3-to-8 Decoder/Demultiplexer

General Description

74HC138V is a high-speed CMOS decoder circuit, it accepts a three-bit binary weighed address on input pins A0, A1, A2 and when enabled will produce one active low output and other seven output high level.

In addition, the circuit has two low-level enable pins $\overline{E1}$ and $\overline{E2}$ and high-level enable pin E3. When the circuit is in the non-enable state, all output pins output high level; When the circuit is enabled, $\overline{E1}$ and $\overline{E2}$ are low level and E3 is high level.

The circuit uses multiple enable signals to realize the expansion of the decoder. Without using additional devices, it can be expanded into a 4 to 16 decoder, while expanding 5 to 32 decoding requires an inverter.

Features

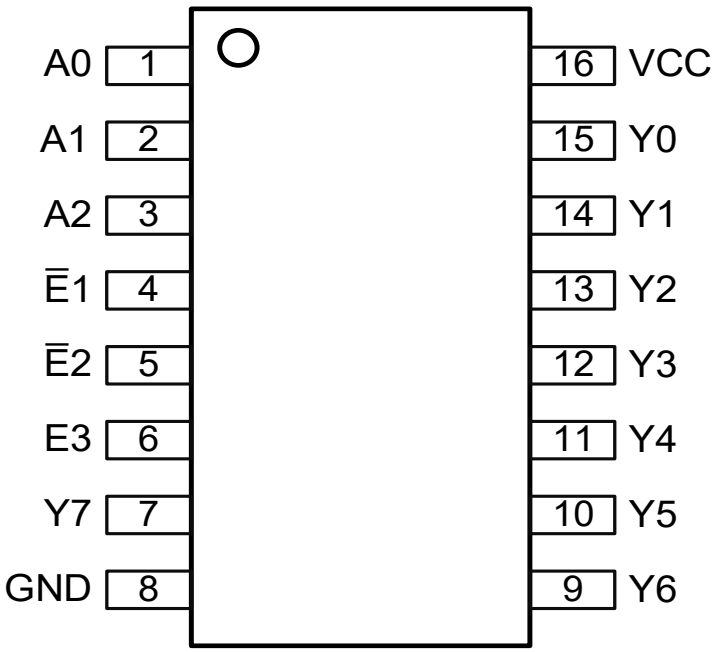
- Designed for 2V to 6V V_{CC} Operation
- Provide 8mA Current with V_{CC} = 4.5V
- CMOS Low Power Design
- Schmitt Trigger Input Port
- ESD Protection Complies with JESD22 Standard
  -- HBM: ±2000V Pass (JEDEC JS-001)
  -- CDM: ±200V Pass (JEDEC JS-002)
- These Devices are Pb. Free, Halogen Free/BFR Free and are RoHS Compliant
- Part No. and Package Information

Product Name	Package	MSL
74HC138V	TSSOP16	Level 3

Applications

- Memory Chip Select Decoding
- Data Transmission System

Pin Configuration



TOP VIEW

Figure1. Pin Configuration

Pin Function

Pin No.	Symbol	Description
1	A0	Address Input 0
2	A1	Address Input 1
3	A2	Address Input 2
4	$\overline{E1}$	Enable Input 1(Active Low)
5	$\overline{E2}$	Enable Input 2(Active Low)
6	E3	Enable Input 3(Active High)
7	Y7	Output 7
8	GND	GND
9	Y6	Output 6
10	Y5	Output 5
11	Y4	Output 4
12	Y3	Output 3
13	Y2	Output 2
14	Y1	Output 1
15	Y0	Output 0
16	V_{CC}	Supply Voltage

