

# HEF4077B

## Quad 2-input EXCLUSIVE-NOR gate

Rev. 6 — 14 March 2017

Product data sheet

### 1 General description

The HEF4077B is a quad 2-input EXCLUSIVE-NOR gate. The outputs are fully buffered for the highest noise immunity and pattern insensitivity to output impedance.

The HEF4077B operates over a recommended  $V_{DD}$  power supply range of 3 V to 15 V referenced to  $V_{SS}$  (usually ground). Unused inputs must be connected to  $V_{DD}$ ,  $V_{SS}$ , or another input.

### 2 Features and benefits

- Fully static operation
- 5 V, 10 V, and 15 V parametric ratings
- Standardized symmetrical output characteristics
- Specified from -40 °C to +85 °C
- Complies with JEDEC standard JESD 13-B

### 3 Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
HEF4077BT	-40 °C to +85 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1

### 4 Functional diagram

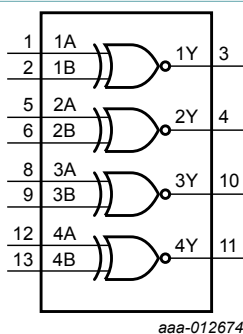


Figure 1. Functional diagram

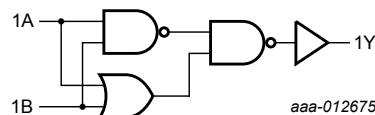


Figure 2. Logic diagram (one gate)

## 5 Pinning information

### 5.1 Pinning

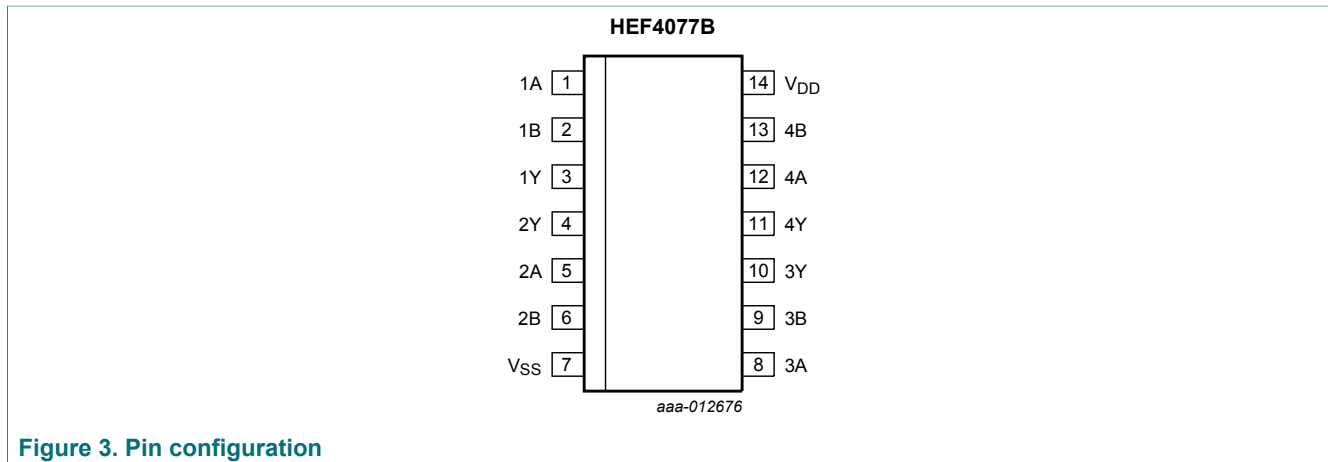


Figure 3. Pin configuration

### 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1A to 4A	1, 5, 8, 12	input
1B to 4B	2, 6, 9, 13	input
1Y to 4Y	3, 4, 10, 11	output
V <sub>SS</sub>	7	ground (0 V)
V <sub>DD</sub>	14	supply voltage

## 6 Functional description

Table 3. Functional table <sup>[1]</sup>

Input		Output
nA	nB	nY
L	L	H
L	H	L
H	L	L
H	H	H

[1] H = HIGH voltage level;  
L = LOW voltage level

## 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	+85	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to +85 °C			
		SO14 package [1]	-	500	mW
P	power dissipation	per output	-	100	mW

[1] For SO14 package:  $P_{tot}$  derates linearly with 8 mW/K above 70 °C.

