

# 74LVC4T3144

4-bit dual supply buffer/line driver; 3-state

Rev. 1 — 14 August 2017

Product data sheet

## 1 General description

The 74LVC4T3144 is a 4-bit, dual-supply level translating buffer with 3-state outputs. It features four data inputs (An and B4), four data outputs (YBn and YA4), and an output enable input ( $\overline{OE}$ ). The device is configured to translate three inputs from  $V_{CC(A)}$  to  $V_{CC(B)}$  and one input from  $V_{CC(B)}$  to  $V_{CC(A)}$ .  $\overline{OE}$ , An and YA4 are referenced to  $V_{CC(A)}$  and YBn and B4 are referenced to  $V_{CC(B)}$ . A HIGH on  $\overline{OE}$  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 outputs, 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 outputs are in the high-impedance OFF-state.

## 2 Features and benefits

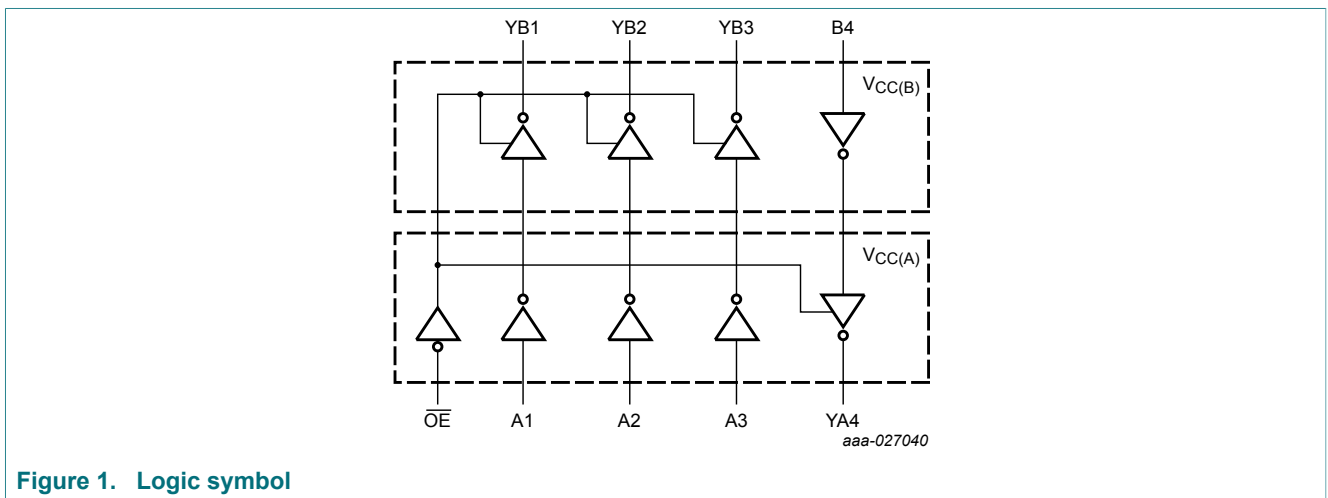
- Wide supply voltage range:
  - $V_{CC(A)}$ : 1.2 V to 5.5 V
  - $V_{CC(B)}$ : 1.2 V to 5.5 V
- High noise immunity
- Complies with JEDEC standards:
  - JESD8-11A (1.4 V to 1.6 V)
  - JESD8-7 (1.65 V to 1.95 V)
  - JESD8-5 (2.3 V to 2.7 V)
  - JESD8C (3.0 V to 3.6 V)
  - JESD12-6 (4.5 V to 5.5 V)
- ESD protection:
  - HBM JESD22-A114F Class 3A exceeds 4000 V
  - CDM JESD22-C101E exceeds 1000 V
- Maximum data rates:
  - 200 Mbps (3.3 V to 5.0 V translation)
  - 140 Mbps (translate to 3.3 V)
  - 100 Mbps (translate to 2.5 V)
  - 75 Mbps (translate to 1.8 V)
  - 60 Mbps (translate to 1.5 V)
- Suspend mode
- Latch-up performance exceeds 100 mA per JESD 78B Class II
- $\pm 24$  mA output drive ( $V_{CC} = 3.0$  V)
- Inputs accept voltages up to 5.5 V
- Low power consumption: 30  $\mu$ A maximum  $I_{CC}$
- $I_{OFF}$  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

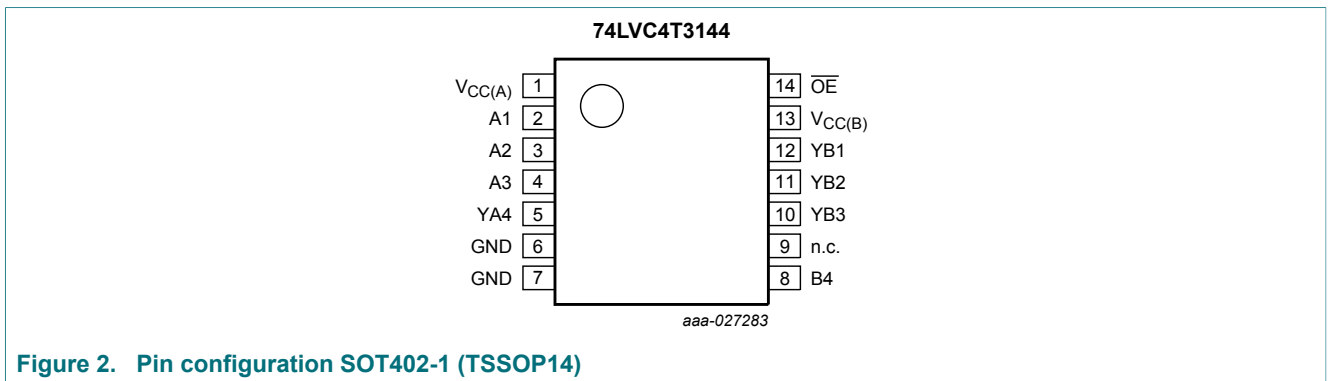
Type number	Package			Version
	Temperature range	Name	Description	
74LVC4T3144PW	-40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1

### 4 Functional diagram



### 5 Pinning information

#### 5.1 Pinning



## 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$V_{CC(A)}$	1	supply voltage A (An inputs, YA4 output and $\overline{OE}$ input are referenced to $V_{CC(A)}$ )
A1, A2, A3	2, 3, 4	data input
YA4	5	data output
GND	6, 7	ground (0 V)
B4	8	data input
n.c.	9	not connected
YB3, YB2, YB1	10, 11, 12	data output
$V_{CC(B)}$	13	supply voltage B (YBn outputs and B4 input are referenced to $V_{CC(B)}$ )
$\overline{OE}$	14	output enable input (active LOW)

## 6 Functional description

Table 3. Function table <sup>[1]</sup>

Supply voltage	Control	Input	Output
$V_{CC(A)}$ , $V_{CC(B)}$	$\overline{OE}^{[2]}$	An, B4 <sup>[2]</sup>	YBn, YA4 <sup>[2]</sup>
1.2 V to 5.5 V	L	L	L
1.2 V to 5.5 V	L	H	H
1.2 V to 5.5 V	H	X	Z
GND <sup>[3]</sup>	X	X	Z

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

[2] The An inputs, YA4 output and  $\overline{OE}$  input are referenced to  $V_{CC(A)}$ ; The YBn outputs and B4 input are 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.

## 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	+6.5	V
$V_{CC(B)}$	supply voltage B		-0.5	+6.5	V
$I_{IK}$	input clamping current	$V_I < 0$ V	-50	-	mA
$V_I$	input voltage	[1]	-0.5	+6.5	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	+6.5	V
$I_O$	output current	$V_O = 0$ V to $V_{CCO}$ [2]	-	$\pm 50$	mA
$I_{CC}$	supply current	$I_{CC(A)}$ or $I_{CC(B)}$ ; per $V_{CC}$ pin	-	100	mA
$I_{GND}$	ground current	per GND pin	-100	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to +125 °C [4]	-	500	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 6.5 V.

[4] For TSSOP14 package:  $P_{tot}$  derates linearly at 7.0 mW/K above 75 °C.

