# DATA SHEET

For a complete data sheet, please also download:

- The IC04 LOCMOS HE4000B Logic Family Specifications HEF, HEC
- The IC04 LOCMOS HE4000B Logic Package Outlines/Information HEF, HEC

# HEF4528B
# MSI
# Dual monostable multivibrator

Product specification
File under Integrated Circuits, IC04

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PHILIPS

# Dual monostable multivibrator

# HEF4528B MSI

## DESCRIPTION

The HEF4528B is a dual retriggerable-resettable monostable multivibrator. Each multivibrator has an active LOW input ($\overline{I}_0$), and active HIGH input ($I_1$), an active LOW clear direct input ($\overline{C}_D$), an output (O) and its complement ($\overline{O}$), and two pins for connecting the external timing components ($C_{TC}$(1), $RC_{TC}$).

An external timing capacitor ($C_t$ ) must be connected between $C_{TC}$ and $RC_{TC}$ and an external resistor ($R_t$) must be connected between $RC_{TC}$ and $V_{DD}$. The duration of the output pulse is determined by the external timing components $C_t$ and $R_t$.

A HIGH to LOW transition on $\overline{I}_0$ when $I_1$ is LOW or a LOW to HIGH transition on $I_1$ when $\overline{I}_0$ is HIGH produces a positive pulse (LOW-HIGH-LOW) and O and a negative pulse (HIGH-LOW-HIGH) on $\overline{O}$ if the $\overline{C}_D$ is HIGH. A LOW on $\overline{C}_D$ forces O LOW, O HIGH and inhibits any further pulses until $\overline{C}_D$ is HIGH.

(1) Always connected to ground.

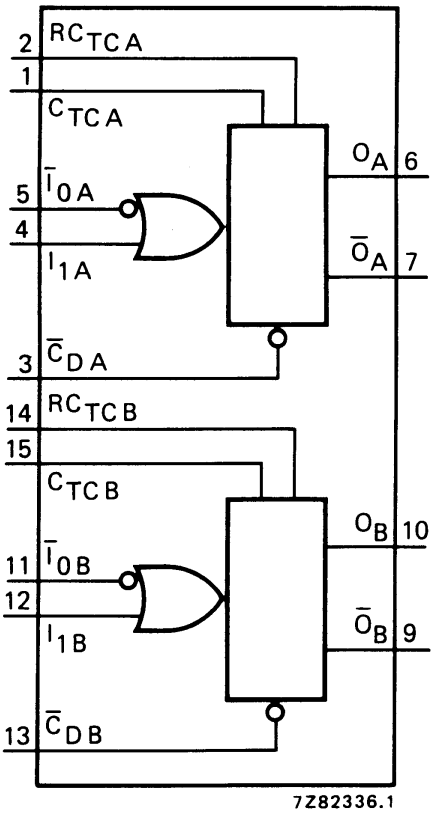


Fig.1 Functional diagram.

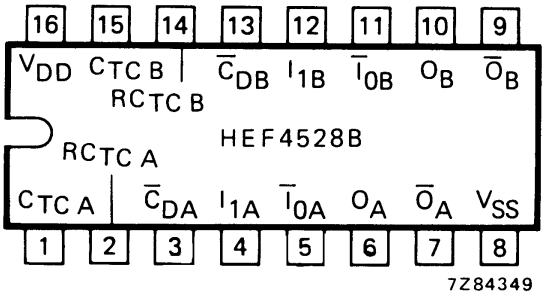


Fig.2 Pinning diagram.

