



# FAST CMOS 16-BIT REGISTER (3-STATE)

## IDT74FCT162374AT/CT/ET

### FEATURES:

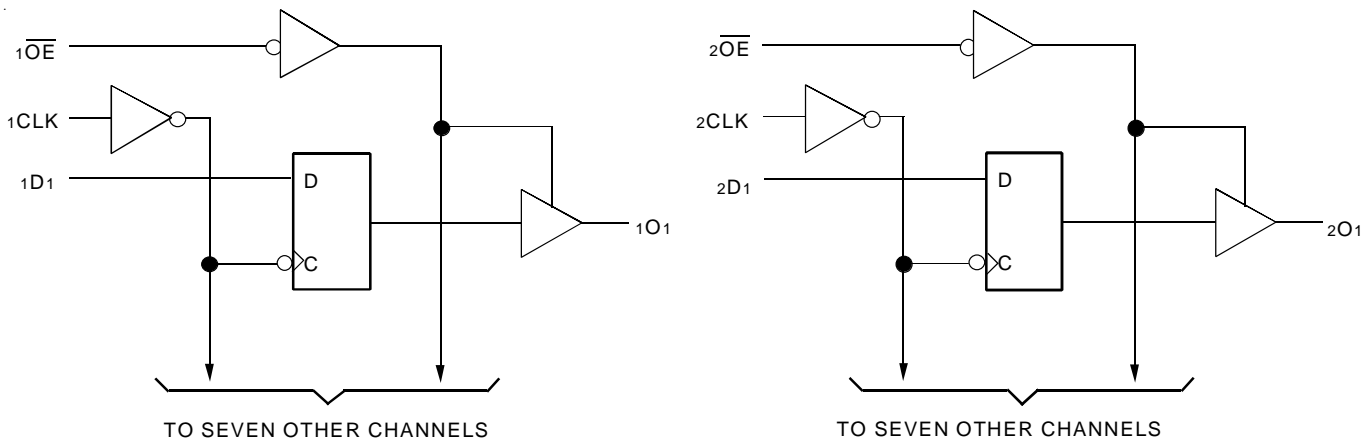
- 0.5 MICRON CMOS Technology
- High-speed, low-power CMOS replacement for ABT functions
- Typical  $t_{sk(o)}$  (Output Skew) < 250ps
- Low input and output leakage  $\leq 1\mu A$  (max.)
- $V_{cc} = 5V \pm 10\%$
- Balanced Output Drivers:  $\pm 24mA$
- Reduced system switching noise
- Typical VOLP (Output Ground Bounce) < 0.6V at  $V_{cc} = 5V$ ,  $T_A = 25^\circ C$
- Available in SSOP, TSSOP, and TVSOP packages

### DESCRIPTION:

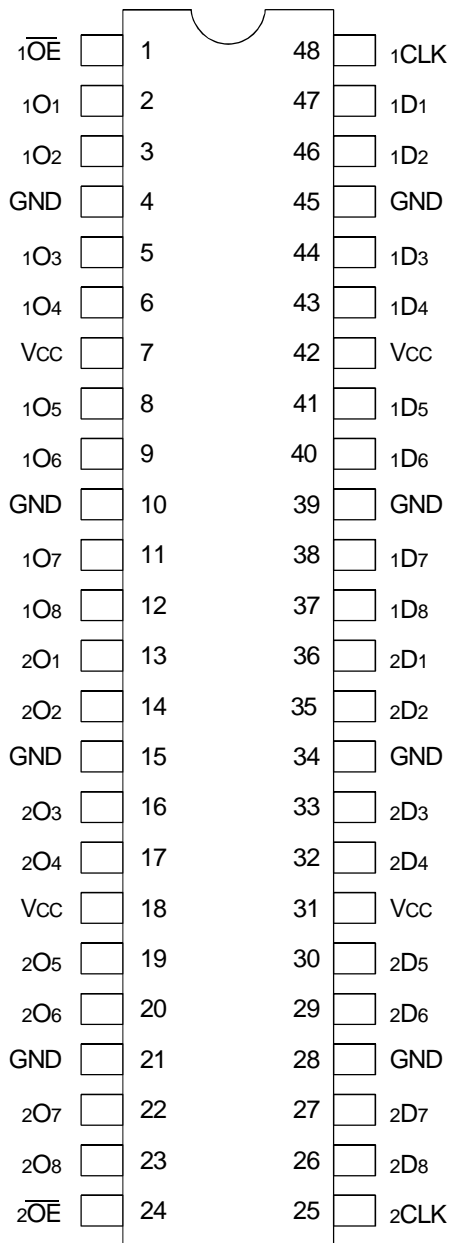
The FCT162374T 16-bit edge-triggered D-type registers are built using advanced dual metal CMOS technology. These high-speed, low-power registers are ideal for use as buffer registers for data synchronization and storage. The Output Enable ( $\overline{xOE}$ ) and clock ( $xCLK$ ) controls are organized to operate each device as two 8-bit registers or one 16-bit register with common clock. Flow-through organization of signal pins simplifies layout. All inputs are designed with hysteresis for improved noise margin.

