

# 74HC3G06; 74HCT3G06

Triple inverter with open-drain outputs

Rev. 03 — 11 May 2009

Product data sheet

## 1. General description

The 74HC3G06 and 74HCT3G06 are high-speed Si-gate CMOS devices. They provide three inverting buffers with open-drain outputs.

The outputs of the 74HC3G06 and 74HCT3G06 devices are open drains and can be connected to other open-drain outputs to implement active-LOW wired-OR or active-HIGH wired-AND functions. For digital operation this device must have a pull-up resistor to establish a logic HIGH-level.

The HC device has CMOS input switching levels and supply voltage range 2 V to 6 V.

The HCT device has TTL input switching levels and supply voltage range 4.5 V to 5.5 V.

## 2. Features

- Wide supply voltage range from 2.0 V to 6.0 V
- High noise immunity
- Low power dissipation
- Multiple package options
- ESD protection:
  - ◆ HBM JESD22-A114E exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

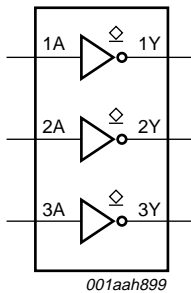
Type number	Package			
	Temperature range	Name	Description	Version
74HC3G06DP 74HCT3G06DP	-40 °C to +125 °C	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm	SOT505-2
74HC3G06DC 74HCT3G06DC	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1
74HC3G06GD 74HCT3G06GD	-40 °C to +125 °C	XSON8U	plastic extremely thin small outline package; no leads; 8 terminals; UTLP based; body 3 × 2 × 0.5 mm	SOT996-2

## 4. Marking

Table 2. Marking code

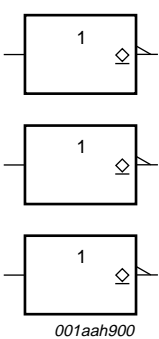
Type number	Marking code
74HC3G06DP	H06
74HCT3G06DP	T06
74HC3G06DC	H06
74HCT3G06DC	T06
74HC3G06GD	H06
74HCT3G06GD	T06

## 5. Functional diagram



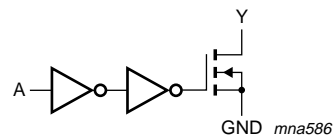
001aah899

**Fig 1. Logic symbol**



001aah900

**Fig 2. IEC logic symbol**

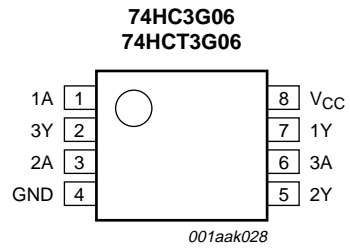


001aah900

**Fig 3. Logic diagram (one inverter)**

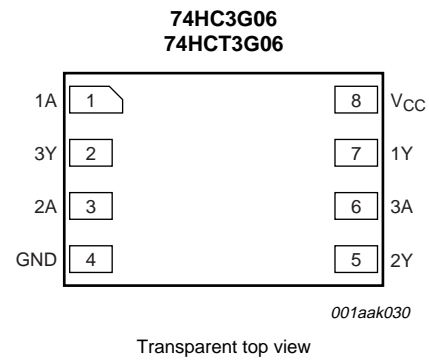
## 6. Pinning information

### 6.1 Pinning



001aak028

**Fig 4. Pin configuration SOT505-2 (TSSOP8) and SOT765-1 (VSSOP8)**



001aak030

Transparent top view

**Fig 5. Pin configuration SOT996-2 (XSON8U)**

## 6.2 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

## 7. Functional description

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

Input nA	Output nY
L	Z
H	L

[1] H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

## 8. 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 <sub>CC</sub>	supply voltage		-0.5	7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V	[1] -	±20	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < -0.5 V	[1] -20	-	mA
V <sub>O</sub>	output voltage	active mode	[1] -0.5	V <sub>CC</sub> + 0.5	V
		high-impedance mode	[1] -0.5	7.0	V
I <sub>O</sub>	output current	V <sub>O</sub> = -0.5 V to 7.0 V	[1] -	25	mA
I <sub>CC</sub>	supply current		[1] -	50	mA
I <sub>GND</sub>	ground current		[1] -50	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>D</sub>	dynamic power dissipation	T <sub>amb</sub> = -40 °C to +125 °C	[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<sub>tot</sub> derates linearly with 2.5 mW/K.  
 For VSSOP8 package: above 110 °C the value of P<sub>tot</sub> derates linearly with 8 mW/K.  
 For XSON8U package: above 118 °C the value of P<sub>tot</sub> derates linearly with 7.8 mW/K.

