Low-power dual inverter with open-drain output

Rev. 6 — 15 March 2019

Product data sheet

1. General description

The 74AUP2G06 provides two inverting buffers with open-drain output. The output of the device is an open drain and can be connected to other open-drain outputs to implement active-LOW wired-OR or active-HIGH wired-AND functions.

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; $I_{CC} = 0.9 \mu A$ (maximum)
- Latch-up performance exceeds 100 mA per JESD 78B 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

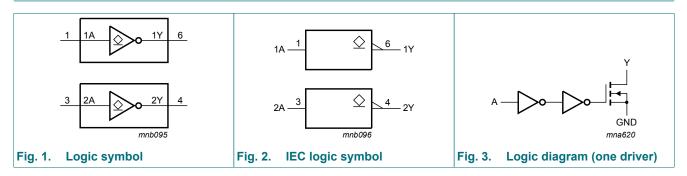
Table 1. Ordering in	formation								
Type number	Package								
	Temperature range Nam		Description	Version					
74AUP2G06GW	-40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363					
74AUP2G06GM	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm	SOT886					
74AUP2G06GF	-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					
74AUP2G06GN	-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					
74AUP2G06GS	-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]
74AUP2G06GW	p6
74AUP2G06GM	p6
74AUP2G06GF	p6
74AUP2G06GN	p6
74AUP2G06GS	p6

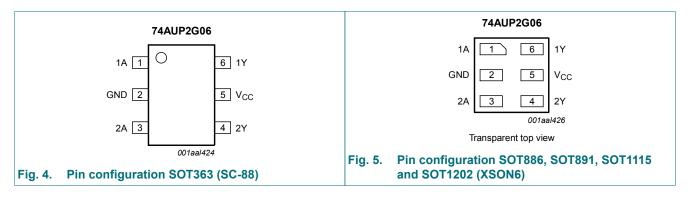
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



6. Pinning information

6.1. Pinning



6.2. Pin description

Table 3. Pin description						
Symbol	Pin	Description				
1A, 2A	1, 3	data input				
GND	2	ground (0 V)				
1Y, 2Y	6, 4	data output				
V _{CC}	5	supply voltage				

7. Functional description

Table 4. Function table

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

Input nA	Output nY
L	Z
Н	L

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	Мах	Unit
V _{CC}	supply voltage		-0.5	+4.6	V
I _{IK}	input clamping current	V ₁ < 0 V	-50	-	mA
VI	input voltage	[1]	-0.5	+4.6	V
I _{ОК}	output clamping current	V _O < 0 V	-50	-	mA
Vo	output voltage	Active mode and Power-down mode [1]	-0.5	+4.6	V
lo	output current	$V_{O} = 0 V \text{ to } V_{CC}$	-	+20	mA
I _{CC}	supply current		-	+50	mA
I _{GND}	ground current		-50	-	mA
T _{stg}	storage temperature		-65	+150	°C

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Symbol	Parameter	Conditions	Min	Max	Unit
P _{tot}	total power dissipation	$T_{amb} = -40 \text{ °C to } +125 \text{ °C}$ [2]	-	250	mW

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

[2] For SC-88 package: 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.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		0.8	3.6	V
VI	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	0	200	ns/V

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 × V _{CC}	-	-	V
		V _{CC} = 0.9 V to 1.95 V	0.65 × 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	-	-	$0.30 \times V_{CC}$	V
		V _{CC} = 0.9 V to 1.95 V	-	-	0.35 × 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 _{OL}	LOW-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		$I_{\rm O}$ = 20 µA; $V_{\rm CC}$ = 0.8 V to 3.6 V	-	-	0.1	V
		I _O = 1.1 mA; V _{CC} = 1.1 V	-	-	$0.3 \times V_{CC}$	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_{I} = GND to 3.6 V; V_{CC} = 0 V to 3.6 V	-	-	±0.1	μA
I _{OZ}	OFF-state output current	$V_{I} = V_{IL}; V_{O} = 0 V \text{ to } 3.6 V;$ $V_{CC} = 0 V \text{ to } 3.6 V$	-	-	±0.1	μA
I _{OFF}	power-off leakage current	V_{I} or V_{O} = 0 V to 3.6 V; V_{CC} = 0 V	-	-	±0.2	μA
ΔI _{OFF}	additional power-off leakage current	$V_1 \text{ or } V_0 = 0 \text{ V to } 3.6 \text{ V};$ $V_{CC} = 0 \text{ V to } 0.2 \text{ V}$	-	-	±0.2	μA

