

# SN10KHT5541 OCTAL ECL-TO-TTL TRANSLATOR WITH 3-STATE OUTPUTS

SDZS003A – OCTOBER 1989 – REVISED OCTOBER 1990

- 10KH Compatible
- ECL and TTL Control Inputs
- Noninverting Outputs
- Flow-Through Architecture Optimizes PCB Layout
- Center Pin  $V_{CC}$ ,  $V_{EE}$ , and GND Configurations Minimize High-Speed Switching Noise
- Package Options Include “Small Outline” Packages and Standard Plastic 300-mil DIPs

## description

This octal ECL-to-TTL translator is designed to provide a efficient translation between a 10KH ECL signal environment and a TTL signal environment. This device is designed specifically to improve the performance and density of ECL-to-TTL CPU/bus-oriented functions such as memory-address drivers, clock drivers, and bus-oriented receivers and transmitters.

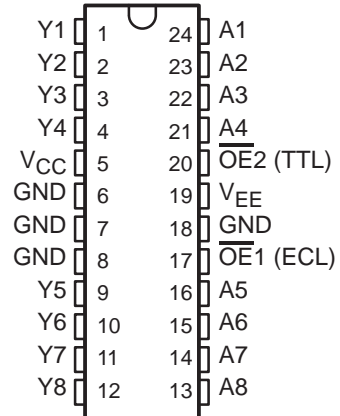
Two output-enable pins,  $\overline{OE}1$  and  $\overline{OE}2$ , are provided. These control inputs are ANDed together with  $\overline{OE}1$  being ECL compatible and  $\overline{OE}2$  being TTL compatible. This offers the choice of controlling the outputs of the device from either a TTL or ECL signal environment.

The SN10KHT5541 is characterized for operation from 0°C to 75°C.

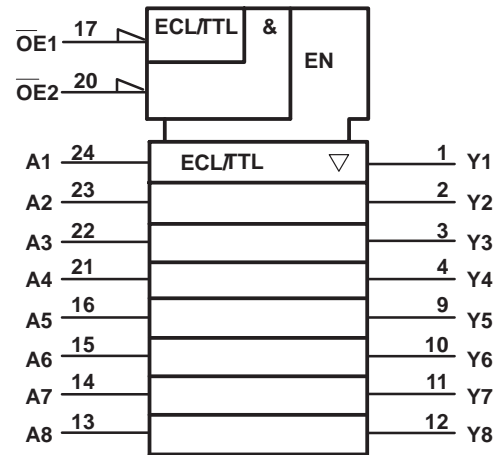
FUNCTION TABLE

OUTPUT ENABLE		DATA INPUT A	OUTPUT (TTL) Y
$\overline{OE}1$	$\overline{OE}2$		
X	H	X	Z
H	X	X	Z
L	L	L	L
L	L	H	H

DW OR NT PACKAGE  
(TOP VIEW)



