74HC138D-HX/74HC138N-HX 3-TO-8 LINE DECODERS / DEMULTIPLEXERS

DESCRIPTION

The 74HC138D-HX/74HC138N-HX is a 3-to-8 line decoder that converts a three-bit binary address into one of eight active-low output signals.

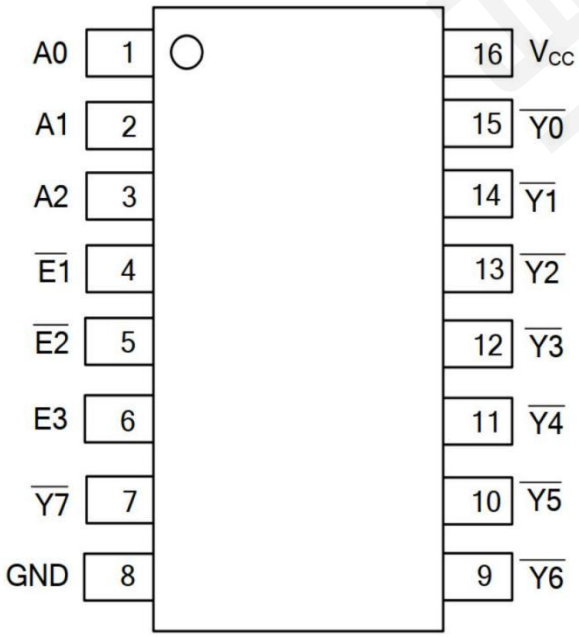
This device incorporates three chip select inputs—two active-low and one active-high—to support demultiplexing, cascading, and chip selection operations.

Demultiplexing is implemented by using the address inputs to select the desired output line; in this configuration, one chip select input serves as the data input, while the remaining chip select inputs are held in their respective active states.The packaging provides SOP-6 and DIP-16.

FEATURES

- Operate from 2.0V ~ 6.0V
- Low Input Current: 100nA Max
- Low Quiescent Current: 8μA Max
- Typ t_{PD}=15ns
- Output Drive:4mA @ 5V

