



# FAST CMOS OCTAL BUFFER/LINE DRIVER

**IDT54/74FCT541/A/C**

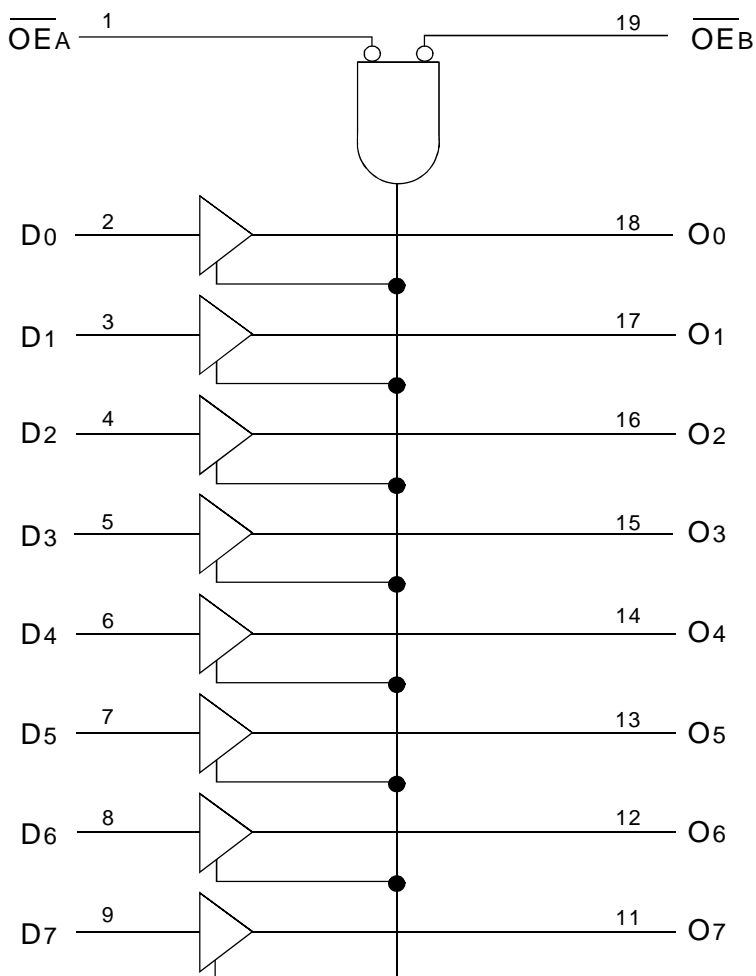
## FEATURES:

- IDT54/74FCT541 equivalent to FAST™ speed and drive
- IDT54/74FCT541A 25% faster than FAST
- IDT54/74FCT541C up to 55% faster than FAST
- IOL = 64mA (commercial) and 48mA (military)
- CMOS power levels (1mW typ. static)
- Military product compliant to MIL-STD-883, Class B
- Meets or exceeds JEDEC Standard 18 specifications
- Available in the following packages:
  - Commercial: SOIC
  - Military: CERDIP, LCC, CERPACK

## DESCRIPTION:

The IDT octal buffer/line drivers are built using an advanced dual metal CMOS technology. The FCT541 is designed to be employed as a memory and address driver, clock driver and bus-oriented transmitter/receiver which provides improved board density. The FCT541 is similar in function to the FCT244, except that the inputs and outputs are on opposite sides of the package. This pinout arrangement makes these devices especially useful as output ports for microprocessors and as backplane drivers, allowing ease of layout and greater board density.

