# SN74LV374A Octal Edge-Triggered D-Type Flip-Flops With 3-State Outputs

## 1 Features

- $V_{CC}$ operation of 2 V to 5.5 V
- Maximum $t_{pd}$ of 9.5 ns at 5 V
- Typical $V_{OLP}$ (Output Ground Bounce) <0.8 V at $V_{CC}$ = 3.3 V, $T_A$ = 25°C
- Typical $V_{OHV}$ (Output $V_{OH}$ Undershoot) >2.3 V at $V_{CC}$ = 3.3 V, $T_A$ = 25°C
- Support Mixed-Mode Voltage Operation on All Ports
- $I_{off}$ Supports Partial-Power-Down Mode Operation
- Latch-up Performance Exceeds 250 mA Per JESD 17

## 2 Applications

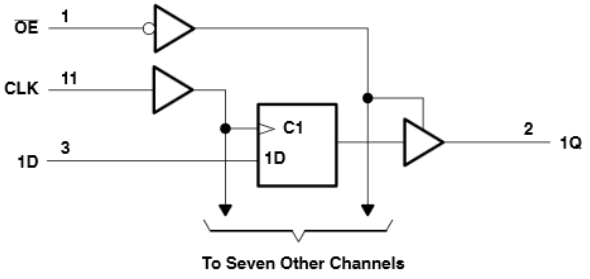
- Programmable Logic Controller (PLC)
- DCS and PAC: Analog Input Module
- Trains, Trams, and Subway Carriages
- AC Inverter Drives
- Printers

## 3 Description

The SN74LV374A devices are octal edge-triggered D-type flip-flops designed for 2 V to 5.5 V $V_{CC}$ operation.

**Package Information**

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|---|---|---|
| SN74LV374A | DB (SSOP, 20) | 7.20 mm × 5.30 mm |
| | DW (SOIC, 20) | 12.80 mm × 7.50 mm |
| | NS (SO, 20) | 12.60 mm × 5.30 mm |
| | PW (TSSOP, 20) | 6.50 mm × 4.40 mm |




Pin numbers shown are for the DB, DW, NS, PW, and RGY packages.

**Logic Diagram (Positive Logic)**

## Table of Contents



## 4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

**Changes from Revision K (December 2022) to Revision L (March 2023)** **Page**

- Updated structural layout of document and format of tables....1
- Updated thermal values for DW package from RθJA = 79.2 to 102.3, RθJC(top) = 43.7 to 69.9, RθJB = 47 to 70.8, ΨJT =18.6 to 46.4, ΨJB = 46.5 to 70.4, all values in °C/W....5

**Changes from Revision J (March 2015) to Revision K (December 2022)** **Page**

- Updated the format for tables, figures, and cross-references throughout the document....1

**Changes from Revision I (March 2015) to Revision J (October 2016)** **Page**

- Added Junction temperature, $T_J$....4
- Deleted "$V_{CC}$ × 0.3" from MIN and added "$V_{CC}$ × 0.3" to MAX for SN54LV374A and SN74LV374A....5
- Changed "SN54LV384A" to "SN54LV374A" in *Electrical Characteristics* table....6
- Added *Related Links* section, *Receiving Notification of Documentation Updates* section, and *Community Resources* section....14

**Changes from Revision H (April 2005) to Revision I (March 2015)** **Page**

- Added *Pin Configuration and Functions* section, *ESD Ratings* table, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section....1

## 5 Pin Configuration and Functions

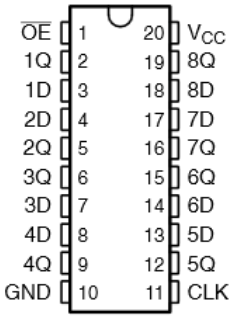



**Figure 5-1. DB, DW, NS, or PW Package 20-PIN SSOP, SOIC, SO, or TSSOP (Top View)**

**Table 5-1. Pin Functions**

| PIN | | TYPE | DESCRIPTION |
|---|---|---|---|
| NAME | NO. | | |
| $\overline{OE}$ | 1 | I | Enable pin |
| 1Q | 2 | O | Output 1 |
| 1D | 3 | I | Input 1 |
| 2D | 4 | I | Input 2 |
| 2Q | 5 | O | Output 2 |
| 3Q | 6 | O | Output 3 |
| 3D | 7 | I | Input 3 |
| 4D | 8 | I | Input 4 |
| 4Q | 9 | O | Output 4 |
| GND | 10 | – | Ground pin |
| CLK | 11 | I | Clock pin |
| 5Q | 12 | O | Output 5 |
| 5D | 13 | I | Input 5 |
| 6D | 14 | I | Input 6 |
| 6Q | 15 | O | Output 6 |
| 7Q | 16 | O | Output 7 |
| 7D | 17 | I | Input 7 |
| 8D | 18 | I | Input 8 |
| 8Q | 19 | O | Output 8 |
| $V_{CC}$ | 20 | – | Power pin |

# 6 Specifications

## 6.1 Absolute Maximum Ratings

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

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | −0.5 | 7 | V |
| $V_I$ | Input voltage(2) | | −0.5 | 7 | V |
| $V_O$ | Voltage applied to any output in the high-impedance or power-off state (2) | | −0.5 | 7 | V |
| $V_O$ | Output voltage(2) (3) | | −0.5 | $V_{CC}$ + 0.5 | V |
| $I_{IK}$ | Input clamp current | ($V_I$ < 0) | | –20 | mA |
| $I_{OK}$ | Output clamp current | ($V_O$ < 0) | | –50 | mA |
| $I_O$ | Continuous output current | ($V_O$ = 0 to $V_{CC}$) | | ±35 | mA |
| | Continuous current through $V_{CC}$ or GND | | | ±70 | mA |
| $T_J$ | Junction temperature | | | 150 | °C |
| $T_{stg}$ | Storage temperature | | –65 | 150 | °C |

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. 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 current ratings are observed.
(3) This value is limited to 5.5 V maximum.

## 6.2 ESD Ratings

| | | | VALUE | UNIT |
|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001(1) | ±2000 | V |
| | | Charged-device model (CDM), per JEDEC specification JESD22-C101(2) | ±1000 | |
| | | Machine Model (A115-A) | ±200 | |

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

## 6.3 Recommended Operating Conditions

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

| | | | SN74LV374A | | UNIT |
|---|---|---|---|---|---|
| | | | MIN | MAX | |
| $V_{CC}$ | Supply voltage | | 2 | 5.5 | V |
| $V_{IH}$ | High-level input voltage | $V_{CC}$ = 2 V | 1.5 | | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | $V_{CC}$ × 0.7 | | |
| | | $V_{CC}$ = 3 V to 3.6 V | $V_{CC}$ × 0.7 | | |
| | | $V_{CC}$ = 4.5 V to 5.5 V | $V_{CC}$ × 0.77 | | |
| $V_{IL}$ | Low-level input voltage | $V_{CC}$ = 2 V | | 0.5 | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | | $V_{CC}$ × 0.3 | |
| | | $V_{CC}$ = 3 V to 3.6 V | | $V_{CC}$ × 0.3 | |
| | | $V_{CC}$ = 4.5 V to 5.5 V | | $V_{CC}$ × 0.3 | |
| $V_I$ | Input voltage | | 0 | 5.5 | V |
| $V_O$ | Output voltage | High or low state | 0 | $V_{CC}$ | V |
| | | 3-state | 0 | 5.5 | |
| $I_{OH}$ | High-level output current | $V_{CC}$ = 2 V | | –50 | μA |
| | | $V_{CC}$ = 2.3 V to 2.7 V | | –2 | mA |
| | | $V_{CC}$ = 3 V to 3.6 V | | –8 | |
| | | $V_{CC}$ = 4.5 V to 5.5 V | | –16 | |
| $I_{OL}$ | Low-level output current | $V_{CC}$ = 2 V | | 50 | μA |
| | | $V_{CC}$ = 2.3 V to 2.7 V | | 2 | mA |
| | | $V_{CC}$ = 3 V to 3.6 V | | 8 | |
| | | $V_{CC}$ = 4.5 V to 5.5 V | | 16 | |
| Δt/Δv | Input transition rise or fall rate | $V_{CC}$ = 2.3 V to 2.7 V | | 200 | ns/V |
| | | $V_{CC}$ = 3 V to 3.6 V | | 100 | |
| | | $V_{CC}$ = 4.5 V to 5.5 V | | 20 | |
| $T_A$ | Operating free-air temperature | | –40 | 125 | °C |

(1) All unused inputs of the device must be held at $V_{CC}$ or GND to ensure proper device operation. See *Implications of Slow or Floating CMOS Inputs*, SCBA004.

