Integrated Device Technology, Inc.

FEATURES:

- Std., A, C and D speed grades
- Low input and output leakage ≤1µA (max.)
- CMOS power levels
- True TTL input and output compatibility
  - V_{OH} = 3.3V (typ.)
  - V_{OL} = 0.3V (typ.)
- High drive outputs (-15mA I_{OH}, 48mA I_{OL})
- Power off disable outputs permit "live insertion"
- Meets or exceeds JEDEC standard 18 specifications
- Product available in Radiation Tolerant and Radiation Enhanced versions
- Military product compliant to MIL-STD-883, Class B and DESC listed (dual marked)
- Available in DIP, SOIC, QSOP, CERPACK and LCC packages

DESCRIPTION:

The IDT54/74FCT157T/AT/CT/DT and IDT54/74FCT257T/AT/CT/DT are high-speed quad 2-input multiplexers built using an advanced dual metal CMOS technology. Four bits of data from two sources can be selected using the common select input. The four buffered outputs present the selected data in the true (non-inverting) form.

The IDT54/74FCT157T/AT/CT/DT has a common, active-LOW, enable input. When the enable input is not active, all four outputs are held LOW. A common application of 'FCT157T is to move data from two different groups of registers to a common bus. Another application is as a function generator. The 'FCT157T can generate any four of the 16 different functions of two variables with one variable common.

The IDT54/74FCT257T/AT/CT/DT has a common Output Enable ($\overline{OE}$) input. When $\overline{OE}$ is HIGH, all outputs are switched to a high-impedance state allowing the outputs to interface directly with bus-oriented systems.

FUNCTIONAL BLOCK DIAGRAM
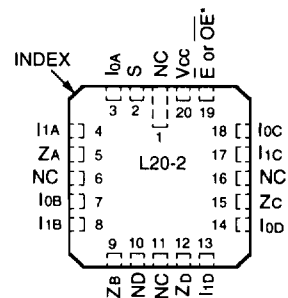

2537 drw 01
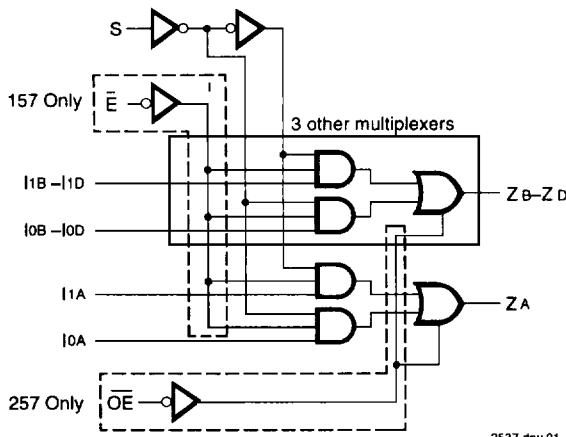
PIN CONFIGURATIONS

2537 drw 02
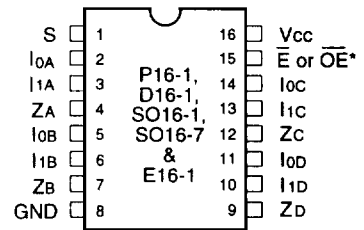
**DIP/SOIC/QSOP/CERPACK
TOP VIEW**

2537 drw 03

**LCC
TOP VIEW**

* $\overline{E}$ for FCT157, $\overline{OE}$ for FCT257.

