DATA SHEET

74AHC1G04; 74AHCT1G04
Inverter

Product specification
Supersedes data of 2002 May 27

2003 Sep 04

Philips Semiconductors

PHILIPS

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 μW).
   $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$ 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;
   N = total load switching outputs;
   $\sum(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.
2. The condition is V_I = GND to V_{CC}.

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_{CC}	supply voltage

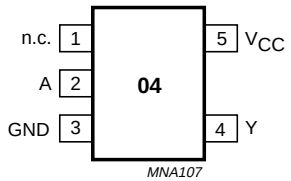


Fig.1 Pin configuration.

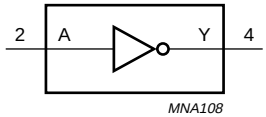


Fig.2 Logic symbol.

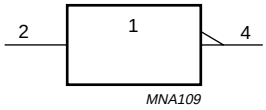


Fig.3 IEC logic symbol.

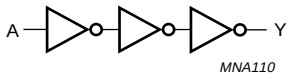


Fig.4 Logic diagram.

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	74AHC1G04			74AHCT1G04			UNIT
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
V_{CC}	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
V_I	input voltage		0	–	5.5	0	–	5.5	V
V_O	output voltage		0	–	V_{CC}	0	–	V_{CC}	V
T_{amb}	operating ambient temperature	see DC and AC characteristics per device	–40	+25	+125	–40	+25	+125	°C
t_r, t_f ($\Delta t/\Delta f$)	input rise and fall times	V_{CC} = 3.3 ±0.3 V	–	–	100	–	–	–	ns/V
		V_{CC} = 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_{CC}	supply voltage		–0.5	+7.0	V
V_I	input voltage		–0.5	+7.0	V
I_{IK}	input diode current	V_I < –0.5 V	–	–20	mA
I_{OK}	output diode current	V_O < –0.5 or V_O > V_{CC} + 0.5 V; note 1	–	±20	mA
I_O	output source or sink current	–0.5 V < V_O < V_{CC} + 0.5 V	–	±25	mA
I_{CC}, I_{GND}	V_{CC} or GND current		–	±75	mA
T_{stg}	storage temperature		–65	+150	°C
P_D	power dissipation	T_{amb} = –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.

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_{CC} (V)				
T_{amb} = 25 °C							
V_{IH}	HIGH-level input voltage		2.0	1.5	–	–	V
			3.0	2.1	–	–	V
			5.5	3.85	–	–	V
V_{IL}	LOW-level input voltage		2.0	–	–	0.5	V
			3.0	–	–	0.9	V
			5.5	–	–	1.65	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}					
		I_O = –50 μA	2.0	1.9	2.0	–	V
		I_O = –50 μA	3.0	2.9	3.0	–	V
		I_O = –50 μA	4.5	4.4	4.5	–	V
		I_O = –4.0 mA	3.0	2.58	–	–	V
		I_O = –8.0 mA	4.5	3.94	–	–	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}					
		I_O = 50 μA	2.0	–	0	0.1	V
		I_O = 50 μA	3.0	–	0	0.1	V
		I_O = 50 μA	4.5	–	0	0.1	V
		I_O = 4.0 mA	3.0	–	–	0.36	V
		I_O = 8.0 mA	4.5	–	–	0.36	V
I_{LI}	input leakage current	V_I = V_{CC} or GND	5.5	–	–	0.1	μA
I_{CC}	quiescent supply current	V_I = V_{CC} or GND; I_O = 0	5.5	–	–	10	μA
C_I	input capacitance		–	–	1.5	10	pF