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
I _{CC}	supply current	$V_{I} = GND \text{ or } V_{CC}; I_{O} = 0 \text{ A}; V_{CC} = 0.8 \text{ V to } 3.6 \text{ V}$	-	-	0.5	μA
ΔI _{CC}	additional supply current	$V_{I} = V_{CC} - 0.6 \text{ V}; I_{O} = 0 \text{ A}; V_{CC} = 3.3 \text{ V}$	-	0.540-0.81.71.1-0.70 × V_{CC} 0.65 × V_{CC} 1.62.00.30 × V0.35 × V0.7-0.90.1		
CI	input capacitance	V_{CC} = 0 V to 3.6 V; V _I = GND or V _{CC}	-	0.8	-	pF
Co	output capacitance	output enabled; V_0 = GND; V_{CC} = 0 V	-	1.7	-	pF
		output disabled; V_0 = GND; V_{CC} = 0 V	-	1.1	-	pF
T _{amb} = -4	10 °C to +85 °C					-
V _{IH}	HIGH-level input voltage	V _{CC} = 0.8 V	0.70 × V _{CC}	-	-	V
		V _{CC} = 0.9 V to 1.95 V	0.65 × 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 × V _{CC}	V
		V _{CC} = 0.9 V to 1.95 V	-	-	0.35 × V _{CC}	V
		V _{CC} = 2.3 V to 2.7 V	-	-	0.7	V
		V _{CC} = 3.0 V to 3.6 V	V to 3.6 V 0.9	0.9	V	
V _{OL}	LOW-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		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 × 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_0 = 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	μA
I _{OZ}	OFF-state output current	$V_{I} = V_{IL}; V_{O} = 0 V \text{ to } 3.6 V;$ $V_{CC} = 0 V \text{ to } 3.6 V$	-	-	±0.5	μA
I _{OFF}	power-off leakage current	V_{I} or V_{O} = 0 V to 3.6 V; V_{CC} = 0 V	-	-	±0.5	μA
ΔI _{OFF}	additional power-off leakage current	$V_{I} \text{ or } V_{O} = 0 \text{ V to } 3.6 \text{ V};$ $V_{CC} = 0 \text{ V to } 0.2 \text{ V}$	-	-	±0.6	μA
I _{CC}	supply current	$V_{I} = GND \text{ or } V_{CC}; I_{O} = 0 \text{ A};$ $V_{CC} = 0.8 \text{ V to } 3.6 \text{ V}$	-	-	0.9	μA
ΔI _{CC}	additional supply current	$V_{I} = V_{CC} - 0.6 \text{ V}; I_{O} = 0 \text{ A}; V_{CC} = 3.3 \text{ V}$	-	-	50	μA

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
T _{amb} = -4	40 °C to +125 °C					
VIH	HIGH-level input voltage	V _{CC} = 0.8 V	0.75 × V _{CC}	-	-	V
		V _{CC} = 0.9 V to 1.95 V	0.70 × 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 × V _{CC}	V
		V _{CC} = 0.9 V to 1.95 V	-	-	0.30 × 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 _{OL}	LOW-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		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 × 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	V
		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
l _l	input leakage current	V_I = GND to 3.6 V; V_{CC} = 0 V to 3.6 V	-	-	±0.75	μA
I _{OZ}	OFF-state output current	$V_{I} = V_{IL}; V_{O} = 0 V \text{ to } 3.6 V;$ $V_{CC} = 0 V \text{ to } 3.6 V$	-	-	±0.75	μA
I _{OFF}	power-off leakage current	V_{I} or V_{O} = 0 V to 3.6 V; V_{CC} = 0 V	-	-	±0.75	μA
ΔI _{OFF}	additional power-off leakage current	$V_1 \text{ or } V_0 = 0 \text{ V to } 3.6 \text{ V};$ $V_{CC} = 0 \text{ V to } 0.2 \text{ V}$	-	-	±0.75	μA
I _{CC}	supply current	$V_{I} = GND \text{ or } V_{CC}; I_{O} = 0 \text{ A};$ $V_{CC} = 0.8 \text{ V to } 3.6 \text{ V}$	-	-	1.4	μA
ΔI _{CC}	additional supply current	$V_{I} = V_{CC} - 0.6 \text{ V}; I_{O} = 0 \text{ A}; V_{CC} = 3.3 \text{ V}$	-	-	75	μA

11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.

