



# MC74AC138 MC74ACT138

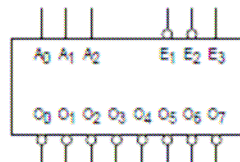
1-OF-8 DECODER/  
DEMULTIPLEXER



N SUFFIX  
CASE 648-08  
PLASTIC



LOGIC SYMBOL



## 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



**PIN NAMES**

- 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

## FUNCTIONAL DESCRIPTION

The MC74AC138/74ACT138 high-speed 1-of-8 decoder/demultiplexer accepts three binary weighted inputs (A<sub>0</sub>, A<sub>1</sub>, A<sub>2</sub>) and, when enabled, provides eight mutually exclusive active-LOW outputs (O<sub>0</sub>-O<sub>7</sub>). The MC74AC138/74ACT138 features three Enable inputs, two active-LOW (E<sub>1</sub>, E<sub>2</sub>) and one active-HIGH (E<sub>3</sub>). All outputs will be HIGH unless E<sub>1</sub> and E<sub>2</sub> are LOW and E<sub>3</sub> is HIGH. This multiple enabled function allows easy parallel expansion of the device to a 1-of-32 (5

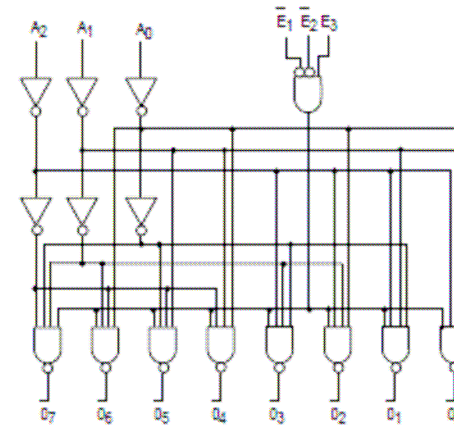
lines to 32 lines) decoder with just four MC74AC138/74ACT138 devices and one inverter (See Figure a). The MC74AC138/74ACT138 can be used as an 8-output demultiplexer by using one of the active LOW Enable inputs as the data input and the other Enable inputs as strobes. The Enable inputs which are not used must be permanently tied to their appropriate active-HIGH or active-LOW state.

**TRUTH TABLE**

Inputs			Outputs										
E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>	A <sub>0</sub>	A <sub>1</sub>	A <sub>2</sub>	O <sub>0</sub>	O <sub>1</sub>	O <sub>2</sub>	O <sub>3</sub>	O <sub>4</sub>	O <sub>5</sub>	O <sub>6</sub>	O <sub>7</sub>
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	L	H	L	H	H	H	H	H
L	L	H	L	H	L	L	H	H	L	H	H	H	H
L	L	H	H	H	L	L	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

