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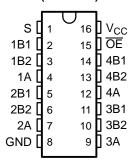
SCDS149-OCTOBER 2003-REVISED MARCH 2005

### **FEATURES**

- Output Voltage Translation Tracks V<sub>CC</sub>
- Supports Mixed-Mode Signal Operation on All Data I/O Ports
  - 5-V Input Down to 3.3-V Output Level Shift With 3.3-V V<sub>CC</sub>
  - 5-V/3.3-V Input Down to 2.5-V Output Level Shift With 2.5-V  $\mbox{V}_{\mbox{\scriptsize CC}}$
- 5-V-Tolerant I/Os With Device Powered Up or Powered Down
- Bidirectional Data Flow With Near-Zero Propagation Delay
- Low ON-State Resistance (r<sub>on</sub>) Characteristics (r<sub>on</sub> = 5 Ω Typ)
- Low Input/Output Capacitance Minimizes Loading (C<sub>io(OFF)</sub> = 5 pF Typ)
- Data and Control Inputs Provide Undershoot Clamp Diodes

- Low Power Consumption ( $I_{CC} = 20 \mu A Max$ )
- V<sub>CC</sub> 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<sub>off</sub> Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Performance Tested Per JESD 22
  - 2000-V Human-Body Model (A114-B, Class II)
  - 1000-V Charged-Device Model (C101)
- Supports Digital Applications: Level Translation, USB Interface, Memory Interleaving, Bus Isolation
- Ideal for Low-Power Portable Equipment

#### DGV OR PW PACKAGE (TOP VIEW)



### **DESCRIPTION/ORDERING INFORMATION**

The SN74CB3T3257 is a high-speed TTL-compatible FET multiplexer/demultiplexer with low ON-state resistance  $(r_{on})$ , allowing for minimal propagation delay. The device fully supports mixed-mode signal operation on all data I/O ports by providing voltage translation that tracks  $V_{CC}$ . The SN74CB3T3257 supports systems using 5-V TTL, 3.3-V LVTTL, and 2.5-V CMOS switching standards, as well as user-defined switching levels (see Figure 1).

#### ORDERING INFORMATION

T <sub>A</sub>	PACKA	GE <sup>(1)</sup>	ORDERABLE PART NUMBER	TOP-SIDE MARKING
	TCCOD DW	Tube	SN74CB3T3257PW	KC0E7
–40°C to 85°C	TSSOP – PW	Tape and reel	SN74CB3T3257PWR	KS257
	TVSOP - DGV	Tape and reel	SN74CB3T3257DGVR	KS257

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at 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.



### **DESCRIPTION/ORDERING INFORMATION (CONTINUED)**

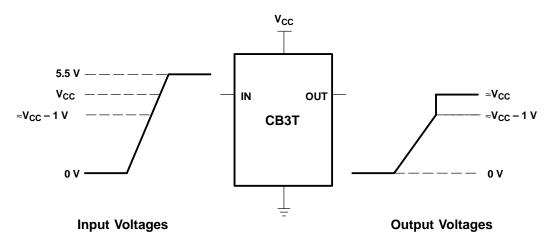
The SN74CB3T3257 is a 4-bit 1-of-2 multiplexer/demultiplexer with a single output-enable  $(\overline{OE})$  input. The select (S) input controls the data path of the multiplexer/demultiplexer. When  $\overline{OE}$  is low, the multiplexer/demultiplexer is enabled, and the A port is connected to the B port, allowing bidirectional data flow between ports. When  $\overline{OE}$  is high, the multiplexer/demultiplexer is disabled, and a high-impedance state exists between the A and B ports.

This device is fully specified for partial-power-down applications using I<sub>off</sub>. The I<sub>off</sub> 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.

