

# HEF4082B-Q100

## Dual 4-input AND gate

Rev. 2 — 24 February 2022

Product data sheet

## 1. General description

The HEF4082B-Q100 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  $V_{DD}$ .

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

## 2. Features and benefits

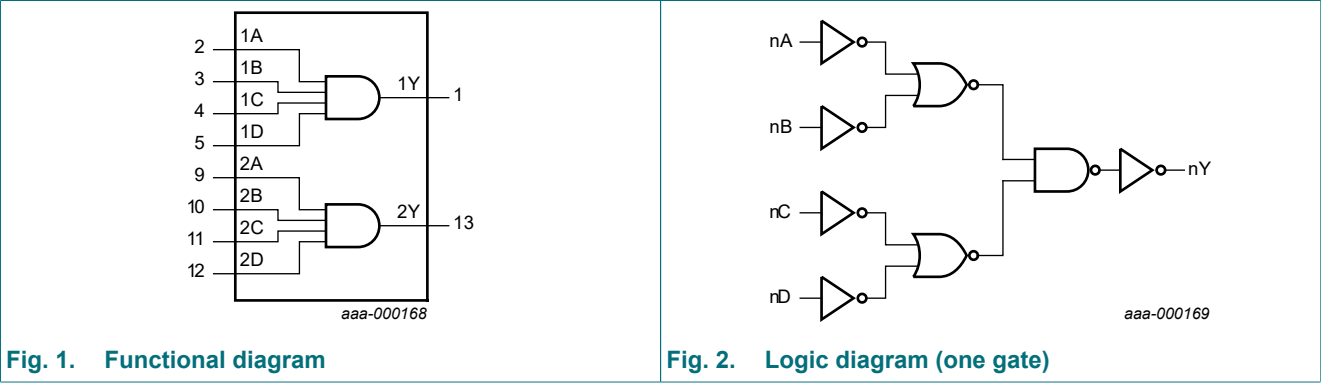
- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Fully static operation
- 5 V, 10 V, and 15 V parametric ratings
- Wide supply voltage range from 3.0 V to 15.0 V
- CMOS low power dissipation
- High noise immunity
- Standardized symmetrical output characteristics
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V ( $C = 200$  pF,  $R = 0$   $\Omega$ )
- Complies with JEDEC standard JESD 13-B

## 3. Ordering information

Table 1. Ordering information

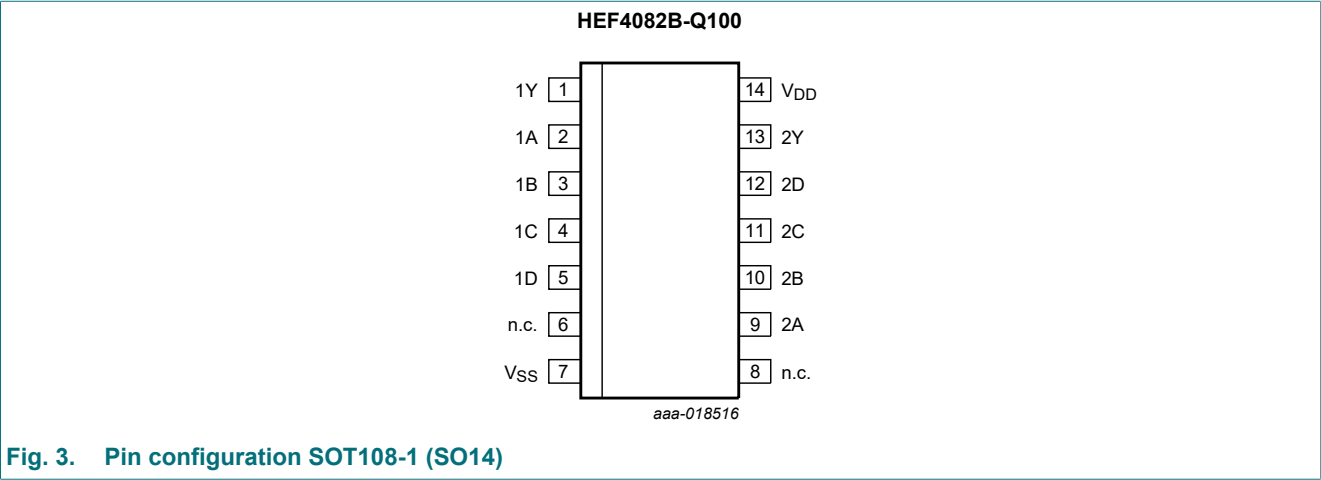
Type number	Package			
	Temperature range	Name	Description	Version
HEF4082BT-Q100	-40 °C to +125 °C.	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1

4. Functional diagram



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 <sub>SS</sub>	7	ground (0 V)
V <sub>DD</sub>	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	-	$\pm 10$	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	-	$\pm 10$	mA
$I_{I/O}$	input/output current		-	$\pm 10$	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**

