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April 1988  
Revised January 2004

## 74F538 1-of-8 Decoder with 3-STATE Outputs

### General Description

The 74F538 decoder/demultiplexer accepts three Address ( $A_0$ - $A_2$ ) input signals and decodes them to select one of eight mutually exclusive outputs. A polarity control input (P) determines whether the outputs are active LOW or active HIGH. A HIGH Signal on either of the active LOW Output Enable ( $\overline{OE}$ ) inputs forces all outputs to the high impedance state. Two active HIGH and two active LOW input enables are available for easy expansion to 1-of-32 decoding with four packages, or for data demultiplexing to 1-of-8 or 1-of-16 destinations.

### Features

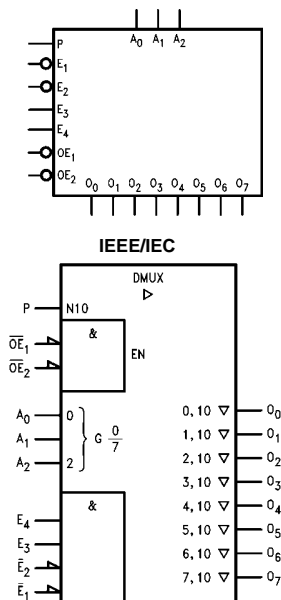
- Output polarity control
- Data demultiplexing capability
- Multiple enables for expansion
- 3-STATE outputs

### Ordering Code:

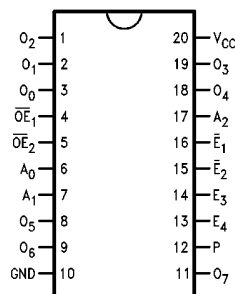
Order Number	Package Number	Package Description
74F538SC	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
74F538PC	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

