

MC14541B

Programmable Timer

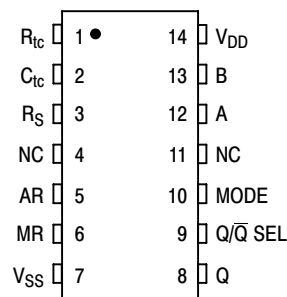
The MC14541B programmable timer consists of a 16–stage binary counter, an integrated oscillator for use with an external capacitor and two resistors, an automatic power–on reset circuit, and output control logic.

Timing is initialized by turning on power, whereupon the power–on reset is enabled and initializes the counter, within the specified V_{DD} range. With the power already on, an external reset pulse can be applied. Upon release of the initial reset command, the oscillator will oscillate with a frequency determined by the external RC network. The 16–stage counter divides the oscillator frequency (f_{osc}) with the n^{th} stage frequency being $f_{osc}/2^n$.

Features

- Available Outputs 2^8 , 2^{10} , 2^{13} or 2^{16}
- Increments on Positive Edge Clock Transitions
- Built–in Low Power RC Oscillator ($\pm 2\%$ accuracy over temperature range and $\pm 20\%$ supply and $\pm 3\%$ over processing at < 10 kHz)
- Oscillator May Be Bypassed if External Clock Is Available (Apply external clock to Pin 3)
- External Master Reset Totally Independent of Automatic Reset Operation
- Operates as 2^n Frequency Divider or Single Transition Timer
- Q/\bar{Q} Select Provides Output Logic Level Flexibility
- Reset (auto or master) Disables Oscillator During Resetting to Provide No Active Power Dissipation
- Clock Conditioning Circuit Permits Operation with Very Slow Clock Rise and Fall Times
- Automatic Reset Initializes All Counters On Power Up
- Supply Voltage Range = 3.0 Vdc to 18 Vdc with Auto Reset Disabled (Pin 5 = V_{DD})
= 8.5 Vdc to 18 Vdc with Auto Reset Enabled (Pin 5 = V_{SS})
- Pb–Free Packages are Available

PIN ASSIGNMENT

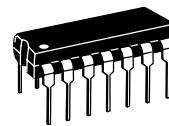


NC = NO CONNECTION

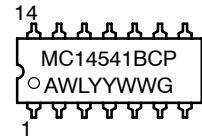


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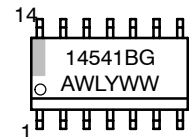
MARKING DIAGRAMS



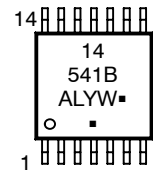
PDIP–14
P SUFFIX
CASE 646



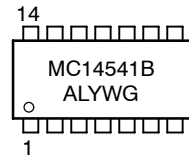
SOIC–14
D SUFFIX
CASE 751A



TSSOP–14
DT SUFFIX
CASE 948G



SOEIAJ–14
F SUFFIX
CASE 965



A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week
G or ■ = Pb–Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

MC14541B

MAXIMUM RATINGS (Voltages Referenced to V_{SS})

| Symbol | Parameter | Value | Unit |
|-------------------|--|------------------------|------|
| V_{DD} | DC Supply Voltage Range | -0.5 to +18.0 | V |
| V_{in}, V_{out} | Input or Output Voltage Range, (DC or Transient) | -0.5 to $V_{DD} + 0.5$ | V |
| I_{in} | Input Current (DC or Transient) | ± 10 (per Pin) | mA |
| I_{out} | Output Current (DC or Transient) | ± 45 (per Pin) | mA |
| P_D | Power Dissipation, per Package (Note 1) | 500 | mW |
| T_A | Ambient Temperature Range | -55 to +125 | °C |
| T_{stg} | Storage Temperature Range | -65 to +150 | °C |
| T_L | Lead Temperature, (8-Second Soldering) | 260 | °C |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Temperature Derating:

Plastic "P and D/DW" Packages: - 7.0 mW/°C From 65°C To 125°C

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|---------------|------------------------|-----------------------|
| MC14541BCP | PDIP-14 | 25 Units / Rail |
| MC14541BCPG | PDIP-14 (Pb-Free) | |
| MC14541BD | SOIC-14 | 55 Units / Rail |
| MC14541BDG | SOIC-14 (Pb-Free) | |
| MC14541BDR2 | SOIC-14 | 2500 / Tape & Reel |
| MC14541BDR2G | SOIC-14 (Pb-Free) | |
| MC14541BDTR2 | TSSOP-14* | |
| MC14541BDTR2G | TSSOP-14* | |
| MC14541BF | SOEIAJ-14 | 50 Units / Rail |
| MC14541BFG | SOEIAJ-14 (Pb-Free) | |
| MC14541BFEL | SOEIAJ-14 | 2000 / Tape & Reel |
| MC14541BFELG | SOEIAJ-14 (Pb-Free) | |

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*This package is inherently Pb-Free.

MC14541B

ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS})

| Characteristic | Symbol | V _{DD} Vdc | - 55° C | | 25° C | | | 125° C | | Unit | |
|---|------------------|------------------------|---|-------|-------|-----------------|--------|--------|-------|------|------|
| | | | Min | Max | Min | Typ (Note 2) | Max | Min | Max | | |
| Output Voltage V _{in} = V _{DD} or 0 | "0" Level | V _{OL} | 5.0 | - | 0.05 | - | 0 | 0.05 | - | 0.05 | Vdc |
| | | | 10 | - | 0.05 | - | 0 | 0.05 | - | 0.05 | |
| | | | 15 | - | 0.05 | - | 0 | 0.05 | - | 0.05 | |
| | "1" Level | V _{OH} | 5.0 | 4.95 | - | 4.95 | 5.0 | - | 4.95 | - | Vdc |
| | | | 10 | 9.95 | - | 9.95 | 10 | - | 9.95 | - | |
| | | | 15 | 14.95 | - | 14.95 | 15 | - | 14.95 | - | |
| Input Voltage (V _O = 4.5 or 0.5 Vdc) (V _O = 9.0 or 1.0 Vdc) (V _O = 13.5 or 1.5 Vdc) | "0" Level | V _{IL} | 5.0 | - | 1.5 | - | 2.25 | 1.5 | - | 1.5 | Vdc |
| | | | 10 | - | 3.0 | - | 4.50 | 3.0 | - | 3.0 | |
| | | | 15 | - | 4.0 | - | 6.75 | 4.0 | - | 4.0 | |
| | "1" Level | V _{IH} | 5.0 | 3.5 | - | 3.5 | 2.75 | - | 3.5 | - | Vdc |
| | | | 10 | 7.0 | - | 7.0 | 5.50 | - | 7.0 | - | |
| | | | 15 | 11 | - | 11 | 8.25 | - | 11 | - | |
| Output Drive Current (V _{OH} = 2.5 Vdc) (V _{OH} = 9.5 Vdc) (V _{OH} = 13.5 Vdc) | Source | I _{OH} | 5.0 | -7.96 | - | -6.42 | -12.83 | - | -4.49 | - | mAdc |
| | | | 10 | -4.19 | - | -3.38 | -6.75 | - | -2.37 | - | |
| | | | 15 | -16.3 | - | -13.2 | -26.33 | - | -9.24 | - | |
| | Sink | I _{OL} | 5.0 | 1.93 | - | 1.56 | 3.12 | - | 1.09 | - | mAdc |
| | | | 10 | 4.96 | - | 4.0 | 8.0 | - | 2.8 | - | |
| | | | 15 | 19.3 | - | 15.6 | 31.2 | - | 10.9 | - | |
| Input Current | I _{in} | 15 | - | ± 0.1 | - | ± 0.00001 | ± 0.1 | - | ± 1.0 | μAdc | |
| Input Capacitance (V _{in} = 0) | C _{in} | - | - | - | - | 5.0 | 7.5 | - | - | pF | |
| Quiescent Current (Pin 5 is High) Auto Reset Disabled | I _{DD} | 5.0 | - | 5.0 | - | 0.005 | 5.0 | - | 150 | μAdc | |
| | | 10 | - | 10 | - | 0.010 | 10 | - | 300 | | |
| | | 15 | - | 20 | - | 0.015 | 20 | - | 600 | | |
| Auto Reset Quiescent Current (Pin 5 is low) | I _{DDR} | 10 | - | 250 | - | 30 | 250 | - | 1500 | μAdc | |
| | | 15 | - | 500 | - | 82 | 500 | - | 2000 | | |
| Supply Current (Notes 3 & 4) (Dynamic plus Quiescent) | I _D | 5.0 | I _D = (0.4 μA/kHz) f + I _{DD} | | | | | | | μAdc | |
| | | 10 | I _D = (0.8 μA/kHz) f + I _{DD} | | | | | | | | |
| | | 15 | I _D = (1.2 μA/kHz) f + I _{DD} | | | | | | | | |

2. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

3. The formulas given are for the typical characteristics only at 25°C.

4. When using the on chip oscillator the total supply current (in μAdc) becomes: $I_T = I_D + 2 C_{tc} V_{DD} f \times 10^{-3}$ where I_D is in μA, C_{tc} is in pF, V_{DD} in Volts DC, and f in kHz. (see Fig. 3) Dissipation during power-on with automatic reset enabled is typically 50 μA @ V_{DD} = 10 Vdc.

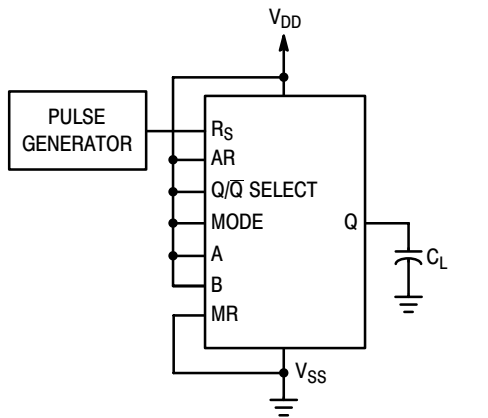
MC14541B

SWITCHING CHARACTERISTICS (Note 5) ($C_L = 50 \text{ pF}$, $T_A = 25^\circ\text{C}$)

| Characteristic | Symbol | V_{DD} | Min | Typ (Note 6) | Max | Unit |
|---|--------------------|-----------------|-------------------|--------------------|--------------------|---------------|
| Output Rise and Fall Time $t_{TLH}, t_{THL} = (1.5 \text{ ns/pF}) C_L + 25 \text{ ns}$ $t_{TLH}, t_{THL} = (0.75 \text{ ns/pF}) C_L + 12.5 \text{ ns}$ $t_{TLH}, t_{THL} = (0.55 \text{ ns/pF}) C_L + 9.5 \text{ ns}$ | t_{TLH}, t_{THL} | 5.0 10 15 | – – – | 100 50 40 | 200 100 80 | ns |
| Propagation Delay, Clock to Q (2^8 Output) $t_{PLH}, t_{PHL} = (1.7 \text{ ns/pF}) C_L + 3415 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.66 \text{ ns/pF}) C_L + 1217 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.5 \text{ ns/pF}) C_L + 875 \text{ ns}$ | t_{PLH}, t_{PHL} | 5.0 10 15 | – – – | 3.5 1.25 0.9 | 10.5 3.8 2.9 | μs |
| Propagation Delay, Clock to Q (2^{16} Output) $t_{PHL}, t_{PLH} = (1.7 \text{ ns/pF}) C_L + 5915 \text{ ns}$ $t_{PHL}, t_{PLH} = (0.66 \text{ ns/pF}) C_L + 3467 \text{ ns}$ $t_{PHL}, t_{PLH} = (0.5 \text{ ns/pF}) C_L + 2475 \text{ ns}$ | t_{PHL}, t_{PLH} | 5.0 10 15 | – – – | 6.0 3.5 2.5 | 18 10 7.5 | μs |
| Clock Pulse Width | $t_{WH(cl)}$ | 5.0 10 15 | 900 300 225 | 300 100 85 | – – – | ns |
| Clock Pulse Frequency (50% Duty Cycle) | f_{cl} | 5.0 10 15 | – – – | 1.5 4.0 6.0 | 0.75 2.0 3.0 | MHz |
| MR Pulse Width | $t_{WH(R)}$ | 5.0 10 15 | 900 300 225 | 300 100 85 | – – – | ns |
| Master Reset Removal Time | t_{rem} | 5.0 10 15 | 420 200 200 | 210 100 100 | – – – | ns |

5. The formulas given are for the typical characteristics only at 25°C .

6. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.



