74AUP1T45

Low-power dual supply translating transceiver; 3-state

Rev. 01 — 18 October 2006 Product data sheet

1. General description

The 74AUP1T45 is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families.

The 74AUP1T45 is a single bit transceiver featuring two data input-outputs (A and B), a direction control input (DIR) and dual supply pins ($V_{CC(A)}$ and $V_{CC(B)}$) which enable bidirectional level translation. Both $V_{CC(A)}$ and $V_{CC(B)}$ can be supplied at any voltage between 1.1 V and 3.6 V making the device suitable for interfacing between any of the low voltage nodes (1.2 V, 1.5 V, 1.8 V, 2.5 V and 3.3 V). Pins A and DIR are referenced to $V_{CC(A)}$ and pin B is referenced to $V_{CC(B)}$. A HIGH on DIR allows transmission from A to B and a LOW on DIR allows transmission from B to A.

Schmitt trigger action on all inputs makes the circuit tolerant of slower input rise and fall times across the entire $V_{CC(A)}$ and $V_{CC(B)}$ ranges. The device ensures low static and dynamic power consumption and 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, both A and B are in the high-impedance OFF-state.

2. Features

- Wide supply voltage range:
  - $V_{CC(A)}$: 1.1 V to 3.6 V
  - $V_{CC(B)}$: 1.1 V to 3.6 V
- High noise immunity
- Complies with JEDEC standards:
  - 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-A114-D Class 3A exceeds 5000 V
  - MM JESD22-A115-A exceeds 200 V
  - CDM JESD22-C101-C exceeds 1000 V
- Low static power consumption; I_{CC} = 0.9 μA (maximum)
- Suspend mode
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- Inputs accept voltages up to 3.6 V
- Low noise overshoot and undershoot < 10 % of V_{CC}
- I_{OFF} circuitry provides partial Power-down mode operation

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- 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
74AUP1T45GW	–40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363
74AUP1T45GM	–40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
74AUP1T45GF	–40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm	SOT891

4. Marking

Table 2. Marking

Type number	Marking code
74AUP1T45GW	a5
74AUP1T45GM	a5
74AUP1T45GF	a5

5. Functional diagram

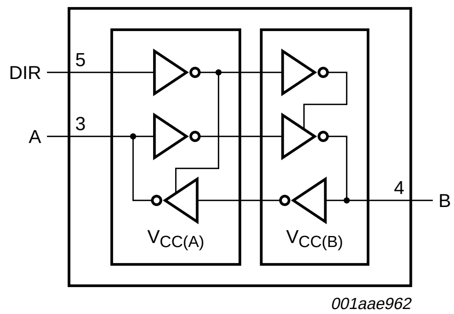


Fig 1. Logic symbol

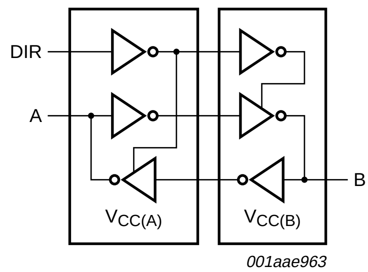


Fig 2. Logic diagram

6. Pinning information

6.1 Pinning

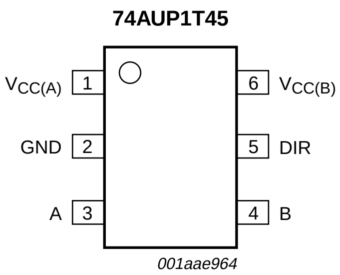


Fig 3. Pin configuration SOT363 (SC-88)

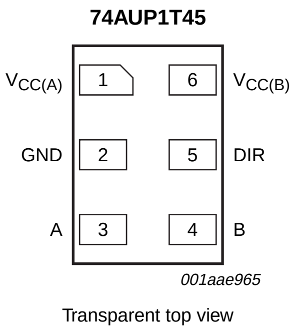


Fig 4. Pin configuration SOT886 (XSON6)

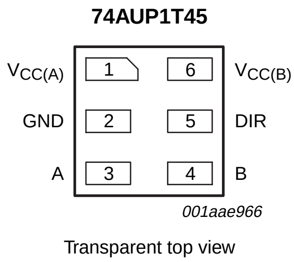


Fig 5. Pin configuration SOT891 (XSON6)

6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
$V_{CC(A)}$	1	supply voltage port A
GND	2	ground (0 V)
A	3	data input or output A
B	4	data input or output B
DIR	5	direction control DIR
$V_{CC(B)}$	6	supply voltage port B

7. Functional description

Table 4. Function table[1]

Supply voltage	Input[2]	Input/output[3]	
$V_{CC(A)}$, $V_{CC(B)}$	DIR	A	B
1.1 V to 3.6 V	L	A = B	input
1.1 V to 3.6 V	H	input	B = A
GND	X	suspend mode	suspend mode

[1] H = HIGH voltage level;
L = LOW voltage level;
X = don't care.

[2] The DIR input circuit is referenced to $V_{CC(A)}$.

[3] The input circuit of the data I/Os are always active.

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 port A			–0.5	+4.6	V
$V_{CC(B)}$	supply voltage port 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				
		A port	[1][2]	–0.5	$V_{CC(A)}$ + 0.5	V
		B port	[1][2]	–0.5	$V_{CC(B)}$ + 0.5	V
		suspend or 3-state mode	[1][2]	–0.5	+4.6	V
I_O	output current	V_O = 0 V to V_{CC}		-	±20	mA
I_{CC}	supply current			-	50	mA
I_{GND}	ground current			-	–50	mA
T_{stg}	storage temperature			–65	+150	°C
P_{tot}	total power dissipation	T_{amb} = –40 °C to +125 °C	[3]	-	250	mW

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

[2] The values of $V_{CC(A)}$ and $V_{CC(B)}$ are provided in the recommended operating conditions; see Table 6.

[3] For SC-88 packages: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K.
For XSON6 packages: above 45 °C the value of P_{tot} derates linearly with 2.4 mW/K.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions		Min	Max	Unit
$V_{CC(A)}$	supply voltage port A			1.1	3.6	V
$V_{CC(B)}$	supply voltage port B			1.1	3.6	V
V_I	input voltage			0	3.6	V
V_O	output voltage		[1]	0	V_{CCO}	V
T_{amb}	ambient temperature			–40	+125	°C
Δt/ΔV	input transition rise and fall rate	V_{CCI} =1.1 V to 3.6 V		0	200	ns/V

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

10. Static characteristics

Table 7. Static characteristics
At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
T_{amb} = 25 °C							
V_{IH}	HIGH-level input voltage	data input	[1][3]				
		V_{CCI} = 1.1 V to 1.95 V		0.65 × V_{CCI}	-	-	V
		V_{CCI} = 2.3 V to 2.7 V		1.6	-	-	V
		V_{CCI} = 3.0 V to 3.6 V		2.0	-	-	V
		DIR input	[1][4]				
		V_{CCI} = 1.1 V to 1.95 V		0.65 × $V_{CC(A)}$	-	-	V
		V_{CCI} = 2.3 V to 2.7 V		1.6	-	-	V
		V_{CCI} = 3.0 V to 3.6 V		2.0	-	-	V
V_{IL}	LOW-level input voltage	data input	[1][3]				
		V_{CCI} = 1.1 V to 1.95 V		-	-	0.35 × V_{CCI}	V
		V_{CCI} = 2.3 V to 2.7 V		-	-	0.7	V
		V_{CCI} = 3.0 V to 3.6 V		-	-	0.9	V
		DIR input	[1][4]				
		V_{CCI} = 1.1 V to 1.95 V		-	-	0.35 × $V_{CC(A)}$	V
		V_{CCI} = 2.3 V to 2.7 V		-	-	0.7	V
		V_{CCI} = 3.0 V to 3.6 V		-	-	0.9	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$					
		I_O = −20 μA; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V	[2]	V_{CCO} − 0.1	-	-	V
		I_O = −1.1 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V	[2]	0.75 × V_{CCO}	-	-	V
		I_O = −1.7 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.4 V		1.11	-	-	V
		I_O = −1.9 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.65 V		1.32	-	-	V
		I_O = −2.3 mA; $V_{CC(A)} = V_{CC(B)}$ = 2.3 V		2.05	-	-	V
		I_O = −3.1 mA; $V_{CC(A)} = V_{CC(B)}$ = 2.3 V		1.9	-	-	V
		I_O = −2.7 mA; $V_{CC(A)} = V_{CC(B)}$ = 3.0 V		2.72	-	-	V
		I_O = −4.0 mA; $V_{CC(A)} = V_{CC(B)}$ = 3.0 V		2.6	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IL}$					
		I_O = 20 μA; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	0.1	V
		I_O = 1.1 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V	[2]	-	-	0.3 × V_{CCO}	V
		I_O = 1.7 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.4 V		-	-	0.31	V
		I_O = 1.9 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.65 V		-	-	0.31	V
		I_O = 2.3 mA; $V_{CC(A)} = V_{CC(B)}$ = 2.3 V		-	-	0.31	V
		I_O = 3.1 mA; $V_{CC(A)} = V_{CC(B)}$ = 2.3 V		-	-	0.44	V
		I_O = 2.7 mA; $V_{CC(A)} = V_{CC(B)}$ = 3.0 V		-	-	0.31	V
		I_O = 4.0 mA; $V_{CC(A)} = V_{CC(B)}$ = 3.0 V		-	-	0.44	V
I_I	input leakage current	DIR input; V_I = GND to $V_{CC(A)}$; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.1	μA

