

DATA SHEET

74HC3G04; 74HCT3G04

Inverter

Product specification
Supersedes data of 2002 Jul 26

2003 Oct 30

Inverter

74HC3G04; 74HCT3G04

FEATURES

- Wide supply voltage range from 2.0 to 6.0 V
- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- Very small 8 pins package
- Output capability: standard
- ESD protection:
HBM EIA/JESD22-A114-A exceeds 2000 V
MM EIA/JESD22-A115-A exceeds 200 V.

DESCRIPTION

The 74HC3G/HCT3G04 is a high-speed Si-gate CMOS device and is pin compatible with low power Schottky TTL (LSTTL). Specified in compliance with JEDEC standard no. 7.

The 74HC3G/HCT3G04 provides three inverting buffers.

QUICK REFERENCE DATA

GND = 0 V; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_r = t_f \leq 6.0\text{ ns}$.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC3G04	HCT3G04	
t_{PHL}/t_{PLH}	propagation delay nA to nY	$C_L = 50\text{ pF}$; $V_{CC} = 4.5\text{ V}$	8	10	ns
C_I	input capacitance		1.5	1.5	pF
C_{PD}	power dissipation capacitance per buffer	notes 1 and 2	9	9	pF

Notes

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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

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 switching outputs;

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

2. For HC3G04 the condition is $V_I = \text{GND to } V_{CC}$.

For HCT3G04 the condition is $V_I = \text{GND to } V_{CC} - 1.5\text{ V}$.

FUNCTION TABLE

See note 1.

INPUT	OUTPUT
nA	nY
L	H
H	L

Note

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

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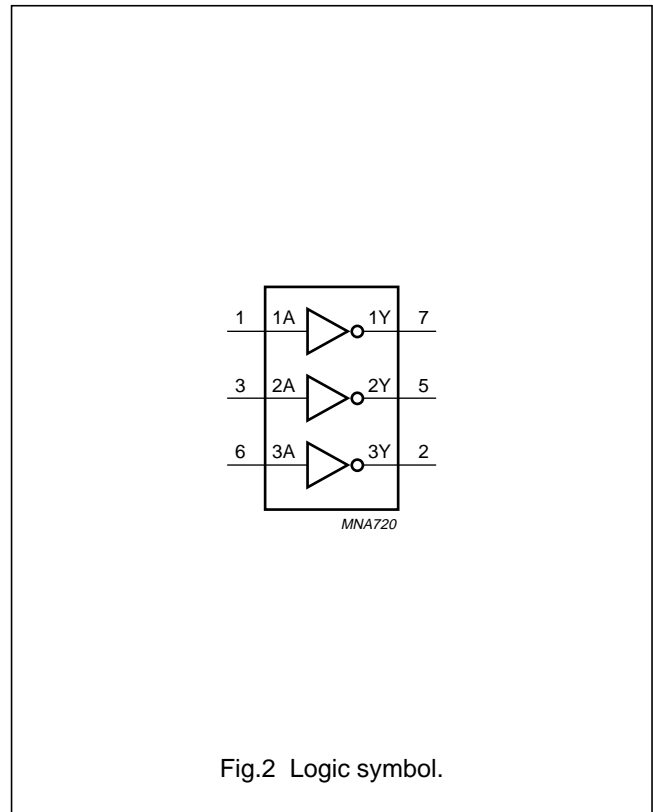
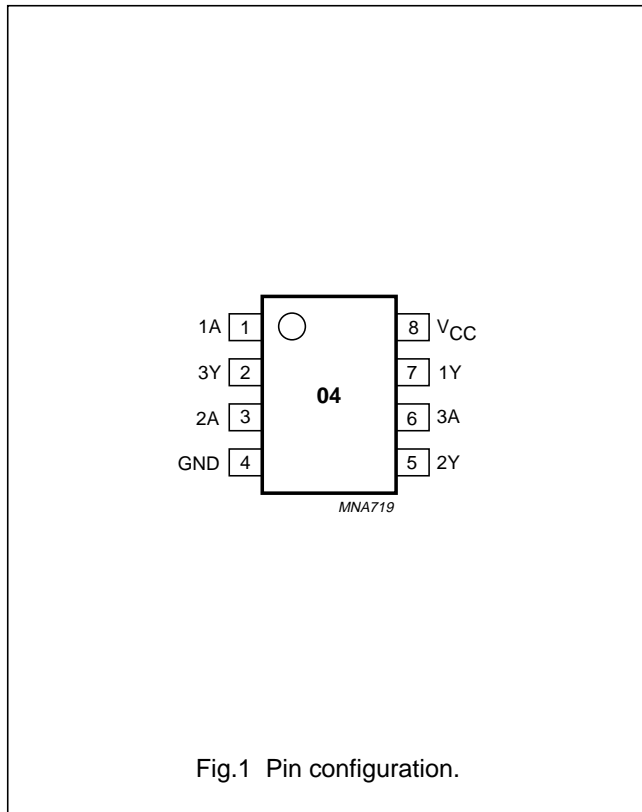
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ORDERING INFORMATION