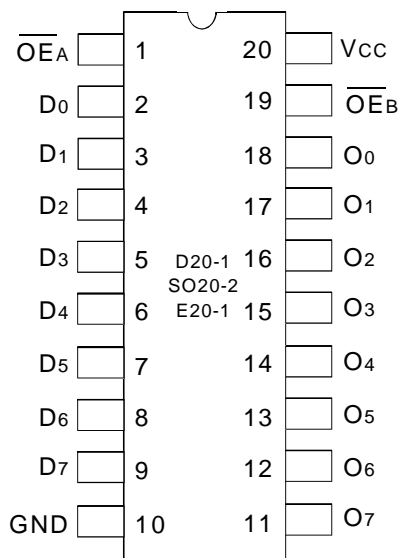
## FUNCTIONAL BLOCK DIAGRAM



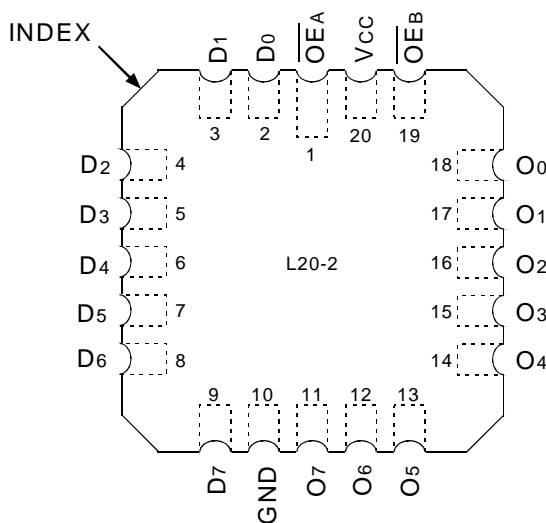
**MILITARY AND COMMERCIAL TEMPERATURE RANGES**

**JUNE 2000**

### PIN CONFIGURATION



CERDIP/ SOIC/ CERPACK  
TOP VIEW



LCC  
TOP VIEW

### ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Rating	Commercial	Military	Unit
V <sub>TERM</sub> <sup>(2)</sup>	Terminal Voltage with Respect to GND	-0.5 to +7	-0.5 to +7	V
V <sub>TERM</sub> <sup>(3)</sup>	Terminal Voltage with Respect to GND	-0.5 to V <sub>CC</sub>	-0.5 to V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature	0 to +70	-55 to +125	°C
T <sub>BIAS</sub>	Temperature Under Bias	-55 to +125	-65 to +135	°C
T <sub>STG</sub>	Storage Temperature	-55 to +125	-65 to +150	°C
P <sub>T</sub>	Power Dissipation	0.5	0.5	W
I <sub>OUT</sub>	DC Output Current	120	120	mA

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#### NOTES:

- Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability. No terminal voltage may exceed V<sub>CC</sub> by +.5V unless otherwise noted.
- Input and V<sub>CC</sub> terminals only.
- Outputs and I/O terminals only.

### CAPACITANCE (T<sub>A</sub> = +25°C, f = 1.0MHz)

Symbol	Parameter <sup>(1)</sup>	Conditions	Typ.	Max.	Unit
C <sub>IN</sub>	Input Capacitance	V <sub>IN</sub> = 0V	6	10	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>OUT</sub> = 0V	8	12	pF

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#### NOTE:

- This parameter is measured at characterization but not tested.

### PIN DESCRIPTION

Pin Names	Description
OE <sub>A</sub> , OE <sub>B</sub>	3-State Output Enable Inputs (Active LOW)
D <sub>x</sub>	Inputs
O <sub>x</sub>	Outputs

### FUNCTION TABLE(1)

Inputs			Output
OE <sub>A</sub>	OE <sub>B</sub>	D <sub>x</sub>	O <sub>x</sub>
L	L	L	L
L	L	H	H
H	H	X	Z

#### NOTE:

- H = High Voltage Level  
X = Don't Care  
L = Low Voltage Level  
Z = HIGH Impedance

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:  $V_{LC} = 0.2V$ ;  $V_{HC} = V_{CC} - 0.2V$

Commercial:  $T_A = 0^\circ C$  to  $+70^\circ C$ ,  $V_{CC} = 5.0V \pm 5\%$ ; Military:  $T_A = -55^\circ C$  to  $+125^\circ C$ ,  $V_{CC} = 5.0V \pm 10\%$

