74AHC1G4210

10-stage divider and oscillator

Rev. 1 — 15 April 2016

Product data sheet

1. General description

74AHC1G4210 is a 10-stage divider and oscillator. It consists of a chain of 10 flip-flops. Each flip-flop divides the frequency of the previous flip-flop by two, consequently the 74AHC1G4210 counts up to $2^{10} = 1024$. The single inverting stage (X1 to X2) functions as a crystal oscillator or an input buffer for an external oscillator. When used as a buffer the output X2 should be left floating. The frequency of the output (Q) is the frequency applied to X1 divided by 1024. The divider advances on the negative-going transition of X1.

The X1 input is overvoltage tolerant. This feature allows the use of this device as a voltage level translator in mixed voltage environments.

2. Features and benefits

- Wide supply voltage range from 2.0 V to 5.5 V
- Overvoltage tolerant inputs to 5.5 V
- High noise immunity
- CMOS low power dissipation
- ESD protection:
    - HBM JESD22-A114F: exceeds 2000 V
    - CDM JESD22-C101E: exceeds 1000 V
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- 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
74AHC1G4210GW	−40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74AHC1G4210GM	−40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body $1 \times 1.45 \times 0.5$ mm	SOT886

4. Marking

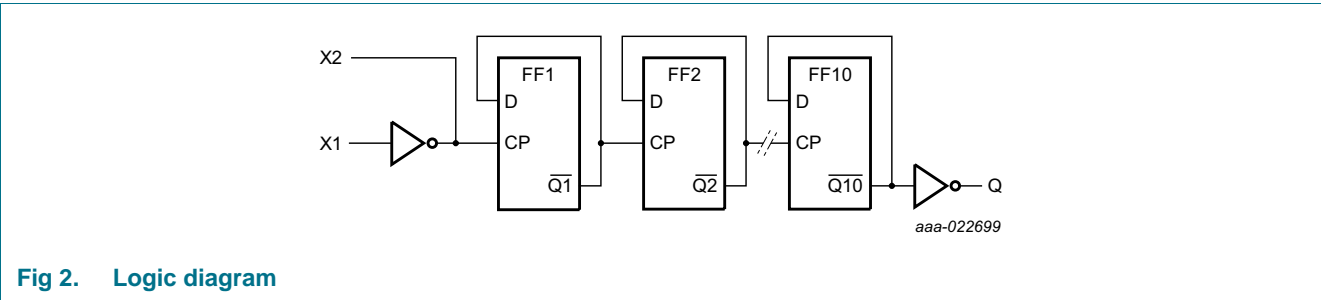**Table 2.   Marking codes**

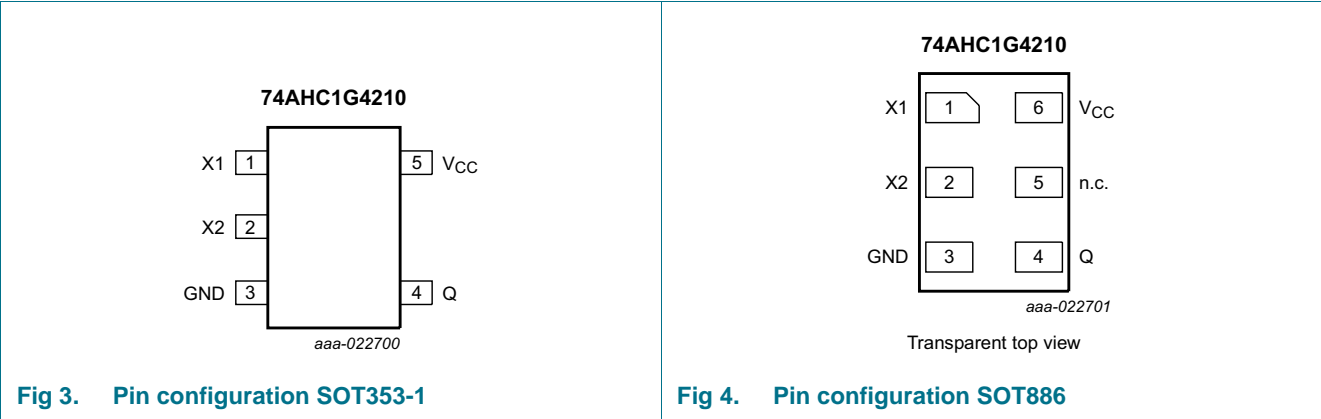| Type number	Marking[1]
74AHC1G4210GW	C1
74AHC1G4210GM	C1

