

### FEATURES:

- 5Ω A/B bi-directional switch
- Isolation Under Power-Off Conditions
- Over-voltage tolerant
- 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 TSSOP package

### APPLICATIONS:

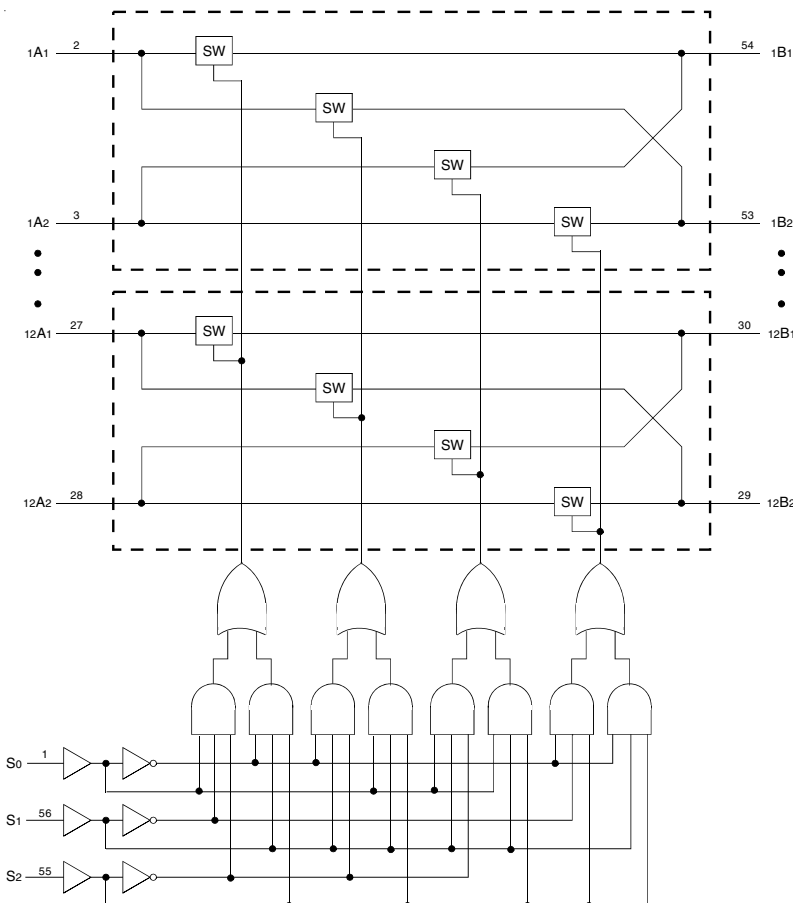
- 3.3V High Speed Bus Switching and Bus Isolation

### DESCRIPTION:

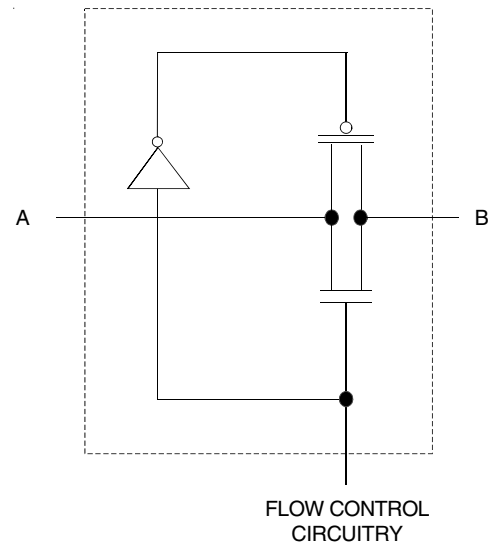
The CBTLV16212 provides a set of 24 high-speed switches for bus exchanging and switching. The device has low ON resistance, resulting in under 250ps propagation delay through the switch. The CBTLV16212 operates as a single 24-bit bus switch or as a 12-bit bus exchanger, which provides data exchanging between the four signal ports through the data select (S0-S2) pins.

The CBTLV16212 has the break-before-make feature, which allows zero current when switching between ports B1 and B2.

