

74LVC1GU04GV-Q100H Datasheet

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DiGi Electronics Part Number Manufacturer Manufacturer Product Number Description Detailed Description 74LVC1GU04GV-Q100H-DG Nexperia USA Inc. 74LVC1GU04GV-Q100H IC INVERTER 1CH 1-INP SC74A Inverter IC 1 Channel SC-74A

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Manufacturer Product Number:	Manufacturer:
74LVC1GU04GV-Q100H	Nexperia USA Inc.
Series:	Product Status:
74LVC	Active
Logic Type:	Number of Circuits:
Inverter	1
Number of Inputs:	Features:
1	
Voltage - Supply:	Current - Quiescent (Max):
1.65V ~ 5.5V	4 μΑ
Current - Output High, Low:	Input Logic Level - Low:
32mA, 32mA	0.33V ~ 1.1V
Input Logic Level - High:	Max Propagation Delay @ V, Max CL:
1.32V ~ 4.4V	4ns @ 5V, 50pF
Operating Temperature:	Grade:
-40°C ~ 125°C (TA)	Automotive
Qualification:	Mounting Type:
AEC-Q100	Surface Mount
Supplier Device Package:	Package / Case:
SC-74A	SC-74A, SOT-753
Base Product Number:	
74LVC1GU04	

Environmental & Export classification

RoHS Status:	Moisture Sensitivity Level (MSL):
ROHS3 Compliant	1 (Unlimited)
REACH Status:	ECCN:
REACH Unaffected	EAR99
HTSUS:	
8542.39.0001	

Unbuffered inverter Rev. 6 — 13 November 2024

Product data sheet

1. General description

The 74LVC1GU04-Q100 is a single unbuffered inverter. The input can be driven from either 3.3 V or 5 V devices. This feature allows the use of this device in a mixed 3.3 V and 5 V environment.

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 -40 °C to +125 °C
- Overvoltage tolerant inputs to 5.5 V
- Wide supply voltage range from 1.65 V to 5.5 V
- High noise immunity
- ±24 mA output drive (V_{CC} = 3.0 V)
- CMOS low power dissipation
- Latch-up performance exceeds 250 mA
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Multiple package options

3. Ordering information

Table 1. Ordering information

Type number	Package	ckage						
	Temperature range	Name	Description	Version				
74LVC1GU04GW-Q100	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	<u>SOT353-1</u>				
74LVC1GU04GV-Q100	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	<u>SOT753</u>				
74LVC1GU04GZ-Q100	-40 °C to +125 °C	XSON5	plastic thermal enhanced extremely thin small outline package with side-wettable flanks (SWF); no leads; 5 terminals; body 1.1 × 0.85 × 0.5 mm	<u>SOT8065-1</u>				

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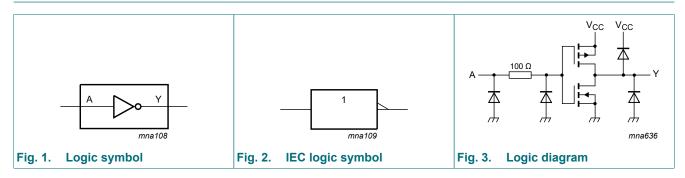
74LVC1GU04-Q100

4. Marking

Table 2. Marking codes				
Type number	Marking[1]			
74LVC1GU04GW-Q100	VD			
74LVC1GU04GV-Q100	VU4			
74LVC1GU04GZ-Q100	VD			

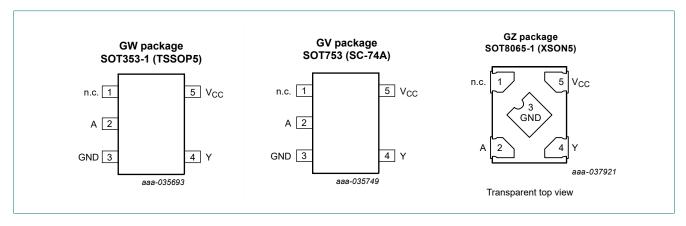
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



