CY74FCT16374T
CY74FCT162374T

16-Bit Registers

SCCS055 - August 1994 - Revised March 2000

Features

- **FCT-E speed at 3.7 ns**
- **Power-off disable outputs permits live insertion**
- **Edge-rate control circuitry for significantly improved noise characteristics**
- **Typical output skew < 250 ps**
- **ESD > 2000V**
- **TSSOP (19.6-mil pitch) and SSOP (25-mil pitch) packages**
- **Industrial temperature range of –40˚C to +85˚C**
- **V_{CC} = 5V ± 10%**

CY74FCT16374T Features:

- **64 mA sink current, 32 mA source current**
- **Typical V_{OLP} (ground bounce) <1.0V at V_{CC} = 5V, T_A = 25˚C**

CY74FCT162374T Features:

- **Balanced 24 mA output drivers**
- **Reduced system switching noise**
- **Typical V_{OLP} (ground bounce) <0.6V at V_{CC} = 5V, T_A= 25˚C**

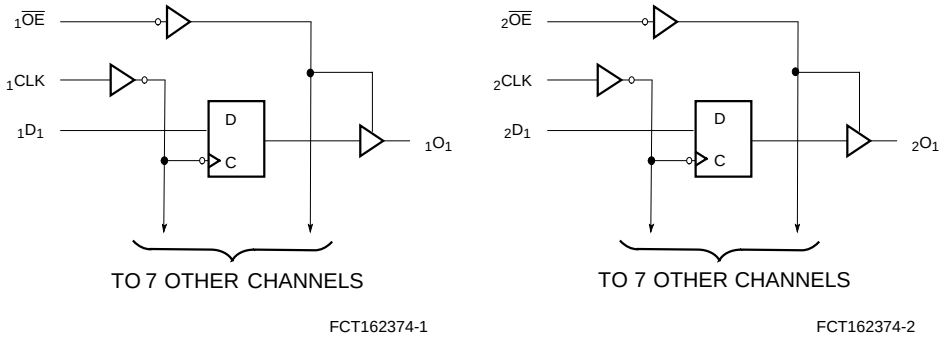
Functional Description

CY74FCT16374T and CY74FCT162374T are 16-bit D-type registers designed for use as buffered registers in high-speed, low power bus applications. These devices can be used as two independent 8-bit registers or as a single 16-bit register by connecting the output Enable (OE) and Clock (CLK) inputs. Flow-through pinout and small shrink packaging aid in simplifying board layout. The output buffers are designed with power-off disable feature that allows live insertion of boards.

The CY74FCT16374T is ideally suited for driving high-capacitance loads and low-impedance backplanes.

The CY74FCT162374T has 24-mA balanced output drivers with current limiting resistors in the outputs. This reduces the need for external terminating resistors and provides for minimal undershoot and reduced ground bounce. The CY74FCT162374T is ideal for driving transmission lines.

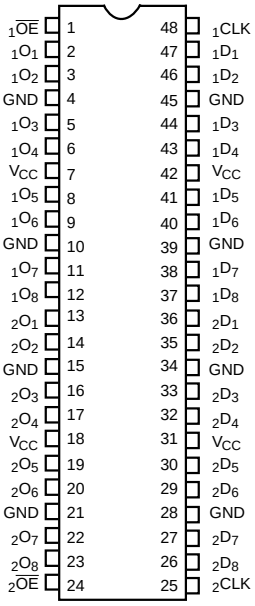
Logic Block Diagrams



FCT162374-1 FCT162374-2

Pin Configuration

SSOP/TSSOP
Top View



FCT162374-3

Function Table[1]

Inputs			Outputs	
D	CLK	$\overline{OE}$	O	Function
X	L	H	Z	High-Z
X	H	H	Z	
L	⌐	L	L	Load Register
H	⌐	L	H	
L	⌐	H	Z	
H	⌐	H	Z	

Pin Description

Name	Description
D	Data Inputs
CLK	Clock Inputs
$\overline{OE}$	Three-State Output Enable Inputs (Active LOW)
O	Three-State Outputs

Maximum Ratings[2, 3]

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature ..... –55°C to +125°C

Ambient Temperature with Power Applied ..... –55°C to +125°C

DC Input Voltage ..... –0.5V to +7.0V

DC Output Voltage ..... –0.5V to +7.0V

DC Output Current (Maximum Sink Current/Pin) .....–60 to +120 mA

Power Dissipation 1.0W

Static Discharge Voltage .....>2001V (per MIL-STD-883, Method 3015)

