

SN74LVC2244A Octal Buffer/Driver With 3-State Outputs

1 Features

- Operates From 1.65 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max t_{pd} of 5.5 ns at 3.3 V
- Output Ports Have Equivalent 26- Ω Series Resistors, So No External Resistors Are Required
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- Typical V_{OHV} (Output V_{OH} Undershoot) >2 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- Supports 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

- Wearable Health and Fitness Devices
- Network Switches
- Servers
- Tests and Measurements

3 Description

The SN74LVC2244A octal buffer/line driver is designed for 1.65-V to 3.6-V V_{CC} operation.

Device Information⁽¹⁾

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|--------------|------------|--------------------|
| SN74LVC2244A | SSOP (20) | 7.20 mm x 5.30 mm |
| | SSOP (20) | 8.65 mm x 3.90 mm |
| | TVSOP (20) | 5.00 mm x 4.40 mm |
| | SOIC (20) | 12.80 mm x 7.50 mm |
| | TSSOP (20) | 6.50 mm x 4.40 mm |

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

4 Simplified Schematic

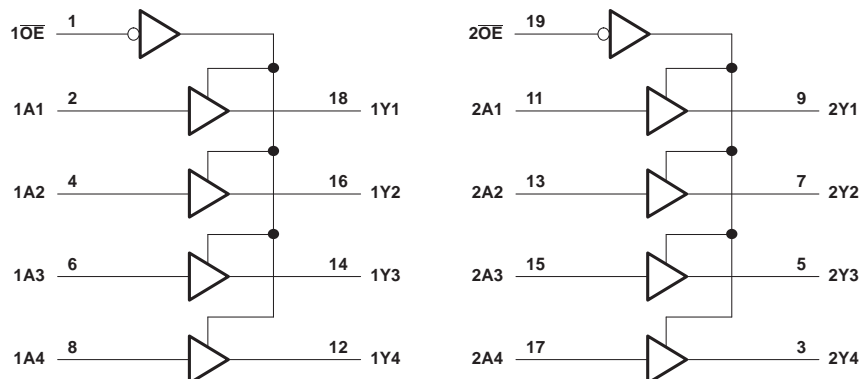


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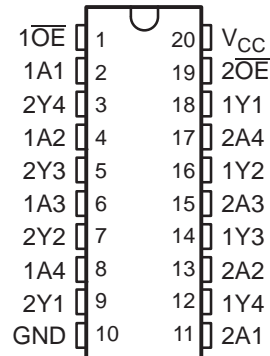
5 Revision History

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

| Changes from Revision K (March 2005) to Revision L | Page |
|--|-------------|
| • Updated document to new TI data sheet standards. | 1 |
| • Deleted Ordering Information table. | 1 |
| • Changed I_{off} bullet in Features list. | 1 |
| • Added Applications. | 1 |
| • Added Pin Functions table. | 3 |
| • Added Handling Ratings table. | 4 |
| • Changed MAX ambient temperature to 125°C in Recommended Operating Conditions. | 5 |
| • Added Thermal Information table. | 5 |
| • Added –40°C to 125°C temperature range in Electrical Characteristics table. | 6 |
| • Added data to Switching Characteristics, –40°C to 85°C. | 6 |
| • Added Switching Characteristics table, –40°C to 125°C. | 6 |
| • Changed Operating Characteristics table. | 7 |
| • Added Typical Characteristics. | 7 |
| • Added Detailed Description section. | 9 |
| • Added Application and Implementation section. | 10 |

6 Pin Configuration and Functions

DB, DBQ, DGV, DW, NS, OR PW PACKAGE
(TOP VIEW)



Pin Functions

| PIN | | I/O | DESCRIPTION |
|-----|------------------|-----|-----------------|
| NO. | NAME | | |
| 1 | $\overline{1OE}$ | I | Output Enable 1 |
| 2 | 1A1 | I | 1A1 Input |
| 3 | 2Y4 | O | 2Y4 Output |
| 4 | 1A2 | I | 1A2 Input |
| 5 | 2Y3 | O | 2Y3 Output |
| 6 | 1A3 | I | 1A3 Input |
| 7 | 2Y2 | O | 2Y2 Output |
| 8 | 1A4 | I | 1A4 Input |
| 9 | 2Y1 | O | 2Y1 Output |
| 10 | GND | — | Ground Pin |
| 11 | 2A1 | I | 2A1 Input |
| 12 | 1Y4 | O | 1Y4 Output |
| 13 | 2A2 | I | 2A2 Input |
| 14 | 1Y3 | O | 1Y3 Output |
| 15 | 2A3 | I | 2A3 Input |
| 16 | 1Y2 | O | 1Y2 Output |
| 17 | 2A4 | I | 2A4 Input |
| 18 | 1Y1 | O | 1Y1 Output |
| 19 | $\overline{2OE}$ | I | Output Enable 2 |
| 20 | VCC | — | Power Pin |

7 Specifications

7.1 Absolute Maximum Ratings

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

| | | 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⁾ | -0.5 | 6.5 | V |
| V _O | Voltage range applied to any output in the high or low state ⁽²⁾ ⁽³⁾ | -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* is 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 | 2000 | V |
| | | Charged device model (CDM), per JEDEC specification JESD22-C101, all pins ⁽²⁾ | 0 | 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.

