

# DATA SHEET

## **74HC1G08; 74HCT1G08** 2-input AND gate

Product specification  
File under Integrated Circuits, IC06

1998 Nov 10

## 2-input AND gate

74HC1G08;  
74HCT1G08

## FEATURES

- Wide operating voltage:  
2.0 to 6.0 V
- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- Very small 5 pins package
- Output capability: standard.

## DESCRIPTION

The 74HC1G/HCT1G08 is a high-speed Si-gate CMOS device.

The 74HC1G/HCT1G08 provides the 2-input AND function. The standard output currents are  $\frac{1}{2}$  compared to the 74HC/HCT08.

## FUNCTION TABLE

See note 1.

| INPUTS |     | OUTPUT |
|--------|-----|--------|
| inA    | inB | outY   |
| L      | L   | L      |
| L      | H   | L      |
| H      | L   | L      |
| H      | H   | H      |

## Note

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

## 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                                      | TYP. |       | UNIT |
|-------------------|---------------------------------------|-------------------------------------------------|------|-------|------|
|                   |                                       |                                                 | HC1G | HCT1G |      |
| $t_{PHL}/t_{PLH}$ | propagation delay<br>inA, inB to outY | $C_L = 15\text{ pF}$ ;<br>$V_{CC} = 5\text{ V}$ | 7    | 11    | ns   |
| $C_I$             | input capacitance                     |                                                 | 1.5  | 1.5   | pF   |
| $C_{PD}$          | power dissipation<br>capacitance      | notes 1 and 2                                   | 19   | 21    | pF   |

## Notes

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

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

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

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

2. For HC1G the condition is  $V_I = \text{GND to } V_{CC}$ .

For HCT1G the condition is  $V_I = \text{GND to } V_{CC} - 1.5\text{ V}$ .