## 9. Recommended operating conditions

**Table 6. Recommended operating conditions**

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

Symbol	Parameter	Conditions	74HC3G06			74HCT3G06			Unit
			Min	Typ	Max	Min	Typ	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V <sub>I</sub>	input voltage		0	-	6.0	0	-	5.5	V
V <sub>O</sub>	output voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 2.0 V	-	-	625	-	-	-	ns/V
		V <sub>CC</sub> = 4.5 V	-	1.67	139	-	1.67	139	ns/V
		V <sub>CC</sub> = 6.0 V	-	-	83	-	-	-	ns/V

## 10. Static characteristics

**Table 7. Static characteristics**

Voltages are referenced to GND (ground = 0 V). All typical values are measured at T<sub>amb</sub> = 25 °C.

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
<b>74HC3G06</b>								
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	1.2	-	1.5	-	V
		V <sub>CC</sub> = 4.5 V	3.15	2.4	-	3.15	-	V
		V <sub>CC</sub> = 6.0 V	4.2	3.2	-	4.2	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	0.8	0.5	-	0.5	V
		V <sub>CC</sub> = 4.5 V	-	2.1	1.35	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	2.8	1.8	-	1.8	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> = 2.0 V	-	0	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	0	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.33	-	0.4	V
I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	0.16	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	μA
I <sub>LO</sub>	output leakage current	V <sub>I</sub> = V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND	-	-	±5.0	-	±10	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;	-	-	10	-	20	μA
C <sub>I</sub>	input capacitance		-	1.5	-	-	-	pF

**Table 7. Static characteristics ...continued**

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

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
<b>74HCT3G06</b>								
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	2.0	1.6	-	2.0	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	-	1.2	0.8	-	0.8	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$						
		$I_O = 20\text{ }\mu\text{A}; V_{CC} = 4.5\text{ V}$	-	0	0.1	-	0.1	V
		$I_O = 4.0\text{ mA}; V_{CC} = 4.5\text{ V}$	-	0.15	0.33	-	0.4	V
$I_I$	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$	-	-	$\pm 1.0$	-	$\pm 1.0$	$\mu\text{A}$
$I_{LO}$	output leakage current	$V_I = V_{IL}; V_O = V_{CC}$ or GND	-	-	$\pm 5.0$	-	$\pm 10$	$\mu\text{A}$
$I_{CC}$	supply current	per input pin; $V_{CC} = 5.5\text{ V}; V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$ ;	-	-	10	-	20	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	per input; $V_{CC} = 4.5\text{ V to }5.5\text{ V}; V_I = V_{CC} - 2.1\text{ V}; I_O = 0\text{ A}$	-	-	375	-	410	$\mu\text{A}$
$C_I$	input capacitance		-	1.5	-	-	-	pF

[1] Typical values are measured at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

## 11. Dynamic characteristics

**Table 8. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); all typical values are measured at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ; for test circuit see [Figure 7](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
<b>74HC3G06</b>								
$t_{PZL}$	OFF-state to LOW propagation delay	nA to nY; see <a href="#">Figure 6</a>						
		$V_{CC} = 2.0\text{ V}$	-	22	95	-	125	ns
		$V_{CC} = 4.5\text{ V}$	-	9	18	-	25	ns
		$V_{CC} = 6.0\text{ V}$	-	8	16	-	20	ns
$t_{PLZ}$	LOW to OFF-state propagation delay	nA to nY; see <a href="#">Figure 6</a>						
		$V_{CC} = 2.0\text{ V}$	-	24	95	-	125	ns
		$V_{CC} = 4.5\text{ V}$	-	11	20	-	27	ns
		$V_{CC} = 6.0\text{ V}$	-	10	19	-	23	ns
$t_{THL}$	HIGH to LOW output transition time	nY; see <a href="#">Figure 6</a>						
		$V_{CC} = 2.0\text{ V}$	-	18	95	-	125	ns
		$V_{CC} = 4.5\text{ V}$	-	6	19	-	25	ns
		$V_{CC} = 6.0\text{ V}$	-	5	16	-	20	ns
$C_{PD}$	power dissipation capacitance	$V_I = \text{GND to } V_{CC}$	<sup>[1]</sup>	4	-	-	-	pF