6. Pinning information

6.1. Pinning



6.2. Pin description

Table 3. Pin description					
Symbol	Pin	Description			
n.c.	1	not connected			
A	2	data input			
GND	3	ground (0 V)			
Y	4	data output			
V _{cc}	5	supply voltage			

74LVC1GU04_Q100

7. Functional description

Table 4. Function table

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

Input (A)	Output (Y)
L	Н
Н	L

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
I _{IK}	input clamping current	V _I < 0 V		-	-50	mA
VI	input voltage		[1]	-0.5	+6.5	V
I _{ОК}	output clamping current	$V_{O} > V_{CC}$ or $V_{O} < 0 V$		-	±50	mA
Vo	output voltage	Active mode	[1][2]	-0.5	V _{CC} + 0.5	V
I _O	output current	$V_{O} = 0 V \text{ to } V_{CC}$		-	±50	mA
I _{CC}	supply current			-	+100	mA
I _{GND}	ground current			-	-100	mA
P _{tot}	total power dissipation	T _{amb} = -40 °C to +125 °C	[3]	-	250	mW
T _{stg}	storage temperature			-65	+150	°C

[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 operation

[3] For SOT353-1 (TSSOP5) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.

For SOT753 (SC-74A) package: P_{tot} derates linearly with 3.8 mW/K above 85 °C.

For SOT8065-1 (XSON5) package: P_{tot} derates linearly with 3.2 mW/K above 72 °C.

9. Recommended operating conditions

Table 6. Recommended operating conditions

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

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V _{CC}	supply voltage		1.65	-	5.5	V
VI	input voltage		0	-	5.5	V
Vo	output voltage	Active mode	0	-	V _{CC}	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	0	-	20	ns/V
		V _{CC} = 2.7 V to 5.5 V	0	-	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 5.5 V	$0.75 \times V_{CC}$	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.65 V to 5.5 V	-	-	$0.25 \times V_{CC}$	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	-	-	V
		I _O = -8 mA; V _{CC} = 2.3 V	1.9	-	-	V
		I _O = -12 mA; V _{CC} = 2.7 V	2.2	-	-	V
		I _O = -24 mA; V _{CC} = 3.0 V	2.3	-	-	V
		I _O = -32 mA; V _{CC} = 4.5 V	3.8	-	-	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	-	-	0.45	V
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.3	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	-	0.4	V
		I _O = 24 mA; V _{CC} = 3.0 V	-	-	0.55	V
		I _O = 32 mA; V _{CC} = 4.5 V	-	-	0.55	V
l _l	input leakage current	V_{I} = 5.5 V or GND; V_{CC} = 0 V to 5.5 V	-	±0.1	±1	μA
I _{CC}	supply current	V _I = 5.5 V or GND; I _O = 0 A; V _{CC} = 1.65 V to 5.5 V	-	0.1	4	μA
CI	input capacitance	V_{CC} = 3.3 V; V_{I} = GND to V_{CC}	-	6	-	pF

74LVC1GU04-Q100

Unbuffered inverter

Symbol	Parameter	Conditions	Min	Typ[1]	Мах	Unit
T _{amb} = -4	10 °C to +125 °C					1
VIH	HIGH-level input voltage	V _{CC} = 1.65 V to 5.5 V	0.8 × V _{CC}	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.65 V to 5.5 V	-	-	$0.2 \times V_{CC}$	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	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	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		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	-	-	0.7	V
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.45	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	-	0.6	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
I _I	input leakage current	V_1 = 5.5 V or GND; V_{CC} = 0 V to 5.5 V	-	±0.1	±1	μA
I _{CC}	supply current	V _I = 5.5 V or GND; I _O = 0 A; V _{CC} = 1.65 V to 5.5 V	-	-	4	μA