MILITARY AND COMMERCIAL TEMPERATURE RANGES **APRIL 1994**

PIN DESCRIPTION

Pin Names	Description
$I_{0A}-I_{0D}$	Source 0 Data Inputs
$I_{1A}-I_{1D}$	Source 1 Data Inputs
$\overline{E}$	Enable Input (Active LOW)–FCT157T
$\overline{OE}$	Output Enable (Active LOW)–FCT257T
S	Select Input
Z_A-Z_D	Outputs

2537 tbl 01

FUNCTION TABLE[1]

Inputs				Output Z_N	
$\overline{E}/\overline{OE}$	S	I_0	I_1	157	257
H	X	X	X	L	Z
L	H	X	L	L	L
L	H	X	H	H	H
L	L	L	X	L	L
L	L	H	X	H	H

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

2537 tbl 02

ABSOLUTE MAXIMUM RATINGS[1]

Symbol	Rating	Commercial	Military	Unit
V_{TERM}[2]	Terminal Voltage with Respect to GND	−0.5 to +7.0	−0.5 to +7.0	V
V_{TERM}[3]	Terminal Voltage with Respect to GND	−0.5 to V_{CC} +0.5	−0.5 to V_{CC} +0.5	V
T_A	Operating Temperature	0 to +70	−55 to +125	°C
T_{BIAS}	Temperature Under Bias	−55 to +125	−65 to +135	°C
T_{STG}	Storage Temperature	−55 to +125	−65 to +150	°C
P_T	Power Dissipation	0.5	0.5	W
I_{OUT}	DC Output Current	−60 to +120	−60 to +120	mA

2537 lnk 03

NOTES:
1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability. No terminal voltage may exceed Vcc by +0.5V unless otherwise noted.
2. Input and Vcc terminals only.
3. Outputs and I/O terminals only.

CAPACITANCE (T_A = +25°C, f = 1.0MHz)

Symbol	Parameter[1]	Conditions	Typ.	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	6	10	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V	8	12	pF

NOTE:
1. This parameter is measured at characterization but not tested.

2537 lnk 04

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DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Commercial: T_A = 0°C to +70°C, V_{CC} = 5.0V ± 5%; Military: T_A = –55°C to +125°C, V_{CC} = 5.0V ± 10%

Symbol	Parameter	Test Conditions[1]		Min.	Typ.[2]	Max.	Unit
V_{IH}	Input HIGH Level	Guaranteed Logic HIGH Level		2.0	—	—	V
V_{IL}	Input LOW Level	Guaranteed Logic LOW Level		—	—	0.8	V
I_{IH}	Input HIGH Current[4]	V_{CC} = Max.	V_I = 2.7V	—	—	±1	μA
I_{IL}	Input LOW Current[4]	V_{CC} = Max.	V_I = 0.5V	—	—	±1	μA
I_{OZH}	High Impedance Output[4]	V_{CC} = Max.	V_O = 2.7V	—	—	±1	μA
I_{OZL}	Current		V_O = 0.5V	—	—	±1	
I_I	Input HIGH Current[4]	V_{CC} = Max., V_I = V_{CC} (Max.)		—	—	±1	μA
V_{IK}	Clamp Diode Voltage	V_{CC} = Min., I_N = –18mA		—	–0.7	–1.2	V
I_{OS}	Short Circuit Current	V_{CC} = Max.[3], V_O = GND		–60	–120	–225	mA
V_{OH}	Output HIGH Voltage	V_{CC} = Min. V_{IN} = V_{IH} or V_{IL}	I_{OH} = –6mA MIL. I_{OH} = –8mA COM'L.	2.4	3.3	—	V
			I_{OH} = –12mA MIL. I_{OH} = –15mA COM'L.	2.0	3.0	—	V
V_{OL}	Output LOW Voltage	V_{CC} = Min. V_{IN} = V_{IH} or V_{IL}	I_{OL} = 32mA MIL. I_{OL} = 48mA COM'L.	—	0.3	0.5	V
I_{OFF}	Input/Output Power Off Leakage[5]	V_{CC} = 0V, V_{IN} or V_O ≤ 4.5V		—	—	±1	μA
V_H	Input Hysteresis	—		—	200	—	mV
I_{CC}	Quiescent Power Supply Current	V_{CC} = Max. V_{IN} = GND or V_{CC}		—	0.01	1	mA

2537 tbl 05

NOTES:
1. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at V_{CC} = 5.0V, +25°C ambient.
3. Not more than one output should be shorted at one time. Duration of the short circuit test should not exceed one second.
4. The test limit for this parameter is ±5μA at T_A = -55°C.
5. This parameter is guaranteed but not tested.

POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions[1]		Min.	Typ.[2]	Max.	Unit
ΔI_{CC}	Quiescent Power Supply Current TTL Inputs HIGH	V_{CC} = Max. V_{IN} = 3.4V[3]		—	0.5	2.0	mA
I_{CCD}	Dynamic Power Supply Current[4]	V_{CC} = Max. Outputs Open $\overline{E}$ or $\overline{OE}$ = GND One Bit Toggling 50% Duty Cycle	V_{IN} = V_{CC} V_{IN} = GND	—	0.15	0.25	mA/MHz
I_C	Total Power Supply Current[6]	V_{CC} = Max. Outputs Open f_0 = 10MHz	V_{IN} = V_{CC} V_{IN} = GND	—	1.5	3.5	mA
		50% Duty Cycle $\overline{E}$ or $\overline{OE}$ = GND One Bit Toggling	V_{IN} = 3.4V V_{IN} = GND	—	1.8	4.5	
		V_{IN} = V_{CC} Outputs Open f_0 = 2.5MHz	V_{IN} = V_{CC} V_{IN} = GND	—	1.5	3.5[5]	
		50% Duty Cycle $\overline{E}$ or $\overline{OE}$ = GND Four Bits Toggling	V_{IN} = 3.4V V_{IN} = GND	—	2.5	7.5[5]	

2537 tbl 06

NOTES:
1. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at V_{CC} = 5.0V, +25°C ambient.
3. Per TTL driven input (V_{IN} = 3.4V); all other inputs at V_{CC} or GND.
4. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
5. Values for these conditions are examples of the Icc formula. These limits are guaranteed but not tested.
6. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_0 N_0)$
   I_{CC} = Quiescent Current
   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 Output Transition Pair (HLH or LHL)
   f_0 = Output Frequency
   N_0 = Number of Outputs at f_0
   All currents are in milliamps and all frequencies are in megahertz.

6

SWITCHING CHARACTERISTICS OVER OPERATING RANGE – FCT157T/AT/CT/DT

| Symbol | Parameter | Condition[1] | 54/74FCT157T | | | | 54/74FCT157AT | | | | Unit |
| | | | Com'l. | | Mil. | | Com'l. | | Mil. | | |
			Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	
t_{PLH} t_{PHL}	Propagation Delay IN to Z_N	$C_L = 50pF$ $R_L = 500\Omega$	1.5	6.0	1.5	7.0	1.5	5.0	1.5	5.8	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{E}$ to Z_N		1.5	10.5	1.5	12.0	1.5	6.0	1.5	7.4	ns
t_{PLH} t_{PHL}	Propagation Delay S to Z_N		1.5	10.5	1.5	12.0	1.5	7.0	1.5	8.1	ns

2537 tbl 07

| Symbol | Parameter | Condition[1] | 54/74FCT157CT | | | | 54/74FCT157DT | | | | Unit |
| | | | Com'l. | | Mil. | | Com'l. | | Mil. | | |
			Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	
t_{PLH} t_{PHL}	Propagation Delay IN to Z_N	$C_L = 50pF$ $R_L = 500\Omega$	1.5	4.3	1.5	5.0	1.5	3.9	—	—	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{E}$ to Z_N		1.5	4.8	1.5	5.9	1.5	4.4	—	—	ns
t_{PLH} t_{PHL}	Propagation Delay S to Z_N		1.5	5.2	1.5	6.0	1.5	4.6	—	—	ns

