

74LVC2G08-Q100

Dual 2-input AND gate

Rev. 1 — 26 June 2013

Product data sheet

1. General description

The 74LVC2G08-Q100 provides a 2-input AND gate function.

Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of the 74LVC2G08-Q100 as a translator in a mixed 3.3 V and 5 V environment.

This device is fully specified for partial power-down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing a damaging backflow current through the device when it is powered down.

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 $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$
- Wide supply voltage range from 1.65 V to 5.5 V
- 5 V tolerant outputs for interfacing with 5 V logic
- High noise immunity
- $\pm 24\text{ mA}$ output drive ($V_{CC} = 3.0\text{ V}$)
- CMOS low power consumption
- Complies with JEDEC standard:
 - ◆ JESD8-7 (1.65 V to 1.95 V)
 - ◆ JESD8-5 (2.3 V to 2.7 V)
 - ◆ JESD8-B/JESD36 (2.7 V to 3.6 V)
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Inputs accept voltages up to 5 V
- ESD protection:
 - ◆ MIL-STD-883, method 3015 exceeds 2000 V
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V ($C = 200\text{ pF}$, $R = 0\text{ }\Omega$)
- Multiple package options



3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC2G08DP-Q100	−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
74LVC2G08DC-Q100	−40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1

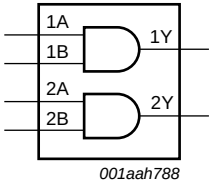
4. Marking

Table 2. Marking codes

Type number	Marking code ^[1]
74LVC2G08DP-Q100	V08
74LVC2G08DC-Q100	V08

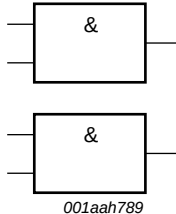
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



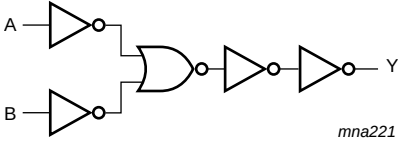
001aah788

Fig 1. Logic symbol



001aah789

Fig 2. IEC logic symbol

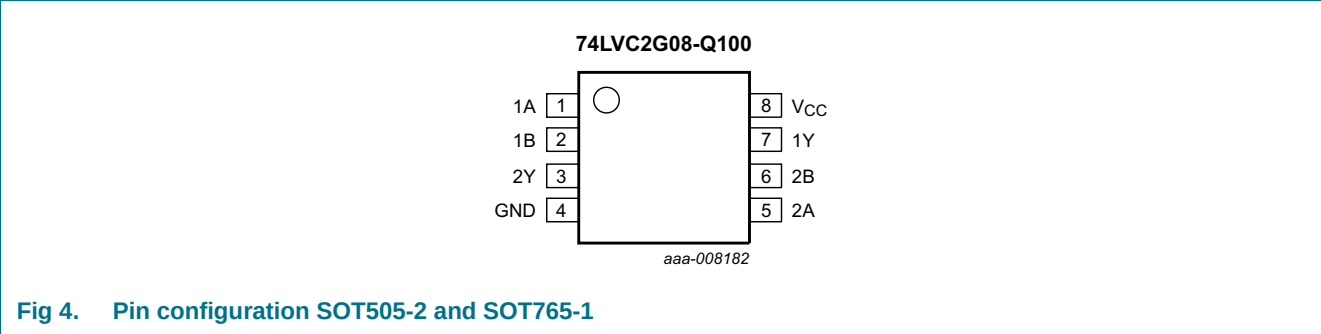


mna221

Fig 3. Logic diagram (one gate)

6. Pinning information

6.1 Pinning



6.2 Pin description

Table 3. Pin description

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

7. Functional description

Table 4. Function table^[1]

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

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care.

