

# GD54/74HC138, GD54/74HCT138

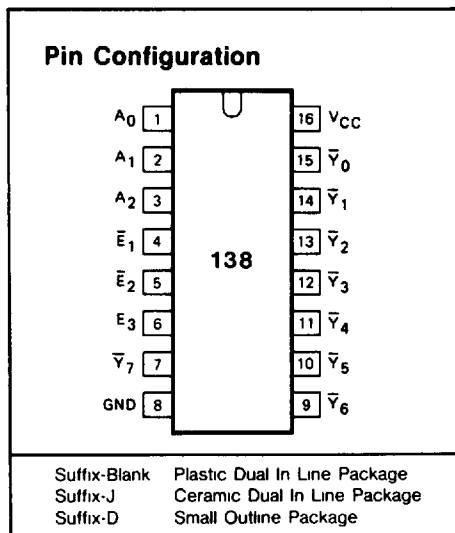
## 3-TO-8 LINE DECODER/DEMULTIPLEXER

### 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

### 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: 80 $\mu$ A Max. (74HC)
- High noise immunity characteristic of CMOS
- Diode protection on all inputs



### Function Table

INPUTS						OUTPUTS							
E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>	A <sub>0</sub>	A <sub>1</sub>	A <sub>2</sub>	$\bar{Y}_0$	$\bar{Y}_1$	$\bar{Y}_2$	$\bar{Y}_3$	$\bar{Y}_4$	$\bar{Y}_5$	$\bar{Y}_6$	$\bar{Y}_7$
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	H	H	H	H	H	H	L	H	H	H
L	L	H	H	H	H	H	H	H	H	H	L	H	H
L	L	H	H	H	H	H	H	H	H	H	H	L	H

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 $V_i > V_{CC} + 0.5$ V		20	mA
$I_O$	DC output source or sink current	for $-0.5$ V $< V_O < V_{CC} + 0.5$ V		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 4.5V		1000 500 400 500	ns

## Logic Diagram

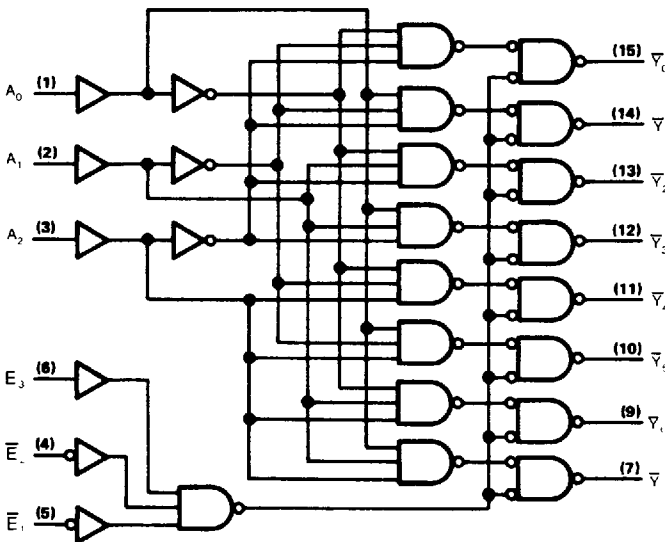


Fig. 1 Logic diagram

DC Electrical Characteristics for HC

SYMBOL	PARAMETER	TEST CONDITION	V <sub>CC</sub> (V)	T <sub>A</sub> =25°C			GD74HC138		GD54HC138		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		
				6 0	5 9	6 0		5 9		5 9		
		or V <sub>IL</sub>	I <sub>OH</sub> =-4mA I <sub>OH</sub> =-5.2mA	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
				6 0			0 1		0 1			0 1
		or V <sub>IL</sub>	I <sub>OL</sub> =4mA I <sub>OL</sub> =5.2mA	4 5		0 17	0 26		0 33			0 4
				6 0		0 15	0 26		0 33			0 4
I <sub>IN</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			8		80		160	μA	

DC Electrical Characteristics for HCT

SYMBOL	PARAMETER	TEST CONDITION	V <sub>CC</sub> (V)	T <sub>A</sub> =25°C			GD74HCT138		GD54HCT138		UNIT	
				MIN	TYP	MAX	MIN	MAX	MIN	MAX		
V <sub>IH</sub>	HIGH level input Voltage		4 5								V	
			to	2 0			2 0		2 0			
			5 5									
V <sub>IL</sub>	LOW level input voltage		4 5			0 8		0 8		0 8	V	
			to									
			5 5									
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		
				4 5								
		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
				4 5								
I <sub>IN</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			8		80		160	μA	

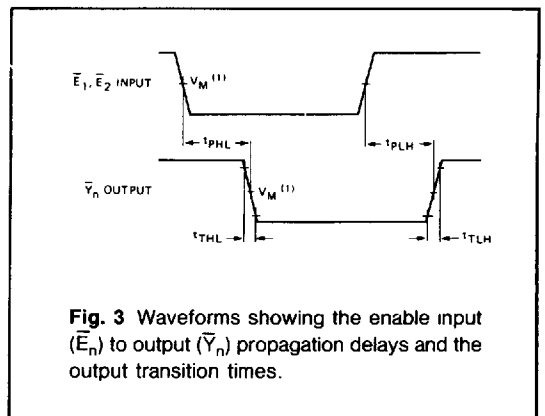
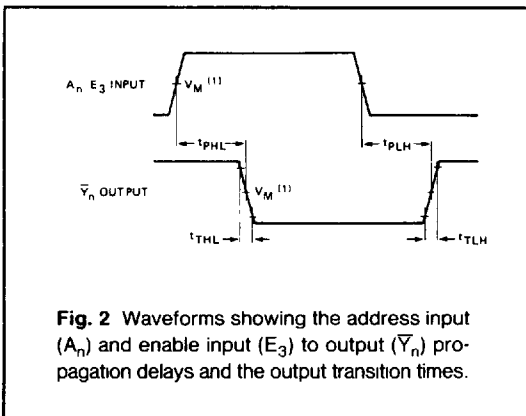
## AC Characteristics for HC: $t_r=t_f=6\text{ns}$ $C_L=50\text{ pF}$

SYMBOL	PARAMETER	$V_{CC}$ (V)	$T_A=25^\circ\text{C}$			GD74HC138		GD54HC138		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time	2.0		40	150		190		225	ns
	$A_n, E_3$ to $\bar{Y}_n$	4.5		15	30		38		45	
		6.0		12	26		33		38	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time	2.0		40	150		190		225	ns
	$\bar{E}_1, \bar{E}_2$ to $\bar{Y}_n$	4.5		15	34		38		45	
		6.0		12	32		33		38	
$t_{TLH}$ $t_{THL}$	Output Transition Time	2.0		19	75		95		110	ns
		4.5		7	15		19		22	
		6.0		6	13		16		19	

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

SYMBOL	PARAMETER	$V_{CC}$ (V)	$T_A=25^\circ\text{C}$			GD74HCT138		GD54HCT138		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time	4.5		19	34		43		52	ns
	$A_n, E_3$ to $\bar{Y}_n$									
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time	4.5		18	40		50		60	ns
	$\bar{E}_1, \bar{E}_2$ to $\bar{Y}_n$									
$t_{TLH}$ $t_{THL}$	Output Transition Time	4.5		7	15		19		22	ns

## AC Waveforms



### Note to AC waveforms

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