

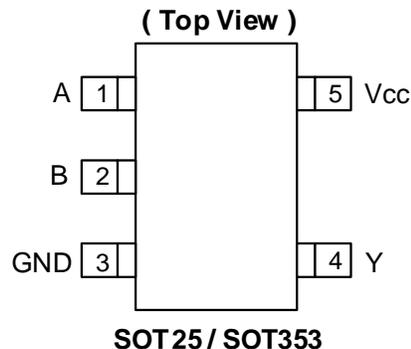
Description

The 74LVC1G02Q is an automotive compliant single 2-input positive NOR 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_{OFF}. The I_{OFF} circuitry disables the output preventing damaging current backflow when the device is powered down.

The gate performs the positive Boolean function:

$$Y = \overline{A + B} \text{ or } Y = \overline{A} \cdot \overline{B}$$

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_{OFF} Supports Partial-Power-Down Mode Operation
- Inputs Accept up to 5.5V
- 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 74LVC1G02Q 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/>

- 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.

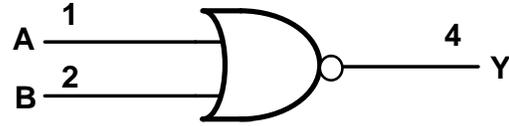
Applications

- 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

Pin Descriptions

| Pin Name | Description |
|-----------------|----------------|
| A | Data Input |
| B | Data Input |
| GND | Ground |
| Y | Data Output |
| V _{CC} | Supply Voltage |

Logic Diagram



Function Table

| Inputs | | Output |
|--------|---|--------|
| A | B | Y |
| H | X | L |
| X | H | L |
| 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 _{CC} | Supply Voltage Range | -0.5 to 6.5 | V |
| V _I | Input Voltage Range | -0.5 to 6.5 | V |
| V _O | Voltage Applied to Output in High Impedance or I _{OFF} State | -0.5 to 6.5 | V |
| V _O | Voltage Applied to Output in High or Low State | -0.5 to V _{CC} +0.5 | V |
| I _{IK} | Input Clamp Current V _I < 0 | -50 | mA |
| I _{OK} | Output Clamp Current | -50 | mA |
| I _O | Continuous Output Current | ±50 | mA |
| I _{CC} , I _{GND} | Continuous current through V _{CC} or GND | ±100 | mA |
| T _J | Operating Junction Temperature | -40 to +150 | °C |
| T _{STG} | 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 _{CC} | Operating Voltage | Operating | 1.65 | 5.5 | V |
| | | Data Retention Only | 1.5 | — | V |
| V _{IH} | High-Level Input Voltage | V _{CC} = 1.65V to 1.95V | 0.65 × V _{CC} | — | V |
| | | V _{CC} = 2.3V to 2.7V | 1.7 | — | |
| | | V _{CC} = 3V to 3.6V | 2 | — | |
| | | V _{CC} = 4.5V to 5.5V | 0.7 × V _{CC} | — | |
| V _{IL} | Low-Level Input Voltage | V _{CC} = 1.65V to 1.95V | — | 0.35 × V _{CC} | V |
| | | V _{CC} = 2.3V to 2.7V | — | 0.7 | |
| | | V _{CC} = 3V to 3.6V | — | 0.8 | |
| | | V _{CC} = 4.5V to 5.5V | — | 0.3 × V _{CC} | |
| V _I | Input Voltage | 0 | 5.5 | V | |
| V _O | Output Voltage | 0 | V _{CC} | V | |
| I _{OH} | High-Level Output Current | V _{CC} = 1.65V | — | -4 | mA |
| | | V _{CC} = 2.3V | — | -8 | |
| | | V _{CC} = 2.7V | — | -12 | |
| | | V _{CC} = 3V | — | -16 | |
| | | V _{CC} = 4.5V | — | -24 | |
| I _{OL} | Low-Level Output Current | V _{CC} = 1.65V | — | 4 | mA |
| | | V _{CC} = 2.3V | — | 8 | |
| | | V _{CC} = 2.7V | — | 12 | |
| | | V _{CC} = 3V | — | 16 | |
| | | V _{CC} = 4.5V | — | 24 | |
| Δt/ΔV | Input Transition Rise or Fall Rate | V _{CC} = 1.8V ± 0.15V, 2.5V ± 0.2V | — | 20 | ns/V |
| | | V _{CC} = 3.3V ± 0.3V | — | 10 | |
| | | V _{CC} = 5V ± 0.5V | — | 5 | |
| T _A | Operating Free-Air Temperature | — | -40 | +125 | °C |