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V_{CC} (V)				
T_{amb} = −40 to +85 °C							
V_{IH}	HIGH-level input voltage		2.0	1.5	–	–	V
			3.0	2.1	–	–	V
			5.5	3.85	–	–	V
V_{IL}	LOW-level input voltage		2.0	–	–	0.5	V
			3.0	–	–	0.9	V
			5.5	–	–	1.65	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}					
		I_O = –50 μA	2.0	1.9	–	–	V
		I_O = –50 μA	3.0	2.9	–	–	V
		I_O = –50 μA	4.5	4.4	–	–	V
		I_O = –4.0 mA	3.0	2.48	–	–	V
		I_O = –8.0 mA	4.5	3.8	–	–	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}					
		I_O = 50 μA	2.0	–	–	0.1	V
		I_O = 50 μA	3.0	–	–	0.1	V
		I_O = 50 μA	4.5	–	–	0.1	V
		I_O = 4.0 mA	3.0	–	–	0.44	V
		I_O = 8.0 mA	4.5	–	–	0.44	V
I_{LI}	input leakage current	V_I = V_{CC} or GND	5.5	–	–	1.0	μA
I_{CC}	quiescent supply current	V_I = V_{CC} or GND; I_O = 0	5.5	–	–	10	μA
C_I	input capacitance		–	–	–	10	pF

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V_{CC} (V)				
T_{amb} = −40 to +125 °C							
V_{IH}	HIGH-level input voltage		2.0	1.5	–	–	V
			3.0	2.1	–	–	V
			5.5	3.85	–	–	V
V_{IL}	LOW-level input voltage		2.0	–	–	0.5	V
			3.0	–	–	0.9	V
			5.5	–	–	1.65	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}					
		I_O = –50 μA	2.0	1.9	–	–	V
		I_O = –50 μA	3.0	2.9	–	–	V
		I_O = –50 μA	4.5	4.4	–	–	V
		I_O = –4.0 mA	3.0	2.40	–	–	V
		I_O = –8.0 mA	4.5	3.70	–	–	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}					
		I_O = 50 μA	2.0	–	–	0.1	V
		I_O = 50 μA	3.0	–	–	0.1	V
		I_O = 50 μA	4.5	–	–	0.1	V
		I_O = 4.0 mA	3.0	–	–	0.55	V
		I_O = 8.0 mA	4.5	–	–	0.55	V
I_{LI}	input leakage current	V_I = V_{CC} or GND	5.5	–	–	2.0	μA
I_{CC}	quiescent supply current	V_I = V_{CC} or GND; I_O = 0	5.5	–	–	40	μA
C_I	input capacitance		–	–	–	10	pF

Type 74AHCT1G04

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

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V_{CC} (V)				
T_{amb} = 25 °C							
V_{IH}	HIGH-level input voltage		4.5 to 5.5	2.0	–	–	V
V_{IL}	LOW-level input voltage		4.5 to 5.5	–	–	0.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}					
		I_O = –50 μA	4.5	4.4	4.5	–	V
		I_O = –8.0 mA	4.5	3.94	–	–	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}					
		I_O = 50 μA	4.5	–	0	0.1	V
		I_O = 8.0 mA	4.5	–	–	0.36	V
I_{LI}	input leakage current	V_I = V_{IH} or V_{IL}	5.5	–	–	0.1	μA
I_{CC}	quiescent supply current	V_I = V_{CC} or GND; I_O = 0	5.5	–	–	1.0	μA
ΔI_{CC}	additional quiescent supply current per input pin	V_I = 3.4 V; other inputs at V_{CC} or GND; I_O = 0	5.5	–	–	1.35	mA
C_I	input capacitance			–	1.5	10	pF
T_{amb} = –40 to +85 °C							
V_{IH}	HIGH-level input voltage		4.5 to 5.5	2.0	–	–	V
V_{IL}	LOW-level input voltage		4.5 to 5.5	–	–	0.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}					
		I_O = –50 μA	4.5	4.4	–	–	V
		I_O = –8.0 mA	4.5	3.8	–	–	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}					
		I_O = 50 μA	4.5	–	–	0.1	V
		I_O = 8.0 mA	4.5	–	–	0.44	V
I_{LI}	input leakage current	V_I = V_{IH} or V_{IL}	5.5	–	–	1.0	μA
I_{CC}	quiescent supply current	V_I = V_{CC} or GND; I_O = 0	5.5	–	–	10	μA
ΔI_{CC}	additional quiescent supply current per input pin	V_I = 3.4 V; other inputs at V_{CC} or GND; I_O = 0	5.5	–	–	1.5	mA
C_I	input capacitance		–	–	–	10	pF

