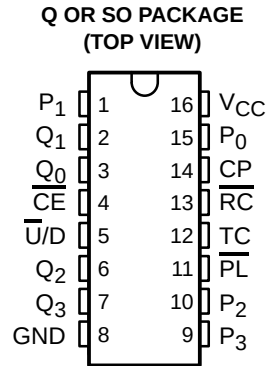


- Function, Pinout, and Drive Compatible With FCT and F Logic
- Reduced  $V_{OH}$  (Typically = 3.3 V) Versions of Equivalent FCT Functions
- Edge-Rate Control Circuitry for Significantly Improved Noise Characteristics
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)
- Matched Rise and Fall Times
- 64-mA Output Sink Current  
32-mA Output Source Current



### description

The CY74FCT191T is a reversible modulo-16 binary counter, featuring synchronous counting and asynchronous presetting. The preset allows the CY74FCT191T to be used in programmable dividers. The count enable input, terminal count output, and ripple-clock output make possible a variety of methods of implementing multiusage counters. In the counting modes, state changes are initiated by the rising edge of the clock.

This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

**PIN DESCRIPTION**

| NAME             | DESCRIPTION                                   |
|------------------|-----------------------------------------------|
| $\overline{CE}$  | Count enable input (active low)               |
| CP               | Clock pulse input (active rising edge)        |
| P                | Parallel data inputs                          |
| $\overline{PL}$  | Asynchronous parallel load input (active low) |
| $\overline{U/D}$ | Up/down count control input                   |
| Q                | Flip-flop outputs                             |
| $\overline{RC}$  | Ripple clock output (active low)              |
| TC               | Terminal count output                         |



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2001, Texas Instruments Incorporated

# CY74FCT191T

## 4-BIT UP/DOWN BINARY COUNTER

SCCS016A – MAY 1994 – REVISED SEPTEMBER 2001

### ORDERING INFORMATION

| T <sub>A</sub> | PACKAGE <sup>†</sup> |               | SPEED (ns) | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|----------------------|---------------|------------|-----------------------|------------------|
| –40°C to 85°C  | QSOP – Q             | Tape and reel | 6.2        | CY74FCT191CTQCT       | FT191-3          |
|                | SOIC – SO            | Tube          | 6.2        | CY74FCT191CTSOC       | FCT191C          |
|                |                      | Tape and reel | 6.2        | CY74FCT191CTSOCT      |                  |
|                | SOIC – SO            | Tube          | 7.8        | CY74FCT191ATSOC       | FCT191A          |
|                |                      | Tape and reel | 7.8        | CY74FCT191ATSOCT      |                  |

<sup>†</sup> 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).

### Function Tables

#### $\overline{RC}$ FUNCTION

| INPUTS          |                                                                                   | OUTPUTS         |                                                                                   |
|-----------------|-----------------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------|
| $\overline{CE}$ | CP                                                                                | TC <sup>†</sup> | $\overline{RC}$                                                                   |
| L               |  | H               |  |
| H               | X                                                                                 | X               | H                                                                                 |
| X               | X                                                                                 | L               | H                                                                                 |

H = High logic level, L = Low logic level,

X = Don't care,  = Low pulse

<sup>†</sup> TC is generated internally.

