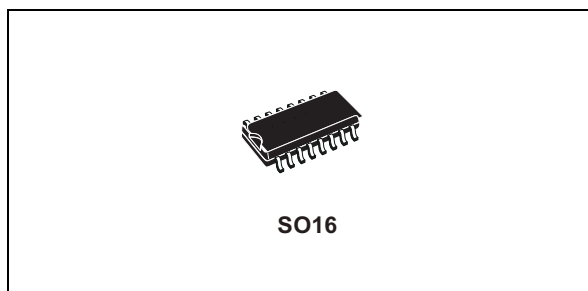


Hex buffer/converter (non-inverting)

Datasheet - production data



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.

Features

- Propagation delay time
 - $t_{PD} = 50 \text{ ns}$ (typ.) at $V_{DD} = 10 \text{ V}$, $C_L = 50 \text{ pF}$
- 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
- $I_I = 100 \text{ nA}$ (max.) at $V_{DD} = 18 \text{ V}$, $T_A = 25 \text{ }^\circ\text{C}$
100% tested for quiescent current
- ESD performance
 - CDM: 1 kV
 - HBM: 1 kV
 - MM: 150 V

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.

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1 Pin information

Figure 1. Pin connections

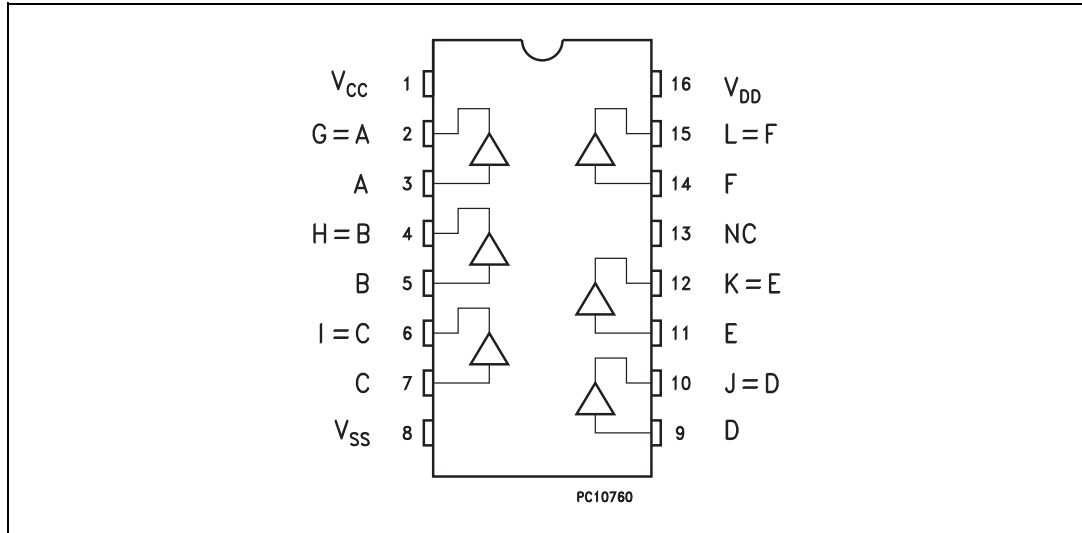


Table 2. Pin description

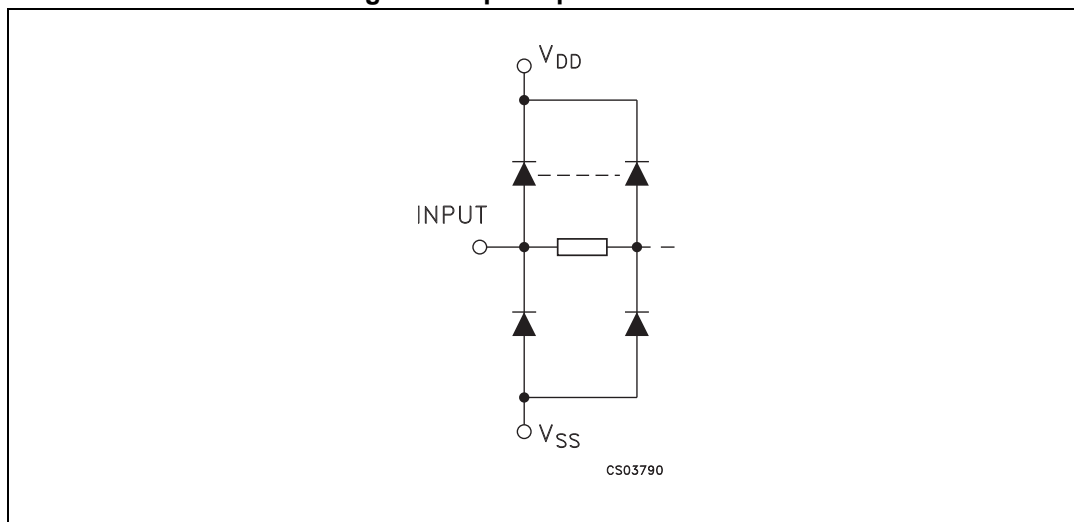
Pin number	Symbol/name	Function
