

74F538

1-of-8 Decoder with TRI-STATE® Outputs

General Description

The 'F538 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.

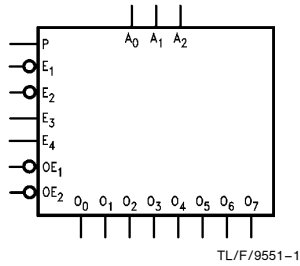
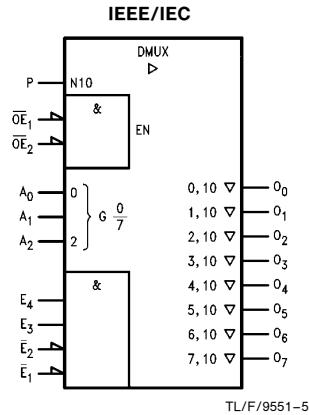
Features

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

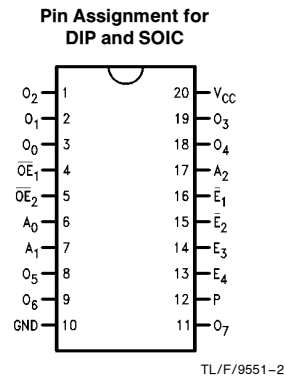
Commercial	Package Number	Package Description
74F538PC	N20A	20-Lead (0.300" Wide) Molded Dual-In-Line
74F538SC (Note 1)	M20B	20-Lead (0.300" Wide) Molded Small Outline, JEDEC
74F538SJ (Note 1)	M20D	20-Lead (0.300" Wide) Molded Small Outline, EIAJ

Note 1: Devices also available in 13" reel. Use suffix = SCX and SJX.

Logic Symbols



Connection Diagram



Unit Loading/Fan Out

Pin Names	Description	74F	
		U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
A_0 – A_2	Address Inputs	1.0/1.0	20 μ A/ –0.6 mA
$\overline{E}_1, \overline{E}_2$	Enable Inputs (Active LOW)	1.0/1.0	20 μ A/ –0.6 mA
E_3, E_4	Enable Inputs (Active HIGH)	1.0/1.0	20 μ A/ –0.6 mA
P	Polarity Control Input	1.0/1.0	20 μ A/ –0.6 mA
$\overline{OE}_1, \overline{OE}_2$	Output Enable Inputs (Active LOW)	1.0/1.0	20 μ A/ –0.6 mA
O_0 – O_7	TRI-STATE Outputs	150/40 (33.3)	–3 mA/24 mA (20 mA)

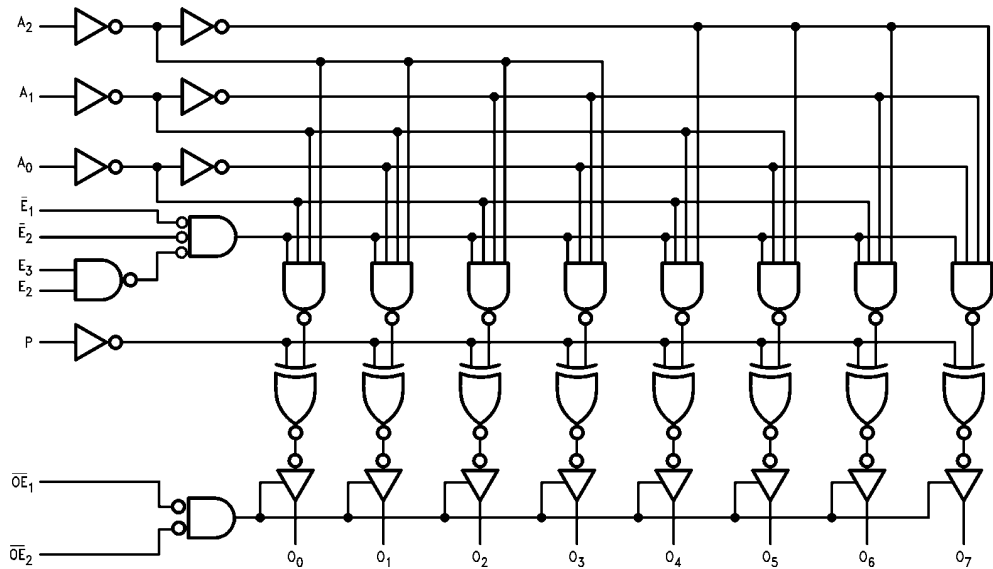
TRI-STATE® is a registered trademark of National Semiconductor Corporation.

