CY29FCT818T
DIAGNOSTIC SCAN REGISTER

FEATURES

- **Function, Pinout and Drive Compatible with the FCT, F Logic and AM29818**
- **FCT-C speed at 6.0ns max. (Com'l) FCT-B speed at 7.5ns max. (Com'l)**
- **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**
- **64 mA Sink Current (Com'l), 20 mA (Mil) 15 mA Source Current (Com'l), 3 mA (Mil)**
- **8-Bit Pipeline and Shadow Register**

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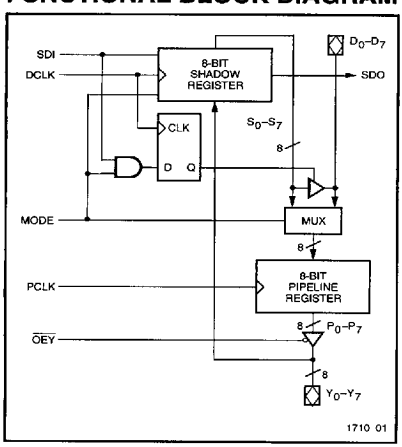
DESCRIPTION

The 'FCT818T contain a high speed 8-bit general-purpose data pipeline register and a high speed 8-bit shadow register. The general-purpose register can be used in an 8-bit wide data path for a normal system application. The shadow register is designed for applications, such as diagnostics in sequential circuits, where it is desirable to load known data at a specific location in the circuit and to read the data at that location.

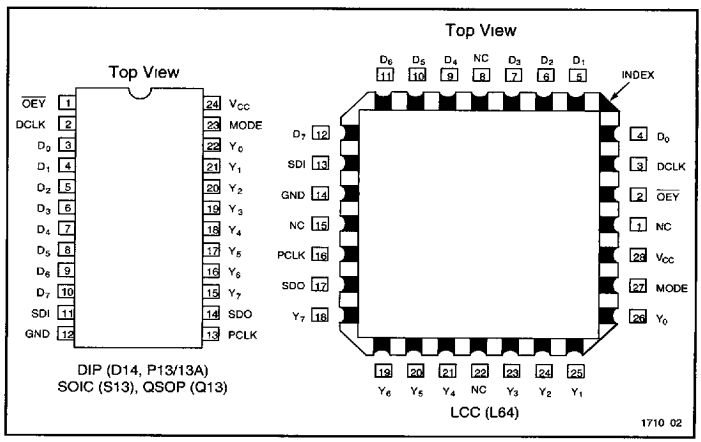
The shadow registers can load data from the output of the 'FCT818T, and can be used as a right-shift register with bit-serial input SDI and output SDO, using DCLK. The data register input is multiplexed to enable loading from the shadow register or from the data input pins using PCLK. Note that data can be loaded simultaneously from the shadow register to the pipeline register, and from the pipeline register to the shadow register provided set-up and hold time requirements are satisfied with respect to the two independent clock inputs.

In a typical application, the general-purpose register in the 'FCT818T replaces an 8-bit data register in the normal data path of a system. The shadow register is placed in an auxiliary bit-serial loop which is used for diagnostics. During diagnostic operation, data is shifted serially into the shadow register, then transferred to the general-purpose register to load a known value into the data path. To read the contents at that point in the data path, the data is transferred from the data register into the shadow register, then shifted serially in the auxiliary diagnostic loop to make it accessible to the diagnostics controller. This data is then compared with the expected value to diagnose faulty operation of the sequential circuit.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATIONS



The contents of the shadow register can also be output by enabling the 8-bit wide D input/output port. In an application such as micro-program testing, the microinstruction register is formed using the general-purpose registers of 'FCT818T devices with cascaded shadow registers. To modify the microinstruction register, the corrected instruction word is shifted serially into the shadow registers and then transferred into the data registers. This word is also loaded easily into the Writeable Control Store (WCS) by enabling the D output from the shadow registers.

