

# NXU0204-Q100

## 4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

Rev. 2 — 2 December 2024

Product data sheet

## 1. General description

The NXU0204-Q100 is a 4-bit, dual-supply level translating buffer with Schmitt-trigger inputs and 3-state outputs. It features four data inputs (A1, A2, B3 and B4), four data outputs (YB1, YB2, YA3 and YA4) and an output enable input (OE).

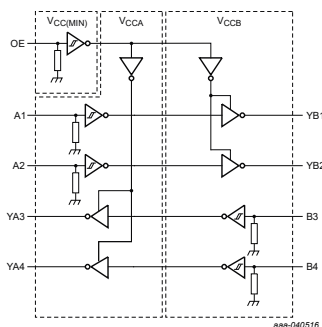
Both  $V_{CCA}$  and  $V_{CCB}$  can be supplied at any voltage between 0.9 V and 5.5 V making the device suitable for translating between any of the voltage nodes (1.2 V, 1.5 V, 1.8 V, 2.5 V, 3.3 V and 5.0 V).

This device facilitates asynchronous communication between data buses. Transmit data with a fixed direction (unidirectionally) from the A bus to the B bus on three channels and from the B bus to the A bus for on one channel. The OE pin can be referenced to  $V_{CCA}$  and  $V_{CCB}$  domain and when OE pin is set LOW the outputs are disabled and enter a high-impedance OFF-state which isolates the buses. The OE pin can be left floating or externally pulled down to ground to ensure the high-impedance state of the outputs during power up or power down.

This device ensures low static and dynamic power consumption across the entire supply range and is fully specified for partial power down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry prevents potentially damaging backflow current through the device when it is powered down or if one of the power supplies is disconnected (floating).

No power supply sequencing is required and output glitches during power supply transitions are prevented. As a result, glitches will not appear on the outputs for supply transitions during power-up/down.

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
- Wide supply voltage range:
  - $V_{CCA}$ : 0.9 V to 5.5 V
  - $V_{CCB}$ : 0.9 V to 5.5 V
- Low power consumption for supply voltage range 1.1 V to 5.5 V
  - 3  $\mu$ A ( $T_{amb} = 25$  °C)
  - 5  $\mu$ A ( $T_{amb} = -40$  °C to +125 °C)
- Schmitt-trigger inputs with integrated static high ohmic pull-down resistor on the input
- Maximum data rates:
  - 250 Mbps ( $\geq 1.8$  V to 5 V translation)
- High output drive 12 mA at 5 V
- Output enable (OE) allows connection to  $V_{CCA}$  or  $V_{CCB}$  domain
- Suspend mode when either one of the supply voltages is below 100 mV or disconnected (floating)
- Low noise overshoot and undershoot <10% of  $V_{CCO}$
- $I_{OFF}$  circuitry provides partial power-down mode operation
- Latch-up performance exceeds 100 mA per JESD78D Class II
- Complies with JEDEC standard:
  - JESD8-12 (0.9 V to 1.3 V)
  - JESD8-11 (1.4 V to 1.6 V)
  - JESD8-7 (1.65 V to 1.95 V)
  - JESD8-5 (2.3 V to 2.7 V)
  - JESD8C (2.7 V to 3.6 V)
  - JESD12-6 (4.5 V to 5.5 V)
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2500 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1500 V
- Similar functions: NXU0104-Q100 and NXU0304-Q100
- DHVQFN package with Side-Wettable Flanks enabling Automated Optical Inspection (AOI) of solder joints

### 3. Applications

- General purpose I/O level translation
- Noisy environments or slow input signals
- Supports push-pull voltage translation as UART, SPI and JTAG protocols
- Consumer

### 4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
<a href="#">NXU0204PW-Q100</a>	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	<a href="#">SOT402-1</a>
<a href="#">NXU0204BQ-Q100</a>	-40 °C to +125 °C	DHVQFN14	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 × 3 × 0.85 mm	<a href="#">SOT762-1</a>
<a href="#">NXU0204GU12-Q100</a>	-40 °C to +125 °C	XQFN12	plastic, extremely thin quad flat package; no leads; 12 terminals; body 1.70 × 2.0 × 0.50 mm	<a href="#">SOT1174-1</a>

### 5. Marking

Table 2. Marking

Type number	Marking code <sup>[1]</sup>
NXU0204PW-Q100	NXU0204
NXU0204BQ-Q100	U0204
NXU0204GU12-Q100	L5

[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

## 6. Functional diagram

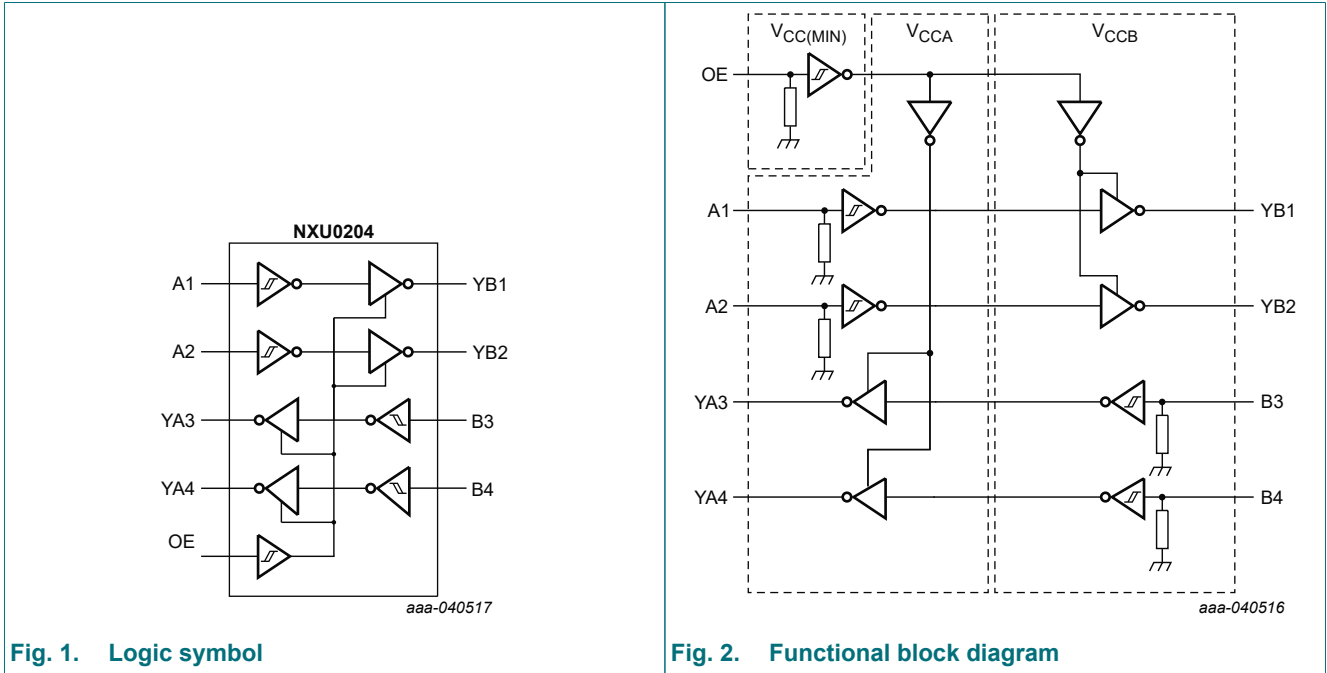
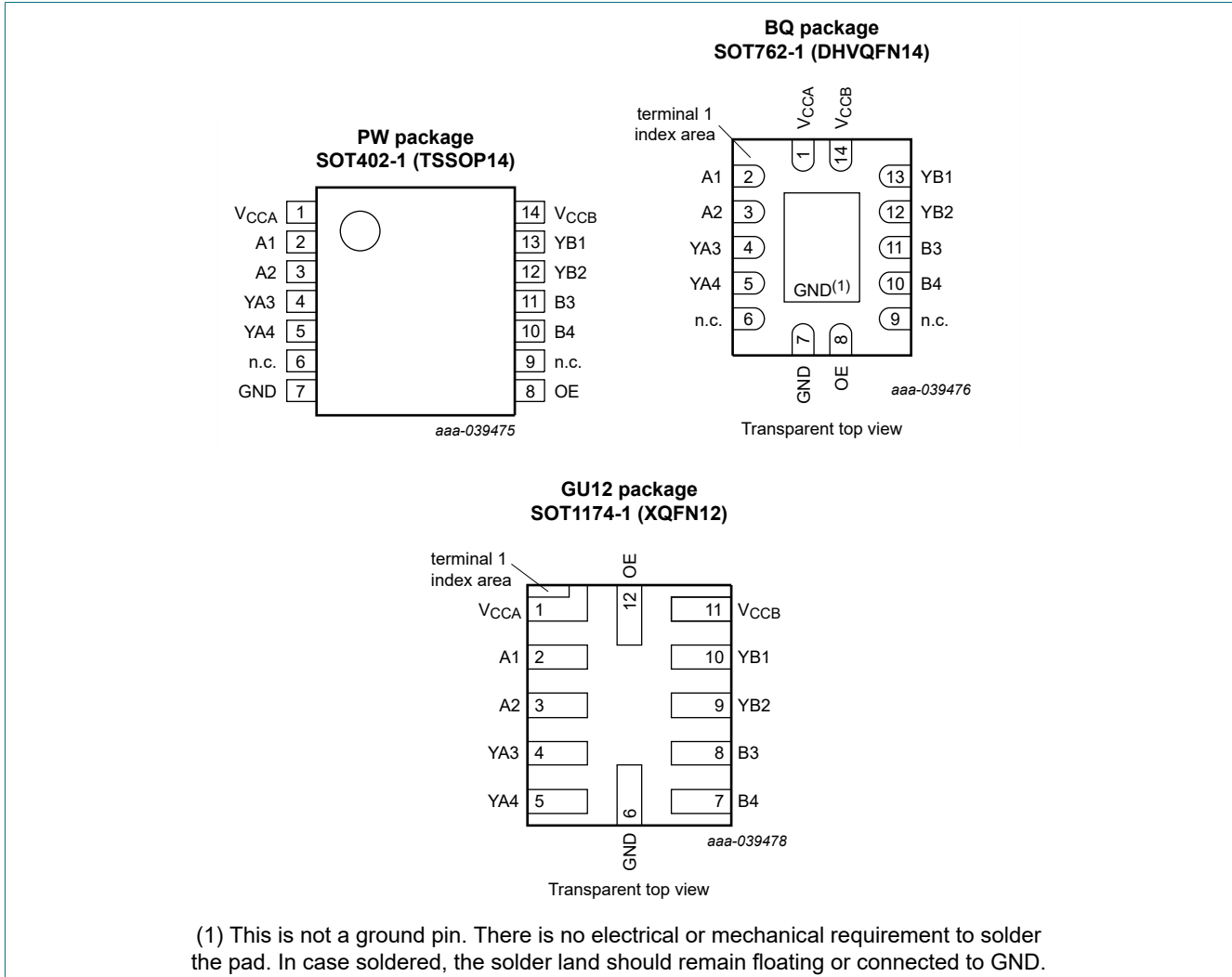


Fig. 1. Logic symbol

Fig. 2. Functional block diagram

## 7. Pinning information

### 7.1. Pinning



### 7.2. Pin description

Table 3. Pin description

Symbol	Pin		I/O	Description
	SOT402-1, SOT762-1	SOT1174-1		
V <sub>CCA</sub>	1	1	-	supply voltage A-side (A1, A2, YA3, YA4)
A1, A2, B3, B4	2, 3, 11, 10	2, 3, 8, 7	I	data inputs A-side and referenced to V <sub>CCA</sub> data input B-side and referenced to V <sub>CCB</sub>
n.c.	6, 9	-	-	not connected
GND	7	6	-	ground (0 V)
YB1, YB2, YA3, YA4	13, 12, 4, 5	10, 9, 4, 5	O	data outputs B-side and referenced to V <sub>CCB</sub> data output A-side and referenced to V <sub>CCA</sub>
OE	8	12	I	output enable input (active HIGH)
V <sub>CCB</sub>	14	11	-	supply voltage B-side (YB1, YB2, B3, B4)

## 8. Functional description

**Table 4. Function table**

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

Supply voltage	Input	Input	Output
$V_{CCA}$ , $V_{CCB}$	OE	An, Bn	YBn, YAn
0.9 V to 5.5 V	H	L	L
0.9 V to 5.5 V	H	H	H
0.9 V to 5.5 V	L	X	Z
GND [1]	X	X	Z
Floating [2]	X	X	Z

[1] If either  $V_{CCA}$  or  $V_{CCB}$  is below 100 mV or GND, the device goes into suspend mode (Hi-Z).

[2] If either  $V_{CCA}$  or  $V_{CCB}$  disconnected (floating), the device goes into suspend mode (Hi-Z).

### 8.1. Overview

The NXU0204-Q100 is a 4-bit, dual-supply level translating buffer with Schmitt-trigger inputs and 3-state outputs. It features four data inputs (A1, A2, B3 and B4), four data outputs (YB1, YB2, YA3 and YA4), and an output enable input (OE). Both  $V_{CCA}$  and  $V_{CCB}$  can be supplied at any voltage between 0.9 V and 5.5 V.

