74AUP1G11

Low-power 3-input AND gate

Rev. 5 — 20 August 2018

Product data sheet

1. General description

The 74AUP1G11 provides a low-power, low-voltage single 3-input AND gate.

Schmitt trigger action at all inputs makes the circuit tolerant to slower input rise and fall times across the entire V_{CC} range from 0.8 V to 3.6 V.

This device ensures a very low static and dynamic power consumption across the entire V_{CC} range from 0.8 V to 3.6 V.

This device is fully specified for partial power-down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

2. Features and benefits

- Wide supply voltage range from 0.8 V to 3.6 V
- · High noise immunity
- · Complies with JEDEC standards:
 - JESD8-12 (0.8 V to 1.3 V)
 - JESD8-11 (0.9 V to 1.65 V)
 - JESD8-7 (1.2 V to 1.95 V)
 - JESD8-5 (1.8 V to 2.7 V)
 - JESD8-B (2.7 V to 3.6 V)
- ESD protection:
 - HBM JESD22-A114F Class 3A exceeds 5000 V
 - MM JESD22-A115-A exceeds 200 V
 - CDM JESD22-C101E exceeds 1000 V
- Low static power consumption; I_{CC} = 0.9 μA (maximum)
- 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
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C



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3. Ordering information

Table 1. Ordering information

Type number	Package							
	Temperature range	Name	Description	Version				
74AUP1G11GW	-40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363				
74AUP1G11GM	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm	SOT886				
74AUP1G11GF	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm	SOT891				
74AUP1G11GN	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 x 1.0 x 0.35 mm	SOT1115				
74AUP1G11GS	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 x 1.0 x 0.35 mm	SOT1202				

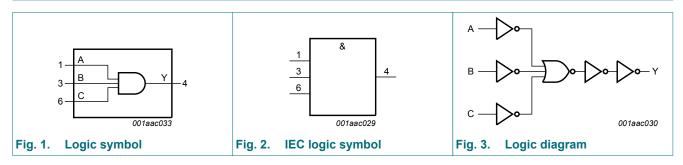
4. Marking

Table 2. Marking

Type number	Marking code[1]
74AUP1G11GW	pU
74AUP1G11GM	pU
74AUP1G11GF	pU
74AUP1G11GN	pU
74AUP1G11GS	pU

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

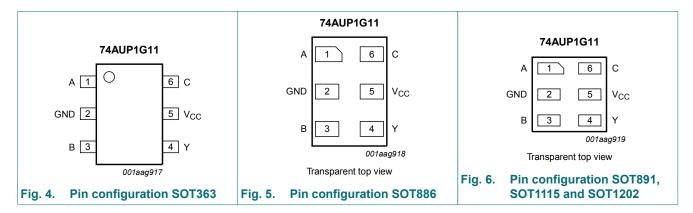
5. Functional diagram



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6. Pinning information

6.1. Pinning



6.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
Α	1	data input
GND	2	ground (0 V)
В	3	data input
Υ	4	data output
V _{CC}	5	supply voltage
С	6	data input

7. Functional description

Table 4. Function table

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level; \ X = don't \ care.$

Input	Output		
A	В	С	Υ
Н	Н	Н	Н
L	X	X	L
X	L	X	L
X	X	L	L

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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}	supply voltage		-0.5	+4.6	V
I _{IK}	input clamping current	V _I < 0 V	-50	-	mA
VI	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 and Power-down [1] mode	-0.5	+4.6	V
Io	output current	$V_O = 0 \text{ V to } V_{CC}$	-	±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	$T_{amb} = -40 ^{\circ}\text{C to } +125 ^{\circ}\text{C}$ [2]	-	250	mW

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

9. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		0.8	3.6	V
V _I	input voltage		0	3.6	V
Vo	output voltage	Active mode	0	V _{CC}	V
		Power-down mode; V _{CC} = 0 V	0	3.6	V
T _{amb}	ambient temperature		-40	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 0.8 V to 3.6 V	-	200	ns/V

^[2] For SC-88 packages: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K. For XSON6 packages: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

