



# HCF4093B

## QUAD 2 INPUT NAND SCHMITT TRIGGER

- SCHMITT TRIGGER ACTION ON EACH INPUT WITH NO EXTERNAL COMPONENTS
- HYSTERESIS VOLTAGE TYPICALLY 0.9V at  $V_{DD} = 5V$  AND 2.3V at  $V_{DD} = 10V$
- NOISE IMMUNITY GREATER THAN 50% OF  $V_{DD}$  (Typ.)
- NO LIMIT ON INPUT RISE AND FALL TIMES
- QUIESCENT CURRENT SPECIFIED UP TO 20V
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- 5V, 10V AND 15V PARAMETRIC RATINGS
- INPUT LEAKAGE CURRENT  
 $I_l = 100nA$  (MAX) AT  $V_{DD} = 18V$   $T_A = 25^\circ C$
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B "STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"

### DESCRIPTION

The HCF4093B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages.

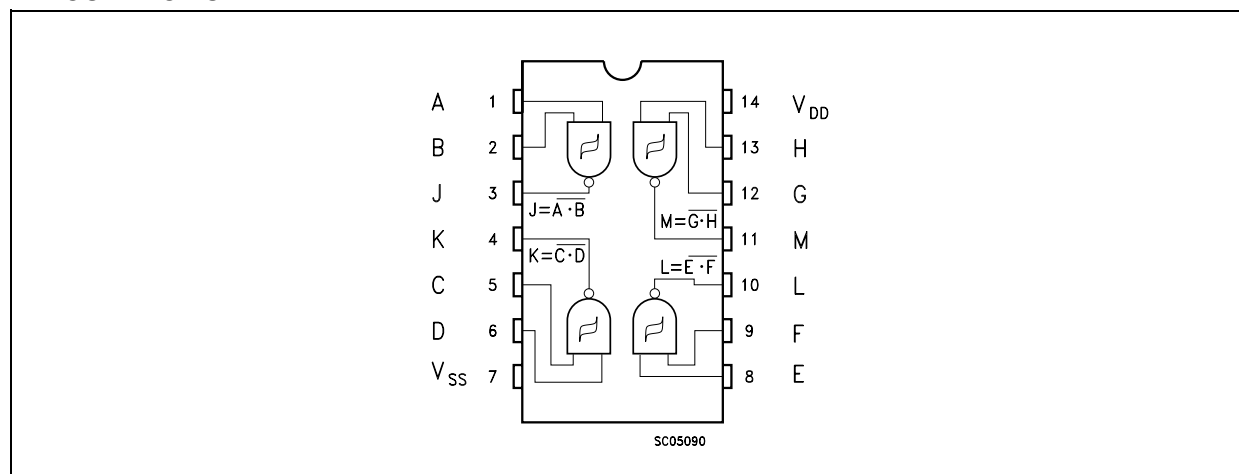


### ORDER CODES

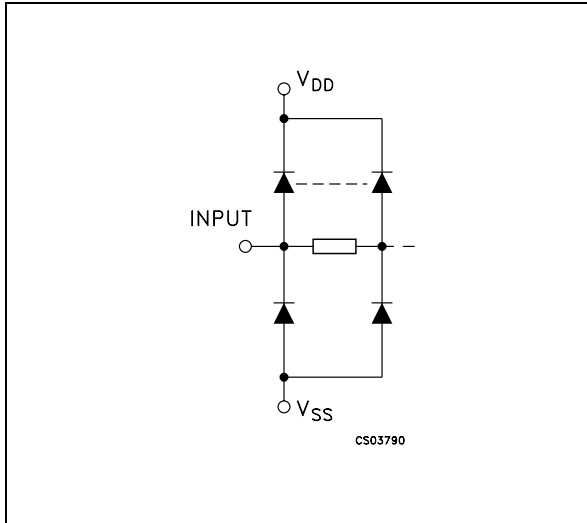
PACKAGE	TUBE	T & R
DIP	HCF4093BEY	
SOP	HCF4093BM1	HCF4093M013TR

The HCF4093B type consists of four schmitt trigger circuits. Each circuit functions as a two input NAND gate with schmitt trigger action on both inputs. The gate switches at different points for positive and negative going signals. The difference between the positive voltage ( $V_P$ ) and the negative voltage ( $V_N$ ) is defined as hysteresis voltage ( $V_H$ ).

### PIN CONNECTION



**INPUT EQUIVALENT CIRCUIT**



**PIN DESCRIPTION**

PIN No	SYMBOL	NAME AND FUNCTION
1, 2, 5, 6, 8, 9, 12, 13	A, B, C, D, E, F, G, 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

**TRUTH TABLE**

INPUTS		OUTPUTS
A, C, E, G	B, D, F, H	J, K, L, M
L	L	H
L	H	H
H	L	H
H	H	L

**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	$\pm 10$	mA
$P_D$	Power Dissipation per Package	200	mW
	Power Dissipation per Output Transistor	100	mW
$T_{op}$	Operating Temperature	-55 to +125	$^{\circ}C$
$T_{stg}$	Storage Temperature	-65 to +150	$^{\circ}C$

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 referred to  $V_{SS}$  pin voltage.

