

74HC3G14; 74HCT3G14

Triple inverting Schmitt trigger

Rev. 5 — 9 December 2013

Product data sheet

1. General description

The 74HC3G14; 74HCT3G14 is a triple inverter with Schmitt-trigger inputs. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} . Schmitt trigger inputs transform slowly changing input signals into sharply defined jitter-free output signals.

2. Features and benefits

- Wide supply voltage range from 2.0 V to 6.0 V
- Complies with JEDEC standard no. 7A
- Input levels:
 - ◆ For 74HC3G14: CMOS level
 - ◆ For 74HCT3G14: TTL level
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- Unlimited input rise and fall times
- Multiple package options
- ESD protection:
 - ◆ HBM JESD22-A114E exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Applications

- Wave and pulse shaper for highly noisy environments
- Astable multivibrators
- Monostable multivibrators



4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74HC3G14DP 74HCT3G14DP	-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
74HC3G14DC 74HCT3G14DC	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1
74HC3G14GD 74HCT3G14GD	-40 °C to +125 °C	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body 3 × 2 × 0.5 mm	SOT996-2

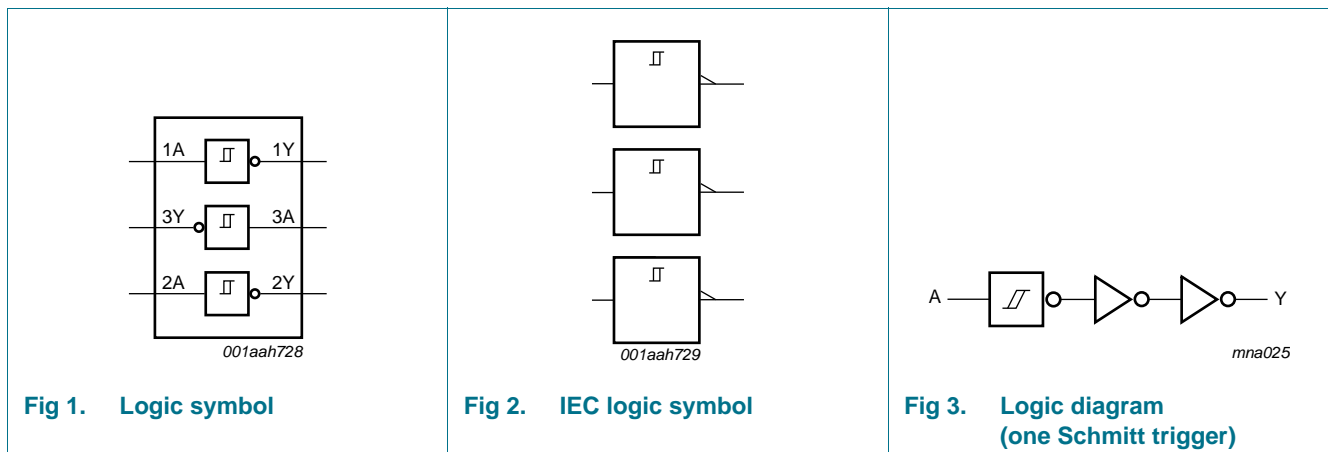
5. Marking

Table 2. Marking

Type number	Marking code ^[1]
74HC3G14DP	H14
74HCT3G14DP	T14
74HC3G14DC	H14
74HCT3G14DC	T14
74HC3G14GD	H14
74HCT3G14GD	T14

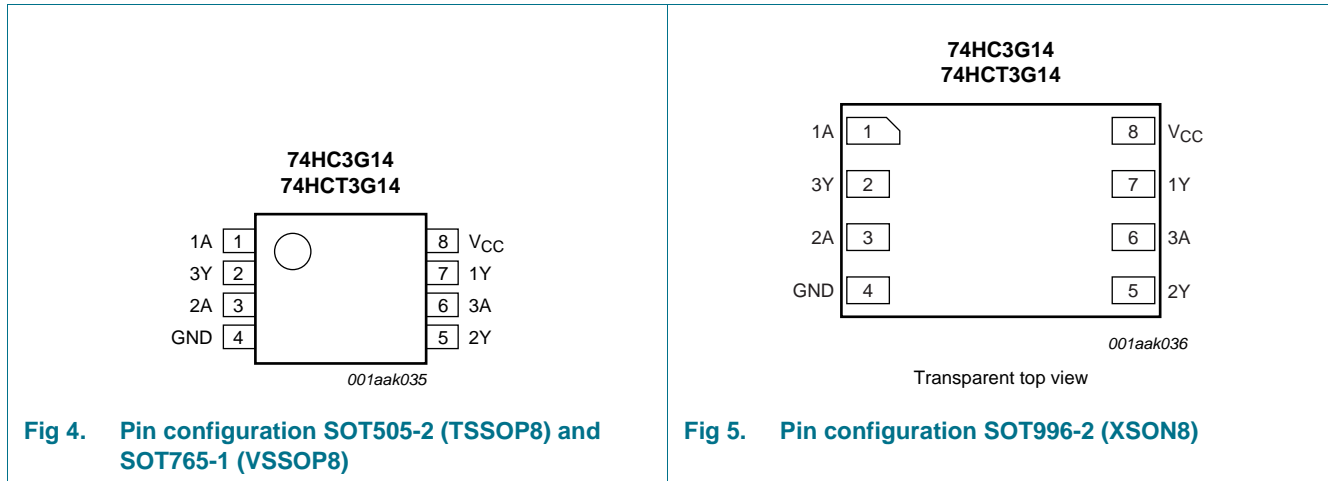
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

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^[1]

Input	Output
nA	nY
L	H
H	L

[1] H = HIGH voltage level; L = LOW voltage level.

