XC7SET14
Inverting Schmitt trigger
Rev. 3 — 18 December 2023

1. General description

XC7SET14 is a high-speed Si-gate CMOS device. It provides an inverting buffer function 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
- Low power dissipation
- TTL input levels
- Balanced propagation delays
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +125 °C

3. Applications

- Wave and pulse shapers
- Astable multivibrators
- Monostable multivibrators

4. Ordering information

Table 1. Ordering information

| Type number	Package			
	Temperature range	Name	Description	Version
XC7SET14GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
XC7SET14GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753

5. Marking

Table 2. Marking codes

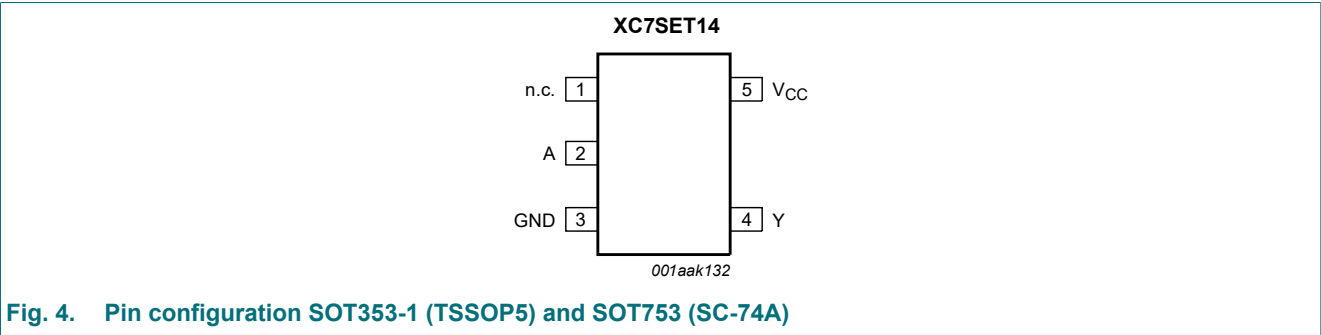| Type number	Marking code [1]
XC7SET14GW	gF
XC7SET14GV	g14

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

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6. Functional diagram

Fig. 1.   Logic symbol

Fig. 2.   IEC logic symbol

Fig. 3.   Logic diagram
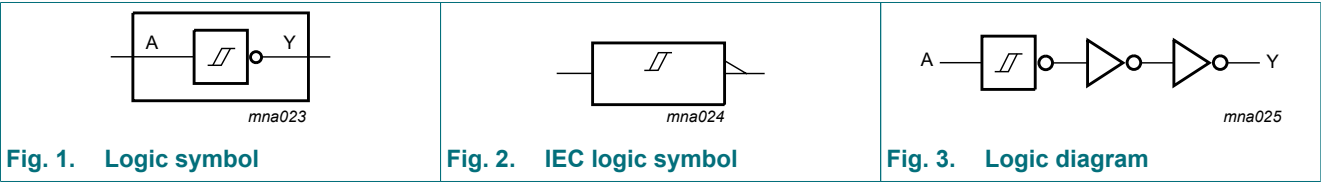
7. Pinning information

7.1. Pinning

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Fig. 4.   Pin configuration SOT353-1 (TSSOP5) and SOT753 (SC-74A)

7.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
n.c.	1	not connected
A	2	data input
GND	3	ground (0 V)
Y	4	data output
V_{CC}	5	supply voltage

8. Functional description

Table 4. Function table

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

Input	Output
A	**Y**
L	H
H	L

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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	$V_I < -0.5$ V	-20	-	mA
I_{OK}	output clamping current	$V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V [1]	-	±20	mA
I_O	output current	-0.5 V $< V_O < V_{CC} + 0.5$ 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	$T_{amb} = -40$ °C to +125 °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 SOT353-1 (TSSOP5) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.
For SOT753 (SC-74A) package: P_{tot} derates linearly with 3.8 mW/K above 85 °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

