



# LOW-VOLTAGE 12-BIT 1:2 MUX / DEMUX BUS SWITCH WITH INTERNAL PULL DOWN RESISTORS

**IDT74CBTLVR16292**

## FEATURES:

- Isolation Under Power-Off Conditions
- Make-before-break feature
- Over-voltage tolerant
- Internal 500Ω pull-down resistor to GND
- Both A and B ports have 25Ω series dampening resistors
- Latch-up performance exceeds 100mA
- VCC = 2.3V - 3.6V, normal range
- ESD >2000V per MIL-STD-883, Method 3015; >200V using machine model (C = 200pF, R = 0)
- Available in SSOP, TSSOP, and TVSOP packages

## APPLICATIONS:

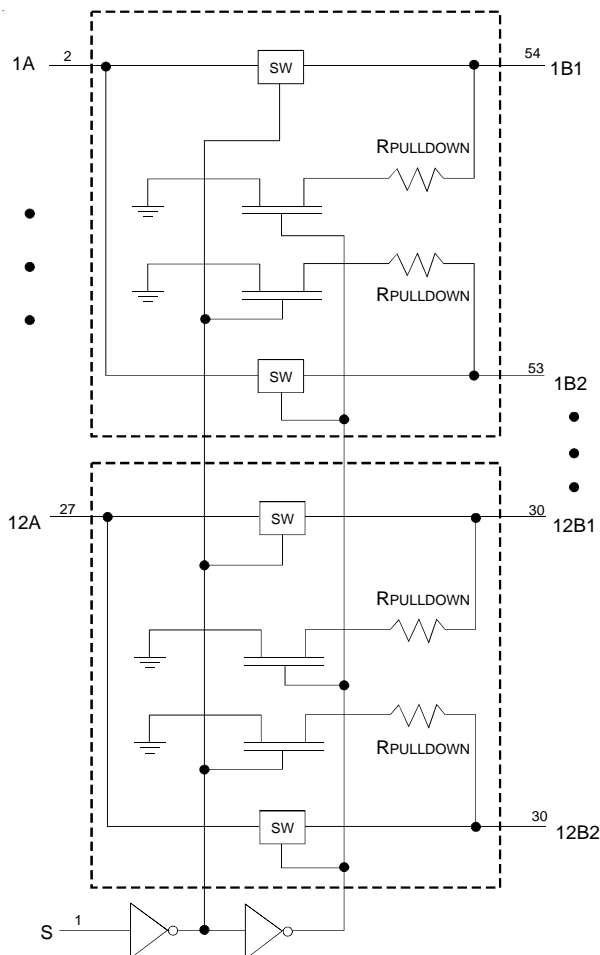
- 3.3V High Speed Bus Switching and Bus Isolation
- Resource sharing

## DESCRIPTION:

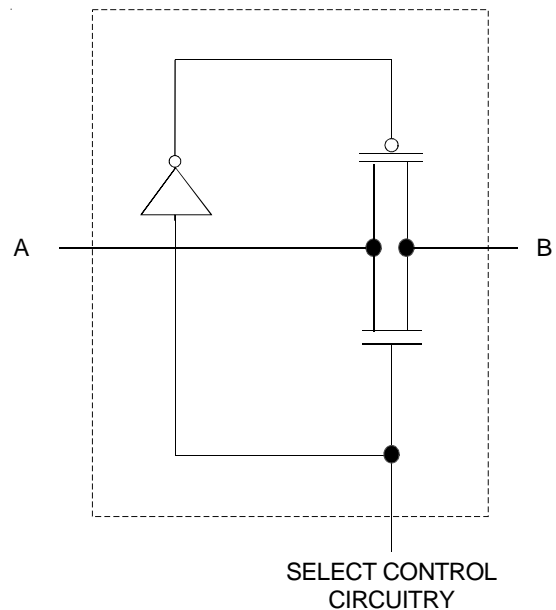
The CBTLVR16292 is a single 12-bit multiplexing / demultiplexing bus switch, which provides high speed switching. Both A and B ports have 25Ω series dampening resistors to minimize undershoot, reflection noise, and charge sharing effects. The demultiplexer side has a 500Ω resistor termination to GND to eliminate floating nodes.

When the select (S) input is low, the A port is connected to the B1 port, and the R pulldown is connected to the B2 port. Similarly, when the S input is high, A port is connected to B2 port and the R pulldown is connected to B1 port.

