

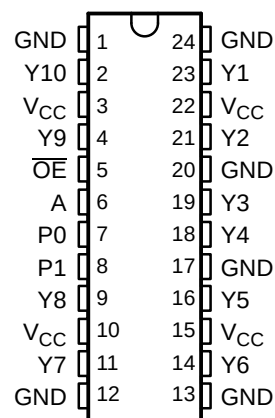


# THE DATASHEET OF CDC351DB

## FEATURES

- Low Output Skew, Low Pulse Skew for Clock-Distribution and Clock-Generation Applications
- Operates at 3.3-V  $V_{CC}$
- LVTTTL-Compatible Inputs and Outputs
- Supports Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V  $V_{CC}$ )
- Distributes One Clock Input to Ten Outputs
- Distributed  $V_{CC}$  and Ground Pins Reduce Switching Noise
- High-Drive Outputs ( $-32\text{-mA } I_{OH}$ ,  $32\text{-mA } I_{OL}$ )
- State-of-the-Art *EPIC-IIB*™ BiCMOS Design Significantly Reduces Power Dissipation
- Package Options Include Plastic Small-Outline (DW) and Shrink Small-Outline (DB) Packages

DB OR DW PACKAGE  
(TOP VIEW)



## DESCRIPTION

The CDC351 is a high-performance clock-driver circuit that distributes one input (A) to ten outputs (Y) with minimum skew for clock distribution. The output-enable ( $\overline{OE}$ ) input disables the outputs to a high-impedance state. The CDC351 operates at nominal 3.3-V  $V_{CC}$ .

The propagation delays are adjusted at the factory using the P0 and P1 pins. The factory adjustments ensure that the part-to-part skew is minimized and is kept within a specified window. Pins P0 and P1 are not intended for customer use and should be connected to GND.

FUNCTION TABLE

| INPUTS |                 | OUTPUTS |
|--------|-----------------|---------|
| A      | $\overline{OE}$ | $Y_n$   |
| L      | H               | Z       |
| H      | H               | Z       |
| L      | L               | L       |
| H      | L               | H       |

## AVAILABLE OPTIONS

| $T_A$          | Shrink Small-Outline Package (DB) (1) | Small-Outline Package (DW) (1) |
|----------------|---------------------------------------|--------------------------------|
| 0°C to 70°C    | CDC351DB                              | CDC351DW                       |
| – 40°C to 85°C | CDC351IDB                             | CDC351IDW                      |

(1) This package is available tape and reel. Order by adding an R to the orderable part number (e.g., CDC351DBR).

*EPIC-IIB* is a trademark of Texas Instruments.



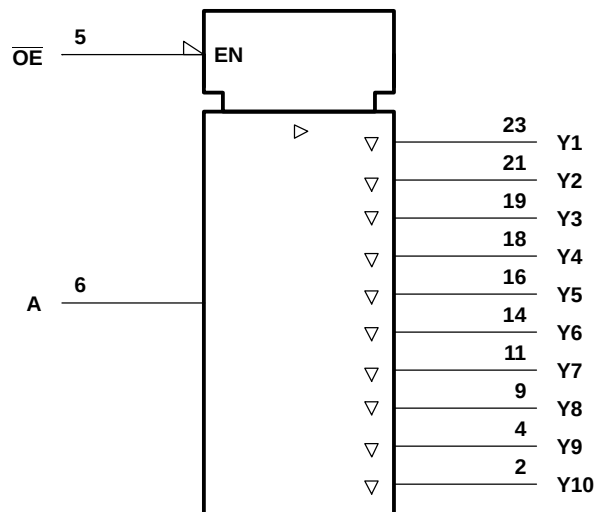
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# CDC351. CDC351I

