

# 74HC3G14-Q100; 74HCT3G14-Q100

Triple inverting Schmitt trigger

Rev. 1 — 15 November 2013

Product data sheet

## 1. General description

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The 74HC3G14-Q100; 74HCT3G14-Q100 is a triple inverter with Schmitt-trigger inputs. Inputs include clamp diodes that enable 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

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- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - ◆ Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$
- Wide supply voltage range from 2.0 V to 6.0 V
- Input levels:
  - ◆ For 74HC3G14-Q100: CMOS level
  - ◆ For 74HCT3G14-Q100: TTL level
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- Unlimited input rise and fall times
- Multiple package options
- ESD protection:
  - ◆ MIL-STD-883, method 3015 exceeds 2000 V
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V ( $C = 200\text{ pF}$ ,  $R = 0\text{ }\Omega$ )

## 3. Applications

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- 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 <sup>[1]</sup>
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

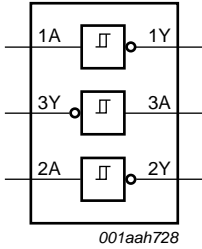


Fig 1. Logic symbol

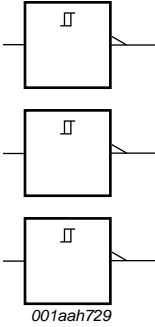


Fig 2. IEC logic symbol

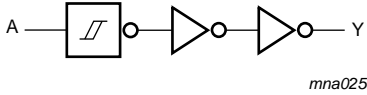
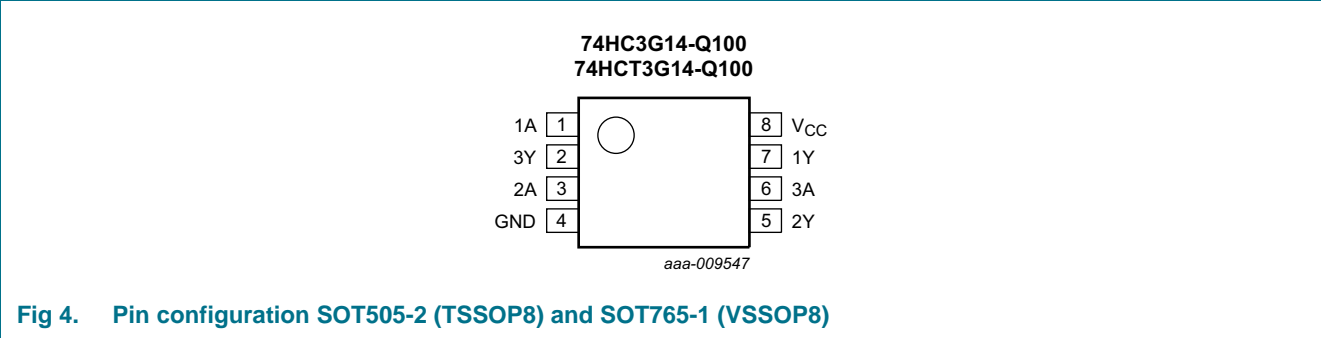


Fig 3. Logic diagram (one Schmitt trigger)

## 7. Pinning information

### 7.1 Pinning



### 7.2 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

## 8. Functional description

Table 4. Function table<sup>[1]</sup>

Input	Output
nA	nY
L	H
H	L

[1] H = HIGH voltage level; L = LOW voltage level.

## 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	$V_O < -0.5\text{ V}$ 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
$I_{CC}$	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] -	300	mW

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

[2] For TSSOP8 package: above 55 °C the value of  $P_{tot}$  derates linearly with 2.5 mW/K.  
For VSSOP8 package: above 110 °C the value of  $P_{tot}$  derates linearly with 8 mW/K.

