

HEF4082B

Dual 4-input AND gate

Rev. 7 — 24 February 2022

Product data sheet

1. General description

The HEF4082B is a dual 4-input AND gate. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{DD} .

2. Features and benefits

- Fully static operation
- 5 V, 10 V, and 15 V parametric ratings
- Wide supply voltage range from 3.0 V to 15.0 V
- CMOS low power dissipation
- High noise immunity
- Standardized symmetrical output characteristics
- Complies with JEDEC standard JESD 13-B
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-B exceeds 200 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|-------------|--------------------|------|---|----------|
| | Temperature range | Name | Description | Version |
| HEF4082BT | -40 °C to +125 °C. | SO14 | plastic small outline package; 14 leads; body width 3.9 mm | SOT108-1 |

4. Functional diagram

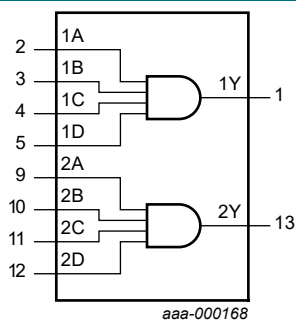


Fig. 1. Functional diagram

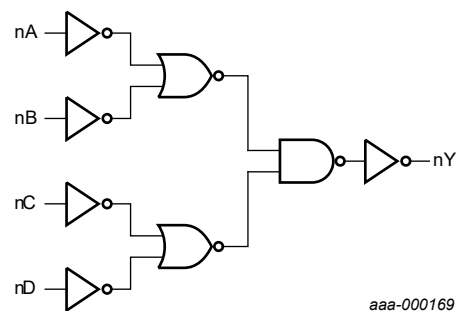
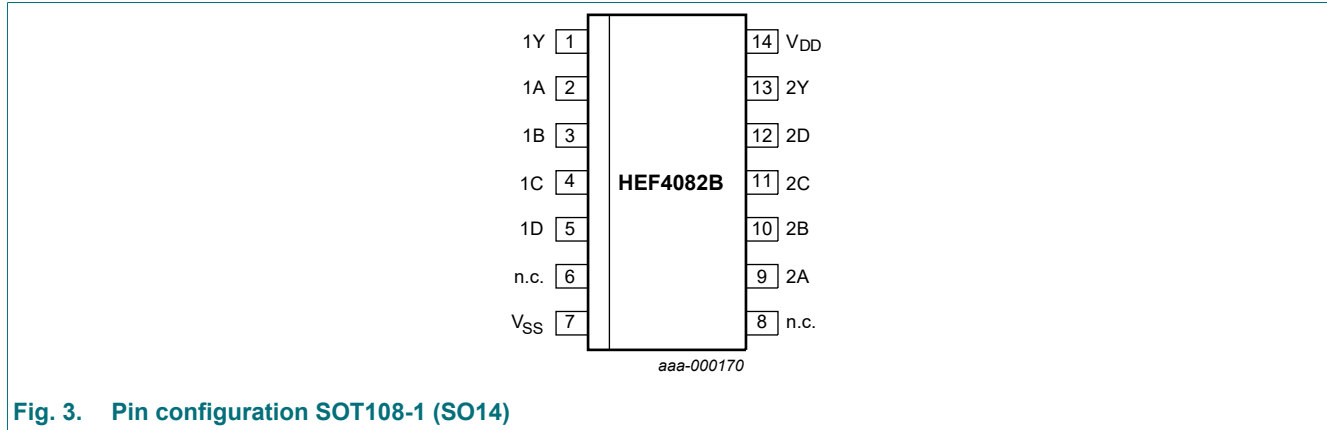


Fig. 2. Logic diagram (one gate)

5. Pinning information

5.1. Pinning



5.2. Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|-----------------|---------------|----------------|
| 1A, 1B, 1C, 1D | 2, 3, 4, 5 | input |
| 2A, 2B, 2C, 2D | 9, 10, 11, 12 | input |
| 1Y, 2Y | 1, 13 | output |
| n.c. | 6, 8 | not connected |
| V _{SS} | 7 | ground (0 V) |
| V _{DD} | 14 | supply voltage |

