Dual buffer gate

Rev. 1 — 2 November 2015

1. General description

The 74HC2G16; 74HCT2G16 is a high-speed Si-gate CMOS device.

The 74HC2G16; 74HCT2G16 provides two buffers.

2. Features and benefits

- Wide supply voltage range from 2.0 V to 6.0 V
- Complies with JEDEC standard no. 7A
- High noise immunity
- ESD protection:
 - HBM JESD22-A114-D exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
- Low power dissipation
- Balanced propagation delays
- Unlimited input rise and fall times
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

3. Ordering information

Table 1. Ordering information

Type number	Package						
	Temperature range	Name	Description	Version			
74HC2G16GW	–40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363			
74HC2G16GV	–40 °C to +125 °C	SC-74	plastic surface-mounted package (TSOP6); 6 leads	SOT457			
74HCT2G16GW	–40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363			
74HCT2G16GV	–40 °C to +125 °C	SC-74	plastic surface-mounted package (TSOP6); 6 leads	SOT457			

4. Marking

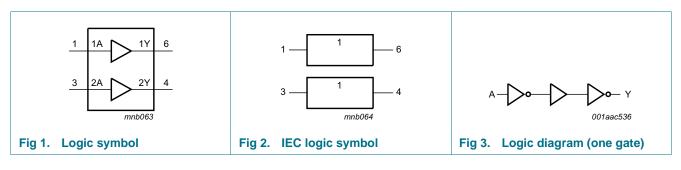
Table 2.Marking

Type number	Marking code
74HC2G16GW	P6
74HC2G16GV	P6
74HCT2G16GW	U6
74HCT2G16GV	U6

nexperia

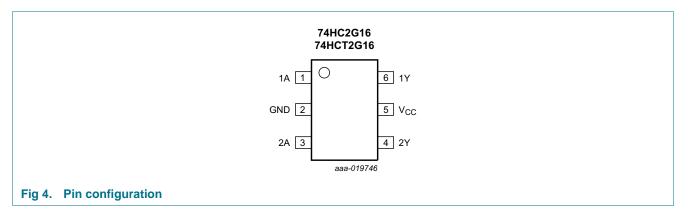
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5. Functional diagram



6. Pinning information

6.1 Pinning



6.2 Pin description

Table 3. Pin description		
Symbol	Pin	Description
1A	1	data input
GND	2	ground (0 V)
2A	3	data input
2Y	4	data output
V _{CC}	5	supply voltage
1Y	6	data output

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7. Functional description

Table 4.Function table^[1]

Input	Output
	nY
L	L
Н	Н

[1] H = HIGH voltage level;

L = LOW voltage level.

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
I _{IK}	input clamping current	V_{I} < -0.5 V or V_{I} > V_{CC} + 0.5 V	<u>[1]</u>	-	±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
I _O	output current	$V_{O} = -0.5$ V to V_{CC} + 0.5 V	<u>[1]</u>	-	±25	mA
I _{CC}	supply current		<u>[1]</u>	-	+50	mA
I _{GND}	ground current		<u>[1]</u>	-	-50	mA
T _{stg}	storage temperature			-65	+150	°C
P _{tot}	total power dissipation		[2]	-	250	mW

[1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SC-88 and SC-74 packages: above 87.5 °C the value of Ptot derates linearly with 4.0 mW/K.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Type 74HC	2G16		1			
V _{CC}	supply voltage		2.0	5.0	6.0	V
VI	input voltage		0	-	V _{CC}	V
Vo	output voltage		0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C
t _r	rise time	except for Schmitt trigger inputs				
		V _{CC} = 2.0 V	-	-	1000	ns
		$V_{CC} = 4.5 V$	-	-	500	ns
		V _{CC} = 6.0 V	-	-	400	ns
t _f	fall time	except for Schmitt trigger inputs				
		V _{CC} = 2.0 V	-	-	1000	ns
		V _{CC} = 4.5 V	-	-	500	ns
		V _{CC} = 6.0 V	-	-	400	ns

