74AVCH20T245

20-bit dual supply translating transceiver with configurable voltage translation; 3-state

Rev. 6 — 14 January 2019 | Product data sheet

1. General description

The 74AVCH20T245 is a 20-bit, dual supply transceiver that enables bi-directional voltage level translation. The device can be used as two 10-bit transceivers or as a single 20-bit transceiver. It features four 10-bit input-output ports (1An, 1Bn and 2An, 2Bn), two output enable inputs ($n\overline{OE}$), two direction inputs (nDIR) and dual supplies ($V_{CC(A)}$ and $V_{CC(B)}$). $V_{CC(A)}$ and $V_{CC(B)}$ can be independently supplied at any voltage between 0.8 V and 3.6 V making the device suitable for bi-directional voltage level translation 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. The 1An and 2An ports, $n\overline{OE}$ and nDIR are referenced to $V_{CC(A)}$, the 1Bn and 2Bn ports are referenced to $V_{CC(B)}$. A HIGH on a 1DIR allows transmission from 1An to 1Bn and a LOW on 1DIR allows transmission from 1Bn to 1An. A HIGH on $n\overline{OE}$ causes the outputs to assume a HIGH impedance OFF-state.

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, all output ports will assume a high impedance OFF-state. The bus hold circuitry on the powered-up side always stays active.

The 74AVCH20T245 has active bus hold circuitry which is provided to hold unused or floating data inputs at a valid logic level. This feature eliminates the need for external pull-up or pull-down resistors.

2. Features and benefits

- 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
  - MM JESD22-A115-A exceeds 200 V
  - CDM JESD22-C101C exceeds 1000 V

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- Maximum data rates:
  - 380 Mbit/s (≥ 1.8 V to 3.3 V translation)
  - 260 Mbit/s (≥ 1.1 V to 3.3 V translation)
  - 260 Mbit/s (≥ 1.1 V to 2.5 V translation)
  - 210 Mbit/s (≥ 1.1 V to 1.8 V translation)
  - 120 Mbit/s (≥ 1.1 V to 1.5 V translation)
  - 100 Mbit/s (≥ 1.1 V to 1.2 V translation)
- Suspend mode
- Bus hold on data inputs
- 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
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	**Name**	**Description**	**Version**
74AVCH20T245DGG	-40 °C to +125 °C	TSSOP56	plastic thin shrink small outline package; 56 leads; body width 6.1 mm	SOT364-1