6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care.

| Input | | | | Output |
|-------|----|----|----|--------|
| nA | nB | nC | nD | nY |
| L | X | X | X | L |
| X | L | X | X | L |
| X | X | L | X | L |
| X | X | X | L | L |
| H | H | H | H | H |

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to $V_{SS} = 0$ V (ground).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|-------------------------|--|------|----------------|------|
| V_{DD} | supply voltage | | -0.5 | +18 | V |
| I_{IK} | input clamping current | $V_I < -0.5$ V or $V_I > V_{DD} + 0.5$ V | - | ± 10 | mA |
| V_I | input voltage | | -0.5 | $V_{DD} + 0.5$ | V |
| I_{OK} | output clamping current | $V_O < -0.5$ V or $V_O > V_{DD} + 0.5$ V | - | ± 10 | mA |
| $I_{I/O}$ | input/output current | | - | ± 10 | mA |
| I_{DD} | supply current | | - | 50 | mA |
| T_{stg} | storage temperature | | -65 | +150 | °C |
| T_{amb} | ambient temperature | | -40 | +125 | °C |
| P_{tot} | total power dissipation | $T_{amb} = -40$ °C to +125 °C [1] | - | 500 | mW |
| P | power dissipation | per output | - | 100 | mW |

[1] For SOT108-1 (SO14) package: P_{tot} derates linearly with 10.1 mW/K above 100 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---------------------|-------------------------------------|-----------------|-----|----------|------|
| V_{DD} | supply voltage | | 3 | 15 | V |
| V_I | input voltage | | 0 | V_{DD} | V |
| T_{amb} | ambient temperature | in free air | -40 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{DD} = 5$ V | - | 3.75 | ns/V |
| | | $V_{DD} = 10$ V | - | 0.5 | ns/V |
| | | $V_{DD} = 15$ V | - | 0.08 | ns/V |

9. Static characteristics

Table 6. Static characteristics

$V_{SS} = 0$ V; $V_I = V_{SS}$ or V_{DD} ; unless otherwise specified.

| Symbol | Parameter | Conditions | V_{DD} | $T_{amb} = -40$ °C | | $T_{amb} = +25$ °C | | $T_{amb} = +85$ °C | | $T_{amb} = +125$ °C | | Unit |
|----------|---------------------------|---------------------|----------|--------------------|-----|--------------------|-----|--------------------|-----|---------------------|-----|------|
| | | | | Min | Max | Min | Max | Min | Max | Min | Max | |
| V_{IH} | HIGH-level input voltage | $ I_O < 1$ μ A | 5 V | 3.5 | - | 3.5 | - | 3.5 | - | 3.5 | - | V |
| | | | 10 V | 7.0 | - | 7.0 | - | 7.0 | - | 7.0 | - | V |
| | | | 15 V | 11.0 | - | 11.0 | - | 11.0 | - | 11.0 | - | V |
| V_{IL} | LOW-level input voltage | $ I_O < 1$ μ A | 5 V | - | 1.5 | - | 1.5 | - | 1.5 | - | 1.5 | V |
| | | | 10 V | - | 3.0 | - | 3.0 | - | 3.0 | - | 3.0 | V |
| | | | 15 V | - | 4.0 | - | 4.0 | - | 4.0 | - | 4.0 | V |
| V_{OH} | HIGH-level output voltage | $ I_O < 1$ μ A | 5 V | 4.95 | - | 4.95 | - | 4.95 | - | 4.95 | - | V |
| | | | 10 V | 9.95 | - | 9.95 | - | 9.95 | - | 9.95 | - | V |
| | | | 15 V | 14.95 | - | 14.95 | - | 14.95 | - | 14.95 | - | V |