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11. Static characteristics

Table 7. Static characteristics

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

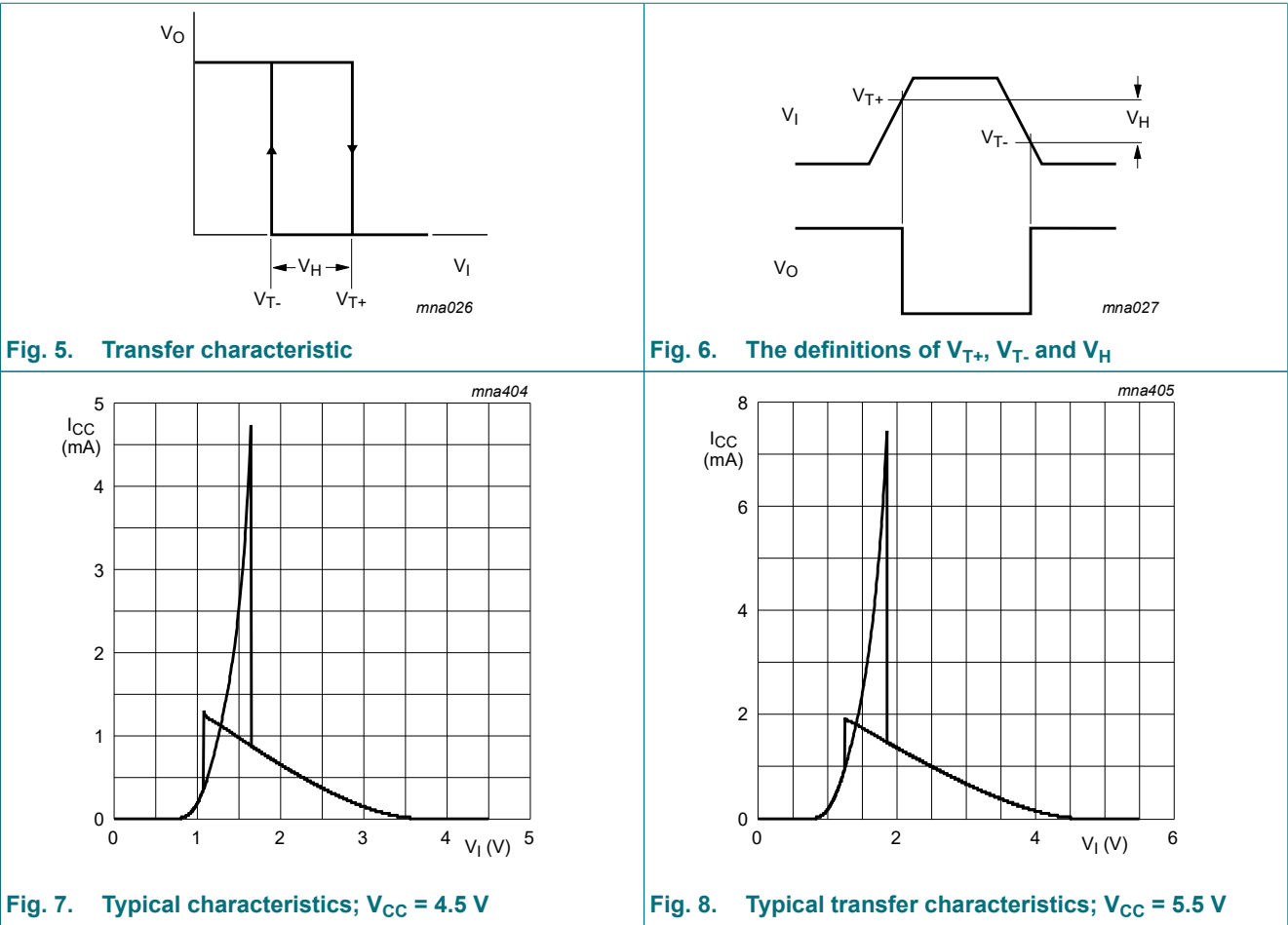| Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}; V_{CC} = 4.5 V								
		I_O = -50 μA	4.4	4.5	-	4.4	-	4.4	-	V
		I_O = -8.0 mA	3.94	-	-	3.8	-	3.70	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{T+}$ 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

12. Transfer characteristics

Table 8. Transfer characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V). See Fig. 5 and Fig. 6.

