MC14538B

Dual Precision Retriggerable/Resettable Monostable Multivibrator

The MC14538B is a dual, retriggerable, resettable monostable multivibrator. It may be triggered from either edge of an input pulse, and produces an accurate output pulse over a wide range of widths, the duration and accuracy of which are determined by the external timing components, C_X and R_X. Output Pulse Width $T = R_X \cdot C_X$ (secs)

R_X = Ω

C_X = Farads

Features

- Unlimited Rise and Fall Time Allowed on the A Trigger Input
- Pulse Width Range = 10 μs to 10 s
- Latched Trigger Inputs
- Separate Latched Reset Inputs
- 3.0 Vdc to 18 Vdc Operational Limits
- Triggerable from Positive (A Input) or Negative−Going Edge (B−Input)
- Capable of Driving Two Low−Power TTL Loads or One Low−Power Schottky TTL Load Over the Rated Temperature Range
- Pin−for−pin Compatible with MC14528B and CD4528B (CD4098)
- Use the MC54/74HC4538A for Pulse Widths Less Than 10 μs with Supplies Up to 6 V
- Pb−Free Packages are Available*

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}, I_{out}	Input or Output Current (DC or Transient) per Pin	±10	mA
P_D	Power Dissipation, per Package (Note 1)	500	mW
T_A	Operating Temperature Range	−55 to +125	°C
T_{stg}	Storage Temperature Range	−65 to +150	°C
T_L	Lead Temperature (8−Second Soldering)	260	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Temperature Derating:
   Plastic “P and D/DW” Packages: – 7.0 mW/°C From 65°C To 125°C

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high−impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range $V_{SS} \le (V_{in}$ or $V_{out}) \le V_{DD}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}). Unused outputs must be left open.

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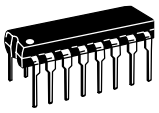
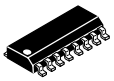
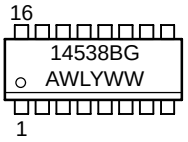
MARKING DIAGRAMS

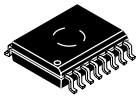


PDIP−16
P SUFFIX
CASE 648

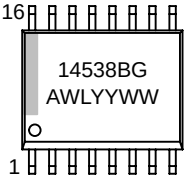


SOIC−16
D SUFFIX
CASE 751B

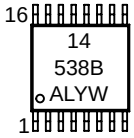


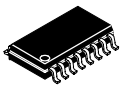


SOIC−16
DW SUFFIX
CASE 751G

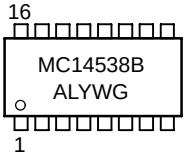


TSSOP−16
DT SUFFIX
CASE 948F





SOEIAJ−16
F SUFFIX
CASE 966



A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week
G = Pb−Free Indicator

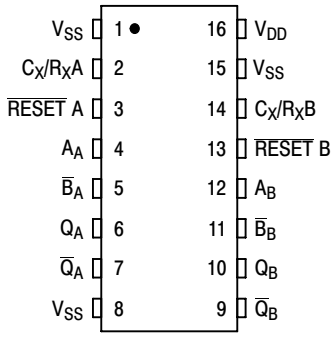
ORDERING INFORMATION

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

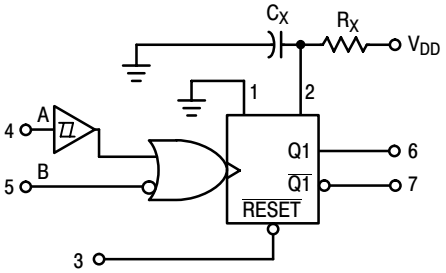
*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

