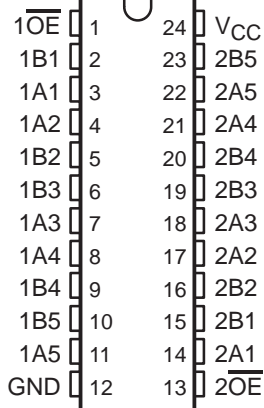


# SN54CBTD3384, SN74CBTD3384 10-BIT FET BUS SWITCHES WITH LEVEL SHIFTING

SCDS025R – MAY 1995 – REVISED JANUARY 2004

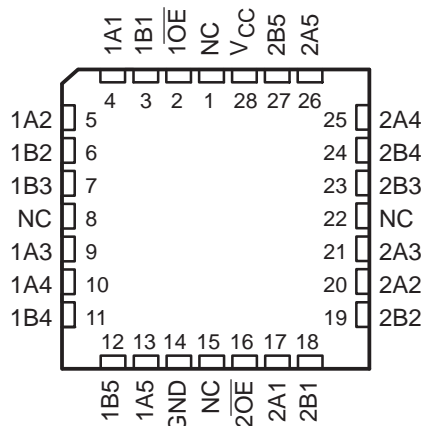
- 5-Ω Switch Connection Between Two Ports
- TTL-Compatible Input Levels

SN54CBTD3384 . . . JT OR W PACKAGE  
SN74CBTD3384 . . . DB, DBQ, DGV, DW, OR PW PACKAGE  
(TOP VIEW)



- Designed to Be Used in Level-Shifting Applications

SN54CBTD3384 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

## description/ordering information

The 'CBTD3384 devices provide ten bits of high-speed TTL-compatible bus switching. The low on-state resistance of the switches allows connections to be made without adding propagation delay. A diode to  $V_{CC}$  is integrated on the die to allow for level shifting from 5-V signals at the device inputs to 3.3-V signals at the device outputs.

These devices are organized as two 5-bit switches with separate output-enable ( $\overline{OE}$ ) inputs. When  $\overline{OE}$  is low, the 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.

## ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	SOIC – DW	Tube	SN74CBTD3384DW	CBTD3384
		Tape and reel	SN74CBTD3384DWR	
	SSOP – DB	Tape and reel	SN74CBTD3384DBR	CC384
	SSOP (QSOP) – DBQ	Tape and reel	SN74CBTD3384DBQR	CBTD3384
	TSSOP – PW	Tube	SN74CBTD3384PW	CC384
		Tape and reel	SN74CBTD3384PWR	
–55°C to 125°C	TVSOP – DGV	Tape and reel	SN74CBTD3384DGVR	CC384
	CDIP – JT	Tube	SNJ54CBTD3384JT	SNJ54CBTD3384JT
	CFP – W	Tube	SNJ54CBTD3384W	SNJ54CBTD3384W
	LCCC – FK	Tube	SNJ54CBTD3384FK	SNJ54CBTD3384FK

† 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).



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

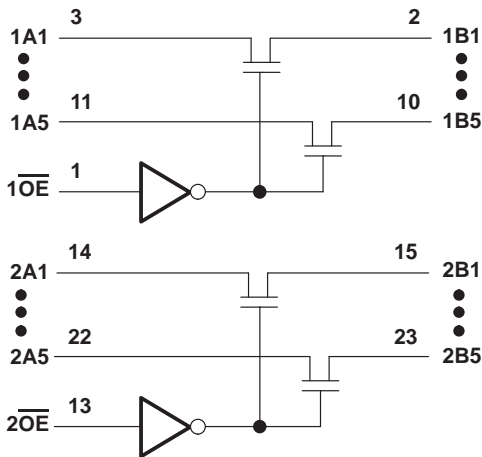
# SN54CBTD3384, SN74CBTD3384 10-BIT FET BUS SWITCHES WITH LEVEL SHIFTING

SCDS025R – MAY 1995 – REVISED JANUARY 2004

FUNCTION TABLE  
(each 5-bit bus switch)

INPUTS		INPUTS/OUTPUTS	
1OE	2OE	1B1–1B5	2B1–2B5
L	L	1A1–1A5	2A1–2A5
L	H	1A1–1A5	Z
H	L	Z	2A1–2A5
H	H	Z	Z

## logic diagram (positive logic)



Pin numbers shown are for the DB, DBQ, DGV, DW, JT, PW, and W packages.

