FAST CMOS OCTAL D FLIP-FLOP WITH CLOCK ENABLE

IDT74FCT377AT/CT/DT

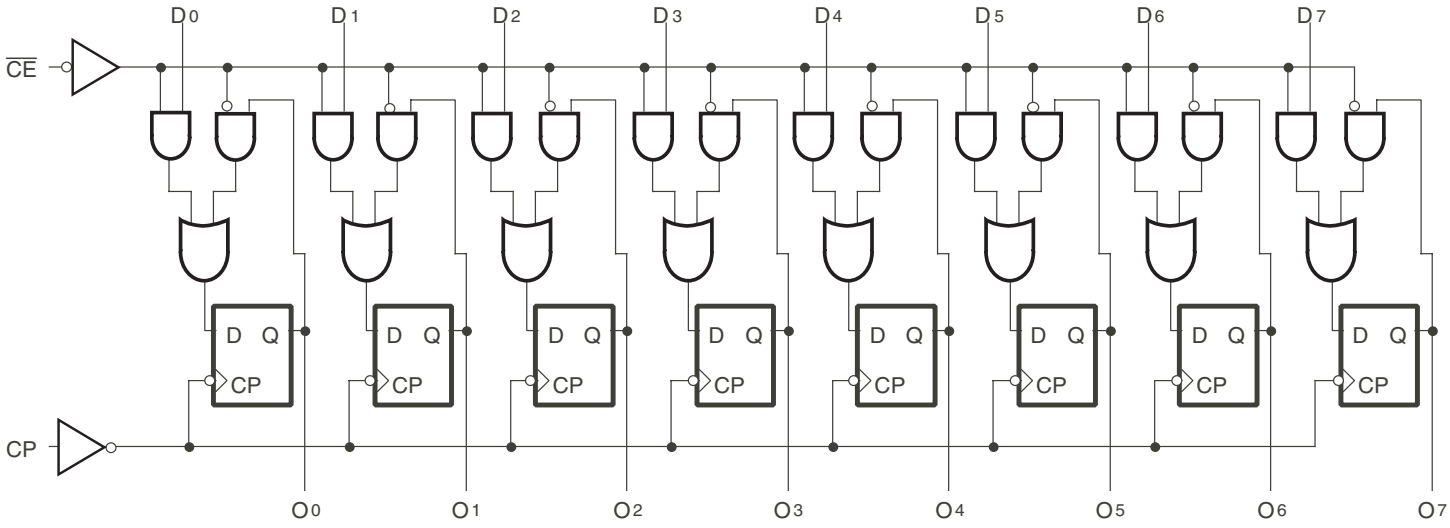
FEATURES:

- **A, C, and D grades**
- **Low input and output leakage ≤1µA (max.)**
- **CMOS power levels**
- **True TTL input and output compatibility:**
  - *V_{OH} = 3.3V (typ.)*
  - *V_{OL} = 0.3V (typ.)*
- **High Drive outputs (-15mA I_{OH}, 48mA I_{OL})**
- **Meets or exceeds JEDEC standard 18 specifications**
- **Power off disable outputs permit "live insertion"**
- **Available in SOIC and QSOP packages**

DESCRIPTION:

The IDT74FCT377T is an octal D flip-flop built using an advanced dual metal CMOS technology. The IDT74FCT377T has eight edge-triggered, D-type flip-flops with individual D inputs and O outputs. The common buffered Clock (CP) input loads all flip-flops simultaneously when the Clock Enable ($\overline{CE}$) is low. The register is fully edge-triggered. The state of each D input, one set-up time before the low-to-high clock transition, is transferred to the corresponding flip-flop's O output. The $\overline{CE}$ input must be stable only one set-up time prior to the low-to-high transition for predictable operation.

