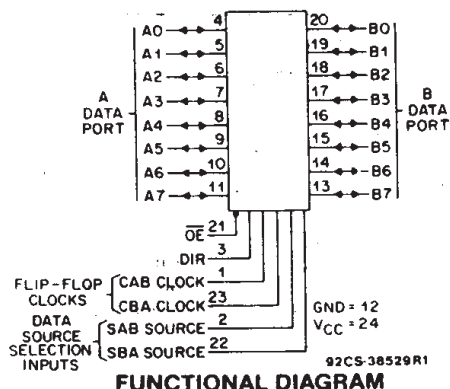


# CD54/74AC646, CD54/74AC648 CD54/74ACT646, CD54/74ACT648



Data sheet acquired from Harris Semiconductor  
SCHS293



## Octal-Bus Transceiver/Registers, 3-State

CD54/74AC/ACT646 - Non-Inverting

CD54/74AC/ACT648 - Inverting

### Type Features:

- Buffered inputs
- Typical propagation delay:  
5.3 ns @  $V_{CC} = 5V$ ,  $T_A = 25^\circ C$ ,  $C_L = 50 pF$

### Family Features:

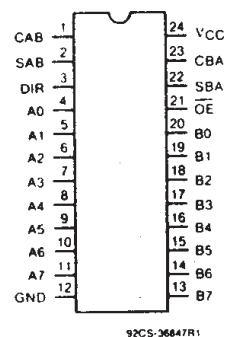
- Exceeds 2-kV ESD Protection - MIL-STD-883, Method 3015
- SCR-Latchup-resistant CMOS process and circuit design
- Speed of bipolar FAST<sup>®</sup>/AS/S with significantly reduced power consumption
- Balanced propagation delays
- AC types feature 1.5-V to 5.5-V operation and balanced noise immunity at 30% of the supply
- $\pm 24$ -mA output drive current
  - Fanout to 15 FAST<sup>®</sup> ICs
  - Drives 50-ohm transmission lines

\*FAST is a Registered Trademark of Fairchild Semiconductor Corp.

The RCA CD54/74AC646 and CD54/74AC648 and the CD54/74ACT646 and CD54/74ACT648 3-state, octal-bus transceiver/registers use the RCA ADVANCED CMOS technology. The CD54/74AC648 and CD54/74ACT648 have inverting outputs. The CD54/74AC646 and CD54/74ACT646 have non-inverting outputs. These devices are bus transceivers with D-type flip-flops which act as internal storage registers on the LOW-to-HIGH transition of either CAB or CBA clock inputs. Output Enable (OE) and Direction (DIR) inputs control the transceiver functions. Data present at the high-impedance output can be stored in either register or both but only one of the two buses can be enabled as outputs at any one time. The Select controls (SAB and SBA) can multiplex stored and transparent (real time) data. The Direction control determines which data bus will receive data when the Output Enable (OE) is LOW. In the high-impedance mode (Output Enable HIGH), A data can be stored in one register and B data can be stored in the other register. The clocks are not gated with the Direction (DIR) and Output Enable (OE) terminals; data at the A or B terminals can be clocked into the storage flip-flops at any time.

The CD74AC/ACT646 and CD74AC/ACT648 are supplied in 24-lead dual-in-line narrow-body plastic packages (EN suffix) and in 24-lead dual-in-line small-outline plastic packages (M suffix). Both package types are operable over the following temperature ranges: Commercial (0 to 70°C); Industrial (-40 to +85°C); and Extended Industrial/Military (-55 to +125°C).

The CD54AC/ACT646 and CD54AC/ACT648, available in chip form (H suffix), are operable over the -55 to +125°C temperature range.



### TERMINAL ASSIGNMENT

This data sheet is applicable to the CD74AC646 and CD74ACT646. The CD54AC646, CD54/74AC648, CD54ACT646, and CD54/74ACT648 were not acquired from Harris Semiconductor.

File Number 1970

# CD54/74AC646, CD54/74AC648

## CD54/74ACT646, CD54/74ACT648

FUNCTION TABLE

| INPUTS |     |        |        |     |     | DATA I/O#     |               | OPERATION OR FUNCTION     |                                   |
|--------|-----|--------|--------|-----|-----|---------------|---------------|---------------------------|-----------------------------------|
| OE     | DIR | CAB    | CBA    | SAB | SBA | A0 THRU A7    | B0 THRU B7    | 646                       | 648                               |
| X      | X   |        | X      | X   | X   | Input         | Not specified | Store A, B unspecified    | Store A, B unspecified            |
| X      | X   | X      |        | X   | X   | Not specified | Input         | Store B, A unspecified    | Store B, A unspecified            |
| H      | X   |        |        | X   | X   | Input         | Input         | Store A and B Data        | Store A and B Data                |
| H      | X   | H or L | H or L | X   | X   |               |               | Isolation, hold storage   | Isolation, hold storage           |
| L      | L   | X      | X      | X   | L   | Output        | Input         | Real-Time B Data to A Bus | Real-Time $\bar{B}$ Data to A Bus |
| L      | L   | X      | H or L | X   | H   |               |               | Stored B Data to A Bus    | Stored $\bar{B}$ Data to A Bus    |
| L      | H   | X      | X      | L   | X   | Input         | Output        | Real-Time A Data to B Bus | Real-Time $\bar{A}$ Data to B Bus |
| L      | H   | H or L | X      | H   | X   |               |               | Stored A Data to B Bus    | Stored $\bar{A}$ Data to B Bus    |

#The data output functions may be enabled or disabled by various signals at the OE and DIR inputs. Data input functions are always enabled, i.e., data at the bus pins will be stored on every low-to-high transition on the clock inputs.

To prevent excess currents in the High-Z modes, all I/O terminals should be terminated with 10 kΩ resistors.

