

# 74AHC2G08-Q100; 74AHCT2G08-Q100

Dual 2-input AND gate

Rev. 1 — 13 November 2013

Product data sheet

## 1. General description

The 74AHC2G08-Q100 and 74AHCT2G08-Q100 are high-speed Si-gate CMOS devices. They provide two 2-input NAND gates.

The AHC device has CMOS input switching levels and supply voltage range 2 V to 5.5 V.

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

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

## 2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - ◆ Specified from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  and from  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$
- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- Multiple package options
- ESD protection:
  - ◆ MIL-STD-883, method 3015 exceeds 2000 V
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V ( $C = 200\text{ pF}$ ,  $R = 0\ \Omega$ )

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AHC2G08DP-Q100 74AHCT2G08DP-Q100	$-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm	SOT505-2
74AHC2G08DC-Q100 74AHCT2G08DC-Q100	$-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1



4. Marking

Table 2. Marking

Type number	Marking code <sup>[1]</sup>
74AHC2G08DP-Q100	A08
74AHCT2G08DP-Q100	C08
74AHC2G08DC-Q100	A08
74AHCT2G08DC-Q100	C08

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

5. Functional diagram

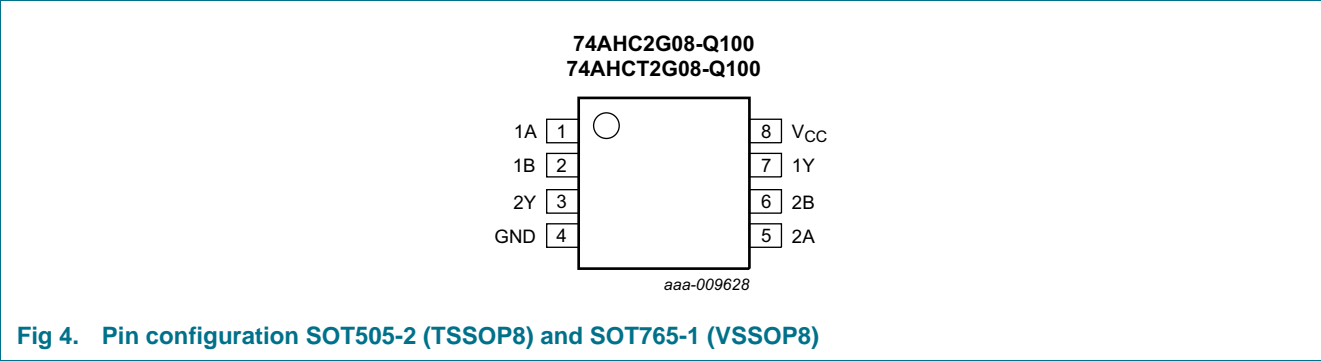
**Fig 1. Logic symbol**

**Fig 2. IEC logic symbol**

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

## 6. Pinning information

### 6.1 Pinning



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

## 7. Functional description

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

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

[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
$V_I$	input voltage		-0.5	+7.0	V
$I_{IK}$	input clamping current	$V_I < -0.5$ 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	$-0.5$ V < $V_O$ < $V_{CC} + 0.5$ V	-	±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	$T_{amb} = -40$ °C to +125 °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 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.

## 9. Recommended operating conditions

**Table 6. Recommended operating conditions**

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

Symbol	Parameter	Conditions	74AHC2G08-Q100			74AHCT2G08-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
$V_{CC}$	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
$V_I$	input voltage		0	-	5.5	0	-	5.5	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	$V_{CC} = 3.3$ V ± 0.3 V	-	-	100	-	-	-	ns/V
		$V_{CC} = 5.0$ V ± 0.5 V	-	-	20	-	-	20	ns/V

## 10. 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	
74AHC2G08-Q100										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
		V <sub>CC</sub> = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V <sub>CC</sub> = 5.5 V	3.85	-	-	3.85	-	3.85	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
		V <sub>CC</sub> = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V <sub>CC</sub> = 5.5 V	-	-	1.65	-	1.65	-	1.65	V

**Table 7. Static characteristics ...continued**  
 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>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = –50 µA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = –50 µA; V <sub>CC</sub> = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	V
		I <sub>O</sub> = –50 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> = 3.0 V	2.58	-	-	2.48	-	2.40	-	V
		I <sub>O</sub> = –8.0 mA; V <sub>CC</sub> = 4.5 V	3.94	-	-	3.8	-	3.70	-	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> = 50 µA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 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> = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
		I <sub>O</sub> = 8.0 mA; V <sub>CC</sub> = 4.5 V	-	-	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
C <sub>I</sub>	input capacitance		-	1.5	10	-	10	-	10	pF
<b>74AHCT2G08-Q100</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.8	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</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>IH</sub> or V <sub>IL</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

## 11. Dynamic characteristics

**Table 8. Dynamic characteristics**

$GND = 0\text{ V}$ ; for test circuit see [Figure 6](#).