9. Limiting values

Table 5. 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
I_{IK}	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	[1] -	±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	$V_O = -0.5\text{ V}$ to $V_{CC} + 0.5\text{ V}$	[1] -	±25	mA
I_{CC}	supply current		[1] -	+50	mA
I_{GND}	ground current		[1] -50	-	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation		[2] -	300	mW

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

[2] For TSSOP8 package: above 55 °C the value of P_{tot} derates linearly with 2.5 mW/K.

For VSSOP8 package: above 110 °C the value of P_{tot} derates linearly with 8 mW/K.

For XSON8 package: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

10. Recommended operating conditions

Table 6. Recommended operating conditions

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

Symbol	Parameter	Conditions	74HC3G14			74HCT3G14			Unit
			Min	Typ	Max	Min	Typ	Max	
V_{CC}	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V_I	input voltage		0	-	V_{CC}	0	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	0	-	V_{CC}	V
T_{amb}	ambient temperature		-40	+25	+125	-40	+25	+125	°C

11. Static characteristics

Table 7. Static characteristics

Voltages are referenced to GND (ground = 0 V). All typical values are measured at $T_{amb} = 25\text{ °C}$.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC3G14										
V _{OH}	HIGH-level output voltage	V _I = V _{T+} or V _{T-}								
		I _O = -20 μA; V _{CC} = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -20 μA; V _{CC} = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		I _O = -4.0 mA; V _{CC} = 4.5 V	4.18	4.32	-	4.13	-	3.7	-	V
		I _O = -5.2 mA; V _{CC} = 6.0 V	5.68	5.81	-	5.63	-	5.2	-	V
V _{OL}	LOW-level output voltage	V _I = V _{T+} or V _{T-}								
		I _O = 20 μA; V _{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 20 μA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 20 μA; V _{CC} = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 4.0 mA; V _{CC} = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I _O = 5.2 mA; V _{CC} = 6.0 V	-	0.16	0.26	-	0.33	-	0.4	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±0.1	-	±1.0	-	±1.0	μA
I _{CC}	supply current	per input pin; V _{CC} = 6.0 V; V _I = V _{CC} or GND; I _O = 0 A;	-	-	1.0	-	10	-	20	μA
C _I	input capacitance		-	2.0	-	-	-	-	-	pF
74HCT3G14										
V _{OH}	HIGH-level output voltage	V _I = V _{T+} or V _{T-}								
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -4.0 mA; V _{CC} = 4.5 V	4.18	4.32	-	4.13	-	3.7	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}								
		I _O = 20 μA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 4.0 mA; V _{CC} = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 5.5 V	-	-	±0.1	-	±1.0	-	±1.0	μA
I _{CC}	supply current	per input pin; V _{CC} = 5.5 V; V _I = V _{CC} or GND; I _O = 0 A;	-	-	1.0	-	10	-	20	μA
ΔI _{CC}	additional supply current	per input; V _{CC} = 4.5 V to 5.5 V; V _I = V _{CC} - 2.1 V; I _O = 0 A	-	-	300	-	375	-	410	μA
C _I	input capacitance		-	2.0	-	-	-	-	-	pF

Table 8. Transfer characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 11](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +125 °C			Unit
			Min	Typ	Max	Min	Max (85 °C)	Max (125 °C)	
74HC3G14									
V _{T+}	positive-going threshold voltage	see Figure 6 , Figure 7							
		V _{CC} = 2.0 V	1.00	1.18	1.50	1.00	1.50	1.50	V
		V _{CC} = 4.5 V	2.30	2.60	3.15	2.30	3.15	3.15	V
		V _{CC} = 6.0 V	3.00	3.46	4.20	3.00	4.20	4.20	V
V _{T-}	negative-going threshold voltage	see Figure 6 , Figure 7							
		V _{CC} = 2.0 V	0.30	0.60	0.90	0.30	0.90	0.90	V
		V _{CC} = 4.5 V	1.13	1.47	2.00	1.13	2.00	2.00	V
		V _{CC} = 6.0 V	1.50	2.06	2.60	1.50	2.60	2.60	V
V _H	hysteresis voltage	(V _{T+} - V _{T-}); see Figure 6 , Figure 7 and Figure 9							
		V _{CC} = 2.0 V	0.30	0.60	1.00	0.30	1.00	1.00	V
		V _{CC} = 4.5 V	0.60	1.13	1.40	0.60	1.40	1.40	V
		V _{CC} = 6.0 V	0.80	1.40	1.70	0.80	1.70	1.70	V
74HCT3G14									
V _{T+}	positive-going threshold voltage	see Figure 6 , Figure 7							
		V _{CC} = 4.5 V	1.20	1.58	1.90	1.20	1.90	1.90	V
		V _{CC} = 5.5 V	1.40	1.78	2.10	1.40	2.10	2.10	V
V _{T-}	negative-going threshold voltage	see Figure 6 , Figure 7							
		V _{CC} = 4.5 V	0.50	0.87	1.20	0.50	1.20	1.20	V
		V _{CC} = 5.5 V	0.60	1.11	1.40	0.60	1.40	1.40	V
V _H	hysteresis voltage	(V _{T+} - V _{T-}); see Figure 6 , Figure 7 and Figure 8							
		V _{CC} = 4.5 V	0.40	0.71	-	0.40	-	-	V
		V _{CC} = 5.5 V	0.40	0.67	-	0.40	-	-	V