4. Functional diagram

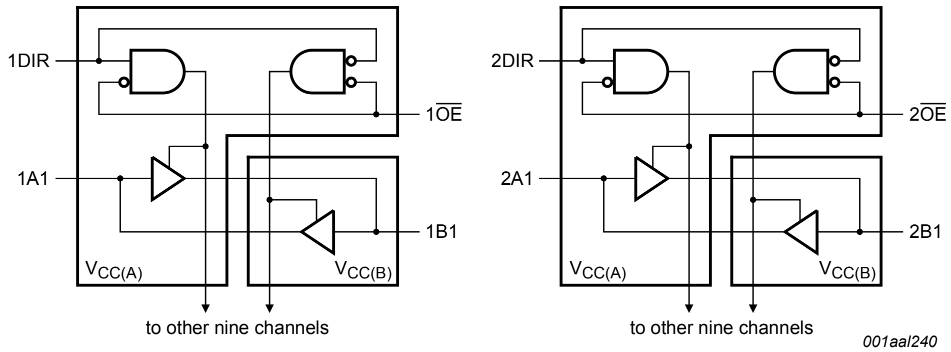


Fig. 1. Logic diagram

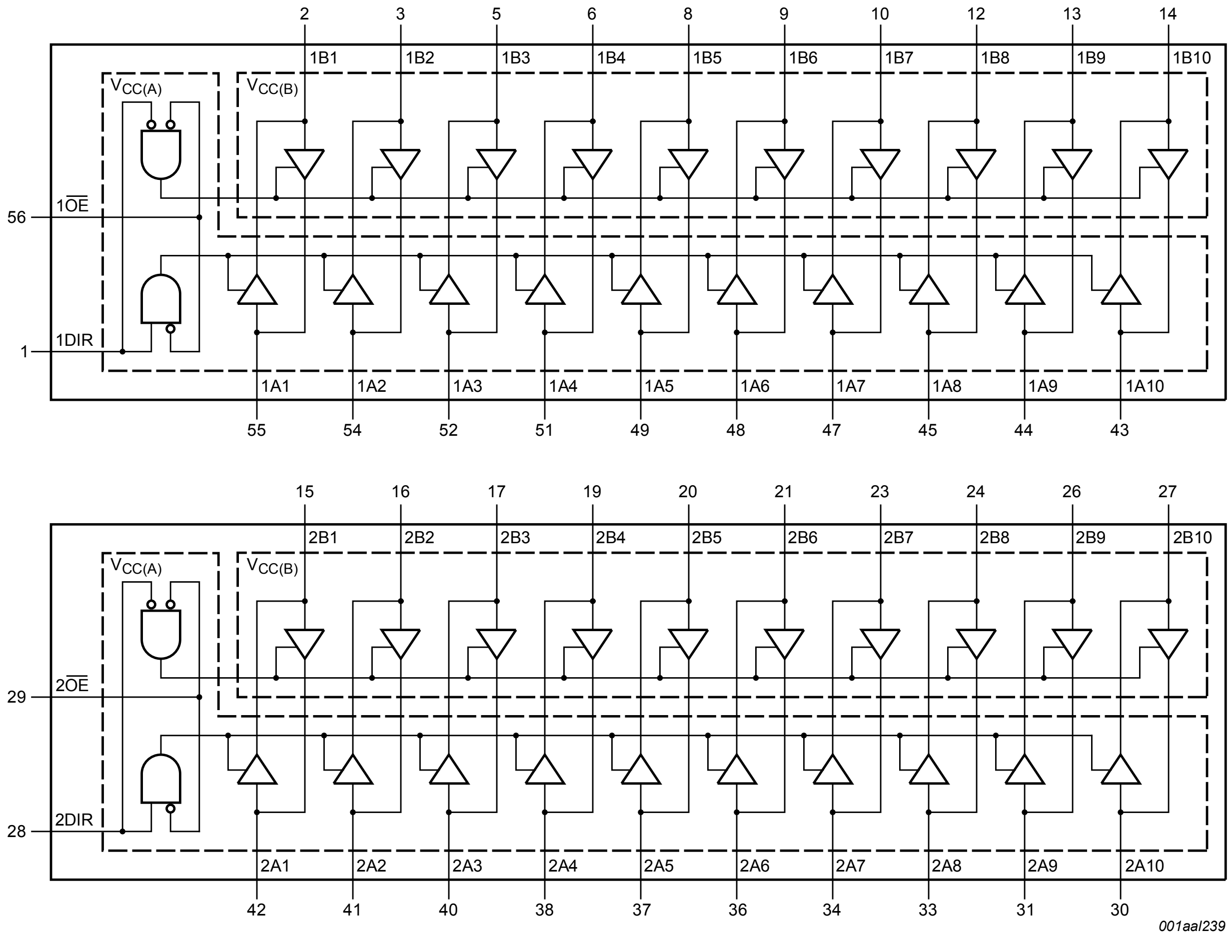


Fig. 2. Logic symbol

5. Pinning information

5.1. Pinning

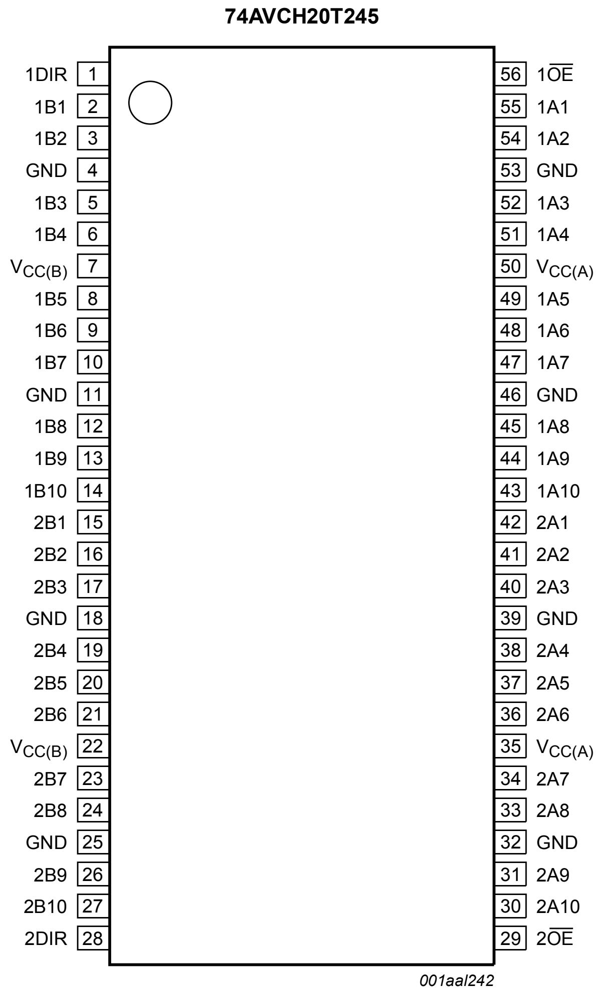


Fig. 3. Pin configuration SOT364-1 (TSSOP56)

5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1DIR, 2DIR	1, 28	direction control
1B1 to 1B10	2, 3, 5, 6, 8, 9, 10, 12, 13, 14	data input or output
2B1 to 2B10	15, 16, 17, 19, 20, 21, 23, 24,26, 27	data input or output
GND[1]	4, 11, 18, 25, 32, 39, 46, 53	ground (0 V)
$V_{CC(B)}$	7, 22	supply voltage B (nBn inputs are referenced to $V_{CC(B)}$)
1$\overline{OE}$, 2$\overline{OE}$	56, 29	output enable input (active LOW)
1A1 to 1A10	55, 54, 52, 51, 49, 48, 47, 45,44, 43	data input or output
2A1 to 2A10	42, 41, 40, 38, 37, 36, 34, 33,31, 30	data input or output
$V_{CC(A)}$	35, 50	supply voltage A (nAn, n$\overline{OE}$ and nDIR inputs are referenced to $V_{CC(A)}$)

[1] All GND pins must be connected to ground (0 V).

6. Functional description

Table 3. Function table
[1]

Supply voltage	Input		Input/output [2]	
$V_{CC(A)}$, $V_{CC(B)}$	**n$\overline{OE}$ [3]**	**nDIR [3]**	**nAn [3]**	**nBn [3]**
0.8 V to 3.6 V	L	L	nAn = nBn	input
0.8 V to 3.6 V	L	H	input	nBn = nAn
0.8 V to 3.6 V	H	X	Z	Z
GND [2]	X	X	Z	Z

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.
[2] If at least one of $V_{CC(A)}$ or $V_{CC(B)}$ is at GND level, the device goes into suspend mode.
[3] The nAn, nDIR and n$\overline{OE}$ input circuit is referenced to $V_{CC(A)}$; The nBn input circuit is referenced to $V_{CC(B)}$.

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC(A)}$	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]	-	±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 [4]	-	600	mW

[1] The minimum input and minimum output voltage ratings may be exceeded if the input and output clamping 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] Above 55 °C the value of P_{tot} derates linearly with 8.0 mW/K.

8. Recommended operating conditions

Table 5. 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]	-	5	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.

9. Static characteristics

Table 6. Typical static characteristics at T_{amb} = 25 °C

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).[1] [2]

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = -1.5 mA; $V_{CC(A)} = V_{CC(B)}$ = 0.8 V		-	0.69	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = 1.5 mA; $V_{CC(A)} = V_{CC(B)}$ = 0.8 V		-	0.07	-	V
I_I	input leakage current	nDIR, n$\overline{OE}$ input; V_I = 0 V or 3.6 V; $V_{CC(A)} = V_{CC(B)}$ = 0.8 V to 3.6 V		-	±0.025	±0.25	μA
I_{BHL}	bus hold LOW current	A or B port; V_I = 0.42 V; $V_{CC(A)} = V_{CC(B)}$ = 1.2 V	[3]	-	26	-	μA
I_{BHH}	bus hold HIGH current	A or B port; V_I = 0.78 V; $V_{CC(A)} = V_{CC(B)}$ = 1.2 V	[4]	-	-24	-	μA
I_{BHLO}	bus hold LOW overdrive current	A or B port; $V_{CC(A)} = V_{CC(B)}$ = 1.2 V	[5]	-	27	-	μA
I_{BHHO}	bus hold HIGH overdrive current	A or B port; $V_{CC(A)} = V_{CC(B)}$ = 1.2 V	[6]	-	-26	-	μA
I_{OZ}	OFF-state output current	A or B port; V_O = 0 V or V_{CCO}; $V_{CC(A)} = V_{CC(B)}$ = 3.6 V	[7]	-	±0.5	±2.5	μA
		suspend mode A port; V_O = 0 V or V_{CCO}; $V_{CC(A)}$ = 3.6 V; $V_{CC(B)}$ = 0 V	[7]	-	±0.5	±2.5	μA
		suspend mode B port; V_O = 0 V or V_{CCO}; $V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 3.6 V	[7]	-	±0.5	±2.5	μA
I_{OFF}	power-off leakage current	A port; V_I or V_O = 0 V to 3.6 V; $V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 0.8 V to 3.6 V		-	±0.1	±1	μA
		B port; V_I or V_O = 0 V to 3.6 V; $V_{CC(B)}$ = 0 V; $V_{CC(A)}$ = 0.8 V to 3.6 V		-	±0.1	±1	μA
C_I	input capacitance	nDIR, n$\overline{OE}$ input; V_I = 0 V or 3.3 V; $V_{CC(A)} = V_{CC(B)}$ = 3.3 V		-	2.0	-	pF
$C_{I/O}$	input/output capacitance	A and B port; V_O = 3.3 V or 0 V; $V_{CC(A)} = V_{CC(B)}$ = 3.3 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] The bus hold circuit can sink at least the minimum low sustaining current at V_{IL} max. I_{BHL} should be measured after lowering V_I to GND and then raising it to V_{IL} max.

[4] The bus hold circuit can source at least the minimum high sustaining current at V_{IH} min. I_{BHH} should be measured after raising V_I to V_{CC} and then lowering it to V_{IH} min.

[5] An external driver must source at least I_{BHLO} to switch this node from LOW to HIGH.

[6] An external driver must sink at least I_{BHHO} to switch this node from HIGH to LOW.

