TEXAS INSTRUMENTS

CY54/74FCT157T

SCCS014 - May 1994 - Revised February 2000

Quad 2-Input Multiplexer

Features

- **Function, pinout, and drive compatible with FCT and F logic**
- **FCT-C speed at 4.3 ns max. (Com'l), FCT-A speed at 5.0 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**
- **Matched rise and fall times**
- **Fully compatible with TTL input and output logic levels**
- **ESD > 2000V**
- **Extended commercial range of −40˚C to +85˚C**
- **Sink current   64 mA (Com'l), 32 mA (Mil)**
  Source current   32 mA (Com'l), 12 mA (Mil)
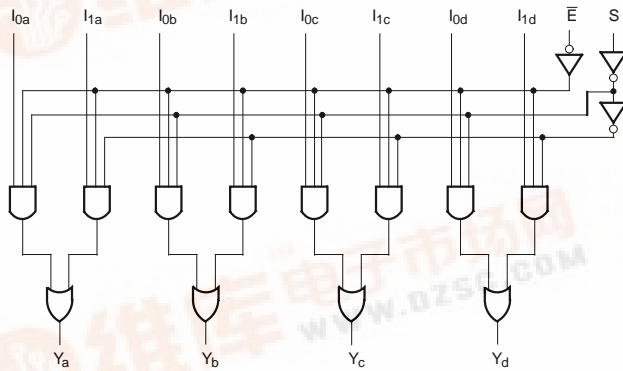
Functional Description

The FCT157T is a quad two-input multiplexer that selects four bits of data from two sources under the control of a common data Select input (S). The Enable input ($\overline{E}$) is Active LOW. When ($\overline{E}$) is HIGH, all of the outputs (Y) are forced LOW regardless of all other input conditions.

Moving data from two groups of registers to four common output buses is a common use of the FCT157T. The state of the Select input determines the particular register from which the data comes. It can also be used as a function generator. The device is useful for implementing highly irregular logic by generating any four of the sixteen different functions of two variables with one variable common.
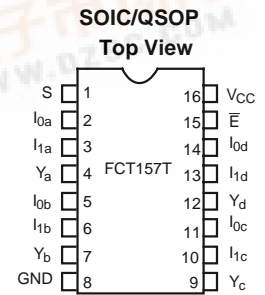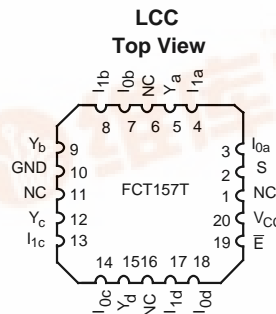
The FCT157T is a logic implementation of a four-pole, two-position switch where the position of the switch is determined by the logic levels supplied to the Select input.

The outputs are designed with a power-off disable feature to allow for live insertion of boards.
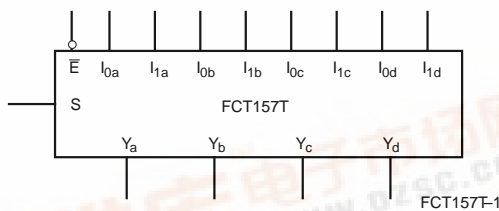
Logic Block Diagram, FCT157T

Pin Configurations

Logic Symbol

FCT157T–1

Pin Description

Name	Description
S	Common Select Input
$\bar{E}$	Enable Inputs (Active LOW)
I_0	Data Inputs from Source 0
I_1	Data Inputs from Source 1
Y	Non-Inverted Output

Function Table[1]

Inputs				Outputs
E	**S**	**I_1**	**I_1**	**Y**
H	X	X	X	L
L	H	X	L	L
L	H	X	H	H
L	L	L	X	L
L	L	H	X	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...>2001V
(per MIL-STD-883, Method 3015)

Operating Range

Range	Range	Ambient Temperature	V_{CC}
Commercial	All	−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}=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_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