7.3 Recommended Operating Conditions

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

| | | MIN | MAX | UNIT | |
|-----------------|------------------------------------|------------------------------------|------------------------|------------------------|------|
| V _{CC} | Supply voltage | Operating | 1.65 | 3.6 | V |
| | | Data retention only | 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 | | |
| 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 | |
| V _I | Input voltage | 0 | 5.5 | V | |
| V _O | Output voltage | High or low state | 0 | V _{CC} | V |
| | | 3-state | 0 | 5.5 | |
| I _{OH} | High-level output current | V _{CC} = 1.65 V | | -2 | mA |
| | | V _{CC} = 2.3 V | | -4 | |
| | | V _{CC} = 2.7 V | | -8 | |
| | | V _{CC} = 3 V | | -12 | |
| I _{OL} | Low-level output current | V _{CC} = 1.65 V | | 2 | mA |
| | | V _{CC} = 2.3 V | | 4 | |
| | | V _{CC} = 2.7 V | | 8 | |
| | | V _{CC} = 3 V | | 12 | |
| Δt/Δv | Input transition rise or fall rate | | | 10 | ns/V |
| T _A | Operating free-air temperature | -40 | 125 | | °C |

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

7.4 Thermal Information

| THERMAL METRIC ⁽¹⁾ | SN74LVC2244A | | | | | | UNIT | |
|-------------------------------|--|------|------|-------|------|------|-------|------|
| | DB | DBQ | DGV | DW | NS | PW | | |
| | 20 PINS | | | | | | | |
| R _{θJA} | Junction-to-ambient thermal resistance | 94.5 | 94.7 | 114.7 | 88.3 | 74.7 | 102.5 | °C/W |
| R _{θJC(top)} | Junction-to-case (top) thermal resistance | 56.2 | 47.9 | 29.8 | 51.1 | 40.5 | 35.9 | |
| R _{θJB} | Junction-to-board thermal resistance | 49.7 | 45.0 | 56.2 | 50.9 | 42.3 | 53.5 | |
| ψ _{JT} | Junction-to-top characterization parameter | 18.1 | 11.0 | 0.8 | 20.0 | 14.3 | 2.2 | |
| ψ _{JB} | Junction-to-board characterization parameter | 49.5 | 44.6 | 55.5 | 50.5 | 41.9 | 52.9 | |
| R _{θJC(bot)} | Junction-to-case (bottom) thermal resistance | n/a | n/a | n/a | n/a | n/a | n/a | |

(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} | –40°C to 85°C | | | –40°C to 125°C | | | UNIT |
|--------------------------|--|--------------------|-----------------------|--------------------|-----|-----------------------|--------------------|-----|------|
| | | | 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 |
| | I _{OH} = –2 mA | 1.65 V | 1.2 | | | 1.2 | | | |
| | I _{OH} = –4 mA | 2.3 V | 1.7 | | | 1.7 | | | |
| | | 2.7 V | 2.2 | | | 2.2 | | | |
| | I _{OH} = –6 mA | 3 V | 2.4 | | | 2.4 | | | |
| | I _{OH} = –8 mA | 2.7 V | 2 | | | 2 | | | |
| I _{OH} = –12 mA | 3 V | 2 | | | 2 | | | | |
| V _{OL} | I _{OL} = 100 μA | 1.65 V to 3.6 V | 0.2 | | | 0.2 | | | V |
| | I _{OL} = 2 mA | 1.65 V | 0.45 | | | 0.45 | | | |
| | I _{OL} = 4 mA | 2.3 V | 0.7 | | | 0.7 | | | |
| | | 2.7 V | 0.4 | | | 0.4 | | | |
| | I _{OL} = 6 mA | 3 V | 0.55 | | | 0.55 | | | |
| | I _{OL} = 8 mA | 2.7 V | 0.6 | | | 0.6 | | | |
| I _{OL} = 12 mA | 3 V | 0.8 | | | 0.8 | | | | |
| I _I | V _I = 0 to 5.5 V | 3.6 V | ±5 | | | ±5 | | | μA |
| I _{off} | V _I or V _O = 5.5 V | 0 | ±10 | | | ±10 | | | μA |
| I _{OZ} | V _O = 0 to 5.5 V | 3.6 V | ±10 | | | ±10 | | | μA |
| I _{CC} | V _I = V _{CC} or GND | I _O = 0 | 10 | | | 10 | | | μA |
| | 3.6 V ≤ V _I ≤ 5.5 V ⁽²⁾ | | 10 | | | 10 | | | |
| ΔI _{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 | | | μA |
| C _i | V _I = V _{CC} or GND | 3.3 V | 4 | | | 4 | | | pF |
| C _o | V _O = V _{CC} or GND | 3.3 V | 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 Switching Characteristics, –40°C to 85°C

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

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | 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 | | UNIT |
|------------------|-----------------|-------------|----------------------------------|------|---------------------------------|-----|-------------------------|-----|---------------------------------|-----|------|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| t _{pd} | A | Y | | 10.9 | | 7.9 | | 6.4 | 1.5 | 5.5 | ns |
| t _{en} | \overline{OE} | Y | | 12.6 | | 9.6 | | 8.1 | 1 | 7.1 | ns |
| t _{dis} | \overline{OE} | Y | | 12.1 | | 7.8 | | 7.3 | 1.5 | 6.8 | ns |

