

74AHC1G14-Q100; 74AHCT1G14-Q100

Inverting Schmitt trigger

Rev. 4 — 12 January 2022

Product data sheet

1. General description

The 74AHC1G14-Q100 and 74AHCT1G14-Q100 are single inverters with Schmitt-trigger inputs. Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

The AHC device has CMOS input switching levels and supply voltage range 2 V to 5.5 V.

The AHCT device has TTL input switching levels and supply voltage range 4.5 V to 5.5 V.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Wide supply voltage range from 2.0 V to 5.5 V
- Overvoltage tolerant inputs to 5.5 V
- CMOS low power dissipation
- Symmetrical output impedance
- High noise immunity
- Latch-up performance exceeds 100 mA per JESD78 Class II Level A
- ESD protection:
 - MIL-STD-883, method 3015 exceeds 2000 V
 - HBM JESD22-A114E: exceeds 2000 V
 - MM JESD22-A115-A: exceeds 200 V

3. Applications

- Wave and pulse shapers
- Astable multivibrators
- Monostable multivibrators

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AHC1G14GW-Q100	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74AHCT1G14GW-Q100				
74AHC1G14GV-Q100	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74AHCT1G14GV-Q100				

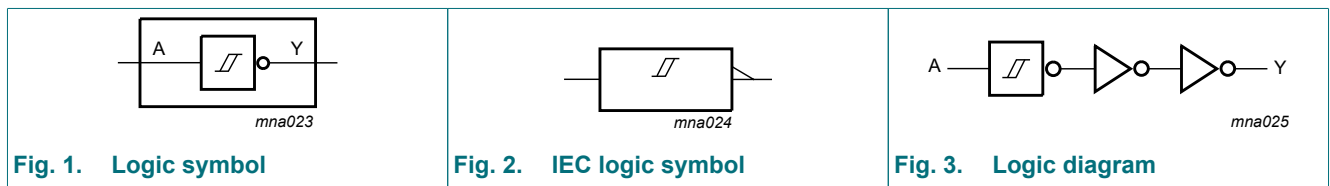
5. Marking

Table 2. Marking codes

Type number	Marking code ^[1]
74AHC1G14GW-Q100	AF
74AHCT1G14GW-Q100	CF
74AHC1G14GV-Q100	A14
74AHCT1G14GV-Q100	C14

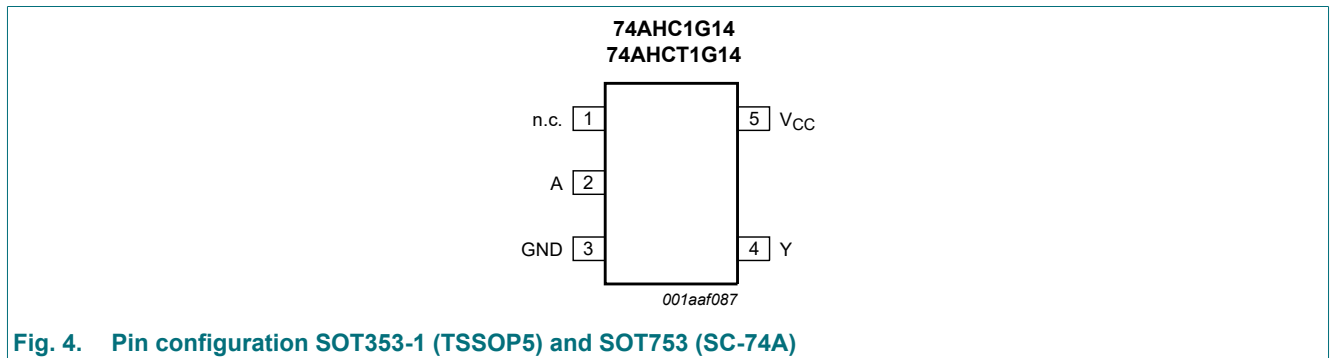
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

6. Functional diagram



7. Pinning information

7.1. Pinning



7.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
n.c.	1	not connected
A	2	data input
GND	3	ground (0 V)
Y	4	data output
V _{CC}	5	supply voltage

8. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level

Input	Output
A	Y
L	H
H	L

9. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

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 SOT353-1 (TSSOP5) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.

For SOT753 (SC-74A) package: P_{tot} derates linearly with 3.8 mW/K above 85 °C.

10. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	74AHC1G14-Q100			74AHCT1G14-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
V_{CC}	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
V_I	input voltage		0	-	5.5	0	-	5.5	V
V_O	output voltage		0	-	V_{CC}	0	-	V_{CC}	V
T_{amb}	ambient temperature		-40	+25	+125	-40	+25	+125	°C

11. 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	
74AHC1G14-Q100										
V _{OH}	HIGH-level output voltage	V _I = V _{T+} or V _{T-}								
		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
V _{OL}	LOW-level output voltage	V _I = V _{T+} or V _{T-}								
		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
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
74AHCT1G14-Q100										
V _{OH}	HIGH-level output voltage	V _I = V _{T+} or V _{T-} ; V _{CC} = 4.5 V								
		I _O = -50 µA	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -8.0 mA	3.94	-	-	3.8	-	3.70	-	V
V _{OL}	LOW-level output voltage	V _I = V _{T+} or V _{T-} ; V _{CC} = 4.5 V								
		I _O = 50 µA	-	0	0.1	-	0.1	-	0.1	V
		I _O = 8.0 mA	-	-	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
ΔI _{CC}	additional supply current	per input pin; V _I = 3.4 V; other inputs at V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
C _I	input capacitance		-	1.5	10	-	10	-	10	pF

11.1. Transfer characteristics

Table 8. Transfer characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V). See Fig. 5 and Fig. 6.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74AHC1G14-Q100										
V _{T+}	positive-going threshold voltage	V _{CC} = 3.0 V	-	-	2.2	-	2.2	-	2.2	V
		V _{CC} = 4.5 V	-	-	3.15	-	3.15	-	3.15	V
		V _{CC} = 5.5 V	-	-	3.85	-	3.85	-	3.85	V
V _{T-}	negative-going threshold voltage	V _{CC} = 3.0 V	0.9	-	-	0.9	-	0.9	-	V
		V _{CC} = 4.5 V	1.35	-	-	1.35	-	1.35	-	V
		V _{CC} = 5.5 V	1.65	-	-	1.65	-	1.65	-	V
V _H	hysteresis voltage	V _{CC} = 3.0 V	0.3	-	1.2	0.3	1.2	0.25	1.2	V
		V _{CC} = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V _{CC} = 5.5 V	0.5	-	1.6	0.5	1.6	0.45	1.6	V
74AHCT1G14-Q100										
V _{T+}	positive-going threshold voltage	V _{CC} = 4.5 V	-	-	2.0	-	2.0	-	2.0	V
		V _{CC} = 5.5 V	-	-	2.0	-	2.0	-	2.0	V
V _{T-}	negative-going threshold voltage	V _{CC} = 4.5 V	0.5	-	-	0.5	-	0.5	-	V
		V _{CC} = 5.5 V	0.6	-	-	0.6	-	0.6	-	V
V _H	hysteresis voltage	V _{CC} = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V _{CC} = 5.5 V	0.4	-	1.6	0.4	1.6	0.35	1.6	V

