74HC7014-Q100

Hex non-inverting precision Schmitt-trigger

Rev. 1 — 26 May 2014 Product data sheet

1. General description

The 74HC7014-Q100 is a hex buffer with precision Schmitt-trigger inputs. The precisely defined trigger levels are lying in a window between 0.55 × V_{CC} and 0.65 × V_{CC}. It makes the circuit suitable to operate in a highly noisy environment. Input shorts are allowed to −1.5 V and +16 V without disturbing other channels. Inputs include clamp diodes that enable 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.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from −40 °C to +85 °C and from −40 °C to +125 °C
- Operating voltage 3.0 V to 6.0 V
- Complies with JEDEC standard no. 7A
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)

3. Applications

- Wave and pulse shapers for highly noisy environments

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC7014D-Q100	−40 °C to +125 °C	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1

5. Functional diagram

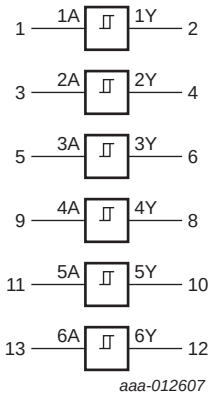


Fig 1. Logic symbol

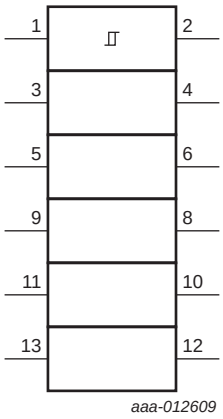


Fig 2. IEC logic symbol

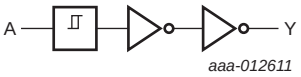


Fig 3. Logic diagram (one gate)

6. Pinning information

6.1 Pinning

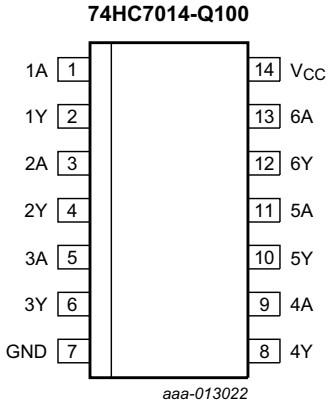


Fig 4. Pin configuration

6.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1A to 6A	1, 3, 5, 9, 11, 13	data input
1Y to 6Y	2, 4, 6, 8, 10, 12	data output
GND	7	ground (0 V)
V_{CC}	14	supply voltage

7. Functional description

Table 3. Functional table[1]

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

[1] H = HIGH voltage level; L = LOW voltage level

8. 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	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	$–0.5$ V $< V_O < V_{CC} + 0.5$ 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	[2]	-	500	mW

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

[2] For SO14 packages: P_{tot} derates linearly with 5.5 mW/K above 60 °C.

9. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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	-	+125	°C

10. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions	T_{amb} = 25 °C			T_{amb} = –40 °C to +85 °C		T_{amb} = –40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
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	-	1.9	-	1.9	-	V
		I_O = –20 μA; V_{CC} = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I_O = –20 μA; V_{CC} = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		I_O = –4.0 mA; V_{CC} = 4.5 V	3.98	4.32	-	3.84	-	3.7	-	V
		I_O = –5.2 mA; V_{CC} = 6.0 V	5.48	5.81	-	5.34	-	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	0.1	-	0.1	-	0.1	V
		I_O = 20 μA; V_{CC} = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I_O = 20 μA; V_{CC} = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I_O = 4.0 mA; V_{CC} = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I_O = 5.2 mA; V_{CC} = 6.0 V	-	0.16	0.26	-	0.33	-	0.4	V
I_I	input leakage current	V_{CC} = 6.00 V; $V_I = V_{CC}$ or GND	-	-	0.1	1.0	-	1.0	-	μA
		V_{CC} = 3.00 V to 6.00 V; V_I = 16 V or GND	-	-	0.5	5.0	-	5.0	-	μA
I_{CC}	supply current	V_{CC} = 3.00 V	-	0.7	1.4	-	1.8	-	2.1	mA
		V_{CC} = 5.25 V	-	3.0	6.0	-	7.5	-	7.5	mA
		V_{CC} = 6.00 V	-	3.7	7.4	-	10.0	-	13.0	mA
C_I	input capacitance		-	3.5	-	-	-	-	-	pF