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

Supply voltage range, $V_{CC}$	–0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1)	–0.5 V to 7 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):	
DB package	63°C/W
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

† 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.

# SN54CBTD3384, SN74CBTD3384 10-BIT FET BUS SWITCHES WITH LEVEL SHIFTING

SCDS025R – MAY 1995 – REVISED JANUARY 2004

## recommended operating conditions (see Note 3)

		SN54CBTD3384		SN74CBTD3384		UNIT
		MIN	MAX	MIN	MAX	
$V_{CC}$	Supply voltage	4.5	5.5	4.5	5.5	V
$V_{IH}$	High-level control input voltage	2		2		V
$V_{IL}$	Low-level control input voltage		0.8		0.8	V
$T_A$	Operating free-air temperature	–55	125	–40	85	°C

In applications with fast edge rates, multiple outputs switching, and operating at high frequencies, the output may have little or no level-shifting effect.

NOTE 3: 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 over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS		SN54CBTD3384			SN74CBTD3384			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
V <sub>IK</sub>		V <sub>CC</sub> = 4.5 V, I <sub>I</sub> = −18 mA		−1.2			−1.2			V
V <sub>OH</sub>		See Figure 2								
I <sub>I</sub>		V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 5.5 V or GND		±1			±1			μA
I <sub>CC</sub>		V <sub>CC</sub> = 5.5 V, I <sub>O</sub> = 0, V <sub>I</sub> = V <sub>CC</sub> or GND		1.5			1.5			mA
ΔI <sub>CC</sub> ‡	Control inputs	V <sub>CC</sub> = 5.5 V, One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND		2.5			2.5			mA
C <sub>i</sub>	Control inputs	V <sub>I</sub> = 3 V or 0		3			3			pF
C <sub>io</sub> (OFF)		V <sub>O</sub> = 3 V or 0, $\overline{OE}$ = V <sub>CC</sub>		3.5			3.5			pF
r <sub>on</sub> §		V <sub>CC</sub> = 4.5 V	V <sub>I</sub> = 0	I <sub>I</sub> = 64 mA	5		5		7	Ω
				I <sub>I</sub> = 30 mA	5		5		7	
			V <sub>I</sub> = 2.4 V, I <sub>I</sub> = 15 mA	35		35		50		

† Typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

‡ This is the increase in supply current for each input that is at the specified TTL voltage level, rather than  $V_{CC}$  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 lowest voltage of the two (A or B) terminals.

## switching characteristics over recommended ranges of supply voltage and operating free-air temperature range, $C_L = 50\text{ pF}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54CBTD3384		SN74CBTD3384		UNIT
			MIN	MAX	MIN	MAX	
$t_{pd}^\P$	A or B	B or A		0.25		0.25	ns
$t_{en}$	$\overline{OE}$	A or B	2.2	9.7	2.3	7	ns
$t_{dis}$	$\overline{OE}$	A or B	1.5	8.6	1.7	5.3	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).

