
**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 <sup>(1)</sup>	–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.

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# 1 Device overview

Figure 1. Pin connections

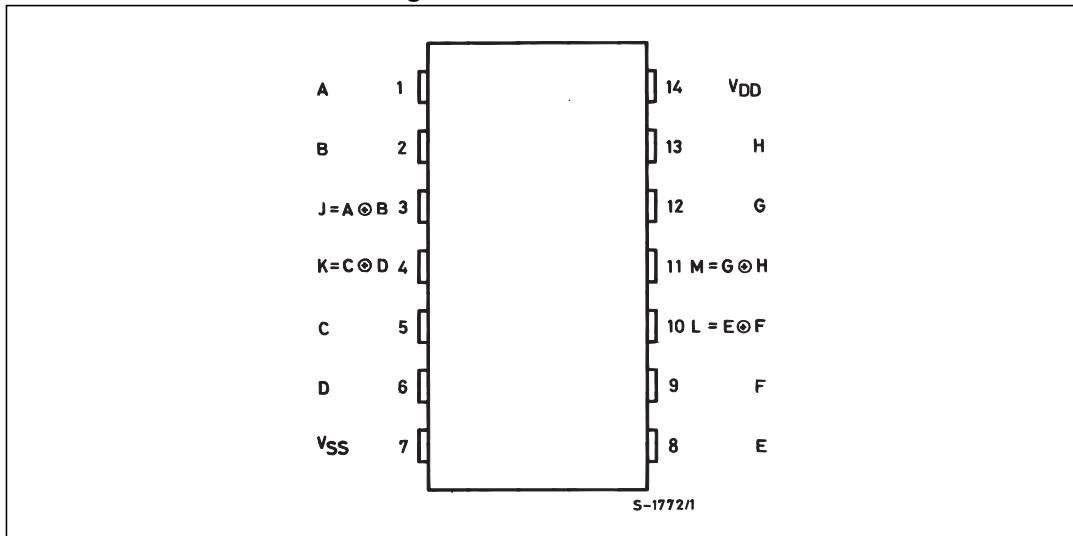


Table 2. Pin description

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 <sub>SS</sub>	Negative supply voltage
14	V <sub>DD</sub>	Positive supply voltage

