HEF40373B

Octal transparent latch with 3-state outputs

Rev. 4 — 29 June 2018 Product data sheet

1 General description

The HEF40373B is an 8-bit transparent latch with 3-state buffered outputs. The output stages have high current output capability suitable for driving highly capacitive loads. The latch outputs follow the data inputs when the latch enable (E) is HIGH. When E is LOW, the data that meets the set-up times is latched. The 3-state outputs are controlled by the output enable input $\overline{EO}$. A HIGH on $\overline{EO}$ causes the outputs to assume a high impedance OFF-state. The device features hysteresis on the E input to improve noise rejection. Schmitt-trigger action in the E input makes the circuit highly tolerant to slower input rise and fall times.

2 Features and benefits

- Octal bus interface
- 3-state buffers
- Fully static operation
- 5 V, 10 V, and 15 V parametric ratings
- Standardized symmetrical output characteristics
- Specified from −40 °C to +85 °C

3 Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
HEF40373BT	-40 °C to +85 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1

nexperia

4 Functional diagram

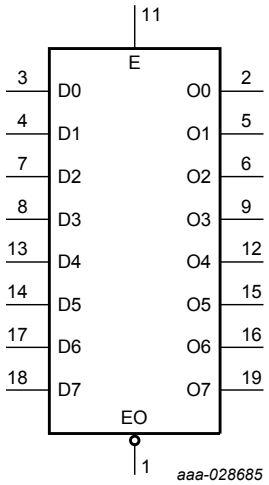


Figure 1. Logic symbol

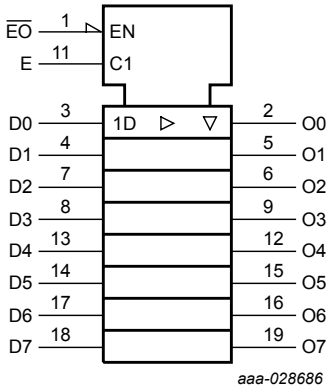


Figure 2. IEC logic symbol

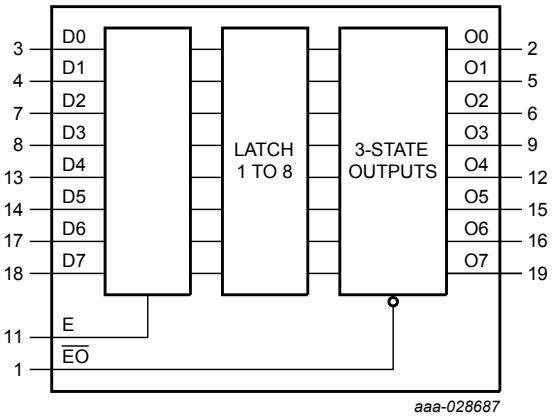


Figure 3. Functional diagram

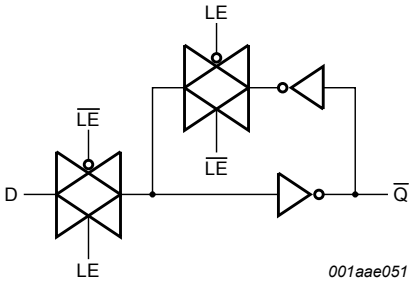


Figure 4. Logic diagram (one latch)

