# SNx4LV374A Octal Edge-Triggered D-Type Flip-Flops With 3-State Outputs

## 1 Features

- 2-V to 5.5-V $V_{CC}$ Operation
- 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
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

## 2 Applications

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

## 3 Description

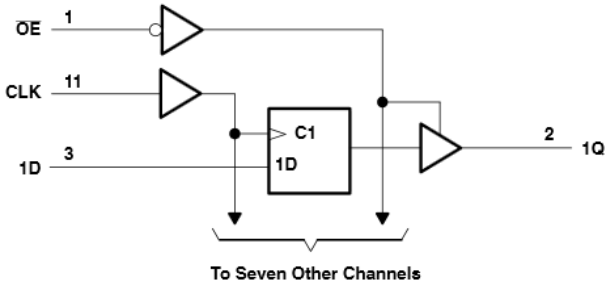
The SNx4LV374A devices are octal edge-triggered D-type flip-flops designed for 2-V to 5.5-V $V_{CC}$ operation.

**Device Information**(1)

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|---|---|---|
| SN74LV374ADB | SSOP (20) | 7.20 mm × 5.30 mm |
| SN74LV374ADW | SOIC (20) | 12.80 mm × 7.50 mm |
| SN74LV374ANS | SO (20) | 12.60 mm × 5.30 mm |
| SN74LV374APW | TSSOP (20) | 6.50 mm × 4.40 mm |

(1) For all available packages, see the orderable addendum at the end of the data sheet.

**Logic Diagram (Positive Logic)**




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

## Table of Contents



## 4 Revision History

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

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

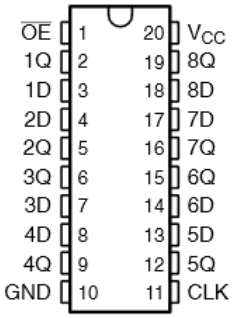
- Added Junction temperature, $T_J$ ... 4
- Deleted "$V_{CC}$ × 0.3" from MIN and added "$V_{CC}$ × 0.3" to MAX for SN54LV374A and SN74LV374A ... 5
- Changed "SN54LV384A" to "SN54LV374A" in *Electrical Characteristics* table ... 6
- Added *Related Links* section, *Receiving Notification of Documentation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

**Changes from Revision H (April 2005) to Revision I** — **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

**DB, DW, NS, or PW Package**
**20-PIN SSOP, SOIC, SO, or TSSOP**
**Top View**




**Pin Functions**

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

(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)

| | | | SN54LV374A (2) | | SN74LV374A | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | MIN | MAX | |
| $V_{CC}$ | Supply voltage | | 2 | 5.5 | 2 | 5.5 | V |
| $V_{IH}$ | High-level input voltage | $V_{CC}$ = 2 V | 1.5 | | 1.5 | | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | $V_{CC}$ × 0.7 | | $V_{CC}$ × 0.7 | | |
| | | $V_{CC}$ = 3 V to 3.6 V | $V_{CC}$ × 0.7 | | $V_{CC}$ × 0.7 | | |
| | | $V_{CC}$ = 4.5 V to 5.5 V | $V_{CC}$ × 0.7 | | $V_{CC}$ × 0.77 | | |
| $V_{IL}$ | Low-level input voltage | $V_{CC}$ = 2 V | | 0.5 | | 0.5 | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | | $V_{CC}$ × 0.3 | | $V_{CC}$ × 0.3 | |
| | | $V_{CC}$ = 3 V to 3.6 V | | $V_{CC}$ × 0.3 | | $V_{CC}$ × 0.3 | |
| | | $V_{CC}$ = 4.5 V to 5.5 V | | $V_{CC}$ × 0.3 | | $V_{CC}$ × 0.3 | |
| $V_I$ | Input voltage | | 0 | 5.5 | 0 | 5.5 | V |
| $V_O$ | Output voltage | High or low state | 0 | $V_{CC}$ | 0 | $V_{CC}$ | V |
| | | 3-state | 0 | 5.5 | 0 | 5.5 | |
| $I_{OH}$ | High-level output current | $V_{CC}$ = 2 V | | –50 | | −50 | μA |
| | | $V_{CC}$ = 2.3 V to 2.7 V | | –2 | | –2 | mA |
| | | $V_{CC}$ = 3 V to 3.6 V | | –8 | | –8 | |
| | | $V_{CC}$ = 4.5 V to 5.5 V | | –16 | | –16 | |
| $I_{OL}$ | Low-level output current | $V_{CC}$ = 2 V | | 50 | | 50 | μA |
| | | $V_{CC}$ = 2.3 V to 2.7 V | | 2 | | 2 | mA |
| | | $V_{CC}$ = 3 V to 3.6 V | | 8 | | 8 | |
| | | $V_{CC}$ = 4.5 V to 5.5 V | | 16 | | 16 | |
| Δt/Δv | Input transition rise or fall rate | $V_{CC}$ = 2.3 V to 2.7 V | | 200 | | 200 | ns/V |
| | | $V_{CC}$ = 3 V to 3.6 V | | 100 | | 100 | |
| | | $V_{CC}$ = 4.5 V to 5.5 V | | 20 | | 20 | |
| $T_A$ | Operating free-air temperature | | –55 | 125 | –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.
(2) PRODUCT PREVIEW

## 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 | 79.2 | 76.7 | 102.4 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 56.4 | 43.7 | 43.2 | 36.5 | °C/W |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 49.7 | 47 | 44.2 | 53.6 | °C/W |
| $\psi_{JT}$ | Junction-to-top characterization parameter | 18.5 | 18.6 | 16.8 | 2.4 | °C/W |
| $\psi_{JB}$ | Junction-to-board characterization parameter | 49.3 | 46.5 | 43.8 | 52.9 | °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 | $V_{CC}$ | SN54LV374A(1) | | | SN74LV374A –40°C to +85°C | | | SN74LV374A –40°C to +125°C | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | 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 | | | $V_{CC}$−0.1 | | | V |
| | $I_{OH}$ = −2 mA | 2.3 V | 2 | | | 2 | | | 2 | | | |
| | $I_{OH}$ = –8 mA | 3 V | 2.48 | | | 2.48 | | | 2.48 | | | |
| | $I_{OH}$ = −16 mA | 4.5 V | 3.8 | | | 3.8 | | | 3.8 | | | |
| $V_{OL}$ | $I_{OL}$ = 50 µA | 2 V to 5.5 V | | | 0.1 | | | 0.1 | | | 0.1 | V |
| | $I_{OL}$ = 2 mA | 2.3 V | | | 0.4 | | | 0.4 | | | 0.4 | |
| | $I_{OL}$ = 8 mA | 3 V | | | 0.44 | | | 0.44 | | | 0.44 | |
| | $I_{OL}$ = 16 mA | 4.5 V | | | 0.55 | | | 0.55 | | | 0.55 | |
| $I_I$ | $V_I$ = 5.5 V or GND | 0 to 5.5 V | | | ±1 | | | ±1 | | | ±1 | µA |
| $I_{OZ}$ | $V_O$ = $V_{CC}$ or GND | 5.5 V | | | ±5 | | | ±5 | | | ±5 | µA |
| $I_{CC}$ | $V_I$ = $V_{CC}$ or GND , $I_O$ = 0 | 5.5 V | | | 20 | | | 20 | | | 20 | µA |
| $I_{off}$ | $V_I$ or $V_O$ = 0 to 5.5 V | 0 | | | 5 | | | 5 | | | 5 | µA |
| $C_i$ | $V_I$ = $V_{CC}$ or GND | 3.3 V | | 2.9 | | | 2.9 | | | 2.9 | | pF |