[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
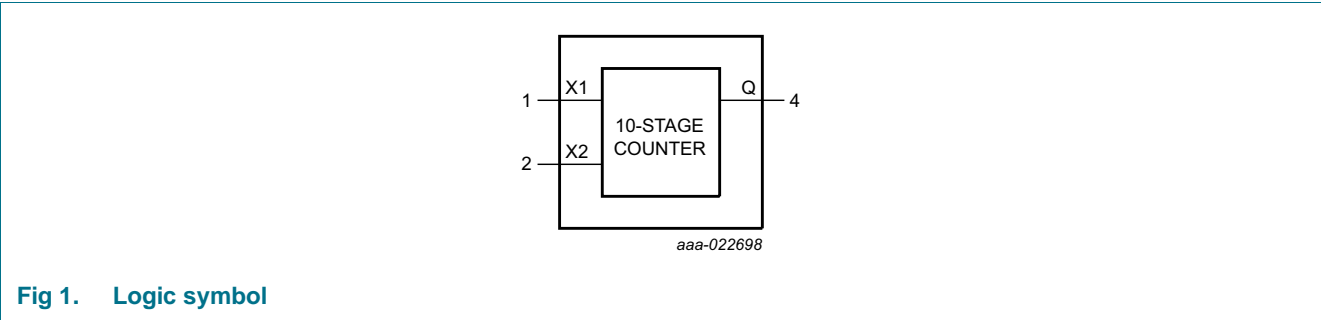
6. Pinning information

6.1 Pinning

Fig 3.   Pin configuration SOT353-1

Transparent top view

Fig 4.   Pin configuration SOT886

6.2 Pin description

Table 3. Pin description

Symbol	Pin		Description
	SOT353-1	**SOT886**	
X1	1	1	clock input/oscillator pin
X2	2	2	oscillator pin
GND	3	3	ground (0 V)
Q	4	4	divider output
n.c.	-	5	not connected
V_{CC}	5	6	supply voltage

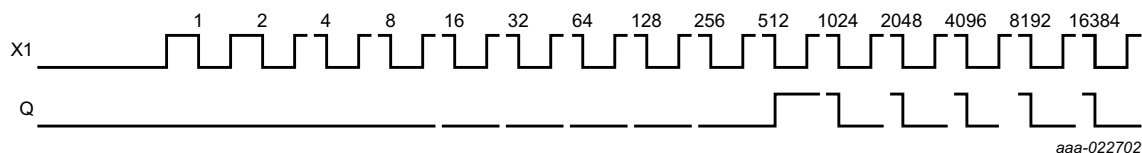# 7. Functional description

aaa-022702

Fig 5. Timing diagram

8. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		−0.5	+7.0	V
V_I	input voltage		−0.5	+7.0	V
I_{IK}	input clamping current	$V_I < -0.5$ V	−20	-	mA
I_{OK}	output clamping current	$V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V [1]	-	±20	mA
I_O	output current	-0.5 V $< V_O < V_{CC} + 0.5$ V	-	±25	mA
I_{CC}	supply current		-	75	mA
I_{GND}	ground current		−75	-	mA
T_{stg}	storage temperature		−65	+150	°C
P_{tot}	total power dissipation	$T_{amb} = -40$ °C to +125 °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 TSSOP5 package: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K.
For XSON6 package: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

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9. Recommended operating conditions

Table 5.   Recommended operating conditions
Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		2.0	5.0	5.5	V
V_I	input voltage		0	-	5.5	V
V_O	output voltage		0	-	V_{CC}	V
T_{amb}	ambient temperature		−40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	V_{CC} = 3.3 V ± 0.3 V	-	-	100	ns/V
		V_{CC} = 5.0 V ± 0.5 V	-	-	20	ns/V