HEF4528BP(N): 16-lead DIL; plastic (SOT38-1)
HEF4528BD(F): 16-lead DIL; ceramic (cerdip) (SOT74)
HEF4528BT(D): 16-lead SO; plastic (SOT109-1)
( ): Package Designator North America

## PINNING

| | |
|---|---|
| $\overline{I}_{0A}$, $\overline{I}_{0B}$ | input (HIGH to LOW triggered) |
| $I_{1A}$, $I_{1B}$ | input (LOW to HIGH triggered) |
| $\overline{C}_{DA}$, $\overline{C}_{DB}$ | clear direct 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 (1) |
| $RC_{TC\,A}$, $RC_{TC\,B}$ | external capacitor/ resistor connections |

## FAMILY DATA, $I_{DD}$ LIMITS category MSI

See Family Specifications

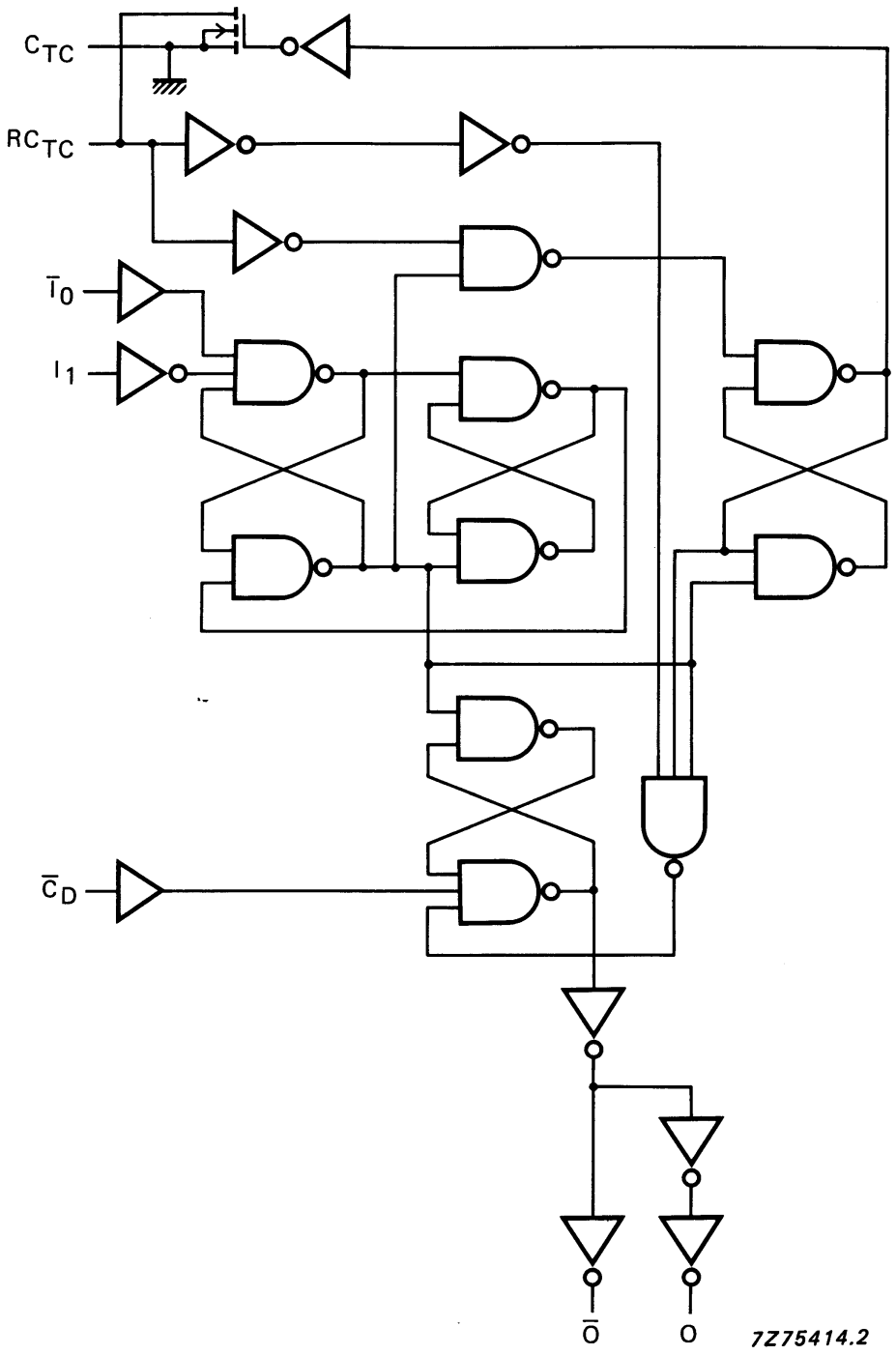


Fig.3 Logic diagram (one monostable multivibrator).

