

# P54/74FCT373T/AT/CT—P54/74FCT533T/AT/CT— P54/74FCT563T/AT/CT—P54/74FCT573T/AT/CT OCTAL TRANSPARENT LATCHES W/ 3-STATE OUTPUTS

## FEATURES

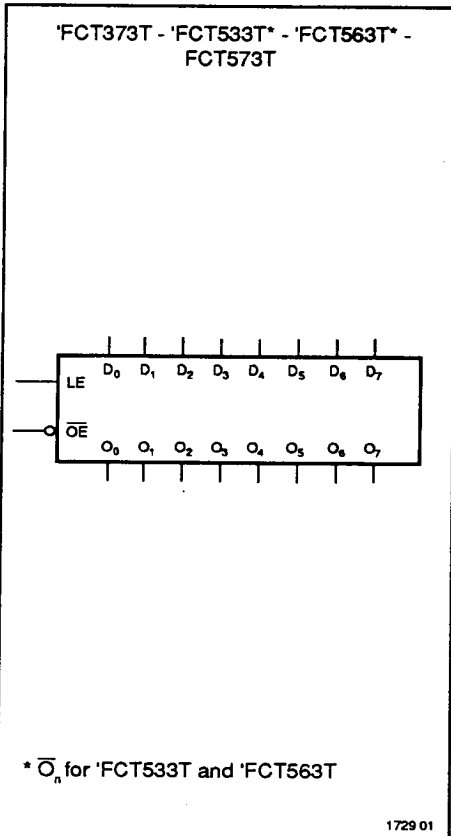
- Function, Pinout and Drive Compatible with the Fastest Bipolar Logic
- FCT-C speed at 4.2ns max. (Com'I)  
FCT-A speed at 5.2ns max. (Com'I)
- Reduced  $V_{OH}$  (typically = 3.0V) versions of Equivalent and FCT functions
- Edge-rate Control Circuitry for Significantly Improved Noise Characteristics
- ESD protection exceeds 2000V
- Power-off disable feature
- Matched Rise and Fall times
- Fully Compatible with TTL Input and Output Logic Levels
- 64 mA Sink Current (Com'I), 32 mA (Mil)  
15 mA Source Current (Com'I), 12 mA (Mil)
- Manufactured in 0.7 micron PACE Technology™

## DESCRIPTION

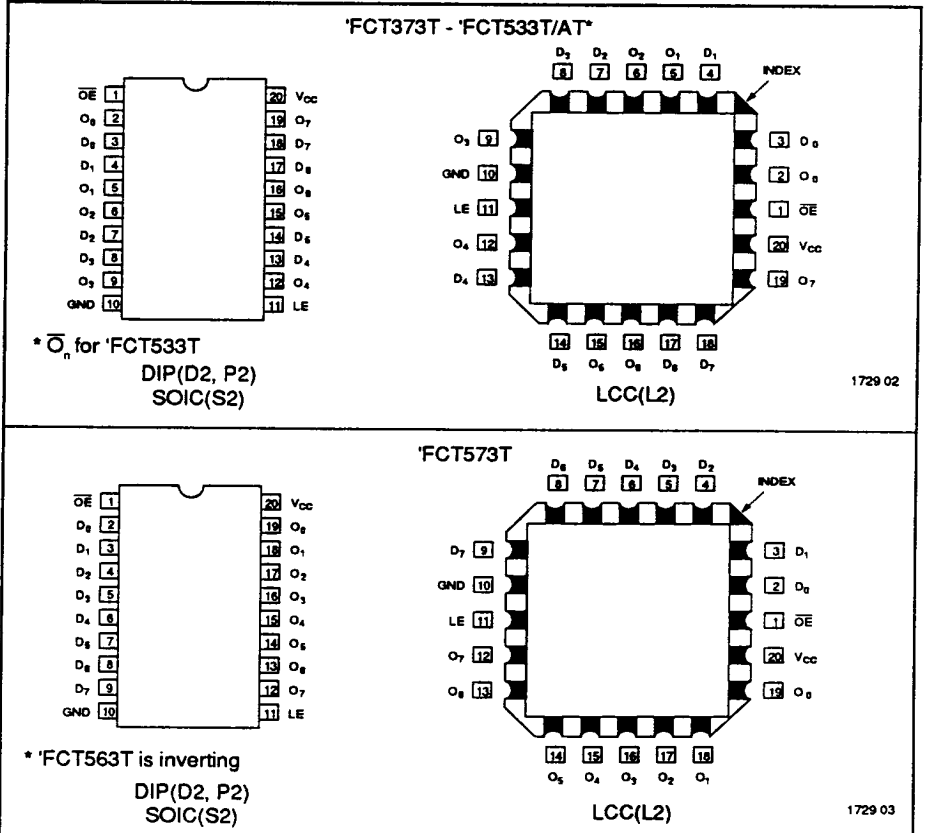
The 'FCT373T, 'FCT533T, 'FCT563T and 'FCT573T consist of eight latches with 3-state outputs for bus organized system applications. When latch enable (LE) is high, the flip flops appear transparent to the data. Data that meets the required set-up times are latched when LE transitions from HIGH to LOW. Data appears on the bus when the output enable ( $\overline{OE}$ ) is LOW. When output