10. Static characteristics

Table 6.   Static characteristics
Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			−40 °C to +85 °C		−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V_{IH}	HIGH-level input voltage	X1								
		V_{CC} = 2.0 V	1.7	-	-	1.7	-	1.7	-	V
		V_{CC} = 3.0 V	2.4	-	-	2.4	-	2.4	-	V
		V_{CC} = 5.5 V	4.4	-	-	4.4	-	4.4	-	V
V_{IL}	LOW-level input voltage	X1								
		V_{CC} = 2.0 V	-	-	0.3	-	0.3	-	0.3	V
		V_{CC} = 3.0 V	-	-	0.6	-	0.6	-	0.6	V
		V_{CC} = 5.5 V	-	-	1.1	-	1.1	-	1.1	V
V_{OH}	HIGH-level output voltage	Q; $V_I = V_{IH}$ or V_{IL}								
		I_O = −50 µA; V_{CC} = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I_O = −50 µA; V_{CC} = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	V
		I_O = −50 µA; V_{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I_O = −4.0 mA; V_{CC} = 3.0 V	2.58	-	-	2.48	-	2.40	-	V
		I_O = −8.0 mA; V_{CC} = 4.5 V	3.94	-	-	3.8	-	3.70	-	V
		X2; $V_I = V_{IH}$ or V_{IL}								
		I_O = −50 µA; V_{CC} = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I_O = −50 µA; V_{CC} = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	V
		I_O = −50 µA; V_{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I_O = −2.0 mA; V_{CC} = 3.0 V	2.58	-	-	2.48	-	2.40	-	V
		I_O = −3.0 mA; V_{CC} = 4.5 V	3.94	-	-	3.8	-	3.70	-	V

Table 6. **Static characteristics** *…continued*
Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			–40 °C to +85 °C		–40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V_{OL}	LOW-level output voltage	Q; $V_I = V_{IH}$ or V_{IL}								
		I_O = 50 μA; V_{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I_O = 50 μA; V_{CC} = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I_O = 50 μA; V_{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I_O = 4.0 mA; V_{CC} = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
		I_O = 8.0 mA; V_{CC} = 4.5 V	-	-	0.36	-	0.44	-	0.55	V
		X2; $V_I = V_{IH}$ or V_{IL}								
		I_O = 50 μA; V_{CC} = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I_O = 50 μA; V_{CC} = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I_O = 50 μA; V_{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I_O = 2.0 mA; V_{CC} = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
		I_O = 3.0 mA; V_{CC} = 4.5 V	-	-	0.36	-	0.44	-	0.55	V
I_I	input leakage current	X1; V_I = 5.5 V or GND; V_{CC} = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	1.0	-	10	-	40	μA
C_I	input capacitance	X1	-	3	8	-	8	-	8	pF

11. Dynamic characteristics

Table 7. **Dynamic characteristics**
GND = 0 V; $t_r = t_f = \leq 3.0$ ns. For test circuit see Figure 8. For waveforms see Figure 6 and Figure 7.

Symbol	Parameter	Conditions		25 °C			–40 °C to +85 °C		–40 °C to +125 °C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t_{pd}	propagation delay	X1 to X2	[1]								
		V_{CC} = 3.0 V to 3.6 V	[2]								
		C_L = 15 pF		-	3	7	1	11	1	13	ns
		C_L = 50 pF		-	7	13	1	16	1	18	ns
		V_{CC} = 4.5 V to 5.5 V	[3]								
		C_L = 15 pF		-	2	5	1	7	1	9	ns
		C_L = 50 pF		-	6	10	1	11	1	12	ns
		X1 to Q	[1]								
		V_{CC} = 3.0 V to 3.6 V	[2]								
		C_L = 15 pF		-	24	41	1	50	1	59	ns
		C_L = 50 pF		-	26	45	1	53	1	63	ns
		V_{CC} = 4.5 V to 5.5 V	[3]								
		C_L = 15 pF		-	17	27	1	33	1	39	ns
		C_L = 50 pF		-	19	30	1	38	1	44	ns

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Table 7. **Dynamic characteristics** *…continued*

GND = 0 V; $t_r = t_f = \leq 3.0$ ns. For test circuit see Figure 8. For waveforms see Figure 6 and Figure 7.

