

# 74AHC132-Q100; 74AHCT132-Q100

Quad 2-input NAND Schmitt trigger

Rev. 2 — 3 July 2020

Product data sheet

## 1. General description

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The 74AHC132-Q100; 74AHCT132-Q100 is a quad 2-input NAND gate with Schmitt-trigger inputs. Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

## 2. Features and benefits

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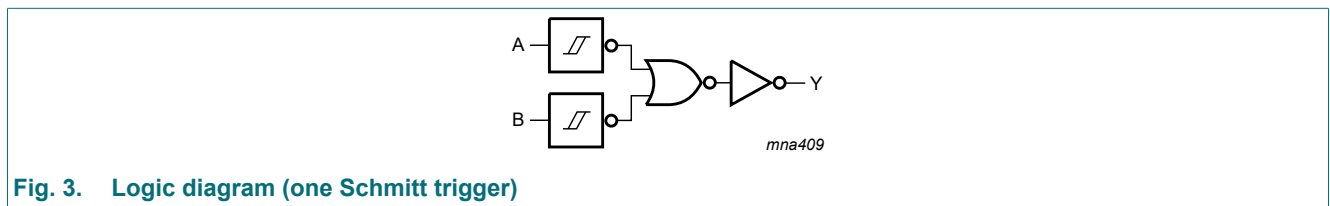
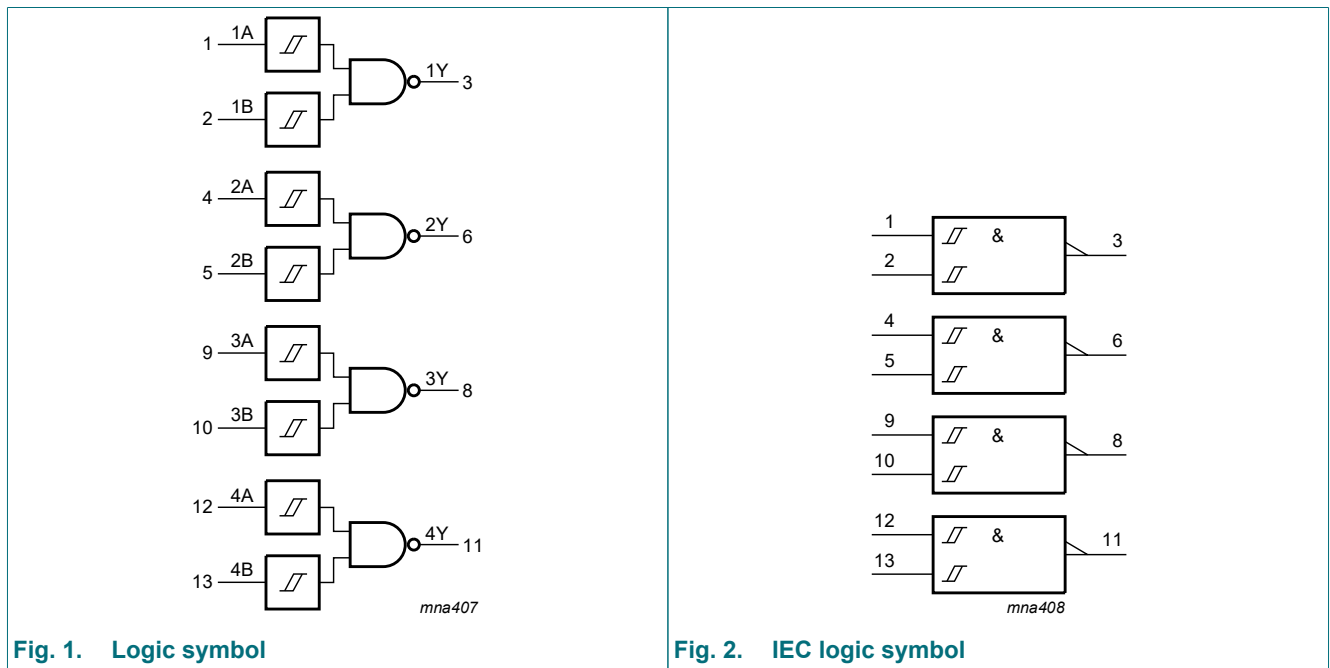
- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Wide supply voltage range from 2.0 V to 5.5 V
- Overvoltage tolerant inputs to 5.5 V
- High noise immunity
- CMOS low power dissipation
- Input levels:
  - For 74AHC132-Q100: CMOS level
  - For 74AHCT132-Q100: TTL level
- 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 Ω)
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level A
- Multiple package options
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

