

DS90LVRA2-Q1 Automotive LVDS Dual Differential Line Receiver

1 Features

- AEC-Q100 and AEC-Q006 qualified for automotive applications
 - Temperature grade 2: -40°C to $+105^{\circ}\text{C}$
- 600Mbps (300MHz) switching rates
- 50ps differential skew (typical)
- 0.1ns channel-to-channel skew (typical)
- Supports 1.8V to 3.3V power supply
- Flow-through pinout
- Power down high impedance on LVDS inputs
- Output slew rate control
- LVDS inputs accept LVDS/CML/LVPECL signals
- Conforms to ANSI/TIA/EIA-644 standard
- Pin compatible with DS90LV028A-Q1

2 Applications

- [Automotive infotainment and cluster](#)
- [Automotive head unit](#)

3 Description

The DS90LVRA2-Q1 is a dual CMOS differential line receiver designed for applications requiring high input common mode range, high data rates, and CMOS output with slew rate control. The device is designed to support data rates of 600Mbps (300MHz) utilizing low voltage differential signaling (LVDS) technology.

The DS90LVRA2-Q1 accepts low voltage (350mV typical) differential input signals and translates them from 1.8V to 3.3V CMOS output levels depending on power supply voltage. The DS90LVRA2-Q1 has a flow-through design for easy PCB layout.

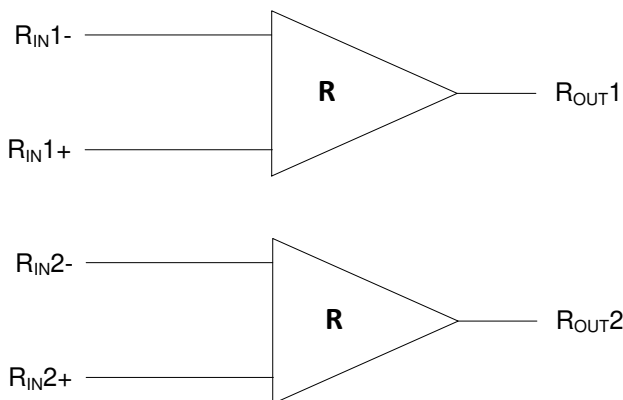
The DS90LVRA2-Q1 and companion LVDS line driver DS90LV027AQ provide a new alternative to high power PECL/ECL devices for high speed point-to-point interface applications.

Package Information

| PART NUMBER | PACKAGE ⁽¹⁾ | PACKAGE SIZE ⁽²⁾ |
|--------------|------------------------|-----------------------------|
| DS90LVRA2-Q1 | DEM (WSON, 8) | 2mm × 2mm |

(1) For more information, see [Section 11](#).

(2) The package size (length × width) is a nominal value and includes pins, where applicable.



Functional Diagram



Table of Contents

| | | | |
|--|---|--|----|
| 1 Features | 1 | 7.4 Device Functional Modes..... | 9 |
| 2 Applications | 1 | 8 Application and Implementation | 10 |
| 3 Description | 1 | 8.1 Application Information..... | 10 |
| 4 Pin Configuration and Functions | 3 | 8.2 Typical Application..... | 10 |
| 5 Specifications | 4 | 8.3 Power Supply Recommendations..... | 11 |
| 5.1 Absolute Maximum Ratings..... | 4 | 8.4 Layout..... | 11 |
| 5.2 ESD Ratings..... | 4 | 9 Device and Documentation Support | 13 |
| 5.3 Recommended Operating Conditions..... | 4 | 9.1 Documentation Support..... | 13 |
| 5.4 Thermal Information..... | 4 | 9.2 Receiving Notification of Documentation Updates.... | 13 |
| 5.5 Electrical Characteristics..... | 5 | 9.3 Support Resources..... | 13 |
| 5.6 Switching Characteristics..... | 6 | 9.4 Trademarks..... | 13 |
| 5.7 Typical Characteristics..... | 7 | 9.5 Electrostatic Discharge Caution..... | 13 |
| 6 Parameter Measurement Information | 8 | 9.6 Glossary..... | 13 |
| 7 Detailed Description | 9 | 10 Revision History | 13 |
| 7.1 Overview..... | 9 | 11 Mechanical, Packaging, and Orderable Information | 13 |
| 7.2 Functional Block Diagram..... | 9 | | |
| 7.3 Feature Description..... | 9 | | |

4 Pin Configuration and Functions

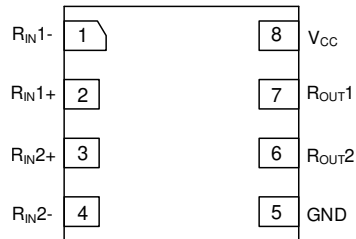


Figure 4-1. DEM Package, WSON 8 Pin (Top View)

Table 4-1. Pin Functions

| PIN | | TYPE ⁽¹⁾ | DESCRIPTION |
|-------------------|-----|---------------------|----------------------------------|
| NAME | NO. | | |
| GND | 5 | G | Ground pin |
| R _{IN1-} | 1 | I | Inverting receiver input pin |
| R _{IN2-} | 4 | I | |
| R _{IN1+} | 2 | I | Non-inverting receiver input pin |
| R _{IN2+} | 3 | I | |
| R _{OUT2} | 6 | O | Receiver output pin |
| R _{OUT1} | 7 | O | |
| V _{CC} | 8 | P | Power supply pin |

(1) I = input, O = output, G = ground

5 Specifications

5.1 Absolute Maximum Ratings

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

| | | MIN | MAX | UNIT |
|---|----------|------|-----|------|
| Supply Voltage (V_{CC}) | | -0.3 | 4 | V |
| Input Voltage (R_{IN+} , R_{IN-}) | | -5 | 6 | V |
| Differential Voltage (R_{IN+} - R_{IN-}) for LVDS | | 0 | 3 | V |
| Output Voltage (R_{OUT}) | | -0.3 | 3.6 | V |
| Lead Temperature Range Soldering | (4 sec.) | | 260 | °C |
| Maximum Junction Temperature | | | 135 | °C |
| Storage temperature, T_{stg} | | -65 | 150 | °C |

- (1) Operation outside the *Absolute Maximum Rating* may cause permanent device damage. *Absolute Maximum Rating* do not imply functional operation of the device at these or any other conditions beyond those listed under *Recommended Operating Condition*. If used outside the *Recommended Operating Condition* but within the *Absolute Maximum Rating*, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.