### FUNCTIONAL BLOCK DIAGRAM



### SIMPLIFIED SCHEMATIC, EACH SWITCH

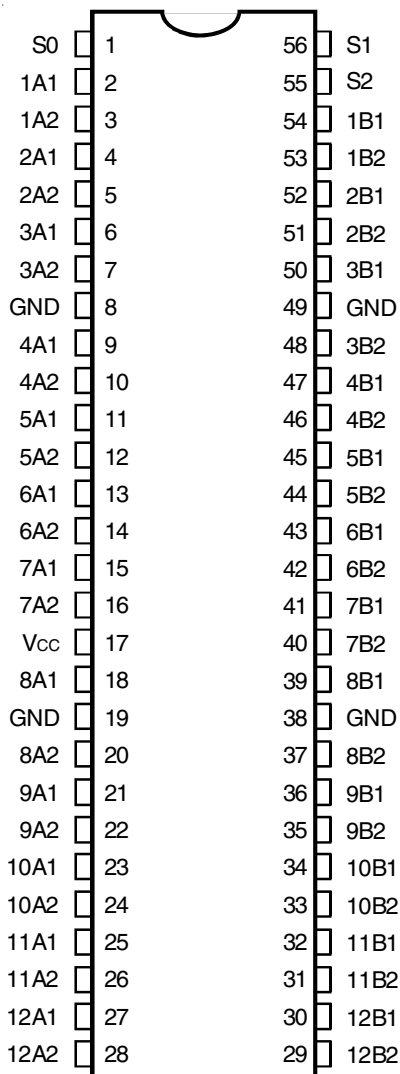


The IDT logo is a registered trademark of Integrated Device Technology, Inc.

INDUSTRIAL TEMPERATURE RANGE

JUNE 2019

PIN CONFIGURATION



TOP VIEW

Package Type	Package Code	Order Code
TSSOP	PAG56	PAG

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
I <sub>CC</sub>	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 <sub>x</sub>	Data Select
xA <sub>x</sub>	Port A Inputs or Outputs
xB <sub>x</sub>	Port B Inputs or Outputs

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

Inputs			Inputs/Outputs		Operation
S <sub>2</sub>	S <sub>1</sub>	S <sub>0</sub>	A <sub>1</sub>	A <sub>2</sub>	
L	L	L	Z	Z	Disconnect
L	L	H	B <sub>1</sub>	Z	A <sub>1</sub> port = B <sub>1</sub> port
L	H	L	B <sub>2</sub>	Z	A <sub>1</sub> port = B <sub>2</sub> port
L	H	H	Z	B <sub>1</sub>	A <sub>2</sub> port = B <sub>1</sub> port
H	L	L	Z	B <sub>2</sub>	A <sub>2</sub> port = B <sub>2</sub> port
H	L	H	Z	Z	Disconnect
H	H	L	B <sub>1</sub>	B <sub>2</sub>	A <sub>1</sub> port = B <sub>1</sub> port A <sub>2</sub> port = B <sub>2</sub> port
H	H	H	B <sub>2</sub>	B <sub>1</sub>	A <sub>1</sub> port = B <sub>2</sub> port A <sub>2</sub> port = B <sub>1</sub> port

NOTE:

- H = HIGH Voltage Level  
L = LOW Voltage Level  
Z = High-Impedance

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

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>OZ</sub>	Data I/O	V <sub>CC</sub> = 3.6V, V <sub>O</sub> = 0V or 3.6V switch disabled		—	—	5	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> = 3V or 0		—	5	—	pF
C <sub>I(OFF)</sub>		V <sub>O</sub> = 3V or 0 (switch off)		—	13.5	—	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	—	5	8	Ω
			I <sub>O</sub> = 24mA	—	5	8	
	V <sub>CC</sub> = 3V	V <sub>I</sub> = 1.7V	I <sub>O</sub> = 15mA	—	27	40	
			I <sub>O</sub> = 64mA	—	5	7	
		V <sub>I</sub> = 0	I <sub>O</sub> = 24mA	—	5	7	
			I <sub>O</sub> = 15mA	—	10	15	

**NOTES:**

- Typical values are at 3.3V, +25°C ambient.
- 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.
- 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	—	0.15	—	0.25	ns
t <sub>PD</sub>	Propagation Delay S to A or B	3	11.1	3	8.8	ns
t <sub>EN</sub>	Output Enable Time S to A or B	3	10.9	3	8.6	ns
t <sub>DIS</sub>	Output Disable Time S to A or B	1	8.7	2	8.8	ns

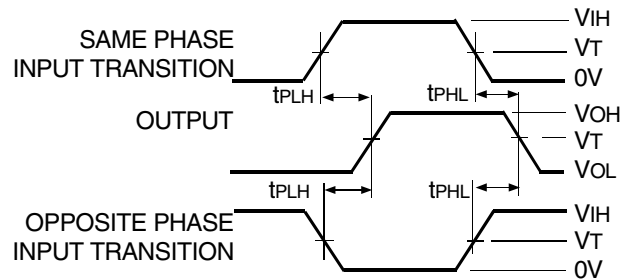
**NOTE:**

- 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).

