

# 74CB3Q3253

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

Rev. 2 — 28 June 2021

Product data sheet

## 1. General description

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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 ( $\bar{n}OE$ ). The switch is disabled when the  $\bar{n}OE$  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

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- 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  $\Omega$  (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-001-2012 Class 2 exceeds 2 kV
  - CDM JESD22-C101F exceeds 1000 V
- Specified from -40 °C to +85 °C

## 3. Applications

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

### 4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
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

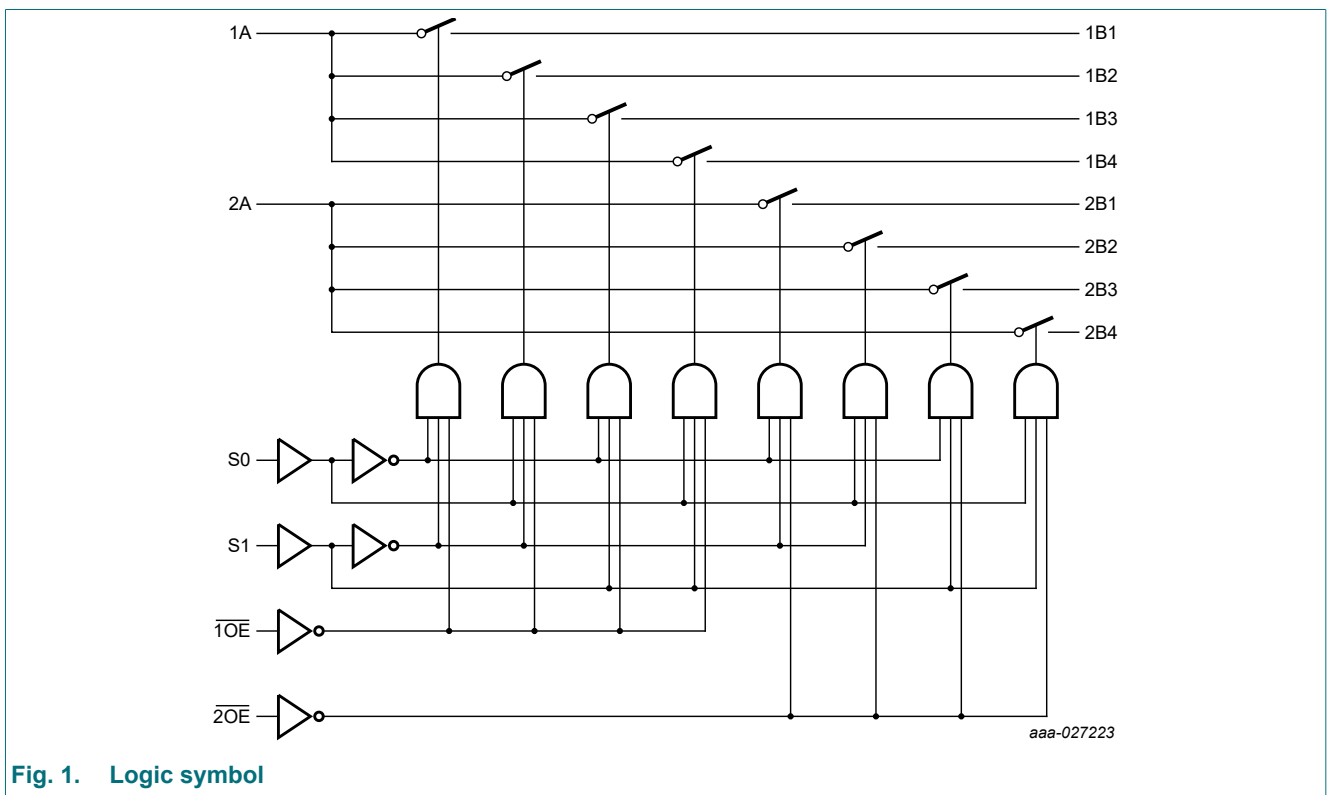


Fig. 1. Logic symbol

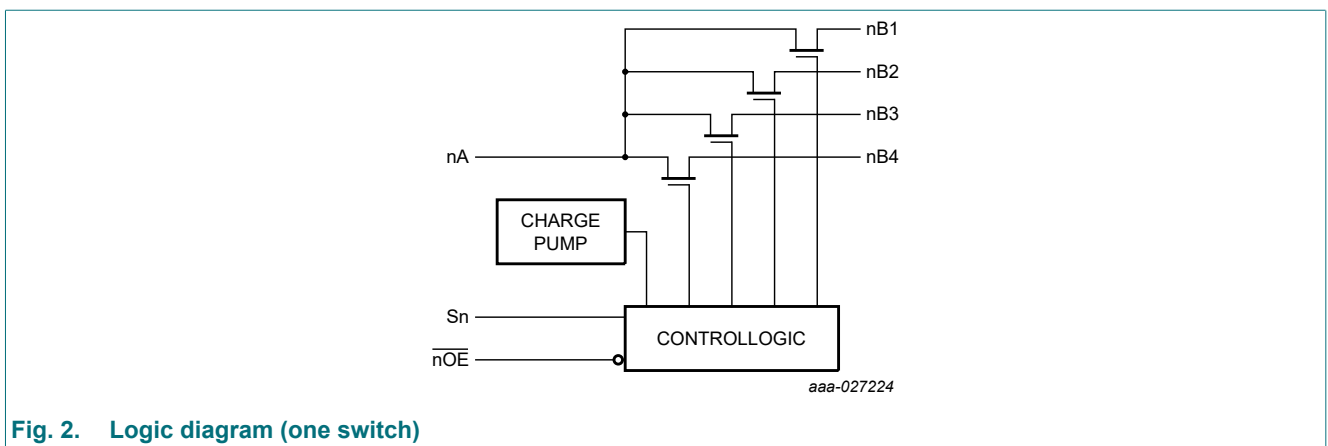


Fig. 2. Logic diagram (one switch)

## 6. Pinning information

### 6.1. Pinning

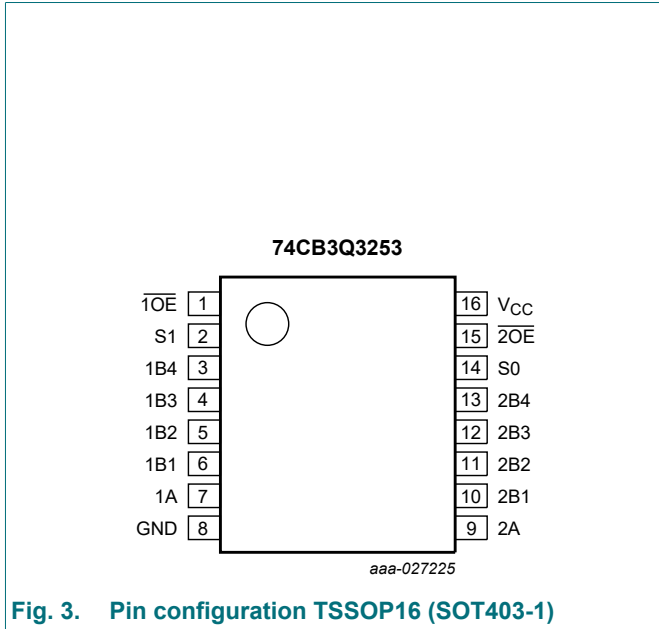


Fig. 3. Pin configuration TSSOP16 (SOT403-1)

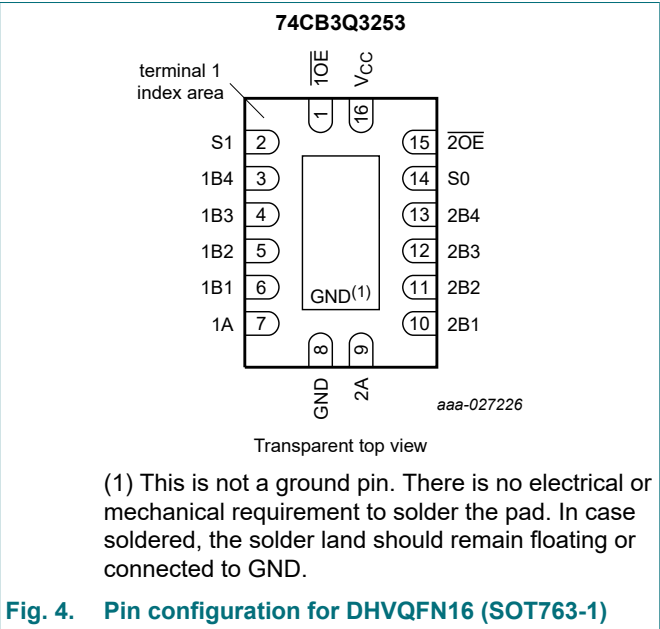


Fig. 4. Pin configuration for DHVQFN16 (SOT763-1)