Note: 6. Unused inputs should be held at V_{CC} 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 _{OH} | High Level Output Voltage | V _I = V _{IH} or V _{IL} | I _{OH} = -100µA | 1.65V to 5.5V | V _{CC} - 0.1 | — | — | V |
| | | | I _{OH} = -4mA | 1.65V | 0.95 | — | — | |
| | | | I _{OH} = -8mA | 2.3V | 1.7 | — | — | |
| | | | I _{OH} = -12mA | 2.7V | 1.9 | — | — | |
| | | | I _{OH} = -24mA | 3V | 2.0 | — | — | |
| | | | I _{OH} = -32mA | 4.5V | 3.4 | — | — | |
| V _{OL} | Low Level Output Voltage | V _I = V _{IH} or V _{IL} | I _{OL} = 100µA | 1.65V to 5.5V | — | — | 0.10 | V |
| | | | I _{OL} = 4mA | 1.65V | — | — | 0.70 | |
| | | | I _{OL} = 8mA | 2.3V | — | — | 0.45 | |
| | | | I _{OL} = 12mA | 2.7V | — | — | 0.60 | |
| | | | I _{OL} = 24mA | 3V | — | — | 0.80 | |
| | | | I _{OL} = 32mA | 4.5V | — | — | 0.80 | |
| I _I | Input Current | V _I = 5.5V or GND | 0 to 5.5V | — | ±0.1 | ±1 | µA | |
| I _{OFF} | Power Down Leakage Current | V _I or V _O = 5.5V | 0V | — | — | ±2 | µA | |
| I _{CC} | Supply Current | V _I = 5.5V or GND I _O = 0 | 5.5V | — | 0.1 | 4 | µA | |
| ΔI _{CC} | Additional Supply Current | One input at V _{CC} - 0.6V Other inputs at V _{CC} or GND | 3V to 5.5V | — | — | 500 | µA | |
| C _I | Input Capacitance | V _I = GND to V _{CC} | 3.3V | — | 5.0 | — | pF | |

Package Characteristics

| Symbol | Parameter | Package | Test Conditions | Min | Typ | Max | Unit |
|-----------------|---|---------|-----------------|-----|-----|-----|------|
| θ _{JA} | Thermal Resistance Junction-to-Ambient | SOT25 | Note 7 | — | 184 | — | °C/W |
| | | SOT353 | | — | 385 | — | |
| θ _{JC} | Thermal Resistance 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.

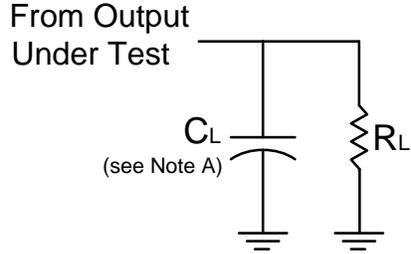
| Parameter | From Input | To Output | Vcc | T _A = -40°C to +125°C | | | Unit |
|-----------------|------------|-----------|--------------|----------------------------------|-----|------|------|
| | | | | Min | Typ | Max | |
| t _{PD} | A or B | Y | 1.8V ± 0.15V | 1.0 | 3.2 | 10.5 | ns |
| | | | 2.5V ± 0.2V | 0.5 | 2.2 | 7.0 | |
| | | | 2.7V | 0.5 | 2.5 | 7.0 | |
| | | | 3.3V ± 0.3V | 0.5 | 2.1 | 6.0 | |
| | | | 5.0V ± 0.5V | 0.5 | 1.7 | 5.5 | |

