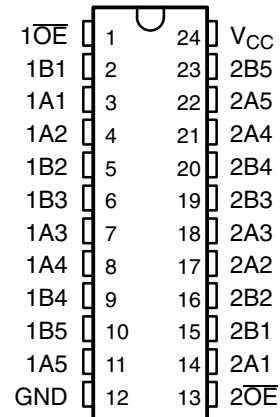


# SN74CBTLV3384 LOW-VOLTAGE 10-BIT FET BUS SWITCH

SCDS059G – MARCH 1998 – REVISED JUNE 2004

- 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)



## description/ordering information

The SN74CBTLV3384 provides ten bits of high-speed bus switching. The low on-state resistance of the switch allows connections to be made with minimal propagation delay.

The device is organized as dual 5-bit bus switches with separate output-enable ( $\overline{OE}$ ) inputs. It can be used as two 5-bit bus switches or one 10-bit bus switch. When  $\overline{OE}$  is low, the associated 5-bit bus switch is on, and A port is connected to B port. 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,  $\overline{OE}$  shall 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†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QSOP – DBQ	Tape and reel	SN74CBTLV3384DBQR	CBTLV3384
	SOIC – DW	Tube	SN74CBTLV3384DW	CBTLV3384
		Tape and reel	SN74CBTLV3384DWR	
	TSSOP – PW	Tape and reel	SN74CBTLV3384PWR	CL384
TVSOP – DGV	Tape and reel	SN74CBTLV3384DGVR	CL384	

† 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 (each 5-bit bus switch)

INPUTS		INPUTS/OUTPUTS	
$1\overline{OE}$	$2\overline{OE}$	1B1–1B5	2B1–2B5
L	L	1A1–1A5	2A1–2A5
L	H	1A1–1A5	Z
H	L	Z	2A1–2A5
H	H	Z	Z



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 **TEXAS  
INSTRUMENTS**

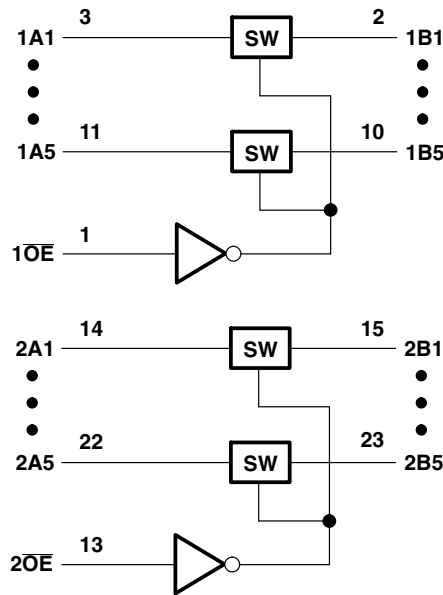
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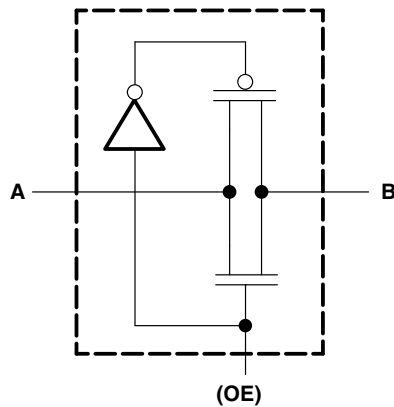
# SN74CBTLV3384 LOW-VOLTAGE 10-BIT FET BUS SWITCH

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## logic diagram (positive logic)



## simplified schematic, each FET switch



## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

Supply voltage range, $V_{CC}$	-0.5 V to 4.6 V
Input voltage range, $V_I$ (see Note 1)	-0.5 V to 4.6 V
Continuous channel current	128 mA
Input clamp current, $I_{IK}$ ( $V_{I/O} < 0$ )	-50 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2):	
DBQ package	61°C/W
DGV package	86°C/W
DW package	46°C/W
PW package	88°C/W
Storage temperature range, $T_{stg}$	-65°C to 150°C

<sup>†</sup> 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. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.  
2. The package thermal impedance is calculated in accordance with JESD 51-7.