11.2. Transfer characteristic waveforms

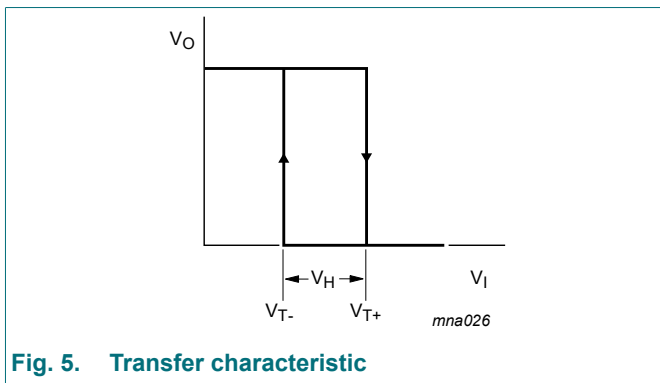


Fig. 5. Transfer characteristic

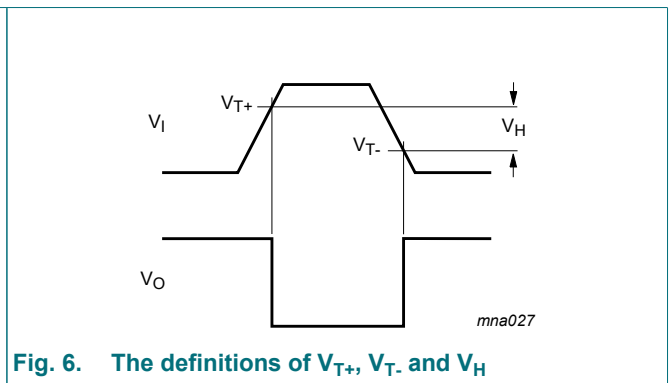
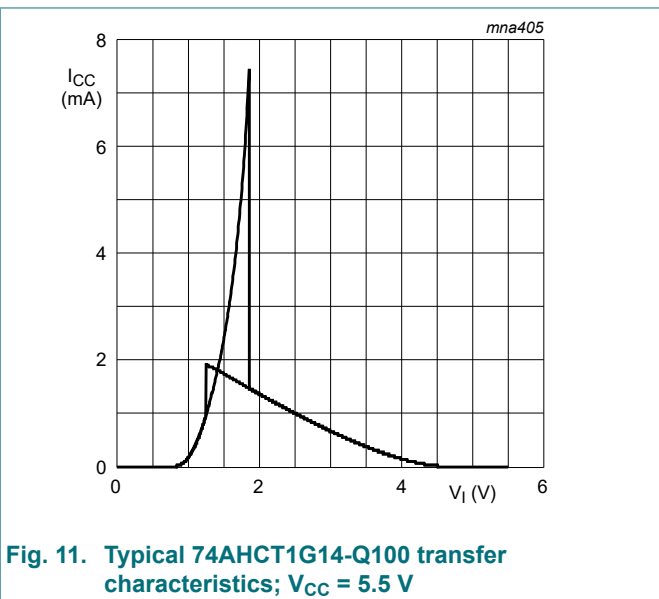
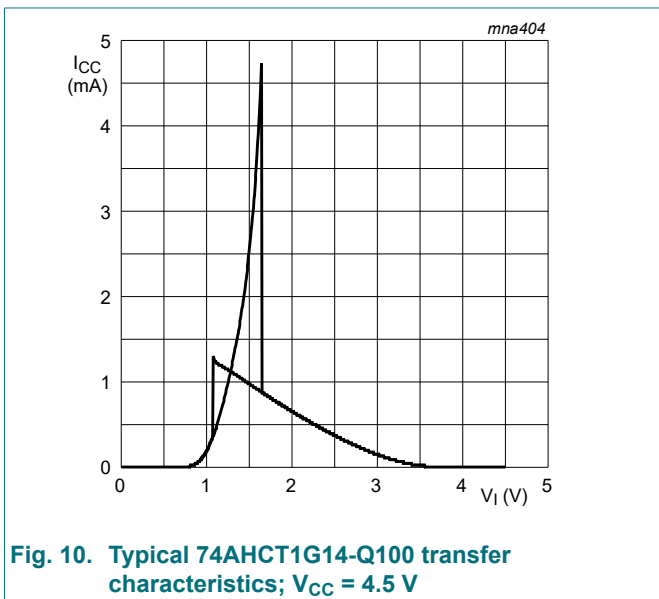
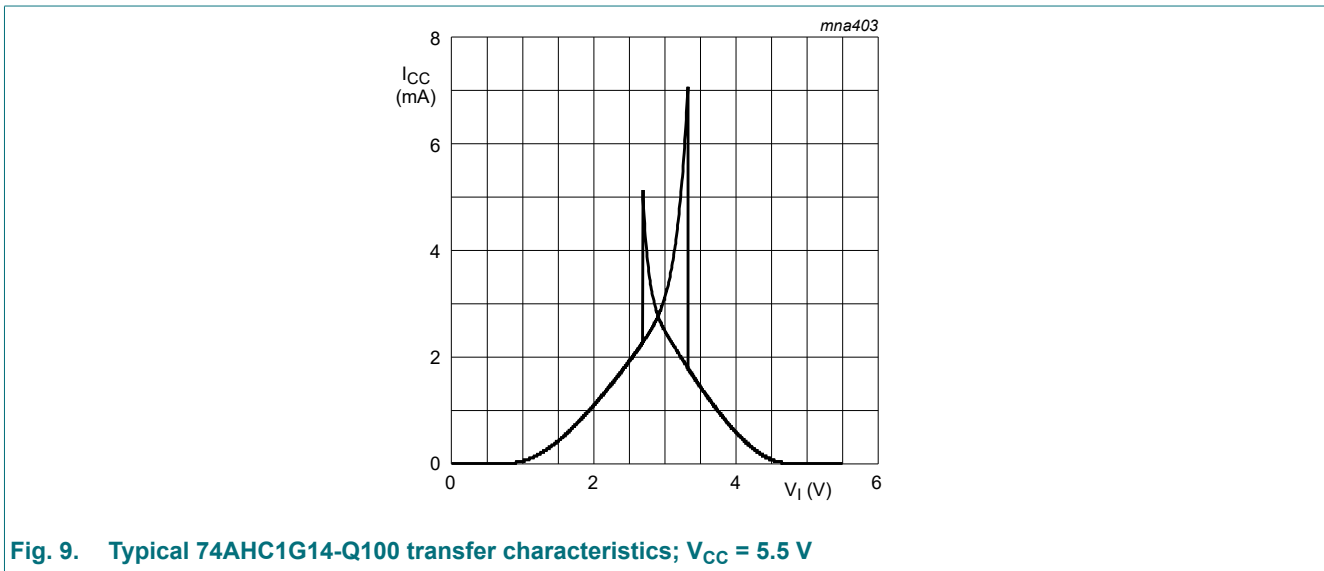
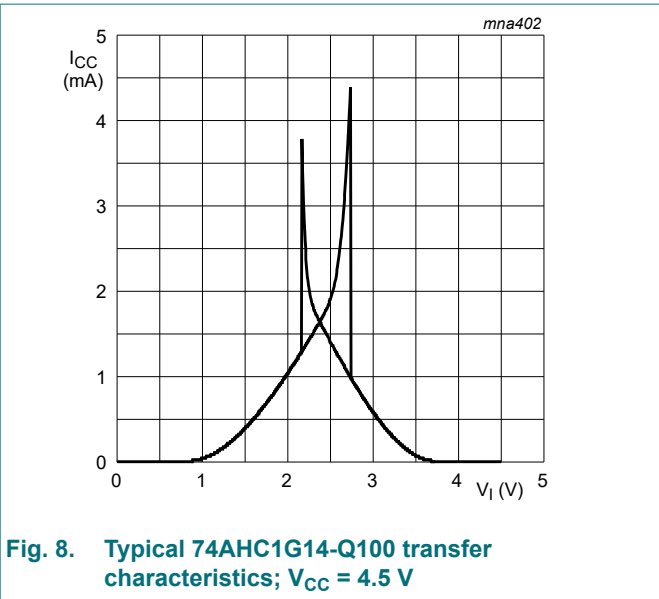
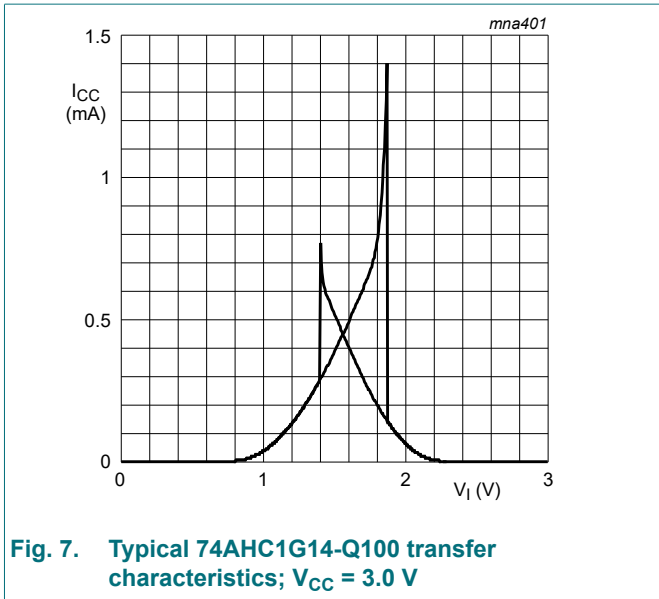


