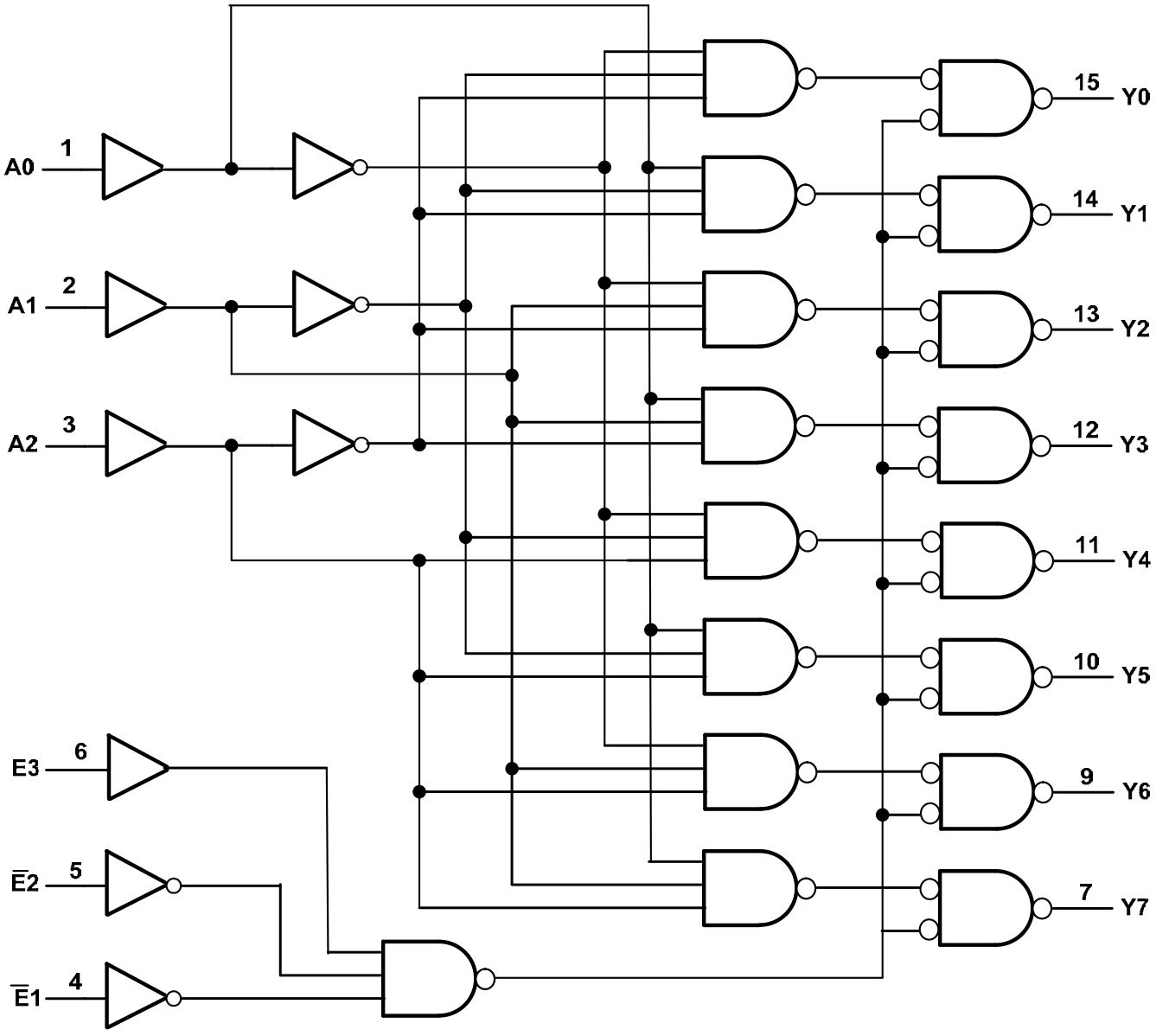
Pin Descriptions

Pin Number	Pin Name	Description
1	A0	Address Input 0
2	A1	Address Input 1
3	A2	Address Input 2
4	$\overline{E}1$	Enable Input 1 (active LOW)
5	$\overline{E}2$	Enable Input 2 (active LOW)
6	E3	Enable Input 3 (active HIGH)
7	Y7	Output 7 (active LOW)
8	GND	Ground
9	Y6	Output 6 (active LOW)
10	Y5	Output 5 (active LOW)
11	Y4	Output 4 (active LOW)
12	Y3	Output 3 (active LOW)
13	Y2	Output 2 (active LOW)
14	Y1	Output 1 (active LOW)
15	Y0	Output o (active LOW)
16	Vcc	Supply Voltage

