

# HEF4528B

## Dual monostable multivibrator

Rev. 06 — 27 November 2009

Product data sheet

## 1. General description

The HEF4528B is a dual retriggerable-resettable monostable multivibrator. Each multivibrator has an active LOW input ( $n\bar{A}$ ), and active HIGH input ( $nB$ ), an active LOW clear direct input ( $n\bar{CD}$ ), an output ( $nQ$ ) and its complement ( $n\bar{Q}$ ), and two external timing component connecting pins ( $nC_{EXT}$ , always connected to ground, and  $nR_{EXT}/C_{EXT}$ ).

An external timing capacitor ( $C_{EXT}$ ) must be connected between  $nC_{EXT}$  and  $nR_{EXT}/C_{EXT}$  and an external resistor ( $R_{EXT}$ ) must be connected between  $nR_{EXT}/C_{EXT}$  and  $V_{DD}$ . The output pulse duration is determined by the external timing components  $C_{EXT}$  and  $R_{EXT}$ . A HIGH-to-LOW transition on  $n\bar{A}$  when  $nB$  is LOW or a LOW-to-HIGH transition on  $nB$  when  $n\bar{A}$  is HIGH produces a positive pulse (LOW-HIGH-LOW) on  $nQ$  and a negative pulse (HIGH-LOW-HIGH) on  $n\bar{Q}$  if the  $n\bar{CD}$  is HIGH. A LOW on  $n\bar{CD}$  forces  $nQ$  LOW,  $n\bar{Q}$  HIGH and inhibits any further pulses until  $n\bar{CD}$  is HIGH.

It operates over a recommended  $V_{DD}$  power supply range of 3 V to 15 V referenced to  $V_{SS}$  (usually ground). Unused inputs must be connected to  $V_{DD}$ ,  $V_{SS}$ , or another input. It is also suitable for use over the full industrial ( $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ ) temperature range.

## 2. Features

- Fully static operation
- 5 V, 10 V, and 15 V parametric ratings
- Standardized symmetrical output characteristics
- Operates across the full industrial temperature range  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$
- Complies with JEDEC standard JESD 13-B

## 3. Applications

- Industrial

## 4. Ordering information

Table 1. Ordering information

All types operate from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .

Type number	Package		Version
	Name	Description	
HEF4528BP	DIP16	plastic dual in-line package; 16 leads (300 mil)	SOT38-4
HEF4528BT	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1

