

74HC2G00; 74HCT2G00

Dual 2-input NAND gate

Rev. 5 — 26 September 2013

Product data sheet

1. General description

The 74HC2G00; 74HCT2G00 is a dual 2-input NAND gate. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} .

2. Features and benefits

- Wide supply voltage range from 2.0 V to 6.0 V
- Input levels:
 - ◆ For 74HC2G00: CMOS level
 - ◆ For 74HCT2G00: TTL level
- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- Multiple package options
- ESD protection:
 - ◆ HBM JESD22-A114E exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
- Specified from -40 °C to $+85\text{ °C}$ and -40 °C to $+125\text{ °C}$

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC2G00DP 74HCT2G00DP	-40 °C to $+125\text{ °C}$	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm	SOT505-2
74HC2G00DC 74HCT2G00DC	-40 °C to $+125\text{ °C}$	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1
74HC2G00GD 74HCT2G00GD	-40 °C to $+125\text{ °C}$	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body $3 \times 2 \times 0.5$ mm	SOT996-2

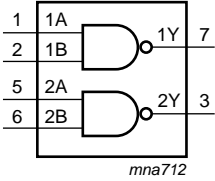
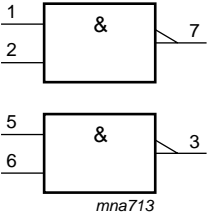
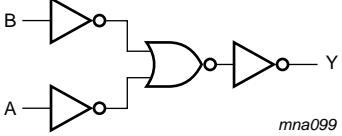
4. Marking

Table 2. Marking code

Type number	Marking code ^[1]
74HC2G00DP	H00
74HCT2G00DP	T00
74HC2G00DC	H00
74HCT2G00DC	T00
74HC2G00GD	H00
74HCT2G00GD	T00

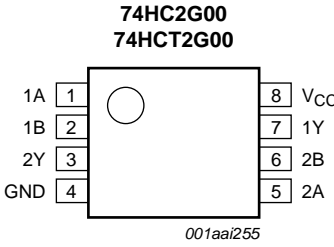
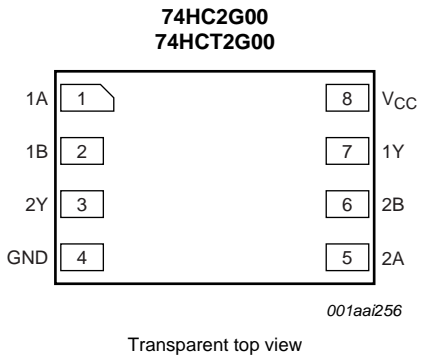
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram

 <p>Fig 1. Logic symbol</p>	 <p>Fig 2. IEC logic symbol</p>	 <p>Fig 3. Logic diagram (one driver)</p>
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6. Pinning information

6.1 Pinning

 <p>Fig 4. Pin configuration SOT505-2 (TSSOP8) and SOT765-1 (VSSOP8)</p>	 <p>Fig 5. Pin configuration SOT996-2 (XSON8)</p>
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6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
1A, 2A	1, 5	data input
1B, 2B	2, 6	data input
GND	4	ground (0 V)
1Y, 2Y	7, 3	data output
V _{CC}	8	supply voltage

7. Functional description

Table 4. Function table^[1]

Input		Output
nA	nB	nY
L	L	H
L	H	H
H	L	H
H	H	L

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

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 _{CC}	supply voltage		-0.5	+7.0	V
I _{IK}	input clamping current	V _I < -0.5 V or V _I > V _{CC} + 0.5 V	[1]	±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	V _O = -0.5 V to (V _{CC} + 0.5 V)	[1]	25	mA
I _{CC}	supply current		[1]	50	mA
I _{GND}	ground current		[1]	-	mA
T _{stg}	storage temperature		-65	+150	°C
P _D	dynamic power dissipation	T _{amb} = -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_{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 45 °C the value of P_{tot} derates linearly with 2.4 mW/K.