### 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 <sub>CC</sub>	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 <sub>CC</sub>	supply voltage		-0.5	+4.6	V
V <sub>I</sub>	input voltage	S <sub>n</sub> , nOE input [1]	-0.5	+7.0	V
V <sub>SW</sub>	switch voltage	[2]	-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V	-50	-	mA
I <sub>SK</sub>	switch clamping current	V <sub>I</sub> < -0.5 V	-50	-	mA
I <sub>SW</sub>	switch current		-	±120	mA
I <sub>CC</sub>	supply current		-	+100	mA
I <sub>GND</sub>	ground current		-100	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -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<sub>tot</sub> derates linearly with 8.5 mW/K above 91 °C.

For SOT763-1 (DHVQFN16) package: P<sub>tot</sub> 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 <sub>CC</sub>	supply voltage		2.3	3.6	V
V <sub>I</sub>	input voltage	S <sub>n</sub> , nOE input	0	5.5	V
V <sub>SW</sub>	switch voltage		0	5.5	V
T <sub>amb</sub>	ambient temperature		-40	+85	°C
Δt/ΔV	input transition rise and fall rate	S <sub>n</sub> , nOE input			
		V <sub>CC</sub> = 2.3 V to 2.7 V	0	20	ns/V
		V <sub>CC</sub> = 2.7 V to 3.6 V	0	10	ns/V

## 10. Static characteristics

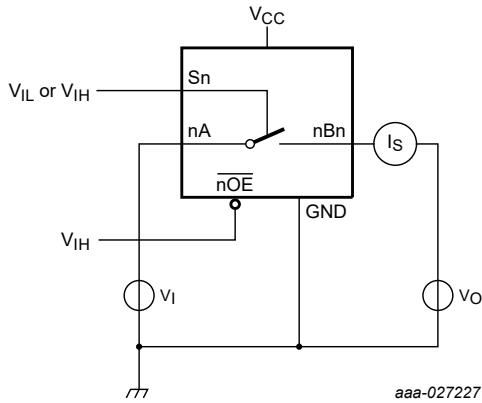
**Table 6. Static characteristics**

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

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

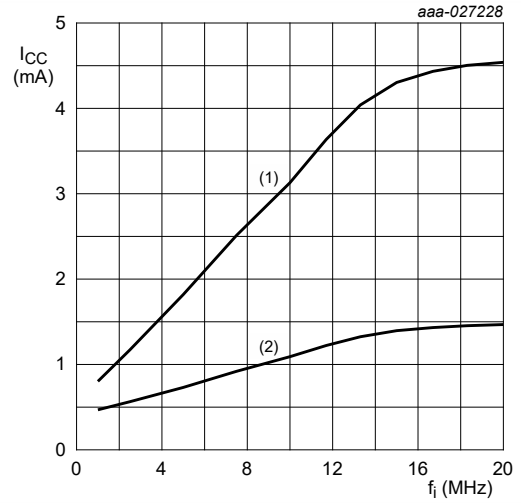
[1] Typical values are measured at V<sub>CC</sub> = 3.3 V unless otherwise specified.

10.1. Test circuit and graph



$V_I = 5.5\text{ V or GND}$  and  $V_O = \text{GND or } 5.5\text{ V}$ .

Fig. 5. Test circuit for measuring OFF-state leakage current (one channel)



$T_{\text{amb}} = 25\text{ }^\circ\text{C}$ ;  $V_{\text{CC}} = 3.3\text{ V}$ ; nA and nBn not connected.