Block Diagram

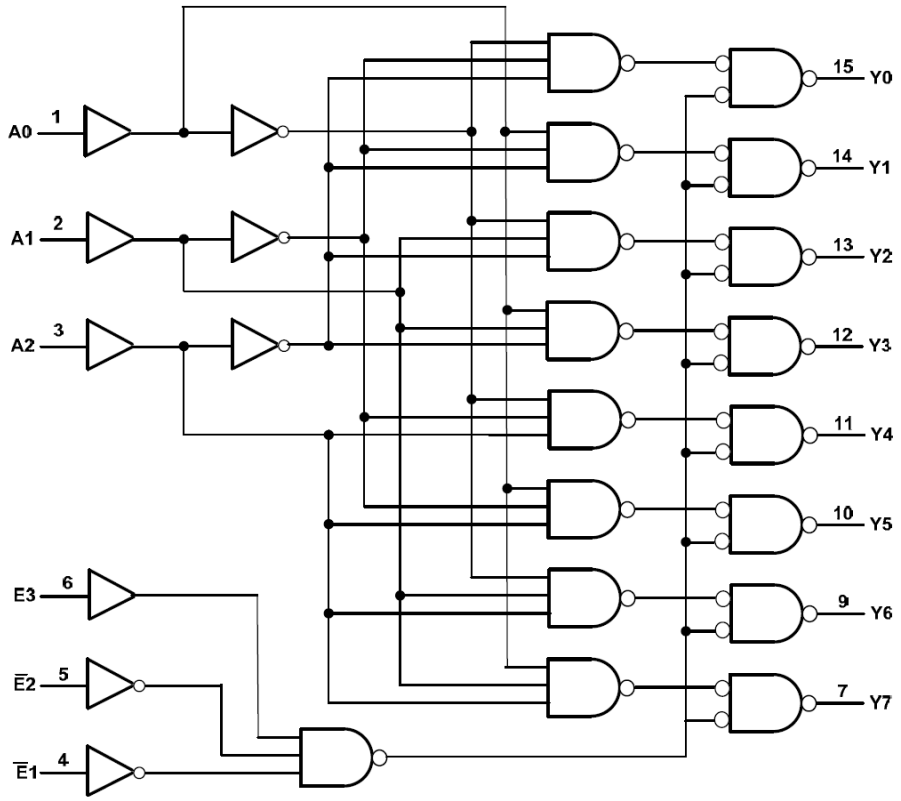


Figure2. Block Diagram

Functional Description

Chip Select			Address			Output							
$\overline{E1}$	$\overline{E2}$	E3	A2	A1	A0	Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0
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	H	H	H	H	H	H	H	L
L	L	H	L	L	H	H	H	H	H	H	H	L	H
L	L	H	L	H	L	H	H	H	H	H	L	H	H
L	L	H	L	H	H	H	H	H	H	L	H	H	H
L	L	H	H	L	L	H	H	H	L	H	H	H	H
L	L	H	H	L	H	H	H	L	H	H	H	H	H
L	L	H	H	H	L	H	L	H	H	H	H	H	H
L	L	H	H	H	H	L	H	H	H	H	H	H	H

Note: H = High voltage level;
L = Low voltage level;
X = Don't care.

Absolute Maximum Ratings

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	Supply Voltage		-0.5	7.0	V
V_I	Input Voltage		-0.5	7.0	V
V_O	Output Voltage		-0.3	V_{CC} + 0.5	V
I_{IK}	Input Diode Current	V_I < -0.5V		-20	mA
		V_I > V_{CC} + 0.5V		20	mA
I_{OK}	Output Diode Current	V_O < -0.5V		-20	mA
		V_O > V_{CC} + 0.5V		20	mA
I_O	Output Source/Sink Current			±25	mA
I_{CC}	Supply Current Per Supply Pin			50	mA
I_{GND}	Ground Current Per Ground Pin			-50	mA
T_A	Operate Temperature Range		-40	85	°C
T_{STG}	Storage Temperature Range		-65	150	°C

