

# 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

January 1995

# Dual monostable multivibrator

# HEF4528B MSI

### DESCRIPTION

The HEF4528B is a dual retriggerable-resettable monostable multivibrator. Each multivibrator has an active LOW input ( $\bar{I}_0$ ), and active HIGH input ( $I_1$ ), an active LOW clear direct input ( $\bar{C}_D$ ), an output (O) and its complement ( $\bar{O}$ ), 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

(1) Always connected to ground.

output pulse is determined by the external timing components  $C_t$  and  $R_t$ .

A HIGH to LOW transition on  $\bar{I}_0$  when  $I_1$  is LOW or a LOW to HIGH transition on  $I_1$  when  $\bar{I}_0$  is HIGH produces a positive pulse (LOW-HIGH-LOW) and O and a negative pulse (HIGH-LOW-HIGH) on  $\bar{O}$  if the  $\bar{C}_D$  is HIGH. A LOW

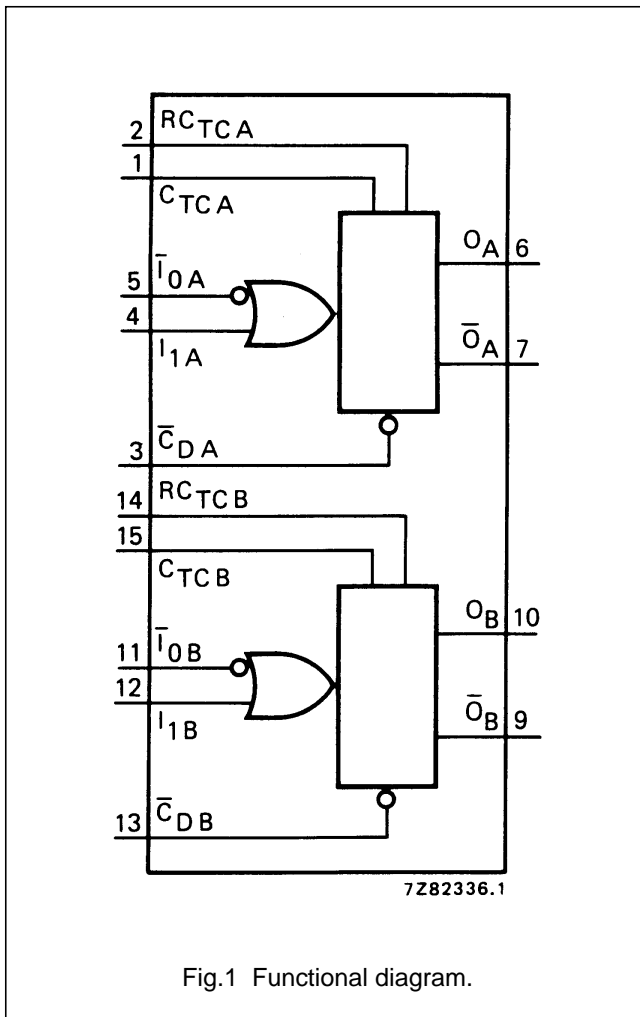


Fig.1 Functional diagram.

on  $\bar{C}_D$  forces O LOW, O HIGH and inhibits any further pulses until  $\bar{C}_D$  is HIGH.

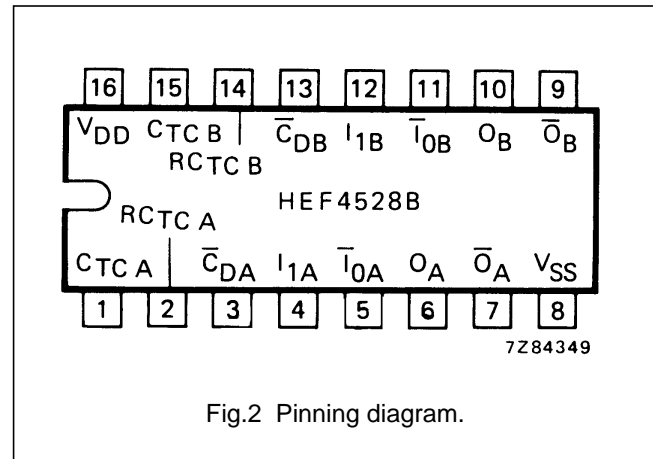


Fig.2 Pinning diagram.

