

P54/74FCT139T/AT/CT HIGH-SPEED DUAL 1-OF-4 DECODER



FEATURES

- Function, Pinout and Drive Compatible with the FCT and F Logic
- FCT-C speed at 5.0ns max. (Com'I)
FCT-A speed at 5.9ns max. (Com'I)
- Reduced V_{OH} (typically = 3.3V) versions of Equivalent FCT functions
- Edge-rate Control Circuitry for Significantly Improved Noise Characteristics
- ESD protection exceeds 2000V
- Power-off disable feature
- Matched Rise and Fall times
- Fully Compatible with TTL Input and Output Logic Levels
- 64 mA Sink Current (Com'I), 32 mA (MII)
15 mA Source Current (Com'I), 12 mA (MII)
- Manufactured in 0.7 micron PACE Technology™



DESCRIPTION

The 'FCT139T is a dual 1-of-4 decoders which has two independent decoders, each of which accept two binary weighted inputs (A_0-A_1) and provide four mutual exclusive active LOW outputs (O_0-O_3). Each decoder has an active LOW enable (E). When \bar{E} is HIGH, all outputs are forced HIGH.

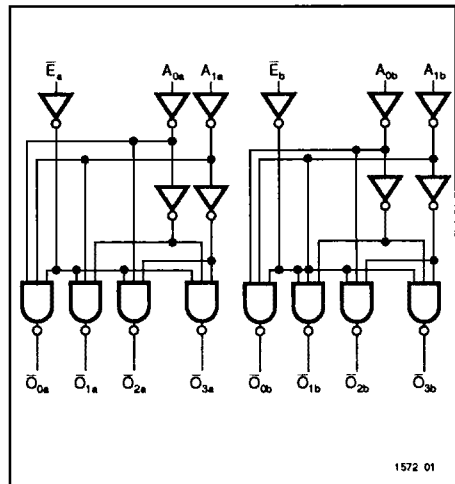
The 'FCT139T is manufactured using PACE Technology™ which is Performance Advanced CMOS Engineered to

use 0.7 micron effective channel lengths giving 400 picoseconds loaded* internal gate delays. PACE Technology includes two-level metal and epitaxial substrates. In addition to very high performance and very high density, the technology features latch-up protection, single event upset protection, and is supported by a Class 1 environment volume production facility.

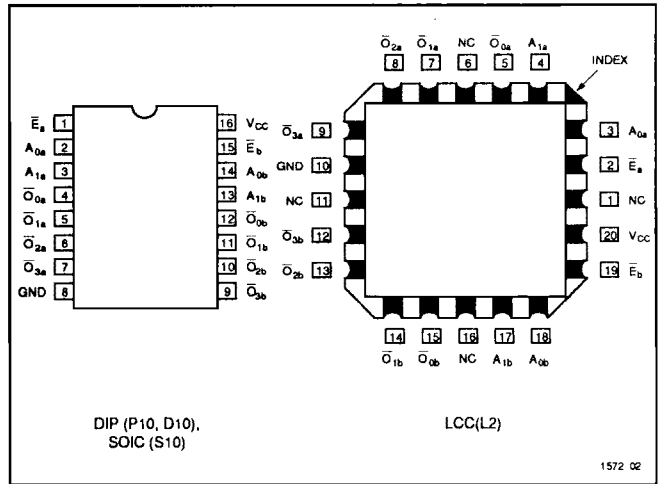
*For a fan-in/fan-out of 4, at 85°C junction temperature and 5.0V.



FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATIONS



Means Quality, Service and Speed

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ABSOLUTE MAXIMUM RATINGS^{1,2}

Symbol	Parameter	Value	Unit
T _{STG}	Storage Temperature	-65 to +150	°C
T _A	Ambient Temperature Under Bias	-65 to +135	°C
V _{CC}	V _{CC} Potential to Ground	-0.5 to +7.0	V
P _T	Power Dissipation	0.5	W

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Symbol	Parameter	Value	Unit
I _{OUTPUT}	Current Applied to Output	120	mA
V _{IN}	Input Voltage	-0.5 to +7.0	V
V _{OUT}	Voltage Applied to Output	-0.5 to +7.0	V

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Notes:

1. Operation beyond the limits set forth in the above table may impair the useful life of the device. Unless otherwise noted, these limits are over the operating free-air temperature range.
2. Unused inputs must always be connected to an appropriate logic voltage level, preferably either V_{CC} or ground.

