RENESAS

LOW-VOLTAGE 24-BIT BUS EXCHANGE SWITCH

74CBTLV16212

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)**
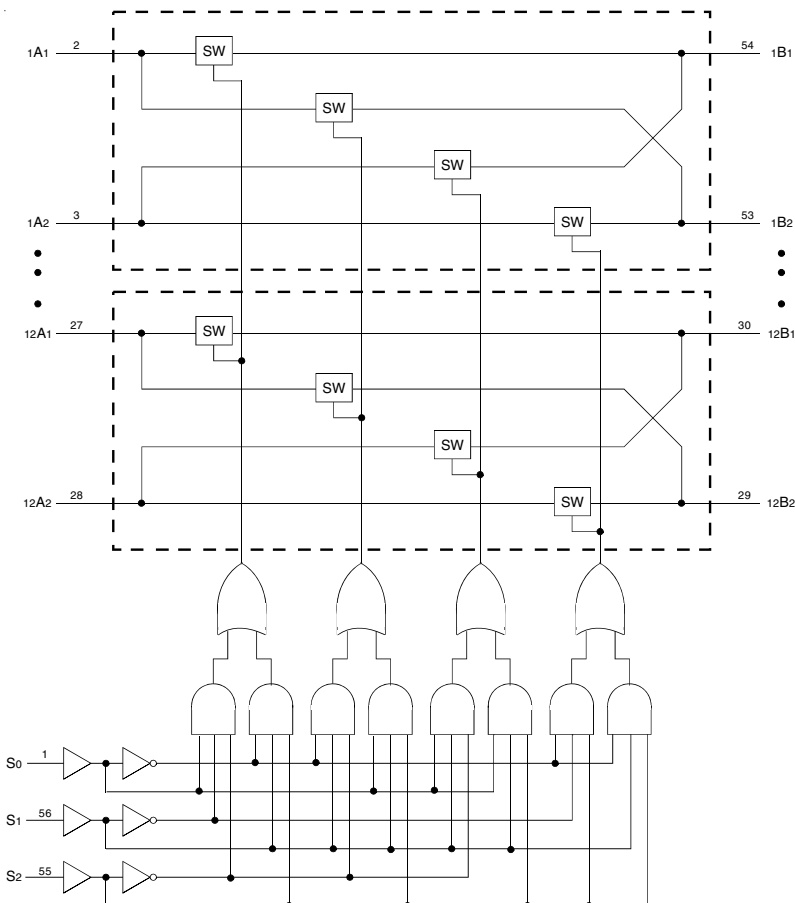- **Available in TSSOP package**

APPLICATIONS:
- **3.3V High Speed Bus Switching and Bus Isolation**
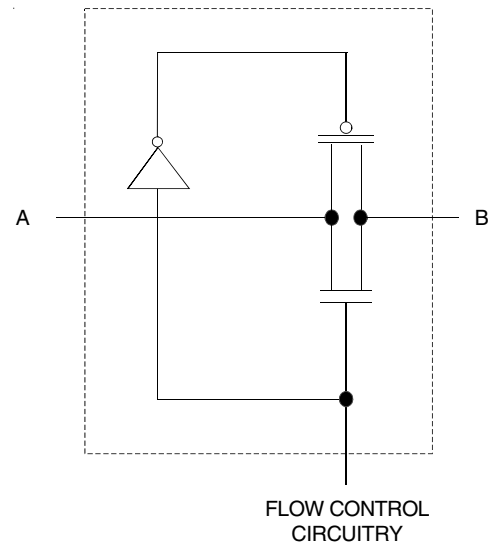
DESCRIPTION:

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 (S_0-S_2) pins.