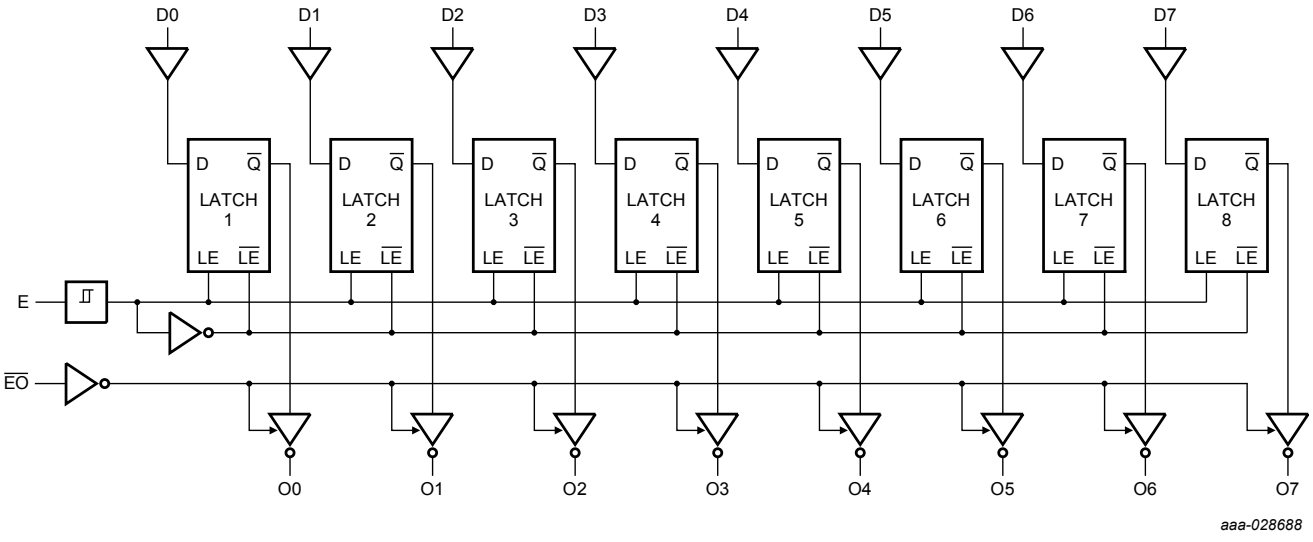


Figure 5. Logic diagram

5 Pinning information

5.1 Pinning

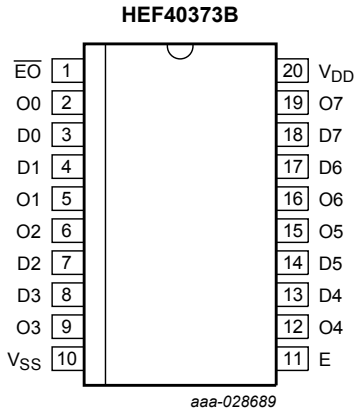


Figure 6. Pin configuration for SO20

5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$\overline{EO}$	1	output enable input (active low)
E	11	latch enable input
D0, D1, D2, D3, D4, D5, D6, D7	3, 4, 7, 8, 13, 14, 17, 18	data inputs
O0, O1, O2, O3, O4, O5, O6, O7	2, 5, 6, 9, 12, 15, 16, 19	data outputs
V_{SS}	10	ground supply voltage
V_{DD}	20	supply voltage

6 Functional description

Table 3. Function table [1]

Operating mode	Inputs			Internal latches	Outputs On
	$\overline{EO}$	E	Dn		
enable and read register (transparent mode)	L	H	L	L	L
	L	H	H	H	H
latch and read register	L	↓	l	L	L
	L	↓	h	H	H
Hold	L	L	X	NC	NC
Latch register and disable outputs	H	L	X	NC	Z
	H	H	nDn	nDn	Z

[1] H = HIGH voltage level;
L = LOW voltage level;
↓ = HIGH-to-LOW E transition;
h = HIGH voltage level one set-up time prior to the HIGH-to-LOW E transition;
l = LOW voltage level one set-up time prior to the HIGH-to-LOW E transition;
X = don't care;
NC = No change;
Z = high-impedance OFF-state.

7 Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DD}	supply voltage		-0.5	+18	V
V_I	input voltage		-0.5	V_{DD} + 0.5	V
I_{DD}	supply current		-	±100	mA
I_{IK}	input clamping current		-	±10	mA
I_{OK}	output clamping current		-	±25	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			
		SO20 package [1]	-	500	mW
P	power dissipation	per output	-	100	mW