**FUNCTION TABLE**

| INPUTS | | | OUTPUTS | |
|---|---|---|---|---|
| $\bar{I}_0$ | $I_1$ | $\overline{C}_D$ | O | $\overline{O}$ |
| ↘ | L | H | ⎍ | ⎍ |
| H | ↗ | H | ⎍ | ⎍ |
| X | X | L | L | H |

**Notes**

1. H = HIGH state (the more positive voltage)
2. L = LOW state (the less positive voltage)
3. X = state is immaterial
4. ↗ = positive-going transition
5. ↘ = negative-going transition
6. ⎍ ⎍ = positive or negative output pulse; width is determined by $C_t$ and $R_t$

**AC 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 | | | | | | | |
| $\bar{I}_0$, $I_1 \rightarrow \overline{O}$ | 5 | | | 140 | 280 | ns | 113 ns + (0,55 ns/pF) $C_L$ |
| HIGH to LOW | 10 | $t_{PHL}$ | | 50 | 100 | ns | 39 ns + (0,23 ns/pF) $C_L$ |
| | 15 | | | 35 | 70 | ns | 27 ns + (0,16 ns/pF) $C_L$ |
| $\bar{I}_0$, $I_1 \rightarrow$ O | 5 | | | 155 | 305 | ns | 128 ns + (0,55 ns/pF) $C_L$ |
| LOW to HIGH | 10 | $t_{PLH}$ | | 60 | 115 | ns | 49 ns + (0,23 ns/pF) $C_L$ |
| | 15 | | | 40 | 80 | ns | 32 ns + (0,16 ns/pF) $C_L$ |
| $\overline{C}_D \rightarrow$ O | 5 | | | 105 | 210 | ns | 78 ns + (0,55 ns/pF) $C_L$ |
| HIGH to LOW | 10 | $t_{PHL}$ | | 40 | 85 | ns | 29 ns + (0,23 ns/pF) $C_L$ |
| | 15 | | | 30 | 60 | ns | 22 ns + (0,16 ns/pF) $C_L$ |
| $\overline{C}_D \rightarrow \overline{O}$ | 5 | | | 120 | 240 | ns | 93 ns + (0,55 ns/pF) $C_L$ |
| LOW to HIGH | 10 | $t_{PLH}$ | | 50 | 105 | ns | 39 ns + (0,23 ns/pF) $C_L$ |
| | 15 | | | 35 | 70 | ns | 27 ns + (0,16 ns/pF) $C_L$ |
| Output transition | 5 | | | 60 | 120 | ns | 10 ns + (1,0 ns/pF) $C_L$ |
| times | 10 | $t_{THL}$ | | 30 | 60 | ns | 9 ns + (0,42 ns/pF) $C_L$ |
| HIGH to LOW | 15 | | | 20 | 40 | ns | 6 ns + (0,28 ns/pF) $C_L$ |
| | 5 | | | 60 | 120 | ns | 10 ns + (1,0 ns/pF) $C_L$ |
| LOW to HIGH | 10 | $t_{TLH}$ | | 30 | 60 | ns | 9 ns + (0,42 ns/pF) $C_L$ |
| | 15 | | | 20 | 40 | ns | 6 ns + (0,28 ns/pF) $C_L$ |

