# 74LVC2G32-Q100

### Dual 2-input OR gate Rev. 4 — 22 August 2023

**Product data sheet** 

### 1. General description

The 74LVC2G32-Q100 is a dual 2-input OR gate. Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V environments.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

This device is fully specified for partial power down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output, preventing the potentially 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
- Overvoltage tolerant inputs to 5.5 V
- High noise immunity
- CMOS low power dissipation
- 5 V tolerant outputs in the Power-down mode
- ±24 mA output drive (V<sub>CC</sub> = 3.0 V)
- Latch-up performance exceeds 250 mA
- · Direct interface with TTL levels
- I<sub>OFF</sub> circuitry provides partial Power-down mode operation
- Complies with JEDEC standard:
  - JESD8-7 (1.65 V to 1.95 V)
  - JESD8-5 (2.3 V to 2.7 V)
  - JESD8C (2.7 V to 3.6 V)
  - JESD36 (4.5 V to 5.5 V)
- · ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC2G32DP-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
74LVC2G32DC-Q100	-40 °C to +125 °C		plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	<u>SOT765-1</u>



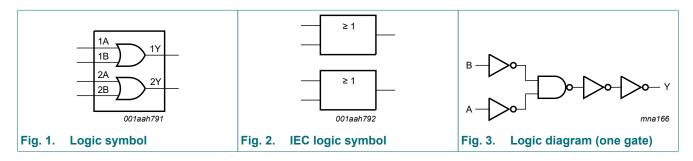
### 4. Marking

#### Table 2. Marking codes

Type number	Marking code[1]
74LVC2G32DP-Q100	V32
74LVC2G32DC-Q100	V32

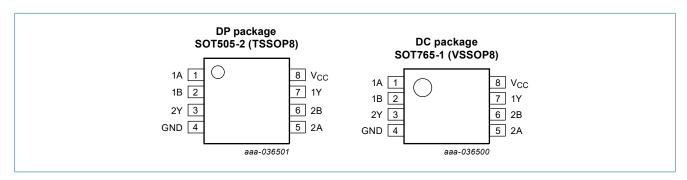
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

## 5. Functional diagram



## 6. Pinning information

### 6.1. Pinning



### 6.2. Pin description

Table 3. Pin description

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

## 7. Functional description

#### **Table 4. Function table**

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level.$ 

Input		Output
nA	nB	nY
L	L	L
L	Н	Н
Н	L	Н
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 <sub>CC</sub>	supply voltage			-0.5	+6.5	V
VI	input voltage		[1]	-0.5	+6.5	V
Vo	output voltage	Active mode	[1]	-0.5	V <sub>CC</sub> + 0.5	V
		Power-down mode; V <sub>CC</sub> = 0 V	[1]	-0.5	+6.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V		-50	-	mA
I <sub>OK</sub>	output clamping current	$V_O < 0 \text{ V or } V_O > V_{CC}$		-	±50	mA
Io	output current	$V_O = 0 V \text{ to } V_{CC}$		-	±50	mA
I <sub>CC</sub>	supply current			-	100	mA
I <sub>GND</sub>	ground current			-100	-	mA
T <sub>stg</sub>	storage temperature			-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C				
		SOT505-2 (TSSOP8) SOT765-1 (VSSOP8)	[2]	-	250	mW

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

## 9. Recommended operating conditions

**Table 6. Operating conditions** 

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		1.65	5.5	V
VI	input voltage		0	5.5	V
Vo	output voltage	Active mode	0	V <sub>CC</sub>	V
		Power-down mode; V <sub>CC</sub> = 0 V	0	5.5	V
T <sub>amb</sub>	ambient temperature		-40	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 1.65 V to 2.7 V	-	20	ns/V
		V <sub>CC</sub> = 2.7 V to 5.5 V	-	10	ns/V

<sup>[2]</sup> For SOT505-2 (TSSOP8) package: P<sub>tot</sub> derates linearly with 4.6 mW/K above 96 °C. For SOT765-1 (VSSOP8) package: P<sub>tot</sub> derates linearly with 4.9 mW/K above 99 °C.

### 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 <sub>amb</sub> = -4	0 °C to +85 °C					
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 × V <sub>CC</sub>	-	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.7 × V <sub>CC</sub>	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35 × V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.3 × V <sub>CC</sub>	V
V <sub>OH</sub>	HIGH-level output voltage	$V_{I} = V_{IH}$ or $V_{IL}$				
		I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 1.65 V to 5.5 V	V <sub>CC</sub> - 0.1	-	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	1.2	1.53	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.9	2.13	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	2.2	2.50	-	V
		I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V	2.3	2.60	-	V
		I <sub>O</sub> = -32 mA; V <sub>CC</sub> = 4.5 V	3.8	4.10	-	V
V <sub>OL</sub>	LOW-level output voltage	$V_{I} = V_{IH}$ or $V_{IL}$				
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 1.65 V to 5.5 V	-	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	0.08	0.45	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	0.14	0.3	V
		$I_{O}$ = 12 mA; $V_{CC}$ = 2.7 V	-	0.19	0.4	V
		$I_O = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	0.37	0.55	V
		$I_{O}$ = 32 mA; $V_{CC}$ = 4.5 V	-	0.43	0.55	V
l <sub>l</sub>	input leakage current	$V_I = 5.5 \text{ V or GND}$ ; $V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	-	±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 <sub>CC</sub>	supply current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 1.65 V to 5.5 V; I <sub>O</sub> = 0 A	-	0.1	4	μA
Δl <sub>CC</sub>	additional supply current	per pin; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; V <sub>CC</sub> = 2.3 V to 5.5 V; I <sub>O</sub> = 0 A	-	5	500	μА
Ci	input capacitance		-	2.5	-	pF

