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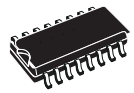
HCF4010

Hex buffer/converter (non-inverting)

Datasheet - production data



SO16

Features

- Propagation delay time
  - t_{PD} = 50 ns (typ.) at V_{DD} = 10 V, C_L = 50 pF
- High to low level logic conversion
- Multiplexer: 1 to 6 or 6 to 1
- High “sink” and “source” current capability
- Quiescent current specified up to 20 V
- 5 V, 10 V and 15 V parametric ratings
- Input leakage current
- I_I = 100 nA (max.) at V_{DD} = 18 V, T_A = 25 °C
  100% tested for quiescent current
- ESD performance
  - CDM: 1 kV
  - HBM: 1 kV
  - MM: 150 V

Applications

- Automotive
- Industrial
- Computer
- Consumer

Description

The HCF4010 device is a monolithic integrated circuit fabricated in MOS (metal oxide semiconductor) technology available in an SO16 package.

It is a non-inverting hex buffer/converter and can be used as a CMOS to TTL logic level converter, as a current “sink” or “source” driver, or as a multiplexer (1 to 6).

It is the preferred replacement of the HCF4050B in buffer applications.

Table 1. Device summary

Order code	Temperature range	Package	Packing	Marking
HCF4010M013TR	–55 °C to +125 °C	SO16	Tape and reel	HCF4010
HCF4010YM013TR(1)	–40 °C to +125 °C	SO16 (automotive grade)		HCF4010Y

1. Qualification and characterization according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 and Q002 or equivalent.

This is information on a product in full production. www.st.com

Contents

1 Pin information

Figure 1. Pin connections

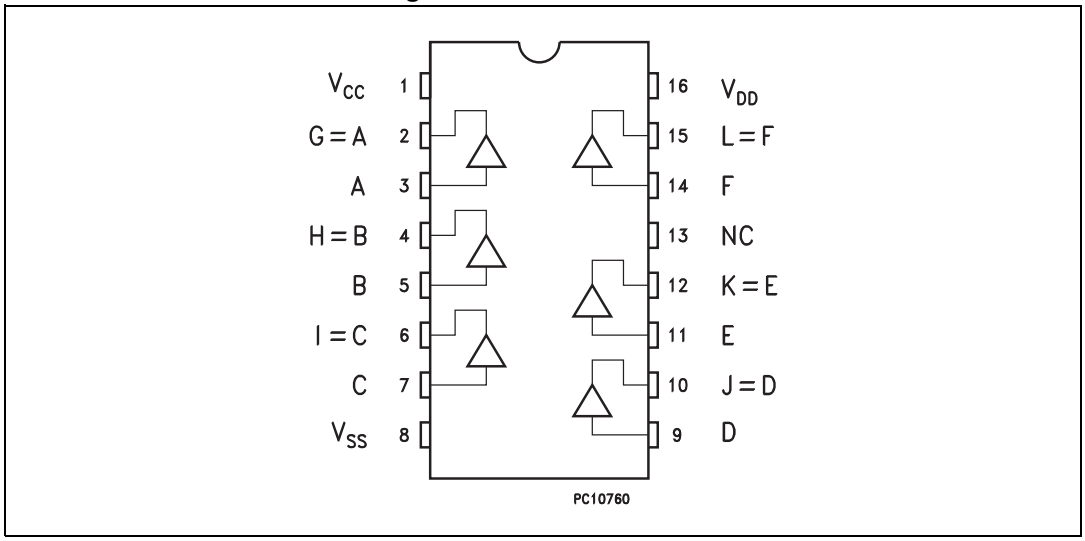


Table 2. Pin description

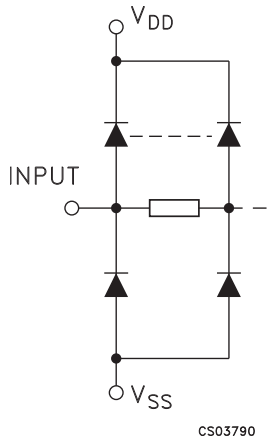
Pin number	Symbol/name	Function
3, 5, 7, 9, 11, 14	A, B, C, D, E, F	Data inputs
2, 4, 6, 10, 12, 15	G, H, I, J, K, L	Data outputs
13	NC	Not connected
1	V_{CC}	Positive supply voltage
8	V_{SS}	Negative supply voltage
16	V_{DD}	Positive supply voltage

2 Functional description

Table 3. Truth table

Inputs (A, B, C, D, E, F)	Outputs (G, H, I, J, K, L)
L	L
H	H

Figure 2. Input equivalent circuit



3 Electrical characteristics

Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. All voltage values are referred to V_{SS} pin voltage.

Table 4. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DD}	Supply voltage	-0.5 to +22	V
V_I	DC Input voltage	-0.5 to V_{DD} + 0.5	
I_I	DC input current	±10	mA
P_D	Power dissipation per package	200	mW
	Power dissipation per output transistor	100	
T_{op}	Operating temperature	-55 to +125	°C
T_{stg}	Storage temperature	-65 to +150	

Table 5. Recommended operating conditions

Symbol	Parameter		Value	Unit
V_{DD}	Supply voltage		3 to 20	V
V_I	Input voltage		0 to V_{DD}	
T_{op}	Operating temperature	SO16	-55 to 125	°C
		SO16 (automotive grade)	-40 to 125	

Table 6. DC specifications(1)

Sym.	Parameter	Test condition				Value							Unit
		V_I (V)	V_O (V)	$\|I_O\|$ (µA)	$V_{DD} = V_{CC}$ (V)	T_A = 25 °C			-40 to 85 °C		-55 to 125 °C		
						Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
I_L	Quiescent current	0/5			5		0.02	1		30		30	µA
		0/10			10		0.02	2		60		60	
		0/15			15		0.02	4		120		120	
		0/20			20		0.04	20		600		600	
V_{OH}	High-level output voltage	0/5		<1	5	4.95			4.95		4.95		V
		0/10		<1	10	9.95			9.95		9.95		
		0/15		<1	15	14.95			14.95		14.95		
V_{OL}	Low-level output voltage	5/0		<1	5		0.05			0.05		0.05	
		10/0		<1	10		0.05			0.05		0.05	
		15/0		<1	15		0.05			0.05		0.05	
V_{IH}	High-level input voltage		0.5/4.5	<1	5	3.5			3.5		3.5		
			1/9	<1	10	7			7		7		
			1.5/13.5	<1	15	11			11		11		
V_{IL}	Low-level input voltage		4.5/0.5	<1	5			1.5		1.5		1.5	
			9/1	<1	10			3		3		3	
			13.5/1.5	<1	15			4		4		4	
I_{OH}	Output drive current	0/5	2.5	<1	5	-0.8	-1.6		-0.65		-0.65		mA
		0/5	4.6	<1	5	-0.2	-0.4		-0.18		-0.18		
		0/10	9.5	<1	10	-0.45	-0.9		-0.38		-0.38		
		0/15	13.5	<1	15	-1.5	-3		-1.25		-1.25		
I_{OL}	Output sink current	0/5	0.4	<1	5	3	4		2.4		2.4		
		0/10	0.5	<1	10	8	10		6.4		6.4		
		0/15	1.5	<1	15	24	36		19		19		
I_I	Input leakage current	0/18	Any input		18		$\pm 10^{-5}$	±0.1		±1		±1	µA
C_I	Input capacitance		Any input				5	7.5					pF

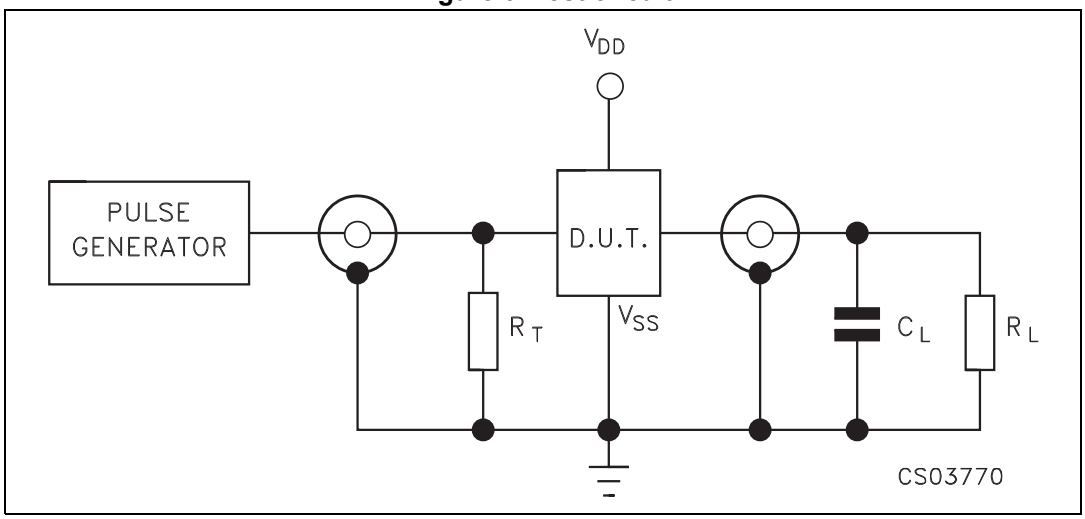
1. The noise margin for both level “1” and “0” is: 1 V min. with V_{DD} = 5 V, 2 V min. with V_{DD} = 10 V, 2.5 V min. with V_{DD} = 15 V.

Table 7. Dynamic electrical characteristics
(T_{amb} = 25 °C, C_L = 50 pF, R_L = 200 kΩ, $t_r = t_f$ = 20 ns)

Symbol	Parameter	Test condition			Value(1)			Unit
		V_{DD} (V)	V_I (V)	V_{CC} (V)	Min.	Typ.	Max.	
t_{TLH}	Output transition time	5	5	5		150	350	ns
		10	10	10		75	15	
		15	15	15		55	110	
t_{THL}	Output transition time	5	5	5		35	70	
		10	10	10		20	40	
		15	15	15		15	30	
t_{PLH}	Propagation delay time	5	5	5		100	200	
		10	10	10		50	100	
		10	10	5		50	100	
		15	15	15		35	70	
		15	15	5		35	70	
t_{PHL}	Propagation delay time	5	5	5		65	130	
		10	10	10		35	70	
		10	10	5		30	70	
		15	15	15		25	50	
		15	15	5		20	40	

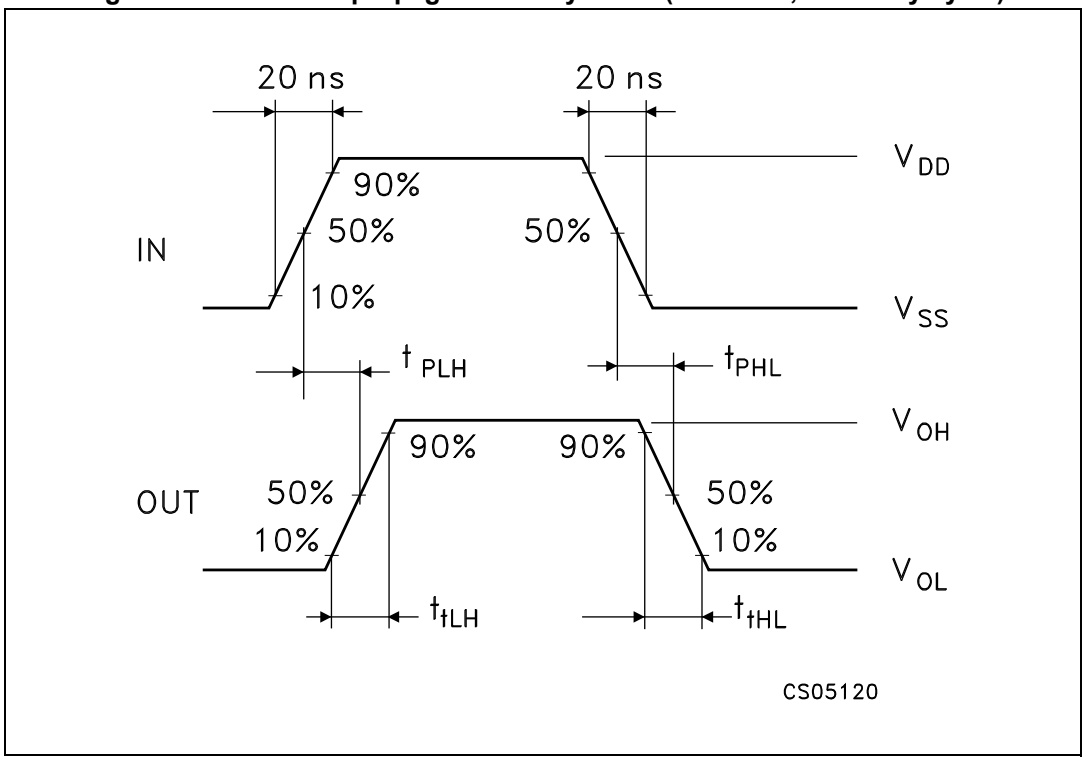
1. Typical temperature coefficient for all V_{DD} values is 0.3%/°C.

Figure 3. Test circuit



1. C_L = 50 pF or equivalent (includes jig and probe capacitance).
2. R_L = 200 kΩ.
3. $R_T = Z_{OUT}$ of pulse generator (typically 50 Ω).

Figure 4. Waveform - propagation delay times (f = 1 MHz; 50% duty cycle)



4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK is an ST trademark.

4.1 SO16 package information

Figure 5. SO16 package outline

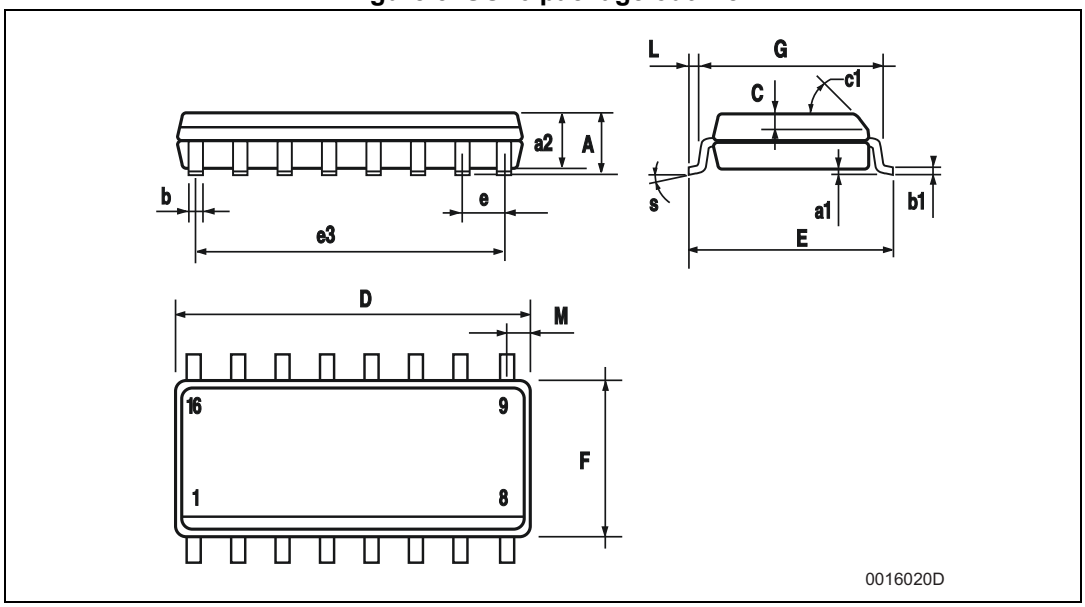
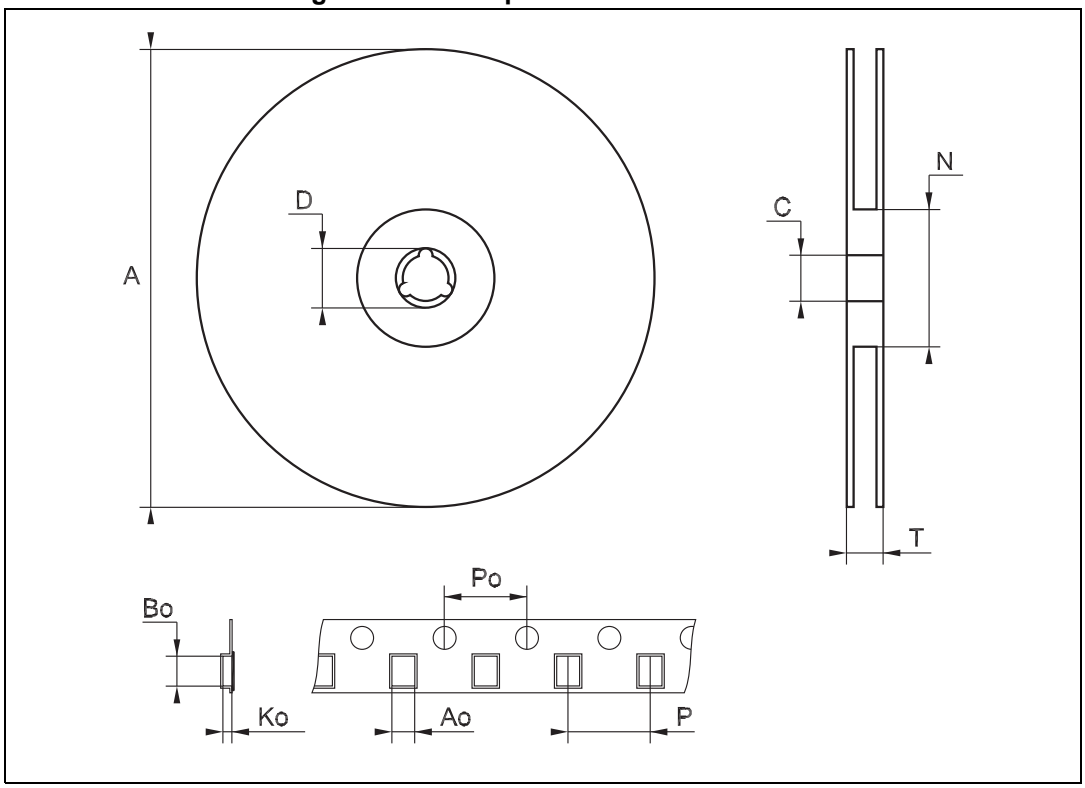


Table 8. SO16 package mechanical data

Symbol	Dimensions					
	mm			inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.068
a1	0.1		0.25	0.004		0.010
a2			1.64			0.063
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8° (max.)					

Figure 6. SO16 tape and reel information



1. Drawing not in scale.

Table 9. SO16 tape and reel information

Symbol	Dimensions					
	mm			inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.45		6.65	0.254		0.262
Bo	10.3		10.5	0.406		0.414
Ko	2.1		2.3	0.082		0.090
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319

5 Ordering information

Table 10. Order codes

Order code	Temperature range	Package	Packing	Marking
HCF4010M013TR	–55 °C to +125 °C	SO16	Tape and reel	HCF4010
HCF4010YM013TR(1)	–40 °C to +125 °C	SO16 (automotive grade)		HCF4010Y

1. Qualification and characterization according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 and Q002 or equivalent.

6 Revision history

Table 11. Document revision history

Date	Revision	Changes
16-Mar-2005	3	Add V_{CC} on Table 6
11-Jun-2012	4	Added *Applications on page 1* Updated *Table 1: Device summary* Removed DIP16 package from document Revised document presentation, minor textual updates
15-Jun-2012	5	Updated temperature range in *Table 1* Updated T_{op} in *Table 5*
19-Oct-2012	6	Updated *Features* (added ESD data). Updated *Table 1* (added Marking, updated note *1.*) Reformatted *Section 4* (added *Figure 5* and *Figure 6*, *Table 8* and *Table 9*). Minor corrections throughout document.
25-Apr-2013	7	Updated *Features*: ESD data modified, removed information regarding B series CMOS devices. Added *Section 5: Ordering information*
13-Jan-2014	8	*Table 1: Device summary*: added “Packing”

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