

## 20-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

SCAS197B – JUNE 1990 – REVISED NOVEMBER 1996

- **Members of the Texas Instruments Widebus™ Family**
- **Inputs Are TTL-Voltage Compatible**
- **3-State Outputs Drive Bus Lines Directly**
- **Flow-Through Architecture Optimizes PCB Layout**
- **Distributed V<sub>CC</sub> and GND Pin Configuration Minimizes High-Speed Switching Noise**
- **EPIC™ (Enhanced-Performance Implanted CMOS) 1-μm Process**
- **500-mA Typical Latch-Up Immunity at 125°C**
- **Package Options Include Shrink Plastic Small-Outline 300-mil (DL) Packages Using 25-mil Center-to-Center Pin Spacings and 380-mil Fine-Pitch Ceramic Flat (WD) Packages Using 25-mil Center-to-Center Pin Spacings**

54ACT16861 ... WD PACKAGE  
74ACT16861 ... DL PACKAGE  
(TOP VIEW)

1OEAB	1	56	1OEBA
1B1	2	55	1A1
1B2	3	54	1A2
GND	4	53	GND
1B3	5	52	1A3
1B4	6	51	1A4
V <sub>CC</sub>	7	50	V <sub>CC</sub>
1B5	8	49	1A5
1B6	9	48	1A6
1B7	10	47	1A7
GND	11	46	GND
1B8	12	45	1A8
1B9	13	44	1A9
1B10	14	43	1A10
2B1	15	42	2A1
2B2	16	41	2A2
2B3	17	40	2A3
GND	18	39	GND
2B4	19	38	2A4
2B5	20	37	2A5
2B6	21	36	2A6
V <sub>CC</sub>	22	35	V <sub>CC</sub>
2B7	23	34	2A7
2B8	24	33	2A8
GND	25	32	GND
2B9	26	31	2A9
2B10	27	30	2A10
2OEAB	28	29	2OEBA

### description

The 'ACT16861 are noninverting 20-bit transceivers designed for asynchronous communication between data buses. The control-function implementation minimizes external timing requirements.

The 'ACT16861 can be used as two 10-bit transceivers or one 20-bit transceiver. They allow data transmission from the A bus to the B bus or from the B bus to the A bus, depending upon the logic level at the output-enable (OEAB or OEBA) inputs. The output-enable inputs can be used to disable the device so that the buses are effectively isolated.

The 74ACT16861 is packaged in TI's shrink small-outline package, which provides twice the I/O pin count and functionality of standard small-outline packages in the same printed-circuit-board area.

The 54ACT16861 is characterized for operation over the full military temperature range of –55°C to 125°C. The 74ACT16861 is characterized for operation from –40°C to 85°C.