The FCT162374T has balanced output drive with current limiting resistors. This offers low ground bounce, minimal undershoot, and controlled output fall times—reducing the need for external series terminating resistors. The FCT162374T are plug-in replacements for the FCT16374T and ABT16374 for on-board bus interface applications.

### FUNCTIONAL BLOCK DIAGRAM



## PIN CONFIGURATION



SSOP/ TSSOP/ TVSOP  
TOP VIEW

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Symbol	Description	Max	Unit
VTERM <sup>(2)</sup>	Terminal Voltage with Respect to GND	-0.5 to 7	V
VTERM <sup>(3)</sup>	Terminal Voltage with Respect to GND	-0.5 to Vcc+0.5	V
TSTG	Storage Temperature	-65 to +150	°C
IOUT	DC Output Current	-60 to 120	mA

### NOTES:

- Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
- All device terminals except FCT162XXX Output and I/O terminals.
- Output and I/O terminals terminals for FCT162XXX.

## CAPACITANCE (TA = +25°C, F = 1.0MHz)

Symbol	Parameter <sup>(1)</sup>	Conditions	Typ.	Max.	Unit
CIN	Input Capacitance	VIN = 0V	3.5	6	pF
COUT	Output Capacitance	VOUT = 0V	3.5	8	pF

### NOTE:

- This parameter is measured at characterization but not tested.

## PIN DESCRIPTION

Pin Names	Description
xDx	Data Inputs
xCLK	Clock Inputs
xOx	3-State Outputs
xOE	3-State Outputs Enable Input (Active LOW)

## FUNCTION TABLE<sup>(1)</sup>

Function	Inputs			Outputs
	xDx	xCLK	xOE	xOx
Hi-Z	X	L	H	Z
	X	H	H	Z
Load Register	L	↑	L	L
	H	↑	L	H
	L	↑	H	Z
	H	↑	H	Z

### NOTE:

- H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Don't Care  
Z = High-Impedance  
↑ = LOW-to-HIGH transition

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Industrial:  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$

Symbol	Parameter	Test Conditions <sup>(1)</sup>		Min.	Typ. <sup>(2)</sup>	Max.	Unit
$V_{IH}$	Input HIGH Level	Guaranteed Logic HIGH Level		2	—	—	V
$V_{IL}$	Input LOW Level	Guaranteed Logic LOW Level		—	—	0.8	V
$I_{IH}$	Input HIGH Current (Input pins) <sup>(5)</sup>	$V_{CC} = \text{Max.}$	$V_i = V_{CC}$	—	—	$\pm 1$	$\mu\text{A}$
	Input HIGH Current (I/O pins) <sup>(5)</sup>			—	—	$\pm 1$	
$I_{IL}$	Input LOW Current (Input pins) <sup>(5)</sup>		$V_i = \text{GND}$	—	—	$\pm 1$	
	Input LOW Current (I/O pins) <sup>(5)</sup>			—	—	$\pm 1$	
$I_{OZH}$	High Impedance Output Current (3-State Output pins) <sup>(5)</sup>	$V_{CC} = \text{Max.}$	$V_o = 2.7\text{V}$	—	—	$\pm 1$	$\mu\text{A}$
$I_{OZL}$			$V_o = 0.5\text{V}$	—	—	$\pm 1$	
$V_{IK}$	Clamp Diode Voltage	$V_{CC} = \text{Min.}, I_{IN} = -18\text{mA}$		—	-0.7	-1.2	V
$I_{OS}$	Short Circuit Current	$V_{CC} = \text{Max.}, V_o = \text{GND}^{(3)}$		-80	-140	-250	mA
$V_H$	Input Hysteresis	—		—	100	—	mV
$I_{CCL}$ $I_{CCH}$ $I_{CCZ}$	Quiescent Power Supply Current	$V_{CC} = \text{Max.}$ $V_{IN} = \text{GND or } V_{CC}$		—	5	500	$\mu\text{A}$

## OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions <sup>(1)</sup>		Min	Typ. <sup>(2)</sup>	Max.	Unit
$I_{ODL}$	Output LOW Current	$V_{CC} = 5\text{V}, V_{IN} = V_{IH} \text{ or } V_{IL}, V_o = 1.5\text{V}^{(3)}$		60	115	200	mA
$I_{ODH}$	Output HIGH Current	$V_{CC} = 5\text{V}, V_{IN} = V_{IH} \text{ or } V_{IL}, V_o = 1.5\text{V}^{(3)}$		-60	-115	-200	mA
$V_{OH}$	Output HIGH Voltage	$V_{CC} = \text{Min}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -24\text{mA}$	2.4	3.3	—	V
$V_{OL}$	Output LOW Voltage	$V_{CC} = \text{Min}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 24\text{mA}$	—	0.3	0.55	V

### NOTES:

1. For conditions shown as Min. or Max., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at  $V_{CC} = 5.0\text{V}$ ,  $+25^{\circ}\text{C}$  ambient.
3. Not more than one output should be tested at one time. Duration of the test should not exceed one second.
4. Duration of the condition can not exceed one second.
5. The test limit for this parameter is  $\pm 5\mu\text{A}$  at  $T_A = -55^{\circ}\text{C}$ .

## POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions <sup>(1)</sup>		Min.	Typ. <sup>(2)</sup>	Max.	Unit
$\Delta I_{CC}$	Quiescent Power Supply Current TTL Inputs HIGH	V <sub>CC</sub> = Max. V <sub>IN</sub> = 3.4V <sup>(3)</sup>		—	0.5	1.5	mA
I <sub>CCD</sub>	Dynamic Power Supply Current <sup>(4)</sup>	V <sub>CC</sub> = Max. Outputs Open $\overline{xO\overline{E}}$ = GND One Input Toggling 50% Duty Cycle	V <sub>IN</sub> = V <sub>CC</sub> V <sub>IN</sub> = GND	—	60	100	μA/ MHz
I <sub>C</sub>	Total Power Supply Current <sup>(6)</sup>	V <sub>CC</sub> = Max. Outputs Open f <sub>CP</sub> = 10MHz 50% Duty Cycle $\overline{xO\overline{E}}$ = GND fi = 5MHz 50% Duty Cycle One Bit Toggling	V <sub>IN</sub> = V <sub>CC</sub> V <sub>IN</sub> = GND	—	0.6	1.5	mA
			V <sub>IN</sub> = 3.4V V <sub>IN</sub> = GND	—	1.1	3	
		V <sub>CC</sub> = Max. Outputs Open f <sub>CP</sub> = 10MHz 50% Duty Cycle $\overline{xO\overline{E}}$ = GND Sixteen Bits Toggling fi = 2.5MHz 50% Duty Cycle	V <sub>IN</sub> = V <sub>CC</sub> V <sub>IN</sub> = GND	—	3	5.5 <sup>(5)</sup>	
			V <sub>IN</sub> = 3.4V V <sub>IN</sub> = GND	—	7.5	19 <sup>(5)</sup>	

### NOTES:

- For conditions shown as Min. or Max., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at V<sub>CC</sub> = 5.0V, +25°C ambient.
- Per TTL driven input (V<sub>IN</sub> = 3.4V). All other inputs at V<sub>CC</sub> or GND.
- This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
- Values for these conditions are examples of the I<sub>CC</sub> formula. These limits are guaranteed but not tested.
- I<sub>C</sub> = I<sub>QUIESCENT</sub> + I<sub>INPUTS</sub> + I<sub>DYNAMIC</sub>  
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP} N_{CP} / 2 + f_i N_i)$   
 I<sub>CC</sub> = Quiescent Current (I<sub>CC1</sub>, I<sub>CC2</sub> and I<sub>CC3</sub>)  
 $\Delta I_{CC}$  = Power Supply Current for a TTL High Input (V<sub>IN</sub> = 3.4V)  
 D<sub>H</sub> = Duty Cycle for TTL Inputs High  
 N<sub>T</sub> = Number of TTL Inputs at D<sub>H</sub>  
 I<sub>CCD</sub> = Dynamic Current caused by an Input Transition Pair (HLH or LHL)  
 f<sub>CP</sub> = Clock Frequency for Register Devices (Zero for Non-Register Devices)  
 N<sub>CP</sub> = Number of Clock Inputs at f<sub>CP</sub>  
 f<sub>i</sub> = Input Frequency  
 N<sub>i</sub> = Number of Inputs at f<sub>i</sub>