## 10. Recommended operating conditions

**Table 6. Recommended operating conditions**

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

Symbol	Parameter	Conditions	74HC3G14-Q100			74HCT3G14-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
$V_{CC}$	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
$V_I$	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

## 11. Static characteristics

**Table 7. Static characteristics**

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

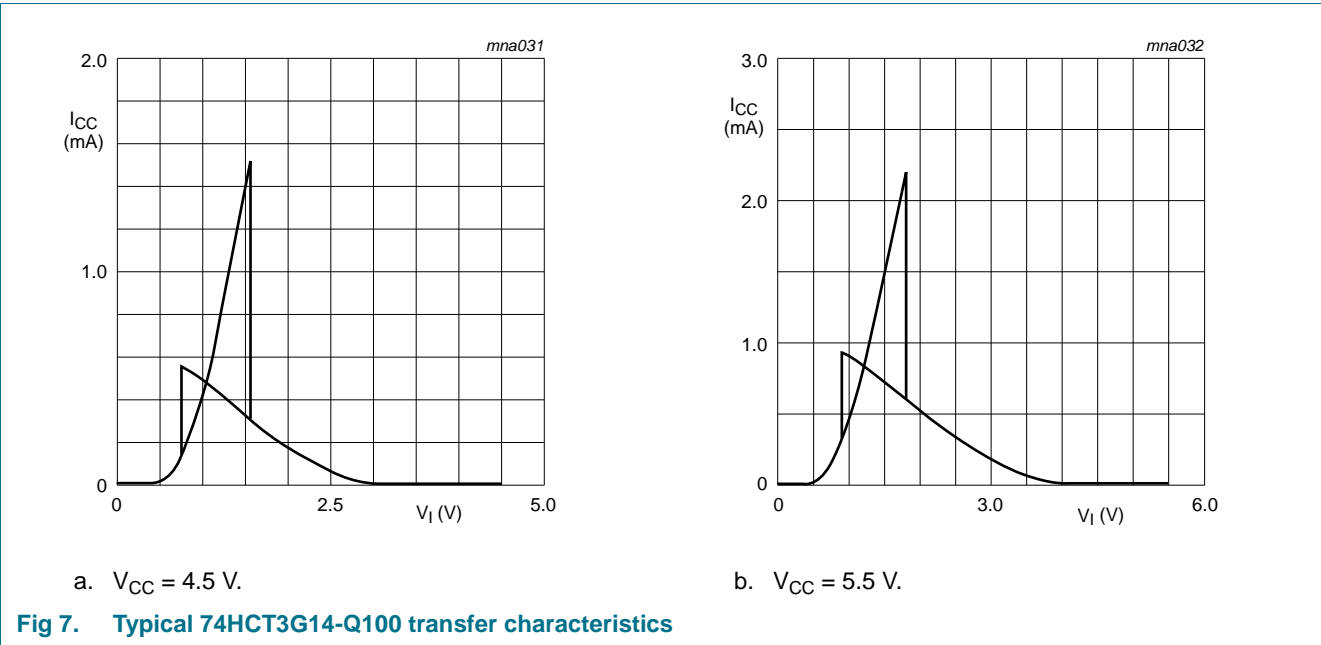
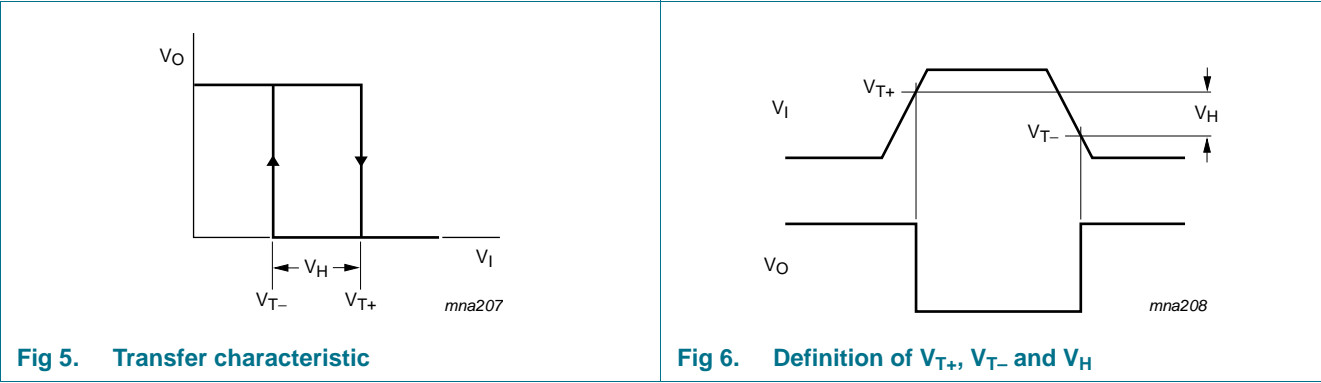
Symbol	Parameter	Conditions	25 °C			–40 °C to +85 °C		–40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC3G14-Q100										
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T–</sub>								
		I <sub>O</sub> = –20 μA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = –20 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = –20 μA; V <sub>CC</sub> = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		I <sub>O</sub> = –4.0 mA; V <sub>CC</sub> = 4.5 V	4.18	4.32	-	4.13	-	3.7	-	V
		I <sub>O</sub> = –5.2 mA; V <sub>CC</sub> = 6.0 V	5.68	5.81	-	5.63	-	5.2	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T–</sub>								
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	0.16	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.1	-	±1.0	-	±1.0	μA
I <sub>CC</sub>	supply current	per input pin; V <sub>CC</sub> = 6.0 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;	-	-	1.0	-	10	-	20	μA
C <sub>I</sub>	input capacitance		-	2.0	-	-	-	-	-	pF
74HCT3G14-Q100										
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T–</sub>								
		I <sub>O</sub> = –20 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> = 4.5 V	4.18	4.32	-	4.13	-	3.7	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	±0.1	-	±1.0	-	±1.0	μA
I <sub>CC</sub>	supply current	per input pin; V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;	-	-	1.0	-	10	-	20	μA
ΔI <sub>CC</sub>	additional supply current	per input; V <sub>CC</sub> = 4.5 V to 5.5 V; V <sub>I</sub> = V <sub>CC</sub> – 2.1 V; I <sub>O</sub> = 0 A	-	-	300	-	375	-	410	μA
C <sub>I</sub>	input capacitance		-	2.0	-	-	-	-	-	pF