Table 7. Static characteristics *...continued*

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{OZ}	OFF-state output current	A or B port; $V_I = V_{IH}$ or V_{IL}; V_O = 0 V to V_{CCO}; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V	[2]	-	-	±0.1	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; $V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.2	µA
		B port; V_I or V_O = 0 V to 3.6 V; $V_{CC(B)}$ = 0 V; $V_{CC(A)}$ = 1.1 V to 3.6 V		-	-	±0.2	µA
		DIR input; V_I or V_O = 0 V to 3.6 V; $V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.2	µA
ΔI_{OFF}	additional power-off leakage current	A port; V_I or V_O = 0 V to 3.6 V; $V_{CC(A)}$ = 0 V to 0.2 V; $V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.2	µA
		B port; V_I or V_O = 0 V to 3.6 V; $V_{CC(B)}$ = 0 V to 0.2 V; $V_{CC(A)}$ = 1.1 V to 3.6 V		-	-	±0.2	µA
		DIR input; V_I or V_O = 0 V to 3.6 V; $V_{CC(A)}$ = 0 V to 0.2 V; $V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.2	µA
I_{CC}	supply current	A port; V_I = GND or V_{CCI}; I_O = 0 A	[1]				
		$V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	0.5	µA
		$V_{CC(A)}$ = 3.6 V; $V_{CC(B)}$ = 0 V		-	-	0.5	µA
		$V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 3.6 V		-	0	-	µA
		B port; V_I = GND or V_{CCI}; I_O = 0 A	[1]				
		$V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	0.5	µA
		$V_{CC(A)}$ = 3.6 V; $V_{CC(B)}$ = 0 V		-	0	-	µA
		$V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 3.6 V		-	-	0.5	µA
		A plus B port ($I_{CC(A)} + I_{CC(B)}$); I_O = 0 A; V_I = GND or V_{CCI}; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V	[1]	-	-	0.5	µA
ΔI_{CC}	additional supply current	A port; $V_{CC(A)} = V_{CC(B)}$ = 3.3 V; A port at $V_{CC(A)}$ – 0.6 V; DIR at $V_{CC(A)}$; B port = open		-	-	40	µA
		B port; $V_{CC(A)} = V_{CC(B)}$ = 3.3 V; B port at $V_{CC(B)}$ – 0.6 V; DIR at GND; A port = open		-	-	40	µA
		DIR input; $V_{CC(A)} = V_{CC(B)}$ = 3.3 V; A port at $V_{CC(A)}$ or GND; B port = open; DIR at $V_{CC(A)}$ – 0.6 V		-	-	40	µA
C_I	input capacitance	DIR input; V_I = GND or $V_{CC(A)}$; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V		-	0.9	-	pF
$C_{I/O}$	input/output capacitance	A and B port; suspend mode; V_{CCI} = 0 V; V_{CCO} = 1.1 V to 3.6 V; $V_O = V_{CCO}$ or GND	[1][2]	-	2.0	-	pF

Table 7. Static characteristics *...continued*

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
T_{amb} = –40 °C to +85 °C							
V_{IH}	HIGH-level input voltage	data input	[1][3]				
		V_{CCI} = 1.1 V to 1.95 V		$0.65 \times V_{CCI}$	-	-	V
		V_{CCI} = 2.3 V to 2.7 V		1.6	-	-	V
		V_{CCI} = 3.0 V to 3.6 V		2.0	-	-	V
		DIR input	[1][4]				
		V_{CCI} = 1.1 V to 1.95 V		$0.65 \times V_{CC(A)}$	-	-	V
		V_{CCI} = 2.3 V to 2.7 V		1.6	-	-	V
		V_{CCI} = 3.0 V to 3.6 V		2.0	-	-	V
V_{IL}	LOW-level input voltage	data input	[1][3]				
		V_{CCI} = 1.1 V to 1.95 V		-	-	$0.35 \times V_{CCI}$	V
		V_{CCI} = 2.3 V to 2.7 V		-	-	0.7	V
		V_{CCI} = 3.0 V to 3.6 V		-	-	0.9	V
		DIR input	[1][4]				
		V_{CCI} = 1.1 V to 1.95 V		-	-	$0.35 \times V_{CC(A)}$	V
		V_{CCI} = 2.3 V to 2.7 V		-	-	0.7	V
		V_{CCI} = 3.0 V to 3.6 V		-	-	0.9	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$					
		I_O = –20 μA; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V	[2]	$V_{CCO} - 0.1$	-	-	V
		I_O = –1.1 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V	[2]	$0.7 \times V_{CCO}$	-	-	V
		I_O = –1.7 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.4 V		1.03	-	-	V
		I_O = –1.9 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.65 V		1.30	-	-	V
		I_O = –2.3 mA; $V_{CC(A)} = V_{CC(B)}$ = 2.3 V		1.97	-	-	V
		I_O = –3.1 mA; $V_{CC(A)} = V_{CC(B)}$ = 2.3 V		1.85	-	-	V
		I_O = –2.7 mA; $V_{CC(A)} = V_{CC(B)}$ = 3.0 V		2.67	-	-	V
		I_O = –4.0 mA; $V_{CC(A)} = V_{CC(B)}$ = 3.0 V		2.55	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IL}$					
		I_O = 20 μA; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	0.1	V
		I_O = 1.1 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V	[2]	-	-	$0.3 \times V_{CCO}$	V
		I_O = 1.7 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.4 V		-	-	0.37	V
		I_O = 1.9 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.65 V		-	-	0.35	V
		I_O = 2.3 mA; $V_{CC(A)} = V_{CC(B)}$ = 2.3 V		-	-	0.33	V
		I_O = 3.1 mA; $V_{CC(A)} = V_{CC(B)}$ = 2.3 V		-	-	0.45	V
		I_O = 2.7 mA; $V_{CC(A)} = V_{CC(B)}$ = 3.0 V		-	-	0.33	V
		I_O = 4.0 mA; $V_{CC(A)} = V_{CC(B)}$ = 3.0 V		-	-	0.45	V
I_I	input leakage current	DIR input; V_I = GND to $V_{CC(A)}$; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.5	μA
I_{OZ}	OFF-state output current	A or B port; $V_I = V_{IH}$ or V_{IL}; V_O = 0 V to V_{CCO}; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V	[2]	-	-	±0.5	μA

Table 7. Static characteristics *...continued*

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{OFF}	power-off leakage current	A port; V_I or V_O = 0 V to 3.6 V; $V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.5	μA
		B port; V_I or V_O = 0 V to 3.6 V; $V_{CC(B)}$ = 0 V; $V_{CC(A)}$ = 1.1 V to 3.6 V		-	-	±0.5	μA
		DIR input; V_I or V_O = 0 V to 3.6 V; $V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.5	μA
ΔI_{OFF}	additional power-off leakage current	A port; V_I or V_O = 0 V to 3.6 V; $V_{CC(A)}$ = 0 V to 0.2 V; $V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.6	μA
		B port; V_I or V_O = 0 V to 3.6 V; $V_{CC(B)}$ = 0 V to 0.2 V; $V_{CC(A)}$ = 1.1 V to 3.6 V		-	-	±0.6	μA
		DIR input; V_I or V_O = 0 V to 3.6 V; $V_{CC(A)}$ = 0 V to 0.2 V; $V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.6	μA
I_{CC}	supply current	A port; V_I = GND or V_{CCI}; I_O = 0 A	[1]				
		$V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	0.9	μA
		$V_{CC(A)}$ = 3.6 V; $V_{CC(B)}$ = 0 V		-	-	0.9	μA
		$V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 3.6 V		-	0	-	μA
		B port; V_I = GND or V_{CCI}; I_O = 0 A	[1]				
		$V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	0.9	μA
		$V_{CC(A)}$ = 3.6 V; $V_{CC(B)}$ = 0 V		-	0	-	μA
		$V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 3.6 V		-	-	0.9	μA
		A plus B port ($I_{CC(A)} + I_{CC(B)}$); I_O = 0 A; V_I = GND or V_{CCI}; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V	[1]	-	-	0.9	μA
ΔI_{CC}	additional supply current	A port; $V_{CC(A)} = V_{CC(B)}$ = 3.3 V; A port at $V_{CC(A)}$ − 0.6 V; DIR at $V_{CC(A)}$; B port = open		-	-	50	μA
		B port; $V_{CC(A)} = V_{CC(B)}$ = 3.3 V; B port at $V_{CC(B)}$ − 0.6 V; DIR at GND; A port = open		-	-	50	μA
		DIR input; $V_{CC(A)} = V_{CC(B)}$ = 3.3 V; A port at $V_{CC(A)}$ or GND; B port = open; DIR at $V_{CC(A)}$ − 0.6 V		-	-	50	μA
T_{amb} = −40 °C to +125 °C							
V_{IH}	HIGH-level input voltage	data input	[1][3]				
		V_{CCI} = 1.1 V to 1.95 V		0.7 × V_{CCI}	-	-	V
		V_{CCI} = 2.3 V to 2.7 V		1.6	-	-	V
		V_{CCI} = 3.0 V to 3.6 V		2.0	-	-	V
		DIR input	[1][4]				
		V_{CCI} = 1.1 V to 1.95 V		0.7 × $V_{CC(A)}$	-	-	V
		V_{CCI} = 2.3 V to 2.7 V		1.6	-	-	V
		V_{CCI} = 3.0 V to 3.6 V		2.0	-	-	V

