DUAL PRECISION MONOSTABLE MULTIVIBRATOR

The HEF4538B is a dual retriggerable-resettable monostable multivibrator. Each multivibrator has an active LOW trigger/retrigger input ($\overline{I}_0$), an active HIGH trigger/retrigger input (I_1), an overriding active LOW direct reset input ($\overline{C}_D$), an output (O) and its complement ($\overline{O}$), and two pins (C_{TC}* RC_{TC}) for connecting the external timing components C_t and R_t. Typical pulse width variation over temperature range is ± 0,2%.

The HEF4538B may be triggered by either the positive or the negative edges of the input pulse and will produce an accurate output pulse with a pulse width range of 10 μs to infinity. The duration and accuracy of the output pulse are determined by the external timing components C_t and R_t. The output pulse width (T) is equal to R_t x C_t. The linear design techniques in LOCMOS guarantee precise control of the output pulse width.

A LOW level at $\overline{CE}$ terminates the output pulse immediately.

Schmitt-trigger action in the trigger inputs makes the circuit highly tolerant to slower rise and fall times.

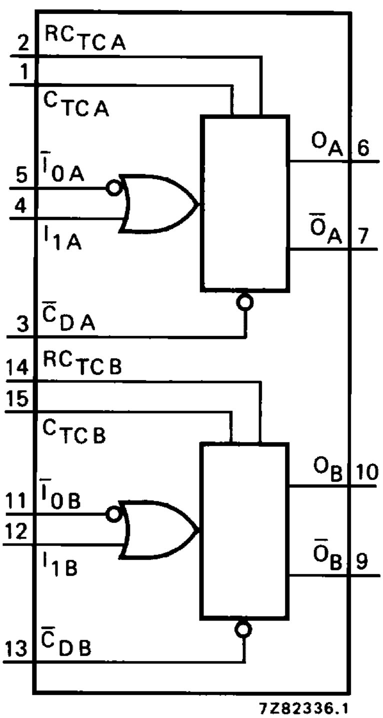


Fig. 1 Functional diagram.

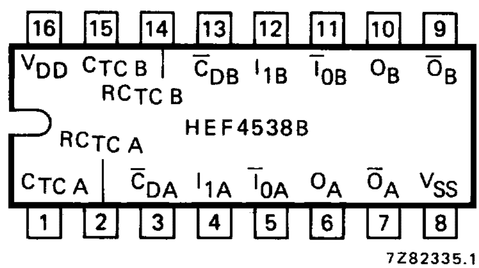


Fig. 2 Pinning diagram.

HEF4538BP : 16-lead DIL; plastic (SOT-38Z).
HEF4538BD: 16-lead DIL; ceramic (cerdip) (SOT-74).
HEF4538BT : 16-lead mini-pack; plastic (SO-16; SOT-109A).

PINNING

$\overline{I}_{0A}$, $\overline{I}_{0B}$	input (HIGH to LOW triggered)
I_{1A}, I_{1B}	input (LOW to HIGH triggered)
$\overline{C}_{DA}$, $\overline{C}_{DB}$	direct reset input (active LOW)
O_A, O_B	output
$\overline{O}_A$, $\overline{O}_B$	complementary output (active LOW)
C_{TC} A, C_{TC} B	external capacitor connections*
RC_{TC} A, RC_{TC} B	external capacitor/ resistor connections

* Always connected to ground.

FAMILY DATA; I_{DD} LIMITS category MSI: see Family specifications.