### 8.2. Inputs

The inputs have integrated pull-down resistors of 6.5 MΩ (typical) which prevent an undefined state at the Schmitt-trigger input and the output. If an external pull-up is required, it should be no larger than 1 MΩ to avoid contention with the 6.5 MΩ internal pull-down.

Additionally, each input is provided with a through Schmitt-trigger which makes this device tolerant for slow and noisy input signals. Prolonged input slopes at a slow rate may lead to increased dynamic current consumption.

The output-enable input (OE) can be referenced to V<sub>CCA</sub> and V<sub>CCB</sub> domain by making use of the developed V<sub>CC(MIN)</sub> circuitry. When the OE pin is set LOW, the output is disabled and enters high-impedance OFF-state which isolates the output. The OE pin can be left floating or externally pulled down to ground to ensure outputs remain in the high-impedance state during power up or power down.

The input signals can be safely driven above the supply voltage, as long as the maximum input voltage value specified in the Recommended Operating Conditions is not exceeded.

### Input transfer characteristics

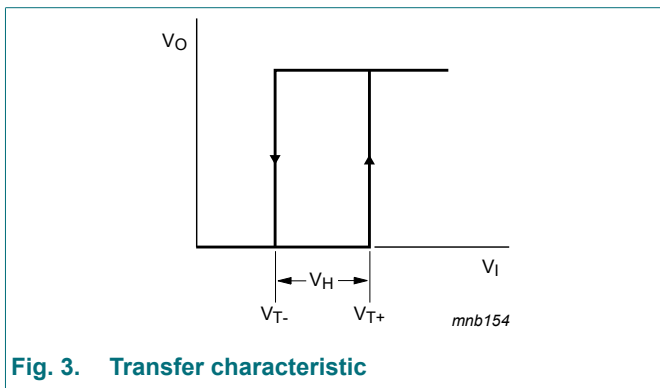


Fig. 3. Transfer characteristic

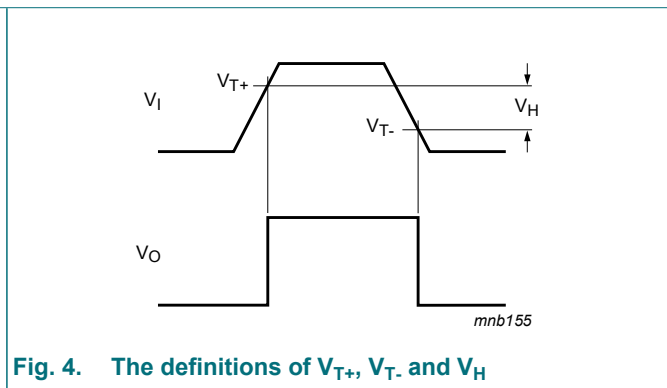


Fig. 4. The definitions of V<sub>T+</sub>, V<sub>T-</sub> and V<sub>H</sub>

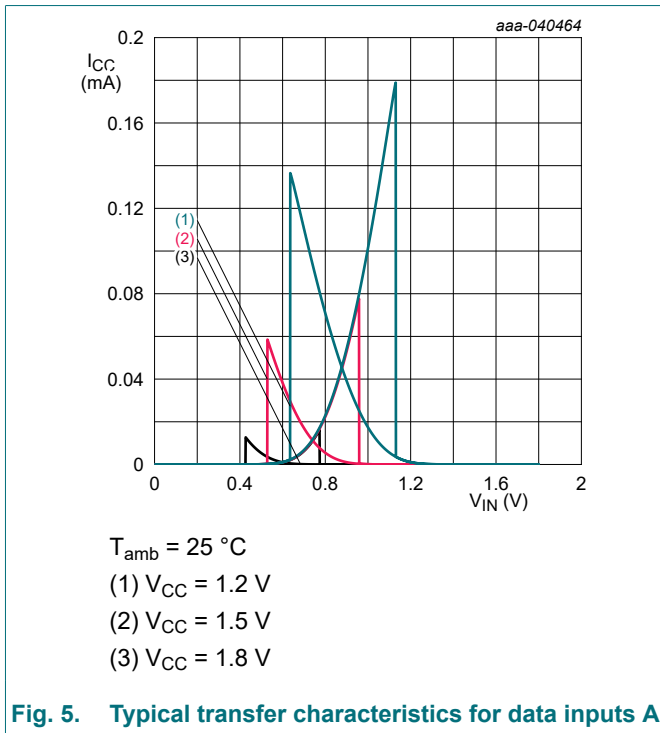
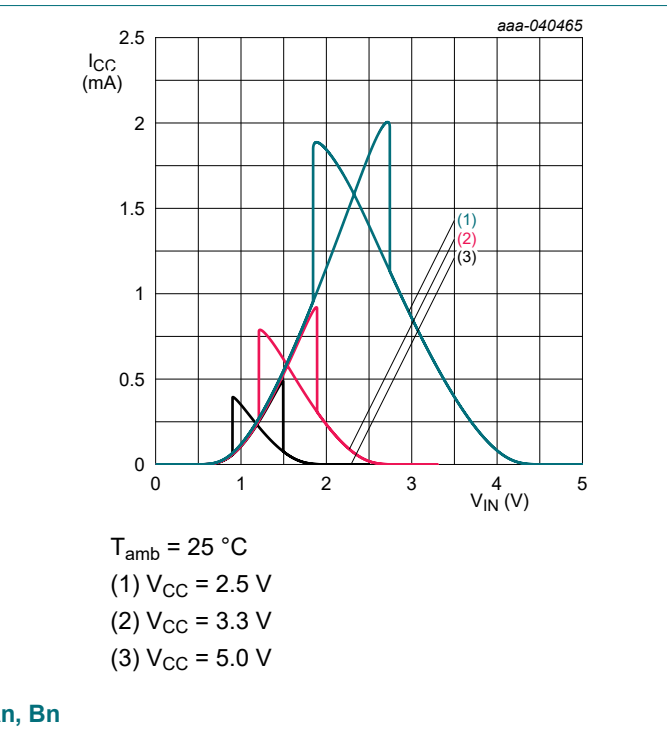


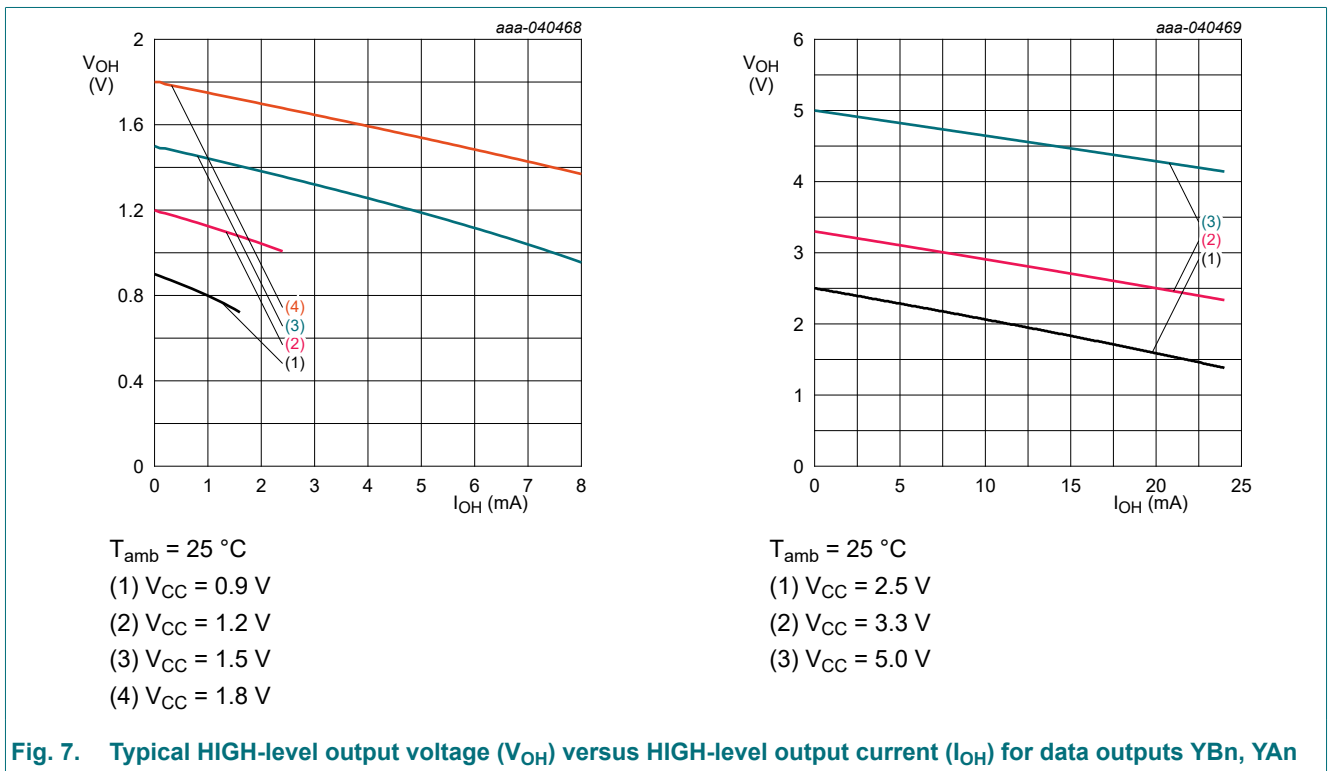
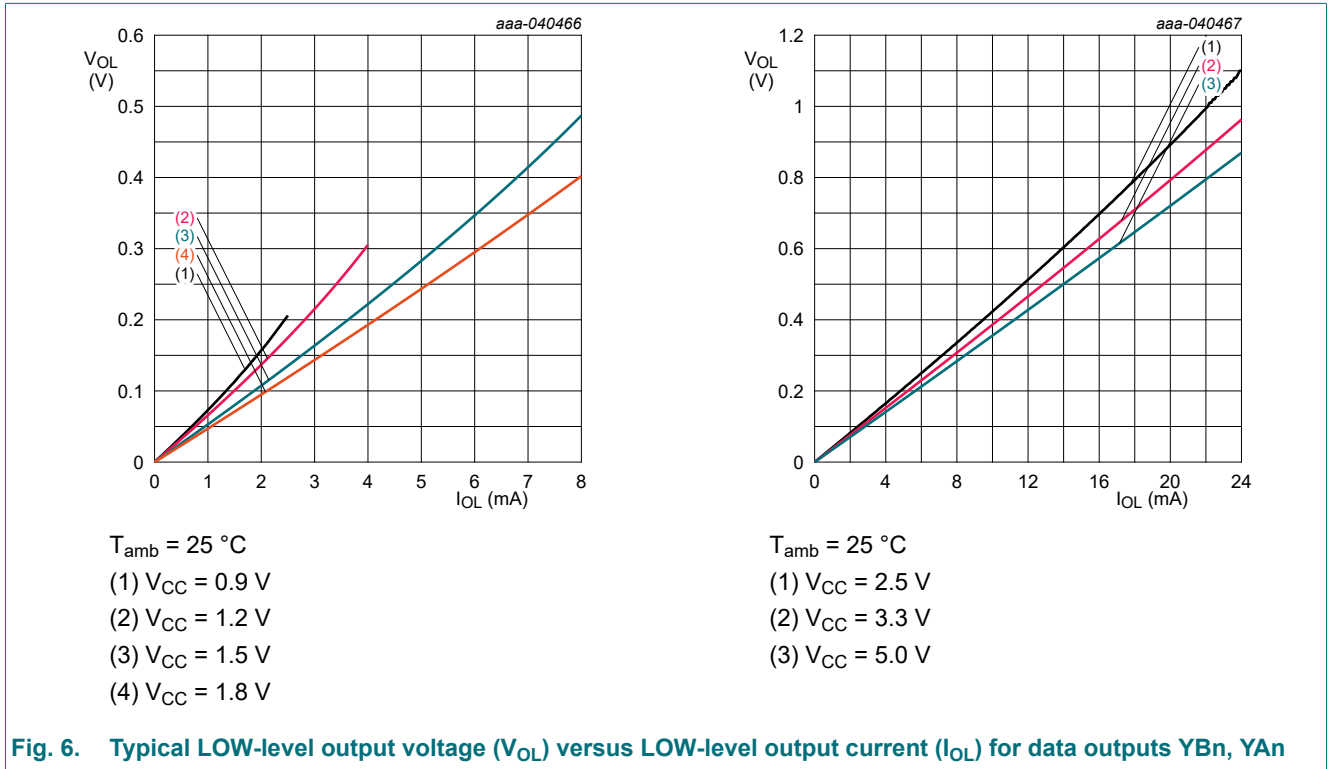
Fig. 5. Typical transfer characteristics for data inputs An, Bn



### 8.3. Outputs

Balanced output enables the device to both sink and source similar currents. The high drive capability of this device creates fast edges and capable of driving larger currents.

#### Output transfer characteristics



### 8.4. Suspend mode and I<sub>OFF</sub> protection circuitry

When either V<sub>CCA</sub> or V<sub>CCB</sub> drops below 100 mV or becomes disconnected (floating) the product enters suspend mode (Hi-Z). All outputs are disabled and in transition to a high-impedance OFF-state. The I<sub>OFF</sub> circuitry prevents potentially damaging backflow current through the device when it is powered down or if one of the power supplies is disconnected (floating). It is advisable to keep the inputs in low state before disconnecting (floating) either supply.

