



High-Speed CMOS Bus Interface 9- and 10-Bit Registers

QS54/74FCT821T
QS54/74FCT823T
QS54/74FCT2821T
QS54/74FCT2823T

FEATURES/BENEFITS

- Pin and function compatible to the 74F821/3, 74FCT821/3 and 74FCT821T/3T
- Industrial temperature -40°C to 85°C
- CMOS power levels: $<7.5\text{mW}$ static
- Available in DIP, SOIC, QSOP, ZIP, HQSOP
- Undershoot clamp diodes on all inputs
- TTL-compatible input and output levels
- Ground bounce controlled outputs
- Reduced output swing of 0-3.5V
- Military product compliant to MIL-STD-883, Class B

FCT 821T, 823T

- JEDEC-FCT spec compatible
- $I_{OL} = 48\text{mA Ind.}, 32\text{mA Mil.}$

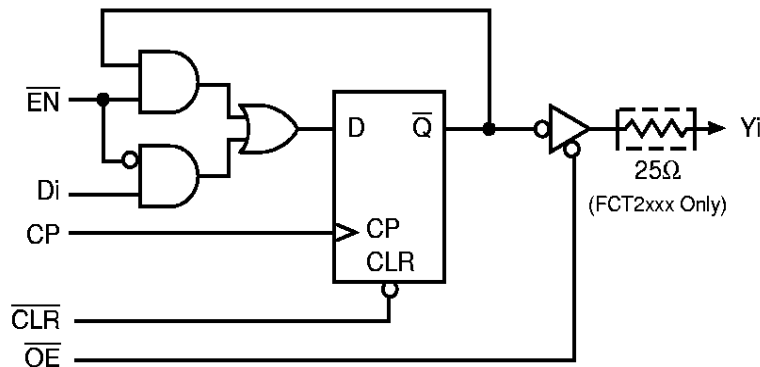
FCT 2821T, 2823T

- Built-in 25Ω series resistor outputs reduce reflection and other system noise
- $I_{OL} = 12\text{mA Ind.}$

DESCRIPTION

The QSFCT821T/823T and QSFCT2821T/2823T are 10- and 9-bit high-speed CMOS TTL-compatible buffered registers with three-state outputs that are ideal for driving high capacitance loads such as memory and address buses. The 2821/3 devices are 25Ω resistor output versions useful for driving transmission lines and reducing system noise. The 2821/3 series parts can replace the 821/3 series to reduce noise in an existing design. All inputs have clamp diodes for undershoot noise suppression. All outputs have ground bounce suppression (see QSI Application Note AN-001), and outputs will not load an active bus when V_{CC} is removed from the device.

Figure 1. Functional Block Diagram



FCT821/2821 - 10-BIT REGISTER

Figure 2. Pin Configurations (All Pins Top View)

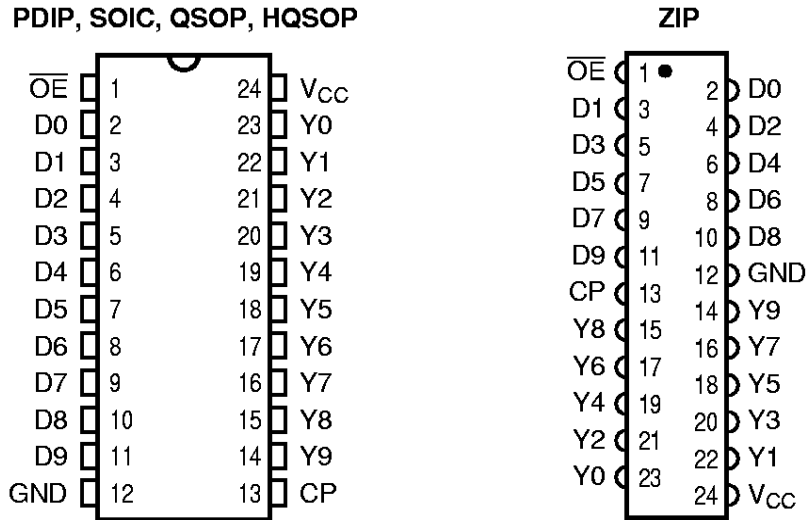
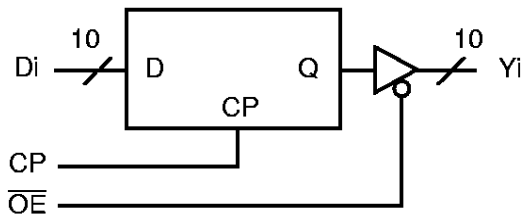


Table 1. Pin Description

Name	I/O	Description
D _i	I	Data Inputs
Y _i	O	Data Outputs-Three State
CP	I	Clock Pulse
\overline{OE}	I	Output Enable