**MAXIMUM RATINGS, Absolute-Maximum Values:**

|                                                                                                       |                                                     |
|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| DC SUPPLY-VOLTAGE ( $V_{CC}$ )                                                                        | -0.5 to 6 V                                         |
| DC INPUT DIODE CURRENT, $I_{IK}$ (for $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V)                       | ±20 mA                                              |
| DC OUTPUT DIODE CURRENT, $I_{OK}$ (for $V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V)                      | ±50 mA                                              |
| DC OUTPUT SOURCE OR SINK CURRENT per Output Pin, $I_O$ (for $V_O > -0.5$ V or $V_O < V_{CC} + 0.5$ V) | ±50 mA                                              |
| DC $V_{CC}$ or GROUND CURRENT ( $I_{CC}$ or $I_{GND}$ )                                               | ±100 mA*                                            |
| POWER DISSIPATION PER PACKAGE ( $P_D$ ):                                                              |                                                     |
| For $T_A = -55$ to $+100^\circ\text{C}$ (PACKAGE TYPE E)                                              | 500 mW                                              |
| For $T_A = +100$ to $+125^\circ\text{C}$ (PACKAGE TYPE E)                                             | Derate Linearly at 8 mW/ $^\circ\text{C}$ to 300 mW |
| For $T_A = -55$ to $+70^\circ\text{C}$ (PACKAGE TYPE M)                                               | 400 mW                                              |
| For $T_A = +70$ to $+125^\circ\text{C}$ (PACKAGE TYPE M)                                              | Derate Linearly at 6 mW/ $^\circ\text{C}$ to 70 mW  |
| OPERATING-TEMPERATURE RANGE ( $T_A$ )                                                                 | -55 to $+125^\circ\text{C}$                         |
| STORAGE TEMPERATURE ( $T_{stg}$ )                                                                     | -65 to $+150^\circ\text{C}$                         |
| LEAD TEMPERATURE (DURING SOLDERING):                                                                  |                                                     |
| At distance 1/16 ± 1/32 in. (1.59 ± 0.79 mm) from case for 10 s maximum                               | +265 $^\circ\text{C}$                               |
| Unit inserted into PC board min. thickness 1/16 in. (1.59 mm) with solder contacting lead tips only   | +300 $^\circ\text{C}$                               |

\*For up to 4 outputs per device; add ± 25 mA for each additional output.

**RECOMMENDED OPERATING CONDITIONS:**

For maximum reliability, normal operating conditions should be selected so that operation is always within the following ranges:

| CHARACTERISTICS                                                                   | LIMITS |          | UNITS            |
|-----------------------------------------------------------------------------------|--------|----------|------------------|
|                                                                                   | MIN.   | MAX.     |                  |
| Supply-Voltage Range, $V_{CC}$ *:<br>(For $T_A$ = Full Package-Temperature Range) |        |          |                  |
| AC Types                                                                          | 1.5    | 5.5      | V                |
| ACT Types                                                                         | 4.5    | 5.5      | V                |
| DC Input or Output Voltage, $V_I$ , $V_O$                                         | 0      | $V_{CC}$ | V                |
| Operating Temperature, $T_A$                                                      | -55    | +125     | $^\circ\text{C}$ |
| Input Rise and Fall Slew Rate, $dt/dv$                                            |        |          |                  |
| at 1.5 V to 3 V (AC Types)                                                        | 0      | 50       | ns/V             |
| at 3.6 V to 5.5 V (AC Types)                                                      | 0      | 20       | ns/V             |
| at 4.5 V to 5.5 V (ACT Types)                                                     | 0      | 10       | ns/V             |

\*Unless otherwise specified, all voltages are referenced to ground.

# CD54/74AC646, CD54/74AC648

## CD54/74ACT646, CD54/74ACT648

## STATIC ELECTRICAL CHARACTERISTICS: AC Series

| CHARACTERISTICS               |          | TEST CONDITIONS                                                |               | $V_{CC}$<br>(V) | AMBIENT TEMPERATURE ( $T_A$ ) - °C |                    |                    |                    |                    |                    | UNITS |
|-------------------------------|----------|----------------------------------------------------------------|---------------|-----------------|------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|-------|
|                               |          |                                                                |               |                 | +25                                |                    | -40 to +85         |                    | -55 to +125        |                    |       |
|                               |          | $V_i$<br>(V)                                                   | $I_o$<br>(mA) |                 | MIN.                               | MAX.               | MIN.               | MAX.               | MIN.               | MAX.               |       |
| High-Level Input Voltage      | $V_{IH}$ |                                                                |               | 1.5<br>3<br>5.5 | 1.2<br>2.1<br>3.85                 | —<br>—<br>—        | 1.2<br>2.1<br>3.85 | —<br>—<br>—        | 1.2<br>2.1<br>3.85 | —<br>—<br>—        | V     |
| Low-Level Input Voltage       | $V_{IL}$ |                                                                |               | 1.5<br>3<br>5.5 | —<br>—<br>—                        | 0.3<br>0.9<br>1.65 | —<br>—<br>—        | 0.3<br>0.9<br>1.65 | —<br>—<br>—        | 0.3<br>0.9<br>1.65 | V     |
| High-Level Output Voltage     | $V_{OH}$ | $V_{IH}$<br>or<br>$V_{IL}$                                     | -0.05         | 1.5             | 1.4                                | —                  | 1.4                | —                  | 1.4                | —                  | V     |
|                               |          |                                                                | -0.05         | 3               | 2.9                                | —                  | 2.9                | —                  | 2.9                | —                  |       |
|                               |          |                                                                | -0.05         | 4.5             | 4.4                                | —                  | 4.4                | —                  | 4.4                | —                  |       |
|                               |          |                                                                | -4            | 3               | 2.58                               | —                  | 2.48               | —                  | 2.4                | —                  |       |
|                               |          |                                                                | -24           | 4.5             | 3.94                               | —                  | 3.8                | —                  | 3.7                | —                  |       |
|                               |          | #, * {                                                         | -75           | 5.5             | —                                  | —                  | 3.85               | —                  | —                  | —                  |       |
|                               |          |                                                                | -50           | 5.5             | —                                  | —                  | —                  | —                  | 3.85               | —                  |       |
| Low-Level Output Voltage      | $V_{OL}$ | $V_{IH}$<br>or<br>$V_{IL}$                                     | 0.05          | 1.5             | —                                  | 0.1                | —                  | 0.1                | —                  | 0.1                | V     |
|                               |          |                                                                | 0.05          | 3               | —                                  | 0.1                | —                  | 0.1                | —                  | 0.1                |       |
|                               |          |                                                                | 0.05          | 4.5             | —                                  | 0.1                | —                  | 0.1                | —                  | 0.1                |       |
|                               |          |                                                                | 12            | 3               | —                                  | 0.36               | —                  | 0.44               | —                  | 0.5                |       |
|                               |          |                                                                | 24            | 4.5             | —                                  | 0.36               | —                  | 0.44               | —                  | 0.5                |       |
|                               |          | #, * {                                                         | 75            | 5.5             | —                                  | —                  | —                  | 1.65               | —                  | —                  |       |
|                               |          |                                                                | 50            | 5.5             | —                                  | —                  | —                  | —                  | —                  | 1.65               |       |
| Input Leakage Current         | $I_i$    | $V_{CC}$<br>or<br>GND                                          |               | 5.5             | —                                  | ±0.1               | —                  | ±1                 | —                  | ±1                 | μA    |
| 3-State Leakage Current       | $I_{OZ}$ | $V_{IH}$<br>or<br>$V_{IL}$<br>$V_O =$<br>$V_{CC}$<br>or<br>GND |               | 5.5             | —                                  | ±0.5               | —                  | ±5                 | —                  | ±10                | μA    |
| Quiescent Supply Current, MSI | $I_{CC}$ | $V_{CC}$<br>or<br>GND                                          | 0             | 5.5             | —                                  | 8                  | —                  | 80                 | —                  | 160                | μA    |

#Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.

