

# DATA SHEET

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## 74AHC1G04; 74AHCT1G04

### Inverter

Product specification  
Supersedes data of 2002 May 27

2003 Sep 04

## Inverter

## 74AHC1G04; 74AHCT1G04

## FEATURES

- Symmetrical output impedance
- High noise immunity
- ESD protection:
  - HBM EIA/JESD22-A114-A exceeds 2000 V
  - MM EIA/JESD22-A115-A exceeds 200 V
  - CDM EIA/JESD22-C101 exceeds 1000 V.
- Low power dissipation
- Balanced propagation delays
- Very small 5-pin package
- Specified from  $-40$  to  $+85$  °C and  $-40$  to  $+125$  °C.

## DESCRIPTION

The 74AHC1G04/74AHCT1G04 are high-speed Si-gate CMOS devices.

The 74AHC1G04/74AHCT1G04 provides the inverting buffer.

## QUICK REFERENCE DATA

GND = 0 V;  $T_{amb} = 25$  °C;  $t_r = t_f \leq 3.0$  ns.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			74AHC1G04	74AHCT1G04	
$t_{PHL}/t_{PLH}$	propagation delay input A to output Y	$C_L = 15$ pF; $V_{CC} = 5$ V	3.1	3.4	ns
$C_I$	input capacitance		1.5	1.5	pF
$C_{PD}$	power dissipation capacitance	$C_L = 50$ pF; $f = 1$ MHz; notes 1 and 2	15	16	pF

## Notes

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

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

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

$N$  = total load switching outputs;

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

2. The condition is  $V_I = \text{GND to } V_{CC}$ .

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**FUNCTION TABLE**

See note 1.

INPUT	OUTPUT
A	Y
L	H
H	L

**Note**

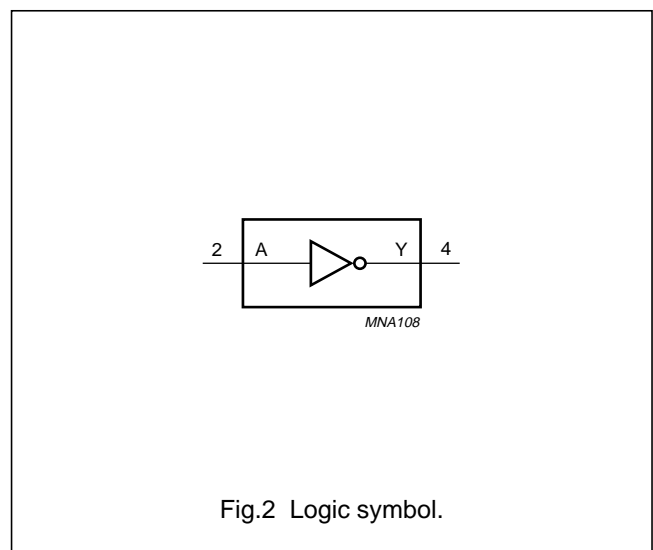
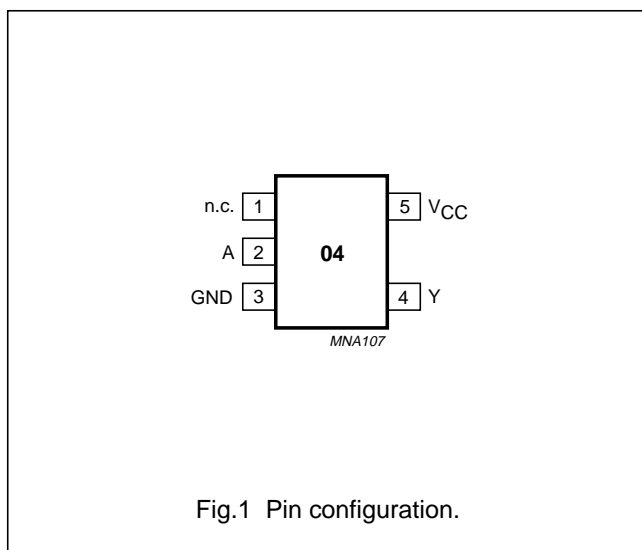
- 1. H = HIGH voltage level;  
L = LOW voltage level.

