



CYPRESS

CY54/74FCT138T

1-of-8 Decoder

Features

- Function, pinout, and drive compatible with FCT and F logic
- FCT-C speed at 5.0 ns max. (Com'l)
FCT-A speed at 5.8 ns max. (Com'l)
- Reduced V_{OH} (typically = 3.3V)
versions of equivalent FCT functions
- Edge-rate control circuitry for significantly improved noise characteristics
- Power-off disable feature
- ESD > 2000V

- Matched rise and fall times
- Fully compatible with TTL input and output logic levels
- Sink current **64 mA (Com'l),**
 32 mA (Mil)
- Source current **32 mA (Com'l),**
 12 mA (Mil)
- Dual 1-of-8 decoder with enables

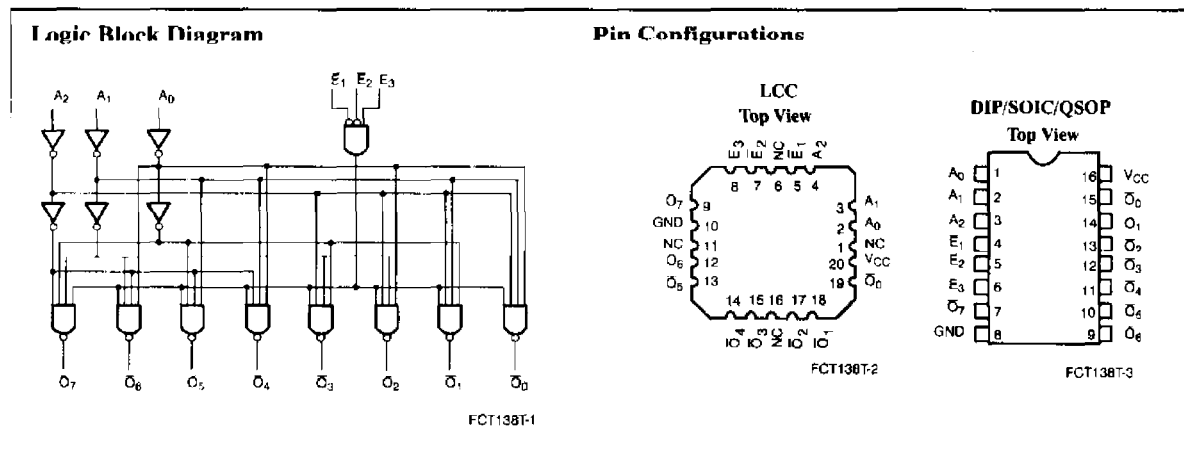
Functional Description

The FCT138T is a 1-of-8 decoder. The FCT138T accepts three binary weighted inputs (A_0, A_1, A_2) and, when enabled, provides eight mutually exclusive active

LOW outputs ($\bar{O}_0 - \bar{O}_7$). The FCT138T features three enable inputs, two active LOW (\bar{E}_1, \bar{E}_2) and one active HIGH (E_3).

All inputs will be HIGH unless \bar{E}_1 and \bar{E}_2 are LOW and E_3 is HIGH. This multiple enable function allows easy parallel expansion of the device to a 1-of-32 (5 lines to 32 lines) decoder with just four FCT138T devices and one inverter.

The outputs are designed with a power-off disable feature to allow for live insertion of boards.



Pin Description

Name	Description
A	Address Inputs
$\bar{E}_1 - \bar{E}_2$	Enable Inputs (Active LOW)
E_3	Enable Input (Active HIGH)
\bar{O}	Outputs



Function Table^[1]

Inputs						Outputs							
\bar{E}_1	\bar{E}_2	E_3	A_0	A_1	A_2	\bar{O}_0	\bar{O}_1	\bar{O}_2	\bar{O}_3	\bar{O}_4	\bar{O}_5	\bar{O}_6	\bar{O}_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	L	L	L	L	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H

Maximum Ratings^[2, 3]

(Above which the useful life may be impaired. For user guidelines, not tested.)

