

# 74HC3G14; 74HCT3G14

## Triple inverting Schmitt trigger

Rev. 5 — 9 December 2013

Product data sheet

### 1. General description

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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

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- 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

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- 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

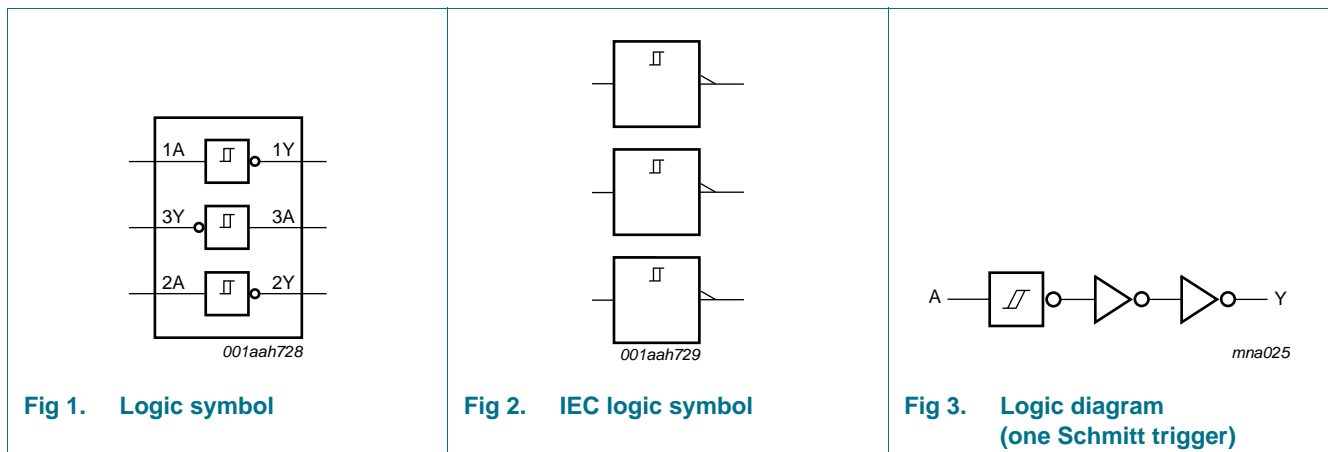
## 5. Marking

Table 2. Marking

Type number	Marking code <sup>[1]</sup>
74HC3G14DP	H14
74HCT3G14DP	T14
74HC3G14DC	H14
74HCT3G14DC	T14
74HC3G14GD	H14
74HCT3G14GD	T14

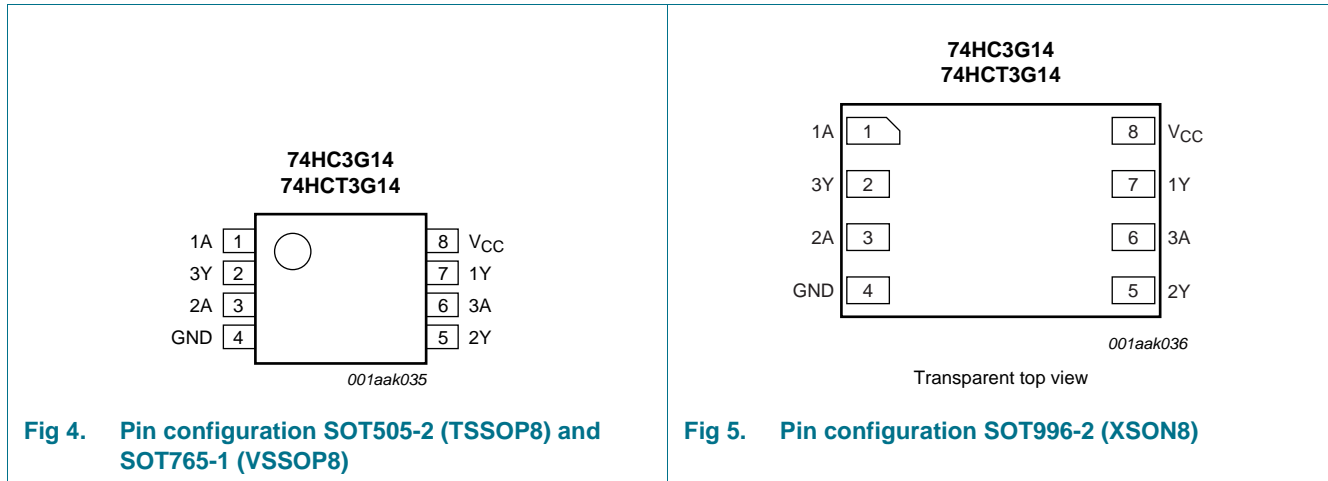
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

