Integrated Device Technology, Inc

HIGH-SPEED CMOS UP/DOWN BINARY COUNTER

IDT54/74AHCT191

FEATURES:

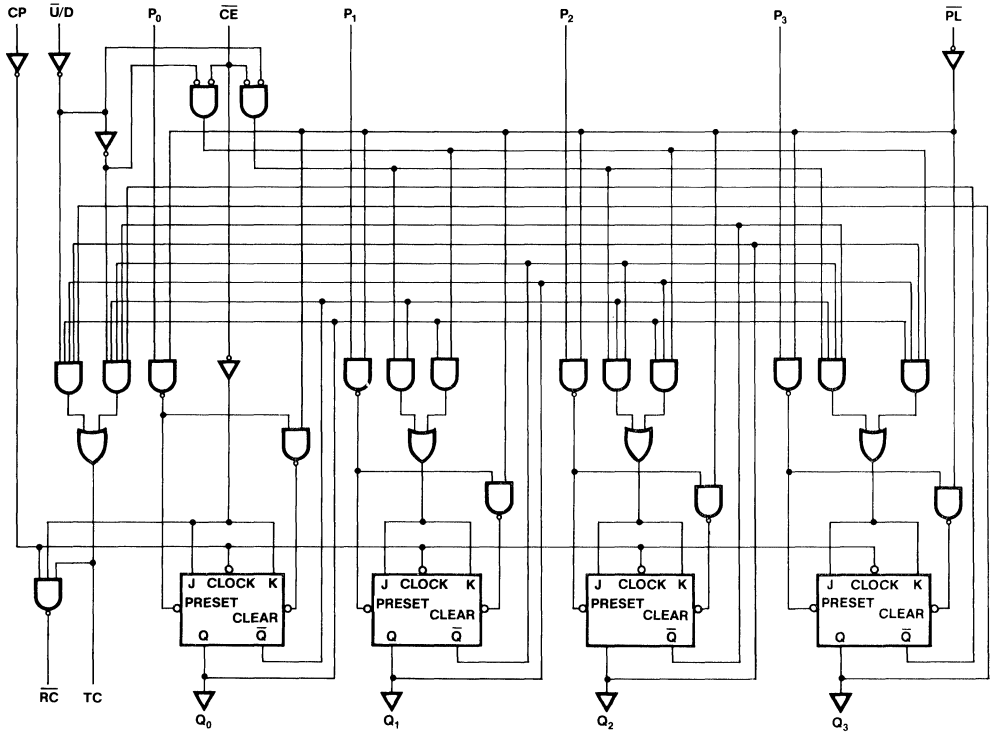
- Equivalent to ALS speeds and output drive over full temperature and voltage supply extremes
- I_{OL} = 14mA over full military temperature range
- CMOS power levels (5μW typ. static)
- Both CMOS and TTL output compatible
- Substantially lower input current levels than ALS (5μ max.)
- 100% product assurance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

DESCRIPTION:

The IDT54/74AHCT191 is a reversible modulo-16 binary counter, featuring synchronous counting and asynchronous presetting, built using advanced CEMOS™, a dual metal CMOS technology.

The preset feature allows the IDT54/74AHCT191 to be used in programmable dividers. The Count Enable input, the Terminal Count output and the Ripple Clock output make possible a variety of methods of implementing multistage counters. In the counting modes, state changes are initiated by the rising edge of the clock.

FUNCTIONAL BLOCK DIAGRAM



SSDFCT191-001

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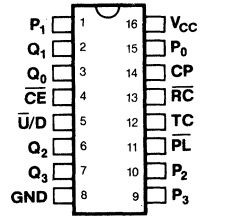
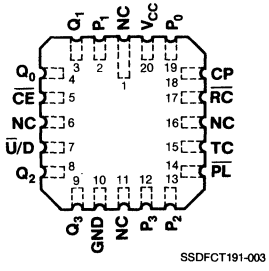
PIN CONFIGURATIONS



DIP
TOP VIEW



LCC
TOP VIEW

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	Operation 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}	Power Supply Current Per TTL Input 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 Count Up or Down $\overline{CE} = V_{LC}$ $\overline{PL} = P_0 - P_3 = V_{HC}$ $\overline{U}/D = V_{HC}$ or V_{LC}	$V_{IN} \geq V_{HC}$ $V_{IN} \leq V_{LC}$	—	0.3	—	mA/ MHz
I_{CC}	Total Power Supply Current[4]	V_{CC} = Max. Outputs Open f_{CP} = 1.0MHz 50% Duty Cycle Count Up or Down $\overline{CE} = V_{LC}$ $\overline{PL} = P_0 - P_3 = V_{HC}$ $\overline{U}/D = V_{HC}$ or V_{LC}	$V_{IN} \geq V_{HC}$ $V_{IN} \leq V_{LC}$ (AHCT)	—	0.3	—	mA
			V_{IN} = 3.4V or V_{IN} = GND	—	1.1	—	

