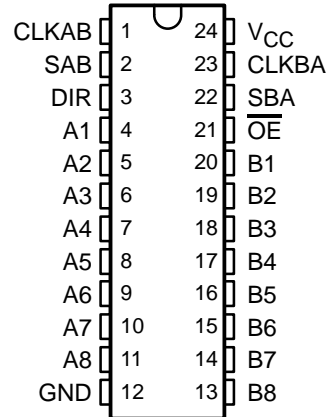


# CD54HC646, CD74HCT646 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

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- 2-V to 6-V  $V_{CC}$  Operation (CD54HC646)
- 4.5-V to 5.5-V  $V_{CC}$  Operation (CD74HCT646)
- Wide Operating Temperature Range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$
- Balanced Propagation Delays and Transition Times
- Standard Outputs Drive Up To 15 LS-TTL Loads
- Significant Power Reduction Compared to LS-TTL Logic ICs
- Inputs Are TTL-Voltage Compatible (CD74HCT646)
- Independent Registers for A and B Buses
- Multiplexed Real-Time and Stored Data
- True Data Paths

CD54HC646 . . . F PACKAGE  
CD74HCT646 . . . M PACKAGE  
(TOP VIEW)



## description/ordering information

The CD54HC646 and CD74HCT646 consist of bus-transceiver circuits with 3-state outputs, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly from the input bus or from the internal registers. Data on the A or B bus is clocked into the registers on the low-to-high transition of the appropriate clock (CLKAB or CLKBA) input. Figure 1 illustrates the four fundamental bus-management functions that can be performed with these devices.

Output-enable ( $\overline{OE}$ ) and direction-control (DIR) inputs control the transceiver functions. In the transceiver mode, data present at the high-impedance port can be stored in either or both registers.

The select-control (SAB and SBA) inputs can multiplex stored and real-time (transparent mode) data. DIR determines which bus receives data when  $\overline{OE}$  is active (low). In the isolation mode ( $\overline{OE}$  high), A data can be stored in one register and/or B data can be stored in the other register.

When an output function is disabled, the input function still is enabled and can be used to store data. Only one of the two buses, A or B, can be driven at a time.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

## ORDERING INFORMATION

| $T_A$                                          | PACKAGE† |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|------------------------------------------------|----------|---------------|-----------------------|------------------|
| $-55^{\circ}\text{C}$ to $125^{\circ}\text{C}$ | SOIC – M | Tape and reel | CD74HCT646M96         | HCT646M          |
|                                                | CDIP – F | Tube          | CD54HC646F3A          | CD54HC646F3A     |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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# CD54HC646, CD74HCT646

## OCTAL BUS TRANSCEIVERS AND REGISTERS

### WITH 3-STATE OUTPUTS

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FUNCTION TABLE

| INPUTS          |     |        |        |     |     | DATA I/O       |                | OPERATION OR FUNCTION     |
|-----------------|-----|--------|--------|-----|-----|----------------|----------------|---------------------------|
| $\overline{OE}$ | DIR | CLKAB  | CLKBA  | SAB | SBA | A1–A8          | B1–B8          |                           |
| X               | X   | ↑      | X      | X   | X   | Input          | Unspecified†   | Store A, B unspecified†   |
| X               | X   | X      | ↑      | X   | X   | Unspecified†   | Input          | Store B, A unspecified†   |
| H               | X   | ↑      | ↑      | X   | X   | Input          | Input          | Store A and B data        |
| H               | X   | H or L | H or L | X   | X   | Input disabled | Input disabled | Isolation, hold storage   |
| L               | L   | X      | X      | X   | L   | Output         | Input          | Real-time B data to A bus |
| L               | L   | X      | H or L | X   | H   | Output         | Input          | Stored B data to A bus    |
| L               | H   | X      | X      | L   | X   | Input          | Output         | Real-time A data to B bus |
| L               | H   | H or L | X      | H   | X   | Input          | Output         | Stored A data to B bus    |

† The data-output functions can be enabled or disabled by various signals at  $\overline{OE}$  and DIR. Data-input functions always are enabled; i.e., data at the bus terminals is stored on every low-to-high transition of the clock inputs.

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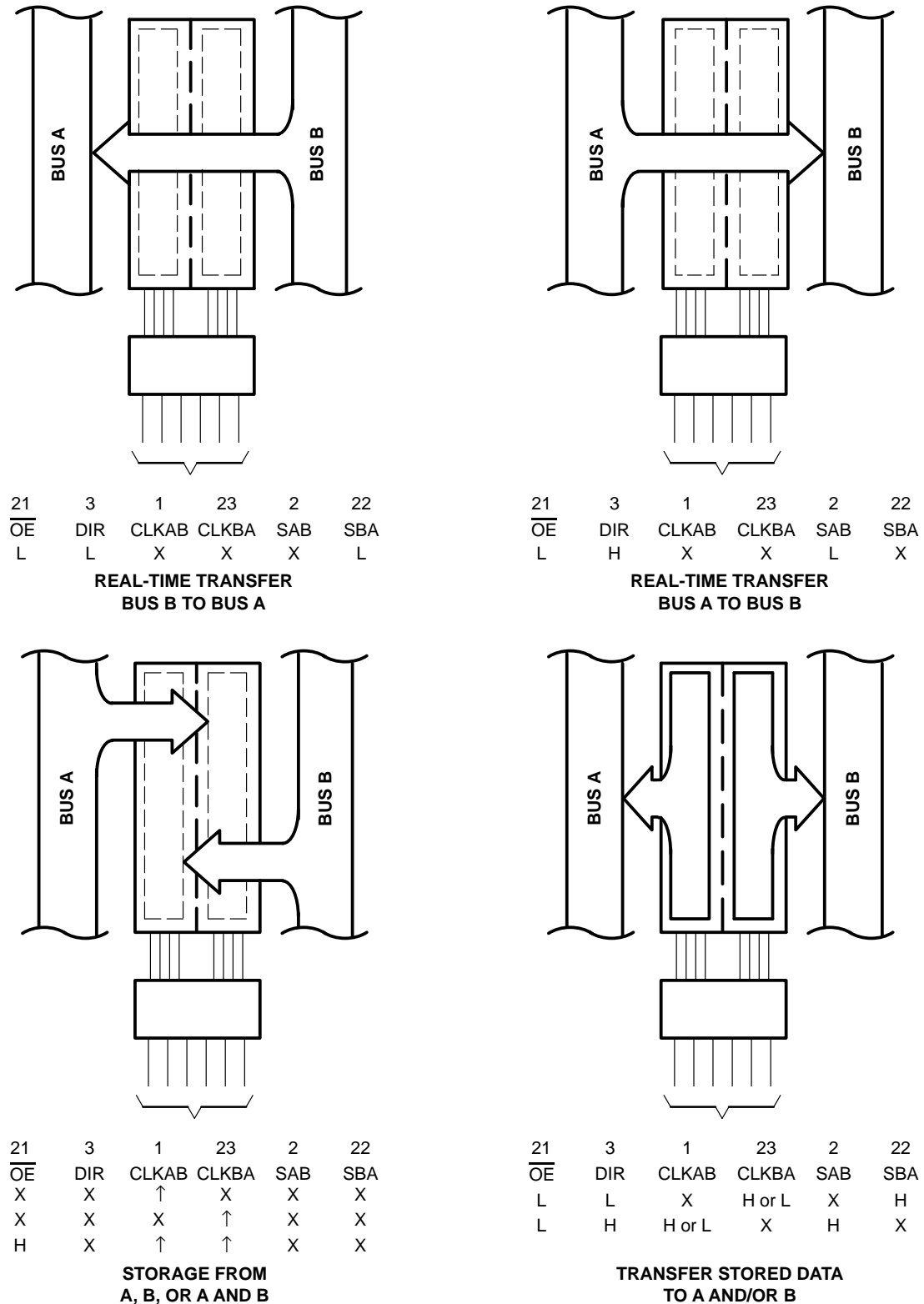


