



74HC3GU04-Q100

Triple unbuffered inverter

Rev. 3 — 5 August 2024

Product data sheet

1. General description

The 74HC3GU04-Q100 is a triple unbuffered inverter. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} .

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 2.0 V to 6.0 V
- Symmetrical output impedance
- High noise immunity
- Low-power dissipation
- Balanced propagation delays
- 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
74HC3GU04DP-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
74HC3GU04DC-Q100	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1

4. Marking

Table 2. Marking

Type number	Marking code ^[1]
74HC3GU04DP-Q100	HU4
74HC3GU04DC-Q100	HU4

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

5. Functional diagram

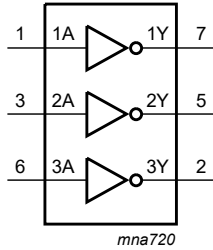


Fig. 1. Logic symbol

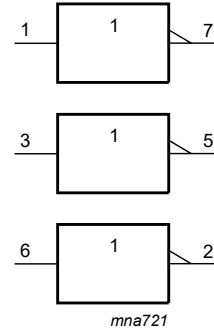
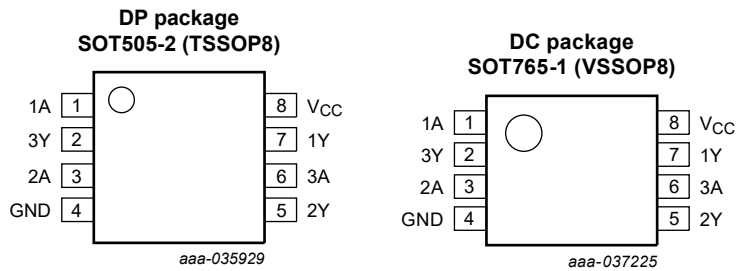


Fig. 2. IEC logic symbol

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
1Y, 2Y, 3Y	7, 5, 2	data output
GND	4	ground (0 V)
V _{CC}	8	supply voltage

7. Functional description

Table 4. Function table

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

Input	Output
nA	nY
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_{CC}	supply voltage		-0.5	+7.0	V
I_{IK}	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ [1]	-	± 20	mA
I_{OK}	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ [1]	-	± 20	mA
I_O	output current	$V_O = -0.5\text{ V}$ to $(V_{CC} + 0.5\text{ V})$ [1]	-	± 25	mA
I_{CC}	quiescent supply current	[1]	-	50	mA
I_{GND}	ground current	[1]	-50	-	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation	$T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$ [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_{tot} derates linearly with 4.6 mW/K above 96 °C.
For SOT765-1 (VSSOP8) package: P_{tot} 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_{CC}	supply voltage		2.0	5.0	6.0	V
V_I	input voltage		0	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	V
T_{amb}	ambient temperature		-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0\text{ V}$	-	-	625	ns/V
		$V_{CC} = 4.5\text{ V}$	-	1.67	139	ns/V
		$V_{CC} = 6.0\text{ V}$	-	-	83	ns/V

10. Static characteristics

Table 7. Static characteristics

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

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
V_{IH}	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.7	1.1	-	1.7	-	V
		$V_{CC} = 4.5\text{ V}$	3.6	2.4	-	3.6	-	V
		$V_{CC} = 6.0\text{ V}$	4.8	3.1	-	4.8	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$	-	0.9	0.3	-	0.3	V
		$V_{CC} = 4.5\text{ V}$	-	2.1	0.9	-	0.9	V
		$V_{CC} = 6.0\text{ V}$	-	2.9	1.2	-	1.2	V

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}						
		I _O = -20 μA; V _{CC} = 2.0 V	1.9	2.0	-	1.9	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	4.5	-	4.4	-	V
		I _O = -20 μA; V _{CC} = 6.0 V	5.9	6.0	-	5.9	-	V
		I _O = -4.0 mA; V _{CC} = 4.5 V	4.13	4.32	-	3.7	-	V
		I _O = -5.2 mA; V _{CC} = 6.0 V	5.63	5.81	-	5.2	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}						
		I _O = 20 μA; V _{CC} = 2.0 V	-	0	0.1	-	0.1	V
		I _O = 20 μA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	V
		I _O = 20 μA; V _{CC} = 6.0 V	-	0	0.1	-	0.1	V
		I _O = 4.0 mA; V _{CC} = 4.5 V	-	0.15	0.33	-	0.4	V
		I _O = 5.2 mA; V _{CC} = 6.0 V	-	0.16	0.33	-	0.4	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 6.0 V	-	-	±1.0	-	±1.0	μA
I _{CC}	supply current	per input pin; V _I = V _{CC} or GND; I _O = 0A; V _{CC} = 6.0 V	-	-	10	-	20	μA
C _I	input capacitance		-	3.0	-	-	-	pF

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

11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 4.

