

# 74AVC4T774

4-bit dual supply translating transceiver; 3-state

Rev. 1 — 25 September 2017

Product data sheet

## 1 General description

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The 74AVC4T774 is a 4-bit, dual supply transceiver that enables bidirectional level translation. It features eight 1-bit input-output ports ( $A_n$  and  $B_n$ ), four direction control inputs (DIR1, DIR2, DIR3 and DIR4), an output enable input ( $\overline{OE}$ ) and dual supply pins ( $V_{CC(A)}$  and  $V_{CC(B)}$ ). Both  $V_{CC(A)}$  and  $V_{CC(B)}$  can be supplied at any voltage between 0.8 V and 3.6 V making the device suitable for translating between any of the low voltage nodes (0.8 V, 1.2 V, 1.5 V, 1.8 V, 2.5 V and 3.3 V). Pins  $A_n$ ,  $\overline{OE}$  and DIRn are referenced to  $V_{CC(A)}$  and pins  $B_n$  are referenced to  $V_{CC(B)}$ . A HIGH on DIRn allows transmission from  $A_n$  to  $B_n$  and a LOW on DIRn allows transmission from  $B_n$  to  $A_n$ . The output enable input ( $\overline{OE}$ ) can be used to disable the outputs so the buses are effectively isolated.

The device is fully specified for partial power-down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output, preventing any damaging backflow current through the device when it is powered down. In suspend mode when either  $V_{CC(A)}$  or  $V_{CC(B)}$  are at GND level, both  $A_n$  and  $B_n$  are in the high-impedance OFF-state.

## 2 Features and benefits

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- Wide supply voltage range:
  - $V_{CC(A)}$ : 0.8 V to 3.6 V
  - $V_{CC(B)}$ : 0.8 V to 3.6 V
- Complies with JEDEC standards:
  - JESD8-12 (0.8 V to 1.3 V)
  - JESD8-11 (0.9 V to 1.65 V)
  - JESD8-7 (1.2 V to 1.95 V)
  - JESD8-5 (1.8 V to 2.7 V)
  - JESD8-B (2.7 V to 3.6 V)
- ESD protection:
  - HBM JESD22-A114E Class 3B exceeds 8000 V
  - CDM JESD22-C101C exceeds 1500 V
- Maximum data rates:
  - 380 Mbit/s ( $\geq$  1.8 V to 3.3 V translation)
  - 200 Mbit/s ( $\geq$  1.1 V to 3.3 V translation)
  - 200 Mbit/s ( $\geq$  1.1 V to 2.5 V translation)
  - 200 Mbit/s ( $\geq$  1.1 V to 1.8 V translation)
  - 150 Mbit/s ( $\geq$  1.1 V to 1.5 V translation)
  - 100 Mbit/s ( $\geq$  1.1 V to 1.2 V translation)
- Suspend mode
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- Inputs accept voltages up to 3.6 V
- $I_{OFF}$  circuitry provides partial Power-down mode operation

- Specified from -40 °C to +85 °C and -40 °C to +125 °C

### 3 Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74AVC4T774BQ	-40 °C to +125 °C	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
74AVC4T774GU	-40 °C to +125 °C	XQFN16	plastic, extremely thin quad flat package; no leads; 16 terminals; body 1.80 x 2.60 x 0.50 mm	SOT1161-1

### 4 Marking

Table 2. Marking codes

Type number	Marking code
74AVC4T774BQ	C4T774
74AVC4T774GU	B77

### 5 Functional diagram

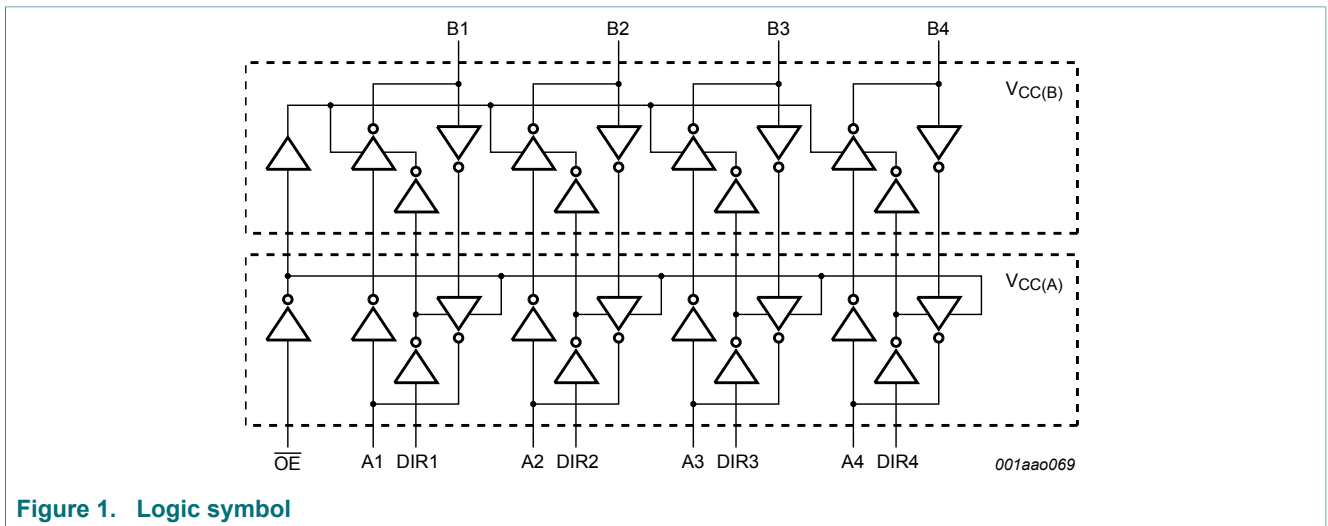


Figure 1. Logic symbol

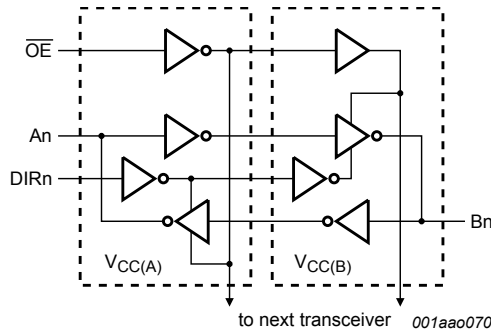


Figure 2. Logic diagram (one 1-bit transceiver)

## 6 Pinning information

### 6.1 Pinning

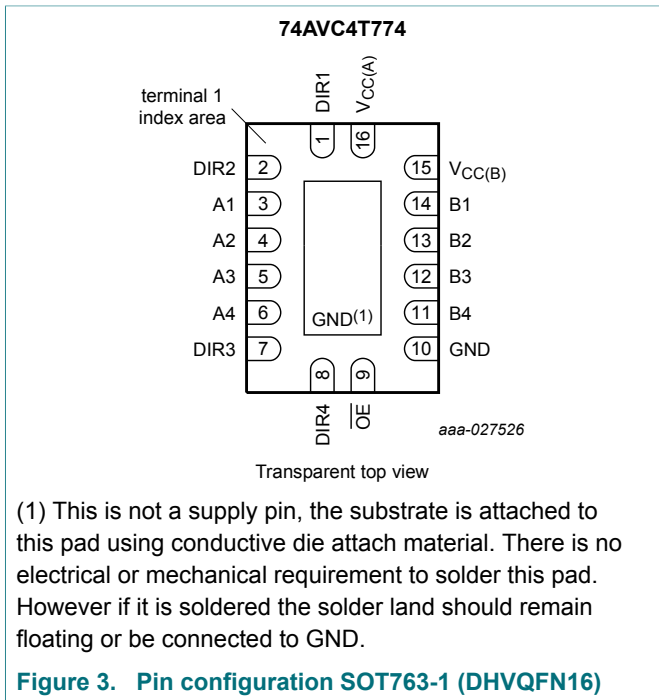


Figure 3. Pin configuration SOT763-1 (DHVQFN16)

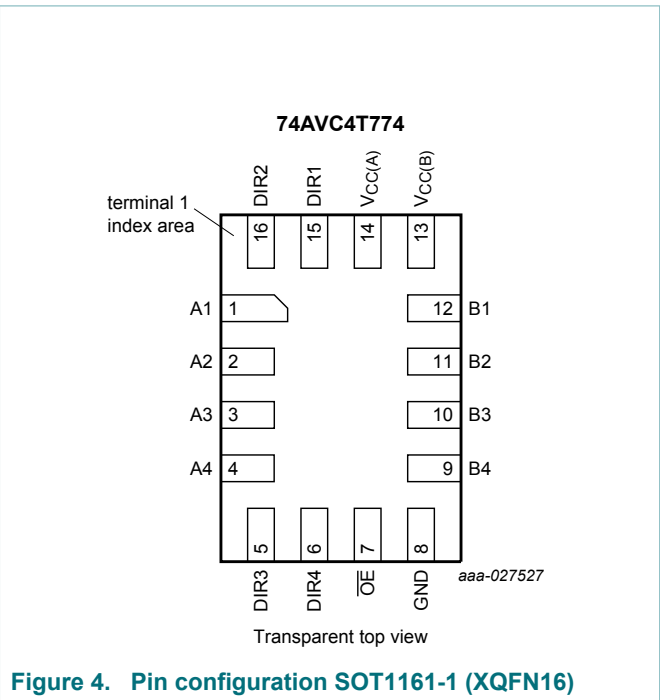


Figure 4. Pin configuration SOT1161-1 (XQFN16)

