

# SN10KHT5540 OCTAL ECL-TO-TTL TRANSLATOR WITH 3-STATE OUTPUTS

SDZS006 – DECEMBER 1990

- 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.

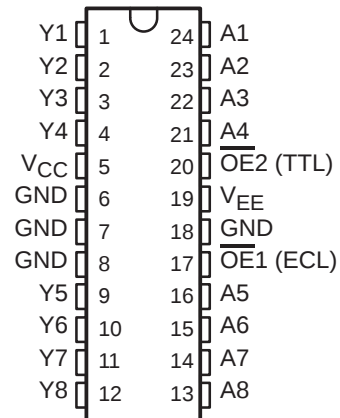
Two output enable pins,  $\overline{OE1}$  and  $\overline{OE2}$ , are provided. These control inputs are ANDed together with  $\overline{OE1}$  being ECL compatible and  $\overline{OE2}$  being TTL compatible. This offers the choice of controlling the outputs of the device from either a TTL or ECL signal environment.

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

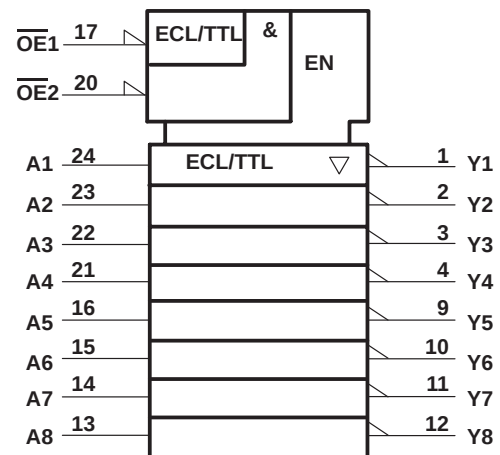
FUNCTION TABLE

| OUTPUT ENABLE    |                  | DATA INPUT | OUTPUT (TTL) |
|------------------|------------------|------------|--------------|
| $\overline{OE1}$ | $\overline{OE2}$ |            |              |
| X                | H                | X          | Z            |
| H                | X                | X          | Z            |
| L                | L                | L          | H            |
| L                | L                | H          | L            |

DW OR NT PACKAGE  
(TOP VIEW)



## logic symbol†

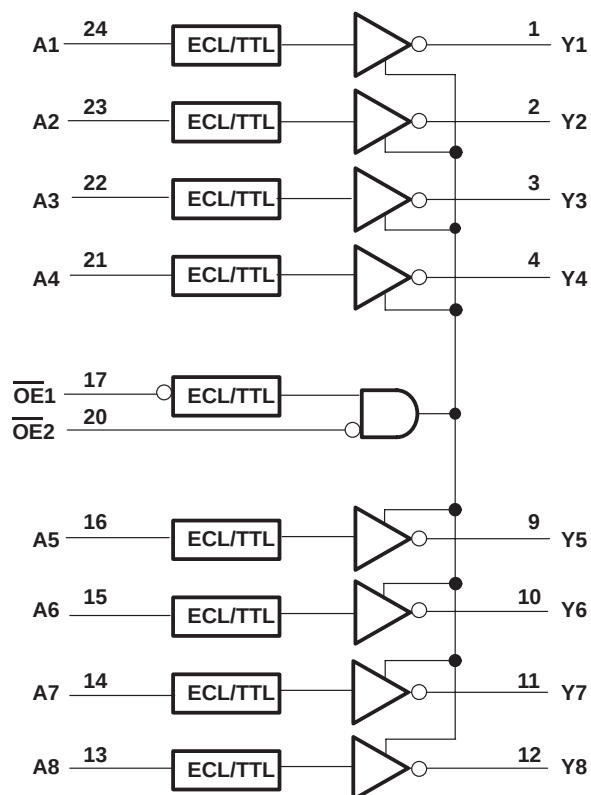


† This symbol is in accordance with ANSI/IEEE STD 91-1984 and IEC Publication 617-12.

**SN10KHT5540**  
**OCTAL ECL-TO-TTL TRANSLATOR**  
**WITH 3-STATE OUTPUTS**

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logic diagram (positive logic)



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

|                                                                  |                    |
|------------------------------------------------------------------|--------------------|
| 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   |

<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.

# 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  $V_{CC} = 5\text{ V}$ ,  $V_{EE} = -5.2\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

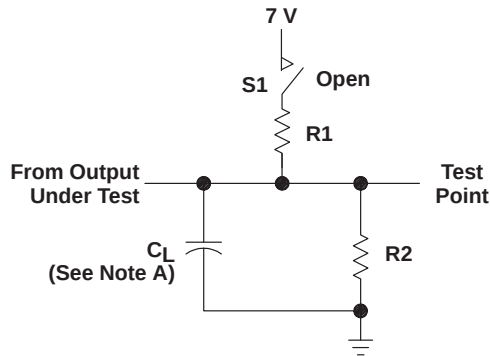
<sup>‡</sup> Not more than one output should be tested at a time and the duration of the test should not exceed 10 ms.

