

HEF4043B-Q100

Quad R/S latch with 3-state outputs

Rev. 4 — 3 September 2024

Product data sheet

1. General description

The HEF4043B-Q100 is a quad R/S latch with 3-state outputs and common output enable input (OE). Each latch has set (nS), and reset (nR) inputs and a 3-state output (nQ). When OE is LOW, the latch outputs are in the high impedance OFF-state. OE does not affect the state of the latch. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{DD} .

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
- Wide supply voltage range from 3.0 V to 15.0 V
- CMOS low power dissipation
- High noise immunity
- Fully static operation
- 5 V, 10 V, and 15 V parametric ratings
- Standardized symmetrical output characteristics
- Complies with JEDEC standard JESD 13-B
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V

3. Applications

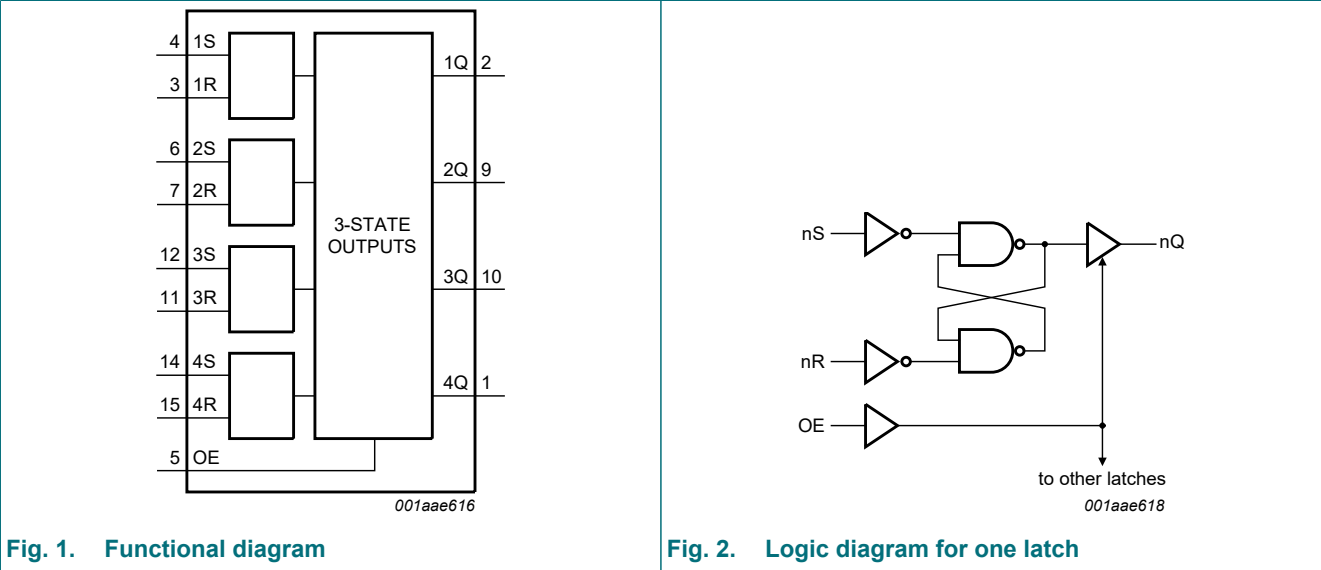
- Four-bit storage with output enable

4. Ordering information

Table 1. Ordering information

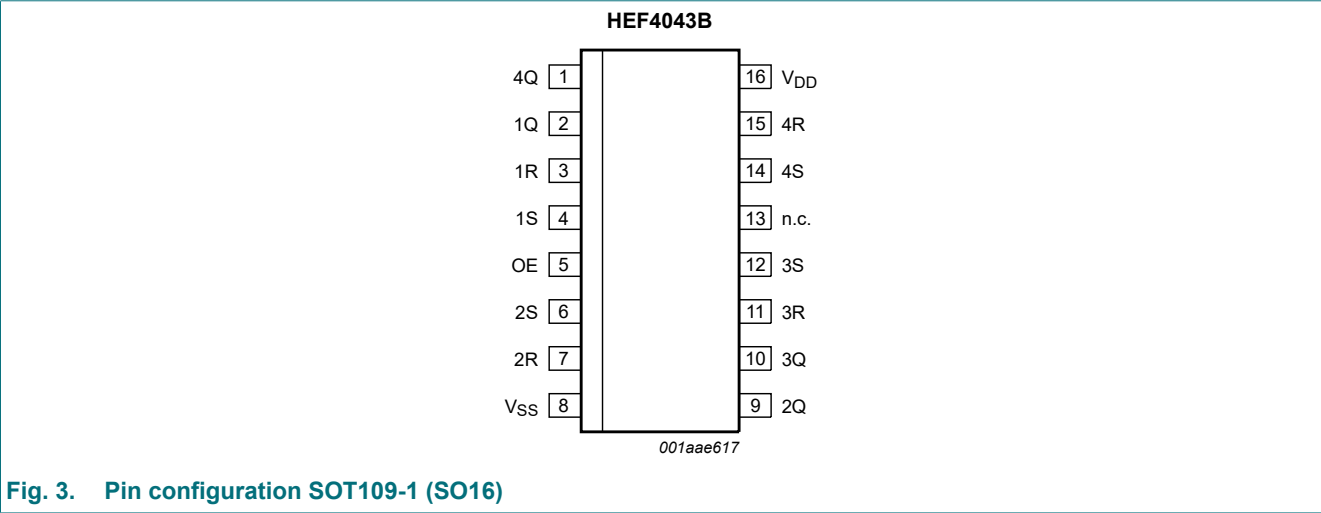
Type number	Package			
	Temperature range	Name	Description	Version
HEF4043BT-Q100	-40 °C to +85 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1

5. Functional diagram



6. Pinning information

6.1. Pinning



6.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1Q, 2Q, 3Q, 4Q	2, 9, 10, 1	3-state buffered latch output
1R, 2R, 3R, 4R	3, 7, 11, 15	reset input (active HIGH)
1S, 2S, 3S, 4S	4, 6, 12, 14	set input (active HIGH)
OE	5	common output enable input
V _{SS}	8	ground supply voltage
n.c.	13	not connected
V _{DD}	16	supply voltage

7. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high impedance state.

Inputs			Output
OE	nS	nR	nQ
L	X	X	Z
H	L	H	L
H	H	X	H
H	L	L	latched

8. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

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 _O < -0.5 V or V _O > 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	-	500	mW
P	power dissipation	per output	-	100	mW

9. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	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
Δt/ΔV	input transition rise and fall rate	V _{DD} = 5 V	-	-	3.75	μs/V
		V _{DD} = 10 V	-	-	0.5	μs/V
		V _{DD} = 15 V	-	-	0.08	μs/V

10. Static characteristics

Table 6. Static characteristics

V_{SS} = 0 V; V_I = V_{SS} or V_{DD} unless otherwise specified.