# SN74CBTLV3384 LOW-VOLTAGE 10-BIT FET BUS SWITCH

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## recommended operating conditions (see Note 3)

			MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage		2.3	3.6	V
V <sub>IH</sub>	High-level control input voltage	V <sub>CC</sub> = 2.3 V to 2.7 V	1.7		V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2		
V <sub>IL</sub>	Low-level control input voltage	V <sub>CC</sub> = 2.3 V to 2.7 V		0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V		0.8	
T <sub>A</sub>	Operating free-air temperature		-40	85	°C

NOTE 3: All unused control inputs of the device must be held at V<sub>CC</sub> 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 over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V <sub>IK</sub>		V <sub>CC</sub> = 3 V,	I <sub>I</sub> = -18 mA			-1.2	V
I <sub>I</sub>		V <sub>CC</sub> = 3.6 V,	V <sub>I</sub> = V <sub>CC</sub> or GND			±1	μA
I <sub>off</sub>		V <sub>CC</sub> = 0,	V <sub>I</sub> or V <sub>O</sub> = 0 to 3.6 V			10	μA
I <sub>CC</sub>		V <sub>CC</sub> = 3.6 V,	I <sub>O</sub> = 0, V <sub>I</sub> = V <sub>CC</sub> or GND			10	μA
ΔI <sub>CC</sub> ‡	Control inputs	V <sub>CC</sub> = 3.6 V,	One input at 3 V, Other inputs at V <sub>CC</sub> or GND			300	μA
C <sub>i</sub>	Control inputs	V <sub>I</sub> = 3 V or 0				4.5	pF
C <sub>io(OFF)</sub>		V <sub>O</sub> = 3 V or 0,	$\overline{OE}$ = V <sub>CC</sub>			10	pF
r <sub>on</sub> §		V <sub>CC</sub> = 2.3 V, TYP at V <sub>CC</sub> = 2.5 V	V <sub>I</sub> = 0	I <sub>I</sub> = 64 mA	5	8	Ω
				I <sub>I</sub> = 24 mA	5	8	
			V <sub>I</sub> = 1.7 V,	I <sub>I</sub> = 15 mA	27	40	
		V <sub>CC</sub> = 3 V	V <sub>I</sub> = 0	I <sub>I</sub> = 64 mA	5	7	
				I <sub>I</sub> = 24 mA	5	7	
			V <sub>I</sub> = 2.4 V,	I <sub>I</sub> = 15 mA	10	15	

† All typical values are at V<sub>CC</sub> = 3.3 V (unless otherwise noted), T<sub>A</sub> = 25°C.

‡ This is the increase in supply current for each input that is at the specified voltage level, rather than V<sub>CC</sub> or GND.

§ 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 <sub>CC</sub> = 2.5 V ± 0.2 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		UNIT
			MIN	MAX	MIN	MAX	
t <sub>pd</sub> <sup>¶</sup>	A or B	B or A	0.15		0.25		ns
t <sub>en</sub>	$\overline{OE}$	A or B	1	5	1	4.3	ns
t <sub>dis</sub>	$\overline{OE}$	A or B	1	5.5	1	5.5	ns

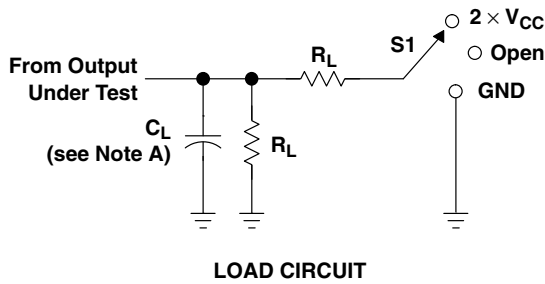
¶ The propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).