Figure 1. Bus-Management Functions

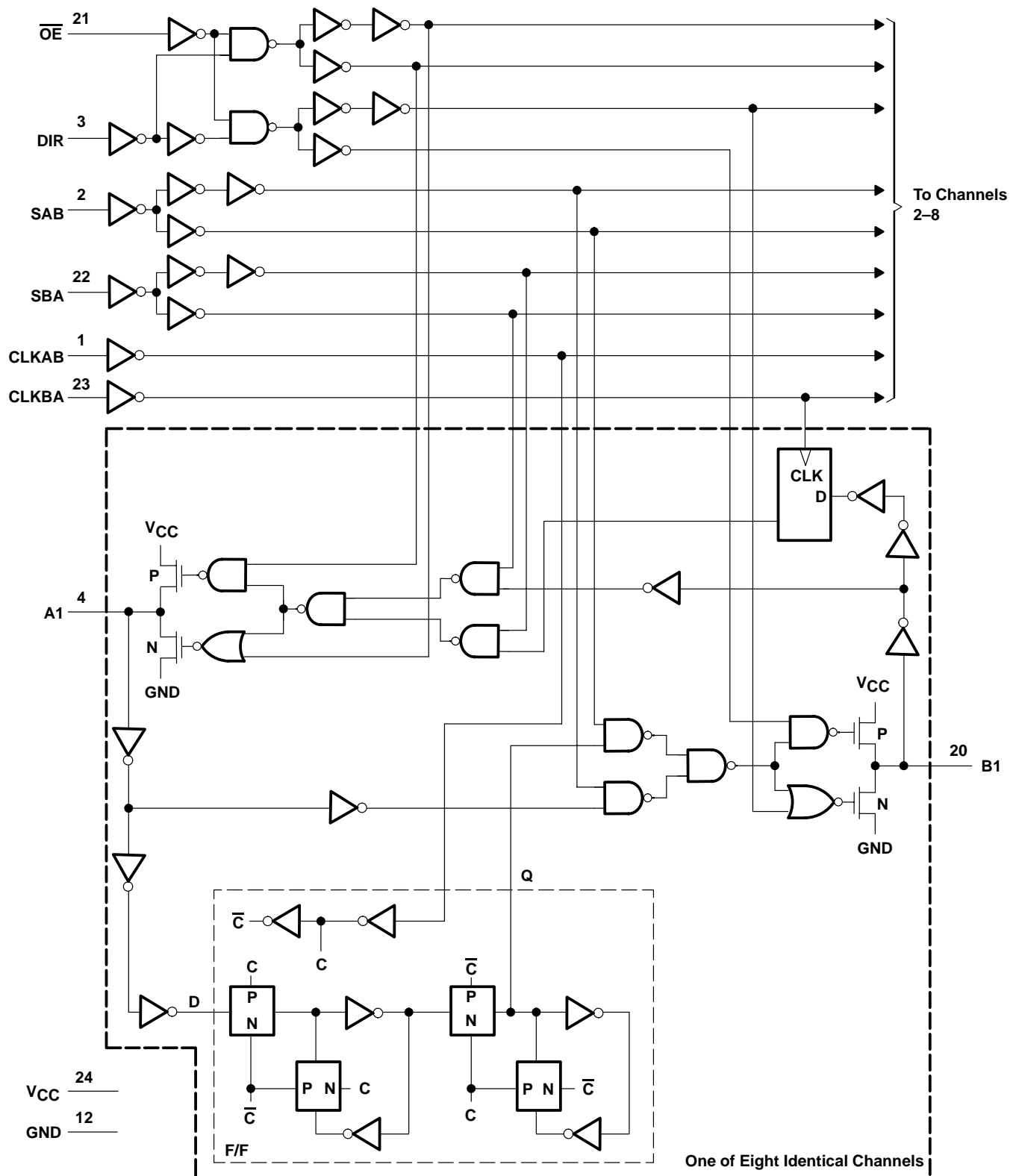
# CD54HC646, CD74HCT646

## OCTAL BUS TRANSCEIVERS AND REGISTERS

### WITH 3-STATE OUTPUTS

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#### logic diagram (positive logic)



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# CD54HC646, CD74HCT646

## OCTAL BUS TRANSCEIVERS AND REGISTERS

### WITH 3-STATE OUTPUTS

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

|                                                                             |                |
|-----------------------------------------------------------------------------|----------------|
| Supply voltage range, $V_{CC}$                                              | –0.5 V to 7 V  |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ ) (see Note 1)  | ±20 mA         |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) (see Note 1) | ±20 mA         |
| Continuous output drain current per output, $I_O$ ( $V_O = 0$ to $V_{CC}$ ) | ±35 mA         |
| Continuous current through $V_{CC}$ or GND                                  | ±50 mA         |
| Package thermal impedance, $\theta_{JA}$ (see Note 2) M package             | 46°C/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 package thermal impedance is calculated in accordance with JESD 51-7.