## 1-LINE TO 10-LINE CLOCK DRIVER WITH 3-STATE OUTPUTS

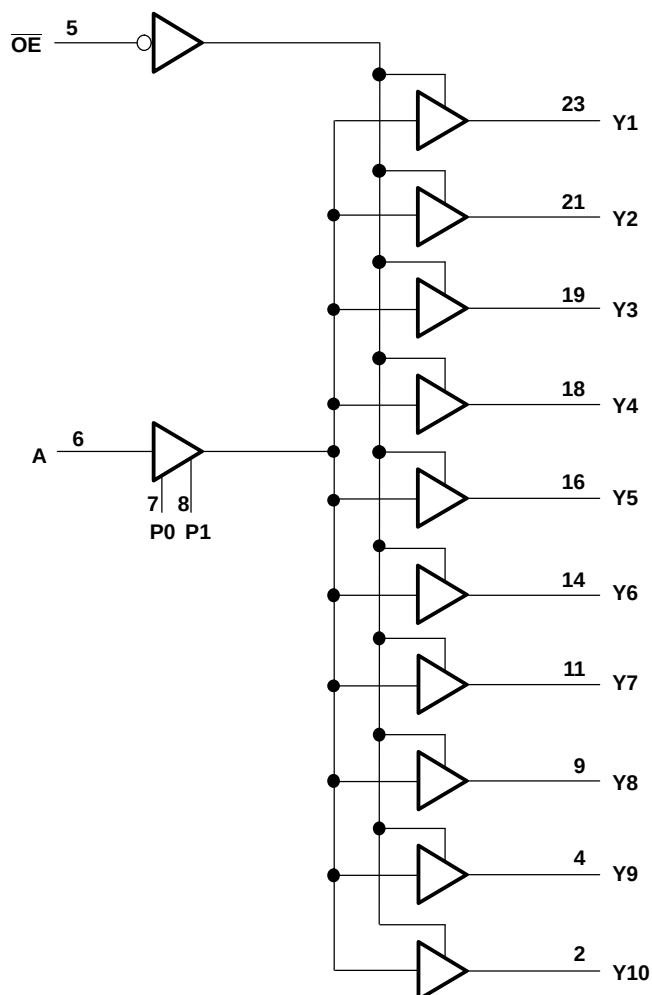
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**LOGIC SYMBOL <sup>A</sup>**



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

**LOGIC DIAGRAM (POSITIVE LOGIC)**



## ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted) (1)

|                                                                                     |            |                  |
|-------------------------------------------------------------------------------------|------------|------------------|
| Supply voltage range, $V_{CC}$                                                      |            | – 0.5 V to 4.6 V |
| Input voltage range, $V_I$ (2)                                                      |            | – 0.5 V to 7 V   |
| Voltage range applied to any output in the high state or power-off state, $V_O$ (2) |            | – 0.5 V to 3.6 V |
| Current into any output in the low state, $I_O$                                     |            | 64 mA            |
| Input clamp current, $I_{IK}(V_I < 0)$                                              |            | – 18 mA          |
| Output clamp current, $I_{OK}(V_I < 0)$                                             |            | – 50 mA          |
| Package thermal impedance $\Theta_{JA}$ (3):                                        | DB package | 147°C/ W         |
|                                                                                     | DW package | 101°C/ W         |
| Storage temperature range, $T_{stg}$                                                |            | – 65°C to 150°C  |

- (1) 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.
- (2) The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (3) The package thermal impedance is calculated in accordance with JESD51.

## RECOMMENDED OPERATING CONDITIONS (1)

|                    |                                |            | MIN  | MAX  | UNIT |
|--------------------|--------------------------------|------------|------|------|------|
| V <sub>CC</sub>    | Supply voltage                 |            | 3    | 3.6  | V    |
| V <sub>IH</sub>    | High-level input voltage       |            | 2    |      | V    |
| V <sub>IL</sub>    | Low-level input voltage        |            |      | 0.8  | V    |
| V <sub>I</sub>     | Input voltage                  |            | 0    | 5.5  | V    |
| I <sub>OH</sub>    | High-level output current      |            |      | – 32 | mA   |
| I <sub>OL</sub>    | Low-level output current       |            |      | 32   | mA   |
| f <sub>clock</sub> | Input clock frequency          |            |      | 100  | MHz  |
| T <sub>A</sub>     | Operating free-air temperature | Commercial | 0    | 70   | °C   |
|                    |                                | Industrial | – 40 | 85   | °C   |

- (1) Unused pins (input or I/O) must be held high or low.

## ELECTRICAL CHARACTERISTICS

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

| PARAMETER | TEST CONDITIONS                                     |                       | MIN              | TYP | MAX      | UNIT    |
|-----------|-----------------------------------------------------|-----------------------|------------------|-----|----------|---------|
| $V_{IK}$  | $V_{CC} = 3$ V,                                     | $I_I = -18$ mA        |                  |     | –1.2     | V       |
| $V_{OH}$  | $V_{CC} = 3$ V,                                     | $I_{OH} = -32$ mA     | 2                |     |          | V       |
| $V_{OL}$  | $V_{CC} = 3$ V,                                     | $I_{OL} = 32$ mA      |                  |     | 0.5      | V       |
| $I_I$     | $V_{CC} = 3.6$ V,                                   | $V_I = V_{CC}$ or GND |                  |     | $\pm 1$  | $\mu$ A |
| $I_O$ (1) | $V_{CC} = 3.6$ V,                                   | $V_O = 2.5$ V         | –15              |     | –150     | mA      |
| $I_{OZ}$  | $V_{CC} = 3.6$ V,                                   | $V_O = 3$ V or 0      |                  |     | $\pm 10$ | $\mu$ A |
| $I_{CC}$  | $V_{CC} = 3.6$ V, $I_O = 0$ , $V_I = V_{CC}$ or GND |                       | Outputs high     |     | 0.3      | mA      |
|           |                                                     |                       | Outputs low      |     | 25       |         |
|           |                                                     |                       | Outputs disabled |     | 0.3      |         |
| $C_i$     | $V_I = V_{CC}$ or GND,                              | $V_{CC} = 3.3$ V,     | $f = 10$ MHz     |     | 4        | pF      |
| $C_o$     | $V_O = V_{CC}$ or GND,                              | $V_{CC} = 3.3$ V,     | $f = 10$ MHz     |     | 6        | pF      |