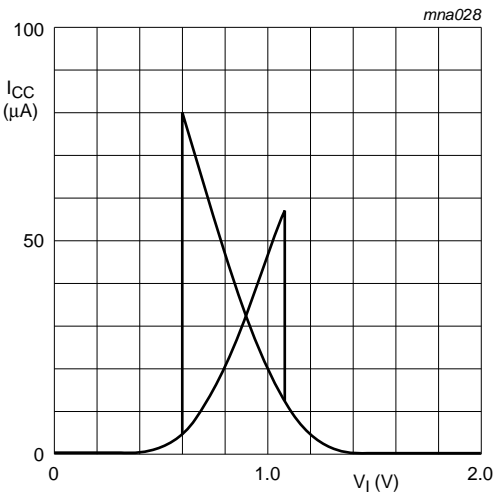
**Table 8. Transfer characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit, see [Figure 10](#).

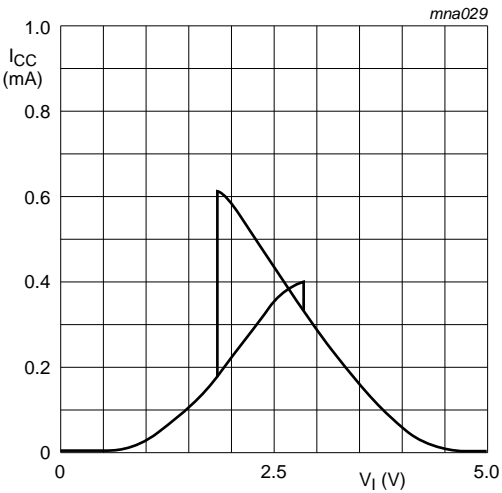
Symbol	Parameter	Conditions	25 °C			–40 °C to +125 °C			Unit
			Min	Typ	Max	Min	Max (85 °C)	Max (125 °C)	
74HC3G14-Q100									
V <sub>T+</sub>	positive-going threshold voltage	see <a href="#">Figure 5</a> , <a href="#">Figure 6</a>							
		V <sub>CC</sub> = 2.0 V	1.00	1.18	1.50	1.00	1.50	1.50	V
		V <sub>CC</sub> = 4.5 V	2.30	2.60	3.15	2.30	3.15	3.15	V
		V <sub>CC</sub> = 6.0 V	3.00	3.46	4.20	3.00	4.20	4.20	V
V <sub>T–</sub>	negative-going threshold voltage	see <a href="#">Figure 5</a> , <a href="#">Figure 6</a>							
		V <sub>CC</sub> = 2.0 V	0.30	0.60	0.90	0.30	0.90	0.90	V
		V <sub>CC</sub> = 4.5 V	1.13	1.47	2.00	1.13	2.00	2.00	V
		V <sub>CC</sub> = 6.0 V	1.50	2.06	2.60	1.50	2.60	2.60	V
V <sub>H</sub>	hysteresis voltage	(V <sub>T+</sub> – V <sub>T–</sub> ); see <a href="#">Figure 5</a> , <a href="#">Figure 6</a> and <a href="#">Figure 8</a>							
		V <sub>CC</sub> = 2.0 V	0.30	0.60	1.00	0.30	1.00	1.00	V
		V <sub>CC</sub> = 4.5 V	0.60	1.13	1.40	0.60	1.40	1.40	V
		V <sub>CC</sub> = 6.0 V	0.80	1.40	1.70	0.80	1.70	1.70	V
74HCT3G14-Q100									
V <sub>T+</sub>	positive-going threshold voltage	see <a href="#">Figure 5</a> , <a href="#">Figure 6</a>							
		V <sub>CC</sub> = 4.5 V	1.20	1.58	1.90	1.20	1.90	1.90	V
		V <sub>CC</sub> = 5.5 V	1.40	1.78	2.10	1.40	2.10	2.10	V
V <sub>T–</sub>	negative-going threshold voltage	see <a href="#">Figure 5</a> , <a href="#">Figure 6</a>							
		V <sub>CC</sub> = 4.5 V	0.50	0.87	1.20	0.50	1.20	1.20	V
		V <sub>CC</sub> = 5.5 V	0.60	1.11	1.40	0.60	1.40	1.40	V