**Table 8. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V); all typical values are measured at  $T_{amb} = 25\text{ }^\circ\text{C}$ ; for test circuit see [Figure 7](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
<b>74HCT3G06</b>								
$t_{PZL}$	OFF-state to LOW propagation delay	nA to nY; see <a href="#">Figure 6</a> $V_{CC} = 4.5\text{ V}$	-	9	24	-	29	ns
$t_{PLZ}$	LOW to OFF-state propagation delay	nA to nY; see <a href="#">Figure 6</a> $V_{CC} = 4.5\text{ V}$	-	12	27	-	32	ns
$t_{THL}$	HIGH to LOW output transition time	$V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 6</a>	-	6	19	-	22	ns
$C_{PD}$	power dissipation capacitance	$V_I = \text{GND to } V_{CC} - 1.5\text{ V}$ <a href="#">[1]</a>	-	4	-	-	-	pF

[1]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

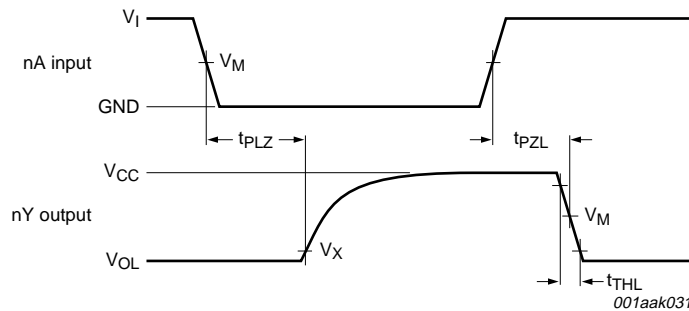
$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

$\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

## 12. Waveforms



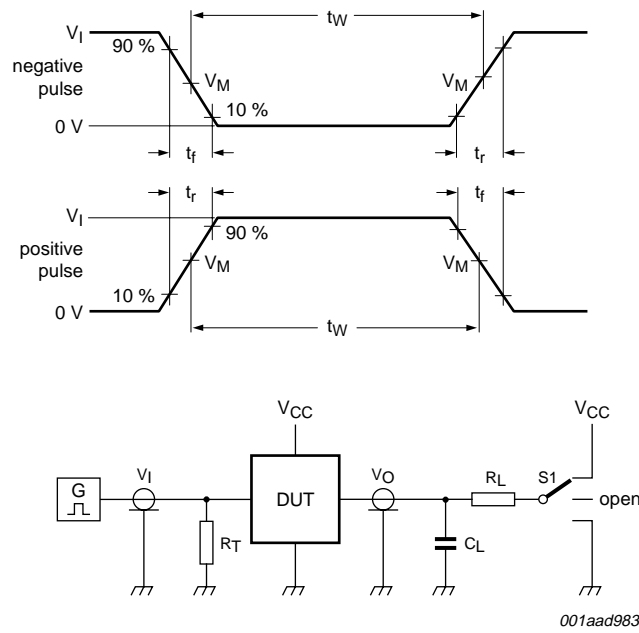
Measurement points are given in [Table 9](#).

$V_{OL}$  is the typical output voltage level that occurs with the output load.

**Fig 6. The input (nA) to output (nY) propagation delays**

**Table 9. Measurement points**

Type	Input	Output	
	$V_M$	$V_M$	$V_X$
74HC3G06	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$0.1 \times V_{CC}$
74HCT3G06	1.3 V	1.3 V	$0.1 \times V_{CC}$



Test data is given in [Table 10](#).