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

Table 7. Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).[1] [2]

Symbol	Parameter	Conditions	-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Max	Min	Max	
V_{IH}	HIGH-level input voltage	data input					
		V_{CCI} = 0.8 V	$0.70V_{CCI}$	-	$0.70V_{CCI}$	-	V
		V_{CCI} = 1.1 V to 1.95 V	$0.65V_{CCI}$	-	$0.65V_{CCI}$	-	V
		V_{CCI} = 2.3 V to 2.7 V	1.6	-	1.6	-	V
		V_{CCI} = 3.0 V to 3.6 V	2	-	2	-	V
		nDIR, n$\overline{OE}$ input					
		$V_{CC(A)}$ = 0.8 V	$0.70V_{CC(A)}$	-	$0.70V_{CC(A)}$	-	V
		$V_{CC(A)}$ = 1.1 V to 1.95 V	$0.65V_{CC(A)}$	-	$0.65V_{CC(A)}$	-	V
		$V_{CC(A)}$ = 2.3 V to 2.7 V	1.6	-	1.6	-	V
		$V_{CC(A)}$ = 3.0 V to 3.6 V	2	-	2	-	V
V_{IL}	LOW-level input voltage	data input					
		V_{CCI} = 0.8 V	-	$0.30V_{CCI}$	-	$0.30V_{CCI}$	V
		V_{CCI} = 1.1 V to 1.95 V	-	$0.35V_{CCI}$	-	$0.35V_{CCI}$	V
		V_{CCI} = 2.3 V to 2.7 V	-	0.7	-	0.7	V
		V_{CCI} = 3.0 V to 3.6 V	-	0.8	-	0.8	V
		nDIR, n$\overline{OE}$ input					
		$V_{CC(A)}$ = 0.8 V	-	$0.30V_{CC(A)}$	-	$0.30V_{CC(A)}$	V
		$V_{CC(A)}$ = 1.1 V to 1.95 V	-	$0.35V_{CC(A)}$	-	$0.35V_{CC(A)}$	V
		$V_{CC(A)}$ = 2.3 V to 2.7 V	-	0.7	-	0.7	V
		$V_{CC(A)}$ = 3.0 V to 3.6 V	-	0.8	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = -100 μA; $V_{CC(A)} = V_{CC(B)}$ = 0.8 V to 3.6 V	V_{CCO} - 0.1	-	V_{CCO} - 0.1	-	V
		I_O = -3 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V	0.85	-	0.85	-	V
		I_O = -6 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.4 V	1.05	-	1.05	-	V
		I_O = -8 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.65 V	1.2	-	1.2	-	V
		I_O = -9 mA; $V_{CC(A)} = V_{CC(B)}$ = 2.3 V	1.75	-	1.75	-	V
		I_O = -12 mA; $V_{CC(A)} = V_{CC(B)}$ = 3.0 V	2.3	-	2.3	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = 100 μA; $V_{CC(A)} = V_{CC(B)}$ = 0.8 V to 3.6 V	-	0.1	-	0.1	V
		I_O = 3 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V	-	0.25	-	0.25	V
		I_O = 6 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.4 V	-	0.35	-	0.35	V
		I_O = 8 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.65 V	-	0.45	-	0.45	V
		I_O = 9 mA; $V_{CC(A)} = V_{CC(B)}$ = 2.3 V	-	0.55	-	0.55	V
		I_O = 12 mA; $V_{CC(A)} = V_{CC(B)}$ = 3.0 V	-	0.7	-	0.7	V
I_I	input leakage current	nDIR, n$\overline{OE}$ input; V_I = 0 V or 3.6 V; $V_{CC(A)} = V_{CC(B)}$ = 0.8 V to 3.6 V	-	±1	-	±5	μA

Symbol	Parameter	Conditions		-40 °C to +85 °C		-40 °C to +125 °C		Unit
				Min	Max	Min	Max	
I_{BHL}	bus hold LOW current	A or B port	[3]					
		V_I = 0.49 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.4 V		15	-	15	-	μA
		V_I = 0.58 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.65 V		25	-	25	-	μA
		V_I = 0.70 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 2.3 V		45	-	45	-	μA
		V_I = 0.80 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 3.0 V		100	-	90	-	μA
I_{BHH}	bus hold HIGH current	A or B port	[4]					
		V_I = 0.91 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.4 V		-15	-	-15	-	μA
		V_I = 1.07 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 1.65 V		-25	-	-25	-	μA
		V_I = 1.60 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 2.3 V		-45	-	-45	-	μA
		V_I = 2.00 V; $V_{CC(A)}$ = $V_{CC(B)}$ = 3.0 V		-100	-	-100	-	μA
I_{BHLO}	bus hold LOW overdrive current	A or B port	[5]					
		$V_{CC(A)}$ = $V_{CC(B)}$ = 1.6 V		125	-	125	-	μA
		$V_{CC(A)}$ = $V_{CC(B)}$ = 1.95 V		200	-	200	-	μA
		$V_{CC(A)}$ = $V_{CC(B)}$ = 2.7 V		300	-	300	-	μA
		$V_{CC(A)}$ = $V_{CC(B)}$ = 3.6 V		500	-	500	-	μA
I_{BHHO}	bus hold HIGH overdrive current	A or B port	[6]					
		$V_{CC(A)}$ = $V_{CC(B)}$ = 1.6 V		-125	-	-125	-	μA
		$V_{CC(A)}$ = $V_{CC(B)}$ = 1.95 V		-200	-	-200	-	μA
		$V_{CC(A)}$ = $V_{CC(B)}$ = 2.7 V		-300	-	-300	-	μA
		$V_{CC(A)}$ = $V_{CC(B)}$ = 3.6 V		-500	-	-500	-	μA
I_{OZ}	OFF-state output current	A or B port; V_O = 0 V or V_{CCO}; $V_{CC(A)}$ = $V_{CC(B)}$ = 3.6 V	[7]	-	±5	-	±30	μA
		suspend mode A port; V_O = 0 V or V_{CCO}; $V_{CC(A)}$ = 3.6 V; $V_{CC(B)}$ = 0 V	[7]	-	±5	-	±30	μA
		suspend mode B port; V_O = 0 V or V_{CCO}; $V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 3.6 V	[7]	-	±5	-	±30	μA
I_{OFF}	power-off leakage current	A port; V_I or V_O = 0 V to 3.6 V; $V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 0.8 V to 3.6 V		-	±5	-	±30	μA
		B port; V_I or V_O = 0 V to 3.6 V; $V_{CC(B)}$ = 0 V; $V_{CC(A)}$ = 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_{CC}	supply current	A port; V_I = 0 V or V_{CCI}; I_O = 0 A					
		$V_{CC(A)}$ = 0.8 V to 3.6 V; $V_{CC(B)}$ = 0.8 V to 3.6 V	-	45	-	190	μA
		$V_{CC(A)}$ = 1.1 V to 3.6 V; $V_{CC(B)}$ = 1.1 V to 3.6 V	-	35	-	140	μA
		$V_{CC(A)}$ = 3.6 V; $V_{CC(B)}$ = 0 V	-	35	-	140	μA
		$V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 3.6 V	-5	-	-20	-	μA
		B port; V_I = 0 V or V_{CCI}; I_O = 0 A					
		$V_{CC(A)}$ = 0.8 V to 3.6 V; $V_{CC(B)}$ = 0.8 V to 3.6 V	-	45	-	190	μA
		$V_{CC(A)}$ = 1.1 V to 3.6 V; $V_{CC(B)}$ = 1.1 V to 3.6 V	-	35	-	140	μA
		$V_{CC(A)}$ = 3.6 V; $V_{CC(B)}$ = 0 V	-5	-	-20	-	μA
		$V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 3.6 V	-	35	-	140	μA
		A plus B port ($I_{CC(A)}$ + $I_{CC(B)}$); I_O = 0 A; V_I = 0 V or V_{CCI}; $V_{CC(A)}$ = 0.8 V to 3.6 V; $V_{CC(B)}$ = 0.8 V to 3.6 V	-	80	-	270	μA
		A plus B port ($I_{CC(A)}$ + $I_{CC(B)}$); I_O = 0 A; V_I = 0 V or V_{CCI}; $V_{CC(A)}$ = 1.1 V to 3.6 V; $V_{CC(B)}$ = 1.1 V to 3.6 V	-	65	-	220	μA

