

# DATA SHEET

## **74HC08; 74HCT08** Quad 2-input AND gate

Product specification  
Supersedes data of 1990 Dec 01

2003 Jul 25

## Quad 2-input AND gate

## 74HC08; 74HCT08

## FEATURES

- Complies with JEDEC standard no. 8-1A
- ESD protection:  
HBM EIA/JESD22-A114-A exceeds 2000 V  
MM EIA/JESD22-A115-A exceeds 200 V.
- Specified from  $-40$  to  $+85$  °C and  $-40$  to  $+125$  °C.

## DESCRIPTION

The 74HC/HCT08 are high-speed Si-gate CMOS devices and are pin compatible with low power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard no. 7A. The 74HC/HCT08 provide the 2-input AND function.

## QUICK REFERENCE DATA

GND = 0 V;  $T_{amb} = 25$  °C;  $t_r = t_f = 6$  ns.

| SYMBOL            | PARAMETER                              | CONDITIONS                    | TYPICAL |         | UNIT |
|-------------------|----------------------------------------|-------------------------------|---------|---------|------|
|                   |                                        |                               | 74HC08  | 74HCT08 |      |
| $t_{PHL}/t_{PLH}$ | propagation delay nA, nB to nY         | $C_L = 15$ pF; $V_{CC} = 5$ V | 7       | 11      | ns   |
| $C_I$             | input capacitance                      |                               | 3.5     | 3.5     | pF   |
| $C_{PD}$          | power dissipation capacitance per gate | notes 1 and 2                 | 10      | 20      | pF   |

## Notes

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

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

$f_i$  = 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;

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

- For 74HC08: the condition is  $V_i = \text{GND to } V_{CC}$ .

For 74HCT08: the condition is  $V_i = \text{GND to } V_{CC} - 1.5$  V.

## FUNCTION TABLE

| INPUT |    | OUTPUT |
|-------|----|--------|
| nA    | nB | nY     |
| L     | L  | L      |
| L     | H  | L      |
| H     | L  | L      |
| H     | H  | H      |

## Note

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

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## ORDERING INFORMATION

| TYPE NUMBER | PACKAGE           |      |          |          |          |
|-------------|-------------------|------|----------|----------|----------|
|             | TEMPERATURE RANGE | PINS | PACKAGE  | MATERIAL | CODE     |
| 74HC08N     | −40 to +125 °C    | 14   | DIP14    | plastic  | SOT27-1  |
| 74HCT08N    | −40 to +125 °C    | 14   | DIP14    | plastic  | SOT27-1  |
| 74HC08D     | −40 to +125 °C    | 14   | SO14     | plastic  | SOT108-1 |
| 74HCT08D    | −40 to +125 °C    | 14   | SO14     | plastic  | SOT108-1 |
| 74HC08DB    | −40 to +125 °C    | 14   | SSOP14   | plastic  | SOT337-1 |
| 74HCT08DB   | −40 to +125 °C    | 14   | SSOP14   | plastic  | SOT337-1 |
| 74HC08PW    | −40 to +125 °C    | 14   | TSSOP14  | plastic  | SOT402-1 |
| 74HCT08PW   | −40 to +125 °C    | 14   | TSSOP14  | plastic  | SOT402-1 |
| 74HC08BQ    | −40 to +125 °C    | 14   | DHVQFN14 | plastic  | SOT762-1 |
| 74HCT08BQ   | −40 to +125 °C    | 14   | DHVQFN14 | plastic  | SOT762-1 |

## PINNING

| PIN | SYMBOL          | DESCRIPTION    |
|-----|-----------------|----------------|
| 1   | 1A              | data input     |
| 2   | 1B              | data input     |
| 3   | 1Y              | data output    |
| 4   | 2A              | data input     |
| 5   | 2B              | data input     |
| 6   | 2Y              | data output    |
| 7   | GND             | ground (0 V)   |
| 8   | 3Y              | data output    |
| 9   | 3A              | data input     |
| 10  | 3B              | data input     |
| 11  | 4Y              | data output    |
| 12  | 4A              | data input     |
| 13  | 4B              | data input     |
| 14  | V <sub>CC</sub> | supply voltage |

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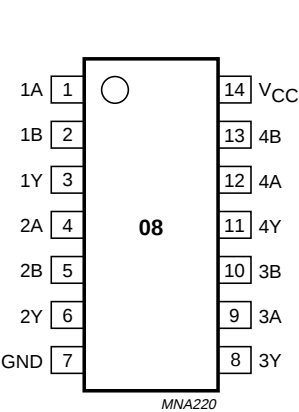
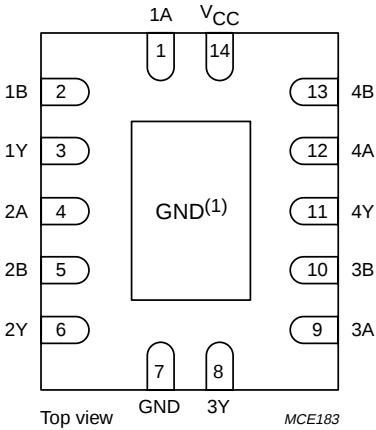


Fig.1 Pin configuration DIP14, SO14 and (T)SSOP14.



(1) The die substrate is attached to this pad using conductive die attach material. It can not be used as a supply pin or input.

Fig.2 Pin configuration DHVQFN14.

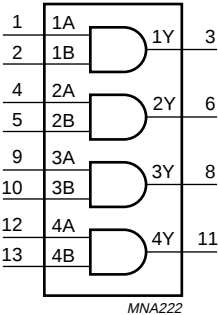


Fig.3 Logic symbol.

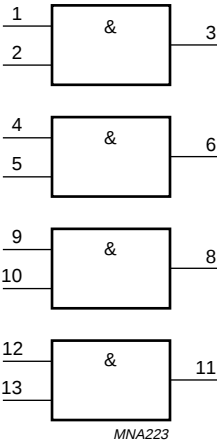
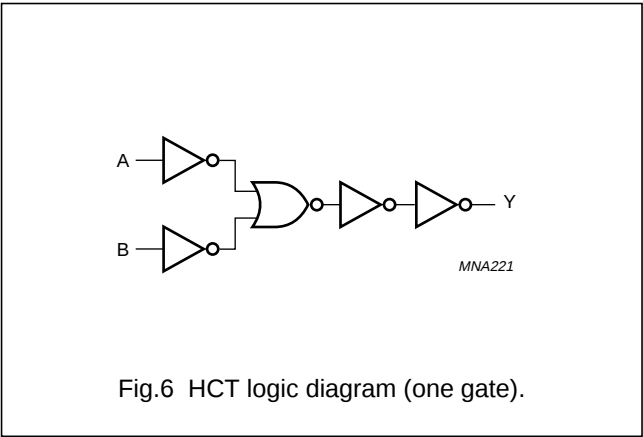
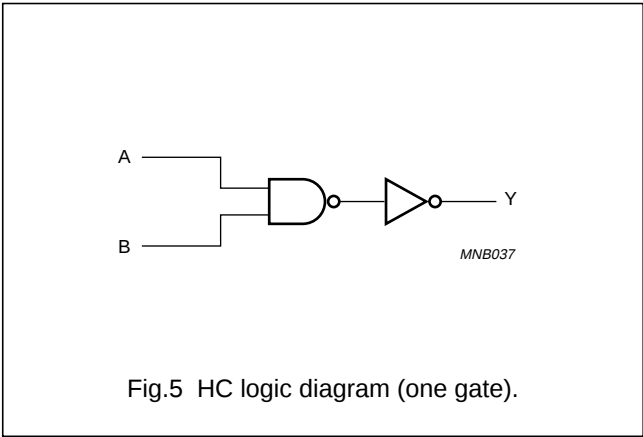


Fig.4 IEC logic symbol.