- (1) Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

# CDC351. CDC351I

## 1-LINE TO 10-LINE CLOCK DRIVER WITH 3-STATE OUTPUTS

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### SWITCHING CHARACTERISTICS

$C_L = 50$  pF (see Figure 1 and Figure 2)

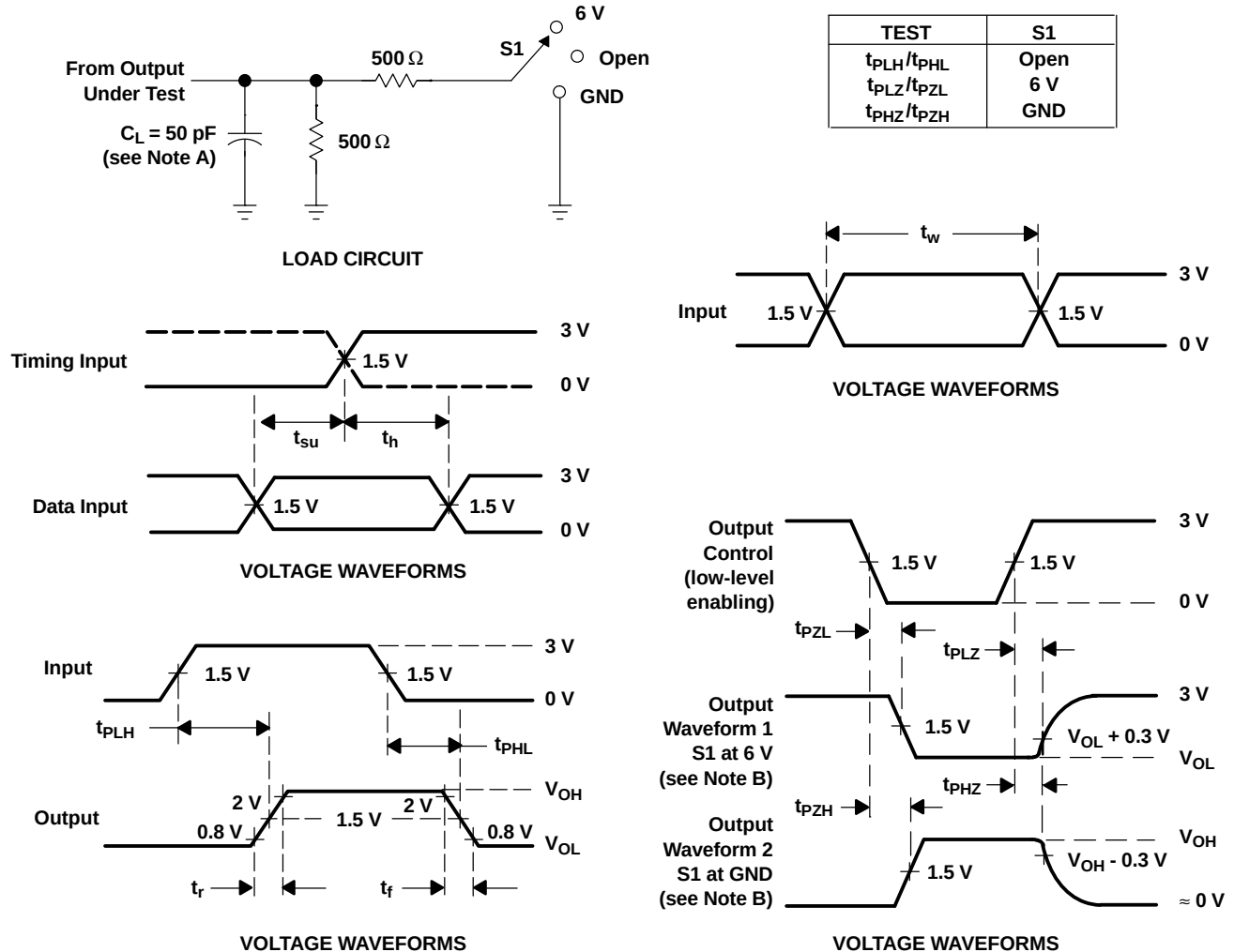
| PARAMETER    | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$ |     |     | $V_{CC} = 3$ V to $3.6$ V,<br>$T_A = 0^\circ\text{C}$ to $70^\circ\text{C}$ |     | $V_{CC} = 3$ V to $3.6$ V,<br>$T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$ |     | UNIT |
|--------------|-----------------|----------------|--------------------------------------------|-----|-----|-----------------------------------------------------------------------------|-----|-------------------------------------------------------------------------------|-----|------|
|              |                 |                | MIN                                        | TYP | MAX | MIN                                                                         | MAX | MIN                                                                           | MAX |      |
| $t_{PLH}$    | A               | Y              | 3.2                                        | 3.7 | 4.2 |                                                                             |     |                                                                               |     | ns   |
| $t_{PHL}$    |                 |                | 3                                          | 3.5 | 4   |                                                                             |     |                                                                               |     |      |
| $t_{PZH}$    | $\overline{OE}$ | Y              | 1.8                                        | 3.8 | 5.5 | 1.3                                                                         | 5.9 | 1.1                                                                           | 6.1 | ns   |
| $t_{PZL}$    |                 |                | 1.8                                        | 3.8 | 5.5 | 1.3                                                                         | 5.9 | 1.1                                                                           | 6.1 |      |
| $t_{PHZ}$    | $\overline{OE}$ | Y              | 1.8                                        | 3.9 | 5.9 | 1.7                                                                         | 6.3 | 1.5                                                                           | 6.5 | ns   |
| $t_{PLZ}$    |                 |                | 1.8                                        | 4.2 | 5.9 | 1.7                                                                         | 6.4 | 1.5                                                                           | 6.6 |      |
| $t_{sk(o)}$  | A               | Y              |                                            | 0.3 | 0.5 |                                                                             | 0.5 |                                                                               | 0.6 | ns   |
| $t_{sk(p)}$  | A               | Y              |                                            | 0.2 | 0.8 |                                                                             | 0.8 |                                                                               | 0.9 | ns   |
| $t_{sk(pr)}$ | A               | Y              |                                            |     | 1   |                                                                             | 1   |                                                                               | 1.1 | ns   |
| $t_r$        | A               | Y              |                                            |     |     |                                                                             | 1.5 |                                                                               | 1.5 | ns   |
| $t_f$        | A               | Y              |                                            |     |     |                                                                             | 1.5 |                                                                               | 1.5 | ns   |