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10. Static characteristics

Table 7. Static characteristics

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

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
T _{amb} = 2	5 °C					
V _{IH}	HIGH-level input voltage	V _{CC} = 0.8 V	0.70 x V _{CC}	-	-	V
		V _{CC} = 0.9 V to 1.95 V	0.65 x V _{CC}	-	-	V
		V _{CC} = 2.3 V to 2.7 V	1.6	-	-	V
		V _{CC} = 3.0 V to 3.6 V	2.0	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 0.8 V	-	-	0.30 x V _{CC}	V
		V _{CC} = 0.9 V to 1.95 V	-	-	0.35 x V _{CC}	V
		V _{CC} = 2.3 V to 2.7 V	-	-	0.7	V
		V _{CC} = 3.0 V to 3.6 V	-	-	0.9	V
V _{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I_{O} = -20 μ A; V_{CC} = 0.8 V to 3.6 V	V _{CC} - 0.1	-	-	V
		I _O = -1.1 mA; V _{CC} = 1.1 V	0.75 x V _{CC}	-	-	V
		I _O = -1.7 mA; V _{CC} = 1.4 V	1.11	-	-	V
		I _O = -1.9 mA; V _{CC} = 1.65 V	1.32	-	-	V
		I _O = -2.3 mA; V _{CC} = 2.3 V	2.05	-	-	V
		I _O = -3.1 mA; V _{CC} = 2.3 V	1.9	-	-	V
		I _O = -2.7 mA; V _{CC} = 3.0 V	2.72	-	-	V
		I _O = -4.0 mA; V _{CC} = 3.0 V	2.6	-	-	V
V _{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I _O = 20 μA; V _{CC} = 0.8 V to 3.6 V	-	-	0.1	V
		I _O = 1.1 mA; V _{CC} = 1.1 V	-	-	0.3 x V _{CC}	V
		I _O = 1.7 mA; V _{CC} = 1.4 V	-	-	0.31	V
		I _O = 1.9 mA; V _{CC} = 1.65 V	-	-	0.31	V
		I _O = 2.3 mA; V _{CC} = 2.3 V	-	-	0.31	V
		I _O = 3.1 mA; V _{CC} = 2.3 V	-	-	0.44	V
		I _O = 2.7 mA; V _{CC} = 3.0 V	-	-	0.31	V
		I _O = 4.0 mA; V _{CC} = 3.0 V	-	-	0.44	V
l _l	input leakage current	V_1 = GND to 3.6 V; V_{CC} = 0 V to 3.6 V	-	-	±0.1	μΑ
l _{OFF}	power-off leakage current	V_1 or $V_0 = 0 V$ to 3.6 V; $V_{CC} = 0 V$	-	-	±0.2	μΑ
ΔI_{OFF}	additional power-off leakage current	V_1 or $V_0 = 0$ V to 3.6 V; $V_{CC} = 0$ V to 0.2 V	-	-	±0.2	μA
I _{CC}	supply current	V_{I} = GND or V_{CC} ; I_{O} = 0 A; V_{CC} = 0.8 V to 3.6 V	-	-	0.5	μA
ΔI _{CC}	additional supply current	$V_1 = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A};$ [1] $V_{CC} = 3.3 \text{ V}$	-	-	40	μA
C _I	input capacitance	V_{CC} = 0 V to 3.6 V; V_I = GND or V_{CC}	-	8.0	-	pF
Co	output capacitance	V _O = GND; V _{CC} = 0 V	-	1.7	-	pF