DC ELECTRICAL CHARACTERISTICS (Over recommended operating conditions)

Symbol	Parameter		Min	Typ[1]	Max	Units	V_{CC}	Conditions
V_{IH}	Input HIGH Voltage		2.0			V		
V_{IL}	Input LOW Voltage				0.8	V		
V_H	Hysteresis			0.2		V		All inputs
V_{IK}	Input Clamp Diode Voltage			–0.7	–1.2	V	MIN	I_{IN} = –18mA
V_{OH}	Output HIGH Voltage	Military	2.4	3.3		V	MIN	I_{OH} = –3mA
		Commercial	2.4	3.3		V	MIN	I_{OH} = –15mA
V_{OL}	Output LOW Voltage	Military		0.3	0.5	V	MIN	I_{OL} = 20mA
		Commercial		0.3	0.5	V	MIN	I_{OL} = 24mA
		Commercial		0.3	0.5	V	MIN	I_{OL} = 64mA
I_I	Input HIGH Current				5	µA	MAX	$V_{IN} = V_{CC}$
I_{IH}	Input HIGH Current				5	µA	MAX	V_{IN} = 2.7V
I_{IL}	Input LOW Current				–5	µA	MAX	V_{IN} = 0.5V
I_{OZH}	Off State I_{OUT} HIGH-Level Output Current				10	µA	MAX	V_{OUT} = 2.7V
I_{OZL}	Off State I_{OUT} LOW-Level Output Current				–10	µA	MAX	V_{OUT} = 0.5V
I_{OS}	Output Short Circuit Current[2]		–60	–120	–225	mA	MAX	V_{OUT} = 0.0V
I_{OFF}	Power-off Disable				100	µA	0V	V_{OUT} = 4.5V
C_{IN}	Input Capacitance[3]			5	10	pF	MAX	All inputs
C_{OUT}	Output Capacitance[3]			9	12	pF	MAX	All outputs
I_{CC}	Quiescent Power Supply Current			0.2	1.5	mA	MAX	$V_{IN} \leq 0.2V$, $V_{IN} \geq V_{CC} - 0.2V$

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Notes:

1. Typical values are at V_{CC} = 5.0V, T_A = +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_{OS} tests should be performed last.
3. This parameter is guaranteed but not tested.

ABSOLUTE MAXIMUM RATINGS[1,2]

Symbol	Parameter	Value	Unit
T_{STG}	Storage Temperature	–65 to +150	°C
T_A	Ambient Temperature Under Bias	–65 to +135	°C
V_{CC}	V_{CC} Potential to Ground	–0.5 to +7.0	V
P_T	Power Dissipation	0.5	W

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Symbol	Parameter	Value	Unit
I_{OUTPUT}	Current Applied to Output	120	mA
V_{IN}	Input Voltage	–0.5 to +7.0	V
V_{OUT}	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_{CC} or ground.

RECOMMENDED OPERATING CONDITIONS

Free Air Ambient Temperature	Min.	Max.
Military	–55°C	+125°C
Commercial	0°C	+70°C

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Supply Voltage (V_{CC})	Min.	Max.
Military	+4.5V	+5.5V
Commercial	+4.75V	+5.25V

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

Symbol	Parameter	Typ.[1]	Max.	Units	Conditions
ΔI_{CC}	Quiescent Power Supply Current (TTL inputs)[2]	0.5	2.0	mA	V_{CC} = MAX, Outputs Open, f_1 = 0, V_{IN} = 3.4V
I_{CCD}	Dynamic Power Supply Current[3]		0.25	mA/ MHz	V_{CC} = MAX, One Input Toggling, 50% Duty Cycle, Outputs Open, $\overline{OEY}$ = GND, $V_{IN} \le 0.2V$ or $V_{IN} \ge V_{CC} - 0.2V$
I_C	Total Power Supply Current[6]		5.3	mA	V_{CC} = MAX, f_0 = 10MHz, 50% Duty Cycle, Outputs Open, One Bit Toggling at f_1 = 5MHz, $\overline{OEY}$ = GND, $V_{IN} \le 0.2V$ or $V_{IN} \ge V_{CC} - 0.2V$
			7.3	mA	V_{CC} = MAX, f_0 = 10MHz, 50% Duty Cycle, Outputs Open, One Bit Toggling at f_1 = 5MHz, $\overline{OEY}$ = GND, V_{IN} = 3.4V or V_{IN} = GND
			17.8[4]	mA	V_{CC} = MAX, f_0 = 10MHz, 50% Duty Cycle, Outputs Open, Eight Bits and Four Controls Toggling, $\overline{OEY}$ = GND, f_1 = 5MHz, $V_{IN} \le 0.2V$ or $V_{IN} \ge V_{CC} - 0.2V$
			30.8[4]	mA	V_{CC} = MAX, f_0 = 10MHz, 50% Duty Cycle, Outputs Open, Eight Bits and Four Controls Toggling, $\overline{OEY}$ = GND, f_1 = 5MHz, V_{IN} = 3.4V or V_{IN} = GND

