

SN74LVC16952

16-BIT REGISTERED TRANSCEIVER WITH 3-STATE OUTPUTS

SCAS320A - NOVEMBER 1993 - REVISED JULY 1995

- Member of the Texas Instruments *Widebus™* Family
- EPIC™ (Enhanced-Performance Implanted CMOS) Submicron Process
- Typical V_{OLP} (Output Ground Bounce) $< 0.8\text{ V}$ at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$
- Typical V_{OHV} (Output V_{OH} Undershoot) $> 2\text{ V}$ at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Supports Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V V_{CC})
- Package Options Include Plastic 300-mil Shrink Small-Outline (DL) and Thin Shrink Small-Outline (DGG) Packages

description

This 16-bit registered transceiver is designed for low-voltage (3.3-V) V_{CC} operation; it can interface to a 5-V system environment.

The SN74LVC16952 contains two sets of D-type flip-flops for temporary storage of data flowing in either direction. It can be used as two 8-bit transceivers or one 16-bit transceiver. Data on the A or B bus is stored in the registers on the low-to-high transition of the clock (CLKAB or CLKBA) input provided that the clock-enable ($\overline{\text{CEAB}}$ or $\overline{\text{CEBA}}$) input is low. Taking the output-enable ($\overline{\text{OEAB}}$ or $\overline{\text{OEBA}}$) input low accesses the data on either port.

To ensure the high-impedance state during power up or power down, $\overline{\text{OE}}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

The SN74LVC16952 is characterized for operation from -40°C to 85°C .

DGG OR DL PACKAGE
(TOP VIEW)

$\overline{1\text{OEAB}}$	1	56	$1\overline{\text{OEBA}}$
1CLKAB	2	55	1CLKBA
$\overline{1\text{CEAB}}$	3	54	$1\overline{\text{CEBA}}$
GND	4	53	GND
1A1	5	52	1B1
1A2	6	51	1B2
V_{CC}	7	50	V_{CC}
1A3	8	49	1B3
1A4	9	48	1B4
1A5	10	47	1B5
GND	11	46	GND
1A6	12	45	1B6
1A7	13	44	1B7
1A8	14	43	1B8
2A1	15	42	2B1
2A2	16	41	2B2
2A3	17	40	2B3
GND	18	39	GND
2A4	19	38	2B4
2A5	20	37	2B5
2A6	21	36	2B6
V_{CC}	22	35	V_{CC}
2A7	23	34	2B7
2A8	24	33	2B8
GND	25	32	GND
$\overline{2\text{CEAB}}$	26	31	$2\overline{\text{CEBA}}$
2CLKAB	27	30	2CLKBA
$\overline{2\text{OEAB}}$	28	29	$2\overline{\text{OEBA}}$

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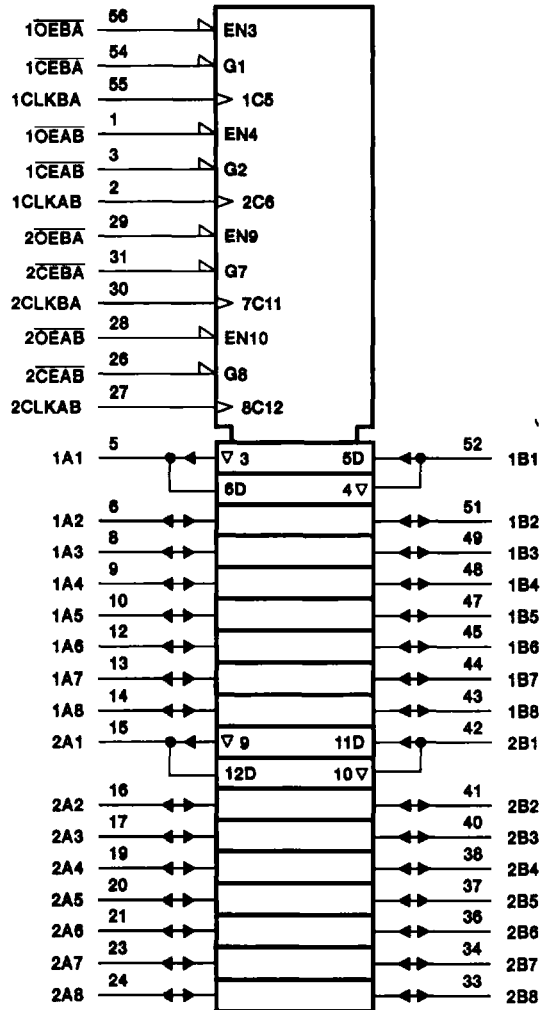
FUNCTION TABLE†

INPUTS				OUTPUT
CLKENAB	CLKAB	OEAB	A	B
H	X	L	X	B ₀ ‡
X	L	L	X	B ₀ ‡
L	↑	L	L	L
L	↑	L	H	H
X	X	H	X	Z

† A-to-B data flow is shown; B-to-A data flow is similar but uses CLKENBA, CLKBA, and OEBA.