5.2 ESD Ratings

| | | | VALUE | UNIT |
|-------------|-------------------------|---|-------|------|
| $V_{(ESD)}$ | Electrostatic discharge | Human-body model (HBM), per AEC Q100-002 ⁽¹⁾ | ±2000 | V |
| | | Charged-device model (CDM), per AEC Q100-011 ⁽²⁾ | ±1000 | |

- (1) AEC Q100-002 HBM ESD Classification Level 2
(2) AEC Q100-011 CDM ESD Classification Level C4A

5.3 Recommended Operating Conditions

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

| | | MIN | NOM | MAX | UNIT |
|-----------|--|------|------|------|------|
| V_{CC} | Supply voltage (3.3V mode) | 3.0 | 3.3 | 3.6 | V |
| V_{CC} | Supply voltage (2.5V mode) | 2.25 | 2.5 | 2.75 | V |
| V_{CC} | Supply voltage (1.8V mode) | 1.62 | 1.80 | 1.98 | V |
| V_R | Receiver input voltage (LVDS) | 0 | | 3.0 | V |
| T_A | Operating free-air temperature | -40 | | 105 | °C |
| T_{PCB} | PCB temperature (1mm away from device) | | | 112 | °C |
| T_J | Junction temperature | | | 125 | °C |

5.4 Thermal Information

| THERMAL METRIC ⁽¹⁾ | | DEM | UNIT |
|-------------------------------|--|--------|------|
| | | (WSN) | |
| | | 8 PINS | |
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 143.7 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 77.9 | °C/W |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 69.8 | °C/W |
| Ψ_{JT} | Junction-to-top characterization parameter | 5.0 | °C/W |
| Ψ_{JB} | Junction-to-board characterization parameter | 69.6 | °C/W |

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

5.5 Electrical Characteristics

over recommended operating conditions (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|------------------------|--|---|------|-----|------|------|
| V _{ITH} | Differential input high threshold | V _{IB} = -4 V or 5V, V _{CC} = 1.62 V to 3.6 V | 100 | | | mV |
| V _{ITL} | Differential input low threshold | | -100 | | | |
| V _{HYS} | Differential input voltage hysteresis, V _{IT1} – V _{IT2} | V _{CC} = 1.62 V to 3.6 V | 20 | 40 | 120 | mV |
| V _{CM_RANGE} | Input common mode voltage range | V _{CC} = 1.62 - 1.98V | -1 | 1.2 | 2 | V |
| | | V _{CC} = 2.3 - 2.7 V | -2.5 | 1.2 | 3 | V |
| | | V _{CC} = 3.0 - 3.6 V | -4 | 1.2 | 5 | V |
| V _{OH} | High-level output voltage | I _{OH} = -4mA, V _{CC} = 1.8V ± 10% | 1.3 | | | V |
| | | I _{OH} = -4mA, V _{CC} = 2.5V ± 10% | 1.8 | | | V |
| | | I _{OH} = -4mA, V _{CC} = 3.3V ± 10% | 2.6 | | | V |
| V _{OL} | Low-level output voltage | I _{OL} = 4mA, V _{CC} = 1.8V ± 10% | | | 0.2 | V |
| | | I _{OL} = 4mA, V _{CC} = 2.5V ± 10% | | | 0.3 | V |
| | | I _{OL} = 4mA, V _{CC} = 3.3V ± 10% | | | 0.4 | V |
| I _{CC_ACTIVE} | Supply current | V _{CC} = 3.6 V, No load, Steady-state, V _{ID} =200mV/-200mV | | | 25 | mA |
| | | V _{CC} = 2.7 V, No load, Steady-state, V _{ID} =200mV/-200mV | | | 25 | mA |
| | | V _{CC} = 1.98V, No load, Steady-state, V _{ID} =200mV/-200mV | | | 25 | mA |
| I _I | Input current (A or B inputs) | V _I = -1.0 V, Other input open | | | ±35 | μA |
| | | V _I = 2.4 V, Other input open | | | ±20 | μA |
| | | V _I = -4 V, Other input open (split between 85°C) (±80 μA) | | | ±120 | μA |
| | | V _I = 5V, Other input open | | | ±40 | μA |
| I _{I(OFF)} | Power-off output current (Y or Z outputs) | V _Y or V _Z = 1.98V, V _{CC} = 0 V | | | ±20 | μA |
| I _{I(OFF)} | Power-off input current (A or B inputs) | V _A or V _B = -1 V or 2.0 V, V _{CC} = 0 V | | | ±30 | μA |
| | | V _A or V _B = -4 or 5V, V _{CC} = 0 V | | | ±70 | μA |
| | | V _A or V _B = 0 V or 2.4 V, V _{CC} = 0 V | | | ±30 | μA |

5.6 Switching Characteristics

$V_{ID} = 200\text{mV}$, $C_L = 10\text{pF}$ and over operating temperature ranges, unless otherwise specified. ⁽¹⁾ ⁽²⁾