TYPE NUMBER	PACKAGE					
	TEMPERATURE RANGE	PINS	PACKAGE	MATERIAL	CODE	MARKING
74HC3G04DP	-40 to +125 °C	8	TSSOP8	plastic	SOT505-2	H04
74HCT3G04DP	-40 to +125 °C	8	TSSOP8	plastic	SOT505-2	T04
74HC3G04DC	-40 to +125 °C	8	VSSOP8	plastic	SOT765-2	H04
74HCT3G04DC	-40 to +125 °C	8	VSSOP8	plastic	SOT765-2	T04

PINNING

PIN	SYMBOL	DESCRIPTION
1	1A	data input 1A
2	3Y	data output 3Y
3	2A	data input 2A
4	GND	ground (0 V)
5	2Y	data output 2Y
6	3A	data input 3A
7	1Y	data output 1Y
8	V _{CC}	supply voltage



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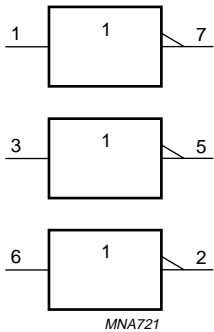


Fig.3 IEC logic symbol.

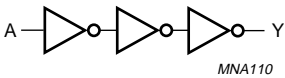


Fig.4 Logic diagram (one driver).

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RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	74HC3G04			74HCT3G04			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}	operating ambient temperature	see DC and AC characteristics per device	–40	+25	+125	–40	+25	+125	°C
t_r, t_f	input rise and fall times	$V_{CC} = 2.0$ V	–	–	1000	–	–	–	ns
		$V_{CC} = 4.5$ V	–	6.0	500	–	6.0	500	ns
		$V_{CC} = 6.0$ V	–	–	400	–	–	–	ns

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 diode current	$V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V; note 1	–	±20	mA
I_{OK}	output diode current	$V_O < -0.5$ V 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; note 1	–	25	mA
I_{CC}	V_{CC} or GND current	note 1	–	50	mA
T_{stg}	storage temperature		–65	+150	°C
P_D	power dissipation	$T_{amb} = -40$ to $+125$ °C; note 2	–	300	mW

Notes

1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. Above 110 °C the value of P_D derates linearly with 8 mW/K.

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DC CHARACTERISTICS

Type 74HC3G04

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	1.2	–	V
			4.5	3.15	2.4	–	V
			6.0	4.2	3.2	–	V
V _{IL}	LOW-level input voltage		2.0	–	0.8	0.5	V
			4.5	–	2.1	1.35	V
			6.0	–	2.8	1.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL} I _O = –20 µA	2.0	1.9	2.0	–	V
		I _O = –20 µA	4.5	4.4	4.5	–	V
		I _O = –20 µA	6.0	5.9	6.0	–	V
		I _O = –4.0 mA	4.5	4.18	4.32	–	V
		I _O = –5.2 mA	6.0	5.68	5.81	–	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL} I _O = 20 µA	2.0	–	0	0.1	V
		I _O = 20 µA	4.5	–	0	0.1	V
		I _O = 20 µA	6.0	–	0	0.1	V
		I _O = 4.0 mA	4.5	–	0.15	0.26	V
		I _O = 5.2 mA	6.0	–	0.16	0.26	V
I _{LI}	input leakage current	V _I = V _{CC} or GND	6.0	–	–	±0.1	µA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0	6.0	–	–	1.0	µA