(1) PRODUCT PREVIEW

## 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 | | | SN54LV374A | | SN74LV374A –40°C to +85°C | | SN74LV374A –40°C to +125°C | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| $f_{max}$ | | | $C_L$ = 15 pF | 60(1) | 105(1) | | 50(1) | | 50 | | 50 | | MHz |
| | | | $C_L$ = 50 pF | 50 | 85 | | 40 | | 40 | | 40 | | |
| $t_{pd}$ | CLK | Q | $C_L$ = 15 pF | | 9.7(1) | 16.3(1) | 1(1) | 19(1) | 1 | 19 | 1 | 20.5 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | | 8.9(1) | 15.9(1) | 1(1) | 19(1) | 1 | 19 | 1 | 20.5 | |
| $t_{dis}$ | $\overline{OE}$ | Q | | | 6.3(1) | 12.6(1) | 1(1) | 15(1) | 1 | 15 | 1 | 16.5 | |
| $t_{pd}$ | CLK | Q | $C_L$ = 50 pF | | 11.8 | 19.3 | 1 | 23 | 1 | 23 | 1 | 24.5 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | | 10.9 | 18.8 | 1 | 22 | 1 | 22 | 1 | 23.5 | |
| $t_{dis}$ | $\overline{OE}$ | Q | | | 8.2 | 17.3 | 1 | 19 | 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 | | | SN54LV374A | | SN74LV374A –40°C to +85°C | | SN74LV374A –40°C to +125°C | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| $f_{max}$ | | | $C_L$ = 15 pF | 80(1) | 150(1) | | 70(1) | | 70 | | 70 | | MHz |
| | | | $C_L$ = 50 pF | 55 | 110 | | 50 | | 50 | | 50 | | |
| $t_{pd}$ | CLK | Q | $C_L$ = 15 pF | | 6.8(1) | 12.7(1) | 1(1) | 15(1) | 1 | 15 | 1 | 16 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | | 6.3(1) | 11(1) | 1(1) | 13(1) | 1 | 13 | 1 | 14 | |
| $t_{dis}$ | $\overline{OE}$ | Q | | | 4.7(1) | 10.5(1) | 1(1) | 12.5(1) | 1 | 12.5 | 1 | 13.5 | |
| $t_{pd}$ | CLK | Q | $C_L$ = 50 pF | | 8.3 | 16.2 | 1 | 18.5 | 1 | 18.5 | 1 | 19.5 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | | 7.7 | 14.5 | 1 | 16.5 | 1 | 16.5 | 1 | 17.5 | |
| $t_{dis}$ | $\overline{OE}$ | Q | | | 5.9 | 14 | 1 | 16 | 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 | | | SN54LV374A | | SN74LV374A –40°C to +85°C | | SN74LV374A –40°C to +125°C | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| $f_{max}$ | | | $C_L$ = 15 pF | 130(1) | 205(1) | | 110(1) | | 110 | | 110 | | MHz |
| | | | $C_L$ = 50 pF | 85 | 1705 | | 75 | | 75 | | 75 | | |
| $t_{pd}$ | CLK | Q | $C_L$ = 15 pF | | 4.9(1) | 8.1(1) | 1(1) | 9.5(1) | 1 | 9.5 | 1 | 10.5 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | | 4.6(1) | 7.6(1) | 1(1) | 9(1) | 1 | 9 | 1 | 10 | |
| $t_{dis}$ | $\overline{OE}$ | Q | | | 3.4(1) | 6.8(1) | 1(1) | 8(1) | 1 | 8 | 1 | 9 | |
| $t_{pd}$ | CLK | Q | $C_L$ = 50 pF | | 5.9 | 10.1 | 1 | 11.5 | 1 | 11.5 | 1 | 12.5 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | | 5.5 | 9.6 | 1 | 11 | 1 | 11 | 1 | 12 | |
| $t_{dis}$ | $\overline{OE}$ | Q | | | 4 | 8.8 | 1 | 10 | 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 Figure 3)

| | | $T_A$ = 25°C | | SN54LV374A (1) | | SN74LV374A –40°C to +85°C | | SN74LV374A –40°C to +125°C | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | MIN | MAX | 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 | | 7 | | ns |
| $t_{su}$ | Setup time, data before CLK↑ | 5 | | 5.5 | | 5.5 | | 6 | | ns |
| $t_h$ | Hold time, data after CLK↑ | 2.5 | | 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 | | 5.5 | | ns |
| $t_{su}$ | Setup time, data before CLK↑ | 4.5 | | 45 | | 4.5 | | 5 | | ns |
| $t_h$ | Hold time, data after CLK↑ | 2 | | 2 | | 2 | | 2.5 | | ns |
| **$V_{CC}$ = 5 V ± 0.5 V** | | | | | | | | | | |
| $t_w$ | Pulse duration, CLK high or low | 5 | | 5 | | 5 | | 5 | | ns |
| $t_{su}$ | Setup time, data before CLK↑ | 3 | | 3 | | 3 | | 3.5 | | ns |
| $t_h$ | Hold time, data after CLK↑ | 2 | | 2 | | 2 | | 2.5 | | ns |