# FUNCTION TABLE (EACH MULTIPLEXER)

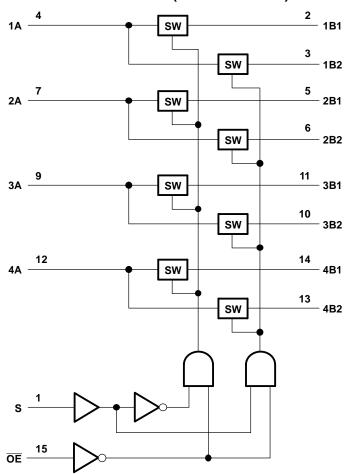
INPL	JTS	INPUT/OUTPUT	FUNCTION				
ŌĒ	s	Α	FUNCTION				
L	L	B1	A port = B1 port				
L	Н	B2	A port = B2 port				
Н	Χ	Z	Disconnect				



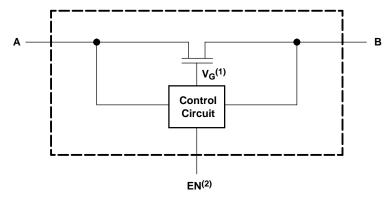
NOTE A: If the input high voltage (V<sub>IH</sub>) level is greater than or equal to V<sub>CC</sub> – 1 V, and less than or equal to 5.5 V, then the output high voltage (V<sub>OH</sub>) level will be equal to approximately the V<sub>CC</sub> voltage level.

Figure 1. Typical DC Voltage Translation Characteristics

### **LOGIC DIAGRAM (POSITIVE LOGIC)**



### SIMPLIFIED SCHEMATIC, EACH FET SWITCH (SW)



- (1) Gate voltage (V<sub>G</sub>) is equal to approximately V<sub>CC</sub> + V<sub>T</sub> when the switch is ON and V<sub>I</sub> > V<sub>CC</sub> + V<sub>T</sub>.
- (2) EN is the internal enable signal applied to the switch.

### SN74CB3T3257 4-BIT 1-OF-2 FET MULTIPLEXER/DEMULTIPLEXER 2.5-V/3.3-V LOW-VOLTAGE BUS SWITCH WITH 5-V-TOLERANT LEVEL SHIFTER



SCDS149-OCTOBER 2003-REVISED MARCH 2005

### 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	7	V
V <sub>IN</sub>	Control input voltage range (2)(3)			-0.5	7	V
V <sub>I/O</sub>	Switch I/O voltage range (2)(3)(4)			-0.5	7	V
I <sub>IK</sub>	Control input clamp current	V <sub>IN</sub> < 0			-50	mA
I <sub>I/OK</sub>	I/O port clamp current	I/O port clamp current $V_{I/O} < 0$				mA
I <sub>IO</sub>	ON-state switch current <sup>(5)</sup>				±128	mA
	Continuous current through V <sub>CC</sub> or GND				±100	mA
0	Deckage thermal impedance (6)	DGV package			120	°C/W
$\theta_{JA}$	Package thermal impedance (6)	PW package			108	·C/VV
T <sub>stg</sub>	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.
- All voltages are with respect to ground, unless otherwise specified.
- The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (4)  $V_I$  and  $V_O$  are used to denote specific conditions for  $V_{I/O}$ .
- $I_{\rm l}$  and  $I_{\rm O}$  are used to denote specific conditions for  $I_{\rm l/O}$ . The package thermal impedance is calculated in accordance with JESD 51-7.

### Recommended Operating Conditions<sup>(1)</sup>

			MIN	MAX	UNIT
$V_{CC}$	Supply voltage		2.3	3.6	V
.,	High level control input valte as	V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	5.5	W
V <sub>IH</sub>	High-level control input voltage	V <sub>CC</sub> = 2.7 V to 3.6 V	2	5.5	V
.,	Laveland control in out wellows	V <sub>CC</sub> = 2.3 V to 2.7 V	0	0.7	W
$V_{IL}$	Low-level control input voltage	V <sub>CC</sub> = 2.7 V to 3.6 V	0	0.8	V
V <sub>I/O</sub>	Data input/output voltage		0	5.5	V
$T_A$	Operating free-air temperature		-40	85	°C

<sup>(1)</sup> 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.