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
T <sub>amb</sub> = -4	0 °C to +125 °C		_			
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 × V <sub>CC</sub>	-	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.7 × V <sub>CC</sub>	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35 × V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.3 × V <sub>CC</sub>	V
V <sub>OH</sub>	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 1.65 V to 5.5 V	V <sub>CC</sub> - 0.1	-	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	0.95	-	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.7	-	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	1.9	-	-	V
		$I_{O}$ = -24 mA; $V_{CC}$ = 3.0 V	2.0	-	-	V
		I <sub>O</sub> = -32 mA; V <sub>CC</sub> = 4.5 V	3.4	-	-	V
V <sub>OL</sub>	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 1.65 V to 5.5 V	-	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.70	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.45	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.60	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.80	V
		I <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V	-	-	0.80	V
lı	input leakage current	$V_{I} = 5.5 \text{ V or GND}; V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	-	-	±1	μA
I <sub>OFF</sub>	power-off leakage current	$V_{I}$ or $V_{O} = 5.5 \text{ V}$ ; $V_{CC} = 0 \text{ V}$	-	-	±2	μΑ
I <sub>CC</sub>	supply current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 1.65 V to 5.5 V; I <sub>O</sub> = 0 A		4	μΑ	
ΔI <sub>CC</sub>	additional supply current	per pin; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; V <sub>CC</sub> = 2.3 V to 5.5 V; I <sub>O</sub> = 0 A	-	-	500	μΑ

<sup>[1]</sup> 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. 5.

Symbol	Parameter	Conditions	-40	°C to +85	°C	-40 °C to	+125 °C	Unit
			Min	Typ[1]	Max	Min	Max	
t <sub>pd</sub>	propagation delay	nA, nB to nY; see Fig. 4 [2]						
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.3	3.9	8.8	1.3	11	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.8	2.4	4.7	0.8	5.9	ns
		V <sub>CC</sub> = 2.7 V	0.8	2.7	4.8	0.8	6.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.9	2.2	4.2	0.9	5.3	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.7	1.7	3.2	0.7	4.0	ns
C <sub>PD</sub>	power dissipation capacitance	per gate; $V_I$ = GND to $V_{CC}$ [3]	-	14	-	-	-	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  $\mu W$ ).

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

f<sub>i</sub> = input frequency in MHz;

 $f_o$  = output frequency in MHz;

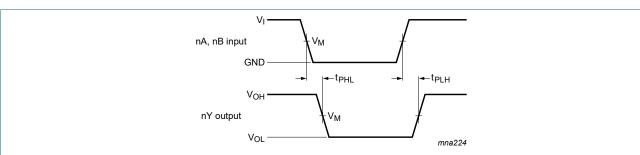
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = 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. Waveform and test circuit



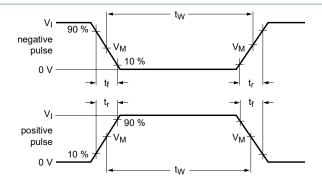
Measurement points are given in Table 9.

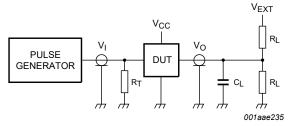
V<sub>OL</sub> and V<sub>OH</sub> are typical output voltage levels that occur with the output load.

Input (nA, nB) to output (nY) propagation delays

**Table 9. Measurement points** 

Supply voltage	Input	Output
V <sub>CC</sub>	V <sub>M</sub>	V <sub>M</sub>
1.65 V to 1.95 V	0.5 × V <sub>CC</sub>	0.5 × V <sub>CC</sub>
2.3 V to 2.7 V	0.5 × V <sub>CC</sub>	0.5 × V <sub>CC</sub>
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 <sub>CC</sub>	0.5 × V <sub>CC</sub>





Test data is given in Table 10.

Definitions for test circuit:

R<sub>L</sub> = Load resistance;

C<sub>L</sub> = Load capacitance including jig and probe capacitance;

 $R_{T}$  = Termination resistance should be equal to output impedance  $Z_{o}$  of the pulse generator;

V<sub>EXT</sub> = Test voltage for switching times.