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

12.1. Transfer characteristic waveforms

Fig. 5.   Transfer characteristic

Fig. 6.   The definitions of V_{T+}, V_{T-} and V_H

Fig. 7.   Typical characteristics; V_{CC} = 4.5 V

Fig. 8.   Typical transfer characteristics; V_{CC} = 5.5 V

13. Dynamic characteristics

Table 9. Dynamic characteristics

GND = 0 V. For waveform see <u>Fig. 9</u>*. For test circuit see* <u>Fig. 10</u>*.*

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	A to Y; 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; V_I = GND to V_{CC}	[3]	-	13	-	-	-	-	-	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.

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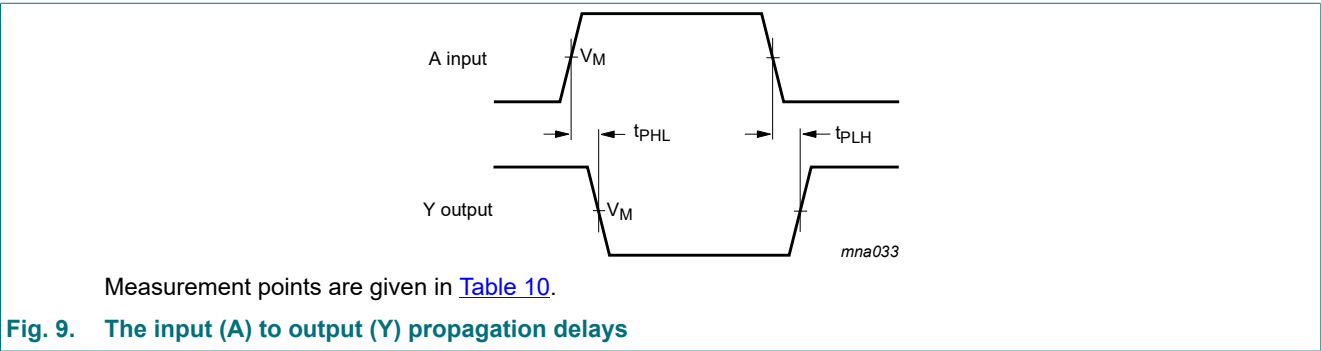**Product data sheet**

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13.1. Waveform and test circuit

Measurement points are given in Table 10.

Fig. 9.   The input (A) to output (Y) propagation delays

Table 10. Measurement points

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

Test data is given in Table 11.

Definitions for test circuit:

C_L = Load capacitance including jig and probe capacitance;

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

Fig. 10. Test circuit for measuring switching times
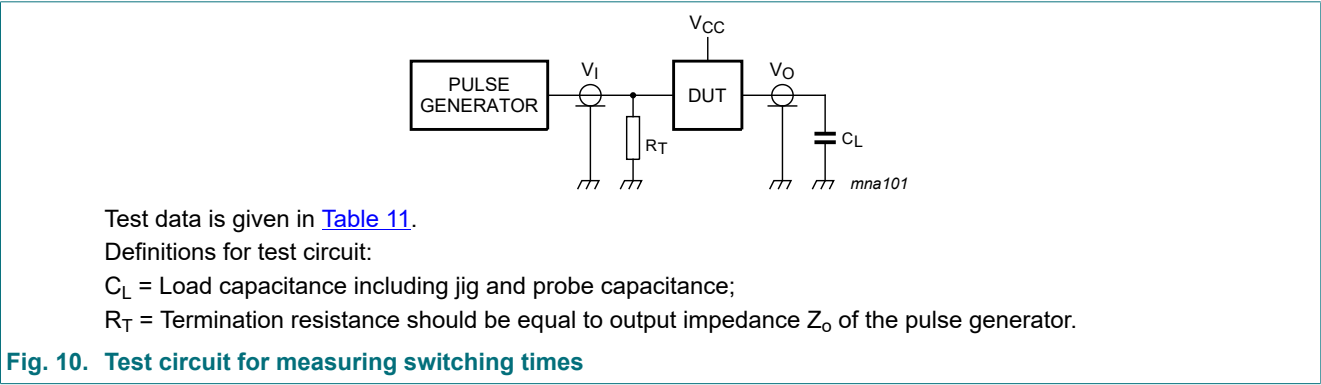
Table 11. Test data