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	+6.5	V
V_I	input voltage		[1] -0.5	+6.5	V
V_O	output voltage	Active mode	[1] -0.5	$V_{CC} + 0.5$	V
		Power-down mode	[1][2] -0.5	+6.5	V
I_{IK}	input clamping current	$V_I < 0$ V	-50	-	mA
I_{OK}	output clamping current	$V_O < 0$ V or $V_O > V_{CC}$	-	± 50	mA
I_O	output current	$V_O = 0$ V to V_{CC}	-	± 50	mA
I_{CC}	supply current		-	100	mA
I_{GND}	ground current		-100	-	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation	$T_{amb} = -40$ °C to +125 °C	[3] -	300	mW

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

[2] When $V_{CC} = 0$ V (Power-down mode), the output voltage can be 5.5 V in normal condition.

[3] 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. Operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		1.65	5.5	V
V_I	input voltage		0	5.5	V
V_O	output voltage	Active mode	0	V_{CC}	V
		Power-down mode	0	5.5	V
T_{amb}	ambient temperature		-40	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.65$ V to 2.7 V	-	20	ns/V
		$V_{CC} = 2.7$ V to 5.5 V	-	10	ns/V

10. Static characteristics

Table 7. Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = -40 °C to +85 °C						
V _{IH}	HIGH-level input voltage	V _{CC} = 1.65 V to 1.95 V	0.65 × V _{CC}	-	-	V
		V _{CC} = 2.3 V to 2.7 V	1.7	-	-	V
		V _{CC} = 2.7 V to 3.6 V	2.0	-	-	V
		V _{CC} = 4.5 V to 5.5 V	0.7 × V _{CC}	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.65 V to 1.95 V	-	-	0.35 × V _{CC}	V
		V _{CC} = 2.3 V to 2.7 V	-	-	0.7	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.8	V
		V _{CC} = 4.5 V to 5.5 V	-	-	0.3 × V _{CC}	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}				
		I _O = -100 µA; V _{CC} = 1.65 V to 5.5 V	V _{CC} - 0.1	-	-	V
		I _O = -4 mA; V _{CC} = 1.65 V	1.2	1.53	-	V
		I _O = -8 mA; V _{CC} = 2.3 V	1.9	2.13	-	V
		I _O = -12 mA; V _{CC} = 2.7 V	2.2	2.50	-	V
		I _O = -24 mA; V _{CC} = 3.0 V	2.3	2.60	-	V
		I _O = -32 mA; V _{CC} = 4.5 V	3.8	4.10	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}				
		I _O = 100 µA; V _{CC} = 1.65 V to 5.5 V	-	-	0.1	V
		I _O = 4 mA; V _{CC} = 1.65 V	-	0.08	0.45	V
		I _O = 8 mA; V _{CC} = 2.3 V	-	0.14	0.3	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	0.19	0.4	V
		I _O = 24 mA; V _{CC} = 3.0 V	-	0.37	0.55	V
		I _O = 32 mA; V _{CC} = 4.5 V	-	0.43	0.55	V
I _I	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	±0.1	±5	µA
I _{OFF}	power-off leakage current	V _I or V _O = 5.5 V; V _{CC} = 0 V	-	±0.1	±10	µA
I _{CC}	supply current	V _I = 5.5 V or GND; V _{CC} = 1.65 V to 5.5 V; I _O = 0 A	-	0.1	10	µA
ΔI _{CC}	additional supply current	per pin; V _I = V _{CC} - 0.6 V; I _O = 0 A; V _{CC} = 2.3 V to 5.5 V	-	5	500	µA
C _i	input capacitance		-	2.5	-	pF
T_{amb} = -40 °C to +125 °C						
V _{IH}	HIGH-level input voltage	V _{CC} = 1.65 V to 1.95 V	0.65 × V _{CC}	-	-	V
		V _{CC} = 2.3 V to 2.7 V	1.7	-	-	V
		V _{CC} = 2.7 V to 3.6 V	2.0	-	-	V
		V _{CC} = 4.5 V to 5.5 V	0.7 × V _{CC}	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.65 V to 1.95 V	-	-	0.35 × V _{CC}	V
		V _{CC} = 2.3 V to 2.7 V	-	-	0.7	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.8	V
		V _{CC} = 4.5 V to 5.5 V	-	-	0.3 × V _{CC}	V

