



SCCS033 - May 1994 - Revised March 2000

8-/9-/10-Bit Bus Interface Registers

Features

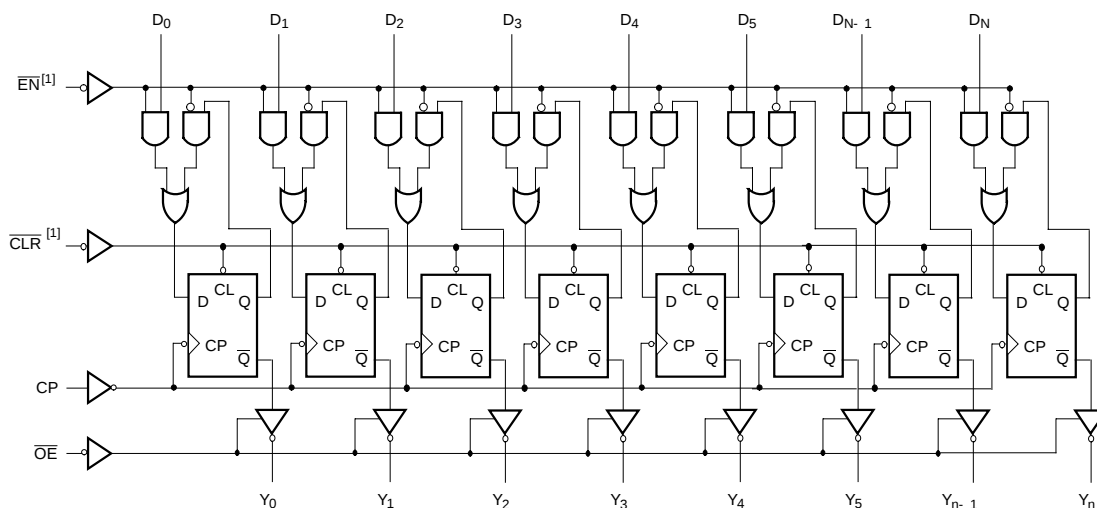
- Function, pinout, and drive compatible with FCT, F, and Am29821/23/25 logic
- FCT-C speed at 6.0 ns max.
FCT-B speed at 7.5 ns max.
- Reduced V_{OH} (typically = 3.3V) versions of equivalent FCT functions
- Edge-rate control circuitry for significantly improved noise characteristics
- Power-off disable feature
- Matched rise and fall times
- Fully compatible with TTL input and output logic levels
- ESD > 2000V
- Sink current 64 mA
Source current 32 mA
- High-speed parallel registers with positive edge-triggered D-type flip-flops
- Buffered common clock enable (EN) and asynchronous clear input (CLR)
- Extended commercial range of -40°C to $+85^{\circ}\text{C}$

Functional Description

These bus interface registers are designed to eliminate the extra packages required to buffer existing registers and provide extra data width for wider address/data paths or buses carrying parity. The FCT821T is a buffered, 10-bit wide version of the popular FCT374 function. The FCT823T is a 9-bit wide buffered register with clock enable (EN) and clear (CLR) ideal for parity bus interfacing in high-performance microprogrammed systems. The FCT825T is an 8-bit buffered register with all the FCT823T controls plus multiple enables ($\overline{OE}_1$, $\overline{OE}_2$, $\overline{OE}_3$) to allow multiuser control of the interface, e.g., CS, DMA, and $\overline{RD}/\overline{WR}$. They are ideal for use as an output port requiring high I_{OL}/I_{OH} .

These devices are designed for high-capacitance load drive capability, while providing low-capacitance bus loading at both inputs and outputs. Outputs are designed for low-capacitance bus loading in the high-impedance state and are designed with a power-off disable feature to allow for live insertion of boards.

