

# 74AHC1G4214

## 14-stage divider and oscillator

Rev. 3 — 26 April 2018

Product data sheet

## 1 General description

74AHC1G4214 is a 14-stage divider and oscillator. It consists of a chain of 14 flip-flops. Each flip-flop divides the frequency of the previous flip-flop by two, consequently the 74AHC1G4214 counts up to  $2^{14} = 16384$ . 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 16384. 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 from -40 °C to +125 °C

## 3 Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AHC1G4214GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1

## 4 Marking

Table 2. Marking codes

Type number	Marking <sup>[1]</sup>
74AHC1G4214GW	C4

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

## 5 Functional diagram

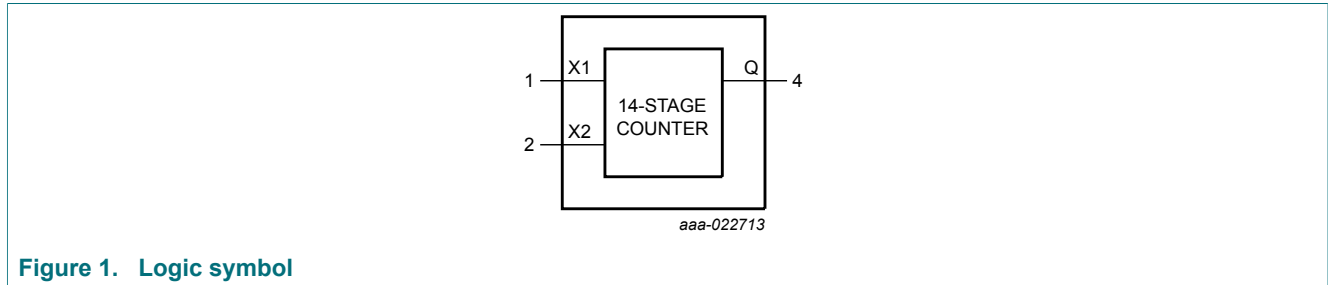


Figure 1. Logic symbol

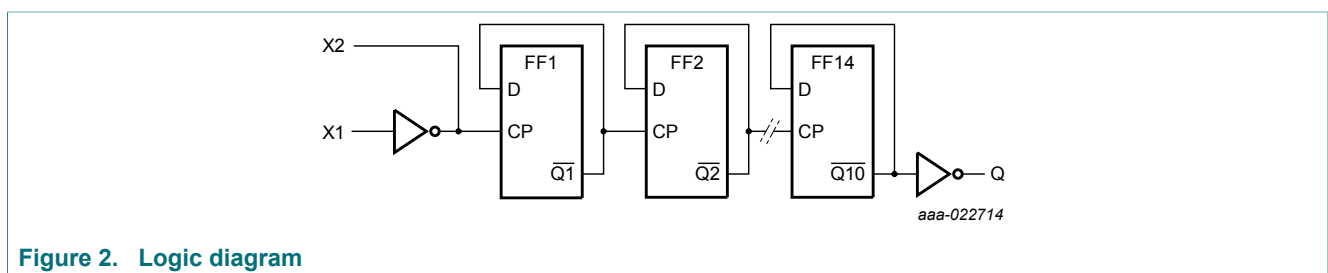


Figure 2. Logic diagram

## 6 Pinning information

### 6.1 Pinning

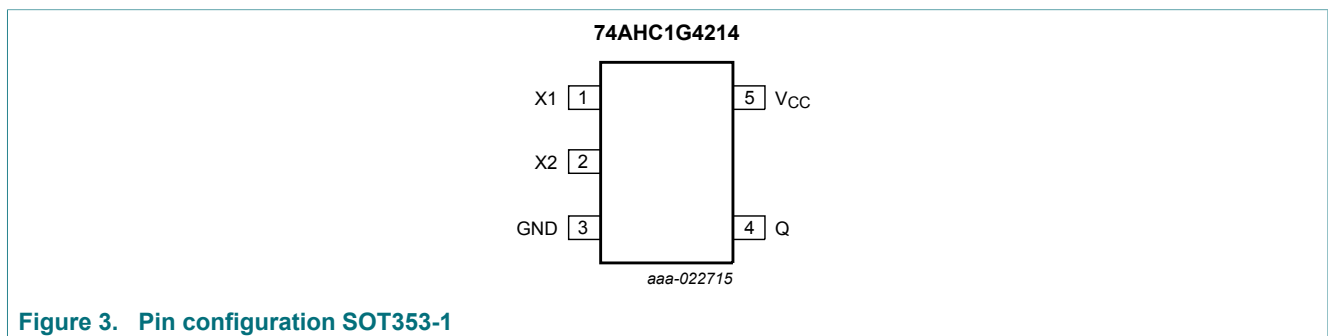


Figure 3. Pin configuration SOT353-1

### 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
X1	1	clock input/oscillator pin
X2	2	oscillator pin
GND	3	ground (0 V)
Q	4	divider output
V <sub>CC</sub>	5	supply voltage

## 7 Functional description

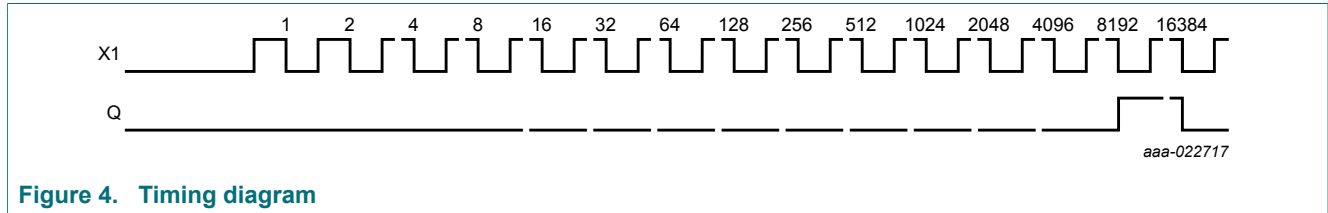


Figure 4. Timing diagram

## 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 <sup>[1]</sup>	-	±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 <sup>[2]</sup>	-	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.

## 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	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$	-	-	100	ns/V
		$V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$	-	-	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								
		$V_{CC} = 2.0 \text{ V}$	1.7	-	-	1.7	-	1.7	-	V
