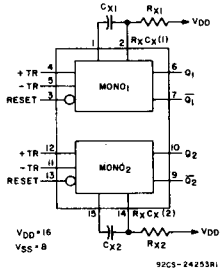
HARRIS

CD4538B Types

NOT RECOMMENDED FOR NEW DESIGNS SEE CD14538B

CMOS Dual Precision Monostable Multivibrator



CD4538B
Functional Diagram

Features:

- *Retriggerable/resettable capability*
- *Trigger and reset propagation delays independent of R_X, C_X*
- *Triggering from leading or trailing edge*
- *Q and $\overline{Q}$ buffered outputs available*
- *Separate resets*
- *Wide range of output-pulse widths*
- *Schmitt trigger input allows unlimited rise and fall times on +TR and −TR inputs*
- *100% tested for maximum quiescent current at 15 V*
- *Maximum input current of 1 μA at 12 V over full package-temperature range; 100 nA at 12 V and 25° C*
- *Noise margin (full package-temperature range): 1 V at V_{DD}=5 V; 2 V at V_{DD}=10 V*
- *5-V and 10-V parametric ratings*
- *Standardized, symmetrical output characteristics*

Applications:

- *Pulse delay and timing*
- *Pulse shaping*

CD4538B dual precision monostable multivibrator provides stable retriggerable/resettable one-shot operation for any fixed-voltage timing application.

An external resistor (R_X) and an external capacitor (C_X) control the timing and accuracy for the circuit. Adjustment of R_X and C_X provides a wide range of output pulse widths from the Q and $\overline{Q}$ terminals. The time delay from trigger input to output transition (trigger propagation delay) and the time delay from reset input to output transition (reset propagation delay) are independent of R_X and C_X. Precision control of output pulse widths is achieved through linear CMOS techniques.

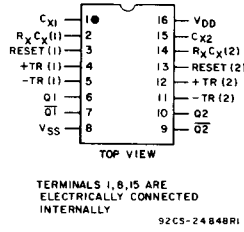
Leading-edge-triggering (+TR) and trailing-edge-triggering (-TR) inputs are provided for triggering from either edge of an input pulse. An unused +TR input should be tied to V_{SS}. An unused -TR input should be tied to V_{DD}. A RESET (on low level) is provided for immediate termination of the output pulse or to prevent output pulses when power is turned on. An unused RESET input should be tied to V_{DD}. However, if an entire section of the CD4538B is not used, its inputs must be tied to either V_{DD} or V_{SS}. See Table I.

In normal operation the circuit retriggers (extends the output pulse one period) on the application of each new trigger pulse. For operation in the non-retriggerable mode, $\overline{Q}$ is connected to -TR when leading-edge triggering (+TR) is used or Q is connected to +TR when trailing-edge triggering (-TR) is used. The time period (T) for this multivibrator can be calculated by: $T=R_XC_X$.

The minimum value of external resistance, R_X, is 4 KΩ. The maximum and minimum values of external capacitance, C_X, are 100 μF and 5000 pF, respectively.

The CD4538B types are supplied in 16-lead hermetic dual-in-line ceramic packages (F suffix), 16-lead dual-in-line plastic packages (E suffix), and in chip form (H suffix).

The CD4538B is similar to type MC14538 and is pin-for-pin compatible with the CD4098B and CD14538B. The CD14538B is recommended when operation requires a supply voltage greater than 12 V, an extended temperature range, or smaller C_X values.



Terminal Assignment

3 COMMERCIAL CMOS HIGH VOLTAGE ICs

MAXIMUM RATINGS, *Absolute-Maximum Values:*

DC SUPPLY-VOLTAGE RANGE, (V_{DD})
(Voltages referenced to V_{SS} Terminal) ..... -0.5 to +15 V
INPUT VOLTAGE RANGE, ALL INPUTS ..... -0.5 to V_{DD} +0.5 V
DC INPUT CURRENT, ANY ONE INPUT ..... ±10 mA
POWER DISSIPATION PER PACKAGE (P_D):
For T_A=-40 to +60°C (PACKAGE TYPE E) ..... 500 mW
For T_A=+60 to +85°C (PACKAGE TYPE E) ..... Derate Linearly at 12 mW/°C to 200 mW
For T_A=-40 to +85°C (PACKAGE TYPE F) ..... 500 mW
DEVICE DISSIPATION PER OUTPUT TRANSISTOR
FOR T_A=FULL PACKAGE-TEMPERATURE RANGE (All Package Types) ..... 100 mW
OPERATING-TEMPERATURE RANGE (T_A):
PACKAGE TYPES E,F ..... -40 to +85°C
STORAGE TEMPERATURE RANGE (T_{stg}) ..... -65 to +150°C
LEAD TEMPERATURE (DURING SOLDERING):
At distance 1/16 ± 1/32 in. (1.59 ± 0.79 mm) from case for 10 s max. ..... +265°C

