

# SN74CB3Q16244 16-Bit FET Bus Switch

## 2.5-V – 3.3-V Low-Voltage High-Bandwidth Bus Switch

### 1 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 ( $r_{on} = 5 \Omega$  Typical)
- 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 and Output Capacitance Minimizes Loading and Signal Distortion ( $C_{io(OFF)} = 4 \text{ pF}$  Typical)
- Fast Switching Frequency ( $f_{OE} = 20 \text{ MHz}$  Maximum)
- Data and Control Inputs Provide Undershoot Clamp Diodes
- Low Power Consumption ( $I_{CC} = 1 \text{ mA}$  Typical)
- $V_{CC}$  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 and 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

<sup>(1)</sup> 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*, (SCDA008).

### 2 Applications

- IP Phones: Wired and Wireless
- Optical Modules
- Optical Networking: Video Over Fiber and EPON
- Private Branch Exchange (PBX)
- WiMAX and Wireless Infrastructure Equipment

### 3 Description

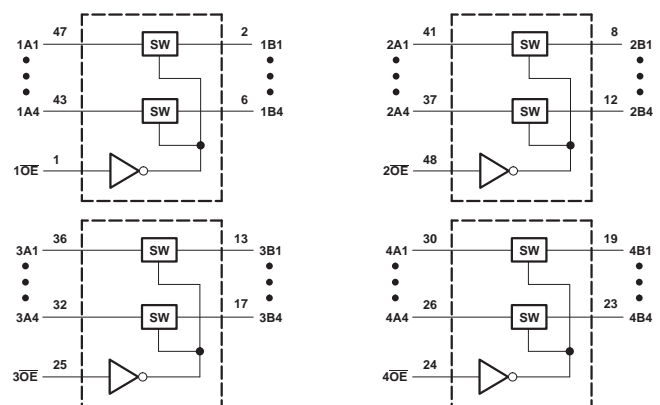
The SN74CB3Q16244 device is a high-bandwidth FET bus switch using a charge pump to elevate the gate voltage of the pass transistor, providing a low and flat ON-state resistance ( $r_{on}$ ). The low and flat ON-state resistance allows for minimal propagation delay and supports rail-to-rail switching on the data input/output (I/O) ports. The SN74CB3Q16244 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 SN74CB3Q16244 device provides an optimized interface solution ideally suited for broadband communications, networking, and data-intensive computing systems.

#### Device Information<sup>(1)</sup>

PART NUMBER	PACKAGE	BODY SIZE (NOM)
SN74CB3Q16244DGG	TSSOP (48)	12.50 mm × 6.10 mm
SN74CB3Q16244DGV	TVSOP (48)	9.70 mm × 4.40 mm
SN74CB3Q16244DL	SSOP (48)	15.88 mm × 7.49 mm

<sup>(1)</sup> For all available packages, see the orderable addendum at the end of the data sheet.

#### Logic Diagram (Positive Logic)



## Table of Contents

<b>1 Features</b> .....	<b>1</b>	9.2 Functional Block Diagram .....	<b>9</b>
<b>2 Applications</b> .....	<b>1</b>	9.3 Feature Description.....	<b>10</b>
<b>3 Description</b> .....	<b>1</b>	9.4 Device Functional Modes.....	<b>10</b>
<b>4 Revision History</b> .....	<b>2</b>	<b>10 Application and Implementation</b> .....	<b>11</b>
<b>5 Description continued</b> .....	<b>3</b>	10.1 Application Information.....	<b>11</b>
<b>6 Pin Configuration and Functions</b> .....	<b>4</b>	10.2 Typical Application .....	<b>11</b>
<b>7 Specifications</b> .....	<b>5</b>	<b>11 Power Supply Recommendations</b> .....	<b>12</b>
7.1 Absolute Maximum Ratings .....	<b>5</b>	<b>12 Layout</b> .....	<b>13</b>
7.2 ESD Ratings.....	<b>5</b>	12.1 Layout Guidelines .....	<b>13</b>
7.3 Recommended Operating Conditions .....	<b>5</b>	12.2 Layout Example .....	<b>13</b>
7.4 Thermal Information .....	<b>5</b>	<b>13 Device and Documentation Support</b> .....	<b>14</b>
7.5 Electrical Characteristics .....	<b>6</b>	13.1 Documentation Support .....	<b>14</b>
7.6 Switching Characteristics .....	<b>6</b>	13.2 Community Resources.....	<b>14</b>
7.7 Typical Characteristics .....	<b>7</b>	13.3 Trademarks .....	<b>14</b>
<b>8 Parameter Measurement Information</b> .....	<b>8</b>	13.4 Electrostatic Discharge Caution.....	<b>14</b>
<b>9 Detailed Description</b> .....	<b>9</b>	13.5 Glossary .....	<b>14</b>
9.1 Overview .....	<b>9</b>	<b>14 Mechanical, Packaging, and Orderable Information</b> .....	<b>14</b>

## 4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

### Changes from Revision A (March 2005) to Revision B

Page

- Added *Applications*, *Device Information* table, *Pin Configuration and Functions* section, *ESD Ratings* table, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section .....
- 1**
- Removed Ordering Information table. ....
- 1**

