

GD54/74HC107, GD54/74HCT107

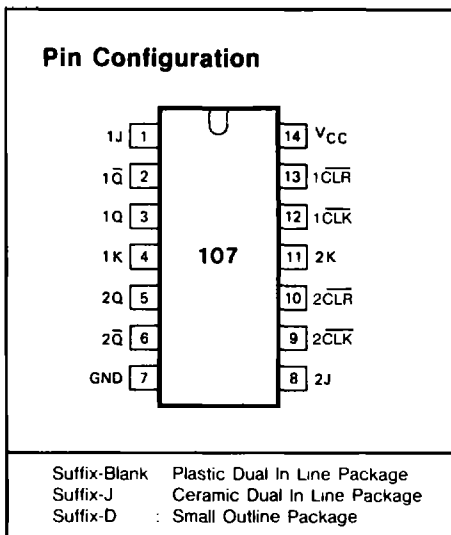
DUAL J-K FLIP-FLOPS WITH CLEAR

General Description

These devices are identical in pinout to the 54/74LS107. They consist of two J-K flip-flops with individual J, K, clock, and clear inputs. These flip-flops are edge sensitive to the clock input and change state on the negative going transition of the clock pulse. Both Q and \bar{Q} outputs are available from each flip-flop clear is independent of the clock and accomplished by a low on the input. These devices are characterized for operation over wide temperature ranges to meet industry and military specifications.

Features

- Low Power consumption characteristic of CMOS devices
- Output drive capability: 10 LS TTL Loads Min.
- Operating speed superior to LS TTL
- Wide operating voltage range: for HC 2 to 6 volts
for HCT 4.5 to 5.5 volts
- Low input current: 1 μ A Max.
- Low quiescent current: 40 μ A Max. (74HC)
- High noise immunity characteristic of CMOS
- Diode protection on all inputs



Function Table

OPERATING MODE	INPUTS			OUTPUTS		
	n \bar{CLR}	n \bar{CLK}	J	K	Q	\bar{Q}
asynchronous reset	L	X	X	X	L	H
toggle	H	\downarrow	h	h	q	\bar{q}
load "0" (reset)	H	\downarrow	l	h	L	H
load "1" (set)	H	\downarrow	h	l	H	L
hold "no change"	H	\downarrow	l	l	q	\bar{q}

H = HIGH voltage level
 h = HIGH voltage level one set-up time prior to the LOW-to-HIGH CLK transition
 L = LOW voltage level
 l = LOW voltage level one set-up time prior to the LOW-to-HIGH CLK transition
 q = lower case letters indicate the state of the referenced output one set-up time prior to the LOW-to-HIGH CLK transition
 X = don't care
 \downarrow = HIGH-to-LOW CLK transition

Absolute Maximum Ratings

SYMBOL	PARAMETER	CONDITIONS	MIN	MAX	UNIT
V_{CC}	DC Supply voltage		-0.5	+7	V
I_{IK}, I_{OZ}	DC input or output diode current	for $V_I < -0.5$ or $V_I > V_{CC} + 0.5$ V		20	mA
I_O	DC output source or sink current	for -0.5 V < $V_O < V_{CC} + 0.5$ V		25	mA
I_{CC}	DC V_{CC} or GND current			50	mA
T_{stg}	Storage temperature range		-65	150	°C
P_D	Power dissipation per package	above +70°C derate linearly with 8mW/K		500	mW
T_L	Lead temperature	At distance 1.16 ± 1.32 in from case for 60 sec(CERAMIC) 10 sec(PLASTIC)		300 260	C

Recommended Operating Conditions

CHARACTERISTIC	LIMITS		UNITS
	MIN	MAX	
Supply-Voltage Range V_{CC} GD54/74HC Types GD54/74HCT Types	2 4.5	6 5.5	V
DC Input or Output Voltage V_I, V_O	0	V_{CC}	V
Operating Temperature T_A GD74 Types GD54 Types	-40 -55	+85 +125	°C
Input Rise and Fall times t_r, t_f GD54/74HC Types at 2V at 4.5V at 6V GD54/74HCT Types at 4.5V		1000 500 400 500	ns

Logic Diagram

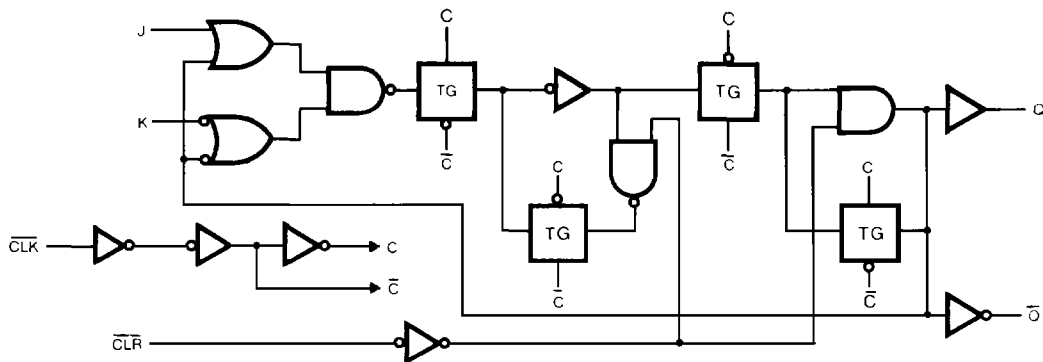


Fig. 1 Logic diagram (one flip flop)

