

74AHC1G4212

12-stage divider and oscillator

Rev. 1 — 15 April 2016

Product data sheet

1. General description

74AHC1G4212 is a 12-stage divider and oscillator. It consists of a chain of 12 flip-flops. Each flip-flop divides the frequency of the previous flip-flop by two, consequently the 74AHC1G4212 counts up to $2^{12} = 4096$. 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 4096. 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 $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AHC1G4212GW	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74AHC1G4212GM	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body $1 \times 1.45 \times 0.5\text{ mm}$	SOT886



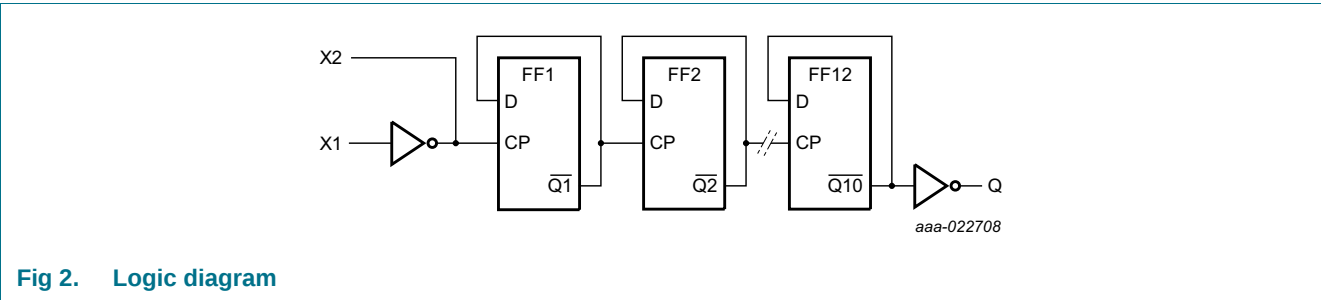
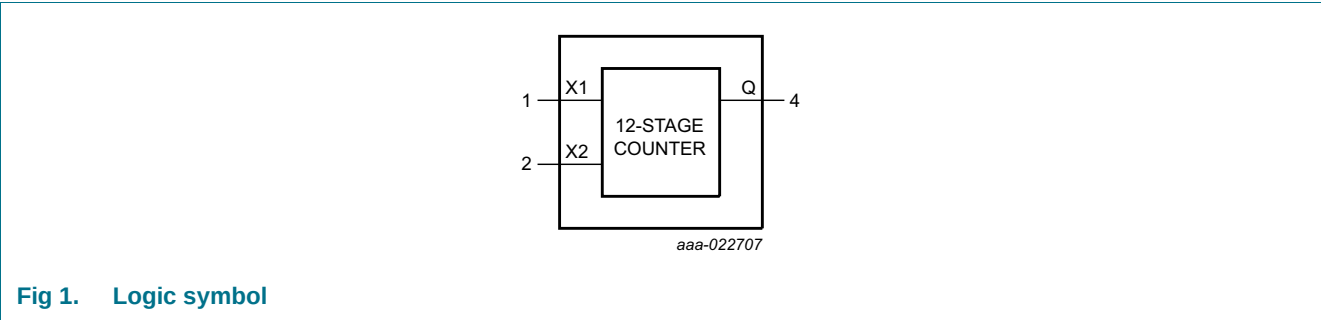
4. Marking

Table 2. Marking codes

Type number	Marking ^[1]
74AHC1G4212GW	C2
74AHC1G4212GM	C2

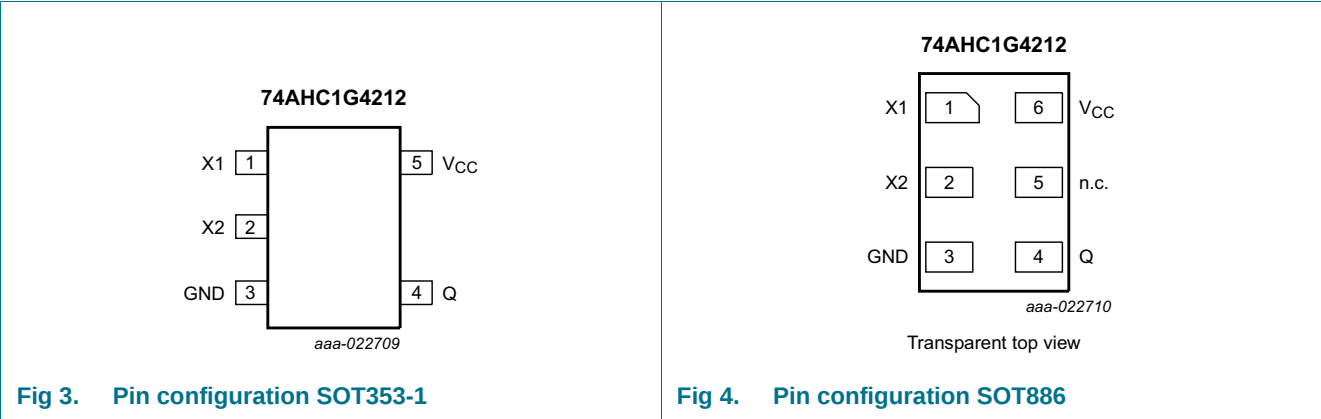
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