Symbol	Parameter	Conditions	25 °C		25 °C -40 °C to +125 °C			25 °C	Unit
			Min	Typ <mark>[1]</mark>	Мах	Min	Max (85 °C)	Max (125 °C)	
C _L = 5 pF	•								
t _{pd}	propagation delay	nA to nY; see Fig. 6 [2]							
		V _{CC} = 0.8 V	-	12.8	-	-	-	-	ns
		V _{CC} = 1.1 V to 1.3 V	2.3	4.3	9.9	2.0	10.9	12.0	ns
		V _{CC} = 1.4 V to 1.6 V	1.8	3.1	6.1	1.5	7.1	7.8	ns
		V _{CC} = 1.65 V to 1.95 V	1.5	2.8	4.7	1.2	5.7	6.3	ns
		V_{CC} = 2.3 V to 2.7 V	1.2	2.2	3.2	1.0	3.9	4.3	ns
		V _{CC} = 3.0 V to 3.6 V	1.1	2.2	3.3	0.8	3.6	4.0	ns

Symbol	Parameter	Conditions		25 °C			-40 °C to +125 °C			
				Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	-	
C _L = 10 p	р F									
t _{pd}	propagation delay	nA to nY; see Fig. 6 [2]								
		V _{CC} = 0.8 V	-	15.8	-	-	-	-	ns	
		V _{CC} = 1.1 V to 1.3 V	2.7	5.4	11.2	2.5	13.2	15.0	ns	
		V _{CC} = 1.4 V to 1.6 V	2.2	3.9	7.0	2.0	8.5	9.4	ns	
		V _{CC} = 1.65 V to 1.95 V	1.9	3.6	5.4	1.7	6.7	7.4	ns	
		V _{CC} = 2.3 V to 2.7 V	1.7	2.9	3.8	1.4	4.5	5.0	ns	
		V _{CC} = 3.0 V to 3.6 V	1.6	3.2	4.6	1.2	4.9	5.4	ns	
C _L = 15 p	р F			1	1		1	1		
t _{pd}	propagation delay	nA to nY; see Fig. 6 [2]								
		V _{CC} = 0.8 V	-	18.8	-	-	-	-	ns	
		V _{CC} = 1.1 V to 1.3 V	3.2	6.4	12.2	2.9	15.2	17.0	ns	
		V _{CC} = 1.4 V to 1.6 V	2.6	4.6	7.7	2.3	9.4	10.0	ns	
		V _{CC} = 1.65 V to 1.95 V	2.3	4.5	6.6	2.1	7.3	8.1	ns	
		V _{CC} = 2.3 V to 2.7 V	2.1	3.5	4.6	1.7	5.1	5.7	ns	
		V _{CC} = 3.0 V to 3.6 V	2.0	4.0	6.0	1.5	6.5	7.2	ns	
C _L = 30 p	р F			1						
t _{pd}	propagation delay	nA to nY; see Fig. 6 [2]								
		V _{CC} = 0.8 V	-	27.8	-	-	-	-	ns	
		V _{CC} = 1.1 V to 1.3 V	4.4	9.3	16.5	3.9	19.3	21.3	ns	
		V _{CC} = 1.4 V to 1.6 V	3.6	6.8	10.1	3.2	12.0	13.2	ns	
		V _{CC} = 1.65 V to 1.95 V	3.2	6.8	10.7	2.9	11.0	13.2 15.0 1 8.5 9.4 1 6.7 7.4 1 4.5 5.0 1 4.9 5.4 1 - - 1 15.2 17.0 1 9.4 10.0 1 7.3 8.1 1 5.1 5.7 1 6.5 7.2 1 19.3 21.3 1 12.0 13.2 1 11.0 12.1 1 7.8 8.6 1 10.8 11.9 1 - - 1 - - 1 - - 1 10.8 11.9 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - - 1 - -	ns	
		V _{CC} = 2.3 V to 2.7 V	2.9	5.3	7.2	2.6	7.8	8.6	ns	
		V _{CC} = 3.0 V to 3.6 V	2.9	6.5	10.5	2.5	10.8	11.9	ns	
C _L = 5 pF	F, 10 pF, 15 pF and	30 pF								
C _{PD}	power dissipation	$f_i = 1 \text{ MHz}; V_I = \text{GND to } V_{\text{CC}}$ [3]								
	capacitance	V _{CC} = 0.8 V	-	0.5	-	-	-	-	pF	
		V _{CC} = 1.1 V to 1.3 V	-	0.6	-	-	-	-	pF	
		V _{CC} = 1.4 V to 1.6 V	-	0.7	-	-	-	-	pF	
		V _{CC} = 1.65 V to 1.95 V	-	0.7	-	-	-	-	pF	
		V_{CC} = 2.3 V to 2.7 V	-	1.0	-	-	-	-	pF	
		V _{CC} = 3.0 V to 3.6 V	-	1.2	-	-	-	-	pF	