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Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Type 74HC	Г2G16				_	
V _{CC}	supply voltage		4.5	5.0	5.5	V
VI	input voltage		0	-	V _{CC}	V
Vo	output voltage		0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C
t _r	rise time	except for Schmitt trigger inputs				
		$V_{CC} = 4.5 V$	-	-	500	ns
t _f	fall time	except for Schmitt trigger inputs				
		V _{CC} = 4.5 V	-	-	500	ns

Table 6. Recommended operating conditions ...continued

10. Static characteristics

Table 7. Static characteristics for 74HC2G16

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
T _{amb} = 25	°C	, ,	I		1	
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5	1.2	-	V
		$V_{CC} = 4.5 V$	3.15	2.4	-	V
		V _{CC} = 6.0 V	4.2	3.2	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.0 V	-	0.8	0.5	V
		$V_{CC} = 4.5 V$	-	2.1	1.35	V
		$V_{CC} = 6.0 V$	-	2.8	1.8	V
V _{OH}	HIGH-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		$I_{O} = -20 \ \mu A; \ V_{CC} = 2.0 \ V$	1.9	2.0	-	V
		$I_{O} = -20 \ \mu A; \ V_{CC} = 4.5 \ V$	4.4	4.5	-	V
		$I_{O} = -20 \ \mu A; \ V_{CC} = 6.0 \ V$	5.9	6.0	-	V
		$I_{O} = -4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	4.18	4.32	-	V
		$I_{O} = -5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	5.68	5.81	-	V
V _{OL}	LOW-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		$I_{O} = 20 \ \mu A; \ V_{CC} = 2.0 \ V$	-	0	0.1	V
		$I_{O} = 20 \ \mu A; \ V_{CC} = 4.5 \ V$	-	0	0.1	V
		$I_{O} = 20 \ \mu A; \ V_{CC} = 6.0 \ V$	-	0	0.1	V
		$I_{O} = 4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	0.15	0.26	V
		$I_{O} = 5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	-	0.16	0.26	V
l _l	input leakage current	$V_I = GND \text{ or } V_{CC}; V_{CC} = 6.0 \text{ V}$	-	-	±0.1	μA
I _{CC}	supply current	$V_I = GND \text{ or } V_{CC}; I_O = 0 \text{ A};$	-	-	1.0	μA
		$V_{CC} = 6.0 V$				
CI	input capacitance		-	1.5	-	pF

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Table 7. Static characteristics for 74HC2G16 ... continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
T _{amb} = -40) °C to +85 °C		I			
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5	-	-	V
		V _{CC} = 4.5 V	3.15	-	-	V
		V _{CC} = 6.0 V	4.2	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.0 V	-	-	0.5	V
νı <u>c</u>		V _{CC} = 4.5 V	-	-	1.35	V
		V _{CC} = 6.0 V	-	-	1.8	V
V _{OH}	HIGH-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		$I_{O} = -20 \ \mu A; \ V_{CC} = 2.0 \ V$	1.9	-	-	V
		$I_{O} = -20 \ \mu A; \ V_{CC} = 4.5 \ V$	4.4	-	-	V
		$I_{O} = -20 \ \mu A; \ V_{CC} = 6.0 \ V$	5.9	-	-	V
		$I_{O} = -4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	4.13	-	-	V
		$I_{O} = -5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	5.63	-	-	V
V _{OL}	LOW-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		$I_0 = 20 \ \mu A; \ V_{CC} = 2.0 \ V$	-	-	0.1	V
		$I_0 = 20 \ \mu A; \ V_{CC} = 4.5 \ V$	-	-	0.1	V
		$I_0 = 20 \ \mu A; \ V_{CC} = 6.0 \ V$	-	-	0.1	V
		$I_0 = 4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.33	V
		$I_0 = 5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	-	-	0.33	V
lı	input leakage current	$V_{I} = GND \text{ or } V_{CC}; V_{CC} = 6.0 \text{ V}$	-	-	±1.0	μA
I _{CC}	supply current	$V_I = GND \text{ or } V_{CC}; I_O = 0 \text{ A};$	-	-	10.0	μA
		$V_{CC} = 6.0 V$				
T _{amb} = -40) °C to +125 °C					
V _{IH}	HIGH-level input voltage	V _{CC} = 2.0 V	1.5	-	-	V
		$V_{CC} = 4.5 V$	3.15	-	-	V
		$V_{CC} = 6.0 V$	4.2	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 2.0 V	-	-	0.5	V
		$V_{CC} = 4.5 V$	-	-	1.35	V
		$V_{CC} = 6.0 V$	-	-	1.8	V
V _{OH}	HIGH-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		$I_0 = -20 \ \mu A; \ V_{CC} = 2.0 \ V$	1.9	-	-	V
		$I_0 = -20 \ \mu A; \ V_{CC} = 4.5 \ V$	4.4	-	-	V
		$I_0 = -20 \ \mu A; \ V_{CC} = 6.0 \ V$	5.9	-	-	V
		$I_{O} = -4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.7	-	-	V
		$I_{O} = -5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	5.2	-	-	V

