

# DATA SHEET

**74F139**

Dual 1-of-4 decoder/demultiplexer

Product specification

1990 Feb 23

IC15 Data Handbook

# 1-of-4 decoder/demultiplexer

# 74F139

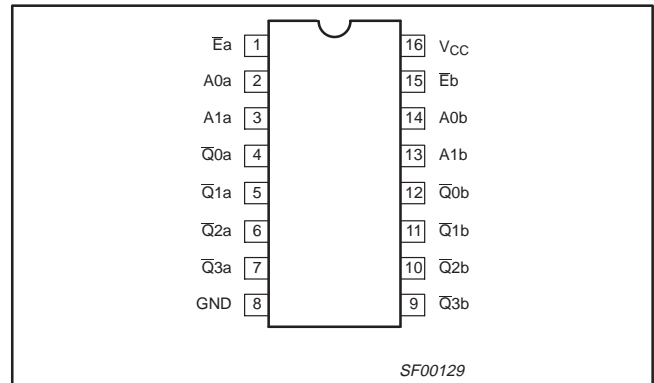
## FEATURES

- Demultiplexing capability
- Two independent 1-of-4 decoders
- Multifunction capability

## DESCRIPTION

The 74F139 is a high speed, dual 1-of-4 decoder/demultiplexer. This device has two independent decoders, each accepting two binary weighted inputs (A0n, A1n) and providing four mutually exclusive active-Low outputs ( $\bar{Q}0n$ – $\bar{Q}3n$ ). Each decoder has an active-Low Enable ( $\bar{E}$ ). When  $\bar{E}$  is High, every output is forced High. The Enable can be used as the Data input for a 1-of-4 demultiplexer application.

## PIN CONFIGURATION



TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74F139	5.3ns	13mA

## ORDERING INFORMATION

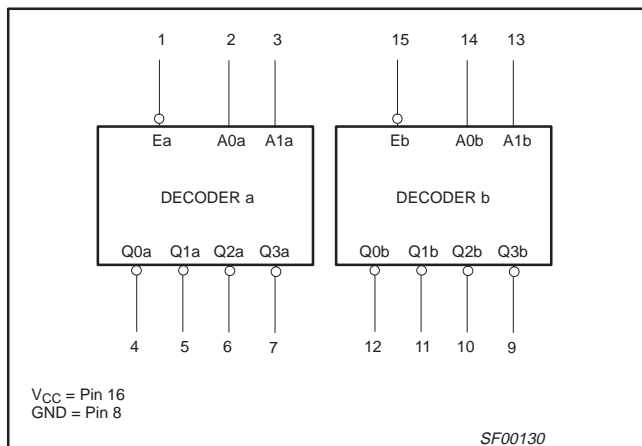
DESCRIPTION	COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$ , $T_{amb} = 0^{\circ}C$ to $+70^{\circ}C$	PKG DWG #
16-pin plastic DIP	N74F139N	SOT38-4
16-pin plastic SO	N74F139D	SOT109-1

## INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

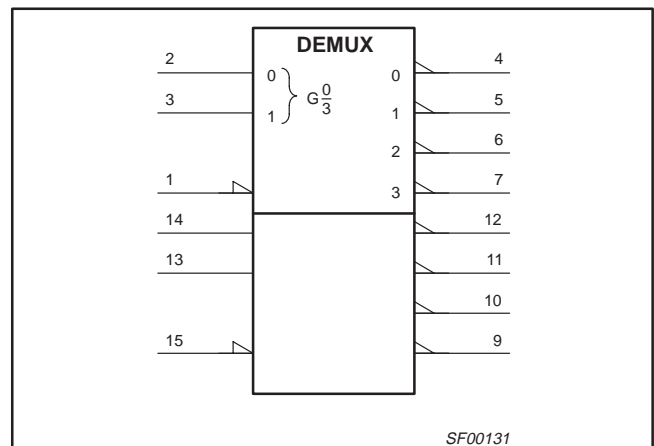
PINS	DESCRIPTION	74F (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
Ana, Anb	Address inputs	1.0/1.0	20 $\mu$ A/0.6mA
$\bar{E}a, \bar{E}b$	Enable inputs (active Low)	1.0/1.0	20 $\mu$ A/0.6mA
$\bar{Q}0n$ – $\bar{Q}3n$	Data outputs (active Low)	50/33	1.0mA/20mA

