74HC2G16; 74HCT2G16

Dual buffer gate

Rev. 3 — 5 December 2023

Product data sheet

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
- High noise immunity
- CMOS low power dissipation
- · Balanced propagation delays
- · Unlimited input rise and fall times
- Complies with JEDEC standards:
 - JESD8C (2.7 V to 3.6 V)
 - JESD7A (2.0 V to 6.0 V)
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

3. Ordering information

Table 1. Ordering information

Table 1. Ordering information							
Type number	Package						
	Temperature range	Name	Description	Version			
74HC2G16GW	-40 °C to +125 °C	TSSOP6	plastic thin shrink small outline package; 6 leads;	SOT363-2			
74HCT2G16GW			body width 1.25 mm				
74HC2G16GV	-40 °C to +125 °C	SC-74;	plastic surface-mounted package; 6 leads	SOT457			
74HCT2G16GV		TSOP6					
74HC12G16GV							

4. Marking

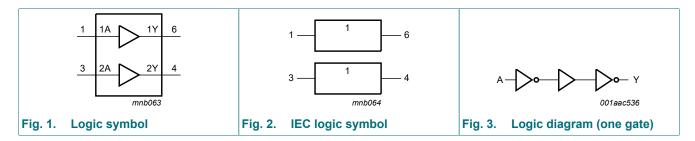
Table 2. Marking

Type number	Marking code[1]
74HC2G16GW	P6
74HCT2G16GW	U6
74HC2G16GV	P6
74HCT2G16GV	U6

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

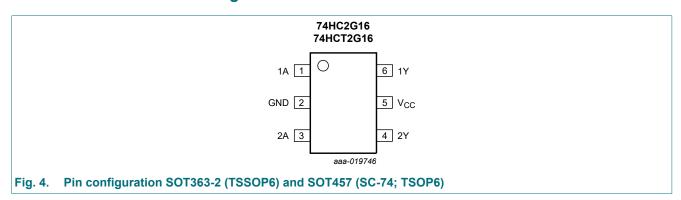


5. Functional diagram



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

7. Functional description

Table 4. Function table

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level.$

Input	Output
nA	nY
L	L
Н	Н

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	$V_1 < -0.5 \text{ V or } V_1 > V_{CC} + 0.5 \text{ V}$ [1]	-	±20	mA
I _{OK}	output clamping current	$V_O < -0.5 \text{ V or } V_O > V_{CC} + 0.5 \text{ V}$ [1]	-	±20	mA
Io	output current	$V_O = -0.5 \text{ V to } V_{CC} + 0.5 \text{ V}$ [1]	-	±25	mA
I _{CC}	supply current	[1]	-	+50	mA
I_{GND}	ground current	[1]	-	-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.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
74HC20	316	,			•	'
V _{CC}	supply voltage		2.0	5.0	6.0	V
V _I	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
74HCT2	2G16					
V _{CC}	supply voltage		4.5	5.0	5.5	V
V _I	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

^[2] For SOT363-2 (TSSOP6) package: P_{tot} derates linearly with 3.7 mW/K above 83 °C. For SOT457 (SC-74; TSOP6) package: P_{tot} derates linearly with 4.1 mW/K above 89 °C.

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} = 2	25 °C	'			-	
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	$V_I = V_{IH}$ or V_{IL}				
		I _O = -20 μA; V _{CC} = 2.0 V	1.9	2.0	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	4.5	-	V
		I _O = -20 μA; V _{CC} = 6.0 V	5.9	6.0	-	V
		I_{O} = -4.0 mA; V_{CC} = 4.5 V	4.18	4.32	-	V
		I _O = -5.2 mA; V _{CC} = 6.0 V	5.68	5.81	-	V
V _{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I_{O} = 20 μ A; V_{CC} = 2.0 V	-	0	0.1	V
		I_{O} = 20 μ A; V_{CC} = 4.5 V	-	0	0.1	V
		I_{O} = 20 μ A; V_{CC} = 6.0 V	-	0	0.1	V
		I _O = 4.0 mA; V _{CC} = 4.5 V	-	0.15	0.26	V
		I _O = 5.2 mA; V _{CC} = 6.0 V	-	0.16	0.26	V
I _I	input leakage current	V_I = GND or V_{CC} ; V_{CC} = 6.0 V	-	-	±0.1	μΑ
I _{CC}	supply current	V_I = GND or V_{CC} ; I_O = 0 A; V_{CC} = 6.0 V	-	-	1.0	μA
Cı	input capacitance		-	1.5	-	pF