## PINNING

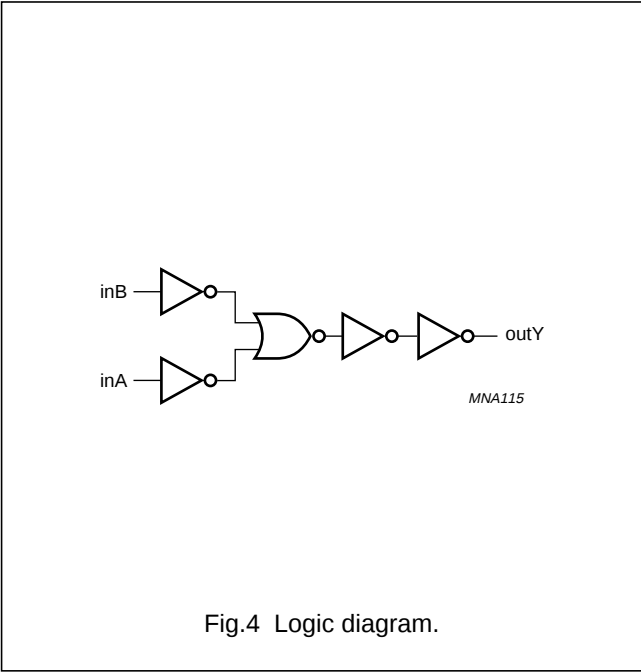
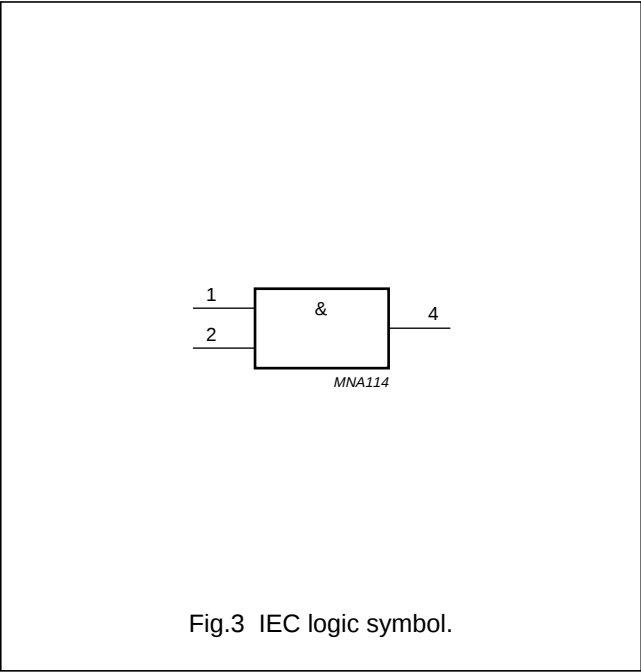
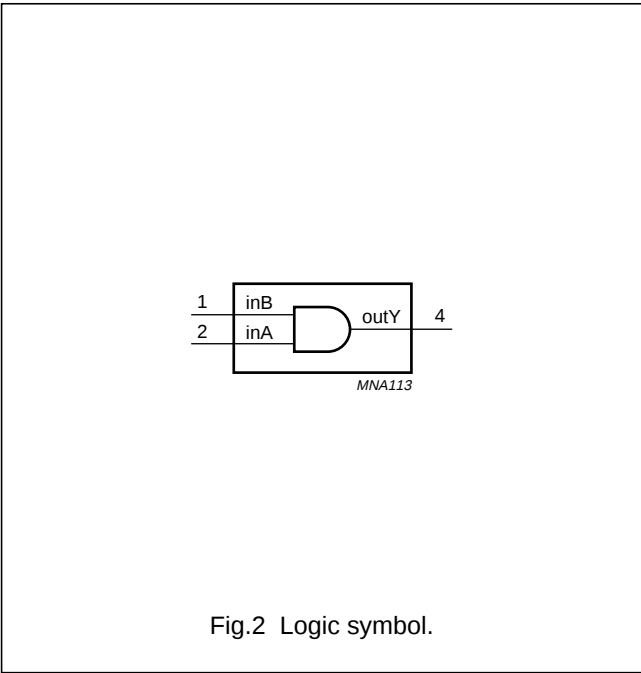
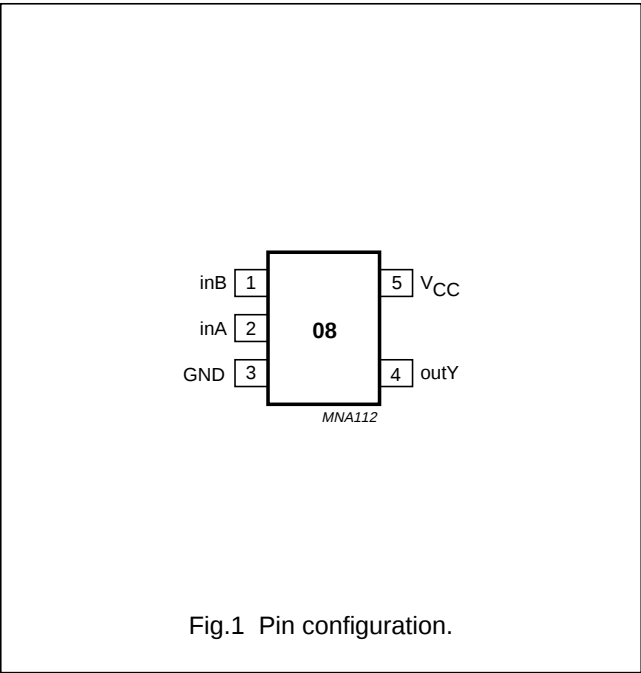
| PIN | SYMBOL   | DESCRIPTION       |
|-----|----------|-------------------|
| 1   | inB      | data input B      |
| 2   | inA      | data input A      |
| 3   | GND      | ground (0 V)      |
| 4   | outY     | data output       |
| 5   | $V_{CC}$ | DC supply voltage |

2-input AND gate

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ORDERING AND PACKAGE INFORMATION

| OUTSIDE NORTH AMERICA | PACKAGES          |      |         |          |        |         |
|-----------------------|-------------------|------|---------|----------|--------|---------|
|                       | TEMPERATURE RANGE | PINS | PACKAGE | MATERIAL | CODE   | MARKING |
| 74HC1G08GW            | −40 to +125 °C    | 5    | SC-88A  | plastic  | SOT353 | HE      |
| 74HCT1G08GW           |                   | 5    | SC-88A  | plastic  | SOT353 | TE      |



