

FAST 74F138 Decoder/Demultiplexer

FAST Products

1-Of-8 Decoder/Demultiplexer

FEATURES

- Demultiplexing capability
- Multiple input enable for easy expansion
- Ideal for memory chip select decoding
- High speed replacement for Intel 3205

Product Specification

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74F138	5.8ns	13mA

DESCRIPTION

The 74F138 decoder accepts three binary weighted inputs (A_0, A_1, A_2) and when enabled, provides eight mutually exclusive, active-Low outputs ($\bar{Q}_0-\bar{Q}_7$). The device features three Enable inputs; two active-Low (\bar{E}_0, \bar{E}_1) and one active High (E_2). Every output will be High unless \bar{E}_0 and \bar{E}_1 are Low and E_2 is High. This multiple enable function allows easy parallel expansion of the device to 1-of-32 (5 lines to 32 lines) decoder with just four 'F138s and one inverter. The device can be used as an eight output demultiplexer by using one of the active-Low Enable inputs as the Data input and the remaining Enable inputs as strobes. Enable inputs not used must be permanently tied to their appropriate active-High or active-Low state.

ORDERING INFORMATION

PACKAGES	COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$; $T_A = 0^\circ C$ to $+70^\circ C$
16-Pin Plastic DIP	N74F138N
16-Pin Plastic SO	N74F138D

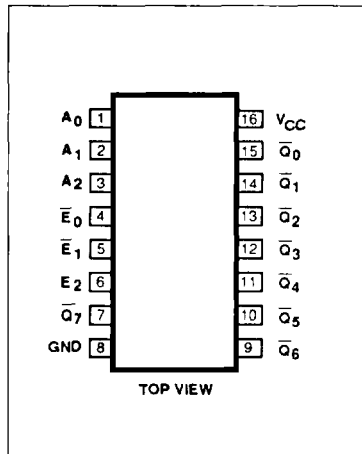
INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74F(U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
A_0-A_2	Address inputs	1.0/1.0	20 μ A/0.6mA
\bar{E}_0, \bar{E}_1	Enable inputs (active Low)	1.0/1.0	20 μ A/0.6mA
E_2	Enable input (active High)	1.0/1.0	20 μ A/0.6mA
$\bar{Q}_0-\bar{Q}_7$	Data outputs (active Low)	50/33	1.0mA/20mA

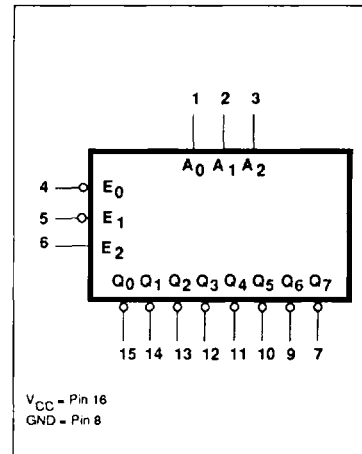
NOTE:

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

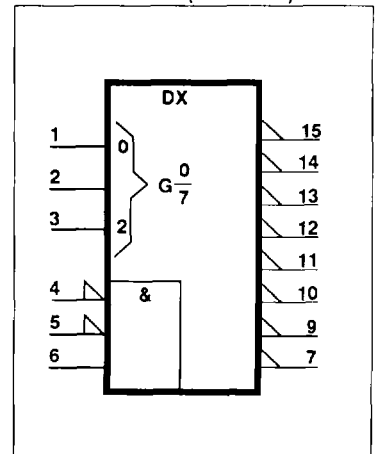
PIN CONFIGURATION



LOGIC SYMBOL



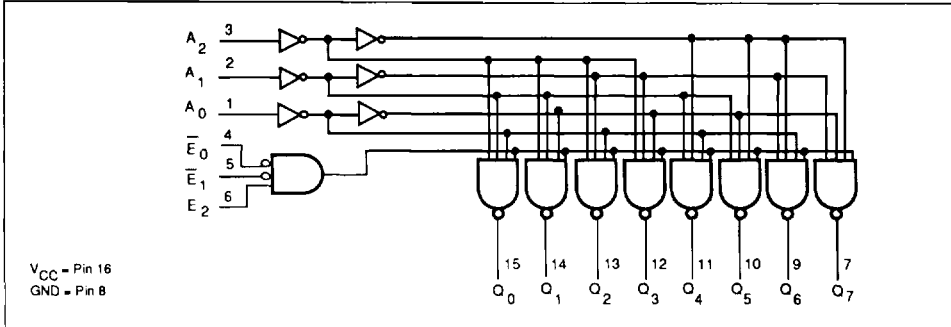
LOGIC SYMBOL (IEEE/IEC)