## 5 Description continued

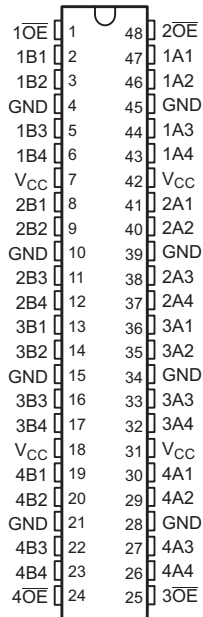
The SN74CB3Q16244 device is organized as four 4-bit bus switches with separate output-enable ( $\overline{1OE}$ ,  $\overline{2OE}$ ,  $\overline{3OE}$ ,  $\overline{4OE}$ ) inputs. It can be used as four 4-bit bus switches, two 8-bit bus switches, or one 16-bit bus switch. When  $\overline{OE}$  is low, the associated 4-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 4-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.

## 6 Pin Configuration and Functions

**DGG, DGV, or DL Package  
48-Pin TSSOP, TVSOP, or SSOP  
Top View**



### Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
1A1, 1A2 1A3, 1A4	47, 46 44, 43	I/O	Bidirectional signal to be switched
1B1, 1B2 1B3, 1B4	2, 3 5, 6	I/O	Bidirectional signal to be switched
$1\overline{OE}$	1	I	Switch Output Enable to connect pins 1A1, 1A2, 1A3, 1A4 to 1B1, 1B2, 1B3, 1B4 (Active Low: L = ON, H = OFF)
2A1, 2A2 2A3, 2A4	41, 40 38, 37	I/O	Bidirectional signal to be switched
2B1, 2B2 2B3, 2B4	8, 9 11, 12	I/O	Bidirectional signal to be switched
$2\overline{OE}$	48	I	Switch Output Enable to connect pins 2A1, 2A2, 2A3, 2A4 to 2B1, 2B2, 2B3, 2B4 (Active Low: L = ON, H = OFF)
3A1, 3A2 3A3, 3A4	36, 35 33, 32	I/O	Bidirectional signal to be switched
3B1, 3B2 3B3, 3B4	13, 14 16, 17	I/O	Bidirectional signal to be switched
$3\overline{OE}$	25	I	Switch Output Enable to connect pins 3A1, 3A2, 3A3, 3A4 to 3B1, 3B2, 3B3, 3B4 (Active Low: L = ON, H = OFF)
4A1, 4A2 4A3, 4A4	30, 29 27, 26	I/O	Bidirectional signal to be switched
4B1, 4B2 4B3, 4B4	19, 20 22, 23	I/O	Bidirectional signal to be switched
$4\overline{OE}$	24	I	Switch Output Enable to connect pins 4A1, 4A2, 4A3, 4A4 to 4B1, 4B2, 4B3, 4B4 (Active Low: L = ON, H = OFF)
V <sub>CC</sub>	7, 18, 31, 42	—	Power Supply
GND	4, 10, 15, 21 28, 34, 39, 45	—	Ground

## 7 Specifications

### 7.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage <sup>(2)</sup>	-0.5	4.6	V
V <sub>IN</sub>	Control input voltage <sup>(2)(3)</sup>	-0.5	7	V
V <sub>I/O</sub>	Switch I/O voltage <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/O</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
	Continuous current through V <sub>CC</sub> or GND		±100	mA
T <sub>J</sub>	Junction temperature		150	°C
T <sub>stg</sub>	Storage temperature	-65	150	

- (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<sub>I</sub> and V<sub>O</sub> are used to denote specific conditions for V<sub>I/O</sub>.
- (5) I<sub>I</sub> and I<sub>O</sub> are used to denote specific conditions for I<sub>I/O</sub>.

### 7.2 ESD Ratings

		VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	+2000
		Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup>	+1000
			V

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

### 7.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)<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 <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 <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<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs (SCBA004)*.

### 7.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>	SN74CB3Q16244			UNIT	
	DGG (TSSOP)	DGV (TVSOP)	DL (SSOP)		
	48 PINS	48 PINS	48 PINS		
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	70	58	63	°C/W

- (1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, [SPRA953](#).

## 7.5 Electrical Characteristics

 over recommended operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

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	$V_{CC} = 3.6\text{ V}$ ,	$V_{IN} = 0\text{ to }5.5\text{ V}$			±1	µA
$I_{OZ}$ <sup>(3)</sup>		$V_{CC} = 3.6\text{ V}$ ,	$V_O = 0\text{ to }5.5\text{ V}$ , $V_I = 0$ , Switch OFF, $V_{IN} = V_{CC}\text{ or GND}$			±1	µA
$I_{off}$		$V_{CC} = 0$ ,	$V_O = 0\text{ to }5.5\text{ V}$ , $V_I = 0$			1	µA
$I_{CC}$		$V_{CC} = 3.6\text{ V}$ ,	$I_{I/O} = 0$ , 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	µA
$I_{CCD}$ <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	$V_{CC} = 3.3\text{ V}$ ,	$V_{IN} = 5.5\text{ V}, 3.3\text{ V},\text{ or }0$		3.5	5	pF
$C_{io(OFF)}$		$V_{CC} = 3.3\text{ V}$ ,	Switch OFF, $V_{IN} = V_{CC}\text{ or GND}$ , $V_{I/O} = 5.5\text{ V}, 3.3\text{ V},\text{ or }0$		4	6	pF
$C_{io(ON)}$		$V_{CC} = 3.3\text{ V}$ ,	Switch ON, $V_{IN} = V_{CC}\text{ or GND}$ , $V_{I/O} = 5.5\text{ V}, 3.3\text{ V},\text{ or }0$		10	13	pF
$r_{on}$ <sup>(6)</sup>	$V_{CC} = 2.3\text{ V}$ , TYP at $V_{CC} = 2.5\text{ V}$	$V_I = 0$ ,	$I_O = 30\text{ mA}$		6	8	Ω
		$V_I = 1.7\text{ V}$ ,	$I_O = -15\text{ mA}$		5	10	
	$V_{CC} = 3\text{ V}$	$V_I = 0$ ,	$I_O = 30\text{ mA}$		6	8	
		$V_I = 2.4\text{ V}$ ,	$I_O = -15\text{ mA}$		5	9	