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

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14. Application information

The slow input rise and fall times cause additional power dissipation, which can be calculated using the following formula:
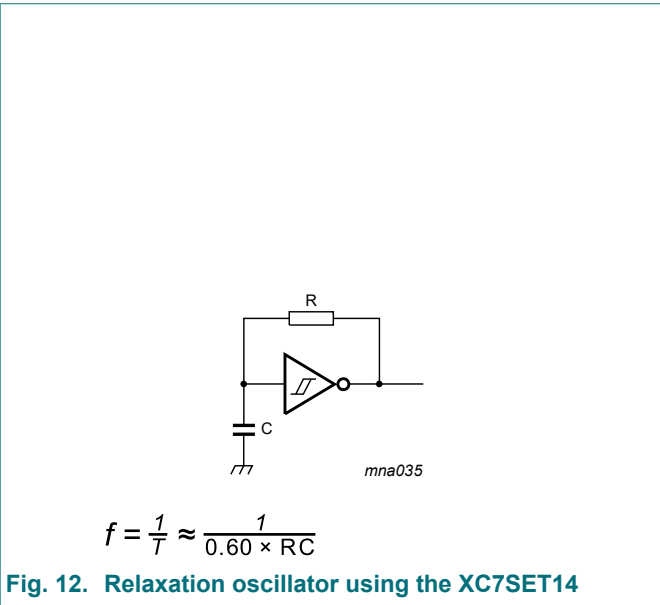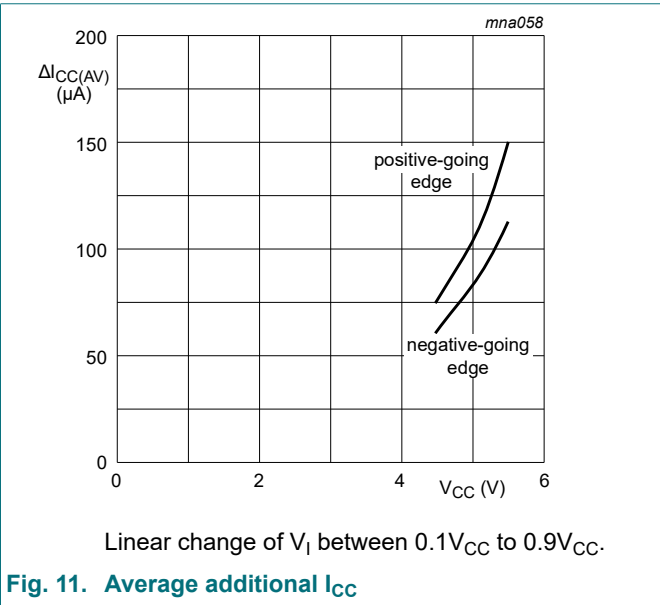
$P_{add} = f_i \times (t_r \times \Delta I_{CC(AV)} + t_f \times \Delta I_{CC(AV)}) \times V_{CC}$ where:

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).

Average additional I_{CC} differs with positive or negative input transitions, as shown in Fig. 11.

For XC7SET14 used in relaxation oscillator circuit, see Fig. 12.

Note to the application information: 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 XC7SET14

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15. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm **SOT353-1**

Dimensions (mm are the original dimensions)

Unit		A	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	e_1	H_E	L_p	v	w	y	θ
mm	max	1.1	0.1	1.0	0.15	0.30	0.25	2.2	1.35	0.65	1.3	2.4	0.46	0.3	0.1	0.1	8°
	min	0.8	0	0.8		0.15	0.08	1.8	1.15			1.8	0.26				0°