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
T _{amb} = -4	10 °C to +85 °C					
V _{IH}	HIGH-level input voltage	V _{CC} = 0.8 V	0.70 x V _{CC}	-	-	V
		V _{CC} = 0.9 V to 1.95 V	0.65 x V _{CC}	-	-	V
		V _{CC} = 2.3 V to 2.7 V	1.6	-	-	V
		V _{CC} = 3.0 V to 3.6 V	2.0	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 0.8 V	-	-	0.30 x V _{CC}	V
		V _{CC} = 0.9 V to 1.95 V	-	-	0.35 x V _{CC}	V
		V _{CC} = 2.3 V to 2.7 V	-	-	0.7	V
		V _{CC} = 3.0 V to 3.6 V	-	-	0.9	V
V _{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I_{O} = -20 μ A; V_{CC} = 0.8 V to 3.6 V	V _{CC} - 0.1	-	-	V
		I _O = -1.1 mA; V _{CC} = 1.1 V	0.7 x V _{CC}	-	-	V
		I _O = -1.7 mA; V _{CC} = 1.4 V	1.03	-	-	V
		I _O = -1.9 mA; V _{CC} = 1.65 V	1.30	-	-	V
		I_{O} = -2.3 mA; V_{CC} = 2.3 V		-	-	V
		I _O = -3.1 mA; V _{CC} = 2.3 V	1.85	-	-	V
		I_{O} = -2.7 mA; V_{CC} = 3.0 V		-	-	V
		I_{O} = -4.0 mA; V_{CC} = 3.0 V	2.55	-	-	V
V _{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I _O = 20 μA; V _{CC} = 0.8 V to 3.6 V	-	-	0.1	V
		I _O = 1.1 mA; V _{CC} = 1.1 V	-	-	0.3 x V _{CC}	V
		I _O = 1.7 mA; V _{CC} = 1.4 V	-	-	0.37	V
		I _O = 1.9 mA; V _{CC} = 1.65 V	-	-	0.35	V
		I _O = 2.3 mA; V _{CC} = 2.3 V	-	-	0.33	V
		I _O = 3.1 mA; V _{CC} = 2.3 V	-	-	0.45	V
		I _O = 2.7 mA; V _{CC} = 3.0 V	-	-	0.33	V
		I _O = 4.0 mA; V _{CC} = 3.0 V	-	-	0.45	V
l _l	input leakage current	V _I = GND to 3.6 V; V _{CC} = 0 V to 3.6 V	-	-	±0.5	μΑ
I _{OFF}	power-off leakage current	V_{I} or $V_{O} = 0$ V to 3.6 V; $V_{CC} = 0$ V	-	-	±0.5	μΑ
Δl _{OFF}	additional power-off leakage current	V _I or V _O = 0 V to 3.6 V; V _{CC} = 0 V to 0.2 V	-	-	±0.6	μΑ
I _{CC}	supply current	V_I = GND or V_{CC} ; I_O = 0 A; V_{CC} = 0.8 V to 3.6 V	-	-	0.9	μΑ
ΔI _{CC}	additional supply current	$V_1 = V_{CC} - 0.6 \text{ V}; I_0 = 0 \text{ A};$ [1] $V_{CC} = 3.3 \text{ V}$	-	-	50	μΑ

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
T _{amb} = -4	10 °C to +125 °C					•
V _{IH}	HIGH-level input voltage	V _{CC} = 0.8 V	0.75 x V _{CC}	-	-	V
		V _{CC} = 0.9 V to 1.95 V	0.70 x V _{CC}	-	-	V
		V _{CC} = 2.3 V to 2.7 V	1.6	-	-	V
		V _{CC} = 3.0 V to 3.6 V	2.0	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 0.8 V	-	-	0.25 x V _{CC}	V
		V _{CC} = 0.9 V to 1.95 V	-	-	0.30 x V _{CC}	V
		V _{CC} = 2.3 V to 2.7 V	-	-	0.7	V
		V _{CC} = 3.0 V to 3.6 V	-	-	0.9	V
V _{OH}	HIGH-level output voltage	$V_{I} = V_{IH}$ or V_{IL}				
		I_{O} = -20 μ A; V_{CC} = 0.8 V to 3.6 V	V _{CC} - 0.11	-	-	V
		I _O = -1.1 mA; V _{CC} = 1.1 V	0.6 x V _{CC}	-	-	V
		I _O = -1.7 mA; V _{CC} = 1.4 V	0.93	-	-	V
		I _O = -1.9 mA; V _{CC} = 1.65 V	1.17	-	-	V
		$I_{\rm O}$ = -2.3 mA; $V_{\rm CC}$ = 2.3 V	1.77	-	-	V
		I _O = -3.1 mA; V _{CC} = 2.3 V	1.67	-	-	V
		I_{O} = -2.7 mA; V_{CC} = 3.0 V	2.40	-	-	V
		I _O = -4.0 mA; V _{CC} = 3.0 V	2.30	-	-	V
V _{OL}	LOW-level output voltage	$V_{I} = V_{IH}$ or V_{IL}				
		I _O = 20 μA; V _{CC} = 0.8 V to 3.6 V	-	-	0.11	V
		I _O = 1.1 mA; V _{CC} = 1.1 V	-	-	0.33 x V _{CC}	V
		I _O = 1.7 mA; V _{CC} = 1.4 V	-	-	0.41	V
		I _O = 1.9 mA; V _{CC} = 1.65 V	-	-	0.39	V
		I _O = 2.3 mA; V _{CC} = 2.3 V	-	-	0.36	٧
		I _O = 3.1 mA; V _{CC} = 2.3 V	-	-	0.50	V
		I _O = 2.7 mA; V _{CC} = 3.0 V	-	-	0.36	V
		I _O = 4.0 mA; V _{CC} = 3.0 V	-	-	0.50	V
I _I	input leakage current	V_{I} = GND to 3.6 V; V_{CC} = 0 V to 3.6 V	-	-	±0.75	μΑ
I _{OFF}	power-off leakage current	V_1 or $V_0 = 0$ V to 3.6 V; $V_{CC} = 0$ V	-	-	±0.75	μΑ
ΔI _{OFF}	additional power-off leakage current	V _I or V _O = 0 V to 3.6 V; V _{CC} = 0 V to 0.2 V	-	-	±0.75	μΑ
I _{CC}	supply current	V_1 = GND or V_{CC} ; I_O = 0 A; V_{CC} = 0.8 V to 3.6 V	-	-	1.4	μΑ
Δl _{CC}	additional supply current	$V_1 = V_{CC} - 0.6 \text{ V}; I_0 = 0 \text{ A};$ [1] $V_{CC} = 3.3 \text{ V}$	-	-	75	μΑ