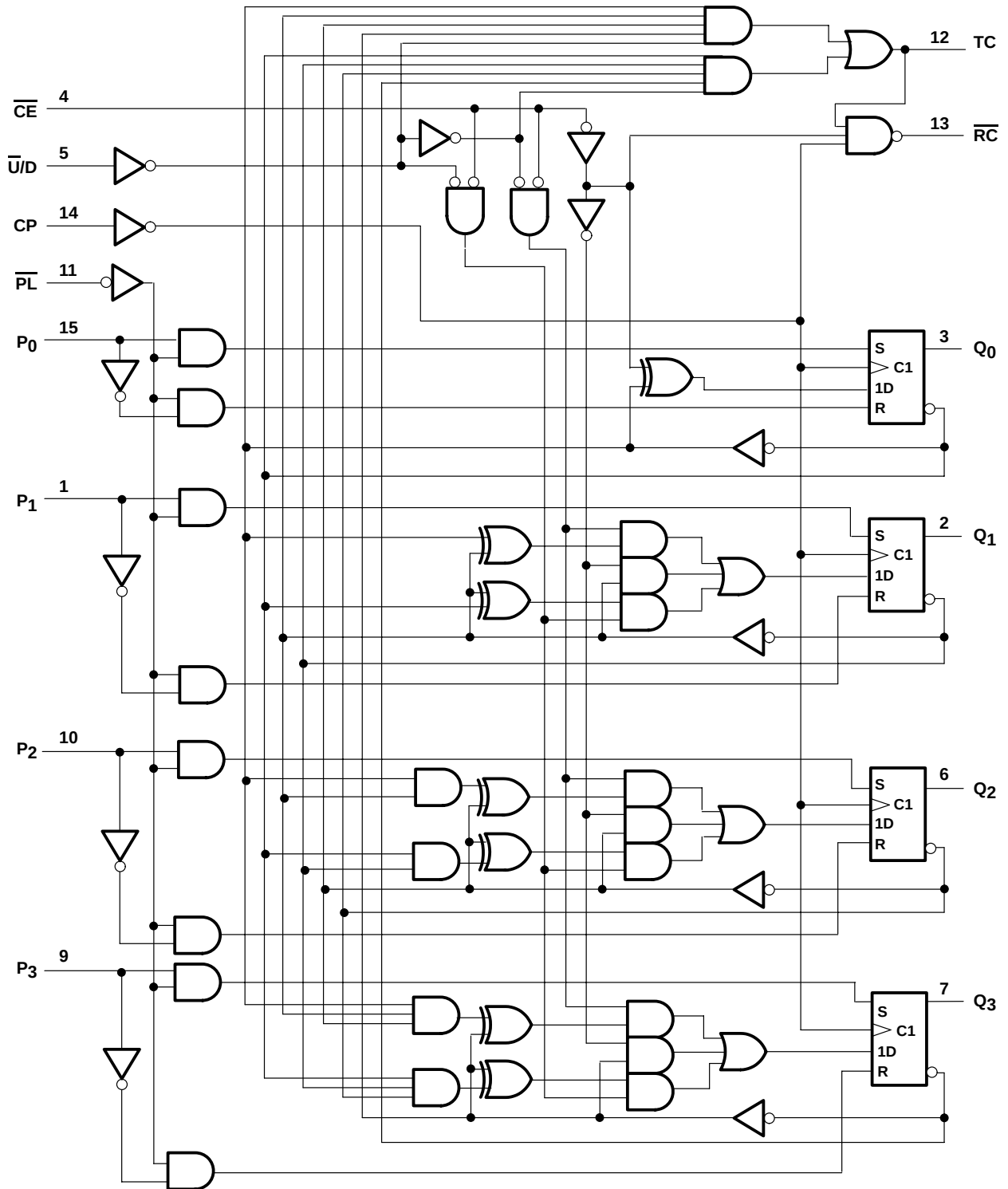
#### MODE SELECT

| INPUTS          |                 |                  |    | MODE                  |
|-----------------|-----------------|------------------|----|-----------------------|
| $\overline{PL}$ | $\overline{CE}$ | $\overline{U/D}$ | CP |                       |
| H               | L               | L                | ↑  | Count up              |
| H               | L               | H                | ↑  | Count down            |
| L               | X               | X                | X  | Preset (asynchronous) |
| H               | H               | X                | X  | No change (hold)      |

H = High logic level, L = Low logic level, X = Don't care,

↑ = Low-to-high clock transition

logic diagram (positive logic)



CY74FCT191T  
4-BIT UP/DOWN BINARY COUNTER

SCCS016A – MAY 1994 – REVISED SEPTEMBER 2001

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

|                                                                  |                |
|------------------------------------------------------------------|----------------|
| Supply voltage range to ground potential                         | –0.5 V to 7 V  |
| DC input voltage range                                           | –0.5 V to 7 V  |
| DC output voltage range                                          | –0.5 V to 7 V  |
| DC output current (maximum sink current/pin)                     | 120 mA         |
| Package thermal impedance, $\theta_{JA}$ (see Note 1): Q package | 90°C/W         |
| SO package                                                       | 57°C/W         |
| Ambient temperature range with power applied, $T_A$              | –65°C to 135°C |
| Storage temperature range, $T_{Stg}$                             | –65°C to 150°C |

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 2)

|                                      | MIN  | NOM | MAX  | UNIT |
|--------------------------------------|------|-----|------|------|
| $V_{CC}$ Supply voltage              | 4.75 | 5   | 5.25 | V    |
| $V_{IH}$ High-level input voltage    | 2    |     |      | V    |
| $V_{IL}$ Low-level input voltage     |      |     | 0.8  | V    |
| $I_{OH}$ High-level output current   |      |     | –32  | mA   |
| $I_{OL}$ Low-level output current    |      |     | 64   | mA   |
| $T_A$ Operating free-air temperature | –40  |     | 85   | °C   |

NOTE 2: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation.