5. Functional diagram

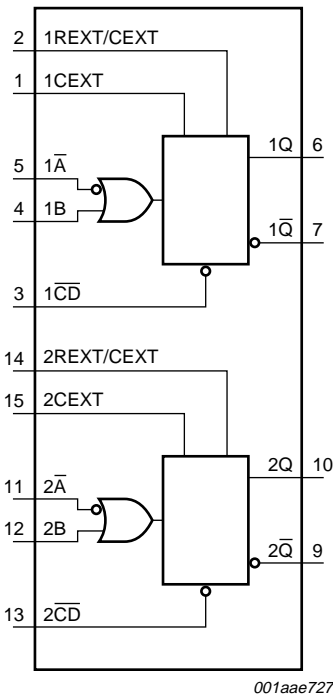


Fig 1. Functional diagram

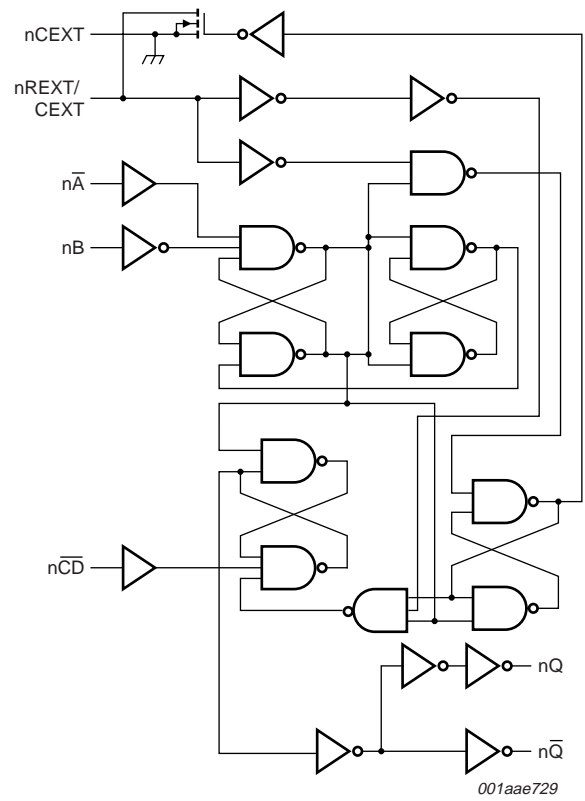


Fig 2. Logic diagram for one monostable multivibrator

## 6. Pinning information

### 6.1 Pinning

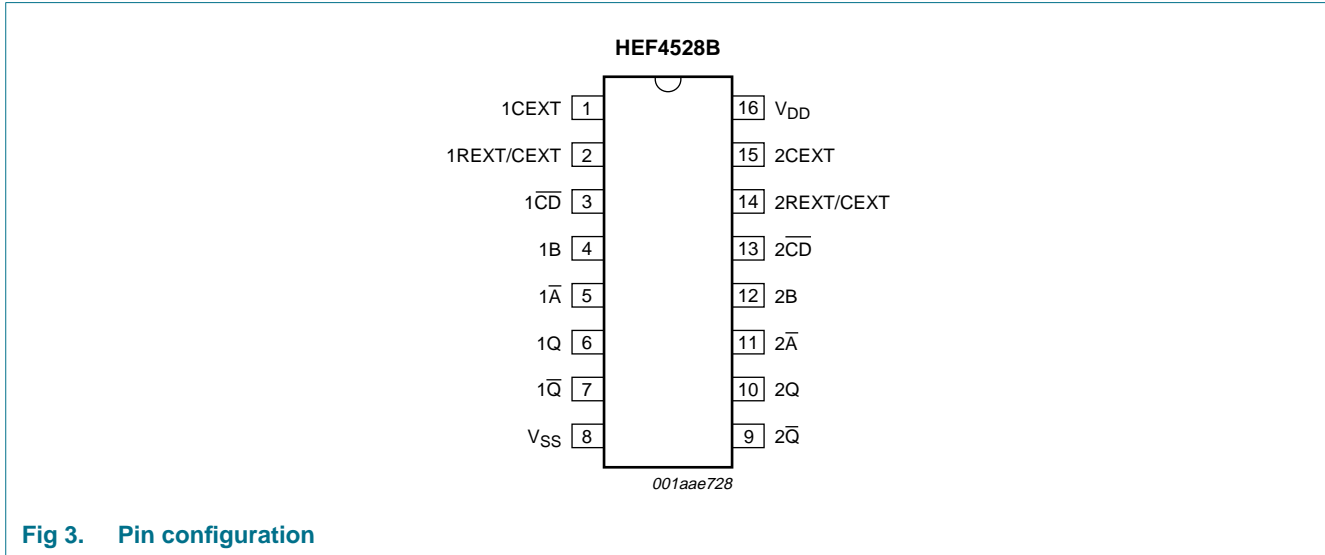


Fig 3. Pin configuration





### 6.2 Pin description

Table 2. Pin description


Symbol	Pin	Description
1CEXT, 2CEXT	1, 15	external capacitor connection (always connected to ground)
1REXT/CEXT, 2REXT/CEXT	2, 14	external capacitor/resistor connection
1CD, 2CD	3, 13	clear direct input (active LOW)
1B, 2B	4, 12	input (LOW-to-HIGH triggered)
1A, 2A	5, 11	input (HIGH-to-LOW triggered)
1Q, 2Q	6, 10	output
1Q, 2Q	7, 9	complementary output (active LOW)
V <sub>SS</sub>	8	ground supply voltage
V <sub>DD</sub>	16	supply voltage


## 7. Functional description

Table 3. Function table<sup>[1]</sup>

Inputs			Outputs	
$\bar{A}$	B	$\overline{CD}$	Q	$\bar{Q}$
↓	L	H		
H	↑	H		
X	X	L	L	H

- [1] H = HIGH voltage level; L = LOW voltage level; X = don't care;  
 ↑ = positive-going transition; ↓ = negative-going transition;

 = one HIGH level output pulse, with the pulse width determined by  $C_{EXT}$  and  $R_{EXT}$ ;

 = one LOW level output pulse, with the pulse width determined by  $C_{EXT}$  and  $R_{EXT}$ .

## 8. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to  $V_{SS} = 0$  V (ground).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DD}$	supply voltage		-0.5	+18	V
$I_{IK}$	input clamping current	$V_I < -0.5$ V or $V_I > V_{DD} + 0.5$ V	-	±10	mA
$V_I$	input voltage		-0.5	$V_{DD} + 0.5$	V
$I_{OK}$	output clamping current	$V_I < -0.5$ V or $V_I > V_{DD} + 0.5$ V	-	±10	mA
$I_{I/O}$	input/output current		-	±10	mA
$I_{DD}$	supply current		-	50	mA
$T_{stg}$	storage temperature		-65	+150	°C
$T_{amb}$	ambient temperature		-40	+85	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to +85 °C			
		DIP16 package	<sup>[1]</sup> -	750	mW
		SO16 package	<sup>[2]</sup> -	500	mW
P	power dissipation	per output	-	100	mW

- [1] For DIP16 package:  $P_{tot}$  derates linearly with 12 mW/K above 70 °C.  
 [2] For SO16 package:  $P_{tot}$  derates linearly with 8 mW/K above 70 °C.

## 9. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>DD</sub>	supply voltage		3	-	15	V
V <sub>I</sub>	input voltage		0	-	V <sub>DD</sub>	V
T <sub>amb</sub>	ambient temperature	in free air	-40	-	+85	°C
Δt/ΔV	input transition rise and fall rate	V <sub>DD</sub> = 5 V	-	-	3.75	μs/V
		V <sub>DD</sub> = 10 V	-	-	0.5	μs/V
		V <sub>DD</sub> = 15 V	-	-	0.08	μs/V

## 10. Static characteristics

**Table 6. Static characteristics**

V<sub>SS</sub> = 0 V; V<sub>I</sub> = V<sub>SS</sub> or V<sub>DD</sub>; unless otherwise specified.