Table 7. Static characteristics *...continued*

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{IL}	LOW-level input voltage	data input	[1][3]				
		V_{CCI} = 1.1 V to 1.95 V		-	-	0.3 × V_{CCI}	V
		V_{CCI} = 2.3 V to 2.7 V		-	-	0.7	V
		V_{CCI} = 3.0 V to 3.6 V		-	-	0.9	V
		DIR input	[1][4]				
		V_{CCI} = 1.1 V to 1.95 V		-	-	0.3 × $V_{CC(A)}$	V
		V_{CCI} = 2.3 V to 2.7 V		-	-	0.7	V
		V_{CCI} = 3.0 V to 3.6 V		-	-	0.9	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$					
		I_O = −20 μA; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V	[2]	V_{CCO} − 0.11	-	-	V
		I_O = −1.1 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V	[2]	0.6 × V_{CCO}	-	-	V
		I_O = −1.7 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.4 V		0.93	-	-	V
		I_O = −1.9 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.65 V		1.17	-	-	V
		I_O = −2.3 mA; $V_{CC(A)} = V_{CC(B)}$ = 2.3 V		1.77	-	-	V
		I_O = −3.1 mA; $V_{CC(A)} = V_{CC(B)}$ = 2.3 V		1.67	-	-	V
		I_O = −2.7 mA; $V_{CC(A)} = V_{CC(B)}$ = 3.0 V		2.40	-	-	V
		I_O = −4.0 mA; $V_{CC(A)} = V_{CC(B)}$ = 3.0 V		2.30	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IL}$					
		I_O = 20 μA; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	0.11	V
		I_O = 1.1 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V	[2]	-	-	0.33 × V_{CCO}	V
		I_O = 1.7 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.4 V		-	-	0.41	V
		I_O = 1.9 mA; $V_{CC(A)} = V_{CC(B)}$ = 1.65 V		-	-	0.39	V
		I_O = 2.3 mA; $V_{CC(A)} = V_{CC(B)}$ = 2.3 V		-	-	0.36	V
		I_O = 3.1 mA; $V_{CC(A)} = V_{CC(B)}$ = 2.3 V		-	-	0.50	V
		I_O = 2.7 mA; $V_{CC(A)} = V_{CC(B)}$ = 3.0 V		-	-	0.36	V
		I_O = 4.0 mA; $V_{CC(A)} = V_{CC(B)}$ = 3.0 V		-	-	0.50	V
I_I	input leakage current	DIR input; V_I = GND to $V_{CC(A)}$; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.75	μA
I_{OZ}	OFF-state output current	A or B port; $V_I = V_{IH}$ or V_{IL}; V_O = 0 V to V_{CCO}; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V	[2]	-	-	±0.75	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; $V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.75	μA
		B port; V_I or V_O = 0 V to 3.6 V; $V_{CC(B)}$ = 0 V; $V_{CC(A)}$ = 1.1 V to 3.6 V		-	-	±0.75	μA
		DIR input; V_I or V_O = 0 V to 3.6 V; $V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.75	μA

Table 7. Static characteristics *...continued*

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
ΔI_{OFF}	additional power-off leakage current	A port; V_I or V_O = 0 V to 3.6 V; $V_{CC(A)}$ = 0 V to 0.2 V; $V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.75	µA
		B port; V_I or V_O = 0 V to 3.6 V; $V_{CC(B)}$ = 0 V to 0.2 V; $V_{CC(A)}$ = 1.1 V to 3.6 V		-	-	±0.75	µA
		DIR input; V_I or V_O = 0 V to 3.6 V; $V_{CC(A)}$ = 0 V to 0.2 V; $V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	±0.75	µA
I_{CC}	supply current	A port; V_I = GND or V_{CCI}; I_O = 0 A	[1]				
		$V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	1.4	µA
		$V_{CC(A)}$ = 3.6 V; $V_{CC(B)}$ = 0 V		-	-	1.4	µA
		$V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 3.6 V		-	0	-	µA
		B port; V_I = GND or V_{CCI}; I_O = 0 A	[1]				
		$V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V		-	-	1.4	µA
		$V_{CC(A)}$ = 3.6 V; $V_{CC(B)}$ = 0 V		-	0	-	µA
		$V_{CC(A)}$ = 0 V; $V_{CC(B)}$ = 3.6 V		-	-	1.4	µA
		A plus B port ($I_{CC(A)} + I_{CC(B)}$); I_O = 0 A; V_I = GND or V_{CCI}; $V_{CC(A)} = V_{CC(B)}$ = 1.1 V to 3.6 V	[1]	-	-	1.4	µA
ΔI_{CC}	additional supply current	A port; $V_{CC(A)} = V_{CC(B)}$ = 3.3 V; A port at $V_{CC(A)}$ – 0.6 V; DIR at $V_{CC(A)}$; B port = open		-	-	75	µA
		B port; $V_{CC(A)} = V_{CC(B)}$ = 3.3 V; B port at $V_{CC(B)}$ – 0.6 V; DIR at GND; A port = open		-	-	75	µA
		DIR input; $V_{CC(A)} = V_{CC(B)}$ = 3.3 V; A port at $V_{CC(A)}$ or GND; B port = open; DIR at $V_{CC(A)}$ – 0.6 V		-	-	75	µA

[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.

[3] For V_{CCI} values not specified in the data sheet: minimum $V_{IH} = 0.7 \times V_{CCI}$ and maximum $V_{IL} = 0.3 \times V_{CCI}$.

[4] For V_{CCI} values not specified in the data sheet: minimum $V_{IH} = 0.7 \times V_{CC(A)}$ and maximum $V_{IL} = 0.3 \times V_{CC(A)}$.

[5] All unused data inputs of the device must be held at V_{CCI} or GND to ensure proper device operation.

11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

Symbol	Parameter	Conditions		25 °C			−40 °C to +125 °C			Unit
				Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
C_L = 5 pF; $V_{CC(A)}$ = 1.1 V to 1.3 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.8	15.4	28.0	2.4	28.3	31.2	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.8	10.2	16.2	2.6	17.5	19.3	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.4	8.1	13.0	2.2	14.4	15.9	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.5	6.3	10.0	2.1	10.7	11.8	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.3	5.6	9.0	1.9	9.7	10.7	ns
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.7	5.3	8.5	2.5	8.7	9.6	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.9	5.3	8.4	2.7	8.7	9.7	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.7	5.3	8.5	2.5	9.0	10.0	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.7	5.3	8.7	2.5	8.9	9.9	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.9	5.3	8.7	2.5	9.1	10.1	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		6.1	13.2	22.1	5.4	23.4	25.8	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		5.0	9.3	13.9	4.4	15.2	16.7	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		4.2	8.1	12.3	3.6	13.5	14.9	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.3	6.3	9.3	2.9	10.2	11.2	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.6	6.3	9.2	3.2	9.7	10.7	ns
C_L = 5 pF; $V_{CC(A)}$ = 1.4 V to 1.6 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.5	14.5	26.6	2.2	27.1	29.9	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.5	9.4	14.5	2.3	15.9	17.5	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.1	7.4	11.2	1.9	12.7	14.0	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.2	5.5	8.0	1.8	8.9	9.8	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.0	4.7	6.8	1.6	7.6	8.4	ns