PIN CONFIGURATION

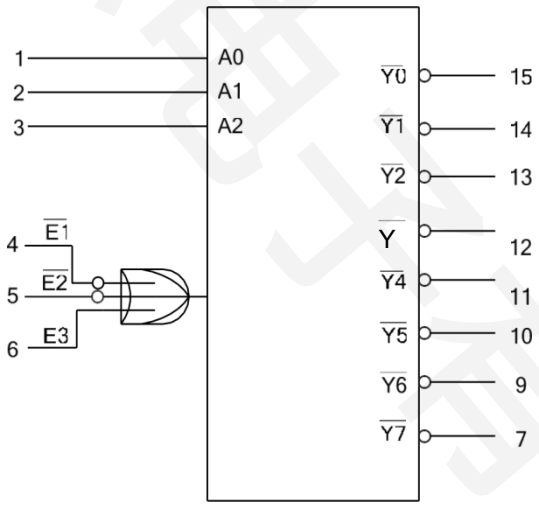


FUNCTION TABLE

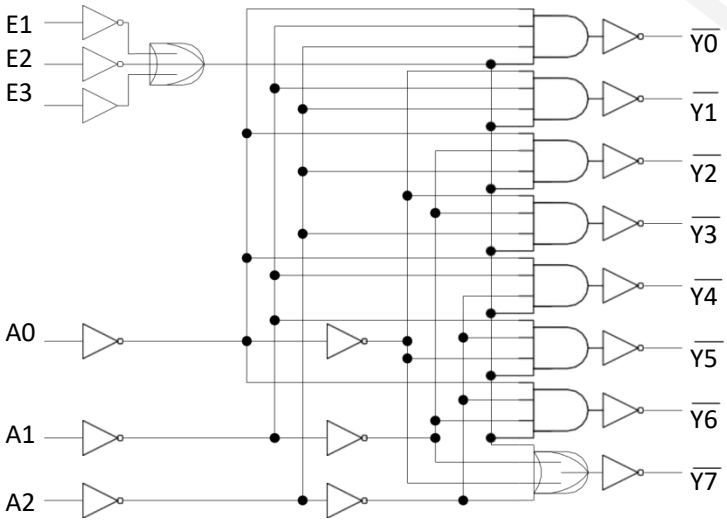
INPUTS						OUTPUTS							
$\overline{E1}$	$\overline{E2}$	E3	A0	A1	A2	$\overline{Y0}$	$\overline{Y1}$	$\overline{Y2}$	$\overline{Y3}$	$\overline{Y4}$	$\overline{Y5}$	$\overline{Y6}$	$\overline{Y7}$
H	X	X	X	X	X	H	H	H	H	H	H	H	H
X	H	X	X	X	X	H	H	H	H	H	H	H	H
X	X	L	X	X	X	H	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	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

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

LOGIC SYMBOL



LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{CC}	-0.5 ~ 7.0	V
Input Clamp Current(V_I<0 or V_I>V_{CC})	I_{IK}	±20	mA
Output Clamp Current(V_O<0 or V_O>V_{CC})	I_{OK}	±20	mA
Continuous Output Current(V_O=0 ~ V_{CC})	I_O	±25	mA
V_{CC} or GND Current	I_{CC}	±50	mA
Storage Temperature	T_{STG}	-65 ~ + 150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage	V_{CC}	Operating	2.0	5.0	6.0	V
Input Voltage	V_{IN}		0	-	V_{CC}	V
Output Voltage	V_{OUT}		0	-	V_{CC}	V
Operating Temperature	T_A		-40	-	+125	°C
Input Rise or Fall Times	t_R, t_F	V_{CC}=2.0V	-	-	1000	ns
		V_{CC}=4.5V	-	-	500	
		V_{CC}=6.0V	-	-	400	

THERMAL CHARACTERISTICS

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	DIP-16	θ_{JA}	67	°C/W
	SOP-16		73	

ELECTRICAL CHARACTERISTICS (T_A=25°C)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
High-level input voltage	V_{IH}	V_{CC}=2V	1.5	1.2	-	V
		V_{CC}=4.5V	3.15	2.4	-	V
		V_{CC}=6V	4.2	3.2	-	V
Low-level output voltage	V_{IL}	V_{CC}=2V	-	0.8	0.5	V
		V_{CC}=4.5V	-	2.1	1.35	V
		V_{CC}=6V	-	2.8	1.8	V
High-Level Output Voltage	V_{OH}	V_{CC}=2V, I_{OH}=-20μA	1.9	2	-	V
		V_{CC}=4.5V, I_{OH}=-20μA	4.4	4.5	-	V
		V_{CC}=6V, I_{OH}=-20μA	5.9	6	-	V
		V_{CC}=4.5V, I_{OH}=-4.0mA	3.98	4.32	-	V
		V_{CC}=6V, I_{OH}=-5.2mA	5.48	5.81	-	V
Low-Level Output Voltage	V_{OL}	V_{CC}=2V, I_{OL}=20μA	-	0	0.1	V
		V_{CC}=4.5V, I_{OL}=20μA	-	0	0.1	V
		V_{CC}=6V, I_{OL}=20μA	-	0	0.1	V
		V_{CC}=4.5V, I_{OL}=4mA	-	0.15	0.26	V
		V_{CC}=6V, I_{OL}=5.2mA	-	0.16	0.26	V
Input Leakage Current	$I_{I(LEAK)}$	V_{CC}=6V, V_{IN}= V_{CC} or GND	-	±0.1	±100	nA
Quiescent Supply Current	I_{CC}	V_{CC}=6V, V_{IN}=V_{CC} or GND, I_{OUT}=0	-	-	8	μA
Input Capacitance	C_I	V_{CC}=2~6V	-	3	10	pF

