

# 74AHC3GU04

Triple unbuffered inverter

Rev. 7 — 6 September 2023

Product data sheet

## 1. General description

The 74AHC3GU04 is a triple unbuffered inverter. Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

## 2. Features and benefits

- Symmetrical output impedance
- Balanced propagation delays
- Wide supply voltage range from 2.0 to 5.5 V
- Overvoltage tolerant inputs to 5.5 V
- CMOS input level
- High noise immunity
- CMOS low power dissipation
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level A
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
<a href="#">74AHC3GU04DP</a>	-40 °C to +125 °C	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm	<a href="#">SOT505-2</a>
<a href="#">74AHC3GU04DC</a>	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	<a href="#">SOT765-1</a>

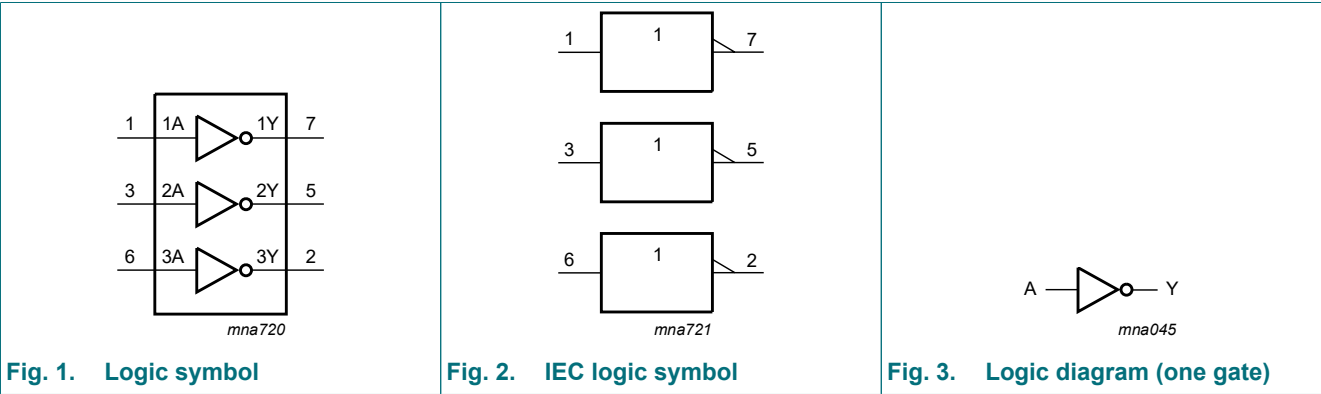
## 4. Marking

Table 2. Marking codes

Type number	Marking code [1]
74AHC3GU04DP	AU4
74AHC3GU04DC	AU4

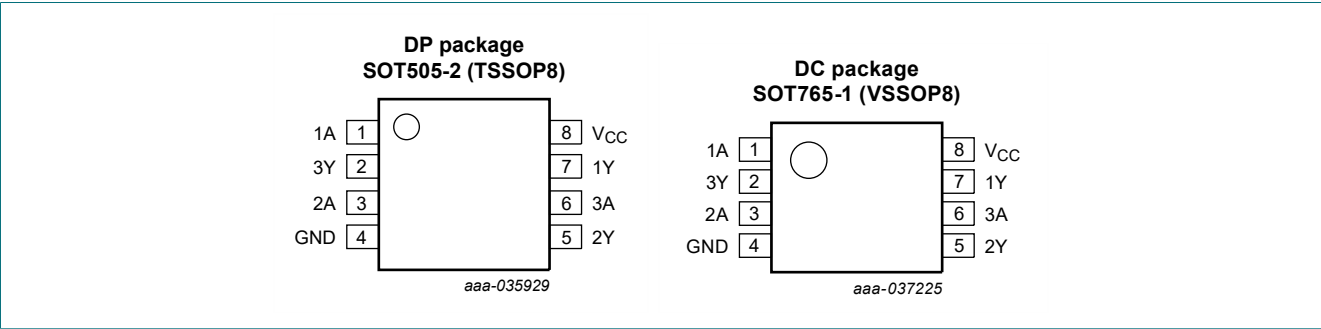
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



6. Pinning information

6.1. Pinning



6.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
1A, 2A, 3A	1, 3, 6	data input
GND	4	ground (0 V)
1Y, 2Y, 3Y	7, 5, 2	data output
V <sub>CC</sub>	8	supply voltage

