

DATA SHEET

74F538

1-of -8 decoder (3-state)

Product specification

1989 Apr 06

IC15 Data Handbook

1-of-8 decoder (3-State)

74F538

DESCRIPTION

The 74F538 decoder/demultiplexer accepts three address (A0 - A2) input signals and decodes them to select one of eight mutually exclusive outputs. A Polarity control (P) input determines whether the outputs are active Low or active High. The 74F538 has 3-State outputs, and a High signal on the Output Enables ($\overline{OE}n$) inputs will force all outputs to the high impedance state. Two active High (E2, E3) and two active Low ($\overline{E}0$, $\overline{E}1$) inputs 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.

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74F538	8.5ns	35mA

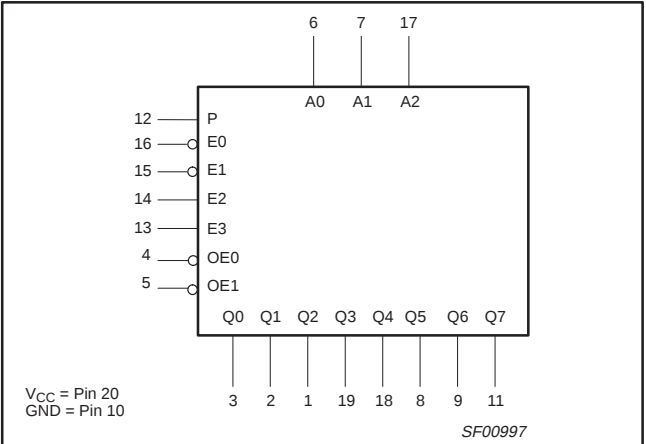
DESCRIPTION	COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$, $T_{amb} = 0^{\circ}C \text{ to } +70^{\circ}C$	PKG DWG #
20-Pin Plastic DIP	N74F538N	SOT146-1
20-Pin Plastic SOL	N74F538D	SOT163-1

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

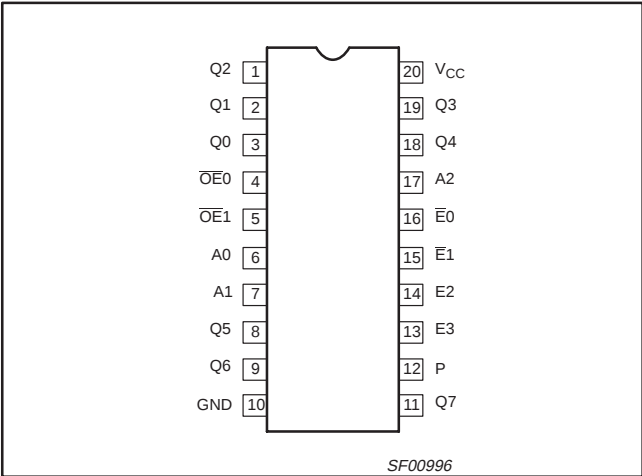
PINS	DESCRIPTION	74F(U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
A0 - A2	Address inputs	1.0/1.0	20 μ A/0.6mA
$\overline{E}0$, $\overline{E}1$	Enable inputs (active Low)	1.0/1.0	20 μ A/0.6mA
E2, E3	Enable inputs (active High)	1.0/1.0	20 μ A/0.6mA
P	Polarity control input	1.0/1.0	20 μ A/0.6mA
$\overline{OE}0$, $\overline{OE}1$	Output Enable inputs	1.0/1.0	20 μ A/0.6mA
Q0 - Q7	Data outputs	150/40	3.0mA/24mA

NOTE: One (1.0) FAST Unit Load is defined as: 20 μ A in the High state and 0.6mA in the Low state.

