



# CY54/74FCT377T

## 8-Bit Register

### Features

- Function, pinout and drive compatible with FCT and F logic
- FCT-C speed at 5.2 ns max. (Com'I)
- FCT-A speed at 7.2 ns max. (Com'I)
- 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
- ESD > 2000V
- Fully compatible with TTL input and output logic levels
- Sink Current **64 mA (Com'I), 32 mA (Mil)**
- Source Current **32 mA (Com'I), 12 mA (Mil)**

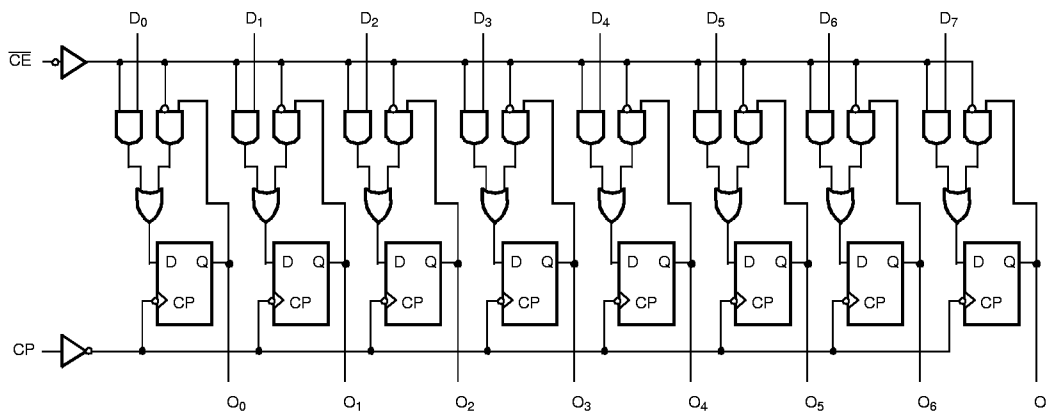
- Clock Enable for address and data synchronization application
- Eight edge-triggered D flip-flops
- Extended commercial range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

### Functional Description

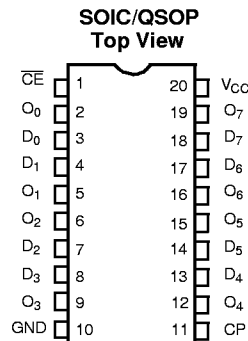
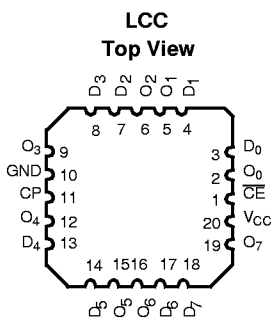
The FCT377T has eight triggered D-type flip-flops with individual D inputs. The common buffered clock inputs (CP) loads all flip-flops simultaneously when the Clock Enable (CE) is LOW. The register is fully edge-triggered. The state of each D input, one set-up time before the LOW-to-HIGH clock transition, is transferred to the corresponding flip-flop's O output. The  $\overline{\text{CE}}$  input must be stable only one set-up time prior to the LOW-to-HIGH clock transition for predictable operation.

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

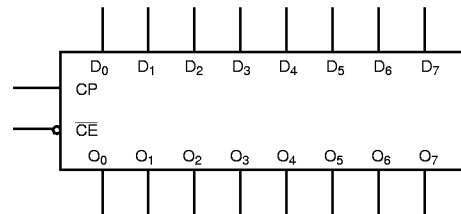
### Logic Block Diagram



### Pin Configurations



### Logic Symbol





Function Table<sup>[1]</sup>

Operating Mode	Inputs			Outputs
	CP	CE	D	O
Load "1"	┐	l	h	H
Load "0"	┐	l	l	L
Hold	┐ X	h H	X X	No Change No Change

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)

Maximum Ratings<sup>[2, 3]</sup>

(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

Operating Range

Range	Range	Ambient Temperature	V <sub>CC</sub>
Commercial	All	-40°C to +85°C	5V ± 5%
Military <sup>[4]</sup>	All	-55°C to +125°C	5V ± 10%