‡ Level of B before the indicated steady-state input conditions were established

logic symbol



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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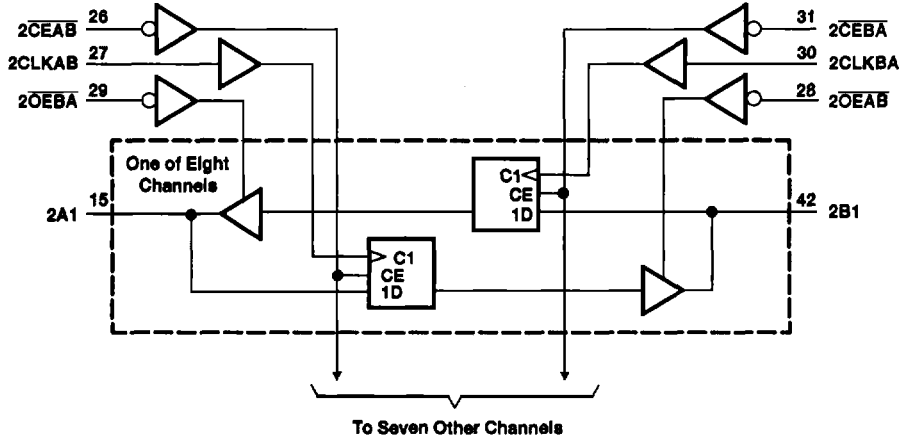
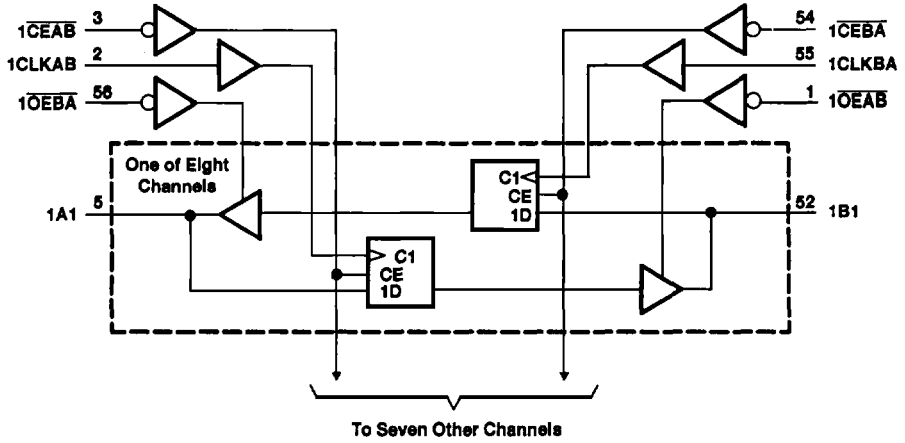


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logic diagram (positive logic)



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

Supply voltage range, V_{CC}	-0.5 V to 6.5 V
Input voltage range, V_I	-0.5 V to 6.5 V
Voltage range applied to any output in the high-impedance state or power-off state, V_O (see Note 1)	-0.5 V to 6.5 V
Voltage range applied to any output in the high or low state, V_O (see Notes 1 and 2)	-0.5 V to $V_{CC} + 0.5$ V
Output voltage range, V_O (see Notes 1 and 2)	-0.5 V to $V_{CC} + 0.5$ V
Input clamp current, I_{IK} ($V_I < 0$)	-50 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$)	±50 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC})	±50 mA
Continuous current through V_{CC} or GND	±100 mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 3): DGG package	1 W
DL package	1.4 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. This value is limited to 4.6 V maximum.
 3. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils. For more information, refer to the *Package Thermal Considerations* application note in the 1994 *ABT Advanced BICMOS Technology Data Book*, literature number SCBD002B.

recommended operating conditions (see Note 4)

		MIN	MAX	UNIT	
V _{CC}	Supply voltage	Operating	2	3.6	V
		Data retention only	1.5		
V _{IH}	High-level input voltage	V _{CC} = 2.7 V to 3.6 V		2	V
V _{IL}	Low-level input voltage	V _{CC} = 2.7 V to 3.6 V		0.8	V
V _I	Input voltage	0	5.5		V
V _O	Output voltage	0	V _{CC}		V
I _{OH}	High-level output current	V _{CC} = 2.7 V		-12	mA
		V _{CC} = 3 V		-24	
I _{OL}	Low-level output current	V _{CC} = 2.7 V		12	mA
		V _{CC} = 3 V		24	
Δt/Δv	Input transition rise or fall rate	0	10		ns/V
T _A	Operating free-air temperature	-40	85		°C

NOTE 4: Unused control inputs must be held high or low to prevent them from floating.

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

PARAMETER		TEST CONDITIONS	V _{CC} †	MIN	TYP‡	MAX	UNIT
V _{OH}		I _{OH} = -100 µA	MIN to MAX	V _{CC} -0.2			V
		I _{OH} = -12 mA	2.7 V	2.2			
		I _{OH} = -24 mA	3 V	2.4			
V _{OL}		I _{OL} = 100 µA	MIN to MAX			0.2	V
		I _{OL} = 12 mA	2.7 V			0.4	
		I _{OL} = 24 mA	3 V			0.55	
I _I		V _I = 5.5 V or GND	3.6 V			±5	µA
I _I (hold)	A or B ports	V _I = 0.8 V	3 V	75			µA
		V _I = 2 V		-75			
I _{OZ} §		V _O = 5.5 V or GND	3.6 V			±10	µA
I _{CC}		V _I = V _{CC} or GND, I _O = 0	3.6 V			40	µA
ΔI _{CC}		One input at V _{CC} - 0.6 V, Other inputs at V _{CC} or GND	2.7 V to 3.6 V			500	µA
C _i	Control inputs	V _I = V _{CC} or GND	3.3 V				pF
C _{io}	A or B ports	V _O = V _{CC} or GND	3.3 V				pF

† For conditions shown as MIN or MAX, use the appropriate values under recommended operating conditions.

‡ All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

§ For I/O ports, the parameter I_{OZ} includes the input leakage current.

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