National Semiconductor

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54FCT574
Octal D-Type Flip-Flop with TRI-STATE® Outputs

General Description

The 'FCT574 is an octal flip-flop with a buffered common Clock (CP) and a buffered common Output Enable ($\overline{OE}$). The information presented to the D inputs is stored in the flip-flops on the LOW-to-HIGH Clock (CP) transition.

The device is functionally identical to the 'FCT374 except for the pinouts.

Features

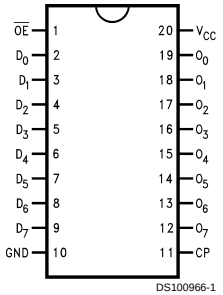
- Inputs and outputs on opposite sides of package allowing easy interface with microprocessors
- Useful as input or output port for microprocessors
- Functionally identical to 'FCT374
- TRI-STATE outputs for bus-oriented applications
- Output sink capability of 32 mA, source capability of 12 mA
- TTL input and output level compatible
- CMOS power consumption
- Standard Microcircuit Drawing (SMD) 5962-8951301

Ordering Code

Military	Package Number	Package Description
54FCT574DMQB	J20A	20-Lead Ceramic Dual-In-Line
54FCT574FMQB	W20A	20-Lead Cerpack
54FCT574LMQB	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

Connection Diagrams

Pin Assignment for DIP and Flatpak



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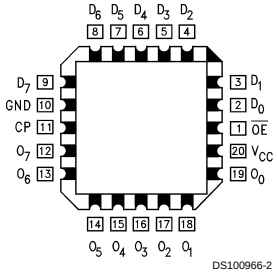
Pin Assignment for LCC



DS100966-2

Pin Descriptions

Pin Names	Description
D_0–D_7	Data Inputs
CP	Clock Pulse Input (Active Rising Edge)
$\overline{OE}$	TRI-STATE Output Enable Input (Active LOW)
O_0–O_7	TRI-STATE Outputs

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Functional Description

The 'FCT574 consists of eight edge-triggered flip-flops with individual D-type inputs and TRI-STATE true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold times requirements on the LOW-to-HIGH Clock (CP) transition. With the Output Enable ($\overline{OE}$) LOW, the contents of the eight flip-flops are available at the outputs. When $\overline{OE}$ is HIGH, the outputs are in a high impedance state. Operation of the $\overline{OE}$ input does not affect the state of the flip-flops.

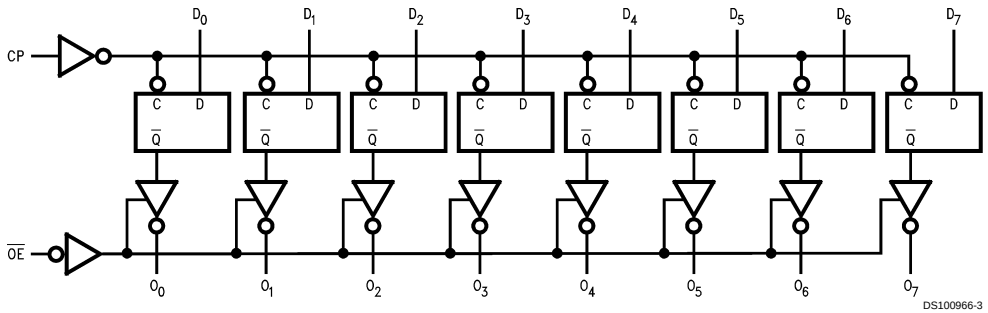
Function Table

Inputs			Internal	Outputs	Function
$\overline{OE}$	CP	D	Q	O	
H	H or L	L	NC	Z	Hold

Inputs			Internal	Outputs	Function
$\overline{OE}$	CP	D	Q	O	
H	H or L	H	NC	Z	Hold
H	N	L	L	Z	Load
H	N	H	H	Z	Load
L	N	L	L	L	Data Available
L	N	H	H	H	Data Available
L	H or L	L	NC	NC	No Change in Data
L	H or L	H	NC	NC	No Change in Data

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
Z = High Impedance
N = LOW-to-HIGH Transition
NC = No Change

Logic Diagram



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Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Storage Temperature	−65˚C to +150˚C
Ambient Temperature under Bias	−55˚C to +125˚C
Junction Temperature under Bias	
Ceramic	−55˚C to +175˚C
V_{CC} Pin Potential to Ground Pin	−0.5V to +7.0V
Input Voltage (Note 2)	−0.5V to +7.0V
Input Current (Note 2)	−30 mA to +5.0 mA
Voltage Applied to Any Output in	
the Disabled or Power-Off State	−0.5V to 5.5V
in the HIGH State	−0.5V to V_{CC}
Current Applied to Output in LOW State (Max)	twice the rated I_{OL} (mA)
DC Latchup Source Current	−500 mA
Over Voltage Latchup (I/O)	10V