enable is HIGH, the bus output is in the high impedance state. In this mode, data may be entered into the latches. The 'FCT533T is the same as the 'FCT373T, except that the outputs are inverted. The 'FCT573T is identical to 'FCT373T except that all the inputs are on one side of the package and the outputs on the other side. The 'FCT563T is identical to 'FCT573T, but with inverted outputs.

## LOGIC SYMBOL



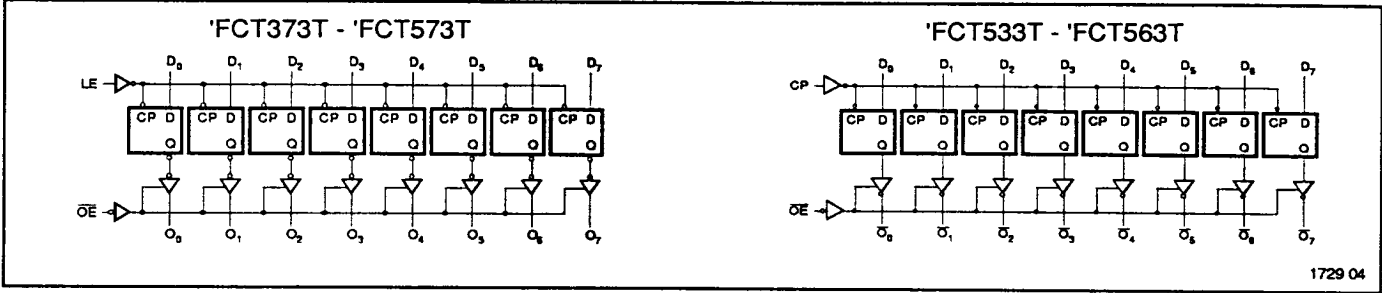
## PIN CONFIGURATIONS



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LOGIC DIAGRAMS



ABSOLUTE MAXIMUM RATINGS<sup>1,2</sup>

Symbol	Parameter	Value	Unit
T <sub>STG</sub>	Storage Temperature	-65 to +150	°C
T <sub>A</sub>	Ambient Temperature Under Bias	-65 to +135	°C
V <sub>CC</sub>	V <sub>CC</sub> Potential to Ground	-0.5 to +7.0	V
P <sub>T</sub>	Power Dissipation	0.5	W

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Symbol	Parameter	Value	Unit
I <sub>OUTPUT</sub>	Current Applied to Output	120	mA
V <sub>IN</sub>	Input Voltage	-0.5 to +7.0	V
V <sub>OUT</sub>	Voltage Applied to Output	-0.5 to +7.0	V

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Notes:

1. Operation beyond the limits set forth in the above table may impair the useful life of the device. Unless otherwise noted, these limits are over the operating free-air temperature range.

2. Unused inputs must always be connected to an appropriate logic voltage level, preferably either V<sub>CC</sub> or ground.