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

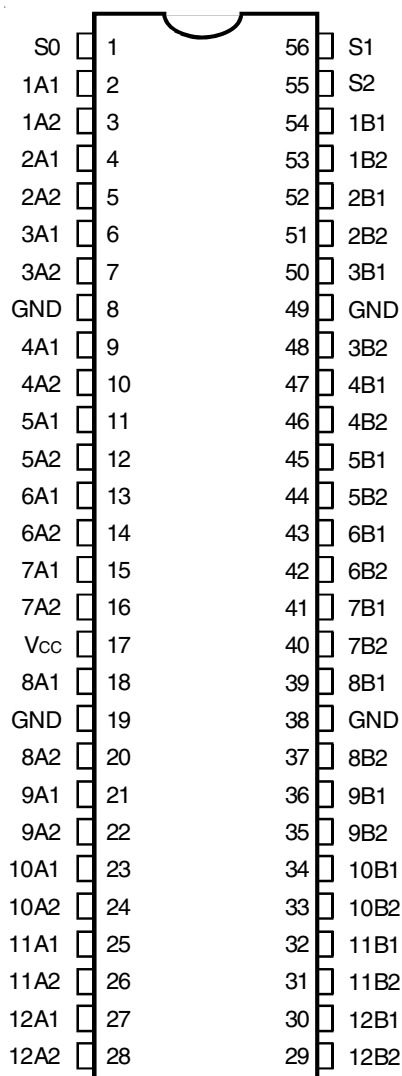## FUNCTIONAL BLOCK DIAGRAM

SIMPLIFIED SCHEMATIC, EACH SWITCH

FLOW CONTROL CIRCUITRY

INDUSTRIAL TEMPERATURE RANGE

JUNE 2019

DSC-5889/9

PIN CONFIGURATION

S0	1	56	S1
1A1	2	55	S2
1A2	3	54	1B1
2A1	4	53	1B2
2A2	5	52	2B1
3A1	6	51	2B2
3A2	7	50	3B1
GND	8	49	GND
4A1	9	48	3B2
4A2	10	47	4B1
5A1	11	46	4B2
5A2	12	45	5B1
6A1	13	44	5B2
6A2	14	43	6B1
7A1	15	42	6B2
7A2	16	41	7B1
Vcc	17	40	7B2
8A1	18	39	8B1
GND	19	38	GND
8A2	20	37	8B2
9A1	21	36	9B1
9A2	22	35	9B2
10A1	23	34	10B1
10A2	24	33	10B2
11A1	25	32	11B1
11A2	26	31	11B2
12A1	27	30	12B1
12A2	28	29	12B2

TOP VIEW

Package Type	Package Code	Order Code
TSSOP	PAG56	PAG

ABSOLUTE MAXIMUM RATINGS[1]

Symbol	Description	Max.	Unit
V_{CC}	Supply Voltage Range	−0.5 to 4.6	V
V_I	Input Voltage Range	−0.5 to 4.6	V
	Continuous Channel Current	128	mA
I_{IK}	Input Clamp Current, $V_{I/O}$ < 0	−50	mA
T_{STG}	Storage Temperature Range	−65 to +150	°C

NOTE:
1. 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 x	Data Select
x A x	Port A Inputs or Outputs
x B x	Port B Inputs or Outputs

FUNCTION TABLE[1]

Inputs			Inputs/Outputs		
S2	S1	S0	A1	A2	Operation
L	L	L	Z	Z	Disconnect
L	L	H	B1	Z	A1 port = B1 port
L	H	L	B2	Z	A1 port = B2 port
L	H	H	Z	B1	A2 port = B1 port
H	L	L	Z	B2	A2 port = B2 port
H	L	H	Z	Z	Disconnect
H	H	L	B1	B2	A1 port = B1 port A2 port = B2 port
H	H	H	B2	B1	A1 port = B2 port A2 port = B1 port

NOTE:
1. H = HIGH Voltage Level
   L = LOW Voltage Level
   Z = High-Impedance

OPERATING CHARACTERISTICS[1]