(R_{ic} AND C_{ic} OUTPUTS ARE LEFT OPEN)

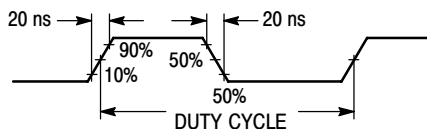


Figure 1. Power Dissipation Test Circuit and Waveform

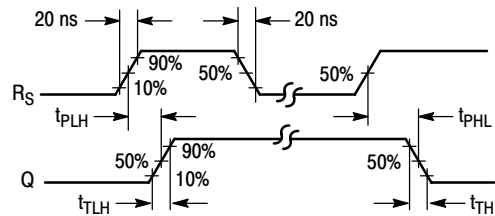
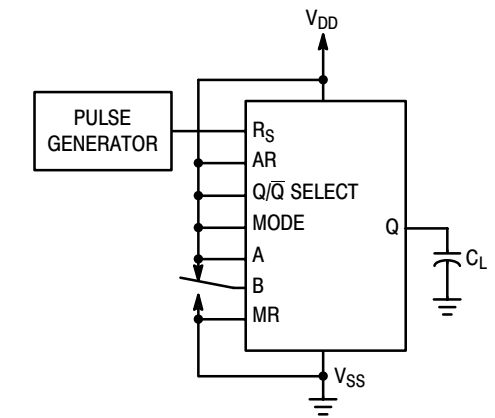
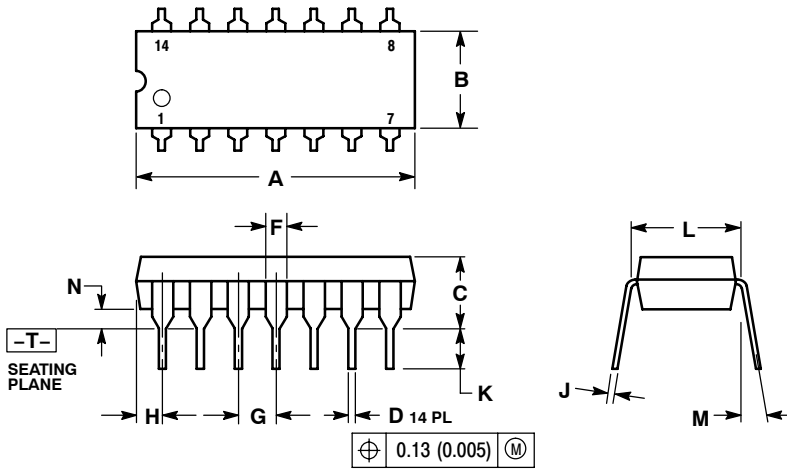


Figure 2. Switching Time Test Circuit and Waveforms

MC14541B

PACKAGE DIMENSIONS

PDIP-14
CASE 646-06
ISSUE P



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.715 | 0.770 | 18.16 | 19.56 |
| B | 0.240 | 0.260 | 6.10 | 6.60 |
| C | 0.145 | 0.185 | 3.69 | 4.69 |
| D | 0.015 | 0.021 | 0.38 | 0.53 |
| F | 0.040 | 0.070 | 1.02 | 1.78 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.052 | 0.095 | 1.32 | 2.41 |
| J | 0.008 | 0.015 | 0.20 | 0.38 |
| K | 0.115 | 0.135 | 2.92 | 3.43 |
| L | 0.290 | 0.310 | 7.37 | 7.87 |
| M | --- | 10° | --- | 10° |
| N | 0.015 | 0.039 | 0.38 | 1.01 |