

# CD74FCT16841T, CD74FCT162841T

December 1996

## Fast CMOS 20-Bit Transparent Latches

### Features

- These Devices are High-speed, Low Power Devices with High Current Drive
- $V_{CC} = 5V \pm 10\%$
- Hysteresis on All Inputs
- CD74FCT16841T
  - High Output Drive:  $I_{OH} = -32mA$ ;  $I_{OL} = 64mA$
  - Power Off Disable Outputs Permit "Live Insertion"
  - Typical  $V_{OLP}$  (Output Ground Bounce)  $< 1.0V$  at  $V_{CC} = 5V$ ,  $T_A = 25^\circ C$
- CD74FCT162841T
  - Balanced Output Drivers:  $\pm 24mA$
  - Reduced System Switching Noise
  - Typical  $V_{OLP}$  (Output Ground Bounce)  $< 0.6V$  at  $V_{CC} = 5V$ ,  $T_A = 25^\circ C$

### Description

Harris' CD74FCT16841T and CD74FCT162841T are produced in an advanced 0.8 micron CMOS technology, achieving industry leading speed grades.

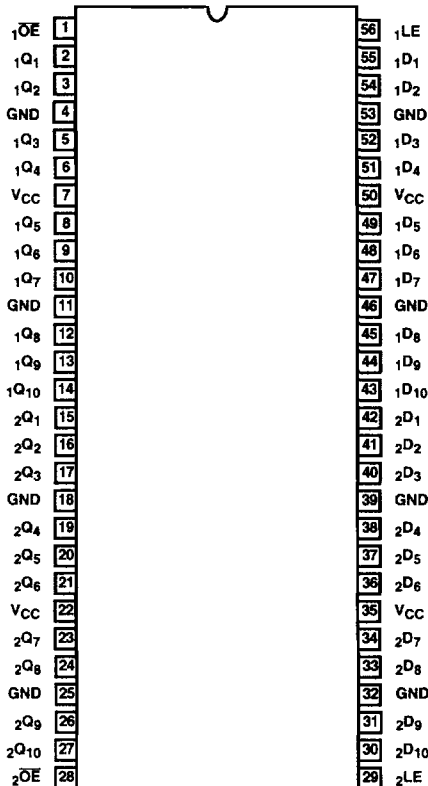
These devices are 20-bit wide transparent latches designed to provide temporary storage of data and can be used as I/O ports, memory address latches, and bus drivers. The Output Enable and Latch Enable controls allow the devices to be operated as two 10-bit latches or one 20-bit latch. Signal pins are arranged in a flow-through organization for ease of layout and hysteresis is designed into all inputs to improve noise margin.

The output buffers are especially designed for driving high-capacitance loads and low impedance backplanes and include a Power-Off Disable function allowing "live insertion" of boards when the devices are used as backplane drivers.

The CD74FCT162841T has  $\pm 24mA$  balanced output drivers. It is designed with current limiting resistors at its outputs to control the output edge rate resulting in lower ground bounce and undershoot. This eliminates the need for external terminating resistors for most interface applications.