Below a graphical explanation:

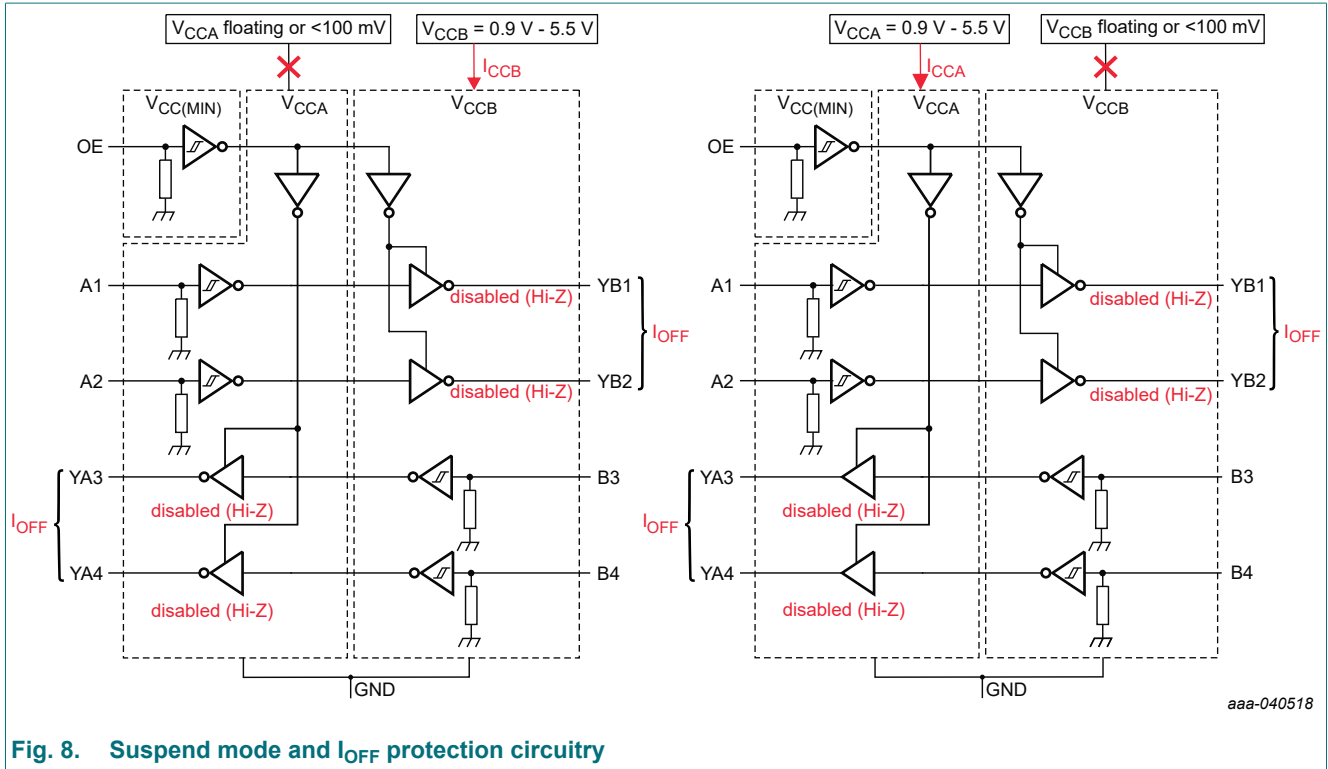


Fig. 8. Suspend mode and I<sub>OFF</sub> protection circuitry

## 9. Limiting values

Table 5. 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>CCA</sub>	supply voltage A		-0.5	+6.5	V
V <sub>CCB</sub>	supply voltage B		-0.5	+6.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-50	-	mA
V <sub>I</sub>	input voltage	[1]	-0.5	+6.5	V
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < 0 V	-50	-	mA
V <sub>O</sub>	output voltage	Active mode	[1][2][3]	V <sub>CCO</sub> + 0.5	V
		Suspend or 3-state mode	[1]	+6.5	V
I <sub>O</sub>	output current	V <sub>O</sub> = 0 V to V <sub>CCO</sub>	[2]	±25	mA
I <sub>CC</sub>	supply current	I <sub>CCA</sub> or I <sub>CCB</sub> ; per V <sub>CC</sub> pin	-	100	mA
I <sub>GND</sub>	ground current	per GND pin	-100	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C



## 4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

Symbol	Parameter	Conditions	Min	Max	Unit
P <sub>tot</sub>	total power dissipation	SOT402-1 (TSSOP14) [4]	-	500	mW
		SOT762-1 (DHVQFN14)			
		SOT1174-1 (XQFN12) [5]	-	250	mW

[1] The minimum input voltage ratings and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] V<sub>CCO</sub> is the supply voltage associated with the outputs (YBn, YAn).

[3] V<sub>CCO</sub> + 0.5 V should not exceed 6.5 V.

[4] For SOT402-1 (TSSOP14) package: P<sub>tot</sub> derates linearly with 7.3 mW/K above 81 °C.

For SOT762-1 (DHVQFN14) package: P<sub>tot</sub> derates linearly with 9.6 mW/K above 98 °C.

[5] For SOT1174-1 (XQFN12) package: P<sub>tot</sub> derates linearly with 5.6 mW/K above 105 °C.

## 10. ESD ratings

Table 6. ESD ratings

Symbol	Parameter	Conditions	Value	Unit
V <sub>ESD</sub>	electrostatic discharge voltage	HBM: ANSI/ESDA/JEDEC JS-001 class 2	± 2500	V
		CDM: ANSI/ESDA/JEDEC JS-002 class C3	± 1500	V

## 11. Recommended operating conditions

Table 7. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CCA</sub>	supply voltage A		0.9	5.5	V
V <sub>CCB</sub>	supply voltage B		0.9	5.5	V
V <sub>I</sub>	input voltage		0	5.5	V
V <sub>O</sub>	output voltage	Active mode [1]	0	V <sub>CCO</sub>	V
		Suspend or 3-state mode	0	5.5	V
T <sub>amb</sub>	ambient temperature		-40	+125	°C

[1] V<sub>CCO</sub> is the supply voltage associated with the outputs (YBn, YAn).

## 12. Thermal characteristics

Table 8. Thermal characteristics

Symbol	Parameter	Condition	SOT402-1	SOT762-1	SOT1174-1	Unit
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air; JEDEC test board	134	98	172	°C/W
R <sub>th(j-c)</sub>	thermal resistance from case (top) of package	in free air; JEDEC test board	59	65	82	°C/W
Ψ <sub>j-top</sub>	thermal characterization parameter from junction to top of package	in free air; JEDEC test board	5.4	14	3.3	°C/W

### 13. Static characteristics

**Table 9. Static characteristics**

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

Symbol	Parameter	Conditions	+25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit	
			Min	Typ	Max	Min	Max	Min	Max		
V <sub>T+</sub>	positive-going threshold voltage	A1, A2, B3, B4 inputs									
		V <sub>CCA</sub> = V <sub>CCB</sub> = 0.9 V	-	0.58	-	-	-	-	-	V	
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.1 V	-	0.71	-	0.44	0.88	0.44	0.88	V	
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.4 V	-	0.89	-	0.60	0.98	0.60	0.98	V	
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.65 V	-	1.05	-	0.76	1.13	0.76	1.13	V	
		V <sub>CCA</sub> = V <sub>CCB</sub> = 2.3 V	-	1.39	-	1.08	1.56	1.08	1.56	V	
		V <sub>CCA</sub> = V <sub>CCB</sub> = 3.0 V	-	1.75	-	1.48	1.92	1.48	1.92	V	
		V <sub>CCA</sub> = V <sub>CCB</sub> = 4.5 V	-	2.50	-	2.19	2.74	2.19	2.74	V	
		V <sub>CCA</sub> = V <sub>CCB</sub> = 5.5 V	-	3.02	-	2.65	3.33	2.65	3.33	V	
		OE input (referenced to V <sub>CCA</sub> or V <sub>CCB</sub> )									
		V <sub>CCA</sub> = V <sub>CCB</sub> = 0.9 V	-	0.58	-	-	-	-	-	V	
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.1 V	-	0.70	-	0.44	0.88	0.44	0.88	V	
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.4 V	-	0.89	-	0.60	0.98	0.60	0.98	V	
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.65 V	-	1.04	-	0.76	1.13	0.76	1.13	V	
		V <sub>CCA</sub> = V <sub>CCB</sub> = 2.3 V	-	1.38	-	1.08	1.56	1.08	1.56	V	
		V <sub>CCA</sub> = V <sub>CCB</sub> = 3.0 V	-	1.74	-	1.48	1.92	1.48	1.92	V	
		V <sub>CCA</sub> = V <sub>CCB</sub> = 4.5 V	-	2.50	-	2.19	2.74	2.19	2.74	V	
		V <sub>CCA</sub> = V <sub>CCB</sub> = 5.5 V	-	3.03	-	2.65	3.33	2.65	3.33	V	

## 4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

Symbol	Parameter	Conditions	+25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V <sub>T-</sub>	negative-going threshold voltage	A1, A2, B3, B4 inputs								
		V <sub>CCA</sub> = V <sub>CCB</sub> = 0.9 V	-	0.33	-	-	-	-	-	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.1 V	-	0.40	-	0.17	0.48	0.17	0.48	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.4 V	-	0.50	-	0.28	0.59	0.28	0.59	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.65 V	-	0.59	-	0.35	0.69	0.35	0.69	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 2.3 V	-	0.84	-	0.56	0.97	0.56	0.97	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 3.0 V	-	1.12	-	0.89	1.5	0.89	1.5	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 4.5 V	-	1.71	-	1.51	1.97	1.51	1.97	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 5.5 V	-	2.10	-	1.88	2.4	1.88	2.4	V
		OE input (referenced to V <sub>CCA</sub> or V <sub>CCB</sub> )								
		V <sub>CCA</sub> = V <sub>CCB</sub> = 0.9 V	-	0.33	-	-	-	-	-	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.1 V	-	0.41	-	0.17	0.48	0.17	0.48	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.4 V	-	0.51	-	0.28	0.59	0.28	0.59	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.65 V	-	0.59	-	0.35	0.69	0.35	0.69	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 2.3 V	-	0.84	-	0.56	0.97	0.56	0.97	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 3.0 V	-	1.12	-	0.89	1.5	0.89	1.5	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 4.5 V	-	1.69	-	1.51	1.97	1.51	1.97	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 5.5 V	-	2.07	-	1.88	2.46	1.88	2.46	V

## 4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

Symbol	Parameter	Conditions	+25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V <sub>H</sub>	hysteresis voltage	A1, A2, B3, B4 inputs								
		V <sub>CCA</sub> = V <sub>CCB</sub> = 0.9 V	-	0.25	-	-	-	-	-	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.1 V	-	0.31	-	0.2	0.4	0.2	0.4	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.4 V	-	0.39	-	0.25	0.5	0.25	0.5	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.65 V	-	0.46	-	0.3	0.55	0.3	0.55	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 2.3 V	-	0.59	-	0.38	0.65	0.38	0.65	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 3.0 V	-	0.63	-	0.46	0.72	0.46	0.72	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 4.5 V	-	0.79	-	0.58	0.93	0.58	0.93	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 5.5 V	-	0.93	-	0.69	1.06	0.69	1.06	V
		OE input (referenced to V <sub>CCA</sub> or V <sub>CCB</sub> )								
		V <sub>CCA</sub> = V <sub>CCB</sub> = 0.9 V	-	0.25	-	-	-	-	-	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.1 V	-	0.30	-	0.15	0.41	0.15	0.41	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.4 V	-	0.39	-	0.2	0.5	0.2	0.5	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 1.65 V	-	0.44	-	0.23	0.55	0.23	0.55	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 2.3 V	-	0.54	-	0.32	0.65	0.32	0.65	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 3.0 V	-	0.62	-	0.39	0.72	0.39	0.72	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 4.5 V	-	0.81	-	0.57	0.97	0.57	0.97	V
		V <sub>CCA</sub> = V <sub>CCB</sub> = 5.5 V	-	0.96	-	0.69	1.18	0.69	1.18	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>T+(MAX)</sub> [1][2]								
		I <sub>O</sub> = -0.1 mA; V <sub>CCO</sub> = 0.9 V to 5.5 V	V <sub>CCO</sub> - 0.1	0.9	-	V <sub>CCO</sub> - 0.1	-	V <sub>CCO</sub> - 0.1	-	V
		I <sub>O</sub> = -1.5 mA; V <sub>CCO</sub> = 1.1 V	0.825	1.0	-	0.825	-	0.825	-	V
		I <sub>O</sub> = -3 mA; V <sub>CCO</sub> = 1.4 V	1.05	1.2	-	1.05	-	1.05	-	V
		I <sub>O</sub> = -4.5 mA; V <sub>CCO</sub> = 1.65 V	1.2	1.4	-	1.2	-	1.2	-	V
		I <sub>O</sub> = -8 mA; V <sub>CCO</sub> = 2.3 V	1.7	1.94	-	1.7	-	1.7	-	V
		I <sub>O</sub> = -10 mA; V <sub>CCO</sub> = 3.0 V	2.2	2.6	-	2.2	-	2.2	-	V
		I <sub>O</sub> = -12 mA; V <sub>CCO</sub> = 4.5 V	3.7	4.1	-	3.7	-	3.7	-	V