## 2-input AND gate

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## RECOMMENDED OPERATING CONDITIONS

| SYMBOL     | PARAMETER                                                   | 74HC1G04 |      |          | 74HCT1G04 |      |          | UNIT | CONDITIONS                               |
|------------|-------------------------------------------------------------|----------|------|----------|-----------|------|----------|------|------------------------------------------|
|            |                                                             | MIN.     | TYP. | MAX.     | MIN.      | TYP. | MAX.     |      |                                          |
| $V_{CC}$   | DC 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                               | –40      | +25  | +125     | –40       | +25  | +125     | °C   | see DC and AC characteristics per device |
| $t_r, t_f$ | input rise and fall times except for Schmitt trigger inputs | –        | –    | 1000     | –         | –    | –        | ns   | $V_{CC} = 2.0\text{ V}$                  |
|            |                                                             | –        | –    | 500      | –         | –    | 500      | ns   | $V_{CC} = 4.5\text{ V}$                  |
|            |                                                             | –        | –    | 400      | –         | –    | –        | ns   | $V_{CC} = 6.0\text{ V}$                  |

## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134); voltages are referenced to GND (ground = 0 V).

| SYMBOL       | PARAMETER                                                  | CONDITIONS                                                      | MIN. | MAX. | UNIT |
|--------------|------------------------------------------------------------|-----------------------------------------------------------------|------|------|------|
| $V_{CC}$     | DC supply voltage                                          |                                                                 | –0.5 | +7.0 | V    |
| $\pm I_{IK}$ | DC input diode current                                     | $V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ ; note 1 | –    | 20   | mA   |
| $\pm I_{OK}$ | DC output diode current                                    | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ ; note 1 | –    | 20   | mA   |
| $\pm I_O$    | DC output source or sink current standard outputs          | $-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$ ; note 1          | –    | 12.5 | mA   |
| $\pm I_{CC}$ | DC $V_{CC}$ or GND current for types with standard outputs | note 1                                                          | –    | 25   | mA   |
| $T_{stg}$    | storage temperature                                        |                                                                 | –65  | +150 | °C   |
| $P_D$        | power dissipation per package                              | temperature range: –40 to +125 °C; note 2                       | –    | 200  | mW   |

## Notes

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  $P_D$  derates linearly with 2.5 mW/K.

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74HCT1G08

## DC CHARACTERISTICS

## Family 74HC1G

Additional type data to the recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| SYMBOL          | PARAMETER                                   | T <sub>amb</sub> (°C) |                     |      |             |      | UNIT | TEST CONDITIONS     |                                                                                   |
|-----------------|---------------------------------------------|-----------------------|---------------------|------|-------------|------|------|---------------------|-----------------------------------------------------------------------------------|
|                 |                                             | −40 to +85            |                     |      | −40 to +125 |      |      | V <sub>CC</sub> (V) | OTHER                                                                             |
|                 |                                             | MIN.                  | TYP. <sup>(1)</sup> | MAX. | MIN.        | MAX. |      |                     |                                                                                   |
| V <sub>IH</sub> | HIGH-level input voltage                    | 1.5                   | 1.2                 | −    | 1.5         | −    | V    | 2.0                 |                                                                                   |
|                 |                                             | 3.15                  | 2.4                 | −    | 3.15        | −    |      | 4.5                 |                                                                                   |
|                 |                                             | 4.2                   | 3.2                 | −    | 4.2         | −    |      | 6.0                 |                                                                                   |
| V <sub>IL</sub> | LOW-level input voltage                     | −                     | 0.8                 | 0.5  | −           | 0.5  | V    | 2.0                 |                                                                                   |
|                 |                                             | −                     | 2.1                 | 1.35 | −           | 1.35 |      | 4.5                 |                                                                                   |
|                 |                                             | −                     | 2.8                 | 1.8  | −           | 1.8  |      | 6.0                 |                                                                                   |
| V <sub>OH</sub> | HIGH-level output voltage; all outputs      | 1.9                   | 2.0                 | −    | 1.9         | −    | V    | 2.0                 | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>−I <sub>O</sub> = 20 μA  |
|                 |                                             | 4.4                   | 4.5                 | −    | 4.4         | −    |      | 4.5                 |                                                                                   |
|                 |                                             | 5.9                   | 6.0                 | −    | 5.9         | −    |      | 6.0                 |                                                                                   |
| V <sub>OH</sub> | HIGH-level output voltage; standard outputs | 4.13                  | 4.32                | −    | 3.7         | −    | V    | 4.5                 | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>−I <sub>O</sub> = 2.0 mA |
|                 |                                             | 5.63                  | 5.81                | −    | 5.2         | −    |      | 6.0                 | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>−I <sub>O</sub> = 2.6 mA |
| V <sub>OL</sub> | LOW-level output voltage; all outputs       | −                     | 0                   | 0.1  | −           | 0.1  | V    | 2.0                 | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>I <sub>O</sub> = 20 μA   |
|                 |                                             | −                     | 0                   | 0.1  | −           | 0.1  |      | 4.5                 |                                                                                   |
|                 |                                             | −                     | 0                   | 0.1  | −           | 0.1  |      | 6.0                 |                                                                                   |
| V <sub>OL</sub> | LOW-level output voltage; standard outputs  | −                     | 0.15                | 0.33 | −           | 0.4  | V    | 4.5                 | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>I <sub>O</sub> = 2.0 mA  |
|                 |                                             | −                     | 0.16                | 0.33 | −           | 0.4  |      | 6.0                 | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>I <sub>O</sub> = 2.6 mA  |
| I <sub>I</sub>  | input leakage current                       | −                     | −                   | 1.0  | −           | 1.0  | μA   | 6.0                 | V <sub>I</sub> = V <sub>CC</sub> or GND                                           |
| I <sub>CC</sub> | quiescent supply current                    | −                     | −                   | 10   | −           | 20   | μA   | 6.0                 | V <sub>I</sub> = V <sub>CC</sub> or GND;<br>I <sub>O</sub> = 0                    |