### SN74CB3T3257 4-BIT 1-OF-2 FET MULTIPLEXER/DEMULTIPLEXER 2.5-V/3.3-V LOW-VOLTAGE BUS SWITCH WITH 5-V-TOLERANT LEVEL SHIFTER

SCDS149-OCTOBER 2003-REVISED MARCH 2005

### Electrical Characteristics(1)

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

PA	RAMETER	TEST CONDITION	ONS	MIN	TYP <sup>(2)</sup>	MAX	UNIT	
$V_{IK}$		$V_{CC} = 3 \text{ V, I}_{I} = -18 \text{ mA}$				-1.2	V	
V <sub>OH</sub>		See Figures 3 and 4						
I <sub>IN</sub>	Control inputs	V <sub>CC</sub> = 3.6 V, V <sub>IN</sub> = 3.6 V to 5.5 V or GND				±10	μΑ	
		V <sub>CC</sub> = 3.6 V,	$V_1 = V_{CC} - 0.7 \text{ V to } 5.5 \text{ V}$			±20		
I <sub>I</sub>		Switch ON,	$V_{I} = 0.7 \text{ V to } V_{CC} - 0.7 \text{ V}$			-40	μΑ	
		$V_{IN} = V_{CC}$ or GND	$V_1 = 0 \text{ to } 0.7 \text{ V}$			±5		
I <sub>OZ</sub> (3)		$V_{CC} = 3.6 \text{ V}, V_{O} = 0 \text{ to } 5.5 \text{ V}, V_{I} = 0, \text{ Switch } 0$	OFF, V <sub>IN</sub> = V <sub>CC</sub> or GND			±10	μΑ	
I <sub>off</sub>	W 0.4					10	μΑ	
		$V_{CC} = 3.6 \text{ V}, I_{I/O} = 0,$	$V_I = V_{CC}$ or GND			20		
Icc		Switch ON or OFF, $V_{IN} = V_{CC}$ or GND	V <sub>I</sub> = 5.5 V			20	μΑ	
$\Delta I_{CC}^{(4)}$	Control inputs	$V_{CC}$ = 3 V to 3.6 V, One input at $V_{CC}$ – 0.6 V			300	μΑ		
C <sub>in</sub>	Control inputs	$V_{CC} = 3.3 \text{ V}, V_{IN} = V_{CC} \text{ or GND}$			3		pF	
0	A port	V 00 V V 55 V 00 V 27 OND 02	Cirl OFF V V OND		7			
$C_{io(OFF)}$	B port	$V_{CC} = 3.3 \text{ V}, V_{I/O} = 5.5 \text{ V}, 3.3 \text{ V}, \text{ or GND, Sw}$	5			pF		
	A1		$V_{I/O} = 5.5 \text{ V or } 3.3 \text{ V}$		6			
•	A port	$V_{CC} = 3.3 \text{ V},$	$V_{I/O} = GND$		16		_	
$C_{io(ON)}$	Daniel	Switch ON, $V_{IN} = V_{CC}$ or GND	$V_{I/O} = 5.5 \text{ V or } 3.3 \text{ V}$	4			pF	
	B port		$V_{I/O} = GND$		16			
		$V_{CC} = 2.3 \text{ V}$ , TYP at $V_{CC} = 2.5 \text{ V}$ ,	I <sub>O</sub> = 24 mA		5	8		
<b>~</b> (5)		$V_1 = 0$	I <sub>O</sub> = 16 mA		5	8	Ω	
r <sub>on</sub> (5)		$V_{CC} = 3 \text{ V},$ $I_{O} = 64 \text{ mA}$			5	7	22	
		$V_1 = 0$	I <sub>O</sub> = 32 mA		5	7		

- $V_{IN}$  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 V (unless otherwise noted),  $T_{A}$  = 25°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.
- Measured by the voltage drop between 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**

