HIGH-SPEED CMOS OCTAL D FLIP-FLOP WITH CLOCK ENABLE

IDT54/74AHCT377

Integrated Device Technology, Inc.

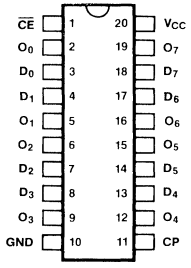
FEATURES:

- Equivalent to ALS speeds and output drive over full temperature and voltage supply extremes
- 10ns typical clock to output
- I_{OL} = 14mA over full military temperature range
- CMOS power levels (5μW typ. static)
- Both CMOS and TTL output compatible
- Substantially lower input current levels than ALS (5μA max.)
- Octal D flip-flop with clock enable
- 100% product assurance screening to MIL-STD-883, Class B is available
- JEDEC standard pinout for DIP and LCC

DESCRIPTION:

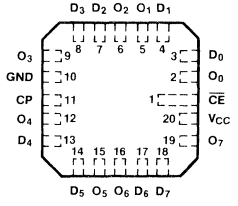
The IDT54/74AHCT377 is an octal D flip-flop built using advanced CEMOS™, a dual metal CMOS technology. The IDT54/74AHCT377 has eight edge-triggered, D-type flip-flops with individual D inputs and O outputs. The common buffered Clock (CP) input loads all flip-flops simultaneously when the Clock Enable ($\overline{CE}$) is LOW. The register is fully edge-triggered. The state of each D input, one setup 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 setup time prior to the LOW-to-HIGH clock transition for predictable operation.

PIN CONFIGURATIONS



SSD54/74FCT377-001

DIP
TOP VIEW



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LCC
TOP VIEW

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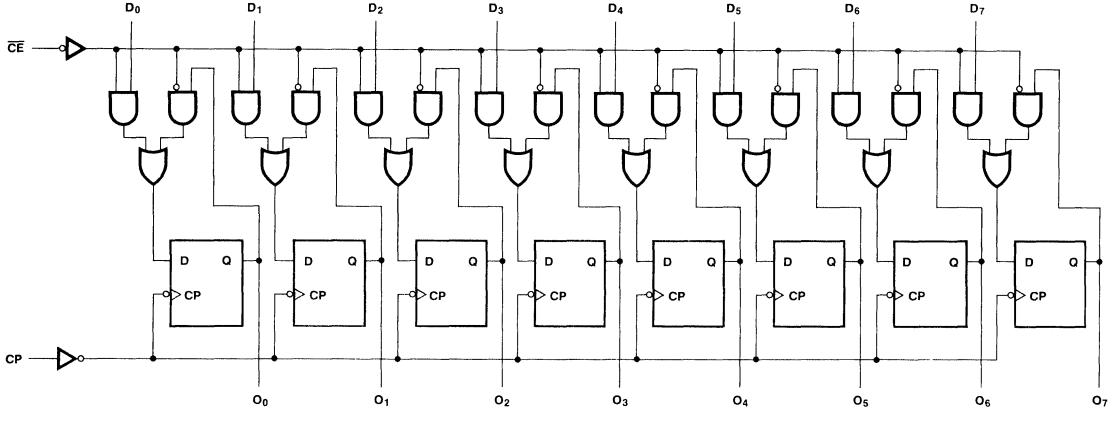
FUNCTIONAL BLOCK DIAGRAM



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SSD54/74FCT377-003

ABSOLUTE MAXIMUM RATING(1)

SYMBOL	RATING	COMMERCIAL	MILITARY	UNIT
V_{TERM}	Terminal Voltage with Respect to GND	-0.5 to +7.0	-0.5 to +7.0	V
T_A	Operating Temperature	0 to +70	-55 to +125	°C
T_{BIAS}	Temperature Under Bias	-55 to +125	-65 to +135	°C
T_{STG}	Storage Temperature	-55 to +125	-65 to +155	°C
I_{OUT}	DC Output Current	120	120	mA

NOTE:
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.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

T_A = 0°C to +70°C V_{CC} = 5.0V ± 5% Min. = 4.75V Max. = 5.25V (Commercial)
T_A = -55°C to +125°C V_{CC} = 5.0V ± 10% Min. = 4.50V Max. = 5.50V (Military)
V_{LC} = 0.2V
V_{HC} = V_{CC} - 0.2V