9. Recommended operating conditions

Table 6. Recommended operating conditions

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

Symbol	Parameter	Conditions	74HC2G00			74HCT2G00			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
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0\text{ V}$	-	-	625	-	-	-	ns/V
		$V_{CC} = 4.5\text{ V}$	-	1.67	139	-	1.67	139	ns/V
		$V_{CC} = 6.0\text{ V}$	-	-	83	-	-	-	ns/V

10. Static characteristics

Table 7. Static characteristics

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

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
74HC2G00								
V_{IH}	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.5	1.2	-	1.5	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	2.4	-	3.15	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	3.2	-	4.2	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$	-	0.8	0.5	-	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	2.1	1.35	-	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	2.8	1.8	-	1.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}						
		$I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 2.0\text{ V}$	1.9	2.0	-	1.9	-	V
		$I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 4.5\text{ V}$	4.4	4.5	-	4.4	-	V
		$I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 6.0\text{ V}$	5.9	6.0	-	5.9	-	V
		$I_O = -4.0\text{ mA}$; $V_{CC} = 4.5\text{ V}$	4.13	4.32	-	3.7	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}						
		$I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 2.0\text{ V}$	-	0	0.1	-	0.1	V
		$I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 4.5\text{ V}$	-	0	0.1	-	0.1	V
		$I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 6.0\text{ V}$	-	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
		$I_O = 5.2\text{ mA}$; $V_{CC} = 6.0\text{ V}$	-	0.16	0.33	-	0.4	V
I_I	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0\text{ V}$	-	-	± 1.0	-	± 1.0	μA
I_{CC}	supply current	per input pin; $V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$; $V_{CC} = 6.0\text{ V}$	-	-	10	-	20	μA
C_I	input capacitance		-	1.5	-	-	-	pF

Table 7. Static characteristics ...continued

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

Symbol	Parameter	Conditions	–40 °C to +85 °C			–40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
74HCT2G00								
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_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}						
		$I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 4.5\text{ V}$	4.4	4.5	-	4.4	-	V
		$I_O = -4.0\text{ mA}$; $V_{CC} = 4.5\text{ V}$	4.13	4.32	-	3.7	-	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; $V_{CC} = 5.5\text{ V}$	-	-	± 1.0	-	± 1.0	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$; $V_{CC} = 5.5\text{ V}$	-	-	10	-	20	μA
ΔI_{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	μA
C_I	input capacitance		-	1.5	-	-	-	pF

11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); all typical values are measured at $T_{amb} = 25\text{ °C}$; 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	
74HC2G00								
t_{pd}	propagation delay	nA and nB to nY; see Figure 6 [1]						
		$V_{CC} = 2.0\text{ V}$	-	25	95	-	110	ns
		$V_{CC} = 4.5\text{ V}$	-	9	19	-	22	ns
		$V_{CC} = 6.0\text{ V}$	-	7	16	-	20	ns
t_t	transition time	see Figure 6 [2]						
		$V_{CC} = 2.0\text{ V}$	-	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	$V_I = \text{GND to } V_{CC}$ [3]	-	10	-	-	-	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	
74HCT2G00								
t_{pd}	propagation delay	nA and nB to nY; see Figure 6	[1]					
		$V_{CC} = 4.5\text{ V}$	-	12	24	-	29	ns
t_t	transition time	$V_{CC} = 4.5\text{ V}$; see Figure 6	[2]	6	19	-	22	ns
C_{PD}	power dissipation capacitance	$V_I = \text{GND to } V_{CC} - 1.5\text{ V}$	[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).
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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