## 6.4 Thermal Information

| THERMAL METRIC(1) | | SN74LV374A | | | | UNIT |
|---|---|---|---|---|---|---|
| | | DB (SSOP) | DW (SOIC) | NS (SO) | PW (TSSOP) | |
| | | 20 PINS | 20 PINS | 20 PINS | 20 PINS | |
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 94.5 | 102.3 | 76.7 | 102.4 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 56.4 | 69.9 | 43.2 | 36.5 | °C/W |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 49.7 | 70.8 | 44.2 | 53.6 | °C/W |
| $\psi_{JT}$ | Junction-to-top characterization parameter | 18.5 | 46.4 | 16.8 | 2.4 | °C/W |
| $\psi_{JB}$ | Junction-to-board characterization parameter | 49.3 | 70.4 | 43.8 | 52.9 | °C/W |
| $R_{\theta JC(bot)}$ | Junction-to-case (bottom) thermal resistance | N/A | N/A | N/A | N/A | °C/W |

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report.

## 6.5 Electrical Characteristics

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

| PARAMETER | TEST CONDITIONS | $V_{CC}$ | SN74LV374A –40°C to +85°C | | | SN74LV374A –40°C to +125°C | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_{OH}$ | $I_{OH}$ = −50 µA | 2 V to 5.5 V | $V_{CC}$−0.1 | | | $V_{CC}$−0.1 | | | V |
| | $I_{OH}$ = −2 mA | 2.3 V | 2 | | | 2 | | | |
| | $I_{OH}$ = −8 mA | 3 V | 2.48 | | | 2.48 | | | |
| | $I_{OH}$ = −16 mA | 4.5 V | 3.8 | | | 3.8 | | | |
| $V_{OL}$ | $I_{OL}$ = 50 µA | 2 V to 5.5 V | | | 0.1 | | | 0.1 | V |
| | $I_{OL}$ = 2 mA | 2.3 V | | | 0.4 | | | 0.4 | |
| | $I_{OL}$ = 8 mA | 3 V | | | 0.44 | | | 0.44 | |
| | $I_{OL}$ = 16 mA | 4.5 V | | | 0.55 | | | 0.55 | |
| $I_I$ | $V_I$ = 5.5 V or GND | 0 to 5.5 V | | | ±1 | | | ±1 | µA |
| $I_{OZ}$ | $V_O$ = $V_{CC}$ or GND | 5.5 V | | | ±5 | | | ±5 | µA |
| $I_{CC}$ | $V_I$ = $V_{CC}$ or GND , $I_O$ = 0 | 5.5 V | | | 20 | | | 20 | µA |
| $I_{off}$ | $V_I$ or $V_O$ = 0 to 5.5 V | 0 | | | 5 | | | 5 | µA |
| $C_i$ | $V_I$ = $V_{CC}$ or GND | 3.3 V | | 2.9 | | | 2.9 | | pF |

## 6.6 Switching Characteristics, $V_{CC}$ = 2.5 V ± 0.2 V

over recommended operating free-air temperature range, $V_{CC}$ = 2.5 V ± 0.2 V (unless otherwise noted)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE | $T_A$ = 25°C | | | SN74LV374A –40°C to +85°C | | SN74LV374A –40°C to +125°C | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| $f_{max}$ | | | $C_L$ = 15 pF | 60[1] | 105[1] | | 50 | | 50 | | MHz |
| | | | $C_L$ = 50 pF | 50 | 85 | | 40 | | 40 | | |
| $t_{pd}$ | CLK | Q | $C_L$ = 15 pF | | 9.7[1] | 16.3[1] | 1 | 19 | 1 | 20.5 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | | 8.9[1] | 15.9[1] | 1 | 19 | 1 | 20.5 | |
| $t_{dis}$ | $\overline{OE}$ | Q | | | 6.3[1] | 12.6[1] | 1 | 15 | 1 | 16.5 | |
| $t_{pd}$ | CLK | Q | $C_L$ = 50 pF | | 11.8 | 19.3 | 1 | 23 | 1 | 24.5 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | | 10.9 | 18.8 | 1 | 22 | 1 | 23.5 | |
| $t_{dis}$ | $\overline{OE}$ | Q | | | 8.2 | 17.3 | 1 | 19 | 1 | 20.5 | |
| $t_{sk(o)}$ | | | | | | 2 | | 2 | | | |

(1) On products compliant to MIL-PRF-38535, this parameter is not production tested.

## 6.7 Switching Characteristics, $V_{CC}$ = 3.3 V ± 0.3 V

over recommended operating free-air temperature range, $V_{CC}$ = 3.3 V ± 0.3 V (unless otherwise noted)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE | $T_A$ = 25°C | | | SN74LV374A –40°C to +85°C | | SN74LV374A –40°C to +125°C | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| $f_{max}$ | | | $C_L$ = 15 pF | 80[1] | 150[1] | | 70 | | 70 | | MHz |
| | | | $C_L$ = 50 pF | 55 | 110 | | 50 | | 50 | | |
| $t_{pd}$ | CLK | Q | $C_L$ = 15 pF | | 6.8[1] | 12.7[1] | 1 | 15 | 1 | 16 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | | 6.3[1] | 11[1] | 1 | 13 | 1 | 14 | |
| $t_{dis}$ | $\overline{OE}$ | Q | | | 4.7[1] | 10.5[1] | 1 | 12.5 | 1 | 13.5 | |
| $t_{pd}$ | CLK | Q | $C_L$ = 50 pF | | 8.3 | 16.2 | 1 | 18.5 | 1 | 19.5 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | | 7.7 | 14.5 | 1 | 16.5 | 1 | 17.5 | |
| $t_{dis}$ | $\overline{OE}$ | Q | | | 5.9 | 14 | 1 | 16 | 1 | 17 | |
| $t_{sk(o)}$ | | | | | | 1.5 | | 1.5 | | | |

(1) On products compliant to MIL-PRF-38535, this parameter is not production tested.

## 6.8 Switching Characteristics, $V_{CC}$ = 5 V ± 0.5 V

over recommended operating free-air temperature range, $V_{CC}$ = 5 V ± 0.5 V (unless otherwise noted)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE | $T_A$ = 25°C | | | SN74LV374A –40°C to +85°C | | SN74LV374A –40°C to +125°C | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| $f_{max}$ | | | $C_L$ = 15 pF | 130[1] | 205[1] | | 110 | | 110 | | MHz |
| | | | $C_L$ = 50 pF | 85 | 1705 | | 75 | | 75 | | |
| $t_{pd}$ | CLK | Q | $C_L$ = 15 pF | | 4.9[1] | 8.1[1] | 1 | 9.5 | 1 | 10.5 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | | 4.6[1] | 7.6[1] | 1 | 9 | 1 | 10 | |
| $t_{dis}$ | $\overline{OE}$ | Q | | | 3.4[1] | 6.8[1] | 1 | 8 | 1 | 9 | |
| $t_{pd}$ | CLK | Q | $C_L$ = 50 pF | | 5.9 | 10.1 | 1 | 11.5 | 1 | 12.5 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | | 5.5 | 9.6 | 1 | 11 | 1 | 12 | |
| $t_{dis}$ | $\overline{OE}$ | Q | | | 4 | 8.8 | 1 | 10 | 1 | 11 | |
| $t_{sk(o)}$ | | | | | | 1 | | 1 | | | |

(1) On products compliant to MIL-PRF-38535, this parameter is not production tested.

## 6.9 Timing Requirements

over recommended operating free-air temperature range, (unless otherwise noted) (see Load Circuit and Voltage Waveforms)

| | | $T_A$ = 25°C | | SN74LV374A –40°C to +85°C | | SN74LV374A –40°C to +125°C | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | MIN | MAX | MIN | MAX | MIN | MAX | |
| **$V_{CC}$ = 2.5 V ± 0.2 V** | | | | | | | | |
| $t_w$ | Pulse duration, CLK high or low | 6 | | 7 | | 7 | | ns |
| $t_{su}$ | Setup time, data before CLK↑ | 5 | | 5.5 | | 6 | | ns |
| $t_h$ | Hold time, data after CLK↑ | 2.5 | | 2.5 | | 3 | | ns |
| **$V_{CC}$ = 3.3 V ± 0.3 V** | | | | | | | | |
| $t_w$ | Pulse duration, CLK high or low | 5 | | 5.5 | | 5.5 | | ns |
| $t_{su}$ | Setup time, data before CLK↑ | 4.5 | | 4.5 | | 5 | | ns |
| $t_h$ | Hold time, data after CLK↑ | 2 | | 2 | | 2.5 | | ns |
| **$V_{CC}$ = 5 V ± 0.5 V** | | | | | | | | |
| $t_w$ | Pulse duration, CLK high or low | 5 | | 5 | | 5 | | ns |
| $t_{su}$ | Setup time, data before CLK↑ | 3 | | 3 | | 3.5 | | ns |
| $t_h$ | Hold time, data after CLK↑ | 2 | | 2 | | 2.5 | | ns |

## 6.10 Noise Characteristics

$V_{CC}$ = 3.3 V, $C_L$ = 50 pF, $T_A$ = 25°C (1)

| PARAMETER | | SN74LV374A | | | UNIT |
|---|---|---|---|---|---|
| | | MIN | TYP | MAX | |
| $V_{OL(P)}$ | Quiet output, maximum dynamic $V_{OL}$ | | 0.6 | 0.8 | V |
| $V_{OL(V)}$ | Quiet output, minimum dynamic $V_{OL}$ | | −0.5 | −0.8 | V |
| $V_{OH(V)}$ | Quiet output, minimum dynamic $V_{OH}$ | 2.9 | 2.9 | | V |
| $V_{IH(D)}$ | High-level dynamic input voltage | 2.31 | | | V |
| $V_{IL(D)}$ | Low-level dynamic input voltage | | | 0.99 | V |

(1) Characteristics are for surface-mount packages only.

