V_{\Delta}$
$2.5 \text{ V} \pm 0.2 \text{ V}$	30 pF	500 $\Omega$	0.15 V
$3.3 \text{ V} \pm 0.3 \text{ V}$	50 pF	500 $\Omega$	0.3 V



- 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  $\leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 2$  ns,  $t_f \leq 2$  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  $t_{pd}$ .  
 H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
74CBTLV3245ADBQRE4	ACTIVE	SSOP/QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
74CBTLV3245ADBQRG4	ACTIVE	SSOP/QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
74CBTLV3245ADGVRE4	ACTIVE	TVSOP	DGV	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBTLV3245ADGVRG4	ACTIVE	TVSOP	DGV	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBTLV3245ADWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBTLV3245ADWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBTLV3245ADWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBTLV3245APWRE4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBTLV3245APWRG4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBTLV3245ARGYRG4	ACTIVE	QFN	RGY	20	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
SN74CBTLV3245ADBQR	ACTIVE	SSOP/QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
SN74CBTLV3245ADGVR	ACTIVE	TVSOP	DGV	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTLV3245ADW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTLV3245ADWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTLV3245ADWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTLV3245AGQNR	NRND	BGA MICROSTAR JUNIOR	GQN	20	1000	TBD	SNPB	Level-1-240C-UNLIM
SN74CBTLV3245APW	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTLV3245APWE4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTLV3245APWG4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTLV3245APWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTLV3245ARGYR	ACTIVE	QFN	RGY	20	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
SN74CBTLV3245AZQNR	ACTIVE	BGA MICROSTAR JUNIOR	ZQN	20	1000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM

<sup>(1)</sup> The marketing status values are defined as follows:  
**ACTIVE:** Product device recommended for new designs.

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

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

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

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

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

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

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

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

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

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

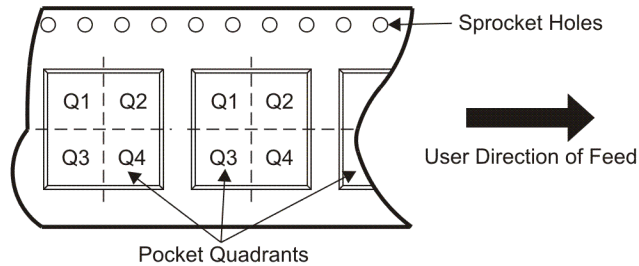
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**TAPE AND REEL INFORMATION**



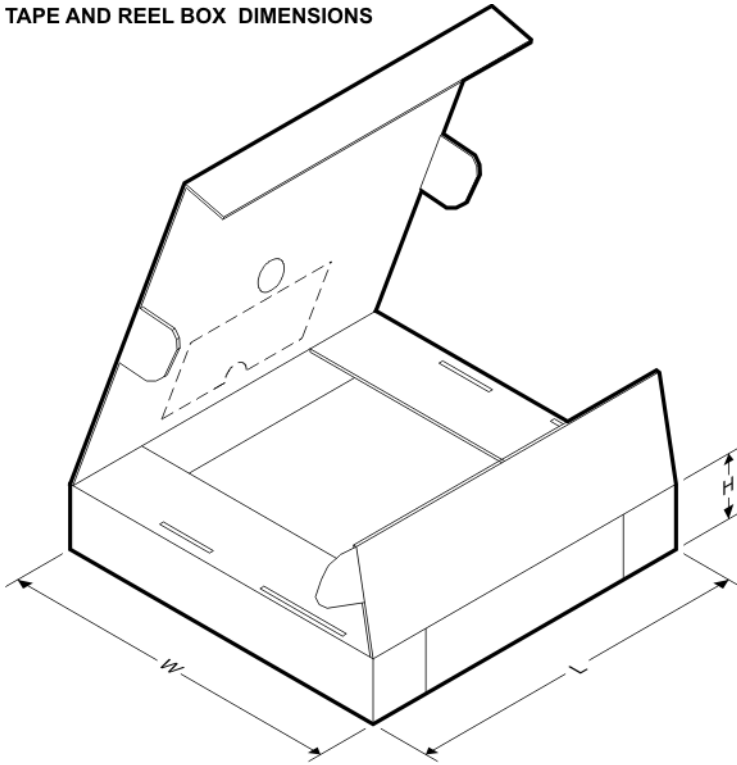
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



