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Team Nexperia

XC7SH86

2-input EXCLUSIVE-OR gate

Rev. 01 — 7 September 2009

Product data sheet

1. General description

XC7SH86 is a high-speed Si-gate CMOS device. It provides a 2-input EXCLUSIVE-OR function.

2. Features

- Symmetrical output impedance
- High noise immunity
- ESD protection:
 - ◆ HBM JESD22-A114E: exceeds 2000 V
 - ◆ MM JESD22-A115-A: exceeds 200 V
 - ◆ CDM JESD22-C101C: exceeds 1000 V
- Low power dissipation
- Balanced propagation delays
- SOT353-1 and SOT753 package options
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
XC7SH86GW	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
XC7SH86GV	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SC-74A	plastic surface-mounted package; 5 leads	SOT753

4. Marking

Table 2. Marking codes

Type number	Marking code ^[1]
XC7SH86GW	fH
XC7SH86GV	f86

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

5. Functional diagram

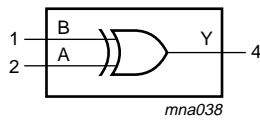


Fig 1. Logic symbol

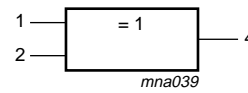


Fig 2. IEC logic symbol

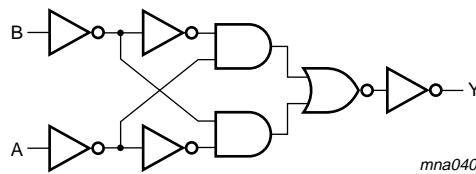


Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

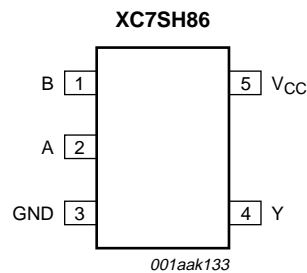


Fig 4. Pin configuration SOT353-1 and SOT753

6.2 Pin description

Table 3. Pin description

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

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level

Inputs		Output
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	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	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 both TSSOP5 and SC-74A packages: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K.

9. Recommended operating conditions

Table 6. 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	$V_{CC} = 3.3 V \pm 0.3 V$	-	-	100	ns/V
		$V_{CC} = 5.0 V \pm 0.5 V$	-	-	20	ns/V

10. Static characteristics

Table 7. 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	$V_{CC} = 2.0 V$	1.5	-	-	1.5	-	1.5	-	V
		$V_{CC} = 3.0 V$	2.1	-	-	2.1	-	2.1	-	V
		$V_{CC} = 5.5 V$	3.85	-	-	3.85	-	3.85	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 2.0 V$	-	-	0.5	-	0.5	-	0.5	V
		$V_{CC} = 3.0 V$	-	-	0.9	-	0.9	-	0.9	V
		$V_{CC} = 5.5 V$	-	-	1.65	-	1.65	-	1.65	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}								
		$I_O = -50 \mu A$; $V_{CC} = 2.0 V$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -50 \mu A$; $V_{CC} = 3.0 V$	2.9	3.0	-	2.9	-	2.9	-	V
		$I_O = -50 \mu A$; $V_{CC} = 4.5 V$	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
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}								
		$I_O = 50 \mu A$; $V_{CC} = 2.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu A$; $V_{CC} = 3.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu A$; $V_{CC} = 4.5 V$	-	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
I_I	input leakage current	$V_I = 5.5 V$ 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		-	1.5	10	-	10	-	10	pF

11. Dynamic characteristics

Table 8. Dynamic characteristics

$GND = 0\text{ V}$. For waveform see [Figure 5](#). For test circuit see [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_{pd}	propagation delay	A and B to Y [1]								
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ [2]								
		$C_L = 15\text{ pF}$	-	4.0	11.0	1.0	13.0	1.0	14.0	ns
		$C_L = 50\text{ pF}$	-	5.8	14.5	1.0	16.5	1.0	18.5	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ [3]								
		$C_L = 15\text{ pF}$	-	3.4	6.8	1.0	8.0	1.0	8.5	ns
C_{PD}	power dissipation capacitance	$C_L = 50\text{ pF}; f = 1\text{ MHz};$								
		$V_I = GND\text{ to }V_{CC}$	-	9	-	-	-	-	-	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).

$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum(C_L \times V_{CC}^2 \times f_o)$ where:

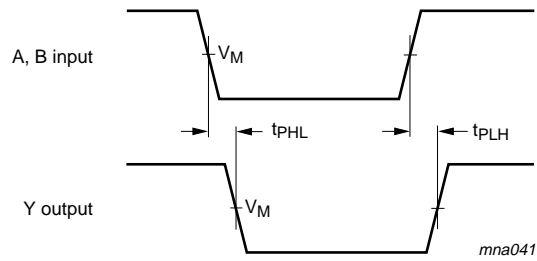
f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in V.