		$V_{CC} = 3.0 \text{ V}$	2.4	-	-	2.4	-	2.4	-	V
		$V_{CC} = 5.5 \text{ V}$	4.4	-	-	4.4	-	4.4	-	V
$V_{IL}$	LOW-level input voltage	X1								
		$V_{CC} = 2.0 \text{ V}$	-	-	0.3	-	0.3	-	0.3	V
		$V_{CC} = 3.0 \text{ V}$	-	-	0.6	-	0.6	-	0.6	V
		$V_{CC} = 5.5 \text{ V}$	-	-	1.1	-	1.1	-	1.1	V
$V_{OH}$	HIGH-level output voltage	Q; $V_I = V_{IH}$ or $V_{IL}$								
		$I_O = -50 \mu\text{A}; V_{CC} = 2.0 \text{ V}$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -50 \mu\text{A}; V_{CC} = 3.0 \text{ V}$	2.9	3.0	-	2.9	-	2.9	-	V
		$I_O = -50 \mu\text{A}; V_{CC} = 4.5 \text{ V}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.58	-	-	2.48	-	2.40	-	V
		$I_O = -8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.94	-	-	3.8	-	3.70	-	V
		X2; $V_I = V_{IH}$ or $V_{IL}$								
		$I_O = -50 \mu\text{A}; V_{CC} = 2.0 \text{ V}$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -50 \mu\text{A}; V_{CC} = 3.0 \text{ V}$	2.9	3.0	-	2.9	-	2.9	-	V
		$I_O = -50 \mu\text{A}; V_{CC} = 4.5 \text{ V}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -2.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.58	-	-	2.48	-	2.40	-	V
		$I_O = -3.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.94	-	-	3.8	-	3.70	-	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 <sub>OL</sub>	LOW-level output voltage	Q; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
		I <sub>O</sub> = 8.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.36	-	0.44	-	0.55	V
		X2; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 2.0 mA; V <sub>CC</sub> = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
I <sub>O</sub> = 3.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.36	-	0.44	-	0.55	V		
I <sub>I</sub>	input leakage current	X1; V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	1.0	-	10	-	40	µA
C <sub>I</sub>	input capacitance	X1	-	3	8	-	8	-	8	pF