Symbol	Parameter	Conditions	V <sub>DD</sub>	T <sub>amb</sub> = -40 °C		T <sub>amb</sub> = +25 °C		T <sub>amb</sub> = +85 °C		Unit
				Min	Max	Min	Max	Min	Max	
V <sub>IH</sub>	HIGH-level input voltage	I <sub>O</sub>   < 1 μA	5 V	3.5	-	3.5	-	3.5	-	V
			10 V	7.0	-	7.0	-	7.0	-	V
			15 V	11.0	-	11.0	-	11.0	-	V
V <sub>IL</sub>	LOW-level input voltage	I <sub>O</sub>   < 1 μA	5 V	-	1.5	-	1.5	-	1.5	V
			10 V	-	3.0	-	3.0	-	3.0	V
			15 V	-	4.0	-	4.0	-	4.0	V
V <sub>OH</sub>	HIGH-level output voltage	I <sub>O</sub>   < 1 μA	5 V	4.95	-	4.95	-	4.95	-	V
			10 V	9.95	-	9.95	-	9.95	-	V
			15 V	14.95	-	14.95	-	14.95	-	V
V <sub>OL</sub>	LOW-level output voltage	I <sub>O</sub>   < 1 μA	5 V	-	0.05	-	0.05	-	0.05	V
			10 V	-	0.05	-	0.05	-	0.05	V
			15 V	-	0.05	-	0.05	-	0.05	V
I <sub>OH</sub>	HIGH-level output current	V <sub>O</sub> = 2.5 V	5 V	-1.7	-	-1.4	-	-1.1	-	mA
		V <sub>O</sub> = 4.6 V	5 V	-0.52	-	-0.44	-	-0.36	-	mA
		V <sub>O</sub> = 9.5 V	10 V	-1.3	-	-1.1	-	-0.9	-	mA
		V <sub>O</sub> = 13.5 V	15 V	-3.6	-	-3.0	-	-2.4	-	mA
I <sub>OL</sub>	LOW-level output current	V <sub>O</sub> = 0.4 V	5 V	0.52	-	0.44	-	0.36	-	mA
		V <sub>O</sub> = 0.5 V	10 V	1.3	-	1.1	-	0.9	-	mA
		V <sub>O</sub> = 1.5 V	15 V	3.6	-	3.0	-	2.4	-	mA
I <sub>I</sub>	input leakage current		15 V	-	±0.3	-	±0.3	-	±1.0	μA
I <sub>DD</sub>	supply current	all valid input combinations; I <sub>O</sub> = 0 A	5 V	-	20	-	20	-	150	μA
			10 V	-	40	-	40	-	300	μA
			15 V	-	80	-	80	-	600	μA
C <sub>I</sub>	input capacitance		-	-	-	-	7.5	-	-	pF

## 11. Dynamic characteristics

**Table 7. Dynamic characteristics**

$V_{SS} = 0\text{ V}$ ;  $T_{amb} = 25\text{ °C}$ ; for waveforms see [Figure 6](#); for test circuit see [Figure 7](#); unless otherwise specified.

Symbol	Parameter	Conditions	$V_{DD}$	Extrapolation formula <sup>[1]</sup>	Min	Typ	Max	Unit
$t_{PHL}$	HIGH to LOW propagation delay	$n\bar{A}$ or $nB$ to $n\bar{Q}$ ; see <a href="#">Figure 5</a>	5 V	$113\text{ ns} + (0.55\text{ ns/pF}) C_L$	-	140	280	ns
			10 V	$39\text{ ns} + (0.23\text{ ns/pF}) C_L$	-	50	100	ns
			15 V	$27\text{ ns} + (0.16\text{ ns/pF}) C_L$	-	35	70	ns
		$n\bar{CD}$ to $n\bar{Q}$ ; see <a href="#">Figure 5</a>	5 V	$78\text{ ns} + (0.55\text{ ns/pF}) C_L$	-	105	210	ns
			10 V	$29\text{ ns} + (0.23\text{ ns/pF}) C_L$	-	40	85	ns
			15 V	$22\text{ ns} + (0.16\text{ ns/pF}) C_L$	-	30	60	ns
$t_{PLH}$	LOW to HIGH propagation delay	$n\bar{A}$ or $nB$ to $nQ$ ; see <a href="#">Figure 5</a>	5 V	$128\text{ ns} + (0.55\text{ ns/pF}) C_L$	-	155	305	ns
			10 V	$49\text{ ns} + (0.23\text{ ns/pF}) C_L$	-	60	115	ns
			15 V	$32\text{ ns} + (0.16\text{ ns/pF}) C_L$	-	40	80	ns
		$n\bar{CD}$ to $n\bar{Q}$ ; see <a href="#">Figure 5</a>	5 V	$93\text{ ns} + (0.55\text{ ns/pF}) C_L$	-	120	240	ns
			10 V	$39\text{ ns} + (0.23\text{ ns/pF}) C_L$	-	50	105	ns
			15 V	$27\text{ ns} + (0.16\text{ ns/pF}) C_L$	-	35	70	ns
$t_t$	transition time	$nQ$ , $n\bar{Q}$ ; see <a href="#">Figure 5</a>	5 V <sup>[2]</sup>	$10\text{ ns} + (1.00\text{ ns/pF}) C_L$	-	60	120	ns
			10 V	$9\text{ ns} + (0.42\text{ ns/pF}) C_L$	-	30	60	ns
			15 V	$6\text{ ns} + (0.28\text{ ns/pF}) C_L$	-	20	40	ns
$t_{rec}$	recovery time	$n\bar{CD}$ to $n\bar{A}$ or $nB$ ; see <a href="#">Figure 6</a>	5 V		0	-75	-	ns
			10 V		0	-30	-	ns
			15 V		0	-25	-	ns
$t_{su}$	set-up time	$n\bar{CD}$ to $n\bar{A}$ or $nB$ ; see <a href="#">Figure 6</a>	5 V		0	-105	-	ns
			10 V		0	-40	-	ns
			15 V		0	-25	-	ns
$t_W$	pulse width	$n\bar{A}$ LOW; minimum width; see <a href="#">Figure 6</a>	5 V		50	25	-	ns
			10 V		30	15	-	ns
			15 V		20	10	-	ns
		$nB$ HIGH; minimum width; see <a href="#">Figure 6</a>	5 V		50	25	-	ns
			10 V		30	15	-	ns
			15 V		20	10	-	ns
		$n\bar{CD}$ LOW; minimum width; see <a href="#">Figure 6</a>	5 V		60	30	-	ns
			10 V		35	15	-	ns
			15 V		25	10	-	ns
		$nQ$ or $n\bar{Q}$ ; $R_{EXT} = 5\text{ k}\Omega$ ; $C_{EXT} = 15\text{ pF}$ ; see <a href="#">Figure 6</a>	5 V <sup>[3]</sup>		-	235	-	ns
			10 V		-	155	-	ns
			15 V		-	140	-	ns
$nQ$ or $n\bar{Q}$ ; $R_{EXT} = 10\text{ k}\Omega$ ; $C_{EXT} = 1\text{ nF}$ ; see <a href="#">Figure 6</a>	5 V <sup>[4]</sup>		-	5.45	-	$\mu\text{s}$		
	10 V		-	4.95	-	$\mu\text{s}$		
	15 V		-	4.85	-	$\mu\text{s}$		