SYMBOL	PARAMETER	TEST CONDITIONS(1)		MIN.	TYP.(2)	MAX.	UNIT
V_{IH}	Input HIGH Level	Guaranteed Logic High Level		2.0	—	—	V
V_{IL}	Input LOW Level	Guaranteed Logic Low Level		—	—	0.8	V
I_{IH}	Input HIGH Current	V_{CC} = Max., V_{IN} = V_{CC}		—	—	5	µA
I_{IL}	Input LOW Current	V_{CC} = Max., V_{IN} = GND		—	—	-5	µA
I_{SC}	Short Circuit Current	V_{CC} = Max.(3)		-60	-100	—	mA
V_{OH}	Output HIGH Voltage	V_{CC} = 3V, V_{IN} = V_{LC} or V_{HC}, I_{OH} = -32µA		V_{HC}	V_{CC}	—	V
		V_{CC} = Min., V_{IN} = V_{IH} or V_{IL}	I_{OH} = -150µA	V_{HC}	V_{CC}	—	
			I_{OH} = -1.0mA MIL.	2.4	4.3	—	
			I_{OH} = -2.6mA COM'L.	2.4	4.3	—	
V_{OL}	Output LOW Voltage	V_{CC} = 3V, V_{IN} = V_{LC} or V_{HC}, I_{OL} = 300µA		—	GND	V_{LC}	V
		V_{CC} = Min., V_{IN} = V_{IH} or V_{IL}	I_{OL} = 300µA	—	GND	V_{LC}	
			I_{OL} = 14mA MIL.	—	—	0.4	
			I_{OL} = 24mA COM'L.	—	—	0.5	

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 and maximum loading.
3. Not more than one output should be shorted at one time. Duration of the short circuit test should not exceed one second.

POWER SUPPLY CHARACTERISTICS

V_{LC} = 0.2V; V_{HC} = V_{CC} - 0.2V

SYMBOL	PARAMETER	TEST CONDITIONS[1]		MIN.	TYP.[2]	MAX.	UNIT
I_{CCQ}	Quiescent Power Supply Current	V_{CC} = Max. $V_{IN} \geq V_{HC}$; $V_{IN} \leq V_{LC}$ $f_{CP} = f_i = 0$		—	0.001	1.5	mA
I_{CCT}	Quiescent Power Supply Current TTL Inputs HIGH	V_{CC} = Max. V_{IN} = 3.4V[3]		—	0.5	1.6	mA
I_{CCD}	Dynamic Power Supply Current	V_{CC} = Max. Outputs Open $\overline{CE}$ = GND One Bit Toggling 50% Duty Cycle	$V_{IN} \geq V_{HC}$ $V_{IN} \leq V_{LC}$	—	0.15	0.25	mA/ MHz
I_{CC}	Total Power Supply[4] Current	V_{CC} = Max. Outputs Open f_{CP} = 10MHz 50% Duty Cycle $\overline{CE}$ = GND One Bit Toggling at f_i = 500KHz 50% Duty Cycle	$V_{IN} \geq V_{HC}$ $V_{IN} \leq V_{LC}$ (AHCT)	—	0.15	1.8	mA
			V_{IN} = 3.4V or V_{IN} = GND	—	0.65	3.4	
		V_{CC} = Max. Outputs Open F_{CP} = 1.0MHz 50% Duty Cycle $\overline{CE}$ = GND Eight Bits Toggling at f_i = 250KHz 50% Duty Cycle	$V_{IN} \geq V_{HC}$ $V_{IN} \leq V_{LC}$ (AHCT)	—	0.63	2.2	
			V_{IN} = 3.4V or V_{IN} = GND	—	2.88	9.4	

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 and maximum loading.
3. Per TTL driven input (V_{IN} = 3.4V); all other inputs at V_{CC} or GND.
4. $I_{CC} = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_{CC} = I_{CCQ} + I_{CCT}D_HN_T + I_{CCD}(f_{CP}/2 + f_iN_i)$
   I_{CCQ} = Quiescent Current
   I_{CCT} = 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.

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DEFINITION OF FUNCTIONAL TERMS

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

TRUTH TABLE

OPERATING MODE	INPUTS			OUTPUTS
	CP	$\overline{CE}$	D_N	O_N
Load "1"	↑	l	h	H
Load "0"	↑	l	l	L
Hold (Do Nothing)	↑	h	X	No Change
	X	H	X	No Change

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 = Immaterial
↑ = LOW-to-HIGH Clock Transition

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

SYMBOL	PARAMETER	CONDITION	TYPICAL	COMMERCIAL		MILITARY		UNITS
				MIN.	MAX.	MIN.	MAX.	
t_{PLH} t_{PHL}	Propagation Delay CP to O_N	C_L = 50pf R_L = 500Ω	10.0	4.0	18.0	4.0	20.0	ns
t_S	Set Up Time HIGH or LOW D_N to CP		5.0	6.0	—	6.0	—	ns
t_H	Hold Time HIGH or LOW D_N to CP		2.0	3.0	—	4.0	—	ns
t_S	Set Up Time HIGH or LOW $\overline{CE}$ to CP		3.0	5.0	—	5.0	—	ns
t_H	Hold Time HIGH or LOW $\overline{CE}$ to CP		2.0	6.0	—	8.0	—	ns
t_W	Clock Pulse Width, LOW		7.0	10.0	—	10.0	—	ns