Symbol	Parameter	Test Conditions <sup>(1)</sup>		Min.	Typ. <sup>(2)</sup>	Max.	Unit
$V_{IH}$	Input HIGH Level	Guaranteed Logic HIGH Level		2	—	—	V
$V_{IL}$	Input LOW Level	Guaranteed Logic LOW Level		—	—	0.8	V
$I_{IH}$	Input HIGH Current	$V_{CC} = \text{Max.}$	$V_I = V_{CC}$	—	—	5	$\mu A$
$I_{IL}$	Input LOW Current		$V_I = 2.7V$	—	—	5 <sup>(4)</sup>	
			$V_I = 0.5V$	—	—	-5 <sup>(4)</sup>	
			$V_I = GND$	—	—	-5	
$I_{OZH}$	Off State (High Impedance) Output Current	$V_{CC} = \text{Max.}$	$V_O = V_{CC}$	—	—	10	$\mu A$
$I_{OZL}$			$V_O = 2.7V$	—	—	10 <sup>(4)</sup>	
			$V_O = 0.5V$	—	—	-10 <sup>(4)</sup>	
			$V_O = GND$	—	—	-10	
$V_{IK}$	Clamp Diode Voltage	$V_{CC} = \text{Min.}, I_N = -18mA$		—	-0.7	-1.2	V
$I_{OS}$	Short Circuit Current	$V_{CC} = \text{Max.}^{(3)}, V_O = GND$		-60	-120	—	mA
$V_{OH}$	Output HIGH Voltage	$V_{CC} = 3V, V_{IN} = V_{LC} \text{ or } V_{HC}, I_{OH} = -32\mu A$		$V_{HC}$	$V_{CC}$	—	V
		$V_{CC} = \text{Min.}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -300\mu A$	$V_{HC}$	$V_{CC}$	—	
			$I_{OH} = -12mA \text{ MIL.}$	2.4	4.3	—	
			$I_{OH} = -15mA \text{ COM'L.}$	2.4	4.3	—	
$V_{OL}$	Output LOW Voltage	$V_{CC} = 3V, V_{IN} = V_{LC} \text{ or } V_{HC}, I_{OL} = 300\mu A$		—	GND	$V_{LC}$	V
		$V_{CC} = \text{Min.}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 300\mu A$	—	GND	$V_{LC}^{(4)}$	
			$I_{OL} = 48mA \text{ MIL.}$	—	0.3	0.55	
			$I_{OL} = 64mA \text{ COM'L.}$	—	0.3	0.55	

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### NOTES:

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at  $V_{CC} = 5.0V$ ,  $+25^\circ C$  ambient and maximum loading.
- Not more than one output should be shorted at one time. Duration of the short circuit test should not exceed one second.
- This parameter is guaranteed but not tested.

