SN74CBTS16212 24-BIT FET BUS-EXCHANGE SWITCH WITH SCHOTTKY DIODE CLAMPING

SCDS036E - DECEMBER 1997 - REVISED NOVEMBER 2001

 Member of the Texas Instruments Widebus[™] Family 	DGG, DGV, OR DL PACK/ (TOP VIEW)	AGE
 5-Ω Switch Connection Between Two Ports 		
TTL-Compatible Input Levels	1A1 2 55 S2	
 Latch-Up Performance Exceeds 250 mA Per 	1A2 3 54 1B	
JESD 17	2A1 4 53 1B	
 ESD Protection Exceeds JESD 22 	2A1 4 55 112 2A2 5 52 2B	
 2000-V Human-Body Model (A114-A) 	3A1 6 51 2B	
– 200-V Machine Model (A115-A)	3A2 7 50 3B	
	GND 8 49 GN	
description	4A1 0 9 48 3B	
	4A2 [10 47] 4B	
The SN74CBTS16212 provides 24 bits of	5A1 🛛 11 46 🗍 4B2	2
high-speed TTL-compatible bus switching or	5A2 🛛 12 45 🗍 5B	1
exchanging with Schottky diodes on the I/Os to clamp undershoot. The low on-state resistance of	6A1 🛛 13 44 🗍 5B:	2
the switch allows connections to be made with	6A2 🛛 14 43 🗋 6B [.]	
minimal propagation delay.	7A1 🛛 15 42 🖸 6B:	
	7A2 1 6 41 7 8	
The device operates as a 24-bit bus switch or as	V _{CC} 17 40 7B	
a 12-bit bus exchanger that provides data	8A1 0 18 39 8B	
exchanging between the four signal ports via the	GND [] 19 38 [] GN	
data-select (S0–S2) terminals.	8A2 20 37 8B	
	9A1 21 36 9B	
	9A2 22 35 9B	
	11A1 2 5 32 1 1E	31

ORDERING INFORMATION

TA	PACK	AGE [†]	ORDERABLE PART NUMBER	TOP-SIDE MARKING
SSOP – DL		Tube	SN74CBTS16212DL	CBTS16212
40°C to 95°C	330F - DL	Tape and reel	SN74CBTS16212DLR	CB1310212
–40°C to 85°C	TSSOP – DGG	Tape and reel	SN74CBTS16212DGGR	CBTS16212
	TVSOP – DGV Tape and reel		SN74CBTS16212DGVR	CYS212

[†]Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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31 🛛 11B2

30 12B1

12B2

29

11A2 26 12A1 🛛 27

12A2 🛛 28

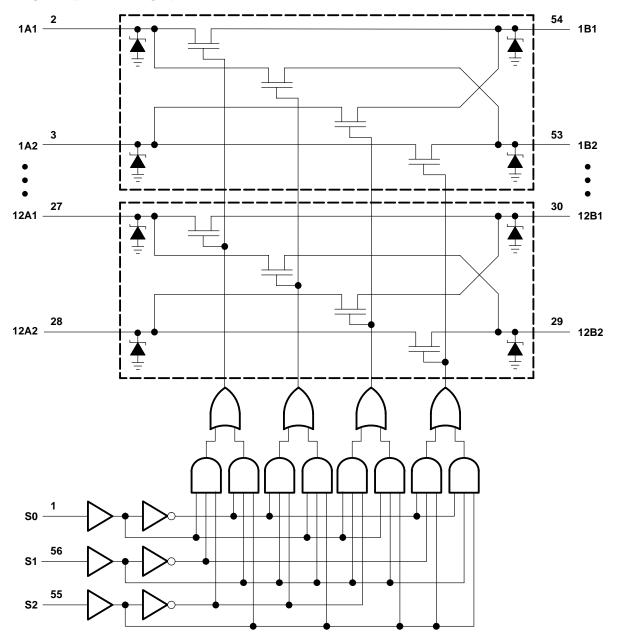
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	FUNCTION TABLE												
	INPUTS		INPUTS/	OUTPUTS	FUNCTION								
S2	S1	S0	A1	A2	FUNCTION								
L	L	L	Z	Z	Disconnect								
L	L	н	B1	Z	A1 port = B1 port								
L	Н	L	B2	Z	A1 port = B2 port								
L	Н	Н	Z	B1	A2 port = B1 port								
н	L	L	Z	B2	A2 port = B2 port								
н	L	Н	Z	Z	Disconnect								
н	Н	L	B1	B2	A1 port = B1 port A2 port = B2 port								
н	Н	Н	B2	B1	A1 port = B2 port A2 port = B1 port								



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logic diagram (positive logic)





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

Supply voltage range, V _{CC}		
Input voltage range, V _I (see Note 1)		
Continuous channel current		
Input clamp current, I_{IK} (V _I < 0)		–50 mA
Package thermal impedance, θ_{JA} (see Note 2)	: DGG package	64°C/W
	DGV package	48°C/W
	DL package	56°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 51-7.

recommended operating conditions (see Note 3)

	MIN	MAX	UNIT
Supply voltage	4	5.5	V
High-level control input voltage	2		V
Low-level control input voltage		0.8	V
Operating free-air temperature	-40	85	°C
	High-level control input voltage Low-level control input voltage	Supply voltage 4 High-level control input voltage 2 Low-level control input voltage 4	Supply voltage45.5High-level control input voltage22Low-level control input voltage0.8

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.

