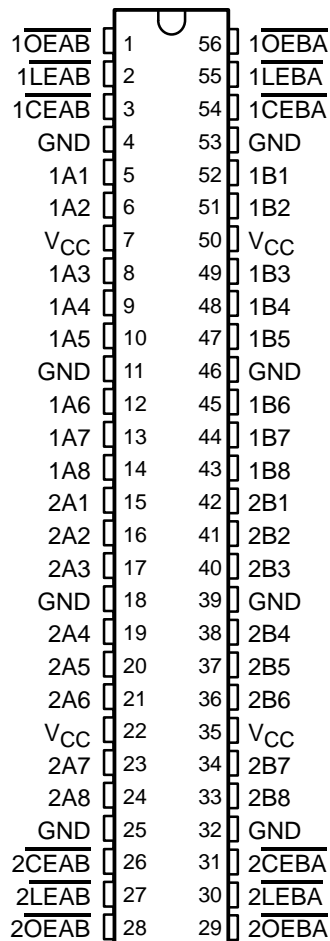


54ACT16544, 74ACT16544 16-BIT REGISTERED TRANSCEIVERS WITH 3-STATE OUTPUTS

SCAS161A – AUGUST 1990 – REVISED APRIL 1996

- Members of the Texas Instruments *Widebus*™ Family
- Inputs Are TTL-Voltage Compatible
- 3-State Inverted Outputs
- Flow-Through Architecture Optimizes PCB Layout
- Distributed V_{CC} 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 Plastic 300-mil Shrink Small-Outline (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

54ACT16544 ... WD PACKAGE
74ACT16544 ... DL PACKAGE
(TOP VIEW)



description

The 'ACT16544 are 16-bit registered transceivers that contain two sets of D-type latches for temporary storage of data flowing in either direction. They can be used as two 8-bit transceivers or one 16-bit transceiver. Separate latch-enable ($\overline{\text{LEAB}}$ or $\overline{\text{LEBA}}$) and output-enable ($\overline{\text{OEAB}}$ or $\overline{\text{OEBA}}$) inputs are provided for each register to permit independent control in either direction of data flow.

The A-to-B enable ($\overline{\text{CEAB}}$) input must be low to enter data from A or to output data to B. Having $\overline{\text{CEAB}}$ low and $\overline{\text{LEAB}}$ low makes the A-to-B latches transparent; a subsequent low-to-high transition at $\overline{\text{LEAB}}$ puts the A latches in the storage mode. Data flow from B to A is similar, but requires using the $\overline{\text{CEBA}}$, $\overline{\text{LEBA}}$, and $\overline{\text{OEBA}}$ inputs.

The 74ACT16544 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 54ACT16544 is characterized for operation over the full military temperature range of -55°C to 125°C. The 74ACT16544 is characterized for operation from -40°C to 85°C.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

EPIC and Widebus are trademarks of Texas Instruments Incorporated.

UNLESS OTHERWISE NOTED this document contains PRODUCTION DATA information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1996, Texas Instruments Incorporated

54ACT16544, 74ACT16544

16-BIT REGISTERED TRANSCEIVERS

WITH 3-STATE OUTPUTS

SCAS161A – AUGUST 1990 – REVISED APRIL 1996

FUNCTION TABLE†

INPUTS				OUTPUT B
$\overline{\text{CEAB}}$	$\overline{\text{LEAB}}$	$\overline{\text{OEAB}}$	A	
H	X	X	X	Z
L	X	H	X	Z
L	H	L	X	B_0^\ddagger
L	L	L	L	H
L	L	L	H	L