11.1 Waveforms transfer characteristics

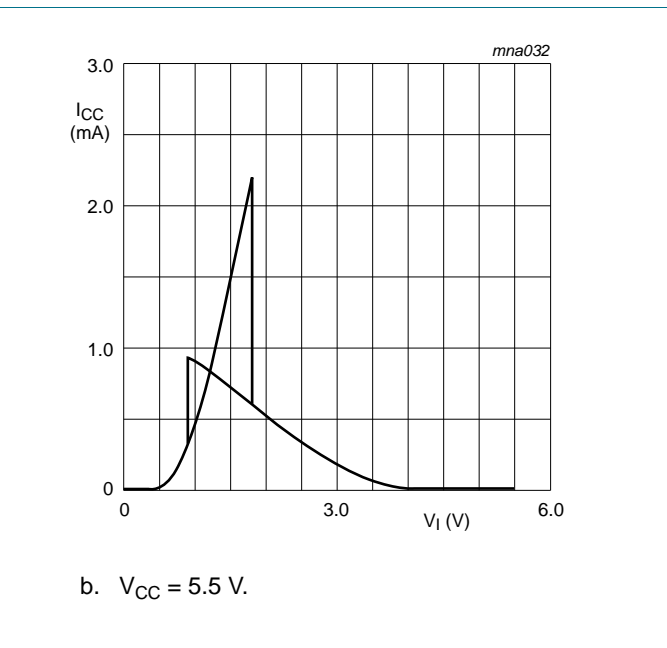
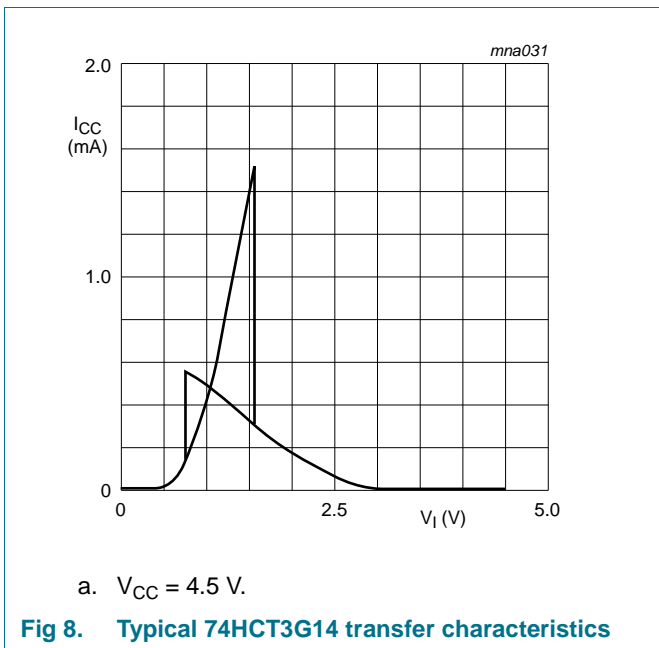
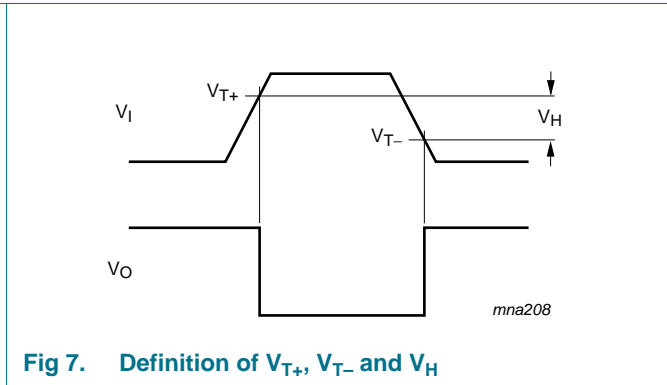
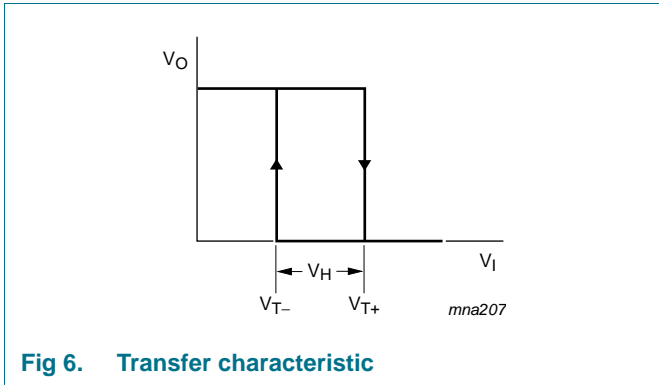
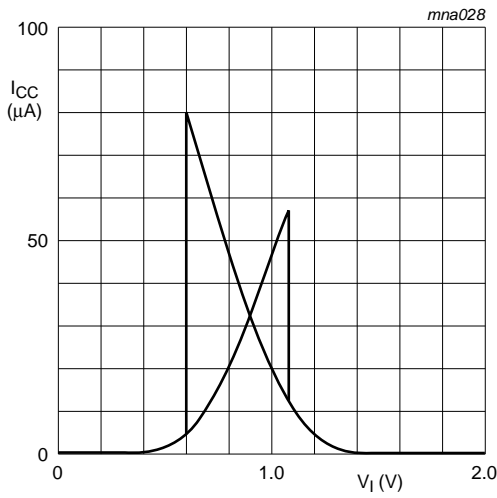
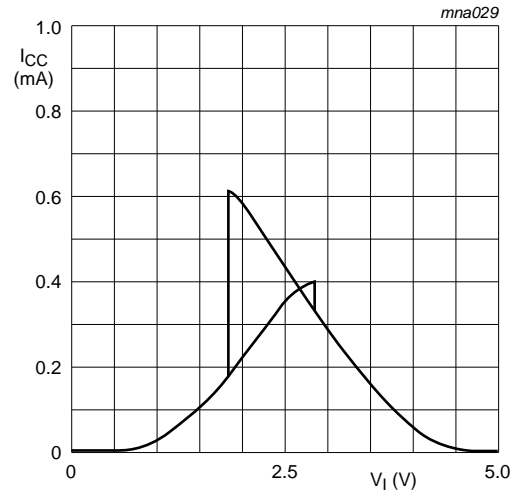


