

GD54/74HC112, GD54/74HCT112

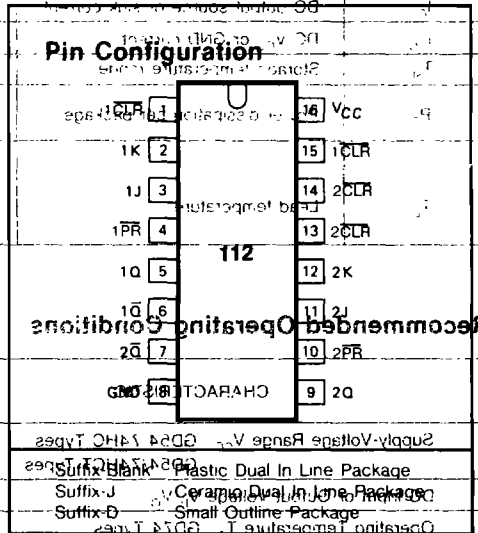
DUAL J-K FLIP-FLOPS WITH PRESET & CLEAR

General Description

These devices are identical in pinout to the 54/74LS112. They consist of two J-K flip-flops with individual J, K, CLOCK, PRESET, 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. PRESET and CLEAR is independent of the clock and accomplished by a LOW level on the corresponding 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	
	nPR	nCLR	1R	1J	1K	1C	1Q	1Q-bar
asynchronous set	L	H	X	X	X	H	L	L
asynchronous reset	H	L	X	X	X	L	H	H
undetermined	L	L	X	X	X	H	H	H
toggle	H	H	↓	h	h	q	q	q-bar
load "0" (reset)	H	H	↓	h	h	L	H	L
load "1" (set)	H	H	↓	h	h	H	L	H
hold "no change"	H	H	↓	l	l	q	q	q-bar

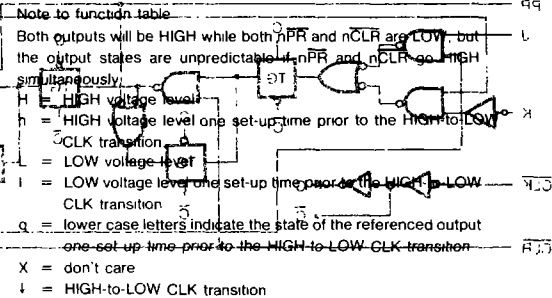


Fig. 2 Logic Diagram

Absolute Maximum Ratings

SYMBOL	PARAMETER	CONDITIONS	MIN	MAX	UNIT
V_{CC}	DC Supply voltage		-0.5	+7	V
I_{IK} I_{OK}	DC input or output diode current	for $V_I < -0.5$ or $V_I > V_{CC} + 0.5V$		20	mA
I_O	DC output source or sink current	for $-0.5V < V_O < V_{CC} + 0.5V$		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