Table 8. Dynamic characteristics *...continued*

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

Symbol	Parameter	Conditions		25 °C			−40 °C to +125 °C			Unit
				Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.0	3.8	5.3	1.9	5.7	6.3	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.2	3.8	5.3	2.0	5.7	6.4	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.1	3.8	5.5	1.8	5.9	6.6	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.1	3.8	5.5	1.9	5.9	6.6	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.2	3.8	5.5	1.9	6.0	6.6	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		5.7	12.7	21.0	5.2	22.3	24.6	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		4.7	8.7	12.7	4.1	14.1	15.5	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.9	7.4	10.9	3.3	12.3	13.5	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.0	5.6	7.8	2.6	8.8	9.7	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.3	5.5	7.4	2.9	8.1	8.9	ns
C_L = 5 pF; $V_{CC(A)}$ = 1.65 V to 1.95 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.4	14.2	26.1	2.0	26.5	29.2	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.4	9.1	13.9	2.1	15.4	17.0	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.0	7.0	10.7	1.7	12.1	13.4	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.0	5.1	7.4	1.6	8.2	9.1	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		1.9	4.3	6.1	1.5	6.9	7.7	ns
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.0	3.5	4.8	1.8	5.2	5.8	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.1	3.5	4.8	1.9	5.2	5.7	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.0	3.5	5.0	1.8	5.4	6.0	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.0	3.5	4.9	1.8	5.4	6.0	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.1	3.5	4.9	1.8	5.4	6.0	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		5.8	12.4	20.6	5.1	21.9	24.2	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		4.6	8.4	12.2	3.9	13.5	14.9	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.8	7.1	10.4	3.2	11.8	13.0	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.9	5.2	7.3	2.5	8.3	9.1	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.1	5.1	6.9	2.7	7.5	8.3	ns
C_L = 5 pF; $V_{CC(A)}$ = 2.3 V to 2.7 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.4	13.6	25.5	2.0	25.9	28.6	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.3	8.5	13.3	2.1	14.7	16.2	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		1.9	6.5	10.0	1.7	11.4	12.5	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		1.9	4.6	6.7	1.6	7.5	8.3	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		1.8	3.8	5.3	1.4	6.2	6.8	ns

Table 8. Dynamic characteristics *...continued*

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

Symbol	Parameter	Conditions		25 °C			−40 °C to +125 °C			Unit
				Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		1.4	2.5	3.3	1.3	3.6	4.0	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		1.6	2.5	3.3	1.4	3.6	4.0	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		1.5	2.5	3.4	1.3	3.8	4.2	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		1.4	2.5	3.4	1.3	3.8	4.2	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		1.6	2.5	3.4	1.3	3.7	4.1	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		5.8	12.3	20.4	5.1	21.8	24.0	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		4.5	8.3	11.9	4.0	13.2	14.5	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.7	7.0	10.0	3.2	11.3	12.5	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.8	5.0	6.8	2.5	7.8	8.6	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.1	4.9	6.4	2.7	7.0	7.8	ns
C_L = 5 pF; $V_{CC(A)}$ = 3.0 V to 3.6 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.3	13.1	24.9	2.0	25.2	27.8	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.3	8.1	12.8	2.0	14.1	15.5	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		1.9	6.1	9.5	1.7	10.8	12.0	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		1.9	4.3	6.2	1.6	7.0	7.7	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		1.7	3.5	5.0	1.4	5.7	6.3	ns
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		1.7	2.8	3.5	1.5	3.8	4.2	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		1.8	2.8	3.5	1.7	3.8	4.2	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		1.7	2.8	3.6	1.5	4.0	4.4	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		1.7	2.8	3.6	1.5	3.9	4.4	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		1.8	2.8	3.6	1.5	3.9	4.3	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		5.8	12.3	20.6	5.1	22.0	24.2	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		4.6	8.3	11.8	4.0	13.1	14.5	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.8	6.9	10.0	3.2	11.3	12.5	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.8	5.0	6.7	2.5	7.6	8.4	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.1	4.9	6.3	2.7	6.9	7.6	ns
C_L = 10 pF; $V_{CC(A)}$ = 1.1 V to 1.3 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		3.0	16.2	29.8	2.7	30.2	33.3	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		3.0	10.8	17.5	2.7	18.6	20.5	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.1	8.7	13.5	2.8	14.6	16.1	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.7	6.8	10.5	2.4	11.2	12.4	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.7	6.1	9.6	2.4	10.1	11.1	ns

Table 8. Dynamic characteristics *...continued*
Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

Symbol	Parameter	Conditions		25 °C			−40 °C to +125 °C			Unit
				Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		3.2	6.5	9.9	3.1	10.2	11.3	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		3.5	6.5	10.0	3.2	10.2	11.3	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.7	6.5	9.8	3.5	10.1	11.1	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.2	6.5	10.1	3.1	10.2	11.3	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.6	6.5	10.1	3.2	10.3	11.4	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		6.4	14.3	23.5	5.8	24.8	27.4	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		5.3	10.2	15.4	4.6	16.6	18.4	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		5.2	9.2	13.6	4.7	14.7	16.2	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.6	7.1	10.1	3.2	11.0	12.1	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		4.4	7.6	10.8	3.8	11.4	12.5	ns
C_L = 10 pF; $V_{CC(A)}$ = 1.4 V to 1.6 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.7	15.3	28.3	2.4	29.0	31.9	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.7	10.0	15.8	2.5	17.0	18.7	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.8	7.9	11.8	2.5	13.0	14.4	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.4	6.0	8.6	2.2	9.4	10.4	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.4	5.2	7.4	2.1	8.0	8.9	ns
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.5	4.7	6.4	2.3	6.8	7.6	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.7	4.7	6.5	2.4	6.9	7.6	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.9	4.7	6.5	2.6	6.9	7.6	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.5	4.7	6.5	2.3	6.9	7.6	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.8	4.7	6.6	2.4	6.9	7.7	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		6.1	13.7	22.4	5.6	23.8	26.3	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		5.0	9.6	14.2	4.3	15.5	17.1	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		4.9	8.5	12.3	4.4	13.4	14.8	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.3	6.4	8.7	3.0	9.6	10.6	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		4.1	6.7	9.1	3.5	9.7	10.8	ns
C_L = 10 pF; $V_{CC(A)}$ = 1.65 V to 1.95 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.6	15.0	27.8	2.3	28.3	31.2	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.6	9.7	15.2	2.3	16.5	18.2	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.7	7.5	11.2	2.3	12.4	13.7	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.3	5.6	7.9	2.0	8.8	9.7	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.3	4.8	6.7	1.9	7.4	8.2	ns

Table 8. Dynamic characteristics *...continued*

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

Symbol	Parameter	Conditions		25 °C			−40 °C to +125 °C			Unit
				Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.5	4.6	6.2	2.4	6.6	7.3	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.7	4.6	6.3	2.5	6.7	7.4	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.9	4.6	6.3	2.7	6.7	7.4	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.5	4.6	6.2	2.4	6.7	7.4	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.8	4.6	6.3	2.5	6.7	7.4	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		6.1	13.5	22.1	5.4	23.4	25.8	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		5.0	9.3	13.6	4.2	14.9	16.5	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		4.8	8.3	11.8	4.2	13.0	14.3	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.2	6.0	8.1	2.8	9.1	10.0	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.9	6.4	8.5	3.3	9.2	10.2	ns
C_L = 10 pF; $V_{CC(A)}$ = 2.3 V to 2.7 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.5	14.4	27.2	2.3	27.8	30.6	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.5	9.1	14.6	2.3	15.8	17.4	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.6	7.0	10.5	2.2	11.7	12.9	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.2	5.1	7.2	1.9	8.0	8.9	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.2	4.3	5.9	1.9	6.6	7.3	ns
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		1.8	3.3	4.2	1.7	4.6	5.1	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.0	3.3	4.4	1.8	4.7	5.2	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.1	3.3	4.4	2.0	4.7	5.2	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		1.8	3.3	4.3	1.7	4.7	5.2	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.1	3.3	4.4	1.8	4.7	5.2	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		6.1	13.4	21.8	5.4	23.2	25.6	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		4.9	9.2	13.3	4.2	14.6	16.1	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		4.8	8.1	11.4	4.2	12.5	13.8	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.1	5.8	7.7	2.8	8.6	9.5	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.9	6.2	8.0	3.3	8.7	9.6	ns
C_L = 10 pF; $V_{CC(A)}$ = 3.0 V to 3.6 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.5	14.0	26.6	2.2	27.0	29.8	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.5	8.7	14.0	2.3	15.1	16.7	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.5	6.6	10.1	2.2	11.2	12.4	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.2	4.8	6.8	1.9	7.5	8.3	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.1	4.0	5.5	1.9	6.1	6.8	ns