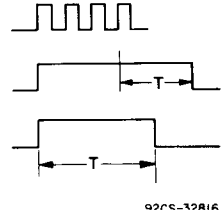
RECOMMENDED OPERATING CONDITIONS
For maximum reliability, nominal operating conditions should be selected so that operating is always within the following ranges:

CHARACTERISTIC		V_{DD} (V)	LIMITS		UNITS
			Min.	Max.	
Supply-Voltage Range (For T_A=Full Package-Temperature Range)		—	3	12	V
Input Pulse Width +TR, -TR, or RESET	t_{WH}, t_{WL}	5 10	140 80	— —	ns

TABLE I
CD4538B FUNCTIONAL TERMINAL CONNECTIONS

FUNCTIION	V_{DD} TO TERM. NO.		V_{SS} TO TERM. NO.		INPUT PULSE TO TERM. NO.		OTHER CONNECTIONS	
	$MONO_1$	$MONO_2$	$MONO_1$	$MONO_2$	$MONO_1$	$MONO_2$	$MONO_1$	$MONO_2$
Leading-Edge Trigger/ Retriggerable	3, 5	11, 13			4	12		
Leading-Edge Trigger/ Non-Retriggerable	3	13			4	12	5-7	11-9
Trailing-Edge Trigger/ Retriggerable	3	13	4	12	5	11		
Trailing-Edge Trigger/ Non-Retriggerable	3	13			5	11	4-6	12-10

NOTES:
1. A RETRIGGERABLE ONE-SHOT MULTIVIBRATOR HAS AN OUTPUT PULSE WIDTH WHICH IS EXTENDED ONE FULL TIME PERIOD (T) AFTER APPLICATION OF THE LAST TRIGGER PULSE.
2. A NON—RETRIGGERABLE ONE-SHOT MULTIVIBRATOR HAS A TIME PERIOD (T) REFERENCED FROM THE APPLICATION OF THE FIRST TRIGGER PULSE.



92CS-32816

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)					UNITS
	V_O (V)	V_{IN} (V)	V_{DD} (V)	-40	+85	+25 Min.	+25 Typ.	+25 Max.	
Quiescent Device Current, I_{DD} Max.	—	0,5	5	5	150	—	0.04	5	μA
	—	0,10	10	10	300	—	0.04	10	
	—	0,15	15	20	600	—	0.04	20	
Output Low (Sink) Current, I_{OL} Min.	0.4	0,5	5	0.61	0.42	0.51	1	—	mA
	0.5	0,10	10	1.5	1.1	1.3	2.6	—	
Output High (Source) Current, I_{OH} Min.	4.6	0,5	5	-0.61	-0.42	-0.51	-1	—	
	2.5	0,5	5	-1.8	-1.3	-1.6	-3.2	—	
	9.5	0,10	10	-1.5	-1.1	-1.3	-2.6	—	
Output Voltage: Low-Level, V_{OL} Max.	—	0,5	5	0.05		—	0	0.05	V
	—	0,10	10	0.05		—	0	0.05	
Output Voltage: High-Level, V_{OH} Min.	—	0,5	5	4.95		4.95	5	—	
	—	0,10	10	9.95		9.95	10	—	
Input Low Voltage, V_{IL} Max.	0.5,4.5	—	5	1.5		—	—	1.5	V
	1,9	—	10	3		—	—	3	
Input High Voltage, V_{IH} Min.	0.5,4.5	—	5	3.5		3.5	—	—	
	1,9	—	10	7		7	—	—	
Input Current, I_{IN} Max.	—	0,12	12	±0.1	±1	—	$\pm 10^{-5}$	±0.1	μA