Figure 2. Input equivalent circuit

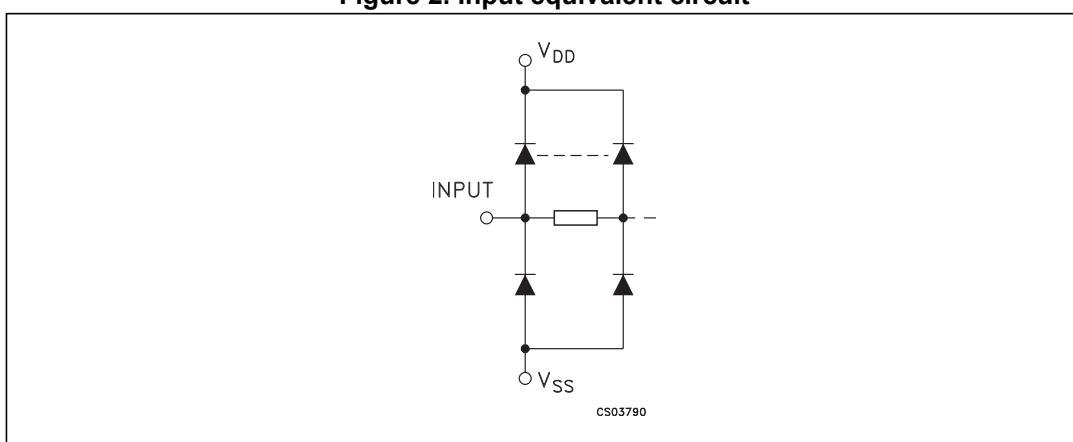


Figure 3. Logic diagram

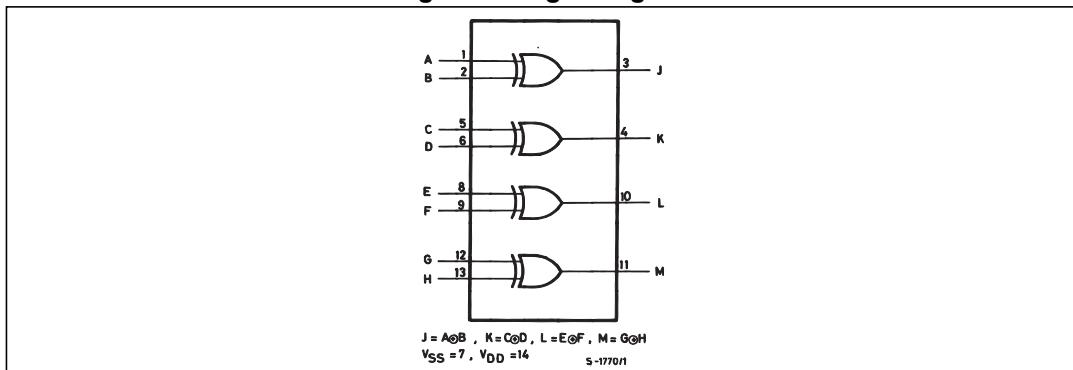


Table 3. Truth table

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 <sub>DD</sub>	Supply voltage	-0.5 to +22	V
V <sub>I</sub>	DC input voltage	-0.5 to V <sub>DD</sub> + 0.5	V
I <sub>I</sub>	DC input current	± 10	mA
P <sub>D</sub>	Power dissipation per package	200	mW
	Power dissipation per output transistor	100	mW
T <sub>op</sub>	Operating temperature	-55 to +125	°C
T <sub>stg</sub>	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<sub>SS</sub> pin voltage.

Table 5. Recommended operating conditions

Symbol	Parameter	Value	Unit
V <sub>DD</sub>	Supply voltage	3 to 20	V
V <sub>I</sub>	Input voltage	0 to V <sub>DD</sub>	V
T <sub>op</sub>	Operating temperature	SO14	°C
		SO14 (automotive grade)	°C

Table 6. DC specifications

Sym.	Parameter	Test condition				Value						Unit	
		V <sub>I</sub> (V)	V <sub>O</sub> (V)	I <sub>OL</sub>   ( $\mu$ A)	V <sub>DD</sub> (V)	T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
						Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
I <sub>L</sub>	Quiescent current	0/5			5		0.02	1		30		30	$\mu$ A
		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 <sub>OH</sub>	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 <sub>OL</sub>	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 <sub>IH</sub>	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 <sub>IL</sub>	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 <sub>OH</sub>	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 <sub>OL</sub>	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 <sub>I</sub>	Input leakage current	0/18	Any Input	18		$\pm 10^{-5}$	$\pm 0.1$		$\pm 1$		$\pm 1$	$\mu$ A	
C <sub>I</sub>	Input capacitance		Any Input			5	7.5					pF	

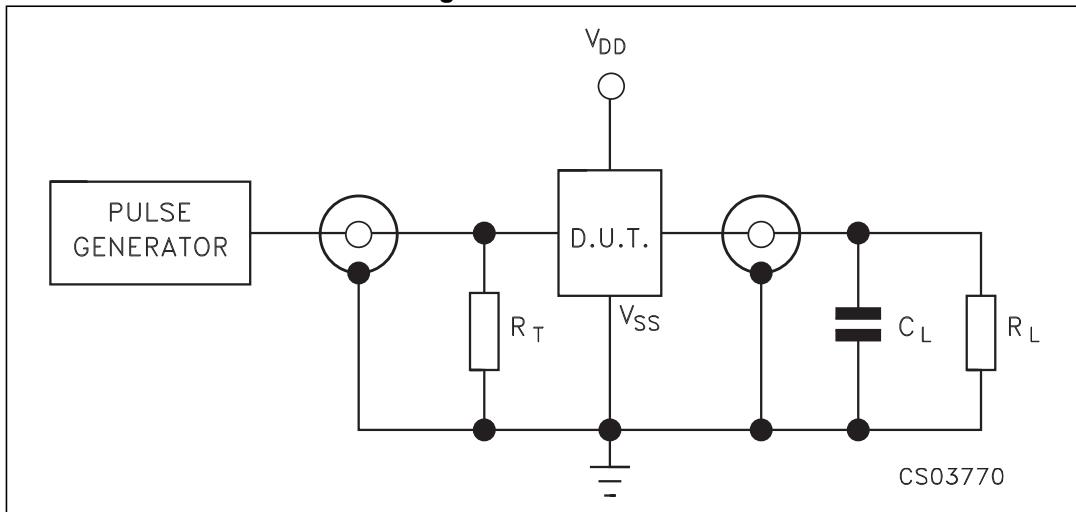
The noise margin for both the "1" and "0" level is: 1 V min. with V<sub>DD</sub> = 5 V, 2 V min. with V<sub>DD</sub> = 10 V, 2.5 V min. with V<sub>DD</sub> = 15 V.

