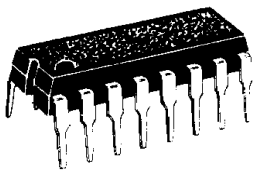
# MN4040B / MN4040BS

## 12-Stage Binary Counters

### ■ Description

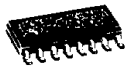
The MN4040B/S are 12-stage binary ripple counters with a clock input. The reset input and outputs are fully buffered. The counter advances on the negative going edge of the clock input.
A High on the MR input clears all counter stages and forces all outputs ($O_0 \sim O_{11}$) Low, independent of the clock input.
These are suitable for frequency dividers and center-control circuits, and are equivalent to MOTOROLA MC14040B and RCA CD4040B.

P-3



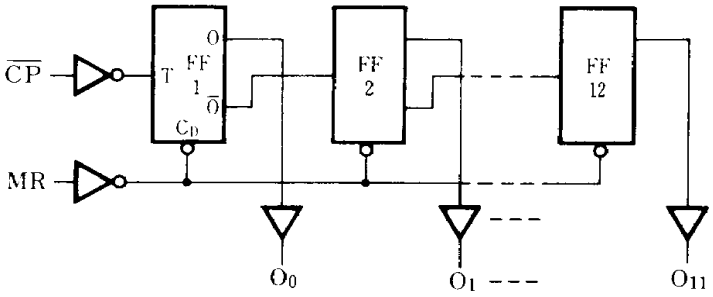
16-Pin • Plastic DIL Package

P-4

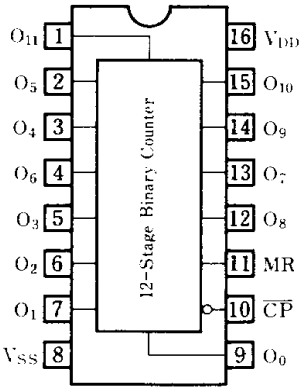


16-Pin • Panaflat Package (SO-16D)

### ■ Logic Diagram




### Pin Configuration




### Pin Explanation

$\overline{CP}$ : Clock input ( ⌝⌞ )
MR : Reset input
$O_0 \sim O_{11}$ : Output (12 Bits)

### ■ Maximum Ratings (Ta=25℃)

| Item | | Symbol | Ratings | Unit |
|---|---|---|---|---|
| Supply Voltage | | $V_{DD}$ | −0.5~+18 | V |
| Input Voltage | | $V_I$ | −0.5~$V_{DD}$+0.5* | V |
| Output Voltage | | $V_O$ | −0.5~$V_{DD}$+0.5* | V |
| Peak Input · Output Current | | $\pm I_I$ | max. 10 | mA |
| Power Dissipation (per package) | Ta=−40~+60℃ | $P_D$ | max. 400 | mW |
| | Ta=+60~+85℃ | | Decrease up to 200mW rating at 8mW/°C | |
| Power Dissipation (per output terminal) | | $P_D$ | max. 100 | mW |
| Operating Ambient Temperature | | Topr | −40~+85 | ℃ |
| Storage Temperature | | Tstg | −65~+150 | ℃ |