Table 7. Static characteristics ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = -100\ \mu\text{A}$; $V_{CC} = 1.65\ \text{V}$ to $5.5\ \text{V}$	$V_{CC} - 0.1$	-	-	V
		$I_O = -4\ \text{mA}$; $V_{CC} = 1.65\ \text{V}$	0.95	-	-	V
		$I_O = -8\ \text{mA}$; $V_{CC} = 2.3\ \text{V}$	1.7	-	-	V
		$I_O = -12\ \text{mA}$; $V_{CC} = 2.7\ \text{V}$	1.9	-	-	V
		$I_O = -24\ \text{mA}$; $V_{CC} = 3.0\ \text{V}$	2.0	-	-	V
		$I_O = -32\ \text{mA}$; $V_{CC} = 4.5\ \text{V}$	3.4	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = 100\ \mu\text{A}$; $V_{CC} = 1.65\ \text{V}$ to $5.5\ \text{V}$	-	-	0.1	V
		$I_O = 4\ \text{mA}$; $V_{CC} = 1.65\ \text{V}$	-	-	0.70	V
		$I_O = 8\ \text{mA}$; $V_{CC} = 2.3\ \text{V}$	-	-	0.45	V
		$I_O = 12\ \text{mA}$; $V_{CC} = 2.7\ \text{V}$	-	-	0.60	V
		$I_O = 24\ \text{mA}$; $V_{CC} = 3.0\ \text{V}$	-	-	0.80	V
		$I_O = 32\ \text{mA}$; $V_{CC} = 4.5\ \text{V}$	-	-	0.80	V
I_I	input leakage current	$V_I = 5.5\ \text{V}$ or GND; $V_{CC} = 0\ \text{V}$ to $5.5\ \text{V}$	-	-	± 20	μA
I_{OFF}	power-off leakage current	V_I or $V_O = 5.5\ \text{V}$; $V_{CC} = 0\ \text{V}$	-	-	± 20	μA
I_{CC}	supply current	$V_I = 5.5\ \text{V}$ or GND; $V_{CC} = 1.65\ \text{V}$ to $5.5\ \text{V}$; $I_O = 0\ \text{A}$	-	-	40	μA
ΔI_{CC}	additional supply current	per pin; $V_I = V_{CC} - 0.6\ \text{V}$; $I_O = 0\ \text{A}$; $V_{CC} = 2.3\ \text{V}$ to $5.5\ \text{V}$	-	-	5000	μA

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

11. Dynamic characteristics

Table 8. Dynamic characteristicsVoltages are referenced to GND (ground = 0 V); for test circuit, see [Figure 6](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
t_{pd}	propagation delay	nA, nB to nY; see Figure 5 ^[2]						
		$V_{CC} = 1.65\ \text{V}$ to $1.95\ \text{V}$	1.0	3.2	9.0	1.0	11.3	ns
		$V_{CC} = 2.3\ \text{V}$ to $2.7\ \text{V}$	0.5	2.2	5.1	0.5	6.4	ns
		$V_{CC} = 2.7\ \text{V}$	1.0	2.5	5.3	1.0	6.7	ns
		$V_{CC} = 3.0\ \text{V}$ to $3.6\ \text{V}$	0.5	2.1	4.7	0.5	5.9	ns
		$V_{CC} = 4.5\ \text{V}$ to $5.5\ \text{V}$	0.5	1.7	3.8	0.5	4.8	ns

Table 8. Dynamic characteristics ...continued
Voltages are referenced to GND (ground = 0 V); for test circuit, see [Figure 6](#).

Symbol	Parameter	Conditions	−40 °C to +85 °C			−40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
C _{PD}	power dissipation capacitance	per gate; V _I = GND to V _{CC} ^[3]	-	14.4	-	-	-	pF

- [1] Typical values are measured at nominal V_{CC} and at T_{amb} = 25 °C.
- [2] t_{pd} is the same as t_{PLH} and t_{PHL}.
- [3] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).
P_D = C_{PD} × V_{CC}² × f_i × N + Σ(C_L × V_{CC}² × 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;
Σ(C_L × V_{CC}² × f_o) = sum of outputs.