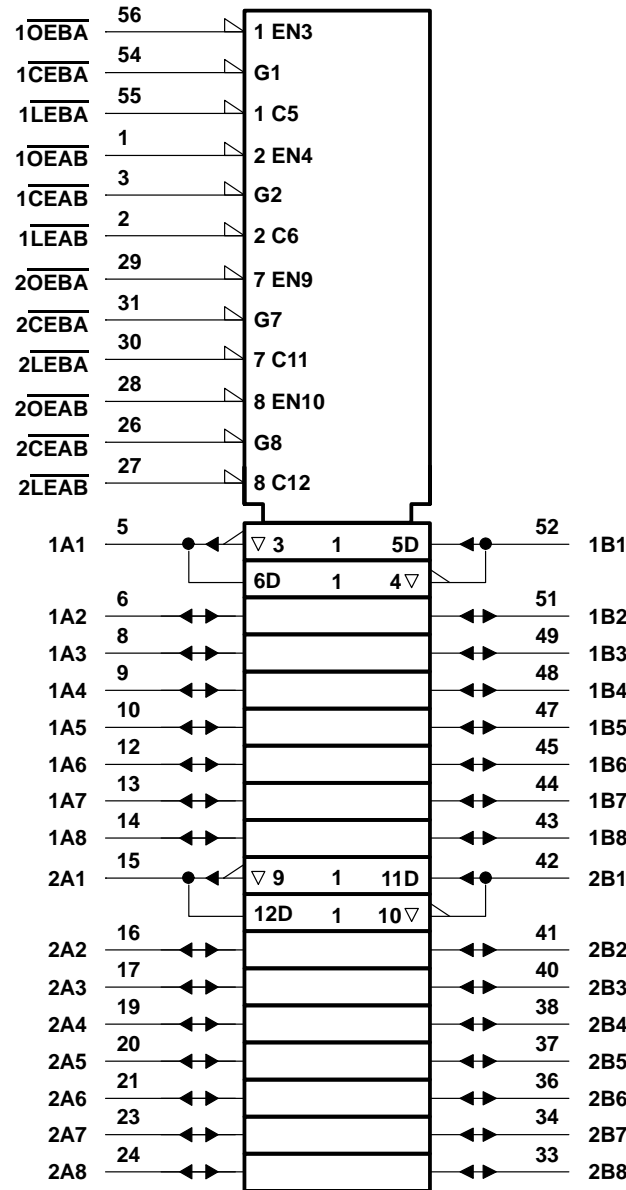
† A-to-B data flow is shown; B-to-A flow control is the same except that it uses CEBA, LEBA, and OEBA.

‡ Output level before the indicated steady-state input conditions were established