* $V_{DD}$ + 0.5V should be under 18V

## ■ DC Characteristics ($V_{SS}=0V$)

| Item | $V_{DD}$ V | Sym-bol | Conditions | | Ta=−40℃ min. | Ta=−40℃ max. | Ta=25℃ min. | Ta=25℃ max. | Ta=85℃ min. | Ta=85℃ max. | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Quiescent Power Supply Current | 5 | $I_{DD}$ | $V_I=V_{SS}$ or $V_{DD}$ | | — | 20 | — | 20 | — | 150 | μA |
| | 10 | | | | — | 40 | — | 40 | — | 300 | |
| | 15 | | | | — | 80 | — | 80 | — | 600 | |
| Output Voltage Low Level | 5 | $V_{OL}$ | $V_I=V_{SS}$ or $V_{DD}$ $\lvert I_O\rvert<1\mu A$ | | — | 0.05 | — | 0.05 | — | 0.05 | V |
| | 10 | | | | — | 0.05 | — | 0.05 | — | 0.05 | |
| | 15 | | | | — | 0.05 | — | 0.05 | — | 0.05 | |
| Output Voltage High Level | 5 | $V_{OH}$ | $V_I=V_{SS}$ or $V_{DD}$ $\lvert I_O\rvert<1\mu A$ | | 4.95 | — | 4.95 | — | 4.95 | — | V |
| | 10 | | | | 9.95 | — | 9.95 | — | 9.95 | — | |
| | 15 | | | | 14.95 | — | 14.95 | — | 14.95 | — | |
| Input Voltage Low Level | 5 | $V_{IL}$ | $\lvert I_O\rvert<1\mu A$ | $V_O=0.5V$ or $4.5V$ | — | 1.5 | — | 1.5 | — | 1.5 | V |
| | 10 | | | $V_O=1V$ or $9V$ | — | 3 | — | 3 | — | 3 | |
| | 15 | | | $V_O=1.5V$ or $13.5V$ | — | 4 | — | 4 | — | 4 | |
| Input Voltage High Level | 5 | $V_{IH}$ | $\lvert I_O\rvert<1\mu A$ | $V_O=0.5V$ or $4.5V$ | 3.5 | — | 3.5 | — | 3.5 | — | V |
| | 10 | | | $V_O=1V$ or $9V$ | 7 | — | 7 | — | 7 | — | |
| | 15 | | | $V_O=1.5V$ or $13.5V$ | 11 | — | 11 | — | 11 | — | |
| Output Current Low Level | 5 | $I_{OL}$ | $V_O=0.4V$, $V_I=0$ or $5V$ | | 0.52 | — | 0.44 | — | 0.36 | — | mA |
| | 10 | | $V_O=0.5V$, $V_I=0$ or $10V$ | | 1.3 | — | 1.1 | — | 0.9 | — | |
| | 15 | | $V_O=1.5V$, $V_I=0$ or $15V$ | | 3.6 | — | 3 | — | 2.4 | — | |
| Output Current High Level | 5 | $-I_{OH}$ | $V_O=4.6V$, $V_I=0$ or $5V$ | | 0.52 | — | 0.44 | — | 0.36 | — | mA |
| | 10 | | $V_O=9.5V$, $V_I=0$ or $10V$ | | 1.3 | — | 1.1 | — | 0.9 | — | |
| | 15 | | $V_O=13.5V$, $V_I=0$ or $15V$ | | 3.6 | — | 3 | — | 2.4 | — | |
| Output Current High Level | 5 | $-I_{OH}$ | $V_O=2.5V$, $V_I=0$ or $5V$ | | 1.7 | — | 1.4 | — | 1.1 | — | mA |
| Input Leakage Current | 15 | $\pm I_I$ | $V_I=0$ or $15V$ | | — | 0.3 | — | 0.3 | — | 1 | μA |

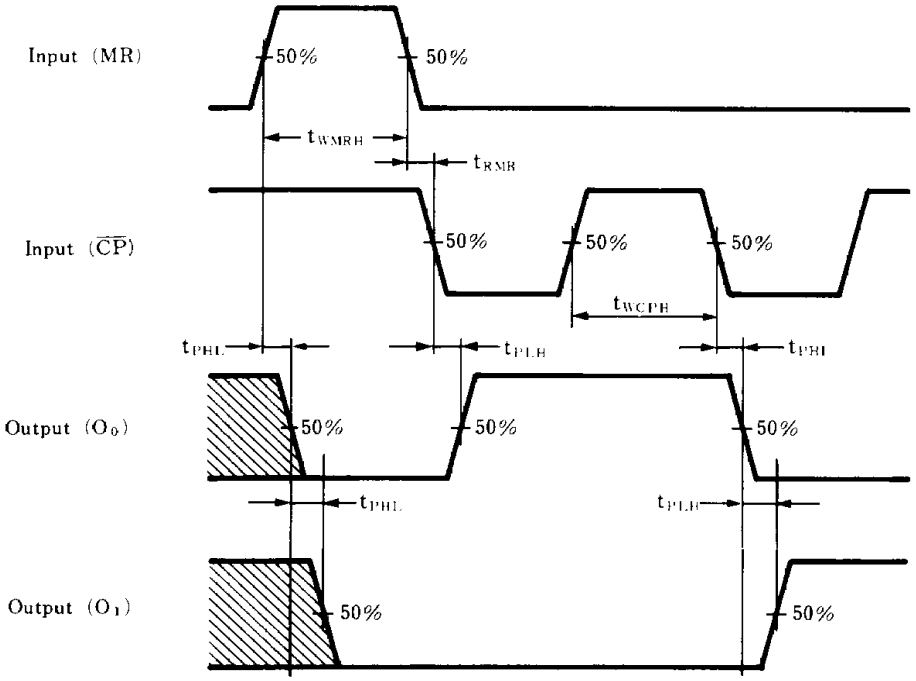
## ■ Switching Characteristics (Ta=25℃, $V_{SS}=0V$, $C_L=50pF$)