## 6.11 Operating Characteristics, $T_A$ = 25°C

| PARAMETER | | | TEST CONDITIONS | | $V_{CC}$ | TYP | UNIT |
|---|---|---|---|---|---|---|---|
| $C_{pd}$ | Power dissipation capacitance | Outputs enabled | $C_L$ = 50 pF, | f = 10 MHz | 3.3 V | 21.1 | pF |
| | | | | | 5 V | 22.8 | |

## 6.12 Typical Characteristics

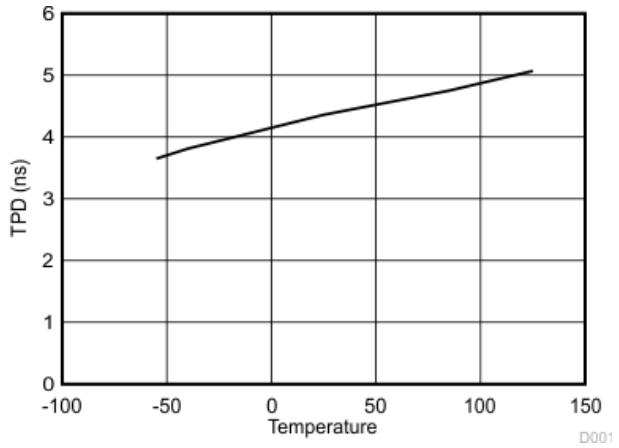



Figure 6-1. TPD vs. Temperature at 5 V

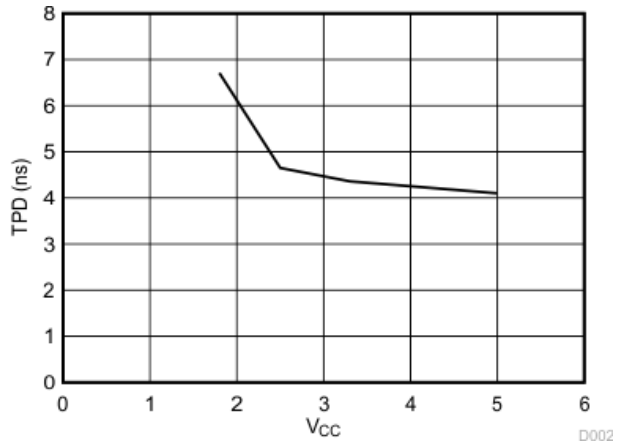
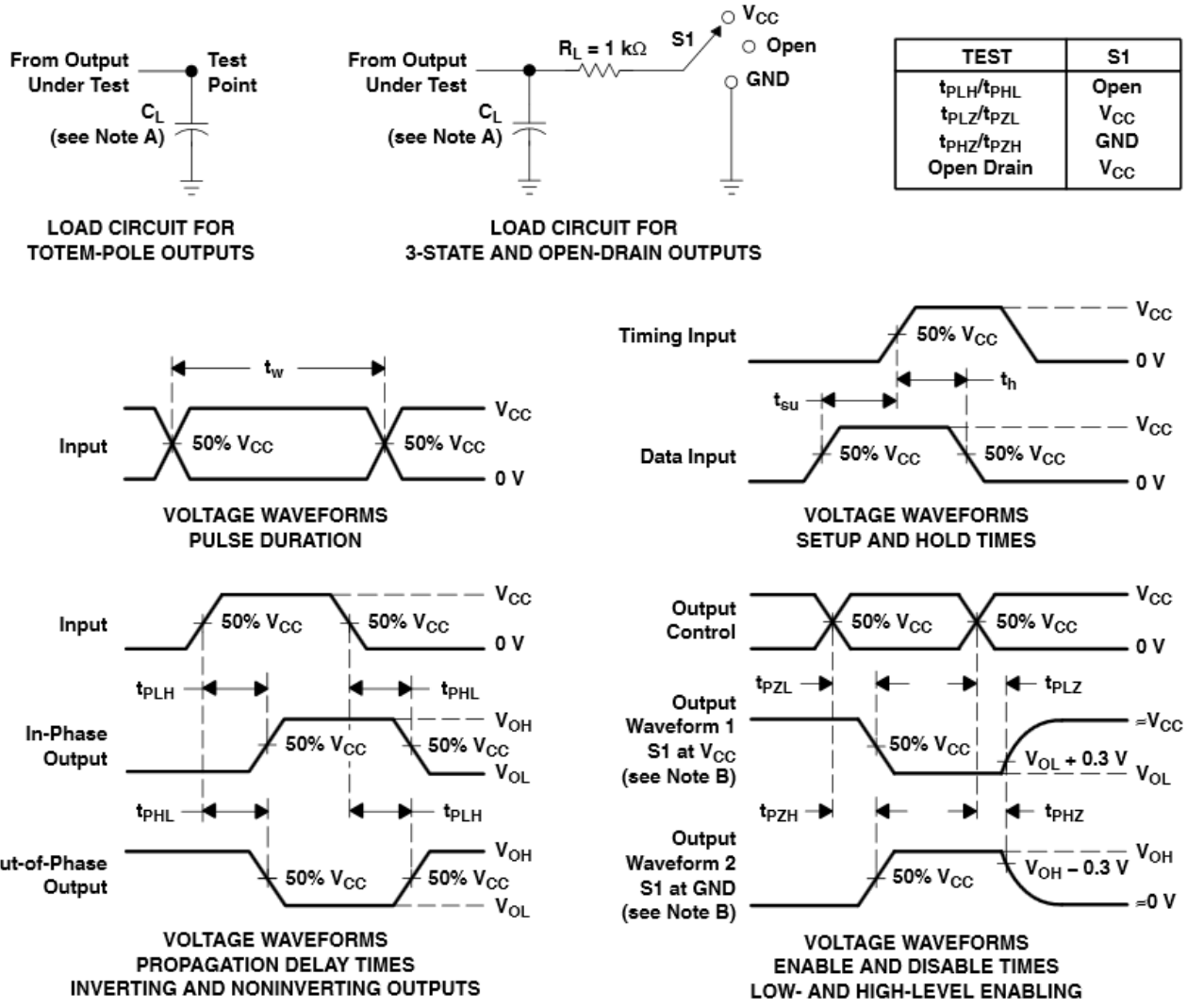



Figure 6-2. TPD vs. $V_{CC}$ at 25°C

## 7 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. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, $Z_O$ = 50 Ω, $t_r$ ≤ 3 ns, $t_f$ ≤ 3 ns.
D. The outputs are measured one at a time, with one input transition per measurement.
E. $t_{PLZ}$ and $t_{PHZ}$ are the same as $t_{dis}$.
F. $t_{PZL}$ and $t_{PZH}$ are the same as $t_{en}$.
G. $t_{PHL}$ and $t_{PLH}$ are the same as $t_{pd}$.
H. All parameters and waveforms are not applicable to all devices.

**Figure 7-1. Load Circuit and Voltage Waveforms**

# 8 Detailed Description

## 8.1 Overview

The SN74LV374A devices are octal edge-triggered D-type flip-flops designed for 2 V to 5.5 V $V_{CC}$ operation. These devices feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. They are particularly suitable for implementing buffer registers, I/O ports, bi-directional bus drivers, and working registers.

On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels set up at the data (D) inputs. A buffered output-enable ( $\overline{OE}$) input can be used to place the eight outputs in either a normal logic state (high or low logic levels) or high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and the increased drive provide the capability to drive bus lines without need for interface or pullup components. $\overline{OE}$ does not affect internal operations of the latch.

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

These devices are fully specified for partial-power-down applications using Ioff. The Ioff circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down. The output of the device is unknown until the first valid rising clock edge occurs while $V_{CC}$ is within the *Section 6.3* range.

## 8.2 Functional Block Diagram

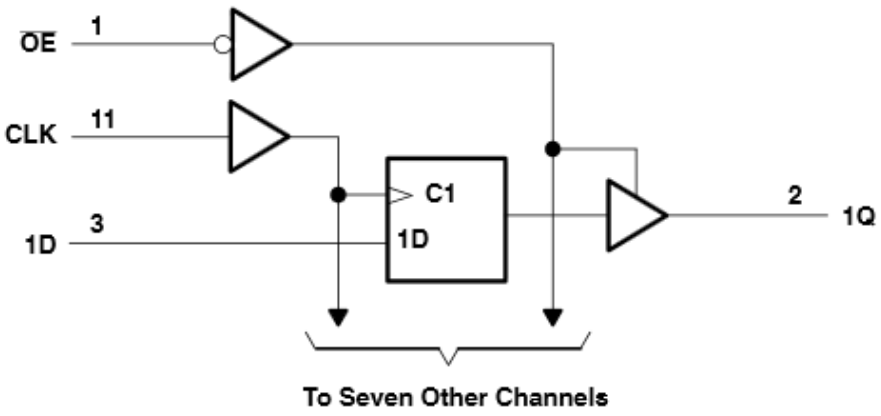



**Figure 8-1. Logic Diagram (Positive Logic)**

## 8.3 Feature Description

The device's wide operating range allows it to be used in a variety of systems that use different logic levels. The low propagation delay allows fast switching and higher speeds of operation. In addition, the low ground bounce stabilizes the performance of non-switching outputs while another output is switching.