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RECOMMENDED OPERATING CONDITIONS

| SYMBOL                          | PARAMETER                 | CONDITIONS                               | 74HC08 |      |                 | 74HCT08 |      |                 | UNIT |
|---------------------------------|---------------------------|------------------------------------------|--------|------|-----------------|---------|------|-----------------|------|
|                                 |                           |                                          | MIN.   | TYP. | MAX.            | MIN.    | TYP. | MAX.            |      |
| V <sub>CC</sub>                 | supply voltage            |                                          | 2.0    | 5.0  | 6.0             | 4.5     | 5.0  | 5.5             | V    |
| V <sub>I</sub>                  | input voltage             |                                          | 0      | –    | V <sub>CC</sub> | 0       | –    | V <sub>CC</sub> | V    |
| V <sub>O</sub>                  | output voltage            |                                          | 0      | –    | V <sub>CC</sub> | 0       | –    | V <sub>CC</sub> | V    |
| T <sub>amb</sub>                | ambient temperature       | see DC and AC characteristics per device | –40    | +25  | +125            | –40     | +25  | +125            | °C   |
| t <sub>r</sub> , t <sub>f</sub> | input rise and fall times | V <sub>CC</sub> = 2.0 V                  | –      | –    | 1000            | –       | –    | –               | ns   |
|                                 |                           | V <sub>CC</sub> = 4.5 V                  | –      | 6.0  | 500             | –       | 6.0  | 500             | ns   |
|                                 |                           | V <sub>CC</sub> = 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 <sub>CC</sub>                    | supply voltage                  |                                                                                        | –0.5   | +7.0       | V        |
| I <sub>IK</sub>                    | input diode current             | V <sub>I</sub> < –0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V                    | –      | ±20        | mA       |
| I <sub>OK</sub>                    | output diode current            | V <sub>O</sub> < –0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V                    | –      | ±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  |                                                                                        | –      | ±50        | mA       |
| T <sub>stg</sub>                   | storage temperature             |                                                                                        | –65    | +150       | °C       |
| P <sub>tot</sub>                   | power dissipation               |                                                                                        |        |            |          |
|                                    | DIP14 package<br>other packages | T <sub>amb</sub> = –40 to +125 °C; note 1<br>T <sub>amb</sub> = –40 to +125 °C; note 2 | –<br>– | 750<br>500 | mW<br>mW |

Notes

1. For DIP14 packages: above 70 °C derate linearly with 12 mW/K.
2. For SO14 packages: above 70 °C derate linearly with 8 mW/K.  
For SSOP14 and TSSOP14 packages: above 60 °C derate linearly with 5.5 mW/K.  
For DHVQFN14 packages: above 60 °C derate linearly with 4.5 mW/K.

## Quad 2-input AND gate

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## DC CHARACTERISTICS

## Family 74HC08

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) |      |      |      |      |
| T <sub>amb</sub> = 25 °C |                           |                                                                                                  |                     |      |      |      |      |
| V <sub>IH</sub>          | 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 <sub>IL</sub>          | 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 <sub>OH</sub>          | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                              |                     |      |      |      |      |
|                          |                           | I <sub>O</sub> = –20 μA                                                                          | 2.0                 | 1.9  | 2.0  | –    | V    |
|                          |                           | I <sub>O</sub> = –20 μA                                                                          | 4.5                 | 4.4  | 4.5  | –    | V    |
|                          |                           | I <sub>O</sub> = –4.0 mA                                                                         | 4.5                 | 3.98 | 4.32 | –    | V    |
|                          |                           | I <sub>O</sub> = –20 μA                                                                          | 6.0                 | 5.9  | 6.0  | –    | V    |
| V <sub>OL</sub>          | LOW-level output voltage  | I <sub>O</sub> = –5.2 mA                                                                         | 6.0                 | 5.48 | 5.81 | –    | V    |
|                          |                           | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                              |                     |      |      |      |      |
|                          |                           | I <sub>O</sub> = 20 μA                                                                           | 2.0                 | –    | 0    | 0.1  | V    |
|                          |                           | I <sub>O</sub> = 20 μA                                                                           | 4.5                 | –    | 0    | 0.1  | V    |
|                          |                           | I <sub>O</sub> = 4.0 mA                                                                          | 4.5                 | –    | 0.15 | 0.26 | V    |
|                          |                           | I <sub>O</sub> = 20 μA                                                                           | 6.0                 | –    | 0    | 0.1  | V    |
| I <sub>CC</sub>          | quiescent supply current  | I <sub>O</sub> = 5.2 mA                                                                          | 6.0                 | –    | 0.16 | 0.26 | V    |
|                          |                           | V <sub>I</sub> = V <sub>CC</sub> or GND                                                          | 6.0                 | –    | 0.1  | ±0.1 | μA   |
|                          |                           | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>V <sub>O</sub> = V <sub>CC</sub> or GND | 6.0                 | –    | –    | ±0.5 | μA   |
|                          |                           | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0                                      | 6.0                 | –    | –    | 2    | μA   |

