Single Schmitt trigger buffer Rev. 2 — 5 October 2016

General description 1.

The 74AHC1G17 and 74AHCT1G17 are single buffers 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.

Features and benefits 2.

- 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
- Specified from -40 °C to +125 °C

Applications 3.

- Wave and pulse shapers
- Astable multivibrators
- Monostable multivibrators



Ordering information 4.

Type number	Package										
	Temperature range	Name	Description	Version							
74AHC1G17GW	–40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package;	SOT353-							
74AHCT1G17GW			5 leads; body width 1.25 mm								
74AHC1G17GV	–40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753							
74AHCT1G17GV											

Marking 5.

Table 2. Marking codes						
Type number	Marking code ^[1]					
74AHC1G17GW	AJ					
74AHCT1G17GW	CJ					
74AHC1G17GV	A17					
74AHCT1G17GV	C17					

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

Functional diagram 6.

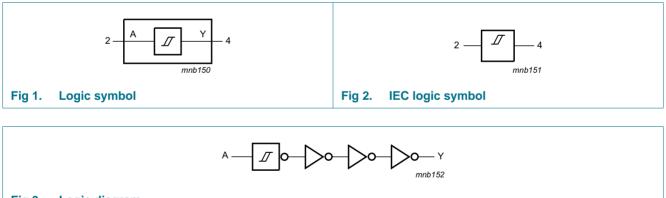
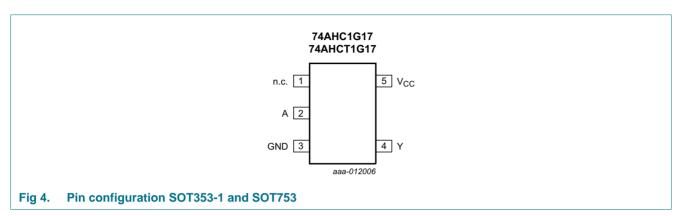


Fig 3. Logic diagram _____

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	L
Н	Н

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
VI	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	<u>[1]</u>	-	±20	mA
lo	output current	$-0.5 \text{ V} < \text{V}_{\text{O}} < \text{V}_{\text{CC}} + 0.5 \text{ V}$		-	±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	$T_{amb} = -40 \ ^{\circ}C \ to +125 \ ^{\circ}C$	[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 and SC-74A packages: above 87.5 °C the value of Ptot derates linearly with 4.0 mW/K.

10. Recommended operating conditions

Table 6. Recommended operating conditions

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

Symbol	Parameter	Conditions	74AHC1G17			74AHCT1G17			Unit
			Min	Тур	Max	Min	Тур	Max	
V _{CC}	supply voltage		2.0	5.0	5.5	4.5	5.0	5.5	V
VI	input voltage		0	-	5.5	0	-	5.5	V
Vo	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	Тур	Max	Min	Max	Min	Мах	
74AHC1	G17				1		1		1	
V _{OH}	HIGH-level	$V_I = V_{T+} \text{ or } V_{T-}$								
output voltage	output voltage	$I_0 = -50 \ \mu A; \ V_{CC} = 2.0 \ V$	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	$V_I = V_{T+} \text{ or } V_{T-}$								
	output voltage	$I_0 = 50 \ \mu A; \ V_{CC} = 2.0 \ V$	-	0	0.1	-	0.1	-	0.1	V
		$I_0 = 50 \ \mu A; \ V_{CC} = 3.0 \ V$	-	0	0.1	-	0.1	-	0.1	V
		$I_0 = 50 \ \mu A; \ V_{CC} = 4.5 \ V$	-	0	0.1	-	0.1	-	0.1	V
		$I_{O} = 4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V
		I_{O} = 8.0 mA; V_{CC} = 4.5 V	-	-	0.36	-	0.44	-	0.55	V
lı	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		-	-	1.0	-	10	-	40	μA
CI	input capacitance		-	1.5	10	-	10	-	10	pF
74AHCT	1G17				1	1	1		1	
V _{OH}	HIGH-level	$V_{I} = V_{T+} \text{ or } V_{T-}; V_{CC} = 4.5 \text{ V}$								
	output voltage	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	$V_{I} = V_{T+} \text{ or } V_{T-}; V_{CC} = 4.5 \text{ V}$								
	output voltage	I _O = 50 μA	-	0	0.1	-	0.1	-	0.1	V
		I _O = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
lı	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
Δl _{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
CI	input capacitance		-	1.5	10	-	10	-	10	pF

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11.1 Transfer characteristics

Table 8. Transfer characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V). See Figure 7 and Figure 8.

