

# XC7SET14

Inverting Schmitt trigger

Rev. 3 — 18 December 2023

Product data sheet

## 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
<a href="#">XC7SET14GW</a>	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	<a href="#">SOT353-1</a>
<a href="#">XC7SET14GV</a>	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	<a href="#">SOT753</a>

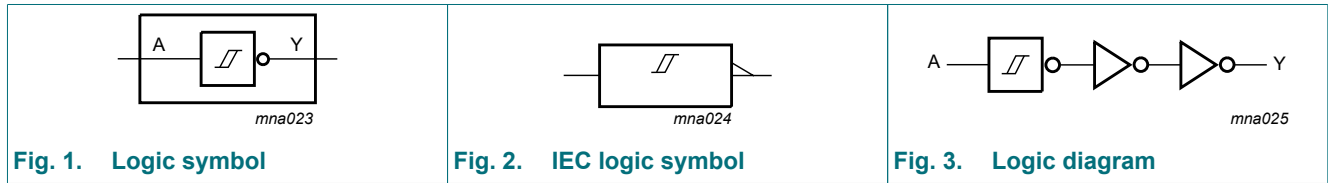
## 5. Marking

Table 2. Marking codes

Type number	Marking code [1]
XC7SET14GW	gF
XC7SET14GV	g14

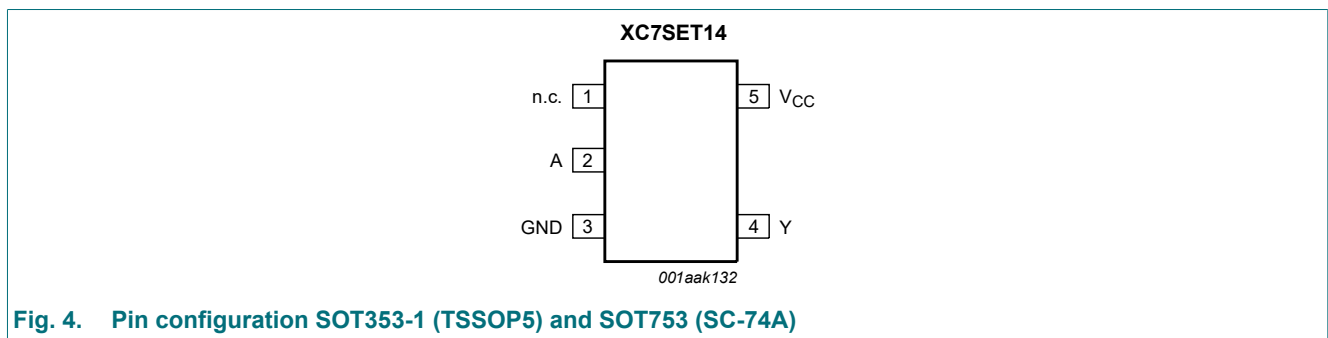
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

## 6. Functional diagram



## 7. Pinning information

### 7.1. Pinning



### 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 <sub>CC</sub>	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

## 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]	-	$\pm 20$	mA
$I_O$	output current	$-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$	-	$\pm 25$	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 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

## 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 <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	-	-	3.8	-	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	-	-	1.0	-	10	-	40	μA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>I</sub> = 3.4 V; other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
C <sub>I</sub>	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 <sub>T+</sub>	positive-going threshold voltage	V <sub>CC</sub> = 4.5 V	-	-	2.0	-	2.0	-	2.0	V
		V <sub>CC</sub> = 5.5 V	-	-	2.0	-	2.0	-	2.0	V
V <sub>T-</sub>	negative-going threshold voltage	V <sub>CC</sub> = 4.5 V	0.5	-	-	0.5	-	0.5	-	V
		V <sub>CC</sub> = 5.5 V	0.6	-	-	0.6	-	0.6	-	V
V <sub>H</sub>	hysteresis voltage	V <sub>CC</sub> = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V <sub>CC</sub> = 5.5 V	0.4	-	1.6	0.4	1.6	0.35	1.6	V