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Table 7. Static characteristics for 74HC2G16 ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V _{OL}	LOW-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		$I_0 = 20 \ \mu A; \ V_{CC} = 2.0 \ V$	-	-	0.1	V
		$I_{O} = 20 \ \mu A; \ V_{CC} = 4.5 \ V$	-	-	0.1	V
		$I_{O} = 20 \ \mu A; \ V_{CC} = 6.0 \ V$	-	-	0.1	V
		$I_{O} = 4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.4	V
		$I_{O} = 5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	-	-	0.4	V
I _I	input leakage current	$V_I = GND \text{ or } V_{CC}; V_{CC} = 6.0 \text{ V}$	-	-	±1.0	μA
I _{CC}	supply current	$V_I = GND \text{ or } V_{CC}; I_O = 0 \text{ A};$	-	-	20.0	μA
		$V_{CC} = 6.0 V$				

Table 8. Static characteristics for 74HCT2G16

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
T _{amb} = 25	°C					
VIH	HIGH-level input voltage	$V_{CC} = 4.5 V \text{ to } 5.5 V$	2.0	1.6	-	V
VIL	LOW-level input voltage	$V_{CC} = 4.5 V \text{ to } 5.5 V$	-	1.2	0.8	V
V _{OH}	HIGH-level output voltage	$V_{I} = V_{IH}$ or V_{IL}			1	
		$I_{O} = -20 \ \mu\text{A}; \ V_{CC} = 4.5 \ \text{V}$	4.4	4.5	-	V
		$I_{O} = -4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	4.18	4.32	-	V
V _{OL}	LOW-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		$I_{O} = 20 \ \mu A; \ V_{CC} = 4.5 \ V$	-	0	0.1	V
		$I_{O} = 4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	0.15	0.26	V
I _I	input leakage current	$V_I = GND \text{ or } V_{CC}; V_{CC} = 5.5 \text{ V}$	-	-	±0.1	μA
I _{CC}	supply current	$\label{eq:VI} \begin{array}{l} V_{I} = GND \text{ or } V_{CC}; \ I_{O} = 0 \ A; \\ V_{CC} = 5.5 \ V \end{array}$	-	-	1.0	μA
ΔI_{CC}	additional supply current	$V_{I} = V_{CC} - 2.1 V;$ $V_{CC} = 4.5 V \text{ to } 5.5 V; I_{O} = 0 \text{ A}$	-	-	300	μA
Cı	input capacitance		-	1.5	-	pF
T _{amb} = -40) °C to +85 °C		1	•	-	
VIH	HIGH-level input voltage	$V_{CC} = 4.5 V \text{ to } 5.5 V$	2.0	-	-	V
VIL	LOW-level input voltage	$V_{CC} = 4.5 V \text{ to } 5.5 V$	-	-	0.8	V
V _{OH}	HIGH-level output voltage	$V_{I} = V_{IH}$ or V_{IL}				
		$I_{O} = -20 \ \mu\text{A}; \ V_{CC} = 4.5 \ \text{V}$	4.4	-	-	V
		$I_{O} = -4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	4.13	-	-	V
V _{OL}	LOW-level output voltage	$V_{I} = V_{IH}$ or V_{IL}				
		$I_{O} = 20 \ \mu A; \ V_{CC} = 4.5 \ V$	-	-	0.1	V
		$I_{O} = 4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.33	V
l _l	input leakage current	$V_I = GND \text{ or } V_{CC}; V_{CC} = 5.5 \text{ V}$	-	-	±1.0	μA
I _{CC}	supply current	$\label{eq:VI} \begin{array}{l} V_{I} = GND \text{ or } V_{CC}; \ I_{O} = 0 \ A; \\ V_{CC} = 5.5 \ V \end{array}$	-	-	10.0	μA
ΔI_{CC}	additional supply current	$V_{I} = V_{CC} - 2.1 \text{ V};$ $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}; I_{O} = 0 \text{ A}$	-	-	375	μA

