

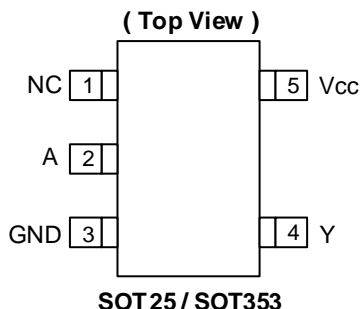
## Description

The 74LVC1G04Q is an automotive-compliant, single inverter gate with a standard push-pull output. The device is designed for operation with a power supply range of 1.65V to 5.5V. The inputs are tolerant to 5.5V allowing this device to be used in a mixed voltage environment. The device is fully specified for partial power down applications using I<sub>OFF</sub>. The I<sub>OFF</sub> circuitry disables the output preventing damaging current backflow when the device is powered down.

The gate performs the positive Boolean function:

$$Y = \bar{A}$$

## Pin Assignments



## Features

- Grade 1 Ambient Temperature Operation: -40°C to +125°C
- Wide Supply Voltage Range from 1.65V to 5.5V
- ±24mA Output Drive at 3.3V
- CMOS Low Power Consumption
- I<sub>OFF</sub> Supports Partial-Power-Down Mode Operation
- Inputs Accept up to 5.5V Regardless of V<sub>CC</sub> Level
- ESD Protection Tested per AEC-Q100
- Exceeds 2000V Human Body Model (AEC-Q100-002)
- Exceeds 1000V Charged Device Model (AEC-Q100-011)
- Latch-Up Exceeds 100mA (AEC-Q100-004)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The 74LVC1G04Q is suitable for automotive applications requiring specific change control; this part is AEC-Q100 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**

<https://www.diodes.com/quality/product-definitions/>

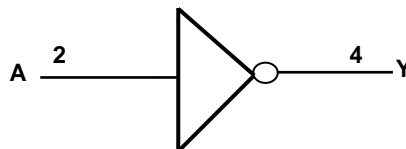
## Applications

- Voltage Level Shifting
- General Purpose Logic
- Power Down Signal Isolation
- Wide Array of Products such as:
  - Automotive Applications within Grade 1 Temperature Range
  - Industrial Computing/Controls/Automation
  - High Reliability Networking/Communications
  - Industrial/Agricultural Equipment

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

**Pin Descriptions**

| Pin Name        | Description    |
|-----------------|----------------|
| NC              | No Connection  |
| A               | Data Input     |
| GND             | Ground         |
| Y               | Data Output    |
| V <sub>CC</sub> | Supply Voltage |

**Logic Diagram**

**Function Table**

| Input | Output |
|-------|--------|
| A     | Y      |
| H     | L      |
| L     | H      |

**Absolute Maximum Ratings** (Notes 4 & 5)

| Symbol                             | Description   | Rating                       | Unit |
|------------------------------------|---|------------------------------|------|
| ESD HBM                            | Human Body Model ESD Protection                                       | 2                            | kV   |
| ESD CDM                            | Charged Device Model ESD Protection                                   | 1                            | kV   |
| V <sub>CC</sub>                    | Supply Voltage Range  | -0.5 to 6.5                  | V    |
| V <sub>I</sub>                     | Input Voltage Range   | -0.5 to 6.5                  | V    |
| V <sub>O</sub>                     | Voltage Applied to Output in High Impedance or I <sub>OFF</sub> State | -0.5 to 6.5                  | V    |
| V <sub>O</sub>                     | Voltage Applied to Output in High or Low State                        | -0.5 to V <sub>CC</sub> +0.5 | V    |
| I <sub>IK</sub>                    | Input Clamp Current V <sub>I</sub> < 0                                | -50                          | mA   |
| I <sub>OK</sub>                    | Output Clamp Current  | -50                          | mA   |
| I <sub>O</sub>                     | Continuous Output Current   | ±50                          | mA   |
| I <sub>CC</sub> , I <sub>GND</sub> | Continuous Current Through V <sub>CC</sub> or GND                     | ±100                         | mA   |
| T <sub>J</sub>                     | Operating Junction Temperature  | -40 to +150                  | °C   |
| T <sub>STG</sub>                   | Storage Temperature   | -65 to +150                  | °C   |

- Notes:
- Stresses beyond the absolute maximum can result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.
  - Forcing the maximum allowed voltage could cause a condition exceeding the maximum current or conversely forcing the maximum current could cause a condition exceeding the maximum voltage. The ratings of both current and voltage must be maintained within the controlled range.

