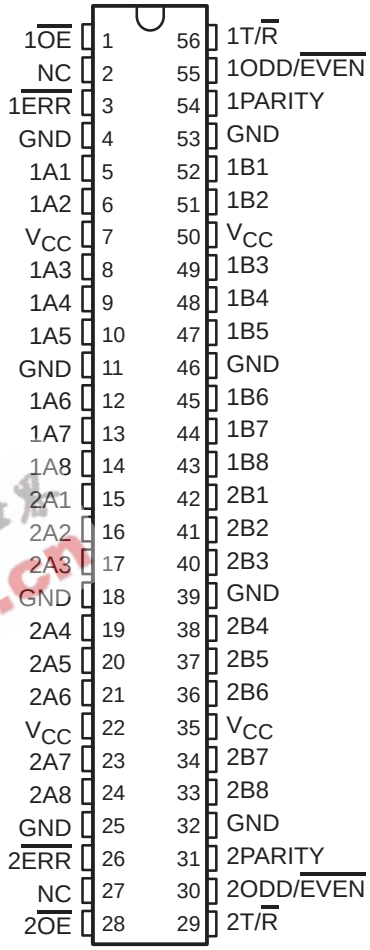
54ACT16657, 74ACT16657
16-BIT TRANSCEIVERS
WITH PARITY GENERATORS/CHECKERS AND 3-STATE OUTPUTS

SCAS164A – JANUARY 1991 – REVISED APRIL 1996

- **Members of the Texas Instruments *Widebus*™ Family**
- **Inputs Are TTL-Voltage Compatible**
- **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**

54ACT16657 . . . WD PACKAGE
74ACT16657 . . . DL PACKAGE
(TOP VIEW)



NC – No internal connection

description

The ’ACT16657 contain two noninverting octal transceiver sections with separate parity generator/checker circuits and control signals. For either section, the transmit/receive (1T/$\overline{R}$ or 2T/$\overline{R}$) input determines the direction of data flow. When 1T/$\overline{R}$ (or 2T/$\overline{R}$) is high, data flows from the 1A (or 2A) port to the 1B (or 2B) port (transmit mode); when 1T/$\overline{R}$ (or 2T/$\overline{R}$) is low, data flows from the 1B (or 2B) port to the 1A (or 2A) port (receive mode). When the output-enable (1$\overline{OE}$ or 2$\overline{OE}$) input is high, both the 1A (or 2A) and 1B (or 2B) ports are in the high-impedance state.

Odd or even parity is selected by a logic high or low level, respectively, on the 1ODD/$\overline{EVEN}$ (or 2ODD/$\overline{EVEN}$) input. 1PARITY (or 2PARITY) carries the parity bit value; it is an output from the parity generator/checker in the transmit mode and an input to the parity generator/checker in the receive mode.

In the transmit mode, after the 1A (or 2A) bus is polled to determine the number of high bits, 1PARITY (or 2PARITY) is set to the logic level that maintains the parity sense selected by the level at the 1ODD/$\overline{EVEN}$ (or 2ODD/$\overline{EVEN}$) input. For example, if 1ODD/$\overline{EVEN}$ is low (even parity selected) and there are five high bits on the 1A bus, then 1PARITY is set to the logic high level so that an even number of the nine total bits (eight 1A-bus bits plus parity bit) are high.

TEXAS INSTRUMENTS
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

description (continued)

In the receive mode, after the 1B (or 2B) bus is polled to determine the number of high bits, the 1$\overline{ERR}$ (or 2$\overline{ERR}$) output logic level indicates whether or not the data to be received exhibits the correct parity sense. For example, if 1ODD/$\overline{EVEN}$ is high (odd parity selected), 1PARITY is high, and there are three high bits on the 1B bus, then 1$\overline{ERR}$ is low, indicating a parity error.