(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) This parameter specifies the dynamic power-supply current associated with the operating frequency of a single control input (see Figure 1).

(6) 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.

## 7.6 Switching Characteristics

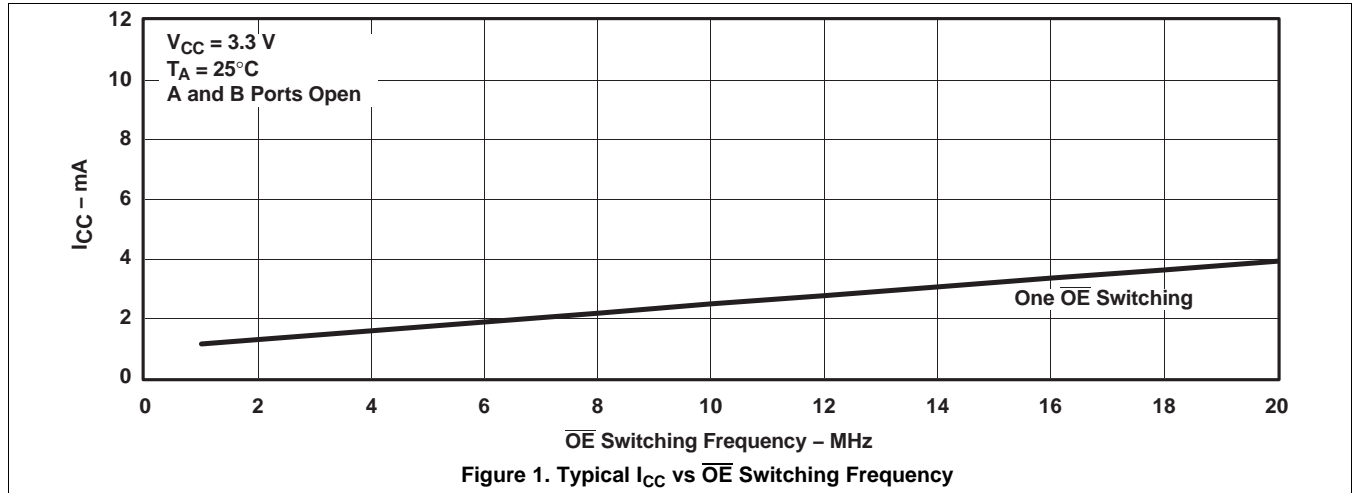
over recommended operating free-air temperature range (unless otherwise noted) (see Figure 2)

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	
$f_{OE}$ <sup>(1)</sup>	$\overline{OE}$	A or B		10		20	MHz
$t_{pd}$ <sup>(2)</sup>	A or B	B or A		0.18		0.3	ns
$t_{en}$	$\overline{OE}$	A or B	1.5	8	1.5	7	ns
$t_{dis}$	$\overline{OE}$	A or B	1	8	1	7	ns

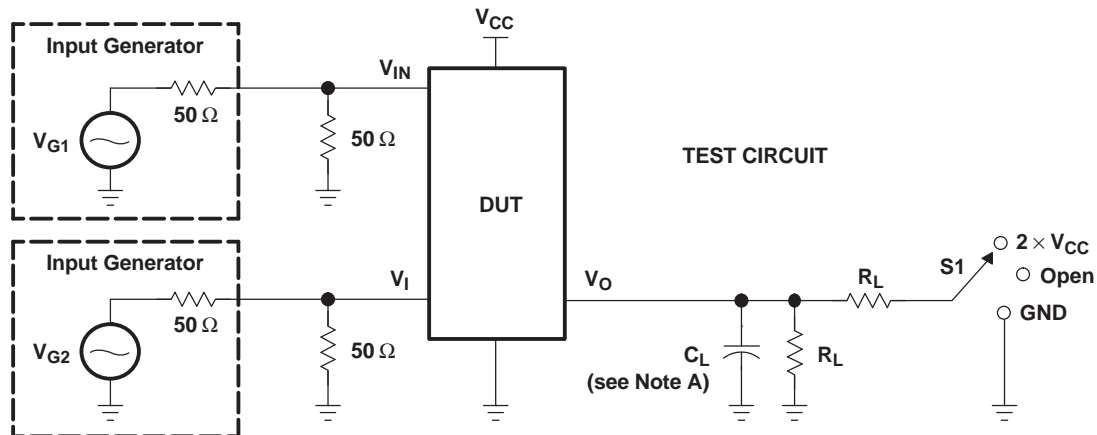
(1) Maximum switching frequency for control input ( $V_O > V_{CC}$ ,  $V_I = 5\text{ V}$ ,  $R_L \geq 1\text{ M}\Omega$ ,  $C_L = 0$ )

(2) 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).