7.7 Switching Characteristics, –40°C to 125°C

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

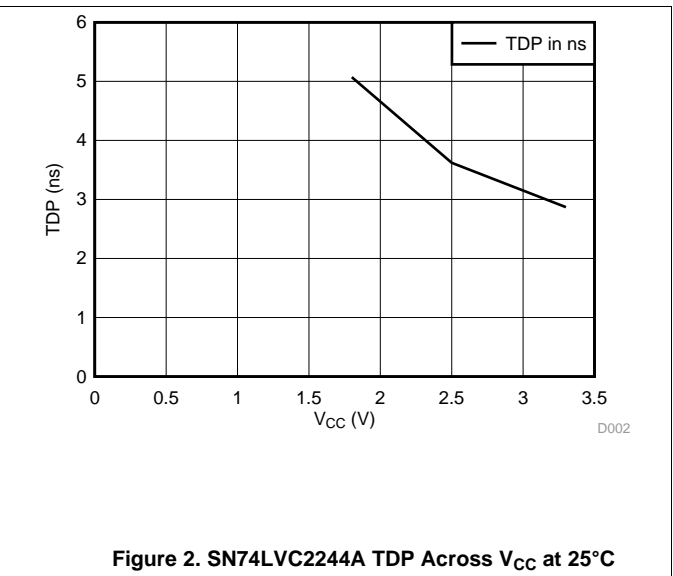
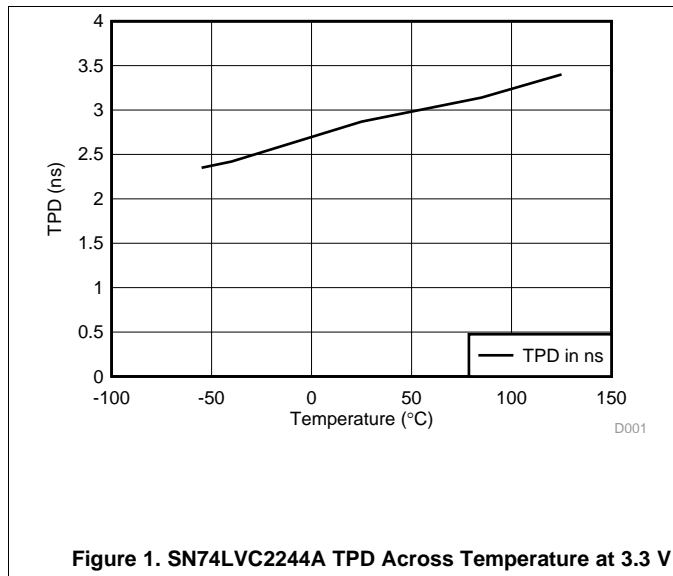
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} = 1.8 V ± 0.15 V | | V _{CC} = 2.5 V ± 0.2 V | | V _{CC} = 2.7 V | | V _{CC} = 3.3 V ± 0.3 V | | UNIT |
|------------------|-----------------|-------------|----------------------------------|------|---------------------------------|------|-------------------------|-----|---------------------------------|-----|------|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| t _{pd} | A | Y | | 12.4 | | 10 | | 7.1 | 1.5 | 6.5 | ns |
| t _{en} | \overline{OE} | Y | | 14.1 | | 11.7 | | 8.5 | 1 | 7.8 | ns |
| t _{dis} | \overline{OE} | Y | | 13.6 | | 9.9 | | 7.8 | 1.5 | 7.6 | ns |

7.8 Operating Characteristics

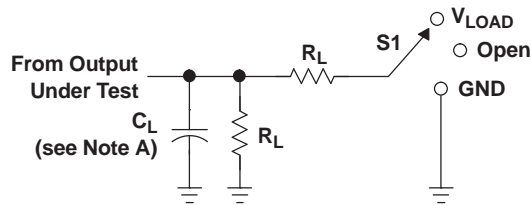
T_A = 25°C

| 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 buffer/driver | Outputs enabled | 43 | 43 | 46 | pF |
| | | Outputs disabled | 1 | 1 | 2 | |

7.9 Typical Characteristics

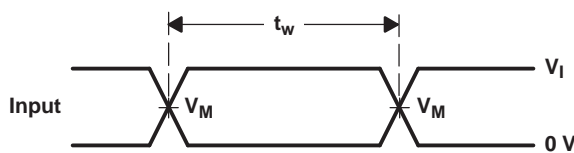
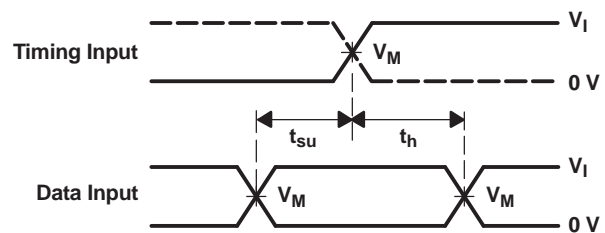
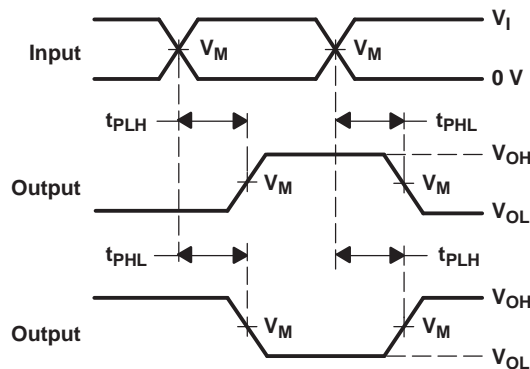
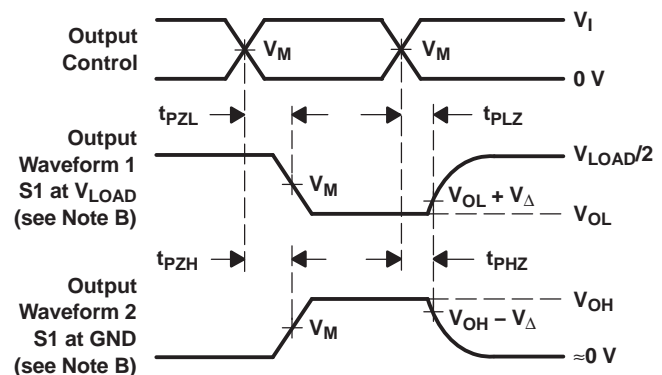