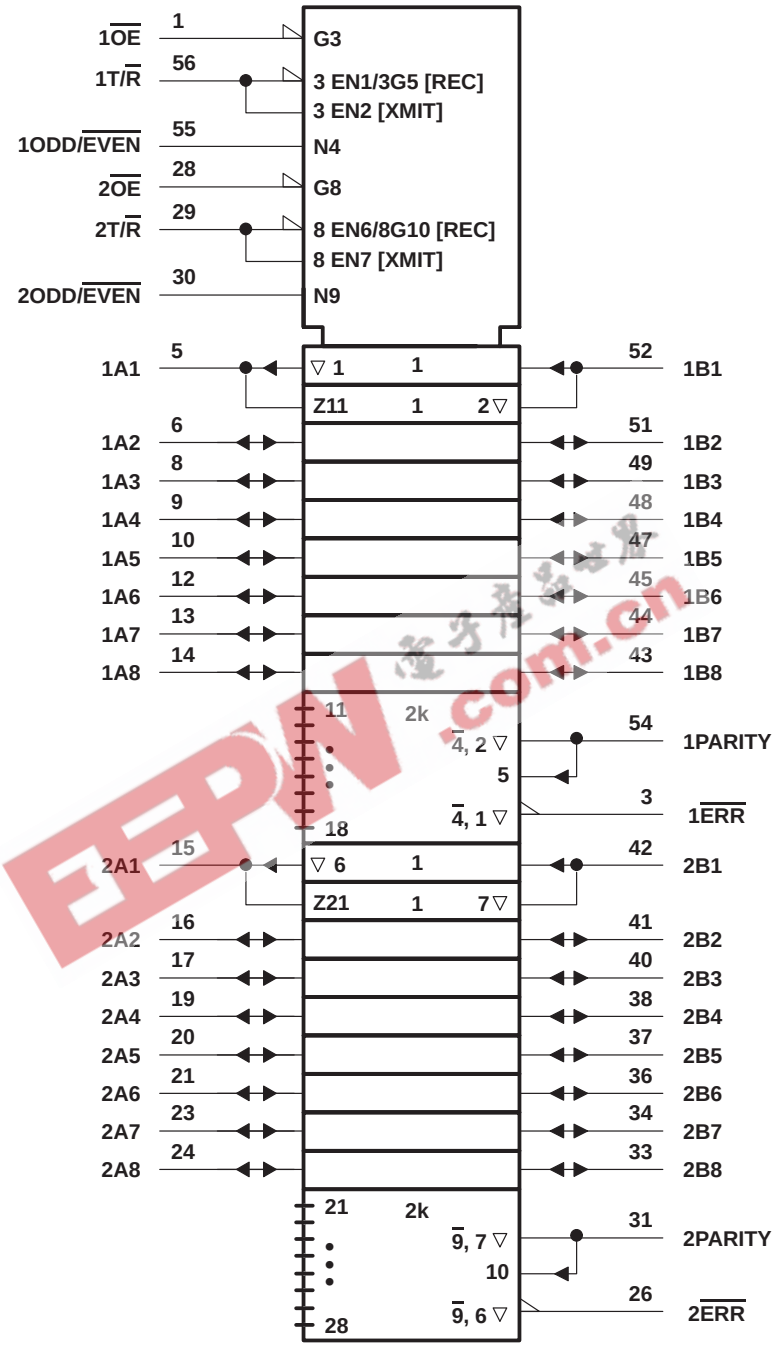
The 74ACT16657 is packaged in TI's shrink small-outline package, which provides twice the I/O pin count and functionality of standard small-outline packages in the same printed-circuit-board area.

The 54ACT16657 is characterized for operation over the full military temperature range of –55°C to 125°C. The 74ACT16657 is characterized for operation from –40°C to 85°C.