^[1] One input at V_{CC} - 0.6 V, other input at V_{CC} or GND.

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11. Dynamic characteristics

Table 8. Dynamic characteristics

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

Symbol	Parameter	Conditions		25 °C		-4() °C to +1	25 °C	Unit
			Min	Typ [1]	Max	Min	Max (85 °C)	Max (125 °C)	
C _L = 5 pl	F				•				
t _{pd}	propagation	A, B and C to Y; see Fig. 7 [2]							
	delay	V _{CC} = 0.8 V	-	18.9	-	-	-	-	ns
		V _{CC} = 1.1 V to 1.3 V	3.0	5.6	9.5	2.8	9.9	10.0	ns
		V _{CC} = 1.4 V to 1.6 V	2.3	3.9	5.9	2.2	6.5	6.8	ns
		V _{CC} = 1.65 V to 1.95 V	1.9	3.1	4.8	1.8	5.3	5.5	ns
		V _{CC} = 2.3 V to 2.7 V	1.6	2.5	3.6	1.4	4.0	4.2	ns
		V _{CC} = 3.0 V to 3.6 V	1.3	2.2	3.2	1.2	3.5	3.7	ns
C _L = 10	ρF								
t _{pd}	propagation	A, B and C to Y; see Fig. 7 [2]							
	delay	V _{CC} = 0.8 V	-	22.5	-	-	-	-	ns
		V _{CC} = 1.1 V to 1.3 V	3.5	6.5	11.1	3.3	11.6	11.8	ns
		V _{CC} = 1.4 V to 1.6 V	2.8	4.5	6.8	2.6	7.5	7.8	ns
		V _{CC} = 1.65 V to 1.95 V	2.4	3.7	5.6	2.1	6.2	6.4	ns
		V _{CC} = 2.3 V to 2.7 V	1.9	3.0	4.4	1.7	4.8	5.1	ns
		V _{CC} = 3.0 V to 3.6 V	1.7	2.8	4.0	1.5	4.3	4.5	ns
C _L = 15 p	ρF								
t _{pd}	propagation	A, B and C to Y; see Fig. 7 [2]							
	delay	V _{CC} = 0.8 V	-	23.6	-	-	-	-	ns
		V _{CC} = 1.1 V to 1.3 V	3.9	7.3	12.5	3.6	13.3	13.4	ns
		V _{CC} = 1.4 V to 1.6 V	3.2	5.1	7.6	2.9	8.5	8.8	ns
		V _{CC} = 1.65 V to 1.95 V	2.7	4.2	6.3	2.4	6.9	7.3	ns
		V _{CC} = 2.3 V to 2.7 V	2.3	3.5	5.0	2.0	5.5	5.8	ns
		V _{CC} = 3.0 V to 3.6 V	2.0	3.2	4.6	1.8	5.0	5.2	ns
C _L = 30	ρF								
t _{pd}	propagation	A, B and C to Y; see Fig. 7 [2]							
	delay	V _{CC} = 0.8 V	-	36.3	-	-	-	-	ns
		V _{CC} = 1.1 V to 1.3 V	5.1	9.5	16.8	4.8	17.9	18.3	ns
		V _{CC} = 1.4 V to 1.6 V	4.2	6.7	10.0	3.8	11.3	11.8	ns
		V _{CC} = 1.65 V to 1.95 V	3.6	5.5	8.1	3.2	9.1	9.7	ns
		V _{CC} = 2.3 V to 2.7 V	3.0	4.6	6.6	2.8	7.2	7.5	ns
		V _{CC} = 3.0 V to 3.6 V	2.7	4.3	6.1	2.5	6.6	6.9	ns

