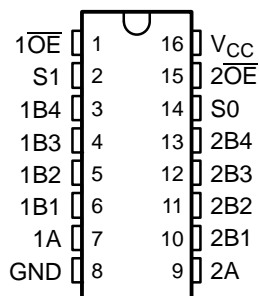


## FEATURES

- Output Voltage Translation Tracks  $V_{CC}$
- 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  $V_{CC}$
  - 5-V/3.3-V Input Down to 2.5-V Output Level Shift With 2.5-V  $V_{CC}$
- 5-V Tolerant I/Os With Device Powered Up or Powered Down
- Bidirectional Data Flow With Near-Zero Propagation Delay
- Low ON-State Resistance ( $r_{on}$ ) Characteristics ( $r_{on} = 5 \Omega$  Typ)
- Low Input/Output Capacitance Minimizes Loading ( $C_{io(OFF)} = 5$  pF Typ)
- Data and Control Inputs Provide Undershoot Clamp Diodes
- Low Power Consumption ( $I_{CC} = 20 \mu A$  Max)
- $V_{CC}$  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
- $I_{off}$  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

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



## DESCRIPTION/ORDERING INFORMATION

The SN74CB3T3253 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 SN74CB3T3253 supports systems using 5-V TTL, 3.3-V LVTTTL, and 2.5-V CMOS switching standards, as well as user-defined switching levels (see [Figure 1](#)).

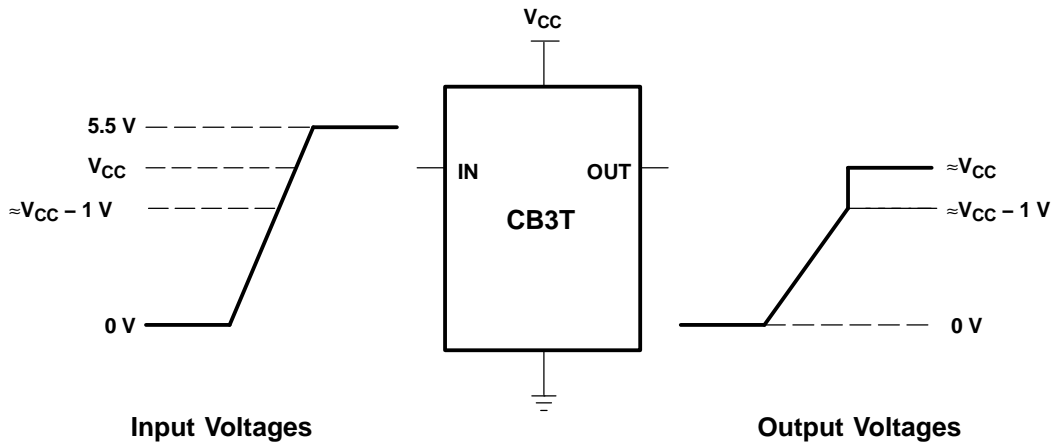
The SN74CB3T3253 is organized as two 1-of-4 multiplexer/demultiplexers with separate output-enable ( $1\overline{OE}$ ,  $2\overline{OE}$ ) inputs. The select (S0, S1) inputs control the data path of each multiplexer/demultiplexer. When  $\overline{OE}$  is low, the associated multiplexer/demultiplexer is ON, and the A port is connected to the B port, allowing bidirectional data flow between ports. When  $\overline{OE}$  is high, the associated multiplexer/demultiplexer is OFF, and a high-impedance state exists between the A and B 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.



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.



NOTE A: If the input high voltage ( $V_{IH}$ ) level is greater than or equal to  $V_{CC} - 1\text{ V}$ , and less than or equal to  $5.5\text{ V}$ , then the output high voltage ( $V_{OH}$ ) level will be equal to approximately the  $V_{CC}$  voltage level.