## 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 <sub>CC</sub>	8	supply voltage

## 8. Functional description

Table 4. Function table<sup>[1]</sup>

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  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74HC3G14</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> = -20 μA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	4.18	4.32	-	4.13	-	3.7	-	V
		I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	5.68	5.81	-	5.63	-	5.2	-	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> = 20 μA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	0.16	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.1	-	±1.0	-	±1.0	μA
I <sub>CC</sub>	supply current	per input pin; V <sub>CC</sub> = 6.0 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;	-	-	1.0	-	10	-	20	μA
C <sub>I</sub>	input capacitance		-	2.0	-	-	-	-	-	pF
<b>74HCT3G14</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> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	4.18	4.32	-	4.13	-	3.7	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = 20 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> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	±0.1	-	±1.0	-	±1.0	μA
I <sub>CC</sub>	supply current	per input pin; V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;	-	-	1.0	-	10	-	20	μA
ΔI <sub>CC</sub>	additional supply current	per input; V <sub>CC</sub> = 4.5 V to 5.5 V; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; I <sub>O</sub> = 0 A	-	-	300	-	375	-	410	μA
C <sub>I</sub>	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)	
<b>74HC3G14</b>									
V <sub>T+</sub>	positive-going threshold voltage	see <a href="#">Figure 6</a> , <a href="#">Figure 7</a>							
		V <sub>CC</sub> = 2.0 V	1.00	1.18	1.50	1.00	1.50	1.50	V
		V <sub>CC</sub> = 4.5 V	2.30	2.60	3.15	2.30	3.15	3.15	V
		V <sub>CC</sub> = 6.0 V	3.00	3.46	4.20	3.00	4.20	4.20	V
V <sub>T-</sub>	negative-going threshold voltage	see <a href="#">Figure 6</a> , <a href="#">Figure 7</a>							
		V <sub>CC</sub> = 2.0 V	0.30	0.60	0.90	0.30	0.90	0.90	V
		V <sub>CC</sub> = 4.5 V	1.13	1.47	2.00	1.13	2.00	2.00	V
		V <sub>CC</sub> = 6.0 V	1.50	2.06	2.60	1.50	2.60	2.60	V
V <sub>H</sub>	hysteresis voltage	(V <sub>T+</sub> - V <sub>T-</sub> ); see <a href="#">Figure 6</a> , <a href="#">Figure 7</a> and <a href="#">Figure 9</a>							
		V <sub>CC</sub> = 2.0 V	0.30	0.60	1.00	0.30	1.00	1.00	V
		V <sub>CC</sub> = 4.5 V	0.60	1.13	1.40	0.60	1.40	1.40	V
		V <sub>CC</sub> = 6.0 V	0.80	1.40	1.70	0.80	1.70	1.70	V
<b>74HCT3G14</b>									
V <sub>T+</sub>	positive-going threshold voltage	see <a href="#">Figure 6</a> , <a href="#">Figure 7</a>							
		V <sub>CC</sub> = 4.5 V	1.20	1.58	1.90	1.20	1.90	1.90	V
		V <sub>CC</sub> = 5.5 V	1.40	1.78	2.10	1.40	2.10	2.10	V
V <sub>T-</sub>	negative-going threshold voltage	see <a href="#">Figure 6</a> , <a href="#">Figure 7</a>							
		V <sub>CC</sub> = 4.5 V	0.50	0.87	1.20	0.50	1.20	1.20	V
		V <sub>CC</sub> = 5.5 V	0.60	1.11	1.40	0.60	1.40	1.40	V
V <sub>H</sub>	hysteresis voltage	(V <sub>T+</sub> - V <sub>T-</sub> ); see <a href="#">Figure 6</a> , <a href="#">Figure 7</a> and <a href="#">Figure 8</a>							
		V <sub>CC</sub> = 4.5 V	0.40	0.71	-	0.40	-	-	V
		V <sub>CC</sub> = 5.5 V	0.40	0.67	-	0.40	-	-	V