## 8 Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC(A)}$	supply voltage A		1.2	5.5	V
$V_{CC(B)}$	supply voltage B		1.2	5.5	V
$V_I$	input voltage		0	5.5	V
$V_O$	output voltage	Active mode [1]	0	$V_{CCO}$	V
		Suspend or 3-state mode	0	5.5	V
$T_{amb}$	ambient temperature		-40	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CCI} = 1.2$ V [2]	-	20	ns/V
		$V_{CCI} = 1.4$ V to 1.95 V	-	20	ns/V
		$V_{CCI} = 2.3$ V to 2.7 V	-	20	ns/V
		$V_{CCI} = 3$ V to 3.6 V	-	10	ns/V
		$V_{CCI} = 4.5$ V to 5.5 V	-	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  $T_{amb} = 25\text{ °C}$**

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	YBn, YA4; $V_I = V_{IH}$ or $V_{IL}$ [1]				
		$I_O = -3\text{ mA}$ ; $V_{CCO} = 1.2\text{ V}$	-	1.09	-	V
$V_{OL}$	LOW-level output voltage	YBn, YA4; $V_I = V_{IH}$ or $V_{IL}$				
		$I_O = 3\text{ mA}$ ; $V_{CCO} = 1.2\text{ V}$ [1]	-	0.07	-	V
$I_I$	input leakage current	An, B4 and $\overline{OE}$ input; $V_I = 0\text{ V}$ to $5.5\text{ V}$ ; $V_{CCI} = 1.2\text{ V}$ to $5.5\text{ V}$ [2]	-	-	$\pm 1$	$\mu\text{A}$
$I_{OZ}$	OFF-state output current	YBn, YA4; $V_O = 0\text{ V}$ or $V_{CCO}$ ; $V_{CCO} = 1.2\text{ V}$ to $5.5\text{ V}$ [1]	-	-	$\pm 1$	$\mu\text{A}$
		YBn, YA4; suspend mode; $V_O = 0\text{ V}$ or $V_{CCO}$ ; $V_{CC(A)} = 5.5\text{ V}$ ; $V_{CC(B)} = 0\text{ V}$ [1]	-	-	$\pm 1$	$\mu\text{A}$
		YBn, YA4; suspend mode; $V_O = 0\text{ V}$ or $V_{CCO}$ ; $V_{CC(A)} = 0\text{ V}$ ; $V_{CC(B)} = 5.5\text{ V}$ [1]	-	-	$\pm 1$	$\mu\text{A}$
$I_{OFF}$	power-off leakage current	A port; $V_I$ or $V_O = 0\text{ V}$ to $5.5\text{ V}$ ; $V_{CC(A)} = 0\text{ V}$ ; $V_{CC(B)} = 1.2\text{ V}$ to $5.5\text{ V}$	-	-	$\pm 1$	$\mu\text{A}$
		B port; $V_I$ or $V_O = 0\text{ V}$ to $5.5\text{ V}$ ; $V_{CC(B)} = 0\text{ V}$ ; $V_{CC(A)} = 1.2\text{ V}$ to $5.5\text{ V}$	-	-	$\pm 1$	$\mu\text{A}$
$C_I$	input capacitance	An, B4 and $\overline{OE}$ input; $V_I = 0\text{ V}$ or $3.3\text{ V}$ ; $V_{CC(A)} = 3.3\text{ V}$ ; $V_{CC(B)} = 3.3\text{ V}$	-	3	-	pF
$C_O$	output capacitance	YBn, YA4 output; $V_O = 0\text{ V}$ or $3.3\text{ V}$ ; $\overline{OE}$ input = $3.3\text{ V}$ ; $V_{CC(A)} = 3.3\text{ V}$ ; $V_{CC(B)} = 3.3\text{ V}$	-	6.5	-	pF

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

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

Table 7. Static characteristics

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 <sup>[1]</sup>					
		V <sub>CCI</sub> = 1.2 V	0.8V <sub>CCI</sub>	-	0.8V <sub>CCI</sub>	-	V
		V <sub>CCI</sub> = 1.4 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	1.7	-	1.7	-	V
		V <sub>CCI</sub> = 3.0 V to 3.6 V	2.0	-	2.0	-	V
		V <sub>CCI</sub> = 4.5 V to 5.5 V	0.7V <sub>CCI</sub>	-	0.7V <sub>CCI</sub>	-	V
		$\overline{OE}$ input					
		V <sub>CCI</sub> = 1.2 V	0.8V <sub>CC(A)</sub>	-	0.8V <sub>CC(A)</sub>	-	V
		V <sub>CCI</sub> = 1.4 V to 1.95 V	0.65V <sub>CC(A)</sub>	-	0.65V <sub>CC(A)</sub>	-	V
		V <sub>CCI</sub> = 2.3 V to 2.7 V	1.7	-	1.7	-	V
		V <sub>CCI</sub> = 3.0 V to 3.6 V	2.0	-	2.0	-	V
		V <sub>CCI</sub> = 4.5 V to 5.5 V	0.7V <sub>CC(A)</sub>	-	0.7V <sub>CC(A)</sub>	-	V
V <sub>IL</sub>	LOW-level input voltage	data input <sup>[1]</sup>					
		V <sub>CCI</sub> = 1.2 V	-	0.2V <sub>CCI</sub>	-	0.2V <sub>CCI</sub>	V
		V <sub>CCI</sub> = 1.4 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
		V <sub>CCI</sub> = 4.5 V to 5.5 V	-	0.3V <sub>CCI</sub>	-	0.3V <sub>CCI</sub>	V
		$\overline{OE}$ input					
		V <sub>CCI</sub> = 1.2 V	-	0.2V <sub>CC(A)</sub>	-	0.2V <sub>CC(A)</sub>	V
		V <sub>CCI</sub> = 1.4 V to 1.95 V	-	0.35V <sub>CC(A)</sub>	-	0.35V <sub>CC(A)</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
		V <sub>CCI</sub> = 4.5 V to 5.5 V	-	0.3V <sub>CC(A)</sub>	-	0.3V <sub>CC(A)</sub>	V

Symbol	Parameter	Conditions	-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Max	Min	Max	
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub>					
		I <sub>O</sub> = -100 µA; V <sub>CCO</sub> = 1.2 V to 4.5 V <sup>[2]</sup>	V <sub>CCO</sub> - 0.1	-	V <sub>CCO</sub> - 0.1	-	V
		I <sub>O</sub> = -6 mA; V <sub>CCO</sub> = 1.4 V	1.0	-	1.0	-	V
		I <sub>O</sub> = -8 mA; V <sub>CCO</sub> = 1.65 V	1.2	-	1.2	-	V
		I <sub>O</sub> = -12 mA; V <sub>CCO</sub> = 2.3 V	1.9	-	1.9	-	V
		I <sub>O</sub> = -24 mA; V <sub>CCO</sub> = 3.0 V	2.4	-	2.4	-	V
		I <sub>O</sub> = -24 mA; V <sub>CCO</sub> = 4.5 V	3.85	-	3.85	-	V
		I <sub>O</sub> = -32 mA; V <sub>CCO</sub> = 4.5 V	3.8	-	3.8	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IL</sub> <sup>[2]</sup>					
		I <sub>O</sub> = 100 µA; V <sub>CCO</sub> = 1.2 V to 4.5 V	-	0.1	-	0.1	V
		I <sub>O</sub> = 6 mA; V <sub>CCO</sub> = 1.4 V	-	0.3	-	0.3	V
		I <sub>O</sub> = 8 mA; V <sub>CCO</sub> = 1.65 V	-	0.45	-	0.45	V
		I <sub>O</sub> = 12 mA; V <sub>CCO</sub> = 2.3 V	-	0.3	-	0.3	V
		I <sub>O</sub> = 24 mA; V <sub>CCO</sub> = 3.0 V	-	0.55	-	0.55	V
		I <sub>O</sub> = 24 mA; V <sub>CCO</sub> = 4.5 V	-	0.50	-	0.50	V
		I <sub>O</sub> = 32 mA; V <sub>CCO</sub> = 4.5 V	-	0.55	-	0.55	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 0 V to 5.5 V; V <sub>CCI</sub> = 1.2 V to 5.5 V	-	±2	-	±10	µA
I <sub>OZ</sub>	OFF-state output current	V <sub>O</sub> = 0 V or V <sub>CCO</sub> ; V <sub>CCO</sub> = 1.2 V to 5.5 V <sup>[2]</sup>	-	±2	-	±10	µA
		suspend mode; V <sub>O</sub> = 0 V or V <sub>CCO</sub> ; V <sub>CC(A)</sub> = 5.5 V; V <sub>CC(B)</sub> = 0 V <sup>[2]</sup>	-	±2	-	±10	µA
		suspend mode; V <sub>O</sub> = 0 V or V <sub>CCO</sub> ; V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 5.5 V <sup>[2]</sup>	-	±2	-	±10	µA
I <sub>OFF</sub>	power-off leakage current	A port; V <sub>I</sub> or V <sub>O</sub> = 0 V to 5.5 V; V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 1.2 V to 5.5 V	-	±2	-	±10	µA
		B port; V <sub>I</sub> or V <sub>O</sub> = 0 V to 5.5 V; V <sub>CC(B)</sub> = 0 V; V <sub>CC(A)</sub> = 1.2 V to 5.5 V	-	±2	-	±10	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 <sup>[1]</sup>					
		V <sub>CC(A)</sub> , V <sub>CC(B)</sub> = 1.2 V to 5.5 V	-	15	-	20	μA
		V <sub>CC(A)</sub> = 5.5 V; V <sub>CC(B)</sub> = 0 V	-	15	-	20	μA
		V <sub>CC(A)</sub> = 0 V; V <sub>CC(B)</sub> = 5.5 V	-2	-	-4	-	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> , V <sub>CC(B)</sub> = 1.2 V to 5.5 V	-	15	-	20	μA
		V <sub>CC(B)</sub> = 0 V; V <sub>CC(A)</sub> = 5.5 V	-2	-	-4	-	μA
		V <sub>CC(B)</sub> = 5.5 V; V <sub>CC(A)</sub> = 0 V	-	15	-	20	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> , V <sub>CC(B)</sub> = 1.2 V to 5.5 V	-	25	-	30	μA		
ΔI <sub>CC</sub>	additional supply current	per input; V <sub>CC(A)</sub> , V <sub>CC(B)</sub> = 3.0 V to 5.5 V					
		OE input; OE input at V <sub>CC(A)</sub> - 0.6 V; A port at V <sub>CC(A)</sub> or GND; B port = open	-	50	-	75	μA
		A port; A port at V <sub>CC(A)</sub> - 0.6 V; B port = open	-	50	-	75	μA
		B port; B port at V <sub>CC(B)</sub> - 0.6 V; A port = open	-	50	-	75	μA

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

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



## 10 Dynamic characteristics

**Table 8. Typical dynamic characteristics at  $V_{CC(A)} = 1.2\text{ V}$  and  $T_{amb} = 25\text{ °C}$  [1]**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 5](#); for waveforms see [Figure 3](#) and [Figure 4](#).