Symbol	Parameter	Conditions	25 °C			–40 °C to +85 °C		–40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t_W	pulse width	X1 HIGH or LOW								
		V_{CC} = 3.0 V to 3.6 V	4	-	-	5	-	7	-	ns
		V_{CC} = 4.5 V to 5.5 V	3	-	-	4	-	5	-	ns
f_{max}	maximum frequency	X1								
		V_{CC} = 3.3 V	125	-	-	100	-	70	-	MHz
		V_{CC} = 5 V	165	-	-	125	-	100	-	MHz
C_{PD}	power dissipation capacitance	C_L = 50 pF; f_i = 1 MHz; V_I = GND to V_{CC}								
		V_{CC} = 3.3 V [4]	-	4	-	-	-	-	-	pF
		V_{CC} = 5 V [4]	-	5	-	-	-	-	-	pF

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

[2] Typical values are measured at V_{CC} = 3.3 V.

[3] Typical values are measured at V_{CC} = 5.0 V.

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

  $P_D = C_{PD} \times V_{CC}^2 \times f_i + C_L \times V_{CC}^2 \times f_i/1024$ where:

  f_i = input frequency in MHz;

  C_L = output load capacitance in pF;
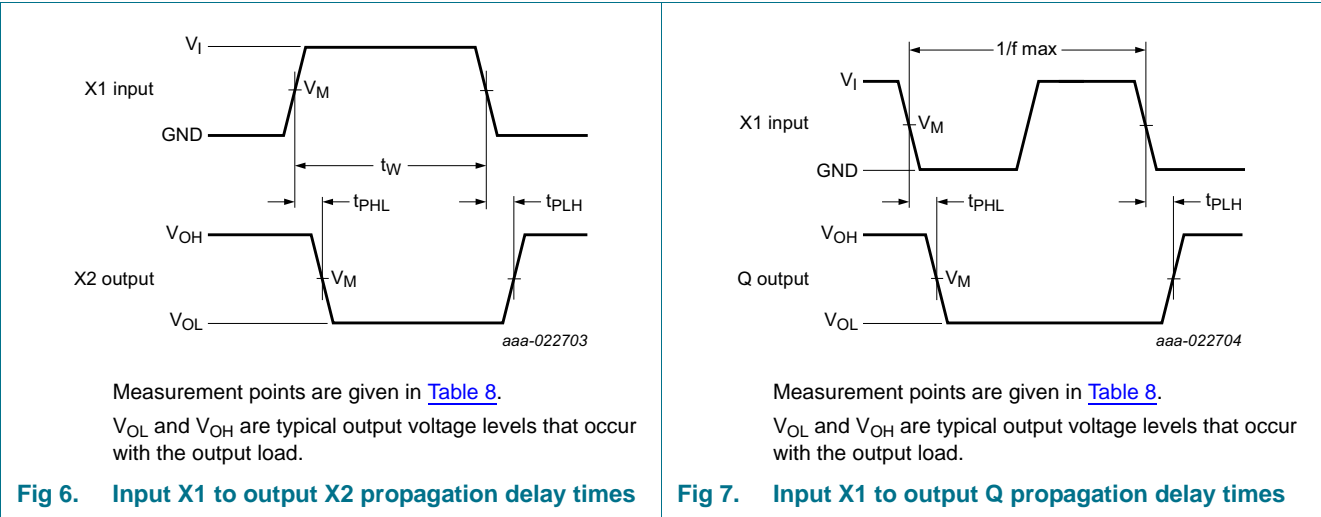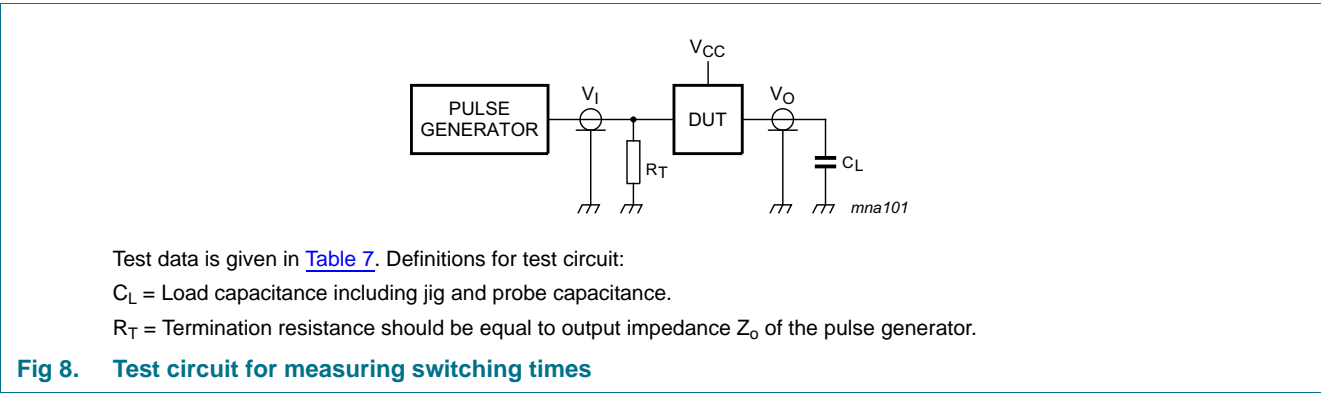
  V_{CC} = supply voltage in Volts.