## 4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

Symbol	Parameter	Conditions	+25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>T-(MIN)</sub> [1][2]								
		I <sub>O</sub> = 0.1 mA; V <sub>CCO</sub> = 0.9 V to 5.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 1.5 mA; V <sub>CCO</sub> = 1.1 V	-	0.12	0.275	-	0.275	-	0.275	V
		I <sub>O</sub> = 3 mA; V <sub>CCO</sub> = 1.4 V	-	0.17	0.35	-	0.35	-	0.35	V
		I <sub>O</sub> = 4.5 mA; V <sub>CCO</sub> = 1.65 V	-	0.23	0.45	-	0.45	-	0.45	V
		I <sub>O</sub> = 8 mA; V <sub>CCO</sub> = 2.3 V	-	0.35	0.7	-	0.7	-	0.7	V
		I <sub>O</sub> = 10 mA; V <sub>CCO</sub> = 3.0 V	-	0.39	0.8	-	0.8	-	0.8	V
		I <sub>O</sub> = 8 mA; V <sub>CCO</sub> = 4.5 V	-	0.28	0.5	-	0.5	-	0.5	V
		I <sub>O</sub> = 12 mA; V <sub>CCO</sub> = 4.5 V	-	0.43	0.8	-	0.8	-	0.8	V
I <sub>I</sub>	input leakage current	An, Bn inputs; V <sub>I</sub> = 0 V to 5.5 V; V <sub>CC1</sub> = 0.9 V to 5.5 V [3]	-0.1	1	1.5	-0.1	1.85	-0.1	2	μA
		OE input; V <sub>I</sub> = 0 V to 5.5 V; V <sub>CC1</sub> = 0.9 V to 5.5 V [3]	-0.1	1	1.5	-0.1	1.85	-0.1	2	μA
I <sub>OZ</sub>	OFF-state output current	suspend mode YBn, YAn output; V <sub>O</sub> = 0 V or V <sub>CCO</sub> ; V <sub>CCA</sub> = 5.5 V; V <sub>CCB</sub> = 0 V [1]	-0.1	-	0.1	-0.5	0.5	-2	2	μA
I <sub>OFF</sub>	power-off leakage current	YBn, YAn output; V <sub>I</sub> or V <sub>O</sub> = 0 V to 5.5 V; V <sub>CCA</sub> = 0 V; V <sub>CCB</sub> = 0.9 V to 5.5 V	-1.5	-	1.5	-1.85	1.85	-2	2	μA
		YBn, YAn output; V <sub>I</sub> or V <sub>O</sub> = 0 V to 5.5 V; V <sub>CCB</sub> = 0 V; V <sub>CCA</sub> = 0.9 V to 5.5 V	-1.5	-	1.5	-1.85	1.85	-2	2	μA
		YBn, YAn output; V <sub>I</sub> or V <sub>O</sub> = GND; V <sub>CCA</sub> = floating; V <sub>CCB</sub> = 0.9 V to 5.5 V [4]	-1.5	-	1.5	-1.85	1.85	-2	2	μA
		YBn, YAn output; V <sub>I</sub> or V <sub>O</sub> = GND; V <sub>CCB</sub> = floating; V <sub>CCA</sub> = 0.9 V to 5.5 V [4]	-1.5	-	1.5	-1.85	1.85	-2	2	μA

## 4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

Symbol	Parameter	Conditions	+25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
I <sub>CC</sub>	supply current	I <sub>CCA</sub> ; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; I <sub>O</sub> = 0 A [3]								
		V <sub>CCA</sub> , V <sub>CCB</sub> = 0.9 V to 5.5 V	-	1	1.8	-	2.5	-	3	μA
		V <sub>CCA</sub> = 5.5 V; V <sub>CCB</sub> = 0 V	-	1	1.8	-	2.5	-	3	μA
		V <sub>CCA</sub> = 0 V; V <sub>CCB</sub> = 5.5 V	-0.1	-	0.1	-0.4	0.4	-1	1	μA
		I <sub>CCB</sub> ; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; I <sub>O</sub> = 0 A [3]								
		V <sub>CCA</sub> , V <sub>CCB</sub> = 0.9 V to 5.5 V	-	1	1.8	-	2.5	-	3	μA
		V <sub>CCB</sub> = 5.5 V; V <sub>CCA</sub> = 0 V	-	1	1.8	-	2.5	-	3	μA
		V <sub>CCB</sub> = 0 V; V <sub>CCA</sub> = 5.5 V	-0.1	-	0.1	-0.4	0.4	-1	1	μA
		I <sub>CCA</sub> or I <sub>CCB</sub> ; V <sub>I</sub> or V <sub>O</sub> = GND; I <sub>O</sub> = 0 A								
		I <sub>CCA</sub> ; V <sub>CCB</sub> = floating; V <sub>CCA</sub> = 5.5 V [4]	-	1	1.5	-	2.5	-	3	μA
		I <sub>CCB</sub> ; V <sub>CCA</sub> = floating; V <sub>CCB</sub> = 5.5 V [4]	-	1	1.5	-	2.5	-	3	μA
		I <sub>CCA</sub> + I <sub>CCB</sub> combined; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; I <sub>O</sub> = 0 A; V <sub>CCA</sub> = V <sub>CCB</sub> = 0.9 V to 5.5 V [3]	-	2	3	-	4.5	-	5	μA

[1] V<sub>CCO</sub> is the supply voltage associated with the outputs (YBn, YAn).

[2] Typical values for V<sub>OL</sub> and V<sub>OH</sub> are measured at V<sub>CCO</sub> is 0.9 V.

[3] V<sub>CCI</sub> is the supply voltage associated with the inputs (An, Bn).

[4] Floating is defined, if one of the supply pins is not actively driven externally and has a leakage not exceeding 10 nA

## 4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

Table 10. Typical total supply current  $I_{CCA}$  at  $T_{amb} = 25\text{ °C}$ 

Voltages are referenced to GND (ground = 0 V).

$V_{CCA}$	$V_{CCB}$								Unit
	0 V	0.9 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	5.0 V	
0 V	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	$\mu\text{A}$
0.9 V	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	$\mu\text{A}$
1.2 V	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	$\mu\text{A}$
1.5 V	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	$\mu\text{A}$
1.8 V	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	$\mu\text{A}$
2.5 V	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	$\mu\text{A}$
3.3 V	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	$\mu\text{A}$
5.0 V	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	$\mu\text{A}$

Table 11. Typical total supply current  $I_{CCB}$  at  $T_{amb} = 25\text{ °C}$ 

Voltages are referenced to GND (ground = 0 V).

$V_{CCA}$	$V_{CCB}$								Unit
	0 V	0.9 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	5.0 V	
0 V	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	$\mu\text{A}$
0.9 V	0.01	0.2	0.25	0.3	0.4	0.45	0.5	0.7	$\mu\text{A}$
1.2 V	0.01	0.2	0.25	0.3	0.4	0.45	0.5	0.7	$\mu\text{A}$
1.5 V	0.01	0.2	0.25	0.3	0.4	0.45	0.5	0.7	$\mu\text{A}$
1.8 V	0.01	0.2	0.25	0.3	0.4	0.45	0.5	0.7	$\mu\text{A}$
2.5 V	0.01	0.2	0.25	0.3	0.4	0.45	0.5	0.7	$\mu\text{A}$
3.3 V	0.01	0.2	0.25	0.3	0.4	0.45	0.5	0.7	$\mu\text{A}$
5.0 V	0.01	0.2	0.25	0.3	0.4	0.45	0.5	0.9	$\mu\text{A}$

## 14. Dynamic characteristics

**Table 12. Maximum data rate and output skew**

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 12.

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +125 °C			Unit
			Min	Typ	Max	
f <sub>data</sub>	data rate	50% duty cycle input; one channel switching; 20% of pulse > 0.7xV <sub>CCO</sub> ; 20% of pulse < 0.3xV <sub>CCO</sub> [1]				
		<b>Up translation</b> [1][2]				
		V <sub>CCI</sub> = 3.0 V to 3.6 V; V <sub>CCO</sub> = 4.5 V to 5.5 V	-	350	250	Mbps
		V <sub>CCI</sub> = 1.65 V to 1.95 V; V <sub>CCO</sub> = 4.5 V to 5.5 V	-	350	250	Mbps
		V <sub>CCI</sub> = 1.1 V to 1.3 V; V <sub>CCO</sub> = 4.5 V to 5.5 V	-	220	100	Mbps
		V <sub>CCI</sub> = 1.65 V to 1.95 V; V <sub>CCO</sub> = 3.0 V to 3.6 V	-	230	150	Mbps
		V <sub>CCI</sub> = 1.1 V to 1.3 V; V <sub>CCO</sub> = 3.0 V to 3.6 V	-	300	140	Mbps
		V <sub>CCI</sub> = 1.1 V to 1.3 V; V <sub>CCO</sub> = 1.65 V to 1.95 V	-	100	40	Mbps
		<b>Down translation</b> [1][2]				
		V <sub>CCI</sub> = 4.5 V to 5.5 V; V <sub>CCO</sub> = 3.0 V to 3.6 V	-	250	170	Mbps
		V <sub>CCI</sub> = 4.5 V to 5.5 V; V <sub>CCO</sub> = 1.65 V to 1.95 V	-	150	60	Mbps
		V <sub>CCI</sub> = 4.5 V to 5.5 V; V <sub>CCO</sub> = 1.1 V to 1.3 V	-	80	30	Mbps
		V <sub>CCI</sub> = 3.0 V to 3.6 V; V <sub>CCO</sub> = 1.65 V to 1.95 V	-	150	60	Mbps
		V <sub>CCI</sub> = 3.0 V to 3.6 V; V <sub>CCO</sub> = 1.1 V to 1.3 V	-	80	30	Mbps
		V <sub>CCI</sub> = 1.65 V to 1.95 V; V <sub>CCO</sub> = 1.1 V to 1.3 V	-	70	30	Mbps
t <sub>sk(o)</sub>	output skew time	Timing skew between any switching outputs on the rising or falling edge				
		<b>Up translation</b> [1][2]				
		V <sub>CCI</sub> = 3.0 V to 3.6 V; V <sub>CCO</sub> = 4.5 V to 5.5 V	-	0.15	0.7	ns
		V <sub>CCI</sub> = 1.65 V to 1.95 V; V <sub>CCO</sub> = 4.5 V to 5.5 V	-	0.25	1	ns
		V <sub>CCI</sub> = 1.1 V to 1.3 V; V <sub>CCO</sub> = 4.5 V to 5.5 V	-	0.5	2.1	ns
		V <sub>CCI</sub> = 1.65 V to 1.95 V; V <sub>CCO</sub> = 3.0 V to 3.6 V	-	0.25	1	ns
		V <sub>CCI</sub> = 1.1 V to 1.3 V; V <sub>CCO</sub> = 3.0 V to 3.6 V	-	0.5	2.1	ns
		V <sub>CCI</sub> = 1.1 V to 1.3 V; V <sub>CCO</sub> = 1.65 V to 1.95 V	-	0.5	2.1	ns
		<b>Down translation</b> [1][2]				
		V <sub>CCI</sub> = 4.5 V to 5.5 V; V <sub>CCO</sub> = 3.0 V to 3.6 V	-	0.15	0.8	ns
		V <sub>CCI</sub> = 4.5 V to 5.5 V; V <sub>CCO</sub> = 1.65 V to 1.95 V	-	0.25	1.1	ns
		V <sub>CCI</sub> = 4.5 V to 5.5 V; V <sub>CCO</sub> = 1.1 V to 1.3 V	-	0.6	2.5	ns
		V <sub>CCI</sub> = 3.0 V to 3.6 V; V <sub>CCO</sub> = 1.65 V to 1.95 V	-	0.25	2.5	ns
		V <sub>CCI</sub> = 3.0 V to 3.6 V; V <sub>CCO</sub> = 1.1 V to 1.3 V	-	0.6	2.5	ns
		V <sub>CCI</sub> = 1.65 V to 1.95 V; V <sub>CCO</sub> = 1.1 V to 1.3 V	-	0.6	2.5	ns

[1] V<sub>CCO</sub> is the supply voltage associated with the outputs (YBn, YAn).

[2] V<sub>CCI</sub> is the supply voltage associated with the inputs (An, Bn)..



4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

**Table 13. Typical dynamic characteristics at  $V_{CCA} = 0.9\text{ V}$  and  $T_{amb} = 25\text{ °C}$**

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 12; for waveforms see Fig. 9, Fig. 11 and Fig. 10.

Symbol	Parameter	Conditions	$V_{CCB}$							Unit
			0.9 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	5.0 V	
$t_{pd}$	propagation delay	An to YBn [1]	61	44	41	39.5	38.5	38.5	39.4	ns
		Bn to YAn [1]	55.4	34.1	29.8	28.1	27.1	26.5	27.5	ns
$t_{dis}$	disable time	OE to YAn [1]	65	67	68	70	74	79	92	ns
		OE to YBn [1]	67	51	47	47	44	44	42	ns
$t_{en}$	enable time	OE to YAn [1]	70	58	58	58	58	58.2	58.2	ns
		OE to YBn [1]	67	51	47	47	44	44	42	ns

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

**Table 14. Typical dynamic characteristics at  $V_{CCA} = 0.9\text{ V}$  and  $T_{amb} = 25\text{ °C}$**

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 12; for waveforms see Fig. 9, Fig. 11 and Fig. 10.

