



FAST CMOS 20-BIT TRANSPARENT LATCH

IDT54/74FCT162841AT/BT/CT

FEATURES:

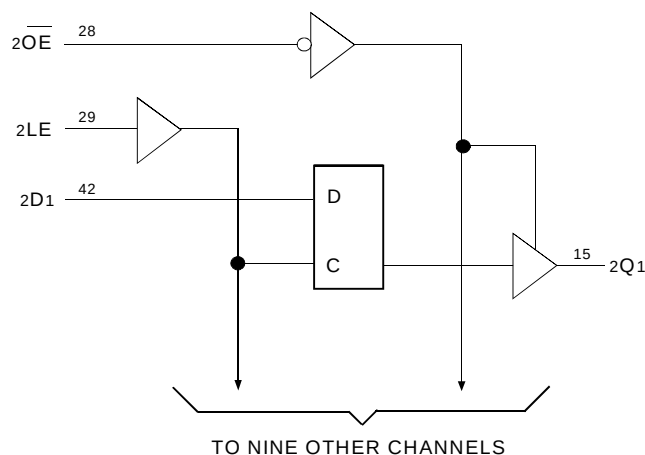
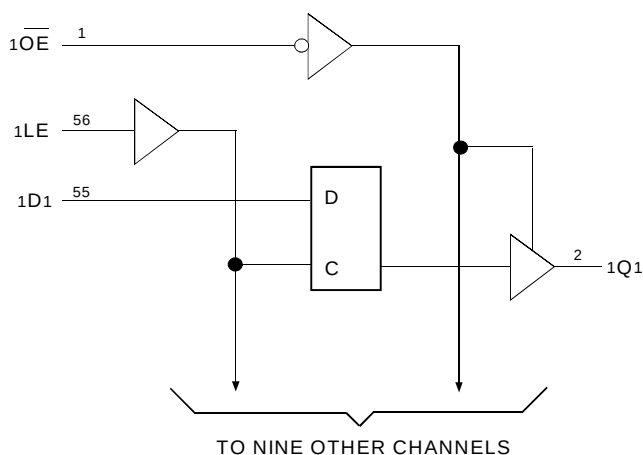
- 0.5 MICRON CMOS Technology
- High-speed, low-power CMOS replacement for ABT functions
- Typical $t_{sk(o)}$ (Output Skew) < 250ps
- Low input and output leakage $\leq 1\mu A$ (max.)
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- $V_{CC} = 5V \pm 10\%$
- **Balanced Output Drivers:**
 - $\pm 24mA$ (industrial)
 - $\pm 16mA$ (military)
- Reduced system switching noise
- Typical VolP (Output Ground Bounce) < 0.6V at $V_{CC} = 5V$, $T_A = 25^\circ C$
- Available in the following packages:
 - Industrial: SSOP, TSSOP
 - Military: CERPACK

DESCRIPTION:

The FCT162841T 20-bit transparent D-type latches are built using advanced dual metal CMOS technology. These high-speed, low-power latches are ideal for temporary data storage. They can be used for implementing memory address latches, I/O ports, and bus drivers. The Output Enable ($\overline{OE}$) and Latch Enable (LE) controls are organized to operate each device as two 10-bit latches or one 20-bit latch. Flow-through organization of signal pins simplifies layout. All inputs are designed with hysteresis for improved noise margin.

The FCT162841T 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 FCT162841T is a plug-in replacement for the FCT16841T and ABT16841 for on-board interface applications.