**Table 7. Dynamic characteristics ...continued**

$V_{SS} = 0\text{ V}$ ;  $T_{amb} = 25\text{ °C}$ ; for waveforms see [Figure 6](#); for test circuit see [Figure 7](#); unless otherwise specified.

Symbol	Parameter	Conditions	V <sub>DD</sub>	Extrapolation formula <sup>[1]</sup>	Min	Typ	Max	Unit
Δt <sub>W</sub>	pulse width variation	nQ output variation over temperature range	5 V	[5]	-	±3	-	%
			10 V		-	±2	-	%
			15 V		-	±2	-	%
		nQ output variation over voltage range V <sub>DD</sub> ± 5 %	5 V		-	±2	-	%
			10 V		-	±1	-	%
			15 V		-	±1	-	%
R <sub>EXT</sub>	external timing resistor	see <a href="#">Figure 4</a>	5 V		5	-	2	MΩ
			10 V		5	-	2	MΩ
			15 V		5	-	2	MΩ
C <sub>EXT</sub>	external timing capacitor	see <a href="#">Figure 4</a>	5 V		no limits			
			10 V		no limits			
			15 V		no limits			

[1] The typical values of the propagation delay and transition times are calculated from the extrapolation formulas shown (C<sub>L</sub> in pF).

[2] t<sub>i</sub> is the same as t<sub>THL</sub> and t<sub>TLH</sub>.

[3] For other R<sub>EXT</sub>, C<sub>EXT</sub> combinations and C<sub>EXT</sub> < 0.01 μF see [Figure 4](#).

[4] For other R<sub>EXT</sub>, C<sub>EXT</sub> combinations and C<sub>EXT</sub> > 0.01 μF use formula t<sub>W</sub> = K × R<sub>EXT</sub> × C<sub>EXT</sub>.

where: t<sub>W</sub> = output pulse width (s);

R<sub>EXT</sub> = external timing resistor (Ω);

C<sub>EXT</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;

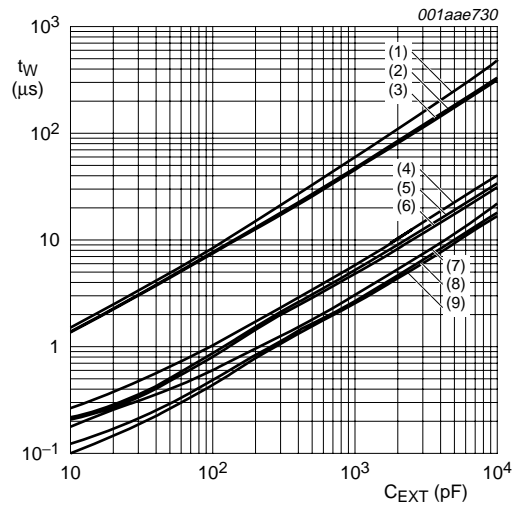
K = 0.30 for V<sub>DD</sub> = 15 V.

[5] T<sub>amb</sub> = -40 °C to +85 °C; Δt<sub>W</sub> is referenced to t<sub>W</sub> at T<sub>amb</sub> = 25 °C.

**Table 8. Dynamic power dissipation P<sub>D</sub>**

P<sub>D</sub> can be calculated from the formulas shown. V<sub>SS</sub> = 0 V; t<sub>r</sub> = t<sub>f</sub> ≤ 20 ns; T<sub>amb</sub> = 25 °C.

Symbol	Parameter	V <sub>DD</sub>	Typical formula for P <sub>D</sub> (μW)	where:
P <sub>D</sub>	dynamic power dissipation	5 V	$P_D = 4000 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$	f <sub>i</sub> = input frequency in MHz;
		10 V	$P_D = 20000 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$	f <sub>o</sub> = output frequency in MHz;
		15 V	$P_D = 59000 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$	C <sub>L</sub> = output load capacitance in pF;
				V <sub>DD</sub> = supply voltage in V;
				Σ(f <sub>o</sub> × C <sub>L</sub> ) = sum of the outputs.