12.1. Transfer characteristic waveforms

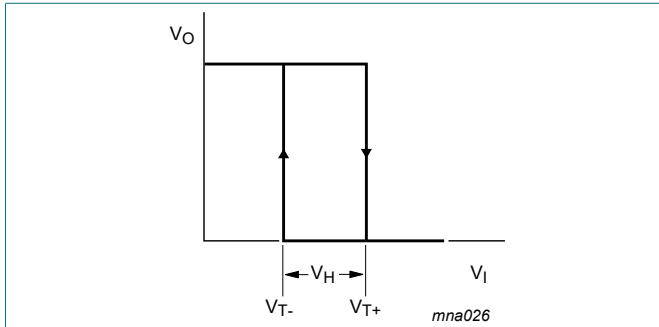


Fig. 5. Transfer characteristic

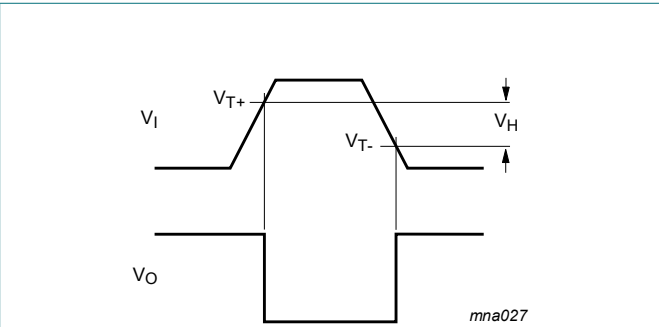


Fig. 6. The definitions of  $V_{T+}$ ,  $V_{T-}$  and  $V_H$

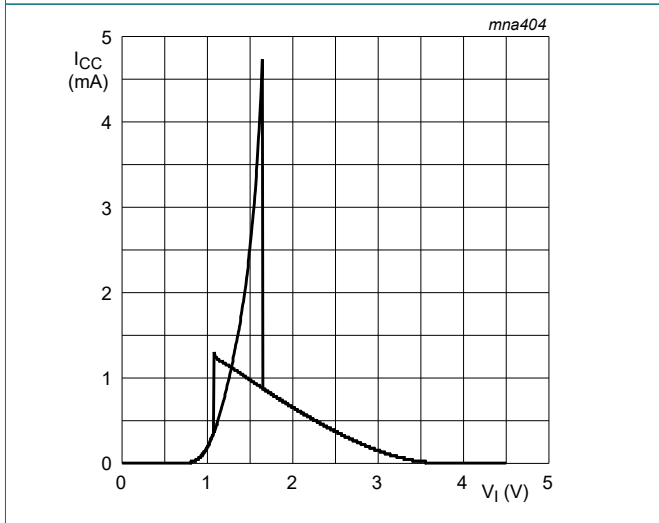


Fig. 7. Typical characteristics;  $V_{CC} = 4.5$  V

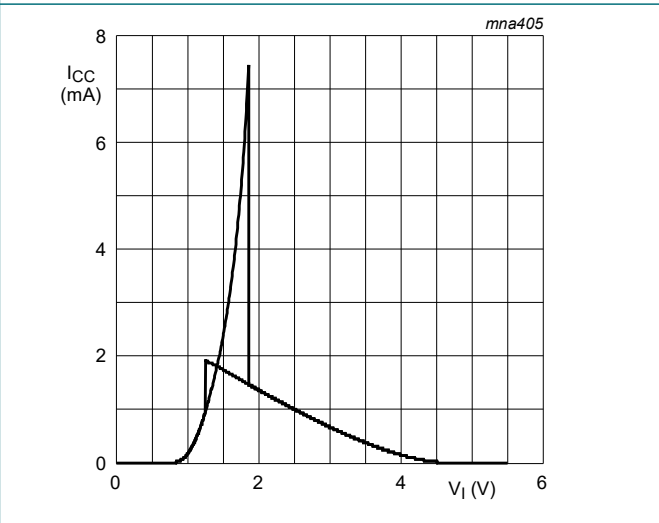


Fig. 8. Typical transfer characteristics;  $V_{CC} = 5.5$  V

13. Dynamic characteristics

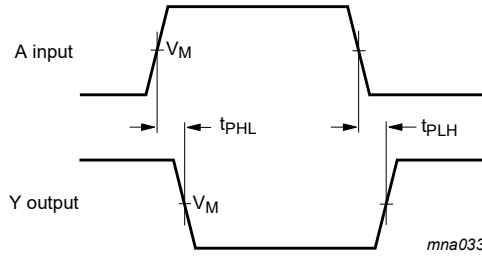
Table 9. Dynamic characteristics

$GND = 0$  V. For waveform see Fig. 9. 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	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  $P_D$  ( $\mu$ W).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum(C_L \times V_{CC}^2 \times f_o)$  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.