FUNCTIONAL BLOCK DIAGRAM

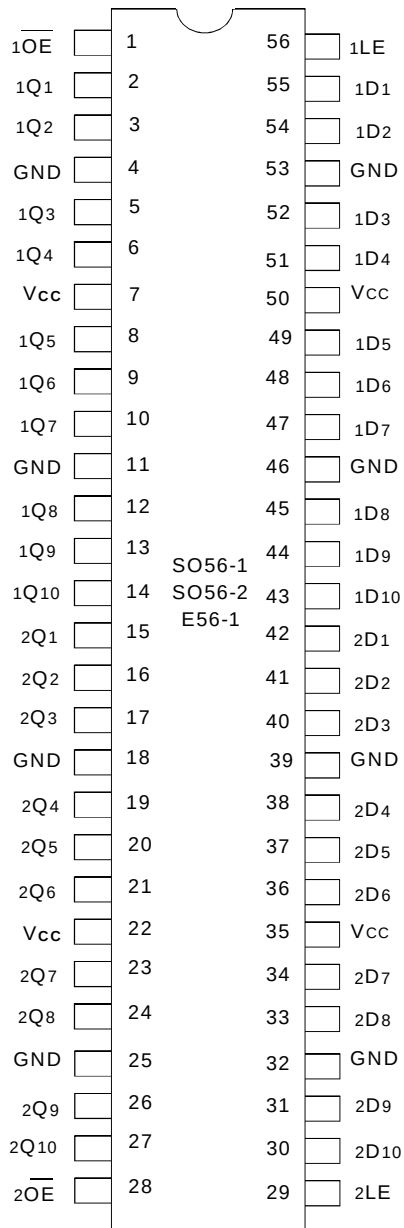


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MILITARY AND INDUSTRIAL TEMPERATURE RANGES

MAY 2001

PIN CONFIGURATION



ABSOLUTE MAXIMUM RATINGS⁽¹⁾

Symbol	Description	Max	Unit
V _{TERM} ⁽²⁾	Terminal Voltage with Respect to GND	-0.5 to 7	V
V _{TERM} ⁽³⁾	Terminal Voltage with Respect to GND	-0.5 to V _{CC} +0.5	V
T _{STG}	Storage Temperature	-65 to +150	°C
I _{OUT}	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.
- Outputs and I/O terminals for FCT162XXX.

CAPACITANCE (T_A = +25°C, f = 1.0MHz)

Symbol	Parameter ⁽¹⁾	Conditions	Typ.	Max.	Unit
C _{IN}	Input Capacitance	V _{IN} = 0V	3.5	6	pF
C _{OUT}	Output Capacitance	V _{OUT} = 0V	3.5	8	pF

NOTE:

- This parameter is measured at characterization but not tested.

PIN DESCRIPTION

Pin Names	Description
xD _x	Data Inputs
xLE	Latch Enable Inputs (Active HIGH)
x $\overline{OE}$	Output Enable Inputs (Active LOW)
xQ _x	3-State Outputs

FUNCTION TABLE⁽¹⁾

Inputs			Outputs
xD _x	xLE	x $\overline{OE}$	xQ _x
H	H	L	H
L	H	L	L
X	L	L	Q ⁽²⁾
X	X	H	Z

NOTES:

- H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
Z = High-Impedance
- Output level before xLE HIGH-to-LOW transition.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Industrial: $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 5.0\text{V} \pm 10\%$; Military: $T_A = -55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, $V_{CC} = 5.0\text{V} \pm 10\%$

Symbol	Parameter	Test Conditions ⁽¹⁾		Min.	Typ. ⁽²⁾	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) ⁽⁴⁾	V _{CC} = Max.	V _I = V _{CC}	—	—	±1	μA
	Input HIGH Current (I/O pins) ⁽⁴⁾			—	—	±1	
I _{IL}	Input LOW Current (Input pins) ⁽⁴⁾		V _I = GND	—	—	±1	
	Input LOW Current (I/O pins) ⁽⁴⁾			—	—	±1	
I _{OZH}	High Impedance Output Current	V _{CC} = Max.	V _O = 2.7V	—	—	±1	μA
I _{OZL}	(3-State Output pins) ⁽⁴⁾		V _O = 0.5V	—	—	±1	
V _{IK}	Clamp Diode Voltage	V _{CC} = Min., I _{IN} = −18mA		—	−0.7	−1.2	V
I _{OS}	Short Circuit Current	V _{CC} = Max., V _O = GND ⁽³⁾		−80	−140	−250	mA
V _H	Input Hysteresis	—		—	100	—	mV
I _{CCL}	Quiescent Power Supply Current	V _{CC} = Max		—	5	500	μA
I _{CCH}		V _{IN} = GND or V _{CC}					
I _{CCZ}							

OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions ⁽¹⁾		Min.	Typ. ⁽²⁾	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	$V_{CC} = \text{Min.}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -16\text{mA MIL}$ $I_{OH} = -24\text{mA IND}$	2.4	3.3	—	V
V_{OL}	Output LOW Voltage	$V_{CC} = \text{Min.}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 16\text{mA MIL}$ $I_{OL} = 24\text{mA IND}$	—	0.3	0.55	V

NOTES:

- For conditions shown as Min. or Max., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at $V_{CC} = 5.0\text{V}$, $+25^{\circ}\text{C}$ ambient.
- Not more than one output should be shorted at one time. Duration of the test should not exceed one second.
- This 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 ⁽¹⁾		Min.	Typ. ⁽²⁾	Max.	Unit
ΔI_{CC}	Quiescent Power Supply Current TTL Inputs HIGH	$V_{CC} = \text{Max.}$ $V_{IN} = 3.4V^{(3)}$		—	0.5	1.5	mA
I_{CCD}	Dynamic Power Supply Current ⁽⁴⁾	$V_{CC} = \text{Max.}$ Outputs Open $\overline{xOE} = \text{GND}$ One Input Toggling 50% Duty Cycle	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	60	100	$\mu A /$ MHz
I_C	Total Power Supply Current ⁽⁶⁾	$V_{CC} = \text{Max.}$ Outputs Open $f_i = 10\text{MHz}$ 50% Duty Cycle $\overline{xOE} = \text{GND}$ $xLE = V_{CC}$ One Bit Toggling	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	0.6	1.5	mA
			$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$	—	0.9	2.3	
		$V_{CC} = \text{Max.}$ Outputs Open $f_i = 2.5\text{MHz}$ 50% Duty Cycle $\overline{xOE} = \text{GND}$ $xLE = V_{CC}$ Twenty Bits Toggling	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	3	5.5 ⁽⁵⁾	
			$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$	—	8	20.5 ⁽⁵⁾	

NOTES:

- For conditions shown as Min. or Max., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at $V_{CC} = 5.0V$, $+25^\circ\text{C}$ ambient.
- Per TTL driven input ($V_{IN} = 3.4V$). All other inputs at V_{CC} 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_{CC} formula. These limits are guaranteed but not tested.
- $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP} N_{CP} / 2 + f_i N_i)$
 $I_{CC} = \text{Quiescent Current (} I_{CCL}, I_{CCH} \text{ and } I_{CCZ} \text{)}$
 $\Delta I_{CC} = \text{Power Supply Current for a TTL High Input (} V_{IN} = 3.4V \text{)}$
 $D_H = \text{Duty Cycle for TTL Inputs High}$
 $N_T = \text{Number of TTL Inputs at } D_H$
 $I_{CCD} = \text{Dynamic Current Caused by an Input Transition Pair (HLH or LHL)}$
 $f_{CP} = \text{Clock Frequency for Register Devices (Zero for Non-Register Devices)}$
 $N_{CP} = \text{Number of Clock Inputs at } f_{CP}$
 $f_i = \text{Input Frequency}$
 $N_i = \text{Number of Inputs at } f_i$