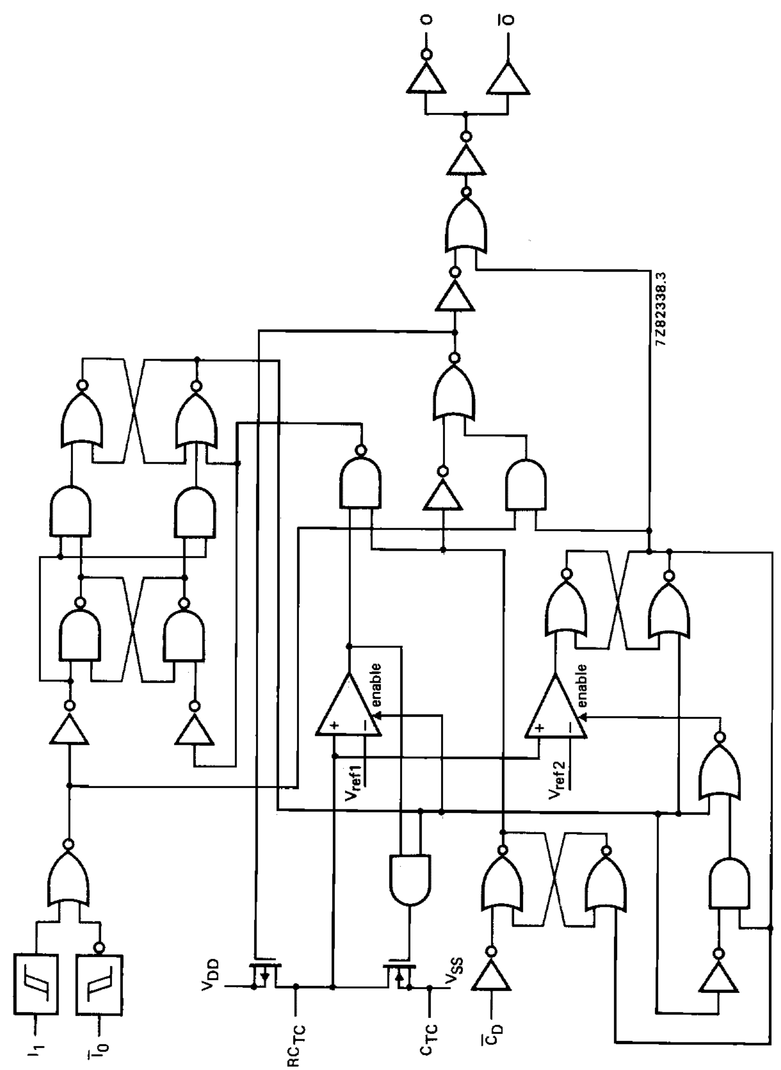


Fig. 3 Logic diagram.

FUNCTION TABLE

inputs			outputs	
$\overline{I}_0$	I_1	$\overline{C}_D$	O	$\overline{O}$
╲	L	H	⎍	⊔
H	╱	H	⎍	⊔
X	X	L	L	H

H = HIGH state (the more positive voltage)
L = LOW state (the less positive voltage)
X = state is immaterial
╱ = positive-going transition
╲ = negative-going transition
⎍ = positive output pulse
⊔ = negative output pulse

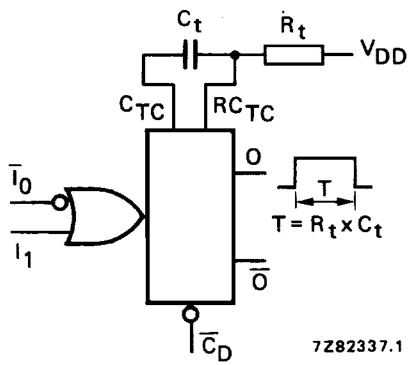


Fig. 4 Connection of the external timing components R_t and C_t.

D.C. CHARACTERISTICS

$V_{SS} = 0$ V

	V_{DD} V	symbol	T_{amb} (°C) −40 typ.	−40 max.	+25 typ.	+25 max.	+85 typ.	+85 max.	
Supply current active state (see note)	5	I_D			55				μA
	10				150				μA
	15				220				μA
Input leakage current (pins 2 and 14)	15	$\pm I_{IN}$				300		1000	nA

Note
Only one monostable is switching: current present during output pulse (output O is HIGH).