V <sub>H</sub>	hysteresis voltage	(V <sub>T+</sub> – V <sub>T–</sub> ); see <a href="#">Figure 5</a> , <a href="#">Figure 6</a> and <a href="#">Figure 7</a>							
		V <sub>CC</sub> = 4.5 V	0.40	0.71	-	0.40	-	-	V
		V <sub>CC</sub> = 5.5 V	0.40	0.67	-	0.40	-	-	V

11.1 Waveforms transfer characteristics

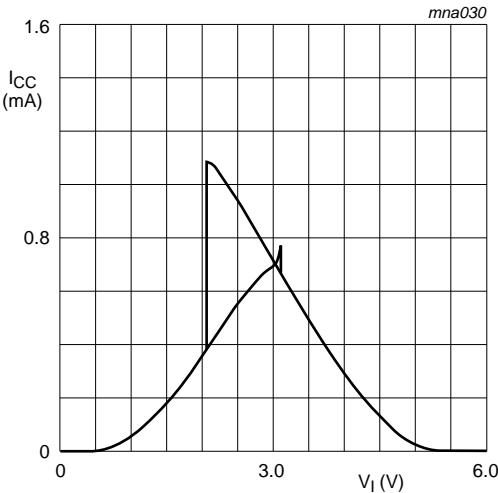




a.  $V_{CC} = 2.0 V$



b.  $V_{CC} = 4.5 V$



c.  $V_{CC} = 6.0 V$

Fig 8. Typical 74HC3G14-Q100 transfer characteristics



## 12. Dynamic characteristics

**Table 9. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit, see [Figure 10](#).

Symbol	Parameter	Conditions	25 °C			–40 °C to +125 °C			Unit
			Min	Typ	Max	Min	Max (85 °C)	Max (125 °C)	
74HC3G14-Q100									
t <sub>pd</sub>	propagation delay	nA to nY; see <a href="#">Figure 9</a> <a href="#">[1]</a>							
		V <sub>CC</sub> = 2.0 V	-	53	125	-	155	190	ns
		V <sub>CC</sub> = 4.5 V	-	16	25	-	31	38	ns
		V <sub>CC</sub> = 6.0 V	-	13	21	-	26	32	ns
t <sub>t</sub>	transition time	nY; see <a href="#">Figure 9</a> <a href="#">[2]</a>							
		V <sub>CC</sub> = 2.0 V	-	20	75	-	95	110	ns
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	22	ns
		V <sub>CC</sub> = 6.0 V	-	5	13	-	16	19	ns
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub> <a href="#">[3]</a>	-	10	-	-	-	-	pF
74HCT3G14-Q100									
t <sub>pd</sub>	propagation delay	nA to nY; see <a href="#">Figure 9</a> <a href="#">[1]</a>							
		V <sub>CC</sub> = 4.5 V	-	21	32	-	40	48	ns
t <sub>t</sub>	transition time	nY; see <a href="#">Figure 9</a> <a href="#">[2]</a>							
		V <sub>CC</sub> = 4.5 V	-	6	15	-	19	22	ns
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub> – 1.5 V <a href="#">[3]</a>	-	10	-	-	-	-	pF

