

GD54/74HC14, GD54/74HCT14

HEX SCHMITT-TRIGGER INVERTERS

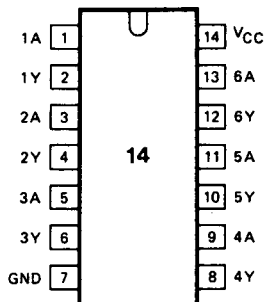
General Description

These devices are identical in pinout to the 54/74LS14. They contain six independent schmitt-trigger inverters. Each circuit functions as an inverter, but because of the schmitt-trigger action, it has different input threshold levels for positive (V_{T+}) and for negative (V_{T-}) going signals. 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: $20\mu\text{A}$ Max. (74HC)
- High noise immunity characteristic of CMOS
- Diode protection on all inputs

Pin Configuration



Suffix-Blank : Plastic Dual In Line Package
 Suffix-J : Ceramic Dual In Line Package
 Suffix-D : Small Outline Package

Logic Symbol and Schematic Diagram

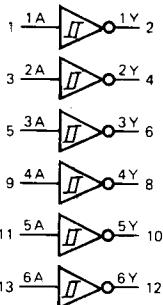


Fig. 1 Logic symbol

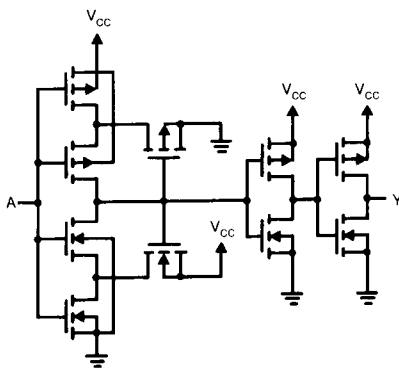


Fig. 2 Schematic diagram

Function Table

INPUT	OUTPUT
nA	nY
L	H
H	L

H=HIGH Voltage level
 L=LOW Voltage level

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 4.5 V		1000 500 400 500	ns

DC Electrical Characteristics for HC

SYMBOL	PARAMETER	TEST CONDITION	V _{CC} (V)	T _A =25°C			GD74HC14		GD54HC14		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		
				6.0	5.9	6.0		5.9		5.9		
		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
				6.0			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			2		20		40	μA	

DC Electrical Characteristics for HCT

SYMBOL	PARAMETER	TEST CONDITION	V _{CC} (V)	T _A =25°C			GD74HCT14		GD54HCT14		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	
				4.5	3.98	4.3		3.84		3.7		
				4.5								
		or V _{IL}	I _{OH} =-4mA	4.5	3.98	4.3		3.84		3.7		
				4.5								
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			
				4.5			0.1		0.1			
		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			2		20		40	μA	

Transfer Characteristic for HC

SYMBOL	PARAMETER	TEST CONDITION	V _{CC} (V)	T _A =25°C			GD74HC14		GD54HC14		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
V _{T+}	Positive-going threshold		2.0	0.7	1.2	1.5	0.7	1.5	0.7	1.5	V
			4.5	1.7	2.4	3.15	1.7	3.15	1.7	3.15	
			6.0	2.1	3.2	4.2	2.1	4.2	2.1	4.2	
V _{T-}	Negative-going threshold		2.0	0.3	0.65	1.0	0.3	1.0	0.3	1.0	V
			4.5	0.9	1.7	2.2	0.9	2.2	0.9	2.2	
			6.0	1.2	2.1	3.0	1.2	3.0	1.2	3.0	
V _H	Hysteresis(V _{T+} -V _{T-})		2.0	0.2	0.5	1.0	0.2	1.0	0.2	1.0	V
			4.5	0.4	0.9	1.4	0.4	1.4	0.4	1.4	
			6.0	0.5	1.3	1.7	0.5	1.7	0.5	1.7	

Transfer Characteristic for HCT

SYMBOL	PARAMETER	TEST CONDITION	V _{CC} (V)	T _A =25°C			GD74HCT14		GD54HCT14		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
V _{T+}	Positive-going threshold		4.5	1.2	1.55	1.9	1.2	1.9	1.2	1.9	V
			5.5	1.4	1.75	2.1	1.4	2.1	1.4	2.1	
V _{T-}	Negative-going threshold		4.5	0.5	0.85	1.2	0.5	1.2	0.5	1.2	V
			5.5	0.6	1.0	1.4	0.6	1.4	0.6	1.4	
V _H	Hysteresis(V _{T+} -V _{T-})		4.5	0.4	0.9	1.4	0.4	1.4	0.4	1.4	V
			5.5	0.5	1.0	1.5	0.5	1.5	0.5	1.5	

