# SNx4LVC374A Octal Edge-Triggered D-Type Flip-Flops With 3-State Outputs

## 1 Features

- Operate From 1.65 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max $t_{pd}$ of 6.5 ns at 3.3 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 V at $V_{CC}$ = 3.3 V, $T_A$ = 25°C
- Support Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V $V_{CC}$)
- $I_{off}$ Supports Live Insertion, Partial-Power-Down Mode, and Back-Drive Protection
- 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

- Electronic Points of Sale
- TV Set-top Boxes
- Infotainment
- Servers
- Appliances

## 3 Description

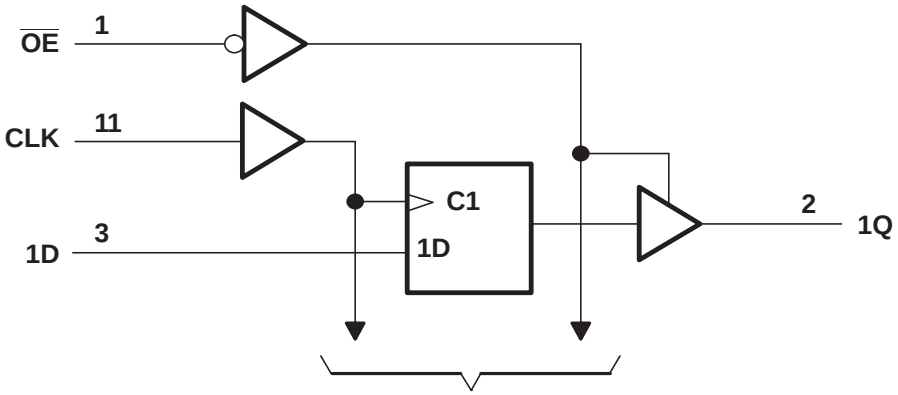
The SN54LVC374A octal edge-triggered D-type flip-flop is designed for 2.7-V to 3.6-V $V_{CC}$ operation, and the SN74LVC374A octal edge-triggered D-type flip-flop is designed for 1.65-V to 3.6-V $V_{CC}$ operation.

**Device Information(1)**

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|---|---|---|
| SNx4LVC374A | PDIP (20) | 25.40 mm x 6.35 mm |
| | VQFN (20) | 4.50 mm x 3.50 mm |
| | SOIC (20) | 12.80 mm x 7.50 mm |
| | SSOP (20) | 7.20 mm x 5.30 mm |
| | TVSOP (20) | 5.00 mm x 4.40 mm |

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

## 4 Simplified Schematic



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## 5 Revision History

**Changes from Revision N (May 2005) to Revision O** **Page**

- Updated data sheet temperature range ... 1
- Updated $I_{off}$ bullet in Features list. ... 1
- Added Applications. ... 1
- Added Pin Functions table ... 3
- Added Handling Ratings table. ... 4
- Changed MAX operating temperature range from 85°C to 125°C in Recommended Operating Conditions table. ... 5
- Added Thermal Information table. ... 5
- Added –40°C TO 125°C for SN74LVC374A to Electrical Characteristics table. ... 6
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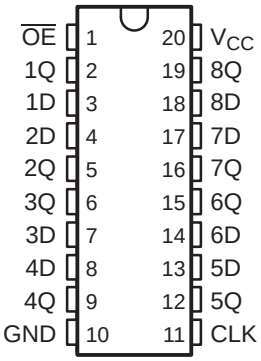
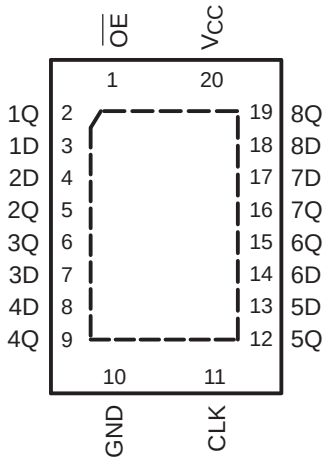
# 6 Pin Configuration and Functions

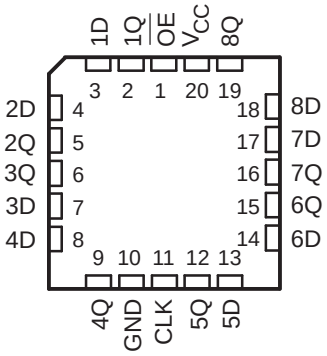
**SN54LVC374A . . . J OR W PACKAGE**
**SN74LVC374A . . . DB, DGV, DW, N, NS, OR PW PACKAGE**
**(TOP VIEW)**




**SN74LVC374A . . . RGY PACKAGE**
**(TOP VIEW)**




**SN54LVC374A . . . FK PACKAGE**
**(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 |
| 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 | VCC | — | Power pin |

# 7 Specifications

## 7.1 Absolute Maximum Ratings(1)

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

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage range | | –0.5 | 6.5 | V |
| $V_I$ | Input voltage range(2) | | –0.5 | 6.5 | V |
| $V_O$ | Voltage range applied to any output in the high-impedance or power-off state(2) (3) | | –0.5 | 6.5 | V |
| $V_O$ | Voltage range applied to any output in the high or low state | | –0.5 | $V_{CC}$ + 0.5 | V |
| $I_{IK}$ | Input clamp current | $V_I$ < 0 | | –50 | mA |
| $I_{OK}$ | Output clamp current | $V_O$ < 0 | | –50 | mA |
| $I_O$ | Continuous output current | | | ±50 | mA |
| | Continuous current through $V_{CC}$ or GND | | | ±100 | mA |

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* are not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
(3) The value of $V_{CC}$ is provided in the recommended operating conditions table.

## 7.2 Handling Ratings

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| $T_{stg}$ | Storage temperature range | | –65 | 150 | °C |
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins(1) | 0 | 2 | kV |
| | | Charged device model (CDM), per JEDEC specification JESD22-C101, all pins(2) | 0 | 1000 | V |

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process. Pins listed as 500 V may actually have higher performance.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process. Pins listed as 250 V may actually have higher performance.

## 7.3 Recommended Operating Conditions

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

| | | | SN54LVC374A | | SN74LVC374A | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | MIN | MAX | |
| $V_{CC}$ | Supply voltage | Operating | 2 | 3.6 | 1.65 | 3.6 | V |
| | | Data retention only | 1.5 | | 1.5 | | |
| $V_{IH}$ | High-level input voltage | $V_{CC}$ = 1.65 V to 1.95 V | | | 0.65 × $V_{CC}$ | | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | | | 1.7 | | |
| | | $V_{CC}$ = 2.7 V to 3.6 V | 2 | | 2 | | |
| $V_{IL}$ | Low-level input voltage | $V_{CC}$ = 1.65 V to 1.95 V | | | | 0.35 × $V_{CC}$ | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | | | | 0.7 | |
| | | $V_{CC}$ = 2.7 V to 3.6 V | | 0.8 | | 0.8 | |
| $V_I$ | 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 | $V_{CC}$ = 1.65 V | | | | –4 | mA |
| | | $V_{CC}$ = 2.3 V | | | | –8 | |
| | | $V_{CC}$ = 2.7 V | | –12 | | –12 | |
| | | $V_{CC}$ = 3 V | | –24 | | –24 | |
| $I_{OL}$ | Low-level output current | $V_{CC}$ = 1.65 V | | | | 4 | mA |
| | | $V_{CC}$ = 2.3 V | | | | 8 | |
| | | $V_{CC}$ = 2.7 V | | 12 | | 12 | |
| | | $V_{CC}$ = 3 V | | 24 | | 24 | |
| Δt/Δv | Input transition rise or fall rate | | | 10 | | 10 | ns/V |
| $T_A$ | 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. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, (SCBA004).

## 7.4 Thermal Information

| THERMAL METRIC(1) | | SN74LVC374A | UNIT |
|---|---|---|---|
| | | PW | |
| | | 20 PIN | |
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 102.5 | °C/W |
| $R_{\theta JCtop}$ | Junction-to-case (top) thermal resistance | 35.9 | |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 53.5 | |
| $\psi_{JT}$ | Junction-to-top characterization parameter | 2.2 | |
| $\psi_{JB}$ | Junction-to-board characterization parameter | 52.9 | |

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, (SPRA953).

## 7.5 Electrical Characteristics

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

| PARAMETER | TEST CONDITIONS | | $V_{CC}$ | SN54LVC374A | | | SN74LVC374A –40°C TO 85°C | | | SN74LVC374A –40°C TO 125°C | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP(1) | MAX | MIN | TYP(1) | MAX | MIN | TYP(1) | MAX | |
| $V_{OH}$ | $I_{OH}$ = –100 µA | | 1.65 V to 3.6 V | | | | $V_{CC}$ – 0.2 | | | $V_{CC}$ – 0.2 | | | V |
| | | | 2.7 V to 3.6 V | $V_{CC}$ – 0.2 | | | | | | | | | |
| | $I_{OH}$ = –4 mA | | 1.65 V | | | | 1.2 | | | 1.20 | | | |
| | $I_{OH}$ = –8 mA | | 2.3 V | | | | 1.7 | | | 1.70 | | | |
| | $I_{OH}$ = –12 mA | | 2.7 V | 2.2 | | | 2.2 | | | 2.20 | | | |
| | | | 3 V | 2.4 | | | 2.4 | | | 2.40 | | | |
| | $I_{OH}$ = –24 mA | | 3 V | 2.2 | | | 2.2 | | | 2.20 | | | |
| $V_{OL}$ | $I_{OL}$ = 100 µA | | 1.65 V to 3.6 V | | | | | | 0.2 | | | 0.20 | V |
| | | | 2.7 V to 3.6 V | | | 0.2 | | | | | | | |
| | $I_{OL}$ = 4 mA | | 1.65 V | | | | | | 0.45 | | | 0.45 | |
| | $I_{OL}$ = 8 mA | | 2.3 V | | | | | | 0.7 | | | 0.70 | |
| | $I_{OL}$ = 12 mA | | 2.7 V | | | 0.4 | | | 0.4 | | | 0.40 | |
| | $I_{OL}$ = 24 mA | | 3 V | | | 0.55 | | | 0.55 | | | 0.55 | |
| $I_I$ | $V_I$ = 0 to 5.5 V | | 3.6 V | | | ±5 | | | ±5 | | | ±5 | µA |
| $I_{off}$ | $V_I$ or $V_O$ = 5.5 V | | 0 | | | | | | ±10 | | | ±20 | µA |
| $I_{OZ}$ | $V_O$ = 0 to 5.5 V | | 3.6 V | | | ±15 | | | ±10 | | | ±15 | µA |
| $I_{CC}$ | $V_I$ = $V_{CC}$ or GND | $I_O$ = 0 | 3.6 V | | | 10 | | | 10 | | | 10 | µA |
| | 3.6 V ≤ $V_I$ ≤ 5.5 V(2) | | | | | 10 | | | 10 | | | 10 | |
| $\Delta I_{CC}$ | One input at $V_{CC}$ – 0.6 V, Other inputs at $V_{CC}$ or GND | | 2.7 V to 3.6 V | | | 500 | | | 500 | | | 500 | µA |
| $C_i$ | $V_I$ = $V_{CC}$ or GND | | 3.3 V | | 4 | 12 | | 4 | | 75 | 4 | | pF |
| $C_o$ | $V_O$ = $V_{CC}$ or GND | | 3.3 V | | 5.5 | 12 | | 5.5 | | | 5.5 | | pF |

(1) All typical values are at $V_{CC}$ = 3.3 V, $T_A$ = 25°C.
(2) This applies in the disabled state only.