Symbol	Parameter	Test Conditions	Min.	Max.	Unit
V_{CC}	Supply Voltage		2.3	3.6	V
V_{IH}	High-Level Control Input Voltage	V_{CC} = 2.3V to 2.7V	1.7	—	V
		V_{CC} = 2.7V to 3.6V	2	—	
V_{IL}	Low-Level Control Input Voltage	V_{CC} = 2.3V to 2.7V	—	0.7	V
		V_{CC} = 2.7V to 3.6V	—	0.8	
T_A	Operating Free-Air Temperature		−40	+85	°C

NOTE:
1. All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Operating Condition: T_A = –40°C to +85°C

Symbol	Parameter	Test Conditions		Min.	Typ.[1]	Max.	Unit
V_{IK}	Control Inputs, Data I/O	V_{CC} = 3V, I_I = –18mA		—	—	–1.2	V
I_I	Control Inputs	V_{CC} = 3.6V, V_I = V_{CC} or GND		—	—	±1	µA
I_{OZ}	Data I/O	V_{CC} = 3.6V, V_O = 0V or 3.6V switch disabled		—	—	5	µA
I_{OFF}		V_{CC} = 0V, V_I or V_O = 0V or 3.6V		—	—	10	µA
I_{CC}		V_{CC} = 3.6V, I_O = 0, V_I = V_{CC} or GND		—	—	10	µA
ΔI_{CC}[2]	Control Inputs	V_{CC} = 3.6V, one input at 3V, other inputs at V_{CC} or GND		—	—	300	µA
C_I	Control Inputs	V_I = 3V or 0		—	5	—	pF
$C_{IO(OFF)}$		V_O = 3V or 0 (switch off)		—	13.5	—	pF
R_{ON}[3]	Max. at V_{CC} = 2.3V	V_I = 0	I_O = 64mA	—	5	8	Ω
	Typ. at V_{CC} = 2.5V		I_O = 24mA	—	5	8	
		V_I = 1.7V	I_O = 15mA	—	27	40	
	V_{CC} = 3V	V_I = 0	I_O = 64mA	—	5	7	
			I_O = 24mA	—	5	7	
		V_I = 2.4V	I_O = 15mA	—	10	15	

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_{CC} 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_{CC} = 2.5V ± 0.2V		V_{CC} = 3.3V ± 0.3V		Unit
		Min.	Max.	Min.	Max.	
t_{PD}[1]	Propagation Delay A to B or B to A	—	0.15	—	0.25	ns
t_{PD}	Propagation Delay S to A or B	3	11.1	3	8.8	ns
t_{EN}	Output Enable Time S to A or B	3	10.9	3	8.6	ns
t_{DIS}	Output Disable Time S to A or B	1	8.7	2	8.8	ns

NOTE:

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).
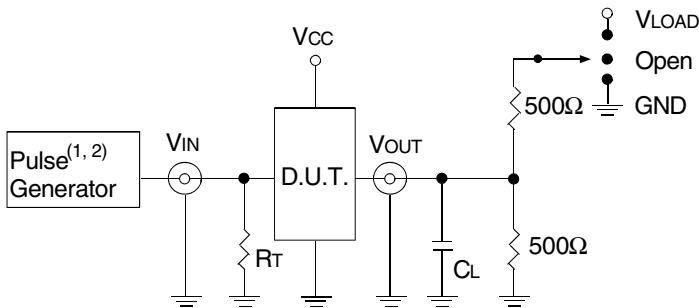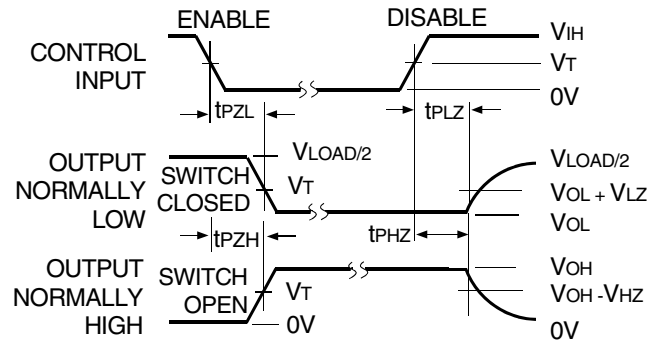
TEST CIRCUITS AND WAVEFORMS