Function Table Diagram

Control			Input			Output							
$\overline{E}1$	$\overline{E}2$	E3	A2	A1	A0	$\overline{Y}7$	$\overline{Y}6$	$\overline{Y}5$	$\overline{Y}4$	$\overline{Y}3$	$\overline{Y}2$	$\overline{Y}1$	$\overline{Y}0$
H	X	X	X	X	X	H	H	H	H	H	H	H	H
X	H	X	–	–	–	–	–	–	–	–	–	–	–
X	X	L	–	–	–	–	–	–	–	–	–	–	–
L	L	H	–	–	–	–	–	–	–	–	–	–	–
–	–	–	L	L	L	H	H	H	H	H	H	H	L
–	–	–	L	L	H	H	H	H	H	H	H	L	H
–	–	–	L	H	L	H	H	H	H	H	L	H	H
–	–	–	L	H	H	H	H	H	H	L	H	H	H
–	–	–	H	L	L	H	H	H	L	H	H	H	H
–	–	–	H	L	H	H	H	L	H	H	H	H	H
–	–	–	H	H	L	H	L	H	H	H	H	H	H
–	–	–	H	H	H	L	H	H	H	H	H	H	H

Logic Diagram



Absolute Maximum Ratings (Note 4) (@T_A = +25°C, unless otherwise specified.)

Symbol	Description	Rating	Unit
ESD HBM	Human Body Model ESD Protection	2	kV
ESD CDM	Charged Device Model ESD Protection	1	kV
ESD MM	Machine Model ESD Protection	200	V
V_{CC}	Supply Voltage Range	-0.5 to +7.0	V
V_I	Input Voltage Range	-0.5 to +7.0	V
V_o	Voltage applied to output in high or low state	-0.3 to V_{CC} +0.5	V
I_{IK}	Input Clamp Current V_I< -0.5V	-20	mA
I_{IK}	Input Clamp Current VI > V_{CC} +0.5V	20	mA
I_{OK}	Output Clamp Current V_O<-0.5V	-20	mA
I_{OK}	Output Clamp Current V_O> V_{CC} + 0.5V	20	mA
I_O	Continuous output current	±25	mA
I_{CC}	Continuous current through V_{CC}	50	mA
I_{GND}	Continuous current through GND	-50	mA
T_J	Operating Junction Temperature	-40 to +150	°C
T_{STG}	Storage Temperature	-65 to +150	°C
P_{TOT}	Total Power Dissipation	500	mW

Note: 4. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.

Recommended Operating Conditions (Note 5) (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	Supply Voltage	–	2.0	6.0	V
V_I	Input Voltage	–	0	V_{CC}	V
V_O	Output Voltage	Active Mode	0	V_{CC}	V
$\Delta t/\Delta V$	Input transition Rise or Fall Rate	V_{CC} = 2.0V	–	1000	ns/V
		V_{CC} = 4.5V	–	500	
		V_{CC} = 6.0V	–	400	–
T_A	Operating Free-Air Temperature	–	-40	+125	°C

Note: 5. Unused inputs should be held at V_{CC} or Ground.