- 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

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

### FAMILY DATA, I<sub>DD</sub> LIMITS category MSI

See Family Specifications

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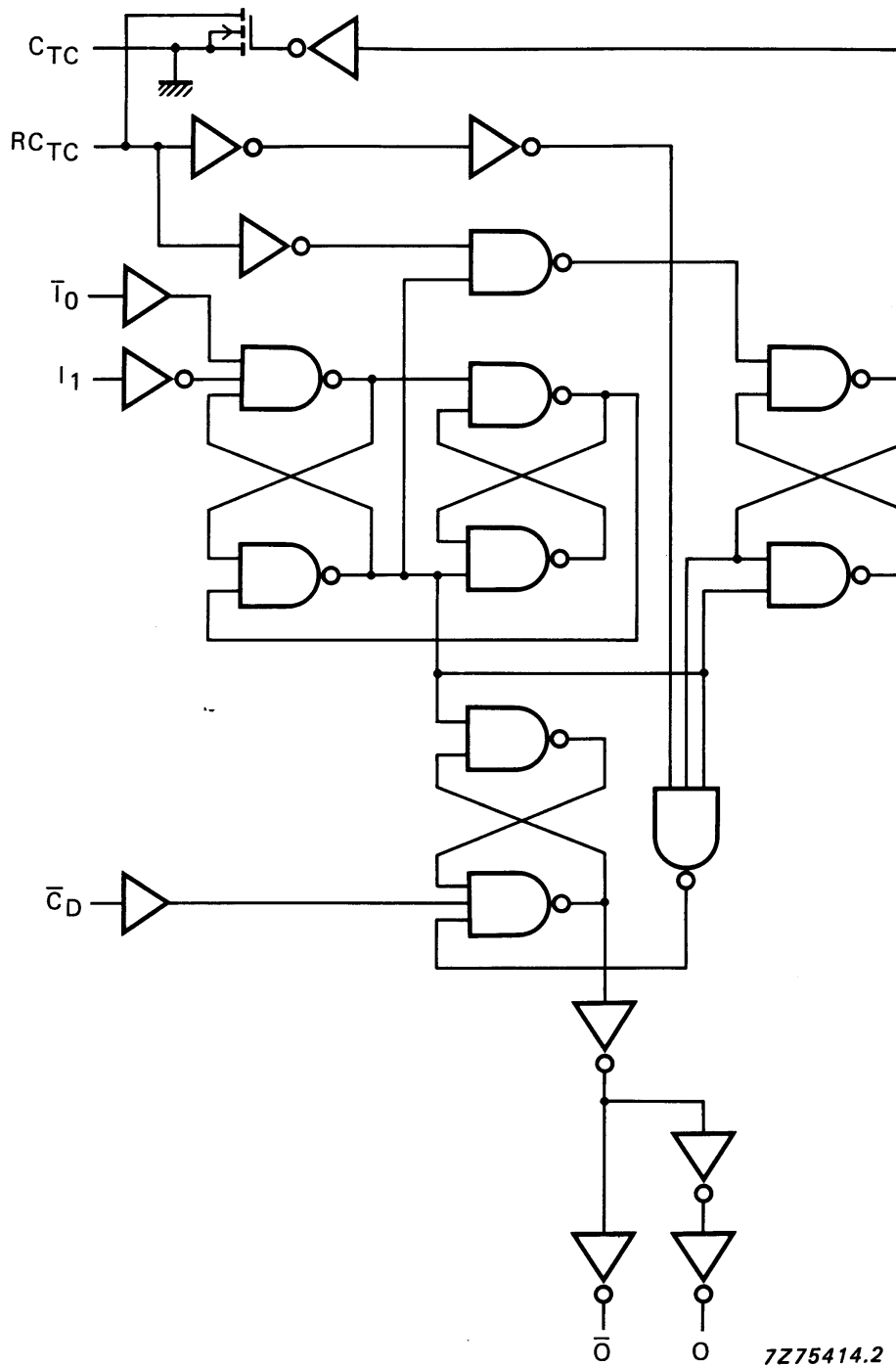








Fig.3 Logic diagram (one monostable multivibrator).





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## FUNCTION TABLE

| INPUTS  |   |             | OUTPUTS   |   |
|---|---|-------------|---|---|
| $\bar{I}_0$   | $I_1$   | $\bar{C}_D$ | O   | $\bar{O}$   |
|  | 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

