

# HEF4528-Q100B

## Dual monostable multivibrator

Rev. 2 — 4 March 2022

Product data sheet

## 1. General description

The HEF4528B-Q100 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 ( $n\bar{C}\bar{D}$ ), 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  $n\bar{C}\bar{D}$  is HIGH. A LOW on  $n\bar{C}\bar{D}$  forces  $nQ$  LOW,  $n\bar{Q}$  HIGH and inhibits any further pulses until  $n\bar{C}\bar{D}$  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.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 3) and is suitable for use in automotive applications.

## 2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 3)
  - Specified from -40 °C to +85 °C
- Fully static operation
- Wide supply voltage range from 3.0 V to 15.0 V
- CMOS low power dissipation
- High noise immunity
- 5 V, 10 V, and 15 V parametric ratings
- Standardized symmetrical output characteristics
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V ( $C = 200$  pF,  $R = 0$   $\Omega$ )
- Complies with JEDEC standard JESD 13-B

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
HEF4528BT-Q100	40 °C to +85 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1

### 4. Functional diagram

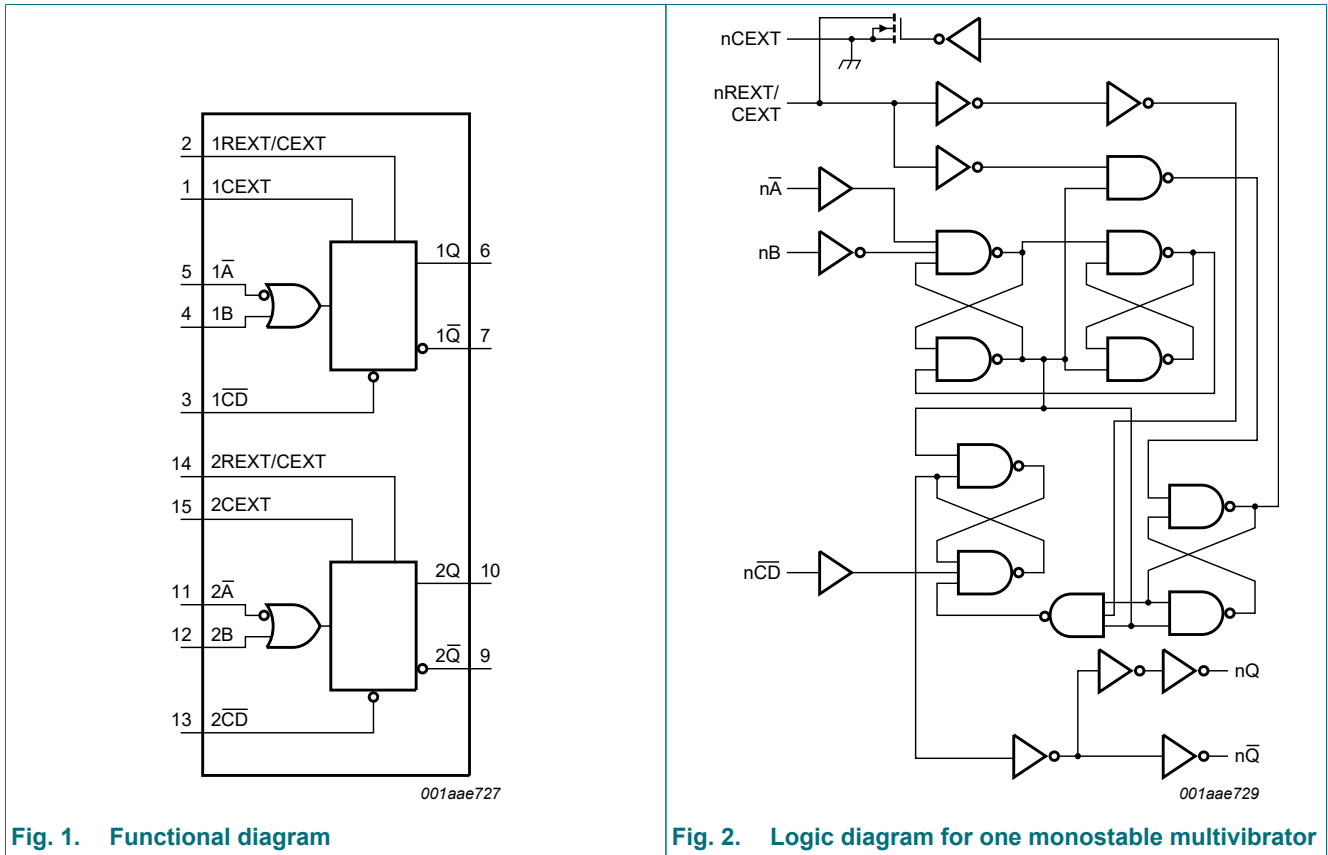


Fig. 1. Functional diagram

Fig. 2. Logic diagram for one monostable multivibrator

### 5. Pinning information

#### 5.1. Pinning

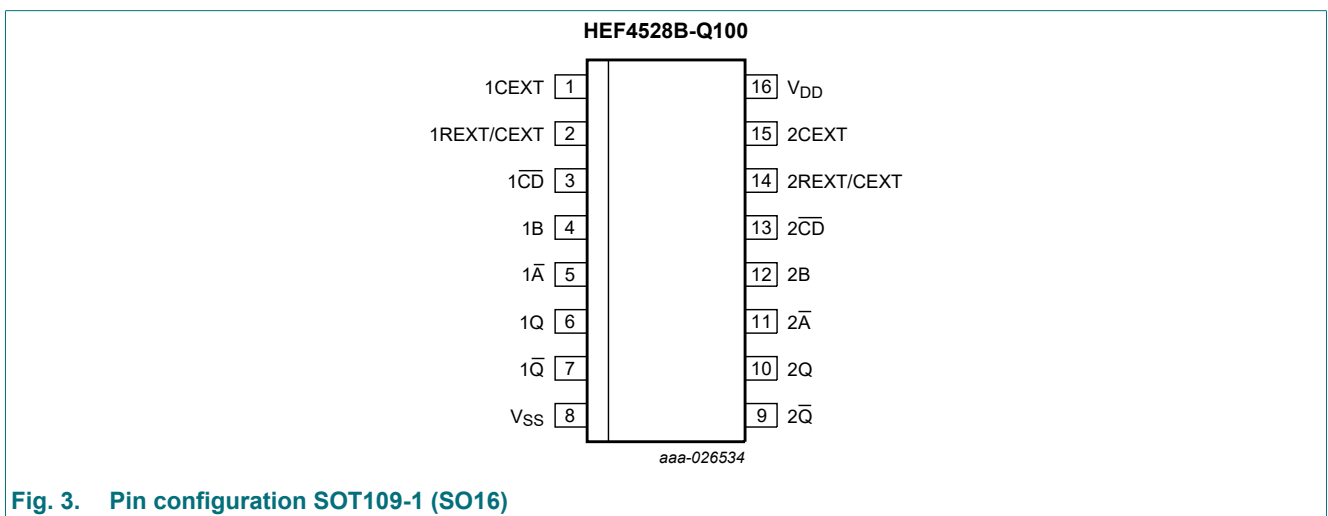


Fig. 3. Pin configuration SOT109-1 (SO16)

## 5.2. 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
1 $\overline{CD}$ , 2 $\overline{CD}$	3, 13	clear direct input (active LOW)
1B, 2B	4, 12	input (LOW-to-HIGH triggered)
1 $\overline{A}$ , 2 $\overline{A}$	5, 11	input (HIGH-to-LOW triggered)