**Recommended Operating Conditions** (Note 6)

| Symbol          | Parameter                          | Min   | Max                    | Unit                   |      |
|-----------------|------------------------------------|---|------------------------|------------------------|------|
| V <sub>CC</sub> | Operating Voltage                  | Operating                                   | 1.65                   | 5.5                    | V    |
|                 |                                    | Data Retention Only                         | 1.5                    | —                      | V    |
| V <sub>IH</sub> | High-Level Input Voltage           | V <sub>CC</sub> = 1.65V to 1.95V            | 0.65 × V <sub>CC</sub> | —                      | V    |
|                 |                                    | V <sub>CC</sub> = 2.3V to 2.7V              | 1.7                    | —                      |      |
|                 |                                    | V <sub>CC</sub> = 3V to 3.6V                | 2                      | —                      |      |
|                 |                                    | V <sub>CC</sub> = 4.5V to 5.5V              | 0.7 × V <sub>CC</sub>  | —                      |      |
| V <sub>IL</sub> | Low-Level Input Voltage            | V <sub>CC</sub> = 1.65V to 1.95V            | —                      | 0.35 × V <sub>CC</sub> | V    |
|                 |                                    | V <sub>CC</sub> = 2.3V to 2.7V              | —                      | 0.7                    |      |
|                 |                                    | V <sub>CC</sub> = 3V to 3.6V                | —                      | 0.8                    |      |
|                 |                                    | V <sub>CC</sub> = 4.5V to 5.5V              | —                      | 0.3 × V <sub>CC</sub>  |      |
| 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> = 1.65V                     | —                      | -4                     | mA   |
|                 |                                    | V <sub>CC</sub> = 2.3V                      | —                      | -8                     |      |
|                 |                                    | V <sub>CC</sub> = 2.7V                      | —                      | -12                    |      |
|                 |                                    | V <sub>CC</sub> = 3V                        | —                      | -16                    |      |
|                 |                                    | V <sub>CC</sub> = 4.5V                      | —                      | -24                    |      |
| I <sub>OL</sub> | Low-Level Output Current           | V <sub>CC</sub> = 1.65V                     | —                      | 4                      | mA   |
|                 |                                    | V <sub>CC</sub> = 2.3V                      | —                      | 8                      |      |
|                 |                                    | V <sub>CC</sub> = 2.7V                      | —                      | 12                     |      |
|                 |                                    | V <sub>CC</sub> = 3V                        | —                      | 16                     |      |
|                 |                                    | V <sub>CC</sub> = 4.5V                      | —                      | 24                     |      |
| Δt/ΔV           | Input Transition Rise or Fall Rate | V <sub>CC</sub> = 1.8V ± 0.15V, 2.5V ± 0.2V | —                      | 20                     | ns/V |
|                 |                                    | V <sub>CC</sub> = 3.3V ± 0.3V               | —                      | 10                     |      |
|                 |                                    | V <sub>CC</sub> = 5V ± 0.5V                 | —                      | 5                      |      |
| T <sub>A</sub>  | Operating Free-Air Temperature     | —   | -40                    | +125                   | °C   |

Note: 6. Unused inputs should be held at V<sub>CC</sub> or Ground.

