TEXAS INSTRUMENTS

SCCS036 - September 1994 - Revised March 2000

CY74FCT2240T
CY74FCT2244T

8-Bit Buffers/Line Drivers

Features

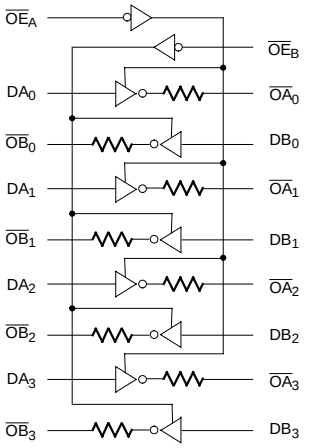
- **Function and pinout compatible with FCT and F logic**
- **25Ω output series resistors to reduce transmission line reflection noise**
- **FCT-C speed at 4.1 ns max. (Com'l) FCT-A speed at 4.8 ns max. (Com'l)**
- **TTL output level versions of equivalent FCT functions**
- **Edge-rate control circuitry for significantly improved noise characteristics**
- **Power-off disable feature permits live insertion**
- **ESD > 2000V**
- **Fully compatible with TTL input and output logic levels**
- **Sink current 12 mA**
  Source current15 mA
- **Extended commercial temp. range of –40˚C to +85˚C**
- **Three-state outputs**

Functional Description

The FCT2240T and FCT2244T are octal buffers and line drivers that include on-chip 25Ω terminating resistors at each of the outputs, to minimize noise resulting from reflections or standing waves in high-performance applications. The on-chip resistors reduce overall board space and component count. Designed to be employed as memory address drivers, clock drivers, and bus-oriented transmitters/receivers, these devices provide speed and drive capabilities commensurate with their fastest bipolar logic counterparts while reducing power dissipation. The input and output voltage levels allow direct interface with TTL, NMOS, and CMOS devices without the need for external components.

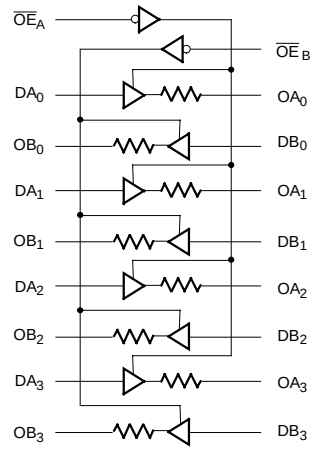
The outputs are designed with a power-off disable feature to allow for live insertion of boards.

Logic Block Diagram FCT2240T



FCT2240T–2

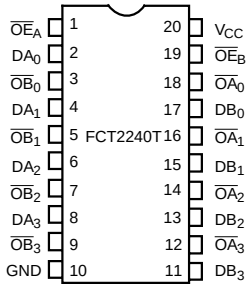
Logic Block Diagram FCT2244T



FCT2240T–4

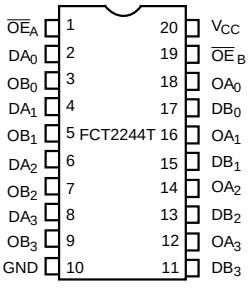
Pin Configurations

SOIC/QSOP
Top View



FCT2240T–3

DIP/SOIC/QSOP
Top View



FCT2240T–6

Function Table FCT2240T[1]

Inputs			Output
$\overline{OE}_A$	$\overline{OE}_B$	D	
L	L	L	H
L	L	H	L
H	H	X	Z

Function Table FCT2244T[1]

Inputs			Output
$\overline{OE}_A$	$\overline{OE}_B$	D	
L	L	L	L
L	L	H	H
H	H	X	Z

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

Operating Range

Range	Range	Ambient Temperature	V_{CC}
Commercial	T, AT, CT	–40°C to +85°C	5V ± 5%

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}=–15 mA	Com'l	2.4	3.3		V
V_{OL}	Output LOW Voltage	V_{CC}=Min., I_{OL}=12 mA	Com'l		0.3	0.55	V
R_{OUT}	Output Resistance	V_{CC}=Min., I_{OL}=12 mA	Com'l	20	25	40	Ω
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_I	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_{OZH}	Off State HIGH-Level Output Current	V_{CC}=Max., V_{OUT}=2.7V				10	µA
I_{OZL}	Off State LOW-Level Output Current	V_{CC}=Max., V_{OUT}=0.5V				–10	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:

1. H = HIGH Voltage Level. L = LOW Voltage Level. X = Don't Care.
2. Unless otherwise noted, these limits are over the operating free-air temperature range.
3. Unused inputs must always be connected to an appropriate logic voltage level, preferably either V_{CC} or ground.
4. T_A is the "instant on" case temperature.
5. Typical values are at V_{CC}=5.0V, T_A=+25˚C ambient.
6. This parameter is specified but not tested.
7. 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., $V_{IN} \le 0.2V$, $V_{IN} \ge V_{CC}-0.2V$	0.1	0.2	mA
ΔI_{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_{CCD}	Dynamic Power Supply Current[9]	V_{CC}=Max., One Input Toggling, 50% Duty Cycle, Outputs Open, $\overline{OE}_1$=$\overline{OE}_2$=GND, $V_{IN} \le 0.2V$ or $V_{IN} \ge V_{CC}-0.2V$	0.06	0.12	mA/ MHz
I_C	Total Power Supply Current[10]	V_{CC}=Max., 50% Duty Cycle, Outputs Open, One Bit Toggling at f_1=10 MHz, $\overline{OE}_1$=$\overline{OE}_2$=GND, $V_{IN} \le 0.2V$ or $V_{IN} \ge V_{CC}-0.2V$	0.7	1.4	mA
		V_{CC}=Max., 50% Duty Cycle, Outputs Open, One Bit Toggling at f_1=10 MHz, $\overline{OE}_1$=$\overline{OE}_2$=GND, V_{IN}=3.4V or V_{IN}=GND	1.0	2.4	mA
		V_{CC}=Max., 50% Duty Cycle, Outputs Open, Eight Bits Toggling at f_1=2.5 MHz, $\overline{OE}_1$=$\overline{OE}_2$=GND, $V_{IN} \le 0.2V$ or $V_{IN} \ge V_{CC}-0.2V$	1.3	2.6[11]	mA
		V_{CC}=Max., 50% Duty Cycle, Outputs Open, Eight Bits Toggling at f_1=2.5 MHz, $\overline{OE}_1$=$\overline{OE}_2$=GND, V_{IN}=3.4V or V_{IN}=GND	3.3	10.6[11]	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. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
    $I_C = I_{CC}+\Delta I_{CC}D_HN_T+I_{CCD}(f_0/2 + f_1N_1)$
    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 registered devices, otherwise zero
    f_1 = Input signal frequency
    N_1 = Number of inputs changing at f_1
    All currents are in milliamps and all frequencies are in megahertz.
11. Values for these conditions are examples of the I_{CC} formula. These limits are specified but not tested.

Switching Characteristics FCT2240T Over the Operating Range[12]

Parameter	Description	FCT2240T Commercial Min.	FCT2240T Commercial Max.	FCT2240AT Commercial Min.	FCT2240AT Commercial Max.	FCT2240CT Commercial Min.	FCT2240CT Commercial Max.	Unit	Fig. No.[13]
t_{PLH} t_{PHL}	Propagation Delay Data to Input	1.5	8.0	1.5	8.0	1.5	4.1	ns	1, 2
t_{PZH} t_{PZL}	Output Enable Time	1.5	10.0	1.5	10.0	1.5	5.8	ns	1, 7, 8
t_{PHZ} t_{PLZ}	Output Disable Time	1.5	9.5	1.5	9.5	1.5	5.2	ns	1, 7, 8

Switching Characteristics FCT2244T Over the Operating Range[12]

Parameter	Description	FCT2244T Commercial Min.	FCT2244T Commercial Max.	FCT2244AT Commercial Min.	FCT2244AT Commercial Max.	FCT2244CT Commercial Min.	FCT2244CT Commercial Max.	Unit	Fig. No.[13]
t_{PLH} t_{PHL}	Propagation Delay Data to Input	1.5	6.5	1.5	4.6	1.5	4.1	ns	1, 3
t_{PZH} t_{PZL}	Output Enable Time	1.5	8.0	1.5	6.2	1.5	5.8	ns	1, 7, 8
t_{PHZ} t_{PLZ}	Output Disable Time	1.5	7.0	1.5	5.6	1.5	5.2	ns	1, 7, 8

Notes:
12. Minimum limits are specified but not tested on Propagation Delays.
13. See “Parameter Measurement Information” in the General Information section.

