

# SN54CBTD3384, SN74CBTD3384 10-BIT FET BUS SWITCHES WITH LEVEL SHIFTING

SCDS025L – MAY 1995 – REVISED MAY 2000

- 5-Ω Switch Connection Between Two Ports
- TTL-Compatible Input Levels
- Designed to Be Used in Level-Shifting Applications
- Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB, DBQ), Thin Very Small-Outline (DGV), and Thin Shrink Small-Outline (PW) Packages, Ceramic Flat (W) Package, Ceramic DIPs (JT), and Ceramic Chip Carriers (FK)

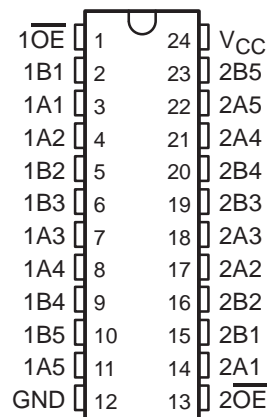
## description

The 'CBTD3384 devices provide ten bits of high-speed TTL-compatible bus switching. The low on-state resistance of the switches allows connections to be made without adding propagation delay. A diode to  $V_{CC}$  is integrated on the die to allow for level shifting between 5-V inputs and 3.3-V outputs.

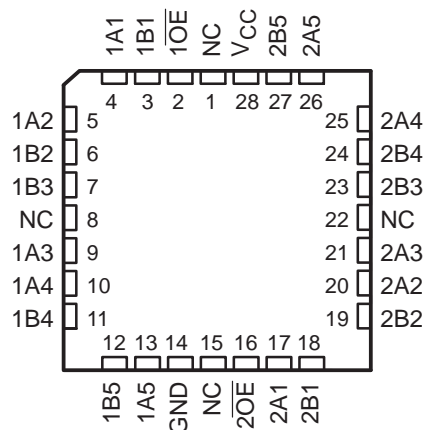
These devices are organized as two 5-bit switches with separate output-enable ( $\overline{OE}$ ) inputs. When  $\overline{OE}$  is low, the switch is on, and port A is connected to port B. When  $\overline{OE}$  is high, the switch is open, and a high-impedance state exists between the two ports.

The SN54CBTD3384 is characterized for operation over the full military temperature range from  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74CBTD3384 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

SN54CBTD3384 . . . JT OR W PACKAGE  
SN74CBTD3384 . . . DB, DBQ, DGV, DW, OR PW PACKAGE  
(TOP VIEW)



SN54CBTD3384 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

FUNCTION TABLE  
(each 5-bit bus switch)

INPUTS		INPUTS/OUTPUTS	
$\overline{1OE}$	$\overline{2OE}$	1B1–1B5	2B1–2B5
L	L	1A1–1A5	2A1–2A5
L	H	1A1–1A5	Z
H	L	Z	2A1–2A5
H	H	Z	Z



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**TEXAS  
INSTRUMENTS**

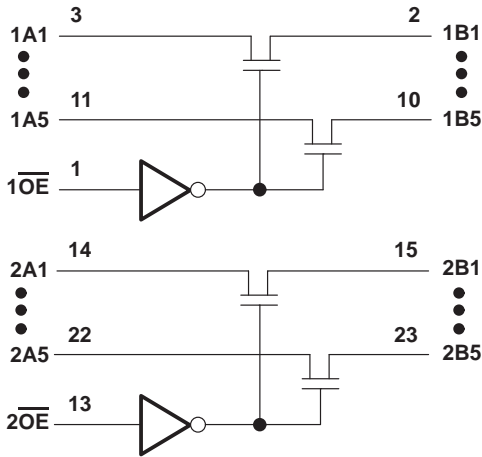
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logic diagram (positive logic)



Pin numbers shown are for the DB, DBQ, DGV, DW, JT, PW, and W packages.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, $V_{CC}$	–0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1)	–0.5 V to 7 V
Continuous channel current	128 mA
Input clamp current, $I_{IK}$ ( $V_{I/O} < 0$ )	–50 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2):	
DB package	63°C/W
DBQ package	61°C/W
DGV package	86°C/W
DW package	46°C/W
PW package	88°C/W
Storage temperature range, $T_{stg}$	–65°C to 150°C

† 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.

- NOTES: 1. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.  
2. The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions (see Note 3)

	SN54CBTD3384		SN74CBTD3384		UNIT
	MIN	MAX	MIN	MAX	
$V_{CC}$ Supply voltage	4.5	5.5	4.5	5.5	V
$V_{IH}$ High-level control input voltage	2		2		V
$V_{IL}$ Low-level control input voltage		0.8		0.8	V
$T_A$ Operating free-air temperature	–55	125	–40	85	°C

NOTE 3: 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.