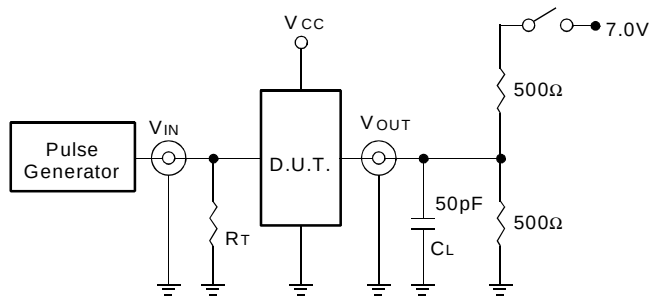
SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Symbol	Parameter	Condition ⁽¹⁾	FCT162841AT				FCT162841BT				FCT162841CT				Unit
			Ind.		Mil.		Ind.		Mil.		Ind.		Mil.		
			Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	
t _{PLH} t _{PHL}	Propagation Delay xDx to xQx (LE = HIGH)	C _L = 50pF R _L = 500Ω	1.5	9	1.5	10	1.5	6.5	1.5	7.5	1.5	3.8	1.5	6.3	ns
		C _L = 300pF ⁽⁵⁾ R _L = 500Ω	1.5	13	1.5	15	1.5	13	1.5	15	1.5	7.5	1.5	15	
t _{PLH} t _{PHL}	Propagation Delay xLE to xQx	C _L = 50pF R _L = 500Ω	1.5	12	1.5	13	1.5	8	1.5	10.5	1.5	3.8	1.5	6.8	ns
		C _L = 300pF ⁽⁵⁾ R _L = 500Ω	1.5	16	1.5	20	1.5	15.5	1.5	18	1.5	7.5	1.5	16	
t _{PZH} t _{PZL}	Output Enable Time x $\overline{\text{OE}}$ to xQx	C _L = 50pF R _L = 500Ω	1.5	11.5	1.5	13	1.5	8	1.5	8.5	1.5	4.6	1.5	7.3	ns
		C _L = 300pF ⁽⁵⁾ R _L = 500Ω	1.5	23	1.5	25	1.5	14	1.5	15	1.5	9	1.5	13	
t _{PHZ} t _{PLZ}	Output Disable Time x $\overline{\text{OE}}$ to xQx	C _L = 5pF ⁽⁵⁾ R _L = 500Ω	1.5	7	1.5	9	1.5	6	1.5	6.5	1.5	3.6	1.5	6	ns
		C _L = 50pF R _L = 500Ω	1.5	8	1.5	10	1.5	7	1.5	7.5	1.5	3.6	1.5	6.3	
t _{SU}	Set-Up Time HIGH or LOW, xDx to xLE	C _L = 50pF R _L = 500Ω	2.5	—	2.5	—	2.5	—	2.5	—	1	—	2.5	—	ns
t _H	Hold Time HIGH or LOW xDx to xLE		2.5	—	3	—	2.5	—	2.5	—	1	—	2.5	—	ns
t _w	xLE Pulse Width HIGH		4 ⁽⁴⁾	—	5	—	4 ⁽⁴⁾	—	4 ⁽⁴⁾	—	3 ⁽⁴⁾	—	4 ⁽⁴⁾	—	ns
t _{SK(o)}	Output Skew ⁽³⁾		—	0.5	—	0.5	—	0.5	—	0.5	—	0.5	—	0.5	ns

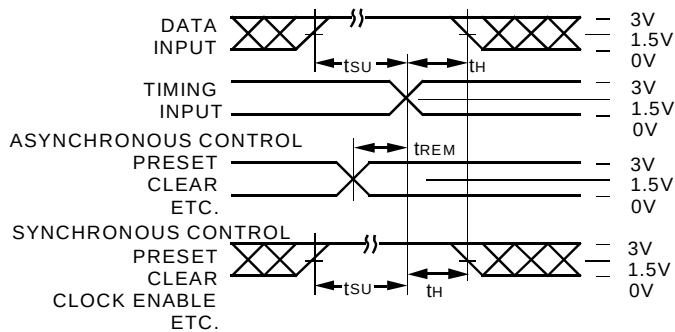
NOTES:

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.
5. This condition is guaranteed but not tested.