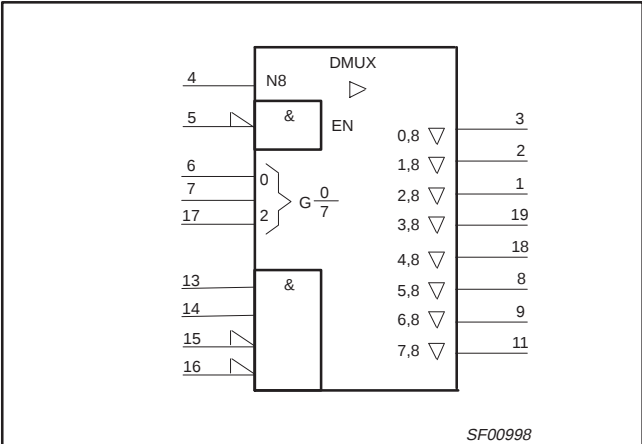
LOGIC SYMBOL



PIN CONFIGURATION



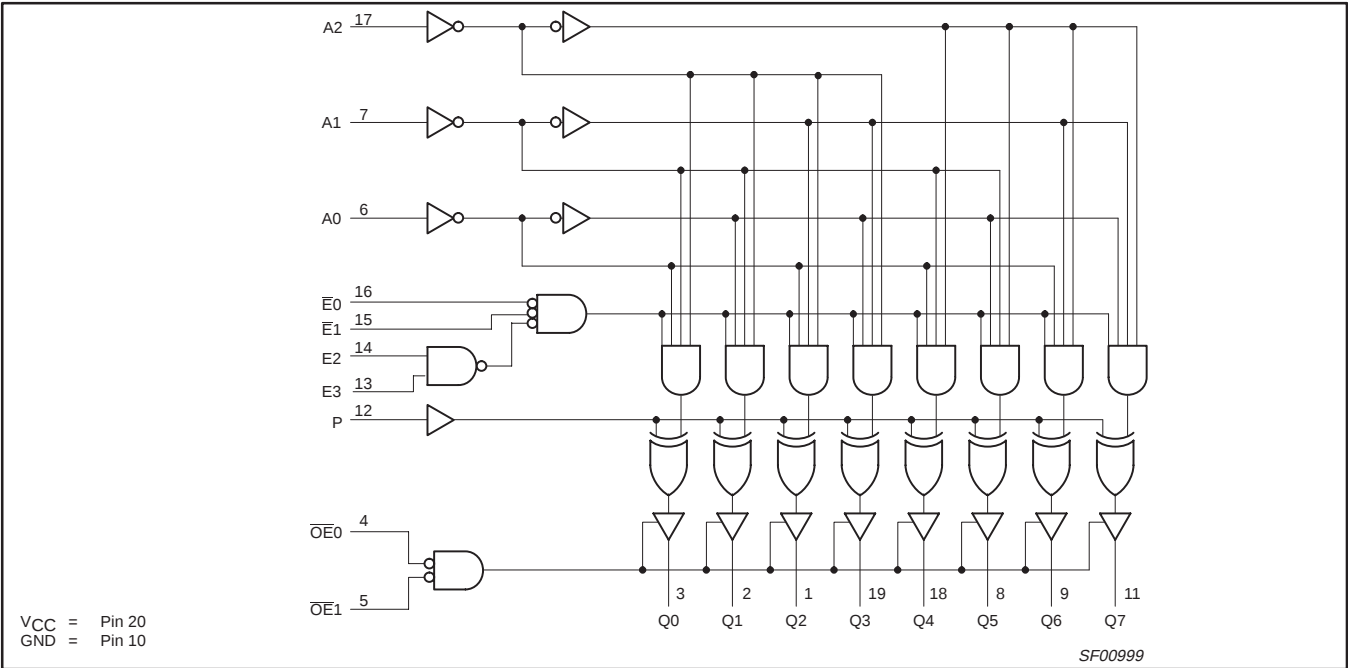
LOGIC SYMBOL (IEEE/IEC)



1-of-8 decoder (3-State)

74F538

LOGIC DIAGRAM



FUNCTION TABLE

INPUTS									OUTPUTS								OPERATING MODE
OE ₀	OE ₁	E ₀	E ₁	E ₂	E ₃	A ₂	A ₁	A ₀	Q ₀	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇	
H	X	X	X	X	X	X	X	X	Z	Z	Z	Z	Z	Z	Z	Z	High Impedance
X	H	X	X	X	X	X	X	X	Z	Z	Z	Z	Z	Z	Z	Z	
L	L	H	X	X	X	X	X	X	Outputs equal P input								Disable
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									
L	L	L	L	H	H	L	L	L	H	L	L	L	L	L	L	L	Active High output (P = 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	L	H	H	L	L	L	L	L	L	L	L	
L	L	L	L	H	H	H	L	L	L	L	L	H	H	H	H	H	Active Low output (P = 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	L	H	H	H	H	H	L	H	H	H	H	

