DATA SHEET

74HC14; 74HCT14
Hex inverting Schmitt trigger

Product specification
Supersedes data of 1997 Aug 26

2003 Oct 30

Philips
Semiconductors

PHILIPS

Hex inverting Schmitt trigger 74HC14; 74HCT14

FEATURES

- Applications:
  - Wave and pulse shapers
  - Astable multivibrators
  - Monostable multivibrators.
- Complies with JEDEC standard no. 7A
- ESD protection:
  HBM EIA/JESD22-A114-A exceeds 2000 V
  MM EIA/JESD22-A115-A exceeds 200 V.
- Specified from –40 to +85 °C and –40 to +125 °C.

DESCRIPTION

The 74HC14 and 74HCT14 are high-speed Si-gate CMOS devices and are pin compatible with low power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard no. 7A.

The 74HC14 and 74HCT14 provide six inverting buffers with Schmitt-trigger action. They are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

QUICK REFERENCE DATA

GND = 0 V; T_{amb} = 25 °C; $t_r = t_f$ = 6 ns

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC	HCT	
t_{PHL}/t_{PLH}	propagation delay nA to nY	C_L = 15 pF; V_{CC} = 5 V	12	17	ns
C_I	input capacitance		3.5	3.5	pF
C_{PD}	power dissipation capacitance per gate	notes 1 and 2	7	8	pF

Notes

1. 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 Volts;
   N = total load switching outputs;
   $\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.
2. For type 74HC14 the condition is V_I = GND to V_{CC}.
   For type 74HCT14 the condition is V_I = GND to V_{CC} – 1.5 V.

FUNCTION TABLE

INPUT	OUTPUT
nA	**nY**
L	H
H	L

Note

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

ORDERING INFORMATION

TYPE NUMBER	PACKAGE				
	TEMPERATURE RANGE	PINS	PACKAGE	MATERIAL	CODE
74HC14D	–40 to +125 °C	14	SO14	plastic	SOT108-1
74HCT14D	–40 to +125 °C	14	SO14	plastic	SOT108-1
74HC14DB	–40 to +125 °C	14	SSOP14	plastic	SOT337-1
74HCT14DB	–40 to +125 °C	14	SSOP14	plastic	SOT337-1
74HC14N	–40 to +125 °C	14	DIP14	plastic	SOT27-1
74HCT14N	–40 to +125 °C	14	DIP14	plastic	SOT27-1
74HC14PW	–40 to +125 °C	14	TSSOP14	plastic	SOT402-1
74HCT14PW	–40 to +125 °C	14	TSSOP14	plastic	SOT402-1
74HC14BQ	–40 to +125 °C	14	DHVQFN14	plastic	SOT762-1
74HCT14BQ	–40 to +125 °C	14	DHVQFN14	plastic	SOT762-1

PINNING

PIN	SYMBOL	DESCRIPTION
1	1A	data input
2	1Y	data output
3	2A	data input
4	2Y	data output
5	3A	data input
6	3Y	data output
7	GND	ground (0 V)
8	4Y	data output
9	4A	data input
10	5Y	data output
11	5A	data input
12	6Y	data output
13	6A	data input
14	V_{CC}	supply voltage

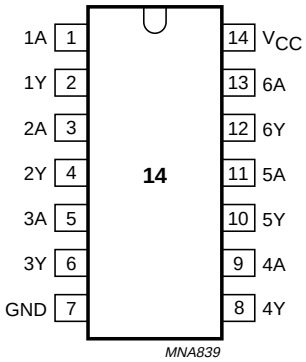
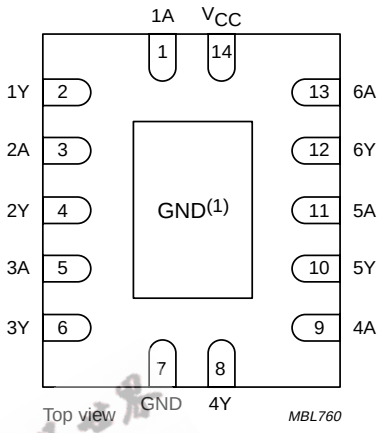


Fig.1 Pin configuration.



(1) The die substrate is attached to this pad using conductive die attach material. It can not be used as a supply pin or input.

Fig.2 Pin configuration DHVQFN14.

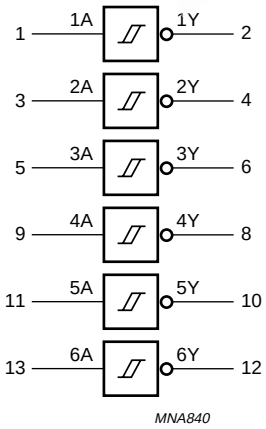


Fig.3 Logic symbol.

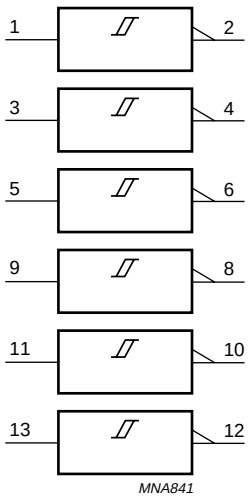


Fig.4 IEC logic symbol.