Symbol	Parameter	Conditions	$V_{CCA}$							Unit
			0.9 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	5.0 V	
$t_{pd}$	propagation delay	An to YBn [1]	61	44	41	39.5	38.5	38.5	39.4	ns
		Bn to YAn [1]	54.5	43.7	40.3	39.2	38.5	38.6	39.5	ns
$t_{dis}$	disable time	OE to YAn [1]	65	51	47	47	44	45	44	ns
		OE to YBn [1]	67	68	70	72	76	81	94	ns
$t_{en}$	enable time	OE to YAn [1]	60	52	52	52	52	50	70	ns
		OE to YBn [1]	70	60	52	52	52	50	50	ns

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

4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

Table 15. Typical dynamic characteristics at  $T_{amb} = 25\text{ °C}$

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 12.

Symbol	Parameter	Conditions	Supply voltage ( $V_{CCA} = V_{CCB}$ )						Unit	
			0.9 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V		5.0 V
$C_{PD}$	power dissipation capacitance	$V_{CCA}$ [1][2][3] $f_i = 10\text{ MHz}$ ; $V_I = \text{GND to } V_{CCI}$ ; $t_r = t_f = 1\text{ ns}$ ; $C_L = 0\text{ pF}$ ; $R_L = \infty\ \Omega$								
		An to YBn; outputs disabled	1.5	1.6	1.7	1.7	1.9	2.1	2.7	pF
		Bn to YAn; outputs disabled	1.5	1.6	1.7	1.7	1.9	2.1	2.7	pF
		An to YBn; outputs enabled	1.5	1.6	1.7	1.7	1.9	2.1	2.7	pF
		Bn to YAn; outputs enabled	10	10.4	10.6	10.7	10.9	11.3	12.1	pF
		$V_{CCB}$ [1][2][3] $f_i = 10\text{ MHz}$ ; $V_I = \text{GND to } V_{CCI}$ ; $t_r = t_f = 1\text{ ns}$ ; $C_L = 0\text{ pF}$ ; $R_L = \infty\ \Omega$								
		An to YBn; outputs disabled	1.5	1.6	1.7	1.7	1.9	2.1	2.7	pF
		Bn to YAn; outputs disabled	1.5	1.6	1.7	1.7	1.9	2.1	2.7	pF
		An to YBn; outputs enabled	10	10.4	10.6	10.7	10.9	11.3	12.1	pF
		Bn to YAn; outputs enabled	1.5	1.6	1.7	1.7	1.9	2.1	2.7	pF
$C_I$	input capacitance	$V_I = 0\text{ V or } V_{CCI}$ [2]	1.9	1.9	1.9	1.9	1.9	1.9	1.9	pF
$C_O$	output capacitance	$OE = \text{GND}$ ; $V_{CCA} = 3.3\text{ V}$ ; $V_{CCB} = 3.3\text{ V}$ ; $V_O = 0\text{ V or } V_{CCI}$	3.2	3.2	3.2	3.2	3.2	3.2	3.2	pF

[1]  $C_{PD}$  per channel is used to determine the dynamic power dissipation ( $P_{DYN}$  in  $\mu\text{W}$ ).

$$P_{DYN} = N \times (C_{PD} \times V_{CCI}^2 \times f_i) + N \times (C_L \times V_{CCO}^2 \times f_o) \text{ where:}$$

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = load capacitance in pF;

$V_{CCI}$  = the supply voltage associated with input pins in V;

$V_{CCO}$  = the supply voltage associated with the output pins in V;

$N$  = total number of inputs or outputs switching.

[2]  $V_{CCI}$  is the supply voltage associated with the inputs (An, Bn).

[3]  $V_{CCO}$  is the supply voltage associated with the outputs (YBn, YAn).

## 4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

Table 16. Dynamic characteristics for temperature range -40 °C to +85 °C

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 12; for waveforms see Fig. 9, Fig. 11 and Fig. 10.

Symbol	Parameter	Conditions	$V_{CCB}$												Unit
			1.2 V ± 0.1 V		1.5 V ± 0.1 V		1.8 V ± 0.15 V		2.5 V ± 0.2 V		3.3 V ± 0.3 V		5.0 V ± 0.5 V		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
$t_{pd}$	propagation delay	An to YBn [1]													
		$V_{CCA} = 1.2 \text{ V} \pm 0.1 \text{ V}$	6.0	42.1	5.3	30.1	5.0	26.5	4.7	22.8	4.7	21.5	4.7	21.9	ns
		$V_{CCA} = 1.5 \text{ V} \pm 0.1 \text{ V}$	5.3	33.4	4.6	21.4	4.2	18.1	3.8	14.6	3.8	13.3	3.8	12.7	ns
		$V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$	5.0	31.3	4.3	19.2	3.5	15.6	3.4	12.4	3.4	11.2	3.4	10.1	ns
		$V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$	4.6	29.5	3.7	17.3	3.4	13.6	3.0	10.1	2.9	8.8	2.9	7.7	ns
		$V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$	4.6	29.1	3.8	16.6	3.5	12.9	3.1	9.4	2.9	7.9	2.8	6.8	ns
		$V_{CCA} = 5.0 \text{ V} \pm 0.5 \text{ V}$	4.8	29.6	4.1	16.3	3.7	12.5	3.2	8.7	2.9	7.3	2.6	6.1	ns
		Bn to YAn													
		$V_{CCA} = 1.2 \text{ V} \pm 0.1 \text{ V}$	6.7	42.1	5.9	34.4	5.5	32.3	5.1	30.4	5.1	29.8	5.1	30.3	ns
		$V_{CCA} = 1.5 \text{ V} \pm 0.1 \text{ V}$	6.1	30.6	5.2	22.5	4.5	20.3	4.1	18.2	4.1	17.4	4.1	17.1	ns
		$V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$	5.7	27.4	4.7	19.1	4.0	16.4	3.5	14.1	3.5	13.3	3.5	12.8	ns
		$V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$	5.4	23.7	4.4	15.3	3.6	12.7	3.2	10.3	3.2	9.6	3.3	8.9	ns
		$V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$	5.3	22.3	4.3	13.9	3.5	11.3	3.0	9.1	3.1	8.1	3.1	7.4	ns
		$V_{CCA} = 5.0 \text{ V} \pm 0.5 \text{ V}$	5.1	22.7	4.1	13.3	3.5	10.4	3.0	7.9	2.8	6.9	2.7	6.2	ns

## 4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

Symbol	Parameter	Conditions	$V_{CCB}$												Unit
			1.2 V ± 0.1 V		1.5 V ± 0.1 V		1.8 V ± 0.15 V		2.5 V ± 0.2 V		3.3 V ± 0.3 V		5.0 V ± 0.5 V		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
$t_{en}$	enable time	OE to YBn [1]													
		$V_{CCA} = 1.2 \text{ V} \pm 0.1 \text{ V}$	8.5	42.8	7.7	31.8	7.4	28.5	7.2	25.5	7.2	24.6	7.2	24.2	ns
		$V_{CCA} = 1.5 \text{ V} \pm 0.1 \text{ V}$	7.9	39.4	6.4	23.1	5.8	19.8	5.6	16.7	5.6	15.7	5.6	15.2	ns
		$V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$	7.5	38.5	6.1	22.2	5.2	17.2	4.7	13.7	4.6	12.5	4.6	11.8	ns
		$V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$	7.1	37.5	5.3	21.3	4.4	16.1	3.9	10.7	3.7	9.5	3.7	8.6	ns
		$V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$	6.6	37.1	5.1	20.8	4.1	15.5	3.4	10.1	3.3	8.2	3.2	7.3	ns
		$V_{CCA} = 5.0 \text{ V} \pm 0.5 \text{ V}$	6.2	36.5	4.5	20.2	3.6	15.1	2.9	9.4	2.6	7.4	2.6	6.2	ns
		OE to YAn													
		$V_{CCA} = 1.2 \text{ V} \pm 0.1 \text{ V}$	8.5	42.8	8.7	42.7	8.7	42.7	8.7	42.7	8.5	42.7	8.5	42.7	ns
		$V_{CCA} = 1.5 \text{ V} \pm 0.1 \text{ V}$	7.4	38.6	6.4	28.2	6.5	28.2	6.5	28.2	6.4	28.2	6.4	28.2	ns
		$V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$	6.5	33.3	5.6	23.8	5.2	23.8	5.2	23.8	5.2	23.8	5.2	23.8	ns
		$V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$	5.6	28.6	4.7	19.6	4.3	17.7	4.1	15.8	4.1	15.8	3.4	15.8	ns
		$V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$	5.2	27.8	4.2	18.2	3.7	16.1	3.4	9.2	3.4	8.3	3.0	8.3	ns
		$V_{CCA} = 5.0 \text{ V} \pm 0.5 \text{ V}$	4.8	25.7	3.8	16.0	3.3	9.7	2.8	7.4	2.7	6.6	2.7	6.2	ns

4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

Symbol	Parameter	Conditions	$V_{CCB}$												Unit
			1.2 V ± 0.1 V		1.5 V ± 0.1 V		1.8 V ± 0.15 V		2.5 V ± 0.2 V		3.3 V ± 0.3 V		5.0 V ± 0.5 V		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
$t_{dis}$	disable time	OE to YBn [1]													
		$V_{CCA} = 1.2\text{ V} \pm 0.1\text{ V}$	11.7	44.1	10.9	37.2	11.5	36.2	10.6	32.9	10.8	33.7	9.9	32.2	ns
		$V_{CCA} = 1.5\text{ V} \pm 0.1\text{ V}$	11.6	44.2	8.5	26.4	8.9	25.1	7.4	21.6	7.4	22.1	7.4	20.2	ns
		$V_{CCA} = 1.8\text{ V} \pm 0.15\text{ V}$	11.6	44.4	8.4	26.3	6.9	21.3	5.3	18.1	5.3	18.4	6.3	16.3	ns
		$V_{CCA} = 2.5\text{ V} \pm 0.2\text{ V}$	11.6	44.9	8.3	26.4	7.1	21.3	4.7	17.9	6.0	15.3	4.6	13.7	ns
		$V_{CCA} = 3.3\text{ V} \pm 0.3\text{ V}$	11.3	45.6	8.2	26.6	6.7	21.4	4.1	15.1	4.9	14.6	4.1	12.2	ns
		$V_{CCA} = 5.0\text{ V} \pm 0.5\text{ V}$	11.3	47.1	8.4	27.2	6.4	24.6	3.4	16.7	4.9	17.1	3.1	12.7	ns
		OE to YAn													
		$V_{CCA} = 1.2\text{ V} \pm 0.1\text{ V}$	11.6	58.7	11.6	58.7	11.6	58.7	11.6	58.7	11.6	58.7	11.6	58.7	ns
		$V_{CCA} = 1.5\text{ V} \pm 0.1\text{ V}$	10.8	50.5	8.5	39.4	8.5	39.4	8.5	39.4	8.7	39.4	8.7	39.4	ns
		$V_{CCA} = 1.8\text{ V} \pm 0.15\text{ V}$	7.5	49.5	7.5	37.9	7.5	34.3	5.0	34.3	5.0	34.3	4.0	27.0	ns
		$V_{CCA} = 2.5\text{ V} \pm 0.2\text{ V}$	7.5	44.5	7.5	32.5	5.0	28.9	5.0	25.1	5.0	16.1	2.6	19.5	ns
		$V_{CCA} = 3.3\text{ V} \pm 0.3\text{ V}$	7.5	39.6	7.5	27.2	5.0	22.4	5.0	15.0	5.0	14.9	4.7	18.1	ns
		$V_{CCA} = 5.0\text{ V} \pm 0.5\text{ V}$	7.5	33.7	7.5	20.4	4.9	16.5	4.9	12.3	4.9	11.9	3.6	12.3	ns

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

## 4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

Table 17. Dynamic characteristics for temperature range -40 °C to +125 °C

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 12; for waveforms see Fig. 9, Fig. 11 and Fig. 10.