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level

Input	Output
A	Y
L	H
H	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 <sub>CC</sub>	supply voltage		-0.5	+7.0	V
V <sub>I</sub>	input voltage		-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V [1]	-20	-	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V [1]	-	±20	mA
I <sub>O</sub>	output current	-0.5 V < V <sub>O</sub> < V <sub>CC</sub> + 0.5 V	-	±25	mA
I <sub>CC</sub>	supply current		-	75	mA
I <sub>GND</sub>	ground current		-75	-	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 [2]	-	250	mW

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

[2] 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.

9. Recommended operating conditions

Table 6. Recommended operating conditions

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CC</sub>	supply voltage		2.0	5.0	5.5	V
V <sub>I</sub>	input voltage		0	-	5.5	V
V <sub>O</sub>	output voltage		0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 3.3 V ± 0.3 V	-	-	100	ns/V
		V <sub>CC</sub> = 5.0 V ± 0.5 V	-	-	20	ns/V

10. Static characteristics

Table 7. Static characteristics  
Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 2.0 V	1.7	-	-	1.7	-	1.7	-	V
		V <sub>CC</sub> = 3.0 V	2.4	-	-	2.4	-	2.4	-	V
		V <sub>CC</sub> = 5.5 V	4.4	-	-	4.4	-	4.4	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 2.0 V	-	-	0.3	-	0.3	-	0.3	V
		V <sub>CC</sub> = 3.0 V	-	-	0.6	-	0.6	-	0.6	V
		V <sub>CC</sub> = 5.5 V	-	-	1.1	-	1.1	-	1.1	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	V
		I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V	2.58	-	-	2.48	-	2.40	-	V
V <sub>OL</sub>	LOW-level output voltage	I <sub>O</sub> = -8.0 mA; V <sub>CC</sub> = 4.5 V	3.94	-	-	3.8	-	3.70	-	V
		V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
I <sub>I</sub>	input leakage current	I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
		I <sub>O</sub> = 8.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.36	-	0.44	-	0.55	V
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	1.0	-	10	-	40	µA
C <sub>I</sub>	input capacitance		-	3.0	10	-	10	-	10	pF

