

# MC74AC138, MC74ACT138

## 1-of-8 Decoder/Demultiplexer

The MC74AC138/74ACT138 is a high-speed 1-of-8 decoder/demultiplexer. This device is ideally suited for high-speed bipolar memory chip select address decoding.

The multiple input enables allow parallel expansion to a 1-of-24 decoder using just three MC74AC138/74ACT138 devices or a 1-of-32 decoder using four MC74AC138/74ACT138 devices and one inverter.

- Demultiplexing Capability
- Multiple Input Enable for Easy Expansion
- Active LOW Mutually Exclusive Outputs
- Outputs Source/Sink 24 mA
- 'ACT138 Has TTL Compatible Inputs
- These devices are available in Pb-free package(s). Specifications herein apply to both standard and Pb-free devices.

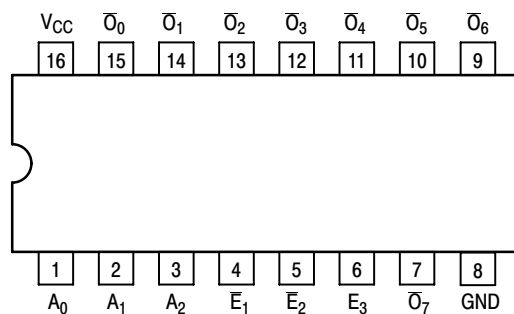


Figure 1. Pinout: 16-Lead Packages Conductors (Top View)

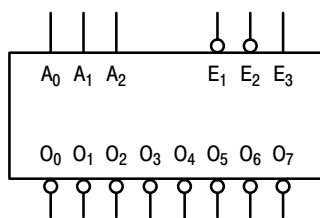


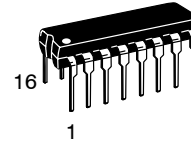
Figure 2. Logic Symbol

### PIN ASSIGNMENT

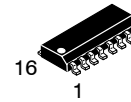
PIN	FUNCTION
A <sub>0</sub> -A <sub>2</sub>	Address Inputs
E <sub>1</sub> -E <sub>2</sub>	Enable Inputs
E <sub>3</sub>	Enable Input
O <sub>0</sub> -O <sub>7</sub>	Outputs