- (1) Sn input switching (50% duty cycle)
- (2)  $\overline{\text{nOE}}$  input switching (50% duty cycle)

Fig. 6. Typical supply current as function of (Sn,  $\overline{\text{nOE}}$ ) input frequency

### 10.2. ON resistance

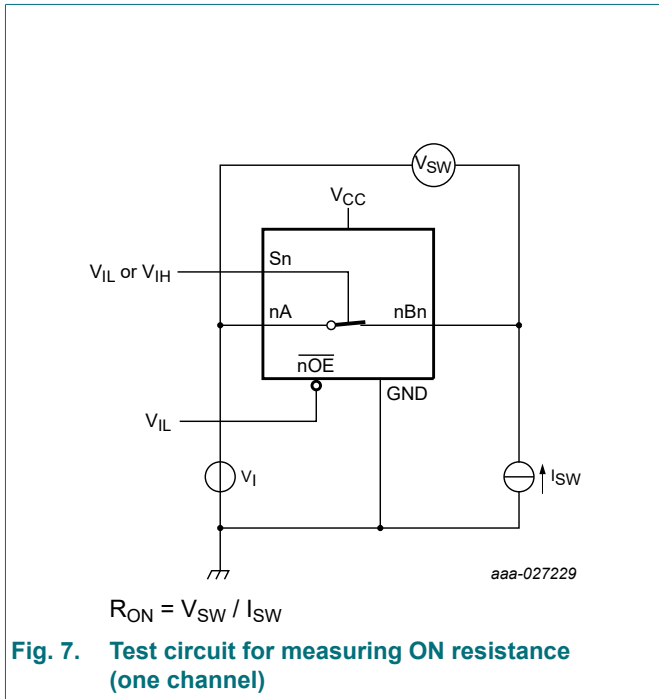
**Table 7. ON resistance**

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

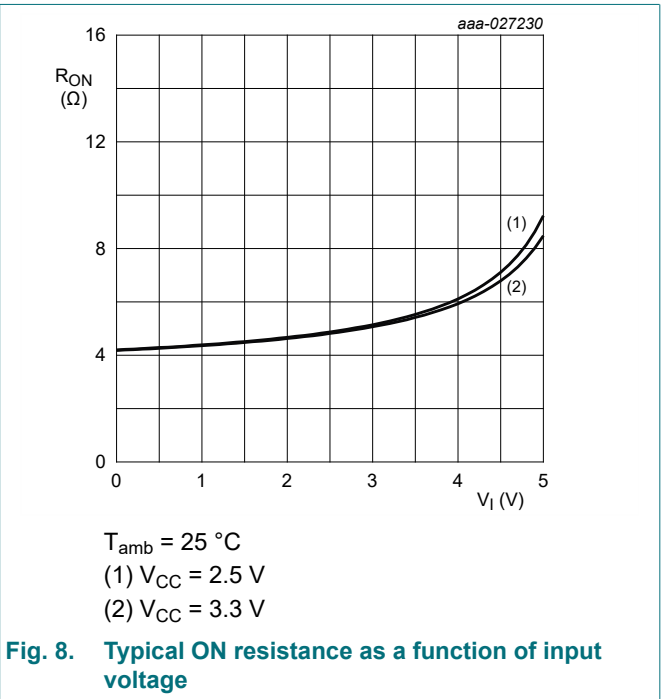
Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +85 °C		Unit
			Min	Typ	Max	Min	Max	
R <sub>ON</sub>	ON resistance	V <sub>CC</sub> = 2.3 V; see Fig. 8						
		V <sub>I</sub> = 0 V; I <sub>SW</sub> = 30 mA [1]	-	4	-	-	10	Ω
		V <sub>I</sub> = 1.7 V; I <sub>SW</sub> = -15 mA [1]	-	4.5	-	-	11	Ω
		V <sub>CC</sub> = 3.0 V; see Fig. 8						
		V <sub>I</sub> = 0 V; I <sub>SW</sub> = 30 mA [2]	-	4	-	-	8	Ω
		V <sub>I</sub> = 2.4 V; I <sub>SW</sub> = -15 mA [2]	-	4.8	-	-	10	Ω

[1] Typical values are measured at V<sub>CC</sub> = 2.5 V.  
 [2] Typical values are measured at V<sub>CC</sub> = 3.3 V.