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

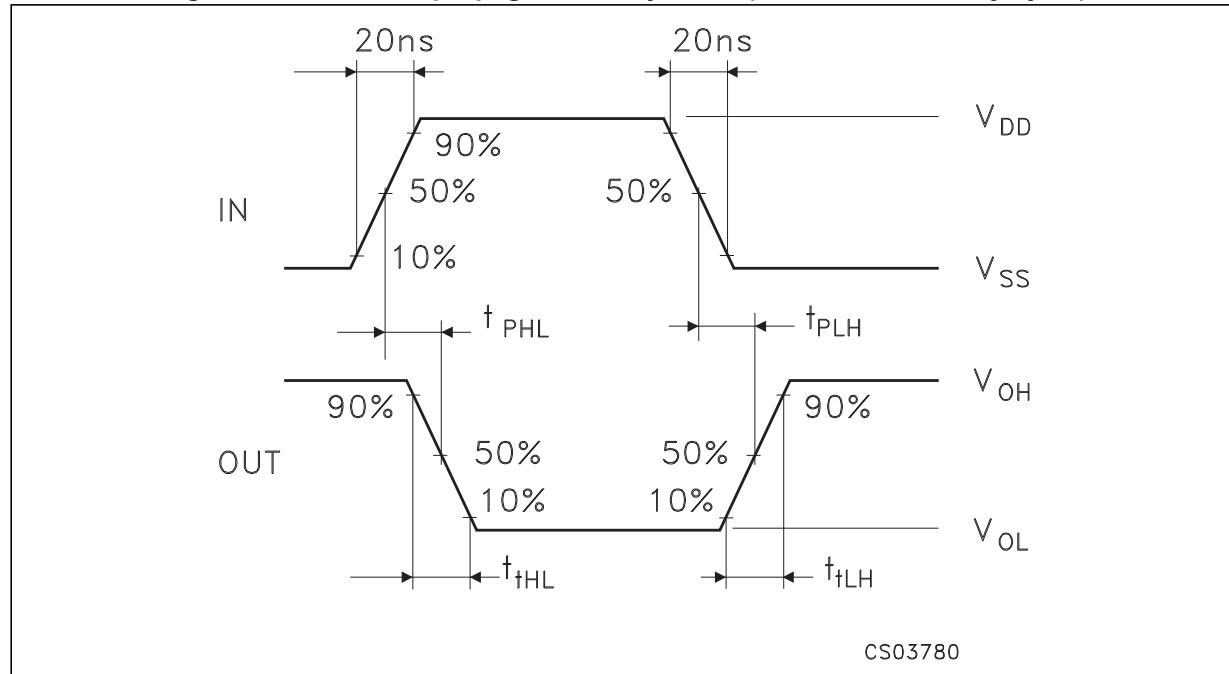
Symbol	Parameter	Test condition	Value <sup>(1)</sup>			Unit
		$V_{DD}$ (V)	Min.	Typ.	Max.	
$t_{PLH} t_{PHL}$	Propagation delay time	5		140	280	ns
		10		70	130	
		15		50	100	
$t_{TLH} t_{THL}$	Output transition time	5		100	200	ns
		10		50	100	
		15		40	80	

1. Typical temperature coefficient for all  $V_{DD}$  values is  $0.3\%/\text{ }^{\circ}\text{C}$ .

**Figure 4. Test circuit**



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

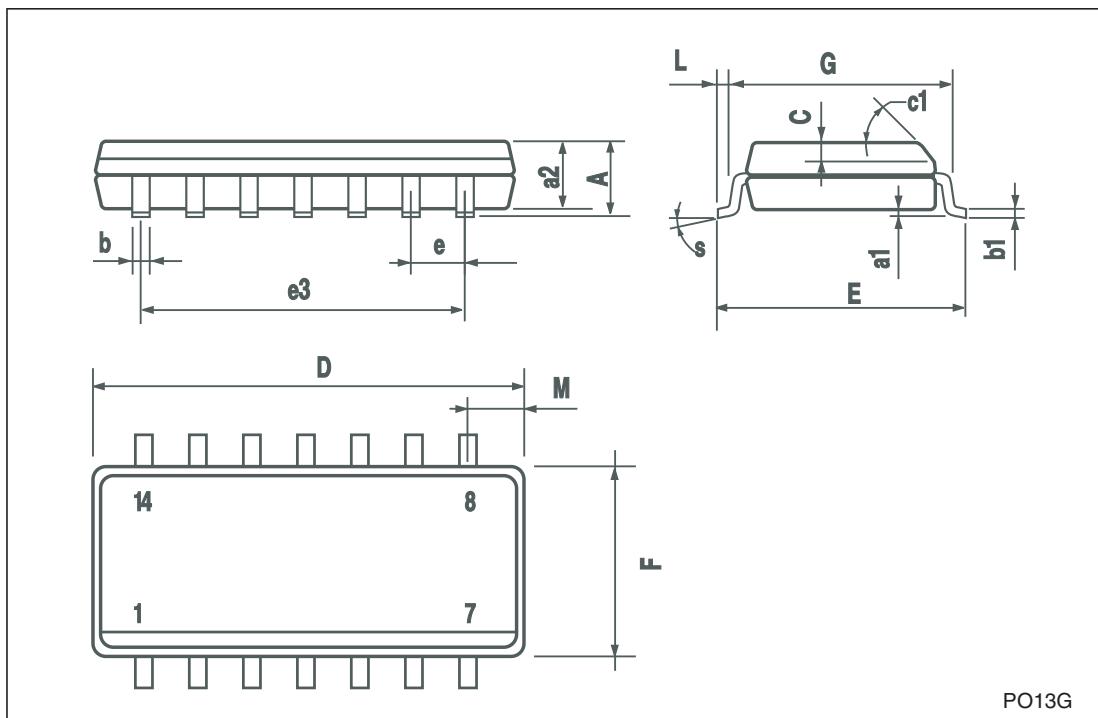
**Figure 5. Waveform - propagation delay times (f = 1 MHz; 50% duty cycle)**