| Symbol | Parameter | Conditions | V _{DD} | T _{amb} = -40 °C | | T _{amb} = +25 °C | | T _{amb} = +85 °C | | T _{amb} = +125 °C | | Unit |
|-----------------|---------------------------|---|-----------------|---------------------------|-------|---------------------------|------|---------------------------|-------|----------------------------|-------|------|
| | | | | Min | Max | Min | Max | Min | Max | Min | Max | |
| V _{OL} | LOW-level output voltage | I _O < 1 μA | 5 V | - | 0.05 | - | 0.05 | - | 0.05 | - | 0.05 | V |
| | | | 10 V | - | 0.05 | - | 0.05 | - | 0.05 | - | 0.05 | V |
| | | | 15 V | - | 0.05 | - | 0.05 | - | 0.05 | - | 0.05 | V |
| I _{OH} | HIGH-level output current | V _O = 2.5 V | 5 V | - | -1.7 | - | -1.4 | - | -1.1 | - | -1.1 | mA |
| | | V _O = 4.6 V | 5 V | - | -0.64 | - | -0.5 | - | -0.36 | - | -0.36 | mA |
| | | V _O = 9.5 V | 10 V | - | -1.6 | - | -1.3 | - | -0.9 | - | -0.9 | mA |
| | | V _O = 13.5 V | 15 V | - | -4.2 | - | -3.4 | - | -2.4 | - | -2.4 | mA |
| I _{OL} | LOW-level output current | V _O = 0.4 V | 5 V | 0.64 | - | 0.5 | - | 0.36 | - | 0.36 | - | mA |
| | | V _O = 0.5 V | 10 V | 1.6 | - | 1.3 | - | 0.9 | - | 0.9 | - | mA |
| | | V _O = 1.5 V | 15 V | 4.2 | - | 3.4 | - | 2.4 | - | 2.4 | - | mA |
| I _I | input leakage current | | 15 V | - | ±0.1 | - | ±0.1 | - | ±1.0 | - | ±1.0 | μA |
| I _{DD} | supply current | all valid input combinations; I _O = 0 A | 5 V | - | 0.25 | - | 0.25 | - | 7.5 | - | 7.5 | μA |
| | | | 10 V | - | 0.5 | - | 0.5 | - | 15.0 | - | 15.0 | μA |
| | | | 15 V | - | 1.0 | - | 1.0 | - | 30.0 | - | 30.0 | μA |
| C _I | input capacitance | | | - | - | - | 7.5 | - | - | - | pF | |

10. Dynamic characteristics

Table 7. Dynamic characteristics

T_{amb} = 25 °C; C_L = 50 pF; t_r = t_f ≤ 20 ns, unless otherwise specified. For waveforms see Fig. 4; test circuit see Fig. 5.

| Symbol | Parameter | Conditions | V _{DD} | Extrapolation formula[1] | Min | Typ | Max | Unit |
|------------------|------------------------------------|----------------------|-----------------|----------------------------|-----|-----|-----|------|
| t _{pd} | propagation delay | nA, nB, nC, nD to nY | 5 V [2] | 38 + 0.55 × C _L | - | 65 | 125 | ns |
| | | | 10 V | 19 + 0.23 × C _L | - | 30 | 60 | ns |
| | | | 15 V | 17 + 0.16 × C _L | - | 25 | 45 | ns |
| t _{THL} | HIGH to LOW output transition time | nY | 5 V | 10 + 1.0 × C _L | - | 60 | 120 | ns |
| | | | 10 V | 9 + 0.42 × C _L | - | 30 | 60 | ns |
| | | | 15 V | 6 + 0.28 × C _L | - | 20 | 40 | ns |
| t _{TLH} | LOW to HIGH output transition time | nY | 5 V | 10 + 1.0 × C _L | - | 60 | 120 | ns |
| | | | 10 V | 9 + 0.42 × C _L | - | 30 | 60 | ns |
| | | | 15 V | 6 + 0.28 × C _L | - | 20 | 40 | ns |

[1] The typical value of the propagation delay and output transition time can be calculated with the extrapolation formula (C_L in pF).