H = High voltage level
L = Low voltage level
X = Don't care
Z = High impedance "off" state

1-of-8 decoder (3-State)

74F538

ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limits set forth in this table may impair the useful life of the device.
Unless otherwise noted these limits are over the operating free-air temperature range.)

SYMBOL	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage	-0.5 to +7.0	V
V_{IN}	Input voltage	-0.5 to +7.0	V
I_{IN}	Input current	-30 to +5.0	mA
V_{OUT}	Voltage applied to output in High output state	-0.5 to + V_{CC}	V
I_{OUT}	Current applied to output in Low output state	48	mA
T_{amb}	Operating free-air temperature range	0 to +70	°C
T_{stg}	Storage temperature	-65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5.0	5.5	V
V_{IH}	High-level input voltage	2.0			V
V_{IL}	Low-level input voltage			0.8	V
I_{IK}	Input clamp current			-18	mA
I_{OH}	High-level output current			-3.0	mA
I_{OL}	Low-level output current			24	mA
T_{amb}	Operating free-air temperature range	0		70	°C

DC ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER		TEST CONDITIONS ¹	LIMITS			UNIT	
				MIN	TYP ²	MAX		
V _{OH}	High-level output voltage		V _{CC} = MIN, V _{IL} = MAX, V _{IH} = MIN, I _{OH} = MAX	±10%V _{CC}	2.4		V	
				±5%V _{CC}	2.7	3.3	V	
V _{OL}	Low-level output voltage		V _{CC} = MIN, V _{IL} = MAX, V _{IH} = MIN, I _{OL} = MAX	±10%V _{CC}		0.35	0.50	V
				±5%V _{CC}		0.35	0.50	V
V _{IK}	Input clamp voltage		V _{CC} = MIN, I _I = I _{IK}		−0.73	−1.2	V	
I _I	Input current at maximum input voltage		V _{CC} = MAX, V _I = 7.0V			100	μA	
I _{IH}	High-level input current		V _{CC} = MAX, V _I = 2.7V			20	μA	
I _{IL}	Low-level input current		V _{CC} = MAX, V _I = 0.5V			−0.6	mA	
I _{OZH}	Off-state output current High-level voltage applied		V _{CC} = MAX, V _O = 2.7V			50	μA	
I _{OZL}	Off-state output current Low-level voltage applied		V _{CC} = MAX, V _O = 0.5V			−50	μA	
I _{OS}	Short-circuit output current ³		V _{CC} = MAX	−60		−150	mA	
I _{CC}	Supply current	I _{CCH}	V _{CC} = MAX		30	40	mA	
		I _{CCL}			35	50	mA	
		I _{CCZ}			35	50	mA	

NOTES:

- For conditions shown as MIN or MAX, use the appropriate value under the recommended operating conditions for the applicable type.
- All typical values are at $V_{CC} = 5\text{V}$, $T_{amb} = 25^\circ\text{C}$.
- Not more than one output should be shorted at a time. For testing I_{OS} , the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a High output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I_{OS} should be performed last.

1-of-8 decoder (3-State)