**Figure 1. Typical DC Voltage-Translation Characteristics**

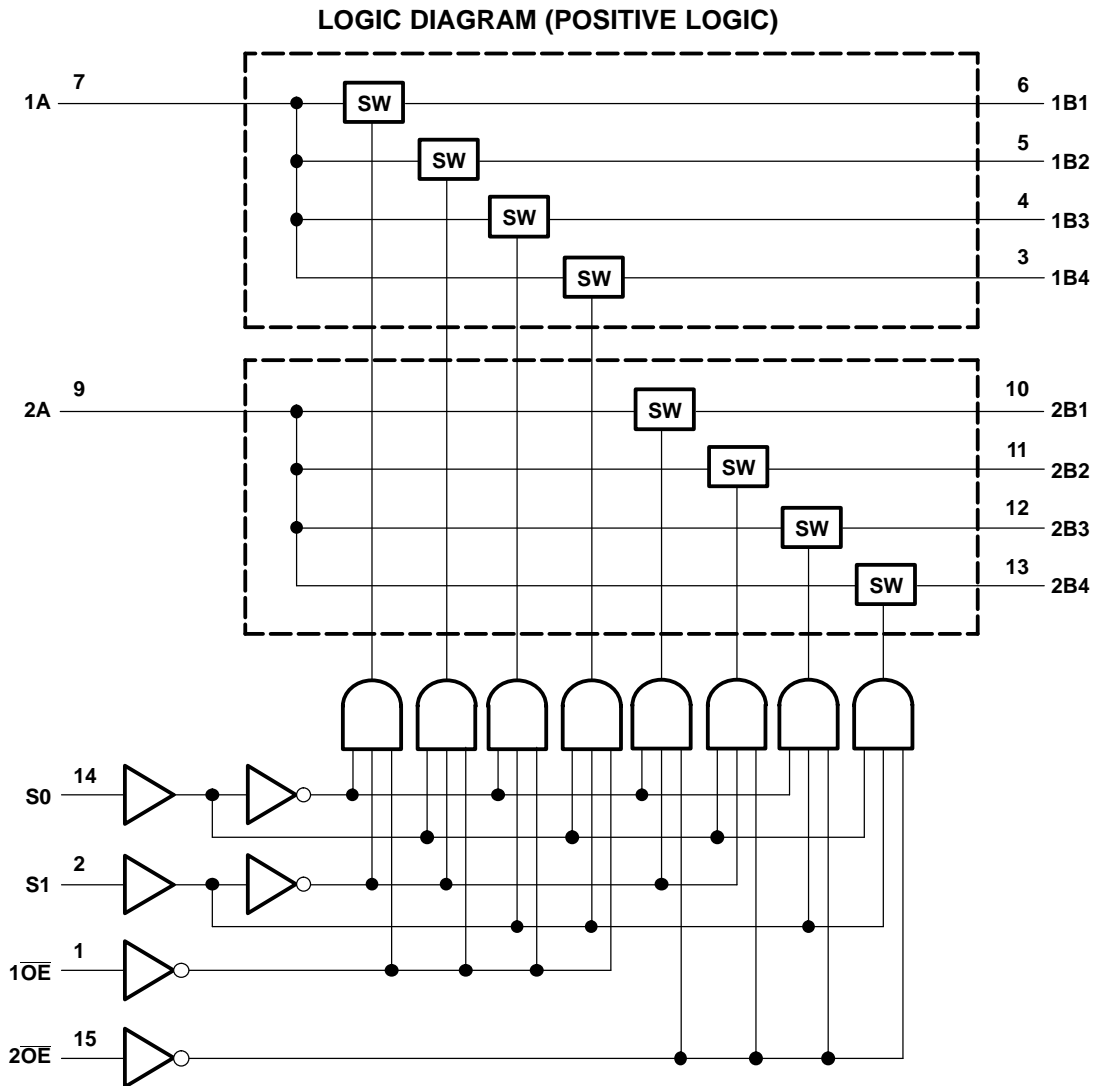
**ORDERING INFORMATION**

$T_A$	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	SOIC – D	Tube	SN74CB3T3253D	CB3T3253
		Tape and reel	SN74CB3T3253DR	
	SSOP (QSOP) – DBQ	Tape and reel	SN74CB3T3253DBQR	KS253
	TSSOP – PW	Tube	SN74CB3T3253PW	KS253
		Tape and reel	SN74CB3T3253PWR	
	TVSOP – DGV	Tape and reel	SN74CB3T3253DGVR	KS253

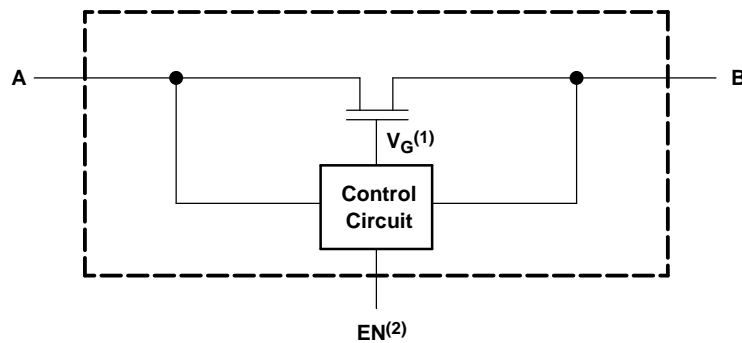
(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

**FUNCTION TABLE**  
**(EACH MULTIPLEXER/DEMULTIPLEXER)**

INPUTS			INPUT/OUTPUT A	FUNCTION
$\overline{OE}$	S1	S0		
L	L	L	B1	A port = B1 port
L	L	H	B2	A port = B2 port
L	H	L	B3	A port = B3 port
L	H	H	B4	A port = B4 port
H	X	X	Z	Disconnect



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



- (1) Gate voltage ( $V_G$ ) is approximately equal to  $V_{CC} + V_T$  when the switch is ON and  $V_I > V_{CC} + V_T$ .
- (2) EN is the internal enable signal applied to the switch.