#### recommended operating conditions for CD54HC646 (see Note 3)

|          |                                       | MIN              | MAX      | UNIT |
|----------|---------------------------------------|------------------|----------|------|
| $V_{CC}$ | Supply voltage                        | 2                | 6        | V    |
| $V_{IH}$ | High-level input voltage              | $V_{CC} = 2$ V   | 1.5      | V    |
|          |                                       | $V_{CC} = 4.5$ V | 3.15     |      |
|          |                                       | $V_{CC} = 6$ V   | 4.2      |      |
| $V_{IL}$ | Low-level input voltage               | $V_{CC} = 2$ V   | 0.5      | V    |
|          |                                       | $V_{CC} = 4.5$ V | 1.35     |      |
|          |                                       | $V_{CC} = 6$ V   | 1.8      |      |
| $V_I$    | Input voltage                         | 0                | $V_{CC}$ | V    |
| $V_O$    | Output voltage                        | 0                | $V_{CC}$ | V    |
| $t_t$    | Input transition (rise and fall) time | $V_{CC} = 2$ V   | 1000     | ns   |
|          |                                       | $V_{CC} = 4.5$ V | 500      |      |
|          |                                       | $V_{CC} = 6$ V   | 400      |      |
| $T_A$    | Operating free-air temperature        | –55              | 125      | °C   |

NOTE 3: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

#### recommended operating conditions for CD74HCT646 (see Note 3)

|          |                                       | MIN | MAX      | UNIT |
|----------|---------------------------------------|-----|----------|------|
| $V_{CC}$ | Supply voltage                        | 4.5 | 5.5      | V    |
| $V_{IH}$ | High-level input voltage              | 2   |          | V    |
| $V_{IL}$ | Low-level input voltage               |     | 0.8      | V    |
| $V_I$    | Input voltage                         |     | $V_{CC}$ | V    |
| $V_O$    | Output voltage                        |     | $V_{CC}$ | V    |
| $t_t$    | Input transition (rise and fall) time |     | 500      | ns   |
| $T_A$    | Operating free-air temperature        | –55 | 125      | °C   |

NOTE 4: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

# CD54HC646, CD74HCT646

## OCTAL BUS TRANSCEIVERS AND REGISTERS

### WITH 3-STATE OUTPUTS

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electrical characteristics for CD54HC646 over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER       | TEST CONDITIONS                                           |                           | V <sub>CC</sub> | T <sub>A</sub> = 25°C |      | T <sub>A</sub> = -55°C TO 125°C |     | T <sub>A</sub> = -40°C TO 85°C |      | UNIT |
|-----------------|-----------------------------------------------------------|---------------------------|-----------------|-----------------------|------|---------------------------------|-----|--------------------------------|------|------|
|                 |                                                           |                           |                 | MIN                   | MAX  | MIN                             | MAX | MIN                            | MAX  |      |
| V <sub>OH</sub> | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>       | I <sub>OH</sub> = -20 µA  | 2 V             | 1.9                   |      | 1.9                             |     | 1.9                            |      | V    |
|                 |                                                           |                           | 4.5 V           | 4.4                   |      | 4.4                             |     | 4.4                            |      |      |
|                 |                                                           |                           | 6 V             | 5.9                   |      | 5.9                             |     | 5.9                            |      |      |
|                 |                                                           | I <sub>OH</sub> = -6 mA   | 4.5 V           | 3.98                  |      | 3.7                             |     | 3.84                           |      |      |
|                 |                                                           | I <sub>OH</sub> = -7.8 mA | 6 V             | 5.48                  |      | 5.2                             |     | 5.34                           |      |      |
| V <sub>OL</sub> | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>       | I <sub>OL</sub> = 20 µA   | 2 V             |                       | 0.1  |                                 | 0.1 |                                | 0.1  | V    |
|                 |                                                           |                           | 4.5 V           |                       | 0.1  |                                 | 0.1 |                                | 0.1  |      |
|                 |                                                           |                           | 6 V             |                       | 0.1  |                                 | 0.1 |                                | 0.1  |      |
|                 |                                                           | I <sub>OL</sub> = 6 mA    | 4.5 V           |                       | 0.26 |                                 | 0.4 |                                | 0.33 |      |
|                 |                                                           | I <sub>OL</sub> = 7.8 mA  | 6 V             |                       | 0.26 |                                 | 0.4 |                                | 0.33 |      |
| I <sub>I</sub>  | V <sub>I</sub> = V <sub>CC</sub> or 0                     |                           | 6 V             |                       | ±0.1 |                                 | ±1  |                                | ±1   | µA   |
| I <sub>OZ</sub> | V <sub>O</sub> = V <sub>CC</sub> or 0                     |                           | 6 V             |                       | ±0.5 |                                 | ±10 |                                | ±5   | µA   |
| I <sub>CC</sub> | V <sub>I</sub> = V <sub>CC</sub> or 0, I <sub>O</sub> = 0 |                           | 6 V             |                       | 8    |                                 | 160 |                                | 80   | µA   |
| C <sub>i</sub>  |                                                           |                           |                 |                       | 10   |                                 | 10  |                                | 10   | pF   |
| C <sub>o</sub>  |                                                           |                           |                 |                       | 20   |                                 | 20  |                                | 20   | pF   |

electrical characteristics for CD74HCT646 over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER                     | TEST CONDITIONS                                                            |                          | V <sub>CC</sub> | T <sub>A</sub> = 25°C |     |      | T <sub>A</sub> = -55°C TO 125°C |     | T <sub>A</sub> = -40°C TO 85°C |      | UNIT |
|-------------------------------|----------------------------------------------------------------------------|--------------------------|-----------------|-----------------------|-----|------|---------------------------------|-----|--------------------------------|------|------|
|                               |                                                                            |                          |                 | MIN                   | TYP | MAX  | MIN                             | MAX | MIN                            | MAX  |      |
| V <sub>OH</sub>               | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                        | I <sub>OH</sub> = -20 µA | 4.5 V           | 4.4                   |     |      | 4.4                             |     | 4.4                            |      | V    |
|                               |                                                                            | I <sub>OH</sub> = -6 mA  |                 | 3.98                  |     |      | 3.7                             |     | 3.84                           |      |      |
| V <sub>OL</sub>               | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                        | I <sub>OL</sub> = 20 µA  | 4.5 V           |                       |     | 0.1  |                                 | 0.1 |                                | 0.1  | V    |
|                               |                                                                            | I <sub>OL</sub> = 6 mA   |                 |                       |     | 0.26 |                                 | 0.4 |                                | 0.33 |      |
| I <sub>I</sub>                | V <sub>I</sub> = V <sub>CC</sub> to GND                                    |                          | 5.5 V           |                       |     | ±0.1 |                                 | ±1  |                                | ±1   | µA   |
| I <sub>OZ</sub>               | V <sub>O</sub> = V <sub>CC</sub> or 0                                      |                          | 5.5 V           |                       |     | ±0.5 |                                 | ±10 |                                | ±5   | µA   |
| I <sub>CC</sub>               | V <sub>I</sub> = V <sub>CC</sub> or 0, I <sub>O</sub> = 0                  |                          | 5.5 V           |                       |     | 8    |                                 | 160 |                                | 80   | µA   |
| ΔI <sub>CC</sub> <sup>†</sup> | One input at V <sub>CC</sub> - 2.1 V, Other inputs at 0 or V <sub>CC</sub> |                          | 4.5 V to 5.5 V  |                       | 100 | 360  |                                 | 490 |                                | 450  | µA   |
| C <sub>i</sub>                |                                                                            |                          |                 |                       |     | 10   |                                 | 10  |                                | 10   | pF   |
| C <sub>o</sub>                |                                                                            |                          |                 |                       |     | 20   |                                 | 20  |                                | 20   | pF   |