- (1)  $R_{EXT} = 100\text{ k}\Omega$ ,  $V_{DD} = 5\text{ V}$ .
- (2)  $R_{EXT} = 100\text{ k}\Omega$ ,  $V_{DD} = 10\text{ V}$ .
- (3)  $R_{EXT} = 100\text{ k}\Omega$ ,  $V_{DD} = 15\text{ V}$ .
- (4)  $R_{EXT} = 10\text{ k}\Omega$ ,  $V_{DD} = 5\text{ V}$ .
- (5)  $R_{EXT} = 10\text{ k}\Omega$ ,  $V_{DD} = 10\text{ V}$ .
- (6)  $R_{EXT} = 10\text{ k}\Omega$ ,  $V_{DD} = 15\text{ V}$ .
- (7)  $R_{EXT} = 5\text{ k}\Omega$ ,  $V_{DD} = 5\text{ V}$ .
- (8)  $R_{EXT} = 5\text{ k}\Omega$ ,  $V_{DD} = 10\text{ V}$ .
- (9)  $R_{EXT} = 5\text{ k}\Omega$ ,  $V_{DD} = 15\text{ V}$ .

Fig 4. Output pulse width ( $t_W$ ) as a function of external timing capacitor ( $C_{EXT}$ )



12. Waveforms

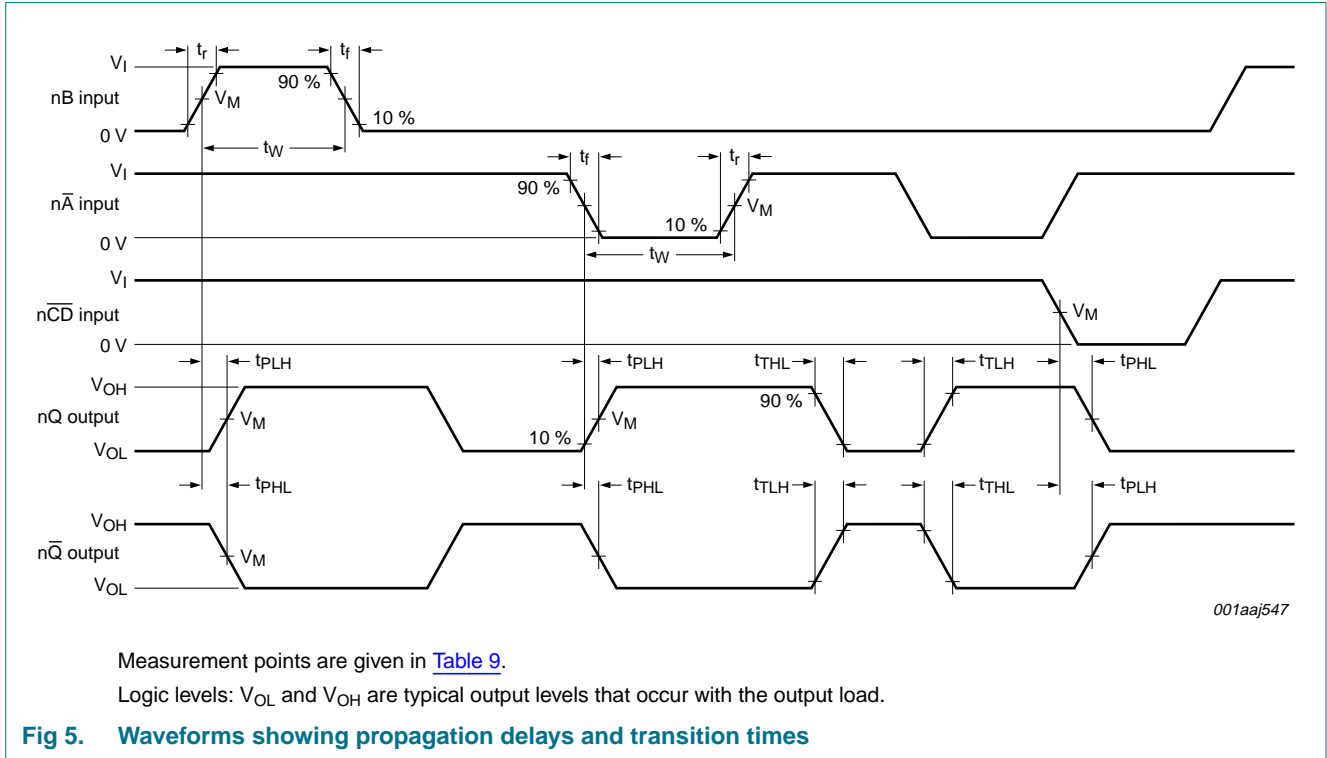


Table 9. Measurement points

Supply voltage	Input	Output
$V_{DD}$	$V_M$	$V_M$
5 V to 15 V	$0.5V_{DD}$	$0.5V_{DD}$

