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: 1µA Max.
- Low quiescent current: 20µA Max. (74HC)
- High noise immunity characteristic of CMOS
- Diode protection on all inputs

Pin Configuration

Pin		Pin	
1A	1	14	Vcc
1Y	2	13	6A
2A	3	12	6Y
2Y	4	11	5A
3A	5	10	5Y
3Y	6	9	4A
GND	7	8	4Y
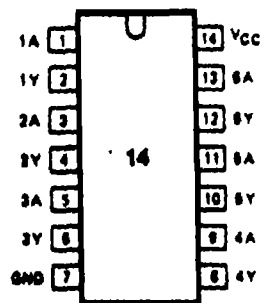
Suffix-Blank : Plastic Dual In Line Package
Suffix-J . Ceramic Dual In Line Package
Suffix-D . Small Outline Package

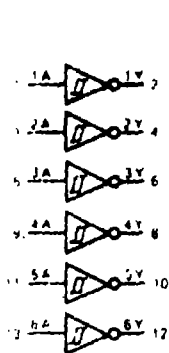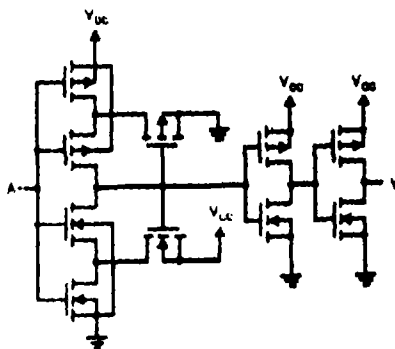### Logic Symbol and Schematic Diagram

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 $1/16 \pm 1/32$ 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 4.5 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	$V_{IN}=V_{IH}$	$I_{OH}=-20\mu A$	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}	$I_{OH}=-4mA$	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	$V_{IN}=V_{IH}$	$I_{OL}=20\mu A$	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_{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 $I_{out}=0\mu A$		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	$V_{IN}=V_{IH}$	$I_{OH}=-20\mu A$	4.5	4.4	4.5		4.4		4.4		V
		or V_{IL}	$I_{OH}=-4mA$	4.5	3.98	4.3		3.84		3.7		
V_{OL}	LOW level output voltage	$V_{IN}=V_{IH}$	$I_{OL}=20\mu A$	4.5			0.1		0.1		0.1	V
		or V_{IL}	$I_{OL}=4mA$	4.5		0.17	0.26		0.33		0.4	
$|I_{IN}|$	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 $I_{out}=0\mu A$		5.5			2		20		40	µA

Transfer Characteristic for HC

SYMBOL	PARAMETER	TEST CONDITION	V_{CC} (V)	$T_A=25°C$ MIN	$T_A=25°C$ TYP.	$T_A=25°C$ MAX.	GD74HC14 MIN.	GD74HC14 MAX.	GD54HC14 MIN.	GD54HC14 MAX.	UNIT
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

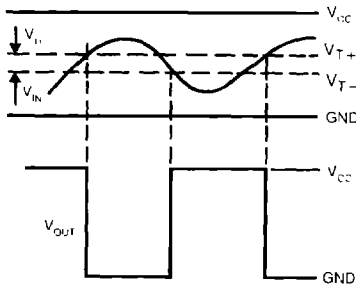| SYMBOL	PARAMETER	TEST CONDITION	V_{CC} (V)	$T_A=25°C$ MIN	$T_A=25°C$ TYP	$T_A=25°C$ MAX	GD74HCT14 MIN.	GD74HCT14 MAX.	GD54HCT14 MIN	GD54HCT14 MAX	UNIT
V_{T+}	Postive-going threshold		4 5	1 2	1.55	1 9	1 2	1 9	1 2	1 9	V
			5 5	1 4	1.75	2 1	1 4	2 1	1 4	2 1	
V_{T-}	Negative-going threshold		4 5	0 5	0 85	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)	$T_A=25°C$ MIN	$T_A=25°C$ TYP	$T_A=25°C$ MAX	GD74HC14 MIN	GD74HC14 MAX	GD54HC14 MIN	GD54HC14 MAX	UNIT
t_{PLH}	Propagation delay time nA to nY	2 0		36	120		150		180	ns
t_{PHL}		4 5		11	24		30		36	
		6 0		9	20		24		30	
t_{TLH}	Output transition time	2 0		19	75		95		110	ns
t_{THL}		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)	$T_A=25°C$ MIN	$T_A=25°C$ TYP	$T_A=25°C$ MAX	GD74HCT14 MIN	GD74HCT14 MAX	GD54HCT14 MIN	GD54HCT14 MAX	UNIT
t_{PLH}	Propagation delay time nA to nY	4.5		15	25		31		38	ns
t_{PHL}										
t_{TLH}	Output transition time	4 5		7	15		19		22	ns
t_{THL}										

Typical Applications

(a) A Schmitt trigger squares up inputs with slow rise and fall times
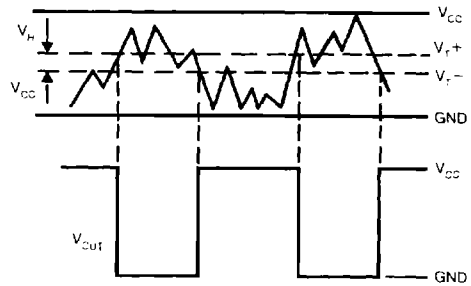
(b) A Schmitt trigger offers offers maximum noise immunity

Fig. 3 Typical applications
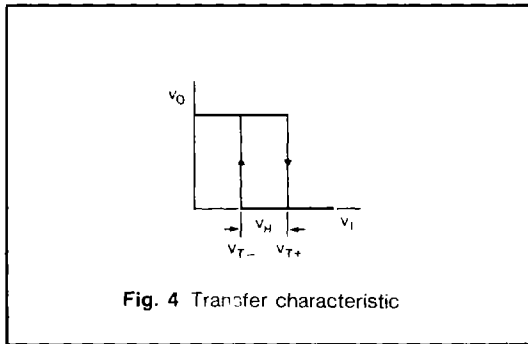
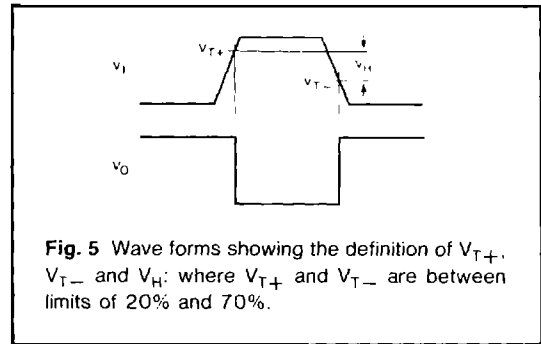## Transfer characteristic waveforms

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%.
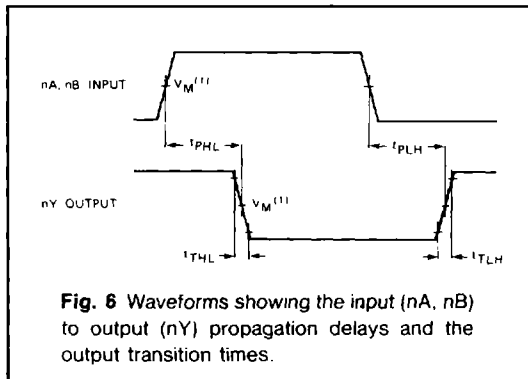
AC Waveform

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