Recommended operating conditions

Symbol	Parameter		Min	Max	Unit
V_{CC}			2.0	6.0	V
V_I	Input Voltage		0	V_{CC}	V
V_O	Enable State		0	V_{CC}	V
$\Delta t/\Delta_V$	Input Signal Swing	V_{CC} = 2.0V		1000	ns/V
		V_{CC} = 4.5V		500	ns/V
		V_{CC} = 6.0V		400	ns/V
T_A	Operating Free-Air Temperature		-40	85	°C

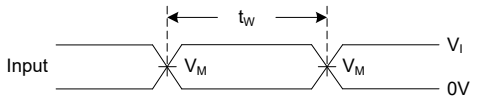
DC Electrical Characteristics

Symbol	Parameter	Test Condition	VCC (V)	T_A = +25°C			T_A = -40°C to +85°C		T_A = -40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V_{IH}	High-Level Input Voltage	-	2.0	1.5	1.2	-	1.5	-	1.5	-	V
		-	4.5	3.15	2.4	-	3.15	-	3.15	-	
		-	6.0	4.2	3.2	-	4.2	-	4.2	-	
V_{IL}	Low-Level Input Voltage	-	2.0	-	0.8	0.5	-	0.5	-	0.5	V
		-	4.5	-	2.1	1.0	-	1.0	-	1.0	
		-	6.0	-	2.8	1.5	-	1.5	-	1.5	
V_{OH}	High-Level Output Voltage	I_{OH} = -20μA All Outputs	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	2.0	3.98	4.32	-	3.84	-	3.7	-	
		I_{OH} = -5.2mA	4.5	5.48	5.81	-	5.34	-	5.2	-	
V_{OL}	Low-Level Output Voltage	I_{OL} = 20μA All Outputs	2.0	-	0	0.1	-	0.1	-	0.1	V
			4.5	-	0	0.1	-	0.1	-	0.1	
			6.0	-	0	0.1	-	0.1	-	0.1	
		I_{OL} = 4mA	2.0	-	0.15	0.26	-	0.33	-	0.4	
		I_{OL} = 5.2mA	4.5	-	0.16	0.26	-	0.33	-	0.4	
I_I	Input Current	V_I = GND or 6.0V	6.0	-	-	±0.1	-	±1	-	±1	μA
I_{CC}	Supply Current	V_I = GND or V_{CC} I_O = 0mA	6.0	-	-	8.0	-	80	-	160	μA
C_I	Input Capacitance	VI = V_{CC} or GND	6.0	-	4	10	-	10	-	10	pF

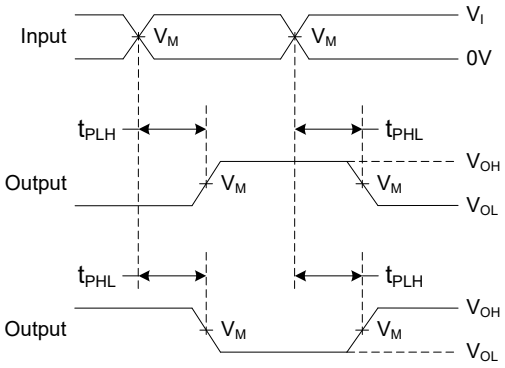
AC Characteristics

Symbol	Parameter	Test Condition	VCC (V)	T_A = +25°C			T_A = -40°C to +85°C		T_A = -40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t_{PLH}, t_{PLH} Propagation Delay	An to Yn	Figure1	2.0	-	41	150	-	190	-	225	ns
			4.5	-	15	30	-	38	-	45	
			5.0	-	12	-	-	-	-	-	
			6.0	-	12	26	-	33	-	38	
	E3 to Yn	Figure1	2.0	-	47	150	-	190	-	225	
			4.5	-	17	30	-	38	-	45	
			5.0	-	14	-	-	-	-	-	
			6.0	-	14	26	-	33	-	38	
	$\overline{E}$n to Yn	Figure1	2.0	-	47	150	-	190	-	225	
			4.5	-	17	30	-	38	-	45	
			5.0	-	14	-	-	-	-	-	
			6.0	-	14	26	-	33	-	38	
t_{TLH}, t_{THL} Transition Time	Yn	Figure1	2.0	-	19	75	-	95	-	110	ns
			5.0	-	7	15	-	19	-	22	
			6.0	-	6	13	-	16	-	19	

