

74CB3Q3253

Dual 1-of-4 FET multiplexer/demultiplexer with charge pump

Rev. 3 — 11 April 2024

Product data sheet

1. General description

The 74CB3Q3253 is a dual high-bandwidth single-pole, quad-throw FET bus switch. Each switch features a select input (S_n) and an output enable input ($\overline{nOE}$). The switch is disabled when the $\overline{nOE}$ input is HIGH. An internal charge-pump increases the gate voltage of the NMOS pass transistor. The result is improved R_{ON} and $R_{ON(Flat)}$ performance and the ability to switch 5 V signals when $V_{CC} = 3.3$ V.

2. Features and benefits

- Wide supply voltage range from 2.3 V to 3.6 V
- Overvoltage switching on switch ports:
 - 0 V to 5 V switching with $V_{CC} = 2.5$ V
 - 0 V to 5 V switching with $V_{CC} = 3.3$ V
- Switch voltage accepts signals up to 5.5 V
- 4 Ω (typical) ON resistance
- 3.5 pF (typical) OFF-state capacitance
- High bandwidth 0.5 GHz (maximum)
- Low input/output capacitance minimizes loading and signal distortion
- Fast switching frequency $f_{max} = 20$ MHz (maximum)
- Low power consumption $I_{CC} = 0.4$ mA (typical)
- Control inputs can be driven by TTL or 5 V/3.3 V CMOS outputs
- I_{OFF} supports partial power-down mode operation
- Latch-up performance exceeds 100 mA per JESD 78E Class II Level A
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C

3. Applications

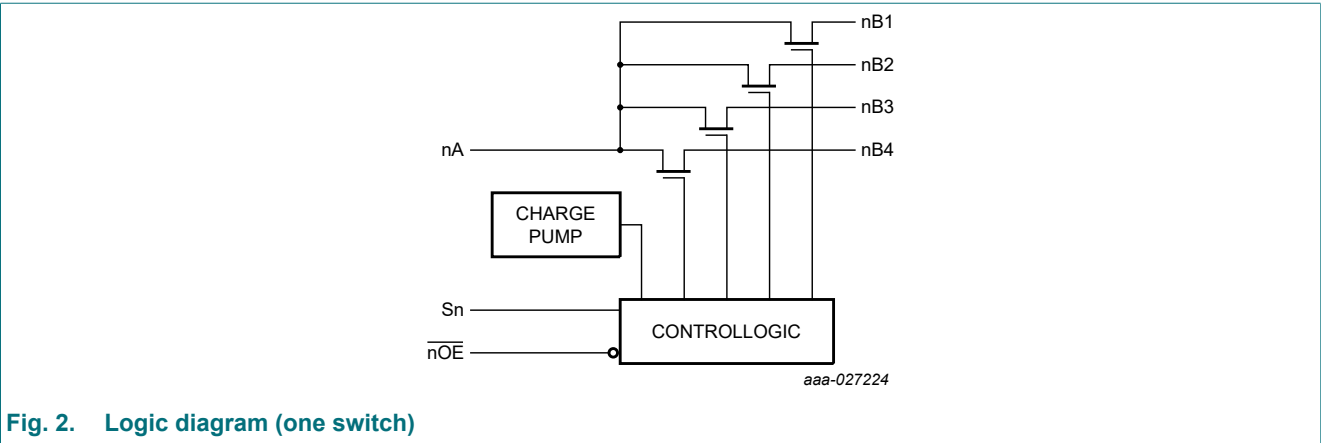
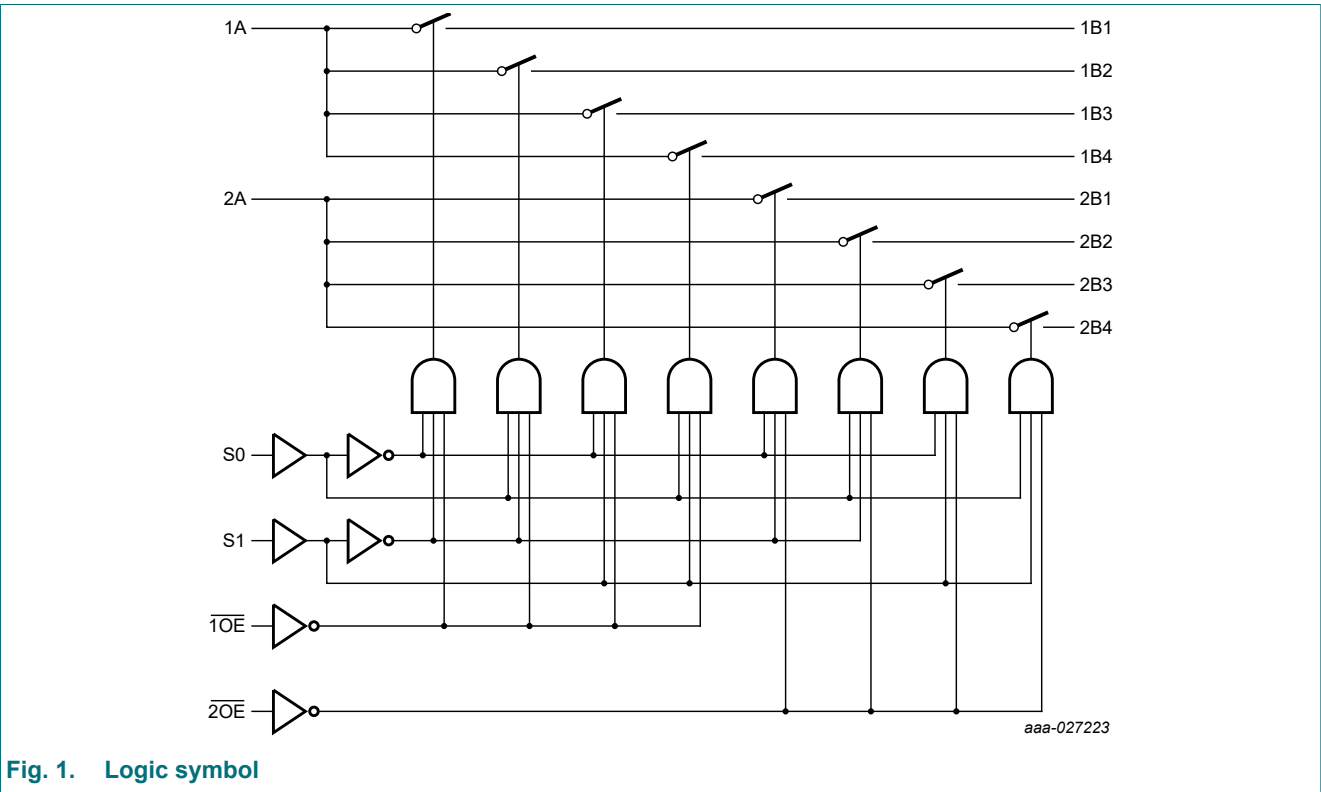
- Communication infrastructure
- Bus isolation
- Memory interleaving
- Sensor multiplexing