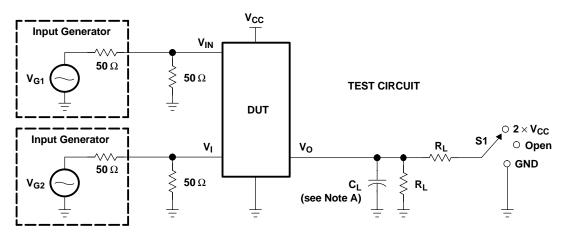
over recommended operating free-air temperature range (unless otherwise noted) (see Figure 2)

PARAMETER	FROM	TO (OUTPUT)	V <sub>CC</sub> = ± 0.2	2.5 V 2 V	$V_{CC}$ = 3.3 V $\pm$ 0.3 V		UNIT
	(INPUT)	(001701)	MIN	MAX	MIN	MAX	
t <sub>pd</sub> <sup>(1)</sup>	A or B	B or A		0.15		0.25	ns
t <sub>pd(s)</sub>	S	A	1	9.5	1	7	ns
	S	В	1	9	1	7.5	
t <sub>en</sub>	ŌĒ	A or B	1	9	1	7.5	ns
t <sub>dis</sub>	S	В	1	7	1	7.5	
	ŌE	A or B	1	6	1	8	ns

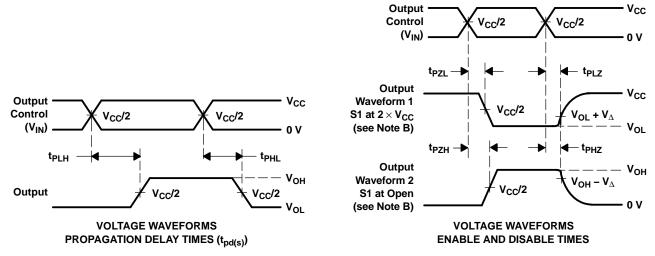
The propagation delay is the calculated RC time constant of the typical ON-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).



#### PARAMETER MEASUREMENT INFORMATION



TEST	V <sub>CC</sub>	S1	$R_{L}$	VI	CL	$V_{\Delta}$
t <sub>pd(s)</sub>	$2.5 \text{ V} \pm 0.2 \text{ V} \\ 3.3 \text{ V} \pm 0.3 \text{ V}$	Open Open	<b>500</b> Ω <b>500</b> Ω	3.6 V or GND 5.5 V or GND	30 pF 50 pF	
t <sub>PLZ</sub> /t <sub>PZL</sub>	$\begin{array}{c} \textbf{2.5 V} \pm \textbf{0.2 V} \\ \textbf{3.3 V} \pm \textbf{0.3 V} \end{array}$	2×V <sub>CC</sub> 2×V <sub>CC</sub>	<b>500</b> Ω <b>500</b> Ω	GND GND	30 pF 50 pF	0.15 V 0.3 V
t <sub>PHZ</sub> /t <sub>PZH</sub>	$\begin{array}{c} \textbf{2.5 V} \pm \textbf{0.2 V} \\ \textbf{3.3 V} \pm \textbf{0.3 V} \end{array}$	Open Open	<b>500</b> Ω <b>500</b> Ω	3.6 V 5.5 V	30 pF 50 pF	0.15 V 0.3 V



NOTES: A. C<sub>L</sub> 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,  $Z_Q = 50 \Omega$ ,  $t_f \leq$  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<sub>PLH</sub> and t<sub>PHL</sub> are the same as t<sub>pd(s)</sub>. The tpd 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 2. Test Circuit and Voltage Waveforms