## POWER SUPPLY CHARACTERISTICS

$V_{LC} = 0.2V$ ;  $V_{HC} = V_{CC} - 0.2V$

Symbol	Parameter	Test Conditions <sup>(1)</sup>		Min.	Typ. <sup>(2)</sup>	Max.	Unit
I <sub>CC</sub>	Quiescent Power Supply Current	V <sub>CC</sub> = Max. V <sub>IN</sub> ≥ V <sub>HC</sub> ; V <sub>IN</sub> ≤ V <sub>LC</sub>		—	0.2	1.5	mA
ΔI <sub>CC</sub>	Quiescent Power Supply Current TTL Inputs HIGH	V <sub>CC</sub> = Max. V <sub>IN</sub> = 3.4V <sup>(3)</sup>		—	0.5	2	mA
I <sub>CCD</sub>	Dynamic Power Supply Current <sup>(4)</sup>	V <sub>CC</sub> = Max. Outputs Open $\overline{OE}_A = \overline{OE}_B = GND$ or $\overline{OE}_A = GND$ , One Input Toggling 50% Duty Cycle	V <sub>IN</sub> ≥ V <sub>HC</sub> V <sub>IN</sub> ≤ V <sub>LC</sub>	—	0.15	0.25	mA/ MHz
I <sub>C</sub>	Total Power Supply Current <sup>(6)</sup>	V <sub>CC</sub> = Max. Outputs Open f <sub>i</sub> = 10MHz 50% Duty Cycle $\overline{OE}_A = \overline{OE}_B = GND$ or $\overline{OE}_A = GND$ , One Bit Toggling	V <sub>IN</sub> ≥ V <sub>HC</sub> V <sub>IN</sub> ≤ V <sub>LC</sub> (FCT)	—	1.7	4	mA
			V <sub>IN</sub> = 3.4V V <sub>IN</sub> = GND	—	2	5	
		V <sub>CC</sub> = Max. Outputs Open f <sub>i</sub> = 2.5MHz 50% Duty Cycle $\overline{OE}_A = \overline{OE}_B = GND$ or $\overline{OE}_A = GND$ , Eight Bits Toggling	V <sub>IN</sub> ≥ V <sub>HC</sub> V <sub>IN</sub> ≤ V <sub>LC</sub> (FCT)	—	3.2	6.5 <sup>(5)</sup>	
			V <sub>IN</sub> = 3.4V V <sub>IN</sub> = GND	—	5.2	14.5 <sup>(5)</sup>	

### NOTES:

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at V<sub>CC</sub> = 5.0V, +25°C ambient.
- Per TTL driven input (V<sub>IN</sub> = 3.4V); all other inputs at V<sub>CC</sub> or GND.
- This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
- Values for these conditions are examples of the I<sub>CC</sub> formula. These limits are guaranteed but not tested.
- I<sub>C</sub> = I<sub>QUIESCENT</sub> + I<sub>INPUTS</sub> + I<sub>DYNAMIC</sub>  
 $I_C = I_{CC} + \Delta I_{CC} \cdot DH_{NT} + I_{CCD} (f_{CP}/2 + f_i N_i)$   
 I<sub>CC</sub> = Quiescent Current  
 ΔI<sub>CC</sub> = Power Supply Current for a TTL High Input (V<sub>IN</sub> = 3.4V)  
 DH = Duty Cycle for TTL Inputs High  
 N<sub>T</sub> = Number of TTL Inputs at DH  
 I<sub>CCD</sub> = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)  
 f<sub>CP</sub> = Clock Frequency for Register Devices (Zero for Non-Register Devices)  
 f<sub>i</sub> = Input Frequency  
 N<sub>i</sub> = Number of Inputs at f<sub>i</sub>  
 All currents are in milliamps and all frequencies are in megahertz.

## SWITCHING CHARACTERISTICS OVER OPERATING RANGE<sup>(1,2)</sup>

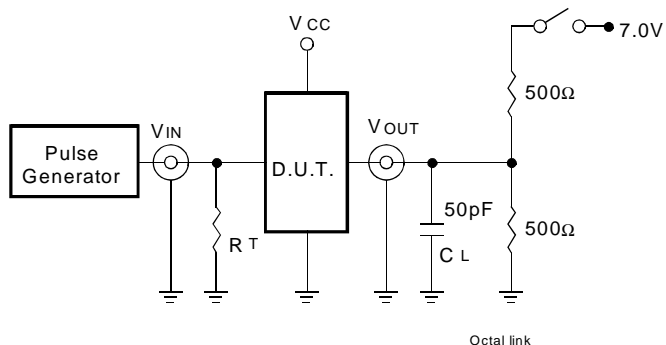
Symbol	Parameter	Condition	54/74FCT541		54/74FCT541A				54/74FCT541C				Unit		
			Com'l.		Mil.		Com'l.		Mil.		Com'l.			Mil.	
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		Min.	Max.
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay D <sub>N</sub> to O <sub>N</sub>		1.5	8	1.5	9	1.5	4.8	1.5	5.1	1.5	4.1	1.5	4.6	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable Time		1.5	10	1.5	10.5	1.5	6.2	1.5	6.5	1.5	5.8	1.5	6.5	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output Disable Time		1.5	9.5	1.5	10	1.5	5.6	1.5	5.9	1.5	5.2	1.5	5.7	ns

### NOTES:

- See test circuit and wave forms.
- Minimum limits are guaranteed but not tested on Propagation Delays.

