

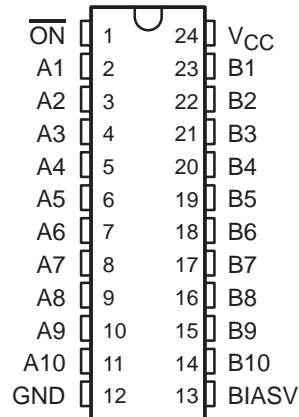
# SN74CBTK6800

## 10-BIT FET BUS SWITCH WITH PRECHARGED OUTPUTS AND ACTIVE-CLAMP UNDERSHOOT-PROTECTION CIRCUIT

SCDS107B – APRIL 2000 – REVISED OCTOBER 2000

- 5-Ω Switch Connection Between Two Ports
- TTL-Compatible Input Levels
- Power Off Disables Outputs, Permitting Live Insertion
- Outputs Are Precharged by Bias Voltage to Minimize Signal Distortion During Live Insertion
- Active-Clamp Undershoot-Protection Circuit on the I/Os Clamps Undershoots Down to -2 V
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

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



### description

The SN74CBTK6800 device provides ten bits of high-speed TTL-compatible bus switching. The low on-state resistance of the switch allows bidirectional connections to be made while adding near-zero propagation delay. The device also precharges the B port to a user-selectable bias voltage (BIASV) to minimize live-insertion noise.

The A and B ports have an active-clamp undershoot-protection circuit. When there is an undershoot, the active-clamp circuit is enabled and current from  $V_{CC}$  is supplied to clamp the output, preventing the pass transistor from turning on.

The SN74CBTK6800 is organized as one 10-bit switch with a single enable ( $\overline{ON}$ ) input. When  $\overline{ON}$  is low, the switch is on, and port A is connected to port B. When  $\overline{ON}$  is high, the switch between port A and port B is open. When  $\overline{ON}$  is high or  $V_{CC}$  is 0 V, B port is precharged to BIASV through the equivalent of a 10-kΩ resistor.

### ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	SOIC – DW	Tube	SN74CBTK6800DW	CBTK6800
		Tape and reel	SN74CBTK6800DWR	
	SSOP (QSOP) – DBQ	Tape and reel	SN74CBTK6800DBQR	CBTK6800
	TSSOP – PW	Tape and reel	SN74CBTK6800PWR	BK6800
	TVSOP – DGV	Tape and reel	SN74CBTK6800DGVR	BK6800

† 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

INPUT $\overline{ON}$	FUNCTION
L	A port = B port
H	A port = Z B port = BIASV



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 **TEXAS  
INSTRUMENTS**

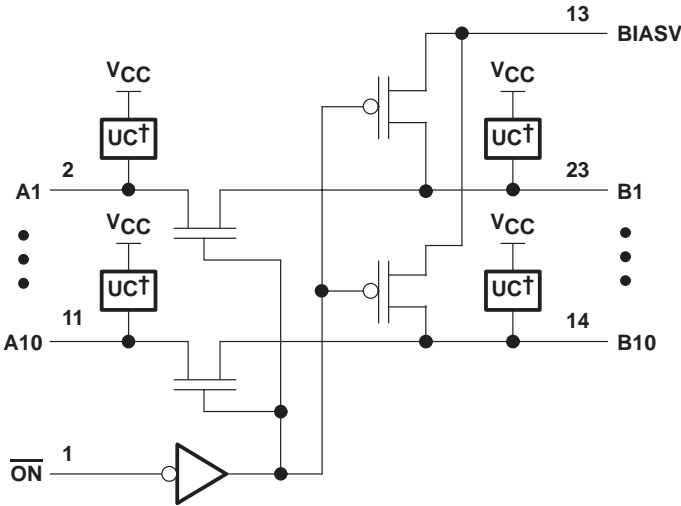
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logic diagram (positive logic)



† Undershoot clamp

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

Supply voltage range, $V_{CC}$	–0.5 V to 7 V
Bias voltage range, BIASV	–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, $I_{IK}$ ( $V_I < 0$ )	–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

‡ 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.

recommended operating conditions (see Note 3)

	MIN	MAX	UNIT
$V_{CC}$ Supply voltage	4	5.5	V
BIASV Supply voltage	1.3	$V_{CC}$	V
$V_{IH}$ High-level control input voltage	2		V
$V_{IL}$ Low-level control input voltage		0.8	V
$T_A$ Operating free-air temperature	–40	85	°C

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.

