



## U74LVC1G02

CMOS IC

### SINGLE 2-INPUT NOR GATE

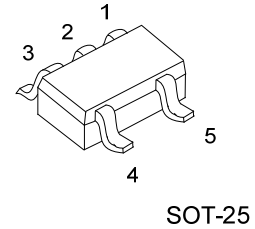
#### DESCRIPTION

The **U74LVC1G02** is a 2-input NOR gate device which provides the Function  $Y=A+B$  in positive logic.

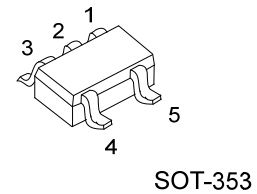
This device has power-down protective circuit preventing device from destruction when it is powered down.

#### FEATURES

- \* Operate From 1.65V to 5.5V
- \* Inputs Accept Voltages To 5.5V
- \* High Noise Immunity
- \* Low Power Dissipation
- \* Max  $t_{PD}$  of 3.6 ns at 3.3V



SOT-25

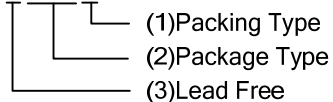


SOT-353

#### ORDERING INFORMATION

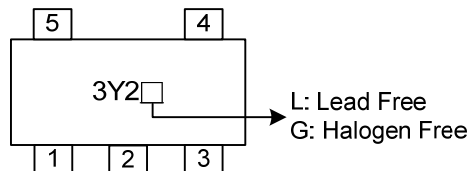
| Ordering Number   |                   | Package | Packing   |
|-------------------|-------------------|---------|-----------|
| Lead Free         | Halogen Free      |         |           |
| U74LVC1G02L-AF5-R | U74LVC1G02G-AF5-R | SOT-25  | Tape Reel |
| U74LVC1G02L-AL5-R | U74LVC1G02G-AL5-R | SOT-353 | Tape Reel |

U74LVC1G02L-AL5-R

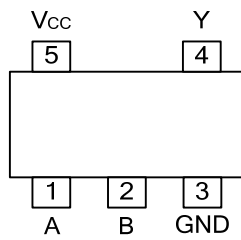


- (1) R: Tape Reel
- (2) AF5: SOT-25, AL5: SOT-353
- (3) G: Halogen Free, L: Lead Free

#### MARKING



## ■ PIN CONFIGURATION

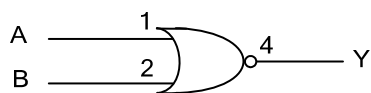


## ■ FUNCTION TABLE

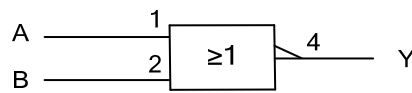
| INPUT(A) | INPUT(B) | OUTPUT(Y) |
|----------|----------|-----------|
| H        | H        | L         |
| H        | L        | L         |
| L        | H        | L         |
| L        | L        | H         |

Note: H: HIGH voltage level; L: LOW voltage level.

## ■ LOGIC DIAGRAM (positive logic)



Logic Symbol



IEC Logic Symbol

### ■ ABSOLUTE MAXIMUM RATING (unless otherwise specified)

| PARAMETER                                               |                                                 | SYMBOL    | RATINGS               | UNIT |
|---------------------------------------------------------|-------------------------------------------------|-----------|-----------------------|------|
| Supply Voltage                                          |                                                 | $V_{CC}$  | -0.5 ~ +6.5           | V    |
| Input Voltage                                           |                                                 | $V_{IN}$  | -0.5 ~ +6.5           | V    |
| Output Voltage                                          | Output in the high or low state                 | $V_{OUT}$ | -0.5 ~ $V_{CC} + 0.5$ | V    |
|                                                         | Output in the high-impedance or power-off state |           | -0.5 ~ +6.5           | V    |
| $V_{CC}$ or GND Current (Output in the power-off state) |                                                 | $I_{CC}$  | ±100                  | mA   |
| Continuous Output Current ( $V_{OUT}=0$ to $V_{CC}$ )   |                                                 | $I_{OUT}$ | ±50                   | mA   |
| Input Clamp Current ( $V_{IN}<0$ )                      |                                                 | $I_{IK}$  | -50                   | mA   |
| Output Clamp Current ( $V_{OUT}<0$ )                    |                                                 | $I_{OK}$  | -50                   | mA   |
| Storage Temperature                                     |                                                 | $T_{STG}$ | -65 ~ +150            | °C   |

