

# MC1488, SN55188, SN75188 QUADRUPLE LINE DRIVERS

SLLS094B – SEPTEMBER 1983 – REVISED MAY 1995

- Meet or Exceed the Requirements of ANSI EIA/TIA-232-E and ITU Recommendation V.28
- Designed to Be Interchangeable With Motorola MC1488
- Current-Limited Output: 10 mA Typical
- Power-Off Output Impedance: 300  $\Omega$  Minimum
- Slew Rate Control by Load Capacitor
- Flexible Supply Voltage Range
- Input Compatible With Most TTL Circuits

## description

The MC1488, SN55188, and SN75188 are monolithic quadruple line drivers designed to interface data terminal equipment with data communications equipment in conformance with ANSI EIA/TIA-232-E using a diode in series with each supply-voltage terminal as shown under typical applications.

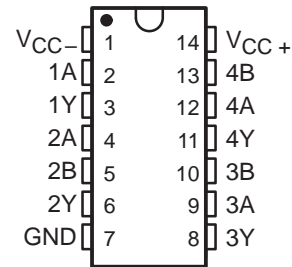
The SN55188 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The MC1488 and SN75188 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

**FUNCTION TABLE**  
(drivers 2–4)

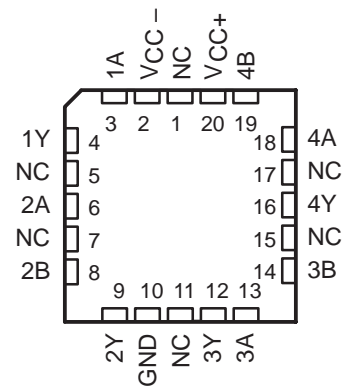
A	B	Y
H	H	L
L	X	H
X	L	H

H = high level, L = low level,  
X = irrelevant

SN55188 . . . J OR W PACKAGE  
MC1488, SN75188 . . . D OR N PACKAGE  
(TOP VIEW)



SN55188 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

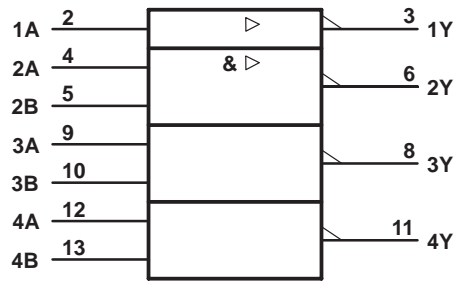
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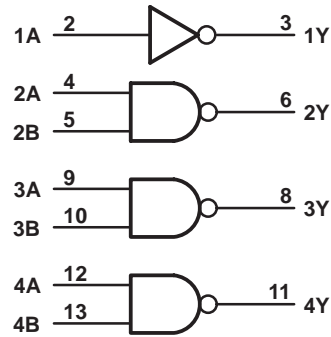
## logic symbol†



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

Pin numbers shown are for the D and N packages.