## FUNCTIONAL BLOCK DIAGRAM



## SIMPLIFIED SCHEMATIC, EACH SWITCH

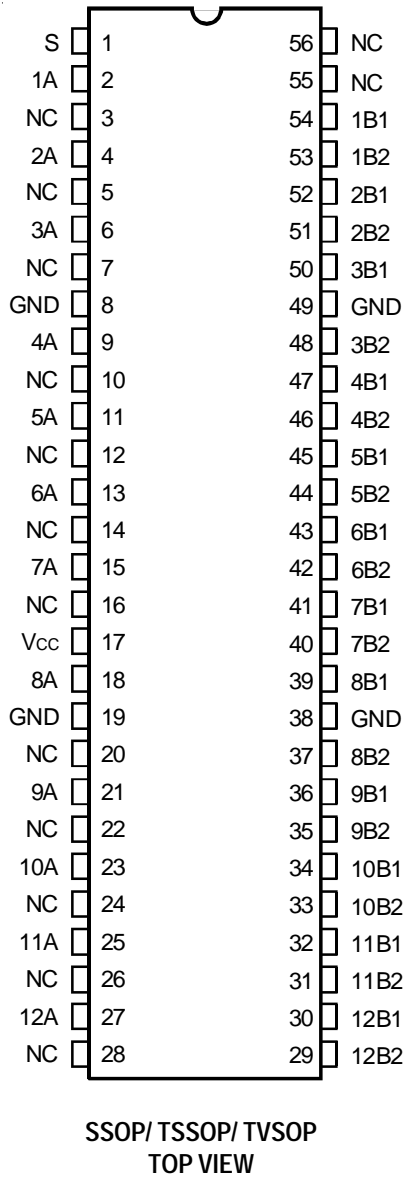


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**INDUSTRIAL TEMPERATURE RANGE**

**AUGUST 2002**

PIN CONFIGURATION



ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Symbol	Description	Max.	Unit
V <sub>CC</sub>	Supply Voltage Range	-0.5 to 4.6	V
V <sub>I</sub>	Input Voltage Range	-0.5 to 4.6	V
	Continuous Channel Current	128	mA
I <sub>IK</sub>	Input Clamp Current, V <sub>I/O</sub> < 0	-50	mA
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C

NOTE:

- Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

PIN DESCRIPTION

Pin Names	Description
S	Select Input
x Ax	Port A Inputs or Outputs
x Bx	Port B Inputs or Outputs

FUNCTION TABLE<sup>(1)</sup>

Input	Operation
S	
L	A Port = B1 Port R <sub>PULLDOWN</sub> = B2 Port
H	A Port = B2 Port R <sub>PULLDOWN</sub> = B1 Port

NOTE:

- H = HIGH Voltage Level  
L = LOW Voltage Level

OPERATING CHARACTERISTICS<sup>(1)</sup>

Symbol	Parameter	Test Conditions	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> = 2.3V to 2.7V	1.7	—	V
		V <sub>CC</sub> = 2.7V to 3.6V	2	—	
V <sub>IL</sub>	Low-Level Control Input Voltage	V <sub>CC</sub> = 2.3V to 2.7V	—	0.7	V
		V <sub>CC</sub> = 2.7V to 3.6V	—	0.8	
T <sub>A</sub>	Operating Free-Air Temperature		-40	+85	°C

NOTE:

- All unused control inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation.

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Operating Condition: TA = -40°C to +85°C

Symbol	Parameter	Test Conditions	Min.	Typ. <sup>(1)</sup>	Max.	Unit	
V <sub>IK</sub>	Control Inputs, Data I/O	V <sub>CC</sub> = 3V, I <sub>I</sub> = -18mA	—	—	-1.2	V	
I <sub>I</sub>	Control Inputs	V <sub>CC</sub> = 3.6V, V <sub>I</sub> = V <sub>CC</sub> or GND	—	—	±1	μA	
I <sub>OFF</sub>		V <sub>CC</sub> = 0V, V <sub>I</sub> or V <sub>O</sub> = 0V or 3.6V	—	—	10	μA	
I <sub>CC</sub>		V <sub>CC</sub> = 3.6V, I <sub>O</sub> = 0, V <sub>I</sub> = V <sub>CC</sub> or GND	—	—	10	μA	
ΔI <sub>CC</sub> <sup>(2)</sup>	Control Inputs	V <sub>CC</sub> = 3.6V, one input at 3V, other inputs at V <sub>CC</sub> or GND	—	—	300	μA	
C <sub>I</sub>	Control Inputs	V <sub>I</sub> = 3.3V or 0	—	3.5	—	pF	
C <sub>IO(OFF)</sub>	A port or B port	V <sub>O</sub> = 3.3V or 0	—	23	—	pF	
R <sub>ON</sub> <sup>(3)</sup>	Max. at V <sub>CC</sub> = 2.3V Typ. at V <sub>CC</sub> = 2.5V	V <sub>I</sub> = 0	I <sub>O</sub> = 64mA	—	30	47	Ω
			I <sub>O</sub> = 24mA	—	30	47	
	V <sub>CC</sub> = 3V	V <sub>I</sub> = 1.7V	I <sub>O</sub> = 15mA	—	36	80	
			V <sub>I</sub> = 0	I <sub>O</sub> = 64mA	—	30	
		I <sub>O</sub> = 24mA		—	30	42	
		I <sub>O</sub> = 15mA	—	32	47		