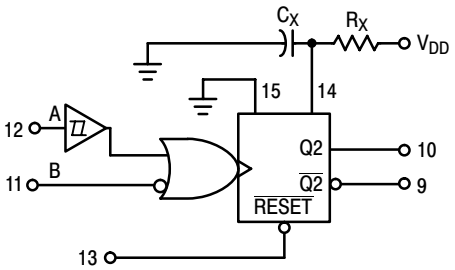
Publication Order Number:
MC14538B/D

PIN ASSIGNMENT



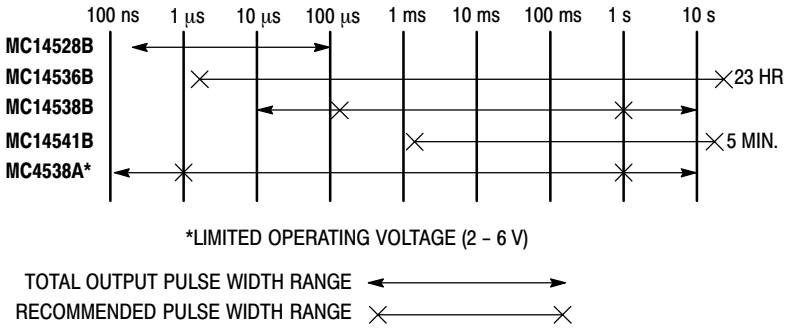
BLOCK DIAGRAM





RX AND CX ARE EXTERNAL COMPONENTS.
VDD = PIN 16
VSS = PIN 8, PIN 1, PIN 15

ONE−SHOT SELECTION GUIDE



*LIMITED OPERATING VOLTAGE (2 – 6 V)

TOTAL OUTPUT PULSE WIDTH RANGE
RECOMMENDED PULSE WIDTH RANGE

ORDERING INFORMATION

Device	Package	Shipping†
MC14538BCP	PDIP−16	500 Units / Rail
MC14538BCPG	PDIP−16 (Pb−Free)	500 Units / Rail
MC14538BD	SOIC−16	48 Units / Rail
MC14538BDG	SOIC−16 (Pb−Free)	48 Units / Rail
MC14538BDR2	SOIC−16	2500 Units / Tape & Reel
MC14538BDR2G	SOIC−16 (Pb−Free)	2500 Units / Tape & Reel
MC14538BDW	SOIC−16 WB	47 Units / Rail
MC14538BDWR2	SOIC−16 WB	1000 Units / Tape & Reel
MC14538BDWR2G	SOIC−16 WB (Pb−Free)	1000 Units / Tape & Reel
MC14538BDTR2	TSSOP−16*	2500 Units / Tape & Reel
MC14538BF	SOEIAJ−16	50 Units / Rail
MC14538BFG	SOEIAJ−16 (Pb−Free)	50 Units / Rail
MC14538BFEL	SOEIAJ−16	2000 Units / Tape & Reel
MC14538BFELG	SOEIAJ−16 (Pb−Free)	2000 Units / Tape & Reel

†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.

ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS})

Characteristic	Symbol	V_{DD} Vdc	− 55°C Min	− 55°C Max	25°C Min	25°C Typ (Note 2)	25°C Max	125°C Min	125°C Max	Unit
Output Voltage “0” Level V_{in} = V_{DD} or 0	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_{in} = 0 or V_{DD}	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 “0” Level	V_{IL}									Vdc
(V_O = 4.5 or 0.5 Vdc)		5.0	−	1.5	−	2.25	1.5	−	1.5	
(V_O = 9.0 or 1.0 Vdc)		10	−	3.0	−	4.50	3.0	−	3.0	
(V_O = 13.5 or 1.5 Vdc)		15	−	4.0	−	6.75	4.0	−	4.0	
“1” Level	V_{IH}									Vdc
(V_O = 0.5 or 4.5 Vdc)		5.0	3.5	−	3.5	2.75	−	3.5	−	
(V_O = 1.0 or 9.0 Vdc)		10	7.0	−	7.0	5.50	−	7.0	−	
(V_O = 1.5 or 13.5 Vdc)		15	11	−	11	8.25	−	11	−	
Output Drive Current	I_{OH}									mAdc
(V_{OH} = 2.5 Vdc) Source		5.0	− 3.0	−	− 2.4	− 4.2	−	− 1.7	−	
(V_{OH} = 4.6 Vdc)		5.0	− 0.64	−	− 0.51	− 0.88	−	− 0.36	−	
(V_{OH} = 9.5 Vdc)		10	− 1.6	−	− 1.3	− 2.25	−	− 0.9	−	
(V_{OH} = 13.5 Vdc)		15	− 4.2	−	− 3.4	− 8.8	−	− 2.4	−	
(V_{OL} = 0.4 Vdc) Sink	I_{OL}	5.0	0.64	−	0.51	0.88	−	0.36	−	mAdc
(V_{OL} = 0.5 Vdc)		10	1.6	−	1.3	2.25	−	0.9	−	
(V_{OL} = 1.5 Vdc)		15	4.2	−	3.4	8.8	−	2.4	−	
Input Current, Pin 2 or 14	I_{in}	15	−	±0.05	−	±0.00001	±0.05	−	±0.5	μAdc
Input Current, Other Inputs	I_{in}	15	−	±0.1	−	±0.00001	±0.1	−	±1.0	μAdc
Input Capacitance, Pin 2 or 14	C_{in}	−	−	−	−	25	−	−	−	pF
Input Capacitance, Other Inputs (V_{in} = 0)	C_{in}	−	−	−	−	5.0	7.5	−	−	pF
Quiescent Current (Per Package) Q = Low, $\overline{Q}$ = High	I_{DD}	5.0	−	5.0	−	0.005	5.0	−	150	μAdc
		10	−	10	−	0.010	10	−	300	
		15	−	20	−	0.015	20	−	600	
Quiescent Current, Active State (Both) (Per Package) Q = High, $\overline{Q}$ = Low	I_{DD}	5.0	−	2.0	−	0.04	0.20	−	2.0	mAdc
		10	−	2.0	−	0.08	0.45	−	2.0	
		15	−	2.0	−	0.13	0.70	−	2.0	
Total Supply Current at an external load capacitance (C_L) and at external timing network (R_X, C_X) (Note 3)	I_T	5.0	$I_T = (3.5 \times 10^{-2})\ R_X C_X f + 4C_X f + 1 \times 10^{-5}\ C_L f$ $I_T = (8.0 \times 10^{-2})\ R_X C_X f + 9C_X f + 2 \times 10^{-5}\ C_L f$ $I_T = (1.25 \times 10^{-1})\ R_X C_X f + 12C_X f + 3 \times 10^{-5}\ C_L f$ where: I_T in μA (one monostable switching only), C_X in μF, C_L in pF, R_X in k ohms, and f in Hz is the input frequency.							μAdc
		10								