## logic diagram (positive logic)

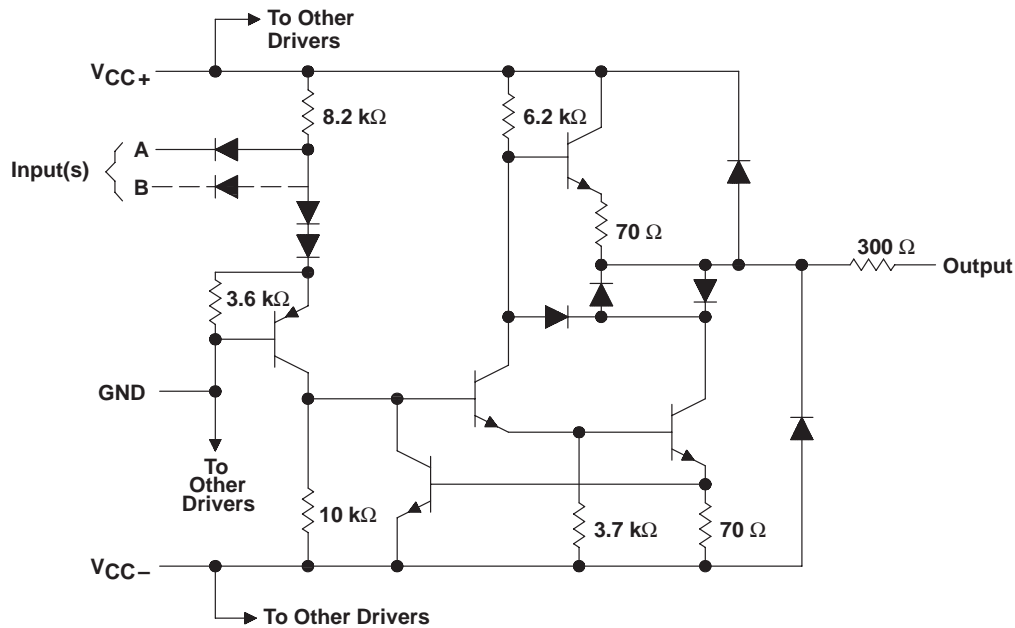


Positive logic

$$Y = \overline{A} \text{ (driver 1)}$$

$$Y = AB \text{ or } A + B \text{ (drivers 2 thru 4)}$$

## schematic (each driver)



Resistor values shown are nominal.

**absolute maximum ratings over operating free-air temperature (unless otherwise noted)†**

Supply voltage, $V_{CC+}$ at (or below) 25°C free-air temperature (see Notes 1 and 2)	15 V
Supply voltage, $V_{CC-}$ at (or below) 25°C free-air temperature (see Notes 1 and 2)	-15 V
Input voltage, $V_I$	-15 V to 7 V
Output voltage, $V_O$	-15 V to 15 V
Continuous total power dissipation (see Note 2)	See Dissipation Rating Table
Operating free-air temperature range, $T_A$ : SN55188	-55°C to 125°C
MC1488, SN75188	0°C to 70°C
Storage temperature range, $T_{stg}$	-65°C to 150°C
Case temperature for 60 seconds, FK package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or N package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J or W package	300°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. All voltage values are with respect to the network ground terminal.  
2. For operation above 25°C free-air temperature, refer to the maximum supply voltage curve, Figure 6. In the FK and J packages, SN55188 chips are alloy mounted.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
D	950 mW	7.6 mW/°C	608 mW	–
FK	1375 mW	11.0 mW/°C	880 mW	275 mW
J	1375 mW	11.0 mW/°C	880 mW	275 mW
N	1150 mW	9.2 mW/°C	736 mW	–
W	1000 mW	8.0 mW/°C	640 mW	200 mW

**recommended operating conditions**

	SN55188			MC1488, SN75188			UNIT		
	MIN	NOM	MAX	MIN	NOM	MAX			
Supply voltage, $V_{CC+}$	7.5	9	15	7.5	9	15	V		
Supply voltage, $V_{CC-}$	-7.5	-9	-15	-7.5	-9	-15	V		
High-level input voltage, $V_{IH}$	1.9			1.9			V		
Low-level input voltage, $V_{IL}$	0.8			0.8			V		
Operating free-air temperature, $T_A$	-55			125			0	70	°C