### Logic Symbols



### Connection Diagram



74F538

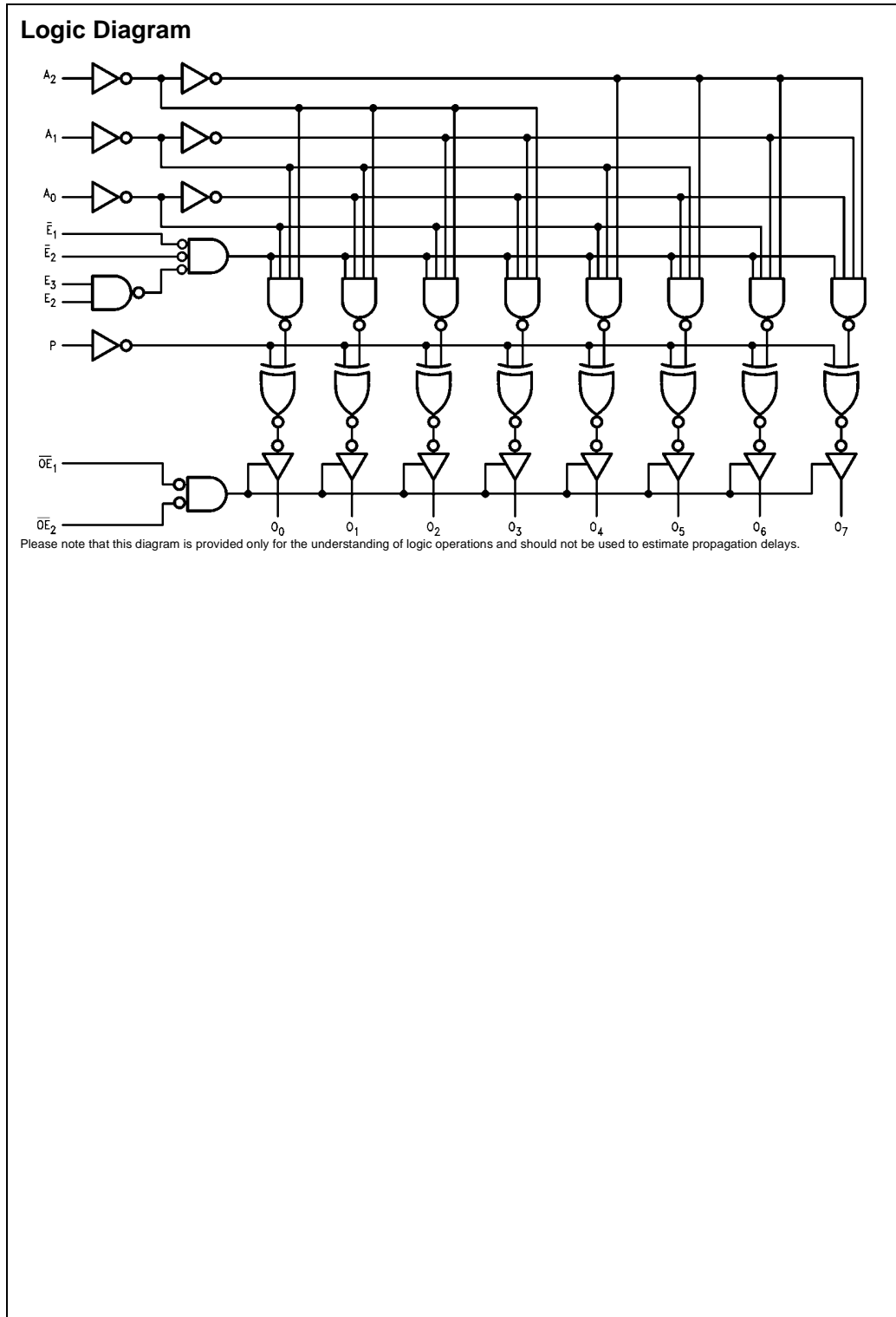
**Unit Loading/Fan Out**

Pin Names	Description	U.L. HIGH/LOW	Input I <sub>H</sub> /I <sub>L</sub> Output I <sub>OH</sub> /I <sub>OL</sub>
A <sub>0</sub> -A <sub>2</sub>	Address Inputs	1.0/1.0	20 μA/-0.6 mA
$\overline{E}_1, \overline{E}_2$	Enable Inputs (Active LOW)	1.0/1.0	20 μA/-0.6 mA
E <sub>3</sub> , E <sub>4</sub>	Enable Inputs (Active HIGH)	1.0/1.0	20 μA/-0.6 mA
P	Polarity Control Input	1.0/1.0	20 μA/-0.6 mA
$\overline{OE}_1, \overline{OE}_2$	Output Enable Inputs (Active LOW)	1.0/1.0	20 μA/-0.6 mA
O <sub>0</sub> -O <sub>7</sub>	3-STATE Outputs	150/40 (33.3)	-3 mA/24 mA (20 mA)

**Truth Table**

Function	Inputs									Outputs							
	$\overline{OE}_1$	$\overline{OE}_2$	$\overline{E}_1$	E <sub>2</sub>	E <sub>3</sub>	E <sub>4</sub>	A <sub>2</sub>	A <sub>1</sub>	A <sub>0</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>
High Impedance	H	X	X	X	X	X	X	X	X	Z	Z	Z	Z	Z	Z	Z	Z
Disable	L	L	H	X	X	X	X	X	X	Outputs Equal P Input							
	L	L	X	H	X	X	X	X	X								
	L	L	X	X	L	X	X	X	X								
	L	L	X	X	X	L	X	X	X								
Active HIGH Output (P = L)	L	L	L	L	H	H	L	L	L	H	L	L	L	L	L	L	L
	L	L	L	L	H	H	L	L	H	L	H	L	L	L	L	L	L
	L	L	L	L	H	H	L	H	H	L	L	L	H	L	L	L	L
	L	L	L	L	H	H	H	L	L	L	L	L	L	H	L	L	L
	L	L	L	L	H	H	H	L	H	L	L	L	L	L	H	L	L
	L	L	L	L	H	H	H	H	L	L	L	L	L	L	L	H	L
	L	L	L	L	H	H	H	H	H	L	L	L	L	L	L	L	H
Active LOW Output (P = H)	L	L	L	L	H	H	L	L	L	L	H	H	H	H	H	H	H
	L	L	L	L	H	H	L	L	H	H	L	H	H	H	H	H	H
	L	L	L	L	H	H	L	H	H	H	H	L	H	H	H	H	H
	L	L	L	L	H	H	L	H	H	H	H	H	L	H	H	H	H
	L	L	L	L	H	H	H	L	H	H	H	H	H	H	L	H	H
	L	L	L	L	H	H	H	H	L	H	H	H	H	H	H	L	H
	L	L	L	L	H	H	H	H	H	L	H	H	H	H	H	H	L