# SN74CBTLV3384

## LOW-VOLTAGE 10-BIT FET BUS SWITCH

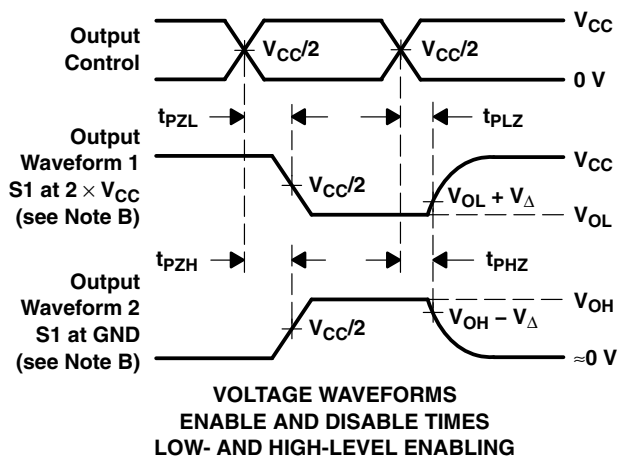
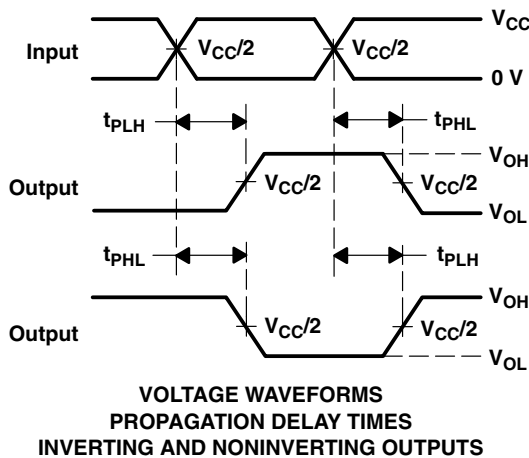
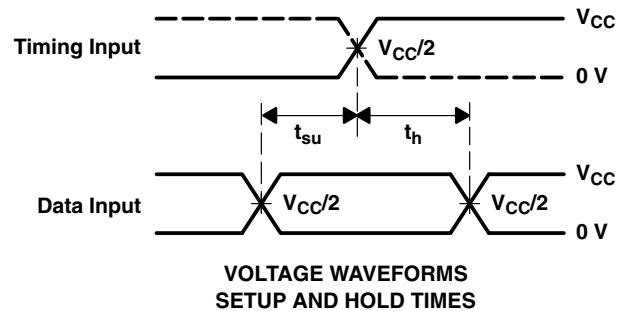
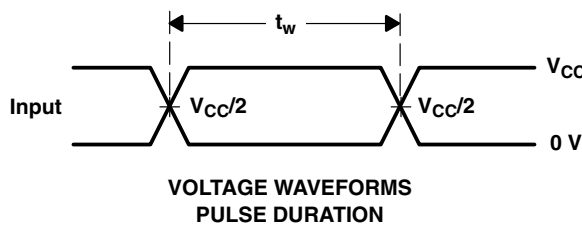
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### PARAMETER MEASUREMENT INFORMATION



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:
- $C_L$  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:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2 \text{ ns}$ ,  $t_f \leq 2 \text{ ns}$ .
  - The outputs are measured one at a time, with one transition per measurement.
  - $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74CBTLV3384DBQR	ACTIVE	SSOP	DBQ	24	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	CBTLV3384	<a href="#">Samples</a>
SN74CBTLV3384DGVR	ACTIVE	TVSOP	DGV	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	CL384	<a href="#">Samples</a>
SN74CBTLV3384DW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	CBTLV3384	<a href="#">Samples</a>
SN74CBTLV3384DWR	ACTIVE	SOIC	DW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	CBTLV3384	<a href="#">Samples</a>
SN74CBTLV3384PW	ACTIVE	TSSOP	PW	24	60	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	CL384	<a href="#">Samples</a>
SN74CBTLV3384PWR	ACTIVE	TSSOP	PW	24	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	CL384	<a href="#">Samples</a>

(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.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

<sup>(6)</sup> Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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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
SN74CBTLV3384DBQR	SSOP	DBQ	24	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74CBTLV3384DGVR	TVSOP	DGV	24	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74CBTLV3384DWR	SOIC	DW	24	2000	330.0	24.4	10.75	15.7	2.7	12.0	24.0	Q1
SN74CBTLV3384PWR	TSSOP	PW	24	2000	330.0	16.4	6.95	8.3	1.6	8.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74CBTLV3384DBQR	SSOP	DBQ	24	2500	367.0	367.0	38.0
SN74CBTLV3384DGVR	TVSOP	DGV	24	2000	367.0	367.0	35.0
SN74CBTLV3384DWR	SOIC	DW	24	2000	367.0	367.0	45.0
SN74CBTLV3384PWR	TSSOP	PW	24	2000	367.0	367.0	38.0



