



## U74LVC1G09

CMOS IC

### SINGLE 2-INPUT POSITIVE-AND GATE WITH OPEN-DRAIN OUTPUT

#### DESCRIPTION

The **U74LVC1G09** is a single 2-input AND gate with open-drain output . It performs the Boolean function  $Y = A \bullet B$  or  $Y = \overline{A + B}$  in positive logic . For digital operation this device must have a external pull-up resistor to establish a logic HIGH-level.

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

#### FEATURES

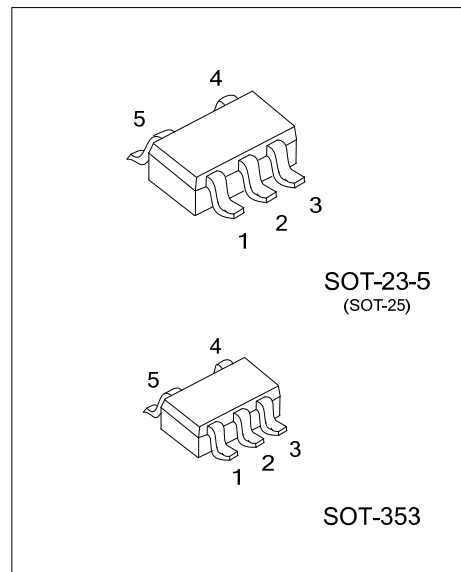
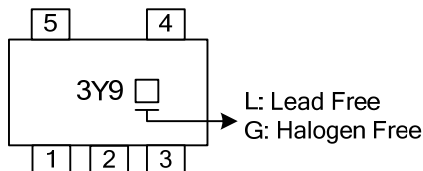
- \* Operate from 1.65V to 5.5V
- \* Inputs accept voltages to 5.5V
- \*  $I_{off}$  supports partial-power-down mode
- \*  $\pm 24mA$  output drive( $V_{CC}=3.3V$ )
- \* Low power dissipation
- \* High noise immunity

#### ORDERING INFORMATION

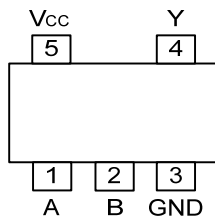
Ordering Number		Package	Packing
Lead Free	Halogen Free		
U74LVC1G09L-AE5-R	U74LVC1G09G-AE5-R	SOT-23-5	Tape Reel
U74LVC1G09L-AL5-R	U74LVC1G09G-AL5-R	SOT-353	Tape Reel

<p>U74LVC1G09L-AE5-R</p> <p>(1) Packing Type (2) Package Type (3) Lead Free</p>	<p>(1) R: Tape Reel (2) AE5: SOT-23-5, AL5: SOT-353 (3) G: Halogen Free, L: Lead Free</p>
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#### MARKING



■ PIN CONFIGURATION

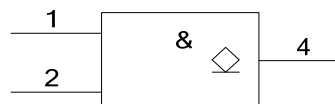
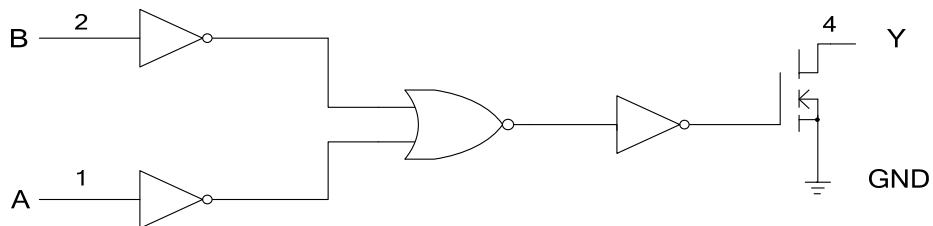


■ FUNCTION TABLE

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

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

■ LOGIC DIAGRAM (positive logic)



IEC logic symbol

### ■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	$V_{CC}$	-0.5 ~ +6.5	V
Input Voltage	$V_{IN}$	-0.5 ~ +6.5	V
Output Voltage	$V_{OUT}$	Output in the high or low state	-0.5 ~ +6.5
		Output in the high-impedance or power-off state	-0.5 ~ +6.5
$V_{CC}$ or GND Current	$I_{CC}$	±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
Operating Temperature	$T_{OPR}$	-40~+85	°C
Storage Temperature Range	$T_{STG}$	-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.

### ■ 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	$V_{OUT}$	active mode	0		$V_{CC}$	V
		high-impedance mode	0		5.5	V
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
Input Transition Rise or Fall Rate	$\Delta t/\Delta V$	$V_{CC}=1.8V\pm 0.15V, 2.5V\pm 0.2V$			20	ns/V
		$V_{CC}=3.3V\pm 0.3V$			10	ns/V
		$V_{CC}=5V\pm 0.5V$			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> =3.0V~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> =3.0V~3.6V			0.8	V
		V <sub>CC</sub> =4.5V~5.5V			0.3*V <sub>CC</sub>	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			±1	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>CC</sub>	V <sub>IN</sub> =5.5V or GND, I <sub>OUT</sub> =0 V <sub>CC</sub> =1.65~5.5V			10	μA
Additional Quiescent Supply Current Per Input Pin	ΔI <sub>CC</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		3.5		pF
Output Capacitance	C <sub>OUT</sub>	V <sub>CC</sub> =3.3V, V <sub>IN</sub> =V <sub>CC</sub> or GND		4.5		pF