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 shold be shorted at one time. Duration of the short circuit test should not exceed one second.
4. Per TTL driven input (V_{IN} = 3.4V); all other inputs at V_{CC} or GND.
5. $I_{CC} = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_{CC} = I_{CCQ} + I_{CCT}D_HN_T + I_{CCD}(f_{CP} + f_iN_i)$
   I_{CCQ} = Quiescent Current
   I_{CCT} = Power Supply Current for a TTL High Input (V_{IN} = 3.4V)
   D_H = Duty Cycle for TTL Input 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} = Count Clock or Load Clock Frequency
   $f_i = P_{0-3}$ Input Frequency (Load)
   N_i = Number of P_{0-3} Inputs at f_i (Load)
   All currents are in milliamps and all frequencies are in megahertz.

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DEFINITION OF FUNCTIONAL TERMS

PIN NAMES	DESCRIPTION
$\overline{CE}$	Count Enable Input (Active LOW)
CP	Count Pulse Input (Active Rising Edge)
P_{0-3}	Parallel Data Inputs
$\overline{PL}$	Asynchronous Parallel Load Input (Active LOW)
$\overline{U}/D$	Up/Down Count Control Input
Q_{0-3}	Flip-Flop Outputs
$\overline{RC}$	Ripple Clock Output (Active LOW)
TC	Terminal Clock Output (Active HIGH)

RC TRUTH TABLE

INPUTS			OUTPUT
$\overline{CE}$	TC(1)	CP	$\overline{RC}$
L	H		
H	X	X	H
X	L	X	H

NOTES:

1. TC is generated internally.

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial

TRUTH TABLES
MODE SELECT TABLE

INPUTS				MODE
$\overline{PL}$	$\overline{CE}$	$\overline{U}/D$	CP	
H	L	L	↑	Count Up
H	L	H	↑	Count Down
L	X	X	X	Preset (Asynch.)
H	H	X	X	No Change (Hold)

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

SYMBOL	PARAMETER	CONDITION	TYPICAL	COMMERCIAL		MILITARY		UNITS
				MIN..	MAX.	MIN.	MAX.	
t_{PLH} t_{PHL}	Propagation Delay CP to Q_n	C_L = 50pF R_L = 500Ω	—	3.0	18.0	3.0	22.0	ns
t_{PLH} t_{PHL}	Propagation Delay CP to TC		—	6.0	31.0	6.0	34.0	ns
t_{PLH} t_{PHL}	Propagation Delay CP to $\overline{RC}$		—	5.0	20.0	4.0	24.0	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{CE}$ to $\overline{RC}$		—	4.0	18.0	4.0	21.0	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{U}/D$ to $\overline{RC}$		—	6.0	25.0	6.0	30.0	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{U}/D$ to TC		—	6.0	25.0	6.0	30.0	ns
t_{PLH} t_{PHL}	Propagation Delay P_n to Q_n		—	4.0	21.0	4.0	25.0	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{PL}$ to Q_n		—	6.0	30.0	6.0	34.0	ns
$t_S(H)$ $t_S(L)$	Setup Time HIGH or LOW P_n to $\overline{PL}$		—	20.0	—	25.0	—	ns
$t_H(H)$ $t_H(L)$	Hold Time HIGH or LOW P_n to $\overline{PL}$		—	5.0	—	5.0	—	ns
$t_S(L)$	Setup Time LOW $\overline{CE}$ to CP		—	20.0	—	25.0	—	
$t_H(L)$	Hold Time LOW $\overline{CE}$ to CP		—	0	—	0	—	
$t_S(H)$ $t_S(L)$	Setup Time HIGH or LOW $\overline{U}/D$ to CP		—	20.0	—	20.0	—	ns
$t_H(H)$ $t_H(L)$	Hold Time HIGH or LOW $\overline{U}/D$ to CP		—	0	—	0	—	ns
$t_W(L)$	$\overline{PL}$ Pulse Width LOW		—	20.0	—	25.0	—	ns
$t_W(L)$	CP Pulse Width LOW		—	15.0	—	20.0	—	ns
t_{REC}	Recovery Time $\overline{PL}$ to CP		—	15.0	—	20.0	—	ns