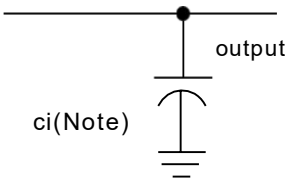
SWITCHING CHARACTERISTICS (T_A=25°C, C_L=50pF, see Test Circuit and Waveforms)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Propagation delay from input (An) to output(Yn)	t_{PLH}/t_{PHL}	V_{CC} =2.0V	-	41	150	ns
		V_{CC} =4.5V	-	15	30	ns
		V_{CC} =6.0V	-	12	26	ns
Propagation delay from input (E3) to output(Yn)	t_{PLH}/t_{PHL}	V_{CC} =2.0V	-	47	150	ns
		V_{CC} =4.5V	-	17	20	ns
		V_{CC} =6.0V	-	14	26	ns
Propagation delay from input (En) to output(Yn)	t_{PLH}/t_{PHL}	V_{CC} =2.0V	-	47	150	ns
		V_{CC} =4.5V	-	17	20	ns
		V_{CC} =6.0V	-	14	26	ns
Output Transition Time	t_{TLH}/t_{THL}	V_{CC} =2.0V	-	19	75	ns
		V_{CC} =4.5V	-	7	15	ns
		V_{CC} =6.0V	-	6	13	ns

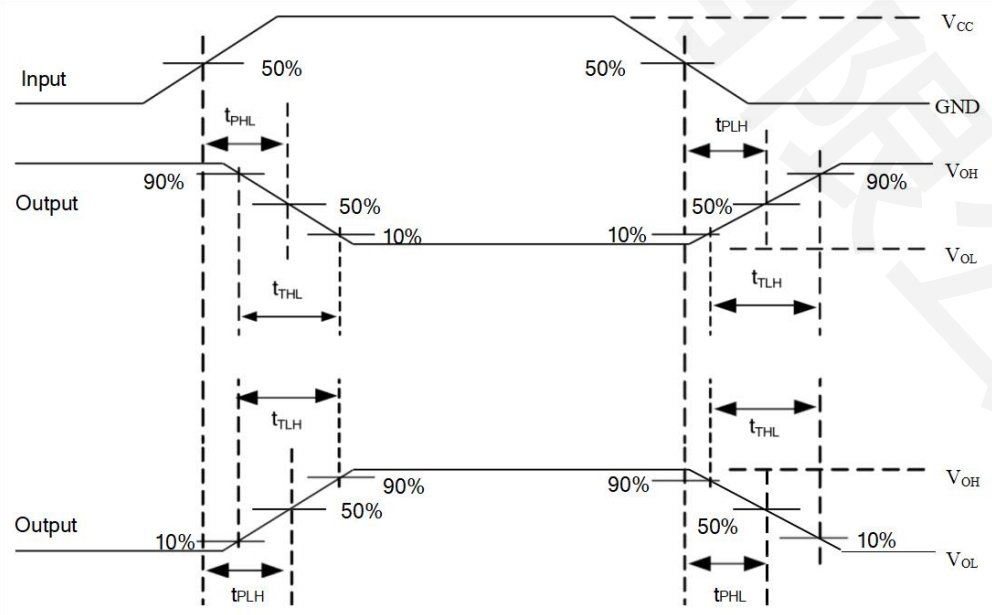
OPERATING CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Dissipation Capacitance	C_{PD}	No Load	-	85	-	pF