**SN74CB3T3253**  
**DUAL 1-OF-4 FET MULTIPLEXER/DEMULTIPLEXER**  
**2.5-V/3.3-V LOW-VOLTAGE BUS SWITCH WITH 5-V TOLERANT LEVEL SHIFTER**



SCDS148–OCTOBER 2003–REVISED JUNE 2005

**Absolute Maximum Ratings**<sup>(1)</sup>

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

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage range <sup>(2)</sup>	-0.5	7	V
$V_{IN}$	Control input voltage range <sup>(2)(3)</sup>	-0.5	7	V
$V_{I/O}$	Switch I/O voltage range <sup>(2)(3)(4)</sup>	-0.5	7	V
$I_{IK}$	Control input clamp current	$V_{IN} < 0$		-50 mA
$I_{I/OK}$	I/O port clamp current	$V_{I/O} < 0$		-50 mA
$I_{I/O}$	ON-state switch current <sup>(5)</sup>			±128 mA
	Continuous current through $V_{CC}$ or GND			±100 mA
$\theta_{JA}$	Package thermal impedance <sup>(6)</sup>	D package		73
		DBQ package		90
		DGV package		120
		PW package		108
$T_{stg}$	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) All voltages are with respect to ground, unless otherwise specified.
- (3) 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  $V_{I/O}$ .
- (5)  $I_I$  and  $I_O$  are used to denote specific conditions for  $I_{I/O}$ .
- (6) 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
$V_{IH}$	High-level control input voltage	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		1.7 5.5
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$		2 5.5
$V_{IL}$	Low-level control input voltage	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		0 0.7
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$		0 0.8
$V_{I/O}$	Data input/output voltage	0	5.5	V
$T_A$	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.

## Electrical Characteristics<sup>(1)</sup>

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

PARAMETER		TEST CONDITIONS		MIN	TYP <sup>(2)</sup>	MAX	UNIT
$V_{IK}$		$V_{CC} = 3\text{ V}$ , $I_I = -18\text{ mA}$				-1.2	V
$V_{OH}$		See <a href="#">Figure 3</a> and <a href="#">Figure 4</a>					
$I_{IN}$	Control inputs	$V_{CC} = 3.6\text{ V}$ , $V_{IN} = 3.6\text{ V}$ to $5.5\text{ V}$ or GND				±10	μA
$I_I$		$V_{CC} = 3.6\text{ V}$ , Switch ON, $V_{IN} = V_{CC}$ or GND	$V_I = V_{CC} - 0.7\text{ V}$ to $5.5\text{ V}$			±20	μA
			$V_I = 0.7\text{ V}$ to $V_{CC} - 0.7\text{ V}$			-40	
			$V_I = 0$ to $0.7\text{ V}$			±5	
$I_{OZ}$ <sup>(3)</sup>		$V_{CC} = 3.6\text{ V}$ , $V_O = 0$ to $5.5\text{ V}$ , $V_I = 0$ , Switch OFF, $V_{IN} = V_{CC}$ or GND				±10	μA
$I_{off}$		$V_{CC} = 0$ , $V_O = 0$ to $5.5\text{ V}$ , $V_I = 0$				10	μA
$I_{CC}$		$V_{CC} = 3.6\text{ V}$ , $I_{I/O} = 0$ , Switch ON or OFF, $V_{IN} = V_{CC}$ or GND		$V_I = V_{CC}$ or GND		20	μA
				$V_I = 5.5\text{ V}$		20	
$\Delta I_{CC}$ <sup>(4)</sup>	Control inputs	$V_{CC} = 3\text{ V}$ to $3.6\text{ V}$ , One input at $V_{CC} - 0.6\text{ V}$ , Other inputs at $V_{CC}$ or GND				300	μA
$C_{in}$	Control inputs	$V_{CC} = 3.3\text{ V}$ , $V_{IN} = V_{CC}$ or GND				3	pF
$C_{io(OFF)}$	A port	$V_{CC} = 3.3\text{ V}$ , $V_{I/O} = 5.5\text{ V}$ , $3.3\text{ V}$ , or GND, Switch OFF, $V_{IN} = V_{CC}$ or GND				12	pF
	B port					5	
$C_{io(ON)}$	A port	$V_{CC} = 3.3\text{ V}$ , Switch ON, $V_{IN} = V_{CC}$ or GND	$V_{I/O} = 5.5\text{ V}$ or $3.3\text{ V}$			10	pF
			$V_{I/O} = \text{GND}$			22	
	B port		$V_{I/O} = 5.5\text{ V}$ or $3.3\text{ V}$			4	
			$V_{I/O} = \text{GND}$			22	
$r_{on}$ <sup>(5)</sup>		$V_{CC} = 2.3\text{ V}$ , TYP at $V_{CC} = 2.5\text{ V}$ , $V_I = 0$	$I_O = 24\text{ mA}$			5	Ω
			$I_O = 16\text{ mA}$			5	
	$V_{CC} = 3\text{ V}$ , $V_I = 0$	$I_O = 64\text{ mA}$			5		
		$I_O = 32\text{ mA}$			5		