Logic Block Diagram

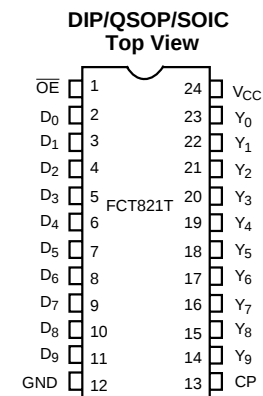
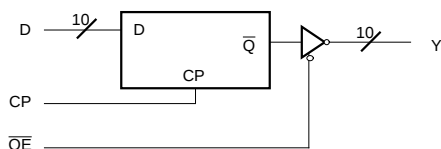


Note:

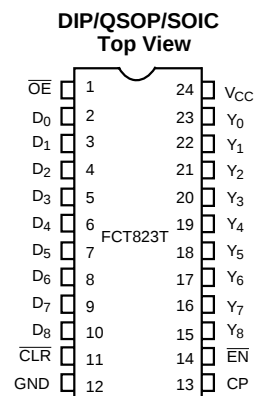
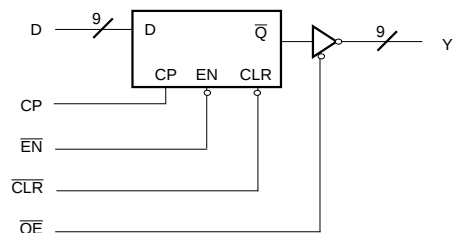
1. Not on FCT821.

Logic Diagrams

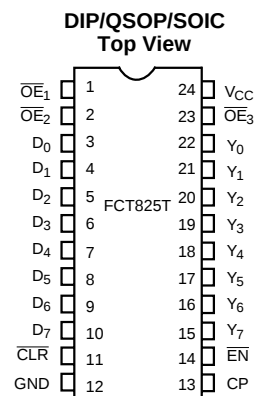
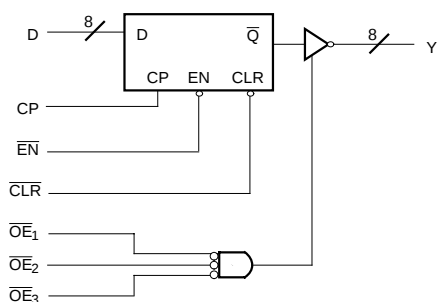
FCT821T (10-Bit Register)



FCT823T (9-Bit Register)



FCT825T (8-Bit Register)



Pin Description

Name	I/O	Description
D	I	The D flip-flop data inputs.
CLR	I	When $\overline{\text{CLR}}$ is LOW and $\overline{\text{OE}}$ is LOW, the Q outputs are LOW. When $\overline{\text{CLR}}$ is HIGH, data can be entered into the register.
CP	O	Clock Pulse for the register; enters data into the register on the LOW-to-HIGH transition.
Y	O	The register three-state outputs.
EN	I	Clock Enable. When $\overline{\text{EN}}$ is LOW, data on the D input is transferred to the Q output on the LOW-to-HIGH clock transition. When $\overline{\text{EN}}$ is HIGH, the Q outputs do not change state, regardless of the data or clock input transitions.
$\overline{\text{OE}}$	I	Output Control. When $\overline{\text{OE}}$ is HIGH, the Y outputs are in the high-impedance state. When $\overline{\text{OE}}$ is LOW, the TRUE register data is present at the Y outputs.

Function Table^[2]

Inputs					Internal Outputs		Function
$\overline{\text{OE}}$	$\overline{\text{CLR}}$	$\overline{\text{EN}}$	D	CP	Q	Y	
H	H	L	L	┐	L	Z	High Z
H	H	L	H	┐	H	Z	
H	L	X	X	X	L	Z	Clear
L	L	X	X	X	L	L	
H	H	H	X	X	NC	Z	Hold
L	H	H	X	X	NC	NC	
H	H	L	L	┐	L	Z	Load
H	H	L	H	┐	H	Z	
L	H	L	L	┐	L	L	
L	H	L	H	┐	H	H	

Maximum Ratings^[3,4]

(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%

Notes:

- H = HIGH Voltage Level, L = LOW Voltage Level, X = Don't Care, NC = No Change, ┐ = LOW-to-HIGH Transition, Z = HIGH Impedance.
- 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_{CC} or ground.

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	2.0			V
V _{OH}	Output HIGH Voltage	V _{CC} = Min., I _{OH} = -15 mA	2.4	3.3		V
V _{OL}	Output LOW Voltage	V _{CC} = Min., I _{OL} = 64 mA		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

Capacitance^[6]

Parameter	Description	Typ. ^[5]	Max.	Unit
C _{IN}	Input Capacitance	5	10	pF
C _{OUT}	Output Capacitance	9	12	pF

Notes:

- Typical values are at V_{CC}=5.0V, T_A=+25°C ambient.
- This parameter is specified 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_{OS} tests should be performed last.