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
t _{pd}	propagation delay	nA to nY; see Fig. 3 [2]						
		V _{CC} = 2.0 V	-	13	75	-	90	ns
		V _{CC} = 4.5 V	-	6	15	-	18	ns
		V _{CC} = 6.0 V	-	5	13	-	15	ns
t _t	transition time	nY; see Fig. 3 [3]						
		V _{CC} = 2.0 V	-	18	95	-	125	ns
		V _{CC} = 4.5 V	-	6	19	-	25	ns
		V _{CC} = 6.0 V	-	5	16	-	20	ns
C _{PD}	power dissipation capacitance	V _I = GND to V _{CC} [4]	-	5	-	-	-	pF

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

[2] t_{pd} is the same as t_{PLH} and t_{PHL}.

[3] t_t is the same as t_{TLH} and t_{THL}.

[4] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

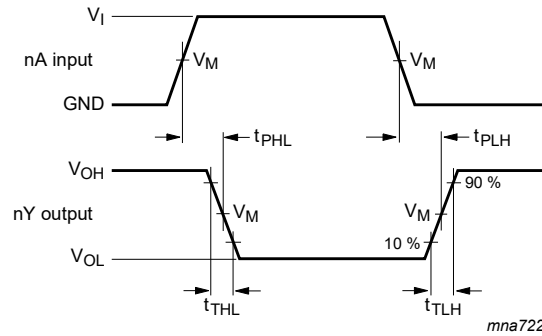
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

Σ(C_L × V_{CC}² × f_o) = sum of outputs.

11.1. Waveforms and test circuit

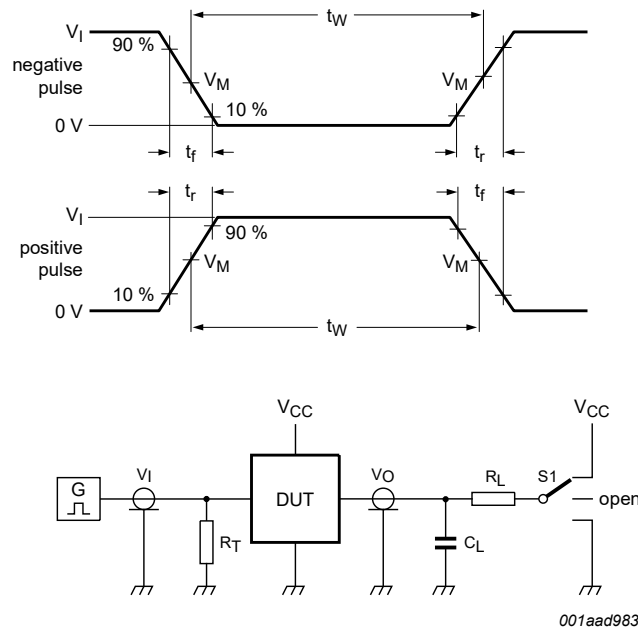


Measurement points are given in [Table 9](#).

Fig. 3. Propagation delay data input (nA) to data output (nY) and transition time output (nY)

Table 9. Measurement points

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



Test data is given in [Table 10](#).

Definitions test circuit:

R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator;

C_L = Load capacitance including jig and probe capacitance;

R_L = Load resistance;

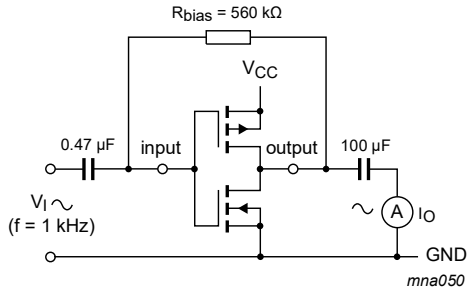
S1 = Test selection switch.