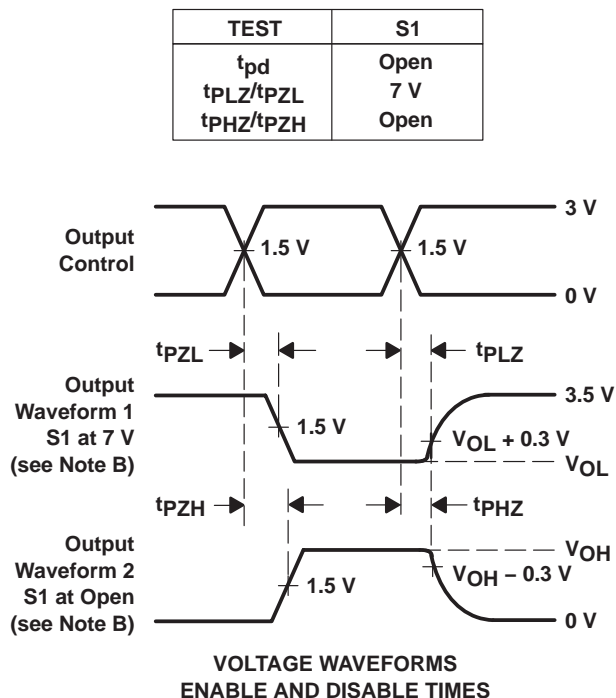
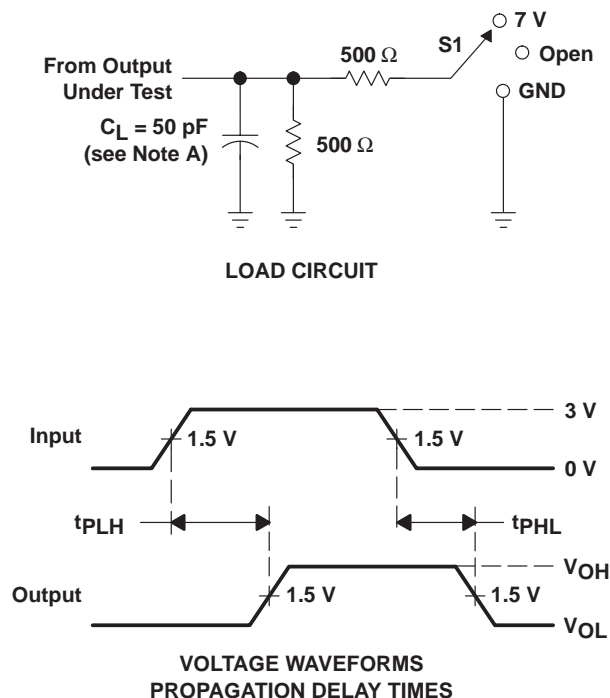
# SN54CBTD3384, SN74CBTD3384

