

74HC3G14-Q100; 74HCT3G14-Q100

Triple inverting Schmitt trigger

Rev. 4 — 18 December 2023

Product data sheet

1. General description

The 74HC3G14-Q100; 74HCT3G14-Q100 is a triple inverter with Schmitt-trigger inputs. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}. Schmitt trigger inputs transform slowly changing input signals into sharply defined jitter-free output signals.

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
- Input levels:
 - For 74HC3G14-Q100: CMOS level
 - For 74HCT3G14-Q100: TTL level
- CMOS low power dissipation
- High noise immunity
- · Unlimited input rise and fall times
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
 - JESD8C (2.7 V to 3.6 V)
 - JESD7A (2.0 V to 6.0 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. Applications

- Wave and pulse shaper for highly noisy environments
- Astable multivibrators
- Monostable multivibrators

4. Ordering information

Table 1. Ordering information

Type number	Package						
	Temperature range	Name	Description	Version			
74HC3G14DP-Q100 74HCT3G14DP-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			
74HC3G14DC-Q100 74HCT3G14DC-Q100	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1			



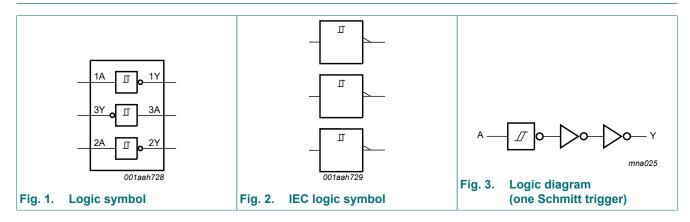
5. Marking

Table 2. Marking

Type number	Marking code [1]
74HC3G14DP-Q100	H14
74HCT3G14DP-Q100	T14
74HC3G14DC-Q100	H14
74HCT3G14DC-Q100	T14

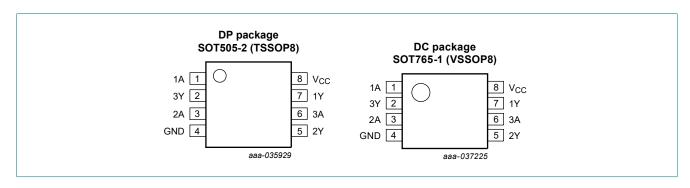
^[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

6. Functional diagram



7. Pinning information

7.1. Pinning



7.2. Pin description

Table 3. Pin description

Table 6.1 III decemption					
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 _{CC}	8	supply voltage			

8. Functional description

Table 4. Function table

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

Input	Output
nA	nY
L	Н
Н	L

9. 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 V or V_{O} > V_{CC} + 0.5 V	[1]	-	±20	mA
Io	output current	$V_{O} = -0.5 \text{ V to } V_{CC} + 0.5 \text{ V}$	[1]	-	±25	mA
I _{CC}	supply current		[1]	-	+50	mA
I _{GND}	ground current		[1]	-50	-	mA
T _{stg}	storage temperature			-65	+150	°C
P _{tot}	total power dissipation		[2]	-	250	mW

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

10. Recommended operating conditions

Table 6. Recommended operating conditions

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

Symbol	Parameter Conditions		74HC3G14-Q100			74H	Unit		
			Min	Тур	Max	Min	Тур	Max	
V _{CC}	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
VI	input voltage		0	-	V _{CC}	0	-	V _{CC}	V
V_{O}	output voltage		0	-	V _{CC}	0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	-40	+25	+125	°C

^{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.

11. Static characteristics

Table 7. Static characteristics

Voltages are referenced to GND (ground = 0 V). All typical values are measured at T_{amb} = 25 °C.

