



SCCS029 - May 1994 - Revised March 2000

CY54/74FCT540T CY54/74FCT541T

8-Bit Buffers/Line Drivers

Features

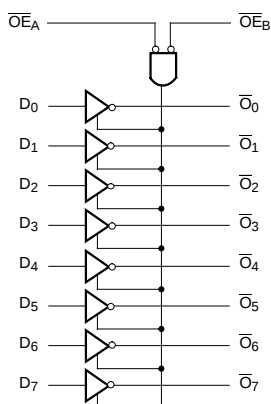
- Function, pinout, and drive compatible with FCT and F logic
- FCT-C speed at 4.1 ns max. (Com'l)
FCT-A speed at 4.8 ns max. (Com'l)
- Reduced V_{OH} (typically = 3.3V) versions of equivalent FCT functions
- Edge-rate control circuitry for significantly improved noise characteristics
- Power-off disable feature
- ESD > 2000V
- Matched rise and fall times
- Fully compatible with TTL input and output logic levels
- Sink current 64 mA (Com'l), 48 mA (Mil)
Source current 32 mA (Com'l), 12 mA (Mil)
- Extended commercial range of -40°C to $+85^{\circ}\text{C}$

Functional Description

The FCT540T inverting buffer/line driver and the FCT541T non-inverting buffer/line driver are designed to be employed as memory address drivers, clock drivers, and bus-oriented transmitters/receivers. The devices provide speed and drive capabilities equivalent to 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 external components.

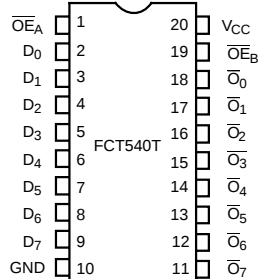
The outputs are designed with a power-off disable feature to allow for live insertion of boards.

Logic Block Diagram—FCT540T

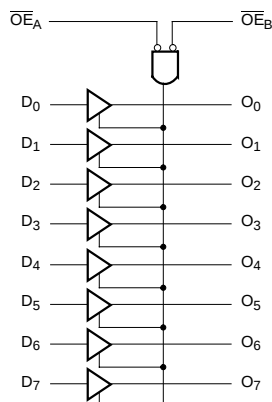


Pin Configurations

CERDIP/SOIC/QSOP Top View

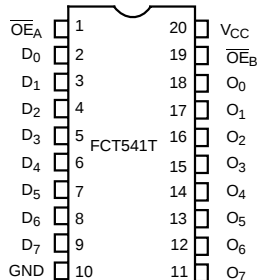


Logic Block Diagram—FCT541T



CERDIP/DIP/SOIC/QSOP

Top View



Function Table FCT540T^[1]

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

Function Table FCT541T^[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%
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'l	2.0			V
		V _{CC} = Min., I _{OH} = –15 mA	Com'l	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'l		0.3	0.55	V
		V _{CC} = Min., I _{OL} = 48 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 _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:

- H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
Z = High Impedance
- 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 specified 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 parametric tests, I_{OS} tests should be performed last.

Capacitance^[6]

Parameter	Description	Test Conditions	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
ΔI _{CC}	Quiescent Power Supply Current (TTL inputs)	V _{CC} = Max., V _{IN} = 3.4V, f ₁ = 0, Outputs Open ^[8]	0.5	2.0	mA
I _{CCD}	Dynamic Power Supply Current ^[9]	V _{CC} = Max., 50% Duty Cycle, Outputs Open, One Bit Toggling at f ₁ = 10 MHz, OE _A =OE _B =GND, or OE _A =GND, OE _B =V _{CC} , 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., 50% Duty Cycle, Outputs Open, One Bit Toggling at f ₁ =10 MHz, OE _A =OE _B =GND, or OE _A =GND, OE _B =V _{CC} , V _{IN} ≤0.2V or V _{IN} ≥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, OE _A =OE _B =GND, or OE _A =GND, OE _B =V _{CC} , 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, OE _A =OE _B =GND, or OE _A =GND, OE _B =V _{CC} , V _{IN} ≤ 0.2V or V _{IN} ≥ 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, OE _A =OE _B =GND, or OE _A =GND, OE _B =V _{CC} , 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. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_0/2 + f_1 N_1)$
 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 registered devices, otherwise zero
 f_1 = Input signal frequency
 N_1 = Number of inputs changing at f₁
 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 Over the Operating Range^[12]