\*Test verifies a minimum 50-ohm transmission-line-drive capability at +85°C, 75 ohms at +125°C.

# CD54/74AC646, CD54/74AC648

## CD54/74ACT646, CD54/74ACT648

### STATIC ELECTRICAL CHARACTERISTICS: ACT Series

| CHARACTERISTICS                                                                                         | TEST CONDITIONS                                                               |                        | V <sub>CC</sub><br>(V) | AMBIENT TEMPERATURE (T <sub>A</sub> ) - °C |      |            |      |             |      | UNITS |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------|------------------------|--------------------------------------------|------|------------|------|-------------|------|-------|
|                                                                                                         | V <sub>I</sub><br>(V)                                                         | I <sub>O</sub><br>(mA) |                        | +25                                        |      | -40 to +85 |      | -55 to +125 |      |       |
|                                                                                                         |                                                                               |                        |                        | MIN.                                       | MAX. | MIN.       | MAX. | MIN.        | MAX. |       |
| High-Level Input Voltage<br>V <sub>IH</sub>                                                             |                                                                               |                        | 4.5 to 5.5             | 2                                          | —    | 2          | —    | 2           | —    | V     |
| Low-Level Input Voltage<br>V <sub>IL</sub>                                                              |                                                                               |                        | 4.5 to 5.5             | —                                          | 0.8  | —          | 0.8  | —           | 0.8  | V     |
| High-Level Output Voltage<br>V <sub>OH</sub>                                                            | V <sub>IH</sub> or V <sub>IL</sub><br>#, * }                                  | -0.05                  | 4.5                    | 4.4                                        | —    | 4.4        | —    | 4.4         | —    | V     |
|                                                                                                         |                                                                               | -24                    | 4.5                    | 3.94                                       | —    | 3.8        | —    | 3.7         | —    |       |
|                                                                                                         |                                                                               | -75                    | 5.5                    | —                                          | —    | 3.85       | —    | —           | —    |       |
|                                                                                                         |                                                                               | -50                    | 5.5                    | —                                          | —    | —          | —    | 3.85        | —    |       |
| Low-Level Output Voltage<br>V <sub>OL</sub>                                                             | V <sub>IH</sub> or V <sub>IL</sub><br>#, * }                                  | 0.05                   | 4.5                    | —                                          | 0.1  | —          | 0.1  | —           | 0.1  | V     |
|                                                                                                         |                                                                               | 24                     | 4.5                    | —                                          | 0.36 | —          | 0.44 | —           | 0.5  |       |
|                                                                                                         |                                                                               | 75                     | 5.5                    | —                                          | —    | —          | 1.65 | —           | —    |       |
|                                                                                                         |                                                                               | 50                     | 5.5                    | —                                          | —    | —          | —    | —           | 1.65 |       |
| Input Leakage Current<br>I <sub>I</sub>                                                                 | V <sub>CC</sub> or GND                                                        |                        | 5.5                    | —                                          | ±0.1 | —          | ±1   | —           | ±1   | μA    |
| 3-State Leakage Current<br>I <sub>OZ</sub>                                                              | V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = V <sub>CC</sub> or GND |                        | 5.5                    | —                                          | ±0.5 | —          | ±5   | —           | ±10  | μA    |
| Quiescent Supply Current, MSI<br>I <sub>CC</sub>                                                        | V <sub>CC</sub> or GND                                                        | 0                      | 5.5                    | —                                          | 8    | —          | 80   | —           | 160  | μA    |
| Additional Quiescent Supply Current per Input Pin<br>TTL Inputs High<br>1 Unit Load<br>ΔI <sub>CC</sub> | V <sub>CC</sub> -2.1                                                          |                        | 4.5 to 5.5             | —                                          | 2.4  | —          | 2.8  | —           | 3    | mA    |

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#Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.

\*Test verifies a minimum 50-ohm transmission-line-drive capability at +85°C. 75 ohms at +125°C.

#### ACT INPUT LOADING TABLE

| INPUT    | UNIT LOAD* |
|----------|------------|
| CAB, CBA | 1.25       |
| SAB, SBA | 1.2        |
| DIR      | 0.67       |
| OE       | 1.17       |
| An, Bn   | 0.4        |

\*Unit load is  $\Delta I_{CC}$  limit specified in Static Characteristics Chart, e.g., 2.4 mA max. @ 25°C.

# CD54/74AC646, CD54/74AC648

## CD54/74ACT646, CD54/74ACT648

PREREQUISITE FOR SWITCHING: AC Series

| CHARACTERISTICS             | SYMBOL           | V <sub>cc</sub><br>(V) | AMBIENT TEMPERATURE (T <sub>A</sub> ) - °C |      |             |      | UNITS |
|-----------------------------|------------------|------------------------|--------------------------------------------|------|-------------|------|-------|
|                             |                  |                        | -40 to +85                                 |      | -55 to +125 |      |       |
|                             |                  |                        | MIN.                                       | MAX. | MIN.        | MAX. |       |
| Max. Frequency              | f <sub>max</sub> | 1.5                    | 11                                         | —    | 10          | —    | MHz   |
|                             |                  | 3.3*                   | 101                                        | —    | 89          | —    |       |
|                             |                  | 5†                     | 143                                        | —    | 125         | —    |       |
| Setup Time<br>Data to Clock | t <sub>su</sub>  | 1.5                    | 27                                         | —    | 31          | —    | ns    |
|                             |                  | 3.3                    | 3.1                                        | —    | 3.5         | —    |       |
|                             |                  | 5                      | 2.2                                        | —    | 2.5         | —    |       |
| Hold Time<br>Data to Clock  | t <sub>h</sub>   | 1.5                    | 2                                          | —    | 2           | —    | ns    |
|                             |                  | 3.3                    | 2                                          | —    | 2           | —    |       |
|                             |                  | 5                      | 2                                          | —    | 2           | —    |       |
| Clock Pulse Width           | t <sub>w</sub>   | 1.5                    | 44                                         | —    | 50          | —    | ns    |
|                             |                  | 3.3                    | 4.9                                        | —    | 5.6         | —    |       |
|                             |                  | 5                      | 3.5                                        | —    | 4           | —    |       |