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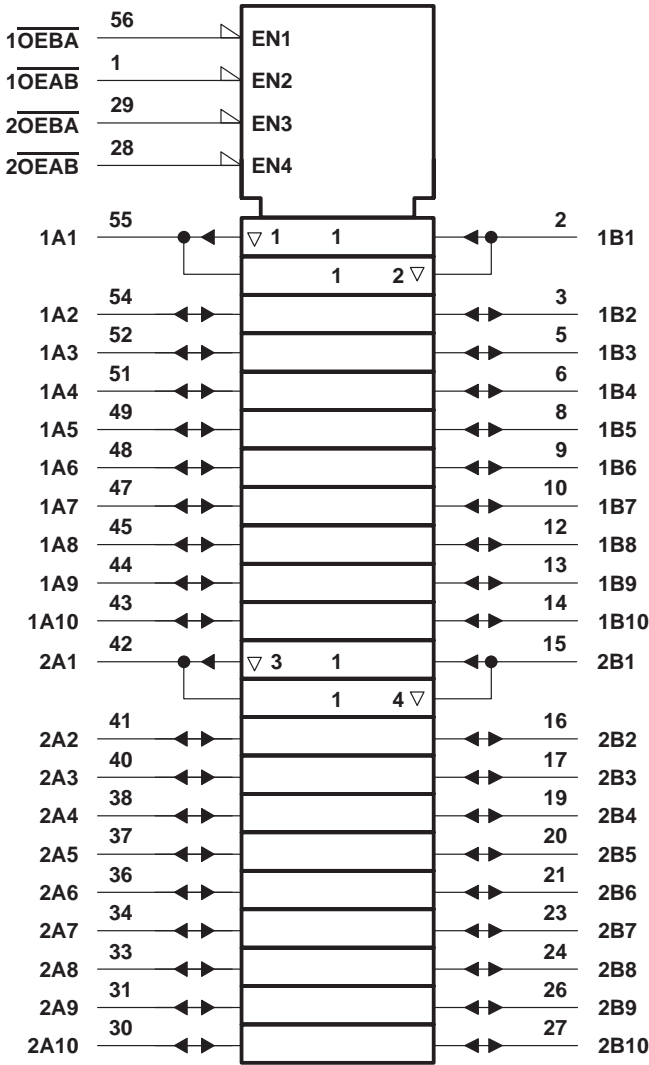
54ACT16861, 74ACT16861  
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FUNCTION TABLE  
(each 10-bit section)

INPUTS		OPERATION
OEAB	OEBA	
L	L	Latch A and B (A = B)
L	H	A to B
H	L	B to A
H	H	Isolation

logic symbol†

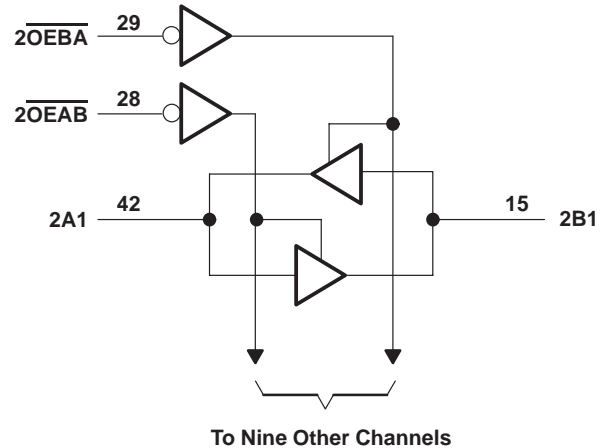
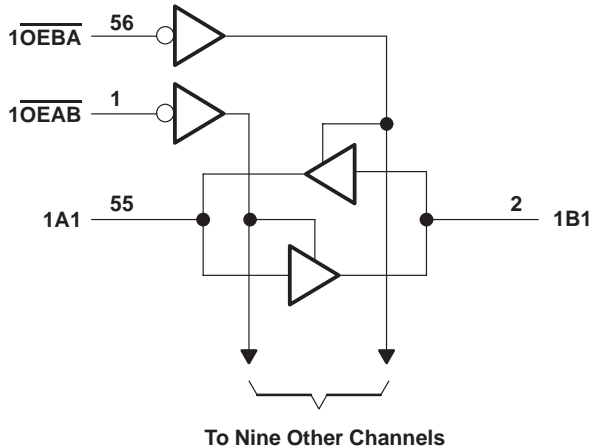


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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## logic diagram (positive logic)



## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

Supply voltage range, $V_{CC}$	–0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1)	–0.5 V to $V_{CC} + 0.5$ V
Output voltage range, $V_O$ (see Note 1)	–0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ )	±20 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	±500 mA
Maximum power package dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 2): DL package	1.4 W
Storage temperature range, $T_{stg}$	–65°C to 150°C

<sup>†</sup> 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 voltage ratings may be exceeded if the input and output current ratings are observed.  
2. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils.