## 6.2 Pin description

Table 3. Pin description

Symbol	Pin		Description
	SOT763-1	SOT1161-1	
$V_{CC(A)}$	16	14	supply voltage A ( $A_n$ , $\overline{OE}$ and $DIR_n$ inputs are referenced to $V_{CC(A)}$ )
DIR1, DIR2, DIR3, DIR4	1, 2, 7, 8	15, 16, 5, 6	direction control input
A1, A2, A3, A4	3, 4, 5, 6	1, 2, 3, 4	data input or output
GND	10	8	ground (0 V)
B1, B2, B3, B4	14, 13, 12, 11	12, 11, 10, 9	data input or output
$\overline{OE}$	9	7	output enable input (active LOW)
$V_{CC(B)}$	15	13	supply voltage B ( $B_n$ pins are referenced to $V_{CC(B)}$ )

## 7 Functional description

Table 4. Function table <sup>[1]</sup> <sup>[2]</sup>

Supply voltage	Input					Input/output		
	$V_{CC(A)}$ , $V_{CC(B)}$	$\overline{OE}$	DIR1	DIR2	DIR3	DIR4	$A_n$	$B_n$
0.8 V to 3.6 V	L	L	L	X	X	X	A1 = B1	input B1
0.8 V to 3.6 V	L	L	H	X	X	X	input A1	B1 = A1
0.8 V to 3.6 V	L	L	X	L	X	X	A2 = B2	input B2
0.8 V to 3.6 V	L	L	X	H	X	X	input A2	B2 = A2
0.8 V to 3.6 V	L	L	X	X	L	X	A3 = B3	input B3
0.8 V to 3.6 V	L	L	X	X	H	X	input A3	B3 = A3
0.8 V to 3.6 V	L	L	X	X	X	L	A4 = B4	input B4
0.8 V to 3.6 V	L	L	X	X	X	H	input A4	B4 = A4
0.8 V to 3.6 V	H	H	X	X	X	X	Z	Z
GND <sup>[3]</sup>	X	X	X	X	X	X	Z	Z

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

[2] The  $A_n$ ,  $DIR_n$  and  $\overline{OE}$  input circuit is referenced to  $V_{CC(A)}$ ; The  $B_n$  input circuit is referenced to  $V_{CC(B)}$ .

[3] If at least one of  $V_{CC(A)}$  or  $V_{CC(B)}$  is at GND level, the device goes into suspend mode.

## 8 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
$V_{CC(A)}$	supply voltage A		-0.5	+4.6	V
$V_{CC(B)}$	supply voltage B		-0.5	+4.6	V
$I_{IK}$	input clamping current	$V_I < 0$ V	-50	-	mA
$V_I$	input voltage	[1]	-0.5	+4.6	V
$I_{OK}$	output clamping current	$V_O < 0$ V	-50	-	mA
$V_O$	output voltage	Active mode [1] [2] [3]	-0.5	$V_{CCO} + 0.5$	V
		Suspend or 3-state mode [1]	-0.5	+4.6	V
$I_O$	output current	$V_O = 0$ V to $V_{CCO}$ [2]	-	$\pm 50$	mA
$I_{CC}$	supply current	$I_{CC(A)}$ or $I_{CC(B)}$	-	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 $+125$ °C			
		DHVQFN16 [4]	-	500	mW
		XQFN16	-	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]  $V_{CCO}$  is the supply voltage associated with the output port.

[3]  $V_{CCO} + 0.5$  V should not exceed 4.6 V.

[4] For DHVQFN16 package: above 60 °C the value of  $P_{tot}$  derates linearly at 4.5 mW/K.

## 9 Recommended operating conditions

**Table 6. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC(A)}$	supply voltage A		0.8	3.6	V
$V_{CC(B)}$	supply voltage B		0.8	3.6	V
$V_I$	input voltage		0	3.6	V
$V_O$	output voltage	Active mode [1]	0	$V_{CCO}$	V
		Suspend or 3-state mode	0	3.6	V
$T_{amb}$	ambient temperature		-40	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CCI} = 0.8$ V to 3.6 V [2]	-	10	ns/V

[1]  $V_{CCO}$  is the supply voltage associated with the output port.

[2]  $V_{CCI}$  is the supply voltage associated with the input port.

## 10 Static characteristics

**Table 7. Typical static characteristics at  $T_{amb} = 25\text{ °C}$  [1] [2]**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$I_O = -1.5\text{ mA}$ ; $V_{CC(A)} = V_{CC(B)} = 0.8\text{ V}$	-	0.69	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$I_O = 1.5\text{ mA}$ ; $V_{CC(A)} = V_{CC(B)} = 0.8\text{ V}$	-	0.07	-	V
$I_I$	input leakage current	DIRn, $\overline{OE}$ input; $V_I = 0\text{ V}$ or $3.6\text{ V}$ ; $V_{CC(A)} = V_{CC(B)} = 0.8\text{ V}$ to $3.6\text{ V}$	-	$\pm 0.025$	$\pm 0.25$	$\mu\text{A}$
$I_{OZ}$	OFF-state output current	A or B port; $V_O = 0\text{ V}$ or $V_{CCO}$ ; $V_{CC(A)} = V_{CC(B)} = 3.6\text{ V}$ [3]	-	$\pm 0.5$	$\pm 2.5$	$\mu\text{A}$
		suspend mode A port; $V_O = 0\text{ V}$ or $V_{CCO}$ ; $V_{CC(A)} = 3.6\text{ V}$ ; $V_{CC(B)} = 0\text{ V}$ [3]	-	$\pm 0.5$	$\pm 2.5$	$\mu\text{A}$
		suspend mode B port; $V_O = 0\text{ V}$ or $V_{CCO}$ ; $V_{CC(A)} = 0\text{ V}$ ; $V_{CC(B)} = 3.6\text{ V}$ [3]	-	$\pm 0.5$	$\pm 2.5$	$\mu\text{A}$
$I_{OFF}$	power-off leakage current	A port; $V_I$ or $V_O = 0\text{ V}$ to $3.6\text{ V}$ ; $V_{CC(A)} = 0\text{ V}$ ; $V_{CC(B)} = 0.8\text{ V}$ to $3.6\text{ V}$	-	$\pm 0.1$	$\pm 1$	$\mu\text{A}$
		B port; $V_I$ or $V_O = 0\text{ V}$ to $3.6\text{ V}$ ; $V_{CC(B)} = 0\text{ V}$ ; $V_{CC(A)} = 0.8\text{ V}$ to $3.6\text{ V}$	-	$\pm 0.1$	$\pm 1$	$\mu\text{A}$
$C_I$	input capacitance	DIRn, $\overline{OE}$ input; $V_I = 0\text{ V}$ or $3.3\text{ V}$ ; $V_{CC(A)} = V_{CC(B)} = 3.3\text{ V}$	-	2.0	-	pF
$C_{I/O}$	input/output capacitance	A and B port; $V_O = 3.3\text{ V}$ or $0\text{ V}$ ; $V_{CC(A)} = V_{CC(B)} = 3.3\text{ V}$	-	4.0	-	pF

[1]  $V_{CCO}$  is the supply voltage associated with the output port.

[2]  $V_{CCI}$  is the supply voltage associated with the data input port.

[3] For I/O ports, the parameter  $I_{OZ}$  includes the input leakage current.

