

GD54/74HC175, GD54/74HCT175

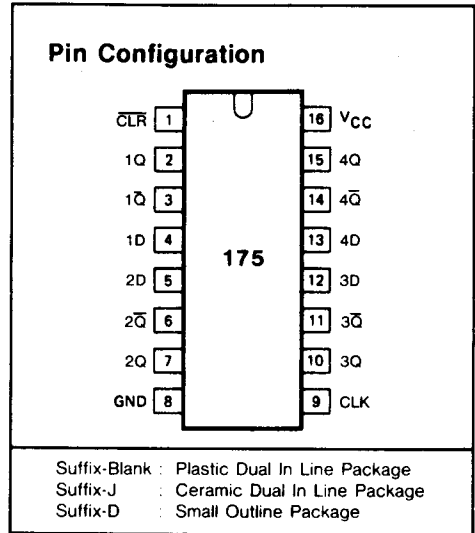
QUAD D-TYPE FLIP-FLIPS WITH COMMON CLOCK & CLEAR

General Description

These devices are identical in pinout to the 54/74LS175. They contain four D-type flip-flops with common clock and clear inputs, and separate data inputs. Information at a data input is transferred to the Q and \bar{Q} outputs on the rising edge of the clock pulse. Both true and complementary outputs from each flip-flop are externally available. clear is asynchronous and active-low. 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: $1\mu\text{A}$ Max.
- Low quiescent current: $80\mu\text{A}$ 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	$\overline{\text{nQ}}$
clear	L	X	X	L	H
load "1"	H	↑	h	H	L
load "0"	H	↑	l	L	H

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 on set-up time prior to the LOW-to-HIGH CLK transition

↑ = LOW-to-HIGH CLK transition

X = don't care

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 $1/16 \pm 1/32$ 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

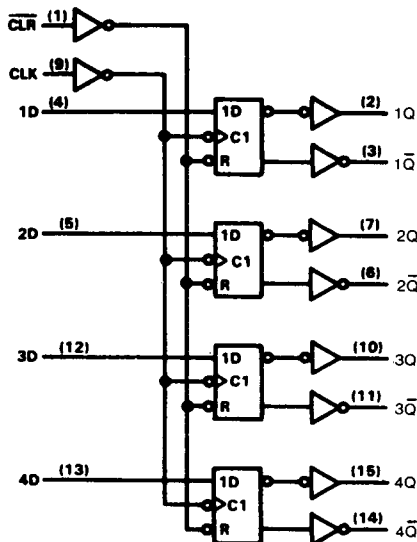


Fig. 1 Logic diagram

DC Electrical Characteristics for HC

SYMBOL	PARAMETER	TEST CONDITION	V _{CC} (V)	T _A =25°C			GD74HC175		GD54HC175		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 I _{OH} =-5.2mA	4.5	3.98	4.3		3.84		3.7		
				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			0.1
		or V _{IL}	I _{OL} =4mA I _{OL} =5.2mA	4.5		0.17	0.26		0.33			0.4
				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			8		80		160	μA	

DC Electrical Characteristics for HCT

SYMBOL	PARAMETER	TEST CONDITION	V _{CC} (V)	T _A =25°C			GD74HCT175		GD54HCT175		UNIT	
				MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.		
V _{IH}	HIGH level input Voltage		4.5								V	
			to	2.0			2.0		2.0			
			5.5									
V _{IL}	LOW level input voltage		4.5								V	
			to			0.8		0.8		0.8		
			5.5									
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	3.98	4.3		3.84		3.7		
				4.5			0.1		0.1			0.1
V _{OL}	LOW level output voltage	V _{IN} =V _{IH}	I _{OL} =20μA	4.5			0.1		0.1		V	
				4.5		0.17	0.26		0.33			0.4
		or V _{IL}	I _{OL} =4mA	4.5		0.17	0.26		0.33			0.4
				4.5								
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			8		80		160	μA	

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

SYMBOL	PARAMETER		V_{CC} (V)	$T_A=25^\circ\text{C}$			GD74HC175		GD54HC175		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_w	Pulse width	$\overline{\text{CLR}}$ low	2.0	80	30		100		120		ns
			4.5	16	10		20		25		
			6.0	14	8		18		22		
		CLK high or low	2.0	80	30		100		120		
			4.5	16	10		20		25		
			6.0	14	8		18		22		
t_{su}	Setup time	nD 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	$\overline{\text{CLR}}$ 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 nD	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)	$T_A=25^\circ\text{C}$			GD74HC175		GD54HC175		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, 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 $\overline{\text{CLR}}$ to nQ, n $\overline{\text{Q}}$		2.0		46	160		200		240	ns
			4.5		16	30		40		50	
			6.0		15	28		35		45	
$t_{TLH}/$ t_{THL}	Output Transition Time		2.0		25	7		85		100	ns
			4.5		8	15		18		22	
			6.0		7	13		16		19	