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	Min.	Typ. <sup>[5]</sup>	Max.	Unit	
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> =Min., I <sub>OH</sub> =-32 mA	Com'l	2.0		V	
		V <sub>CC</sub> =Min., I <sub>OH</sub> =-15 mA	Com'l	2.4	3.3	V	
		V <sub>CC</sub> =Min., I <sub>OH</sub> =-12 mA	Mil	2.4	3.3	V	
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> =Min., I <sub>OL</sub> =64 mA	Com'l		0.3	0.55	V
		V <sub>CC</sub> =Min., I <sub>OL</sub> =32 mA	Mil		0.3	0.55	V
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 <sup>[6]</sup>	All inputs		0.2		V	
V <sub>IK</sub>	Input Clamp Diode Voltage	V <sub>CC</sub> =Min., I <sub>IN</sub> =-18 mA		-0.7	-1.2	V	
I <sub>I</sub>	Input HIGH Current	V <sub>CC</sub> =Max., V <sub>IN</sub> =V <sub>CC</sub>			5	μA	
I <sub>IH</sub>	Input HIGH Current	V <sub>CC</sub> =Max., V <sub>IN</sub> =2.7V			±1	μA	
I <sub>IL</sub>	Input LOW Current	V <sub>CC</sub> =Max., V <sub>IN</sub> =0.5V			±1	μA	
I <sub>OS</sub>	Output Short Circuit Current <sup>[7]</sup>	V <sub>CC</sub> =Max., V <sub>OUT</sub> =0.0V	-60	-120	-225	mA	
I <sub>OFF</sub>	Power-Off Disable	V <sub>CC</sub> =0V., V <sub>OUT</sub> =4.5V			±1	μA	

Notes:

- H = HIGH Voltage Level  
 h = HIGH Voltage Level one set-up time prior to the LOW-to-HIGH Clock Transition  
 L = LOW Voltage Level  
 l = LOW Voltage Level one set-up time prior to the LOW-to-HIGH Clock Transition  
 X = Don't Care  
 Z = HIGH Impedance  
 ┐ = LOW-to-HIGH clock transition
- 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<sub>CC</sub> or ground.
- T<sub>A</sub> is the "instant on" case temperature.
- Typical values are at V<sub>CC</sub>=5.0V, T<sub>A</sub>=+25°C ambient.
- This parameter is guaranteed 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 parameter tests, I<sub>OS</sub> tests should be performed last.

**Capacitance<sup>[2]</sup>**

Parameter	Description	Typ. <sup>[5]</sup>	Max.	Unit
C <sub>IN</sub>	Input Capacitance	5	10	pF
C <sub>OUT</sub>	Output Capacitance	9	12	pF

**Power Supply Characteristics**

Parameter	Description	Test Conditions	Typ. <sup>[5]</sup>	Max.	Unit
I <sub>CC</sub>	Quiescent Power Supply Current	V <sub>CC</sub> =Max., V <sub>IN</sub> ≤0.2V, V <sub>IN</sub> ≥V <sub>CC</sub> -0.2V	0.1	0.2	mA
ΔI <sub>CC</sub>	Quiescent Power Supply Current (TTL inputs HIGH)	V <sub>CC</sub> =Max., V <sub>IN</sub> =3.4V, f <sub>1</sub> =0, Outputs Open <sup>[8]</sup>	0.5	2.0	mA
I <sub>CCD</sub>	Dynamic Power Supply Current <sup>[9]</sup>	V <sub>CC</sub> =Max., One Bit Toggling, 50% Duty Cycle, Outputs Open, $\overline{CE}$ =GND, V <sub>IN</sub> ≤0.2V or V <sub>IN</sub> ≥V <sub>CC</sub> -0.2V	0.06	0.12	mA/MHz
I <sub>C</sub>	Total Power Supply Current <sup>[10]</sup>	V <sub>CC</sub> =Max., f <sub>0</sub> =10 MHz, 50% Duty Cycle, Outputs Open, One Bit Toggling at f <sub>1</sub> =5 MHz, $\overline{CE}$ =GND, V <sub>IN</sub> ≤0.2V or V <sub>IN</sub> ≥V <sub>CC</sub> -0.2V	0.7	1.4	mA
		V <sub>CC</sub> =Max., f <sub>0</sub> =10 MHz, 50% Duty Cycle, Outputs Open, One Bit Toggling at f <sub>1</sub> =5 MHz, $\overline{CE}$ =GND, V <sub>IN</sub> =3.4V or V <sub>IN</sub> =GND	1.2	3.4	mA
		V <sub>CC</sub> =Max., f <sub>0</sub> =10 MHz, 50% Duty Cycle, Outputs Open, Eight Bits Toggling at f <sub>1</sub> =2.5 MHz, $\overline{CE}$ =GND, V <sub>IN</sub> ≤0.2V or V <sub>IN</sub> ≥V <sub>CC</sub> -0.2V	1.6	3.2 <sup>[11]</sup>	mA
		V <sub>CC</sub> =Max., f <sub>0</sub> =10 MHz, 50% Duty Cycle, Outputs Open, Eight Bits Toggling at f <sub>1</sub> =2.5 MHz, $\overline{CE}$ =GND, V <sub>IN</sub> =3.4V or V <sub>IN</sub> =GND	3.9	12.2 <sup>[11]</sup>	mA