<sup>†</sup> Additional quiescent supply current per input pin, TTL inputs high, 1 unit load

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**OCTAL BUS TRANSCEIVERS AND REGISTERS**  
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**HCT INPUT LOADING TABLE**

| INPUT           | UNIT LOAD† |
|-----------------|------------|
| $\overline{OE}$ | 1.3        |
| DIR             | 0.75       |
| CLKAB or CLKBA  | 0.6        |
| SAB or SBA      | 0.45       |
| A or B          | 0.3        |

† Unit Load is  $\Delta I_{CC}$  limit specified in electrical characteristics table (e.g., 360  $\mu$ A max at 25°C).

**timing requirements for CD54HC646 over recommended operating free-air temperature range (unless otherwise noted) (see Figure 2)**

|                                                         | $V_{CC}$ | $T_A = 25^\circ\text{C}$ |     | $T_A = -55^\circ\text{C}$<br>TO $125^\circ\text{C}$ |     | $T_A = -40^\circ\text{C}$<br>TO $85^\circ\text{C}$ |     | UNIT |
|---------------------------------------------------------|----------|--------------------------|-----|-----------------------------------------------------|-----|----------------------------------------------------|-----|------|
|                                                         |          | MIN                      | MAX | MIN                                                 | MAX | MIN                                                | MAX |      |
| $f_{\text{clock}}$ Clock frequency                      | 2 V      |                          | 6   |                                                     | 4   |                                                    | 5   | MHz  |
|                                                         | 4.5 V    |                          | 30  |                                                     | 20  |                                                    | 25  |      |
|                                                         | 6 V      |                          | 35  |                                                     | 23  |                                                    | 29  |      |
| $t_w$ Pulse duration, CLKBA or CLKAB high or low        | 2 V      |                          | 80  |                                                     | 120 |                                                    | 100 | ns   |
|                                                         | 4.5 V    |                          | 16  |                                                     | 24  |                                                    | 20  |      |
|                                                         | 6 V      |                          | 14  |                                                     | 20  |                                                    | 17  |      |
| $t_{su}$ Setup time, A before CLKAB↑ or B before CLKBA↑ | 2 V      |                          | 60  |                                                     | 90  |                                                    | 75  | ns   |
|                                                         | 4.5 V    |                          | 12  |                                                     | 18  |                                                    | 15  |      |
|                                                         | 6 V      |                          | 10  |                                                     | 15  |                                                    | 13  |      |
| $t_h$ Hold time, A after CLKAB↑ or B after CLKBA↑       | 2 V      |                          | 35  |                                                     | 55  |                                                    | 45  | ns   |
|                                                         | 4.5 V    |                          | 7   |                                                     | 11  |                                                    | 9   |      |
|                                                         | 6 V      |                          | 6   |                                                     | 9   |                                                    | 8   |      |

**timing requirements for CD74HCT646 over recommended operating free-air temperature range,  $V_{CC} = 4.5\text{ V}$  (unless otherwise noted) (see Figure 3)**

|                                                         | $T_A = 25^\circ\text{C}$ |     | $T_A = -55^\circ\text{C}$<br>TO $125^\circ\text{C}$ |     | $T_A = -40^\circ\text{C}$<br>TO $85^\circ\text{C}$ |     | UNIT |
|---------------------------------------------------------|--------------------------|-----|-----------------------------------------------------|-----|----------------------------------------------------|-----|------|
|                                                         | MIN                      | MAX | MIN                                                 | MAX | MIN                                                | MAX |      |
| $f_{\text{clock}}$ Clock frequency                      |                          | 25  |                                                     | 17  |                                                    | 20  | MHz  |
| $t_w$ Pulse duration, CLKBA or CLKAB high or low        |                          | 25  |                                                     | 38  |                                                    | 31  | ns   |
| $t_{su}$ Setup time, A before CLKAB↑ or B before CLKBA↑ |                          | 12  |                                                     | 18  |                                                    | 15  | ns   |
| $t_h$ Hold time, A after CLKAB↑ or B after CLKBA↑       |                          | 5   |                                                     | 5   |                                                    | 5   | ns   |

# CD54HC646, CD74HCT646

## OCTAL BUS TRANSCEIVERS AND REGISTERS

### WITH 3-STATE OUTPUTS

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switching characteristics for CD54HC646 over recommended operating free-air temperature range (unless otherwise noted) (see Figure 2)

