74HC2G14; 74HCT2G14

Dual inverting Schmitt trigger

Rev. 3 — 28 January 2022 Product data sheet

1. General description

The 74HC2G14; 74HCT2G14 is a dual inverter with Schmitt-trigger inputs. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}. Schmitt trigger inputs transform slowly changing input signals into sharply defined jitter-free output signals.

2. Features and benefits

- Wide supply voltage range from 2.0 V to 6.0 V
- Input levels:
  - For 74HC2G14: CMOS level
  - For 74HCT2G14: TTL level
- High noise immunity
- CMOS low power dissipation
- Balanced propagation delays
- Unlimited input rise and fall times
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- ESD protection:
  - HBM JESD22-A114E exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

3. Applications

- Wave and pulse shaper for highly noisy environments
- Astable multivibrators
- Monostable multivibrators

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	**Name**	**Description**	**Version**
74HC2G14GW	-40 °C to +125 °C	TSSOP6	plastic thin shrink small outline package; 6 leads; body width 1.25 mm	SOT363-2
74HCT2G14GW				
74HC2G14GV	-40 °C to +125 °C	SC-74; TSOP6	plastic surface-mounted package; 6 leads	SOT457
74HCT2G14GV				

5. Marking

Table 2. Marking

Type number	Marking code[1]
74HC2G14GW	HK
74HCT2G14GW	TK
74HC2G14GV	H14
74HCT2G14GV	T14

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

6. Functional diagram

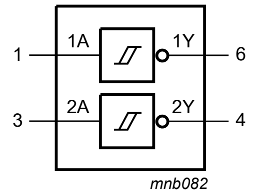


Fig. 1. Logic symbol

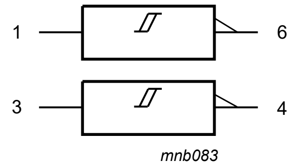


Fig. 2. IEC logic symbol

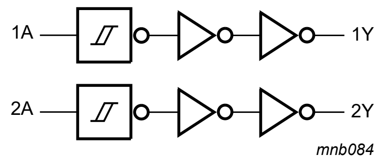


Fig. 3. Logic diagram

7. Pinning information

7.1. Pinning

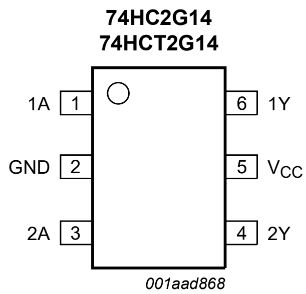


Fig. 4. Pin configuration SOT363-2 (TSSOP6) and SOT457 (SC-74; TSOP6)

7.2. 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

8. Functional description

Table 4. Function table

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

Input	Output
nA	**nY**
L	H
H	L

9. 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	[1]	-	±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	$V_O = -0.5$ V to $V_{CC} + 0.5$ 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.

[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. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
74HC2G14						
V_{CC}	supply voltage		2.0	5.0	6.0	V
V_I	input voltage		0	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	V
T_{amb}	ambient temperature		-40	+25	+125	°C
74HCT2G14						
V_{CC}	supply voltage		4.5	5.0	5.5	V
V_I	input voltage		0	-	V_{CC}	V
V_O	output voltage		0	-	V_{CC}	V
T_{amb}	ambient temperature		-40	+25	+125	°C