## recommended operating conditions (see Note 3)

		54ACT16861			74ACT16861			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
$V_{IH}$	High-level input voltage	2			2			V
$V_{IL}$	Low-level input voltage			0.8			0.8	V
$V_I$	Input voltage	0		$V_{CC}$	0		$V_{CC}$	V
$V_O$	Output voltage	0		$V_{CC}$	0		$V_{CC}$	V
$I_{OH}$	High-level output current			–24			–24	mA
$I_{OL}$	Low-level output current			24			24	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	0		10	0		10	ns/V
$T_A$	Operating free-air temperature	–55		125	–40		85	°C

NOTE 3: Unused 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 <sub>CC</sub>	T <sub>A</sub> = 25°C			54ACT16861		74ACT16861		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = -50 µA		4.5 V	4.4			4.4		4.4		V
			5.5 V	5.4			5.4		5.4		
	I <sub>OH</sub> = -24 mA		4.5 V	3.94			3.8		3.8		
			5.5 V	4.94			4.8		4.8		
	I <sub>OH</sub> = -75 mA†		5.5 V				3.85		3.85		
V <sub>OL</sub>	I <sub>OL</sub> = 50 µA		4.5 V			0.1		0.1		0.1	V
			5.5 V			0.1		0.1		0.1	
	I <sub>OL</sub> = 24 mA		4.5 V			0.36		0.44		0.44	
			5.5 V			0.36		0.44		0.44	
	I <sub>OL</sub> = 75 mA†		5.5 V					1.65		1.65	
I <sub>I</sub>	Control inputs	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5 V			±0.1		±1		±1	µA
I <sub>OZ</sub> ‡	A or B ports	V <sub>O</sub> = V <sub>CC</sub> or GND	5.5 V			±0.5		±5		±5	µA
I <sub>CC</sub>		V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V			8		80		80	µA
ΔI <sub>CC</sub> §		One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND	5.5 V			0.9		1		1	mA
C <sub>i</sub>	Control inputs	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V			4.5					pF
C <sub>io</sub>	A or B ports	V <sub>O</sub> = V <sub>CC</sub> or GND	5 V			17					pF

† Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

‡ For I/O ports, the parameter I<sub>OZ</sub> includes the input leakage current.

§ This is the increase in supply current for each input that is at one of the specified TTL voltage levels rather than 0 V or V<sub>CC</sub>.

**switching characteristics over recommended operating free-air temperature range,  
V<sub>CC</sub> = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T <sub>A</sub> = 25°C			54ACT16861		74ACT16861		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	B or A	3.1	6.5	9.2	3.1	10.4	3.1	10.4	ns
t <sub>PHL</sub>			2.9	7.5	10	2.9	11.1	2.9	11.1	
t <sub>PZH</sub>	OEBA or OEAB	A or B	2.4	6.6	9	2.4	10	2.4	10	ns
t <sub>PZL</sub>			3.7	8.5	11.5	3.7	12.7	3.7	12.7	
t <sub>PHZ</sub>	OEBA or OEAB	A or B	4.9	7.4	9.8	4.9	10.7	4.9	10.7	ns
t <sub>PLZ</sub>			4.5	6.9	9.3	4.5	10	4.5	10	