**NOTE:** One (1.0) FAST unit load is defined as: 20 $\mu$ A in the High state and 0.6mA in the Low state.

## LOGIC SYMBOL



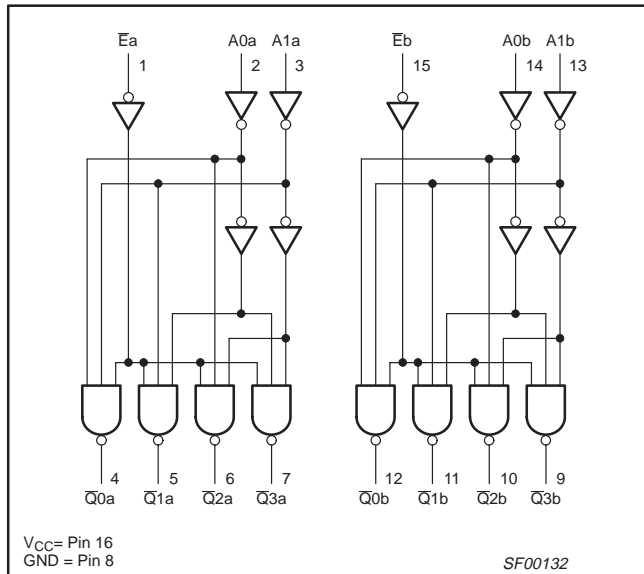
## IEC/IEEE SYMBOL



# 1-of-4 decoder/demultiplexer

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## LOGIC DIAGRAM



## FUNCTION TABLE

INPUTS			OUTPUTS			
$\bar{E}$	A0	A1	$\bar{Q}0$	$\bar{Q}1$	$\bar{Q}2$	$\bar{Q}3$
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	H	L	H	L	H	H
L	L	H	H	H	L	H
L	H	H	H	H	H	L

**NOTES:**  
 H = High voltage level  
 L = Low voltage level  
 X = Don't care

## 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	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	40	mA
$T_{amb}$	Operating free-air temperature range	0 to +70	°C
$T_{stg}$	Storage temperature range	-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			-1	mA
$I_{OL}$	Low-level output current			20	mA
$T_{amb}$	Operating free-air temperature range	0		+70	°C

# 1-of-4 decoder/demultiplexer

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## DC ELECTRICAL CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS <sup>1</sup>	LIMITS			UNIT	
			MIN	TYP <sup>2</sup>	MAX		
V <sub>OH</sub>	High-level output voltage	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX	±10%V <sub>CC</sub>	2.5		V	
		V <sub>IH</sub> = MIN, I <sub>OH</sub> = MAX	±5%V <sub>CC</sub>	2.7	3.4	V	
V <sub>OL</sub>	Low-level output voltage	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX	±10%V <sub>CC</sub>		0.30	0.50	V
		V <sub>IH</sub> = MIN, I <sub>OL</sub> = MAX	±5%V <sub>CC</sub>		0.30	0.50	V
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>		-0.73	-1.2	V	
I <sub>I</sub>	Input current at maximum input voltage	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7.0V			100	μA	
I <sub>IH</sub>	High-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V			20	μA	
I <sub>ILL</sub>	Low-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5V			-0.6	mA	
I <sub>OS</sub>	Short-circuit output current <sup>3</sup>	V <sub>CC</sub> = MAX	-60		-150	mA	
I <sub>CC</sub>	Supply current (total)	V <sub>CC</sub> = MAX		13	20	mA	

**NOTES:**

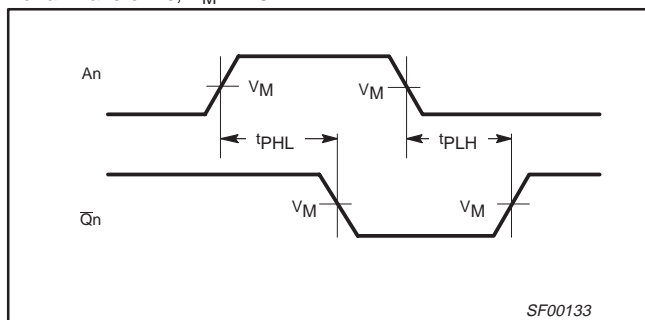
1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at V<sub>CC</sub> = 5V, T<sub>amb</sub> = 25°C.
3. Not more than one output should be shorted at a time. For testing I<sub>OS</sub>, the 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<sub>OS</sub> tests should be performed last.

