

# SN54LS15, SN54S15, SN74LS15, SN74S15 TRIPLE 3-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS

SDLS133 – APRIL 1985 – REVISED MARCH 1988

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages, and Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

## description

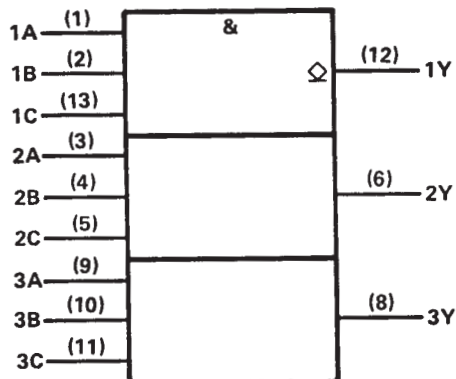
These devices contain three independent 3-input AND gates with open-collector outputs. The open-collector outputs require pull-up resistors to perform correctly. They may be connected to other open-collector outputs to implement active-low wired-OR or active-high wired-AND functions. Open-collector devices are often used to generate high  $V_{OH}$  levels.

The SN54LS15 and SN54S15 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74LS15 and SN74S15 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

FUNCTION TABLE (each gate)

INPUTS			OUTPUT
A	B	C	Y
H	H	H	H
L	X	X	L
X	L	X	L
X	X	L	L

## logic symbol†

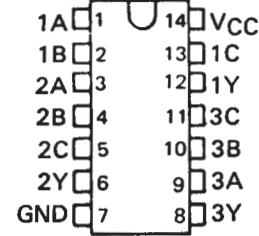


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

Pin numbers shown are for D, J, N, and W packages.

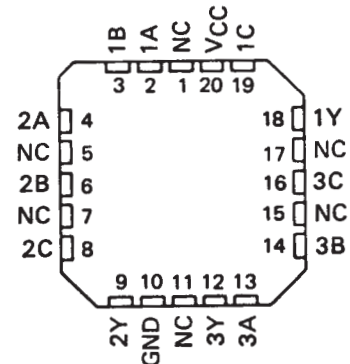
SN54LS15, SN54S15 . . . J OR W PACKAGE  
SN74LS15, SN74S15 . . . D OR N PACKAGE

(TOP VIEW)



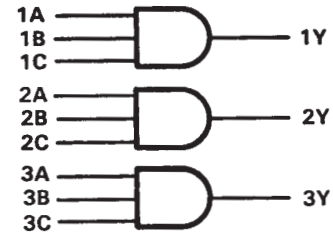
SN54LS15, SN54S15 . . . FK PACKAGE

(TOP VIEW)



NC—No internal connection

## logic diagram (positive logic)



$$Y = A \cdot B \cdot C \text{ or}$$

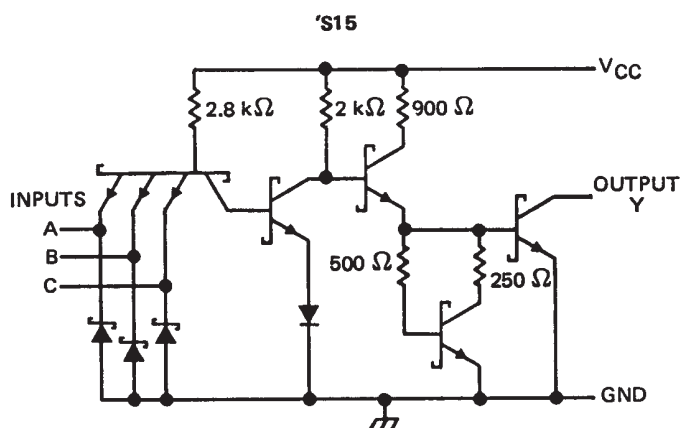
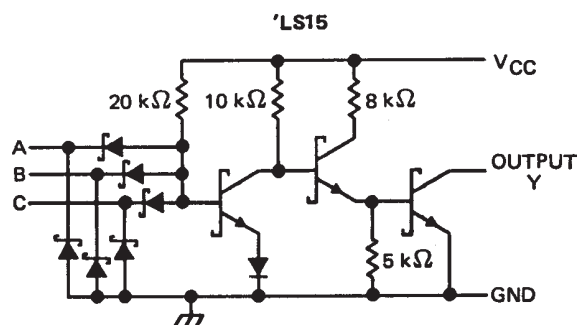
$$Y = \overline{A} + \overline{B} + \overline{C}$$

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# SN54LS15, SN54S15, SN74LS15, SN74S15 TRIPLE 3-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS

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## schematics (each gate)



Resistor values shown are nominal.

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, $V_{CC}$ (See Note 1)	7 V
Input voltage: 'S15	5.5 V
'LS15	7 V
Off-state output voltage	7 V
Operating free-air temperature range: SN54'	-55°C to 125°C
SN74'	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

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SN54LS15, SN54S15,  
SN74LS15, SN74S15

# TRIPLE 3-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS

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## recommended operating conditions

	SN54LS15			SN74LS15			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub> High-level input voltage	2			2			V
V <sub>IL</sub> Low-level input voltage			0.7			0.8	V
V <sub>OH</sub> High-level output voltage			5.5			5.5	V
I <sub>OL</sub> Low-level output current			4			8	mA
T <sub>A</sub> Operating free-air temperature	– 55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS†	SN54LS15			SN74LS15			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = – 18 mA			– 1.5			– 1.5	V
I <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>OH</sub> = 5.5 V			0.1			0.1	mA
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 4 mA	0.25	0.4		0.25	0.4		V
	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 8 mA				0.35	0.5		
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V			0.1			0.1	mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V			20			20	μA
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V			– 0.4			– 0.4	mA
I <sub>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V	1.8	3.6		1.8	3.6		mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0 V	3.3	6.6		3.3	6.6		mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

## switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	A, B, or C	Y	R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 15 pF		20	35	ns
t <sub>PHL</sub>					17	35	ns

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

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**recommended operating conditions**

	SN54S15			SN74S15			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$ Supply voltage	4.5	5	5.5	4.75	5	5.25	V
$V_{IH}$ High-level input voltage	2			2			V
$V_{IL}$ Low-level input voltage			0.8			0.8	V
$V_{OH}$ High-level output voltage			5.5			5.5	V
$I_{OL}$ Low-level output current			20			20	mA
$T_A$ Operating free-air temperature	– 55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS†	MIN	TYP‡	MAX	UNIT
$V_{IK}$	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$		– 1.2		V
$I_{OH}$	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{OH} = 5.5 \text{ V}$		0.25		mA
$V_{OL}$	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 20 \text{ mA}$		0.5		V
$I_I$	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$		1		mA
$I_{IH}$	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$		50		μA
$I_{IL}$	$V_{CC} = \text{MAX}, V_I = 0.5 \text{ V}$		– 2		mA
$I_{CCH}$	$V_{CC} = \text{MAX}, V_I = 4.5 \text{ V}$		10.5	19.5	mA
$I_{CCL}$	$V_{CC} = \text{MAX}, V_I = 0 \text{ V}$		24	42	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ .

**switching characteristics,  $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$  (see note 2)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	A, B, or C	Y	$R_L = 280 \Omega, C_L = 15 \text{ pF}$	5.5	8.5		ns
$t_{PHL}$				6	9		ns
$t_{PLH}$			$R_L = 280 \Omega, C_L = 50 \text{ pF}$	8.5			ns
$t_{PHL}$				8			ns

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

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