Table 8. Static characteristics [1] [2]

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

Symbol	Parameter	Conditions	-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Max	Min	Max	
V <sub>IH</sub>	HIGH-level input voltage	data input					
		V <sub>CCI</sub> = 0.8 V	0.70V <sub>CCI</sub>	-	0.70V <sub>CCI</sub>	-	V
		V <sub>CCI</sub> = 1.1 V to 1.95 V	0.65V <sub>CCI</sub>	-	0.65V <sub>CCI</sub>	-	V
		V <sub>CCI</sub> = 2.3 V to 2.7 V	1.6	-	1.6	-	V
		V <sub>CCI</sub> = 3.0 V to 3.6 V	2	-	2	-	V
		DIRn, $\overline{OE}$ input					
		V <sub>CC(A)</sub> = 0.8 V	0.70V <sub>CC(A)</sub>	-	0.70V <sub>CC(A)</sub>	-	V
		V <sub>CC(A)</sub> = 1.1 V to 1.95 V	0.65V <sub>CC(A)</sub>	-	0.65V <sub>CC(A)</sub>	-	V
		V <sub>CC(A)</sub> = 2.3 V to 2.7 V	1.6	-	1.6	-	V
V <sub>CC(A)</sub> = 3.0 V to 3.6 V	2	-	2	-	V		
V <sub>IL</sub>	LOW-level input voltage	data input					
		V <sub>CCI</sub> = 0.8 V	-	0.30V <sub>CCI</sub>	-	0.30V <sub>CCI</sub>	V
		V <sub>CCI</sub> = 1.1 V to 1.95 V	-	0.35V <sub>CCI</sub>	-	0.35V <sub>CCI</sub>	V
		V <sub>CCI</sub> = 2.3 V to 2.7 V	-	0.7	-	0.7	V
		V <sub>CCI</sub> = 3.0 V to 3.6 V	-	0.8	-	0.8	V
		DIRn, $\overline{OE}$ input					
		V <sub>CC(A)</sub> = 0.8 V	-	0.30V <sub>CC(A)</sub>	-	0.30V <sub>CC(A)</sub>	V
		V <sub>CC(A)</sub> = 1.1 V to 1.95 V	-	0.35V <sub>CC(A)</sub>	-	0.35V <sub>CC(A)</sub>	V
		V <sub>CC(A)</sub> = 2.3 V to 2.7 V	-	0.7	-	0.7	V
V <sub>CC(A)</sub> = 3.0 V to 3.6 V	-	0.8	-	0.8	V		
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>					
		I <sub>O</sub> = -100 μA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 0.8 V to 3.6 V	V <sub>CCO</sub> - 0.1	-	V <sub>CCO</sub> - 0.1	-	V
		I <sub>O</sub> = -3 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.1 V	0.85	-	0.85	-	V
		I <sub>O</sub> = -6 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.4 V	1.05	-	1.05	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.65 V	1.2	-	1.2	-	V
		I <sub>O</sub> = -9 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 2.3 V	1.75	-	1.75	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 3.0 V	2.3	-	2.3	-	V

Symbol	Parameter	Conditions	-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Max	Min	Max	
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>					
		I <sub>O</sub> = 100 μA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 0.8 V to 3.6 V	-	0.1	-	0.1	V
		I <sub>O</sub> = 3 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.1 V	-	0.25	-	0.25	V
		I <sub>O</sub> = 6 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.4 V	-	0.35	-	0.35	V
		I <sub>O</sub> = 8 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 1.65 V	-	0.45	-	0.45	V
		I <sub>O</sub> = 9 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 2.3 V	-	0.55	-	0.55	V
		I <sub>O</sub> = 12 mA; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 3.0 V	-	0.7	-	0.7	V
I <sub>I</sub>	input leakage current	DIRn, $\overline{OE}$ input; V <sub>I</sub> = 0 V or 3.6 V; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 0.8 V to 3.6 V	-	±1	-	±5	μA
I <sub>OZ</sub>	OFF-state output current	A or B port; V <sub>O</sub> = 0 V or V <sub>CCO</sub> ; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 3.6 V <sup>[3]</sup>	-	±5	-	±30	μA
		suspend mode A port; V <sub>O</sub> = 0 V or V <sub>CCO</sub> ; V <sub>CC(A)</sub> = 3.6 V; V <sub>CC(B)</sub> = 0 V <sup>[3]</sup>	-	±5	-	±30	μA
		suspend mode B port; V <sub>O</sub> = 0 V or V <sub>CCO</sub> ; V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 3.6 V <sup>[3]</sup>	-	±5	-	±30	μA
I <sub>OFF</sub>	power-off leakage current	A port; V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 0.8 V to 3.6 V	-	±5	-	±30	μA
		B port; V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC(B)</sub> = 0 V; V <sub>CC(A)</sub> = 0.8 V to 3.6 V	-	±5	-	±30	μA



Symbol	Parameter	Conditions	-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Max	Min	Max	
I <sub>CC</sub>	supply current	A port; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; I <sub>O</sub> = 0 A					
		V <sub>CC(A)</sub> = 0.8 V to 3.6 V; V <sub>CC(B)</sub> = 0.8 V to 3.6 V	-	10	-	55	μA
		V <sub>CC(A)</sub> = 1.1 V to 3.6 V; V <sub>CC(B)</sub> = 1.1 V to 3.6 V	-	8	-	50	μA
		V <sub>CC(A)</sub> = 3.6 V; V <sub>CC(B)</sub> = 0 V	-	8	-	50	μA
		V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 3.6 V	-2	-	-12	-	μA
		B port; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; I <sub>O</sub> = 0 A					
		V <sub>CC(A)</sub> = 0.8 V to 3.6 V; V <sub>CC(B)</sub> = 0.8 V to 3.6 V	-	10	-	55	μA
		V <sub>CC(A)</sub> = 1.1 V to 3.6 V; V <sub>CC(B)</sub> = 1.1 V to 3.6 V	-	8	-	50	μA
		V <sub>CC(A)</sub> = 3.6 V; V <sub>CC(B)</sub> = 0 V	-2	-	-12	-	μA
		V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 3.6 V	-	8	-	50	μA
		A plus B port (I <sub>CC(A)</sub> + I <sub>CC(B)</sub> ); I <sub>O</sub> = 0 A; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; V <sub>CC(A)</sub> = 0.8 V to 3.6 V; V <sub>CC(B)</sub> = 0.8 V to 3.6 V	-	20	-	70	μA
A plus B port (I <sub>CC(A)</sub> + I <sub>CC(B)</sub> ); I <sub>O</sub> = 0 A; V <sub>I</sub> = 0 V or V <sub>CCI</sub> ; V <sub>CC(A)</sub> = 1.1 V to 3.6 V; V <sub>CC(B)</sub> = 1.1 V to 3.6 V	-	16	-	65	μA		
ΔI <sub>CC</sub>	additional supply current	V <sub>I</sub> = 3.0 V; V <sub>CC(A)</sub> = V <sub>CC(B)</sub> = 3.6 V	-	500	-	650	μA

[1] V<sub>CCO</sub> is the supply voltage associated with the output port.

[2] V<sub>CCI</sub> is the supply voltage associated with the data input port.

[3] For I/O ports, the parameter I<sub>OZ</sub> includes the input leakage current.

**Table 9. Typical total supply current (I<sub>CC(A)</sub> + I<sub>CC(B)</sub>)**

V <sub>CC(A)</sub>	V <sub>CC(B)</sub>							Unit
	0 V	0.8 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	
0 V	0	0.1	0.1	0.1	0.1	0.1	0.1	μA
0.8 V	0.1	0.1	0.1	0.1	0.1	0.3	1.6	μA
1.2 V	0.1	0.1	0.1	0.1	0.1	0.1	0.8	μA
1.5 V	0.1	0.1	0.1	0.1	0.1	0.1	0.4	μA
1.8 V	0.1	0.1	0.1	0.1	0.1	0.1	0.2	μA
2.5 V	0.1	0.3	0.1	0.1	0.1	0.1	0.1	μA
3.3 V	0.1	1.6	0.8	0.4	0.2	0.1	0.1	μA

## 11 Dynamic characteristics

**Table 10. Typical power dissipation capacitance at  $V_{CC(A)} = V_{CC(B)}$  and  $T_{amb} = 25\text{ °C}$  [1] [2]**

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

Symbol	Parameter	Conditions	$V_{CC(A)} = V_{CC(B)}$						Unit
			0.8 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	
C <sub>PD</sub>	power dissipation capacitance	A port: (direction An to Bn); output enabled	0.2	0.2	0.2	0.2	0.3	0.4	pF
		A port: (direction An to Bn); output disabled	0.2	0.2	0.2	0.2	0.3	0.4	pF
		A port: (direction Bn to An); output enabled	9.5	9.7	9.8	9.9	10.7	11.9	pF
		A port: (direction Bn to An); output disabled	0.6	0.6	0.6	0.6	0.7	0.7	pF
		B port: (direction An to Bn); output enabled	9.5	9.7	9.8	9.9	10.7	11.9	pF
		B port: (direction An to Bn); output disabled	0.6	0.6	0.6	0.6	0.7	0.7	pF
		B port: (direction Bn to An); output enabled	0.2	0.2	0.2	0.2	0.3	0.4	pF
		B port: (direction Bn to An); output disabled	0.2	0.2	0.2	0.2	0.3	0.4	pF

[1] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

C<sub>L</sub> = load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

$\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

[2] f<sub>i</sub> = 10 MHz; V<sub>I</sub> = GND to V<sub>CC</sub>; t<sub>r</sub> = t<sub>f</sub> = 1 ns; C<sub>L</sub> = 0 pF; R<sub>L</sub> = ∞ Ω.