DC ELECTRICAL CHARACTERISTICS (Over recommended operating conditions)

Symbol	Parameter		Min	Typ <sup>1</sup>	Max	Units	V <sub>CC</sub>	Conditions
V <sub>IH</sub>	Input HIGH Voltage		2.0			V		
V <sub>IL</sub>	Input LOW Voltage				0.8	V		
V <sub>H</sub>	Hysteresis			0.2		V		All inputs
V <sub>IK</sub>	Input Clamp Diode Voltage			-0.7	-1.2	V	MIN	I <sub>IN</sub> = -18mA
V <sub>OH</sub>	Output HIGH Voltage	Military	2.4	3.3		V	MIN	I <sub>OH</sub> = -12mA I <sub>OH</sub> = -15mA
		Commercial	2.4	3.3		V	MIN	
V <sub>OL</sub>	Output LOW Voltage	Military		0.3	0.5	V	MIN	I <sub>OL</sub> = 32mA I <sub>OL</sub> = 48mA I <sub>OL</sub> = 64mA
		Commercial		0.3	0.5	V	MIN	
		Commercial		0.3	0.5	V	MIN	
I <sub>I</sub>	Input HIGH Current				20	µA	MAX	V <sub>IN</sub> = V <sub>CC</sub>
I <sub>IH</sub>	Input HIGH Current				5	µA	MAX	V <sub>IN</sub> = 2.7V
I <sub>IL</sub>	Input LOW Current				-5	µA	MAX	V <sub>IN</sub> = 0.5V
I <sub>OZH</sub>	Off State I <sub>OUT</sub> HIGH-Level Output Current				10	µA	MAX	V <sub>OUT</sub> = 2.7V
I <sub>OZL</sub>	Off State I <sub>OUT</sub> LOW-Level Output Current				-10	µA	MAX	V <sub>OUT</sub> = 0.5V
I <sub>OS</sub>	Output Short Circuit Current <sup>2</sup>		-60	-120	-225	mA	MAX	V <sub>OUT</sub> = 0.0V
I <sub>OFF</sub>	Power-off Disable				100	µA	0V	V <sub>OUT</sub> = 4.5V
C <sub>IN</sub>	Input Capacitance <sup>3</sup>			6	10	pF	MAX	All inputs
C <sub>OUT</sub>	Output Capacitance <sup>3</sup>			8	12	pF	MAX	All outputs
I <sub>CC</sub>	Quiescent Power Supply Current			0.2	1.5	mA	MAX	V <sub>IN</sub> ≤ 0.2V, V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2V

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Notes:

1. Typical limits are at V<sub>CC</sub> = 5.0V, T<sub>A</sub> = +25°C ambient.  
 2. 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 parameter tests. In any sequence of parameter tests, I<sub>OS</sub> tests should be performed last.

3. This parameter is guaranteed but not tested.

**RECOMMENDED OPERATING CONDITIONS**

<b>Free Air Ambient Temperature</b>	<b>Min</b>	<b>Max</b>
Military	-55°C	+125°C
Commercial	0°C	+70°C
<b>Supply Voltage (V<sub>CC</sub>)</b>	<b>Min</b>	<b>Max</b>
Military	+4.5V	+5.5V
Commercial	+4.75V	+5.25V

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**FUNCTION TABLES (Each Latch)**

Inputs			Outputs 'FCT373/'FCT573	Outputs 'FCT533/'FCT563
$\overline{OE}$	LE	D	O <sub>n</sub>	$\overline{O}_n$
L	H	H	H	L
L	H	L	L	H
L	L	X	Q <sub>0</sub>	$\overline{Q}_0$
H	X	X	Z	Z

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H = HIGH Voltage Level      Z = HIGH Impedance  
 L = LOW Voltage Level      Q<sub>0</sub> = previous state of flip flops (Q<sub>n-1</sub>)  
 X = Don't Care                 $\overline{Q}_0$  = previous state of flip flops ( $\overline{Q}_{n-1}$ )