## TEST CIRCUITS AND WAVEFORMS

### TEST CIRCUITS FOR ALL OUTPUTS



### SWITCH POSITION

Test	Switch
Open Drain	Closed
Disable Low	
Enable Low	
All Other Tests	Open

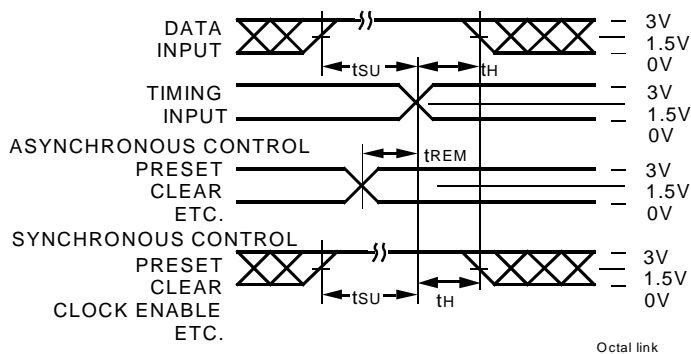
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#### DEFINITIONS:

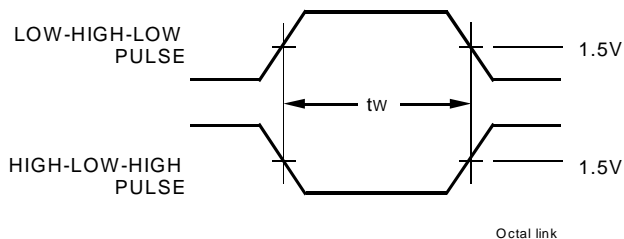
$C_L$  = Load capacitance: includes jig and probe capacitance.

$R_T$  = Termination resistance: should be equal to  $Z_{OUT}$  of the Pulse Generator.