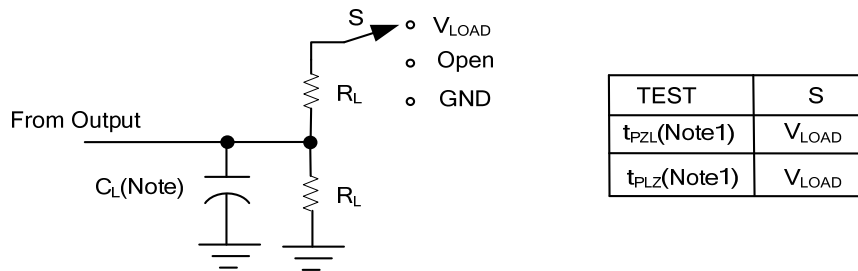
■ SWITCHING CHARACTERISTICS (T<sub>A</sub>=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Propagation delay from input (A or B) to output(Y)	t <sub>PZL</sub> / t <sub>PLZ</sub>	V <sub>CC</sub> =1.8±0.15V, C <sub>L</sub> =15pF, R <sub>L</sub> =1MΩ	2.9		7.4	ns	
		V <sub>CC</sub> =2.5±0.2V, C <sub>L</sub> =15pF, R <sub>L</sub> =1MΩ	1.7		3.8	ns	
		V <sub>CC</sub> =3.3±0.3V, C <sub>L</sub> =15pF, R <sub>L</sub> =1MΩ	1.5		4.9	ns	
		V <sub>CC</sub> =5±0.5V, C <sub>L</sub> =15pF, R <sub>L</sub> =1MΩ	0.9		2.4	ns	
		V <sub>CC</sub> =1.8±0.15V, R <sub>L</sub> =1KΩ	C <sub>L</sub> =30pF or 50pF	2.8		10	ns
		V <sub>CC</sub> =2.5±0.2V, R <sub>L</sub> =500Ω		1.6		6.0	ns
		V <sub>CC</sub> =3.3±0.3V, R <sub>L</sub> =500Ω		1.4		4.5	ns
		V <sub>CC</sub> =5±0.5V, R <sub>L</sub> =500Ω		1.0		3.9	ns

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

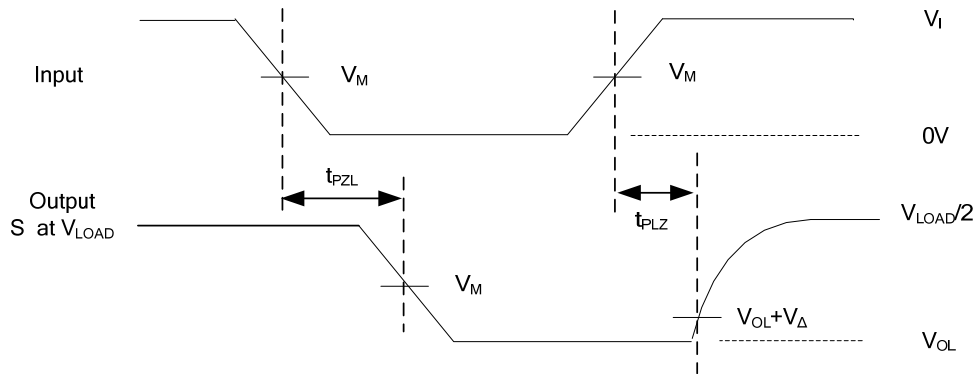
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Dissipation Capacitance	C <sub>PD</sub>	V <sub>CC</sub> =1.8V, f=10MHz		3		pF
		V <sub>CC</sub> =2.5V, f=10MHz		3		pF
		V <sub>CC</sub> =3.3V, f=10MHz		4		pF
		V <sub>CC</sub> =5V, f=10MHz		6		pF

## ■ TEST CIRCUIT AND WAVEFORMS



Note: Since this device has open drain outputs, the  $t_{PLZ}$  and  $t_{PZL}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

$V_{CC}$	$V_{IN}$	$t_R/t_F$	$V_M$	$V_{LOAD}$	$C_L$	$R_L$	$V_{\Delta}$
$1.8V \pm 0.15V$	$V_{CC}$	$\leq 2ns$	$V_{CC}/2$	$2 * V_{CC}$	15pF	1M $\Omega$	0.15V
$2.5V \pm 0.2V$	$V_{CC}$	$\leq 2ns$	$V_{CC}/2$	$2 * V_{CC}$	15pF	1M $\Omega$	0.15V
$3.3V \pm 0.3V$	3 V	$\leq 2.5ns$	1.5V	6V	15pF	1M $\Omega$	0.3V
$5V \pm 0.5V$	$V_{CC}$	$\leq 2.5ns$	$V_{CC}/2$	$2 * V_{CC}$	15pF	1M $\Omega$	0.3V
$1.8V \pm 0.15V$	$V_{CC}$	$\leq 2ns$	$V_{CC}/2$	$2 * V_{CC}$	30pF	1K $\Omega$	0.15V
$2.5V \pm 0.2V$	$V_{CC}$	$\leq 2ns$	$V_{CC}/2$	$2 * V_{CC}$	30pF	500 $\Omega$	0.15V
$3.3V \pm 0.3V$	3 V	$\leq 2.5ns$	1.5V	6V	50pF	500 $\Omega$	0.3V
$5V \pm 0.5V$	$V_{CC}$	$\leq 2.5ns$	$V_{CC}/2$	$2 * V_{CC}$	50pF	500 $\Omega$	0.3V



Note:  $C_L$  includes probe and jig capacitance.  
 All input pulses are supplied by generators having the following characteristics: PRR  $\leq 10MHz$ ,  $Z_0 = 50\Omega$ .  
 Since this device has open drain outputs, the  $t_{PLZ}$  and  $t_{PZL}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

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