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Table 8. Static characteristics for 74HCT2G16 ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
T _{amb} = -40	°C to +125 °C		I	1	1	
V _{IH}	HIGH-level input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	-	-	V
V _{IL}	LOW-level input voltage	$V_{CC} = 4.5 V \text{ to } 5.5 V$	-	-	0.8	V
V _{OH}	HIGH-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		$I_{O} = -20 \ \mu\text{A}; \ V_{CC} = 4.5 \ \text{V}$	4.4	-	-	V
		$I_{O} = -4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.7	-	-	V
V _{OL}	LOW-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		$I_{O} = 20 \ \mu A; \ V_{CC} = 4.5 \ V$	-	-	0.1	V
		$I_{O} = 4.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.4	V
l _l	input leakage current	$V_{I} = GND \text{ or } V_{CC}; V_{CC} = 5.5 \text{ V}$	-	-	±1.0	μA
I _{CC}	supply current	$\label{eq:VI} \begin{array}{l} V_{I} = GND \text{ or } V_{CC}; \ I_{O} = 0 \ A; \\ V_{CC} = 5.5 \ V \end{array}$	-	-	20.0	μΑ
Δl _{CC}	additional supply current	$V_{I} = V_{CC} - 2.1 V;$ $V_{CC} = 4.5 V \text{ to } 5.5 V; I_{O} = 0 \text{ A}$	-	-	410	μA

11. Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see <u>Figure 6</u>.

Symbol	Parameter	Conditions		25 °C			–40 °C to +125 °C		
				Тур	Мах	Min	Max (85 °C)	Max (125 °C)	
74HC2G1	6								_
t _{pd}	propagation delay	nA to nY; see Figure 5	1]						
		$V_{CC} = 2.0 \text{ V}; \text{ C}_{L} = 50 \text{ pF}$	-	29	75	-	95	125	ns
		$V_{CC} = 4.5 \text{ V}; \text{ C}_{L} = 50 \text{ pF}$	-	9	15	-	19	25	ns
		$V_{CC} = 6.0 \text{ V}; \text{ C}_{L} = 50 \text{ pF}$	-	8	13	-	16	20	ns
t _t	transition time	nY; see Figure 5	2]						
		$V_{CC} = 2.0 \text{ V}; \text{ C}_{L} = 50 \text{ pF}$	-	18	75	-	95	125	ns
		$V_{CC} = 4.5 \text{ V}; \text{ C}_{L} = 50 \text{ pF}$	-	6	15	-	19	25	ns
		$V_{CC} = 6.0 \text{ V}; \text{ C}_{L} = 50 \text{ pF}$	-	5	13	-	16	20	ns
C _{PD}	power dissipation capacitance	$V_I = GND$ to V_{CC}	3] _	10	-	-	-	-	pF

Dual buffer gate

Table 9. Dynamic characteristics ...continued

Voltages are referenced to GND (ground = 0 V); for test circuit see <u>Figure 6</u>.