\*3.3 V: min. is @ 3 V

†5 V: min is @ 4.5 V

SWITCHING CHARACTERISTICS: AC Series; t<sub>r</sub>, t<sub>f</sub> = 3 ns, C<sub>L</sub> = 50 pF

| CHARACTERISTICS                                                                               | SYMBOL                                               | V <sub>CC</sub><br>(V) | AMBIENT TEMPERATURE (T <sub>A</sub> ) - °C |      |             |      | UNITS |
|-----------------------------------------------------------------------------------------------|------------------------------------------------------|------------------------|--------------------------------------------|------|-------------|------|-------|
|                                                                                               |                                                      |                        | -40 to +85                                 |      | -55 to +125 |      |       |
|                                                                                               |                                                      |                        | MIN.                                       | MAX. | MIN.        | MAX. |       |
| Propagation Delays:                                                                           |                                                      |                        |                                            |      |             |      |       |
| Store A Data to B Bus                                                                         | t <sub>PLH</sub>                                     | 1.5                    | —                                          | 154  | —           | 169  | ns    |
| Store B Data to A Bus                                                                         | t <sub>PHL</sub>                                     | 3.3*                   | 4.8                                        | 17.1 | 4.7         | 18.9 |       |
| 646                                                                                           |                                                      | 5†                     | 3.5                                        | 12.3 | 3.4         | 13.5 |       |
| Store $\bar{A}$ Data to B Bus                                                                 | t <sub>PLH</sub>                                     | 1.5                    | —                                          | 154  | —           | 169  | ns    |
| Store $\bar{B}$ Data to A Bus                                                                 | t <sub>PHL</sub>                                     | 3.3                    | 4.8                                        | 17.1 | 4.7         | 18.9 |       |
| 648                                                                                           |                                                      | 5                      | 3.5                                        | 12.3 | 3.4         | 13.5 |       |
| A Data to B Bus                                                                               | t <sub>PLH</sub>                                     | 1.5                    | —                                          | 125  | —           | 138  | ns    |
| B Data to A Bus                                                                               | t <sub>PHL</sub>                                     | 3.3                    | 4                                          | 14   | 3.9         | 15.4 |       |
| 646                                                                                           |                                                      | 5                      | 2.8                                        | 10   | 2.8         | 11   |       |
| $\bar{A}$ Data to B Bus                                                                       | t <sub>PLH</sub>                                     | 1.5                    | —                                          | 125  | —           | 138  | ns    |
| $\bar{B}$ Data to A Bus                                                                       | t <sub>PHL</sub>                                     | 3.3                    | 4                                          | 14   | 3.9         | 15.4 |       |
| 648                                                                                           |                                                      | 5                      | 2.8                                        | 10   | 2.8         | 11   |       |
| Select to Data                                                                                | t <sub>PLH</sub>                                     | 1.5                    | —                                          | 136  | —           | 150  | ns    |
| 646                                                                                           | t <sub>PHL</sub>                                     | 3.3                    | 4.3                                        | 15.3 | 4.2         | 16.8 |       |
|                                                                                               |                                                      | 5                      | 3.1                                        | 10.9 | 3           | 12   |       |
| Select to Data                                                                                | t <sub>PLH</sub>                                     | 1.5                    | —                                          | 136  | —           | 150  | ns    |
| 648                                                                                           | t <sub>PHL</sub>                                     | 3.3                    | 4.3                                        | 15.3 | 4.2         | 16.8 |       |
|                                                                                               |                                                      | 5                      | 3.1                                        | 10.9 | 3           | 12   |       |
| 3-State Enabling/<br>Disabling Time                                                           | t <sub>PZL</sub>                                     | 1.5                    | —                                          | 154  | —           | 169  | ns    |
| Bus to Output or                                                                              | t <sub>PZH</sub>                                     | 3.3                    | 5.2                                        | 18.4 | 5.1         | 20.2 |       |
| Register to Output                                                                            | t <sub>PLZ</sub>                                     | 5                      | 3.5                                        | 12.3 | 3.4         | 13.5 |       |
|                                                                                               | t <sub>PHZ</sub>                                     |                        |                                            |      |             |      |       |
| Power Dissipation Capacitance                                                                 | C <sub>PD</sub> §                                    | —                      | 150 Typ.                                   |      | 150 Typ.    |      | pF    |
| Min. (Valley)<br>During Switching of<br>Other Outputs (Output<br>Under Test Not<br>Switching) | V <sub>OH</sub><br>V <sub>OHV</sub><br>See<br>Fig. 1 | 5                      | 4 Typ. @ 25°C                              |      |             |      | V     |
| Max. (Peak)<br>During Switching of<br>Other Outputs (Output<br>Under Test Not<br>Switching)   | V <sub>OL</sub><br>V <sub>OLP</sub><br>See<br>Fig. 1 | 5                      | 1 Typ. @ 25°C                              |      |             |      | V     |
| Input Capacitance                                                                             | C <sub>I</sub>                                       | —                      | —                                          | 10   | —           | 10   | pF    |
| 3-State Output Capacitance                                                                    | C <sub>O</sub>                                       | —                      | —                                          | 15   | —           | 15   | pF    |

\*3.3 V: min. is @ 3.6 V  
max. is @ 3 V†5 V: min. is @ 5.5 V  
max. is @ 4.5 V§C<sub>PD</sub> is used to determine the dynamic power consumption, per package.P<sub>D</sub> = V<sub>CC</sub><sup>2</sup> C<sub>PD</sub> f<sub>i</sub> + Σ (V<sub>CC</sub><sup>2</sup> C<sub>L</sub> f<sub>o</sub>) where f<sub>i</sub> = input frequencyf<sub>o</sub> = output frequencyC<sub>L</sub> = output load capacitanceV<sub>CC</sub> = supply voltage.

