

74AXP1T32

Dual supply 2-input OR gate

Rev. 2 — 22 March 2019

Product data sheet

1. General description

The 74AXP1T32 is a dual supply 2-input OR gate. It features two inputs (A, B), an output (Y) and dual supply pins (V_{CCI} and V_{CCO}). The inputs are referenced to V_{CCI} and the output is referenced to V_{CCO} . All inputs can be connected directly to V_{CCI} or GND. V_{CCI} can be supplied at any voltage between 0.7 V and 2.75 V. V_{CCO} can be supplied at any voltage between 1.2 V and 5.5 V. This feature allows voltage level translation.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

This device ensures very low static and dynamic power consumption across the entire supply range and is fully specified for partial power down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing the potentially damaging backflow current through the device when it is powered down.

2. Features and benefits

- Wide supply voltage range:
 - V_{CCI} : 0.7 V to 2.75 V
 - V_{CCO} : 1.2 V to 5.5 V
- Low input capacitance; $C_I = 0.6$ pF (typical)
- Low output capacitance; $C_O = 1.8$ pF (typical)
- Low dynamic power consumption; $C_{PD} = 0.5$ pF at $V_{CCI} = 1.2$ V (typical)
- Low dynamic power consumption; $C_{PD} = 7.1$ pF at $V_{CCO} = 3.3$ V (typical)
- Low static power consumption; $I_{CCI} = 0.5$ μ A (85 °C maximum)
- Low static power consumption; $I_{CCO} = 1.8$ μ A (85 °C maximum)
- High noise immunity
- Complies with JEDEC standard:
 - JESD8-12A.01 (1.1 V to 1.3 V; A, B input)
 - JESD8-11A.01 (1.4 V to 1.6 V)
 - JESD8-7A (1.65 V to 1.95 V)
 - JESD8-5A.01 (2.3 V to 2.7 V)
 - JESD8-C (2.7 V to 3.6 V; Y output)
 - JESD12-6 (4.5 V to 5.5 V; Y output)
- ESD protection:
 - HBM ANSI/ESDA/JEDEC JS-001 Class 2 exceeds 2 kV
 - CDM JESD22-C101E exceeds 1000 V
- Latch-up performance exceeds 100 mA per JESD78D Class II
- Inputs accept voltages up to 2.75 V
- Low noise overshoot and undershoot < 10 % of V_{CCO}
- I_{OFF} circuitry provides partial power-down mode operation
- Specified from -40 °C to +85 °C

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AXP1T32GX	-40 °C to +85 °C	X2SON6	plastic thermal enhanced extremely thin small outline package; no leads; 6 terminals; body 1.0 x 0.8 x 0.35 mm	SOT1255

4. Marking

Table 2. Marking

Type number	Marking code[1]
74AXP1T32GX	rT

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

5. Functional diagram

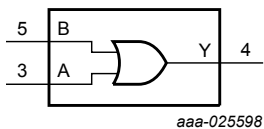


Fig. 1. Logic symbol

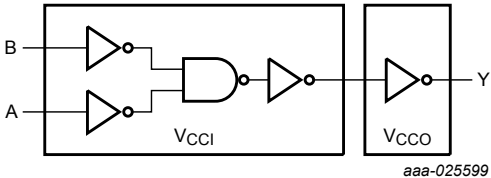


Fig. 2. Logic diagram

6. Pinning information

6.1. Pinning

74AXP1T32

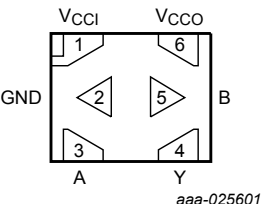


Fig. 3. Pin configuration SOT1255 (X2SON6)

6.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
V _{CCI}	1	input supply voltage
GND	2	ground (0 V)
A	3	data input A
Y	4	data output Y
B	5	data input B
V _{CCO}	6	output supply voltage

7. Functional description

Table 4. Function table

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

Supply voltage		Input		Output
V _{CCI}	V _{CCO}	A	B	Y
0.7 V to 2.75 V	1.2 V to 5.5 V	L	L	L
0.7 V to 2.75 V	1.2 V to 5.5 V	L	H	H
0.7 V to 2.75 V	1.2 V to 5.5 V	H	L	H
0.7 V to 2.75 V	1.2 V to 5.5 V	H	H	H
GND	1.2 V to 5.5 V	X	X	Z
0.7 V to 2.75 V	GND	X	X	Z
GND	GND	X	X	Z