## Note

1. All typical values are measured at T<sub>amb</sub> = 25 °C.

## 2-input AND gate

74HC1G08;  
74HCT1G08**Family 74HCT1G**

Additional type data to the recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| SYMBOL           | PARAMETER                                   | T <sub>amb</sub> (°C) |                     |      |             |      | UNIT | TEST CONDITIONS     |                                                                                   |
|------------------|---------------------------------------------|-----------------------|---------------------|------|-------------|------|------|---------------------|-----------------------------------------------------------------------------------|
|                  |                                             | –40 to +85            |                     |      | –40 to +125 |      |      | V <sub>CC</sub> (V) | OTHER                                                                             |
|                  |                                             | MIN.                  | TYP. <sup>(1)</sup> | MAX. | MIN.        | MAX. |      |                     |                                                                                   |
| V <sub>IH</sub>  | HIGH-level input voltage                    | 2.0                   | 1.6                 | –    | 2.0         | –    | V    | 4.5 to 5.5          |                                                                                   |
| V <sub>IL</sub>  | LOW-level input voltage                     | –                     | 1.2                 | 0.8  | –           | 0.8  | V    | 4.5 to 5.5          |                                                                                   |
| V <sub>OH</sub>  | HIGH-level output voltage; all outputs      | 4.4                   | 4.5                 | –    | 4.4         | –    | V    | 4.5                 | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>–I <sub>O</sub> = 20 μA  |
| V <sub>OH</sub>  | HIGH-level output voltage; standard outputs | 4.13                  | 4.32                | –    | 3.7         | –    | V    | 4.5                 | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>–I <sub>O</sub> = 2.0 mA |
| V <sub>OL</sub>  | LOW-level output voltage; all outputs       | –                     | 0                   | 0.1  | –           | 0.1  | V    | 4.5                 | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>I <sub>O</sub> = 20 μA   |
| V <sub>OL</sub>  | LOW-level output voltage; standard outputs  | –                     | 0.15                | 0.33 | –           | 0.4  | V    | 4.5                 | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>I <sub>O</sub> = 2.0 mA  |
| I <sub>I</sub>   | input leakage current                       | –                     | –                   | 1.0  | –           | 1.0  | μA   | 5.5                 | V <sub>I</sub> = V <sub>CC</sub> or GND                                           |
| I <sub>CC</sub>  | quiescent supply current                    | –                     | –                   | 10.0 | –           | 20   | μA   | 5.5                 | V <sub>I</sub> = V <sub>CC</sub> or GND;<br>I <sub>O</sub> = 0                    |
| ΔI <sub>CC</sub> | additional supply current per input         | –                     | –                   | 500  | –           | 850  | μA   | 4.5 to 5.5          | V <sub>I</sub> = V <sub>CC</sub> – 2.1;<br>I <sub>O</sub> = 0                     |