**Notes:**

8. Per TTL driven input (V<sub>IN</sub>=3.4V); all other inputs at V<sub>CC</sub> or GND.
9. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
10. I<sub>C</sub> = I<sub>QUIESCENT</sub> + I<sub>INPUTS</sub> + I<sub>DYNAMIC</sub>  
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_0/2 + f_1 N_1)$   
 I<sub>CC</sub> = Quiescent Current with CMOS input levels  
 ΔI<sub>CC</sub> = 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 registered devices, otherwise zero  
 f<sub>1</sub> = Input signal frequency  
 N<sub>1</sub> = Number of inputs changing at f<sub>1</sub>  
 All currents are in milliamps and all frequencies are in megahertz.
11. Values for these conditions are examples of the I<sub>CC</sub> formula. These limits are guaranteed but not tested.



Switching Characteristics Over the Operating Range<sup>[12, 13]</sup>

Parameter	Description	FCT377T				FCT377AT				Unit	Fig. No. <sup>[14]</sup>
		Military		Commercial		Military		Commercial			
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Clock to Output	2.0	15.0	2.0	13.0	2.0	8.3	2.0	7.2	ns	1, 5
t <sub>S</sub>	Set-Up Time HIGH or LOW Data to CP	3.0		2.0		2.0		2.0		ns	4
t <sub>H</sub>	Hold Time HIGH or LOW Data to CP	2.5		1.5		1.5		1.5		ns	4
t <sub>W</sub>	Set-Up Time HIGH or LOW $\overline{CE}$ to CP	4.0		3.5		3.5		3.5		ns	4
t <sub>W</sub>	Set-Up Time HIGH or LOW $\overline{CE}$ to CP	1.5		1.5		1.5		1.5		ns	4
t <sub>W</sub>	Clock Pulse Width <sup>[15]</sup> HIGH or LOW	7.0		6.0		7.0		6.0		ns	6

Parameter	Description	FCT377CT				Unit	Fig. No. <sup>[14]</sup>
		Military		Commercial			
		Min.	Max.	Min.	Max.		
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Clock to Output	2.0	5.5	2.0	5.2	ns	1, 5
t <sub>S</sub>	Set-Up Time, HIGH or LOW, Data to CP	2.0		2.0		ns	4
t <sub>H</sub>	Hold Time, HIGH or LOW, Data to CP	1.5		1.5		ns	4
t <sub>W</sub>	Set-Up Time, HIGH or LOW, $\overline{CE}$ to CP	3.5		3.5		ns	4
t <sub>W</sub>	Set-Up Time HIGH or LOW, $\overline{CE}$ to CP	1.5		1.5		ns	4
t <sub>W</sub>	Clock Pulse Width <sup>[15]</sup> HIGH or LOW	7.0		6.0		ns	6

Notes:

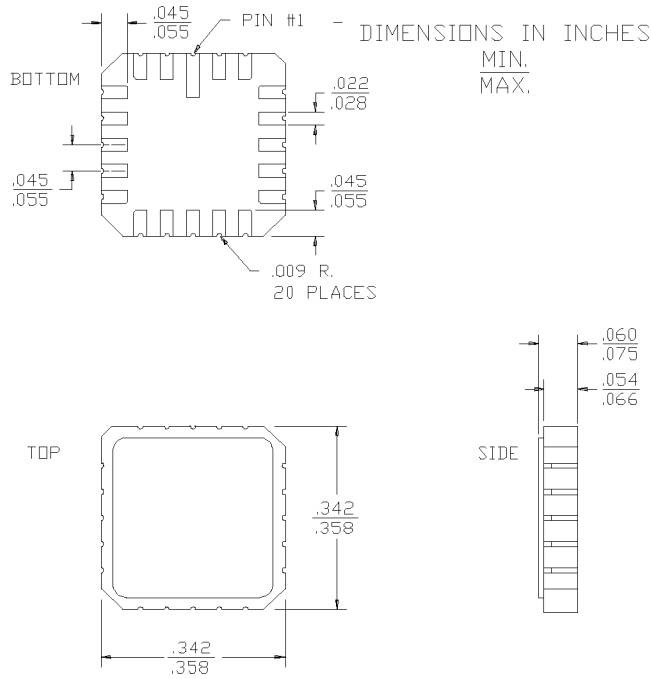
- 12. AC Characteristics guaranteed with C<sub>L</sub>=50 pF as shown in Figure 1 of the "Parameter Measurement Information" in the General Information section.
- 13. Minimum limits are guaranteed but not tested on Propagation Delays.
- 14. See "Parameter Measurement Information" in the General Information section.
- 15. With one data channel toggling, t<sub>W(L)</sub>=t<sub>W(H)</sub>=4.0 ns and t<sub>r</sub>=t<sub>f</sub>=1.0 ns.

Ordering Information—FCT377T

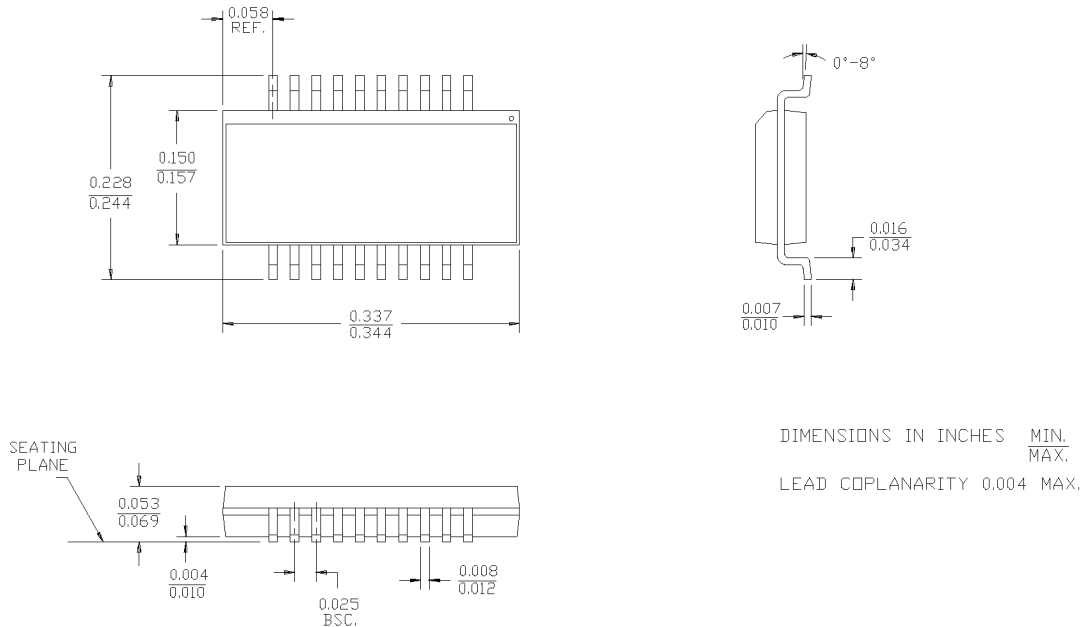
Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
5.2	CY74FCT377CTQC	Q5	20-Lead (150-Mil) QSOP	Commercial
	CY74FCT377CTSOC	S5	20-Lead (300-Mil) Molded SOIC	
5.5	CY54FCT377CTLMB	L61	20-Pin Square Leadless Chip Carrier	Military
7.2	CY74FCT377ATQC	Q5	20-Lead (150-Mil) QSOP	Commercial
	CY74FCT377ATSOC	S5	20-Lead (300-Mil) Molded SOIC	
13.0	CY74FCT377TQC	Q5	20-Lead (150-Mil) QSOP	Commercial
	CY74FCT377TSOC	S5	20-Lead (300-Mil) Molded SOIC	
15.0	CY54FCT377TLMB	L61	20-Pin Square Leadless Chip Carrier	Military

**Package Diagrams**

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



**20-Lead Quarter Size Outline Q5**



**Package Diagrams (continued)**
**20-Lead (300-Mil) Molded SOIC S5**