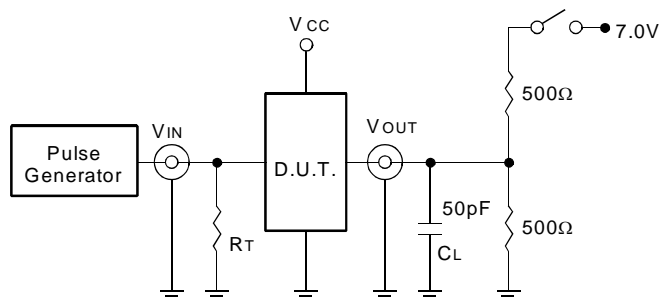
## SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Symbol	Parameter	Condition <sup>(1)</sup>	74FCT162374T		74FCT162374CT		74FCT162374ET		Unit
			Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	
t <sub>PLH</sub>	Propagation Delay	C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω	2	6.5	2	5.2	1.5	3.7	ns
t <sub>PHL</sub>	xCLK to xOx								
t <sub>PZH</sub>	Output Enable Time		1.5	6.5	1.5	5.5	1.5	4.4	ns
t <sub>PZL</sub>									
t <sub>PHZ</sub>	Output Disable Time		1.5	5.5	1.5	5	1.5	3.6	ns
t <sub>PLZ</sub>									
t <sub>SU</sub>	Set-up Time HIGH or LOW, xDx to xCLK		2	—	2	—	1.5	—	ns
t <sub>H</sub>	Hold Time HIGH or LOW, xDx to xCLK		1.5	—	1.5	—	0	—	ns
t <sub>w</sub>	xCLK Pulse Width HIGH or LOW		5	—	5	—	3 <sup>(4)</sup>	—	ns
t <sub>SK(o)</sub>	Output Skew <sup>(3)</sup>	—	0.5	—	0.5	—	0.5	ns	

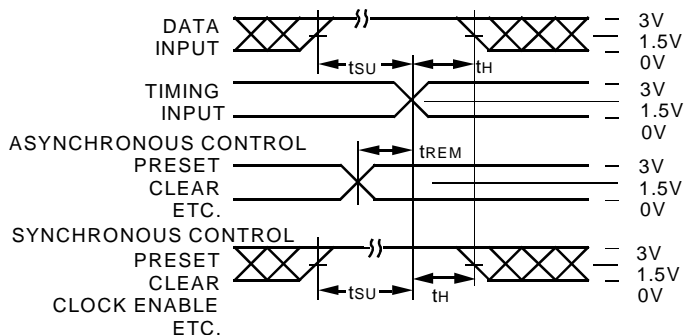
**NOTES:**

1. See test circuit and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.
4. This limit is guaranteed but not tested.

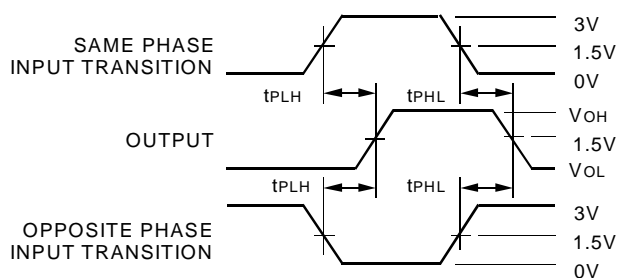
## TEST CIRCUITS AND WAVEFORMS



Test Circuit for All Outputs



Set-up, Hold and Release Times



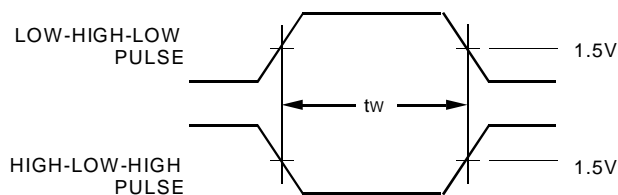
Propagation Delay

## SWITCH POSITION

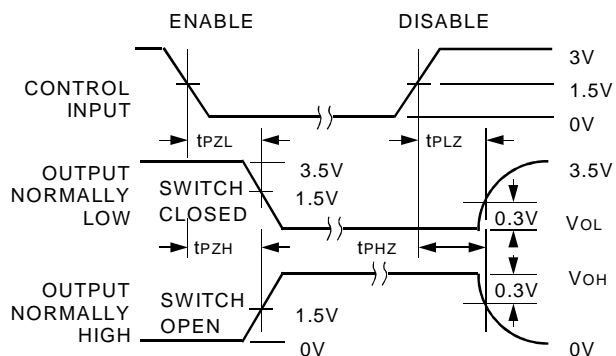
Test	Switch
Open Drain Disable Low Enable Low	Closed
All Other Tests	Open