| Symbol | Parameter | Conditions | MIN | TYP | MAX | UNIT |
|------------------|--|---|-------|-----|------|------|
| t_{PHLD} | Differential Propagation Delay High to Low | $V_{CC} = 1.8\text{V} \pm 10\%$, $\text{trf} = 1\text{ns}$ | 2.5 | 4.4 | 7.7 | ns |
| | | $V_{CC} = 2.5\text{V} \pm 10\%$, $\text{trf} = 1\text{ns}$ | 2.2 | 3.3 | 5.1 | ns |
| | | $V_{CC} = 3.3\text{V} \pm 10\%$, $\text{trf} = 1\text{ns}$ | 1.9 | 2.9 | 4.1 | ns |
| t_{PLHD} | Differential Propagation Delay Low to High | $V_{CC} = 1.8\text{V} \pm 10\%$, $\text{trf} = 1\text{ns}$ | 2.7 | 4.4 | 7.7 | ns |
| | | $V_{CC} = 2.5\text{V} \pm 10\%$, $\text{trf} = 1\text{ns}$ | 2.4 | 3.4 | 5.1 | ns |
| | | $V_{CC} = 3.3\text{V} \pm 10\%$, $\text{trf} = 1\text{ns}$ | 2.2 | 3.1 | 4.1 | ns |
| t_{SKD1_S} | Differential Pulse Skew ($t_{PHLD} - t_{PLHD}$) ⁽³⁾ | $V_{CC} = 1.8\text{V} \pm 10\%$, $\text{trf} = 1\text{ns}$ | -680 | | 680 | ps |
| | | $V_{CC} = 2.5\text{V} \pm 10\%$, $\text{trf} = 1\text{ns}$ | -500 | | 500 | ps |
| | | $V_{CC} = 3.3\text{V} \pm 10\%$, $\text{trf} = 1\text{ns}$ | -610 | | 610 | ps |
| t_{SKD1_400M} | Differential Pulse Skew ($t_{PHLD} - t_{PLHD}$) ⁽³⁾ | $V_{CC} = 1.8\text{V} \pm 10\%$, $\text{trf} = 0.25\text{ns}$, 400Mbps | -1990 | | 1990 | ps |
| | | $V_{CC} = 2.5\text{V} \pm 10\%$, $\text{trf} = 0.25\text{ns}$, 400Mbps | -1400 | | 1400 | ps |
| | | $V_{CC} = 3.3\text{V} \pm 10\%$, $\text{trf} = 0.25\text{ns}$, 400Mbps | -1800 | | 1800 | ps |
| t_{SKD2} | Differential Channel-to-Channel Skew ⁽⁴⁾ | $V_{CC} = 1.8\text{V} \pm 10\%$, $\text{trf} = 0.25\text{ns}$ | | | 0.6 | ns |
| | | $V_{CC} = 2.5\text{V} \pm 10\%$, $\text{trf} = 0.25\text{ns}$ | | | 0.3 | ns |
| | | $V_{CC} = 3.3\text{V} \pm 10\%$, $\text{trf} = 0.25\text{ns}$ | | | 0.3 | ns |
| t_{SKD3} | Differential Part to Part Skew ⁽⁵⁾ | $V_{CC} = 1.8\text{V} \pm 10\%$, $\text{trf} = 0.25\text{ns}$ | | | 3.0 | ns |
| | | $V_{CC} = 2.5\text{V} \pm 10\%$, $\text{trf} = 0.25\text{ns}$ | | | 1.7 | ns |
| | | $V_{CC} = 3.3\text{V} \pm 10\%$, $\text{trf} = 0.25\text{ns}$ | | | 1.2 | ns |
| t_R | Rise Time | $V_{CC} = 1.8\text{V}$ | 250 | 500 | 740 | ps |
| | | $V_{CC} = 2.5\text{V}$ | 250 | 390 | 740 | ps |
| | | $V_{CC} = 3.3\text{V}$ | 250 | 450 | 740 | ps |
| t_F | Fall Time | $V_{CC} = 1.8\text{V}$ | 250 | 560 | 740 | ps |
| | | $V_{CC} = 2.5\text{V}$ | 250 | 360 | 740 | ps |
| | | $V_{CC} = 3.3\text{V}$ | 250 | 400 | 740 | ps |
| f_{MAX} | Maximum Operating Frequency ⁽¹¹⁾ | | 300 | | | MHz |

- (1) C_L includes probe and jig capacitance.
- (2) Generator waveform for all tests unless otherwise specified: $f = 1\text{MHz}$, $Z_O = 50\Omega$, t_r and t_f (0% to 100%) $\leq 3\text{ns}$ for R_{IN} .
- (3) t_{SKD1} is the magnitude difference in differential propagation delay time between the positive-going-edge and the negative-going-edge of the same channel.
- (4) t_{SKD2} is the differential channel-to-channel skew of any event on the same device. This specification applies to devices having multiple receivers within the integrated circuit.
- (5) t_{SKD3} , part to part skew, is the differential channel-to-channel skew of any event between devices. This specification applies to devices at the same V_{CC} and within 5°C of each other within the operating temperature range.
- (6) f_{MAX} generator input conditions: $t_r = t_f < 1\text{ns}$ (0% to 100%), 50% duty cycle, differential (1.05V to 1.35 peak to peak). Output criteria: 60%/40% duty cycle, V_{OL} (max), V_{OH} (min), load = 15pF (stray plus probes).

5.7 Typical Characteristics

$T_A = 25^\circ\text{C}$, Load = 5pF (unless otherwise notes)

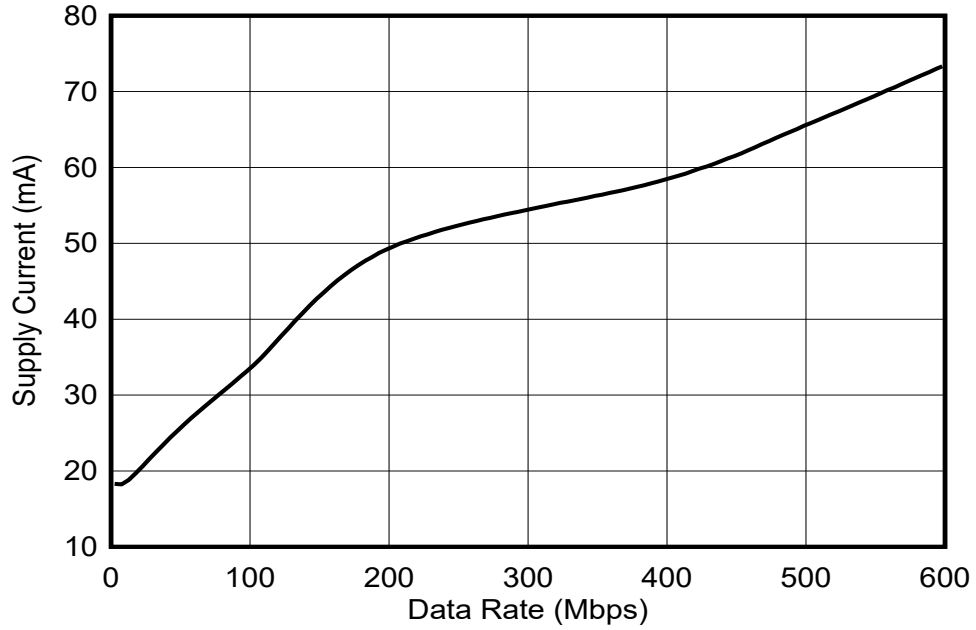


Figure 5-1. Power Supply Current vs Data Rate ($V_{CC} = 1.8\text{V}$, 2 Channels)