# CD54/74AC646, CD54/74AC648

## CD54/74ACT646, CD54/74ACT648

## PREREQUISITE FOR SWITCHING: ACT Series

| CHARACTERISTICS             | SYMBOL           | V <sub>CC</sub><br>(V) | AMBIENT TEMPERATURE (T <sub>A</sub> ) - °C |      |             |      | UNITS |
|-----------------------------|------------------|------------------------|--------------------------------------------|------|-------------|------|-------|
|                             |                  |                        | -40 to +85                                 |      | -55 to +125 |      |       |
|                             |                  |                        | MIN.                                       | MAX. | MIN.        | MAX. |       |
| Max. Frequency              | f <sub>max</sub> | 5*                     | 125                                        | —    | 110         | —    | MHz   |
| Setup Time<br>Data to Clock | t <sub>su</sub>  | 5                      | 2.2                                        | —    | 2.5         | —    | ns    |
| Hold Time<br>Data to Clock  | t <sub>h</sub>   | 5                      | 2                                          | —    | 2           | —    | ns    |
| Clock Pulse Width           | t <sub>w</sub>   | 5                      | 3.9                                        | —    | 4.5         | —    | ns    |

\*5 V: min. is @ 4.5 V

SWITCHING CHARACTERISTICS: ACT Series; t<sub>r</sub>, t<sub>f</sub> = 3 ns, C<sub>L</sub> = 50 pF

| CHARACTERISTICS                                                                               | SYMBOL                                                                       | V <sub>CC</sub><br>(V) | AMBIENT TEMPERATURE (T <sub>A</sub> ) - °C |      |             |      | UNITS |
|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------------|--------------------------------------------|------|-------------|------|-------|
|                                                                                               |                                                                              |                        | -40 to +85                                 |      | -55 to +125 |      |       |
|                                                                                               |                                                                              |                        | MIN.                                       | MAX. | MIN.        | MAX. |       |
| Propagation Delays:<br>Store A Data to B Bus<br>Store B Data to A Bus<br>646                  | t <sub>PLH</sub><br>t <sub>PHL</sub>                                         | 5*                     | 4                                          | 14.1 | 3.9         | 15.5 | ns    |
| Store $\bar{A}$ Data to B Bus<br>Store $\bar{B}$ Data to A Bus<br>648                         | t <sub>PLH</sub><br>t <sub>PHL</sub>                                         | 5                      | 4                                          | 14.1 | 3.9         | 15.5 | ns    |
| A Data to B Bus<br>B Data to A Bus<br>646                                                     | t <sub>PLH</sub><br>t <sub>PHL</sub>                                         | 5                      | 3.2                                        | 11.4 | 3.1         | 12.5 | ns    |
| $\bar{A}$ Data to B Bus<br>$\bar{B}$ Data to A Bus<br>648                                     | t <sub>PLH</sub><br>t <sub>PHL</sub>                                         | 5                      | 3.2                                        | 11.4 | 3.1         | 12.5 | ns    |
| Select to Data<br>646                                                                         | t <sub>PLH</sub><br>t <sub>PHL</sub>                                         | 5                      | 3.7                                        | 13.2 | 3.6         | 14.5 | ns    |
| Select to Data<br>648                                                                         | t <sub>PLH</sub><br>t <sub>PHL</sub>                                         | 5                      | 4                                          | 14.1 | 3.9         | 15.5 | ns    |
| 3-State Enabling/<br>Disabling Time<br>Bus to Output or<br>Register to Output                 | t <sub>PZL</sub><br>t <sub>PZH</sub><br>t <sub>PLZ</sub><br>t <sub>PHZ</sub> | 5                      | 4                                          | 14.1 | 3.9         | 15.5 | ns    |
| Power Dissipation Capacitance                                                                 | C <sub>PD</sub> §                                                            | —                      | 150 Typ.                                   |      | 150 Typ.    |      | pF    |
| Min. (Valley)<br>During Switching of<br>Other Outputs (Output<br>Under Test Not<br>Switching) | V <sub>OH</sub><br><br>V <sub>OHV</sub><br>See<br>Fig. 1                     | 5                      | 4 Typ. @ 25°C                              |      |             |      | V     |
| Max. (Peak)<br>During Switching of<br>Other Outputs (Output<br>Under Test Not<br>Switching)   | V <sub>OL</sub><br><br>V <sub>OLP</sub><br>See<br>Fig. 1                     | 5                      | 1 Typ. @ 25°C                              |      |             |      | V     |
| Input Capacitance                                                                             | C <sub>I</sub>                                                               | —                      | —                                          | 10   | —           | 10   | pF    |
| 3-State Output Capacitance                                                                    | C <sub>O</sub>                                                               | —                      | —                                          | 15   | —           | 15   | pF    |

\*5 V: min. is @ 5.5 V  
max. is @ 4.5 V§C<sub>PD</sub> is used to determine the dynamic power consumption, per package.

$$P_D = C_{PD} V_{CC}^2 f_i + \sum (C_L V_{CC}^2 f_o) + V_{CC} \Delta I_{CC} \text{ where } f_i = \text{input frequency}$$

$$f_o = \text{output frequency}$$

$$C_L = \text{output load capacitance}$$

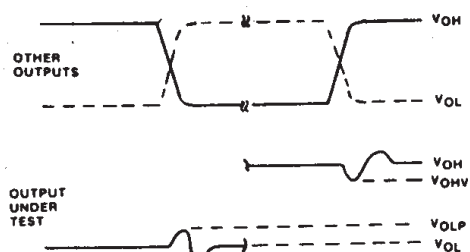
$$V_{CC} = \text{supply voltage.}$$

# Technical Data

## CD54/74AC646, CD54/74AC648

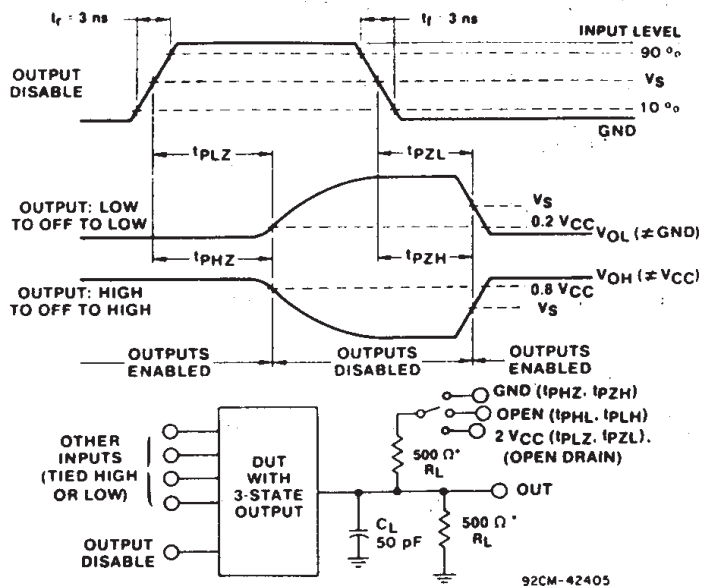
## CD54/74ACT646, CD54/74ACT648

### PARAMETER MEASUREMENT INFORMATION



- NOTES:
1.  $V_{OHV}$  and  $V_{OLP}$  are measured with respect to a ground reference near the output under test.
  2. INPUT PULSES HAVE THE FOLLOWING CHARACTERISTICS:  
 $PRR \leq 1 \text{ MHz}$ ,  $t_r = 3 \text{ ns}$ ,  $t_f = 3 \text{ ns}$ , SKEW 1 ns.
  3. R.F. FIXTURE WITH 700-MHz DESIGN RULES REQUIRED.  
 IC SHOULD BE SOLDERED INTO TEST BOARD AND BYPASSED WITH 0.1  $\mu\text{F}$  CAPACITOR. SCOPE AND PROBES REQUIRE 700-MHz BANDWIDTH.