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

| PARAMETER                     | TEST CONDITIONS                                                                                                                                                                                                                                                                                      |                                                                 | MIN                                      | TYP <sup>†</sup> | MAX  | UNIT   |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|------------------------------------------|------------------|------|--------|
| V <sub>IK</sub>               | V <sub>CC</sub> = 4.75 V,                                                                                                                                                                                                                                                                            | I <sub>IN</sub> = –18 mA                                        |                                          | –0.7             | –1.2 | V      |
| V <sub>OH</sub>               | V <sub>CC</sub> = 4.75 V,                                                                                                                                                                                                                                                                            | I <sub>OH</sub> = –32 mA                                        | 2                                        |                  |      | V      |
|                               | V <sub>CC</sub> = 4.75 V,                                                                                                                                                                                                                                                                            | I <sub>OH</sub> = –15 mA                                        | 2.4                                      | 3.3              |      |        |
| V <sub>OL</sub>               | V <sub>CC</sub> = 4.75 V,                                                                                                                                                                                                                                                                            | I <sub>OL</sub> = 64 mA                                         |                                          | 0.3              | 0.55 | V      |
| V <sub>H</sub>                | All inputs                                                                                                                                                                                                                                                                                           |                                                                 |                                          | 0.2              |      | V      |
| I <sub>I</sub>                | V <sub>CC</sub> = 5.25 V,                                                                                                                                                                                                                                                                            | V <sub>IN</sub> = V <sub>CC</sub>                               |                                          |                  | 5    | μA     |
| I <sub>IH</sub>               | V <sub>CC</sub> = 5.25 V,                                                                                                                                                                                                                                                                            | V <sub>IN</sub> = 2.7 V                                         |                                          |                  | ±1   | μA     |
| I <sub>IL</sub>               | V <sub>CC</sub> = 5.25 V,                                                                                                                                                                                                                                                                            | V <sub>IN</sub> = 0.5 V                                         |                                          |                  | ±1   | μA     |
| I <sub>OS</sub> <sup>‡</sup>  | V <sub>CC</sub> = 5.25 V,                                                                                                                                                                                                                                                                            | V <sub>OUT</sub> = 0 V                                          | –60                                      | –120             | –225 | mA     |
| I <sub>off</sub>              | V <sub>CC</sub> = 0 V,                                                                                                                                                                                                                                                                               | V <sub>OUT</sub> = 4.5 V                                        |                                          |                  | ±1   | μA     |
| I <sub>CC</sub>               | V <sub>CC</sub> = 5.25 V, V <sub>IN</sub> ≤ 0.2 V, V <sub>IN</sub> ≥ V <sub>CC</sub> – 0.2 V                                                                                                                                                                                                         |                                                                 |                                          | 0.1              | 0.2  | mA     |
| ΔI <sub>CC</sub>              | V <sub>CC</sub> = 5.25 V, V <sub>IN</sub> = 3.4 V <sup>§</sup> , f <sub>1</sub> = 0, Outputs open                                                                                                                                                                                                    |                                                                 |                                          | 0.5              | 2    | mA     |
| I <sub>CCD</sub> <sup>¶</sup> | V <sub>CC</sub> = 5.25 V, One bit switching at 50% duty cycle, Preset mode, Outputs open, MR = V <sub>CC</sub> = $\overline{\text{SR}}$ , $\overline{\text{PL}}$ = $\overline{\text{CE}}$ = $\overline{\text{U/D}}$ = CP = GND, V <sub>IN</sub> ≤ 0.2 V or V <sub>IN</sub> ≥ V <sub>CC</sub> – 0.2 V |                                                                 |                                          | 0.06             | 0.12 | mA/MHz |
| I <sub>C</sub> <sup>#</sup>   | V <sub>CC</sub> = 5.25 V,<br>Preset mode,<br>Outputs open,<br>$\overline{\text{PL}}$ = $\overline{\text{CE}}$ = $\overline{\text{U/D}}$ = CP = GND                                                                                                                                                   | One bit switching at f <sub>1</sub> = 5 MHz at 50% duty cycle   | V <sub>IN</sub> = V <sub>CC</sub> or GND | 0.4              | 0.8  | mA     |
|                               |                                                                                                                                                                                                                                                                                                      |                                                                 | V <sub>IN</sub> = 3.4 V or GND           | 0.7              | 1.8  | mA     |
|                               |                                                                                                                                                                                                                                                                                                      | Four bits switching at f <sub>1</sub> = 5 MHz at 50% duty cycle | V <sub>IN</sub> = V <sub>CC</sub> or GND | 1.3              | 2.6  | mA     |
|                               |                                                                                                                                                                                                                                                                                                      |                                                                 | V <sub>IN</sub> = 3.4 V or GND           | 2.3              | 6.6  | mA     |
| C <sub>i</sub>                |                                                                                                                                                                                                                                                                                                      |                                                                 |                                          | 5                | 10   | pF     |
| C <sub>0</sub>                |                                                                                                                                                                                                                                                                                                      |                                                                 |                                          | 9                | 12   | pF     |

<sup>†</sup> Typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

<sup>‡</sup> Not more than one output should be shorted at a time. Duration of short should not exceed one second. The use of high-speed test apparatus and/or sample-and-hold techniques are preferable to minimize internal chip heating and more accurately reflect operational values. Otherwise, prolonged shorting of a high output can raise the chip temperature well above normal and cause invalid readings in other parametric tests. In any sequence of parameter tests, I<sub>OS</sub> tests should be performed last.

<sup>§</sup> Per TTL-driven input (V<sub>IN</sub> = 3.4 V); all other inputs at V<sub>CC</sub> or GND

<sup>¶</sup> This parameter is derived for use in total power-supply calculations.

<sup>#</sup> I<sub>C</sub> = I<sub>CC</sub> + ΔI<sub>CC</sub> × D<sub>H</sub> × N<sub>T</sub> + I<sub>CCD</sub> (f<sub>0</sub>/2 + f<sub>1</sub> × N<sub>1</sub>)

Where:

I<sub>C</sub> = Total supply current

I<sub>CC</sub> = Power-supply current with CMOS input levels

ΔI<sub>CC</sub> = Power-supply current for a TTL high input (V<sub>IN</sub> = 3.4 V)

D<sub>H</sub> = Duty cycle for TTL inputs high

N<sub>T</sub> = Number of TTL inputs at D<sub>H</sub>

I<sub>CCD</sub> = Dynamic current caused by an input transition pair (HLH or LHL)

f<sub>0</sub> = Clock frequency for registered devices, otherwise zero

f<sub>1</sub> = Input signal frequency

N<sub>1</sub> = Number of inputs changing at f<sub>1</sub>

All currents are in milliamperes and all frequencies are in megahertz.

|| Values for these conditions are examples of the I<sub>CC</sub> formula.