Symbo	ol Parameter	Conditions	Min	Тур	Max	Unit
T _{amb} =	-40 °C to +85 °C				1	
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} LO	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	$V_{I} = V_{IH}$ or V_{IL}				
		I _O = -20 μA; V _{CC} = 2.0 V	1.9	-	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	-	-	V
		I _O = -20 μA; V _{CC} = 6.0 V	5.9	-	-	V
		I_{O} = -4.0 mA; V_{CC} = 4.5 V	4.13	-	-	V
		I_{O} = -5.2 mA; V_{CC} = 6.0 V	5.63	-	-	V
V _{OL}	LOW-level output voltage	$V_{I} = V_{IH}$ or V_{IL}				
		I_{O} = 20 μ A; V_{CC} = 2.0 V	-	-	0.1	V
		I_{O} = 20 μ 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 mA; V _{CC} = 4.5 V	-	-	0.33	V
		I _O = 5.2 mA; V _{CC} = 6.0 V	-	-	0.33	V
l _l	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 or V_{CC} ; I_O = 0 A; V_{CC} = 6.0 V	-	-	10.0	μΑ
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	$V_I = V_{IH}$ or V_{IL}				
		I _O = -20 μA; V _{CC} = 2.0 V	1.9	-	-	V
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	-	-	V
		I _O = -20 μA; 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 mA; V_{CC} = 6.0 V	5.2	-	-	V
V _{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				+
		$I_{O} = 20 \mu A; V_{CC} = 2.0 V$	-	-	0.1	V
		$I_O = 20 \mu A; V_{CC} = 4.5 V$	-	-	0.1	V
		I _O = 20 μA; V _{CC} = 6.0 V	-	-	0.1	V
		I _O = 4.0 mA; V _{CC} = 4.5 V	-	-	0.4	V
		I _O = 5.2 mA; V _{CC} = 6.0 V	-	-	0.4	V
l _l	input leakage current	$V_I = GND \text{ or } V_{CC}; V_{CC} = 6.0 \text{ V}$	-	-	±1.0	μΑ
I _{CC}	supply current	V _I = GND or V _{CC} ; I _O = 0 A; V _{CC} = 6.0 V	-	-	20.0	μΑ

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} = 2	25 °C					
V _{IH}	HIGH-level input voltage	V _{CC} = 4.5 V to 5.5 V	2.0	1.6	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 4.5 V to 5.5 V	-	1.2	0.8	V
V _{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	4.5	-	V
		I_{O} = -4.0 mA; V_{CC} = 4.5 V	4.18	4.32	-	V
V _{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I_{O} = 20 μ A; V_{CC} = 4.5 V	-	0	0.1	V
		I _O = 4.0 mA; V _{CC} = 4.5 V	-	0.15	0.26	V
l _l	input leakage current	$V_I = GND \text{ or } V_{CC}; V_{CC} = 5.5 \text{ V}$	-	-	±0.1	μΑ
I _{CC}	supply current	$V_{I} = GND \text{ or } V_{CC}; I_{O} = 0 \text{ A}; V_{CC} = 5.5 \text{ V}$	-	-	1.0	μΑ
ΔI _{CC}	additional supply current	$V_I = V_{CC} - 2.1 \text{ V};$ $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}; I_O = 0 \text{ A}$	-	-	300	μΑ
Cı	input capacitance		-	1.5	-	pF
T _{amb} = -	40 °C to +85 °C			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 to 5.5 V	-	-	0.8	V
V _{OH}	HIGH-level output voltage	$V_{I} = V_{IH}$ or V_{IL}				
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	-	-	V
		I_{O} = -4.0 mA; V_{CC} = 4.5 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 mA; V _{CC} = 4.5 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	$V_{I} = GND \text{ or } V_{CC}; I_{O} = 0 \text{ A}; V_{CC} = 5.5 \text{ V}$	-	-	10.0	μΑ
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	μΑ
T _{amb} = -	40 °C to +125 °C			•		
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 to 5.5 V	-	-	0.8	V
V _{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I _O = -20 μA; V _{CC} = 4.5 V	4.4	-	-	V
		I_{O} = -4.0 mA; V_{CC} = 4.5 V	3.7	-	-	V
V _{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I_{O} = 20 μ 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	μΑ
I _{CC}	supply current	V_I = GND or V_{CC} ; I_O = 0 A; V_{CC} = 5.5 V	-	-	20.0	μΑ
ΔI _{CC}	additional supply current	$V_1 = V_{CC} - 2.1 \text{ V};$ $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}; I_O = 0 \text{ A}$	-	-	410	μA

11. Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 6.

Symbol	Parameter	Conditions		25 °C		-40 °C to	o +85 °C	-40 °C to	+125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74HC2G	16				•				'	
t _{pd}	propagation	nA to nY; see Fig. 5 [1]								
	delay	V_{CC} = 2.0 V; C_L = 50 pF	-	29	75	-	95	-	125	ns
		$V_{CC} = 4.5 \text{ V}; C_L = 50 \text{ pF}$	-	9	15	-	19	-	25	ns
		$V_{CC} = 6.0 \text{ V}; C_L = 50 \text{ pF}$	-	8	13	-	16	-	20	ns
t _t	transition time	nY; see <u>Fig. 5</u> [2]								
		V_{CC} = 2.0 V; C_L = 50 pF	-	18	75	-	95	-	125	ns
		V _{CC} = 4.5 V; C _L = 50 pF	-	6	15	-	19	-	25	ns
		$V_{CC} = 6.0 \text{ V}; C_L = 50 \text{ pF}$	-	5	13	-	16	-	20	ns
C _{PD}	power dissipation capacitance	$V_I = GND \text{ to } V_{CC}$ [3]	-	10	-	-	-	-	-	pF
74HCT2	G16									
t _{pd}	propagation	nA to nY; see Fig. 5 [1]								
	delay	V_{CC} = 4.5 V; C_L = 50 pF	-	10	18	-	23	-	29	ns
t _t	transition time	nY; see Fig. 5 [2]								
		$V_{CC} = 4.5 \text{ V}; C_L = 50 \text{ pF}$	-	6	15	-	19	-	25	ns
C _{PD}	power dissipation capacitance	$V_{I} = GND \text{ to } V_{CC} - 1.5 \text{ V}$ [3]	-	9	-	-	-	-	-	pF

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

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

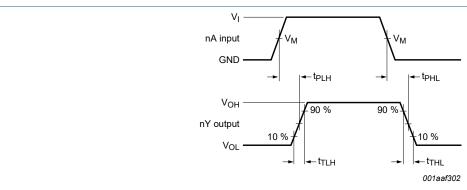
V_{CC} = supply voltage in V;

N = number of inputs switching;

 $\Sigma(C_L \times V_{CC}^2 \times f_0)$ = sum of the outputs.

^[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 μW).

11.1. Waveforms and test circuit



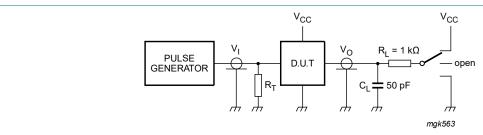
Measurement points are given in Table 10.

V_{OL} and V_{OH} are typical voltage output drop that occur with the output load.

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



Test data is given in Table 11.

Definitions test circuit:

 R_L = Load resistance.

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.

