P54/74FCT399T/AT/CT
FAST QUAD DUAL-PORT REGISTER

FEATURES

- Function, Pinout and Drive Compatible with the FCT and F Logic
- FCT-C speed at 6.1ns max. (Com'l)
  FCT-A speed at 7.0ns max. (Com'l)
- Reduced V_{OH} (typically = 3.3V) versions of Equivalent 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'l), 32 mA (Mil)
  15 mA Source Current (Com'l), 12 mA (Mil)
- Manufactured in 0.7 micron PACE Technology™

DESCRIPTION

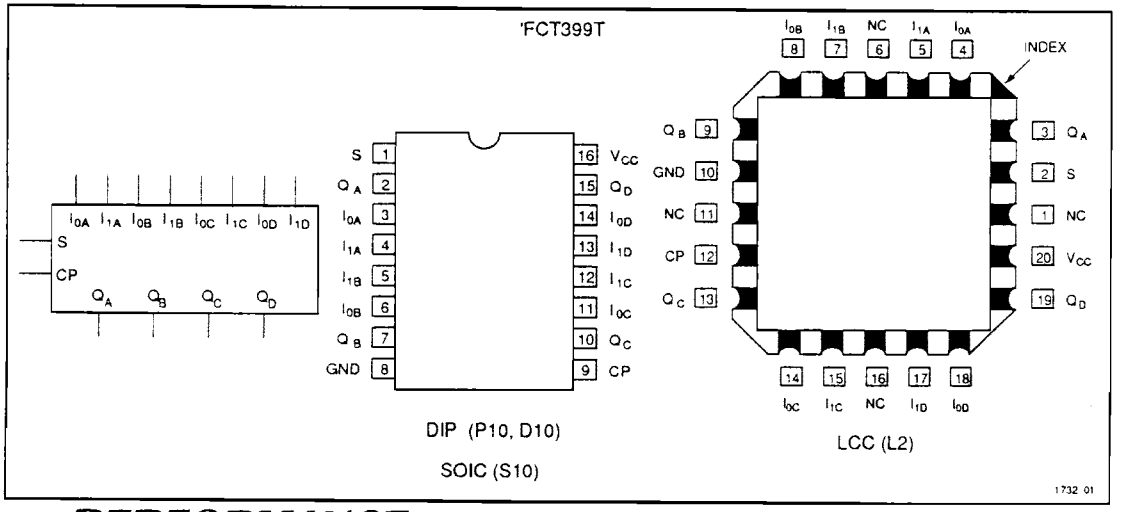
The 'FCT399T is a high-speed quad dual-port registers that select four bits of data from either of two sources (Ports) under control of a common Select input (S). The selected data is transferred to a 4-bit output register synchronous with the LOW-to- HIGH transition of the Clock input (CP). The 4-bit D-type output register is fully edge-triggered. The Data inputs (I_{0x},I_{1x}) and Select input (S) must be stable only one set-up time prior to, and hold time after, the LOW-to HIGH transition of the Clock input for predictable operation. The 'FCT399T offers true outputs.

The 'FCT399T is manufactured using PACE Technology™ which is Performance Advanced CMOS Engineered to use 0.7 micron effective channel lengths giving 400 picoseconds loaded* internal gate delays. PACE Technology includes two-level metal and epitaxial substrates. In addition to very high performance and very high density, the technology features latch-up protection, single event upset protection, and is supported by a Class 1 environment volume production facility.

*For a fan-in/fan-out of 4, at 85°C junction temperature and 5.0V.

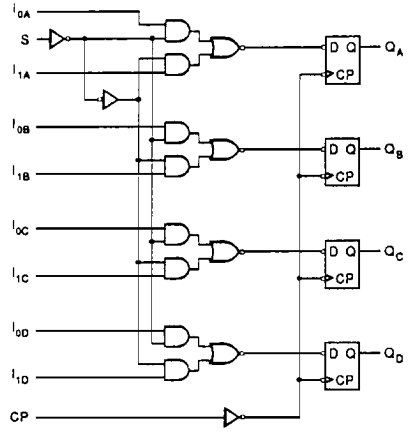
7

LOGIC SYMBOL AND PIN CONFIGURATIONS



FUNCTIONAL BLOCK DIAGRAM

'FCT399T



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
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

Notes: 1732 Tbl 01

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

1732 Tbl 02

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} = −12mA
		Commercial	2.4	3.3		V	MIN	I_{OH} = −15mA
V_{OL}	Output LOW Voltage	Military		0.3	0.5	V	MIN	I_{OL} = 32mA
		Commercial		0.3	0.5	V	MIN	I_{OL} = 48mA
		Commercial		0.3	0.5	V	MIN	I_{OL} = 64mA
I_I	Input HIGH Current				20	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_{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	$V_{IN} \leq 0.2V$, $V_{IN} \geq V_{CC}-0.2V$