**Note**

1. All typical values are measured at T<sub>amb</sub> = 25 °C.

## 2-input AND gate

74HC1G08;  
74HCT1G08

## AC CHARACTERISTICS

## Type 74HC1G08

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

| SYMBOL                             | PARAMETER                             | T <sub>amb</sub> (°C) |                     |      |             |      | UNIT | TEST CONDITIONS     |                  |
|------------------------------------|---------------------------------------|-----------------------|---------------------|------|-------------|------|------|---------------------|------------------|
|                                    |                                       | −40 to +85            |                     |      | −40 to +125 |      |      | V <sub>CC</sub> (V) | WAVEFORMS        |
|                                    |                                       | MIN.                  | TYP. <sup>(1)</sup> | MAX. | MIN.        | MAX. |      |                     |                  |
| t <sub>PHL</sub> /t <sub>PLH</sub> | propagation delay<br>inA, inB to outY | −                     | 25                  | 115  | −           | 135  | ns   | 2.0                 | see Figs 5 and 6 |
|                                    |                                       | −                     | 9                   | 23   | −           | 27   | ns   | 4.5                 |                  |
|                                    |                                       | −                     | 8                   | 20   | −           | 23   | ns   | 6.0                 |                  |

## Note

1. All typical values are measured at  $T_{amb} = 25$  °C.

## Type 74HCT1G08

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

| SYMBOL                             | PARAMETER                             | T <sub>amb</sub> (°C) |                     |      |             |      | UNIT | TEST CONDITIONS     |                  |
|------------------------------------|---------------------------------------|-----------------------|---------------------|------|-------------|------|------|---------------------|------------------|
|                                    |                                       | –40 to +85            |                     |      | –40 to +125 |      |      | V <sub>CC</sub> (V) | WAVEFORMS        |
|                                    |                                       | MIN.                  | TYP. <sup>(1)</sup> | MAX. | MIN.        | MAX. |      |                     |                  |
| t <sub>PHL</sub> /t <sub>PLH</sub> | propagation delay<br>inA, inB to outY | –                     | 11                  | 23   | –           | 27   | ns   | 4.5                 | see Figs 5 and 6 |

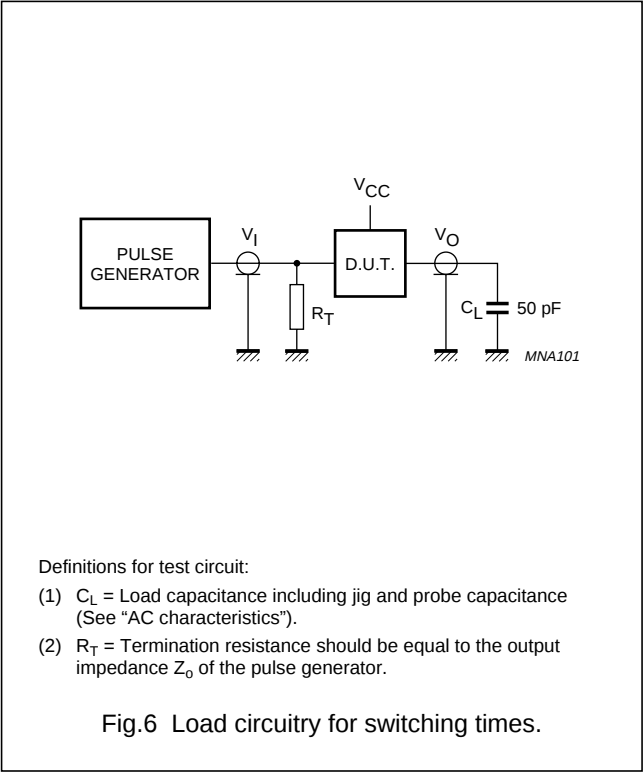
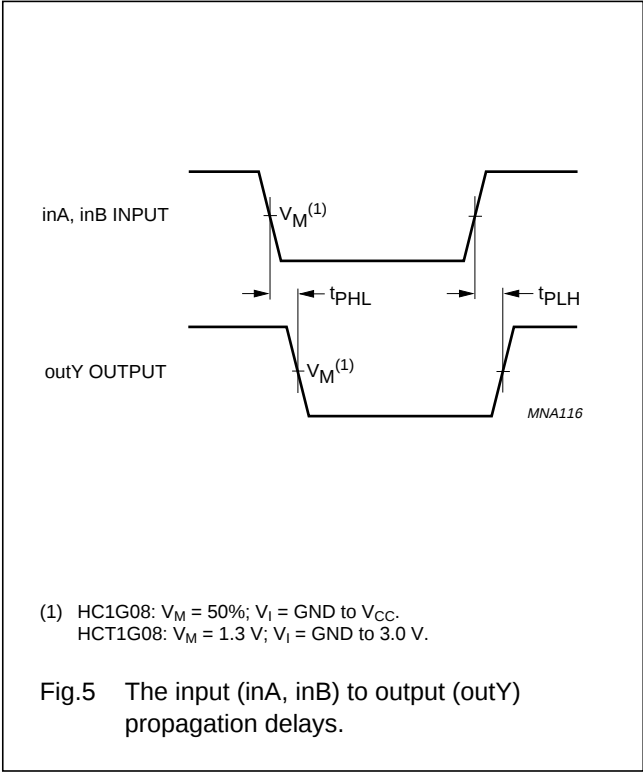
## Note