2537 tbl 08

SWITCHING CHARACTERISTICS OVER OPERATING RANGE – FCT257T/AT/CT/DT

| Symbol | Parameter | Condition[1] | 54/74FCT257T | | | | 54/74FCT257AT | | | | Unit |
| | | | Com'l. | | Mil. | | Com'l. | | Mil. | | |
			Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	
t_{PLH} t_{PHL}	Propagation Delay IN to Z_N	$C_L = 50pF$ $R_L = 500\Omega$	1.5	6.0	1.5	7.0	1.5	5.0	1.5	5.8	ns
t_{PLH} t_{PHL}	Propagation Delay S to Z_N		1.5	10.5	1.5	12.0	1.5	7.0	1.5	8.1	ns
t_{PZH} t_{PZL}	Output Enable Time		1.5	8.5	1.5	10.0	1.5	7.0	1.5	8.0	ns
t_{PHZ} t_{PLZ}	Output Disable Time		1.5	6.0	1.5	8.0	1.5	5.5	1.5	5.8	ns

2537 tbl C

| Symbol | Parameter | Condition[1] | 54/74FCT257CT | | | | 54/74FCT257DT | | | | Unit |
| | | | Com'l. | | Mil. | | Com'l. | | Mil. | | |
			Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	
t_{PLH} t_{PHL}	Propagation Delay IN to Z_N	$C_L = 50pF$ $R_L = 500\Omega$	1.5	4.3	1.5	5.0	1.5	3.9	—	—	ns
t_{PLH} t_{PHL}	Propagation Delay S to Z_N		1.5	5.2	1.5	6.0	1.5	4.4	—	—	ns
t_{PZH} t_{PZL}	Output Enable Time		1.5	6.0	1.5	6.8	1.5	4.4	—	—	ns
t_{PHZ} t_{PLZ}	Output Disable Time		1.5	5.0	1.5	5.3	1.5	4.4	—	—	ns

2537 tbl 1

NOTES:
1. See test circuits and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delay.

TEST CIRCUITS AND WAVEFORMS

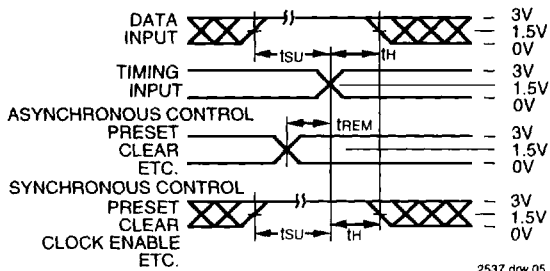## TEST CIRCUITS FOR ALL OUTPUTS
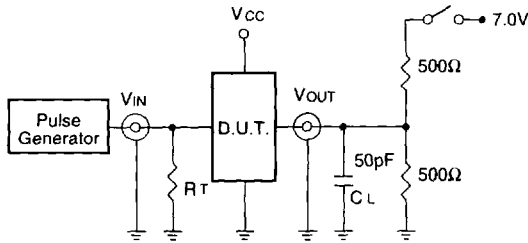
2537 drw 04

SWITCH POSITION

Test	Switch
Open Drain Disable Low Enable Low	Closed
All Other Tests	Open

2537 lnk 11

DEFINITIONS:

C_L = Load capacitance: includes jig and probe capacitance.

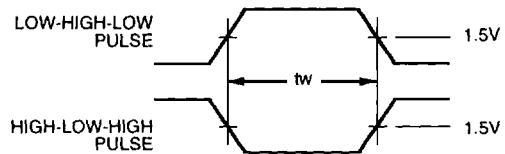R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.
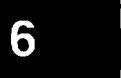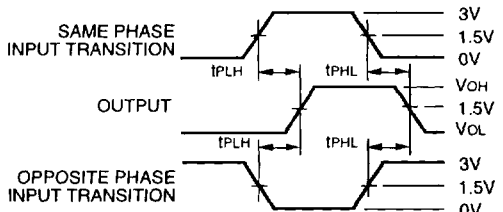
SET-UP, HOLD AND RELEASE TIMES