10.1. Typical transfer characteristics

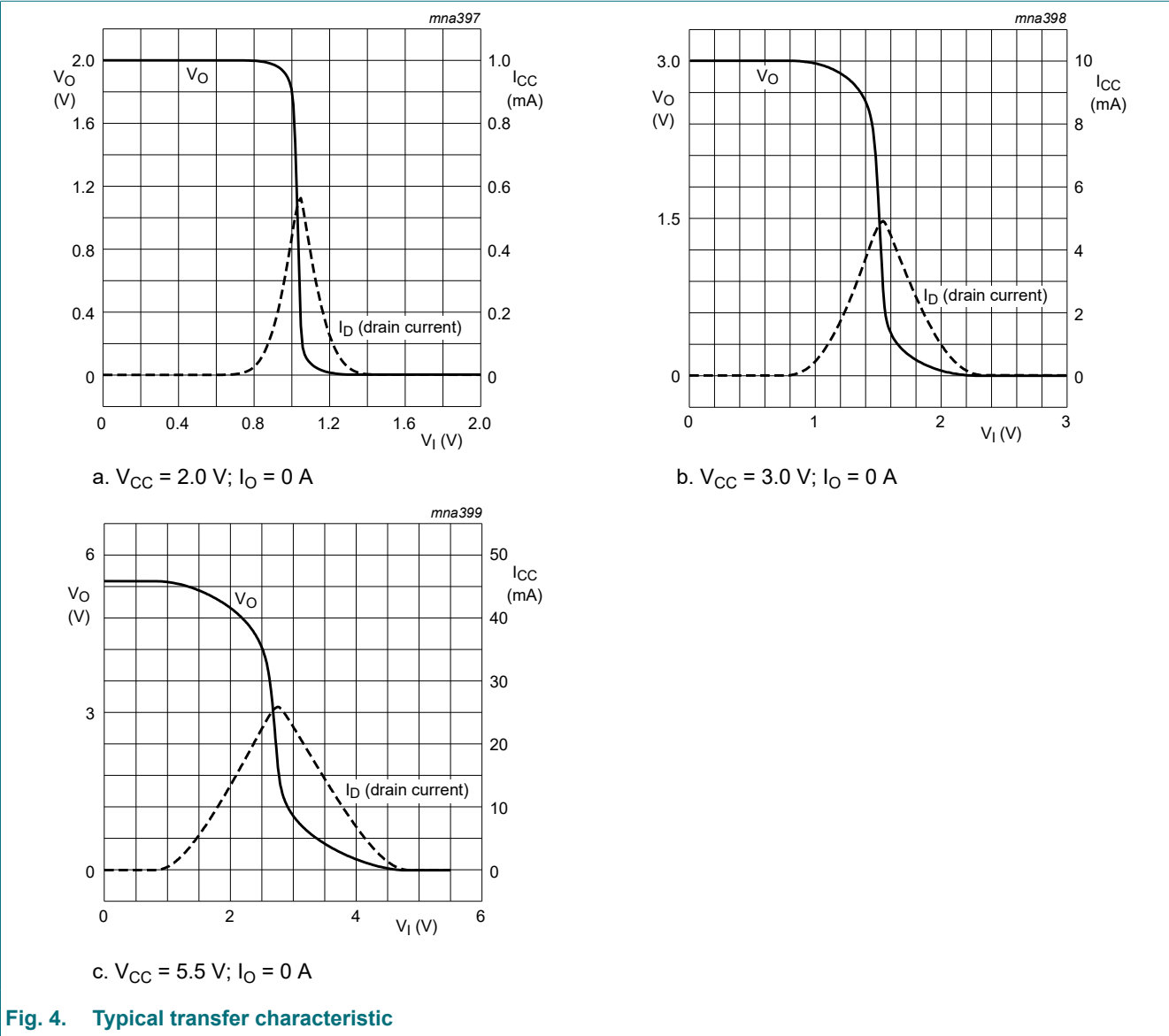


Fig. 4. Typical transfer characteristic

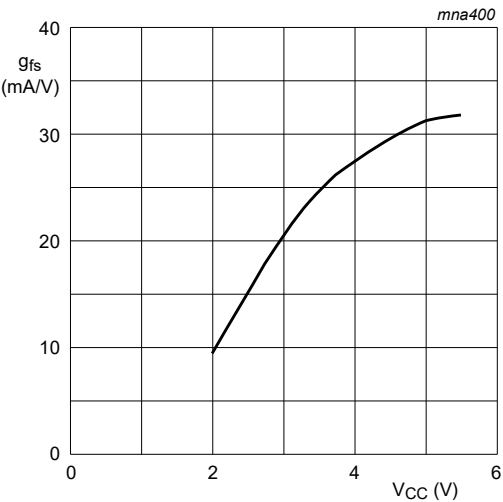
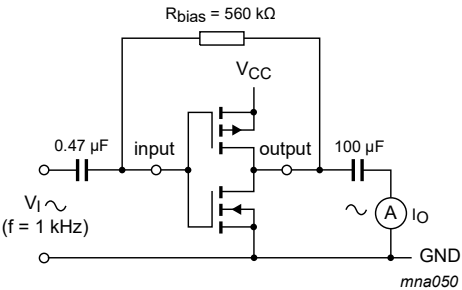


Fig. 5. Typical forward transconductance  $g_{fs}$  as a function of the supply voltage at  $T_{amb} = 25\text{ }^{\circ}\text{C}$



$g_{fs} = \Delta I_O / \Delta V_I$  at  $V_O$  is constant

Fig. 6. Test set-up for measuring forward transconductance

11. Dynamic characteristics

Table 8. Dynamic characteristics

GND = 0 V; For test circuit see Fig. 8.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>pd</sub>	propagation delay	nA to nY; see Fig. 7 [1]								
		V <sub>CC</sub> = 3.0 V to 3.6 V; C <sub>L</sub> = 15 pF [2]	-	3.0	7.1	1.0	8.5	1.0	10.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V; C <sub>L</sub> = 50 pF [2]	-	4.3	10.6	1.0	12.0	1.0	13.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V; C <sub>L</sub> = 15 pF [3]	-	2.5	5.5	1.0	6.0	1.0	7.0	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V; C <sub>L</sub> = 50 pF [3]	-	3.5	7.0	1.0	8.0	1.0	9.0	ns
C <sub>PD</sub>	power dissipation capacitance	per buffer; V <sub>I</sub> = GND to V <sub>CC</sub> [4]	-	4	-	-	-	-	-	pF

- [1] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.
- [2] Typical values are measured at V<sub>CC</sub> = 3.3 V.
- [3] Typical values are measured at V<sub>CC</sub> = 5.0 V.
- [4] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  where:  
f<sub>i</sub> = 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;  
Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of the outputs.