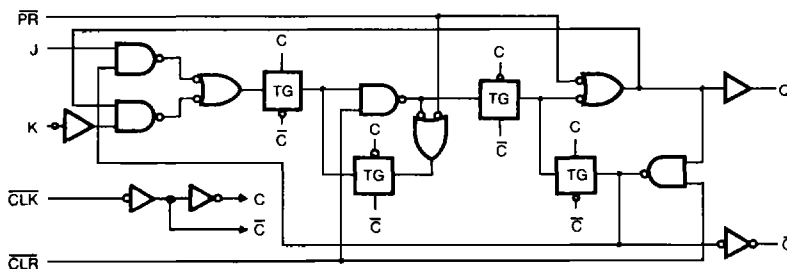


Fig. 2 logic diagram

DC Electrical Characteristics for HC

SYMBOL	PARAMETER	TEST CONDITION	V _{CC} (V)	T _A =25°C			GD74HC112		GD54HC112		UNIT	
				MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.		
V _{IH}	HIGH level input Voltage		2.0	1.5			1.5		1.5		V	
			4.5	3.15			3.15		3.15			
			6.0	4.2			4.2		4.2			
V _{IL}	LOW level input voltage		2.0			0.3		0.3		0.3	V	
			4.5			0.9		0.9		0.9		
			6.0			1.2		1.2		1.2		
V _{OH}	HIGH level output voltage	V _{IN} =V _{IH}	I _{OH} =-20μA	2.0	1.9	2.0		1.9		1.9	V	
				4.5	4.4	4.5		4.4		4.4		
		or V _{IL}	I _{OH} =-4mA	4.5	3.98	4.3		3.84		3.7		
			I _{OH} =-5.2mA	6.0	5.48	5.2		5.34		5.2		
V _{OL}	LOW level output voltage	V _{IN} =V _{IH}	I _{OL} =20μA	2.0			0.1		0.1		V	
				4.5			0.1		0.1			
		or V _{IL}	I _{OL} =4mA	4.5		0.17	0.26		0.33			0.4
			I _{OL} =5.2mA	6.0		0.15	0.26		0.33			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			GD74HCT112		GD54HCT112		UNIT	
				MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.		
V _{IH}	HIGH level input Voltage		4.5								V	
			to 5.5	2.0			2.0		2.0			
V _{IL}	LOW level input voltage		4.5								V	
			to 5.5			0.8		0.8		0.8		
V _{OH}	HIGH level output voltage	V _{IN} =V _{IH}	I _{OH} =-20μA	4.5	4.4	4.5		4.4		4.4	V	
				4.5	3.98	4.3		3.84		3.7		
		or V _{IL}	I _{OH} =-4mA	4.5								
			I _{OH} =-5.2mA	6.0								
V _{OL}	LOW level output voltage	V _{IN} =V _{IH}	I _{OL} =20μA	4.5			0.1		0.1		V	
				4.5			0.1		0.1			
		or V _{IL}	I _{OL} =4mA	4.5		0.17	0.26		0.33			0.4
			I _{OL} =5.2mA	6.0								
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: $t_r=t_f=6\text{ns}$ $C_L=50\text{ pF}$

SYMBOL	PARAMETER	V _{CC} (V)	T _A =25°C			GD74HC112		GD54HC112		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t _w	Pulse width	2.0	80	30		100		120	ns	
		4.5	16	10		20		25		
		6.0	14	8		18		22		
t _{su}	Set up Time	2.0	80	30		100		120	ns	
		4.5	16	10		20		25		
		6.0	14	8		18		22		
t _{rec}	Recovery time	2.0	5	0		5		5	ns	
		4.5	5	0		5		5		
		6.0	5	0		5		5		
t _h	Hold Time	2.0	3	0		3		3	ns	
		4.5	3	0		3		3		
		6.0	3	0		3		3		

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

SYMBOL	PARAMETER	V _{CC} (V)	T _A =25°C			GD74HC112		GD54HC112		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f _{max}	Maximum Clock Pulse Frequency	2.0	6	20		5		4	MHz	
		4.5	30	65		25		20		
		6.0	35	75		30		25		
t _{PLH} / t _{PHL}	Propagation Delay Time n $\overline{\text{CLK}}$ to nQ	2.0		46	160		200		240	ns
		4.5		15	30		40		50	
		6.0		14	28		35		45	
t _{PLH} / t _{PHL}	Propagation Delay Time n $\overline{\text{CLK}}$ to n $\overline{\text{Q}}$	2.0		50	160		200		240	ns
		4.5		17	30		40		50	
		6.0		16	28		35		45	
t _{PLH} / t _{PHL}	Propagation Delay Time n $\overline{\text{PR}}$ to nQ, n $\overline{\text{Q}}$	2.0		45	155		190		230	ns
		4.5		15	28		38		45	
		6.0		14	26		34		42	
t _{PLH} / t _{PHL}	Propagation Delay time n $\overline{\text{CLR}}$ to nQ, n $\overline{\text{Q}}$	2.0		45	155		190		230	ns
		4.5		15	28		38		45	
		6.8		14	26		34		42	
t _{TLH} / t _{TFL}	Output Transition time	2.0		25	70		85		100	ns
		4.5		8	15		18		22	
		6.0		7	13		16		19	