(1)  $V_{IN}$  and  $I_{IN}$  refer to control inputs.  $V_I$ ,  $V_O$ ,  $I_I$ , and  $I_O$  refer to data pins.

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

(3) For I/O ports, the parameter  $I_{OZ}$  includes the input leakage current.

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

(5) 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.

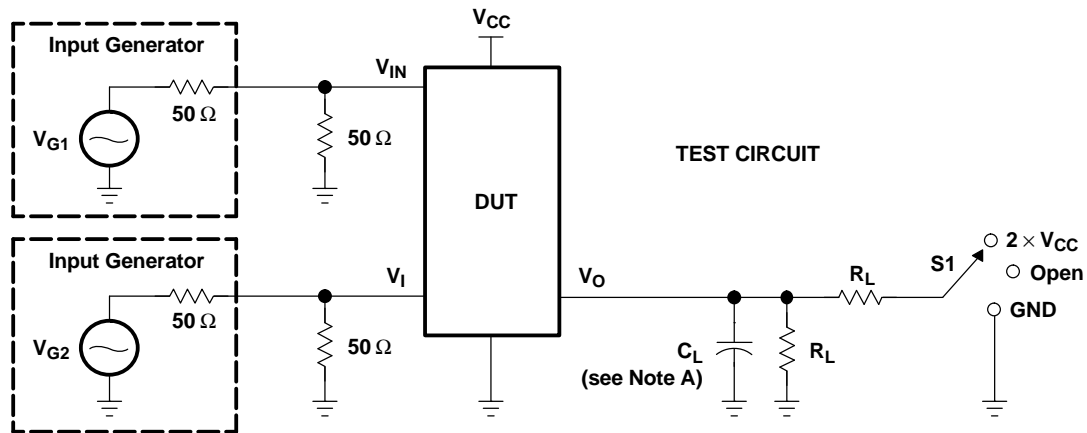
## Switching Characteristics

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

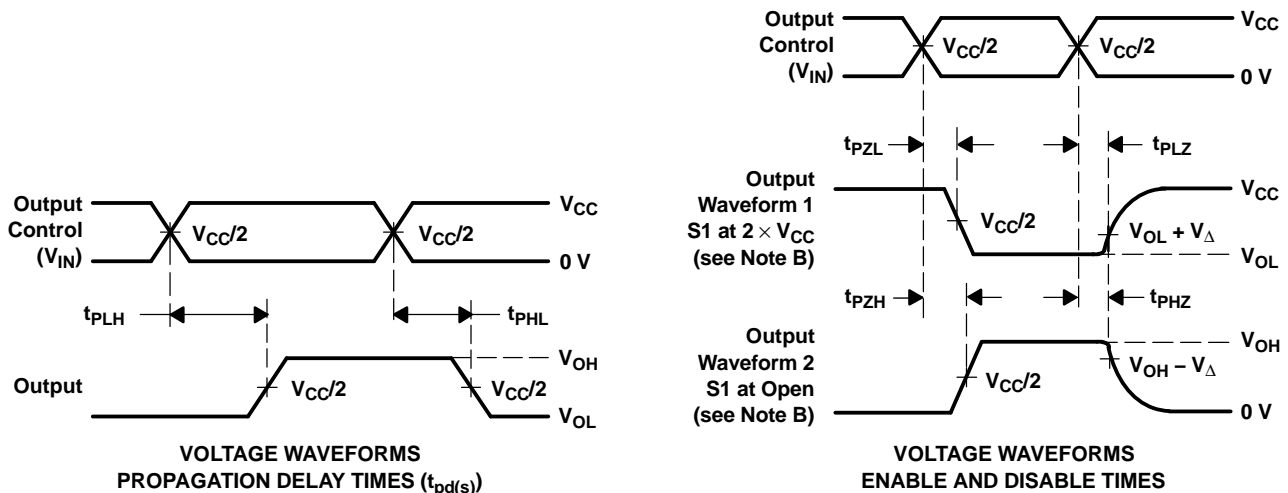
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$		$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		UNIT
			MIN	MAX	MIN	MAX	
$t_{pd}$ <sup>(1)</sup>	A or B	B or A	0.15		0.25		ns
$t_{pd(s)}$	S	A	1	10.5	1	8	ns
$t_{en}$	S	B	1	10	1	8	ns
	$\overline{OE}$	A or B	1	8.5	1	8	
$t_{dis}$	S	B	1	7.5	1	8.5	ns
	$\overline{OE}$	A or B	1	6.5	1	8	