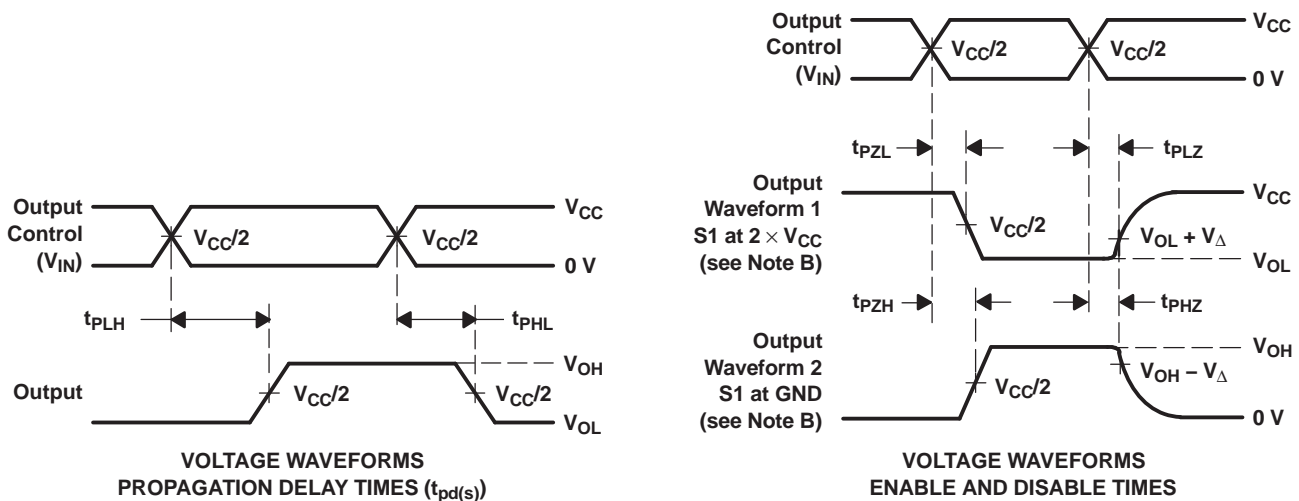
## 7.7 Typical Characteristics



## 8 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



- 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>PZH</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(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).
  - H. All parameters and waveforms are not applicable to all devices.

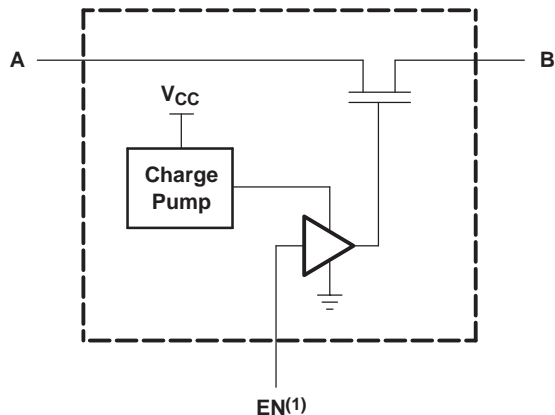
Figure 2. Test Circuit and Voltage Waveforms



## 9 Detailed Description

### 9.1 Overview

The SN74CB3Q16244 is part of the CB3Q family of switches. The SN74CB3Q16244 is a 16-bit FET bus switch in which 4 Output Enable pins each control a set of 4 switches totaling 16 switches.



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

Figure 3. Simplified Schematic, Each FET Switch (SW)