3, 5, 7, 9, 11, 14	A, B, C, D, E, F	Data inputs
2, 4, 6, 10, 12, 15	G, H, I, J, K, L	Data outputs
13	NC	Not connected
1	V _{CC}	Positive supply voltage
8	V _{SS}	Negative supply voltage
16	V _{DD}	Positive supply voltage

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 _{OL} (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	V
		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		V
			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	V
			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		mA
		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		±10 ⁻⁵	±0.1		±1		±1	μA
C _I	Input capacitance		Any input				5	7.5					pF

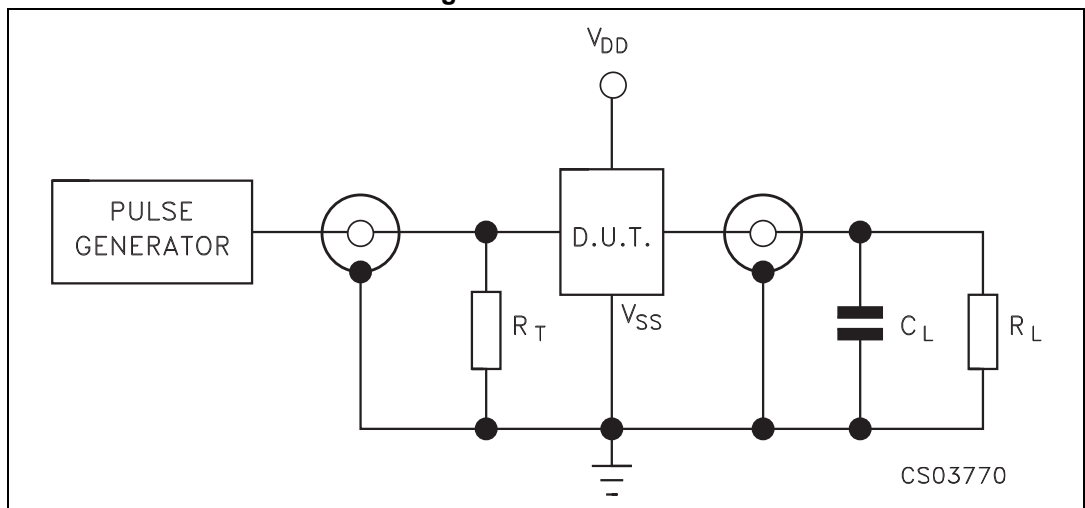
1. The noise margin for both level "1" and "0" is: 1 V min. with V_{DD} = 5 V, 2 V min. with V_{DD} = 10 V, 2.5 V min. with V_{DD} = 15 V.