TEST CONDITIONS

Symbol	$V_{CC}^{(1)} = 3.3V \pm 0.3V$	$V_{CC}^{(2)} = 2.5V \pm 0.2V$	Unit
V_{LOAD}	6	$2 \times V_{CC}$	V
V_{IH}	3	V_{CC}	V
V_T	1.5	$V_{CC} / 2$	V
V_{LZ}	300	150	mV
V_{HZ}	300	150	mV
C_L	50	30	pF
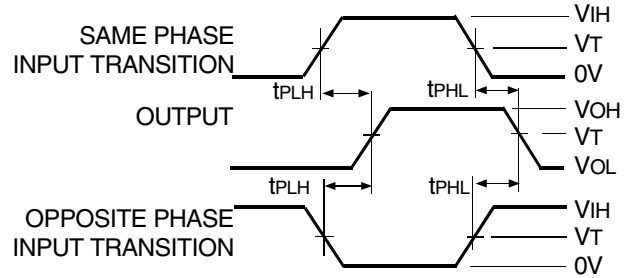
Propagation Delay

Test Circuits for All Outputs

DEFINITIONS:
C_L = Load capacitance: includes jig and probe capacitance.
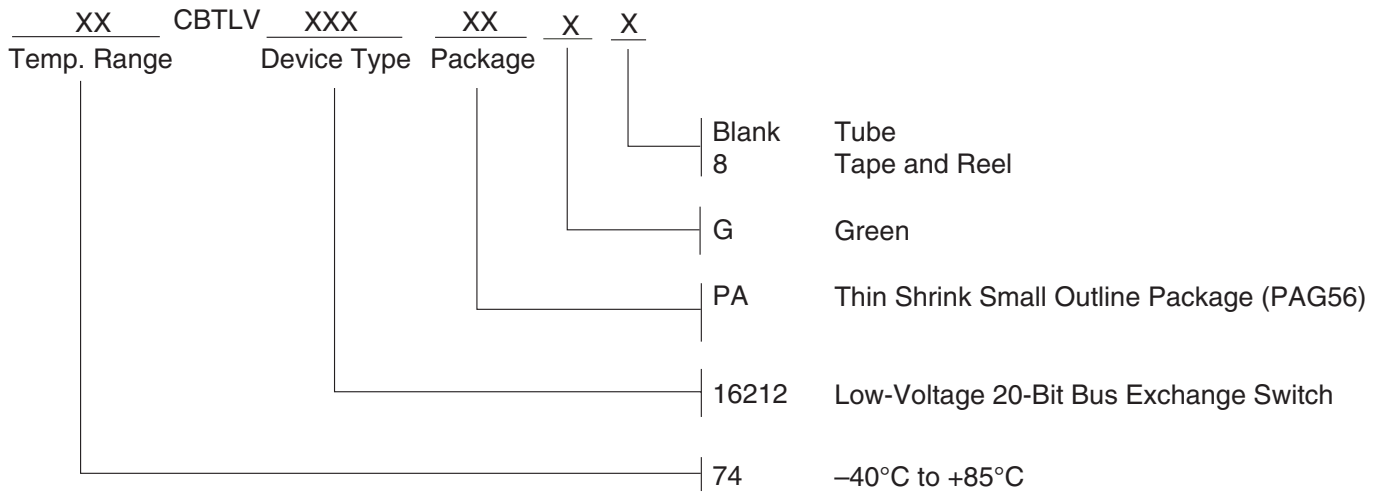R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

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

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

Enable and Disable Times

SWITCH POSITION

Test	Switch
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND
t_{PD}	Open

ORDERING INFORMATION

XX CBTLV XXX XX X X

Temp. Range   Device Type   Package

Blank	Tube
8	Tape and Reel

G	Green

PA	Thin Shrink Small Outline Package (PAG56)

16212	Low-Voltage 20-Bit Bus Exchange Switch

74	–40°C to +85°C

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.

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