## 74HC3G04-Q100; 74HCT3G04-Q100

Triple inverter

Rev. 3 — 26 November 2018

Product data sheet

## 1. General description

The 74HC3G04-Q100; 74HCT3G04-Q100 is a triple 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
- Input levels:
  - For 74HC3G04-Q100: CMOS level
  - For 74HCT3G04-Q100: TTL level
- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- 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 pF; R = 0 Ω)

## 3. Ordering information

Type number	Package	'ackage								
	Temperature range	Name	Description	Version						
74HC3G04DP-Q100	-40 °C to +125 °C	TSSOP8	plastic thin shrink small outline package; 8 leads;	SOT505-2						
74HCT3G04DP-Q100			body width 3 mm; lead length 0.5 mm							
74HC3G04DC-Q100	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package;	SOT765-1						
74HCT3G04DC-Q100			8 leads; body width 2.3 mm							

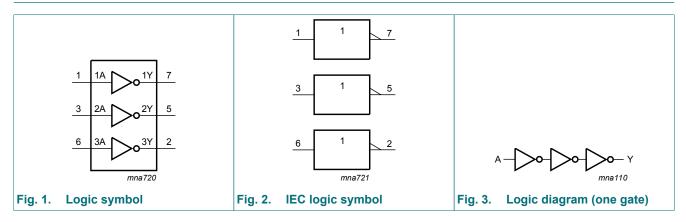
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## 4. Marking

Table 2. Marking codes								
Type number	Marking code[1]							
74HC3G04DP-Q100	H04							
74HCT3G04DP-Q100	Т04							
74HC3G04DC-Q100	H04							
74HCT3G04DC-Q100	Т04							

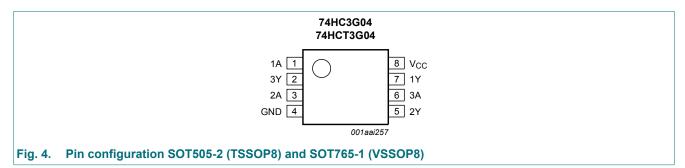
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

## 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
nA	nY
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	Мах	Unit
V <sub>CC</sub>	supply voltage			-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	$V_{\rm I}$ < -0.5 V or $V_{\rm I}$ > $V_{\rm CC}$ + 0.5 V	[1]	-	±20	mA
I <sub>ОК</sub>	output clamping current	$V_{\rm O}$ < -0.5 V or $V_{\rm O}$ > $V_{\rm CC}$ + 0.5 V	[1]	-	±20	mA
I <sub>O</sub>	output current	$V_{\rm O}$ = -0.5 V to (V <sub>CC</sub> + 0.5 V)	[1]	-	25	mA
I <sub>CC</sub>	supply current		[1]	-	50	mA
I <sub>GND</sub>	ground current		[1]	-50	-	mA
T <sub>stg</sub>	storage temperature			-65	+150	°C
P <sub>D</sub>	dynamic power dissipation	$T_{amb}$ = -40 °C to +125 °C	[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  $\mathsf{P}_{tot}$  derates linearly with 2.5 mW/K.

For VSSOP8 package: above 110 °C the value of P<sub>tot</sub> derates linearly with 8 mW/K.

## 9. Recommended operating conditions

## Table 6. Recommended operating conditions

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

Symbol	Parameter Conditions		74H	C3G04-0	2100	74H	Unit		
			Min	Тур	Max	Min	Тур	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
VI	input voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
Vo	output voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C
Δt/ΔV	input transition rise and	V <sub>CC</sub> = 2.0 V	-	-	625	-	-	-	ns/V
	fall rate	V <sub>CC</sub> = 4.5 V	-	1.67	139	-	1.67	139	ns/V
		V <sub>CC</sub> = 6.0 V	-	-	83	-	-	-	ns/V

74HC\_HCT3G04\_Q100

## **10. 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		-40 °C to	o +85 °C	-40 °C to	o +125 °C	Unit
			Min	Тур	Max	Min	Мах	Min	Max	
74HC3G	04-Q100									
VIH	HIGH-level	V <sub>CC</sub> = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
	input voltage	V <sub>CC</sub> = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V <sub>CC</sub> = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V <sub>IL</sub>	LOW-level	V <sub>CC</sub> = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
	input voltage	V <sub>CC</sub> = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	V
V <sub>OH</sub>	HIGH-level	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
	output voltage	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	$V_{I} = V_{IH} \text{ or } V_{IL}$								
	output voltage	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	$V_{I} = V_{CC}$ or GND; $V_{CC} = 6.0 V$	-	-	±0.1	-	±1.0	-	±1.0	μA
I <sub>CC</sub>	supply current	per input pin; $V_{CC}$ = 6.0 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;	-	-	1.0	-	10	-	20	μA
CI	input capacitance		-	1.5	-	-	-	-	-	pF

