# 74LVC1G38-Q100

# 2-input NAND gate; open drain Rev. 2 — 9 December 2016

**Product data sheet** 

#### **General description** 1.

The 74LVC1G38-Q100 provides a 2-input NAND function.

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

This device is fully specified for partial power-down applications using I<sub>OFF</sub>. The I<sub>OFF</sub> circuitry disables the output, preventing the 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
- 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).
- $\pm$  24 mA output drive (V<sub>CC</sub> = 3.0 V)
- CMOS low power consumption
- Open drain outputs
- 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)



# 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC1G38GW-Q100	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74LVC1G38GV-Q100	−40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753

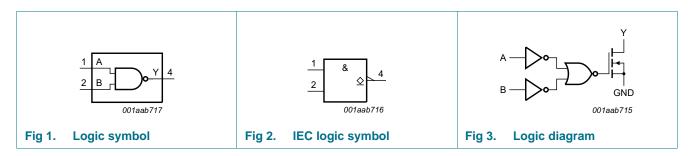
### 4. Marking

#### Table 2. Marking

Type number	Marking code <sup>[1]</sup>
74LVC1G38GW-Q100	YB
74LVC1G38GV-Q100	YB

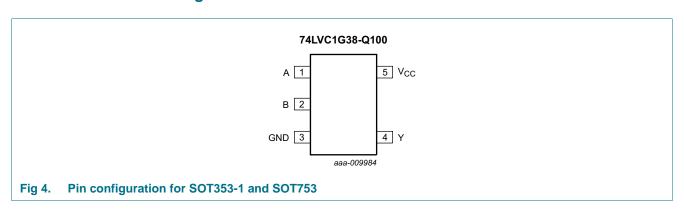
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

### 5. Functional diagram



# 6. Pinning information

### 6.1 Pinning



74LVC1G38\_Q100

# 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
A	1	data input
В	2	data input
GND	3	ground (0 V)
Υ	4	data output
V <sub>CC</sub>	5	supply voltage

# 7. Functional description

Table 4. Function table[1]

Input	Output	
Α	В	Υ
L	L	Z
L	Н	Z
Н	L	Z
Н	Н	L

<sup>[1]</sup> H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF state.

### 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
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V		-50	-	mA
VI	input voltage		<u>[1]</u>	-0.5	+6.5	V
I <sub>OK</sub>	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V		-	±50	mA
Vo	output voltage	Active mode	[1][2]	-0.5	+6.5	V
		Power-down mode	[1][2]	-0.5	+6.5	V
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			<b>-65</b>	+150	°C
P <sub>tot</sub>	total power dissipation	$T_{amb} = -40  ^{\circ}\text{C} \text{ to } +125  ^{\circ}\text{C}$	[3]	-	300	mW

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

<sup>[2]</sup> When  $V_{CC} = 0 \text{ V}$  (Power-down mode), the output voltage can be 5.5 V in normal operation.

<sup>[3]</sup> For TSSOP5 and SC-74A packages: above 87.5 °C the value of Ptot derates linearly with 4.0 mW/K.

# 9. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Тур	Max	Unit	
V <sub>CC</sub>	supply voltage		1.65	-	5.5	V	
VI	input voltage		0	-	5.5	V	
V <sub>O</sub> output volta	output voltage	Active mode	0	-	5.5	V	
		Disable mode; V <sub>CC</sub> = 1.65 V to 5.5 V	0	-	5.5	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 training fall rate	input transition rise and	V <sub>CC</sub> = 1.65 V to 2.7 V	-	-	20	ns/V	
	fall rate	V <sub>CC</sub> = 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	Тур	Max	Unit
T <sub>amb</sub> = -	40 °C to +85 °C[1]		'			
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65V <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	0.7V <sub>CC</sub>	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35V <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	-	-	0.3V <sub>CC</sub>	V
V <sub>OL</sub>	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$	-	-	-	
		$I_{O}$ = 100 $\mu$ A; $V_{CC}$ = 1.65 V to 5.5 V	-	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.45	V
		$I_{O} = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.3	V
		$I_{O}$ = 12 mA; $V_{CC}$ = 2.7 V	-	-	0.4	V
		$I_{O} = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.55	V
		$I_{O} = 32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	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	μА
l <sub>OZ</sub>	OFF-state output current	$V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	±0.1	±2	μА
I <sub>OFF</sub>	power-off leakage current	$V_{I}$ or $V_{O} = 5.5 \text{ V}$ ; $V_{CC} = 0 \text{ V}$	-	±0.1	±2	μА
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	μА
$\Delta I_{CC}$	additional supply current	$V_{I} = V_{CC} - 0.6 \text{ V}; I_{O} = 0 \text{ A};$ $V_{CC} = 2.3 \text{ V to 5.5 V}; \text{ per pin}$	-	5	500	μА
Cı	input capacitance		-	2.5	-	pF