[1] For SO20 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	referenced to V_{SS} (usually ground)	3	15	V
V_I	input voltage		0	V_{DD}	V
T_{amb}	ambient temperature	in free air	-40	+85	°C
Δt/ΔV	input transition rise and fall rate	V_{DD} = 5 V	-	3.75	μs/V
		V_{DD} = 10 V	-	0.5	μs/V
		V_{DD} = 15 V	-	0.08	μs/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		T_{amb} = -40 °C		T_{amb} = 25 °C			T_{amb} = 85 °C		Unit
			V_{DD}	Min	Max	Min	Typ	Max	Min	Max	
V_{IH}	HIGH-level input voltage	$\|I_O\|$ < 1 μA									
		V_O = 0.5 V or 4.5 V	5 V	3.5	-	3.5	-	-	3.5	-	V
		V_O = 1.0 V or 9.0 V	10 V	7.0	-	7.0	-	-	7.0	-	V
		V_O = 1.5 V or 13.5 V	15 V	11.0	-	11.0	-	-	11.0	-	V
V_{IL}	LOW-level input voltage	$\|I_O\|$ < 1 μA									
		V_O = 0.5 V or 4.5 V	5 V	-	1.5	-	-	1.5	-	1.5	V
		V_O = 1.0 V or 9.0 V	10 V	-	3.0	-	-	3.0	-	3.0	V
		V_O = 1.5 V or 13.5 V	15 V	-	4.0	-	-	4.0	-	4.0	V
V_{OH}	HIGH-level output voltage	$\|I_O\|$ < 1 μA	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 μA	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	see Figure 7 and Figure 8.									
		V_{OH} = 3.6 V	5 V	−9.3	-	−10	−24	-	−10.7	-	mA
		V_{OH} = 4.6 V	5 V	−0.75	-	−0.6	−1.2	-	−0.45	-	mA
		V_{OH} = 8.4 V	10 V	−14.4	-	−15	−46	-	−15	-	mA
		V_{OH} = 9.5 V	10 V	−1.85	-	−1.5	−3.0	-	−1.1	-	mA
		V_{OH} = 13.2 V	15 V	−19.5	-	−20	−62	-	−19.8	-	mA
		V_{OH} = 13.5 V	15 V	−14.5	-	−15	−50	-	−15.5	-	mA

Symbol	Parameter	Conditions		T_{amb} = -40 °C		T_{amb} = 25 °C			T_{amb} = 85 °C		Unit
			V_{DD}	Min	Max	Min	Typ	Max	Min	Max	
I_{OL}	LOW-level output current	V_{OL} = 0.4 V	5 V	2.9	-	2.3	5.4	-	1.75	-	mA
		V_{OL} = 0.5 V	10 V	9.5	-	7.6	17	-	5.5	-	mA
		V_{OL} = 1.5 V	15 V	30.0	-	25	45	-	19.0	-	mA
I_I	input leakage current	[1]	15 V	-	±0.3	-	-	±0.3	-	±1.0	µA
I_{OZ}	OFF-state output current	$V_O = V_{DD}$	15 V	-	1.6	-	-	1.6	-	12.0	µA
		$V_O = V_{SS}$	15 V	-	−1.6	-	-	−1.6	-	−12.0	µA
I_{DD}	supply current	I_O = 0 A	5 V	-	20.0	-	-	20.0	-	150	µA
			10 V	-	40.0	-	-	40.0	-	300	µA
			15 V	-	80.0	-	-	80.0	-	600	µA
V_H	hysteresis voltage	E input	5 V	-	-	-	220	-	-	-	mV
			10 V	-	-	-	250	-	-	-	mV
			15 V	-	-	-	320	-	-	-	mV
C_I	input capacitance			-	-	-	7.5	-	-	-	pF

[1] Unused inputs must be connected to V_{DD}, V_{SS} or another input.

10 Dynamic characteristics

Table 7. Dynamic characteristics

V_{SS} = 0 V; T_{amb} = 25 °C; unless otherwise specified; for waveform and test circuit, see Figure 13.