6 Parameter Measurement Information

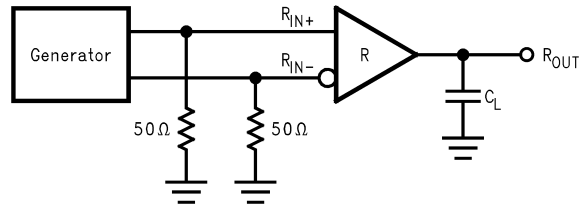


Figure 6-1. Receiver Propagation Delay and Transition Time Test Circuit

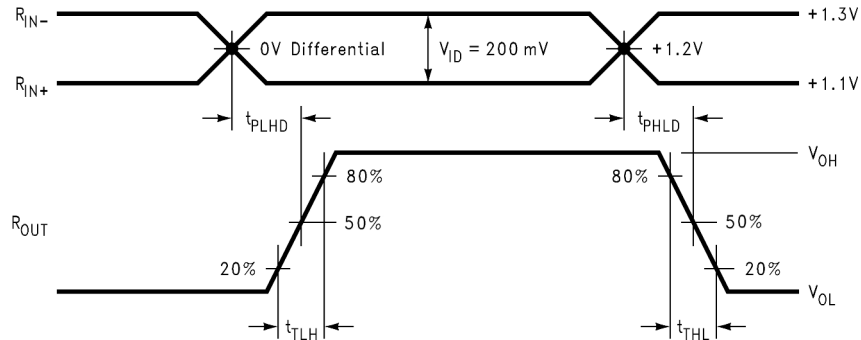


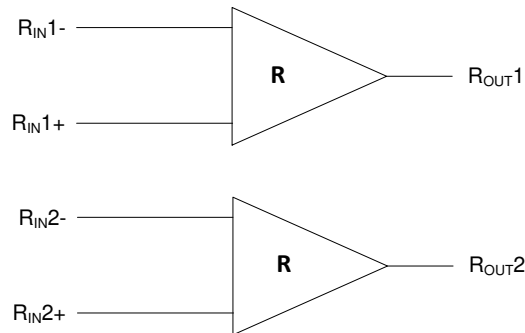
Figure 6-2. Receiver Propagation Delay and Transition Time Waveforms

7 Detailed Description

7.1 Overview

Figure 8-1 shows how LVDS drivers and receivers are intended to be used primarily in a simple point-to-point configuration. This configuration provides a clean signaling environment for the fast edge rates of the drivers. The receiver is connected to the source through a impedance controlled 100Ω differential PCB traces. Use a termination resistor of 100Ω and place it as close to the receiver input pins as possible. The termination resistor converts the driver output (current mode) into a voltage that is detected by the receiver.

7.2 Functional Block Diagram



7.3 Feature Description

The DS90LVRA2-Q1 differential line receiver is capable of detecting signals as low as 100mV over a common-mode range of -4V to 5V (V_{CC} at 3.3V). The common voltage range is related to the LVDS driver offset voltage, which is typically +1.2V. The differential signal from the LVDS driver is centered around the +1.2V offset voltage and may shift around this center point. The shifting may be the result of a ground potential difference between the driver's ground reference and the receiver's ground reference, the common-mode effects of coupled noise, or a combination of the two. The AC parameters of both receiver input pins are optimized for a recommended operating input voltage range of +0V to +3V (measured from each pin to ground).

7.4 Device Functional Modes

Table 7-1. Truth Table

| INPUTS ⁽¹⁾ | OUTPUT |
|---|--------------|
| $V_{ID} \geq 100\text{mV}$ | H |
| $V_{ID} \leq -100\text{mV}$ | L |
| $-100\text{mV} \leq V_{ID} \leq 100\text{mV}$ | Undetermined |

(1) $V_{ID} = [R_{IN+}] - [R_{IN-}]$

8 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.

8.1 Application Information

For general application guidelines and hints about LVDS drivers and receivers, refer to the [LVDS application notes and design guides](#).

8.2 Typical Application

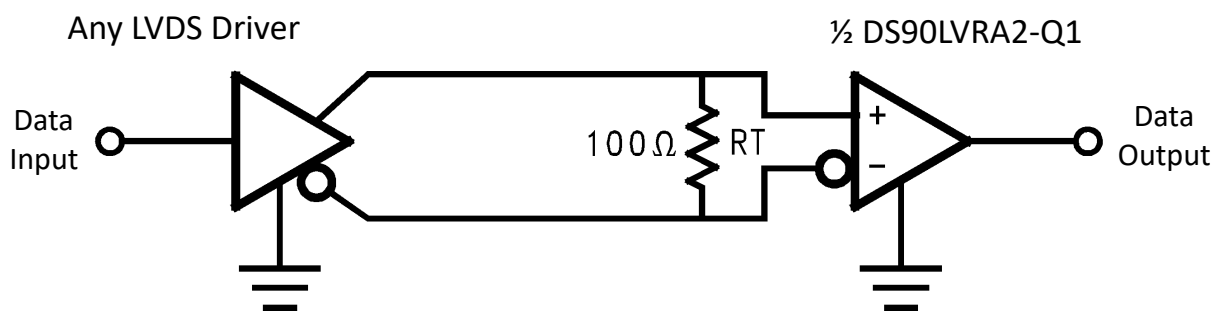


Figure 8-1. Balanced System Point-to-Point Application

8.2.1 Design Requirements

When using LVDS devices, it is important to specify controlled impedance PCB traces. All components of the transmission media must have a matched differential impedance of 100Ω and must not introduce major impedance discontinuities.

8.2.2 Detailed Design Procedure

8.2.2.1 Power Decoupling Recommendations

Bypass capacitors must be used on power pins. It is recommended to use surface mount high frequency ceramic 0.1μF and 0.01μF capacitors in parallel at the power supply pin with the smallest value capacitor closest to the device supply pin. Additional scattered capacitors over the printed circuit board will improve decoupling. Multiple vias should be used to connect the decoupling capacitors to the power planes. A 10μF (35V) or greater solid tantalum capacitor should be connected at the power entry point on the printed circuit board between the supply and ground.

8.2.2.2 Termination

Use a termination resistor that best matches the differential impedance or the transmission line. The resistor should be between 90Ω and 110Ω. Remember that the current mode outputs need the termination resistor to generate the differential voltage. LVDS will not work correctly without resistor termination. Typically, connecting a single resistor across the pair at the receiver end will suffice. Surface mount 1% resistors are the best

PCB stubs, component lead, and the distance from the termination to the receiver inputs should be minimized. The distance between the termination resistor and the receiver should be < 10mm (12mm maximum).

8.2.2.3 Input Failsafe Biasing

External pull up and pull down resistors may be used to provide enough of an offset to enable an input failsafe under open-circuit conditions. This configuration ties the positive LVDS input pin to V_{DD} through a pull up resistor and ties the negative LVDS input pin to GND by a pull down resistor. The pull up and pull down resistors should be in the 5k Ω to 15k Ω range to minimize loading and waveform distortion to the driver. Set the common-mode bias point to approximately 1.2V so that it is compatible with the internal circuitry. For more information, refer to application note AN-1194 [Failsafe Biasing of LVDS Interfaces](#).

8.2.2.4 Probing LVDS Transmission Lines

Always use high impedance (> 100k Ω), low capacitance (< 2pF) scope probes with a wide bandwidth (1GHz) scope. Improper probing will give deceiving results.