 Table 7.
 Static characteristics ...continued

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

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
T <sub>amb</sub> = -	-40 °C to +125 °C		'			
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65V <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	0.7V <sub>CC</sub>	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35V <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	-	-	0.3V <sub>CC</sub>	V
V <sub>OL</sub>	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$	-	-	-	
		$I_{O}$ = 100 $\mu$ A; $V_{CC}$ = 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
		$I_{O}$ = 8 mA; $V_{CC}$ = 2.3 V	-	-	0.45	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 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
l <sub>l</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	±1	μА
I <sub>OZ</sub>	OFF-state output current	$V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	±2	μА
I <sub>OFF</sub>	power-off leakage current	$V_{I}$ or $V_{O} = 5.5 \text{ V}$ ; $V_{CC} = 0 \text{ V}$	-	-	±2	μА
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
Δl <sub>CC</sub>	additional supply current	$V_I = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A};$ $V_{CC} = 2.3 \text{ V} \text{ to 5.5 V}; \text{ per pin}$	-	-	500	μΑ

<sup>[1]</sup> All typical values are measured at  $V_{CC}$  = 3.3 V and  $T_{amb}$  = 25 °C.

### 11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 6.

Symbol	Parameter	Conditions	-40	°C to +8	5 °C	-40 °C to	Unit	
			Min	Typ[1]	Max	Min	Max	
t <sub>pd</sub>	propagation delay	A, B to Y; see Figure 5						
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.0	3.0	10.0	1.0	12.5	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.5	1.8	6.0	0.5	7.5	ns
		V <sub>CC</sub> = 2.7 V	0.5	2.5	5.0	0.5	6.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.5	2.3	4.5	0.5	5.7	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.5	1.5	3.9	0.5	4.9	ns
$C_{PD}$	power dissipation capacitance	$V_{CC} = 3.3 \text{ V};$ [3] $V_I = \text{GND to V}_{CC}$	-	6	-	-	-	pF

- [1] Typical values are measured at  $T_{amb} = 25$  °C and  $V_{CC} = 1.8$  V, 2.5 V, 2.7 V, 3.3 V and 5.0 V respectively.
- [2]  $t_{pd}$  is the same as  $t_{PZL}$  and  $t_{PLZ}$ .
- [3]  $C_{PD}$  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:

 $f_i$  = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

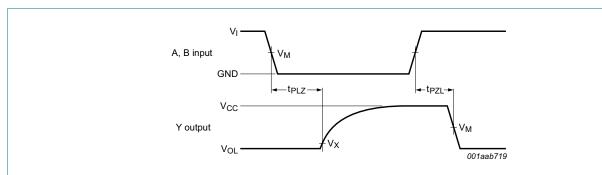
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

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

### 12. Waveform and test circuit



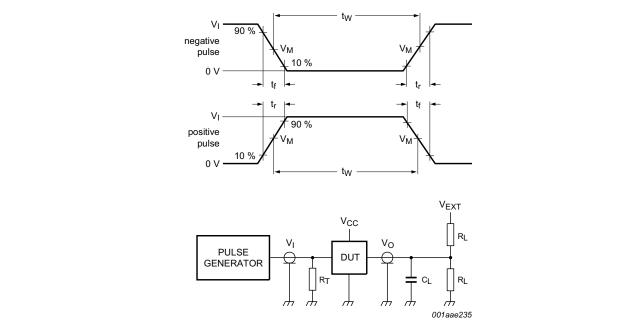
Measurement points are given in Table 9.

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

Fig 5. The input (A, B) to output (Y) propagation delays

Table 9. Measurement points

Supply voltage	upply voltage Input Output			
V <sub>CC</sub>	V <sub>M</sub>	V <sub>M</sub>	V <sub>X</sub>	
1.65 V to 1.95 V	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>	V <sub>OL</sub> + 0.15 V	
2.3 V to 2.7 V	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>	V <sub>OL</sub> + 0.15 V	
2.7 V	1.5 V	1.5 V	V <sub>OL</sub> + 0.3 V	
3.0 V to 3.6 V	1.5 V	1.5 V	V <sub>OL</sub> + 0.3 V	
4.5 V to 5.5 V	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>	V <sub>OL</sub> + 0.3 V	



Test data is given in Table 10.