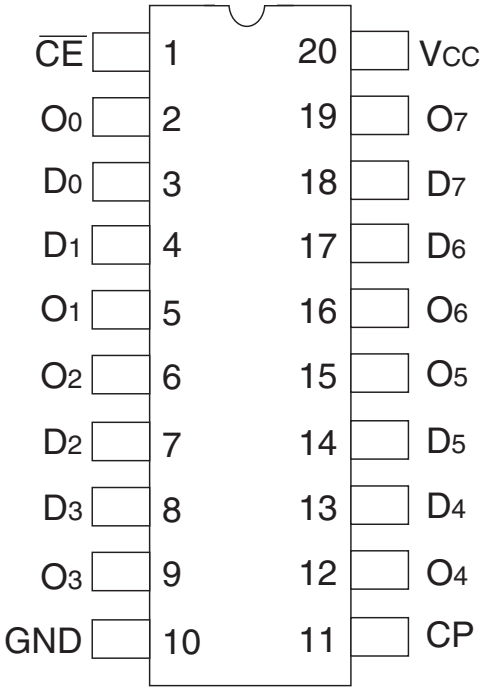
FUNCTIONAL BLOCK DIAGRAM



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PIN CONFIGURATION



SOIC/ QSOP
TOP VIEW

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:
1. 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. No terminal voltage may exceed Vcc by +0.5V unless otherwise noted.
2. Inputs and Vcc terminals only.
3. Output and I/O terminals only.

CAPACITANCE (T_A = +25°C, F = 1.0MHz)

Symbol	Parameter(1)	Conditions	Typ.	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	6	10	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V	8	12	pF

NOTE:
1. This parameter is measured at characterization but not tested.

PIN DESCRIPTION

Pin Names	Description
D_0 – D_7	Data Inputs
$\overline{CE}$	Clock Enable (Active LOW)
O_0 – O_7	Data Outputs
CP	Clock Pulse Input

FUNCTION TABLE(1)

	Inputs			Outputs
Operating Mode	CP	$\overline{CE}$	D	O
Load "1"	↑	l	h	H
Load "0"	↑	l	l	L
Hold	↑	h	X	No Change
	H	H	X	No Change

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

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DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Industrial : T_A = –40°C to +85°C, V_{CC} = 5.0V ± 5%

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[4]	V_{CC} = Max.	V_I = 2.7V	—	—	±1	µA
I_{IL}	Input LOW Current[4]	V_{CC} = Max.	V_I = 0.5V	—	—	±1	µA
I_I	Input HIGH Current[4]	V_{CC} = Max., V_I = V_{CC} (Max.)		—	—	±1	µA
V_{IK}	Clamp Diode Voltage	V_{CC} = Min., I_N = –18mA		—	–0.7	–1.2	V
I_{OS}	Short Circuit Current	V_{CC} = Max.[3], V_O = GND		–60	–120	–225	mA
V_{OH}	Output HIGH Voltage	V_{CC} = Min.	I_{OH} = –8mA	2.4	3.3	—	V
		V_{IN} = V_{IH} or V_{IL}	I_{OH} = –12mA	2	3	—	
V_{OL}	Output LOW Voltage	V_{CC} = Min.	I_{OL} = 48mA	—	0.3	0.5	V
		V_{IN} = V_{IH} or V_{IL}					
I_{OFF}	Input/Output Power Off Leakage[5]	V_{CC} = 0V, V_{IN} or V_O - 4.5V		—	—	±1	µA
V_H	Input Hysteresis	—		—	200	—	mV
I_{CC}	Quiescent Power Supply Current	V_{CC} = Max.		—	0.01	1	mA
		V_{IN} = GND or V_{CC}					

NOTES:

1. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at V_{CC} = 5.0V, +25°C ambient.
3. Not more than one output should be shorted at one time. Duration of the short circuit test should not exceed one second.
4. The test limit for this parameter is ±5µA at T_A = -55°C.
5. This parameter is guaranted but not tested.

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POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions[1]		Min.	Typ.[2]	Max.	Unit
ΔI_{CC}	Quiescent Power Supply Current TTL Inputs HIGH	V_{CC} = Max. V_{IN} = 3.4V[3]		—	0.5	2	mA
I_{CCD}	Dynamic Power Supply Current[4]	V_{CC} = Max., Outputs Open $\overline{CE}$ = GND One Input Toggling 50% Duty Cycle	V_{IN} = V_{CC} V_{IN} = GND	—	0.15	0.25	mA/ MHz
I_C	Total Power Supply Current[6]	V_{CC} = Max., Outputs Open f_{CP} = 10MHz	V_{IN} = V_{CC} V_{IN} = GND	—	1.5	3.5	mA
		$\overline{CE}$ = GND One Bit Toggling f_i = 5MHz 50% Duty Cycle	V_{IN} = 3.4V V_{IN} = GND	—	2	5.5	
		V_{CC} = Max., Outputs Open f_{CP} = 10MHz, 50% Duty Cycle	V_{IN} = V_{CC} V_{IN} = GND	—	3.8	7.3[5]	
		$\overline{CE}$ = GND Eight Bits Toggling f_i = 2.5MHz 50% Duty Cycle	V_{IN} = 3.4V V_{IN} = GND	—	6	16.3[5]	