Symbol	Parameter	Conditions	$V_{CC(B)}$						Unit
			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	15.6	11.6	9.8	7.8	6.9	6.3	ns
		B4 to YA4	15.6	14.5	14.0	13.5	13.3	13.8	ns
$t_{dis}$	disable time	$\overline{OE}$ to YA4	8.7	8.7	8.7	8.7	8.7	8.7	ns
		$\overline{OE}$ to YBn	11.9	9.2	8.7	7.4	7.7	6.8	ns
$t_{en}$	enable time	$\overline{OE}$ to YA4	17.5	17.5	17.5	17.5	17.5	17.5	ns
		$\overline{OE}$ to YBn	18.3	13.6	11.5	9.5	8.8	8.5	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 9. Typical dynamic characteristics at  $V_{CC(B)} = 1.2\text{ V}$  and  $T_{amb} = 25\text{ °C}$  [1]**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 5](#); for waveforms see [Figure 3](#) and [Figure 4](#).

Symbol	Parameter	Conditions	$V_{CC(A)}$						Unit
			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	15.6	14.5	14.0	13.5	13.3	13.1	ns
		B4 to YA4	15.6	11.6	9.8	7.8	6.9	6.3	ns
$t_{dis}$	disable time	$\overline{OE}$ to YA4	8.7	6.1	5.5	3.9	4.1	2.9	ns
		$\overline{OE}$ to YBn	11.9	10.5	9.9	9.2	8.9	8.4	ns
$t_{en}$	enable time	$\overline{OE}$ to YA4	17.5	11.6	9.0	5.7	4.6	3.8	ns
		$\overline{OE}$ to YBn	18.3	17.0	16.4	15.8	15.6	15.4	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 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	$V_{CC(A)}$ and $V_{CC(B)}$						Unit
			1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	5.0 V	
$C_{PD}$	power dissipation capacitance	inputs An, B4	0.5	0.5	0.5	0.7	0.9	1.3	pF
		outputs YBn, YA4	12	12	12	12	12	12	pF

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

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

$f_i$  = 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]  $f_i = 10\text{ MHz}$ ;  $V_i = \text{GND to } V_{CC}$ ;  $t_r = t_f = 1\text{ ns}$ ;  $C_L = 0\text{ pF}$ ;  $R_L = \infty\ \Omega$ .

Table 11. Dynamic characteristics for temperature range -40 °C to +85 °C [1]

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 5; for waveforms see Figure 3 and Figure 4.

Symbol	Parameter	Conditions	V <sub>CC(B)</sub>										Unit
			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	
V <sub>CC(A)</sub> = 1.5 V ± 0.1 V													
t <sub>pd</sub>	propagation delay	An to YBn	1.7	20.7	1.6	17.1	1.3	12.9	1.1	11.1	1.0	9.5	ns
		B4 to YA4	1.7	20.7	1.6	19.8	1.6	19.0	1.5	18.5	1.5	18.3	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to YA4	1.3	11.6	1.3	11.6	1.3	11.6	1.3	11.6	1.3	11.6	ns
		$\overline{OE}$ to YBn	1.5	14.4	1.6	13.2	1.3	10.4	1.5	10.7	1.2	9.4	ns
t <sub>en</sub>	enable time	$\overline{OE}$ to YA4	2.1	21.8	2.1	21.8	2.1	21.8	2.1	21.8	2.1	21.8	ns
		$\overline{OE}$ to YBn	2.1	22.2	1.8	18.4	1.5	14.2	1.3	12.5	1.2	11.4	ns
V <sub>CC(A)</sub> = 1.8 V ± 0.15 V													
t <sub>pd</sub>	propagation delay	An to YBn	1.6	19.8	1.4	16.2	1.2	11.9	1.0	10.2	0.9	8.5	ns
		B4 to YA4	1.6	17.1	1.4	16.2	1.3	15.3	1.2	14.9	1.2	14.5	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to YA4	1.4	10.1	1.4	10.1	1.4	10.1	1.4	10.1	1.4	10.1	ns
		$\overline{OE}$ to YBn	1.4	13.7	1.5	12.3	1.2	9.5	1.4	9.7	1.1	8.2	ns
t <sub>en</sub>	enable time	$\overline{OE}$ to YA4	1.8	17.2	1.8	17.2	1.8	17.2	1.8	17.2	1.8	17.2	ns
		$\overline{OE}$ to YBn	2.0	21.4	1.7	17.4	1.4	12.9	1.2	11.1	1.1	9.8	ns
V <sub>CC(A)</sub> = 2.5 V ± 0.2 V													
t <sub>pd</sub>	propagation delay	An to YBn	1.6	19.0	1.3	15.3	1.0	11.0	0.9	9.1	0.7	7.2	ns
		B4 to YA4	1.3	12.9	1.2	11.9	1.0	11.0	0.9	10.6	0.9	10.2	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to YA4	0.9	7.2	0.9	7.2	0.9	7.2	0.9	7.2	0.9	7.2	ns
		$\overline{OE}$ to YBn	1.3	12.8	1.4	11.3	1.1	8.4	1.3	8.5	1.0	6.9	ns
t <sub>en</sub>	enable time	$\overline{OE}$ to YA4	1.4	11.7	1.4	11.7	1.4	11.7	1.4	11.7	1.4	11.7	ns
		$\overline{OE}$ to YBn	2.0	20.8	1.6	16.6	1.3	11.9	1.2	9.9	1.0	8.2	ns
V <sub>CC(A)</sub> = 3.3 V ± 0.3 V													
t <sub>pd</sub>	propagation delay	An to YBn	1.5	18.5	1.2	14.9	0.9	10.6	0.8	8.5	0.7	6.6	ns
		B4 to YA4	1.1	11.1	1.0	10.2	0.9	9.1	0.8	8.5	0.7	8.1	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to YA4	1.1	7.2	1.1	7.2	1.1	7.2	1.1	7.2	1.1	7.2	ns
		$\overline{OE}$ to YBn	1.2	12.3	1.3	10.9	1.0	8.0	1.2	8.0	0.9	6.3	ns
t <sub>en</sub>	enable time	$\overline{OE}$ to YA4	1.2	9.3	1.2	9.3	1.2	9.3	1.2	9.3	1.2	9.3	ns
		$\overline{OE}$ to YBn	2.0	20.4	1.7	16.5	1.4	11.5	1.2	9.4	1.0	7.5	ns

Symbol	Parameter	Conditions	$V_{CC(B)}$										Unit
			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	
$V_{CC(A)} = 5.0 V \pm 0.5 V$													
$t_{pd}$	propagation delay	An to YBn	1.5	18.3	1.2	14.5	0.9	10.2	0.7	8.1	0.6	6.3	ns
		B4 to YA4	1.0	9.5	0.9	8.5	0.7	7.2	0.7	6.6	0.6	6.3	ns
$t_{dis}$	disable time	$\overline{OE}$ to YA4	0.7	5.3	0.7	5.3	0.7	5.3	0.7	5.3	0.7	5.3	ns
		$\overline{OE}$ to YBn	1.2	12.0	1.3	10.5	0.9	7.6	1.2	7.6	0.8	5.8	ns
$t_{en}$	enable time	$\overline{OE}$ to YA4	1.1	7.0	1.1	7.0	1.1	7.0	1.1	7.0	1.1	7.0	ns
		$\overline{OE}$ to YBn	2.0	20.5	1.7	16.4	1.4	11.4	1.2	9.2	1.0	7.2	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. Dynamic characteristics for temperature range -40 °C to +125 °C [1]**