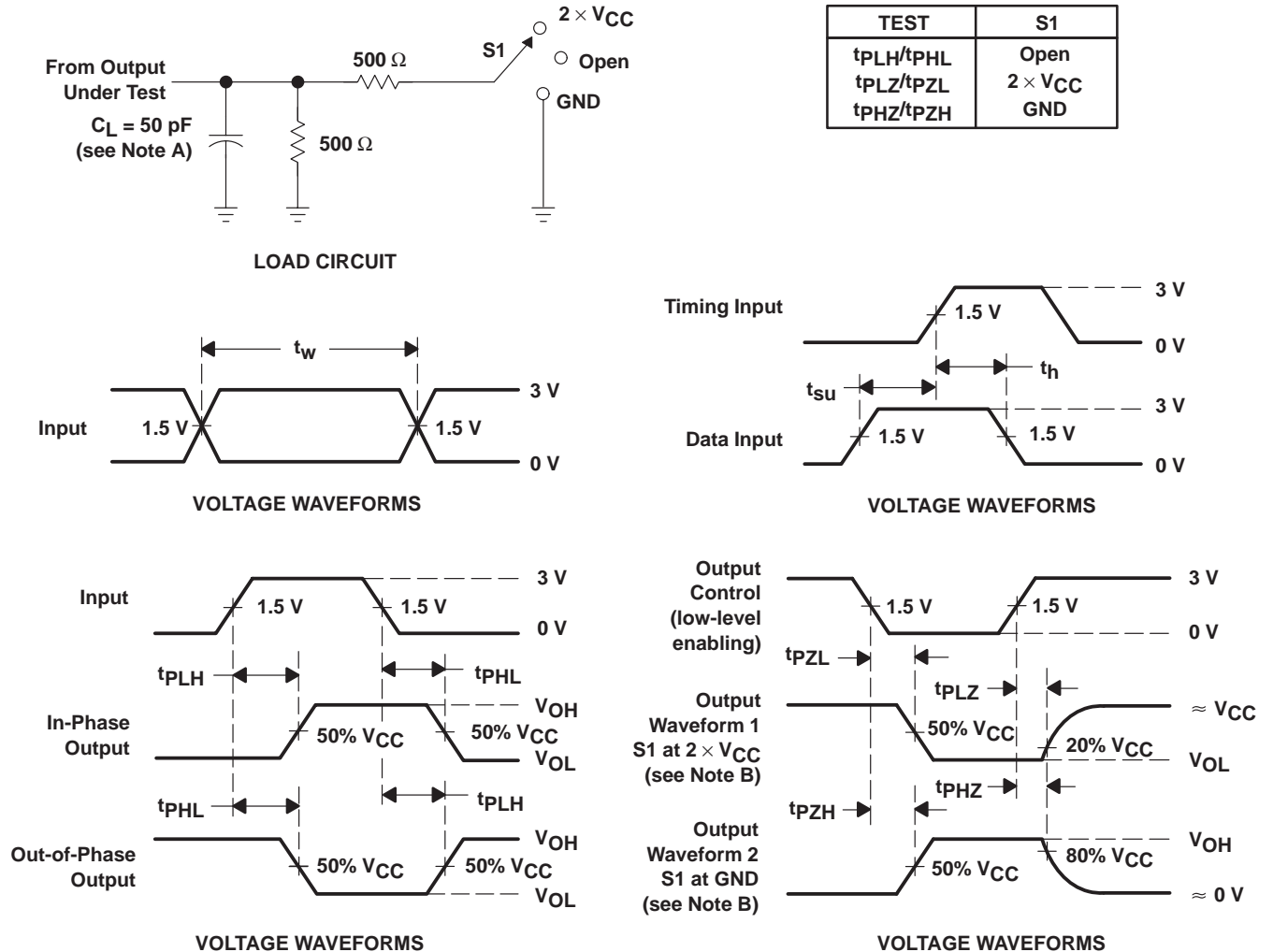
**operating characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C**

PARAMETER		TEST CONDITIONS		TYP	UNIT
C <sub>pd</sub>	Power dissipation capacitance per transceiver	Outputs enabled	C <sub>L</sub> = 50 pF, f = 1 MHz	64	pF
		Outputs disabled		14	

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## PARAMETER MEASUREMENT INFORMATION



- NOTES:
- $C_L$  includes probe and jig capacitance.
  - 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.
  - All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r = 3 \text{ ns}$ ,  $t_f = 3 \text{ ns}$ .
  - The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

## PACKAGING INFORMATION

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
74ACT16861DL	ACTIVE	SSOP	DL	56	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ACT16861DLR	ACTIVE	SSOP	DL	56	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> 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.

**OBSELETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) 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.

**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)

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

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