

# GD54/74LS107A

## DUAL NEGATIVE-EDGE-TRIGGERED MASTER-SLAVE J-K FLIP-FLOPS WITH CLEAR, AND COMPLEMENTARY OUTPUTS

### Features

- Negative edge-triggering
- Independent input/output terminals for each flip-flop.
- Direct reset input
- Q and  $\bar{Q}$  outputs

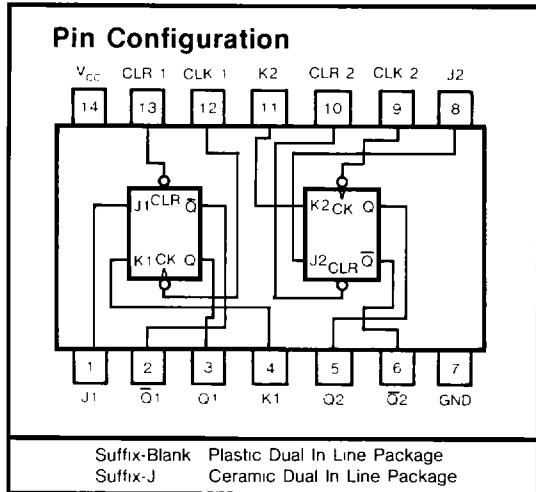
### Description

This device contains two independent negative-edge-triggered J-K flip-flops with complementary outputs. The J and K inputs must be stable one setup time prior to the High-to-Low clock transition for predictable operation. The clock triggering occurs at a voltage level and is not directly related to the transition time of the negative going edge of the clock pulse. The data on the J and K inputs may change while the clock is high or low without affecting the outputs as long as setup and hold times are not violated. A low logic level on the clear input will reset the outputs regardless of the logic levels of the other inputs.

↓ = Negative going edge of pulse

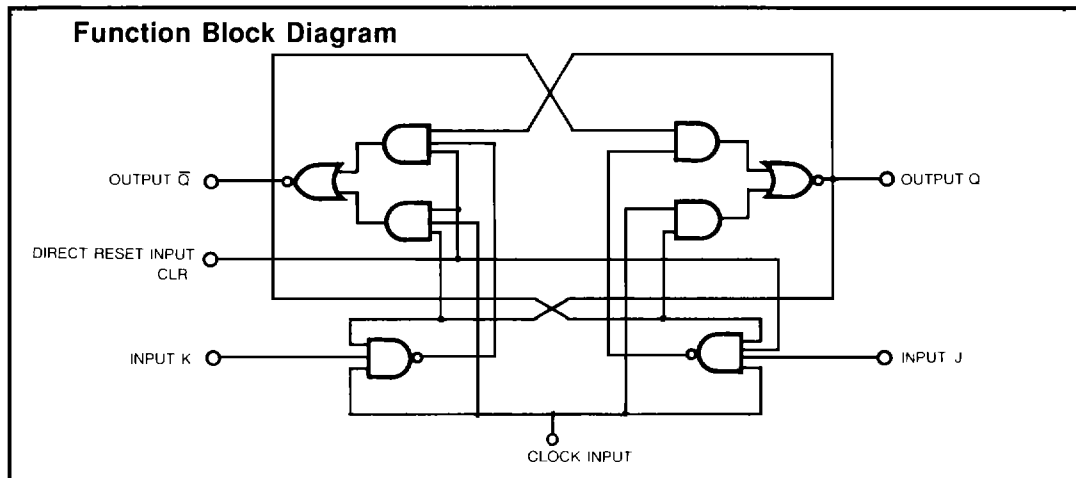
$Q_0$  = The output logic level before the indicated input conditions were established

Toggle = Each output changes to the complement of its previous level on each falling edge of the clock pulse



### Function Table

Inputs				Outputs	
CLR	CLK	J	K	Q	$\bar{Q}$
L	X	X	X	L	H
H	↓	L	L	$Q_0$	$\bar{Q}_0$
H	↓	H	L	H	L
H	↓	L	H	L	H
H	↓	H	H	Toggle	Toggle
H	H	X	X	$Q_0$	$\bar{Q}_0$