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 7. Test circuit for measuring switching times**

**Table 10. Test data**

Type	Input		Load			S1 position
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{pZL}, t_{PLZ}$	
74HC3G06	GND to $V_{CC}$	$\leq 6$ ns	50 pF	1 k $\Omega$	$V_{CC}$	
74HCT3G06	GND to 3 V	$\leq 6$ ns	50 pF	1 k $\Omega$	$V_{CC}$	

13. Package outline

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

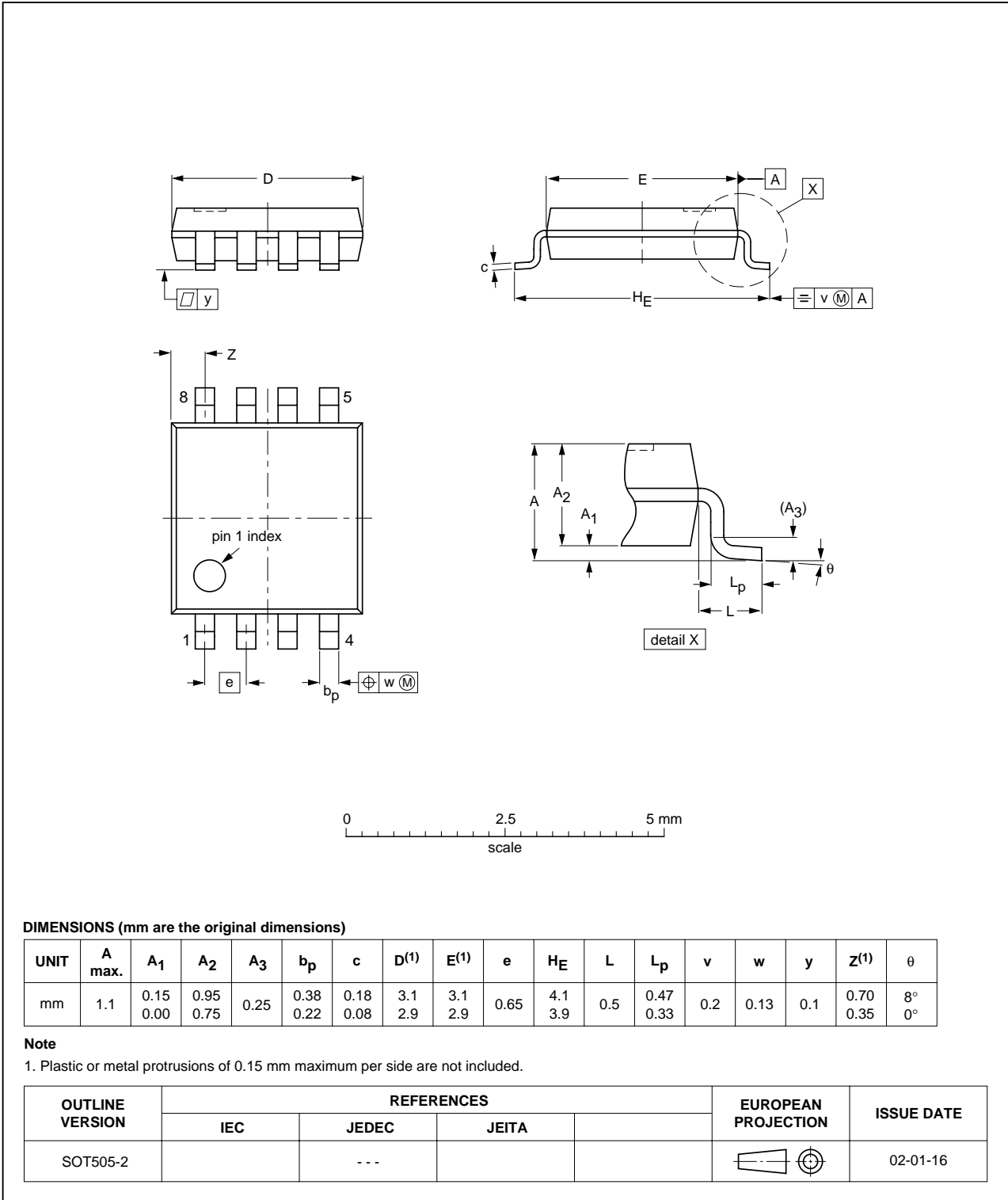


Fig 8. Package outline SOT505-2 (TSSOP8)