11. Static characteristics

Table 7. Static characteristics for 74HC2G14

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = 25 °C						
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}				
		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	$V_I = V_{T+}$ or V_{T-}				
		I_O = 20 μA; V_{CC} = 2.0 V	-	0	0.1	V
		I_O = 20 μA; V_{CC} = 4.5 V	-	0	0.1	V
		I_O = 20 μA; 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	μA
I_{CC}	supply current	V_I = GND or V_{CC}; I_O = 0 μA; V_{CC} = 6.0 V	-	-	1.0	μA
C_I	input capacitance		-	2.0	-	pF
T_{amb} = -40 °C to +85 °C						
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}				
		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	$V_I = V_{T+}$ or V_{T-}				
		I_O = 20 μA; V_{CC} = 2.0 V	-	-	0.1	V
		I_O = 20 μA; 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	-	-	0.33	V
		I_O = 5.2 mA; V_{CC} = 6.0 V	-	-	0.33	V
I_I	input leakage current	V_I = GND or V_{CC}; V_{CC} = 6.0 V	-	-	±1.0	μA
I_{CC}	supply current	V_I = GND or V_{CC}; I_O = 0 μA; V_{CC} = 6.0 V	-	-	10.0	μA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = -40 °C to +125 °C						
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}				
		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	3.7	-	-	V
		I_O = -5.2 mA; V_{CC} = 6.0 V;	5.2	-	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{T+}$ or V_{T-}				
		I_O = 20 μA; V_{CC} = 2.0 V	-	-	0.1	V
		I_O = 20 μA; 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
I_I	input leakage current	V_I = GND or V_{CC}; V_{CC} = 6.0 V	-	-	±1.0	μA
I_{CC}	supply current	V_I = GND or V_{CC}; I_O = 0 μA; V_{CC} = 6.0 V	-	-	20.0	μA

Table 8. Static characteristics for 74HCT2G14

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = 25 °C						
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}				
		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	$V_I = V_{T+}$ or V_{T-}				
		I_O = 20 μA; V_{CC} = 4.5 V	-	0	0.1	V
		I_O = 4.0 mA; V_{CC} = 4.5 V	-	0.15	0.26	V
I_I	input leakage current	V_I = GND or V_{CC}; V_{CC} = 5.5 V	-	-	±0.1	μA
I_{CC}	supply current	V_I = GND or V_{CC}; I_O = 0 μA; V_{CC} = 5.5 V	-	-	1.0	μA
ΔI_{CC}	additional supply current	$V_I = V_{CC}$ - 2.1 V; V_{CC} = 4.5 V to 5.5 V; I_O = 0 μA	-	-	300	μA
C_I	input capacitance		-	2.0	-	pF
T_{amb} = -40 °C to +85 °C						
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}				
		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	$V_I = V_{T+}$ or V_{T-}				
		I_O = 20 μA; V_{CC} = 4.5 V	-	-	0.1	V
		I_O = 4.0 mA; V_{CC} = 4.5 V	-	-	0.33	V
I_I	input leakage current	V_I = GND or V_{CC}; V_{CC} = 5.5 V	-	-	±1.0	μA
I_{CC}	supply current	V_I = GND or V_{CC}; I_O = 0 μA; V_{CC} = 5.5 V	-	-	10.0	μA
ΔI_{CC}	additional supply current	$V_I = V_{CC}$ - 2.1 V; V_{CC} = 4.5 V to 5.5 V; I_O = 0 μA	-	-	375	μA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = -40 °C to +125 °C						
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}				
		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	$V_I = V_{T+}$ or V_{T-}				
		I_O = 20 µA; V_{CC} = 4.5 V	-	-	0.1	V
		I_O = 4.0 mA; V_{CC} = 4.5 V	-	-	0.4	V
I_I	input leakage current	V_I = GND or V_{CC}; V_{CC} = 5.5 V	-	-	±1.0	µA
I_{CC}	supply current	V_I = GND or V_{CC}; I_O = 0 µA; V_{CC} = 5.5 V	-	-	20.0	µA
ΔI_{CC}	additional supply current	V_I = V_{CC} - 2.1 V; V_{CC} = 4.5 V to 5.5 V; I_O = 0 µA	-	-	410	µA