1. All typical values are measured at  $T_{amb} = 25$  °C.

2-input AND gate

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AC WAVEFORMS



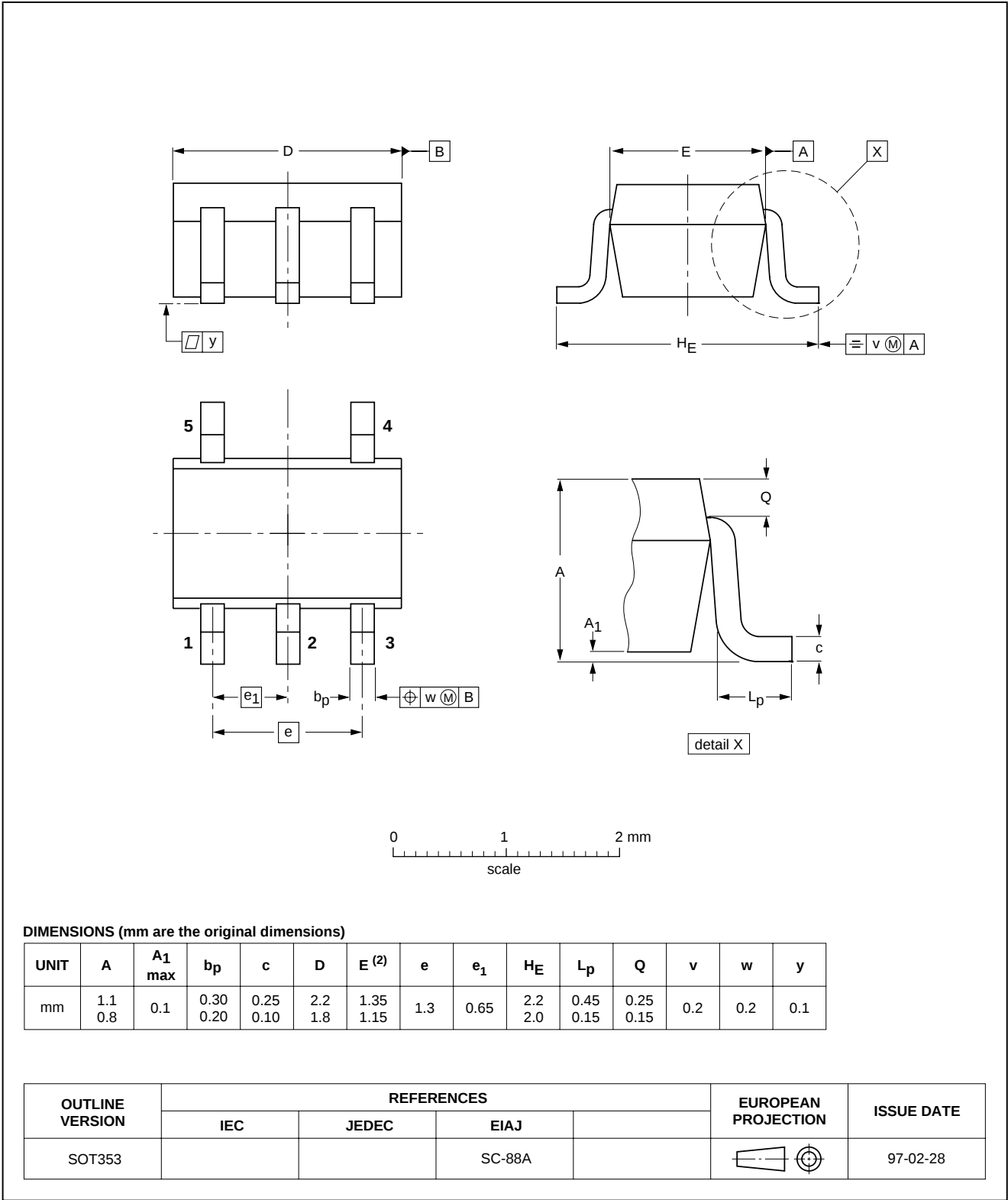
2-input AND gate

74HC1G08;  
74HCT1G08

PACKAGE OUTLINE

Plastic surface mounted package; 5 leads

SOT353



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2-input AND gate

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74HC1G08;  
74HCT1G08

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**SOLDERING****Introduction**

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted IC's, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering IC's can be found in our *"Data Handbook IC26; Integrated Circuit Packages"* (order code 9398 652 90011).