1Q, 2Q	6, 10	output
1 $\overline{Q}$ , 2 $\overline{Q}$	7, 9	complementary output (active LOW)
V <sub>SS</sub>	8	ground supply voltage
V <sub>DD</sub>	16	supply voltage


## 6. Functional description





Table 3. Function table

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<sub>EXT</sub> and R<sub>EXT</sub>;

 = one LOW level output pulse, with the pulse width determined by C<sub>EXT</sub> and R<sub>EXT</sub>.

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

## 7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to V<sub>SS</sub> = 0 V (ground).

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>DD</sub>	supply voltage		-0.5	+18	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>DD</sub> + 0.5 V	-	±10	mA
V <sub>I</sub>	input voltage		-0.5	V <sub>DD</sub> + 0.5	V
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>DD</sub> + 0.5 V	-	±10	mA
I <sub>I/O</sub>	input/output current		-	±10	mA
I <sub>DD</sub>	supply current		-	50	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
T <sub>amb</sub>	ambient temperature		-40	+85	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +85 °C	-	500	mW
P	power dissipation	per output	-	100	mW

## 8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DD}$	supply voltage		3	15	V
$V_I$	input voltage		0	$V_{DD}$	V
$T_{amb}$	ambient temperature	in free air	-40	+85	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{DD} = 5\text{ V}$	-	3.75	$\mu\text{s/V}$
		$V_{DD} = 10\text{ V}$	-	0.5	$\mu\text{s/V}$
		$V_{DD} = 15\text{ V}$	-	0.08	$\mu\text{s/V}$

## 9. Static characteristics

Table 6. Static characteristics

$V_{SS} = 0\text{ V}$ ;  $V_I = V_{SS}$  or  $V_{DD}$ , unless otherwise specified.

