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Kind regards,

Team Nexperia

74HC73

Dual JK flip-flop with reset; negative-edge trigger Rev. 5 — 2 December 2015 Prod

Product data sheet

General description 1.

The 74HC73 is a dual negative edge triggered JK flip-flop with individual J, K, clock (nCP) and reset (nR) inputs and complementary nQ and nQ outputs. The J and K inputs must be stable one set-up time prior to the HIGH-to-LOW clock transition for predictable operation. (nR) is asynchronous, when LOW it overrides the clock and data inputs, forcing the nQ output LOW and the nQ output HIGH. Schmitt-trigger action in the clock input makes the circuit highly tolerant to slower clock rise and fall times. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} .

Features and benefits 2.

- Low-power dissipation
- Complies with JEDEC standard no. 7A
- ESD protection:
 - ♦ HBM JESD22-A114F exceeds 2000 V
 - ♦ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to +80 °C and from -40 °C to +125 °C

Ordering information

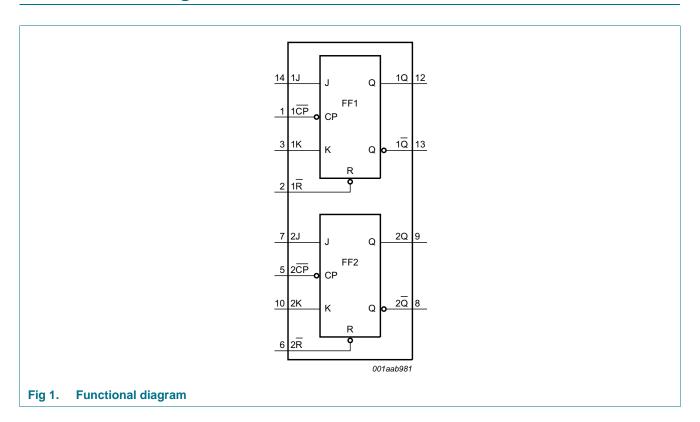
Ordering information Table 1.

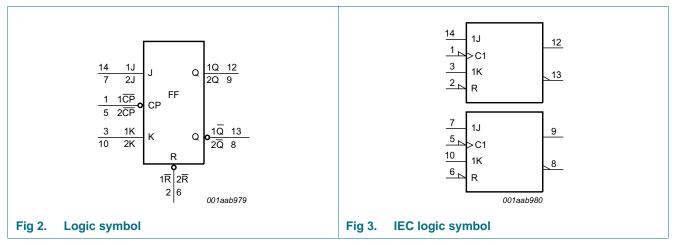
Type number	Package										
	Temperature range	Name	Description	Version							
74HC73D	-40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1							
74HC73DB	–40 °C to +125 °C	SSOP14	plastic shrink small outline package; 14 leads; body width 5.3 mm	SOT337-1							
74HC73PW	–40 °C to +125 °C	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1							



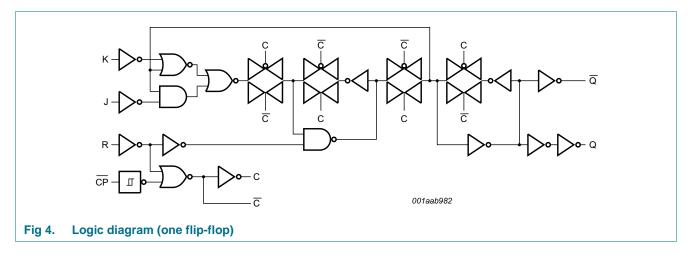
Dual JK flip-flop with reset; negative-edge trigger

4. Functional diagram



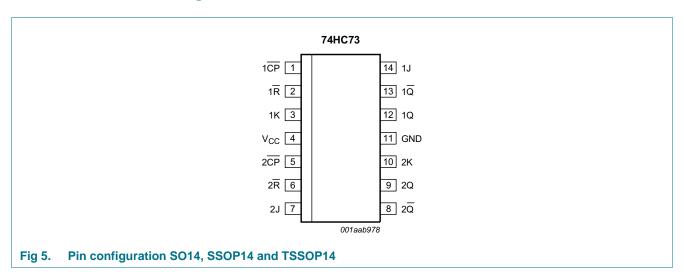


Dual JK flip-flop with reset; negative-edge trigger



5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1CP, 2CP	1, 5	clock input (HIGH-to-LOW edge-triggered); also referred to as nCP
1R, 2R	2, 6	asynchronous reset input (active LOW); also referred to as nR
1K, 2K	3, 10	synchronous K input; also referred to as nK
V _{CC}	4	positive supply voltage
GND	11	ground (0 V)
1Q, 2Q	12, 9	true output; also referred to as nQ
1Q, 2Q	13, 8	complement output; also referred to as $n\overline{Q}$
1J, 2J	14, 7	synchronous J input; also referred to as nJ

