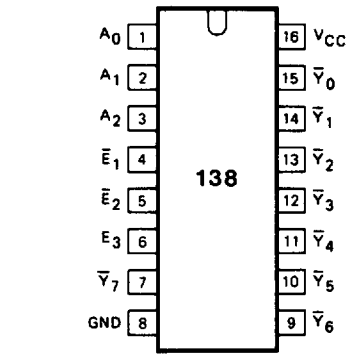
GD54/74HC138, GD54/74HCT138

3-TO-8 LINE DECODER/DEMULTIPLEXER

General Description

These devices are identical in pinout to the 54/74LS138. Each device has 3 Binary select (A, B, and C), and decodes A 3-Bit address to 1-of-8 active-LOW outputs. This device features three chip enable inputs. Two active-LOW and one active-HIGH to facilitate the demultiplexing, cascading, and chip-selecting functions. These devices are characterized for operation over wide temperature ranges to meet industry and military specifications

Pin Configuration



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

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 curent: 1μA Max.
- Low quiescent current: 80μA Max. (74HC)
- High noise immunity characteristic of CMOS
- Diode protection on all inputs

Function Table

INPUTS						OUTPUTS							
$\overline{E}_1$	$\overline{E}_2$	E_3	A_0	A_1	A_2	$\overline{Y}_0$	$\overline{Y}_1$	$\overline{Y}_2$	$\overline{Y}_3$	$\overline{Y}_4$	$\overline{Y}_5$	$\overline{Y}_6$	$\overline{Y}_7$
H	X	X	X	X	X	H	H	H	H	H	H	H	H
X	H	X	X	X	X	H	H	H	H	H	H	H	H
X	X	L	X	X	X	H	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	H	L	L	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	L	H	H	H	H	H
L	L	H	H	H	L	H	H	H	L	H	H	H	H
L	L	H	L	L	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	L	H	H
L	L	H	L	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	L

H = HIGH voltage level
L = LOW voltage level
X = don't care

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	

Logic Diagram

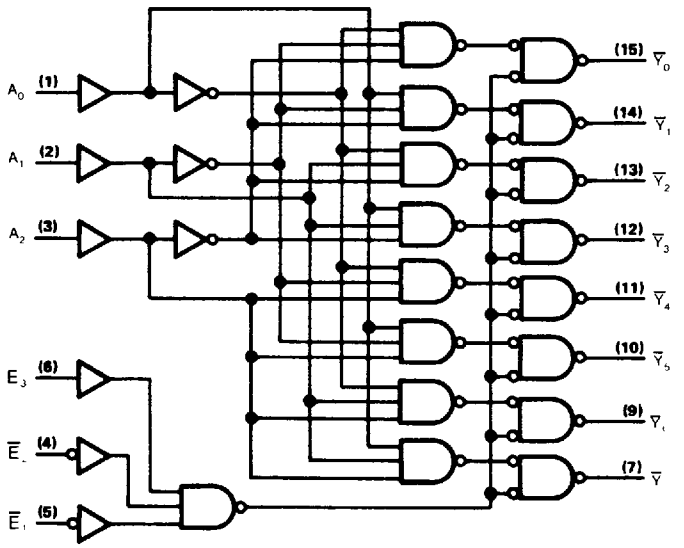


Fig. 1 Logic diagram

DC Electrical Characteristics for HC

SYMBOL	PARAMETER	TEST CONDITION		V_{CC} (V)	T_A=25°C			GD74HC138		GD54HC138		UNIT
					MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{IH}	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_{IL}	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_{OH}	HIGH level output voltage	$V_{IN}=V_{IH}$ or V_{IL}	$I_{OH}=-20\mu A$	2 0 4 5 6 0	1 9 4 4 5 9	2 0 4 5 6 0		1 9 4 4 5 9		1 9 4 4 5 9		V
			$I_{OH}=-4mA$ $I_{OH}=-5\ 2mA$	4 5 6 0	3 98 5 48	4 3 5 2		3 84 5 34		3 7 5 2		
V_{OL}	LOW level output voltage	$V_{IN}=V_{IH}$ or V_{IL}	$I_{OL}=20\mu A$	2 0 4 5 6 0			0 1 0 1 0 1		0 1 0 1 0 1		0 1 0 1 0 1	V
			$I_{OL}=4mA$ $I_{OL}=5\ 2mA$	4 5 6 0		0 17 0 15	0 26 0 26		0 33 0 33		0 4 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			8		80		160	μA

DC Electrical Characteristics for HCT

SYMBOL	PARAMETER	TEST CONDITION		V_{CC} (V)	T_A=25°C			GD74HCT138		GD54HCT138		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			8		80		160	μA

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

SYMBOL	PARAMETER	V_{CC} (V)	$T_A=25°C$			GD74HC138		GD54HC138		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation Delay Time An, E_3 to $\overline{Y}n$	2 0 4 5 6 0		40 15 12	150 30 26		190 38 33		225 45 38	ns
t_{PLH} t_{PHL}	Propagation Delay Time $\overline{E}_1$, $\overline{E}_2$ to $\overline{Y}n$	2 0 4 5 6 0		40 15 12	150 34 32		190 38 33		225 45 38	ns
t_{TLH} t_{THL}	Output Transition Time	2 0 4 5 6 0		19 7 6	75 15 13		95 19 16		110 22 19	ns

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

SYMBOL	PARAMETER	V_{CC} (V)	$T_A=25°C$			GD74HCT138		GD54HCT138		UNIT
			MIN	TYP	MAX	MIN.	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation Delay Time An, E_3 to $\overline{Y}n$	4 5		19	34		43		52	ns
t_{PLH} t_{PHL}	Propagation Delay Time $\overline{E}_1$, $\overline{E}_2$ to $\overline{Y}n$	4 5		18	40		50		60	ns
t_{TLH} t_{THL}	Output Transition Time	4 5		7	15		19		22	ns

AC Waveforms

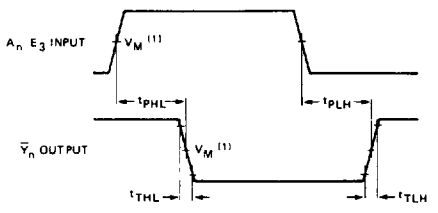


Fig. 2 Waveforms showing the address input (A_n) and enable input (E_3) to output ($\overline{Y}_n$) propagation delays and the output transition times.

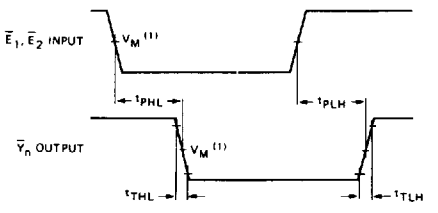


Fig. 3 Waveforms showing the enable input ($\overline{E}_n$) to output ($\overline{Y}_n$) propagation delays and the output transition times.

Note to AC waveforms

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