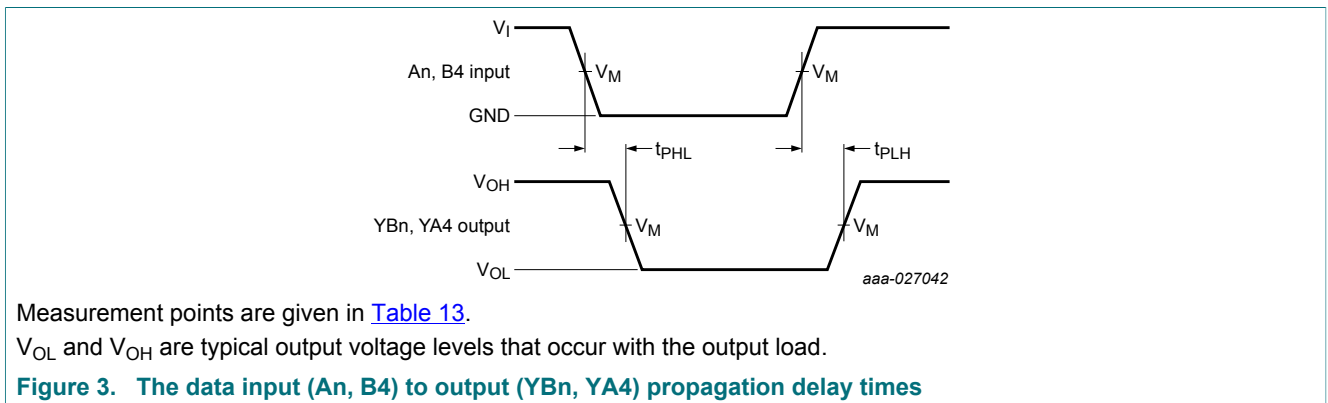
Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 5; for waveforms see Figure 3 and Figure 4.

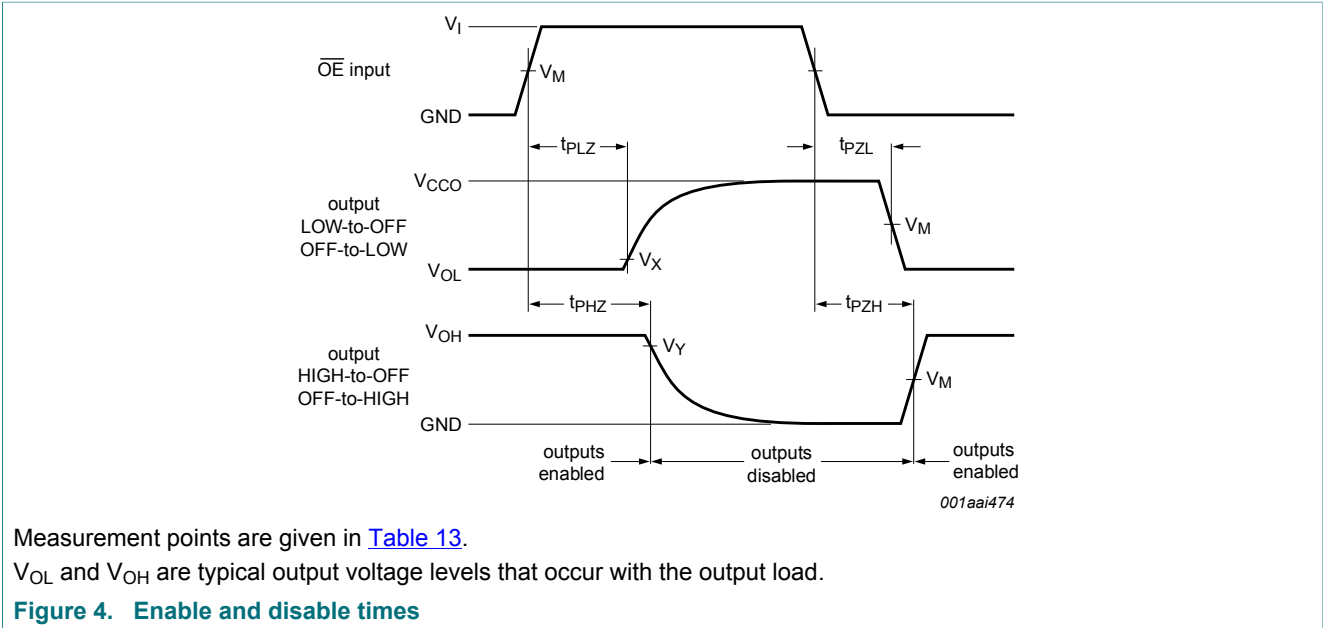
Symbol	Parameter	Conditions	$V_{CC(B)}$										Unit
			1.5 V±0.1 V		1.8 V±0.15 V		2.5 V±0.2 V		3.3 V±0.3 V		5.0 V±0.5 V		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
$V_{CC(A)} = 1.5 V \pm 0.1 V$													
$t_{pd}$	propagation delay	An to YBn	1.7	22.0	1.6	18.3	1.3	14.0	1.1	12.2	1.0	10.5	ns
		B4 to YA4	1.7	22.0	1.6	21.0	1.6	20.1	1.5	19.5	1.5	19.4	ns
$t_{dis}$	disable time	$\overline{OE}$ to YA4	1.3	12.8	1.3	12.8	1.3	12.8	1.3	12.8	1.3	12.8	ns
		$\overline{OE}$ to YBn	1.5	15.8	1.6	14.5	1.3	11.5	1.5	11.1	1.2	9.7	ns
$t_{en}$	enable time	$\overline{OE}$ to YA4	2.1	23.2	2.1	23.2	2.1	23.2	2.1	23.2	2.1	23.2	ns
		$\overline{OE}$ to YBn	2.1	23.6	1.8	19.6	1.5	15.4	1.3	13.7	1.2	12.6	ns
$V_{CC(A)} = 1.8 V \pm 0.15 V$													
$t_{pd}$	propagation delay	An to YBn	1.6	21.0	1.4	17.4	1.2	13.0	1.0	11.2	0.9	9.3	ns
		B4 to YA4	1.6	18.3	1.4	17.4	1.3	16.4	1.2	16.0	1.2	15.6	ns
$t_{dis}$	disable time	$\overline{OE}$ to YA4	1.4	11.2	1.4	11.2	1.4	11.2	1.4	11.2	1.4	11.2	ns
		$\overline{OE}$ to YBn	1.4	15.2	1.5	13.5	1.2	10.5	1.4	10.0	1.1	8.5	ns
$t_{en}$	enable time	$\overline{OE}$ to YA4	1.8	18.4	1.8	18.4	1.8	18.4	1.8	18.4	1.8	18.4	ns
		$\overline{OE}$ to YBn	2.0	22.7	1.7	18.7	1.4	14.1	1.2	12.2	1.1	10.8	ns

Symbol	Parameter	Conditions	$V_{CC(B)}$										Unit
			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	
$V_{CC(A)} = 2.5 V \pm 0.2 V$													
$t_{pd}$	propagation delay	An to YBn	1.6	20.1	1.3	16.4	1.0	11.9	0.9	9.9	0.7	7.9	ns
		B4 to YA4	1.3	14.0	1.2	13.0	1.0	11.9	0.9	11.5	0.9	11.1	ns
$t_{dis}$	disable time	$\overline{OE}$ to YA4	0.9	8.0	0.9	8.0	0.9	8.0	0.9	8.0	0.9	8.0	ns
		$\overline{OE}$ to YBn	1.3	14.0	1.4	12.5	1.1	9.3	1.3	9.3	1.0	7.5	ns
$t_{en}$	enable time	$\overline{OE}$ to YA4	1.4	12.7	1.4	12.7	1.4	12.7	1.4	12.7	1.4	12.7	ns
		$\overline{OE}$ to YBn	2.0	22.0	1.6	17.9	1.3	13.0	1.2	10.8	1.0	9.0	ns
$V_{CC(A)} = 3.3 V \pm 0.3 V$													
$t_{pd}$	propagation delay	An to YBn	1.5	19.5	1.2	16.0	0.9	11.5	0.8	9.3	0.7	7.3	ns
		B4 to YA4	1.1	12.2	1.0	11.2	0.9	9.9	0.8	9.3	0.7	8.8	ns
$t_{dis}$	disable time	$\overline{OE}$ to YA4	1.1	7.8	1.1	7.8	1.1	7.8	1.1	7.8	1.1	7.8	ns
		$\overline{OE}$ to YBn	1.2	13.6	1.3	12.1	1.0	8.8	1.2	8.3	0.9	6.5	ns
$t_{en}$	enable time	$\overline{OE}$ to YA4	1.2	10.1	1.2	10.1	1.2	10.1	1.2	10.1	1.2	10.1	ns
		$\overline{OE}$ to YBn	2.0	21.6	1.7	17.5	1.4	12.6	1.2	10.3	1.0	8.3	ns
$V_{CC(A)} = 5.0 V \pm 0.5 V$													
$t_{pd}$	propagation delay	An to YBn	1.5	19.4	1.2	15.6	0.9	11.1	0.7	8.8	0.6	6.8	ns
		B4 to YA4	1.0	10.5	0.9	9.3	0.7	7.9	0.7	7.3	0.6	6.8	ns
$t_{dis}$	disable time	$\overline{OE}$ to YA4	0.7	5.7	0.7	5.7	0.7	5.7	0.7	5.7	0.7	5.7	ns
		$\overline{OE}$ to YBn	1.2	13.3	1.3	11.7	0.9	8.4	1.2	7.9	0.8	6.0	ns
$t_{en}$	enable time	$\overline{OE}$ to YA4	1.1	7.7	1.1	7.7	1.1	7.7	1.1	7.7	1.1	7.7	ns
		$\overline{OE}$ to YBn	2.0	21.7	1.7	17.4	1.4	12.5	1.2	10.1	1.0	7.9	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  $t_{PZH}$ .

