

# GD54/74HC174, GD54/74HCT174

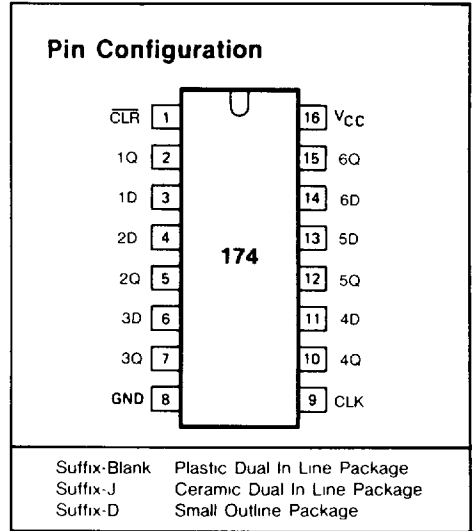
## HEX D-TYPE FLIP-FLOPS WITH COMMON CLOCK & CLEAR

### General Description

These devices are identical in pinout to the 54/74LS174. They contain six D-type flip-flops with common clock and clear inputs. Data on the D inputs having the specified setup and hold times are transferred to the outputs on the rising edge of the clock pulse. Clear is asynchronous and active-low. The clear input when low, sets all outputs to a low state. 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 $\mu$ A Max.
- Low quiescent current: 80 $\mu$ A Max. (74HC)
- High noise immunity characteristic of CMOS
- Diode protection on all inputs



### Function Table

OPERATING MODES	INPUTS			OUTPUTS
	$\overline{\text{CLR}}$	CLK	nD	nQ
clear	L	X	X	L
load "1"	H	↑	h	H
load "0"	H	↑	l	L

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  
 X = don't care  
 ↑ = LOW to HIGH CLK transition

## 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

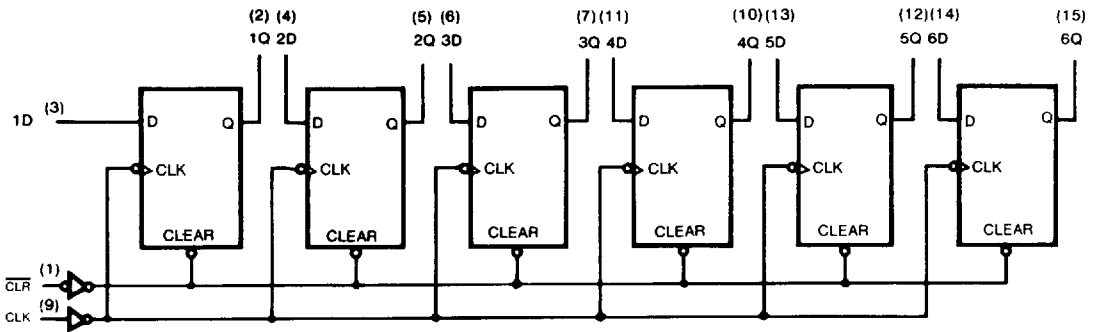


Fig. 1 Logic diagram

DC Electrical Characteristics for HC

SYMBOL	PARAMETER	TEST CONDITION	V <sub>CC</sub> (V)	T <sub>A</sub> =25°C			GD74HC174		GD54HC174		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>IH</sub>	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 <sub>IL</sub>	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 <sub>OH</sub>	HIGH level output voltage	V <sub>IN</sub> =V <sub>IH</sub>	I <sub>OH</sub> =-20μA	2.0	1.9	2.0		1.9		1.9	V
				4.5	4.4	4.5		4.4		4.4	
				6.0	5.9	6.0		5.9		5.9	
		or V <sub>IL</sub>	I <sub>OH</sub> =-4mA	4.5	3.98	4.3		3.84		3.7	
				6.0	5.48	5.2		5.34		5.2	
V <sub>OL</sub>	LOW level output voltage	V <sub>IN</sub> =V <sub>IH</sub>	I <sub>OL</sub> =20μA	2.0			0.1		0.1	0.1	V
				4.5			0.1		0.1	0.1	
				6.0			0.1		0.1	0.1	
		or V <sub>IL</sub>	I <sub>OL</sub> =4mA	4.5		0.17	0.26		0.33	0.4	
				6.0		0.15	0.26		0.33	0.4	
I <sub>IN</sub>	Input leakage Current	V <sub>IN</sub> =V <sub>CC</sub> or GND	6.0			0.1		1.0		1.0	μA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> =V <sub>CC</sub> or GND I <sub>out</sub> =0μA	6.0			8		80		160	μA