- Storage Temperature -65°C to +150°C
- Ambient Temperature with Power Applied -65°C to +135°C
- Supply Voltage to Ground Potential -0.5V to +7.0V
- DC Input Voltage -0.5V to +7.0V
- DC Output Voltage -0.5V to +7.0V
- DC Output Current (Maximum Sink Current/Pin) 120 mA
- Power Dissipation 0.5W

Static Discharge Voltage > 7001V (per MIL-STD-883, Method 3015)

Operating Range

Range	Range	Ambient Temperature	V _{CC}
Commercial	CT	0°C to +70°C	5V ± 5%
Commercial	T, AT	-40°C to +85°C	5V ± 5%
Military ^[4]	All	-55°C to +125°C	5V ± 10%

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	Min.	Typ. ^[5]	Max.	Unit	
V _{OH}	Output HIGH Voltage	V _{CC} =Min., I _{OH} =-32 mA	Com ¹	2.0		V	
		V _{CC} =Min., I _{OH} =-15 mA	Com ²	2.4	3.3	V	
		V _{CC} =Min., I _{OH} =-12 mA	Mil	2.4	3.3	V	
V _{OL}	Output LOW Voltage	V _{CC} =Min., I _{OL} =64 mA	Com ¹		0.3	0.55	V
		V _{CC} =Min., I _{OL} =32 mA	Mil		0.3	0.55	V
V _{IH}	Input HIGH Voltage		2.0			V	
V _{IL}	Input LOW Voltage				0.8	V	
V _H	Hysteresis ^[6]	All inputs		0.2		V	
V _{IK}	Input Clamp Diode Voltage	V _{CC} =Min., I _{IN} =-18 mA		-0.7	-1.2	V	
I _H	Input HIGH Current	V _{CC} =Max., V _{IN} =V _{CC}			5	μA	
I _{IH}	Input HIGH Current	V _{CC} =Max., V _{IN} =2.7V			±1	μA	
I _{IL}	Input LOW Current	V _{CC} =Max., V _{IN} =0.5V			±1	μA	
I _{OS}	Output Short Circuit Current ^[7]	V _{CC} =Max., V _{OUT} =0.0V	-60	-120	-225	mA	
I _{OFF}	Power-Off Disable	V _{CC} =0V, V _{OUT} =4.5V			±1	μA	

Notes:

- H = HIGH Voltage Level, L = LOW Voltage Level, X = Don't Care.
- Unless otherwise noted, these limits are over the operating free-air temperature range.
- Unused inputs must always be connected to an appropriate logic voltage level, preferably either V_{CC} or ground.
- T_A is the "instant on" case temperature.
- Typical values are at V_{CC}=5.0V, T_A=+25°C ambient.
- This parameter is guaranteed but not tested.
- 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 parametric tests. In any sequence of parameter tests, I_{OS} tests should be performed last.

Capacitance^[6]

Parameter	Description	Typ. ^[5]	Max.	Unit
C _{IN}	Input Capacitance	5	10	pF
C _{OUT}	Output Capacitance	9	12	pF

Power Supply Characteristics

Parameter	Description	Test Conditions	Typ. ^[5]	Max.	Unit
I _{CC}	Quiescent Power Supply Current	V _{CC} = Max., V _{IN} ≤ 0.2V, V _{IN} ≥ V _{CC} - 0.2V	0.1	0.2	mA
Al _{CC}	Quiescent Power Supply Current (TTL inputs)	V _{CC} = Max., V _{IN} = 3.4V ^[8] f ₁ = 0, Outputs Open	0.5	2.0	mA
I _{CC(D)}	Dynamic Power Supply Current ^[9]	V _{CC} = Max., One Input Toggling, 50% Duty Cycle, Outputs Open, V _{IN} ≤ 0.2V or V _{IN} ≥ V _{CC} - 0.2V	0.06	0.12	mA/ MHz
I _C	Total Power Supply Current ^[10]	V _{CC} = Max., f ₁ = 10 MHz, 50% Duty Cycle, Outputs Open, Toggle E ₁ , E ₂ , or E ₃ , One Output Toggling, V _{IN} ≤ 0.2V or V _{IN} ≥ V _{CC} - 0.2V	0.7	1.4	mA
		V _{CC} = Max., f ₁ = 10 MHz, 50% Duty Cycle, Outputs Open, Toggle E ₁ , E ₂ , or E ₃ , One Output Toggling, V _{IN} = 3.4V or V _{IN} = GND	1.0	2.4	mA

NOTES:

8. Per TTL driven input (V_{IN} = 3.4V); all other inputs at V_{CC} or GND.

9. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.