# CY74FCT191T

## 4-BIT UP/DOWN BINARY COUNTER

SCCS016A – MAY 1994 – REVISED SEPTEMBER 2001

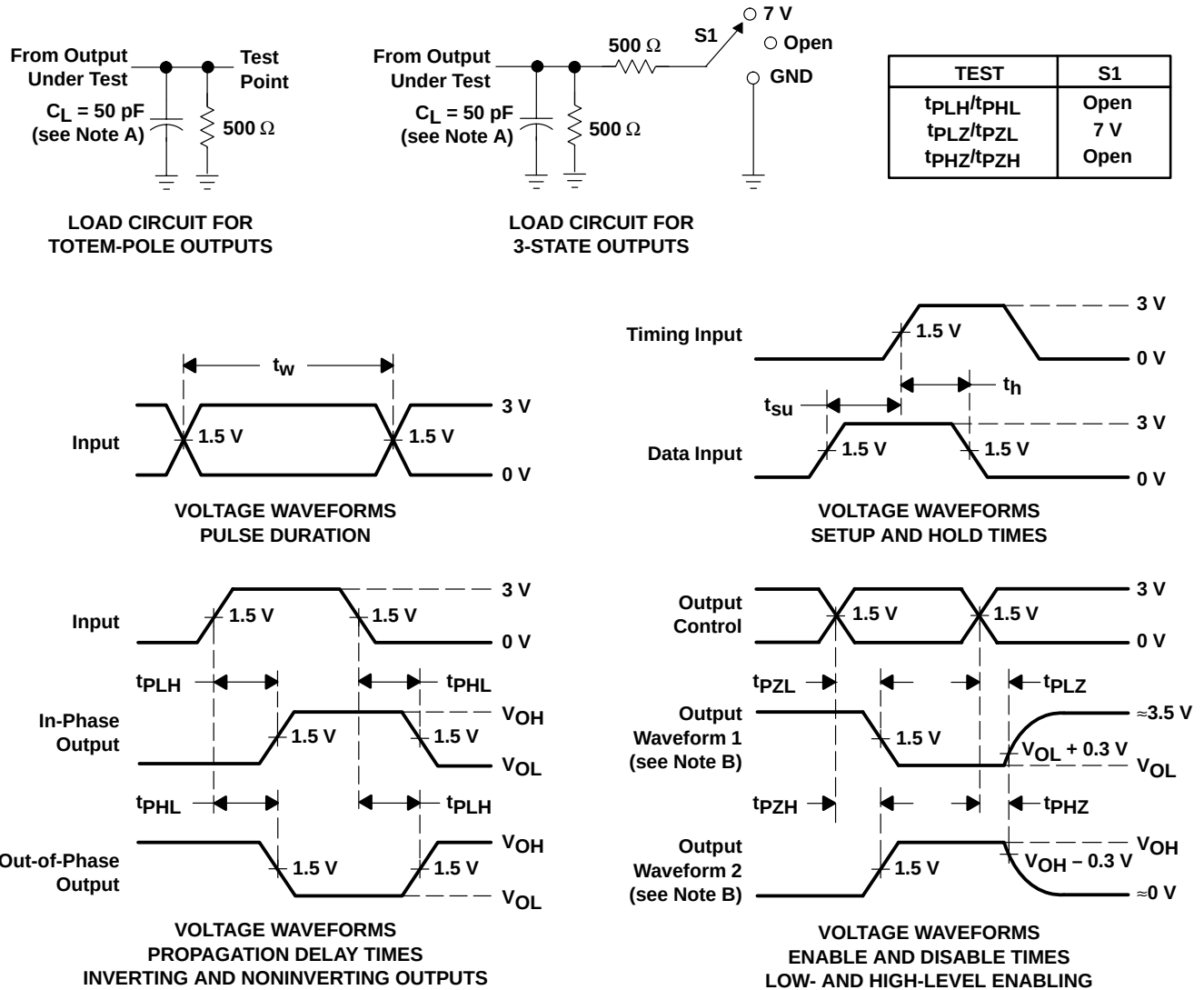
timing requirements over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

| PARAMETER               |                                       |             | CY74FCT191AT |     | CY74FCT191CT |     | UNIT |
|-------------------------|---------------------------------------|-------------|--------------|-----|--------------|-----|------|
|                         |                                       |             | MIN          | MAX | MIN          | MAX |      |
| $t_w$ Pulse duration    | CP                                    | High or Low | 4            |     | 4            |     | ns   |
|                         | $\overline{PL}$ low                   |             | 5.5          |     | 5            |     |      |
| $t_{su}$ Setup time     | Data before $\overline{PL}\downarrow$ | High or Low | 4            |     | 3.5          |     | ns   |
|                         | $\overline{CE}$ before $CP\uparrow$   | Low         | 9            |     | 7.2          |     |      |
|                         | $\overline{U/D}$ before $CP\uparrow$  | High or Low | 10           |     | 8            |     |      |
| $t_h$ Hold time         | Data after $\overline{PL}\downarrow$  | High or Low | 1.5          |     | 1            |     | ns   |
|                         | $\overline{CE}$ after $CP\uparrow$    | Low         | 0            |     | 0            |     |      |
|                         | $\overline{U/D}$ after $CP\uparrow$   | High or Low | 0            |     | 0            |     |      |
| $t_{rec}$ Recovery time | $\overline{PL}$ after $CP\uparrow$    |             | 5            |     | 4.5          |     | ns   |

switching characteristics over operating free-air temperature range (see Figure 1)