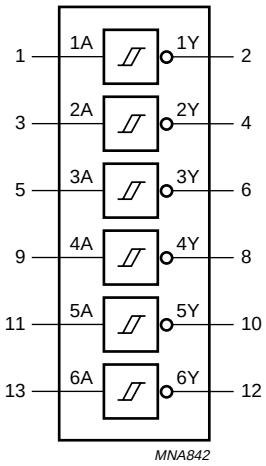


Fig.5 Functional diagram.

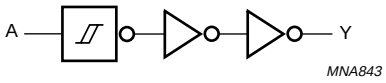


Fig.6 Logic diagram (one Schmitt trigger).

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	74HC14			74HCT14			UNIT
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
V_{CC}	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V_I	input voltage		0	–	V_{CC}	0	–	V_{CC}	V
V_O	output voltage		0	–	V_{CC}	0	–	V_{CC}	V
T_{amb}	operating ambient temperature	see DC and AC characteristics per device	–40	+25	+85	–40	+25	+85	°C
			–40	–	+125	–40	–	+125	°C

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 60134); voltages are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CC}	supply voltage		–0.5	+7	V
I_{IK}	input diode current	$V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V	–	±20	mA
I_{OK}	output diode current	$V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V	–	±20	mA
I_O	output source or sink current	-0.5 V $< V_O < V_{CC} + 0.5$ V	–	±25	mA
I_{CC}; I_{GND}	V_{CC} or GND current		–	50	mA
T_{stg}	storage temperature		–65	+150	°C
P_{tot}	power dissipation	T_{amb} = –40 to +125 °C			
		DIP14 packages; note 1	–	750	mW
		Other packages; note 2	–	500	mW

Notes

1. For DIP14 packages: above 70 °C the value of P_D derates linearly with 12 mW/K.
2. For SO14 packages: above 70 °C the value of P_D derates linearly with 8 mW/K.
   For (T)SSOP14 packages: above 60 °C the value of P_D derates linearly with 5.5 mW/K.
   For DHVQFN14 packages: above 60 °C the value of P_D derates linearly with 4.5 mW/K.

DC CHARACTERISTICS

Type 74HC14

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

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.(1)	MAX.	UNIT
		OTHER	V_{CC} (V)				
T_{amb} = 25 °C							
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = –20 µA	2.0	1.9	2.0	–	V
		I_O = –20 µA	4.5	4.4	4.5	–	V
		I_O = –20 µA	6.0	5.9	6.0	–	V
		I_O = –4.0 mA	4.5	3.98	4.32	–	V
		I_O = –5.2 mA	6.0	5.48	5.81	–	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = 20 µA	2.0	–	0	0.1	V
		I_O = 20 µA	4.5	–	0	0.1	V
		I_O = 20 µA	6.0	–	0	0.1	V
		I_O = 4.0 mA	4.5	–	0.15	0.26	V
		I_O = 5.2 mA	6.0	–	0.16	0.26	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND	6.0	–	–	0.1	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; I_O = 0	6.0	–	–	2.0	µA
T_{amb} = –40 to +85 °C							
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = –20 µA	2.0	1.9	–	–	V
		I_O = –20 µA	4.5	4.4	–	–	V
		I_O = –20 µA	6.0	5.9	–	–	V
		I_O = –4.0 mA	4.5	3.84	–	–	V
		I_O = –5.2 mA	6.0	5.34	–	–	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = 20 µA	2.0	–	–	0.1	V
		I_O = 20 µA	4.5	–	–	0.1	V
		I_O = 20 µA	6.0	–	–	0.1	V
		I_O = 4.0 mA	4.5	–	–	0.33	V
		I_O = 5.2 mA	6.0	–	–	0.33	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND	6.0	–	–	1.0	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; I_O = 0	6.0	–	–	20	µA

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.(1)	MAX.	UNIT
		OTHER	V_{CC} (V)				
T_{amb} = −40 to +125 °C							
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}					
		I_O = −20 µA	2.0	1.9	–	–	V
		I_O = −20 µA	4.5	4.4	–	–	V
		I_O = −20 µA	6.0	5.9	–	–	V
		I_O = −4.0 mA	4.5	3.7	–	–	V
		I_O = −5.2 mA	6.0	5.2	–	–	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}					
		I_O = 20 µA	2.0	–	–	0.1	V
		I_O = 20 µA	4.5	–	–	0.1	V
		I_O = 20 µA	6.0	–	–	0.1	V
		I_O = 4.0 mA	4.5	–	–	0.4	V
		I_O = 5.2 mA	6.0	–	–	0.4	V
I_{LI}	input leakage current	V_I = V_{CC} or GND	6.0	–	–	1.0	µA
I_{CC}	quiescent supply current	V_I = V_{CC} or GND; I_O = 0	6.0	–	–	40	µA