### Pinouts

CD74FCT16841T, CD74FCT162841T  
(SSOP, TSSOP)  
TOP VIEW

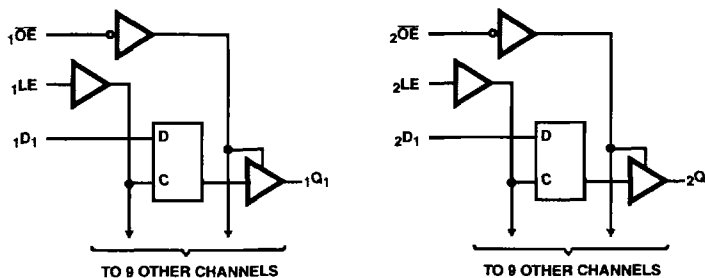


### Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
CD74FCT16841ATMT	-40 to 85	56 Ld TSSOP	M56.240-P
CD74FCT16841ATSM	-40 to 85	56 Ld SSOP	M56.300-P
CD74FCT16841BTMT	-40 to 85	56 Ld TSSOP	M56.240-P
CD74FCT16841BTSM	-40 to 85	56 Ld SSOP	M56.300-P
CD74FCT16841CTMT	-40 to 85	56 Ld TSSOP	M56.240-P
CD74FCT16841CTSM	-40 to 85	56 Ld SSOP	M56.300-P
CD74FCT162841ATMT	-40 to 85	56 Ld TSSOP	M56.240-P
CD74FCT162841ATSM	-40 to 85	56 Ld SSOP	M56.300-P
CD74FCT162841BTMT	-40 to 85	56 Ld TSSOP	M56.240-P
CD74FCT162841BTSM	-40 to 85	56 Ld SSOP	M56.300-P
CD74FCT162841CTMT	-40 to 85	56 Ld TSSOP	M56.240-P
CD74FCT162841CTSM	-40 to 85	56 Ld SSOP	M56.300-P
CD74FCT16841DTMT	-40 to 85	56 Ld TSSOP	M56.240-P
CD74FCT16841DTSM	-40 to 85	56 Ld SSOP	M56.300-P
CD74FCT16841ETMT	-40 to 85	56 Ld TSSOP	M56.240-P
CD74FCT16841ETSM	-40 to 85	56 Ld SSOP	M56.300-P
CD74FCT162841DTMT	-40 to 85	56 Ld TSSOP	M56.240-P
CD74FCT162841DTSM	-40 to 85	56 Ld SSOP	M56.300-P
CD74FCT162841ETMT	-40 to 85	56 Ld TSSOP	M56.240-P
CD74FCT162841ETSM	-40 to 85	56 Ld SSOP	M56.300-P

NOTE: When ordering, use the entire part number. Add the suffix 96 to obtain the variant in the tape and reel.

**Functional Block Diagram**



TRUTH TABLE (NOTE 1)

INPUTS			OUTPUTS
$x D_x$	$x LE$	$x \overline{OE}$	$x Q_x$
H	H	L	H
L	H	L	L
X	L	L	Q (Note 2)
X	X	H	Z

NOTES:

1. H = High Voltage Level  
L = Low Voltage Level  
X = Don't Care  
Z = High Impedance
2. Output level before the  $x LE$  HIGH-to-LOW Transition

**Pin Descriptions**

PIN NAME	DESCRIPTION
$x D_x$	Data Inputs
$x LE$	Latch Enable Input (Active LOW)
$x \overline{OE}$	Output Enable Input (Active LOW)
$x Q_x$	Three-State Outputs

**5**  
D.D. 5V FCT BAL.  
AND HIGH DRIVE

## CD74FCT16841T, CD74FCT162841T

### Absolute Maximum Ratings

DC Input Voltage	-0.5V to 7.0V
DC Output Current	120mA

### Operating Conditions

Operating Temperature Range	-40°C to 85°C
Supply Voltage to Ground Potential	
Inputs and V <sub>CC</sub> Only	-0.5V to 7.0V
Supply Voltage to Ground Potential	
Outputs and D/O Only	-0.5V to 7.0V

### Thermal Information

Thermal Resistance (Typical, Note 3)	$\theta_{JA}$ (°C/W)
TSSOP Package	85
SSOP Package	70
Maximum Junction Temperature	150°C
Maximum Storage Temperature Range	-65°C to 150°C
Maximum Lead Temperature (Soldering 10s)	300°C (Lead Tips Only)