[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] The bus hold circuit can sink at least the minimum low sustaining current at V_{IL} max. I_{BHL} should be measured after lowering V_I to GND and then raising it to V_{IL} max.
[4] The bus hold circuit can source at least the minimum high sustaining current at V_{IH} min. I_{BHH} should be measured after raising V_I to V_{CC} and then lowering it to V_{IH} min.
[5] An external driver must source at least I_{BHLO} to switch this node from LOW to HIGH.
[6] An external driver must sink at least I_{BHHO} to switch this node from HIGH to LOW.
[7] For I/O ports, the parameter I_{OZ} includes the input leakage current.

Table 8. Typicaltotal supply current ($I_{CC(A)}$ + $I_{CC(B)}$)

$V_{CC(A)}$	$V_{CC(B)}$							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

10. Dynamic characteristics

Table 9. Typical power dissipation capacitance at $V_{CC(A)} = V_{CC(B)}$ and $T_{amb} = 25$ °C

Voltages are referenced to GND (ground = 0 V).[1][2]

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_{PD}	power dissipation capacitance	A port: (direction A to B); output enabled	0.2	0.2	0.2	0.2	0.3	0.4	pF
		A port: (direction A to B); output disabled	0.2	0.2	0.2	0.2	0.3	0.4	pF
		A port: (direction B to A); output enabled	9.5	9.7	9.8	9.9	10.7	11.9	pF
		A port: (direction B to A); output disabled	0.6	0.6	0.6	0.6	0.7	0.7	pF
		B port: (direction A to B); output enabled	9.5	9.7	9.8	9.9	10.7	11.9	pF
		B port: (direction A to B); output disabled	0.6	0.6	0.6	0.6	0.7	0.7	pF
		B port: (direction B to A); output enabled	0.2	0.2	0.2	0.2	0.3	0.4	pF
		B port: (direction B to A); output disabled	0.2	0.2	0.2	0.2	0.3	0.4	pF

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ where:
f_i = input frequency in MHz;
f_o = output frequency in MHz;
C_L = load capacitance in pF;
V_{CC} = 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_i = 10 MHz; V_I = GND to V_{CC}; $t_r = t_f$ = 1 ns; C_L = 0 pF; $R_L = \infty\ \Omega$.

Table 10. Typical dynamic characteristics at $V_{CC(A)} = 0.8$ V and $T_{amb} = 25$ °C

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 6; for wave forms see Fig. 4 and Fig. 5.[1]

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	nAn to nBn	14.4	7.0	6.2	6.0	5.9	6.0	ns
		nBn to nAn	14.4	12.4	12.1	11.9	11.8	11.8	ns
t_{dis}	disable time	$n\overline{OE}$ to nAn	16.2	16.2	16.2	16.2	16.2	16.2	ns
		$n\overline{OE}$ to nBn	17.6	10.0	9.0	9.1	8.7	9.3	ns
t_{en}	enable time	$n\overline{OE}$ to nAn	21.9	21.9	21.9	21.9	21.9	21.9	ns
		$n\overline{OE}$ to nBn	22.2	11.1	9.8	9.4	9.4	9.6	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 11. Typical dynamic characteristics at $V_{CC(B)} = 0.8$ V and $T_{amb} = 25$ °C

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 6; for wave forms see Fig. 4 and Fig. 5. [1]

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	nAn to nBn	14.4	12.4	12.1	11.9	11.8	11.8	ns
		nBn to nAn	14.4	7.0	6.2	6.0	5.9	6.0	ns
t_{dis}	disable time	$n\overline{OE}$ to nAn	16.2	5.9	4.4	4.2	3.1	3.5	ns
		$n\overline{OE}$ to nBn	17.6	14.2	13.7	13.6	13.3	13.1	ns
t_{en}	enable time	$n\overline{OE}$ to nAn	21.9	6.4	4.4	3.5	2.6	2.3	ns
		$n\overline{OE}$ to nBn	22.2	17.7	17.2	17.0	16.8	16.7	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. Dynamic characteristics for temperature range -40 °C to +85 °C

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 6; for wave forms see Fig. 4 and Fig. 5. [1]

Symbol	Parameter	Conditions	$V_{CC(B)}$										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	
$V_{CC(A)}$ = 1.1 V to 1.3 V													
t_{pd}	propagation delay	nAn to nBn	0.5	9.4	0.5	7.1	0.5	6.2	0.5	5.2	0.5	5.1	ns
		nBn to nAn	0.5	9.4	0.5	8.9	0.5	8.7	0.5	8.4	0.5	8.2	ns
t_{dis}	disable time	n$\overline{OE}$ to nAn	2.0	11.9	2.0	11.9	2.0	11.9	2.0	11.9	2.0	11.9	ns
		n$\overline{OE}$ to nBn	1.5	12.7	1.5	9.8	1.5	9.6	1.0	8.1	1.0	9.0	ns
t_{en}	enable time	n$\overline{OE}$ to nAn	1.5	15.3	1.5	15.3	1.5	15.3	1.5	15.3	1.5	15.3	ns
		n$\overline{OE}$ to nBn	1.0	15.6	1.0	11.5	1.0	10.0	0.5	8.4	0.5	8.0	ns
$V_{CC(A)}$ = 1.4 V to 1.6 V													
t_{pd}	propagation delay	nAn to nBn	0.5	8.9	0.5	6.4	0.5	5.4	0.5	4.3	0.5	3.9	ns
		nBn to nAn	0.5	7.1	0.5	6.4	0.5	6.1	0.5	5.8	0.5	5.7	ns
t_{dis}	disable time	n$\overline{OE}$ to nAn	2.0	9.0	2.0	9.0	2.0	9.0	2.0	9.0	2.0	9.0	ns
		n$\overline{OE}$ to nBn	1.5	11.7	1.5	9.0	1.5	7.8	1.0	6.4	1.0	6.0	ns
t_{en}	enable time	n$\overline{OE}$ to nAn	1.5	10.3	1.5	10.3	1.5	10.3	1.5	10.2	1.5	10.2	ns
		n$\overline{OE}$ to nBn	1.0	14.3	1.0	10.3	1.0	8.4	0.5	6.1	0.5	5.3	ns
$V_{CC(A)}$ = 1.65 V to 1.95 V													
t_{pd}	propagation delay	nAn to nBn	0.5	8.7	0.5	6.1	0.5	5.0	0.5	3.9	0.5	3.5	ns
		nBn to nAn	0.5	6.2	0.5	5.4	0.5	5.0	0.5	4.7	0.5	4.6	ns
t_{dis}	disable time	n$\overline{OE}$ to nAn	2.0	7.4	2.0	7.4	2.0	7.4	2.0	7.4	2.0	7.4	ns
		n$\overline{OE}$ to nBn	1.5	11.3	1.5	8.7	1.5	7.4	1.0	5.8	1.0	5.6	ns
t_{en}	enable time	n$\overline{OE}$ to nAn	1.0	8.1	1.0	8.1	1.0	7.9	1.0	7.9	1.0	7.9	ns
		n$\overline{OE}$ to nBn	0.5	13.8	0.5	10.0	0.5	7.9	0.5	5.7	0.5	4.8	ns
$V_{CC(A)}$ = 2.3 V to 2.7 V													
t_{pd}	propagation delay	nAn to nBn	0.5	8.4	0.5	5.8	0.5	4.7	0.5	3.5	0.5	3.0	ns
		nBn to nAn	0.5	5.2	0.5	4.3	0.5	3.9	0.5	3.5	0.5	3.4	ns
t_{dis}	disable time	n$\overline{OE}$ to nAn	1.1	5.2	1.1	5.2	1.1	5.2	1.1	5.2	1.1	5.2	ns
		n$\overline{OE}$ to nBn	1.2	10.8	1.2	8.2	1.2	6.9	1.0	5.3	1.0	5.2	ns
t_{en}	enable time	n$\overline{OE}$ to nAn	0.5	5.4	0.5	5.4	0.5	5.3	0.5	5.2	0.5	5.2	ns
		n$\overline{OE}$ to nBn	0.5	13.3	0.5	9.6	0.5	7.6	0.5	5.3	0.5	4.3	ns
$V_{CC(A)}$ = 3.0 V to 3.6 V													
t_{pd}	propagation delay	nAn to nBn	0.5	8.2	0.5	5.7	0.5	4.6	0.5	3.4	0.5	2.9	ns
		nBn to nAn	0.5	5.1	0.5	3.9	0.5	3.5	0.5	3.0	0.5	2.9	ns
t_{dis}	disable time	n$\overline{OE}$ to nAn	0.8	5.0	0.8	5.0	0.8	5.0	0.8	5.0	0.8	5.0	ns
		n$\overline{OE}$ to nBn	1.2	10.5	1.2	8.1	1.2	6.7	1.0	5.1	0.8	5.0	ns
t_{en}	enable time	n$\overline{OE}$ to nAn	0.5	4.4	0.5	4.4	0.5	4.3	0.5	4.2	0.5	4.1	ns
		n$\overline{OE}$ to nBn	1.0	13.1	1.0	9.6	0.5	7.5	0.5	5.1	0.5	4.1	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}.