## 8 Recommended operating conditions

**Table 5. 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	+85	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{DD} = 5$ V	-	3.75	$\mu\text{s/V}$
		$V_{DD} = 10$ V	-	0.5	$\mu\text{s/V}$
		$V_{DD} = 15$ V	-	0.08	$\mu\text{s/V}$

## 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	$V_{DD}$	$T_{amb} = -40\text{ }^{\circ}\text{C}$		$T_{amb} = 25\text{ }^{\circ}\text{C}$		$T_{amb} = 85\text{ }^{\circ}\text{C}$		Unit
				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	-	V
			10 V	7.0	-	7.0	-	7.0	-	V
			15 V	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	V
			10 V	-	3.0	-	3.0	-	3.0	V
			15 V	-	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	-	V
			10 V	9.95	-	9.95	-	9.95	-	V
			15 V	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	V
			10 V	-	0.05	-	0.05	-	0.05	V
			15 V	-	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	mA
		$V_O = 4.6\text{ V}$	5 V	-	-0.52	-	-0.44	-	-0.36	mA
		$V_O = 9.5\text{ V}$	10 V	-	-1.3	-	-1.1	-	-0.9	mA
		$V_O = 13.5\text{ V}$	15 V	-	-3.6	-	-3.0	-	-2.4	mA
$I_{OL}$	LOW-level output current	$V_O = 0.4\text{ V}$	5 V	0.52	-	0.44	-	0.36	-	mA
		$V_O = 0.5\text{ V}$	10 V	1.3	-	1.1	-	0.9	-	mA
		$V_O = 1.5\text{ V}$	15 V	3.6	-	3.0	-	2.4	-	mA
$I_I$	input leakage current		15 V	-	$\pm 0.3$	-	$\pm 0.3$	-	$\pm 3.0$	$\mu\text{A}$
$I_{DD}$	supply current	all valid input combinations; $I_O = 0\text{ A}$	5 V	-	1.0	-	1.0	-	7.5	$\mu\text{A}$
			10 V	-	2.0	-	2.0	-	15.0	$\mu\text{A}$
			15 V	-	4.0	-	4.0	-	30.0	$\mu\text{A}$
$C_I$	input capacitance		-	-	-	-	7.5	-	-	pF

## 10 Dynamic characteristics

**Table 7. Dynamic characteristics** <sup>[1]</sup>

$T_{amb} = 25\text{ }^{\circ}\text{C}$ ; unless otherwise specified; for waveform see [Figure 4](#); for test circuit see [Figure 5](#).

Symbol	Parameter	Conditions	V <sub>DD</sub>	Extrapolation formula	Min	Typ	Max	Unit
t <sub>PHL</sub>	HIGH to LOW propagation delay	nA or nB to nY	5 V	48 ns + (0.55 ns/pF)C <sub>L</sub>	-	75	150	ns
			10 V	24 ns + (0.23 ns/pF)C <sub>L</sub>	-	35	70	ns
			15 V	22 ns + (0.16 ns/pF)C <sub>L</sub>	-	30	55	ns
t <sub>PLH</sub>	LOW to HIGH propagation delay	nA or nB to nY	5 V	43 ns + (0.55 ns/pF)C <sub>L</sub>	-	70	145	ns
			10 V	19 ns + (0.23 ns/pF)C <sub>L</sub>	-	30	60	ns
			15 V	17 ns + (0.16 ns/pF)C <sub>L</sub>	-	25	50	ns
t <sub>t</sub>	transition time	nY	5 V <sup>[2]</sup>	10 ns + (1.00 ns/pF)C <sub>L</sub>	-	60	120	ns
			10 V	9 ns + (0.42 ns/pF)C <sub>L</sub>	-	30	60	ns
			15 V	6 ns + (0.28 ns/pF)C <sub>L</sub>	-	20	40	ns

[1] The typical value of the propagation delay and output transition time can be calculated with the extrapolation formula (C<sub>L</sub> in pF).

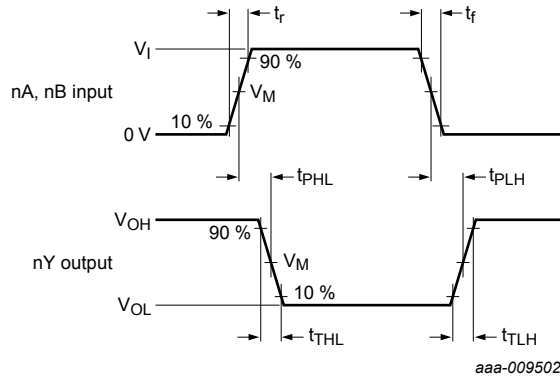
[2] t<sub>t</sub> is the same as t<sub>T<sub>HL</sub></sub> and t<sub>T<sub>LH</sub></sub>.

**Table 8. Dynamic power dissipation**

V<sub>SS</sub> = 0 V; t<sub>r</sub> = t<sub>f</sub> ≤ 20 ns; T<sub>amb</sub> = 25 °C.

Symbol	Parameter	V <sub>DD</sub>	Typical formula	where:
P <sub>D</sub>	dynamic power dissipation	5 V	$P_D = 850 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$ (μW)	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	$P_D = 4500 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$ (μW)	
		15 V	$P_D = 114700 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$ (μW)	

10.1 Waveform and test circuit

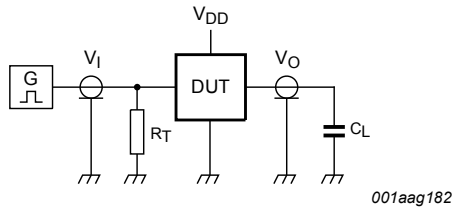


Measurement points are given in [Table 9](#).  
 Logic levels:  $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

Figure 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	$0.5V_{DD}$	$0.5V_{DD}$



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.

Figure 5. Test circuit

Table 10. Test data

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

11 Package outline

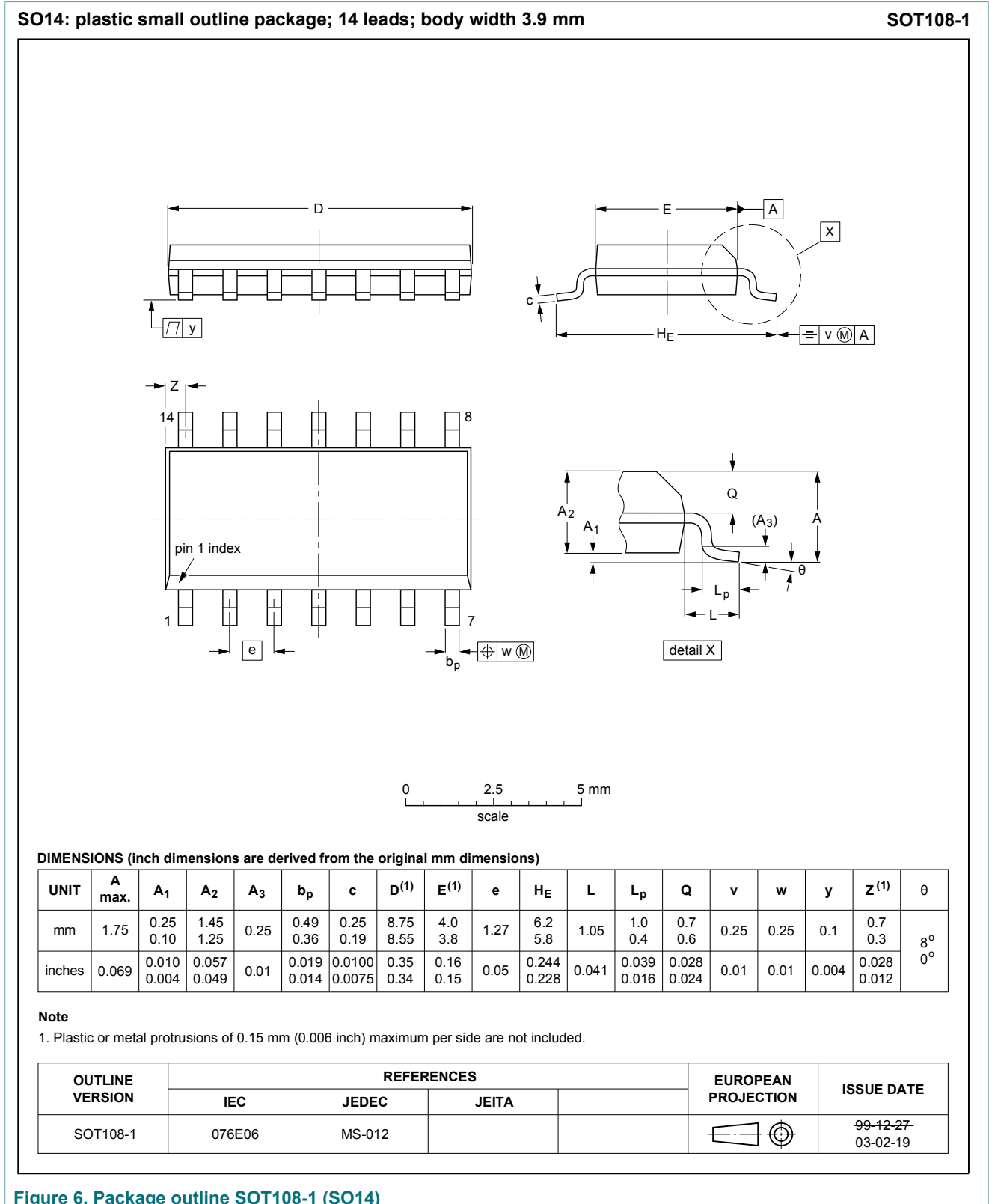


Figure 6. Package outline SOT108-1 (SO14)

## 12 Abbreviations

Table 11. Abbreviations

Acronym	Description
DUT	Device Under Test
ESD	ElectroStatic Discharge

## 13 Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
HEF4077B v.6	20170314	Product data sheet	-	HEF4077B v.5
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>			
HEF4077B v.5	20151210	Product data sheet	-	HEF4077B v.4
Modifications:	<ul style="list-style-type: none"> <li>Type number HEF4077BP (SOT27-1) removed.</li> </ul>			
HEF4077B v.4	20140718	Product data sheet	-	HEF4077B_CNV_3
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Data sheet is imported into latest template.</li> </ul>			
HEF4077B_CNV_3	19950101	Product specification	-	-



## 14 Legal information

### 14.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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.

[1] Please consult the most recently issued document before initiating or completing a design.

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

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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