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

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
$V_{IK}$		$V_{CC} = 4.5\text{ V}$ ,	$I_I = -18\text{ mA}$			-1.2	V
$V_{IKU}$		$V_{CC} = 5.5\text{ V}$ ,	$0\text{ mA} \geq I_I \geq -50\text{ mA}$ , $\overline{OE} = 5.5\text{ V}$			-2	V
$I_I$		$V_{CC} = 5.5\text{ V}$ ,	$V_I = 5.5\text{ V}$ or GND			$\pm 5$	$\mu\text{A}$
$I_{off}$		$V_{CC} = 0$ ,	$V_I$ or $V_O = 0$ to $5.5\text{ V}$ , $\text{BIASV} = \text{Open}$			20	$\mu\text{A}$
$I_O$		$V_{CC} = 4.5\text{ V}$ ,	$V_O = 0$ , $\text{BIASV} = 2.4\text{ V}$	0.25			mA
$I_{CC}$		$V_{CC} = 5.5\text{ V}$ ,	$V_I = V_{CC}$ or GND, $I_O = 0$			20	$\mu\text{A}$
$\Delta I_{CC}^\ddagger$	Control inputs	$V_{CC} = 5.5\text{ V}$ ,	One input at $3.4\text{ V}$ , Other inputs at $V_{CC}$ or GND			2.5	mA
$C_i$	Control inputs	$V_I = 3\text{ V}$ or 0				3	pF
$C_{O(OFF)}$		$V_O = 3\text{ V}$ or 0, Switch off				8.5	pF
$r_{on}^\S$		$V_{CC} = 4\text{ V}$ , TYP at $V_{CC} = 4\text{ V}$	$V_I = 2.4\text{ V}$ , $I_I = 15\text{ mA}$			11 20	$\Omega$
		$V_{CC} = 4.5\text{ V}$	$V_I = 0$ , $I_I = 64\text{ mA}$			3 7	
			$I_I = 30\text{ mA}$			3 7	
			$V_I = 2.4\text{ V}$ , $I_I = 15\text{ mA}$			6 15	

† All typical values are at  $V_{CC} = 5\text{ V}$  (unless otherwise noted),  $T_A = 25^\circ\text{C}$ .

‡ 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 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)	TEST CONDITIONS	$V_{CC} = 4\text{ V}$		$V_{CC} = 5\text{ V}$ $\pm 0.5\text{ V}$		UNIT
				MIN	MAX	MIN	MAX	
$t_{pd}^\parallel$	A or B	B or A			0.35		0.25	ns
$t_{PZH}$	$\overline{ON}$	A or B	$\text{BIASV} = \text{GND}$		6	2	5.1	ns
$t_{PZL}$			$\text{BIASV} = 3\text{ V}$		6	2	5.6	
$t_{PHZ}$	$\overline{ON}$	A or B	$\text{BIASV} = \text{GND}$		5.5	1	5	ns
$t_{PLZ}$			$\text{BIASV} = 3\text{ V}$		5.5	2	5.9	

¶ 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).

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undershoot characteristics

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
V <sub>OUTU</sub>	See Figures 1 and 2, and Table 1	2	V <sub>OH</sub> –0.3		V

† All typical values are at V<sub>CC</sub> = 5 V (unless otherwise noted), T<sub>A</sub> = 25°C.

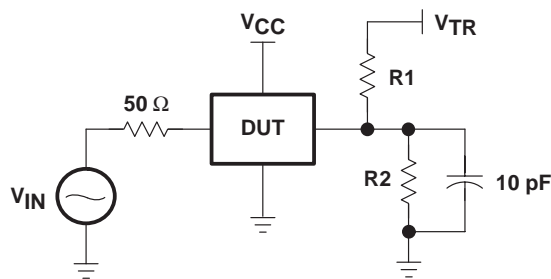


Figure 1. Device Test Setup

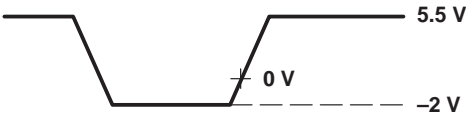


Figure 2. Transient Input Voltage Waveform

Table 1. Device Test Conditions

PARAMETER	VALUE	UNIT
B port under test‡	See Figure 1	
V <sub>IN</sub>	See Figure 2	V
t <sub>w</sub>	20	ns
t <sub>r</sub>	2	ns
t <sub>f</sub>	2	ns
R1 = R2	100	kΩ
V <sub>TR</sub>	11	V
V <sub>CC</sub>	5.5	V
BIASV	Open	