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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
			4.5	3.15	-	-	V
			6.0	4.2	-	-	V
V _{IL}	LOW-level input voltage		2.0	-	-	0.5	V
			4.5	-	-	1.35	V
			6.0	-	-	1.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL} I _O = -20 μA	2.0	1.9	-	-	V
		I _O = -20 μA	4.5	4.4	-	-	V
		I _O = -20 μA	6.0	5.9	-	-	V
		I _O = -4.0 mA	4.5	4.13	-	-	V
		I _O = -5.2 mA	6.0	5.63	-	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL} I _O = 20 μA	2.0	-	-	0.1	V
		I _O = 20 μA	4.5	-	-	0.1	V
		I _O = 20 μA	6.0	-	-	0.1	V
		I _O = 4.0 mA	4.5	-	-	0.33	V
		I _O = 5.2 mA	6.0	-	-	0.33	V
I _{LI}	input leakage current	V _I = V _{CC} or GND	6.0	-	-	±1.0	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0	6.0	-	-	10	μA

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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
			4.5	3.15	–	–	V
			6.0	4.2	–	–	V
V _{IL}	LOW-level input voltage		2.0	–	–	0.5	V
			4.5	–	–	1.35	V
			6.0	–	–	1.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL} I _O = -20 μA	2.0	1.9	–	–	V
		I _O = -20 μA	4.5	4.4	–	–	V
		I _O = -20 μA	6.0	5.9	–	–	V
		I _O = -4.0 mA	4.5	3.7	–	–	V
		I _O = -5.2 mA	6.0	5.2	–	–	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL} I _O = 20 μA	2.0	–	–	0.1	V
		I _O = 20 μA	4.5	–	–	0.1	V
		I _O = 20 μA	6.0	–	–	0.1	V
		I _O = 4.0 mA	4.5	–	–	0.4	V
		I _O = 5.2 mA	6.0	–	–	0.4	V
I _{LI}	input leakage current	V _I = V _{CC} or GND	6.0	–	–	±1.0	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; I _O = 0	6.0	–	–	20	μA

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Type 74HCT3G04

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	1.6	–	V
V _{IL}	LOW-level input voltage		4.5 to 5.5	–	1.2	0.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL} I _O = –20 µA	4.5	4.4	4.5	–	V
		I _O = –4.0 mA	4.5	4.18	4.32	–	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL} I _O = 20 µA	4.5	–	0	0.1	V
		I _O = 4.0 mA	4.5	–	0.15	0.26	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	–	–	1.0	µA
ΔI _{CC}	additional supply current per input	V _I = V _{CC} – 2.1 V; I _O = 0	4.5 to 5.5	–	–	300	µA
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 = –20 µA	4.5	4.4	–	–	V
		I _O = –4.0 mA	4.5	4.13	–	–	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL} I _O = 20 µA	4.5	–	–	0.1	V
		I _O = 4.0 mA	4.5	–	–	0.33	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
ΔI _{CC}	additional supply current per input	V _I = V _{CC} – 2.1 V; I _O = 0	4.5 to 5.5	–	–	375	µA

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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 = -20 µA	4.5	4.4	–	–	V
		I _O = -4.0 mA	4.5	3.7	–	–	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL} I _O = 20 µA	4.5	–	–	0.1	V
		I _O = 4.0 mA	4.5	–	–	0.4	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	–	–	20	µA
ΔI _{CC}	additional supply current per input	V _I = V _{CC} - 2.1 V; I _O = 0	4.5 to 5.5	–	–	410	µA

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AC CHARACTERISTICS

Type 74HC3G04

GND = 0 V; $t_r = t_f \leq 6.0$ ns; $C_L = 50$ pF.