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V_{CC} (V)				
T_{amb} = −40 to +125 °C							
V_{IH}	HIGH-level input voltage		4.5 to 5.5	2.0	–	–	V
V_{IL}	LOW-level input voltage		4.5 to 5.5	–	–	0.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}					
		I_O = –50 μA	4.5	4.4	–	–	V
		I_O = –8.0 mA	4.5	3.70	–	–	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}					
		I_O = 50 μA	4.5	–	–	0.1	V
		I_O = 8.0 mA	4.5	–	–	0.55	V
I_{LI}	input leakage current	V_I = V_{IH} or V_{IL}	5.5	–	–	2.0	μA
I_{CC}	quiescent supply current	V_I = V_{CC} or GND; I_O = 0	5.5	–	–	40	μA
ΔI_{CC}	additional quiescent supply current per input pin	V_I = 3.4 V; other inputs at V_{CC} or GND; I_O = 0	5.5	–	–	1.5	mA
C_I	input capacitance		–	–	–	10	pF

AC CHARACTERISTICS

Type 74AHC1G04

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

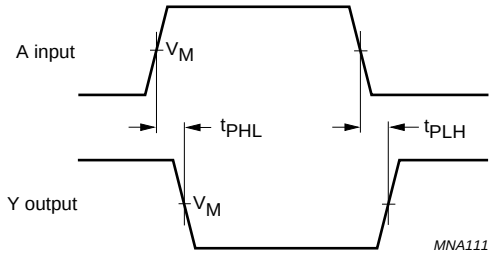
SYMBOL	PARAMETER	TEST CONDITIONS			MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	C_L (pF)	V_{CC} (V)				
T_{amb} = 25 °C								
t_{PHL}/t_{PLH}	propagation delay input A to output Y	see Figs 5 and 6	15	3.0 to 3.6	–	–	7.1	ns
				3.3	–	4.3	–	ns
				4.5 to 5.5	–	–	5.5	ns
				5	–	3.1	–	ns
			50	3.0 to 3.6	–	–	10.6	ns
				3.3	–	6.1	–	ns
				4.5 to 5.5	–	–	7.5	ns
				5	–	4.5	–	ns
T_{amb} = −40 to +85 °C								
t_{PHL}/t_{PLH}	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
T_{amb} = −40 to +125 °C								
t_{PHL}/t_{PLH}	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

Type 74AHCT1G04

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

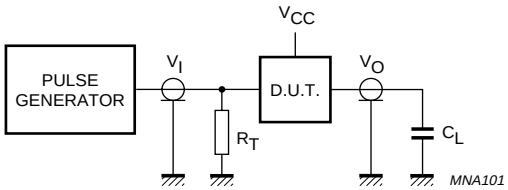
SYMBOL	PARAMETER	TEST CONDITIONS			MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	C_L (pF)	V_{CC} (V)				
T_{amb} = 25 °C								
t_{PHL}/t_{PLH}	propagation delay input A to output Y	see Figs 5 and 6	15	4.5 to 5.5	–	–	6.7	ns
				5	–	3.4	–	ns
			50	4.5 to 5.5	–	–	7.7	ns
				5	–	4.9	–	ns
T_{amb} = −40 to +85 °								
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
T_{amb} = −40 to +125 °C								
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

AC WAVEFORMS



TYPE	V_I INPUT REQUIREMENTS	V_M INPUT	V_M OUTPUT
74AHC1G04	GND to V_{CC}	50% V_{CC}	50% V_{CC}
74AHCT1G04	GND to 3.0 V	1.5 V	50% V_{CC}

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



Definitions for test circuit:

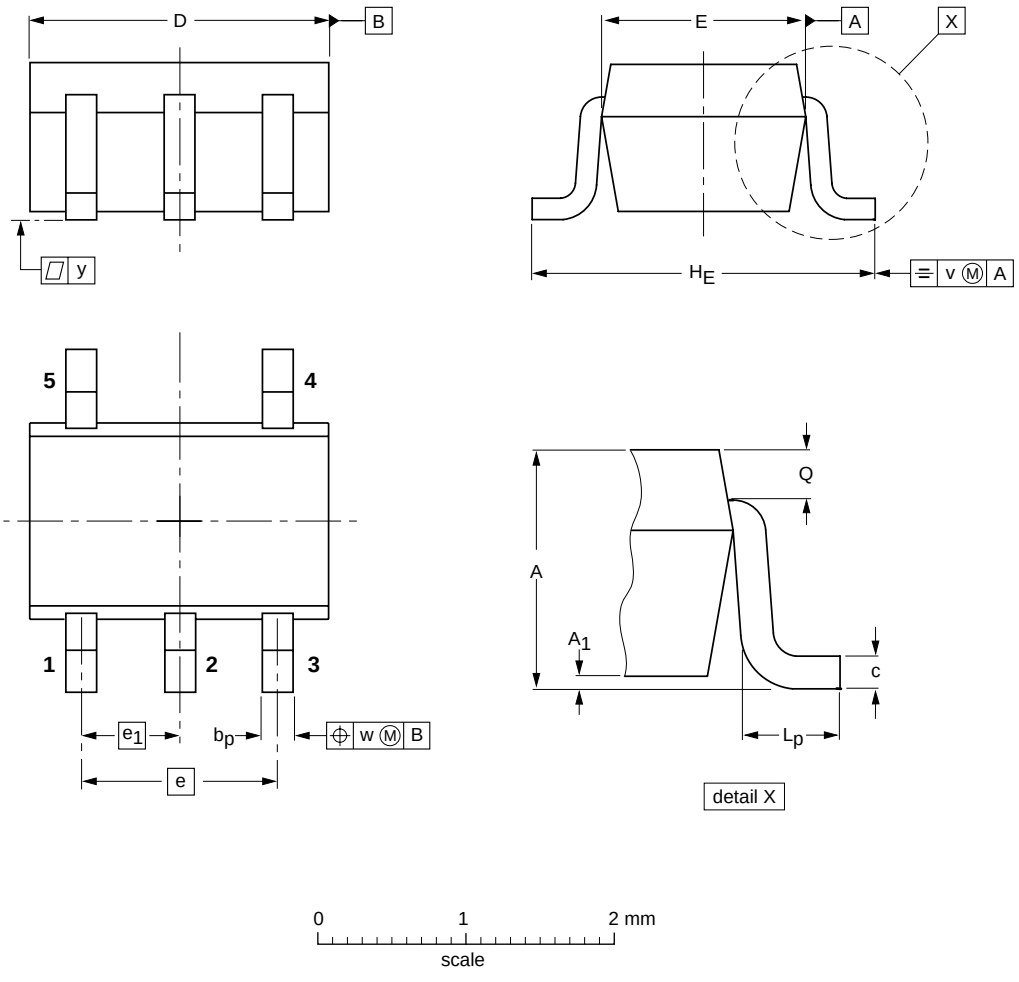
C_L = load capacitance including jig and probe capacitance (see Chapter “AC characteristics”).

R_T = termination resistance should be equal to the output impedance Z_0 of the pulse generator.

Fig.6 Load circuitry for switching times.

