

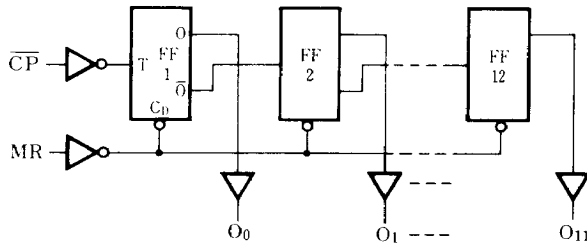
# MN4040B / MN4040BS

## 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.

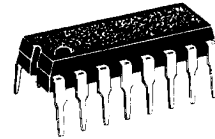
### ■ Logic Diagram



### Pin Explanation

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

P- 3



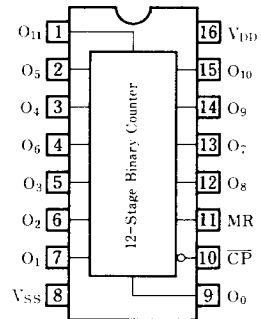
16-Pin • Plastic DIL Package

P- 4



16-Pin • Panafiat Package (SO-16D)

### Pin Configuration



### ■ Maximum Ratings (Ta=25°C)

| 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)         | $T_a = -40 \sim +60^\circ\text{C}$ | max. 400                              | mW   |
|   | $T_a = +60 \sim +85^\circ\text{C}$ | Decrease up to 200mW rating at 8mW/°C |      |
| Power Dissipation (per output terminal) | $P_D$                              | max. 100                              | mW   |
| Operating Ambient Temperature           | $T_{opr}$                          | -40 ~ +85                             | °C   |
| Storage Temperature                     | $T_{stg}$                          | -65 ~ +150                            | °C   |

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

■ DC Characteristics ( $V_{SS}=0V$ )

| Item                              | $V_{DD}$<br>V | Sym-<br>bol | Conditions  | $T_a=-40^\circ C$ |      | $T_a=25^\circ C$ |      | $T_a=85^\circ C$ |      | Unit    |
|-----------------------------------|---------------|-------------|---|-------------------|------|------------------|------|------------------|------|---------|
|                                   |               |             |   | min.              | max. | min.             | max. | min.             | max. |         |
| Quiescent Power<br>Supply Current | 5             | $I_{DD}$    | $V_i=V_{SS}$ or $V_{DD}$  | —                 | 20   | —                | 20   | —                | 150  | $\mu A$ |
|                                   | 10            |             |   | —                 | 40   | —                | 40   | —                | 300  |         |
|                                   | 15            |             |   | —                 | 80   | —                | 80   | —                | 600  |         |
| Output Voltage<br>Low Level       | 5             | $V_{OL}$    | $V_i=V_{SS}$ or $V_{DD}$<br>$ I_o  < 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<br>High Level      | 5             | $V_{OH}$    | $V_i=V_{SS}$ or $V_{DD}$<br>$ I_o  < 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<br>Low Level        | 5             | $V_{IL}$    | $ I_o  < 1\mu A$<br>$V_o=0.5V$ or $4.5V$<br>$V_o=1V$ or $9V$<br>$V_o=1.5V$ or $13.5V$           | —                 | 1.5  | —                | 1.5  | —                | 1.5  | V       |
|                                   | 10            |             |   | —                 | 3    | —                | 3    | —                | 3    |         |
|                                   | 15            |             |   | —                 | 4    | —                | 4    | —                | 4    |         |
| Input Voltage<br>High Level       | 5             | $V_{IH}$    | $ I_o  < 1\mu A$<br>$V_o=0.5V$ or $4.5V$<br>$V_o=1V$ or $9V$<br>$V_o=1.5V$ or $13.5V$           | 3.5               | —    | 3.5              | —    | 3.5              | —    | V       |
|                                   | 10            |             |   | 7                 | —    | 7                | —    | 7                | —    |         |
|                                   | 15            |             |   | 11                | —    | 11               | —    | 11               | —    |         |
| Output Current<br>Low Level       | 5             | $I_{OL}$    | $V_o=0.4V$ , $V_i=0$ or $5V$<br>$V_o=0.5V$ , $V_i=0$ or $10V$<br>$V_o=1.5V$ , $V_i=0$ or $15V$  | 0.52              | —    | 0.44             | —    | 0.36             | —    | mA      |
|                                   | 10            |             |   | 1.3               | —    | 1.1              | —    | 0.9              | —    |         |
|                                   | 15            |             |   | 3.6               | —    | 3                | —    | 2.4              | —    |         |
| Output Current<br>High Level      | 5             | $-I_{OH}$   | $V_o=4.6V$ , $V_i=0$ or $5V$<br>$V_o=9.5V$ , $V_i=0$ or $10V$<br>$V_o=13.5V$ , $V_i=0$ or $15V$ | 0.52              | —    | 0.44             | —    | 0.36             | —    | mA      |
|                                   | 10            |             |   | 1.3               | —    | 1.1              | —    | 0.9              | —    |         |
|                                   | 15            |             |   | 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    | $\mu A$ |