## Quad 2-input AND gate

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| SYMBOL                           | PARAMETER                  | TEST CONDITIONS                                                                                  |                     | MIN. | TYP. | MAX. | UNIT |
|----------------------------------|----------------------------|--------------------------------------------------------------------------------------------------|---------------------|------|------|------|------|
|                                  |                            | OTHER                                                                                            | V <sub>CC</sub> (V) |      |      |      |      |
| T <sub>amb</sub> = −40 to +85 °C |                            |                                                                                                  |                     |      |      |      |      |
| V <sub>IH</sub>                  | HIGH-level input voltage   |                                                                                                  | 2.0                 | 1.5  | —    | —    | V    |
|                                  |                            |                                                                                                  | 4.5                 | 3.15 | —    | —    | V    |
|                                  |                            |                                                                                                  | 6.0                 | 4.2  | —    | —    | V    |
| V <sub>IL</sub>                  | LOW-level input voltage    |                                                                                                  | 2.0                 | —    | —    | 0.5  | V    |
|                                  |                            |                                                                                                  | 4.5                 | —    | —    | 1.35 | V    |
|                                  |                            |                                                                                                  | 6.0                 | —    | —    | 1.8  | 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> = −20 μA                                                                          | 2.0                 | 1.9  | —    | —    | V    |
|                                  |                            | I <sub>O</sub> = −20 μA                                                                          | 4.5                 | 4.4  | —    | —    | V    |
|                                  |                            | I <sub>O</sub> = −4.0 mA                                                                         | 4.5                 | 3.84 | —    | —    | V    |
|                                  |                            | I <sub>O</sub> = −20 μA                                                                          | 6.0                 | 5.9  | —    | —    | V    |
|                                  |                            | I <sub>O</sub> = −5.2 mA                                                                         | 6.0                 | 5.34 | —    | —    | 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> = 20 μA                                                                           | 2.0                 | —    | —    | 0.1  | V    |
|                                  |                            | I <sub>O</sub> = 20 μA                                                                           | 4.5                 | —    | —    | 0.1  | V    |
|                                  |                            | I <sub>O</sub> = 4.0 mA                                                                          | 4.5                 | —    | —    | 0.33 | V    |
|                                  |                            | I <sub>O</sub> = 20 μA                                                                           | 6.0                 | —    | —    | 0.1  | V    |
|                                  |                            | I <sub>O</sub> = 5.2 mA                                                                          | 6.0                 | —    | —    | 0.33 | V    |
| I <sub>LI</sub>                  | input leakage current      | V <sub>I</sub> = V <sub>CC</sub> or GND                                                          | 6.0                 | —    | —    | ±1.0 | μA   |
| I <sub>OZ</sub>                  | 3-state output OFF current | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>V <sub>O</sub> = V <sub>CC</sub> or GND | 6.0                 | —    | —    | ±5.0 | μA   |
| I <sub>CC</sub>                  | quiescent supply current   | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0                                      | 6.0                 | —    | —    | 20   | μA   |

## Quad 2-input AND gate

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| SYMBOL                            | PARAMETER                 | TEST CONDITIONS                                                                                  |                     | MIN. | TYP. | MAX.  | UNIT |
|-----------------------------------|---------------------------|--------------------------------------------------------------------------------------------------|---------------------|------|------|-------|------|
|                                   |                           | OTHER                                                                                            | V <sub>CC</sub> (V) |      |      |       |      |
| T <sub>amb</sub> = −40 to +125 °C |                           |                                                                                                  |                     |      |      |       |      |
| V <sub>IH</sub>                   | HIGH-level input voltage  |                                                                                                  | 2.0                 | 1.5  | —    | —     | V    |
|                                   |                           |                                                                                                  | 4.5                 | 3.15 | —    | —     | V    |
|                                   |                           |                                                                                                  | 6.0                 | 4.2  | —    | —     | V    |
| V <sub>IL</sub>                   | LOW-level input voltage   |                                                                                                  | 2.0                 | —    | —    | 0.5   | V    |
|                                   |                           |                                                                                                  | 4.5                 | —    | —    | 1.35  | V    |
|                                   |                           |                                                                                                  | 6.0                 | —    | —    | 1.8   | 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> = −20 μA                                                                          | 2.0                 | 1.9  | —    | —     | V    |
|                                   |                           | I <sub>O</sub> = −20 μA                                                                          | 4.5                 | 4.4  | —    | —     | V    |
|                                   |                           | I <sub>O</sub> = −4.0 mA                                                                         | 4.5                 | 3.7  | —    | —     | V    |
|                                   |                           | I <sub>O</sub> = −20 μA                                                                          | 6.0                 | 5.9  | —    | —     | V    |
| V <sub>OL</sub>                   | LOW-level output voltage  | I <sub>O</sub> = −5.2 mA                                                                         | 6.0                 | 5.2  | —    | —     | V    |
|                                   |                           | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                              |                     |      |      |       |      |
|                                   |                           | I <sub>O</sub> = 20 μA                                                                           | 2.0                 | —    | —    | 0.1   | V    |
|                                   |                           | I <sub>O</sub> = 20 μA                                                                           | 4.5                 | —    | —    | 0.1   | V    |
|                                   |                           | I <sub>O</sub> = 4.0 mA                                                                          | 4.5                 | —    | —    | 0.4   | V    |
|                                   |                           | I <sub>O</sub> = 20 μA                                                                           | 6.0                 | —    | —    | 0.1   | V    |
| I <sub>LI</sub>                   | input leakage current     | I <sub>O</sub> = 5.2 mA                                                                          | 6.0                 | —    | —    | 0.4   | V    |
|                                   |                           | V <sub>I</sub> = V <sub>CC</sub> or GND                                                          | 6.0                 | —    | —    | ±1.0  | μA   |
|                                   |                           | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>V <sub>O</sub> = V <sub>CC</sub> or GND | 6.0                 | —    | —    | ±10.0 | μA   |
|                                   |                           | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0                                      | 6.0                 | —    | —    | 40    | μA   |
|                                   |                           |                                                                                                  |                     |      |      |       |      |

## Quad 2-input AND gate

## 74HC08; 74HCT08

## Family 74HCT08

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

| SYMBOL                           | PARAMETER                           | TEST CONDITIONS                                                                                                         |                     | MIN. | TYP. | MAX. | UNIT |
|----------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------|---------------------|------|------|------|------|
|                                  |                                     | OTHER                                                                                                                   | V <sub>CC</sub> (V) |      |      |      |      |
| T <sub>amb</sub> = 25 °C         |                                     |                                                                                                                         |                     |      |      |      |      |
| V <sub>IH</sub>                  | HIGH-level input voltage            |                                                                                                                         | 4.5 to 5.5          | 2.0  | 1.6  | –    | V    |
| V <sub>IL</sub>                  | LOW-level input voltage             |                                                                                                                         | 4.5 to 5.5          | –    | 1.2  | 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> = –20 μA                                                                                                 | 4.5                 | 4.4  | 4.5  | –    | V    |
|                                  |                                     | I <sub>O</sub> = –4.0 mA                                                                                                | 4.5                 | 3.84 | 4.32 | –    | 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> = 20 μA                                                                                                  | 4.5                 | –    | 0    | 0.1  | V    |
|                                  |                                     | I <sub>O</sub> = 4.0 mA                                                                                                 | 4.5                 | –    | 0.15 | 0.26 | 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>OZ</sub>                  | 3-state output OFF current          | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>V <sub>O</sub> = V <sub>CC</sub> or GND;<br>I <sub>O</sub> = 0 | 5.5                 | –    | –    | ±0.5 | μA   |
| I <sub>CC</sub>                  | quiescent supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND;<br>I <sub>O</sub> = 0                                                          | 5.5                 | –    | –    | 2    | μA   |
| ΔI <sub>CC</sub>                 | additional supply current per input | V <sub>I</sub> = V <sub>CC</sub> – 2.1 V;<br>I <sub>O</sub> = 0                                                         | 4.5 to 5.5          | –    | 60   | 216  | μA   |
| T <sub>amb</sub> = –40 to +85 °C |                                     |                                                                                                                         |                     |      |      |      |      |
| 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> = –20 μA                                                                                                 | 4.5                 | 4.4  | –    | –    | V    |
|                                  |                                     | I <sub>O</sub> = –4.0 mA                                                                                                | 4.5                 | 3.84 | –    | –    | 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> = 20 μA                                                                                                  | 4.5                 | –    | –    | 0.1  | V    |
|                                  |                                     | I <sub>O</sub> = 4.0 mA                                                                                                 | 4.5                 | –    | –    | 0.33 | 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>OZ</sub>                  | 3-state output OFF current          | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>V <sub>O</sub> = V <sub>CC</sub> or GND;<br>I <sub>O</sub> = 0 | 5.5                 | –    | –    | ±5.0 | μA   |
| I <sub>CC</sub>                  | quiescent supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND;<br>I <sub>O</sub> = 0                                                          | 5.5                 | –    | –    | 20   | μA   |
| ΔI <sub>CC</sub>                 | additional supply current per input | V <sub>I</sub> = V <sub>CC</sub> – 2.1 V;<br>I <sub>O</sub> = 0                                                         | 4.5 to 5.5          | –    | –    | 270  | μA   |

