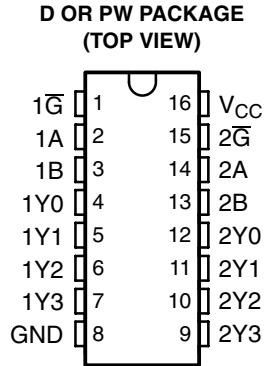


# SN74LVC139A-Q1

## DUAL 2-LINE TO 4-LINE DECODER/DEMULTIPLEXER

SCAS782B – SEPTEMBER 2004 – REVISED JANUARY 2008

- Qualified for Automotive Applications
- Operates From 1.65 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max  $t_{pd}$  of 6.2 ns
- Typical  $V_{OLP}$  (Output Ground Bounce) <math><0.8\text{ V}</math> at  $V_{CC} = 3.3\text{ V}$ ,  $T_A = 25^\circ\text{C}$
- Typical  $V_{OHV}$  (Output  $V_{OH}$  Undershoot) >2 V at  $V_{CC} = 3.3\text{ V}$ ,  $T_A = 25^\circ\text{C}$
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Level Per AEC-Q100 Classification
  - 2000-V (H2) Human-Body Model
  - 200-V (M3) Machine Model
  - 1000-V (C5) Charged-Device Model



### description/ordering information

This dual 2-line to 4-line decoder/demultiplexer is designed for 1.65-V to 3.6-V  $V_{CC}$  operation.

The device comprises two individual 2-line to 4-line decoders in a single package. The active-low enable ( $\bar{G}$ ) input can be used as a data line in demultiplexing applications. This decoder/demultiplexer features fully buffered inputs, each of which represents only one normalized load to its driving circuit.

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.

### ORDERING INFORMATION†

| $T_A$          | PACKAGE‡   |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|------------|--------------|-----------------------|------------------|
| –40°C to 125°C | SOIC – D   | Reel of 2500 | SN74LVC139AQDRQ1      | LVC139AQ         |
|                | TSSOP – PW | Reel of 2000 | SN74LVC139AQPWRQ1     | LC139AQ          |

† For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).

‡ Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).

**FUNCTION TABLE**  
(each decoder/demultiplexer)

| INPUTS    |        |   | OUTPUTS |    |    |    |
|-----------|--------|---|---------|----|----|----|
| $\bar{G}$ | SELECT |   | Y3      | Y2 | Y1 | Y0 |
|           | B      | A |         |    |    |    |
| L         | L      | L | H       | H  | H  | L  |
| L         | L      | H | H       | H  | L  | H  |
| L         | H      | L | H       | L  | H  | H  |
| L         | H      | H | L       | H  | H  | H  |
| H         | X      | X | H       | H  | H  | H  |



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

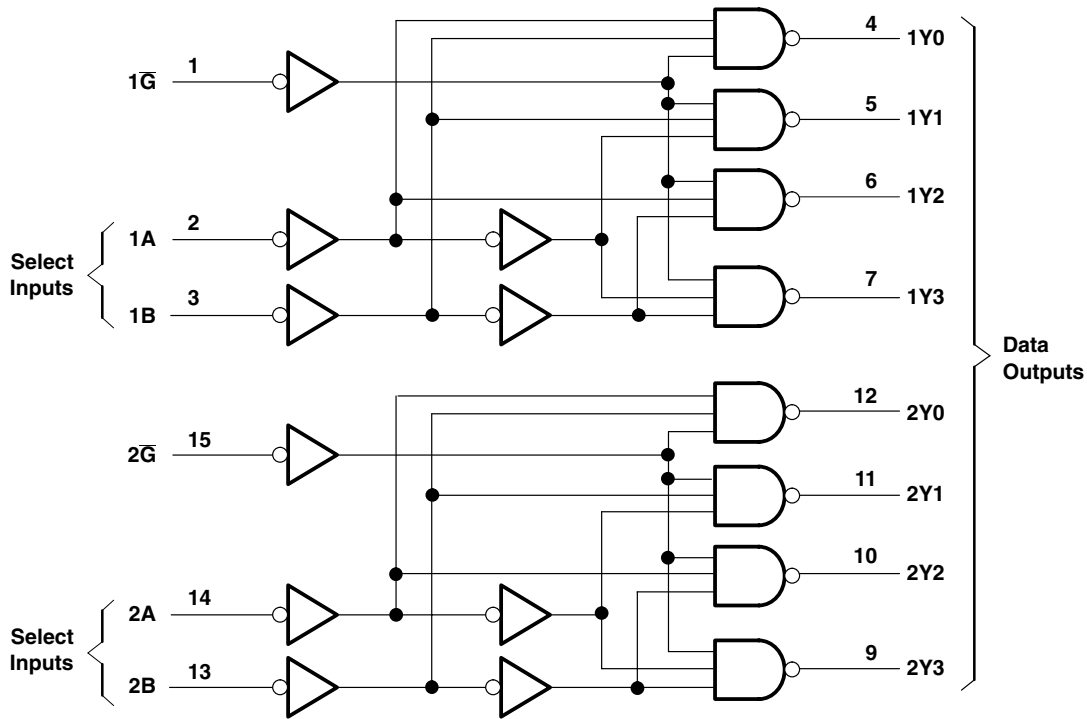
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# SN74LVC139A-Q1