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 _{CCI}	input supply voltage		-0.5	3.3	V
V _{CCO}	output supply voltage		-0.5	6.0	V
I _{IK}	input clamping current	V _I < 0 V	-50	-	mA
V _I	input voltage	[1]	-0.5	3.3	V
I _{OK}	output clamping current	V _O < 0 V	-50	-	mA
V _O	output voltage	Active mode [1][2]	-0.5	V _{CCO} + 0.5	V
		Power-down or 3-state mode [1]	-0.5	6.0	V
I _O	output current	V _O = 0 V to V _{CCO}	-	±25	mA
I _{CCI}	input supply current		-	50	mA
I _{CCO}	output supply current		-	50	mA
I _{GND}	ground current		-50	-	mA
T _{stg}	storage temperature		-65	+150	°C

Symbol	Parameter	Conditions	Min	Max	Unit
P _{tot}	total power dissipation	T _{amb} = -40 °C to +85 °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] V_{CCO} + 0.5 V should not exceed 6.0 V.

[3] For X2SON6 package: above 118 °C, the value of P_{tot} derates linearly with 7.8 mW/K.

9. Recommended operating conditions

Table 6. Recommended operating conditions

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

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CCI}	input supply voltage		0.7	2.75	V
V _{CCO}	output supply voltage		1.2	5.5	V
V _I	input voltage		0	2.75	V
V _O	output voltage	Active mode	0	V _{CCO}	V
		Power-down or 3-state mode	0	5.5	V
T _{amb}	ambient temperature		-40	+85	°C
Δt/ΔV	input transition rise and fall rate	V _{CCI} = 0.7 V to 2.75 V	0	200	ns/V

10. Static characteristics

Table 7. Static characteristics

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

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +85 °C		Unit
			Min	Typ	Max	Min	Max	
V _{IH}	HIGH-level input voltage	V _{CCI} = 0.75 V to 0.85 V	0.75V _{CCI}	-	-	0.75V _{CCI}	-	V
		V _{CCI} = 1.1 V to 1.95 V	0.65V _{CCI}	-	-	0.65V _{CCI}	-	V
		V _{CCI} = 2.3 V to 2.7 V	1.6	-	-	1.6	-	V
V _{IL}	LOW-level input voltage	V _{CCI} = 0.75 V to 0.85 V	-	-	0.25V _{CCI}	-	0.25V _{CCI}	V
		V _{CCI} = 1.1 V to 1.95 V	-	-	0.35V _{CCI}	-	0.35V _{CCI}	V
		V _{CCI} = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
V _{OH}	HIGH-level output voltage	I _O = -2 mA; V _{CCO} = 1.2 V [1]	-	1.05	-	-	-	V
		I _O = -3 mA; V _{CCO} = 1.4 V	1.05	-	-	1.05	-	V
		I _O = -4.5 mA; V _{CCO} = 1.65 V	1.2	-	-	1.2	-	V
		I _O = -8 mA; V _{CCO} = 2.3 V	1.7	-	-	1.7	-	V
		I _O = -10 mA; V _{CCO} = 3.0 V	2.2	-	-	2.2	-	V
		I _O = -12 mA; V _{CCO} = 4.5 V	3.7	-	-	3.7	-	V
V _{OL}	LOW-level output voltage	I _O = 2 mA; V _{CCO} = 1.2 V [1]	-	0.18	-	-	-	V
		I _O = 3 mA; V _{CCO} = 1.4 V	-	-	0.35	-	0.35	V
		I _O = 4.5 mA; V _{CCO} = 1.65 V	-	-	0.45	-	0.45	V
		I _O = 8 mA; V _{CCO} = 2.3 V	-	-	0.7	-	0.7	V
		I _O = 10 mA; V _{CCO} = 3.0 V	-	-	0.8	-	0.8	V
		I _O = 12 mA; V _{CCO} = 4.5 V	-	-	0.8	-	0.8	V
I _I	input leakage current	V _I = 0 V to 2.75 V; V _{CCI} = 0 V to 2.75 V [1]	-	±0.001	±0.1	-	±0.5	μA