## 7.6 Timing Requirements, SN54LVC374A

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

| PARAMETER | | SN54LVC374A | | | | UNIT |
|---|---|---|---|---|---|---|
| | | $V_{CC}$ = 2.7 V | | $V_{CC}$ = 3.3 V ± 0.3 V | | |
| | | MIN | MAX | MIN | MAX | |
| $f_{clock}$ | Clock frequency | | 80 | | 100 | MHz |
| $t_w$ | Pulse duration, CLK high or low | 3.3 | | 3.3 | | ns |
| $t_{su}$ | Setup time, data before CLK↑ | 2 | | 2 | | ns |
| $t_h$ | Hold time, data after CLK↑ | 1.5 | | 1.5 | | ns |

## 7.7 Timing Requirements, SN74LVC374A

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

| PARAMETER | | SN74LVC374A | | | | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | –40°C TO 85°C | | | | | | | | |
| | | $V_{CC}$ = 1.8 V ± 0.15 V | | $V_{CC}$ = 2.5 V ± 0.2 V | | $V_{CC}$ = 2.7 V | | $V_{CC}$ = 3.3 V ± 0.3 V | | |
| | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| $f_{clock}$ | Clock frequency | | 55 | | 95 | | 80 | | 100 | MHz |
| $t_w$ | Pulse duration, CLK high or low | 9 | | 4 | | 3.3 | | 3.3 | | ns |
| $t_{su}$ | Setup time, data before CLK↑ | 6 | | 4 | | 2 | | 2 | | ns |
| $t_h$ | Hold time, data after CLK↑ | 4 | | 2 | | 1.5 | | 1.5 | | ns |

## 7.8 Timing Requirements, SN74LVC374A

| PARAMETER | | SN74LVC374A | | | | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | –40°C TO 85°C | | | | | | | | |
| | | $V_{CC}$ = 1.8 V ± 0.15 V | | $V_{CC}$ = 2.5 V ± 0.2 V | | $V_{CC}$ = 2.7 V | | $V_{CC}$ = 3.3 V ± 0.3 V | | |
| | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| $f_{clock}$ | Clock frequency | | 40 | | 80 | | 80 | | 100 | MHz |
| $t_w$ | Pulse duration, CLK high or low | 9 | | 4 | | 3.3 | | 3.3 | | ns |
| $t_{su}$ | Setup time, data before CLK↑ | 6 | | 4 | | 2 | | 2 | | ns |
| $t_h$ | Hold time, data after CLK↑ | 4 | | 2 | | 1.5 | | 1.5 | | ns |

## 7.9 Switching Characteristics, SN54LVC374A

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | SN54LVC374A | | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | $V_{CC}$ = 2.7 V | | $V_{CC}$ = 3.3 V ± 0.3 V | | |
| | | | MIN | MAX | MIN | MAX | |
| $f_{max}$ | | | 80 | | 100 | | MHz |
| $t_{pd}$ | CLK | Q | | 9.5 | 1 | 8.5 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | 9.5 | 1 | 8.5 | ns |
| $t_{dis}$ | $\overline{OE}$ | Q | | 8 | 1 | 7 | ns |

## 7.10 Switching Characteristics, SN74LVC374A

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | SN74LVC374A | | | | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | –40°C TO 85°C | | | | | | | | |
| | | | $V_{CC}$ = 1.8 V ± 0.15 V | | $V_{CC}$ = 2.5 V ± 0.2 V | | $V_{CC}$ = 2.7 V | | $V_{CC}$ = 3.3 V ± 0.3 V | | |
| | | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| $f_{max}$ | | | 55 | | 95 | | 80 | | 100 | | MHz |
| $t_{pd}$ | CLK | Q | | 21.9 | | 10.8 | | 8.1 | 1.5 | 7 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | 19.8 | | 10.8 | | 8.5 | 1.5 | 7.5 | ns |
| $t_{dis}$ | $\overline{OE}$ | Q | | 19.1 | | 18.1 | | 7.1 | 1.5 | 6.5 | ns |
| $t_{sk(o)}$ | | | | 1 | | 1 | | 1 | | 1 | ns |

## 7.11 Switching Characteristics, SN74LVC374A

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

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | SN74LVC374A | | | | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | –40°C TO 125°C | | | | | | | | |
| | | | $V_{CC}$ = 1.8 V ± 0.15 V | | $V_{CC}$ = 2.5 V ± 0.2 V | | $V_{CC}$ = 2.7 V | | $V_{CC}$ = 3.3 V ± 0.3 V | | |
| | | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| $f_{max}$ | | | 55 | | 95 | | 80 | | 100 | | MHz |
| $t_{pd}$ | CLK | Q | | 21.9 | | 10.8 | | 8.1 | 1.5 | 7.6 | ns |
| $t_{en}$ | $\overline{OE}$ | Q | | 19.8 | | 10.8 | | 8.9 | 1.5 | 8.0 | ns |
| $t_{dis}$ | $\overline{OE}$ | Q | | 19.1 | | 18.1 | | 7.7 | 1.5 | 7.0 | ns |
| $t_{sk(o)}$ | | | | 1.5 | | 1.5 | | 1.5 | | 1.5 | ns |

## 7.12 Operating Characteristics

$T_A$ = 25°C

| PARAMETER | | | TEST CONDITIONS | $V_{CC}$ = 1.8 V | $V_{CC}$ = 2.5 V | $V_{CC}$ = 3.3 V | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | TYP | TYP | TYP | |
| $C_{pd}$ | Power dissipation capacitance per flip-flop | Outputs enabled | f = 10 MHz | 53 | 54 | 54.5 | pF |
| | | Outputs disabled | | 12 | 15 | 13.5 | |

## 7.13 Typical Characteristics

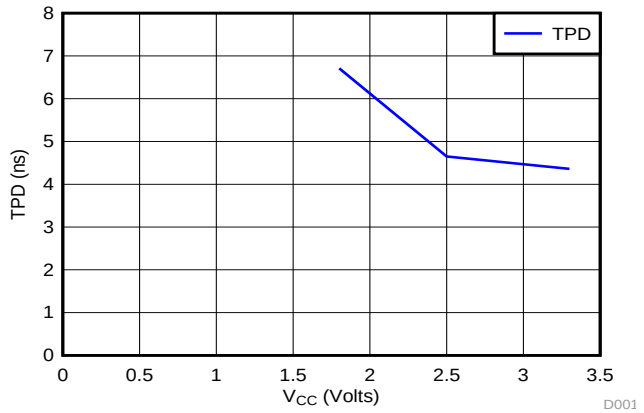



**Figure 1. SN74LVC374A Clock to Q TDP $V_{CC}$ vs TPD at 25°C**

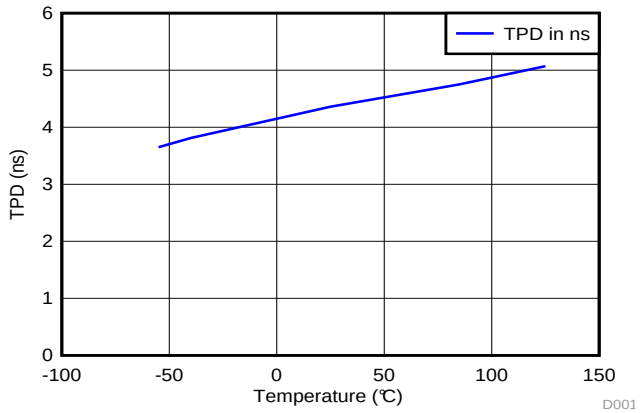
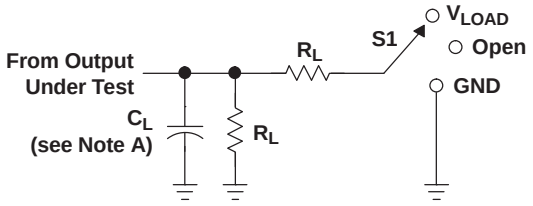



**Figure 2. SN74LVC374A Clock to Q Across Temp 3.3-V $V_{CC}$**

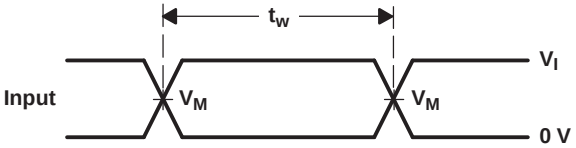
# 8 Parameter Measurement Information



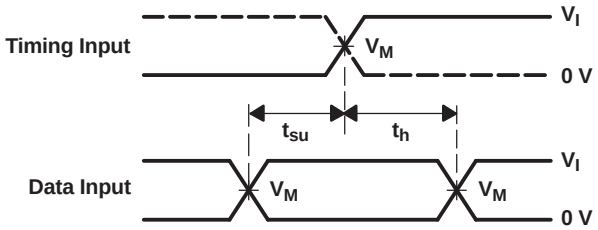

LOAD CIRCUIT

| TEST | S1 |
|---|---|
| $t_{PLH}/t_{PHL}$ | Open |
| $t_{PLZ}/t_{PZL}$ | $V_{LOAD}$ |
| $t_{PHZ}/t_{PZH}$ | GND |

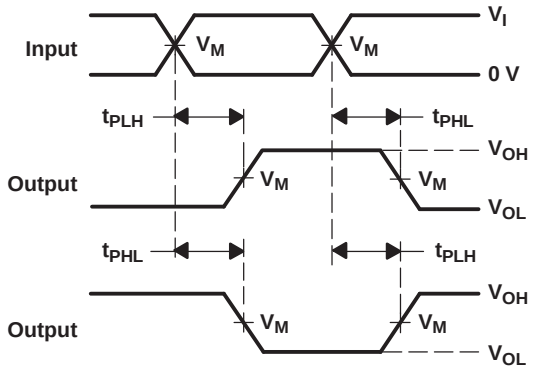
| $V_{CC}$ | INPUTS | | $V_M$ | $V_{LOAD}$ | $C_L$ | $R_L$ | $V_\Delta$ |
|---|---|---|---|---|---|---|---|
| | $V_I$ | $t_r/t_f$ | | | | | |
| 1.8 V ± 0.15 V | $V_{CC}$ | ≤2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 kΩ | 0.15 V |
| 2.5 V ± 0.2 V | $V_{CC}$ | ≤2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 Ω | 0.15 V |
| 2.7 V | 2.7 V | ≤2.5 ns | 1.5 V | 6 V | 50 pF | 500 Ω | 0.3 V |
| 3.3 V ± 0.3 V | 2.7 V | ≤2.5 ns | 1.5 V | 6 V | 50 pF | 500 Ω | 0.3 V |



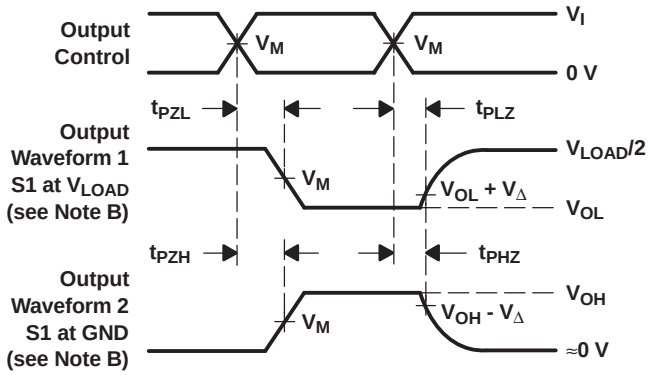

VOLTAGE WAVEFORMS
PULSE DURATION




VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES




VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS




VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

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 ≤ 10 MHz, $Z_O$ = 50 Ω.
D. The outputs are measured one at a time with one 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. $t_{PLH}$ and $t_{PHL}$ are the same as $t_{pd}$.
H. All parameters and waveforms are not applicable to all devices.