## 10-BIT FET BUS SWITCHES

### WITH LEVEL SHIFTING

SCDS025R – MAY 1995 – REVISED JANUARY 2004

#### 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  $t_{pd}$ .

Figure 1. Load Circuit and Voltage Waveforms

## TYPICAL CHARACTERISTICS

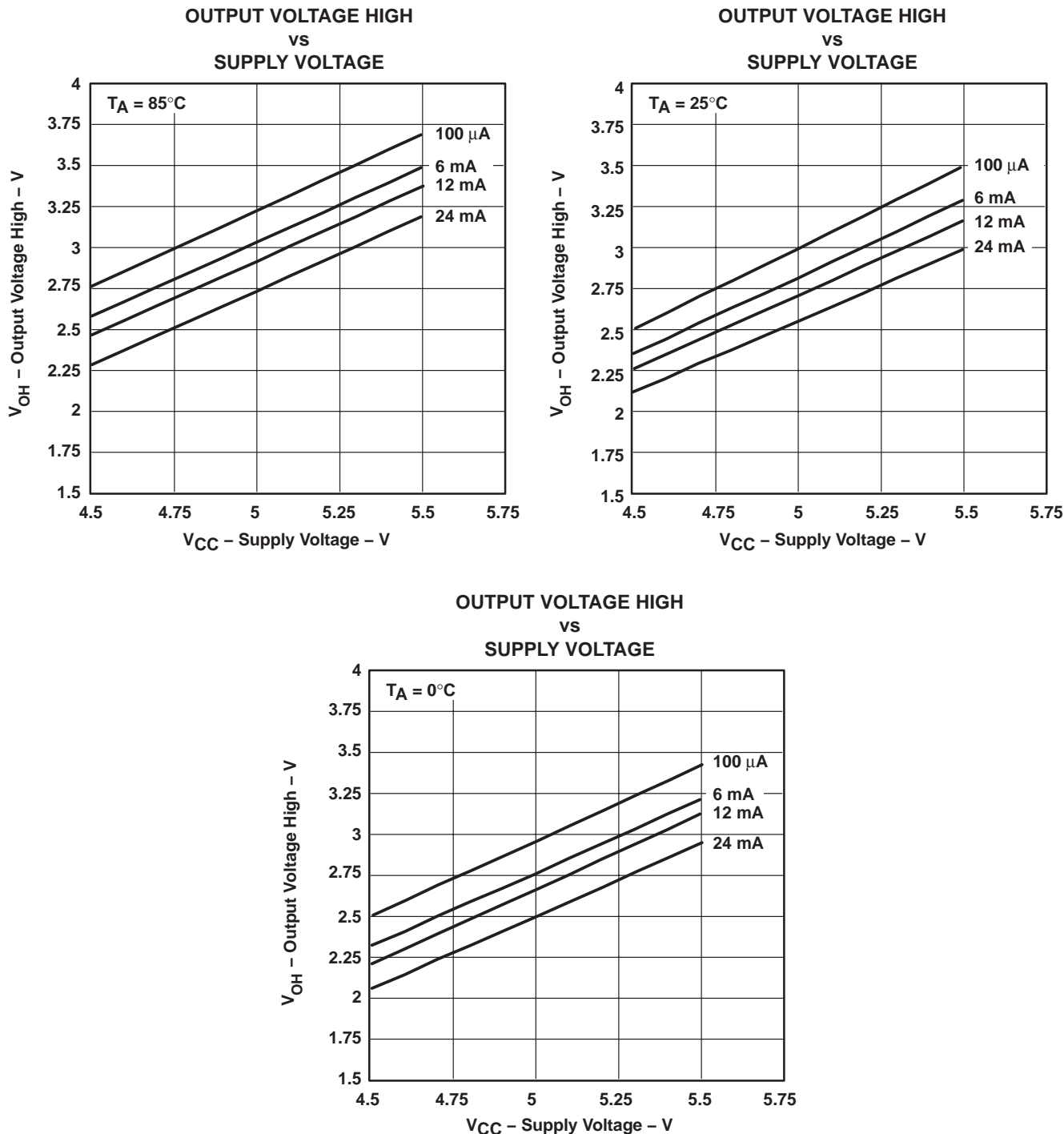


Figure 2. VOH Values

## 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="#">5962-9752701Q3A</a>	Active	Production	LCCC (FK)   28	42   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 9752701Q3A SNJ54CBTD 3384FK
<a href="#">SN74CBTD3384DBQR</a>	Obsolete	Production	SSOP (DBQ)   24	-	-	Call TI	Call TI	-40 to 85	CBTD3384
<a href="#">SN74CBTD3384DBR</a>	NRND	Production	SSOP (DB)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CC384
SN74CBTD3384DBR.A	NRND	Production	SSOP (DB)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CC384
<a href="#">SN74CBTD3384DGVR</a>	Obsolete	Production	TVSOP (DGV)   24	-	-	Call TI	Call TI	-40 to 85	CC384
SN74CBTD3384DGVR.B	Obsolete	Production	TVSOP (DGV)   24	-	-	Call TI	Call TI	-40 to 85	CC384
<a href="#">SN74CBTD3384DW</a>	Obsolete	Production	SOIC (DW)   24	-	-	Call TI	Call TI	-40 to 85	CBTD3384
<a href="#">SN74CBTD3384DWR</a>	Obsolete	Production	SOIC (DW)   24	-	-	Call TI	Call TI	-40 to 85	CBTD3384
<a href="#">SN74CBTD3384PW</a>	Obsolete	Production	TSSOP (PW)   24	-	-	Call TI	Call TI	-40 to 85	CC384
<a href="#">SNJ54CBTD3384FK</a>	Active	Production	LCCC (FK)   28	42   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 9752701Q3A SNJ54CBTD 3384FK
SNJ54CBTD3384FK.A	Active	Production	LCCC (FK)   28	42   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 9752701Q3A SNJ54CBTD 3384FK

(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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**OTHER QUALIFIED VERSIONS OF SN54CBTD3384, SN74CBTD3384 :**

- Catalog : [SN74CBTD3384](#)
- Military : [SN54CBTD3384](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

## 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
SN74CBTD3384DBR	SSOP	DB	24	2000	330.0	16.4	8.2	8.8	2.5	12.0	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)
SN74CBTD3384DBR	SSOP	DB	24	2000	353.0	353.0	32.0

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)