(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	V <sub>CC</sub>	S1	R <sub>L</sub>	V <sub>I</sub>	C <sub>L</sub>	V <sub>Δ</sub>
t <sub>pd</sub> (s)	2.5 V ± 0.2 V	Open	500 Ω	3.6 V or GND	30 pF	
	3.3 V ± 0.3 V	Open	500 Ω	5.5 V or GND	50 pF	
t <sub>PLZ</sub> /t <sub>PZL</sub>	2.5 V ± 0.2 V	2 × V <sub>CC</sub>	500 Ω	GND	30 pF	0.15 V
	3.3 V ± 0.3 V	2 × V <sub>CC</sub>	500 Ω	GND	50 pF	0.3 V
t <sub>PHZ</sub> /t <sub>PZH</sub>	2.5 V ± 0.2 V	Open	500 Ω	3.6 V	30 pF	0.15 V
	3.3 V ± 0.3 V	Open	500 Ω	5.5 V	50 pF	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 ≤ 10 MHz, Z<sub>O</sub> = 50 Ω, t<sub>r</sub> ≤ 2.5 ns, t<sub>f</sub> ≤ 2.5 ns.
  - D. The outputs are measured one at a time, with one transition per measurement.
  - E. t<sub>PLZ</sub> and t<sub>PHZ</sub> are the same as t<sub>dis</sub>.
  - F. t<sub>PZL</sub> and t<sub>PZH</sub> are the same as t<sub>en</sub>.
  - G. t<sub>PLH</sub> and t<sub>PHL</sub> are the same as t<sub>pd</sub>. The t<sub>pd</sub> 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