Symbol	Parameter	Conditions	$V_{CCB}$												Unit	
			1.2 V ± 0.1 V		1.5 V ± 0.1 V		1.8 V ± 0.15 V		2.5 V ± 0.2 V		3.3 V ± 0.3 V		5.0 V ± 0.5 V			
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
$t_{pd}$	propagation delay	A to YBn [1]														
		$V_{CCA} = 1.2 \text{ V} \pm 0.1 \text{ V}$	6.0	42.1	5.3	31.1	5.0	27.4	4.7	23.6	4.7	22.2	4.7	22.3	ns	
		$V_{CCA} = 1.5 \text{ V} \pm 0.1 \text{ V}$	5.3	34.1	4.6	22.6	4.2	19.2	3.8	15.7	3.8	14.2	3.8	13.4	ns	
		$V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$	5.0	31.8	4.3	20.4	3.5	16.6	3.4	13.3	3.4	12.1	3.4	10.7	ns	
		$V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$	4.6	29.9	3.7	18.3	3.4	14.5	3.0	10.9	2.9	9.4	2.9	8.2	ns	
		$V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$	4.6	29.5	3.8	17.6	3.5	13.7	3.1	10.1	2.9	8.5	2.8	7.2	ns	
		$V_{CCA} = 5.0 \text{ V} \pm 0.5 \text{ V}$	4.8	29.9	4.1	17.2	3.7	13.2	3.2	9.3	2.9	7.7	2.6	6.4	ns	
		B to YAn														
		$V_{CCA} = 1.2 \text{ V} \pm 0.1 \text{ V}$	6.7	42.7	5.9	35.2	5.5	32.7	5.1	30.6	5.1	30.1	5.1	30.7	ns	
		$V_{CCA} = 1.5 \text{ V} \pm 0.1 \text{ V}$	6.1	31.9	5.2	24.2	4.5	21.5	4.1	19.1	4.1	18.3	4.1	17.8	ns	
		$V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$	5.7	28.6	4.7	20.3	4.0	17.5	3.5	15.1	3.5	14.2	3.5	13.6	ns	
		$V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$	5.4	24.6	4.4	16.3	3.6	13.6	3.2	11.2	3.2	10.2	3.3	9.6	ns	
		$V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$	5.3	23.2	4.3	14.9	3.5	12.2	3.0	9.6	3.1	8.6	3.1	7.9	ns	
		$V_{CCA} = 5.0 \text{ V} \pm 0.5 \text{ V}$	5.1	23.2	4.1	14.2	3.5	11.1	3.0	8.4	2.8	7.4	2.7	6.6	ns	

## 4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

Symbol	Parameter	Conditions	$V_{CCB}$												Unit
			1.2 V ± 0.1 V		1.5 V ± 0.1 V		1.8 V ± 0.15 V		2.5 V ± 0.2 V		3.3 V ± 0.3 V		5.0 V ± 0.5 V		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
$t_{en}$	enable time	OE to YBn [1]													
		$V_{CCA} = 1.2 \text{ V} \pm 0.1 \text{ V}$	8.5	43.3	7.7	32.7	7.4	29.4	7.2	26.2	7.2	25.3	7.2	24.8	ns
		$V_{CCA} = 1.5 \text{ V} \pm 0.1 \text{ V}$	7.9	39.8	6.4	24.3	6.1	21.1	5.6	17.6	5.6	16.5	5.6	15.9	ns
		$V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$	7.5	38.9	6.1	23.4	5.2	18.2	4.7	14.6	4.6	13.3	4.6	12.6	ns
		$V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$	7.1	37.9	5.3	22.4	4.4	17.2	3.9	11.5	3.7	10.2	3.7	9.2	ns
		$V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$	6.6	37.4	5.1	21.9	4.1	16.5	3.4	10.8	3.3	8.8	3.2	7.7	ns
		$V_{CCA} = 5.0 \text{ V} \pm 0.5 \text{ V}$	6.2	36.9	4.5	21.4	3.6	16.1	2.9	10.2	2.6	8.1	2.6	6.5	ns
		OE to YAn													
		$V_{CCA} = 1.2 \text{ V} \pm 0.1 \text{ V}$	8.5	43.2	8.7	43.2	8.7	43.2	8.7	43.2	8.5	43.2	8.5	43.2	ns
		$V_{CCA} = 1.5 \text{ V} \pm 0.1 \text{ V}$	7.4	39.7	6.4	29.4	6.5	29.4	6.5	29.4	6.4	29.4	6.4	29.4	ns
		$V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$	6.5	34.3	5.6	24.9	5.2	23.2	5.2	23.2	5.2	23.2	5.2	23.2	ns
		$V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$	5.6	29.0	4.7	20.5	4.3	18.6	4.1	16.6	4.1	16.6	3.4	16.6	ns
		$V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$	5.2	28.0	4.2	19.1	3.7	16.7	3.4	9.6	3.4	8.9	3.0	8.9	ns
		$V_{CCA} = 5.0 \text{ V} \pm 0.5 \text{ V}$	4.8	28.4	3.8	16.6	3.3	10.4	2.8	7.9	2.7	7.2	2.7	6.5	ns

## 4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

Symbol	Parameter	Conditions	$V_{CCB}$												Unit	
			1.2 V ± 0.1 V		1.5 V ± 0.1 V		1.8 V ± 0.15 V		2.5 V ± 0.2 V		3.3 V ± 0.3 V		5.0 V ± 0.5 V			
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
$t_{dis}$	disable time	OE to YBn [1]														
		$V_{CCA} = 1.2 \text{ V} \pm 0.1 \text{ V}$	11.7	45.2	10.9	38.2	11.5	36.8	10.6	33.2	10.8	33.9	9.9	33.4	ns	
		$V_{CCA} = 1.5 \text{ V} \pm 0.1 \text{ V}$	11.6	45.2	8.5	27.8	8.9	26.3	7.4	22.6	7.4	23.2	7.4	21.2	ns	
		$V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$	11.6	45.4	8.4	27.8	6.9	22.6	5.3	19.2	5.3	19.5	6.3	17.3	ns	
		$V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$	11.6	45.8	8.3	27.9	7.1	22.6	4.7	18.9	6.0	16.0	4.6	14.1	ns	
		$V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$	11.3	46.4	8.2	28.2	6.7	22.7	4.1	15.5	4.9	15.0	4.1	12.8	ns	
		$V_{CCA} = 5.0 \text{ V} \pm 0.5 \text{ V}$	11.3	59.2	8.4	28.8	6.4	25.6	3.4	16.9	4.9	17.1	3.1	13.3	ns	
		OE to YAn														
		$V_{CCA} = 1.2 \text{ V} \pm 0.1 \text{ V}$	11.6	59.6	11.6	59.6	11.6	59.6	11.6	59.6	11.6	59.6	11.6	58.9	ns	
		$V_{CCA} = 1.5 \text{ V} \pm 0.1 \text{ V}$	10.8	51.3	8.5	40.8	8.5	40.8	8.5	40.8	8.7	40.8	8.7	40.8	ns	
		$V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$	7.5	50.3	7.5	40.8	7.5	39.4	5.0	39.4	5.0	39.4	4.0	39.4	ns	
		$V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$	7.5	44.8	7.5	33.7	5.0	30.1	5.0	25.9	5.0	25.9	2.6	19.2	ns	
		$V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$	7.5	39.9	7.5	28.3	5.0	23.5	5.0	16.2	5.0	15.0	4.7	17.1	ns	
		$V_{CCA} = 5.0 \text{ V} \pm 0.5 \text{ V}$	7.5	34.2	7.5	21.5	4.9	17.5	4.9	12.9	4.9	11.6	3.6	11.9	ns	

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



14.1. Waveforms and test circuit

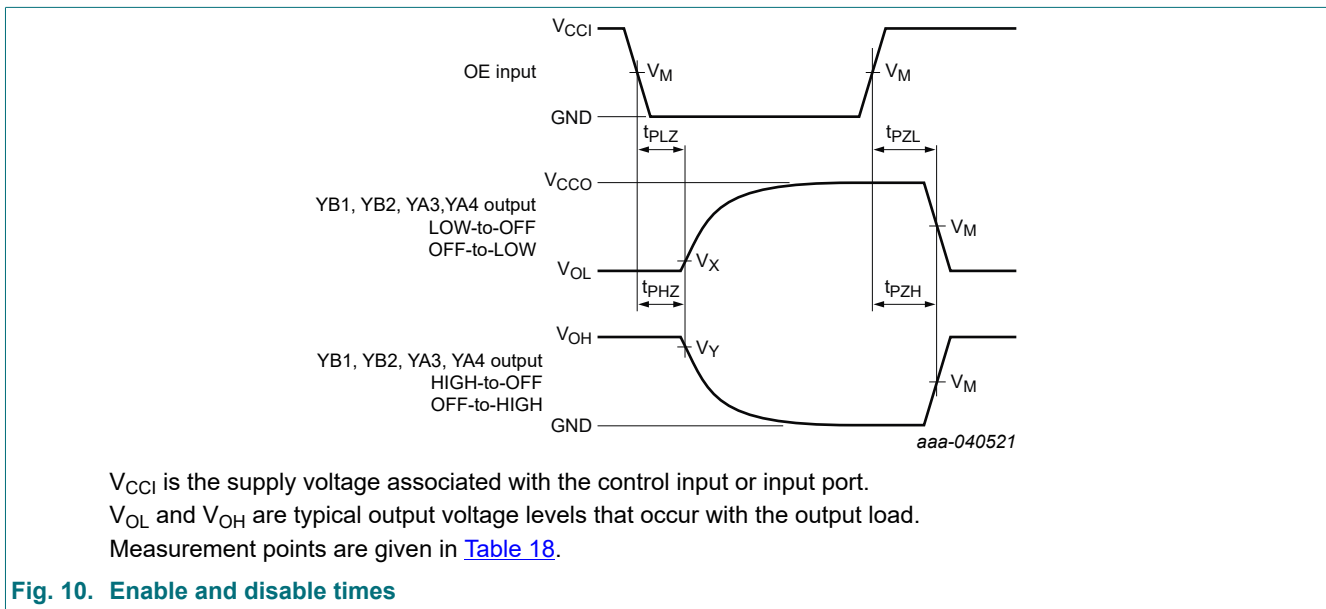
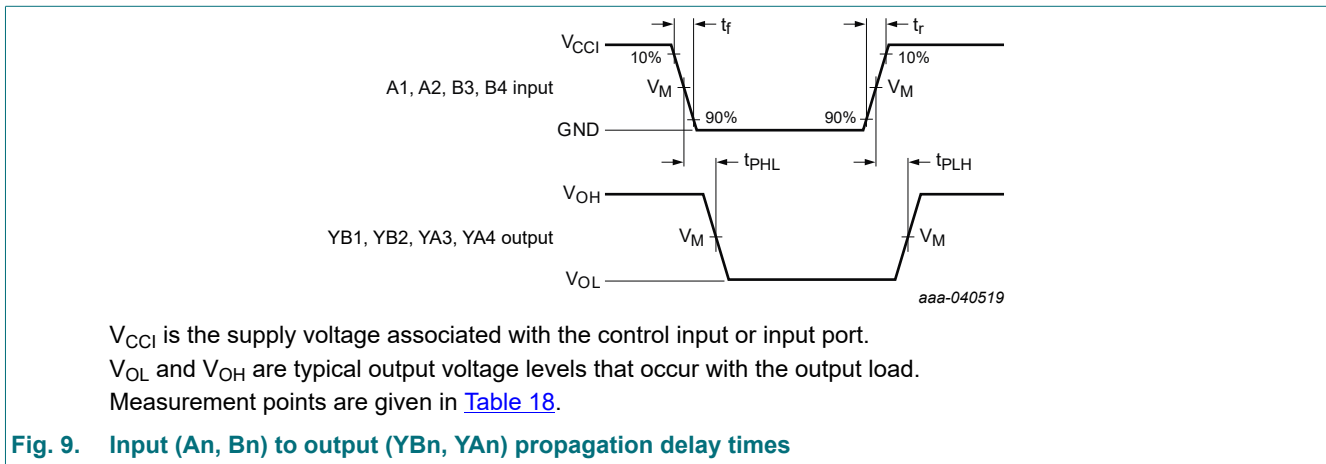


Table 18. Measurement points

Supply voltage	Input[1]	Output[2]		
$V_{CCA}, V_{CCB}$	$V_M$	$V_M$	$V_X$	$V_Y$
0.9 V to 1.6 V	$0.5 \times V_{CCI}$	$0.5 \times V_{CCO}$	$V_{OL} + 0.1 \text{ V}$	$V_{OH} - 0.1 \text{ V}$
1.65 V to 2.7 V	$0.5 \times V_{CCI}$	$0.5 \times V_{CCO}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
3.0 V to 5.5 V	$0.5 \times V_{CCI}$	$0.5 \times V_{CCO}$	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$

[1]  $V_{CCI}$  is the supply voltage associated with the inputs (An, Bn).  
 [2]  $V_{CCO}$  is the supply voltage associated with the outputs (YBn, YAn).