Symbol	Parameter	Conditions		25 °C		_	°C to 5 °C	-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
74HC3G	14-Q100				'	'				
V _{OH}	HIGH-level	$V_I = V_{T+}$ or V_{T-}								
	output voltage	I _O = -20 μA; V _{CC} = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -20 μA; V _{CC} = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		I _O = -4.0 mA; V _{CC} = 4.5 V	4.18	4.32	-	4.13	-	3.7	-	V
		I _O = -5.2 mA; V _{CC} = 6.0 V	5.68	5.81	-	5.63	-	5.2	-	V
V _{OL}	LOW-level	$V_I = V_{T+}$ or V_{T-}								
	output voltage	I _O = 20 μA; V _{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 20 μA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 20 μA; V _{CC} = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 4.0 mA; V _{CC} = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I _O = 5.2 mA; V _{CC} = 6.0 V	-	0.16	0.26	-	0.33	-	0.4	V
I _I	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0 \text{ V}$	-	-	±0.1	-	±1.0	-	±1.0	μΑ
I _{CC}	supply current	per input pin; $V_{CC} = 6.0 \text{ V}$; $V_I = V_{CC}$ or GND; $I_O = 0 \text{ A}$	-	-	1.0	-	10	-	20	μΑ
C _I	input capacitance		-	2.0	-	-	-	-	-	pF
74HCT3	G14-Q100									
V _{OH}	HIGH-level	$V_I = V_{T+}$ or V_{T-}								
	output voltage	I _O = -20 μA; V _{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -4.0 mA; V _{CC} = 4.5 V	4.18	4.32	-	4.13	-	3.7	-	V
V _{OL}	LOW-level	$V_I = V_{IH}$ or V_{IL}								
	output voltage	I _O = 20 μA; V _{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I _O = 4.0 mA; V _{CC} = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
I _I	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	±0.1	-	±1.0	-	±1.0	μΑ
I _{CC}	supply current	per input pin; $V_{CC} = 5.5 \text{ V}$; $V_I = V_{CC}$ or GND; $I_O = 0 \text{ A}$	-	-	1.0	-	10	-	20	μΑ
ΔI _{CC}	additional supply current	per input; V _{CC} = 4.5 V to 5.5 V; V _I = V _{CC} - 2.1 V; I _O = 0 A	-	-	300	-	375	-	410	μΑ
C _I	input capacitance		-	2.0	-	-	-	-	-	pF

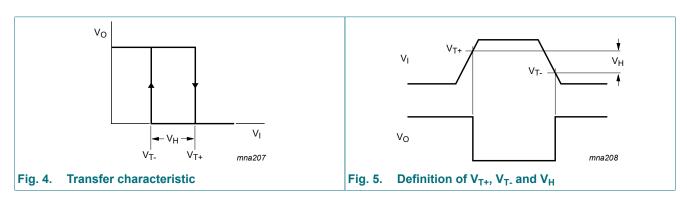
11.1. Transfer characteristics

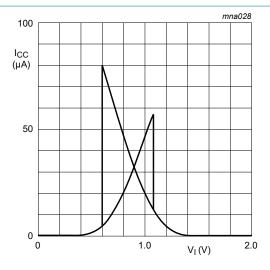
Table 8. Transfer characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 9.

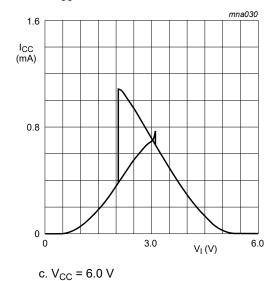
Symbol Parameter		Conditions		25 °C		-40 °C t	o +85 °C	-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
74HC3G	14-Q100									
V_{T+}	positive-going	see Fig. 4, Fig. 5								
	threshold voltage	V _{CC} = 2.0 V	1.00	1.18	1.50	1.00	1.50	1.00	1.50	V
	Voltago	V _{CC} = 4.5 V	2.30	2.60	3.15	2.30	3.15	2.30	3.15	V
		V _{CC} = 6.0 V	3.00	3.46	4.20	3.00	4.20	3.00	4.20	V
V _{T-}	negative-going	see Fig. 4, Fig. 5								
	threshold voltage	V _{CC} = 2.0 V	0.30	0.60	0.90	0.30	0.90	0.30	0.90	V
	Voltage	V _{CC} = 4.5 V	1.13	1.47	2.00	1.13	2.00	1.13	2.00	V
		V _{CC} = 6.0 V	1.50	2.06	2.60	1.50	2.60	1.50	2.60	V
V _H	hysteresis voltage	(V _{T+} - V _{T-}); see <u>Fig. 4</u> , <u>Fig. 5</u> and <u>Fig. 6</u>								
		V _{CC} = 2.0 V	0.30	0.60	1.00	0.30	1.00	0.30	1.00	V
		V _{CC} = 4.5 V	0.60	1.13	1.40	0.60	1.40	0.60	1.40	V
		V _{CC} = 6.0 V	0.80	1.40	1.70	0.80	1.70	0.80	1.70	V
74HCT3	G14-Q100									
V_{T+}	positive-going	see Fig. 4, Fig. 5								
	threshold voltage	V _{CC} = 4.5 V	1.20	1.58	1.90	1.20	1.90	1.20	1.90	V
	Voltago	V _{CC} = 5.5 V	1.40	1.78	2.10	1.40	2.10	1.40	2.10	V
V _{T-}	negative-going	see Fig. 4, Fig. 5								
	threshold voltage	V _{CC} = 4.5 V	0.50	0.87	1.20	0.50	1.20	0.50	1.20	V
	Voltage	V _{CC} = 5.5 V	0.60	1.11	1.40	0.60	1.40	0.60	1.40	V
V _H	hysteresis voltage	(V _{T+} - V _{T-}); see <u>Fig. 4</u> , <u>Fig. 5</u> and <u>Fig. 7</u>								
		V _{CC} = 4.5 V	0.40	0.71	-	0.40	-	0.40	-	V
		V _{CC} = 5.5 V	0.40	0.67	-	0.40	-	0.40	-	V