12. 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 +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74HC2G14										
t_{pd}	propagation delay	nA to nY; see Fig. 5 [1]								
		V_{CC} = 2.0 V; C_L = 50 pF	-	53	125	-	155	-	190	ns
		V_{CC} = 4.5 V; C_L = 50 pF	-	16	25	-	31	-	38	ns
		V_{CC} = 6.0 V; C_L = 50 pF	-	13	21	-	26	-	32	ns
t_t	transition time	nY; see Fig. 5 [2]								
		V_{CC} = 2.0 V; C_L = 50 pF	-	20	75	-	95	-	110	ns
		V_{CC} = 4.5 V; C_L = 50 pF	-	7	15	-	19	-	22	ns
		V_{CC} = 6.0 V; C_L = 50 pF	-	5	13	-	16	-	19	ns
C_{PD}	power dissipation capacitance	V_I = GND to V_{CC} [3]	-	10	-	-	-		-	pF
74HCT2G14										
t_{pd}	propagation delay	nA to nY; see Fig. 5 [1]								
		V_{CC} = 4.5 V; C_L = 50 pF	-	21	32	-	40	-	48	ns
t_t	transition time	nY; see Fig. 5 [2]								
		V_{CC} = 4.5 V; C_L = 50 pF	-	6	15	-	19	-	22	ns
C_{PD}	power dissipation capacitance	V_I = GND to V_{CC} - 1.5 V [3]	-	10	-	-	-	-	-	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 µW).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

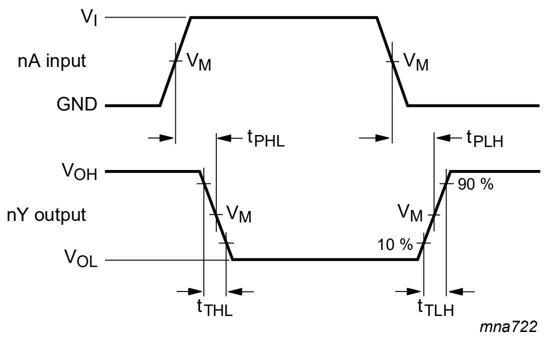
C_L = output load capacitance in pF;

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.

12.1. Waveforms and test circuit



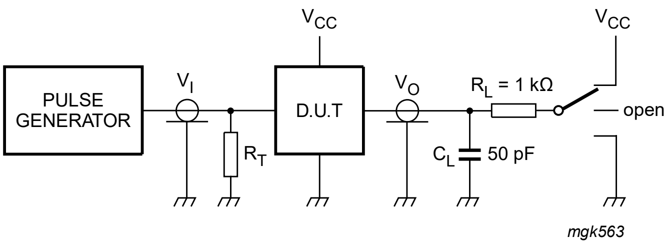
Measurement points are given in Table 10.

V_{OL} and V_{OH} are typical voltage output levels 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

Type	Input			Output
	V_M	V_I	$t_r = t_f$	V_M
74HC2G14	0.5V_{CC}	GND to V_{CC}	6.0 ns	0.5V_{CC}
74HCT2G14	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

Type	Input		Test
	V_I	t_r, t_f	t_{PHL}, t_{PLH}
74HC2G14	GND to V_{CC}	6 ns	open
74HCT2G14	GND to 3.0 V	6 ns	open

13. Transfer characteristics

Table 12. Transfer characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see 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	
74HC2G14										
V_{T+}	positive-going threshold voltage	see Fig. 7, Fig. 8								
		V_{CC} = 2.0 V	1.00	1.18	1.50	1.00	1.50	1.00	1.50	V
		V_{CC} = 4.5 V	2.30	2.60	3.15	2.30	3.15	2.30	3.15	V
		V_{CC} = 6.0 V	3.00	3.46	4.20	3.00	4.20	3.00	4.20	V
V_{T-}	negative-going threshold voltage	see Fig. 7, Fig. 8								
		V_{CC} = 2.0 V	0.30	0.60	0.90	0.30	0.90	0.30	0.90	V
		V_{CC} = 4.5 V	1.13	1.47	2.00	1.13	2.00	1.13	2.00	V
		V_{CC} = 6.0 V	1.50	2.06	2.60	1.50	2.60	1.50	2.60	V
V_H	hysteresis voltage	(V_{T+} - V_{T-}); see Fig. 7, Fig. 8 and Fig. 9								
		V_{CC} = 2.0 V	0.30	0.60	1.00	0.30	1.00	0.30	1.00	V
		V_{CC} = 4.5 V	0.60	1.13	1.40	0.60	1.40	0.60	1.40	V
		V_{CC} = 6.0 V	0.80	1.40	1.70	0.80	1.70	0.80	1.70	V
74HCT2G14										
V_{T+}	positive-going threshold voltage	see Fig. 7 and Fig. 8								
		V_{CC} = 4.5 V	1.20	1.58	1.90	1.20	1.90	1.20	1.90	V
		V_{CC} = 5.5 V	1.40	1.78	2.10	1.40	2.10	1.40	2.10	V
V_{T-}	negative-going threshold voltage	see Fig. 7 and Fig. 8								
		V_{CC} = 4.5 V	0.50	0.87	1.20	0.50	1.20	0.50	1.20	V
		V_{CC} = 5.5 V	0.60	1.11	1.40	0.60	1.40	0.60	1.40	V
V_H	hysteresis voltage	(V_{T+} - V_{T-}); see Fig. 7, Fig. 8 and Fig. 10								
		V_{CC} = 4.5 V	0.40	0.71	-	0.40	-	0.40	-	V
		V_{CC} = 5.5 V	0.40	0.67	-	0.40	-	0.40	-	V