13.1. Waveform and test circuit

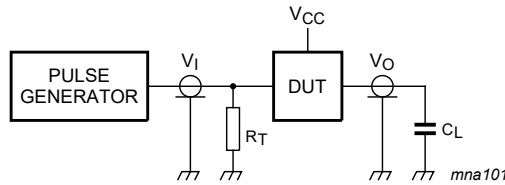


Measurement points are given in [Table 10](#).

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	$\leq 3.0$ ns	15 pF, 50 pF	$t_{PLH}, t_{PHL}$

### 14. Application information

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

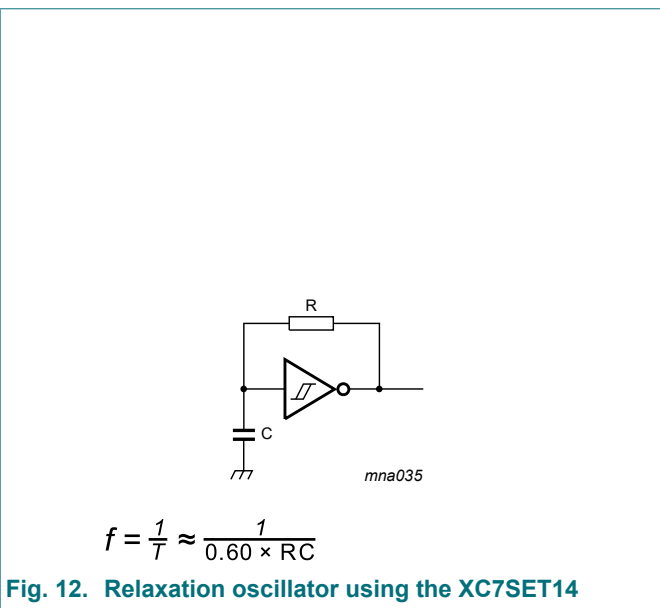
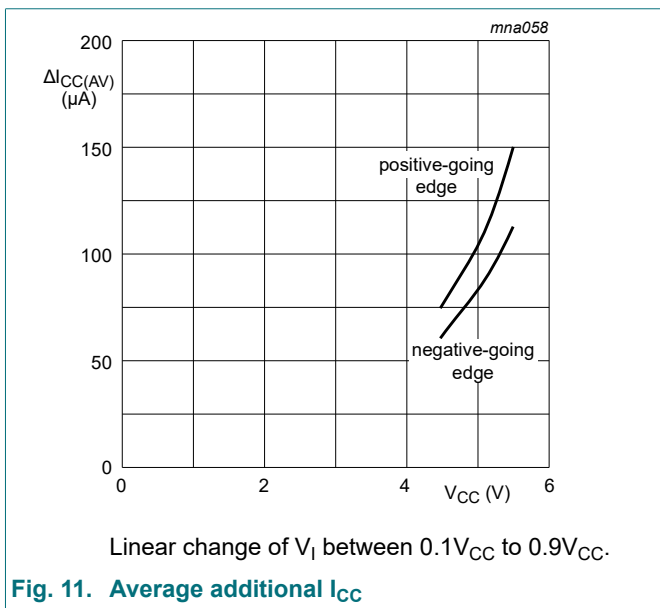
$$P_{add} = f_i \times (t_r \times \Delta I_{CC(AV)} + t_f \times \Delta I_{CC(AV)}) \times V_{CC} \text{ where:}$$

- $P_{add}$  = additional power dissipation ( $\mu\text{W}$ );
- $f_i$  = 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 ( $\mu\text{A}$ ).

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.



