

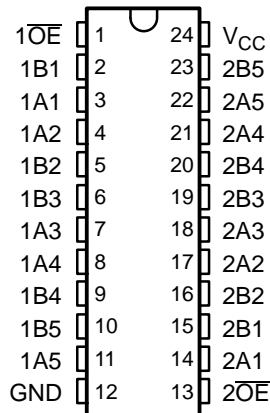
## FEATURES

- High-Bandwidth Data Path (up to 500 MHz <sup>(1)</sup>)
- 5-V Tolerant I/Os With Device Powered Up or Powered Down
- Low and Flat ON-State Resistance ( $r_{on}$ ) Characteristics Over Operating Range ( $r_{on} = 3\ \Omega$  Typ)
- Rail-to-Rail Switching on Data I/O Ports
  - 0- to 5-V Switching With 3.3-V  $V_{CC}$
  - 0- to 3.3-V Switching With 2.5-V  $V_{CC}$
- Bidirectional Data Flow With Near-Zero Propagation Delay
- Low Input/Output Capacitance Minimizes Loading and Signal Distortion ( $C_{io(OFF)} = 4\text{ pF}$  Typ)
- Fast Switching Frequency ( $f_{OE} = 20\text{ MHz}$  Max)

(1) For additional information regarding the performance characteristics of the CB3Q family, refer to the TI application report, *CBT-C, CB3T, and CB3Q Signal-Switch Families*, literature number SCDA008.

- Data and Control Inputs Provide Undershoot Clamp Diodes
- Low Power Consumption ( $I_{CC} = 1\text{ mA}$  Typ)
- $V_{CC}$  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 100 mA Per JESD 78, Class II
- ESD Performance Tested Per JESD 22
  - 2000-V Human-Body Model (A114-B, Class II)
  - 1000-V Charged-Device Model (C101)
- Supports Both Digital and Analog Applications: PCI Interface, Differential Signal Interface, Memory Interleaving, Bus Isolation, Low-Distortion Signal Gating

DBQ, DGV, OR PW PACKAGE  
(TOP VIEW)



## DESCRIPTION/ORDERING INFORMATION

### ORDERING INFORMATION

$T_A$	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QSOP – DBQ	Tape and reel	SN74CB3Q3384ADBQR	CB3Q3384A
	TSSOP – PW	Tube	SN74CB3Q3384APW	BU384A
		Tape and reel	SN74CB3Q3384APWR	
	TVSOP – DGV	Tape and reel	SN74CB3Q3384ADGVR	BU384A

(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).



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**SN74CB3Q3384A**  
**10-BIT FET BUS SWITCH**  
**2.5-V/3.3-V LOW-VOLTAGE HIGH-BANDWIDTH BUS SWITCH**

SCDS114D–DECEMBER 2002–REVISED JUNE 2005



**DESCRIPTION/ORDERING INFORMATION (CONTINUED)**

The SN74CB3Q3384A is a high-bandwidth FET bus switch utilizing a charge pump to elevate the gate voltage of the pass transistor, providing a low and flat ON-state resistance ( $r_{on}$ ). The low and flat ON-state resistance allows for minimal propagation delay and supports rail-to-rail switching on the data input/output (I/O) ports. The device also features low data I/O capacitance to minimize capacitive loading and signal distortion on the data bus. Specifically designed to support high-bandwidth applications, the SN74CB3Q3384A provides an optimized interface solution ideally suited for broadband communications, networking, and data-intensive computing systems.

The SN74CB3Q3384A is organized as two 5-bit bus switches with separate output-enable ( $1\overline{OE}$ ,  $2\overline{OE}$ ) inputs. It can be used as two 5-bit bus switches or as one 10-bit bus switch. When  $\overline{OE}$  is low, the associated 5-bit bus switch 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 5-bit bus switch is OFF, and a high-impedance state exists between the A and B ports.

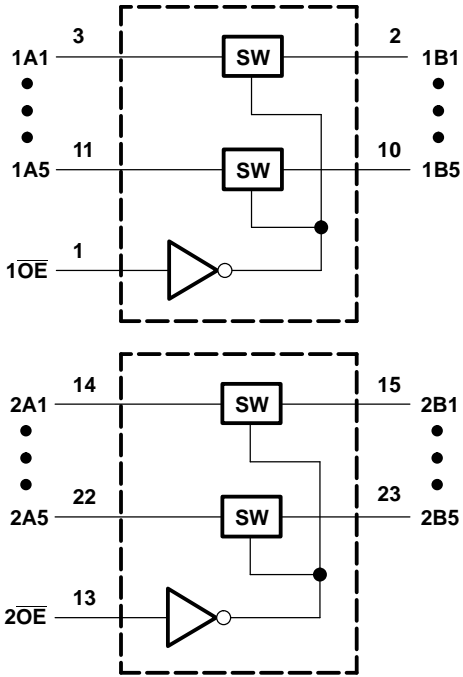
This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry prevents damaging current backflow through the device when it is powered down. The device has isolation during power off.