**ORDERING AND PACKAGE INFORMATION**

TYPE NUMBER	PACKAGES					
	TEMPERATURE RANGE	PINS	PACKAGE	MATERIAL	CODE	MARKING
74AHC1G04GW	-40 to +125 °C	5	SC-88A	plastic	SOT353	AC
74AHCT1G04GW	-40 to +125 °C	5	SC-88A	plastic	SOT353	CC
74AHC1G04GV	-40 to +125 °C	5	SC-74A	plastic	SOT753	A04
74AHCT1G04GV	-40 to +125 °C	5	SC-74A	plastic	SOT753	C04

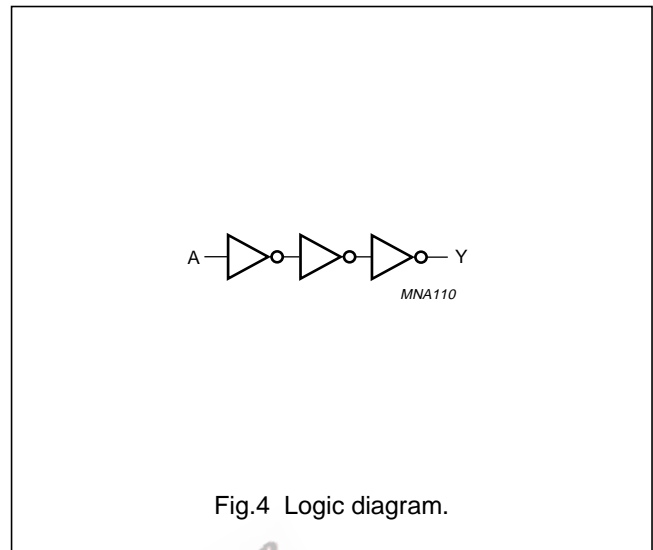
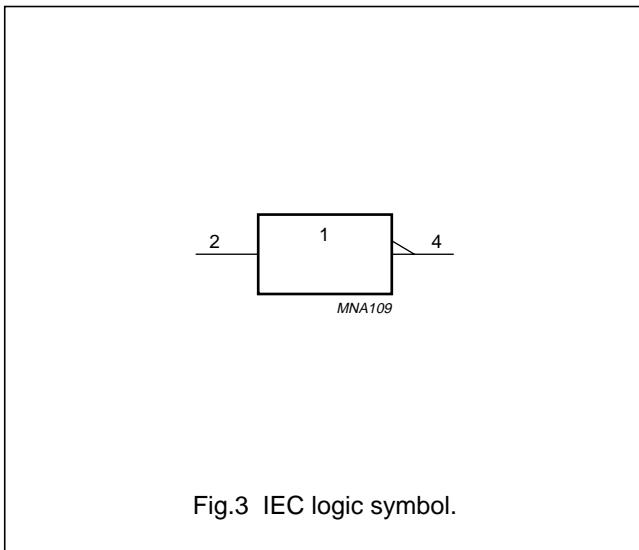
**PINNING**

PIN	SYMBOL	DESCRIPTION
1	n.c.	not connected
2	A	data input A
3	GND	ground (0 V)
4	Y	data output Y
5	V <sub>CC</sub>	supply voltage



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RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	74AHC1G04			74AHCT1G04			UNIT
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
V <sub>CC</sub>	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
V <sub>I</sub>	input voltage		0	–	5.5	0	–	5.5	V
V <sub>O</sub>	output voltage		0	–	V <sub>CC</sub>	0	–	V <sub>CC</sub>	V
T <sub>amb</sub>	operating ambient temperature	see DC and AC characteristics per device	–40	+25	+125	–40	+25	+125	°C
t <sub>r</sub> , t <sub>f</sub> (Δt/Δf)	input rise and fall times	V <sub>CC</sub> = 3.3 ±0.3 V	–	–	100	–	–	–	ns/V
		V <sub>CC</sub> = 5 ±0.5 V	–	–	20	–	–	20	ns/V