11.2. Transfer characteristics waveforms





a. $V_{CC} = 2.0 \text{ V}$



1.0 mna029
ICC (mA)
0.8
0.6
0.4
0.2
0
0
2.5 V₁(V)
5.0

b. $V_{CC} = 4.5 \text{ V}$



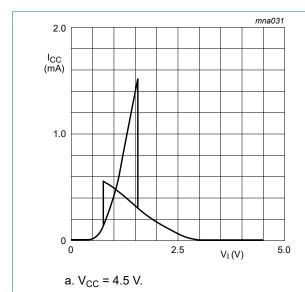
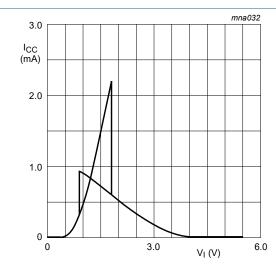


Fig. 7. Typical 74HCT3G14-Q100 transfer characteristics



b. $V_{CC} = 5.5 \text{ V}$.

12. Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 9.

Symbol	Parameter	ter Conditions		25 °C			°C to 5 °C		°C to 25 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74HC3G	14-Q100		'	1	-	'		'		
t _{pd}	propagation delay	nA to nY; see Fig. 8 [1]							
		V _{CC} = 2.0 V	-	53	125	-	155	-	190	ns
		V _{CC} = 4.5 V	-	16	25	-	31	-	38	ns
		V _{CC} = 6.0 V	-	13	21	-	26	-	32	ns
t _t	transition time	nY; see Fig. 8 [2	.]							
		V _{CC} = 2.0 V	-	20	75	-	95	-	110	ns
		V _{CC} = 4.5 V	-	7	15	-	19	-	22	ns
		V _{CC} = 6.0 V	-	5	13	-	16	-	19	ns
C _{PD}	power dissipation capacitance	$V_I = GND \text{ to } V_{CC}$ [3	-	10	-	-	-	-	-	pF
74HCT3	G14-Q100			1	1					
t _{pd}	propagation delay	nA to nY; $V_{CC} = 4.5 \text{ V}$; see Fig. 8] -	21	32	-	40	-	48	ns
t _t	transition time	nY; V _{CC} = 4.5 V; see <u>Fig. 8</u> [2	-	6	15	-	19	-	22	ns
C _{PD}	power dissipation capacitance	$V_I = GND \text{ to } V_{CC} - 1.5 \text{ V}$ [3	-	10	-	-	-	-	-	pF

- tpd is the same as tPLH and tPHL
- t_t is the same as t_{TLH} and t_{THL} C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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

 f_i = input frequency in MHz;

f_o = output frequency in MHz;

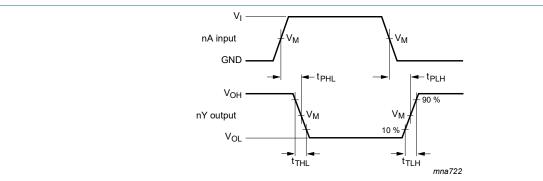
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

 $\Sigma(C_L \times V_{CC}^2 \times f_0)$ = sum of the outputs.

12.1. Waveforms and test circuit



Measurement points are given in Table 10.