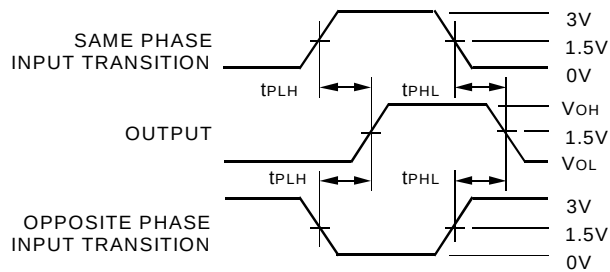
TEST CIRCUITS AND WAVEFORMS



Test Circuits for All Outputs



Set-up, Hold, and Release Times



Propagation Delay

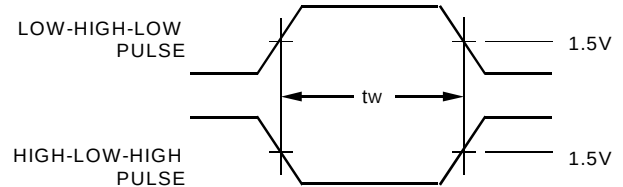
SWITCH POSITION

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

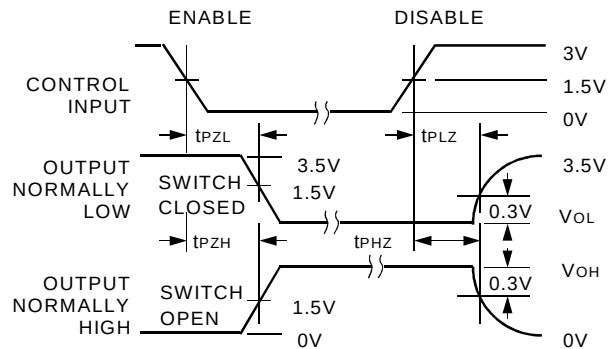
DEFINITIONS:

CL = Load capacitance: includes jig and probe capacitance.

RT = Termination resistance: should be equal to ZOUT of the Pulse Generator.



Pulse Width

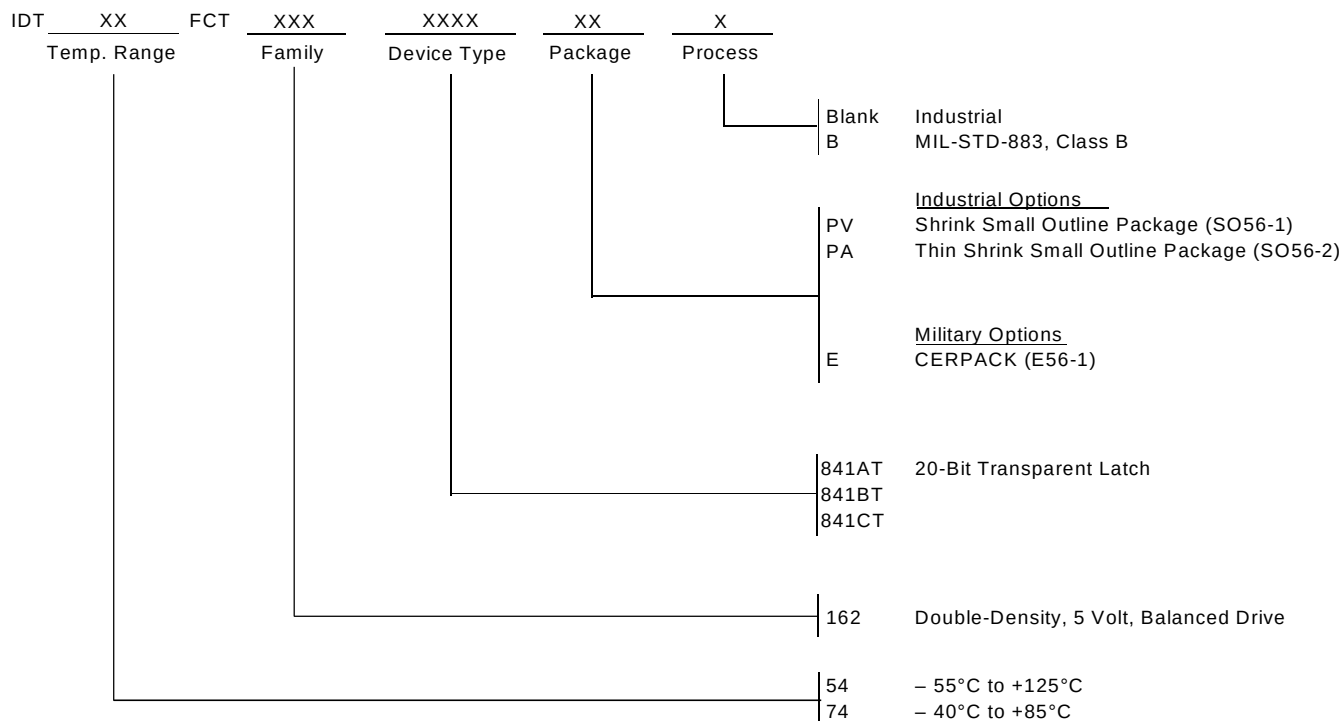


Enable and Disable Times

NOTES:

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

ORDERING INFORMATION



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