DC Electrical Characteristics for HC

SYMBOL	PARAMETER	TEST CONDITION	T _A = 25°C			GD74HC107		GD5474HC107		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{IH}	HIGH level input voltage		1.5		3.15	1.5	1.5	3.15	V	
V _{IL}	LOW level input voltage		0.3		0.9	0.3	0.3	0.9	V	
V _{OH}	HIGH level output voltage	V _{IN} = V _{IH} I _{OH} = -20μA	2.0	1.9	2.0	1.9	1.9	1.9	V	
		or V _{IL} I _{OH} = -4mA I _{OH} = -5.2mA	4.5 6.0	4.4 5.9	4.5 6.0	4.4 5.9	4.4 5.9	3.7 5.2		
V _{OL}	LOW level output voltage	V _{IN} = V _{IH} I _{OL} = 20μA	0.1		0.1	0.1	0.1	0.1	V	
		or V _{IL} I _{OL} = 4mA I _{OL} = 5.2mA	0.17 6.0	0.26	0.15	0.26	0.33	0.33		0.4 0.4
I _{IN}	Input leakage current	V _{IN} = V _{CC} or GND	6.0			0.1	1.0	1.0	μA	
I _{CC}	Quiescent Supply Current	V _{IN} = V _{CC} or GND I _{out} = 0μA	6.0			4	40	80	μA	

DC Electrical Characteristics for HCT

SYMBOL	PARAMETER	TEST CONDITION	V _{CC} (V)	T _A = 25°C			GD74HCT107		GD54HCT107		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{IH}	HIGH level input voltage		4.5 to 5.5	2.0			2.0	2.0		V	
V _{IL}	LOW level input voltage		4.5 to 5.5			0.8	0.8	0.8		V	
V _{OH}	HIGH level output voltage	V _{IN} = V _{IH} I _{OH} = -20μA	4.5	4.4	4.5		4.4	4.4		V	
		or V _{IL} I _{OH} = -4mA	4.5	3.98	4.3		3.84	3.7			
V _{OL}	LOW level output voltage	V _{IN} = V _{IH} I _{OL} = 20μA	4.5			0.1	0.1	0.1		V	
		or V _{IL} I _{OL} = 4mA	4.5		0.17	0.26	0.33	0.4			
I _{IN}	Input leakage current	V _{IN} = V _{CC} or GND	5.5			0.1	1.0	1.0		μA	
I _{CC}	Quiescent Supply Current	V _{IN} = V _{CC} or GND I _{out} = 0μA	5.5			4	40	80		μA	

Timing Requirements for HC: $t_r=t_f=6ns$ $C_L=50 pF$

SYMBOL	PARAMETER	V _{CC} (V)	T _A =25°C			GD74HC107		GD54HC107		UNIT
			MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
t _w	Pulse width	2.0 4.5 6.0	CLR (low)			100		120		ns
			80	30		20		25		
			14	8		18		22		
		2.0 4.5 6.0	CLK (high or low)			100		120		ns
			80	30		20		25		
			14	8		18		22		
t _{su}	Set up Time	2.0 4.5 6.0	Data to CLK			80		100		ns
			60	30		18		20		
			14	8		16		18		
t _{rec}	Recovery time	2.0 4.5 6.0	CLR to CLK			5		5		ns
			5	0		5		5		
			5	0		5		5		
t _h	Hold Time	2.0 4.5 6.0	Data to CLK			3		3		ns
			3	0		3		3		
			3	0		3		3		

AC Characteristics for HC: $t_r=t_f=6ns$ $C_L=50 pF$

SYMBOL	PARAMETER	V _{CC} (V)	T _A =25°C			GD54HC107		GD74HC107		UNIT
			MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
f _{max}	Maximum Clock Pulse Frequency	2.0 4.5 6.0	6	20		5		4		MHz
			30	65		25		20		
			35	75		30		25		
t _{PLH} / t _{PHL}	Propagation Delay Time nCLK to nQ	2.0 4.5 6.0		46	160		200		240	ns
				15	30		40		50	
				14	28		35		45	
t _{PLH} / t _{PHL}	Propagation Delay Time nCLK to nQ	2.0 4.5 6.0		50	160		200		240	ns
				17	30		40		50	
				16	28		35		45	
t _{PLH} / t _{PHL}	Propagation Delay time nCLR to nQ, nQ	2.0 4.5 6.8		45	155		190		230	ns
				15	28		38		45	
				14	26		34		40	
t _{TLH} / t _{THL}	Output Transition time	2.0 4.5 6.0		25	70		85		100	ns
				8	15		18		22	
				7	13		16		19	