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

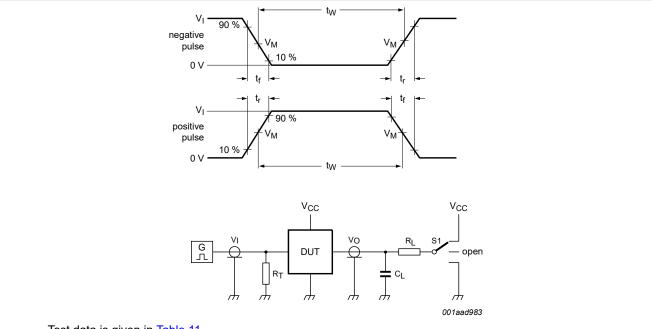
Fig. 8. The data input (nA) to output (nY) propagation delays and output transition times

74HC_HCT3G14_Q100

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Table 10. Measurement points

Туре	Input	Output
	V _M	V _M
74HC3G14-Q100	0.5 × V _{CC}	0.5 × V _{CC}
74HCT3G14-Q100	1.3 V	1.3 V



Test data is given in Table 11.

Definitions for 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. 9. Test circuit for measuring switching times

Table 11. Test data

Туре	Input L		Load	S1 position	
	V _I	t _r , t _f	CL	R_L	t _{PHL} , t _{PLH}
74HC3G14-Q100	GND to V _{CC}	≤ 6 ns	50 pF	1 kΩ	open
74HCT3G14-Q100	GND to 3.0 V	≤ 6 ns	50 pF	1 kΩ	open

13. Application information

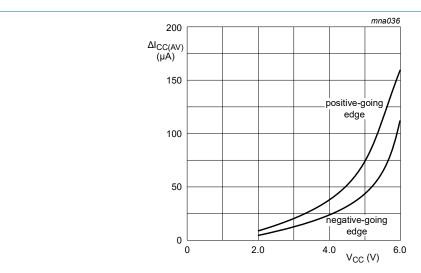
The slow input rise and fall times cause additional power dissipation, which can be calculated using the following formula:

 $P_{add} = f_i \times (t_r \times \Delta I_{CC(AV)} + t_f \times \Delta I_{CC(AV)}) \times V_{CC}$ where:

- P_{add} = additional power dissipation (μW);
- f_i = input frequency (MHz);
- t_r = input rise time (ns); 10 % to 90 %;
- t_f = input fall time (ns); 90 % to 10 %;
- ΔI_{CC(AV)} = average additional supply current (µA).

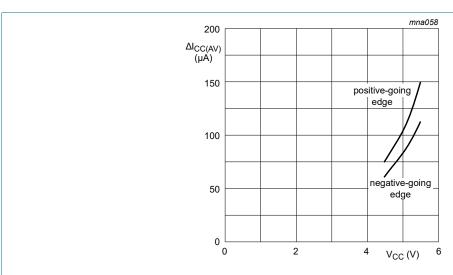
Δl_{CC(AV)} differs with positive or negative input transitions, as shown in Fig. 10 and Fig. 11.

An example of a relaxation circuit using the 74HC3G14-Q100/74HCT3G14-Q100 is shown in Fig. 12.



Linear change of V_I between 0.1 × V_{CC} to 0.9 × V_{CC} .

Fig. 10. $\Delta I_{CC(AV)}$ as a function of V_{CC} for 74HC3G14-Q100



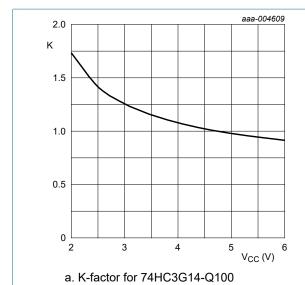
Linear change of V_I between 0.1 × V_{CC} to 0.9 × V_{CC} .

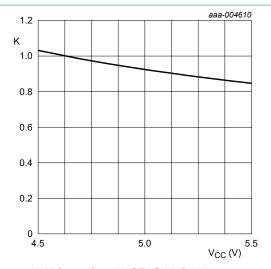
Fig. 11. $\Delta I_{CC(AV)}$ as a function of V_{CC} for 74HCT3G14-Q100

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For 74HC3G14-Q100: $f = \frac{1}{T} \approx \frac{1}{0.8 \times RC}$ For 74HCT3G14-Q100: $f = \frac{1}{T} \approx \frac{1}{0.67 \times RC}$ For K-factor, see Fig. 13