Symbol	Parameter	Conditions	Extrapolation formula	Min	Typ	Max	Unit
t_{PHL}	HIGH to LOW propagation delay	E to On; see Figure 9. [1]					
		V_{DD} = 5 V	138 ns + (0.24 ns/pF)C_L	-	150	300	ns
		V_{DD} = 10 V	59 ns + (0.01 ns/pF)C_L	-	60	120	ns
		V_{DD} = 15 V	36 ns + (0.07 ns/pF)C_L	-	40	80	ns
t_{PLH}	LOW to HIGH propagation delay	E to On; see Figure 9. [1]					
		V_{DD} = 5 V	122 ns + (0.06 ns/pF)C_L	-	125	250	ns
		V_{DD} = 10 V	48 ns + (0.03 ns/pF)C_L	-	50	100	ns
		V_{DD} = 15 V	39 ns + (0.02 ns/pF)C_L	-	40	60	ns
t_{PZH}	OFF-state to HIGH propagation delay	$\overline{EO}$ to On; see Figure 11.					
		V_{DD} = 5 V		-	65	130	ns
		V_{DD} = 10 V		-	30	60	ns
		V_{DD} = 15 V		-	25	50	ns
t_{PZL}	OFF-state to LOW propagation delay	$\overline{EO}$ to On; see Figure 11.					
		V_{DD} = 5 V		-	85	170	ns
		V_{DD} = 10 V		-	35	70	ns
		V_{DD} = 15 V		-	25	50	ns

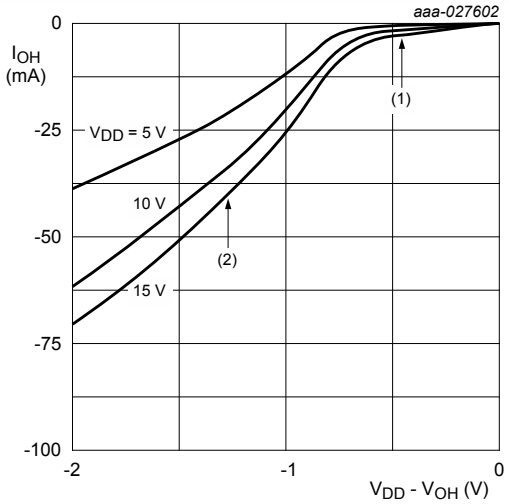
Symbol	Parameter	Conditions	Extrapolation formula	Min	Typ	Max	Unit
t_{PHZ}	HIGH to OFF-state propagation delay	$\overline{EO}$ to On; see Figure 11.					
		V_{DD} = 5 V		-	65	130	ns
		V_{DD} = 10 V		-	30	60	ns
		V_{DD} = 15 V		-	25	50	ns
t_{PLZ}	LOW to OFF-state propagation delay	$\overline{EO}$ to On; see Figure 11.					
		V_{DD} = 5 V		-	75	150	ns
		V_{DD} = 10 V		-	40	80	ns
		V_{DD} = 15 V		-	30	60	ns
t_{THL}	HIGH to LOW output transition time	On; see Figure 9 and Figure 10.					
		V_{DD} = 5 V		-	40	80	ns
		V_{DD} = 10 V		-	20	40	ns
		V_{DD} = 15 V		-	15	30	ns
t_{TLH}	LOW to HIGH output transition time	On; see Figure 9 and Figure 10.					
		V_{DD} = 5 V		-	30	60	ns
		V_{DD} = 10 V		-	20	40	ns
		V_{DD} = 15 V		-	15	30	ns
t_{su}	set-up time	Dn to E; see Figure 12.					
		V_{DD} = 5 V		15	7	-	ns
		V_{DD} = 10 V		10	5	-	ns
		V_{DD} = 15 V		10	5	-	ns
t_h	hold time	Dn to E; see Figure 12.					
		V_{DD} = 5 V		25	15	-	ns
		V_{DD} = 10 V		15	4	-	ns
		V_{DD} = 15 V		10	3	-	ns
t_W	pulse width	E; LOW; see Figure 13.					
		V_{DD} = 5 V		60	30	-	ns
		V_{DD} = 10 V		30	15	-	ns
		V_{DD} = 15 V		20	10	-	ns

[1] The typical values of the propagation delay are calculated from the extrapolation formulas shown (C_L in pF).