### 10.3. ON resistance test circuit and graph



**Fig. 7. Test circuit for measuring ON resistance (one channel)**



**Fig. 8. Typical ON resistance as a function of input voltage**

## 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 <sub>amb</sub> = -40 °C to +85 °C		Unit
			Min	Max	
t <sub>pd</sub>	propagation delay	nA to nBn or nBn to nA; see Fig. 9 [1] [2]			
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	0.12	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	0.2	ns
		Sn to nA; see Fig. 9 [1]			
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	6.7	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.5	5.9	ns
t <sub>en</sub>	enable time	nOE to nA, nBn; see Fig. 10 [1]			
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	6.7	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.5	5.9	ns
		Sn to nBn; see Fig. 10 [1]			
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	6.7	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.5	5.9	ns
t <sub>dis</sub>	disable time	nOE to nA, nBn; see Fig. 10 [1]			
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	6.1	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	6.1	ns
		Sn to nBn; see Fig. 10 [1]			
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	6.1	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	6.1	ns
f <sub>max</sub>	maximum frequency	Sn, nOE; V <sub>O</sub> > V <sub>CC</sub> ; V <sub>I</sub> = 5 V; R <sub>L</sub> ≥ 1 MΩ; C <sub>L</sub> = 0 pF			
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	10	MHz
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	20	MHz

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

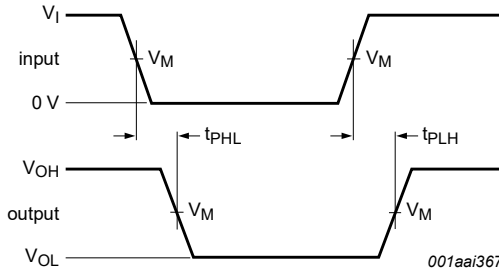
t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>.

t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.

[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).



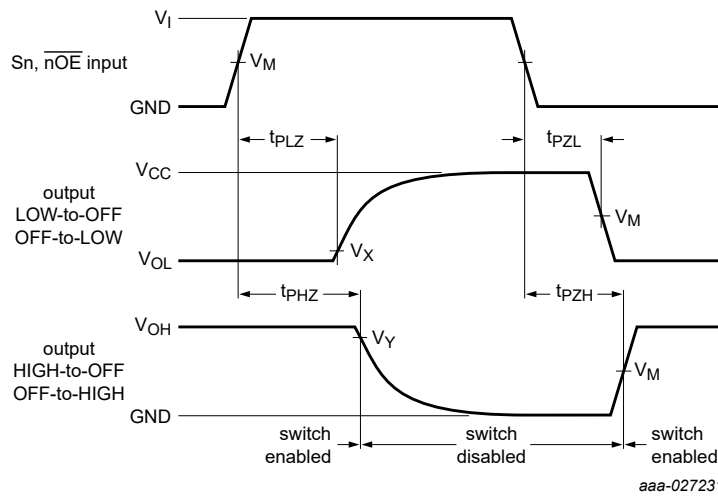
11.1. Waveforms and test circuit



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. 9. The data input (nA or nBn) to output (nBn or nA) propagation delays



Measurement points are given in [Table 9](#).

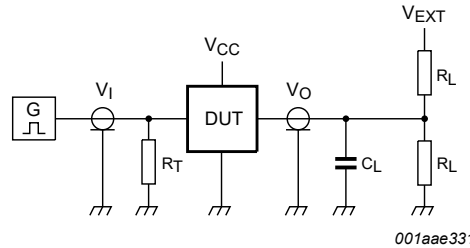
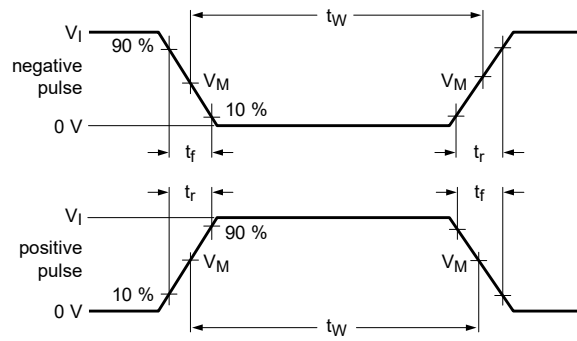
Logic levels:  $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