## Quad 2-input AND gate

74HC08; 74HCT08

| SYMBOL                            | PARAMETER                           | TEST CONDITIONS                                                                                                         |                     | MIN. | TYP. | MAX. | UNIT |
|-----------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------|---------------------|------|------|------|------|
|                                   |                                     | OTHER                                                                                                                   | V <sub>CC</sub> (V) |      |      |      |      |
| T <sub>amb</sub> = −40 to +125 °C |                                     |                                                                                                                         |                     |      |      |      |      |
| 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> = −20 μA                                                                                                 | 4.5                 | 4.4  | –    | –    | V    |
|                                   |                                     | I <sub>O</sub> = −4.0 mA                                                                                                | 4.5                 | 3.7  | –    | –    | 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> = 20 μA                                                                                                  | 4.5                 | –    | –    | 0.1  | V    |
|                                   |                                     | I <sub>O</sub> = 4.0 mA                                                                                                 | 4.5                 | –    | –    | 0.4  | 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>OZ</sub>                   | 3-state output OFF current          | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br>V <sub>O</sub> = V <sub>CC</sub> or GND;<br>I <sub>O</sub> = 0 | 5.5                 | –    | –    | ±10  | μA   |
| I <sub>CC</sub>                   | quiescent supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND;<br>I <sub>O</sub> = 0                                                          | 5.5                 | –    | –    | 40   | μA   |
| ΔI <sub>CC</sub>                  | additional supply current per input | V <sub>I</sub> = V <sub>CC</sub> − 2.1 V;<br>I <sub>O</sub> = 0                                                         | 4.5 to 5.5          | –    | –    | 294  | μA   |

## Quad 2-input AND gate

74HC08; 74HCT08

## AC CHARACTERISTICS

## Family 74HC08

GND = 0 V;  $t_f = t_r = 6$  ns;  $C_L = 50$  pF.

| SYMBOL                             | PARAMETER                      | TEST CONDITIONS  |                     | MIN. | TYP. | MAX. | UNIT |
|------------------------------------|--------------------------------|------------------|---------------------|------|------|------|------|
|                                    |                                | WAVEFORMS        | V <sub>CC</sub> (V) |      |      |      |      |
| T <sub>amb</sub> = 25 °C           |                                |                  |                     |      |      |      |      |
| t <sub>PHL</sub> /t <sub>PLH</sub> | propagation delay nA, nB to nY | see Figs 7 and 8 | 2.0                 | –    | 25   | 90   | ns   |
|                                    |                                |                  | 4.5                 | –    | 9    | 18   | ns   |
|                                    |                                |                  | 6.0                 | –    | 7    | 15   | ns   |
| t <sub>THL</sub> /t <sub>TLH</sub> | output transition time         | see Figs 7 and 8 | 2.0                 | –    | 19   | 75   | ns   |
|                                    |                                |                  | 4.5                 | –    | 7    | 15   | ns   |
|                                    |                                |                  | 6.0                 | –    | 6    | 13   | ns   |
| T <sub>amb</sub> = –40 to +85 °C   |                                |                  |                     |      |      |      |      |
| t <sub>PHL</sub> /t <sub>PLH</sub> | propagation delay nA, nB to nY | see Figs 7 and 8 | 2.0                 | –    | –    | 115  | ns   |
|                                    |                                |                  | 4.5                 | –    | –    | 23   | ns   |
|                                    |                                |                  | 6.0                 | –    | –    | 20   | ns   |
| t <sub>THL</sub> /t <sub>TLH</sub> | output transition time         | see Figs 7 and 8 | 2.0                 | –    | –    | 95   | ns   |
|                                    |                                |                  | 4.5                 | –    | –    | 19   | ns   |
|                                    |                                |                  | 6.0                 | –    | –    | 16   | ns   |
| T <sub>amb</sub> = –40 to +125 °C  |                                |                  |                     |      |      |      |      |
| t <sub>PHL</sub> /t <sub>PLH</sub> | propagation delay nA, nB to nY | see Figs 7 and 8 | 2.0                 | –    | –    | 135  | ns   |
|                                    |                                |                  | 4.5                 | –    | –    | 27   | ns   |
|                                    |                                |                  | 6.0                 | –    | –    | 23   | ns   |
| t <sub>THL</sub> /t <sub>TLH</sub> | output transition time         | see Figs 7 and 8 | 2.0                 | –    | –    | 110  | ns   |
|                                    |                                |                  | 4.5                 | –    | –    | 22   | ns   |
|                                    |                                |                  | 6.0                 | –    | –    | 19   | ns   |