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electrical characteristics over operating free-air temperature range,  $V_{CC\pm} = \pm 9\text{ V}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS		SN55188			MC1488, SN75188			UNIT	
			MIN	TYP†	MAX	MIN	TYP†	MAX		
V <sub>OH</sub> High-level output voltage	V <sub>IL</sub> = 0.8 V, R <sub>L</sub> = 3 kΩ	V <sub>CC+</sub> = 9 V, V <sub>CC-</sub> = -9 V	6	7		6	7		V	
		V <sub>CC+</sub> = 13.2 V, V <sub>CC-</sub> = -13.2 V	9	10.5		9	10.5			
V <sub>OL</sub> Low-level output voltage	V <sub>IH</sub> = 1.9 V, R <sub>L</sub> = 3 kΩ	V <sub>CC+</sub> = 9 V, V <sub>CC-</sub> = -9 V		-7‡	-6		-7	-6	V	
		V <sub>CC+</sub> = 13.2 V, V <sub>CC-</sub> = -13.2 V		-10.5‡	-9		-10.5	-9		
I <sub>IH</sub> High-level input current	V <sub>I</sub> = 5 V				10			10	μA	
I <sub>IL</sub> Low-level input current	V <sub>I</sub> = 0				-1	-1.6		-1	-1.6	mA
I <sub>OS(H)</sub> Short-circuit output current at high level§	V <sub>I</sub> = 0.8 V, V <sub>O</sub> = 0		-4.6	-9	-13.5	-6	-9	-12	mA	
I <sub>OS(L)</sub> Short-circuit output current at low level§	V <sub>I</sub> = 1.9 V, V <sub>O</sub> = 0		4.6	9	13.5	6	9	12	mA	
r <sub>o</sub> Output resistance, power off	V <sub>CC+</sub> = 0, V <sub>O</sub> = -2 V to 2 V V <sub>CC-</sub> = 0,		300			300			Ω	
I <sub>CC+</sub> Supply current from V <sub>CC+</sub>	V <sub>CC+</sub> = 9 V, No load	All inputs at 1.9 V		15	20		15	20	mA	
		All inputs at 0.8 V		4.5	6		4.5	6		
	V <sub>CC+</sub> = 12 V, No load	All inputs at 1.9 V		19	25		19	25		
		All inputs at 0.8 V		5.5	7		5.5	7		
	V <sub>CC+</sub> = 15 V, No load, T <sub>A</sub> = 25°C	All inputs at 1.9 V			34			34		
		All inputs at 0.8 V			12			12		
I <sub>CC-</sub> Supply current from I <sub>CC-</sub>	V <sub>CC-</sub> = -9 V, No load	All inputs at 1.9 V		-13	-17		-13	-17	mA	
		All inputs at 0.8 V			-0.5			-0.015		
	V <sub>CC-</sub> = -12 V, No load	All inputs at 1.9 V		-18	-23		-18	-23		
		All inputs at 0.8 V			-0.5			-0.015		
	V <sub>CC-</sub> = -15 V, No load, T <sub>A</sub> = 25°C	All inputs at 1.9 V			-34			-34		
		All inputs at 0.8 V			-2.5			-2.5		
P <sub>D</sub> Total power dissipation	V <sub>CC+</sub> = 9 V, No load	V <sub>CC-</sub> = -9 V,				333			mW	
	V <sub>CC+</sub> = 12 V, No load	V <sub>CC-</sub> = -12 V,				576				

† All typical values are at T<sub>A</sub> = 25°C.

‡ The algebraic convention, in which the less positive (more negative) limit is designated as minimum, is used in this data sheet for logic voltage levels only, e.g., if -6 V is a maximum, the typical value is a more negative voltage.

§ Not more than one output should be shorted at a time.



