



# 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
- Extended commercial range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Sink current **64 mA (Com'l), 32 mA (Mil)**

Source current **32 mA (Com'l), 12 mA (Mil)**

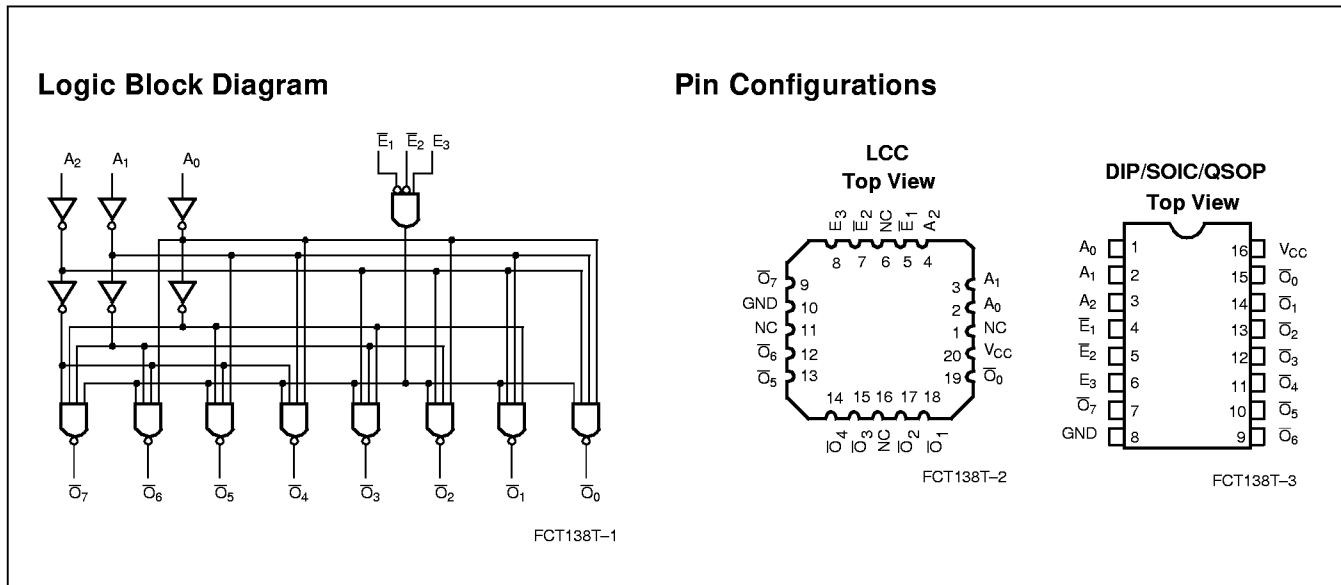
- Dual 1-of-8 decoder with enables

### 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)
O	Outputs



Function Table<sup>[1]</sup>

Inputs						Outputs							
E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>	A <sub>0</sub>	A <sub>1</sub>	A <sub>2</sub>	O <sub>0</sub>	O <sub>1</sub>	O <sub>2</sub>	O <sub>3</sub>	O <sub>4</sub>	O <sub>5</sub>	O <sub>6</sub>	O <sub>7</sub>
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	H	H	H	H	H	H	L	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	L

Maximum Ratings<sup>[2, 3]</sup>

(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 ..... >2001V (per MIL-STD-883, Method 3015)

Operating Range

Range	Range	Ambient Temperature	V <sub>CC</sub>
Commercial	All	-40°C to +85°C	5V ± 5%
Military <sup>[4]</sup>	All	-55°C to +125°C	5V ± 10%

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	Min.	Typ. <sup>[5]</sup>	Max.	Unit
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> =Min., I <sub>OH</sub> =-32 mA	2.0			V
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> =Min., I <sub>OH</sub> =-15 mA	2.4	3.3		V
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> =Min., I <sub>OH</sub> =-12 mA	2.4	3.3		V
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> =Min., I <sub>OL</sub> =64 mA		0.3	0.55	V
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> =Min., I <sub>OL</sub> =32 mA		0.3	0.55	V
V <sub>IH</sub>	Input HIGH Voltage		2.0			V
V <sub>IL</sub>	Input LOW Voltage				0.8	V
V <sub>H</sub>	Hysteresis <sup>[6]</sup>	All inputs		0.2		V
V <sub>IK</sub>	Input Clamp Diode Voltage	V <sub>CC</sub> =Min., I <sub>IN</sub> =-18 mA		-0.7	-1.2	V
I <sub>I</sub>	Input HIGH Current	V <sub>CC</sub> =Max., V <sub>IN</sub> =V <sub>CC</sub>			5	μA
I <sub>IH</sub>	Input HIGH Current	V <sub>CC</sub> =Max., V <sub>IN</sub> =2.7V			±1	μA
I <sub>IL</sub>	Input LOW Current	V <sub>CC</sub> =Max., V <sub>IN</sub> =0.5V			±1	μA
I <sub>OS</sub>	Output Short Circuit Current <sup>[7]</sup>	V <sub>CC</sub> =Max., V <sub>OUT</sub> =0.0V	-60	-120	-225	mA
I <sub>OFF</sub>	Power-Off Disable	V <sub>CC</sub> =0V, V <sub>OUT</sub> =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<sub>CC</sub> or ground.
- T<sub>A</sub> is the "instant on" case temperature.
- Typical values are at V<sub>CC</sub>=5.0V, T<sub>A</sub>=+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<sub>OS</sub> tests should be performed last.