11.1. Waveforms and test circuit

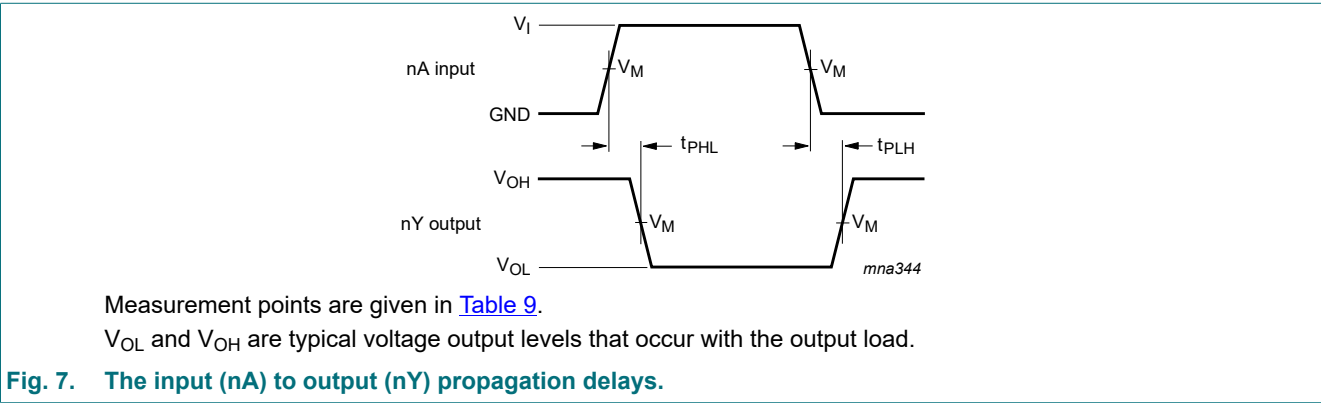


Table 9. Measurement points

Input	Output
$V_M$	$V_M$
$0.5V_{CC}$	$0.5V_{CC}$

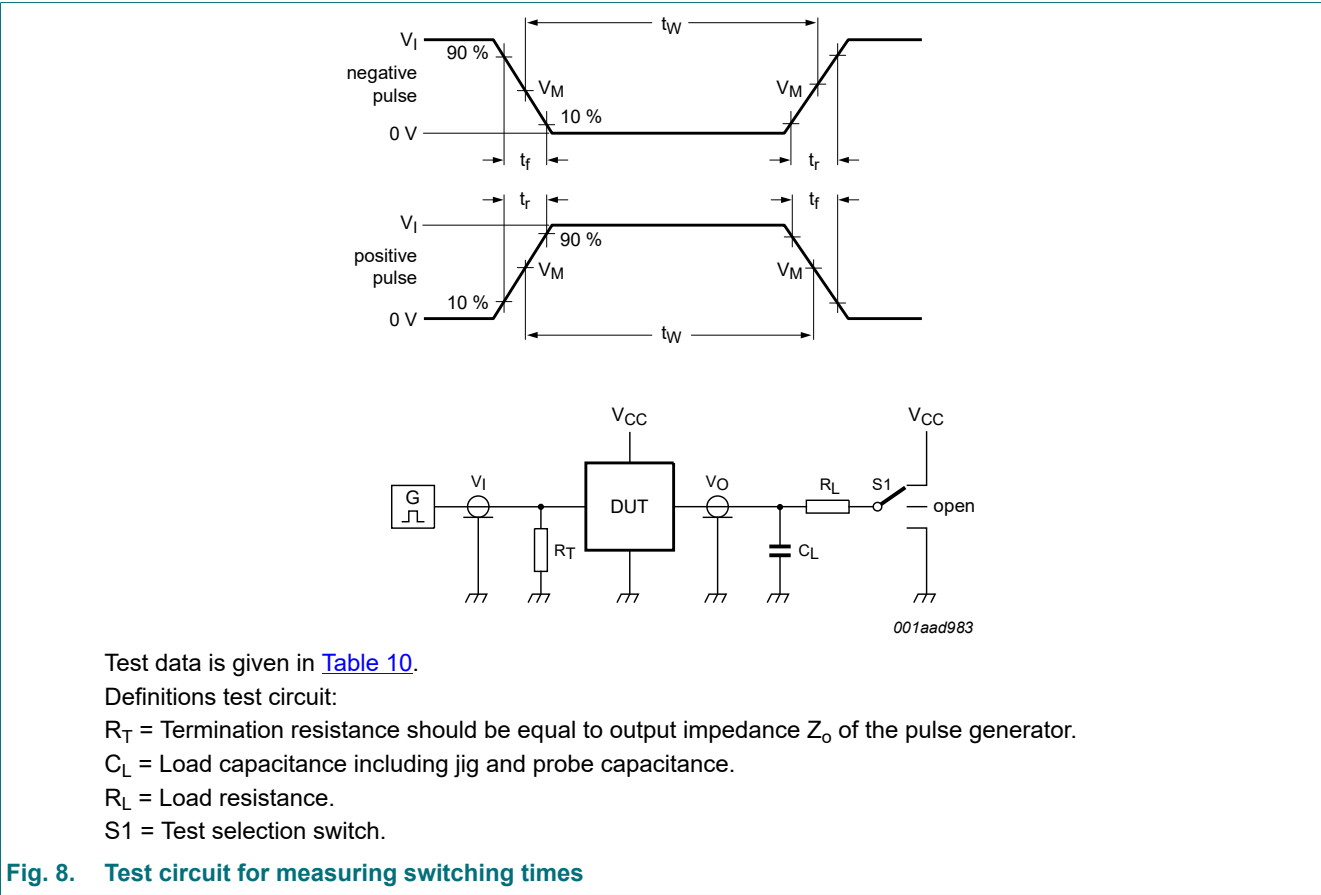