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
4.1	CY74FCT2240CTQCT	Q5	20-Lead (150-Mil) QSOP	Commercial
	CY74FCT2240CTSOC/SOCT	S5	20-Lead (300-Mil) Molded SOIC	
4.8	CY74FCT2240ATQCT	Q5	20-Lead (150-Mil) QSOP	Commercial
8.0	CY74FCT2240TSOC/SOCT	S5	20-Lead (300-Mil) Molded SOIC	Commercial

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
4.3	CY74FCT2244CTQCT	Q5	20-Lead (150-Mil) QSOP	Commercial
	CY74FCT2244CTSOC/SOCT	S5	20-Lead (300-Mil) Molded SOIC	
4.6	CY74FCT2244ATQCT	Q5	20-Lead (150-Mil) QSOP	Commercial
	CY74FCT2244ATSOC/SOCT	S5	20-Lead (300-Mil) Molded SOIC	
6.5	CY74FCT2244TQCT	Q5	20-Lead (150-Mil) QSOP	Commercial
	CY74FCT2244TSOC/SOCT	S5	20-Lead (300-Mil) Molded SOIC	

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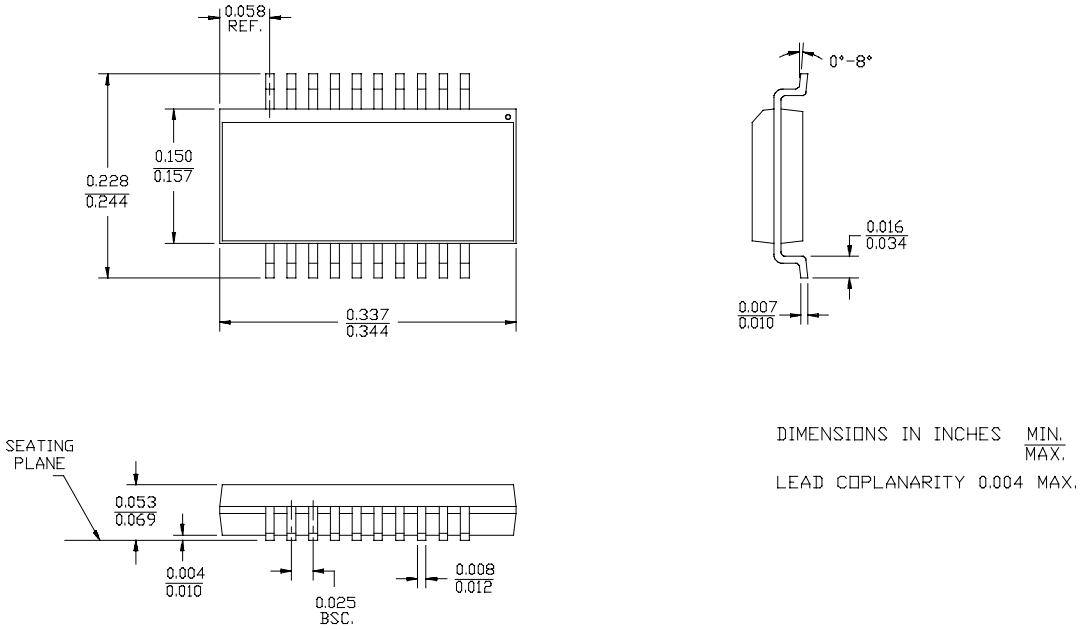
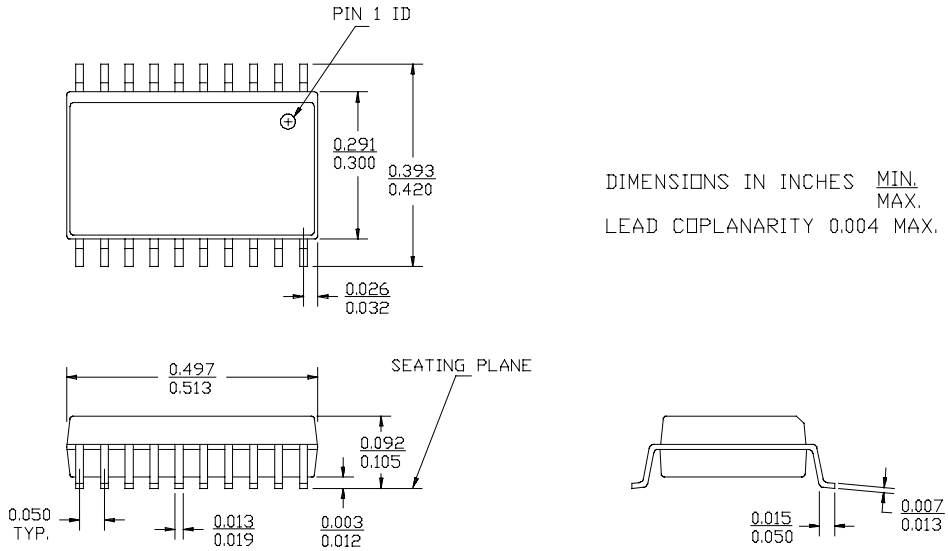
Package Diagrams

20-Lead Quarter Size Outline Q5



20-Lead (300-Mil) Molded SOIC S5



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