### 9.2 Functional Block Diagram

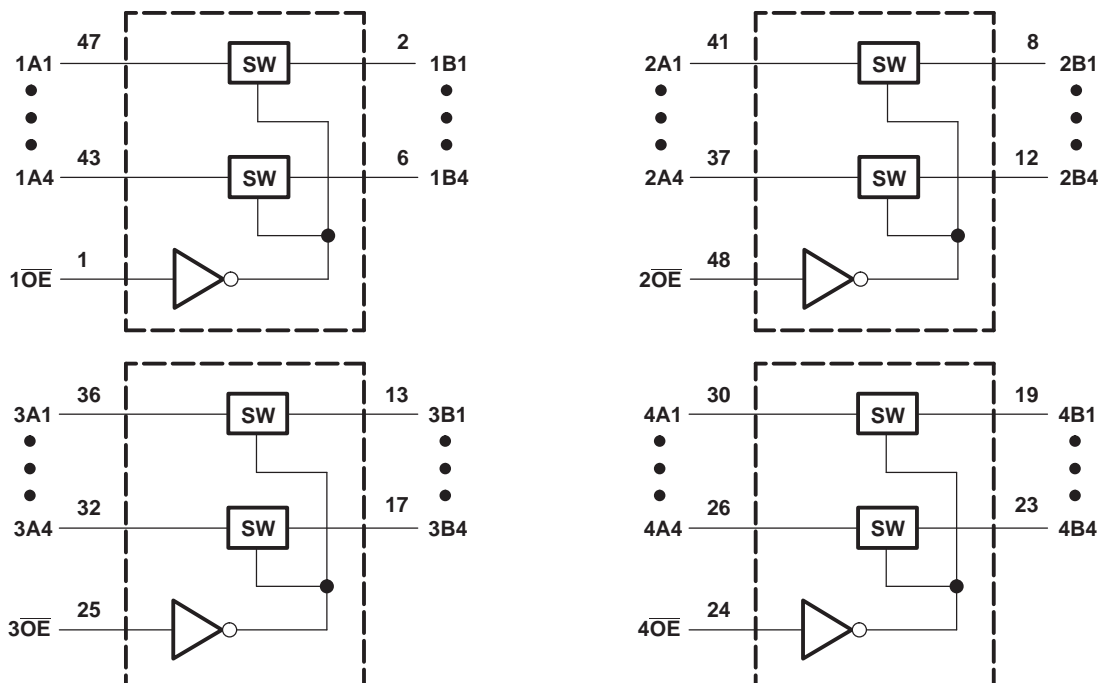


Figure 4. Logic Diagram (Positive Logic)

### 9.3 Feature Description

The SN74CB3Q16244 device has a high-bandwidth data path (up to 500 MHz) and has 5-V tolerant I/Os with the device powered up or powered down. It also has low and flat ON-state resistance ( $r_{on}$ ) characteristics over operating range ( $r_{on} = 5 \Omega$  Typical)

This device also has rail-to-rail switching on data I/O ports for 0 to 5-V switching with 3.3-V  $V_{CC}$  and 0 to 3.3-V switching with 2.5-V  $V_{CC}$  as well as bidirectional data flow with near-zero propagation delay and low input and output capacitance that minimizes loading and signal distortion ( $C_{io(OFF)} = 4 \text{ pF}$  Typical)

The SN74CB3Q16244 also provides a fast switching frequency ( $f_{OE} = 20 \text{ MHz}$  Maximum) with data and control inputs that provide undershoot clamp diodes as well as low power consumption ( $I_{CC} = 1 \text{ mA}$  Typical)

The  $V_{CC}$  operating range is from 2.3 V to 3.6 V and the data I/Os support 0 to 5-V signal levels of (0.8-V, 1.2-V, 1.5-V, 1.8-V, 2.5-V, 3.3-V, 5-V)

The control inputs can be driven by TTL or 5-V and 3.3-V CMOS outputs, and  $I_{off}$  supports partial-power-down mode operation.

### 9.4 Device Functional Modes

Table 1 lists the functional modes of the SN74CB3Q16244.

**Table 1. Function Table  
(Each Multiplexer/Demultiplexer)**

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

## 10 Application and Implementation

### NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 10.1 Application Information

The SN74CB3Q16244 device can be used to control up to 16 bits with 4 channels simultaneously.

### 10.2 Typical Application

The application shown in Figure 5 is a 16-bit bus being controlled. The  $\overline{OE}$  pins are used to control the chip from the bus controller. This is a generic example and can apply to many situations. If an application requires fewer than 16 bits, ensure that the A side is tied either high or low on unused channels.