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} = 5.0V, +25°C ambient.
3. Per TTL driven input; (V_{IN} = 3.4V). All other inputs at V_{CC} or GND.
4. This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
5. Values for these conditions are examples of ΔI_{CC} formula. These limits are guaranteed but not tested.
6. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$
   I_{CC} = Quiescent Current
   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_{CP} = Clock Frequency for Register Devices (Zero for Non-Register Devices)
   f_i = Output Frequency
   N_i = Number of Outputs at f_i

All currents are in milliamps and all frequencies are in megahertz.

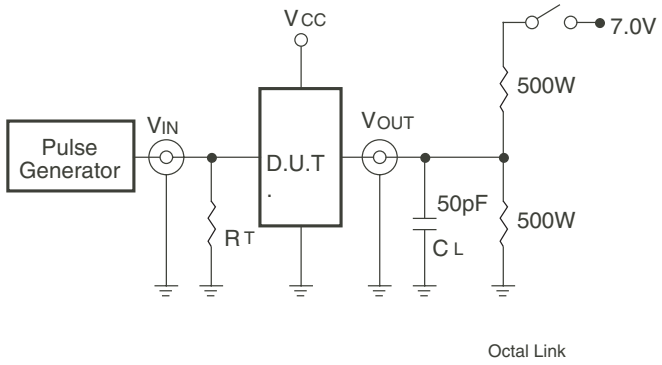
SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Symbol	Parameter	Condition[1]	74FCT377AT		74FCT377CT		74FCT377DT		Unit
			Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	
t_{PLH} t_{PHL}	Propagation Delay CP to Qx	C_L = 50pF R_L = 500Ω	2	7.2	2	5.2	2	4.4	ns
t_{SU}	Set-up Time HIGH or LOW Dx to CP		2	—	2	—	2	—	ns
t_H	Hold Time HIGH or LOW Dx to CP		1.5	—	1.5	—	1	—	ns
t_{SU}	Set-up Time HIGH or LOW $\overline{CE}$ to CP		3.5	—	3.5	—	3	—	ns
t_H	Hold Time HIGH or LOW $\overline{CE}$ to CP		1.5	—	1.5	—	0	—	ns
t_W	CP Pulse Width HIGH or LOW		8	—	6	—	3	—	ns

NOTES:
1. See test circuit and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.

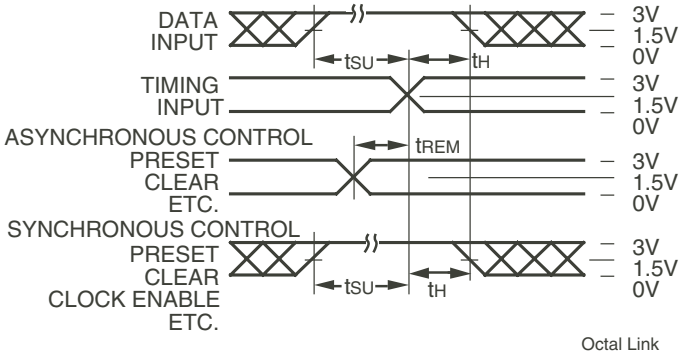
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TEST CIRCUITS AND WAVEFORMS