RECOMMENDED OPERATING CONDITIONS

Free Air Ambient Temperature	Min	Max
Military	-55°C	+125°C
Commercial	0°C	+70°C

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Supply Voltage (V _{CC})	Min	Max
Military	+4.5V	+5.5V
Commercial	+4.75V	+5.25V

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DC ELECTRICAL CHARACTERISTICS (Over recommended operating conditions)

Symbol	Parameter	Min	Typ ¹	Max	Units	V _{CC}	Conditions	
V _{IH}	Input HIGH Voltage	2.0			V			
V _{IL}	Input LOW Voltage			0.8	V			
V _H	Hysteresis		0.2		V		All inputs	
V _{IK}	Input Clamp Diode Voltage		-0.7	-1.2	V	MIN	I _{IN} = -18mA	
V _{OH}	Output HIGH Voltage	Military	2.4	3.3		V	MIN	I _{OH} = -12mA
		Commercial	2.4	3.3		V	MIN	I _{OH} = -15mA
V _{OL}	Output LOW Voltage	Military		0.3	0.5	V	MIN	I _{OL} = 32mA
		Commercial		0.3	0.5	V	MIN	I _{OL} = 48mA
		Commercial		0.3	0.5	V	MIN	I _{OL} = 64mA
I _I	Input HIGH Current			20	µA	MAX	V _{IN} = V _{CC}	
I _{IH}	Input HIGH Current			5	µA	MAX	V _{IN} = 2.7V	
I _{IL}	Input LOW Current			-5	µA	MAX	V _{IN} = 0.5V	
I _{OS}	Output Short Circuit Current ²	-60	-120	-225	mA	MAX	V _{OUT} = 0.0V	
I _{OFF}	Power-off Disable			100	µA	0V	V _{OUT} = 4.5V	
C _{IN}	Input Capacitance ³		6	10	pF	MAX	All inputs	
C _{OUT}	Output Capacitance ³		8	12	pF	MAX	All outputs	
I _{CC}	Quiescent Power Supply Current		0.2	1.5	mA	MAX	V _{IN} ≤ 0.2V, V _{IN} ≥ V _{CC} - 0.2V	

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Notes:

1. Typical limits are at V_{CC} = 5.0V, T_A = +25°C ambient.
2. Not more than one output should be shorted at a time. Duration of short should not exceed one second. The use of high speed test apparatus and/or sample and hold techniques are preferable in order to minimize internal chip 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} tests should be performed last.
3. This parameter is guaranteed but not tested.

DC CHARACTERISTICS (Over recommended operating conditions unless otherwise specified.)

Symbol	Parameter	Typ ¹	Max	Units	Conditions
ΔI_{CC}	Quiescent Power Supply Current (TTL inputs HIGH)	0.5	2.0	mA	$V_{CC} = \text{MAX}$, $V_{IN} = 3.4V^2$, $f_1 = 0$, Outputs Open
I_{CCD}	Dynamic Power Supply Current ³	0.15	0.3	mA/ mHz	$V_{CC} = \text{MAX}$, One Input Toggling, 50% Duty Cycle, Outputs Open, $V_{IN} \leq 0.2V$ or $V_{IN} \geq V_{CC} - 0.2V$
I_C	Total Power Supply Current ⁴	1.7	4.5	mA	$V_{CC} = \text{MAX}$, $f_1 = 10 \text{ MHz}$, 50% Duty Cycle, Outputs Open, One Output Toggling, and $V_{IN} \leq 0.2V$ or $V_{IN} \geq V_{CC} - 0.2V$
		2.0	5.5	mA	$V_{CC} = \text{MAX}$, $f_1 = 10 \text{ MHz}$, 50% Duty Cycle, Outputs Open, One Output Toggling and $V_{IN} = 3.4V$ or $V_{IN} = \text{GND}$
		3.2	7.5 ⁴	mA	$V_{CC} = \text{MAX}$, $f_1 = 10 \text{ MHz}$, 50% Duty Cycle, Outputs Open, One Output Toggling on Each Decoder and $V_{IN} \leq 0.2V$ or $V_{IN} \geq V_{CC} - 0.2V$
		3.7	9.5 ⁴	mA	$V_{CC} = \text{MAX}$, $f_1 = 10 \text{ MHz}$, 50% Duty Cycle, Outputs Open, One Output Toggling on Each Decoder and $V_{IN} = 3.4V$ or $V_{IN} = \text{GND}$

