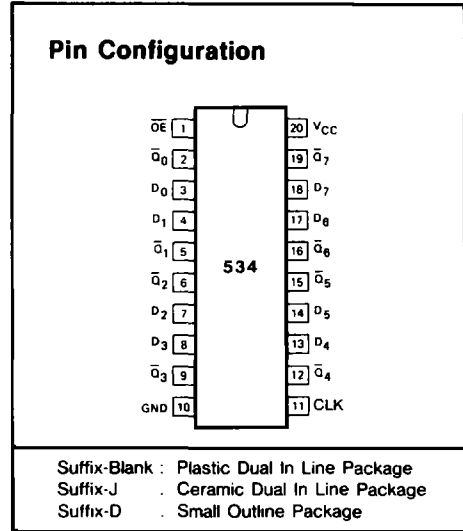


# GD54/74HC534, GD54/74HCT534

## OCTAL 3-STATE INVERTING D-TYPE FLIP-FLOPS

### General Description

These devices are identical in pinout to the 54/74LS534. They contain eight D-type master/slave flip-flops with a common clock and clear. Data meeting the setup and hold time requirements are transferred to the 3-state outputs on the rising edge of the clock pulse. The output enable input does not affect the states of the flip-flops, but when output enable is high, the outputs are forced to the high impedance state. Data may thus be stored even when the device is not selected. The HC/HCT 534 are identical in function to the HC/HCT 564 which have the input pins on the opposite side of the package from the output pins. They are similar in function to the HC/HCT 374 which have noninverting outputs. 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			INTERNAL FLIP-FLOPS	OUTPUT $\bar{Q}_0$ to $\bar{Q}_7$
	$\bar{OE}$	CLK	$D_n$		
load and read register	L	†	l	L	H
	L	†	h	H	L
load register and disable outputs	H	†	l	L	Z
	H	†	h	H	Z

- 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  
 Z = high impedance OFF-state  
 † = LOW-to-HIGH clock 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 $-0.5V < V_O < V_{CC} + 0.5V$		35	mA
$I_{CC}$	DC $V_{CC}$ or GND current			70	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

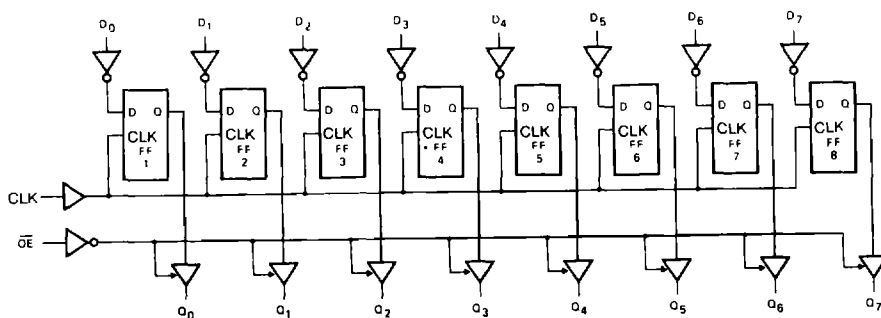


Fig. 1 Logic diagram.