### 3. Ordering information

Table 1. Ordering information

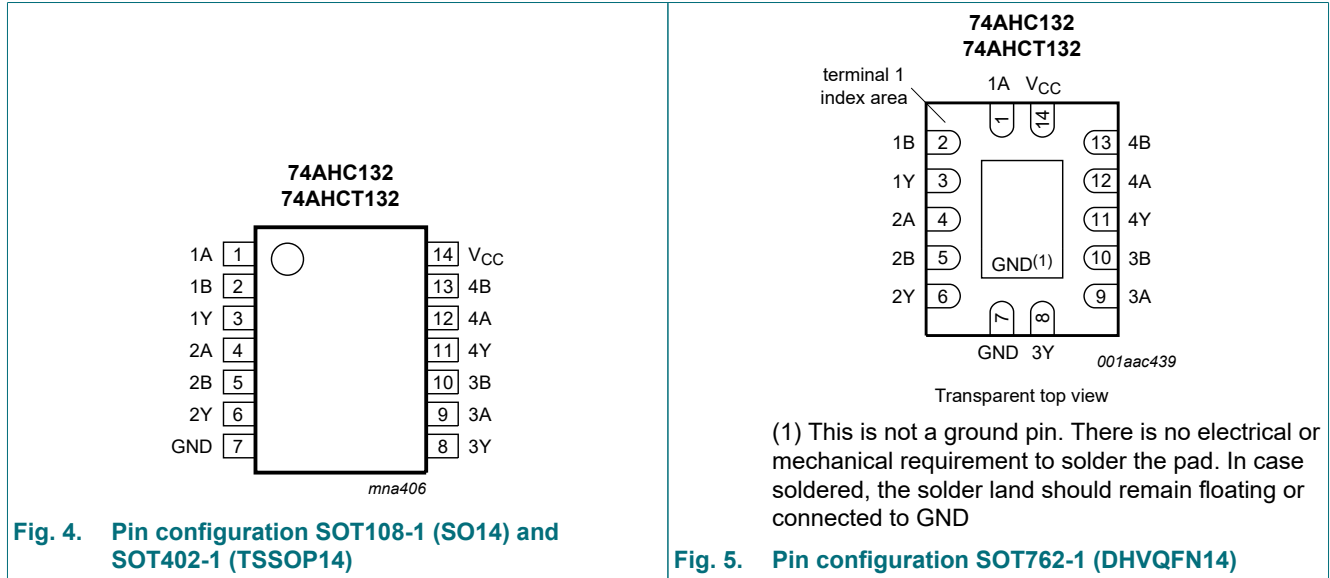
Type number	Package			Version
	Temperature range	Name	Description	
74AHC132D-Q100	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1
74AHCT132D-Q100				
74AHC132PW-Q100	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1
74AHCT132PW-Q100				
74AHC132BQ-Q100	-40 °C to +125 °C	DHVQFN14	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 × 3 × 0.85 mm	SOT762-1
74AHCT132BQ-Q100				

### 4. Functional diagram



## 5. Pinning information

### 5.1. Pinning



### 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1A, 2A, 3A, 4A	1, 4, 9, 12	data input A
1B, 2B, 3B, 4B	2, 5, 10, 13	data input B
1Y, 2Y, 3Y, 4Y	3, 6, 8, 11	data output Y
GND	7	ground (0 V)
V <sub>CC</sub>	14	supply voltage

## 6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level.

Input		Output
nA	nB	nY
L	L	H
L	H	H
H	L	H
H	H	L

## 7. Limiting values

**Table 4. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		-0.5	+7.0	V
$V_I$	input voltage		-0.5	+7.0	V
$I_{IK}$	input clamping current	$V_I < -0.5$ V [1]	-20	-	mA
$I_{OK}$	output clamping current	$V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V [1]	-20	+20	mA
$I_O$	output current	$V_O = -0.5$ V to $(V_{CC} + 0.5$ V)	-25	+25	mA
$I_{CC}$	supply current		-	+75	mA
$I_{GND}$	ground current		-75	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to $+125$ °C [2]	-	500	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SOT108-1 (SO14) package:  $P_{tot}$  derates linearly with 10.1 mW/K above 100 °C.

For SOT402-1 (TSSOP14) package:  $P_{tot}$  derates linearly with 7.3 mW/K above 81 °C.

For SOT762-1 (DHVQFN14) package:  $P_{tot}$  derates linearly with 9.6 mW/K above 98 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	74AHC132-Q100			74AHCT132-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
$V_{CC}$	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
$V_I$	input voltage		0	-	5.5	0	-	5.5	V
$V_O$	output voltage		0	-	$V_{CC}$	0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	+25	+125	-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 3.3$ V $\pm$ 0.3 V	-	-	100	-	-	-	ns/V
		$V_{CC} = 5.0$ V $\pm$ 0.5 V	-	-	20	-	-	20	ns/V

## 9. Static characteristics

**Table 6. Static characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74AHC132-Q100</b>										
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>								
		I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	2.2	1.9	-	V
		I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 3.0 V	2.9	3.0	-	2.9	3.15	2.9	-	V
		I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	3.85	4.4	-	V
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V	2.58	-	-	2.48	-	2.40	-	V
		I <sub>O</sub> = -8.0 mA; V <sub>CC</sub> = 4.5 V	3.94	-	-	3.80	-	3.70	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>								
		I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
		I <sub>O</sub> = 8.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.36	-	0.44	-	0.55	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	2.0	-	20	-	40	μA
C <sub>I</sub>	input capacitance	V <sub>I</sub> = V <sub>CC</sub> or GND	-	3	10	-	10	-	10	pF
C <sub>O</sub>	output capacitance		-	4	-	-	-	-	-	pF
<b>74AHCT132-Q100</b>										
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = -50 μA	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -8.0 mA	3.94	-	-	3.80	-	3.70	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = 50 μA	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	2.0	-	20	-	40	μA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; other pins at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
C <sub>I</sub>	input capacitance	V <sub>I</sub> = V <sub>CC</sub> or GND	-	3	10	-	10	-	10	pF
C <sub>O</sub>	output capacitance		-	4	-	-	-	-	-	pF