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +85 °C		Unit
			Min	Typ	Max	Min	Max	
I _{OZ}	OFF-state output current	V _O = 0 V to 5.5 V; V _{CCO} = 1.2 V to 5.5 V	-	±0.001	±0.1	-	±0.5	µA
I _{OFF}	power-off leakage current	inputs; V _I = 0 V to 2.75 V; V _{CCI} = 0 V; V _{CCO} = 0 V to 5.5 V [1]	-	±0.01	±0.1	-	±0.5	µA
		output; V _O = 0 V to 5.5 V; V _{CCO} = 0 V; V _{CCI} = 0 V to 2.75 V; V _I = 0 V to 2.75 V [1]	-	±0.01	±0.1	-	±0.5	µA
ΔI _{OFF}	additional power-off leakage current	inputs; V _I = 0 V or 2.75 V; V _{CCI} = 0 V to 0.1 V; V _{CCO} = 0 V to 5.5 V [1]	-	±0.02	±0.1	-	±0.5	µA
		output; V _O = 0 V or 5.5 V; V _{CCO} = 0 V to 0.1 V; V _{CCI} = 0 V to 2.75 V; V _I = 0 V or 2.75 V [1]	-	±0.02	±0.1	-	±0.5	µA

[1] Typical values are measured at V_{CCI} = V_{CCO} = 1.2 V unless otherwise specified.

Table 8. Static characteristics supply current

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

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C				Unit
			Typ 25 °C	Max 25 °C	Typ 85 °C	Max 85 °C	
I _{CCI}	input supply current	V _I = 0 V or V _{CCI} ;					
		V _{CCI} = 0.7 V to 1.3 V [1]	1	100	10	300	nA
		V _{CCI} = 1.3 V to 2.75 V [2]	1	100	20	500	nA
		V _{CCI} = 2.75 V; V _{CCO} = 0 V	1	100	20	500	nA
		V _{CCI} = 0 V; V _{CCO} = 5.5 V	1	100	1	100	nA
I _{CCO}	output supply current	V _I = 0 V or V _{CCI} ; I _O = 0 A; see Table 9					
		V _{CCO} = 1.2 V to 3.6 V [1]	0.001	1.0	0.01	1.2	µA
		V _{CCO} = 3.6 V to 5.5 V [3]	0.8	1.5	1.0	1.8	µA
		V _{CCI} = 2.75 V; V _{CCO} = 0 V	0.001	0.1	0.003	0.2	µA
		V _{CCI} = 0 V; V _{CCO} = 3.6 V	0.2	0.6	0.3	0.8	µA
		V _{CCI} = 0 V; V _{CCO} = 5.5 V	0.4	0.8	0.5	1.0	µA
ΔI _{CCI}	additional input supply current	V _I = V _{CCI} - 0.5 V; V _{CCI} = 2.5 V	2	100	14	150	µA

[1] Typical values are measured at V_{CCI} = V_{CCO} = 1.2 V unless otherwise specified.

[2] Typical values are measured at V_{CCI} = V_{CCO} = 2.5 V.

[3] Typical values are measured at V_{CCI} = 1.2 V and V_{CCO} = 5.0 V.

Table 9. Typical output supply current (I_{CCO})

V _{CCI}	V _{CCO}							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	5	20	100	200	400	nA
0.8 V	1	10	150	200	300	500	800	nA
1.2 V	1	1	5	200	300	500	800	nA
1.5 V	1	1	5	100	300	500	800	nA
1.8 V	1	1	5	100	300	500	800	nA
2.5 V	1	1	5	100	100	500	800	nA

11. Dynamic characteristics

Table 10. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit, see Fig. 11; for waveform, see Fig. 4.

Symbol	Parameter	Conditions	V _{CCO}							Unit
			1.2 V	1.5 V ± 0.1 V			1.8 V ± 0.15 V			
			Typ[1]	Min	Typ[1]	Max	Min	Typ[1]	Max	
T _{amb} = 25 °C										
t _{pd}	propagation delay	A, B to Y [2]								
		V _{CCI} = 0.75 V to 0.85 V	23	3	18	73	3	16	69	ns
		V _{CCI} = 1.1 V to 1.3 V	16.9	3.1	10.8	19.9	2.8	8.7	15.9	ns
		V _{CCI} = 1.4 V to 1.6 V	16.0	2.8	9.9	18.2	2.5	7.8	13.2	ns
		V _{CCI} = 1.65 V to 1.95 V	15.6	2.7	9.5	17.3	2.4	7.3	11.8	ns
		V _{CCI} = 2.3 V to 2.7 V	15.2	2.5	9.0	16.8	2.2	6.9	11.0	ns
T _{amb} = -40 °C to +85 °C										
t _{pd}	propagation delay	A, B to Y [2]								
		V _{CCI} = 0.75 V to 0.85 V	23	3	18	148	3	16	145	ns
		V _{CCI} = 1.1 V to 1.3 V	16.9	3.1	10.8	19.9	2.8	8.7	15.9	ns
		V _{CCI} = 1.4 V to 1.6 V	16.0	2.8	9.9	18.2	2.5	7.8	13.2	ns
		V _{CCI} = 1.65 V to 1.95 V	15.6	2.7	9.5	17.3	2.4	7.3	11.8	ns
		V _{CCI} = 2.3 V to 2.7 V	15.2	2.5	9.0	16.8	2.2	6.9	11.0	ns
t _t	transition time	V _{CCI} = 0.75 V to 2.7 V [3]	-	1.0	-	-	1.0	-	-	ns

[1] Typical values are measured at nominal supply voltages and T_{amb} = +25 °C.