Note
1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

sot353-1_po

Outline version	References				European projection		Issue date
	IEC	JEDEC	JEITA				
SOT353-1		MO-203	SC-88A				~~21-12-15~~ 21-12-16
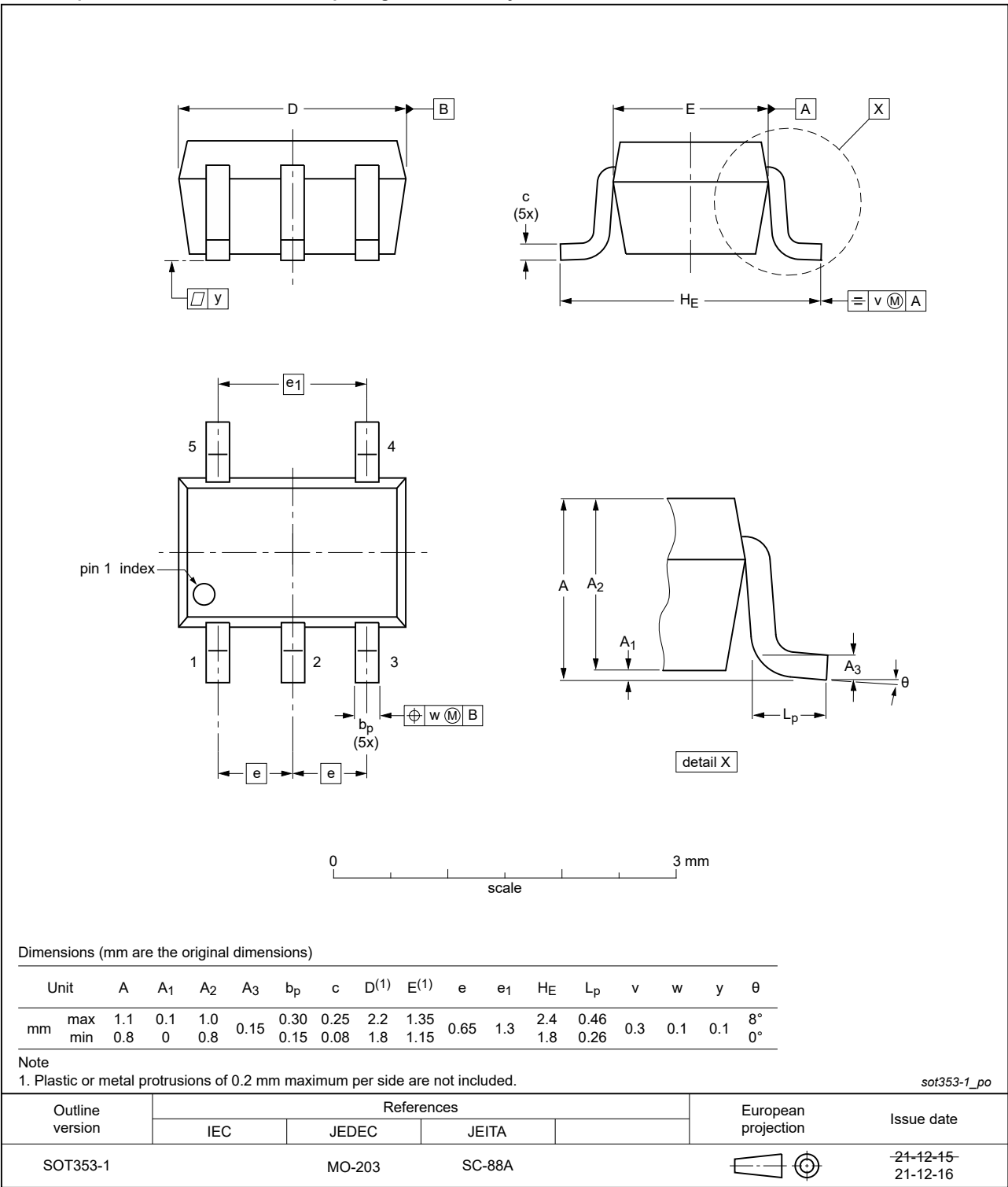
Fig. 13. Package outline SOT353-1 (TSSOP5)

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Plastic surface-mounted package; 5 leads   **SOT753**

DIMENSIONS (mm are the original dimensions)