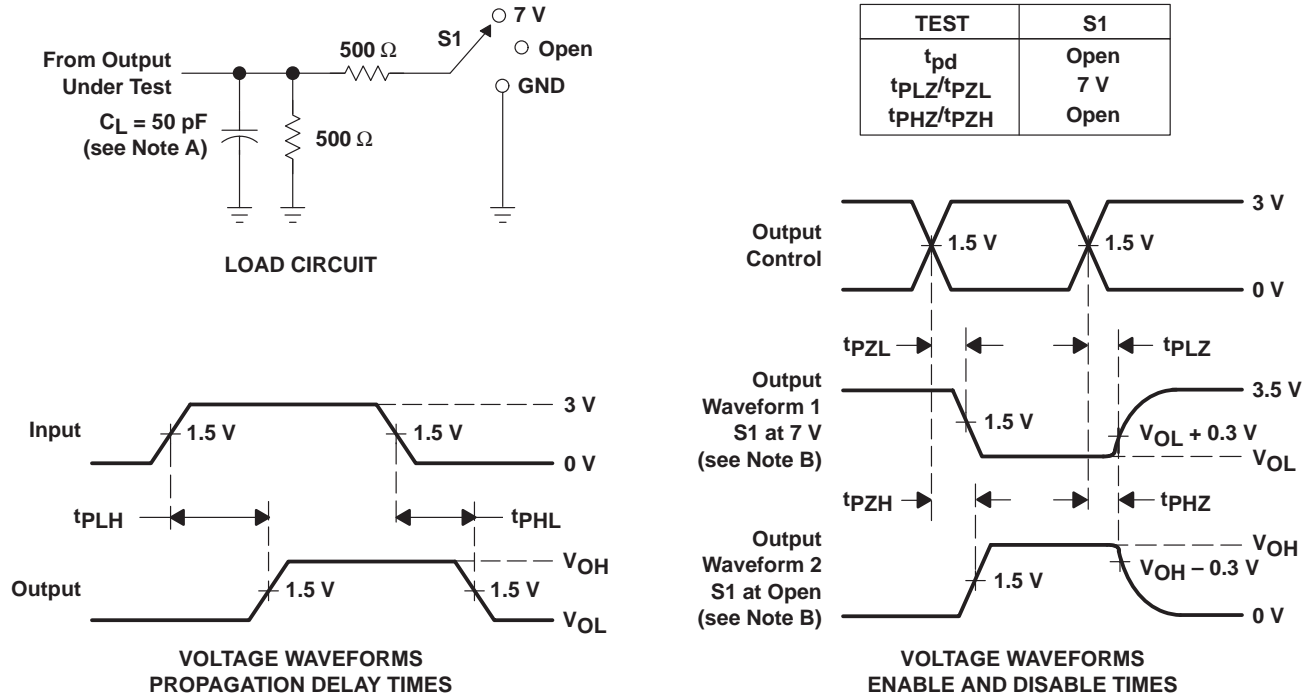
‡ Other B-port outputs are open.

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## 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:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5$  ns,  $t_f \leq 2.5$  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 3. Load 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="#">SN74CBTK6800DBQR</a>	Active	Production	SSOP (DBQ)   24	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	CBTK6800
SN74CBTK6800DBQR.A	Active	Production	SSOP (DBQ)   24	2500   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	CBTK6800
<a href="#">SN74CBTK6800PWR</a>	Active	Production	TSSOP (PW)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BK6800
SN74CBTK6800PWR.A	Active	Production	TSSOP (PW)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BK6800

<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
SN74CBTK6800DBQR	SSOP	DBQ	24	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1