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

PARAMETER		TEST CONDITIONS	SN54CBTD3384			SN74CBTD3384			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
$V_{IK}$		$V_{CC} = 4.5\text{ V}$ , $I_I = -18\text{ mA}$			-1.2			-1.2	V
$V_{OH}$		See Figure 2							
$I_I$		$V_{CC} = 5.5\text{ V}$ , $V_I = 5.5\text{ V}$ or GND			$\pm 1$			$\pm 1$	$\mu\text{A}$
$I_{CC}$		$V_{CC} = 5.5\text{ V}$ , $I_O = 0$ , $V_I = V_{CC}$ or GND			1.5			1.5	mA
$\Delta I_{CC}^\ddagger$	Control inputs	$V_{CC} = 5.5\text{ V}$ , One input at 3.4 V, Other inputs at $V_{CC}$ or GND			2.5			2.5	mA
$C_i$	Control inputs	$V_I = 3\text{ V}$ or 0			3			3	pF
$C_{io(OFF)}$		$V_O = 3\text{ V}$ or 0, $\overline{OE} = V_{CC}$			3.5			3.5	pF
$r_{on}^\S$		$V_{CC} = 4.5\text{ V}$ , $V_I = 0$ , $I_I = 64\text{ mA}$			5			5 7	$\Omega$
		$V_I = 0$ , $I_I = 30\text{ mA}$			5			5 7	
		$V_I = 2.4\text{ V}$ , $I_I = 15\text{ mA}$			35			35 50	

† Typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

‡ 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 the A and B terminals at the indicated current through the switch. On-state resistance is determined by the lowest voltage of the two (A or B) terminals.

**switching characteristics over recommended ranges of supply voltage and operating free-air temperature range,  $C_L = 50\text{ pF}$  (unless otherwise noted) (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54CBTD3384		SN74CBTD3384		UNIT
			MIN	MAX	MIN	MAX	
$t_{pd}^\P$	A or B	B or A		0.25		0.25	ns
$t_{en}$	$\overline{OE}$	A or B	2.2	9.7	2.3	7	ns
$t_{dis}$	$\overline{OE}$	A or B	1.5	8.6	1.7	5.3	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).

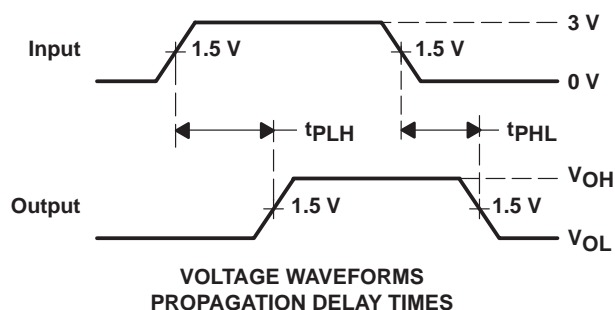
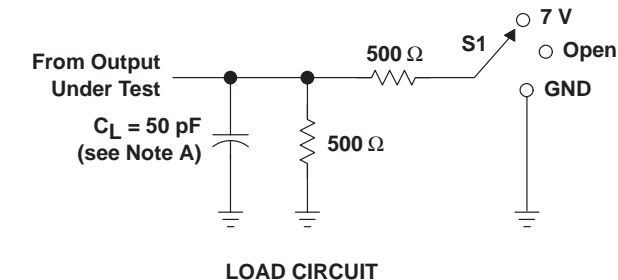
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## 10-BIT FET BUS SWITCHES

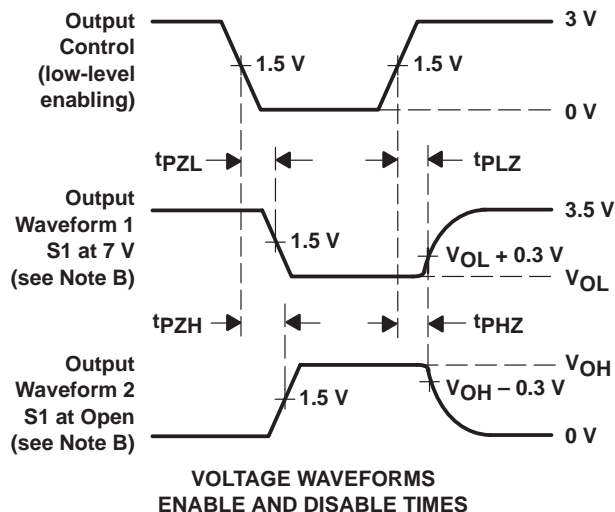
### WITH LEVEL SHIFTING

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#### PARAMETER MEASUREMENT INFORMATION