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

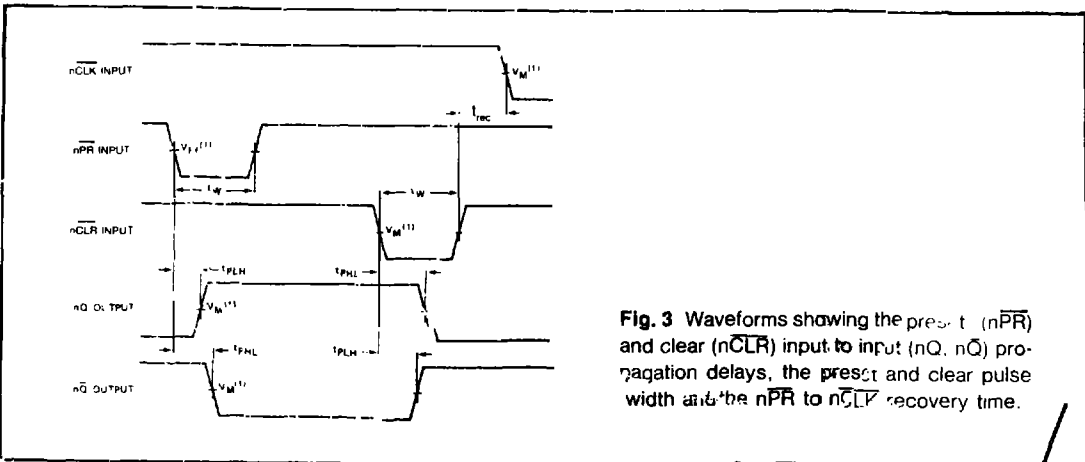
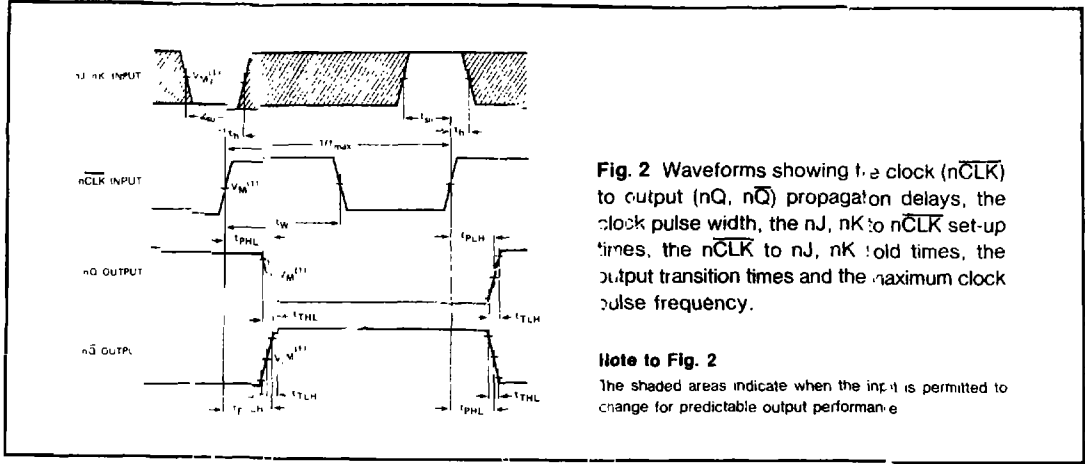
AC Waveforms

SYMBOL	PARAMETER		V _{CC} (V)	T _A =25°C			GD74HCT112		GD54HCT112		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse width	PR, CLR (low)	4.5	18	10	20	25			ns	
t_{su}	Set up Time	PR, CLR to CLK	4.5	16	10	20	25			ns	
t_{rec}	Recovery time	PR, CLR to CLK	4.5	5	0	5	5			ns	
t_h	Hold Time	Data to CLK	4.5	3	0	3	3			ns	

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

SYMBOL	PARAMETER		V _{CC} (V)	T _A =25°C			GD74HCT112		GD54HCT112		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 nCLK to nQ		4.5		17	30	40	50		ns	
t_{PLH} / t_{PHL}	Propagation Delay Time nPR to nQ, nQ		4.5		15	28	38	45		ns	
t_{PLH} / t_{PHL}	Propagation Delay time nCLR to nQ, nQ		4.5		15	28	38	45		ns	
t_{TLH} / t_{THL}	Output Transition time		4.5		8	15	18	22		ns	

AC Waveforms



Note to AC waveforms

- (*) HC $V_M = 50\%$, $V_I = C/10$ to V_{CC}
- HCT $V_M = 3V$, $V_I = C/10$ to $3V$

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