Table 10. Test data

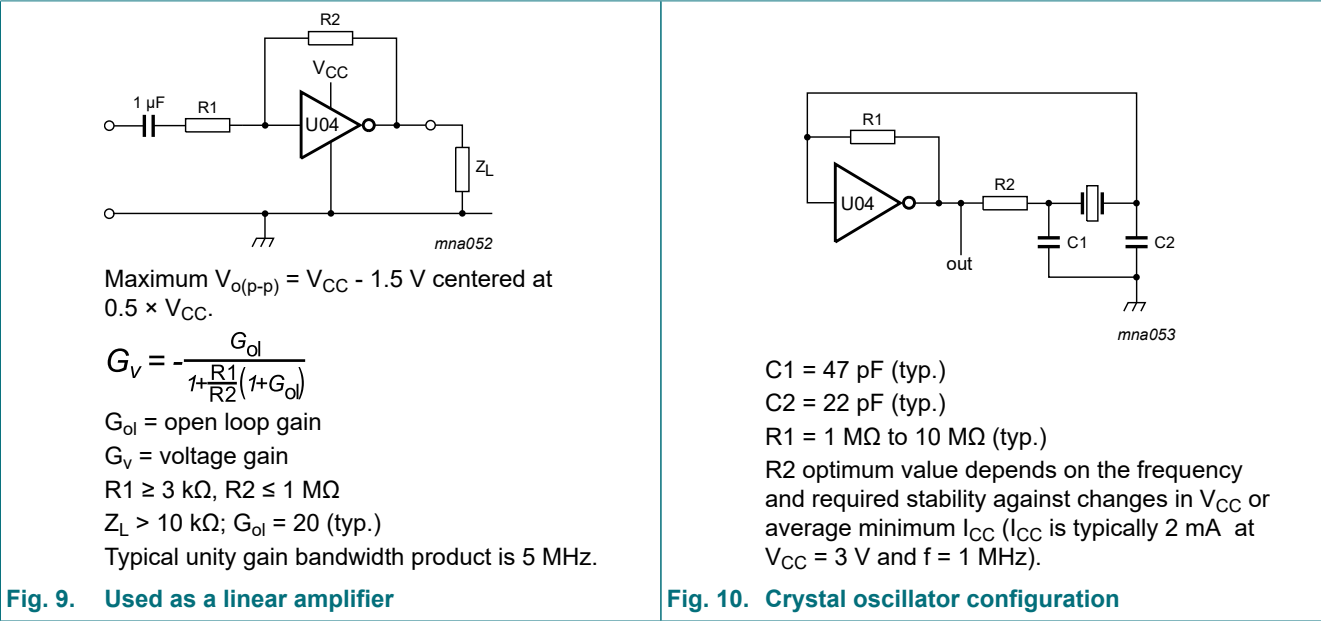
Input		Load		S1 position		
$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
$V_{CC}$	$\leq 3\text{ ns}$	15 pF, 50 pF	1 k $\Omega$	open	GND	$V_{CC}$