DC Electrical Characteristics for HC

SYMBOL	PARAMETER	TEST CONDITION	V <sub>CC</sub> (V)	T <sub>A</sub> =25°C			GD74HC534		GD54HC534		UNIT	
				MIN	TYP	MAX	MIN	MAX	MIN	MAX		
V <sub>IH</sub>	HIGH level input Voltage		2.0 4.5 6.0	1.5 3.15 4.2			1.5 3.15 4.2		1.5 3.15 4.2		V	
V <sub>IL</sub>	LOW level input voltage		2.0 4.5 6.0			0.3 0.9 1.2		0.3 0.9 1.2		0.3 0.9 1.2	V	
V <sub>OH</sub>	HIGH level output voltage	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</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		
				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> or V <sub>IL</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	
				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>OZ</sub>	Three-State leakage current	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> V <sub>O</sub> =V <sub>CC</sub> or GND	6.0		0.01	0.5		5.0		10.0	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			GD74HCT534		GD54HCT534		UNIT	
				MIN	TYP	MAX	MIN	MAX	MIN	MAX		
V <sub>IH</sub>	HIGH level input Voltage		4.5 to 5.0	2.0			2.0		2.0		V	
V <sub>IL</sub>	LOW level input voltage		4.5 to 5.5			0.8		0.8		0.8	V	
V <sub>OH</sub>	HIGH level output voltage	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> =-20μA	4.5	4.4	4.5		4.4		4.4		V
			I <sub>OH</sub> =-6mA	4.5	3.98	4.3		3.84		3.7		
V <sub>OL</sub>	LOW level output voltage	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> =20μA	4.5			0.1		0.1		0.1	V
			I <sub>OL</sub> =6mA	4.5		0.17	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>OZ</sub>	Three-State leakage current	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> V <sub>O</sub> =V <sub>CC</sub> or GND	5.5		0.01	0.5		5.0		10.0	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	

# GD54/74HC534, GD54/74HCT534

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

SYMBOL	PARAMETER		$V_{CC}$ (V)	$T_A=25^\circ\text{C}$			GD74HC534		GD54HC534		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
$t_w$	Pulse width	CLK high or low	2.0	80	30		100		120		ns
			4.5	16	10		20		25		
			6.0	14	8		18		22		
$t_{su}$	Setup time	Data before CLK↑	2.0	60	30		100		120		ns
			4.5	12	10		20		25		
			6.0	10	8		18		22		
$t_h$	Hold time	Data after CLK↑	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)	$T_A=25^\circ\text{C}$			GD74HC534		GD54HC534		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
$t_{max}$	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 $\bar{Q}_n$		2.0		40	140		180		210	ns
			4.5		14	28		36		40	
			6.0		12	26		33		38	
$t_{PZH}/$ $t_{PZL}$	3-state Output Enable Time $\bar{OE}$ to $\bar{Q}_n$		2.0		38	140		180		210	ns
			4.5		13	28		36		40	
			6.0		12	26		33		38	
$t_{PLZ}/$ $t_{PHZ}$	3-state Output disable time $\bar{OE}$ to $\bar{Q}_n$		2.0		38	140		180		210	ns
			4.5		13	28		30		40	
			6.0		12	26		33		38	
$t_{TLH}/$ $t_{THL}$	Output Transition Time		2.0		15	60		75		90	ns
			4.5		6	12		15		18	
			6.0		5	10		13		15	

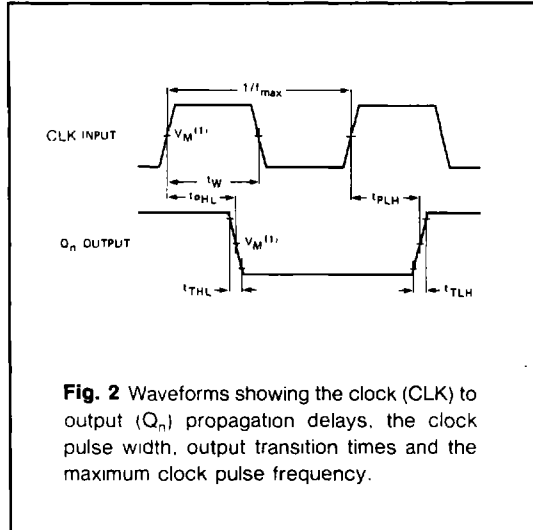
**Timing Requirements for HCT:**  $t_r=t_f=6\text{ns}$   $C_L=50\text{pF}$