### 10.1 Waveforms and test circuit





Measurement points are given in [Table 13](#).

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

**Figure 4. Enable and disable times**

**Table 13. Measurement points**

Supply voltage	Input <sup>[1]</sup>	Output <sup>[2]</sup>		
$V_{CC(A)}, V_{CC(B)}$	$V_M$	$V_M$	$V_X$	$V_Y$
1.2 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 5.5 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 input port.  
 [2]  $V_{CCO}$  is the supply voltage associated with the output port.

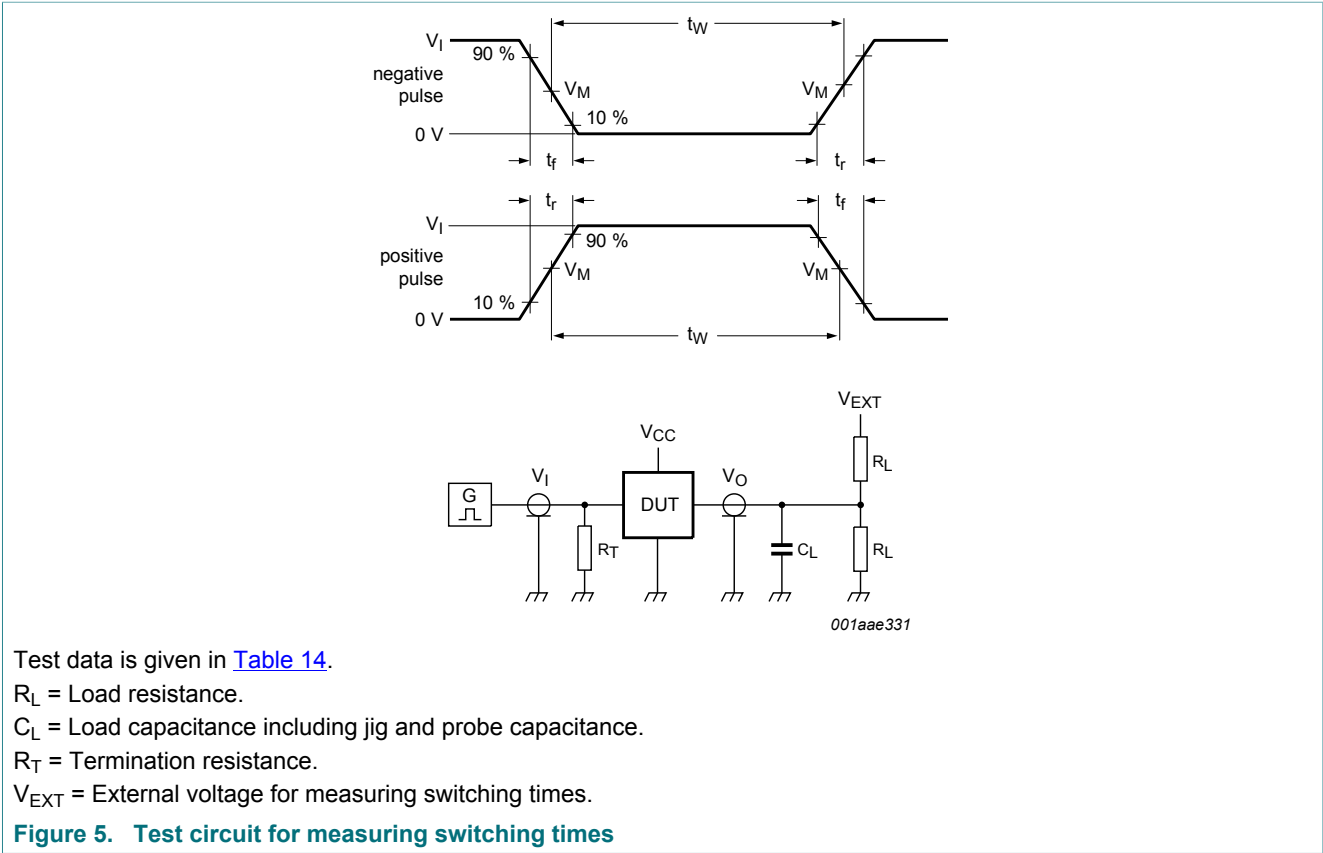
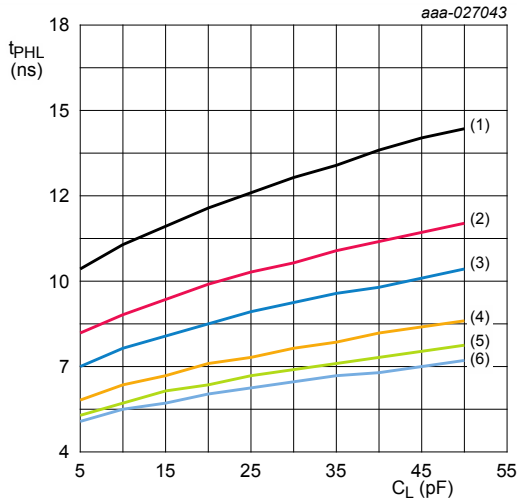


Table 14. Test data

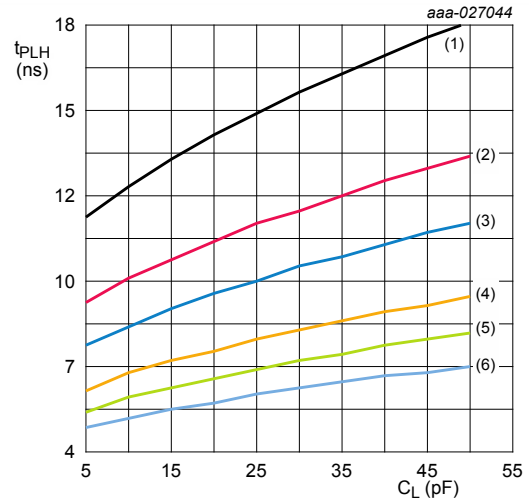
Supply voltage	Input		Load		$V_{EXT}$		
$V_{CC(A)}, V_{CC(B)}$	$V_I$ [1]	$\Delta t/\Delta V$ [2]	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$ [3]
1.2 V to 5.5 V	$V_{CCI}$	$\leq 1.0$ ns/V	15 pF	2 k $\Omega$	open	GND	$2 \times V_{CCO}$

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

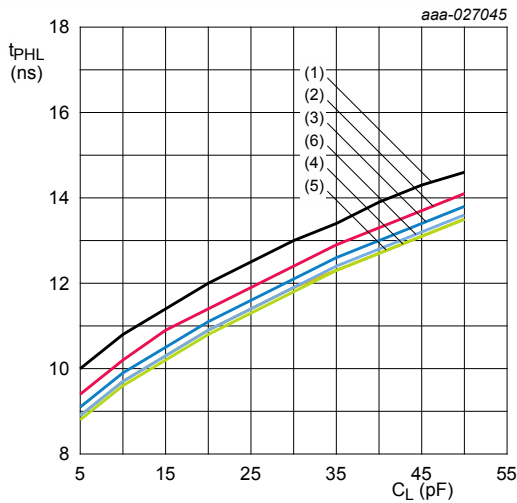
10.2 Typical propagation delay characteristics



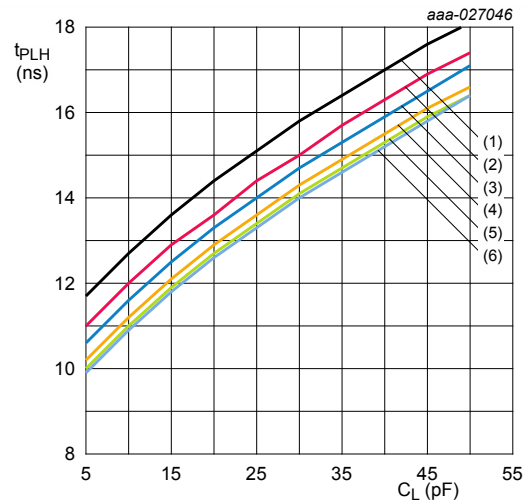
a. HIGH to LOW propagation delay (An to YBn)



b. LOW to HIGH propagation delay (An to YBn)