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

74LVC1GU04_Q100

Unbuffered inverter

11. Dynamic characteristics

Table 8. Dynamic characteristics

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

Symbol	Parameter	Conditions	-40	°C to +85	°C	-40 °C to	+125 °C	Unit
			Min	Typ[1]	Мах	Min	Мах	
t _{pd}	propagation delay	A to Y; see <u>Fig. 4</u> [2]						
		V _{CC} = 1.65 V to 1.95 V	0.3	1.7	5.0	0.3	6.5	ns
		V _{CC} = 2.3 V to 2.7 V	0.3	1.3	4.0	0.3	5.5	ns
		V _{CC} = 2.7 V	0.5	1.7	5.0	0.5	6.5	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	1.6	3.7	0.5	5.0	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	1.3	3.0	0.5	4.0	ns
C _{PD}	power dissipation capacitance	$V_{I} = GND \text{ to } V_{CC}; \qquad [3]$ $V_{CC} = 3.3 \text{ V}$	-	14.9	-	-	-	pF

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. [1]

[2]

 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). [3]

 $P_{D} = C_{PD} \times V_{CC}^{2} \times f_{i} \times N + \sum (C_{L} \times V_{CC}^{2} \times f_{o}) \text{ where:}$

 f_i = input frequency in MHz;

 $f_o = output$ frequency in MHz;

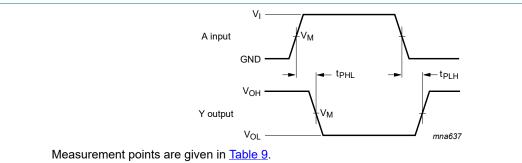
 C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

11.1. Waveform and test circuit



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

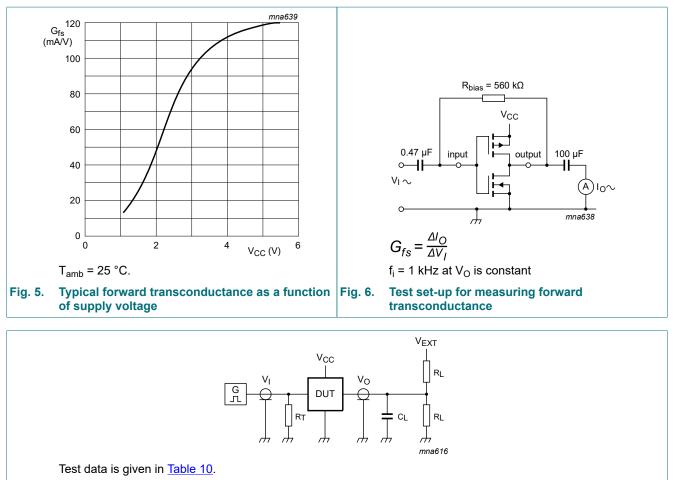
Fig. 4. The input A to output Y propagation delay times

Table 9. Measurement points

Supply voltage	Input	Output
V _{cc}	V _M	V _M
1.65 V to 1.95 V	0.5 x V _{CC}	0.5 x V _{CC}
2.3 V to 2.7 V	0.5 x V _{CC}	0.5 x 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 x V _{CC}	0.5 x V _{CC}

74LVC1GU04-Q100

Unbuffered inverter



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 the output impedance Z_o of the pulse generator;

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

Fig. 7. Test circuit for measuring switching times

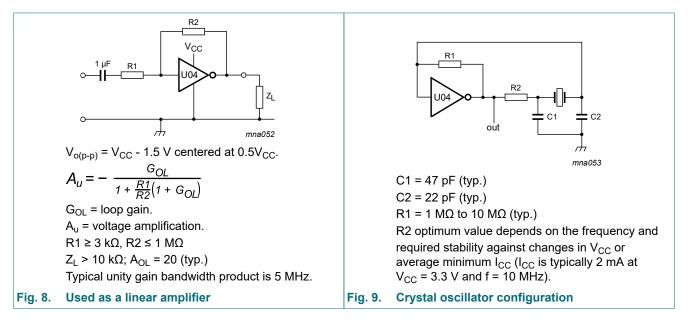
Table 10. Test data V_{EXT} Supply voltage Input Load VI Vcc C_L R_L $t_r = t_f$ t_{PLH}, t_{PHL} ≤ 2.0 ns 1.65 V to 1.95 V 30 pF 1 kΩ V_{CC} open 2.3 V to 2.7 V 30 pF 500 Ω V_{CC} ≤ 2.0 ns open 2.7 V 2.7 V ≤ 2.5 ns 50 pF 500 Ω open 3.0 V to 3.6 V 2.7 V ≤ 2.5 ns 50 pF 500 Ω open 4.5 V to 5.5 V V_{CC} ≤ 2.5 ns 50 pF 500 Ω open