Symbol	Parameter	Conditions	V _{DD}	T _{amb} = -40 °C		T _{amb} = +25 °C		T _{amb} = +85 °C		Unit
				Min	Max	Min	Max	Min	Max	
V _{IH}	HIGH-level input voltage	I _O < 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 _{IL}	LOW-level input voltage	I _O < 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 _{OH}	HIGH-level output voltage	I _O < 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 _{OL}	LOW-level output voltage	I _O < 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 _{OH}	HIGH-level output current	V _O = 2.5 V	5 V	-	-1.7	-	-1.4	-	-1.1	mA
		V _O = 4.6 V	5 V	-	-0.52	-	-0.44	-	-0.36	mA
		V _O = 9.5 V	10 V	-	-1.3	-	-1.1	-	-0.9	mA
		V _O = 13.5 V	15 V	-	-3.6	-	-3.0	-	-2.4	mA
I _{OL}	LOW-level output current	V _O = 0.4 V	5 V	0.52	-	0.44	-	0.36	-	mA
		V _O = 0.5 V	10 V	1.3	-	1.1	-	0.9	-	mA
		V _O = 1.5 V	15 V	3.6	-	3.0	-	2.4	-	mA
I _I	input leakage current		15 V	-	±0.3	-	±0.3	-	±1.0	μA
I _{OZ}	OFF-state output current	nQ output HIGH; returned to V _{DD}	15 V	-	1.6	-	1.6	-	12.0	μA
		nQ output LOW; returned to V _{SS}	15 V	-	1.6	-	1.6	-	12.0	μA
I _{DD}	supply current	I _O = 0 A	5 V	-	20	-	20	-	150	μA
			10 V	-	40	-	40	-	300	μA
			15 V	-	80	-	80	-	600	μA
C _I	input capacitance			-	-	-	7.5	-	-	pF

11. Dynamic characteristics

Table 7. Dynamic characteristics

$V_{SS} = 0\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified; for waveforms and test circuit see [Section 11.1](#).

Symbol	Parameter	Conditions	V_{DD}	Extrapolation formula [1]	Min	Typ	Max	Unit
t_{PHL}	HIGH to LOW propagation delay	nR \rightarrow nQ; see Fig. 4	5 V	$63\text{ ns} + (0.55\text{ ns/pF})C_L$	-	90	180	ns
			10 V	$24\text{ ns} + (0.23\text{ ns/pF})C_L$	-	35	70	ns
			15 V	$17\text{ ns} + (0.16\text{ ns/pF})C_L$	-	25	50	ns
t_{PLH}	LOW to HIGH propagation delay	nS \rightarrow nQ; see Fig. 4	5 V	$38\text{ ns} + (0.55\text{ ns/pF})C_L$	-	65	135	ns
			10 V	$14\text{ ns} + (0.23\text{ ns/pF})C_L$	-	25	50	ns
			15 V	$7\text{ ns} + (0.16\text{ ns/pF})C_L$	-	15	35	ns
t_t	transition time	nQ output; see Fig. 4	5 V [2]	$10\text{ ns} + (1.00\text{ ns/pF})C_L$	-	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_{PHZ}	HIGH to OFF-state propagation delay	OE \rightarrow nQ; see Fig. 5	5 V		-	45	90	ns
			10 V		-	20	35	ns
			15 V		-	10	25	ns
t_{PLZ}	LOW to OFF-state propagation delay	OE \rightarrow nQ; see Fig. 5	5 V		-	50	100	ns
			10 V		-	20	40	ns
			15 V		-	10	25	ns
t_{PZH}	OFF-state to HIGH propagation delay	OE \rightarrow nQ; see Fig. 5	5 V		-	25	50	ns
			10 V		-	15	30	ns
			15 V		-	10	25	ns
t_{PZL}	OFF-state to LOW propagation delay	OE \rightarrow nQ; see Fig. 5	5 V		-	40	80	ns
			10 V		-	20	45	ns
			15 V		-	15	35	ns
t_W	pulse width	nS input HIGH; minimum width; see Fig. 4	5 V		30	15	-	ns
			10 V		20	10	-	ns
			15 V		16	8	-	ns
		nR input HIGH; minimum width; see Fig. 4	5 V		30	15	-	ns
			10 V		20	10	-	ns
			15 V		16	8	-	ns

[1] The typical values of the propagation delay and transition times are calculated from the extrapolation formulas shown (C_L in pF).
[2] t_t is the same as t_{THL} and t_{TLH} .