92CS-42406

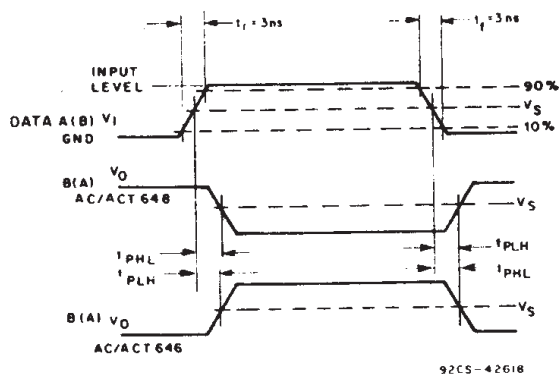


\*FOR AC SERIES ONLY: WHEN  $V_{CC} = 1.5 \text{ V}$ ,  $R_L = 1 \text{ k}\Omega$

92CM-42405

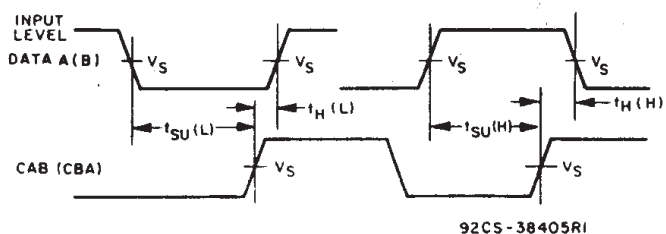
Fig. 1 - Simultaneous switching transient waveforms.

Fig. 2 - Three-state propagation delay waveforms and test circuit.



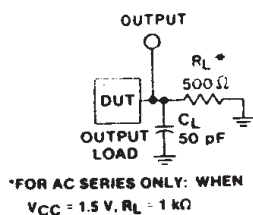
92CS-42618

Fig. 3 - Propagation delay times.



92CS-38405RI

Fig. 4 - Data setup and hold times.



\*FOR AC SERIES ONLY: WHEN  
 $V_{CC} = 1.5 \text{ V}$ ,  $R_L = 1 \text{ k}\Omega$

92CS-42389

Fig. 5 - Test circuit.

|                                 | CD54/74AC    | CD54/74ACT   |
|---------------------------------|--------------|--------------|
| Input Level                     | $V_{CC}$     | 3 V          |
| Input Switching Voltage, $V_S$  | $0.5 V_{CC}$ | 1.5 V        |
| Output Switching Voltage, $V_S$ | $0.5 V_{CC}$ | $0.5 V_{CC}$ |

## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| CD74AC646M       | ACTIVE        | SOIC         | DW                 | 24   | 25             | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | AC646M                  | <a href="#">Samples</a> |
| CD74AC646M96     | ACTIVE        | SOIC         | DW                 | 24   | 2000           | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | AC646M                  | <a href="#">Samples</a> |
| CD74ACT646M      | ACTIVE        | SOIC         | DW                 | 24   | 25             | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | ACT646M                 | <a href="#">Samples</a> |
| CD74ACT646M96    | ACTIVE        | SOIC         | DW                 | 24   | 2000           | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -55 to 125   | ACT646M                 | <a href="#">Samples</a> |

<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> **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

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

<sup>(5)</sup> 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.