[1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$

[2]  $t_t$  is the same as  $t_{TLH}$  and  $t_{THL}$

[3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

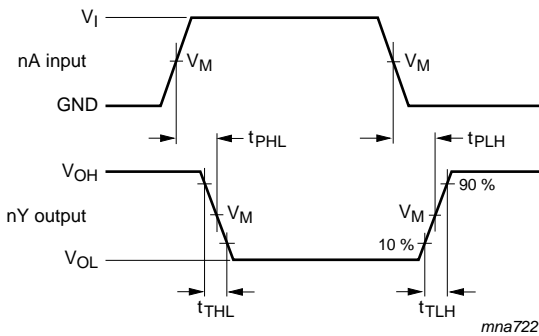
$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

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

13. Waveforms



Measurement points are given in [Table 10](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

Fig 9. The data input (nA) to output (nY) propagation delays and output transition times

Table 10. Measurement points

Type	Input	Output
	$V_M$	$V_M$
74HC3G14-Q100	$0.5V_{CC}$	$0.5V_{CC}$
74HCT3G14-Q100	1.3 V	1.3 V

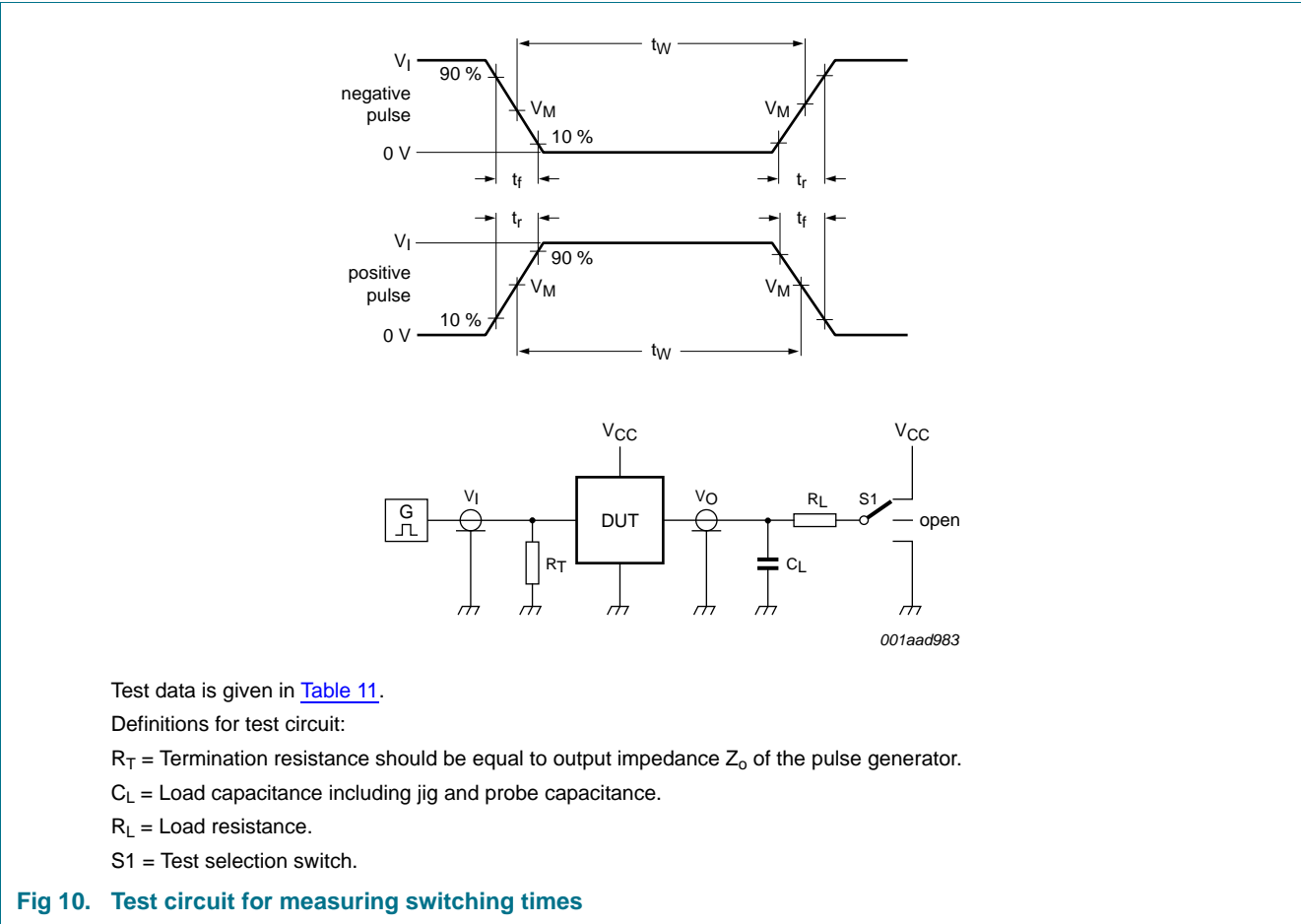


Table 11. Test data

Type	Input		Load		S1 position
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	