## AC ELECTRICAL CHARACTERISTICS

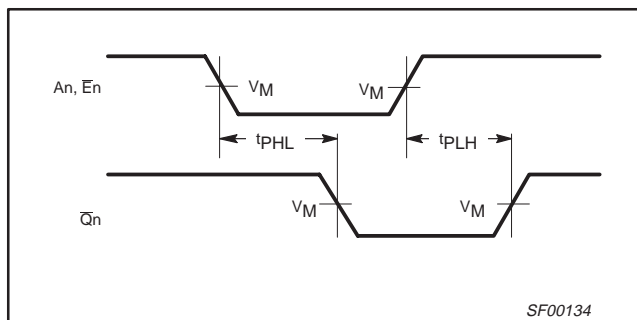
SYMBOL	PARAMETER	TEST CONDITION	LIMITS					UNIT
			V <sub>CC</sub> = +5.0V T <sub>amb</sub> = +25°C C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω			V <sub>CC</sub> = +5.0V ± 10% T <sub>amb</sub> = 0°C to +70°C C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω		
			MIN	TYP	MAX	MIN	MAX	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay A0 ir A1 to Q <sub>na</sub> , Q <sub>nb</sub>	Waveform 1, 2	3.5 4.0	5.3 6.1	7.0 8.0	3.0 4.0	8.0 9.0	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay E <sub>n</sub> to Q <sub>na</sub> , Q <sub>nb</sub>	Waveform 2	3.5 3.0	5.4 4.7	7.0 6.5	3.5 3.0	8.0 7.5	ns

## AC WAVEFORMS

For all waveforms, V<sub>M</sub> = 1.5V



Waveform 1. Propagation Delay for Inverting Outputs

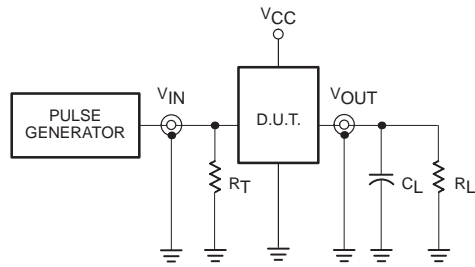


Waveform 2. Propagation Delay for Non-Inverting Outputs

# 1-of-4 decoder/demultiplexer

# 74F139

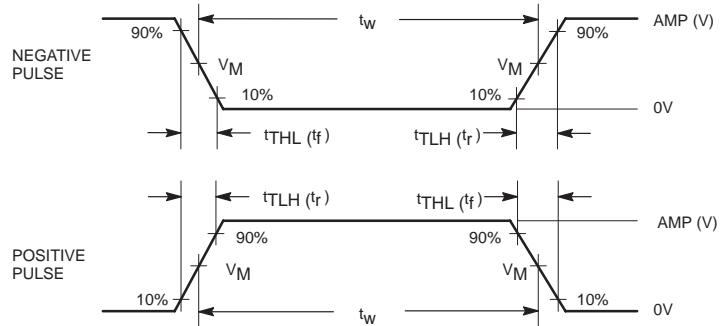
## TEST CIRCUIT AND WAVEFORMS



**Test Circuit for Totem-Pole Outputs**

**DEFINITIONS:**

- $R_L$  = Load resistor; see AC ELECTRICAL CHARACTERISTICS for value.
- $C_L$  = Load capacitance includes jig and probe capacitance; see AC ELECTRICAL CHARACTERISTICS for value.
- $R_T$  = Termination resistance should be equal to  $Z_{OUT}$  of pulse generators.



**Input Pulse Definition**

family	INPUT PULSE REQUIREMENTS					
	amplitude	$V_M$	rep. rate	$t_w$	$t_{TLH}$	$t_{THL}$
74F	3.0V	1.5V	1MHz	500ns	2.5ns	2.5ns