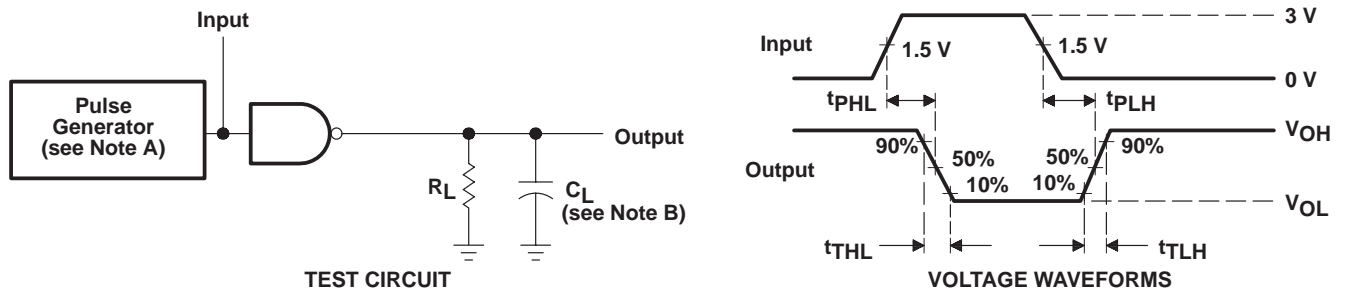
switching characteristics,  $V_{CC\pm} = \pm 9\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ Propagation delay time, low- to high-level output	$R_L = 3\text{ k}\Omega$ , See Figure 1 $C_L = 15\text{ pF}$		220	350	ns
$t_{PHL}$ Propagation delay time, high- to low-level output			100	175	ns
$t_{TLH}$ Transition time, low- to high-level output†			55	100	ns
$t_{THL}$ Transition time, high- to low-level output†			45	75	ns
$t_{TLH}$ Transition time, low- to high-level output‡	$R_L = 3\text{ k}\Omega$ to $7\text{ k}\Omega$ , See Figure 1 $C_L = 2500\text{ pF}$		2.5		$\mu\text{s}$
$t_{THL}$ Transition time, high- to low-level output‡			3.0		$\mu\text{s}$

† Measured between 10% and 90% points of output waveform.

‡ Measured between 3 V and  $-3\text{ V}$  points on the output waveform (EIA/TIA-232-E conditions).

PARAMETER MEASUREMENT INFORMATION



- NOTES: A. The pulse generator has the following characteristics:  $t_w = 0.5\ \mu\text{s}$ ,  $\text{PRR} \leq 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ .  
B.  $C_L$  includes probe and jig capacitance.