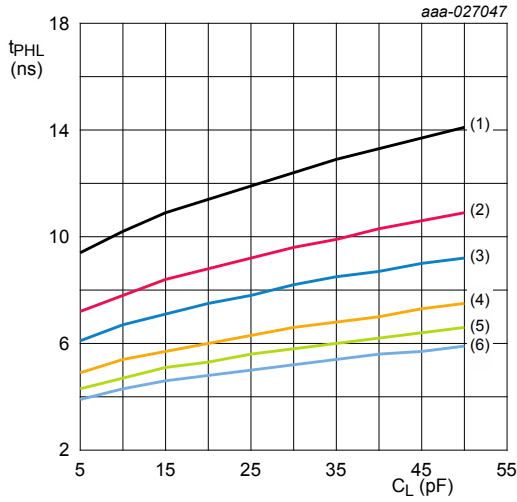
c. HIGH to LOW propagation delay (B4 to YA4)



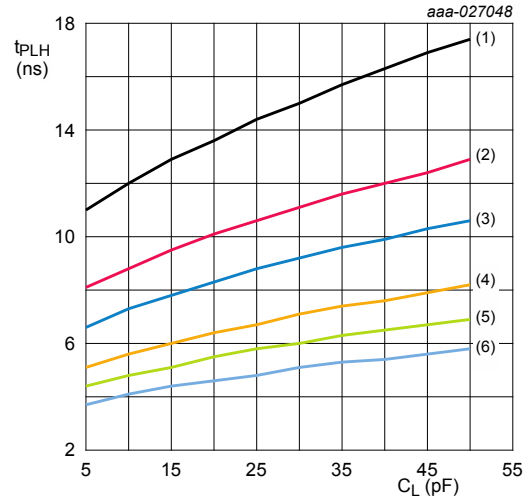
d. LOW to HIGH propagation delay (B4 to YA4)

- (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)  $V_{CC(B)} = 3.3\text{ V}$
- (6)  $V_{CC(B)} = 5.0\text{ V}$

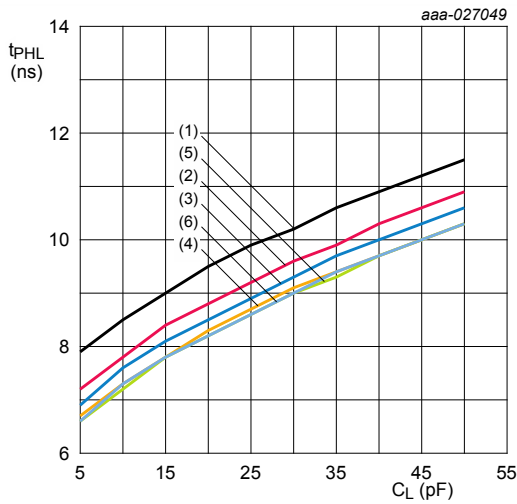
Figure 6. Typical propagation delay versus load capacitance;  $T_{amb} = 25\text{ °C}$ ;  $V_{CC(A)} = 1.2\text{ V}$



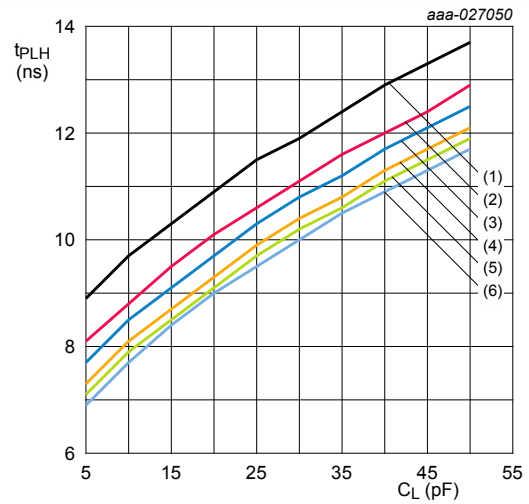
a. HIGH to LOW propagation delay (An to YBn)



b. LOW to HIGH propagation delay (An to YBn)



c. HIGH to LOW propagation delay (B4 to YA4)

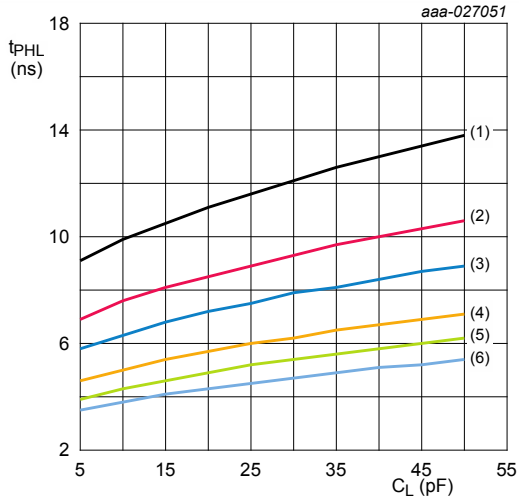


d. LOW to HIGH propagation delay (B4 to YA4)

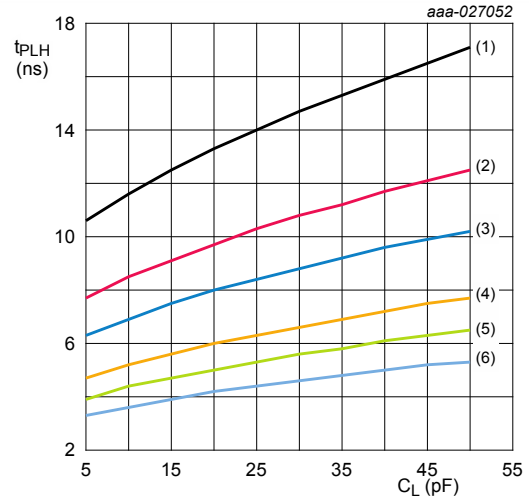
- (1)  $V_{CC(B)} = 1.2$  V
- (2)  $V_{CC(B)} = 1.5$  V
- (3)  $V_{CC(B)} = 1.8$  V
- (4)  $V_{CC(B)} = 2.5$  V
- (5)  $V_{CC(B)} = 3.3$  V
- (6)  $V_{CC(B)} = 5.0$  V

Figure 7. Typical propagation delay versus load capacitance;  $T_{amb} = 25$  °C;  $V_{CC(A)} = 1.5$  V

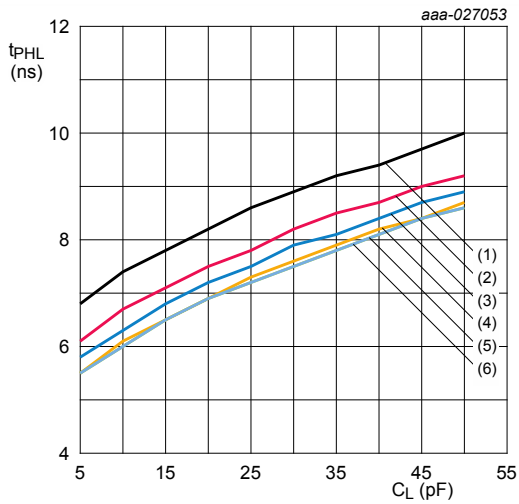




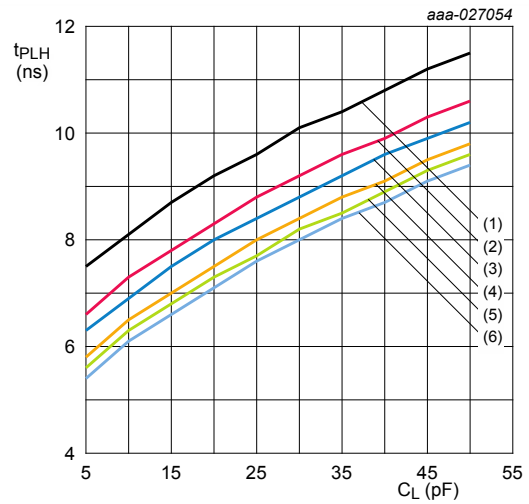
a. HIGH to LOW propagation delay (An to YBn)



b. LOW to HIGH propagation delay (An to YBn)



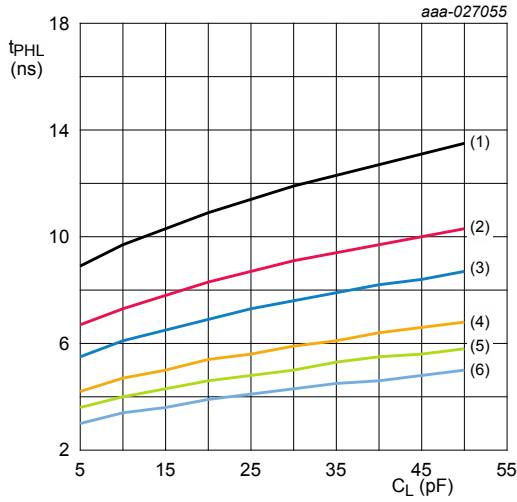
c. HIGH to LOW propagation delay (B4 to YA4)