54ACT16544, 74ACT16544
16-BIT REGISTERED TRANSCEIVERS
WITH 3-STATE OUTPUTS

SCAS161A – AUGUST 1990 – REVISED APRIL 1996

logic symbol†



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

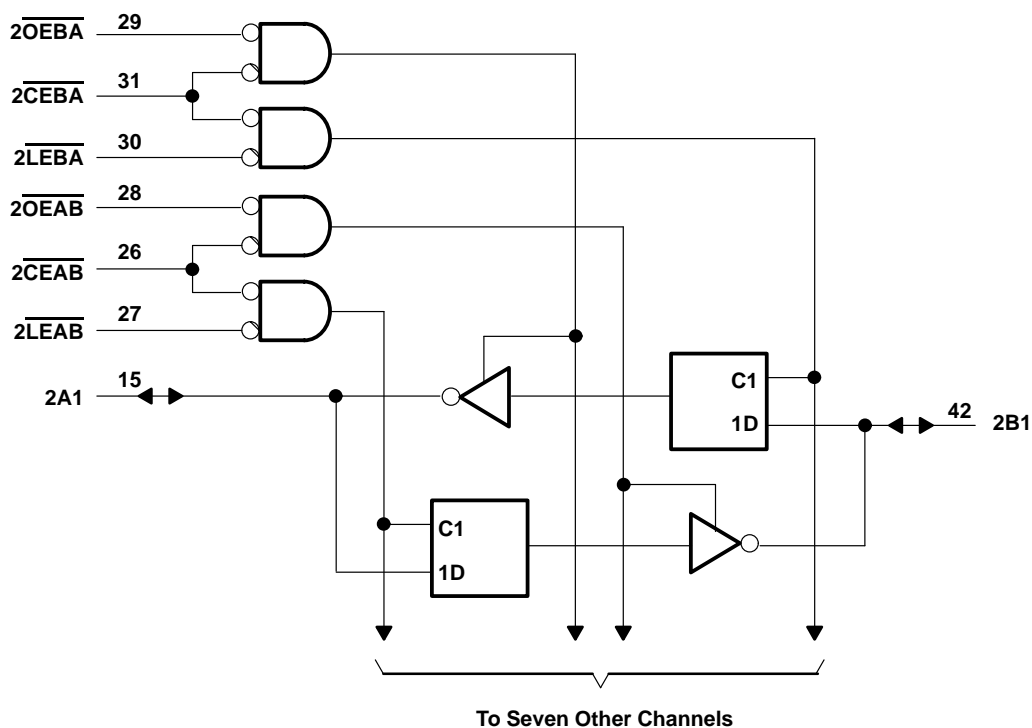
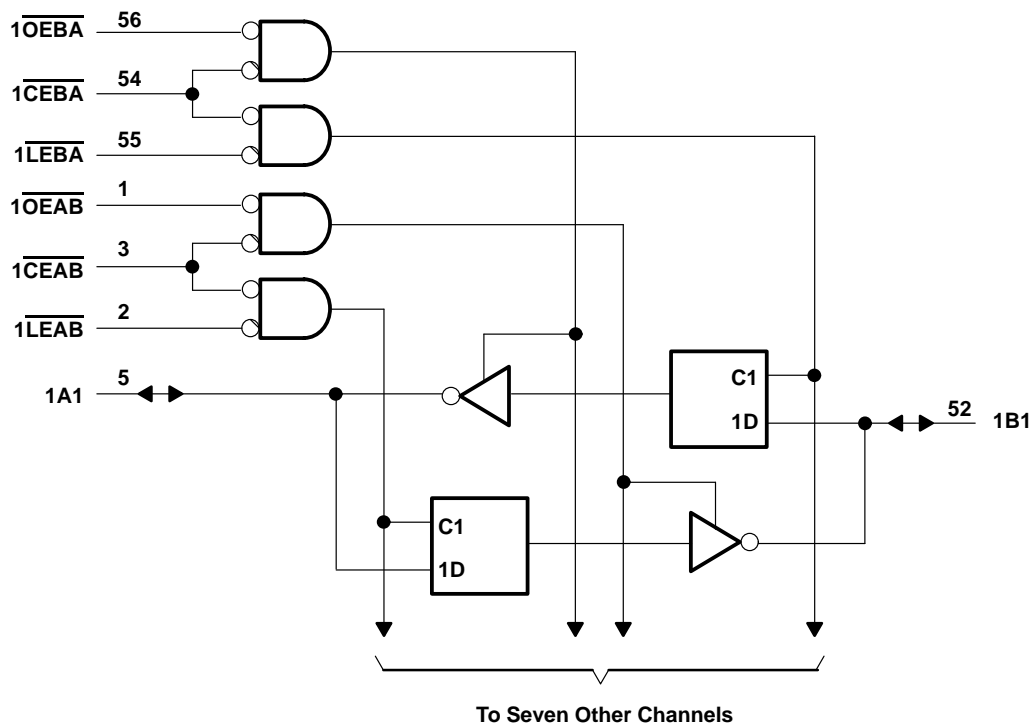
54ACT16544, 74ACT16544

16-BIT REGISTERED TRANSCEIVERS

WITH 3-STATE OUTPUTS

SCAS161A – AUGUST 1990 – REVISED APRIL 1996

logic diagram (positive logic)



54ACT16544, 74ACT16544
16-BIT REGISTERED TRANSCEIVERS
WITH 3-STATE OUTPUTS

SCAS161A – AUGUST 1990 – REVISED APRIL 1996

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

Supply voltage range, V_{CC}	–0.5 to 7 V
Input voltage range, V_I (see Note 1)	–0.5 to $V_{CC} + 0.5$ V
Input voltage range, V_O (see Note 1)	–0.5 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	±400 mA
Maximum power package dissipation at $T_A = 55^\circ\text{C}$ (see Note 2): 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 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)

	54ACT16544			74ACT16544			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.