Operating Characteristics

T_A = +25°C

| Parameter | Test Conditions | Vcc = 1.8V | Vcc = 2.5V | Vcc = 3.3V | Vcc = 5V | Unit |
|-----------------|--|------------|------------|------------|----------|------|
| | | Typ | Typ | Typ | Typ | |
| C _{PD} | Power Dissipation Capacitance f = 10MHz | 14 | 14 | 14 | 14 | 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 Ω |
| $2.5V \pm 0.2V$ | V_{CC} | $\leq 2ns$ | $V_{CC}/2$ | 30pF | 500 Ω |
| 2.7V | V_{CC} | $\leq 2.5ns$ | 1.5V | 50pF | 500 Ω |
| $3.3V \pm 0.3V$ | 3.0V | $\leq 2.5ns$ | 1.5V | 50pF | 500 Ω |
| $5.0V \pm 0.5V$ | V_{CC} | $\leq 2.5ns$ | $V_{CC}/2$ | 50pF | 500 Ω |

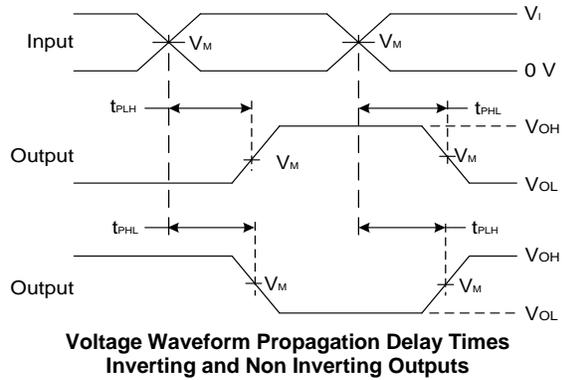
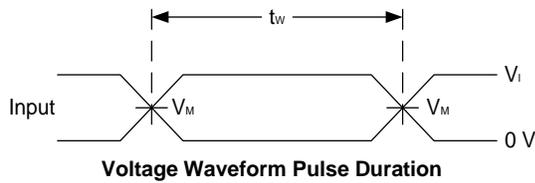
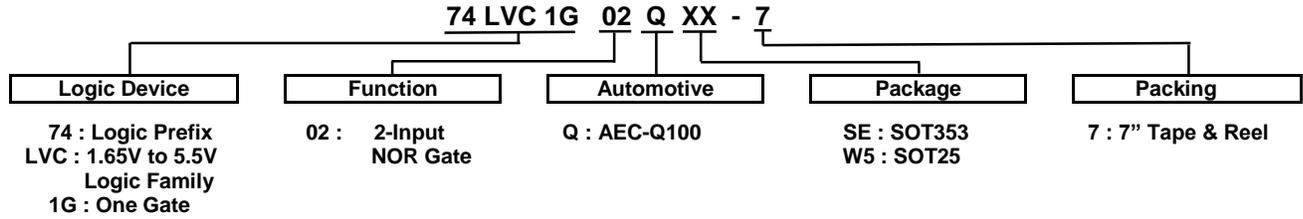


Figure 1. Load Circuit and Voltage Waveforms

- 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} .

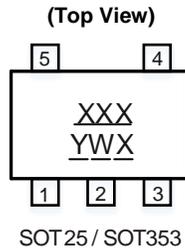
Ordering Information (Note 8)



| Part Number | Package Code | Package (Notes 9 & 10) | Package Size | 7" Tape and Reel | |
|----------------|--------------|------------------------|---|------------------|--------------------|
| | | | | Quantity | Part Number Suffix |
| 74LVC1G02QSE-7 | SE | SOT353 | 2.15mm x 2.1mm x 1.1mm 0.65mm lead pitch | 3000/Tape & Reel | -7 |
| 74LVC1G02QW5-7 | W5 | SOT25 | 3.0mm x 2.8mm x 1.2mm 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