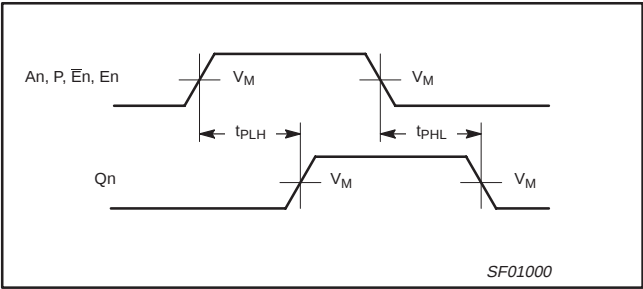
74F538

AC ELECTRICAL CHARACTERISTICS

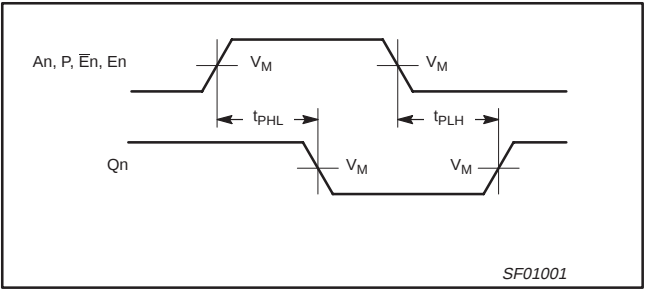
SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS					UNIT
			T _{amb} = +25°C V _{CC} = +5.0V C _L = 50pF, R _L = 500Ω			T _{amb} = 0°C to +70°C V _{CC} = +5.0V ± 10% C _L = 50pF, R _L = 500Ω		
			MIN	TYP	MAX	MIN	MAX	
t _{PLH} t _{PHL}	Propagation delay An to Qn	Waveform 1, 2	5.5 3.0	8.5 7.5	13.0 12.5	5.0 3.0	14.0 13.5	ns ns
t _{PLH} t _{PHL}	Propagation delay E0 or E1 to Qn	Waveform 1, 2	5.5 3.0	8.5 7.5	12.0 12.0	5.0 3.0	13.0 12.5	ns ns
t _{PLH} t _{PHL}	Propagation delay E2 or E3 to Qn	Waveform 1, 2	6.5 4.0	9.0 7.0	12.5 12.5	5.5 3.5	13.5 13.0	ns ns
t _{PLH} t _{PHL}	Propagation delay P to Qn	Waveform 1, 2	4.5 3.5	9.5 6.5	15.0 10.0	4.0 3.5	16.5 10.5	ns ns
t _{PZH} t _{PZL}	Output Enable time OE0 or OE1 to Qn	Waveform 3 Waveform 4	2.5 6.5	5.5 9.5	9.5 13.5	2.0 6.0	11.0 15.0	ns ns
t _{PHZ} t _{PLZ}	Output Disable time OE0 or OE1 to Qn	Waveform 3 Waveform 4	1.0 1.0	3.0 3.5	6.0 8.5	1.0 1.0	7.0 9.5	ns ns

AC WAVEFORMS

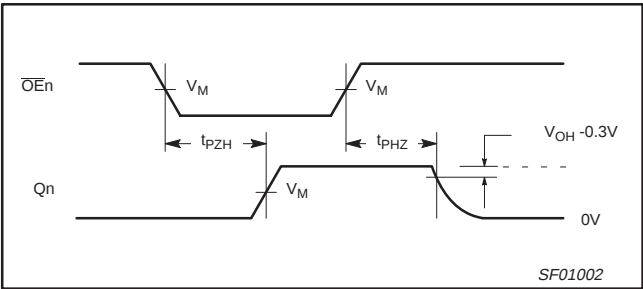
For all waveforms, V_M = 1.5V.



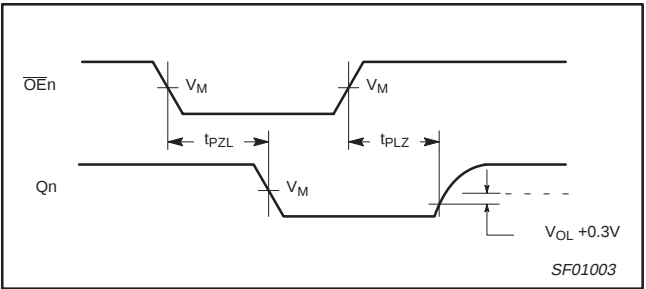
Waveform 1. Propagation Delay for Non-Inverting Outputs



Waveform 2. Propagation Delay for Inverting Outputs



Waveform 3. 3-State Output Enable Time to High Level and Output Disable Time from High Level