A.C. CHARACTERISTICS

V_{SS} = 0 V; T_{amb} = 25 °C; C_L = 50 pF; input transition times ≤ 20 ns

	V_{DD} V	symbol	min.	typ.	max.		typical extrapolation formula
Propagation delays							
$\overline{I}_0$, I_1 → O	5			200	460	ns	173 ns + (0,55 ns/pF) C_L
HIGH to LOW	10	t_{PHL}		90	180	ns	79 ns + (0,23 ns/pF) C_L
	15			60	120	ns	52 ns + (0,16 ns/pF) C_L
$\overline{I}_0$, I_1 → $\overline{O}$	5			220	440	ns	193 ns + (0,55 ns/pF) C_L
LOW to HIGH	10	t_{PLH}		85	190	ns	74 ns + (0,23 ns/pF) C_L
	15			60	120	ns	52 ns + (0,16 ns/pF) C_L
$\overline{C}_D$ → O	5			125	250	ns	98 ns + (0,55 ns/pF) C_L
HIGH to LOW	10	t_{PHL}		55	110	ns	44 ns + (0,23 ns/pF) C_L
	15			40	80	ns	32 ns + (0,16 ns/pF) C_L
$\overline{C}_D$ → $\overline{O}$	5			125	250	ns	98 ns + (0,55 ns/pF) C_L
LOW to HIGH	10	t_{PLH}		55	110	ns	44 ns + (0,23 ns/pF) C_L
	15			40	80	ns	32 ns + (0,16 ns/pF) C_L
Recovery times	5			20	40	ns	
$\overline{C}_D$ → $\overline{I}_0$, I_1	10	t_{RCD}		10	20	ns	
	15			5	10	ns	
Retrigger times	5		0			ns	
O, $\overline{O}$ → $\overline{I}_0$, I_1	10	t_{RO}	0			ns	
	15		0			ns	
Minimum $\overline{I}_0$	5		90	45		ns	
pulse width; LOW	10	t_{WI0L}	30	15		ns	
	15		24	12		ns	
Minimum I_1	5		50	25		ns	
pulse width; HIGH	10	t_{WI1H}	24	12		ns	
	15		20	10		ns	
Minimum $\overline{C}_D$	5		55	25		ns	
pulse width; LOW	10	t_{WCDL}	25	12		ns	
	15		20	10		ns	
Output O or $\overline{O}$	5		218	230	242	μs	
pulse width	10	t_{WO}	213	224	235	μs	R_t = 100 kΩ
	15		211	223	234	μs	C_t = 0,002 μF
Output O or $\overline{O}$	5		10,3	10,8	11,3	ms	
pulse width	10	t_{WO}	10,2	10,7	11,2	ms	R_t = 100 kΩ
	15		10,1	10,6	11,1	ms	C_t = 0,1 μF
Output O or $\overline{O}$	5		1,01	1,09	1,11	s	
pulse width	10	t_{WO}	0,99	1,04	1,09	s	R_t = 100 kΩ
	15		0,99	1,04	1,09	s	C_t = 10 μF

A.C. CHARACTERISTICS

V_{SS} = 0 V; T_{amb} = 25 °C; C_L = 50 pF; input transition times ≤ 20 ns

	V_{DD} V	symbol	min.	typ.	max.		
Change in output O pulse width over temperature (T_{amb})	5 10 15	Δt_{WO}		± 0,2 ± 0,2 ± 0,2		% % %	
Change in output O pulse width over V_{DD} range 5 to 15 V		Δt_{WO}		± 1,5		%	
Pulse width variation between circuits in same package	5 10 15	Δt_{WO}		± 1 ± 1 ± 1		% % %	R_t = 100 kΩ C_t = 2 nF to 10 μF
External timing resistor		R_t	5	–	*	kΩ	
External timing capacitor		C_t	2000	–	no limits	pF	
Input capacitance (pin 2 or 14)		C_{IN}		15		pF	

* The maximum permissible resistance R_t, which holds the specified accuracy of t_{WO}, depends on the leakage current of the capacitor C_t and the leakage of the HEF4538B.