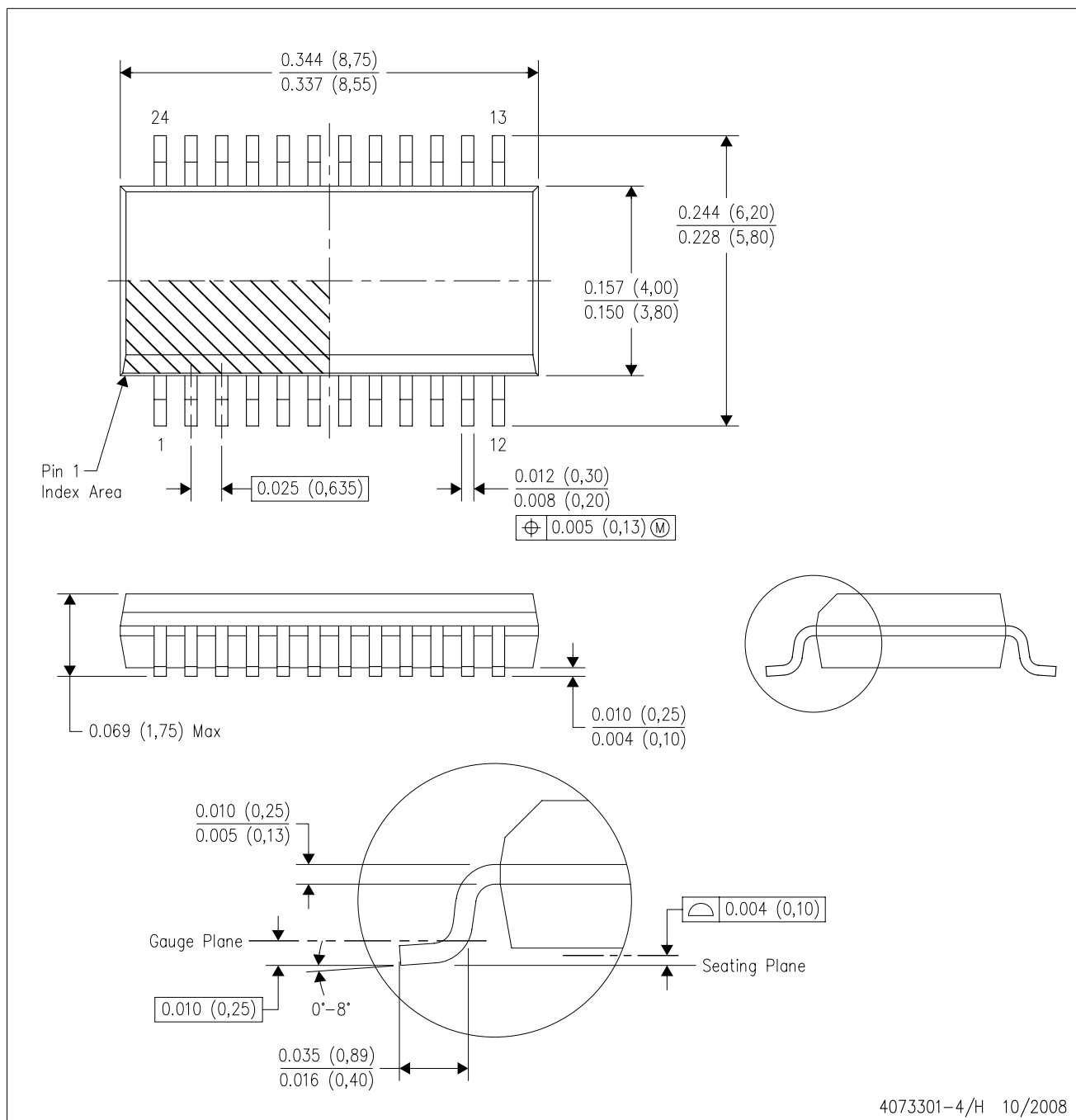


4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - Falls within JEDEC MS-004

DBQ (R-PDSO-G24)