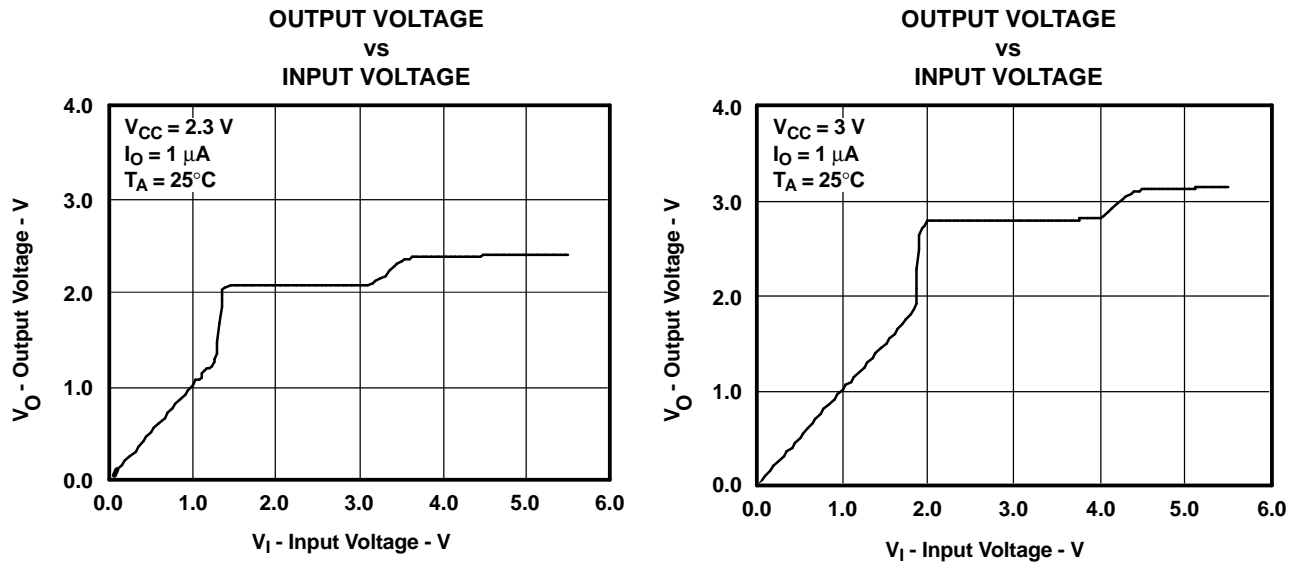


Figure 3. Data Output Voltage vs Data Input Voltage

TYPICAL CHARACTERISTICS

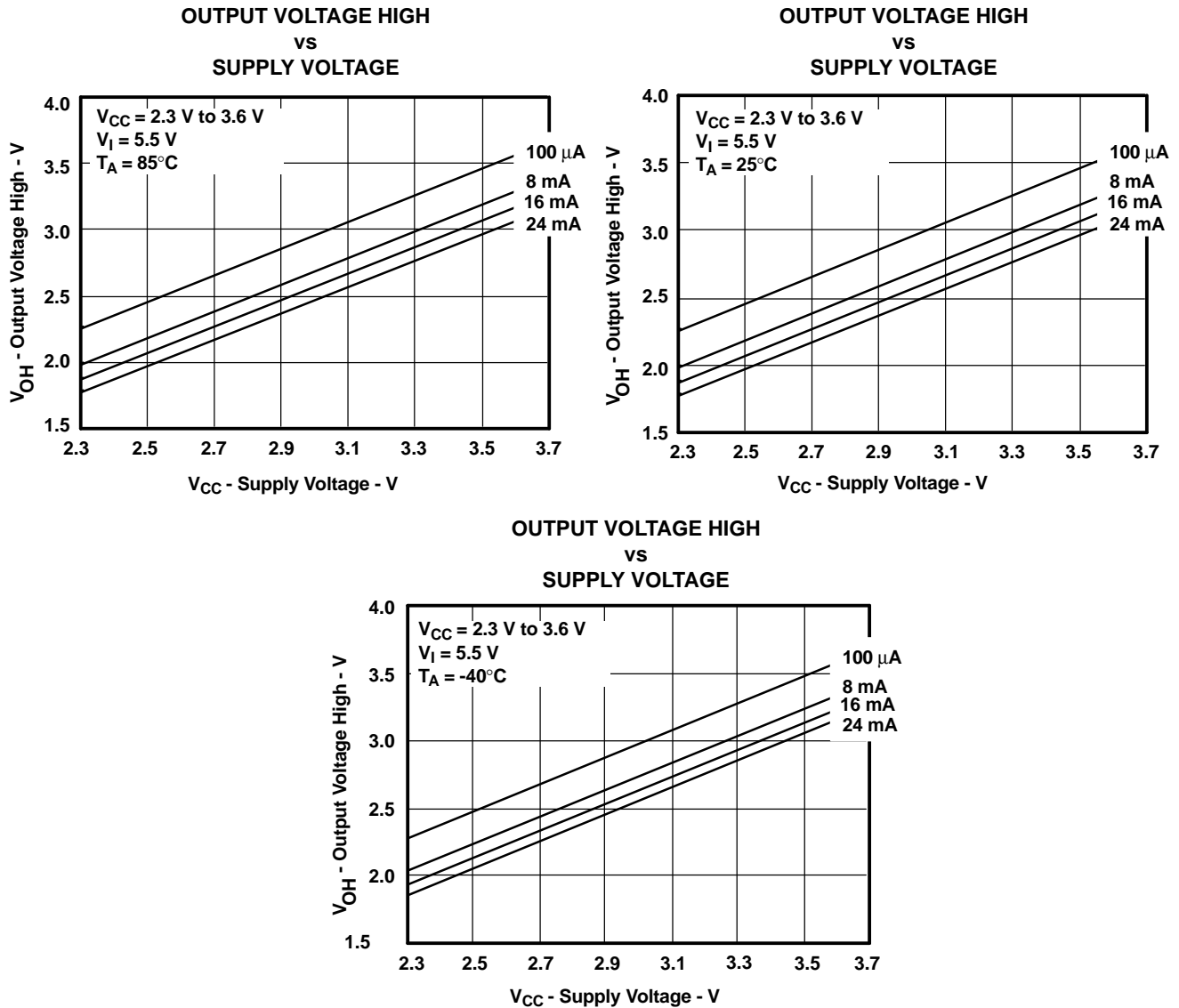


Figure 4.  $V_{OH}$  Values

**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>
74CB3T3253DBQRE4	ACTIVE	SSOP/QSOP	DBQ	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
74CB3T3253DBQRG4	ACTIVE	SSOP/QSOP	DBQ	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
74CB3T3253DGVRE4	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CB3T3253DGVRG4	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CB3T3253D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CB3T3253DBQR	ACTIVE	SSOP/QSOP	DBQ	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
SN74CB3T3253DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CB3T3253DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CB3T3253DGV	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CB3T3253DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CB3T3253DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CB3T3253DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CB3T3253PW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CB3T3253PWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CB3T3253PWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CB3T3253PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CB3T3253PWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CB3T3253PWVG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<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.