**Electrical Characteristics** (All typical values are at  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ C$ )

| Symbol           | Parameter                  | Test Conditions                                    | Vcc                      | -40°C to +125°C |                       |     | Unit |   |
|------------------|----------------------------|--|--------------------------|-----------------|-----------------------|-----|------|---|
|                  |                            |  |                          | Min             | Typ                   | Max |      |   |
| V <sub>OH</sub>  | High Level Output Voltage  | V <sub>I</sub> = V <sub>IL</sub>                   | I <sub>OH</sub> = -100µA | 1.65V to 5.5V   | V <sub>CC</sub> - 0.1 | —   | —    | V |
|                  |                            |  | I <sub>OH</sub> = -4mA   | 1.65V           | 0.95                  | —   | —    |   |
|                  |                            |  | I <sub>OH</sub> = -8mA   | 2.3V            | 1.7                   | —   | —    |   |
|                  |                            |  | I <sub>OH</sub> = -12mA  | 2.7V            | 1.9                   | —   | —    |   |
|                  |                            |  | I <sub>OH</sub> = -24mA  | 3V              | 2.0                   | —   | —    |   |
|                  |                            |  | I <sub>OH</sub> = -32mA  | 4.5V            | 3.4                   | —   | —    |   |
| V <sub>OL</sub>  | Low Level Output Voltage   | V <sub>I</sub> = V <sub>IH</sub>                   | I <sub>OL</sub> = 100µA  | 1.65V to 5.5V   | —                     | —   | 0.10 | V |
|                  |                            |  | I <sub>OL</sub> = 4mA    | 1.65V           | —                     | —   | 0.70 |   |
|                  |                            |  | I <sub>OL</sub> = 8mA    | 2.3V            | —                     | —   | 0.45 |   |
|                  |                            |  | I <sub>OL</sub> = 12mA   | 2.7V            | —                     | —   | 0.60 |   |
|                  |                            |  | I <sub>OL</sub> = 24mA   | 3V              | —                     | —   | 0.80 |   |
|                  |                            |  | I <sub>OL</sub> = 32mA   | 4.5V            | —                     | —   | 0.80 |   |
| I <sub>I</sub>   | Input Current              | V <sub>I</sub> = 5.5V or GND                       | 0 to 5.5V                | —               | ±0.1                  | ±1  | µA   |   |
| I <sub>OFF</sub> | Power Down Leakage Current | V <sub>I</sub> or V <sub>O</sub> = 5.5V            | 0V                       | —               | —                     | ±2  | µA   |   |
| I <sub>CC</sub>  | Supply Current             | V <sub>I</sub> = 5.5V or GND<br>I <sub>O</sub> = 0 | 5.5V                     | —               | 0.1                   | 4   | µA   |   |
| ΔI <sub>CC</sub> | Additional Supply Current  | Input at V <sub>CC</sub> - 0.6V                    | 3V to 5.5V               | —               | —                     | 500 | µA   |   |
| C <sub>I</sub>   | Input Capacitance          | V <sub>I</sub> = GND to V <sub>CC</sub>            | 3.3V                     | —               | 5.0                   | —   | pF   |   |

**Package Characteristics**

| Symbol          | Parameter                                 | Package | Test Conditions | Min | Typ | Max | Unit |
|-----------------|---|---------|-----------------|-----|-----|-----|------|
| θ <sub>JA</sub> | Thermal Resistance<br>Junction-to-Ambient | SOT25   | Note 7          | —   | 184 | —   | °C/W |
|                 |   | SOT353  |                 | —   | 385 | —   |      |
| θ <sub>JC</sub> | Thermal Resistance<br>Junction-to-Case    | SOT25   | Note 7          | —   | 62  | —   | °C/W |
|                 |   | SOT353  |                 | —   | 164 | —   |      |

Note: 7. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

**Switching Characteristics**

Figure 1 Typical Values at  $T_A = +25^\circ C$  and nominal voltages 1.8V, 2.5V, 2.7V, 3.3V, and 5.0V.

