

**Fast CMOS Octal  
Transparent Latches**

**Product Features:**

- PI74FCT373/533/573T have the same speed and drive of Bipolar FAST™ "F" series, at CMOS power levels.
  - "A" speeds at 5.2 ns max.
  - "C" speeds at 4.2 ns max.
  - "D" speeds are an industry first, at 3.8 ns max.
- TTL input and output levels, reducing problematic "ground bounce"
- High output drive,  $I_{OL} = 64$  mA
- Extremely low static power (1 mW, typ.)
- Industry standard pinout, plug into existing "74F" sockets for speed enhancement at reduced power levels
- Octal transparent latch with 3-state output control
- Hysteresis on all inputs
- Packaged in 20-pin plastic DIP, surface mount SOIC, or the industry's new "1/4 size" surface mount QSOP

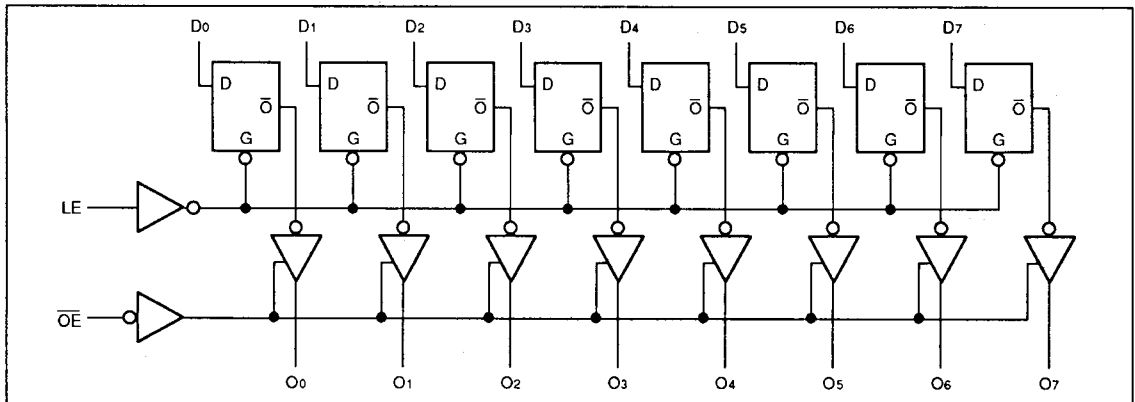
**Product Description:**

Pioneer Semiconductor's PI74FCT series of logic circuits are produced in the Company's advanced 0.8 micron CMOS technology, achieving industry leading speed grades.

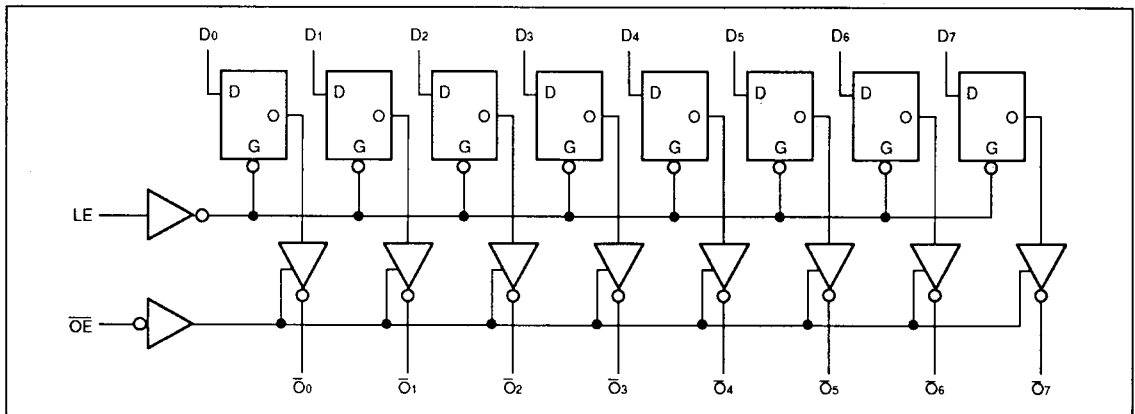
The PI74FCT373T, 533T, and 573T are 8-bit wide octal transparent latches designed with 3-state outputs and are intended for bus oriented applications. When Latch Enable (LE) is HIGH, the flip-flops appear transparent to the data. The data that meets the set-up time when LE is LOW is latched. When  $\overline{OE}$  is HIGH, the bus output is in the high impedance state.

