74HC1G04; 74HCT1G04

Inverter

Rev. 5 — 25 September 2013   **Product data sheet**

1.   General description

The 74HC1G04; 74HCT1G04 is a single inverter. Inputs include clamp diodes that enable the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}.

2.   Features and benefits

- Wide supply voltage range from 2.0 V to 6.0 V
- Input levels:
    - ◆ For 74HC1G04: CMOS level
    - ◆ For 74HCT1G04: TTL level
- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- ESD protection:
    - ◆ HBM JESD22-A114E exceeds 2000 V
    - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from −40 °C to +85 °C and −40 °C to +125 °C

3.   Ordering information

Table 1.   Ordering information

Type number	Package			
	Temperature range	**Name**	**Description**	**Version**
74HC1G04GW	−40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74HCT1G04GW				
74HC1G04GV	−40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74HCT1G04GV				

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4. Marking

Table 2.   **Marking codes**

Type number	Marking[1]
74HC1G04GW	HC
74HCT1G04GW	TC
74HC1G04GV	H04
74HCT1G04GV	T04

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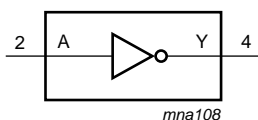
5. Functional diagram
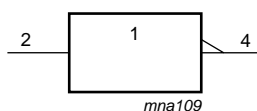

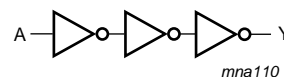| **Fig 1. Logic symbol**	**Fig 2. IEC logic symbol**	**Fig 3. Logic diagram**

6. Pinning information

6.1 Pinning
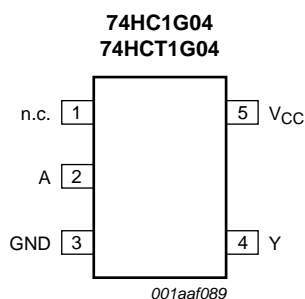
Fig 4. Pin configuration

6.2 Pin description

Table 3.   **Pin description**

Symbol	Pin	Description
n.c.	1	not connected
A	2	data input
GND	3	ground (0 V)
Y	4	data output
V_{CC}	5	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). [1]

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		−0.5	+7.0	V
I_{IK}	input clamping current	$V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V	-	±20	mA
I_{OK}	output clamping current	$V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V	-	±20	mA
I_O	output current	-0.5 V $< V_O < V_{CC} + 0.5$ V	-	±12.5	mA
I_{CC}	supply current		-	25	mA
I_{GND}	ground current		−25	-	mA
T_{stg}	storage temperature		−65	+150	°C
P_{tot}	total power dissipation	$T_{amb} = -40$ °C to +125 °C [2]	-	200	mW

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

[2]   Above 55 °C, the value of P_{tot} derates linearly with 2.5 mW/K.

9. Recommended operating conditions

Table 6.   Recommended operating conditions
Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	74HC1G04			74HCT1G04			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
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0$ V	-	-	625	-	-	-	ns/V
		$V_{CC} = 4.5$ V	-	-	139	-	-	139	ns/V
		$V_{CC} = 6.0$ V	-	-	83	-	-	-	ns/V

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	−40 °C to +85 °C			−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
For type 74HC1G04								
V_{IH}	HIGH-level input voltage	V_{CC} = 2.0 V	1.5	1.2	-	1.5	-	V
		V_{CC} = 4.5 V	3.15	2.4	-	3.15	-	V
		V_{CC} = 6.0 V	4.2	3.2	-	4.2	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 2.0 V	-	0.8	0.5	-	0.5	V
		V_{CC} = 4.5 V	-	2.1	1.35	-	1.35	V
		V_{CC} = 6.0 V	-	2.8	1.8	-	1.8	V
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 = −2.0 mA; V_{CC} = 4.5 V	4.13	4.32	-	3.7	-	V
		I_O = −2.6 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 = 2.0 mA; V_{CC} = 4.5 V	-	0.15	0.33	-	0.4	V
		I_O = 2.6 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	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 6.0 V	-	-	10	-	20	μA
C_I	input capacitance		-	1.5	-	-	-	pF
For type 74HCT1G04								
V_{IH}	HIGH-level input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 4.5 V to 5.5 V	-	1.2	0.8	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}						
		I_O = −20 μA; V_{CC} = 4.5 V	4.4	4.5	-	4.4	-	V
		I_O = −2.0 mA; V_{CC} = 4.5 V	4.13	4.32	-	3.7	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}						
		I_O = 20 μA; V_{CC} = 4.5 V	-	0	0.1	-	0.1	V
		I_O = 2.0 mA; V_{CC} = 4.5 V	-	0.15	0.33	-	0.4	V
I_I	input leakage current	$V_I = V_{CC}$ or GND; V_{CC} = 5.5 V	-	-	1.0	-	1.0	μA