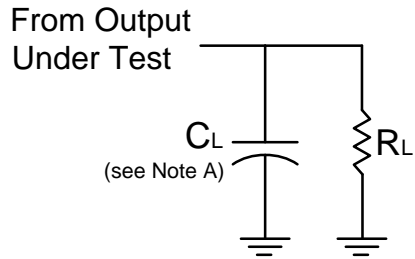
| Parameter       | From Input | To Output | Vcc          | T <sub>A</sub> = -40°C to +125°C |     |     | Unit |
|-----------------|------------|-----------|--------------|----------------------------------|-----|-----|------|
|                 |            |           |              | Min                              | Typ | Max |      |
| t <sub>PD</sub> | A          | Y         | 1.8V ± 0.15V | 1.0                              | 3.0 | 9.5 | ns   |
|                 |            |           | 2.5V ± 0.2V  | 0.5                              | 2.0 | 6.5 |      |
|                 |            |           | 2.7V         | 0.5                              | 2.3 | 7.0 |      |
|                 |            |           | 3.3V ± 0.3V  | 0.5                              | 2.0 | 5.5 |      |
|                 |            |           | 5.0V ± 0.5V  | 0.5                              | 1.6 | 5.0 |      |

**Operating Characteristics**

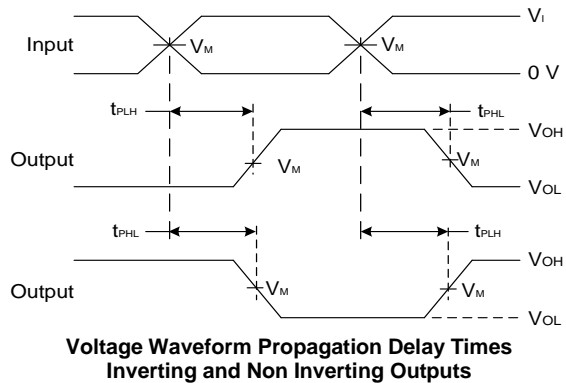
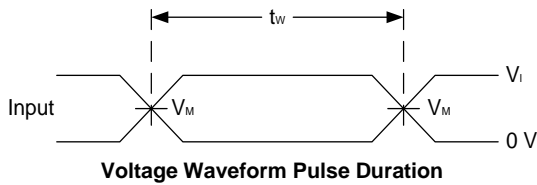
T<sub>A</sub> = +25°C

| Parameter       | Test Conditions                            | Vcc = 1.8V | Vcc = 2.5V | Vcc = 3.3V | Vcc = 5V | Unit |
|-----------------|--|------------|------------|------------|----------|------|
|                 |  | Typ        | Typ        | Typ        | Typ      |      |
| C <sub>PD</sub> | Power Dissipation Capacitance<br>f = 10MHz | 15         | 16         | 16         | 16       | pF   |

**Measurement Information**



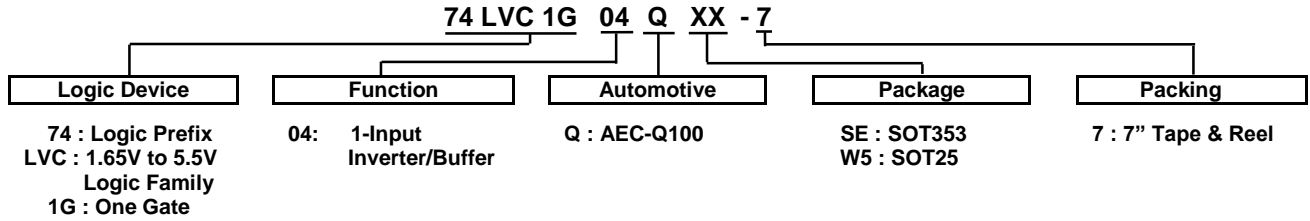
| $V_{CC}$         | Inputs   |              | $V_M$      | $C_L$ | $R_L$        |
|------------------|----------|--------------|------------|-------|--------------|
|                  | $V_I$    | $t_R/t_F$    |            |       |              |
| $1.8V \pm 0.15V$ | $V_{CC}$ | $\leq 2ns$   | $V_{CC}/2$ | 30pF  | 1k $\Omega$  |
| $2.5V \pm 0.2V$  | $V_{CC}$ | $\leq 2ns$   | $V_{CC}/2$ | 30pF  | 500 $\Omega$ |
| 2.7V             | $V_{CC}$ | $\leq 2.5ns$ | 1.5V       | 50pF  | 500 $\Omega$ |
| $3.3V \pm 0.3V$  | 3.0V     | $\leq 2.5ns$ | 1.5V       | 50pF  | 500 $\Omega$ |
| $5.0V \pm 0.5V$  | $V_{CC}$ | $\leq 2.5ns$ | $V_{CC}/2$ | 50pF  | 500 $\Omega$ |