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74CB3Q3253PW	-40 °C to +85 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74CB3Q3253BQ	-40 °C to +85 °C	DHVQFN16	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 × 3.5 × 0.85 mm	SOT763-1

5. Functional diagram



6. Pinning information

6.1. Pinning

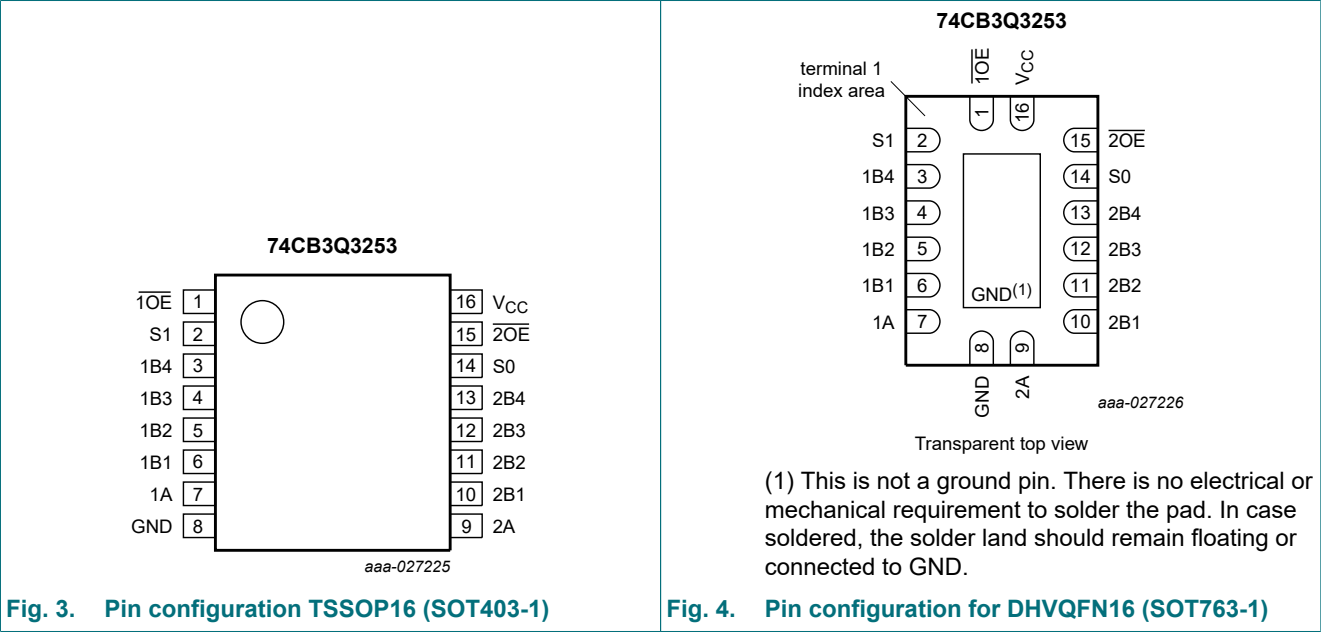


Fig. 3. Pin configuration TSSOP16 (SOT403-1)

Fig. 4. Pin configuration for DHVQFN16 (SOT763-1)

6.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1OE	1	output enable input (active-LOW)
S1	2	select input
1B4	3	independent input or output
1B3	4	independent input or output
1B2	5	independent input or output
1B1	6	independent input or output
1A	7	common output or input
GND	8	ground (0 V)
2A	9	common output or input
2B1	10	independent input or output
2B2	11	independent input or output
2B3	12	independent input or output
2B4	13	independent input or output
S0	14	select input
2OE	15	output enable input (active-LOW)
V _{CC}	16	supply voltage

7. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

Input			Channel on
S1	S0	nOE	
L	L	L	nA = nB1
L	H	L	nA = nB2
H	L	L	nA = nB3
H	H	L	nA = nB4
X	X	H	Z (switch off)

8. Limiting values

Table 4. 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 _{CC}	supply voltage		-0.5	+4.6	V
V _I	input voltage	Sn, nOE input [1]	-0.5	+7.0	V
V _{SW}	switch voltage	[2]	-0.5	+7.0	V
I _{IK}	input clamping current	V _I < -0.5 V	-50	-	mA
I _{SK}	switch clamping current	V _I < -0.5 V	-50	-	mA
I _{SW}	switch current		-	±120	mA
I _{CC}	supply current		-	+100	mA
I _{GND}	ground current		-100	-	mA
T _{stg}	storage temperature		-65	+150	°C
P _{tot}	total power dissipation	T _{amb} = -40 °C to +85 °C [3]	-	500	mW

- [1] The minimum input voltage rating may be exceeded if the input current rating is observed.
[2] The minimum and maximum switch voltage ratings may be exceeded if the switch clamping current rating is observed.
[3] For SOT403-1 (TSSOP16) package: P_{tot} derates linearly with 8.5 mW/K above 91 °C.
For SOT763-1 (DHVQFN16) package: P_{tot} derates linearly with 11.2 mW/K above 106 °C.

9. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		2.3	3.6	V
V _I	input voltage	Sn, nOE input	0	5.5	V
V _{SW}	switch voltage		0	5.5	V
T _{amb}	ambient temperature		-40	+85	°C
Δt/ΔV	input transition rise and fall rate	Sn, nOE input			
		V _{CC} = 2.3 V to 2.7 V	0	20	ns/V
		V _{CC} = 2.7 V to 3.6 V	0	10	ns/V