**Reflow soldering**

Reflow soldering techniques are suitable for all SO packages.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

**Wave soldering**

Wave soldering techniques can be used for all SO packages if the following conditions are observed:

- A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.
- The longitudinal axis of the package footprint must be parallel to the solder flow.
- The package footprint must incorporate solder thieves at the downstream end.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

**Repairing soldered joints**

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

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**DEFINITIONS**

| <b>Data sheet status</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Objective specification                                                                                                                                                                                                                                                                                                                                                                                                                                   | This data sheet contains target or goal specifications for product development.       |
| Preliminary specification                                                                                                                                                                                                                                                                                                                                                                                                                                 | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification                                                                                                                                                                                                                                                                                                                                                                                                                                     | This data sheet contains final product specifications.                                |
| <b>Limiting values</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                       |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). 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. |                                                                                       |
| <b>Application information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                       |
| Where application information is given, it is advisory and does not form part of the specification.                                                                                                                                                                                                                                                                                                                                                       |                                                                                       |

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# Philips Semiconductors – a worldwide company

**Argentina:** see South America

**Australia:** 34 Waterloo Road, NORTH RYDE, NSW 2113,  
Tel. +61 2 9805 4455, Fax. +61 2 9805 4466

**Austria:** Computerstr. 6, A-1101 WIEN, P.O. Box 213, Tel. +43 160 1010,  
Fax. +43 160 101 1210

**Belarus:** Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6,  
220050 MINSK, Tel. +375 172 200 733, Fax. +375 172 200 773

**Belgium:** see The Netherlands

**Brazil:** see South America

**Bulgaria:** Philips Bulgaria Ltd., Energoproject, 15th floor,  
51 James Bourchier Blvd., 1407 SOFIA,  
Tel. +359 2 689 211, Fax. +359 2 689 102

**Canada:** PHILIPS SEMICONDUCTORS/COMPONENTS,  
Tel. +1 800 234 7381

**China/Hong Kong:** 501 Hong Kong Industrial Technology Centre,  
72 Tat Chee Avenue, Kowloon Tong, HONG KONG,  
Tel. +852 2319 7888, Fax. +852 2319 7700

**Colombia:** see South America

**Czech Republic:** see Austria

**Denmark:** Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S,  
Tel. +45 32 88 2636, Fax. +45 31 57 0044

**Finland:** Sinikalliontie 3, FIN-02630 ESPOO,  
Tel. +358 9 615800, Fax. +358 9 61580920

**France:** 51 Rue Carnot, BP317, 92156 SURESNES Cedex,  
Tel. +33 1 40 99 6161, Fax. +33 1 40 99 6427

**Germany:** Hammerbrookstraße 69, D-20097 HAMBURG,  
Tel. +49 40 23 53 60, Fax. +49 40 23 536 300

**Greece:** No. 15, 25th March Street, GR 17778 TAVROS/ATHENS,  
Tel. +30 1 4894 339/239, Fax. +30 1 4814 240

**Hungary:** see Austria

**India:** Philips INDIA Ltd, Band Box Building, 2nd floor,  
254-D, Dr. Annie Besant Road, Worli, MUMBAI 400 025,  
Tel. +91 22 493 8541, Fax. +91 22 493 0966

**Indonesia:** PT Philips Development Corporation, Semiconductors Division,  
Gedung Philips, Jl. Buncit Raya Kav.99-100, JAKARTA 12510,  
Tel. +62 21 794 0040 ext. 2501, Fax. +62 21 794 0080

**Ireland:** Newstead, Clonskeagh, DUBLIN 14,  
Tel. +353 1 7640 000, Fax. +353 1 7640 200

**Israel:** RAPAC Electronics, 7 Kehilat Saloniki St, PO Box 18053,  
TEL AVIV 61180, Tel. +972 3 645 0444, Fax. +972 3 649 1007