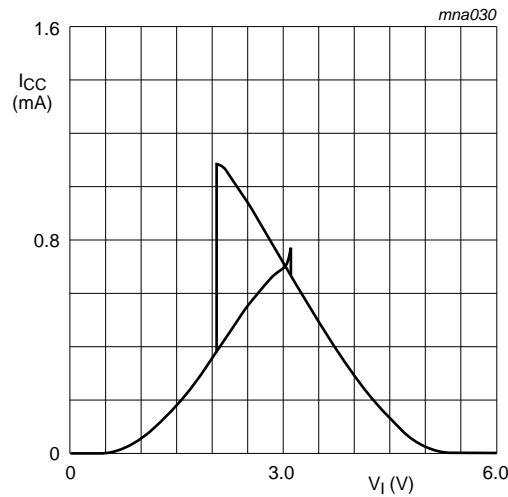
Fig 8. Typical 74HCT3G14 transfer characteristics



a. $V_{CC} = 2.0\text{ V}$



b. $V_{CC} = 4.5\text{ V}$



c. $V_{CC} = 6.0\text{ V}$

Fig 9. Typical 74HC3G14 transfer characteristics

12. Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 11](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +125 °C			Unit
			Min	Typ	Max	Min	Max (85 °C)	Max (125 °C)	
74HC3G14									
t _{pd}	propagation delay	nA to nY; see Figure 10 [1]							
		V _{CC} = 2.0 V	-	53	125	-	155	190	ns
		V _{CC} = 4.5 V	-	16	25	-	31	38	ns
		V _{CC} = 6.0 V	-	13	21	-	26	32	ns
t _t	transition time	nY; see Figure 10 [2]							
		V _{CC} = 2.0 V	-	20	75	-	95	110	ns
		V _{CC} = 4.5 V	-	7	15	-	19	22	ns
		V _{CC} = 6.0 V	-	5	13	-	16	19	ns
C _{PD}	power dissipation capacitance	V _I = GND to V _{CC} [3]	-	10	-	-	-	-	pF
74HCT3G14									
t _{pd}	propagation delay	nA to nY; see Figure 10 [1]							
		V _{CC} = 4.5 V	-	21	32	-	40	48	ns
t _t	transition time	nY; see Figure 10 [2]							
		V _{CC} = 4.5 V	-	6	15	-	19	22	ns
C _{PD}	power dissipation capacitance	V _I = GND to V _{CC} - 1.5 V [3]	-	10	-	-	-	-	pF

[1] t_{pd} is the same as t_{PLH} and t_{PHL}

[2] t_t is the same as t_{TLH} and t_{THL}

[3] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

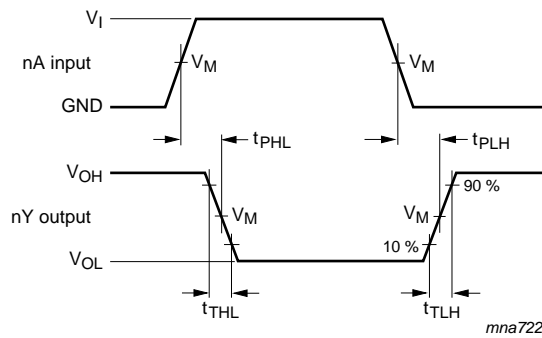
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

Σ(C_L × V_{CC}² × f_o) = sum of the outputs.

