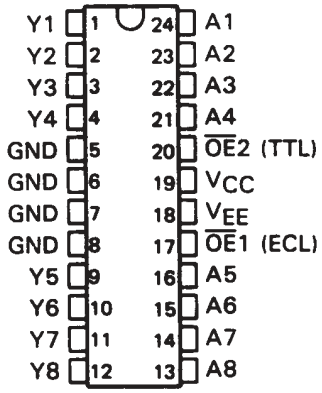
SDZS001A – D3136, AUGUST 1988 – REVISED DECEMBER 1988

- **10KH Compatible**
- **ECL and TTL Control Inputs**
- **P-N-P Inputs Reduce DC Loading**
- **Flow-Through Architectures Optimizes PCB Layout**
- **Center Pin V_{CC}, V_{EE} and GND Configurations Minimize High-Speed Switching Noise**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015**
- **Package Options Include "Small Outline" Packages and Standard Plastic 300-mil DIPs**

DW OR NT PACKAGE
(TOP VIEW)



description

These octal TTL-to-ECL translators are designed to provide efficient translation between a TTL signal environment and a 10KH ECL signal environment. The designer has a choice of inverting ('5542) or true ('5543) outputs. Two pins, $\overline{OE}1$ and $\overline{OE}2$, are provided for output enable control. These control inputs are negative ANDed together, with $\overline{OE}1$ being ECL compatible and $\overline{OE}2$ being TTL compatible. This offers the choice of controlling the outputs of the device from either a TTL or ECL signal environment. The outputs, when disabled, go to a normal ECL logic low level.

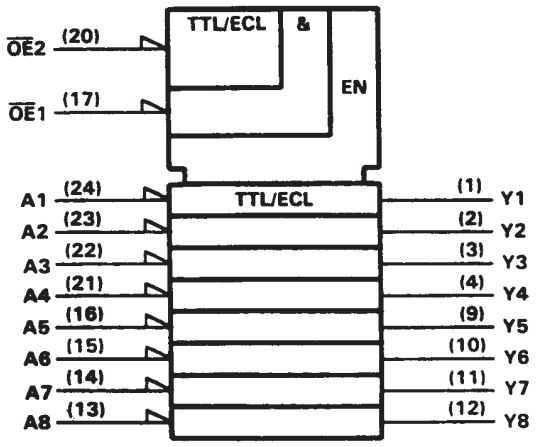
The SN10KHT5542 and SN10KHT5543 are characterized for operation from 0°C to 75°C.

FUNCTION TABLE

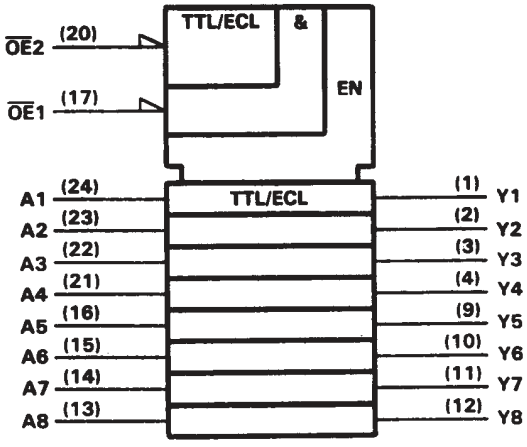
OUTPUT CONTROL		DATA INPUT	OUTPUT	
$\overline{OE}1$	$\overline{OE}2$	A	'5542	'5543
H	X	X	L	L
X	H	X	L	L
L	L	L	H	L
L	L	H	L	H