Note

1. All typical values are measured at T_{amb} = 25 °C.

Type 74HCT14

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

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.(1)	MAX.	UNIT
		OTHER	V_{CC} (V)				
T_{amb} = 25 °C							
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = –20 µA	4.5	4.4	4.5	–	V
		I_O = –4.0 mA	4.5	3.98	4.32	–	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = 20 µA	4.5	–	0	0.1	V
		I_O = 4.0 mA	4.5	–	0.15	0.26	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND	5.5	–	–	0.1	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; I_O = 0	5.5	–	–	2.0	µA
ΔI_{CC}	additional supply current per input	$V_I = V_{CC}$ – 2.1 V; I_O = 0	4.5 to 5.5	–	30	108	µA
T_{amb} = –40 to +85 °C							
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = –20 µA	4.5	4.4	–	–	V
		I_O = –4.0 mA	4.5	3.84	–	–	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = 20 µA	4.5	–	–	0.1	V
		I_O = 4.0 mA	4.5	–	–	0.33	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND	5.5	–	–	1.0	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; I_O = 0	5.5	–	–	20	µA
ΔI_{CC}	additional supply current per input	$V_I = V_{CC}$ – 2.1 V; I_O = 0	4.5 to 5.5	–	–	135	µA
T_{amb} = –40 to +125 °C							
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = –20 µA	4.5	4.4	–	–	V
		I_O = –4.0 mA	4.5	3.7	–	–	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}					
		I_O = 20 µA	4.5	–	–	0.1	V
		I_O = 4.0 mA	4.5	–	–	0.4	V
I_{LI}	input leakage current	$V_I = V_{CC}$ or GND	5.5	–	–	1.0	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; I_O = 0	5.5	–	–	40	µA
ΔI_{CC}	additional supply current per input	$V_I = V_{CC}$ – 2.1 V; I_O = 0	4.5 to 5.5	–	–	147	µA

Note

1. All typical values are measured at T_{amb} = 25 °C.

TRANSFER CHARACTERISTICS

Type 74HC

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

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	V_{CC} (V)				
T_{amb} = 25 °C; note 1							
V_{T+}	positive-going threshold	Figs 7 and 8	2.0	0.7	1.18	1.5	V
			4.5	1.7	2.38	3.15	V
			6.0	2.1	3.14	4.2	V
V_{T-}	negative-going threshold	Figs 7 and 8	2.0	0.3	0.52	0.90	V
			4.5	0.9	1.40	2.00	V
			6.0	1.2	1.89	2.60	V
V_H	hysteresis ($V_{T+} - V_{T-}$)	Figs 7 and 8	2.0	0.2	0.66	1.0	V
			4.5	0.4	0.98	1.4	V
			6.0	0.6	1.25	1.6	V
T_{amb} = −40 to +85 °C							
V_{T+}	positive-going threshold	Figs 7 and 8	2.0	0.7	–	1.5	V
			4.5	1.7	–	3.15	V
			6.0	2.1	–	4.2	V
V_{T-}	negative-going threshold	Figs 7 and 8	2.0	0.3	–	0.90	V
			4.5	0.90	–	2.00	V
			6.0	1.20	–	2.60	V
V_H	hysteresis ($V_{T+} - V_{T-}$)	Figs 7 and 8	2.0	0.2	–	1.0	V
			4.5	0.4	–	1.4	V
			6.0	0.6	–	1.6	V
T_{amb} = −40 to +125 °C							
V_{T+}	positive-going threshold	Figs 7 and 8	2.0	0.7	–	1.5	V
			4.5	1.7	–	3.15	V
			6.0	2.1	–	4.2	V
V_{T-}	negative-going threshold	Figs 7 and 8	2.0	0.30	–	0.90	V
			4.5	0.90	–	2.00	V
			6.0	1.2	–	2.60	V
V_H	hysteresis ($V_{T+} - V_{T-}$)	Figs 7 and 8	2.0	0.2	–	1.0	V
			4.5	0.4	–	1.4	V
			6.0	0.6	–	1.6	V

Note

1. All typical values are measured at T_{amb} = 25 °C.

Family 74HCT

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

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	V_{CC} (V)				
T_{amb} = 25 °C; note 1							
V_{T+}	positive-going threshold	Figs 7 and 8	4.5	1.2	1.41	1.9	V
			5.5	1.4	1.59	2.1	V
V_{T-}	negative-going threshold	Figs 7 and 8	4.5	0.5	0.85	1.2	V
			5.5	0.6	0.99	1.4	V
V_H	hysteresis ($V_{T+} - V_{T-}$)	Figs 7 and 8	4.5	0.4	0.56	–	V
			5.5	0.4	0.60	–	V
T_{amb} = −40 to +85 °C							
V_{T+}	positive-going threshold	Figs 7 and 8	4.5	1.2	–	1.9	V
			5.5	1.4	–	2.1	V
V_{T-}	negative-going threshold	Figs 7 and 8	4.5	0.5	–	1.2	V
			5.5	0.6	–	1.4	V
V_H	hysteresis ($V_{T+} - V_{T-}$)	Figs 7 and 8	4.5	0.4	–	–	V
			5.5	0.4	–	–	V
T_{amb} = −40 to +125 °C							
V_{T+}	positive-going threshold	Figs 7 and 8	4.5	1.2	–	1.9	V
			5.5	1.4	–	2.1	V
V_{T-}	negative-going threshold	Figs 7 and 8	4.5	0.5	–	1.2	V
			5.5	0.6	–	1.4	V
V_H	hysteresis ($V_{T+} - V_{T-}$)	Figs 7 and 8	4.5	0.4	–	–	V
			5.5	0.4	–	–	V