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 <sub>CC</sub>	supply voltage		–0.5	+7.0	V
V <sub>I</sub>	input voltage		–0.5	+7.0	V
I <sub>IK</sub>	input diode current	V <sub>I</sub> < –0.5 V	–	–20	mA
I <sub>OK</sub>	output diode current	V <sub>O</sub> < –0.5 or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V; note 1	–	±20	mA
I <sub>O</sub>	output source or sink current	–0.5 V < V <sub>O</sub> < V <sub>CC</sub> + 0.5 V	–	±25	mA
I <sub>CC</sub> , I <sub>GND</sub>	V <sub>CC</sub> or GND current		–	±75	mA
T <sub>stg</sub>	storage temperature		–65	+150	°C
P <sub>D</sub>	power dissipation	T <sub>amb</sub> = –40 to +125 °C	–	250	mW

Note

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

## Inverter

## 74AHC1G04; 74AHCT1G04

## DC CHARACTERISTICS

## Type 74AHC1G04

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V <sub>CC</sub> (V)				
<b>T<sub>amb</sub> = 25 °C</b>							
V <sub>IH</sub>	HIGH-level input voltage		2.0	1.5	–	–	V
			3.0	2.1	–	–	V
			5.5	3.85	–	–	V
V <sub>IL</sub>	LOW-level input voltage		2.0	–	–	0.5	V
			3.0	–	–	0.9	V
			5.5	–	–	1.65	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>O</sub> = –50 µA	2.0	1.9	2.0	–	V
		I <sub>O</sub> = –50 µA	3.0	2.9	3.0	–	V
		I <sub>O</sub> = –50 µA	4.5	4.4	4.5	–	V
		I <sub>O</sub> = –4.0 mA	3.0	2.58	–	–	V
		I <sub>O</sub> = –8.0 mA	4.5	3.94	–	–	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> = 50 µA	2.0	–	0	0.1	V
		I <sub>O</sub> = 50 µA	3.0	–	0	0.1	V
		I <sub>O</sub> = 50 µA	4.5	–	0	0.1	V
		I <sub>O</sub> = 4.0 mA	3.0	–	–	0.36	V
		I <sub>O</sub> = 8.0 mA	4.5	–	–	0.36	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5	–	–	0.1	µA
I <sub>CC</sub>	quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0	5.5	–	–	10	µA
C <sub>I</sub>	input capacitance		–	–	1.5	10	pF

## Inverter

## 74AHC1G04; 74AHCT1G04

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V <sub>CC</sub> (V)				
<b>T<sub>amb</sub> = -40 to +85 °C</b>							
V <sub>IH</sub>	HIGH-level input voltage		2.0	1.5	–	–	V
			3.0	2.1	–	–	V
			5.5	3.85	–	–	V
V <sub>IL</sub>	LOW-level input voltage		2.0	–	–	0.5	V
			3.0	–	–	0.9	V
			5.5	–	–	1.65	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>O</sub> = -50 µA	2.0	1.9	–	–	V
		I <sub>O</sub> = -50 µA	3.0	2.9	–	–	V
		I <sub>O</sub> = -50 µA	4.5	4.4	–	–	V
		I <sub>O</sub> = -4.0 mA	3.0	2.48	–	–	V
		I <sub>O</sub> = -8.0 mA	4.5	3.8	–	–	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> = 50 µA	2.0	–	–	0.1	V
		I <sub>O</sub> = 50 µA	3.0	–	–	0.1	V
		I <sub>O</sub> = 50 µA	4.5	–	–	0.1	V
		I <sub>O</sub> = 4.0 mA	3.0	–	–	0.44	V
		I <sub>O</sub> = 8.0 mA	4.5	–	–	0.44	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5	–	–	1.0	µA
I <sub>CC</sub>	quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0	5.5	–	–	10	µA
C <sub>I</sub>	input capacitance		–	–	–	10	pF