## 8.4 Device Functional Modes

Table 8-1 lists the functional modes of the SN74LV374A devices.

**Table 8-1. Function Table (Each Flip-Flop)**

| INPUTS | | | OUTPUT Q |
|---|---|---|---|
| $\overline{OE}$ | CLK | D | |
| L | ↑ | H | H |
| L | ↑ | L | L |
| L | L | X | $Q_0$ |
| H | X | X | Z |

# 9 Application and Implementation

**Note**

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

## 9.1 Application Information

The SN74LV374A is a low drive CMOS device that can be used for a multitude of bus interface type applications where output ringing is a concern. The low drive and slow edge rates will minimize overshoot and undershoot on the outputs. The inputs accept voltages up to 5.5 V allowing down translation to the $V_{CC}$ level.

## 9.2 Typical Application

Figure 9-1 shows how the slower edges can reduce ringing on the output compared to higher drive parts like AC.

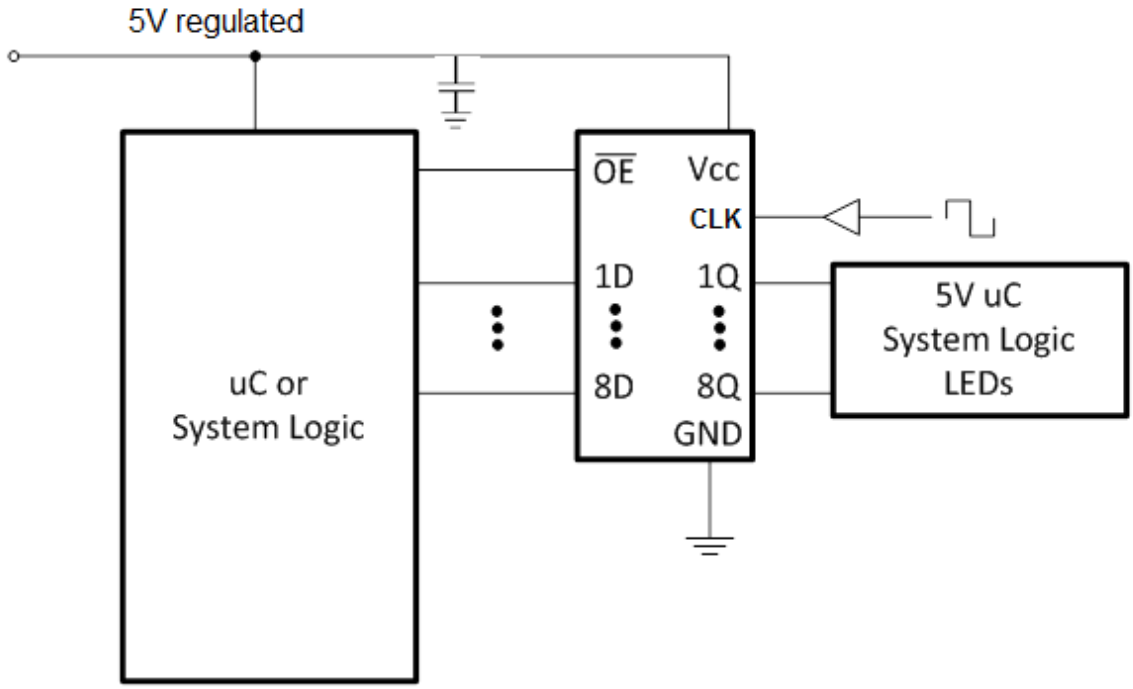



**Figure 9-1. Typical Application Schematic**

### 9.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Take care to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive will also create fast edges into light loads so consider routing and load conditions to prevent ringing.

### 9.2.2 Detailed Design Procedure

- Recommended Input conditions:
  - Rise time and fall time specs see (Δt/ΔV) in *Section 6.3*.
  - Specified High and low levels. See ($V_{IH}$ and $V_{IL}$) in *Section 6.3*.
  - Inputs are overvoltage tolerant allowing them to go as high as 5.5 V at any valid $V_{CC}$.
- Recommended output conditions:
  - Load currents should not exceed 35 mA per output and 70 mA total for the part.
  - Outputs should not be pulled above $V_{CC}$.

### 9.2.3 Application Curve

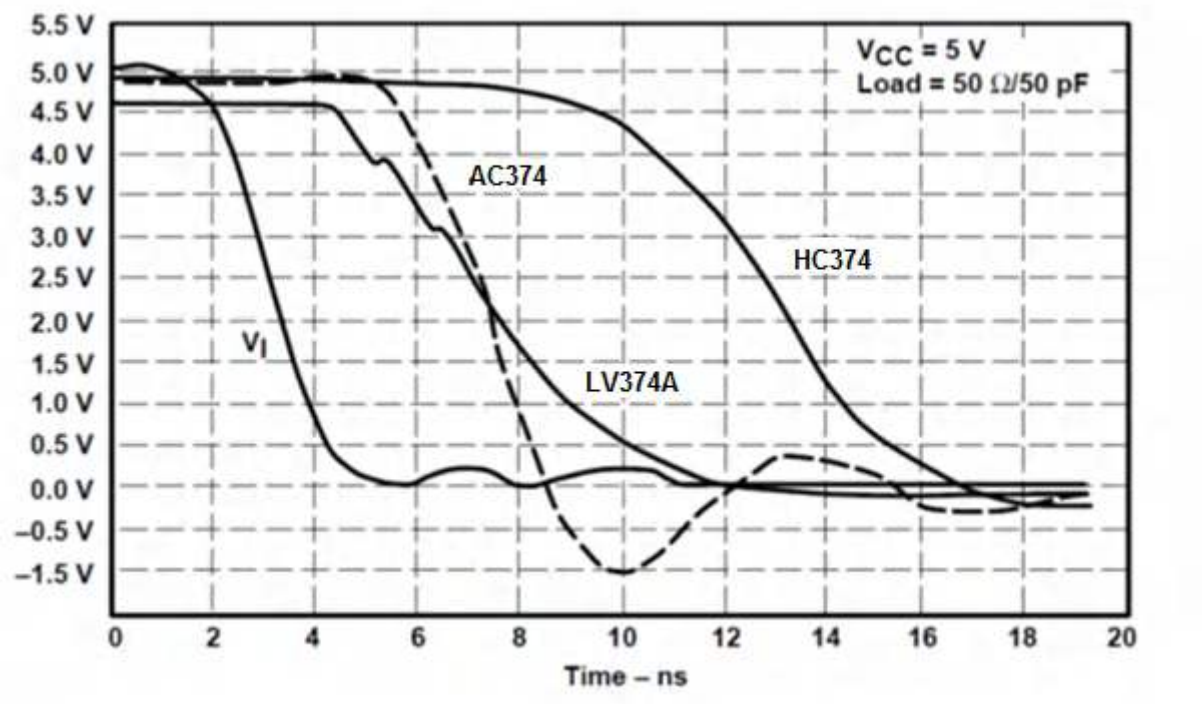



**Figure 9-2. Switching Characteristics Comparison**

## 9.3 Power Supply Recommendations

## 9.4 Layout

### 9.4.1 Layout Guidelines

When using multiple bit logic devices inputs should not ever float. In many cases, functions or parts of functions of digital logic devices are unused, for example, when only two inputs of a triple-input AND gate are used or only three of the four buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. Specified below are the rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or $V_{CC}$ whichever make more sense or is more convenient. Floating outputs is generally acceptable, unless the part is a transceiver. If the transceiver has an output enable pin it will disable the outputs section of the part when asserted. This will not disable the input section of the I.O's so they also cannot float when disabled.

#### 9.4.1.1 Layout Example

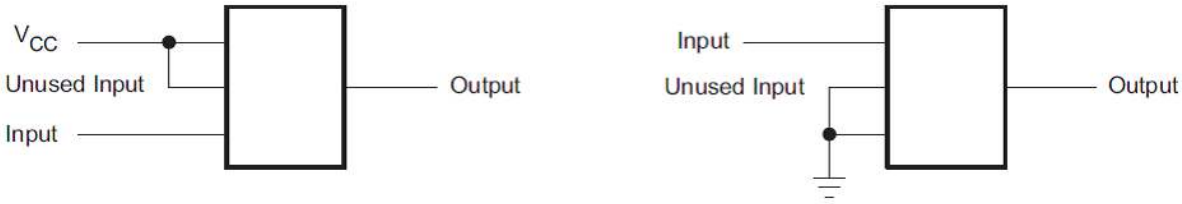



**Figure 9-3. Layout Example**

# 10 Device and Documentation Support

## 10.1 Documentation Support

### 10.1.1 Related Documentation

For related documentation see the following:

*Implications of Slow or Floating CMOS Inputs*, SCBA004

## 10.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

## 10.3 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

## 10.4 Trademarks

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All trademarks are the property of their respective owners.