Notes: 1732 Tbl 03

1. Typical limits 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.

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

Symbol	Parameter	Typ.[1]	Max.	Units	Conditions
ΔI_{CC}	Quiescent Power Supply Current (TTL inputs)	0.5	2.0	mA	V_{CC} = MAX, V_{IN} = 3.4V[2], f_1 = 0, Outputs Open
I_{CCD}	Dynamic Power Supply Current[3]	0.15	0.25	mA/ mHz	V_{CC} = MAX, One Input Toggling, 50% Duty Cycle, Outputs Open, $V_{IN} \leq 0.2V$ or $V_{IN} \geq V_{CC} - 0.2V$
I_C	Total Power Supply Current[5]	1.7	4.0	mA	V_{CC} = MAX, f_0 = 10MHz, 50% Duty Cycle, Outputs Open, One Input Toggling at f_1 = 5MHz, S = Steady State, $V_{IN} \leq 0.2V$ or $V_{IN} \geq V_{CC} - 0.2V$
		2.2	6.0	mA	V_{CC} = MAX, f_0 = 10MHz, 50% Duty Cycle, Outputs Open, One Input Toggling at f_1 = 5MHz, S = Steady State, V_{IN} = 3.4V or V_{IN} = GND
		4.0	7.8[4]	mA	V_{CC} = MAX, f_0 = 10MHz, 50% Duty Cycle, Outputs Open, 4 Inputs Toggling at f_1 = 5MHz, S = Steady State, $V_{IN} \leq 0.2V$ or $V_{IN} \geq V_{CC} - 0.2V$
		5.2	12.8[4]	mA	V_{CC} = MAX, f_0 = 10MHz, 50% Duty Cycle, Outputs Open, 4 Inputs Toggling at f_1 = 5MHz, S = Steady State, V_{IN} = 3.4V or V_{IN} = GND

1732 Tbl 04

Notes:

1. Typical values are at V_{CC} = 5.0V, +25°C ambient and maximum loading.
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.

FUNCTION TABLE — 'FCT399T

Inputs			Outputs
S	I_0	I_1	Q
l	l	X	L
l	h	X	H
h	X	l	L
h	X	h	H

1732 Tbl 05

H = HIGH Voltage Level
L = LOW Voltage Level
h = HIGH Voltage Level one setup time prior to the LOW-to-HIGH Clock Transition
l = LOW Voltage Level one setup time prior to the LOW-to-HIGH Clock Transition
X = Don't Care

7

PIN DESCRIPTION

Pin Names	Description
S	Common Select Input
CP	Clock Pulse Input (Active Rising Edge)
$I_{0A} - I_{0D}$	Data Inputs from Source 0
$I_{1A} - I_{1D}$	Data Inputs from Source 1
$Q_A - Q_D$	Register True Outputs

1732 Tbl 06

AC CHARACTERISTICS

Symbol	Parameter	'FCT399T				'FCT399AT				'FCT399CT				Units	Fig. No.
		MIL		COM'L		MIL		COM'L		MIL		COM'L			
		Min.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.		
t_{PLH} t_{PHL}	Propagation Delay CP to Q	3.0	11.5	3.0	10.0	2.5	7.5	2.5	7.0	2.5	6.6	2.5	6.1	ns	1, 5

1732 Tbl 07

Note:
1. AC Characteristics guaranteed with C_L = 50pF as shown in Figure 1.

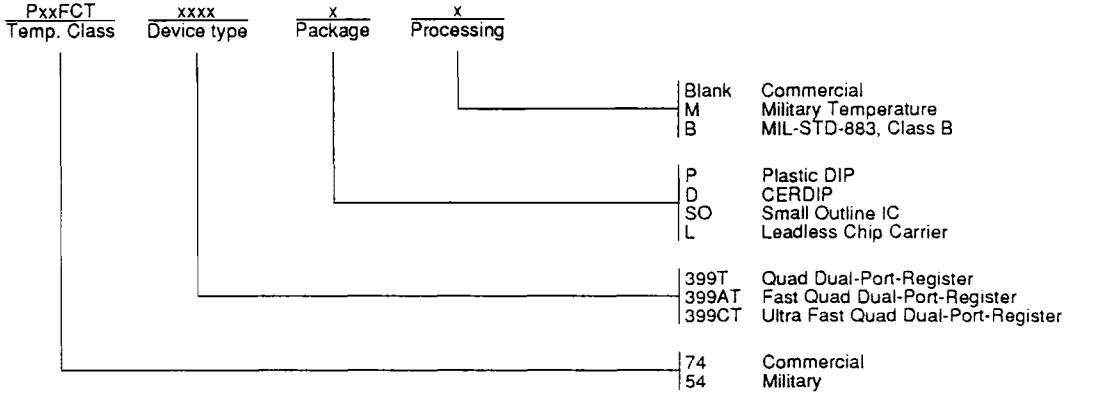
AC OPERATING REQUIREMENTS

Symbol	Parameter	'FCT399T				'FCT399AT				'FCT399CT				Units	Fig. No.
		MIL		COM'L		MIL		COM'L		MIL		COM'L			
		Min.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.		
$t_s(H)$ $t_s(L)$	Setup Time, HIGH or LOW I_n to CP	4.5	—	4.0	—	4.0	—	3.5	—	4.0	—	3.5	—	ns	4
$t_h(H)$ $t_h(L)$	Hold Time, HIGH or LOW I_n to CP	1.5	—	1.0	—	1.0	—	1.0	—	1.0	—	1.0	—	ns	4
$t_s(H)$ $t_s(L)$	Set-up Time, HIGH or LOW SP to CP	9.5	—	9.0	—	9.0	—	8.5	—	9.0	—	8.5	—	ns	4
$t_h(H)$ $t_h(L)$	Hold Time, HIGH or LOW SP to CP	0	—	0	—	0	—	0	—	0	—	0	—	ns	4
$t_w(H)$ $t_w(L)$	Clock Pulse Width[2], HIGH or LOW	7.0	—	5.0	—	6.0	—	5.0	—	6.0	—	5.0	—	ns	5

1732 Tbl 08

Notes:
1. Minimum limits are guaranteed but not tested on Propagation Delays.
2. This parameter is guaranteed but not tested.

ORDERING INFORMATION



1732 03

7