

XC7WT14

Triple inverting Schmitt trigger

Rev. 5 — 17 May 2021

Product data sheet

1. General description

The XC7WT14 is a high-speed Si-gate CMOS device. This device provides three inverting buffers with Schmitt trigger action. This device is capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

2. Features and benefits

- Symmetrical output impedance
- High noise immunity
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
 - CDM JESD22-C101D exceeds 1000 V
- Low power dissipation
- Balanced propagation delays
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

3. Applications

- Wave and pulse shaper for highly noisy environment
- Astable multivibrator
- Monostable multivibrator

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
XC7WT14DP	-40 °C to +125 °C	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm	SOT505-2

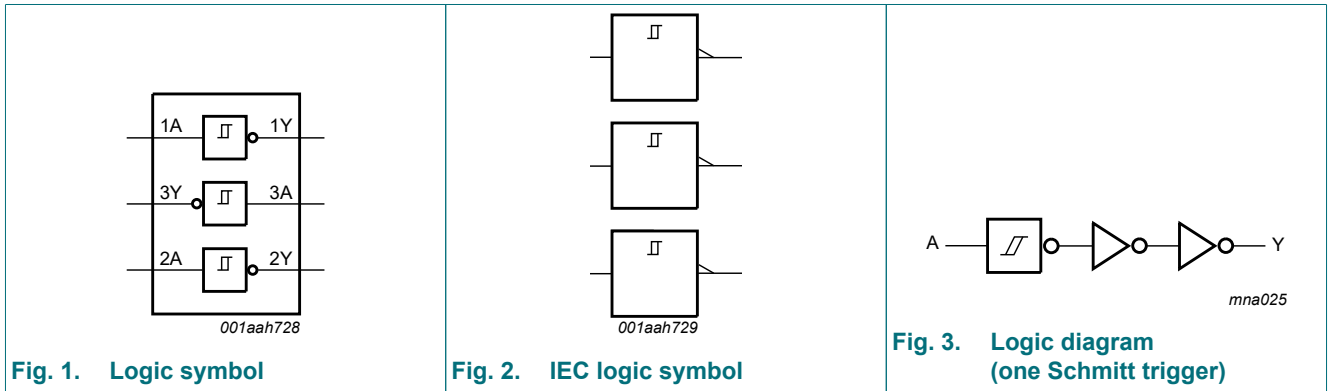
5. Marking

Table 2. Marking codes

Type number	Marking code[1]
XC7WT14DP	g14

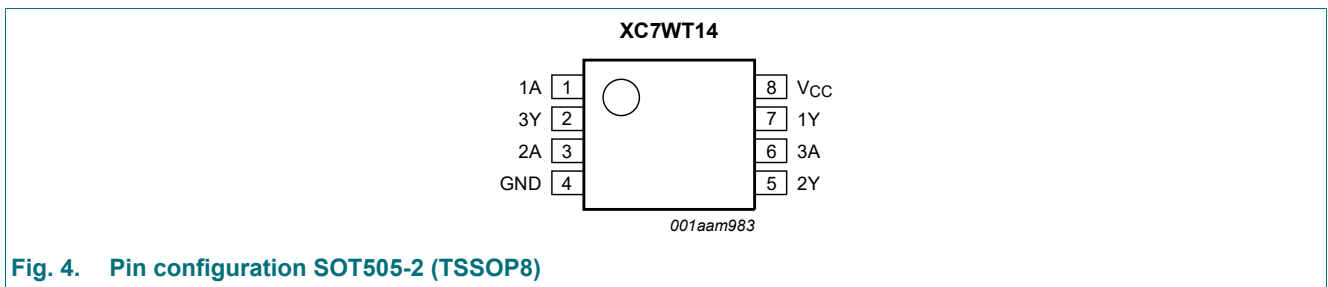
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

6. Functional diagram



7. Pinning information

7.1. Pinning



7.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
1A, 2A, 3A	1, 3, 6	data input
GND	4	ground (0 V)
1Y, 2Y, 3Y	7, 5, 2	data output
V _{CC}	8	supply voltage

8. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level

Input nA	Output nY
L	H
H	L

9. Limiting values

Table 5. Limiting values

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

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	$V_I < -0.5\text{ V}$	-20	-	mA
I_{OK}	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1]	-	± 20	mA
I_O	output current	$-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$	-	± 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	$T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$ [2]	-	250	mW

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

[2] For SOT505-2 (TSSOP8) package: P_{tot} derates linearly with 4.6 mW/K above 96 °C.