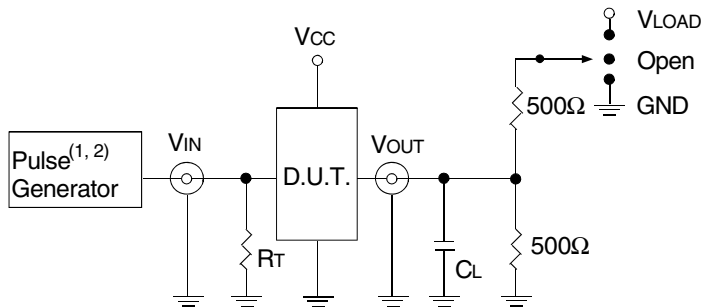
TEST CIRCUITS AND WAVEFORMS

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

DEFINITIONS:

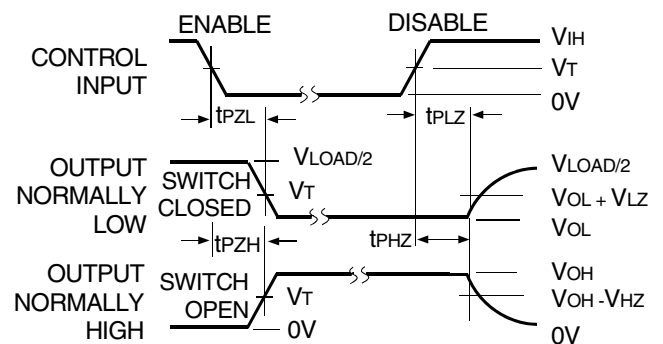
C<sub>L</sub> = Load capacitance: includes jig and probe capacitance.  
R<sub>T</sub> = Termination resistance: should be equal to Z<sub>OUT</sub> of the Pulse Generator.

NOTES:

1. Pulse Generator for All Pulses: Rate ≤ 10MHz; tr ≤ 2.5ns; tr ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; tr ≤ 2ns; tr ≤ 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

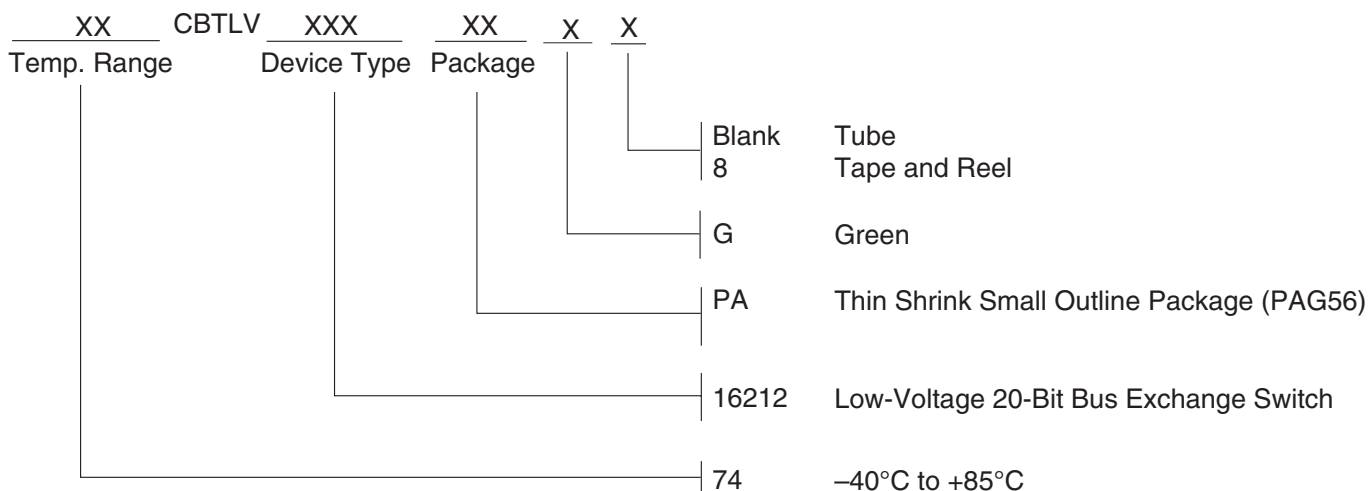


NOTE:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

Enable and Disable Times

ORDERING INFORMATION



Orderable Part Information

Speed (ns)	Orderable Part ID	Pkg. Code	Pkg. Type	Temp. Grade
	74CBTLV16212PAG	PAG56	TSSOP	I
	74CBTLV16212PAG8	PAG56	TSSOP	I

Datasheet Document History

- 12/04/2014 Pg. 5 Updated the ordering information by removing the "IDT" notation, non RoHS part and by adding Tape and Reel information.
- 06/03/2019 Pg. 2,5 Added table under pin configuration diagram with detailed package information and orderable part information table. Updated the ordering information diagram in clearer detail.

## IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES (“RENESAS”) PROVIDES TECHNICAL SPECIFICATIONS 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 OR 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 developers skilled in the art designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only for development of an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising out of your use of these resources. Renesas' products are provided only subject to Renesas' Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

(Rev.1.0 Mar 2020)

### Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,  
Koto-ku, Tokyo 135-0061, Japan  
[www.renesas.com](http://www.renesas.com)

### Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:  
[www.renesas.com/contact/](http://www.renesas.com/contact/)

### Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.