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial  
Z = High Impedance



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### Absolute Maximum Ratings (Note 1)

Storage Temperature	-65°C to +150°C
Ambient Temperature under Bias	-55°C to +125°C
Junction Temperature under Bias	-55°C to +150°C
V <sub>CC</sub> Pin Potential to Ground Pin	-0.5V to +7.0V
Input Voltage (Note 2)	-0.5V to +7.0V
Input Current (Note 2)	-30 mA to +5.0 mA
Voltage Applied to Output in HIGH State (with V <sub>CC</sub> = 0V)	
Standard Output	-0.5V to V <sub>CC</sub>
3-STATE Output	-0.5V to +5.5V
Current Applied to Output in LOW State (Max)	twice the rated I <sub>OL</sub> (mA)

### Recommended Operating Conditions

Free Air Ambient Temperature	0°C to +70°C
Supply Voltage	+4.5V to +5.5V

**Note 1:** Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

**Note 2:** Either voltage limit or current limit is sufficient to protect inputs.

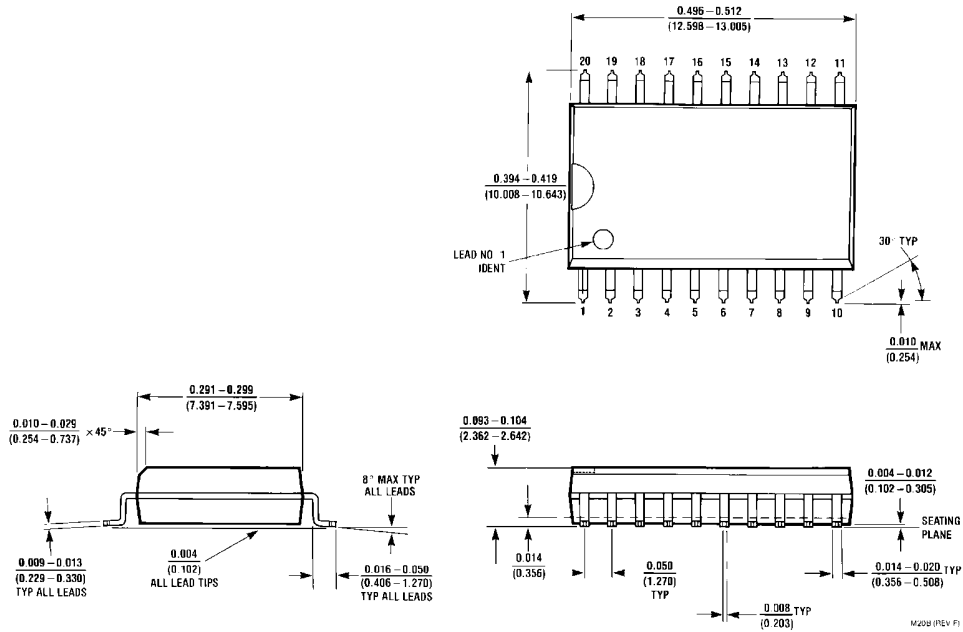
### DC Electrical Characteristics

Symbol	Parameter	Min	Typ	Max	Units	V <sub>CC</sub>	Conditions
V <sub>IH</sub>	Input HIGH Voltage	2.0			V		Recognized as a HIGH Signal
V <sub>IL</sub>	Input LOW Voltage			0.8	V		Recognized as a LOW Signal
V <sub>CD</sub>	Input Clamp Diode Voltage			-1.2	V	Min	I <sub>IN</sub> = -18 mA
V <sub>OH</sub>	Output HIGH Voltage	10% V <sub>CC</sub> 2.5 10% V <sub>CC</sub> 2.4 5% V <sub>CC</sub> 2.7 5% V <sub>CC</sub> 2.7			V	Min	I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -3 mA I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -3 mA
V <sub>OL</sub>	Output LOW Voltage	10% V <sub>CC</sub>		0.5	V	Min	I <sub>OL</sub> = 20 mA
I <sub>IH</sub>	Input HIGH Current			5.0	μA	Max	V <sub>IN</sub> = 2.7V
I <sub>BVI</sub>	Input HIGH Current Breakdown Test			7.0	μA	Max	V <sub>IN</sub> = 7.0V
I <sub>CEX</sub>	Output HIGH Leakage Current			50	μA	Max	V <sub>OUT</sub> = V <sub>CC</sub>
V <sub>ID</sub>	Input Leakage Test	4.75			V	0.0	I <sub>ID</sub> = 1.9 μA All Other Pins Grounded