**AC CHARACTERISTICS**

$V_{SS}$ = 0 V; $T_{amb}$ = 25 °C; input transition times ≤ 20 ns; $R_t$ = 5 kΩ; $C_t$ = 15 pF

| | $V_{DD}$ V | TYPICAL FORMULA FOR P (μW) | |
|---|---|---|---|
| Dynamic power dissipation per package (P) | 5 | $4000\ f_i + \sum (f_o C_L) \times V_{DD}^2$ | where<br>$f_i$ = input freq. (MHz)<br>$f_o$ = output freq. (MHz)<br>$C_L$ = load capacitance (pF)<br>$\sum (f_o C_L)$ = sum of outputs<br>$V_{DD}$ = supply voltage (V) |
| | 10 | $20\ 000\ f_i + \sum (f_o C_L) \times V_{DD}^2$ | |
| | 15 | $59\ 000\ f_i + \sum (f_o C_L) \times V_{DD}^2$ | |

**AC CHARACTERISTICS**

$V_{SS}$ = 0 V; $T_{amb}$ = 25 °C; $C_L$ = 50 pF; input transition times ≤ 20 ns; see also waveforms Fig.5.

| | $V_{DD}$ V | SYMBOL | MIN. | TYP. | MAX. | | |
|---|---|---|---|---|---|---|---|
| Recovery time for $\overline{C}_D$ | 5 | $t_{RCD}$ | 0 | –75 | | ns | |
| | 10 | | 0 | –30 | | ns | |
| | 15 | | 0 | –25 | | ns | |
| Minimum $\bar{I}_0$ pulse width; LOW | 5 | $t_{WI0L}$ | 50 | 25 | | ns | |
| | 10 | | 30 | 15 | | ns | |
| | 15 | | 20 | 10 | | ns | |
| Minimum $I_1$ pulse width; HIGH | 5 | $t_{WI1H}$ | 50 | 25 | | ns | |
| | 10 | | 30 | 15 | | ns | |
| | 15 | | 20 | 10 | | ns | |
| Minimum $\overline{C}_D$ pulse width; LOW | 5 | $t_{WCDL}$ | 60 | 30 | | ns | |
| | 10 | | 35 | 15 | | ns | |
| | 15 | | 25 | 10 | | ns | |
| Set-up time $\overline{C}_D \rightarrow \bar{I}_0$ or $I_1$ | 5 | $t_{su}$ | 0 | –105 | | ns | to avoid change in output |
| | 10 | | 0 | –40 | | ns | |
| | 15 | | 0 | –25 | | ns | |
| Output O pulse width; HIGH | 5 | $t_{WOH}$ | – | 235 | | ns | |
| | 10 | | – | 155 | | ns | note 1 |
| | 15 | | – | 140 | | ns | |
| Output O pulse width; HIGH | 5 | $t_{WOH}$ | – | 5,45 | | μs | |
| | 10 | | – | 4,95 | | μs | note 2 |
| | 15 | | – | 4,85 | | μs | |
| Change in output O pulse width over temperature | 5 | $\Delta t_{WO}$ | – | ±3 | | % | |
| | 10 | | – | ±2 | | % | note 3 |
| | 15 | | – | ±2 | | % | |
| Change in output O pulse width over $V_{DD}$ | 5 | $\Delta t_{WO}$ | – | ±2 | | % | |
| | 10 | | – | ±1 | | % | $V_{DD}$ ± 5% |
| | 15 | | – | ±1 | | % | |

| | $V_{DD}$ V | SYMBOL | MIN. | TYP. | MAX. | | |
|---|---|---|---|---|---|---|---|
| External timing resistor | 5 | $R_t$ | 5 | – | 2000 | kΩ | |
| | 10 | | 5 | – | 2000 | kΩ | |
| | 15 | | 5 | – | 2000 | kΩ | |
| External timing capacitor | 5 | $C_t$ | no limits | | | | |
| | 10 | | no limits | | | | |
| | 15 | | no limits | | | | |

**Notes**

1. $R_t$ = 5 kΩ; $C_t$ = 15 pF; for other $R_t$, $C_t$ combinations and $C_t$ < 0,01 μF see graph Fig.4.
2. $R_t$ = 10 kΩ; $C_t$ = 1000 pF; for other $R_t$, $C_t$ combinations and $C_t$ > 0,01 μF use formula $t_{WO} = K.R_t.C_t$.
   where: $t_{WO}$ = output pulse width (s)
   $R_t$ = external timing resistor (Ω)
   $C_t$ = external timing capacitor (F)
   K = 0,42 for $V_{DD}$ = 5 V
   K = 0,32 for $V_{DD}$ = 10 V
   K = 0,30 for $V_{DD}$ = 15 V
3. $T_{amb}$ = −40 to +85 °C; $\Delta t_{WO}$ is referenced to $t_{WO}$ at $T_{amb}$ = 25 °C.