## TAPE AND REEL BOX DIMENSIONS



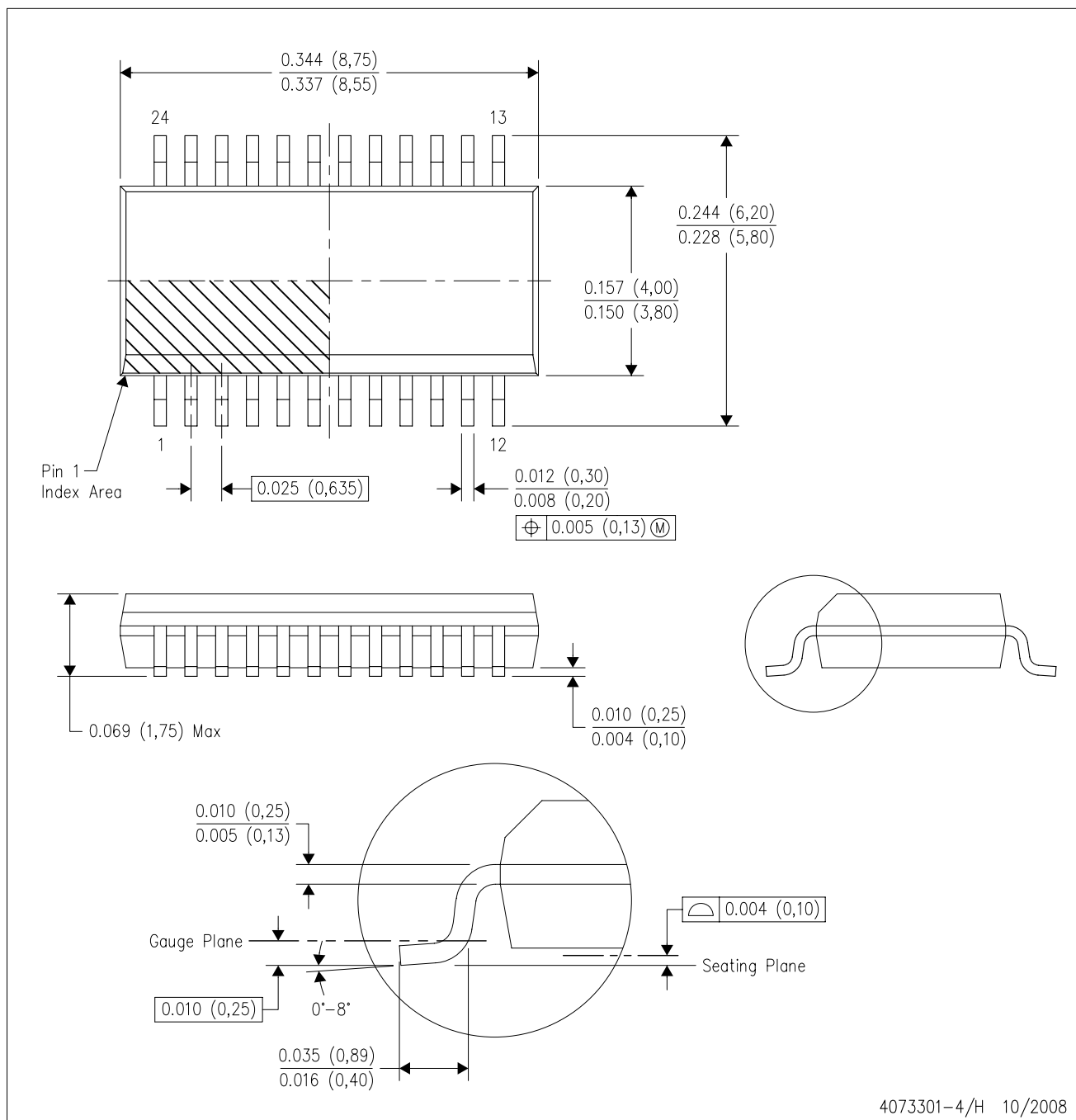
\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74CBTK6800DBQR	SSOP	DBQ	24	2500	353.0	353.0	32.0