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.

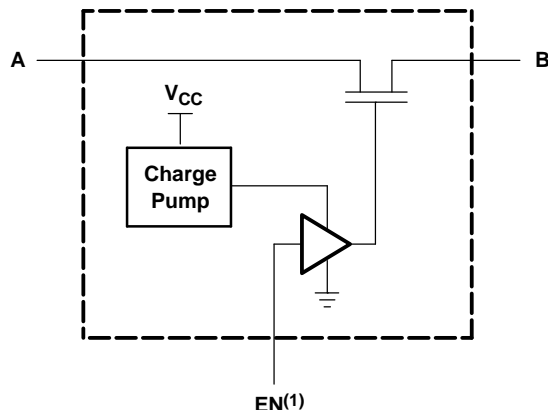
**FUNCTION TABLE**  
**(EACH 5-BIT BUS SWITCH)**

INPUT $\overline{OE}$	INPUT/OUTPUT A	FUNCTION
L	B	A port = B port
H	Z	Disconnect

**LOGIC DIAGRAM (POSITIVE LOGIC)**



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



(1) EN is the internal enable signal applied to the switch.

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

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

			MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage range		−0.5	4.6	V
V <sub>IN</sub>	Control input voltage range <sup>(2)(3)</sup>		−0.5	7	V
V <sub>I/O</sub>	Switch I/O voltage range <sup>(2)(3)(4)</sup>		−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	V <sub>I/O</sub> < 0	−50		mA
I <sub>I/O</sub>	ON-state switch current <sup>(5)</sup>		±64		mA
I <sub>O</sub>	Continuous current through V <sub>CC</sub> or GND		±100		mA
θ <sub>JA</sub>	Package thermal impedance <sup>(6)</sup>	DBQ package	61		°C/W
		DGV package	86		
		PW package	88		
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.
- (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 <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	5.5	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2	5.5	
V <sub>IL</sub>	Low-level control input voltage	V <sub>CC</sub> = 2.3 V to 2.7 V	0	0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	0	0.8	
V <sub>I/O</sub>	Data input/output voltage		0	5.5	V
T <sub>A</sub>	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.

# SN74CB3Q3384A

## 10-BIT FET BUS SWITCH

### 2.5-V/3.3-V LOW-VOLTAGE HIGH-BANDWIDTH BUS SWITCH

SCDS114D–DECEMBER 2002–REVISED JUNE 2005

#### 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
$V_{IK}$		$V_{CC} = 3.6\text{ V}$ ,	$I_I = -18\text{ mA}$			-1.8	V
$I_{IN}$	Control inputs	$V_{CC} = 3.6\text{ V}$ ,	$V_{IN} = 0\text{ to }5.5\text{ V}$			$\pm 1$	$\mu\text{A}$
$I_{OZ}$ <sup>(3)</sup>		$V_{CC} = 3.6\text{ V}$ ,	$V_O = 0\text{ to }5.5\text{ V}$ , $V_I = 0$ , Switch OFF, $V_{IN} = V_{CC}\text{ or GND}$			$\pm 1$	$\mu\text{A}$
$I_{off}$		$V_{CC} = 0$ ,	$V_O = 0\text{ to }5.5\text{ V}$ , $V_I = 0$			1	$\mu\text{A}$
$I_{CC}$		$V_{CC} = 3.6\text{ V}$ ,	$I_{I/O} = 0$ , Switch ON or OFF, $V_{IN} = V_{CC}\text{ or GND}$		1	2	mA
$\Delta I_{CC}$ <sup>(4)</sup>	Control inputs	$V_{CC} = 3.6\text{ V}$ ,	One input at 3 V, Other inputs at $V_{CC}\text{ or GND}$			30	$\mu\text{A}$
$I_{CCD}$ <sup>(5)</sup>	Per control input	$V_{CC} = 3.6\text{ V}$ ,	A and B ports open, Control input switching at 50% duty cycle		0.15	0.25	mA/ MHz
$C_{in}$	Control inputs	$V_{CC} = 3.3\text{ V}$ ,	$V_{IN} = 5.5\text{ V}$ , 3.3 V, or 0		2.5	3.5	pF
$C_{io(OFF)}$		$V_{CC} = 3.3\text{ V}$ ,	Switch OFF, $V_{IN} = V_{CC}\text{ or GND}$ , $V_{I/O} = 5.5\text{ V}$ , 3.3 V, or 0		3.5	5	pF
$C_{io(ON)}$		$V_{CC} = 3.3\text{ V}$ ,	Switch ON, $V_{IN} = V_{CC}\text{ or GND}$ , $V_{I/O} = 5.5\text{ V}$ , 3.3 V, or 0		8	10	pF
$r_{on}$ <sup>(6)</sup>		$V_{CC} = 2.3\text{ V}$ , TYP at $V_{CC} = 2.5\text{ V}$	$V_I = 0$ , $I_O = 30\text{ mA}$		3	8	$\Omega$
			$V_I = 1.7\text{ V}$ , $I_O = -15\text{ mA}$		3.5	9	
		$V_{CC} = 3\text{ V}$	$V_I = 0$ , $I_O = 30\text{ mA}$		3	6	
			$V_I = 2.4\text{ V}$ , $I_O = -15\text{ mA}$		3.5	8	