12. Application information

Some applications are:

- Linear amplifier (see Fig. 8)
- In crystal oscillator design (see Fig. 9)

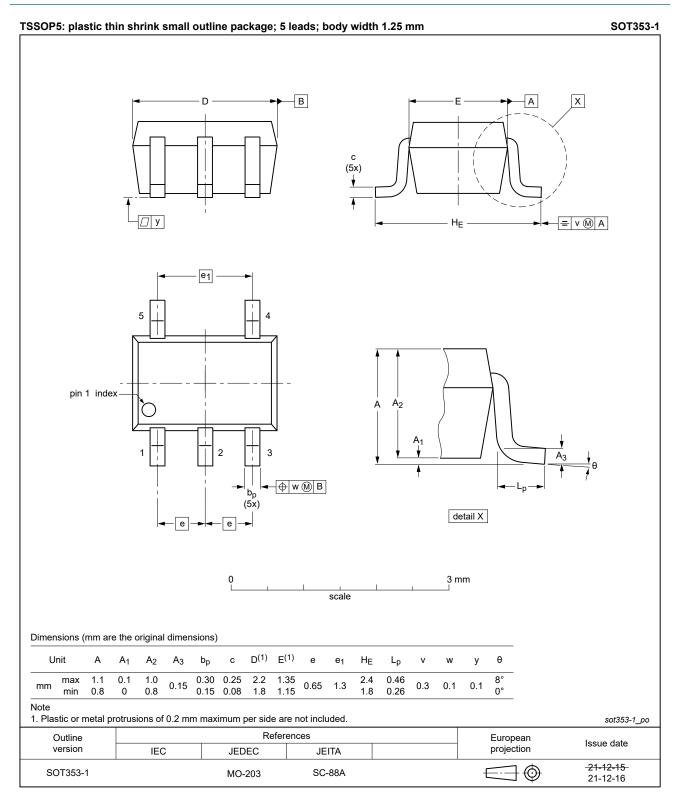
Remark: All values given are typical unless otherwise specified.