TEST CIRCUIT AND WAVEFORMS



Test Circuit

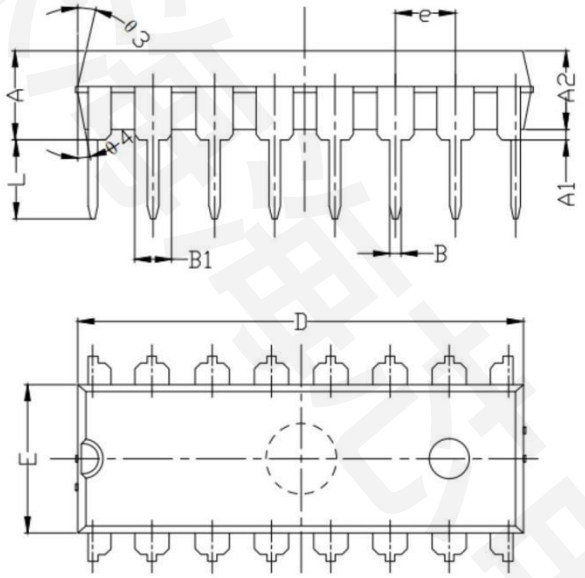


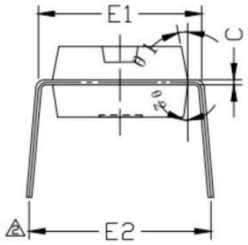
Propagation Delay and Output Transition Times Note: C_L includes probe and jig capacitance.

All input pulses are supplied by generators having the following characteristics: Z_O = 50Ω, t_R =6ns, t_F =6ns.

PACKAGE INFORMATION

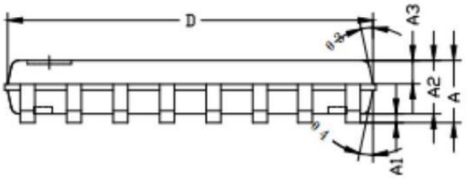
74HC138N-HX DIP16 package information

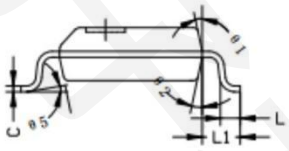


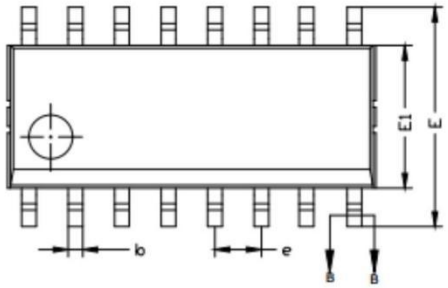


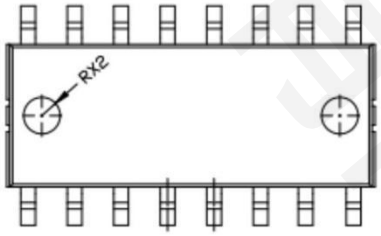
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	3.75	3.90	4.05
A1	0.51	--	--
A2	3.20	3.30	3.45
B	0.38	0.48	0.56
B1	1.52(BSC)		
C	0.20	0.25	0.34
D	18.80	19.05	19.30
E	6.20	6.35	6.50
E1	7.35	7.62	7.85
e	2.54(BSC)		
L	3.00	3.30	3.60
E2	8.00	8.40	8.80
θ1	9°	~	15°
θ2	7°	~	13°
θ3	8°	~	14°
θ4	5°	~	12°

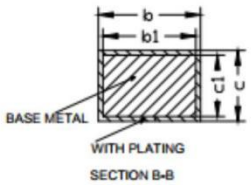
74HC138D-HX SOP16 package information











SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	--	--	1.70
A1	0.10	0.15	0.21
A2	1.40	1.45	1.50
A3	0.60	0.65	0.70
b	0.33	--	0.47
b1	0.32	0.41	0.44
c	0.20	--	0.24
c1	0.19	0.20	0.21
D	9.50	9.90	10.05
E	5.80	6.00	6.20
E1	3.85	3.90	4.00
e	1.27(BSC)		
L	0.50	0.60	0.70
L1	1.10(BSC)		
θ1	8°	~	15°
θ2	8°	~	15°
θ3	8°	~	15°
θ4	8°	~	15°
θ5	0°	~	6°
R	0.45°	0.50°	0.05°