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Notes:

- Typical values are at $V_{CC} = 5.0V$, +25°C ambient.
- Per TTL driven input ($V_{IN} = 3.4V$); all other inputs at V_{CC} or GND.
- This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
- $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_1/2 + f_1 N_1)$
 I_{CC} = Quiescent Current with CMOS input levels
 ΔI_{CC} = Power Supply Current for a TTL High Input ($V_{IN} = 3.4V$)
 D_H = Duty Cycle for TTL Inputs High

- N_T = Number of TTL Inputs at D_H
 I_{CCD} = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)
 f_0 = Clock Frequency for Register Devices (Zero for Non-Register Devices)
 f_1 = Output Frequency
 N_1 = Number of Inputs at f_1
 All currents are in milliamps and all frequencies are in megahertz.

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TRUTH TABLE

Inputs			Outputs			
\bar{E}	A_0	A_1	\bar{O}_0	\bar{O}_1	\bar{O}_2	\bar{O}_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

H = HIGH Voltage Level
 L = LOW Voltage Level
 X = Don't Care

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AC CHARACTERISTICS

Sym	Parameter	'FCT139T				'FCT139AT				'FCT139CT				Units	Fig. No.
		MIL		COM'L		MIL		COM'L		MIL		COM'L			
		Min.'	Max.	Min.'	Max.	Min.'	Max.	Min.'	Max.	Min.'	Max.	Min.'	Max.		
t_{PLH} t_{PHL}	Prop Delay A_0 or A_1 to \bar{O}_n	1.5	12.0	1.5	9.0	1.5	7.8	1.5	5.9	1.5	6.6	1.5	5.0	ns	1, 5
t_{PLH} t_{PHL}	Prop Delay \bar{E}_1 or \bar{E}_2 to \bar{O}_n	1.5	9.0	1.5	8.0	1.5	7.2	1.5	5.5	1.5	6.2	1.5	4.7	ns	1, 5

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Note:

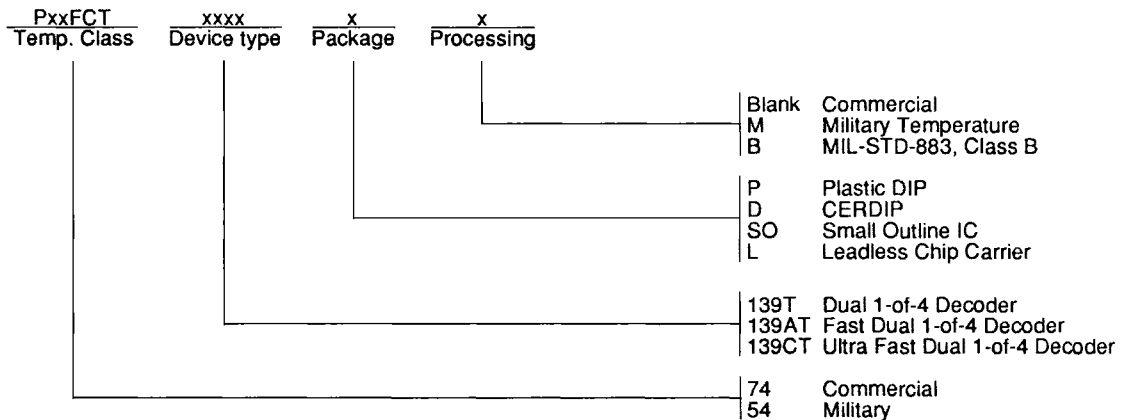
1. Minimum limits are guaranteed but not tested on Propagation Delays.

DEFINITION OF FUNCTIONAL TERMS

Pin Names	Description
A_0, A_1	Address Inputs
\bar{E}_1, \bar{E}_2	Enable Inputs (Active LOW)
$\bar{O}_0 - \bar{O}_3$	Outputs (Active LOW)

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ORDERING INFORMATION



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