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

DW (R-PDSO-G24)

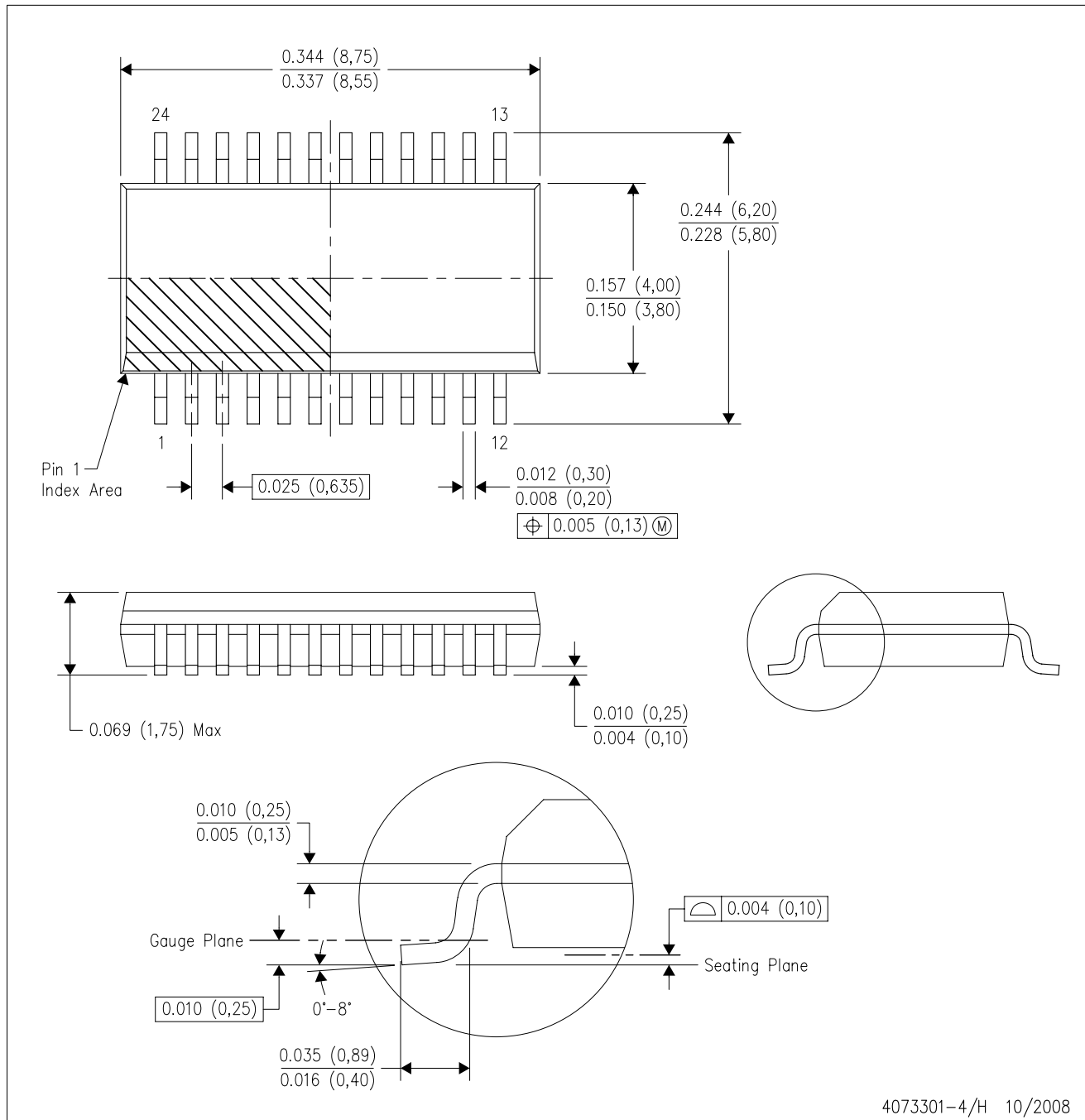
PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - Falls within JEDEC MS-013 variation AD.

