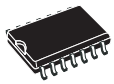
HCF4070

Quad exclusive OR gate

Datasheet - production data



SO14

Features

- Medium-speed operation
  t_{PHL} = t_{PLH} = 70 ns (typ) at C_L = 50 pF and V_{DD} = 10 V
- 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
  - HBM: 2 kV
  - MM: 200 V
  - CDM: 1 kV

Applications

- Automotive
- Industrial
- Computer
- Consumer

Description

The HCF4070 is a monolithic integrated circuit fabricated in metal oxide semiconductor technology available in an SO14 package.

The HCF4070 contains four independent exclusive OR gates. This device provides the system designer with a means for direct implementation of the exclusive OR gate for applications such as logical comparators, adders/subtractors, parity generators and checkers.

Table 1. Device summary

Order code	Temperature range	Package	Packing	Marking
HCF4070M013TR	–55 °C to +125 °C	SO14	Tape and reel	HCF4070
HCF4070YM013TR(1)	–40 °C to +125 °C	SO14 (automotive grade)		HCF4070Y

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

Contents

1 Device overview

Figure 1. Pin connections

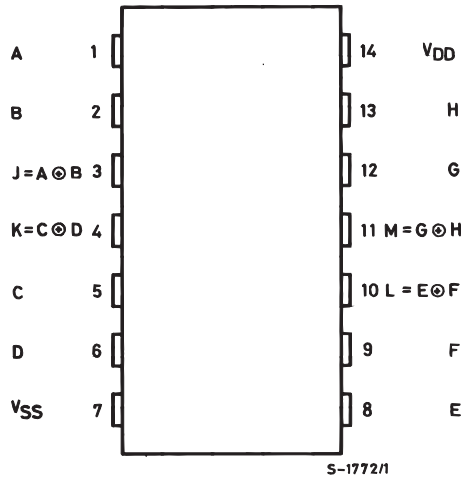


Table 2. Pin description

Pin number	Symbol/name	Function
1, 5, 8, 12	A, C, E, G	Data inputs
2, 6, 9, 13	B, D, F, H	Data inputs
3, 4, 10, 11	J, K, L, M	Data outputs
7	V_{SS}	Negative supply voltage
14	V_{DD}	Positive supply voltage

Figure 2. Input equivalent circuit

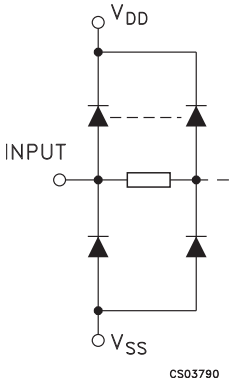


Figure 3. Logic diagram

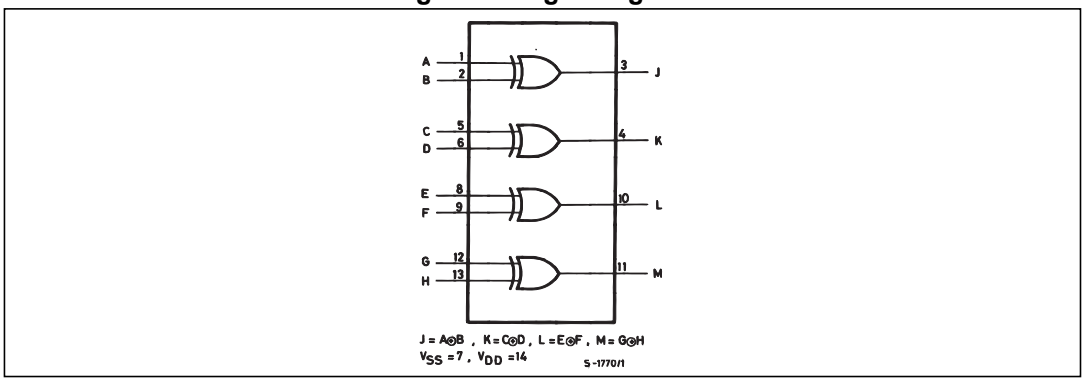


Table 3. Truth table

Inputs		Output
A, C, E, G	**B, D, F, H**	**J, K, L, M**
L	L	L
L	H	H
H	L	H
H	H	L

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	V
I_I	DC input current	± 10	mA
P_D	Power dissipation per package	200	mW
	Power dissipation per output transistor	100	mW
T_{op}	Operating temperature	-55 to +125	°C
T_{stg}	Storage temperature	-65 to +150	°C

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 relative to the V_{SS} pin voltage.

