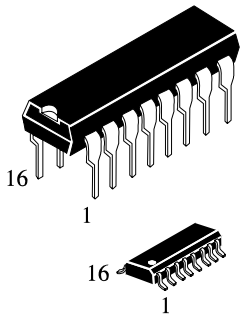
IN74HC138A

1-of-8 Decoder/Demultiplexer



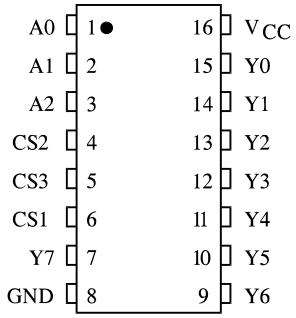
ORDERING INFORMATION
IN74HC138AN Plastic
IN74HC138AD SOIC
IZ74HC138A Chip
T_A = -55° to 125° C for all packages

The IN74HC138A is identical in pinout to the LS/ALS138. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LS/ALSTTL outputs.

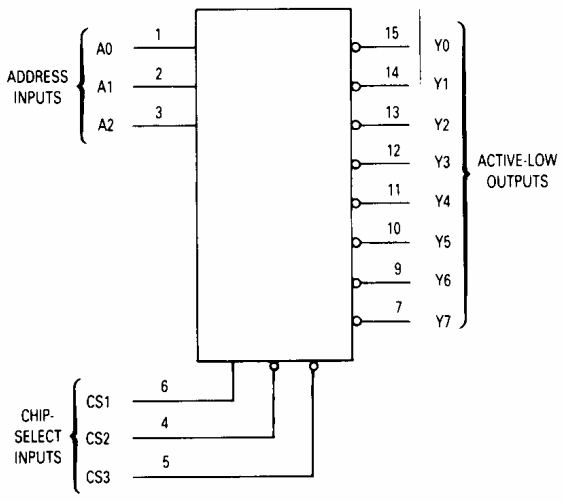
The IN74HC138A decodes a three-bit Address to one-of-eight active-low outputs. This device features three Chip Select inputs, two active-low and one active-high to facilitate the demultiplexing, cascading, and chip-selecting functions. The demultiplexing function is accomplished by using the Address inputs to select the desired device output; one of the Chip Selects is used as a data input while the other Chip Selects are held in their active states.

- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1.0 μA
- High Noise Immunity Characteristic of CMOS Devices

PIN ASSIGNMENT



LOGIC DIAGRAM



PIN 16 =V_{CC}
PIN 8 = GND

FUNCTION TABLE

Inputs		Outputs
CS1 CS2 CS3	A2 A1 A0	Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7
X X H	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
L X X	X X X	H H H H H H H H
H L L	L L L	L H H H H H H H
H L L	L L H	H L H H H H H H
H L L	L H L	H H L H H H H H
H L L	L H H	H H H L H H H H
H L L	H L L	H 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 L	H H H H H H L H
H L L	H H H	H H H H H H H L

H = high level (steady state)
L = low level (steady state)
X = don't care

MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)	-0.5 to +7.0	V
V_{IN}	DC Input Voltage (Referenced to GND)	-1.5 to V_{CC} +1.5	V
V_{OUT}	DC Output Voltage (Referenced to GND)	-0.5 to V_{CC} +0.5	V
I_{IN}	DC Input Current, per Pin	±20	mA
I_{OUT}	DC Output Current, per Pin	±25	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins	±50	mA
P_D	Power Dissipation in Still Air, Plastic DIP** SOIC Package**	750 500	mW
Tstg	Storage Temperature	-65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds (Plastic DIP or SOIC Package)	260	°C

* Maximum Ratings are those values beyond which damage to the device may occur.
Functional operation should be restricted to the Recommended Operating Conditions.
**Derating - Plastic DIP: - 10 mW/°C from 65° to 125°C
SOIC Package: - 7 mW/°C from 65° to 125°C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)		2.0	6.0	V
V_{IN}, V_{OUT}	DC Input Voltage, Output Voltage (Referenced to GND)		0	V_{CC}	V
T_A	Operating Temperature, All Package Types		-55	+125	°C
t_r, t_f	Input Rise and Fall Time (Figure 1)	V_{CC} =2.0 V V_{CC} =4.5 V V_{CC} =6.0 V	0 0 0	1000 500 400	ns