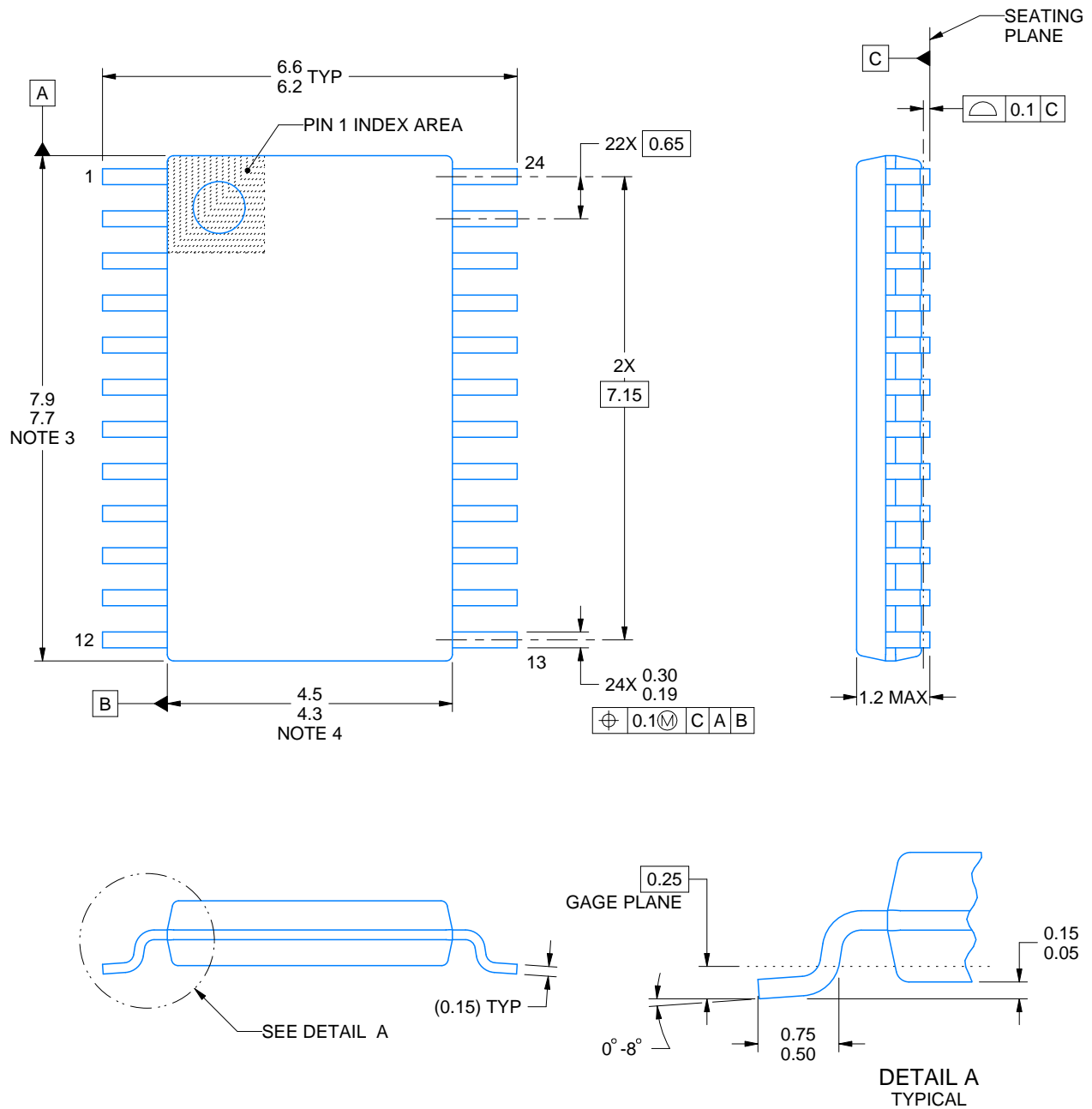
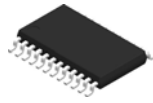


DBQ (R-PDSO-G24)

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.



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## 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

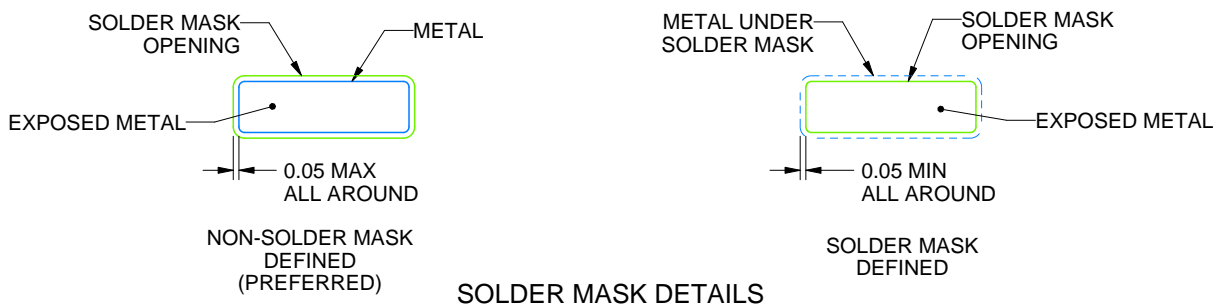
PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



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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

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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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