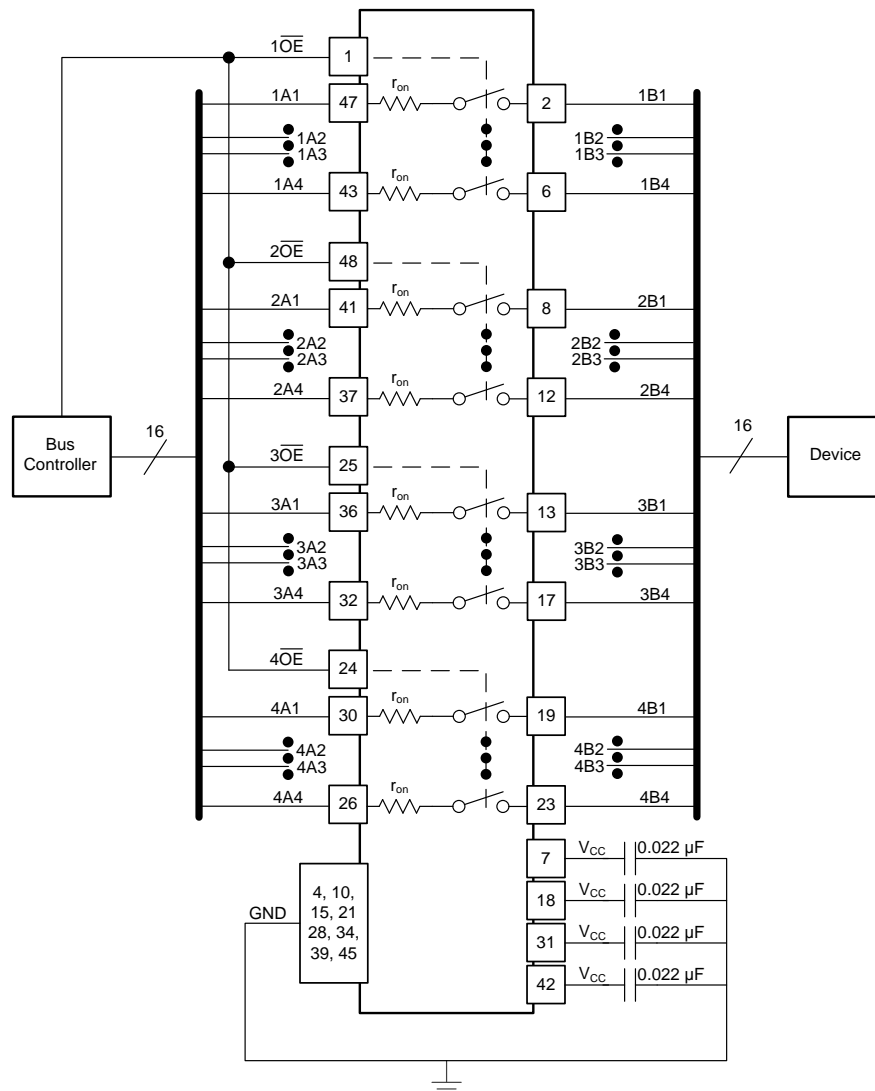


Figure 5. Typical Application of the SN74CB3Q16244

## Typical Application (continued)

### 10.2.1 Design Requirements

A 0.022- $\mu\text{F}$  bypass capacitor should be placed between each  $V_{\text{CC}}$  pin and GND. Each capacitor must be placed as close as possible to the SN74CB3Q16244 device.

### 10.2.2 Detailed Design Procedure

1. Recommended input conditions:
  - For specified high and low levels, see  $V_{\text{IH}}$  and  $V_{\text{IL}}$  in [Recommended Operating Conditions](#)
  - Inputs and outputs are overvoltage tolerant, which allows them to go as high as 5.5 V at any valid  $V_{\text{CC}}$
2. Recommended output conditions:
  - Load currents must not exceed  $\pm 64$  mA per channel
3. Frequency selection criterion:
  - Added trace resistance or capacitance can reduce maximum frequency capability; use layout practices as directed in [Layout](#)