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	V_{CC} (V)				
$T_{amb} = 25\text{ }^{\circ}\text{C}$							
t_{PHL}/t_{PLH}	propagation delay nA to nY	see Figs 5 and 6	2.0	–	22	75	ns
			4.5	–	8	15	ns
			6.0	–	6	13	ns
t_{THL}/t_{TLH}	output transition time	see Figs 5 and 6	2.0	–	18	75	ns
			4.5	–	6	15	ns
			6.0	–	5	13	ns
$T_{amb} = -40\text{ to }+85\text{ }^{\circ}\text{C}$							
t_{PHL}/t_{PLH}	propagation delay nA to nY	see Figs 5 and 6	2.0	–	–	90	ns
			4.5	–	–	18	ns
			6.0	–	–	16	ns
t_{THL}/t_{TLH}	output transition time	see Figs 5 and 6	2.0	–	–	95	ns
			4.5	–	–	19	ns
			6.0	–	–	16	ns
$T_{amb} = -40\text{ to }+125\text{ }^{\circ}\text{C}$							
t_{PHL}/t_{PLH}	propagation delay nA to nY	see Figs 5 and 6	2.0	–	–	110	ns
			4.5	–	–	22	ns
			6.0	–	–	20	ns
t_{THL}/t_{TLH}	output transition time	see Figs 5 and 6	2.0	–	–	125	ns
			4.5	–	–	25	ns
			6.0	–	–	20	ns

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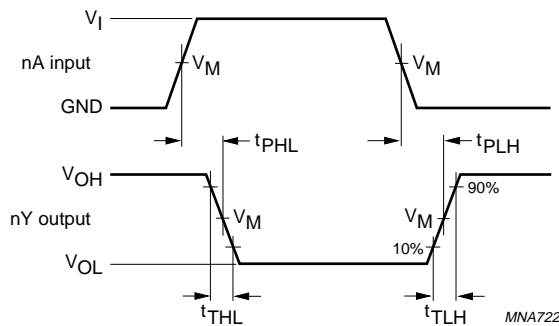
74HC3G04; 74HCT3G04

Type 74HCT3G04

GND = 0 V; $t_r = t_f \leq 6.0$ ns; $C_L = 50$ pF.

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	V_{CC} (V)				
$T_{amb} = 25\text{ }^\circ\text{C}$							
t_{PHL}/t_{PLH}	propagation delay nA to nY	see Figs 5 and 6	4.5	–	10	18	ns
t_{THL}/t_{TLH}	output transition time	see Figs 5 and 6	4.5	–	6	15	ns
$T_{amb} = -40\text{ to }+85\text{ }^\circ\text{C}$							
t_{PHL}/t_{PLH}	propagation delay nA to nY	see Figs 5 and 6	4.5	–	–	23	ns
t_{THL}/t_{TLH}	output transition time	see Figs 5 and 6	4.5	–	–	19	ns
$T_{amb} = -40\text{ to }+125\text{ }^\circ\text{C}$							
t_{PHL}/t_{PLH}	propagation delay nA to nY	see Figs 5 and 6	4.5	–	–	29	ns
t_{THL}/t_{TLH}	output transition time	see Figs 5 and 6	4.5	–	–	22	ns

AC WAVEFORMS

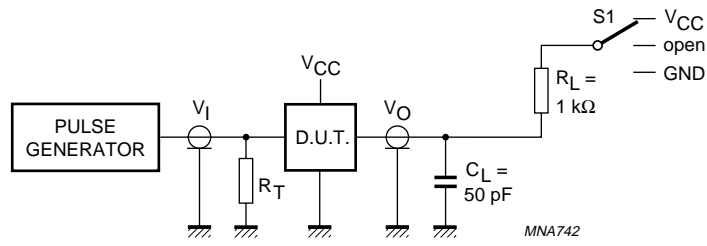


For HC3G: $V_M = 50\%$; $V_I = \text{GND to } V_{CC}$.
 For HCT3G: $V_M = 1.3\text{ V}$; $V_I = \text{GND to } 3.0\text{ V}$.