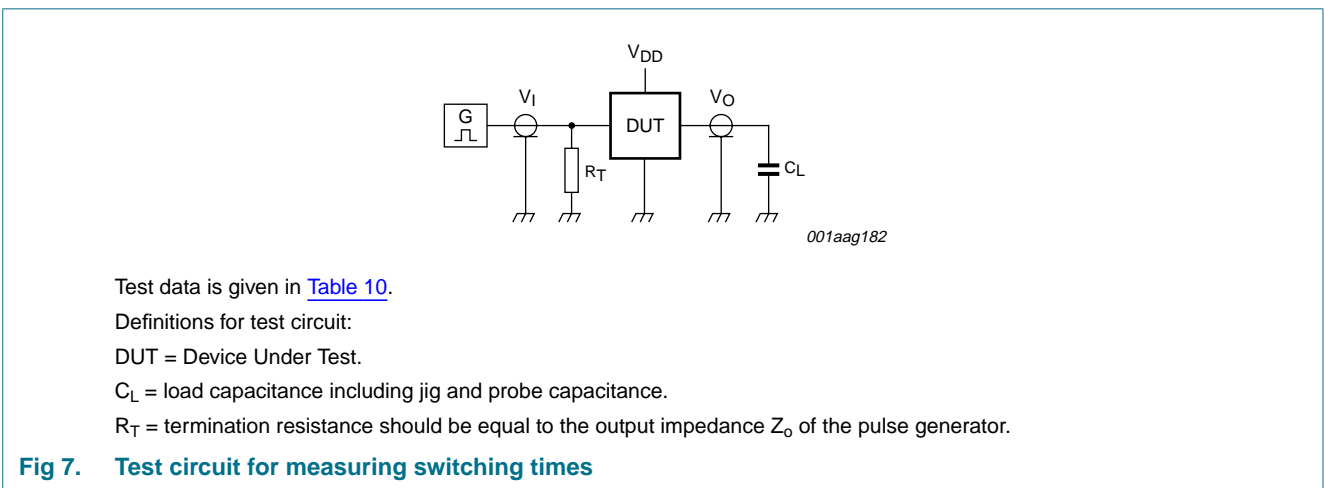
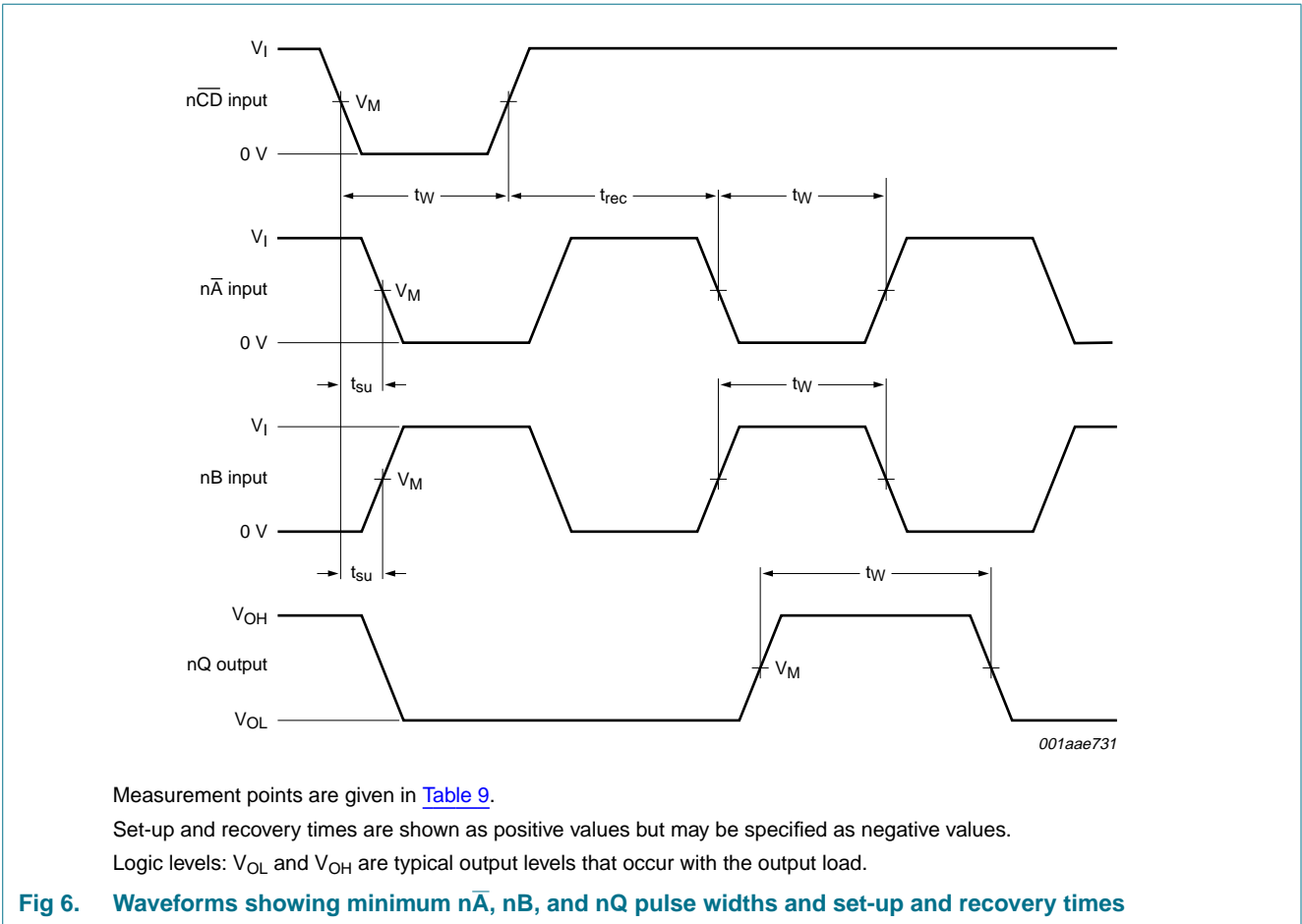