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.  
Absolute maximum ratings are stress ratings only and functional device operation is not implied.

### ■ THERMAL DATA

| PARAMETER           |         | SYMBOL        | RATINGS | UNIT |
|---------------------|---------|---------------|---------|------|
| Junction to Ambient | SOT-25  | $\theta_{JA}$ | 230     | °C/W |
|                     | SOT-353 |               | 350     |      |

### ■ RECOMMENDED OPERATING CONDITIONS

| PARAMETER                          | SYMBOL      | TEST CONDITIONS                    | MIN  | TYP | MAX      | UNIT |
|------------------------------------|-------------|------------------------------------|------|-----|----------|------|
| Supply Voltage                     | $V_{CC}$    | Operating                          | 1.65 |     | 5.5      | V    |
|                                    |             | Data retention only                | 1.5  |     |          | V    |
| Input Voltage                      | $V_{IN}$    |                                    | 0    |     | 5.5      | V    |
| Output Voltage                     | $V_{OUT}$   | High or low state                  | 0    |     | $V_{CC}$ | V    |
| High-Level Output Current          | $I_{OH}$    | $V_{CC}=1.65V$                     |      |     | -4       | mA   |
|                                    |             | $V_{CC}=2.3V$                      |      |     | -8       | mA   |
|                                    |             | $V_{CC}=3V$                        |      |     | -16      | mA   |
|                                    |             | $V_{CC}=3V$                        |      |     | -24      | mA   |
|                                    |             | $V_{CC}=4.5V$                      |      |     | -32      | mA   |
| Low-Level Output Current           | $I_{OL}$    | $V_{CC}=1.65V$                     |      |     | 4        | mA   |
|                                    |             | $V_{CC}=2.3V$                      |      |     | 8        | mA   |
|                                    |             | $V_{CC}=3V$                        |      |     | 16       | mA   |
|                                    |             | $V_{CC}=3V$                        |      |     | 24       | mA   |
|                                    |             | $V_{CC}=4.5V$                      |      |     | 32       | mA   |
| Operating Temperature              | $T_A$       |                                    | -40  |     | 85       | °C   |
| Input Transition Rise or Fall Rate | $t_R / t_F$ | $V_{CC}=1.8V\pm0.15V, 2.5V\pm0.2V$ |      |     | 20       | ns/V |
|                                    |             | $V_{CC}=3.3V\pm0.3V$               |      |     | 10       | ns/V |
|                                    |             | $V_{CC}=5V\pm0.5V$                 |      |     | 5        | ns/V |