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

| PARAMETER | FROM<br>(INPUT)  | TO<br>(OUTPUT) | $C_L = 50\text{ pF}$ ,<br>$R_1 = 500\ \Omega$ ,<br>$R_2 = 500\ \Omega$ |                  |     | 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 |      |

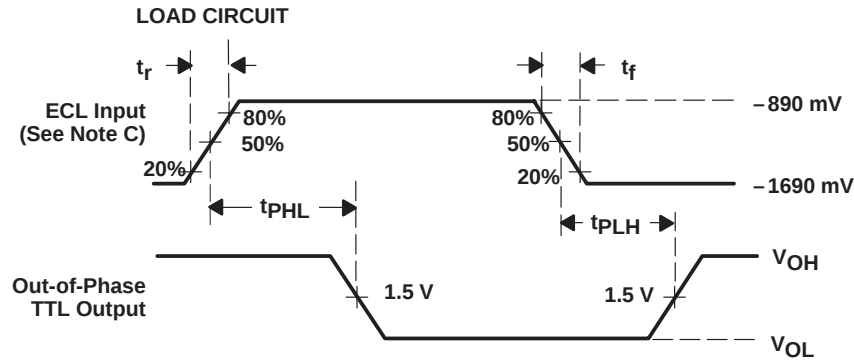
<sup>§</sup> All typical values are at  $V_{CC} = 5\text{ V}$ ,  $V_{EE} = -5.2\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

## PARAMETER MEASUREMENT INFORMATION

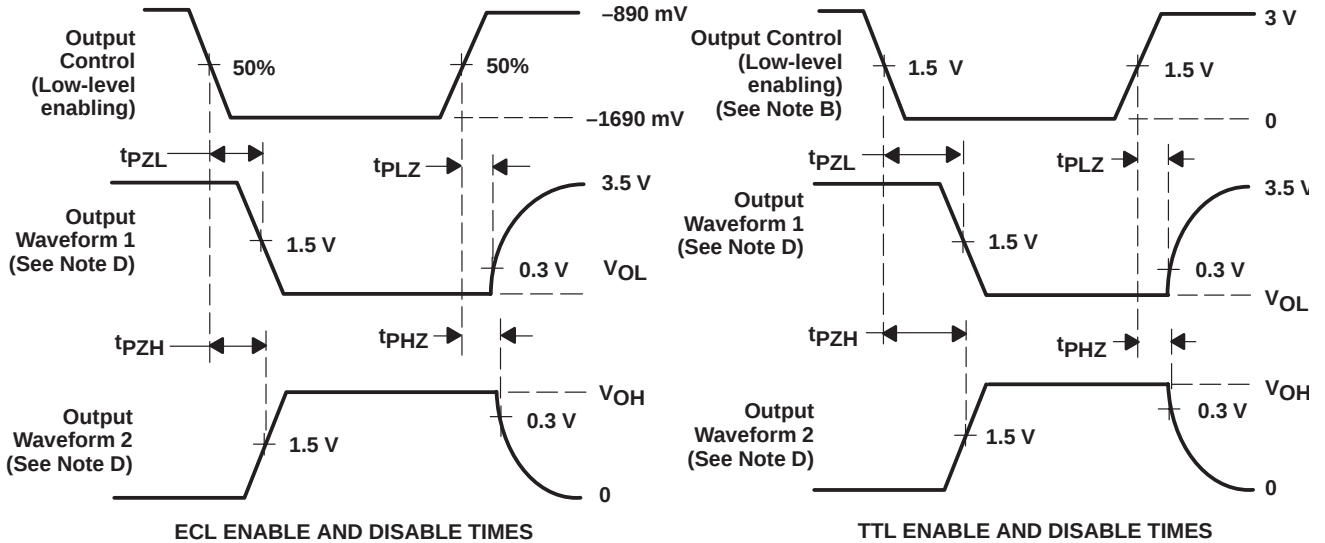


SWITCH POSITION TABLE

| TEST      | S1     |
|-----------|--------|
| $t_{PLH}$ | Open   |
| $t_{PHL}$ | Open   |
| $t_{PZH}$ | Open   |
| $t_{PZL}$ | Closed |
| $t_{PHZ}$ | Open   |
| $t_{PLZ}$ | Closed |



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.

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