Recommended Operating Conditions

Free Air Ambient Temperature	
Military	−55˚C to +125˚C
Supply Voltage	
Military	+4.5V to +5.5V

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

DC Electrical Characteristics

Symbol	Parameter		FCT574 Min	FCT574 Max	Units	V_{CC}	Conditions
V_{IH}	Input HIGH Voltage		2.0		V		Recognized HIGH Signal
V_{IL}	Input LOW Voltage			0.8	V		Recognized LOW Signal
V_{CD}	Input Clamp Diode Voltage			−1.2	V	Min	I_{IN} = −18 mA
V_{OH}	Output HIGH Voltage	54FCT	4.3		V	Min	I_{OH} = −300 µA
		54FCT	2.4		V	Min	I_{OH} = −12 mA
V_{OL}	Output LOW Voltage	54FCT		0.2	V	Min	I_{OL} = 300 µA
		54FCT		0.5	V	Min	I_{OL} = 32mA
I_{IH}	Input HIGH Current			5	µA	Max	V_{IN} = 2.7V (Note 3)
				5			V_{IN} = V_{CC}
I_{IL}	Input LOW Current			−5	µA	Max	V_{IN} = 0.5V (Note 3)
				−5			V_{IN} = 0.0V
I_{OZH}	Output Leakage Current			10	µA	0 − 5.5V	V_{OUT} = 2.7V; $\overline{OE}$ = 2.0V
I_{OZL}	Output Leakage Current			−10	µA	0 − 5.5V	V_{OUT} = 0.5V; $\overline{OE}$ = 2.0V
I_{OS}	Output Short-Circuit Current		−60		mA	Max	V_{OUT} = 0.0V
I_{CCQ}	Power Supply Current			1.5	mA	Max	V_{IN} = 0.2V or V_{IN} = 5.3V, f_I = 0MHz
ΔI_{CC}	Power Supply Current			2.0	mA	Max	V_{IN} = 3.4V
I_{CCT}	Additional I_{CC}/Input			6.0	mA	Max	V_I = V_{CC} − 2.1V or V_{IN} = GND, f_{CP} = 10MHz, Outputs open, $\overline{OE}$ = GND, one bit toggling at f_I = 5MHz, 50% duty cycle
				5.5	mA	Max	V_I = 5.3V or V_{CC} = 0.2V, f_{CP} = 10MHz, Outputs open, $\overline{OE}$ = GND, one bit toggling at f_I = 5MHz, 50% duty cycle
I_{CCD}	Dynamic I_{CC}	No Load		0.40	mA/ MHz	Max	Outputs Open, $\overline{OE}$ = GND, One bit toggling, 50% duty cycle, V_{IN} = 5.3V or V_{IN} = 0.2V

Note 3: Guaranteed, but not tested.

AC Electrical Characteristics

Symbol	Parameter	54FCT $T_A = -55^\circ C$ to $+125^\circ C$, $V_{CC} = 4.5V$ to $5.5V$, $C_L = 50$ pF		Units	Fig. No.
		Min	Max		
t_{PLH}	Propagation Delay	2.0	11.0	ns	*Figure 4*
t_{PHL}	CP to O_n	2.0	11.0		
t_{PZH}	Output Enable Time	1.5	14.0	ns	*Figure 6*
t_{PZL}		1.5	14.0		
t_{PHZ}	Output Disable Time	1.5	8.0	ns	*Figure 6*
t_{PLZ}		1.5	8.0		

AC Operating Requirements

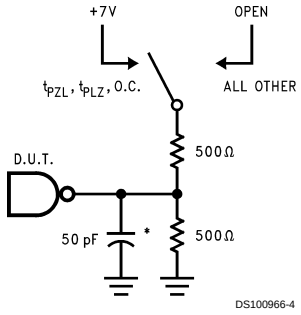
Symbol	Parameter	54FCT $T_A = -55^\circ C$ to $+125^\circ C$, $V_{CC} = 4.5V$ to $5.5V$, $C_L = 50$ pF		Units	Fig. No.
		Min	Max		
$t_s(H)$	Setup Time, HIGH	3.5		ns	*Figure 7*
$t_s(L)$	or LOW D_n to CP	3.5			
$t_h(H)$	Hold Time, HIGH	2.0		ns	*Figure 7*
$t_h(L)$	or LOW D_n to CP	2.0			
$t_w(H)$	Pulse Width, CP,	7.0		ns	*Figure 5*
$t_w(L)$	HIGH or LOW	7.0			