10. I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}
 I_C = I_{CC} + Al_{CC}D_HN_I + I_{CC(D)}(f₀/2 + f₁N_I)
 I_{CC} = Quiescent Current with CMOS input levels
 Al_{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_{CC(D)} = Dynamic Current caused by an input transition pair (HLH or LHL)

f₀ = Clock frequency for registered devices, otherwise zero

f₁ = Input signal frequency

N_I = Number of inputs changing at f₁

All currents are in milliamps and all frequencies are in megahertz.



Switching Characteristics Over the Operating Range

Parameter	Description	FCT138T				FCT138AT				Unit	Fig. No. ^[12]
		Military		Commercial		Military		Commercial			
		Min. ^[11]	Max.	Min. ^[11]	Max.	Min. ^[11]	Max.	Min. ^[11]	Max.		
t _{PLH} t _{PHL}	Propagation Delay A to \bar{O}	1.5	12.0	1.5	9.0	1.5	7.8	1.5	5.8	ns	1, 2
t _{PLH} t _{PHL}	Propagation Delay \bar{E}_1 or \bar{E}_2 to \bar{O}	1.5	12.5	1.5	9.0	1.5	8.0	1.5	5.9	ns	1, 5
t _{PLH} t _{PHL}	Propagation Delay E_3 to \bar{O}	1.5	12.5	1.5	9.0	1.5	8.0	1.5	5.9	ns	1, 5

Parameter	Description	FCT138CT				Unit	Fig. No. ^[12]
		Military		Commercial			
		Min. ^[11]	Max.	Min. ^[11]	Max.		
t _{PLH} t _{PHL}	Propagation Delay A to \bar{O}	1.5	6.0	1.5	5.0	ns	1, 2
t _{PLH} t _{PHL}	Propagation Delay \bar{E}_1 or \bar{E}_2 to \bar{O}	1.5	6.1	1.5	5.0	ns	1, 5
t _{PLH} t _{PHL}	Propagation Delay E_3 to \bar{O}	1.5	6.1	1.5	5.0	ns	1, 5

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
5.0	CY74FCT138CTPC	P1	16-Lead (300-Mil) Molded DIP	Commercial
	CY74FCT138CTOC	Q1	16-Lead (150-Mil) QSOP	
	CY74FCT138CTSOC	S1	16-Lead (300-Mil) Molded SOIC	
5.8	CY74FCT138ATPC	P1	16-Lead (300-Mil) Molded DIP	Commercial
	CY74FCT138ATOC	Q1	16-Lead (150-Mil) QSOP	
	CY74FCT138ATSOC	S1	16-Lead (300-Mil) Molded SOIC	
6.0	CY54FCT138CTDMB	D2	16-Lead (300-Mil) CerDIP	Military
	CY54FCT138CTLMB	L61	20-Pin Square Leadless Chip Carrier	
7.8	CY54FCT138ATDMB	D2	16-Lead (300-Mil) CerDIP	Military
	CY54FCT138ATLMB	L61	20-Pin Square Leadless Chip Carrier	
9.0	CY74FCT138TPC	P1	16-Lead (300-Mil) Molded DIP	Commercial
	CY74FCT138TQC	Q1	16-Lead (150-Mil) QSOP	
	CY74FCT138TSOC	S1	16-Lead (300-Mil) Molded SOIC	
12.0	CY54FCT138TDMB	D2	16-Lead (300-Mil) CerDIP	Military
	CY54FCT138TLMB	L61	20-Pin Square Leadless Chip Carrier	

Notes:

11. Minimum limits are guaranteed but not tested on Propagation Delays. 12. See "Parameter Measurement Information" in the General Information Section.