

# TYPES SN54H15, SN54LS15, SN54S15, SN74H15, SN74LS15, SN74S15 TRIPLE 3-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS

REVISED APRIL 1985

- Package Options Include Both Plastic and Ceramic Chip Carriers in Addition to 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 SN54H15, SN54LS15, and SN54S15 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74H15, 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 diagram (each gate)

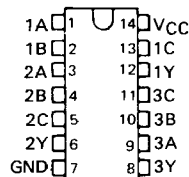


## positive logic

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

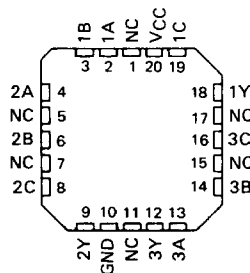
SN54H15, SN54LS15, SN54S15 ... J OR W PACKAGE  
SN74H15 ... J OR N PACKAGE  
SN74LS15, SN74S15 ... D, J OR N PACKAGE

(TOP VIEW)



SN54LS15, SN54S15 ... FK PACKAGE  
SN74LS15, SN74S15 ... FN PACKAGE

(TOP VIEW)



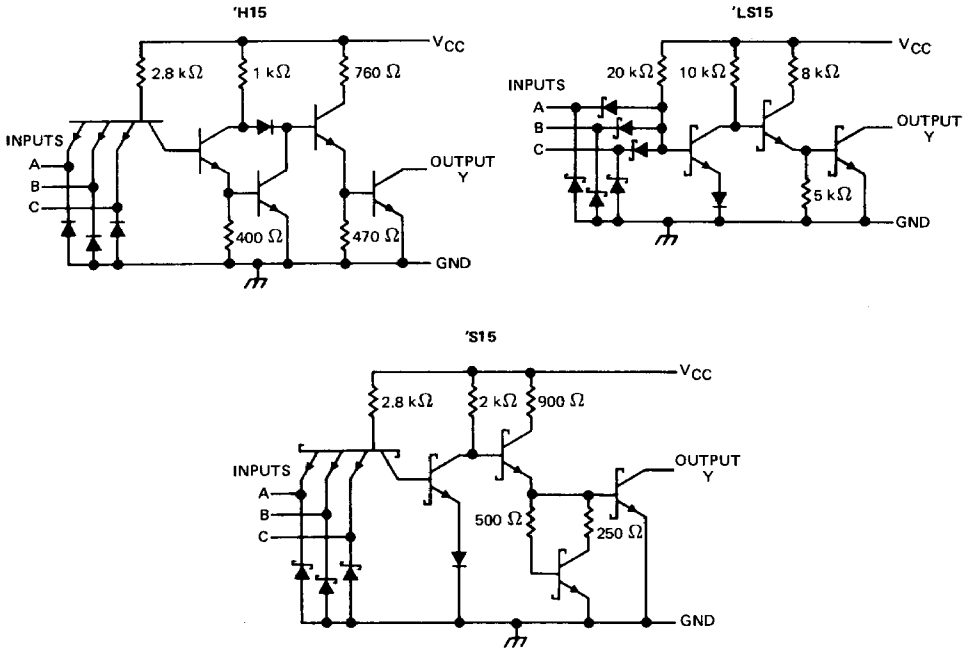
NC - No internal connection

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TTL DEVICES

**TYPES SN54H15, SN54LS15, SN54S15,  
SN74H15, SN74LS15, SN74S15  
TRIPLE 3-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS**

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: 'H15, '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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# TYPES SN54H15, SN74H15 TRIPLE 3-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS

## recommended operating conditions

	SN54H15			SN74H15			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			$^{\circ}\text{C}$

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

PARAMETER	TEST CONDITIONS†	SN54H15			SN74H15			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
$V_{IK}$	$V_{CC} = \text{MIN}$ , $I_I = -8 \text{ mA}$	- 1.5			- 1.5			V
$I_{OH}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $V_{OH} = 5.5 \text{ V}$	0.25			0.25			mA
$V_{OL}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $I_{OL} = 20 \text{ mA}$	0.2	0.4		0.2	0.4	V	
$I_I$	$V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$	0.1			0.1			mA
$I_{IH}$	$V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$	50			50			$\mu\text{A}$
$I_{IL}$	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$	- 2			- 2			mA
$I_{CCH}$	$V_{CC} = \text{MAX}$ , $V_I = 4.5 \text{ V}$	15	25		15	25	mA	
$I_{CCL}$	$V_{CC} = \text{MAX}$ , $V_I = 0 \text{ V}$	30	48		30	48	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	$R_L = 280 \Omega$ , $C_L = 25 \text{ pF}$	12		18	ns
$t_{PHL}$				9		13	ns

NOTE 2: See General Information Section for load circuits and voltage waveforms.

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

## recommended operating conditions

	SN54LS15			SN74LS15			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	0.7			0.8			V		
$V_{OH}$ High-level output voltage	5.5			5.5			V		
$I_{OL}$ Low-level output current	4			8			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†	SN54LS15			SN74LS15			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
$V_{IK}$	$V_{CC} = \text{MIN}$ , $I_I = -18 \text{ mA}$	-1.5			-1.5			V
$I_{OH}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $V_{OH} = 5.5 \text{ V}$	0.1			0.1			mA
$V_{OL}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $I_{OL} = 4 \text{ mA}$	0.25	0.4		0.25	0.4	V	
	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $I_{OL} = 8 \text{ mA}$				0.35	0.5		
$I_I$	$V_{CC} = \text{MAX}$ , $V_I = 7 \text{ V}$	0.1			0.1			mA
$I_{IH}$	$V_{CC} = \text{MAX}$ , $V_I = 2.7 \text{ V}$	20			20			µA
$I_{IL}$	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$	-0.4			-0.4			mA
$I_{CCH}$	$V_{CC} = \text{MAX}$ , $V_I = 4.5 \text{ V}$	1.8	3.6		1.8	3.6	mA	
$I_{CCL}$	$V_{CC} = \text{MAX}$ , $V_I = 0 \text{ V}$	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  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

## 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	$R_L = 2 \text{ k}\Omega$ ,	$C_L = 15 \text{ pF}$	20	35		ns
$t_{PHL}$					17	35		ns

NOTE 2: See General Information Section for load circuits and voltage waveforms.

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TTL DEVICES

TYPES SN54S15, SN74S15  
**TRIPLE 3-INPUT POSITIVE-AND GATES WITH OPEN-COLLECTOR OUTPUTS**

**recommended operating conditions**

	SN54S15			SN74S15			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	0.8			0.8			V
V <sub>OH</sub> High-level output voltage	5.5			5.5			V
I <sub>OL</sub> Low-level output current	20			20			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†	MIN	TYP‡	MAX	UNIT
V <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -12 mA			-1.2	V
I <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>OH</sub> = 5.5 V			0.25	mA
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 16 mA			0.5	V
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V			1	mA
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V			50	μA
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5 V			-2	mA
I <sub>CCH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V		10.5	19.5	mA
I <sub>CCL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0 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<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> = 280 Ω, C <sub>L</sub> = 15 pF	5.5	8.5		ns
t <sub>PHL</sub>				6	9		ns
t <sub>PLH</sub>			R <sub>L</sub> = 280 Ω, C <sub>L</sub> = 50 pF	8.5			ns
t <sub>PHL</sub>				8			ns

NOTE 2: See General Information Section for load circuits and voltage waveforms.

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