Parameter	Description	FCT540T/FCT541T		FCT540AT/FCT541AT		Unit	Fig. No. ^[13]
		Commercial		Commercial			
		Min.	Max.	Min.	Max.		
t _{PLH} t _{PHL}	Propagation Delay Data to Output (FCT540)	1.5	8.5	1.5	4.8	ns	1, 2
t _{PLH} t _{PHL}	Propagation Delay Data to Output (FCT541)	1.5	8.0	1.5	4.8	ns	1, 3
t _{PZH} t _{PZL}	Output Enable Time	1.5	10.0	1.5	6.2	ns	1, 7, 8
t _{PHZ} t _{PLZ}	Output Disable Time	1.5	9.5	1.5	5.6	ns	1, 7, 8

Parameter	Description	FCT540CT/FCT541CT				FCT540DT/ FCT541DT		Unit	Fig. No. ^[13]
		Military		Commercial		Commercial			
		Min.	Max.	Min.	Max.	Min.	Max.		
t _{PLH} t _{PHL}	Propagation Delay Data to Output (FCT540)	1.5	4.7	1.5	4.1	1.5	3.8	ns	1, 2
t _{PLH} t _{PHL}	Propagation Delay Data to Output (FCT541)	1.5	4.6	1.5	4.1	1.5	3.8	ns	1, 3
t _{PZH} t _{PZL}	Output Enable Time	1.5	6.5	1.5	5.8	1.5	5.2	ns	1, 7, 8
t _{PHZ} t _{PLZ}	Output Disable Time	1.5	5.7	1.5	5.2	1.5	5.0	ns	1, 7, 8

Shaded areas contain preliminary information.

Notes:

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

Ordering Information—FCT540T

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
4.1	CY74FCT540CTQCT	Q5	20-Lead (150-Mil) QSOP	Commercial
4.7	CY54FCT540CTDMB	D6	20-Lead (300-Mil) CerDIP	Military

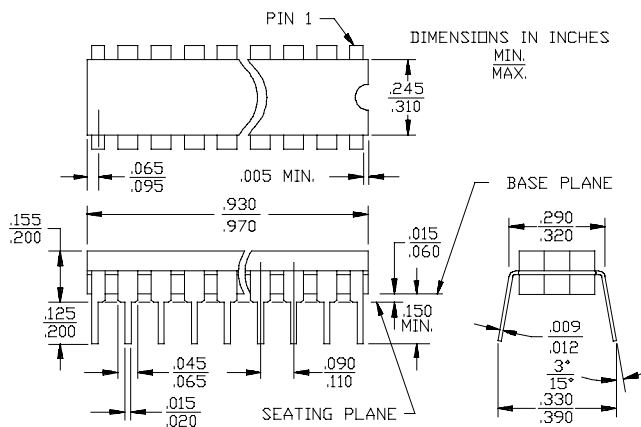
Ordering Information—FCT541T

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
4.1	CY74FCT541CTQCT	Q5	20-Lead (150-Mil) QSOP	Commercial
	CY74FCT541CTSOC/SOCT	S5	20-Lead (300-Mil) Molded SOIC	
4.6	CY54FCT541CTDMB	D6	20-Lead (300-Mil) CerDIP	Military
4.8	CY74FCT541ATPC	P5	20-Lead (300-Mil) Molded DIP	Commercial
	CY74FCT541ATQCT	Q5	20-Lead (150-Mil) QSOP	
	CY74FCT541ATSOC/SOCT	S5	20-Lead (300-Mil) Molded SOIC	
8.0	CY74FCT541TSOC/SOCT	S5	20-Lead (300-Mil) Molded SOIC	Commercial

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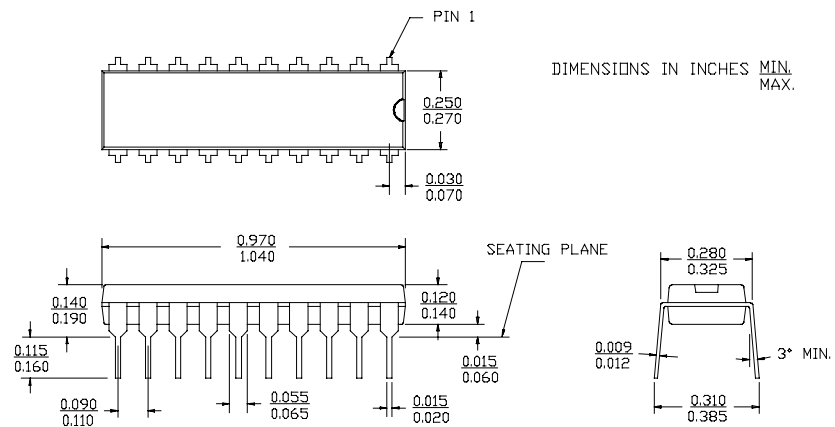
Package Diagrams