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

Symbol	Parameter	Conditions	$V_{DD}$	$T_{amb} = -40\text{ °C}$		$T_{amb} = +25\text{ °C}$		$T_{amb} = +85\text{ °C}$		$T_{amb} = +125\text{ °C}$		Unit
				Min	Max	Min	Max	Min	Max	Min	Max	
$V_{IH}$	HIGH-level input voltage	$ I_O  < 1\text{ }\mu\text{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\text{ }\mu\text{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\text{ }\mu\text{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
$V_{OL}$	LOW-level output voltage	$ I_O  < 1\text{ }\mu\text{A}$	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	$V_O = 2.5\text{ V}$	5 V	-	-1.7	-	-1.4	-	-1.1	-	-1.1	mA
		$V_O = 4.6\text{ V}$	5 V	-	-0.64	-	-0.5	-	-0.36	-	-0.36	mA
		$V_O = 9.5\text{ V}$	10 V	-	-1.6	-	-1.3	-	-0.9	-	-0.9	mA
		$V_O = 13.5\text{ V}$	15 V	-	-4.2	-	-3.4	-	-2.4	-	-2.4	mA
$I_{OL}$	LOW-level output current	$V_O = 0.4\text{ V}$	5 V	0.64	-	0.5	-	0.36	-	0.36	-	mA
		$V_O = 0.5\text{ V}$	10 V	1.6	-	1.3	-	0.9	-	0.9	-	mA
		$V_O = 1.5\text{ V}$	15 V	4.2	-	3.4	-	2.4	-	2.4	-	mA
$I_I$	input leakage current		15 V	-	$\pm 0.1$	-	$\pm 0.1$	-	$\pm 1.0$	-	$\pm 1.0$	$\mu\text{A}$
$I_{DD}$	supply current	all valid input combinations; $I_O = 0\text{ A}$	5 V	-	0.25	-	0.25	-	7.5	-	7.5	$\mu\text{A}$
			10 V	-	0.5	-	0.5	-	15.0	-	15.0	$\mu\text{A}$
			15 V	-	1.0	-	1.0	-	30.0	-	30.0	$\mu\text{A}$
$C_I$	input capacitance			-	-	-	7.5	-	-	-	-	pF

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

$T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $C_L = 50\text{ pF}$ ;  $t_r = t_f \leq 20\text{ ns}$ , unless otherwise specified. For waveforms see Fig. 4; test circuit see Fig. 5.

Symbol	Parameter	Conditions	V <sub>DD</sub>	Extrapolation formula[1]	Min	Typ	Max	Unit
t <sub>pd</sub>	propagation delay	nA, nB, nC, nD to nY	5 V [2]	$38 + 0.55 \times C_L$	-	65	125	ns
			10 V	$19 + 0.23 \times C_L$	-	30	60	ns
			15 V	$17 + 0.16 \times C_L$	-	25	45	ns
t <sub>THL</sub>	HIGH to LOW output transition time	nY	5 V	$10 + 1.0 \times C_L$	-	60	120	ns
			10 V	$9 + 0.42 \times C_L$	-	30	60	ns
			15 V	$6 + 0.28 \times C_L$	-	20	40	ns
t <sub>TLH</sub>	LOW to HIGH output transition time	nY	5 V	$10 + 1.0 \times C_L$	-	60	120	ns
			10 V	$9 + 0.42 \times C_L$	-	30	60	ns
			15 V	$6 + 0.28 \times C_L$	-	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).

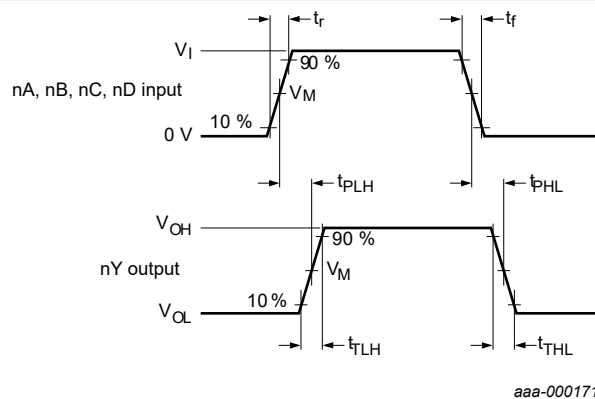
[2] t<sub>pd</sub> is the same as t<sub>PHL</sub> and t<sub>PLH</sub>.

**Table 8. Dynamic power dissipation**

$V_{SS} = 0\text{ V}$ ;  $t_r = t_f \leq 20\text{ ns}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

Symbol	Parameter	V <sub>DD</sub>	Typical formula	where:
P <sub>D</sub>	dynamic power dissipation	5 V	$P_D = 1500 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2\text{ (}\mu\text{W)}$	f <sub>i</sub> = input frequency in MHz; f <sub>o</sub> = output frequency in MHz; C <sub>L</sub> = output load capacitance in pF; Σ(f <sub>o</sub> × C <sub>L</sub> ) = sum of the outputs; V <sub>DD</sub> = supply voltage in V.
		10 V	$P_D = 6700 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2\text{ (}\mu\text{W)}$	
		15 V	$P_D = 16800 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2\text{ (}\mu\text{W)}$	

### 10.1. Waveforms and test circuit



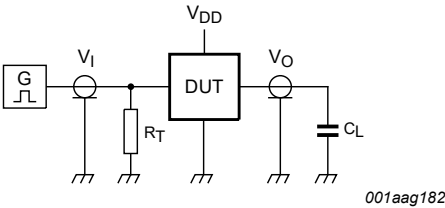
Measurement points are given in Table 9.