Table 8. Dynamic power dissipation

Symbol	Parameter	V_{DD}	Typical formula	where:
P_D	dynamic power dissipation	5 V	$P_D = 3325 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$ (μW)	f_i = input frequency in MHz; f_o = output frequency in MHz; C_L = output load capacitance in pF; $\Sigma(f_o \times C_L)$ = sum of the outputs; V_{DD} = supply voltage in V.
		10 V	$P_D = 14200 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$ (μW)	
		15 V	$P_D = 37425 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$ (μW)	

10.1 Waveforms and test circuit



(1) P-channel MOS transistor conducting.

(2) P-channel MOS transistor and bipolar n-p-n transistor conducting.

Figure 7. Typical output source current characteristic.

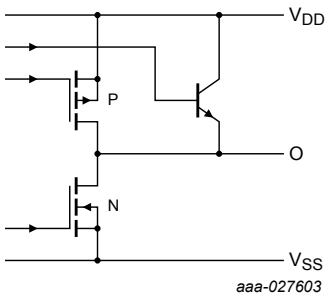
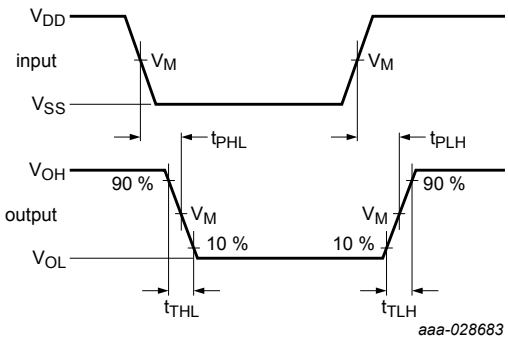


Figure 8. Schematic diagram of output stage.



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 9. Input to output propagation delays and output transition time.

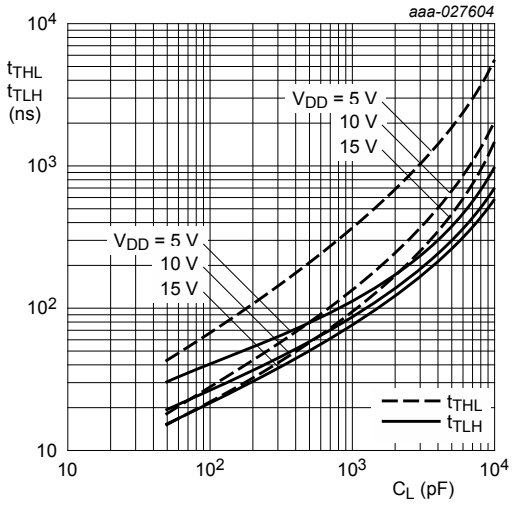
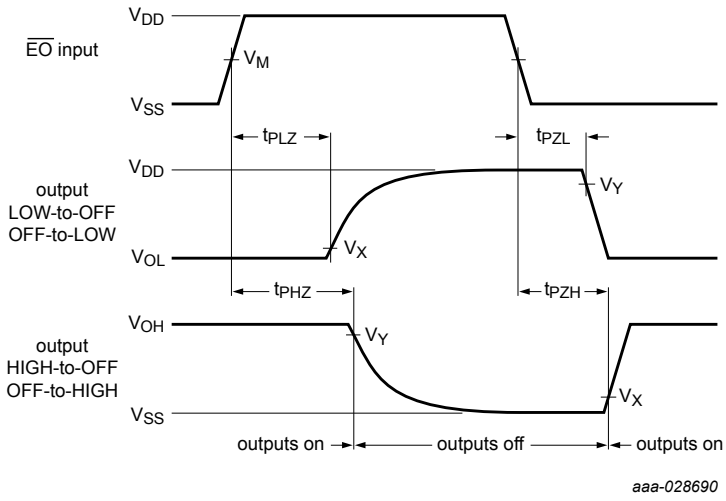