UNIT	A	A$_1$	b$_p$	c	D	E	e	H$_E$	L$_p$	Q	v	w	y
mm	1.1 0.9	0.100 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT753			SC-74A			~~02-04-16~~ 06-03-16
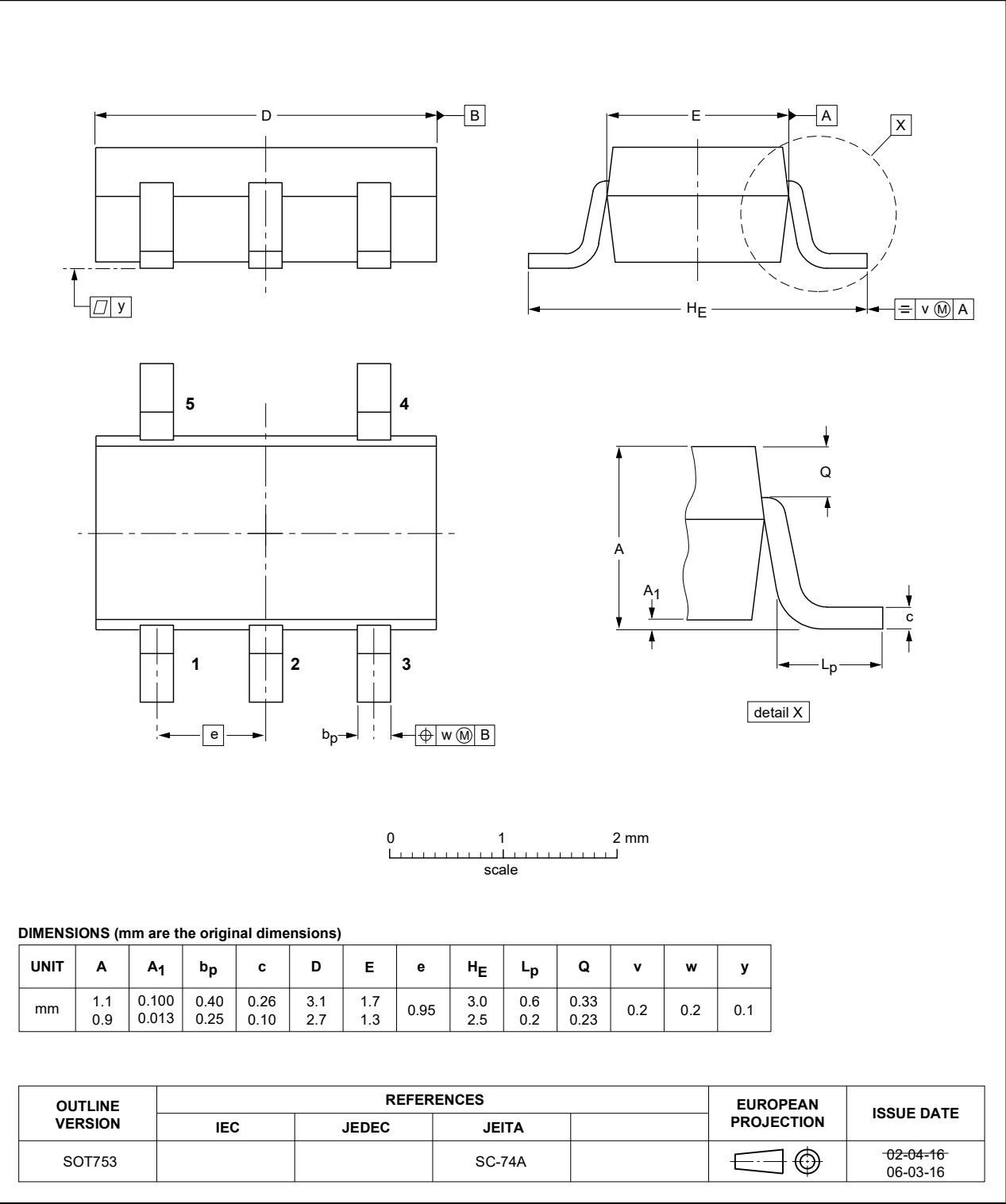
Fig. 14. Package outline SOT753 (SC-74A)

16. 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
TTL	Transistor-Transistor Logic

17. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
XC7SET14 v.3	20231218	Product data sheet	-	XC7SET14 v.2
Modifications:	• Section 2: ESD specification updated according to the latest JEDEC standard.			
XC7SET14 v.2	20220114	Product data sheet	-	XC7SET14 v.1
Modifications:	• 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. • Section 9: Derating values for P_{tot} total power dissipation updated. • Fig. 13: Package outline drawing SOT353-1 (TSSOP5) has changed.			
XC7SET14 v.1	20090831	Product data sheet	-	-

18. 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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