<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.

**Important Information and Disclaimer:**The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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.

**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
SN74CB3T3253DGVR	TVSOP	DGV	16	2000	330.0	12.4	6.8	4.0	1.6	8.0	12.0	Q1
SN74CB3T3253DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74CB3T3253PWR	TSSOP	PW	16	2000	330.0	12.4	7.0	5.6	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)
SN74CB3T3253DGVR	TVSOP	DGV	16	2000	346.0	346.0	29.0
SN74CB3T3253DR	SOIC	D	16	2500	333.2	345.9	28.6
SN74CB3T3253PWR	TSSOP	PW	16	2000	346.0	346.0	29.0

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

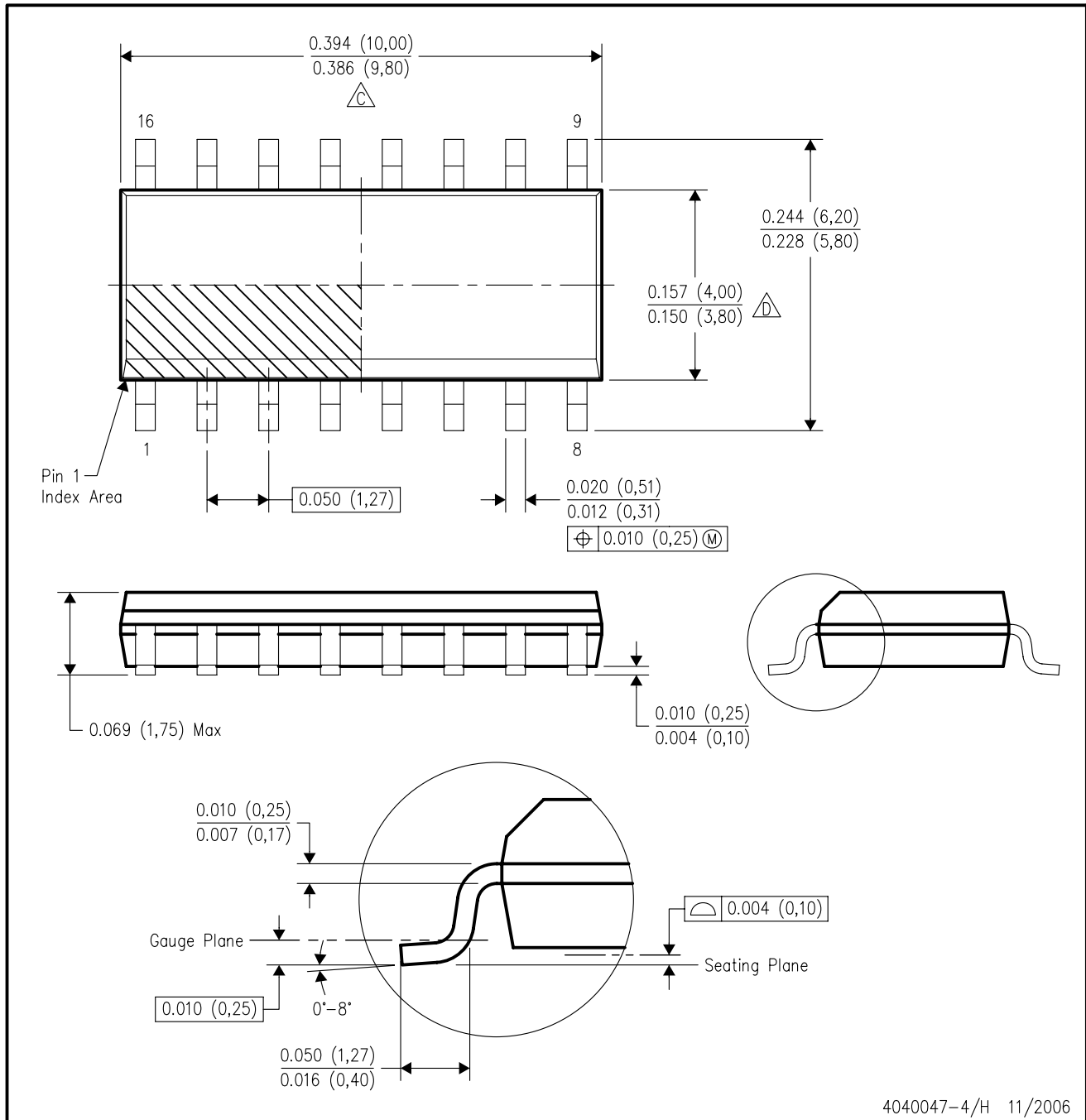


4073251/E 08/00

- 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

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE

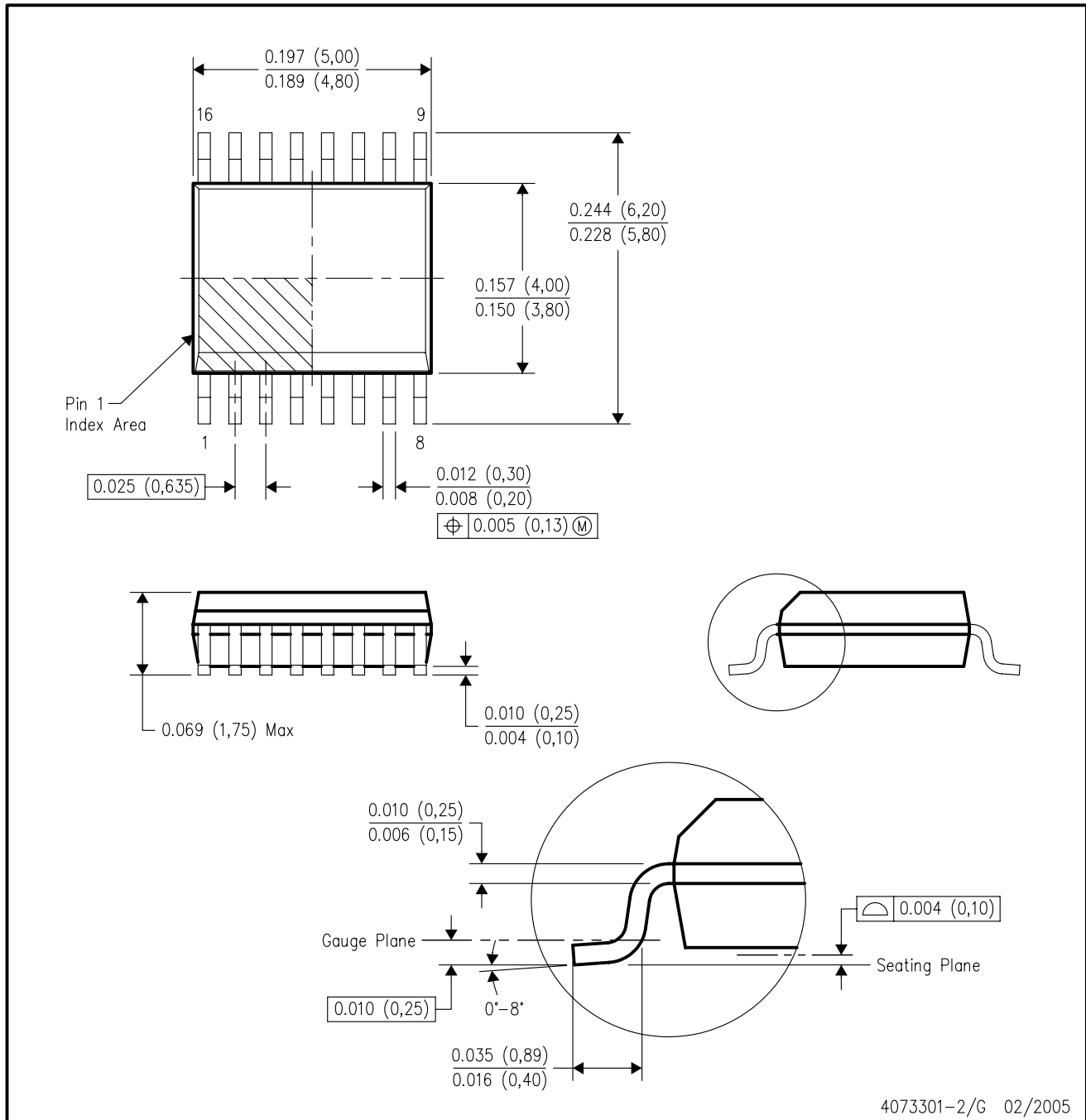


4040047-4/H 11/2006

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AC.

DBQ (R-PDSO-G16)

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 AB.

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