logic symbols†

SN10KHT5542



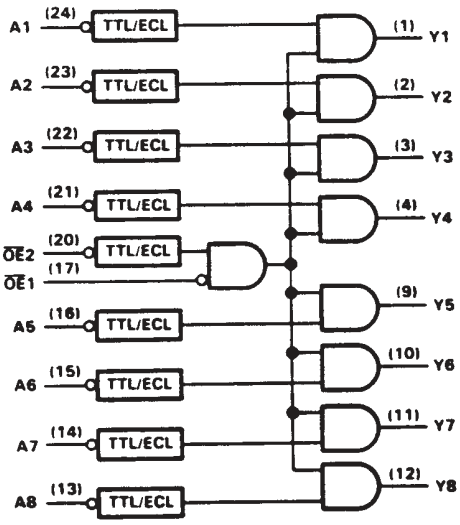
SN10KHT5543



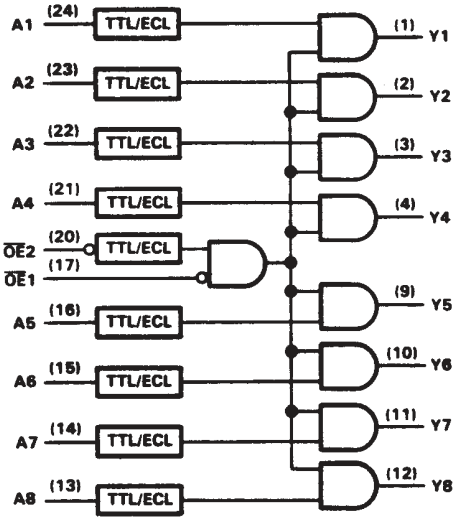
†These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagrams (positive logic)

SN10KHT5542



SN10KHT5543



absolute maximum ratings over operating ambient temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} . . . . . −0.5 V to 7 V
Supply voltage range, V_{EE} . . . . . −8 V to 0 V
Input voltage range (TTL) (See Note 1) . . . . . −1.2 V to 7 V
Input voltage range (ECL) . . . . . V_{EE} to 0 V
Input current range (TTL) . . . . . −30 mA to 5 mA
Operating ambient temperature range . . . . . 0°C to 75°C
Storage temperature range . . . . . −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.

NOTE 1: The input voltage ratings may be exceeded provided the input current ratings are observed.

recommended operating conditions (see Note 2)

			MIN	NOM	MAX	UNIT
V_{CC}	TTL supply voltage		4.5	5.0	5.5	V
V_{EE}	ECL supply voltage		−4.94	−5.2	−5.46	V
V_{IH}	TTL high-level input voltage		2			V
V_{IH}	ECL high-level input voltage‡	0°C	−1170		−840	mV
		25°C	−1130		−810	
		75°C	−1070		−735	
V_{IL}	TTL low-level input voltage				0.8	V
V_{IL}	ECL low-level input voltage‡	0°C	−1950		−1480	mV
		25°C	−1950		−1480	
		75°C	−1950		−1450	
I_{IK}	TTL input clamp current				−18	mA
T_A	Operating ambient temperature (see Note 3)		0		75	°C

‡The algebraic convention, in which the least positive (most negative) value is designated minimum, is used in this data sheet for logic voltage levels and temperature only.

NOTES: 2. If unused, $\overline{OE}1$ should be tied directly to −2 V.

3: Each 10KH series circuit has been designed to meet the dc specifications shown in the electrical characteristics table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board, and transverse air flow greater than 500 linear ft/min is maintained.

electrical characteristics over recommended operating ambient temperature range (unless otherwise noted) (see Note 2)

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IK}	A inputs and $\overline{OE}2$	V_{CC} = 4.5 V, V_{EE} = −4.94 V, I_I = −18 mA				−1.2	V
I_I	A inputs and $\overline{OE}2$	V_{CC} = 5.5 V, V_{EE} = −5.46 V, V_I = 7 V				0.1	mA
I_{IH}	A inputs and $\overline{OE}2$	V_{CC} = 5.5 V, V_{EE} = −5.46 V, V_I = 2.7 V				20	μA
	$\overline{OE}1$ only	V_{CC} = 5.5 V, V_{EE} = −5.46 V, V_I = −840 mV	0°C			350	
		V_{CC} = 5.5 V, V_{EE} = −5.46 V, V_I = −810 mV	25°C			350	
		V_{CC} = 5.5 V, V_{EE} = −5.46 V, V_I = −735 mV	75°C			350	
I_{IL}	A inputs and $\overline{OE}2$	V_{CC} = 5.5 V, V_{EE} = −5.46 V, V_I = 0.5 V				−500	μA
	$\overline{OE}1$ only	V_{CC} = 5.5 V, V_{EE} = −5.46 V, V_I = −1950 mV	0°C	0.5			
			25°C	0.5			
			75°C	0.5			
V_{OH}‡		V_{CC} = 4.5 V, V_{EE} = −5.2 V, ±5%, See Note 3	0°C	−1020		−840	mV
			25°C	−980		−810	
			75°C	−920		−735	
V_{OL}‡		V_{CC} = 4.5 V, V_{EE} = −5.2 V, ±5%, See Note 3	0°C	−1950		−1630	mV
			25°C	−1950		−1630	
			75°C	−1950		−1600	
I_{CCH}		V_{CC} = 5.5 V, V_{EE} = −5.46 V			15	22	mA
I_{CCL}		V_{CC} = 5.5 V, V_{EE} = −5.46 V			17	25	mA
I_{EE}		V_{CC} = 5.5 V, V_{EE} = −5.46 V			−78	−111	mA
C_i		V_{CC} = 5 V, V_{EE} = −5.2 V, f = 10 MHz			5		pF