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.

SWITCHING CHARACTERISTICS (Note 4) (C_L = 50 pF, T_A = 25°C)

Characteristic	Symbol	V_{DD} Vdc	All Types			Unit
			Min	Typ (Note 5)	Max	
Output Rise Time	t_{TLH}					ns
t_{TLH} = (1.35 ns/pF) C_L + 33 ns		5.0	–	100	200	
t_{TLH} = (0.60 ns/pF) C_L + 20 ns		10	–	50	100	
t_{TLH} = (0.40 ns/pF) C_L + 20 ns		15	–	40	80	
Output Fall Time	t_{THL}					ns
t_{THL} = (1.35 ns/pF) C_L + 33 ns		5.0	–	100	200	
t_{THL} = (0.60 ns/pF) C_L + 20 ns		10	–	50	100	
t_{THL} = (0.40 ns/pF) C_L + 20 ns		15	–	40	80	
Propagation Delay Time	t_{PLH},					ns
A or B to Q or $\overline{Q}$	t_{PHL}					
t_{PLH}, t_{PHL} = (0.90 ns/pF) C_L + 255 ns		5.0	–	300	600	
t_{PLH}, t_{PHL} = (0.36 ns/pF) C_L + 132 ns		10	–	150	300	
t_{PLH}, t_{PHL} = (0.26 ns/pF) C_L + 87 ns		15	–	100	220	
$\overline{Reset}$ to Q or $\overline{Q}$						ns
t_{PLH}, t_{PHL} = (0.90 ns/pF) C_L + 205 ns		5.0	–	250	500	
t_{PLH}, t_{PHL} = (0.36 ns/pF) C_L + 107 ns		10	–	125	250	
t_{PLH}, t_{PHL} = (0.26 ns/pF) C_L + 82 ns		15	–	95	190	
Input Rise and Fall Times	t_r, t_f	5	–	–	15	μs
$\overline{Reset}$		10	–	–	5	
		15	–	–	4	
B Input		5	–	300	1.0	ms
		10	–	1.2	0.1	
		15	–	0.4	0.05	
A Input		5	No Limit			–
		10				
		15				
Input Pulse Width	t_{WH},	5.0	170	85	–	ns
A, B, or Reset	t_{WL}	10	90	45	–	
		15	80	40	–	
Retrigger Time	t_{rr}	5.0	0	–	–	ns
		10	0	–	–	
		15	0	–	–	
Output Pulse Width — Q or $\overline{Q}$	T					μs
Refer to Figures 8 and 9						
C_X = 0.002 μF, R_X = 100 kΩ		5.0	198	210	230	
		10	200	212	232	
		15	202	214	234	
C_X = 0.1 μF, R_X = 100 kΩ		5.0	9.3	9.86	10.5	ms
		10	9.4	10	10.6	
		15	9.5	10.14	10.7	
C_X = 10 μF, R_X = 100 kΩ		5.0	0.91	0.965	1.03	s
		10	0.92	0.98	1.04	
		15	0.93	0.99	1.06	
Pulse Width Match between circuits in	100	5.0	–	± 1.0	± 5.0	%
the same package.	$[(T_1 - T_2)/T_1]$	10	–	± 1.0	± 5.0	
C_X = 0.1 μF, R_X = 100 kΩ		15	–	± 1.0	± 5.0	