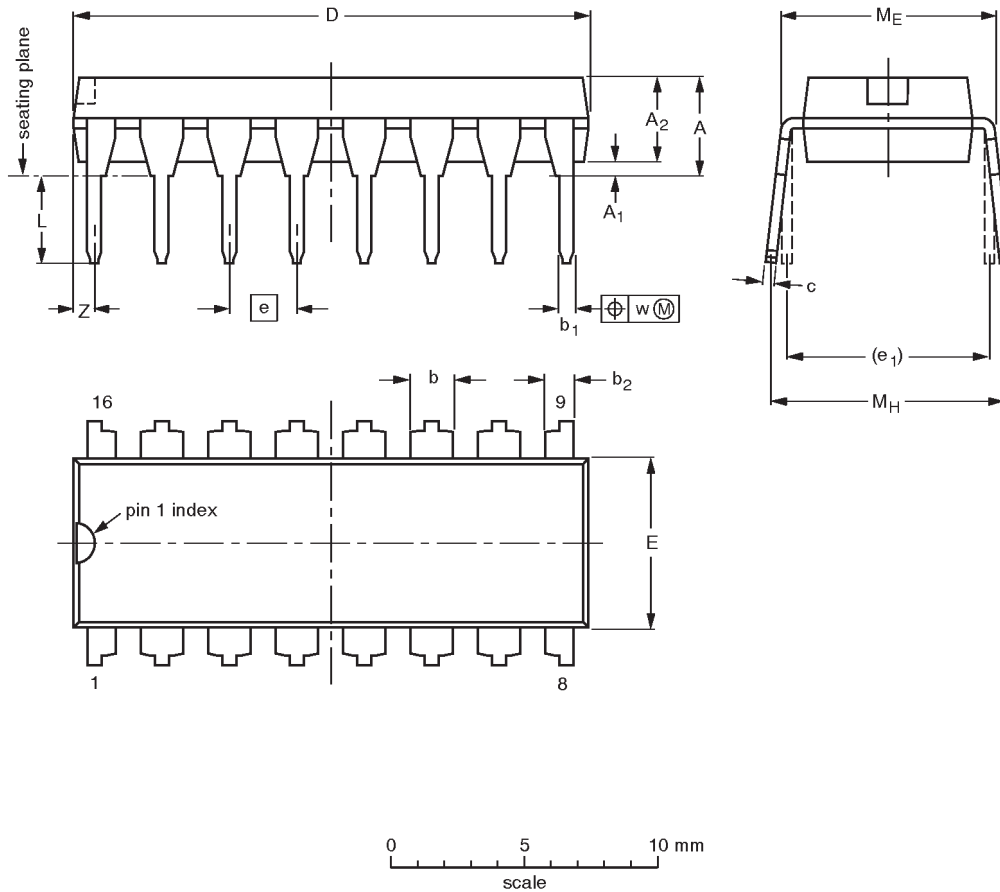
SF00006

# Dual 1-of-4 decoder/demultiplexer

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DIP16: plastic dual in-line package; 16 leads (300 mil)

SOT38-4



**DIMENSIONS** (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	b <sub>2</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	1.25 0.85	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	0.76
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.049 0.033	0.014 0.009	0.77 0.73	0.26 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.030

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

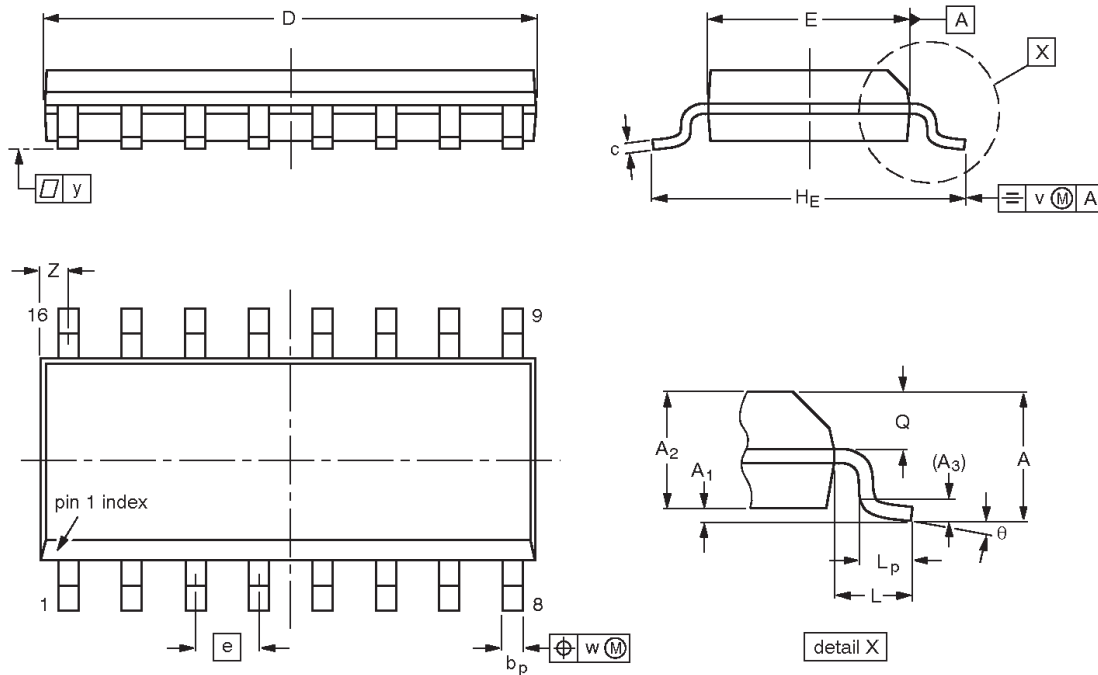
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-4						92-11-17 95-01-14

# Dual 1-of-4 decoder/demultiplexer

# 74F139

**SO16: plastic small outline package; 16 leads; body width 3.9 mm**

**SOT109-1**



**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.39 0.38	0.16 0.15	0.050	0.244 0.228	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT109-1	076E07S	MS-012AC				95-01-23 97-05-22

## Dual 1-of-4 decoder/demultiplexer

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

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**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.

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

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