DC Electrical Characteristics for HCT

SYMBOL	PARAMETER	TEST CONDITION	V <sub>CC</sub> (V)	T <sub>A</sub> =25°C			GD74HCT174		GD54HCT174		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>IH</sub>	HIGH level input Voltage		4.5								V
			to 5.5	2.0			2.0		2.0		
V <sub>IL</sub>	LOW level input voltage		4.5								V
			to 5.5			0.8		0.8		0.8	
V <sub>OH</sub>	HIGH level output voltage	V <sub>IN</sub> =V <sub>IH</sub>	I <sub>OH</sub> =-20μA	4.5	4.4	4.5		4.4		4.4	V
				4.5	3.98	4.3		3.84		3.7	
				6.0							
		or V <sub>IL</sub>	I <sub>OH</sub> =-4mA	4.5							
				4.5	3.98	4.3		3.84		3.7	
				6.0							
V <sub>OL</sub>	LOW level output voltage	V <sub>IN</sub> =V <sub>IH</sub>	I <sub>OL</sub> =20μA	4.5			0.1		0.1	0.1	V
				4.5			0.1		0.1	0.1	
				6.0			0.1		0.1	0.1	
		or V <sub>IL</sub>	I <sub>OL</sub> =4mA	4.5		0.17	0.26		0.33	0.4	
				4.5		0.17	0.26		0.33	0.4	
				6.0		0.15	0.26		0.33	0.4	
I <sub>IN</sub>	Input leakage Current	V <sub>IN</sub> =V <sub>CC</sub> or GND	5.5			0.1		1.0		1.0	μA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> =V <sub>CC</sub> or GND I <sub>out</sub> =0μA	5.5			8		80		160	μA

# GD54/74HC174, GD54/74HCT174

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

SYMBOL	PARAMETER		$V_{CC}$ (V)	$T_A=25^\circ\text{C}$			GD74HC174		GD54HC174		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_w$	Pulse width	$\overline{\text{CLR}}$	2.0	80	30		100		120		ns
			4.5	16	10		20		25		
			6.0	14	8		18		22		
		CLK	2.0	80	30		100		120		ns
			4.5	16	10		20		25		
			6.0	14	8		18		22		
$t_{su}$	Setup time	Data to CLK	2.0	60	30		80		100		ns
			4.5	15	10		18		22		
			6.0	14	8		16		18		
$t_{rec}$	Recovery time	$\overline{\text{PR}}$ or $\overline{\text{CLR}}$ to CLK	2.0	5	0		5		5		ns
			4.5	5	0		5		5		
			6.0	5	0		5		5		
$t_h$	Hold time	CLK to Data	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)	$T_A=25^\circ\text{C}$			GD74HC174		GD54HC174		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 CLK to nQ,	2.0		46	160		200		250	ns	
		4.5		15	30		40		50		
		6.0		14	28		35		45		
$t_{PLH}/$ $t_{PHL}$	Propagation Delay Time $\overline{\text{CLR}}$ to nQ,	2.0		45	155		190		230	ns	
		4.5		15	28		38		45		
		6.0		14	26		34		40		
$t_{TLH}/$ $t_{THL}$	Output Transition Time	2.0		25	70		85		100	ns	
		4.5		8	15		18		22		
		6.0		7	13		16		19		