**CAUTION:** Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

#### NOTE:

- $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

### Electrical Specifications

PARAMETER	SYMBOL	(NOTE 4) TEST CONDITIONS	MIN	(NOTE 5) TYP	MAX	UNITS	
<b>DC ELECTRICAL SPECIFICATIONS</b> Over the Operating Range, T <sub>A</sub> = -40°C to 85°C, V <sub>CC</sub> = 5.0V ±10%							
Input HIGH Voltage	V <sub>IH</sub>	Guaranteed Logic HIGH Level	2.0	-	-	V	
Input LOW Voltage	V <sub>IL</sub>	Guaranteed Logic LOW Level	-	-	0.8	V	
Input HIGH Current	I <sub>IH</sub>	V <sub>CC</sub> = Max      V <sub>IN</sub> = V <sub>CC</sub>	-	-	1	μA	
Input LOW Current	I <sub>IL</sub>	V <sub>CC</sub> = Min      V <sub>IN</sub> = GND	-	-	-1	μA	
High Impedance Output Current	I <sub>OZH</sub>	V <sub>CC</sub> = Max      V <sub>OUT</sub> = 2.7V	-	-	1	μA	
	I <sub>OZL</sub>	V <sub>CC</sub> = Max      V <sub>OUT</sub> = 0.5V	-	-	-1	μA	
Clamp Diode Voltage	V <sub>IK</sub>	V <sub>CC</sub> = Min, I <sub>IN</sub> = -18mA	-	-0.7	-1.2	V	
Short Circuit Current	I <sub>OS</sub>	V <sub>CC</sub> = Max (Note 6), V <sub>OUT</sub> = GND	-80	-140	-200	mA	
Output Drive Current	I <sub>O</sub>	V <sub>CC</sub> = Max (Note 6), V <sub>OUT</sub> = 2.5V	-50	-	-180	mA	
Input Hysteresis	V <sub>H</sub>		-	100	-	mV	
<b>CD74FCT16841T OUTPUT DRIVE SPECIFICATIONS</b> Over the Operating Range, T <sub>A</sub> = -40°C to 85°C, V <sub>CC</sub> = 5.0V ±10%							
Output HIGH Voltage	V <sub>OH</sub>	V <sub>CC</sub> = Min, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -3.0mA	2.5	3.5	-	V
			I <sub>OH</sub> = -15.0mA	2.4	3.5	-	V
			I <sub>OH</sub> = -32.0mA	2.0	3.0	-	V
Output LOW Voltage	V <sub>OL</sub>	V <sub>CC</sub> = Min, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 64mA	-	0.2	0.55	V
Power Down Disable	I <sub>OFF</sub>	V <sub>CC</sub> = 0V, V <sub>IN</sub> or V <sub>OUT</sub> ≤ 4.5V	-	-	±100	μA	
<b>CD74FCT162841T OUTPUT DRIVE SPECIFICATIONS</b> Over the Operating Range, T <sub>A</sub> = -40°C to 85°C, V <sub>CC</sub> = 5.0V ±10%							
Output HIGH Voltage	V <sub>OH</sub>	V <sub>CC</sub> = Min, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -24.0mA	2.4	3.3	-	V
Output LOW Voltage	V <sub>OL</sub>	V <sub>CC</sub> = Min, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 24mA	-	0.3	0.55	V
Output LOW Current	I <sub>ODL</sub>	V <sub>CC</sub> = 5V, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> = 1.5V (Note 6)	60	115	150	mA	
Output HIGH Current	I <sub>ODH</sub>	V <sub>CC</sub> = 5V, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> = 1.5V (Note 6)	-60	-115	-150	mA	
<b>CAPACITANCE</b> T <sub>A</sub> = 25°C, f = 1MHz							
Input Capacitance (Note 7)	C <sub>IN</sub>	V <sub>IN</sub> = 0V	-	4.5	6	pF	

**Electrical Specifications (Continued)**

PARAMETER	SYMBOL	(NOTE 4) TEST CONDITIONS	MIN	(NOTE 5) TYP	MAX	UNITS	
Output Capacitance (Note 7)	C <sub>OUT</sub>	V <sub>OUT</sub> = 0V	-	5.5	8	pF	
<b>POWER SUPPLY SPECIFICATIONS</b>							
Quiescent Power Supply Current	I <sub>CC</sub>	V <sub>CC</sub> = Max	V <sub>IN</sub> = GND or V <sub>CC</sub>	-	0.1	10	μA
Supply Current per Input at TTL HIGH	ΔI <sub>CC</sub>	V <sub>CC</sub> = Max	V <sub>IN</sub> = 3.4V (Note 8)	-	0.5	2.5	mA
Supply Current per Input per MHz (Note 9)	I <sub>CCD</sub>	V <sub>CC</sub> = Max, Outputs Open OE = GND, LE = V <sub>CC</sub> One Input Toggling 50% Duty Cycle	V <sub>IN</sub> = V <sub>CC</sub> V <sub>IN</sub> = GND	-	0.15	0.25	mA/ MHz
Total Power Supply Current (Note 11)	I <sub>C</sub>	V <sub>CC</sub> = Max, Outputs Open f <sub>CP</sub> = 10MHz, 50% Duty Cycle OE = GND; LE = V <sub>CC</sub> f <sub>I</sub> = 5MHz One Bit Toggling	V <sub>IN</sub> = V <sub>CC</sub> V <sub>IN</sub> = GND	-	1.7	4.0 (Note 10)	mA
			V <sub>IN</sub> = 3.4V V <sub>IN</sub> = GND	-	2.0	5.0 (Note 10)	mA
		V <sub>CC</sub> = Max, Outputs Open f <sub>CP</sub> = 10MHz, 50% Duty Cycle OE = GND; LE = V <sub>CC</sub> Eight Bits Toggling f <sub>I</sub> = 2.5MHz, 50% Duty Cycle	V <sub>IN</sub> = V <sub>CC</sub> V <sub>IN</sub> = GND	-	3.2	6.5 (Note 10)	mA
			V <sub>IN</sub> = 3.4V V <sub>IN</sub> = GND	-	5.2	14.5 (Note 10)	mA