**Figure 1. Load Circuit and Voltage Waveforms**

- Notes:
- A. Includes test lead and test apparatus capacitance.
  - B. All pulses are supplied at pulse repetition rate  $\leq 10MHz$ .
  - C. Inputs are measured separately one transition per measurement.
  - D.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{PD}$ .

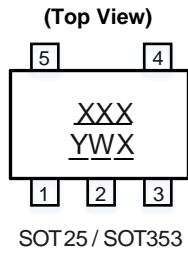
## Ordering Information (Note 8)



| Part Number    | Package Code | Package (Notes 9 & 10) | Package Size                                | 7" Tape and Reel |                    |
|----------------|--------------|------------------------|---|------------------|--------------------|
|                |              |                        |   | Quantity         | Part Number Suffix |
| 74LVC1G04QSE-7 | SE           | SOT353                 | 2.15mm × 2.1mm × 1.1mm<br>0.65mm lead pitch | 3000/Tape & Reel | -7                 |
| 74LVC1G04QW5-7 | W5           | SOT25                  | 3.0mm × 2.8mm × 1.2mm<br>0.95mm lead pitch  | 3000/Tape & Reel | -7                 |

Notes: 8. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.  
 9. Pad layout as shown in Diodes Incorporated's package outline PDFs, which can be found on our website at <http://www.diodes.com/package-outlines.html>.  
 10. The taping orientation is located on our website at <https://www.diodes.com/assets/Packaging-Support-Docs/ap02007.pdf>.

## Marking Information



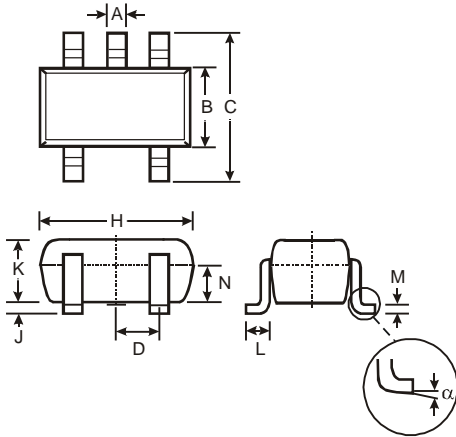
**XXX** : Identification Code  
**Y** : Year 0~9  
**W** : Week: A~Z 1~26 week  
       a~z 27~52 week  
       z represents week 52 and 53  
**X** : A~ Z: Internal Code

| Part Number    | Package | Identification Code |
|----------------|---------|---------------------|
| 74LVC1G04QW5-7 | SOT25   | UUQ                 |
| 74LVC1G04QSE-7 | SOT353  | UUQ                 |

**Package Outline Dimensions**

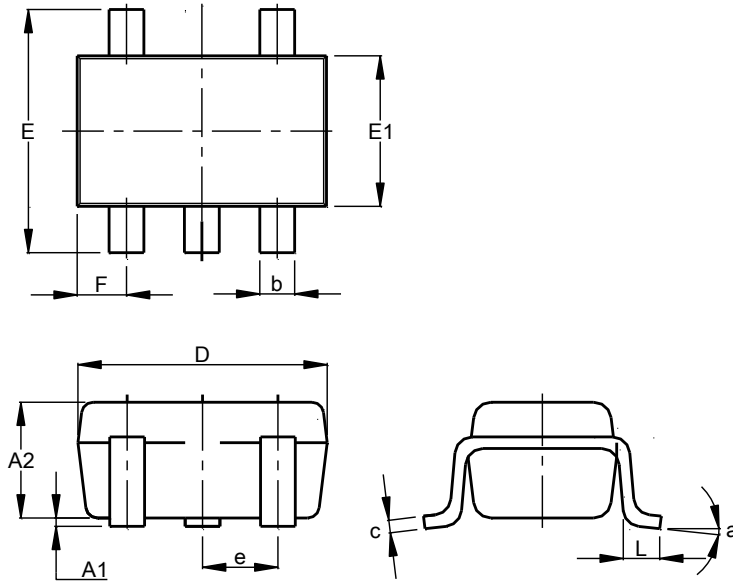
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**(1) Package Type: SOT25**