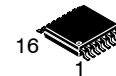
ON Semiconductor™



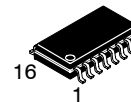
DIP-16  
N SUFFIX  
CASE 648



SO-16  
D SUFFIX  
CASE 751B



TSSOP-16  
DT SUFFIX  
CASE 948F



EIAJ-16  
M SUFFIX  
CASE 966

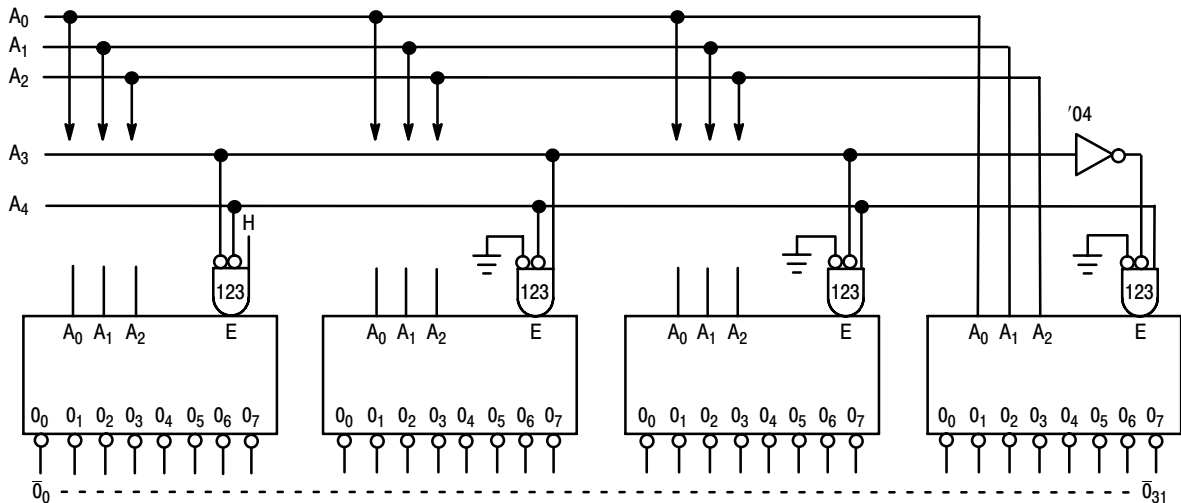
### ORDERING INFORMATION

Device	Package	Shipping
MC74AC138N	PDIP-16	25 Units/Rail
MC74ACT138N	PDIP-16	25 Units/Rail
MC74AC138D	SOIC-16	48 Units/Rail
MC74ACT138D	SOIC-16	48 Units/Rail
MC74AC138DR2	SOIC-16	2500 Tape & Reel
MC74ACT138DR2	SOIC-16	2500 Tape & Reel
MC74AC138DT	TSSOP-16	96 Units/Rail
MC74ACT138DT	TSSOP-16	96 Units/Rail
MC74AC138DTR2	TSSOP-16	2500 Tape & Reel
MC74ACT138DTR2	TSSOP-16	2500 Tape & Reel
MC74AC138M	EIAJ-16	50 Units/Rail
MC74ACT138M	EIAJ-16	50 Units/Rail
MC74AC138MEL	EIAJ-16	2000 Tape & Reel
MC74ACT138MEL	EIAJ-16	2000 Tape & Reel

### DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 6 of this data sheet.

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**Figure 4. Expansion to 1-of-32 Decoding**

### 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)	-0.5 to $V_{CC} + 0.5$	V
$V_{OUT}$	DC Output Voltage (Referenced to GND)	-0.5 to $V_{CC} + 0.5$	V
$I_{IN}$	DC Input Current, per Pin	$\pm 20$	mA
$I_{OUT}$	DC Output Sink/Source Current, per Pin	$\pm 50$	mA
$I_{CC}$	DC $V_{CC}$ or GND Current per Output Pin	$\pm 50$	mA
$T_{stg}$	Storage Temperature	-65 to +150	$^{\circ}C$

\*Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

### RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Unit	
$V_{CC}$	Supply Voltage	'AC	2.0	5.0	6.0	V
		'ACT	4.5	5.0	5.5	
$V_{IN}, V_{OUT}$	DC Input Voltage, Output Voltage (Ref. to GND)	0	-	$V_{CC}$	V	
$t_r, t_f$	Input Rise and Fall Time (Note 1) 'AC Devices except Schmitt Inputs	$V_{CC} @ 3.0 V$	-	150	-	ns/V
		$V_{CC} @ 4.5 V$	-	40	-	
		$V_{CC} @ 5.5 V$	-	25	-	
$t_r, t_f$	Input Rise and Fall Time (Note 2) 'ACT Devices except Schmitt Inputs	$V_{CC} @ 4.5 V$	-	10	-	ns/V
		$V_{CC} @ 5.5 V$	-	8.0	-	
$T_J$	Junction Temperature (PDIP)	-	-	140	$^{\circ}C$	
$T_A$	Operating Ambient Temperature Range	-40	25	85	$^{\circ}C$	
$I_{OH}$	Output Current - High	-	-	-24	mA	
$I_{OL}$	Output Current - Low	-	-	24	mA	

1.  $V_{IN}$  from 30% to 70%  $V_{CC}$ ; see individual Data Sheets for devices that differ from the typical input rise and fall times.
2.  $V_{IN}$  from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