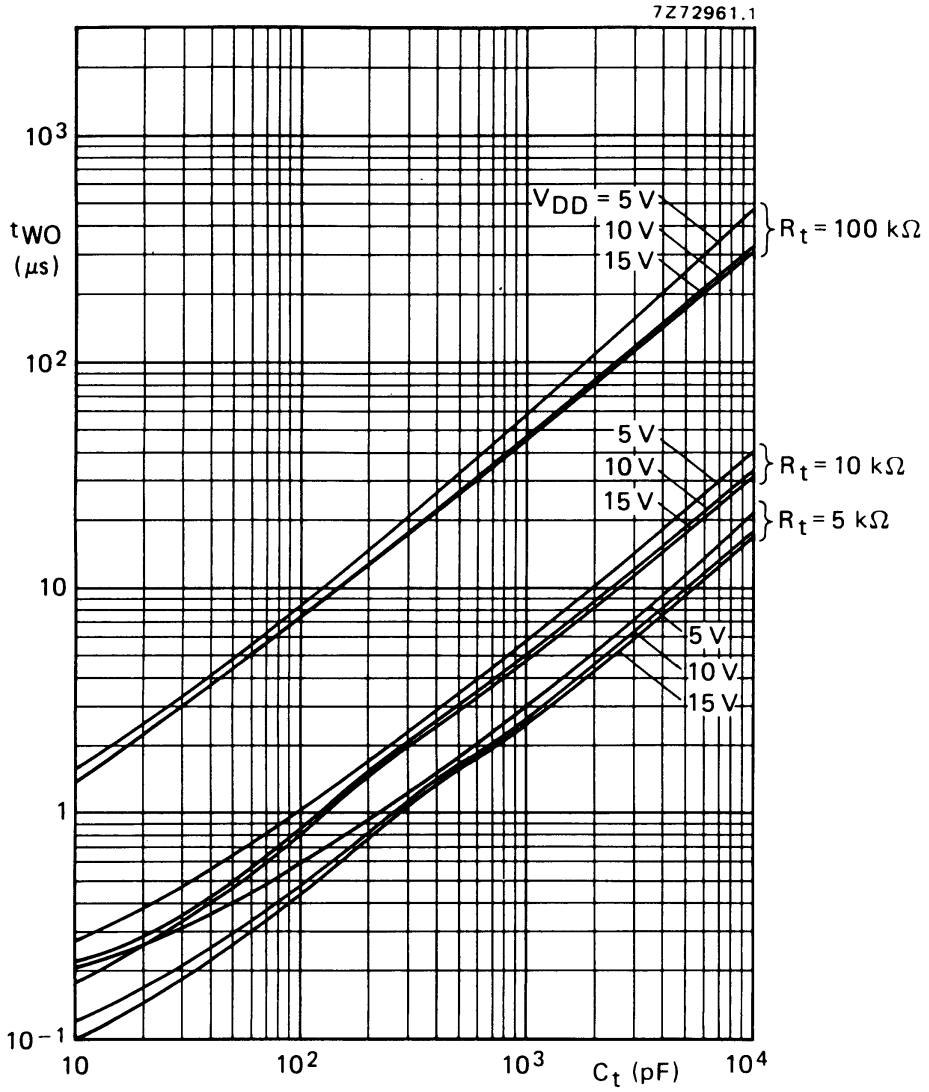


Fig.4 Output pulse width ($t_{WO}$) as a function of external timing capacitor ($C_t$).