### SWITCHING CHARACTERISTICS TEMPERATURE AND $V_{CC}$ COEFFICIENTS

over recommended operating free-air temperature and  $V_{CC}$  range (1)

| PARAMETER           |                                                                  | FROM<br>(INPUT) | TO<br>(OUTPUT) | MIN      | MAX    | UNIT       |
|---------------------|------------------------------------------------------------------|-----------------|----------------|----------|--------|------------|
| $\$t_{PLH}(T)$      | Average temperature coefficient of low to high propagation delay | A               | Y              |          | 65 (2) | ps/10°C    |
| $\$t_{PHL}(T)$      | Average temperature coefficient of high to low propagation delay | A               | Y              |          | 45 (2) | ps/10°C    |
| $\$t_{PLH}(V_{CC})$ | Average $V_{CC}$ coefficient of low to high propagation delay    | A               | Y              | -140 (3) |        | ps/ 100 mV |
| $\$t_{PHL}(V_{CC})$ | Average $V_{CC}$ coefficient of high to low propagation delay    | A               | Y              | -120 (3) |        | ps/ 100 mV |

- (1) These data were extracted from characterization material and are not tested at the factory.
- (2)  $\$t_{PLH}(T)$  and  $\$t_{PHL}(T)$  are virtually independent of  $V_{CC}$ .
- (3)  $\$t_{PLH}(V_{CC})$  and  $\$t_{PHL}(V_{CC})$  are virtually independent of temperature.



A.  $C_L$  includes probe and jig 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. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .

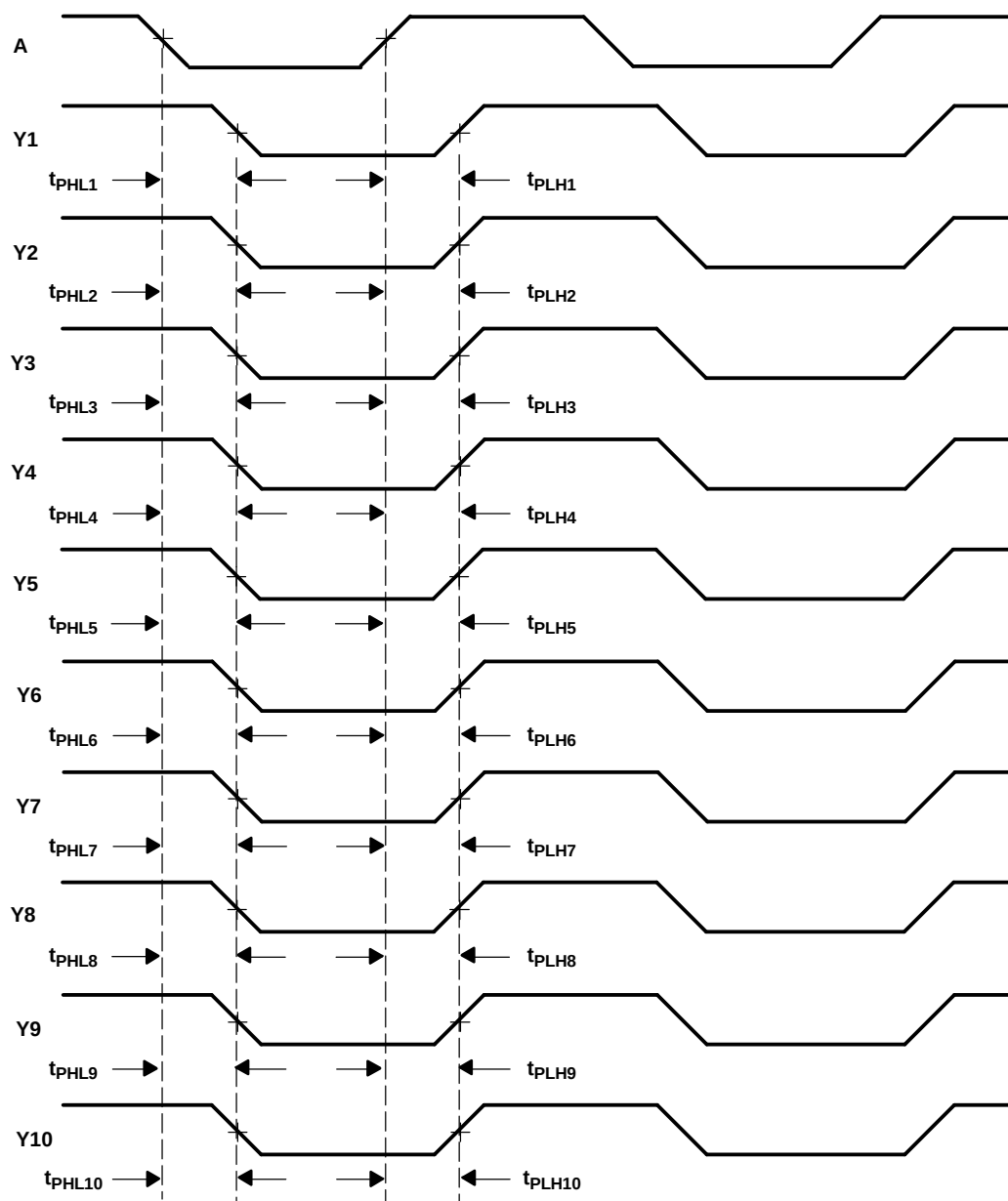
D. The outputs are measured one at a time with one transition per measurement.

**Figure 1. Load Circuit and Voltage Waveforms**

# CDC351. CDC3511

## 1-LINE TO 10-LINE CLOCK DRIVER WITH 3-STATE OUTPUTS

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A. Output skew,  $t_{sk(o)}$ , is calculated as the greater of:

- The difference between the fastest and slowest of  $t_{PLHn}$  ( $n = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$ )
- The difference between the fastest and slowest of  $t_{PHLn}$  ( $n = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$ )

B. Pulse skew,  $t_{sk(p)}$ , is calculated as the greater of  $|t_{PLHn} - t_{PHLn}|$  ( $n = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$ ).

C. Process skew,  $t_{sk(pr)}$ , is calculated as the greater of:

- The difference between the fastest and slowest of  $t_{PLHn}$  ( $n = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$ ) across multiple devices under identical operating conditions
- The difference between the fastest and slowest of  $t_{PHLn}$  ( $n = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$ ) across multiple devices under identical operating conditions

**Figure 2. Waveforms for Calculation of  $t_{sk(o)}$ ,  $t_{sk(p)}$ ,  $t_{sk(pr)}$**

## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| CDC351DB         | ACTIVE        | SSOP         | DB                 | 24   | 60             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | CK351                   | <a href="#">Samples</a> |
| CDC351DBR        | ACTIVE        | SSOP         | DB                 | 24   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | CK351                   | <a href="#">Samples</a> |
| CDC351DBRG4      | ACTIVE        | SSOP         | DB                 | 24   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | CK351                   | <a href="#">Samples</a> |
| CDC351DW         | ACTIVE        | SOIC         | DW                 | 24   | 25             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | CDC351                  | <a href="#">Samples</a> |
| CDC351DWG4       | ACTIVE        | SOIC         | DW                 | 24   | 25             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | CDC351                  | <a href="#">Samples</a> |
| CDC351DWR        | ACTIVE        | SOIC         | DW                 | 24   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | CDC351                  | <a href="#">Samples</a> |
| CDC351DWRG4      | ACTIVE        | SOIC         | DW                 | 24   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | CDC351                  | <a href="#">Samples</a> |
| CDC351IDB        | ACTIVE        | SSOP         | DB                 | 24   | 60             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | CK351-I                 | <a href="#">Samples</a> |
| CDC351IDBG4      | ACTIVE        | SSOP         | DB                 | 24   | 60             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | CK351-I                 | <a href="#">Samples</a> |
| CDC351IDBR       | ACTIVE        | SSOP         | DB                 | 24   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | CK351-I                 | <a href="#">Samples</a> |
| CDC351IDW        | ACTIVE        | SOIC         | DW                 | 24   | 25             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | CDC351-I                | <a href="#">Samples</a> |
| CDC351IDWG4      | ACTIVE        | SOIC         | DW                 | 24   | 25             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | CDC351-I                | <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.