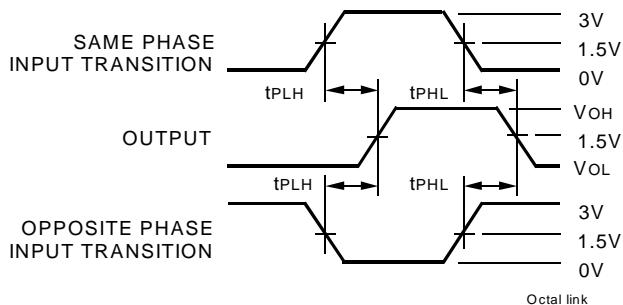
### SET-UP, HOLD, AND RELEASE TIMES



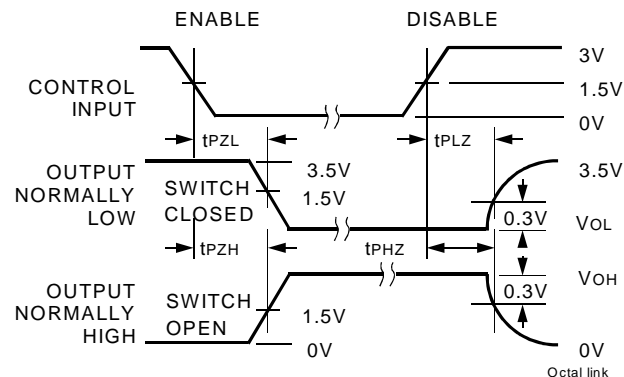
### PULSE WIDTH



### PROPAGATION DELAY



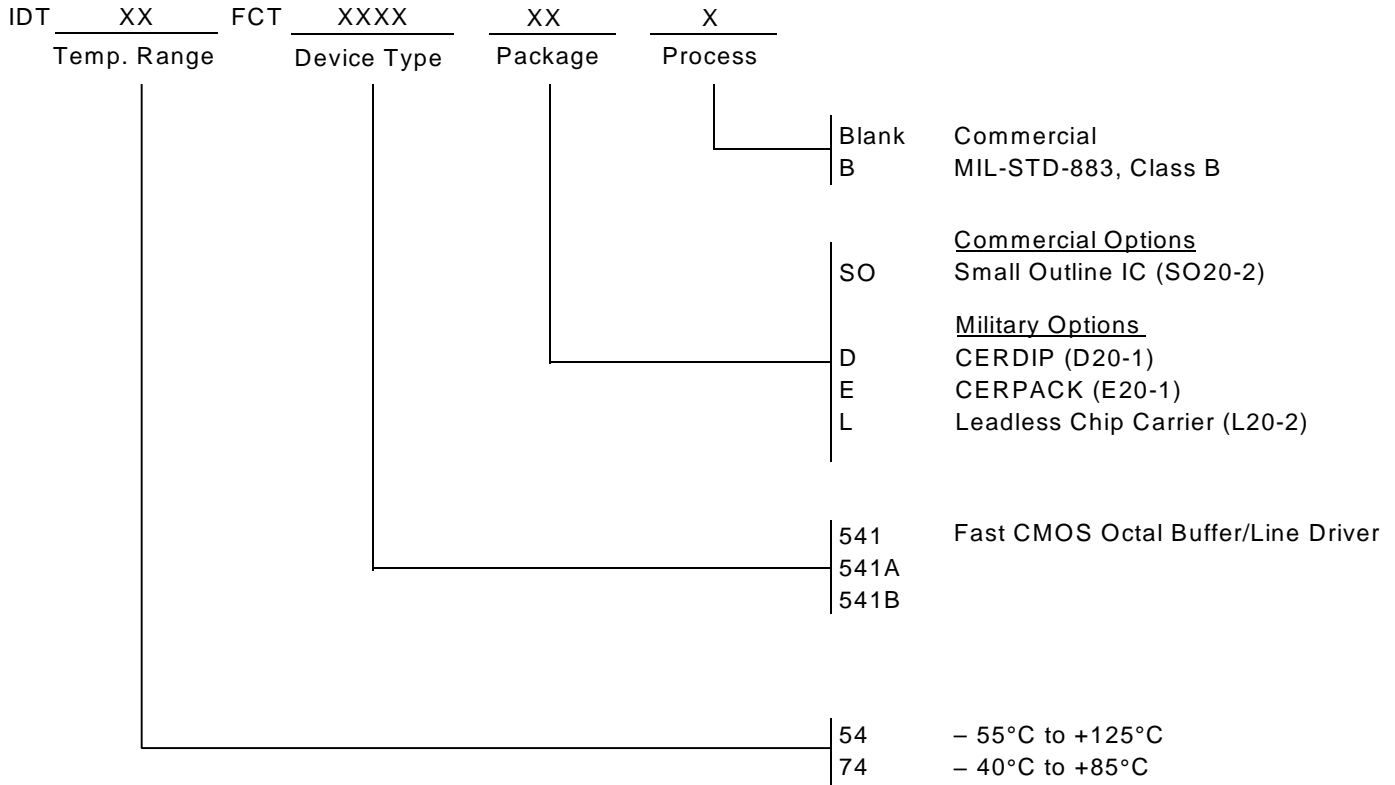
### ENABLE AND DISABLE TIMES



#### NOTES:

- Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.
- Pulse Generator for All Pulses: Rate  $\leq 1.0\text{MHz}$ ;  $Z_o \leq 50\Omega$ ;  $t_f \leq 2.5\text{ns}$ ;  $t_r \leq 2.5\text{ns}$ .

**ORDERING INFORMATION**



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 800-345-7015 or 408-727-6116  
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