## 10.5 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

## 10.6 Glossary

| | |
|---|---|
| TI Glossary | This glossary lists and explains terms, acronyms, and definitions. |

## 11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SN74LV374ADBR | ACTIVE | SSOP | DB | 20 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LV374A | Samples |
| SN74LV374ADWR | ACTIVE | SOIC | DW | 20 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LV374A | Samples |
| SN74LV374ANSR | ACTIVE | SO | NS | 20 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 74LV374A | Samples |
| SN74LV374APWR | ACTIVE | TSSOP | PW | 20 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LV374A | Samples |

(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) **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.

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

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

(5) 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.

(6) 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.

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.

**OTHER QUALIFIED VERSIONS OF SN74LV374A :**

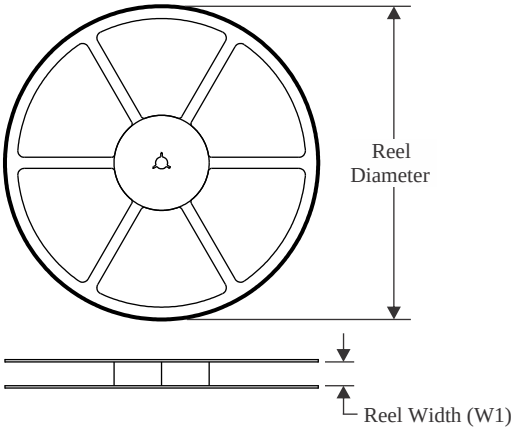
- Automotive : SN74LV374A-Q1
- Enhanced Product : SN74LV374A-EP

NOTE: Qualified Version Definitions:

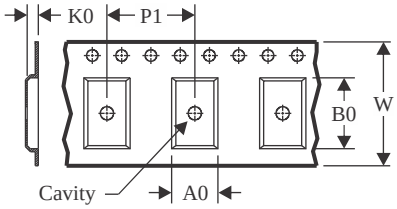
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

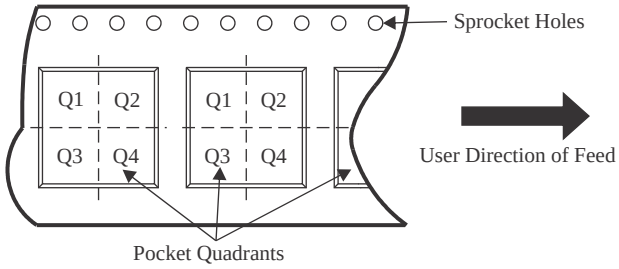



**TAPE DIMENSIONS**




| | |
|---|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

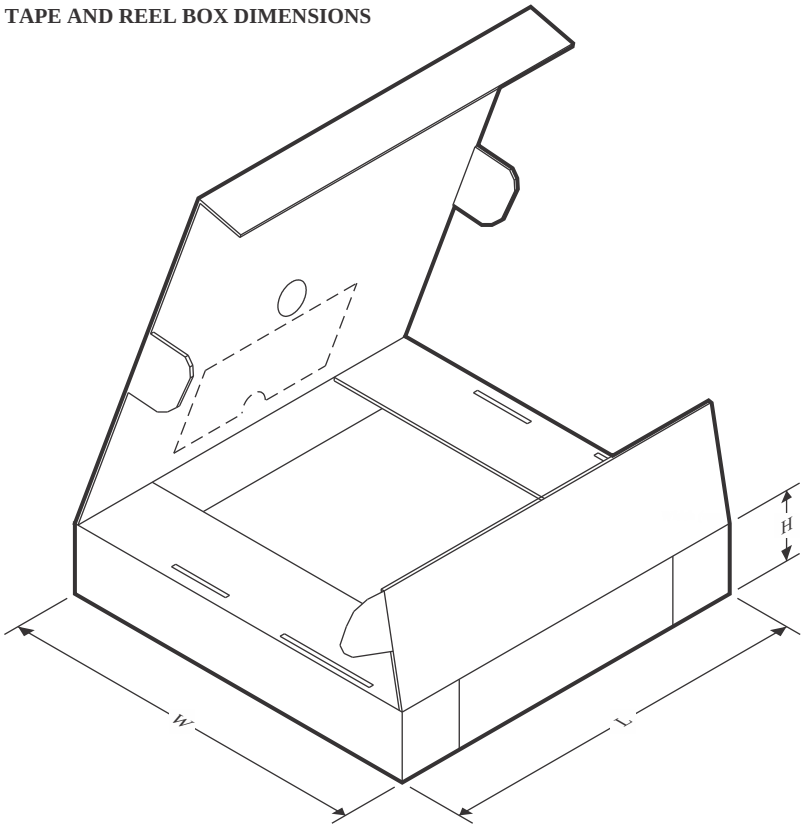
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SN74LV374ADBR | SSOP | DB | 20 | 2000 | 330.0 | 16.4 | 8.2 | 7.5 | 2.5 | 12.0 | 16.0 | Q1 |
| SN74LV374ADWR | SOIC | DW | 20 | 2000 | 330.0 | 24.4 | 10.8 | 13.3 | 2.7 | 12.0 | 24.0 | Q1 |
| SN74LV374ANSR | SO | NS | 20 | 2000 | 330.0 | 24.4 | 8.4 | 13.0 | 2.5 | 12.0 | 24.0 | Q1 |
| SN74LV374APWR | TSSOP | PW | 20 | 2000 | 330.0 | 16.4 | 6.95 | 7.0 | 1.4 | 8.0 | 16.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS




*All dimensions are nominal

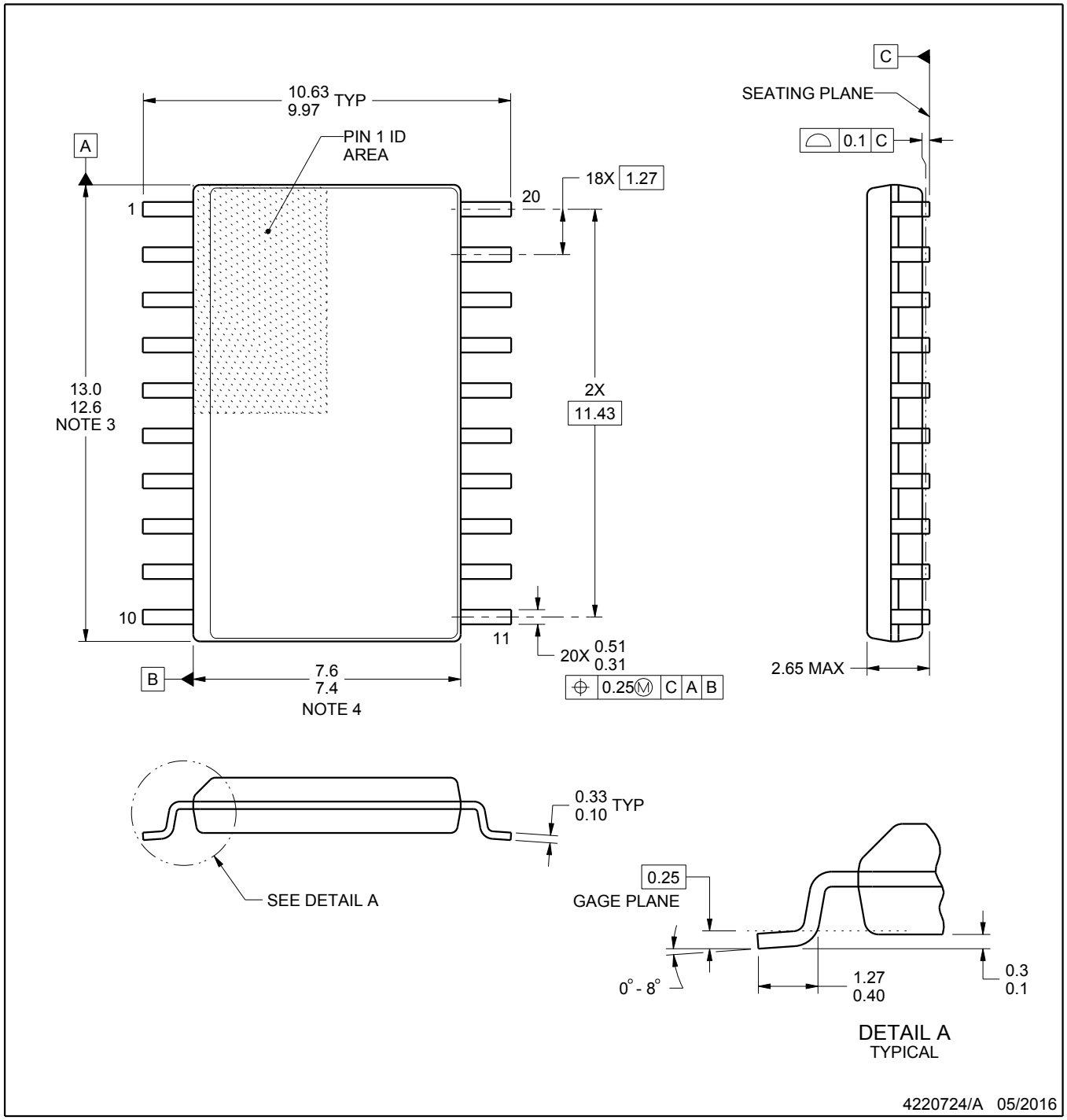
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| SN74LV374ADBR | SSOP | DB | 20 | 2000 | 356.0 | 356.0 | 35.0 |
| SN74LV374ADWR | SOIC | DW | 20 | 2000 | 367.0 | 367.0 | 45.0 |
| SN74LV374ANSR | SO | NS | 20 | 2000 | 367.0 | 367.0 | 45.0 |
| SN74LV374APWR | TSSOP | PW | 20 | 2000 | 356.0 | 356.0 | 35.0 |