12. Waveforms

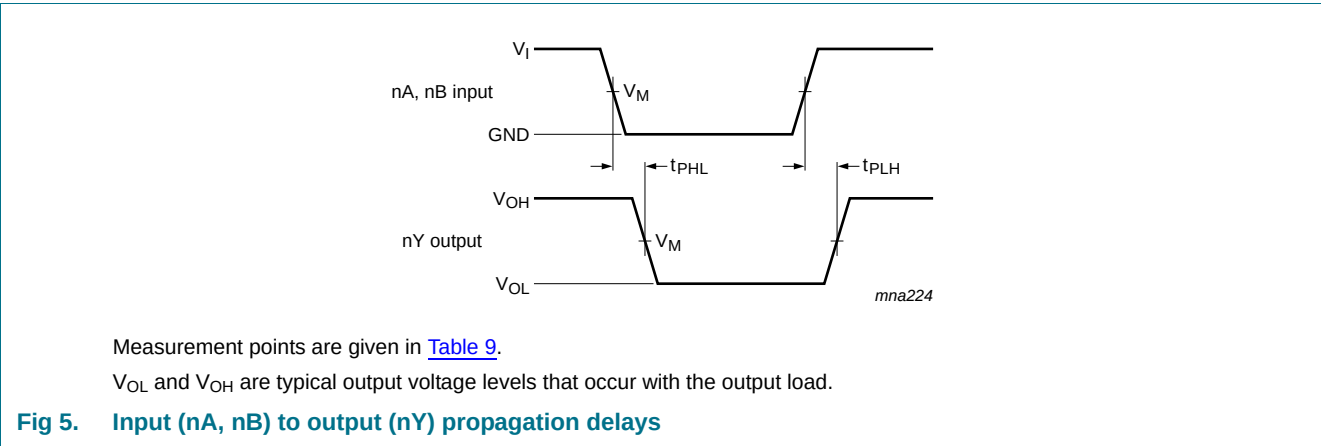
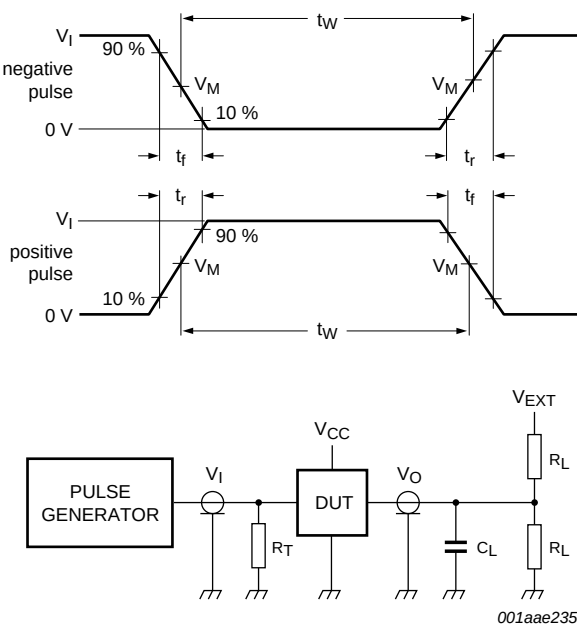


Table 9. Measurement points

Supply voltage	Input	Output
V _{CC}	V _M	V _M
1.65 V to 1.95 V	0.5 × V _{CC}	0.5 × V _{CC}
2.3 V to 2.7 V	0.5 × V _{CC}	0.5 × V _{CC}
2.7 V	1.5 V	1.5 V
3.0 V to 3.6 V	1.5 V	1.5 V
4.5 V to 5.5 V	0.5 × V _{CC}	0.5 × V _{CC}



Test data is given in [Table 10](#).
Definitions for test circuit:
 R_L = Load resistance
 C_L = Load capacitance including jig and probe capacitance
 R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator
 V_{EXT} = Test voltage for switching times

Fig 6. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Input		Load		V_{EXT}
V_{CC}	V_I	t_r, t_f	C_L	R_L	t_{PLH}, t_{PHL}
1.65 V to 1.95 V	V_{CC}	≤ 2.0 ns	30 pF	1 k Ω	open
2.3 V to 2.7 V	V_{CC}	≤ 2.0 ns	30 pF	500 Ω	open
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open
4.5 V to 5.5 V	V_{CC}	≤ 2.5 ns	50 pF	500 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