Dual JK flip-flop with reset; negative-edge trigger

6. Functional description

Table 3. Function table[1]

Input						Operating mode
nR	nCP	nJ	nK	nQ	nQ	
L	X	Х	X	L	Н	asynchronous reset
Н	\	h	h	q	q	toggle
Н	\	I	h	L	Н	load 0 (reset)
Н	\	h	I	Н	L	load 1 (set)
Н	\	I	1	q	q	hold (no change)

^[1] H = HIGH voltage level;

7. Limiting values

Table 4. 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	$V_{I} < -0.5 \text{ V or } V_{I} > V_{CC} + 0.5 \text{ V}$	<u>[1]</u>	-	±20	mA
I _{OK}	output clamping current	$V_{O} < -0.5 \text{ V or } V_{O} > V_{CC} + 0.5 \text{ V}$	<u>[1]</u>	-	±20	mA
I _O	output current	$V_{O} = -0.5 \text{ V to } V_{CC} + 0.5 \text{ V}$		-	±25	mA
I _{CC}	supply current			-	50	mA
I _{GND}	ground current			-50	-	mA
T _{stg}	storage temperature			-65	+150	°C
P _{tot}	total power dissipation	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$				
		SO14 package	[2]	-	500	mW
		(T)SSOP14 package	<u>[3]</u>	-	500	mW

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

h = HIGH voltage level one set-up time prior to the HIGH-to-LOW clock transition;

L = LOW voltage level;

I = LOW voltage level one set-up time prior to the HIGH-to-LOW clock transition;

q = state of referenced output one set-up time prior to the HIGH-to-LOW clock transition;

X = don't care;

 $[\]downarrow$ = HIGH-to-LOW clock transition.

^[2] Ptot derates linearly with 8 mW/K above 70 °C.

^[3] $\;\;$ P $_{tot}$ derates linearly with 5.5 mW/K above 60 $^{\circ}C.$

Dual JK flip-flop with reset; negative-edge trigger

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
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	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 2.0 V	-	-	625	ns/V
		V _{CC} = 4.5 V	-	1.67	139	ns/V
		$V_{CC} = 6.0 \text{ V}$	-	-	83	ns/V

9. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions		25 °C	,	-40 °C t	o +85 °C	-40 °C t	Unit	
			Min	Тур	Max	Min	Max	Min	Max	
V _{IH}	HIGH-level	V _{CC} = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
	input voltage	V _{CC} = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V _{CC} = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
V_{IL}	LOW-level V _{CC} = 2.0 V		-	0.8	0.5	-	0.5	-	0.5	V
	input voltage	V _{CC} = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V _{CC} = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	V
V _{OH}	HIGH-level	$V_I = V_{IH}$ or V_{IL}								
	output voltage	$I_{O} = -20 \mu A; V_{CC} = 2.0 V$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_{O} = -20 \mu A; V_{CC} = 4.5 V$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_{O} = -20 \mu A; V_{CC} = 6.0 V$	5.9	6.0	-	5.9	-	5.9	-	V
		$I_{O} = -4 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.98	4.32	-	3.84	-	3.7	-	V
		$I_{O} = -5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	5.48	5.81	-	5.34	-	5.2	-	V
V_{OL}	LOW-level	$V_I = V_{IH}$ or V_{IL}								
	output voltage	$I_O = 20 \mu A; V_{CC} = 2.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20 \mu A; V_{CC} = 4.5 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20 \mu A; V_{CC} = 6.0 V$	-	0	0.1	-	0.1	-	0.1	V
		$I_{O} = 4 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	0.15	0.26	-	0.33	-	0.4	V
		$I_{O} = 5.2 \text{ mA}; V_{CC} = 6.0 \text{ V}$	-	0.16	0.26	-	0.33	-	0.4	V
l _l	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0 \text{ V}$	-	-	±0.1	-	±1.0	-	±1.0	μΑ
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 6.0 \text{ V}$	-	-	4.0	-	40.0	-	80.0	μА
Cı	input capacitance		-	3.5	-	-	-	-	-	pF