10. Static characteristics

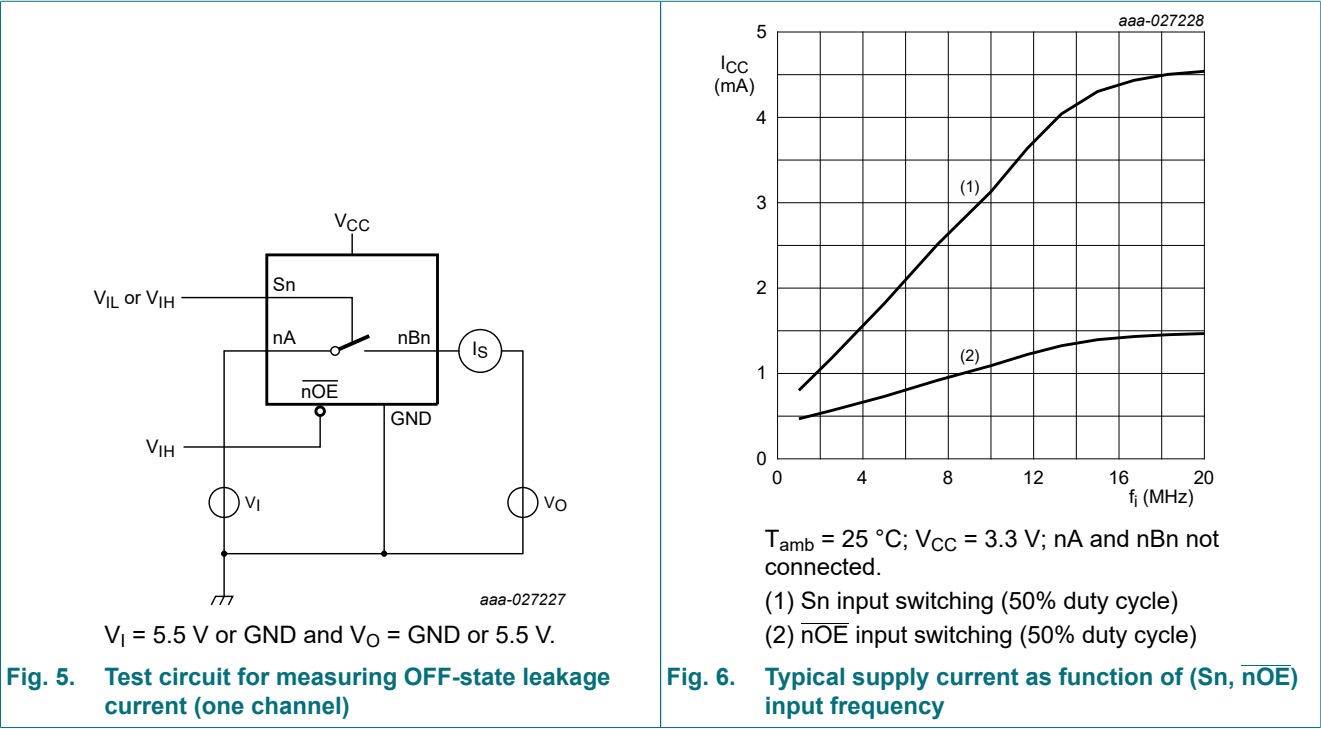
Table 6. Static characteristics

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

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +85 °C		Unit
			Min	Typ[1]	Max	Min	Max	
V _{IH}	HIGH-level input voltage	V _{CC} = 2.3 V to 2.7 V	-	-	-	1.7	-	V
		V _{CC} = 2.7 V to 3.6 V	-	-	-	2	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.3 V to 2.7 V	-	-	-	-	0.7	V
		V _{CC} = 2.7 V to 3.6 V	-	-	-	-	0.8	V
V _{IK}	input clamping voltage	nA; nBn; V _{CC} = 3.6 V; I _I = -18 mA	-	-	-	-	-1.8	V
I _I	input leakage current	Sn, $\overline{\text{noE}}$; V _{CC} = 3.6 V; V _I = GND to 5.5 V	-	-	-	-	±1	µA
I _{OFF}	power-off leakage current	per pin; V _{CC} = 0 V; V _{SW} or V _I = 0 V to 5.5 V	-	-	-	-	±1	µA
I _{S(OFF)}	OFF-state leakage current	nA; nBn; V _{CC} = 3.6 V; see Fig. 5	-	-	-	-	±1	µA
I _{CC}	supply current	V _I = GND or V _{CC} ; I _O = 0 A; V _{SW} = GND or V _{CC} ; V _{CC} = 3.6 V	-	0.4	-	-	0.6	mA
ΔI _{CC}	additional supply current	Sn, $\overline{\text{noE}}$; V _{CC} = 3.6 V; one input at 3 V, other inputs at GND or V _{CC}	-	-	-	-	30	µA
C _I	input capacitance	V _{CC} = 3.3 V; V _{SW} = GND or V _{CC} ; V _I = 0 V, 3.3 V, 5.5 V						
		Sn, $\overline{\text{noE}}$	-	2.5	-	-	3.5	pF
C _{S(OFF)}	OFF-state capacitance	V _{CC} = 3.3 V; V _{SW} = 0 V, 3.3 V, 5.5 V						
		nA	-	8	-	-	11	pF
		nBn	-	3.5	-	-	4.5	pF
C _{S(ON)}	ON-state capacitance	V _{CC} = 3.3 V; V _{SW} = 0 V, 3.3 V, 5.5 V						
		nA, nBn	-	13	-	-	17	pF

[1] Typical values are measured at V_{CC} = 3.3 V unless otherwise specified.

