

## FEATURES

- Member of the Texas Instruments Widebus™ Family
- 5-Ω Switch Connection Between Two Ports
- Rail-to-Rail Switching on Data I/O Ports
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- B-Port Outputs Are Precharged by Bias Voltage to Minimize Signal Distortion During Live Insertion
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)

## DESCRIPTION/ORDERING INFORMATION

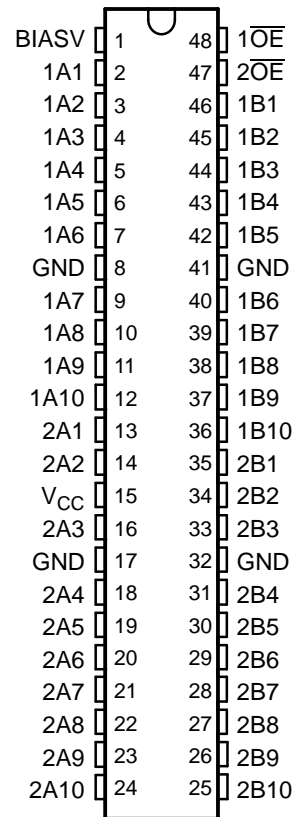
The SN74CBTLV16800 provides 20 bits of high-speed bus switching. The low on-state resistance of the switch allows connections to be made with minimal propagation delay. The device also precharges the B port to a user-selectable bias voltage (BIASV) to minimize live-insertion noise.

The device is organized as dual 10-bit bus switches with separate output-enable ( $\overline{OE}$ ) inputs. It can be used as two 10-bit bus switches or one 20-bit bus switch. When  $\overline{OE}$  is low, the associated 10-bit bus switch is on, and port A is connected to port B. When  $\overline{OE}$  is high, the switch is open, the high-impedance state exists between the two ports, and port B is precharged to BIASV through the equivalent of a 10-kΩ resistor.

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.

DGG, DGV, OR DL PACKAGE  
(TOP VIEW)



## ORDERING INFORMATION

T <sub>A</sub>	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	SSOP – DL	Tube	SN74CBTLV16800DL	CBTLV16800
		Tape and reel	SN74CBTLV16800DLR	
	TSSOP – DGG	Tape and reel	SN74CBTLV16800GR	CBTLV16800
	TVSOP – DGV	Tape and reel	SN74CBTLV16800VR	CN800

(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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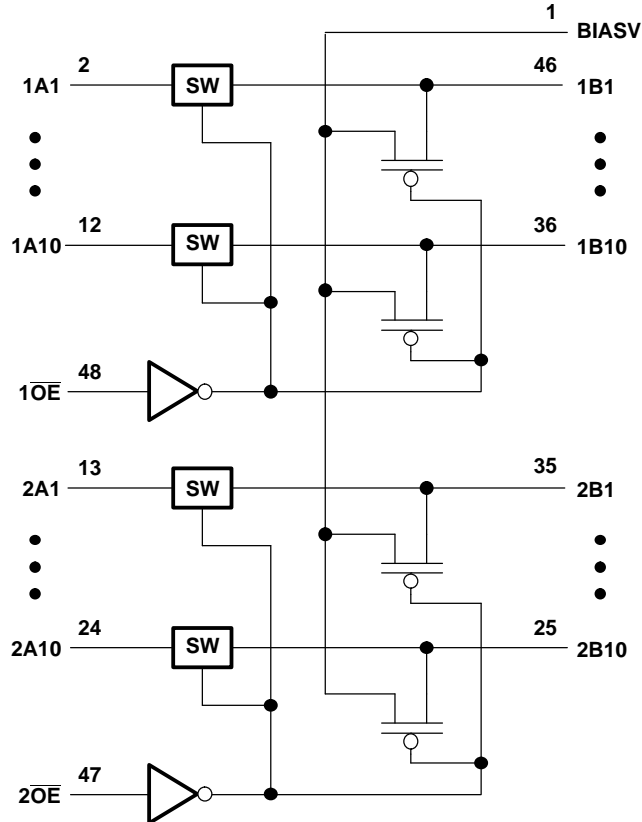
**SN74CBTLV16800**  
**LOW-VOLTAGE 20-BIT FET BUS SWITCH**  
**WITH PRECHARGED OUTPUTS**

SCDS045J–DECEMBER 1997–REVISED MARCH 2005

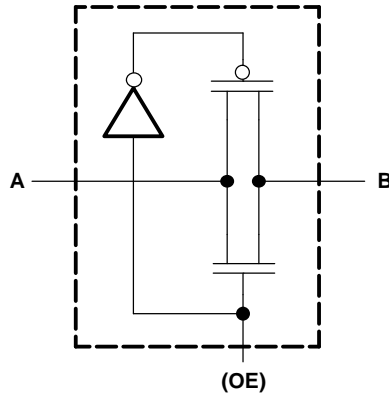
**FUNCTION TABLE**  
**(EACH 10-BIT BUS SWITCH)**