Symbol	Parameter	Conditions	25 °C			–40 °C to +85 °C		–40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74AHC2G08-Q100										
t <sub>pd</sub>	propagation delay	nA, nB to nY; see <a href="#">Figure 5</a> <a href="#">[1]</a>								
		V <sub>CC</sub> = 3.0 V to 3.6 V <a href="#">[2]</a>								
		C <sub>L</sub> = 15 pF	-	4.6	8.8	1.0	10.5	1.0	12.0	ns
		C <sub>L</sub> = 50 pF	-	6.5	12.3	1.0	14.0	1.0	16.0	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V <a href="#">[3]</a>								
		C <sub>L</sub> = 15 pF	-	3.2	5.9	1.0	7.0	1.0	8.0	ns
		C <sub>L</sub> = 50 pF	-	4.6	7.9	1.0	9.0	1.0	10.5	ns
C <sub>PD</sub>	power dissipation capacitance	per buffer; C <sub>L</sub> = 50 pF; f <sub>i</sub> = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> <a href="#">[4]</a>	-	17	-	-	-	-	-	pF
74AHCT2G08-Q100										
t <sub>pd</sub>	propagation delay	nA, nB to nY; see <a href="#">Figure 5</a> <a href="#">[1]</a>								
		V <sub>CC</sub> = 4.5 V to 5.5 V <a href="#">[3]</a>								
		C <sub>L</sub> = 15 pF	-	3.6	6.2	1.0	7.1	1.0	8.0	ns
		C <sub>L</sub> = 50 pF	-	5.1	7.9	1.0	9.0	1.0	10.5	ns
C <sub>PD</sub>	power dissipation capacitance	per buffer; C <sub>L</sub> = 50 pF; f <sub>i</sub> = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> <a href="#">[4]</a>	-	19	-	-	-	-	-	pF

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

[2] Typical values are measured at  $V_{CC} = 3.3\text{ V}$ .

[3] Typical values are measured at  $V_{CC} = 5.0\text{ V}$ .

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

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  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 the outputs.