\*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
SN74CBTLV3245ADBQR	SSOP/QSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74CBTLV3245ADGVR	TVSOP	DGV	20	2000	330.0	12.4	7.0	5.6	1.6	8.0	12.0	Q1
SN74CBTLV3245ADWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
SN74CBTLV3245AGQNR	BGA MICROSTAR JUNIOR	GQN	20	1000	330.0	12.4	3.3	4.3	1.6	8.0	12.0	Q1
SN74CBTLV3245APWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
SN74CBTLV3245ARGYR	QFN	RGY	20	1000	180.0	12.4	3.8	4.8	1.6	8.0	12.0	Q1
SN74CBTLV3245AZQNR	BGA MICROSTAR JUNIOR	ZQN	20	1000	330.0	12.4	3.3	4.3	1.5	8.0	12.0	Q1
SN74CBTLV3245AZQNR	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**

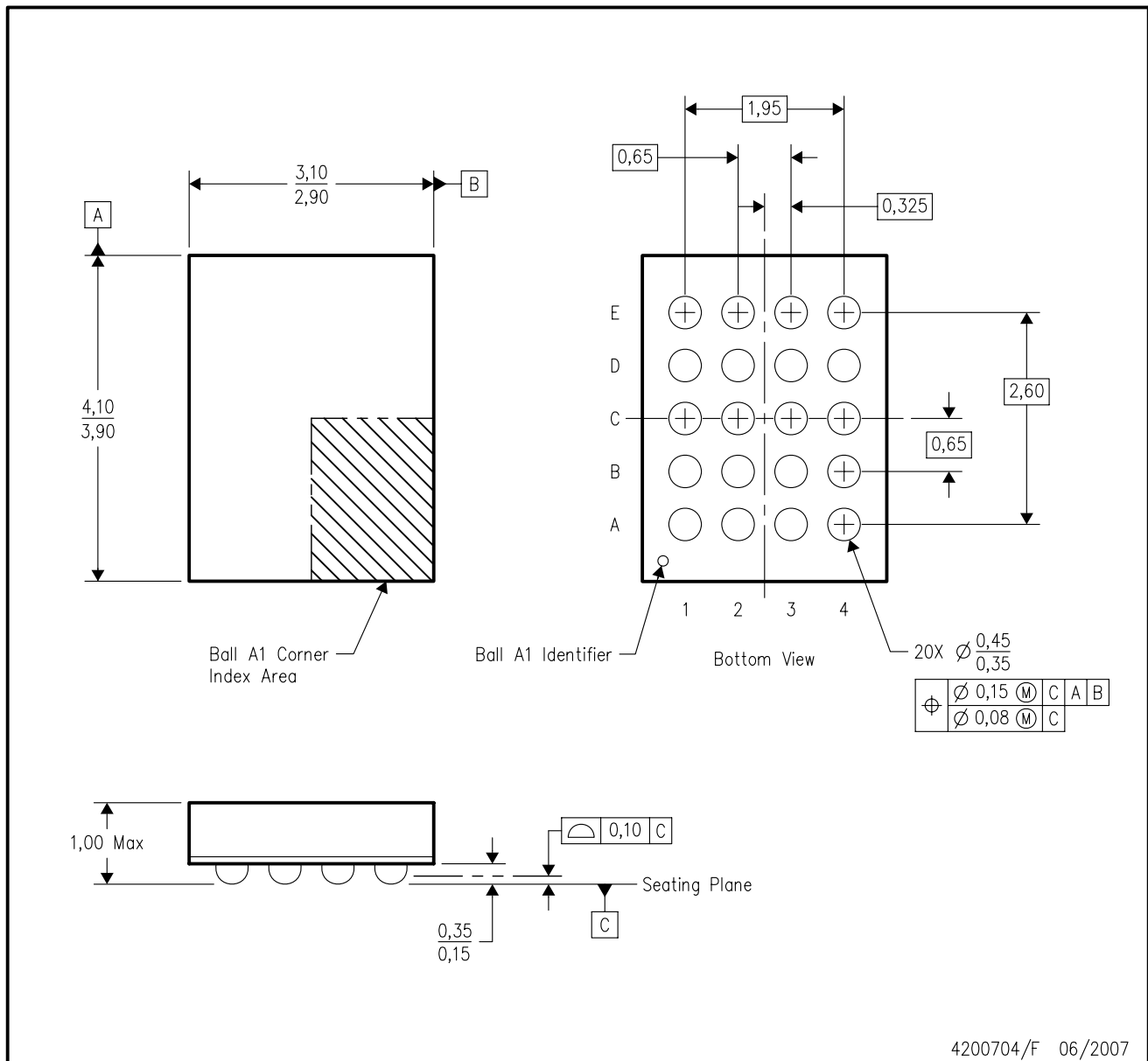


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74CBTLV3245ADBQR	SSOP/QSOP	DBQ	20	2500	346.0	346.0	33.0
SN74CBTLV3245ADGVR	TVSOP	DGV	20	2000	346.0	346.0	29.0
SN74CBTLV3245ADWR	SOIC	DW	20	2000	346.0	346.0	41.0
SN74CBTLV3245AGQNR	BGA MICROSTAR JUNIOR	GQN	20	1000	340.5	338.1	20.6
SN74CBTLV3245APWR	TSSOP	PW	20	2000	346.0	346.0	33.0
SN74CBTLV3245ARGYR	QFN	RGY	20	1000	190.5	212.7	31.8
SN74CBTLV3245AZQNR	BGA MICROSTAR JUNIOR	ZQN	20	1000	346.0	346.0	29.0
SN74CBTLV3245AZQNR	BGA MICROSTAR JUNIOR	ZQN	20	1000	340.5	338.1	20.6

GQN (R-PBGA-N20)