switching characteristics over recommended ranges of operating ambient temperature and supply voltage (unless otherwise noted) (see Note 4)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	MIN	TYP†	MAX	UNIT
t_{PLH}	Any A	Y	0.1	1.7	3.7	ns
t_{PHL}			0.1	1.6	3.3	
t_{PLH}	$\overline{OE}1$ (ECL)	Y	0.8	2.8	5	ns
t_{PHL}			0.4	2.3	4.5	
t_{PLH}	$\overline{OE}2$ (TTL)	Y	0.8	3	5.3	ns
t_{PHL}			0.6	2.5	4.7	
t_r		Y		1.5		ns
t_f				1.5		

† All typical values are at V_{CC} = 5 V, V_{EE} = −5.2 V, T_A = 25°C.

‡ The algebraic convention, in which the least positive (most negative) value is designated minimum, is used in this data sheet for logic voltage levels and temperature only.

NOTES: 2. Each 10KH series circuit has been designed to meet the dc specifications shown in the electrical characteristics table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 linear ft/min is maintained.

3. Outputs are terminated through a 50-Ω resistor to −2 V.

4. Load circuit and switching waveforms are shown in Section 1.

electrical characteristics over recommended operating ambient temperature range (unless otherwise noted) (see Note 2)

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IK}	A inputs and $\overline{OE}2$	V_{CC} = 4.5 V, V_{EE} = −4.94 V, I_I = −18 mA				−1.2	V
I_I	A inputs and $\overline{OE}2$	V_{CC} = 5.5 V, V_{EE} = −5.46 V, V_I = 7 V				0.1	mA
I_{IH}	A inputs and $\overline{OE}2$	V_{CC} = 5.5 V, V_{EE} = −5.46 V, V_I = 2.7 V				20	μA
	$\overline{OE}1$ only	V_{CC} = 5.5 V, V_{EE} = −5.46 V, V_I = −840 mV	0°C			350	
		V_{CC} = 5.5 V, V_{EE} = −5.46 V, V_I = −810 mV	25°C			350	
		V_{CC} = 5.5 V, V_{EE} = −5.46 V, V_I = −735 mV	75°C			350	
I_{IL}	A inputs and $\overline{OE}2$	V_{CC} = 5.5 V, V_{EE} = −5.46 V, V_I = 0.5 V				−500	μA
	$\overline{OE}1$ only	V_{CC} = 5.5 V, V_{EE} = −5.46 V, V_I = −1950 mV	0°C	0.5			
			25°C	0.5			
			75°C	0.5			
V_{OH}‡		V_{CC} = 4.5 V, V_{EE} = −5.2 V, ±5%, See Note 3	0°C	−1020		−840	mV
			25°C	−980		−810	
			75°C	−920		−735	
V_{OL}‡		V_{CC} = 4.5 V, V_{EE} = −5.2 V, ±5%, See Note 3	0°C	−1950		−1630	mV
			25°C	−1950		−1630	
			75°C	−1950		−1600	
I_{CCH}		V_{CC} = 5.5 V, V_{EE} = −5.46 V			17	25	mA
I_{CCL}		V_{CC} = 5.5 V, V_{EE} = −5.46 V			15	22	mA
I_{EE}		V_{CC} = 5.5 V, V_{EE} = −5.46 V			−77	−111	mA
C_i		V_{CC} = 5 V, V_{EE} = −5.2 V, f = 10 MHz			5		pF