Capacitance

Symbol	Parameter	Typ	Units	Conditions $T_A = 25^\circ C$
C_{IN}	Input Capacitance	5.0	pF	$V_{CC} = 0V$
C_{OUT} (Note 4)	Output Capacitance	9.0	pF	$V_{CC} = 5.0V$

Note 4: C_{OUT} is measured at frequency f = 1 MHz, per MIL-STD-883B, Method 3012.

AC Loading



*Includes jig and probe capacitance

FIGURE 1. Standard AC Test Load

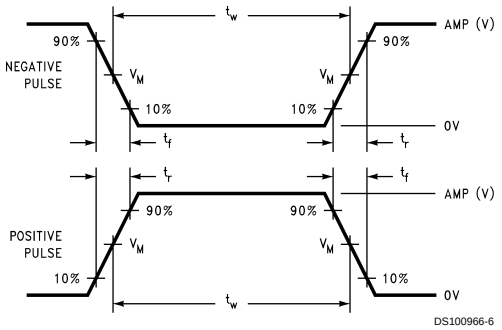


FIGURE 2. V_M = 1.5V

Input Pulse Requirements

Amplitude	Rep. Rate	t_w	t_r	t_f
3.0V	1 MHz	500 ns	2.5 ns	2.5 ns

FIGURE 3. Test Input Signal Requirements

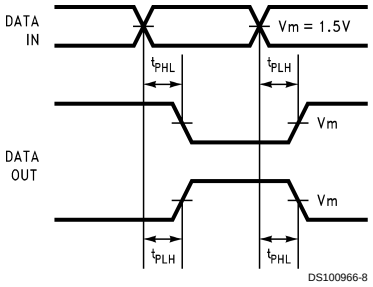


FIGURE 4. Propagation Delay Waveforms for Inverting and Non-Inverting Functions

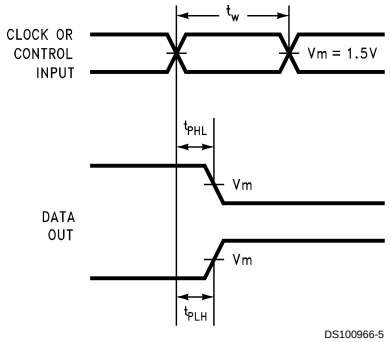


FIGURE 5. Propagation Delay, Pulse Width Waveforms

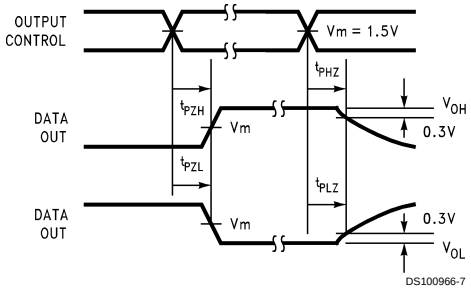


FIGURE 6. TRI-STATE Output HIGH and LOW Enable and Disable Times

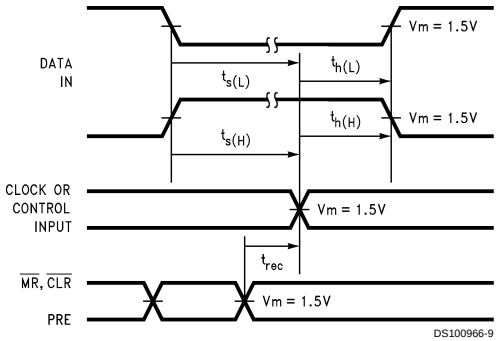
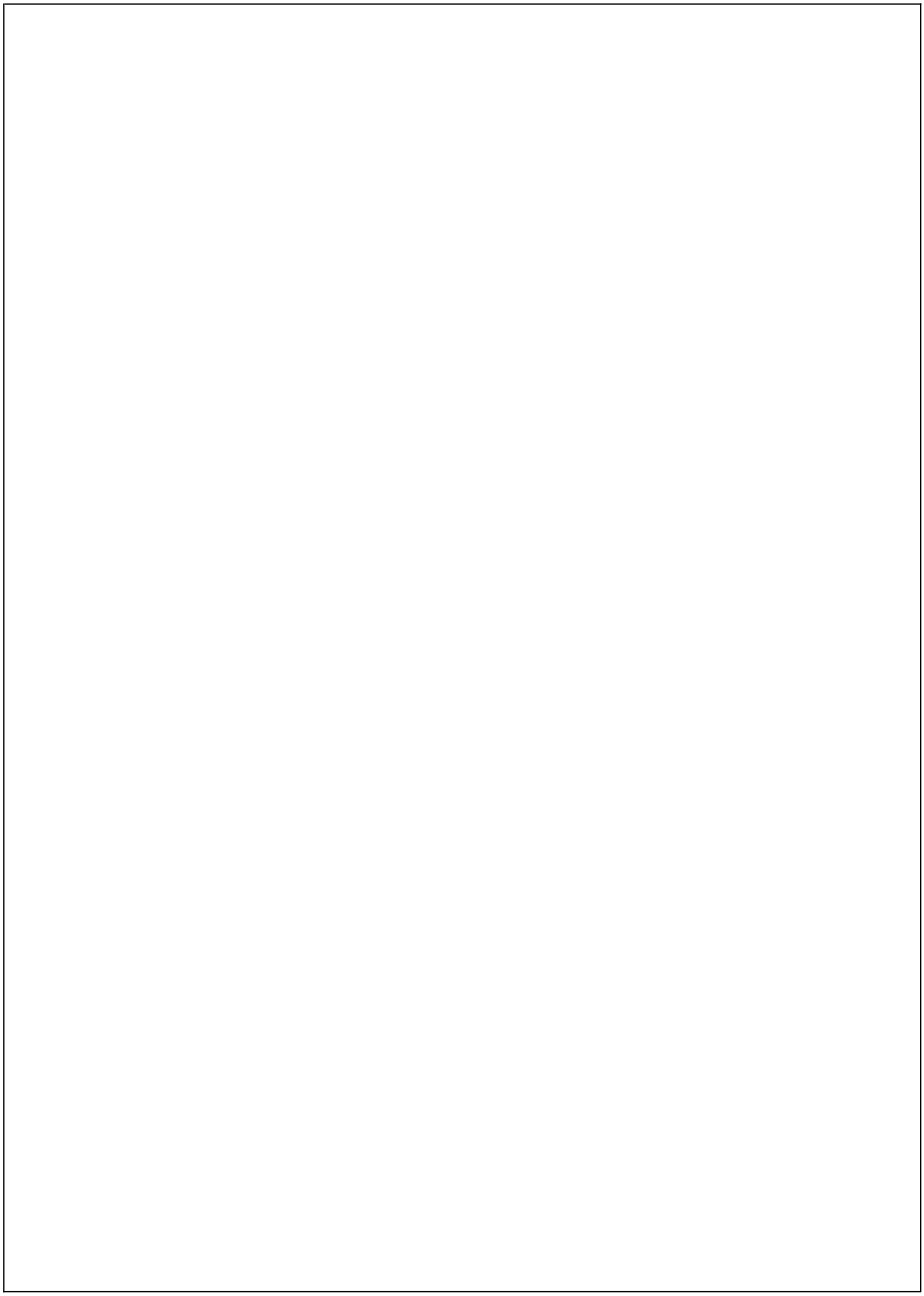
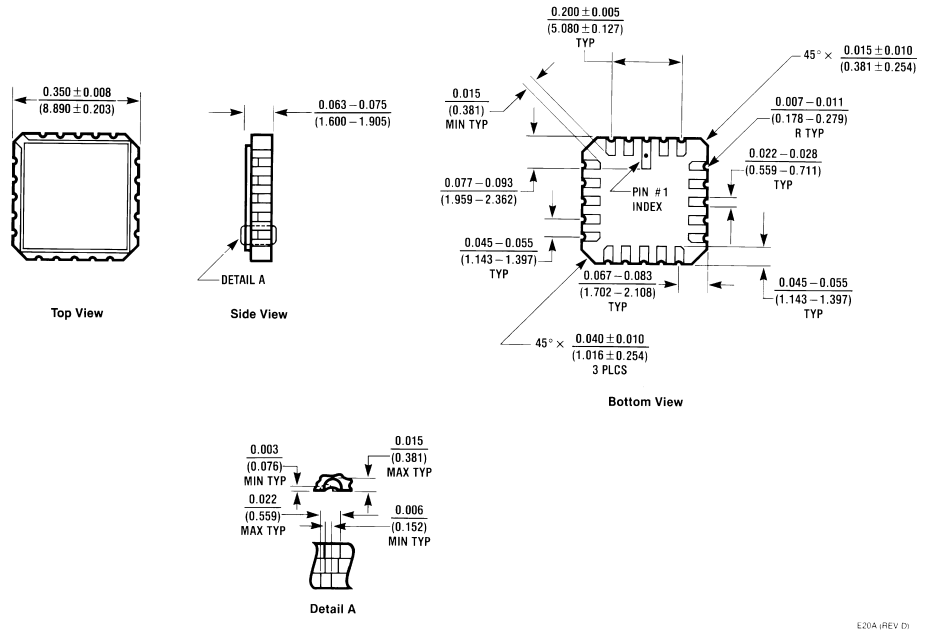