## 11 Dynamic characteristics

**Table 7. Dynamic characteristics**

GND = 0 V; t<sub>r</sub> = t<sub>f</sub> = ≤ 3.0 ns. For test circuit see [Figure 7](#). For waveforms see [Figure 5](#) and [Figure 6](#).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>pd</sub>	propagation delay	X1 to X2 <sup>[1]</sup>								
		V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[2]</sup>								
		C <sub>L</sub> = 15 pF	-	3	7	1	11	1	13	ns
		C <sub>L</sub> = 50 pF	-	7	13	1	16	1	18	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V <sup>[3]</sup>								
		C <sub>L</sub> = 15 pF	-	2	5	1	7	1	9	ns
		C <sub>L</sub> = 50 pF	-	6	10	1	11	1	12	ns
		X1 to Q <sup>[1]</sup>								
		V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[2]</sup>								
		C <sub>L</sub> = 15 pF	-	33	55	1	67	1	78	ns
		C <sub>L</sub> = 50 pF	-	35	60	1	71	1	82	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V <sup>[3]</sup>								
		C <sub>L</sub> = 15 pF	-	23	36	1	44	1	52	ns
C <sub>L</sub> = 50 pF	-	25	40	1	51	1	58	ns		

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>W</sub>	pulse width	X1 HIGH or LOW								
		V <sub>CC</sub> = 3.0 V to 3.6 V	4	-	-	5	-	7	-	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	3	-	-	4	-	5	-	ns
f <sub>max</sub>	maximum frequency	X1								
		V <sub>CC</sub> = 3.3 V	125	-	-	100	-	70	-	MHz
		V <sub>CC</sub> = 5 V	165	-	-	125	-	100	-	MHz
C <sub>PD</sub>	power dissipation capacitance	C <sub>L</sub> = 50 pF; f <sub>i</sub> = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> [4]								
		V <sub>CC</sub> = 3.3 V	-	4	-	-	-	-	-	pF
		V <sub>CC</sub> = 5 V	-	5	-	-	-	-	-	pF

[1] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

[2] Typical values are measured at V<sub>CC</sub> = 3.3 V.

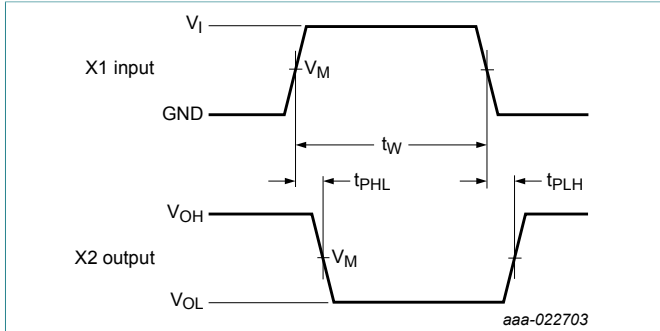
[3] Typical values are measured at V<sub>CC</sub> = 5.0 V.