Note:
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}≤0.2V, V_{IN}≥V_{CC}−0.2V	0.1	0.2	mA
ΔI_{CC}	Quiescent Power Supply Current (TTL inputs HIGH)	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, $\overline{OE}$=GND, 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 Input Toggling at f_1=10 MHz, $\overline{OE}$=GND, 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 Input Toggling at f_1=10 MHz, $\overline{OE}$=GND, V_{IN}=3.4V or V_{IN}=GND	1.0	2.4	mA
		V_{CC}=Max., 50% Duty Cycle, Outputs Open, Four Bits Toggling at f_1=2.5 MHz, $\overline{OE}$=GND, V_{IN}≤0.2V or V_{IN}≥V_{CC}−0.2V	0.7	1.4[11]	mA
		V_{CC}=Max., 50% Duty Cycle, Outputs Open, Four Bits Toggling at f_1=2.5 MHz, $\overline{OE}$=GND, V_{IN}=3.4V or V_{IN}=GND	1.7	5.4[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 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.

![Texas Instruments logo] **TEXAS INSTRUMENTS**

Switching Characteristics Over the Operating Range

| Parameter | Description | FCT157T | | FCT157AT | | | | FCT157CT | | Unit | Fig. No.[13] |
| | | Commercial | | Military | | Commercial | | Commercial | | | |
		Min.[12]	Max.	Min.[12]	Max.	Min.[12]	Max.	Min.[12]	Max.		
t_{PLH} t_{PHL}	Propagation Delay I to Y	1.5	6.0	1.5	5.8	1.5	5.0	1.5	4.3	ns	1, 3
t_{PLH} t_{PHL}	Propagation Delay $\overline{E}$ to Y	1.5	10.5	1.5	7.4	1.5	6.0	1.5	4.8	ns	1, 5
t_{PLH} t_{PHL}	Propagation Delay S to Y	1.5	10.5	1.5	8.1	1.5	7.0	1.5	5.2	ns	1, 3

Ordering Information

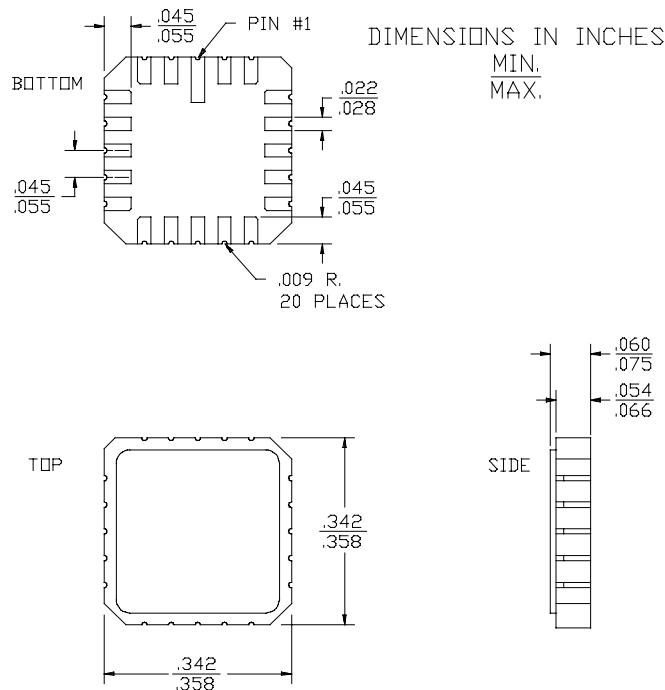| Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
4.3	CY74FCT157CTQCT	Q1	16-Lead (150-Mil) QSOP	Commercial
	CY74FCT157CTSOC/SOCT	S1	16-Lead (300-Mil) Molded SOIC	
5.0	CY74FCT157ATQCT	Q1	16-Lead (150-Mil) QSOP	Commercial
	CY74FCT157ATSOC/SOCT	S1	16-Lead (300-Mil) Molded SOIC	
5.8	CY54FCT157ATLMB	L61	20-Pin Square Leadless Chip Carrier	Military