11. Dynamic characteristics

Table 7. Dynamic characteristics

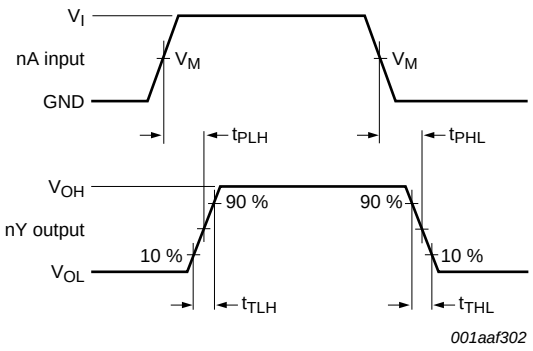
GND = 0 V; for test circuit, see Figure 6.

Symbol	Parameter	Conditions	T_{amb} = 25 °C			T_{amb} = –40 °C to +125 °C		Unit
			Min	Typ	Max	Max (85 °C)	Max (125 °C)	
t_{PHL}	HIGH to LOW propagation delay	nA to nY; see Figure 5						
		V_{CC} = 3.00 V	-	95	475		715	ns
		V_{CC} = 4.75 V	-	38	115	-	175	ns
		V_{CC} = 6.00 V	-	27	73	93	112	ns
t_{PLH}	LOW to HIGH propagation delay	nA to nY; see Figure 5						
		V_{CC} = 3.00 V	-	47	175	220	260	ns
		V_{CC} = 4.75 V	-	23	52	65	78	ns
		V_{CC} = 6.00 V	-	18	46	58	70	ns
t_t	transition time	see Figure 5 [1]						
		V_{CC} = 3.00 V	-	12	20	25	30	ns
		V_{CC} = 4.75 V	-	7	15	19	22	ns
		V_{CC} = 6.00 V	-	6	13	16	19	ns
C_{PD}	power dissipation capacitance	per gate; V_I = GND to V_{CC} [2]	-	9	-	-	-	pF

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

[2] 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 outputs.

12. Waveforms



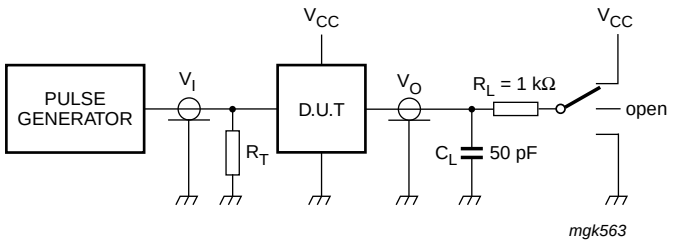
Measurement points are given in Table 8.

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

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

Table 8. Measurement points

Type	Input	Output
	V_M	V_M
74HC7014-Q100	$0.5V_{CC}$	$0.5V_{CC}$



Test data is given in Table 9.

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 9. Test data

Type	Input		Test
	V_I	t_r, t_f	t_{PHL}, t_{PLH}
74HC7014-Q100	GND to V_{CC}	6 ns	open

13. Transfer characteristics

Table 10. Transfer characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); see Figure 7 and Figure 8.

Symbol	Parameter	Conditions	T_{amb} = 25 °C			T_{amb} = –40 °C to +85 °C		T_{amb} = –40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V_{T+}	positive-going threshold voltage	V_{CC} = 3.00 V	-	1.86	1.95	-	1.95	-	1.95	V
		V_{CC} = 4.75 V	-	2.94	3.08	-	3.08	-	3.08	V
		V_{CC} = 5.00 V	-	3.10	3.25	-	3.25	-	3.25	V
		V_{CC} = 5.25 V	-	3.25	3.41	-	3.41	-	3.41	V
		V_{CC} = 6.00 V	-	3.72	3.90	-	3.90	-	3.90	V
V_{T-}	negative-going threshold voltage	V_{CC} = 3.00 V	1.65	1.74	-	1.65	-	1.65	-	V
		V_{CC} = 4.75 V	2.62	2.76	-	2.62	-	2.62	-	V
		V_{CC} = 5.00 V	2.75	2.90	-	2.75	-	2.75	-	V
		V_{CC} = 5.25 V	2.89	3.05	-	2.89	-	2.89	-	V
		V_{CC} = 6.00 V	3.30	3.48	-	3.30	-	3.30	-	V
V_H	hysteresis voltage	V_{CC} = 3.00 V	50	120	-	50	-	50	-	V
		V_{CC} = 4.75 V	100	180	-	100	-	100	-	V
		V_{CC} = 5.00 V	120	200	-	120	-	120	-	V
		V_{CC} = 5.25 V	130	210	-	130	-	130	-	V
		V_{CC} = 6.00 V	160	240	-	160	-	160	-	V