Truth Table

Function	Inputs									Outputs							
	\overline{OE}_1	\overline{OE}_2	\overline{E}_1	E_2	E_3	E_4	A_2	A_1	A_0	O_0	O_1	O_2	O_3	O_4	O_5	O_6	O_7
High Impedance	H	X	X	X	X	X	X	X	X	Z	Z	Z	Z	Z	Z	Z	Z
	X	H	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	L	L	L	H	L	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
	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	L	H	H	L	H	H	H	H	H
	L	L	L	L	H	H	H	L	L	H	H	H	L	H	H	H	H
	L	L	L	L	H	H	H	L	H	H	H	H	H	L	H	H	H
	L	L	L	L	H	H	H	H	L	H	H	H	H	H	L	H	H
	L	L	L	L	H	H	H	H	L	H	H	H	H	H	L	H	H
	L	L	L	L	H	H	H	H	H	L	H	H	H	H	L	H	L

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

Logic Diagram



TL/F/9551-4

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

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 +175°C
Plastic	-55°C to +150°C
V _{CC} 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 _{CC} = 0V)	
Standard Output	-0.5V to V _{CC}
TRI-STATE Output	-0.5V to +5.5V
Current Applied to Output in LOW State (Max)	twice the rated I _{OL} (mA)

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.

Recommended Operating Conditions

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

DC Electrical Characteristics

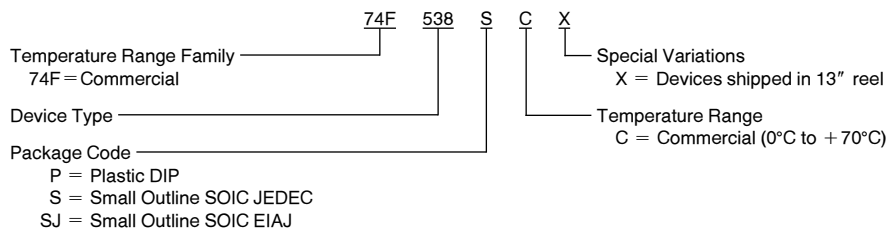
Symbol	Parameter		74F			Units	V _{CC}	Conditions
			Min	Typ	Max			
V _{IH}	Input HIGH Voltage		2.0			V		Recognized as a HIGH Signal
V _{IL}	Input LOW Voltage		0.8			V		Recognized as a LOW Signal
V _{CD}	Input Clamp Diode Voltage		-1.2			V	Min	I _{IN} = -18 mA
V _{OH}	Output HIGH Voltage	74F 10% V _{CC} 74F 10% V _{CC} 74F 5% V _{CC} 74F 5% V _{CC}	2.5 2.4 2.7 2.7			V	Min	I _{OH} = -1 mA I _{OH} = -3 mA I _{OH} = -1 mA I _{OH} = -3 mA
V _{OL}	Output LOW Voltage	74F 10% V _{CC}	0.5			V	Min	I _{OL} = 20 mA
I _{IH}	Input HIGH Current	74F	5.0			μA	Max	V _{IN} = 2.7V
I _{BVI}	Input HIGH Current Breakdown Test	74F	7.0			μA	Max	V _{IN} = 7.0V
I _{CEX}	Output HIGH Leakage Current	74F	50			μA	Max	V _{OUT} = V _{CC}
V _{ID}	Input Leakage Test	74F	4.75			V	0.0	I _{ID} = 1.9 μA All Other Pins Grounded
I _{OD}	Output Leakage Circuit Current	74F	3.75			μA	0.0	V _{IOD} = 150 mV All Other Pins Grounded
I _{IL}	Input LOW Current		-0.6			mA	Max	V _{IN} = 0.5V
I _{OZH}	Output Leakage Current		50			μA	Max	V _{OUT} = 2.7V
I _{OZL}	Output Leakage Current		-50			μA	Max	V _{OUT} = 0.5V
I _{OS}	Output Short-Circuit Current		-60	-150		mA	Max	V _{OUT} = 0V
I _{ZZ}	Bus Drainage Test		500			μA	0.0V	V _{OUT} = 5.25V
I _{CCH}	Power Supply Current		31	45		mA	Max	V _O = HIGH
I _{CCL}	Power Supply Current		37	56		mA	Max	V _O = LOW
I _{CCZ}	Power Supply Current		37	56		mA	Max	V _O = HIGH Z