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12. Waveforms

Measurement points are given in Table 8.

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

Fig 6. Input X1 to output X2 propagation delay times

Measurement points are given in Table 8.

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

Fig 7. Input X1 to output Q propagation delay times

Table 8. Measurement points

Inputs		Output
V_I	V_M	V_M
GND to V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$

Test data is given in Table 7. Definitions for test circuit:

C_L = Load capacitance including jig and probe capacitance.

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

Fig 8. Test circuit for measuring switching times

13. Crystal oscillator

13.1 Typical crystal oscillator circuit

A typical crystal oscillator schematic is shown in Figure 9. R1 is the power limiting resistor, its value depends on the frequency and required stability against changes in V_{CC} or average I_{CC}. For starting and maintaining oscillation a minimum transconductance is necessary, so R1 should not be too large. A practical value for R1 is 2.2 kΩ.

Fig 9. External component connection for a crystal oscillator

$g_{fs} = \Delta I_O / \Delta V_I$ at V_O is constant.

See also Figure 11.

Fig 10. Test set-up for measuring forward transconductance

$T_{amb} = 25\ °C$.

(1) Maximum.

(2) Typical.

(3) Minimum.

Fig 11. Typical forward transconductance as function of the supply voltage
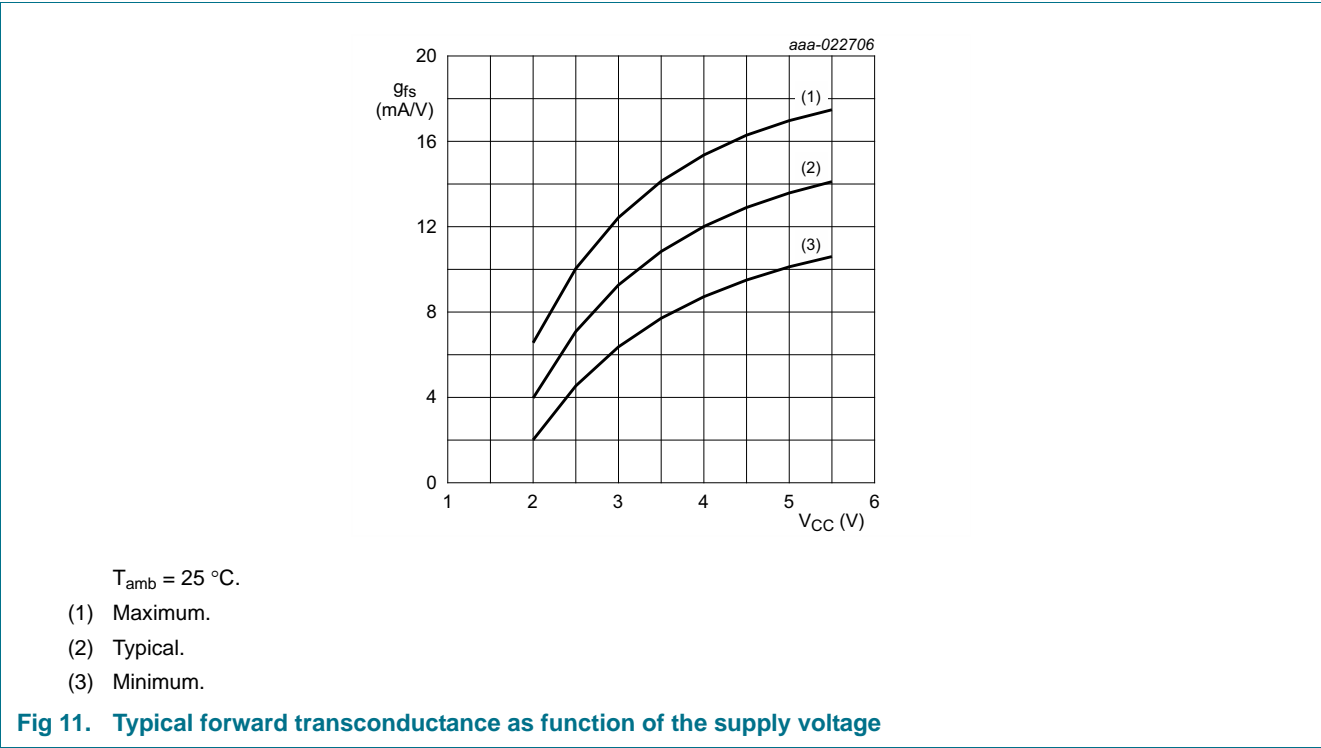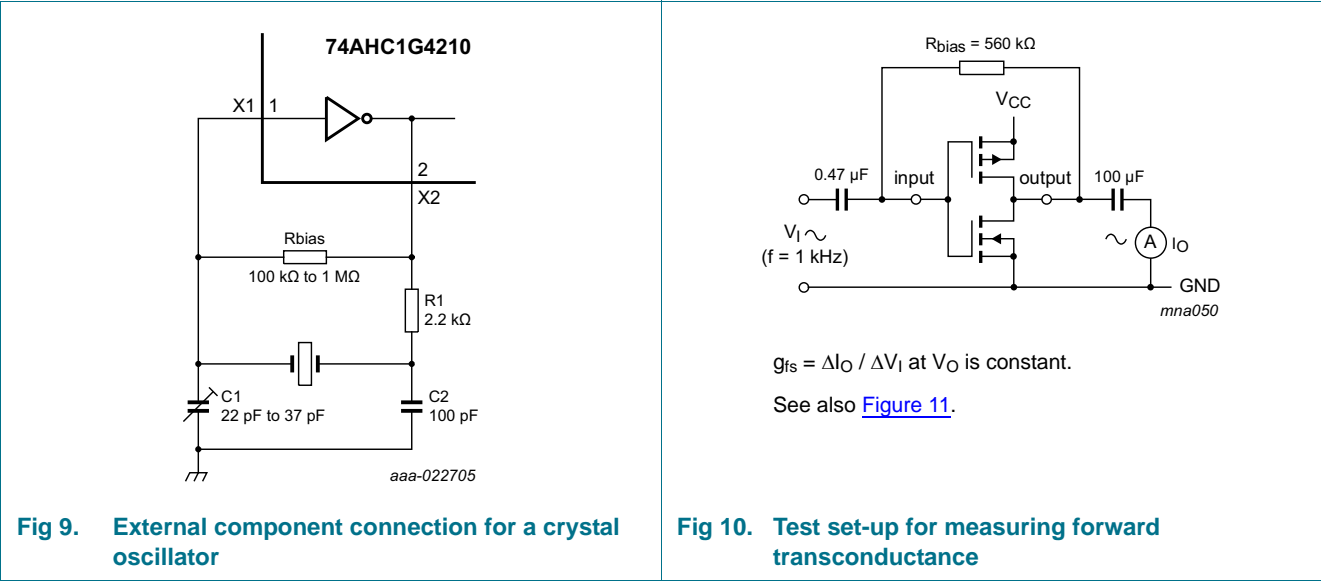
14. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm   SOT353-1

DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A₁	A₂	A₃	bₚ	c	D(1)	E(1)	e	e₁	HE	L	Lₚ	v	w	y	Z(1)	θ
mm	1.1	0.1 0	1.0 0.8	0.15	0.30 0.15	0.25 0.08	2.25 1.85	1.35 1.15	0.65	1.3	2.25 2.0	0.425	0.46 0.21	0.3	0.1	0.1	0.60 0.15	7° 0°