## DUAL 2-LINE TO 4-LINE DECODER/DEMULTIPLEXER

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### logic diagram (positive logic)



### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

|  |                            |
|--|----------------------------|
| Supply voltage range, $V_{CC}$                                   | -0.5 V to 6.5 V            |
| Input voltage range, $V_I$ (see Note 1)                          | -0.5 V to 6.5 V            |
| Output voltage range, $V_O$ (see Notes 1 and 2)                  | -0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ )                      | -50 mA                     |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ )                     | -50 mA                     |
| Continuous output current, $I_O$                                 | $\pm 50$ mA                |
| Continuous current through $V_{CC}$ or GND                       | $\pm 100$ mA               |
| Package thermal impedance, $\theta_{JA}$ (see Note 3): D package | 73°C/W                     |
| (see Note 3): PW package   | 108°C/W                    |
| Storage temperature range, $T_{stg}$                             | -65°C to 150°C             |

<sup>†</sup> 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.

- NOTES: 1. The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.  
 2. The value of  $V_{CC}$  is provided in the recommended operating conditions table.  
 3. The package thermal impedance is calculated in accordance with JESD 51-7.

# SN74LVC139A-Q1

## DUAL 2-LINE TO 4-LINE DECODER/DEMULTIPLEXER

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### recommended operating conditions (see Note 4)

|                 |                                    | MIN                                | MAX                    | UNIT |    |
|-----------------|------------------------------------|------------------------------------|------------------------|------|----|
| V <sub>CC</sub> | Supply voltage                     | Operating                          | 1.65                   | 3.6  | V  |
|                 |                                    | Data retention only                | 1.5                    |      |    |
| V <sub>IH</sub> | High-level input voltage           | V <sub>CC</sub> = 1.65 V to 1.95 V | 0.65 × V <sub>CC</sub> |      | V  |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V   | 1.7                    |      |    |
|                 |                                    | V <sub>CC</sub> = 2.7 V to 3.6 V   | 2                      |      |    |
| V <sub>IL</sub> | Low-level input voltage            | V <sub>CC</sub> = 1.65 V to 1.95 V | 0.35 × V <sub>CC</sub> |      | V  |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V   | 0.7                    |      |    |
|                 |                                    | V <sub>CC</sub> = 2.7 V to 3.6 V   | 0.8                    |      |    |
| V <sub>I</sub>  | Input voltage                      | 0                                  | 5.5                    | V    |    |
| V <sub>O</sub>  | Output voltage                     | 0                                  | V <sub>CC</sub>        | V    |    |
| I <sub>OH</sub> | High-level output current          | V <sub>CC</sub> = 1.65 V           | -4                     |      | mA |
|                 |                                    | V <sub>CC</sub> = 2.3 V            | -8                     |      |    |
|                 |                                    | V <sub>CC</sub> = 2.7 V            | -12                    |      |    |
|                 |                                    | V <sub>CC</sub> = 3 V              | -24                    |      |    |
| I <sub>OL</sub> | Low-level output current           | V <sub>CC</sub> = 1.65 V           | 4                      |      | mA |
|                 |                                    | V <sub>CC</sub> = 2.3 V            | 8                      |      |    |
|                 |                                    | V <sub>CC</sub> = 2.7 V            | 12                     |      |    |
|                 |                                    | V <sub>CC</sub> = 3 V              | 24                     |      |    |
| Δt/Δv           | Input transition rise or fall rate |                                    | 10                     | ns/V |    |
| T <sub>A</sub>  | Operating free-air temperature     | -40                                | 125                    | °C   |    |