| Item | $V_{DD}$ (V) | Symbol | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| Output Rise Time | 5 | $t_{TLH}$ | — | 60 | 180 | ns |
| | 10 | | — | 30 | 90 | |
| | 15 | | — | 20 | 60 | |
| Output Fall Time | 5 | $t_{THL}$ | — | 60 | 180 | ns |
| | 10 | | — | 30 | 90 | |
| | 15 | | — | 20 | 60 | |
| Propagation Delay Time $\overline{CP}\rightarrow O_0$ (L→H) | 5 | $t_{PLH}$ | — | 105 | 315 | ns |
| | 10 | | — | 50 | 150 | |
| | 15 | | — | 35 | 105 | |
| Propagation Delay Time $\overline{CP}\rightarrow O_0$ (H→L) | 5 | $t_{PHL}$ | — | 105 | 315 | ns |
| | 10 | | — | 45 | 135 | |
| | 15 | | — | 30 | 90 | |
| Propagation Delay Time $On\rightarrow On_{-1}$ (L→H) | 5 | $t_{PLH}$ | — | 70 | 210 | ns |
| | 10 | | — | 25 | 75 | |
| | 15 | | — | 20 | 60 | |
| Propagation Delay Time $On\rightarrow On_{-1}$ (H→L) | 5 | $t_{PHL}$ | — | 80 | 240 | ns |
| | 10 | | — | 30 | 90 | |
| | 15 | | — | 20 | 60 | |

## ■ Switching Characteristics (Ta = 25°C, $V_{SS}$ = 0V, $C_L$ = 50pF)

| Item | $V_{DD}$ (V) | Symbol | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| Propagation Delay Time MR→On (H→L) | 5 | $t_{PHL}$ | — | 180 | 540 | ns |
| | 10 | | — | 90 | 270 | |
| | 15 | | — | 70 | 210 | |
| Minimum Clock Pulse Width | 5 | $t_{WCPH}$ | — | 25 | 75 | ns |
| | 10 | | — | 15 | 45 | |
| | 15 | | — | 10 | 30 | |
| Minimum Reset Pulse Width | 5 | $t_{WMRH}$ | — | 65 | 195 | ns |
| | 10 | | — | 50 | 150 | |
| | 15 | | — | 45 | 135 | |
| Reset Recovery Time | 5 | $t_{RMR}$ | — | 60 | 180 | ns |
| | 10 | | — | 35 | 105 | |
| | 15 | | — | 25 | 75 | |
| Maximum Clock Frequency | 5 | fmax | 5 | 10 | — | MHz |
| | 10 | | 13 | 25 | — | |
| | 15 | | 18 | 35 | — | |
| Input Capacitance | | $C_I$ | — | — | 7.5 | pF |

• Dynamic Signal Waveforms




Waveforms showing propagation delays for MR to $O_n$ and $\overline{CP}$ to $O_0$, minimum MR and $\overline{CP}$ pulse widths and recovery time for MR