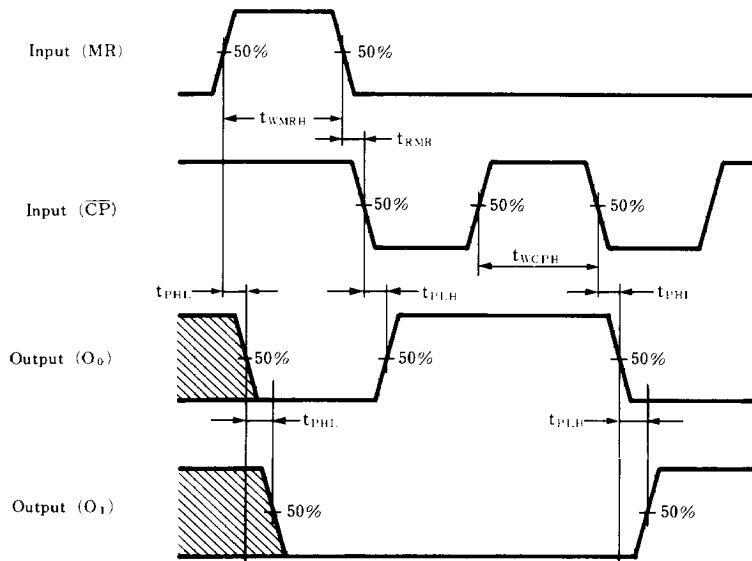
■ Switching Characteristics ( $T_a=25^\circ C$ ,  $V_{SS}=0V$ ,  $C_L=50pF$ )

| 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<br>$\overline{CP} \rightarrow O_0$ (L→H) | 5            | $t_{PLH}$ | —    | 105  | 315  | ns   |
|   | 10           |           | —    | 50   | 150  |      |
|   | 15           |           | —    | 35   | 105  |      |
| Propagation Delay Time<br>$\overline{CP} \rightarrow O_0$ (H→L) | 5            | $t_{PHL}$ | —    | 105  | 315  | ns   |
|   | 10           |           | —    | 45   | 135  |      |
|   | 15           |           | —    | 30   | 90   |      |
| Propagation Delay Time<br>$O_n \rightarrow O_{n-1}$ (L→H)       | 5            | $t_{PLH}$ | —    | 70   | 210  | ns   |
|   | 10           |           | —    | 25   | 75   |      |
|   | 15           |           | —    | 20   | 60   |      |
| Propagation Delay Time<br>$O_n \rightarrow O_{n-1}$ (H→L)       | 5            | $t_{PHL}$ | —    | 80   | 240  | ns   |
|   | 10           |           | —    | 30   | 90   |      |
|   | 15           |           | —    | 20   | 60   |      |

■ Switching Characteristics (Ta = 25°C, Vss = 0V, Cl = 50pF)

| Item                                  | VDD(V) | Symbol            | min. | typ. | max. | Unit |
|---------------------------------------|--------|-------------------|------|------|------|------|
| Propagation Delay Time<br>MR→On (H→L) | 5      | t <sub>PHL</sub>  | —    | 180  | 540  | ns   |
|                                       | 10     |                   | —    | 90   | 270  |      |
|                                       | 15     |                   | —    | 70   | 210  |      |
| Minimum Clock Pulse Width             | 5      | t <sub>WCPH</sub> | —    | 25   | 75   | ns   |
|                                       | 10     |                   | —    | 15   | 45   |      |
|                                       | 15     |                   | —    | 10   | 30   |      |
| Minimum Reset Pulse Width             | 5      | t <sub>WNRH</sub> | —    | 65   | 195  | ns   |
|                                       | 10     |                   | —    | 50   | 150  |      |
|                                       | 15     |                   | —    | 45   | 135  |      |
| Reset Recovery Time                   | 5      | t <sub>RMR</sub>  | —    | 60   | 180  | ns   |
|                                       | 10     |                   | —    | 35   | 105  |      |
|                                       | 15     |                   | —    | 25   | 75   |      |
| Maximum Clock Frequency               | 5      | f <sub>max</sub>  | 5    | 10   | —    | MHz  |
|                                       | 10     |                   | 13   | 25   | —    |      |
|                                       | 15     |                   | 18   | 35   | —    |      |
| Input Capacitance                     |        | C <sub>I</sub>    | —    | —    | 7.5  | pF   |

• Dynamic Signal Waveforms



Waveforms showing propagation delays for MR to O<sub>1</sub> and CP to O<sub>0</sub>, minimum MR and CP pulse widths and recovery time for MR