2537 drw 05

PULSE WIDTH
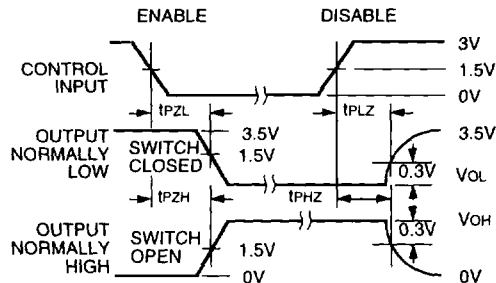

2537 drw 06

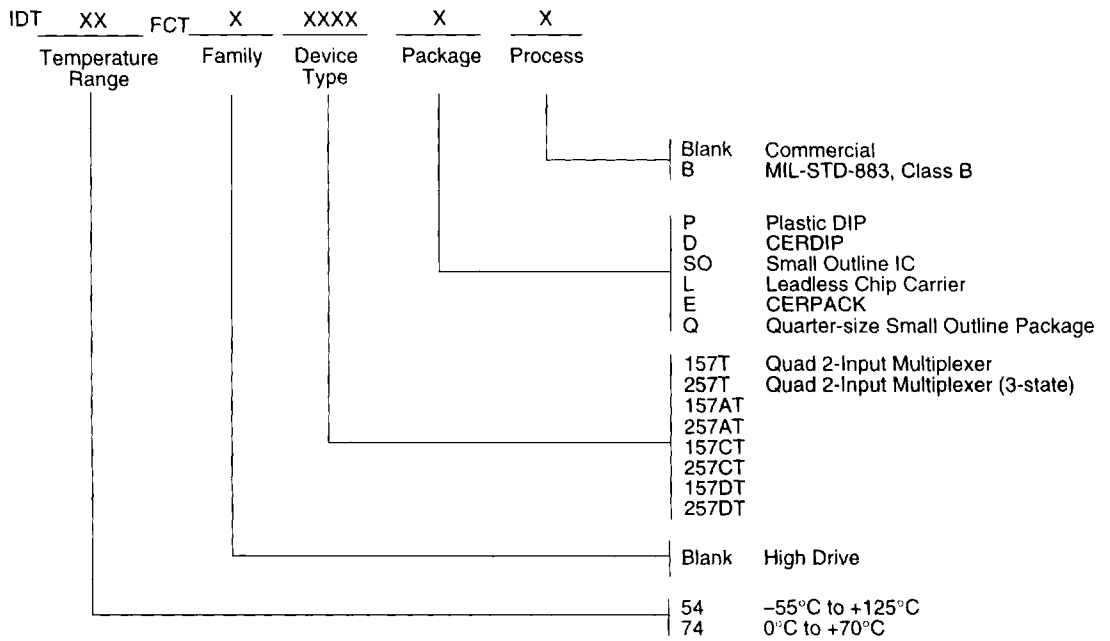## PROPAGATION DELAY

2537 drw 07

ENABLE AND DISABLE TIMES

2537 drw 08

NOTES:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH

2. Pulse Generator for All Pulses: Rate ≤ 1.0MHz; tF ≤ 2.5ns; tR ≤ 2.5ns

ORDERING INFORMATION

```
IDT    XX    FCT    X     XXXX      X        X
     Temperature  Family  Device  Package  Process
       Range               Type
```

Blank	Commercial
B	MIL-STD-883, Class B
P	Plastic DIP
D	CERDIP
SO	Small Outline IC
L	Leadless Chip Carrier
E	CERPACK
Q	Quarter-size Small Outline Package
157T	Quad 2-Input Multiplexer
257T	Quad 2-Input Multiplexer (3-state)
157AT	
257AT	
157CT	
257CT	
157DT	
257DT	
Blank	High Drive
54	−55°C to +125°C
74	0°C to +70°C

2537 drw 09