Symbol	Parameter	Conditions		25 °C			–40 °C to +125 °C			Unit
				Min	Тур	Max	Min	Max (85 °C)	Max (125 °C)	
74HCT2G	16									
t _{pd}	propagation delay	nA to nY; see Figure 5	<u>[1]</u>							
		$V_{CC} = 4.5 \text{ V}; \text{ C}_{L} = 50 \text{ pF}$		-	10	18	-	23	29	ns
t _t	transition time	nY; see Figure 5	[2]							
		$V_{CC} = 4.5 \text{ V}; \text{ C}_{L} = 50 \text{ pF}$		-	6	15	-	19	25	ns
C _{PD}	power dissipation capacitance	$V_{I} = GND$ to $V_{CC} - 1.5 V$	<u>[3]</u>	-	9	-	-	-	-	pF

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

[2] t_t is the same as t_{TLH} and t_{THL}

[3] C_{PD} is used to determine the dynamic power dissipation (P_D in μ W).

 P_D = $C_{PD} \times V_{CC}{}^2 \times f_i \times N$ + $\Sigma (C_L \times V_{CC}{}^2 \times f_o)$ 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;

N = number of inputs switching;

 $\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

12. Waveforms

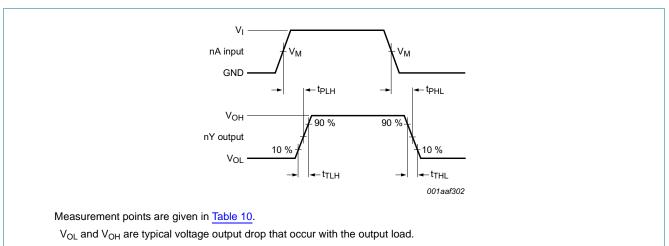


Fig 5. The data input (nA) to output (nY) propagation delays and output transition times

Table 10. Measurement points

Туре	Input	Output		
	V _M	VI	t _r = t _f	V _M
74HC2G16	0.5V _{CC}	GND to V _{CC}	6.0 ns	0.5V _{CC}
74HCT2G16	1.3 V	GND to 3.0 V	6.0 ns	1.3 V

74HC_HCT2G16 Product data sheet

Nexperia

74HC2G16; 74HCT2G16

Dual buffer gate

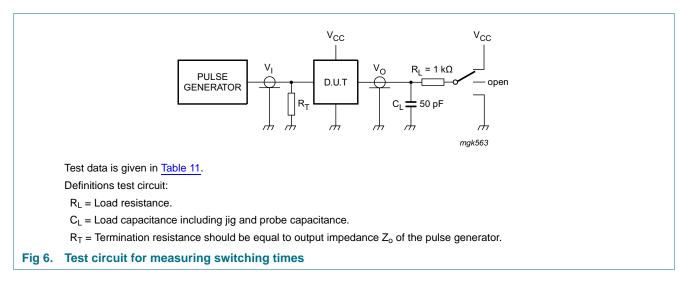


Table 11. Test data

Туре	Input	Test	
	VI	t _r , t _f	t _{PHL} , t _{PLH}
74HC2G16	GND to V _{CC}	6 ns	open
74HCT2G16	GND to 3.0 V	6 ns	open