8 Parameter Measurement Information


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_{Δ} |
|----------------------------------|----------|----------------------|------------|-------------------|-------|--------------|--------------|
| | V_I | t_r/t_f | | | | | |
| $1.8\text{ V} \pm 0.15\text{ V}$ | V_{CC} | $\leq 2\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 k Ω | 0.15 V |
| $2.5\text{ V} \pm 0.2\text{ V}$ | V_{CC} | $\leq 2\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 Ω | 0.15 V |
| 2.7 V | 2.7 V | $\leq 2.5\text{ ns}$ | 1.5 V | 6 V | 50 pF | 500 Ω | 0.3 V |
| $3.3\text{ V} \pm 0.3\text{ V}$ | 2.7 V | $\leq 2.5\text{ ns}$ | 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:
- C_L includes probe and jig capacitance.
 - 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.
 - All input pulses are supplied by generators having the following characteristics: $PRR \leq 10\text{ MHz}$, $Z_O = 50\ \Omega$.
 - The outputs are measured one at a time, with one transition per measurement.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{en} .
 - t_{PLH} and t_{PHL} are the same as t_{pd} .
 - All parameters and waveforms are not applicable to all devices.

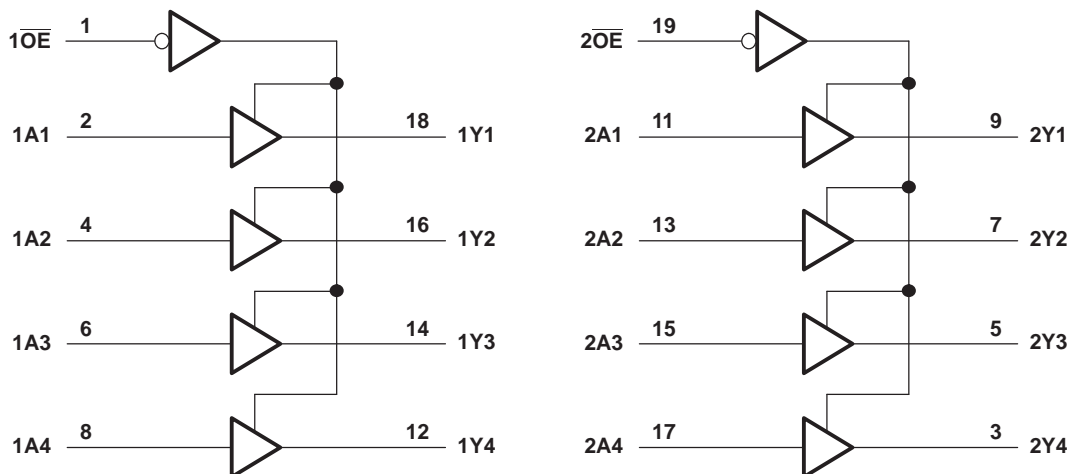
Figure 3. Load Circuit and Voltage Waveforms

9 Detailed Description

9.1 Overview

This octal buffer and line driver is designed for 1.65-V to 3.6-V V_{CC} operation. The SN74LVC2244A device is organized as two 4-bit line drivers with separate output-enable (\overline{OE}) inputs. When \overline{OE} is low, the device passes data from the A inputs to the Y outputs. When \overline{OE} is high, the outputs are in the high-impedance state. The outputs, which are designed to sink up to 12 mA, include equivalent 26-ohm resistors to reduce overshoot and undershoot.

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

Table 1. Function Table
(Each Buffer)

| INPUTS | | OUTPUT |
|-----------------|---|--------|
| \overline{OE} | A | Y |
| L | H | H |
| L | L | L |
| H | X | Z |

10 Application and Implementation

10.1 Application Information

Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of this device as a translator in a mixed 3.3-V/5-V system environment. This device is fully specified for partial-power-down applications using I_{off} . The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down. 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.