INPUT OE	FUNCTION
L	A port = B port
H	A port = Z B port = BIASV

**LOGIC DIAGRAM (POSITIVE LOGIC)**



**SIMPLIFIED SCHEMATIC, EACH FET SWITCH**



### 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	4.6	V	
BIASV	Bias voltage range	–0.5	4.6	V	
$V_I$	Input voltage range <sup>(2)</sup>	–0.5	4.6	V	
Continuous channel current			128	mA	
$I_{IK}$	Input clamp current	$V_I < 0$		–50	mA
$\theta_{JA}$	Package thermal impedance <sup>(3)</sup>	DGG package		70	°C/W
		DGV package		58	
		DL package		63	
$T_{stg}$	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) The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (3) 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	
BIASV	Bias voltage	1.3	$V_{CC}$	V	
$V_{IH}$	High-level control input voltage	$V_{CC} = 2.3\text{ V to }2.7\text{ V}$		1.7	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$		2	
$V_{IL}$	Low-level control input voltage	$V_{CC} = 2.3\text{ V to }2.7\text{ V}$		0.7	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$		0.8	
$T_A$	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.

# SN74CBTLV16800

## LOW-VOLTAGE 20-BIT FET BUS SWITCH WITH PRECHARGED OUTPUTS

SCDS045J–DECEMBER 1997–REVISED MARCH 2005

### Electrical Characteristics

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

PARAMETER		TEST CONDITIONS		MIN	TYP <sup>(1)</sup>	MAX	UNIT
$V_{IK}$		$V_{CC} = 3\text{ V}$ ,	$I_I = -18\text{ mA}$			-1.2	V
$I_I$		$V_{CC} = 3.6\text{ V}$ ,	$V_I = V_{CC}$ or GND			$\pm 1$	$\mu\text{A}$
$I_{off}$	A port	$V_{CC} = 0$ ,	$V_I$ or $V_O = 0$ to $3.6\text{ V}$			10	$\mu\text{A}$
$I_O$		$V_{CC} = 3\text{ V}$ ,	BIASV = $2.4\text{ V}$ , $V_O = 0$ , $\overline{OE} = V_{CC}$			0.25	mA
$I_{CC}$		$V_{CC} = 3.6\text{ V}$ ,	$I_O = 0$ , $V_I = V_{CC}$ or GND			10	$\mu\text{A}$
$\Delta I_{CC}$ <sup>(2)</sup>	Control inputs	$V_{CC} = 3.6\text{ V}$ ,	One input at $3\text{ V}$ , Other inputs at $V_{CC}$ or GND			300	$\mu\text{A}$
$C_i$	Control inputs	$V_I = 3\text{ V}$ or $0$				4.5	pF
$C_{iO(OFF)}$		$V_O = 3\text{ V}$ or $0$ ,	Switch off, BIASV = Open			6.5	pF
$r_{on}$ <sup>(3)</sup>	$V_{CC} = 2.3\text{ V}$ , TYP at $V_{CC} = 2.5\text{ V}$	$V_I = 0$	$I_I = 64\text{ mA}$	5	9	$\Omega$	
			$I_I = 24\text{ mA}$	5	9		
		$V_I = 1.7\text{ V}$ ,	$I_I = 15\text{ mA}$	25	35		
	$V_{CC} = 3\text{ V}$	$V_I = 0$	$I_I = 64\text{ mA}$	5	7		
			$I_I = 24\text{ mA}$	5	7		
		$V_I = 2.4\text{ V}$ ,	$I_I = 15\text{ mA}$	8	15		

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

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

(3) 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.

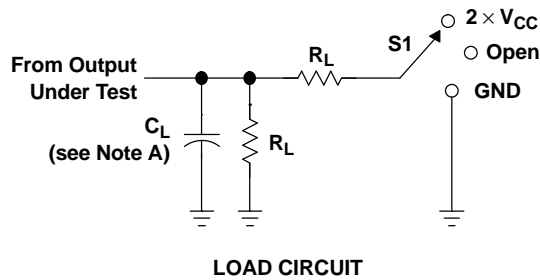
### Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

PARAMETER	TEST CONDITIONS	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
$t_{PZH}$	BIASV = GND	$\overline{OE}$	A or B	2.9	7.7	2.2	5.5	ns
$t_{PZL}$	BIASV = $3\text{ V}$			2.8	6.4	2.1	5.3	
$t_{PHZ}$	BIASV = GND	$\overline{OE}$	A or B	1.4	6.8	2.6	7.6	ns
$t_{PLZ}$	BIASV = $3\text{ V}$			1.3	4.2	1.5	5.1	

