74LVC2G08-Q100

Dual 2-input AND gate Rev. 3 — 28 January 2019

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 °C to +85 °C and from -40 °C to +125 °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
- ±24 mA output drive (V_{CC} = 3.0 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 pF, R = 0 Ω)
- · 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
74LVC2G08GS-Q100	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 x 1.0 x 0.35 mm	SOT1203



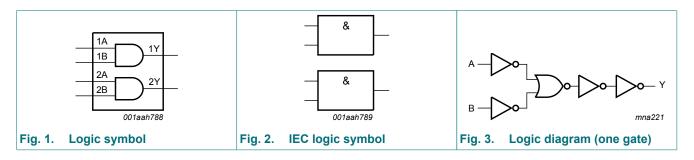
4. Marking

Table 2. Marking codes

Type number	Marking code[1]
74LVC2G08DP-Q100	V08
74LVC2G08DC-Q100	V08
74LVC2G08GS-Q100	VE

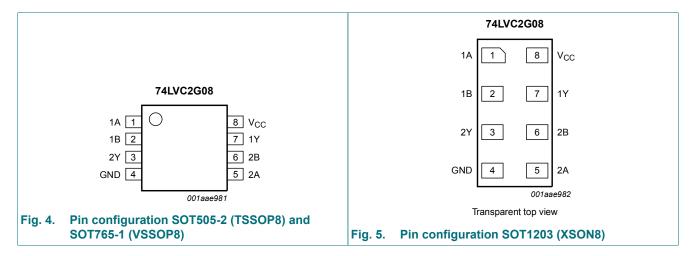
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



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

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level; \ X = don't \ care.$

Input		Output
nA	nB	nY
L	X	L
X	L	L
Н	Н	Н

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
VI	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; V _{CC} = 0 V	[1]	-0.5	+6.5	V
I _{IK}	input clamping current	V _I < 0 V		-50	-	mA
I _{OK}	output clamping current	$V_O < 0 \text{ V or } V_O > V_{CC}$		-	±50	mA
Io	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	[2]	-	300	mW

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

For VSSOP8 package: above 110 $^{\circ}\text{C}$ the value of P_{tot} derates linearly at 8 mW/K.

For XSON8 packages: above 118 $^{\circ}\text{C}$ the value of Ptot derates linearly with 7.8 mW/K.

^[2] For TSSOP8 package: above 55 °C the value of P_{tot} derates linearly at 2.5 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
VI	input voltage		0	5.5	V
V _O	output voltage	Active mode	0	V _{CC}	V
		Power-down mode; V _{CC} = 0 V	0	5.5	V
T _{amb}	ambient temperature		-40	+125	°C
Δt/ΔV	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[1]	Max	Unit
T _{amb} = -4	0 °C to +85 °C					
V _{IH}	HIGH-level input voltage	V _{CC} = 1.65 V to 1.95 V	0.65 x 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 x V _{CC}	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.65 V to 1.95 V	-	-	0.35 x 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 x V _{CC}	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}				
		I_{O} = -100 μ A; 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 μ A; 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	±1	μΑ
I _{OFF}	power-off leakage current	V_{I} or $V_{O} = 5.5 \text{ V}$; $V_{CC} = 0 \text{ V}$	-	±0.1	±2	μΑ
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	4	μΑ

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
Δl _{CC}	additional supply current	per pin; $V_1 = V_{CC} - 0.6 \text{ V}$; $I_O = 0 \text{ A}$; $V_{CC} = 2.3 \text{ V}$ to 5.5 V	-	5	500	μΑ
Ci	input capacitance		-	2.5	-	pF
T _{amb} = -4	0 °C to +125 °C					
V _{IH}	HIGH-level input voltage	V _{CC} = 1.65 V to 1.95 V	0.65 x 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 x V _{CC}	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.65 V to 1.95 V	-	-	0.35 x 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 x V _{CC}	V
V _{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I_{O} = -100 μ A; V_{CC} = 1.65 V to 5.5 V	V _{CC} - 0.1	-	-	V
		I _O = -4 mA; V _{CC} = 1.65 V	0.95	-	-	V
		I_{O} = -8 mA; V_{CC} = 2.3 V	1.7	-	-	V
		I _O = -12 mA; V _{CC} = 2.7 V	1.9	-	-	V
		I _O = -24 mA; V _{CC} = 3.0 V	2.0	-	-	V
		I _O = -32 mA; V _{CC} = 4.5 V	3.4	-	-	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	-	-	0.70	V
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.45	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	-	0.60	V
		I _O = 24 mA; V _{CC} = 3.0 V	-	-	0.80	V
		I _O = 32 mA; V _{CC} = 4.5 V	-	-	0.80	V
lį	input leakage current	$V_I = 5.5 \text{ V or GND}$; $V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	-	-	±1	μΑ
I _{OFF}	power-off leakage current	V_{I} or V_{O} = 5.5 V; V_{CC} = 0 V	-	-	±2	μΑ
I _{CC}	supply current	V _I = 5.5 V or GND; V _{CC} = 1.65 V to 5.5 V; I _O = 0 A	-	-	4	μΑ
ΔI _{CC}	additional supply current	per pin; $V_1 = V_{CC} - 0.6 \text{ V}$; $I_O = 0 \text{ A}$; $V_{CC} = 2.3 \text{ V}$ to 5.5 V	-	-	500	μΑ

^[1] All typical values are measured at T_{amb} = 25 °C.