6. Pinning information

6.1 Pinning



6.2 Pin description

Table 3. Pin description

Symbol	Pin		Description
	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

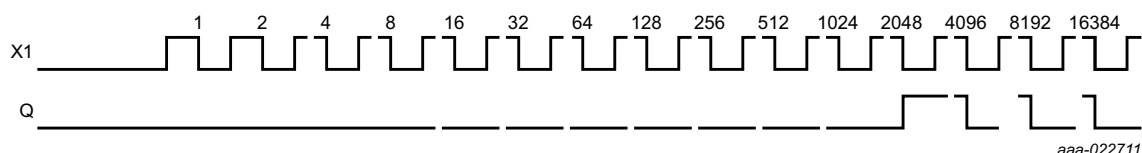


Fig 5. Timing diagram

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.

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
Δt/ΔV	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 = ≤ 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	-	28	48	1	59	1	68	ns
		C _L = 50 pF	-	31	52	1	62	1	73	ns
		V _{CC} = 4.5 V to 5.5 V [3]								
		C _L = 15 pF	-	20	31	1	39	1	45	ns
		C _L = 50 pF	-	22	35	1	45	1	51	ns

Table 7. Dynamic characteristics ...continued

$GND = 0\text{ V}$; $t_r = t_f = \leq 3.0\text{ ns}$. 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								
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	4	-	-	5	-	7	-	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	3	-	-	4	-	5	-	ns
$f_{\max}$	maximum frequency	X1								
		$V_{CC} = 3.3\text{ V}$	125	-	-	100	-	70	-	MHz
		$V_{CC} = 5\text{ V}$	165	-	-	125	-	100	-	MHz
C_{PD}	power dissipation capacitance	$C_L = 50\text{ pF}$; $f_i = 1\text{ MHz}$; $V_i = GND\text{ to }V_{CC}$								
		$V_{CC} = 3.3\text{ V}$ [4]	-	4	-	-	-	-	-	pF
		$V_{CC} = 5\text{ V}$ [4]	-	5	-	-	-	-	-	pF

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

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

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

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

$P_D = C_{PD} \times V_{CC}^2 \times f_i + C_L \times V_{CC}^2 \times f_i/4096$ where:

f_i = input frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in Volts.