Note

1. All typical values are measured at T_{amb} = 25 °C.

AC CHARACTERISTICS

Type 74HC

GND = 0 V; $t_r = t_f$ = 6 ns; C_L = 50 pF

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	V_{CC} (V)				
T_{amb} = 25 °C; note 1							
t_{PHL}/t_{PLH}	propagation delay nA to nY	see Fig.9	2.0	–	41	125	ns
			4.5	–	15	25	ns
			6.0	–	12	21	ns
t_{THL}/t_{TLH}	output transition time	see Fig.9	2.0	–	19	75	ns
			4.5	–	7	15	ns
			6.0	–	6	13	ns
T_{amb} = −40 to +85 °C							
t_{PHL}/t_{PLH}	propagation delay nA to nY	see Fig.9	2.0	–	–	155	ns
			4.5	–	–	31	ns
			6.0	–	–	26	ns
t_{THL}/t_{TLH}	output transition time	see Fig.9	2.0	–	–	95	ns
			4.5	–	–	19	ns
			6.0	–	–	15	ns
T_{amb} = −40 to +125 °C							
t_{PHL}/t_{PLH}	propagation delay nA to nY	see Fig.9	2.0	–	–	190	ns
			4.5	–	–	38	ns
			6.0	–	–	32	ns
t_{THL}/t_{TLH}	output transition time	see Fig.9	2.0	–	–	110	ns
			4.5	–	–	22	ns
			6.0	–	–	19	ns

Note

1. All typical values are measured at T_{amb} = 25 °C.

Type 74HCT

GND = 0 V; $t_r = t_f$ = 6 ns; C_L = 50 pF

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	V_{CC} (V)				
T_{amb} = 25 °C; note 1							
t_{PHL}/t_{PLH}	propagation delay nA to nY	see Fig.9	4.5	–	20	34	ns
t_{THL}/t_{TLH}	output transition time	see Fig.9	4.5	–	7	15	ns
T_{amb} = −40 to +85 °C							
t_{PHL}/t_{PLH}	propagation delay nA to nY	see Fig.9	4.5	43	–	–	ns
t_{THL}/t_{TLH}	output transition time	see Fig.9	4.5	19	–	–	ns
T_{amb} = −40 to +125 °C							
t_{PHL}/t_{PLH}	propagation delay nA to nY	see Fig.9	4.5	–	–	51	ns
t_{THL}/t_{TLH}	output transition time	see Fig.9	4.5	–	–	22	ns

Note

1. All typical values are measured at T_{amb} = 25 °C.

TRANSFER CHARACTERISTIC WAVEFORMS

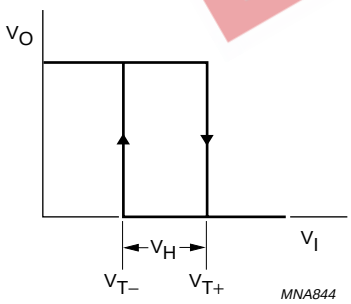
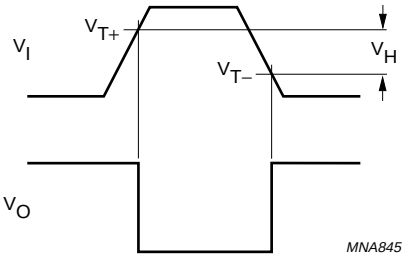
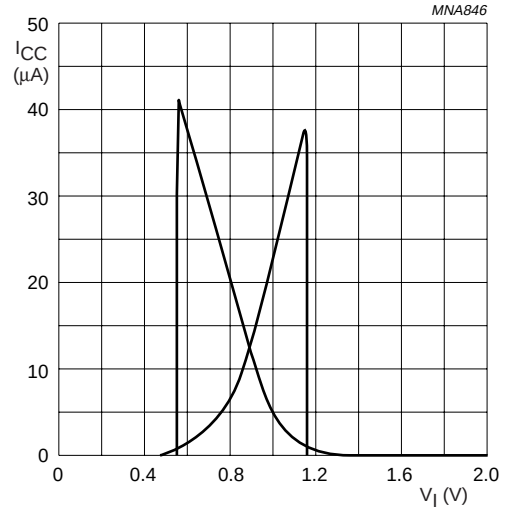


Fig.7 Transfer characteristic.



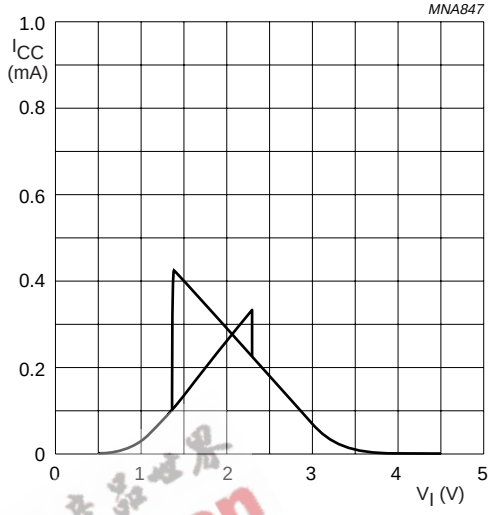
V_{T+} and V_{T-} are between limits of 20% and 70%.

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



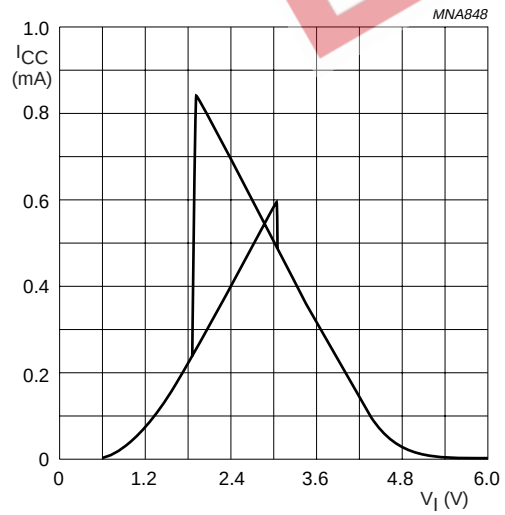
V_{CC} = 2 V.