## Inverter

## 74AHC1G04; 74AHCT1G04

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V <sub>CC</sub> (V)				
<b>T<sub>amb</sub> = -40 to +125 °C</b>							
V <sub>IH</sub>	HIGH-level input voltage		2.0	1.5	–	–	V
			3.0	2.1	–	–	V
			5.5	3.85	–	–	V
V <sub>IL</sub>	LOW-level input voltage		2.0	–	–	0.5	V
			3.0	–	–	0.9	V
			5.5	–	–	1.65	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>O</sub> = -50 µA	2.0	1.9	–	–	V
		I <sub>O</sub> = -50 µA	3.0	2.9	–	–	V
		I <sub>O</sub> = -50 µA	4.5	4.4	–	–	V
		I <sub>O</sub> = -4.0 mA	3.0	2.40	–	–	V
		I <sub>O</sub> = -8.0 mA	4.5	3.70	–	–	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> = 50 µA	2.0	–	–	0.1	V
		I <sub>O</sub> = 50 µA	3.0	–	–	0.1	V
		I <sub>O</sub> = 50 µA	4.5	–	–	0.1	V
		I <sub>O</sub> = 4.0 mA	3.0	–	–	0.55	V
		I <sub>O</sub> = 8.0 mA	4.5	–	–	0.55	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5	–	–	2.0	µA
I <sub>CC</sub>	quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0	5.5	–	–	40	µA
C <sub>I</sub>	input capacitance		–	–	–	10	pF

## Inverter

## 74AHC1G04; 74AHCT1G04

## Type 74AHCT1G04

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V <sub>CC</sub> (V)				
<b>T<sub>amb</sub> = 25 °C</b>							
V <sub>IH</sub>	HIGH-level input voltage		4.5 to 5.5	2.0	–	–	V
V <sub>IL</sub>	LOW-level input voltage		4.5 to 5.5	–	–	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>O</sub> = –50 µA	4.5	4.4	4.5	–	V
		I <sub>O</sub> = –8.0 mA	4.5	3.94	–	–	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> = 50 µA	4.5	–	0	0.1	V
		I <sub>O</sub> = 8.0 mA	4.5	–	–	0.36	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	5.5	–	–	0.1	µA
I <sub>CC</sub>	quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0	5.5	–	–	1.0	µA
ΔI <sub>CC</sub>	additional quiescent supply current per input pin	V <sub>I</sub> = 3.4 V; other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0	5.5	–	–	1.35	mA
C <sub>I</sub>	input capacitance			–	1.5	10	pF
<b>T<sub>amb</sub> = –40 to +85 °C</b>							
V <sub>IH</sub>	HIGH-level input voltage		4.5 to 5.5	2.0	–	–	V
V <sub>IL</sub>	LOW-level input voltage		4.5 to 5.5	–	–	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>O</sub> = –50 µA	4.5	4.4	–	–	V
		I <sub>O</sub> = –8.0 mA	4.5	3.8	–	–	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> = 50 µA	4.5	–	–	0.1	V
		I <sub>O</sub> = 8.0 mA	4.5	–	–	0.44	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	5.5	–	–	1.0	µA
I <sub>CC</sub>	quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0	5.5	–	–	10	µA
ΔI <sub>CC</sub>	additional quiescent supply current per input pin	V <sub>I</sub> = 3.4 V; other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0	5.5	–	–	1.5	mA
C <sub>I</sub>	input capacitance		–	–	–	10	pF



## Inverter

## 74AHC1G04; 74AHCT1G04

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V <sub>CC</sub> (V)				
<b>T<sub>amb</sub> = -40 to +125 °C</b>							
V <sub>IH</sub>	HIGH-level input voltage		4.5 to 5.5	2.0	–	–	V
V <sub>IL</sub>	LOW-level input voltage		4.5 to 5.5	–	–	0.8	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	4.5	4.4	–	–	V
		I <sub>O</sub> = -50 μA I <sub>O</sub> = -8.0 mA	4.5	3.70	–	–	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	4.5	–	–	0.1	V
		I <sub>O</sub> = 50 μA I <sub>O</sub> = 8.0 mA	4.5	–	–	0.55	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	5.5	–	–	2.0	μA
I <sub>CC</sub>	quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0	5.5	–	–	40	μA
ΔI <sub>CC</sub>	additional quiescent supply current per input pin	V <sub>I</sub> = 3.4 V; other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0	5.5	–	–	1.5	mA
C <sub>I</sub>	input capacitance		–	–	–	10	pF

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Inverter

74AHC1G04; 74AHCT1G04

AC CHARACTERISTICS

Type 74AHC1G04

GND = 0 V;  $t_r = t_f \leq 3.0$  ns.