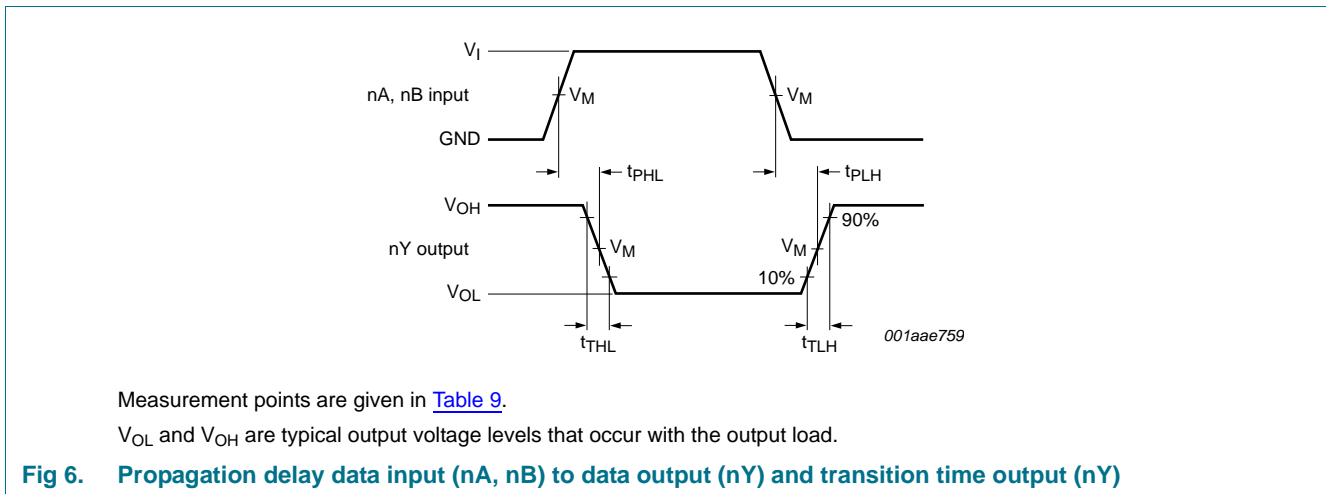
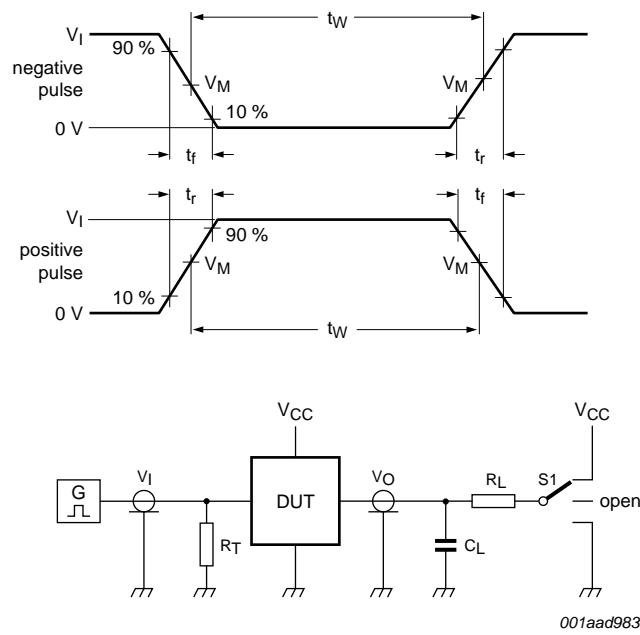


Table 9. Measurement points

Type	Input	Output
	V_M	V_M
74HC2G00	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
74HCT2G00	1.3 V	1.3 V



001aad983

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. Load 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_{PHL}, t_{PLH}
74HC2G00	V_{CC}	≤ 6 ns	50 pF	1 k Ω	open
74HCT2G00	3 V	≤ 6 ns	50 pF	1 k Ω	open