Fig. 4. Test circuit for measuring switching times

Table 10. Test data

Input		Load		S1 position
V_I	t_r, t_f	C_L	R_L	t_{PHL}, t_{PLH}
GND to V_{CC}	≤ 6 ns	50 pF	1 k Ω	open

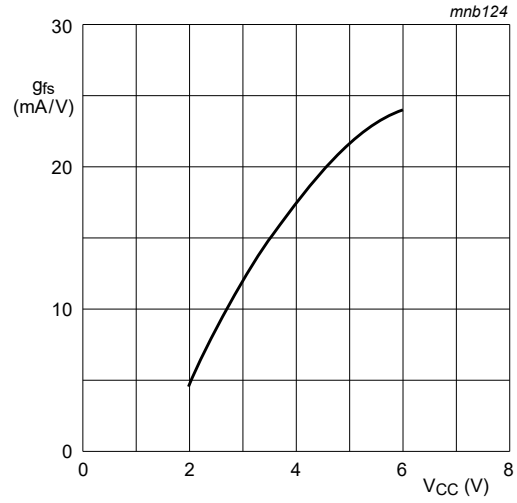
11.2. Additional characteristics



$$g_{fs} = \frac{\Delta I_O}{\Delta V_I}$$

V_O is constant.

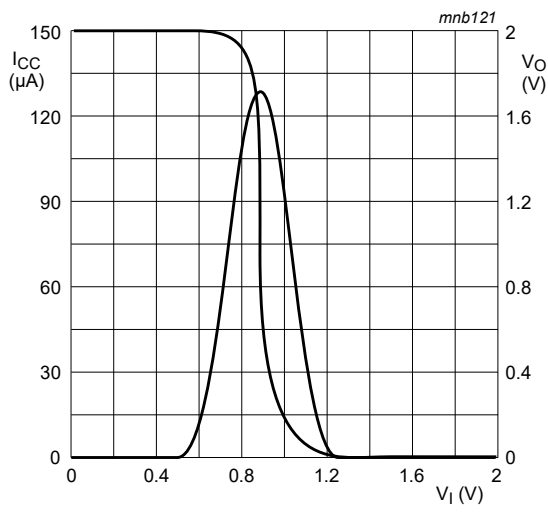
Fig. 5. Test set-up for measuring forward transconductance



T_{amb} = 25 °C.

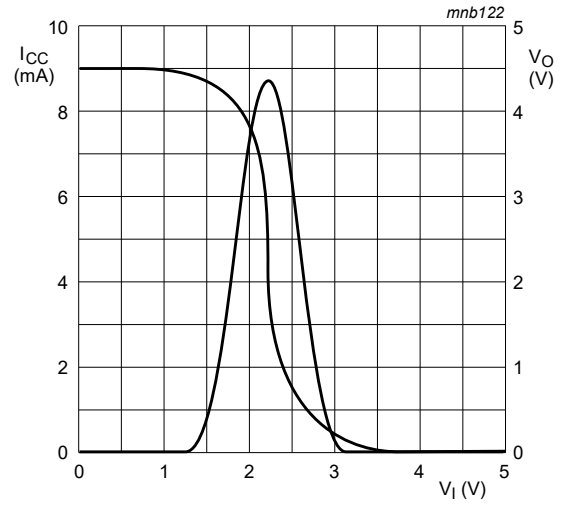
Fig. 6. Typical forward transconductance as a function of supply voltage

12. Typical transfer characteristics



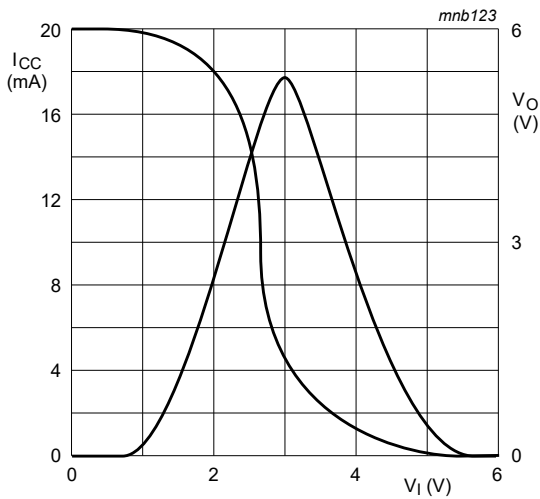
$V_{CC} = 2.0\text{ V}; I_O = 0\text{ A}$.