8.2.3 Application Curves

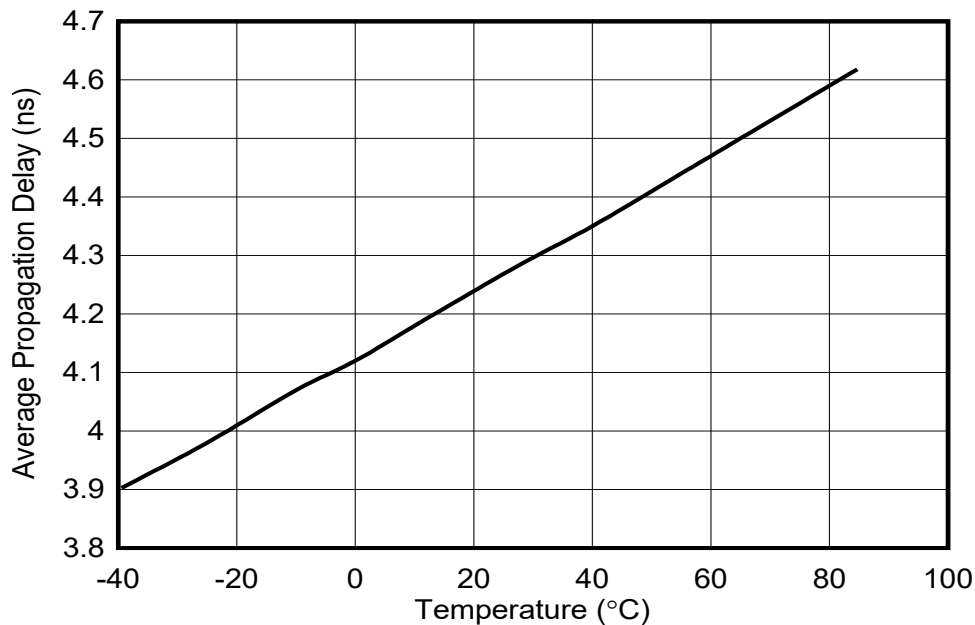


Figure 8-2. Propagation Delay vs Temperature ($V_{CC} = 1.8V$, Load = 10pF, Average of 2 Channels)

8.3 Power Supply Recommendations

Bypass capacitors must be used on power pins. TI recommends using high-frequency, ceramic, 0.1 μ F and 0.01 μ F capacitors in parallel at the power supply pin with the smallest value capacitor closest to the device supply pin. Additional scattered capacitors over the printed-circuit board improves decoupling. Multiple vias must be used to connect the decoupling capacitors to the power planes. A 10 μ F bulk capacitor, 35V (or greater) solid tantalum capacitor must be connected at the power entry point on the printed-circuit board between the supply and ground.

8.4 Layout

8.4.1 Layout Guidelines

8.4.1.1 Differential Traces

Use controlled impedance traces which match the differential impedance of your transmission trace and termination resistor. Run the differential pair trace lines as close together as possible as soon as they leave the IC (stubs should be < 10mm long). This will help eliminate reflections and make sure noise is coupled as common-mode. In fact, differential signals which are 1mm apart radiate far less noise than traces 3mm apart since magnetic field cancellation is much better with the closer traces. In addition, noise induced on the differential lines is much more likely to appear as common-mode, which is rejected by the receiver.

Match electrical lengths between traces to reduce skew. It is important to note: skew between the signals of a pair means a phase difference between signals, which destroys the magnetic field cancellation benefits of differential signals and EMI, will result. (Note that the velocity of propagation, $v = c/E_r$, where c (the speed of light) = 0.2997mm/ps or 0.0118in/ps). Do not rely solely on the auto-route function for differential traces. Carefully review dimensions to match differential impedance and provide isolation for the differential lines. Minimize the number of vias and other discontinuities on the line.

Avoid 90° turns (these cause impedance discontinuities). Use arcs or 45° bevels.

Within a pair of traces, the distance between the two traces should be minimized to maintain common-mode rejection of the receivers. On the printed circuit board, this distance should remain constant to avoid discontinuities in differential impedance. Minor violations at connection points are allowed.

8.4.1.2 PC Board Considerations

Use at least 4 PCB board layers (top to bottom): LVDS signals, ground, power, and TTL signals.

Isolate TTL signals from LVDS signals, otherwise the TTL signals may couple onto the LVDS lines. It is best to put TTL and LVDS signals on different layers, which are isolated by one or more power or ground planes.