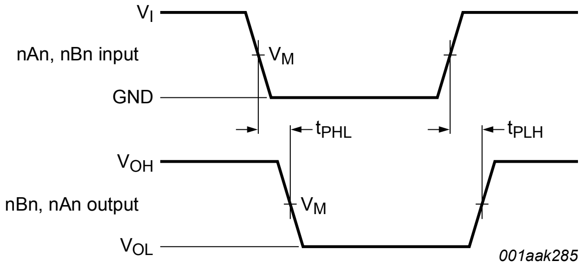
Table 13. Dynamic characteristics for temperature range -40 °C to +125 °C

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 6; for wave forms see Fig. 4 and Fig. 5. [1]

Symbol	Parameter	Conditions	$V_{CC(B)}$										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	
$V_{CC(A)}$ = 1.1 V to 1.3 V													
t_{pd}	propagation delay	nAn to nBn	0.5	10.4	0.5	7.9	0.5	6.9	0.5	5.8	0.5	5.7	ns
		nBn to nAn	0.5	10.4	0.5	9.8	0.5	9.6	0.5	9.3	0.5	9.1	ns
t_{dis}	disable time	n$\overline{OE}$ to nAn	2.0	13.1	2.0	13.1	2.0	13.1	2.0	13.1	2.0	13.1	ns
		n$\overline{OE}$ to nBn	1.5	14.0	1.5	10.8	1.5	10.6	1.0	9.0	1.0	9.9	ns
t_{en}	enable time	n$\overline{OE}$ to nAn	1.5	16.9	1.5	16.9	1.5	16.9	1.5	16.9	1.5	16.9	ns
		n$\overline{OE}$ to nBn	1.0	17.2	1.0	12.7	1.0	11.0	0.5	9.3	0.5	8.8	ns
$V_{CC(A)}$ = 1.4 V to 1.6 V													
t_{pd}	propagation delay	nAn to nBn	0.5	9.8	0.5	7.1	0.5	6.0	0.5	4.8	0.5	4.3	ns
		nBn to nAn	0.5	7.9	0.5	7.1	0.5	6.8	0.5	6.4	0.5	6.3	ns
t_{dis}	disable time	n$\overline{OE}$ to nAn	2.0	9.9	2.0	9.9	2.0	9.9	2.0	9.9	2.0	9.9	ns
		n$\overline{OE}$ to nBn	1.5	12.9	1.5	9.9	1.5	8.6	1.0	7.1	1.0	6.6	ns
t_{en}	enable time	n$\overline{OE}$ to nAn	1.5	11.4	1.5	11.4	1.5	11.4	1.5	11.3	1.5	11.3	ns
		n$\overline{OE}$ to nBn	1.0	15.8	1.0	11.4	1.0	9.3	0.5	6.8	0.5	5.9	ns
$V_{CC(A)}$ = 1.65 V to 1.95 V													
t_{pd}	propagation delay	nAn to nBn	0.5	9.6	0.5	6.8	0.5	5.5	0.5	4.3	0.5	3.9	ns
		nBn to nAn	0.5	6.9	0.5	6.0	0.5	5.5	0.5	5.2	0.5	5.1	ns
t_{dis}	disable time	n$\overline{OE}$ to nAn	2.0	8.2	2.0	8.2	2.0	8.2	2.0	8.2	2.0	8.2	ns
		n$\overline{OE}$ to nBn	1.5	12.5	1.5	9.6	1.5	8.2	1.0	6.4	1.0	6.2	ns
t_{en}	enable time	n$\overline{OE}$ to nAn	1.0	9.0	1.0	9.0	1.0	8.7	1.0	8.7	1.0	8.7	ns
		n$\overline{OE}$ to nBn	0.5	15.2	0.5	11.0	0.5	8.7	0.5	6.3	0.5	5.3	ns
$V_{CC(A)}$ = 2.3 V to 2.7 V													
t_{pd}	propagation delay	nAn to nBn	0.5	9.3	0.5	6.4	0.5	5.2	0.5	3.9	0.5	3.3	ns
		nBn to nAn	0.5	5.8	0.5	4.8	0.5	4.3	0.5	3.9	0.5	3.8	ns
t_{dis}	disable time	n$\overline{OE}$ to nAn	1.1	5.8	1.1	5.8	1.1	5.8	1.1	5.8	1.1	5.8	ns
		n$\overline{OE}$ to nBn	1.2	11.9	1.2	9.1	1.2	7.6	1.0	5.9	1.0	5.8	ns
t_{en}	enable time	n$\overline{OE}$ to nAn	0.5	6.0	0.5	6.0	0.5	5.9	0.5	5.8	0.5	5.8	ns
		n$\overline{OE}$ to nBn	0.5	14.7	0.5	10.6	0.5	8.4	0.5	5.9	0.5	4.8	ns
$V_{CC(A)}$ = 3.0 V to 3.6 V													
t_{pd}	propagation delay	nAn to nBn	0.5	9.1	0.5	6.3	0.5	5.1	0.5	3.8	0.5	3.2	ns
		nBn to nAn	0.5	5.7	0.5	4.3	0.5	3.9	0.5	3.3	0.5	3.2	ns
t_{dis}	disable time	n$\overline{OE}$ to nAn	0.8	5.5	0.8	5.5	0.8	5.5	0.8	5.5	0.8	5.5	ns
		n$\overline{OE}$ to nBn	1.2	11.6	1.2	9.0	1.2	7.4	1.0	5.7	0.8	5.5	ns
t_{en}	enable time	n$\overline{OE}$ to nAn	0.5	4.9	0.5	4.9	0.5	4.8	0.5	4.7	0.5	4.6	ns
		n$\overline{OE}$ to nBn	1.0	14.5	1.0	10.6	0.5	8.3	0.5	5.7	0.5	4.6	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}.