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

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

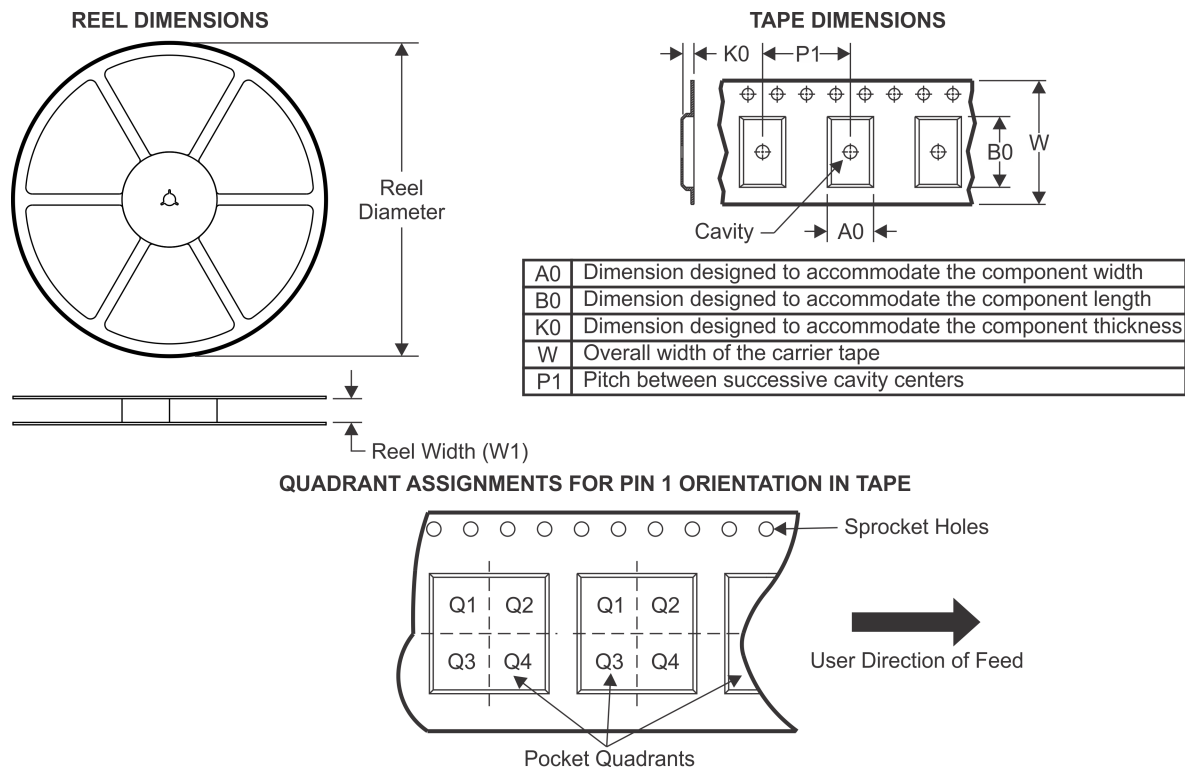
<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

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

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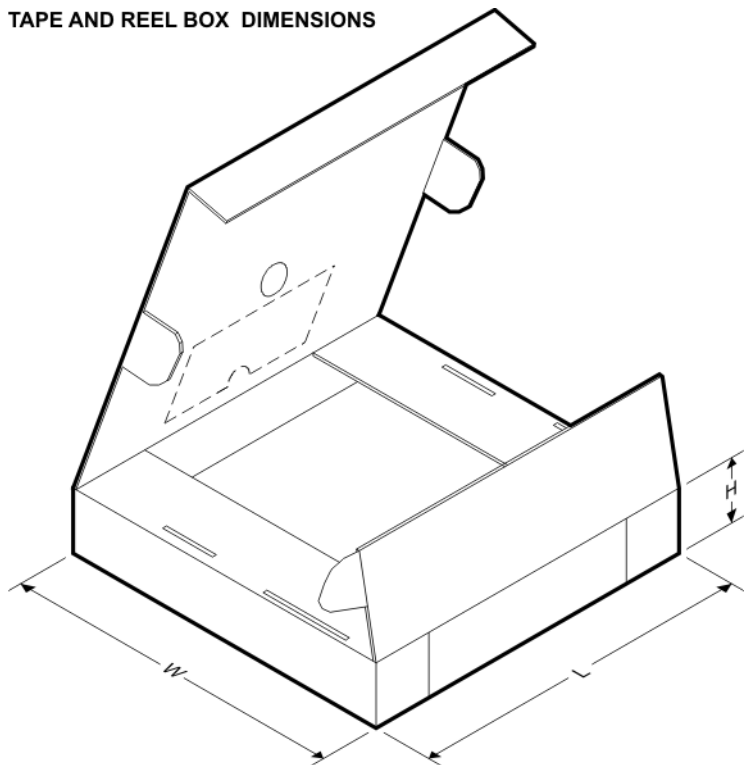
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**TAPE AND REEL INFORMATION**