# PACKAGE OUTLINE

## DW0020A

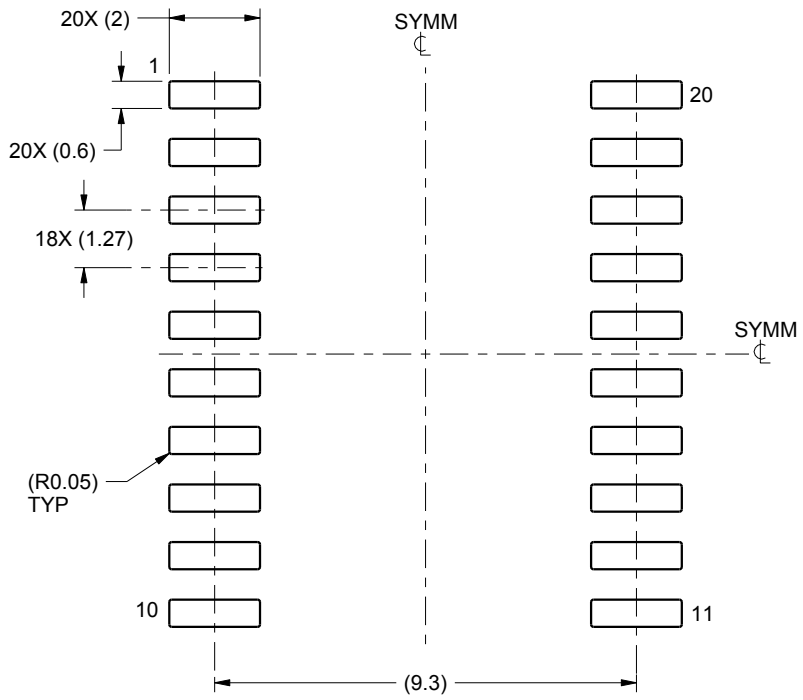
## SOIC - 2.65 mm max height

SOIC

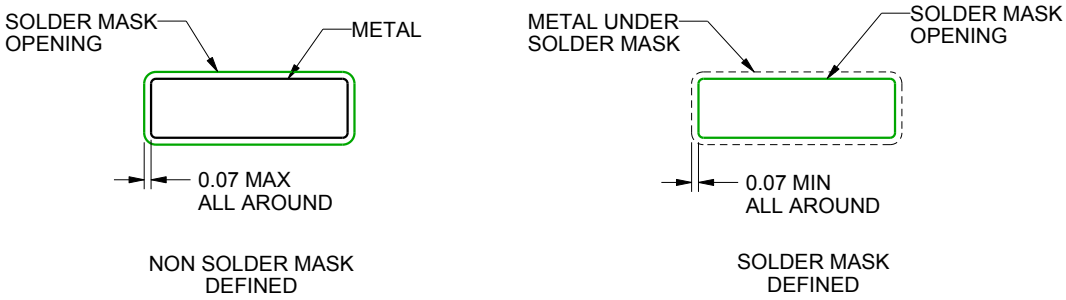



NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
5. Reference JEDEC registration MS-013.




LAND PATTERN EXAMPLE
SCALE:6X

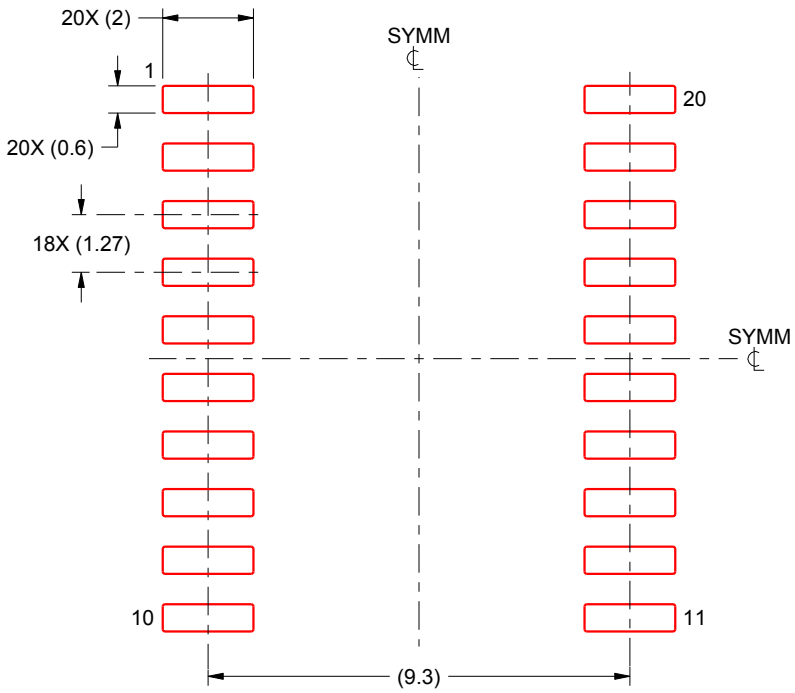



SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.




SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

4220724/A 05/2016

NOTES: (continued)

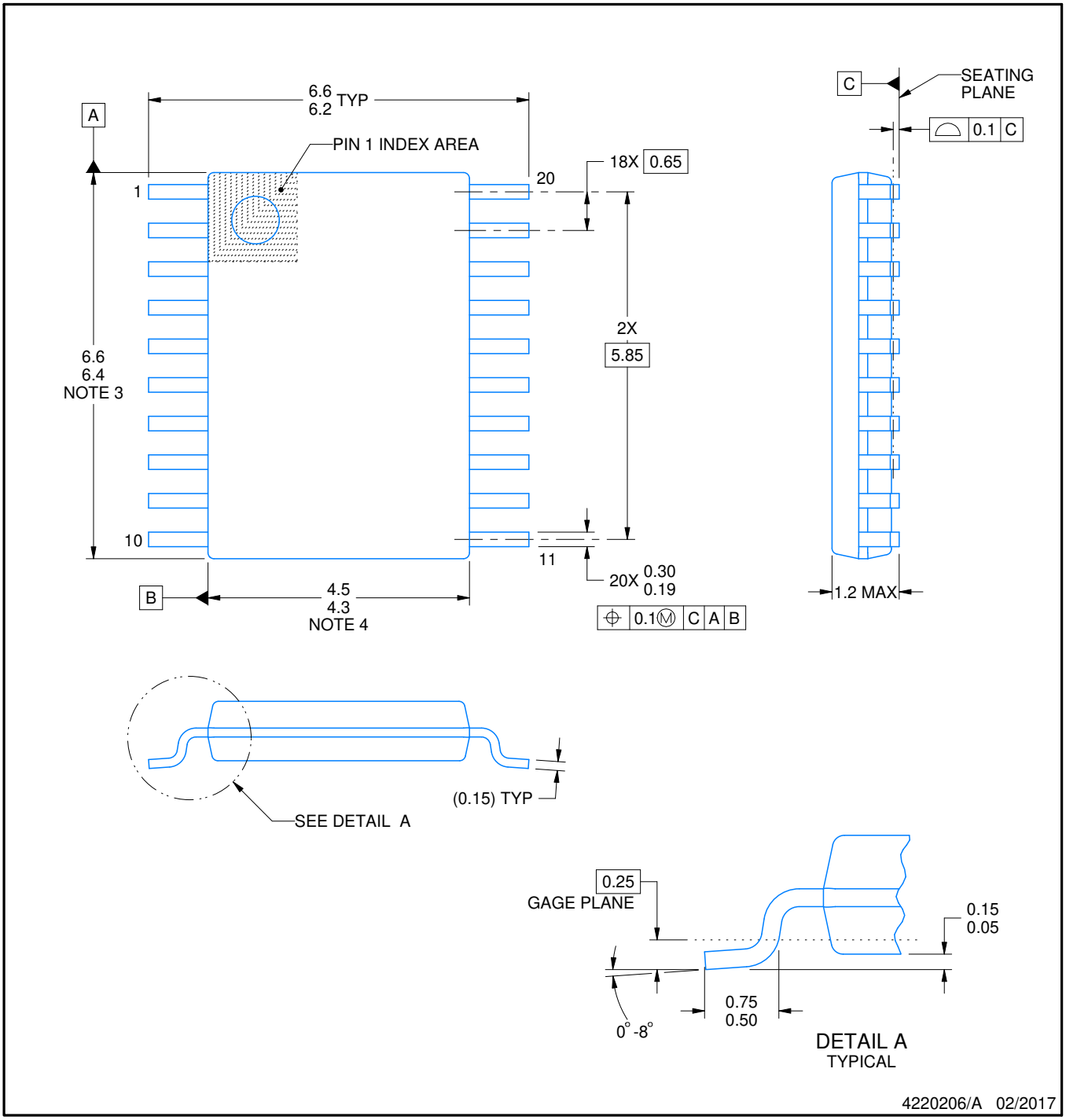
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