**Switching Specifications Over Operating Range**

PARAMETER	SYMBOL	(NOTE 12) TEST CONDITIONS	AT		BT		CT		DT		ET		UNITS
			(NOTE 13) MIN	MAX	(NOTE 13) MIN	MAX	(NOTE 13) MIN	MAX	(NOTE 13) MIN	MAX	(NOTE 13) MIN	MAX	
Propagation Delay x <sub>D</sub> x to x <sub>Q</sub> x (LE = HIGH)	t <sub>PLH</sub> , t <sub>PHL</sub>	C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω	1.5	9.0	1.5	6.5	1.5	5.5	1.5	4.2	1.5	3.4	ns
		C <sub>L</sub> = 300pF (Note 14) R <sub>L</sub> = 500Ω	1.5	13.0	1.5	13.0	1.5	13.0	1.5	13.0	1.5	7.5	ns
Propagation Delay x <sub>LE</sub> to x <sub>Q</sub> x	t <sub>PLH</sub> , t <sub>PHL</sub>	C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω	1.5	12.0	1.5	8.0	1.5	6.4	1.5	4.0	1.5	3.7	ns
		C <sub>L</sub> = 30pF (Note 14) R <sub>L</sub> = 500Ω	1.5	16.0	1.5	15.5	1.5	15.0	1.5	8.0	1.5	7.5	ns
Output Enable Time x <sub>OE</sub> to x <sub>Q</sub> x	t <sub>pZH</sub> , t <sub>pZL</sub>	C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω	1.5	11.5	1.5	8.0	1.5	6.5	1.5	4.8	1.5	4.4	ns
		C <sub>L</sub> = 300pF (Note 15) R <sub>L</sub> = 500Ω	1.5	23.0	1.5	14.0	1.5	12.0	1.5	9.0	1.5	9.0	ns
Output Disable Time (Note 14) x <sub>OE</sub> to x <sub>Q</sub> x	t <sub>pHZ</sub> , t <sub>pLZ</sub>	C <sub>L</sub> = 5pF (Note 14) R <sub>L</sub> = 500Ω	1.5	7.0	1.5	6.0	1.5	5.7	1.5	4.0	1.5	3.6	ns
		C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω	1.5	8.0	1.5	7.0	1.5	6.0	1.5	5.4	1.5	3.6	ns

**5**  
D.D. 5V FCT BAL.  
AND HIGH DRIVE

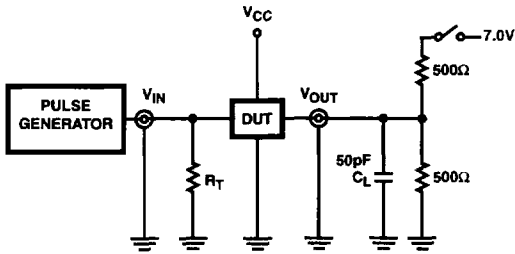
Switching Specifications Over Operating Range (Continued)