**Table 11. Typical dynamic characteristics at  $V_{CC(A)} = 0.8\text{ V}$  and  $T_{amb} = 25\text{ °C}$  [1]**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 7](#); for waveforms see [Figure 5](#) and [Figure 6](#)

Symbol	Parameter	Conditions	$V_{CC(B)}$						Unit
			0.8 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	
$t_{pd}$	propagation delay	An to Bn	14.5	7.3	6.5	6.2	5.9	6.0	ns
		Bn to An	14.5	12.7	12.4	12.3	12.1	12.0	ns
$t_{dis}$	disable time	$\overline{OE}$ to An	14.3	14.3	14.3	14.3	14.3	14.3	ns
		$\overline{OE}$ to Bn	17.0	9.9	9.0	9.4	9.0	9.7	ns
$t_{en}$	enable time	$\overline{OE}$ to An	18.2	18.2	18.2	18.2	18.2	18.2	ns
		$\overline{OE}$ to Bn	19.2	10.7	9.8	9.6	9.7	10.2	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 12. Typical dynamic characteristics at  $V_{CC(B)} = 0.8\text{ V}$  and  $T_{amb} = 25\text{ °C}$  [1]**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 7](#); for waveforms see [Figure 5](#) and [Figure 6](#)

Symbol	Parameter	Conditions	$V_{CC(A)}$						Unit
			0.8 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	
$t_{pd}$	propagation delay	An to Bn	14.5	12.7	12.4	12.3	12.1	12.0	ns
		Bn to An	14.5	7.3	6.5	6.2	5.9	6.0	ns
$t_{dis}$	disable time	$\overline{OE}$ to An	14.3	5.5	4.1	4.0	3.0	3.5	ns
		$\overline{OE}$ to Bn	17.0	13.8	13.4	13.1	12.9	12.7	ns
$t_{en}$	enable time	$\overline{OE}$ to An	18.2	5.6	4.0	3.2	2.4	2.2	ns
		$\overline{OE}$ to Bn	19.2	14.6	14.1	13.9	13.7	13.6	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 13. Dynamic characteristics for temperature range -40 °C to +85 °C [1]

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 7; for waveforms see Figure 5 and Figure 6

Symbol	Parameter	Conditions	V <sub>CC(B)</sub>										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		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
<b>V<sub>CC(A)</sub> = 1.1 V to 1.3 V</b>													
t <sub>pd</sub>	propagation delay	An to Bn	2.0	10.5	1.3	7.8	1.2	6.9	1.0	5.9	0.8	5.7	ns
		Bn to An	2.0	10.5	1.5	9.9	1.5	9.7	1.4	9.4	1.4	9.3	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to An	2.0	10.0	2.0	10.0	2.0	10.0	2.0	10.0	2.0	10.0	ns
		$\overline{OE}$ to Bn	2.0	11.1	2.0	8.6	1.0	8.0	0.7	7.0	1.0	8.0	ns
t <sub>en</sub>	enable time	$\overline{OE}$ to An	2.0	13.5	2.0	13.5	2.0	13.5	2.0	13.5	2.0	13.5	ns
		$\overline{OE}$ to Bn	2.0	15.0	2.0	11.0	2.0	9.4	1.0	7.8	1.0	7.4	ns
<b>V<sub>CC(A)</sub> = 1.4 V to 1.6 V</b>													
t <sub>pd</sub>	propagation delay	An to Bn	1.5	9.9	1.0	7.1	1.0	6.0	0.5	4.8	0.5	4.3	ns
		Bn to An	1.3	7.8	1.0	7.1	0.9	6.9	0.8	6.6	0.6	6.5	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to An	1.0	6.0	1.0	6.0	1.0	6.0	1.0	6.0	1.0	6.0	ns
		$\overline{OE}$ to Bn	2.0	10.2	1.5	7.5	0.9	7.2	0.4	6.2	0.4	6.1	ns
t <sub>en</sub>	enable time	$\overline{OE}$ to An	1.0	7.5	1.0	7.5	1.0	7.5	1.0	7.5	1.0	7.5	ns
		$\overline{OE}$ to Bn	2.0	14.4	1.4	7.9	1.3	7.7	1.1	6.4	1.1	5.6	ns
<b>V<sub>CC(A)</sub> = 1.65 V to 1.95 V</b>													
t <sub>pd</sub>	propagation delay	An to Bn	1.5	9.7	0.9	6.9	0.8	5.7	0.5	4.5	0.3	4.0	ns
		Bn to An	1.2	6.9	1.0	6.0	0.8	5.7	0.5	5.5	0.5	5.3	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to An	0.5	5.7	0.5	5.7	0.5	5.7	0.5	5.7	0.5	5.7	ns
		$\overline{OE}$ to Bn	2.0	9.9	1.5	7.0	0.8	6.9	0.2	5.8	0.2	5.9	ns
t <sub>en</sub>	enable time	$\overline{OE}$ to An	1.0	6.7	1.0	6.7	1.0	6.7	1.0	6.7	1.0	6.7	ns
		$\overline{OE}$ to Bn	1.5	13.9	1.2	7.2	1.2	6.9	0.8	5.4	0.6	5.0	ns
<b>V<sub>CC(A)</sub> = 2.3 V to 2.7 V</b>													
t <sub>pd</sub>	propagation delay	An to Bn	1.4	9.4	0.8	6.6	0.5	5.5	0.4	4.2	0.2	3.7	ns
		Bn to An	1.0	5.9	0.5	4.8	0.5	4.5	0.4	4.2	0.3	3.9	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to An	0.2	4.0	0.2	4.0	0.2	4.0	0.2	4.0	0.2	4.0	ns
		$\overline{OE}$ to Bn	2.0	9.3	1.5	6.7	0.7	6.3	0.2	5.0	0.2	5.7	ns
t <sub>en</sub>	enable time	$\overline{OE}$ to An	0.6	4.5	0.6	4.5	0.6	4.5	0.6	4.5	0.6	4.5	ns
		$\overline{OE}$ to Bn	1.5	13.6	1.0	6.8	1.0	6.0	0.8	4.6	0.6	4.2	ns

Symbol	Parameter	Conditions	V <sub>CC(B)</sub>										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		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
V <sub>CC(A)</sub> = 3.0 V to 3.6 V													
t <sub>pd</sub>	propagation delay	An to Bn	1.4	9.3	0.6	6.5	0.5	5.3	0.3	3.9	0.2	3.5	ns
		Bn to An	0.8	5.7	0.5	4.3	0.3	4.0	0.2	3.7	0.2	3.5	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to An	0.2	4.5	0.2	4.5	0.2	4.5	0.2	4.5	0.2	4.5	ns
		$\overline{OE}$ to Bn	2.0	9.0	1.5	6.4	0.7	6.1	0.2	4.8	0.2	5.6	ns
t <sub>en</sub>	enable time	$\overline{OE}$ to An	0.5	4.0	0.5	4.0	0.5	4.0	0.5	4.0	0.5	4.0	ns
		$\overline{OE}$ to Bn	1.5	13.4	1.0	6.7	1.0	5.9	0.7	4.4	0.5	4.0	ns

[1] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>; t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>; t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>.

**Table 14. Dynamic characteristics for temperature range -40 °C to +125 °C [1]**

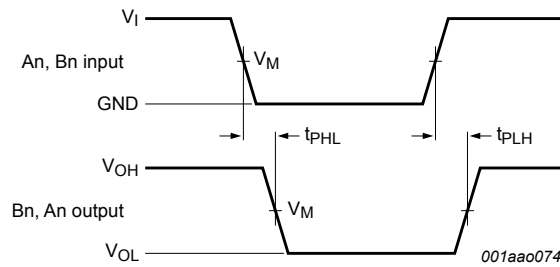
Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 7](#); for waveforms see [Figure 5](#) and [Figure 6](#)

Symbol	Parameter	Conditions	V <sub>CC(B)</sub>										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		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
V <sub>CC(A)</sub> = 1.1 V to 1.3 V													
t <sub>pd</sub>	propagation delay	An to Bn	2.0	12.1	1.3	9.0	1.2	8.0	1.0	6.8	0.8	6.6	ns
		Bn to An	2.0	12.1	1.5	11.4	1.5	11.2	1.4	10.9	1.4	10.7	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to An	2.0	11.5	2.0	11.5	2.0	11.5	2.0	11.5	2.0	11.5	ns
		$\overline{OE}$ to Bn	2.0	12.8	2.0	9.9	1.0	9.2	0.7	8.1	1.0	9.2	ns
t <sub>en</sub>	enable time	$\overline{OE}$ to An	2.0	15.6	2.0	15.6	2.0	15.6	2.0	15.6	2.0	15.6	ns
		$\overline{OE}$ to Bn	2.0	17.3	2.0	12.7	2.0	10.9	1.0	9.0	1.0	8.6	ns
V <sub>CC(A)</sub> = 1.4 V to 1.6 V													
t <sub>pd</sub>	propagation delay	An to Bn	1.5	11.4	1.0	8.2	1.0	6.9	0.5	5.6	0.5	5.0	ns
		Bn to An	1.3	9.0	1.0	8.2	0.9	8.0	0.8	7.6	0.6	7.5	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to An	1.0	6.9	1.0	6.9	1.0	6.9	1.0	6.9	1.0	6.9	ns
		$\overline{OE}$ to Bn	2.0	11.8	1.5	8.7	0.9	8.3	0.4	7.2	0.4	7.1	ns
t <sub>en</sub>	enable time	$\overline{OE}$ to An	1.0	8.7	1.0	8.7	1.0	8.7	1.0	8.7	1.0	8.7	ns
		$\overline{OE}$ to Bn	2.0	16.6	1.4	9.1	1.3	8.9	1.1	7.4	1.1	6.5	ns