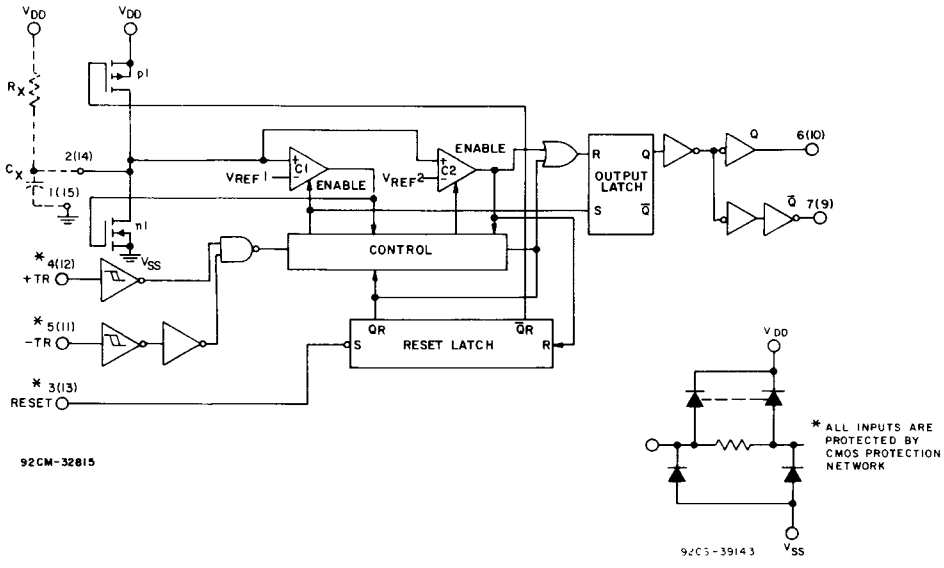


Fig. 1 - Logic diagram (½ of device shown).

DYNAMIC ELECTRICAL CHARACTERISTICS, At T_A=25°C; Input t_r,t_f=20 ns, C_L=50 pF

CHARACTERISTIC		TEST CONDITIONS V_{DD} (V)	LIMITS Min.	LIMITS Typ.	LIMITS Max.	UNITS
Transition Time	t_{TLH}, t_{THL}	5	—	100	200	ns
		10	—	50	100	
Propagation Delay Time:	t_{PLH}, t_{PHL}	5	—	300	600	
+TR or -TR to Q or $\overline{Q}$		10	—	150	300	
Reset to Q or $\overline{Q}$		5	—	250	500	
		10	—	125	250	
Minimum Input Pulse Width:	t_{WH}, t_{WL}	5	—	80	140	
+TR, -TR or Reset		10	—	40	80	
Output Pulse Width - Q or $\overline{Q}$:	T	5	57	60.6	64.5	μs
C_X=0.005 μF, R_X=10 kΩ*		10	55	58.9	63.0	
C_X=0.1 μF, R_X=100 kΩ		5	9.4	9.97	10.5	ms
		10	9.4	9.95	10.6	
C_X=10 μF, R_X=100 kΩ		5	0.95	1.00	1.06	s
		10	0.95	1.00	1.06	
Pulse Width Match between	$\frac{100\ (T_1-T_2)}{T_1}$	5	—	±1	—	%
circuits in same package:		10	—	±1	—	
C_X=0.1 μF, R_X=100 kΩ						
Minimum Retrigger Time	t_{rr}	5	0	—	—	ns
		10	0	—	—	
Input Capacitance	C_{IN}	Any Input	—	5.0	7.5	pF

*Note: Minimum R_X value= 4 kΩ, minimum C_X value=5000 pF.

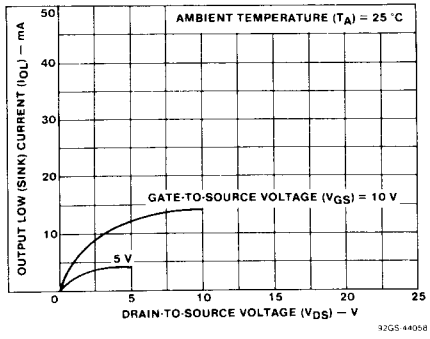


Fig. 2 - Typical output low (sink) current characteristics.