74HC3G14-Q100	GND to $V_{CC}$	$\leq 6$ ns	50 pF	1 k $\Omega$	open
74HCT3G14-Q100	GND to 3.0 V	$\leq 6$ ns	50 pF	1 k $\Omega$	open

## 14. Application information

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

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

$P_{\text{add}}$  = additional power dissipation ( $\mu\text{W}$ );

$f_i$  = input frequency (MHz);

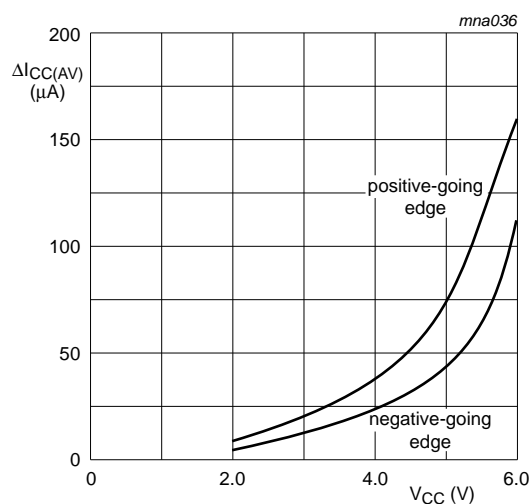
$t_r$  = input rise time (ns); 10 % to 90 %;

$t_f$  = input fall time (ns); 90 % to 10 %;

$\Delta I_{\text{CC(AV)}}$  = average additional supply current ( $\mu\text{A}$ ).

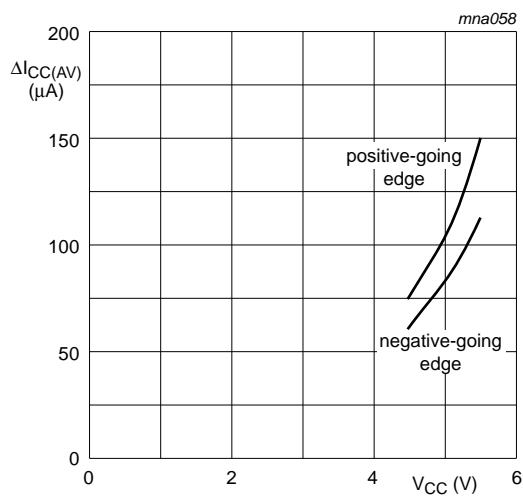
$\Delta I_{\text{CC(AV)}}$  differs with positive or negative input transitions, as shown in [Figure 11](#) and [Figure 12](#).

An example of a relaxation circuit using the 74HC3G14-Q100/74HCT3G14-Q100 is shown in [Figure 13](#).