Table 8. Dynamic characteristics *...continued*

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

Symbol	Parameter	Conditions		25 °C			−40 °C to +125 °C			Unit
				Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.3	4.0	5.0	2.2	5.3	5.9	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.5	4.0	5.2	2.3	5.4	6.0	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.6	4.0	5.2	2.5	5.4	6.0	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.3	4.0	5.1	2.2	5.4	6.0	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.6	4.0	5.2	2.3	5.4	6.0	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		6.2	13.5	22.0	5.5	23.4	25.8	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		4.9	9.2	13.2	4.2	14.6	16.1	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		4.8	8.1	11.3	4.3	12.4	13.7	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.1	5.8	7.6	2.8	8.5	9.4	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.9	6.2	7.9	3.3	8.5	9.5	ns
C_L = 15 pF; $V_{CC(A)}$ = 1.1 V to 1.3 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		3.4	16.9	31.6	3.0	32.0	35.2	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		3.7	11.3	18.2	3.1	19.5	21.5	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.2	9.1	14.3	3.0	15.6	17.2	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.2	7.3	11.2	2.8	12.0	13.2	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.1	6.5	10.2	2.6	10.7	11.8	ns
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		3.9	7.6	11.4	3.8	11.7	12.9	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		4.5	7.6	11.3	4.1	11.7	12.9	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		4.2	7.6	11.3	4.1	11.7	12.9	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.9	7.6	11.7	3.8	11.9	13.1	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		4.5	7.6	11.7	4.1	11.9	13.1	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		7.2	15.4	24.9	6.5	26.3	29.0	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		6.3	11.1	16.3	5.4	17.7	19.5	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		5.7	10.4	15.0	5.2	16.2	17.9	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		4.1	7.9	11.4	3.8	12.1	13.4	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		5.3	8.8	12.2	4.9	12.7	14.1	ns
C_L = 15 pF; $V_{CC(A)}$ = 1.4 V to 1.6 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		3.1	16.1	30.1	2.8	30.7	33.8	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		3.4	10.5	16.5	2.8	17.9	19.7	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.0	8.4	12.6	2.7	13.9	15.4	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.9	6.4	9.3	2.5	10.1	11.2	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.8	5.6	8.0	2.3	8.7	9.6	ns

Table 8. Dynamic characteristics *...continued*

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

Symbol	Parameter	Conditions		25 °C			−40 °C to +125 °C			Unit
				Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		3.1	5.6	7.6	2.9	8.0	8.9	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		3.5	5.6	7.5	3.1	8.0	8.8	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.3	5.6	7.6	3.1	8.0	8.9	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.1	5.6	7.7	2.9	8.1	9.0	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.5	5.6	7.8	3.1	8.1	9.0	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		6.9	14.9	23.8	6.4	25.3	27.9	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		6.0	10.5	15.1	5.2	16.6	18.3	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		5.4	9.7	13.7	5.0	15.0	16.5	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.8	7.2	9.9	3.5	10.7	11.9	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		5.0	8.0	10.5	4.6	11.1	12.3	ns
C_L = 15 pF; $V_{CC(A)}$ = 1.65 V to 1.95 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		3.0	15.8	29.6	2.6	30.1	33.2	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		3.2	10.2	15.9	2.6	17.4	19.2	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.8	8.0	12.0	2.5	13.4	14.8	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.8	6.0	8.6	2.3	9.5	10.5	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.6	5.2	7.3	2.2	8.0	8.9	ns
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		3.2	5.8	7.6	3.1	8.0	8.9	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		3.7	5.8	7.6	3.3	8.1	8.9	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.5	5.8	7.7	3.3	8.1	9.0	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.2	5.8	7.8	3.1	8.2	9.0	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.7	5.8	7.8	3.4	8.1	9.0	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		6.9	14.7	23.4	6.2	24.9	27.4	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		5.9	10.2	14.6	5.0	16.0	17.7	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		5.3	9.4	13.2	4.8	14.5	16.0	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.7	6.8	9.4	3.4	10.2	11.3	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		4.9	7.6	9.9	4.4	10.6	11.7	ns
C_L = 15 pF; $V_{CC(A)}$ = 2.3 V to 2.7 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		3.0	15.2	29.0	2.6	29.5	32.5	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		3.1	9.6	15.3	2.6	16.7	18.4	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.7	7.5	11.3	2.5	12.6	13.9	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.7	5.5	7.9	2.3	8.7	9.6	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.5	4.7	6.5	2.1	7.2	8.0	ns

Table 8. Dynamic characteristics *...continued*

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

Symbol	Parameter	Conditions		25 °C			−40 °C to +125 °C			Unit
				Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.4	4.1	5.2	2.2	5.6	6.2	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		2.7	4.1	5.3	2.4	5.7	6.3	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.5	4.1	5.4	2.4	5.7	6.3	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.4	4.1	5.4	2.2	5.7	6.3	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.7	4.1	5.3	2.4	5.6	6.2	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		6.9	14.6	23.2	6.2	24.7	27.2	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		5.9	10.1	14.2	5.0	15.6	17.3	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		5.3	9.2	12.8	4.8	14.0	15.5	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.7	6.7	8.9	3.4	9.8	10.8	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		4.8	7.4	9.4	4.4	10.1	11.2	ns
C_L = 15 pF; $V_{CC(A)}$ = 3.0 V to 3.6 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		2.9	14.7	28.3	2.6	28.8	31.7	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		3.1	9.2	14.7	2.6	16.0	17.7	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		2.7	7.1	10.9	2.4	12.1	13.4	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		2.7	5.2	7.4	2.2	8.2	9.1	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		2.5	4.5	6.1	2.1	6.8	7.5	ns
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		3.1	5.3	6.5	3.0	6.9	7.6	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		3.5	5.3	6.6	3.2	7.0	7.7	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.3	5.3	6.7	3.2	7.0	7.8	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.1	5.3	6.8	3.0	7.1	7.8	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.5	5.3	6.6	3.2	6.9	7.6	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		6.9	14.6	23.4	6.3	24.9	27.4	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		5.9	10.1	14.2	5.0	15.6	17.2	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		5.3	9.2	12.7	4.8	13.9	15.4	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.7	6.6	8.8	3.4	9.6	10.6	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		4.8	7.4	9.3	4.4	10.0	11.0	ns
C_L = 30 pF; $V_{CC(A)}$ = 1.1 V to 1.3 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		4.2	19.1	36.0	3.8	36.8	40.5	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		4.5	12.8	20.6	4.0	22.0	24.2	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		4.2	10.4	16.2	3.8	17.4	19.2	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		4.0	8.3	12.4	3.5	13.2	14.5	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		4.0	7.5	11.5	3.7	12.5	13.8	ns

Table 8. Dynamic characteristics *...continued*

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

Symbol	Parameter	Conditions		25 °C			–40 °C to +125 °C			Unit
				Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		5.6	11.0	15.7	5.5	16.2	17.9	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		6.1	11.0	15.6	6.0	15.9	17.5	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		6.6	11.0	15.5	6.5	15.8	17.4	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		5.6	11.0	15.6	5.5	15.8	17.5	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		7.0	11.0	15.9	6.6	16.7	18.4	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		8.7	18.9	29.0	8.1	30.5	33.6	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		7.3	13.8	19.3	6.8	20.7	22.8	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		8.1	13.7	19.2	7.7	20.3	22.4	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		5.2	10.3	14.0	4.9	14.7	16.2	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		8.1	12.5	16.5	7.5	18.0	19.9	ns
C_L = 30 pF; $V_{CC(A)}$ = 1.4 V to 1.6 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		4.0	18.2	34.5	3.5	35.5	39.1	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		4.2	12.0	18.9	3.7	20.3	22.4	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.9	9.6	14.4	3.5	15.8	17.4	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.8	7.5	10.4	3.2	11.4	12.6	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.7	6.7	9.3	3.4	10.4	11.4	ns
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		4.4	8.3	10.8	4.3	11.4	12.6	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		4.8	8.3	10.7	4.6	11.2	12.3	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		5.2	8.3	10.8	5.0	11.2	12.4	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		4.4	8.3	10.8	4.3	11.1	12.3	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		5.5	8.3	11.0	5.1	11.8	13.0	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		8.4	18.3	27.9	7.9	29.5	32.5	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		7.1	13.2	18.2	6.6	19.6	21.6	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		7.8	13.1	17.9	7.4	19.1	21.0	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		4.9	9.6	12.6	4.6	13.4	14.8	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		7.7	11.7	14.8	7.2	16.3	18.0	ns
C_L = 30 pF; $V_{CC(A)}$ = 1.65 V to 1.95 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		3.9	18.0	34.0	3.4	34.9	38.4	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		4.1	11.7	18.3	3.5	19.8	21.9	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.8	9.2	13.9	3.4	15.2	16.8	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.6	7.1	9.8	3.1	10.8	11.9	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.5	6.3	8.6	3.2	9.7	10.7	ns