12. Waveforms

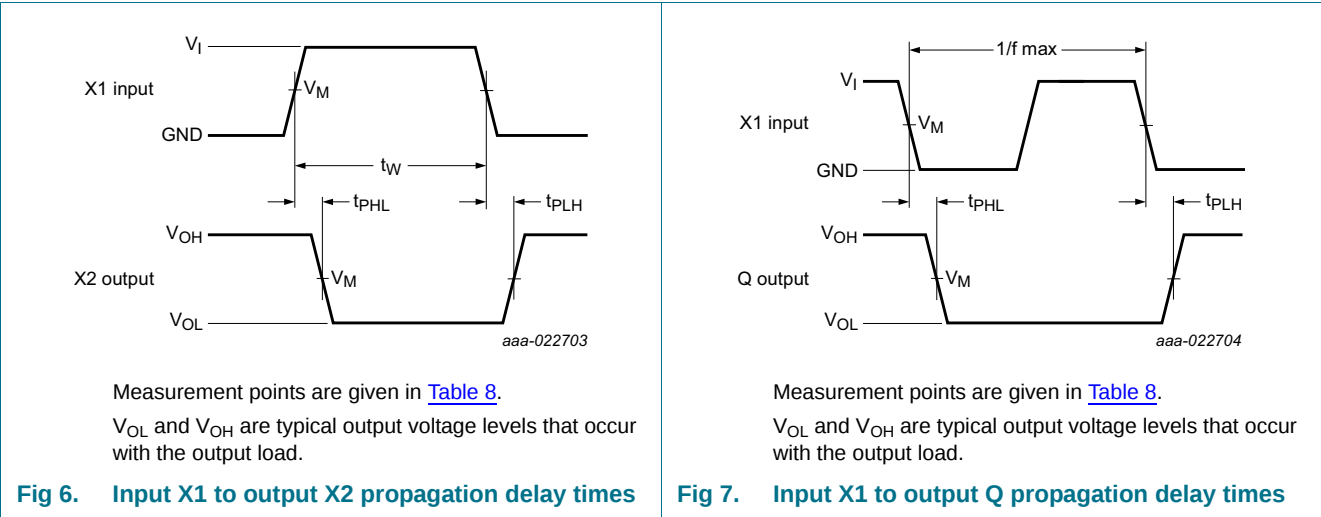
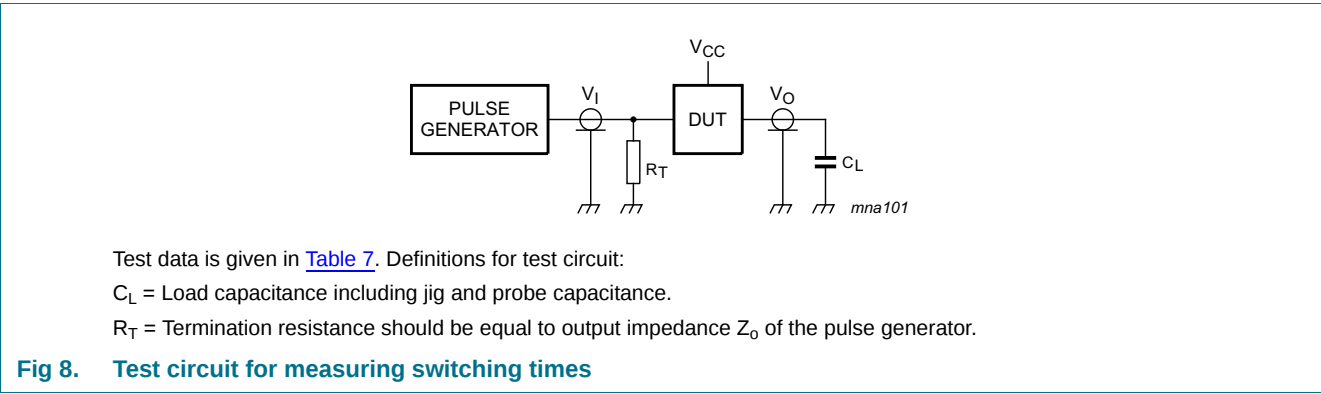