[4] C<sub>PD</sub> is used to determine the dynamic power dissipation P<sub>D</sub> (μW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i + C_L \times V_{CC}^2 \times f_i / 16384$  where:

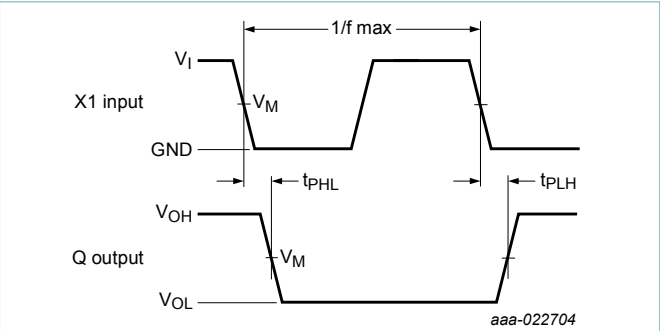
f<sub>i</sub> = input frequency in MHz; C<sub>L</sub> = output load capacitance in pF; V<sub>CC</sub> = supply voltage in Volt.

11.1 Waveforms and test circuit



Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Figure 5. Input X1 to output X2 propagation delay times**

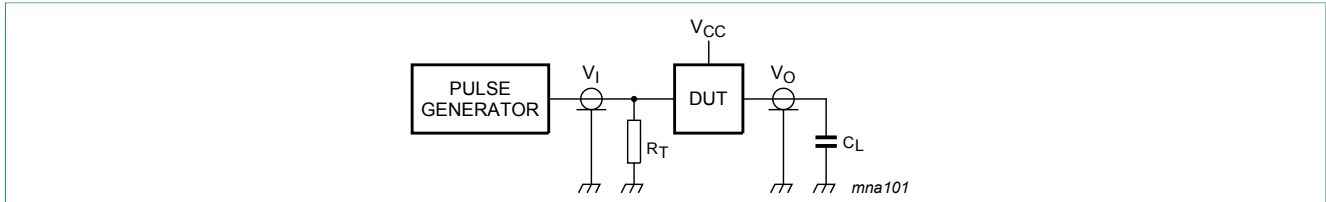


Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Figure 6. Input X1 to output Q propagation delay times**

**Table 8. Measurement points**

Inputs		Output
$V_1$	$V_M$	$V_M$
GND to $V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$



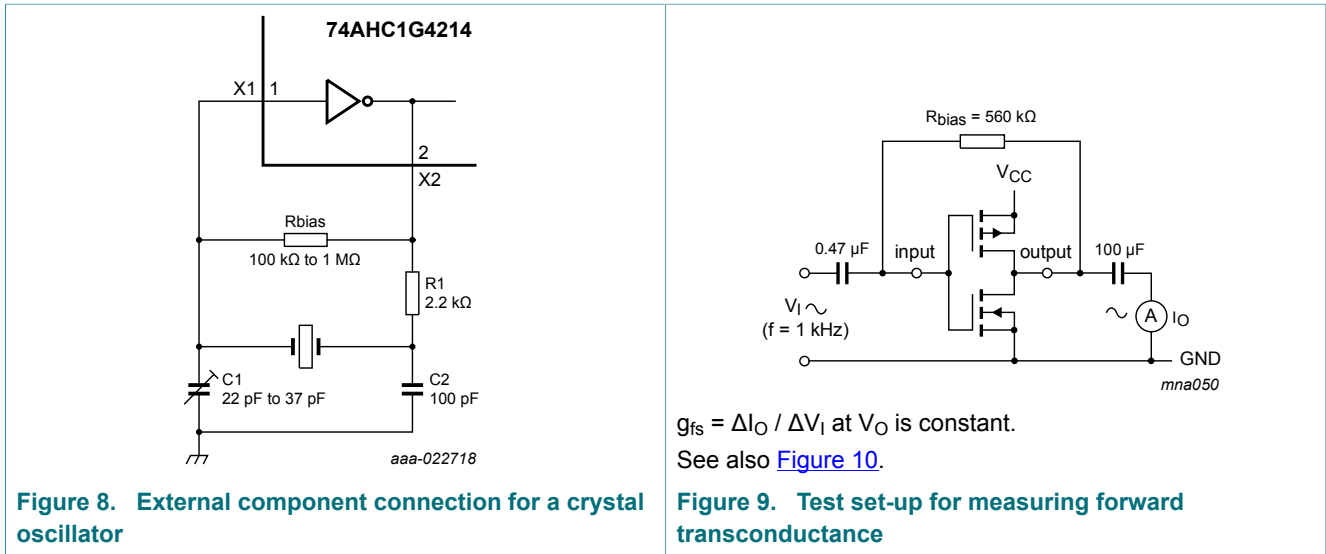
Test data is given in [Table 7](#). Definitions for test circuit:  
 $C_L$  = Load capacitance including jig and probe capacitance.  
 $R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