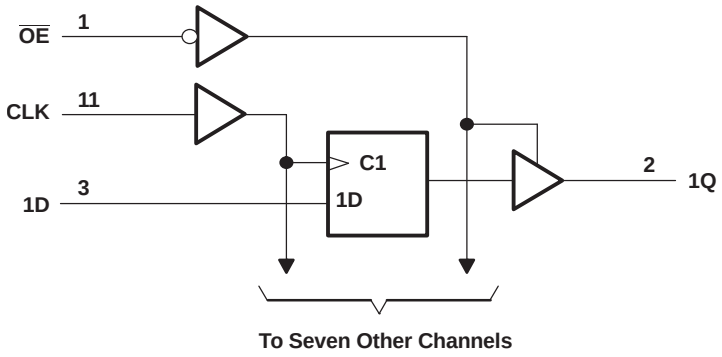
**Figure 3. Load Circuit and Voltage Waveforms**

# 9 Detailed Description

## 9.1 Overview

These devices feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. These devices are particularly suitable for implementing buffer registers, input/output (I/O) ports, bidirectional 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 the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without 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. Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of these devices as translators in a mixed 3.3-V/5-V system environment. These devices are fully specified for partial-power-down applications using $I_{off}$. The $I_{off}$ circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down. 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.

## 9.2 Functional Block Diagram




## 9.3 Feature Description

- Wide operating voltage range
  - Operates from 1.65 V to 3.6 V
- Allows down voltage translation
  - Inputs accept voltages to 5.5 V
- $I_{off}$ feature
  - Allows voltages on the inputs and outputs when $V_{CC}$ is 0 V

## 9.4 Device Functional Modes

**Function Table (Each Flip-Flop)**

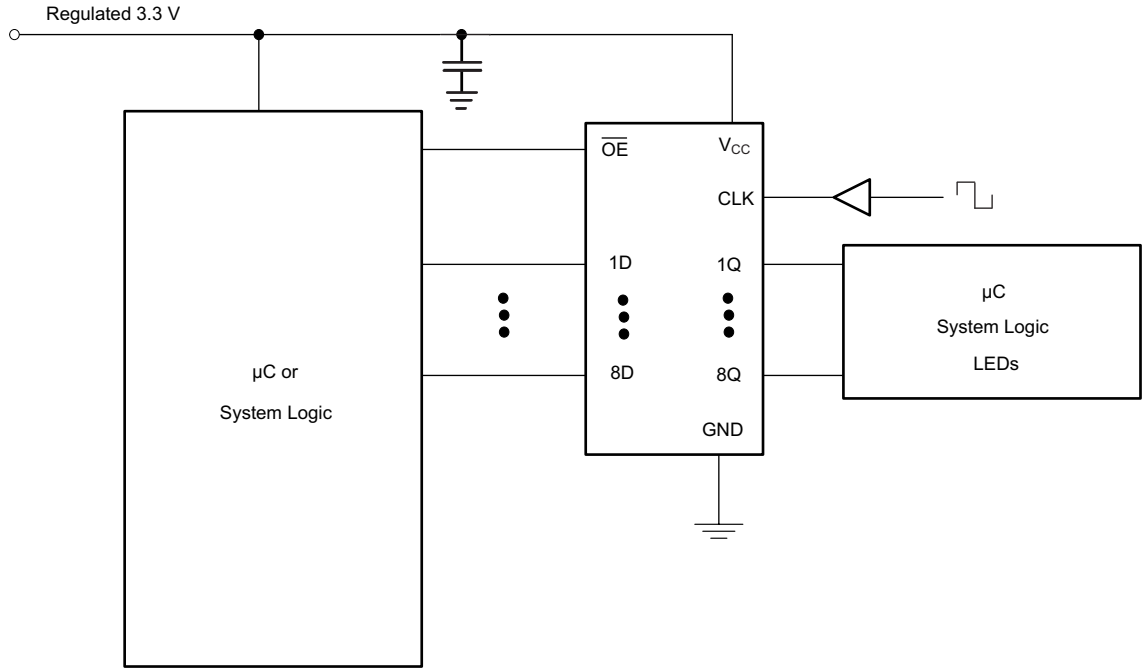
| INPUTS | | | OUTPUT |
|---|---|---|---|
| $\overline{OE}$ | CLK | D | Q |
| L | ↑ | H | H |
| L | ↑ | L | L |
| L | H or L | X | $Q_0$ |
| H | X | X | Z |

# 10 Applications and Implementation

## 10.1 Application Information

The SN74LVC374A is a high-drive CMOS device that can be used for a multitude of bus interface type applications where the data needs to be retained or latched. It can produce 32 mA of drive current at 3.3 V; therefore, making it ideal for driving multiple outputs and good for high speed applications up to 100 MHz. The inputs are 5.5-V tolerant allowing it to translate down to $V_{CC}$.

## 10.2 Typical Application




### 10.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Care should be taken 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 routing and load conditions should be considered to prevent ringing.

### 10.2.2 Detailed Design Procedure

1. Recommended Input conditions
   - Rise time and fall time specs: See (Δt/ΔV) in *Recommended Operating Conditions* table.
   - Specified high and low levels: See ($V_{IH}$ and $V_{IL}$) in *Recommended Operating Conditions* table.
   - Inputs are overvoltage tolerant allowing them to go as high as 5.5 V at any valid $V_{CC}$.
2. Recommend output conditions
   - Load currents should not exceed 25 mA per output and 50 mA total for the part.
   - Outputs should not be pulled above $V_{CC}$.

## Typical Application (continued)

### 10.2.3 Application Curves

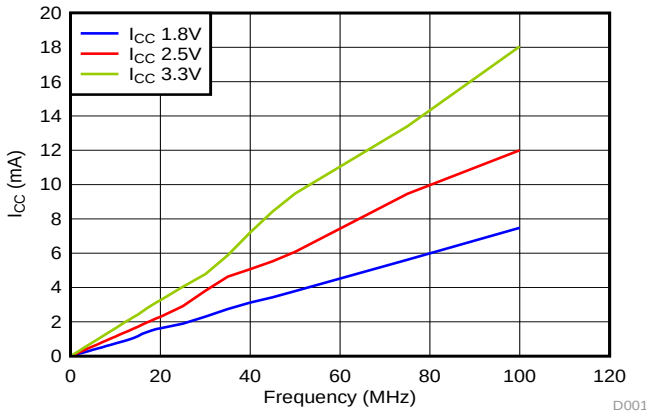



**Figure 4. $I_{CC}$ vs Frequency**

## 11 Power Supply Recommendations

The power supply can be any voltage between the Min and Max supply voltage rating located in the *Recommended Operating Conditions* table.

Each $V_{CC}$ pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, a 0.1-µF capacitor is recommended. If there are multiple $V_{CC}$ pins, then a 0.01-µF or 0.022-µF capacitor is recommended for each power pin. It is ok to parallel multiple bypass capacitors to reject different frequencies of noise. A 0.1-µF and 1-µF capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power pin as possible for best results.

## 12 Layout

### 12.1 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 3 of the 4 buffer gates are used. Such input terminals should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. Figure 5 shows 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 makes more sense or is more convenient. It is generally acceptable to float outputs unless the part is a transceiver. If the transceiver has an output enable terminal it will disable the outputs section of the part when asserted. This will not disable the input section of the IOs so they also cannot float when disabled.

### 12.2 Layout Example

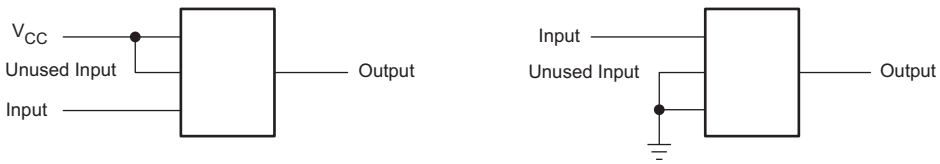



**Figure 5. Layout Diagram**

# 13 Device and Documentation Support

## 13.1 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 1. Related Links**

| PARTS | PRODUCT FOLDER | SAMPLE & BUY | TECHNICAL DOCUMENTS | TOOLS & SOFTWARE | SUPPORT & COMMUNITY |
|---|---|---|---|---|---|
| SN54LVC374A | Click here | Click here | Click here | Click here | Click here |
| SN74LVC374A | Click here | Click here | Click here | Click here | Click here |

## 13.2 Trademarks

All trademarks are the property of their respective owners.

## 13.3 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.

## 13.4 Glossary

SLYZ022 — *TI Glossary*.

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

# 14 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5962-9757401Q2A | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type | -55 to 125 | 5962-9757401Q2A SNJ54LVC374AFK | Samples |
| 5962-9757401QRA | ACTIVE | CDIP | J | 20 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 5962-9757401QRA SNJ54LVC374AJ | Samples |
| 5962-9757401QSA | ACTIVE | CFP | W | 20 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 5962-9757401QSA SNJ54LVC374AW | Samples |
| SN74LVC374ADBR | ACTIVE | SSOP | DB | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LC374A | Samples |
| SN74LVC374ADBRE4 | ACTIVE | SSOP | DB | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LC374A | Samples |
| SN74LVC374ADGVR | ACTIVE | TVSOP | DGV | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LC374A | Samples |
| SN74LVC374ADW | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC374A | Samples |
| SN74LVC374ADWE4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC374A | Samples |
| SN74LVC374ADWR | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC374A | Samples |
| SN74LVC374ADWRE4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC374A | Samples |
| SN74LVC374AN | ACTIVE | PDIP | N | 20 | 20 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | -40 to 85 | SN74LVC374AN | Samples |
| SN74LVC374ANSR | ACTIVE | SO | NS | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC374A | Samples |
| SN74LVC374ANSRG4 | ACTIVE | SO | NS | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC374A | Samples |
| SN74LVC374APW | ACTIVE | TSSOP | PW | 20 | 70 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LC374A | Samples |
| SN74LVC374APWR | ACTIVE | TSSOP | PW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU \| CU SN | Level-1-260C-UNLIM | -40 to 85 | LC374A | Samples |

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SN74LVC374APWRG4 | ACTIVE | TSSOP | PW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LC374A | Samples |
| SN74LVC374APWT | ACTIVE | TSSOP | PW | 20 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LC374A | Samples |
| SN74LVC374ARGYR | ACTIVE | VQFN | RGY | 20 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-2-260C-1 YEAR | -40 to 85 | LC374A | Samples |
| SN74LVC374ARGYRG4 | ACTIVE | VQFN | RGY | 20 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-2-260C-1 YEAR | -40 to 85 | LC374A | Samples |
| SNJ54LVC374AFK | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type | -55 to 125 | 5962-9757401Q2A SNJ54LVC 374AFK | Samples |
| SNJ54LVC374AJ | ACTIVE | CDIP | J | 20 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 5962-9757401QR A SNJ54LVC374AJ | Samples |
| SNJ54LVC374AW | ACTIVE | CFP | W | 20 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 5962-9757401QS A SNJ54LVC374AW | 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 SN54LVC374A, SN74LVC374A :**

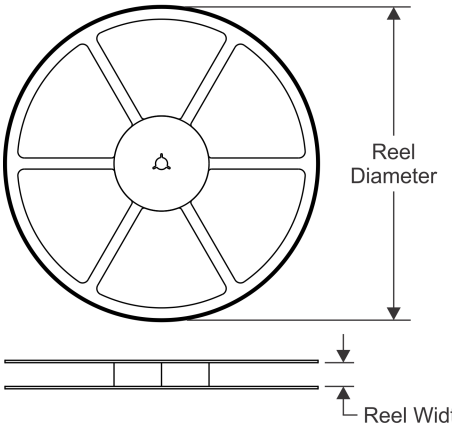
- Catalog: SN74LVC374A
- Automotive: SN74LVC374A-Q1, SN74LVC374A-Q1
- Enhanced Product: SN74LVC374A-EP, SN74LVC374A-EP
- Military: SN54LVC374A