### ■ ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C, unless otherwise specified)

| PARAMETER                                         | SYMBOL               | TEST CONDITIONS                                                                                       | MIN                  | TYP | MAX                  | UNIT |
|---------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------|----------------------|-----|----------------------|------|
| High-Level Input Voltage                          | V <sub>IH</sub>      | V <sub>CC</sub> =1.65V ~ 1.95V                                                                        | 0.65*V <sub>CC</sub> |     |                      | V    |
|                                                   |                      | V <sub>CC</sub> =2.3V ~ 2.7V                                                                          | 1.7                  |     |                      | V    |
|                                                   |                      | V <sub>CC</sub> =3V ~ 3.6V                                                                            | 2                    |     |                      | V    |
|                                                   |                      | V <sub>CC</sub> =4.5V ~ 5.5V                                                                          | 0.7*V <sub>CC</sub>  |     |                      | V    |
| Low-Level Input Voltage                           | V <sub>IL</sub>      | V <sub>CC</sub> =1.65V ~ 1.95V                                                                        |                      |     | 0.35*V <sub>CC</sub> | V    |
|                                                   |                      | V <sub>CC</sub> =2.3V ~ 2.7V                                                                          |                      |     | 0.7                  | V    |
|                                                   |                      | V <sub>CC</sub> =3V ~ 3.6V                                                                            |                      |     | 0.8                  | V    |
|                                                   |                      | V <sub>CC</sub> =4.5V ~ 5.5V                                                                          |                      |     | 0.3*V <sub>CC</sub>  | V    |
| High-Level Output Voltage                         | V <sub>OH</sub>      | I <sub>OH</sub> =-100μA, V <sub>CC</sub> =1.65 ~ 5.5V                                                 | V <sub>CC</sub> -0.1 |     |                      | V    |
|                                                   |                      | I <sub>OH</sub> =-4mA, V <sub>CC</sub> =1.65V                                                         | 1.2                  |     |                      | V    |
|                                                   |                      | I <sub>OH</sub> =-8mA, V <sub>CC</sub> =2.3V                                                          | 1.9                  |     |                      | V    |
|                                                   |                      | I <sub>OH</sub> =-16mA, V <sub>CC</sub> =3.0V                                                         | 2.4                  |     |                      | V    |
|                                                   |                      | I <sub>OH</sub> =-24mA, V <sub>CC</sub> =3.0V                                                         | 2.3                  |     |                      | V    |
|                                                   |                      | I <sub>OH</sub> =-32mA, V <sub>CC</sub> =4.5V                                                         | 3.8                  |     |                      | V    |
| Low-Level Output Voltage                          | V <sub>OL</sub>      | I <sub>OL</sub> =100μA, V <sub>CC</sub> =1.65 ~ 5.5V                                                  |                      |     | 0.1                  | V    |
|                                                   |                      | I <sub>OL</sub> =4mA, V <sub>CC</sub> =1.65V                                                          |                      |     | 0.45                 | V    |
|                                                   |                      | I <sub>OL</sub> =8mA, V <sub>CC</sub> =2.3V                                                           |                      |     | 0.3                  | V    |
|                                                   |                      | I <sub>OL</sub> =16mA, V <sub>CC</sub> =3.0V                                                          |                      |     | 0.4                  | V    |
|                                                   |                      | I <sub>OL</sub> =24mA, V <sub>CC</sub> =3.0V                                                          |                      |     | 0.55                 | V    |
|                                                   |                      | I <sub>OL</sub> =32mA, V <sub>CC</sub> =4.5V                                                          |                      |     | 0.55                 | V    |
| Input Leakage Current                             | I <sub>I(LEAK)</sub> | V <sub>IN</sub> =5.5V or GND, V <sub>CC</sub> =0 ~ 5.5V                                               |                      |     | ± 5                  | μA   |
| Power OFF Leakage Current                         | I <sub>OFF</sub>     | V <sub>IN</sub> or V <sub>OUT</sub> =5.5V, V <sub>CC</sub> =0V                                        |                      |     | ± 10                 | μA   |
| Quiescent Supply Current                          | I <sub>Q</sub>       | V <sub>IN</sub> =V <sub>CC</sub> or GND, I <sub>OUT</sub> =0A, V <sub>CC</sub> =1.65 ~ 5.5V           |                      |     | 10                   | μA   |
| Additional Quiescent Supply Current Per Input Pin | ΔI <sub>Q</sub>      | V <sub>CC</sub> =3 ~ 5.5V, One input at V <sub>CC</sub> -0.6V, Other inputs at V <sub>CC</sub> or GND |                      |     | 500                  | μA   |
| Input Capacitance                                 | C <sub>I</sub>       | V <sub>CC</sub> =3.3V, V <sub>IN</sub> =V <sub>CC</sub> or GND                                        |                      | 4   |                      | pF   |