Fig.5 The input (nA) to output (nY) propagation delays and the output transition times.

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TEST	S ₁
t _{PLH} /t _{PHL}	open
t _{PLZ} /t _{PZL}	V _{CC}
t _{PHZ} /t _{PZH}	GND

Definitions for test circuit:

C_L = load capacitance including jig and probe capacitance.

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

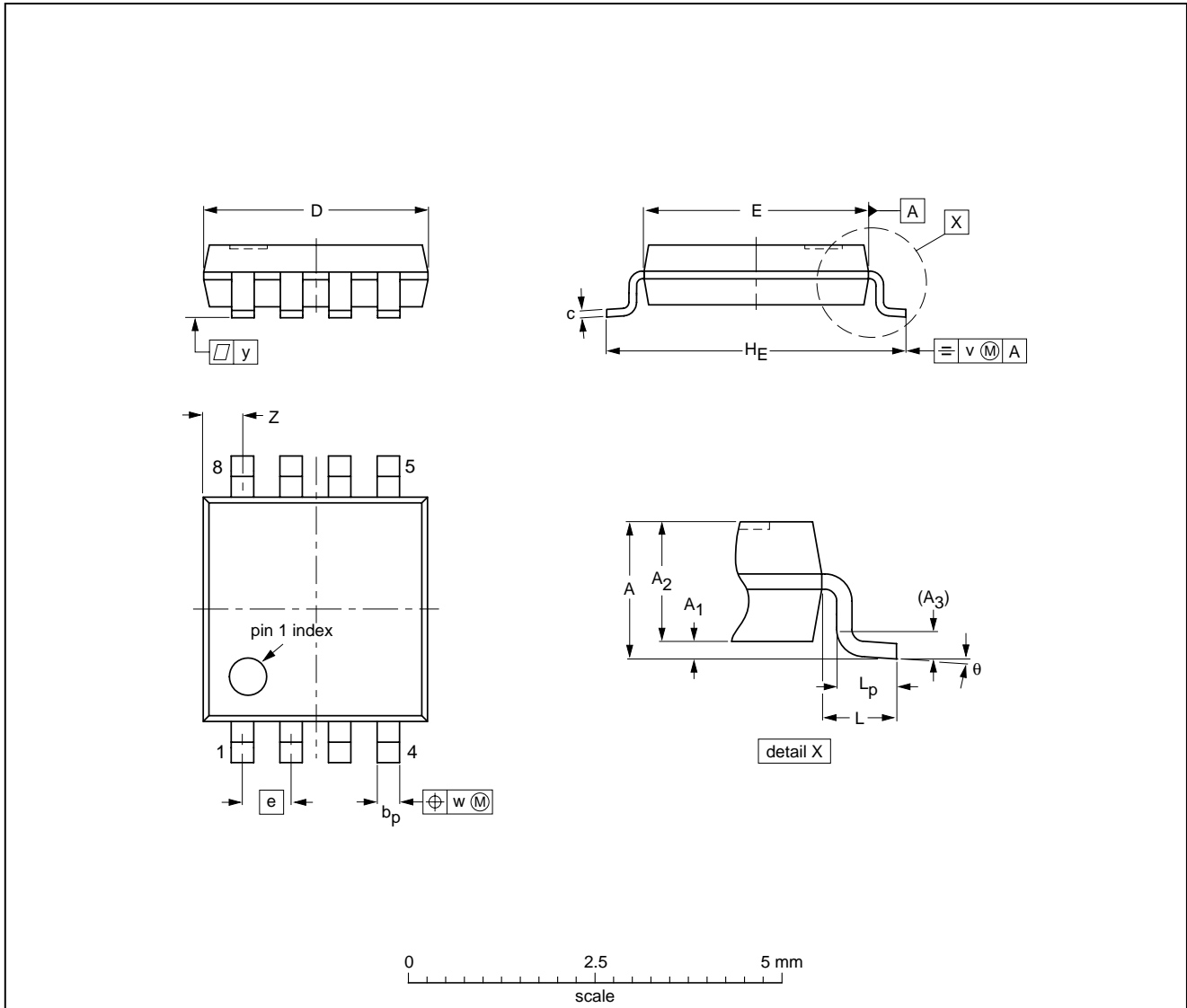
Fig.6 Load circuitry for switching times.