Table 7.   Static characteristics *…continued*

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

Symbol	Parameter	Conditions	−40 °C to +85 °C			−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	10	-	20	µA
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	-	-	500	-	850	µA
C_I	input capacitance		-	1.5	-	-	-	pF

11. Dynamic characteristics

Table 8.   Dynamic characteristics

GND = 0 V; $t_r = t_f \leq 6.0$ ns; All typical values are measured at $T_{amb} = 25\ °C$. For test circuit, see Figure 6

Symbol	Parameter	Conditions	−40 °C to +85 °C			−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
For type 74HC1G04								
t_{pd}	propagation delay	A to Y; see Figure 5 [1]						
		$V_{CC} = 2.0$ V; $C_L = 50$ pF	-	25	105	-	135	ns
		$V_{CC} = 4.5$ V; $C_L = 50$ pF	-	9	21	-	27	ns
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	7	-	-	-	ns
		$V_{CC} = 6.0$ V; $C_L = 50$ pF	-	8	18	-	23	ns
C_{PD}	power dissipation capacitance	$V_I = $ GND to V_{CC} [2]	-	16	-	-	-	pF
For type 74HCT1G04								
t_{pd}	propagation delay	A to Y; see Figure 5 [1]						
		$V_{CC} = 4.5$ V; $C_L = 50$ pF	-	10	24	-	27	ns
		$V_{CC} = 5.0$ V; $C_L = 15$ pF	-	8	-	-	-	ns
C_{PD}	power dissipation capacitance	$V_I = $ GND to $V_{CC} - 1.5$ V [2]	-	18	-	-	-	pF

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

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

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

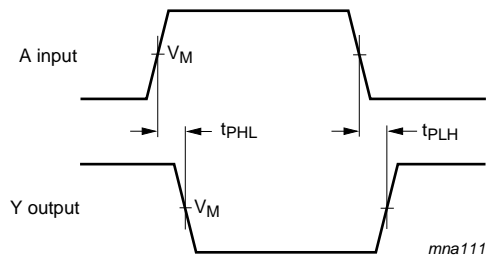f_i = input frequency in MHz

f_o = output frequency in MHz

C_L = output load capacitance in pF

V_{CC} = supply voltage in Volts

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

74HC_HCT1G04
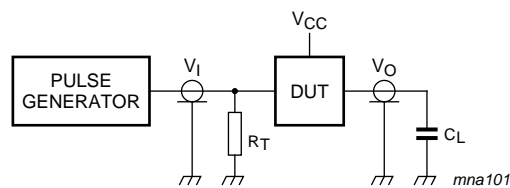
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12. Waveforms

Measurement points are given in Table 9.

Fig 5. **The input (A) to output (Y) propagation delays**

Table 9. **Measurement points**

Type	V_I	V_M
74HC1G04	GND to V_{CC}	$0.5 \times V_{CC}$
74HCT1G04	GND to 03 V	1.3 V

Test data is given in Table 8. 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

Fig 6. **Load circuitry for switching times**

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13. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm   **SOT353-1**

DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A₁	A₂	A₃	b_p	c	D[1]	E[1]	e	e₁	H_E	L	L_p	v	w	y	Z[1]	θ
mm	1.1	0.1 0	1.0 0.8	0.15	0.30 0.15	0.25 0.08	2.25 1.85	1.35 1.15	0.65	1.3	2.25 2.0	0.425	0.46 0.21	0.3	0.1	0.1	0.60 0.15	7° 0°