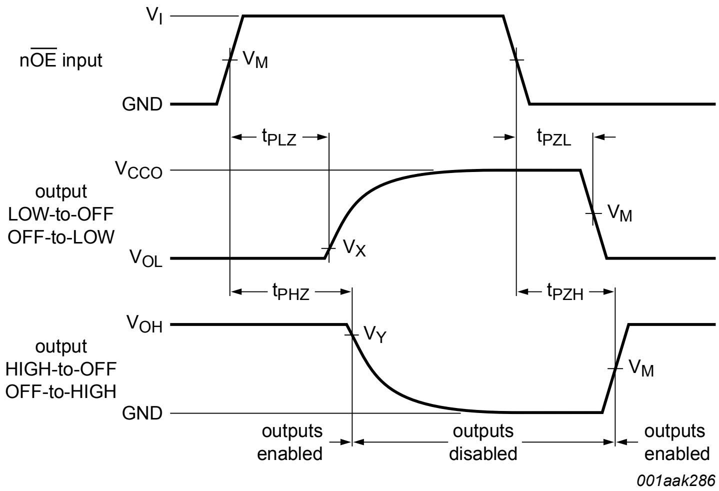
10.1. Waveforms and test circuit



Measurement points are given in Table 14.

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

Fig. 4. The data input (nAn, nBn) to output (nBn, nAn) propagation delay times



Measurement points are given in Table 14.

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

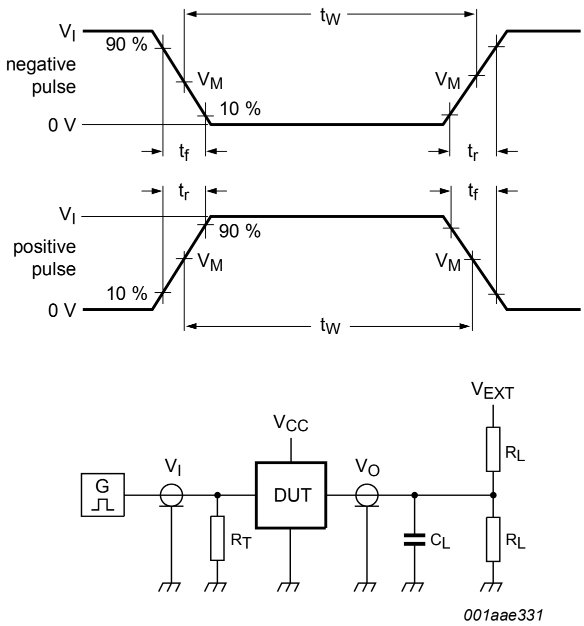
Fig. 5. Enable and disable times

Table 14. Measurement points

Supply voltage	Input [1]	Output [2]		
$V_{CC(A)}$, $V_{CC(B)}$	V_M	V_M	V_X	V_Y
0.8 V to 1.6 V	$0.5V_{CCI}$	$0.5V_{CCO}$	V_{OL} + 0.1 V	V_{OH} - 0.1 V
1.65 V to 2.7 V	$0.5V_{CCI}$	$0.5V_{CCO}$	V_{OL} + 0.15 V	V_{OH} - 0.15 V
3.0 V to 3.6 V	$0.5V_{CCI}$	$0.5V_{CCO}$	V_{OL} + 0.3 V	V_{OH} - 0.3 V

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

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



Test data is given in Table 15.

R_L = Load resistance.

C_L = Load capacitance including jig and probe capacitance.

R_T = Termination resistance.

V_{EXT} = External voltage for measuring switching times.

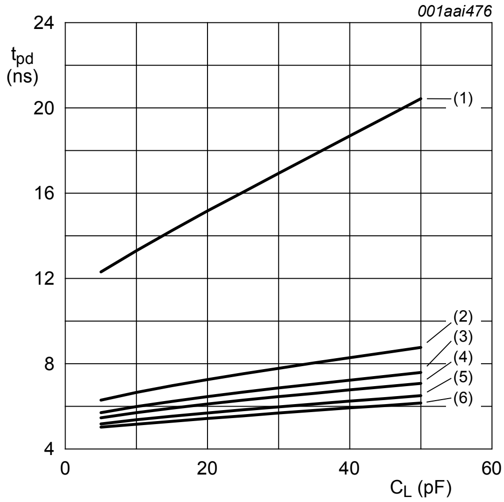
Fig. 6. Test circuit for measuring switching times

Table 15. 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}	≤ 1.0 ns/V	15 pF	2 kΩ	open	GND	$2V_{CCO}$
1.65 V to 2.7 V	V_{CCI}	≤ 1.0 ns/V	15 pF	2 kΩ	open	GND	$2V_{CCO}$
3.0 V to 3.6 V	V_{CCI}	≤ 1.0 ns/V	15 pF	2 kΩ	open	GND	$2V_{CCO}$

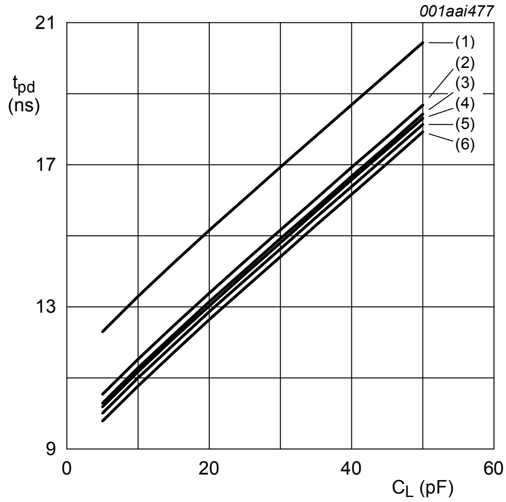
[1] V_{CCI} is the supply voltage associated with the data input port.
[2] dV/dt ≥ 1.0 V/ns
[3] V_{CCO} is the supply voltage associated with the output port.