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11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.

Symbol	Parameter	Conditions	nditions -40 °C to +85 °C -40 °C to +125 °C		+125 °C	Unit		
			Min	Typ[1]	Max	Min	Max	
t _{pd}	propagation delay	nA, nB to nY; see Fig. 6 [2]						
		V _{CC} = 1.65 V to 1.95 V	1.0	3.2	9.0	1.0	11.3	ns
		V _{CC} = 2.3 V to 2.7 V	0.5	2.2	5.1	0.5	6.4	ns
		V _{CC} = 2.7 V	1.0	2.5	5.3	1.0	6.7	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	2.1	4.7	0.5	5.9	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	1.7	3.8	0.5	4.8	ns
C _{PD}	power dissipation capacitance	per gate; $V_I = GND$ to V_{CC} [3]	-	14.4	-	-	-	pF

- Typical values are measured at nominal V_{CC} and at T_{amb} = 25 °C.
- t_{pd} is the same as t_{PLH} and t_{PHL} C_{PD} is used to determine the dynamic power dissipation (P_D in μW). $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o)$ where:

 f_i = input frequency in MHz;

 f_0 = output frequency in MHz;

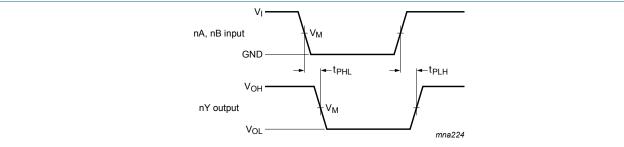
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

 $\sum (C_L \times V_{CC}^2 \times f_0) = \text{sum of outputs.}$

11.1. Waveforms and test circuit



Measurement points are given in Table 9.

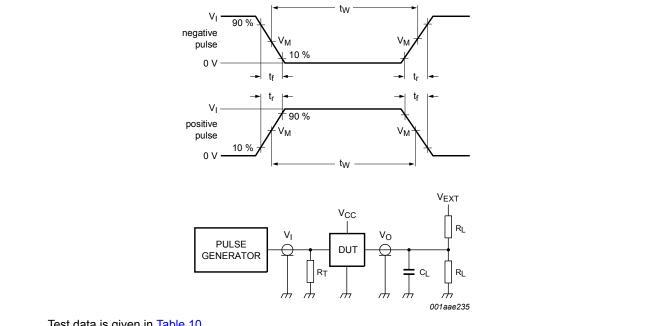
V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Input (nA, nB) to output (nY) propagation delays Fig. 6.

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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 <u>Table 10</u>.

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_0 of the pulse generator

 V_{EXT} = Test voltage for switching times

Test circuit for measuring switching times Fig. 7.

Table 10. Test data

Supply voltage	Input		age Input Load V		V _{EXT}
V _{CC}	V _I	t _r , t _f	CL	R_L	t _{PLH} , t _{PHL}
1.65 V to 1.95 V	V _{CC}	≤ 2.0 ns	30 pF	1 kΩ	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

12. Package outline

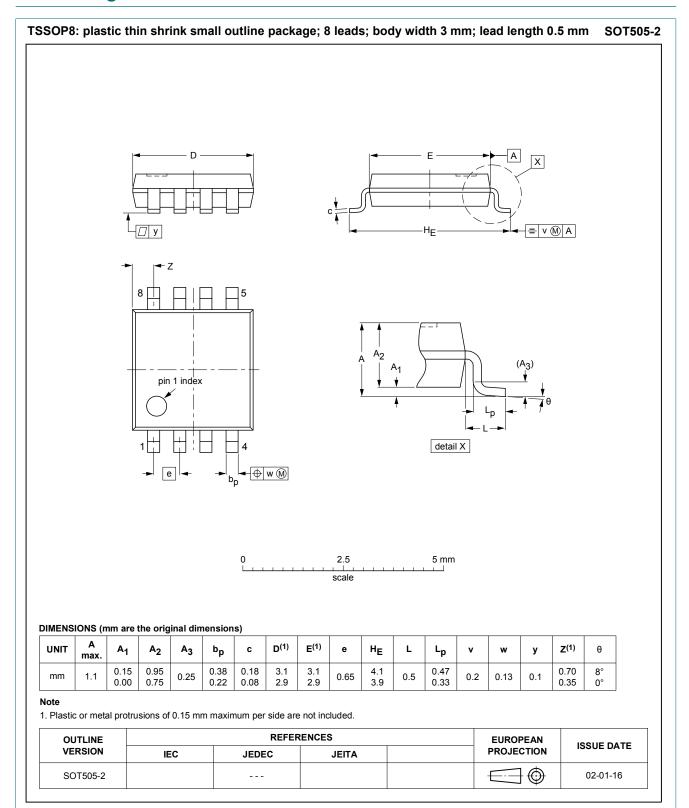


Fig. 8. Package outline SOT505-2 (TSSOP8)