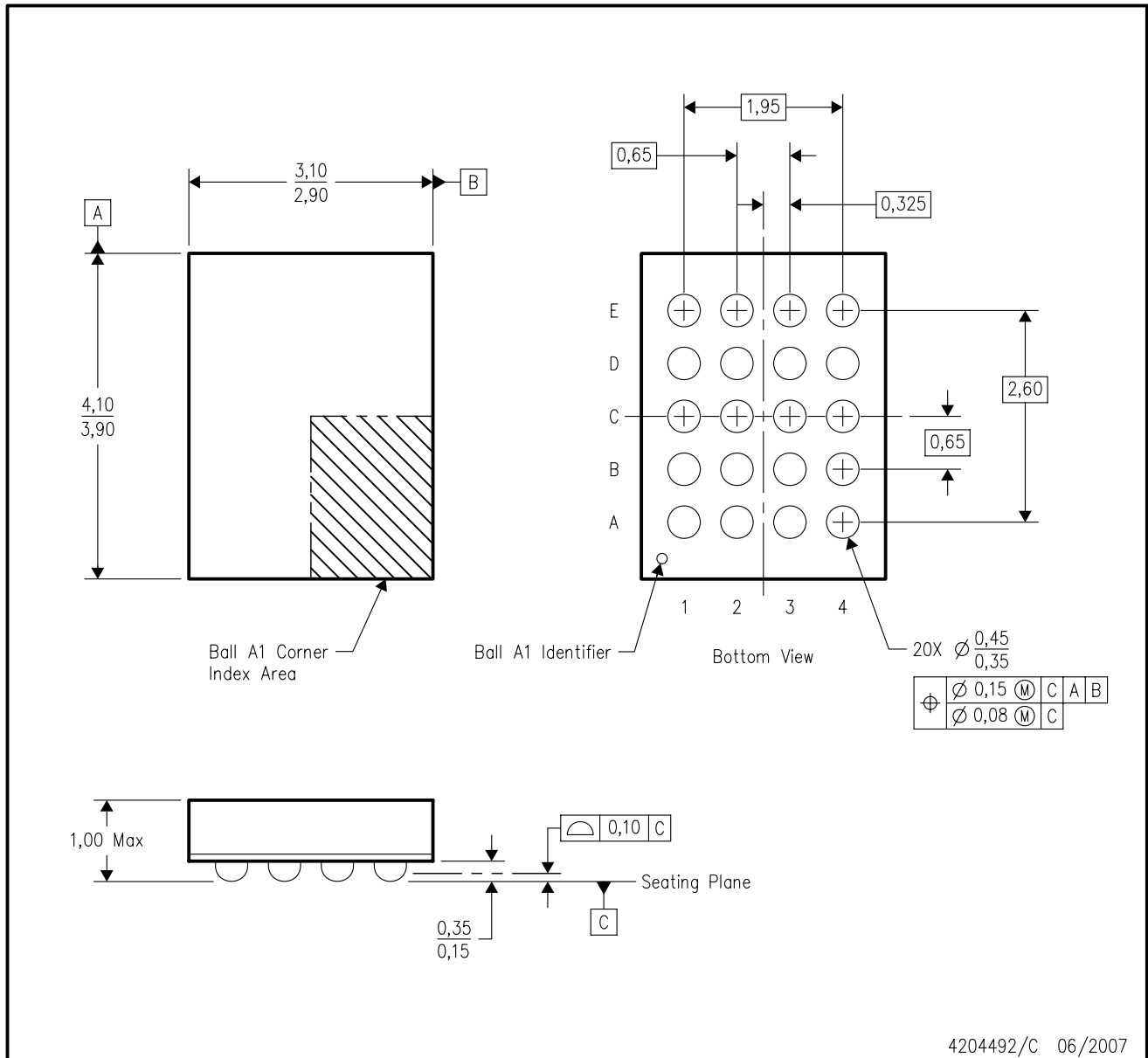
PLASTIC BALL GRID ARRAY



- 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



- 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).

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- 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.  
 D. Falls within JEDEC MO-153

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



DW (R-PDSO-G20)