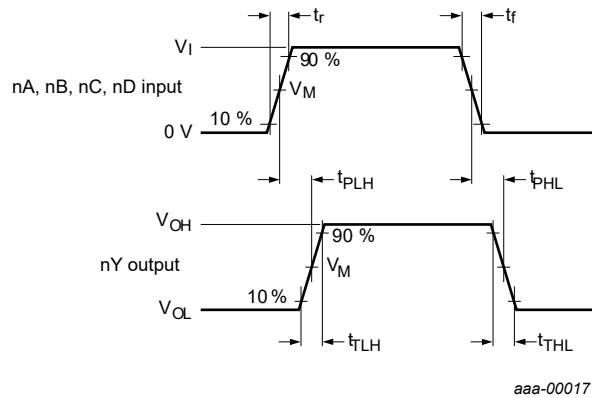
[2] t_{pd} is the same as t_{pHL} and t_{pLH}.

Table 8. Dynamic power dissipation

V_{SS} = 0 V; t_r = t_f ≤ 20 ns; T_{amb} = 25 °C.

| Symbol | Parameter | V _{DD} | Typical formula | where: |
|----------------|---------------------------|-----------------|---|---|
| P _D | dynamic power dissipation | 5 V | P _D = 1500 × f _i + Σ(f _o × C _L) × V _{DD} ² (μW) | f _i = input frequency in MHz; f _o = output frequency in MHz; C _L = output load capacitance in pF; Σ(f _o × C _L) = sum of the outputs; V _{DD} = supply voltage in V. |
| | | 10 V | P _D = 6700 × f _i + Σ(f _o × C _L) × V _{DD} ² (μW) | |
| | | 15 V | P _D = 16800 × f _i + Σ(f _o × C _L) × V _{DD} ² (μW) | |

10.1. Waveforms and test circuit

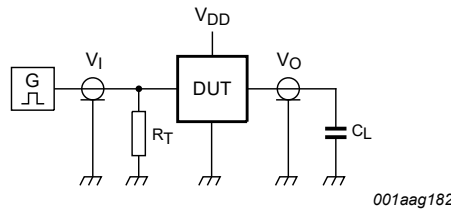


Measurement points are given in [Table 9](#).
 Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig. 4. Input to output propagation delay and output transition times

Table 9. Measurement points

| Supply voltage | Input | Output |
|----------------|---------------------|---------------------|
| V_{DD} | V_M | V_M |
| 5 V to 15 V | $0.5 \times V_{DD}$ | $0.5 \times V_{DD}$ |



Test data is given in [Table 10](#).
 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. 5. Test circuit for measuring switching times

Table 10. Test data

| Supply voltage | Input | Load |
|----------------|----------------------|--------------|
| V_{DD} | V_I | C_L |
| 5 V to 15 V | V_{SS} or V_{DD} | ≤ 20 ns |