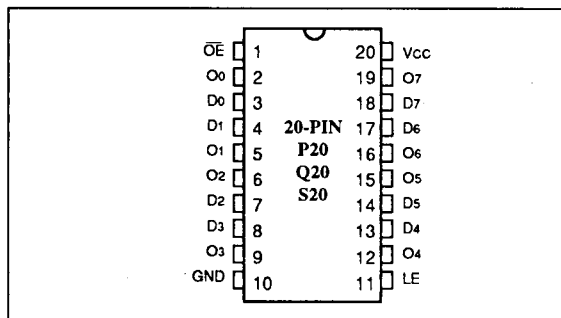
All products are available in three package types: 20-pin, 300 mil wide plastic DIP, 300 mil wide plastic SOIC, and the industry's new 150 mil wide QSOP (one quarter the size of an SOIC).

**PI74FCT373T and PI74FCT573T Logic Block Diagram**

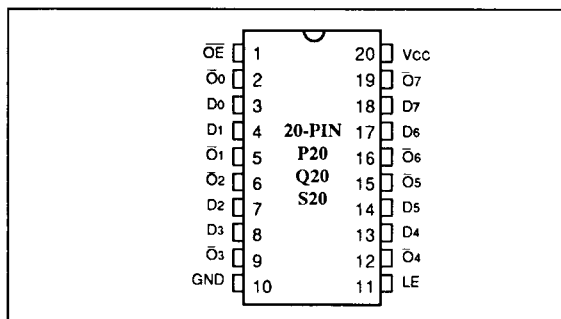


**PI74FCT533T Logic Block Diagram**



**PI74FCT373T Product Pin Configuration**

**Product Pin Description**

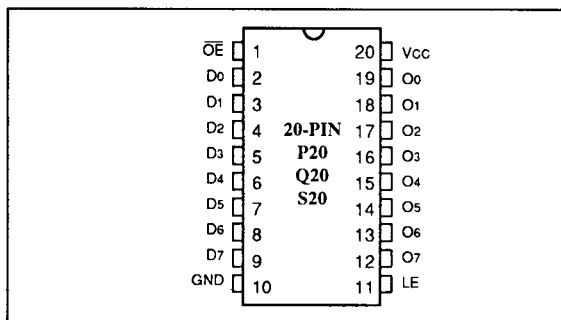
Pin Name	Description
$\overline{OE}$	Output Enable Input (Active LOW)
LE	Latch Enable Input (Active HIGH)
D0-D7	Data Inputs
O0-O7	3-State Outputs
$\overline{O0-O7}$	Complementary 3-State Outputs
GND	Ground
Vcc	Power

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**PI74FCT533T Product Pin Configuration**

**PI74FCT533T Truth Table<sup>(1)</sup>**

Inputs			Outputs
D <sub>N</sub>	LE	$\overline{OE}$	$\overline{O_N}$
H	H	L	L
L	H	L	H
X	X	H	Z

**PI74FCT373/573T Truth Table<sup>(1)</sup>**

Inputs			Outputs
D <sub>N</sub>	LE	$\overline{OE}$	$\overline{O_N}$
H	H	L	H
L	H	L	L
X	X	H	Z

**PI74FCT573T Product Pin Configuration**


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

### Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature .....	-55°C to +125°C
Ambient Temperature with Power Applied .....	0°C to +70°C
Supply Voltage to Ground Potential (Inputs & Vcc Only) .....	-0.5V to +7.0V
Supply Voltage to Ground Potential (Outputs & D/O Only) .....	-0.5V to Vcc
DC Input Voltage .....	-0.5V <sup>(5)</sup> to +7.0V
DC Output Current .....	120 mA
Operating Range: Ambient Temperature .....	0°C to +70°C
Operating Range: Vcc .....	5V ± 5%
Power Dissipation .....	0.5W
ESD protection .....	>2000V

### NOTE:

Stresses greater than those listed under **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.

### DC Electrical Characteristics (Over the Operating Range)

Parameters	Description	Test Conditions <sup>(1)</sup>		Min.	Typ <sup>(2)</sup>	Max.	Units
VOH	Output HIGH Voltage	VCC = Min., VIN = VIH or VIL	IOH = -8.0 mA	2.4	3.3		V
			IOH = -15.0 mA	2.0	3.0		V
VOL	Output LOW Current	VCC = Min., VIN = VIH or VIL	IOL = 64 mA		0.3	0.55	V
VIH	Input HIGH Voltage	Guaranteed Logic HIGH Level		2.0			V
VIL	Input LOW Voltage	Guaranteed Logic LOW Level				0.8	V
IiH	Input HIGH Current	VCC = Max.	VIN = 2.7 V			5	µA
IiL	Input LOW Current	VCC = Max.	VIN = 0.5 V			-5	µA
IOZH	Output Current	VCC = Max.	VOUT = 2.7 V			+10	µA
IOZL			VOUT = 0.5 V			-10	µA
Ii	Input HIGH Current	VCC = Max., VIN = VCC (Max.)				20	µA
VTK	Clamp Diode Voltage	VCC = Min., IIN = -18 mA			-0.7	-1.2	V
Ios	Short Circuit Current	VCC = Max. <sup>(3)</sup> , VOUT = GND		-60	-120		mA
Ioff	Power Down Disable	VCC = GND, VOUT = 4.5 V		—	—	100	µA
VH	Input Hysteresis				200		mV