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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}	1.5	$f_i = 1 \text{ MHz}; V_I = \text{GND to } V_{CC}$ [3]							
	capacitance	V _{CC} = 0.8 V	-	2.7	-	-	-	-	pF
		V _{CC} = 1.1 V to 1.3 V	-	2.8	-	-	-	-	pF
		V _{CC} = 1.4 V to 1.6 V	-	2.9	-	-	-	-	pF
		V _{CC} = 1.65 V to 1.95 V	-	3.1	-	-	-	-	pF
		V _{CC} = 2.3 V to 2.7 V	-	3.5	-	-	-	-	pF
		V _{CC} = 3.0 V to 3.6 V	-	4.1	-	-	-	-	pF

- [1] All typical values are measured at nominal V_{CC}.
- [2] t_{pd} is the same as t_{PLH} and t_{PHL} .
- [3] 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;

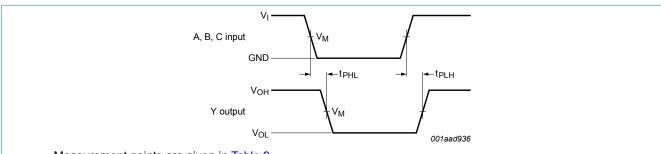
C_L = load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

 $\Sigma(C_L \times V_{CC}^2 \times f_0)$ = sum of the outputs.

11.1. Waveforms and test circuit



Measurement points are given in <u>Table 9</u>.

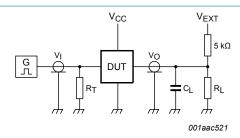
Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig. 7. Input A, B and C to output Y propagation delay times

Table 9. Measurement points

Supply voltage	Output	Input		
V _{CC}	V _M	V _M	VI	$t_r = t_f$
0.8 V to 3.6 V	0.5 x V _{CC}	0.5 x V _{CC}	V _{CC}	≤ 3.0 ns

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Test data is given in Table 10.

Definitions for test circuit:

 R_L = Load resistance.

 C_L = Load capacitance including jig and probe capacitance.

 R_T = Termination resistance should be equal to the output impedance Z_o of the pulse generator.

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

Fig. 8. Test circuit for measuring switching times

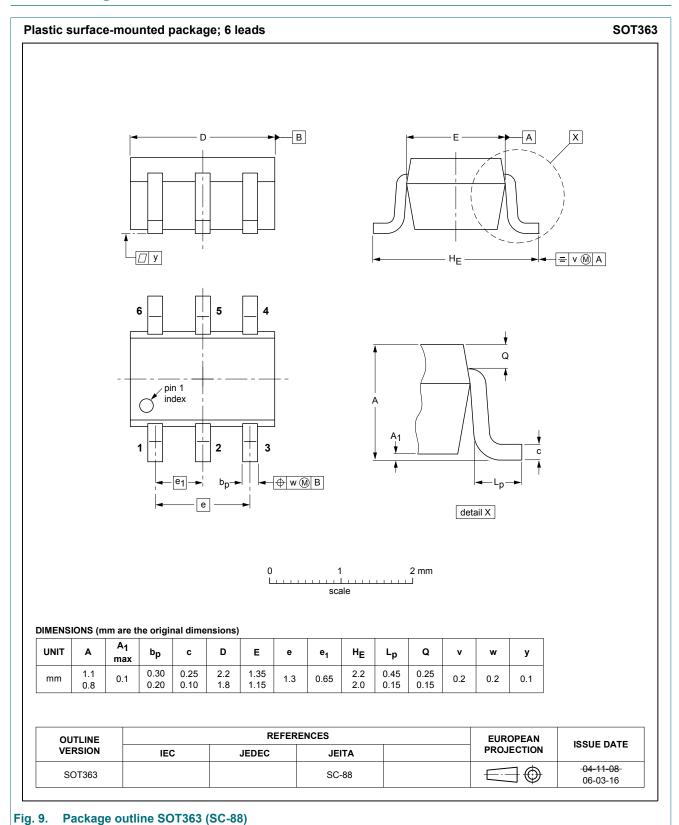
Table 10. Test data

Supply voltage	Load		V _{EXT}		
V _{CC}	CL	R _L [1]	t _{PLH} , t _{PHL}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}
0.8 V to 3.6 V	5 pF, 10 pF, 15 pF and 30 pF	5 kΩ or 1 MΩ	open	GND	2 x V _{CC}

[1] For measuring enable and disable times R_L = 5 k Ω . For measuring propagation delay, setup and hold times and pulse width R_L = 1 M Ω .