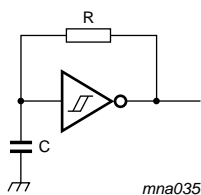
linear change of  $V_I$  between  $0.1V_{\text{CC}}$  to  $0.9V_{\text{CC}}$ .

**Fig 11.**  $\Delta I_{\text{CC(AV)}}$  as a function of  $V_{\text{CC}}$  for 74HC3G14-Q100



linear change of  $V_I$  between  $0.1V_{CC}$  to  $0.9V_{CC}$ .

**Fig 12.**  $\Delta I_{CC(AV)}$  as a function of  $V_{CC}$  for 74HCT3G14-Q100



For 74HC3G14-Q100:  $f = \frac{1}{T} \approx \frac{1}{0.8 \times RC}$

For 74HCT3G14-Q100:  $f = \frac{1}{T} \approx \frac{1}{0.67 \times RC}$

**Fig 13.** Relaxation oscillator

15. Package outline

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

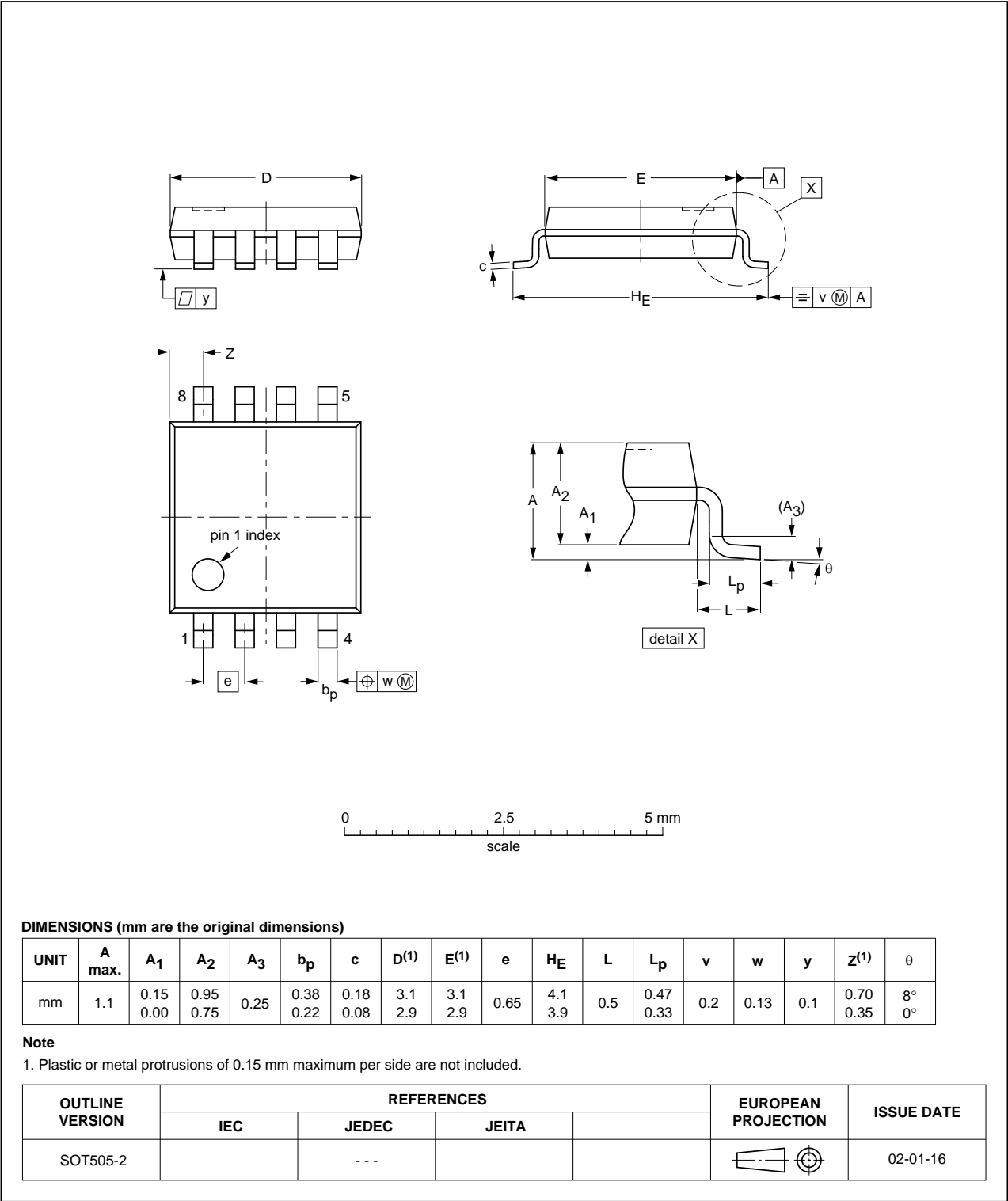
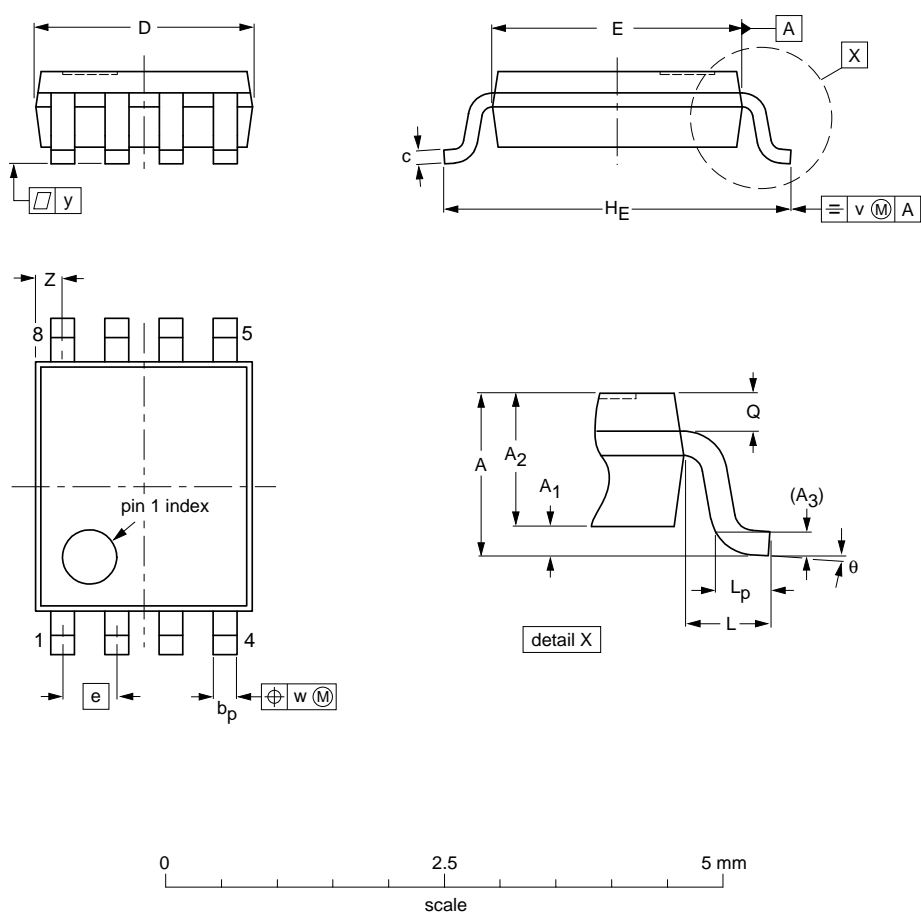


Fig 14. Package outline SOT505-2 (TSSOP8)

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

SOT765-1



DIMENSIONS (mm are the original dimensions)

UNIT	A <sub>max.</sub>	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	1	0.15 0.00	0.85 0.60	0.12	0.27 0.17	0.23 0.08	2.1 1.9	2.4 2.2	0.5	3.2 3.0	0.4	0.40 0.15	0.21 0.19	0.2	0.13	0.1	0.4 0.1	8° 0°

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT765-1		MO-187				02-06-07

Fig 15. Package outline SOT765-1 (VSSOP8)

## 16. Abbreviations

Table 12. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MIL	Military
MM	Machine Model

## 17. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT3G14_Q100 v.1	20131115	Product data sheet	-	-



## 18. Legal information

### 18.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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".

[3] 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 URL <http://www.nxp.com>.

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