\*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 |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CDC351DBR  | SSOP         | DB              | 24   | 2000 | 330.0              | 16.4               | 8.2     | 8.8     | 2.5     | 12.0    | 16.0   | Q1            |
| CDC351DWR  | SOIC         | DW              | 24   | 2000 | 330.0              | 24.4               | 10.75   | 15.7    | 2.7     | 12.0    | 24.0   | Q1            |
| CDC351IDBR | SSOP         | DB              | 24   | 2000 | 330.0              | 16.4               | 8.2     | 8.8     | 2.5     | 12.0    | 16.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS

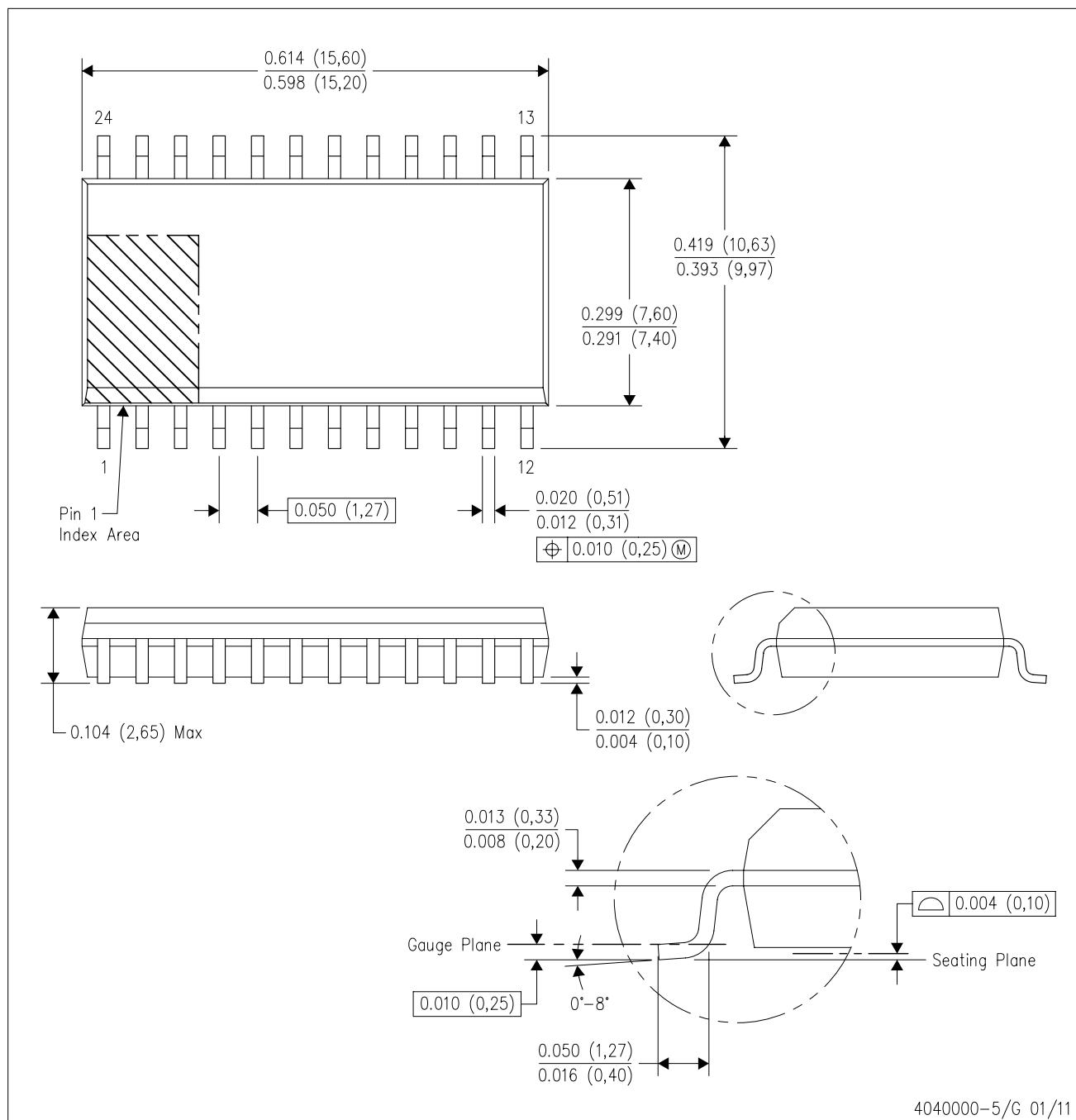