Fig. 12. Relaxation oscillator





b. K-factor for 74HCT3G14-Q100

Fig. 13. Typical K-factor for relaxation oscillator

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14. Package outline

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

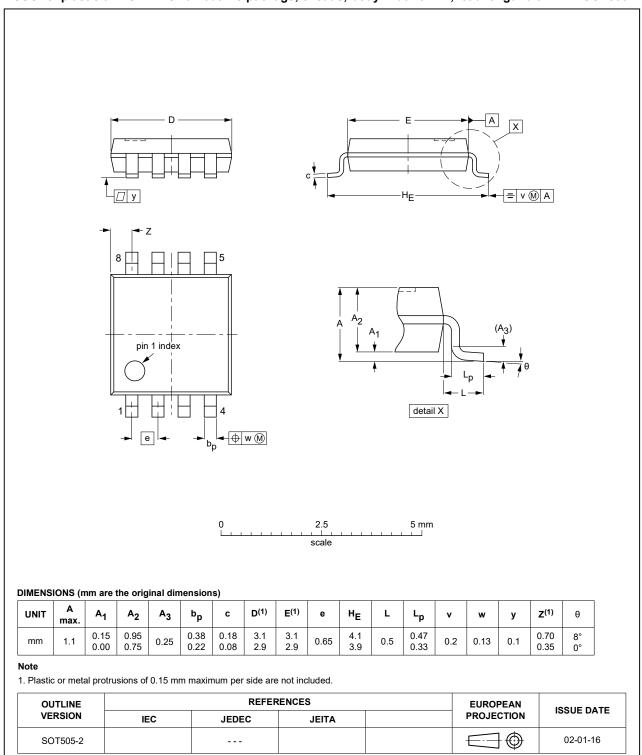


Fig. 14. Package outline SOT505-2 (TSSOP8)

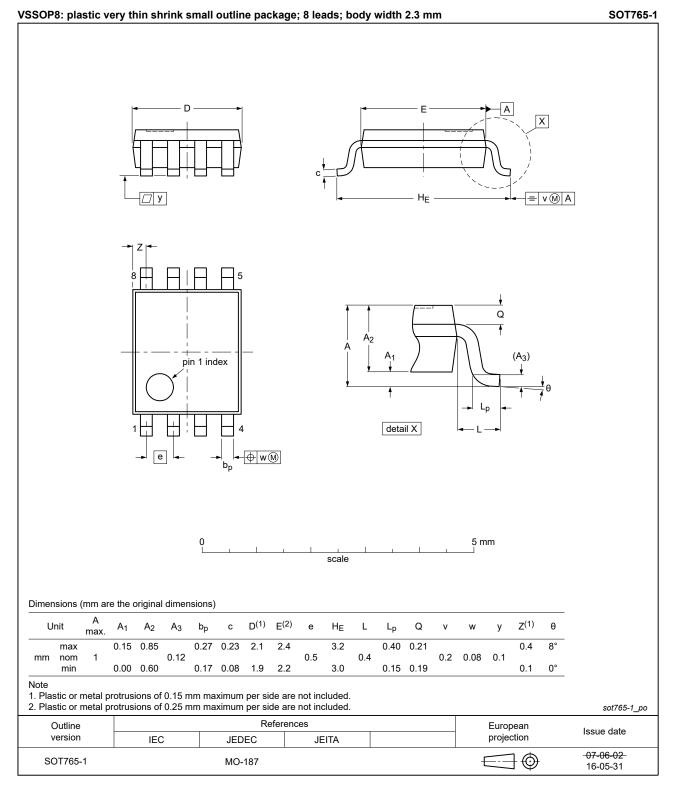


Fig. 15. Package outline SOT765-1 (VSSOP8)

15. Abbreviations

Table 12. 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

16. Revision history

Table 13. Revision history

Table 13. Nevision history							
Document ID	Release date	Data sheet status	Change notice	Supersedes			
74HC_HCT3G14_Q100 v.4	20231218	Product data sheet	-	74HC_HCT3G14_Q100 v.3			
Modifications:	 <u>Section 2</u> updated. <u>Section 2</u>: ESD specification updated according to the latest JEDEC standard. <u>Section 9</u>: P_{tot} and derating values for P_{tot} total power dissipation updated. 						
74HC_HCT3G14_Q100 v.3	20190201	Product data sheet	-	74HC_HCT3G14_Q100 v.2			
Modifications:	 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. Package outline drawing <u>SOT765-1</u> (VSSOP8) updated. 						
74HC_HCT3G14_Q100 v.2	20131209	Product data sheet	-	74HC_HCT3G14_Q100 v.1			
Modifications:	Fig. 13 added (typical K-factor for relaxation oscillator).						
74HC_HCT3G14_Q100 v.1	20131115	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.

- Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
- The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

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