54ACT16544, 74ACT16544

16-BIT REGISTERED TRANSCEIVERS

WITH 3-STATE OUTPUTS

SCAS161A – AUGUST 1990 – REVISED APRIL 1996

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

PARAMETER		TEST CONDITIONS	V _{CC}	T _A = 25°C			54ACT16544		74ACT16544		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}		I _{OH} = -50 µA	4.5 V	4.4			4.4		4.4		V
			5.5 V	5.4			5.4		5.4		
	I _{OH} = -24 mA		4.5 V	3.94			3.8		3.8		
			5.5 V	4.94			4.8		4.8		
			5.5 V				3.85		3.85		
V _{OL}		I _{OL} = 50 µA	4.5 V			0.1		0.1		0.1	V
			5.5 V			0.1		0.1		0.1	
	I _{OL} = 24 mA		4.5 V			0.36		0.44		0.44	
			5.5 V			0.36		0.44		0.44	
		I _{OL} = 75 mA†	5.5 V					1.65		1.65	
I _I	Control inputs	V _I = V _{CC} or GND	5.5 V			±0.1		±1		±1	µA
I _{OZ} ‡	A or B ports	V _O = V _{CC} or GND	5.5 V			±0.5		±5		±5	µA
I _{CC}		V _I = V _{CC} or GND, I _O = 0	5.5 V			8		80		80	µA
ΔI _{CC} §		One input at 3.4 V, Other inputs at V _{CC} or GND	5.5 V			0.9		1		1	mA
C _i	Control inputs	V _I = V _{CC} or GND	5 V			4.5					pF
C _{io}	A or B ports	V _O = V _{CC} or GND	5 V			12					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_{OZ} 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_{CC}.

timing requirements over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

			T _A = 25°C		54ACT16544		74ACT16544		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t _w	Pulse duration	$\overline{\text{LEAB}}$ or $\overline{\text{LEBA}}$ low	5.5		5.5		5.5		ns
t _{su}	Setup time	Data before $\overline{\text{LEAB}}$ or $\overline{\text{LEBA}}\uparrow$	1.5		1.5		1.5		ns
		Data before $\overline{\text{CEAB}}$ or $\overline{\text{CEBA}}\uparrow$	1.5		1.5		1.5		
t _h	Hold time	Data after $\overline{\text{LEAB}}$ or $\overline{\text{LEBA}}\uparrow$	3		3		3		ns
		Data after $\overline{\text{CEAB}}$ or $\overline{\text{CEBA}}\uparrow$	3		3		3		

54ACT16544, 74ACT16544
16-BIT REGISTERED TRANSCEIVERS
WITH 3-STATE OUTPUTS

SCAS161A – AUGUST 1990 – REVISED APRIL 1996

switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			54ACT16544		74ACT16544		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	B or A	2.8	6.7	10	2.8	11.2	2.8	11.2	ns
t_{PHL}			4	7.5	10	4	11.2	4	11.2	
t_{PLH}	\overline{LEBA} or \overline{LEAB}	A or B	2.7	9	13.3	2.7	14	2.7	14	ns
t_{PHL}			2.8	8.5	12.1	2.8	13.5	2.8	13.5	
t_{PZH}	\overline{CEBA} or \overline{CEAB}	A or B	3.2	7.2	10.5	3.2	11.7	3.2	11.7	ns
t_{PZL}			3.8	8.2	12	3.8	13.6	3.8	13.6	
t_{PHZ}	\overline{CEBA} or \overline{CEAB}	A or B	5.8	8.2	10.3	5.8	11.1	5.8	11.1	ns
t_{PLZ}			5	7.4	9.4	5	10.2	5	10.2	
t_{PZH}	\overline{OEBA} or \overline{OEAB}	A or B	2.8	6.9	10.2	2.8	11.4	2.8	11.4	ns
t_{PZL}			3.6	7.9	11.7	3.6	13.3	3.6	13.3	
t_{PHZ}	\overline{OEBA} or \overline{OEAB}	A or B	5.2	7.7	9.8	5.2	10.5	5.2	10.5	ns
t_{PLZ}			3.4	6.8	8.8	3.4	9.6	3.4	9.6	

operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		TYP	UNIT
C_{pd}	Power dissipation capacitance per transceiver	Outputs enabled	$C_L = 50\text{ pF}$, $f = 1\text{ MHz}$	60	pF
		Outputs disabled		13	

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.