Dual JK flip-flop with reset; negative-edge trigger

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND (ground = 0 V); $C_L = 50 \text{ pF}$ unless otherwise specified; for test circuit, see Figure 8

Symbol	Parameter	Conditions		25 °C	;	-40 °C to	o +85 °C	-40 °C to	Unit	
			Min	Тур	Max	Min	Max	Min	Max	
t _{pd}	propagation	nCP to nQ; see Figure 6								
	delay	V _{CC} = 2.0 V	-	52	160	-	200	-	240	ns
		V _{CC} = 4.5 V	-	19	32	-	40	-	48	ns
		V _{CC} = 6.0 V	-	15	27	-	34	-	41	ns
		$V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$	-	16	-	-	-	-	-	ns
		nCP to nQ; see Figure 6								
		V _{CC} = 2.0 V	-	52	160	-	200	-	240	ns
		V _{CC} = 4.5 V	-	19	32	-	40	-	48	ns
		V _{CC} = 6.0 V	-	15	27		34	-	41	ns
		$V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$	-	16	-	-				ns
		nR to nQ, nQ; see Figure 7								
		V _{CC} = 2.0 V	-	50	145	-	180	-	220	ns
		V _{CC} = 4.5 V	-	18	29	-	36	-	44	ns
		V _{CC} = 6.0 V	-	14	25		31	-	38	ns
		$V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$	-	15	-	-	-	-	-	ns
t _t	transition time	nQ, nQ; see Figure 6								
		V _{CC} = 2.0 V	-	19	75	-	95	-	110	ns
		V _{CC} = 4.5 V	-	7	15	-	19	-	22	ns
		V _{CC} = 6.0 V	-	6	13		16	-	19	ns
t _W	pulse width	nCP input, HIGH or LOW; see Figure 6								
		V _{CC} = 2.0 V	80	22	-	100		120	-	ns
		V _{CC} = 4.5 V	16	8	-	20	-	24	-	ns
		V _{CC} = 6.0 V	14	6	-	17	-	20		ns
		nR input, HIGH or LOW; see Figure 7								
		V _{CC} = 2.0 V	80	22	-	100		120	-	ns
		V _{CC} = 4.5 V	16	8	-	20	-	24	-	ns
		V _{CC} = 6.0 V	14	6	-	17	-	20		ns
t _{rec}	recovery time	nR to nCP; see Figure 7								
		V _{CC} = 2.0 V	80	22	-	100		120	-	ns
		V _{CC} = 4.5 V	16	8	-	20	-	24	-	ns
		V _{CC} = 6.0 V	14	6	-	17	-	20		ns
t _{su}	set-up time	nJ, nK to nCP; see Figure 6								
		V _{CC} = 2.0 V	80	22	-	100		120	-	ns
		V _{CC} = 4.5 V	16	8	-	20	-	24	-	ns
		V _{CC} = 6.0 V	14	6	-	17	-	20		ns

Dual JK flip-flop with reset; negative-edge trigger

 Table 7.
 Dynamic characteristics ...continued

GND (ground = 0 V); C_L = 50 pF unless otherwise specified; for test circuit, see Figure 8

Symbol	Parameter	Conditions		25 °C		-40 °C t	o +85 °C	–40 °C to	+125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
t _h	hold time	nJ, nK to nCP; see Figure 6								
		V _{CC} = 2.0 V	3	-8	-	3		3	-	ns
		V _{CC} = 4.5 V	3	-3	-	3	-	3	-	ns
		V _{CC} = 6.0 V	3	-2	-	3	-	3		ns
IIIax	maximum	nCP input; see Figure 6								
	frequency	V _{CC} = 2.0 V	6.0	23	-	4.8		4.0	-	MHz
		V _{CC} = 4.5 V	30	70	-	24	-	20	-	MHz
		V _{CC} = 6.0 V	35	83	-	28	-	24	-	MHz
		$V_{CC} = 5.0 \text{ V}; C_L = 15 \text{ pF}$	-	77	-		-		-	MHz
C _{PD}	power dissipation capacitance	per flip-flop; [3] $V_I = GND$ to V_{CC}	-	30	-	-	-	-	-	pF

- [1] t_{pd} is the same as t_{PHL} , t_{PLH} .
- [2] t_t is the same as t_{THL} , t_{TLH} .
- [3] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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

 f_i = input frequency in MHz;

 f_o = output frequency in MHz;

C_L = output load capacitance in pF;