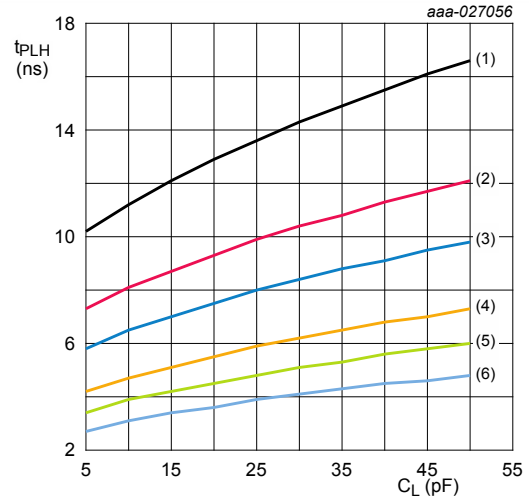
d. LOW to HIGH propagation delay (B4 to YA4)

- (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)  $V_{CC(B)} = 3.3\text{ V}$
- (6)  $V_{CC(B)} = 5.0\text{ V}$

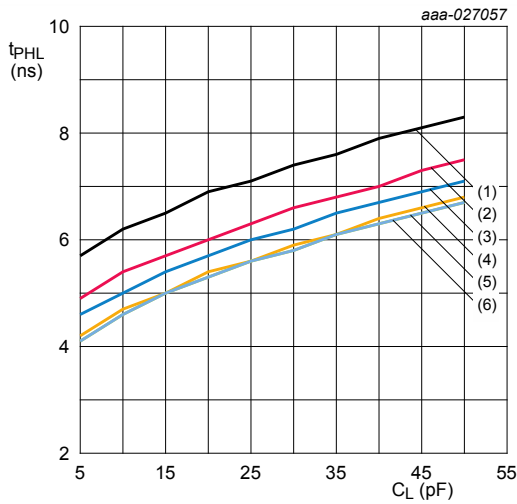
Figure 8. Typical propagation delay versus load capacitance;  $T_{amb} = 25\text{ }^\circ\text{C}$ ;  $V_{CC(A)} = 1.8\text{ V}$



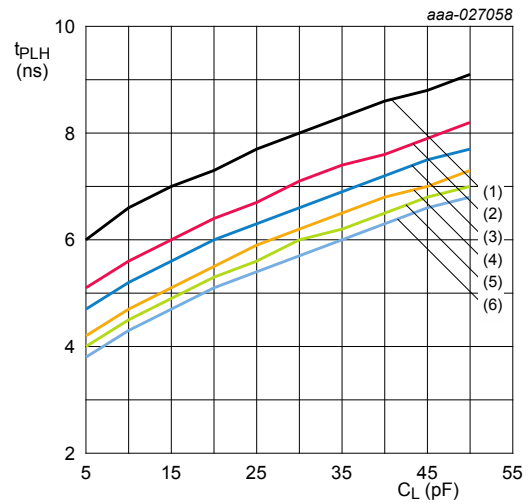
a. HIGH to LOW propagation delay (An to YBn)



b. LOW to HIGH propagation delay (An to YBn)



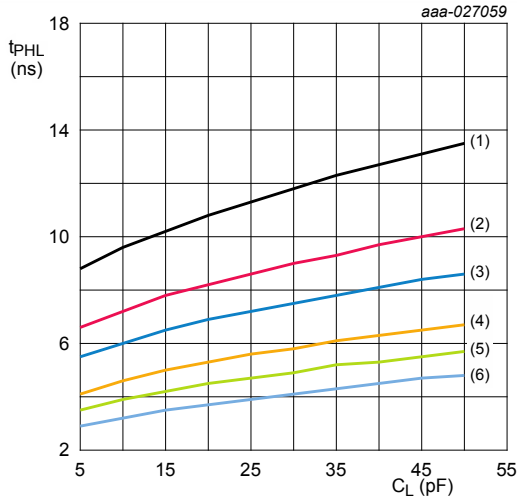
c. HIGH to LOW propagation delay (B4 to YA4)



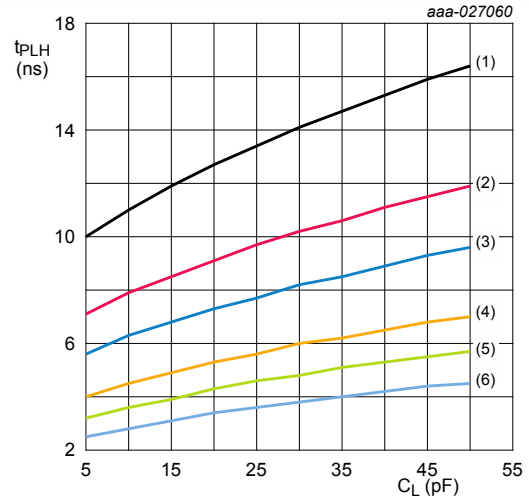
d. LOW to HIGH propagation delay (B4 to YA4)

- (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)  $V_{CC(B)} = 3.3\text{ V}$
- (6)  $V_{CC(B)} = 5.0\text{ V}$

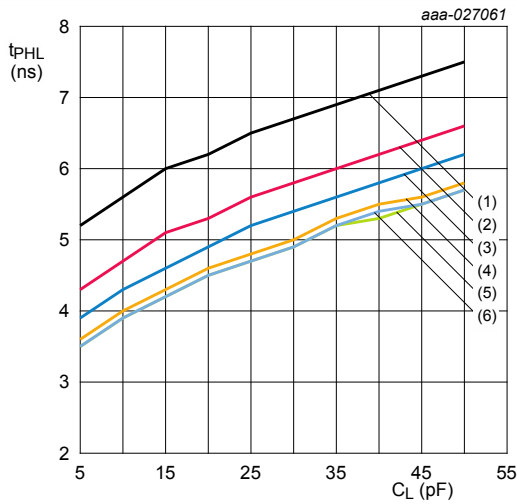
Figure 9. Typical propagation delay versus load capacitance;  $T_{amb} = 25\text{ }^\circ\text{C}$ ;  $V_{CC(A)} = 2.5\text{ V}$



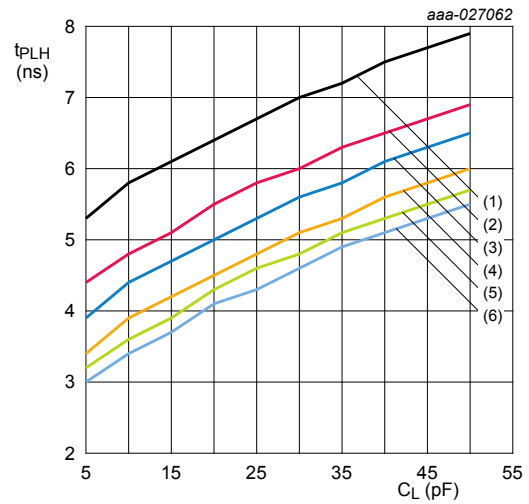
a. HIGH to LOW propagation delay (An to YBn)



b. LOW to HIGH propagation delay (An to YBn)



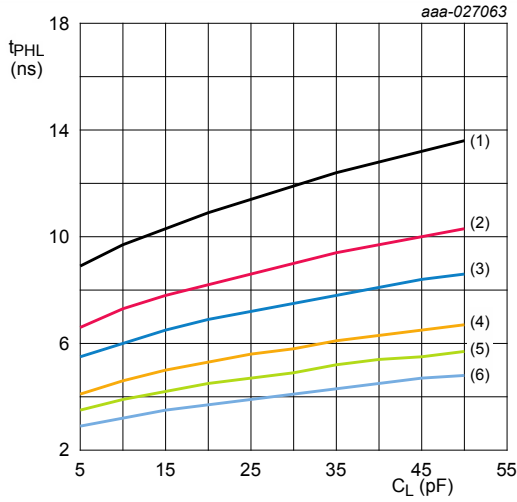
c. HIGH to LOW propagation delay (B4 to YA4)



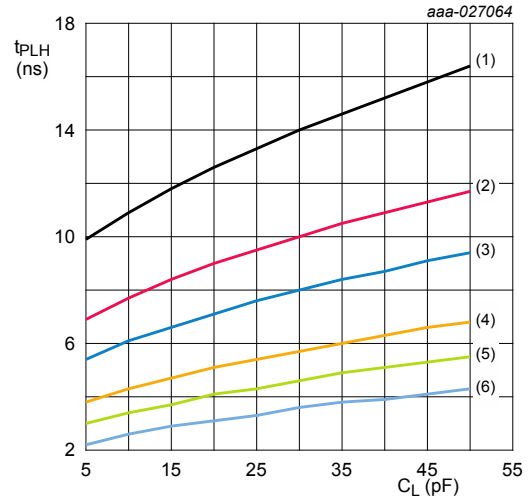
d. LOW to HIGH propagation delay (B4 to YA4)

- (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)  $V_{CC(B)} = 3.3\text{ V}$
- (6)  $V_{CC(B)} = 5.0\text{ V}$