### 15. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1



Fig. 13. Package outline SOT353-1 (TSSOP5)



Plastic surface-mounted package; 5 leads

SOT753

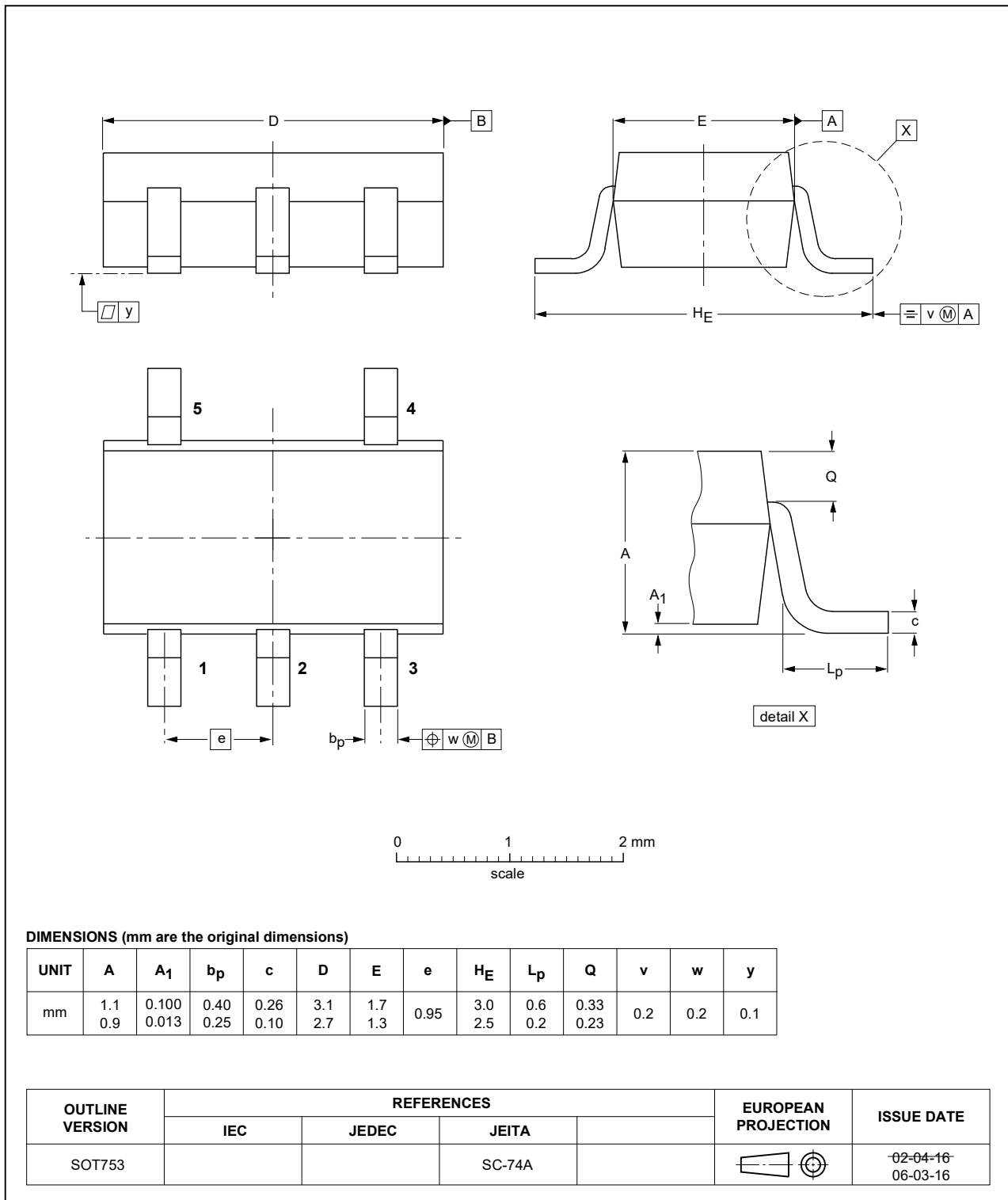


Fig. 14. Package outline SOT753 (SC-74A)

## 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:	<ul style="list-style-type: none"> <li>• <a href="#">Section 2</a>: ESD specification updated according to the latest JEDEC standard.</li> </ul>			
XC7SET14 v.2	20220114	Product data sheet	-	XC7SET14 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 9</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> <li>• <a href="#">Fig. 13</a>: Package outline drawing SOT353-1 (TSSOP5) has changed.</li> </ul>			
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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