## logic symbol†



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

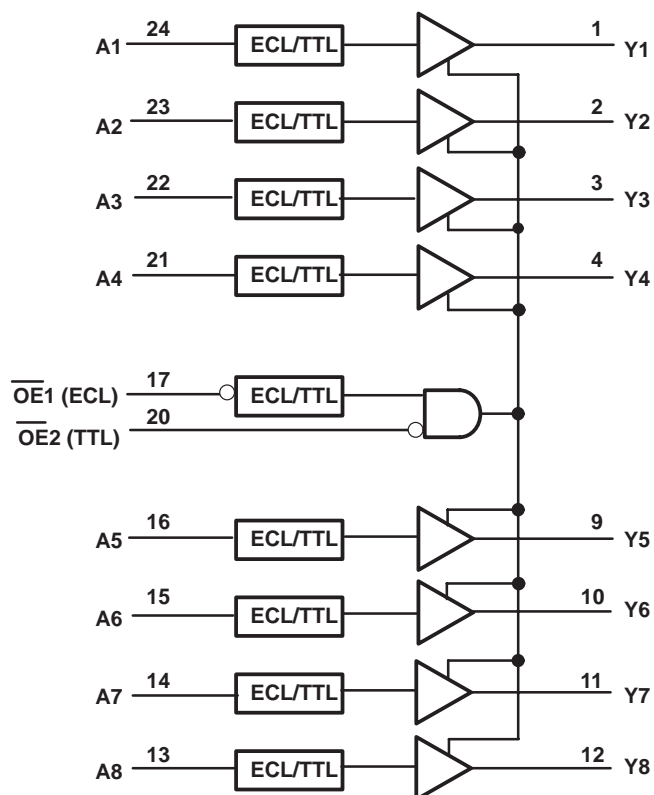
# SN10KHT5541

## OCTAL ECL-TO-TTL TRANSLATOR

### WITH 3-STATE OUTPUTS

SDZS003A – OCTOBER 1989 – REVISED OCTOBER 1990

logic diagram (positive logic)



**SN10KHT5541**  
**OCTAL ECL-TO-TTL TRANSLATOR**  
**WITH 3-STATE OUTPUTS**

SDZS003A – OCTOBER 1989 – REVISED OCTOBER 1990

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

Supply voltage, $V_{CC}$	–0.5 V to 7 V
Supply voltage, $V_{EE}$	–8 V to 0 V
Input voltage (TTL) (see Note 1)	–1.2 V to 7 V
Input voltage (ECL)	$V_{EE}$ to 0 V
Voltage applied to any output in the disabled or power-off state	–0.5 V to 5.5 V
Voltage applied to any output in the high state	–0.5 V to $V_{CC}$
Input current (TTL)	–30 mA to 5 mA
Current into any output in the low state	96 mA
Operating free-air temperature range	0°C to 75°C
Storage temperature range	–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.

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

**recommended operating conditions**

		MIN	NOM	MAX	UNIT
$V_{CC}$	TTL supply voltage	4.5	5	5.5	V
$V_{EE}$	ECL supply voltage	–4.94	–5.2	–5.46	V
$V_{IH}$	TTL high-level input voltage	2			V
$V_{IL}$	TTL low-level input voltage			0.8	V
$V_{IH}^{\ddagger}$	ECL high-level input voltage	$T_A = 0^\circ\text{C}$	–1170	–840	mV
		$T_A = 25^\circ\text{C}$	–1130	–810	
		$T_A = 75^\circ\text{C}$	–1070	–735	
$V_{IL}^{\ddagger}$	ECL low-level input voltage	$T_A = 0^\circ\text{C}$	–1950	–1480	mV
		$T_A = 25^\circ\text{C}$	–1950	–1480	
		$T_A = 75^\circ\text{C}$	–1950	–1450	
$I_{IK}$	TTL input clamp current			–18	mA
$I_{OH}$	High-level output current			–15	mA
$I_{OL}$	Low-level output current			48	mA
$T_A$	Operating free-air temperature	0		75	°C

<sup>‡</sup> The algebraic convention, in which the least positive (most negative) value is designated minimum, is used in this data sheet for logic levels only.