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{IN} and V_{OUT} should be constrained to the range GND≤(V_{IN} or V_{OUT})≤V_{CC}.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

DC ELECTRICAL CHARACTERISTICS(Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V_{CC} V	Guaranteed Limit			Unit
				25 °C to -55°C	≤85 °C	≤125 °C	
V_{IH}	Minimum High-Level Input Voltage	V_{OUT}=0.1 V or V_{CC}-0.1 V $\|I_{OUT}\| \leq 20$ μA	2.0 4.5 6.0	1.5 3.15 4.2	1.5 3.15 4.2	1.5 3.15 4.2	V
V_{IL}	Maximum Low - Level Input Voltage	V_{OUT}=0.1 V or V_{CC}-0.1 V $\|I_{OUT}\| \leq 20$ μA	2.0 4.5 6.0	0.5 1.35 1.8	0.5 1.35 1.8	0.5 1.35 1.8	V
V_{OH}	Minimum High-Level Output Voltage	V_{IN}=V_{IH} or V_{IL} $\|I_{OUT}\| \leq 20$ μA	2.0 4.5 6.0	1.9 4.4 5.9	1.9 4.4 5.9	1.9 4.4 5.9	V
		V_{IN}=V_{IH} or V_{IL} $\|I_{OUT}\| \leq 4.0$ mA $\|I_{OUT}\| \leq 5.2$ mA	 4.5 6.0	 3.98 5.48	 3.84 5.34	 3.7 5.2	
V_{OL}	Maximum Low-Level Output Voltage	V_{IN}=V_{IH} or V_{IL} $\|I_{OUT}\| \leq 20$ μA	2.0 4.5 6.0	0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	V
		V_{IN}=V_{IH} or V_{IL} $\|I_{OUT}\| \leq 4.0$ mA $\|I_{OUT}\| \leq 5.2$ mA	 4.5 6.0	 0.26 0.26	 0.33 0.33	 0.4 0.4	
I_{IN}	Maximum Input Leakage Current	V_{IN}=V_{CC} or GND	6.0	±0.1	±1.0	±1.0	μA
I_{CC}	Maximum Quiescent Supply Current (per Package)	V_{IN}=V_{CC} or GND I_{OUT}=0μA	6.0	4.0	40	160	μA

AC ELECTRICAL CHARACTERISTICS(C_L=50pF,Input t_r=t_f=6.0 ns)

Symbol	Parameter	V_{CC} V	Guaranteed Limit			Unit
			25 °C to -55°C	≤85°C	≤125°C	
t_{PLH}, t_{PHL}	Maximum Propagation Delay, Input A to Output Y (Figures 1 and 4)	2.0 4.5 6.0	135 27 23	170 34 29	205 41 35	ns
t_{PLH}, t_{PHL}	Maximum Propagation Delay , CS1 to Output Y (Figures 2 and 4)	2.0 4.5 6.0	110 22 19	140 28 24	165 33 28	ns
t_{PLH}, t_{PHL}	Maximum Propagation Delay , CS2 or CS3 to Output Y (Figures 3 and 4)	2.0 4.5 6.0	120 24 20	150 30 26	180 36 31	ns
t_{TLH}, t_{THL}	Maximum Output Transition Time, Any Output (Figures 2 and 4)	2.0 4.5 6.0	75 15 13	95 19 16	110 22 19	ns
C_{IN}	Maximum Input Capacitance	-	10	10	10	pF

C_{PD}	Power Dissipation Capacitance (Per Package) Used to determine the no-load dynamic power consumption: $P_D=C_{PD}V_{CC}^2f+I_{CC}V_{CC}$	Typical @25°C,V_{CC}=5.0 V 55	pF