Fig. 6. The definitions of V_{T+}, V_{T-} and V_H



12. Dynamic characteristics

Table 9. Dynamic characteristics

$GND = 0\text{ V}$; $t_r = t_f \leq 3.0\text{ ns}$. For waveform see Fig. 12. For test circuit see Fig. 13.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74AHC1G14-Q100										
t_{pd}	propagation delay	A to Y; [1]								
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ [2]								
		$C_L = 15\text{ pF}$	-	4.2	12.8	1.0	15.0	1.0	16.5	ns
		$C_L = 50\text{ pF}$	-	6.0	16.3	1.0	18.5	1.0	20.5	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ [3]								
		$C_L = 15\text{ pF}$	-	3.2	8.6	1.0	10.0	1.0	11.0	ns
		$C_L = 50\text{ pF}$	-	4.6	10.6	1.0	12.0	1.0	13.5	ns
C_{PD}	power dissipation capacitance	per buffer; $C_L = 50\text{ pF}$; $f = 1\text{ MHz}$; $V_I = GND\text{ to }V_{CC}$ [4]	-	12	-	-	-	-	-	pF
74AHCT1G14-Q100										
t_{pd}	propagation delay	A to Y; [1][3]								
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$								
		$C_L = 15\text{ pF}$	-	4.1	7.0	1.0	8.0	1.0	9.0	ns
		$C_L = 50\text{ pF}$	-	5.9	8.5	1.0	10.0	1.0	11.0	ns
C_{PD}	power dissipation capacitance	per buffer; [4]	-	13	-	-	-	-	-	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).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in Volts.