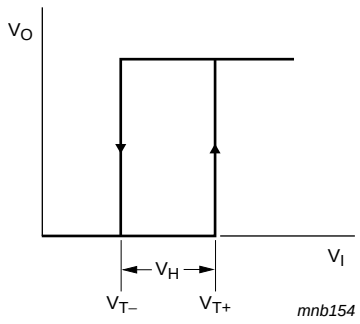
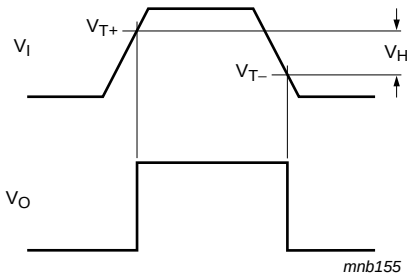


Fig 7. Transfer characteristic

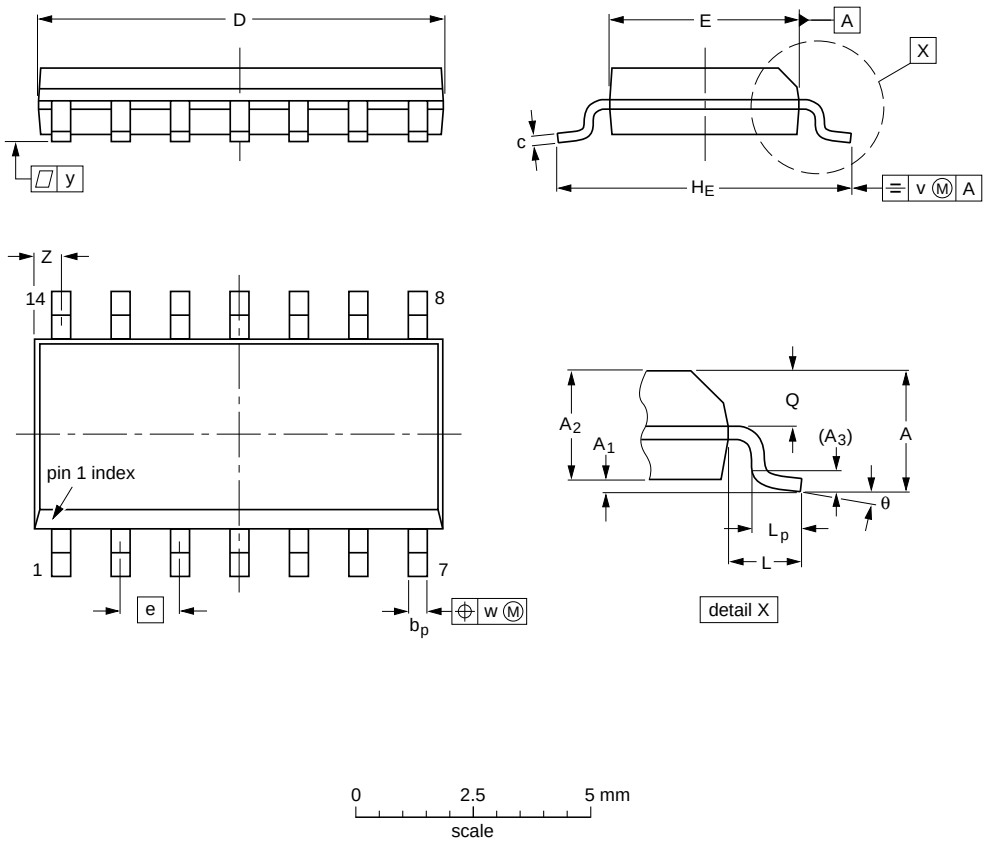


V_{T+} and V_{T-} limits at 70 % and 20 %.

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

14. Package outline

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

Fig 9. Package outline SOT108-1 (SO14)

15. Abbreviations

Table 11. Abbreviations

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

16. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC7014_Q100 v.1	20140526	Product data sheet	-	-

17. Legal information

17.1 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".

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19. Contents

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