(1) PRODUCT PREVIEW

## 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

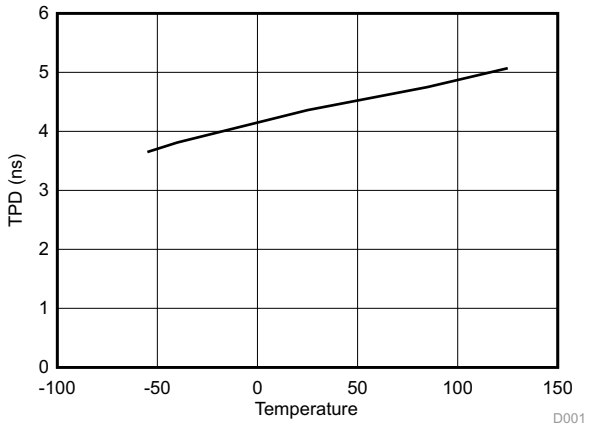



**Figure 1. TPD vs. Temperature at 5 V**

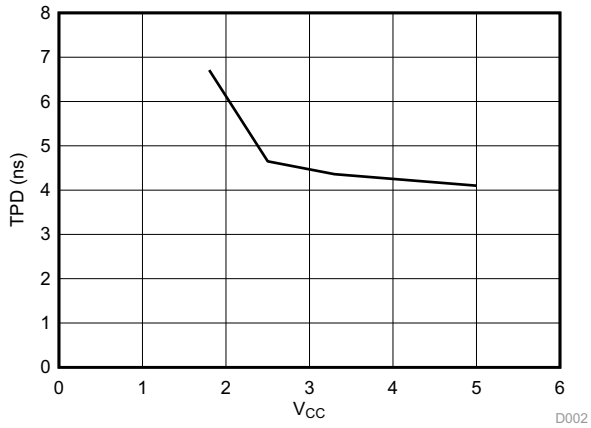
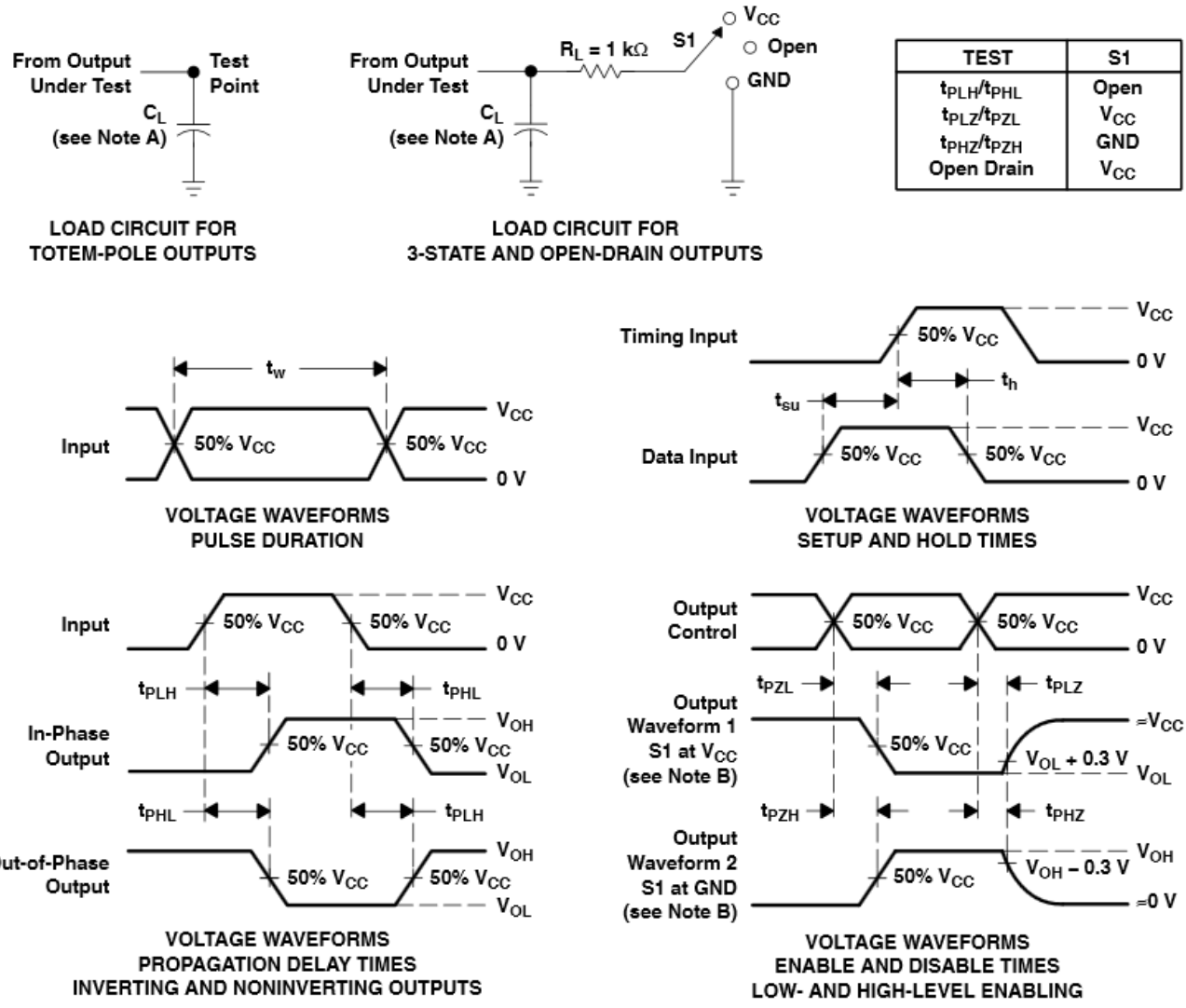



**Figure 2. TPD vs. $V_{CC}$ at 25°C**

# 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 3. Load Circuit and Voltage Waveforms**

# 8 Detailed Description

## 8.1 Overview

The SNx4LV374A 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 *Recommended Operating Conditions* range.

## 8.2 Functional Block Diagram

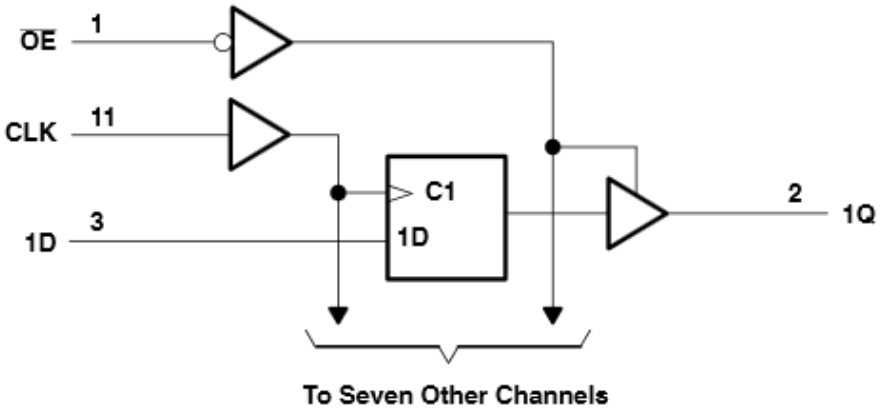



**Figure 4. Logic Diagram (Positive Logic)**

## 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 1 lists the functional modes of the SNx4LV374A devices.

**Table 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. Customers should validate and test 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 5 shows how the slower edges can reduce ringing on the output compared to higher drive parts like AC.