Figure 3. FCT821 Logic Symbol



FCT823/2823 - 9-BIT REGISTER

Figure 4. Pin Configurations (All Pins Top View)

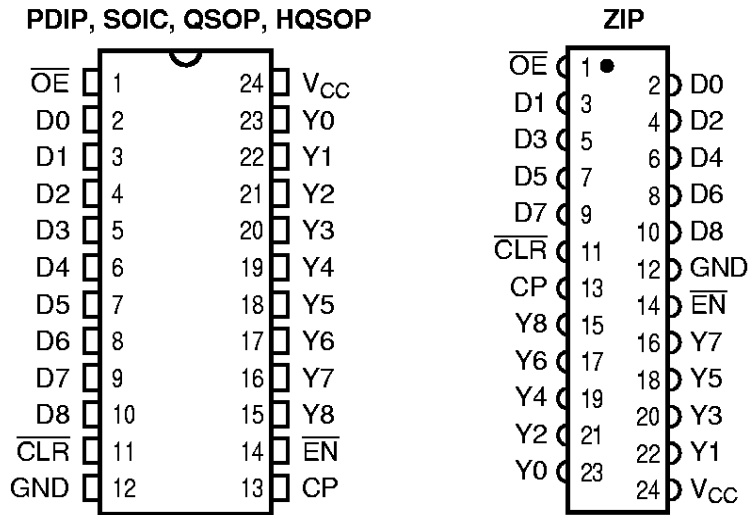


Table 2. Pin Description

Name	I/O	Description
D _i	I	Data Inputs
Y _i	O	Data Outputs-Three State
\overline{OE}	I	Output Enable
CP	I	Clock Pulse
\overline{EN}	I	Clock Enable
\overline{CLR}	I	Asynchronous Reset

Figure 5. FCT823 Logic Symbol

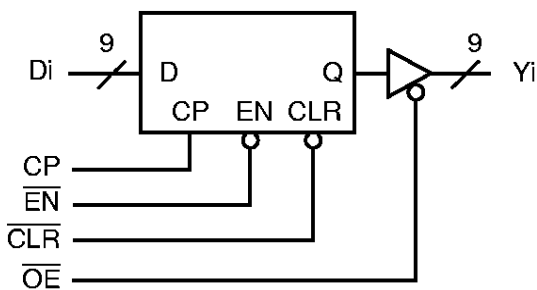


Table 3. Function Table

Inputs					Int.	O/P	Function
\overline{OE}	\overline{CLR}	\overline{EN}	Di	CP	Qi	Yi	
H	X	L	L	↑	L	Hi-Z	High Z
H	X	L	H	↑	H	Hi-Z	High Z
H	L	X	X	X	L	Hi-Z	Clear
L	L	X	X	X	L	L	Clear
H	H	H	X	X	NC	Hi-Z	Hold
L	H	H	X	X	NC	NC	Hold
H	H	L	L	↑	L	Hi-Z	Load
H	H	L	H	↑	H	Hi-Z	Load
L	H	L	L	↑	L	L	Load
L	H	L	H	↑	H	H	Load

Note: For the 821, the HI-Z and Load functions only apply as the \overline{EN} and \overline{CLR} are not present in these devices.

Table 4. Absolute Maximum Ratings

Supply Voltage to Ground	-0.5V to 7.0V
DC Output Voltage V_{OUT}	-0.5V to 7.0V
DC Input Voltage V_{IN}	-0.5V to 7.0V
AC Input Voltage (for a pulse width ≤ 20 ns)	-3.0V
DC Input Diode Current with $V_{IN} < 0$	-20mA
DC Output Diode Current with $V_{OUT} < 0$	-50mA
DC Output Current Max. Sink Current/Pin	120mA
Maximum Power Dissipation	0.5 watts
T_{STG} Storage Temperature	-65° to 150°C

Note: Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to QSI devices that result in functional or reliability type failures.

Table 5. Capacitance⁽¹⁾

$T_A = 25^\circ\text{C}$, $f = 1\text{MHz}$, $V_{IN} = 0\text{V}$, $V_{OUT} = 0\text{V}$

Pins ⁽²⁾	SOIC	QSOP	PDIP	ZIP	Unit
1, 3-11, 13	4	4	5	7	pF
15-22	6	6	7	9	pF
2, 14, 23	8	8	9	10	pF

Notes:

1. Capacitance is characterized but not tested.
2. Pin reference for 24-pin package.

Table 6. Power Supply Characteristics

Symbol	Parameter	Test Conditions ⁽¹⁾	Min	Max	Unit
I_{CC}	Quiescent Power Supply Current	$V_{CC} = \text{Max.}$, freq = 0 $0V \leq V_{IN} \leq 0.2V$ or $V_{CC}-0.2V \leq V_{IN} \leq V_{CC}$	—	1.5	mA
ΔI_{CC}	Supply Current per Input @ TTL HIGH	$V_{CC} = \text{Max.}$, $V_{IN} = 3.4V$, freq = 0 ⁽²⁾	—	2.0	mA
Q_{CCD}	Supply Current per Input per MHz	$V_{CC} = \text{Max.}$, Outputs open and enabled One bit toggling @ 50% duty cycle Other inputs at GND or V_{CC} ^(3,4)	—	0.25	mA/ MHz

Notes:

1. For conditions shown as Min. or Max., use the appropriate values specified under DC specifications.
2. Per TTL driven input ($V_{IN} = 3.4V$).
3. For flip-flops, Q_{CCD} is measured by switching one of the data input pins so that the output changes every clock cycle. This is a measurement of device power consumption only and does not include power to drive load capacitance or tester capacitance. This parameter is guaranteed by design but not tested.
4. I_C can be computed using the above parameters as explained in the Technical Overview section.

Table 7. DC Electrical Characteristics Over Operating Range

Industrial $T_A = -40^\circ\text{C}$ to 85°C , $V_{CC} = 5.0V \pm 5\%$

Military $T_A = -55^\circ\text{C}$ to 125°C , $V_{CC} = 5.0V \pm 10\%$

Symbol	Parameter	Test Conditions	Min	Typ ⁽¹⁾	Max	Unit
V_{IH}	Input HIGH Voltage	Logic HIGH for All Inputs	2.0	—	—	V
V_{IL}	Input LOW Voltage	Logic LOW for All Inputs	—	—	0.8	V
ΔV_T	Input Hysteresis	$V_{TLH} - V_{THL}$ for All Inputs	—	0.2	—	V
$ I_{IH} $ $ I_{IL} $	Input Current Input HIGH or LOW	$V_{CC} = \text{Max.}$, $0 \leq V_{IN} < V_{CC}$	—	—	5	μA
$ I_{OZ} $	Off-State Output Current (Hi-Z)	$V_{CC} = \text{Max.}$, $0 \leq V_{IN} \leq V_{CC}$	—	—	5	μA
I_{OS}	Short Circuit Current (FCTXXX)	$V_{CC} = \text{Max.}$, $V_{OUT} = \text{GND}$ ^(2,3)	-60	—	—	mA
I_{OR}	Current Drive (FCT2XXX)	$V_{CC} = \text{Min.}$, $V_{OUT} = 2.0V$ ⁽³⁾	50	—	—	mA
V_{IC}	Input Clamp Voltage	$V_{CC} = \text{Min.}$, $I_{IN} = -18\text{mA}$, $T_A = 25^\circ\text{C}$ ⁽³⁾	—	-0.7	-1.2	V
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min.}$ $I_{OH} = -15\text{mA}$ (MIL) $I_{OH} = -24\text{mA}$ (IND)	2.4 2.4	— —	— —	V
V_{OL}	Output LOW Voltage (FCTXXX)	$V_{CC} = \text{Min.}$ $I_{OL} = 32\text{mA}$ (MIL) $I_{OL} = 48\text{mA}$ (IND)	— —	— —	0.50 0.50	V
V_{OL}	Output LOW Voltage (FCT2XXX- 25 Ω)	$V_{CC} = \text{Min.}$ $I_{OL} = 12\text{mA}$ (MIL) $I_{OL} = 12\text{mA}$ (IND)	— —	— —	0.50 0.50	V
R_{OUT}	Output Resistance (FCT2XXX- 25 Ω)	$V_{CC} = \text{Min.}$ $I_{OL} = 12\text{mA}$ (MIL) $I_{OL} = 12\text{mA}$ (IND)	— 20	25 28	— 40	Ω

Notes:

1. Typical values indicate $V_{CC} = 5.0V$ and $T_A = 25^\circ\text{C}$.
2. Not more than one output should be shorted and the duration is ≤ 1 second.
3. These parameters are guaranteed by design but not tested.

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Table 8. Switching Characteristics Over Operating Range

Industrial $T_A = -40^\circ\text{C}$ to 85°C , $V_{CC} = 5.0\text{V} \pm 5\%$ Military $T_A = -55^\circ\text{C}$ to 125°C , $V_{CC} = 5.0\text{V} \pm 10\%$
 $C_{LOAD} = 50\text{pF}$, $R_{LOAD} = 500\Omega$ unless otherwise noted.