**DC CHARACTERISTICS** (Over recommended operating conditions unless otherwise specified.)

Symbol	Parameter	Typ <sup>1</sup>	Max	Units	Conditions
$\Delta I_{CC}$	Quiescent Power Supply Current (TTL inputs)	0.5	2.0	mA	V <sub>CC</sub> = MAX, V <sub>IN</sub> = 3.4V <sup>2</sup> , f <sub>1</sub> = 0, Outputs Open
I <sub>CCD</sub>	Dynamic Power Supply Current <sup>3</sup>	0.15	0.25	mA/ mHz	V <sub>CC</sub> = MAX, One Input Toggling, 50% Duty Cycle, Outputs Open, $\overline{OE}$ = GND, V <sub>IN</sub> ≤ 0.2V or V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2V
I <sub>C</sub>	Total Power Supply Current <sup>5</sup>	1.7	4.0	mA	V <sub>CC</sub> = MAX, 50% Duty Cycle, Outputs Open, One Bit Toggling at f <sub>1</sub> = 10MHz, $\overline{OE}$ = GND, LE = V <sub>CC</sub> , V <sub>IN</sub> ≤ 0.2V or V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2V
		2.0	5.0	mA	V <sub>CC</sub> = MAX, 50% Duty Cycle, Outputs Open, One Bit Toggling at f <sub>1</sub> = 10MHz, $\overline{OE}$ = GND, LE = V <sub>CC</sub> , V <sub>IN</sub> = 3.4V or V <sub>IN</sub> = GND
		3.2	6.5 <sup>4</sup>	mA	V <sub>CC</sub> = MAX, 50% Duty Cycle, Outputs Open, Eight Bits Toggling at f <sub>1</sub> = 2.5MHz, $\overline{OE}$ = GND, LE = V <sub>CC</sub> , V <sub>IN</sub> ≤ 0.2V or V <sub>IN</sub> ≥ V <sub>CC</sub> - 0.2V
		5.2	14.5 <sup>4</sup>	mA	V <sub>CC</sub> = MAX, 50% Duty Cycle, Outputs Open, Eight Bits Toggling at f <sub>1</sub> = 2.5MHz, $\overline{OE}$ = GND, LE = V <sub>CC</sub> , V <sub>IN</sub> = 3.4V or V <sub>IN</sub> = GND

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**Notes:**

- Typical values are at V<sub>CC</sub> = 5.0V, +25°C ambient and maximum loading.
- Per TTL driven input (V<sub>IN</sub> = 3.4V); 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>  
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_0/2 + f_1 N_T)$   
 I<sub>CC</sub> = Quiescent Current with CMOS input levels

- $\Delta I_{CC}$  = Power Supply Current for a TTL High Input (V<sub>IN</sub> = 3.4V)  
 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>0</sub> = Clock Frequency for Register Devices (Zero for Non-Register Devices)  
 f<sub>1</sub> = Input Frequency  
 N<sub>T</sub> = Number of Inputs at f<sub>1</sub>  
 All currents are in milliamps and all frequencies are in megahertz.

**AC CHARACTERISTICS ('FCT373T — 'FCT573T)**

Sym.	Parameter	'FCT373T 'FCT573T				'FCT373AT 'FCT573AT				'FCT373CT 'FCT573CT				Units	Fig. No.
		MIL		COM'L		MIL		COM'L		MIL		COM'L			
		Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.		
t <sub>PLH</sub> t <sub>PHL</sub>	Prop Delay D <sub>n</sub> to O <sub>n</sub>	1.5	8.5	1.5	8.0	1.5	5.6	1.5	5.2	1.5	5.1	1.5	4.2	ns	1, 3
t <sub>PLH</sub> t <sub>PHL</sub>	Prop Delay LE to O <sub>n</sub>	2.0	15.0	2.0	13.0	2.0	9.8	2.0	8.5	2.0	8.0	2.0	5.5	ns	1, 5
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable Time	1.5	13.5	1.5	12.0	1.5	7.5	1.5	6.5	1.5	6.3	1.5	5.5	ns	1 7
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output Disable Time	1.5	10.0	1.5	7.5	1.5	6.5	1.5	5.5	1.5	5.9	1.5	5.0	ns	8

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**AC CHARACTERISTICS ('FCT533T)**

Sym.	Parameter	'FCT533T				'FCT533AT				'FCT533CT				Units	Fig. No.
		MIL		COM'L		MIL		COM'L		MIL		COM'L			
		Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.		
t <sub>PLH</sub> t <sub>PHL</sub>	Prop Delay D <sub>n</sub> to O <sub>n</sub>	1.5	12.0	1.5	10.0	1.5	5.6	1.5	5.2	1.5	5.1	1.5	4.2	ns	1, 2
t <sub>PLH</sub> t <sub>PHL</sub>	Prop Delay LE to O <sub>n</sub>	2.0	14.0	2.0	13.0	2.0	9.8	2.0	8.5	2.0	8.0	2.0	5.5	ns	1, 5
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable Time	1.5	12.5	1.5	11.0	1.5	7.5	1.5	6.5	1.5	6.3	1.5	5.5	ns	1 7
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output Disable Time	1.5	8.5	1.5	7.0	1.5	6.5	1.5	5.5	1.5	5.9	1.5	5.0	ns	8

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**AC CHARACTERISTICS ('FCT563T)**