Table 10. Test data

Supply voltage	Input	Load
$V_{DD}$	$V_I$	$C_L$
5 V to 15 V	$V_{SS}$ or $V_{DD}$	50 pF
		$t_r, t_f$
		$\leq 20$ ns

### 13. Application information

An example of a HEF4528B application is:

- Non-retriggerable monostable multivibrator

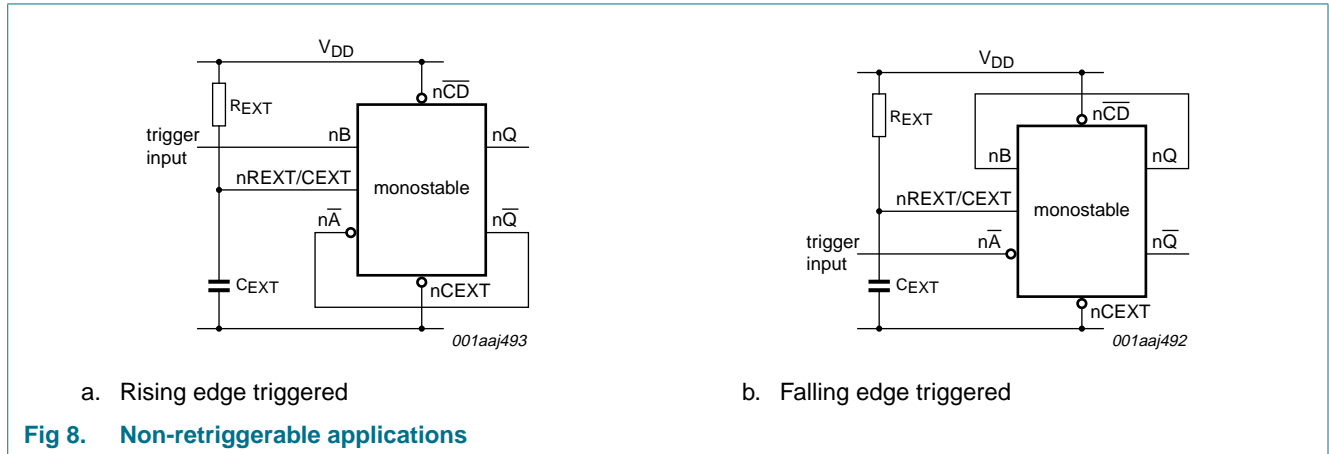


Fig 8. Non-retriggerable applications

14. Package outline

DIP16: plastic dual in-line package; 16 leads (300 mil)