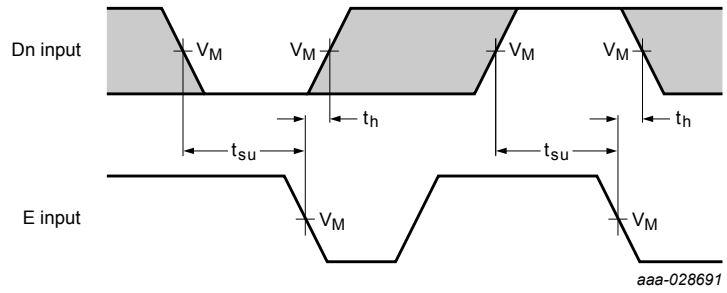
Figure 10. Output transition times as a function of the load capacitance



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 11. 3-state enable and disable times

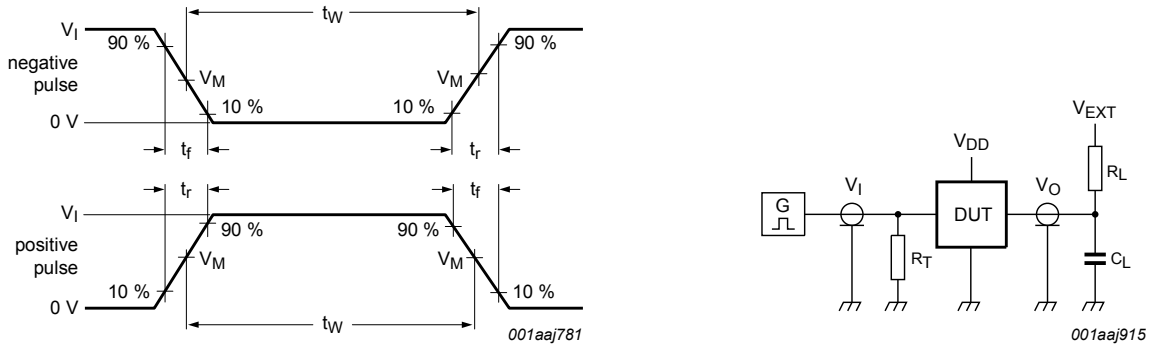


Measurement points are given in Table 9.

Figure 12. Data set-up and hold times for Dn input to E input

Table 9. Measurement points

Supply voltage	Input	Output		
V_{DD}	V_M	V_M	V_X	V_Y
5 V to 15 V	$0.5V_{DD}$	$0.5V_{DD}$	$V_{OL} + 0.1V_{DD}$	$V_{OH} - 0.1V_{DD}$



a. Input waveform

b. Test circuit

Test and measurement data is given in Table 10.

Definitions test circuit:

R_L = Load resistance.

R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.

C_L = Load capacitance including jig and probe capacitance.

