

GD54/74HC138, GD54/74HCT138

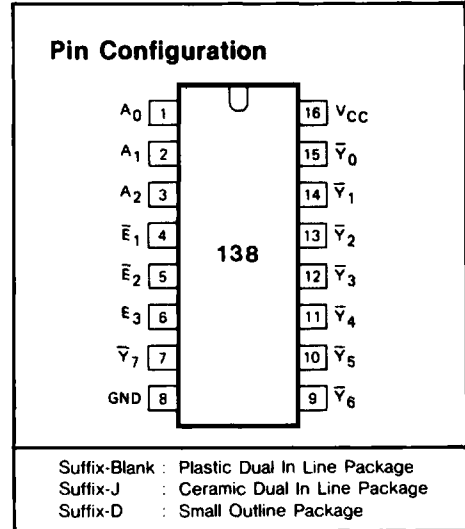
3-TO-8 LINE DECODER/DEMULTIPLEXER

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



Function Table

INPUTS						OUTPUTS							
E ₁	E ₂	E ₃	A ₀	A ₁	A ₂	Y ₀	Y ₁	Y ₂	Y ₃	Y ₄	Y ₅	Y ₆	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	L	H	H	H	H	L	H	H	H	H
L	L	H	H	L	H	H	H	H	H	L	H	H	H
L	L	H	L	H	H	H	H	H	H	H	L	H	H
L	L	H	H	H	H	H	H	H	H	H	H	L	L
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

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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

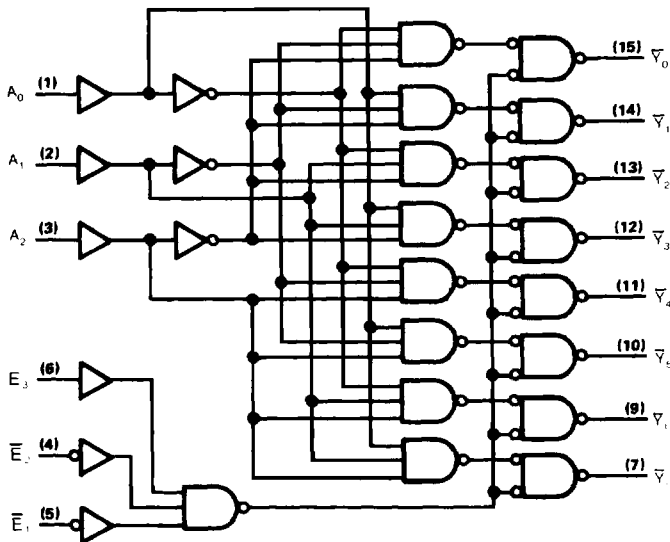


Fig. 1 Logic diagram

GD54/74HC138, GD54/74HCT138

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	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}	I _{OH} =-20μA	2.0	1.9	2.0		1.9		1.9	V	
			4.5	4.4	4.5		4.4		4.4			
		or V _{IL}	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}	I _{OL} =20μA	2.0			0.1		0.1		V	
			4.5			0.1		0.1		0.1		
		or V _{IL}	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} =0μA	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								V	
			to	2.0			2.0		2.0			
			5.5									
V _{IL}	LOW level input voltage		4.5								V	
			to			0.8		0.8		0.8		
			5.5									
V _{OH}	HIGH level output voltage	V _{IN} =V _{IH}	I _{OH} =-20μA	4.5	4.4	4.5		4.4		4.4	V	
			4.5	3.98	4.3		3.84		3.7			
		or V _{IL}	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}	I _{OL} =20μA	4.5			0.1		0.1		V	
			4.5			0.1		0.1		0.1		
		or V _{IL}	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	5.5			0.1		1.0		1.0	μA	
I _{CC}	Quiescent Supply Current	V _{IN} =V _{CC} or GND I _{out} =0μA	5.5			8		80		160	μA	

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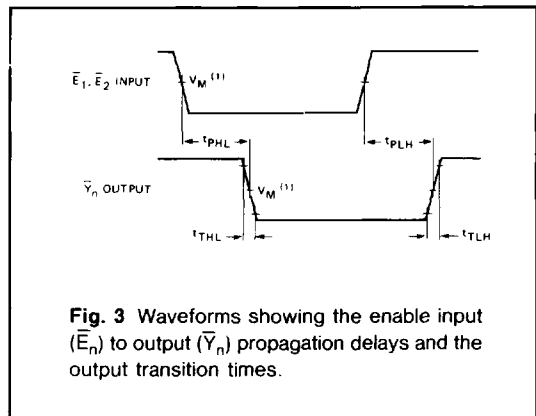
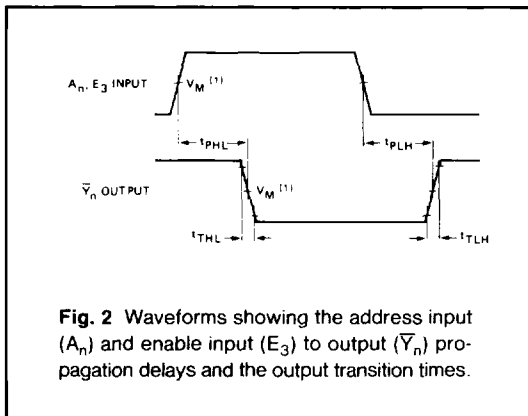
AC Characteristics for HC: $t_r=t_f=6\text{ns}$ $C_L=50\text{ pF}$

SYMBOL	PARAMETER	V_{CC} (V)	$T_A=25^\circ\text{C}$			GD74HC138		GD54HC138		UNIT
			MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	MAX.	
t_{PLH}	Propagation Delay Time A_n, E_3 to \bar{Y}_n	2.0		40	150		190		225	ns
t_{PHL}		4.5		15	30		38		45	
		6.0		12	26		33		38	
t_{PLH}	Propagation Delay Time \bar{E}_1, \bar{E}_2 to \bar{Y}_n	2.0		40	150		190		225	ns
t_{PHL}		4.5		15	34		38		45	
		6.0		12	32		33		38	
t_{TLH}	Output Transition Time	2.0		19	75		95		110	ns
		4.5		7	15		19		22	
t_{THL}		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}	Propagation Delay Time A_n, E_3 to \bar{Y}_n	4.5		19	34		43		52	ns
t_{PHL}										
t_{PLH}	Propagation Delay Time \bar{E}_1, \bar{E}_2 to \bar{Y}_n	4.5		18	40		50		60	ns
t_{PHL}										
t_{TLH}	Output Transition Time	4.5		7	15		19		22	ns
t_{THL}										

AC Waveforms



Note to AC waveforms

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