 $V_{SS} = 0 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ ;  $C_L = 50 \text{ pF}$ ; input transition times  $\leq 20 \text{ ns}$ 

|  | $V_{DD}$<br>V | SYMBOL    | MIN. | TYP. | MAX. | TYPICAL EXTRAPOLATION<br>FORMULA |                             |
|--|---------------|-----------|------|------|------|----------------------------------|-----------------------------|
| Propagation delays<br>$\bar{I}_0, I_1 \rightarrow \bar{O}$<br>HIGH to LOW<br>$\bar{I}_0, I_1 \rightarrow O$<br>LOW to HIGH<br>$\bar{C}_D \rightarrow O$<br>HIGH to LOW<br>$\bar{C}_D \rightarrow \bar{O}$<br>LOW to HIGH | 5             |           |      | 140  | 280  | ns                               | 113 ns + (0,55 ns/pF) $C_L$ |
|  | 10            | $t_{PHL}$ |      | 50   | 100  | ns                               | 39 ns + (0,23 ns/pF) $C_L$  |
|  | 15            |           |      | 35   | 70   | ns                               | 27 ns + (0,16 ns/pF) $C_L$  |
|  | 5             |           |      | 155  | 305  | ns                               | 128 ns + (0,55 ns/pF) $C_L$ |
|  | 10            | $t_{PLH}$ |      | 60   | 115  | ns                               | 49 ns + (0,23 ns/pF) $C_L$  |
|  | 15            |           |      | 40   | 80   | ns                               | 32 ns + (0,16 ns/pF) $C_L$  |
|  | 5             |           |      | 105  | 210  | ns                               | 78 ns + (0,55 ns/pF) $C_L$  |
|  | 10            | $t_{PHL}$ |      | 40   | 85   | ns                               | 29 ns + (0,23 ns/pF) $C_L$  |
|  | 15            |           |      | 30   | 60   | ns                               | 22 ns + (0,16 ns/pF) $C_L$  |
| Output transition<br>times<br>HIGH to LOW<br>LOW to HIGH   | 5             |           |      | 60   | 120  | ns                               | 10 ns + (1,0 ns/pF) $C_L$   |
|  | 10            | $t_{THL}$ |      | 30   | 60   | ns                               | 9 ns + (0,42 ns/pF) $C_L$   |
|  | 15            |           |      | 20   | 40   | ns                               | 6 ns + (0,28 ns/pF) $C_L$   |
|  | 5             |           |      | 60   | 120  | ns                               | 10 ns + (1,0 ns/pF) $C_L$   |
|  | 10            | $t_{TLH}$ |      | 30   | 60   | ns                               | 9 ns + (0,42 ns/pF) $C_L$   |
|  | 15            |           |      | 20   | 40   | ns                               | 6 ns + (0,28 ns/pF) $C_L$   |

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## AC CHARACTERISTICS

 $V_{SS} = 0\text{ V}$ ;  $T_{amb} = 25\text{ °C}$ ; input transition times  $\leq 20\text{ ns}$ ;  $R_t = 5\text{ k}\Omega$ ;  $C_t = 15\text{ pF}$ 

|                 | $V_{DD}$<br>V | TYPICAL FORMULA FOR P ( $\mu\text{W}$ )        |   |
|-----------------|---------------|--|---|
| Dynamic power   | 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) |
| dissipation per | 10            | $20\,000 f_i + \sum (f_o C_L) \times V_{DD}^2$ |   |
| package (P)     | 15            | $59\,000 f_i + \sum (f_o C_L) \times V_{DD}^2$ |   |

## AC CHARACTERISTICS

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

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

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|                           | V <sub>DD</sub><br>V | SYMBOL         | MIN.      | TYP. | MAX. |    |
|---------------------------|----------------------|----------------|-----------|------|------|----|
| External timing resistor  | 5                    | R <sub>t</sub> | 5         | –    | 2000 | kΩ |
|                           | 10                   |                | 5         | –    | 2000 | kΩ |
|                           | 15                   |                | 5         | –    | 2000 | kΩ |
| External timing capacitor | 5                    | C <sub>t</sub> | no limits |      |      |    |
|                           | 10                   |                | no limits |      |      |    |
|                           | 15                   |                | no limits |      |      |    |