Symbol	Parameter	Conditions	$V_{DD}$	$T_{amb} = -40\text{ °C}$		$T_{amb} = 25\text{ °C}$		$T_{amb} = 85\text{ °C}$		Unit
				Min	Max	Min	Max	Min	Max	
$V_{IH}$	HIGH-level input voltage	$ I_O  < 1\ \mu\text{A}$	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
$V_{IL}$	LOW-level input voltage	$ I_O  < 1\ \mu\text{A}$	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
$V_{OH}$	HIGH-level output voltage	$ I_O  < 1\ \mu\text{A}$	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
$V_{OL}$	LOW-level output voltage	$ I_O  < 1\ \mu\text{A}$	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
$I_{OH}$	HIGH-level output current	$V_O = 2.5\text{ V}$	5 V	-	-1.7	-	-1.4	-	-1.1	mA
		$V_O = 4.6\text{ V}$	5 V	-	-0.52	-	-0.44	-	-0.36	mA
		$V_O = 9.5\text{ V}$	10 V	-	-1.3	-	-1.1	-	-0.9	mA
		$V_O = 13.5\text{ V}$	15 V	-	-3.6	-	-3.0	-	-2.4	mA
$I_{OL}$	LOW-level output current	$V_O = 0.4\text{ V}$	5 V	0.52	-	0.44	-	0.36	-	mA
		$V_O = 0.5\text{ V}$	10 V	1.3	-	1.1	-	0.9	-	mA
		$V_O = 1.5\text{ V}$	15 V	3.6	-	3.0	-	2.4	-	mA
$I_I$	input leakage current		15 V	-	$\pm 0.3$	-	$\pm 0.3$	-	$\pm 1.0$	$\mu\text{A}$
$I_{DD}$	supply current	all valid input combinations; $I_O = 0\text{ A}$	5 V	-	20	-	20	-	150	$\mu\text{A}$
			10 V	-	40	-	40	-	300	$\mu\text{A}$
			15 V	-	80	-	80	-	600	$\mu\text{A}$
$C_I$	input capacitance		-	-	-	7.5	-	-	pF	

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

$V_{SS} = 0\text{ V}$ ;  $T_{amb} = 25\text{ °C}$ ; unless otherwise specified; for waveforms see Fig. 4 to Fig. 6; for test circuit see Fig. 7.

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

Symbol	Parameter	Conditions	V <sub>DD</sub>	Extrapolation formula [1]	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 Fig. 4	5 V		5	-	2	MΩ
			10 V		5	-	2	MΩ
			15 V		5	-	2	MΩ
C <sub>EXT</sub>	external timing capacitor	see Fig. 4	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 Fig. 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;

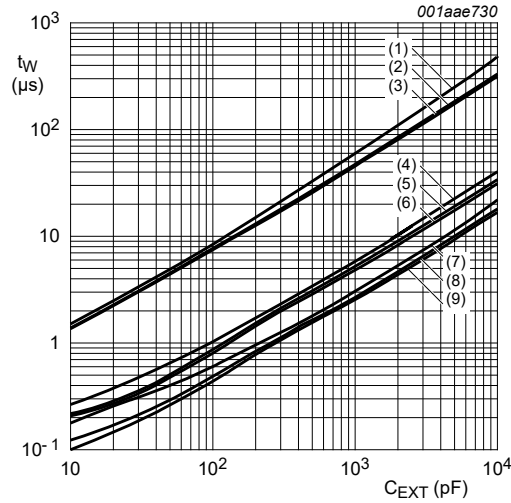
K = 0.30 for V<sub>DD</sub> = 15 V.