AC Characteristics Test Waveform



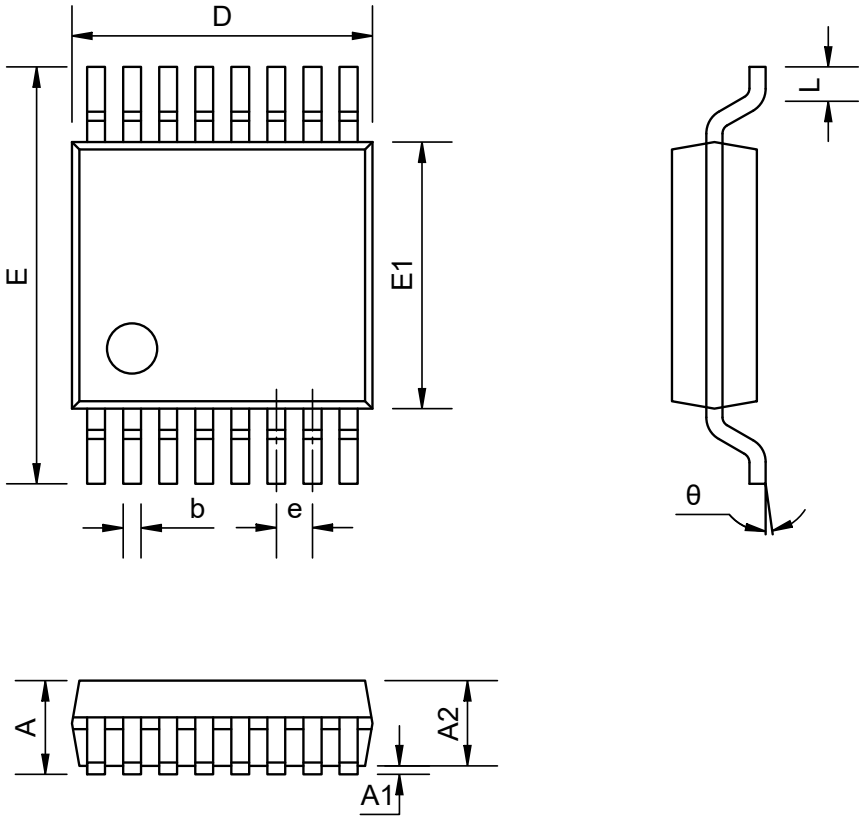
Voltage Waveform
Pulse Duration



Voltage Waveform
Propagation Delay Times
Inverting and Non Inverting Outputs

Figure3. Test Waveform

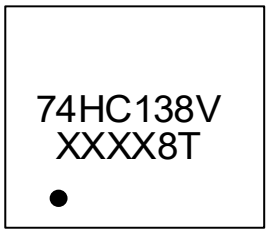
Package Dimension



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	--	--	1.20
A1	0.05	--	0.15
A2	0.90	--	1.05
b	0.20	--	0.28
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65BSC		
L	0.45	0.60	0.75
θ	0°	--	8°

Marking



74HC138V = Part Number

XXXX8T = Tracking Number

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2016-06-23	Original version	Shi Liang Jun	Shi Liang Jun	Zhu Jun Li
1.1	2021-02-13	Form version	Shi Liang Jun	Shi Liang Jun	Zhu Jun Li
1.2	2022-06-13	Typesetting version	Shi Bo	Shi Liang Jun	Zhu Jun Li
1.2.a	2025-11-19	Add Marking	Yang Xiao Xu	Yang Xiao Xu	Liu Jia Ying