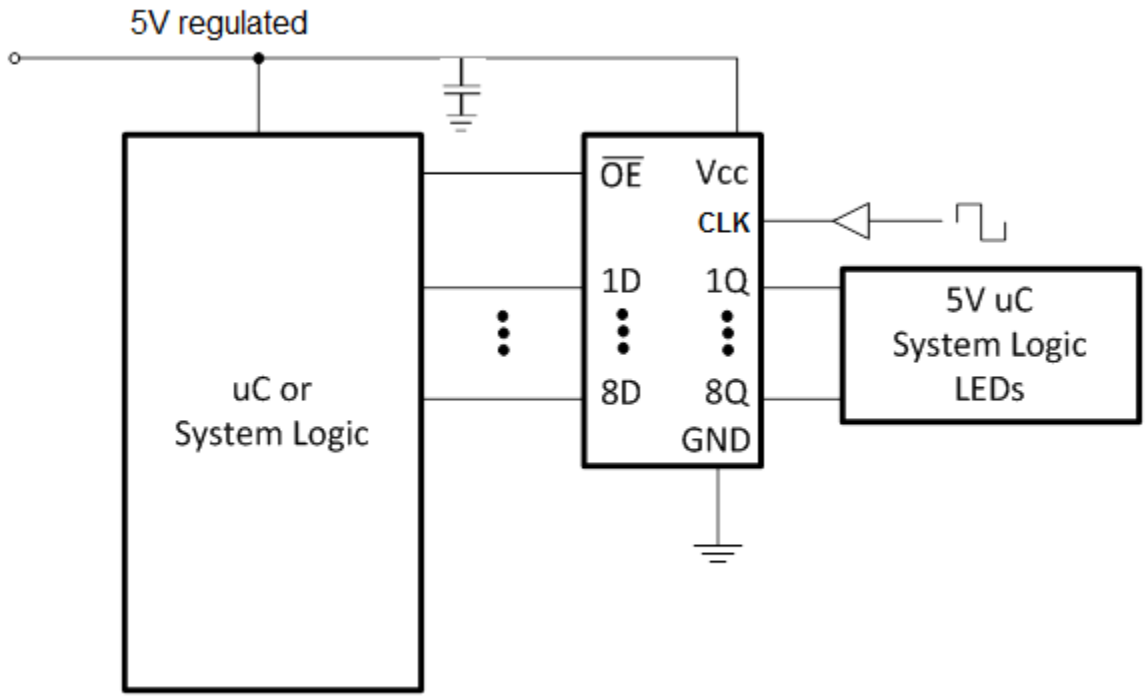



**Figure 5. Typical Application Schematic**

### 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.

## Typical Application (continued)

### 9.2.2 Detailed Design Procedure

- Recommended Input conditions:
  - Rise time and fall time specs see ($\Delta t/\Delta V$) in *Recommended Operating Conditions*.
  - Specified High and low levels. See ($V_{IH}$ and $V_{IL}$) in *Recommended Operating Conditions*.
  - 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

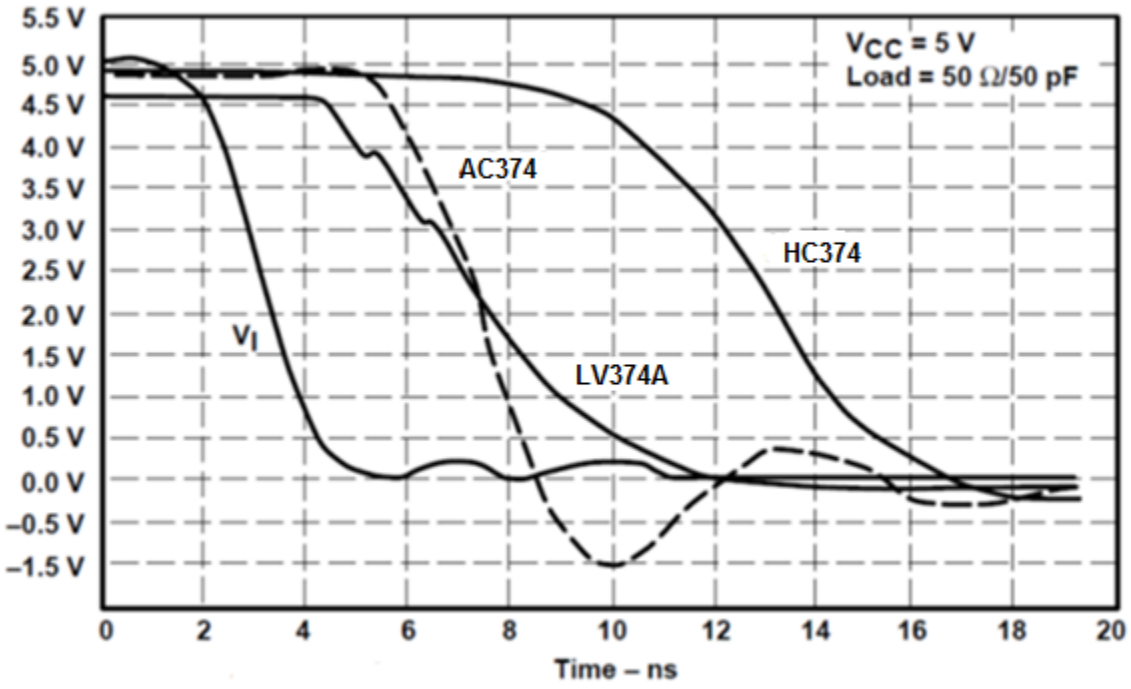



**Figure 6. Switching Characteristics Comparison**

# 10 Power Supply Recommendations

The power supply can be any voltage between the MIN and MAX supply voltage rating located in the *Recommended Operating Conditions*. Each $V_{CC}$ terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, TI recommends a 0.1-μF capacitor and if there are multiple $V_{CC}$ terminals then TI recommends a 0.01-μF or 0.022-μF capacitor for each power terminal. Multiple bypass capacitors can be paralleled to reject different frequencies of noise. Frequencies of 0.1 μF and 1 μF are commonly used in parallel. The bypass capacitor should be installed as close as possible to the power terminal for best results.

# 11 Layout

## 11.1 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.

## 11.2 Layout Example

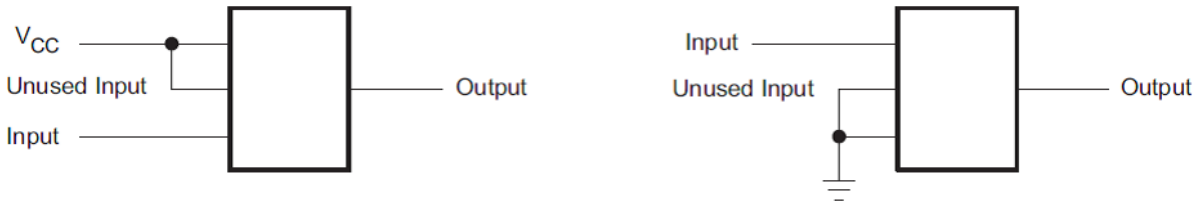



**Figure 7. Layout Example**

# 12 Device and Documentation Support

## 12.1 Documentation Support

### 12.1.1 Related Documentation

For related documentation see the following:

*Implications of Slow or Floating CMOS Inputs*, SCBA004

## 12.2 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

**Table 2. Related Links**

| PARTS | PRODUCT FOLDER | SAMPLE & BUY | TECHNICAL DOCUMENTS | TOOLS & SOFTWARE | SUPPORT & COMMUNITY |
|---|---|---|---|---|---|
| SN54LV374A | Click here | Click here | Click here | Click here | Click here |
| SN74LV374A | Click here | Click here | Click here | Click here | Click here |

## 12.3 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.

## 12.4 Community Resources

The following links connect to TI community resources. Linked contents are 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.

**TI E2E™ Online Community** ***TI's Engineer-to-Engineer (E2E) Community.*** Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

**Design Support** ***TI's Design Support*** Quickly find helpful E2E forums along with design support tools and contact information for technical support.