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

SOT765-1

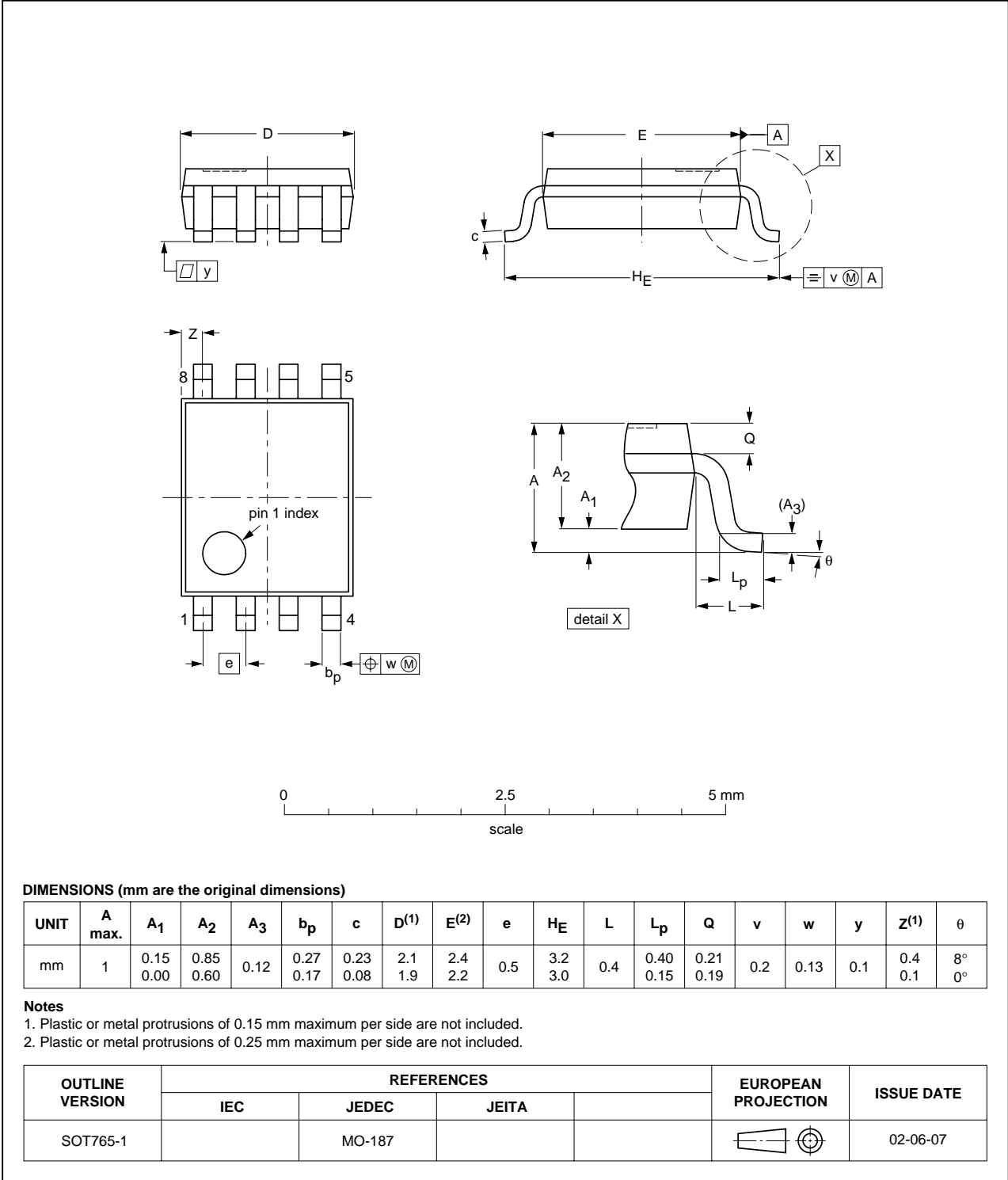


Fig 9. Package outline SOT765-1 (VSSOP8)

XSON8U: plastic extremely thin small outline package; no leads;  
8 terminals; UTLP based; body 3 x 2 x 0.5 mm