I <sub>OD</sub>	Output Leakage Circuit Current			3.75	μA	0.0	V <sub>IOD</sub> = 150 mV All Other Pins Grounded
I <sub>IL</sub>	Input LOW Current			-0.6	mA	Max	V <sub>IN</sub> = 0.5V
I <sub>OZH</sub>	Output Leakage Current			50	μA	Max	V <sub>OUT</sub> = 2.7V
I <sub>OZL</sub>	Output Leakage Current			-50	μA	Max	V <sub>OUT</sub> = 0.5V
I <sub>OS</sub>	Output Short-Circuit Current	-60		-150	mA	Max	V <sub>OUT</sub> = 0V
I <sub>ZZ</sub>	Bus Drainage Test			500	μA	0.0V	V <sub>OUT</sub> = 5.25V
I <sub>CCH</sub>	Power Supply Current		31	45	mA	Max	V <sub>O</sub> = HIGH
I <sub>CCL</sub>	Power Supply Current		37	56	mA	Max	V <sub>O</sub> = LOW
I <sub>CCZ</sub>	Power Supply Current		37	56	mA	Max	V <sub>O</sub> = HIGH Z

AC Electrical Characteristics							
Symbol	Parameter	T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF			T <sub>A</sub> = 0°C to +70°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF		Units
		Min	Typ	Max	Min	Max	
t <sub>PLH</sub>	Propagation Delay	6.0	11.0	16.0	6.0	17.0	ns
t <sub>PHL</sub>	A <sub>n</sub> to O <sub>n</sub>	4.0	7.5	11.0	4.0	12.0	
t <sub>PLH</sub>	Propagation Delay	5.0	8.5	15.0	5.0	16.0	ns
t <sub>PHL</sub>	$\overline{E}_1$ or $\overline{E}_2$ to O <sub>n</sub>	4.0	6.5	9.0	4.0	10.0	
t <sub>PLH</sub>	Propagation Delay	6.0	11.0	16.0	6.0	17.0	ns
t <sub>PHL</sub>	E <sub>3</sub> or E <sub>4</sub> to O <sub>n</sub>	5.0	10.0	14.0	5.0	15.0	
t <sub>PLH</sub>	Propagation Delay	6.0	11.5	18.0	6.0	20.0	ns
t <sub>PHL</sub>	P to O <sub>n</sub>	6.0	11.0	16.0	6.0	17.0	
t <sub>PZH</sub>	Output Enable Time	3.0	5.5	10.0	3.0	11.0	ns
t <sub>PZL</sub>	$\overline{OE}_1$ or $\overline{OE}_2$ to O <sub>n</sub>	5.0	9.0	13.0	5.0	14.0	
t <sub>PHZ</sub>	Output Disable Time	2.0	4.0	6.0	2.0	7.0	ns
t <sub>PLZ</sub>	$\overline{OE}_1$ or $\overline{OE}_2$ to O <sub>n</sub>	3.0	5.0	8.0	3.0	9.0	

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**Physical Dimensions** inches (millimeters) unless otherwise noted



**20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide  
 Package Number M20B**