### Capacitance (TA = 25°C, f = 1 MHz)

Parameters <sup>(4)</sup>	Description	Test Conditions	Typ	Max.	Units
CIN	Input Capacitance	VIN = 0 V	6	10	pF
COU	Output Capacitance	VOUT = 0 V	8	12	pF

### Notes:

- For conditions show as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at Vcc = 5.0, +25°C ambient and maximum loading.
- Not more than one output should be shorted at one time. Duration of the test should not exceed one second.
- This parameter is determined by device characterization but is not production tested.
- VIL = -3.0 V for pulse width less than 5 ns.

**Power Supply Characteristics**

Parameters	Description	Test Conditions <sup>(1)</sup>		Min.	Typ <sup>(2)</sup>	Max.	Units
I <sub>cc</sub>	Quiescent Power Supply Current	V <sub>cc</sub> = Max.	V <sub>IN</sub> = GND or V <sub>cc</sub>		0.2	1.5	mA
ΔI <sub>cc</sub>	Supply Current per Input @ TTL HIGH	V <sub>cc</sub> = Max.,	V <sub>IN</sub> = 3.4 V <sup>(3)</sup>		0.5	2.5	mA
I <sub>ccd</sub>	Supply Current per Input per MHz <sup>(4)</sup>	V <sub>cc</sub> = Max., Outputs Open OE = GND LE = V <sub>cc</sub> One Bit Toggling 50% Duty Cycle	V <sub>IN</sub> = V <sub>cc</sub> V <sub>IN</sub> = GND		0.15	0.25	mA/ MHz
I <sub>c</sub>	Total Power Supply Current <sup>(6)</sup>	V <sub>cc</sub> = Max., Outputs Open f <sub>i</sub> = 10 MHz 50% Duty Cycle OE = GND LE = V <sub>cc</sub> One Bit Toggling	V <sub>IN</sub> = V <sub>cc</sub> V <sub>IN</sub> = GND		1.7	4.0 <sup>(5)</sup>	mA
			V <sub>IN</sub> = 3.4 V V <sub>IN</sub> = GND		2.0	5.0 <sup>(5)</sup>	
		V <sub>cc</sub> = Max., Outputs Open f <sub>i</sub> = 2.5 MHz 50% Duty Cycle OE = GND LE = V <sub>cc</sub> Eight Bits Toggling	V <sub>IN</sub> = V <sub>cc</sub> V <sub>IN</sub> = GND		3.2	6.5 <sup>(5)</sup>	
			V <sub>IN</sub> = 3.4 V V <sub>IN</sub> = GND		5.2	14.5 <sup>(5)</sup>	

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**Notes:**

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device.
- Typical values are at V<sub>cc</sub> = 5.0 V, +25°C ambient.
- Per TTL driven input (V<sub>IN</sub> = 3.4 V); all other inputs at V<sub>cc</sub> or GND.
- This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
- Values for these conditions are examples of the I<sub>cc</sub> formula. These limits are guaranteed but not tested.
- I<sub>c</sub> = I<sub>QUIESCENT</sub> + I<sub>INPUTS</sub> + I<sub>DYNAMIC</sub>

$$I_c = I_{cc} + \Delta I_{cc} D_H N_T + I_{ccd} (f_{CP}/2 + f_i N_i)$$

I<sub>cc</sub> = Quiescent Current

ΔI<sub>cc</sub> = Power Supply Current for a TTL High Input (V<sub>IN</sub> = 3.4 V)

D<sub>H</sub> = Duty Cycle for TTL Inputs High

N<sub>T</sub> = Number of TTL Inputs at D<sub>H</sub>

I<sub>ccd</sub> = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)

f<sub>CP</sub> = Clock Frequency for Register Devices (Zero for Non-Register Devices)

f<sub>i</sub> = Input Frequency

N<sub>i</sub> = Number of Inputs at f<sub>i</sub>

All currents are in milliamps and all frequencies are in megahertz.

