TEXAS INSTRUMENTS

CY74FCT2541T

SCCS041 - September 1994 - Revised March 2000

8-Bit Buffer/Line Driver

Features

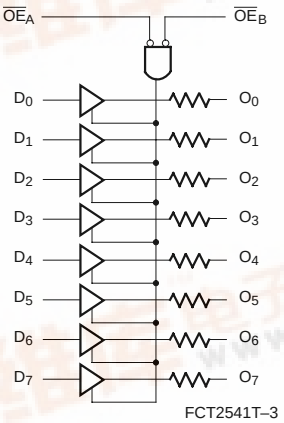
- **Function and pinout compatible with FCT and F logic**
- **FCT-C speed at 4.1 ns max.**
  FCT-A speed at 4.8 ns max.
- **25Ω output series to reduce transmission line reflection noise**
- **Reduced V_{OH} (typically = 3.3V) versions of equivalent FCT functions**
- **Edge-rate control circuitry for 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 12 mA**
  Source current 15 mA
- **Extended commercial temp. range of –40˚C to +85˚C**
- **Three-state outputs**

Functional Description

The FCT2541T is an octal buffer and line driver designed to be employed as a memory address driver, clock driver, and bus-oriented transmitter/receiver. On-chip termination resistors have been added to the outputs to reduce system noise caused by reflections. The FCT2541T can be used to replace the FCT541T to reduce noise in an existing design. The speed of the FCT2541T is comparable to bipolar logic counterparts while reducing power dissipation. The input and output voltage levels allow direct interface with TTL and CMOS devices without external components.

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

Logic Block Diagram



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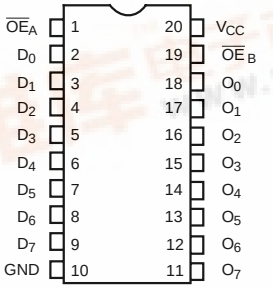
Pin Configurations

SOIC/QSOP
Top View



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Function Table[1]

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

Note:

1. H = HIGH Voltage Level
   L = LOW Voltage Level
   X = Don't Care
   Z = High Impedance

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	Ambient Temperature	V_{CC}
Commercial	–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	2.4	3.3		V
V_{OL}	Output LOW Voltage	V_{CC} = Min., I_{OL} = 12 mA		0.3	0.55	V
R_{OUT}	Output Resistance	V_{CC} = Min., I_{OL} = 12 mA	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			15	µA
I_{OZL}	Off State LOW-Level Output Current	V_{CC} = Max., V_{OUT} = 0.5V			–15	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

Capacitance[6]

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

Notes:

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.

Power Supply Characteristics

Parameter	Description	Test Conditions	Typ.[5]	Max.	Unit
I_{CC}	Quiescent Power Supply Current	V_{CC}=Max., $V_{IN}\leq$0.2V, $V_{IN}\geq V_{CC}$–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., 50% Duty Cycle, Outputs Open, One Bit Toggling, $\overline{OE}_A$=$\overline{OE}_B$=GND, $V_{IN}\leq$0.2V or $V_{IN}\geq V_{CC}$–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, $\overline{OE}_A$=$\overline{OE}_B$=GND, $V_{IN}\leq$0.2V or $V_{IN}\geq V_{CC}$–0.2V	0.7	1.4	mA
		V_{CC}=Max., 50% Duty Cycle, Outputs Open, One Bit Toggling at f_1=10 MHz, $\overline{OE}_A$=$\overline{OE}_B$=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, $\overline{OE}_A$=$\overline{OE}_B$=GND, $V_{IN}\leq$0.2V or $V_{IN}\geq V_{CC}$–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, $\overline{OE}_A$=$\overline{OE}_B$=GND, V_{IN}=3.4V or V_{IN}=GND	3.3	10.6[11]	mA

Switching Characteristics Over the Operating Range[12]

Parameter	Description	CY74FCT2541T		CY74FCT2541AT		CY74FCT2541AT		Unit	Fig. No.[13]
		Min.	Max.	Min.	Max.	Min.	Max.		
t_{PLH} t_{PHL}	Propagation Delay Data to Output	1.5	8.0	1.5	4.8	1.5	4.1	ns	1, 3
t_{PZH} t_{PZL}	Output Enable Time	1.5	10.0	1.5	6.2	1.5	5.8	ns	1, 7, 8
t_{PHZ} t_{PLZ}	Output Disable Time	1.5	9.5	1.5	5.6	1.5	5.2	ns	1, 7, 8