### TYPICAL CHARACTERISTICS

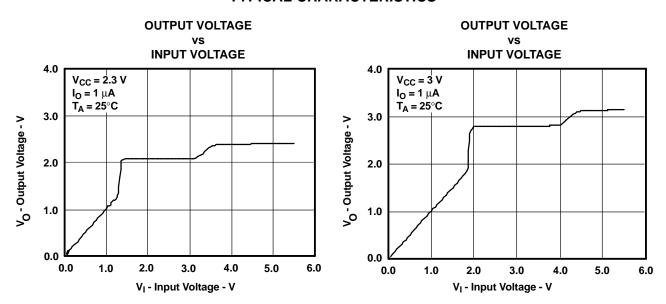
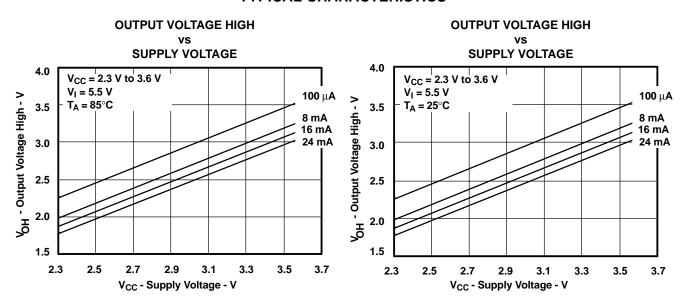


Figure 3. Data Output Voltage vs Data Input Voltage

### TYPICAL CHARACTERISTICS



#### **OUTPUT VOLTAGE HIGH**

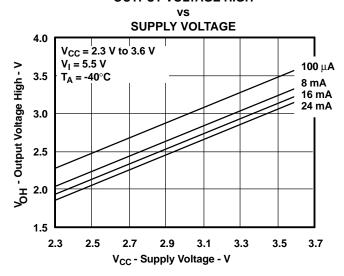


Figure 4. V<sub>OH</sub> Values





10-Jun-2014

#### **PACKAGING INFORMATION**

Orderable Device	Status	Package Type	Package	Pins	Package	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Device Marking	Samples
	(1)		Drawing		Qty	(2)	(6)	(3)		(4/5)	
74CB3T3257DGVRE4	ACTIVE	TVSOP	DGV	16		TBD	Call TI	Call TI	-40 to 85		Samples
74CB3T3257DGVRG4	ACTIVE	TVSOP	DGV	16		TBD	Call TI	Call TI	-40 to 85		Samples
SN74CB3T3257DGVR	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	KS257	Samples
SN74CB3T3257PW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	KS257	Samples
SN74CB3T3257PWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	KS257	Samples
SN74CB3T3257PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	KS257	Samples
SN74CB3T3257PWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	KS257	Samples
SN74CB3T3257PWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	KS257	Samples

<sup>(1)</sup> 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.

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

**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>(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.

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

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



### **PACKAGE OPTION ADDENDUM**

10-Jun-2014

(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.

(6) 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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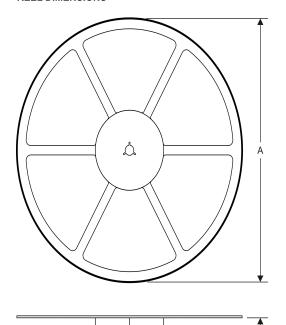
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

### PACKAGE MATERIALS INFORMATION

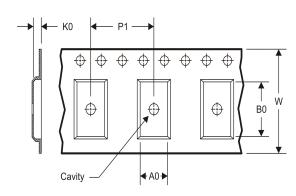
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### TAPE AND REEL INFORMATION

### **REEL DIMENSIONS**



### **TAPE DIMENSIONS**



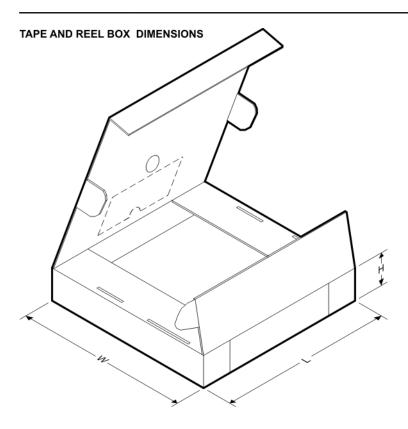
A0	Dimension designed to accommodate the component width
В0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