NOTE: Qualified Version Definitions:

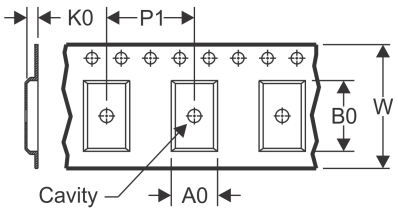
- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications
- Military - QML certified for Military and Defense Applications

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

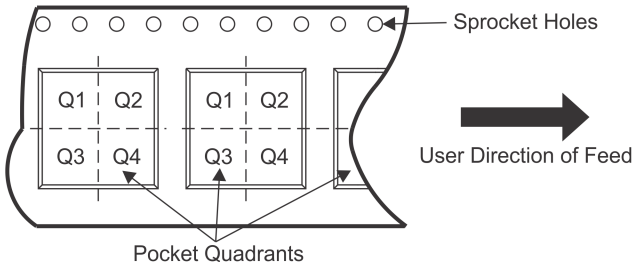



**TAPE DIMENSIONS**




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

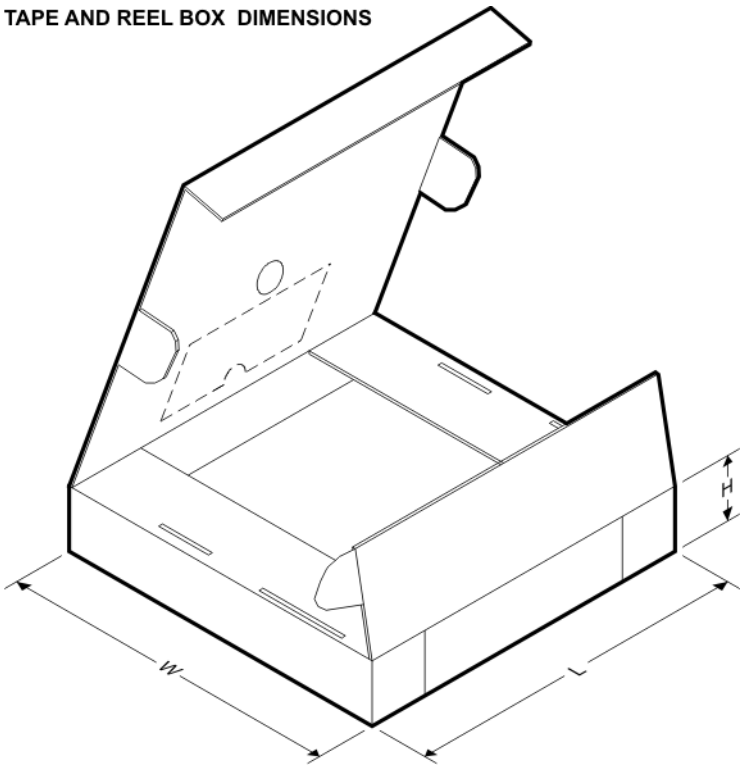
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SN74LVC374ADBR | SSOP | DB | 20 | 2000 | 330.0 | 16.4 | 8.2 | 7.5 | 2.5 | 12.0 | 16.0 | Q1 |
| SN74LVC374ADGVR | TVSOP | DGV | 20 | 2000 | 330.0 | 12.4 | 6.9 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |
| SN74LVC374ADWR | SOIC | DW | 20 | 2000 | 330.0 | 24.4 | 10.8 | 13.3 | 2.7 | 12.0 | 24.0 | Q1 |
| SN74LVC374ANSR | SO | NS | 20 | 2000 | 330.0 | 24.4 | 8.4 | 13.0 | 2.5 | 12.0 | 24.0 | Q1 |
| SN74LVC374APWR | TSSOP | PW | 20 | 2000 | 330.0 | 16.4 | 6.95 | 7.1 | 1.6 | 8.0 | 16.0 | Q1 |
| SN74LVC374APWR | TSSOP | PW | 20 | 2000 | 330.0 | 16.4 | 6.95 | 7.1 | 1.6 | 8.0 | 16.0 | Q1 |
| SN74LVC374APWRG4 | TSSOP | PW | 20 | 2000 | 330.0 | 16.4 | 6.95 | 7.1 | 1.6 | 8.0 | 16.0 | Q1 |
| SN74LVC374APWT | TSSOP | PW | 20 | 250 | 330.0 | 16.4 | 6.95 | 7.1 | 1.6 | 8.0 | 16.0 | Q1 |
| SN74LVC374ARGYR | VQFN | RGY | 20 | 3000 | 330.0 | 12.4 | 3.8 | 4.8 | 1.6 | 8.0 | 12.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS



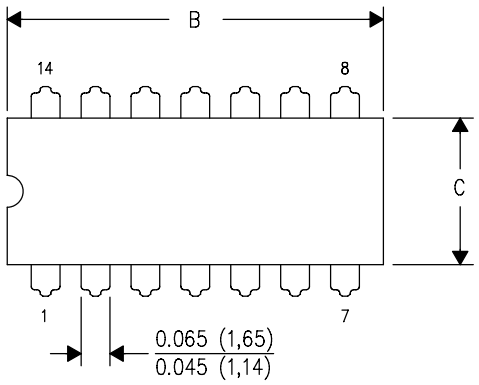

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| SN74LVC374ADBR | SSOP | DB | 20 | 2000 | 367.0 | 367.0 | 38.0 |
| SN74LVC374ADGVR | TVSOP | DGV | 20 | 2000 | 367.0 | 367.0 | 35.0 |
| SN74LVC374ADWR | SOIC | DW | 20 | 2000 | 367.0 | 367.0 | 45.0 |
| SN74LVC374ANSR | SO | NS | 20 | 2000 | 367.0 | 367.0 | 45.0 |
| SN74LVC374APWR | TSSOP | PW | 20 | 2000 | 367.0 | 367.0 | 38.0 |
| SN74LVC374APWR | TSSOP | PW | 20 | 2000 | 364.0 | 364.0 | 27.0 |
| SN74LVC374APWRG4 | TSSOP | PW | 20 | 2000 | 367.0 | 367.0 | 38.0 |
| SN74LVC374APWT | TSSOP | PW | 20 | 250 | 367.0 | 367.0 | 38.0 |
| SN74LVC374ARGYR | VQFN | RGY | 20 | 3000 | 367.0 | 367.0 | 35.0 |

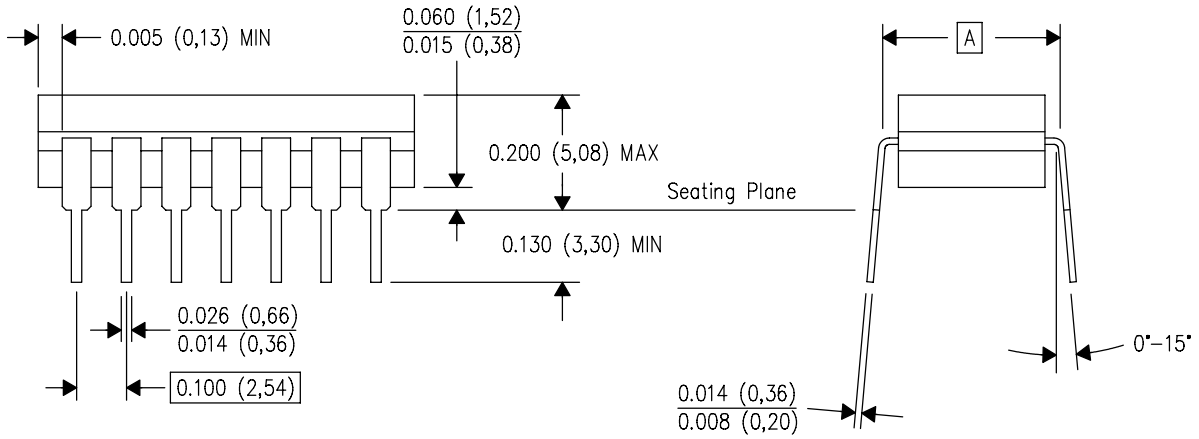
J (R–GDIP–T**)

14 LEADS SHOWN

# CERAMIC DUAL IN–LINE PACKAGE




| DIM \ PINS ** | 14 | 16 | 18 | 20 |
|---|---|---|---|---|
| A | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC |
| B MAX | 0.785 (19,94) | .840 (21,34) | 0.960 (24,38) | 1.060 (26,92) |
| B MIN | — | — | — | — |
| C MAX | 0.300 (7,62) | 0.300 (7,62) | 0.310 (7,87) | 0.300 (7,62) |
| C MIN | 0.245 (6,22) | 0.245 (6,22) | 0.220 (5,59) | 0.245 (6,22) |

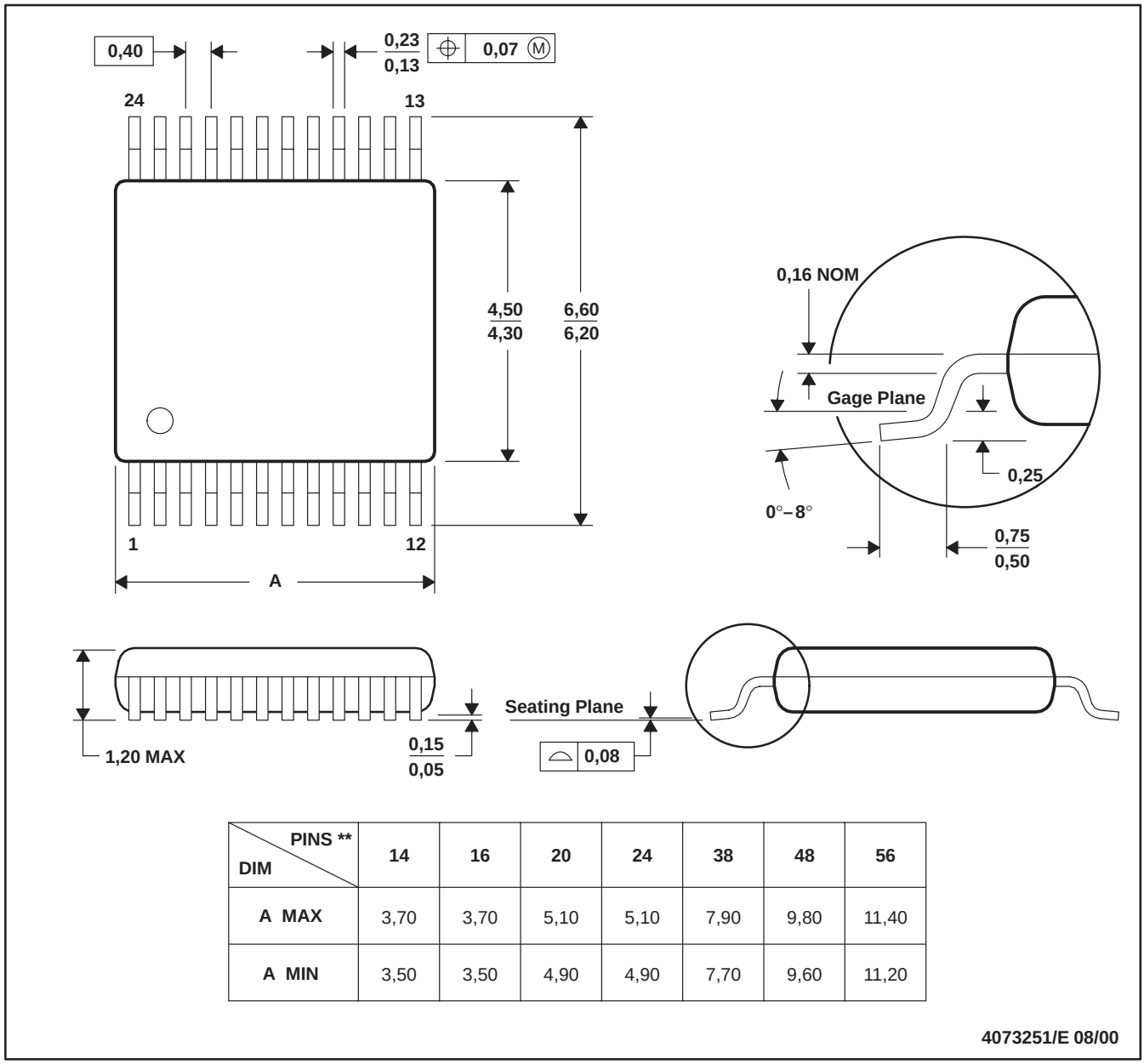



4040083/F 03/03

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
E. Falls within MIL STD 1835 GDIP1–T14, GDIP1–T16, GDIP1–T18 and GDIP1–T20.