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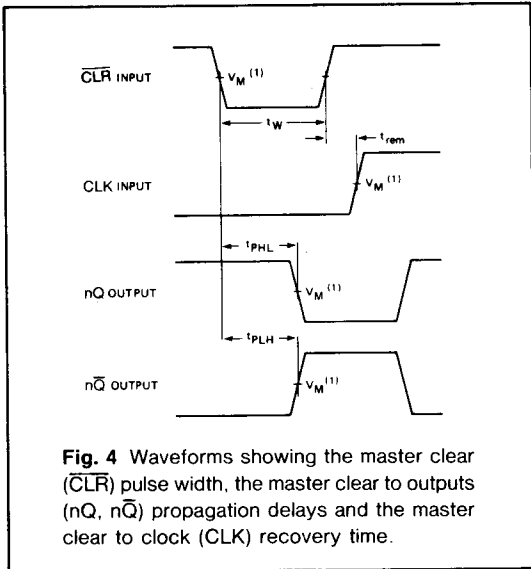
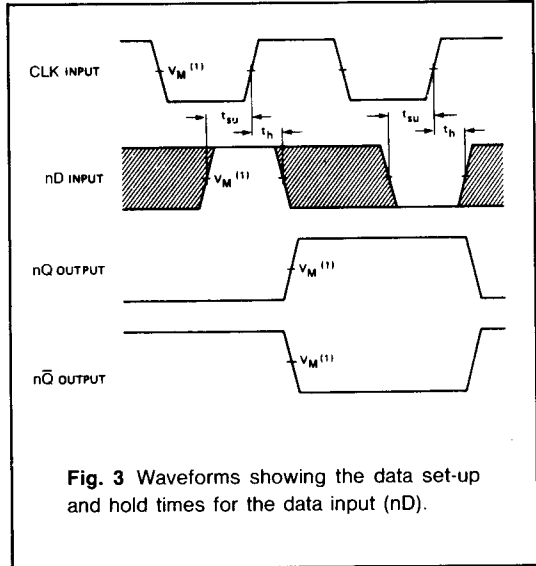
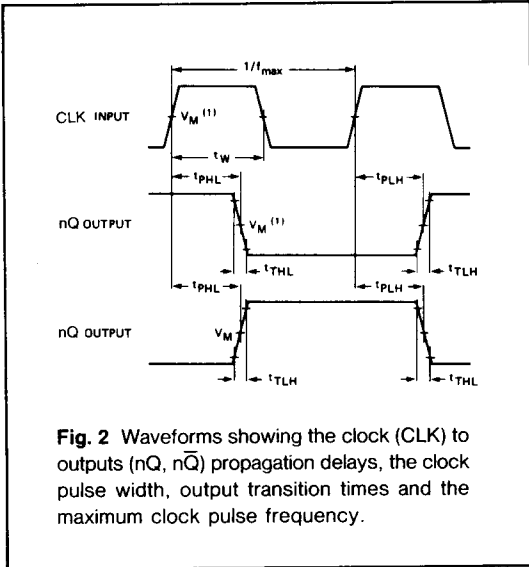
Timing Requirements for HCT: $t_r=t_f=6\text{ns}$ $C_L=50\text{ pF}$

SYMBOL	PARAMETER		V_{CC} (V)	$T_A=25^\circ\text{C}$			GD74HCT175		GD54HCT175		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_w	Pulse width	$\overline{\text{CLR}}$ low	4.5	18	10		20		25		ns
		CLK high or low	4.5	16	10		20		25		ns
t_{su}	Setup time	nD to CLK	4.5	15	10		18		22		ns
t_{rec}	Recovery time	$\overline{\text{CLR}}$ to CLK	4.5	5	0		5		5		ns
t_h	Hold time	CLK to nD	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)	$T_A=25^\circ\text{C}$			GD74HCT175		GD54HCT175		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, n $\overline{\text{Q}}$		4.5		18	31		42		54	ns
$t_{PLH}/$ t_{PHL}	Propagation Delay Time $\overline{\text{CLR}}$ to nQ, n $\overline{\text{Q}}$		4.5		17	30		40		50	ns
$t_{TLH}/$ t_{THL}	Output Transition Time		4.5		8	15		18		22	ns

AC Waveforms



Note to Fig. 3

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 $3V$.