| PARAMETER | FROM<br>(INPUT)  | TO<br>(OUTPUT)  | CY74FCT191AT |      | CY74FCT191CT |     | UNIT |
|-----------|------------------|-----------------|--------------|------|--------------|-----|------|
|           |                  |                 | MIN          | MAX  | MIN          | MAX |      |
| $t_{PLH}$ | CP               | $Q_n$           | 1.5          | 7.8  | 1.5          | 6.2 | ns   |
| $t_{PHL}$ |                  |                 | 1.5          | 7.8  | 1.5          | 6.2 |      |
| $t_{PLH}$ | CP               | TC              | 1.5          | 11.8 | 1.5          | 9.4 | ns   |
| $t_{PHL}$ |                  |                 | 1.5          | 11.8 | 1.5          | 9.4 |      |
| $t_{PLH}$ | CP               | $\overline{RC}$ | 1.5          | 8.5  | 1.5          | 6.8 | ns   |
| $t_{PHL}$ |                  |                 | 1.5          | 8.5  | 1.5          | 6.8 |      |
| $t_{PLH}$ | CE               | $\overline{RC}$ | 1.5          | 7.2  | 1.5          | 6   | ns   |
| $t_{PHL}$ |                  |                 | 1.5          | 7.2  | 1.5          | 6   |      |
| $t_{PLH}$ | $\overline{U/D}$ | $\overline{RC}$ | 1.5          | 13   | 1.5          | 11  | ns   |
| $t_{PHL}$ |                  |                 | 1.5          | 13   | 1.5          | 11  |      |
| $t_{PLH}$ | $\overline{U/D}$ | TC              | 1.5          | 7.2  | 1.5          | 6.1 | ns   |
| $t_{PHL}$ |                  |                 | 1.5          | 7.2  | 1.5          | 6.1 |      |
| $t_{PLH}$ | $P_n$            | $Q_n$           | 1.5          | 9.1  | 1.5          | 7.7 | ns   |
| $t_{PHL}$ |                  |                 | 1.5          | 9.1  | 1.5          | 7.7 |      |
| $t_{PLH}$ | $\overline{PL}$  | $Q_n$           | 2            | 8.5  | 2            | 7.2 | ns   |
| $t_{PHL}$ |                  |                 | 2            | 8.5  | 2            | 7.2 |      |

### PARAMETER MEASUREMENT INFORMATION



- NOTES: 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. The outputs are measured one at a time with one input transition per measurement.

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

**PACKAGING INFORMATION**

| Orderable Device   | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package Qty | Eco Plan<br>(2)            | Lead/Ball Finish | MSL Peak Temp<br>(3) | Op Temp (°C) | Top-Side Markings<br>(4) | Samples                 |
|--------------------|---------------|--------------|--------------------|------|-------------|----------------------------|------------------|----------------------|--------------|--------------------------|-------------------------|
| CY74FCT191ATSOC    | ACTIVE        | SOIC         | DW                 | 16   | 40          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -40 to 85    | FCT191A                  | <a href="#">Samples</a> |
| CY74FCT191ATSOCE4  | ACTIVE        | SOIC         | DW                 | 16   | 40          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -40 to 85    | FCT191A                  | <a href="#">Samples</a> |
| CY74FCT191ATSOCG4  | ACTIVE        | SOIC         | DW                 | 16   | 40          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -40 to 85    | FCT191A                  | <a href="#">Samples</a> |
| CY74FCT191CTQCT    | ACTIVE        | SSOP         | DBQ                | 16   | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR  | -40 to 85    | FT191-3                  | <a href="#">Samples</a> |
| CY74FCT191CTQCTE4  | ACTIVE        | SSOP         | DBQ                | 16   | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR  | -40 to 85    | FT191-3                  | <a href="#">Samples</a> |
| CY74FCT191CTQCTG4  | ACTIVE        | SSOP         | DBQ                | 16   | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR  | -40 to 85    | FT191-3                  | <a href="#">Samples</a> |
| CY74FCT191CTSOC    | ACTIVE        | SOIC         | DW                 | 16   | 40          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -40 to 85    | FCT191C                  | <a href="#">Samples</a> |
| CY74FCT191CTSOCE4  | ACTIVE        | SOIC         | DW                 | 16   | 40          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -40 to 85    | FCT191C                  | <a href="#">Samples</a> |
| CY74FCT191CTSOCG4  | ACTIVE        | SOIC         | DW                 | 16   | 40          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | -40 to 85    | FCT191C                  | <a href="#">Samples</a> |
| CY74FCT191CTSOCT   | OBSOLETE      | SOIC         | DW                 | 16   |             | TBD                        | Call TI          | Call TI              | -40 to 85    | FCT191C                  |                         |
| CY74FCT191CTSOCTG4 | OBSOLETE      | SOIC         | DW                 | 16   |             | TBD                        | Call TI          | Call TI              | -40 to 85    |                          |                         |

(1) 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.

(2) 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.