12.1. Waveform and test circuit

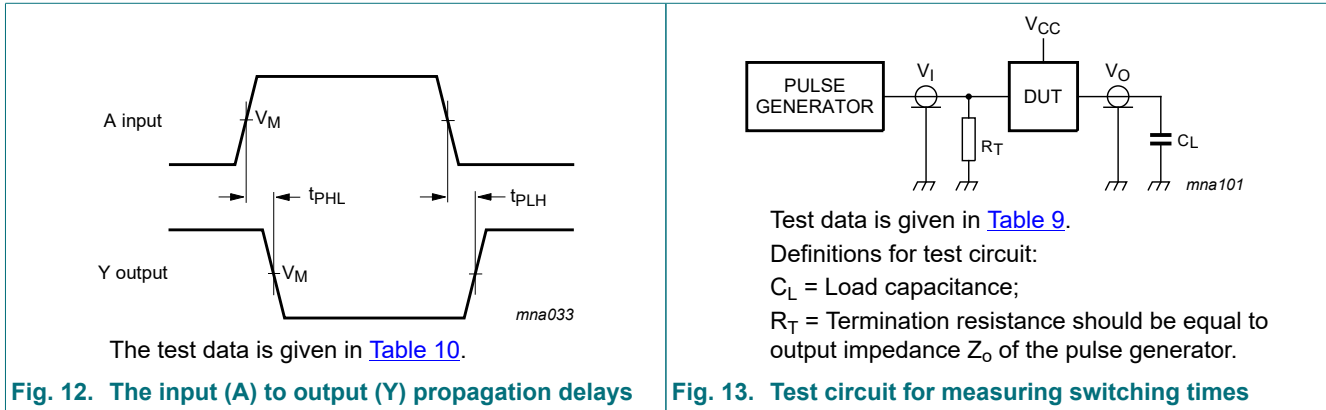


Fig. 12. The input (A) to output (Y) propagation delays

Fig. 13. Test circuit for measuring switching times

Table 10. Test data

Type number	Input		Output
	V_I	V_M	V_M
74AHC1G14-Q100	GND to V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
74AHCT1G14-Q100	GND to 3.0 V	1.5 V	$0.5 \times V_{CC}$

13. Application information

The slow input rise and fall times cause additional power dissipation, which can be calculated using the following formula:

$$P_{add} = f_i \times (t_r \times \Delta I_{CC(AV)} + t_f \times \Delta I_{CC(AV)}) \times V_{CC} \text{ where:}$$