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PACKAGE OUTLINES

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



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _E	L	L _p	v	w	y	Z ⁽¹⁾	θ
mm	1.1	0.15 0.00	0.95 0.75	0.25	0.38 0.22	0.18 0.08	3.1 2.9	3.1 2.9	0.65	4.1 3.9	0.5	0.47 0.33	0.2	0.13	0.1	0.70 0.35	8° 0°

Note

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

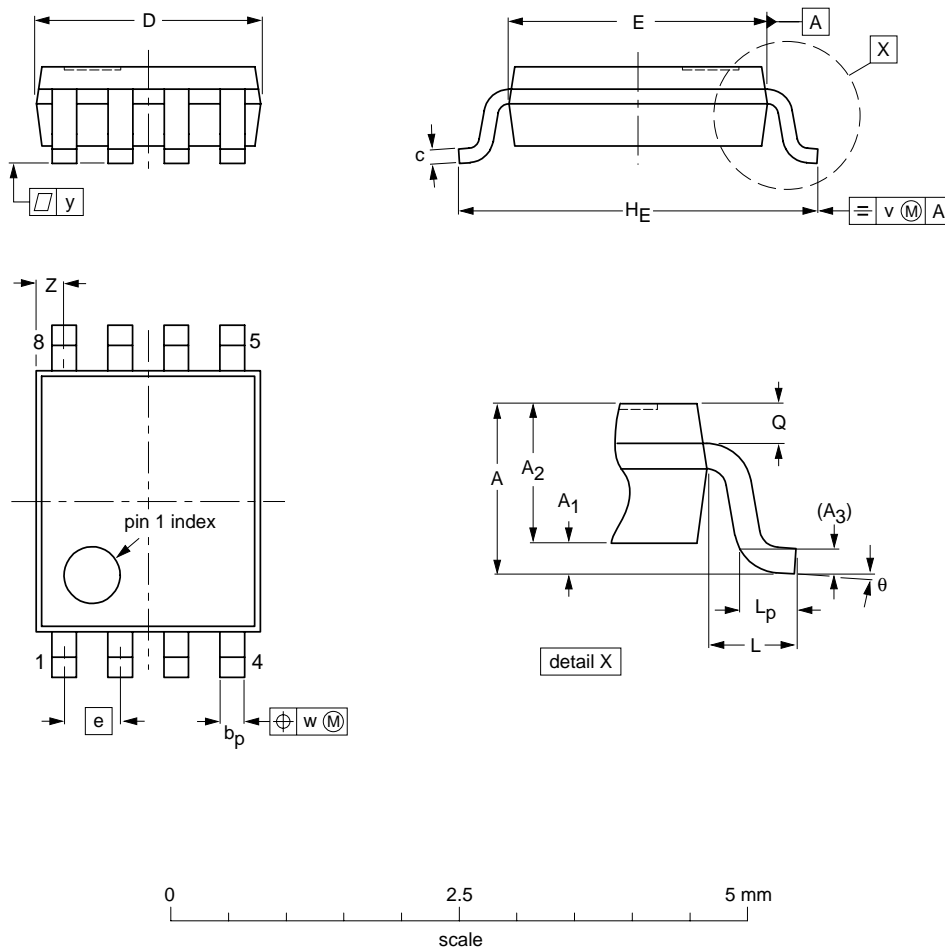
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT505-2		---				02-01-16

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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 max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽²⁾	e	H _E	L	L _p	Q	v	w	y	z ⁽¹⁾	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

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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.
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>.
3. For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

DEFINITIONS

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

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.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

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Printed in The Netherlands

613508/02/pp17

Date of release: 2003 Oct 30

Document order number: 9397 750 10568

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