SOT996-2

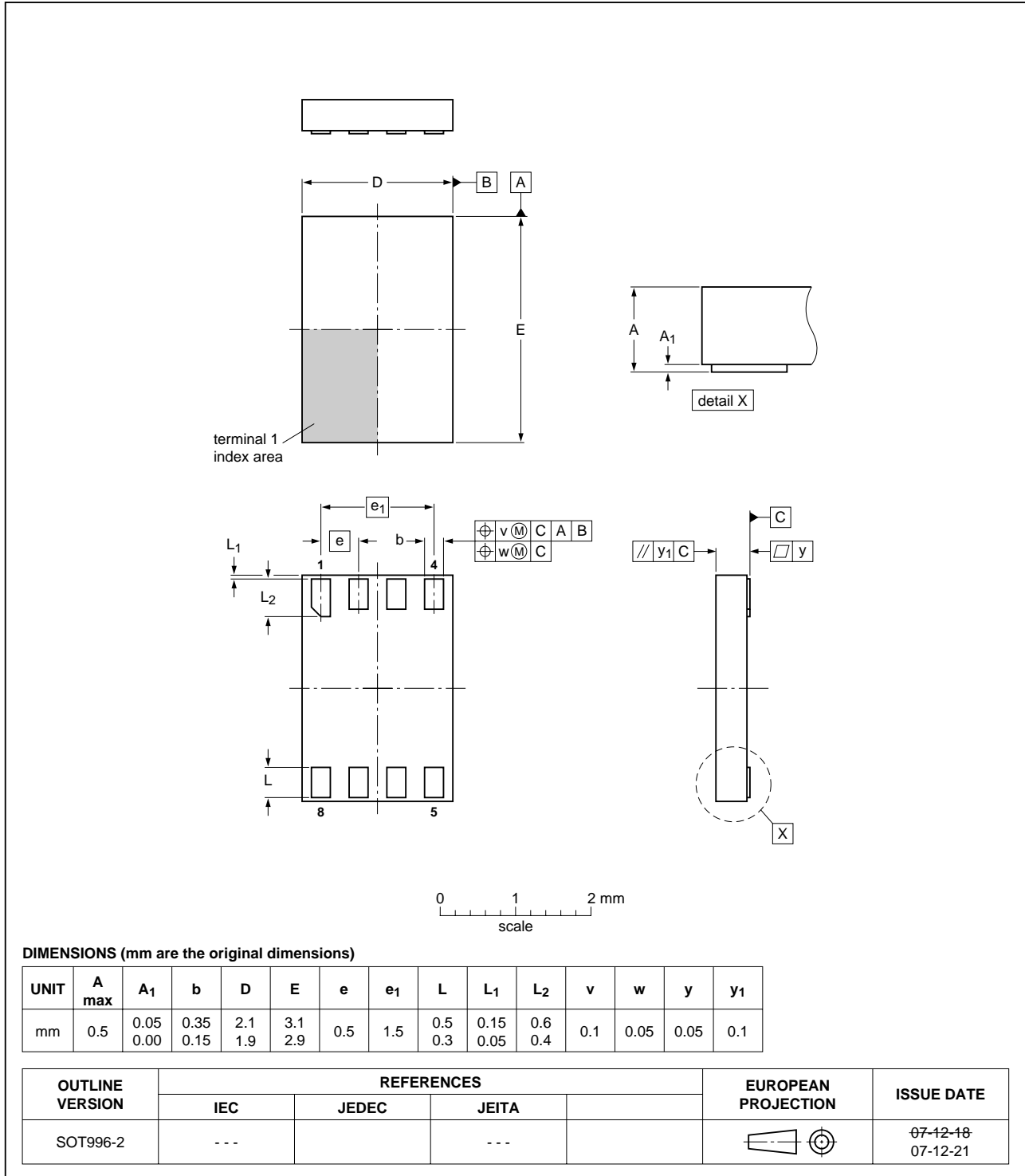


Fig 10. Package outline SOT996-2 (XSON8U)

## 14. Abbreviations

Table 11. Abbreviations

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

## 15. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT3G06_3	20090511	Product data sheet	-	74HC_HCT3G06_2
Modifications:		<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li><li>• Added type number 74HC3G06GD and 74HCT3G06GD (XSON8U package)</li></ul>		
74HC_HCT3G06_2	20031202	Product specification	-	74HC_HCT3G06_1
74HC_HCT3G06_1	20030515	Product specification	-	-

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### 16.1 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.
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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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