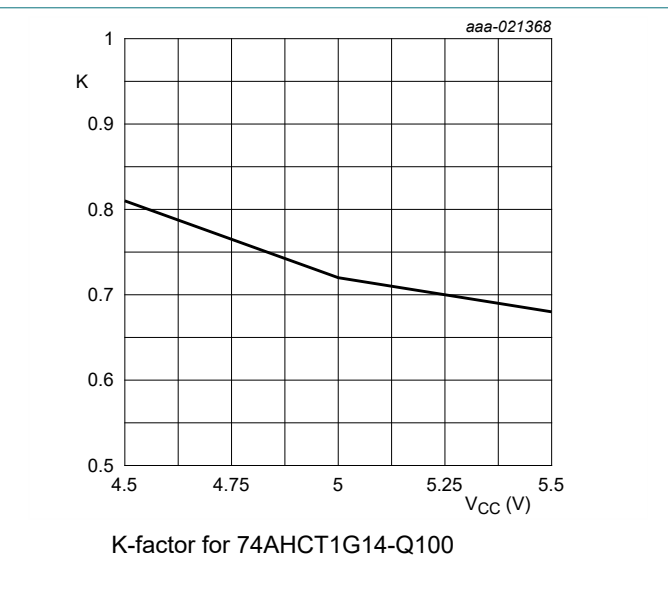
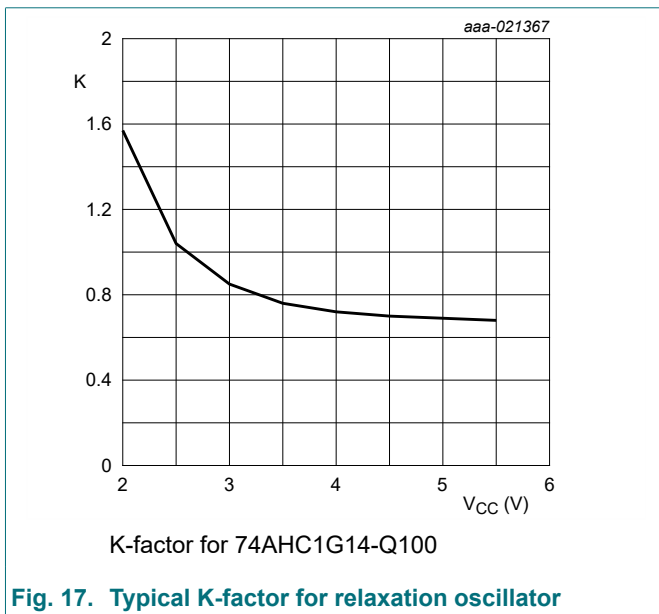
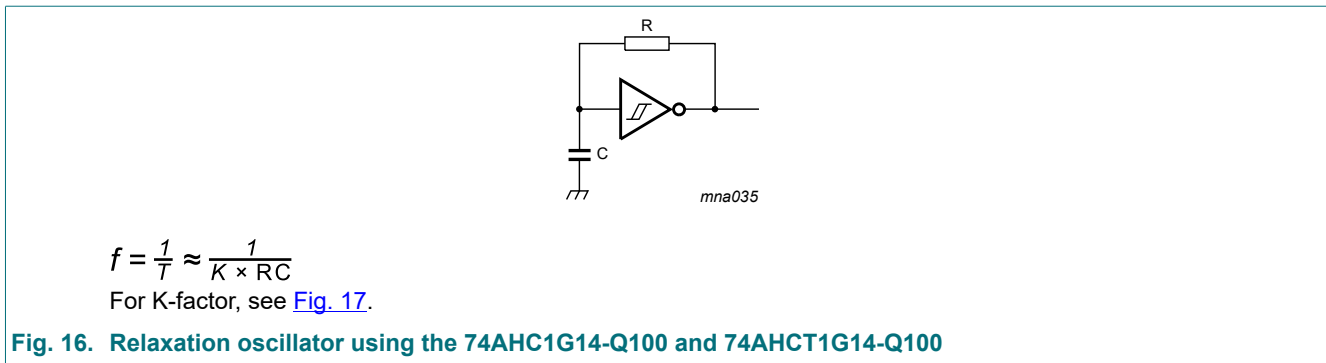
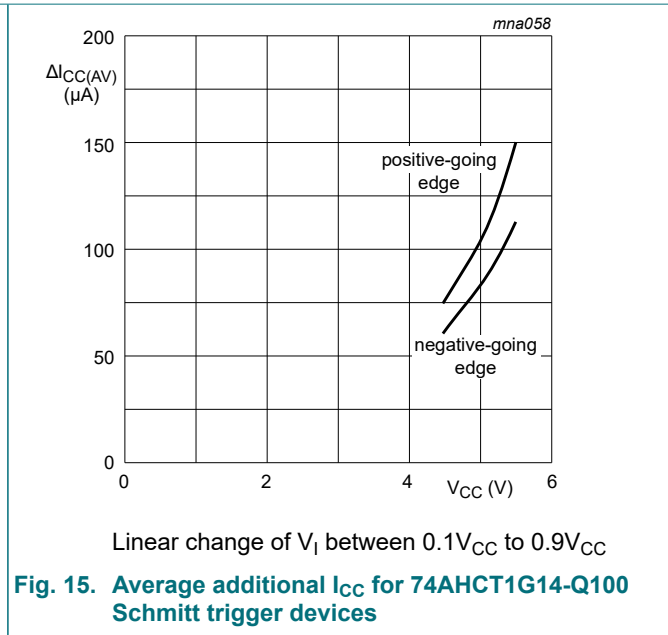
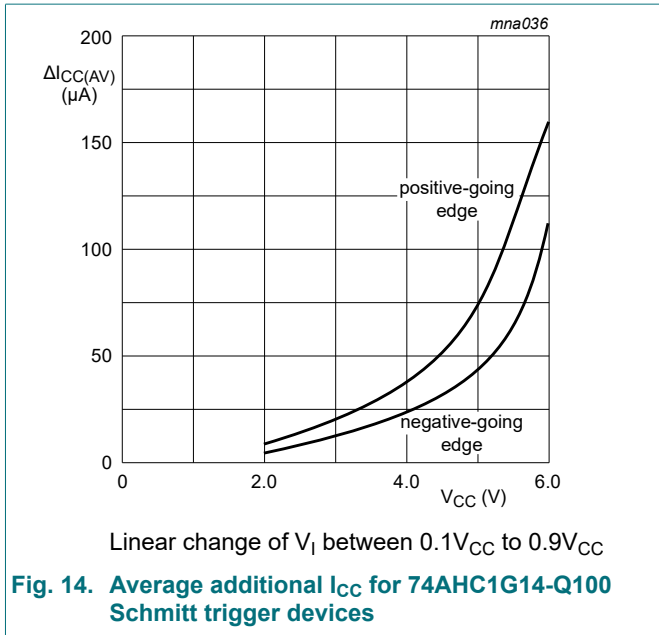
- P_{add} = additional power dissipation (μW);
- f_i = input frequency (MHz);
- t_r = input rise time (ns); 10 % to 90 %;
- t_f = input fall time (ns); 90 % to 10 %;
- $\Delta I_{CC(AV)}$ = average additional supply current (μA).

Average additional I_{CC} differs with positive or negative input transitions, as shown in [Fig. 14](#) and [Fig. 15](#).

For 74AHC1G14-Q100 and 74AHCT1G14-Q100 used in relaxation oscillator circuit, see [Fig. 16](#).

Note to the application information:

- All values given are typical unless otherwise specified.