### NOTES:

1. Typical values are at 3.3V, +25°C ambient.
2. The increase in supply current is attributable to each input that is at the specified voltage level rather than V<sub>CC</sub> or GND.
3. This is measured by the voltage drop between the A and B terminals at the indicated current through the switch.

## SWITCHING CHARACTERISTICS

Symbol	Parameter	V <sub>CC</sub> = 2.5V ± 0.2V		V <sub>CC</sub> = 3.3V ± 0.3V		Unit
		Min.	Max.	Min.	Max.	
t <sub>PD</sub> <sup>(1)</sup>	Propagation Delay A to B or B to A	—	0.9	—	1.5	ns
t <sub>PD</sub> <sup>(2)</sup>	Propagation Delay S to A	3.2	8.5	3.2	8	ns
t <sub>EN</sub>	Output Enable Time S to B	1	6.5	1	5.8	ns
t <sub>DIS</sub>	Output Disable Time S to B	1	5.3	1	4.6	ns
t <sub>MB/B</sub> <sup>(3,4)</sup>	Make-Before-Break Time	0	2	0	2	ns

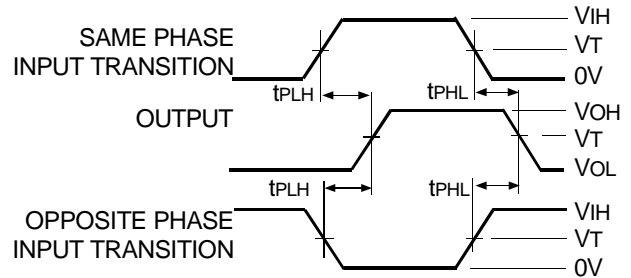
### NOTES:

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).
2. The condition to measure this propagation delay is by observing the change of voltage on the A port introduced by static fields equal to 3V or 0V for 3.3V±0.3V or V<sub>CC</sub> or 0 for 2.5V±0.2V on B1 and B2 ports to get the required transition.
3. The make-before-break time is the duration between the make and break, during transition from one selected port to another.
4. This parameter is guaranteed by design but not production tested.

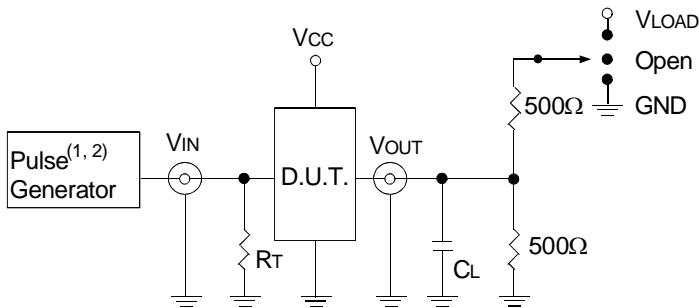
## TEST CIRCUITS AND WAVEFORMS

### TEST CONDITIONS

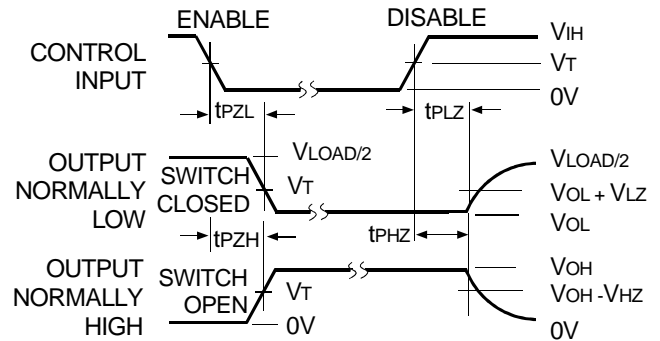
Symbol	V <sub>CC</sub> <sup>(1)</sup> = 3.3V ± 0.3V	V <sub>CC</sub> <sup>(2)</sup> = 2.5V ± 0.2V	Unit
V <sub>LOAD</sub>	6	2 x V <sub>CC</sub>	V
V <sub>IH</sub>	3	V <sub>CC</sub>	V
V <sub>T</sub>	1.5	V <sub>CC</sub> / 2	V
V <sub>LZ</sub>	300	150	mV
V <sub>HZ</sub>	300	150	mV
C <sub>L</sub>	50	30	pF