Fig.9 Typical 74HC14 transfer characteristics.



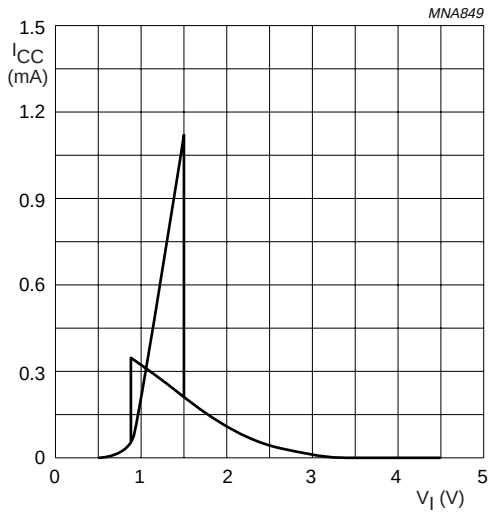
V_{CC} = 4.5 V.

Fig.10 Typical 74HC14 transfer characteristics.



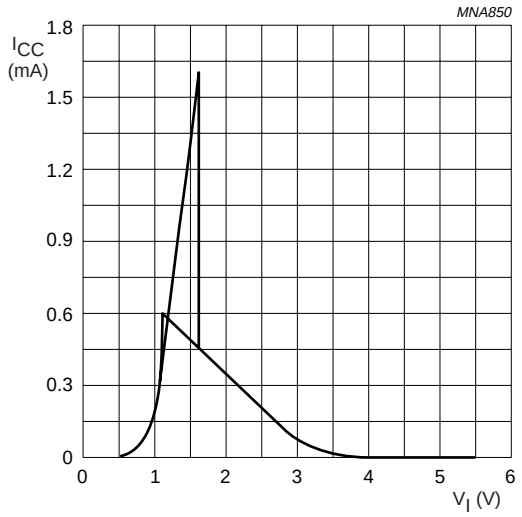
V_{CC} = 6 V.

Fig.11 Typical 74HC14 transfer characteristics.



V_{CC} = 4.5 V.

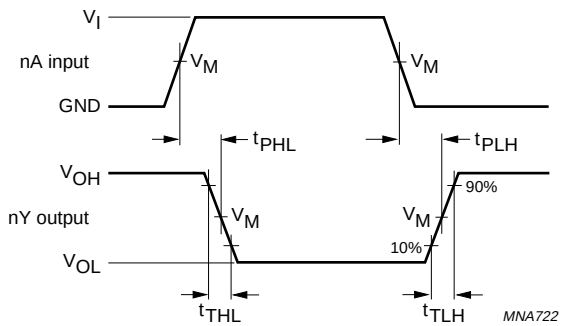
Fig.12 Typical 74HCT14 transfer characteristics.



V_{CC} = 5.5 V.

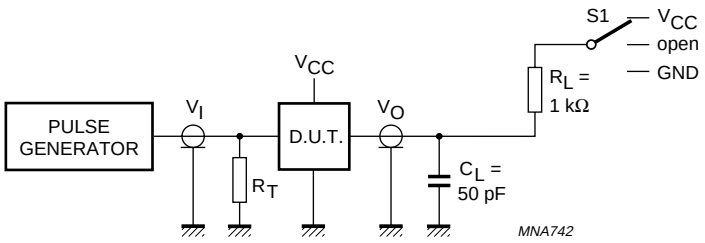
Fig.13 Typical 74HCT14 transfer characteristics.

AC WAVEFORMS



74HC14: V_M = 50%; V_I = GND to V_{CC}.
74HCT14: V_M = 1.3 V; V_I = GND to 3.0 V.

Fig.14 The input (nA) to output (nY) propagation delays and output transitions times.



TEST	S1
t_{PLH}/t_{PHL}	open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND

Definitions for test circuit:
R_L = Load resistor.
C_L = load capacitance including jig and probe capacitance.
R_T = termination resistance should be equal to the output impedance Z_o of the pulse generator.

Fig.15 Load circuitry for switching times.

APPLICATION INFORMATION

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

$P_{ad} = f_i \times (t_r \times I_{CC(AV)} + t_f \times I_{CC(AV)}) \times V_{CC}$.

Where:

P_{ad} = additional power dissipation (μW);

f_i = input frequency (MHz);

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

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

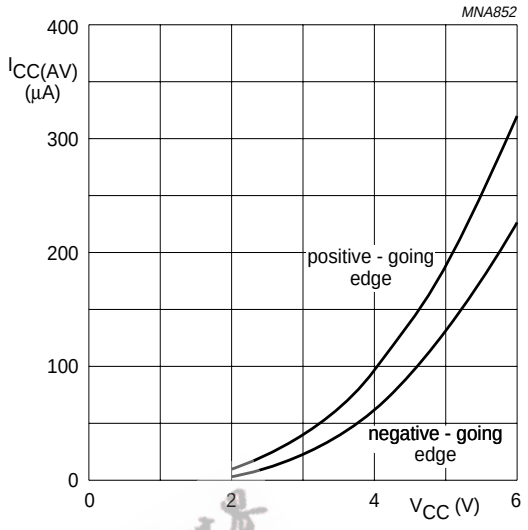
$I_{CC(AV)}$ = average additional supply current (μA).