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Test Conditions	V_{CC}	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	–	2.0V	1.5	1.2	–	1.5	–	1.5	–	V
		–	4.5V	3.15	2.4	–	3.15	–	3.15	–	
		–	6.0V	4.2	3.2	–	4.2	–	4.2	–	
V_{IL}	Low-Level Input Voltage	–	2.0V	–	0.8	0.5	–	0.5	–	0.5	V
		–	4.5V	–	2.1	1.35	–	1.35	–	1.35	
		–	6.0V	–	2.8	1.8	–	1.8	–	1.8	
V_{OH}	High-Level Output Voltage	I_{OH} = -20 µA All outputs	2.0V	1.9	2.0	–	1.9	–	1.9	–	V
			4.5V	4.4	4.5	–	4.4	–	4.4	–	
			6.0V	5.9	6.0	–	5.9	–	5.9	–	
		I_{OH} = -4 mA	4.5V	3.98	4.32	–	3.84	–	3.7	–	
		I_{OH} = -5.2 mA	6.0V	5.48	5.81	–	5.34	–	5.2	–	
V_{OL}	Low-Level Output Voltage	I_{OL} = 20 µA All outputs	2.0V	–	0	0.1	–	0.1	–	0.1	V
			4.5V	–	0	0.1	–	0.1	–	0.1	
			6.0V	–	0	0.1	–	0.1	–	0.1	
		I_{OL} = 4 mA	4.5V	–	0.15	0.26	–	0.33	–	0.4	
		I_{OL} = 5.2 mA	6.0V	–	0.16	0.26	–	0.33	–	0.4	
I_I	Input Current	V_I =GND or 6.0V	6.0V	–	–	±0.1	–	± 1	–	± 1	µA
I_{CC}	Supply Current	V_I = GND or V_{CC} I_O = 0	6.0V	–	–	8.0	–	80	–	160	µA
C_i	Input Capacitance	V_i = V_{CC} or GND	6.0V	–	4	10	–	10	–	10	pF

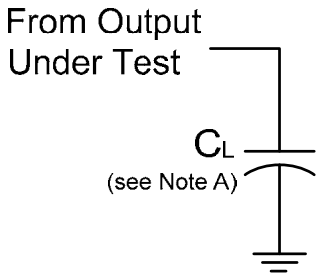
Switching Characteristics

Symbol / Parameter	Pins	Test Conditions	V_{CC}	T_A = +25°C			-40°C to +85°C		-40°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t_{PLH}, t_{PLH} Propagation Delay	An to $\overline{Y}$n	Figure 1	2.0V	–	41	150	–	190	–	225	ns
			4.5V	–	15	30	–	38	–	45	
			5.0V	–	12	–	–	–	–	–	
			6.0V	–	12	26	–	33	–	38	
	E3 to $\overline{Y}$n	Figure 1	2.0V	–	47	150	–	190	–	225	
			4.5V	–	17	30	–	38	–	45	
			5.0V	–	14	–	–	–	–	–	
			6.0V	–	14	26	–	33	–	38	
	$\overline{E}$n to $\overline{Y}$n	Figure 1	2.0V	–	47	150	–	190	–	225	
			4.5V	–	17	30	–	38	–	45	
			5.0V	–	14	–	–	–	–	–	
			6.0V	–	14	26	–	33	–	38	
t_{TLH}, t_{THL} Transition Time	$\overline{Y}$n	Figure 1	2.0V	–	19	75	–	95	–	110	ns
			5.0V	–	7	15	–	19	–	22	
			6.0V	–	6	13	–	16	–	19	

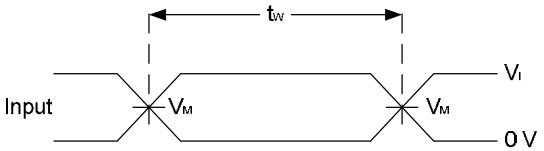
Operating Characteristics (@T_A = +25°C, unless otherwise specified.)

Parameter		Test Conditions	V_{CC} = 5V	Unit
			Typ	
C_{pd}	Power dissipation capacitance	f = 1 MHz all outputs switching-no load	19	pF

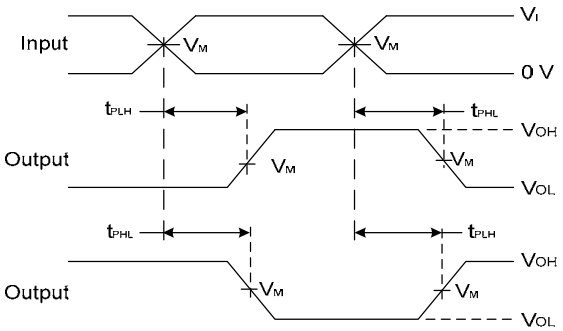
Parameter Measurement Information



Vcc	Inputs		V_M	C_L
	V_I	t_r/t_f		
2.0V -6.0V	V_{CC}	6 ns	$V_{CC}/2$	50pF
5.0V	V_{CC}	6 ns	$V_{CC}/2$	15pF used for 5V typical test