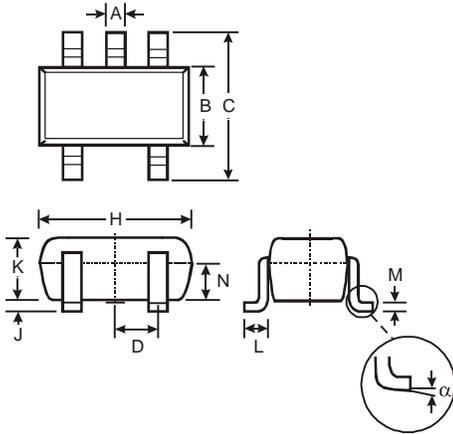
XXX : Identification Code
Y : Year 0~9
W : Week: A~Z 1~26 week
 a~z 27~52 week
 z represents week 52 and 53
X : A~ Z: Internal Code

| Part Number | Package | Identification Code |
|----------------|---------|---------------------|
| 74LVC1G02QW5-7 | SOT25 | UTQ |
| 74LVC1G02QSE-7 | SOT353 | UTQ |

Package Outline Dimensions

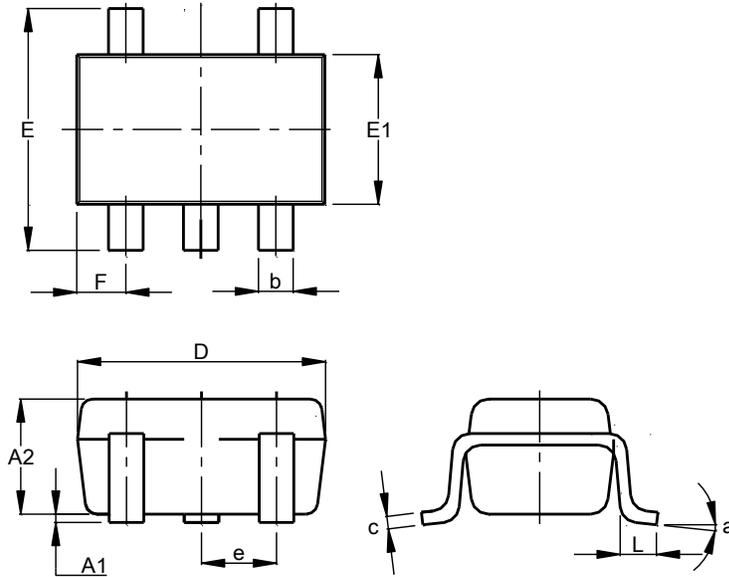
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(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

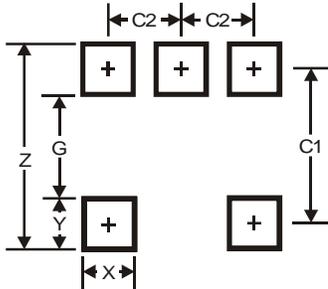


| SOT353 | | | |
|----------------------|-----------|------|-------|
| Dim | Min | Max | Typ |
| A1 | 0.00 | 0.10 | 0.05 |
| A2 | 0.90 | 1.00 | 0.95 |
| b | 0.10 | 0.30 | 0.25 |
| c | 0.10 | 0.22 | 0.11 |
| D | 1.80 | 2.20 | 2.15 |
| E | 2.00 | 2.20 | 2.10 |
| E1 | 1.15 | 1.35 | 1.30 |
| e | 0.650 BSC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

Suggested Pad Layout

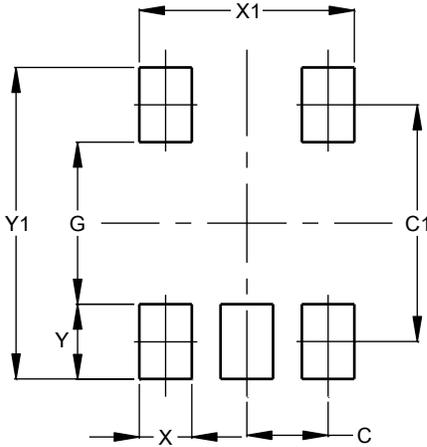
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(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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