### DEFINITIONS:

CL = Load capacitance: includes jig and probe capacitance.  
RT = Termination resistance: should be equal to ZOUT of the Pulse Generator.



Pulse Width

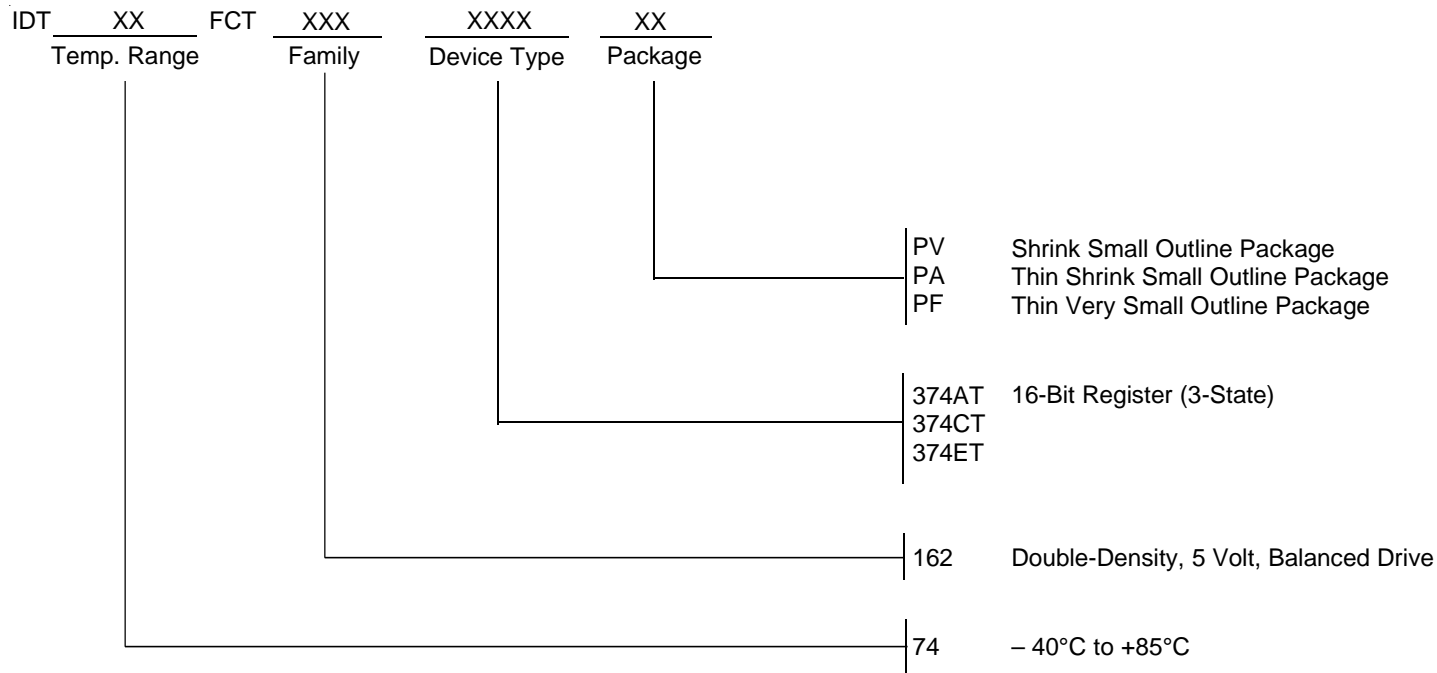


Enable and Disable Times

### NOTES:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.
2. Pulse Generator for All Pulses: Rate  $\leq$  1.0MHz;  $t_r \leq$  2.5ns;  $t_f \leq$  2.5ns.

## ORDERING INFORMATION



## DATA SHEET DOCUMENT HISTORY

- 3/26/2002 Removed standard speed grade
- 6/21/2002 Updated according to PDNs Logic-00-07 and Logic-01-04



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