4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

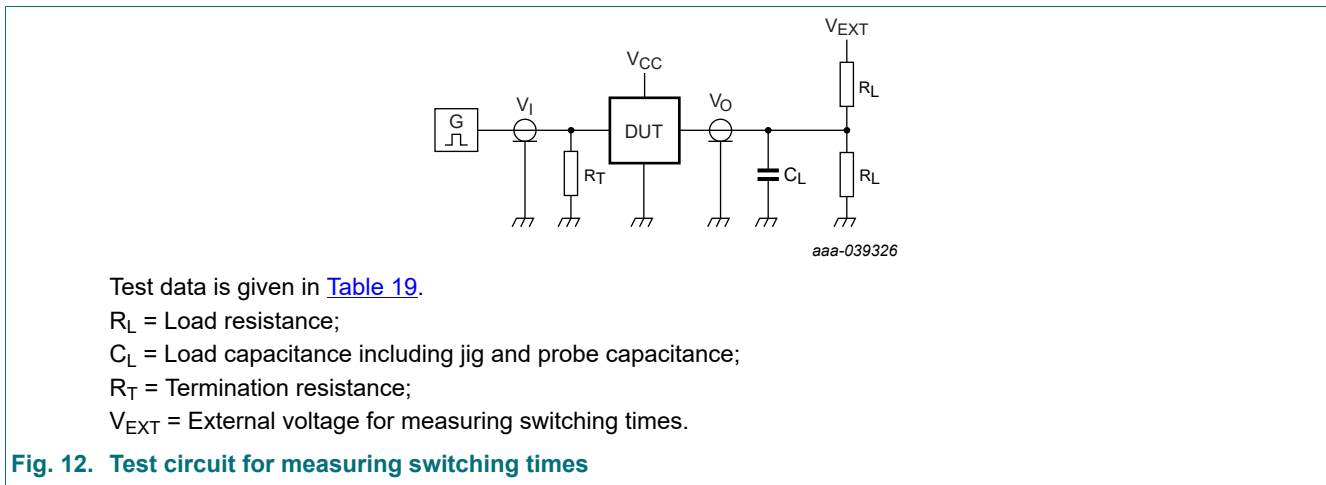
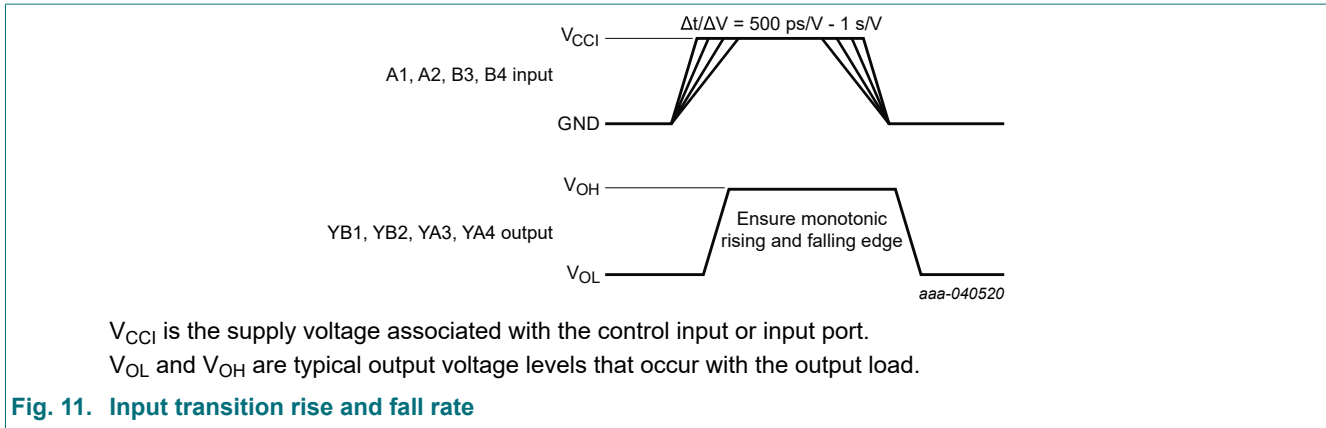
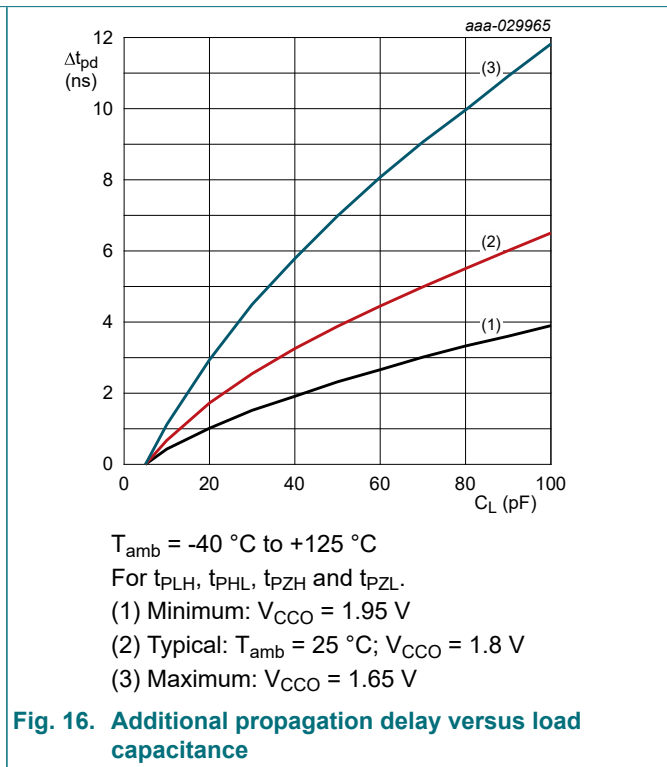
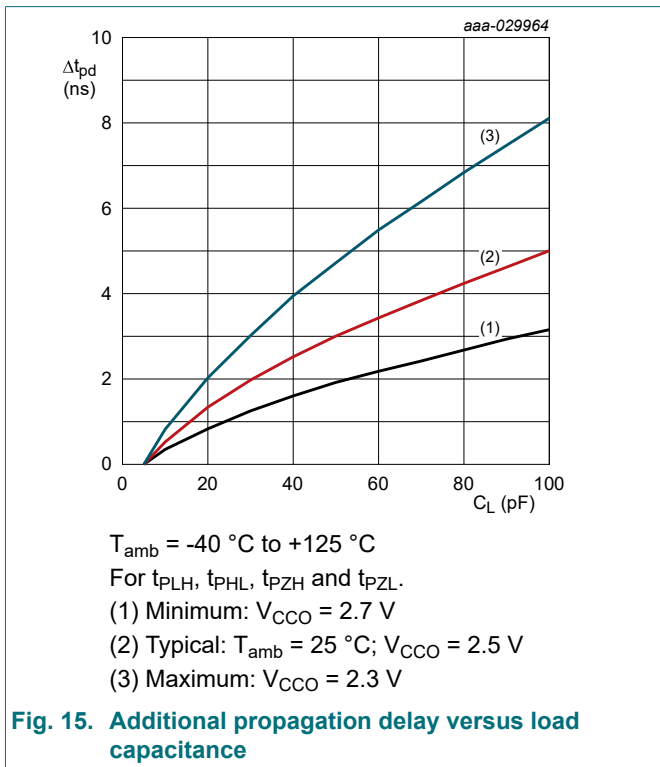
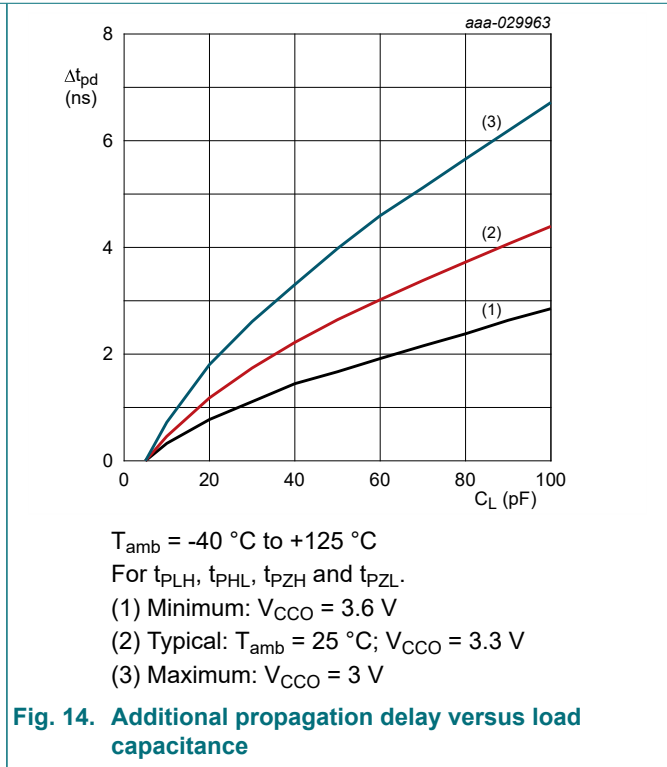
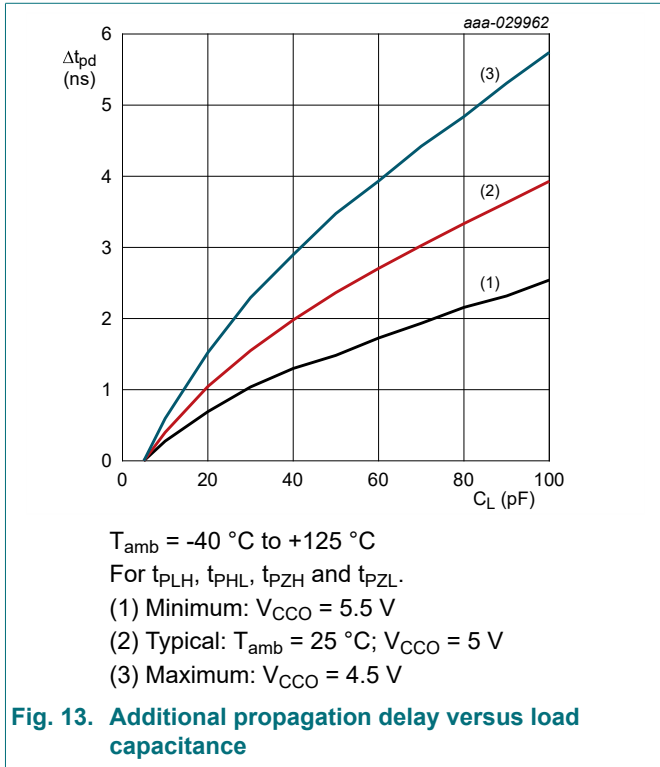


Table 19. Test data

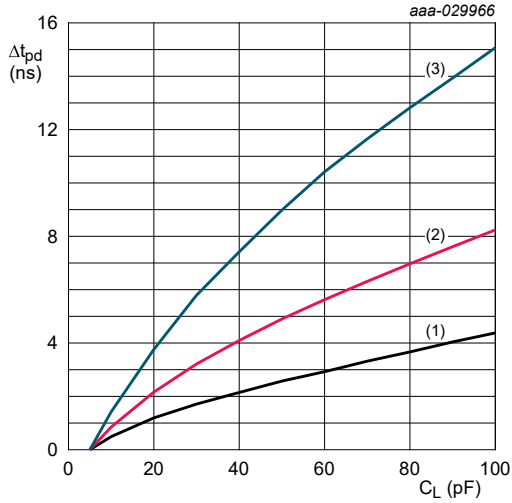
Supply voltage	Load		Input		$V_{EXT}$		
$V_{CCA}, V_{CCB}$	$C_L$	$R_L$	$t_r, t_f$	$V_i$ [1]	$t_{PLH}, t_{PHL}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$ [2]
0.9 V to 5.5 V	5 pF	10 k $\Omega$	$\leq 1.0 \text{ ns/V}$	$V_{CCI}$	open	GND	$2 \times V_{CCO}$

[1]  $V_{CCI}$  is the supply voltage associated with the inputs (An, Bn).  
 [2]  $V_{CCO}$  is the supply voltage associated with the outputs (YBn, YAn).

14.2. Additional propagation delay versus load capacitance graphs

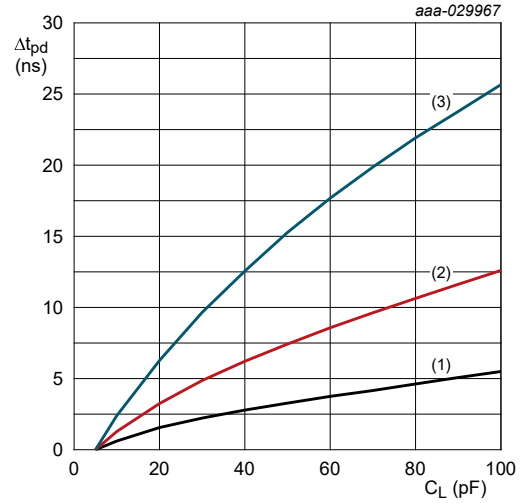


4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state



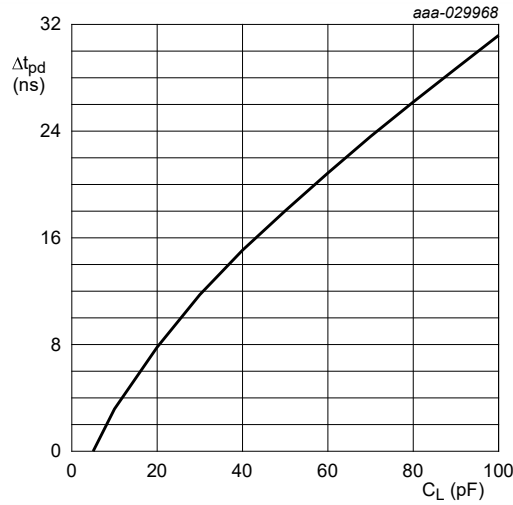
$T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$   
 For  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_{PZH}$  and  $t_{PZL}$ .  
 (1) Minimum:  $V_{CCO} = 1.6\text{ V}$   
 (2) Typical:  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $V_{CCO} = 1.5\text{ V}$   
 (3) Maximum:  $V_{CCO} = 1.4\text{ V}$

Fig. 17. Additional propagation delay versus load capacitance



$T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$   
 For  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_{PZH}$  and  $t_{PZL}$ .  
 (1) Minimum:  $V_{CCO} = 1.3\text{ V}$   
 (2) Typical:  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $V_{CCO} = 1.2\text{ V}$   
 (3) Maximum:  $V_{CCO} = 1.1\text{ V}$

Fig. 18. Additional propagation delay versus load capacitance



$T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  
 For  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_{PZH}$  and  $t_{PZL}$ .  
 $V_{CCO} = 0.9\text{ V}$

Fig. 19. Additional propagation delay versus load capacitance

## 15. Application information

The NXU0204-Q100 is a 4-bit, dual supply, unidirectional voltage translator suitable for level-shifting between two voltage domains. This device is ideal for applications utilizing push-pull drivers on the input pins. Below is an example of a possible configuration for translating from a 1.2 V device to a 3.3 V device. The Schmitt-trigger input is accommodating to slow or noisy input signals, allowing use in a wide range of applications.