\*All dimensions are nominal

| Device     | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CDC351DBR  | SSOP         | DB              | 24   | 2000 | 367.0       | 367.0      | 38.0        |
| CDC351DWR  | SOIC         | DW              | 24   | 2000 | 350.0       | 350.0      | 43.0        |
| CDC351IDBR | SSOP         | DB              | 24   | 2000 | 367.0       | 367.0      | 38.0        |

DW (R-PDSO-G24)

PLASTIC SMALL OUTLINE

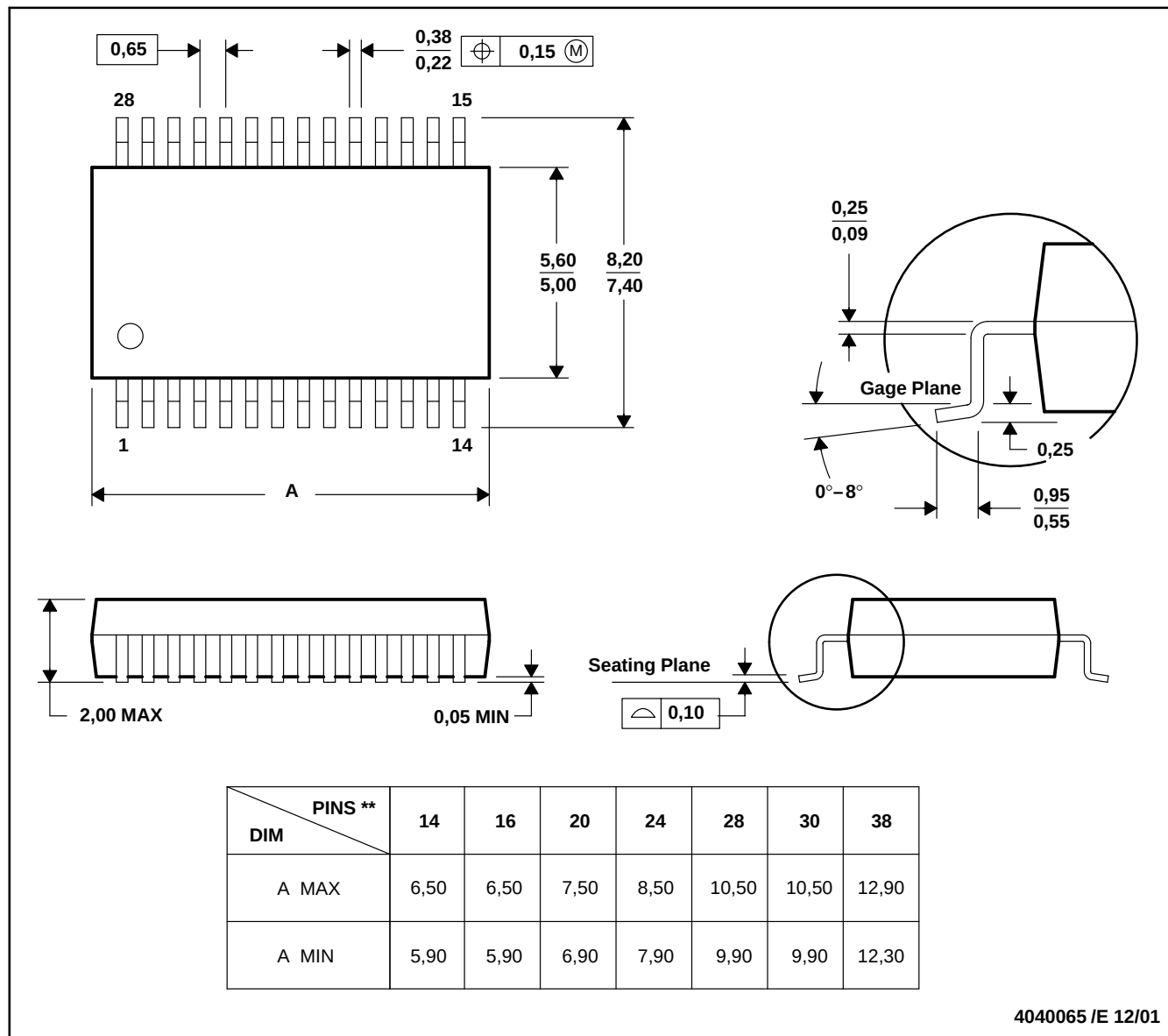


- NOTES:
- All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - Falls within JEDEC MS-013 variation AD.

## DB (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

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