# PACKAGE OUTLINE

## PW0020A

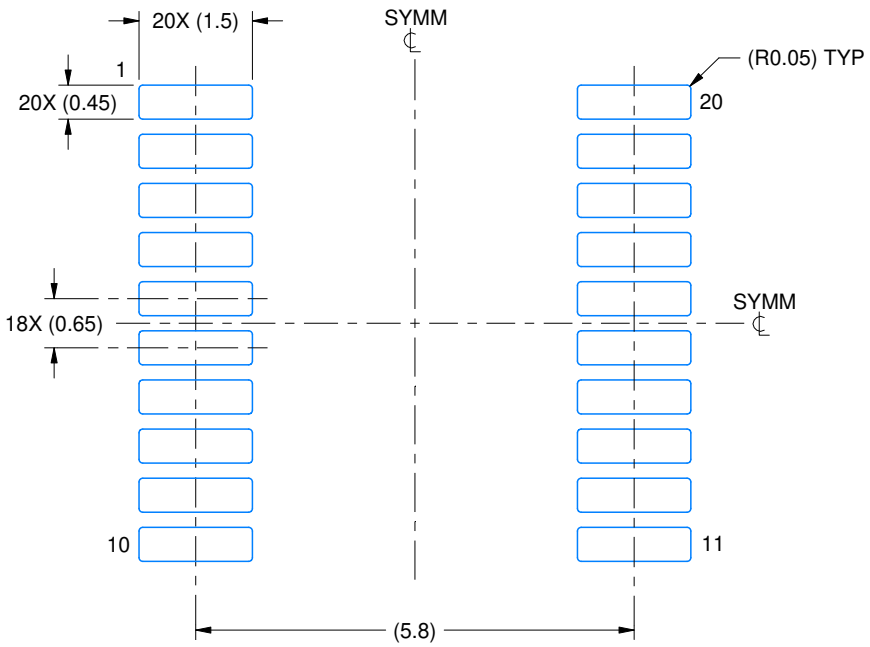
## TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE




NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.



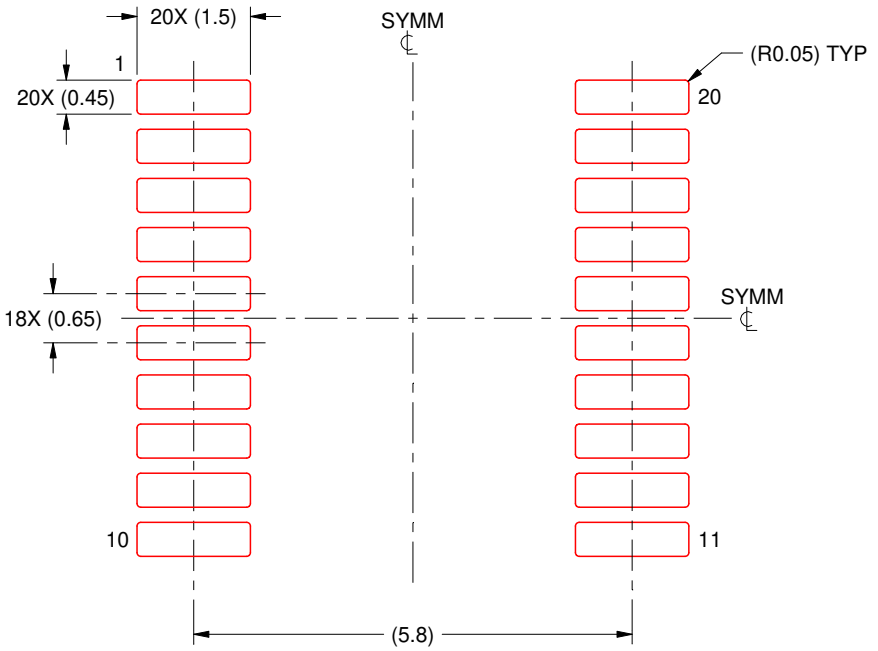

LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X


SOLDER MASK DETAILS

4220206/A 02/2017

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.




SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220206/A 02/2017

NOTES: (continued)

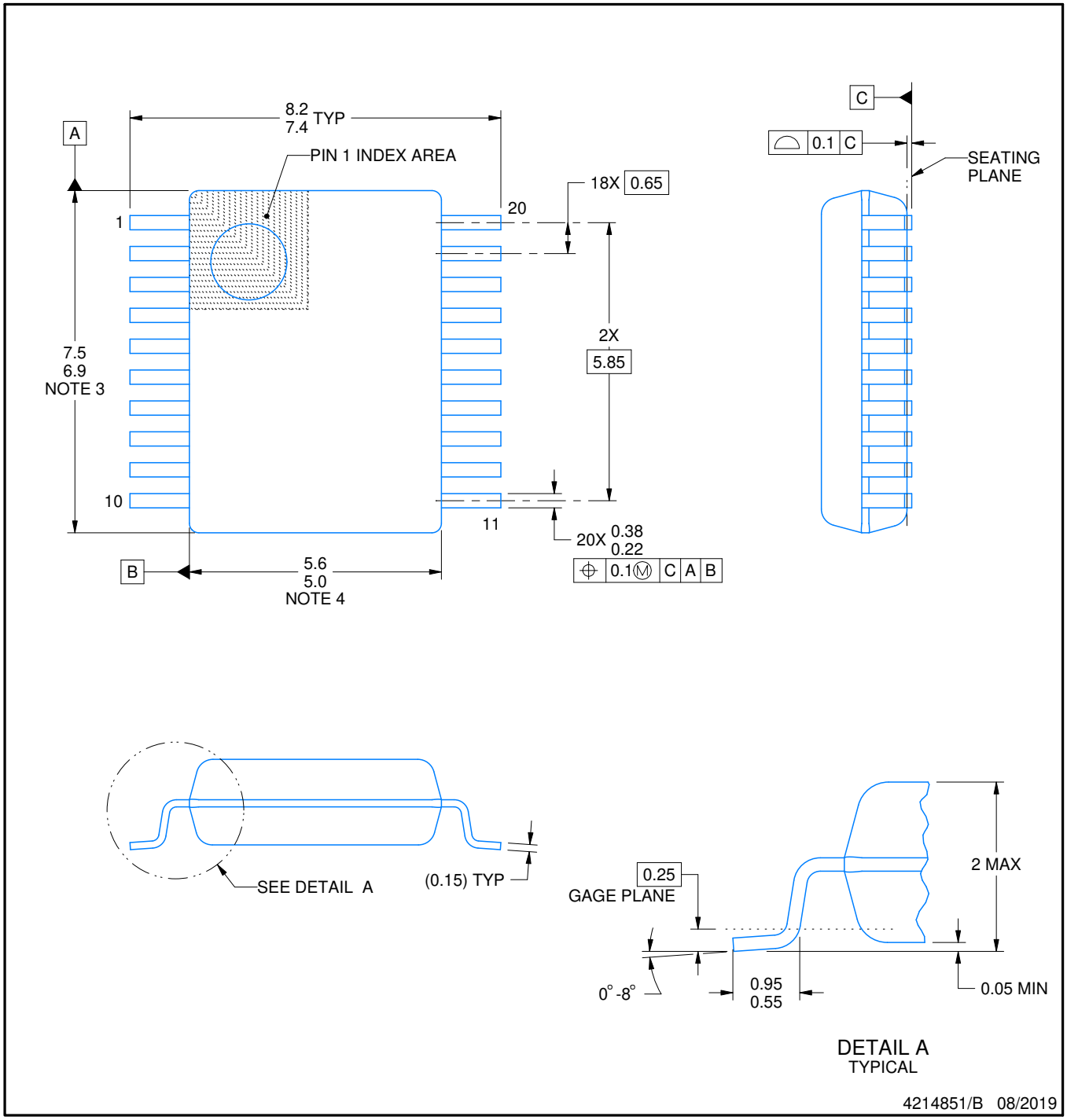
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