Figure 1. Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS†

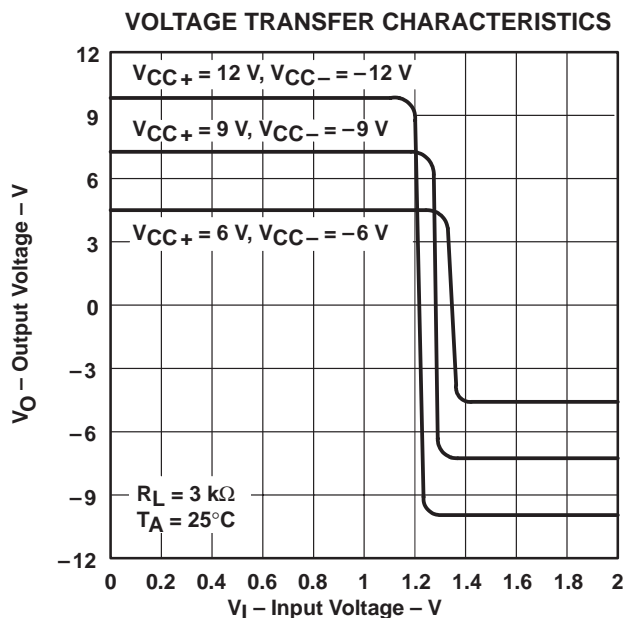


Figure 2

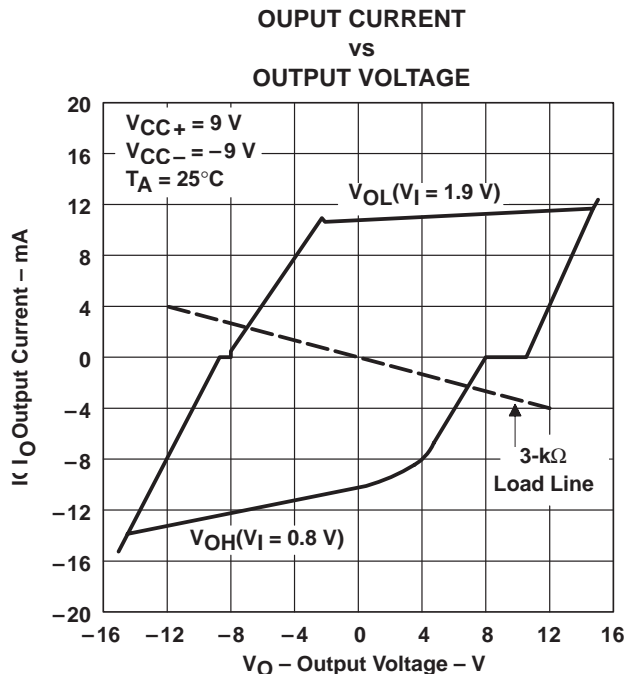


Figure 3

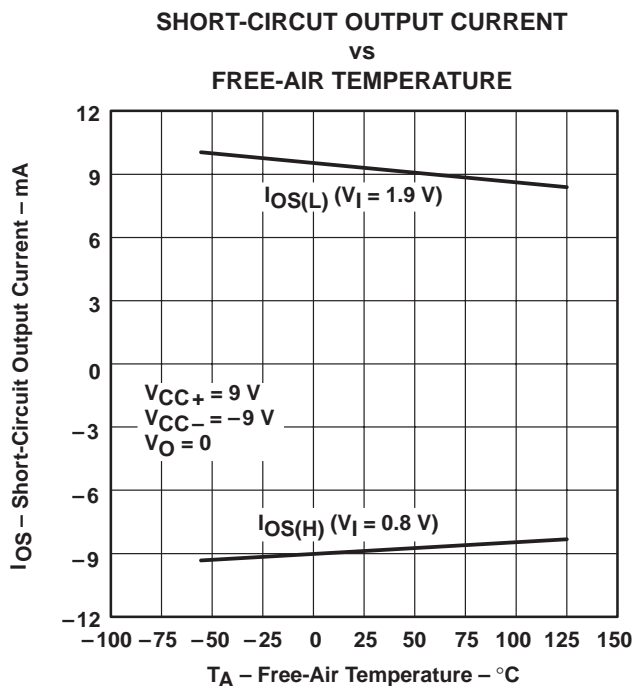


Figure 4

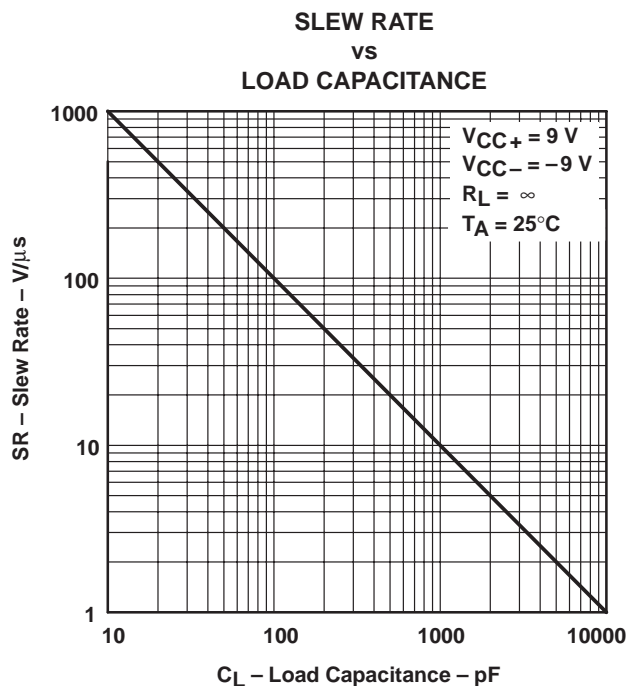


Figure 5

† Data for temperatures below 0°C and above 70°C are applicable to SN55188 circuit only.