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	Min	Max	
<b>74AHC132-Q100</b>										
$t_{pd}$	propagation delay	nA, nB to nY; see Fig. 6 [2]								
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$								
		$C_L = 15\text{ pF}$	-	4.4	11.9	1.0	14.0	1.0	15.0	ns
		$C_L = 50\text{ pF}$	-	6.2	15.4	1.0	17.5	1.0	19.5	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$								
		$C_L = 15\text{ pF}$	-	3.3	7.7	1.0	9.0	1.0	10.0	ns
		$C_L = 50\text{ pF}$	-	4.7	9.7	1.0	11.0	1.0	12.5	ns
$C_{PD}$	power dissipation capacitance	$f_i = 1\text{ MHz}; V_i = \text{GND to }V_{CC}$ [3]	-	11	-	-	-	-	-	pF
<b>74AHCT132-Q100; <math>V_{CC} = 4.5\text{ V to }5.5\text{ V}</math></b>										
$t_{pd}$	propagation delay	nA, nB to nY; see Fig. 6 [2]								
		$C_L = 15\text{ pF}$	-	3.5	7.0	1.0	8.0	1.0	9.0	ns
		$C_L = 50\text{ pF}$	-	5.0	8.0	1.0	9.0	1.0	10.0	ns
$C_{PD}$	power dissipation capacitance	$f_i = 1\text{ MHz}; V_i = \text{GND to }V_{CC}$ [3]	-	14	-	-	-	-	-	pF

[1] Typical values are measured at nominal supply voltage ( $V_{CC} = 3.3\text{ V}$  and  $V_{CC} = 5.0\text{ V}$ ).

[2]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

[3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

$\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

10.1. Waveform and test circuit

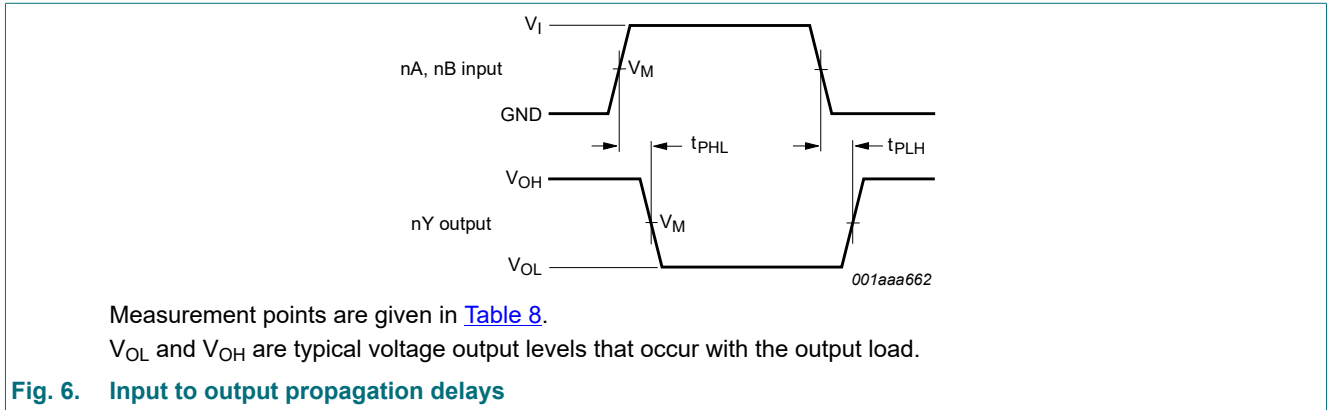


Table 8. Measurement points

Type	Input		Output
	$V_M$		$V_M$
74AHC132-Q100	$0.5 \times V_{CC}$		$0.5 \times V_{CC}$
74AHCT132-Q100	1.5 V		$0.5 \times V_{CC}$