| PARAMETER        | FROM<br>(INPUT)        | TO<br>(OUTPUT) | LOAD<br>CAPACITANCE    | V <sub>CC</sub> | T <sub>A</sub> = 25°C |     |     | T <sub>A</sub> = –55°C<br>TO 125°C |     | T <sub>A</sub> = –40°C<br>TO 85°C |     | UNIT |
|------------------|------------------------|----------------|------------------------|-----------------|-----------------------|-----|-----|------------------------------------|-----|-----------------------------------|-----|------|
|                  |                        |                |                        |                 | MIN                   | TYP | MAX | MIN                                | MAX | MIN                               | MAX |      |
| f <sub>max</sub> |                        |                | C <sub>L</sub> = 50 pF | 2 V             | 6                     |     |     | 4                                  |     | 5                                 |     | MHz  |
|                  |                        |                |                        | 4.5 V           | 30                    |     |     | 20                                 |     | 25                                |     |      |
|                  |                        |                |                        | 6 V             | 35                    |     |     | 23                                 |     | 29                                |     |      |
|                  |                        |                | C <sub>L</sub> = 15 pF | 5 V             |                       | 60  |     |                                    |     |                                   |     |      |
| t <sub>pd</sub>  | CLKBA or<br>CLKAB      | A or B         | C <sub>L</sub> = 50 pF | 2 V             |                       |     | 220 |                                    | 330 |                                   | 275 | ns   |
|                  |                        |                |                        | 4.5 V           |                       |     | 44  |                                    | 66  |                                   | 55  |      |
|                  |                        |                |                        | 6 V             |                       |     | 37  |                                    | 56  |                                   | 47  |      |
|                  |                        |                | C <sub>L</sub> = 15 pF | 5 V             |                       | 18  |     |                                    |     |                                   |     |      |
|                  | A or B                 | B or A         | C <sub>L</sub> = 50 pF | 2 V             |                       |     | 135 |                                    | 205 |                                   | 170 |      |
|                  |                        |                |                        | 4.5 V           |                       |     | 27  |                                    | 41  |                                   | 34  |      |
|                  |                        |                |                        | 6 V             |                       |     | 23  |                                    | 35  |                                   | 29  |      |
|                  |                        |                | C <sub>L</sub> = 15 pF | 5 V             |                       | 12  |     |                                    |     |                                   |     |      |
|                  | SBA or<br>SAB†         | A or B         | C <sub>L</sub> = 50 pF | 2 V             |                       |     | 170 |                                    | 255 |                                   | 215 |      |
|                  |                        |                |                        | 4.5 V           |                       |     | 34  |                                    | 51  |                                   | 43  |      |
|                  |                        |                |                        | 6 V             |                       |     | 29  |                                    | 43  |                                   | 37  |      |
|                  |                        |                | C <sub>L</sub> = 15 pF | 5 V             |                       | 14  |     |                                    |     |                                   |     |      |
| t <sub>en</sub>  | $\overline{\text{OE}}$ | A or B         | C <sub>L</sub> = 50 pF | 2 V             |                       |     | 175 |                                    | 265 |                                   | 220 | ns   |
|                  |                        |                |                        | 4.5 V           |                       |     | 35  |                                    | 53  |                                   | 44  |      |
|                  |                        |                |                        | 6 V             |                       |     | 30  |                                    | 45  |                                   | 37  |      |
|                  |                        |                | C <sub>L</sub> = 15 pF | 5 V             |                       | 14  |     |                                    |     |                                   |     |      |
| t <sub>dis</sub> | $\overline{\text{OE}}$ | A or B         | C <sub>L</sub> = 50 pF | 2 V             |                       |     | 175 |                                    | 265 |                                   | 220 | ns   |
|                  |                        |                |                        | 4.5 V           |                       |     | 35  |                                    | 53  |                                   | 44  |      |
|                  |                        |                |                        | 6 V             |                       |     | 30  |                                    | 45  |                                   | 37  |      |
|                  |                        |                | C <sub>L</sub> = 15 pF | 5 V             |                       | 14  |     |                                    |     |                                   |     |      |
| t <sub>t</sub>   |                        | Any            | C <sub>L</sub> = 50 pF | 2 V             |                       |     | 60  |                                    | 90  |                                   | 75  | ns   |
|                  |                        |                |                        | 4.5 V           |                       |     | 12  |                                    | 18  |                                   | 15  |      |
|                  |                        |                |                        | 6 V             |                       |     | 10  |                                    | 15  |                                   | 13  |      |

† These parameters are measured with the internal output state of the storage register opposite that of the bus input.



**CD54HC646, CD74HCT646**  
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**switching characteristics for CD74HCT646 over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)**

| PARAMETER        | FROM<br>(INPUT)        | TO<br>(OUTPUT) | LOAD<br>CAPACITANCE    | V <sub>CC</sub> | T <sub>A</sub> = 25°C |     |     | T <sub>A</sub> = –55°C<br>TO 125°C |     | T <sub>A</sub> = –40°C<br>TO 85°C |     | UNIT |
|------------------|------------------------|----------------|------------------------|-----------------|-----------------------|-----|-----|------------------------------------|-----|-----------------------------------|-----|------|
|                  |                        |                |                        |                 | MIN                   | TYP | MAX | MIN                                | MAX | MIN                               | MAX |      |
| f <sub>max</sub> |                        |                | C <sub>L</sub> = 50 pF | 4.5 V           | 25                    |     |     | 17                                 |     | 20                                |     | MHz  |
|                  |                        |                | C <sub>L</sub> = 15 pF | 5 V             |                       | 45  |     |                                    |     |                                   |     |      |
| t <sub>pd</sub>  | CLKBA or<br>CLKAB      | A or B         | C <sub>L</sub> = 50 pF | 4.5 V           |                       |     | 44  |                                    | 66  |                                   | 55  | ns   |
|                  |                        |                | C <sub>L</sub> = 15 pF | 5 V             |                       | 18  |     |                                    |     |                                   |     |      |
|                  | A or B                 | B or A         | C <sub>L</sub> = 50 pF | 4.5 V           |                       |     | 37  |                                    | 56  |                                   | 46  |      |
|                  |                        |                | C <sub>L</sub> = 15 pF | 5 V             |                       | 15  |     |                                    |     |                                   |     |      |
|                  | SBA or<br>SAB†         | A or B         | C <sub>L</sub> = 50 pF | 4.5 V           |                       |     | 46  |                                    | 69  |                                   | 58  |      |
|                  |                        |                | C <sub>L</sub> = 15 pF | 5 V             |                       | 19  |     |                                    |     |                                   |     |      |
| t <sub>en</sub>  | $\overline{\text{OE}}$ | A or B         | C <sub>L</sub> = 50 pF | 4.5 V           |                       |     | 45  |                                    | 68  |                                   | 56  | ns   |
|                  |                        |                | C <sub>L</sub> = 15 pF | 5 V             |                       | 19  |     |                                    |     |                                   |     |      |
| t <sub>dis</sub> | $\overline{\text{OE}}$ | A or B         | C <sub>L</sub> = 50 pF | 4.5 V           |                       |     | 35  |                                    | 53  |                                   | 44  | ns   |
|                  |                        |                | C <sub>L</sub> = 15 pF | 5 V             |                       | 14  |     |                                    |     |                                   |     |      |
| t <sub>t</sub>   |                        |                | C <sub>L</sub> = 50 pF | 4.5 V           |                       |     | 12  |                                    | 18  |                                   | 15  | ns   |

† These parameters are measured with the internal output state of the storage register opposite that of the bus input.