12. Waveforms

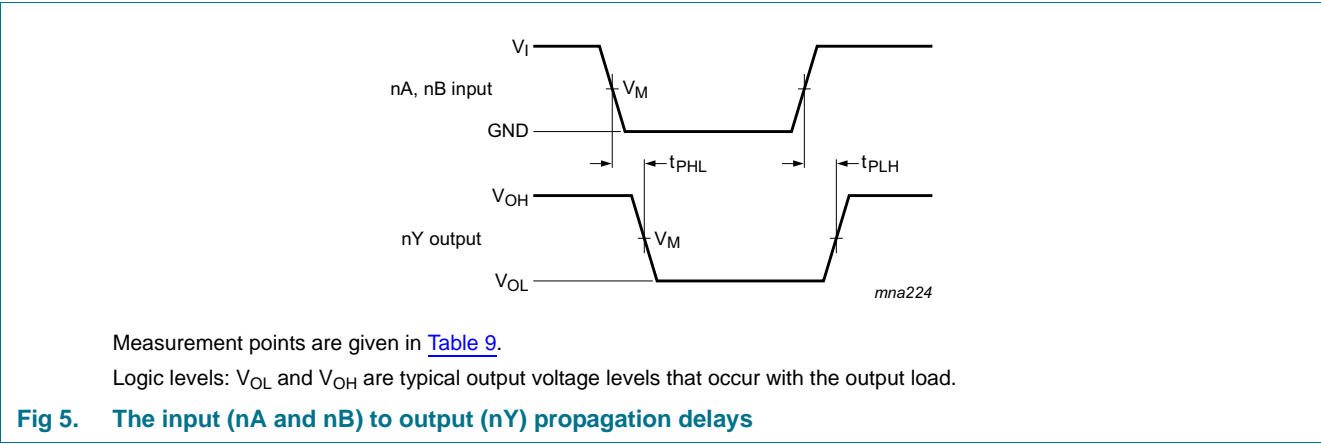
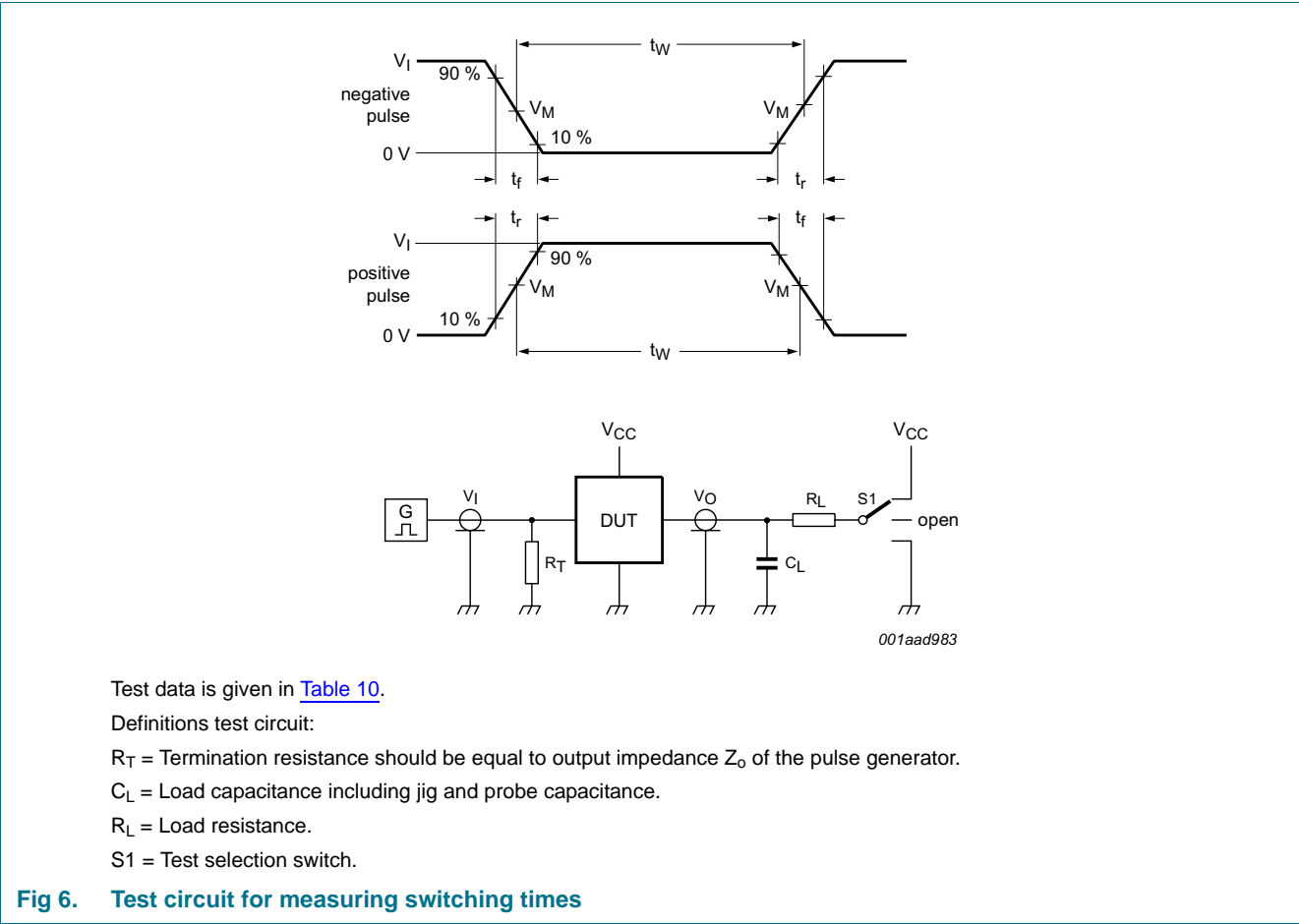


Table 9. Measurement points

Type	Input	Output
	$V_M$	$V_M$
74AHC2G08-Q100	$0.5V_{CC}$	$0.5V_{CC}$
74AHCT2G08-Q100	1.5 V	$0.5V_{CC}$