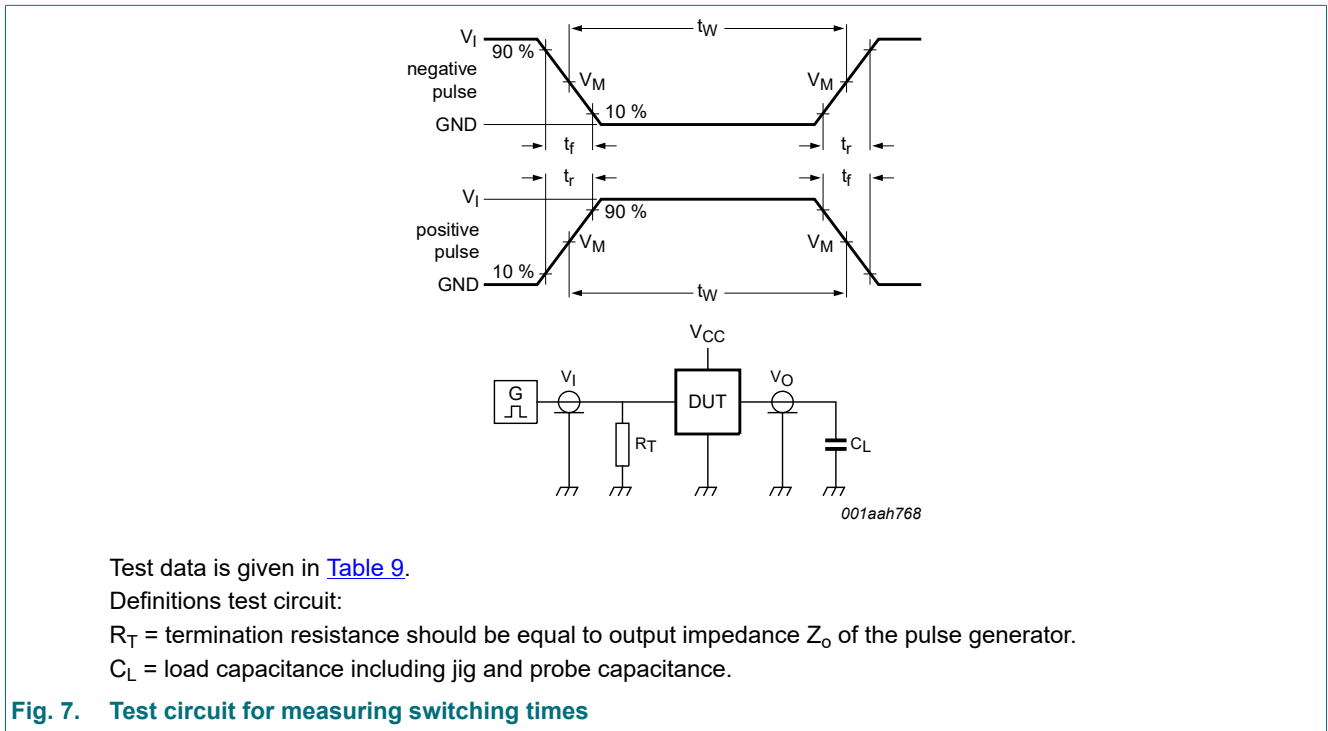


Table 9. Test data

Type	Input		Load	Test
	$V_I$	$t_r, t_f$	$C_L$	
74AHC132-Q100	$V_{CC}$	$\leq 3.0$ ns	50 pF, 15 pF	$t_{PLH}, t_{PHL}$
74AHCT132-Q100	3.0 V	$\leq 3.0$ ns	50 pF, 15 pF	$t_{PLH}, t_{PHL}$

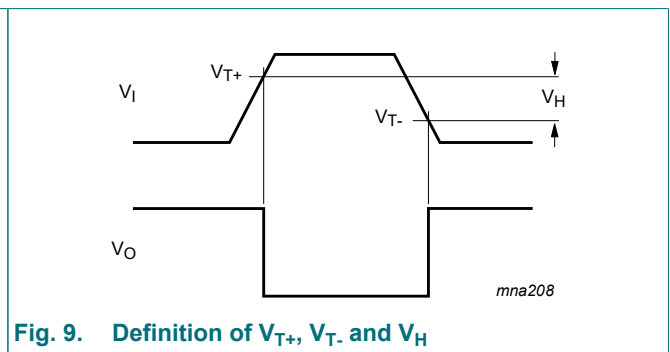
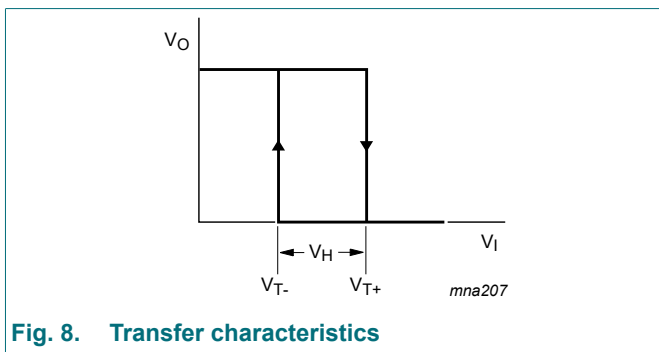
## 11. Transfer characteristics

**Table 10. Transfer characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74AHC132-Q100</b>										
$V_{T+}$	positive-going threshold voltage	$V_{CC} = 3.0\text{ V}$	-	-	2.2	-	2.2	-	2.2	V
		$V_{CC} = 4.5\text{ V}$	-	-	3.15	-	3.15	-	3.15	V
		$V_{CC} = 5.5\text{ V}$	-	-	3.85	-	3.85	-	3.85	V
$V_{T-}$	negative-going threshold voltage	$V_{CC} = 3.0\text{ V}$	0.9	-	-	0.9	-	0.9	-	V
		$V_{CC} = 4.5\text{ V}$	1.35	-	-	1.35	-	1.35	-	V
		$V_{CC} = 5.5\text{ V}$	1.65	-	-	1.65	-	1.65	-	V
$V_H$	hysteresis voltage	$V_{CC} = 3.0\text{ V}$	0.3	-	1.2	0.3	1.2	0.25	1.2	V
		$V_{CC} = 4.5\text{ V}$	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		$V_{CC} = 5.5\text{ V}$	0.5	-	1.6	0.5	1.6	0.45	1.6	V
<b>74AHCT132-Q100</b>										
$V_{T+}$	positive-going threshold voltage	$V_{CC} = 4.5\text{ V}$	-	-	1.9	-	1.9	-	1.9	V
		$V_{CC} = 5.5\text{ V}$	-	-	2.1	-	2.1	-	2.1	V
$V_{T-}$	negative-going threshold voltage	$V_{CC} = 4.5\text{ V}$	0.5	-	-	0.5	-	0.5	-	V
		$V_{CC} = 5.5\text{ V}$	0.6	-	-	0.6	-	0.6	-	V
$V_H$	hysteresis voltage	$V_{CC} = 4.5\text{ V}$	0.3	-	1.4	0.3	1.4	0.3	1.4	V
		$V_{CC} = 5.5\text{ V}$	0.3	-	1.5	0.3	1.5	0.3	1.5	V