**operating characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C**

| PARAMETER                                     | TYP | UNIT |
|-----------------------------------------------|-----|------|
| C <sub>pd</sub> Power dissipation capacitance | 52  | pF   |

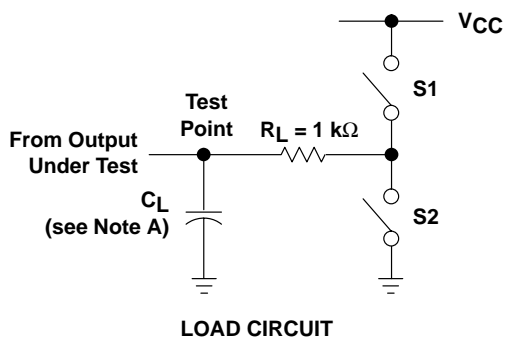
# CD54HC646, CD74HCT646

## OCTAL BUS TRANSCEIVERS AND REGISTERS

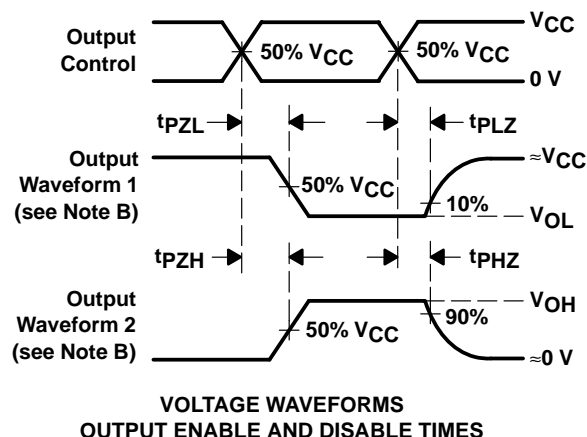
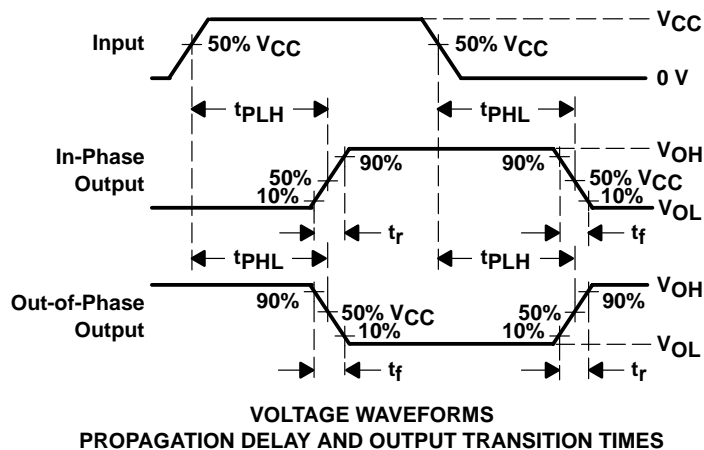
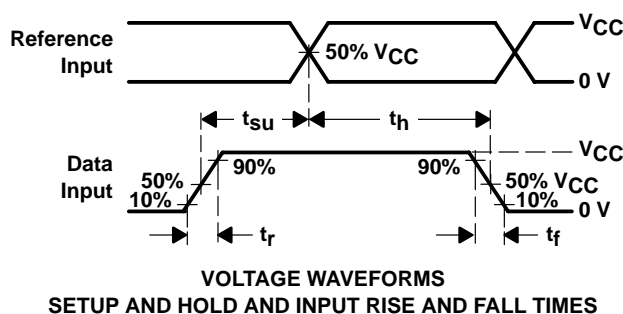
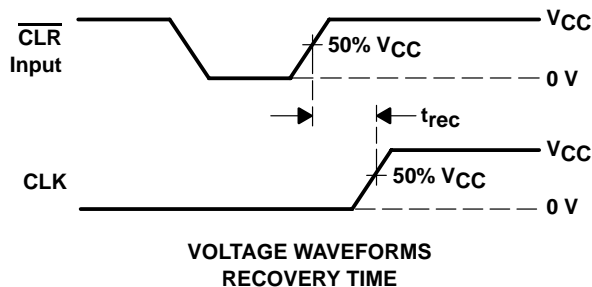
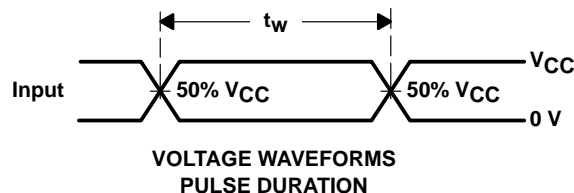
### WITH 3-STATE OUTPUTS

SCHS278B – APRIL 2003 – REVISED APRIL 2003

#### PARAMETER MEASUREMENT INFORMATION – CD54HC646



| PARAMETER         |           | S1     | S2     |
|-------------------|-----------|--------|--------|
| $t_{en}$          | $t_{PZH}$ | Open   | Closed |
|                   | $t_{PZL}$ | Closed | Open   |
| $t_{dis}$         | $t_{PHZ}$ | Open   | Closed |
|                   | $t_{PLZ}$ | Closed | Open   |
| $t_{pd}$ or $t_t$ |           | Open   | Open   |



NOTES: A.  $C_L$  includes probe and test-fixture 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. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r = 6\text{ ns}$ ,  $t_f = 6\text{ ns}$ .

