

HD14160B, HD14161B HD14162B, HD14163B

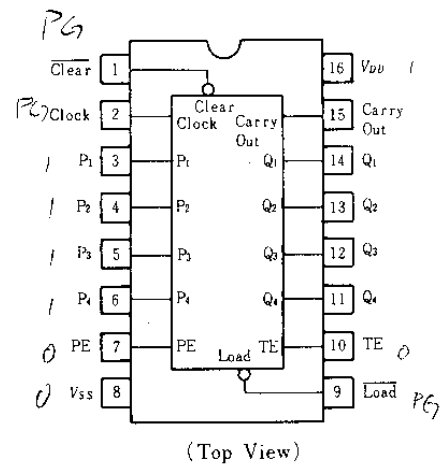
- HD14160B.....Decade Counter with Asynchronous Clear
- HD14161B.....4-bit Binary Counter with Asynchronous Clear
- HD14162B.....Decade Counter with Synchronous Clear
- HD14163B.....4-bit Binary Counter with Synchronous Clear

The HD14160B to HD14163B are synchronous programmable counters and functionally equivalent to the 74160 to 74163 TTL counters. Two are synchronous programmable decade counters with asynchronous and synchronous clear inputs respectively (HD14160B, HD14162B). The other two are synchronous programmable 4-bit binary counters with the asynchronous and synchronous clear respectively (HD14161B, HD14163B).

■ FEATURES

- Internal Look-Ahead for Fast Counting
- Carry Output for N-bit Cascading
- Synchronously Programmable
- Synchronous Counting
- Load Control Line
- Synchronous or Asynchronous Clear Positive Edge Clocked