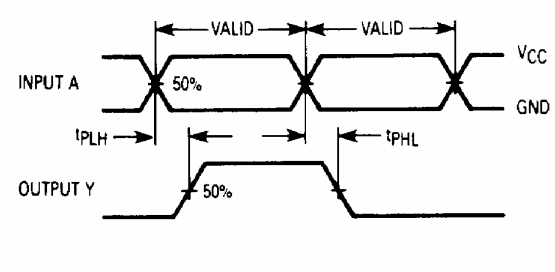


Figure 1. Switching Waveforms

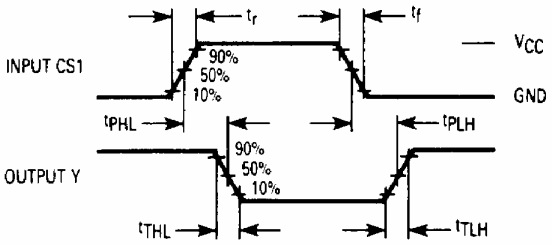


Figure 2. Switching Waveforms

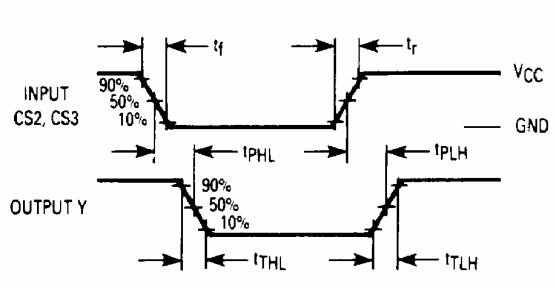


Figure 3. Switching Waveforms

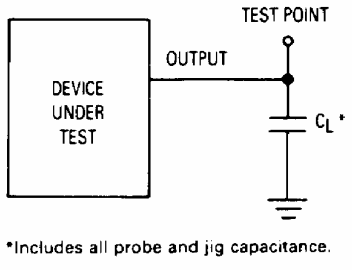
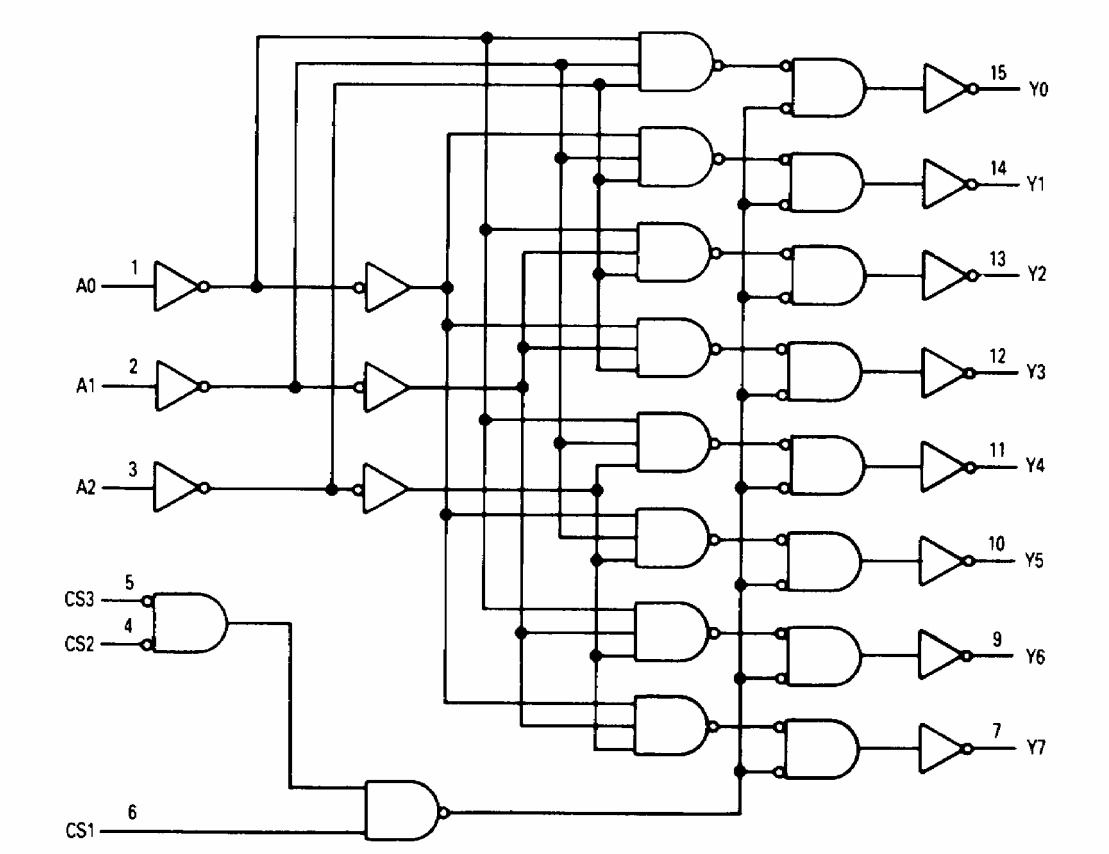
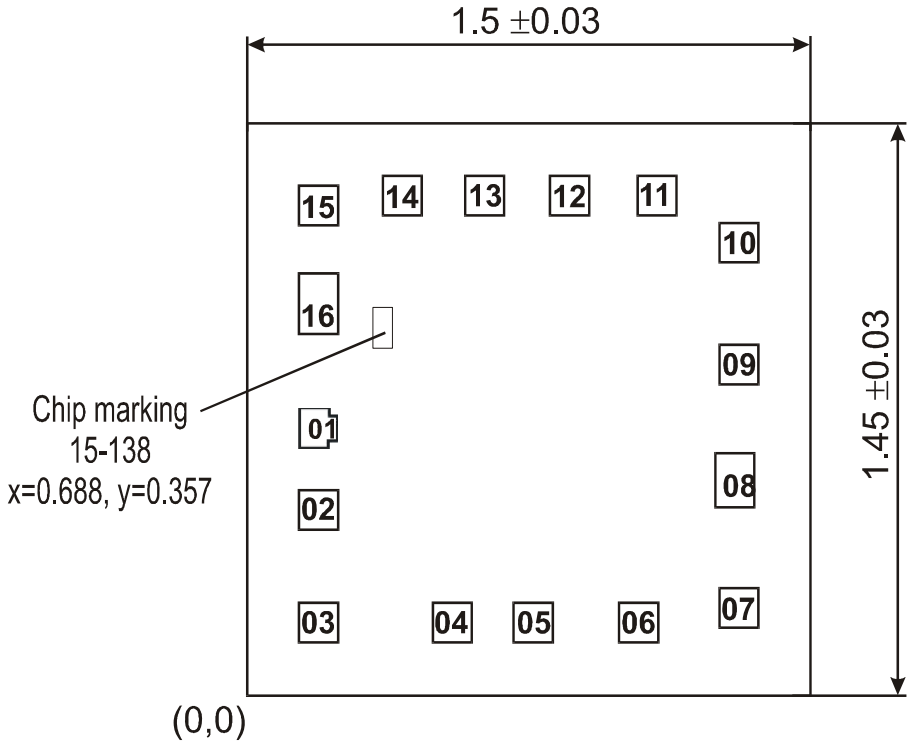


Figure 4. Test Circuit

EXPANDED LOGIC DIAGRAM



CHIP PAD DIAGRAM IZ74HC138A



Pad size is given as per passivation layer
Thickness of chip 0,46±0,02 mm

PAD LOCATION

Pad No	Symbol	X	Y	Pad size
01	SELECT a	0.161	0.690	0.106x0.106
02	A0a	0.161	0.360	0.106x0.106
03	A1a	0.150	0.165	0.106x0.106
04	Y0a	0.497	0.165	0.106x0.106
05	Y1a	0.661	0.165	0.106x0.106
06	Y2a	0.990	0.165	0.106x0.106
07	Y3a	1.261	0.196	0.106x0.106
08	GND	1.261	0.510	0.106x0.113
09	Y0b	1.260	0.793	0.106x0.106
10	Y1b	1.260	1.133	0.106x0.106
11	Y0b	1.034	1.202	0.106x0.106
12	Y1b	0.850	1.202	0.106x0.106
13	A2b	0.665	1.202	0.106x0.106
14	A3b	0.481	1.202	0.106x0.106
15	SELECT b	0.162	1.172	0.106x0.106
16	Vcc	0.170	0.863	0.106x0.113