Symbol	Parameter	Conditions	V <sub>CC(B)</sub>										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		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
<b>V<sub>CC(A)</sub> = 1.65 V to 1.95 V</b>													
t <sub>pd</sub>	propagation delay	An to Bn	1.5	11.2	0.9	8.0	0.8	6.6	0.5	5.2	0.3	4.6	ns
		Bn to An	1.2	8.0	1.0	6.9	0.8	6.6	0.5	6.4	0.5	6.1	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to An	0.5	6.6	0.5	6.6	0.5	6.6	0.5	6.6	0.5	6.6	ns
		$\overline{OE}$ to Bn	2.0	11.4	1.5	8.1	0.8	8.0	0.2	6.7	0.2	6.8	ns
t <sub>en</sub>	enable time	$\overline{OE}$ to An	1.0	7.8	1.0	7.8	1.0	7.8	1.0	7.8	1.0	7.8	ns
		$\overline{OE}$ to Bn	1.5	16.0	1.2	8.3	1.2	8.0	0.8	6.3	0.6	5.8	ns
<b>V<sub>CC(A)</sub> = 2.3 V to 2.7 V</b>													
t <sub>pd</sub>	propagation delay	An to Bn	1.4	10.9	0.8	7.6	0.5	6.4	0.4	4.9	0.2	4.3	ns
		Bn to An	1.0	6.8	0.5	5.6	0.5	5.2	0.4	4.9	0.3	4.5	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to An	0.2	4.6	0.2	4.6	0.2	4.6	0.2	4.6	0.2	4.6	ns
		$\overline{OE}$ to Bn	2.0	10.7	1.5	7.8	0.7	7.3	0.2	5.8	0.2	6.6	ns
t <sub>en</sub>	enable time	$\overline{OE}$ to An	0.6	5.2	0.6	5.2	0.6	5.2	0.6	5.2	0.6	5.2	ns
		$\overline{OE}$ to Bn	1.5	15.7	1.0	7.9	1.0	6.9	0.8	5.3	0.6	4.9	ns
<b>V<sub>CC(A)</sub> = 3.0 V to 3.6 V</b>													
t <sub>pd</sub>	propagation delay	An to Bn	1.4	10.7	0.6	7.5	0.5	6.1	0.3	4.5	0.2	4.1	ns
		Bn to An	0.8	6.6	0.5	5.0	0.3	4.6	0.2	4.3	0.2	4.1	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to An	0.2	5.2	0.2	5.2	0.2	5.2	0.2	5.2	0.2	5.2	ns
		$\overline{OE}$ to Bn	2.0	10.4	1.5	7.4	0.7	7.1	0.2	5.6	0.2	6.5	ns
t <sub>en</sub>	enable time	$\overline{OE}$ to An	0.5	4.6	0.5	4.6	0.5	4.6	0.5	4.6	0.5	4.6	ns
		$\overline{OE}$ to Bn	1.5	15.5	1.0	7.8	1.0	6.8	0.7	5.1	0.5	4.6	ns

[1] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>; t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>; t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>.

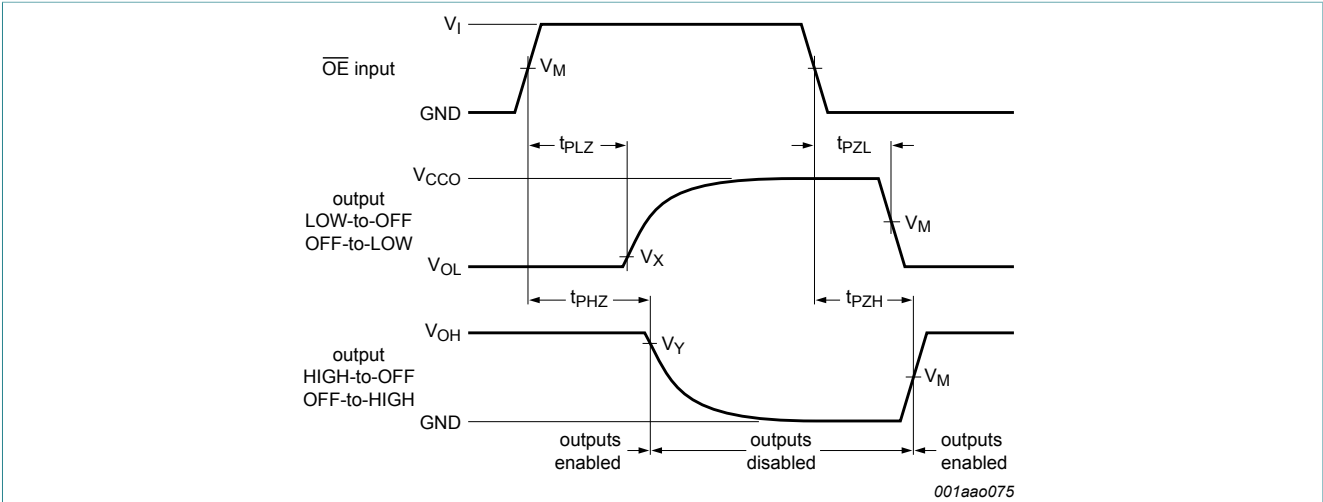
### 11.1 Waveforms and test circuit



Measurement points are given in [Table 15](#).

V<sub>OL</sub> and V<sub>OH</sub> are typical output voltage levels that occur with the output load.

**Figure 5. The data input (An, Bn) to output (Bn, An) propagation delay times**



Measurement points are given in [Table 15](#).

