

- 10KH Compatible
- ECL and TTL Control Inputs
- Inverting 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.

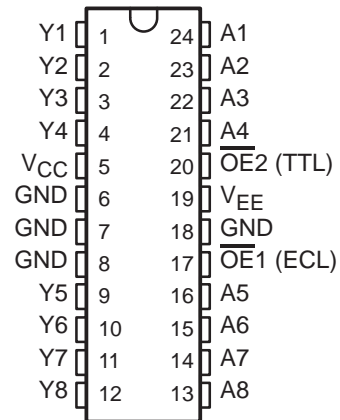
Two output enable pins,  $\overline{OE}1$  and  $\overline{OE}2$ , are provided. These control inputs are ANDed together with  $\overline{OE}1$  being ECL compatible and  $\overline{OE}2$  being TTL compatible. This offers the choice of controlling the outputs of the device from either a TTL or ECL signal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

The SN10KHT5540 is characterized for operation from 0°C to 75°C.

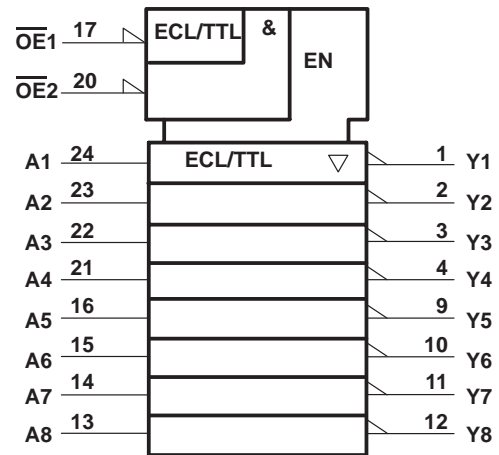
FUNCTION TABLE

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

DW OR NT PACKAGE  
(TOP VIEW)



## logic symbol†



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

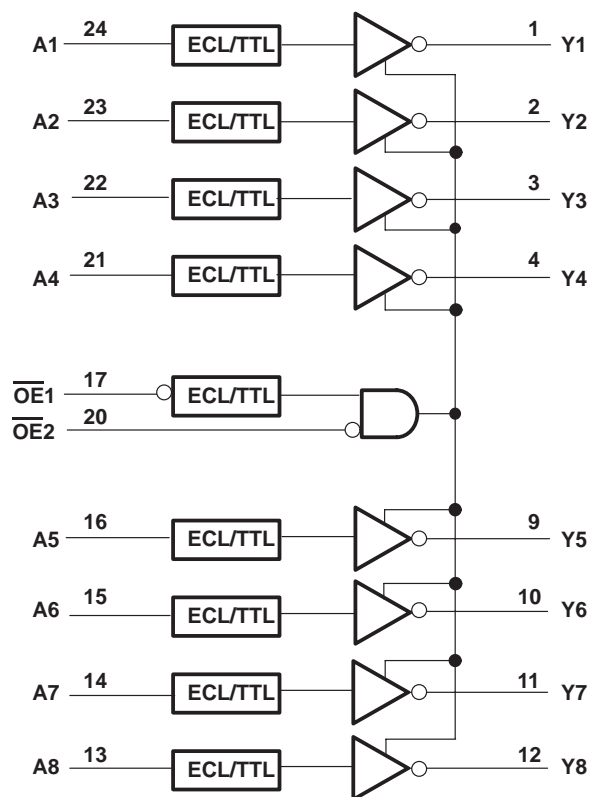
# SN10KHT5540

## OCTAL ECL-TO-TTL TRANSLATOR

### WITH 3-STATE OUTPUTS

SDZS006 – DECEMBER 1990

logic diagram (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
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
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 range (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