$I_{CC(AV)}$ differs with positive or negative input transitions, as shown in Figs 16 and 17.

For 74HC/HCT14 used in a relaxation oscillator circuit, see Fig.18.

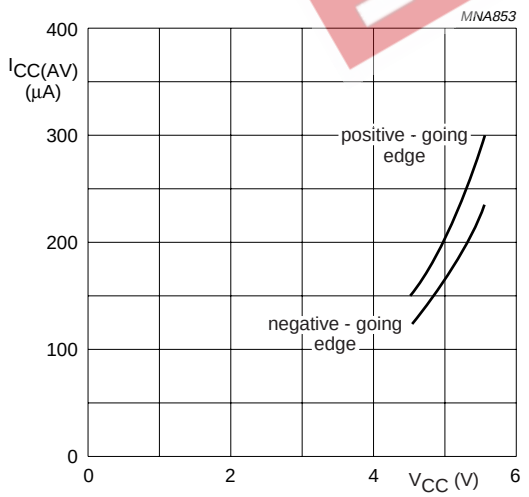
Note to application information

All values given are typical unless otherwise specified.



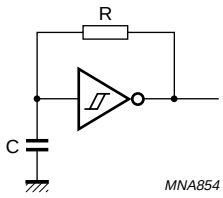
Linear change of V_I between $0.1V_{CC}$ to $0.9V_{CC}$

Fig.16 Average I_{CC} for 74HC14 Schmitt trigger devices.



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

Fig.17 Average I_{CC} for HCT Schmitt trigger devices.



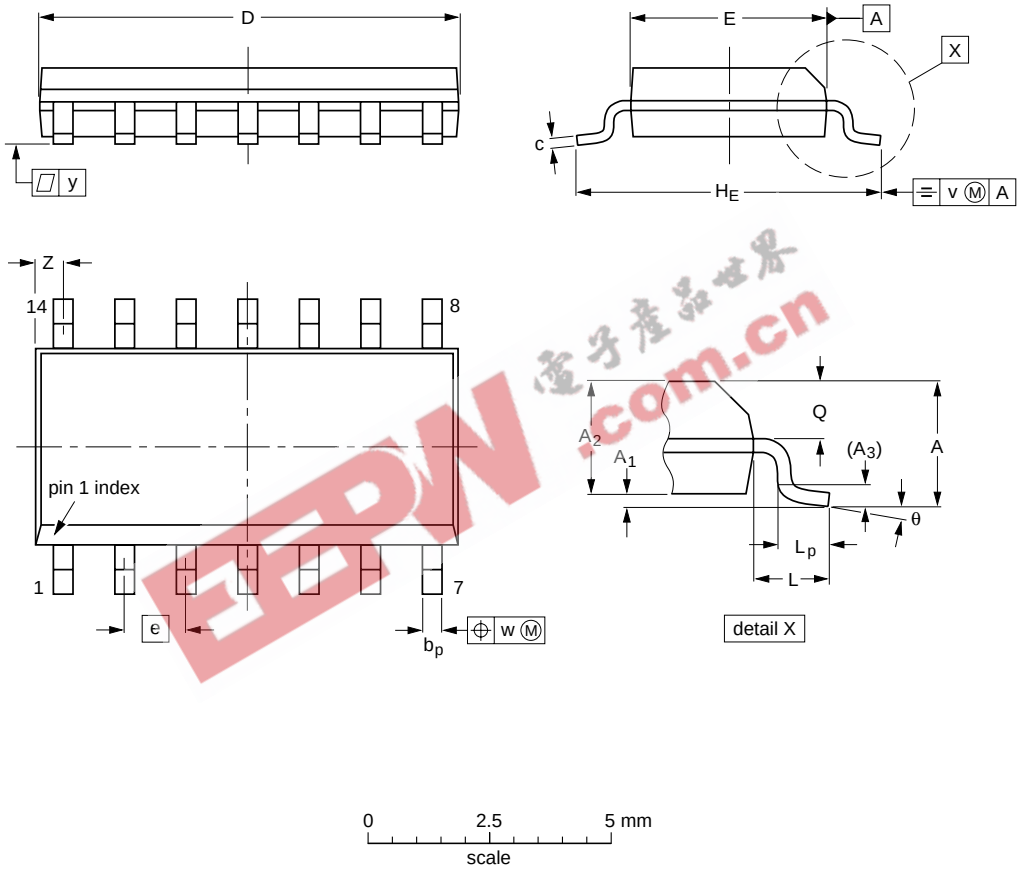
$$74HC14 : f = \frac{1}{T} \approx \frac{1}{0.8\ RC}$$

$$74HCT14 : f = \frac{1}{T} \approx \frac{1}{0.67\ RC}$$

Fig.18 Relaxation oscillator using 74HC/HCT14.