NOTE 4: All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

| PARAMETER                | TEST CONDITIONS           | V <sub>CC</sub>  | T <sub>A</sub> = -40°C TO 125°C |      |     | T <sub>A</sub> = -40°C TO 85°C |      |     | UNIT |    |
|--------------------------|---------------------------|--|---------------------------------|------|-----|--------------------------------|------|-----|------|----|
|                          |                           |  | MIN                             | TYP† | MAX | MIN                            | TYP† | MAX |      |    |
| V <sub>OH</sub>          | I <sub>OH</sub> = -100 μA | 1.65 V to 3.6 V  | V <sub>CC</sub> - 0.2           |      |     | V <sub>CC</sub> - 0.2          |      |     | V    |    |
|                          | I <sub>OH</sub> = -4 mA   | 1.65 V   | 1.2                             |      |     | 1.2                            |      |     |      |    |
|                          | I <sub>OH</sub> = -8 mA   | 2.3 V  | 1.7                             |      |     | 1.7                            |      |     |      |    |
|                          | I <sub>OH</sub> = -12 mA  | 2.7 V  | 2.1                             |      |     | 2.2                            |      |     |      |    |
|                          |                           | 3 V  | 2.3                             |      |     | 2.4                            |      |     |      |    |
| I <sub>OH</sub> = -24 mA | 3 V                       | 2.1  |                                 |      | 2.2 |                                |      |     |      |    |
| V <sub>OL</sub>          | I <sub>OL</sub> = 100 μA  | 1.65 V to 3.6 V  | 0.2                             |      |     | 0.2                            |      |     | V    |    |
|                          | I <sub>OL</sub> = 4 mA    | 1.65 V   | 0.45                            |      |     | 0.45                           |      |     |      |    |
|                          | I <sub>OL</sub> = 8 mA    | 2.3 V  | 0.7                             |      |     | 0.7                            |      |     |      |    |
|                          | I <sub>OL</sub> = 12 mA   | 2.7 V  | 0.4                             |      |     | 0.4                            |      |     |      |    |
|                          | I <sub>OL</sub> = 24 mA   | 3 V  | 0.55                            |      |     | 0.55                           |      |     |      |    |
| I <sub>I</sub>           | All inputs                | V <sub>I</sub> = 5.5 V or GND  | 3.6 V                           | ±5   |     |                                | ±5   |     |      | μA |
| I <sub>CC</sub>          |                           | V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0                  | 3.6 V                           | 10   |     |                                | 10   |     |      | μA |
| ΔI <sub>CC</sub>         |                           | One input at V <sub>CC</sub> - 0.6 V, Other inputs at V <sub>CC</sub> or GND | 2.7 V to 3.6 V                  | 500  |     |                                | 500  |     |      | μA |
| C <sub>i</sub>           |                           | V <sub>I</sub> = V <sub>CC</sub> or GND                                      | 3.3 V                           | 5    |     |                                | 5    |     |      | pF |

† All typical values are at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.



# SN74LVC139A-Q1

## DUAL 2-LINE TO 4-LINE DECODER/DEMULTIPLEXER

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switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

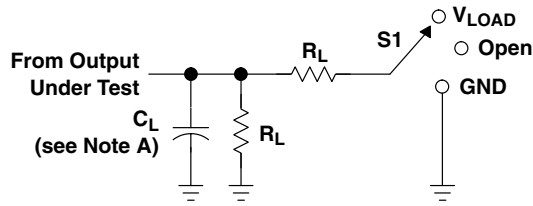
| PARAMETER          | FROM (INPUT)   | TO (OUTPUT) | V <sub>CC</sub> = 2.7 V |     | V <sub>CC</sub> = 3.3 V ± 0.3 V |     | UNIT |
|--------------------|----------------|-------------|-------------------------|-----|---------------------------------|-----|------|
|                    |                |             | MIN                     | MAX | MIN                             | MAX |      |
| t <sub>pd</sub>    | A or B         | Y           | 1                       | 8.8 | 1                               | 7.7 | ns   |
|                    | $\overline{G}$ |             | 1                       | 6.7 | 1                               | 6.2 |      |
| t <sub>sk(o)</sub> |                |             |                         |     |                                 | 1   | ns   |

operating characteristics, T<sub>A</sub> = 25°C

| PARAMETER                                     | TEST CONDITIONS | V <sub>CC</sub> = 1.8 V | V <sub>CC</sub> = 2.5 V | V <sub>CC</sub> = 3.3 V | UNIT |
|---|-----------------|-------------------------|-------------------------|-------------------------|------|
|   |                 | TYP                     | TYP                     | TYP                     |      |
| C <sub>pd</sub> Power dissipation capacitance | f = 10 MHz      | 28.5                    | 29.5                    | 30.5                    | pF   |