[1] [2] All typical values are measured at nominal V_{CC} .

[2] t_{pd} is the same as t_{PZL} and t_{PLZ} . [3] C_{PD} is used to determine the dynamic power dissipation (P_D in μ W).

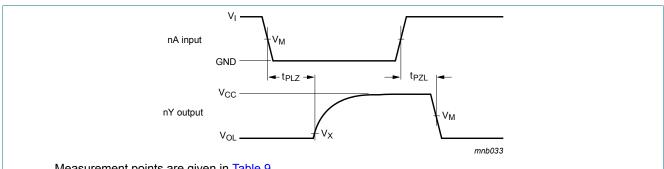
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N$ where:

 f_i = input frequency in MHz;

V_{CC} = supply voltage in V;

N = number of inputs switching.

11.1. Waveform and test circuit



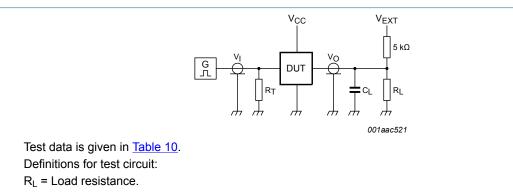
Measurement points are given in Table 9.

Logic level: V_{OL} is the typical output voltage level that occurs at the output load.

The data input (nA) to output (nY) propagation delays Fig. 6.

Table 9. Measurement points

Supply voltage	Input	Output		
V _{cc}	V _M	V _M	V _X	
0.8 V to 1.6 V	0.5 x V _{CC}	0.5 x V _{CC}	V _{OL} + 0.1 V	
1.65 V to 2.7 V	0.5 x V _{CC}	0.5 x V _{CC}	V _{OL} + 0.15 V	
3.0 V to 3.6 V	0.5 x V _{CC}	0.5 x V _{CC}	V _{OL} + 0.3 V	



C_L = Load capacitance including jig and probe capacitance.

 R_T = Termination resistance should be equal to the output impedance Z_0 of the pulse generator.