FUNCTION TABLE

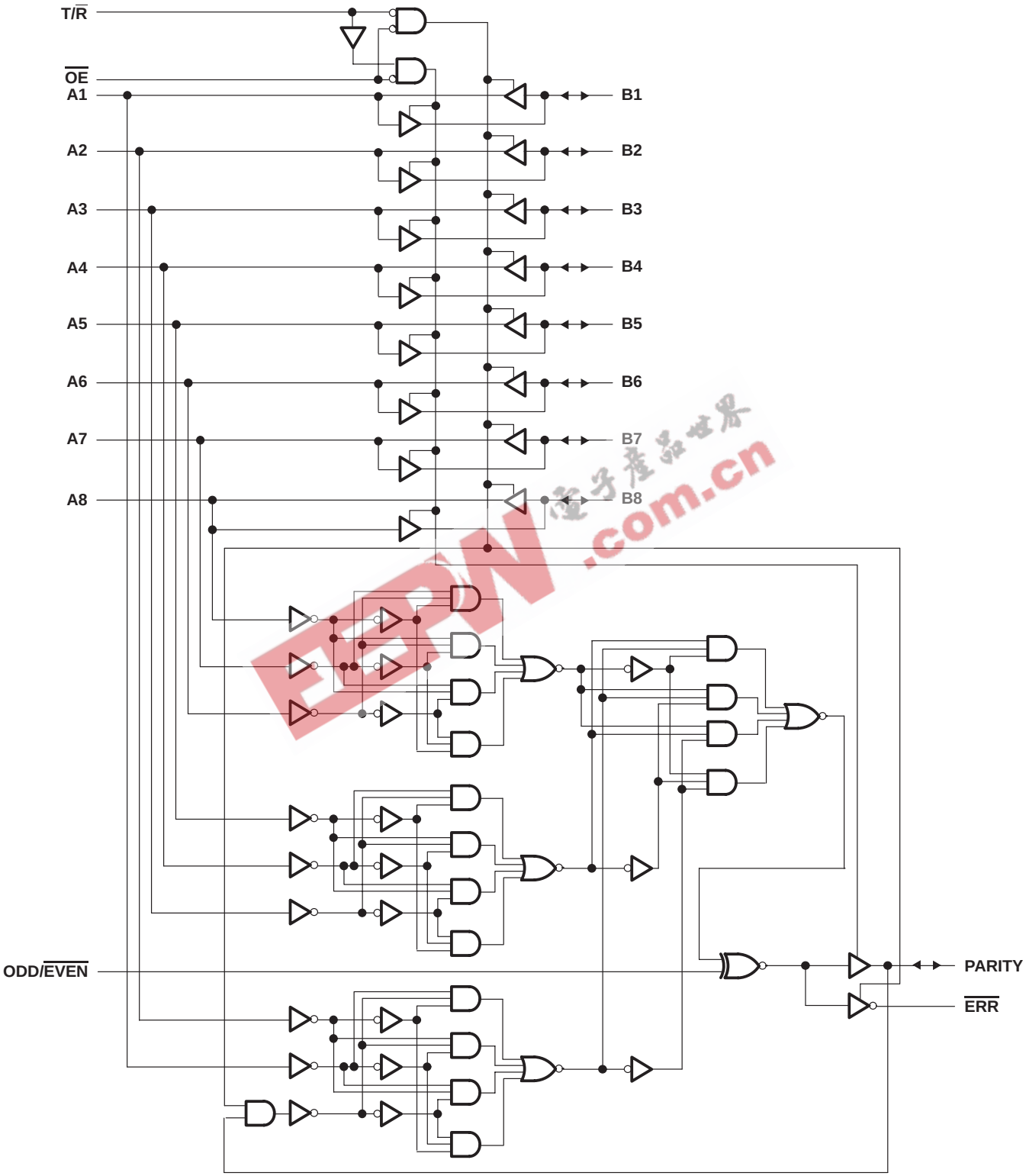
NUMBER OF A OR B INPUTS THAT ARE HIGH	INPUTS			INPUT/OUTPUT PARITY	OUTPUTS	
	$\overline{OE}$	T/$\overline{R}$	ODD/$\overline{EVEN}$		$\overline{ERR}$	OUTPUT MODE
0, 2, 4, 6, 8	L	H	H	H	Z	Transmit
	L	H	L	L	Z	Transmit
	L	L	H	H	H	Receive
	L	L	H	L	L	Receive
	L	L	L	H	L	Receive
	L	L	L	L	H	Receive
1, 3, 5, 7	L	H	H	L	Z	Transmit
	L	H	L	H	Z	Transmit
	L	L	H	H	L	Receive
	L	L	H	L	H	Receive
	L	L	L	H	H	Receive
	L	L	L	L	L	Receive
Don't care	H	X	X	Z	Z	Z

logic symbol†



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

logic diagram, each transceiver (positive logic)



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

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 package power dissipation at T_A = 55°C (in still air) (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)

		54ACT16657			74ACT16657			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.

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

PARAMETER		TEST CONDITIONS	V_{CC}	T_A = 25°C			54ACT16657		74ACT16657		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		
		I_{OH} = –75 mA†	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	A or B ports	$V_I = V_{CC}$ or GND	5.5 V			±0.1		±1		±1	µA
I_{OZ}‡	Control inputs	$V_O = V_{CC}$ 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_o	$\overline{ERR}$	$V_O = V_{CC}$ or GND	5 V		11						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}.