Table 8. Measurement points

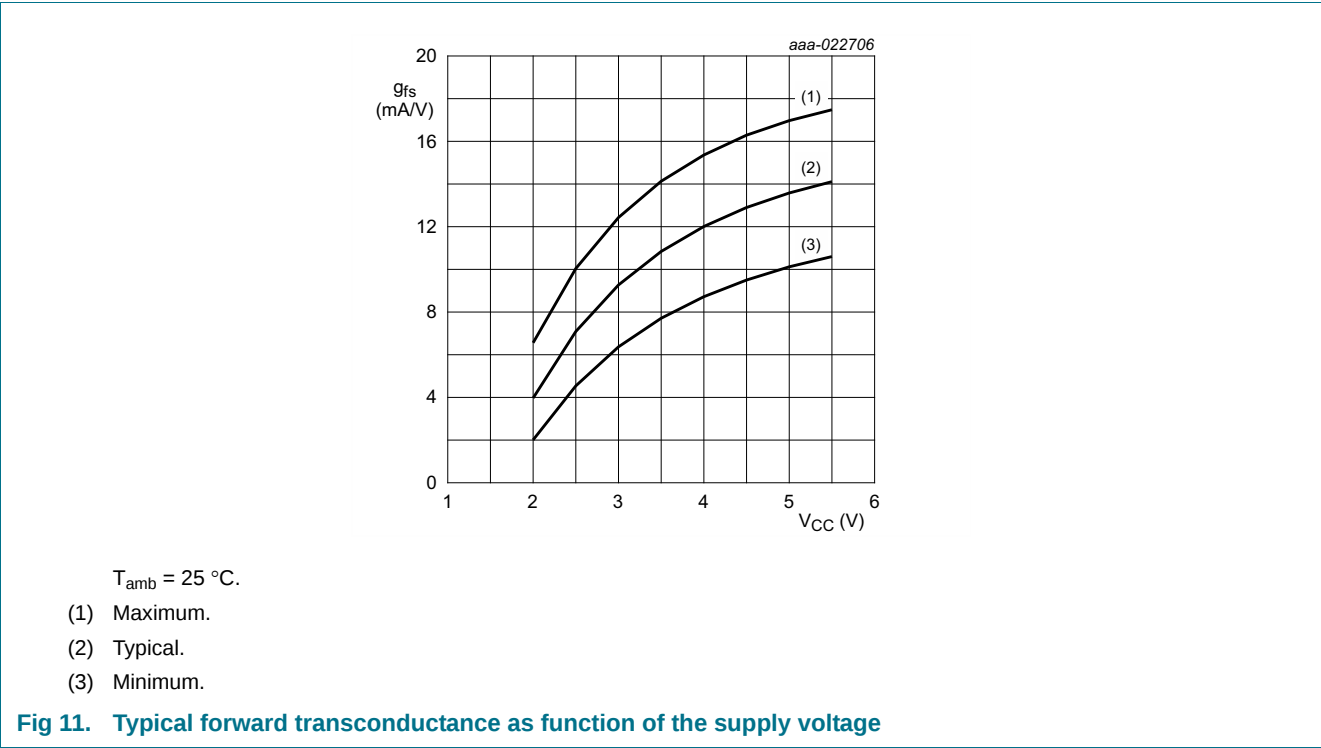
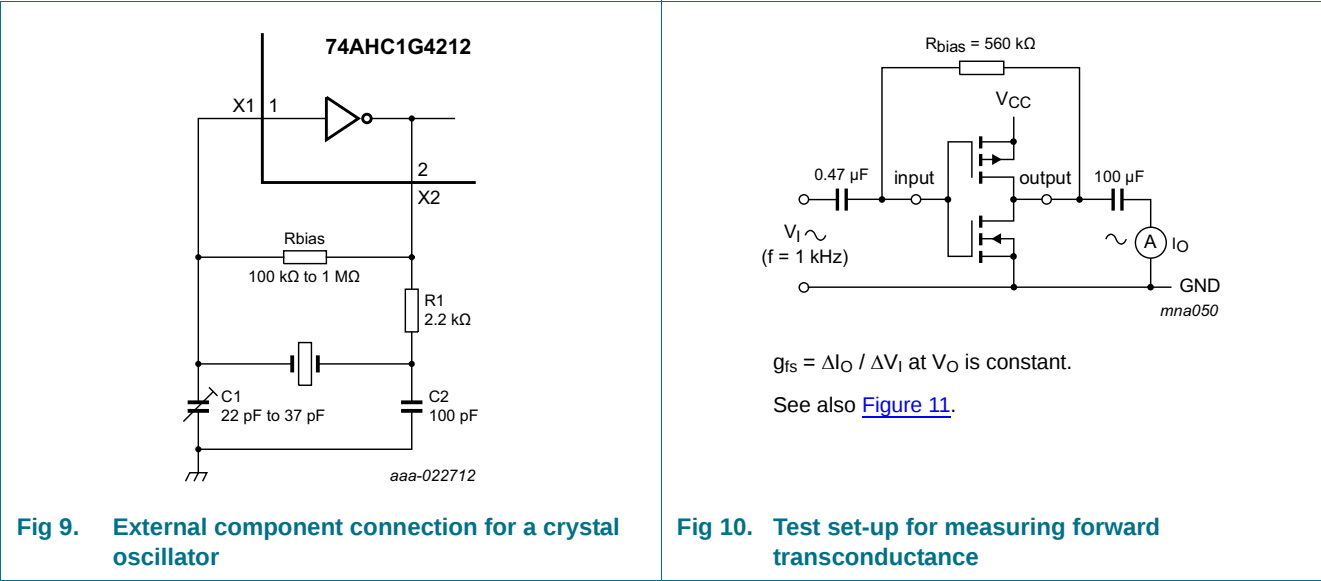
Inputs		Output
V_I	V_M	V_M
GND to V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$



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.