DBQ (R-PDSO-G24)

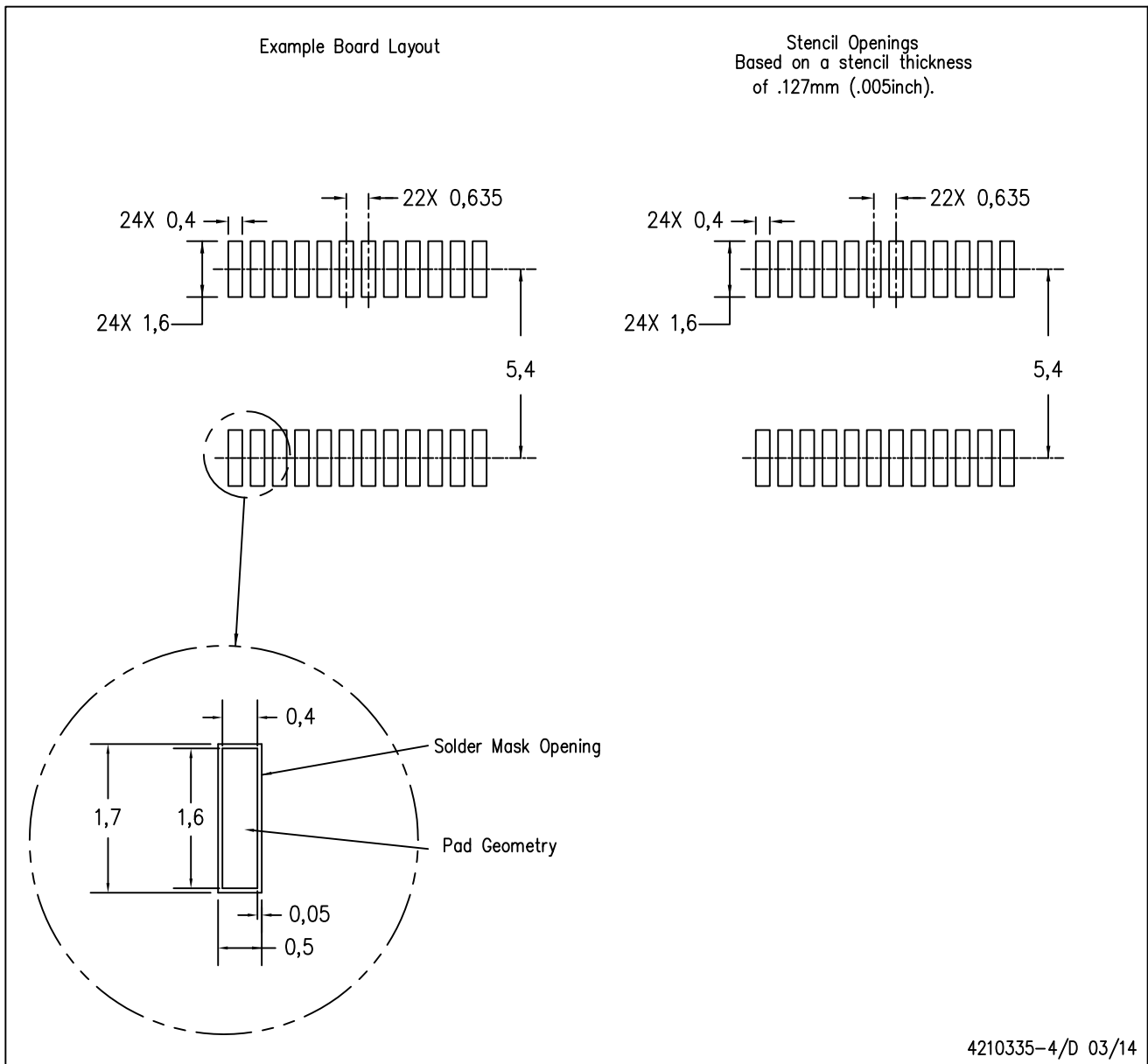
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15) per side.
  - Falls within JEDEC MO-137 variation AE.