## 12.5 Trademarks

E2E is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

## 12.6 Electrostatic Discharge Caution

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

## 12.7 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

# 13 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/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SN74LV374ADBR | ACTIVE | SSOP | DB | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LV374A | Samples |
| SN74LV374ADW | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LV374A | Samples |
| SN74LV374ADWG4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LV374A | Samples |
| SN74LV374ADWR | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LV374A | Samples |
| SN74LV374ANSR | ACTIVE | SO | NS | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 74LV374A | Samples |
| SN74LV374ANSRE4 | ACTIVE | SO | NS | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 74LV374A | Samples |
| SN74LV374APW | ACTIVE | TSSOP | PW | 20 | 70 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LV374A | Samples |
| SN74LV374APWE4 | ACTIVE | TSSOP | PW | 20 | 70 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LV374A | Samples |
| SN74LV374APWR | ACTIVE | TSSOP | PW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU 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) 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)

(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/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.



**OTHER QUALIFIED VERSIONS OF SN74LV374A :**

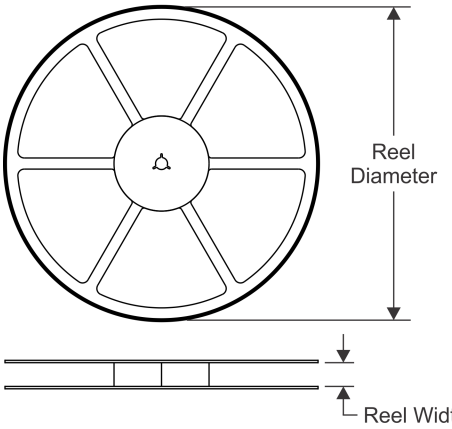
- Automotive: SN74LV374A-Q1
- Enhanced Product: SN74LV374A-EP

NOTE: Qualified Version Definitions:

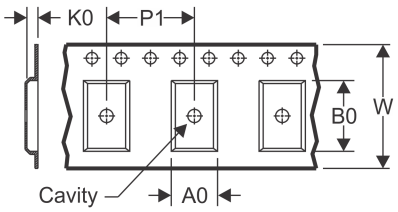
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

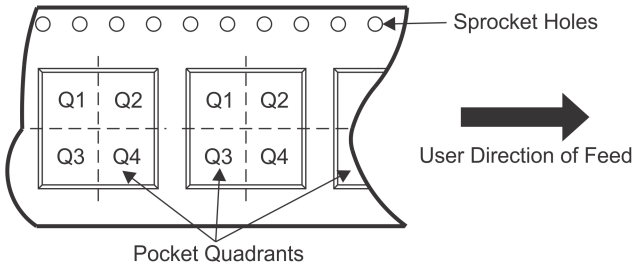



**TAPE DIMENSIONS**




| | |
|---|---|
| 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 |

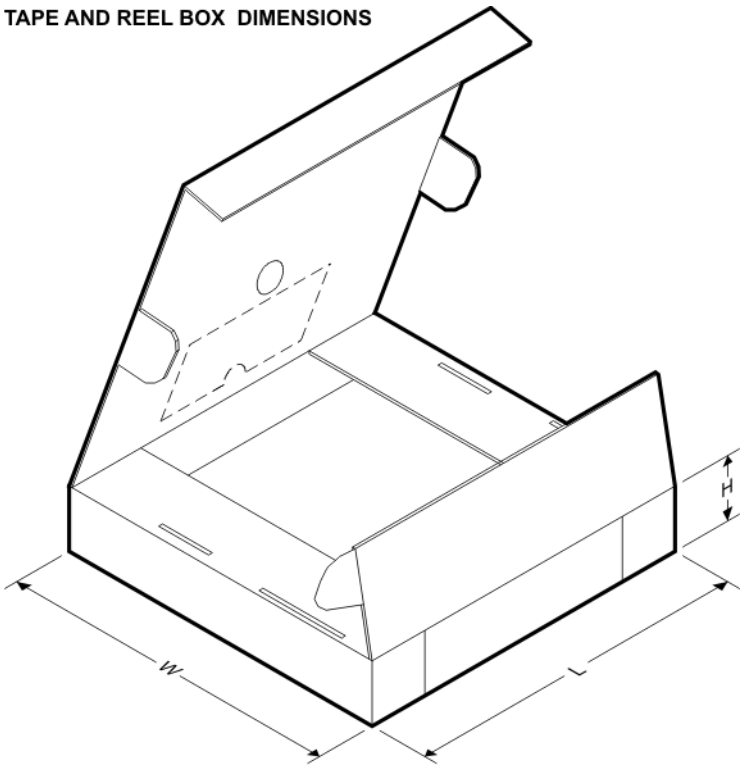
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*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 | 7.1 | 1.6 | 8.0 | 16.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS



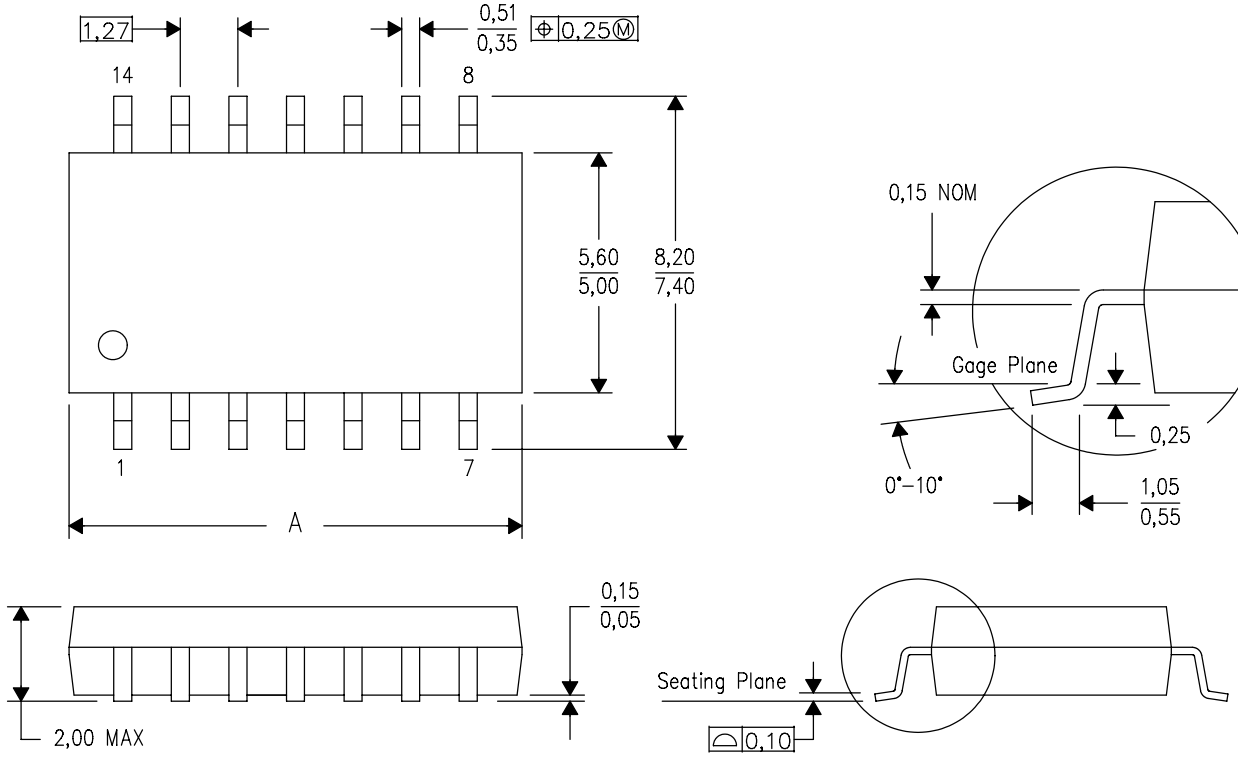

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| SN74LV374ADBR | SSOP | DB | 20 | 2000 | 367.0 | 367.0 | 38.0 |
| 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 | 367.0 | 367.0 | 38.0 |