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## DC CHARACTERISTICS

Symbol	Parameter	V <sub>CC</sub> (V)	74AC		74AC	Unit	Conditions
			T <sub>A</sub> = +25°C		T <sub>A</sub> = -40°C to +85°C		
			Typ	Guaranteed Limits			
V <sub>IH</sub>	Minimum High Level Input Voltage	3.0	1.5	2.1	2.1	V	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V
		4.5	2.25	3.15	3.15		
		5.5	2.75	3.85	3.85		
V <sub>IL</sub>	Maximum Low Level Input Voltage	3.0	1.5	0.9	0.9	V	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V
		4.5	2.25	1.35	1.35		
		5.5	2.75	1.65	1.65		
V <sub>OH</sub>	Minimum High Level Output Voltage	3.0	2.99	2.9	2.9	V	I <sub>OUT</sub> = -50 μA
		4.5	4.49	4.4	4.4		
		5.5	5.49	5.4	5.4		
		3.0	-	2.56	2.46	V	*V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> -12 mA I <sub>OH</sub> -24 mA -24 mA
		4.5	-	3.86	3.76		
		5.5	-	4.86	4.76		
V <sub>OL</sub>	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1	V	I <sub>OUT</sub> = 50 μA
		4.5	0.001	0.1	0.1		
		5.5	0.001	0.1	0.1		
		3.0	-	0.36	0.44	V	*V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> 12 mA I <sub>OL</sub> 24 mA 24 mA
		4.5	-	0.36	0.44		
		5.5	-	0.36	0.44		
I <sub>IN</sub>	Maximum Input Leakage Current	5.5	-	±0.1	±1.0	μA	V <sub>I</sub> = V <sub>CC</sub> , GND
I <sub>OLD</sub>	†Minimum Dynamic Output Current	5.5	-	-	75	mA	V <sub>OLD</sub> = 1.65 V Max
I <sub>OHD</sub>		5.5	-	-	-75	mA	V <sub>OHD</sub> = 3.85 V Min
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	-	8.0	80	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND

\*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

NOTE: I<sub>IN</sub> and I<sub>CC</sub> @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V V<sub>CC</sub>.

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**AC CHARACTERISTICS** (For Figures and Waveforms – See Section 3 of the ON Semiconductor FACT Data Book, DL138/D)

Symbol	Parameter	V <sub>CC</sub> * (V)	74AC			74AC		Unit	Fig. No.
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF			
			Min	Typ	Max	Min	Max		
t <sub>PLH</sub>	Propagation Delay A <sub>n</sub> to $\bar{O}_n$	3.3 5.0	1.5 1.5	8.5 6.5	13.0 9.5	1.5 1.5	15.0 10.5	ns	3-6
t <sub>PHL</sub>	Propagation Delay A <sub>n</sub> to $\bar{O}_n$	3.3 5.0	1.5 1.5	8.0 6.0	12.5 9.0	1.5 1.5	14.0 10.5	ns	3-6
t <sub>PLH</sub>	Propagation Delay $\bar{E}_1$ or $\bar{E}_2$ to $\bar{O}_n$	3.3 5.0	1.5 1.5	11.0 8.0	15.0 11.0	1.5 1.5	16.0 12.0	ns	3-6
t <sub>PHL</sub>	Propagation Delay E <sub>1</sub> or E <sub>2</sub> to $\bar{O}_n$	3.3 5.0	1.5 1.5	9.5 7.0	13.5 9.5	1.5 1.5	15.0 10.5	ns	3-6
t <sub>PLH</sub>	Propagation Delay E <sub>3</sub> to $\bar{O}_n$	3.3 5.0	1.5 1.5	11.0 8.0	15.5 11.0	1.5 1.5	16.5 12.5	ns	3-6
t <sub>PHL</sub>	Propagation Delay E <sub>3</sub> to $\bar{O}_n$	3.3 5.0	1.5 1.5	8.5 6.0	13.0 8.0	1.5 1.0	14.0 9.5	ns	3-6

\*Voltage Range 3.3 V is 3.3 V ±0.3 V.

\*Voltage Range 5.0 V is 5.0 V ±0.5 V.