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.
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	CY74FCT2541CTQCT	Q5	20-Lead (150-Mil) QSOP	Commercial
	CY74FCT2541CTSOC/SOCT	S5	20-Lead (300-Mil) Molded SOIC	
4.8	CY74FCT2541ATQCT	Q5	20-Lead (150-Mil) QSOP	Commercial
	CY74FCT2541ATSOC/SOCT	S5	20-Lead (300-Mil) Molded SOIC	
8.0	CY74FCT2541TQCT	Q5	20-Lead (150-Mil) QSOP	Commercial
	CY74FCT2541TSOC/SOCT	S5	20-Lead (300-Mil) Molded SOIC	

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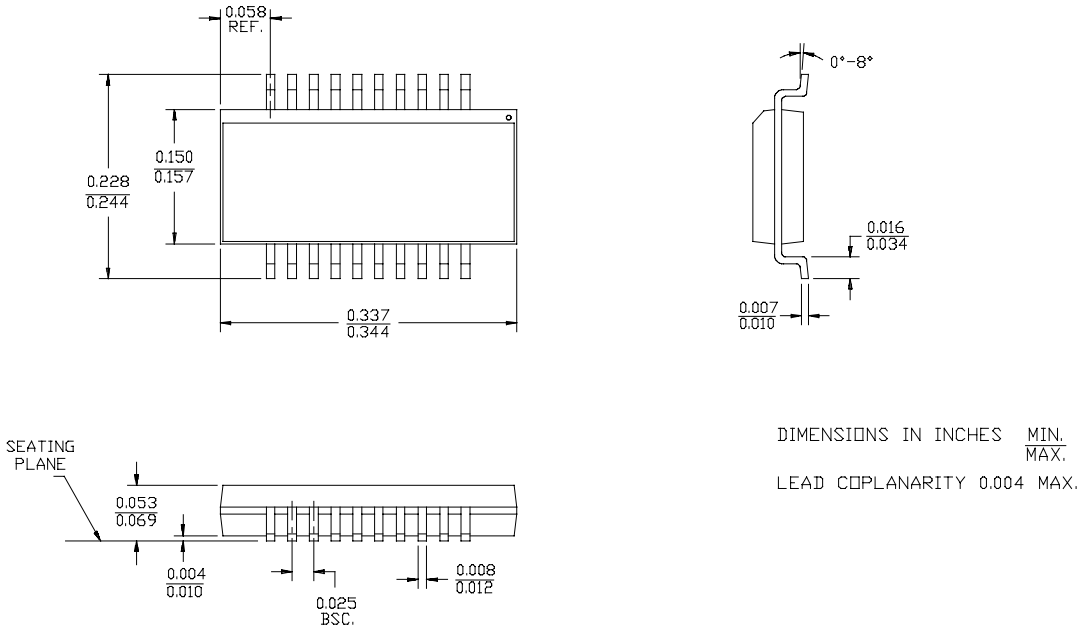
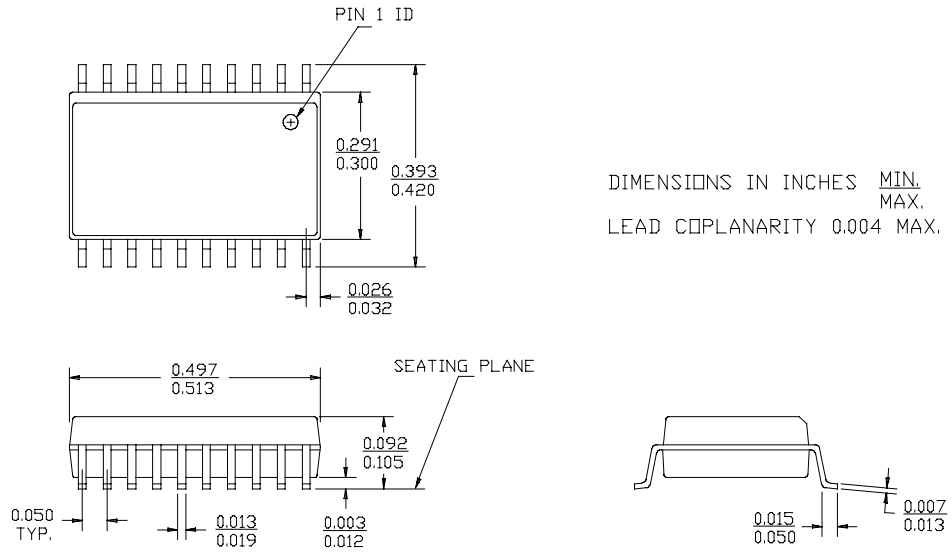
Package Diagrams

20-Lead Quarter Size Outline Q5



20-Lead (300-Mil) Molded SOIC S5



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