PACKAGE OUTLINES

SO14: plastic small outline package; 14 leads; body width 3.9 mm **SOT108-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

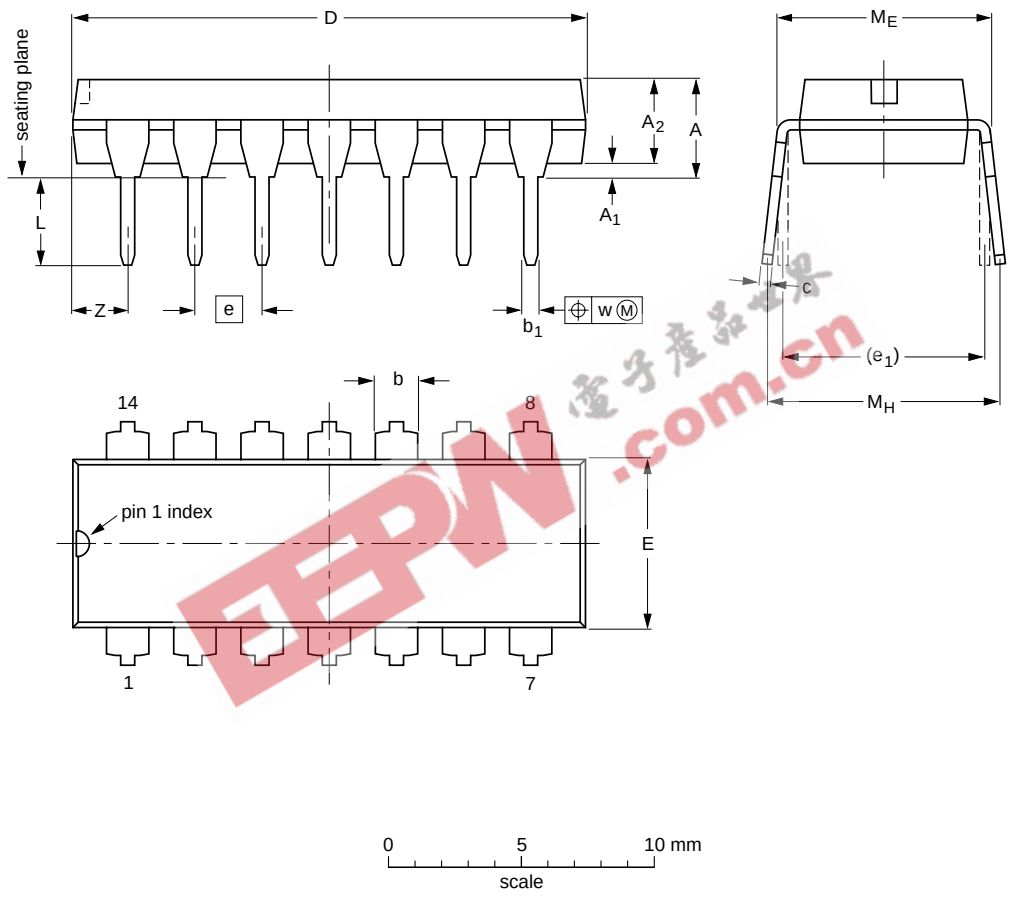
UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	8.75 8.55	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8^o 0^o
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.35 0.34	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

Note

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

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT108-1	076E06	MS-012				~~99-12-27~~ 03-02-19

DIP14: plastic dual in-line package; 14 leads (300 mil) **SOT27-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

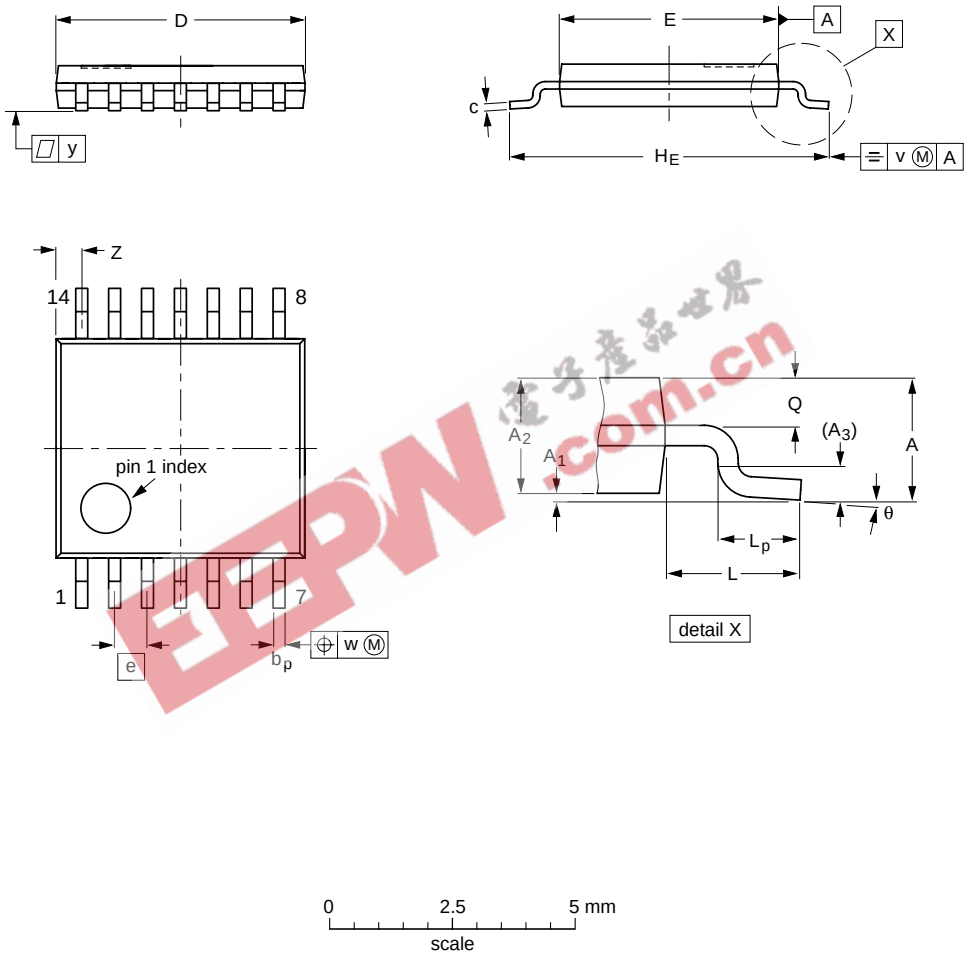
UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.13	0.53 0.38	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2.2
inches	0.17	0.02	0.13	0.068 0.044	0.021 0.015	0.014 0.009	0.77 0.73	0.26 0.24	0.1	0.3	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.087