13. Package outline

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

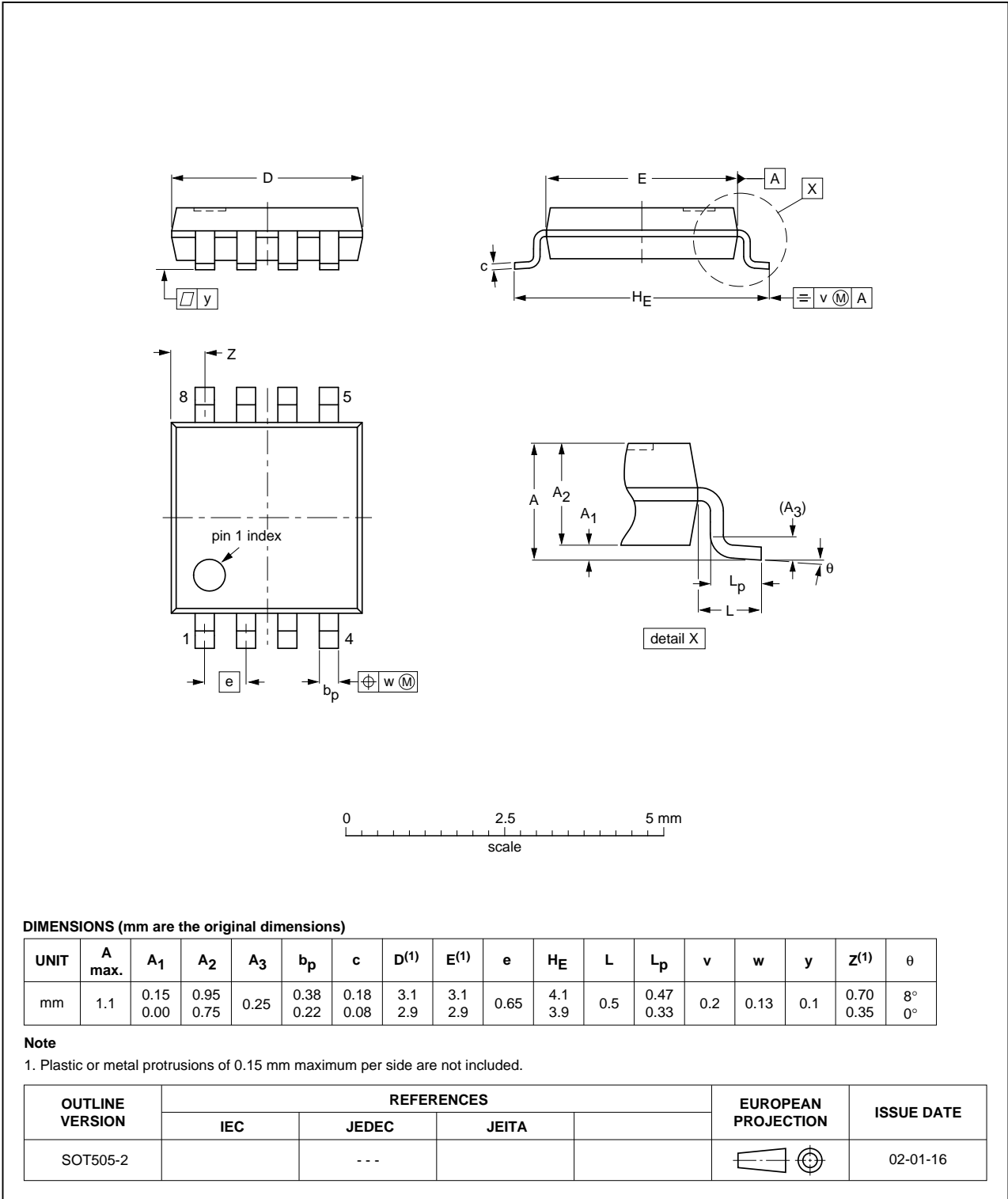


Fig 8. Package outline SOT505-2 (TSSOP8)