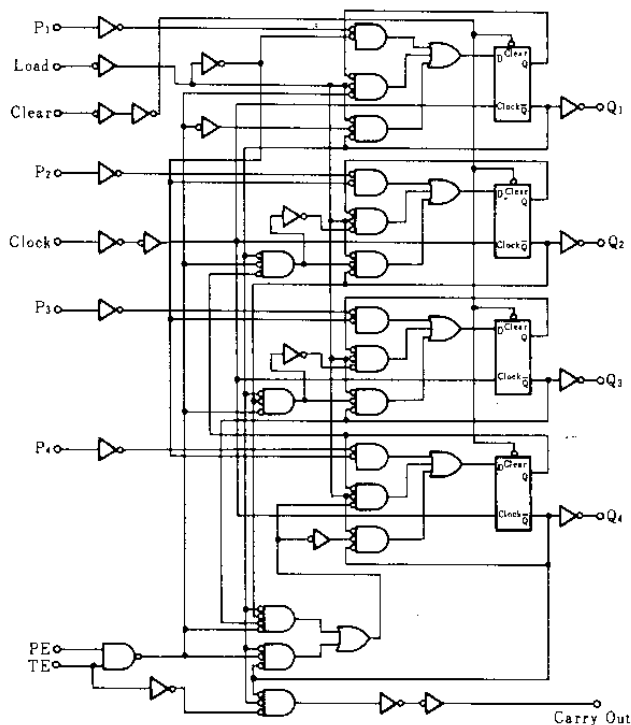
■ PIN ARRANGEMENT



■ LOGIC DIAGRAM

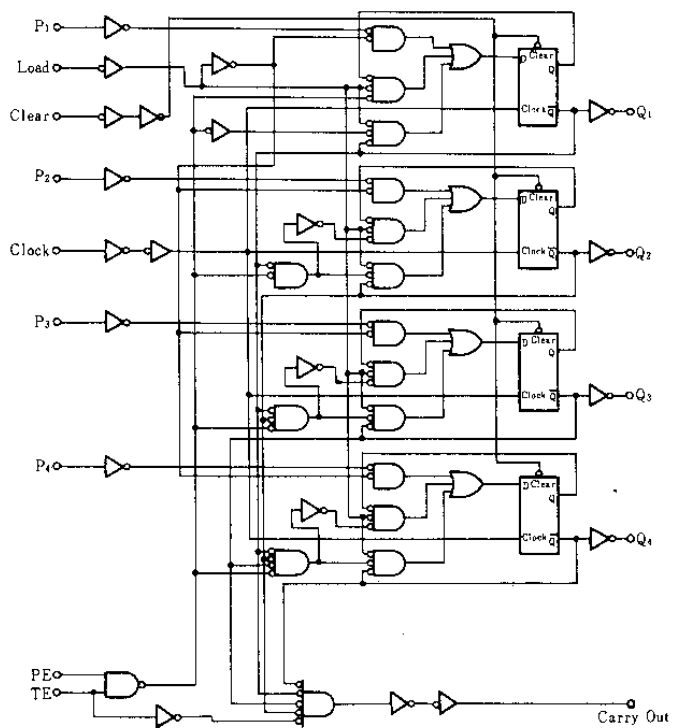
● HD14160B, HD14162B

(Clear is synchronous for HD14162B)



● HD14161B, HD14163B

(Clear is Synchronous for HD14163B)



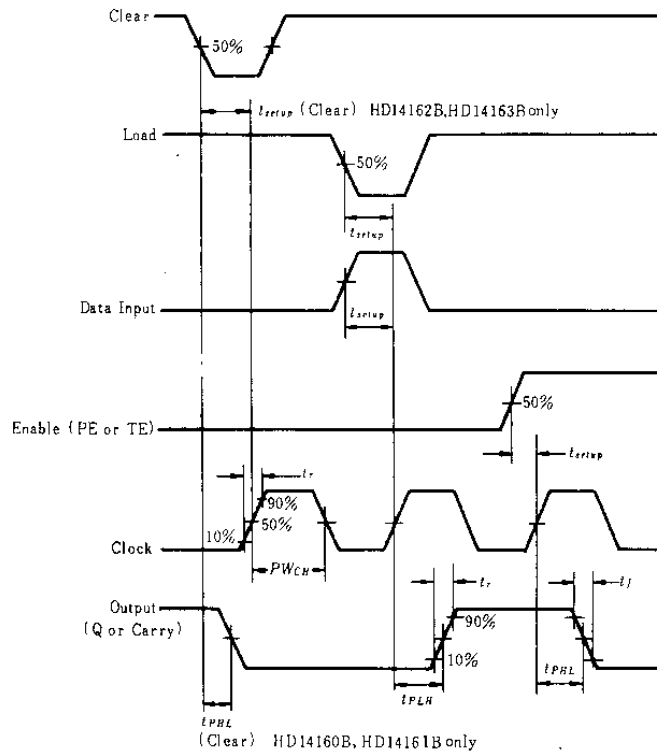
ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | V _{DD} (V) | Test Conditions | -40°C | | 25°C | | | 85°C | | Unit |
|-----------------------|-----------------|-----------------------|---------------------------------------|-------|------|-------|----------|------|-------|------|------|
| | | | | min | max | min | typ | max | min | max | |
| Output Voltage | V _{OL} | 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 | V _{out} =9.0 or 1.0V | — | 3.0 | — | 4.50 | 3.0 | — | 3.0 | |
| | | 15 | V _{out} =13.5 or 1.5V | — | 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 | V _{out} =1.0 or 9.0V | 7.0 | — | 7.0 | 5.50 | — | 7.0 | — | |
| | | 15 | V _{out} =1.5 or 13.5V | 11.0 | — | 11.0 | 8.25 | — | 11.0 | — | |
| Output Drive Current | I _{OH} | 5.0 | V _{OH} =2.5V | -2.5 | — | -2.1 | -4.2 | — | -1.7 | — | mA |
| | | 5.0 | V _{OH} =4.6V | -0.52 | — | -0.44 | -0.88 | — | -0.36 | — | |
| | | 10 | V _{OH} =9.5V | -1.3 | — | -1.1 | -2.25 | — | -0.9 | — | |
| | | 15 | V _{OH} =13.5V | -3.6 | — | -3.0 | -8.8 | — | -2.4 | — | |
| | 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} , | — | — | — | 0.56 | — | — | — | μA |
| | | 10 | per Gate, C _L =50pF | — | — | — | 1.1 | — | — | — | |
| | | 15 | f=1kHz | — | — | — | 1.9 | — | — | — | |

* To calculate total supply current at frequency other than 1kHz.