TEST	S1
$t_{pd}$	Open
$t_{PLZ}/t_{PZL}$	7 V
$t_{PHZ}/t_{PZH}$	Open



- 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:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .
  - 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.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

Figure 1. Load Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

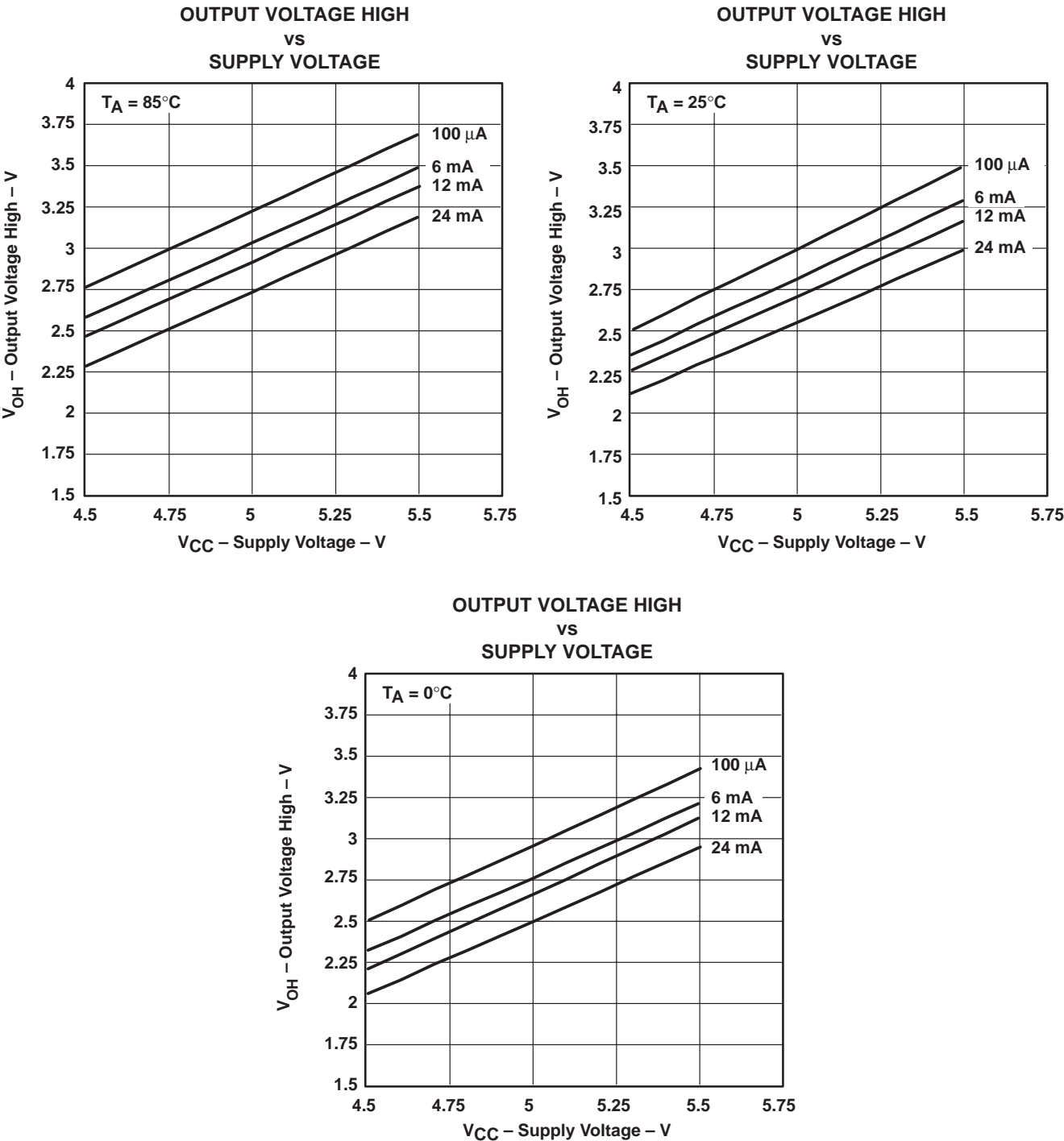


Figure 2.  $V_{OH}$  Values

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