10.2 Typical Application

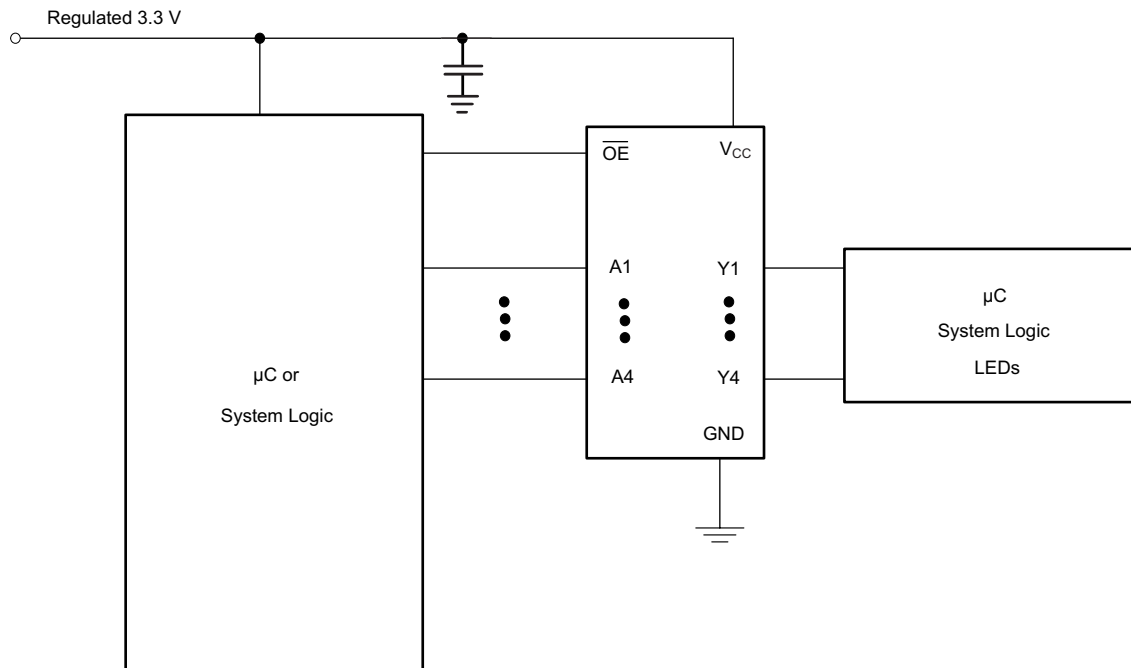


Figure 4. Typical Application Diagram

10.2.1 Design Requirements

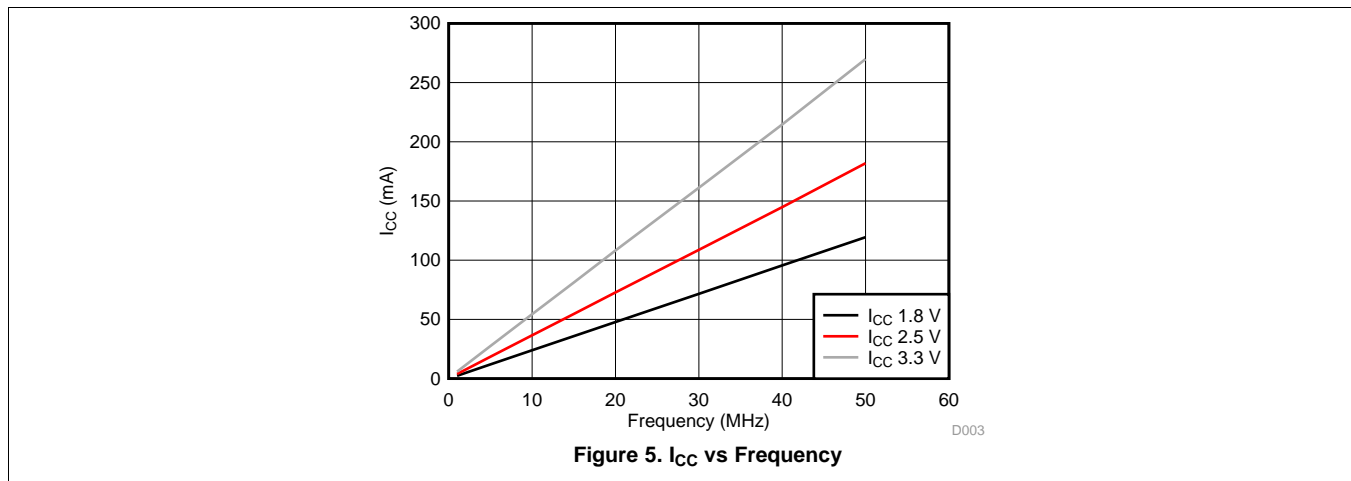
This device uses CMOS technology and has balanced output drive. Care should be taken to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive will also create fast edges into light loads, so routing and load conditions should be considered to prevent ringing.

10.2.2 Detailed Design Procedure

1. Recommended Input Conditions
 - Rise time and fall time specs: See $(\Delta t/\Delta V)$ in the [Recommended Operating Conditions](#) table.
 - Specified high and low levels: See $(V_{IH}$ and $V_{IL})$ in the [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



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, 0.1 μf is recommended; if there are multiple V_{CC} pins, then 0.01 μf or 0.022 μf is recommended for each power pin. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. A 0.1 μf and a 1 μf 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 never 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 pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. [Figure 6](#) specifies 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 pin, it will disable the output section of the part when asserted. This will not disable the input section of the IOs, so they cannot float when disabled.

12.2 Layout Example

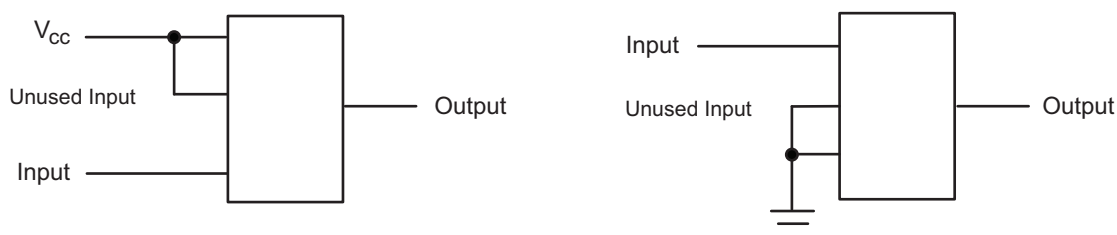


Figure 6. Layout Diagram

13 Device and Documentation Support

13.1 Trademarks

All trademarks are the property of their respective owners.