@V_{DD}=5.0V I_T=(0.56μA/kHz)f+I_{DD}, @V_{DD}=10V I_T=(1.1μA/kHz)f+I_{DD}, @V_{DD}=15V I_T=(1.9μA/kHz)f+I_{DD}

DYNAMIC SIGNAL WAVEFORMS

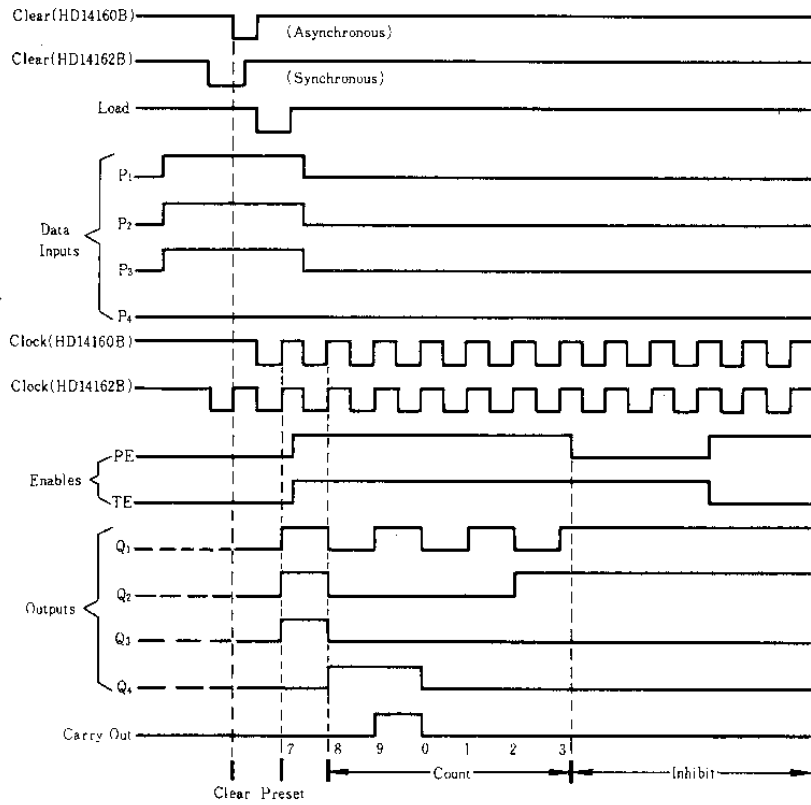


■ SWITCHING CHARACTERISTICS ($C_L=50\text{pF}$, $T_a=25^\circ\text{C}$)

