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

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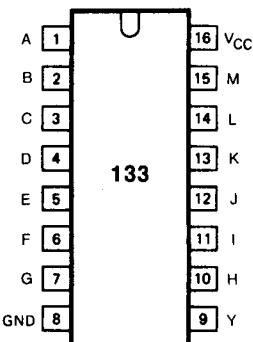
Suffix-Blank :	Plastic Dual In Line Package
Suffix-J :	Ceramic Dual In Line Package
Suffix-D :	Small Outline Package

Logic Diagram
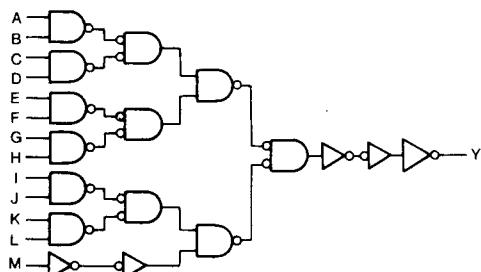
Fig. 1 Logic diagram

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±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	2	6	V
GD54/74HCT Types	4.5	5.5	
DC Input or Output Voltage V_I, V_O	0	V_{CC}	V
Operating Temperature T_A: GD74 Types	−40	+85	°C
GD54 Types	−55	+125	
Input Rise and Fall times t_r, t_f: GD54/74HC Types at 2V		1000	ns
at 4.5V		500	
at 6V		400	
GD54/74HCT Types at 4.5V		500	

DC Electrical Characteristics for HC

SYMBOL	PARAMETER	TEST CONDITION		V_{CC} (V)	$T_A=25°C$			GD74HC133		GD54HC133		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	$V_{IN}=V_{IH}$ or V_{IL}	$I_{OH}=-20\mu A$	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		
			$I_{OH}=-4mA$	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	$V_{IN}=V_{IH}$ or V_{IL}	$I_{OL}=20\mu A$	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	
			$I_{OL}=4mA$	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)	$T_A=25°C$			GD74HCT133		GD54HCT133		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	$V_{IN}=V_{IH}$ or V_{IL}	$I_{OH}=-20\mu A$	4.5	4.4	4.5		4.4		4.4		V
			$I_{OH}=-4mA$	4.5	3.98	4.3		3.84		3.7		
V_{OL}	LOW level output voltage	$V_{IN}=V_{IH}$ or V_{IL}	$I_{OL}=20\mu A$	4.5			0.1		0.1		0.1	V
			$I_{OL}=4mA$	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

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

SYMBOL	PARAMETER	V_{CC} (V)	$T_A=25°C$			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: $t_r=t_f=6ns$ $C_L=50pF$

SYMBOL	PARAMETER	V_{CC} (V)	$T_A=25°C$			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
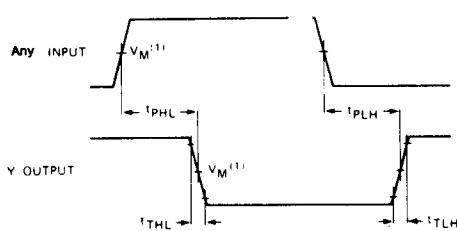
AC Waveform

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.