Fig. 6. Test circuit for measuring switching times

Table 11. Test data

Туре	Input		Test
	V _I	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

12. Package outline

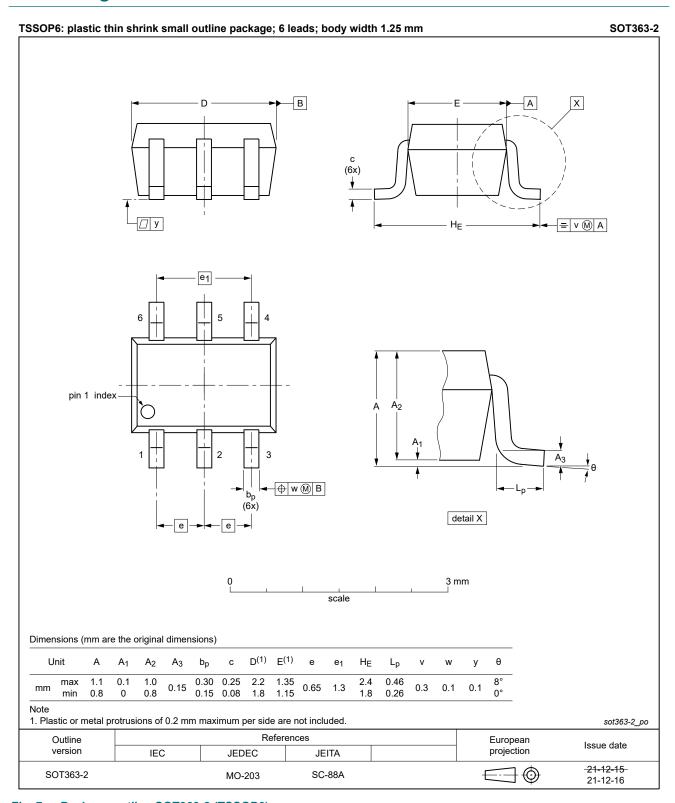


Fig. 7. Package outline SOT363-2 (TSSOP6)

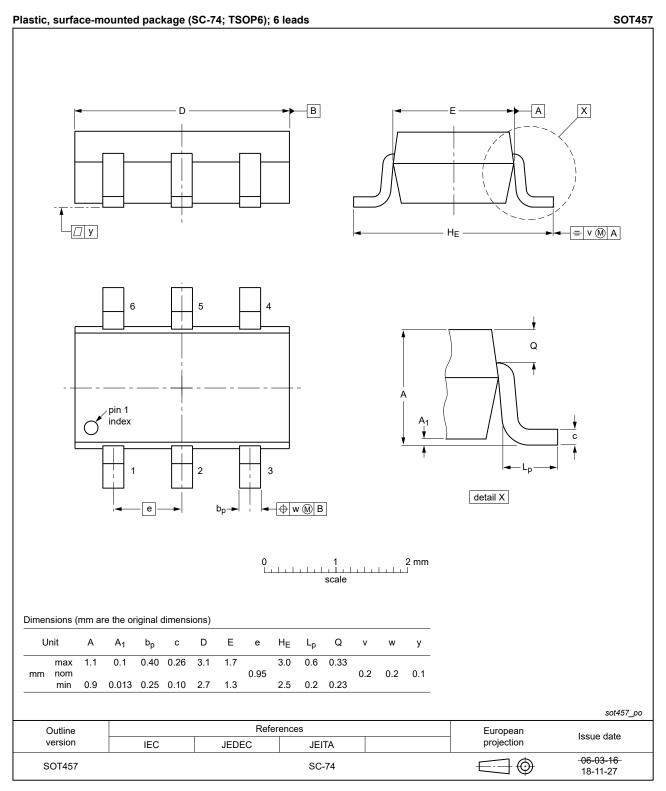


Fig. 8. Package outline SOT457 (SC-74; TSOP6)

13. Abbreviations

Table 12. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model

14. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes		
74HC_HCT2G16 v.3	20231205	Product data sheet	-	74HC_HCT2G16 v.2		
Modifications:	Section 2: E	<u>Section 2</u> : ESD specification updated according to the latest JEDEC standard.				
74HC_HCT2G16 v.2	20220202	Product data sheet	-	74HC_HCT2G16 v.1		
Modifications:	guidelines of Legal texts Package So Section 8: [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. Package SOT363 (SC-88) changed to SOT363-2 (TSSOP6). Section 8: Derating values for Ptot total power dissipation updated. Fig. 8: Package outline drawing SOT457 (SC-74; TSOP6) updated. 				
74HC_HCT2G16 v.1	20151102	Product data sheet	-	-		

15. 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.

- 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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