| Characteristic | | Symbol | $V_{DD}(V)$ | min | typ | max | Unit |
|------------------------|---|--------------------------|-------------|-----|-----|-----|---------------|
| Output Rise Time | | t_r | 5.0 | — | 100 | 200 | ns |
| | | | 10 | — | 50 | 100 | |
| | | | 15 | — | 40 | 80 | |
| Output Fall Time | | t_f | 5.0 | — | 100 | 200 | ns |
| | | | 10 | — | 50 | 100 | |
| | | | 15 | — | 40 | 80 | |
| Propagation Delay Time | Clock to Q | t_{PLH} , t_{PHL} | 5.0 | — | 350 | 700 | ns |
| | | | 10 | — | 150 | 300 | |
| | | | 15 | — | 100 | 200 | |
| | Clock to Carry Out | | 5.0 | — | 440 | 880 | |
| | | | 10 | — | 185 | 370 | |
| | | | 15 | — | 125 | 250 | |
| | TE to Carry Out | | 5.0 | — | 300 | 600 | |
| | | | 10 | — | 130 | 260 | |
| | | | 15 | — | 90 | 180 | |
| | Clear to Q (HD14160B, HD14161B only) | | 5.0 | — | 155 | 310 | |
| | | | 10 | — | 55 | 110 | |
| | | | 15 | — | 35 | 70 | |
| Setup Time | Data to Clock | t_{setup} | 5.0 | 320 | 160 | — | ns |
| | | | 10 | 130 | 65 | — | |
| | | | 15 | 90 | 45 | — | |
| | Load to Clock | | 5.0 | 600 | 300 | — | |
| | | | 10 | 260 | 130 | — | |
| | | | 15 | 180 | 90 | — | |
| | Enable to Clock (PE or TE) | | 5.0 | 420 | 210 | — | |
| | | | 10 | 170 | 85 | — | |
| | | | 15 | 120 | 60 | — | |
| | Clear to Clock (HD14162B, HD14163B only) | | 5.0 | 310 | 155 | — | |
| | | | 10 | 110 | 55 | — | |
| | | | 15 | 70 | 35 | — | |
| Clock Pulse Width | | PW_{CH} | 5.0 | 250 | 125 | — | ns |
| | | | 10 | 100 | 50 | — | |
| | | | 15 | 70 | 35 | — | |
| Clock Rise Time | | t_r | 5.0 | — | — | 15 | μs |
| | | | 10 | — | — | 15 | |
| | | | 15 | — | — | 15 | |
| Clock Frequency | | PRF | 5.0 | — | 2.0 | 1.0 | MHz |
| | | | 10 | — | 5.0 | 2.5 | |
| | | | 15 | — | 8.0 | 4.0 | |

■ TIMING DIAGRAM

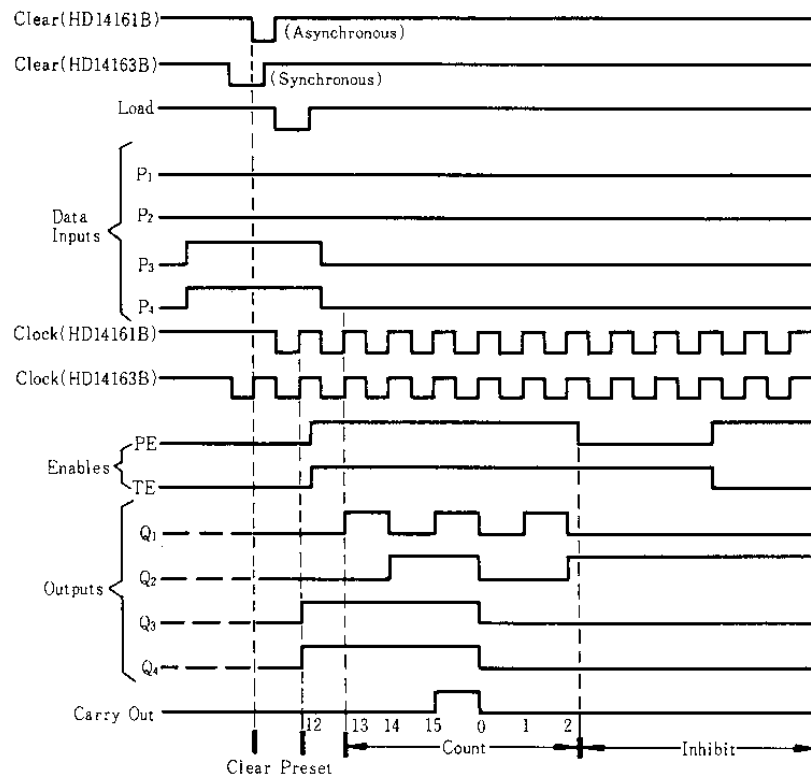
● HD14160B, HD14162B



Sequence illustrated in waveforms :