13.2 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.

13.3 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 |
|--------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74LVC2244ADBQR | ACTIVE | SSOP | DBQ | 20 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-2-260C-1 YEAR | -40 to 85 | LVC2244A | Samples |
| SN74LVC2244ADBQRE4 | ACTIVE | SSOP | DBQ | 20 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-2-260C-1 YEAR | -40 to 85 | LVC2244A | Samples |
| SN74LVC2244ADBR | ACTIVE | SSOP | DB | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LE244A | Samples |
| SN74LVC2244ADBRG4 | ACTIVE | SSOP | DB | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LE244A | Samples |
| SN74LVC2244ADGVR | ACTIVE | TVSOP | DGV | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LE244A | Samples |
| SN74LVC2244ADW | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC2244A | Samples |
| SN74LVC2244ADWR | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC2244A | Samples |
| SN74LVC2244ADWRE4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC2244A | Samples |
| SN74LVC2244ADWRG4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC2244A | Samples |
| SN74LVC2244ANSR | ACTIVE | SO | NS | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC2244A | Samples |
| SN74LVC2244ANSRG4 | ACTIVE | SO | NS | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC2244A | Samples |
| SN74LVC2244APW | ACTIVE | TSSOP | PW | 20 | 70 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LE244A | Samples |
| SN74LVC2244APWG4 | ACTIVE | TSSOP | PW | 20 | 70 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LE244A | Samples |
| SN74LVC2244APWR | ACTIVE | TSSOP | PW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LE244A | Samples |
| SN74LVC2244APWRE4 | ACTIVE | TSSOP | PW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LE244A | Samples |
| SN74LVC2244APWRG4 | ACTIVE | TSSOP | PW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LE244A | Samples |
| SN74LVC2244APWT | ACTIVE | TSSOP | PW | 20 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LE244A | Samples |

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of ≤ 1000 ppm threshold. Antimony trioxide based flame retardants must also meet the ≤ 1000 ppm 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/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.

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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 |
|------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LVC2244ADBQR | SSOP | DBQ | 20 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| SN74LVC2244ADBR | SSOP | DB | 20 | 2000 | 330.0 | 16.4 | 8.2 | 7.5 | 2.5 | 12.0 | 16.0 | Q1 |
| SN74LVC2244ADGVR | TVSOP | DGV | 20 | 2000 | 330.0 | 12.4 | 6.9 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |
| SN74LVC2244ADWR | SOIC | DW | 20 | 2000 | 330.0 | 24.4 | 10.8 | 13.3 | 2.7 | 12.0 | 24.0 | Q1 |
| SN74LVC2244ANSR | SO | NS | 20 | 2000 | 330.0 | 24.4 | 8.4 | 13.0 | 2.5 | 12.0 | 24.0 | Q1 |
| SN74LVC2244APWR | TSSOP | PW | 20 | 2000 | 330.0 | 16.4 | 6.95 | 7.0 | 1.4 | 8.0 | 16.0 | Q1 |
| SN74LVC2244APWT | TSSOP | PW | 20 | 250 | 330.0 | 16.4 | 6.95 | 7.0 | 1.4 | 8.0 | 16.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LVC2244ADBQR | SSOP | DBQ | 20 | 2500 | 367.0 | 367.0 | 38.0 |
| SN74LVC2244ADBR | SSOP | DB | 20 | 2000 | 367.0 | 367.0 | 38.0 |
| SN74LVC2244ADGVR | TVSOP | DGV | 20 | 2000 | 367.0 | 367.0 | 35.0 |
| SN74LVC2244ADWR | SOIC | DW | 20 | 2000 | 367.0 | 367.0 | 45.0 |
| SN74LVC2244ANSR | SO | NS | 20 | 2000 | 367.0 | 367.0 | 45.0 |
| SN74LVC2244APWR | TSSOP | PW | 20 | 2000 | 367.0 | 367.0 | 38.0 |
| SN74LVC2244APWT | TSSOP | PW | 20 | 250 | 367.0 | 367.0 | 38.0 |

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

24 PINS SHOWN



- 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



- 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.

DW0020A



PACKAGE OUTLINE

SOIC - 2.65 mm max height

SOIC



4220724/A 05/2016

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.