## 2 Package mechanical data

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](http://www.st.com). ECOPACK® is an ST trademark.

## SO-14 MECHANICAL DATA

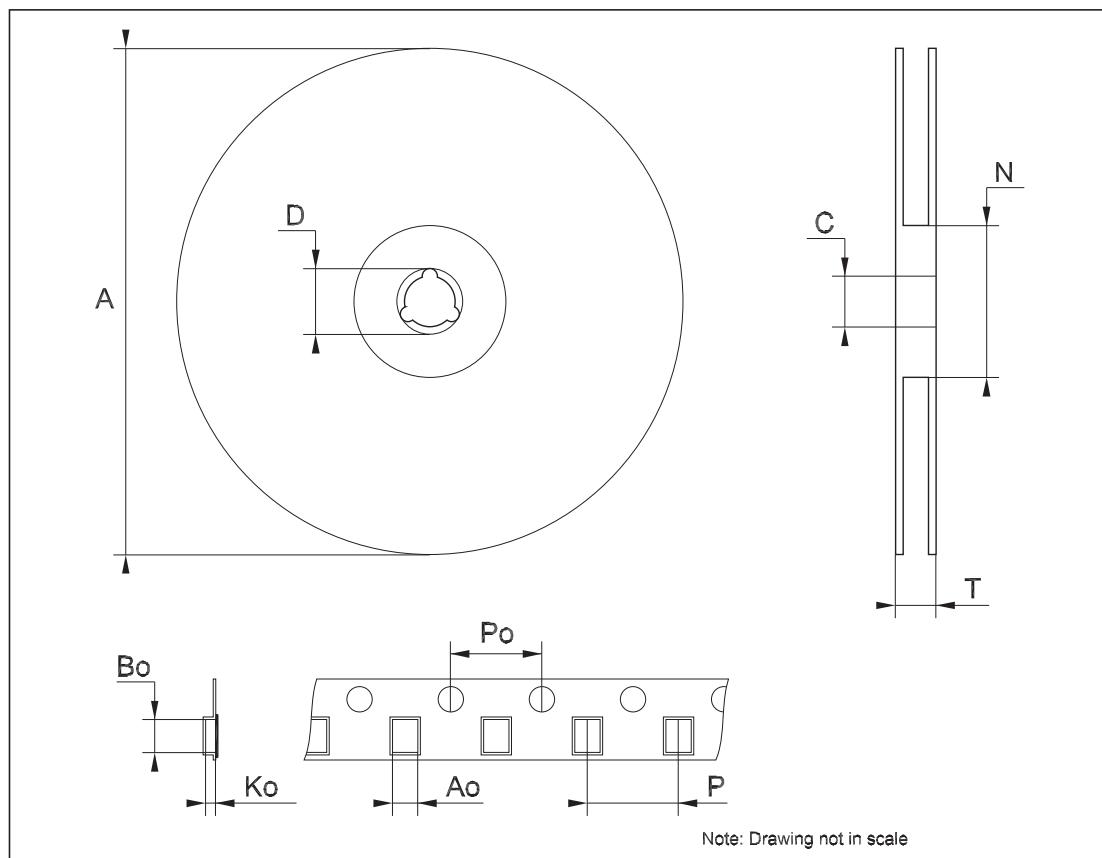
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1		45° (typ.)				
D	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.149		0.157
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 &amp; 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 <i>Applications on page 1</i> Updated <i>Table 1: Device summary</i> Revised document presentation, minor textual updates
15-Jun-2012	4	Updated temperature range in <i>Table 1</i> Updated $T_{op}$ in <i>Table 4</i> and <i>5</i>
06-Jan-2014	5	Removed DIP package option Added ESD performance to <i>Features</i> Added packing and marking to <i>Table 1: Device summary</i> Updated footnote 1 of <i>Table 1: Device summary</i>

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