Symbol	Description ⁽¹⁾		821A 823A 2821A 2823A		821B 823B 2821B 2823B		821C 823C		821D 823D		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
t_{PHL} t_{PLH}	Clock to Y Delay $\overline{OE} = \text{LOW}$, 821/3	Ind Mil	— —	10 11.5	— —	7.5 8.5	— —	6.0 7.0	— —	5.3 —	ns
t_{PHL} t_{PLH}	Clock to Y Delay ^(2,3) $\overline{OE} = \text{LOW}$, 821/3	Ind Mil	— —	20 20	— —	15 16	— —	12.5 13.5	— —	12.5 —	ns
t_{PHL} t_{PLH}	Clock to Y Delay $\overline{OE} = \text{LOW}$, 2821/3	Ind Mil	— —	10 11.5	— —	7.5 8.5	— —	6.0 —	— —	5.3 —	ns
t_{PHL} t_{PLH}	Clock to Y Delay ^(2,3) $\overline{OE} = \text{LOW}$, 2821/3	Ind Mil	— —	20 20	— —	15 16	— —	12.5 —	— —	12.5 —	ns
t_S	Data to CP Setup Time	Ind Mil	4.0 4.0	— —	3.0 3.0	— —	3.0 3.0	— —	3.0 —	— —	ns
t_H	Data to CP Hold Time	Ind Mil	2.0 2.0	— —	1.5 1.5	— —	1.5 1.5	— —	1.5 —	— —	ns
t_{ENS}	\overline{EN} to CP Setup Time	Ind Mil	4.0 4.0	— —	3.0 3.0	— —	3.0 3.0	— —	3.0 —	— —	ns
t_{ENH}	\overline{EN} to CP Hold Time	Ind Mil	2.0 2.0	— —	0.0 0.0	— —	0.0 0.0	— —	0.0 —	— —	ns

Notes:

1. See Test Circuit and Waveforms.
2. This parameter is guaranteed by design but not tested.
3. $C_{LOAD} = 300\text{pF}$

Table 9. Timing Requirements Over Operating Range

Industrial $T_A = -40^\circ\text{C}$ to 85°C , $V_{CC} = 5.0\text{V} \pm 5\%$ Military $T_A = -55^\circ\text{C}$ to 125°C , $V_{CC} = 5.0\text{V} \pm 10\%$
 $C_{LOAD} = 50\text{pF}$, $R_{LOAD} = 500\Omega$ unless otherwise noted.

Symbol	Description ⁽¹⁾		821A 823A 2821A 2823A		821B 823B 2821B 2823B		821C 823C		821D 823D		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
t_{CLR}	\overline{CLR} to Y Delay 823	Ind Mil	— —	11 12	— —	9.0 9.5	— —	8.0 8.5	— —	7.0 —	ns
t_{CLR}	\overline{CLR} to Y Delay 2823	Ind Mil	— —	11 12	— —	9.0 9.5	— —	8.0 —	— —	7.0 —	ns
t_{REC}	\overline{CLR} to CP Setup Time	Ind Mil	6.0 7.0	— —	6.0 6.0	— —	6.0 6.0	— —	6.0 —	— —	ns
t_{PWH} t_{PWL}	Clock Pulse Width ⁽²⁾ HIGH or LOW	Ind Mil	7.0 7.0	— —	6.0 6.0	— —	6.0 6.0	— —	6.0 —	— —	ns
t_{PZH} t_{PZL}	Output Enable Time \overline{OE} to Yi, 821/3	Ind Mil	— —	12 13	— —	8.0 9.0	— —	7.0 8.0	— —	6.5 —	ns
t_{PZH} t_{PZL}	Output Enable Time ^(2,3) \overline{OE} to Yi, 821/3	Ind Mil	— —	23 25	— —	15 16	— —	12.5 13.5	— —	12.5 —	ns
t_{PZH} t_{PZL}	Output Enable Time \overline{OE} to Yi, 2821/3	Ind Mil	— —	12 13	— —	8.0 9.0	— —	7.0 —	— —	6.5 —	ns
t_{PZH} t_{PZL}	Output Enable Time ^(2,3) \overline{OE} to Yi, 2821/3	Ind Mil	— —	23 25	— —	— —	— —	— —	— —	— —	ns
t_{PHZ} t_{PLZ}	Output Disable Time ^(2,4) \overline{OE} to Yi	Ind Mil	— —	7.0 8.0	— —	6.5 7.0	— —	6.2 6.2	— —	6.2 —	ns
t_{PHZ} t_{PLZ}	Output Disable Time ⁽²⁾ \overline{OE} to Yi	Ind Mil	— —	9.0 10	— —	7.5 8.0	— —	6.5 6.5	— —	6.5 —	ns

Notes:

1. See Test Circuit and Waveforms.
2. This parameter is guaranteed by design but not tested.
3. $C_{LOAD} = 300\text{pF}$.
4. $C_{LOAD} = 5\text{pF}$.