11.1 Waveforms transfer characteristics

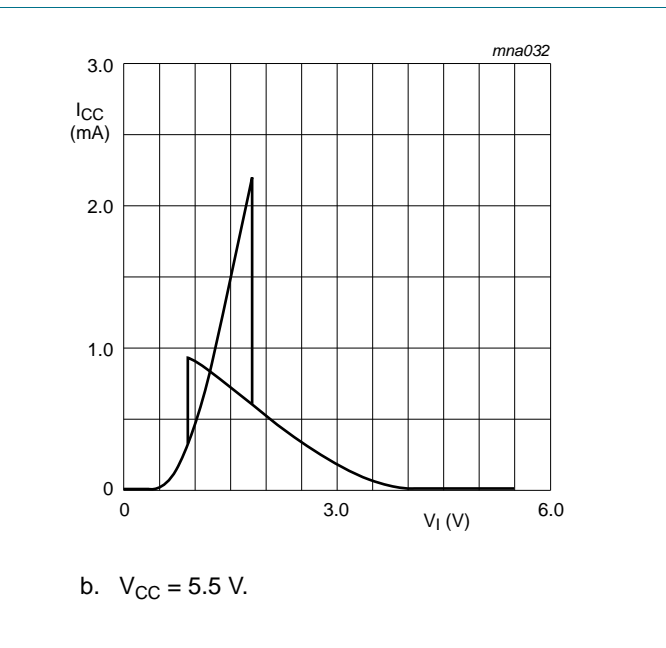
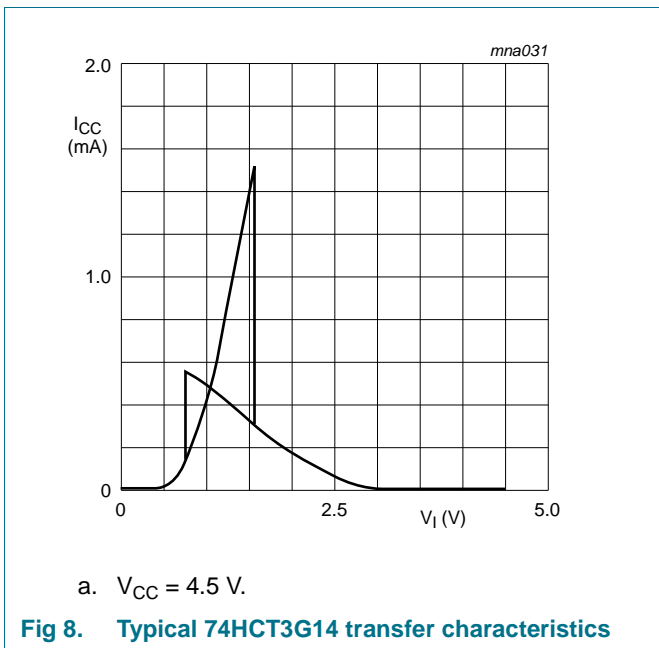
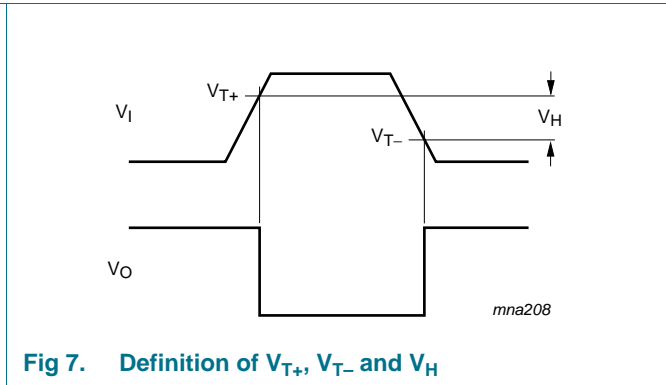
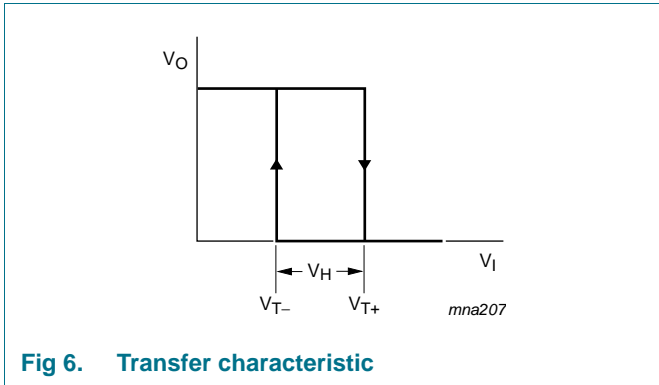
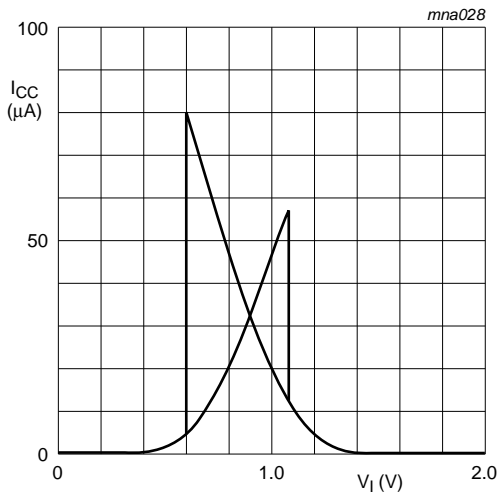
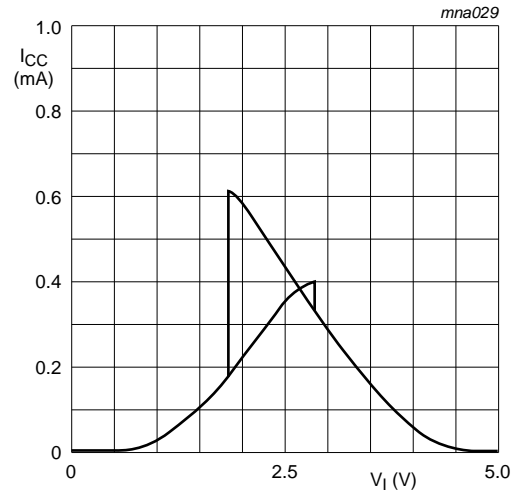