13. Waveforms



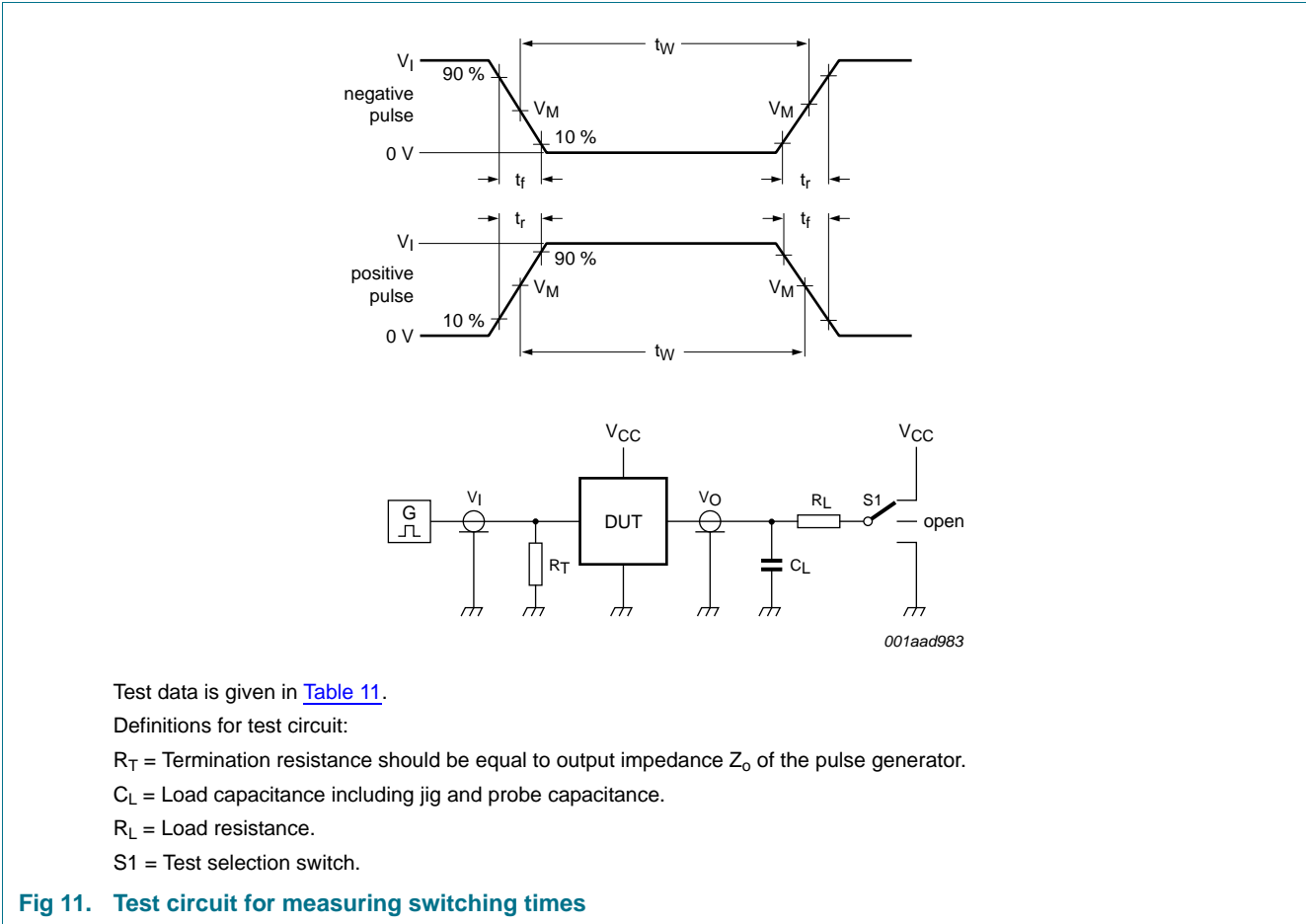
Measurement points are given in [Table 10](#).

V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig 10. The data input (nA) to output (nY) propagation delays and output transition times

Table 10. Measurement points

Type	Input	Output
	V_M	V_M
74HC3G14	$0.5V_{CC}$	$0.5V_{CC}$
74HCT3G14	1.3 V	1.3 V



Test data is given in [Table 11](#).

Definitions for test circuit:

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

C_L = Load capacitance including jig and probe capacitance.

R_L = Load resistance.

S1 = Test selection switch.

Fig 11. Test circuit for measuring switching times

Table 11. Test data

Type	Input		Load		S1 position
	V_I	t_r, t_f	C_L	R_L	t_{PHL}, t_{PLH}
74HC3G14	GND to V_{CC}	≤ 6 ns	50 pF	1 k Ω	open
74HCT3G14	GND to 3.0 V	≤ 6 ns	50 pF	1 k Ω	open

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 (μW);

f_i = input frequency (MHz);

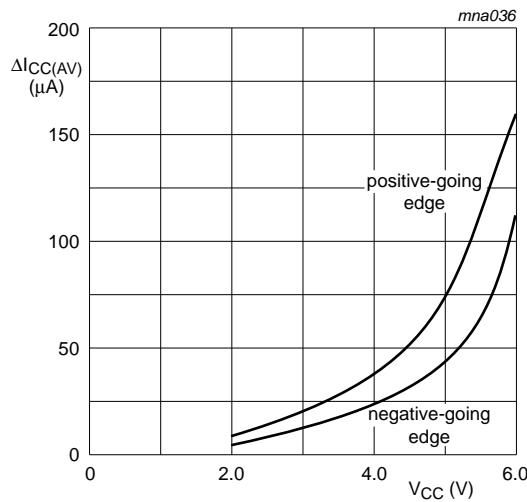
t_r = input rise time (ns); 10 % to 90 %;

t_f = input fall time (ns); 90 % to 10 %;

$\Delta I_{CC(AV)}$ = average additional supply current (μA).