Fig. 7. Typical transfer characteristics $V_{CC} = 2.0\text{ V}$



$V_{CC} = 4.5\text{ V}; I_O = 0\text{ A}$.

Fig. 8. Typical transfer characteristics $V_{CC} = 4.5\text{ V}$



$V_{CC} = 6.0\text{ V}; I_O = 0\text{ A}$.

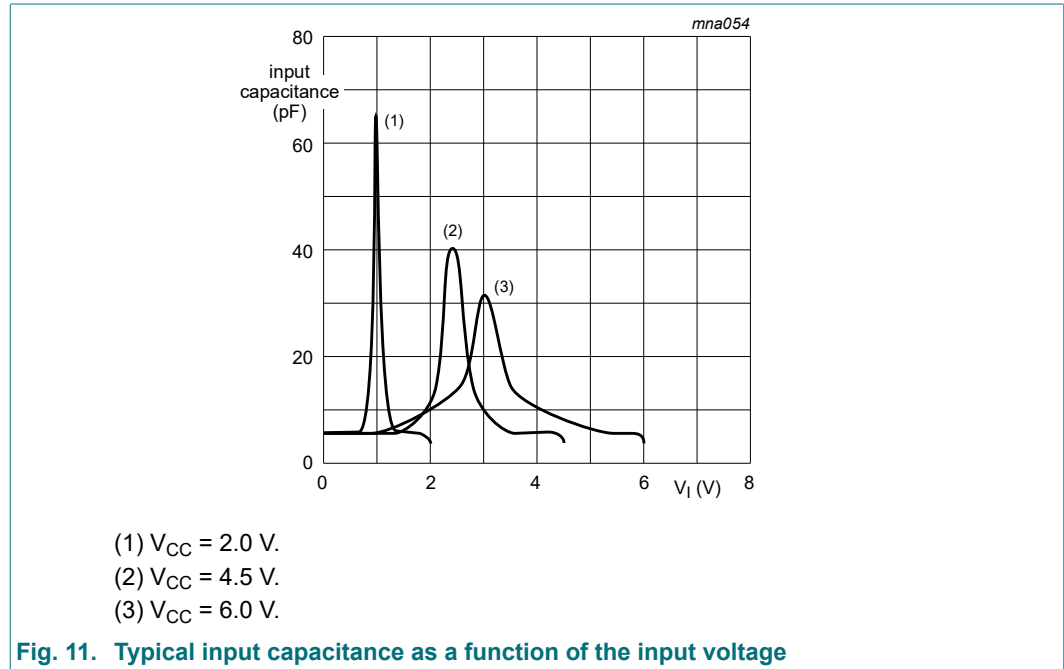
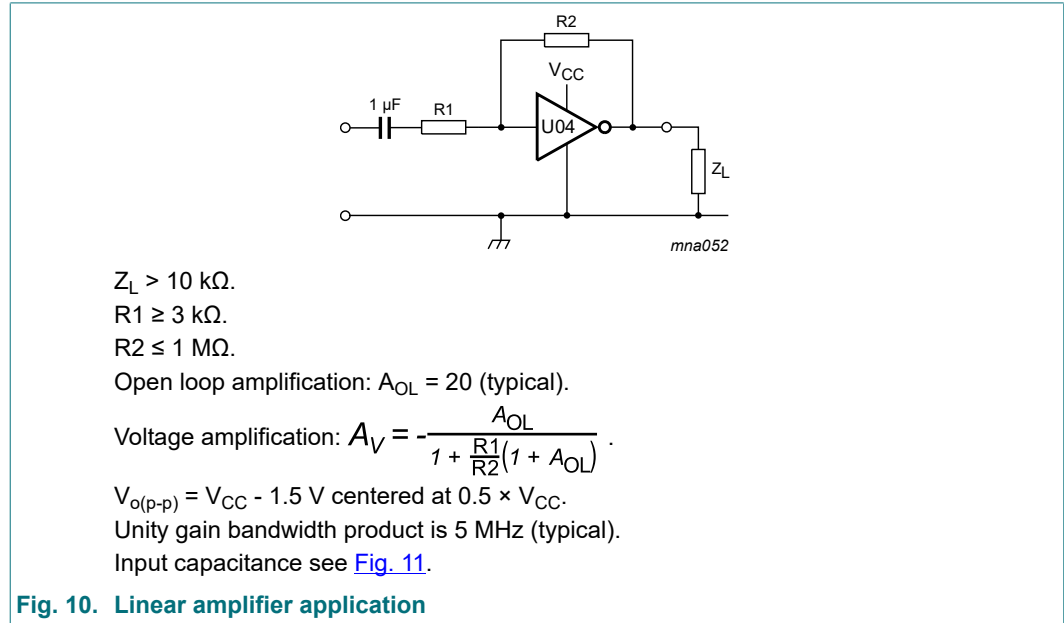
Fig. 9. Typical transfer characteristics $V_{CC} = 6.0\text{ V}$