20-Lead (300-Mil) CerDIP D6
MIL-STD-1835 D-8 Config.A

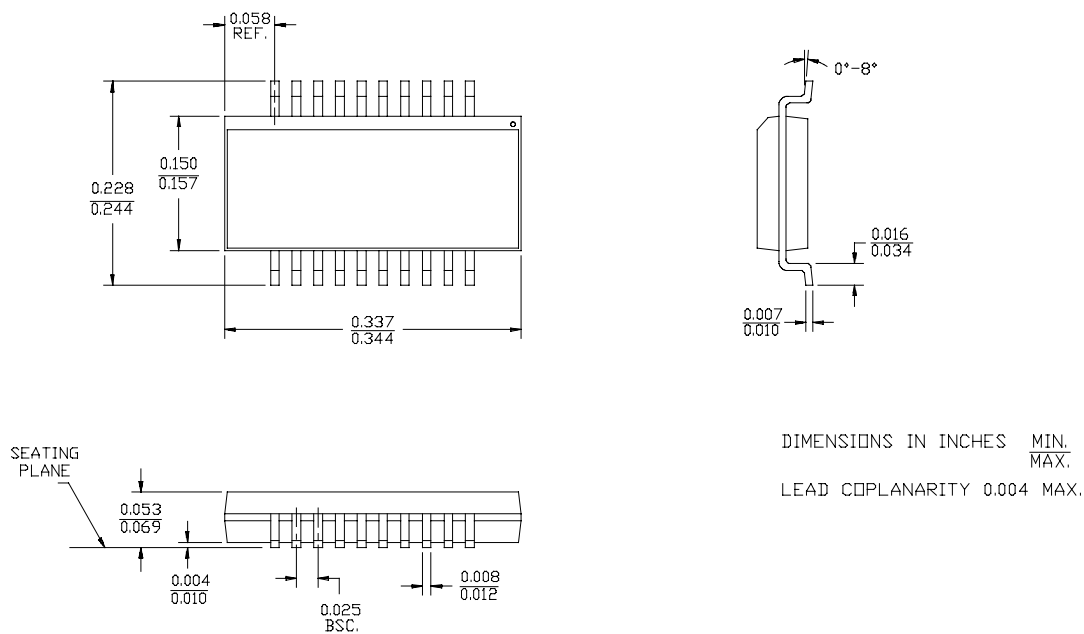


Package Diagrams (continued)

20-Lead (300-Mil) Molded DIP P5

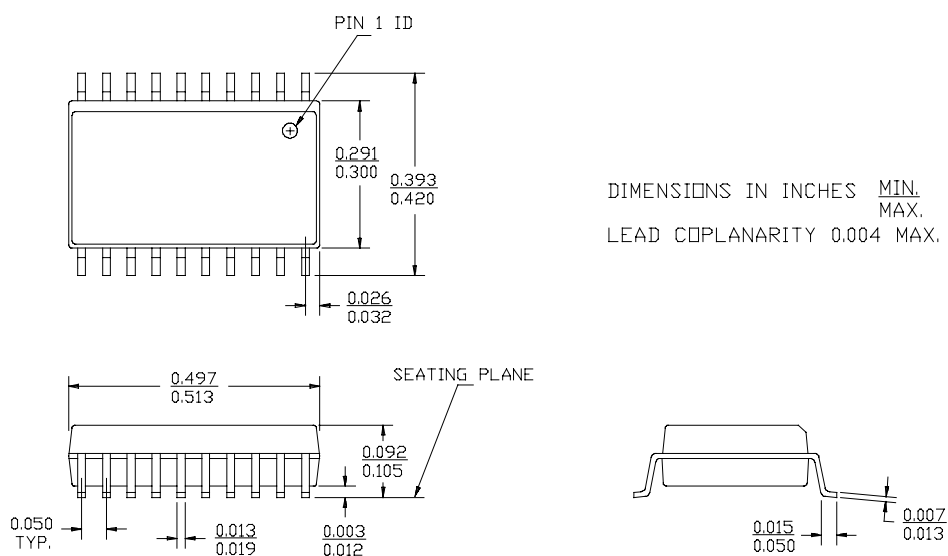


20-Lead Quarter Size Outline Q5



Package Diagrams (continued)

20-Lead (300-Mil) Molded SOIC S5



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