EXAMPLE BOARD LAYOUT

DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

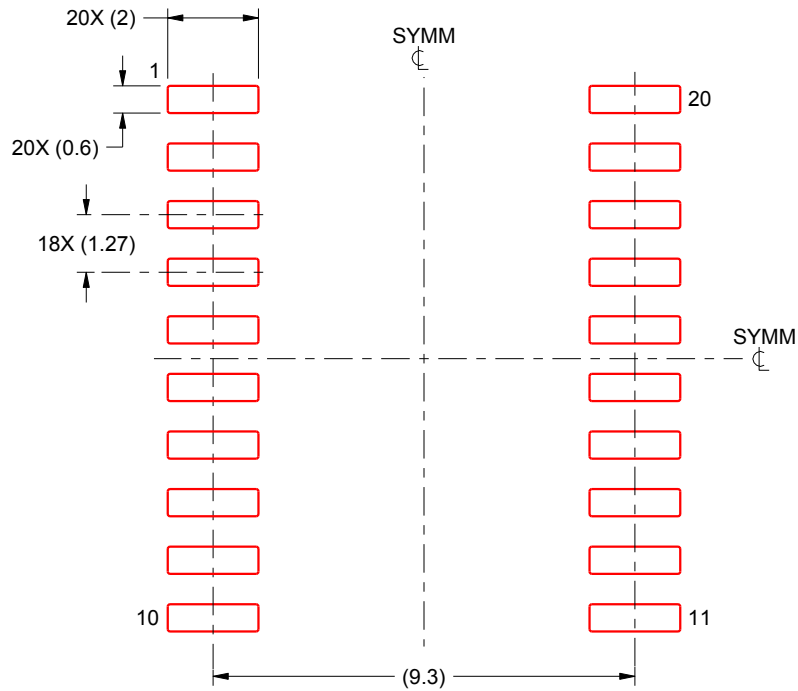
- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



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

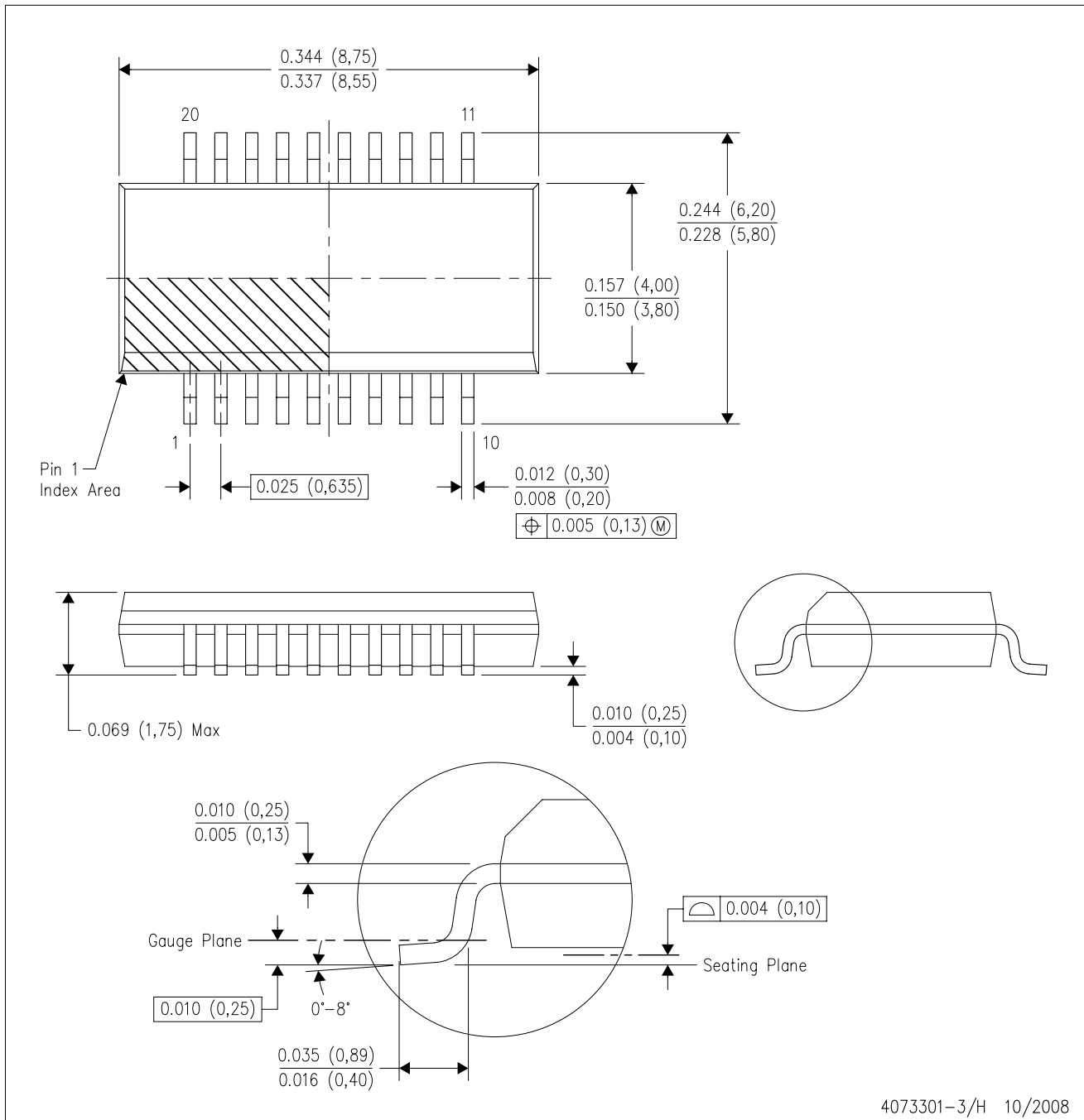
4220724/A 05/2016

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.