Power Supply Characteristics

Parameter	Description	Test Conditions	Typ. ^[5]	Max.	Unit
I_{CC}	Quiescent Power Supply Current	$V_{CC}=\text{Max.}$, $V_{IN}\leq 0.2V$, $V_{IN}\geq V_{CC}-0.2V$	0.1	0.2	mA
ΔI_{CC}	Quiescent Power Supply Current (TTL inputs HIGH)	$V_{CC}=\text{Max.}$, $V_{IN}=3.4V$, ^[8] $f_1=0$, Outputs Open	0.5	2.0	mA
I_{CCD}	Dynamic Power Supply Current ^[9]	$V_{CC}=\text{Max.}$, One Bit Toggling, 50% Duty Cycle, Outputs Open, $\overline{OE}=\overline{EN}=\text{GND}$, $V_{IN}\leq 0.2V$ or $V_{IN}\geq V_{CC}-0.2V$	0.06	0.12	mA/MHz
I_C	Total Power Supply Current ^[10]	$V_{CC}=\text{Max.}$, $f_0=10\text{ MHz}$, 50% Duty Cycle, Outputs Open, One Bit Toggling at $f_1=5\text{ MHz}$, $\overline{OE}=\overline{EN}=\text{GND}$, $V_{IN}\leq 0.2V$ or $V_{IN}\geq V_{CC}-0.2V$	0.7	1.4	mA
		$V_{CC}=\text{Max.}$, $f_0=10\text{ MHz}$, 50% Duty Cycle, Outputs Open, One Bit Toggling at $f_1=5\text{ MHz}$, $\overline{OE}=\overline{EN}=\text{GND}$, $V_{IN}=3.4V$ or $V_{IN}=\text{GND}$	1.2	3.4	mA
		$V_{CC}=\text{Max.}$, $f_0=10\text{ MHz}$, 50% Duty Cycle, Outputs Open, Eight Bits Toggling at $f_1=2.5\text{ MHz}$, $\overline{OE}=\overline{EN}=\text{GND}$, $V_{IN}\leq 0.2V$ or $V_{IN}\geq V_{CC}-0.2V$	1.6	3.2 ^[11]	mA
		$V_{CC}=\text{Max.}$, $f_0=10\text{ MHz}$, 50% Duty Cycle, Outputs Open, Eight Bits Toggling at $f_1=2.5\text{ MHz}$, $\overline{OE}=\overline{EN}=\text{GND}$, $V_{IN}=3.4V$ or $V_{IN}=\text{GND}$	3.9	12.2 ^[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. $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_0/2 + f_1 N_1)$
 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.

Switching Characteristics Over the Operating Range^[12]

