

# GD54/74HC138, GD54/74HCT138

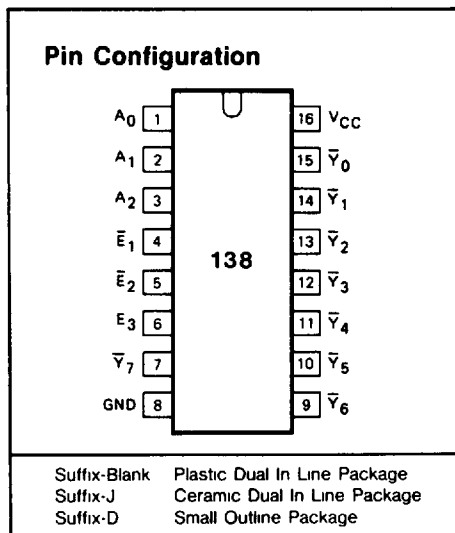
## 3-TO-8 LINE DECODER/DEMULTIPLEXER

### 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	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 $V_i > V_{CC} + 0.5$ 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

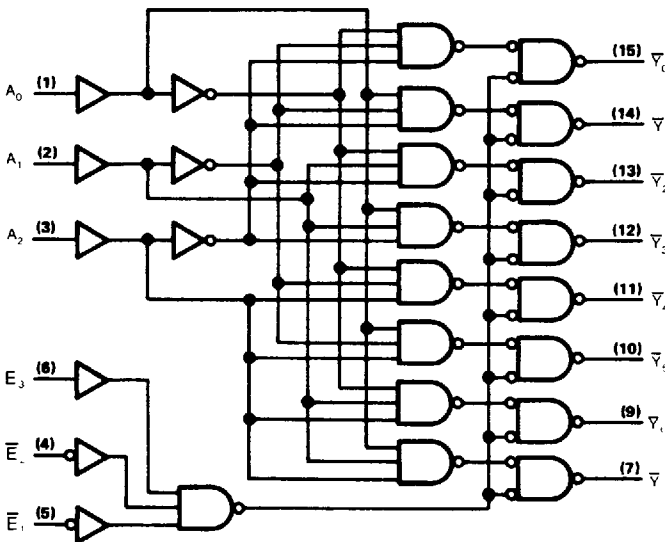


Fig. 1 Logic diagram

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			0.1		0.1			0.1
		or V <sub>IL</sub>	I <sub>OH</sub> =-4mA	4.5	3.98	4.3		3.84		3.7		
				4.5			0.1		0.1			0.1
				4.5		0.17	0.26		0.33			0.4
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	

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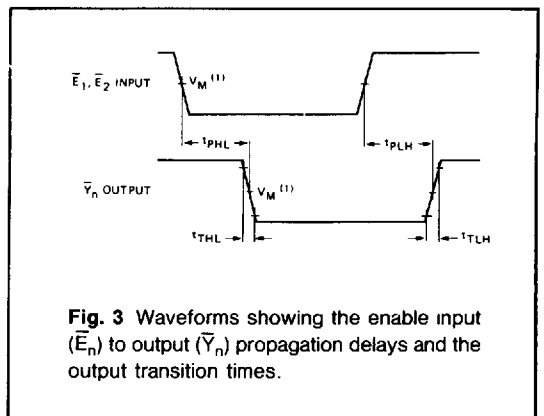
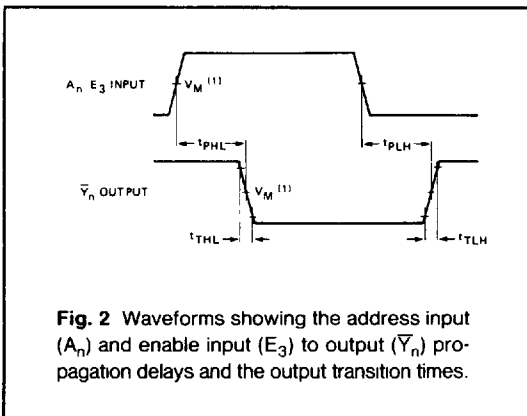
## AC Characteristics for HC: $t_r=t_f=6\text{ns}$ $C_L=50\text{ pF}$

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  $3V$