14. Package outline

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

SOT353-1

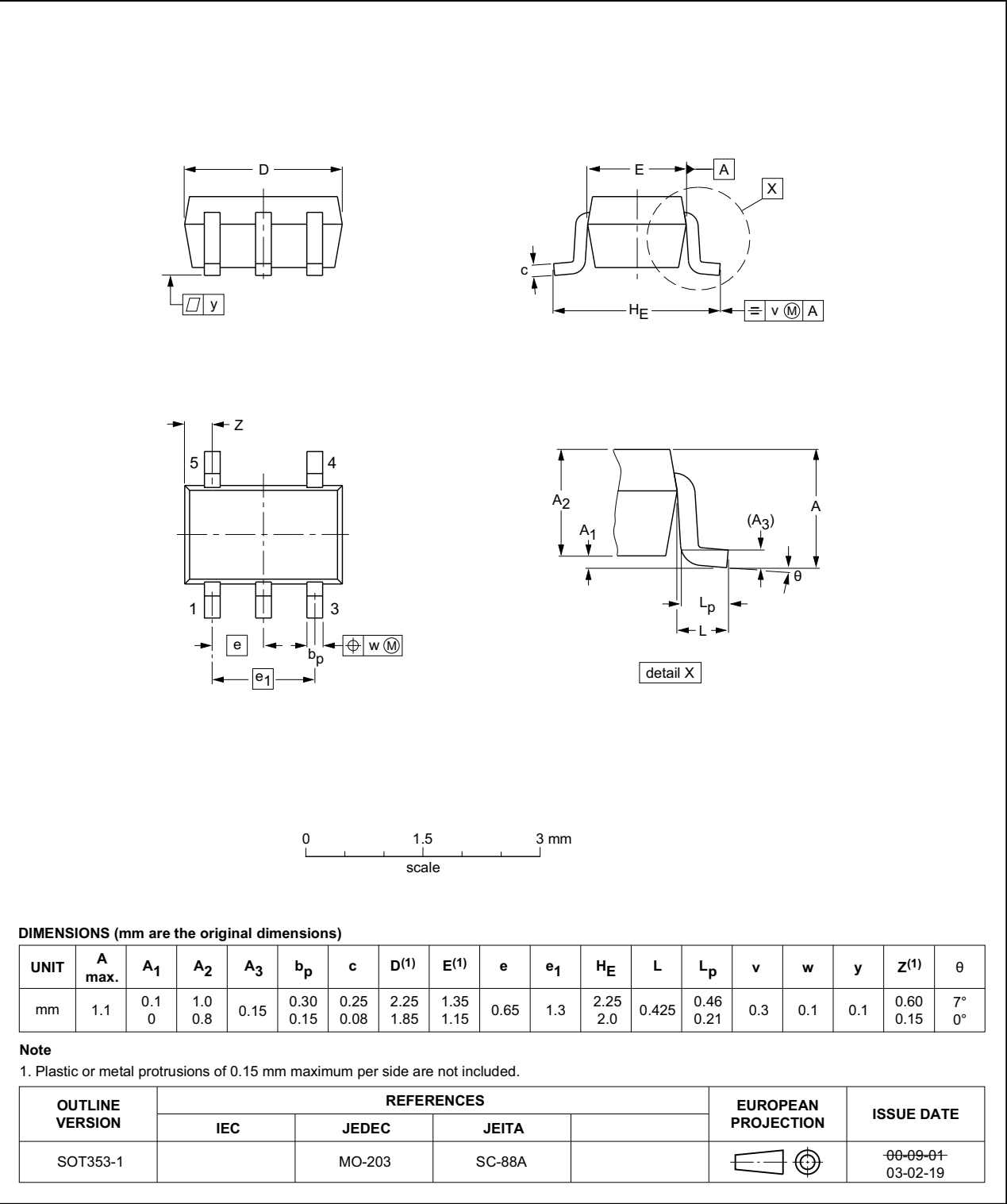


Fig 12. Package outline SOT353-1 (TSSOP5)