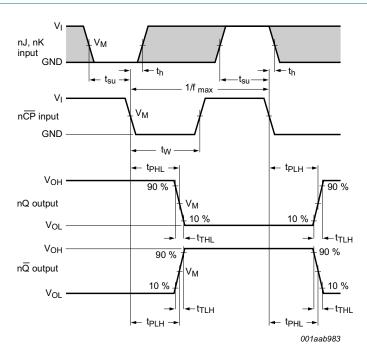
V_{CC} = supply voltage in V;

N = number of inputs switching;

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

Dual JK flip-flop with reset; negative-edge trigger

11. Waveforms

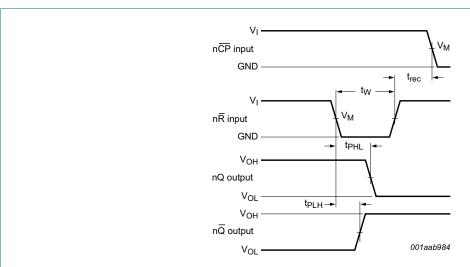


The shaded areas indicate when the input is permitted to change for predictable output performance.

Measurement points are given in Table 8.

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

Fig 6. Waveforms showing the clock (nCP) to output (nQ, nQ) propagation delays, the clock pulse width, the J and K to nCP set-up and hold times, the output transition times and the maximum clock frequency



Measurement points are given in Table 8.

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

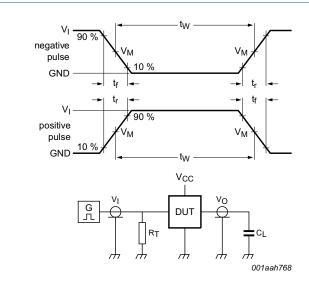
Fig 7. Waveforms showing the reset (nR) input to output (nQ, nQ) propagation delays and the reset pulse width and the nR to nCP removal time

74HC73

Dual JK flip-flop with reset; negative-edge trigger

Table 8. Measurement points

Туре	Input		Output
	VI	V _M	V _M
74HC73	V _{CC}	0.5V _{CC}	0.5V _{CC}



Test data is given in Table 9.

Definitions for test circuit:

 R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.

 C_L = Load capacitance including jig and probe capacitance.

Fig 8. Test circuit for measuring switching times

Table 9. Test data

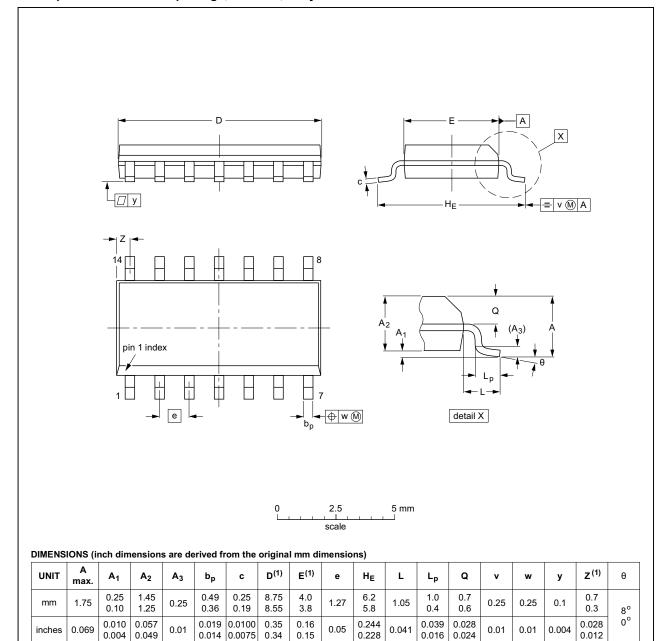
Туре	Input		Load
	V_l t_r, t_f		CL
74HC73	V _{CC}	6 ns	15 pF, 50 pF

Dual JK flip-flop with reset; negative-edge trigger

12. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1



Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE	E		REFER	EUROPEAN	ISSUE DATE			
VERSIO	N	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE	
SOT108	-1	076E06	MS-012				99-12-27 03-02-19	

Fig 9. Package outline SOT108-1 (SO14)