Table 7. Dynamic electrical characteristics
 ($T_{amb} = 25\text{ }^{\circ}\text{C}$, $C_L = 50\text{ pF}$, $R_L = 200\text{ k}\Omega$, $t_r = t_f = 20\text{ ns}$)

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	

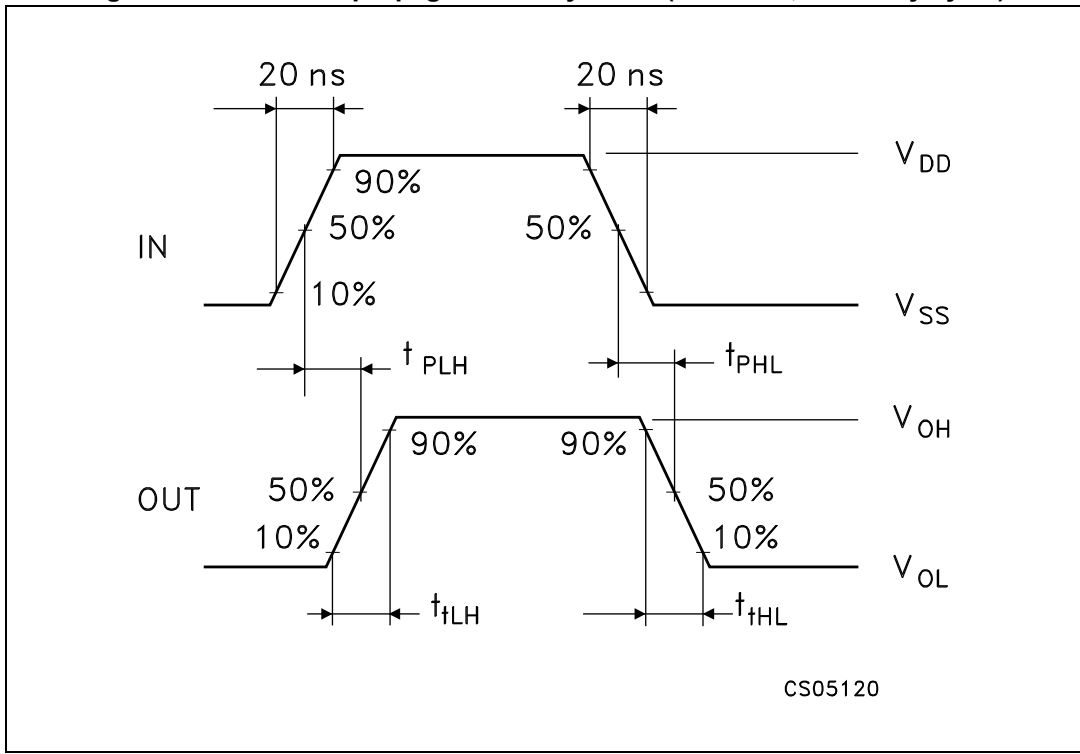
1. Typical temperature coefficient for all V_{DD} values is 0.3%/°C.