Table 8. Dynamic characteristics *...continued*
Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

Symbol	Parameter	Conditions		25 °C			−40 °C to +125 °C			Unit
				Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		5.0	9.2	11.7	4.8	12.3	13.6	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		5.4	9.2	11.7	5.3	12.1	13.4	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		5.8	9.1	11.9	5.7	12.3	13.6	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		5.0	9.1	11.7	4.8	12.1	13.4	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		6.2	9.2	11.9	5.8	12.7	14.1	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		8.4	18.1	27.6	7.8	29.1	32.0	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		7.0	12.9	17.7	6.4	19.1	21.0	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		7.7	12.8	17.4	7.2	18.6	20.6	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		4.8	9.3	12.0	4.5	12.9	14.2	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		7.6	11.3	14.2	7.0	15.8	17.4	ns
C_L = 30 pF; $V_{CC(A)}$ = 2.3 V to 2.7 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		3.8	17.4	33.4	3.4	34.3	37.8	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		4.0	11.1	17.7	3.5	19.1	21.1	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.7	8.7	13.2	3.3	14.4	15.9	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.4	6.5	9.1	3.0	10.0	11.1	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.5	5.7	7.8	3.1	8.9	9.8	ns
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		3.6	6.5	8.1	3.5	8.5	9.4	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		3.9	6.5	8.1	3.8	8.5	9.4	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		4.2	6.5	8.3	4.1	8.6	9.5	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.6	6.5	8.2	3.5	8.5	9.4	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		4.5	6.5	8.2	4.2	8.9	9.8	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		8.4	18.0	27.4	7.8	28.8	31.8	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		7.0	12.8	17.3	6.4	18.7	20.6	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		7.7	12.6	17.0	7.2	18.2	20.0	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		4.8	9.1	11.6	4.5	12.4	13.7	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		7.6	11.1	13.7	7.0	15.3	16.9	ns
C_L = 30 pF; $V_{CC(A)}$ = 3.0 V to 3.6 V										
t_{pd}	propagation delay	A to B or B to A; see Figure 6	[2]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		3.8	16.9	32.8	3.3	33.5	36.9	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		3.9	10.7	17.1	3.5	18.5	20.4	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		3.7	8.3	12.7	3.3	13.9	15.4	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		3.2	6.3	8.6	2.9	9.5	10.5	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		3.4	5.5	7.4	3.1	8.4	9.3	ns

Table 8. Dynamic characteristics *...continued*
Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

Symbol	Parameter	Conditions		25 °C			–40 °C to +125 °C			Unit
				Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t_{dis}	disable time	DIR to A; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		5.0	9.0	11.0	4.9	11.5	12.7	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		5.4	9.0	11.1	5.3	11.4	12.6	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		5.9	9.0	11.3	5.7	11.6	12.8	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		5.0	9.0	11.2	4.9	11.4	12.6	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		6.2	9.0	11.2	5.9	11.9	13.2	ns
		DIR to B; see Figure 7	[3]							
		$V_{CC(B)}$ = 1.1 V to 1.3 V		8.4	18.1	27.6	7.8	29.1	32.0	ns
		$V_{CC(B)}$ = 1.4 V to 1.6 V		7.0	12.8	17.3	6.4	18.6	20.6	ns
		$V_{CC(B)}$ = 1.65 V to 1.95 V		7.7	12.6	17.0	7.2	18.1	19.9	ns
		$V_{CC(B)}$ = 2.3 V to 2.7 V		4.8	9.0	11.5	4.5	12.3	13.6	ns
		$V_{CC(B)}$ = 3.0 V to 3.6 V		7.6	11.1	13.6	7.0	15.1	16.7	ns

Table 8. Dynamic characteristics *...continued*
Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.

Symbol	Parameter	Conditions	25 °C			−40 °C to +125 °C			Unit
			Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
C_L = 5 pF, 10 pF, 15 pF and 30 pF									
C_{PD}	power dissipation capacitance	A port; (direction A to B) [4][5]							
		$V_{CC(A)} = V_{CC(B)} = 1.2$ V	-	0.6	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 1.5$ V	-	0.7	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 1.8$ V	-	0.7	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 2.5$ V	-	0.9	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 3.3$ V	-	1.1	-	-	-	-	pF
		A port; (direction B to A) [4][5]							
		$V_{CC(A)} = V_{CC(B)} = 1.2$ V	-	3.7	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 1.5$ V	-	3.8	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 1.8$ V	-	4.0	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 2.5$ V	-	4.6	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 3.3$ V	-	5.2	-	-	-	-	pF
		B port; (direction A to B) [4][5]							
		$V_{CC(A)} = V_{CC(B)} = 1.2$ V	-	3.7	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 1.5$ V	-	3.8	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 1.8$ V	-	4.0	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 2.5$ V	-	4.6	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 3.3$ V	-	5.2	-	-	-	-	pF
		B port; (direction B to A) [4][5]							
		$V_{CC(A)} = V_{CC(B)} = 1.2$ V	-	0.6	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 1.5$ V	-	0.7	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 1.8$ V	-	0.7	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 2.5$ V	-	0.9	-	-	-	-	pF
		$V_{CC(A)} = V_{CC(B)} = 3.3$ V	-	1.1	-	-	-	-	pF

[1] All typical values are measured at nominal $V_{CC(A)}$ and $V_{CC(B)}$.

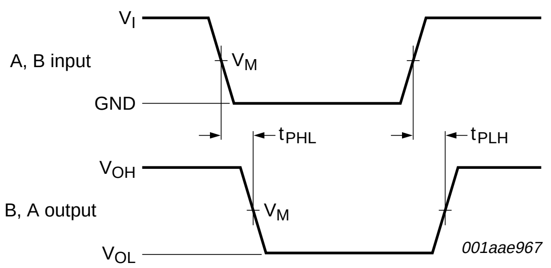
[2] t_{pd} is the same as t_{PLH} and t_{PHL}.

[3] t_{dis} is the same as t_{PLZ} and t_{PHZ}.

[4] 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.

[5] f_i = 1 MHz; V_I = GND to V_{CC}

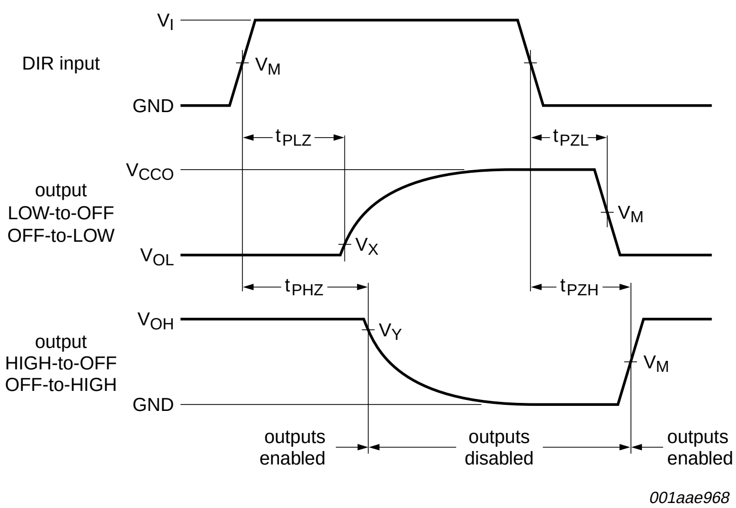
12. Waveforms



Measurement points are given in Table 9.

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

Fig 6. The data input (A, B) to output (B, A) propagation delay times



Measurement points are given in Table 9.

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

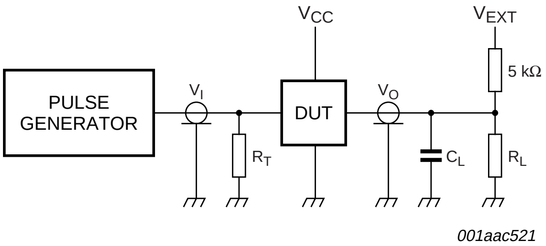
Fig 7. Enable and disable times

Table 9. Measurement points

Supply voltage	Input[1]	Output[2]		
$V_{CC(A)}$, $V_{CC(B)}$	V_M	V_M	V_X	V_Y
1.1 V to 1.6 V	0.5 × V_{CCI}	0.5 × V_{CCO}	V_{OL} + 0.1 V	V_{OH} – 0.1 V
1.65 V to 2.7 V	0.5 × V_{CCI}	0.5 × V_{CCO}	V_{OL} + 0.15 V	V_{OH} – 0.15 V
3.0 V to 3.6 V	0.5 × V_{CCI}	0.5 × V_{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 10.