**Capacitance<sup>[6]</sup>**

Parameter	Description	Typ. <sup>[5]</sup>	Max.	Unit
C <sub>IN</sub>	Input Capacitance	5	10	pF
C <sub>OUT</sub>	Output Capacitance	9	12	pF

**Power Supply Characteristics**

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

**Notes:**

8. Per TTL driven input (V<sub>IN</sub>=3.4V); all other inputs at V<sub>CC</sub> or GND.
9. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
10. I<sub>C</sub> = I<sub>QUIESCENT</sub> + I<sub>INPUTS</sub> + I<sub>DYNAMIC</sub>  
 I<sub>C</sub> = I<sub>CC</sub> + ΔI<sub>CC</sub>D<sub>H</sub>N<sub>T</sub> + I<sub>CCD</sub>(f<sub>0</sub>/2 + f<sub>1</sub>N<sub>1</sub>)  
 I<sub>CC</sub> = Quiescent Current with CMOS input levels  
 ΔI<sub>CC</sub> = Power Supply Current for a TTL HIGH input (V<sub>IN</sub>=3.4V)  
 D<sub>H</sub> = Duty Cycle for TTL inputs HIGH  
 N<sub>T</sub> = Number of TTL inputs at D<sub>H</sub>  
 I<sub>CCD</sub> = Dynamic Current caused by an input transition pair (HLH or LHL)  
 f<sub>0</sub> = Clock frequency for registered devices, otherwise zero  
 f<sub>1</sub> = Input signal frequency  
 N<sub>1</sub> = Number of inputs changing at f<sub>1</sub>  
 All currents are in milliamps and all frequencies are in megahertz.



**Switching Characteristics** Over the Operating Range

Parameter	Description	FCT138T				FCT138AT				Unit	Fig. No. <sup>[12]</sup>
		Military		Commercial		Military		Commercial			
		Min. <sup>[11]</sup>	Max.	Min. <sup>[11]</sup>	Max.	Min. <sup>[11]</sup>	Max.	Min. <sup>[11]</sup>	Max.		
t <sub>PLH</sub> t <sub>PHL</sub>	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 <sub>PLH</sub> t <sub>PHL</sub>	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 <sub>PLH</sub> t <sub>PHL</sub>	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. <sup>[12]</sup>
		Military		Commercial			
		Min. <sup>[11]</sup>	Max.	Min. <sup>[11]</sup>	Max.		
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay A to $\bar{O}$	1.5	6.0	1.5	5.0	ns	1, 2
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay $\bar{E}_1$ or $\bar{E}_2$ to $\bar{O}$	1.5	6.1	1.5	5.0	ns	1, 5
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay $E_3$ to $\bar{O}$	1.5	6.1	1.5	5.0	ns	1, 5

**Ordering Information**

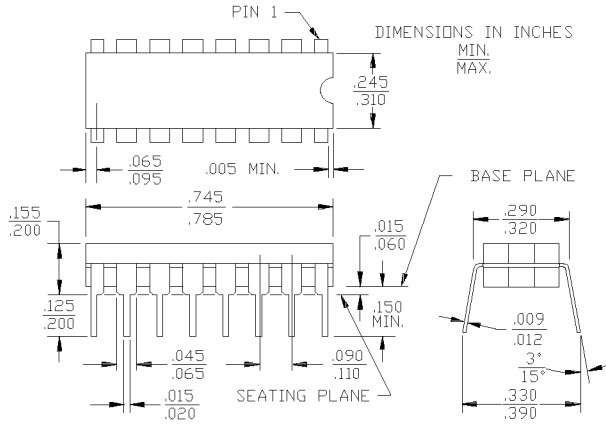
Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
5.0	CY74FCT138CTQC	Q1	16-Lead (150-Mil) QSOP	Commercial
	CY74FCT138CTSOC	S1	16-Lead (300-Mil) Molded SOIC	
5.8	CY74FCT138ATPC	P1	16-Lead (300-Mil) Molded DIP	Commercial
	CY74FCT138ATQC	Q1	16-Lead (150-Mil) QSOP	
	CY74FCT138ATSOC	S1	16-Lead (300-Mil) Molded SOIC	
6.0	CY54FCT138CTDMB	D2	16-Lead (300-Mil) CerDIP	Military
	CY54FCT138CTLMB	L61	20-Pin Square Leadless Chip Carrier	
9.0	CY74FCT138TSOC	S1	16-Lead (300-Mil) Molded SOIC	Commercial