### TAPE AND REEL INFORMATION

#### \*All dimensions are nominal

Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74CB3T3257DGVR	TVSOP	DGV	16	2000	330.0	12.4	6.8	4.0	1.6	8.0	12.0	Q1
SN74CB3T3257PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

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#### \*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74CB3T3257DGVR	TVSOP	DGV	16	2000	367.0	367.0	35.0
SN74CB3T3257PWR	TSSOP	PW	16	2000	367.0	367.0	35.0

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

### **24 PINS SHOWN**

### **PLASTIC SMALL-OUTLINE**



NOTES: A. All linear dimensions are in millimeters.

B. This drawing is subject to change without notice.

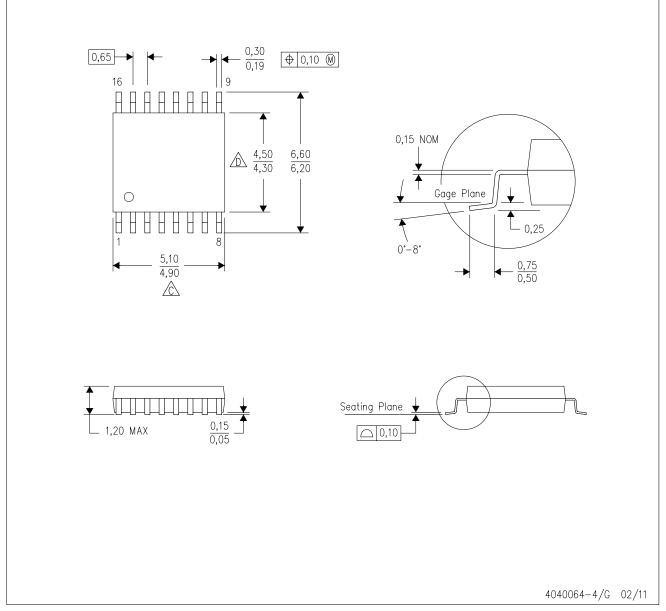
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.

D. Falls within JEDEC: 24/48 Pins – MO-153 14/16/20/56 Pins – MO-194



PW (R-PDSO-G16)

### PLASTIC SMALL OUTLINE



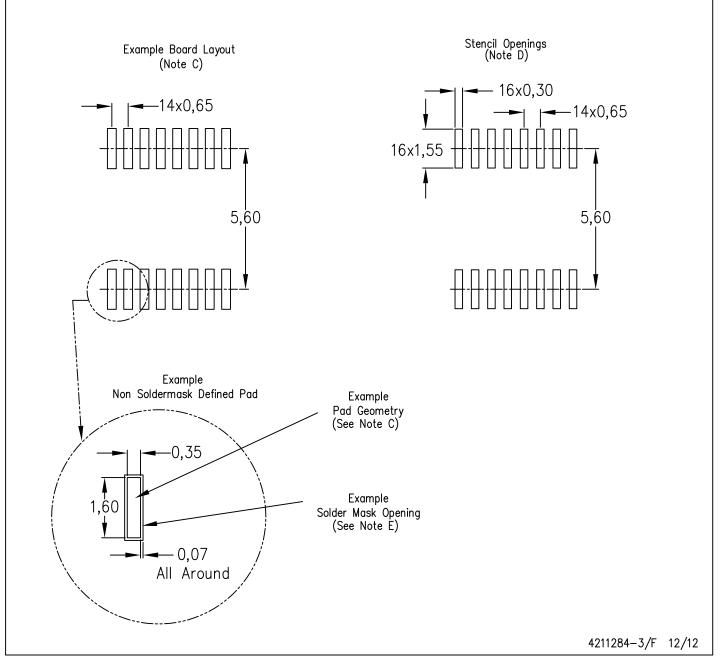
NOTES:

- 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-G16)

### 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 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. 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.



#### IMPORTANT NOTICE

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