

# GD54/74HC133, GD54/74HCT133

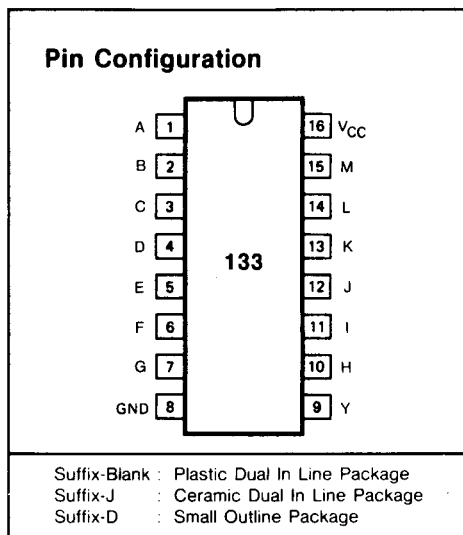
## 13-INPUT NAND GATE

### General Description

These devices are identical in pinout to the 54/74LS133. They contain a single 13-input NAND gate. 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: 20 $\mu$ A Max. (74HC)
- High noise immunity characteristic of CMOS
- Diode protection on all inputs



### Logic Diagram

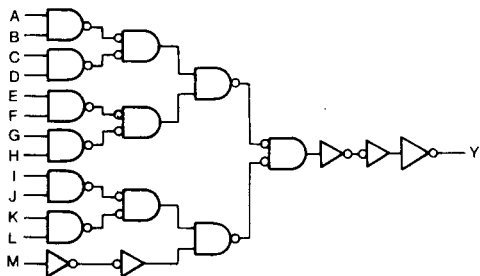


Fig. 1 Logic diagram

### Function Table

INPUTS A THRU M	OUTPUT Y
All inputs H	L
one or more inputs L	H

**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

DC Electrical Characteristics for HC

SYMBOL	PARAMETER	TEST CONDITION	V <sub>CC</sub> (V)	T <sub>A</sub> =25°C			GD74HC133		GD54HC133		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		
		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		V	
				4.5			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>IH</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			2		20		40	μA	

DC Electrical Characteristics for HCT

SYMBOL	PARAMETER	TEST CONDITION	V <sub>CC</sub> (V)	T <sub>A</sub> =25°C			GD74HCT133		GD54HCT133		UNIT	
				MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.		
V <sub>IH</sub>	HIGH level input Voltage		4.5 to 5.5	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>	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		
		or V <sub>IL</sub>	I <sub>OH</sub> =-4mA	4.5			0.1		0.1			0.1
				4.5		0.17	0.26		0.33			0.4
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		V	
				4.5			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		0.15	0.26		0.33			0.4
I <sub>IH</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			2		20		40	μA	

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

SYMBOL	PARAMETER	$V_{CC}$ (V)	$T_A=25^\circ\text{C}$			GD74HC133		GD54HC133		UNIT
			MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
$t_{PLH}/$ $t_{PHL}$	Propagation delay time A thru H to Y	2.0		65	140		180		210	ns
		4.5		15	29		36		42	
		6.0		12	25		31		36	
$t_{TLH}/$ $t_{THL}$	Output transition time	2.0		25	75		95		110	ns
		4.5		8	15		19		22	
		6.0		7	13		16		19	

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

SYMBOL	PARAMETER	$V_{CC}$ (V)	$T_A=25^\circ\text{C}$			GD74HCT133		GD54HCT133		UNIT
			MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
$t_{PLH}/$ $t_{PHL}$	Propagation delay time A thru H to Y	4.5		18	31		40		46	ns
$t_{TLH}/$ $t_{THL}$	Output transition time	4.5		8	15		19		22	ns

AC Waveform

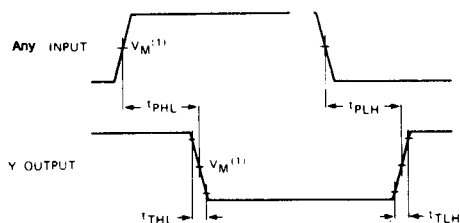


Fig. 2 Waveforms showing the (Any) Input to output (Y) propagation delays and the output transition times.

Note to AC waveform

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