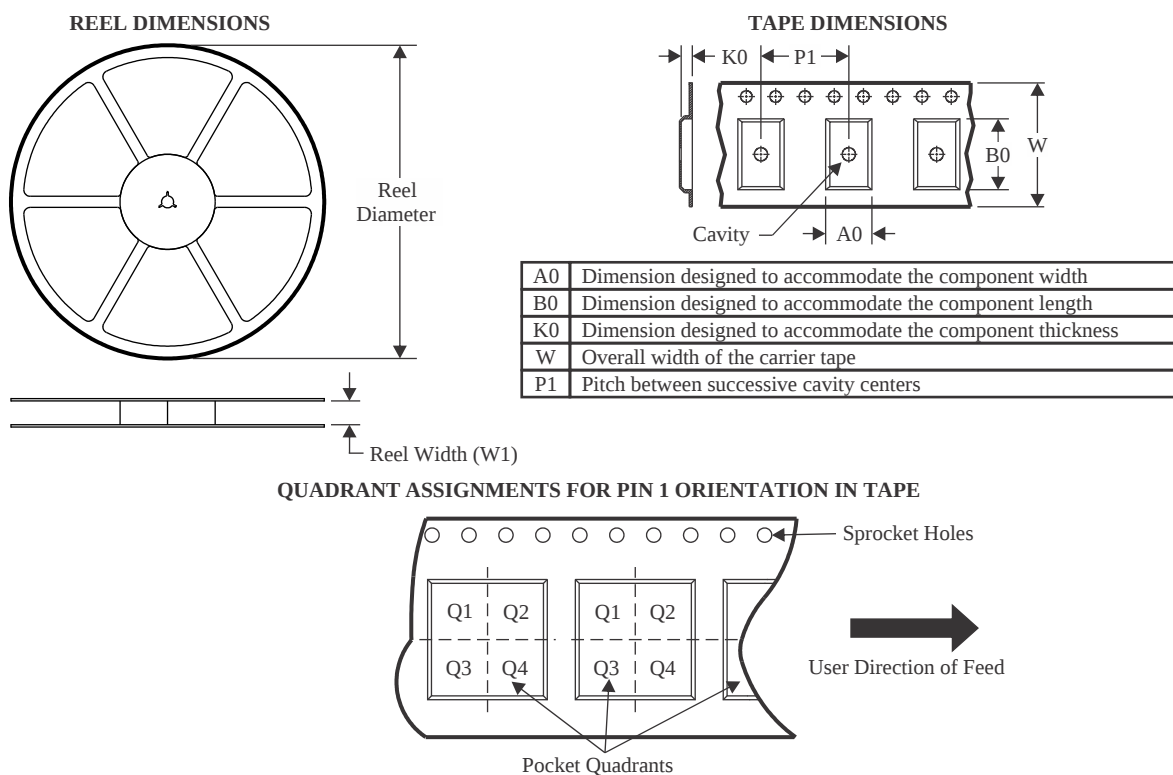
<sup>(6)</sup> Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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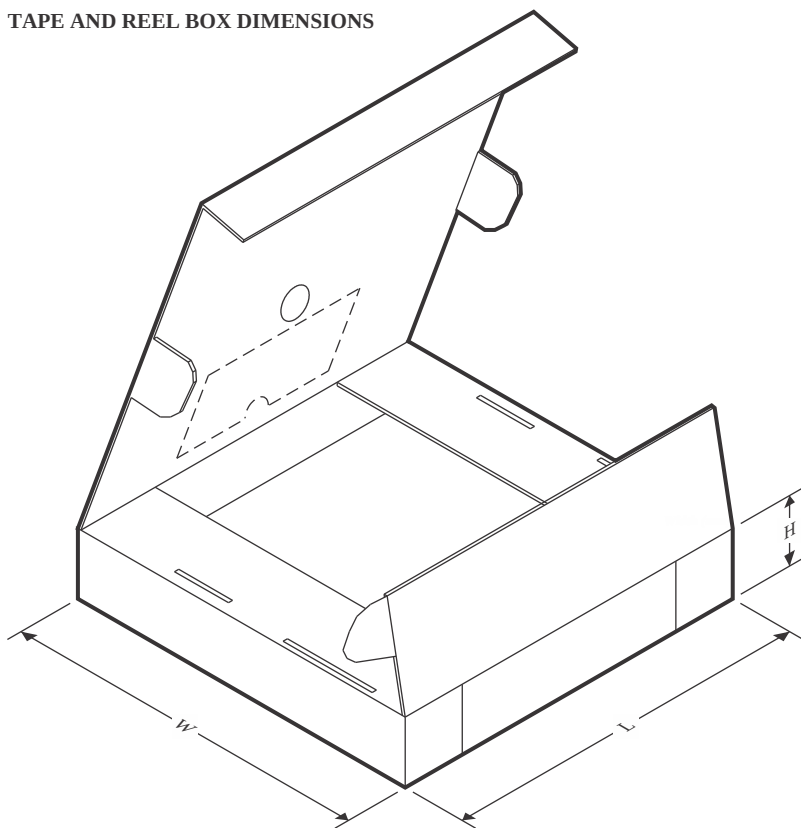
## TAPE AND REEL INFORMATION



\*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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD74AC646M96  | SOIC         | DW              | 24   | 2000 | 330.0              | 24.4               | 10.75   | 15.7    | 2.7     | 12.0    | 24.0   | Q1            |
| CD74ACT646M96 | SOIC         | DW              | 24   | 2000 | 330.0              | 24.4               | 10.75   | 15.7    | 2.7     | 12.0    | 24.0   | Q1            |

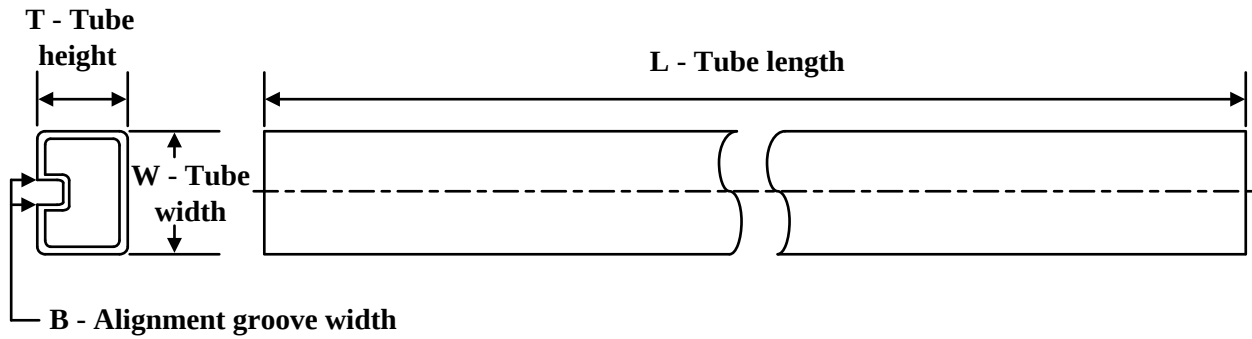
## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CD74AC646M96  | SOIC         | DW              | 24   | 2000 | 350.0       | 350.0      | 43.0        |
| CD74ACT646M96 | SOIC         | DW              | 24   | 2000 | 350.0       | 350.0      | 43.0        |