10.1. Test circuit and graph



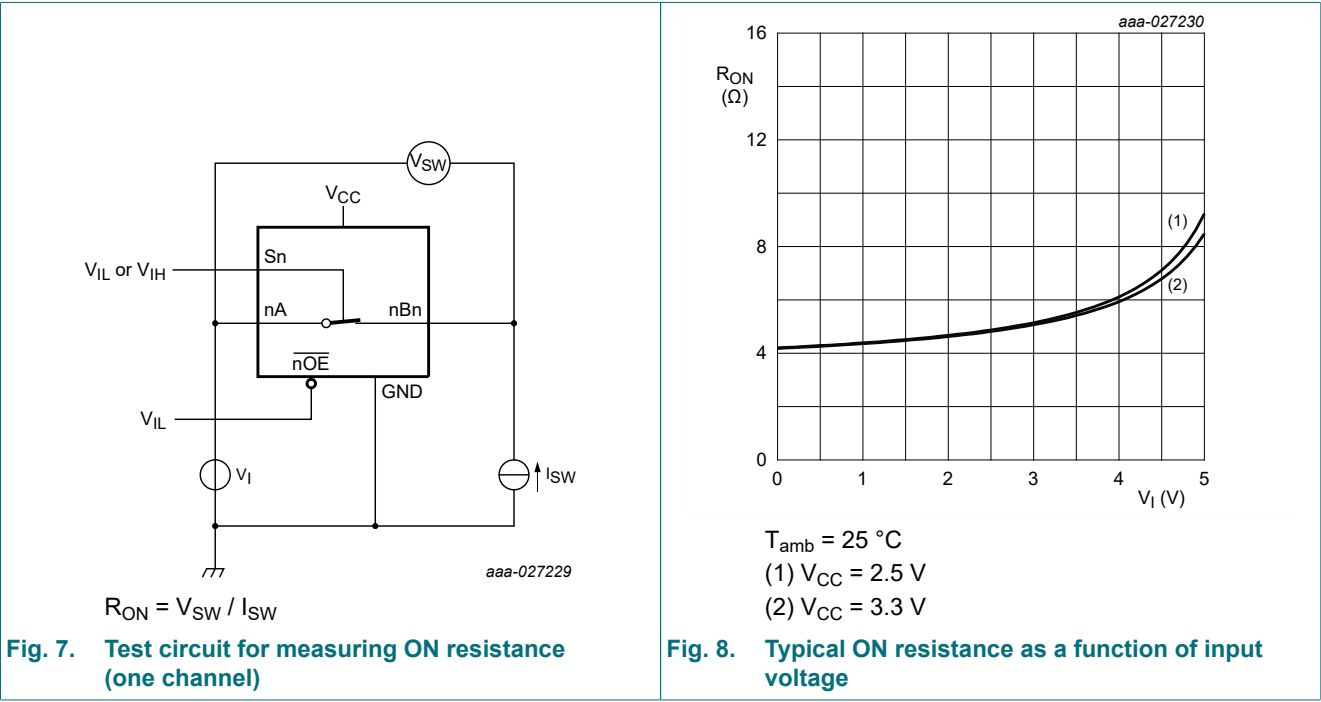
10.2. ON resistance

Table 7. ON resistance
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.

Symbol	Parameter	Conditions	T_amb = 25 °C			T_amb = -40 °C to +85 °C		Unit
			Min	Typ	Max	Min	Max	
R_ON	ON resistance	V_CC = 2.3 V; see Fig. 8						
		V_I = 0 V; I_SW = 30 mA [1]	-	4	-	-	10	Ω
		V_I = 1.7 V; I_SW = -15 mA [1]	-	4.5	-	-	11	Ω
		V_CC = 3.0 V; see Fig. 8						
		V_I = 0 V; I_SW = 30 mA [2]	-	4	-	-	8	Ω
		V_I = 2.4 V; I_SW = -15 mA [2]	-	4.8	-	-	10	Ω

[1] Typical values are measured at V_CC = 2.5 V.
[2] Typical values are measured at V_CC = 3.3 V.

10.3. ON resistance test circuit and graph



11. Dynamic characteristics

Table 8. Dynamic characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit, see Fig. 11.