13.1. Waveforms transfer characteristics

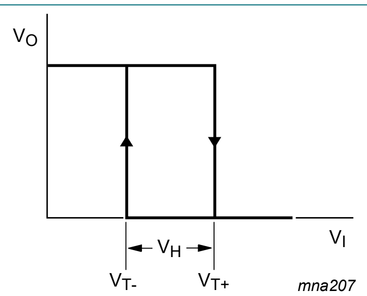


Fig. 7. Transfer characteristic

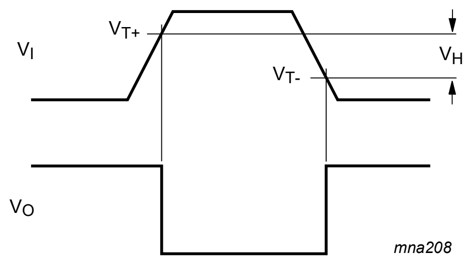
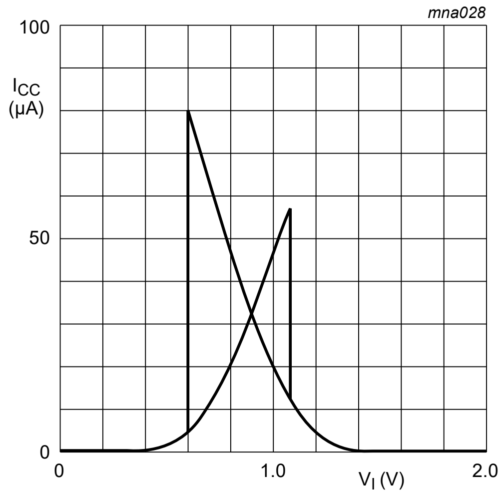
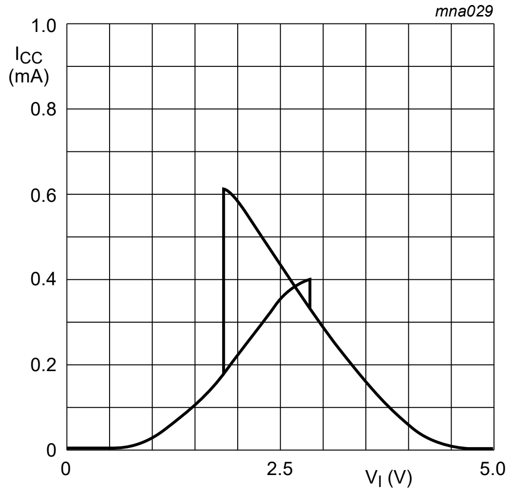


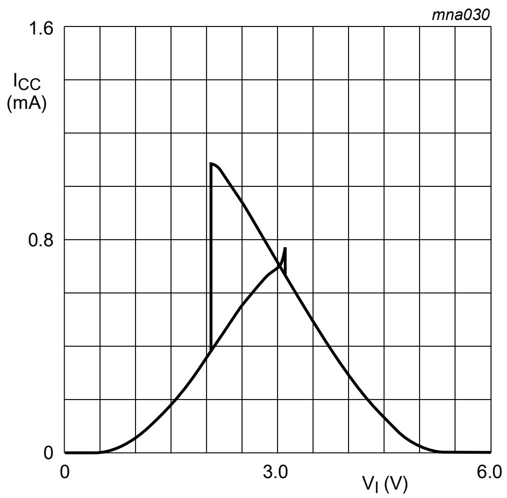
Fig. 8. Definition of V_{T+}, V_{T-} and V_H