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

Definitions 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 6. Test circuit for measuring switching times

Table 10. Test data

Type	Input		Load		S1 position
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$
74AHC2G08-Q100	$V_{CC}$	$\leq 3 \text{ ns}$	15 pF, 50 pF	1 k $\Omega$	open
74AHCT2G08-Q100	3 V	$\leq 3 \text{ ns}$	15 pF, 50 pF	1 k $\Omega$	open



13. Package outline

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

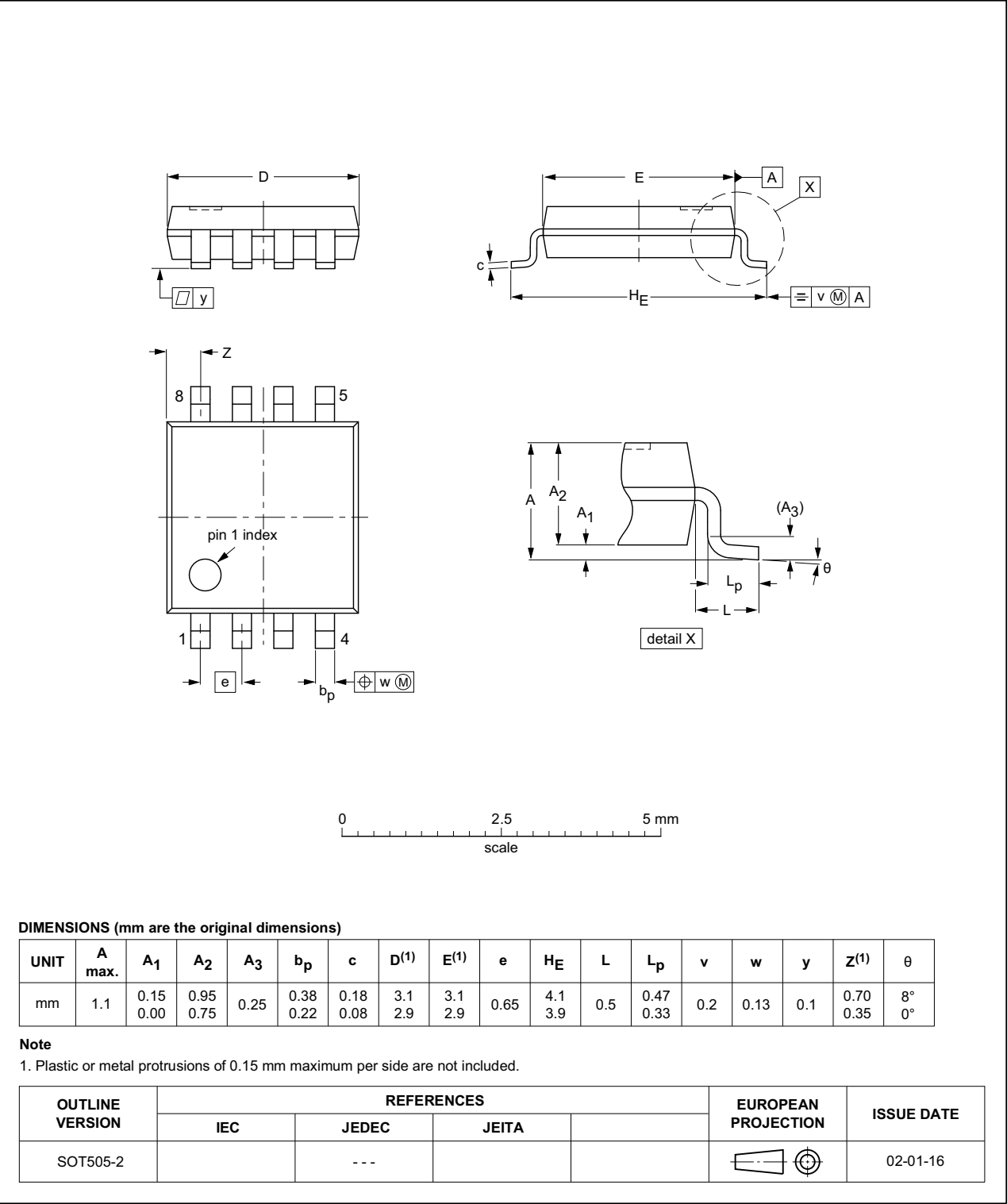


Fig 7. Package outline SOT505-2 (TSSOP8)