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial

**LOGIC DIAGRAM**



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

### MC74AC138 MC74ACT138

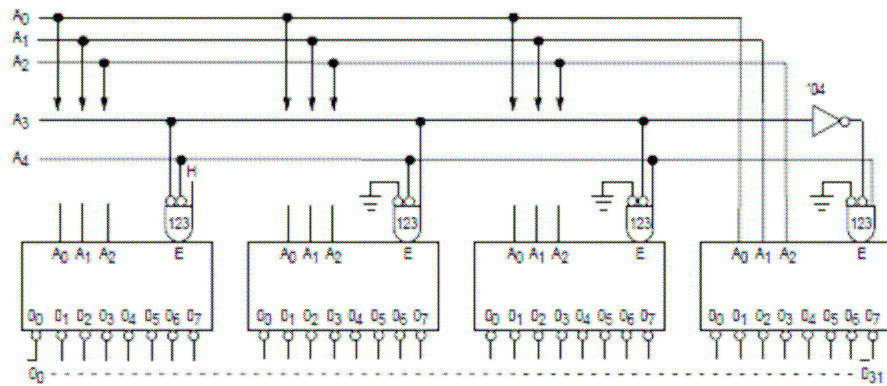


Figure a: Expansion to 1-of-32 Decoding

#### 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	$^{\circ}AC$	2.0	5.0	6.0	V
		$^{\circ}ACT$	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) $^{\circ}AC$ 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) $^{\circ}ACT$ 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	$V_{CC}$ (V)	74AC		74ACT		Unit	Conditions
			$T_A = +25^{\circ}C$		$T_A = -40^{\circ}C$ to $+85^{\circ}C$			
			Typ	Guaranteed Limits	Typ	Guaranteed Limits		
$V_{IH}$	Minimum High Level Input Voltage	3.0 4.5 5.5	1.5 2.25 2.75	2.1 3.15 3.85	2.1 3.15 3.85	V	$V_{OUT} = 0.1 V$ or $V_{CC} - 0.1 V$	
$V_{IL}$	Maximum Low Level Input Voltage	3.0 4.5 5.5	1.5 2.25 2.75	0.9 1.35 1.65	0.9 1.35 1.65	V	$V_{OUT} = 0.1 V$ or $V_{CC} - 0.1 V$	
$V_{OH}$	Minimum High Level Output Voltage	3.0 4.5 5.5	2.99 4.49 5.49	2.9 4.4 5.4	2.9 4.4 5.4	V	$I_{OUT} = -50 \mu A$	
		3.0 4.5 5.5		2.56 3.86 4.86	2.46 3.76 4.76	V	$^{\circ}V_{IN} = V_{IL}$ or $V_{IH}$ -12 mA $I_{OH} = -24$ mA	
$V_{OL}$	Maximum Low Level Output Voltage	3.0 4.5 5.5	0.002 0.001 0.001	0.1 0.1 0.1	0.1 0.1 0.1	V	$I_{OUT} = 50 \mu A$	
		3.0 4.5 5.5		0.36 0.36 0.36	0.44 0.44 0.44	V	$^{\circ}V_{IN} = V_{IL}$ or $V_{IH}$ 12 mA $I_{OL} = 24$ mA	
$I_{IN}$	Maximum Input Leakage Current	5.5		$\pm 0.1$	$\pm 1.0$	$\mu A$	$V_I = V_{CC}, GND$	
$I_{OLD}$	+Minimum Dynamic Output Current	5.5			75	mA	$V_{OLD} = 1.65 V$ Max	
$I_{OHD}$		5.5			-75	mA	$V_{OHD} = 3.85 V$ Min	
$I_{CC}$	Maximum Quiescent Supply Current	5.5		8.0	80	$\mu A$	$V_{IN} = V_{CC}$ 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:  $I_{IN}$  and  $I_{CC}$  @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V  $V_{CC}$ .

## MC74AC138 MC74ACT138

AC CHARACTERISTICS (For Figures and Waveforms — See Section 3)

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 O <sub>n</sub>	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 O <sub>n</sub>	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 E <sub>1</sub> or E <sub>2</sub> to O <sub>n</sub>	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 O <sub>n</sub>	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 O <sub>n</sub>	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 O <sub>n</sub>	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	Typ	Guaranteed Limits		
V <sub>IH</sub>	Minimum High Level Input Voltage	4.5 5.5	1.5 1.5	2.0 2.0	2.0 2.0	V	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V	
V <sub>IL</sub>	Maximum Low Level Input Voltage	4.5 5.5	1.5 1.5	0.8 0.8	0.8 0.8	V	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V	
V <sub>OH</sub>	Minimum High Level Output Voltage	4.5 5.5	4.49 5.49	4.4 5.4	4.4 5.4	V	I <sub>OUT</sub> = -50 μA	
		4.5 5.5	3.86 4.86	3.76 4.76	3.76 4.76	V	*V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> -24 mA I <sub>OH</sub> = -24 mA	
V <sub>OL</sub>	Maximum Low Level Output Voltage	4.5 5.5	0.001 0.001	0.1 0.1	0.1 0.1	V	I <sub>OUT</sub> = 50 μA	
		4.5 5.5	0.36 0.36	0.44 0.44	0.44 0.44	V	*V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> 24 mA I <sub>OL</sub> = 24 mA	
I <sub>IN</sub>	Maximum Input Leakage Current	5.5	±0.1	±1.0	±1.0	μA	V <sub>I</sub> = V <sub>CC</sub> , GND	
I <sub>CCCT</sub>	Additional Max. I <sub>CC</sub> /Input	5.5	0.6	1.5	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	75	mA	V <sub>OLD</sub> = 1.65 V Max	
I <sub>OHD</sub>		5.5		-75	-75	mA	V <sub>OHD</sub> = 3.85 V Min	
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	8.0	80	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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AC CHARACTERISTICS (For Figures and Waveforms — See Section 3)

