

# HD14020B

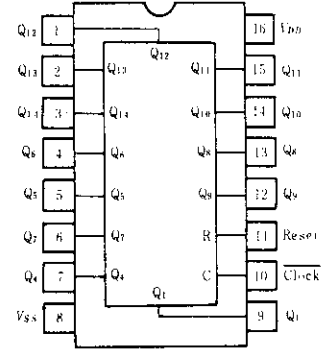
## 14-bit Binary Counter

The HD14020B 14-stage binary counter is designed with an input wave shaping circuit and 14 stages of ripple-carry binary counter. The device advances the count on the negative-going edge of the clock pulse. Applications include time delay circuits, counter controls, and frequency-dividing circuits.

### FEATURES

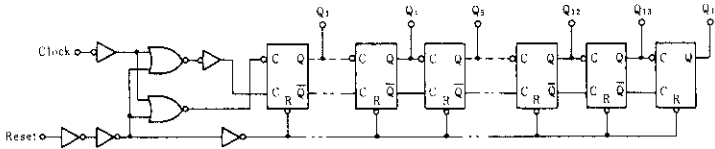
- Supply Voltage Range = 3 to 18V
- Capable of Driving One Low-power Schottky TTL Load Over the Rated Temperature Range
- Common Reset Line
- 13MHz typ. Counting Rate @15V
- Pin-for-Pin Replacement for CD4020B and MC14020B

### PIN ARRANGEMENT



(Top View)

### LOGIC DIAGRAM

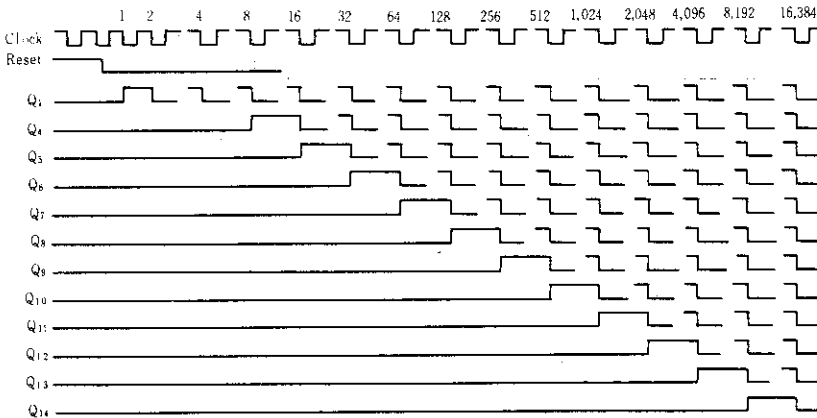


### TRUTH TABLE

Clock	Reset	Outputs State
	0	No Change
	0	Advance to next state
	1	All Outputs are low