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



## PACKAGE OUTLINE

## TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4220208/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

PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

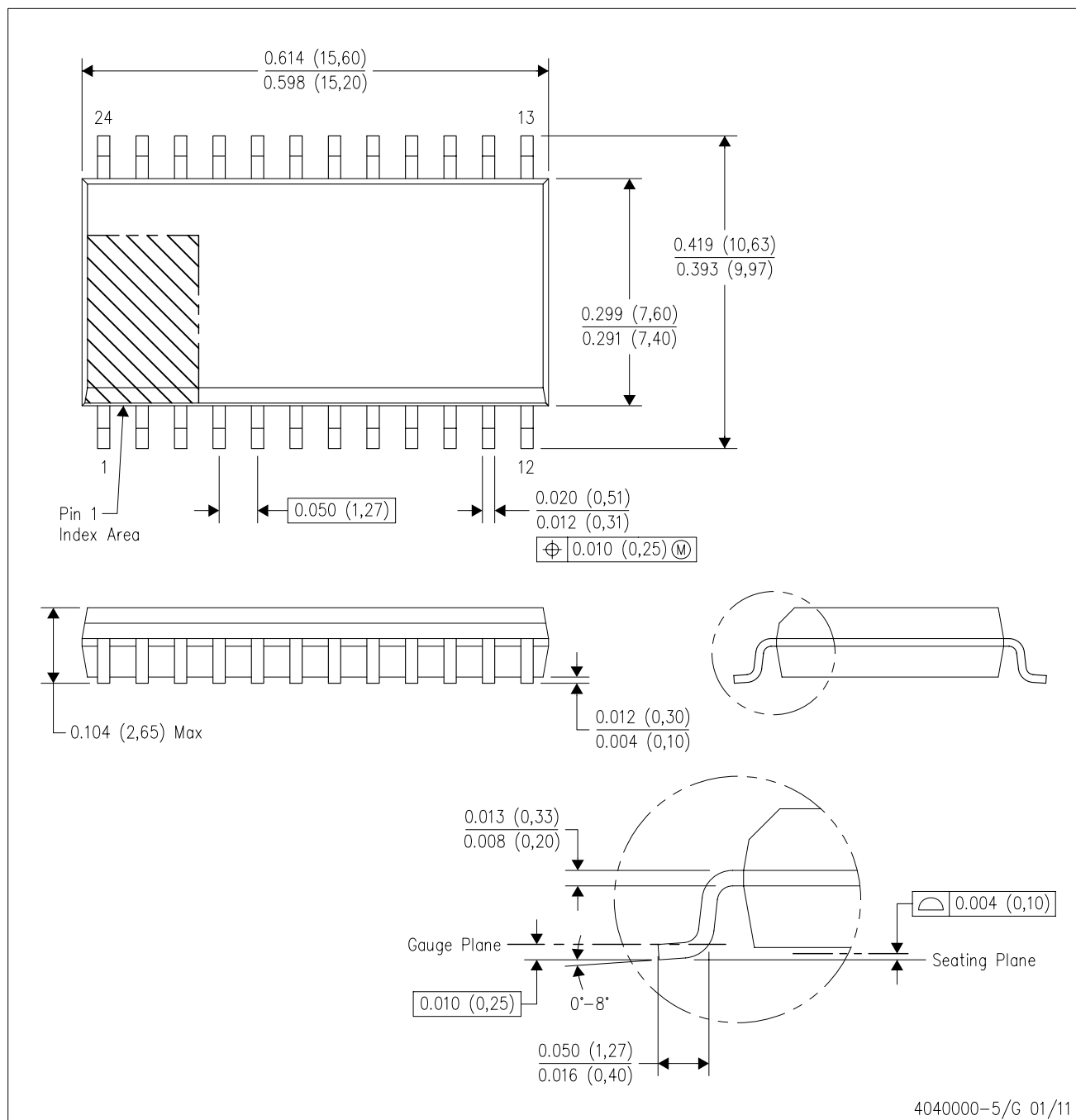
4220208/A 02/2017

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.

DW (R-PDSO-G24)