13. Application information

Some applications for the 74HC3GU04-Q100 are:

- Linear amplifier (see Fig. 10)
- Crystal oscillator (see Fig. 12).

All values given are typical values unless otherwise specified.



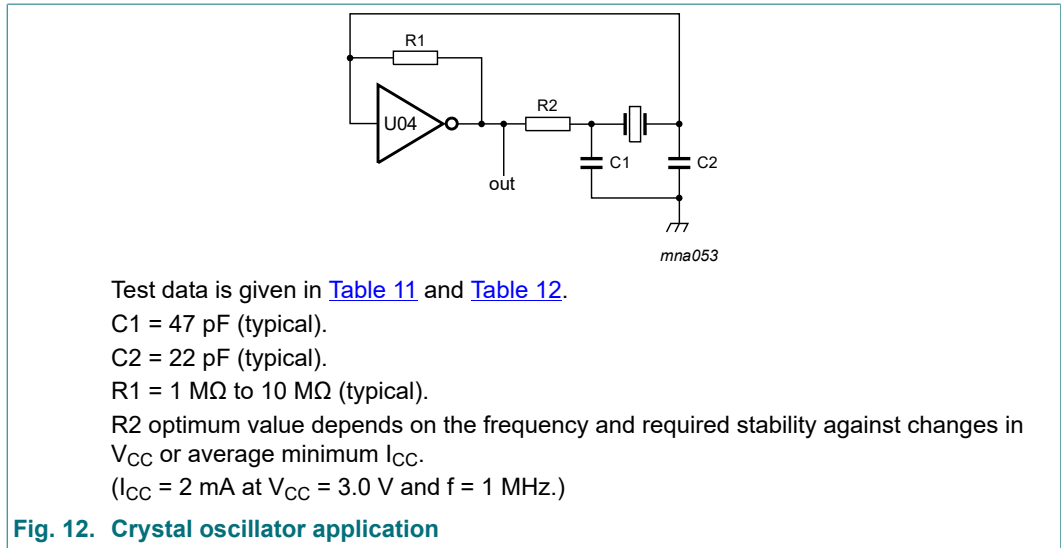


Table 11. External components for resonator (f < 1 MHz)

Frequency	R1	R2	C1	C2
10 kHz to 15.9 kHz	2.2 MΩ	220 kΩ	56 pF	20 pF
16 kHz to 24.9 kHz	2.2 MΩ	220 kΩ	56 pF	10 pF
25 kHz to 54.9 kHz	2.2 MΩ	100 kΩ	56 pF	10 pF
55 kHz to 129.9 kHz	2.2 MΩ	100 kΩ	47 pF	5 pF
130 kHz to 199.9 kHz	2.2 MΩ	47 kΩ	47 pF	5 pF
200 kHz to 349.9 kHz	2.2 MΩ	47 kΩ	47 pF	5 pF
350 kHz to 600 kHz	2.2 MΩ	47 kΩ	47 pF	5 pF

Table 12. Optimum value for R2

Frequency	R2	Optimum
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}
	2.0 kΩ	minimum influence by V _{CC}
> 14 kHz	replace R2 by C3 = 35 pF (typical)	