Note:
12. Minimum limits are specified but not tested on Propagation Delays.
13. See "Parameter Measurement Information" in the General Information Section
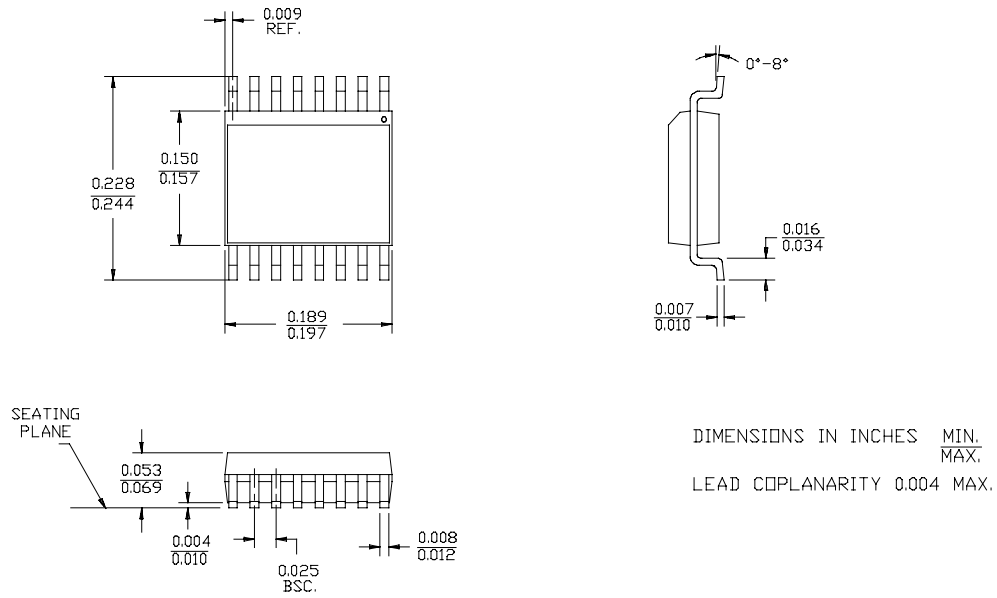
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Package Diagrams

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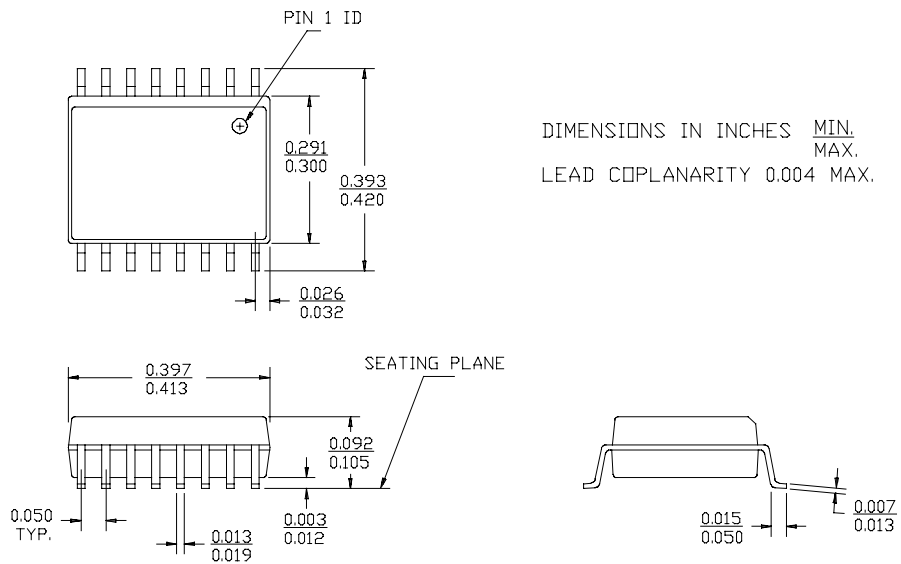MIL−STD−1835 C−2A

TEXAS INSTRUMENTS

Package Diagrams (continued)

16-Lead Quarter Size Outline Q1

0.009
REF.

0.150
0.157

0.228
0.244

0.189
0.197

0°-8°

0.016
0.034

0.007
0.010

SEATING
PLANE

0.053
0.069

0.004
0.010

0.025
BSC.

0.008
0.012

DIMENSIONS IN INCHES   MIN.
                       MAX.
LEAD COPLANARITY 0.004 MAX.

16-Lead Molded SOIC S1

PIN 1 ID

0.291
0.300

0.393
0.420

0.026
0.032

DIMENSIONS IN INCHES   MIN.
                       MAX.
LEAD COPLANARITY 0.004 MAX.

0.397
0.413

SEATING PLANE

0.092
0.105

0.050
TYP.

0.013
0.019

0.003
0.012

0.015
0.050

0.007
0.013

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