## DC CHARACTERISTICS

Symbol	Parameter	V <sub>CC</sub> (V)	74ACT		74ACT		Unit	Conditions
			T <sub>A</sub> = +25°C		T <sub>A</sub> = -40°C to +85°C			
			Typ	Guaranteed Limits				
V <sub>IH</sub>	Minimum High Level Input Voltage	4.5	1.5	2.0	2.0	V	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V	
		5.5	1.5	2.0	2.0			
V <sub>IL</sub>	Maximum Low Level Input Voltage	4.5	1.5	0.8	0.8	V	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V	
		5.5	1.5	0.8	0.8			
V <sub>OH</sub>	Minimum High Level Output Voltage	4.5	4.49	4.4	4.4	V	I <sub>OUT</sub> = -50 μA	
		5.5	5.49	5.4	5.4			
		4.5	-	3.86	3.76	V	*V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> -24 mA	
		5.5	-	4.86	4.76			
V <sub>OL</sub>	Maximum Low Level Output Voltage	4.5	0.001	0.1	0.1	V	I <sub>OUT</sub> = 50 μA	
		5.5	0.001	0.1	0.1			
		4.5	-	0.36	0.44	V	*V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> 24 mA	
		5.5	-	0.36	0.44			
I <sub>IN</sub>	Maximum Input Leakage Current	5.5	-	±0.1	±1.0	μA	V <sub>I</sub> = V <sub>CC</sub> , GND	
ΔI <sub>CCT</sub>	Additional Max. I <sub>CC</sub> /Input	5.5	0.6	-	1.5	mA	V <sub>I</sub> = V <sub>CC</sub> - 2.1 V	
I <sub>OLD</sub>	†Minimum Dynamic Output Current	5.5	-	-	75	mA	V <sub>OLD</sub> = 1.65 V Max	
I <sub>OHD</sub>		5.5	-	-	-75	mA	V <sub>OHD</sub> = 3.85 V Min	
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	-	8.0	80	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND	

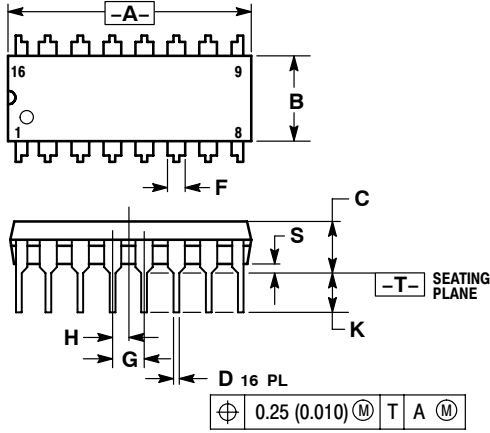
\*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

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## PACKAGE DIMENSIONS

### PDIP-16 N SUFFIX 16 PIN PLASTIC DIP PACKAGE CASE 648-08 ISSUE R

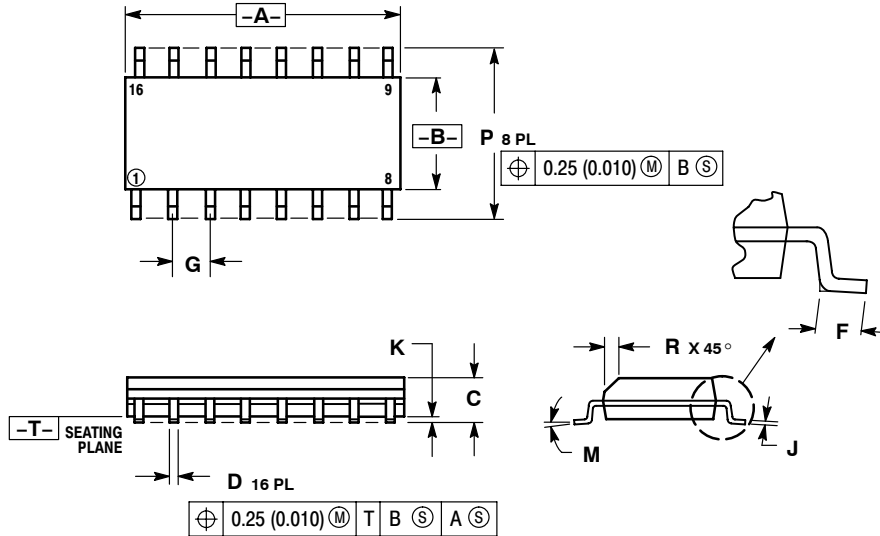


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01

### SO-16 D SUFFIX 16 PIN PLASTIC SOIC PACKAGE CASE 751B-05 ISSUE J



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019