## TUBE

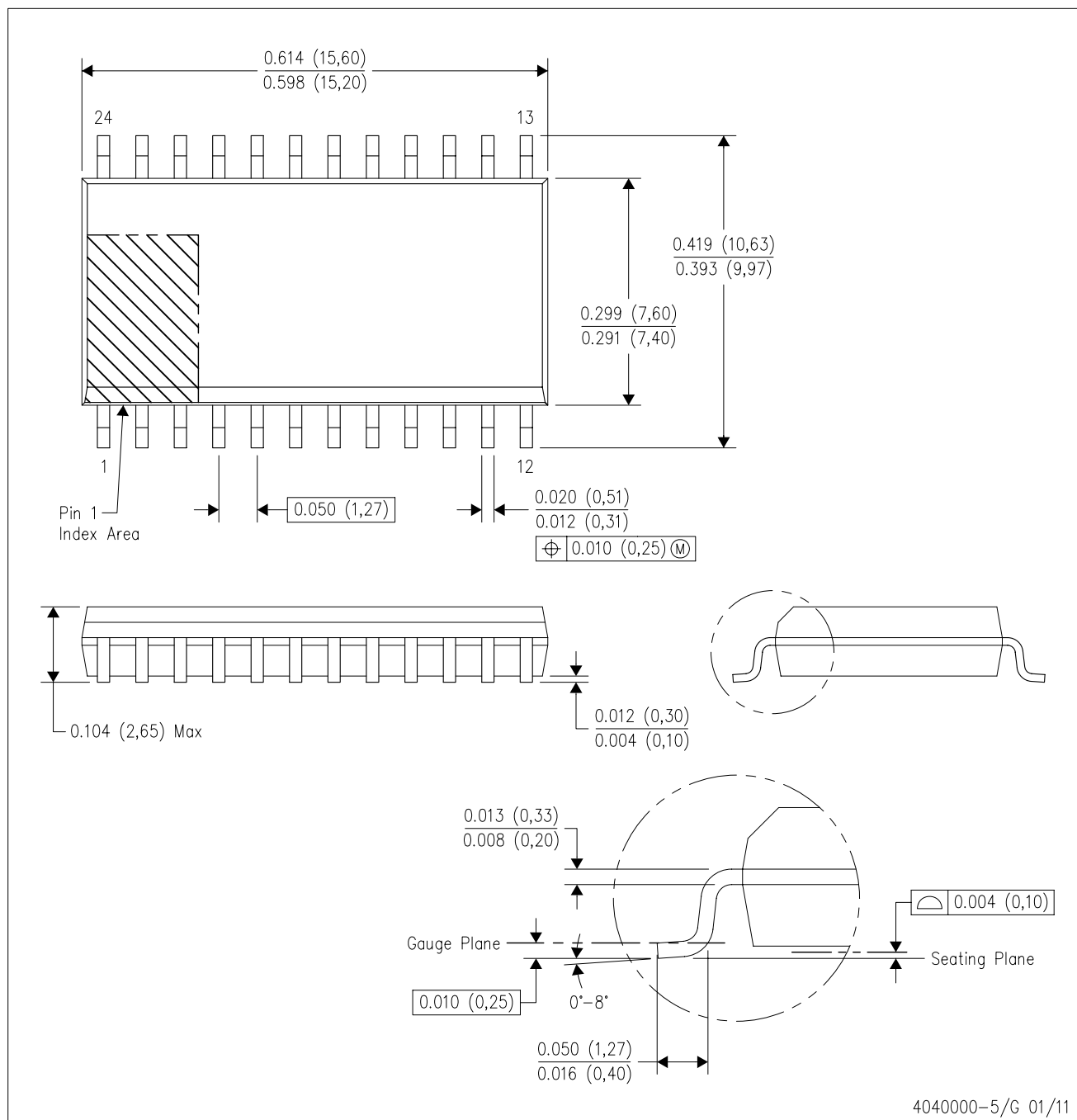


\*All dimensions are nominal

| Device      | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| CD74AC646M  | DW           | SOIC         | 24   | 25  | 506.98 | 12.7   | 4826   | 6.6    |
| CD74ACT646M | DW           | SOIC         | 24   | 25  | 506.98 | 12.7   | 4826   | 6.6    |

DW (R-PDSO-G24)

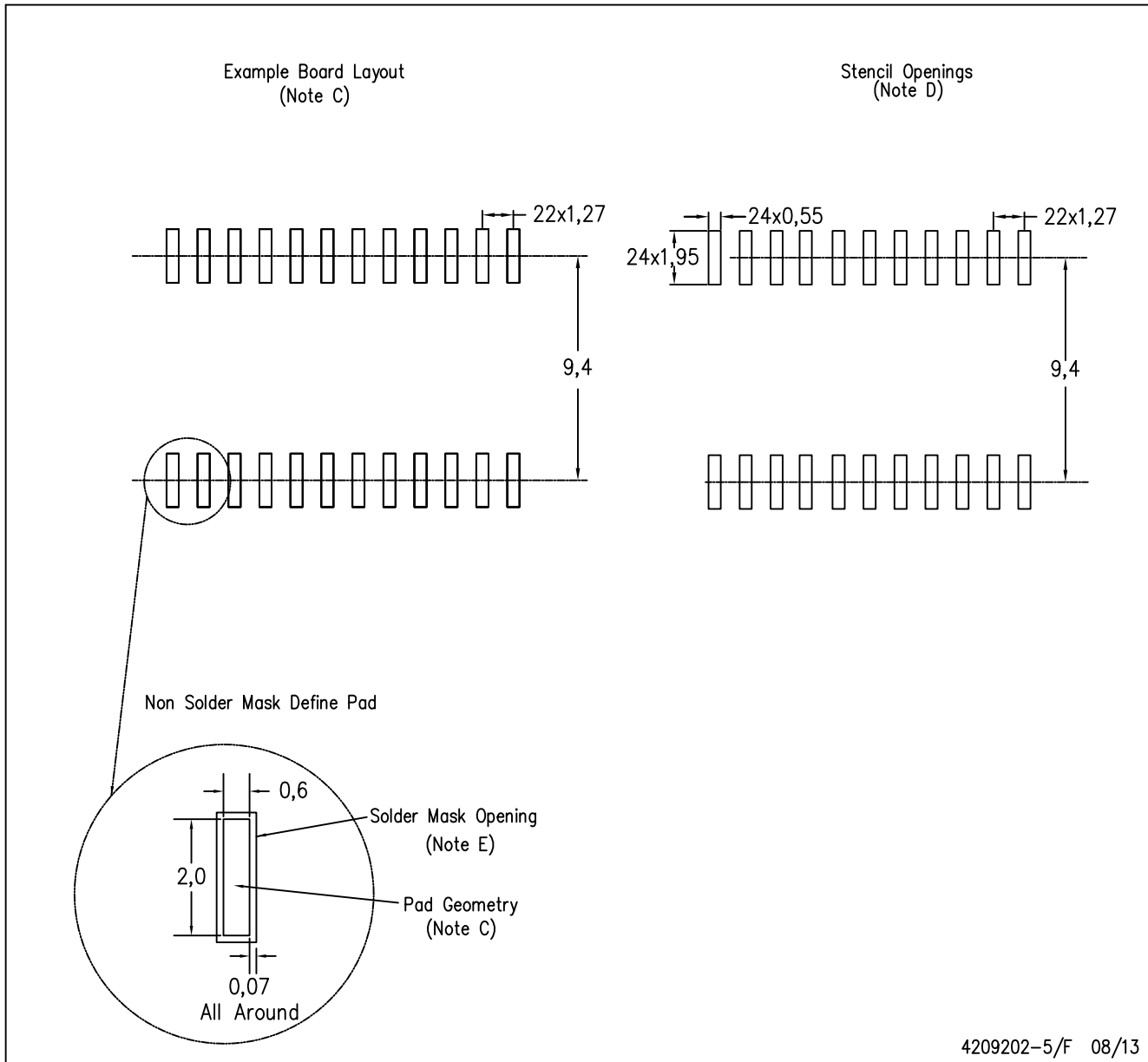
PLASTIC SMALL OUTLINE



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

DW (R-PDSO-G24)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Refer to IPC7351 for alternate board design.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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