Param.	Description	Test Load	CY74FCT821AT CY74FCT823AT CY74FCT825AT		CY74FCT821BT CY74FCT823BT CY74FCT825BT		CY74FCT821CT CY74FCT823CT CY74FCT825CT		Unit	Fig. No. ^[13]
			Commercial		Commercial		Commercial			
			Min.	Max.	Min.	Max.	Min.	Max.		
t _{PLH} t _{PHL}	Propagation Delay CP to Y, ($\overline{\text{OE}}=\text{LOW}$)	C _L =50 pF R _L =500Ω		10.0		7.5		6.0	ns	1, 5
t _{PLH} t _{PHL}	Propagation Delay CP to Y, ($\overline{\text{OE}}=\text{LOW}$) ^[6]	C _L =300 pF R _L =500Ω		20.0		15.0		12.5	ns	1, 5
t _{PLH}	Propagation Delay CLR to Y	C _L =50 pF R _L =500Ω		14.0		9.0		8.0	ns	1, 5
t _{PZH} t _{PZL}	Output Enable Time $\overline{\text{OE}}$ to Y	C _L =50 pF R _L =500Ω		12.0		8.0		7.0	ns	1, 7, 8
t _{PZH} t _{PZL}	Output Enable Time $\overline{\text{OE}}$ to Y ^[6]	C _L =300 pF R _L =500Ω		23.0		15.0		12.5	ns	1, 7, 8
t _{PHZ} t _{PHL}	Output Disable Time $\overline{\text{OE}}$ to Y ^[6]	C _L =5 pF R _L =500Ω		7.0		6.5		6.0	ns	1, 7, 8
t _{PHZ} t _{PHL}	Output Disable Time $\overline{\text{OE}}$ to Y	C _L =50 pF R _L =500Ω		8.0		7.5		6.5	ns	1, 7, 8
t _{SU}	Data to CP, Set-Up Time	C _L =50 pF R _L =500Ω	4.0		3.0		3.0		ns	4
t _H	Data to CP, Hold Time		2.0		1.5		1.5		ns	4
t _{SU}	Enable $\overline{\text{EN}}$ to CP, Set-Up Time		4.0		3.0		3.0		ns	4
t _H	Enable $\overline{\text{EN}}$ to CP, Hold Time		2.0		0.0		0.0		ns	4
t _{REM}	Clear Recovery Time, CLR to CP		6.0		6.0		6.0		ns	6
t _W	Clock Pulse Width		7.0		6.0		6.0		ns	5
t _W	$\overline{\text{CLR}}$ Pulse Width LOW		6.0		6.0		6.0		ns	5

Notes:

12. Minimum limits are specified but not tested on Propagation Delays.
13. See "Parameter Measurement Information."

Ordering Information—FCT821T

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
6.0	CY74FCT821CTQCT	Q13	24-Lead (150-Mil) QSOP	Commercial
	CY74FCT821CTSOC/SOCT	S13	24-Lead (300-Mil) Molded SOIC	
7.5	CY74FCT821BTPC	P13/13A	24-Lead (300-Mil) Molded DIP	Commercial
	CY74FCT821BTSOC/SOCT	S13	24-Lead (300-Mil) Molded SOIC	
10.0	CY74FCT821ATQCT	Q13	24-Lead (150-Mil) QSOP	Commercial
	CY74FCT821ATSOC/SOCT	S13	24-Lead (300-Mil) Molded SOIC	

Ordering Information—FCT823T

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
6.0	CY74FCT823CTQCT	Q13	24-Lead (150-Mil) QSOP	Commercial
	CY74FCT823CTSOC/SOCT	S13	24-Lead (300-Mil) Molded SOIC	
7.5	CY74FCT823BTPC	P13/13A	24-Lead (300-Mil) Molded DIP	Commercial
10.0	CY74FCT823ATPC	P13/13A	24-Lead (300-Mil) Molded DIP	Commercial
	CY74FCT823ATQCT	Q13	24-Lead (150-Mil) QSOP	
	CY74FCT823ATSOC/SOCT	S13	24-Lead (300-Mil) Molded SOIC	

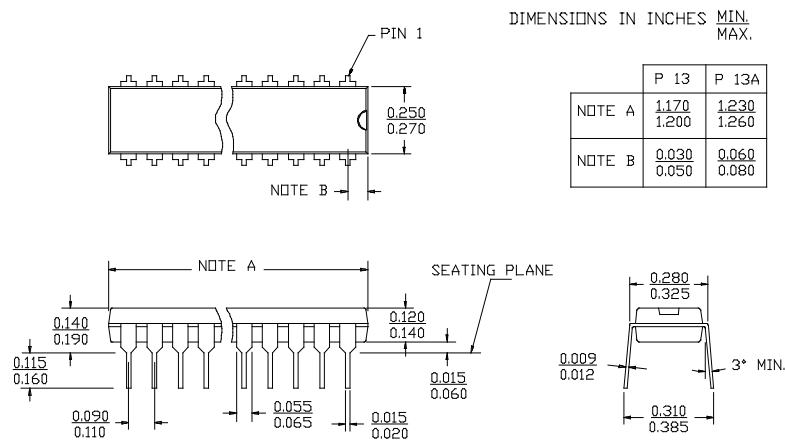
Ordering Information—FCT825T

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
6.0	CY74FCT825CTQCT	Q13	24-Lead (150-Mil) QSOP	Commercial