12. Waveforms

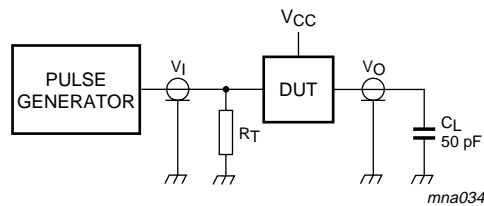


Measurement points are given in [Table 9](#).

Fig 5. The input (A and B) to output (Y) propagation delays

Table 9. Measurement points

Type	Input		Output
	V_I	V_M	V_M
XC7SH86	GND to V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$



Test data is given in [Table 10](#). Definitions for test circuit:

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.

Fig 6. Load circuitry for switching times

Table 10. Test data

Type	Input		Load	Test
	V_I	t_r, t_f	C_L	
XC7SH86	V_{CC}	≤ 3.0 ns	15 pF, 50 pF	t_{PLH}, t_{PHL}

13. Package outline

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

SOT353-1

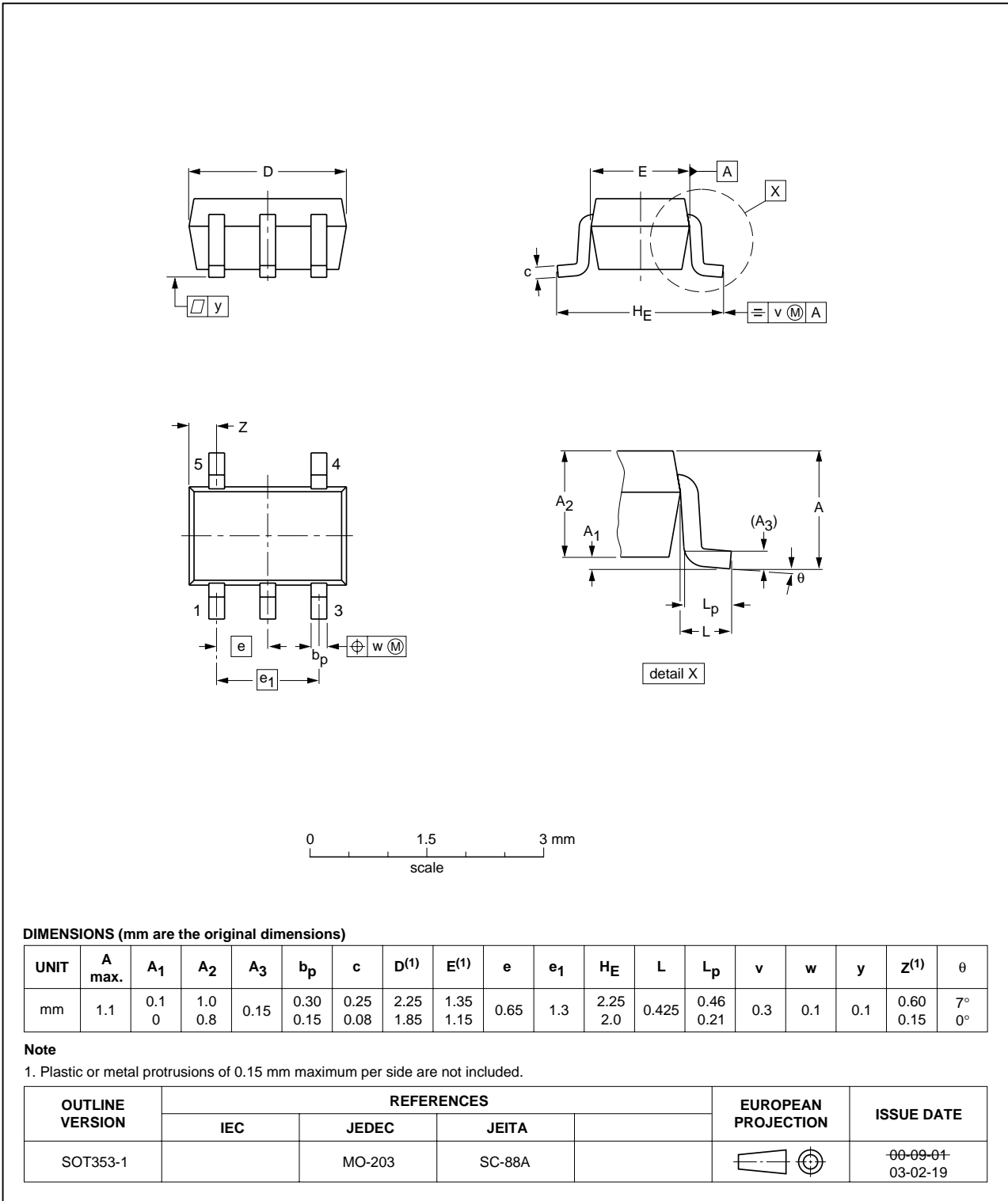


Fig 7. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

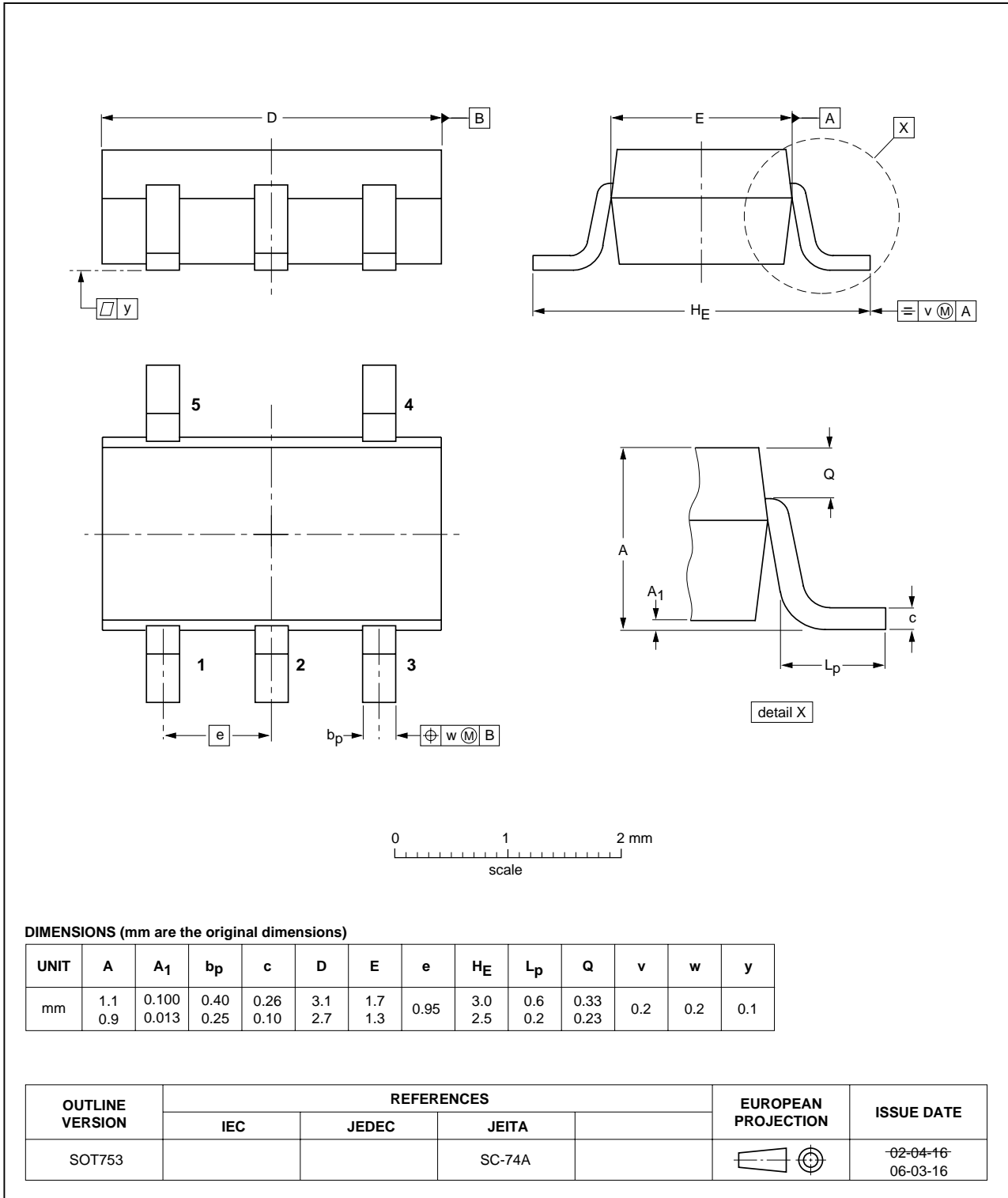


Fig 8. Package outline SOT753 (SC-74A)

14. Abbreviations

Table 11. 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 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
XC7SH86_1	20090907	Product data sheet	-	-

16. Legal information

16.1 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.
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[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".

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18. Contents

1 **General description** 1

2 **Features** 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** 6

13 **Package outline** 7

14 **Abbreviations** 9

15 **Revision history** 9

16 **Legal information** 10

16.1 Data sheet status 10

16.2 Definitions 10

16.3 Disclaimers 10

16.4 Trademarks 10

17 **Contact information** 10

18 **Contents** 11

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Date of release: 7 September 2009

Document identifier: XC7SH86_1