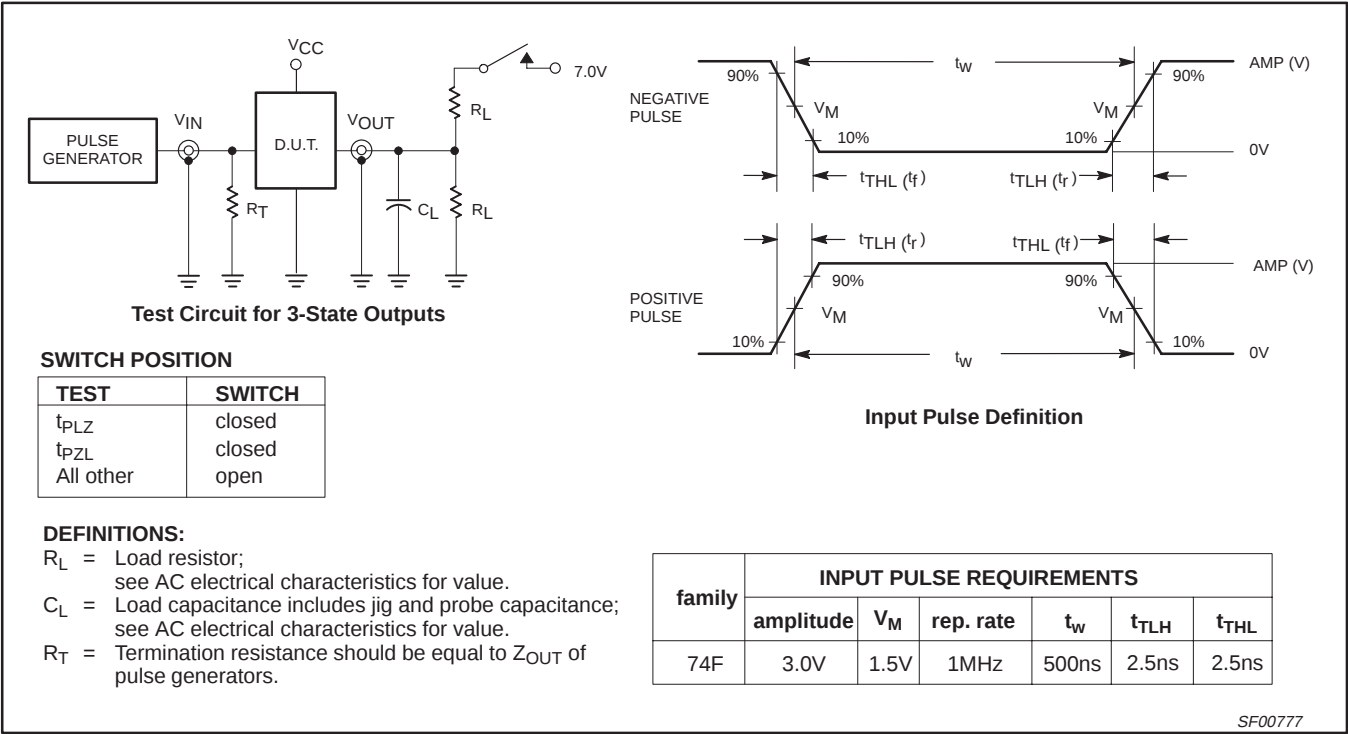


Waveform 4. 3-State Output Enable Time to Low Level and Output Disable Time from Low Level

1-of-8 decoder (3-State)

74F538

TEST CIRCUIT AND WAVEFORM



1-of -8 decoder (3-state)

74F538

DIP20: plastic dual in-line package; 20 leads (300 mil)