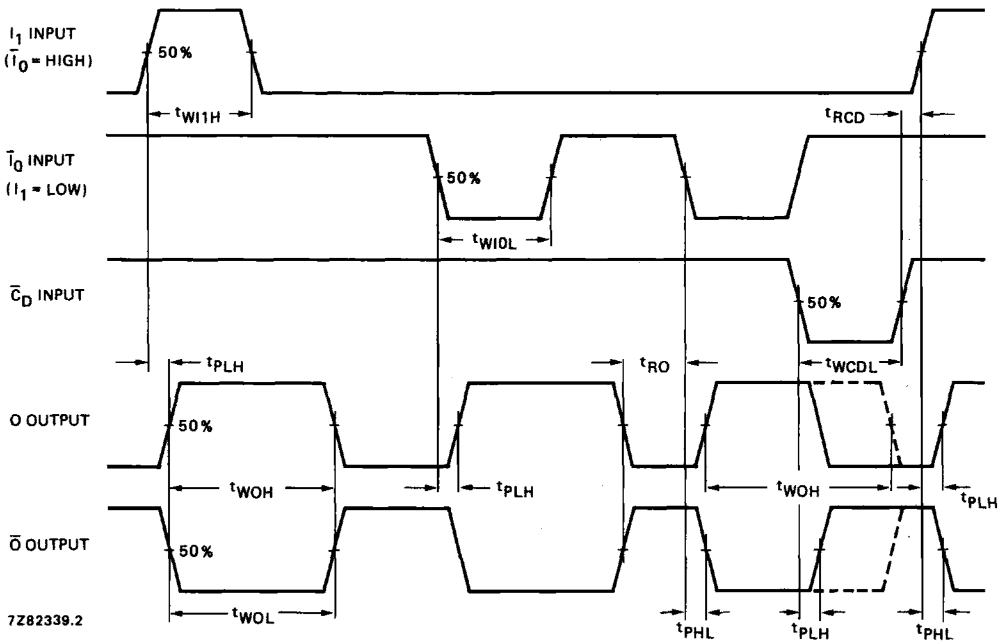
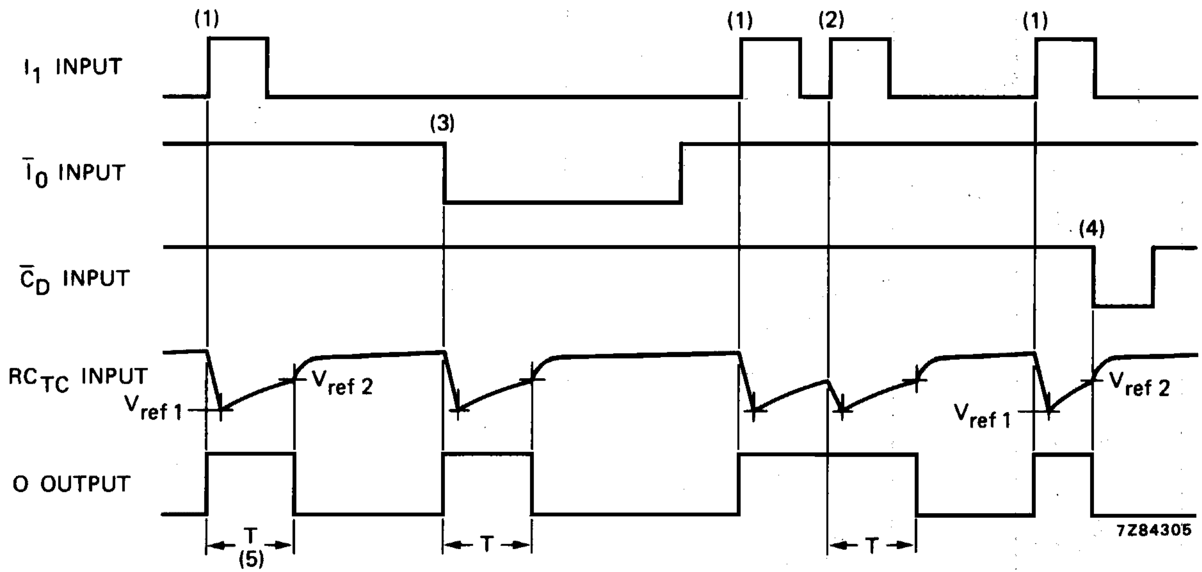


Fig. 5 Waveforms showing minimum $\bar{I}_0$, I_1, O and $\bar{C}_D$ pulse widths, recovery times and propagation delays.