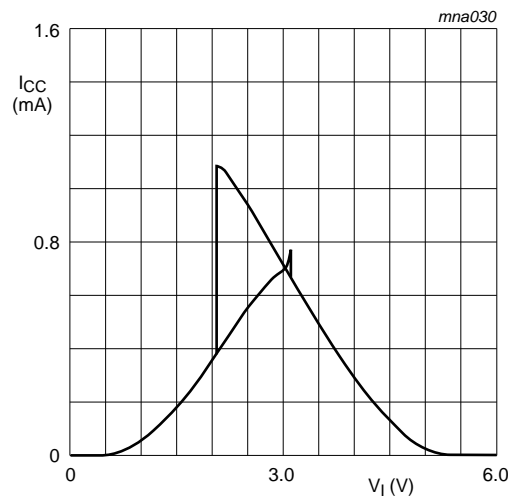
Fig 8. Typical 74HCT3G14 transfer characteristics



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)	
<b>74HC3G14</b>									
t <sub>pd</sub>	propagation delay	nA to nY; see <a href="#">Figure 10</a> <a href="#">[1]</a>							
		V <sub>CC</sub> = 2.0 V	-	53	125	-	155	190	ns
		V <sub>CC</sub> = 4.5 V	-	16	25	-	31	38	ns
		V <sub>CC</sub> = 6.0 V	-	13	21	-	26	32	ns
t <sub>t</sub>	transition time	nY; see <a href="#">Figure 10</a> <a href="#">[2]</a>							
		V <sub>CC</sub> = 2.0 V	-	20	75	-	95	110	ns
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	22	ns
		V <sub>CC</sub> = 6.0 V	-	5	13	-	16	19	ns
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub> <a href="#">[3]</a>	-	10	-	-	-	-	pF
<b>74HCT3G14</b>									
t <sub>pd</sub>	propagation delay	nA to nY; see <a href="#">Figure 10</a> <a href="#">[1]</a>							
		V <sub>CC</sub> = 4.5 V	-	21	32	-	40	48	ns
t <sub>t</sub>	transition time	nY; see <a href="#">Figure 10</a> <a href="#">[2]</a>							
		V <sub>CC</sub> = 4.5 V	-	6	15	-	19	22	ns
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V <a href="#">[3]</a>	-	10	-	-	-	-	pF

[1] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>

[2] t<sub>t</sub> is the same as t<sub>TLH</sub> and t<sub>THL</sub>

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> 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<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

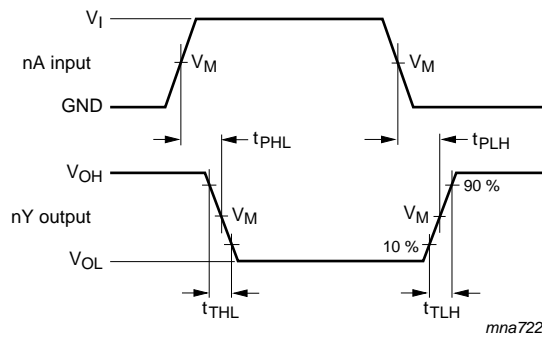
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of the outputs.