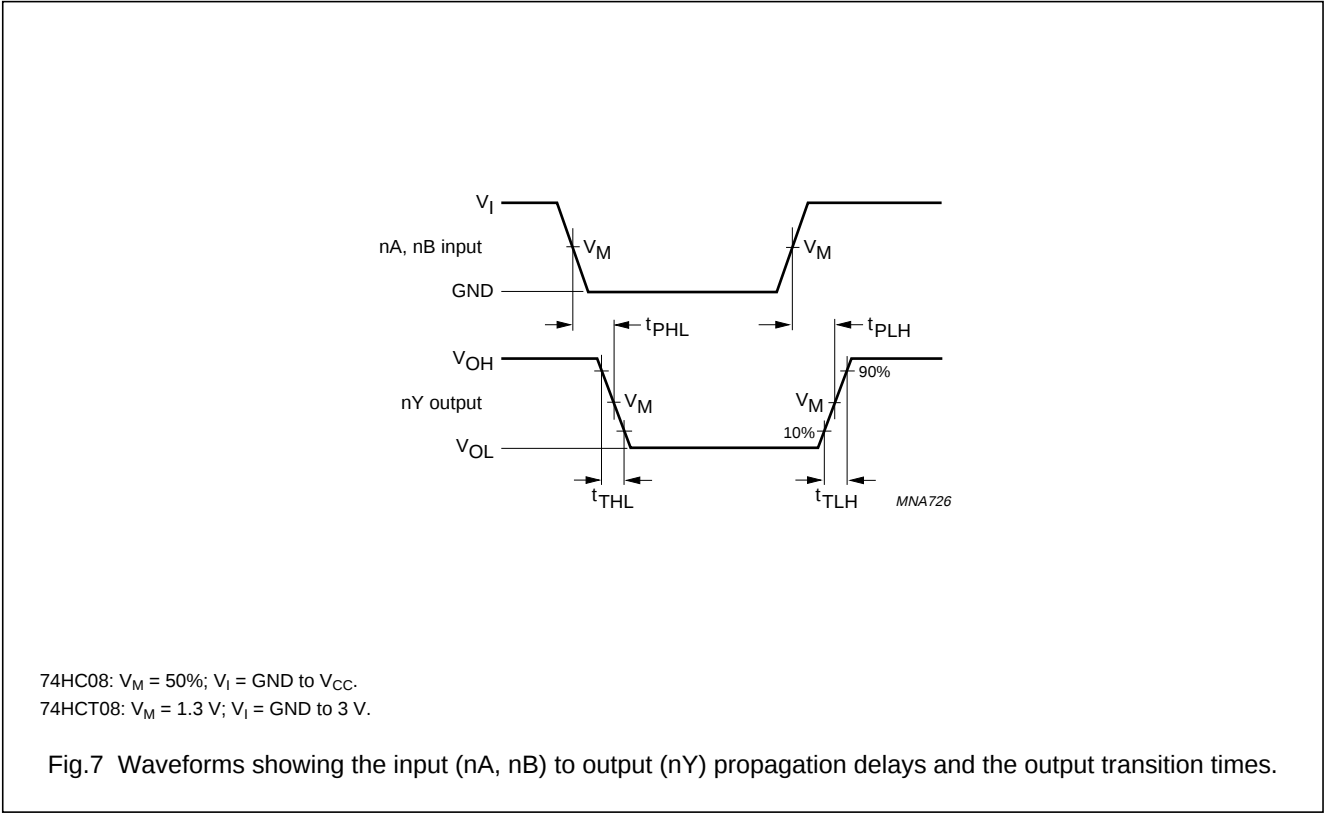
Quad 2-input AND gate

74HC08; 74HCT08

Family 74HCT08  
GND = 0 V;  $t_f = t_r = 6\text{ ns}$ ;  $C_L = 50\text{ pF}$ .

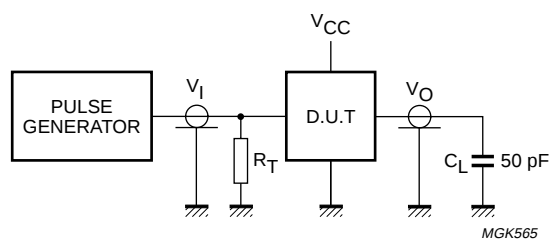
| SYMBOL                             | PARAMETER                      | TEST CONDITIONS  |                     | MIN. | TYP. | MAX. | UNIT |
|------------------------------------|--------------------------------|------------------|---------------------|------|------|------|------|
|                                    |                                | WAVEFORMS        | V <sub>CC</sub> (V) |      |      |      |      |
| T <sub>amb</sub> = 25 °C           |                                |                  |                     |      |      |      |      |
| t <sub>PHL</sub> /t <sub>PLH</sub> | propagation delay nA, nB to nY | see Figs 7 and 8 | 4.5                 | –    | 14   | 24   | ns   |
| t <sub>THL</sub> /t <sub>TLH</sub> | output transition time         | see Figs 7 and 8 | 4.5                 | –    | 7    | 15   | ns   |
| T <sub>amb</sub> = –40 to +85 °C   |                                |                  |                     |      |      |      |      |
| t <sub>PHL</sub> /t <sub>PLH</sub> | propagation delay nA, nB to nY | see Figs 7 and 8 | 4.5                 | –    | –    | 30   | ns   |
| t <sub>THL</sub> /t <sub>TLH</sub> | output transition time         | see Figs 7 and 8 | 4.5                 | –    | –    | 19   | ns   |
| T <sub>amb</sub> = –40 to +125 °C  |                                |                  |                     |      |      |      |      |
| t <sub>PHL</sub> /t <sub>PLH</sub> | propagation delay nA, nB to nY | see Figs 7 and 8 | 4.5                 | –    | –    | 36   | ns   |
| t <sub>THL</sub> /t <sub>TLH</sub> | output transition time         | see Figs 7 and 8 | 4.5                 | –    | –    | 22   | ns   |

AC WAVEFORMS



## Quad 2-input AND gate

74HC08; 74HCT08



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.8 Load circuitry for switching times.