SOT146-1

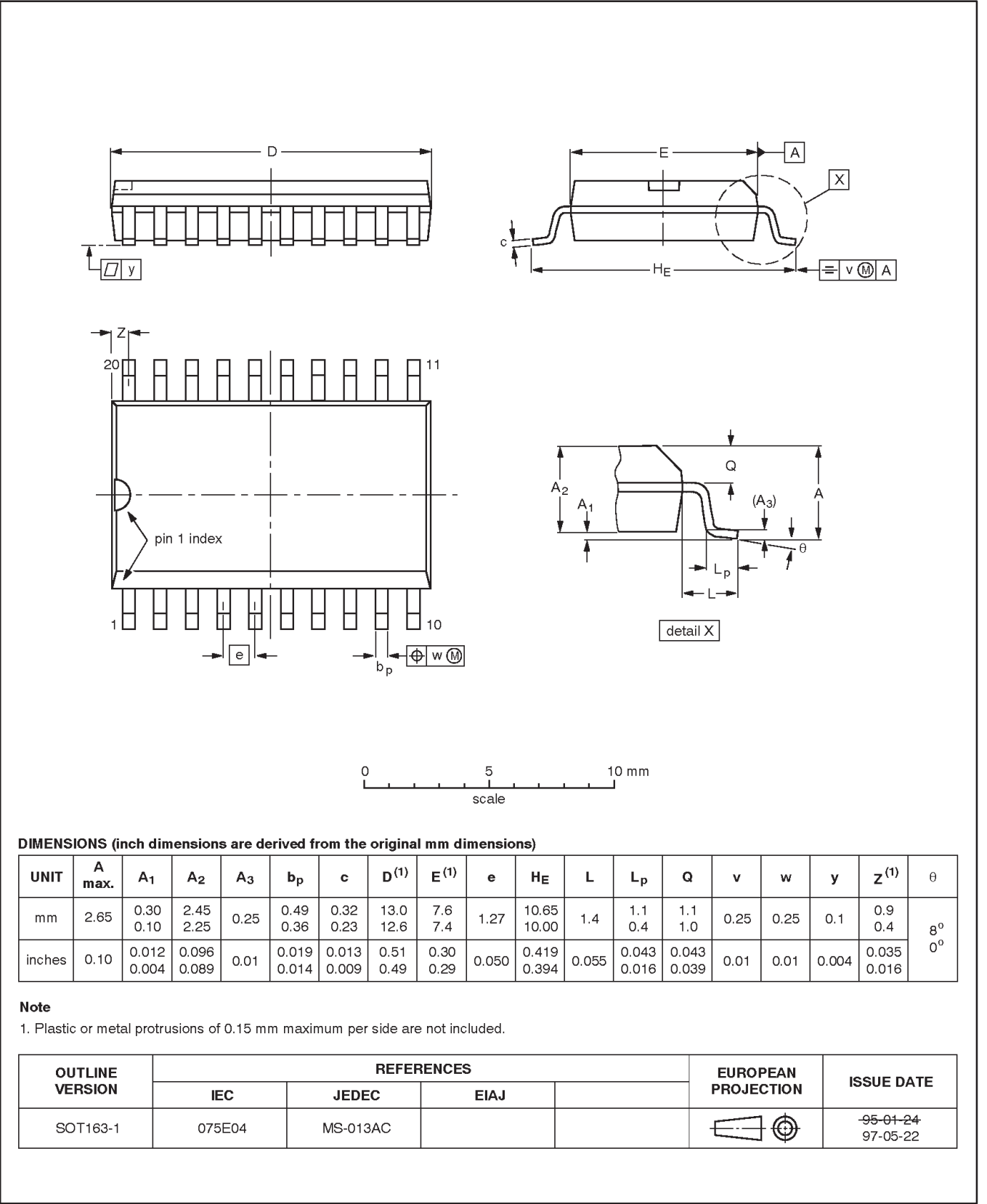


1-of -8 decoder (3-state)

74F538

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



1-of -8 decoder (3-state)**74F538**

NOTES

1-of -8 decoder (3-state)

74F538

Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

[1] Please consult the most recently issued datasheet before initiating or completing a design.

Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Disclaimers

Life support — These products are not designed for use in life support appliances, devices or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

Right to make changes — Philips Semiconductors reserves the right to make changes, without notice, in the products, including circuits, standard cells, and/or software, described or contained herein in order to improve design and/or performance. Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

Philips Semiconductors
811 East Arques Avenue
P.O. Box 3409
Sunnyvale, California 94088-3409
Telephone 800-234-7381

© Copyright Philips Electronics North America Corporation 1998
All rights reserved. Printed in U.S.A.

print code

Date of release: 10-98

Document order number:

9397-750-05133

Let's make things better.