AC Electrical Characteristics

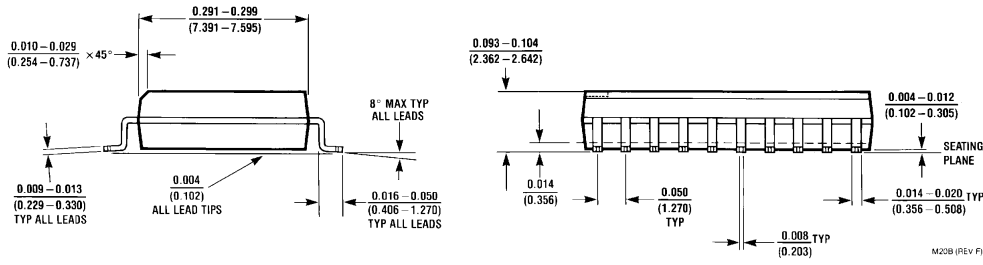
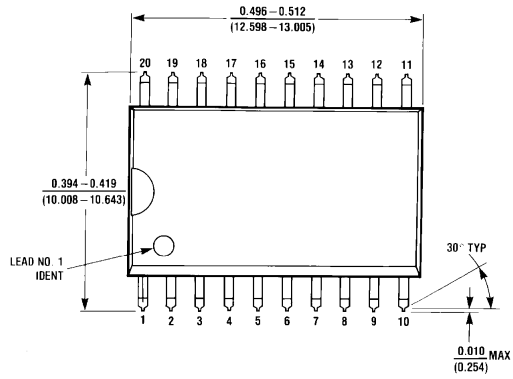
Symbol	Parameter	74F			74F		Units
		T _A = +25°C V _{CC} = +5.0V C _L = 50 pF			T _A , V _{CC} = Com C _L = 50 pF		
		Min	Typ	Max	Min	Max	
t _{PLH} t _{PHL}	Propagation Delay A _n to O _n	6.0 4.0	11.0 7.5	16.0 11.0	6.0 4.0	17.0 12.0	ns
t _{PLH} t _{PHL}	Propagation Delay \bar{E}_1 or \bar{E}_2 to O _n	5.0 4.0	8.5 6.5	15.0 9.0	5.0 4.0	16.0 10.0	
t _{PLH} t _{PHL}	Propagation Delay E ₃ or E ₄ to O _n	6.0 5.0	11.0 10.0	16.0 14.0	6.0 5.0	17.0 15.0	ns
t _{PLH} t _{PHL}	Propagation Delay P to O _n	6.0 6.0	11.5 11.0	18.0 16.0	6.0 6.0	20.0 17.0	
t _{PZH} t _{PZL}	Output Enable Time \bar{OE}_1 or \bar{OE}_2 to O _n	3.0 5.0	5.5 9.0	10.0 13.0	3.0 5.0	11.0 14.0	ns
t _{PHZ} t _{PLZ}	Output Disable Time \bar{OE}_1 or \bar{OE}_2 to O _n	2.0 3.0	4.0 5.0	6.0 8.0	2.0 3.0	7.0 9.0	