## MECHANICAL DATA

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

**14-PINS SHOWN**

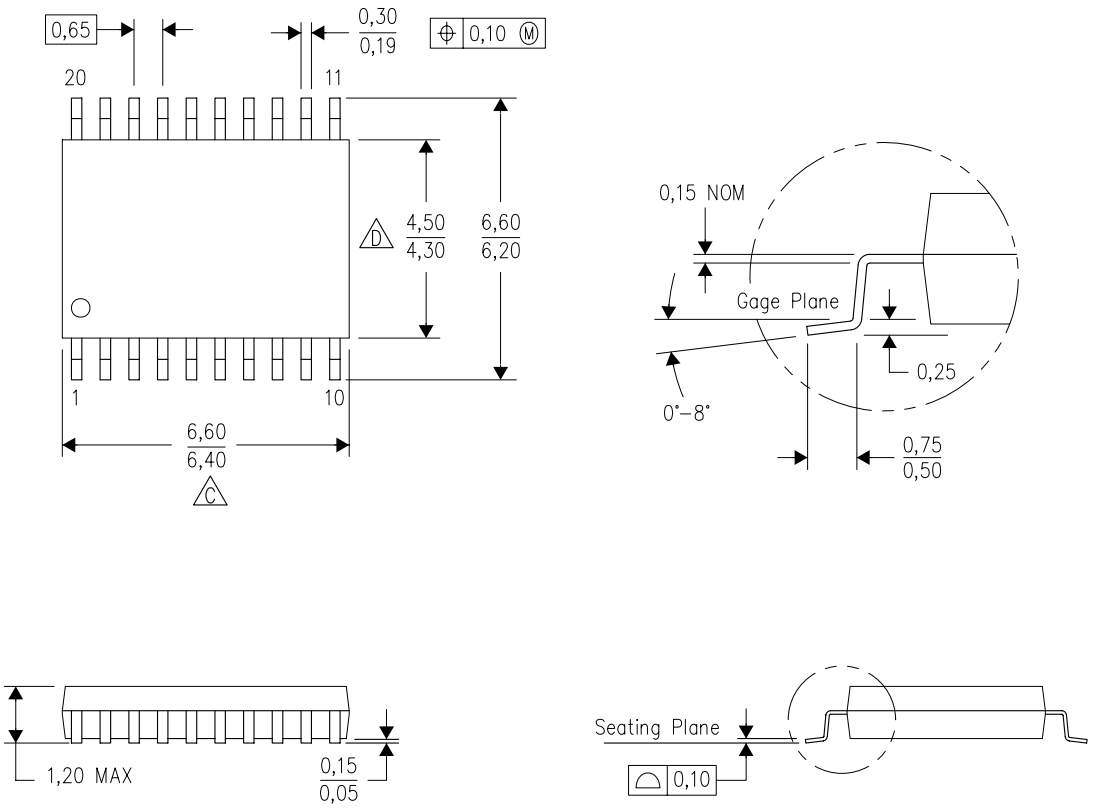



| DIM \ PINS ** | 14 | 16 | 20 | 24 |
|---|---|---|---|---|
| A MAX | 10,50 | 10,50 | 12,90 | 15,30 |
| A MIN | 9,90 | 9,90 | 12,30 | 14,70 |

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.

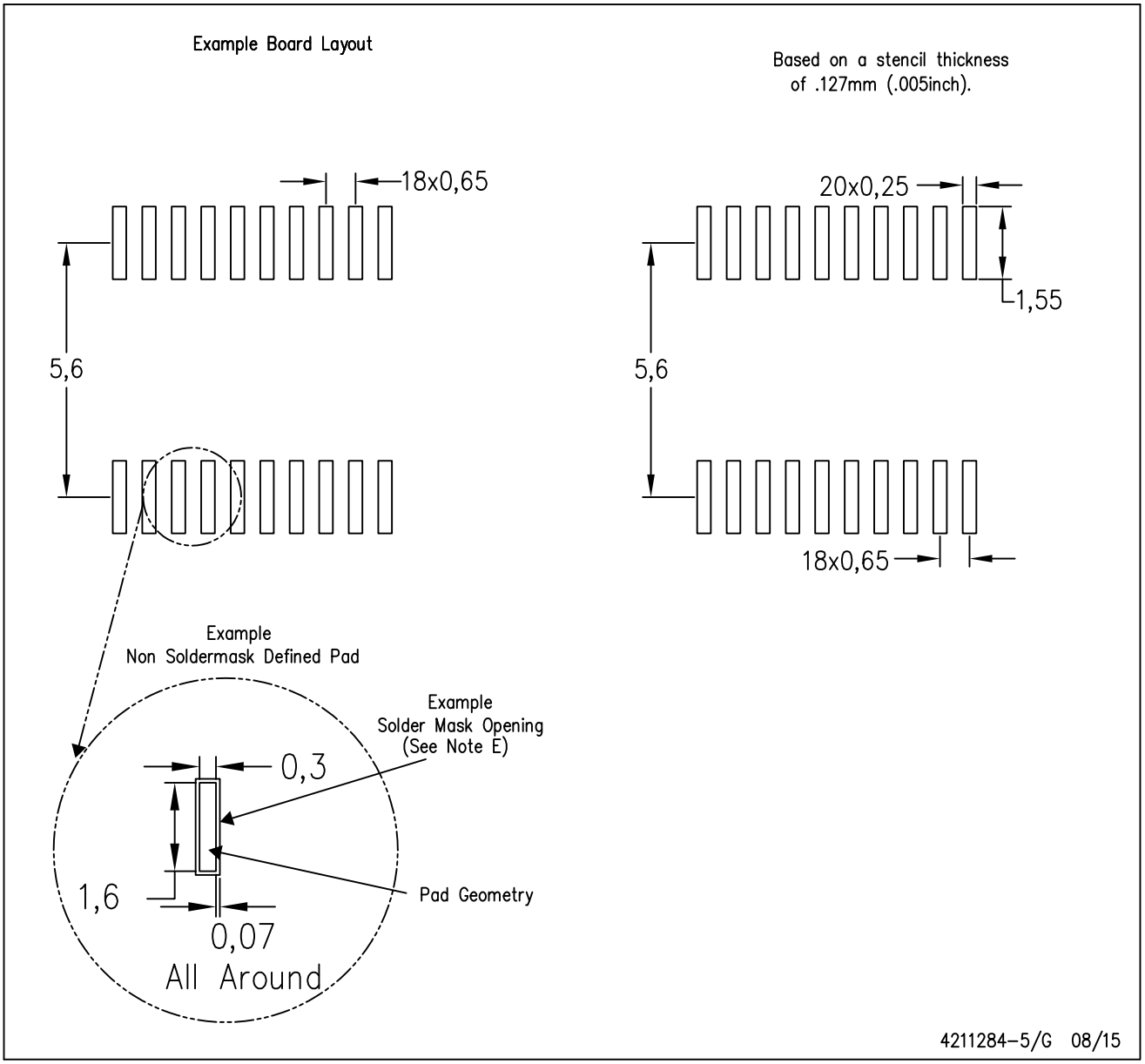
PW (R–PDSO–G20) PLASTIC SMALL OUTLINE




4040064–5/G 02/11

NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
E. Falls within JEDEC MO–153