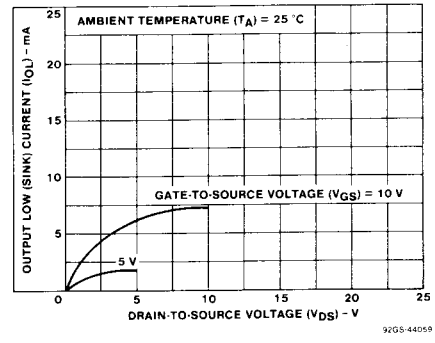


Fig. 3 - Minimum output low (sink) current characteristics.

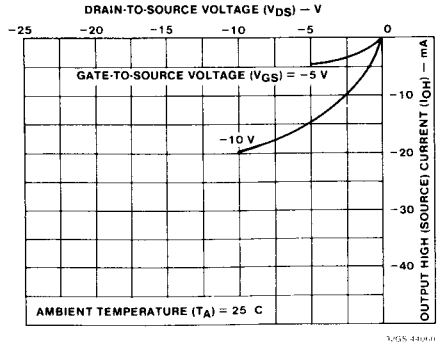


Fig. 4 - Typical output high (source) current characteristics.

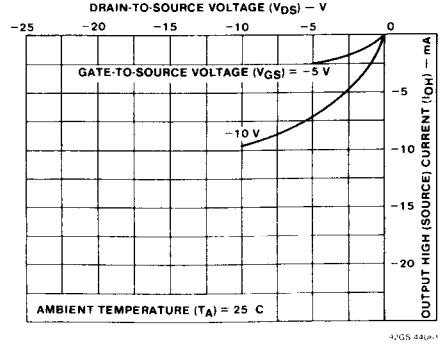


Fig. 5 - Minimum output high (source) current characteristics.

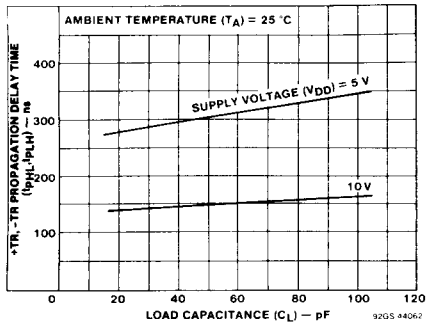


Fig. 6 - Typical propagation delay time as a function of load capacitance (+TR or −TR to Q or $\overline{Q}$).

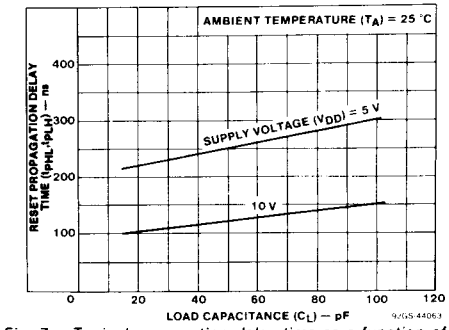


Fig. 7 - Typical propagation delay time as a function of load capacitance (RESET to Q or $\overline{Q}$).

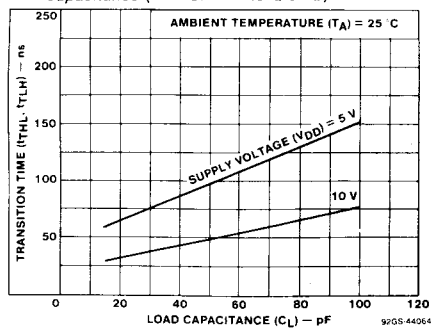


Fig. 8 - Typical transition time as a function of load capacitance.

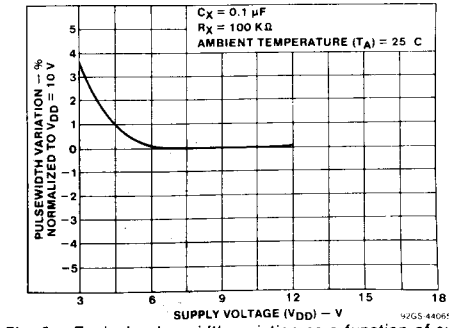


Fig. 9 - Typical pulse-width variation as a function of supply voltage.