Operating Range

Range	Ambient Temperature	V_{CC}
Industrial	–40°C to +85°C	5V ± 10%

Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions	Min.	Typ.[4]	Max.	Unit
V_{IH}	Input HIGH Voltage		2.0			V
V_{IL}	Input LOW Voltage				0.8	V
V_H	Input Hysteresis[5]			100		mV
V_{IK}	Input Clamp Diode Voltage	V_{CC}=Min., I_{IN}=–18 mA		–0.7	–1.2	V
I_{IH}	Input HIGH Current	V_{CC}=Max., V_I=V_{CC}			±1	µA
I_{IL}	Input LOW Current	V_{CC}=Max., V_I=GND			±1	µA
I_{OZH}	High Impedance Output Current (Three-State Output pins)	V_{CC}=Max., V_{OUT}=2.7V			±1	µA
I_{OZL}	High Impedance Output Current (Three-State Output pins)	V_{CC}=Max., V_{OUT}=0.5V			±1	µA
I_{OS}	Short Circuit Current[6]	V_{CC}=Max., V_{OUT}=GND	–80	–140	–200	mA
I_O	Output Drive Current[6]	V_{CC}=Max., V_{OUT}=2.5V	–50		–180	mA
I_{OFF}	Power-Off Disable	V_{CC}=0V, V_{OUT}≤4.5V[7]			±1	µA

Output Drive Characteristics for CY74FCT16374T

Parameter	Description	Test Conditions	Min.	Typ.[4]	Max.	Unit
V_{OH}	Output HIGH Voltage	V_{CC}=Min., I_{OH}=–3 mA	2.5	3.5		V
		V_{CC}=Min., I_{OH}=–15 mA	2.4	3.5		V
		V_{CC}=Min., I_{OH}=–32 mA	2.0	3.0		V
V_{OL}	Output LOW Voltage	V_{CC}=Min., I_{OL}=64 mA		0.2	0.55	V

Notes:

1. H = HIGH Voltage Level. L = LOW Voltage Level. X = Don't Care. Z = HIGH Impedance. ⌐ = LOW-to-HIGH Transition.
2. Operation beyond the limits set forth may impair the useful life of the device. Unless otherwise noted, these limits are over the operating free-air temperature range.
3. Unused inputs must always be connected to an appropriate logic voltage level, preferably either V_{CC} or ground.
4. Typical values are at V_{CC}= 5.0V, T_A= +25˚C ambient.
5. This parameter is specified but not tested.
6. 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.
7. Tested at +25˚C.

Output Drive Characteristics for CY74FCT162374T

Parameter	Description	Test Conditions	Min.	Typ.[4]	Max.	Unit
I_{ODL}	Output LOW Current[6]	V_{CC}=5V, V_{IN}=V_{IH} or V_{IL}, V_{OUT}=1.5V	60	115	150	mA
I_{ODH}	Output HIGH Current[6]	V_{CC}=5V, V_{IN}=V_{IH} or V_{IL}, V_{OUT}=1.5V	–60	–115	–150	mA
V_{OH}	Output HIGH Voltage	V_{CC}=Min., I_{OH}=–24 mA	2.4	3.3		V
V_{OL}	Output LOW Voltage	V_{CC}=Min., I_{OL}=24 mA		0.3	0.55	V

Capacitance[5] (T_A = +25°C, f = 1.0 MHz)

Parameter	Description	Test Conditions	Typ.[4]	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	4.5	6.0	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V	5.5	8.0	pF

Power Supply Characteristics

Parameter	Description	Test Conditions		Typ.[4]	Max.	Unit
I_{CC}	Quiescent Power Supply Current	V_{CC}=Max.	V_{IN}≤0.2V, V_{IN}≥V_{CC}–0.2V	5	500	µA
ΔI_{CC}	Quiescent Power Supply Current (TTL inputs HIGH)	V_{CC}=Max.	V_{IN}=3.4V[8]	0.5	1.5	mA
I_{CCD}	Dynamic Power Supply Current[9]	V_{CC}=Max., One Input Toggling, 50% Duty Cycle, Outputs Open, $\overline{OE}$=GND	V_{IN}=V_{CC} or V_{IN}=GND	60	100	µA/ MHz
I_C	Total Power Supply Current[10]	V_{CC}=Max., f_0=10 MHz, f_1=5 MHz, 50% Duty Cycle, Outputs Open, One Bit Toggling, $\overline{OE}$=GND	V_{IN}=V_{CC} or V_{IN}=GND	0.6	1.5	mA
			V_{IN}=3.4V or V_{IN}=GND	1.1	3.0	mA
		V_{CC}=Max., f_0=10 MHz, f_1=2.5 MHz, 50% Duty Cycle, Outputs Open, Sixteen Bits Toggling, $\overline{OE}$=GND	V_{IN}=V_{CC} or V_{IN}=GND	3.0	5.5[11]	mA
			V_{IN}=3.4V or V_{IN}=GND	7.5	19.0[11]	mA

Note:

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 = $I_{QUIESCENT}$ + 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 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]