PW (R–PDSO–G20) PLASTIC SMALL OUTLINE

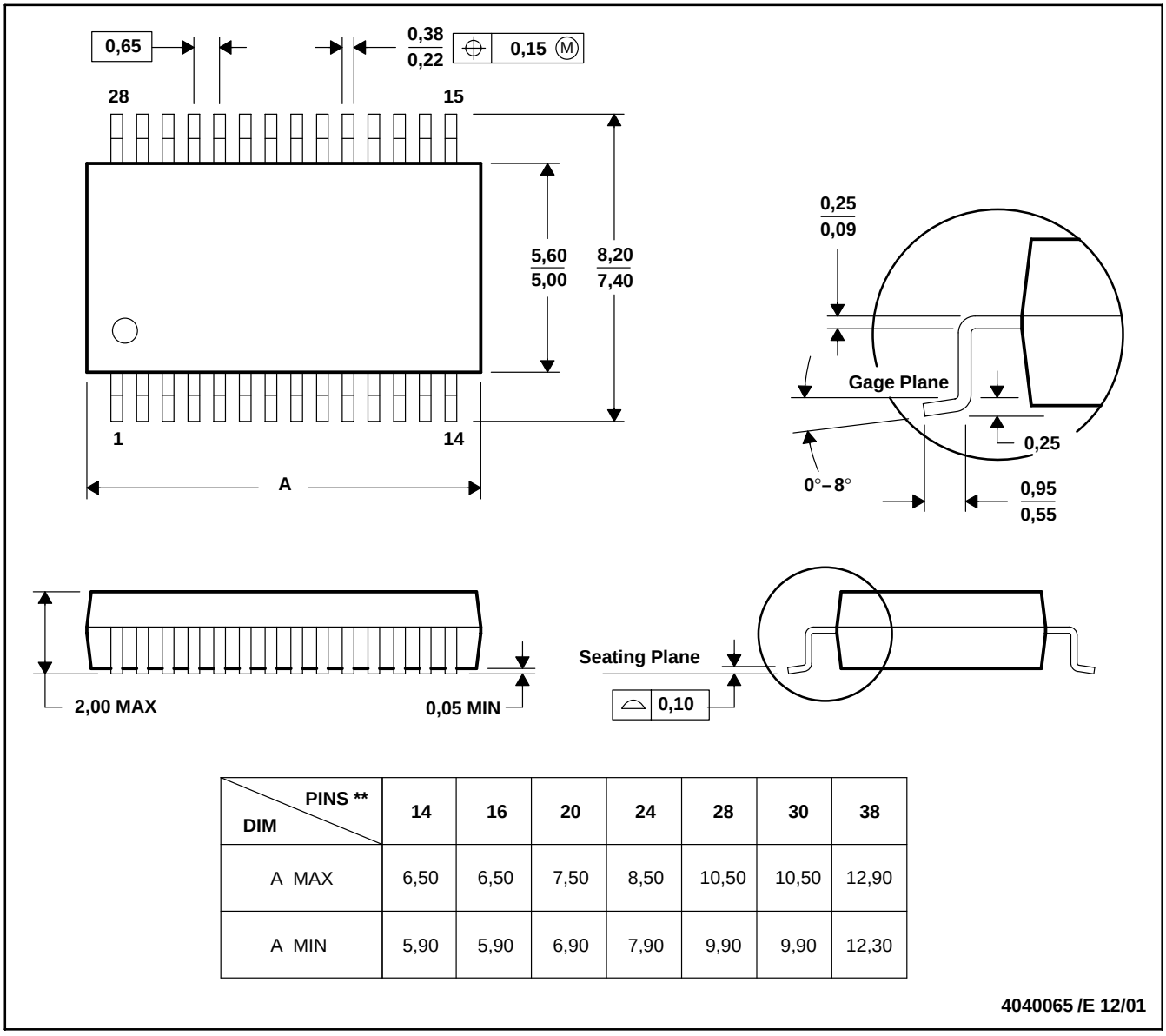



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate design.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

MSSO002E – JANUARY 1995 – REVISED DECEMBER 2001

**DB (R-PDSO-G**)** **PLASTIC SMALL-OUTLINE**

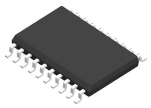
**28 PINS SHOWN**




| DIM \ PINS ** | 14 | 16 | 20 | 24 | 28 | 30 | 38 |
|---|---|---|---|---|---|---|---|
| A MAX | 6,50 | 6,50 | 7,50 | 8,50 | 10,50 | 10,50 | 12,90 |
| A MIN | 5,90 | 5,90 | 6,90 | 7,90 | 9,90 | 9,90 | 12,30 |