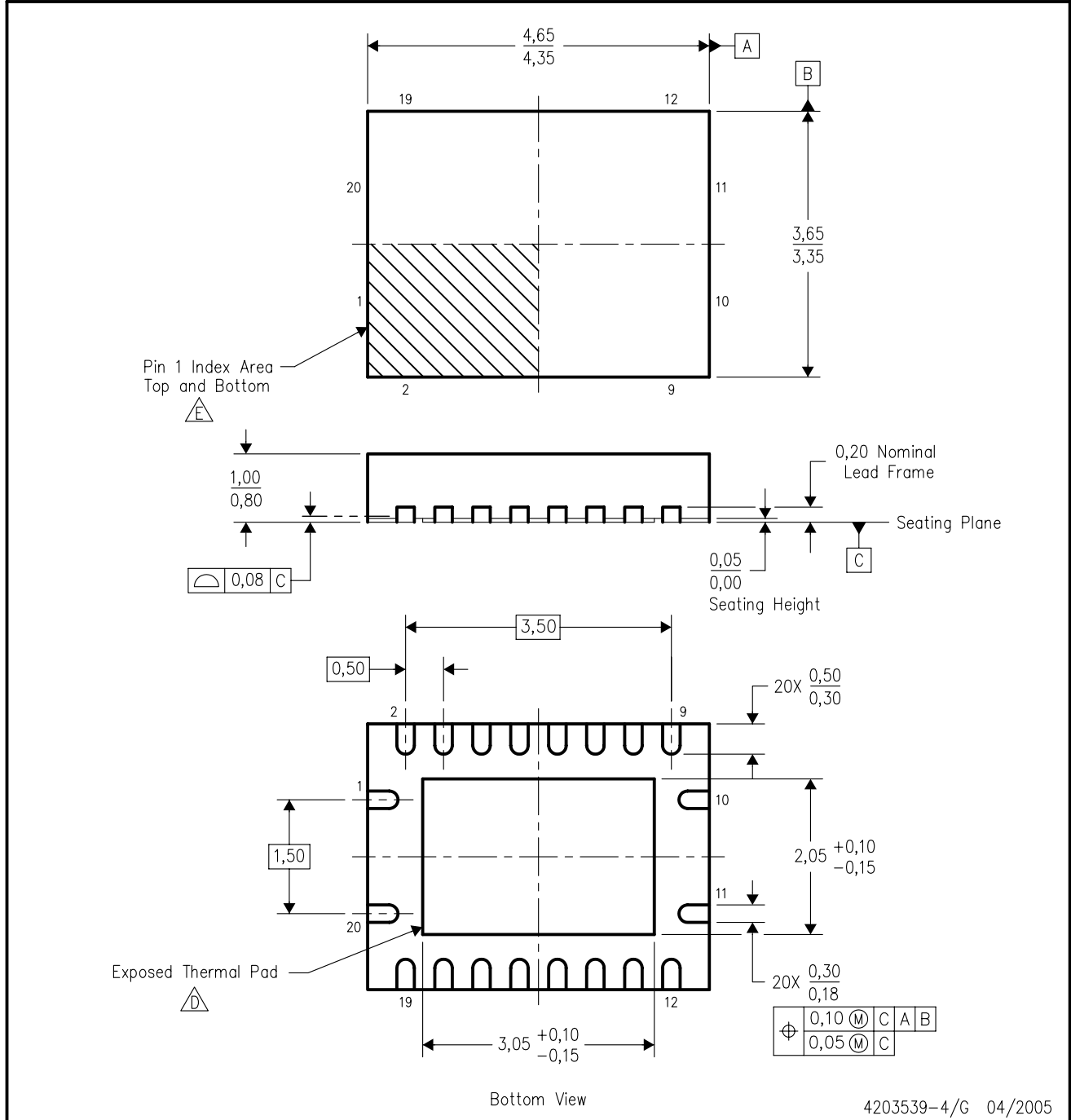
PLASTIC SMALL-OUTLINE PACKAGE



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

RGY (R-PQFP-N20)

PLASTIC QUAD FLATPACK



4203539-4/G 04/2005

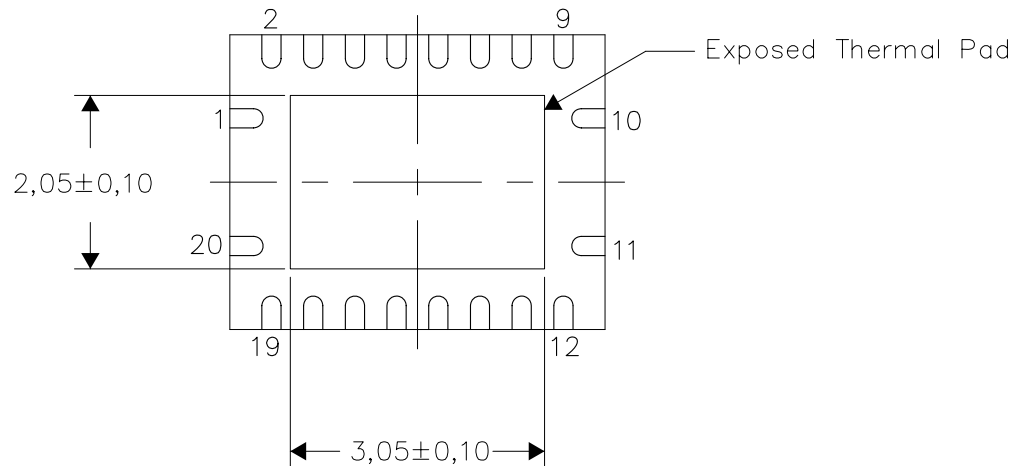
- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. QFN (Quad Flatpack No-Lead) package configuration.
  - D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - E. 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.
  - F. Package complies to JEDEC MO-241 variation BC.

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, Quad Flatpack No-Lead Logic Packages, Texas Instruments Literature No. SCBA017. This document is available at www.ti.com.