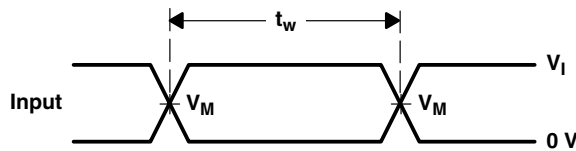
**PARAMETER MEASUREMENT INFORMATION**



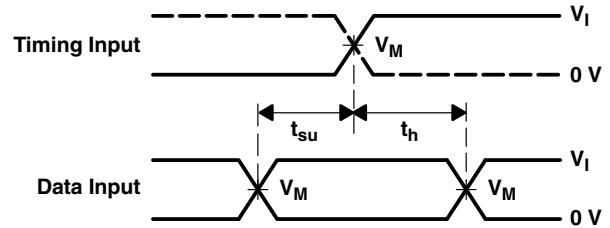
**LOAD CIRCUIT**

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

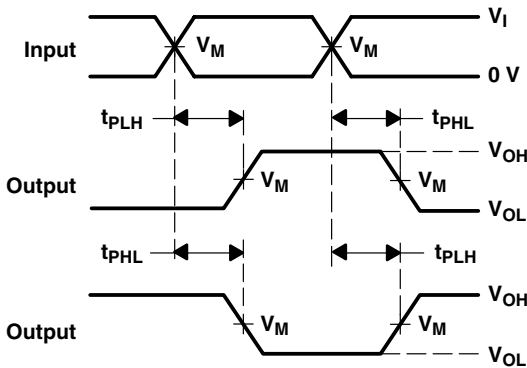
| $V_{CC}$          | INPUTS |               | $V_M$ | $V_{LOAD}$ | $C_L$ | $R_L$        | $V_{\Delta}$ |
|-------------------|--------|---------------|-------|------------|-------|--------------|--------------|
|                   | $V_I$  | $t_r/t_f$     |       |            |       |              |              |
| 2.7 V             | 2.7 V  | $\leq 2.5$ ns | 1.5 V | 6 V        | 50 pF | 500 $\Omega$ | 0.3 V        |
| $3.3 V \pm 0.3 V$ | 2.7 V  | $\leq 2.5$ ns | 1.5 V | 6 V        | 50 pF | 500 $\Omega$ | 0.3 V        |



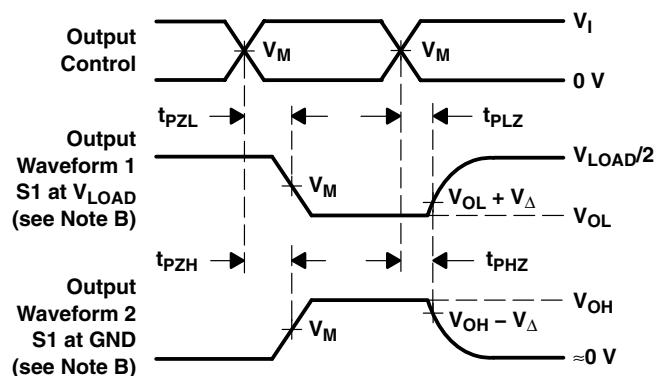
**VOLTAGE WAVEFORMS  
PULSE DURATION**



**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  $\leq 10$  MHz,  $Z_O = 50 \Omega$ .
  - 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 1. Load Circuit and Voltage Waveforms**

**PACKAGING INFORMATION**

| Orderable Device  | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|-------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| CLVC139AQPWRG4Q1  | ACTIVE        | TSSOP        | PW              | 16   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LC139AQ                 | <a href="#">Samples</a> |
| SN74LVC139AQPWRQ1 | ACTIVE        | TSSOP        | PW              | 16   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | LC139AQ                 | <a href="#">Samples</a> |

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

**ACTIVE:** Product device recommended for new designs.

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

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

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

**OBSOLETE:** TI has discontinued the production of the device.

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

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

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

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

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

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**OTHER QUALIFIED VERSIONS OF SN74LVC139A-Q1 :**

- Catalog: [SN74LVC139A](#)

## 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 |
|-------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CLVC139AQPWRG4Q1  | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| SN74LVC139AQPWRQ1 | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 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) |
|-------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CLVC139AQPWRG4Q1  | TSSOP        | PW              | 16   | 2000 | 356.0       | 356.0      | 35.0        |
| SN74LVC139AQPWRQ1 | TSSOP        | PW              | 16   | 2000 | 356.0       | 356.0      | 35.0        |



4220204/A 02/2017

NOTES:

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

# EXAMPLE BOARD LAYOUT

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220204/A 02/2017

NOTES: (continued)

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

# EXAMPLE STENCIL DESIGN

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

4220204/A 02/2017

NOTES: (continued)

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

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