PLASTIC SMALL OUTLINE





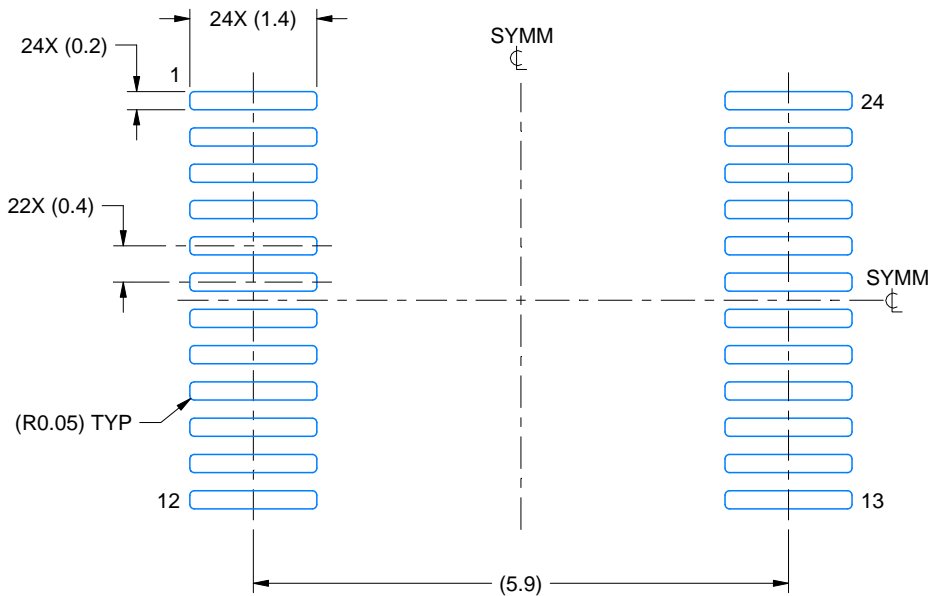


# EXAMPLE BOARD LAYOUT

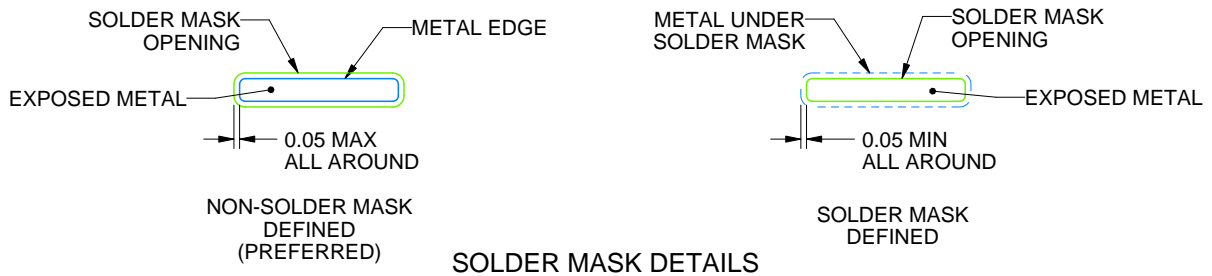
DGV0024A

TVSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 12X



SOLDER MASK DETAILS

4229221/A 12/2022

NOTES: (continued)

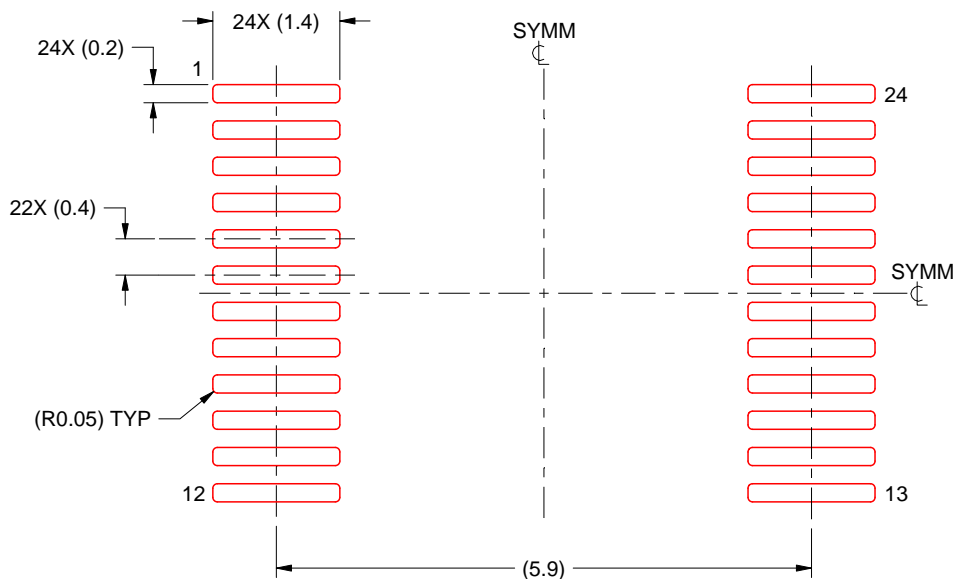
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DGV0024A

TVSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 12X

4229221/A 12/2022

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.

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

## PLASTIC SMALL-OUTLINE

28 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.  
 D. Falls within JEDEC MO-150

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