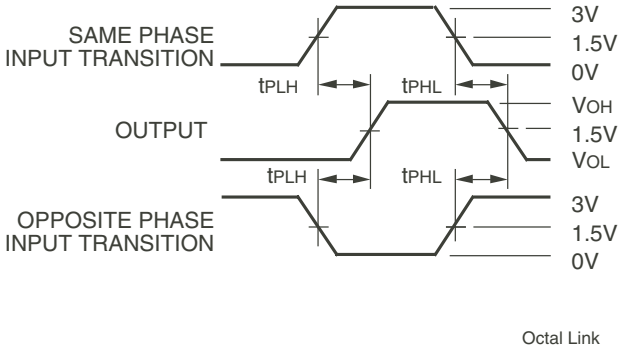
Octal Link

Test Circuits for All Outputs



Octal Link

Set-Up, Hold, and Release Times



Octal Link

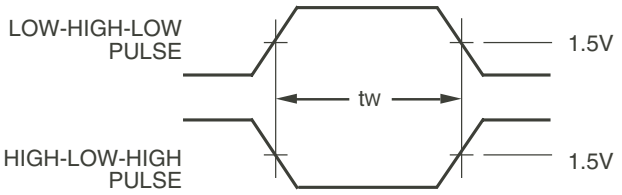
Propagation Delay

SWITCH POSITION

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

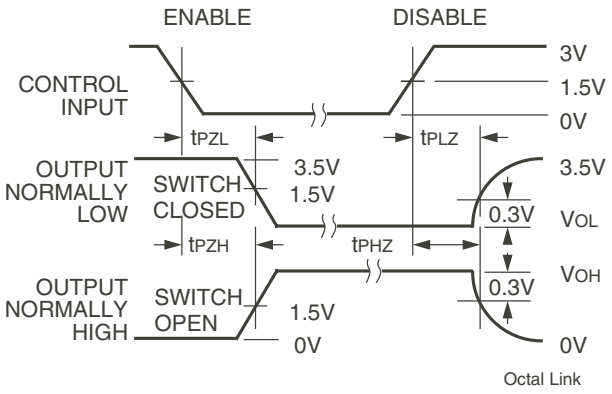
DEFINITIONS:

C_L = Load capacitance: includes jig and probe capacitance.
R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.



Pulse Width

Octal Link



Octal Link

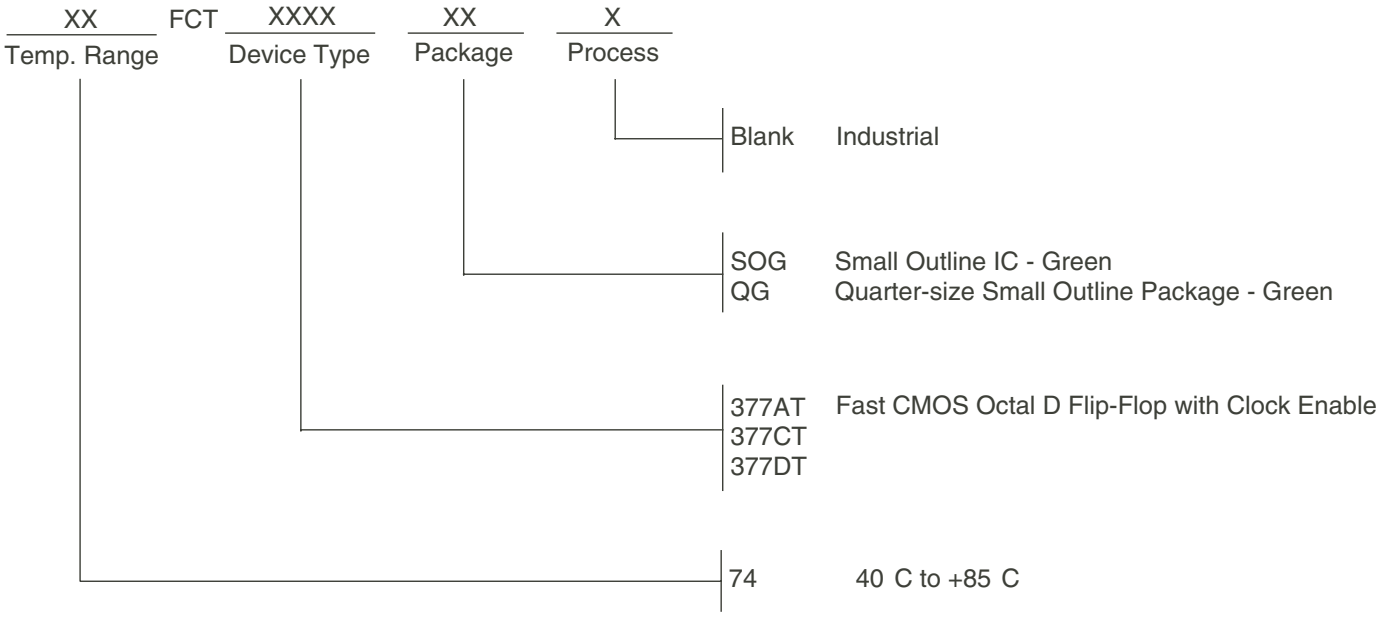
Enable and Disable Times

NOTES:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.
2. Pulse Generator for All Pulses: Rate ≤ 1.0MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.

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ORDERING INFORMATION



Datasheet Document History

10/03/09 Pg. 6 Updated the ordering information by removing the "IDT" notation and non RoHS part.

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Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Contact Information

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