8.4.2 Layout Examples

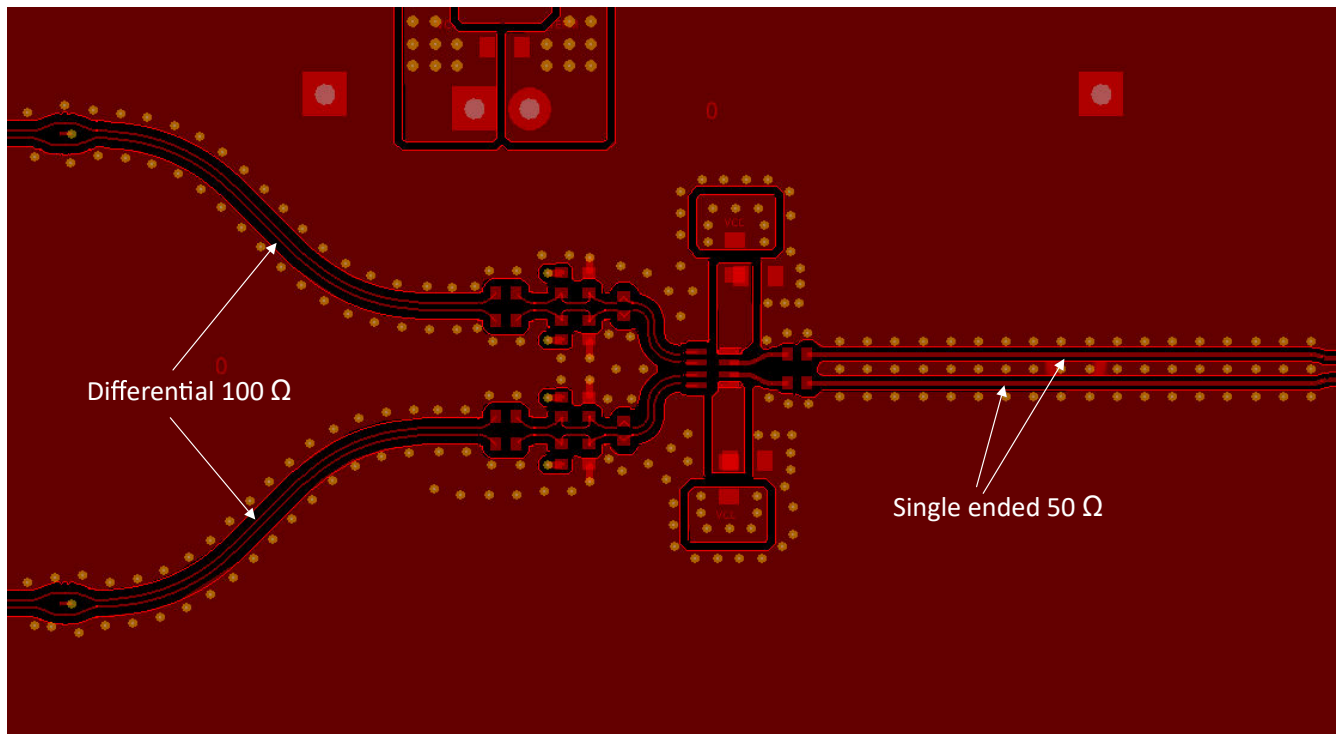


Figure 8-3. EVM Layout

9 Device and Documentation Support

9.1 Documentation Support

9.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, [Failsafe Biasing of LVDS Interfaces application note](#)

9.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* 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.

9.3 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](#).

9.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

9.5 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.

9.6 Glossary

[TI Glossary](#)

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

10 Revision History

| DATE | REVISION | NOTES |
|---------------|----------|-----------------|
| December 2023 | * | Initial Release |

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 |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|---------|
| D9LVRA2DEMRQ1 | ACTIVE | WSON | DEM | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 105 | LR2Q | 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.

OBSELETE: 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.

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OTHER QUALIFIED VERSIONS OF DS90LVRA2-Q1 :

- Catalog : [DS90LVRA2](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

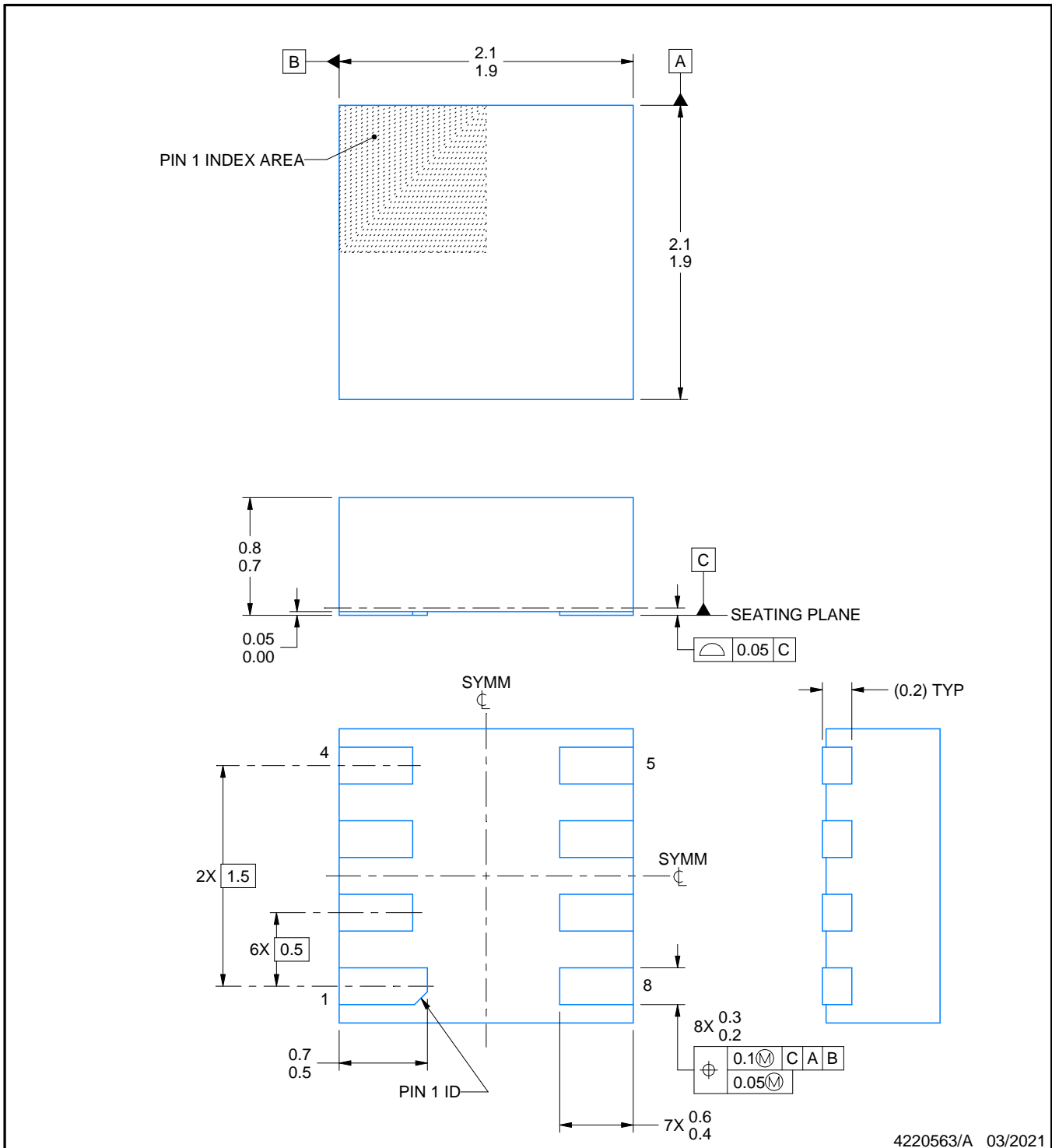
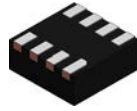

*All dimensions are nominal

| 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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| D9LVRA2DEMRQ1 | WS0N | DEM | 8 | 3000 | 180.0 | 8.4 | 2.3 | 2.3 | 1.15 | 4.0 | 8.0 | Q2 |

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| D9LVRA2DEMRQ1 | WSON | DEM | 8 | 3000 | 210.0 | 185.0 | 35.0 |



4220563/A 03/2021

NOTES:

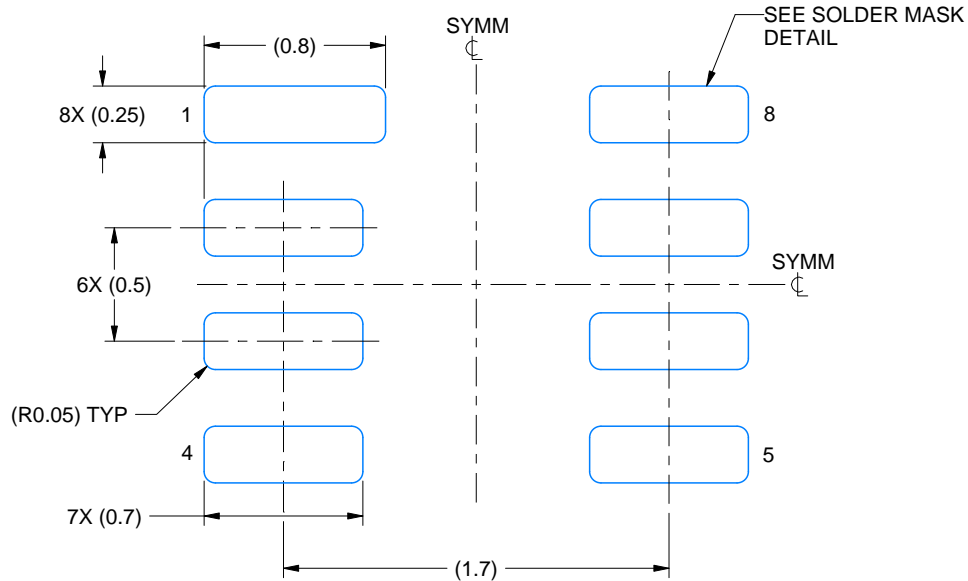
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

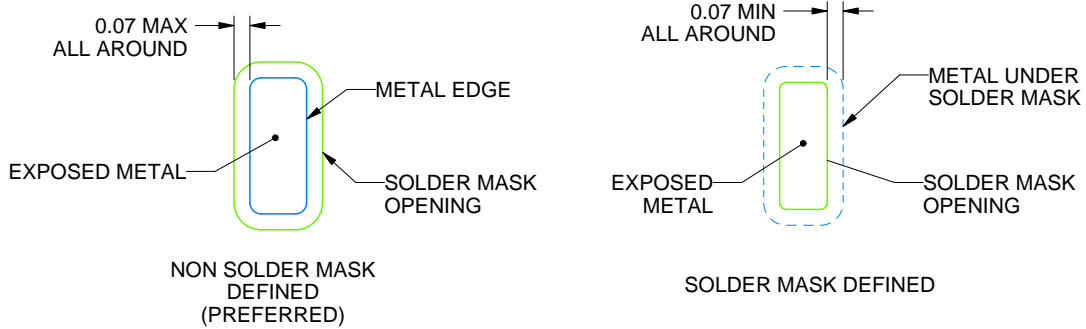
DQF0008A

WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 30X



SOLDER MASK DETAILS

4220563/A 03/2021

NOTES: (continued)

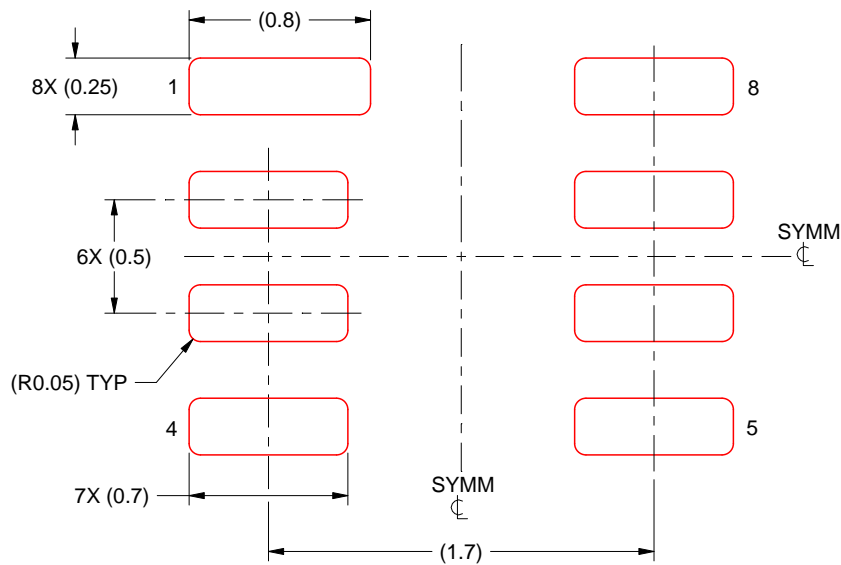
- This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).

EXAMPLE STENCIL DESIGN

DQF0008A

WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD

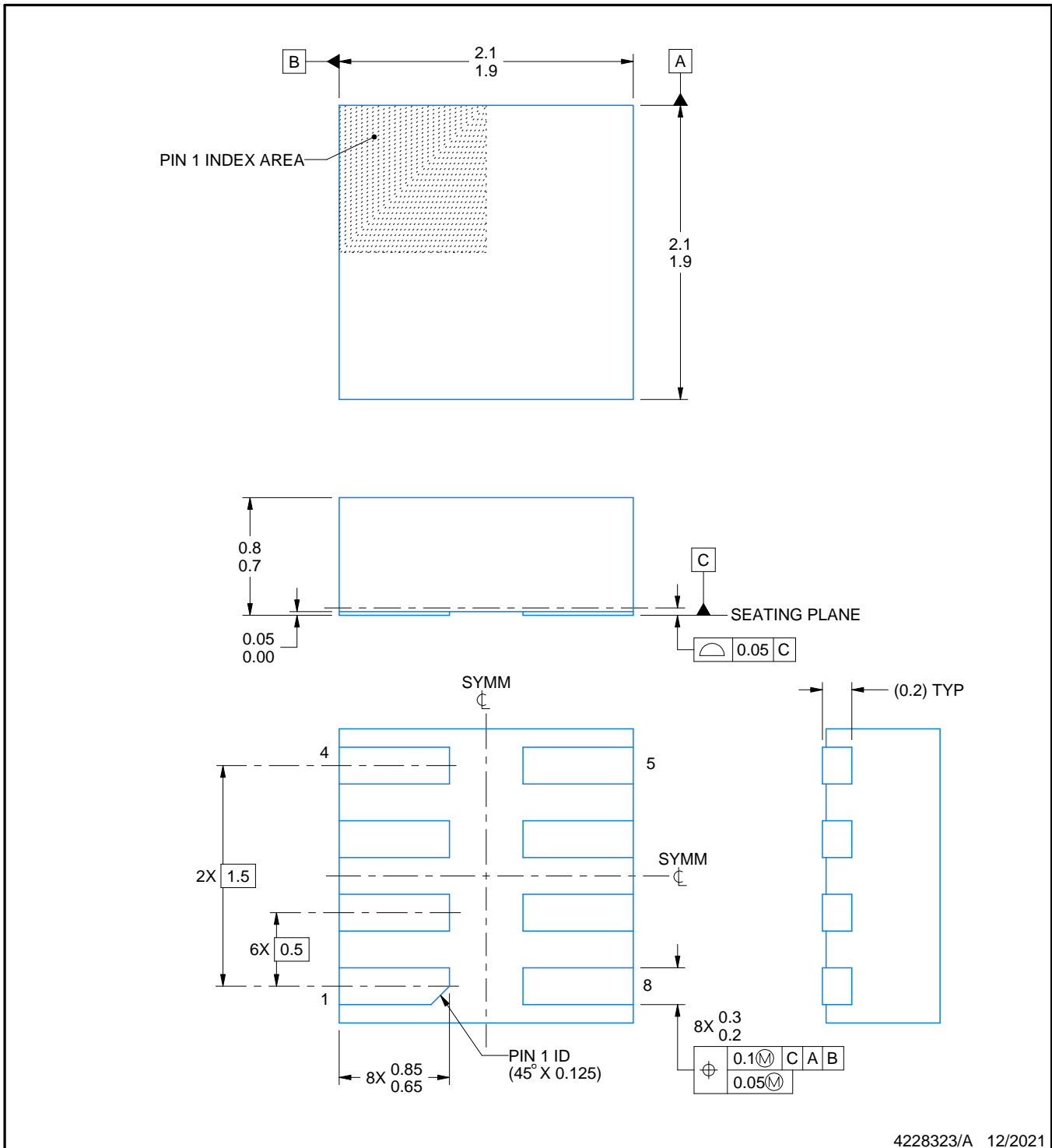
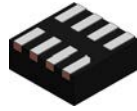