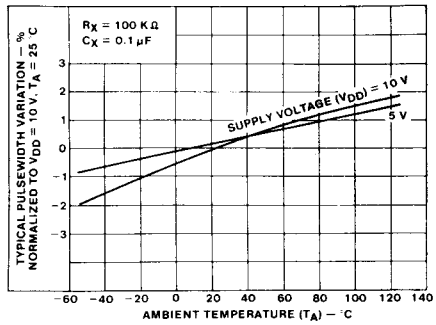


Fig. 10 - Typical pulse-width variation as a function of temperature (R_X=100 KΩ, C_X=0.1 μF).

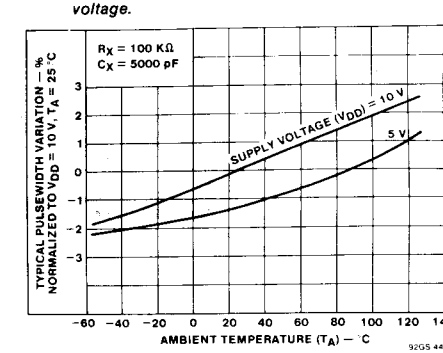


Fig. 11 - Typical pulse-width variation as a function of temperature (R_X=100 KΩ, C_X=5000 pF).

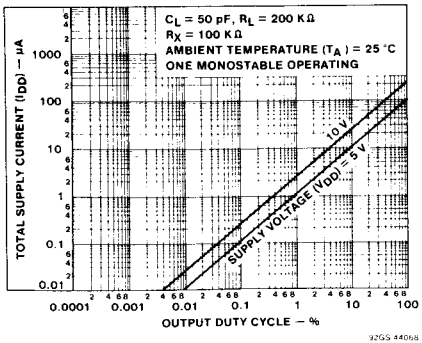


Fig. 12 - Typical total supply current as a function of output duty cycle.

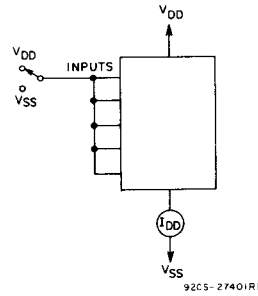
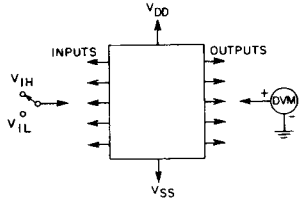
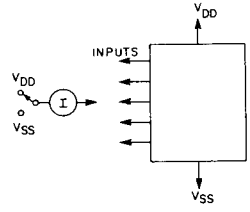


Fig. 13 - Quiescent device current test circuit.



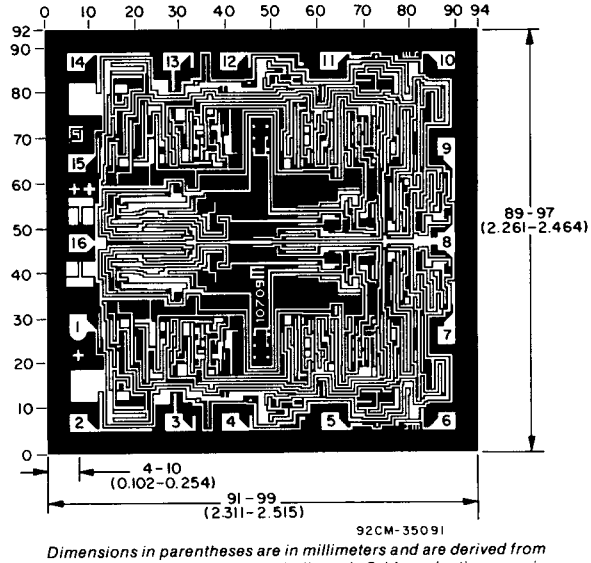
NOTE:
1. Test any combination of inputs.
2. When measuring V_{IH} or V_{IL} for Schmitt trigger inputs (+TR, -TR), the input must first be brought to V_{DD} or V_{SS}, respectively, then reduced to the specified limit.

Fig. 14 - Input-voltage test circuit.



NOTE:
MEASURE INPUTS SEQUENTIALLY, TO BOTH V_{DD} AND V_{SS}. CONNECT ALL UNUSED INPUTS TO EITHER V_{DD} OR V_{SS} EXCEPT PINS 2 AND 14 WHICH SHOULD BE LEFT FLOATING.

Fig. 15 - Input-leakage-current test circuit.



Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils (10^{-3} inch).

Dimensions and pad layout for CD4538BH.