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

[3] t_t is the same as t_{THL} and t_{TLH}.

Table 11. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit, see Fig. 11; for waveform, see Fig. 4.

Symbol	Parameter	Conditions	V _{CCO}									Unit
			2.5 V ± 0.2 V			3.3 V ± 0.3 V			5.0 V ± 0.5 V			
			Min	Typ[1]	Max	Min	Typ[1]	Max	Min	Typ[1]	Max	
T _{amb} = 25 °C												
t _{pd}	propagation delay	A, B to Y [2]										
		V _{CCI} = 0.75 V to 0.85 V	2	14	69	2	14	77	2	15	89	ns
		V _{CCI} = 1.1 V to 1.3 V	2.4	6.9	10.9	2.2	6.3	9.6	2.1	6.0	9.1	ns
		V _{CCI} = 1.4 V to 1.6 V	2.1	6.0	9.1	2.0	5.4	8.2	1.9	5.0	7.7	ns
		V _{CCI} = 1.65 V to 1.95 V	2.0	5.6	8.6	1.8	4.9	7.6	1.8	4.6	7.2	ns
		V _{CCI} = 2.3 V to 2.7 V	1.9	5.1	8.0	1.7	4.5	7.0	1.6	4.1	6.5	ns
T _{amb} = -40 °C to +85 °C												
t _{pd}	propagation delay	A, B to Y [2]										
		V _{CCI} = 0.75 V to 0.85 V	2	14	164	2	14	191	2	15	222	ns
		V _{CCI} = 1.1 V to 1.3 V	2.4	6.9	10.9	2.2	6.3	9.6	2.1	6.0	9.1	ns
		V _{CCI} = 1.4 V to 1.6 V	2.1	6.0	9.1	2.0	5.4	8.2	1.9	5.0	7.7	ns
		V _{CCI} = 1.65 V to 1.95 V	2.0	5.6	8.6	1.8	4.9	7.6	1.8	4.6	7.2	ns
		V _{CCI} = 2.3 V to 2.7 V	1.9	5.1	8.0	1.7	4.5	7.0	1.6	4.1	6.5	ns

Symbol	Parameter	Conditions	V _{CCO}									Unit
			2.5 V ± 0.2 V			3.3 V ± 0.3 V			5.0 V ± 0.5 V			
			Min	Typ[1]	Max	Min	Typ[1]	Max	Min	Typ[1]	Max	
t _t	transition time	V _{CCI} = 0.75 V to 2.7 V [3]	1.0	-	-	1.0	-	-	1.0	-	-	ns

[1] Typical values are measured at nominal supply voltages and t_{amb} = +25 °C.

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

[3] t_t is the same as t_{THL} and t_{TLH}.

Table 12. Typical dynamic characteristics at T_{amb} = 25 °C

Voltages are referenced to GND (ground = 0 V); for test circuit, see Fig. 11; for waveform, see Fig. 4.

Symbol	Parameter	Conditions	V _{CCO}						Unit
			1.2 V	1.5 V	1.8 V	2.5 V	3.3 V	5.0 V	
C _{PD}	power dissipation capacitance	f _i = 1 MHz; R _L = ∞ Ω; V _I = 0 V to V _{CCI} [1]							
		input supply [2]							
		V _{CCI} = 0.8 V	0.5	0.5	0.5	0.5	0.5	0.5	pF
		V _{CCI} = 1.2 V	0.5	0.5	0.5	0.5	0.5	0.5	pF
		V _{CCI} = 1.5 V	0.5	0.5	0.5	0.5	0.5	0.5	pF
		V _{CCI} = 1.8 V	0.6	0.6	0.6	0.6	0.6	0.6	pF
		V _{CCI} = 2.5 V	0.8	0.8	0.8	0.8	0.8	0.8	pF
		output supply [3]							
		V _{CCI} = 0.8 V	6.7	6.8	6.8	6.9	7.5	9.5	pF
		V _{CCI} = 1.2 V	6.8	6.9	7.0	7.0	7.1	7.6	pF
		V _{CCI} = 1.5 V	6.9	6.9	6.9	7.0	7.1	7.6	pF
		V _{CCI} = 1.8 V	6.9	6.9	6.9	7.0	7.2	7.6	pF
		V _{CCI} = 2.5 V	6.9	7.0	7.0	7.0	7.2	7.6	pF
C _I	input capacitance	V _I = 0 V or V _{CCI} ; V _{CCI} = 0 V to 2.7 V	0.6	0.6	0.6	0.6	0.6	0.6	pF
C _O	output capacitance	V _O = 0 V; V _{CCO} = 0 V	1.8	1.8	1.8	1.8	1.8	1.8	pF