# SN10KHT5541

## OCTAL ECL-TO-TTL TRANSLATOR

### WITH 3-STATE OUTPUTS

SDZS003A – OCTOBER 1989 – REVISED OCTOBER 1990

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

PARAMETER		TEST CONDITIONS		MIN	TYP <sup>†</sup>	MAX	UNIT
$V_{IK}$	OE2 only	$V_{CC} = 4.5\text{ V}$ , $V_{EE} = -4.94\text{ V}$ , $I_I = -18\text{ mA}$				-1.2	V
$I_I$	OE2 only	$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_I = 7\text{ V}$				0.1	mA
$I_{IH}$	OE2 only	$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_I = 2.7\text{ V}$				20	$\mu\text{A}$
$I_{IL}$	OE2 only	$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_I = 0.5\text{ V}$				-0.5	mA
$I_{IH}$	Data inputs and $\overline{\text{OE}}1$	$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_I = -840\text{ mV}$	$T_A = 0^\circ\text{C}$			350	$\mu\text{A}$
		$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_I = -810\text{ mV}$	$T_A = 25^\circ\text{C}$			350	
		$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_I = -735\text{ mV}$	$T_A = 75^\circ\text{C}$			350	
$I_{IL}$	Data inputs and $\overline{\text{OE}}1$	$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_I = -1950\text{ mV}$	$T_A = 0^\circ\text{C}$	0.5			$\mu\text{A}$
			$T_A = 25^\circ\text{C}$	0.5			
			$T_A = 75^\circ\text{C}$	0.5			
$V_{OH}$		$V_{CC} = 4.5\text{ V}$ , $V_{EE} = -5.2\text{ V} \pm 5\%$ , $I_{OH} = -3\text{ mA}$		2.4	3.3		V
		$V_{CC} = 4.5\text{ V}$ , $V_{EE} = -5.2\text{ V} \pm 5\%$ , $I_{OH} = -15\text{ mA}$		2	3.1		
$V_{OL}$		$V_{CC} = 4.5\text{ V}$ , $V_{EE} = -5.2\text{ V} \pm 5\%$ , $I_{OL} = 48\text{ mA}$			0.38	0.55	V
$I_{OZH}$		$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_O = 2.7\text{ V}$				50	$\mu\text{A}$
$I_{OZL}$		$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_O = 0.5\text{ V}$				-50	$\mu\text{A}$
$I_{OS}^\ddagger$		$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_O = 0$		-100		-225	mA
$I_{CCH}$		$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$			64	97	mA
$I_{CCL}$		$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$			80	120	mA
$I_{CCZ}$		$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$			77	116	mA
$I_{EE}$		$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$			-22	-33	mA
$C_i$		$V_{CC} = 5\text{ V}$ , $V_{EE} = -5.2\text{ V}$			5		pF
$C_o$		$V_{CC} = 5\text{ V}$ , $V_{EE} = -5.2\text{ V}$			7		pF

<sup>†</sup> All typical values are at  $V_{CC} = 5\text{ V}$ ,  $V_{EE} = -5.2\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

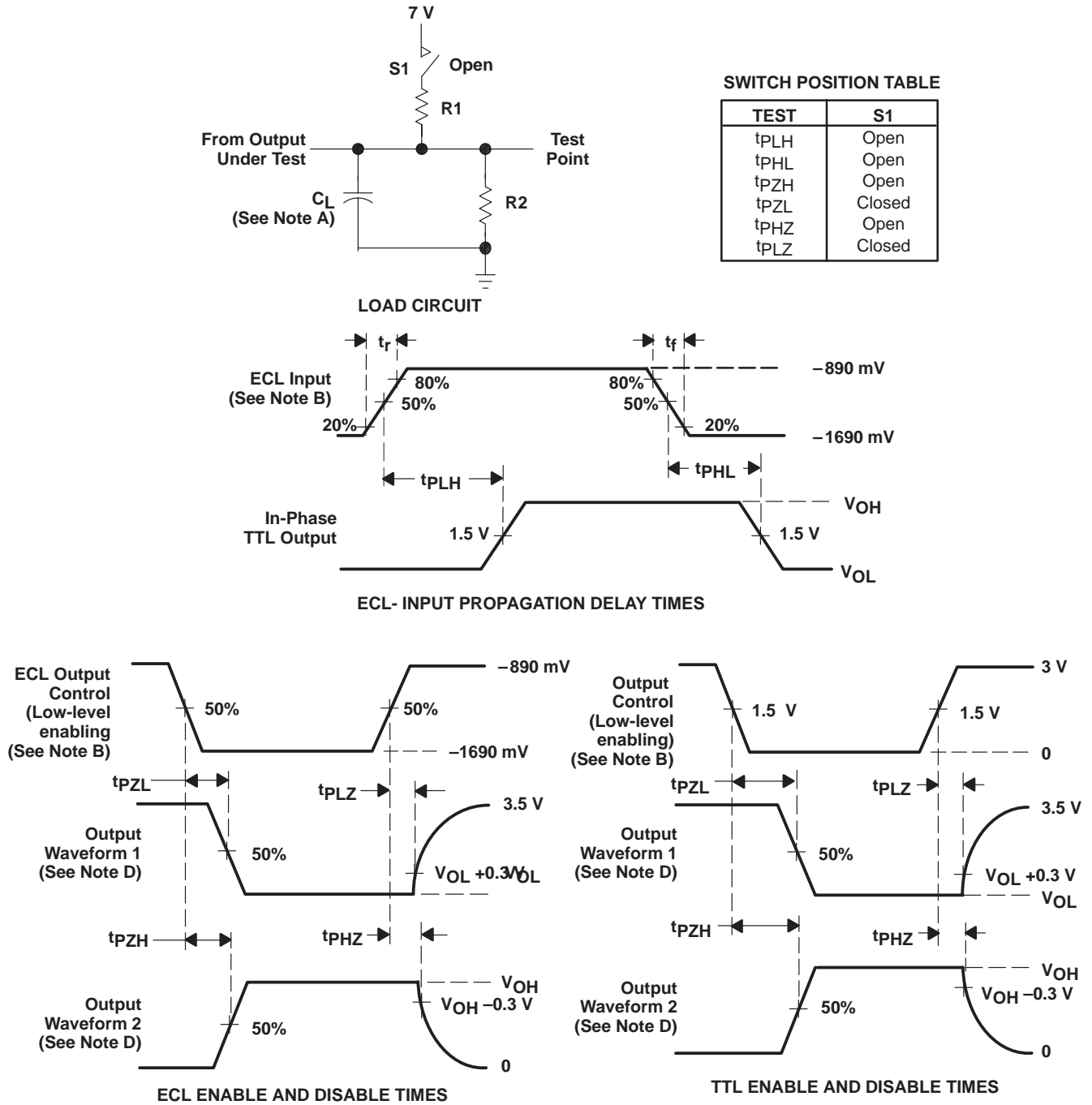
<sup>‡</sup> Not more than one output should be tested at a time and the duration of the test should not exceed 10 ms.