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

**24 PINS SHOWN**

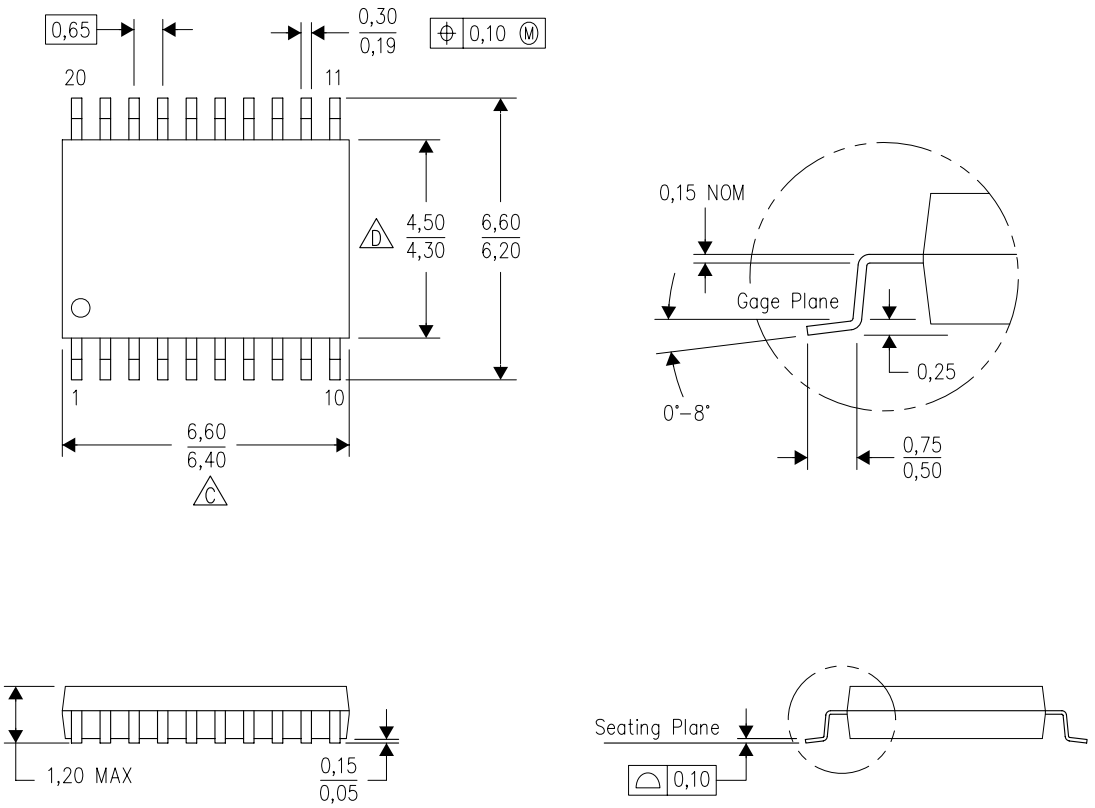



| DIM \ PINS ** | 14 | 16 | 20 | 24 | 38 | 48 | 56 |
|---|---|---|---|---|---|---|---|
| A MAX | 3,70 | 3,70 | 5,10 | 5,10 | 7,90 | 9,80 | 11,40 |
| A MIN | 3,50 | 3,50 | 4,90 | 4,90 | 7,70 | 9,60 | 11,20 |

**4073251/E 08/00**

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 per side.
D. Falls within JEDEC: 24/48 Pins – MO-153
14/16/20/56 Pins – MO-194

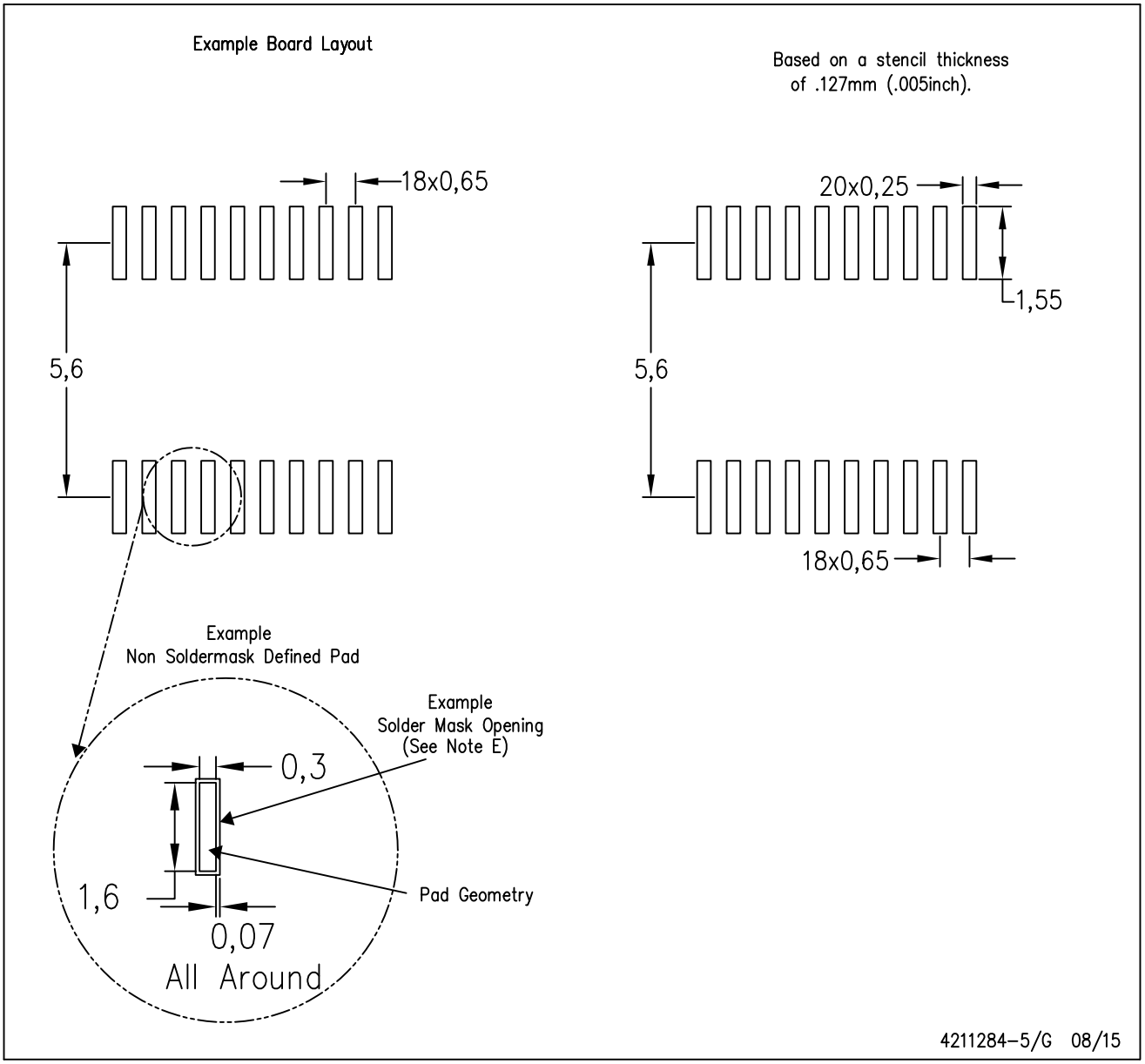
PW (R–PDSO–G20) PLASTIC SMALL OUTLINE




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

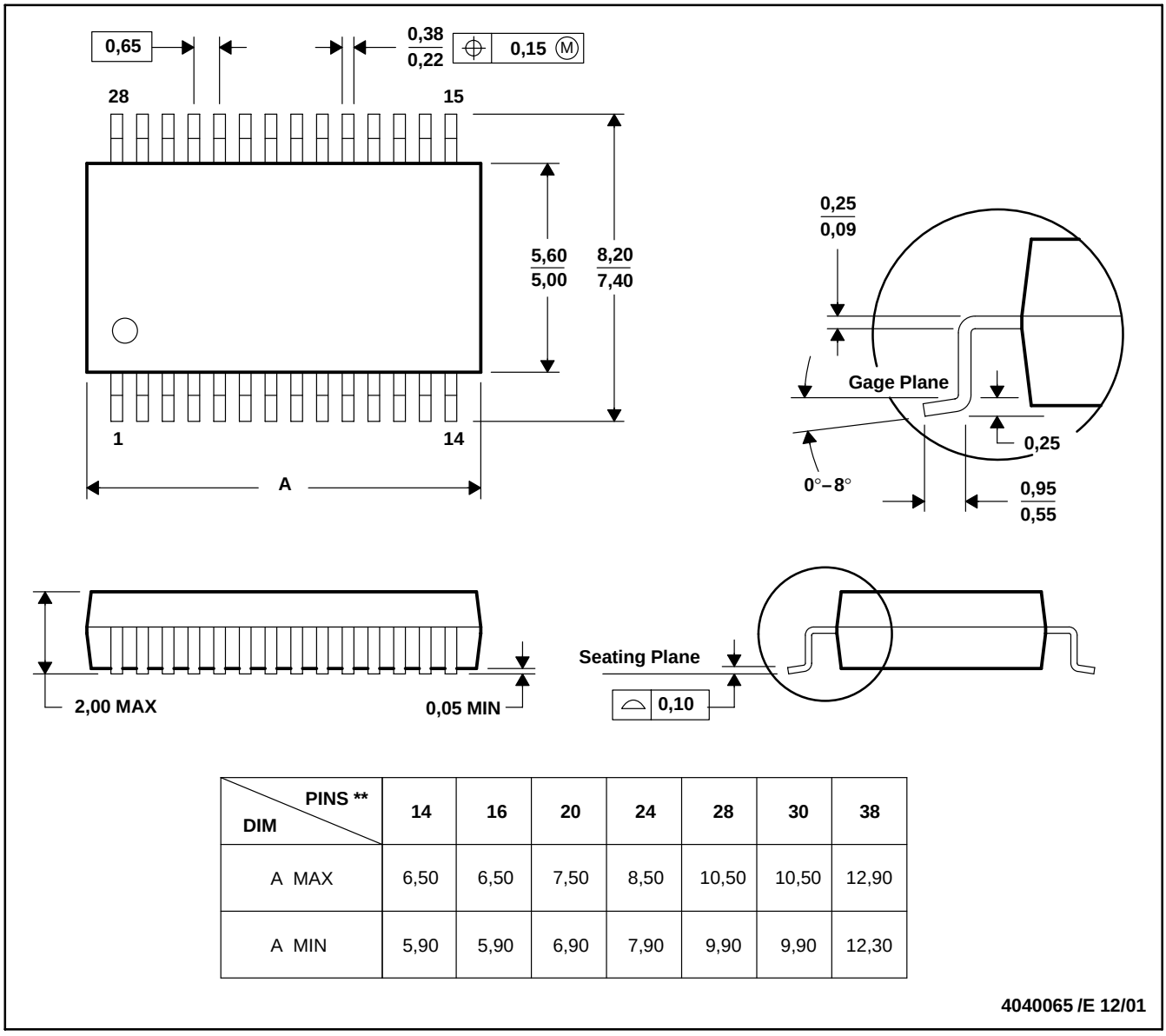



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate design.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their 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 |