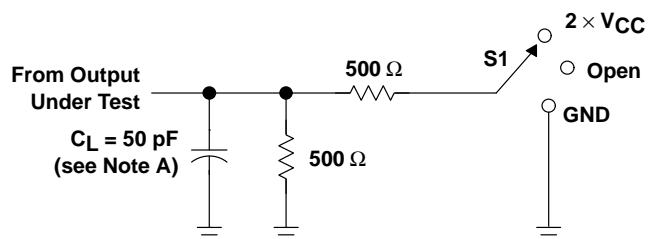


POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

54ACT16544, 74ACT16544 16-BIT REGISTERED TRANSCEIVERS WITH 3-STATE OUTPUTS

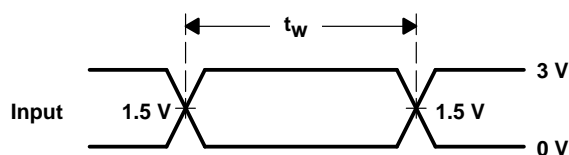
SCAS161A – AUGUST 1990 – REVISED APRIL 1996

PARAMETER MEASUREMENT INFORMATION

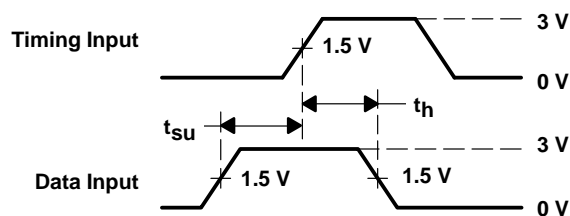


LOAD CIRCUIT

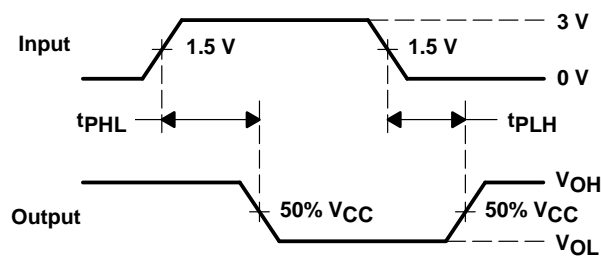
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	$2 \times V_{CC}$
t_{PHZ}/t_{PZH}	GND



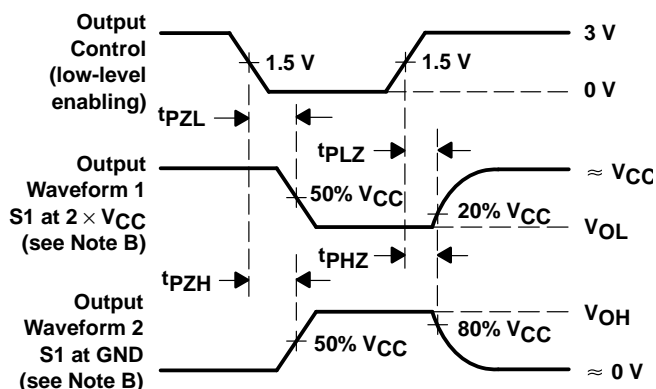
VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS

NOTES: A. C_L 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: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r = 3 \text{ ns}$, $t_f = 3 \text{ ns}$.

D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

IMPORTANT NOTICE

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

TI warrants performance of its semiconductor products and related software to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Certain applications using semiconductor products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications").

TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.

Inclusion of TI products in such applications is understood to be fully at the risk of the customer. Use of TI products in such applications requires the written approval of an appropriate TI officer. Questions concerning potential risk applications should be directed to TI through a local SC sales office.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards should be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TI warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used.