D. For clock inputs,  $f_{max}$  is measured with the input duty cycle at 50%.

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

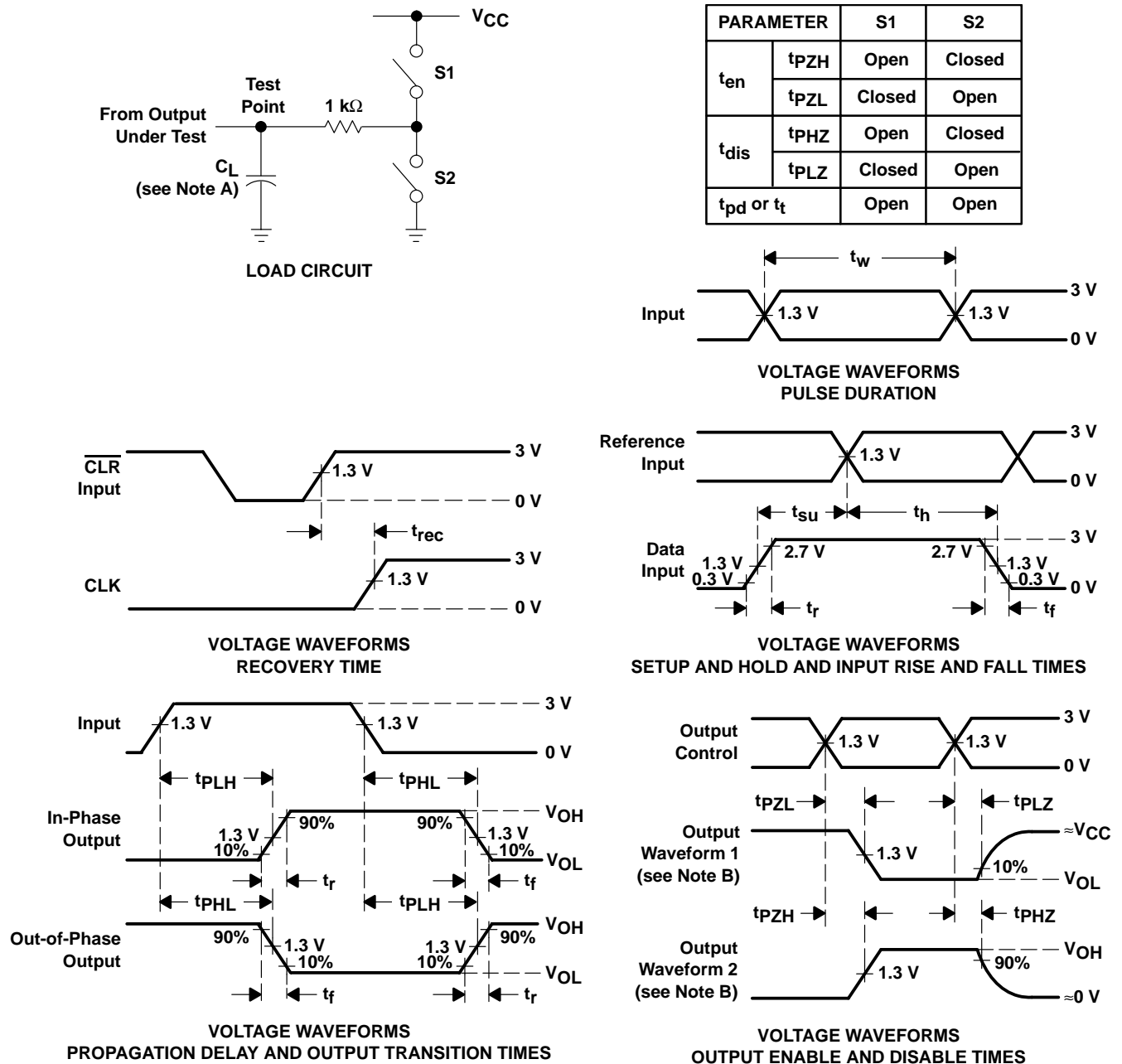
F.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .

G.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .

H.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

Figure 2. Load Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION – CD74HCT646



- NOTES: A. C<sub>L</sub> includes probe and test-fixture 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. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z<sub>O</sub> = 50 Ω, t<sub>r</sub> = 6 ns, t<sub>f</sub> = 6 ns.  
D. For clock inputs, f<sub>max</sub> is measured with the input duty cycle at 50%.  
E. The outputs are measured one at a time with one input transition per measurement.  
F. t<sub>PLZ</sub> and t<sub>PHZ</sub> are the same as t<sub>dis</sub>.  
G. t<sub>PZL</sub> and t<sub>PZH</sub> are the same as t<sub>en</sub>.  
H. t<sub>PLH</sub> and t<sub>PHL</sub> are the same as t<sub>pd</sub>.

Figure 3. 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/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| 5962-8688501JA   | ACTIVE                | CDIP         | J               | 24   | 1           | TBD                        | Call TI              | Call TI                      |                             |
| CD54HC646F3A     | ACTIVE                | CDIP         | J               | 24   | 1           | TBD                        | Call TI              | N / A for Pkg Type           |                             |
| CD74HCT646M96    | ACTIVE                | SOIC         | DW              | 24   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| CD74HCT646M96E4  | ACTIVE                | SOIC         | DW              | 24   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| CD74HCT646M96G4  | ACTIVE                | SOIC         | DW              | 24   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |

<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), 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)

<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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**OTHER QUALIFIED VERSIONS OF CD54HC646 :**

- Catalog: [CD74HC646](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

**TAPE AND REEL INFORMATION**



\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD74HCT646M96 | SOIC         | DW              | 24   | 2000 | 330.0              | 24.4               | 10.75   | 15.7    | 2.7     | 12.0    | 24.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**