- <sup>(1)</sup>  $V_{IN}$  and  $I_{IN}$  refer to control inputs.  $V_I$ ,  $V_O$ ,  $I_I$ , and  $I_O$  refer to data pins.
- <sup>(2)</sup> All typical values are at  $V_{CC} = 3.3\text{ V}$  (unless otherwise noted),  $T_A = 25^\circ\text{C}$ .
- <sup>(3)</sup> For I/O ports, the parameter  $I_{OZ}$  includes the input leakage current.
- <sup>(4)</sup> This is the increase in supply current for each input that is at the specified TTL voltage level, rather than  $V_{CC}$  or GND.
- <sup>(5)</sup> This parameter specifies the dynamic power-supply current associated with the operating frequency of a single control input (see Figure 2).
- <sup>(6)</sup> 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)	$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$		$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		UNIT
			MIN	MAX	MIN	MAX	
$f_{OE}$ <sup>(1)</sup>	$\overline{OE}$	A or B		10		20	MHz
$t_{pd}$ <sup>(2)</sup>	A or B	B or A		0.09		0.15	ns
$t_{en}$	$\overline{OE}$	A or B	1.5	7.2	1.5	6	ns
$t_{dis}$	$\overline{OE}$	A or B	1.5	6.6	1.5	6.6	ns

- <sup>(1)</sup> Maximum switching frequency for control input ( $V_O > V_{CC}$ ,  $V_I = 5\text{ V}$ ,  $R_L \geq 1\text{ M}\Omega$ ,  $C_L = 0$ )
- <sup>(2)</sup> 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).