11. Typical propagation delay characteristics



a. Propagation delay (nAn to nBn); $V_{CC(A)}$ = 0.8 V

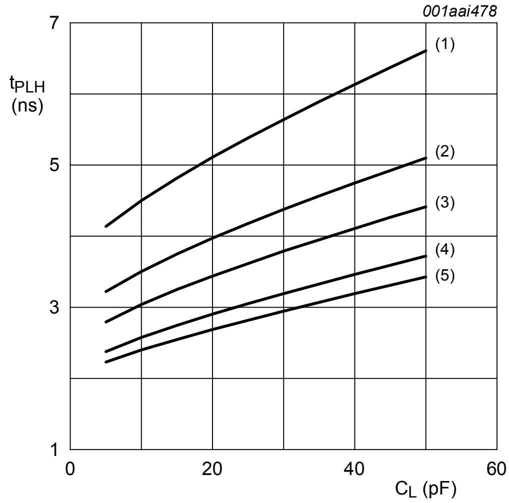
(1) $V_{CC(B)}$ = 0.8 V
(2) $V_{CC(B)}$ = 1.2 V
(3) $V_{CC(B)}$ = 1.5 V
(4) $V_{CC(B)}$ = 1.8 V
(5) $V_{CC(B)}$ = 2.5 V
(6) $V_{CC(B)}$ = 3.3 V



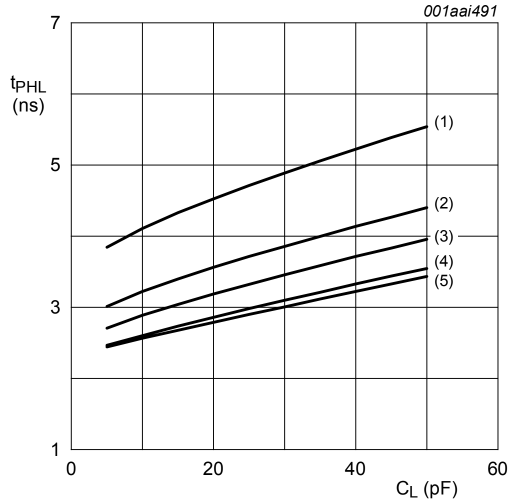
b. Propagation delay (nAn to nBn); $V_{CC(B)}$ = 0.8 V

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

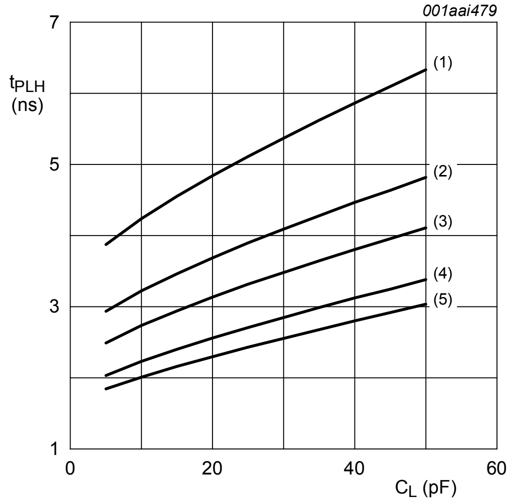
Fig. 7. Typical propagation delay versus load capacitance; T_{amb} = 25 °C



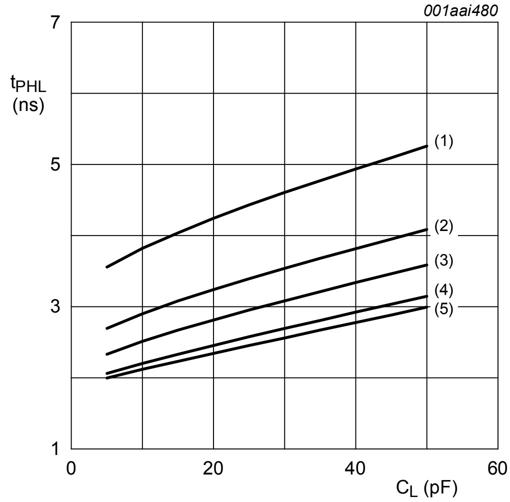
a. LOW to HIGH propagation delay (nAn to nBn); $V_{CC(A)}$ = 1.2 V



b. HIGH to LOW propagation delay (nAn to nBn); $V_{CC(A)}$ = 1.2 V



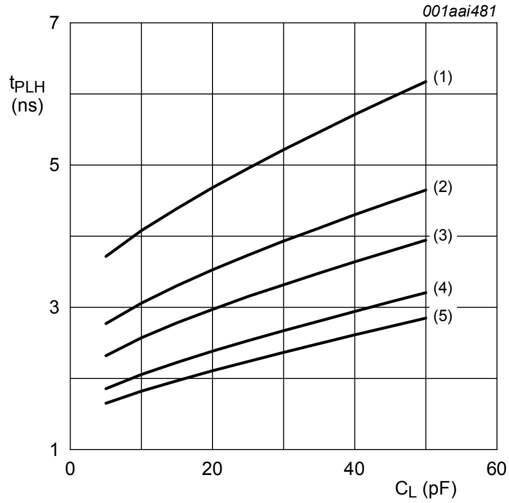
c. LOW to HIGH propagation delay (nAn to nBn); $V_{CC(A)}$ = 1.5 V



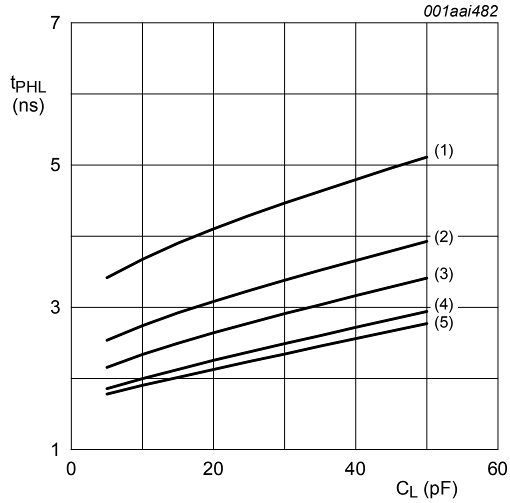
d. HIGH to LOW propagation delay (nAn to nBn); $V_{CC(A)}$ = 1.5 V

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

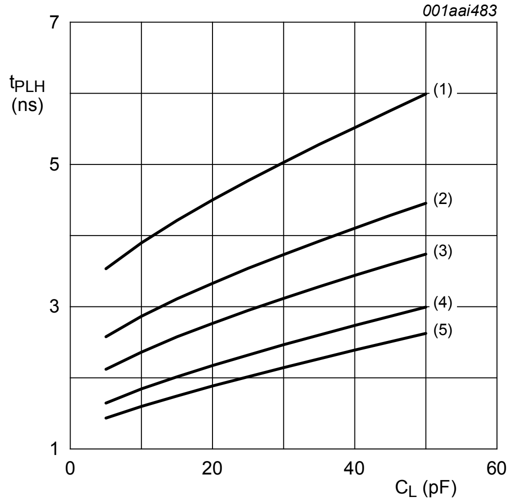
Fig. 8. Typical propagation delay versus load capacitance; T_{amb} = 25 °C



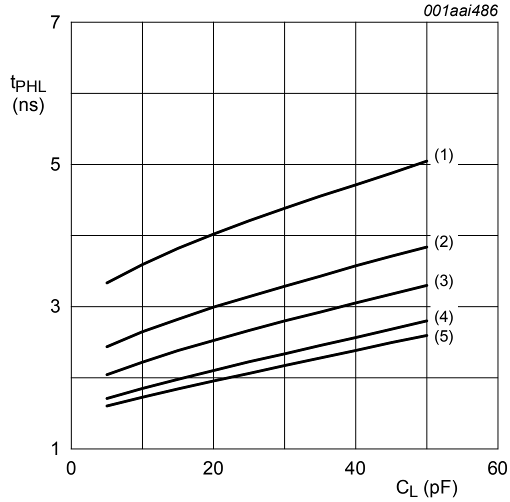
a. LOW to HIGH propagation delay (nAn to nBn); $V_{CC(A)}$ = 1.8 V



