

HD14020B

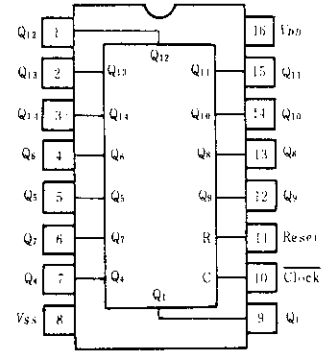
14-bit Binary Counter

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

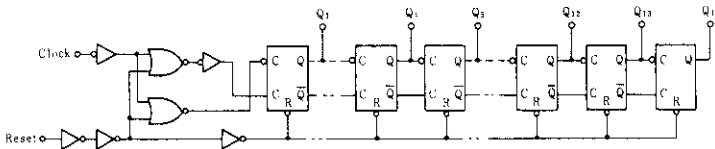
- Supply Voltage Range = 3 to 18V
- Capable of Driving One Low-power Schottky TTL Load Over the Rated Temperature Range
- Common Reset Line
- 13MHz typ. Counting Rate @15V
- Pin-for-Pin Replacement for CD4020B and MC14020B

PIN ARRANGEMENT



(Top View)

LOGIC DIAGRAM

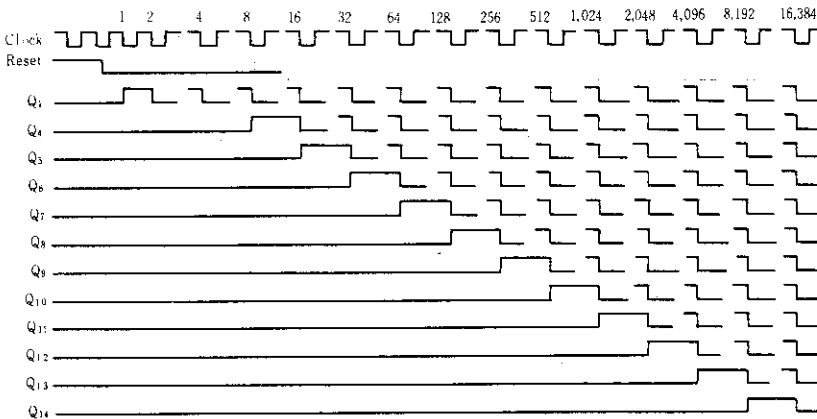


TRUTH TABLE

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

x : Don't Care

TIMING DIAGRAM

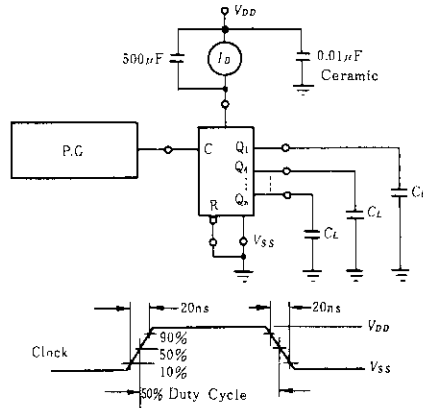


ELECTRICAL CHARACTERISTICS

| 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 | — | |
| | 15 | $V_{OH}=13.5V$ | | -1.4 | | | — | -1.2 | -3.5 | — | -1.0 | — | | | |
| | 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 | — | | | | ± 0.3 | — | ± 0.00001 | ± 0.3 | — | ± 1.0 | μA |
| 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 | μA | |
| | | 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 | — | — | — | μA | | | |
| | | 10 | | | — | — | — | 0.86 | — | — | — | | | | |
| | | 15 | | | — | — | — | 1.45 | — | — | — | | | | |

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

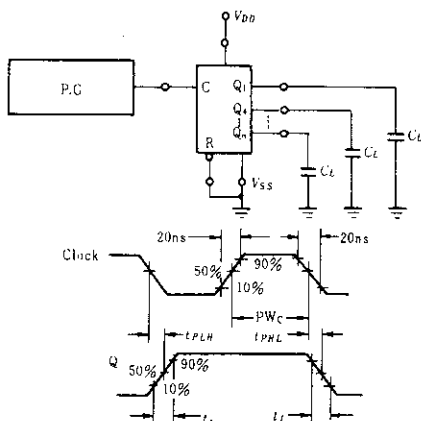
POWER DISSIPATION TEST CIRCUIT AND WAVEFORM

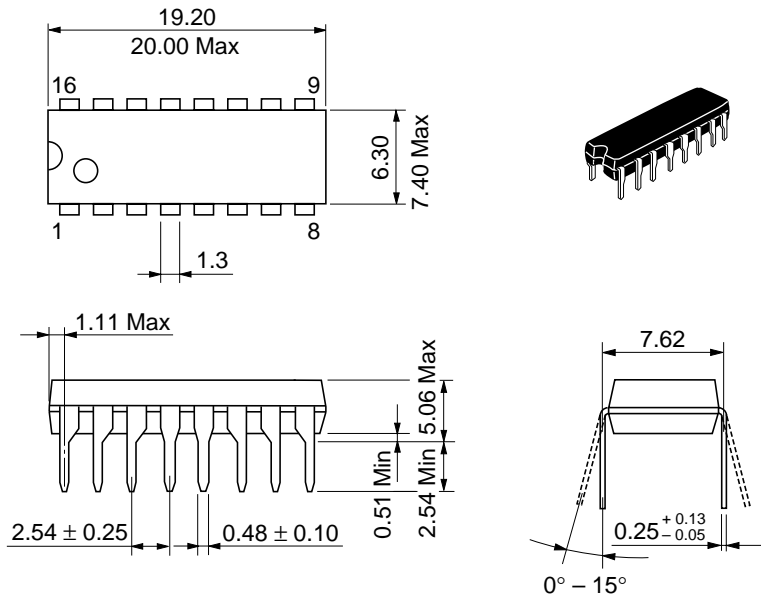


■ SWITCHING CHARACTERISTICS ($C_L=50\text{pF}$, $T_a=25^\circ\text{C}$)

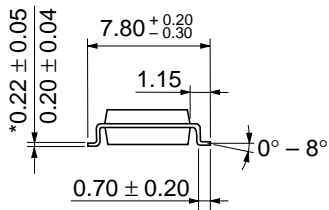
| Characteristic | | Symbol | $V_{DD}(\text{V})$ | min | typ | max | Unit |
|--------------------------------|------------------------|------------|--------------------|----------|-----|------|---------------|
| Output Rise Time | | t_r | 5.0 | — | 180 | 400 | ns |
| | | | 10 | — | 90 | 200 | |
| | | | 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 $Q_{1\bar{}}$ | t_{PHL} | 5.0 | — | 2.8 | 8.4 | μs |
| | | | 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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Hitachi, Ltd.

Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

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For further information write to:

Hitachi Semiconductor
(America) Inc.
179 East Tasman Drive,
San Jose, CA 95134
Tel: <1> (408) 433-1990
Fax: <1> (408) 433-0223

Hitachi Europe GmbH
Electronic components Group
Dornacher Straße 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 778322

Hitachi Asia Pte. Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 049318
Tel: 535-2100
Fax: 535-1533

Hitachi Asia Ltd.
Taipei Branch Office
3F, Hung Kuo Building, No.167,
Tun-Hwa North Road, Taipei (105)
Tel: <886> (2) 2718-3666
Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower, World Finance Centre,
Harbour City, Canton Road, Tsim Sha Tsui,
Kowloon, Hong Kong
Tel: <852> (2) 735 9218
Fax: <852> (2) 730 0281
Telex: 40815 HITEC HX

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