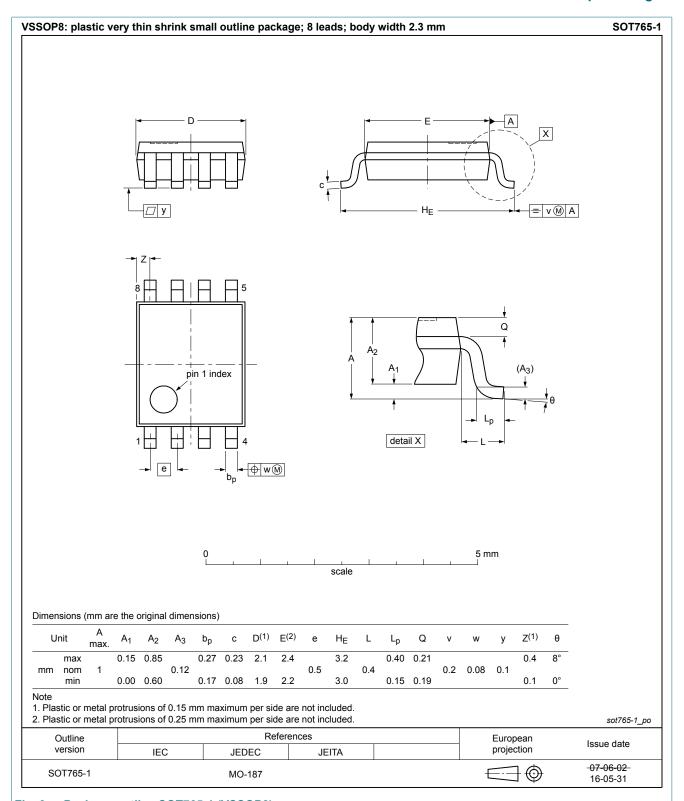


Fig. 9. Package outline SOT765-1 (VSSOP8)

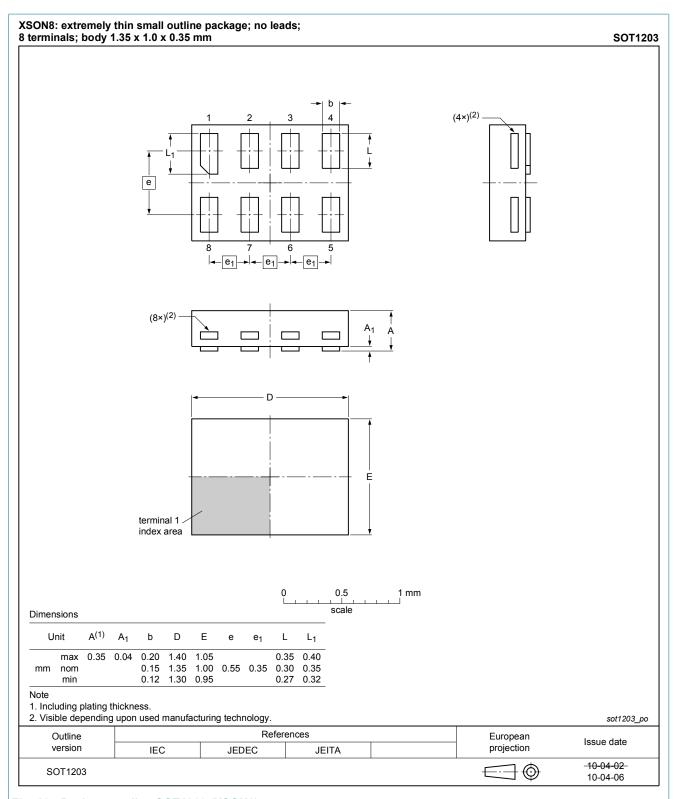


Fig. 10. Package outline SOT1203 (XSON8)

13. Abbreviations

Table 11. Abbreviations

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

14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes	
74LVC2G08_Q100 v.3	20190128	Product data sheet	-	74LVC2G08_Q100 v.2	
Modifications:	 The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Added type number 74LVC2G08GS-Q100 (SOT1203/XSON8). 				
74LVC2G08_Q100 v.2	20161214	Product data sheet	-	74LVC2G08_Q100 v.1	
Modifications:	<u>Table 7</u> : The maximum limits for leakage current and supply current have changed.				
74LVC2G08_Q100 v.1	20130626	Product data sheet	-	-	

15. Legal information

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.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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