**Absolute Maximum Ratings**

- Supply voltage,  $V_{CC}$  ..... 7V
- Input voltage ..... 7V
- Operating free-air temperature range 54LS .....  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$   
74LS .....  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$
- Storage temperature range .....  $-65^{\circ}\text{C}$  to  $150^{\circ}\text{C}$

**Recommended Operating Conditions**

SYMBOL	PARAMETER		MIN	NOM	MAX	UNIT
$V_{CC}$	Supply voltage	54	4.5	5	5.5	V
		74	4.75	5	5.25	
$I_{OH}$	High-level output current	54, 74			-400	$\mu\text{A}$
$I_{OL}$	Low-level output current	54			4	mA
		74			8	
$f_{\text{clock}}$	Clock frequency		0		30	MHz
$t_w$	Pulse Width/enable pulse	Clock High	20			ns
		Clear Low	25			
$t_{su}$	Data setup time		20↓			ns
$t_h$	Data hold time		0↓			ns
$T_A$	Operating free-air temperature	54	-55		125	$^{\circ}\text{C}$
		74	0		70	

**Electrical Characteristics** over recommended operating free-air temperature range (unless otherwise noted)

SYMBOL	PARAMETER	TEST CONDITIONS		MIN		TYP	MAX		UNIT
				(Note 1)					
V <sub>IH</sub>	High-level input voltage			2					V
V <sub>IL</sub>	Low-level input voltage			54			0.7		V
				74			0.8		
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = Min, I <sub>I</sub> = -18mA					-1.5		V
V <sub>OH</sub>	High-level output voltage	V <sub>CC</sub> = Min	V <sub>IL</sub> = Max	54	2.5	3.4		V	
		I <sub>OH</sub> = Max	V <sub>IH</sub> = Min	74	2.7	3.4			
V <sub>OL</sub>	Low-level output voltage	V <sub>CC</sub> = Min	I <sub>OL</sub> = 4mA	54,74	0.25		0.4		V
		V <sub>IL</sub> = Max	I <sub>OL</sub> = 8mA	74	0.35		0.5		
I <sub>I</sub>	Input current at maximum input voltage	V <sub>CC</sub> = Max V <sub>I</sub> = 7V		J,K			0.1		mA
				Clear			0.3		
				Clock			0.4		
I <sub>IH</sub>	High-level input current	V <sub>CC</sub> = Max V <sub>I</sub> = 2.7V		J,K			20		μA
				Clear			60		
				Clock			80		
I <sub>IL</sub>	Low-level input current	V <sub>CC</sub> = Max V <sub>I</sub> = 0.4V		J,K			-0.4		mA
				Clear			-0.8		
				Clock			-0.8		
I <sub>OS</sub>	Short-circuit output current	V <sub>CC</sub> = Max (Note 2)		-20		-100		mA	
I <sub>CC</sub>	Supply current	V <sub>CC</sub> = Max (Note 3)		4		6		mA	

Note 1. All typical values are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C

Note 2. Not more than one output should be shorted at a time, and the duration should not exceed one second. For devices, with feedback from the outputs where shorting the outputs to ground may cause the outputs to change logic state an equivalent test may be performed. V<sub>I</sub> = 2.25V and 2.125V for 54 and 74 series, respectively, with the minimum and maximum limits reduced by one half from their stated values. This is very useful when using automatic test equipment.

Note 3. With all outputs open, I<sub>CC</sub> is measured with the Q and Q̄ outputs high in turn. At the time of measurement the clock is grounded.

**Switching Characteristics, V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C**

PARAMETER*	FROM (INPUT)	TO (OUTPUT)	TEST CONDITION#	MIN	TYP	MAX	UNIT
f <sub>max</sub>			C <sub>L</sub> = 15pF R <sub>L</sub> = 2kΩ	30	45		MHz
t <sub>PLH</sub>	Clear	Q̄		15	20		ns
t <sub>PHL</sub>		Q		15	20		
t <sub>PLH</sub>	Clock	Q or Q̄		15	20		ns
t <sub>PHL</sub>				15	20		

\* f<sub>max</sub> = maximum clock frequency, tested with all outputs loaded

t<sub>PLH</sub> = propagation delay time, low-to-high-level output

t<sub>PHL</sub> = propagation delay time, high-to-low-level output

#For load circuit and voltage waveforms, see page 3-11

**Application Example**  
2BIT SHIFT REGISTER