switching characteristics over recommended ranges of operating ambient temperature and supply voltage (unless otherwise noted) (see Note 4)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	MIN	TYP†	MAX	UNIT
t_{PLH}	Any A	Y	0.1	1.5	3	ns
t_{PHL}			0.1	1.5	3.3	
t_{PLH}	$\overline{OE}1$ (ECL)	Y	0.6	2.2	4.3	ns
t_{PHL}			0.5	2.4	4.3	
t_{PLH}	$\overline{OE}2$ (TTL)	Y	0.7	2.2	4.4	ns
t_{PHL}			0.5	2.6	4.7	
t_r		Y		1.5		ns
t_f				1.5		

† All typical values are at V_{CC} = 5 V, V_{EE} = −5.2 V, T_A = 25°C.

‡ The algebraic convention, in which the least positive (most negative) value is designated minimum, is used in this data sheet for logic voltage levels and temperature only.

NOTES: 2. Each 10KH series circuit has been designed to meet the dc specifications shown in the electrical characteristics table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 linear ft/min is maintained.

3. Outputs are terminated through a 50-Ω resistor to −2 V.

4. Load circuit and voltage waveforms are shown in Section 1.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN10KHT5543DW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	10KHT5543	Samples

(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)

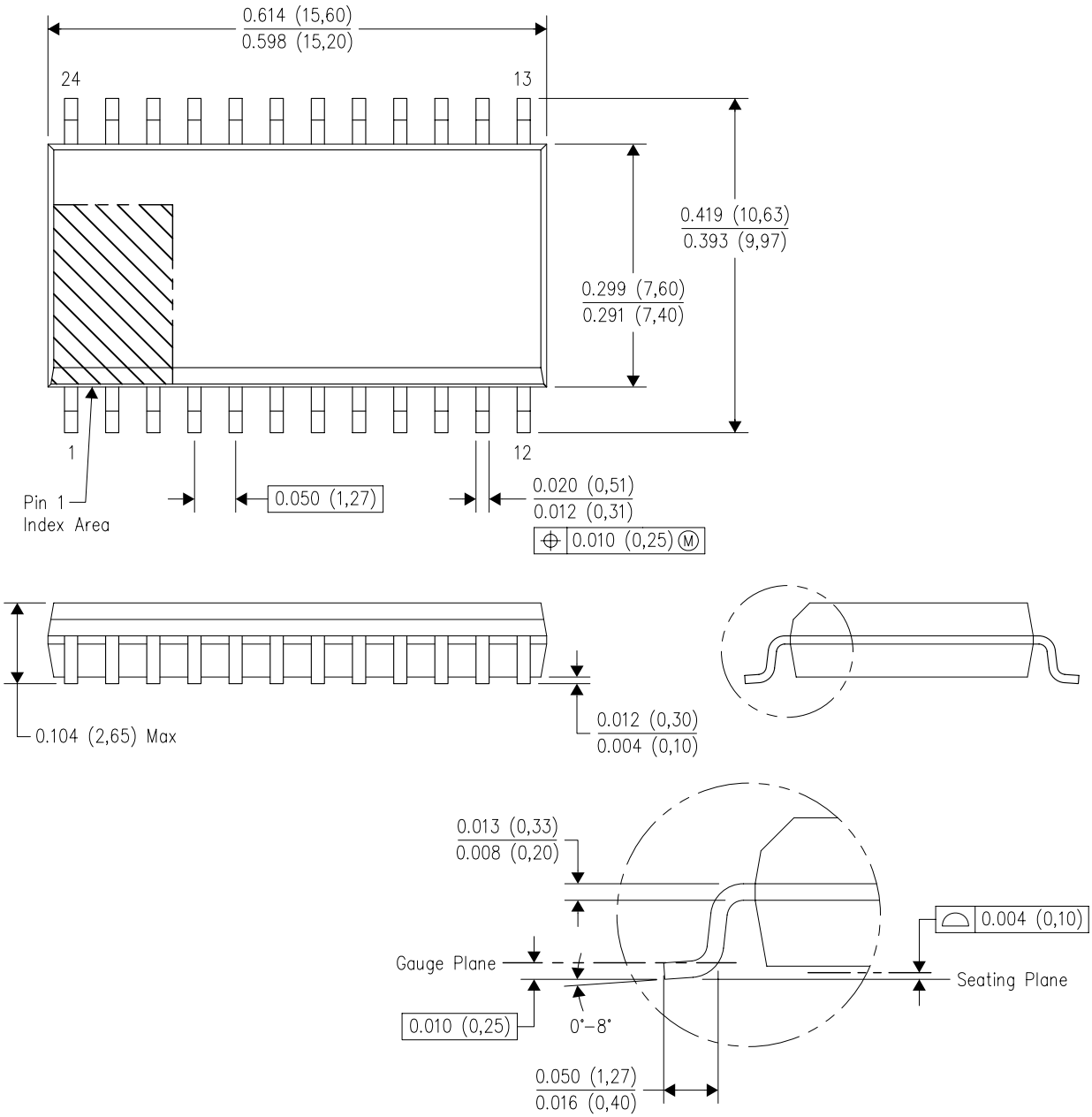
(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