12. Application information

Some applications are:

- Linear amplifier (see Fig. 9)
- In crystal oscillator design (see Fig. 10)

**Remark:** All values given are typical unless otherwise specified.



**Table 11. External components for resonator (f < 1 MHz)**  
 All values given are typical and must be used as an initial set-up.

Frequency	R1	R2	C1	C2
10 kHz to 15.9 kHz	22 MΩ	220 kΩ	56 pF	20 pF
16 kHz to 24.9 kHz	22 MΩ	220 kΩ	56 pF	10 pF
25 kHz to 54.9 kHz	22 MΩ	100 kΩ	56 pF	10 pF
55 kHz to 129.9 kHz	22 MΩ	100 kΩ	47 pF	5 pF
130 kHz to 199.9 kHz	22 MΩ	47 kΩ	47 pF	5 pF
200 kHz to 349.9 kHz	22 MΩ	47 kΩ	47 pF	5 pF
350 kHz to 600 kHz	22 MΩ	47 kΩ	47 pF	5 pF

**Table 12. Optimum value for R2**

Frequency	R2	Optimum for
3 kHz	2.0 kΩ	minimum required $I_{CC}$
	8.0 kΩ	minimum influence due to change in $V_{CC}$
6 kHz	1.0 kΩ	minimum required $I_{CC}$
	4.7 kΩ	minimum influence by $V_{CC}$
10 kHz	0.5 kΩ	minimum required $I_{CC}$
	2.0 kΩ	minimum influence by $V_{CC}$
14 kHz	0.5 kΩ	minimum required $I_{CC}$
	1.0 kΩ	minimum influence by $V_{CC}$
>14 kHz	-	replace R2 by C3 with a typical value of 35 pF