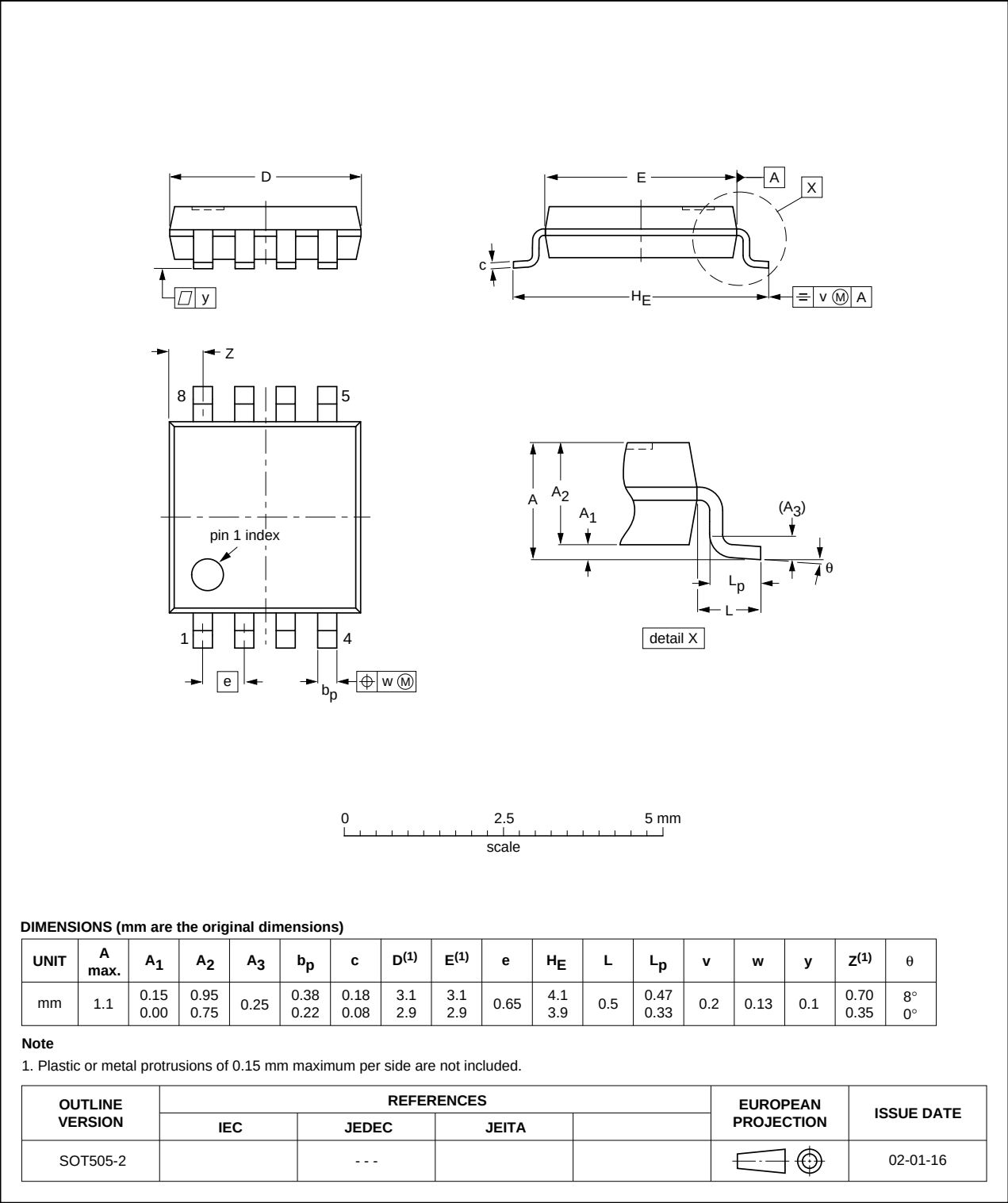


Fig 7. Package outline SOT505-2 (TSSOP8)