Decoder/Demultiplexer

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LOGIC DIAGRAM

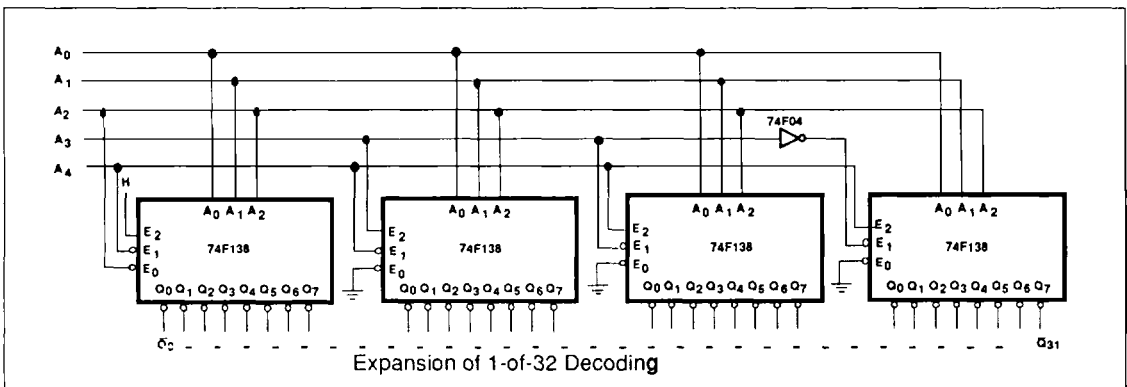


DECODER FUNCTION TABLE

INPUTS						OUTPUTS							
\bar{E}_0	\bar{E}_1	E_2	A_0	A_1	A_2	\bar{Q}_0	\bar{Q}_1	\bar{Q}_2	\bar{Q}_3	\bar{Q}_4	\bar{Q}_5	\bar{Q}_6	\bar{Q}_7
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	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	L	H	H	H	H	H
L	L	H	H	H	L	H	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 = Don't care

APPLICATION



Decoder/Demultiplexer

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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_A	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			-1	mA
I_{OL}	Low-level output current			20	mA
T_A	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	$V_{CC} = \text{MIN}, V_{IL} = \text{MAX}$	$\pm 10\%V_{CC}$	2.5		V	
		$V_{IH} = \text{MIN}, I_{OH} = \text{MAX}$	$\pm 5\%V_{CC}$	2.7	3.4	V	
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}, V_{IL} = \text{MAX}$	$\pm 10\%V_{CC}$		0.30	0.50	V
		$V_{IH} = \text{MIN}, I_{OL} = \text{MAX}$	$\pm 5\%V_{CC}$		0.30	0.50	V
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN}, I_I = I_{IK}$			-0.73	-1.2	V
I_I	Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 7.0V$				100	μA
I_{IH}	High-level input current	$V_{CC} = \text{MAX}, V_I = 2.7V$				20	μA
I_{IL}	Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.5V$				-0.6	mA
I_{OS}	Short circuit output current ³	$V_{CC} = \text{MAX}$		-60		-150	mA
I_{CC}	Supply current (total) ⁴	$V_{CC} = \text{MAX}$			13	20	mA

NOTES:

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at $V_{CC} = 5V, T_A = 25^\circ C$.
- 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 test, I_{OS} tests should be performed last.
- To measure I_{CC} , outputs must be open, V_{IN} on all inputs=4.5V.

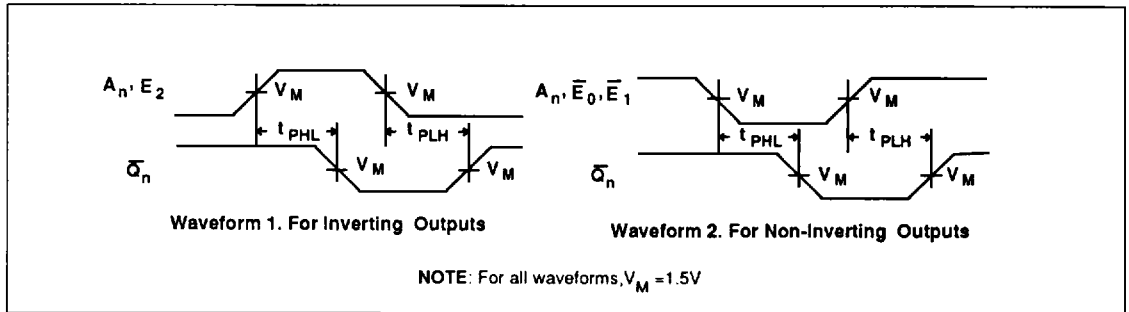
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AC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITION	LIMITS					UNIT
			$T_A = +25^\circ\text{C}$ $V_{CC} = 5\text{V}$ $C_L = 50\text{pF}$ $R_L = 500\Omega$			$T_A = 0^\circ\text{C to } +70^\circ\text{C}$ $V_{CC} = 5\text{V} \pm 10\%$ $C_L = 50\text{pF}$ $R_L = 500\Omega$		
			Min	Typ	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation delay A_n to \bar{Q}_n	Waveform 1, 2	3.5 4.0	5.6 6.1	7.0 8.0	3.5 4.0	8.0 9.0	ns
t_{PLH} t_{PHL}	Propagation delay \bar{E}_0 or E_1 to \bar{Q}_n	Waveform 2	3.5 3.0	6.4 5.3	7.0 7.0	3.5 3.0	8.0 7.5	ns
t_{PLH} t_{PHL}	Propagation delay E_2 to \bar{Q}_n	Waveform 1	4.0 3.5	6.2 5.6	8.0 7.5	4.0 3.5	9.0 8.5	ns

AC WAVEFORMS



TEST CIRCUIT AND WAVEFORMS