Table 8. Dynamic power dissipation P_D

P_D can be calculated from the formulas shown. $V_{SS} = 0\text{ V}$; $t_r = t_f \leq 20\text{ ns}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

Symbol	Parameter	V_{DD}	Typical formula for P_D (μW)	where:
P_D	dynamic power dissipation	5 V	$P_D = 1100 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$	f_i = input frequency in MHz; f_o = output frequency in MHz; C_L = output load capacitance in pF; V_{DD} = supply voltage in V; $\Sigma(f_o \times C_L)$ = sum of the outputs.
		10 V	$P_D = 4400 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$	
		15 V	$P_D = 11400 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$	

11.1. Waveforms and test circuit

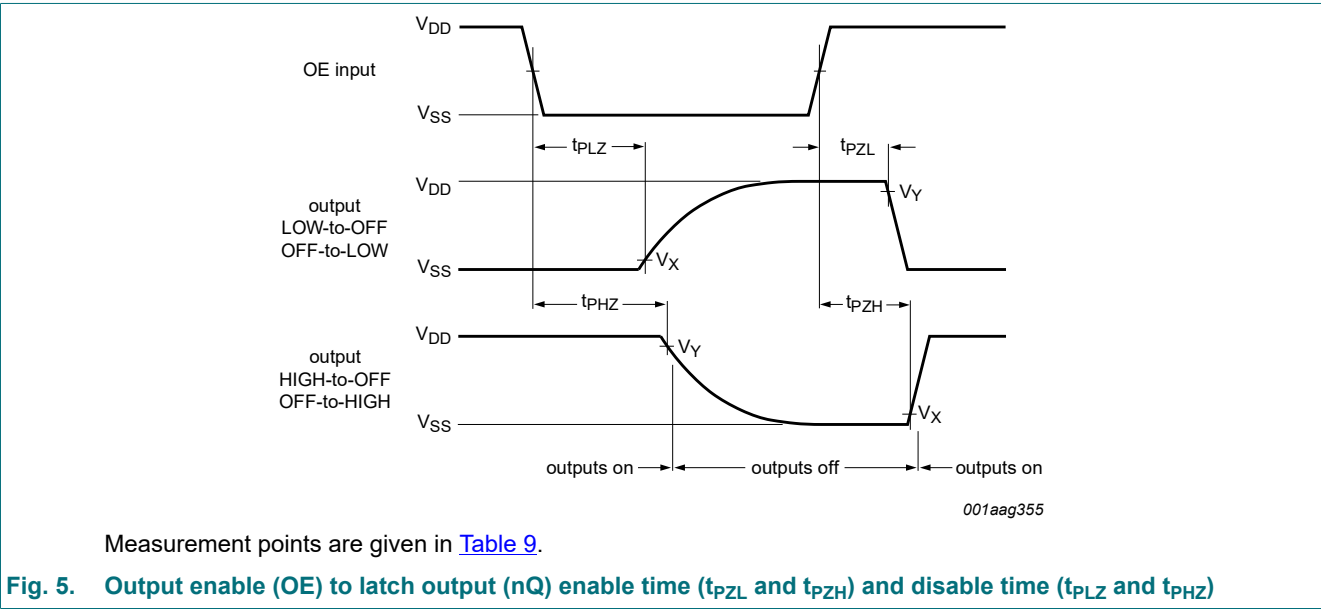
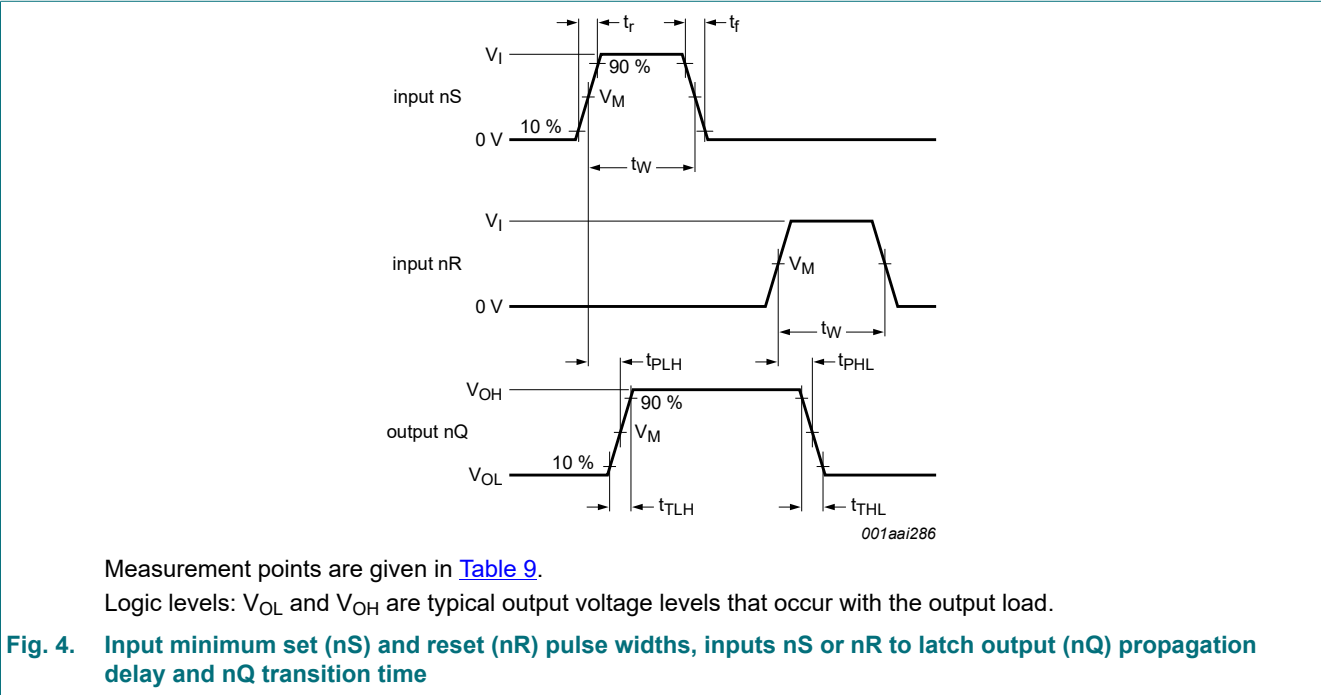