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

PAR	AMETER		TEST CONDITION	ONS	MIN	TYP‡	MAX	UNIT
VIK		V _{CC} = 4.5 V,	lj = -18 mA				-1.2	V
1.	۱ _{IL}	V _{CC} = 5.5 V,	V _I = GND				-1	μA
η η <u>ε</u> η _Η		V _{CC} = 5.5 V,	V _I = 5.5 V				150	μΑ
ICC		V _{CC} = 5.5 V,	I _O = 0,	$V_I = V_{CC}$ or GND			3	μA
∆ICC§	Control inputs	V _{CC} = 5.5 V,	One input at 3.4 V,	Other inputs at V_{CC} or GND			2.5	mA
Ci	Control inputs	VI = 3 V or 0				2.5		pF
C _{io(OFF)}		$V_{O} = 3 V \text{ or } 0,$	S0, S1, and S2 = GN	ND		10.5		pF
		$V_{CC} = 4 V,$	V _I = 2.4 V,	lj = 15 mA			20	
			N/L 0	lj = 64 mA		4	7	Ω
r _{on} ¶		$V_{CC} = 4.5 V$	V _I = 0	lj = 30 mA		4	7	52
			V _I = 2.4 V,	lj = 15 mA		6	12	

[‡] All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^{\circ}\text{C}$.

 \S 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 lower of the voltages of the two (A or B) terminals.

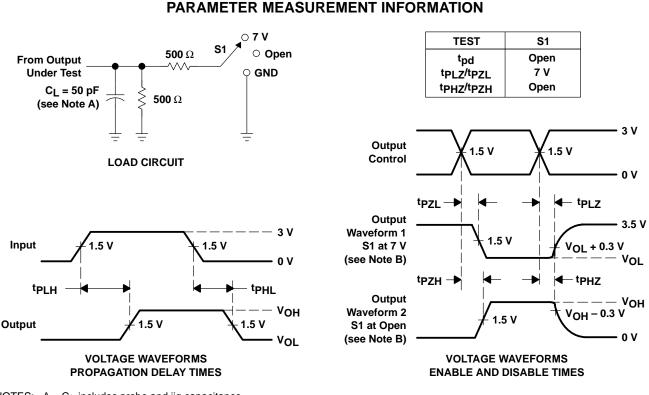


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switching characteristics over recommended operating free-air temperature range, CL = 50 pF (unless otherwise noted) (see Figure 1)

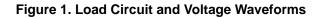
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4 V	= V _{CC} ± 0.5	UNIT	
		(001101)	MIN MAX	MIN	MAX	
t _{pd} †	A or B	B or A	0.35		0.25	ns
^t pd	S	A or B	10	1.5	9.1	ns
t _{en}	S	A or B	10.4	1.5	9.7	ns
^t dis	S	A or B	9.2	1.5	8.8	ns

[†] 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).



NOTES: A. CL 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 MHz, Z_Q = 50 Ω , t_f \leq 2.5 ns, t_f \leq 2.5 ns.
- D. The outputs are measured one at a time with one transition per measurement.
- E. tpLz and tpHz are the same as tdis.
- F. t_{PZL} and t_{PZH} are the same as t_{en}.
- G. tpLH and tpHL are the same as tpd.





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PACKAGING INFORMATION

RUMENTS

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
74CBTS16212DGGRE4	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74CBTS16212DGGRG4	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTS16212DGGR	ACTIVE	TSSOP	DGG	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTS16212DL	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBTS16212DLG4	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

⁽¹⁾ 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.

⁽²⁾ 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)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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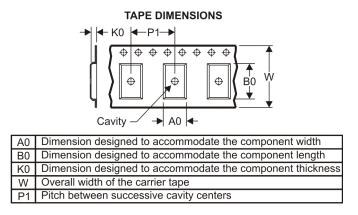
PACKAGE MATERIALS INFORMATION

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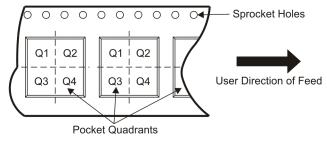
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TAPE AND REEL INFORMATION





QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal										
Device	 Package Drawing	SPQ	Reel Diameter	Reel Width	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadran

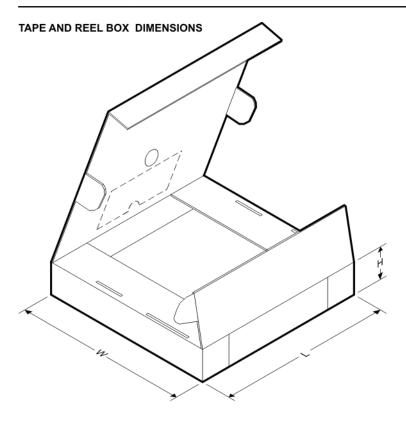
	Туре	Drawing			Diameter (mm)	Width W1 (mm)	(mm)	(mm)	(mm)	(mm)	(mm)	Quadrant
SN74CBTS16212DGGR	TSSOP	DGG	56	2000	330.0	24.4	8.6	15.6	1.8	12.0	24.0	Q1

TEXAS INSTRUMENTS

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PACKAGE MATERIALS INFORMATION

29-Jul-2009



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)	
SN74CBTS16212DGGR	TSSOP	DGG	56	2000	346.0	346.0	41.0	

MECHANICAL DATA

MSSO001C - JANUARY 1995 - REVISED DECEMBER 2001

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN

DL (R-PDSO-G**)



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



MECHANICAL DATA

MTSS003D - JANUARY 1995 - REVISED JANUARY 1998

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



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