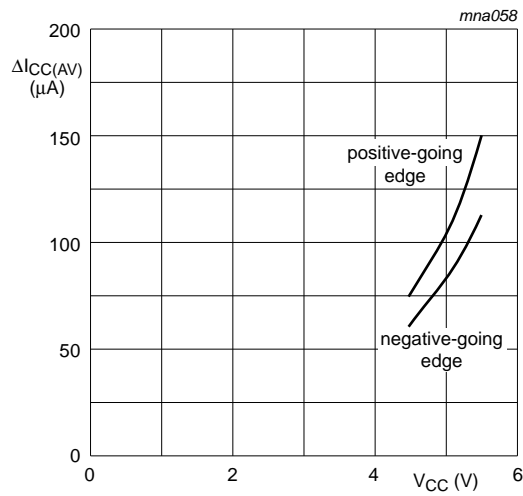
$\Delta I_{CC(AV)}$ differs with positive or negative input transitions, as shown in [Figure 12](#) and [Figure 13](#).

An example of a relaxation circuit using the 74HC3G14/74HCT3G14 is shown in [Figure 14](#).



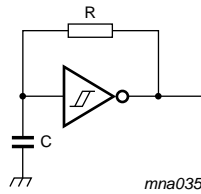
linear change of V_i between $0.1V_{CC}$ to $0.9V_{CC}$.

Fig 12. $\Delta I_{CC(AV)}$ as a function of V_{CC} for 74HC3G14



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

Fig 13. $\Delta I_{CC(AV)}$ as a function of V_{CC} for 74HCT3G14

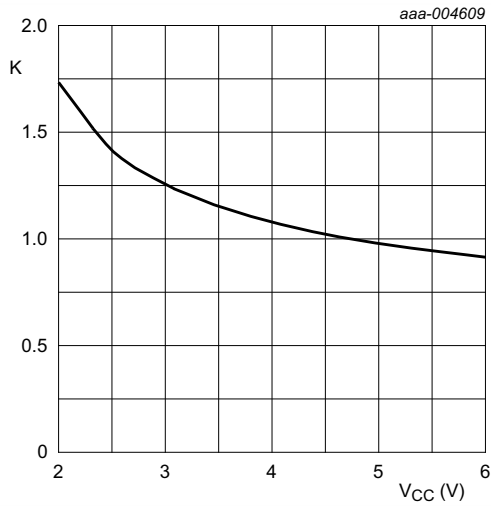


For 74HC3G14: $f = \frac{1}{T} \approx \frac{1}{0.8 \times RC}$

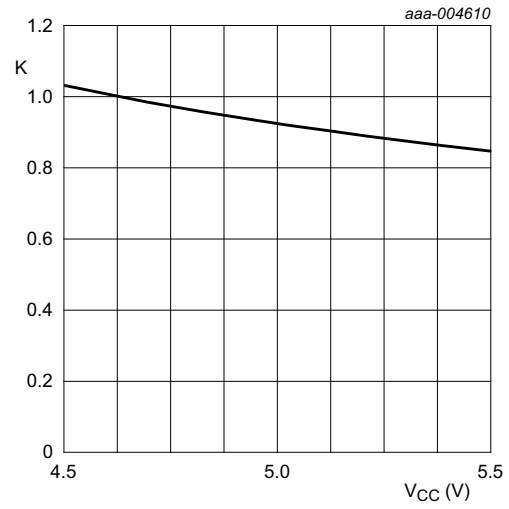
For 74HCT3G14: $f = \frac{1}{T} \approx \frac{1}{0.67 \times RC}$

For K-factor, see [Figure 15](#)