Parameter	Description	CY74FCT16374T CY74FCT162374T		CY74FCT16374AT CY74FCT162374AT		Unit	Fig. No.[13]
		Min.	Max.	Min.	Max.		
t_{PLH} t_{PHL}	Propagation Delay CLK to O	2.0	10.0	2.0	6.5	ns	1, 5
t_{PZH} t_{PZL}	Output Enable Time	1.5	12.5	1.5	6.5	ns	1, 7, 8
t_{PHZ} t_{PLZ}	Output Disable Time	1.5	8.0	1.5	5.5	ns	1, 7, 8
t_{SU}	Set-Up Time HIGH or LOW, D to CLK	2.0		2.0		ns	4
t_H	Hold Time HIGH or LOW, D to CLK	1.5		1.5		ns	4
t_W	CLK Pulse Width HIGH or LOW	5.0		5.0		ns	5
$t_{SK(O)}$	Output Skew[14]		0.5		0.5	ns	

Parameter	Description	CY74FCT16374CT CY74FCT162374CT		CY74FCT16374ET CY74FCT162374ET		Unit	Fig. No.[13]
		Min.	Max.	Min.	Max.		
t_{PLH} t_{PHL}	Propagation Delay CLK to O	2.0	5.2	2.0	3.7	ns	1, 5
t_{PZH} t_{PZL}	Output Enable Time	1.5	5.5	1.5	4.4	ns	1, 7, 8
t_{PHZ} t_{PLZ}	Output Disable Time	1.5	5.0	1.5	3.6	ns	1, 7, 8
t_{SU}	Set-Up Time HIGH or LOW, D to CLK	2.0		1.5		ns	4
t_H	Hold Time HIGH or LOW, D to CLK	1.5		0.0		ns	4
t_W	CLK Pulse Width HIGH or LOW	3.3		3.0		ns	5
$t_{SK(O)}$	Output Skew[14]		0.5		0.5	ns	

Notes:
12. Minimum limits are specified but not tested on Propagation Delays.
13. See “Parameter Measurement Information” in the General Information section.
14. Skew between any two outputs of the same package switching in the same direction. This parameter is ensured by design.

Ordering Information CY74FCT16374T

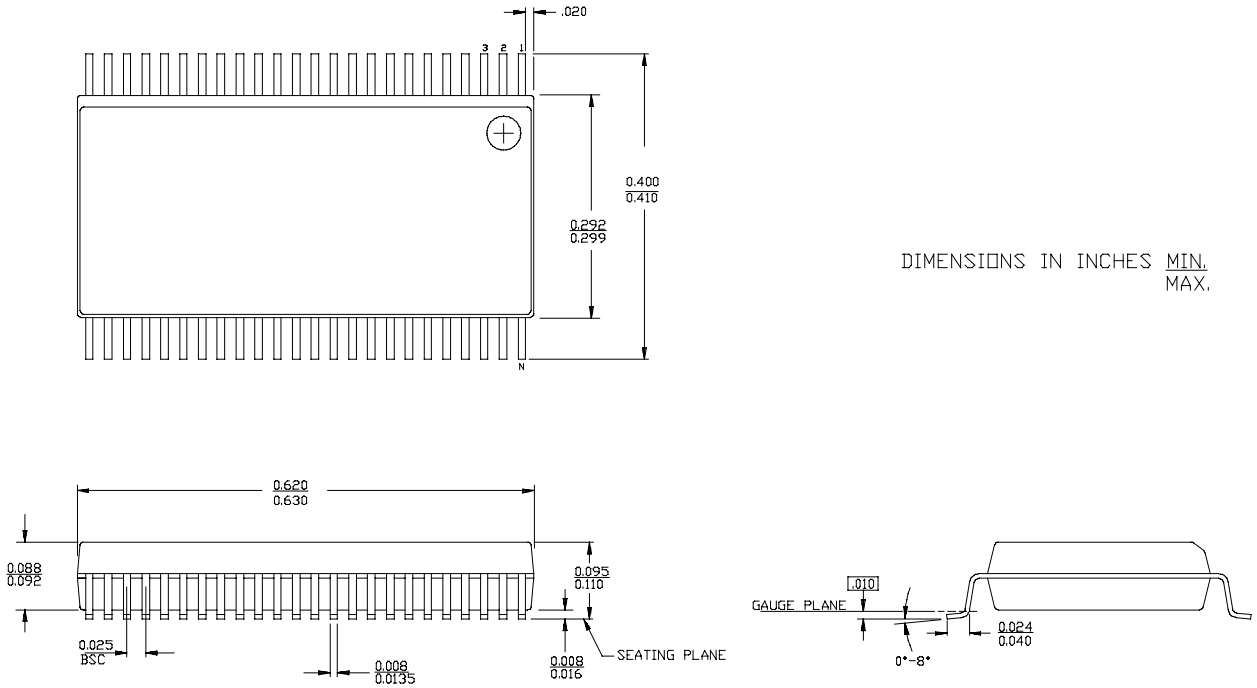
Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
3.7	CY74FCT16374ETPACT	Z48	48-Lead (240-Mil) TSSOP	Industrial
	CY74FCT16374ETPVC/PVCT	O48	48-Lead (300-Mil) SSOP	
5.2	CY74FCT16374CTPACT	Z48	48-Lead (240-Mil) TSSOP	Industrial
	CY74FCT16374CTPVC/PVCT	O48	48-Lead (300-Mil) SSOP	
6.5	CY74FCT16374ATPACT	Z48	48-Lead (240-Mil) TSSOP	Industrial
	CY74FCT16374ATPVC/PVCT	O48	48-Lead (300-Mil) SSOP	
10.0	CY74FCT16374TPVC/PVCT	O48	48-Lead (300-Mil) SSOP	Industrial