SYMBOL	PARAMETER	TEST CONDITIONS			MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	C <sub>L</sub> (pF)	V <sub>CC</sub> (V)				
<b>T<sub>amb</sub> = 25 °C</b>								
t <sub>PHL</sub> /t <sub>PLH</sub>	propagation delay input A to output Y	see Figs 5 and 6	15	3.0 to 3.6	–	–	7.1	ns
				3.3	–	4.3	–	ns
				4.5 to 5.5	–	–	5.5	ns
				5	–	3.1	–	ns
			50	3.0 to 3.6	–	–	10.6	ns
				3.3	–	6.1	–	ns
				4.5 to 5.5	–	–	7.5	ns
				5	–	4.5	–	ns
<b>T<sub>amb</sub> = –40 to +85 °C</b>								
t <sub>PHL</sub> /t <sub>PLH</sub>	propagation delay input A to output Y	see Figs 5 and 6	15	3.0 to 3.6	1.0	–	8.5	ns
				4.5 to 5.5	1.0	–	6.5	ns
			50	3.0 to 3.6	1.0	–	12	ns
				4.5 to 5.5	1.0	–	8.5	ns
<b>T<sub>amb</sub> = –40 to +125 °C</b>								
t <sub>PHL</sub> /t <sub>PLH</sub>	propagation delay input A to output Y	see Figs 5 and 6	15	3.0 to 3.6	1.0	–	11.0	ns
				4.5 to 5.5	1.0	–	7.0	ns
			50	3.0 to 3.6	1.0	–	14.5	ns
				4.5 to 5.5	1.0	–	9.5	ns

## Inverter

## 74AHC1G04; 74AHCT1G04

## Type 74AHCT1G04

GND = 0 V;  $t_r = t_f \leq 3.0$  ns.

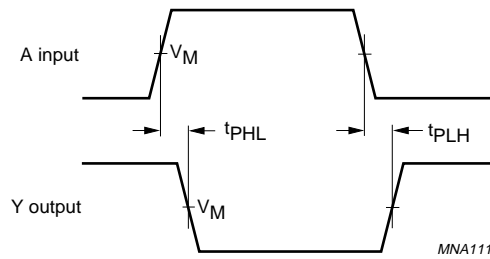
SYMBOL	PARAMETER	TEST CONDITIONS			MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	$C_L$ (pF)	$V_{CC}$ (V)				
<b><math>T_{amb} = 25\text{ }^\circ\text{C}</math></b>								
$t_{PHL}/t_{PLH}$	propagation delay input A to output Y	see Figs 5 and 6	15	4.5 to 5.5	–	–	6.7	ns
				5	–	3.4	–	ns
			50	4.5 to 5.5	–	–	7.7	ns
				5	–	4.9	–	ns
<b><math>T_{amb} = -40\text{ to }+85\text{ }^\circ</math></b>								
$t_{PHL}/t_{PLH}$	propagation delay input A to output Y	see Figs 5 and 6	15	4.5 to 5.5	1.0	–	7.5	ns
			50	4.5 to 5.5	1.0	–	8.5	ns
<b><math>T_{amb} = -40\text{ to }+125\text{ }^\circ\text{C}</math></b>								
$t_{PHL}/t_{PLH}$	propagation delay input A to output Y	see Figs 5 and 6	15	4.5 to 5.5	1.0	–	8.5	ns
			50	4.5 to 5.5	1.0	–	10.0	ns

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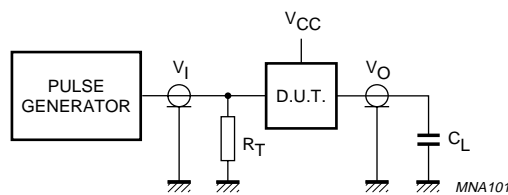
74AHC1G04; 74AHCT1G04

AC WAVEFORMS



TYPE	V <sub>I</sub> INPUT REQUIREMENTS	V <sub>M</sub> INPUT	V <sub>M</sub> OUTPUT
74AHC1G04	GND to V <sub>CC</sub>	50% V <sub>CC</sub>	50% V <sub>CC</sub>
74AHCT1G04	GND to 3.0 V	1.5 V	50% V <sub>CC</sub>

Fig.5 Input (A) to output (Y) propagation delays.



Definitions for test circuit:

C<sub>L</sub> = load capacitance including jig and probe capacitance (see Chapter "AC characteristics").