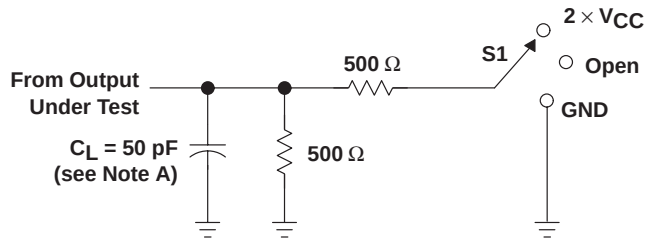
switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			54ACT16657		74ACT16657		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	B or A	4.1	7.3	9.6	4.1	10.7	4.1	10.7	ns
t_{PHL}			3.2	6.8	9.8	3.2	10.6	3.2	10.6	
t_{PLH}	A	PARITY	4	8.6	12.9	4	14.3	4	14.3	ns
t_{PHL}			4.3	9	13.1	4.3	14.3	4.3	14.3	
t_{PLH}	ODD/$\overline{EVEN}$	PARITY, $\overline{ERR}$	3.7	8.3	12.3	3.7	13.7	3.7	13.7	ns
t_{PHL}			4.1	8.8	12.8	4.1	14.1	4.1	14.1	
t_{PLH}	B	$\overline{ERR}$	3.9	8.6	13	3.9	14.6	3.9	14.6	ns
t_{PHL}			4.3	9	13.3	4.3	14.7	4.3	14.7	
t_{PLH}	PARITY	$\overline{ERR}$	3.8	8.4	12.2	3.8	13.8	3.8	13.8	ns
t_{PHL}			4.1	8	12.8	4.1	14.2	4.1	14.2	
t_{PZH}	$\overline{OE}$	A, B, PARITY, or $\overline{ERR}$	2.6	6.1	10.1	2.6	11.3	2.6	11.3	ns
t_{PZL}			3.2	7.2	11.7	3.2	13	3.2	13	
t_{PHZ}	$\overline{OE}$	A, B, PARITY, or $\overline{ERR}$	5.9	8.6	10.5	5.9	11.2	5.9	11.2	ns
t_{PLZ}			5.3	8	9.8	5.3	10.5	5.3	10.5	

operating characteristics, V_{CC} = 5 V, T_A = 25°C

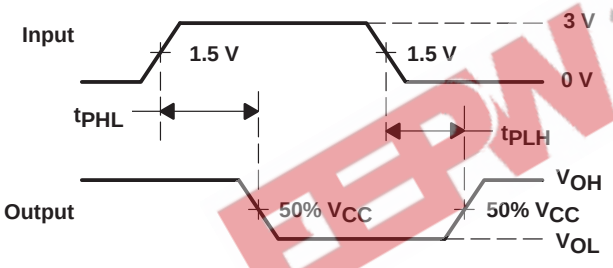
PARAMETER			TEST CONDITIONS		TYP	UNIT
C_{pd}	Power dissipation capacitance per transceiver	Outputs enabled	C_L = 50 pF,	f = 1 MHz	76	pF
		Outputs disabled			35	

PARAMETER MEASUREMENT INFORMATION

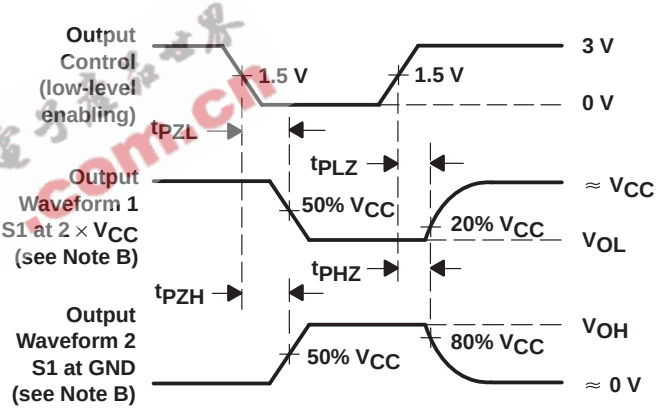


LOAD CIRCUIT

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



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 ≤ 1 MHz, Z_O = 50 Ω, t_r = 3 ns, t_f = 3 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 and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products 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, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

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

TI assumes no liability for applications assistance or customer product design. TI does not 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. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.