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

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

# SN10KHT5540

## OCTAL ECL-TO-TTL TRANSLATOR

### WITH 3-STATE OUTPUTS

SDZS006 – DECEMBER 1990

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

PARAMETER		TEST CONDITIONS		MIN	TYP <sup>†</sup>	MAX	UNIT
$V_{IK}$	$\overline{OE}2$ only	$V_{CC} = 4.5\text{ V}$ , $V_{EE} = -4.94\text{ V}$ , $I_I = -18\text{ mA}$				-1.2	V
$V_{OH}$		$V_{CC} = 4.5\text{ V}$ , $V_{EE} = -5.2\text{ V} \pm 5\%$ , $I_{OH} = -3\text{ mA}$		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
$I_I$	$\overline{OE}2$ only	$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_I = 7\text{ V}$				0.1	mA
$I_{IH}$	$\overline{OE}2$ only	$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_I = 2.7\text{ V}$				20	$\mu\text{A}$
$I_{IL}$	$\overline{OE}2$ 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 $\overline{OE}1$	$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_I = -840\text{ mV}$	$T_A = 0^\circ\text{C}$			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 $\overline{OE}1$	$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_I = -1950\text{ mV}$	$T_A = 0^\circ\text{C}$	0.5			$\mu\text{A}$
			$T_A = 25^\circ\text{C}$	0.5			
			$T_A = 75^\circ\text{C}$	0.5			
$I_{OZH}$		$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$ , $V_O = 2.7\text{ V}$				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
$I_{CCH}$		$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$			67	97	mA
$I_{CCL}$		$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$			84	120	mA
$I_{CCZ}$		$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$			81	116	mA
$I_{EE}$		$V_{CC} = 5.5\text{ V}$ , $V_{EE} = -5.46\text{ V}$			-23	-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  $V_{CC} = 5\text{ V}$ ,  $V_{EE} = -5.2\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

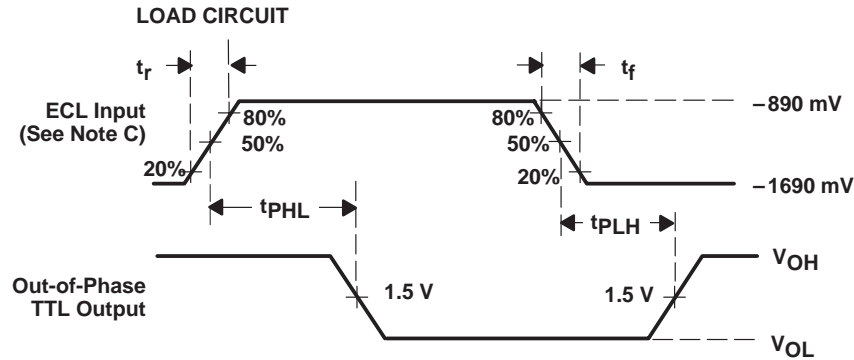
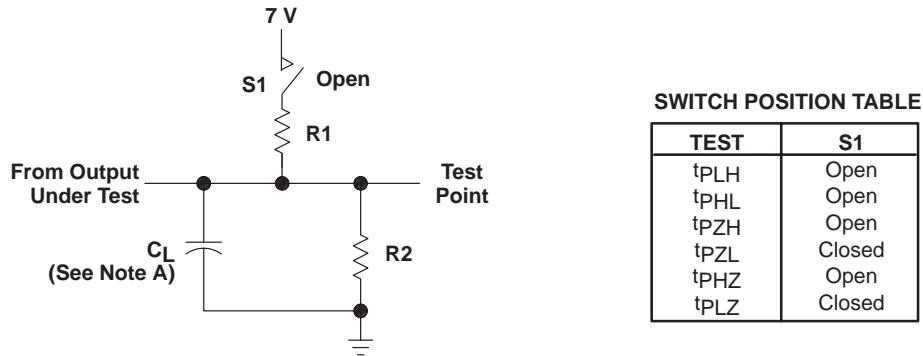
<sup>‡</sup> Not more than one output should be tested at a time and the duration of the test should not exceed 10 ms.