*Propagation Delay*



*Test Circuits for All Outputs*



**NOTES:**

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.
2. Disable Low waveform applies to outputs that are LOW, except when disabled by the output control S.

*Enable and Disable Times*

**DEFINITIONS:**

C<sub>L</sub> = Load capacitance: includes jig and probe capacitance.  
 R<sub>T</sub> = Termination resistance: should be equal to Z<sub>OUT</sub> of the Pulse Generator.

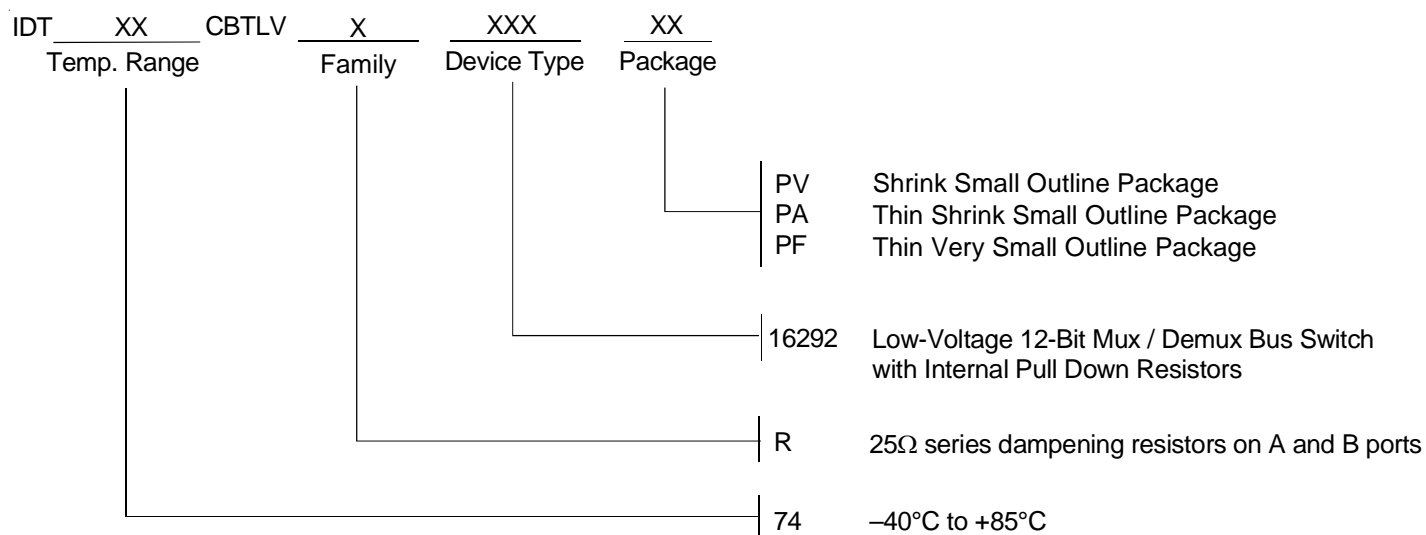
**NOTES:**

1. Pulse Generator for All Pulses: Rate ≤ 10MHz; t<sub>r</sub> ≤ 2.5ns; t<sub>f</sub> ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; t<sub>r</sub> ≤ 2ns; t<sub>f</sub> ≤ 2ns.

### SWITCH POSITION

Test	Switch
t <sub>PLZ</sub> /t <sub>PZL</sub>	V <sub>LOAD</sub>
t <sub>PHZ</sub> /t <sub>PZH</sub>	GND
t <sub>PD</sub>	Open

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**CORPORATE HEADQUARTERS**  
 2975 Stender Way  
 Santa Clara, CA 95054

**for SALES:**  
 800-345-7015 or 408-727-6116  
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 www.idt.com

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 logichelp@idt.com  
 (408) 654-6459