Symbol	Parameter	Conditions		25 °C		-40 °C to	o +85 °C	-40 °C to	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74HCT3	G04-Q100	-								
V <sub>IH</sub>	HIGH-level input voltage	$V_{CC}$ = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	$V_{CC}$ = 4.5 V to 5.5 V	-	1.2	0.8	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH-level	$V_{I} = V_{IH} \text{ or } V_{IL}$								
	output voltage	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	$V_{I} = V_{IH} \text{ or } V_{IL}$								
	output voltage	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	$V_{I} = V_{CC}$ or GND; $V_{CC} = 5.5 V$	-	-	±0.1	-	±1.0	-	±1.0	μA
I <sub>CC</sub>	supply current	per input pin; $V_{CC}$ = 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; $V_{CC} = 4.5 V \text{ to } 5.5 V;$ $V_I = V_{CC} - 2.1 V; I_O = 0 A$	-	-	300	-	375	-	410	μA
CI	input capacitance		-	1.5	-	-	-	-	-	pF

## **11. Dynamic characteristics**

#### Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); all typical values are measured at  $T_{amb}$  = 25 °C; for test circuit see Fig. 6.

Symbol	Parameter	Conditions		25 °C	-	-40 °C to	o +85 °C	-40 °C to	• +125 °C	Unit
			Min	Тур	Мах	Min	Max	Min	Max	
74HC3G	04-Q100									
t <sub>pd</sub>		nA to nY; see Fig. 5 [1]								
	delay	V <sub>CC</sub> = 2.0 V	-	22	75	-	90	-	110	ns
		V <sub>CC</sub> = 4.5 V	-	8	15	-	18	-	22	ns
		V <sub>CC</sub> = 6.0 V	-	6	13	-	16	-	20	ns
t <sub>t</sub>	transition time	see <u>Fig. 5</u> [2]								
		V <sub>CC</sub> = 2.0 V	-	18	75	-	95	-	125	ns
		V <sub>CC</sub> = 4.5 V	-	6	15	-	19	-	25	ns
		V <sub>CC</sub> = 6.0 V	-	5	13	-	16	-	20	ns
C <sub>PD</sub>	power dissipation capacitance	$V_{I} = GND \text{ to } V_{CC}$ [3]	-	9	-	-	-	-	-	pF

Symbol	Parameter	Conditions		25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Мах	
74HCT3	G04-Q100	·								
t <sub>pd</sub>	propagation	nA to nY; see Fig. 5 [1]								
	delay	V <sub>CC</sub> = 4.5 V	-	10	18	-	23	-	29	ns
t <sub>t</sub>	transition time	V <sub>CC</sub> = 4.5 V; see <u>Fig. 5</u> [2]	-	6	15	-	19	-	22	ns
C <sub>PD</sub>	power dissipation capacitance	$V_{I} = GND \text{ to } V_{CC} - 1.5 \text{ V}$ [3]	-	9	-	-	-	-	-	pF

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

[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  $\mu W$ ).

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

f<sub>i</sub> = input frequency in MHz;

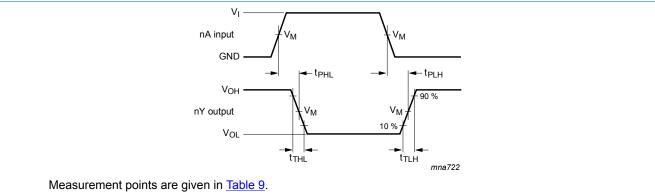
fo = output frequency in MHz;

 $C_L$  = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;  $\Sigma(C_L \times V_{CC}^2 \times f_0)$  = sum of outputs.

### 11.1. Waveforms and test circuit

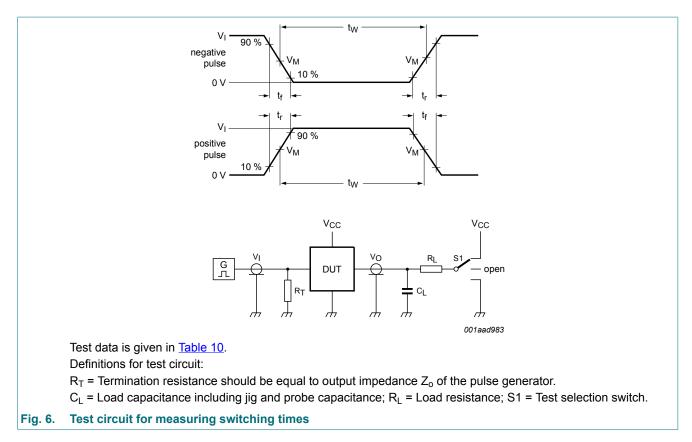


Logic levels: V<sub>OL</sub> and V<sub>OH</sub> are typical output voltage levels that occur with the output load.