Table 9. Measurement points

Supply voltage	Input		Output		
V_{DD}	V_I	V_M	V_M	V_X	V_Y
5 V to 15 V	V_{DD} or 0 V	$0.5V_{DD}$	$0.5V_{DD}$	$0.1V_{DD}$	$0.9V_{DD}$

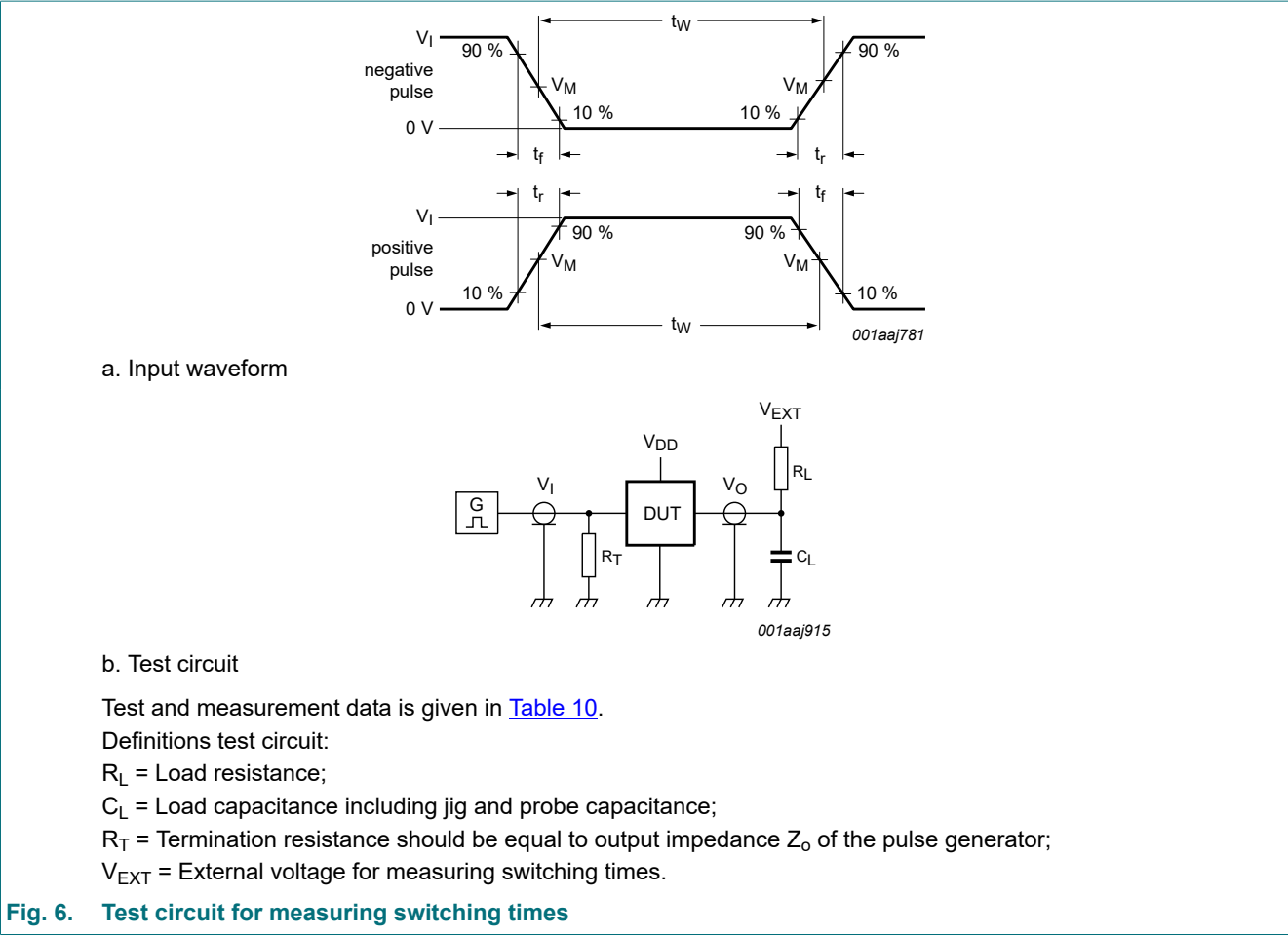


Table 10. Test data

Supply voltage	Input		Load		V _{EXT}		
V _{DD}	V _I	t _r , t _f	C _L	R _L	t _{PLH} , t _{PHL}	t _{PLZ} , t _{PZL}	t _{PHZ} , t _{PZH}
5 V to 15 V	V _{DD}	≤ 20 ns	50 pF	1 kΩ	open	V _{DD}	GND