**Notes**

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

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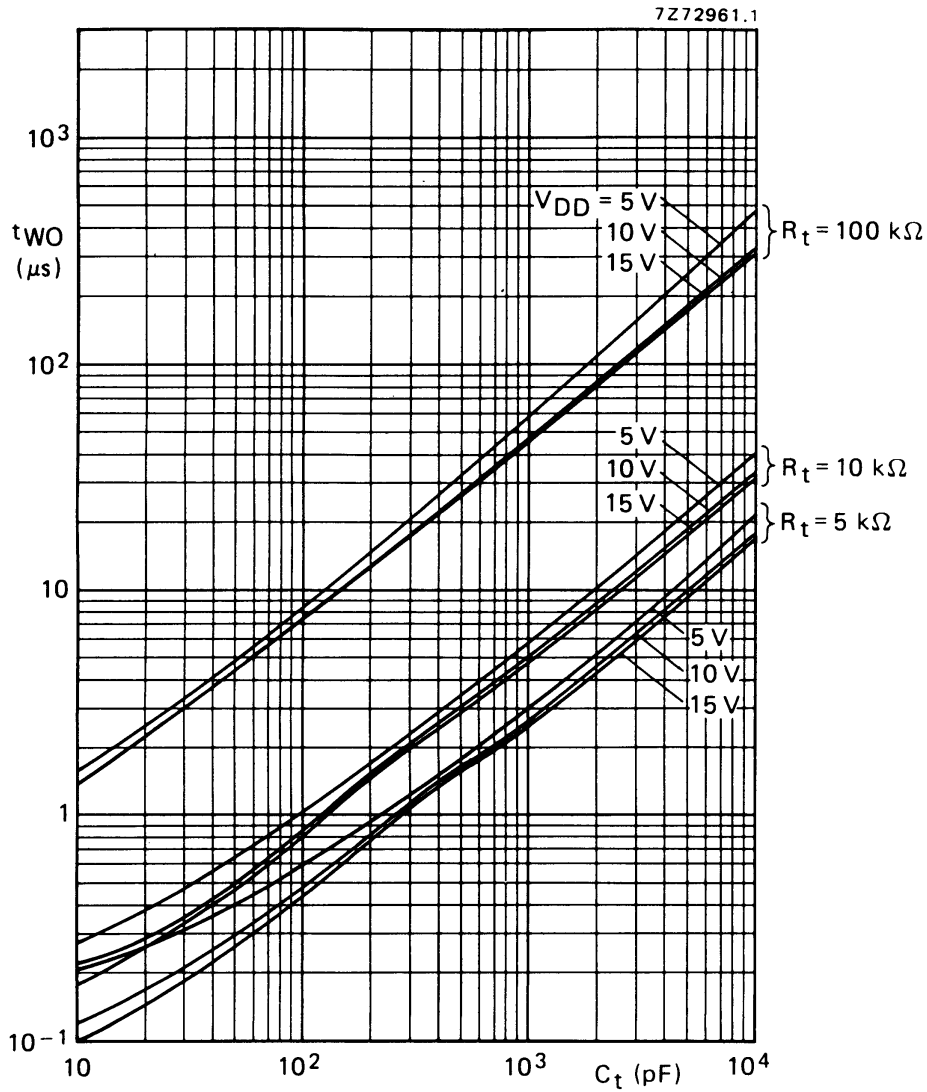


Fig.4 Output pulse width ( $t_{WO}$ ) as a function of external timing capacitor ( $C_t$ ).