#### The data input (nA) to output (nY) propagation delays Fig. 5.

#### **Table 9. Measurement points**

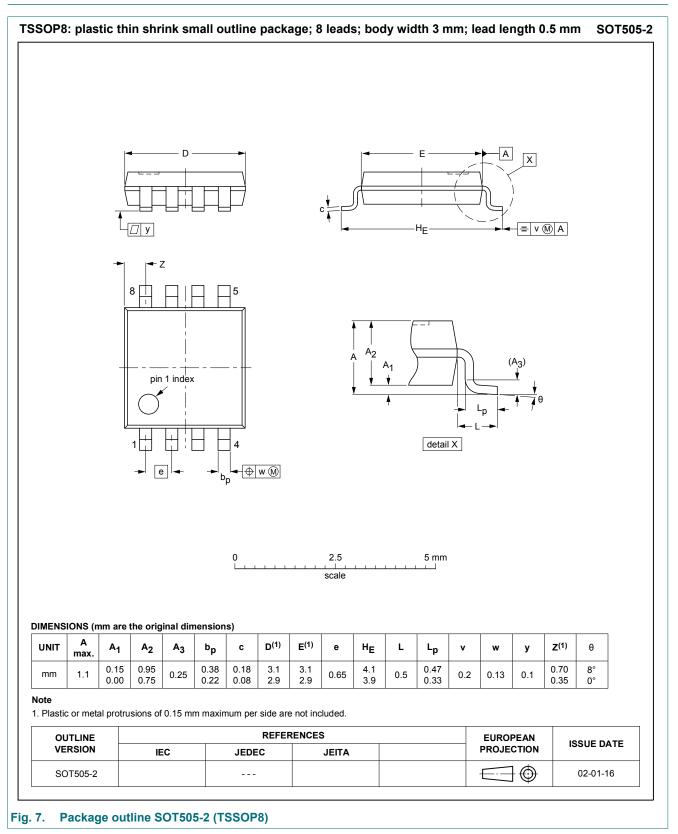
Туре	Input	Output
	V <sub>M</sub>	V <sub>M</sub>
74HC3G04-Q100	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
74HCT3G04-Q100	1.3 V	1.3 V

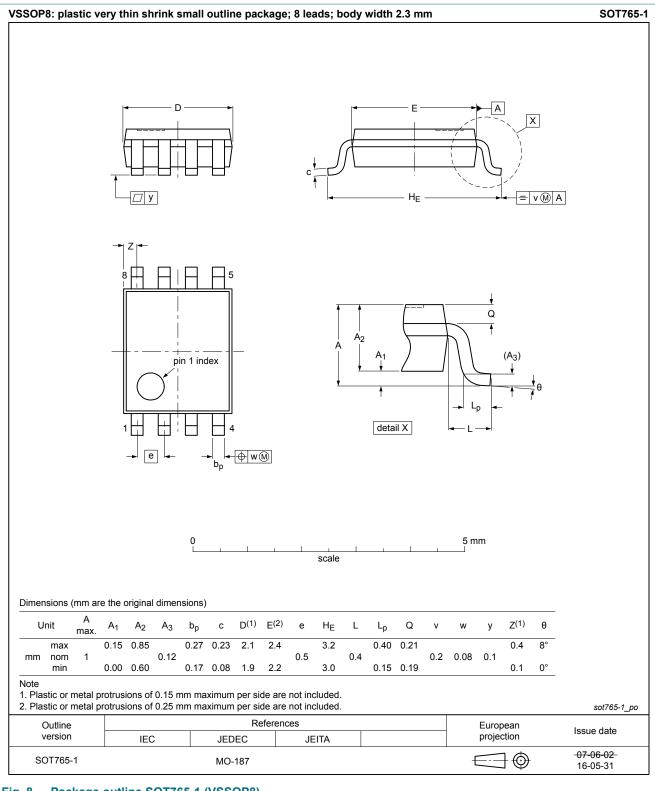


#### Table 10. Test data

Туре	Input		Load		S1 position
	VI	t <sub>r</sub> , t <sub>f</sub>	CL	RL	t <sub>PHL</sub> , t <sub>PLH</sub>
74HC3G04-Q100	V <sub>CC</sub>	≤ 6 ns	50 pF	1 kΩ	open
74HCT3G04-Q100	3 V	≤ 6 ns	50 pF	1 kΩ	open

## 12. Package outline







## 13. Abbreviations

Table 11. Abbrevia	ations
Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
MIL	Military
MM	Machine Model
TTL	Transistor-Transistor Logic

## 14. Revision history

Table 12. Revision history				
Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT3G04_Q100 v.3	20181126	Product data sheet	-	74HC_HCT3G04_Q100 v.2
Modifications:	of Nexperia. <ul> <li>Legal texts have</li> </ul>	been adapted to the	new company name v	ly with the identity guidelines where appropriate. 100 (SOT996-2/XSON8)
74HC_HCT3G04_Q100 v.2	20131118	Product data sheet	-	74HC_HCT3G04_Q100 v.1
Modifications:	Added type num	bers 74HC3G04GD-C	100 and 74HCT3G04	4GD-Q100 (XSON8 package)
74HC_HCT3G04_Q100 v.1	20120827	Product data sheet	-	-

## 15. 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.

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