Fig. 5. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Input L		Load		V <sub>EXT</sub>
V <sub>CC</sub>	VI	t <sub>r</sub> , t <sub>f</sub>	CL	R <sub>L</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>
1.65 V to 1.95 V	V <sub>CC</sub>	≤ 2.0 ns	30 pF	1 kΩ	open
2.3 V to 2.7 V	V <sub>CC</sub>	≤ 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 <sub>CC</sub>	≤ 2.5 ns	50 pF	500 Ω	open

## 12. Package outline

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

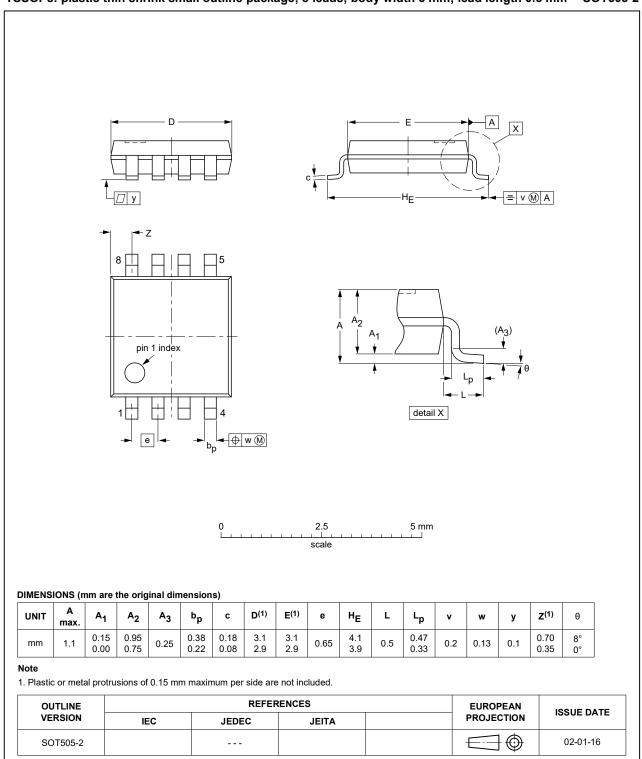


Fig. 6. Package outline SOT505-2 (TSSOP8)

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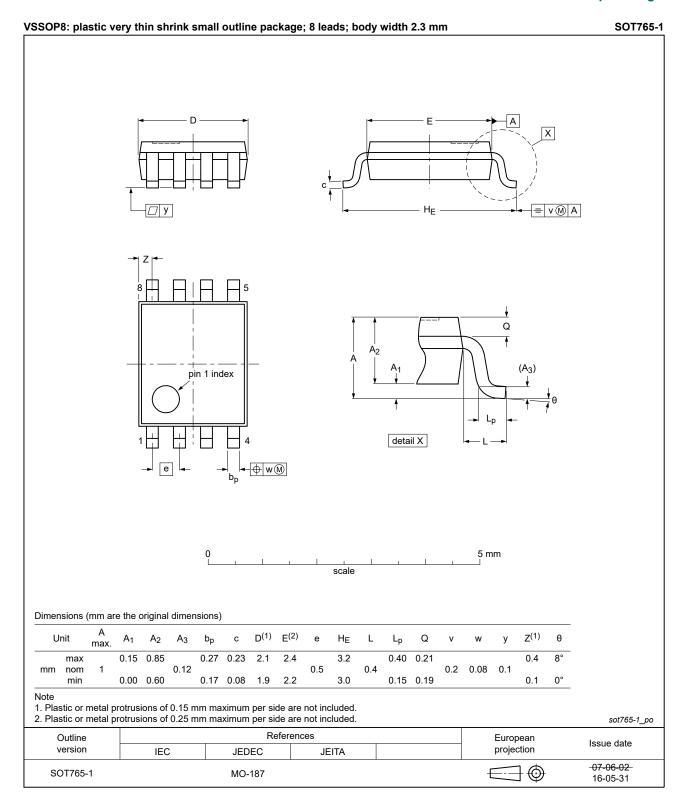


Fig. 7. Package outline SOT765-1 (VSSOP8)

### 13. Abbreviations

#### **Table 11. Abbreviations**

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
TTL	Transistor-Transistor Logic

## 14. Revision history

#### **Table 12. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes			
74LVC2G32_Q100 v.4	20230822	Product data sheet	-	74LVC2G32_Q100 v.3			
Modifications:	Section 2: I	<u>Section 2</u> : ESD specification updated according to the latest JEDEC standard.					
74LVC2G32_Q100 v.3	20220318	Product data sheet	-	74LVC2G32_Q100 v.2			
Modifications:	guidelines Legal texts Section 1	<ul> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Section 1 and Section 2 updated.</li> <li>Table 5: Derating values for P<sub>tot</sub> total power dissipation have been updated.</li> </ul>					
74LVC2G32_Q100 v.2	20161214	Product data sheet	-	74LVC2G32_Q100 v.1			
Modifications:	• <u>Table 7</u> : Th	<u>Table 7</u> : The maximum limits for leakage current and supply current have changed.					
74LVC2G32_Q100 v.1	20130704	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.

- 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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For more information, please visit: http://www.nexperia.com For sales office addresses, please send an email to: salesaddresses@nexperia.com Date of release: 22 August 2023

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