b. HIGH to LOW propagation delay (nAn to nBn); $V_{CC(A)}$ = 1.8 V



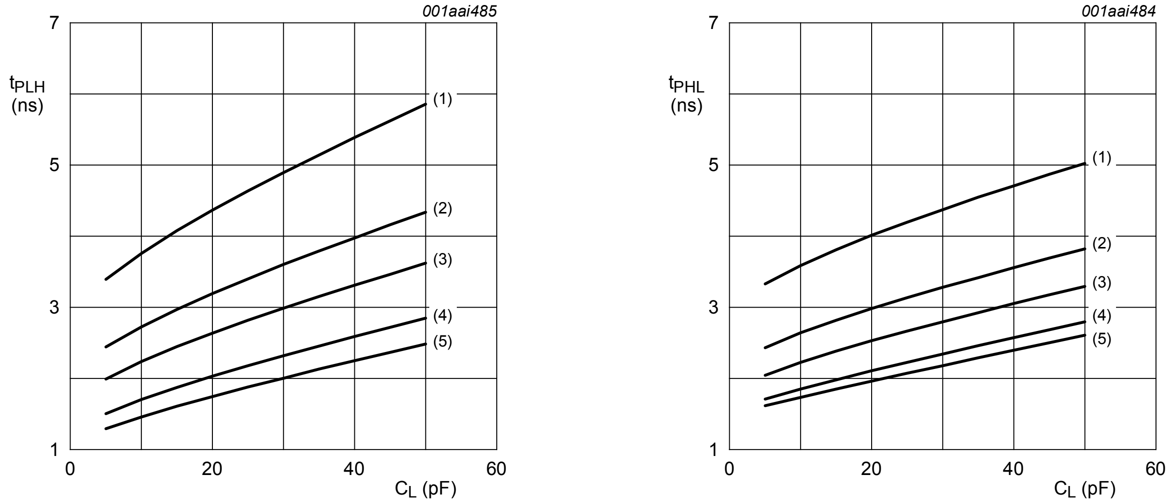
c. LOW to HIGH propagation delay (nAn to nBn); $V_{CC(A)}$ = 2.5 V



d. HIGH to LOW propagation delay (nAn to nBn); $V_{CC(A)}$ = 2.5 V

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

Fig. 9. Typical propagation delay versus load capacitance; T_{amb} = 25 °C



a. LOW to HIGH propagation delay (nAn to nBn); $V_{CC(A)}$ = 3.3 V

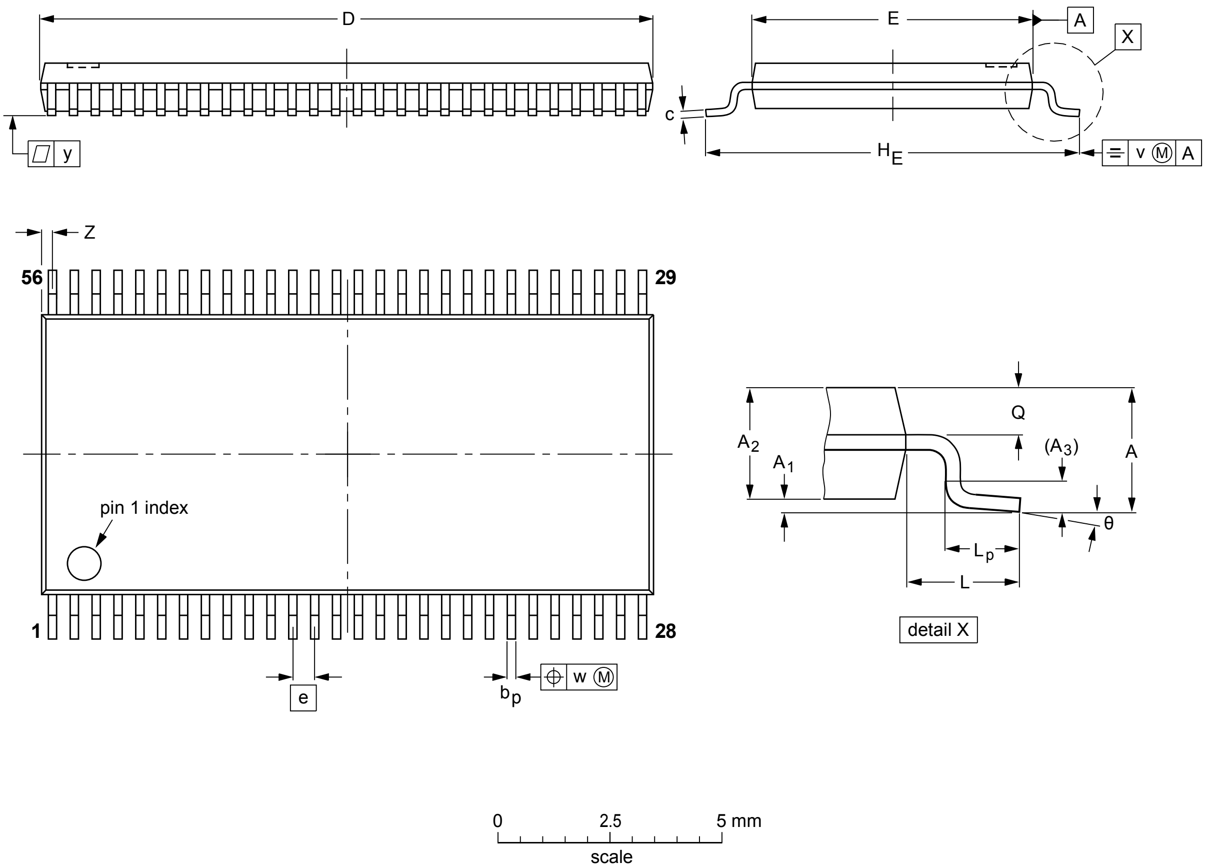
b. HIGH to LOW propagation delay (nAn to nBn); $V_{CC(A)}$ = 3.3 V

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

Fig. 10. Typical propagation delay versus load capacitance; T_{amb} = 25 °C

12. Package outline

TSSOP56: plastic thin shrink small outline package; 56 leads; body width 6.1 mm **SOT364-1**



DIMENSIONS (mm are the original dimensions).

UNIT	A max.	A_1	A_2	A_3	b_p	c	D(1)	E(2)	e	H_E	L	L_p	Q	v	w	y	Z	θ
mm	1.2	0.15 0.05	1.05 0.85	0.25	0.28 0.17	0.2 0.1	14.1 13.9	6.2 6.0	0.5	8.3 7.9	1	0.8 0.4	0.50 0.35	0.25	0.08	0.1	0.5 0.1	8° 0°

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT364-1		MO-153				~~99-12-27~~ 03-02-19

Fig. 11. Package outline SOT364-1 (TSSOP56)

13. Abbreviations

Table 16. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model

14. Revision history

Table 17. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AVCH20T245 v.6	20190114	Product data sheet	-	74AVCH20T245 v.5
Modifications:	• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. • Legal texts have been adapted to the new company name where appropriate. • Type numbers 74AVCH20T245DGV and 74AVCH20T245BX removed.			
74AVCH20T245 v.5	20160223	Product data sheet	-	74AVCH20T245 v.4
Modifications:	• General description updated.			
74AVCH20T245 v.4	20111214	Product data sheet	-	74AVCH20T245 v.3
Modifications:	• Legal pages updated.			
74AVCH20T245 v.3	20110623	Product data sheet	-	74AVCH20T245 v.2
74AVCH20T245 v.2	20100315	Product data sheet	-	74AVCH20T245 v.1
74AVCH20T245 v.1	20100113	Product data sheet	-	-

15. Legal information

Data sheet status

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

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

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Date of release: 14 January 2019

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