10. Recommended operating conditions

Table 6. Recommended operating conditions

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		4.5	5.0	5.5	V
V_I	input voltage		0	-	5.5	V
V_O	output voltage		0	-	V_{CC}	V
T_{amb}	ambient temperature		-40	+25	+125	°C

11. Static characteristics

Table 7. Static characteristics

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	
V _{OH}	HIGH-level output voltage	V _I = V _{T+} or V _{T-} ; V _{CC} = 4.5 V								
		I _O = -50 µA	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -8.0 mA	3.94	-	-	3.8	-	3.70	-	V
V _{OL}	LOW-level output voltage	V _I = V _{T+} or V _{T-} ; V _{CC} = 4.5 V								
		I _O = 50 µA	-	0	0.1	-	0.1	-	0.1	V
		I _O = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
I _I	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	µA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V	-	-	1.0	-	10	-	40	µA
ΔI _{CC}	additional supply current	per input pin; V _I = 3.4 V; other inputs at V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
C _I	input capacitance		-	1.5	10	-	10	-	10	pF

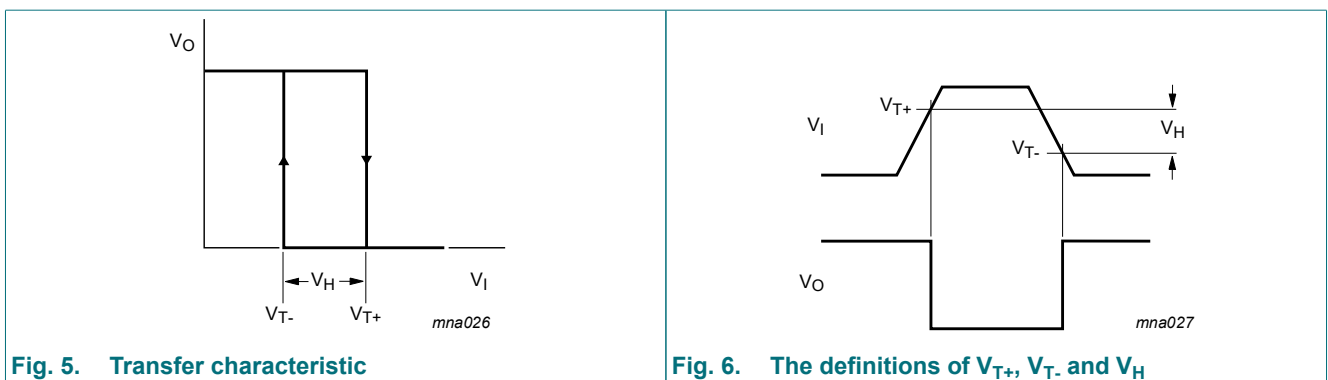
11.1. Transfer characteristics

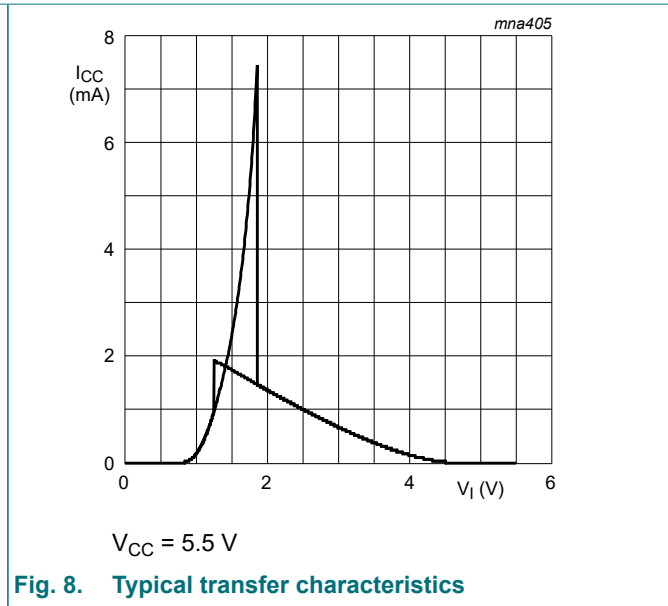
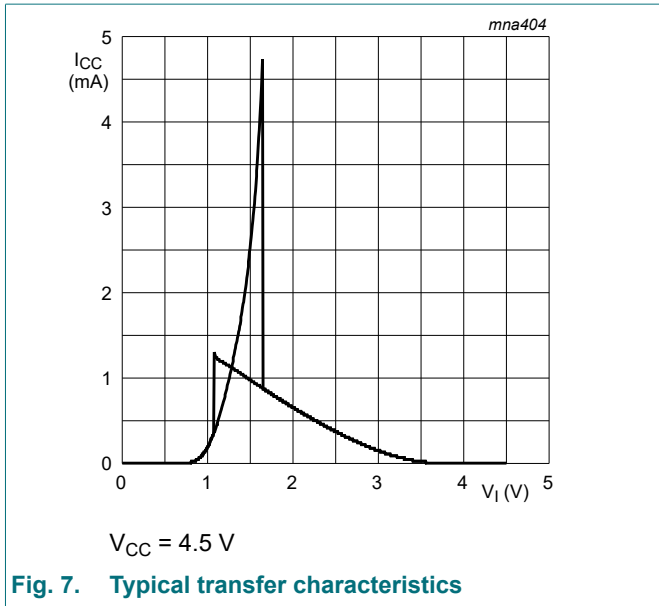
Table 8. Transfer characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V). See Fig. 5 to Fig. 8.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V _{T+}	positive-going threshold voltage	V _{CC} = 4.5 V	-	-	2.0	-	2.0	-	2.0	V
		V _{CC} = 5.5 V	-	-	2.0	-	2.0	-	2.0	V
V _{T-}	negative-going threshold voltage	V _{CC} = 4.5 V	0.5	-	-	0.5	-	0.5	-	V
		V _{CC} = 5.5 V	0.6	-	-	0.6	-	0.6	-	V
V _H	hysteresis voltage	V _{CC} = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V _{CC} = 5.5 V	0.4	-	1.6	0.4	1.6	0.35	1.6	V