11. Package outline

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

SOT108-1

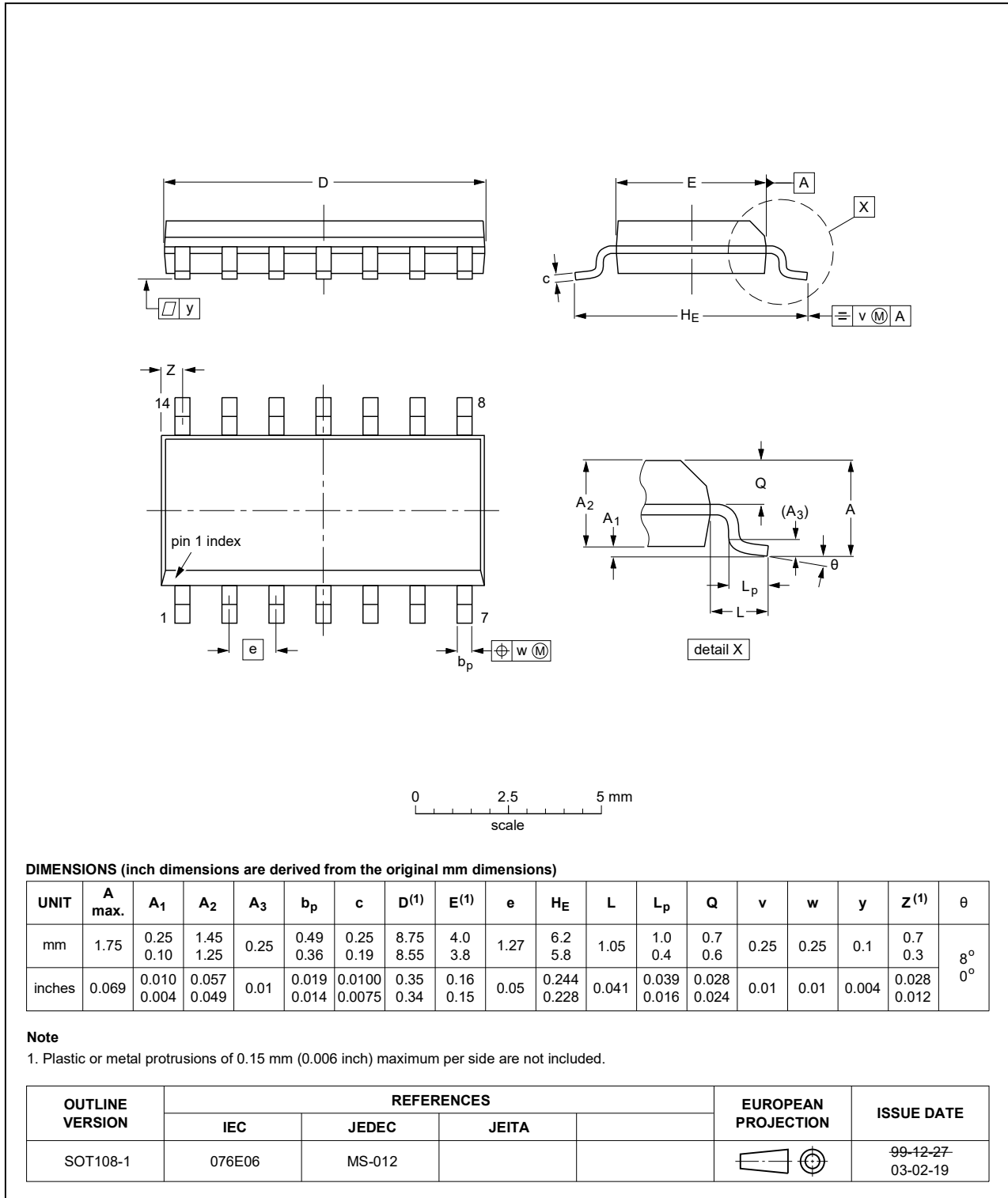


Fig. 6. Package outline SOT108-1 (SO14)

12. Abbreviations

Table 11. Abbreviations

| Acronym | Description |
|---------|-------------------------|
| CDM | Charged Device Model |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |

13. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|------------------|---|-----------------------|---------------|------------------|
| HEF4082B v.7 | 20220224 | Product data sheet | - | HEF4082B v.6 |
| Modifications: | <ul style="list-style-type: none"> • Section 1 and Section 2 updated. | | | |
| HEF4082B v.6 | 20150528 | Product data sheet | - | HEF4082B v.5 |
| Modifications: | <ul style="list-style-type: none"> • Type number HEF4082BP (SOT27-1) removed. | | | |
| HEF4082B v.5 | 20111116 | Product data sheet | - | HEF4082B v.4 |
| Modifications: | <ul style="list-style-type: none"> • Legal pages updated. • Changes in "General description" and "Features and benefits". | | | |
| HEF4082B v.4 | 20110823 | Product data sheet | - | HEF4082B_CNV v.3 |
| HEF4082B_CNV v.3 | 19950101 | Product specification | - | HEF4082B_CNV v.2 |
| HEF4082B_CNV v.2 | 19950101 | Product specification | - | - |

14. Legal information

Data sheet status

| Document status [1][2] | Product status [3] | Definition |
|--------------------------------|--------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

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- [2] The term 'short data sheet' is explained in section "Definitions".
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