**Italy:** PHILIPS SEMICONDUCTORS, Piazza IV Novembre 3,  
20124 MILANO, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

**Japan:** Philips Bldg 13-37, Kohnan 2-chome, Minato-ku,  
TOKYO 108-8507, Tel. +81 3 3740 5130, Fax. +81 3 3740 5077

**Korea:** Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL,  
Tel. +82 2 709 1412, Fax. +82 2 709 1415

**Malaysia:** No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR,  
Tel. +60 3 750 5214, Fax. +60 3 757 4880

**Mexico:** 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905,  
Tel. +9-5 800 234 7381

**Middle East:** see Italy

**Netherlands:** Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB,  
Tel. +31 40 27 82785, Fax. +31 40 27 88399

**New Zealand:** 2 Wagener Place, C.P.O. Box 1041, AUCKLAND,  
Tel. +64 9 849 4160, Fax. +64 9 849 7811

**Norway:** Box 1, Manglerud 0612, OSLO,  
Tel. +47 22 74 8000, Fax. +47 22 74 8341

**Pakistan:** see Singapore

**Philippines:** Philips Semiconductors Philippines Inc.,  
106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI,  
Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

**Poland:** Ul. Lukiska 10, PL 04-123 WARSZAWA,  
Tel. +48 22 612 2831, Fax. +48 22 612 2327

**Portugal:** see Spain

**Romania:** see Italy

**Russia:** Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW,  
Tel. +7 095 755 6918, Fax. +7 095 755 6919

**Singapore:** Lorong 1, Toa Payoh, SINGAPORE 319762,  
Tel. +65 350 2538, Fax. +65 251 6500

**Slovakia:** see Austria

**Slovenia:** see Italy

**South Africa:** S.A. PHILIPS Pty Ltd., 195-215 Main Road Martindale,  
2092 JOHANNESBURG, P.O. Box 7430 Johannesburg 2000,  
Tel. +27 11 470 5911, Fax. +27 11 470 5494

**South America:** Al. Vicente Pinzon, 173, 6th floor,  
04547-130 SÃO PAULO, SP, Brazil,  
Tel. +55 11 821 2333, Fax. +55 11 821 2382

**Spain:** Balmes 22, 08007 BARCELONA,  
Tel. +34 93 301 6312, Fax. +34 93 301 4107

**Sweden:** Kottbygatan 7, Akalla, S-16485 STOCKHOLM,  
Tel. +46 8 5985 2000, Fax. +46 8 5985 2745

**Switzerland:** Allmendstrasse 140, CH-8027 ZÜRICH,  
Tel. +41 1 488 2741 Fax. +41 1 488 3263

**Taiwan:** Philips Semiconductors, 6F, No. 96, Chien Kuo N. Rd., Sec. 1,  
TAIPEI, Taiwan Tel. +886 2 2134 2865, Fax. +886 2 2134 2874

**Thailand:** PHILIPS ELECTRONICS (THAILAND) Ltd.,  
209/2 Sanpavuth-Bangna Road Prakanong, BANGKOK 10260,  
Tel. +66 2 745 4090, Fax. +66 2 398 0793

**Turkey:** Talatpasa Cad. No. 5, 80640 GÜLTEPE/ISTANBUL,  
Tel. +90 212 279 2770, Fax. +90 212 282 6707

**Ukraine:** PHILIPS UKRAINE, 4 Patrice Lumumba str., Building B, Floor 7,  
252042 KIEV, Tel. +380 44 264 2776, Fax. +380 44 268 0461

**United Kingdom:** Philips Semiconductors Ltd., 276 Bath Road, Hayes,  
MIDDLESEX UB3 5BX, Tel. +44 181 730 5000, Fax. +44 181 754 8421

**United States:** 811 East Arques Avenue, SUNNYVALE, CA 94088-3409,  
Tel. +1 800 234 7381

**Uruguay:** see South America

**Vietnam:** see Singapore

**Yugoslavia:** PHILIPS, Trg N. Pasica 5/v, 11000 BEOGRAD,  
Tel. +381 11 625 344, Fax. +381 11 635 777

**For all other countries apply to:** Philips Semiconductors,  
International Marketing & Sales Communications, Building BE-p, P.O. Box 218,  
5600 MD EINDHOVEN, The Netherlands, Fax. +31 40 27 24825

**Internet:** <http://www.semiconductors.philips.com>

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