**PI74FCT373T Switching Characteristics over Operating Range**

Parameters	Description	Conditions <sup>(1)</sup>	FCT373T				FCT373AT				FCT373CT				FCT373DT				Unit
			Com.		Mil.		Com.		Mil.		Com.		Mil.		Com.		Mil.		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay DN to ON	C <sub>L</sub> = 50 pF R <sub>L</sub> = 500Ω	1.5	8.0			1.5	5.2			1.5	4.2			1.5	3.8			ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay LE to ON		2.0	13.0			2.0	8.5			2.0	5.5			2.0	4.0			ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable Time		1.5	12.0			1.5	6.5			1.5	5.5			1.5	4.8			ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output Disable Time		1.5	7.5			1.5	5.5			1.5	5.0			1.5	4.0			ns
t <sub>SU</sub>	Set-up Time HIGH or LOW, DN to LE		2.0	—			2.0	—			2.0	—			1.5	—			ns
t <sub>H</sub>	Hold Time HIGH or LOW, DN to LE		1.5	—			1.5	—			1.5	—			1.0	—			ns
t <sub>w</sub>	LE Pulse Width HIGH		6.0	—			5.0	—			5.0	—			3.0	—			ns

**PI74FCT533T Switching Characteristics over Operating Range**

Parameters	Description	Conditions <sup>(1)</sup>	FCT533T				FCT533AT				FCT533CT				FCT533DT				Unit
			Com.		Mil.		Com.		Mil.		Com.		Mil.		Com.		Mil.		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay DN to ON	C <sub>L</sub> = 50 pF R <sub>L</sub> = 500Ω	1.5	10.0			1.5	5.2			1.5	4.2			1.5	3.8			ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay LE to ON		2.0	13.0			2.0	8.5			2.0	5.5			2.0	4.0			ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable Time		1.5	11.0			1.5	6.5			1.5	5.5			1.5	4.8			ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output Disable Time		1.5	7.0			1.5	5.5			1.5	5.0			1.5	4.0			ns
t <sub>SU</sub>	Set-up Time HIGH or LOW, DN to LE		2.0	—			2.0	—			2.0	—			1.5	—			ns
t <sub>H</sub>	Hold Time HIGH or LOW, DN to LE		1.5	—			1.5	—			1.5	—			1.0	—			ns
t <sub>w</sub>	LE Pulse Width HIGH		6.0	—			5.0	—			5.0	—			3.0	—			ns

**Notes:**

1. See test circuit and wave forms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.

**PI74FCT573T Switching Characteristics over Operating Range**

Parameters	Description	Conditions <sup>(1)</sup>	FCT573T				FCT573AT				FCT573CT				FCT573DT				Unit
			Com.		Mil.		Com.		Mil.		Com.		Mil.		Com.		Mil.		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay DN to $\bar{O}N$	Cl = 50 pF R <sub>L</sub> = 500Ω	1.5	8.0			1.5	5.2			1.5	4.2			1.5	3.8			ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay LE to $\bar{O}N$		2.0	12.0			2.0	8.5			2.0	5.5			2.0	4.0			ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable Time		1.5	9.5			1.5	6.5			1.5	5.5			1.5	4.8			ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output Disable Time		1.5	6.5			1.5	5.5			1.5	5.0			1.5	4.0			ns
t <sub>SU</sub>	Set-up Time HIGH or LOW, DN to LE		2.0	—			2.0	—			2.0	—			1.5	—			ns
t <sub>H</sub>	Hold Time HIGH or LOW, DN to LE		1.5	—			1.5	—			1.5	—			1.0	—			ns
t <sub>W</sub>	LE Pulse Width HIGH		6.0	—			5.0	—			5.0	—			3.0	—			ns

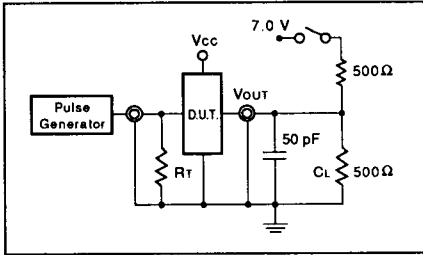
**Notes:**

1. See test circuit and wave forms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.

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## Test Circuits and Waveforms