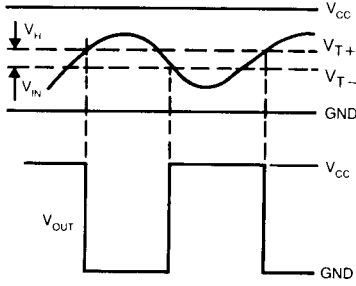
AC Characteristics for HC: t_r=t_f=6ns C_L=50 pF

SYMBOL	PARAMETER	V _{CC} (V)	T _A =25°C			GD74HC14		GD54HC14		UNIT
			MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
t _{PLH} / t _{PHL}	Propagation delay time nA to nY	2.0		36	120		150		180	ns
		4.5		11	24		30		36	
		6.0		9	20		24		30	
t _{TLH} / t _{THL}	Output transition time	2.0		19	75		95		110	ns
		4.5		7	15		19		22	
		6.0		6	13		15		19	

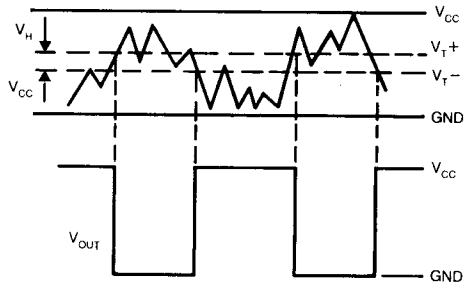
AC Characteristics for HCT: t_r=t_f=6ns C_L=50 pF

SYMBOL	PARAMETER	V _{CC} (V)	T _A =25°C			GD74HCT14		GD54HCT14		UNIT
			MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
t _{PLH} / t _{PHL}	Propagation delay time nA to nY	4.5		15	25		31		38	ns
t _{TLH} / t _{THL}	Output transition time	4.5		7	15		19		22	ns

Typical Applications



(a) A Schmitt trigger squares up inputs with slow rise and fall times.



(b) A Schmitt trigger offers offers maximum noise immunity.

Fig. 3 Typical applications

Transfer characteristic waveforms

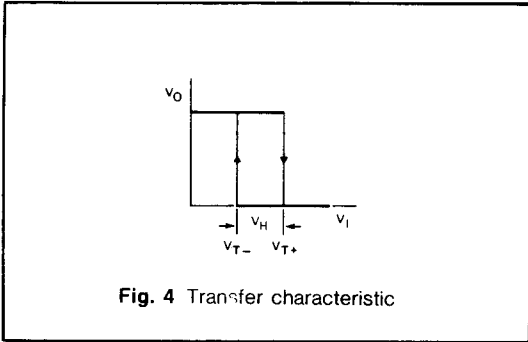


Fig. 4 Transfer characteristic

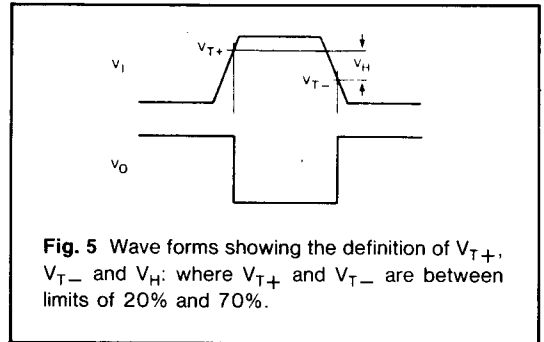


Fig. 5 Wave forms showing the definition of V_{T+} , V_{T-} and V_H ; where V_{T+} and V_{T-} are between limits of 20% and 70%.

AC Waveform

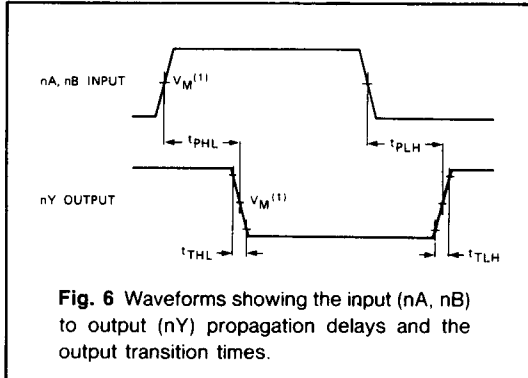


Fig. 6 Waveforms showing the input (nA, nB) to output (nY) propagation delays and the output transition times.

Note to AC waveform

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