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12. Package outline



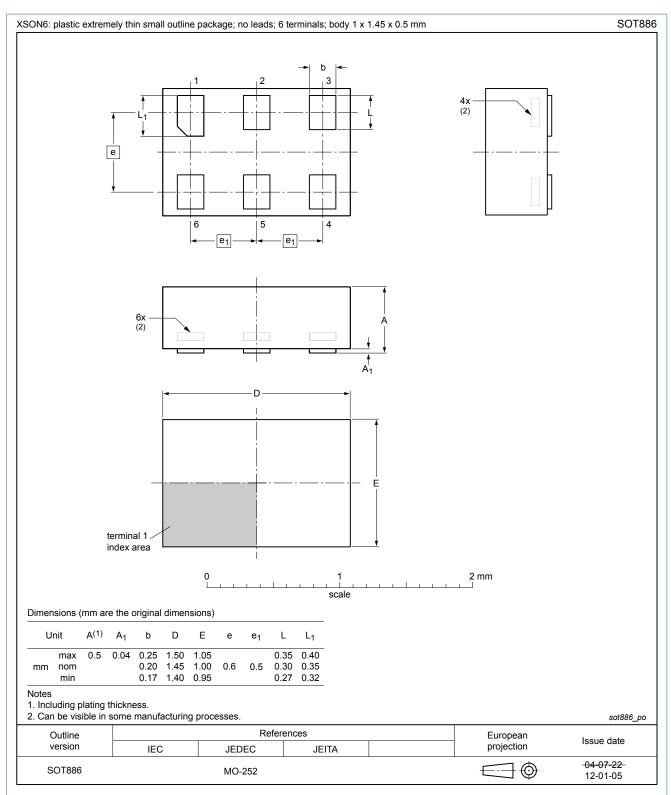


Fig. 10. Package outline SOT886 (XSON6)

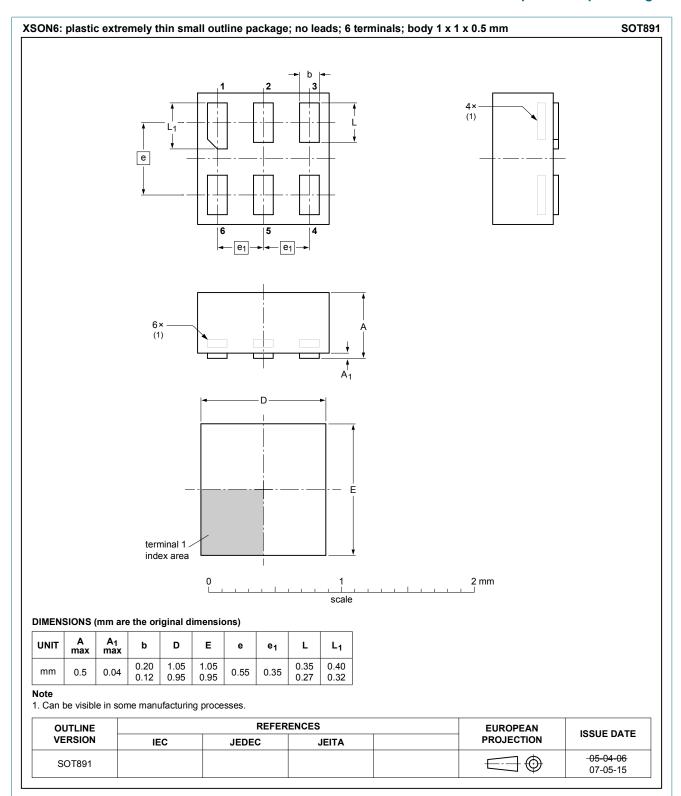


Fig. 11. Package outline SOT891 (XSON6)