### 11.1. Transfer characteristics waveforms





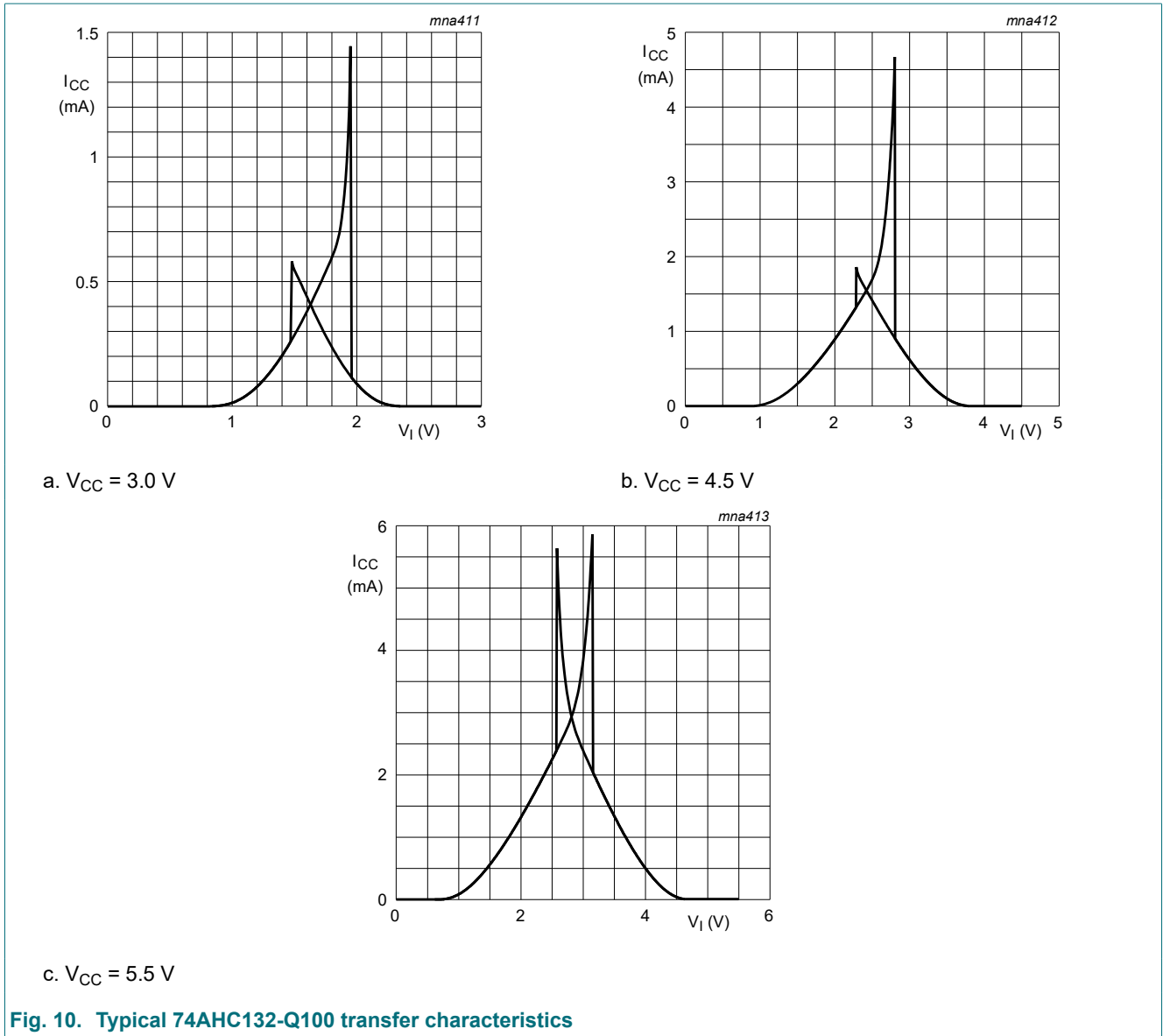


Fig. 10. Typical 74AHC132-Q100 transfer characteristics

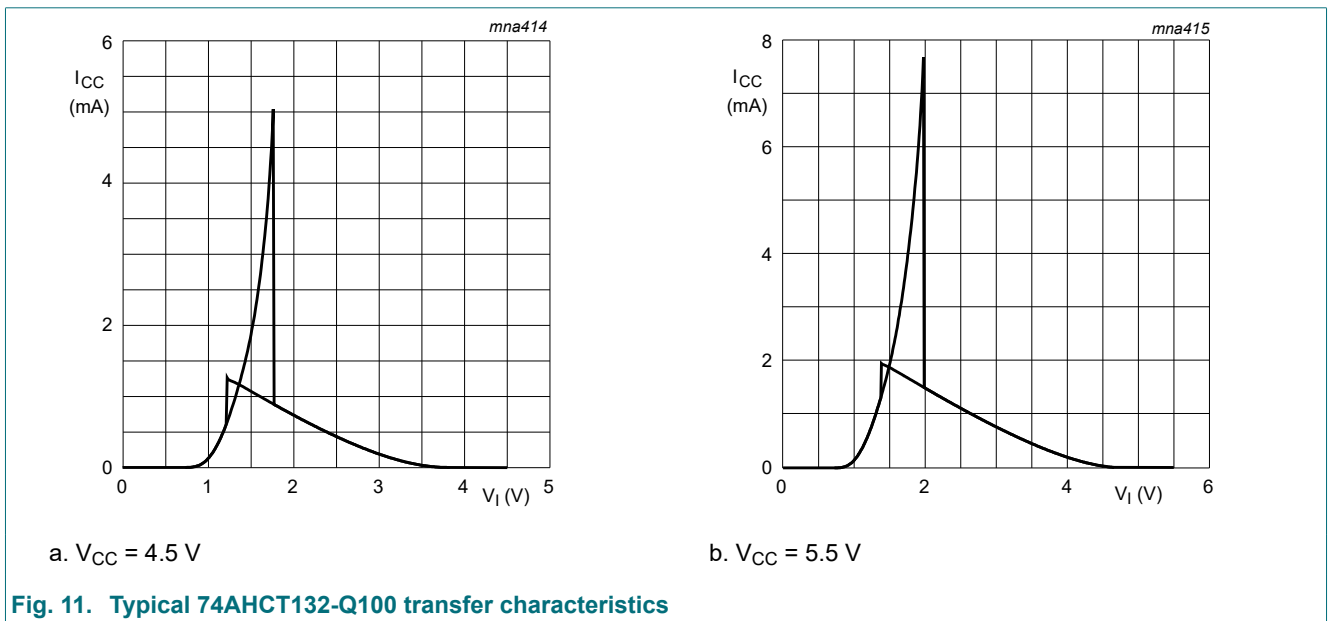
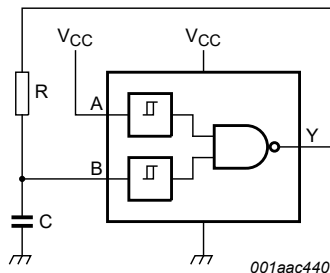


Fig. 11. Typical 74AHCT132-Q100 transfer characteristics

## 12. Application information



$$\text{For 74AHC132-Q100: } f = \frac{1}{T} \approx \frac{1}{0.55 \times RC}$$
$$\text{For 74AHCT132-Q100: } f = \frac{1}{T} \approx \frac{1}{0.60 \times RC}$$

Fig. 12. Relaxation oscillator

### 13. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1

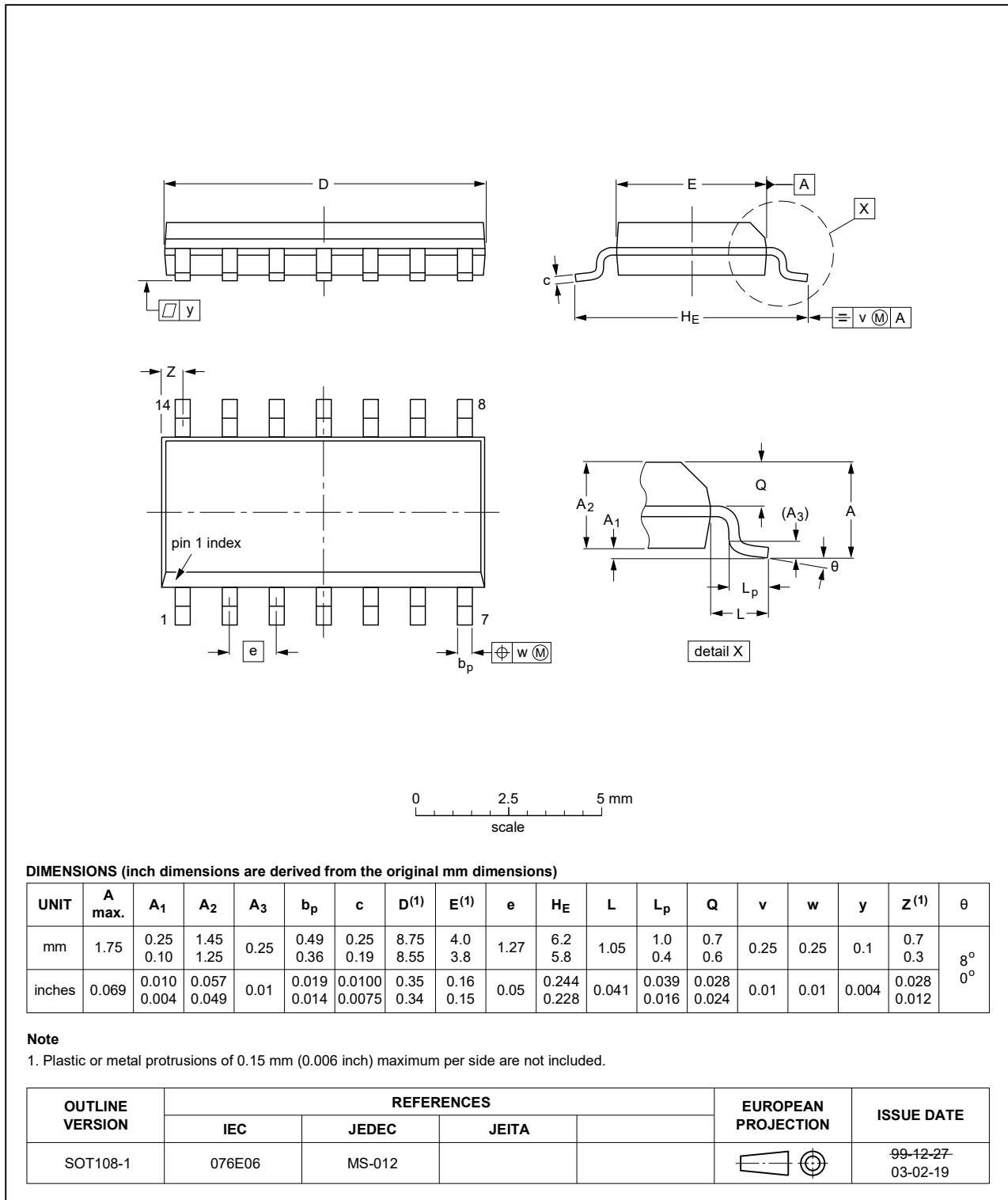


Fig. 13. Package outline SOT108-1 (SO14)