Fig 14. Relaxation oscillator



K-factor for 74HC3G14



K-factor for 74HCT3G14

Fig 15. Typical K-factor for relaxation oscillator

15. Package outline

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

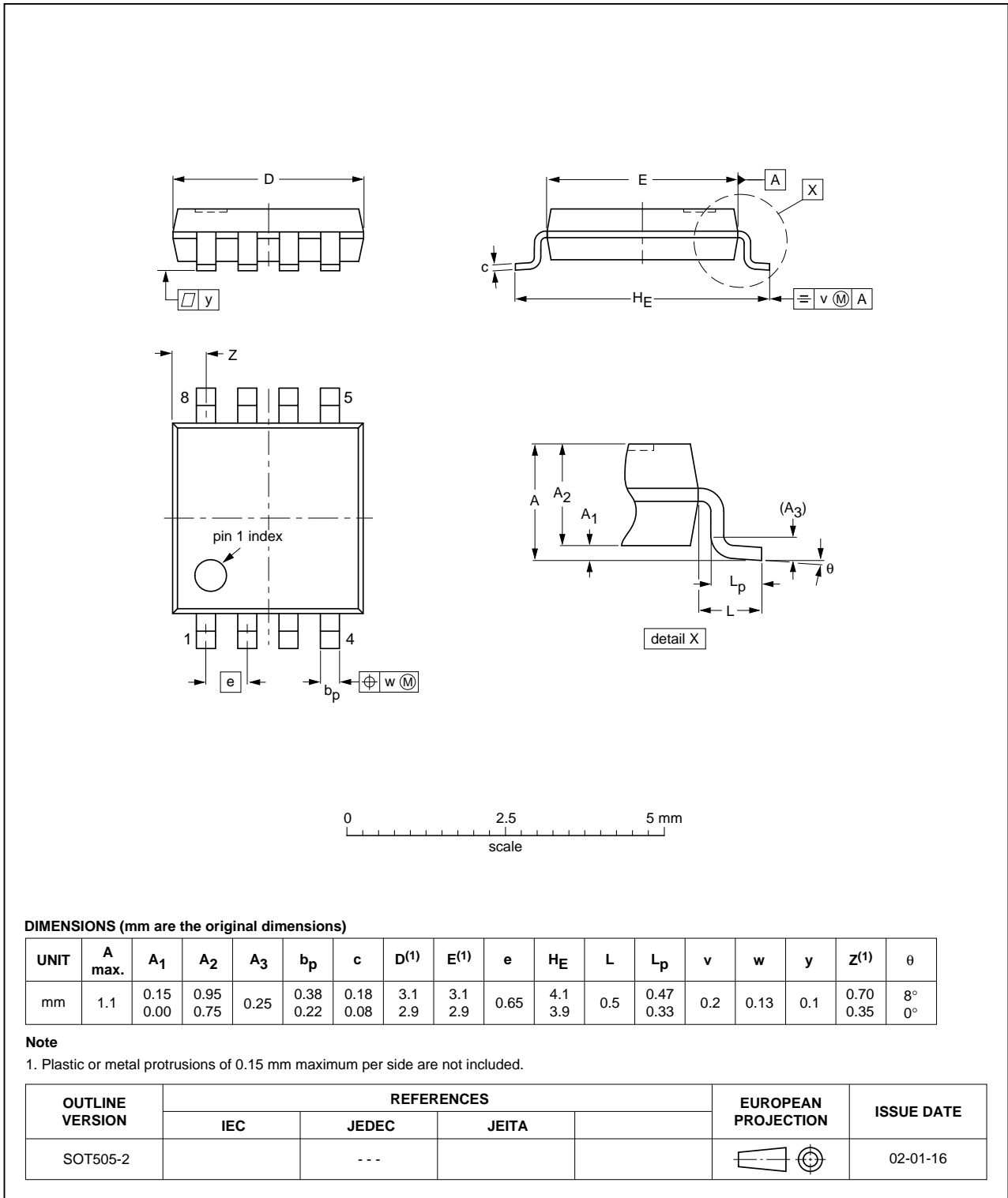


Fig 16. Package outline SOT505-2 (TSSOP8)

VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm

SOT765-1

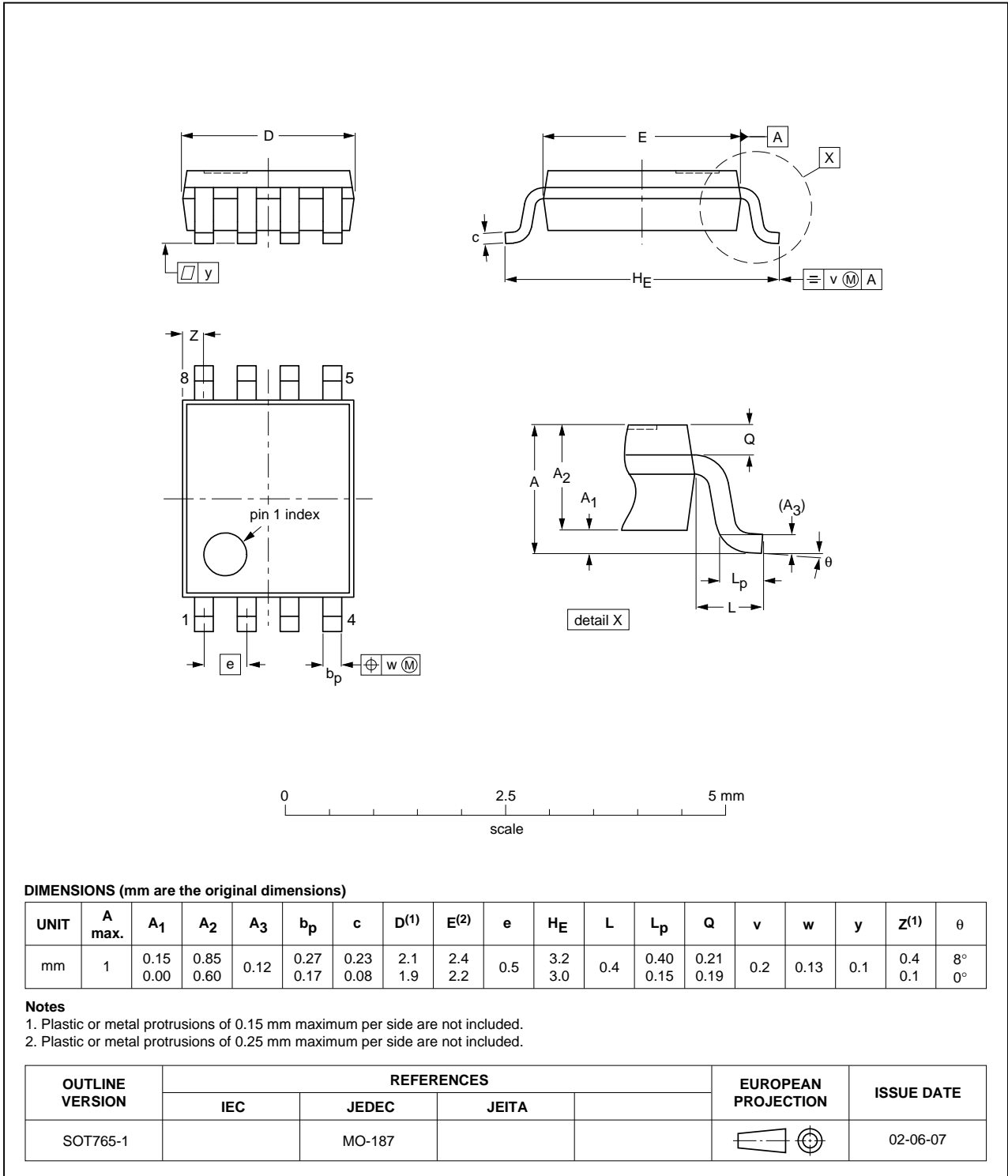


Fig 17. Package outline SOT765-1 (VSSOP8)