11.2. Transfer characteristic waveforms





12. Dynamic characteristics

Table 9. Dynamic characteristics

GND = 0 V; for test circuit see Fig. 10.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t _{pd}	propagation delay	nA to nY; see Fig. 9; V _{CC} = 4.5 V to 5.5 V [1] [2]								
		C _L = 15 pF	-	4.1	7.0	1.0	8.0	1.0	9.0	ns
		C _L = 50 pF	-	5.9	8.5	1.0	10.0	1.0	11.0	ns
C _{PD}	power dissipation capacitance	per buffer; C _L = 50 pF; f _i = 1 MHz; V _I = GND to V _{CC} [3]	-	12	-	-	-	-	-	pF

[1] t_{pd} is the same as t_{PLH} and t_{PHL}.
 [2] Typical values are measured at V_{CC} = 5.0 V.
 [3] C_{PD} is used to determine the dynamic power dissipation P_D (μW).
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum(C_L \times V_{CC}^2 \times f_o)$ 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;
 $\sum(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

12.1. Waveforms and test circuit

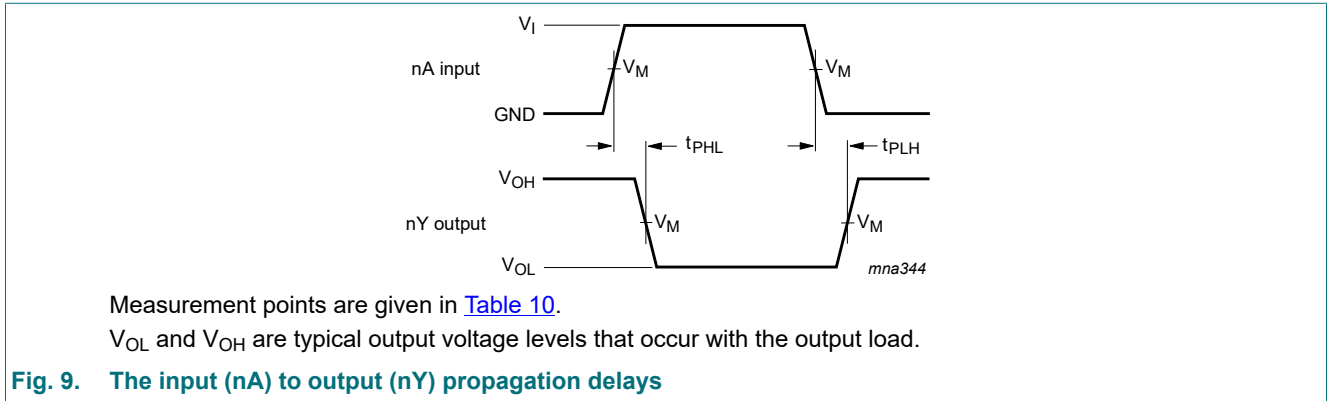


Table 10. Measurement points

Type number	Input		Output
	V_I	V_M	V_M
XC7WT14	GND to 3.0 V	1.5 V	$0.5 \times V_{CC}$