### Test Circuits



### Switch Position

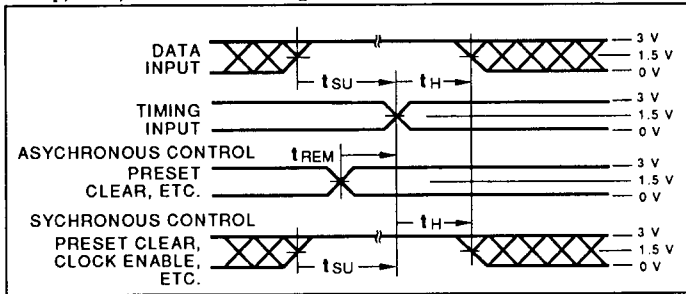
Test	Switch
Open Drain Disable LOW Enable LOW	Closed
All Other Inputs	Open

### DEFINITIONS:

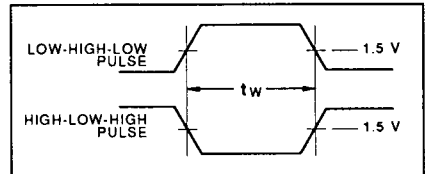
**CL** = Load capacitance: includes jig and probe capacitance.

**RT** = Termination resistance: should be equal to ZOUT of the Pulse Generator.

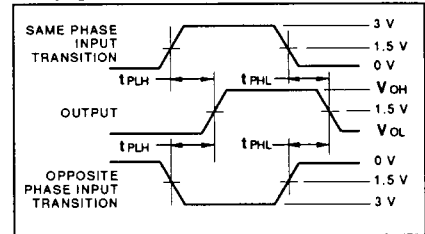
### Setup, Hold, and Release Timing



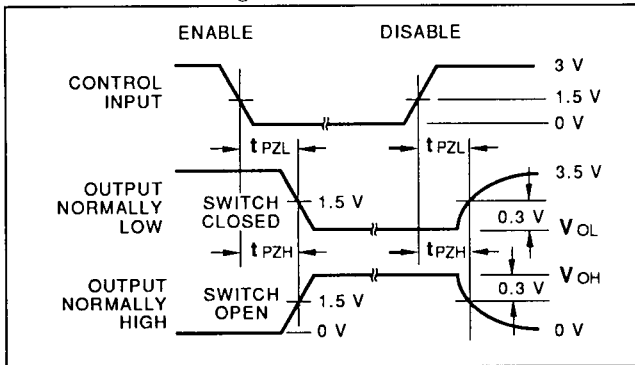
### Pulse Width



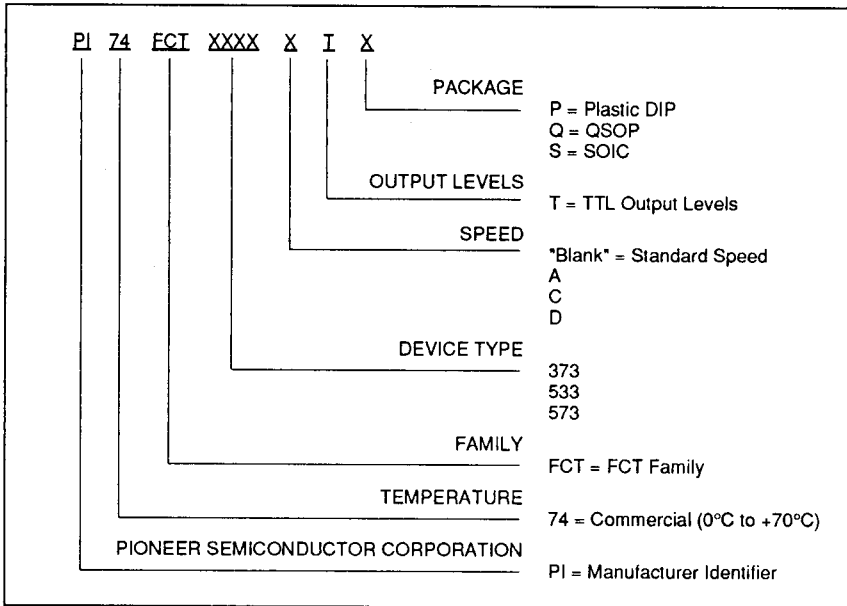
### Propagation Delay



### Enable and Disable Timing



- Figure 5 shown for input Control Enable = Low and input Control Disable = High.
- Pulse Generator for All Pulses: Rate  $\leq 1.0$  MHz; Zout  $\leq 50 \Omega$ ; tr, tr  $\leq 2.5$  ns.

**Ordering Number Information**

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**Part Marking Information**

The Part Marking is identical to the Ordering Number with the following exceptions:

- Speed is marked at the end of the part number so that the speed grade indicator can be added after test. The manufacturing date code is marked under the device part number.
- The QSOP package is not marked with the Pioneer Semiconductor logo due to space limitations on the package. The manufacturing date code is marked to the side of the part number.

EXAMPLE:

