HEF40106B-Q100

Hex inverting Schmitt trigger Rev. 1 — 7 August 2012

Product data sheet

General description 1.

The HEF40106B-Q100 provides six inverting buffers. Each input has a Schmitt trigger circuit. The inverting buffer switches at different points for positive-going and negative-going signals. The difference between the positive voltage (V_{T+}) and the negative voltage (V_T) is defined as hysteresis voltage (V_H).

The HEF40106B-Q100 may be used for enhanced noise immunity or to "square up" slowly changing waveforms.

It operates over a recommended V_{DD} power supply range of 3 V to 15 V referenced to V_{SS} (usually ground). Unused inputs must be connected to V_{DD}, V_{SS}, or another input.

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
- Schmitt trigger input discrimination
- Fully static operation
- 5 V, 10 V, and 15 V parametric ratings
- Standardized symmetrical output characteristics
- ESD protection:
 - ◆ MIL-STD-833, method 3015 exceeds 2000 V
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)
- Complies with JEDEC standard JESD 13-B

Applications 3.

- Wave and pulse shapers
- Astable multivibrators
- Monostable multivibrators



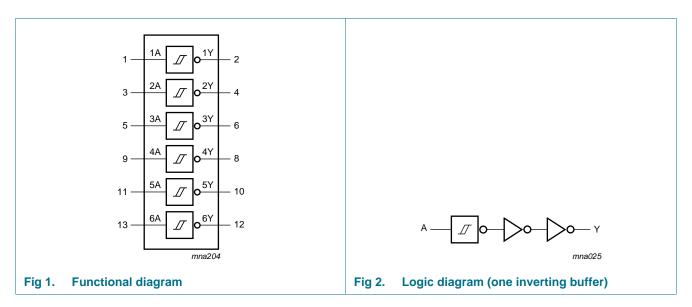
4. Ordering information

Table 1. Ordering information

All types operate from -40 °C to +125 °C

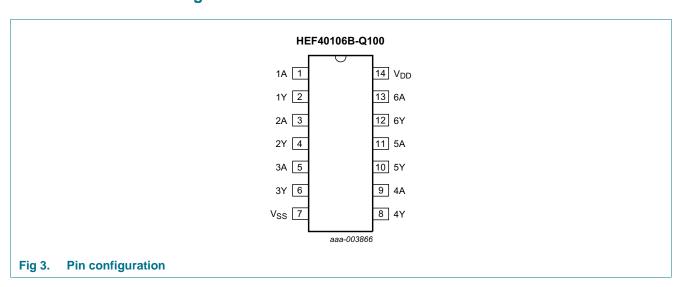
Type number	Package	age								
	Name	Description	Version							
HEF40106BT-Q100	SO14	plastic small outline package; 14 leads; body width 3.9 mm	SOT108-1							
HEF40106BTT-Q100	TSSOP14	plastic thin shrink small outline package; 14 leads; body width 4.4 mm	SOT402-1							

5. Functional diagram



6. Pinning information

6.1 Pinning



HEF40106B_Q100

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6.2 Pin description

Table 2. Pin description

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

7. Functional description

Table 3. Function table[1]

Input	Output
nA	nY
L	Н
Н	L

^[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 $V_{SS} = 0 \text{ V}$ (ground).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DD}	supply voltage		-0.5	+18	V
I _{IK}	input clamping current	$V_{I} < -0.5 \text{ V or } V_{I} > V_{DD} + 0.5 \text{ V}$	-	±10	mA
VI	input voltage		-0.5	$V_{DD} + 0.5$	V
I _{OK}	output clamping current	$V_O < -0.5 \text{ V or } V_O > V_{DD} + 0.5 \text{ V}$	-	±10	mA
I _{I/O}	input/output current		-	±10	mA
I_{DD}	supply current		-	50	mΑ
T _{stg}	storage temperature		-65	+150	°C
T _{amb}	ambient temperature		-40	+125	°C
P _{tot}	total power dissipation	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$			
		SO14	<u>[1]</u> _	500	mW
		TSSOP14	[2] _	500	mW
Р	power dissipation	per output	-	100	mW

^[1] For SO14 packages: above T_{amb} = 70 °C, P_{tot} derates linearly with 8 mW/K.

^[2] For TSSOP14 packages: above T_{amb} = 60 °C, P_{tot} derates linearly with 5.5 mW/K.

9. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions		Max	Unit
V_{DD}	supply voltage		3	15	V
VI	input voltage		0	V_{DD}	V
T _{amb}	ambient temperature	in free air	-40	+125	°C

10. Static characteristics

Table 6. Static characteristics

 $V_{SS} = 0$ V; $V_I = V_{SS}$ or V_{DD} ; unless otherwise specified.

Symbol	Parameter	Conditions	V_{DD}	T _{amb} =	–40 °C	T _{amb} =	+25 °C	T _{amb} =	+85 °C	T _{amb} = ·	+125 °C	Unit
				Min	Max	Min	Max	Min	Max	Min	Max	
V_{OH}	HIGH-level	$ I_O < 1 \mu A$	5 V	4.95	-	4.95	-	4.95	-	4.95	-	V
	output voltage		10 V	9.95	-	9.95	-	9.95	-	9.95	-	V
			15 V	14.95	-	14.95	-	14.95	-	14.95	-	V
V_{OL}	LOW-level	$ I_O < 1 \mu A$	5 V	-	0.05	-	0.05	-	0.05	-	0.05	V
	output voltage		10 V	-	0.05	-	0.05	-	0.05	-	0.05	V
			15 V	-	0.05	-	0.05	-	0.05	-	0.05	V
I _{OH}	HIGH-level output current	$V_0 = 2.5 \text{ V}$	5 V	-	-1.7	-	-1.4	-	-1.1	-	-1.1	mΑ
		$V_0 = 4.6 \text{ V}$	5 V	-	-0.64	-	-0.5	-	-0.36	-	-0.36	mΑ
		V _O = 9.5 V	10 V	-	-1.6	-	-1.3	-	-0.9	-	-0.9	mΑ
		V _O = 13.5 V	15 V	-	-4.2	-	-3.4	-	-2.4	-	-2.4	mΑ
I _{OL}	LOW-level	$V_0 = 0.4 \ V$	5 V	0.64	-	0.5	-	0.36	-	0.36	-	mΑ
	output current	$V_0 = 0.5 \ V$	10 V	1.6	-	1.3	-	0.9	-	0.9	-	mΑ
		V _O = 1.5 V	15 V	4.2	-	3.4	-	2.4	-	2.4	-	mΑ
I _I	input leakage current		15 V	-	±0.1	-	±0.1	-	±1.0	-	±1.0	μΑ
I _{DD}	supply current	all valid input	5 V	-	0.25	-	0.25	-	7.5	-	7.5	μΑ
		combinations;	10 V	-	0.5	-	0.5	-	15.0	-	15.0	μΑ
		$I_O = 0 A$	15 V	-	1.0	-	1.0	-	30.0	-	30.0	μΑ
C _I	input capacitance			-	-	-	7.5	-	-	-	-	pF

11. Dynamic characteristics

Table 7. Dynamic characteristics

 T_{amb} = 25 °C; C_L = 50 pF; t_r = t_f ≤ 20 ns; wave forms see <u>Figure 4</u>; test circuit see <u>Figure 5</u>; unless otherwise specified.

	• • • •						•	
Symbol	Parameter	Conditions	V_{DD}	Extrapolation formula[1]	Min	Тур	Max	Unit
t _{PHL}	HIGH to LOW propagation delay	nA or nB to nY	5 V	63 ns + $(0.55 \text{ ns/pF})C_L$	-	90	180	ns
			10 V	29 ns + (0.23 ns/pF)C _L	-	35	70	ns
			15 V	22 ns + (0.16 ns/pF)C _L	-	30	60	ns
t _{PLH}	LOW to HIGH propagation delay	nA or nB to nY	5 V	$58 \text{ ns} + (0.55 \text{ ns/pF})C_L$	-	75	150	ns
			10 V	29 ns + (0.23 ns/pF)C _L	-	35	70	ns
			15 V	22 ns + (0.16 ns/pF)C _L	-	30	60	ns
t _{THL}	HIGH to LOW output transition time	nY to LOW	5 V	10 ns + (1.00 ns/pF)C _L	-	60	120	ns
			10 V	9 ns + (0.42 ns/pF)C _L	-	30	60	ns
			15 V	6 ns + (0.28 ns/pF)C _L	-	20	40	ns
t _{TLH}	LOW to HIGH output	nA or nB to	5 V	10 ns + (1.00 ns/pF)C _L	-	60	120	ns
	transition time	HIGH	10 V	9 ns + (0.42 ns/pF)C _L	-	30	60	ns
			15 V	6 ns + (0.28 ns/pF)C _L	-	20	40	ns
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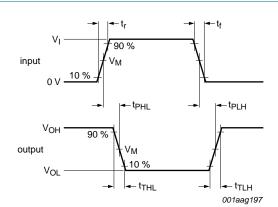
^[1] Typical value of the propagation delay and output transition time can be calculated with the extrapolation formula (C_L in pF).

Table 8. Dynamic power dissipation

 $V_{SS} = 0 \ V; \ t_f = t_f \le 20 \ ns; \ T_{amb} = 25 \ ^{\circ}C.$

Symbol	Parameter	V_{DD}	Typical formula	where:
	dynamic power	5 V	$P_D = 2300 \times f_i + \Sigma (f_o \times C_L) \times V_{DD}^2 (\mu W)$	f_i = input frequency in MHz;
	dissipation	10 V	$P_D = 9000 \times f_i + \Sigma (f_o \times C_L) \times V_{DD}^2 (\mu W)$	f _o = output frequency in MHz;
		15 V	$P_D = 20000 \times f_i + \Sigma (f_o \times C_L) \times V_{DD}^2 (\mu W)$	C_L = output load capacitance in pF; $\Sigma(f_0 \times C_L)$ = sum of the outputs; V_{DD} = supply voltage in V.

12. Waveforms



Measurement points are given in Table 9.

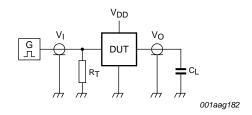
Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

 $t_{\rm r}$, $t_{\rm f}$ = input rise and fall times.

Fig 4. Propagation delay and output transition time

Table 9. Measurement points

Supply voltage	Input	Output
V_{DD}	V _M	V _M
5 V to 15 V	0.5V _{DD}	0.5V _{DD}



Test data given in Table 10.

Definitions for test circuit:

DUT = Device Under Test.

 C_L = load capacitance including jig and probe capacitance.

 R_T = termination resistance should be equal to the output impedance Z_0 of the pulse generator.

Fig 5. Test circuit

Table 10. Test data

Supply voltage	Input	put				
V_{DD}	V _I	t _r , t _f	C _L			
5 V to 15 V	V _{SS} or V _{DD}	≤ 20 ns	50 pF			

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13. Transfer characteristics

Table 11. Transfer characteristics

 $V_{SS} = 0$ V; see Figure 6 and Figure 7.

Symbol	Parameter	Conditions V _{DD}	V _{DD}	T _{amb} =	–40 °C to	+85 °C	T _{amb} = to +1	Unit	
					Typ[1]	Max	Min	Max	
V_{T+}	positive-going threshold voltage	5 V		2.0	3.0	3.5	2.0	3.5	V
		10 V		3.7	5.8	7.0	3.7	7.0	V
		15 V		4.9	8.3	11.0	4.9	11.0	V
V_{T-}	negative-going threshold voltage	5 V		1.5	2.2	3.0	1.5	3.0	V
		10 V		3.0	4.5	6.3	3.0	6.3	V
		15 V		4.0	6.5	10.1	4.0	10.1	V
V_{H}	hysteresis voltage	5 V		0.5	8.0	-	0.5	-	V
		10 V		0.7	1.3	-	0.7	-	V
		15 V		0.9	1.8	-	0.9	-	V

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

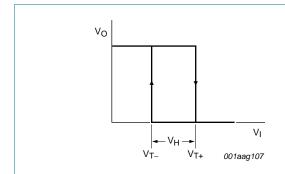


Fig 6. Transfer characteristic

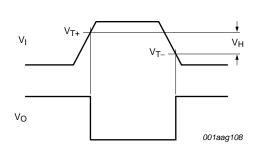
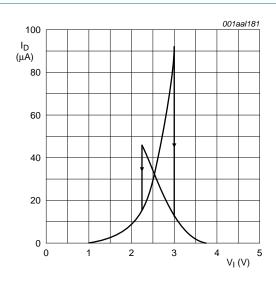
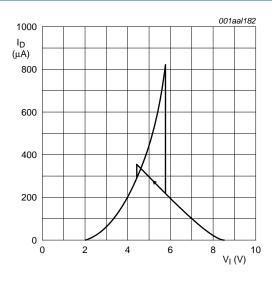
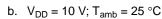


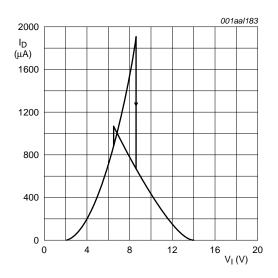
Fig 7. Waveforms showing definition of V_{T+} and V_{T-} (between limits at 30 % and 70 %) and V_{H}





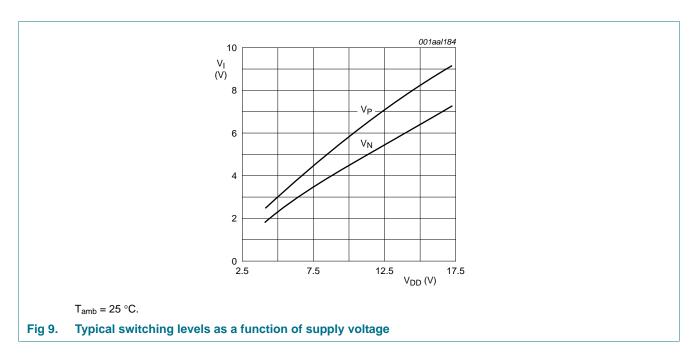
a. $V_{DD} = 5 \text{ V}$; $T_{amb} = 25 ^{\circ}\text{C}$





c. $V_{DD} = 15 \text{ V}; T_{amb} = 25 ^{\circ}\text{C}$

Fig 8. Typical drain current as a function of input



14. Application information

Some examples of applications for the HEF40106B-Q100 are:

- · Wave and pulse shapers
- Astable multivibrators
- Monostable multivibrators



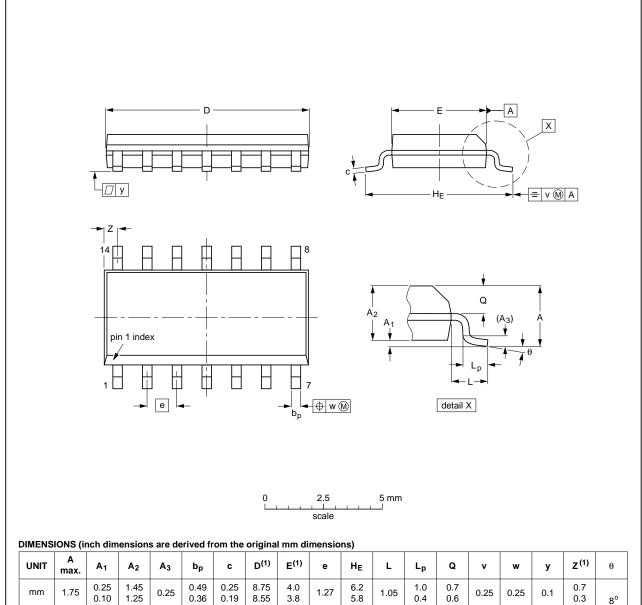
If a Schmitt trigger is driven via a high-impedance (R > 1 k Ω), then it is necessary to incorporate a capacitor C with a value of $\frac{C}{C_P} > \frac{V_{DD} - V_{SS}}{V_H}$; otherwise oscillation can occur on the edges of a pulse.

 C_{p} is the external parasitic capacitance between inputs and output; the value depends on the circuit board layout.

15. Package outline

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

SOT108-1



UNIT	A max.	A ₁	A ₂	А3	bp	С	D ⁽¹⁾	E ⁽¹⁾	е	HE	L	Lp	Q	v	w	у	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°
inches	0.069	0.010 0.004	0.057 0.049	0.01	ı	0.0100 0.0075		0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016		0.01	0.01	0.004	0.028 0.012	0°

Note

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

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

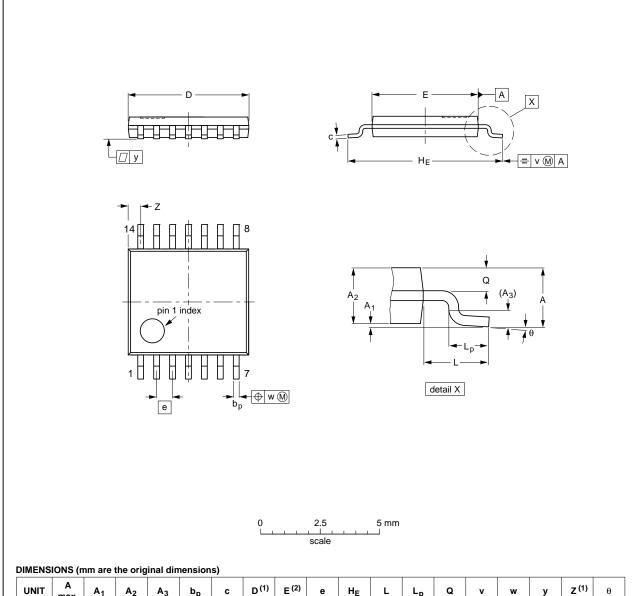
Fig 12. Package outline SOT108-1 (SO14)

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

SOT402-1



Ξ							-,												
	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	
					1	03-02-16	

Fig 13. Package outline SOT402-1 (TSSOP14)

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16. Abbreviations

Table 12. Abbreviations

Acronym	Description
НВМ	Human Body Model
ESD	ElectroStatic Discharge
MM	Machine Model
MIL	Military

17. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
HEF40106B_Q100 v.1	20120807	Product data sheet	-	-

18. Legal information

18.1 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.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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20. Contents

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- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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