**Figure 7. Test circuit for measuring switching times**

## 12 Crystal oscillator

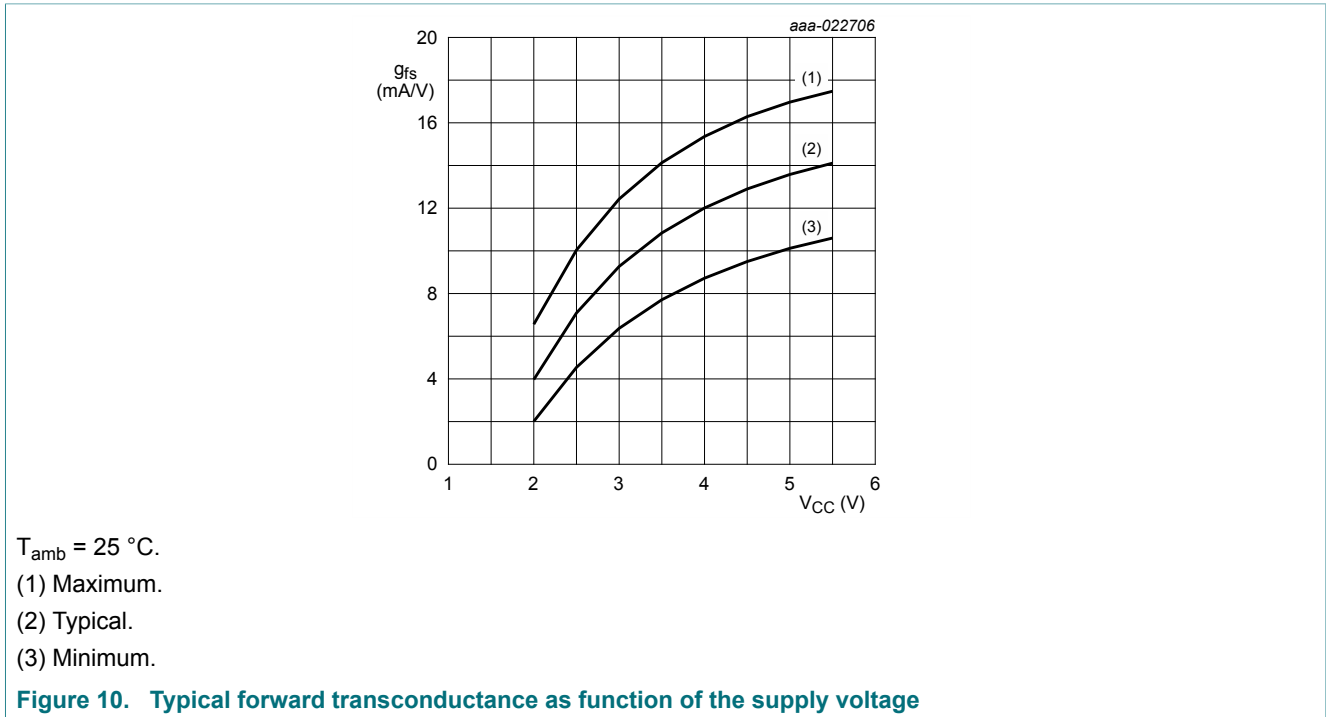
### 12.1 Typical crystal oscillator circuit

A typical crystal oscillator schematic is shown in [Figure 8](#). 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 k $\Omega$ .