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1

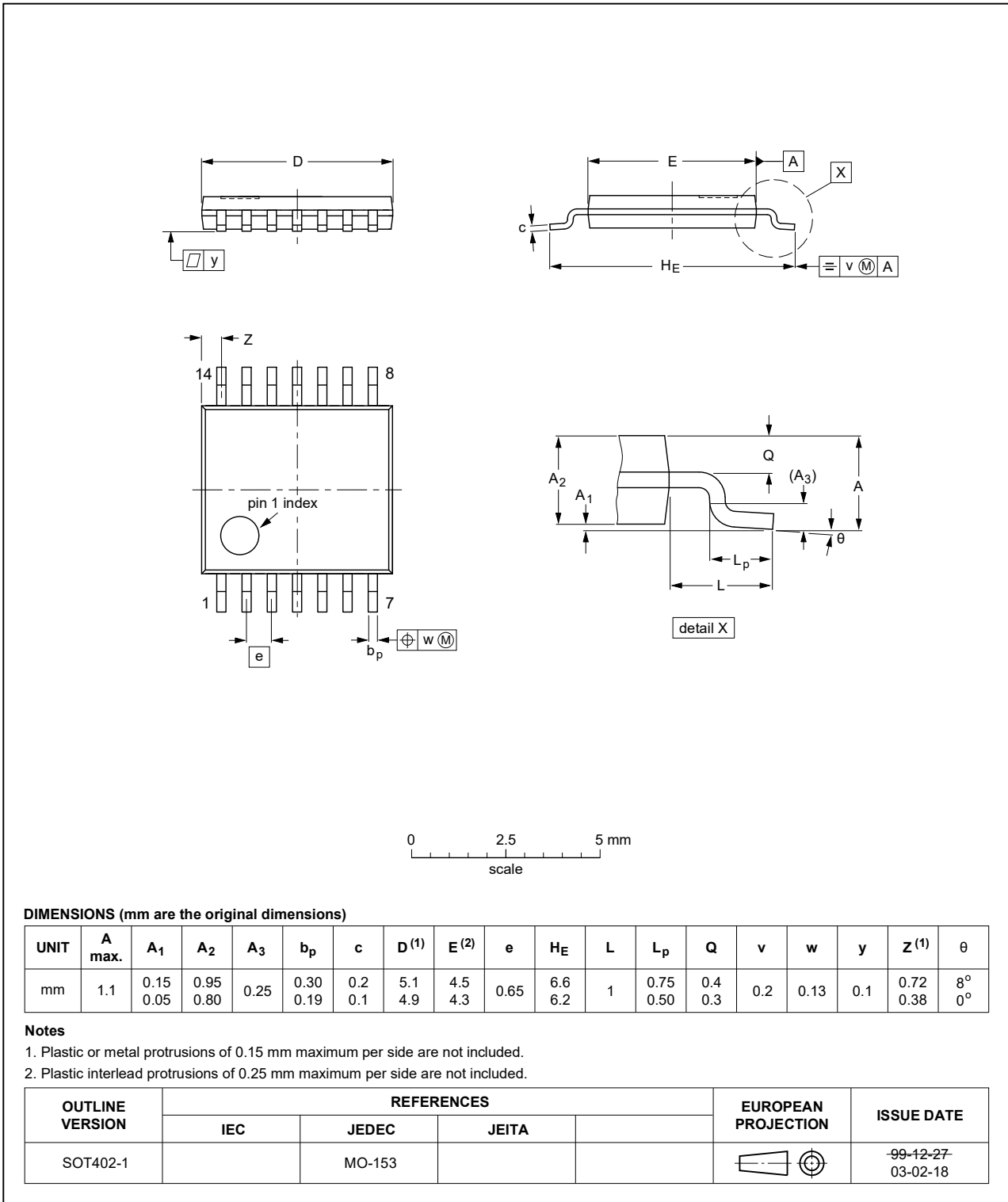


Fig. 14. Package outline SOT402-1 (TSSOP14)

DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 x 3 x 0.85 mm

SOT762-1

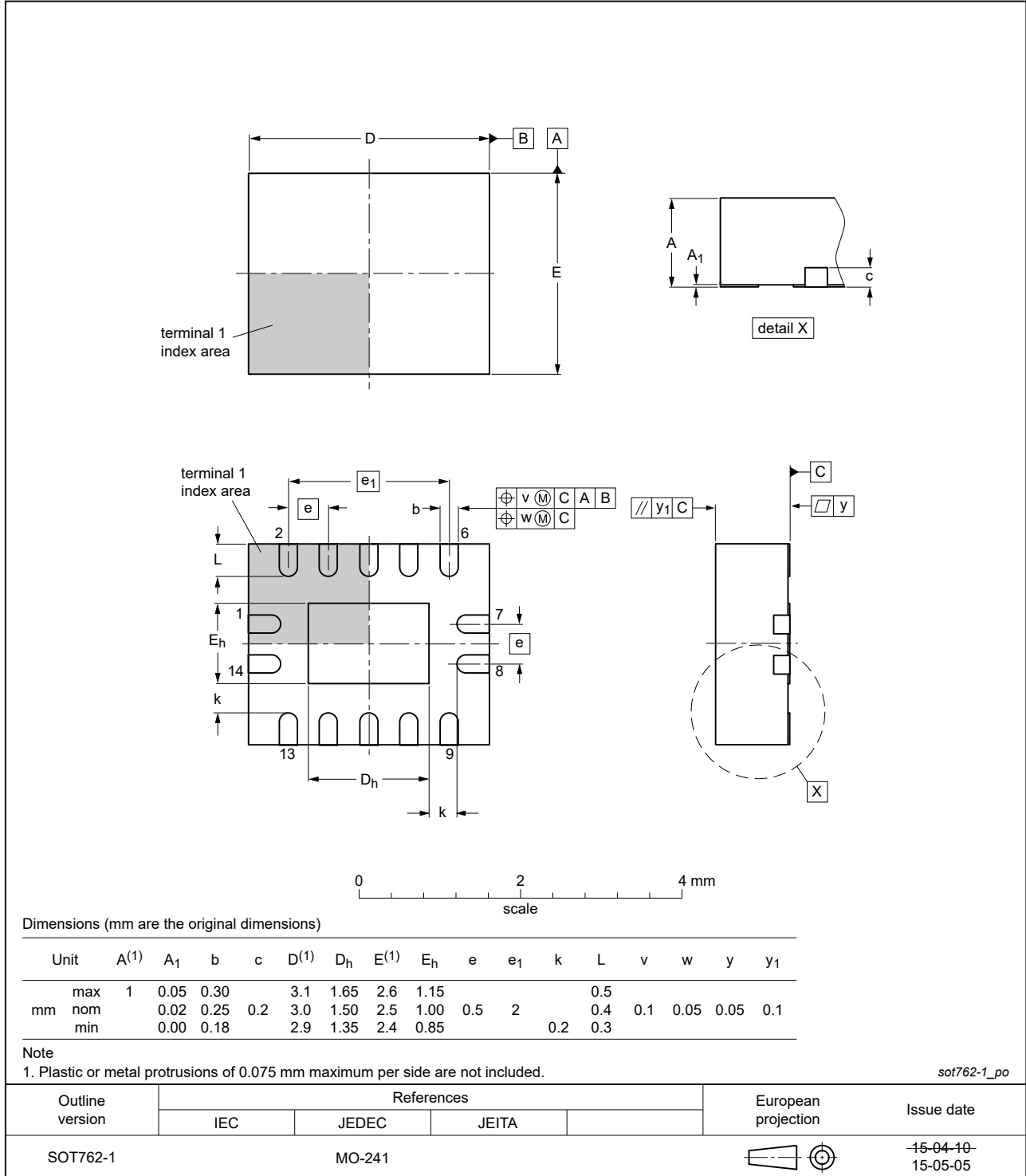


Fig. 15. Package outline SOT762-1 (DHVQFN14)

## 14. Abbreviations

Table 11. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MIL	Military
MM	Machine Model

## 15. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT132_Q100 v.2	20200703	Product data sheet	-	74AHC_AHCT132_Q100 v.1
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Section 1</a> and <a href="#">Section 2</a> updated.</li> <li><a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> <li>Package outline drawing of SOT762-1 (<a href="#">Fig. 15</a>) updated.</li> </ul>			
74AHC_AHCT132_Q100 v.1	20090504	Product data sheet	-	-

## 16. 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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