R<sub>T</sub> = termination resistance should be equal to the output impedance Z<sub>0</sub> of the pulse generator.

Fig.6 Load circuitry for switching times.

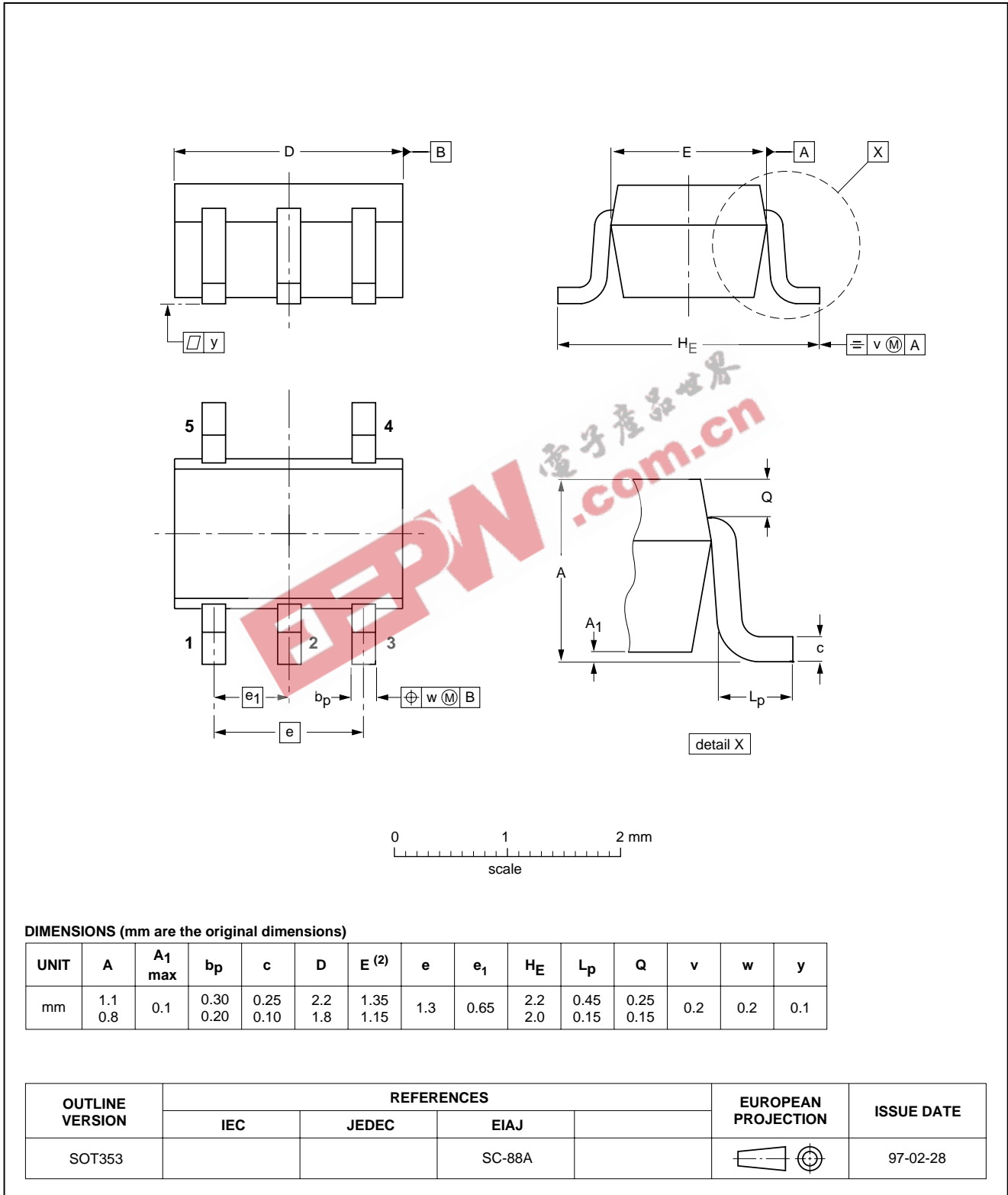
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PACKAGE OUTLINES