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

[2] Power dissipated from input supply (V_{CCI})

$$P_D = C_{PD} \times V_{CCI}^2 \times f_i \times N \text{ where:}$$

C_{PD} = power dissipation capacitance of the input supply.

V_{CCI} = input supply voltage in V;

f_i = input frequency in MHz;

N = number of inputs switching;

[3] Power dissipated from output supply (V_{CCO})

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

C_L = load capacitance in pF;

C_{PD} = power dissipation capacitance of the output supply.

V_{CCO} = output supply voltage in V;

f_o = output frequency in MHz;

11.1. Waveform, graphs and test circuit

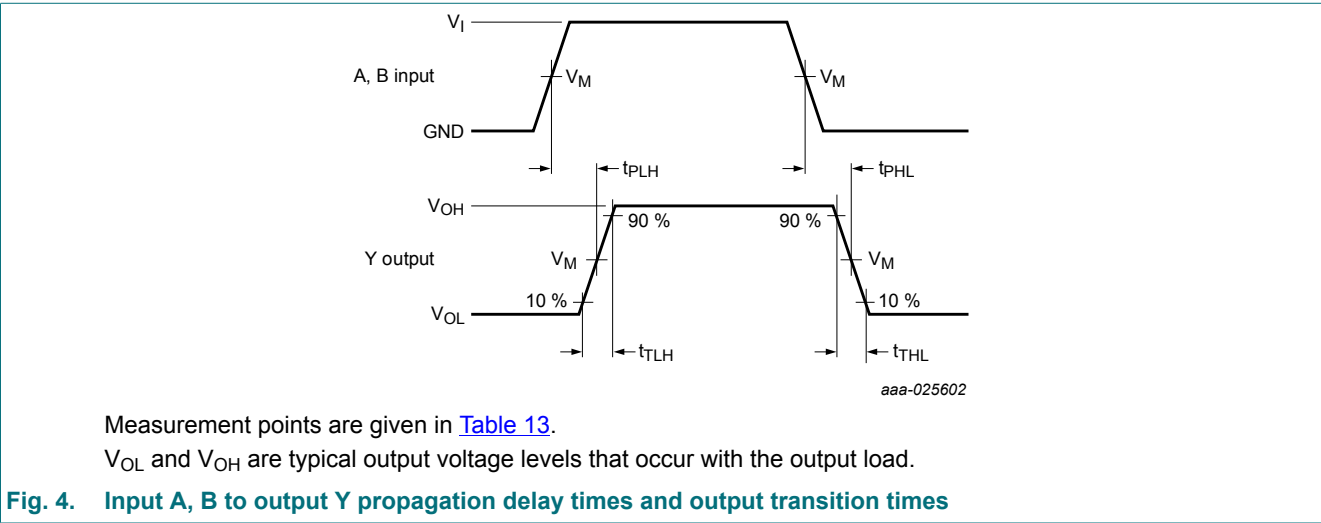
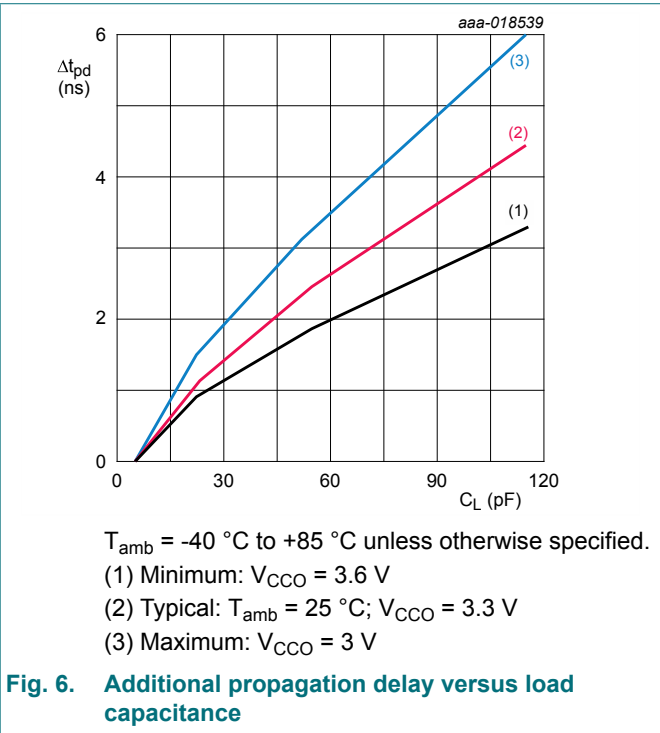
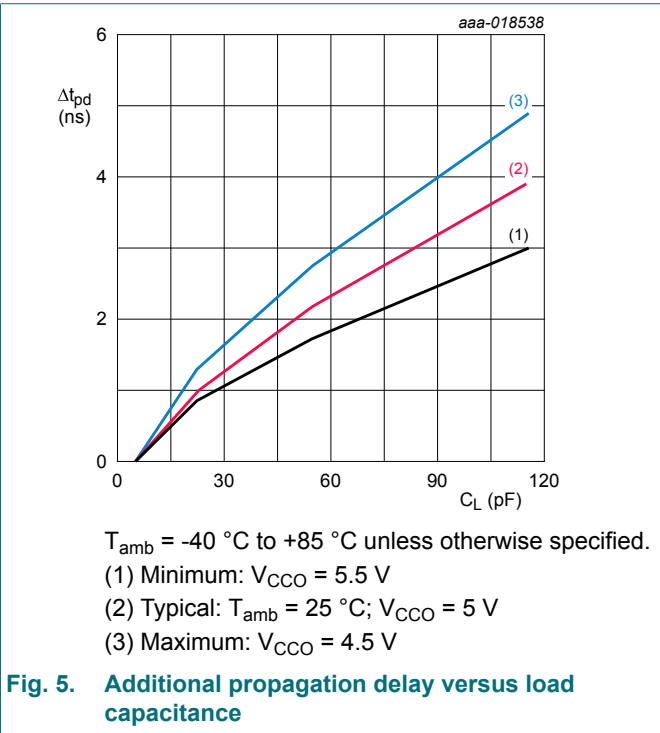
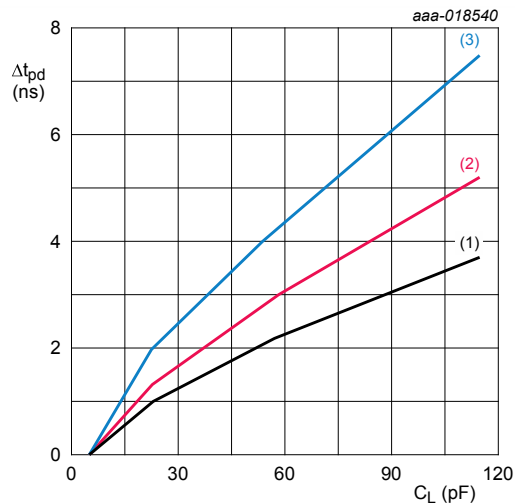


Table 13. Measurement points

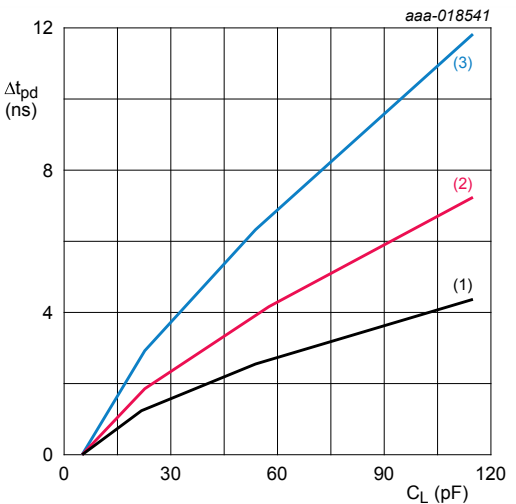
Supply voltage		Output	Input	
V_{CCI}	V_{CCO}	V_M	V_M	V_I
0.75 V to 2.7 V	1.2 V to 5.5 V	$0.5V_{CCO}$	$0.5V_{CCI}$	V_{CCI}