Voltage Waveform
Pulse Duration

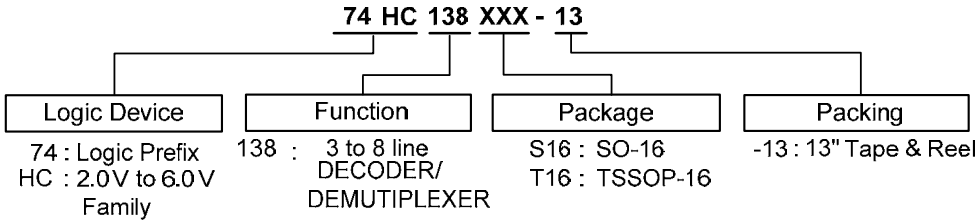


Voltage Waveform
Propagation Delay Times
Inverting and Non Inverting Outputs

Notes: A. Includes test lead and test apparatus capacitance.
B. All pulses are supplied at pulse repetition rate ≤ 10 MHz.
C. Inputs are measured separately one transition per measurement
D. t_{PLH} and t_{PHL} are the same as t_{PD}

Figure 1 Load Circuit and Voltage Waveforms

Ordering Information

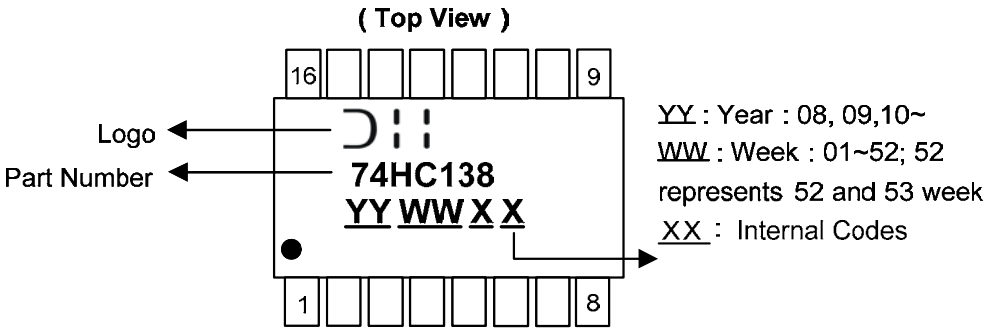


Part Number	Package Code	Packaging	7" Tape and Reel (Note 6)	
			Quantity	Part Number Suffix
74HC138S16-13	S16	SO-16	2500/Tape & Reel	-13
74HC138T16-13	T16	TSSOP-16	2500/Tape & Reel	-13

Notes: 6. The taping orientation is located on our website at http://www.diodes.com/datasheets/ap02007.pdf

Marking Information

(1) SO-16, TSSOP16

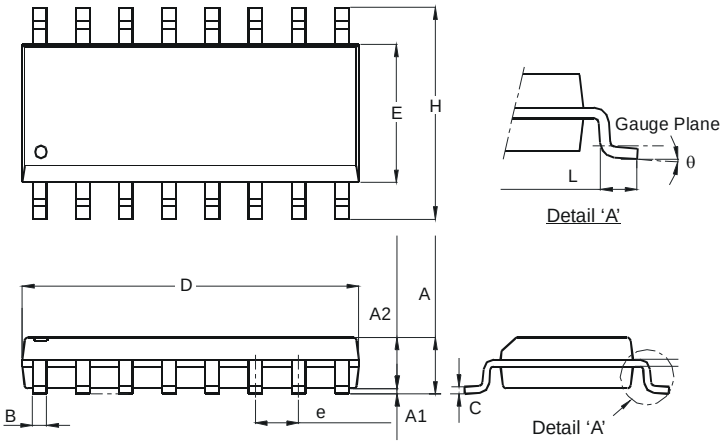


Part Number	Package
74HC138S16	SO-16
74HC138T16	TSSOP-16

Package Outline Dimensions (All dimensions in mm.)