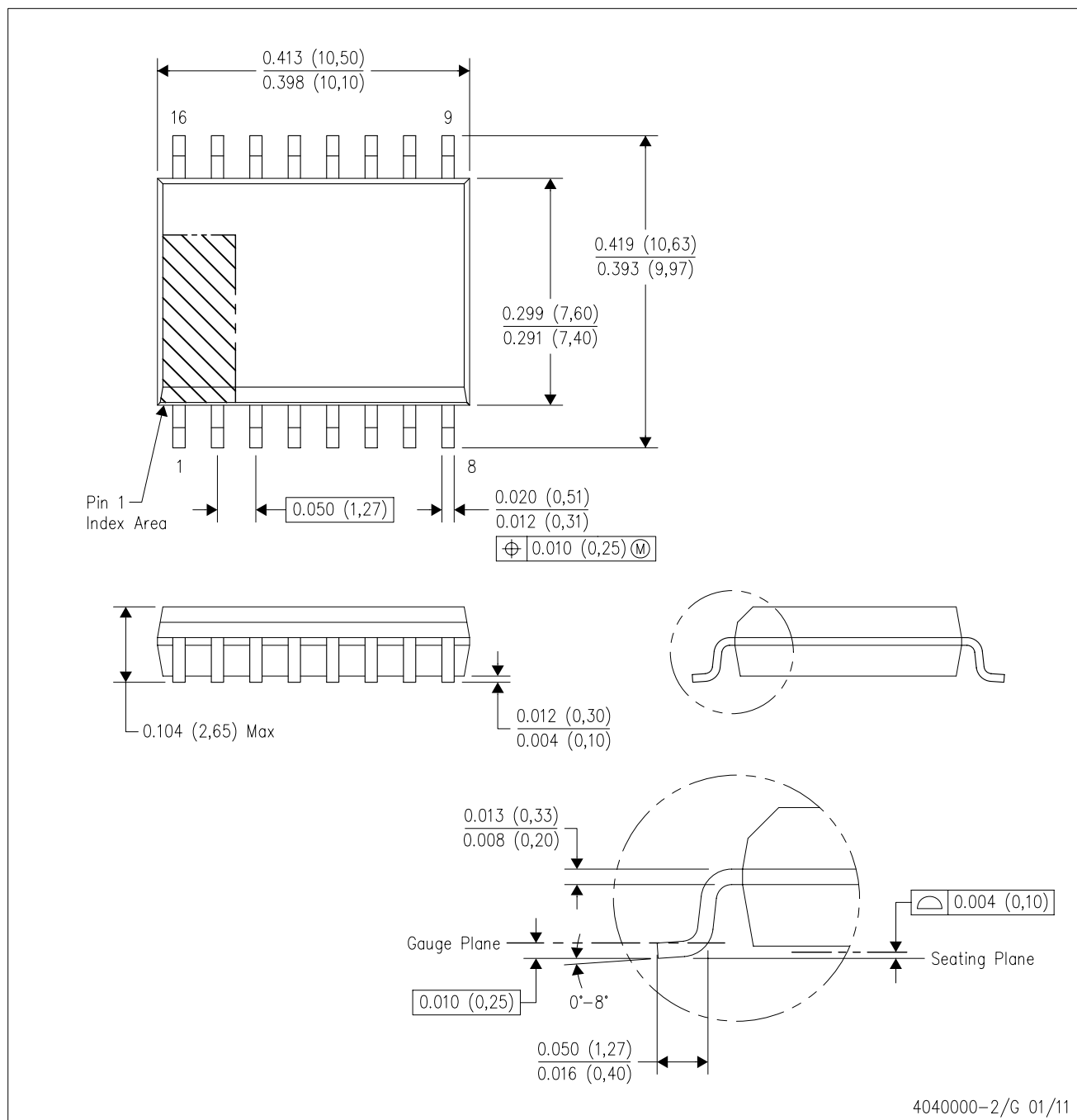
<sup>(4)</sup> Only one of markings shown within the brackets will appear on the physical device.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

DW (R-PDSO-G16)

PLASTIC SMALL OUTLINE

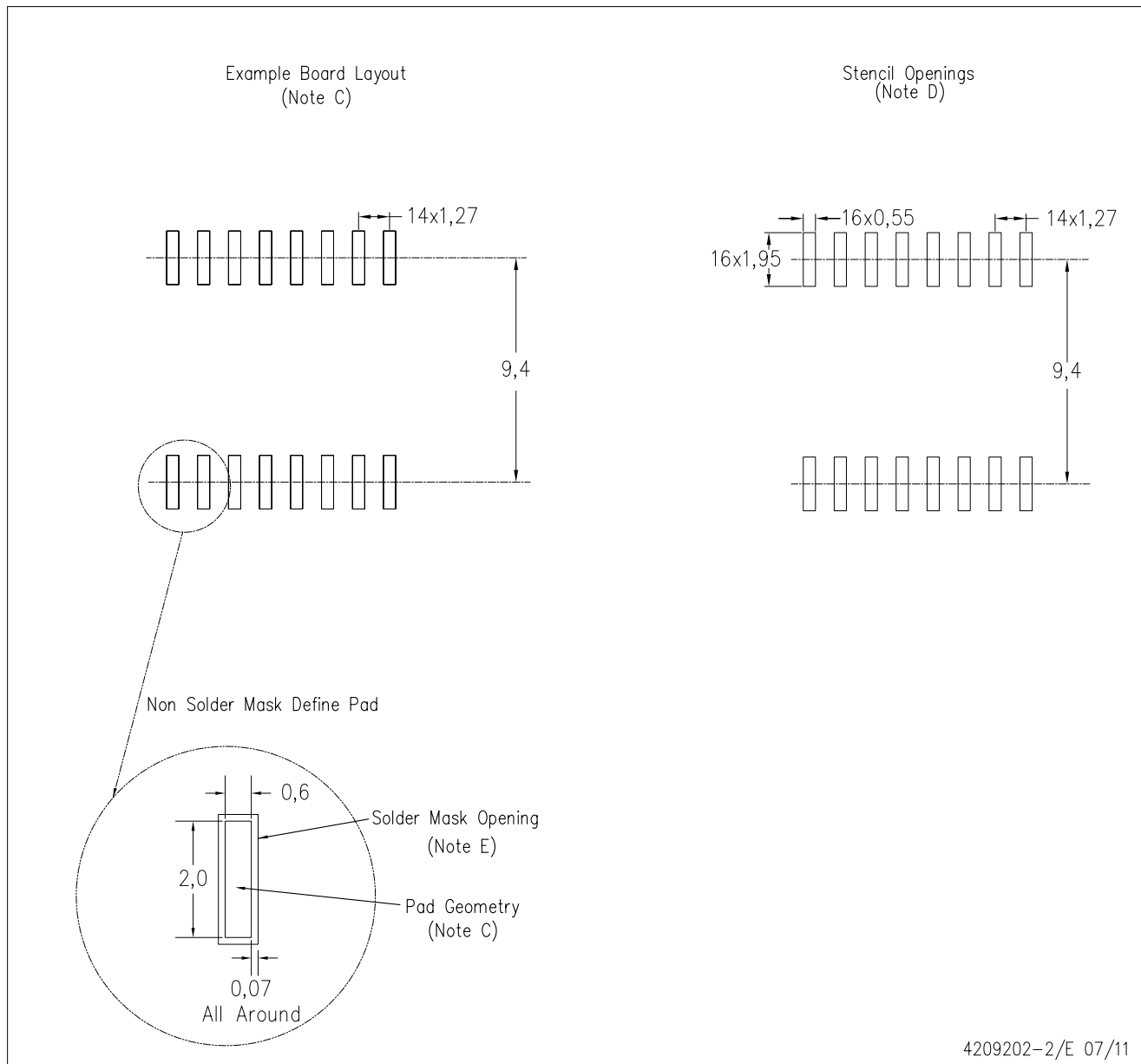


NOTES:

- 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 AA.