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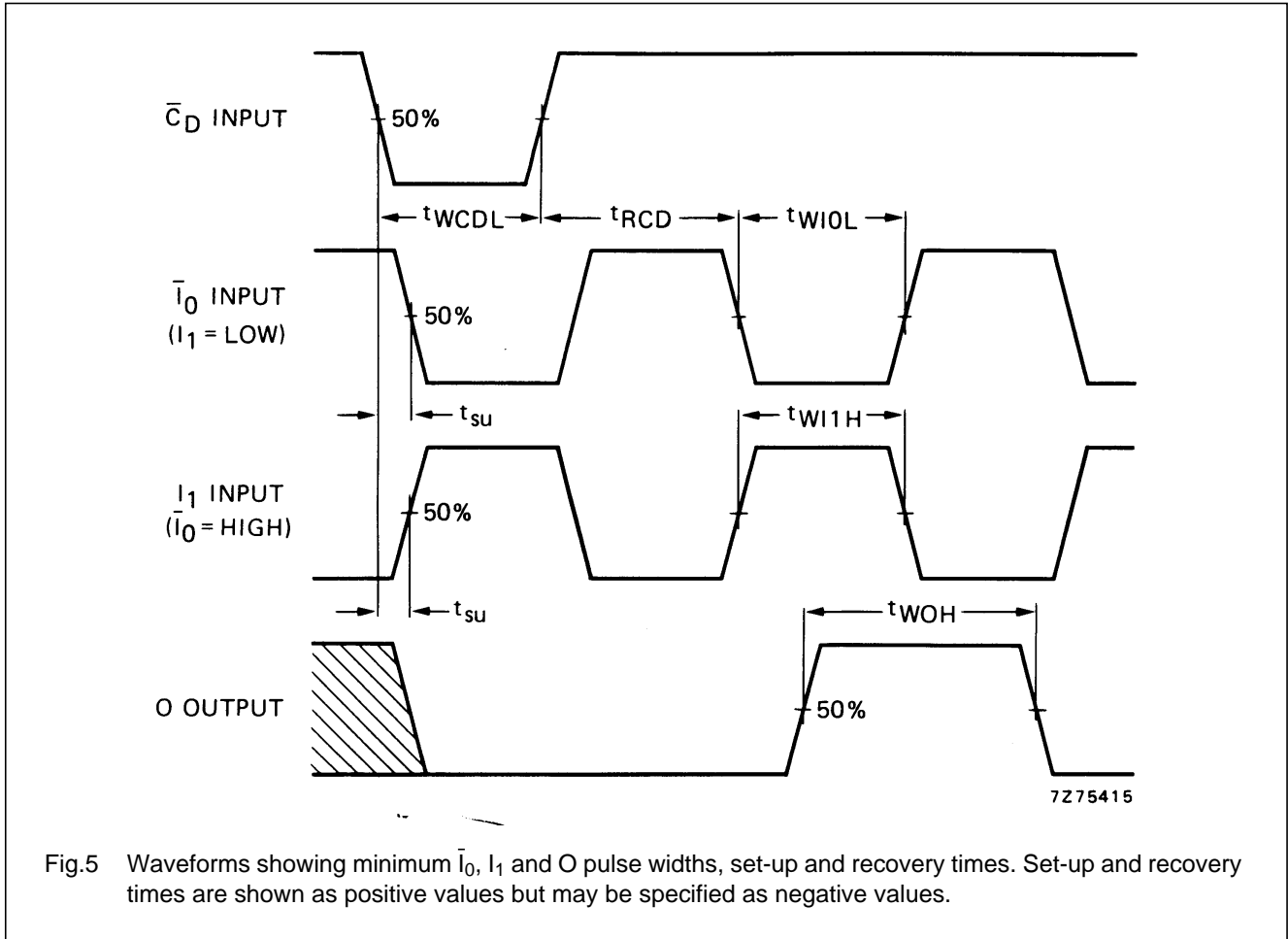


Fig.5 Waveforms showing minimum  $\bar{I}_0$ ,  $I_1$  and O pulse widths, set-up and recovery times. Set-up and recovery times are shown as positive values but may be specified as negative values.

APPLICATION INFORMATION

An example of an application for the HEF4528B is:

- Non-retriggerable monostable multivibrator

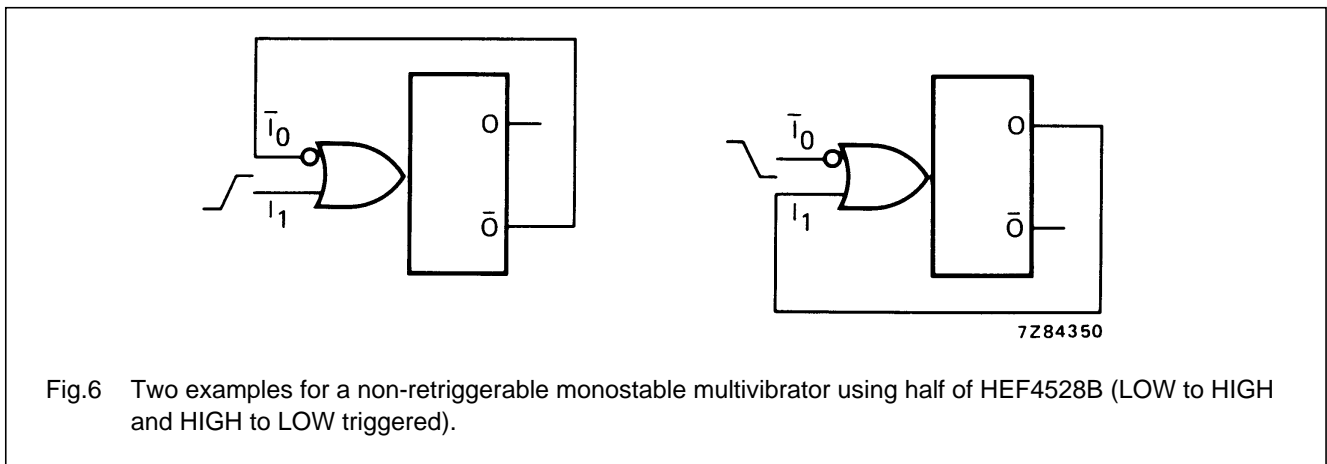


Fig.6 Two examples for a non-retriggerable monostable multivibrator using half of HEF4528B (LOW to HIGH and HIGH to LOW triggered).



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