1. Clear outputs to zero.
2. Preset to BCD seven.
3. Count to eight, nine, zero, one, two, and three.
4. Inhibit.

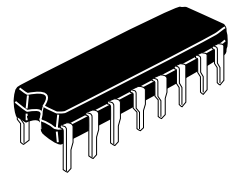
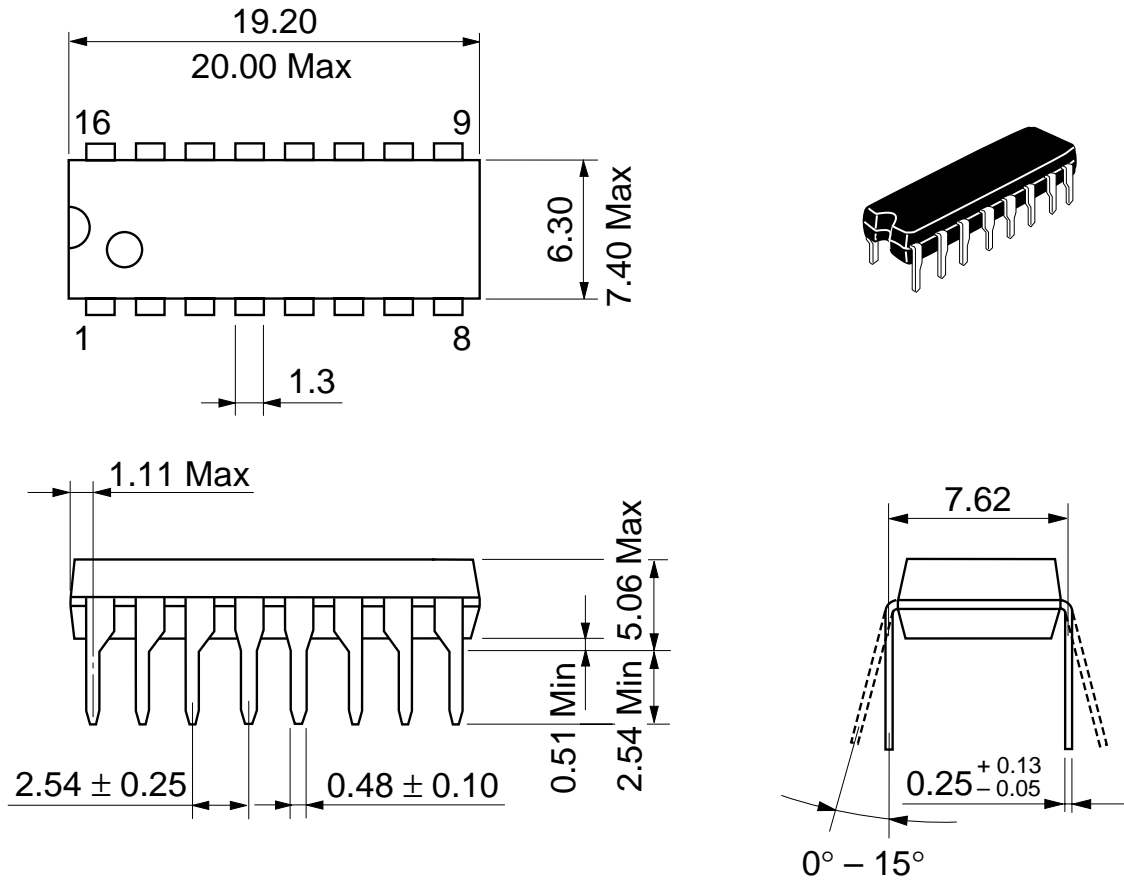
● HD14161B, HD14163B



Sequence illustrated in waveforms :

1. Clear outputs to zero.
2. Preset to binary twelve.
3. Count to thirteen, fourteen, fifteen, zero, one, and two.
4. Inhibit.

Unit: mm



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

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