[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; f <sub>o</sub> = output frequency in MHz; 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.
		10 V	$P_D = 20000 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$	
		15 V	$P_D = 59000 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$	



- (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 ( $C_{EXT}$ )

### 10.1. Waveforms and test circuit

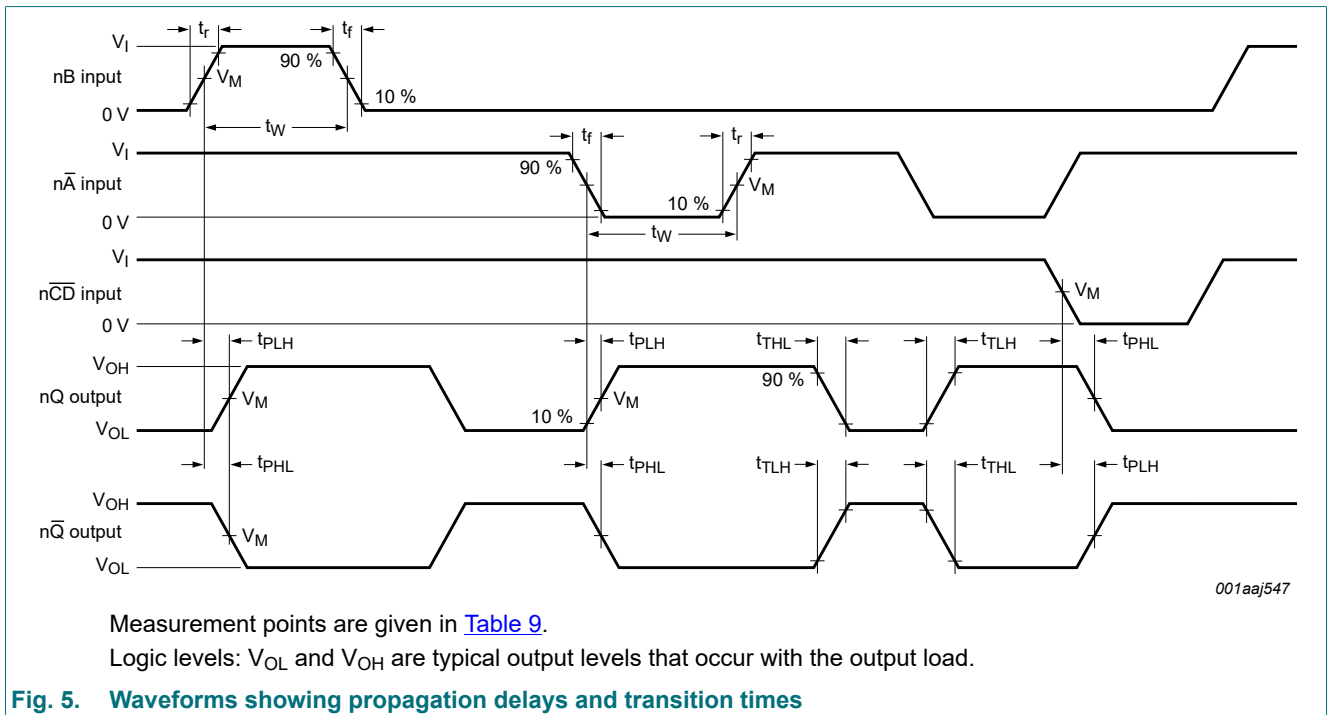


Fig. 5. Waveforms showing propagation delays and transition times

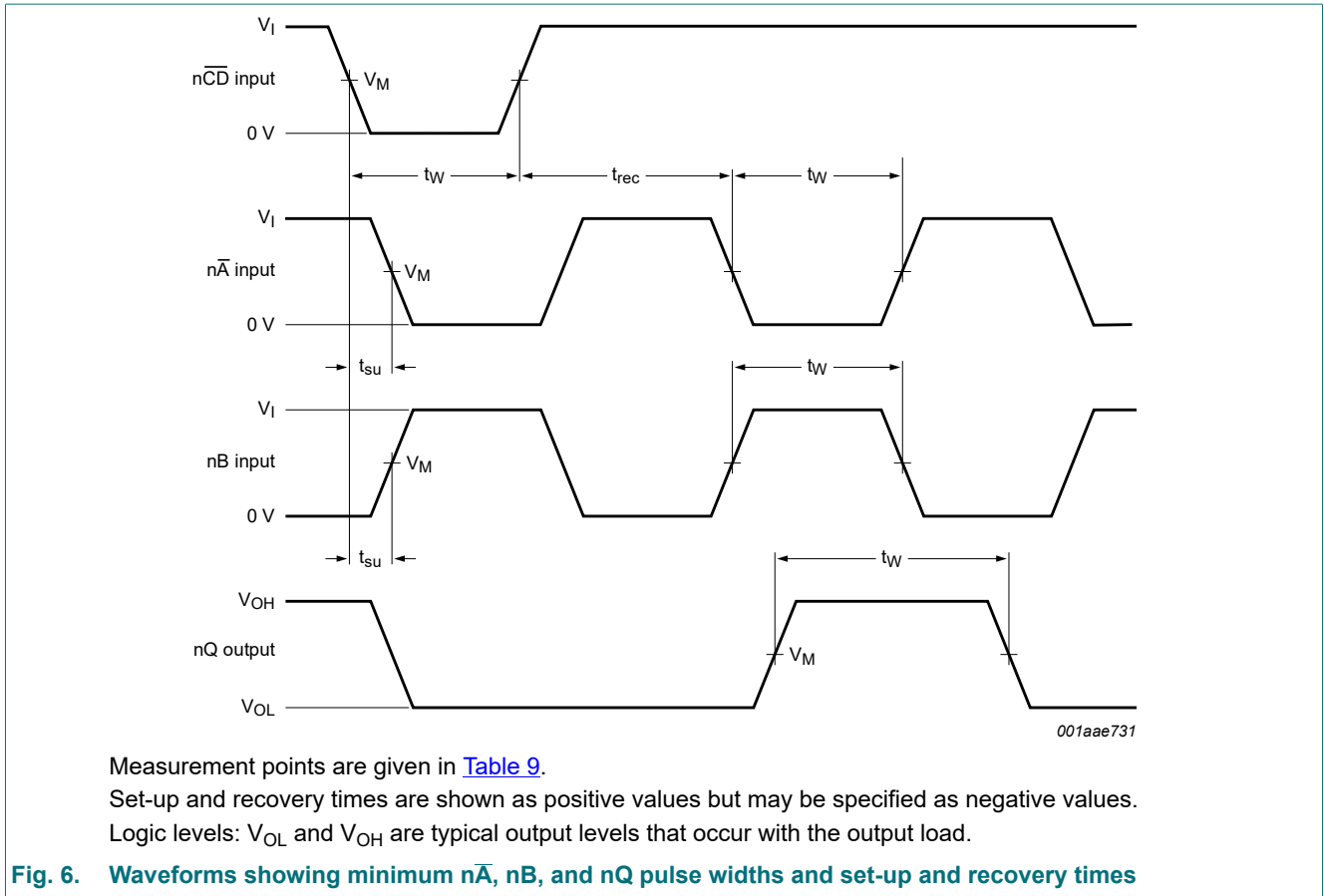
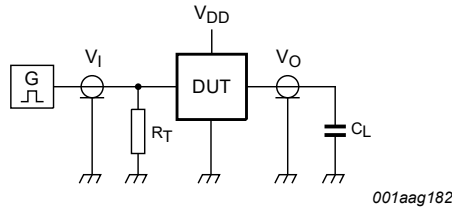