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C		Unit
			Min	Max	
t _{pd}	propagation delay	nA to nBn or nBn to nA; see Fig. 9 [1] [2]			
		V _{CC} = 2.3 V to 2.7 V	-	0.12	ns
		V _{CC} = 3.0 V to 3.6 V	-	0.2	ns
		Sn to nA; see Fig. 9 [1]			
		V _{CC} = 2.3 V to 2.7 V	1.5	6.7	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	5.9	ns
t _{en}	enable time	$\overline{\text{nOE}}$ to nA, nBn; see Fig. 10 [1]			
		V _{CC} = 2.3 V to 2.7 V	1.5	6.7	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	5.9	ns
		Sn to nBn; see Fig. 10 [1]			
		V _{CC} = 2.3 V to 2.7 V	1.5	6.7	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	5.9	ns
t _{dis}	disable time	$\overline{\text{nOE}}$ to nA, nBn; see Fig. 10 [1]			
		V _{CC} = 2.3 V to 2.7 V	1.0	6.1	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	6.1	ns
		Sn to nBn; see Fig. 10 [1]			
		V _{CC} = 2.3 V to 2.7 V	1.0	6.1	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	6.1	ns
f _{max}	maximum frequency	Sn, $\overline{\text{nOE}}$; V _O > V _{CC} ; V _I = 5 V; R _L ≥ 1 MΩ; C _L = 0 pF			
		V _{CC} = 2.3 V to 2.7 V	-	10	MHz
		V _{CC} = 3.0 V to 3.6 V	-	20	MHz

[1] t_{pd} is the same as t_{PLH} and t_{PHL}.
t_{en} is the same as t_{PZL} and t_{PZH}.
t_{dis} is the same as t_{PLZ} and t_{PHZ}.

[2] The propagation delay is the calculated RC time constant of the typical ON resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).

11.1. Waveforms and test circuit

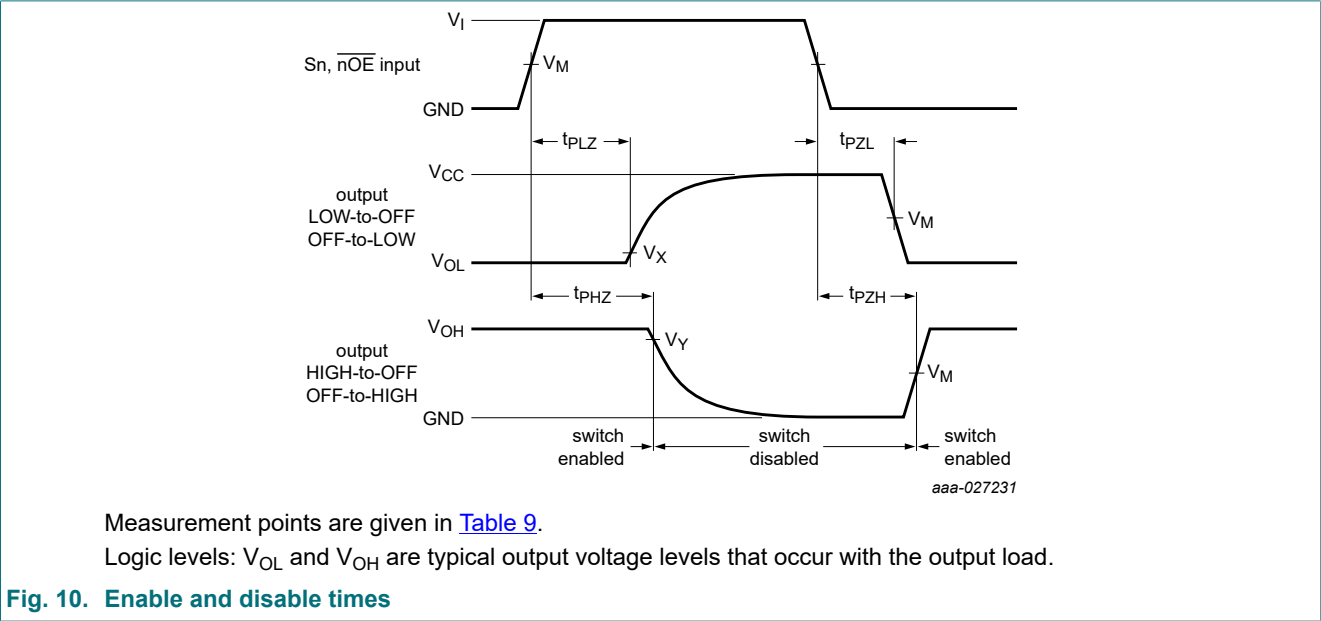
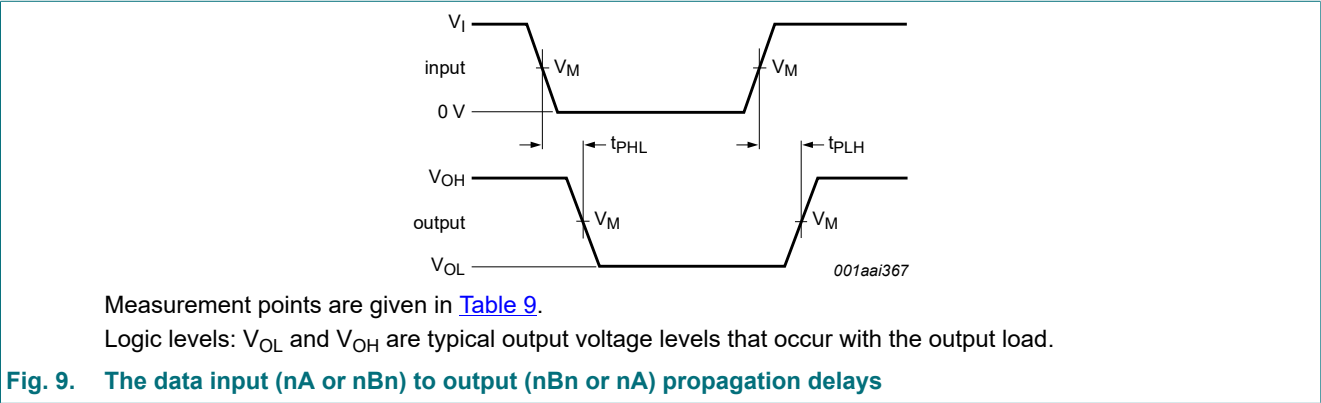
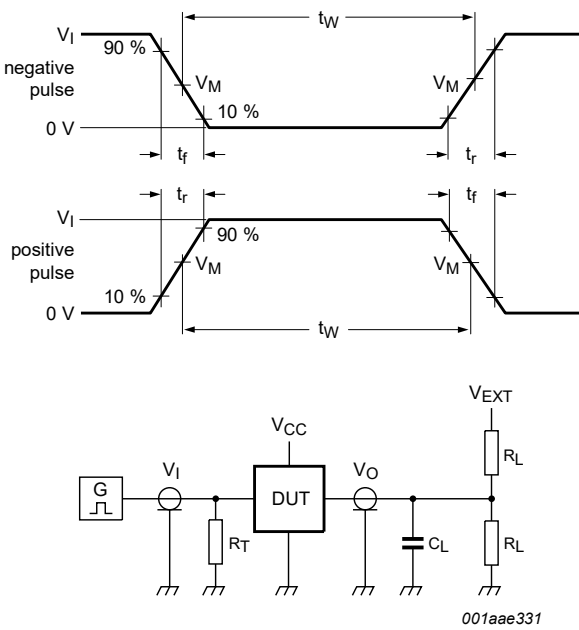