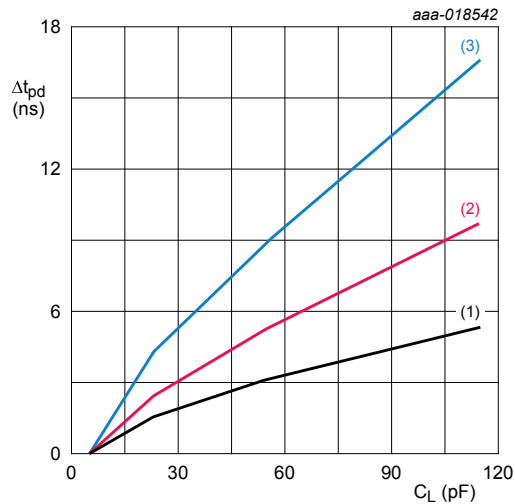
$T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ unless otherwise specified.
(1) Minimum: $V_{CCO} = 2.7\text{ V}$
(2) Typical: $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CCO} = 2.5\text{ V}$
(3) Maximum: $V_{CCO} = 2.3\text{ V}$

Fig. 7. Additional propagation delay versus load capacitance



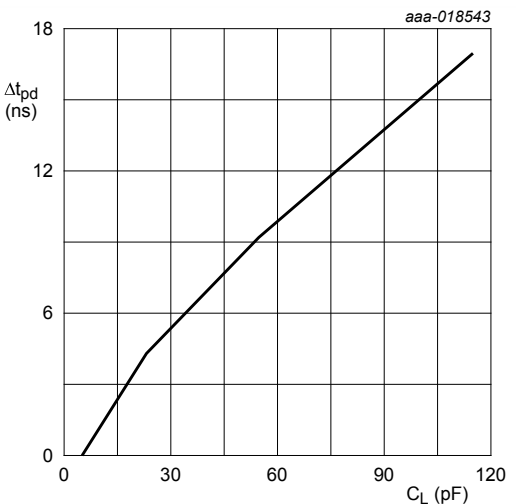
$T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ unless otherwise specified.
(1) Minimum: $V_{CCO} = 1.95\text{ V}$
(2) Typical: $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CCO} = 1.8\text{ V}$
(3) Maximum: $V_{CCO} = 1.65\text{ V}$

Fig. 8. Additional propagation delay versus load capacitance



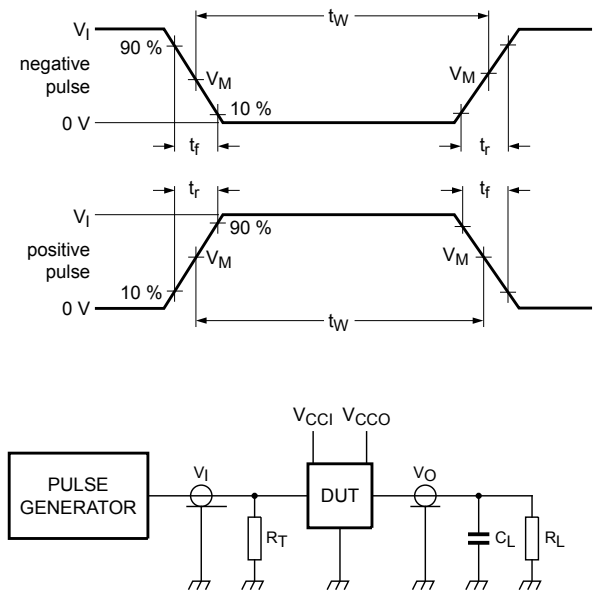
$T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ unless otherwise specified.
(1) Minimum: $V_{CCO} = 1.6\text{ V}$
(2) Typical: $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CCO} = 1.5\text{ V}$
(3) Maximum: $V_{CCO} = 1.4\text{ V}$

Fig. 9. Additional propagation delay versus load capacitance



$T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CCO} = 1.2\text{ V}$.

Fig. 10. Additional propagation delay versus load capacitance



aaa-018544

Test data is given in [Table 14](#).
Definitions test circuit:
 R_T = termination resistance should be equal to output impedance Z_o of the pulse generator.
 C_L = load capacitance including jig and probe capacitance.
 R_L = Load resistance.