Dual buffer gate

13. Package outline

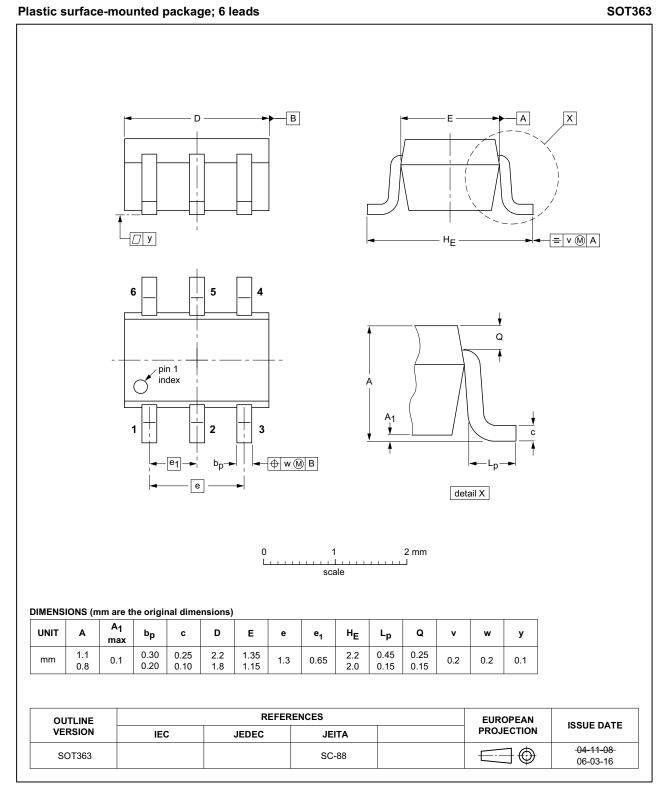


Fig 7. Package outline SOT363 (SC-88)

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74HC_HCT2G16

Dual buffer gate

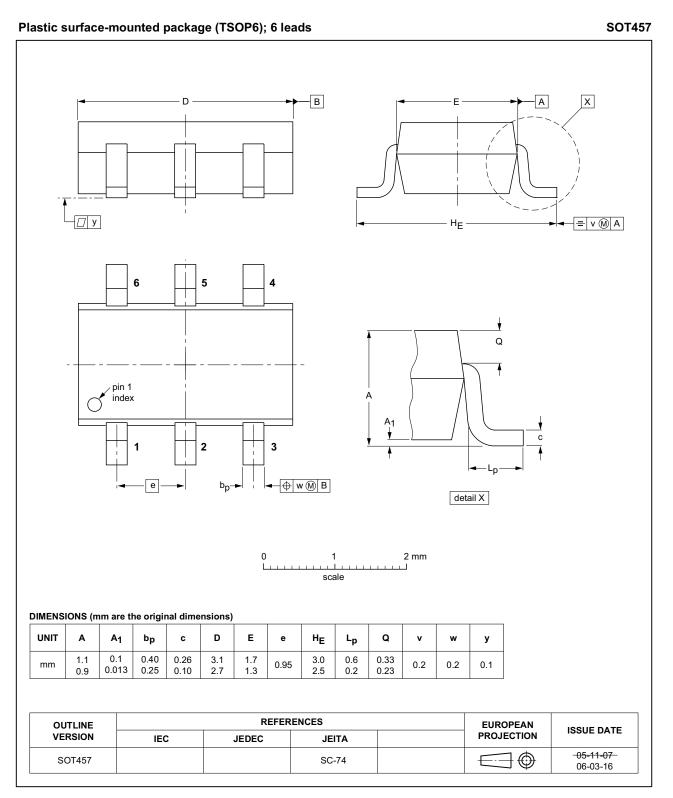


Fig 8. Package outline SOT457 (SC-74)

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74HC_HCT2G16

Dual buffer gate

14. Abbreviations

Table 12. Abbreviations				
Acronym	Description			
CMOS	Complementary Metal Oxide Semiconductor			
ESD	ElectroStatic Discharge			
НВМ	Human Body Model			
MM	Machine Model			
DUT	Device Under Test			

15. Revision history

Table 13.Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT2G16 v.1	20151102	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.
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.

16.2 Definitions

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Dual buffer gate

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Dual buffer gate

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