### Typical 4-wire UART application

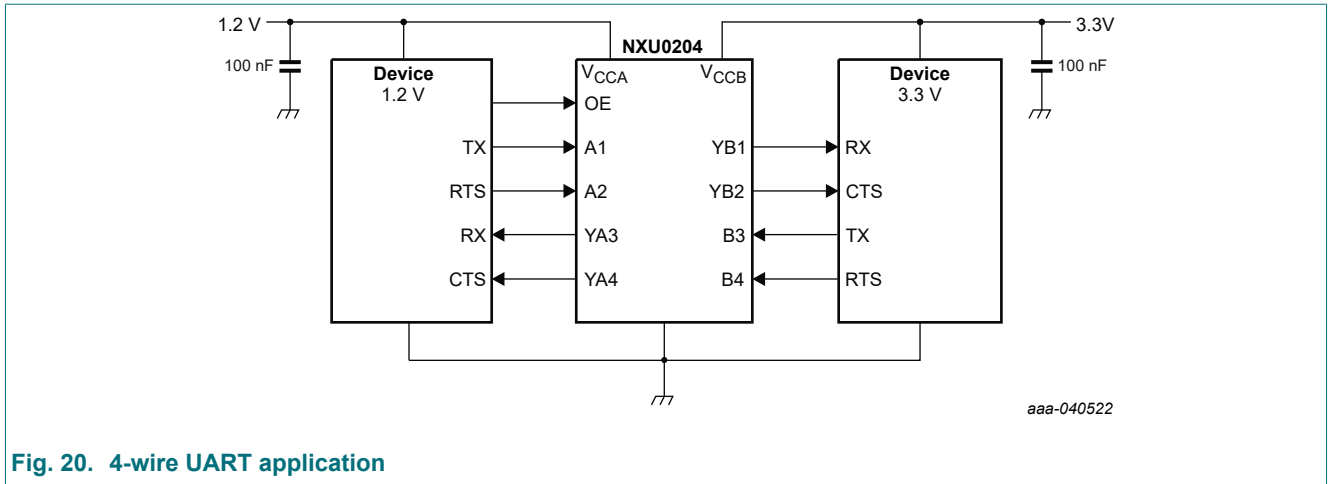


Fig. 20. 4-wire UART application

16. Package outline

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1

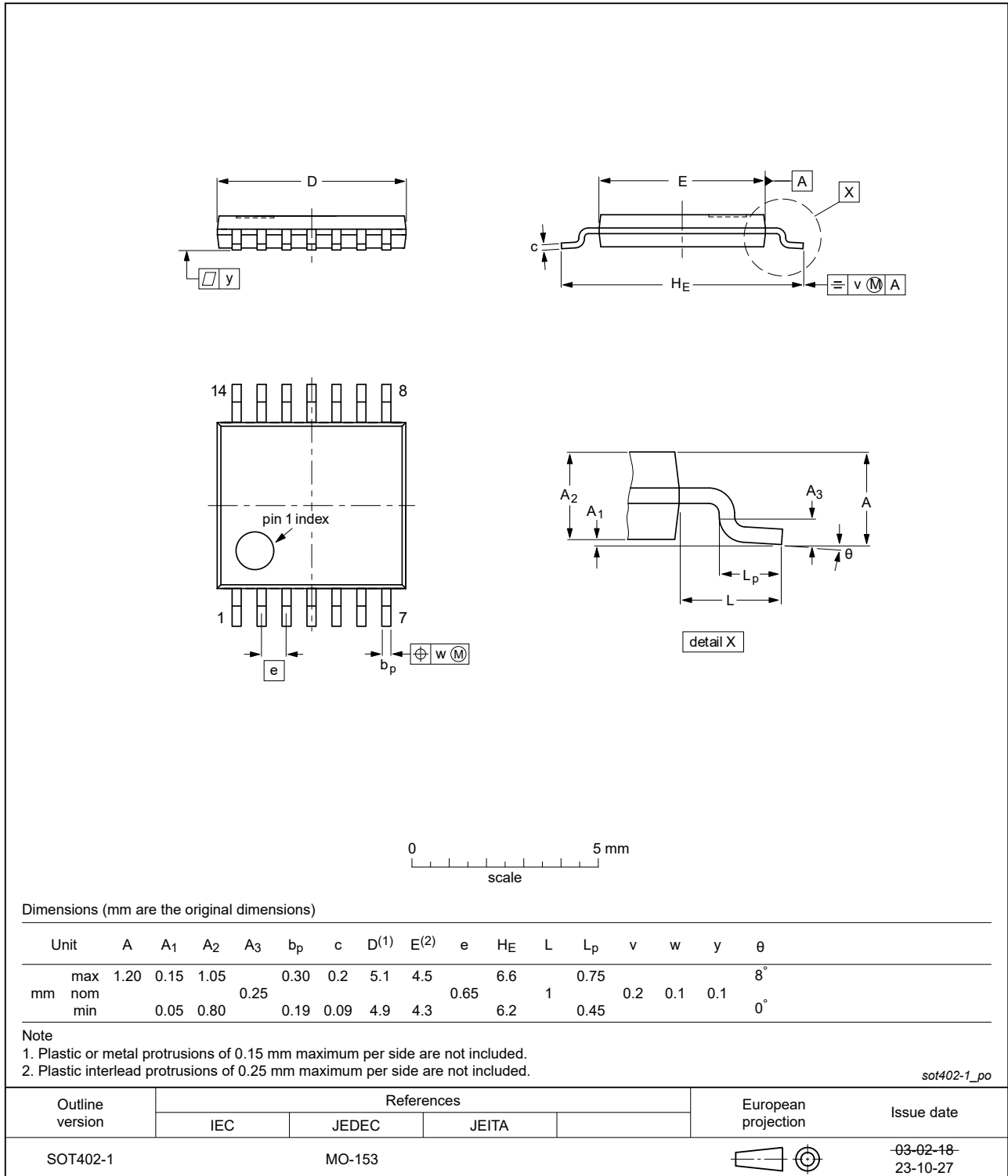


Fig. 21. Package outline SOT402-1 (TSSOP14)

4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 x 3 x 0.85 mm

SOT762-1



Fig. 22. Package outline SOT762-1 (DHVQFN14)

4-bit dual-supply voltage level translating buffer with Schmitt-trigger; 3-state

XQFN12: plastic, extremely thin quad flat package; no leads; 12 terminals; body 1.70 x 2.00 x 0.50 mm

SOT1174-1

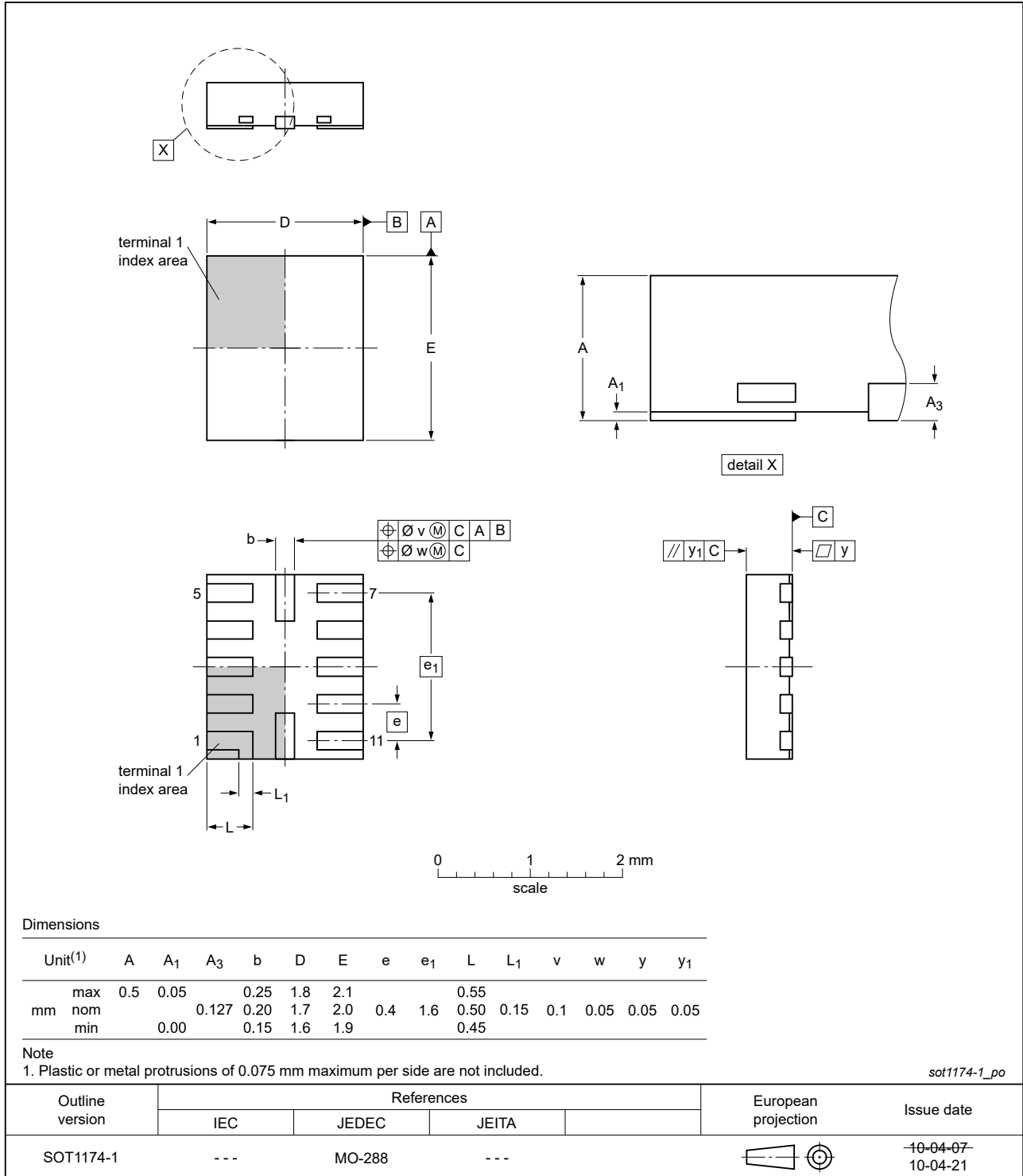


Fig. 23. Package outline SOT1174-1 (XQFN12)



## 17. Abbreviations

Table 20. Abbreviations

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

## 18. Revision history

Table 21. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
NXU0204_Q100 v.2	20241202	Product data sheet	-	NXU0204_Q100 v.1
Modifications	<ul style="list-style-type: none"> <li><a href="#">Fig. 5</a>: input waveform at <math>V_{CC} = 1.8\text{ V}</math> corrected (errata). <a href="#">Section 1</a> and <a href="#">Section 8.1</a>: "Schmitt-trigger" text added.</li> </ul>			
NXU0204_Q100 v.1	20240819	Product data sheet	-	-

## 19. 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>.

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## Contents

<b>1. General description</b>	<b>1</b>
<b>2. Features and benefits</b>	<b>1</b>
<b>3. Applications</b>	<b>2</b>
<b>4. Ordering information</b>	<b>2</b>
<b>5. Marking</b>	<b>2</b>
<b>6. Functional diagram</b>	<b>3</b>
<b>7. Pinning information</b>	<b>4</b>
7.1. Pinning	4
7.2. Pin description	4
<b>8. Functional description</b>	<b>5</b>
8.1. Overview	5
8.2. Inputs	6
8.3. Outputs	7
8.4. Suspend mode and I <sub>OFF</sub> protection circuitry	8
<b>9. Limiting values</b>	<b>8</b>
<b>10. ESD ratings</b>	<b>9</b>
<b>11. Recommended operating conditions</b>	<b>9</b>
<b>12. Thermal characteristics</b>	<b>9</b>
<b>13. Static characteristics</b>	<b>10</b>
<b>14. Dynamic characteristics</b>	<b>16</b>
14.1. Waveforms and test circuit	25
14.2. Additional propagation delay versus load capacitance graphs	27
<b>15. Application information</b>	<b>29</b>
<b>16. Package outline</b>	<b>30</b>
<b>17. Abbreviations</b>	<b>33</b>
<b>18. Revision history</b>	<b>33</b>
<b>19. Legal information</b>	<b>34</b>

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