GD54/74HC107, GD54/74HCT107

Timing Requirements for HCT: $t_r=t_f=6\text{ns}$ $C_L=50\text{ pF}$

SYMBOL	PARAMETER		V _{CC} (V)	T _A =25°C			GD74HCT107		GD54HCT107		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t _w	Pulse width	$\overline{\text{CLR}}$ (low)	4.5	18	10		20		25		ns
		$\overline{\text{CLK}}$ (high or low)	4.5	10	10		20		25		ns
t _{su}	Set up Time	Data to $\overline{\text{CLK}}$ †	4.5	15	10		18		20		ns
t _{rec}	Recovery time	$\overline{\text{CLR}}$ to $\overline{\text{CLK}}$	4.5	5	0		5		5		ns
t _h	Hold Time	Data to $\overline{\text{CLK}}$ †	4.5	3	0		3		3		ns

AC Characteristics for HCT: $t_r=t_f=6\text{ns}$ $C_L=50\text{ pF}$

SYMBOL	PARAMETER		V _{CC} (V)	T _A =25°C			GD74HCT107		GD54HCT107		UNIT
				MIN	TYP.	MAX	MIN.	MAX	MIN	MAX	
f _{max}	Maximum Clock Pulse Frequency		4.5	27	54		22		18		MHz
t _{PLH} t _{PHL}	Propagation Delay Time n $\overline{\text{CLK}}$ to nQ		4.5		17	30		40		50	ns
t _{PLH} t _{PHL}	Propagation Delay Time n $\overline{\text{CLK}}$ to n $\overline{\text{Q}}$		4.5		17	30		40		50	ns
t _{PLH} t _{PHL}	Propagation Delay Time n $\overline{\text{CLR}}$ to nQ n $\overline{\text{Q}}$		4.5		15	28		38		45	ns
t _{TLH} t _{THL}	Output Transition Time		4.5		8	15		18		22	ns

AC Waveforms

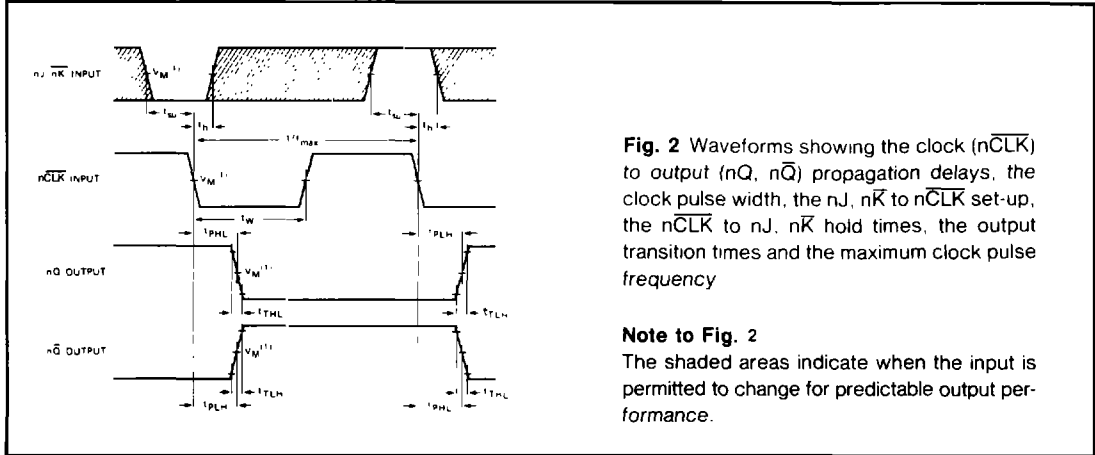


Fig. 2 Waveforms showing the clock ($n\bar{CLK}$) to output ($nQ, n\bar{Q}$) propagation delays, the clock pulse width, the $nJ, n\bar{K}$ to $n\bar{CLK}$ set-up, the $n\bar{CLK}$ to $nJ, n\bar{K}$ hold times, the output transition times and the maximum clock pulse frequency

Note to Fig. 2
The shaded areas indicate when the input is permitted to change for predictable output performance.

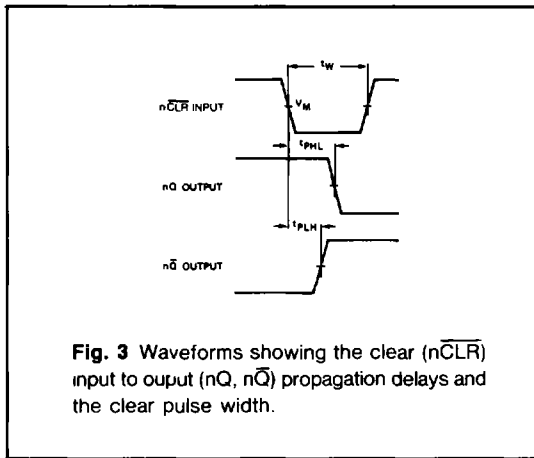


Fig. 3 Waveforms showing the clear ($n\bar{CLR}$) input to output ($nQ, n\bar{Q}$) propagation delays and the clear pulse width.

Note to AC waveforms

- (1) HC $V_M = 50\%$, $V_I = \text{GND to } V_{CC}$
- HCT $V_M = 1.3V$, $V_I = \text{GND to } 3V$