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

SOT886

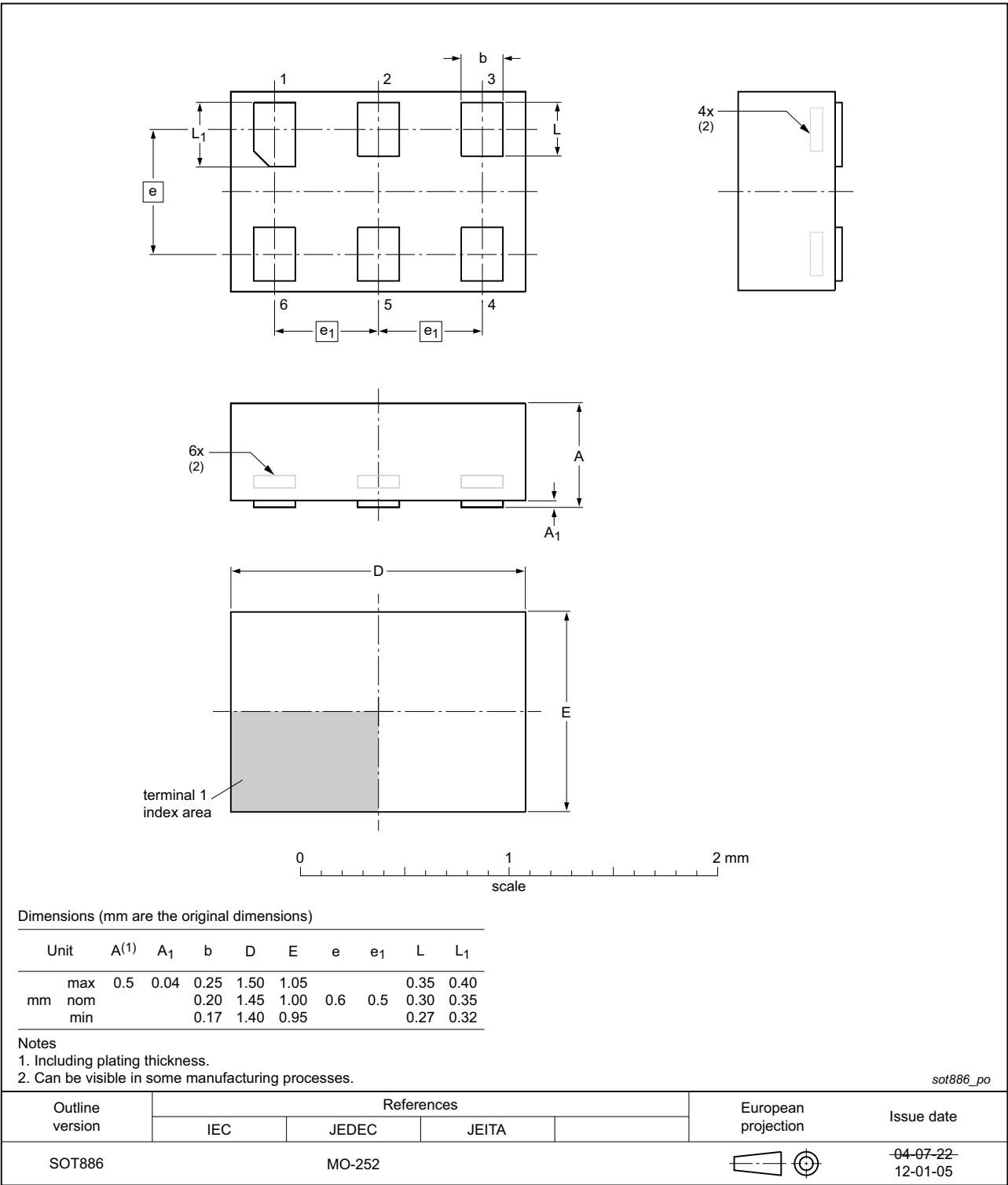


Fig 13. Package outline SOT886 (XSON6)

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
74AHC1G4212 v.1	20160415	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.

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

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19. Contents

1	General description	1
2	Features and benefits	1
3	Ordering information	1
4	Marking	2
5	Functional diagram	2
6	Pinning information	2
6.1	Pinning	2
6.2	Pin description	3
7	Functional description	3
8	Limiting values	3
9	Recommended operating conditions	4
10	Static characteristics	4
11	Dynamic characteristics	5
12	Waveforms	7
13	Crystal oscillator	8
13.1	Typical crystal oscillator circuit	8
14	Package outline	9
15	Abbreviations	11
16	Revision history	11
17	Legal information	12
17.1	Data sheet status	12
17.2	Definitions	12
17.3	Disclaimers	12
17.4	Trademarks	13
18	Contact information	13
19	Contents	14

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