74HC73

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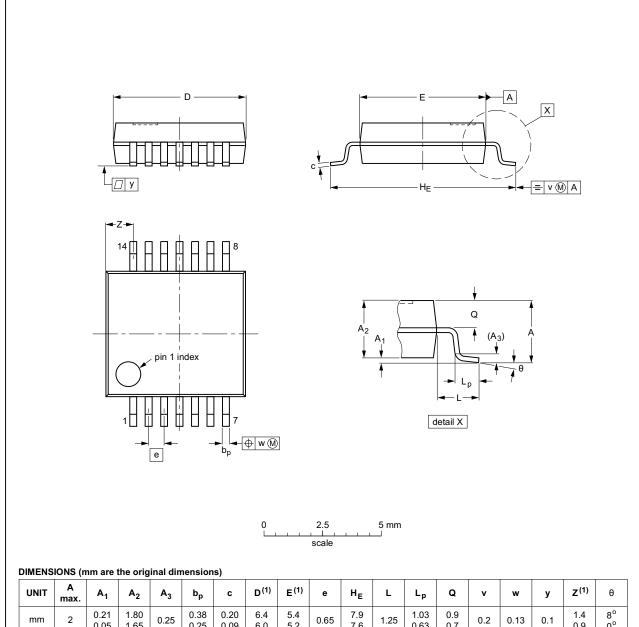
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74HC73 **NXP Semiconductors**

Dual JK flip-flop with reset; negative-edge trigger

SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm

SOT337-1



UNIT	A max.	A ₁	A ₂	A ₃	b _p	U	D ⁽¹⁾	E ⁽¹⁾	е	HE	L	Lp	Q	>	w	у	Z ⁽¹⁾	θ
mm	2	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.4 0.9	8° 0°

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

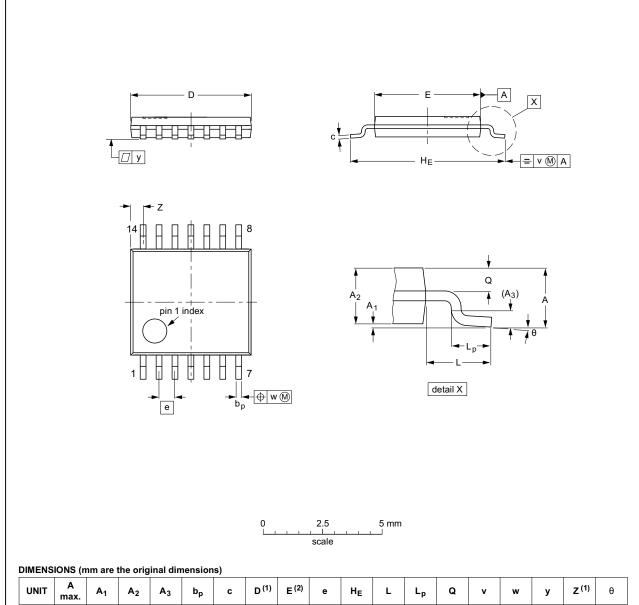
OUTLINE VERSION		REFER	EUROPEAN	ISSUE DATE		
	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT337-1		MO-150				99-12-27 03-02-19

Fig 10. Package outline SOT337-1 (SSOP14)

74HC73 **NXP Semiconductors**

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1



ı	UNIT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E (2)	е	HE	L	Lp	Q	v	w	у	Z ⁽¹⁾	θ
	mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.72 0.38	8° 0°

Notes

- 1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
- 2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE			REFER	EUROPEAN	ISSUE DATE			
	VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE	
	SOT402-1		MO-153				-99-12-27 03-02-18	
	SOT402-1		MO-153				<u>ታ</u>	1 4

Fig 11. Package outline SOT402-1 (TSSOP14)

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Dual JK flip-flop with reset; negative-edge trigger

13. Abbreviations

Table 10. Abbreviations

Acronym	Description
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model

14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes				
74HC73 v.5	20151202	Product data sheet	-	74HC73 v.4				
Modifications:	Type number	74HC73N (SOT27-1) removed	d.					
74HC73 v.4	20080319	Product data sheet	-	74HC73 v.3				
 Modifications: The format of this data sheet has been redesigned to comply with the new ide guidelines of NXP Semiconductors. Legal texts have been adapted to the new company name where appropriate 								
	 Quick reference data incorporated into <u>Section 9</u> and <u>10</u>. 							
	Section 8 "Re	ecommended operating condition	ons" t _r , t _f converted t	ο Δt/ΔV.				
74HC73 v.3	20041112	Product data sheet	-	74HC_HCT73_CNV v.2				
74HC_HCT73_CNV v.2	December 1990	Product specification	-	-				

15.1 Data sheet status

15. Legal information

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.nxp.com.

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