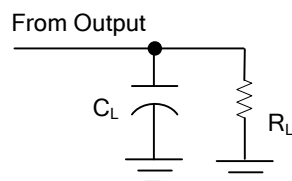
### ■ SWITCHING CHARACTERISTICS (T<sub>A</sub> = 25°C)

| PARAMETER                                          | SYMBOL                              | TEST CONDITIONS                                 | MIN | TYP | MAX | UNIT |
|----------------------------------------------------|-------------------------------------|-------------------------------------------------|-----|-----|-----|------|
| Propagation delay from input (A or B) to output(Y) | t <sub>PLH</sub> / t <sub>PHL</sub> | V <sub>CC</sub> =1.8±0.15V, R <sub>L</sub> =1MΩ | 1.9 |     | 7.2 | ns   |
|                                                    |                                     | V <sub>CC</sub> =2.5±0.2V, R <sub>L</sub> =1MΩ  | 0.8 |     | 4.4 | ns   |
|                                                    |                                     | V <sub>CC</sub> =3.3±0.3V, R <sub>L</sub> =1MΩ  | 0.8 |     | 3.6 | ns   |
|                                                    |                                     | V <sub>CC</sub> =5±0.5V, R <sub>L</sub> =1MΩ    | 0.8 |     | 3.4 | ns   |
|                                                    | t <sub>PLH</sub> / t <sub>PHL</sub> | V <sub>CC</sub> =1.8±0.15V, R <sub>L</sub> =1KΩ | 2.8 |     | 8   | ns   |
|                                                    |                                     | V <sub>CC</sub> =2.5±0.2V, R <sub>L</sub> =500Ω | 1.2 |     | 5.5 | ns   |
|                                                    |                                     | V <sub>CC</sub> =3.3±0.3V, R <sub>L</sub> =500Ω | 1   |     | 4.5 | ns   |
|                                                    |                                     | V <sub>CC</sub> =5±0.5V, R <sub>L</sub> =500Ω   | 1   |     | 4   | ns   |

### ■ OPERATING CHARACTERISTICS (T<sub>A</sub> = 25°C)

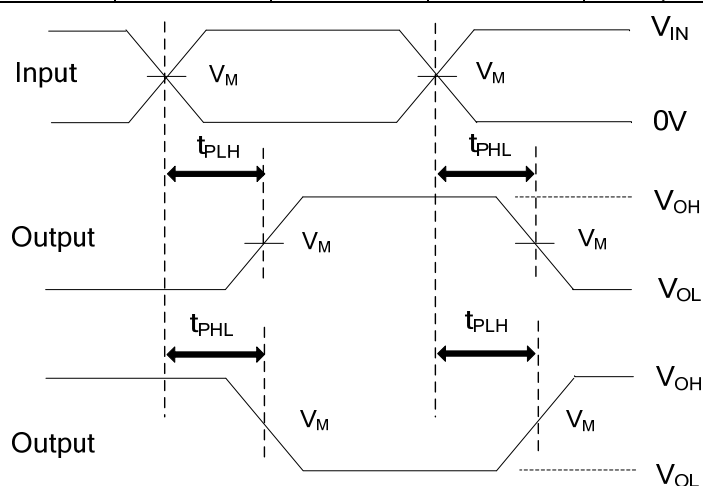
| PARAMETER                     | SYMBOL          | TEST CONDITIONS       | MIN | TYP | MAX | UNIT |
|-------------------------------|-----------------|-----------------------|-----|-----|-----|------|
| Power Dissipation Capacitance | C <sub>PD</sub> | V <sub>CC</sub> =1.8V |     | 23  |     | pF   |
|                               |                 | V <sub>CC</sub> =2.5V |     | 23  |     | pF   |
|                               |                 | V <sub>CC</sub> =3.3V |     | 23  |     | pF   |
|                               |                 | V <sub>CC</sub> =5.0V |     | 25  |     | pF   |