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}	V
T_{op}	Operating temperature	SO14	-55 to 125	°C
		SO14 (automotive grade)	-40 to 125	°C

Table 6. DC specifications

Sym.	Parameter	Test condition				Value							Unit
		V_I (V)	V_O (V)	$\|I_O\|$ (µA)	V_{DD} (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	-1.36	-3.2		-1.15		-1.1		mA
		0/5	4.6	<1	5	-0.44	-1		-0.36		-0.36		
		0/10	9.5	<1	10	-1.1	-2.6		-0.9		-0.9		
		0/15	13.5	<1	15	-3.0	-6.8		-2.4		-2.4		
I_{OL}	Output sink current	0/5	0.4	<1	5	0.44	1		0.36		0.36		mA
		0/10	0.5	<1	10	1.1	2.6		0.9		0.9		
		0/15	1.5	<1	15	3.0	6.8		2.4		2.4		
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

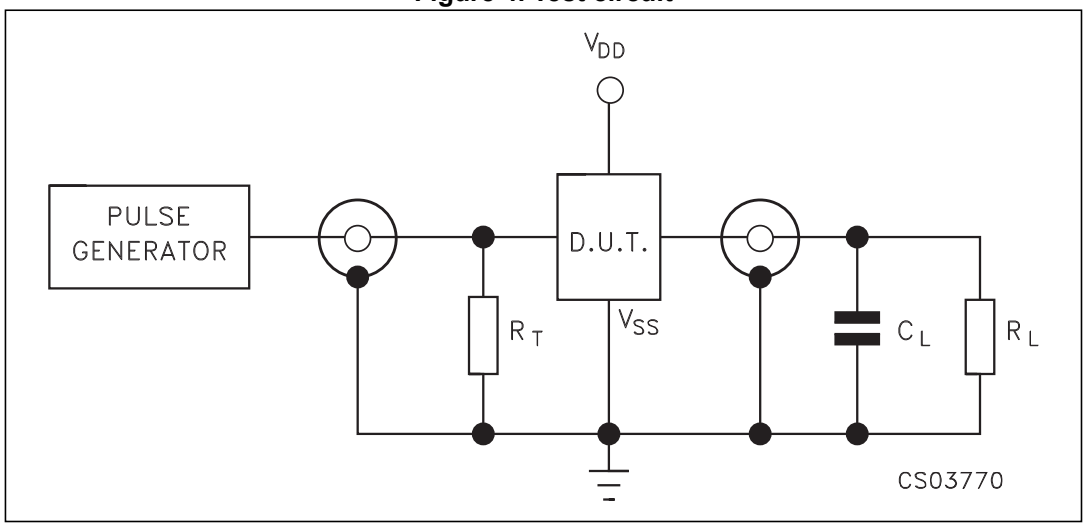
The noise margin for both the "1" and "0" level is: 1 V min. with V_{DD} = 5 V, 2 V min. with V_{DD} = 10 V, 2.5 V min. with V_{DD} = 15 V.

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)	Min.	Typ.	Max.	
t_{PLH} t_{PHL}	Propagation delay time	5		140	280	ns
		10		70	130	
		15		50	100	
t_{TLH} t_{THL}	Output transition time	5		100	200	ns
		10		50	100	
		15		40	80	