Fig. 10. Enable and disable times

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	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$

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



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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	$V_{CC}$	$\leq 2.5$ ns	30 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND
3.0 V to 3.6 V	$V_{CC}$	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND

## 12. Package outline

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

SOT403-1

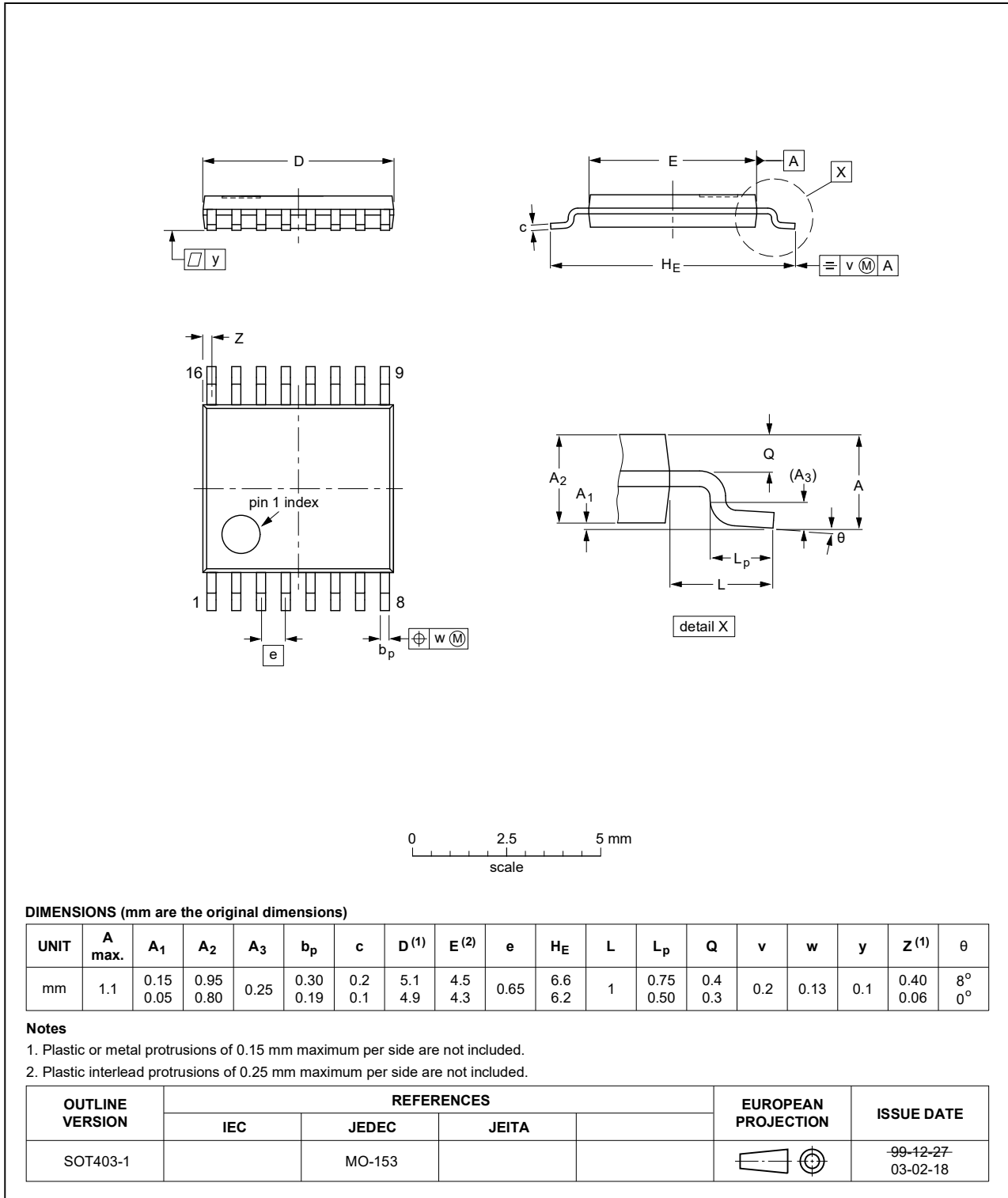


Fig. 12. Package outline SOT403-1 (TSSOP16)