14. Package outline

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

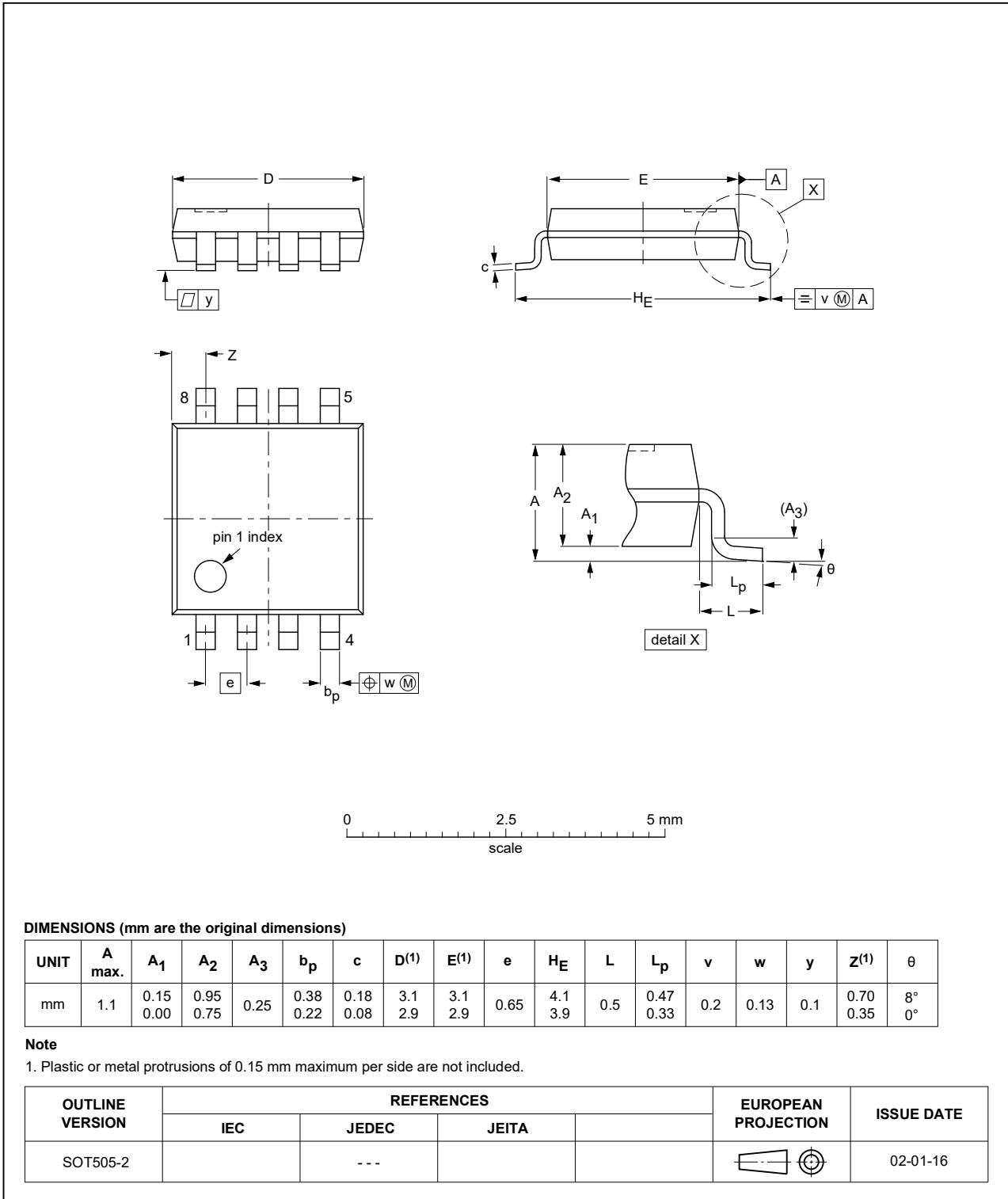


Fig. 13. Package outline SOT505-2 (TSSOP8)