Logic levels: V<sub>OL</sub> and V<sub>OH</sub> 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 <sub>DD</sub>	V <sub>M</sub>	V <sub>M</sub>
5 V to 15 V	0.5 × V <sub>DD</sub>	0.5 × V <sub>DD</sub>



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
$V_{DD}$	$V_I$	$t_r, t_f$	$C_L$
5 V to 15 V	$V_{SS}$ or $V_{DD}$	$\leq 20$ ns	50 pF

11. Package outline

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

SOT108-1

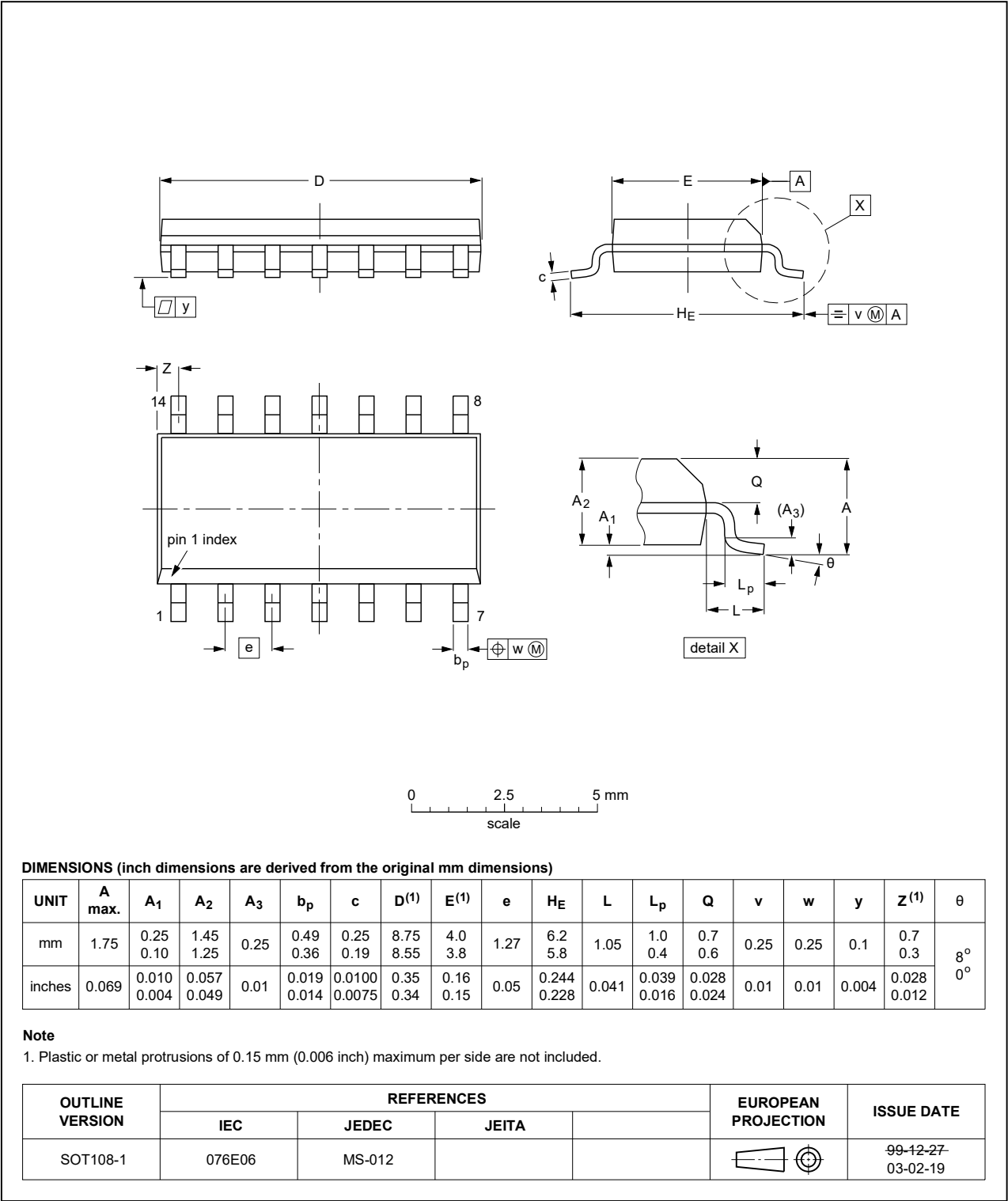


Fig. 6. Package outline SOT108-1 (SO14)

## 12. Abbreviations

Table 11. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MIL	Military

## 13. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
HEF4082B_Q100 v.2	20220224	Product data sheet	-	HEF4082B_Q100 v.1
Modifications	• <a href="#">Section 1</a> and <a href="#">Section 2</a> updated.			
HEF4082B_Q100 v.1	20150529	Product data sheet	-	-



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### 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.
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