DBQ (R-PDSO-G24)

PLASTIC SMALL OUTLINE PACKAGE



- 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. 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

PW (R-PDSO-G24)

PLASTIC SMALL OUTLINE

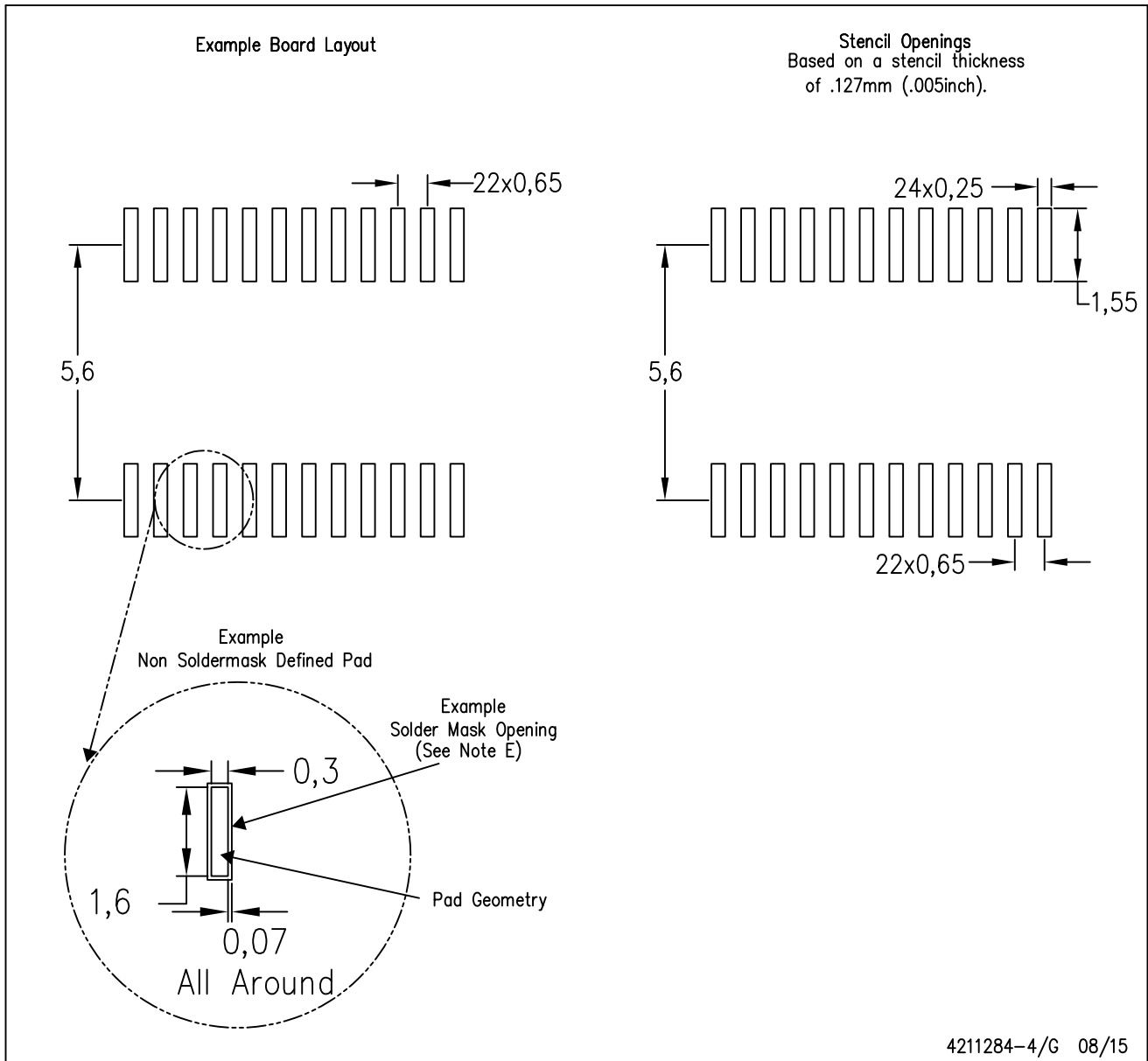


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- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
  - 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-G24)

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.

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