DW (R–PDSO–G24) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M–1994.
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 MS–013 variation AD.

IMPORTANT NOTICE

Texas Instruments Incorporated (TI) reserves the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

TI's published terms of sale for semiconductor products (http://www.ti.com/sc/docs/stdterms.htm) apply to the sale of packaged integrated circuit products that TI has qualified and released to market. Additional terms may apply to the use or sale of other types of TI products and services.

Reproduction of significant portions of TI information in TI data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such reproduced documentation. Information of third parties may be subject to additional restrictions. Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyers and others who are developing systems that incorporate TI products (collectively, "Designers") understand and agree that Designers remain responsible for using their independent analysis, evaluation and judgment in designing their applications and that Designers have full and exclusive responsibility to assure the safety of Designers' applications and compliance of their applications (and of all TI products used in or for Designers' applications) with all applicable regulations, laws and other applicable requirements. Designer represents that, with respect to their applications, Designer has all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. Designer agrees that prior to using or distributing any applications that include TI products, Designer will thoroughly test such applications and the functionality of such TI products as used in such applications.

TI's provision of technical, application or other design advice, quality characterization, reliability data or other services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using TI Resources in any way, Designer (individually or, if Designer is acting on behalf of a company, Designer's company) agrees to use any particular TI Resource solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

Designer is authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS. TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY DESIGNER AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Unless TI has explicitly designated an individual product as meeting the requirements of a particular industry standard (e.g., ISO/TS 16949 and ISO 26262), TI is not responsible for any failure to meet such industry standard requirements.

Where TI specifically promotes products as facilitating functional safety or as compliant with industry functional safety standards, such products are intended to help enable customers to design and create their own applications that meet applicable functional safety standards and requirements. Using products in an application does not by itself establish any safety features in the application. Designers must ensure compliance with safety-related requirements and standards applicable to their applications. Designer may not use any TI products in life-critical medical equipment unless authorized officers of the parties have executed a special contract specifically governing such use. Life-critical medical equipment is medical equipment where failure of such equipment would cause serious bodily injury or death (e.g., life support, pacemakers, defibrillators, heart pumps, neurostimulators, and implantables). Such equipment includes, without limitation, all medical devices identified by the U.S. Food and Drug Administration as Class III devices and equivalent classifications outside the U.S.

TI may expressly designate certain products as completing a particular qualification (e.g., Q100, Military Grade, or Enhanced Product). Designers agree that it has the necessary expertise to select the product with the appropriate qualification designation for their applications and that proper product selection is at Designers' own risk. Designers are solely responsible for compliance with all legal and regulatory requirements in connection with such selection.

Designer will fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of Designer's non-compliance with the terms and provisions of this Notice.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265