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

Fig. 7. Test circuit for measuring switching times

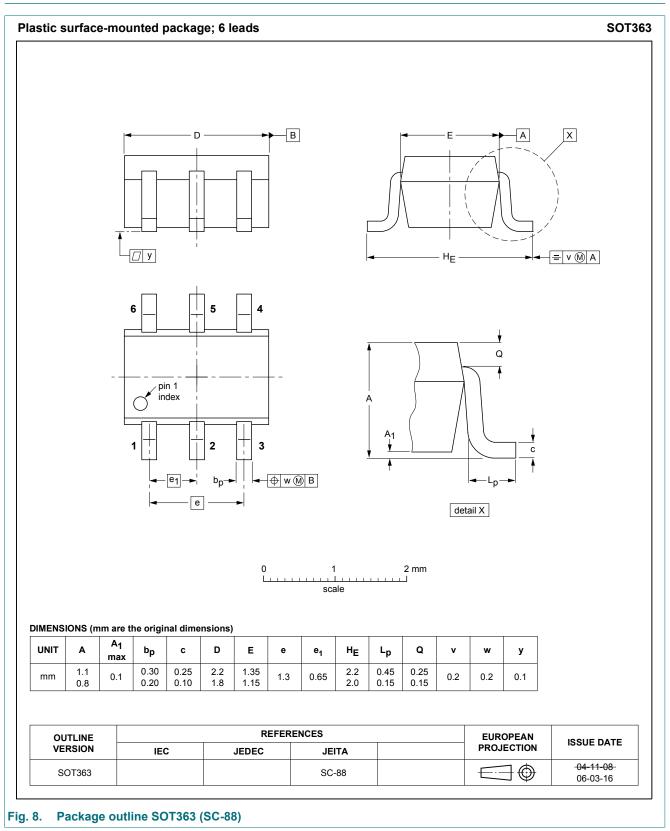
Table 10. Test data

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}

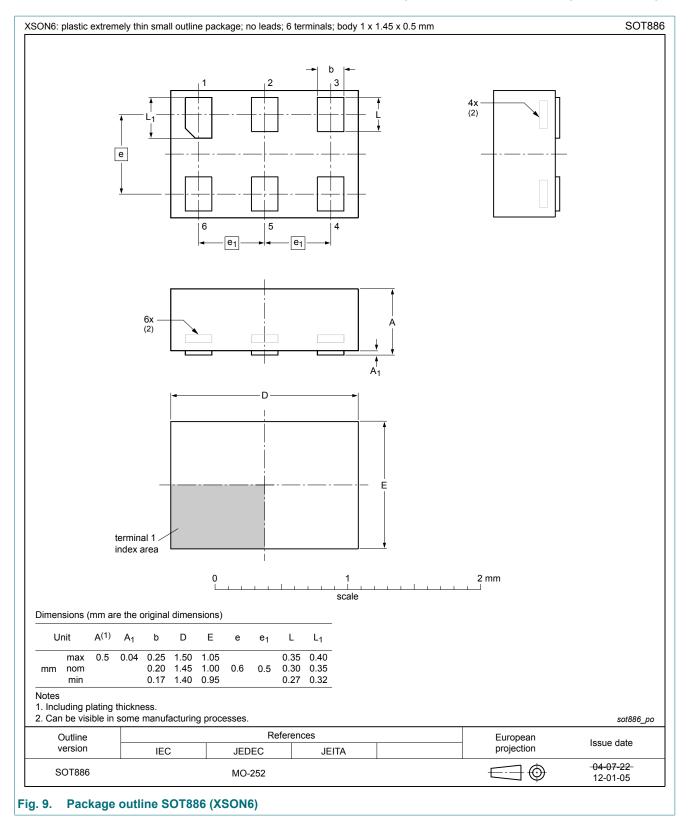
[1] For measuring enable and disable times $R_L = 5 k\Omega$.

For measuring propagation delays, setup and hold times and pulse width R_L = 1 M Ω .