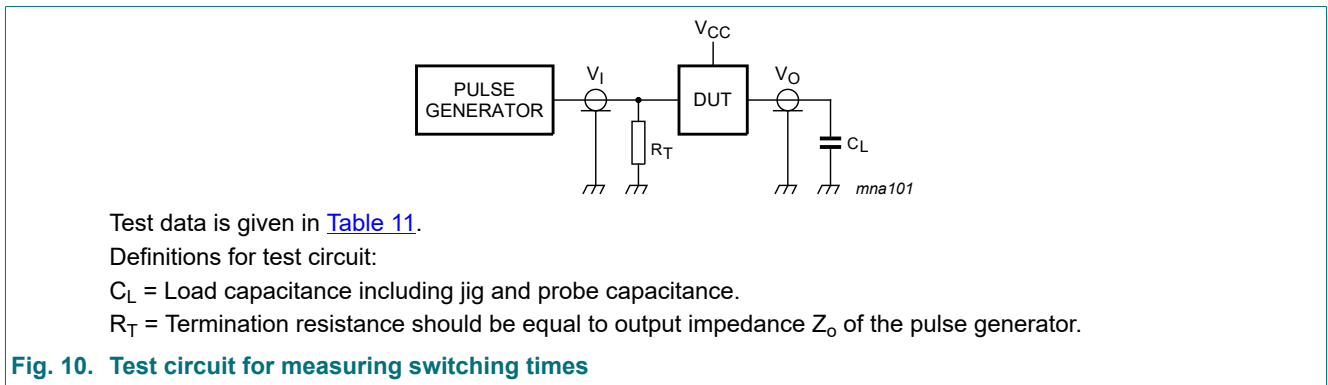


Table 11. Test data

Type	Input		Load	Test
	V_I	t_r, t_f	C_L	
XC7WT14	3.0 V	≤ 3.0 ns	15 pF, 50 pF	t_{PLH}, t_{PHL}

13. Application information

The slow input rise and fall times cause additional power dissipation, which can be calculated using the following formula:

$P_{add} = f_i \times (t_r \times \Delta I_{CC(AV)} + t_f \times \Delta I_{CC(AV)}) \times V_{CC}$ where:

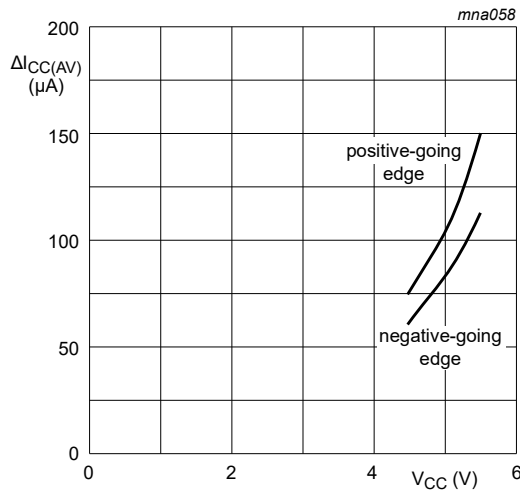
- P_{add} = additional power dissipation (μW);
- f_i = input frequency (MHz);
- t_r = input rise time (ns); 10 % to 90 %;
- t_f = input fall time (ns); 90 % to 10 %;
- $\Delta I_{CC(AV)}$ = average additional supply current (μA).

$\Delta I_{CC(AV)}$ differs with positive or negative input transitions, as shown in Fig. 11.

For XC7WT14 used in relaxation oscillator circuit, see Fig. 12.

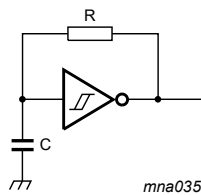
Note to the application information:

1. All values given are typical unless otherwise specified.



Linear change of V_I between $0.1V_{CC}$ to $0.9V_{CC}$

Fig. 11. Average additional I_{CC}



$$f = \frac{1}{T} \approx \frac{1}{0.60 \times RC}$$

Fig. 12. Relaxation oscillator using the XC7WT14

14. Package outline

TSSOP8: plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm SOT505-2

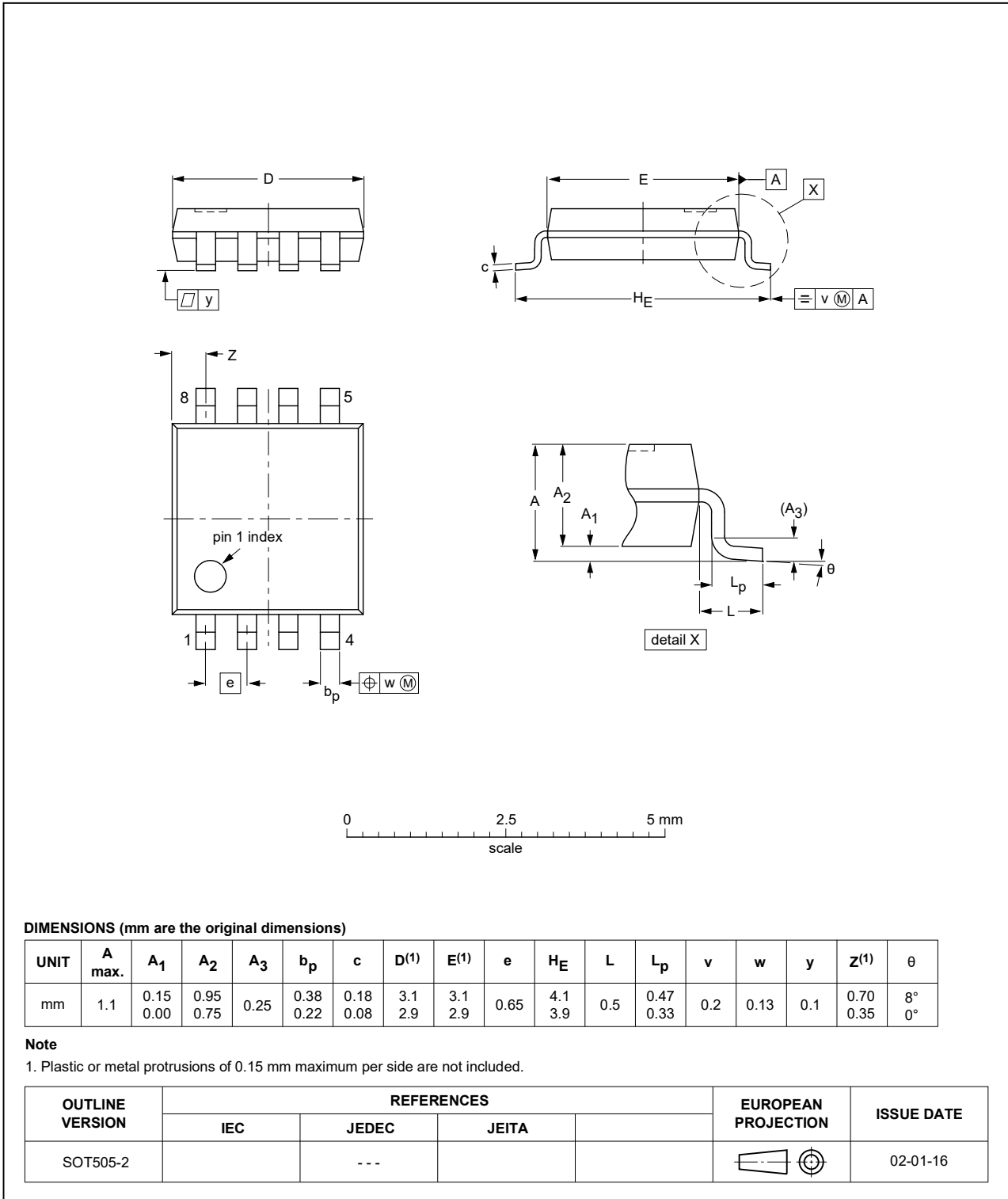


Fig. 13. Package outline SOT505-2 (TSSOP8)

15. Abbreviations

Table 12. Abbreviations

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

16. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
XC7WT14 v.5	20210517	Product data sheet	-	XC7WT14 v.4
Modifications:	<ul style="list-style-type: none"> Type number XC7WT14DC (SOT765-1 / VSSOP8) removed. Type number XC7WT14GT (SOT833-1 / XSON8) removed. Section 9: Derating values for P_{tot} total power dissipation updated. 			
XC7WT14 v.4	20190222	Product data sheet	-	XC7WT14 v.3
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. Type number XC7WT14GD (SOT996-2 / XSON8) removed. Fig. 15: package outline drawing SOT765-1 changed. 			
XC7WT14 v.3	20130123	Product data sheet	-	XC7WT14 v.2
Modifications:	<ul style="list-style-type: none"> For type number XC7WT14GD XSON8U has changed to XSON8. 			
XC7WT14 v.2	20111103	Product data sheet	-	XC7WT14 v.1
XC7WT14 v.1	20110119	Product data sheet	-	-

17. 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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