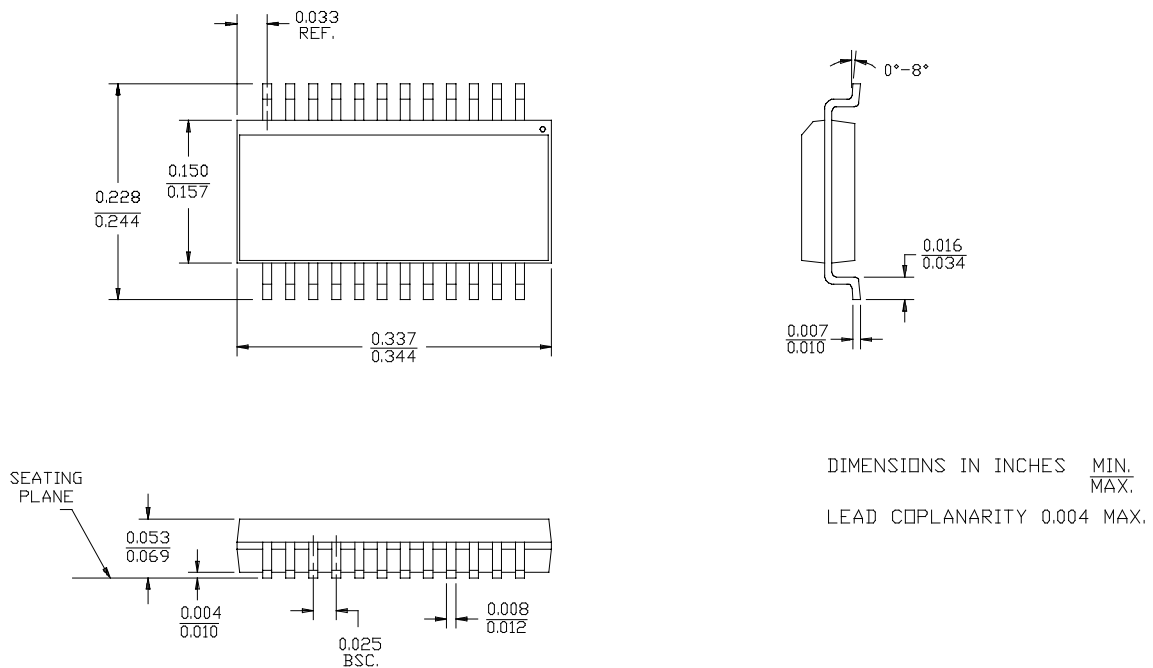
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Package Diagrams

24-Lead (300-Mil) Molded DIP P13/P13A

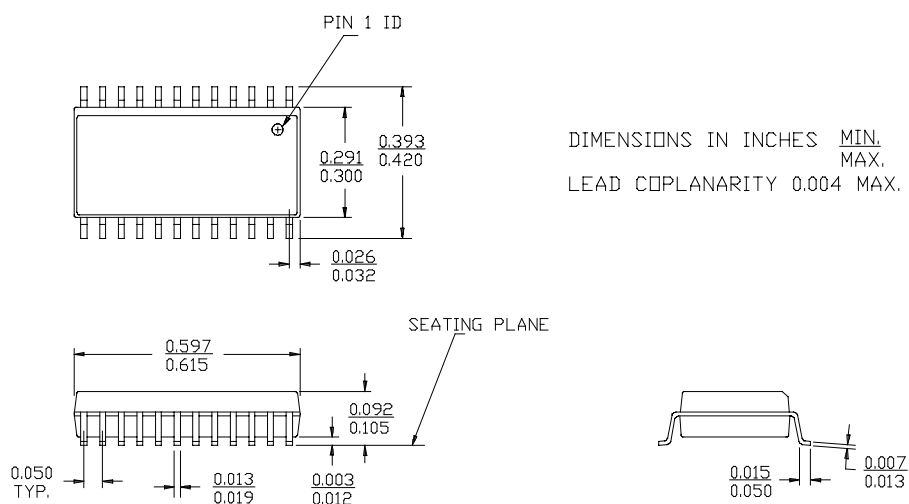


24-Lead Quarter Size Outline Q13



Package Diagrams (continued)

24-Lead (300-Mil) Molded SOIC S13



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