Fig. 11. Test circuit for measuring switching times

Table 14. Test data

Supply voltage		Load		Input	
V_{CCI}	V_{CCO}	C_L	R_L	t_r, t_f	V_I
0.75 V to 2.7 V	1.2 V to 5.5 V	5 pF	5 kΩ	≤3.0 ns	V_{CCI}

12. Package outline

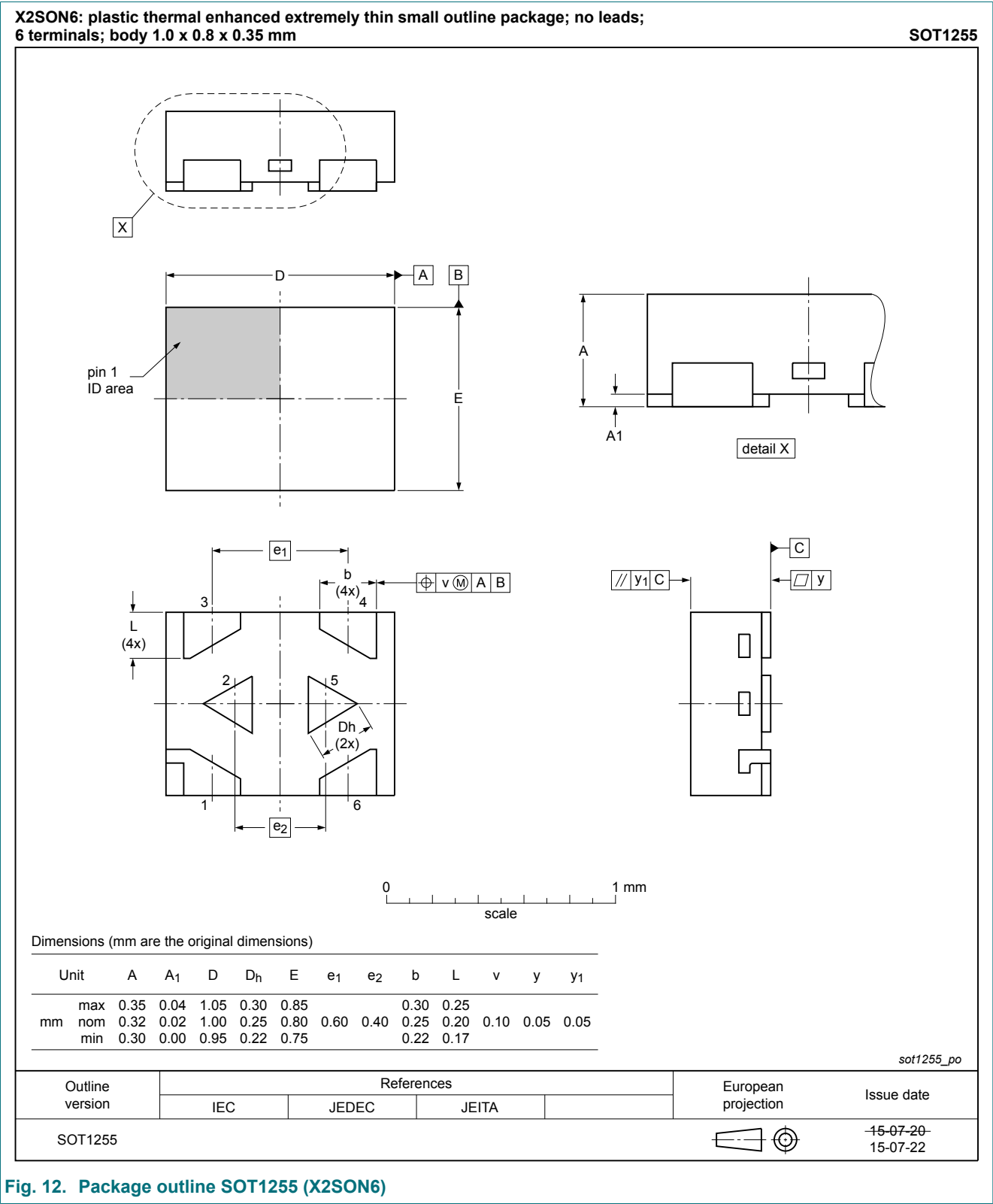


Fig. 12. Package outline SOT1255 (X2SON6)

13. Abbreviations

Table 15. Abbreviations

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

14. Revision history

Table 16. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AXP1T32 v.2	20190322	Product data sheet	-	74AXP1T32 v.1
Modifications:	- The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. - Legal texts have been adapted to the new company name where appropriate. - Type number 74AXP1T32GW (SOT363) removed.			
74AXP1T32 v.1	20161107	Product data sheet	-	-

15. Legal information

Data sheet status

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

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

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