a. V_{CC} = 2.0 V

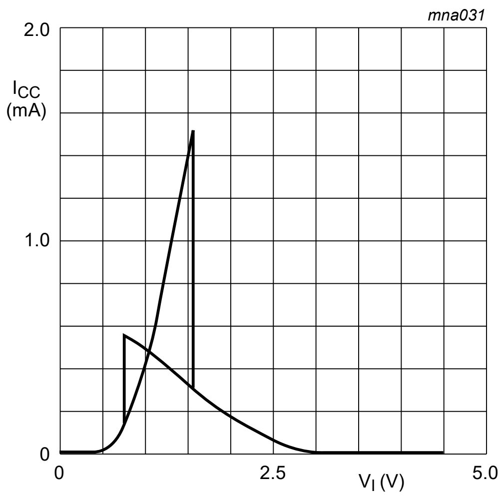


b. V_{CC} = 4.5 V

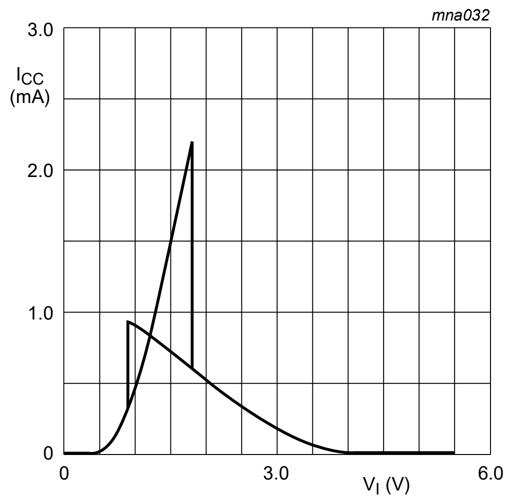


c. V_{CC} = 6.0 V

Fig. 9. Typical 74HC2G14 transfer characteristics



a. V_{CC} = 4.5 V.



b. V_{CC} = 5.5 V.

Fig. 10. Typical 74HCT2G14 transfer characteristics

14. Application information

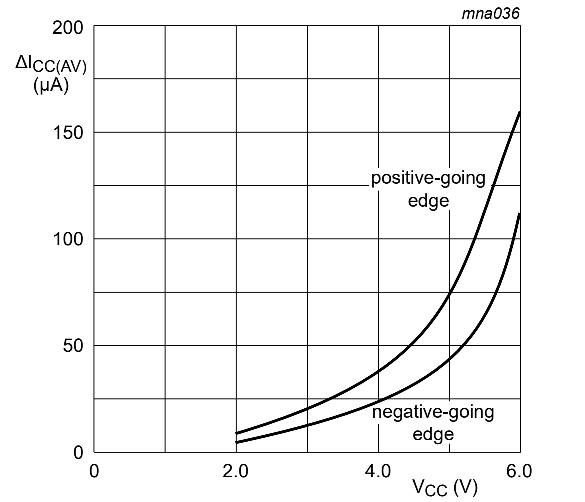
The slow input rise and fall times cause additional power dissipation, this can be calculated using the following formula:

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

- P_{add} = additional power dissipation (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).

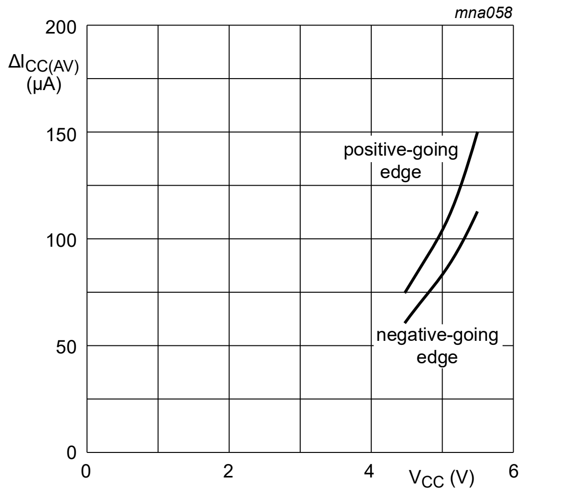
$\Delta I_{CC(AV)}$ differs with positive or negative input transitions, as shown in Fig. 11 and Fig. 12.