PACKAGE OUTLINES

Plastic surface mounted package; 5 leads **SOT353**

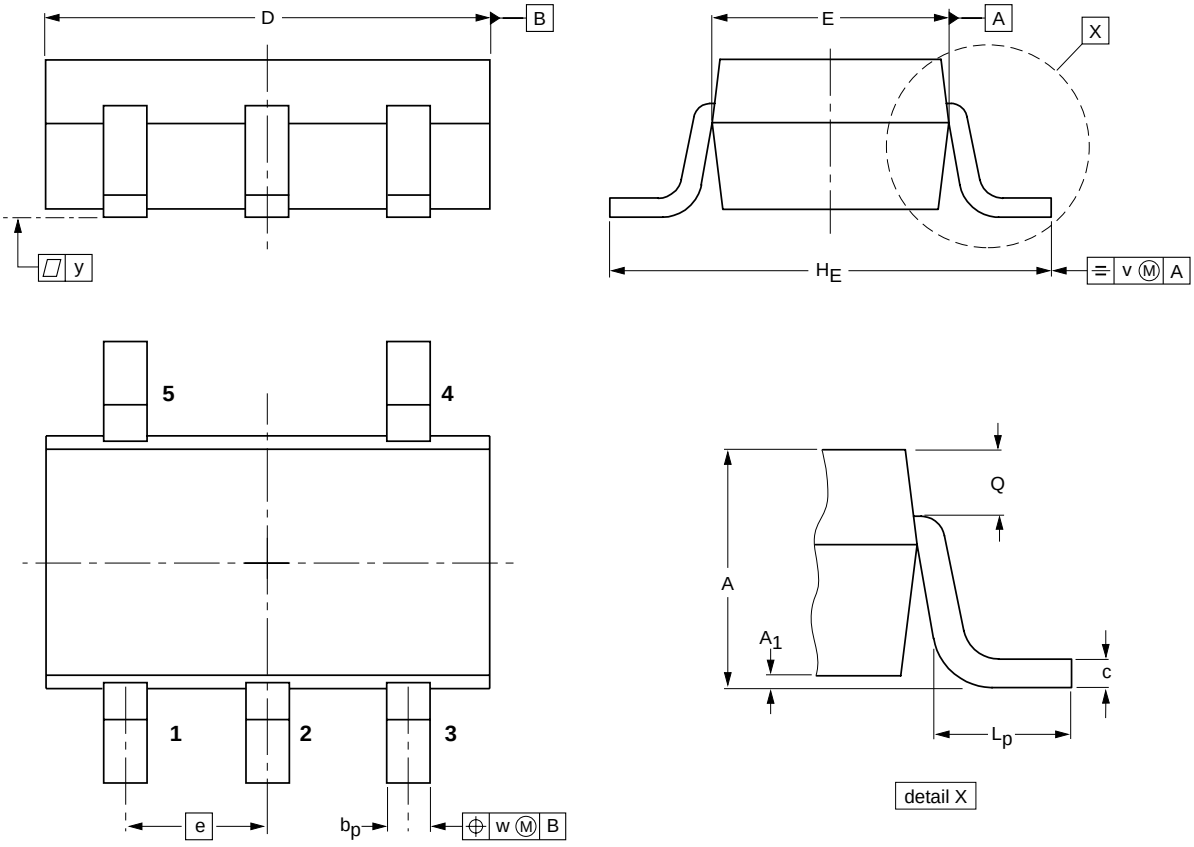


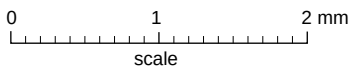
DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	c	D	E (2)	e	e_1	H_E	L_p	Q	v	w	y
mm	1.1 0.8	0.1	0.30 0.20	0.25 0.10	2.2 1.8	1.35 1.15	1.3	0.65	2.2 2.0	0.45 0.15	0.25 0.15	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT353			SC-88A			97-02-28

Plastic surface mounted package; 5 leads **SOT753**





DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	c	D	E	e	H_E	L_p	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

DATA SHEET STATUS

LEVEL	DATA SHEET STATUS(1)	PRODUCT STATUS(2)(3)	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.
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3. For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

DEFINITIONS

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Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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Printed in The Netherlands R44/06/pp16 Date of release: 2003 Sep 04 Document order number: 9397 750 11919

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