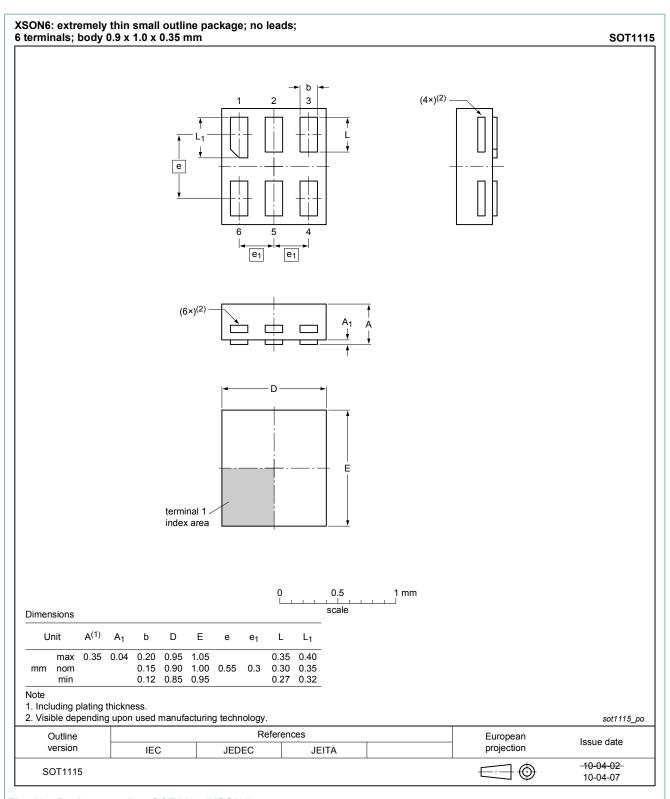


Fig. 12. Package outline SOT1115 (XSON6)

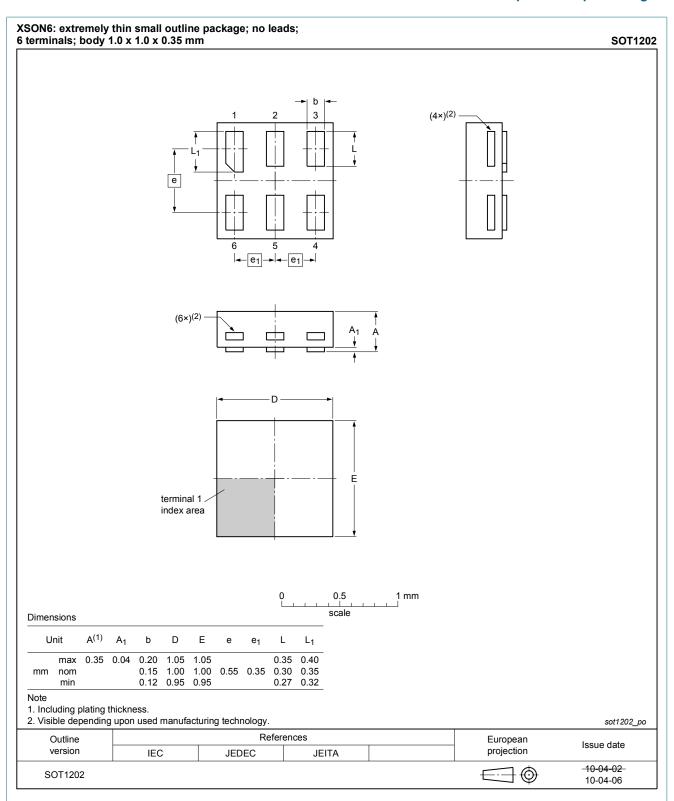


Fig. 13. Package outline SOT1202 (XSON6)

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13. Abbreviations

Table 11. Abbreviations

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

14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes	
74AUP1G11 v.5	20180820	Product data sheet	-	74AUP1G11 v.4	
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. 				
74AUP1G11 v.4	20120803	Product data sheet	-	74AUP1G11 v.3	
Modifications:	Package outline drawing of SOT886 (Fig. 10) modified.				
74AUP1G11 v.3	20111124	Product data sheet	-	74AUP1G11 v.2	
Modifications:	Legal pages updated.				
74AUP1G11 v.2	20101020	Product data sheet	-	74AUP1G11 v.1	
74AUP1G11 v.1	20070904	Product data sheet	-	-	

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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.

- 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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