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT353-1		MO-203	SC-88A			~~00-09-01~~ 03-02-19
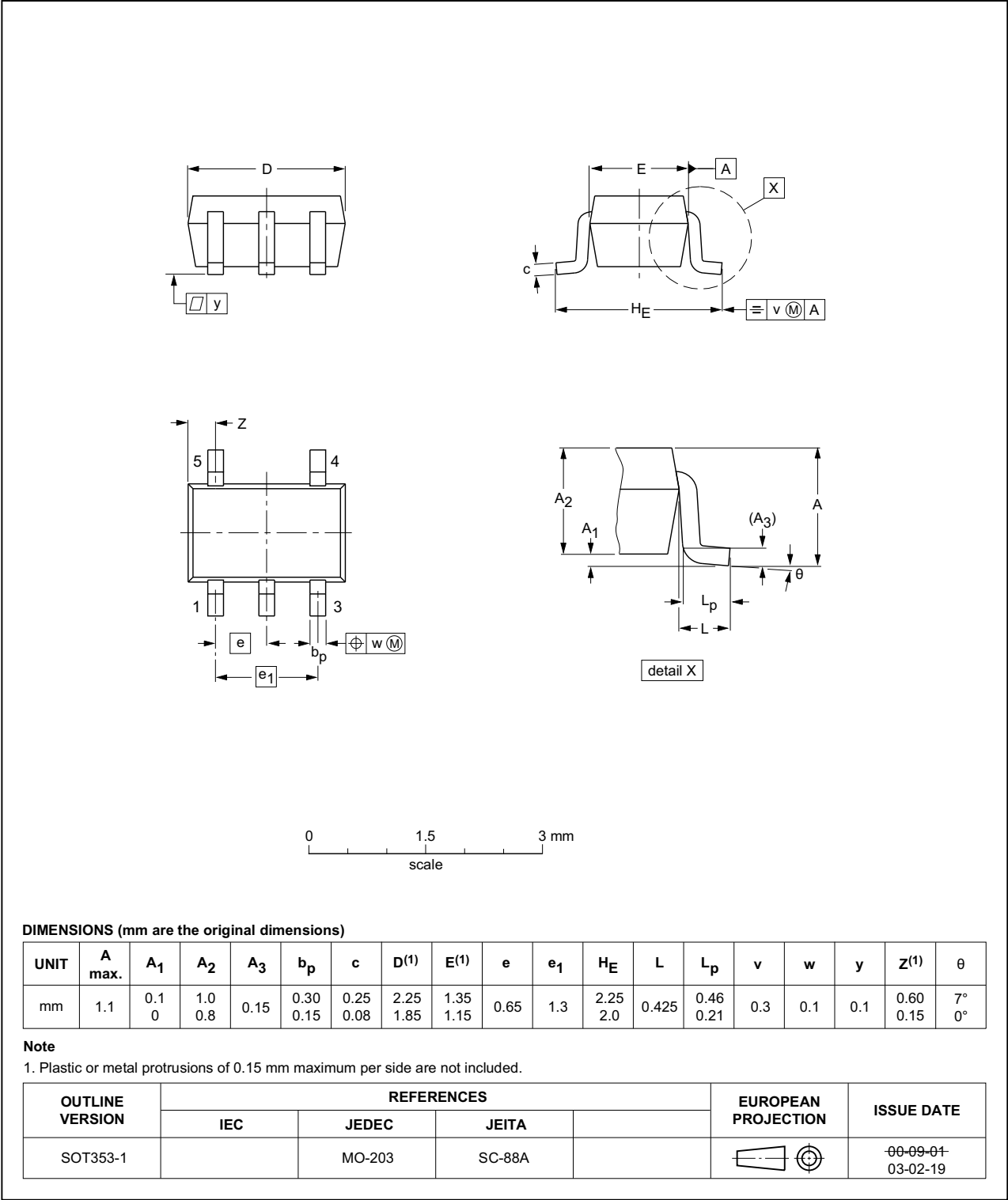
Fig 12. Package outline SOT353-1 (TSSOP5)

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]	A_1	b	D	E	e	e_1	L	L_1
mm	max	0.5	0.04	0.25	1.50	1.05			0.35	0.40
	nom			0.20	1.45	1.00	0.6	0.5	0.30	0.35
	min			0.17	1.40	0.95			0.27	0.32