# PACKAGE OUTLINE

## DB0020A

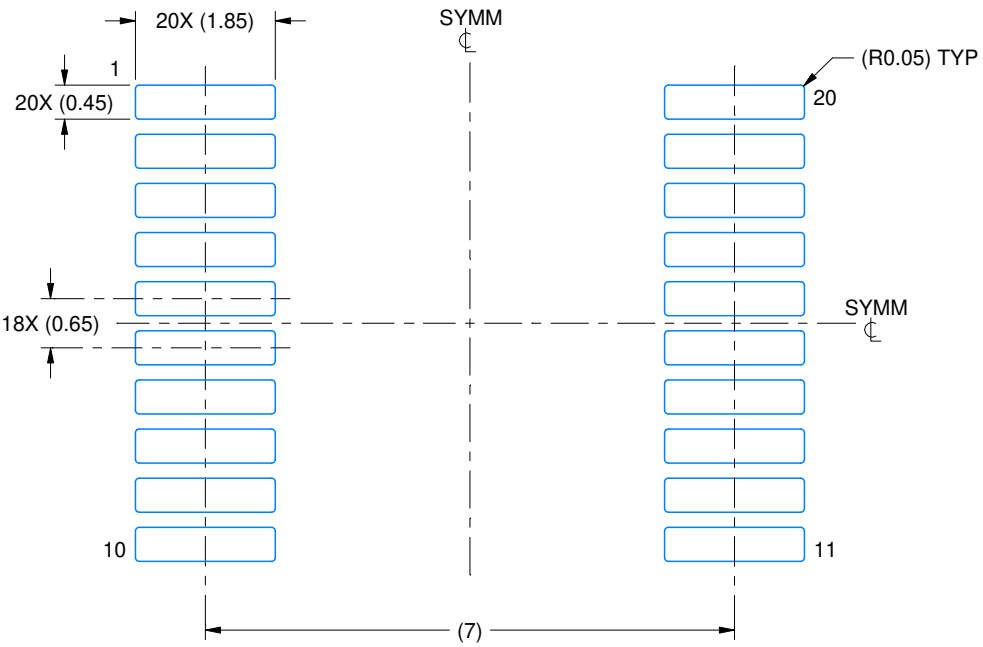
## SSOP - 2 mm max height

SMALL OUTLINE PACKAGE

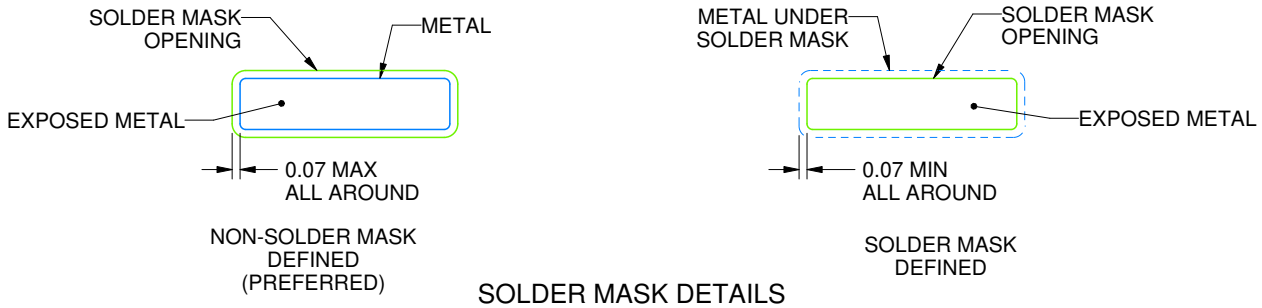



NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-150.




LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

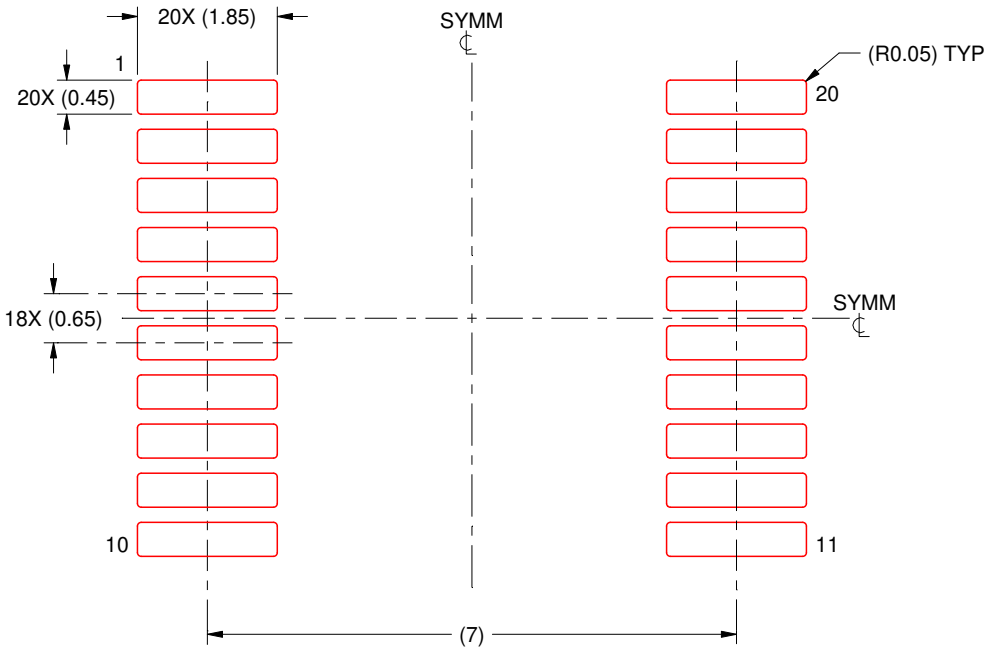



SOLDER MASK DETAILS

4214851/B 08/2019

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.




SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4214851/B 08/2019

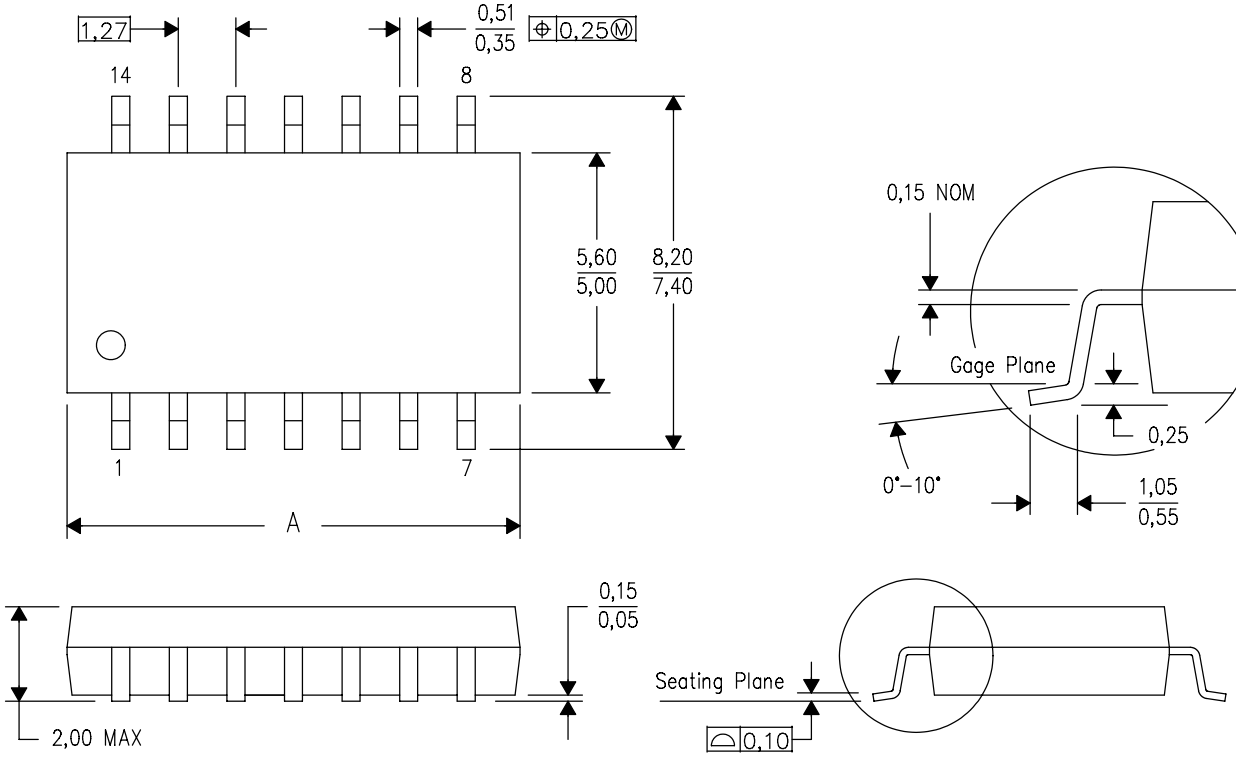
NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

## MECHANICAL DATA

**NS (R-PDSO-G**)** **PLASTIC SMALL-OUTLINE PACKAGE**

**14-PINS SHOWN**




| DIM \ PINS ** | 14 | 16 | 20 | 24 |
|---|---|---|---|---|
| A MAX | 10,50 | 10,50 | 12,90 | 15,30 |
| A MIN | 9,90 | 9,90 | 12,30 | 14,70 |

4040062/C 03/03

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.

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