SOT38-4

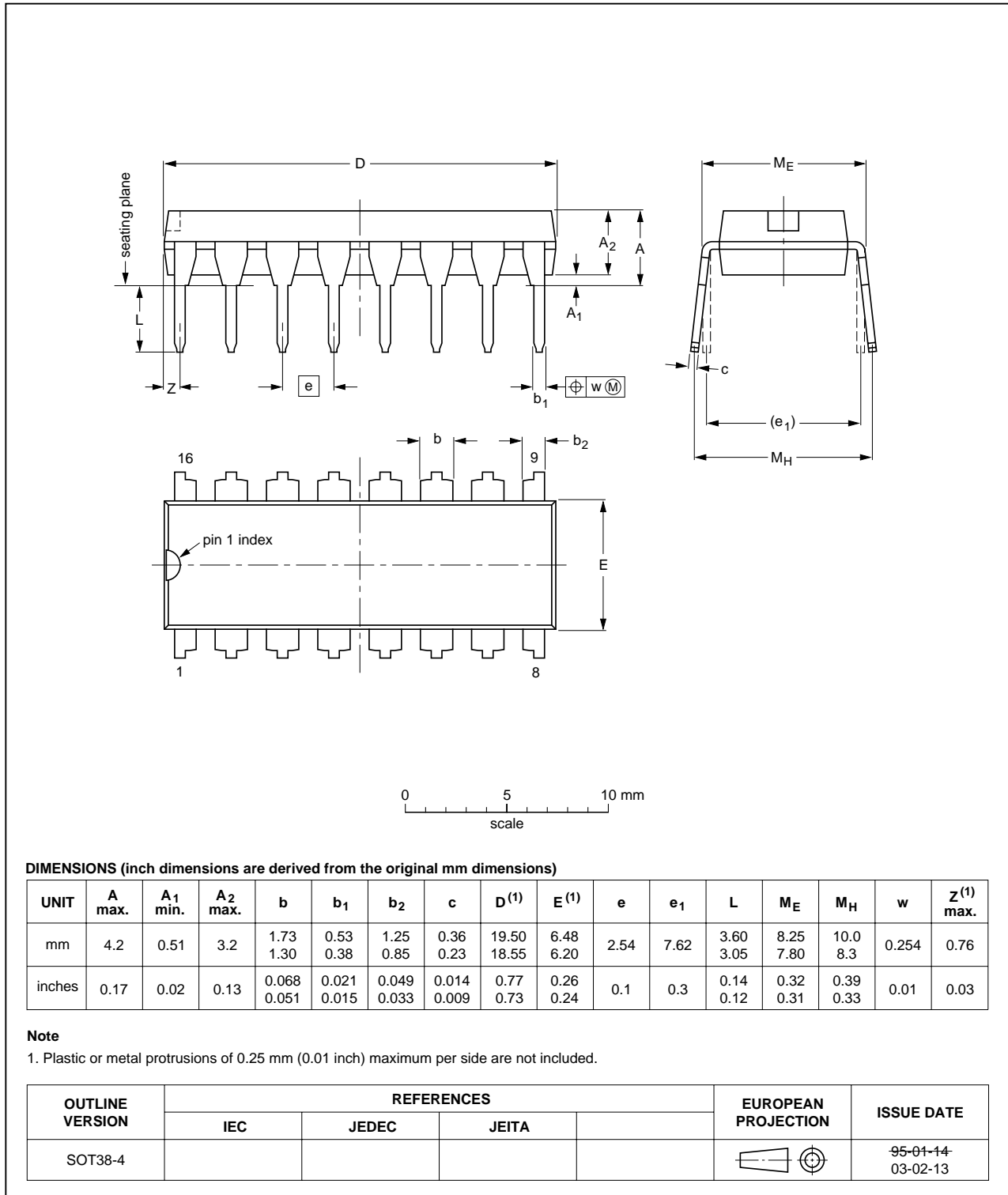


Fig 9. Package outline SOT38-4 (DIP16)

SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1

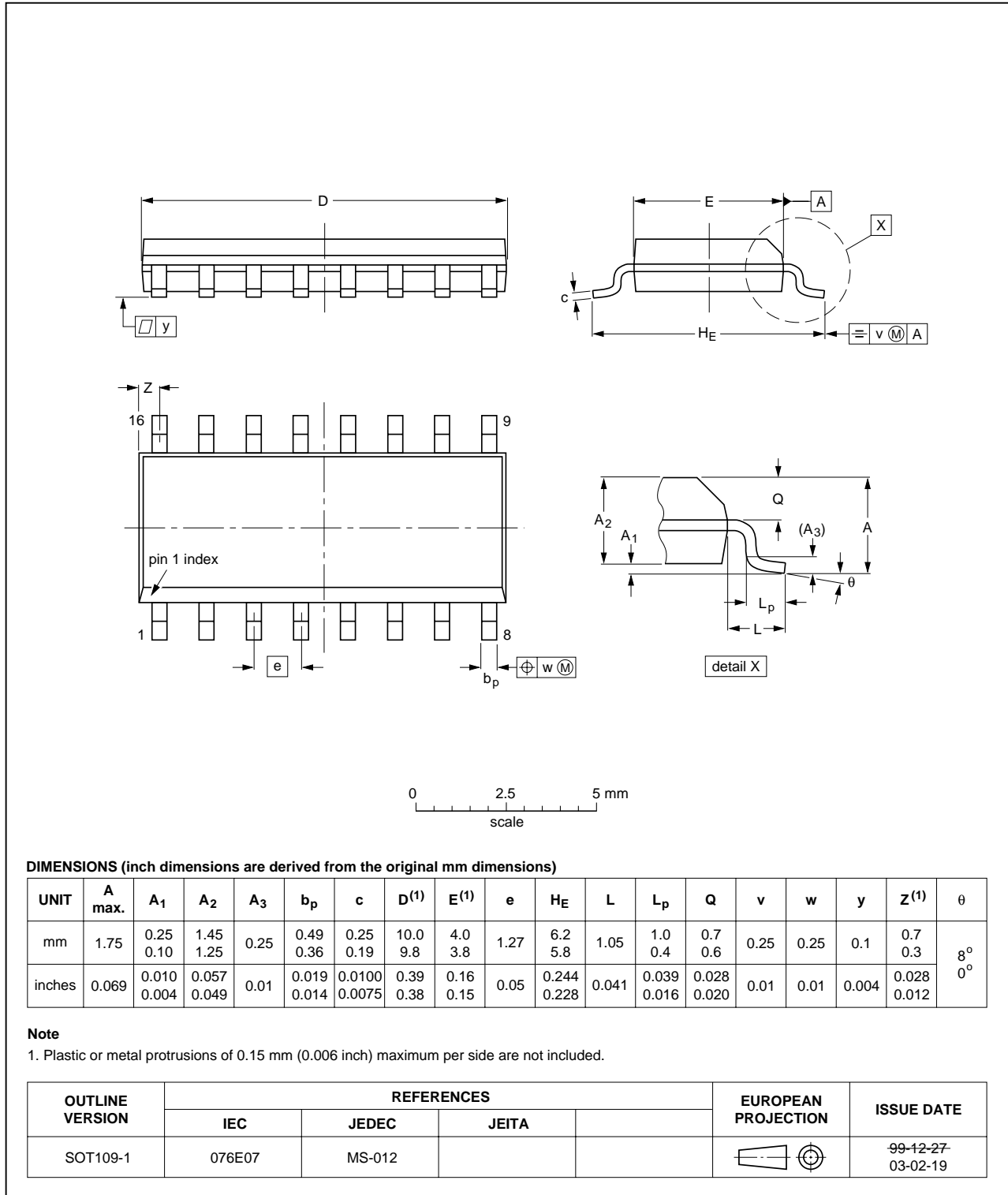


Fig 10. Package outline SOT109-1 (SO16)

## 15. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
HEF4528B_6	20091127	Product data sheet	-	HEF4528B_5
Modifications:	• <a href="#">Section 9 "Recommended operating conditions"</a> : $\Delta t/\Delta V$ values updated.			
HEF4528B_5	20090813	Product data sheet	-	HEF4528B_4
HEF4528B_4	20090209	Product data sheet	-	HEF4528B_CNV_3
HEF4528B_CNV_3	19950101	Product specification	-	HEF4528B_CNV_2
HEF4528B_CNV_2	19950101	Product specification	-	-

## 16. Legal information

### 16.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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