**switching characteristics over recommended ranges of operating free-air temperature and supply voltage (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$C_L = 50\text{ pF}$ , $R_1 = 500\ \Omega$ , $R_2 = 500\ \Omega$			UNIT
			MIN	TYP <sup>§</sup>	MAX	
$t_{PLH}$	A	Y	1.7	4	6.2	ns
$t_{PHL}$			1.6	4	6.2	
$t_{PZH}$	$\overline{\text{OE}}1$	Y	2.6	4.7	6.7	ns
$t_{PZL}$			3.2	5.9	8.5	
$t_{PHZ}$	$\overline{\text{OE}}1$	Y	2.9	5.4	7.8	ns
$t_{PLZ}$			1.9	4.9	7.8	
$t_{PZH}$	$\overline{\text{OE}}2$	Y	1.7	4	6.2	ns
$t_{PZL}$			2.5	5.1	7.7	
$t_{PHZ}$	$\overline{\text{OE}}2$	Y	2.1	4.3	6.4	ns
$t_{PLZ}$			1.1	3.7	6.3	

<sup>§</sup> All typical values are at  $V_{CC} = 5\text{ V}$ ,  $V_{EE} = -5.2\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

## PARAMETER MEASUREMENT INFORMATION



NOTES: A.  $C_L$  includes probe and jig capacitance.

B. For TTL inputs, input pulses are supplied by generators having the following characteristics:  $PRR \leq 10$  MHz,  $Z_0 = 50 \Omega$ ,  $t_r \leq 2.5$  ns,  $t_f \leq 2.5$  ns.

C. For ECL inputs, input pulses are supplied by generators having the following characteristics:  $PRR \leq 10$  MHz,  $Z_0 = 50 \Omega$ ,  $t_r \leq 0.7$  ns,  $t_f \leq 0.7$  ns.

D. 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.

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

FIGURE 1. LOAD CIRCUIT AND VOLTAGE WAVEFORMS

## 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
SN10KHT5541DW	ACTIVE	SOIC	DW	24	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	10KHT5541	<a href="#">Samples</a>
SN10KHT5541NT	ACTIVE	PDIP	NT	24	15	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	10KHT5541	<a href="#">Samples</a>
SN10KHT5541NTE4	ACTIVE	PDIP	NT	24		TBD	Call TI	Call TI	0 to 70		<a href="#">Samples</a>

(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.