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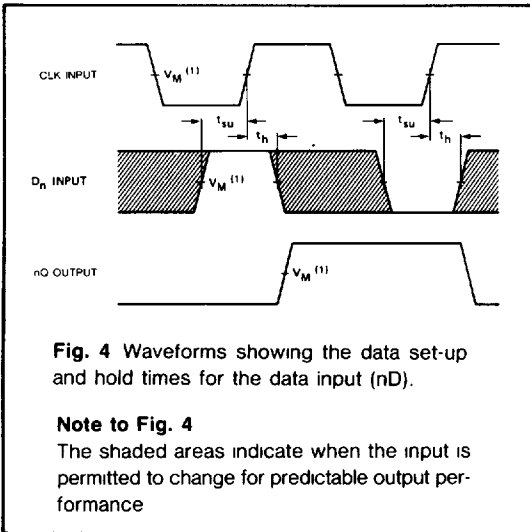
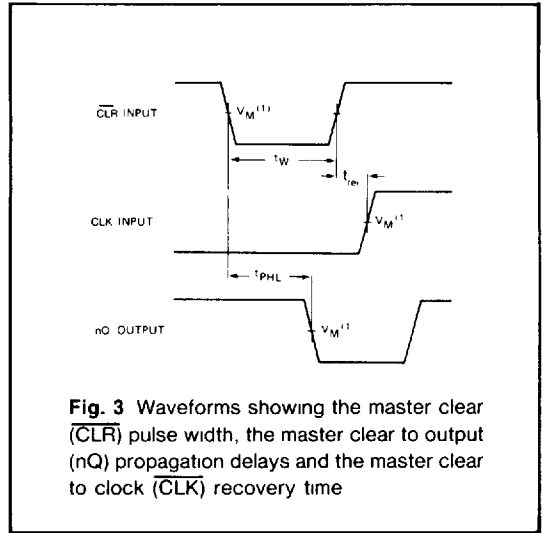
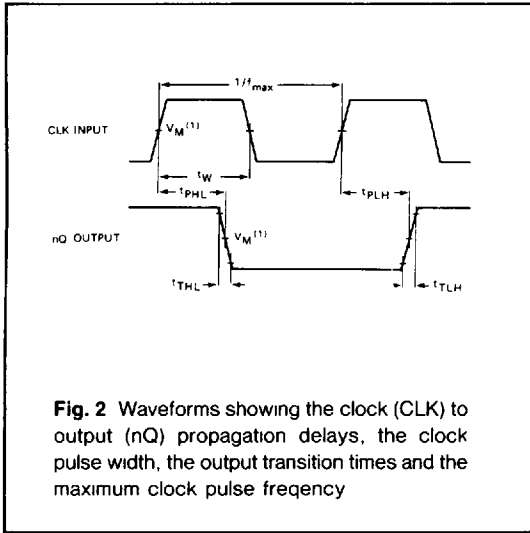
## Timing Requirements for HCT: $t_r=t_f=6\text{ns}$ $C_L=50\text{ pF}$

SYMBOL	PARAMETER		$V_{CC}$ (V)	$T_A=25^\circ\text{C}$			GD74HCT174		GD54HCT174		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_w$	Pulse width	$\overline{\text{CLR}}$	4.5	18	10		20		25		ns
		CLK	4.5	10	10		20		25		ns
$t_{su}$	Setup time	Data to CLK	4.5	15	10		18		20		ns
$t_{rec}$	Recovery time	$\overline{\text{PR}}$ or $\overline{\text{CLR}}$ to CLK	4.5	5	0		5		5		ns
$t_h$	Hold time	CLK to Data	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)	$T_A=25^\circ\text{C}$			GD74HCT174		GD54HCT174		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 CLK to nQ		4.5		16	30		40		50	ns
$t_{PLH}$ / $t_{PHL}$	Propagation Delay time $\overline{\text{CLR}}$ to nQ		4.5		16	30		40		50	ns
$t_{TLH}$ / $t_{THL}$	Output Transition time		4.5		8	15		18		22	ns

AC Waveforms



**Note to Fig. 4**

The shaded areas indicate when the input is permitted to change for predictable output performance

**Note to AC waveforms**

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