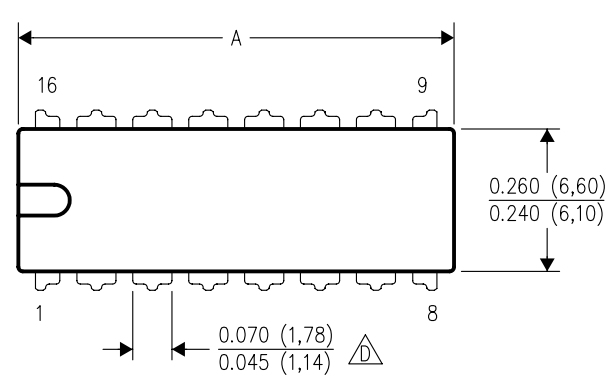
**4040065 /E 12/01**

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

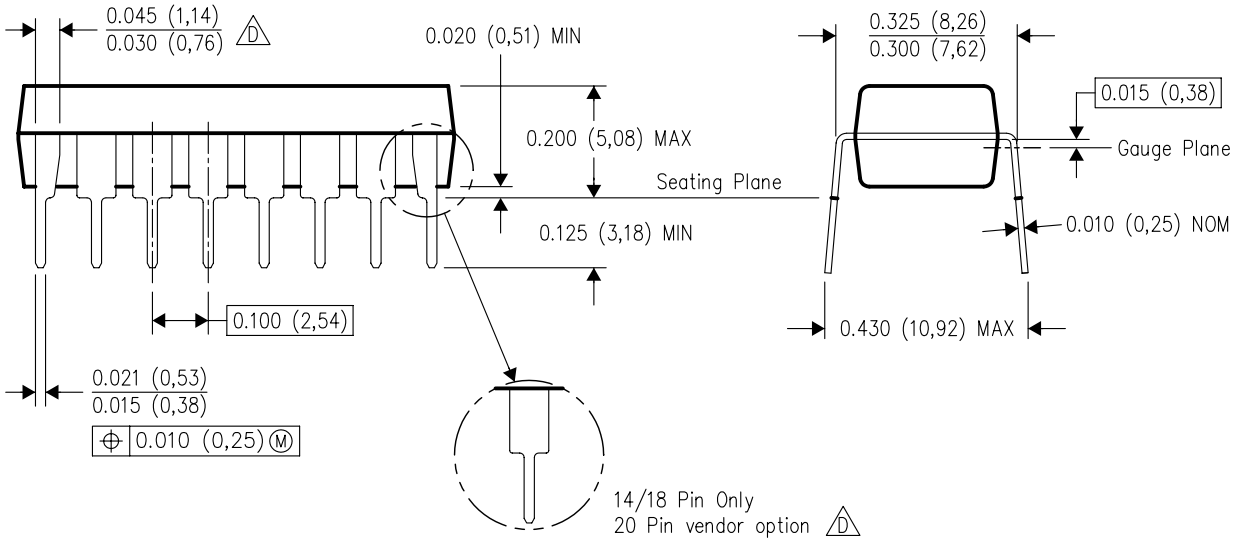
## N (R–PDIP–T**)

## PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN

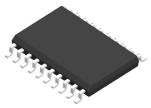



| DIM \ PINS ** | 14 | 16 | 18 | 20 |
|---|---|---|---|---|
| A MAX | 0.775 (19,69) | 0.775 (19,69) | 0.920 (23,37) | 1.060 (26,92) |
| A MIN | 0.745 (18,92) | 0.745 (18,92) | 0.850 (21,59) | 0.940 (23,88) |
| MS–001 VARIATION (C) | AA | BB | AC | AD |




4040049/E 12/2002

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

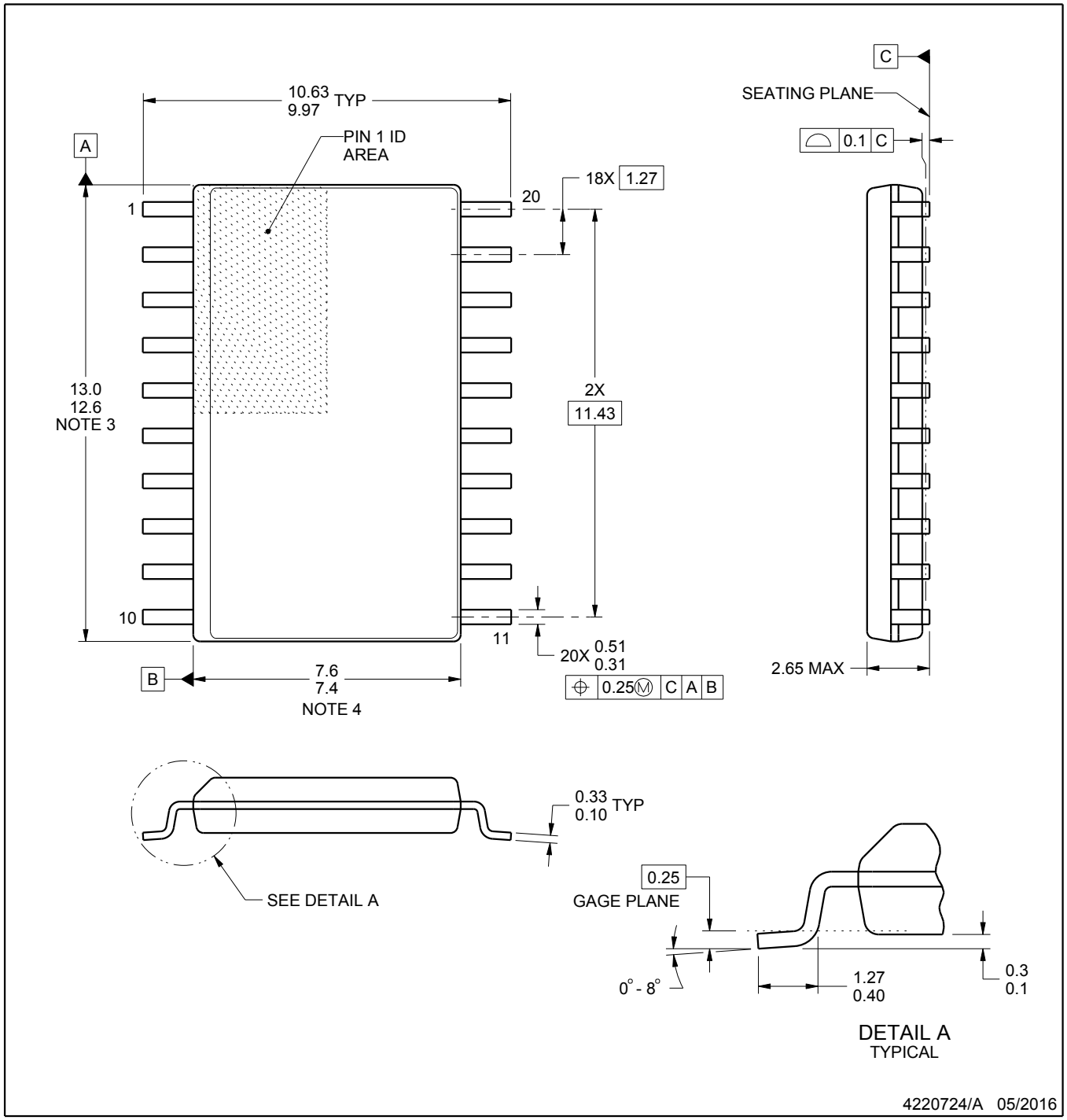


# PACKAGE OUTLINE

## DW0020A

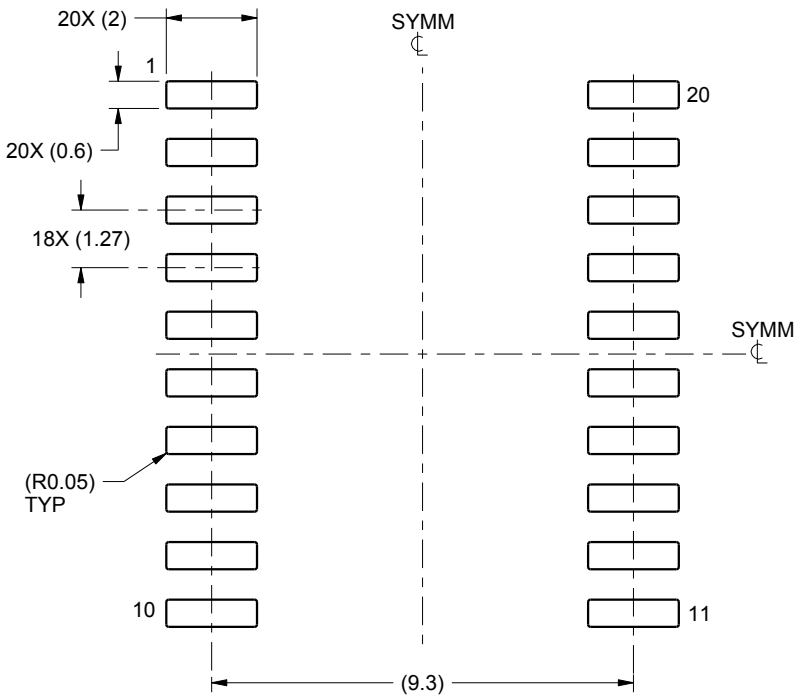
## SOIC - 2.65 mm max height

SOIC

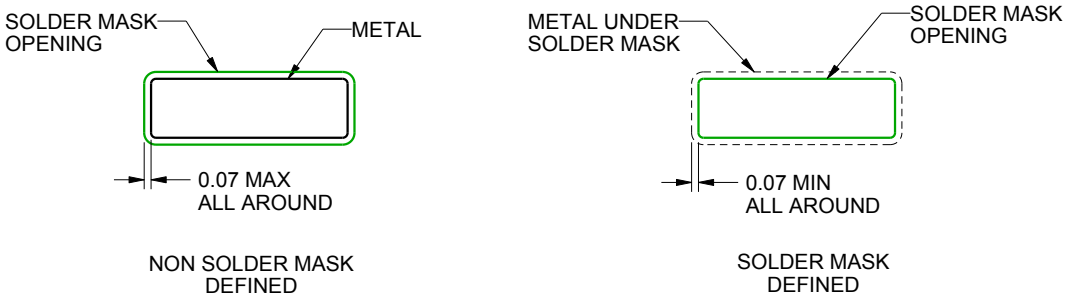



NOTES:

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

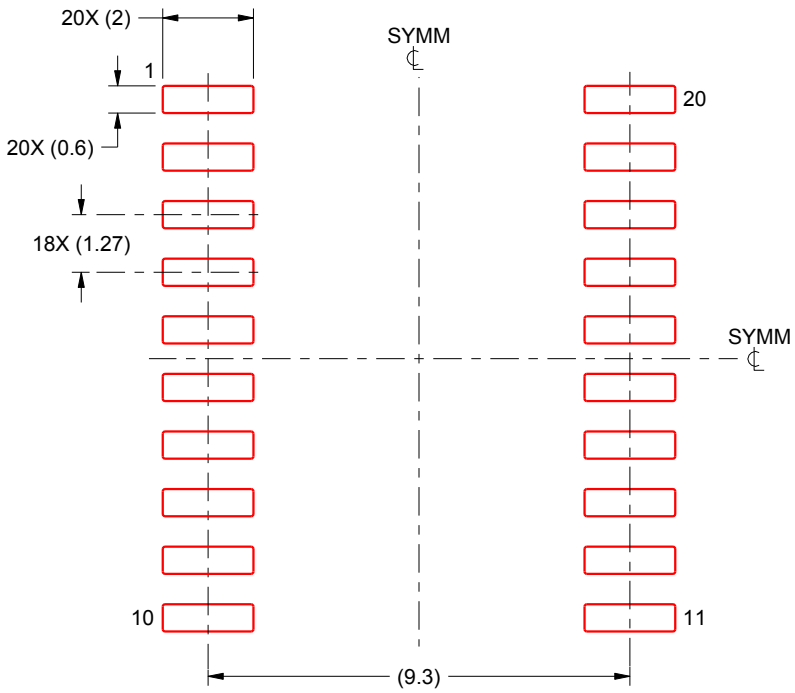



SOLDER MASK DETAILS

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.