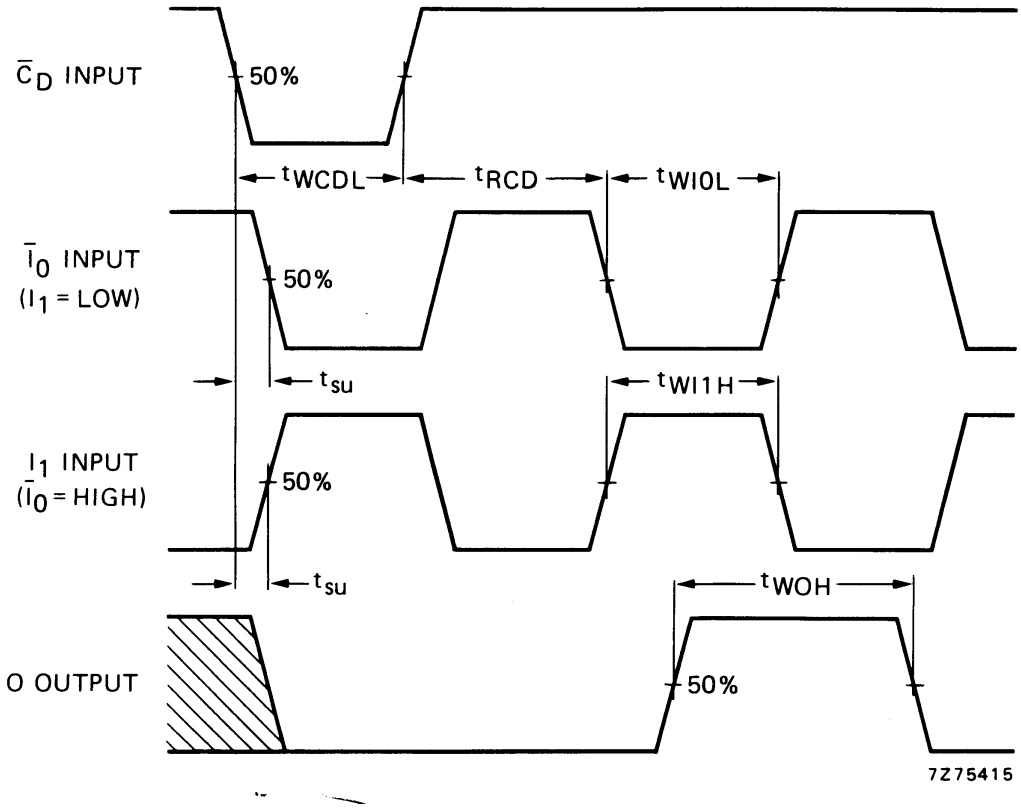


Fig.5 Waveforms showing minimum $\overline{I}_0$, $I_1$ and O pulse widths, set-up and recovery times. Set-up and recovery times are shown as positive values but may be specified as negative values.

**APPLICATION INFORMATION**

An example of an application for the HEF4528B is:

- Non-retriggerable monostable multivibrator

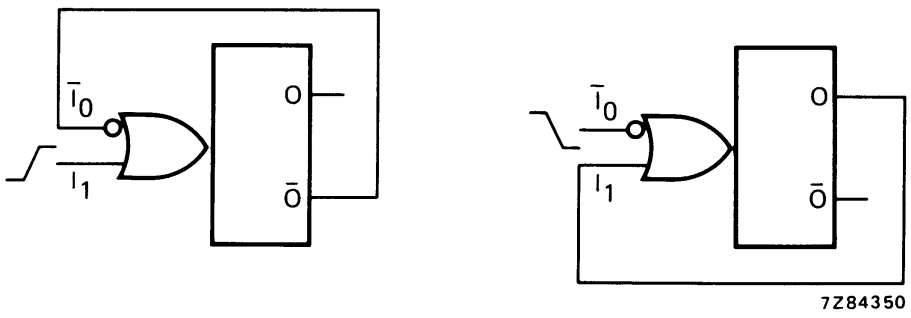


Fig.6 Two examples for a non-retriggerable monostable multivibrator using half of HEF4528B (LOW to HIGH and HIGH to LOW triggered).