13. Package outline

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

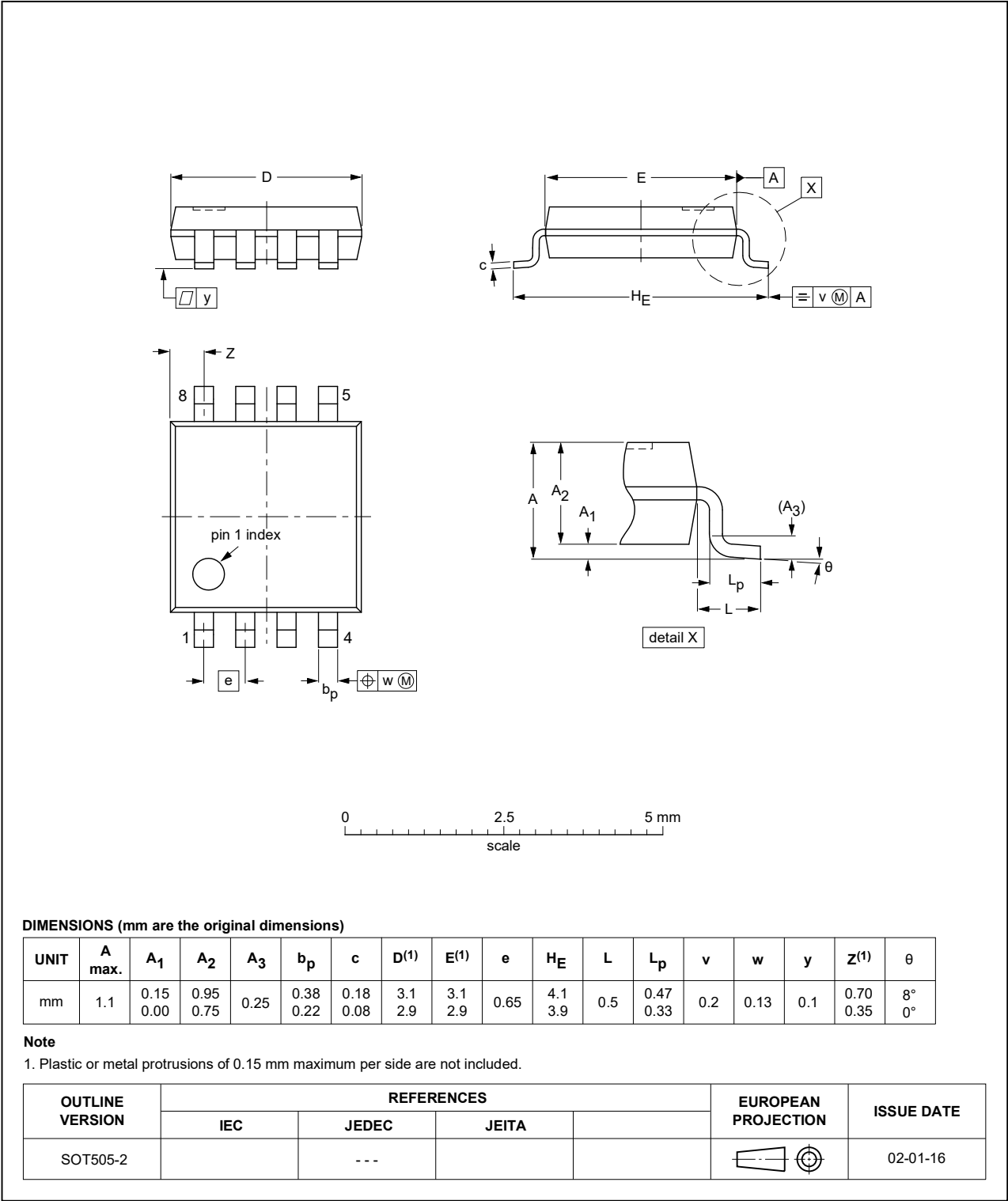


Fig. 11. Package outline SOT505-2 (TSSOP8)