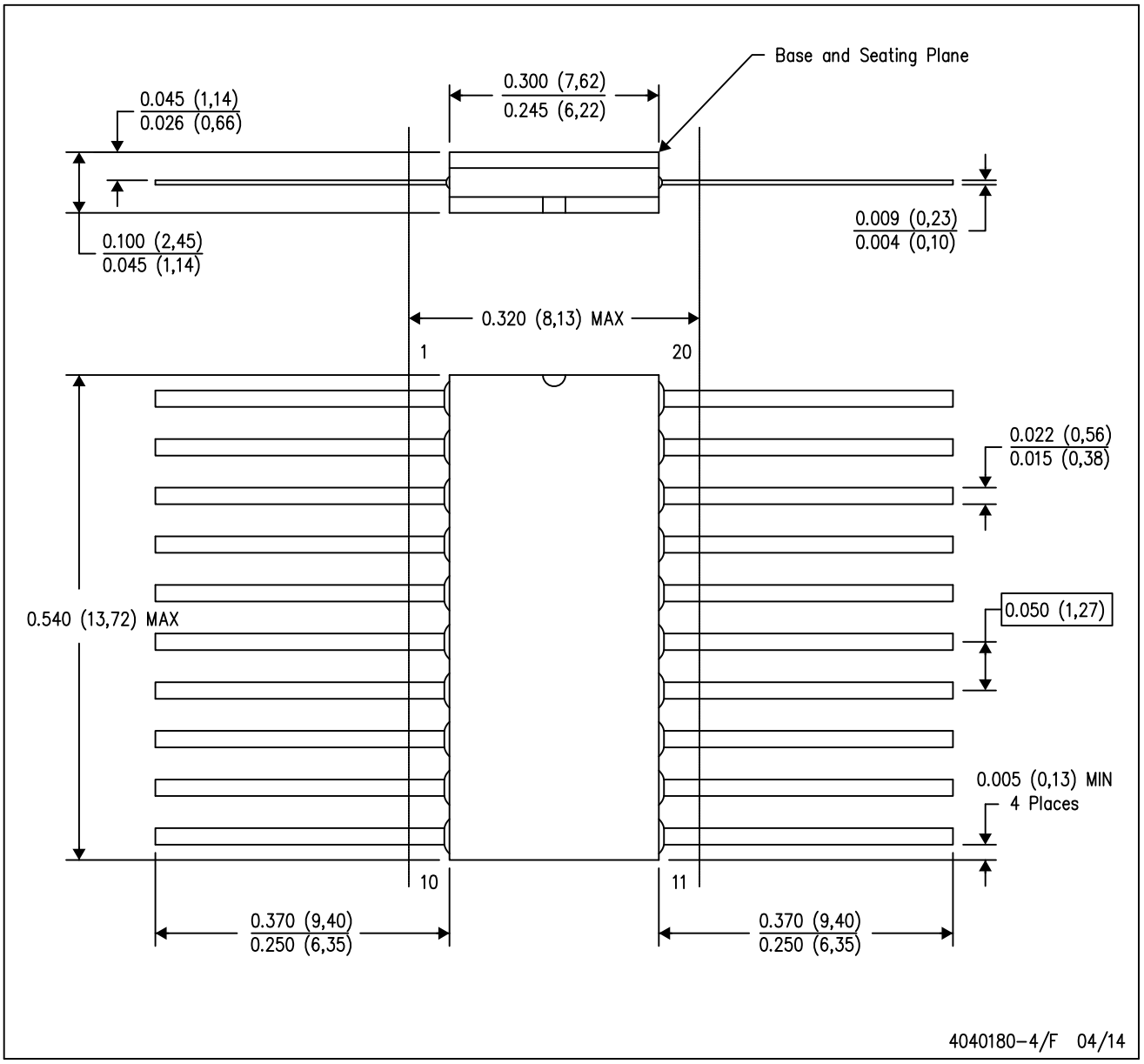

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

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.

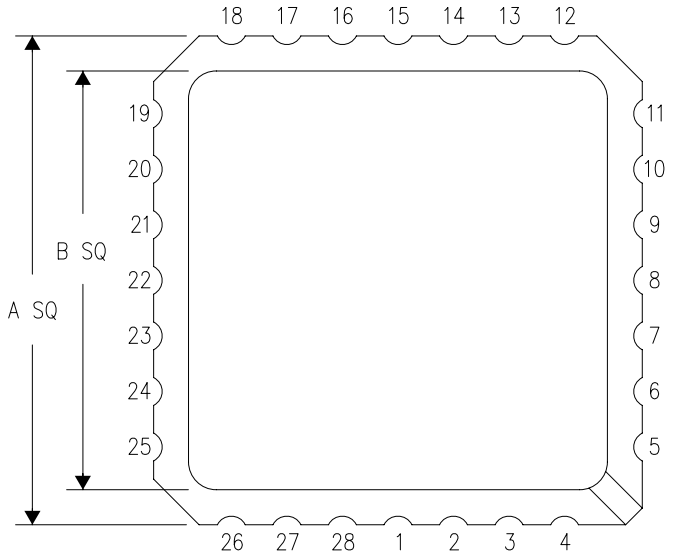
W (R–GDFP–F20) CERAMIC DUAL FLATPACK



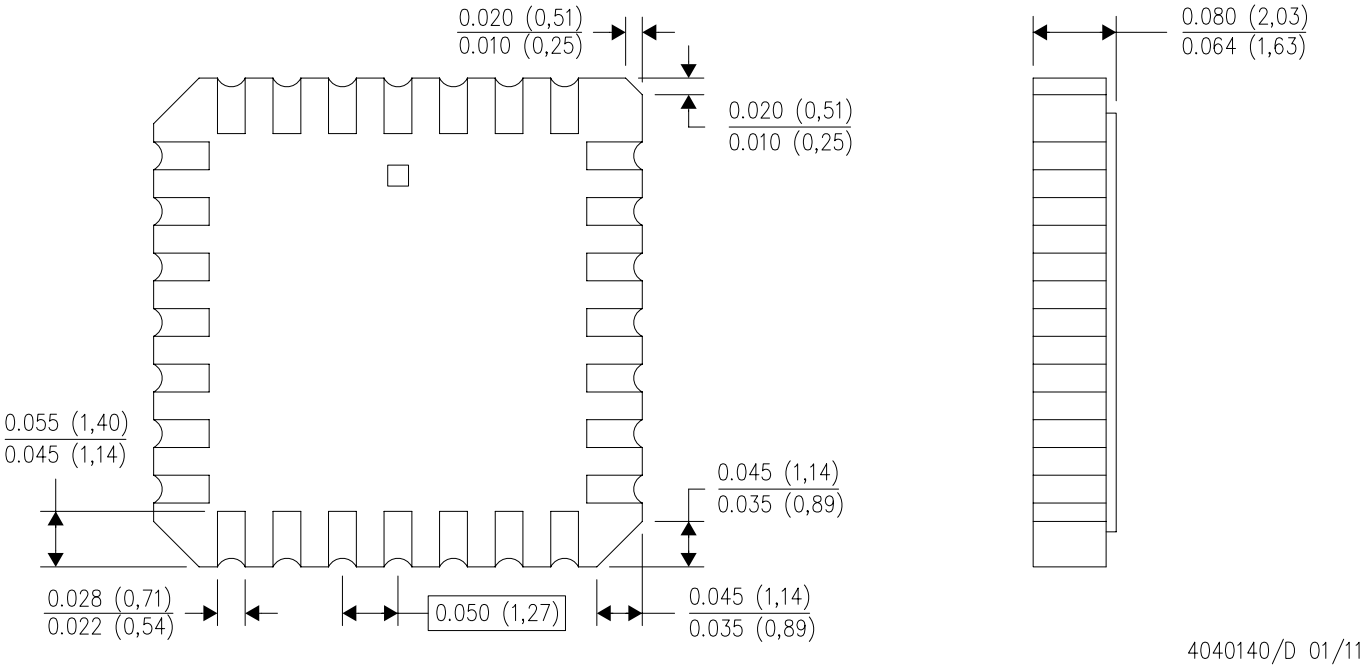

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only.
E. Falls within Mil–Std 1835 GDFP2–F20