DW (R-PDSO-G16)

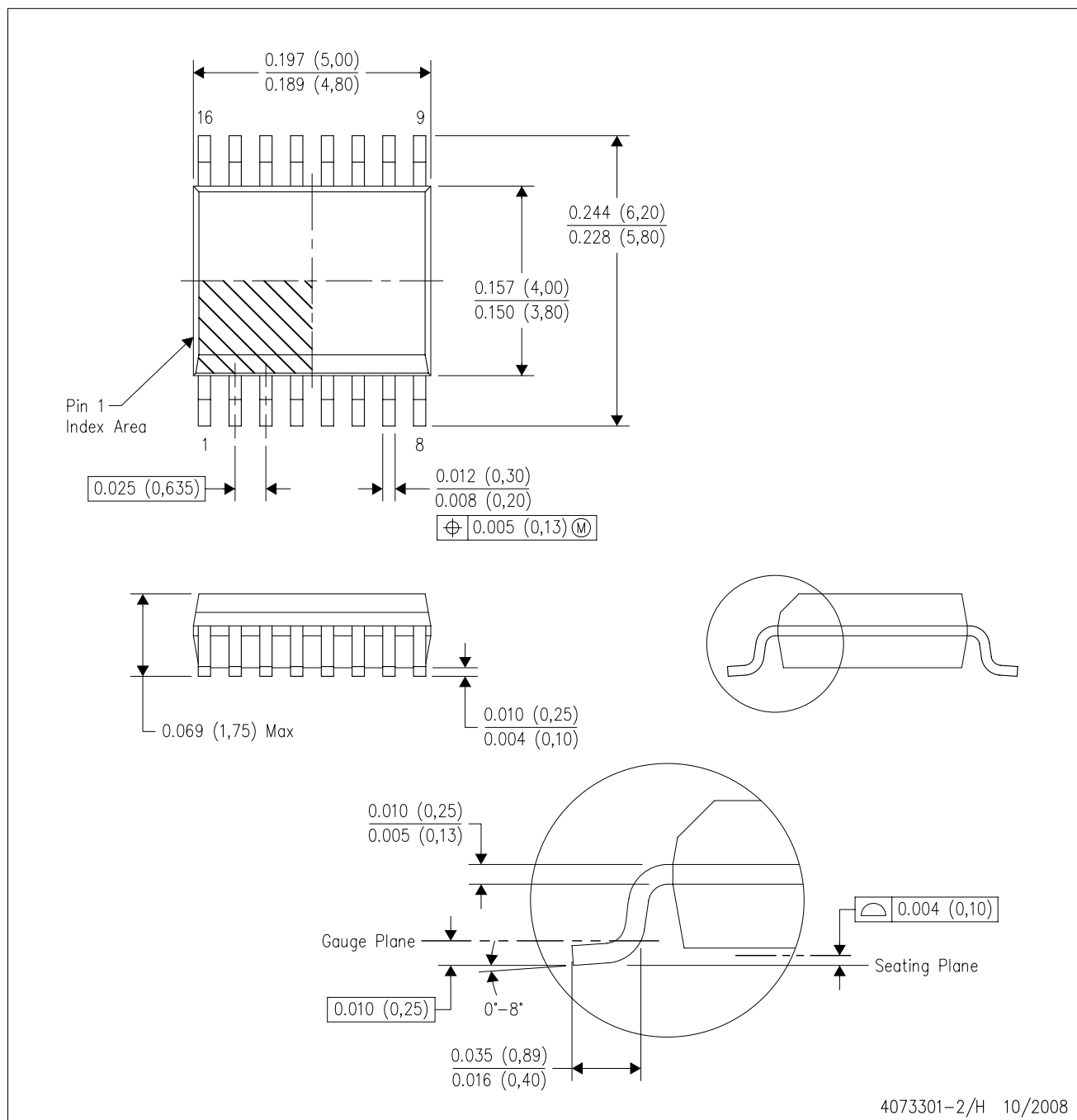
PLASTIC SMALL OUTLINE



- 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.