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

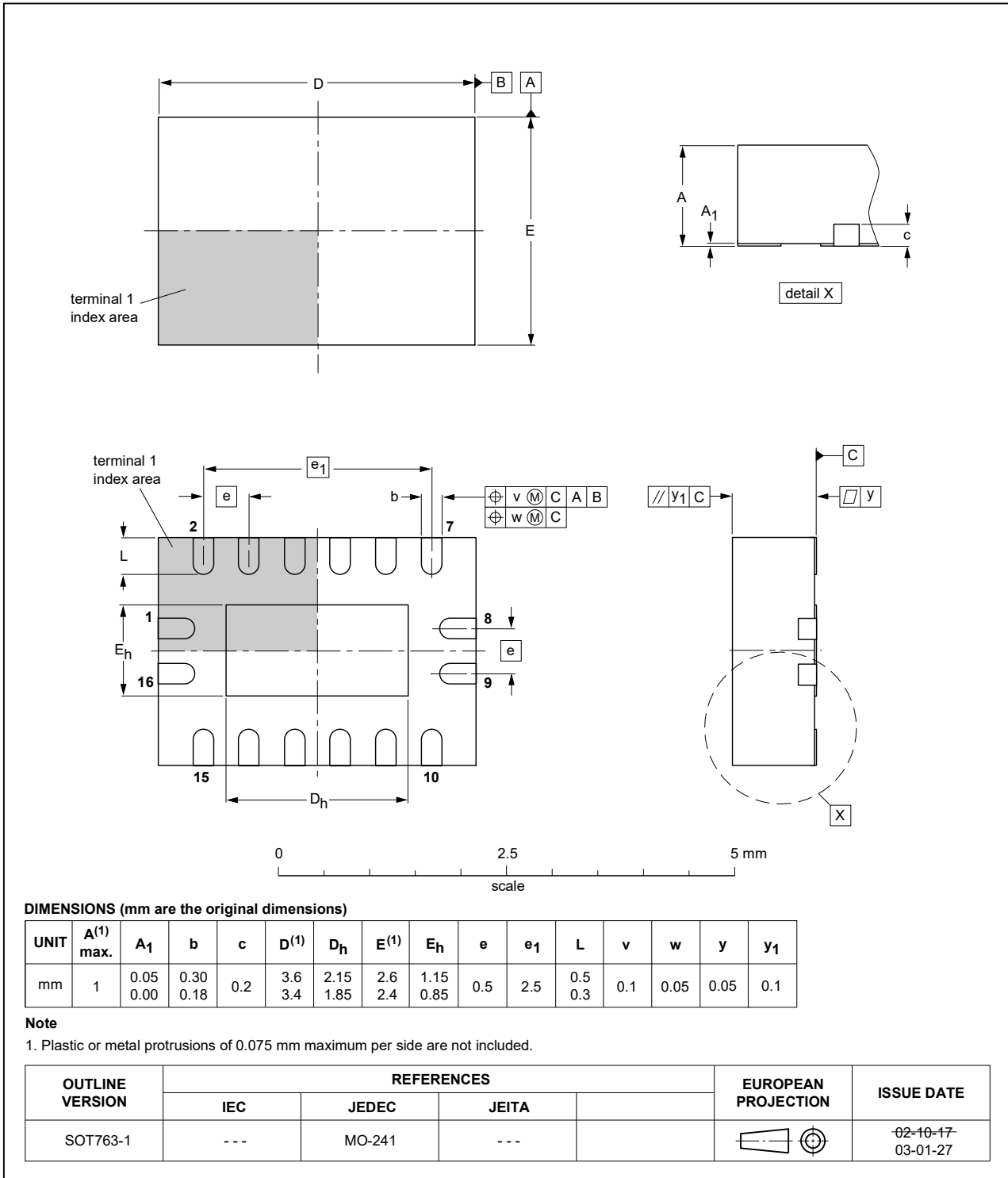


Fig. 13. Package outline SOT763-1 (DHVQFN16)

## 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.2	20210628	Product data sheet	-	74CB3Q3253 v.1
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Fig. 1</a>: Logic symbol corrected.</li> <li><a href="#">Section 8</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul>			
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.
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