12. Package outline



Low-power dual inverter with open-drain output

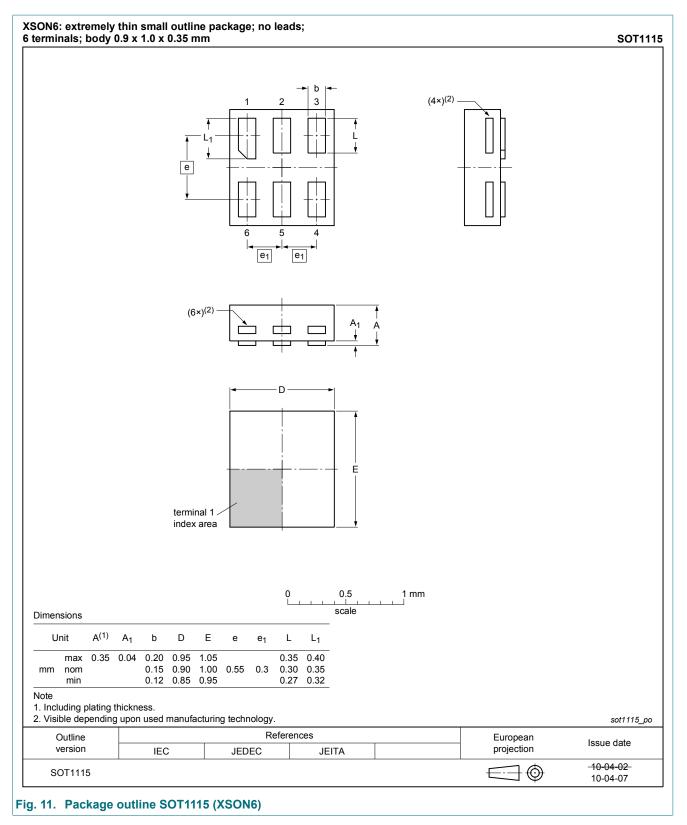


XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm SOT891 4× (1) е 6 5 e₁ e₁ 6× (1) E terminal 1 index area 2 mm 0 scale DIMENSIONS (mm are the original dimensions) A max A₁ max UNIT D Е b е e₁ L L₁ 0.20 1.05 1.05 0.35 0.40 mm 0.5 0.04 0.55 0.35 0.12 0.95 0.95 0.27 0.32 Note 1. Can be visible in some manufacturing processes. REFERENCES OUTLINE EUROPEAN ISSUE DATE PROJECTION VERSION JEITA IEC JEDEC 05-04-06 SOT891 ∃⊚ -E--07-05-15

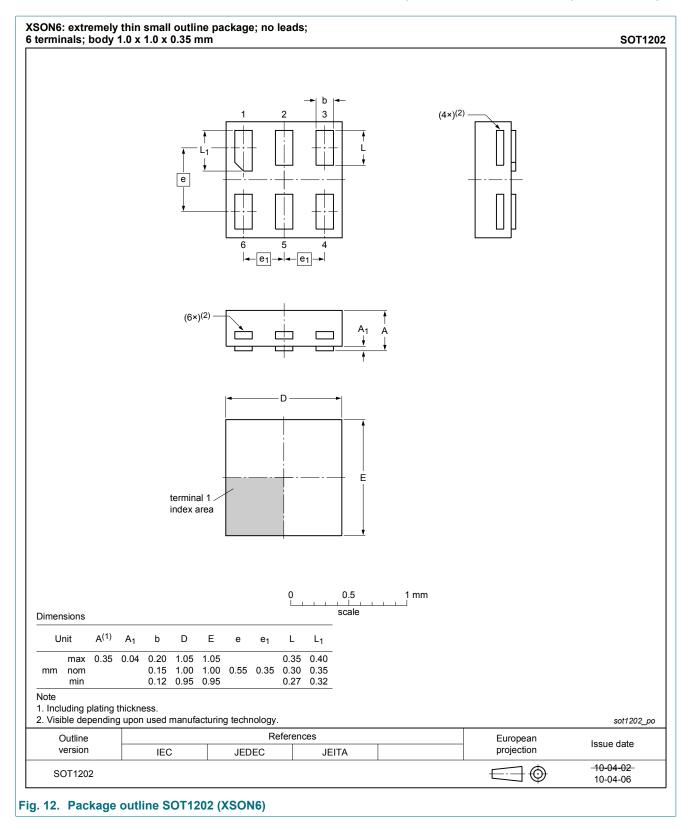
Low-power dual inverter with open-drain output

Fig. 10. Package outline SOT891 (XSON6)

Low-power dual inverter with open-drain output



Low-power dual inverter with open-drain output



13. 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
74AUP2G06 v.6	20190315	Product data sheet	-	74AUP2G06 v.5
Modifications:	 The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. 			
74AUP2G06 v.5	20121129	Product data sheet	-	74AUP2G06 v.4
Modifications:	Package outline drawing of SOT886 (Fig. 9) modified.			
74AUP2G06 v.4	20111206	Product data sheet	-	74AUP2G06 v.3
74AUP2G06 v.3	20101026	Product data sheet	-	74AUP2G06 v.2
74AUP2G06 v.2	20100325	Product data sheet	-	74AUP2G06 v.1
74AUP2G06 v.1	20100211	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.

 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 <u>https://www.nexperia.com</u>.

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Product data sheet

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