DBQ (R-PDSO-G16)

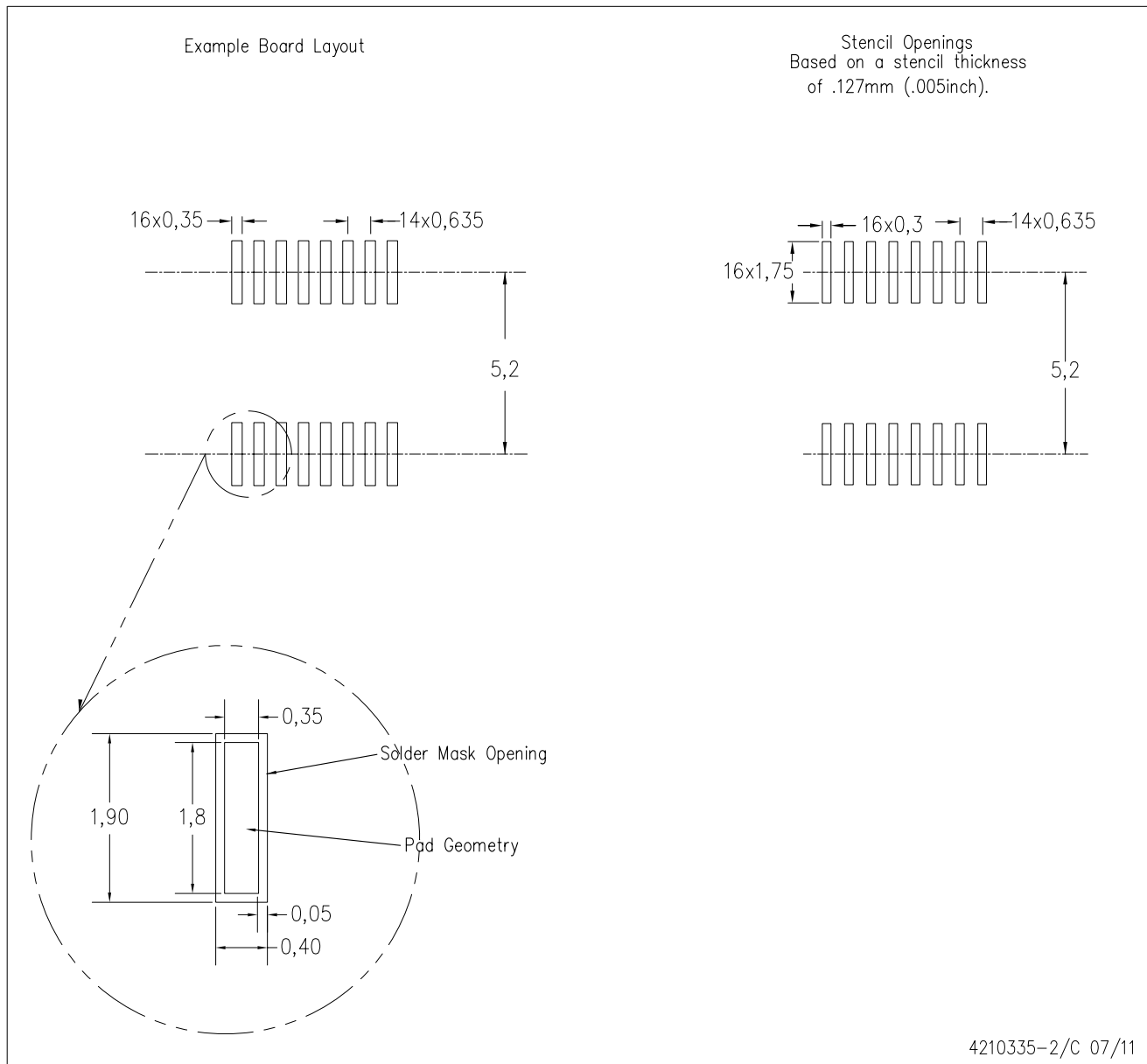
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - 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) per side.
  - D. Falls within JEDEC MO-137 variation AB.

DBQ (R-PDSO-G16)

PLASTIC SMALL OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
  - D. Publication IPC-7351 is recommended for alternate designs.
  - E. 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

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

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

|                              |                                                                                      |
|------------------------------|--------------------------------------------------------------------------------------|
| Audio                        | <a href="http://www.ti.com/audio">www.ti.com/audio</a>                               |
| Amplifiers                   | <a href="http://amplifier.ti.com">amplifier.ti.com</a>                               |
| Data Converters              | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>                       |
| DLP® Products                | <a href="http://www.dlp.com">www.dlp.com</a>                                         |
| DSP                          | <a href="http://dsp.ti.com">dsp.ti.com</a>                                           |
| Clocks and Timers            | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>                             |
| Interface                    | <a href="http://interface.ti.com">interface.ti.com</a>                               |
| Logic                        | <a href="http://logic.ti.com">logic.ti.com</a>                                       |
| Power Mgmt                   | <a href="http://power.ti.com">power.ti.com</a>                                       |
| Microcontrollers             | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a>                   |
| RFID                         | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>                                 |
| OMAP Applications Processors | <a href="http://www.ti.com/omap">www.ti.com/omap</a>                                 |
| Wireless Connectivity        | <a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a> |

### Applications

|                               |                                                                                          |
|-------------------------------|------------------------------------------------------------------------------------------|
| Automotive and Transportation | <a href="http://www.ti.com/automotive">www.ti.com/automotive</a>                         |
| Communications and Telecom    | <a href="http://www.ti.com/communications">www.ti.com/communications</a>                 |
| Computers and Peripherals     | <a href="http://www.ti.com/computers">www.ti.com/computers</a>                           |
| Consumer Electronics          | <a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>                   |
| Energy and Lighting           | <a href="http://www.ti.com/energy">www.ti.com/energy</a>                                 |
| Industrial                    | <a href="http://www.ti.com/industrial">www.ti.com/industrial</a>                         |
| Medical                       | <a href="http://www.ti.com/medical">www.ti.com/medical</a>                               |
| Security                      | <a href="http://www.ti.com/security">www.ti.com/security</a>                             |
| Space, Avionics and Defense   | <a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a> |
| Video and Imaging             | <a href="http://www.ti.com/video">www.ti.com/video</a>                                   |

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)



**Стандарт  
Электрон  
Связь**

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

**Наши контакты:**

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331