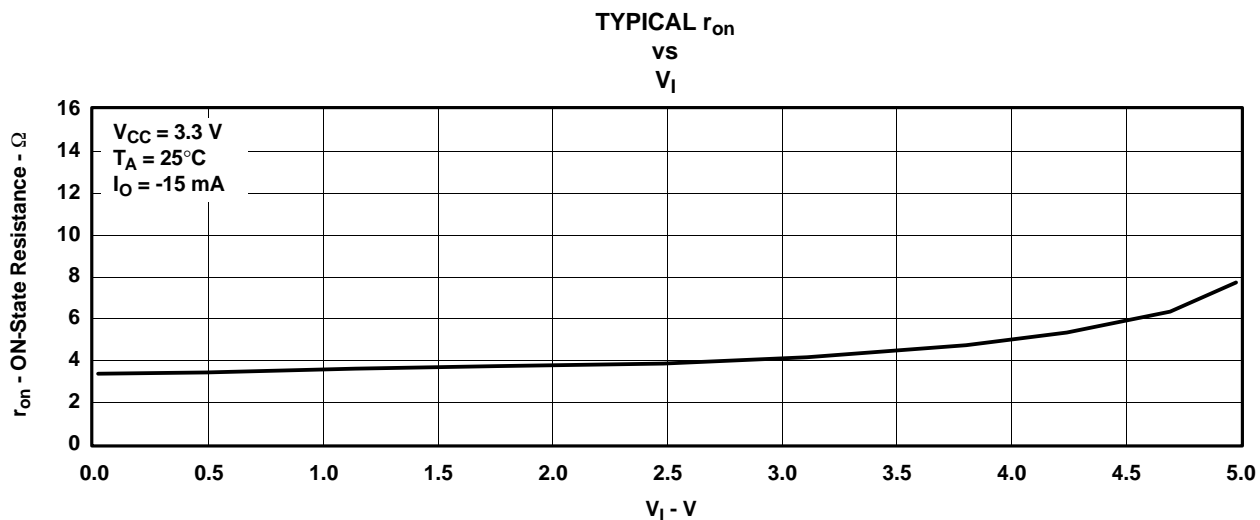


Figure 1. Typical  $r_{on}$  vs  $V_I$

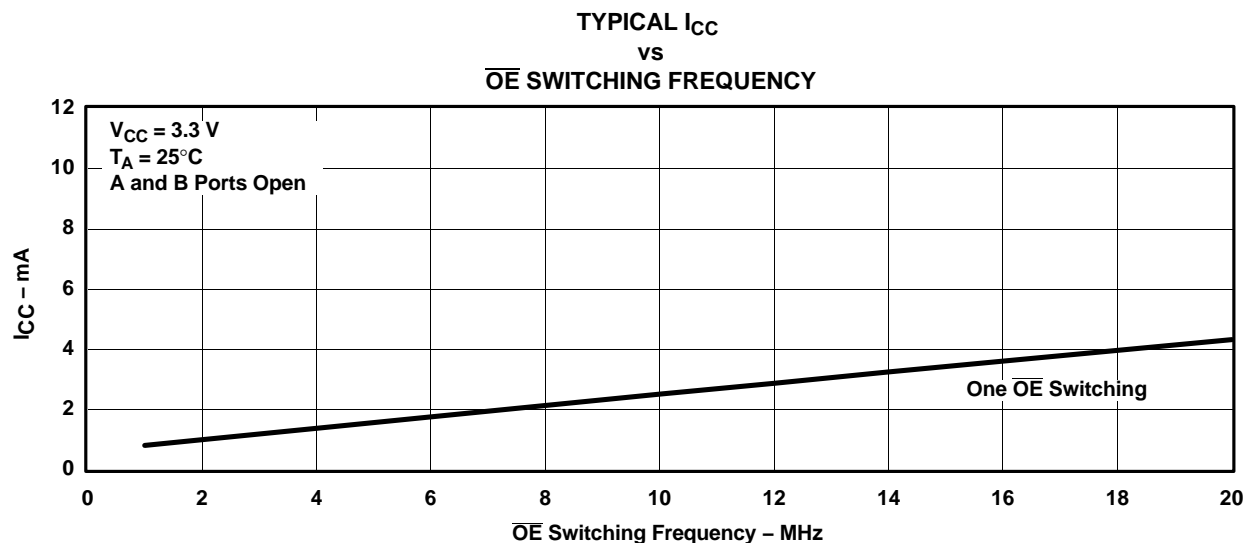
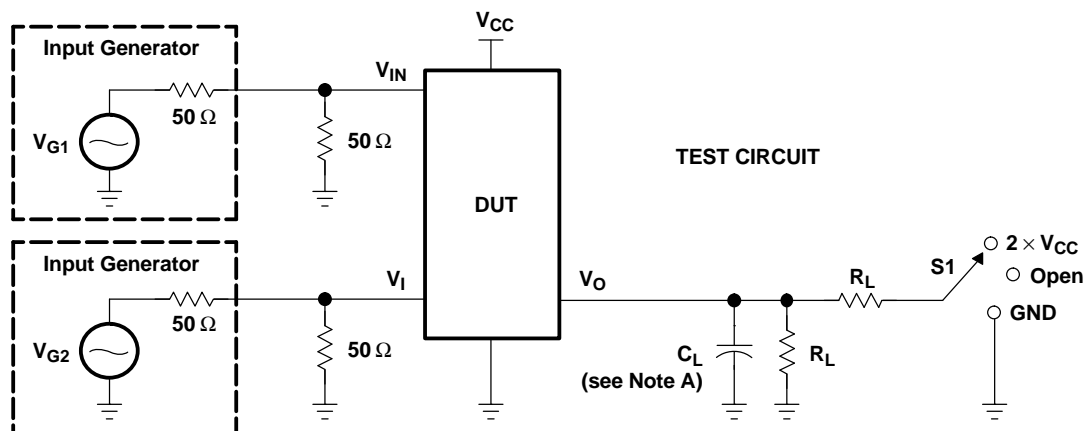
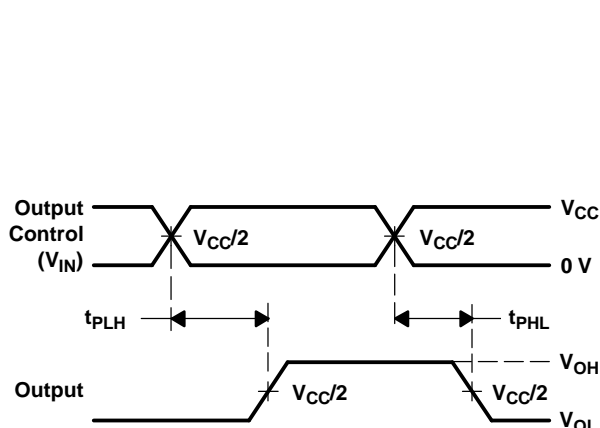