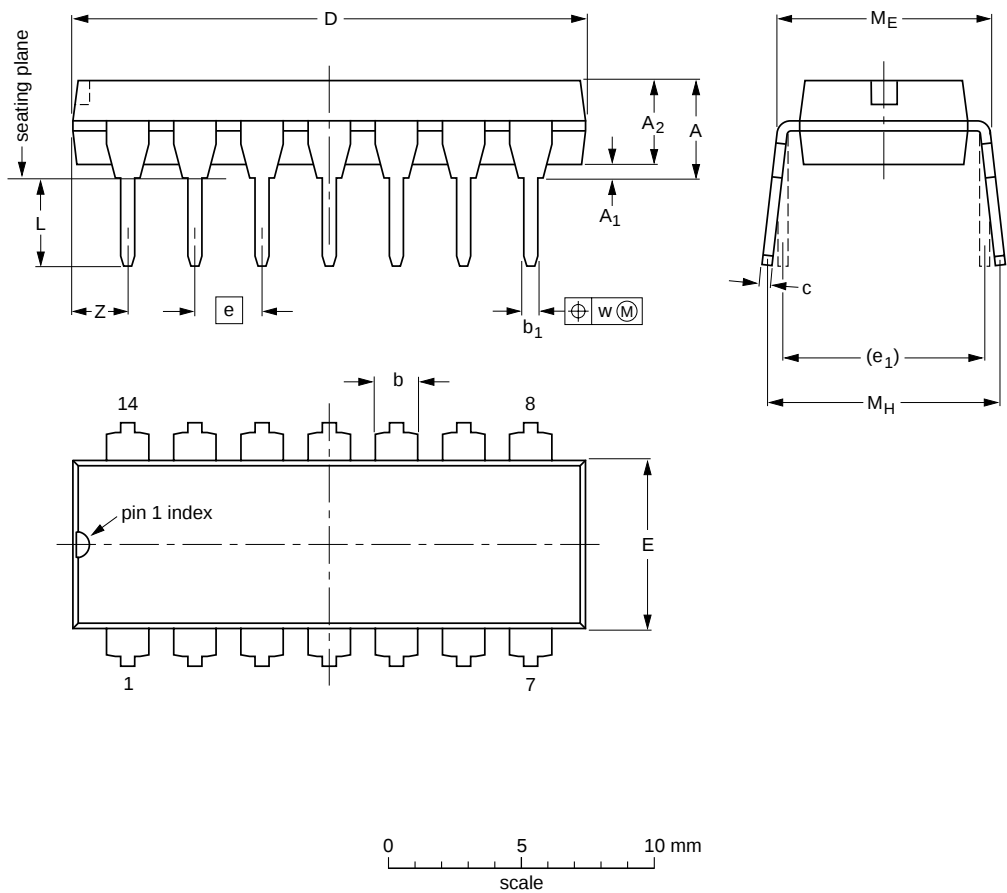
Quad 2-input AND gate

74HC08; 74HCT08

PACKAGE OUTLINES

DIP14: plastic dual in-line package; 14 leads (300 mil)

SOT27-1

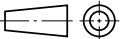


DIMENSIONS (inch dimensions are derived from the original mm dimensions)

| UNIT   | A<br>max. | A <sub>1</sub><br>min. | A <sub>2</sub><br>max. | b              | b <sub>1</sub> | c              | D <sup>(1)</sup> | E <sup>(1)</sup> | e    | e <sub>1</sub> | L            | M <sub>E</sub> | M <sub>H</sub> | w     | z <sup>(1)</sup><br>max. |
|--------|-----------|------------------------|------------------------|----------------|----------------|----------------|------------------|------------------|------|----------------|--------------|----------------|----------------|-------|--------------------------|
| mm     | 4.2       | 0.51                   | 3.2                    | 1.73<br>1.13   | 0.53<br>0.38   | 0.36<br>0.23   | 19.50<br>18.55   | 6.48<br>6.20     | 2.54 | 7.62           | 3.60<br>3.05 | 8.25<br>7.80   | 10.0<br>8.3    | 0.254 | 2.2                      |
| inches | 0.17      | 0.02                   | 0.13                   | 0.068<br>0.044 | 0.021<br>0.015 | 0.014<br>0.009 | 0.77<br>0.73     | 0.26<br>0.24     | 0.1  | 0.3            | 0.14<br>0.12 | 0.32<br>0.31   | 0.39<br>0.33   | 0.01  | 0.087                    |

Note

1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

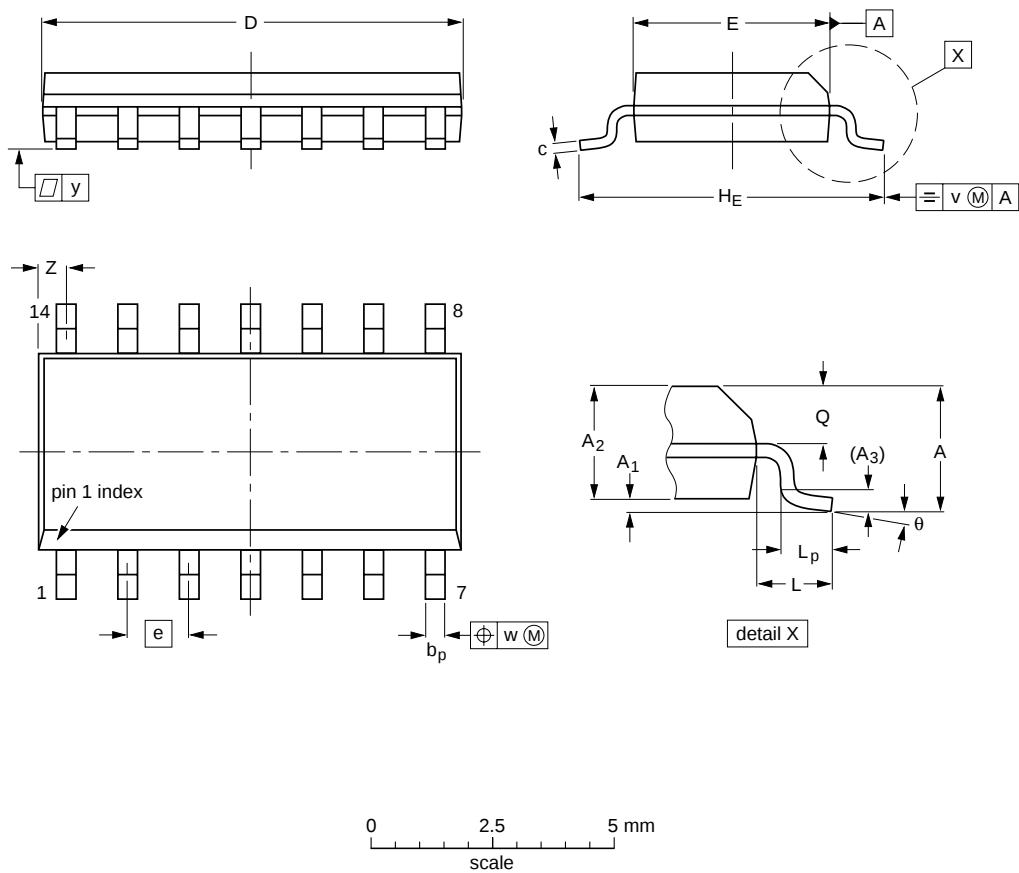
| OUTLINE<br>VERSION | REFERENCES |        |           |  | EUROPEAN<br>PROJECTION                                                                | ISSUE DATE            |
|--------------------|------------|--------|-----------|--|---------------------------------------------------------------------------------------|-----------------------|
|                    | IEC        | JEDEC  | JEITA     |  |                                                                                       |                       |
| SOT27-1            | 050G04     | MO-001 | SC-501-14 |  |  | 99-12-27-<br>03-02-13 |

Quad 2-input AND gate

74HC08; 74HCT08

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

| UNIT   | A<br>max. | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c                | D <sup>(1)</sup> | E <sup>(1)</sup> | e    | H <sub>E</sub> | L     | L <sub>p</sub> | Q              | v    | w    | y     | z <sup>(1)</sup> | θ        |
|--------|-----------|----------------|----------------|----------------|----------------|------------------|------------------|------------------|------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm     | 1.75      | 0.25<br>0.10   | 1.45<br>1.25   | 0.25           | 0.49<br>0.36   | 0.25<br>0.19     | 8.75<br>8.55     | 4.0<br>3.8       | 1.27 | 6.2<br>5.8     | 1.05  | 1.0<br>0.4     | 0.7<br>0.6     | 0.25 | 0.25 | 0.1   | 0.7<br>0.3       | 8°<br>0° |
| inches | 0.069     | 0.010<br>0.004 | 0.057<br>0.049 | 0.01           | 0.019<br>0.014 | 0.0100<br>0.0075 | 0.35<br>0.34     | 0.16<br>0.15     | 0.05 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.024 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012   |          |