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

SOT765-1

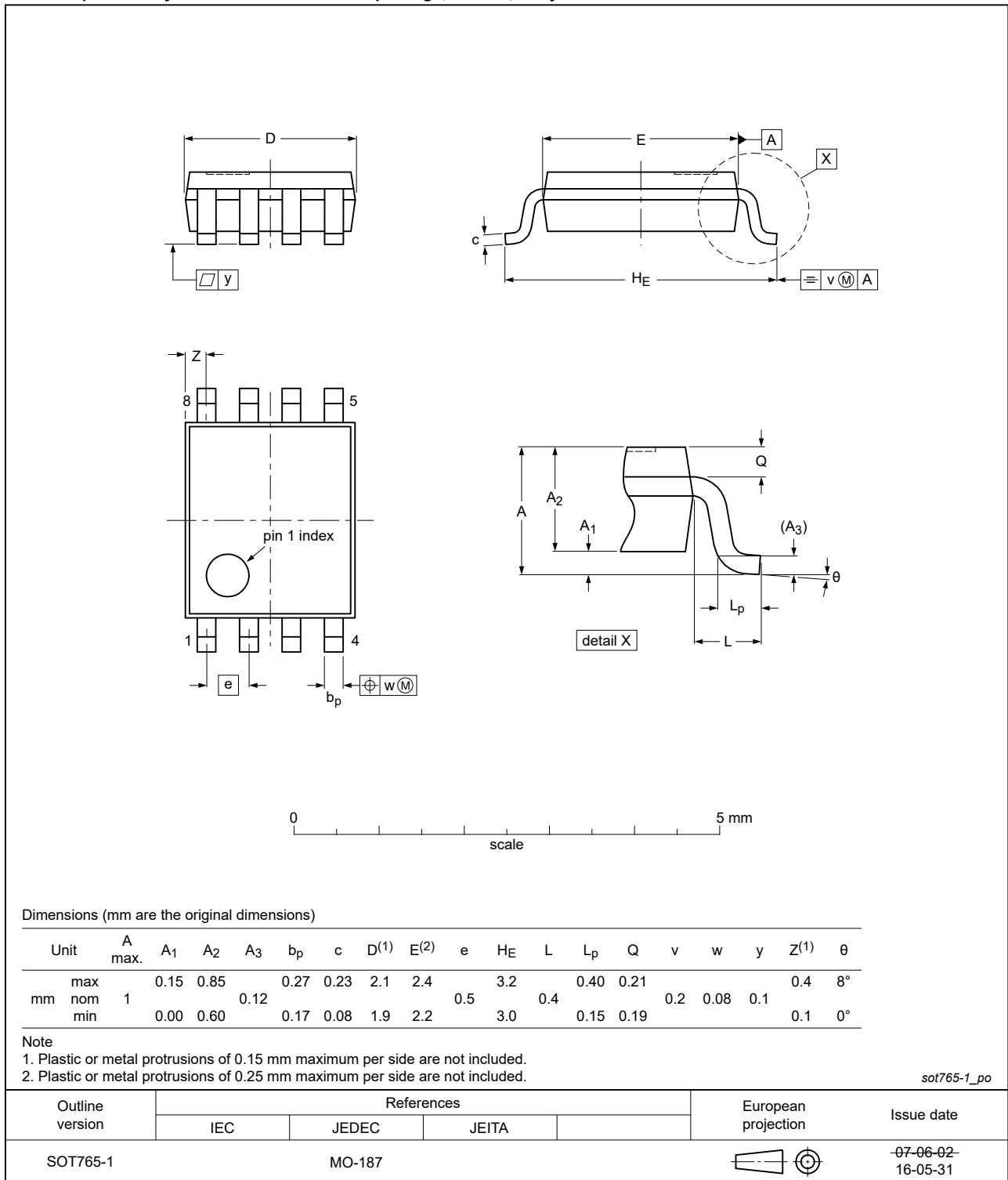


Fig. 14. Package outline SOT765-1 (VSSOP8)

15. Abbreviations

Table 13. Abbreviations

Acronym	Description
ANSI	American National Standards Institute
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
ESDA	ElectroStatic Discharge Association
HBM	Human Body Model
JEDEC	Joint Electron Device Engineering Council

16. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC3GU04_Q100 v.3	20240805	Product data sheet	-	74HC3GU04_Q100 v.2
Modifications:	<ul style="list-style-type: none"> Section 2: ESD specification updated according to the latest JEDEC standard. Section 8: P_{tot} and derating values for P_{tot} total power dissipation updated. 			
74HC3GU04_Q100 v.2	20190129	Product data sheet	-	74HC3GU04_Q100 v.1
Modifications:	<ul style="list-style-type: none"> 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. 			
74HC3GU04_Q100 v.1	20131113	Product data sheet	-	-

17. 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.

- [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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