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

SOT765-1

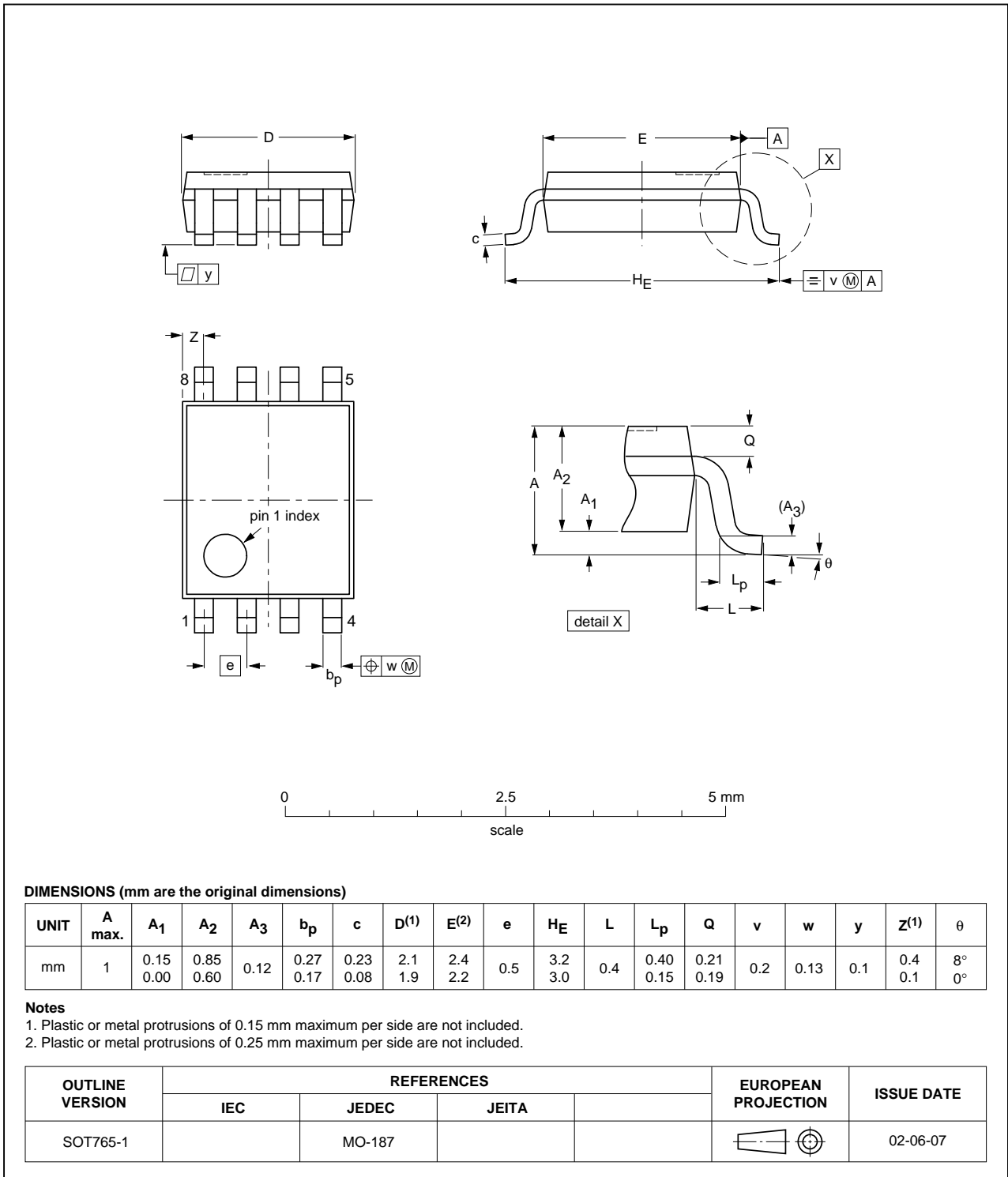


Fig 9. Package outline SOT765-1 (VSSOP8)