12. Package outline

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

SOT109-1

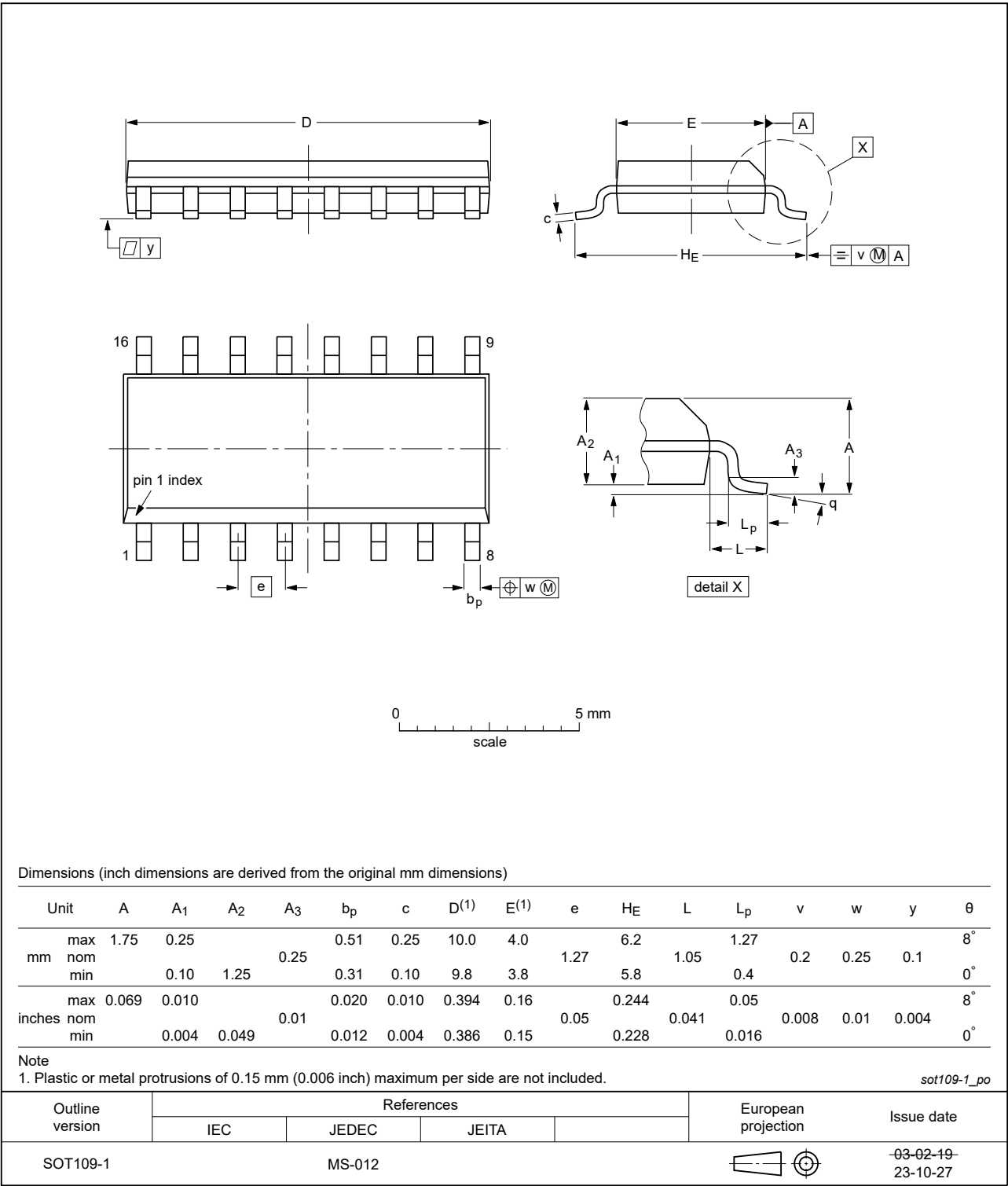


Fig. 7. Package outline SOT109-1 (SO16)

13. Abbreviations

Table 11. Abbreviations

Acronym	Description
ANSI	American National Standards Institute
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
ESDA	ElectroStatic Discharge Association
HBM	Human Body Model
JEDEC	Joint Electron Device Engineering Council

14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
HEF4043B_Q100 v.4	20240903	Product data sheet	-	HEF4043B_Q100 v.3
Modifications:	<ul style="list-style-type: none">Section 2: ESD specification updated according to the latest JEDEC standard.Fig. 7: Aligned SO package outline drawing to JEDEC MS-012			
HEF4043B_Q100 v.3	20211208	Product data sheet	-	HEF4043B_Q100 v.2
Modifications:	<ul style="list-style-type: none">Section 1 and Section 2 updated.Section 13 added.			
HEF4043B_Q100 v.2	20200130	Product data sheet	-	HEF4043B_Q100 v.1
Modifications:	<ul style="list-style-type: none">The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.Legal texts have been adapted to the new company name where appropriate.Fig. 2: Typo corrected.			
HEF4043B_Q100 v.1	20130715	Product specification	-	-

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.

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