**Figure 8. External component connection for a crystal oscillator**

**Figure 9. Test set-up for measuring forward transconductance**



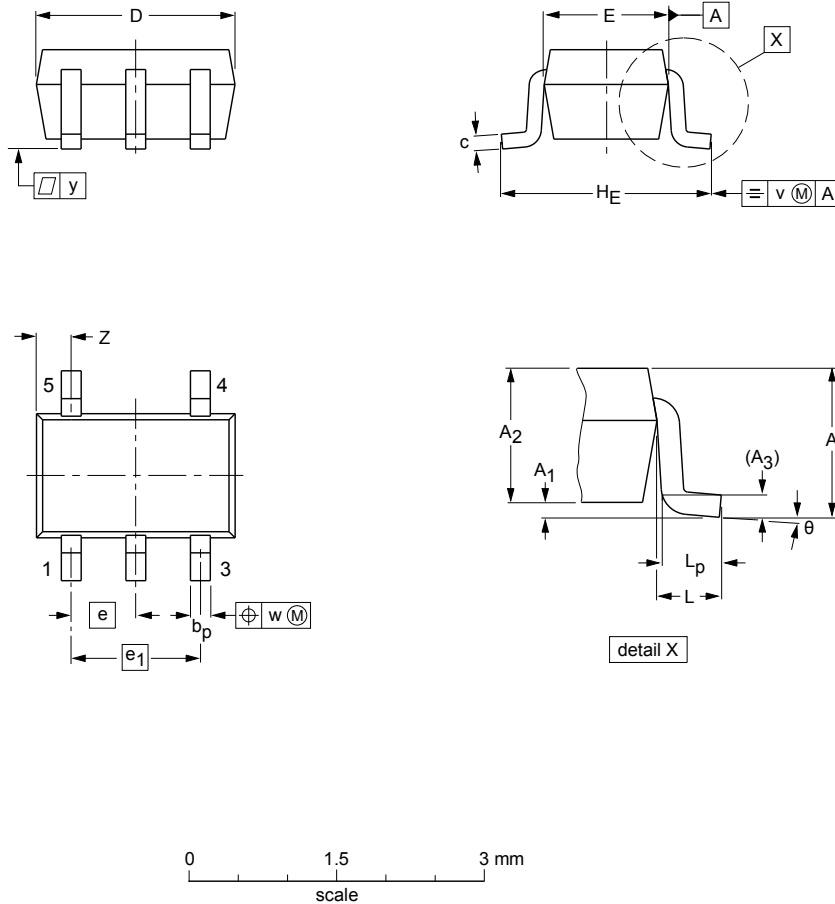
**Figure 10. Typical forward transconductance as function of the supply voltage**



13 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.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	H <sub>E</sub>	L	L <sub>p</sub>	v	w	y	Z <sup>(1)</sup>	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

Figure 11. Package outline SOT353-1 (TSSOP5)

## 14 Abbreviations

Table 9. Abbreviations

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

## 15 Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC1G4214 v.3	20180426	Product data sheet	-	74AHC1G4214 v.2
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>			
74AHC1G4214 v.2	20161026	Product data sheet	-	74AHC1G4214 v.1
Modifications:	<ul style="list-style-type: none"> <li>Type number 74AHC1G4214GM removed.</li> </ul>			
74AHC1G4214 v.1	20160415	Product data sheet	-	-

## 16 Legal information

### 16.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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 URL <http://www.nexperia.com>.

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Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

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