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

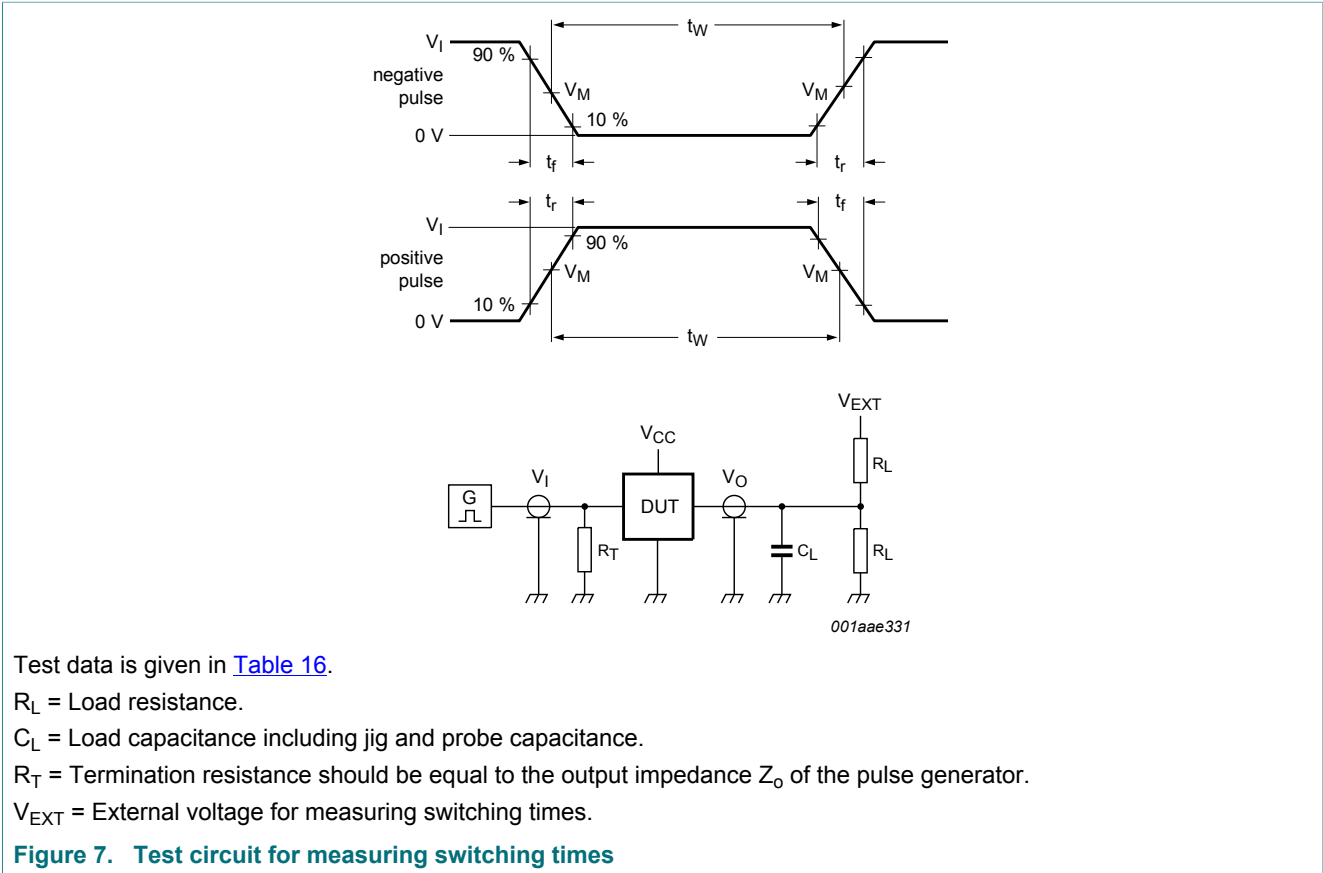
**Figure 6. Enable and disable times**

**Table 15. Measurement points**

Supply voltage	Input <sup>[1]</sup>	Output <sup>[2]</sup>		
	$V_M$	$V_M$	$V_X$	$V_Y$
0.8 V to 1.6 V	$0.5V_{CC1}$	$0.5V_{CC0}$	$V_{OL} + 0.1\text{ V}$	$V_{OH} - 0.1\text{ V}$
1.65 V to 2.7 V	$0.5V_{CC1}$	$0.5V_{CC0}$	$V_{OL} + 0.15\text{ V}$	$V_{OH} - 0.15\text{ V}$
3.0 V to 3.6 V	$0.5V_{CC1}$	$0.5V_{CC0}$	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$

[1]  $V_{CC1}$  is the supply voltage associated with the data input port.

[2]  $V_{CC0}$  is the supply voltage associated with the output port.



Test data is given in [Table 16](#).

$R_L$  = 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.

**Figure 7. Test circuit for measuring switching times**

**Table 16. Test data**

Supply voltage	Input		Load		$V_{EXT}$		
$V_{CC(A)}, V_{CC(B)}$	$V_I$ [1]	$\Delta t/\Delta V$ [2]	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$ [3]
0.8 V to 1.6 V	$V_{CCI}$	$\leq 1.0 \text{ ns/V}$	15 pF	2 k $\Omega$	open	GND	$2V_{CCO}$
1.65 V to 2.7 V	$V_{CCI}$	$\leq 1.0 \text{ ns/V}$	15 pF	2 k $\Omega$	open	GND	$2V_{CCO}$
3.0 V to 3.6 V	$V_{CCI}$	$\leq 1.0 \text{ ns/V}$	15 pF	2 k $\Omega$	open	GND	$2V_{CCO}$

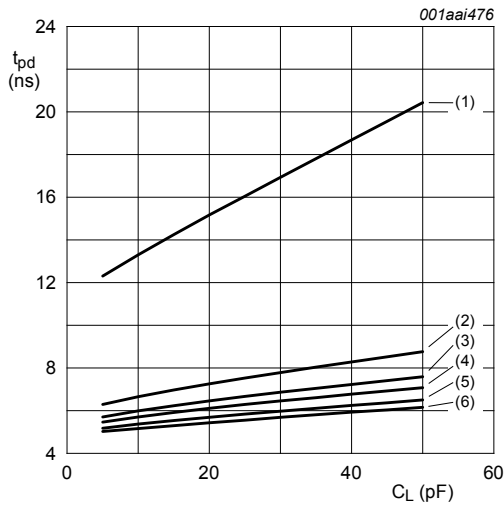
[1]  $V_{CCI}$  is the supply voltage associated with the data input port.

[2]  $dV/dt \geq 1.0 \text{ V/ns}$

[3]  $V_{CCO}$  is the supply voltage associated with the output port.

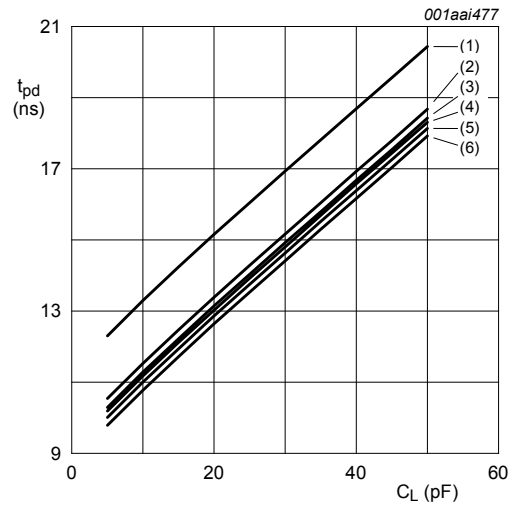


11.2 Typical propagation delay characteristics



a. Propagation delay (A to B);  $V_{CC(A)} = 0.8\text{ V}$

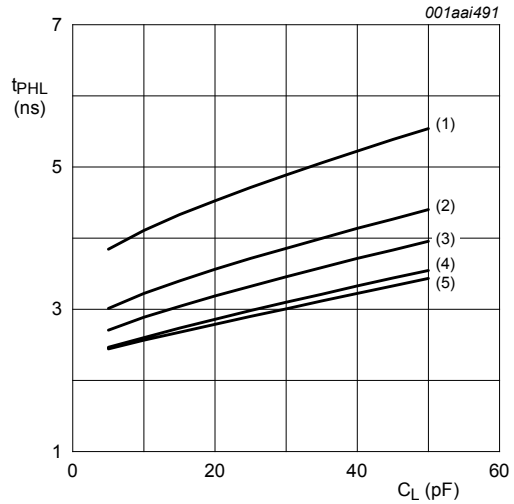
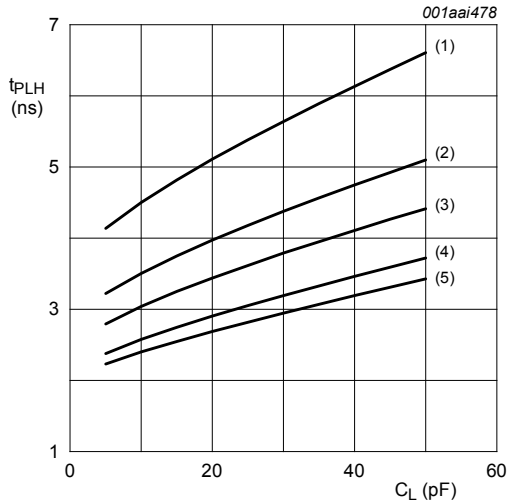
- (1)  $V_{CC(B)} = 0.8\text{ V}$
- (2)  $V_{CC(B)} = 1.2\text{ V}$
- (3)  $V_{CC(B)} = 1.5\text{ V}$
- (4)  $V_{CC(B)} = 1.8\text{ V}$
- (5)  $V_{CC(B)} = 2.5\text{ V}$
- (6)  $V_{CC(B)} = 3.3\text{ V}$



b. Propagation delay (A to B);  $V_{CC(B)} = 0.8\text{ V}$

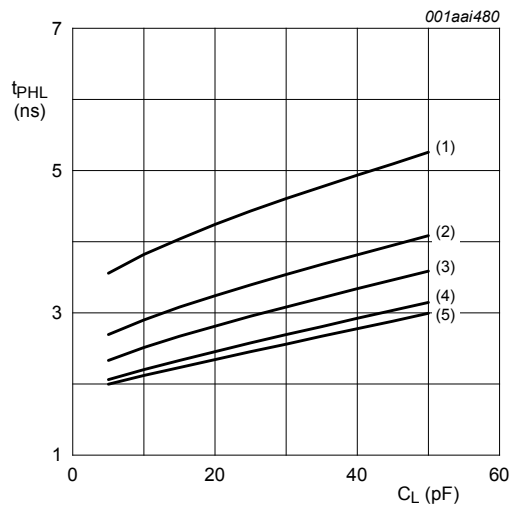
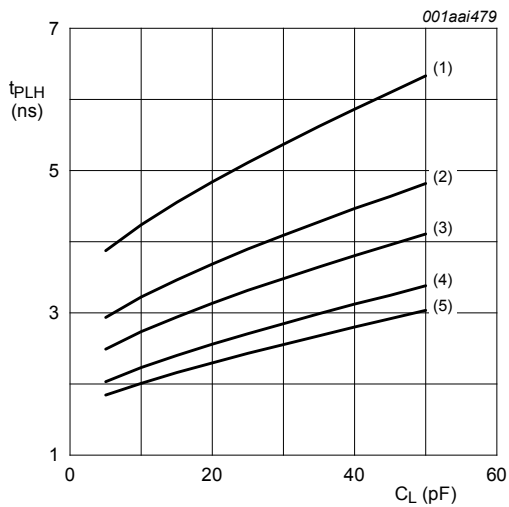
- (1)  $V_{CC(A)} = 0.8\text{ V}$
- (2)  $V_{CC(A)} = 1.2\text{ V}$
- (3)  $V_{CC(A)} = 1.5\text{ V}$
- (4)  $V_{CC(A)} = 1.8\text{ V}$
- (5)  $V_{CC(A)} = 2.5\text{ V}$
- (6)  $V_{CC(A)} = 3.3\text{ V}$