74LVC1GU04_Q100

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13. Package outline





74LVC1GU04-Q100

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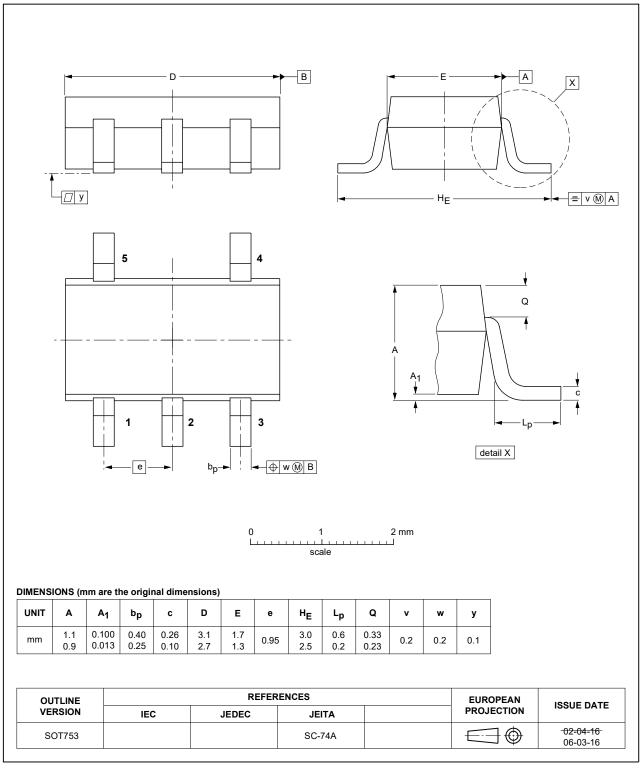
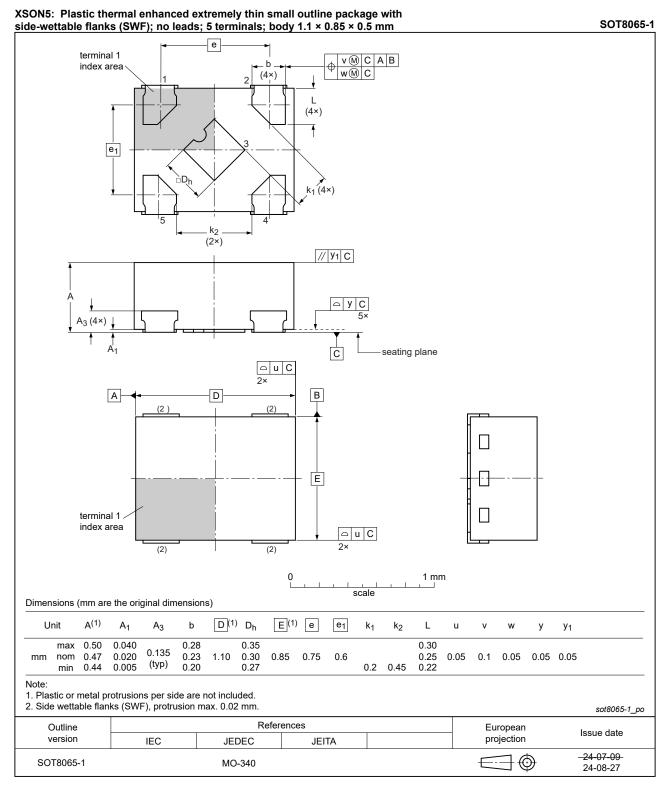


Fig. 11. Package outline SOT753 (SC-74A)

74LVC1GU04-Q100

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14. Abbreviations

Table 11. Abbrev	Description
ANSI	American National Standards Institute
ANSI	
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
ESDA	ElectroStatic Discharge Association
HBM	Human Body Model
JEDEC	Joint Electron Device Engineering Council

15. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes		
74LVC1GU04_Q100 v.6	20241113	Product data sheet	-	74LVC1GU04_Q100 v.5		
Modifications:	Type number	Type number 74LVC1GU04GZ-Q100 (SOT8065-1/XSON5) added.				
74LVC1GU04_Q100 v.5	20230907	Product data sheet	-	74LVC1GU04_Q100 v.4		
Modifications:	<u>Section 1</u> and <u>Section 2</u> updated.					
74LVC1GU04_Q100 v.4	20220112	Product data sheet	-	74LVC1GU04_Q100 v.3		
Modifications:	• <u>Fig. 10</u> : Pac	• Fig. 10: Package outline drawing SOT353-1 (TSSOP5) has changed.				
74LVC1GU04_Q100 v.3	20210927	Product data sheet	-	74LVC1GU04_Q100 v.2		
Modifications:	 <u>Section 1</u> and <u>Section 2</u> updated. <u>Table 5</u>: Derating values for P_{tot} total power dissipation updated. 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. 					
74LVC1GU04_Q100 v.2	20161213	Product data sheet	-	74LVC1GU04_Q100 v.1		
Modifications:	• <u>Table 7</u> : The	e maximum limits for lea	kage current and su	pply current have changed.		
74LVC1GU04 Q100 v.1	20130514	Product data sheet	-	-		

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16. 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.
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[2] The term 'short data sheet' is explained in section "Definitions".

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74LVC1GU04-Q100

Unbuffered inverter

Contents

1. General description	1
2. Features and benefits	1
3. Ordering information	1
4. Marking	2
5. Functional diagram	2
6. Pinning information	2
6.1. Pinning	2
6.2. Pin description	2
7. Functional description	3
8. Limiting values	3
9. Recommended operating conditions	3
10. Static characteristics	4
11. Dynamic characteristics	6
11.1. Waveform and test circuit	6
12. Application information	8
13. Package outline	9
14. Abbreviations	
15. Revision history	12
16. Legal information	13
-	

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