**4040065 /E 12/01**

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

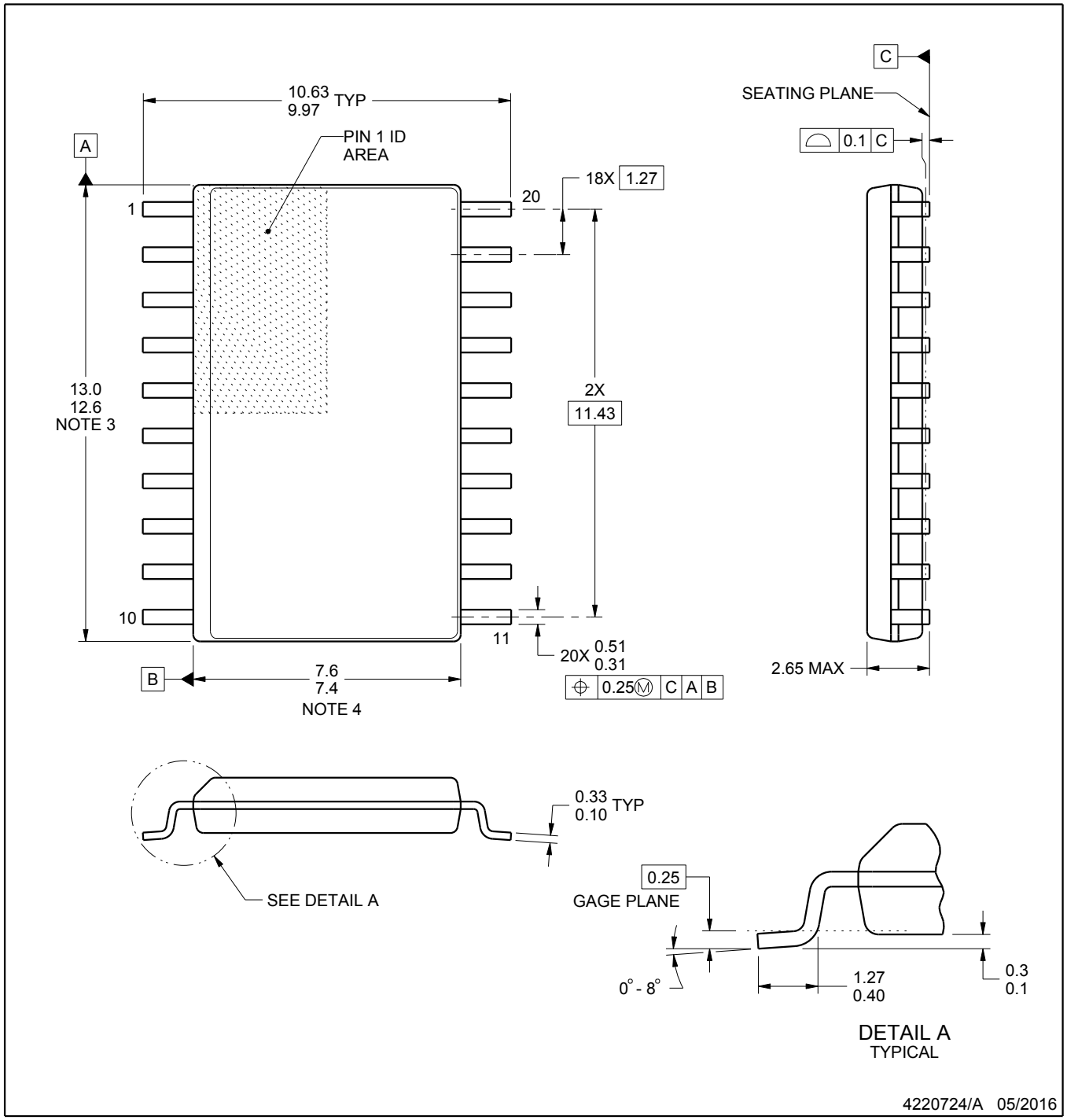


# PACKAGE OUTLINE

## DW0020A

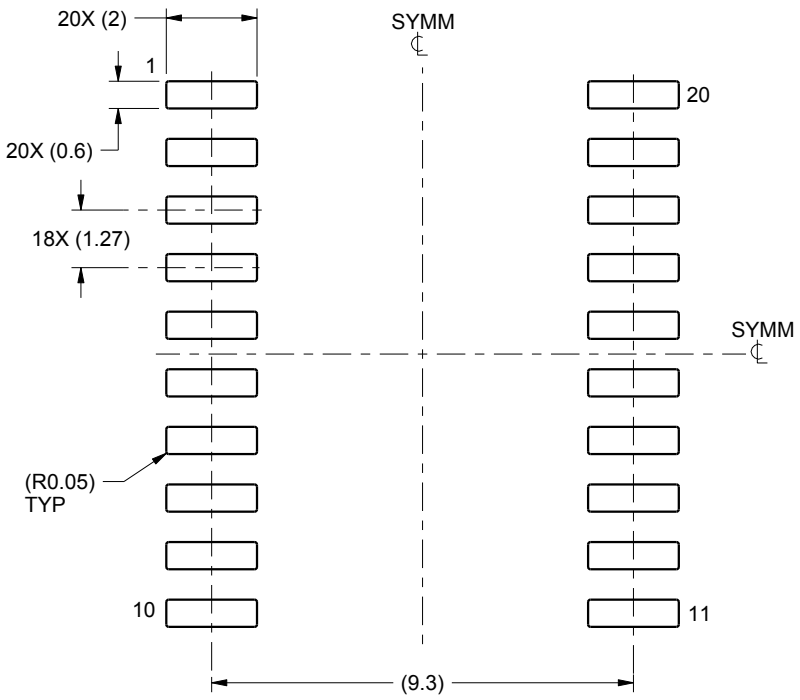
## SOIC - 2.65 mm max height

SOIC

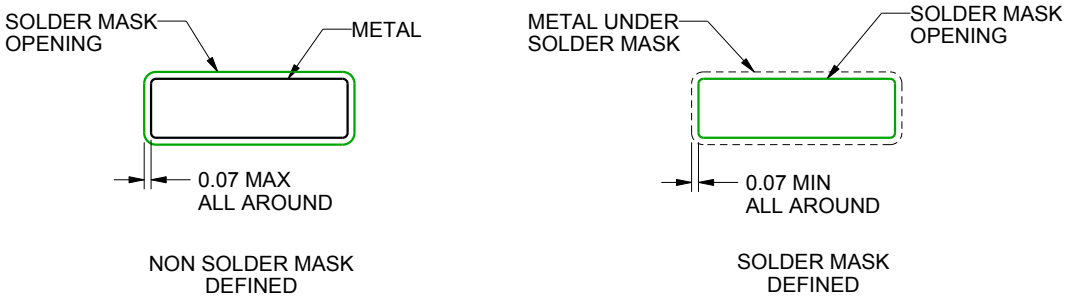



NOTES:

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

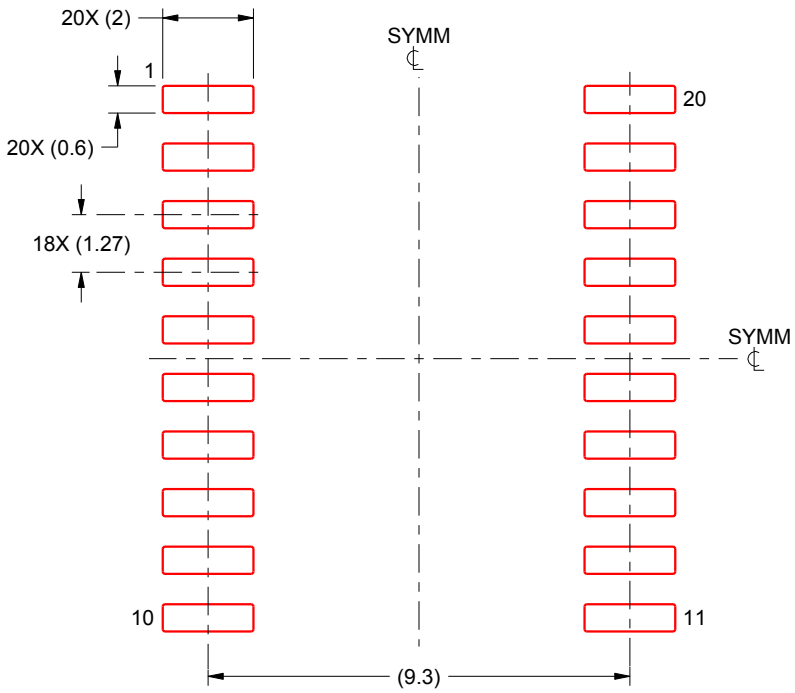



SOLDER MASK DETAILS

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.

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