SYMBOL	PARAMETER		V <sub>CC</sub> (V)	T <sub>A</sub> =25°C			GD74HCT534		GD54HCT534		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
t <sub>w</sub>	Pulse width	CLK high or low	4.5	16	10		20		25		ns
t <sub>su</sub>	Setup time	Data before CLK†	4.5	12	10		20		25		ns
t <sub>h</sub>	Hold time	Data after CLK†	4.5	3	0		3		3		ns

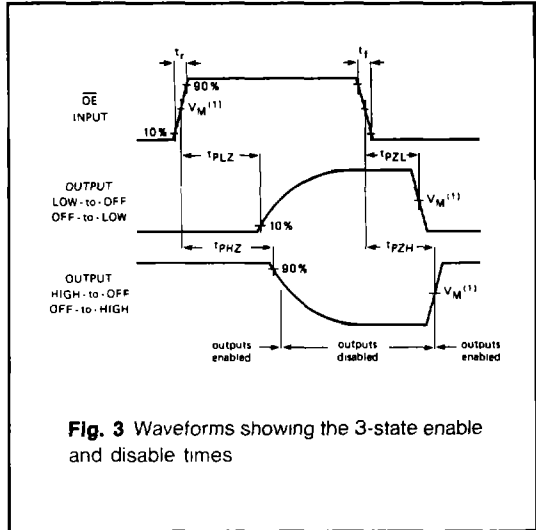
**AC Characteristics for HCT:**  $t_r=t_f=6\text{ns}$   $C_L=50\text{pF}$

SYMBOL	PARAMETER		V <sub>CC</sub> (V)	T <sub>A</sub> =25°C			GD74HCT534		GD54HCT534		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
f <sub>max</sub>	Maximum Clock Pulse Frequency		4.5	27	54		22		18		MHz
t <sub>PLH</sub> / t <sub>PHL</sub>	Propagation Delay Time CLK to $\overline{Q}_n$		4.5		16	30		38		44	ns
t <sub>PZH</sub> / t <sub>PZL</sub>	3-state Output Enable Time $\overline{OE}$ to $\overline{Q}_n$		4.5		15	30		38		45	ns
t <sub>PLZ</sub> / t <sub>PHZ</sub>	3-state Output Disable Time $\overline{OE}$ to $\overline{Q}_n$		4.5		15	30		38		45	ns
t <sub>TLH</sub> / t <sub>THL</sub>	Output Transition Time		4.5		6	12		15		18	ns

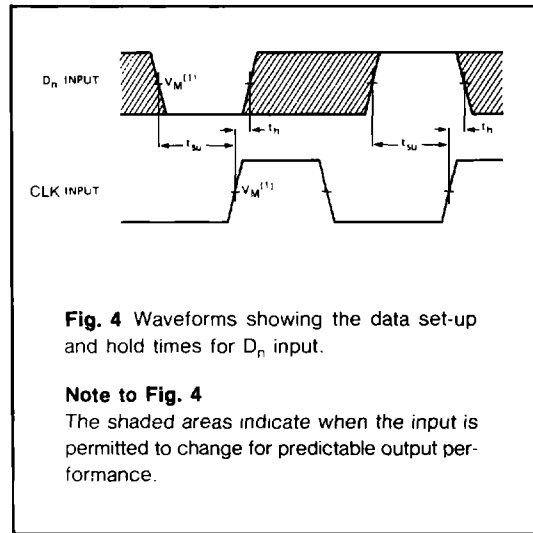
AC Waveforms



**Fig. 2** Waveforms showing the clock (CLK) to output (Q<sub>n</sub>) propagation delays, the clock pulse width, output transition times and the maximum clock pulse frequency.



**Fig. 3** Waveforms showing the 3-state enable and disable times



**Fig. 4** Waveforms showing the data set-up and hold times for D<sub>n</sub> input.

**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 :  $V_M = 50\%$   $V = \text{GND to } V_{CC}$   
 HCT :  $V_M = 1.3V$   $V_i = \text{GND to } 3V$