Note

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

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT353-1		MO-203	SC-88A			~~00-09-01~~ 03-02-19
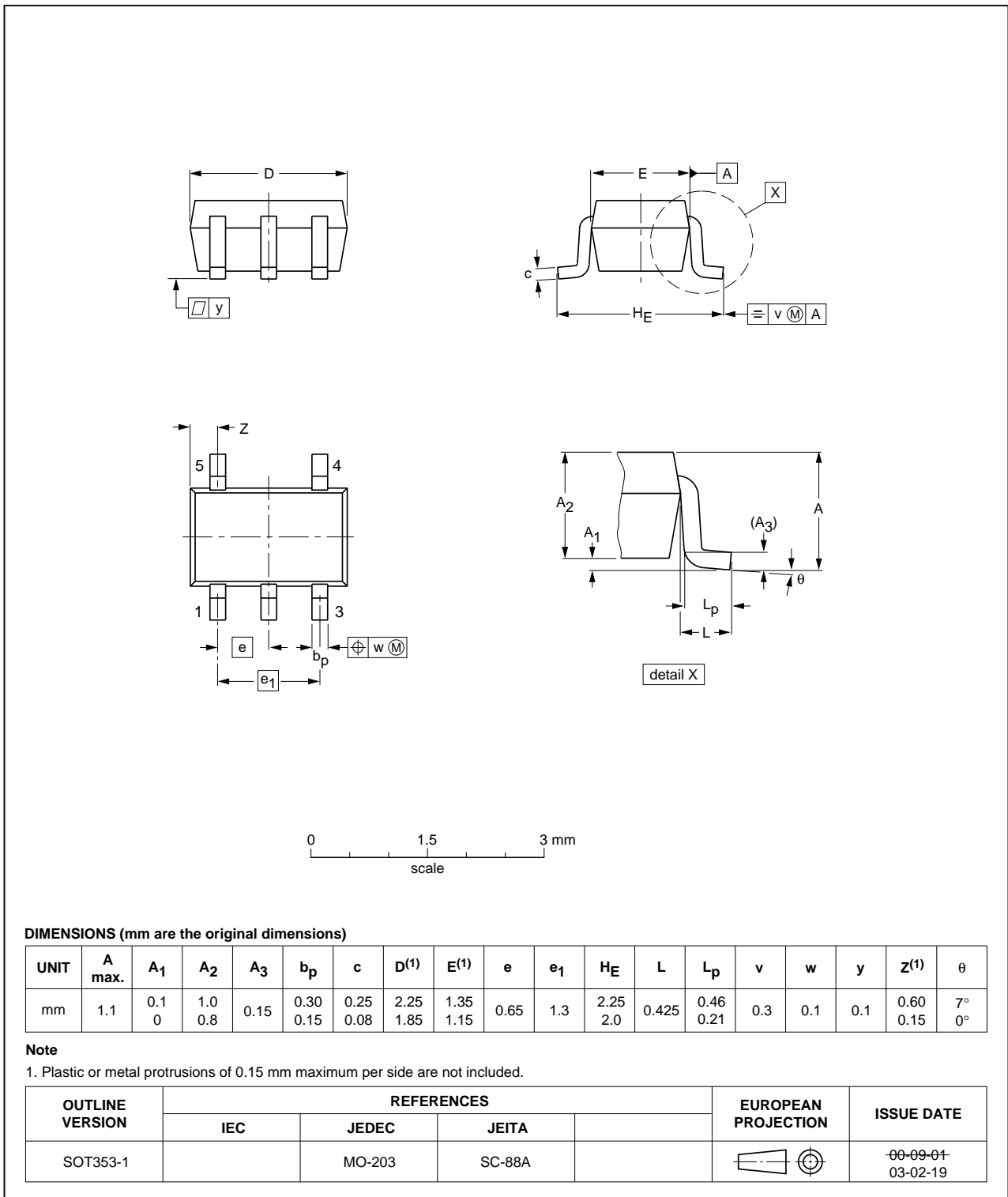
Fig 7. Package outline SOT353-1 (TSSOP5)

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Plastic surface-mounted package; 5 leads

SOT753

DIMENSIONS (mm are the original dimensions)

UNIT	A	A₁	bₚ	c	D	E	e	Hₑ	Lₚ	Q	v	w	y
mm	1.1 0.9	0.100 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT753			SC-74A			~~02-04-16~~ 06-03-16

Fig 8. Package outline SOT753 (SC-74A)

14. Abbreviations

Table 10. Abbreviations

Acronym	Description
DUT	Device Under Test
TTL	Transistor-Transistor Logic

15. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT1G04 v.5	20130925	Product data sheet	-	74HC_HCT1G04 v.4
Modifications:	• Section 1 "General description" updated.			
74HC_HCT1G04 v.4	20070716	Product data sheet	-	74HC_HCT1G04 v.3
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Package SOT353 changed to SOT353-1 in Table 1 and Figure 7. • Quick Reference Data and Soldering sections removed. • Section 2 "Features and benefits" updated.			
74HC_HCT1G04 v.3	20020517	Product specification	-	74HC_HCT1G04 v.2
74HC_HCT1G04 v.2	20010302	Product specification	-	74HC_HCT1G04 v.1
74HC_HCT1G04 v.1	19980831	Preliminary specification	-	-

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16.1 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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