Ordering Information

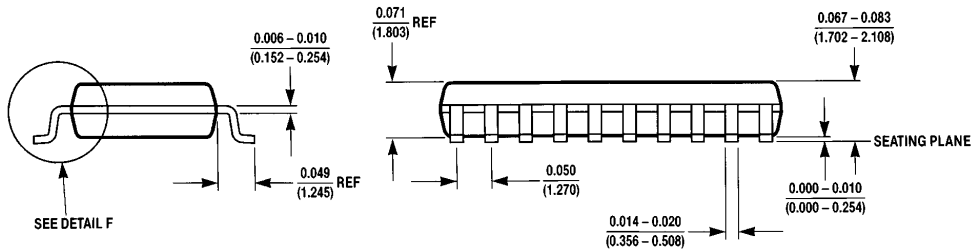
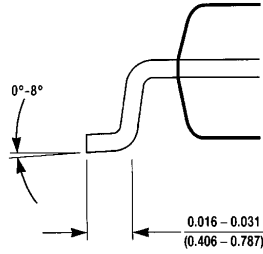
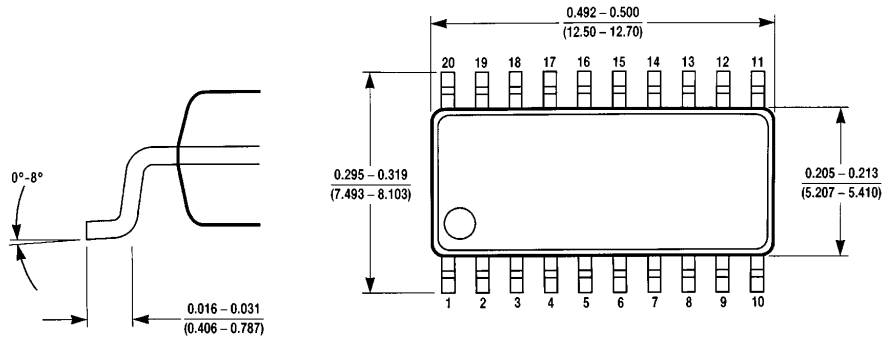
The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



Physical Dimensions inches (millimeters)

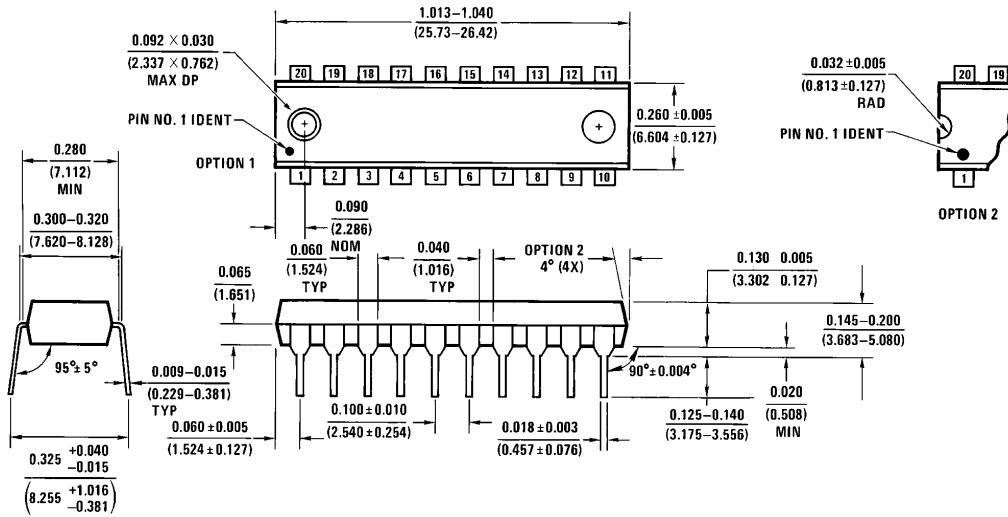


**20-Lead (0.300" Wide) Molded Small Outline Package, JEDEC (S)
NS Package Number M20B**



**20-Lead (0.300" Wide) Molded Small Outline Package, EIAJ (SJ)
NS Package Number M20D**

Physical Dimensions inches (millimeters) (Continued)



**20-Lead (0.300" Wide) Molded Dual-In-Line Package (P)
NS Package Number N20A**

N20A (REV G)

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



National Semiconductor Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

National Semiconductor Europe
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
19th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2309
Fax: 81-043-299-2408

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.