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

SOT765-1

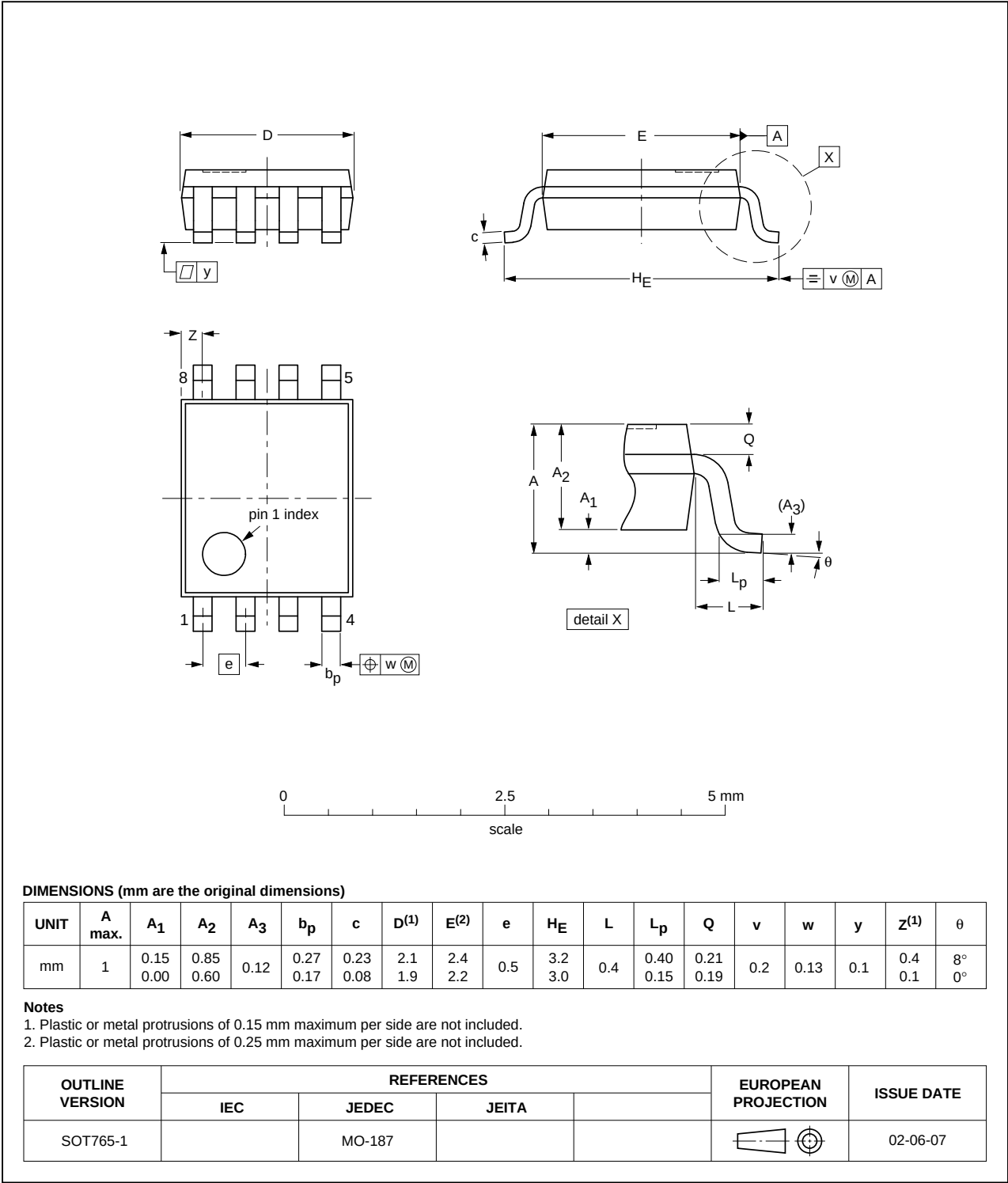


Fig 8. Package outline SOT765-1 (VSSOP8)

14. Abbreviations

Table 11. Abbreviations

Acronym	Description
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
74LVC2G08_Q100 v.1	20130626	Product data sheet	-	-

16. Legal information

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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[1] Please consult the most recently issued document before initiating or completing a design.

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