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

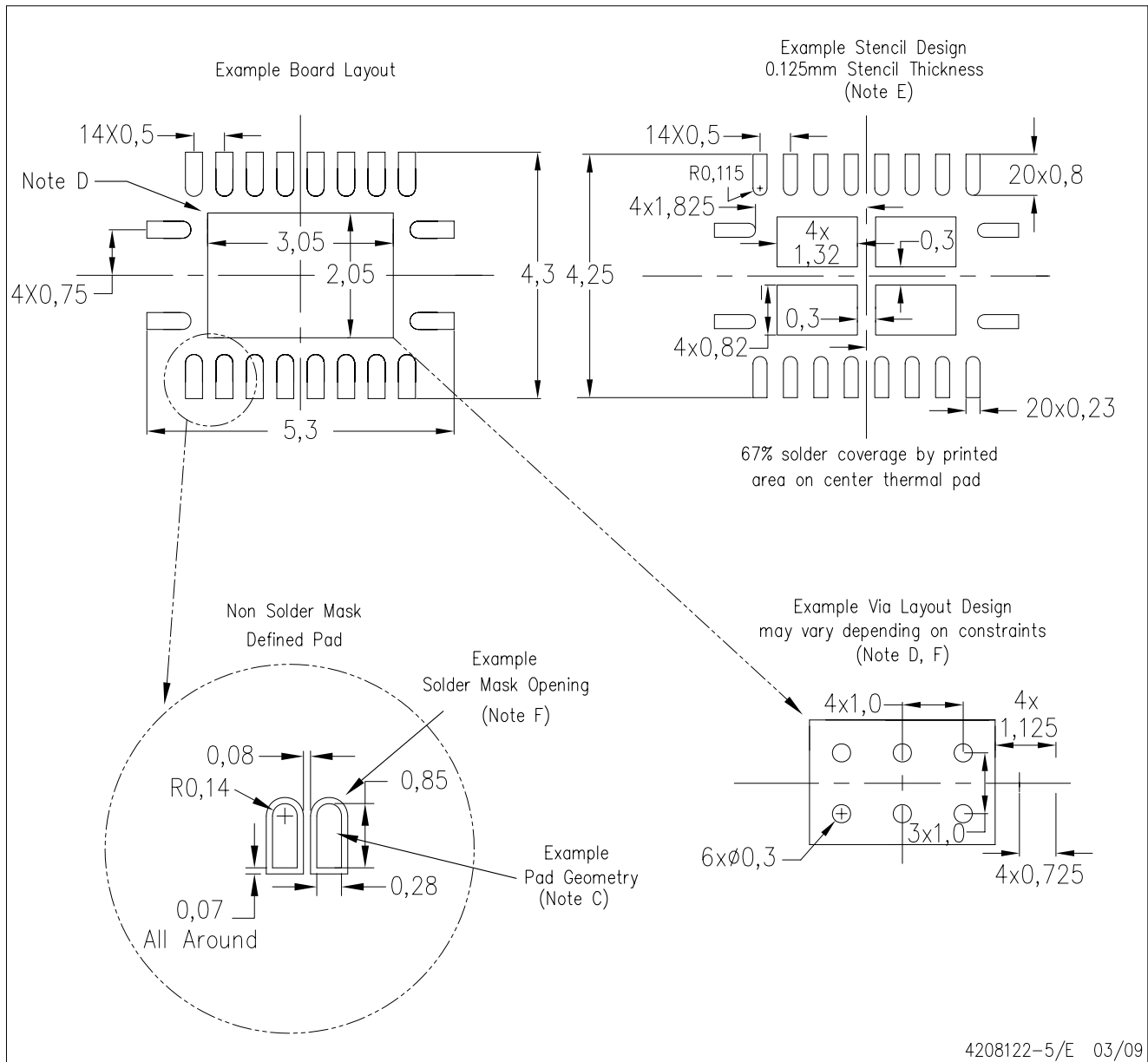


Bottom View

NOTE: All linear dimensions are in millimeters

Exposed Thermal Pad Dimensions

RGY (R-PVQFN-N20)



- 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 designs.
  - D. 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>>.
  - E. 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.
  - F. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

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