Note

1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT27-1	050G04	MO-001	SC-501-14			~~99-12-27~~ 03-02-13

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm **SOT402-1**



DIMENSIONS (mm are the original dimensions)

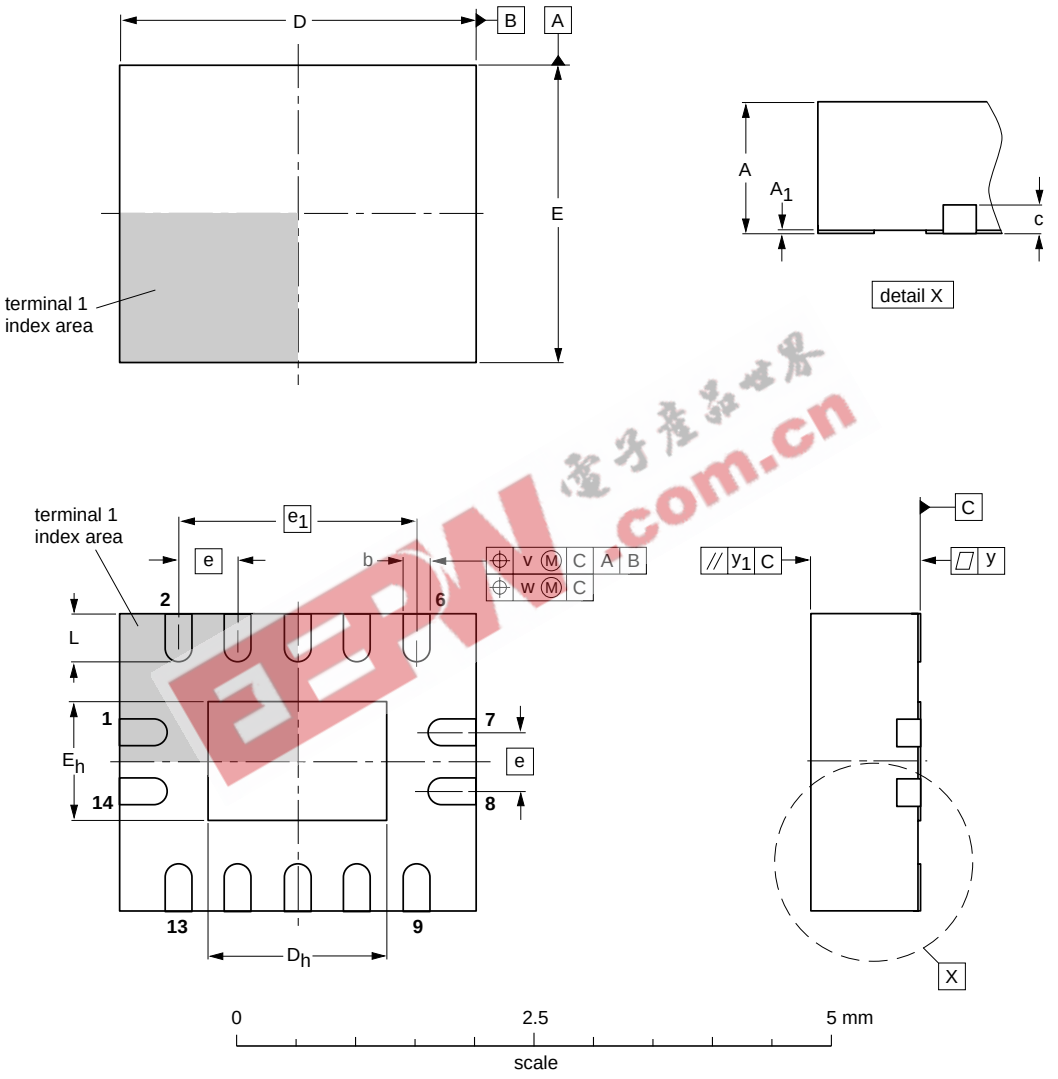
UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (2)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.72 0.38	8^o 0^o

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 VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT402-1		MO-153				~~99-12-27~~ 03-02-18

DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 x 3 x 0.85 mm **SOT762-1**



DIMENSIONS (mm are the original dimensions)

UNIT	$A^{(1)}$ max.	A_1	b	c	$D^{(1)}$	D_h	$E^{(1)}$	E_h	e	e_1	L	v	w	y	y_1
mm	1	0.05 0.00	0.30 0.18	0.2	3.1 2.9	1.65 1.35	2.6 2.4	1.15 0.85	0.5	2	0.5 0.3	0.1	0.05	0.05	0.1

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT762-1	- - -	MO-241	- - -			~~02-10-17~~ 03-01-27

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