PARAMETER	SYMBOL	(NOTE 12) TEST CONDITIONS	AT		BT		CT		DT		ET		UNITS
			(NOTE 13) MIN	MAX	(NOTE 13) MIN	MAX	(NOTE 13) MIN	MAX	(NOTE 13) MIN	MAX	(NOTE 13) MIN	MAX	
Setup Time HIGH or LOW, $\chi D\chi$ to $\chi LE$	$t_{SU}$	$C_L = 50pF$ $R_L = 500\Omega$	2.5	-	2.5	-	2.5	-	1.0	-	1.0	-	ns
Hold Time HIGH or LOW, $\chi D\chi$ to $\chi LE$	$t_H$		2.5	-	2.5	-	2.5	-	1.0	-	1.0	-	ns
$\chi LE$ Pulse Width HIGH (Note 14)	$t_W$		4.0	-	4.0	-	4.0	-	4.0	-	3.0	-	ns
Output Skew (Note 15)	$t_{SK(O)}$		-	0.5	-	0.5	-	0.5	-	0.5	-	0.5	ns

NOTES:

4. For conditions shown as Max or Min, use appropriate value specified under Electrical Specifications for the applicable device type.
5. Typical values are at  $V_{CC} = 5.0V$ ,  $25^\circ C$  ambient and maximum loading.
6. Not more than one output should be shorted at one time. Duration of the test should not exceed one second.
7. This parameter is determined by device characterization but is not production tested.
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. Values for these conditions are examples of the  $I_{CC}$  formula. These limits are guaranteed but not tested.
11.  $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$   
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$   
 $I_{CC}$  = Quiescent Current  
 $\Delta I_{CC}$  = 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)  
 $f_{CP}$  = Clock Frequency for Register Devices (Zero for Non-Register Devices)  
 $f_i$  = Input Frequency  
 $N_i$  = Number of Inputs at  $f_i$   
 All currents are in milliamps and all frequencies are in megahertz.
12. See test circuit and wave forms.
13. Minimum limits are guaranteed but not tested on Propagation Delays.
14. This parameter is guaranteed but not production tested.
15. Skew between any two outputs, of the same package, switching in the same direction. This parameter is guaranteed by design.

Test Circuits and Waveforms



NOTE:

16. Pulse Generator for All Pulses: Rate  $\leq$  1.0MHz;  $Z_{OUT} \leq 50\Omega$ ;  
 $t_r, t_f \leq 2.5ns$ .

FIGURE 1. TEST CIRCUIT

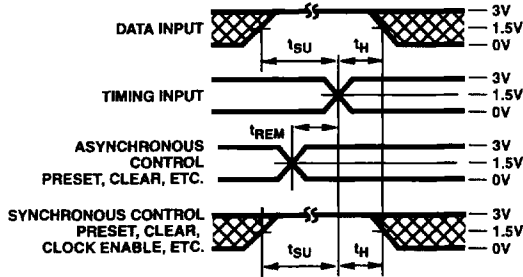


FIGURE 2. SETUP, HOLD, AND RELEASE TIMING

SWITCH POSITION	
TEST	SWITCH
$t_{PLZ}, t_{PZL}$	Closed
$t_{PHZ}, t_{PZH}, t_{PLH}, t_{PHL}$	Open

DEFINITIONS:

$C_L$  = Load capacitance, includes jig and probe capacitance.

$R_T$  = Termination resistance, should be equal to  $Z_{OUT}$  of the Pulse Generator.

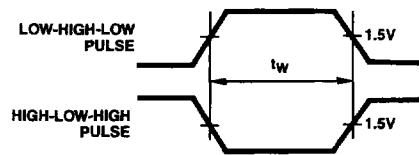


FIGURE 3. PULSE WIDTH

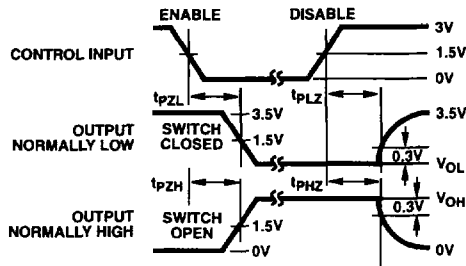


FIGURE 4. ENABLE AND DISABLE TIMING

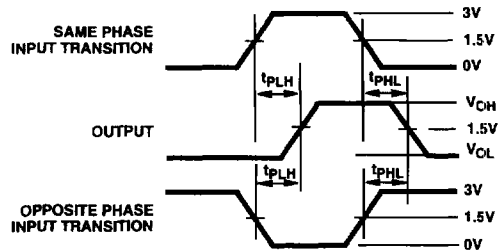


FIGURE 5. PROPAGATION DELAY

5  
D.D. 5V FCT BAL.  
AND HIGH DRIVE