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

SOT765-1

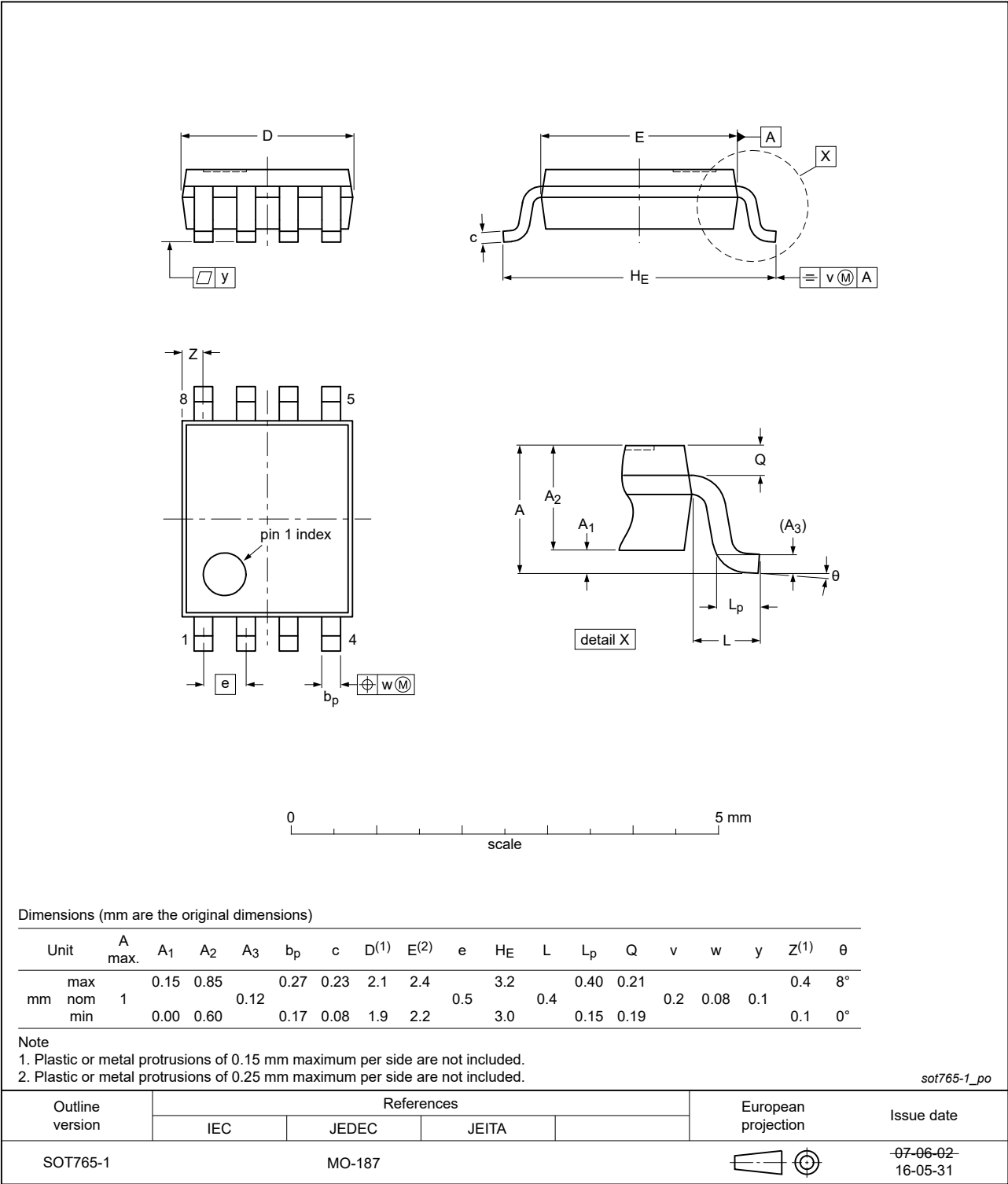


Fig. 12. Package outline SOT765-1 (VSSOP8)

14. Abbreviations

Table 13. Abbreviations

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

15. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC3GU04 v.7	20230906	Product data sheet	-	74AHC3GU04 v.6
Modifications:	<ul style="list-style-type: none"><li>• <a href="#">Section 1</a> and <a href="#">Section 2</a> updated.</li><li>• <a href="#">Section 2</a>: ESD specification updated according to the latest JEDEC standard.</li><li>• <a href="#">Section 8</a>: Derating values for P<sub>tot</sub> total power dissipation updated.</li></ul>			
74AHC3GU04 v.6	20190227	Product data sheet	-	74AHC3GU04 v.5
Modifications:	<ul style="list-style-type: none"><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>• Type number 74AHC3GU04GD (SOT996-2) removed.</li><li>• Package outline drawing <a href="#">SOT765-1</a> (VSSOP8) updated</li></ul>			
74AHC3GU04 v.5	20130508	Product data sheet	-	74AHC3GU04 v.4
Modifications:	<ul style="list-style-type: none"><li>• For type number 74AHC3GU04GD XSON8U has changed to XSON8.</li></ul>			
74AHC3GU04 v.4	20100107	Product data sheet	-	74AHC3GU04 v.3
	<ul style="list-style-type: none"><li>• Marking code for 74AHC3GU04DP package changed from AU04 to AU4</li></ul>			
74AHC3GU04 v.3	20090126	Product data sheet	-	74AHC3GU04 v.2
74AHC3GU04 v.2	20040923	Product specification	-	74AHC3GU04 v.1
74AHC3GU04 v.1	20040305	Product specification	-	-

## 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.
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- [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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Contents

1. General description..... 1

2. Features and benefits..... 1

3. Ordering information..... 1

4. Marking..... 1

5. Functional diagram..... 2

6. Pinning information..... 2

6.1. Pinning..... 2

6.2. Pin description..... 2

7. Functional description..... 2

8. Limiting values..... 3

9. Recommended operating conditions..... 3

10. Static characteristics..... 4

10.1. Typical transfer characteristics..... 5

11. Dynamic characteristics..... 6

11.1. Waveforms and test circuit..... 7

12. Application information..... 8

13. Package outline..... 9

14. Abbreviations..... 11

15. Revision history..... 11

16. Legal information..... 12

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