Figure 2. Typical  $I_{CC}$  vs  $\overline{OE}$  Switching Frequency

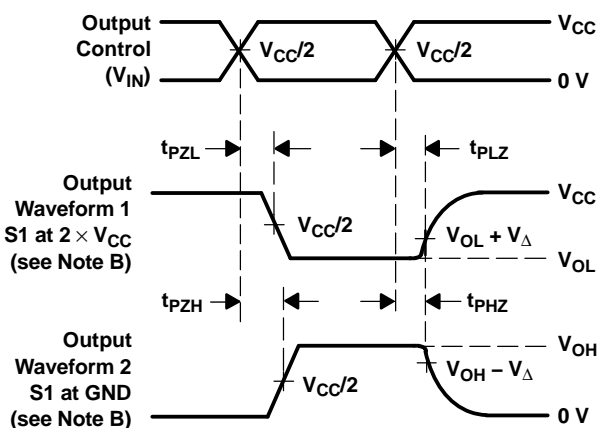
## PARAMETER MEASUREMENT INFORMATION



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(s)</sub>	2.5 V ± 0.2 V	Open	500 Ω	V <sub>CC</sub> or GND	30 pF	
	3.3 V ± 0.3 V	Open	500 Ω	V <sub>CC</sub> 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	GND	500 Ω	V <sub>CC</sub>	30 pF	0.15 V
	3.3 V ± 0.3 V	GND	500 Ω	V <sub>CC</sub>	50 pF	0.3 V



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES (t<sub>pd(s)</sub>)



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES

- NOTES:
- C<sub>L</sub> 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 ≤ 10 MHz, Z<sub>O</sub> = 50 Ω, t<sub>r</sub> ≤ 2.5 ns, t<sub>f</sub> ≤ 2.5 ns.
  - The outputs are measured one at a time, with one transition per measurement.
  - t<sub>PLZ</sub> and t<sub>PZH</sub> are the same as t<sub>dis</sub>.
  - t<sub>PZL</sub> and t<sub>PZH</sub> are the same as t<sub>en</sub>.
  - t<sub>PLH</sub> and t<sub>PHL</sub> are the same as t<sub>pd(s)</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).
  - All parameters and waveforms are not applicable to all devices.

Figure 3. Test Circuit and Voltage Waveforms

## PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74CB3Q3384ADBQR	ACTIVE	SSOP	DBQ	24	2500	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	CB3Q3384A	<a href="#">Samples</a>
SN74CB3Q3384ADGVR	ACTIVE	TVSOP	DGV	24	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BU384A	<a href="#">Samples</a>
SN74CB3Q3384APW	ACTIVE	TSSOP	PW	24	60	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BU384A	<a href="#">Samples</a>
SN74CB3Q3384APWG4	ACTIVE	TSSOP	PW	24	60	TBD	Call TI	Call TI	-40 to 85		<a href="#">Samples</a>
SN74CB3Q3384APWR	ACTIVE	TSSOP	PW	24	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BU384A	<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.

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

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(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.

(6) Lead finish/Ball material - Orderable Devices 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.