FK (S–CQCC–N**) LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



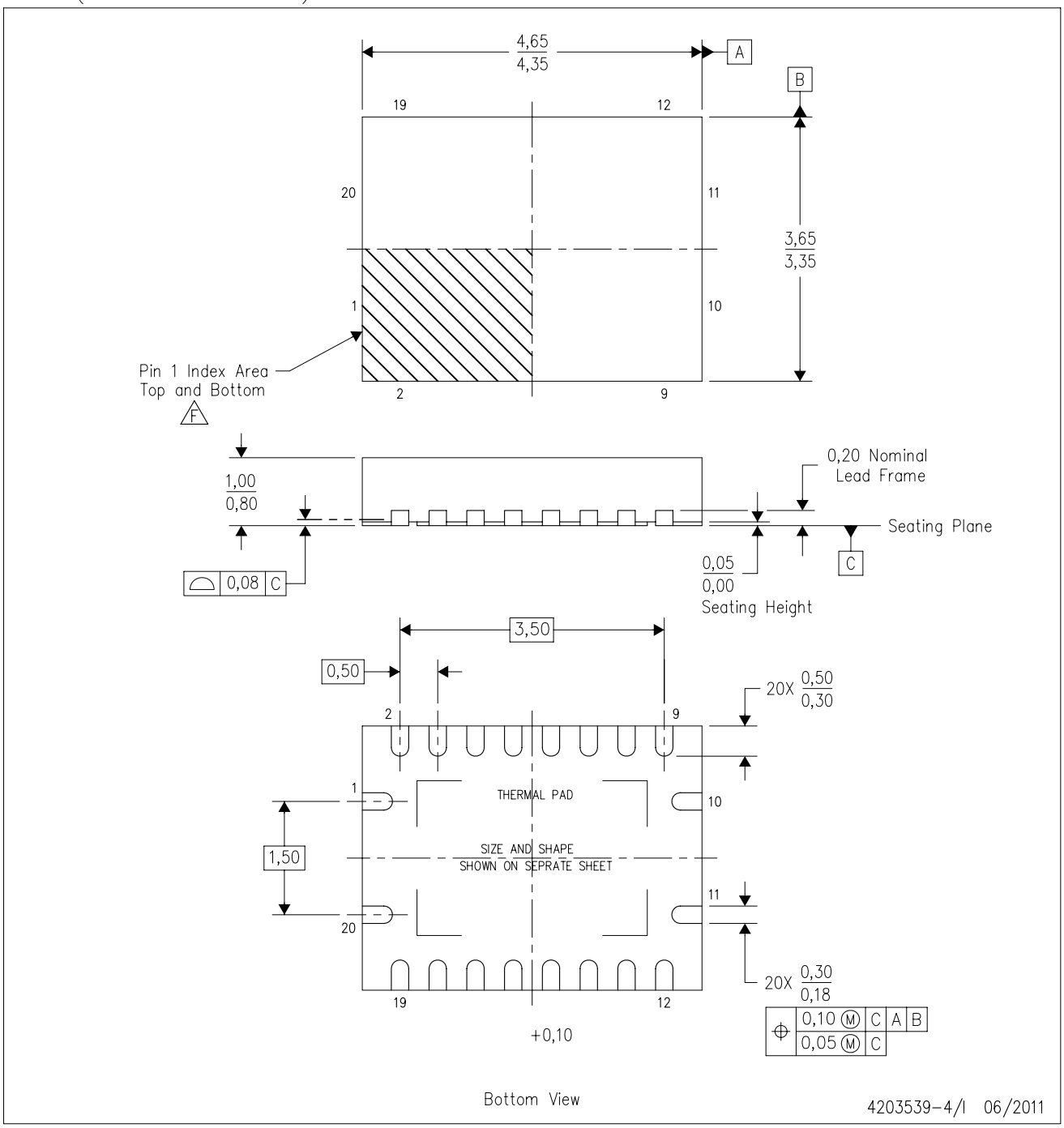

| NO. OF TERMINALS ** | A | | B | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| 20 | 0.342 (8,69) | 0.358 (9,09) | 0.307 (7,80) | 0.358 (9,09) |
| 28 | 0.442 (11,23) | 0.458 (11,63) | 0.406 (10,31) | 0.458 (11,63) |
| 44 | 0.640 (16,26) | 0.660 (16,76) | 0.495 (12,58) | 0.560 (14,22) |
| 52 | 0.740 (18,78) | 0.761 (19,32) | 0.495 (12,58) | 0.560 (14,22) |
| 68 | 0.938 (23,83) | 0.962 (24,43) | 0.850 (21,6) | 0.858 (21,8) |
| 84 | 1.141 (28,99) | 1.165 (29,59) | 1.047 (26,6) | 1.063 (27,0) |




4040140/D 01/11

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. Falls within JEDEC MS–004

RGY (R–PVQFN–N20) PLASTIC QUAD FLATPACK NO–LEAD




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. QFN (Quad Flatpack No–Lead) package configuration.
D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
E. See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
F. Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.
G. Package complies to JEDEC MO–241 variation BA.

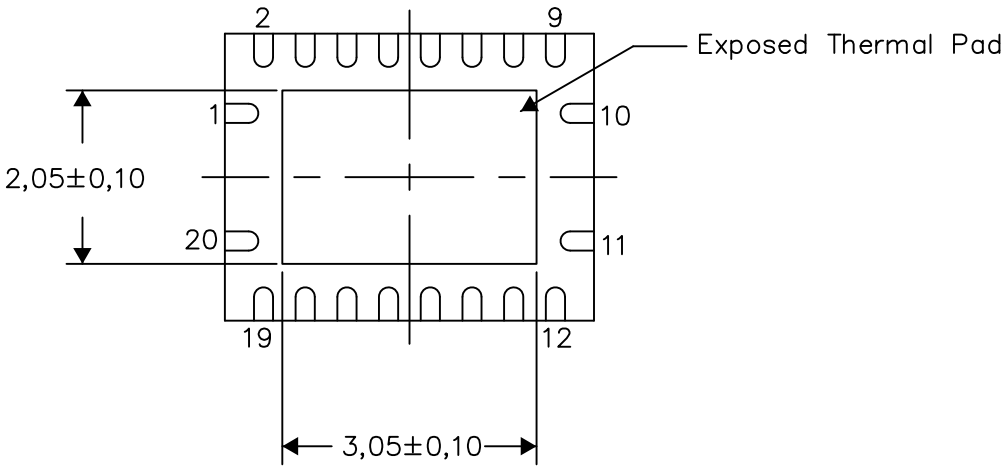
RGY (R–PVQFN–N20) PLASTIC QUAD FLATPACK NO–LEAD

THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No–Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at www.ti.com.

The exposed thermal pad dimensions for this package are shown in the following illustration.



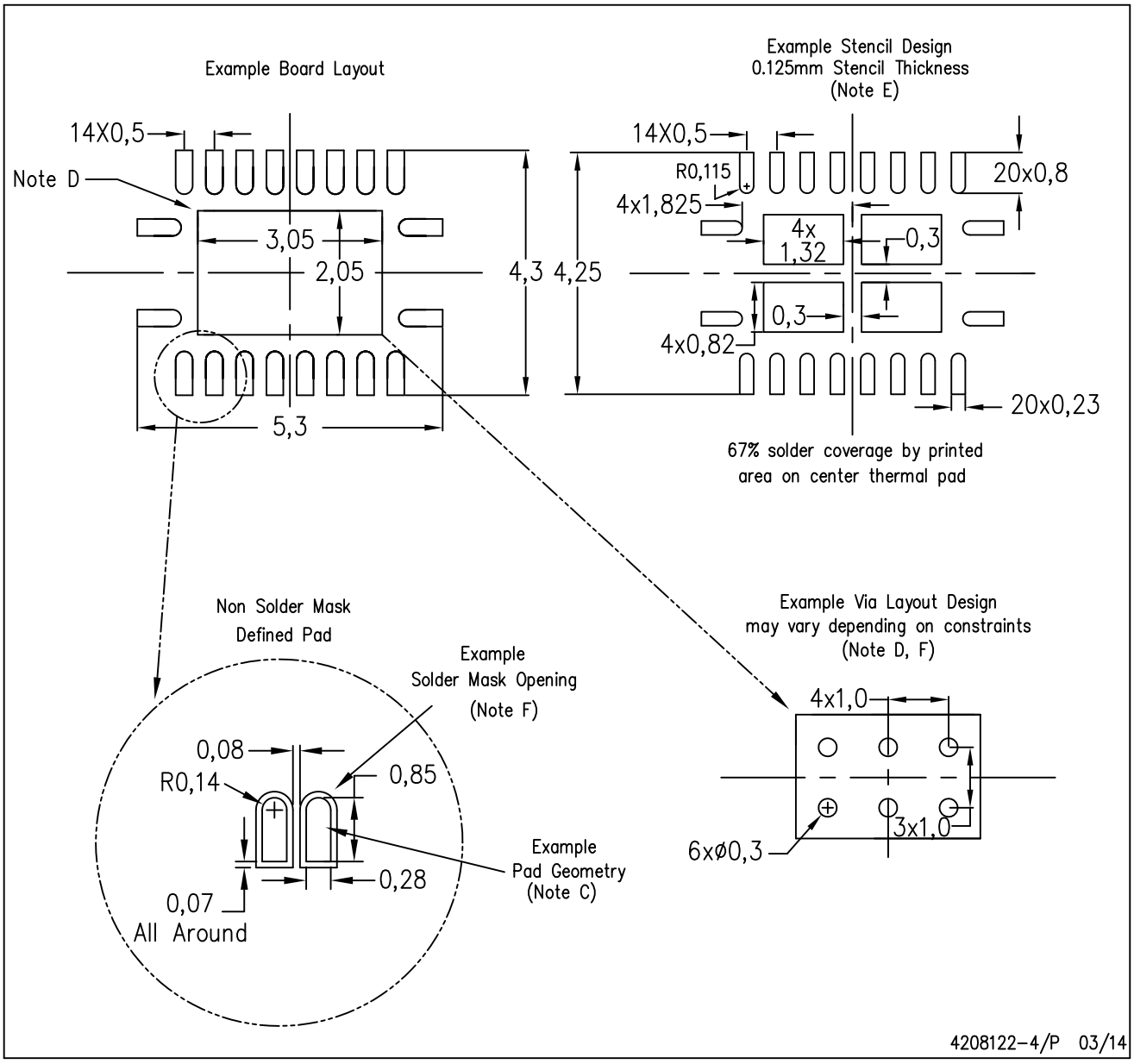

Bottom View

Exposed Thermal Pad Dimensions

4206353–4/P 03/14

NOTE: All linear dimensions are in millimeters

RGY (R–PVQFN–N20) PLASTIC QUAD FLATPACK NO–LEAD

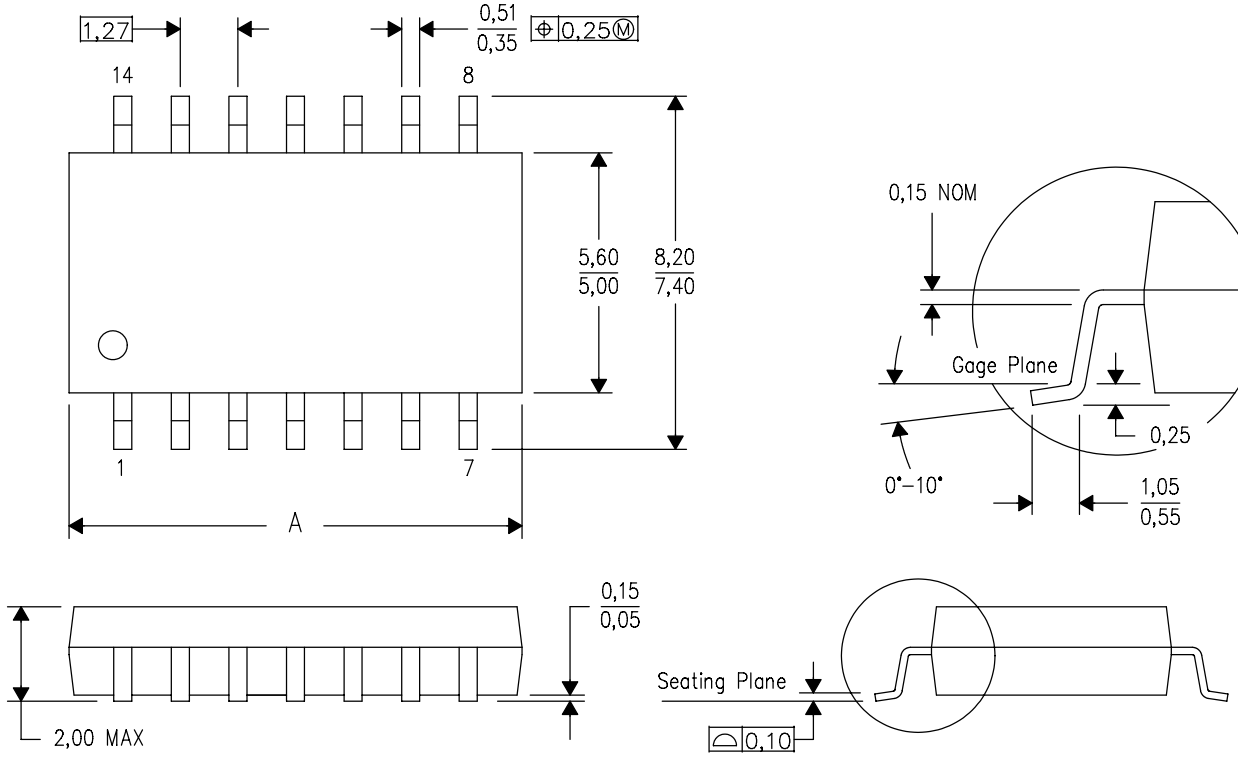



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat–Pack QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at www.ti.com <http: //www.ti.com>.
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. Refer to IPC 7525 for stencil design considerations.
F. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

## 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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