Figure 8. Typical propagation delay versus load capacitance;  $T_{amb} = 25\text{ °C}$



a. LOW to HIGH propagation delay (A to B);  $V_{CC(A)} = 1.2\text{ V}$

b. HIGH to LOW propagation delay (A to B);  $V_{CC(A)} = 1.2\text{ V}$

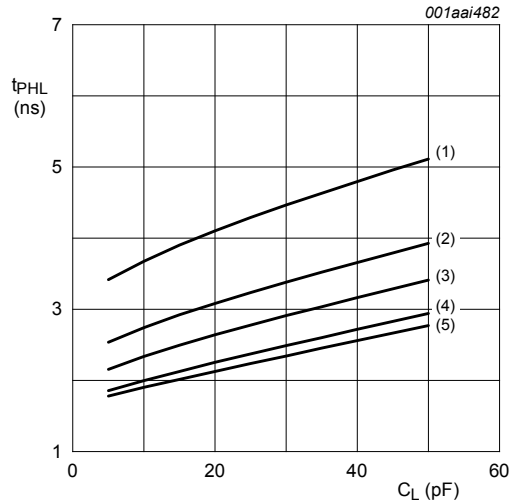
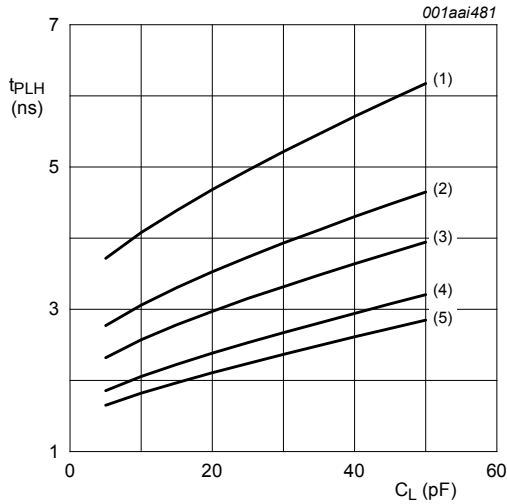


c. LOW to HIGH propagation delay (A to B);  $V_{CC(A)} = 1.5\text{ V}$

d. HIGH to LOW propagation delay (A to B);  $V_{CC(A)} = 1.5\text{ V}$

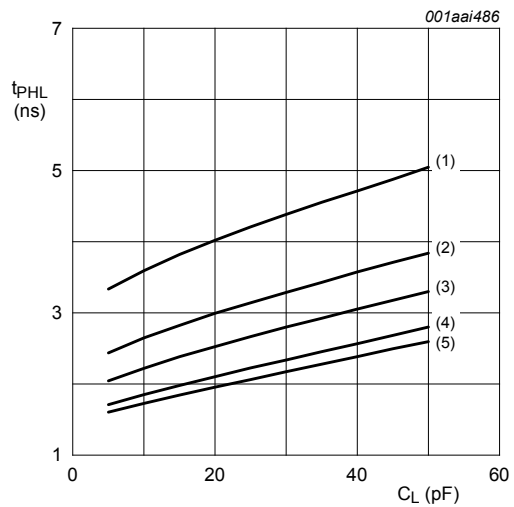
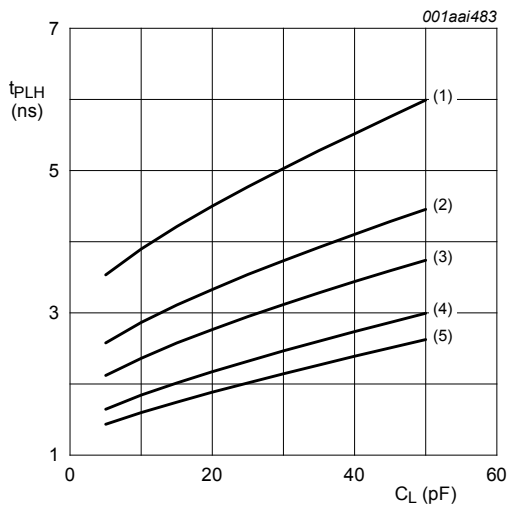
- (1)  $V_{CC(B)} = 1.2\text{ V}$
- (2)  $V_{CC(B)} = 1.5\text{ V}$
- (3)  $V_{CC(B)} = 1.8\text{ V}$
- (4)  $V_{CC(B)} = 2.5\text{ V}$
- (5)  $V_{CC(B)} = 3.3\text{ V}$

Figure 9. Typical propagation delay versus load capacitance;  $T_{amb} = 25\text{ }^\circ\text{C}$



a. LOW to HIGH propagation delay (A to B);  $V_{CC(A)} = 1.8\text{ V}$

b. HIGH to LOW propagation delay (A to B);  $V_{CC(A)} = 1.8\text{ V}$

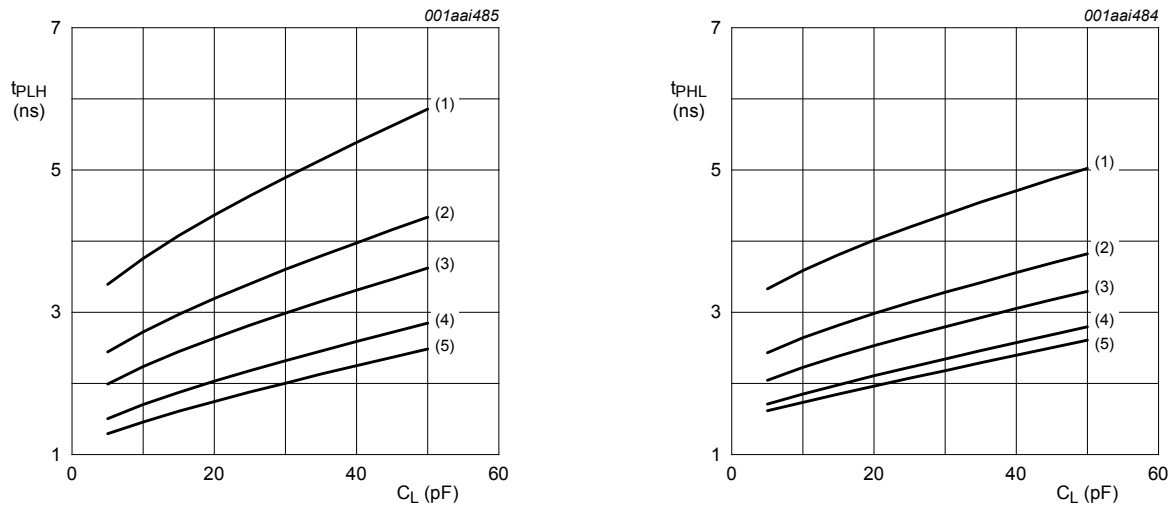


c. LOW to HIGH propagation delay (A to B);  $V_{CC(A)} = 2.5\text{ V}$

d. HIGH to LOW propagation delay (A to B);  $V_{CC(A)} = 2.5\text{ V}$

- (1)  $V_{CC(B)} = 1.2\text{ V}$
- (2)  $V_{CC(B)} = 1.5\text{ V}$
- (3)  $V_{CC(B)} = 1.8\text{ V}$
- (4)  $V_{CC(B)} = 2.5\text{ V}$
- (5)  $V_{CC(B)} = 3.3\text{ V}$

Figure 10. Typical propagation delay versus load capacitance;  $T_{amb} = 25\text{ }^\circ\text{C}$



a. LOW to HIGH propagation delay (A to B);  $V_{CC(A)} = 3.3\text{ V}$     b. HIGH to LOW propagation delay (A to B);  $V_{CC(A)} = 3.3\text{ V}$

- (1)  $V_{CC(B)} = 1.2\text{ V}$
- (2)  $V_{CC(B)} = 1.5\text{ V}$
- (3)  $V_{CC(B)} = 1.8\text{ V}$
- (4)  $V_{CC(B)} = 2.5\text{ V}$
- (5)  $V_{CC(B)} = 3.3\text{ V}$

Figure 11. Typical propagation delay versus load capacitance;  $T_{amb} = 25\text{ °C}$