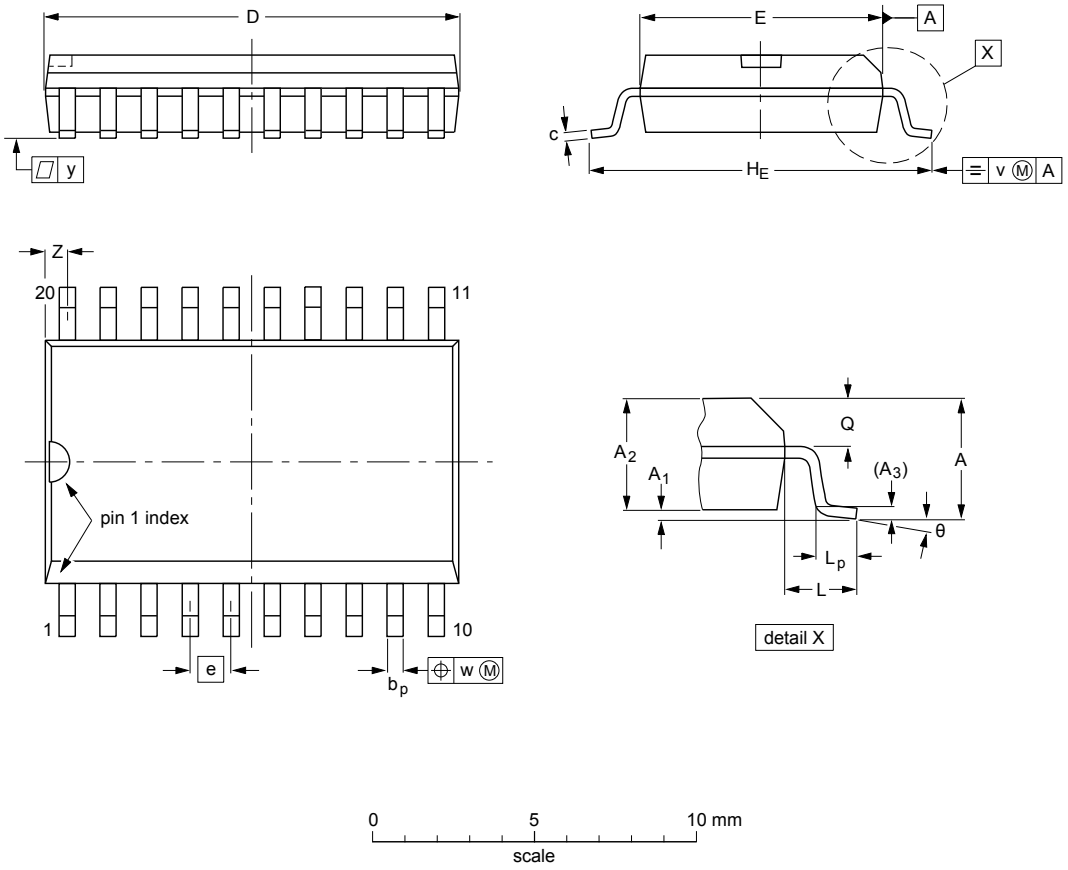
Figure 13. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Input		Load		V_{EXT}		
	V_I	t_r, t_f	C_L	R_L	t_{PLH}, t_{PHL}	t_{PHZ}, t_{PZH}	t_{PLZ}, t_{PZL}
5 V to 15 V	V_{DD}	≤ 20 ns	50 pF	1 kΩ	open	V_{SS}	V_{DD}

11 Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm **SOT163-1**



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

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	2.65	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.05	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

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

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT163-1	075E04	MS-013				~~99-12-27~~ 03-02-19

Figure 14. Package outline SOT163-1 (SO20)

12 Abbreviations

Table 11. Abbreviations

Acronym	Description
DUT	Device Under Test

13 Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
HEF40373B v.4	20180629	Product data sheet	-	HEF40373B v.3
Modifications:	• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. • Legal texts have been adapted to the new company name where appropriate.			
HEF40373B v.3	19950101	Product specification	-	HEF40373B v.2
HEF40373B v.2	19950101	Product specification	-	-

14 Legal information

14.1 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.

[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.

14.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

14.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia. In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory. Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of Nexperia.

Right to make changes — Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — Nexperia products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an Nexperia product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification. Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products. Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nexperia.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Non-automotive qualified products — Unless this data sheet expressly states that this specific Nexperia product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. Nexperia accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications. In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without Nexperia's warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond Nexperia's specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies Nexperia for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond Nexperia's standard warranty and Nexperia's product specifications.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

14.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

Contents

1 General description 1
2 Features and benefits 1
3 Ordering information 1
4 Functional diagram 2
5 Pinning information 3
5.1 Pinning 3
5.2 Pin description 3
6 Functional description 4
7 Limiting values 4
8 Recommended operating conditions 5
9 Static characteristics 5
10 Dynamic characteristics 6
10.1 Waveforms and test circuit 8
11 Package outline 11
12 Abbreviations 12
13 Revision history 12
14 Legal information 13

For more information, please visit: http://www.nexperia.com
For sales office addresses, please send an email to: salesaddresses@nexperia.com

Date of release: 29 June 2018
Document identifier: HEF40373B

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

Данный компонент на территории Российской Федерации

Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

http://moschip.ru/get-element

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:
moschip.ru
moschip.ru_4
moschip.ru_6
moschip.ru_9