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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
SN74CB3Q3384ADBQR	SSOP	DBQ	24	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74CB3Q3384ADGVR	TVSOP	DGV	24	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74CB3Q3384APWR	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)
SN74CB3Q3384ADBQR	SSOP	DBQ	24	2500	356.0	356.0	35.0
SN74CB3Q3384ADGVR	TVSOP	DGV	24	2000	367.0	367.0	35.0
SN74CB3Q3384APWR	TSSOP	PW	24	2000	356.0	356.0	35.0

## TUBE

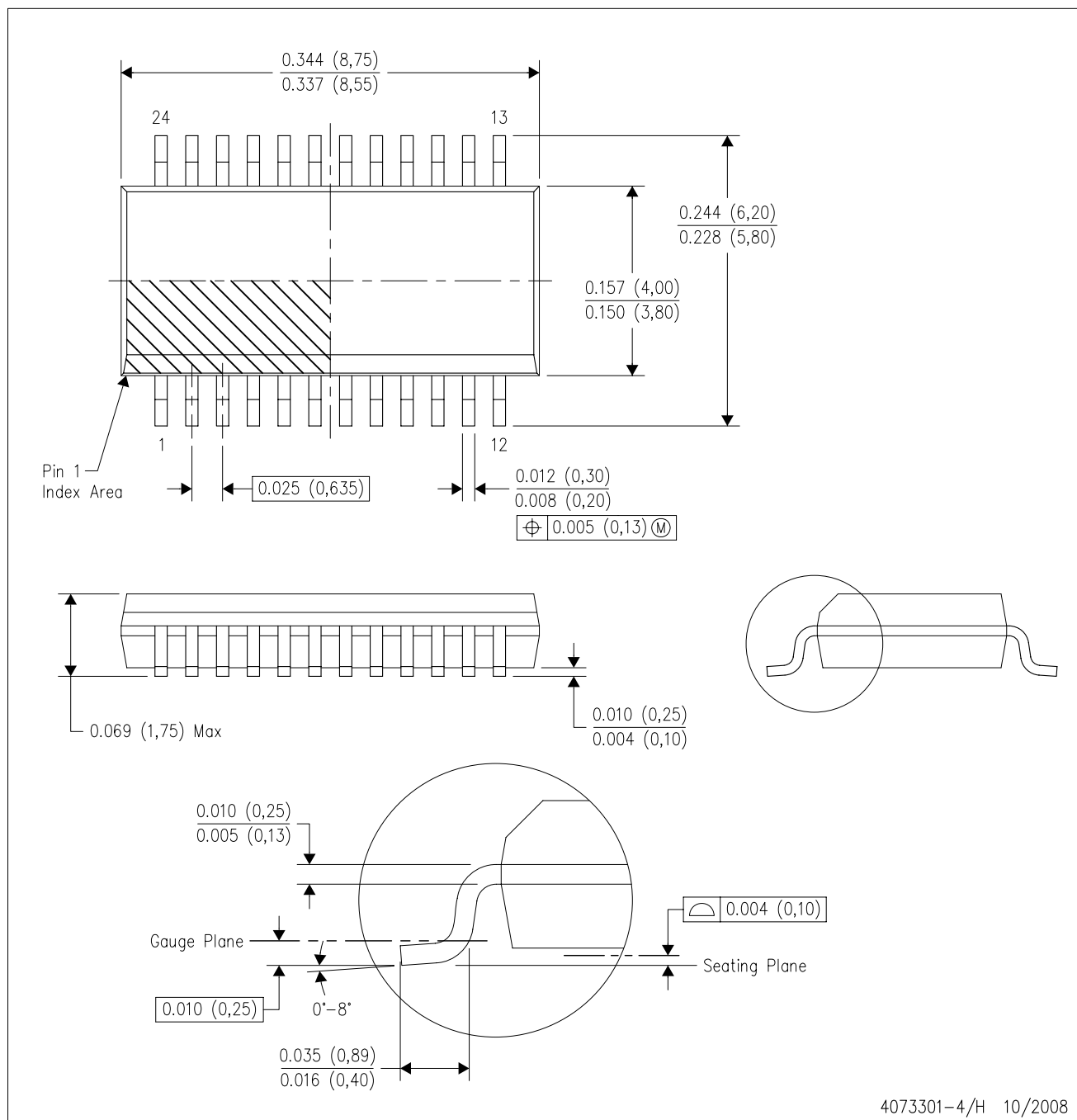


\*All dimensions are nominal

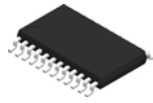
Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74CB3Q3384APW	PW	TSSOP	24	60	530	10.2	3600	3.5

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.



4220208/A 02/2017

## 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



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.

## 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



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