12 Package outline

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

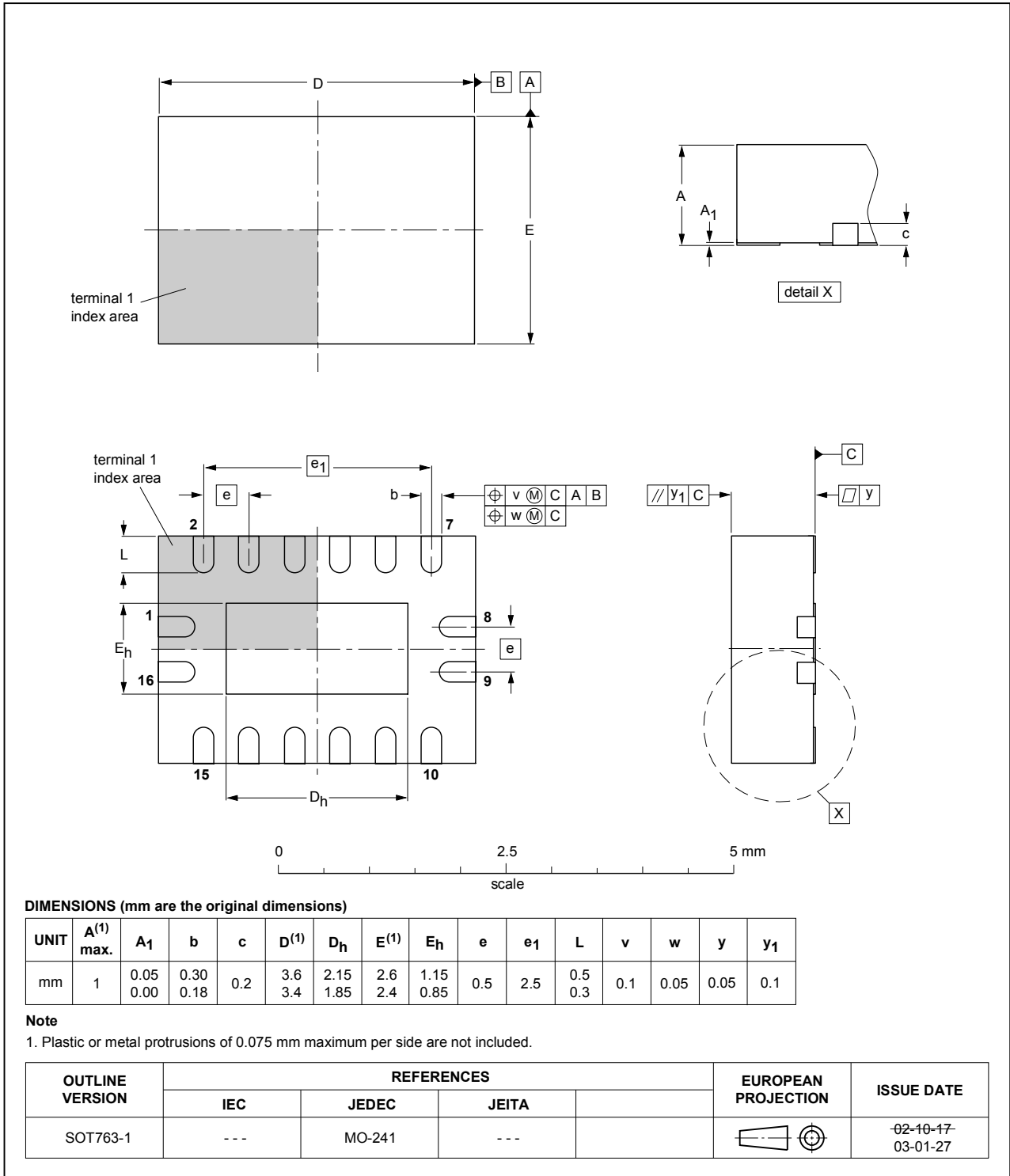
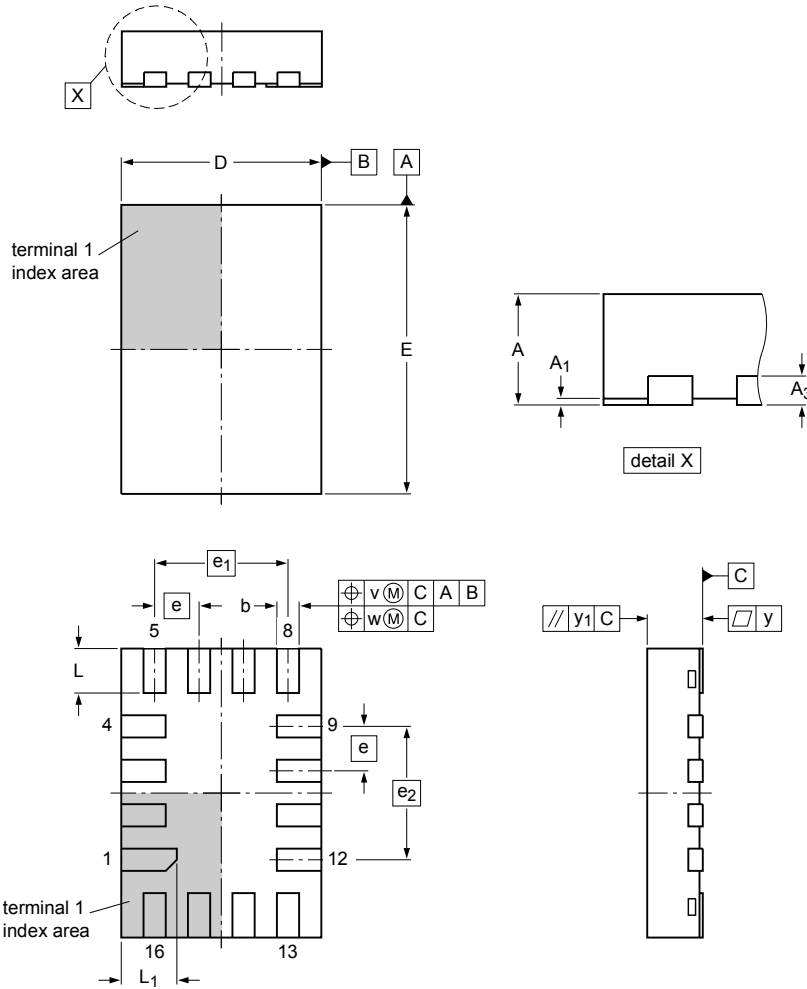


Figure 12. Package outline SOT763-1 (DHVQFN16)

**XQFN16: plastic, extremely thin quad flat package; no leads;**  
**16 terminals; body 1.80 x 2.60 x 0.50 mm**

SOT1161-1



Dimensions

Unit <sup>(1)</sup>	A	A <sub>1</sub>	A <sub>3</sub>	b	D	E	e	e <sub>1</sub>	e <sub>2</sub>	L	L <sub>1</sub>	v	w	y	y <sub>1</sub>
max	0.5	0.05		0.25	1.9	2.7				0.45	0.55				
mm nom			0.127	0.20	1.8	2.6	0.4	1.2	1.2	0.40	0.50	0.1	0.05	0.05	0.05
min		0.00		0.15	1.7	2.5				0.35	0.45				

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot1161-1\_po

Outline version	References			European projection	Issue date
	IEC	JEDEC	JEITA		
SOT1161-1	---	---	---		09-12-28 09-12-29

Figure 13. Package outline SOT1161-1 (XQFN16)

## 13 Abbreviations

Table 17. Abbreviations

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

## 14 Revision history

Table 18. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AVC4T774 v.1	20170925	Product data sheet	-	-

## 15 Legal information

### 15.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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

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

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## Contents

<b>1</b>	<b>General description</b> .....	<b>1</b>
<b>2</b>	<b>Features and benefits</b> .....	<b>1</b>
<b>3</b>	<b>Ordering information</b> .....	<b>2</b>
<b>4</b>	<b>Marking</b> .....	<b>2</b>
<b>5</b>	<b>Functional diagram</b> .....	<b>2</b>
<b>6</b>	<b>Pinning information</b> .....	<b>3</b>
6.1	Pinning .....	3
6.2	Pin description .....	4
<b>7</b>	<b>Functional description</b> .....	<b>4</b>
<b>8</b>	<b>Limiting values</b> .....	<b>5</b>
<b>9</b>	<b>Recommended operating conditions</b> .....	<b>5</b>
<b>10</b>	<b>Static characteristics</b> .....	<b>6</b>
<b>11</b>	<b>Dynamic characteristics</b> .....	<b>10</b>
11.1	Waveforms and test circuit .....	14
11.2	Typical propagation delay characteristics .....	17
<b>12</b>	<b>Package outline</b> .....	<b>21</b>
<b>13</b>	<b>Abbreviations</b> .....	<b>23</b>
<b>14</b>	<b>Revision history</b> .....	<b>23</b>
<b>15</b>	<b>Legal information</b> .....	<b>24</b>

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