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

sot886_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT886		MO-252				04-07-22 12-01-05
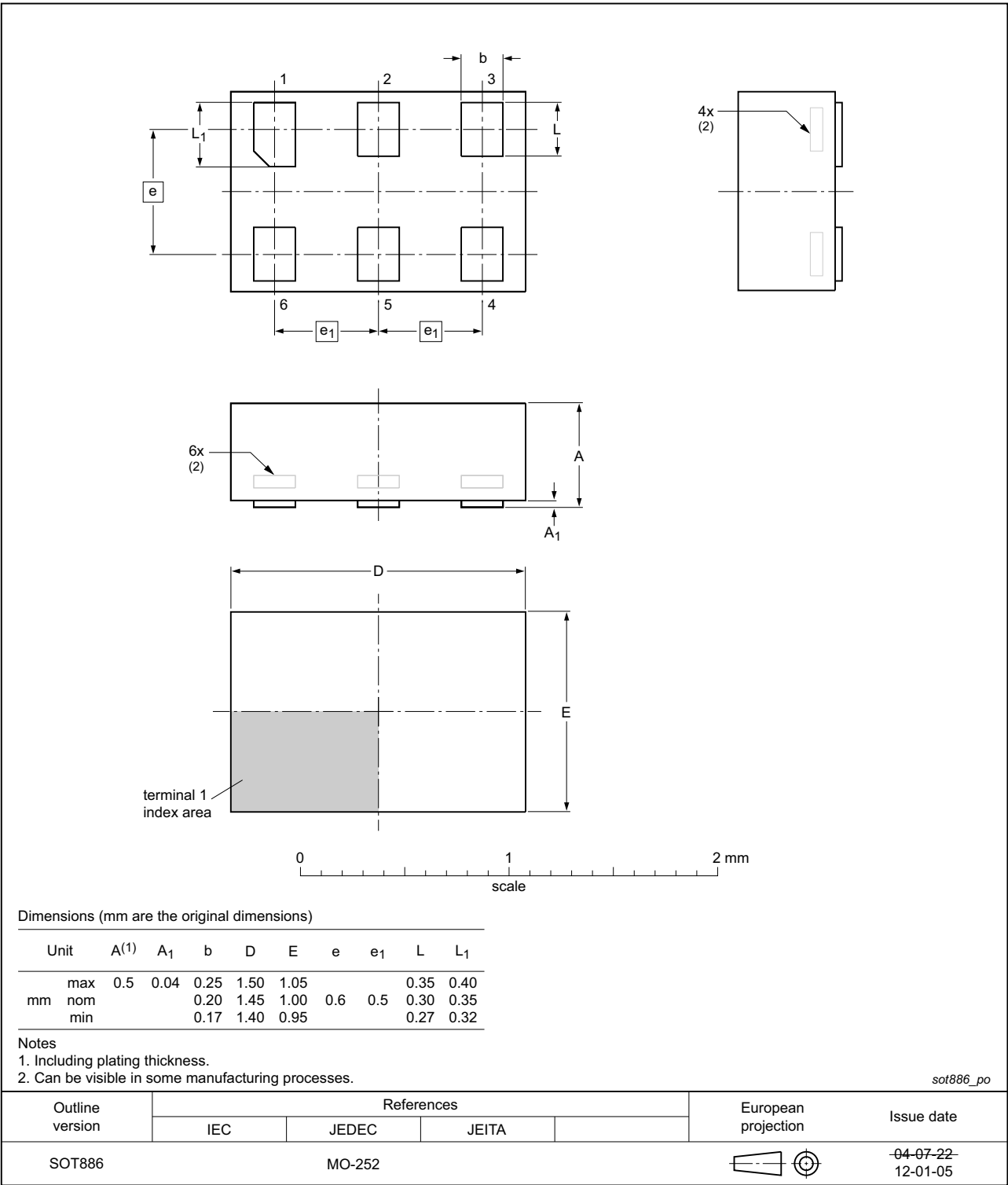
Fig 13. Package outline SOT886 (XSON6)

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15. Abbreviations

Table 9.   Abbreviations

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

16. Revision history

Table 10.   Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC1G4210 v.1	20160415	Product data sheet	-	-

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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.

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[2] The term 'short data sheet' is explained in section "Definitions".

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- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.

Как с нами связаться

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