### 13. Waveforms



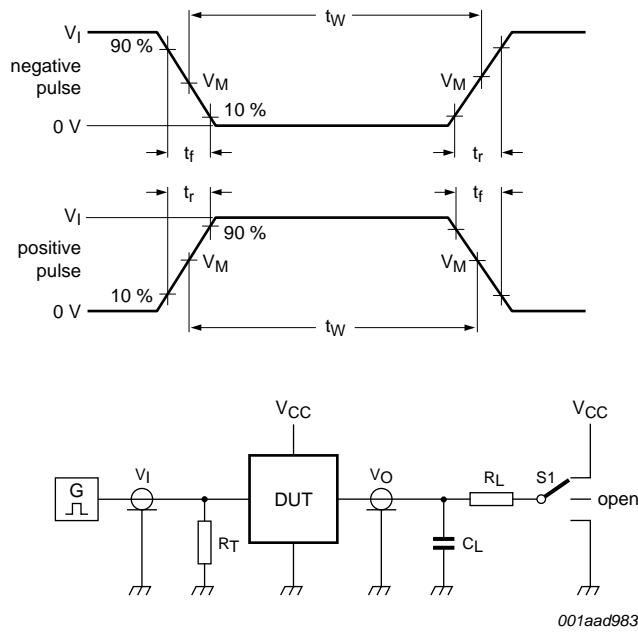
Measurement points are given in [Table 10](#).

$V_{OL}$  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



001aad983

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 $V_{CC}$	$\leq 6$ ns	50 pF	1 k $\Omega$	open
74HCT3G14	GND to 3.0 V	$\leq 6$ ns	50 pF	1 k $\Omega$	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 ( $\mu W$ );

$f_i$  = input frequency (MHz);

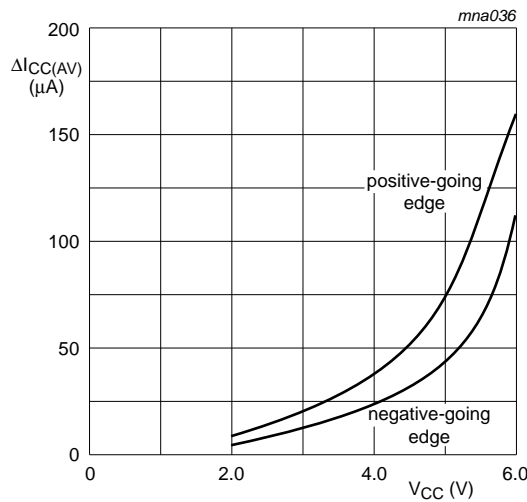
$t_r$  = input rise time (ns); 10 % to 90 %;

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

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

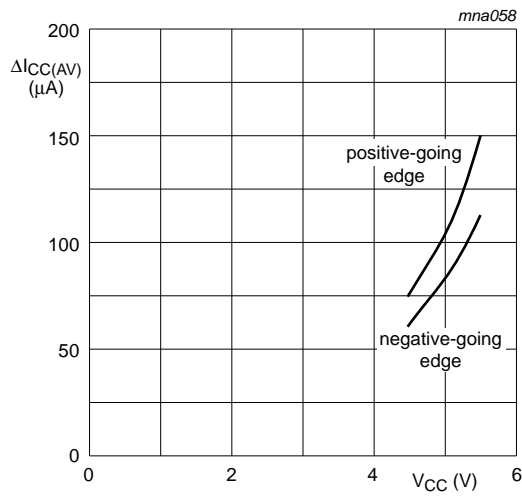
$\Delta I_{CC(AV)}$  differs with positive or negative input transitions, as shown in [Figure 12](#) and [Figure 13](#).

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



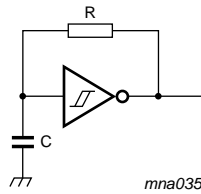
linear change of  $V_i$  between  $0.1V_{CC}$  to  $0.9V_{CC}$ .