× : Don't Care

### TIMING DIAGRAM

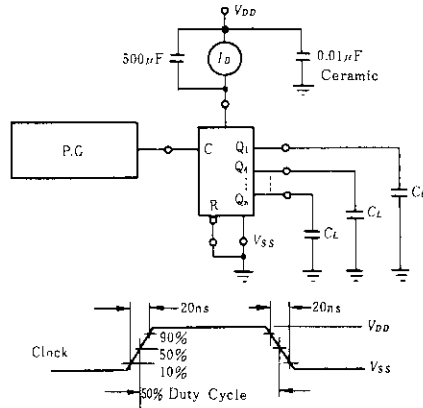


**ELECTRICAL CHARACTERISTICS**

Characteristic	Symbol	Test Conditions	-40°C		25°C			85°C		Unit		
			min	max	min	typ	max	min	max			
Output Voltage	$V_{OL}$	$V_{DD}(V)$ 5.0	$V_{in}=V_{DD}$ or 0	—	0.05	—	0	0.05	—	0.05	V	
		10		—	0.05	—	0	0.05	—	0.05		
		15		—	0.05	—	0	0.05	—	0.05		
	$V_{OH}$	5.0	$V_{in}=0$ or $V_{DD}$	4.95	—	4.95	5.0	—	4.95	—	V	
		10		9.95	—	9.95	10	—	9.95	—		
		15		14.95	—	14.95	15	—	14.95	—		
Input Voltage	$V_{IL}$	5.0	$V_{out}=4.5$ or 0.5V	—	1.5	—	2.25	1.5	—	1.5	V	
		10		—	3.0	—	4.50	3.0	—	3.0		
		15		—	4.0	—	6.75	4.0	—	4.0		
	$V_{IH}$	5.0	$V_{out}=0.5$ or 4.5V	3.5	—	3.5	2.75	—	3.5	—	V	
		10		7.0	—	7.0	5.50	—	7.0	—		
		15		11.0	—	11.0	8.25	—	11.0	—		
Output Drive Current	$I_{OH}$	5.0	$V_{OH}=2.5V$	-1.0	—	-0.8	-1.7	—	-0.6	—	mA	
		5.0		$V_{OH}=4.6V$	-0.2	—	-0.16	-0.36	—	-0.12		—
		10		$V_{OH}=9.5V$	-0.5	—	-0.4	-0.9	—	-0.3		—
	$I_{OL}$	5.0	$V_{OL}=0.4V$	0.52	—	0.44	0.88	—	0.36	—	mA	
		10		$V_{OL}=0.5V$	1.3	—	1.1	2.25	—	0.9		—
		15		$V_{OL}=1.5V$	3.6	—	3.0	8.8	—	2.4		—
Input Current	$I_{in}$	15		—	$\pm 0.3$	—	$\pm 0.00001$	$\pm 0.3$	—	$\pm 1.0$	$\mu A$	
Input Capacitance	$C_{in}$		$V_{in}=0$	—	—	—	5.0	7.5	—	—	pF	
Quiescent Current	$I_{DD}$	5.0	Zero Signal, per Package	—	20	—	0.005	20	—	150	$\mu A$	
		10		—	40	—	0.010	40	—	300		
		15		—	80	—	0.015	80	—	600		
Total Supply Current*	$I_T$	5.0	Dynamic + $I_{DD}$ , per Gate	—	—	—	0.43	—	—	—	$\mu A$	
		10		—	—	—	0.86	—	—	—		
		15		$C_L=50pF, f=1kHz$	—	—	—	1.45	—	—		—

\* To calculate total supply current at frequency other than 1kHz.  
 @  $V_{DD}=5.0V$   $I_T=10.42\mu A/kHz$  /  $f + I_{DD}$ , @  $V_{DD}=10V$   $I_T=10.85\mu A/kHz$  /  $f + I_{DD}$ , @  $V_{DD}=15V$   $I_T=11.43\mu A/kHz$  /  $f + I_{DD}$

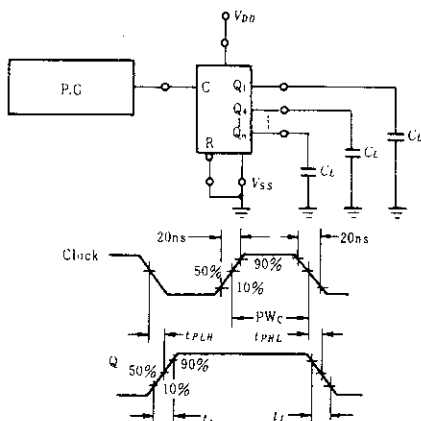
**POWER DISSIPATION TEST CIRCUIT AND WAVEFORM**



■ SWITCHING CHARACTERISTICS ( $C_L=50\text{pF}$ ,  $T_a=25^\circ\text{C}$ )

Characteristic		Symbol	$V_{DD}(\text{V})$	min	typ	max	Unit
Output Rise Time		$t_r$	5.0	—	180	400	ns
			10	—	90	200	
			15	—	65	160	
Output Fall Time		$t_f$	5.0	—	100	200	ns
			10	—	50	100	
			15	—	37	80	
Propagation Delay Time	Clock to $Q_1$	$t_{PLH}$	5.0	—	400	750	ns
			10	—	170	300	
			15	—	120	230	
	Clock to $Q_{1s}$	$t_{PHL}$	5.0	—	2.8	8.4	$\mu\text{s}$
			10	—	1.0	3.0	
			15	—	0.6	2.5	
	Reset to $Q_s$	$t_{PHL}$	5.0	—	595	3500	ns
			10	—	230	900	
			15	—	180	680	
Clock Pulse Width		$PW_C$	5.0	500	140	—	ns
			10	165	55	—	
			15	125	38	—	
Clock Pulse Frequency		$PRF$	5.0	—	3.5	1.0	MHz
			10	—	9.0	3.0	
			15	—	13	4.0	
Clock Pulse Rise and Fall Time		$t_r, t_f$	5.0	No Limit			
			10				
			15				
Reset Pulse Width		$PW_R$	5.0	3000	320	—	ns
			10	550	120	—	
			15	420	80	—	

■ SWITCHING TIME TEST CIRCUIT





Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	1.07 g



\*Dimension including the plating thickness  
 Base material dimension

Hitachi Code	FP-16DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.24 g



\*Dimension including the plating thickness  
Base material dimension

Hitachi Code	FP-16DN
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.15 g

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