Plastic surface mounted package; 5 leads

SOT353

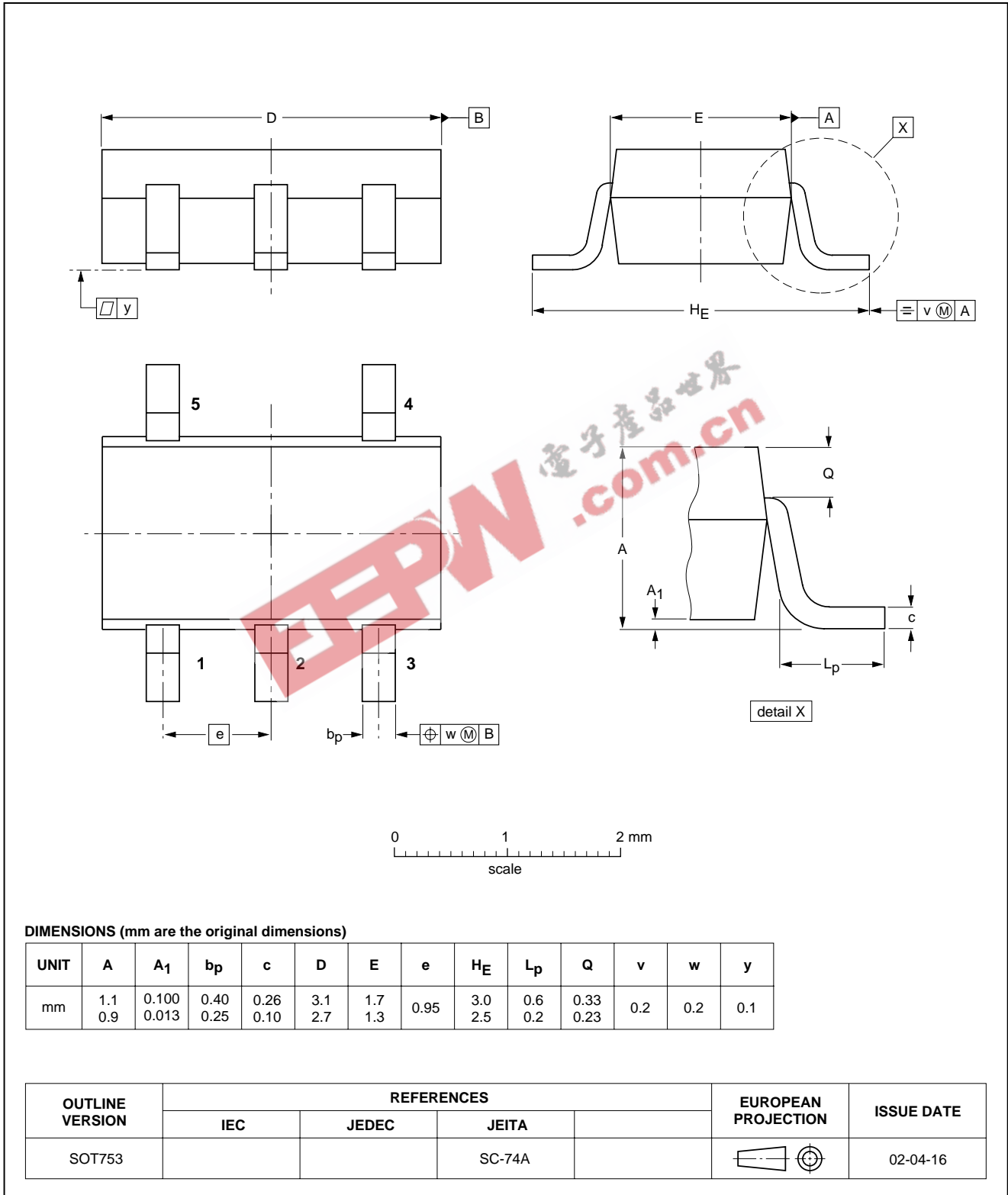


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74AHC1G04; 74AHCT1G04

Plastic surface mounted package; 5 leads

SOT753



## Inverter

## 74AHC1G04; 74AHCT1G04

## DATA SHEET STATUS

LEVEL	DATA SHEET STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)(3)</sup>	DEFINITION
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

## Notes

1. Please consult the most recently issued data sheet before initiating or completing a design.
2. The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.
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