Symbol	Parameter	Conditions		25 °C		–40 °C	to +85 °C	–40 °C t	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74AHC1	G17									
V _{T+}	positive-going	V _{CC} = 3.0 V	-	-	2.2	-	2.2	-	2.2	V
	threshold voltage	V _{CC} = 4.5 V	-	-	3.15	-	3.15	-	3.15	V
	vollage	V _{CC} = 5.5 V	-	-	3.85	-	3.85	-	3.85	V
V _{T-}	negative-going	V _{CC} = 3.0 V	0.9	-	-	0.9	-	0.9	-	V
	threshold	V _{CC} = 4.5 V	1.35	-	-	1.35	-	1.35	-	V
voltage	V _{CC} = 5.5 V	1.65	-	-	1.65	-	1.65	-	V	
V _H hysteresis		V _{CC} = 3.0 V	0.3	-	1.2	0.3	1.2	0.25	1.2	V
	voltage	V _{CC} = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V _{CC} = 5.5 V	0.5	-	1.6	0.5	1.6	0.45	1.6	V
74AHCT	1G17						1		1	
V _{T+}	positive-going	V _{CC} = 4.5 V	-	-	2.0	-	2.0	-	2.0	V
	threshold voltage	V _{CC} = 5.5 V	-	-	2.0	-	2.0	-	2.0	V
V _{T-}	negative-going	V _{CC} = 4.5 V	0.5	-	-	0.5	-	0.5	-	V
threshold voltage		V _{CC} = 5.5 V	0.6	-	-	0.6	-	0.6	-	V
V _H	hysteresis	$V_{CC} = 4.5 V$	0.4	-	1.4	0.4	1.4	0.35	1.4	V
	voltage	V _{CC} = 5.5 V	0.4	-	1.6	0.4	1.6	0.35	1.6	V

12. Dynamic characteristics

Table 9. Dynamic characteristics

GND = 0 V; $t_r = t_f \le 3.0$ ns. For waveform, see <u>Figure 5</u>. For test circuit, see <u>Figure 6</u>.

Symbol	Parameter	Conditions			25 °C		–40 °C	to +85 °C	–40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max		
74AHC1	G17						1	1	1	1	
t _{pd}	propagation	A to Y	<u>[1]</u>								
	delay	$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	[2]								
		C _L = 15 pF		-	4.2	12.8	1.0	15.0	1.0	16.5	ns
		C _L = 50 pF		-	6.0	16.3	1.0	18.5	1.0	20.5	ns
		V_{CC} = 4.5 V to 5.5 V	[3]								-
		C _L = 15 pF		-	3.2	8.6	1.0	10.0	1.0	11.0	ns
		C _L = 50 pF		-	4.6	10.6	1.0	12.0	1.0	13.5	ns
C _{PD}	power dissipation capacitance	per buffer; $C_L = 50 \text{ pF}; f = 1 \text{ MHz};$ $V_I = \text{GND to } V_{CC}$	<u>[4]</u>	-	12	-	-	-	-	-	pF
74AHCT	1G17									1	
t _{pd}	propagation delay	A to Y V _{CC} = 4.5 V to 5.5 V	<u>[1][3]</u>								
		C _L = 15 pF		-	4.1	7.0	1.0	8.0	1.0	9.0	ns
		C _L = 50 pF		-	5.9	8.5	1.0	10.0	1.0	11.0	ns
C _{PD}	power dissipation capacitance	per buffer; V _I = GND to V_{CC}	<u>[4]</u>	-	13	-	-	-	-	-	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 $P_D (\mu W)$. $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$ 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 Volts.

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13. Waveforms

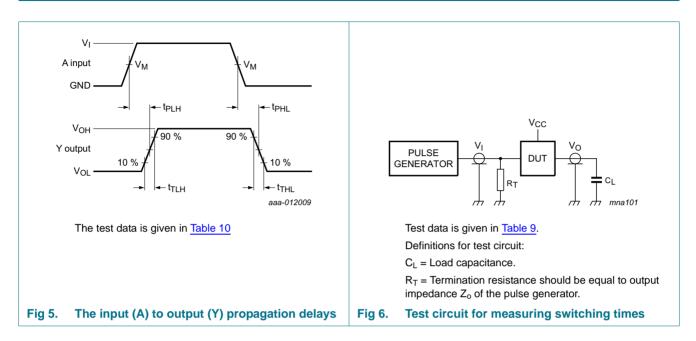
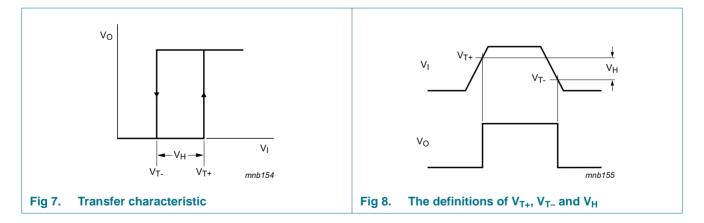