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

SOT996-2

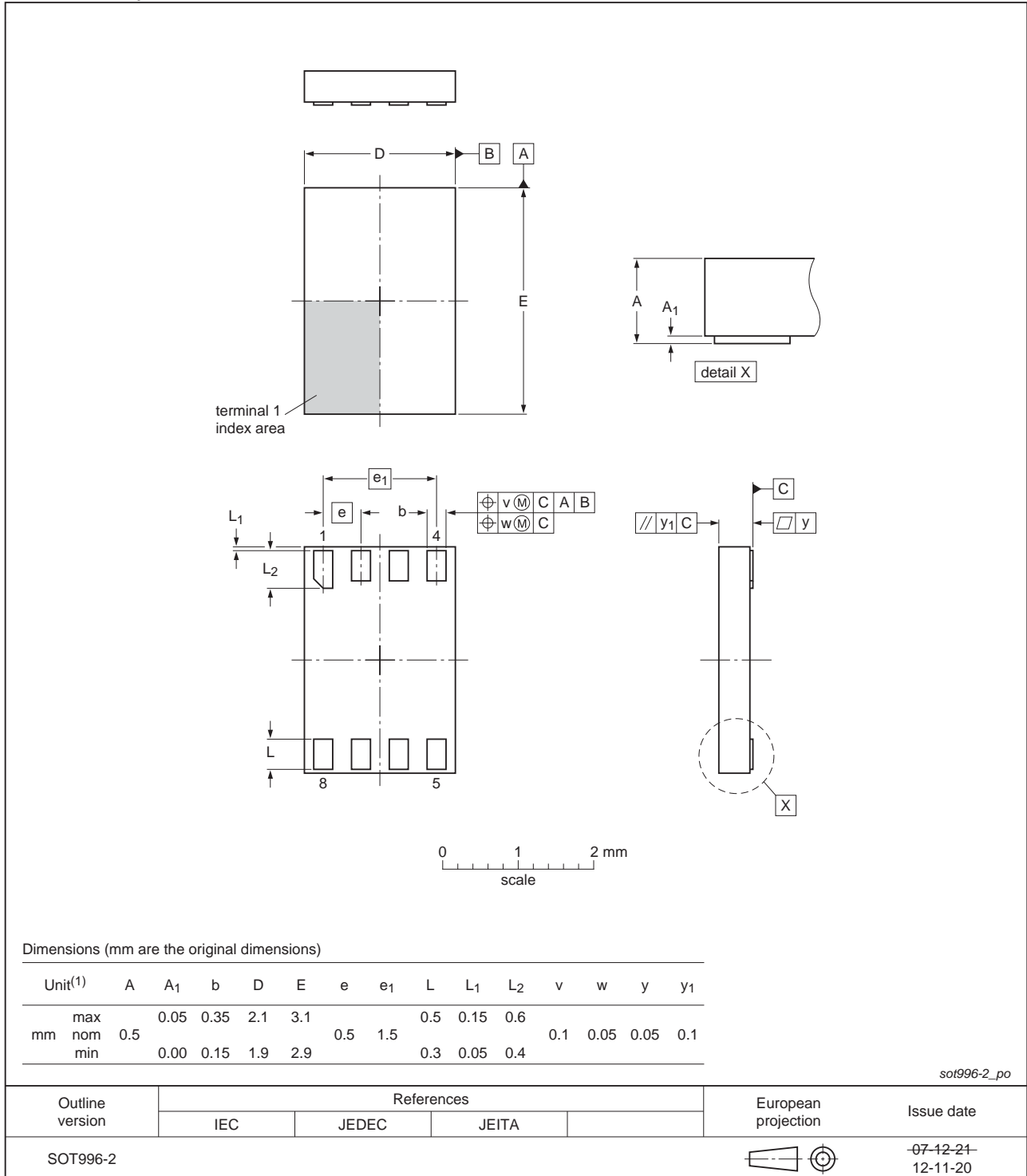


Fig 10. Package outline SOT996-2 (XSON8)

14. Abbreviations

Table 11. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
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_HCT2G00 v.5	20130926	Product data sheet	-	74HC_HCT2G00 v.4
Modifications:	<ul style="list-style-type: none"> For type numbers 74HC2G00GD and 74HCT2G00GD XSON8U has changed to XSON8. 			
74HC_HCT2G00 v.4	20080703	Product data sheet	-	74HC_HCT2G00 v.3
74HC_HCT2G00 v.3	20060405	Product data sheet	-	74HC_HCT2G00 v.2
74HC_HCT2G00 v.2	20030212	Product specification	-	74HC_HCT2G00 v.1
74HC_HCT2G00 v.1	20020710	Product specification	-	-

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16.1 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.
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[NL17SG32P5T5G](#) [NL17SG86DFT2G](#) [NLU1G32CMUTCG](#) [NLV14001UBDR2G](#) [NLVVHC1G132DTT1G](#) [NLVVHC1G86DTT1G](#)
[NLX1G11AMUTCG](#) [NLX1G97MUTCG](#) [746427X](#) [74AUP1G17FW5-7](#) [74LS38](#) [74LVC1G08Z-7](#) [74LVC32ADTR2G](#) [74LVC1G125FW4-7](#)
[74LVC08ADTR2G](#) [MC74HCT20ADTR2G](#) [NLU1G08CMX1TCG](#) [NLV14093BDTR2G](#) [NLV17SZ00DFT2G](#) [NLV17SZ02DFT2G](#)
[NLV17SZ126DFT2G](#) [NLV27WZ17DFT2G](#) [NLV74HC02ADR2G](#) [NLV74HC08ADR2G](#) [NLVVHC1GT32DFT1G](#) [74HC32S14-13](#) [74LS133](#)
[74LVC1G32Z-7](#) [M38510/30402BDA](#) [74LVC1G86Z-7](#) [74LVC2G08RA3-7](#) [M38510/06202BFA](#) [NLV74HC08ADTR2G](#)
[NLV74HC14ADR2G](#)