### 10.2.3 Application Curve

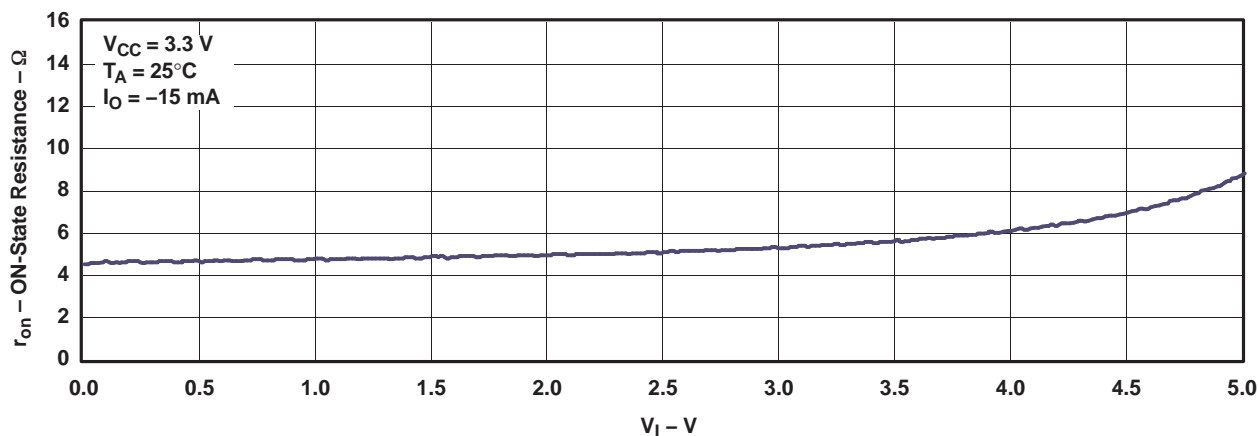


Figure 6. Typical  $r_{\text{on}}$  vs  $V_{\text{I}}$

## 11 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating listed in the [Absolute Maximum Ratings](#) table.

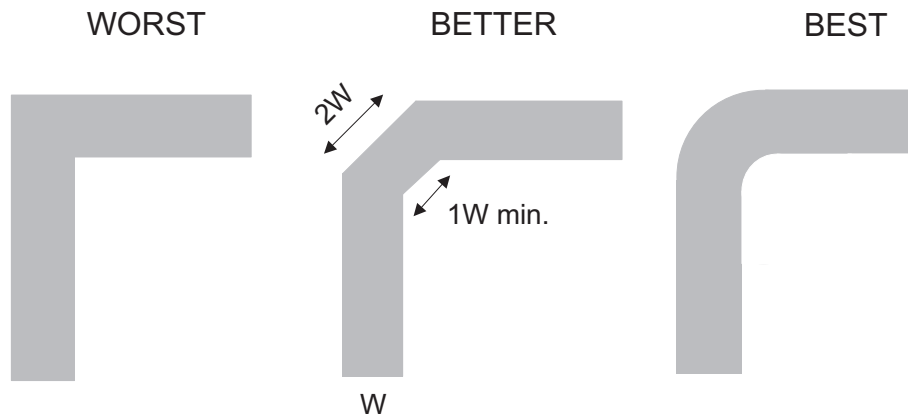
Each  $V_{\text{CC}}$  terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, a 0.1- $\mu\text{F}$  bypass capacitor is recommended. If multiple pins are labeled  $V_{\text{CC}}$ , then a 0.01- $\mu\text{F}$  or 0.022- $\mu\text{F}$  capacitor is recommended for each  $V_{\text{CC}}$  because the  $V_{\text{CC}}$  pins are tied together internally. For devices with dual-supply pins operating at different voltages, for example  $V_{\text{CC}}$  and  $V_{\text{DD}}$ , a 0.1- $\mu\text{F}$  bypass capacitor is recommended for each supply pin. To reject different frequencies of noise, use multiple bypass capacitors in parallel. Capacitors with values of 0.1  $\mu\text{F}$  and 1  $\mu\text{F}$  are commonly used in parallel. The bypass capacitor must be installed as close to the power terminal as possible for best results.

## 12 Layout

### 12.1 Layout Guidelines

Reflections and matching are closely related to the loop antenna theory but are different enough to be discussed separately from the theory. When a PCB trace turns a corner at a 90° angle, a reflection can occur. A reflection occurs primarily because of the change of width of the trace. At the apex of the turn, the trace width increases to 1.414 times the width. This increase upsets the transmission-line characteristics, especially the distributed capacitance and self-inductance of the trace, which results in the reflection. Not all PCB traces can be straight; therefore, some traces must turn corners. Figure 7 shows progressively better techniques of rounding corners. Only the last example (BEST) maintains constant trace width and minimizes reflections.

### 12.2 Layout Example



**Figure 7. Trace Example**

## 13 Device and Documentation Support

### 13.1 Documentation Support

#### 13.1.1 Related Documentation

For related documentation see the following:

- *CBT-C, CB3T, and CB3Q Signal-Switch Families*, [SCDA008](#)
- *Implications of Slow or Floating CMOS Inputs*, [SCBA004](#)
- *Selecting the Right Texas Instruments Signal Switch*, [SZZA030](#)

### 13.2 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

**TI E2E™ Online Community** *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At [e2e.ti.com](#), you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

**Design Support** *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

### 13.3 Trademarks

E2E is a trademark of Texas Instruments.  
All other trademarks are the property of their respective owners.

### 13.4 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### 13.5 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

## 14 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

**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="#">SN74CB3Q16244DGGR</a>	Active	Production	TSSOP (DGG)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CB3Q16244
SN74CB3Q16244DGGR.B	Active	Production	TSSOP (DGG)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CB3Q16244
<a href="#">SN74CB3Q16244DGVR</a>	Active	Production	TVSOP (DGV)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BW244
SN74CB3Q16244DGVR.B	Active	Production	TVSOP (DGV)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	BW244
<a href="#">SN74CB3Q16244DL</a>	Active	Production	SSOP (DL)   48	25   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CB3Q16244
SN74CB3Q16244DL.B	Active	Production	SSOP (DL)   48	25   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CB3Q16244
<a href="#">SN74CB3Q16244DLR</a>	Active	Production	SSOP (DL)   48	1000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CB3Q16244
SN74CB3Q16244DLR.B	Active	Production	SSOP (DL)   48	1000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CB3Q16244

(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.

**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
SN74CB3Q16244DGGR	TSSOP	DGG	48	2000	330.0	24.4	8.6	13.0	1.8	12.0	24.0	Q1
SN74CB3Q16244DGVR	TVSOP	DGV	48	2000	330.0	16.4	7.1	10.2	1.6	12.0	16.0	Q1
SN74CB3Q16244DLR	SSOP	DL	48	1000	330.0	32.4	11.35	16.2	3.1	16.0	32.0	Q1

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74CB3Q16244DGGR	TSSOP	DGG	48	2000	356.0	356.0	45.0
SN74CB3Q16244DGVR	TVSOP	DGV	48	2000	353.0	353.0	32.0
SN74CB3Q16244DLR	SSOP	DL	48	1000	356.0	356.0	53.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74CB3Q16244DL	DL	SSOP	48	25	473.7	14.24	5110	7.87
SN74CB3Q16244DL.B	DL	SSOP	48	25	473.7	14.24	5110	7.87