An example of a relaxation circuit using the 74HC2G14; 74HCT2G14 is shown in Fig. 13.



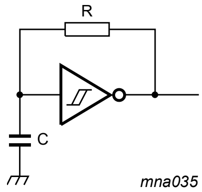
Linear change of V_I between $0.1V_{CC}$ to $0.9V_{CC}$

Fig. 11. $\Delta I_{CC(AV)}$ as a function of V_{CC} for 74HC2G14



Linear change of V_I between $0.1V_{CC}$ to $0.9V_{CC}$

Fig. 12. $\Delta I_{CC(AV)}$ as a function of V_{CC} for 74HCT2G14



For 74HC2G14: $f = \frac{1}{T} \approx \frac{1}{0.8 \times RC}$

For 74HCT2G14: $f = \frac{1}{T} \approx \frac{1}{0.67 \times RC}$

For K-factor, see Fig. 14 or Fig. 15

Fig. 13. Relaxation oscillator

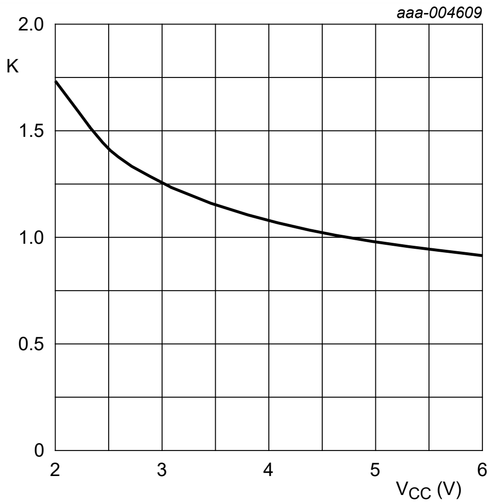


Fig. 14. K-factor for 74HC2G14

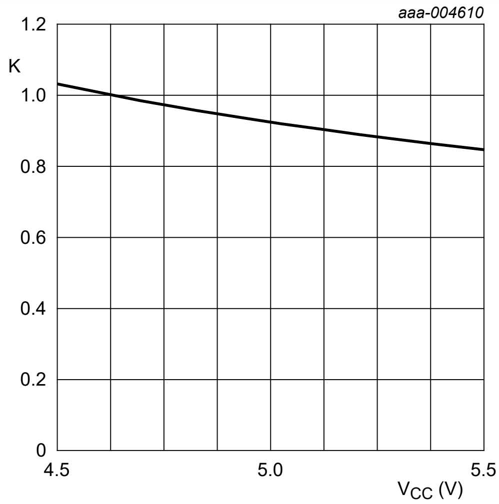
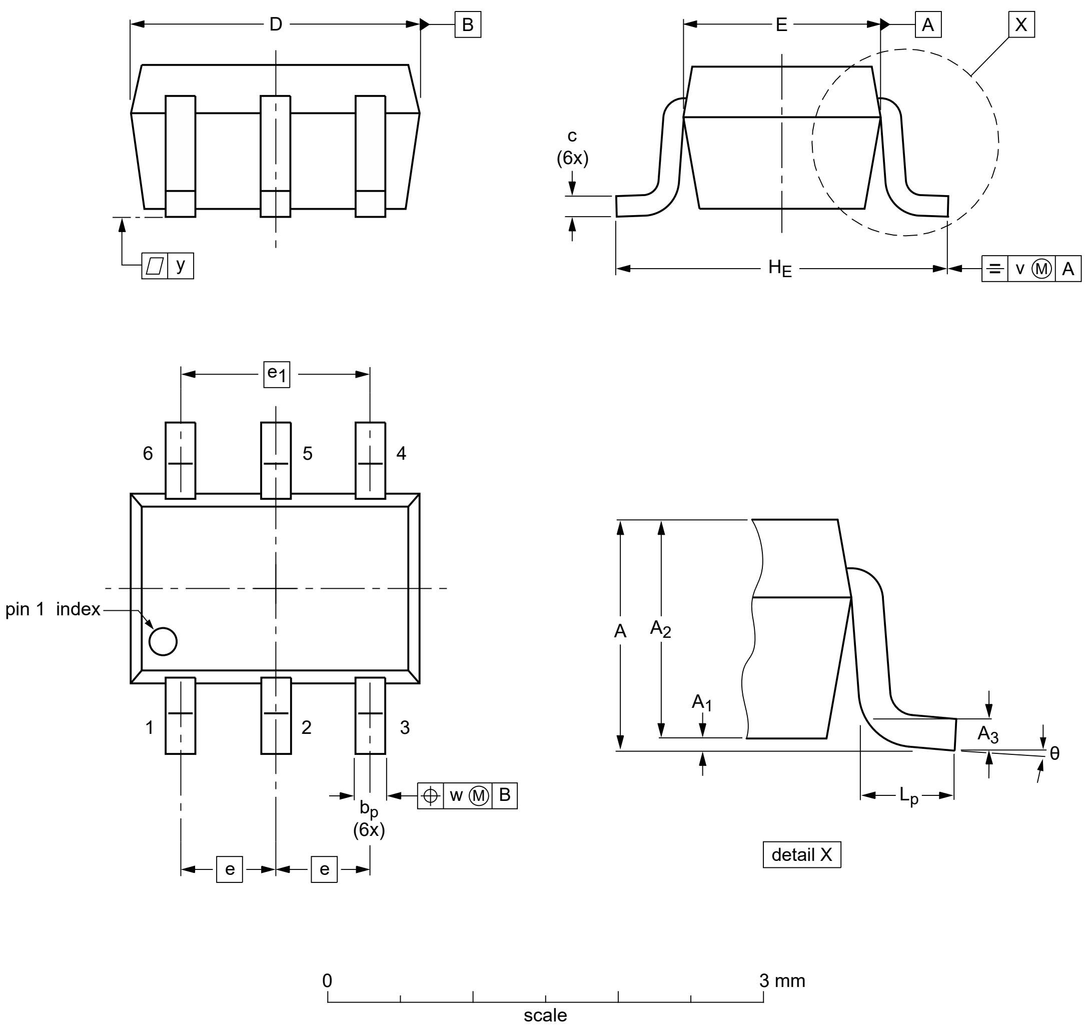


Fig. 15. K-factor for 74HCT2G14

15. Package outline

TSSOP6: plastic thin shrink small outline package; 6 leads; body width 1.25 mm **SOT363-2**



Dimensions (mm are the original dimensions)

Unit		A	A_1	A_2	A_3	b_p	c	D(1)	E(1)	e	e_1	H_E	L_p	v	w	y	θ
mm	max	1.1	0.1	1.0	0.15	0.30	0.25	2.2	1.35	0.65	1.3	2.4	0.46	0.3	0.1	0.1	8°
	min	0.8	0	0.8		0.15	0.08	1.8	1.15			1.8	0.26				0°