Note  
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

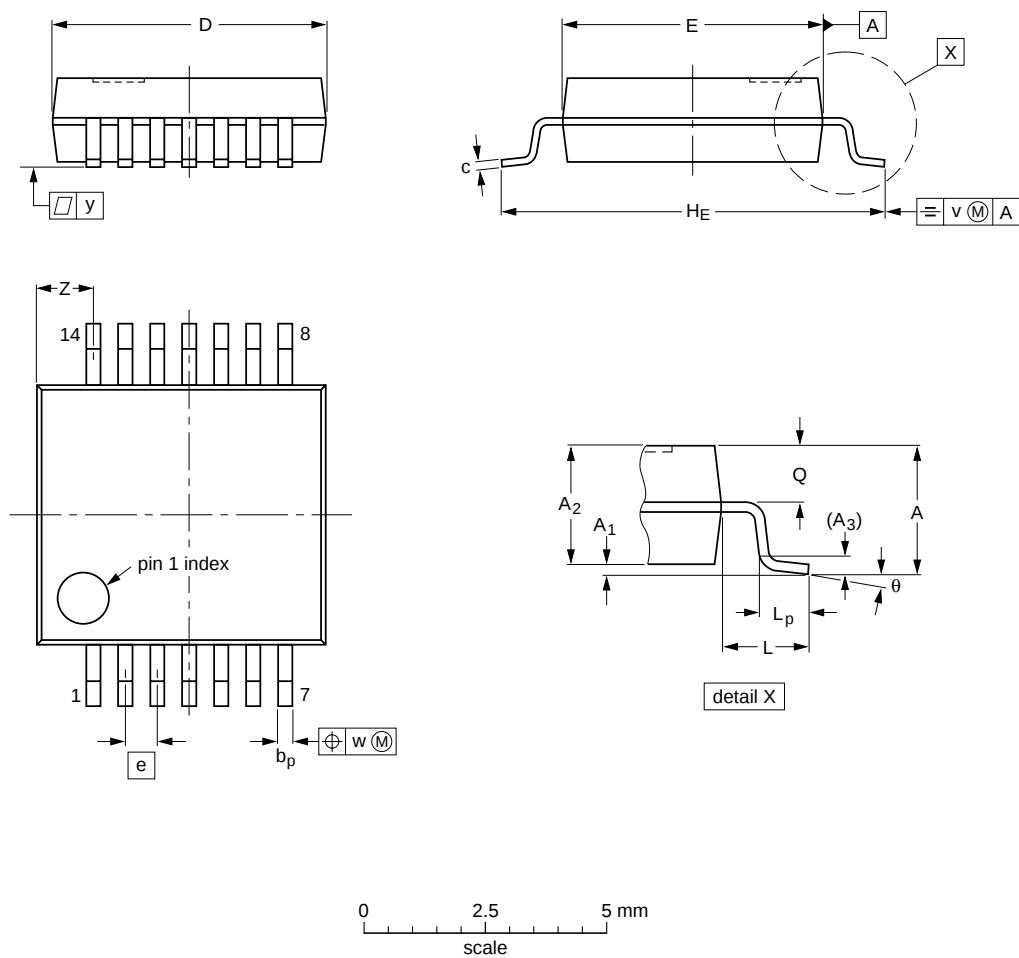
| OUTLINE<br>VERSION | REFERENCES |        |       |  | EUROPEAN<br>PROJECTION | ISSUE DATE           |
|--------------------|------------|--------|-------|--|------------------------|----------------------|
|                    | IEC        | JEDEC  | JEITA |  |                        |                      |
| SOT108-1           | 076E06     | MS-012 |       |  |                        | 99-12-27<br>03-02-19 |

Quad 2-input AND gate

74HC08; 74HCT08

SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm

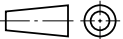
SOT337-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A<br>max. | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c            | D <sup>(1)</sup> | E <sup>(1)</sup> | e    | H <sub>E</sub> | L    | L <sub>p</sub> | Q          | v   | w    | y   | z <sup>(1)</sup> | θ        |
|------|-----------|----------------|----------------|----------------|----------------|--------------|------------------|------------------|------|----------------|------|----------------|------------|-----|------|-----|------------------|----------|
| mm   | 2         | 0.21<br>0.05   | 1.80<br>1.65   | 0.25           | 0.38<br>0.25   | 0.20<br>0.09 | 6.4<br>6.0       | 5.4<br>5.2       | 0.65 | 7.9<br>7.6     | 1.25 | 1.03<br>0.63   | 0.9<br>0.7 | 0.2 | 0.13 | 0.1 | 1.4<br>0.9       | 8°<br>0° |

**Note**  
1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

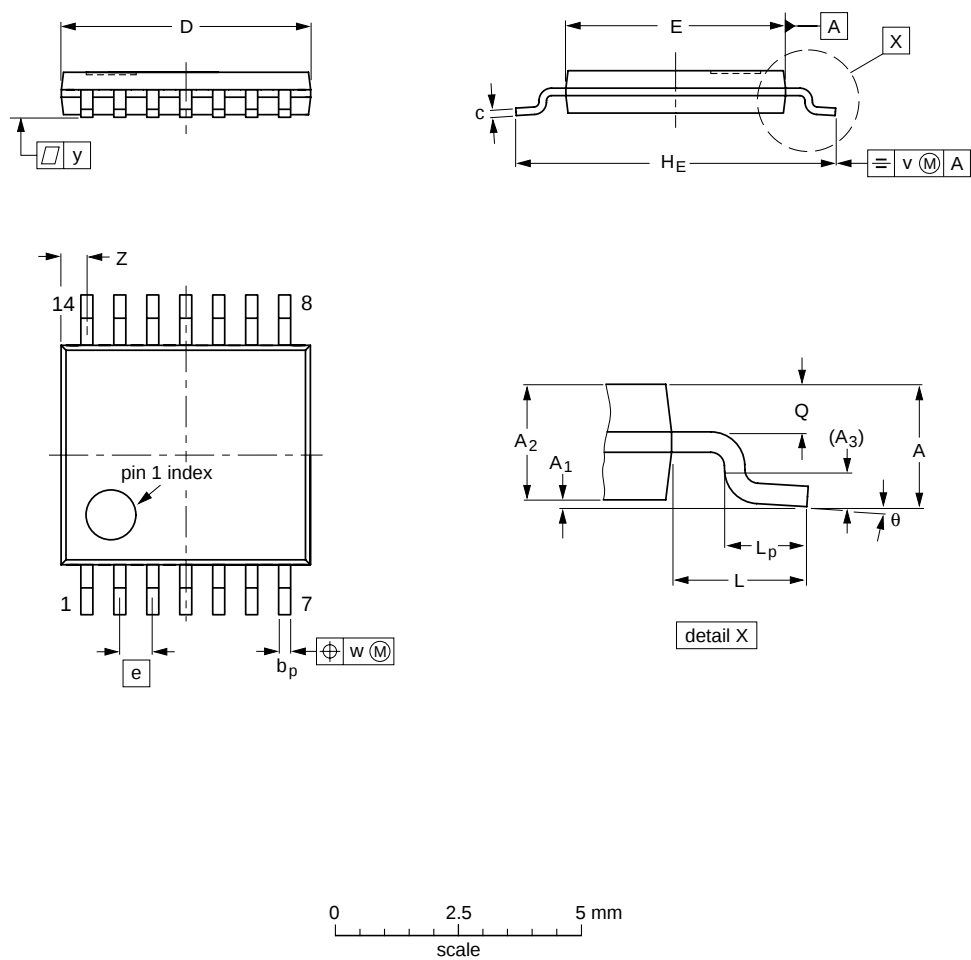
| OUTLINE<br>VERSION | REFERENCES |        |       |  | EUROPEAN<br>PROJECTION                                                                | ISSUE DATE           |
|--------------------|------------|--------|-------|--|---------------------------------------------------------------------------------------|----------------------|
|                    | IEC        | JEDEC  | JEITA |  |                                                                                       |                      |
| SOT337-1           |            | MO-150 |       |  |  | 99-12-27<br>03-02-19 |