Table 9. Measurement points

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





Test data is given in [Table 10](#).

Definitions for test circuit:

$C_L$  = load capacitance including jig and probe capacitance;

$R_T$  = termination resistance should be equal to the output impedance  $Z_o$  of the pulse generator.

**Fig. 7. Test circuit for measuring switching times**

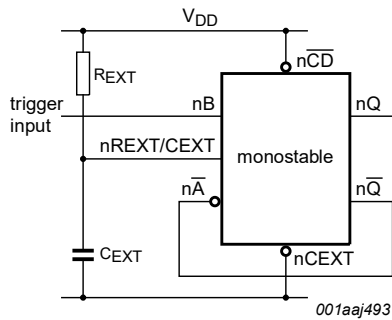
**Table 10. Test data**

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

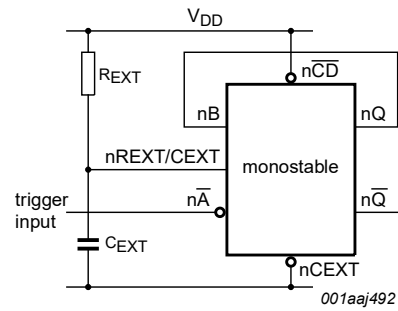
## 11. Application information

An example of a HEF4528B-Q100 application is:

- Non-retriggerable monostable multivibrator



a. Rising edge triggered



b. Falling edge triggered

**Fig. 8. Non-retriggerable applications**

## 12. Package outline

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

SOT109-1

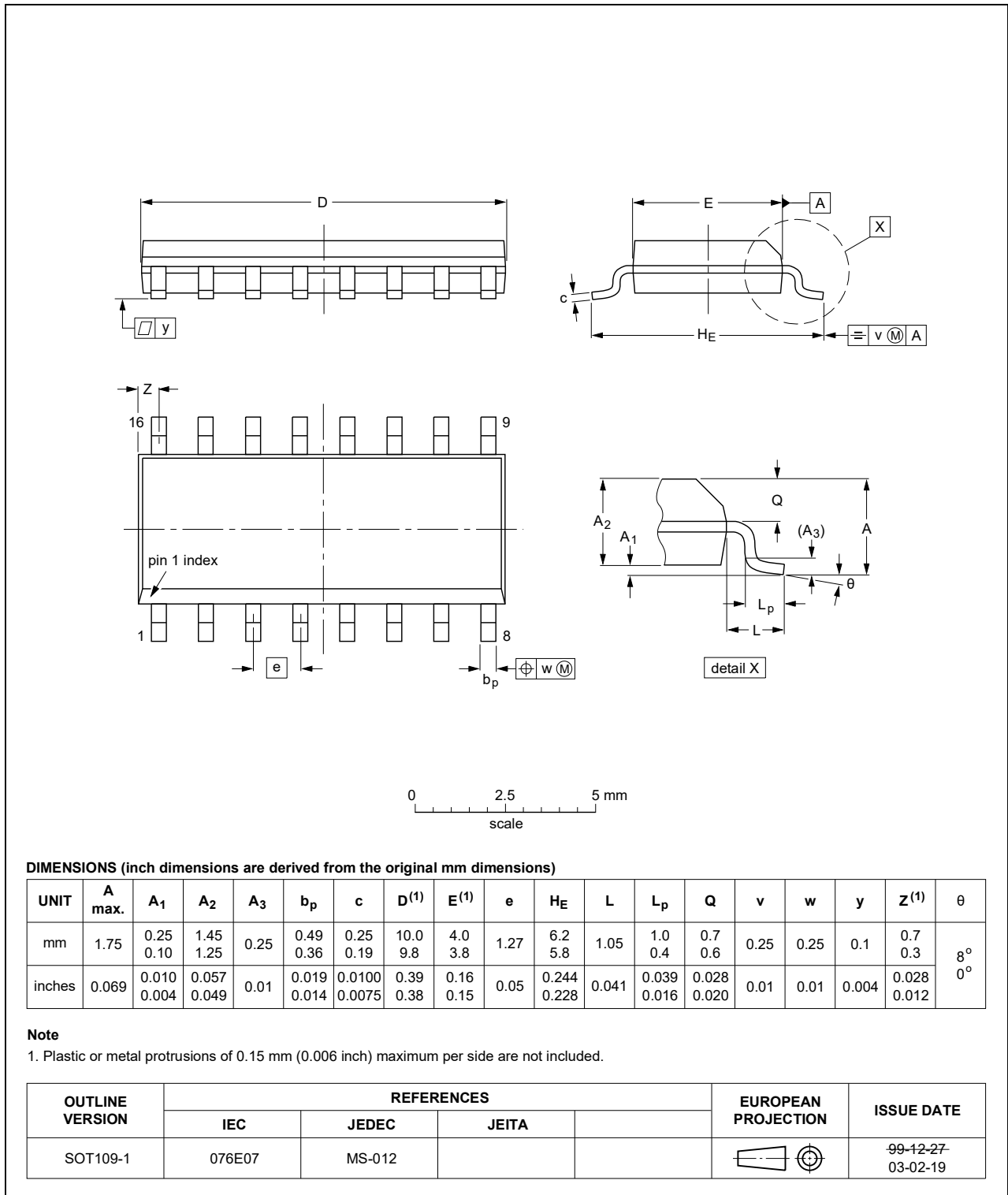


Fig. 9. Package outline SOT109-1 (SO16)

## 13. Abbreviations

Table 11. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MIL	Military
MM	Machine Model

## 14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
HEF4528B_Q100 v.2	20220304	Product data sheet	-	HEF4528B_Q100 v.1
Modifications	<ul style="list-style-type: none"> <li><a href="#">Section 2</a> updated.</li> </ul>			
HEF4528B_Q100 v.1	20170314	Product data sheet	-	-

## 15. Legal information

### Data sheet status

Document status [1][2]	Product status [3]	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".
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Date of release: 4 March 2022

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