**Notes:**

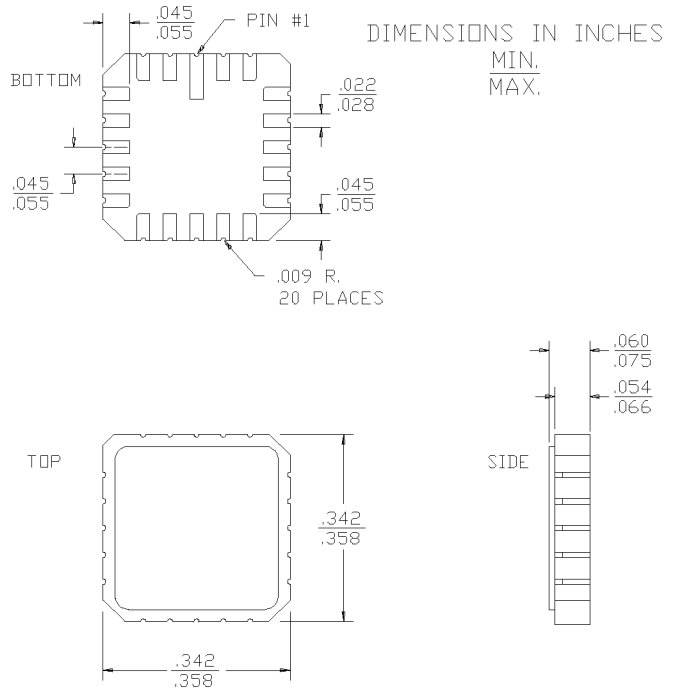
- 11. Minimum limits are guaranteed but not tested on Propagation Delays.
- 12. See "Parameter Measurement Information" in the General Information Section.

## Package Diagrams

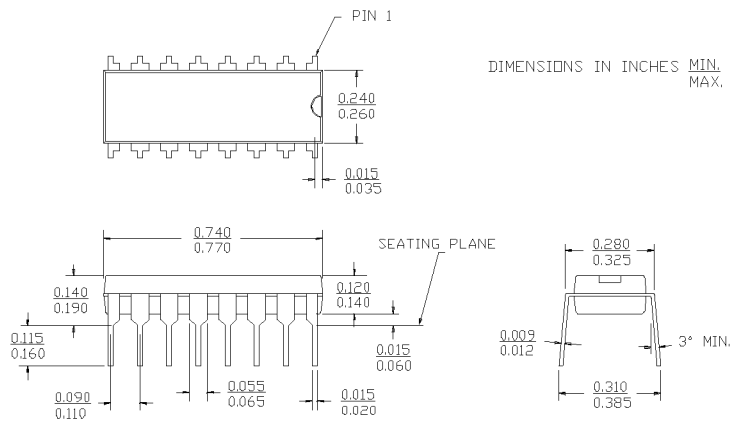
**16-Lead (300-Mil) CerDIP D2**  
MIL-STD-1835 D-2 Config.A

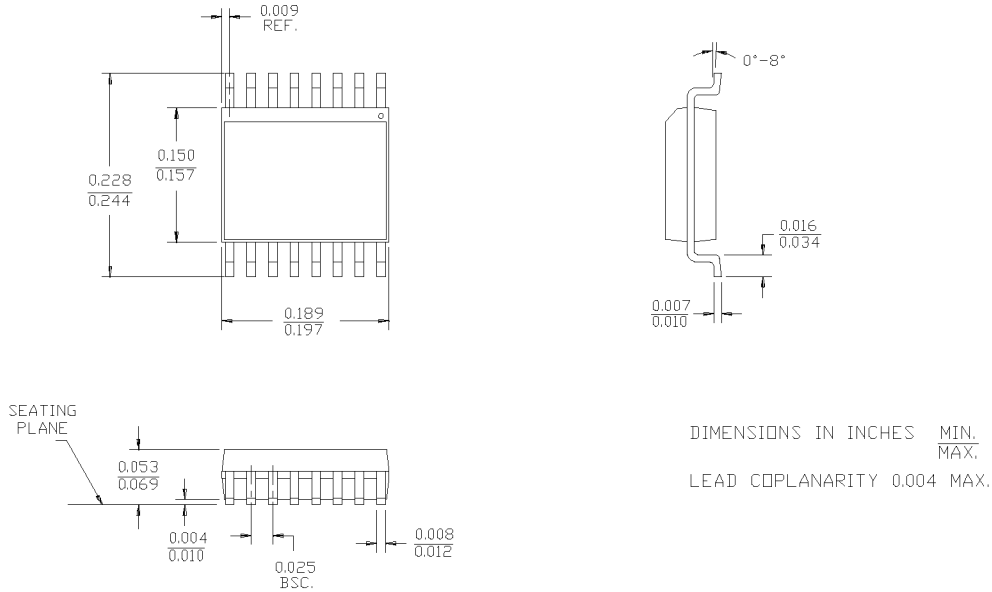


**20-Pin Square Leadless Chip Carrier L61**  
MIL-STD-1835 C-2A



**16-Lead (300-Mil) Molded DIP P1**



**Package Diagrams (continued)**
**16-Lead Quarter Size Outline Q1**

**16-Lead Molded SOIC S1**