## ■ TEST CIRCUIT AND WAVEFORMS



TEST CIRCUIT

| $V_{CC}$         | Inputs   |              | $V_M$      | $C_L$ | $R_L$       |
|------------------|----------|--------------|------------|-------|-------------|
|                  | $V_{IN}$ | $t_R, t_F$   |            |       |             |
| $1.8V \pm 0.15V$ | $V_{CC}$ | $\leq 2ns$   | $V_{CC}/2$ | 15pF  | 1M $\Omega$ |
| $2.5V \pm 0.2V$  | $V_{CC}$ | $\leq 2ns$   | $V_{CC}/2$ | 15pF  | 1M $\Omega$ |
| $3.3V \pm 0.3V$  | 3V       | $\leq 2.5ns$ | 1.5V       | 15pF  | 1M $\Omega$ |
| $5V \pm 0.5V$    | $V_{CC}$ | $\leq 2.5ns$ | $V_{CC}/2$ | 15pF  | 1M $\Omega$ |

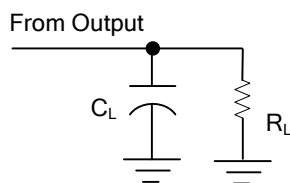


PROPAGATION DELAY TIMES

Note:  $C_L$  includes probe and jig capacitance.

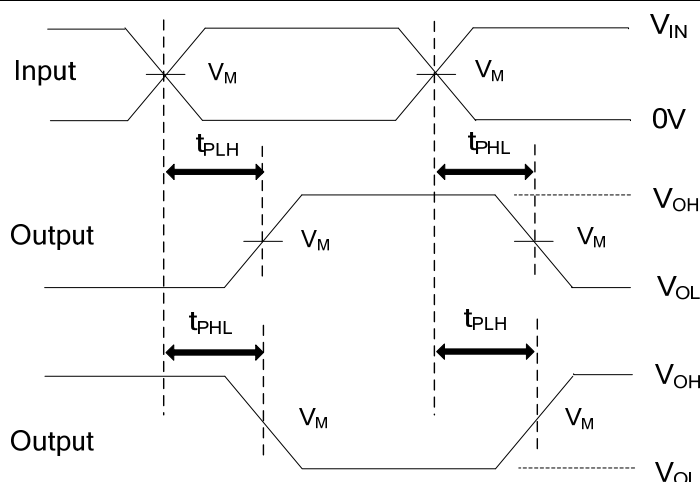
All input pulses are supplied by generators having the following characteristics:  $P_{RR} \leq 10MHz$ ,  $Z_O = 50\Omega$ .

## ■ TEST CIRCUIT AND WAVEFORMS(Cont.)



TEST CIRCUIT

| $V_{CC}$         | Inputs   |              | $V_M$      | $C_L$ | $R_L$        |
|------------------|----------|--------------|------------|-------|--------------|
|                  | $V_{IN}$ | $t_R, t_F$   |            |       |              |
| $1.8V \pm 0.15V$ | $V_{CC}$ | $\leq 2ns$   | $V_{CC}/2$ | 30pF  | 1K $\Omega$  |
| $2.5V \pm 0.2V$  | $V_{CC}$ | $\leq 2ns$   | $V_{CC}/2$ | 30pF  | 500 $\Omega$ |
| $3.3V \pm 0.3V$  | 3V       | $\leq 2.5ns$ | 1.5V       | 50pF  | 500 $\Omega$ |
| $5V \pm 0.5V$    | $V_{CC}$ | $\leq 2.5ns$ | $V_{CC}/2$ | 50pF  | 500 $\Omega$ |



PROPAGATION DELAY TIMES

Note:  $C_L$  includes probe and jig capacitance.

All input pulses are supplied by generators having the following characteristics:  $P_{RR} \leq 10MHz$ ,  $Z_O = 50\Omega$ .

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