**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

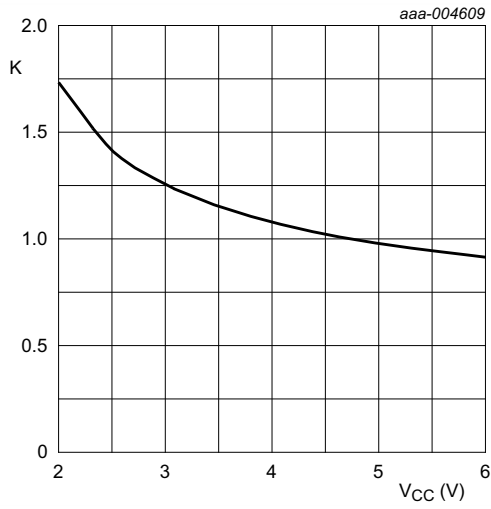


For 74HC3G14:  $f = \frac{1}{T} \approx \frac{1}{0.8 \times RC}$

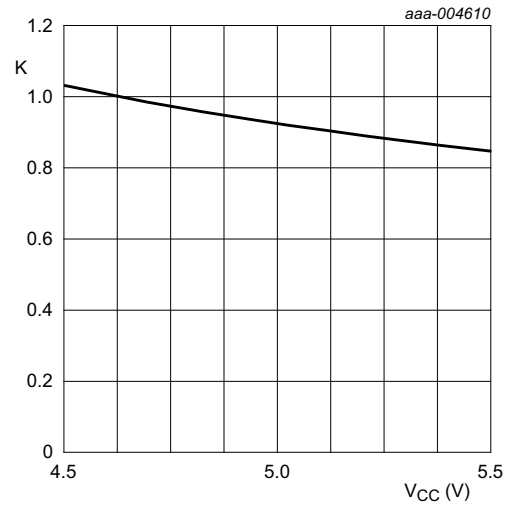
For 74HCT3G14:  $f = \frac{1}{T} \approx \frac{1}{0.67 \times RC}$