Definitions for test circuit:

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

 $C_L$  = Load capacitance including jig and probe capacitance.

 $R_T$  = Termination resistance should be equal to the output impedance  $Z_0$  of the pulse generator.

 $V_{\mathsf{EXT}}$  = External voltage for measuring switching times.

Fig 6. Test circuit for measuring switching times

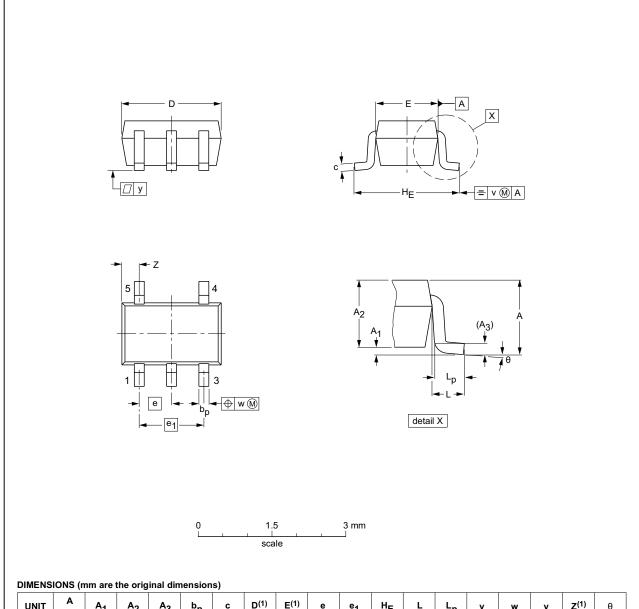
Table 10. Test data

Supply voltage	Input		Load	Load				
V <sub>CC</sub>	VI	t <sub>r</sub> , t <sub>f</sub>	CL	R <sub>L</sub>	t <sub>PZL</sub> , t <sub>PLZ</sub>			
1.65 V to 1.95 V	V <sub>CC</sub>	≤ 2.0 ns	30 pF	1 kΩ	V <sub>CC</sub>			
2.3 V to 2.7 V	V <sub>CC</sub>	≤ 2.0 ns	30 pF	500 Ω	V <sub>CC</sub>			
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	V <sub>CC</sub>			
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	V <sub>CC</sub>			
4.5 V to 5.5 V	V <sub>CC</sub>	≤ 2.5 ns	50 pF	500 Ω	V <sub>CC</sub>			

# 13. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1



UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	Α3	bр	C	D <sup>(1)</sup>	E <sup>(1)</sup>	е	e <sub>1</sub>	HE	L	Lp	v	w	у	Z <sup>(1)</sup>	θ	
mm	1.1	0.1 0	1.0 0.8	0.15	0.30 0.15	0.25 0.08	2.25 1.85	1.35 1.15	0.65	1.3	2.25 2.0	0.425	0.46 0.21	0.3	0.1	0.1	0.60 0.15	7° 0°	

#### Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN	ISSUE DATE
	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT353-1		MO-203	SC-88A			<del>00-09-01</del> 03-02-19

Fig 7. Package outline SOT353-1 (TSSOP5)

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#### **SOT753** Plastic surface-mounted package; 5 leads В A X = v (M) A $H_{\mathsf{E}}$ 5 Q 3 detail X **→** | w (M) B е 2 mm scale **DIMENSIONS (mm are the original dimensions)** UNIT D Q Α Α1 С Ε bp е $H_{\mathsf{E}}$ $L_{\mathbf{p}}$ w у 0.100 0.40 3.1 2.7 3.0 2.5 0.33 0.23 0.26 1.1 0.9 1.7 0.6 0.95 0.1 0.013 0.25 0.10 1.3 0.2 REFERENCES **EUROPEAN** OUTLINE ISSUE DATE VERSION JEDEC **PROJECTION** IEC **JEITA** 02-04-16 SOT753 SC-74A ∄ــــ 06-03-16

Fig 8. Package outline SOT753 (SC-74A)

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### 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
74LVC1G38_Q100 v.1	20161209	Product data sheet	-	74LVC1G38_Q100 v.1
Modifications:	<u>Table 7</u> : The maximum limits for leakage current and supply current have changed.			
74LVC1G38_Q100 v.1	20131127	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.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

- [1] 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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Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию.

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России, а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научноисследовательскими институтами России.

С нами вы становитесь еще успешнее!

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