Ordering Information CY74FCT162374T

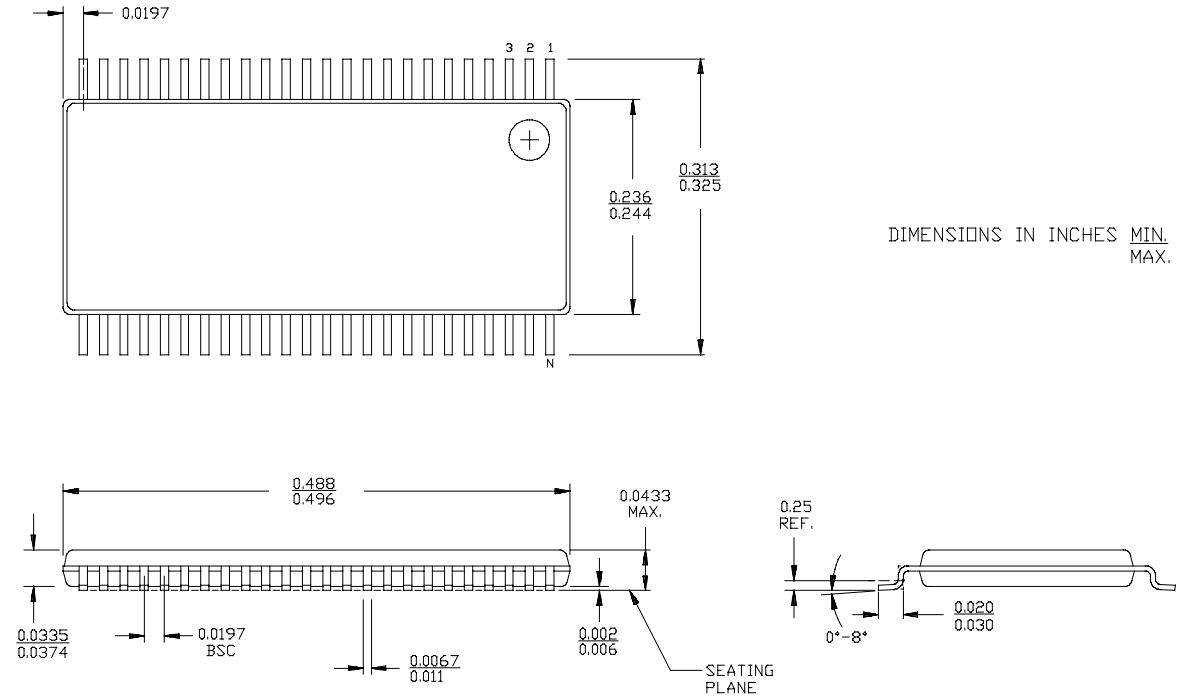
Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
3.7	74FCT162374ETPACT	Z48	48-Lead (240-Mil) TSSOP	Industrial
	CY74FCT162374ETPVC	O48	48-Lead (300-Mil) SSOP	
	74FCT162374ETPVCT	O48	48-Lead (300-Mil) SSOP	
5.2	74FCT162374CTPACT	Z48	48-Lead (240-Mil) TSSOP	Industrial
	CY74FCT162374CTPVC	O48	48-Lead (300-Mil) SSOP	
	74FCT162374CTPVCT	O48	48-Lead (300-Mil) SSOP	
6.5	74FCT162374ATPACT	Z48	48-Lead (240-Mil) TSSOP	Industrial
	CY74FCT162374ATPVC	O48	48-Lead (300-Mil) SSOP	
	74FCT162374ATPVCT	O48	48-Lead (300-Mil) SSOP	
10.0	CY74FCT162374TPVC/PVCT	O48	48-Lead (300-Mil) SSOP	Industrial

Package Diagrams

48-Lead Shrunk Small Outline Package O48



48-Lead Thin Shrunk Small Outline Package Z48



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