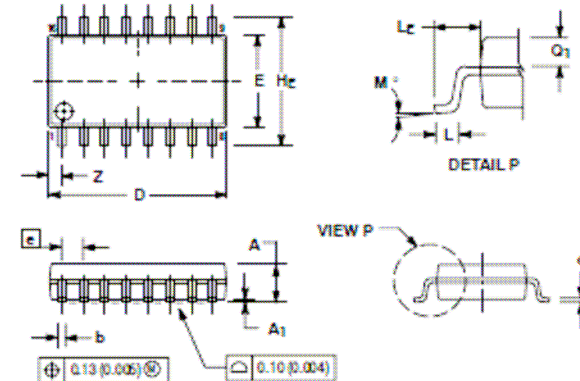
Symbol	Parameter	V <sub>CC</sub> * (V)	74ACT			74ACT		Unit	Fig. No.
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF			
			Min	Typ	Max	Min	Max		
t <sub>PLH</sub>	Propagation Delay A <sub>n</sub> to O <sub>n</sub>	5.0	1.5	7.0	10.5	1.5	11.5	ns	3-6
t <sub>PHL</sub>	Propagation Delay A <sub>n</sub> to O <sub>n</sub>	5.0	1.5	6.5	10.5	1.5	11.5	ns	3-6
t <sub>PLH</sub>	Propagation Delay E <sub>1</sub> or E <sub>2</sub> to O <sub>n</sub>	5.0	2.5	8.0	11.5	2.0	12.5	ns	3-6
t <sub>PHL</sub>	Propagation Delay E <sub>1</sub> or E <sub>2</sub> to O <sub>n</sub>	5.0	2.0	7.5	11.5	2.0	12.5	ns	3-6
t <sub>PLH</sub>	Propagation Delay E <sub>3</sub> to O <sub>n</sub>	5.0	2.5	8.0	12.0	2.0	13.0	ns	3-6
t <sub>PHL</sub>	Propagation Delay E <sub>3</sub> to O <sub>n</sub>	5.0	2.0	6.5	10.5	1.5	11.5	ns	3-6

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

## CAPACITANCE

Symbol	Parameter	Value Typ	Unit	Test Conditions
C <sub>IN</sub>	Input Capacitance	4.5	pF	V <sub>CC</sub> = 5.0 V
C <sub>PD</sub>	Power Dissipation Capacitance	60	pF	V <sub>CC</sub> = 5.0 V

EIAJ-16  
M SUFFIX  
16 PIN PLASTIC EIAJ PACKAGE  
CASE966-01  
ISSUE O



- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1987.  
2. CONTROLLING DIMENSION ON MILLIMETER.  
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.005) PER SIDE.  
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.  
5. THE LEAD WIDTH DIMENSION B) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADII OF THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.4 (0.015).

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	---	2.0	---	0.08
A <sub>1</sub>	0.25	0.25	0.009	0.009
B	0.25	0.25	0.014	0.014
C	0.18	0.27	0.007	0.011
D	2.90	10.40	0.250	0.410
E	5.10	5.40	0.201	0.212
e	1.27 BSC			
F <sub>1</sub>	7.40	8.0	0.291	0.312
L	0.45	0.8	0.018	0.031
L <sub>c</sub>	1.3	1.4	0.043	0.055
M	0.2	10.2	0.008	10.2
Q <sub>1</sub>	0.70	0.90	0.028	0.035
Z	---	0.8	---	0.03