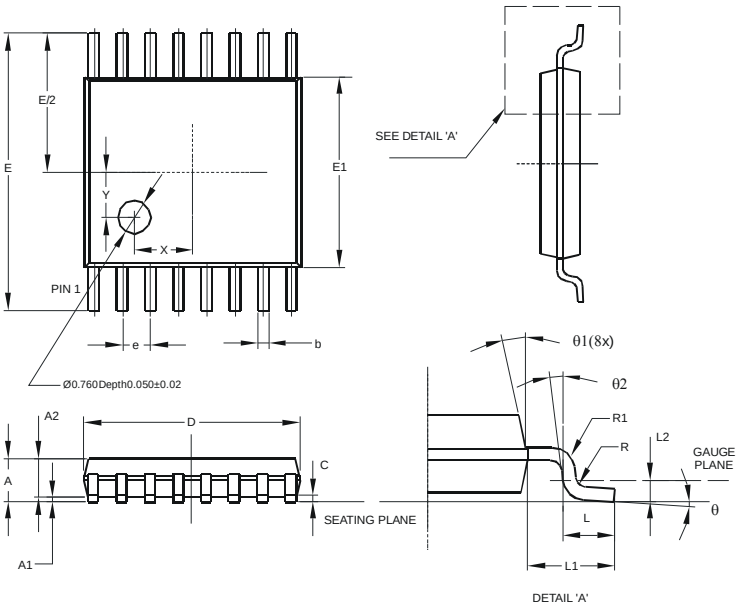
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.

Package Type: SO-16



SO-16		
Dim	**Min**	**Max**
A	1.40	1.75
A1	0.10	0.25
A2	1.30	1.50
B	0.33	0.51
C	0.19	0.25
D	9.80	10.00
E	3.80	4.00
e	1.27 Typ	
H	5.80	6.20
L	0.38	1.27
θ	0°	8°
All Dimensions in mm		

Package Type: TSSOP-16

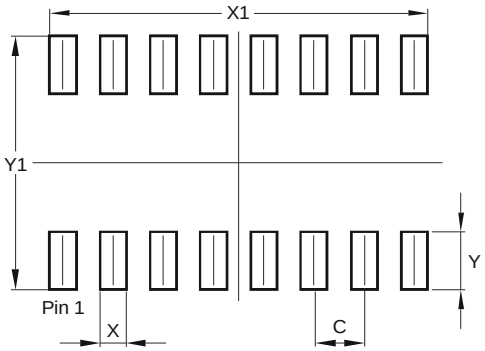


TSSOP-16			
Dim	**Min**	**Max**	**Typ**
A	-	1.08	-
A1	0.05	0.15	-
A2	0.80	0.93	-
b	0.19	0.30	-
c	0.09	0.20	-
D	4.90	5.10	-
E	6.40 BSC		
E1	4.30	4.50	-
e	0.65 BSC		
L	0.45	0.75	-
L1	1.00 REF		
L2	0.25 BSC		
R	0.09	-	-
R1	0.09	-	-
X	-	-	1.350
Y	-	-	1.050
θ	0°	8°	-
θ1	5°	15°	-
θ2	0°	-	-
All Dimensions in mm			

Suggested Pad Layout

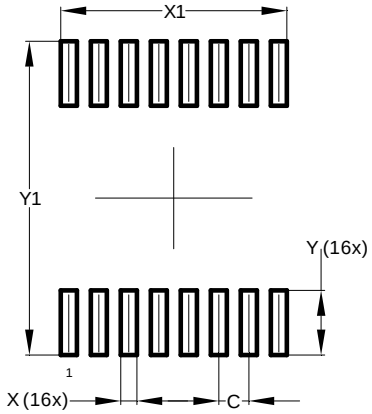
Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.

Package Type: SO-16



Dimensions	Value (in mm)
C	1.270
X	0.670
X1	9.560
Y	1.450
Y1	6.400

Package Type: TSSOP-16



Dimensions	Value (in mm)
C	0.650
X	0.350
X1	4.900
Y	1.400
Y1	6.800

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