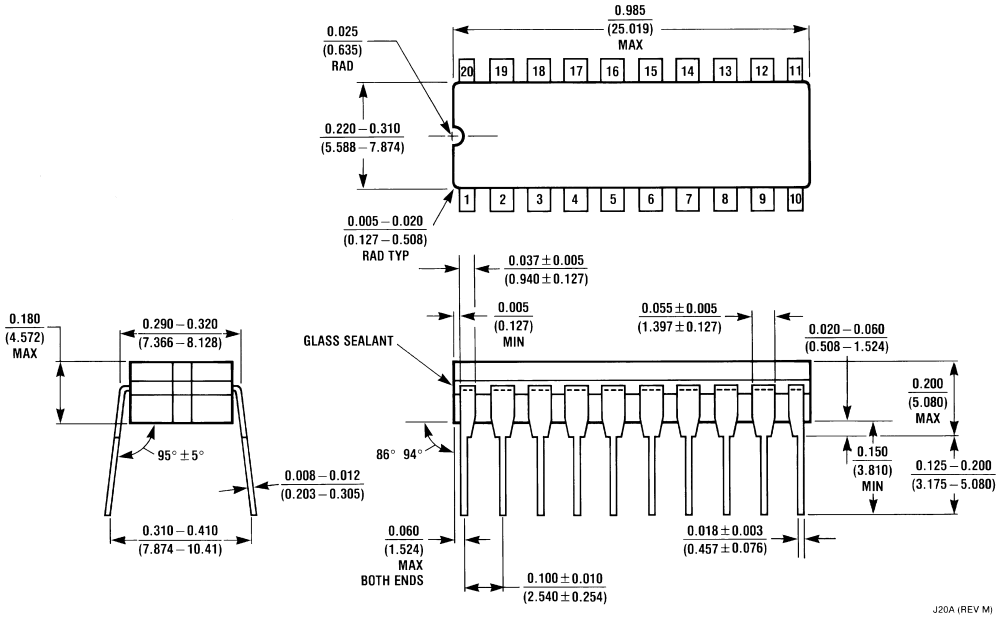
FIGURE 7. Setup Time, Hold Time and Recovery Time Waveforms



Physical Dimensions inches (millimeters) unless otherwise noted

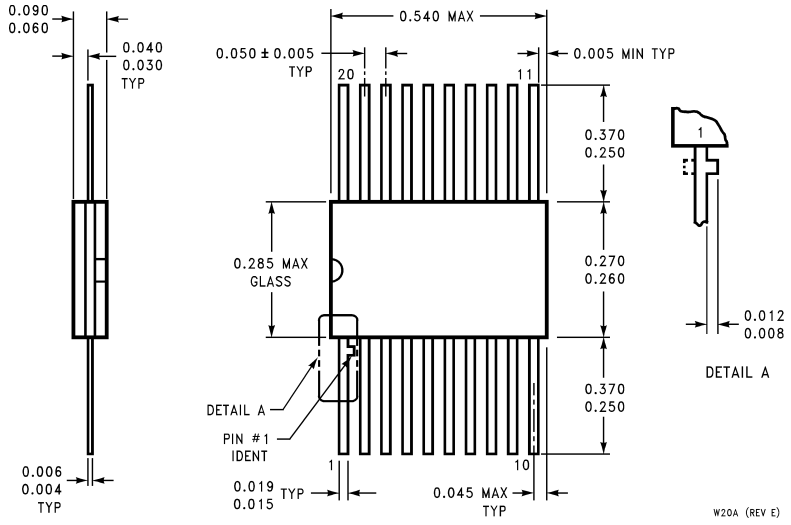


20-Terminal Ceramic Chip Carrier (L)
NS Package Number E20A



20-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J20A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



20-Lead Ceramic Flatpak (F)
NS Package Number W20A

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