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Notes:

1. Typical values are at V_{CC} = 5.0V, +25°C ambient.
2. Per TTL driven input (V_{IN} = 3.4V); all other inputs at V_{CC} or GND.
3. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
4. Values for these conditions are examples of the I_{CC} formula. These limits are guaranteed but not tested.
5. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD}(f_0/2 + f_1 N_1)$
   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 Register Devices (Zero for Non-Register Devices)
   f_1 = Input Frequency
   N_1 = Number of Inputs at f_1
   All currents are in milliamps and all frequencies are in megahertz.

AC CHARACTERISTICS (Over recommended operating conditions)

Symbol	Parameter	'FCT818T				'FCT818AT				Units	Fig. No.*
		MIL		COM'L		MIL		COM'L			
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
t_{PD}	PCLK TO Yx	—	18	—	13	—	12	—	9	ns	5
	MODE to SDO	—	18	—	16	—	18	—	16	ns	6
	SDI to SDO	—	18	—	16	—	18	—	15	ns	3
	DCLK to SDO	—	30	—	25	—	30	—	25	ns	5
t_S	Dx to PCLK	10	—	8	—	6	—	4	—	ns	4
	MODE to PCLK	15	—	15	—	15	—	15	—	ns	
	Yx to DCLK	5	—	5	—	5	—	5	—	ns	
	MODE to DCLK	12	—	12	—	12	—	12	—	ns	
	SDI to DCLK	10	—	10	—	10	—	10	—	ns	
	DCLK to PCLK	15	—	15	—	15	—	15	—	ns	
	PCLK to DCLK	45	—	40	—	45	—	40	—	ns	
t_H	Dx to PCLK	2	—	2	—	2	—	2	—	ns	4
	MODE to PCLK	0	—	0	—	0	—	0	—	ns	
	Yx to DCLK	5	—	5	—	5	—	5	—	ns	
	MODE to DCLK	5	—	2	—	5	—	2	—	ns	
	SDI to DCLK	0	—	0	—	0	—	0	—	ns	
t_{PLZ}	$\overline{OEY}$ to Yx	—	20	—	15	—	20	—	15	ns	7
	DCLK to Dx	—	45	—	45	—	45	—	45	ns	5
t_{PHZ}	$\overline{OEY}$ to Yx	—	30	—	25	—	30	—	25	ns	8
	DCLK to Dx	—	90	—	85	—	90	—	80	ns	5
t_{PZL}	$\overline{OEY}$ to Yx	—	20	—	15	—	20	—	15	ns	7
	DCLK to Dx	—	35	—	30	—	35	—	25	ns	5
t_{PZH}	$\overline{OEY}$ to Yx	—	20	—	15	—	20	—	15	ns	8
	DCLK to Dx	—	30	—	25	—	30	—	25	ns	5
t_W	PCLK (High and Low)	15	—	15	—	15	—	10	—	ns	5
	DCLK (High and Low)	25	—	25	—	25	—	15	—	ns	5

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Notes:
AC Characteristics guaranteed with C_L = 50pF as shown in Figure 1.
*See "Parameter Measurement Information" in the General Information Section.