4. The formulas given are for the typical characteristics only at 25°C.
5. Data labelled “Typ” is not to be used for design purposes but is intended as an indication of the IC’s potential performance.

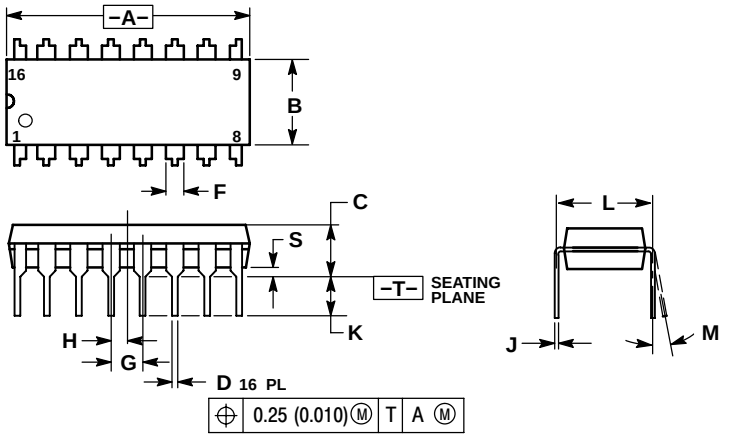
OPERATING CONDITIONS

External Timing Resistance	R_X	–	5.0	–	(Note 6)	kΩ
External Timing Capacitance	C_X	–	0	–	No Limit (Note 7)	μF

6. The maximum usable resistance R_X is a function of the leakage of the capacitor C_X, leakage of the MC14538B, and leakage due to board layout and surface resistance. Susceptibility to externally induced noise signals may occur for R_X > 1 MΩ..
7. If C_X > 15 μF, use discharge protection diode per Fig. 11.

PACKAGE DIMENSIONS

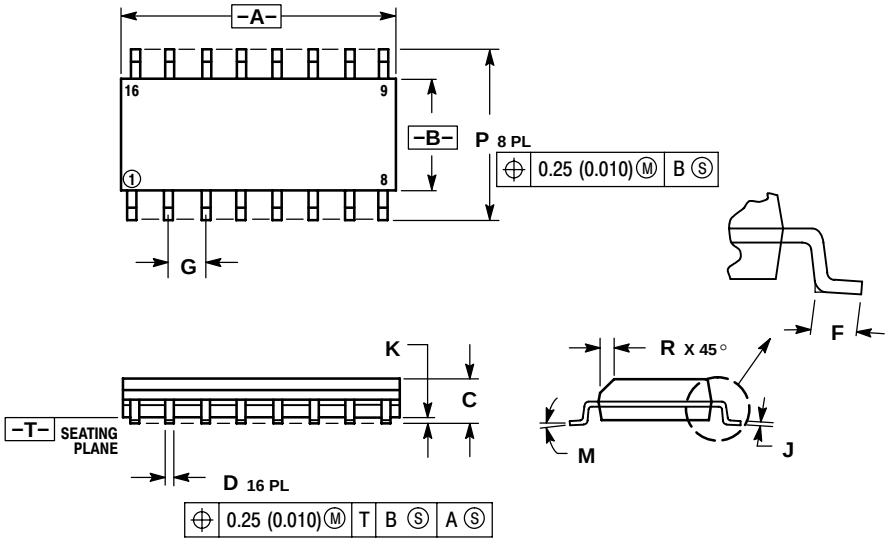
PDIP−16
P SUFFIX
PLASTIC DIP PACKAGE
CASE 648−08
ISSUE T



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.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0 °	10 °	0 °	10 °
S	0.020	0.040	0.51	1.01

SOIC−16
D SUFFIX
PLASTIC SOIC PACKAGE
CASE 751B−05
ISSUE J



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0 °	7 °	0 °	7 °
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019