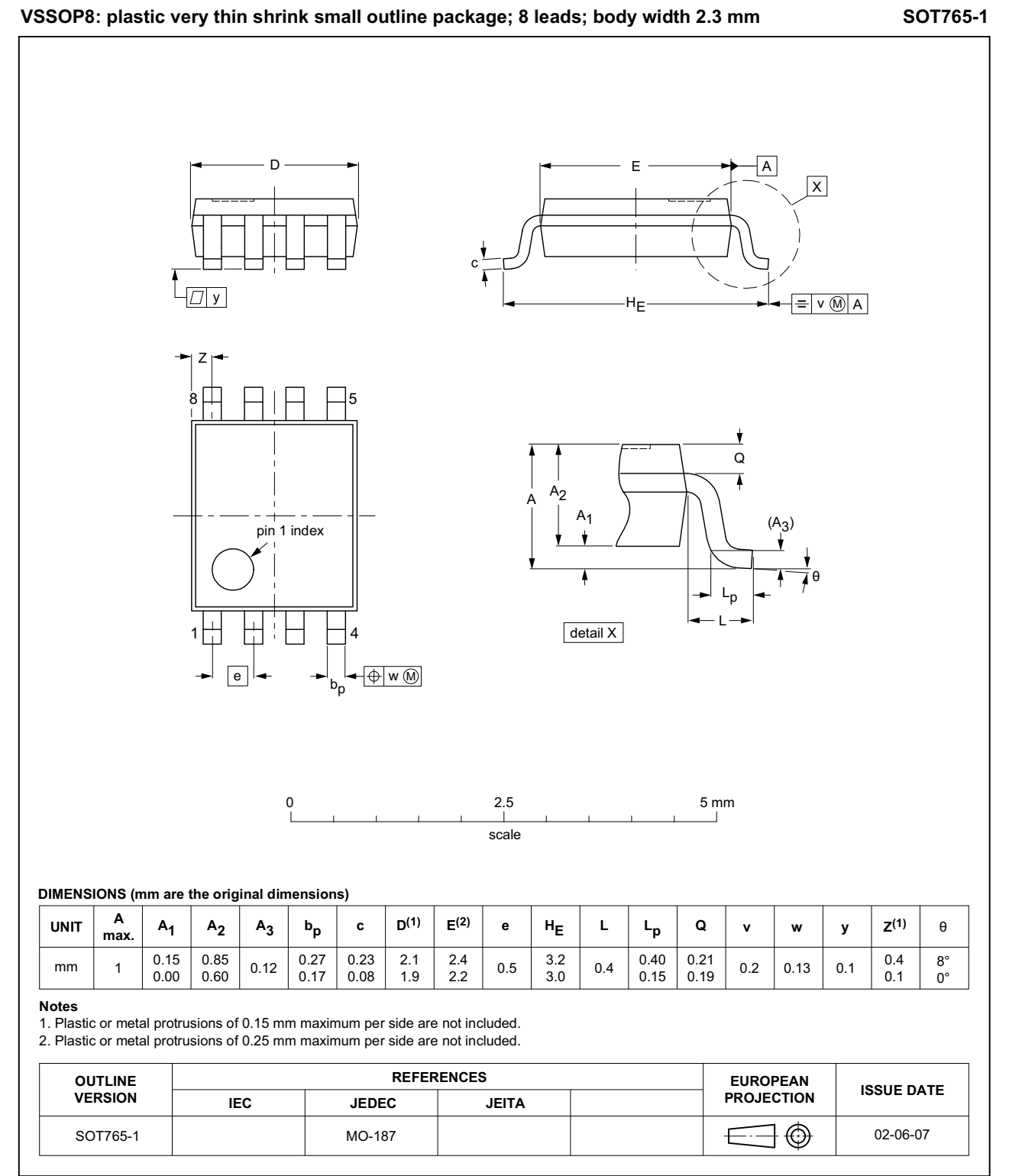


Fig 8. Package outline SOT765-1 (VSSOP8)

## 14. Abbreviations

Table 11. Abbreviations

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

## 15. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT2G08_Q100 v.1	20131113	Product data sheet	-	-

## 16. Legal information

### 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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