AC CHARACTERISTICS (Over recommended operating conditions)

Symbol	Parameter	'FCT818BT				'FCT818CT				Units	Fig. No.*
		MIL		COM'L		MIL		COM'L			
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
t_{PD}	PCLK TO Yx	—	9.0	—	7.5	---	7.6	---	6.0	ns	5
	MODE to SDO	—	10.5	—	9.0	---	8.9	---	7.2	ns	6
	SDI to SDO	—	10.5	—	9.0	---	8.9	---	7.1	ns	3
	DCLK to SDO	—	10.5	—	9.0	---	8.9	---	7.2	ns	5
t_S	Dx to PCLK	4.5	—	3.0	—	3.0	---	2.0	---	ns	4
	MODE to PCLK	6.5	—	5.0	—	5.0	---	3.5	---	ns	
	Yx to DCLK	4.5	—	3.0	—	3.0	---	2.0	---	ns	
	MODE to DCLK	6.5	—	5.0	—	5.0	---	3.5	---	ns	
	SDI to DCLK	6.5	—	5.0	—	5.0	---	3.5	---	ns	
	DCLK to PCLK	6.5	—	5.0	—	5.0	---	3.5	---	ns	
	PCLK to DCLK	12.5	—	11.0	—	11.0	---	8.5	---	ns	
t_H	Dx to PCLK	2	—	2	—	2.0	---	1.5	---	ns	4
	MODE to PCLK	0	—	0	—	0	---	0	---	ns	
	Yx to DCLK	3	—	2	—	3.0	---	1.5	---	ns	
	MODE to DCLK	3	—	2	—	3.0	---	1.5	---	ns	
	SDI to DCLK	0	—	0	—	0	---	0	---	ns	
t_{PLZ}	$\overline{OEY}$ to Yx	—	8.5	—	7.0	---	7.0	---	5.5	ns	7
	DCLK to Dx	—	8.5	—	7.0	---	7.0	---	5.5	ns	5
t_{PHZ}	$\overline{OEY}$ to Yx	—	10.5	—	9.0	---	9.0	---	8.0	ns	8
	DCLK to Dx	—	10.5	—	9.0	---	9.0	---	8.0	ns	5
t_{PZL}	$\overline{OEY}$ to Yx	—	11.5	—	10.0	---	10.0	---	8.0	ns	7
	DCLK to Dx	—	11.5	—	10.0	---	10.0	---	9.0	ns	5
t_{PZH}	$\overline{OEY}$ to Yx	—	11.5	—	10.0	---	10.0	---	8.5	ns	8
	DCLK to Dx	—	12.5	—	11.0	---	11.0	---	9.0	ns	5
t_W	PCLK (High and Low)	7.0	—	6.0	—	6.0	---	5.0	---	ns	5
	DCLK (High and Low)	7.0	—	6.0	—	6.0	---	5.0	---	ns	5

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Notes:
AC Characteristics guaranteed with C_L = 50pF as shown in Figure 1.
*See "Parameter Measurement Information" in the General Information Section.

FUNCTION TABLE

Inputs				Outputs			Operation
MODE	SDI	DCLK	PCLK	SDO	Shadow Register	Pipeline Register	
L	X	⌐¬	X	S_7	$S_0 \leftarrow SDI$ $S_i \leftarrow S_{i-1}$	NA	Serial Shift; D_7–D_0 Output Disabled
L	X	X	⌐¬	S_7	NA	$P_i \leftarrow D_i$	Load Pipeline Register from Data Input
H	L	⌐¬	X	L	$S_i \leftarrow Y_i$	NA	Load Shadow Register from Y Output
H	H	⌐¬	X	H	Hold	NA	Hold Shadow Register; D_7–D_0 Output Enabled
H	X	X	⌐¬	SDI	NA	$P_i \leftarrow S_i$	Load Pipeline Register from Shadow Register

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Note: NA = Not Applicable

ORDERING INFORMATION

CY29FCT — xxxxx (Device type) — x (Package) — x (Processing)

Processing:
- C — Commercial
- M — Military Temperature
- MB — MIL-STD-883, Class B

Package:
- P — Plastic DIP
- D — CERDIP
- SO — Small Outline IC
- L — Leadless Chip Carrier
- Q — QSOP

Device type:
- 818T — Diagnostic Scan Register
- 818AT — Fast Diagnostic Scan Register
- 818BT — Ultra Fast Diagnostic Scan Register
- 818CT — Ultra Fast Diagnostic Scan Register

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