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 8. Load circuitry for switching times

Table 10. Test data

Supply voltage	Input		Load		V_{EXT}		
$V_{CC(A)}$, $V_{CC(B)}$	V_I[1]	$t_r = t_f$	C_L	R_L[2]	t_{PLH}, t_{PHL}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}[3]
1.1 V to 3.6 V	V_{CCI}	≤ 3.0 ns	5 pF, 10 pF, 15 pF and 30 pF	5 kΩ or 1 MΩ	open	GND	2 × V_{CCO}

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

[2] For measuring enable and disable times R_L = 5 kΩ, for measuring propagation delays, setup and hold times and pulse width R_L = 1 MΩ.

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

13. Application information

13.1 Unidirectional logic level-shifting application

The circuit given in Figure 9 is an example of the 74AUP1T45 being used in an unidirectional logic level-shifting application.

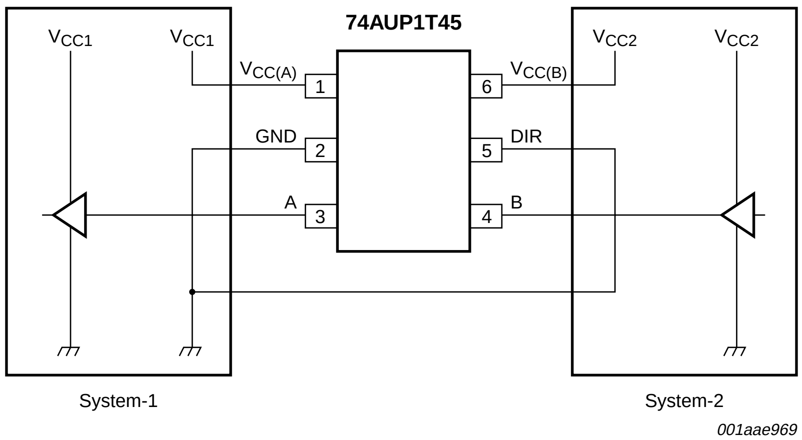


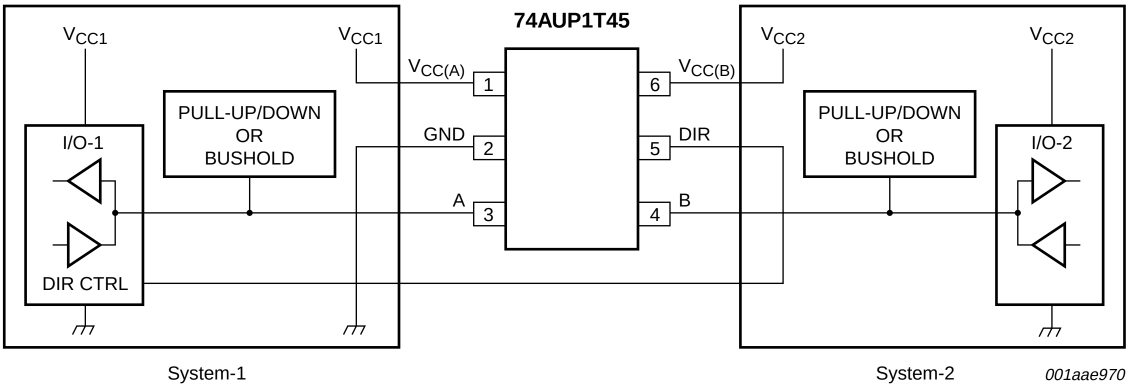
Fig 9. Unidirectional logic level-shifting application

Table 11. Description unidirectional logic level-shifting application

Pin	Name	Function	Description
1	$V_{CC(A)}$	V_{CC1}	supply voltage of system-1 (1.1 V to 3.6 V)
2	GND	GND	device ground (0 V)
3	A	OUT	output level depends on V_{CC1} voltage
4	B	IN	input threshold value depends on V_{CC2} voltage
5	DIR	DIR	the GND (LOW level) determines B port to A port direction
6	$V_{CC(B)}$	V_{CC2}	supply voltage of system-2 (1.1 V to 3.6 V)

13.2 Bidirectional logic level-shifting application

Figure 10 shows the 74AUP1T45 being used in a bidirectional logic level-shifting application. Since the device does not have an output enable (OE) pin, the system designer should take precautions to avoid bus contention between system-1 and system-2 when changing directions.



System-1 and system-2 must use the same conditions, i.e., both pull-up or both pull-down.

Fig 10. Bidirectional logic level-shifting application

Table 12 gives a sequence that will illustrate data transmission from system-1 to system-2 and then from system-2 to system-1.

Table 12. Description bidirectional logic level-shifting application[1][2]

State	DIR CTRL	I/O-1	I/O-2	Description
1	H	output	input	system-1 data to system-2
2	H	Z	Z	system-2 is getting ready to send data to system-1. I/O-1 and I/O-2 are disabled. The bus-line state depends on the pull-up or pull-down.
3	L	Z	Z	DIR bit is flipped. I/O-1 and I/O-2 still are disabled. The bus-line state depends on the pull-up or pull-down.
4	L	input	output	system-2 data to system-1

[1] System-1 and system-2 must use the same conditions, i.e., both pull-up or both pull-down.

[2] H = HIGH voltage level;
L = LOW voltage level;
Z = high-impedance OFF-state.

13.3 Power-up considerations

A proper power-up sequence always should be followed to avoid excessive supply current, bus contention, oscillations, or other anomalies. Take the following precautions to guard against such power-up problems:

- Connect ground before any supply voltage is applied.
- Power-up $V_{CC(A)}$.
- $V_{CC(B)}$ can be ramped up along with or after $V_{CC(A)}$.

13.4 Enable times

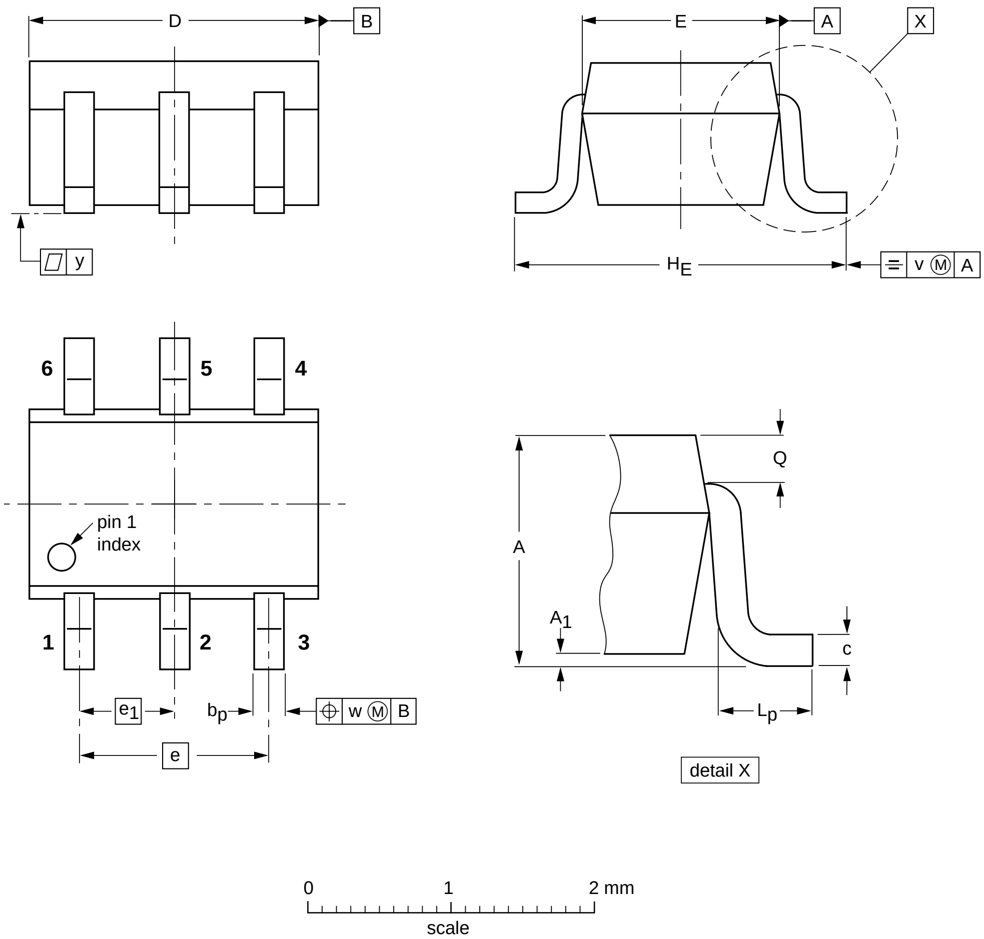
Calculate the enable times for the 74AUP1T45 using the following formulas:

- t_{PZH} (DIR to A) = t_{PLZ} (DIR to B) + t_{PLH} (B to A)
- t_{PZL} (DIR to A) = t_{PHZ} (DIR to B) + t_{PHL} (B to A)
- t_{PZH} (DIR to B) = t_{PLZ} (DIR to A) + t_{PLH} (A to B)
- t_{PZL} (DIR to B) = t_{PHZ} (DIR to A) + t_{PHL} (A to B)

In a bidirectional application, these enable times provide the maximum delay from the time the DIR bit is switched until an output is expected. For example, if the 74AUP1T45 initially is transmitting from A to B, then the DIR bit is switched, the B port of the device must be disabled before presenting it with an input. After the B port has been disabled, an input signal applied to it appears on the corresponding A port after the specified propagation delay.