**OBSELETE:** 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.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and

continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

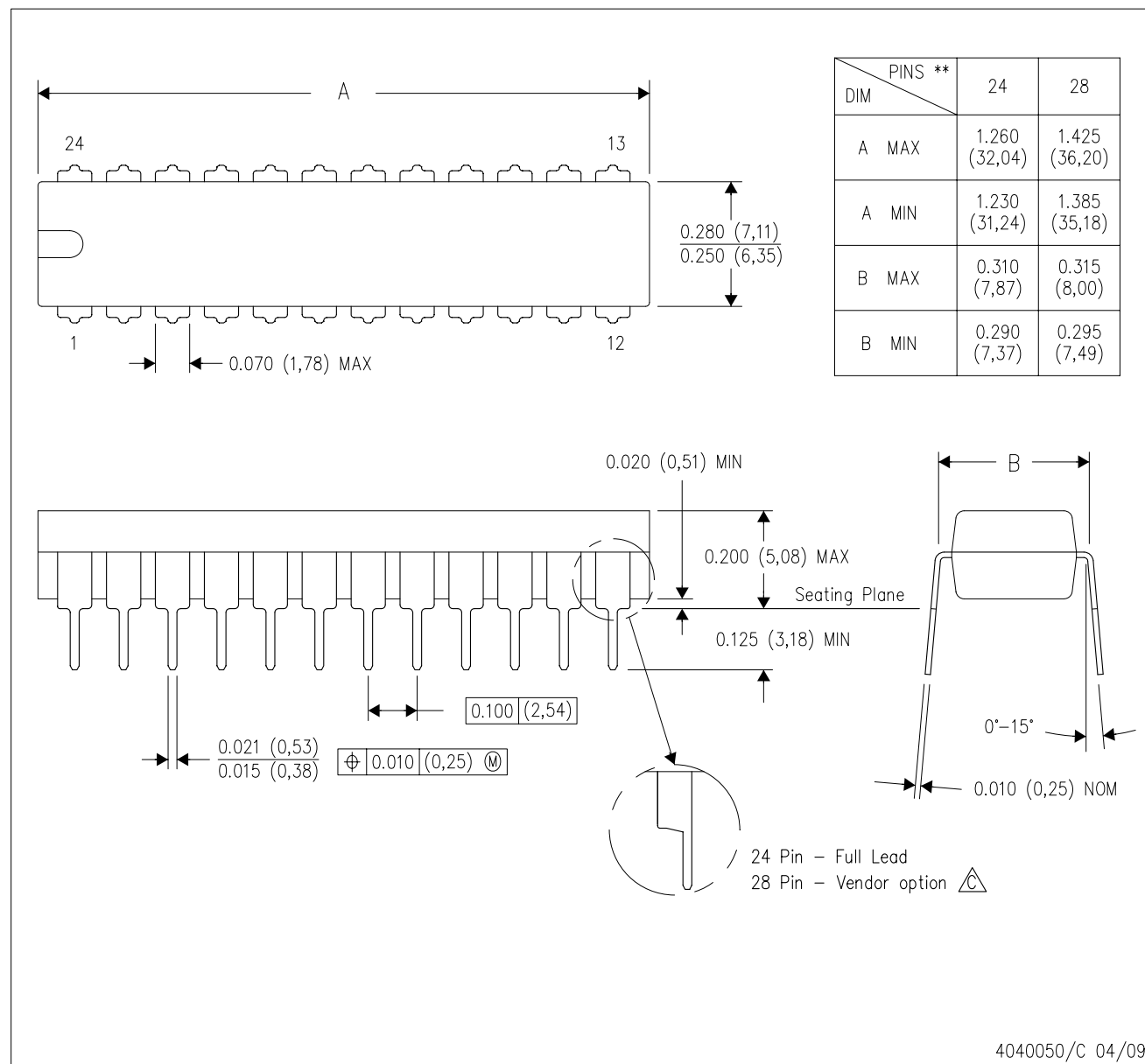
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

# MECHANICAL DATA

NT (R-PDIP-T\*\*)

24 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - $\triangle$  The 28 pin end lead shoulder width is a vendor option, either half or full width.



DW (R-PDSO-G24)

PLASTIC SMALL OUTLINE



NOTES:

- All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
- This drawing is subject to change without notice.
- Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
- Falls within JEDEC MS-013 variation AD.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve 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. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

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 relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information 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.

Reproduction of significant portions of TI information in TI data books or 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 altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)