Table 10. Test data

Type number	Input	Output	
	VI	V _M	V _M
74AHC1G17	GND to V _{CC}	$0.5 imes V_{CC}$	$0.5 imes V_{CC}$
74AHCT1G17	GND to 3.0 V	1.5 V	$0.5 \times V_{CC}$

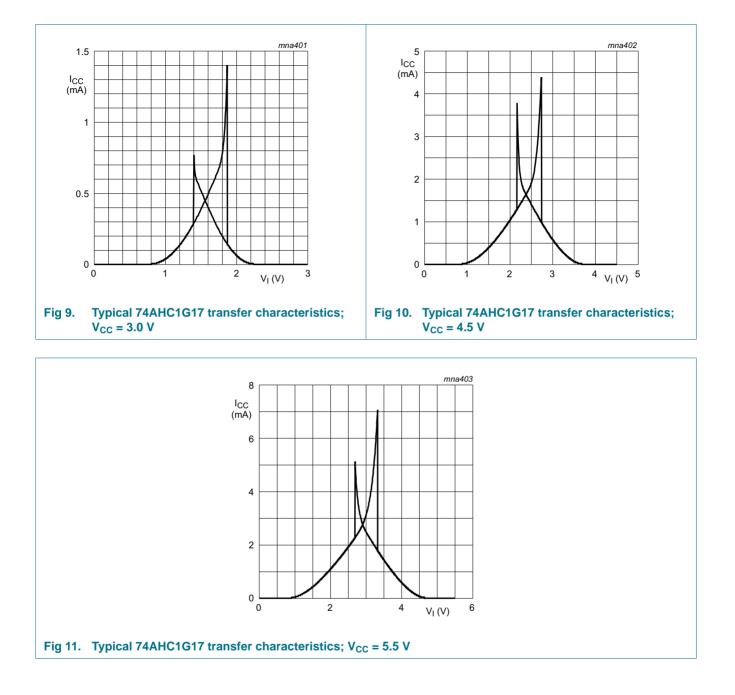
13.1 Transfer characteristic waveforms



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74AHC1G17; 74AHCT1G17

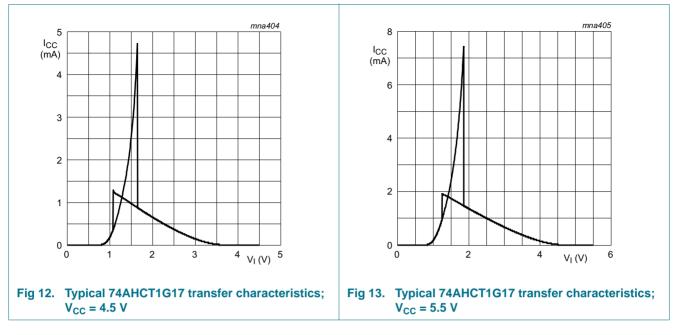
Single Schmitt trigger buffer



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74AHC1G17; 74AHCT1G17

Single Schmitt trigger buffer



14. Application information

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

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

 P_{add} = additional power dissipation (μ W);

 $f_i = input frequency (MHz);$

 t_r = input rise time (ns); 10 % to 90 %;

 t_f = input fall time (ns); 90 % to 10 %;

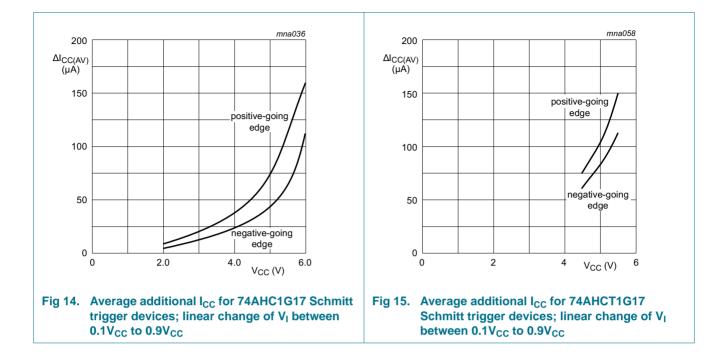
 $\Delta I_{CC(AV)}$ = average additional supply current (µA).

Average additional I_{CC} differs with positive or negative input transitions, as shown in Figure 14 and Figure 15.