Sym.	Parameter	'FCT563T				'FCT563AT				'FCT563CT				Units	Fig. No.
		MIL		COM'L		MIL		COM'L		MIL		COM'L			
		Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.		
t <sub>PLH</sub> t <sub>PHL</sub>	Prop Delay D <sub>n</sub> to O <sub>n</sub>	1.5	12.0	1.5	10.0	1.5	5.6	1.5	5.2	1.5	5.1	1.5	4.7	ns	1, 2
t <sub>PLH</sub> t <sub>PHL</sub>	Prop Delay LE to O <sub>n</sub>	2.0	14.0	2.0	11.0	2.0	9.8	2.0	8.5	2.0	8.0	2.0	6.9	ns	1, 5
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable Time	1.5	12.5	1.5	11.0	1.5	7.5	1.5	6.5	1.5	6.3	1.5	5.5	ns	1 7
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output Disable Time	1.5	8.5	1.5	7.0	1.5	6.5	1.5	5.5	1.5	5.9	1.5	5.0	ns	8

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### AC CHARACTERISTICS

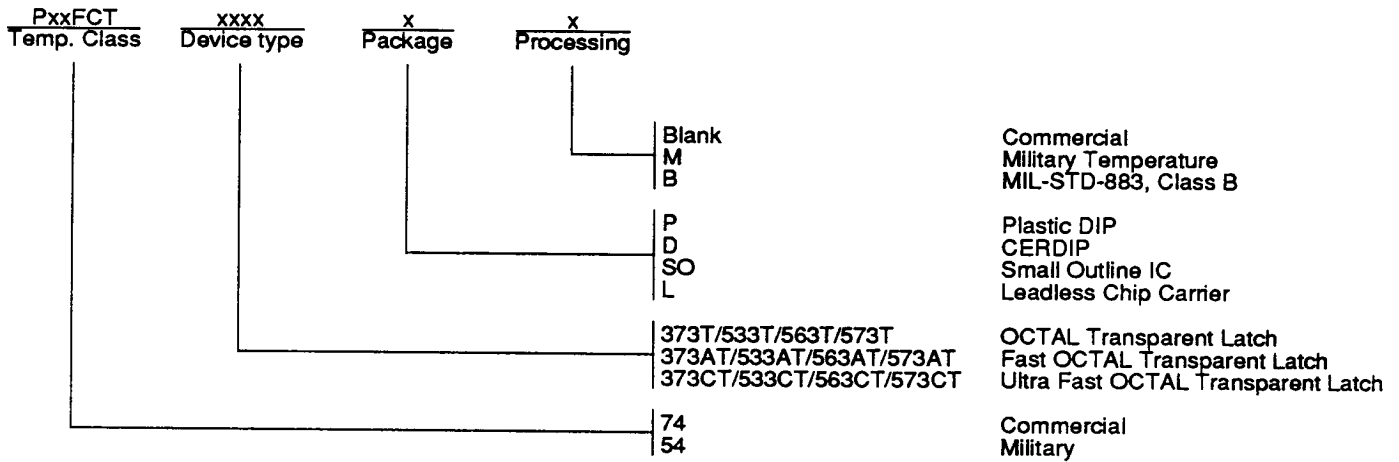
Sym.	Parameter	'FCT373T/'FCT533T 'FCT563T/'FCT573T				'FCT373AT/'FCT533AT 'FCT563AT/'FCT573AT				'FCT373CT/'FCT533CT 'FCT563CT/'FCT573CT				Units	Fig. No.
		MIL		COM'L		MIL		COM'L		MIL		COM'L			
		Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.		
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup Time, High to Low D <sub>n</sub> to LE	2.0	-	2.0	-	2.0	-	2.0	-	2.0	-	2.0	-	ns	9
t <sub>n</sub> (H) t <sub>n</sub> (L)	Hold Time, High to Low D <sub>n</sub> to LE	1.5	-	1.5	-	1.5	-	1.5	-	1.5	-	1.5	-	ns	
t <sub>w</sub> (H)	LE Pulse Width High	6.0	-	6.0	-	6.0	-	5.0	-	6.0	-	5.0	-	ns	5

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**Notes:**

1. Minimum limits are guaranteed but not tested on Propagation Delays. AC Characteristics guaranteed with C<sub>L</sub> = 50 pF as shown in Figure 1.

### ORDERING INFORMATION



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