Table 9. Measurement points

Supply voltage	Input	Output		
V_{CC}	V_M	V_M	V_X	V_Y
2.3 V to 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15\text{ V}$	$V_{OH} - 0.15\text{ V}$
3.0 V to 3.6 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$



Test data is given in [Table 10](#).
Definitions for test circuit:
 R_L = Load resistance.
 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.
 V_{EXT} = External voltage for measuring switching times.

Fig. 11. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Input		Load		V _{EXT}		
V _{CC}	V _I	t _r , t _f	C _L	R _L	t _{PLH} , t _{PHL}	t _{PLZ} , t _{PZL}	t _{PZH} , t _{PHZ}
2.3 V to 2.7 V	V _{CC}	≤ 2.5 ns	30 pF	500 Ω	open	2 × V _{CC}	GND
3.0 V to 3.6 V	V _{CC}	≤ 2.5 ns	50 pF	500 Ω	open	2 × V _{CC}	GND

12. Package outline

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm

SOT403-1

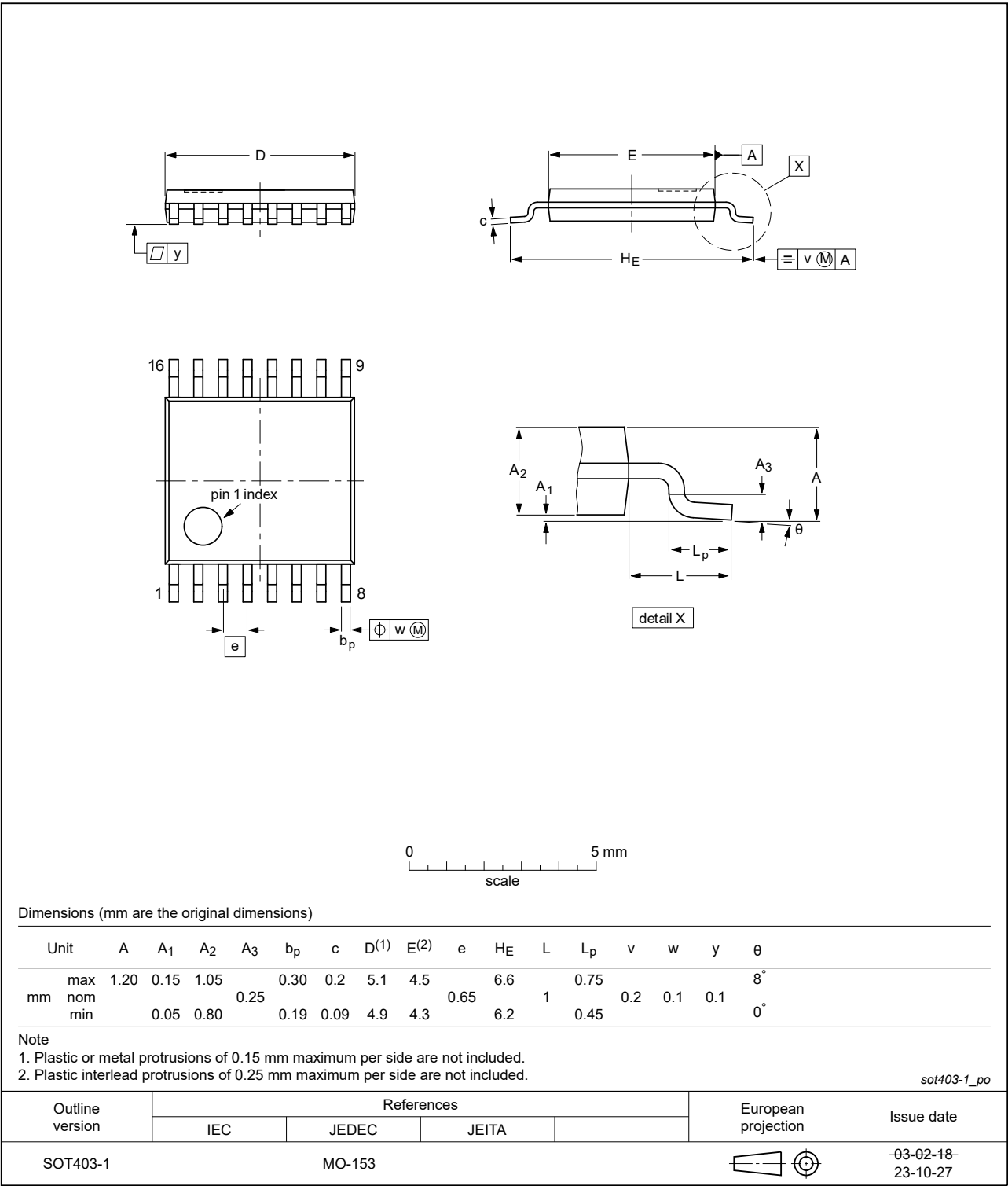


Fig. 12. Package outline SOT403-1 (TSSOP16)

DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 x 3.5 x 0.85 mm

SOT763-1



Fig. 13. Package outline SOT763-1 (DHVQFN16)

13. Abbreviations

Table 11. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
FET	Field-Effect Transistor
HBM	Human Body Model
NMOS	N-channel Metal-Oxide Semiconductor

14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74CB3Q3253 v.3	20240411	Product data sheet	-	74CB3Q3253 v.2
Modifications:	Fig. 12: Aligned TSSOP package outline drawing to JEDEC MO-153. Section 2: ESD specification updated according to the latest JEDEC standard.			
74CB3Q3253 v.2	20210628	Product data sheet	-	74CB3Q3253 v.1
Modifications:	Fig. 1: Logic symbol corrected. Section 8: Derating values for P_{tot} total power dissipation updated.			
74CB3Q3253 v.1	20170814	Product data sheet	-	-

15. 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.

- [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 <https://www.nexperia.com>.

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.

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.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

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.

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. Applications..... 1

4. Ordering information.....2

5. Functional diagram.....2

6. Pinning information.....3

6.1. Pinning.....3

6.2. Pin description..... 3

7. Functional description..... 4

8. Limiting values..... 4

9. Recommended operating conditions.....4

10. Static characteristics.....5

10.1. Test circuit and graph..... 6

10.2. ON resistance..... 7

10.3. ON resistance test circuit and graph..... 7

11. Dynamic characteristics.....8

11.1. Waveforms and test circuit..... 9

12. Package outline..... 11

13. Abbreviations..... 13

14. Revision history.....13

15. Legal information.....14

© Nexperia B.V. 2024. All rights reserved

For more information, please visit: <http://www.nexperia.com>

For sales office addresses, please send an email to: salesaddresses@nexperia.com

Date of release: 11 April 2024