14. Package outline

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

SOT353-1

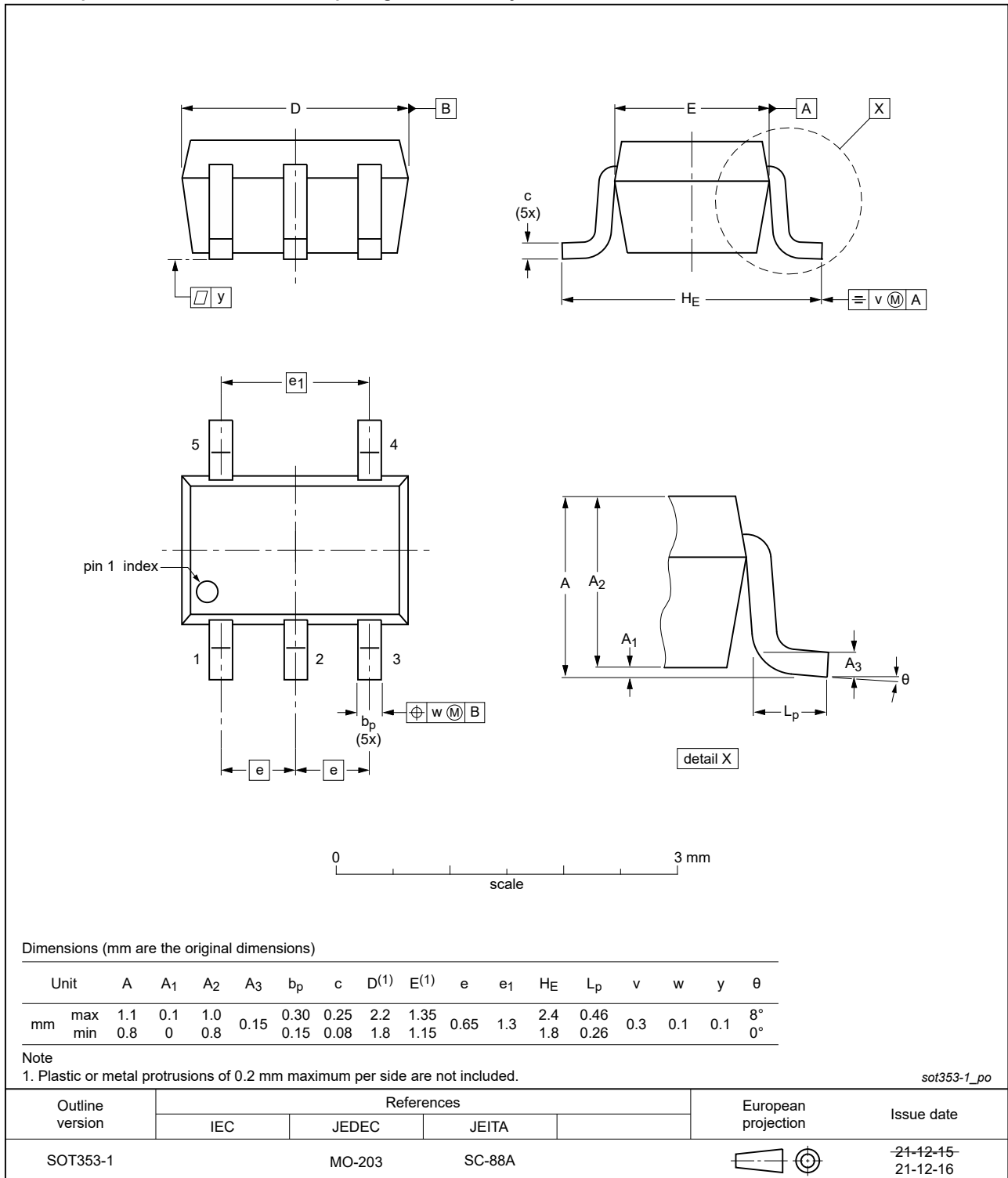


Fig. 18. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

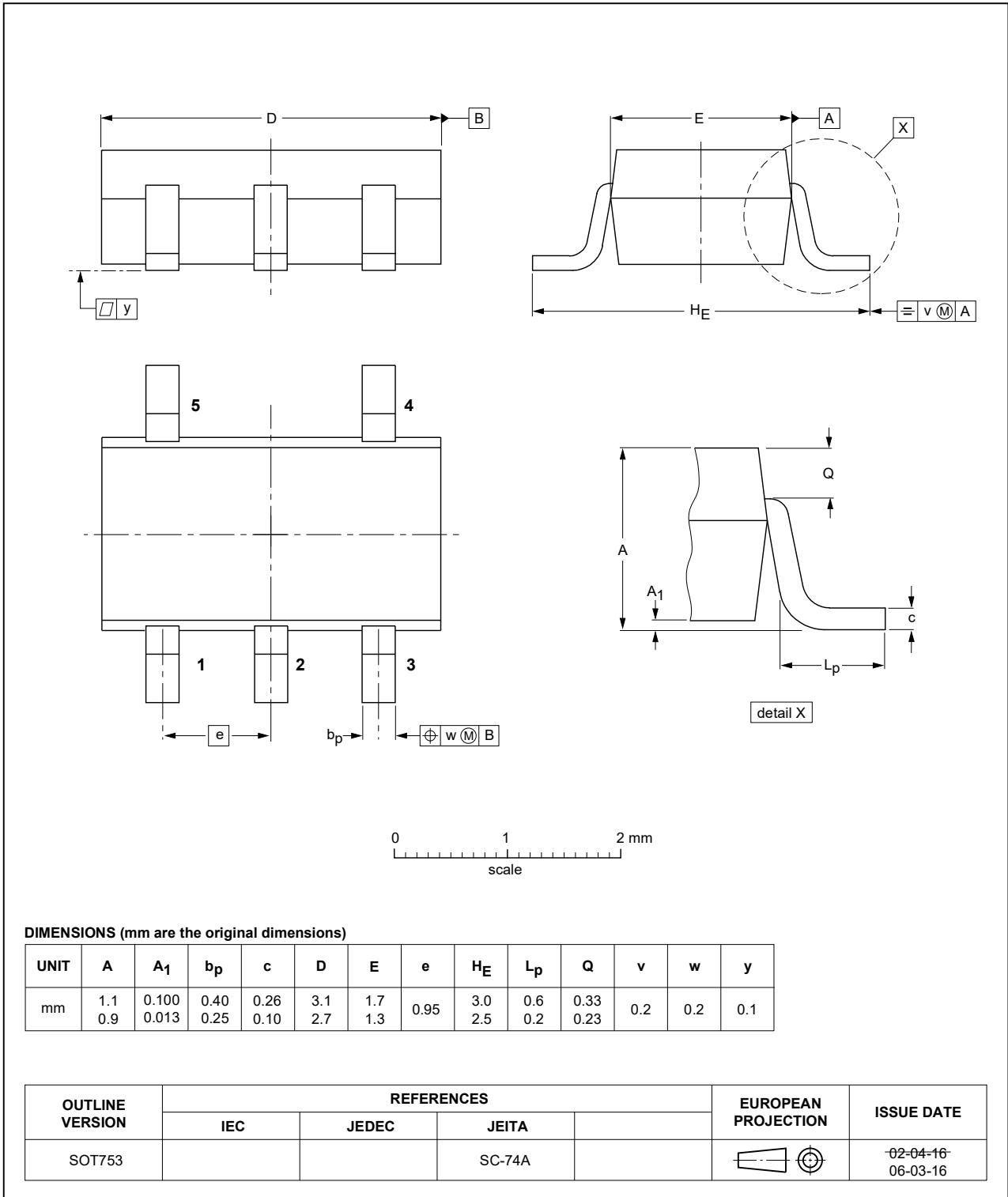


Fig. 19. Package outline SOT753 (SC-74A)

15. Abbreviations

Table 11. Abbreviations

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MIL	Military
MM	Machine Model
TTL	Transistor-Transistor Logic

16. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT1G14_Q100 v.4	20220112	Product data sheet	-	74AHC_AHCT1G14_Q100 v.3
Modifications:	<ul style="list-style-type: none"> • Section 1 and Section 2 updated • Fig. 18: Package outline drawing for SOT353-1 (TSSOP5) has changed. 			
74AHC_AHCT1G14_Q100 v.3	20200403	Product data sheet	-	74AHC_AHCT1G14_Q100 v.2
Modifications:	<ul style="list-style-type: none"> • 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. • Table 5: Derating values for P_{tot} total power dissipation updated. 			
74AHC_AHCT1G14_Q100 v.2	20160118	Product data sheet	-	74AHC_AHCT1G14_Q100 v.1
Modifications:	<ul style="list-style-type: none"> • Fig. 17 added (typical K-factor for relaxation oscillator). 			
74AHC_AHCT1G14_Q100 v.1	20120713	Product data sheet	-	-

17. 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.

- [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 <https://www.nexperia.com>.

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Contents

1. General description	1
2. Features and benefits	1
3. Applications	1
4. Ordering information	1
5. Marking	2
6. Functional diagram	2
7. Pinning information	2
7.1. Pinning.....	2
7.2. Pin description.....	2
8. Functional description	3
9. Limiting values	3
10. Recommended operating conditions	3
11. Static characteristics	4
11.1. Transfer characteristics.....	5
11.2. Transfer characteristic waveforms.....	5
12. Dynamic characteristics	7
12.1. Waveform and test circuit.....	8
13. Application information	8
14. Package outline	10
15. Abbreviations	12
16. Revision history	12
17. Legal information	13

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