Quad 2-input AND gate

74HC08; 74HCT08

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A<br>max. | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c          | D <sup>(1)</sup> | E <sup>(2)</sup> | e    | H <sub>E</sub> | L | L <sub>p</sub> | Q          | v   | w    | y   | z <sup>(1)</sup> | θ        |
|------|-----------|----------------|----------------|----------------|----------------|------------|------------------|------------------|------|----------------|---|----------------|------------|-----|------|-----|------------------|----------|
| mm   | 1.1       | 0.15<br>0.05   | 0.95<br>0.80   | 0.25           | 0.30<br>0.19   | 0.2<br>0.1 | 5.1<br>4.9       | 4.5<br>4.3       | 0.65 | 6.6<br>6.2     | 1 | 0.75<br>0.50   | 0.4<br>0.3 | 0.2 | 0.13 | 0.1 | 0.72<br>0.38     | 8°<br>0° |

Notes

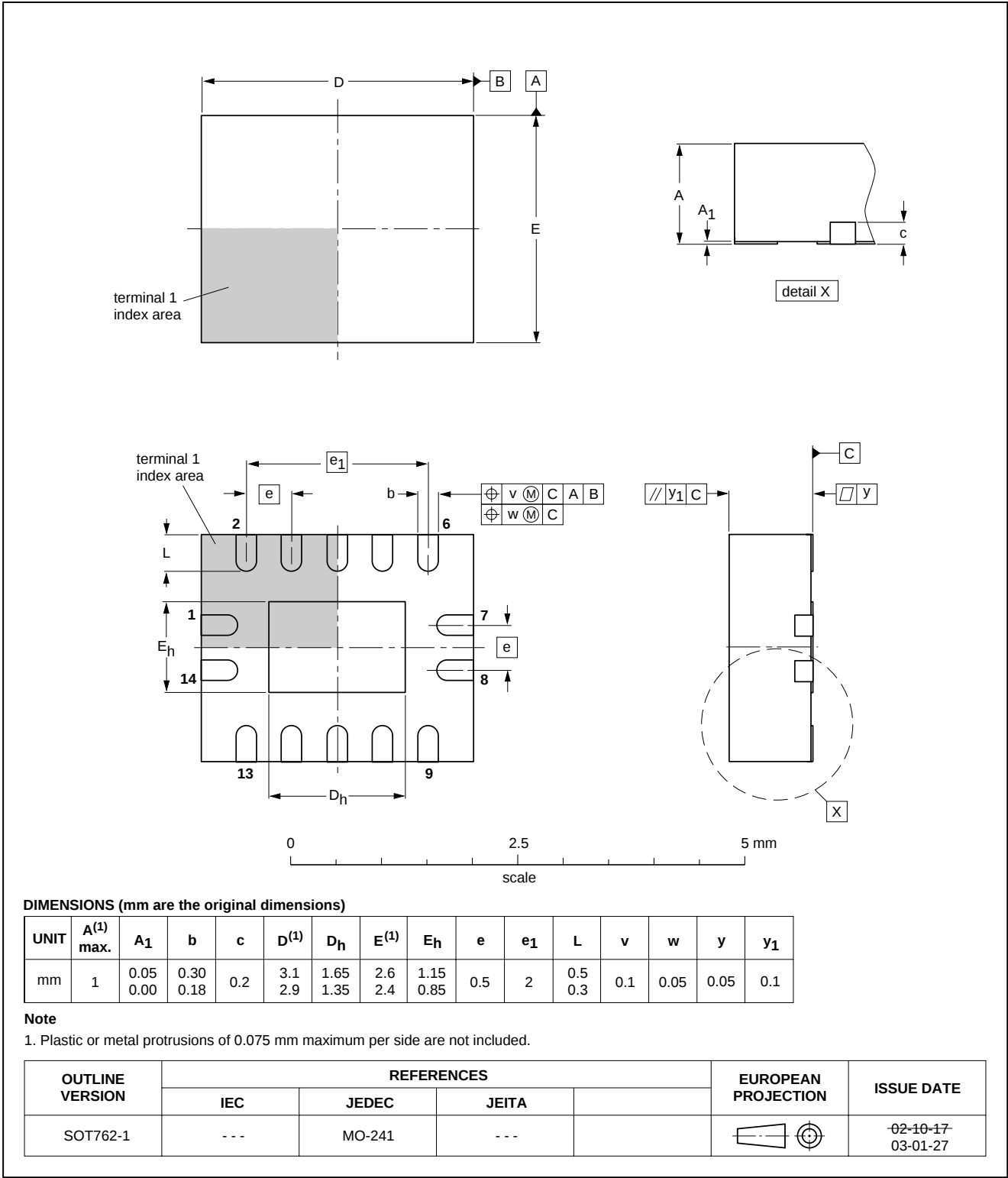
- 1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
- 2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

| OUTLINE<br>VERSION | REFERENCES |        |       |  | EUROPEAN<br>PROJECTION | ISSUE DATE            |
|--------------------|------------|--------|-------|--|------------------------|-----------------------|
|                    | IEC        | JEDEC  | JEITA |  |                        |                       |
| SOT402-1           |            | MO-153 |       |  |                        | 99-12-27-<br>03-02-18 |

Quad 2-input AND gate

74HC08; 74HCT08

DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 x 3 x 0.85 mm SOT762-1



## Quad 2-input AND gate

74HC08; 74HCT08

## 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.             |
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