Figure 3. Test circuit



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

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

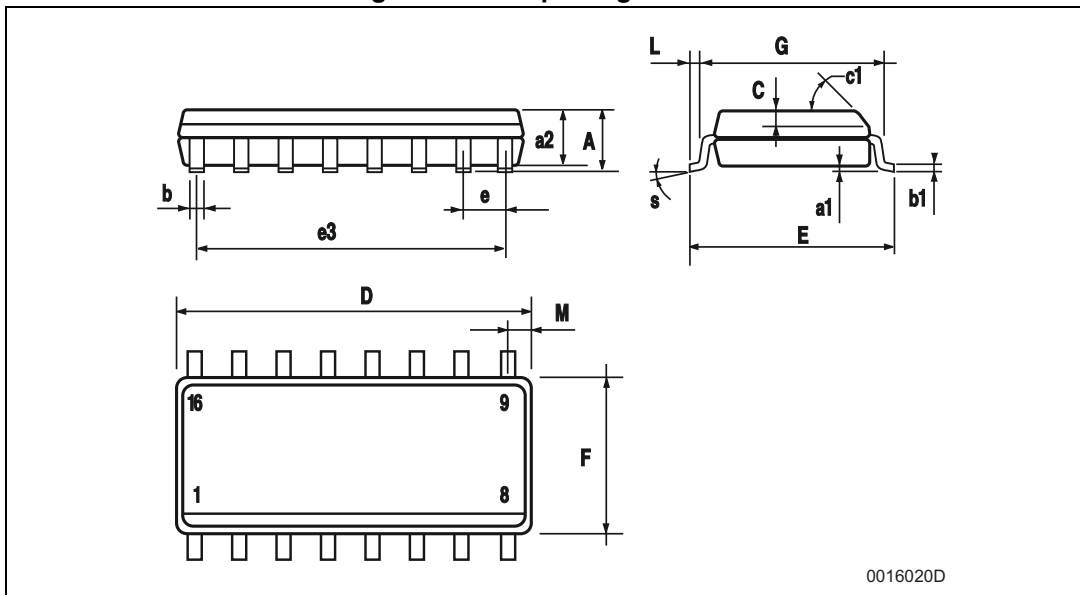


4 Package information

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

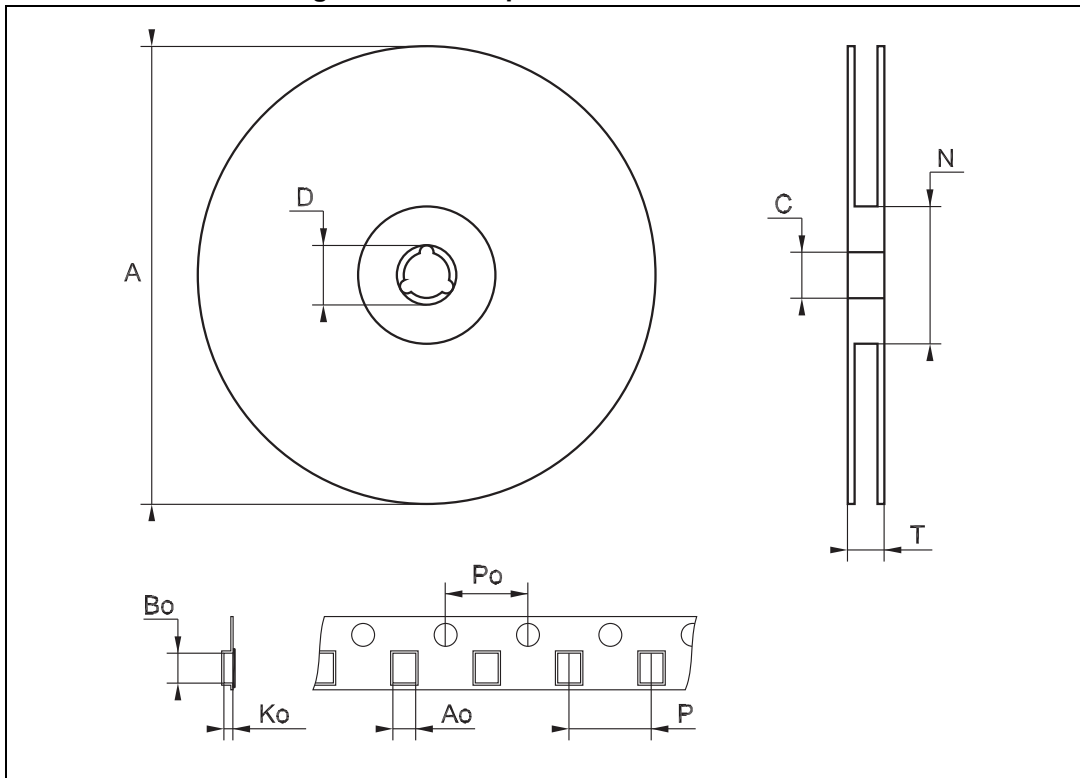


0016020D

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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