| SOT25                |       |      |      |
|----------------------|-------|------|------|
| Dim                  | Min   | Max  | Typ  |
| A                    | 0.35  | 0.50 | 0.38 |
| B                    | 1.50  | 1.70 | 1.60 |
| C                    | 2.70  | 3.00 | 2.80 |
| D                    | -     | -    | 0.95 |
| H                    | 2.90  | 3.10 | 3.00 |
| J                    | 0.013 | 0.10 | 0.05 |
| K                    | 1.00  | 1.30 | 1.10 |
| L                    | 0.35  | 0.55 | 0.40 |
| M                    | 0.10  | 0.20 | 0.15 |
| N                    | 0.70  | 0.80 | 0.75 |
| α                    | 0°    | 8°   | -    |
| All Dimensions in mm |       |      |      |

**(2) Package Type: SOT353**

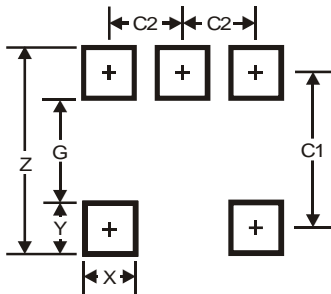


| SOT353               |           |      |       |
|----------------------|-----------|------|-------|
| Dim                  | Min       | Max  | Typ   |
| A1                   | 0.00      | 0.10 | 0.05  |
| A2                   | 0.90      | 1.00 | 0.95  |
| b                    | 0.10      | 0.30 | 0.25  |
| c                    | 0.10      | 0.22 | 0.11  |
| D                    | 1.80      | 2.20 | 2.15  |
| E                    | 2.00      | 2.20 | 2.10  |
| E1                   | 1.15      | 1.35 | 1.30  |
| e                    | 0.650 BSC |      |       |
| F                    | 0.40      | 0.45 | 0.425 |
| L                    | 0.25      | 0.40 | 0.30  |
| a                    | 0°        | 8°   | --    |
| All Dimensions in mm |           |      |       |

## Suggested Pad Layout

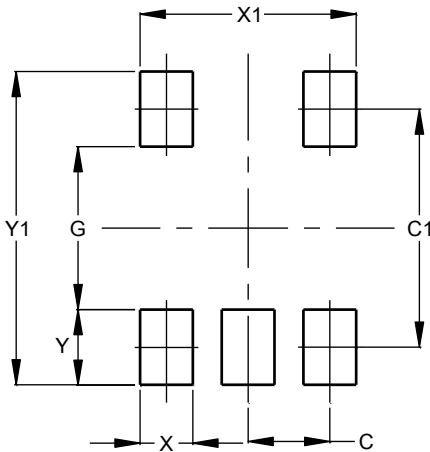
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### (1) Package Type: SOT25



| Dimensions | Value |
|------------|-------|
| Z          | 3.20  |
| G          | 1.60  |
| X          | 0.55  |
| Y          | 0.80  |
| C1         | 2.40  |
| C2         | 0.95  |

### (2) Package Type: SOT353



| Dimensions | Value (in mm) |
|------------|---------------|
| C          | 0.650         |
| C1         | 1.900         |
| G          | 1.300         |
| X          | 0.420         |
| X1         | 1.720         |
| Y          | 0.600         |
| Y1         | 2.500         |

## Mechanical Data

### SOT25

- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208@3
- Weight: 0.0158 grams (Approximate)

### SOT353

- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208@3
- Weight: 0.0064 grams (Approximate)



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