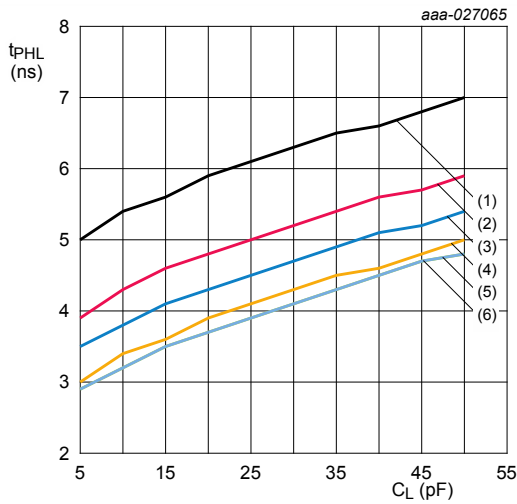
Figure 10. Typical propagation delay versus load capacitance;  $T_{amb} = 25\text{ °C}$ ;  $V_{CC(A)} = 3.3\text{ V}$



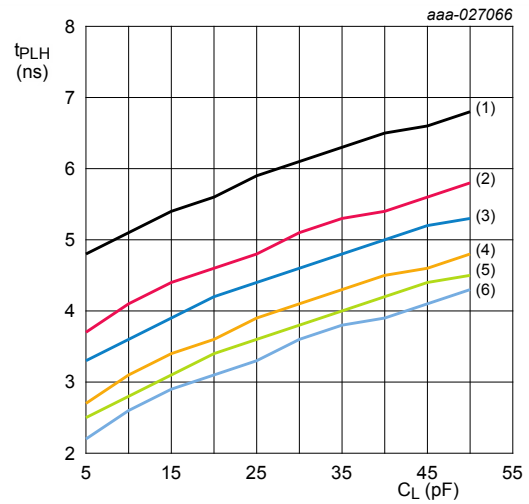
a. HIGH to LOW propagation delay (An to YBn)



b. LOW to HIGH propagation delay (An to YBn)



c. HIGH to LOW propagation delay (B4 to YA4)



d. LOW to HIGH propagation delay (B4 to YA4)

- (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)  $V_{CC(B)} = 3.3\text{ V}$
- (6)  $V_{CC(B)} = 5.0\text{ V}$

Figure 11. Typical propagation delay versus load capacitance;  $T_{amb} = 25\text{ }^\circ\text{C}$ ;  $V_{CC(A)} = 5\text{ V}$

## 11 Application information

### 11.1 Unidirectional logic level-shifting application

The circuit given in [Figure 12](#) is an example of the 74LVC4T3144 being used in an unidirectional logic level-shifting application.

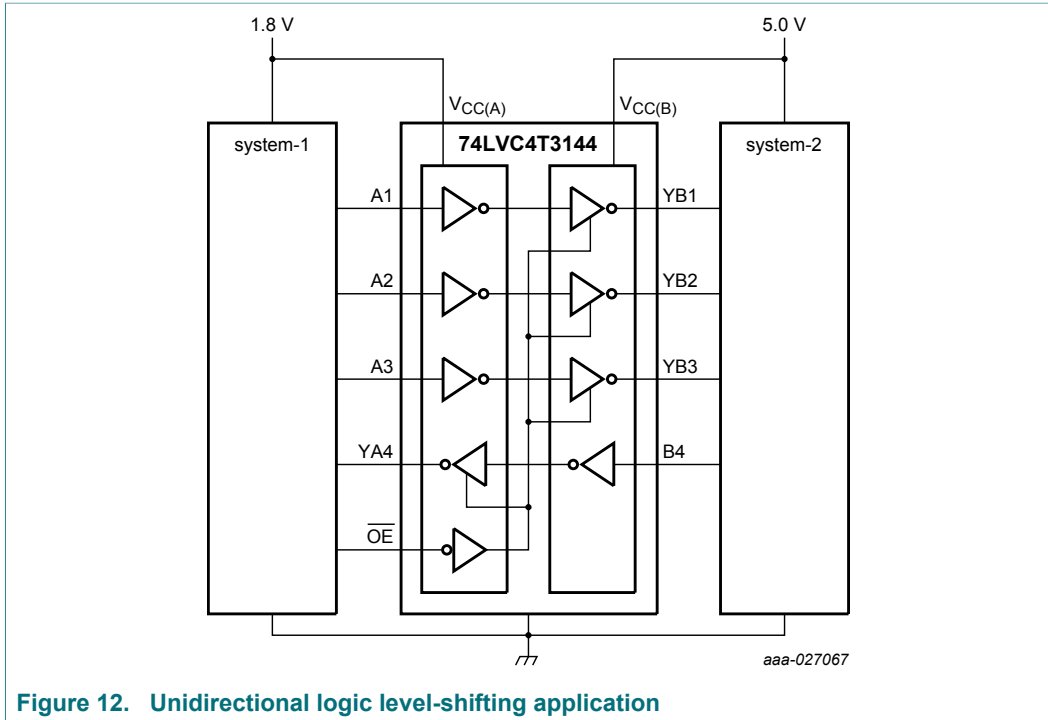


Figure 12. Unidirectional logic level-shifting application

Table 15. Description unidirectional logic level-shifting application

Name	Description
$V_{CC(A)}$	supply voltage of system-1 (1.2 V to 5.5 V)
$V_{CC(B)}$	supply voltage of system-2 (1.2 V to 5.5 V)
A1, A2, A3	input level depends on $V_{CC(A)}$ voltage
YA4	output level depends on $V_{CC(A)}$ voltage
YB1, YB2, YB3	output level depends on $V_{CC(B)}$ voltage
B4	input level depends on $V_{CC(B)}$ voltage
$\overline{OE}$	input level depends on $V_{CC(A)}$ voltage
GND	device GND

## 11.2 Power-up considerations

The device is designed such that no special power-up sequence is required other than GND being applied first.

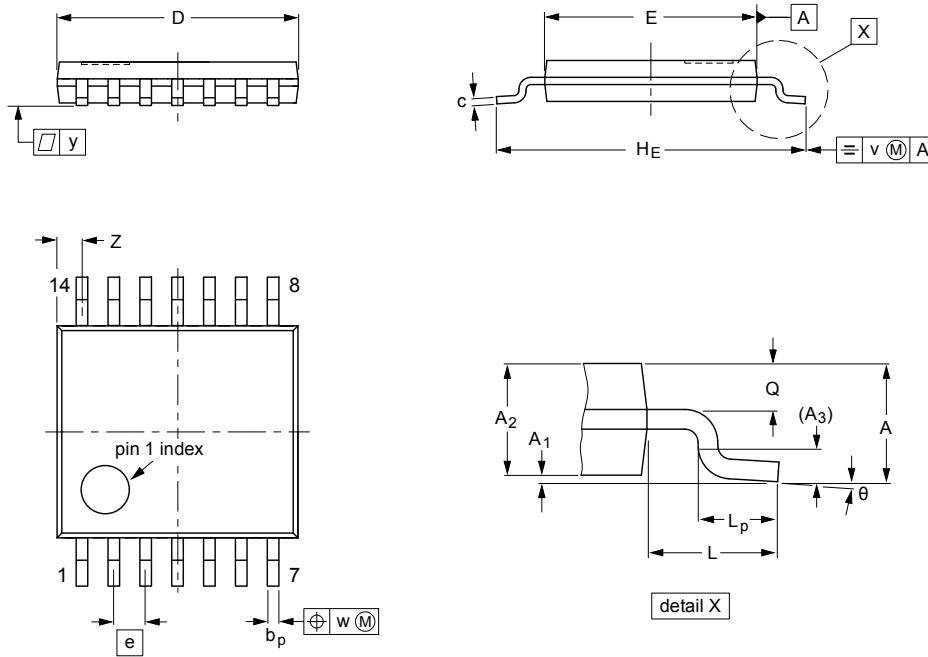
Table 16. Typical total supply current ( $I_{CC(A)} + I_{CC(B)}$ )

$V_{CC(A)}$	$V_{CC(B)}$							Unit
	0 V	1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	5.0 V	
0 V	0	< 1	< 1	< 1	< 1	< 1	< 1	$\mu\text{A}$
1.2 V	< 1	< 1	< 1	< 1	< 1	< 1	1	$\mu\text{A}$
1.5 V	< 1	< 1	< 1	< 1	< 1	< 1	< 1	$\mu\text{A}$
1.8 V	< 1	< 1	< 1	< 1	< 1	< 1	< 1	$\mu\text{A}$
2.5 V	< 1	< 1	< 1	< 1	< 1	< 1	< 1	$\mu\text{A}$
3.3 V	< 1	< 1	< 1	< 1	< 1	< 1	< 1	$\mu\text{A}$
5.0 V	< 1	1	< 1	< 1	< 1	< 1	< 1	$\mu\text{A}$

12 Package outline

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

SOT402-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.72 0.38	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			
SOT402-1		MO-153				99-12-27 03-02-18

Figure 13. Package outline SOT402-1 (TSSOP14)

## 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
74LVC4T3144 v.1	20170814	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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