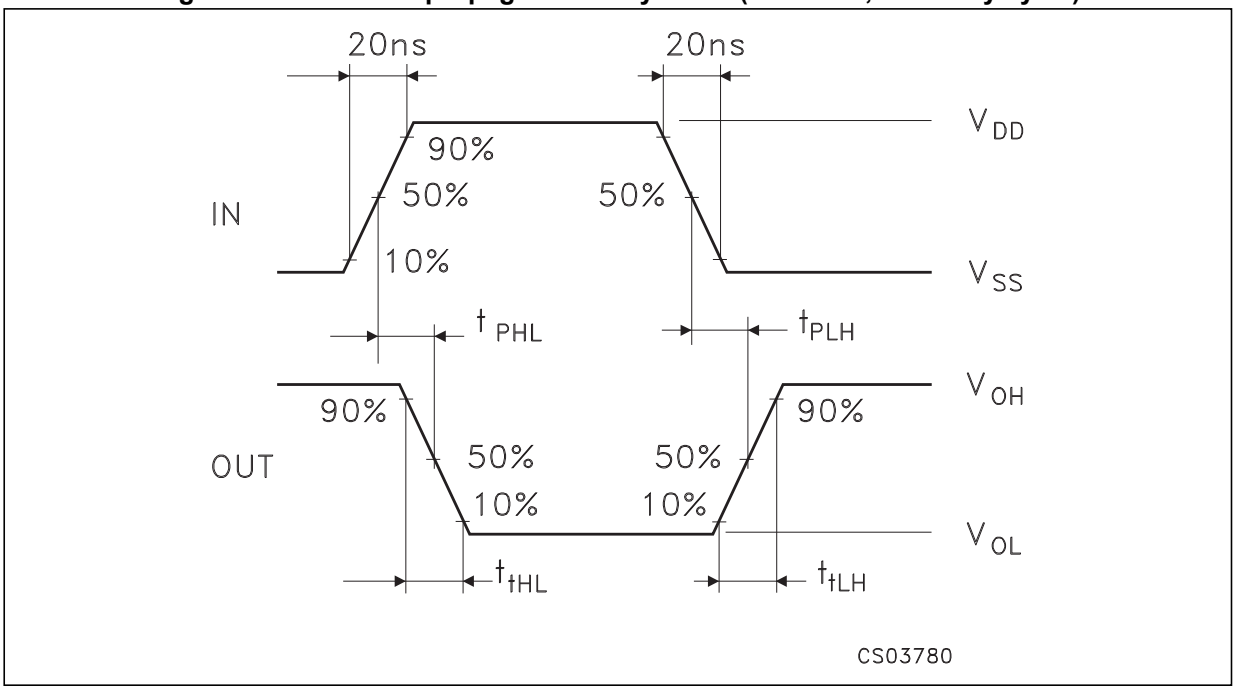
1. Typical temperature coefficient for all V_{DD} values is 0.3%/°C.

Figure 4. 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 5. Waveform - propagation delay times (f = 1 MHz; 50% duty cycle)



2 Package mechanical data

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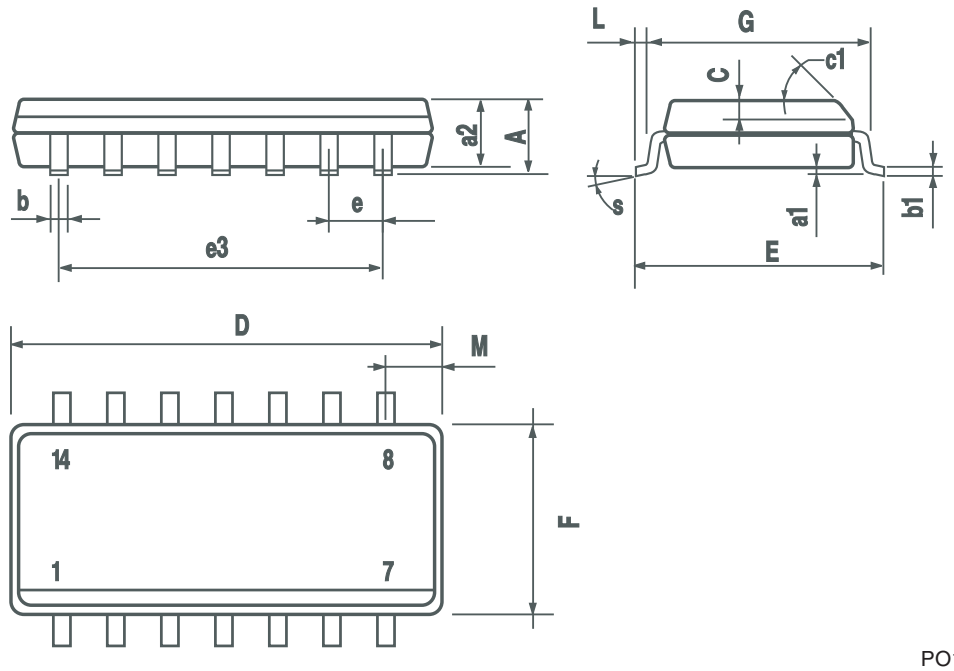
SO-14 MECHANICAL DATA