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

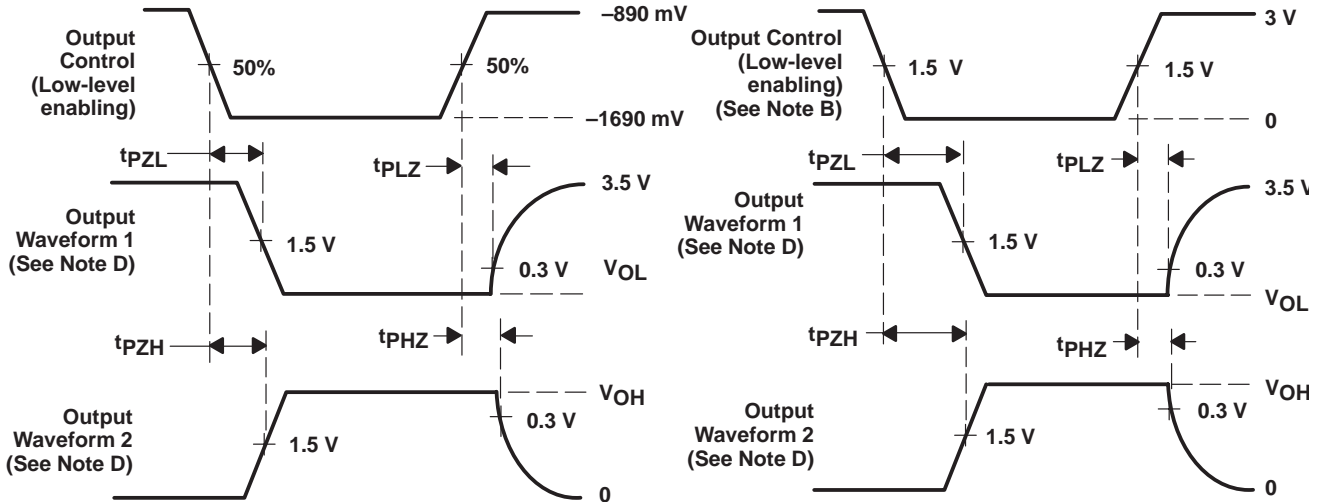
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$C_L = 50\text{ pF}$ , $R_1 = 500\ \Omega$ , $R_2 = 500\ \Omega$			UNIT
			MIN	TYP <sup>§</sup>	MAX	
$t_{PLH}$	A	Y	1.6	3.9	6.4	ns
$t_{PHL}$			1.6	4.2	6.4	
$t_{PZH}$	$\overline{OE}1$	Y	2.4	4.5	6.9	ns
$t_{PZL}$			3.5	5.9	8.7	
$t_{PHZ}$	$\overline{OE}1$	Y	2.8	5.2	8.1	ns
$t_{PLZ}$			2.2	4.6	8	
$t_{PZH}$	$\overline{OE}2$	Y	1.4	3.3	6.1	ns
$t_{PZL}$			2.5	4.7	7.9	
$t_{PHZ}$	$\overline{OE}2$	Y	1.6	4.1	6.5	ns
$t_{PLZ}$			0.7	3.3	6.4	

<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



### ECL INPUT PROPAGATION DELAY TIMES



- 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,  $Z_0 = 50 \Omega$ ,  $t_r \leq 1.5$  ns,  $t_f \leq 1.5$  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 <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN10KHT5540DW	OBSOLETE	SOIC	DW	24		TBD	Call TI	Call TI
SN10KHT5540DWR	OBSOLETE	SOIC	DW	24		TBD	Call TI	Call TI
SN10KHT5540NT	OBSOLETE	PDIP	NT	24		TBD	Call TI	Call TI

<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.

**OBSOLETE:** 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.

**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.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

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

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI 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 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. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

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.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

<b>Products</b>		<b>Applications</b>	
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>	Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>	Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>	Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>	Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>	Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
		Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
		Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
		Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

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

Copyright © 2005, Texas Instruments Incorporated