THERMAL INFORMATION†

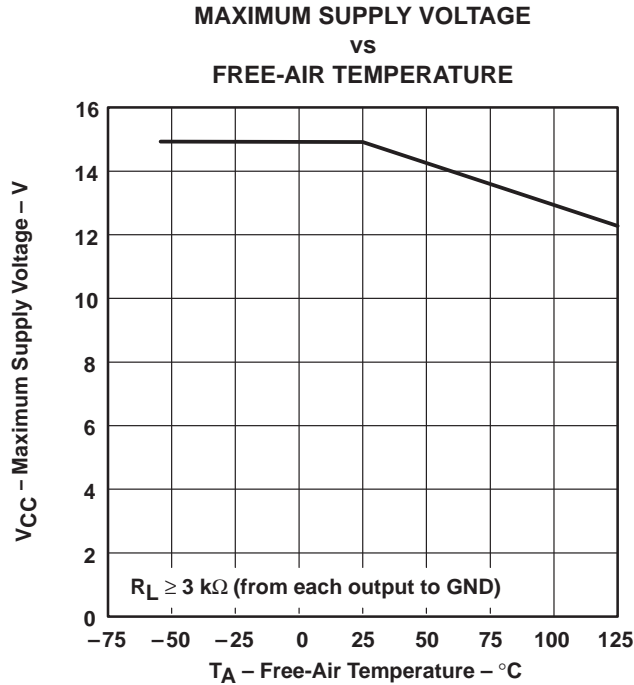


Figure 6

† Data for temperatures below 0°C and above 70°C are applicable to SN55188 circuit only.

APPLICATION INFORMATION

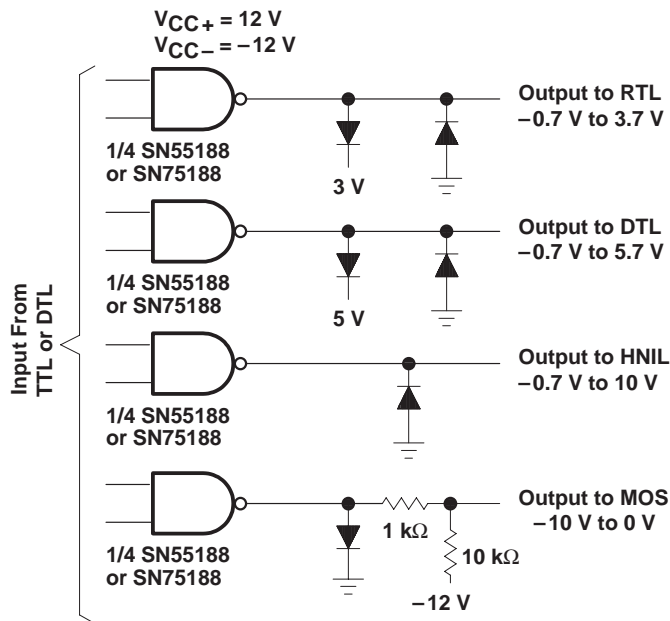
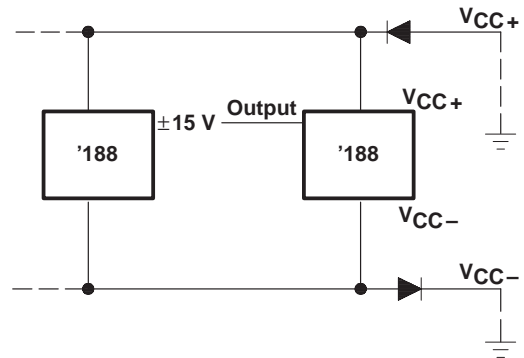


Figure 7. Logic Translator Applications



Diodes placed in series with the  $V_{CC+}$  and  $V_{CC-}$  leads will protect the SN55188/SN75188 in the fault condition in which the device outputs are shorted to  $\pm 15 \text{ V}$  and the power supplies are at low voltage and provide low-impedance paths to ground.

Figure 8. Power Supply Protection to Meet Power-Off Fault Conditions of ANSI EIA/TIA-232-E

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