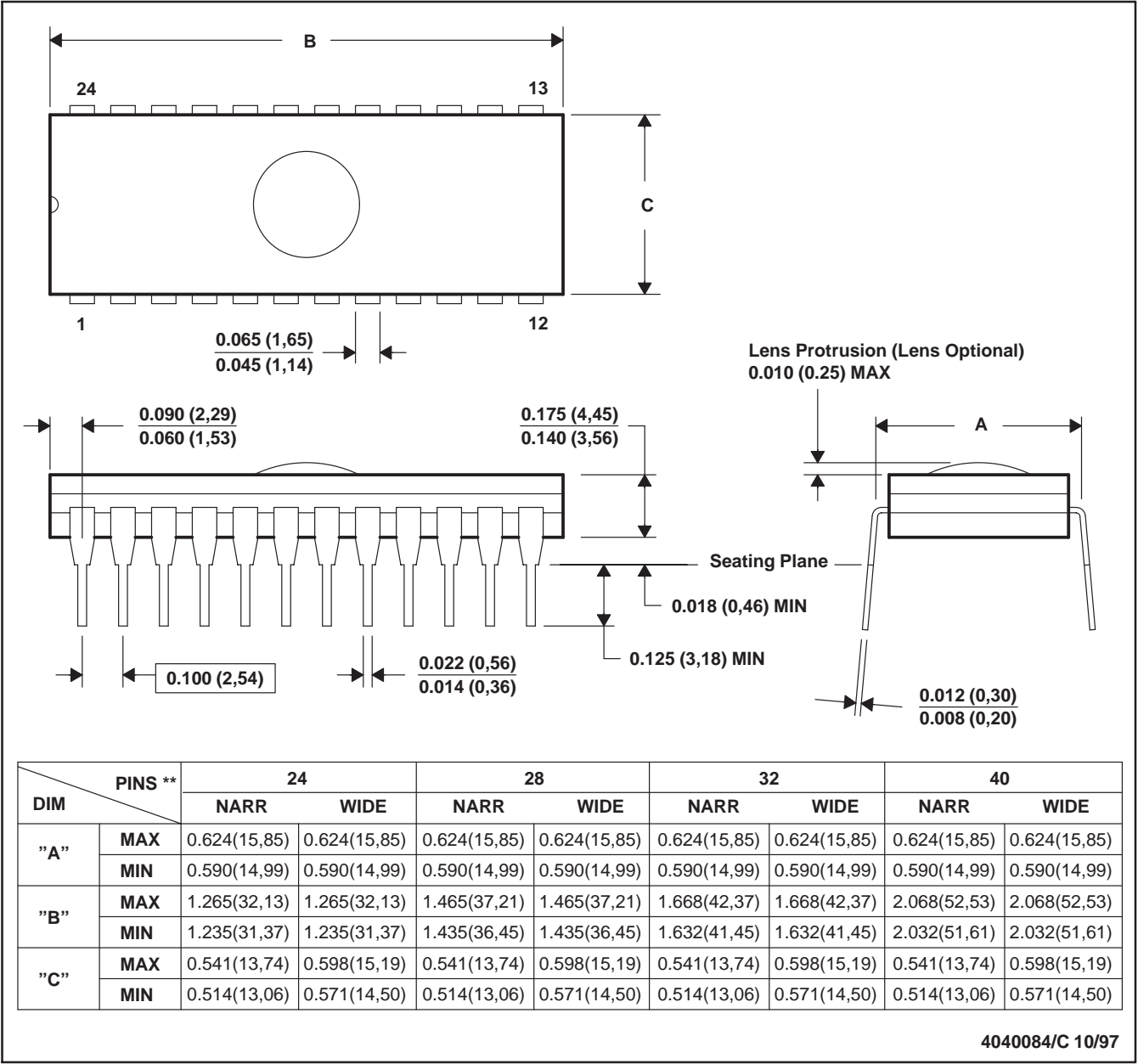


\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CD74HCT646M96 | SOIC         | DW              | 24   | 2000 | 346.0       | 346.0      | 41.0        |

J (R-GDIP-T\*\*)
24 PINS SHOWN

CERAMIC DUAL-IN-LINE PACKAGE

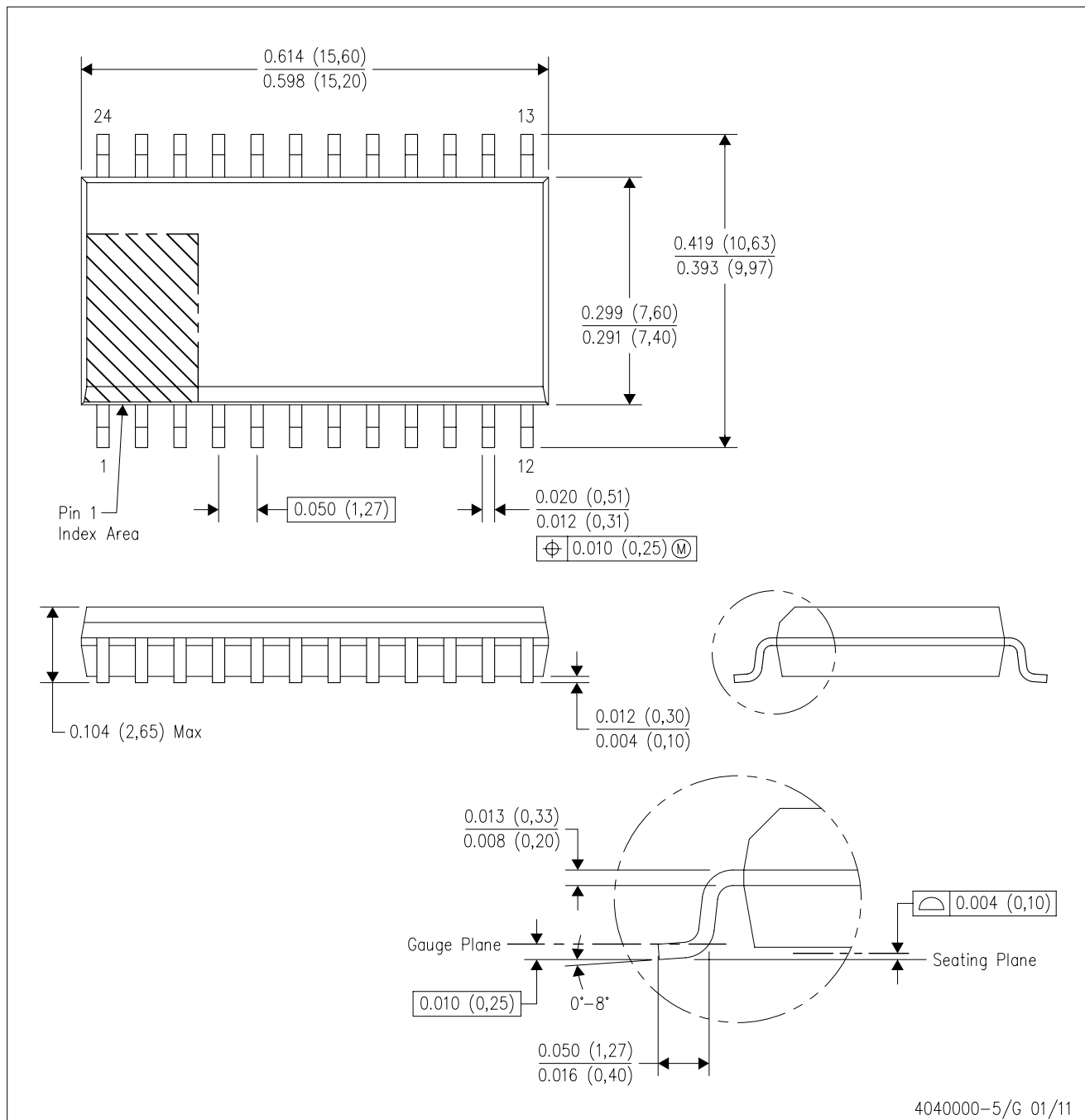


- NOTES: A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Window (lens) added to this group of packages (24-, 28-, 32-, 40-pin).
- D. This package can be hermetically sealed with a ceramic lid using glass frit.
- E. Index point is provided on cap for terminal identification.



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.

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