DBQ (R-PDSO-G20)

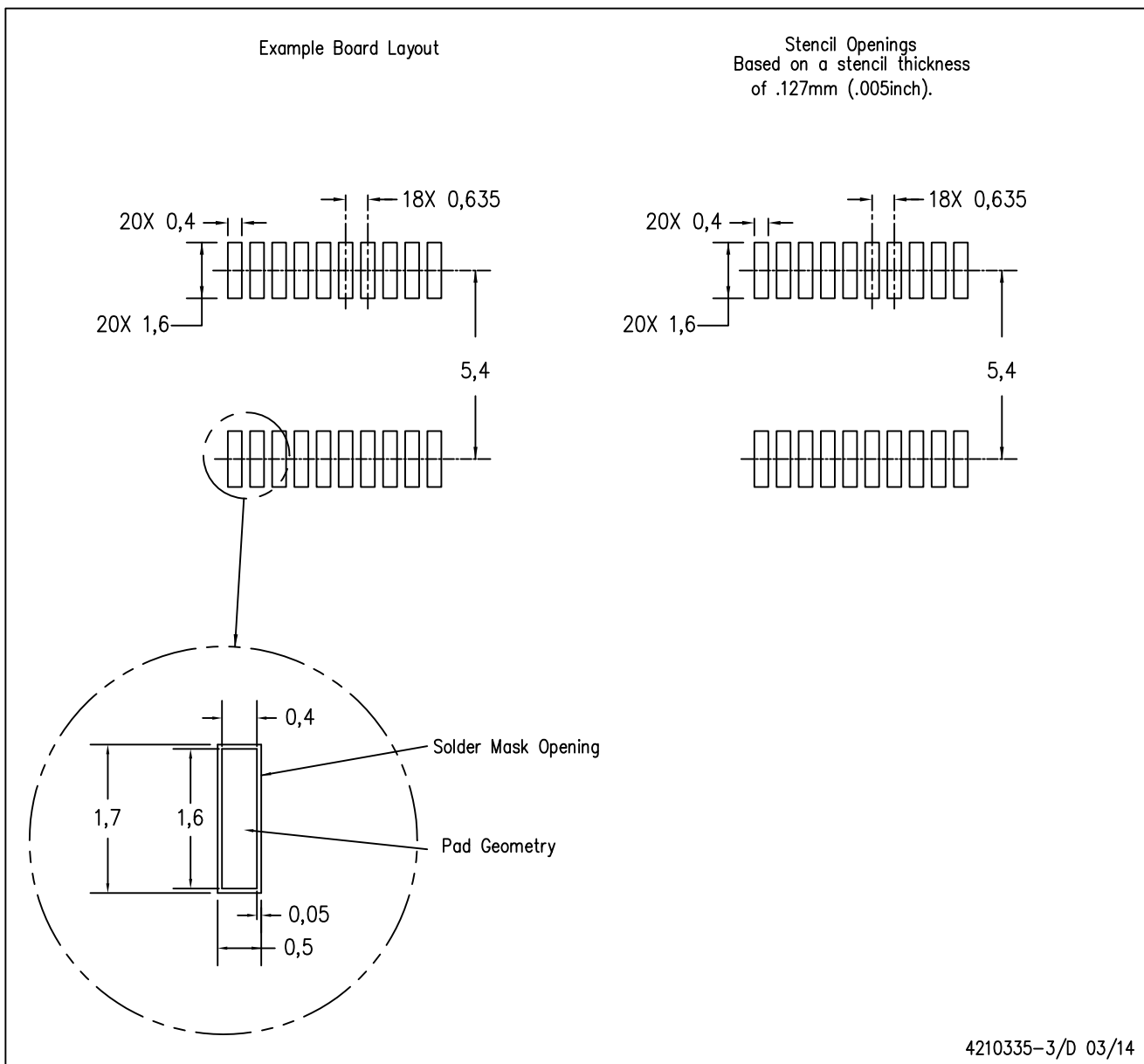
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15) per side.
 - D. Falls within JEDEC MO-137 variation AD.

DBQ (R-PDSO-G20)

PLASTIC SMALL OUTLINE PACKAGE



- 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. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

DB0020A



PACKAGE OUTLINE

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

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

EXAMPLE BOARD LAYOUT

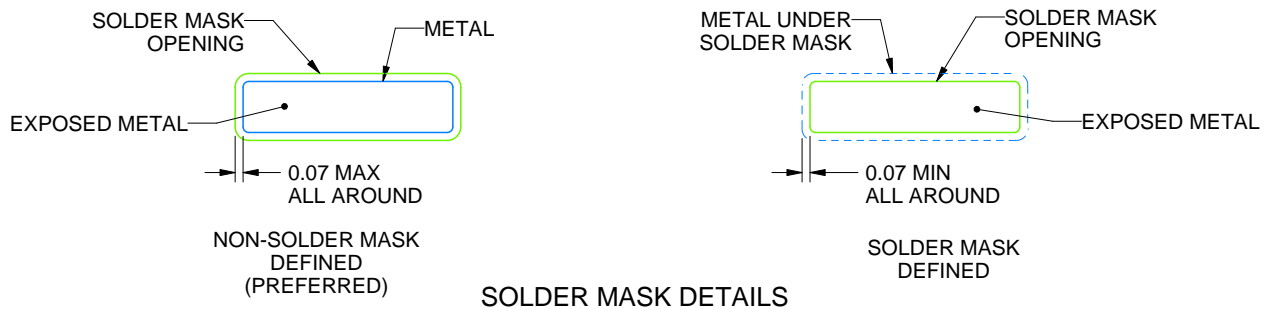
DB0020A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4214851/B 08/2019

NOTES: (continued)

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

EXAMPLE STENCIL DESIGN

DB0020A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



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

4214851/B 08/2019

NOTES: (continued)

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

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- 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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