(1) Positive edge triggering.
(2) Positive edge re-triggering (pulse lengthening).
(3) Negative edge triggering.
(4) Reset (pulse shortening).
(5) $T = R_t \times C_t$.

Fig. 6 Timing diagram.

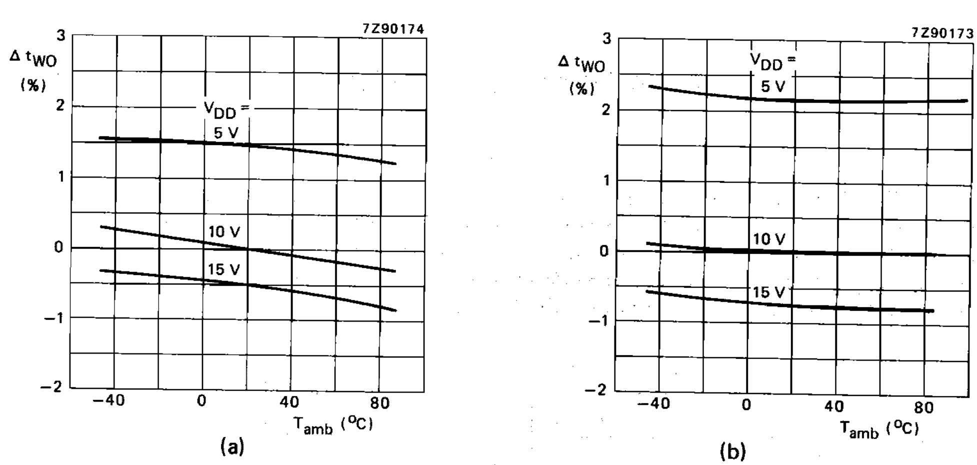


Fig. 7 Typical normalized change in output pulse width as a function of ambient temperature; 0% at V_{DD} = 10 V and T_{amb} = 25 °C.
(a) R_t = 100 kΩ; C_t = 100 nF. (b) R_t = 100 kΩ; C_t = 2 nF.

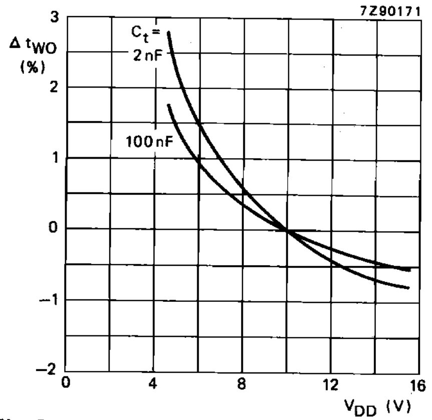


Fig. 8 Typical normalized change in output pulse width as a function of the supply voltage at T_{amb} = 25 °C; 0% at V_{DD} = 10 V; R_t = 100 kΩ.

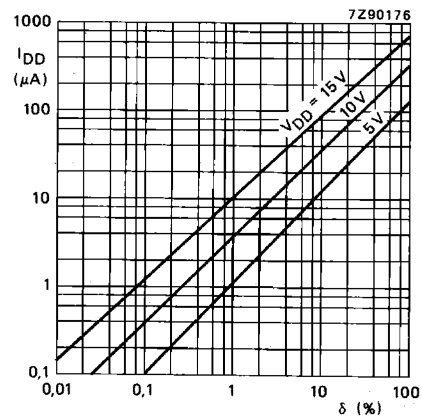


Fig. 9 Total supply current as a function of the output duty factor; R_t = 100 kΩ; C_t = 100 nF; C_L = 50 pF. One monostable multivibrator switching only.