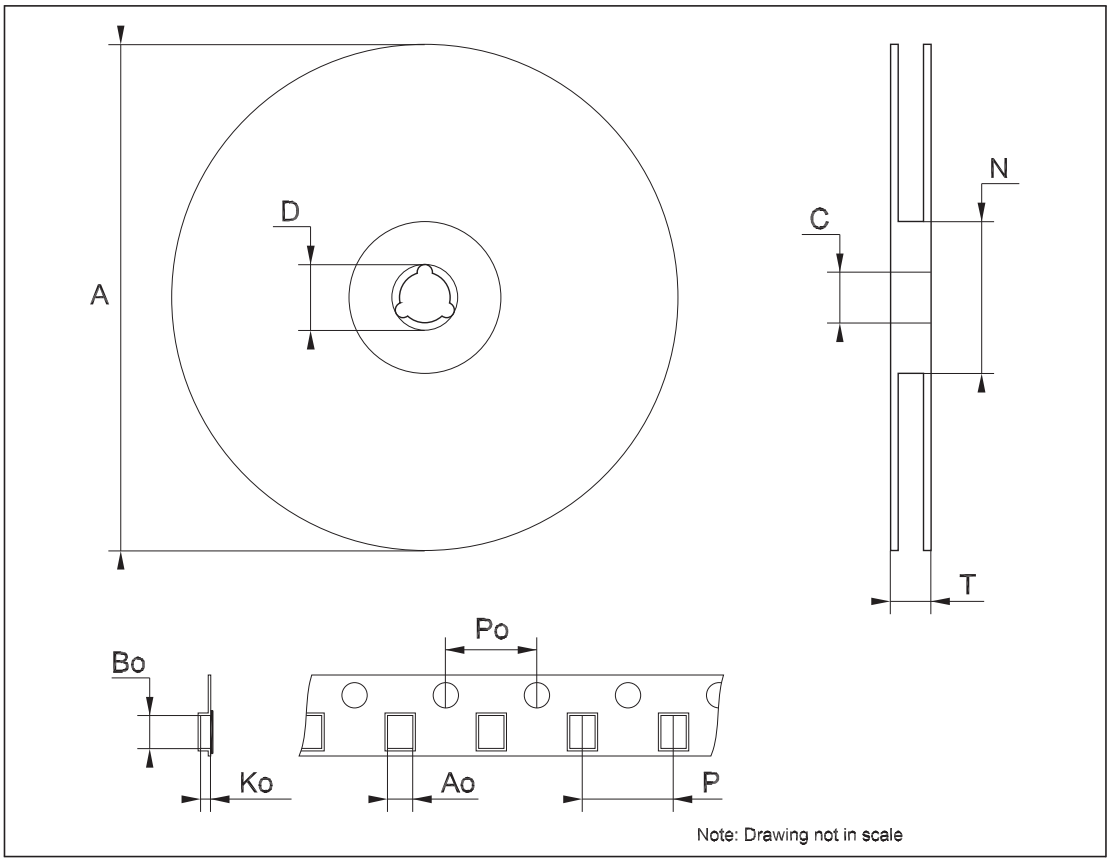
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.68			0.026
S	8° (max.)					



PO13G

Tape & Reel SO-14 MECHANICAL DATA

DIM.	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	6.4		6.6	0.252		0.260
Bo	9		9.2	0.354		0.362
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



3 Revision history

Table 8. Document revision history

Date	Revision	Changes
11-Jun-2012	3	Added *Applications on page 1* Updated *Table 1: Device summary* Revised document presentation, minor textual updates
15-Jun-2012	4	Updated temperature range in *Table 1* Updated T_{op} in *Table 4* and *5*
06-Jan-2014	5	Removed DIP package option Added ESD performance to *Features* Added packing and marking to *Table 1: Device summary* Updated footnote *1* of *Table 1: Device summary*

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