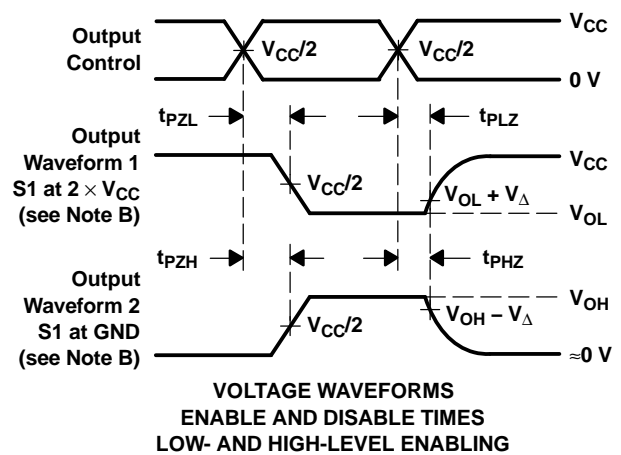
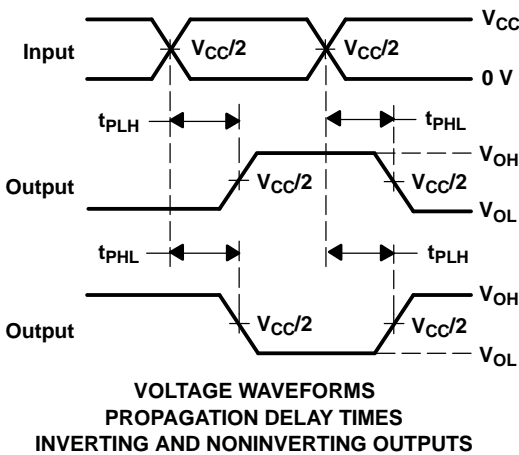
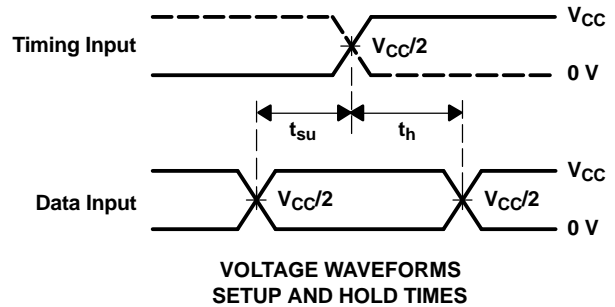
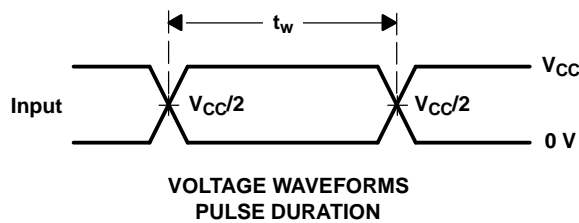
(1) The propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).

PARAMETER MEASUREMENT INFORMATION



TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$2 \times V_{CC}$
$t_{PHZ}/t_{PZH}$	GND

$V_{CC}$	$C_L$	$R_L$	$V_{\Delta}$
$2.5 \text{ V} \pm 0.2 \text{ V}$	30 pF	500 $\Omega$	0.15 V
$3.3 \text{ V} \pm 0.3 \text{ V}$	50 pF	500 $\Omega$	0.3 V



- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.  
 C. All input pulses are supplied by generators having the following characteristics: PRR  $\leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2 \text{ ns}$ ,  $t_f \leq 2 \text{ ns}$ .  
 D. The outputs are measured one at a time, with one transition per measurement.  
 E.  $t_{P LZ}$  and  $t_{P H Z}$  are the same as  $t_{dis}$ .  
 F.  $t_{P Z L}$  and  $t_{P Z H}$  are the same as  $t_{en}$ .  
 G.  $t_{P L H}$  and  $t_{P H L}$  are the same as  $t_{pd}$ .  
 H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

**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>
74CBTLV16800DLG4	ACTIVE	SSOP	DL	48	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBTLV16800DLRG4	ACTIVE	SSOP	DL	48	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBTLV16800GRE4	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBTLV16800GRG4	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBTLV16800VRE4	ACTIVE	TVSOP	DGV	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBTLV16800VRG4	ACTIVE	TVSOP	DGV	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTLV16800DL	ACTIVE	SSOP	DL	48	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTLV16800DLR	ACTIVE	SSOP	DL	48	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTLV16800GR	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTLV16800VR	ACTIVE	TVSOP	DGV	48	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.

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**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
SN74CBTLV16800DLR	SSOP	DL	48	1000	330.0	32.4	11.35	16.2	3.1	16.0	32.0	Q1
SN74CBTLV16800GR	TSSOP	DGG	48	2000	330.0	24.4	8.6	15.8	1.8	12.0	24.0	Q1
SN74CBTLV16800VR	TVSOP	DGV	48	2000	330.0	24.4	6.8	10.1	1.6	12.0	24.0	Q1

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74CBTLV16800DLR	SSOP	DL	48	1000	346.0	346.0	49.0
SN74CBTLV16800GR	TSSOP	DGG	48	2000	346.0	346.0	41.0
SN74CBTLV16800VR	TVSOP	DGV	48	2000	346.0	346.0	41.0



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

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- 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).  
 D. Falls within JEDEC MO-118

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

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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