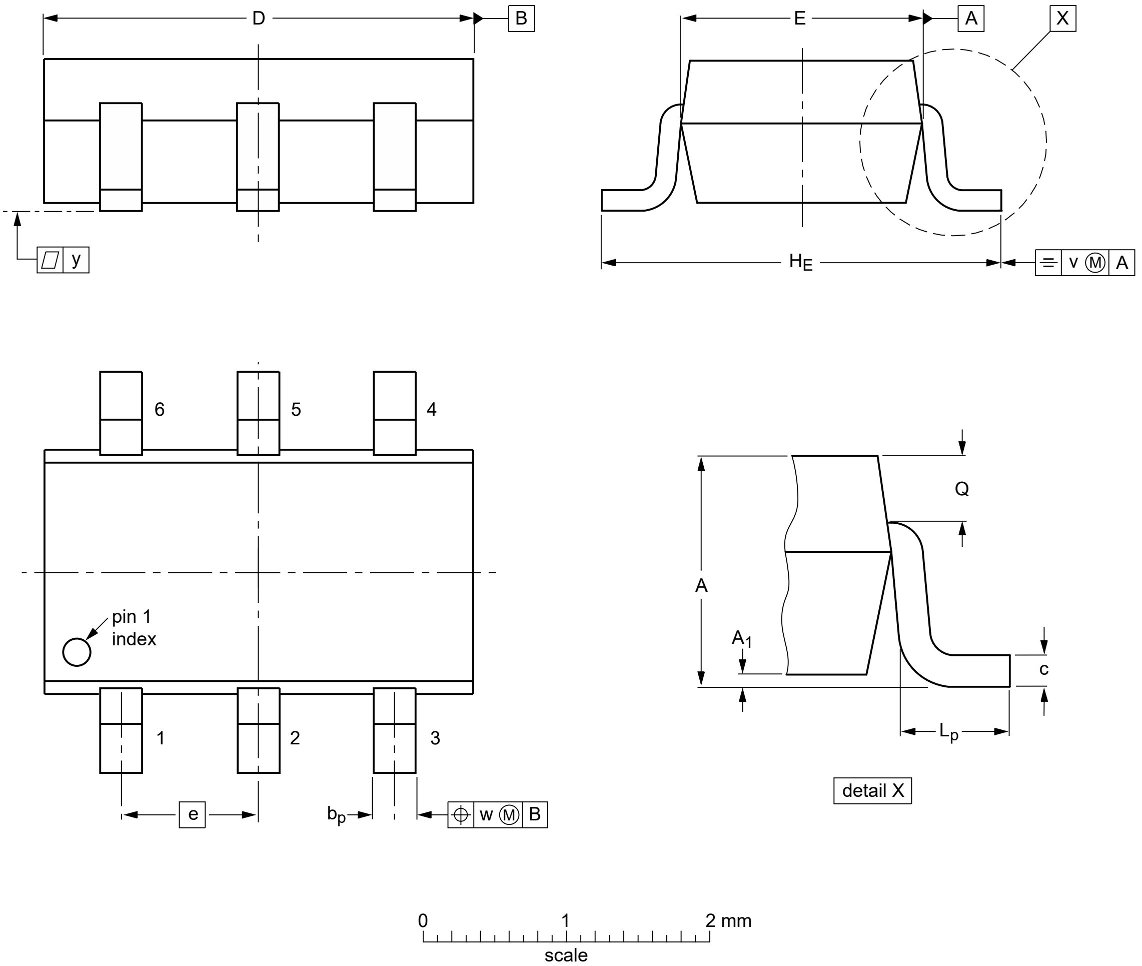
Note
1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

sot363-2_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT363-2		MO-203	SC-88A			~~21-12-15~~ 21-12-16

Fig. 16. Package outline SOT363-2 (TSSOP6)

Plastic, surface-mounted package (SC-74; TSOP6); 6 leads **SOT457**



Dimensions (mm are the original dimensions)

Unit		A	A_1	b_p	c	D	E	e	H_E	L_p	Q	v	w	y
	max	1.1	0.1	0.40	0.26	3.1	1.7		3.0	0.6	0.33			
mm	nom							0.95				0.2	0.2	0.1
	min	0.9	0.013	0.25	0.10	2.7	1.3		2.5	0.2	0.23			

sot457_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT457			SC-74			~~06-03-16~~ 18-11-27

Fig. 17. Package outline SOT457 (SC-74; TSOP6)

16. Abbreviations

Table 13. Abbreviations

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

17. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT2G14 v.3	20220128	Product data sheet	-	74HC_HCT2G14 v.2
Modifications:	• 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 2 updated. • Section 9: Derating values for P_{tot} total power dissipation updated. • Fig. 17: Package outline drawing SOT457 (SC-74; TSOP6) updated.			
74HC_HCT2G14 v.2	20140314	Product data sheet	-	74HC_HCT2G14 v.1
Modifications:	• Fig. 14 and Fig. 15 added (typical K-factor for relaxation oscillator).			
74HC_HCT2G14 v.1	20061011	Product data sheet	-	-

18. 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 .

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