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

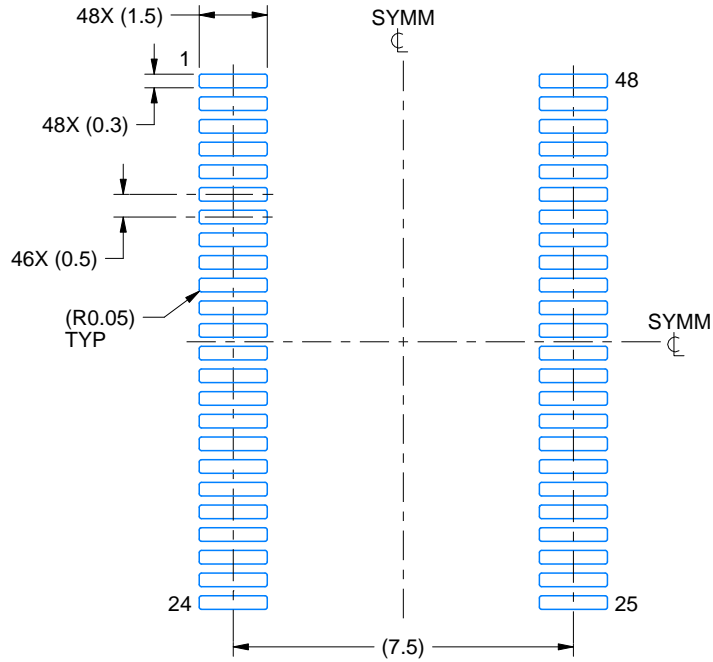


# EXAMPLE BOARD LAYOUT

DGG0048A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

4214859/B 11/2020

NOTES: (continued)

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

# EXAMPLE STENCIL DESIGN

DGG0048A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

4214859/B 11/2020

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

DGG (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



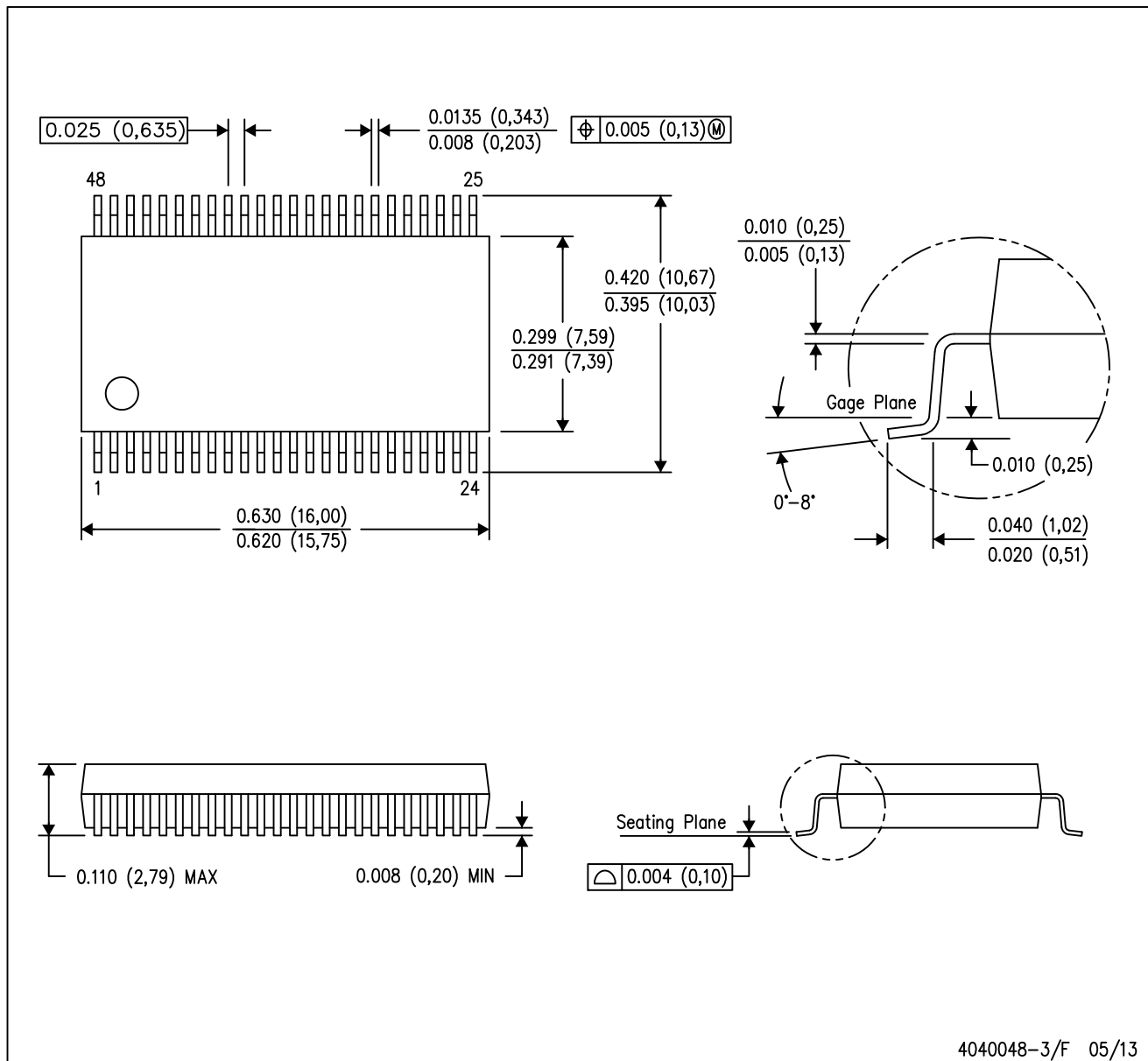
- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153



# MECHANICAL DATA

DL (R-PDSO-G48)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - Falls within JEDEC MO-118

PowerPAD is a trademark of Texas Instruments.

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#), [TI's General Quality Guidelines](#), or other applicable terms available either on [ti.com](http://ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Copyright © 2025, Texas Instruments Incorporated

Last updated 10/2025