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

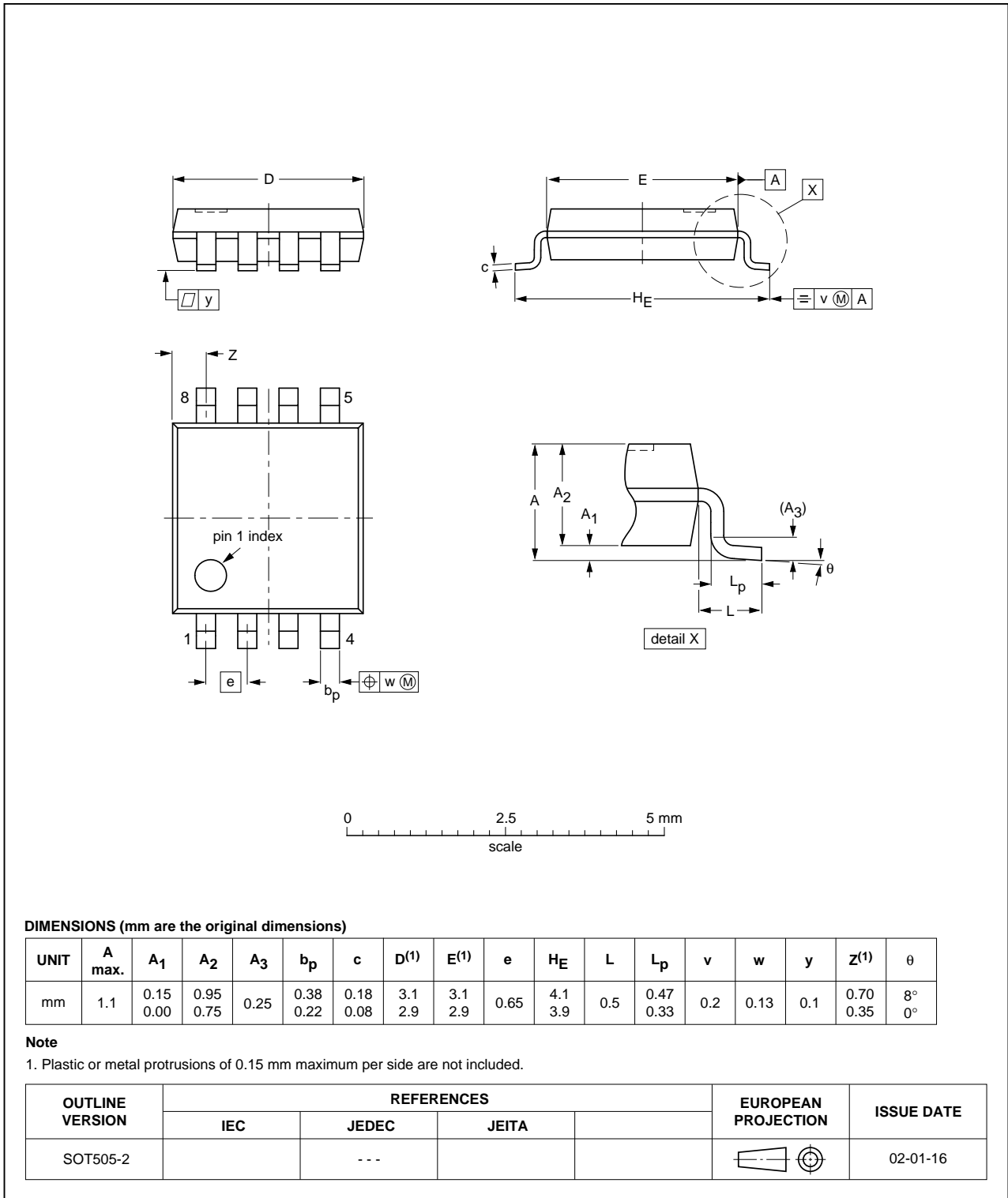


Fig 16. Package outline SOT505-2 (TSSOP8)

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

SOT765-1

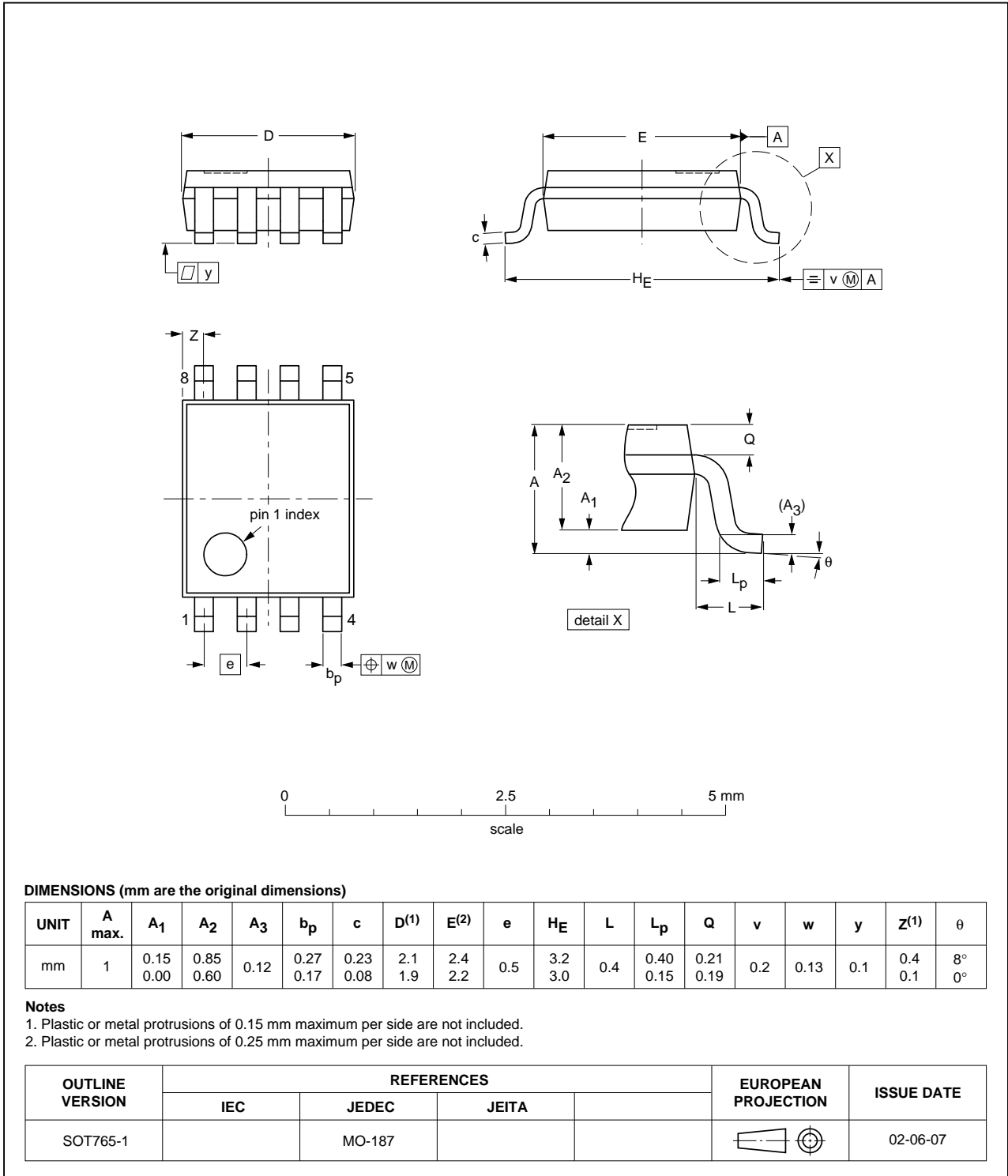


Fig 17. Package outline SOT765-1 (VSSOP8)