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74AHC_AHCT1G17

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15. Package outline

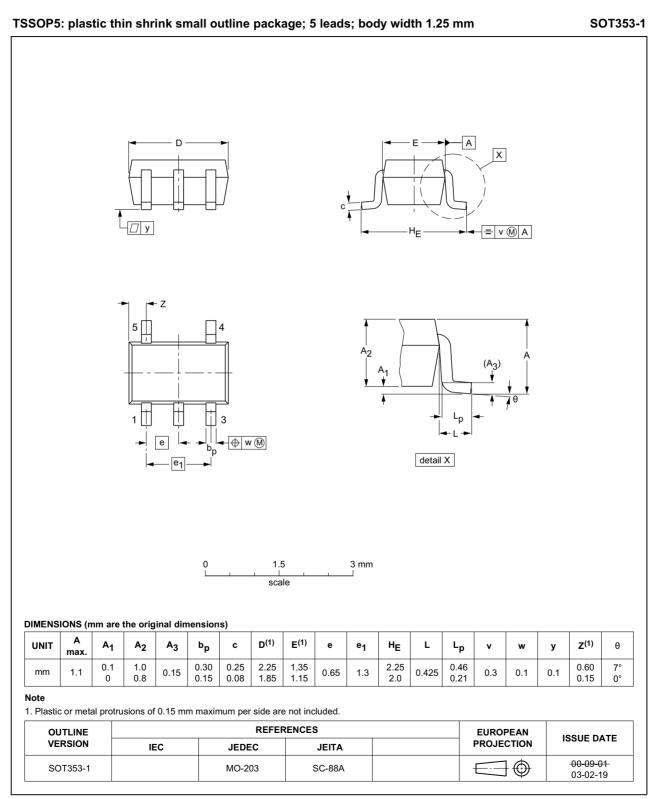


Fig 16. Package outline SOT353-1 (TSSOP5)

74AHC_AHCT1G17

Product data sheet

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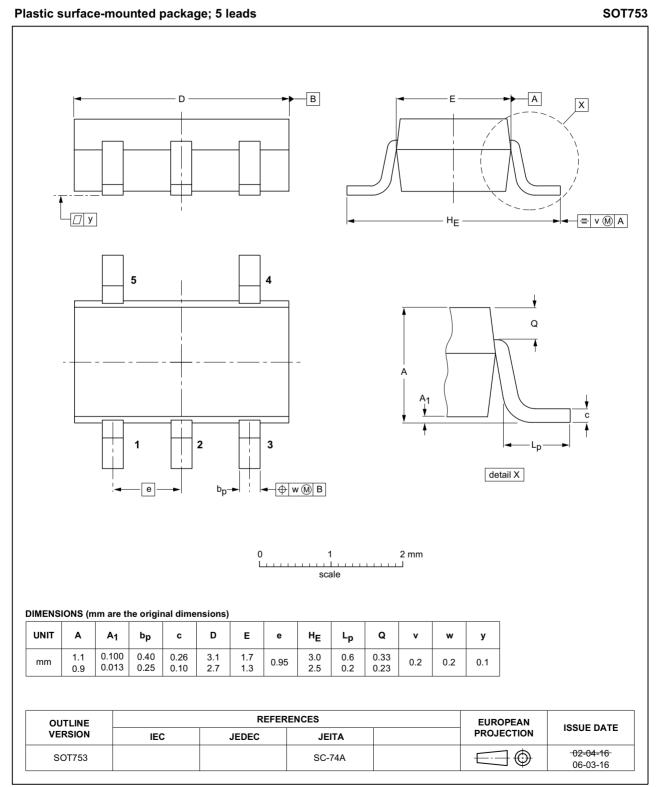


Fig 17. Package outline SOT753 (SC-74A)

74AHC_AHCT1G17

Product data sheet

16. Abbreviations

Table 11. Abbrevia	Table 11. Abbreviations						
Acronym	Description						
CDM	Charged Device Model						
CMOS	Complementary Metal-Oxide Semiconductor						
DUT	Device Under Test						
ESD	ElectroStatic Discharge						
НВМ	Human Body Model						
MM	Machine Model						
TTL	Transistor-Transistor Logic						

17. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT1G17 v.2	20161005	Product data sheet	-	74AHC_AHCT1G17 v.1
Modifications:	 Type numbers removed. 	5 74AHC1G17GF, 74AHC1G17	7GM, 74AHCT1G17	GF and 74AHCT1G17GM
74AHC_AHCT1G17 v.1	20140318	Product data sheet	-	-

18. Legal information

18.1 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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74AHC_AHCT1G17

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