14. Package outline

Plastic surface-mounted package; 6 leads **SOT363**



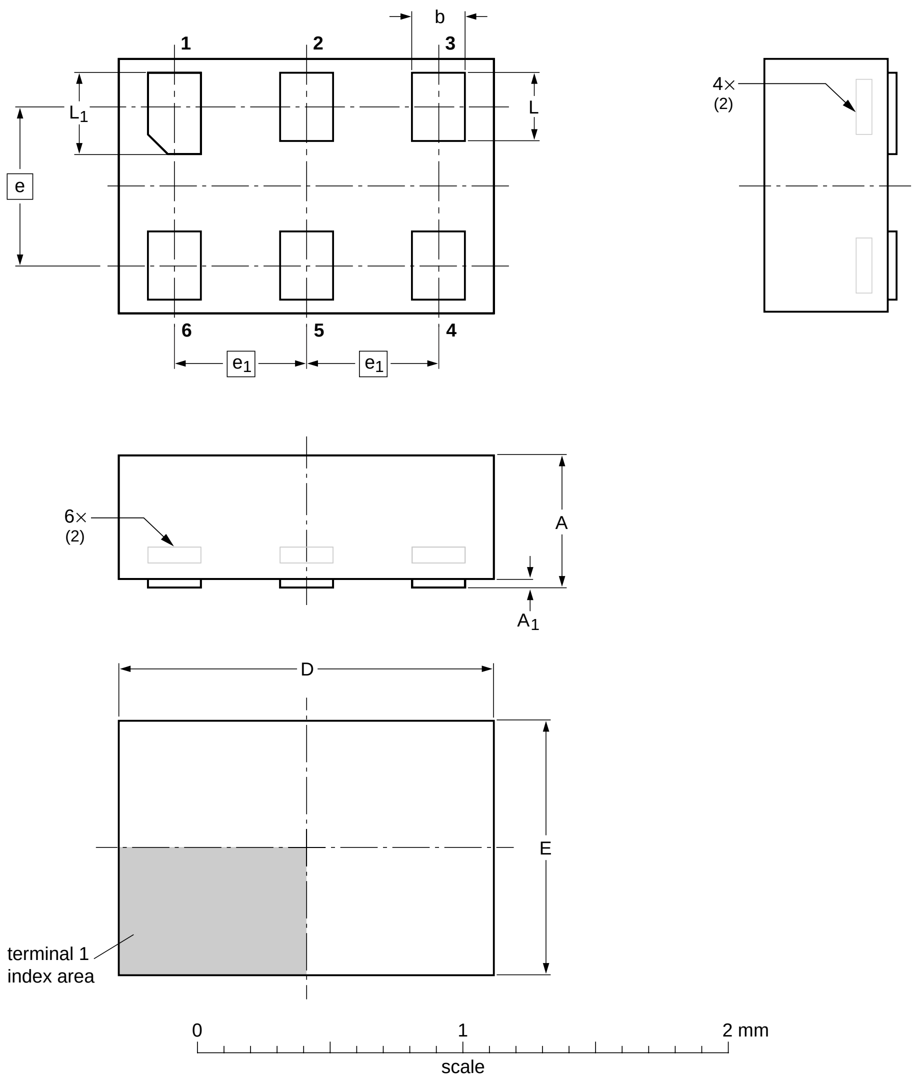
DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.1 0.8	0.1	0.30 0.20	0.25 0.10	2.2 1.8	1.35 1.15	1.3	0.65	2.2 2.0	0.45 0.15	0.25 0.15	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT363			SC-88			~~04-11-08~~ 06-03-16

Fig 11. Package outline SOT363 (SC-88)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm **SOT886**



DIMENSIONS (mm are the original dimensions)

UNIT	A (1) max	A_1 max	b	D	E	e	e_1	L	L_1
mm	0.5	0.04	0.25 0.17	1.5 1.4	1.05 0.95	0.6	0.5	0.35 0.27	0.40 0.32

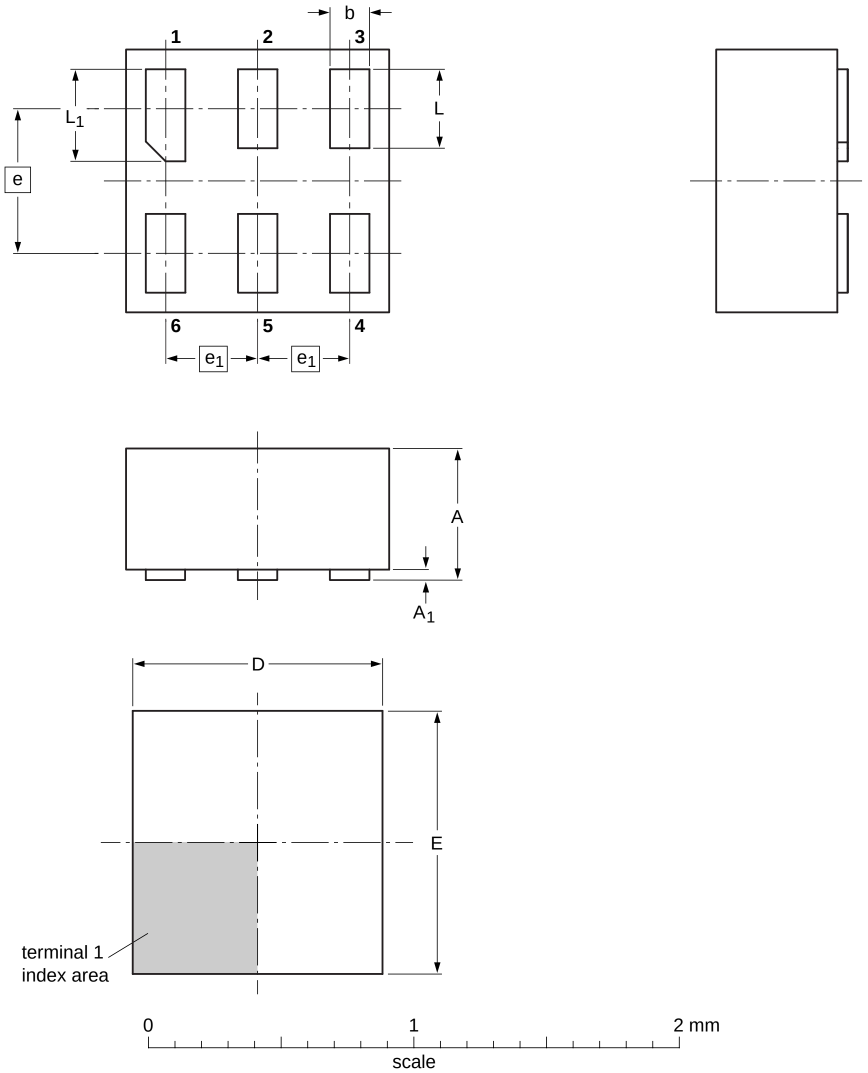
Notes

1. Including plating thickness.
2. Can be visible in some manufacturing processes.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT886		MO-252				~~04-07-15~~ 04-07-22

Fig 12. Package outline SOT886 (XSON6)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm **SOT891**



DIMENSIONS (mm are the original dimensions)

UNIT	A max	A_1 max	b	D	E	e	e_1	L	L_1
mm	0.5	0.04	0.20 0.12	1.05 0.95	1.05 0.95	0.55	0.35	0.35 0.27	0.40 0.32

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT891						~~05-03-11~~ 05-04-06

Fig 13. Package outline SOT891 (XSON6)

15. Abbreviations

Table 13. 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
TTL	Transistor-Transistor Logic

16. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AUP1T45_1	20061018	Product data sheet	-	-

17. Legal information

17.1 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”.

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19. Contents

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Date of release: 18 October 2006

Document identifier: 74AUP1T45_1