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

SOT996-2

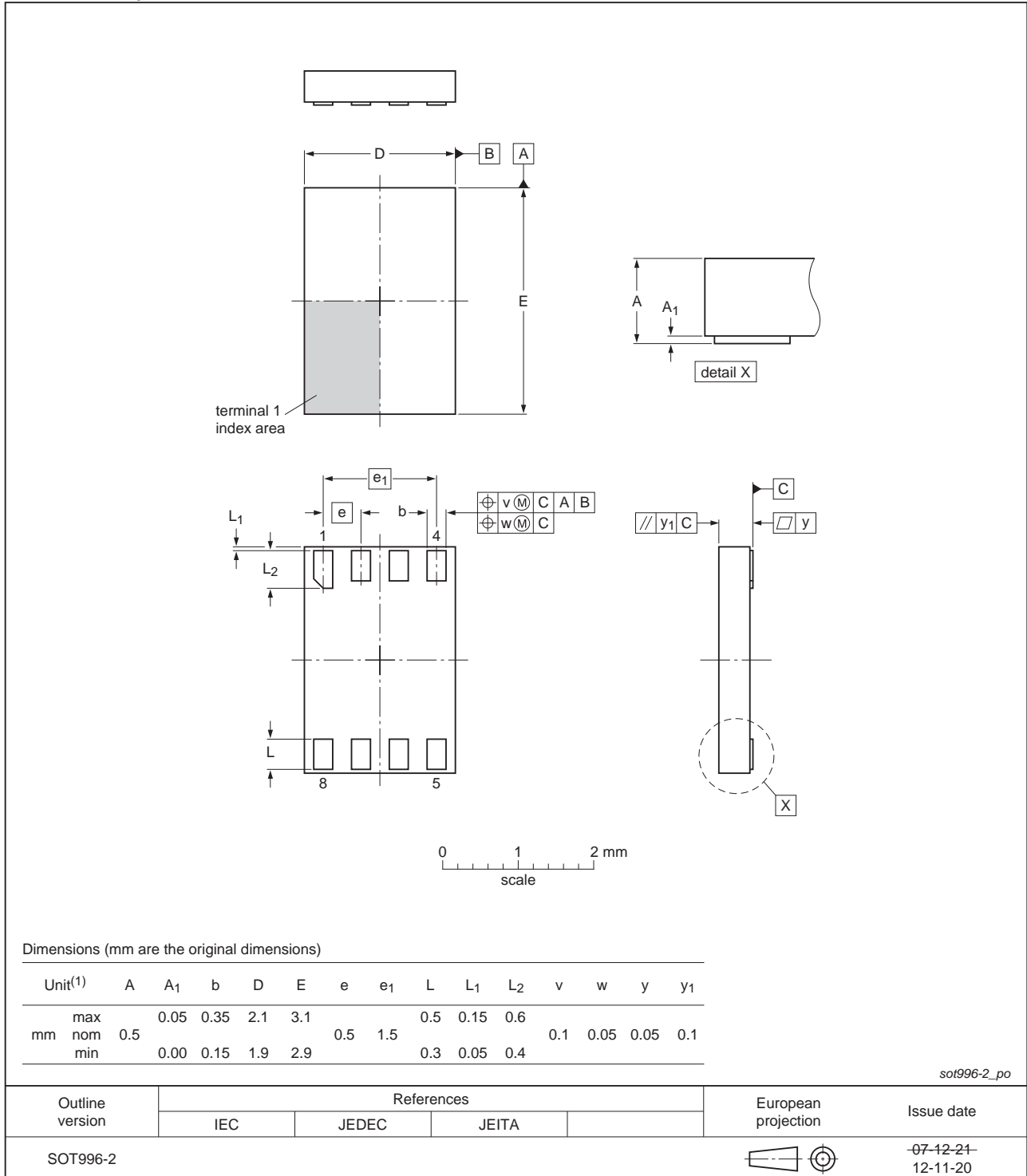


Fig 18. Package outline SOT996-2 (XSON8)

## 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"> <li>• <a href="#">Figure 15</a> added (typical K-factor for relaxation oscillator).</li> </ul>			
74HC_HCT3G14 v.4	20131003	Product data sheet	-	74HC_HCT3G14 v.3
Modifications:	<ul style="list-style-type: none"> <li>• For type numbers 74HC3G14GD and 74HCT3G14GD XSON8U has changed to XSON8.</li> </ul>			
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 <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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