SOLDER PASTE EXAMPLE
BASED ON 0.125 MM THICK STENCIL
SCALE: 30X

4220563/A 03/2021

NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.



NOTES:

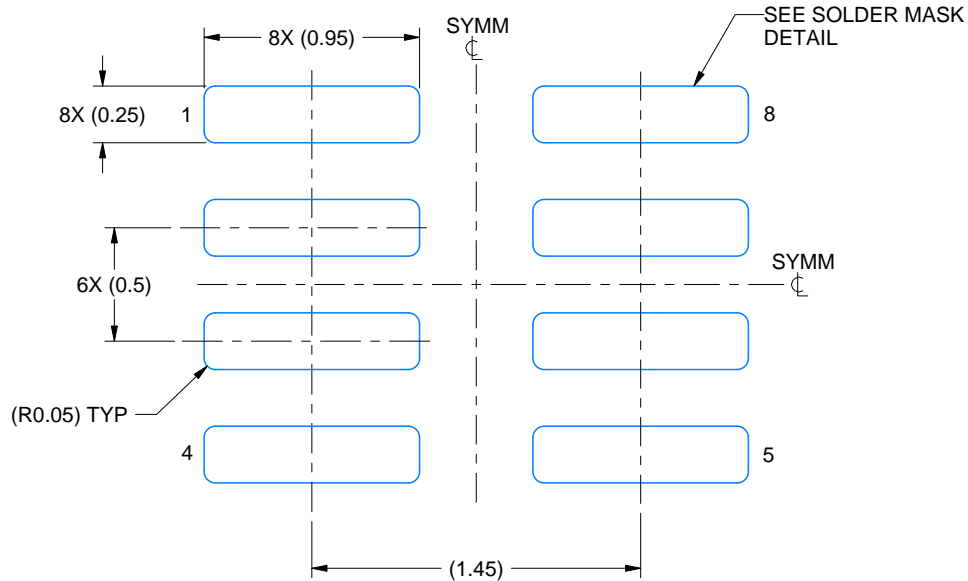
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

EXAMPLE BOARD LAYOUT

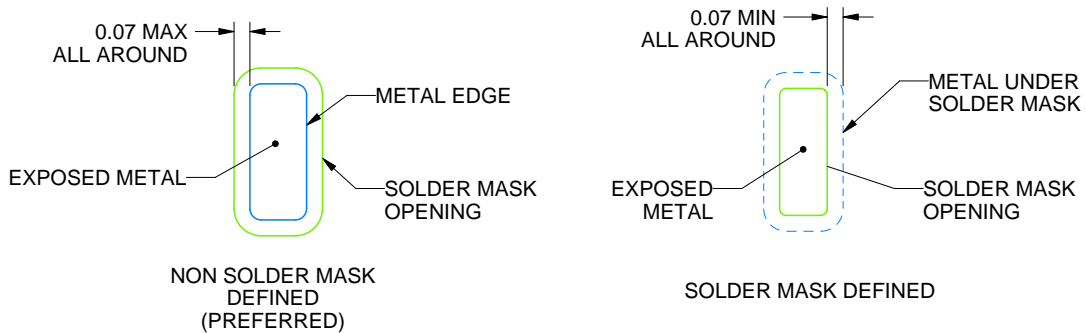
DEM0008A

WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 30X



SOLDER MASK DETAILS

4228323/A 12/2021

NOTES: (continued)

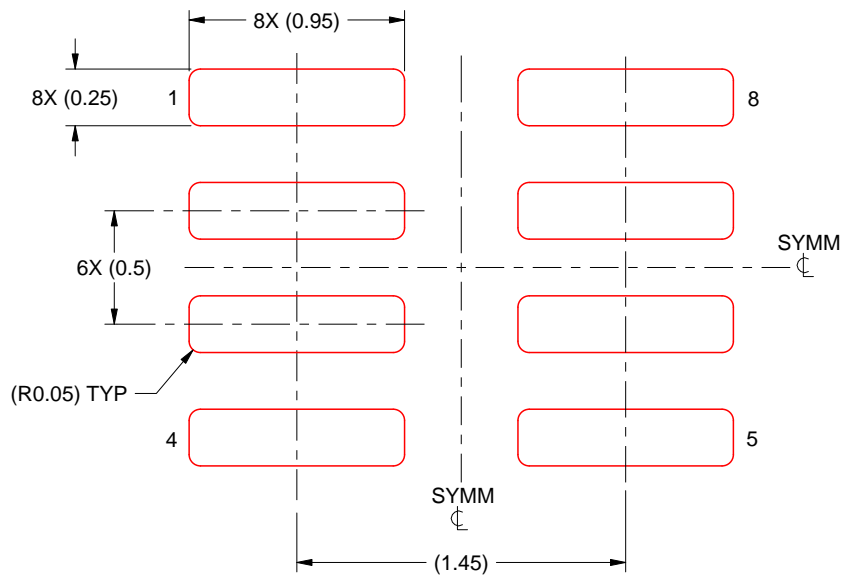
- This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).

EXAMPLE STENCIL DESIGN

DEM0008A

WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 MM THICK STENCIL
SCALE: 30X

4228323/A 12/2021

NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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