XSON8: plastic extremely thin small outline package; no leads;
8 terminals; body 3 x 2 x 0.5 mm

SOT996-2

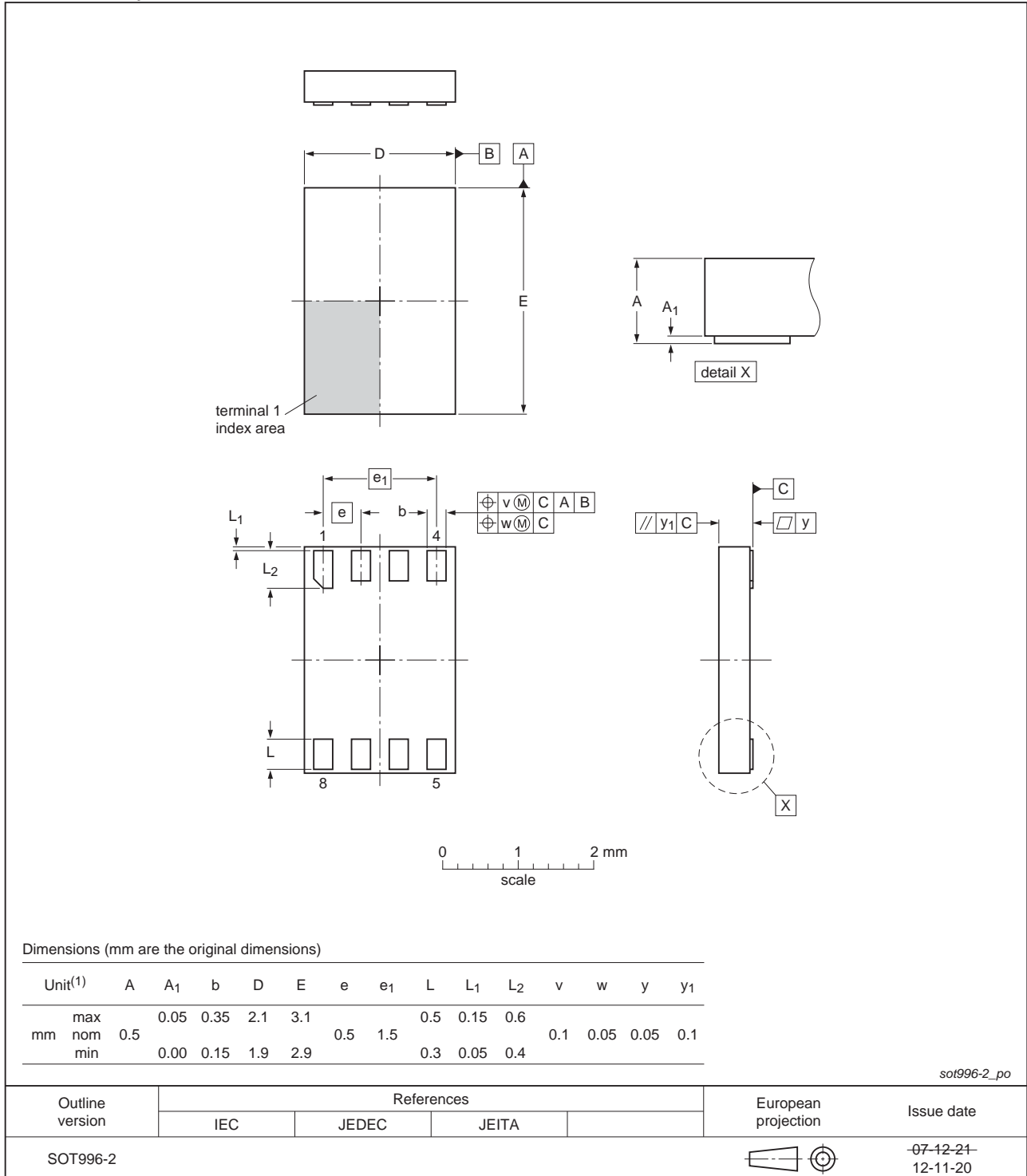


Fig 18. Package outline SOT996-2 (XSON8)

16. Abbreviations

Table 12. Abbreviations

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

17. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT3G14 v.5	20131209	Product data sheet	-	74HC_HCT3G14 v.4
Modifications:	<ul style="list-style-type: none"> • Figure 15 added (typical K-factor for relaxation oscillator). 			
74HC_HCT3G14 v.4	20131003	Product data sheet	-	74HC_HCT3G14 v.3
Modifications:	<ul style="list-style-type: none"> • For type numbers 74HC3G14GD and 74HCT3G14GD XSON8U has changed to XSON8. 			
74HC_HCT3G14 v.3	20090508	Product data sheet	-	74HC_HCT3G14 v.2
74HC_HCT3G14 v.2	20031104	Product specification	-	74HC_HCT3G14 v.1
74HC_HCT3G14 v.1	20020723	Product specification	-	-

18. Legal information

18.1 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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