**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	-55 to 125	$^{\circ}C$

## DC SPECIFICATIONS

Symbol	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>P</sub>	Positive Trigger Threshold Voltage	a			5	2.2	2.9	3.6	2.2	3.6	2.2	3.6	V
		a			10	4.6	5.9	7.1	4.6	7.1	4.6	7.1	
		a			15	6.8	8.8	10.8	6.8	10.8	6.8	10.8	
		b			5	2.6	3.3	4.0	2.6	4	2.6	4	
		b			10	5.6	7	8.2	5.6	8.2	5.6	8.2	
		b			15	6.3	9.4	12.7	6.3	12.7	6.3	12.7	
V <sub>N</sub>	Negative Trigger Threshold Voltage	a			5	0.9	1.9	2.8	0.9	2.8	0.9	2.8	V
		a			10	2.5	3.9	5.2	2.5	5.2	2.5	5.2	
		a			15	4	5.8	7.4	4	7.4	4	7.4	
		b			5	1.4	2.3	3.2	1.4	3.2	1.4	3.2	
		b			10	3.4	5.1	6.6	3.4	6.6	3.4	6.6	
		b			15	4.8	7.3	9.6	4.8	9.6	4.8	9.6	
V <sub>H</sub>	Hysteresis Voltage	a			5	0.3	0.9	1.6	0.3	1.6	0.3	1.6	V
		a			10	1.2	2.3	3.4	1.2	3.4	1.2	3.4	
		a			15	1.6	3.5	5	1.6	5	1.6	5	
		b			5	0.3	0.9	1.6	0.3	1.6	0.3	1.6	
		b			10	1.2	2.3	3.4	1.2	3.4	1.2	3.4	
		b			15	1.6	3.5	5	1.6	5	1.6	5	
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 "1" and "0" level is: 1V min. with V<sub>DD</sub>=5V, 2V min. with V<sub>DD</sub>=10V, 2.5V min. with V<sub>DD</sub>=15V

a : Input on terminals 1, 5, 8, 12 or 2, 6, 9, 13; other inputs to V<sub>DD</sub>.

b : Input on terminals 1 and 2, 5 and 6, 8 and 9, or 12 and 13; other inputs to V<sub>DD</sub>.

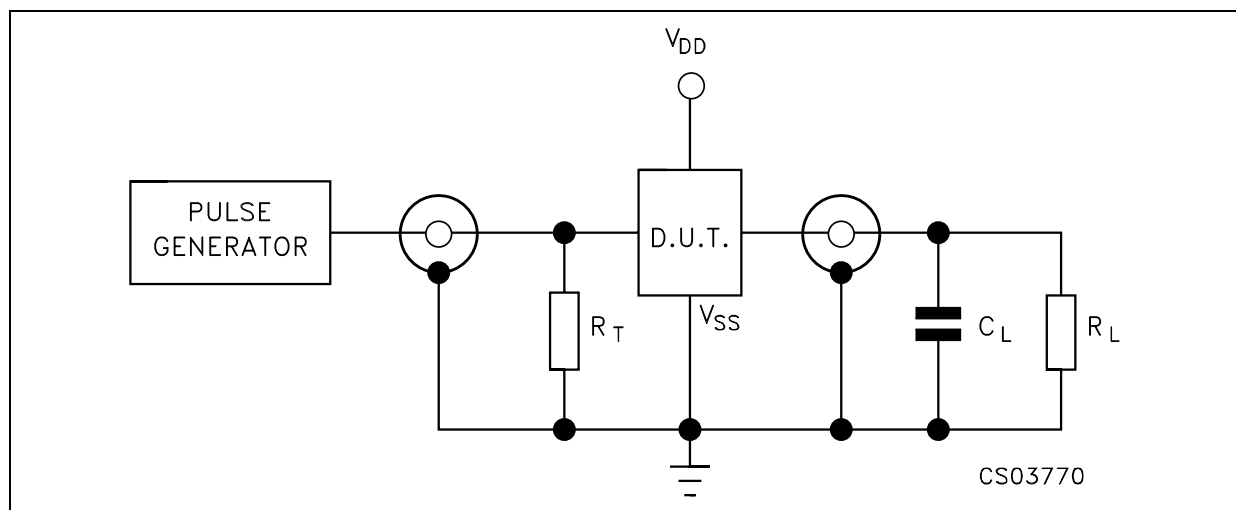
# HCF4093B

## DYNAMIC ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25^{\circ}C$ , $C_L = 50pF$ , $R_L = 200K\Omega$ , $t_r = t_f = 20 ns$ )

Symbol	Parameter	Test Condition		Value (*)			Unit
		$V_{DD}$ (V)		Min.	Typ.	Max.	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time	5			190	380	ns
		10			90	180	
		15			65	130	
$t_{TLH}$ $t_{THL}$	Output Transition Time	5			100	200	ns
		10			50	100	
		15			40	80	

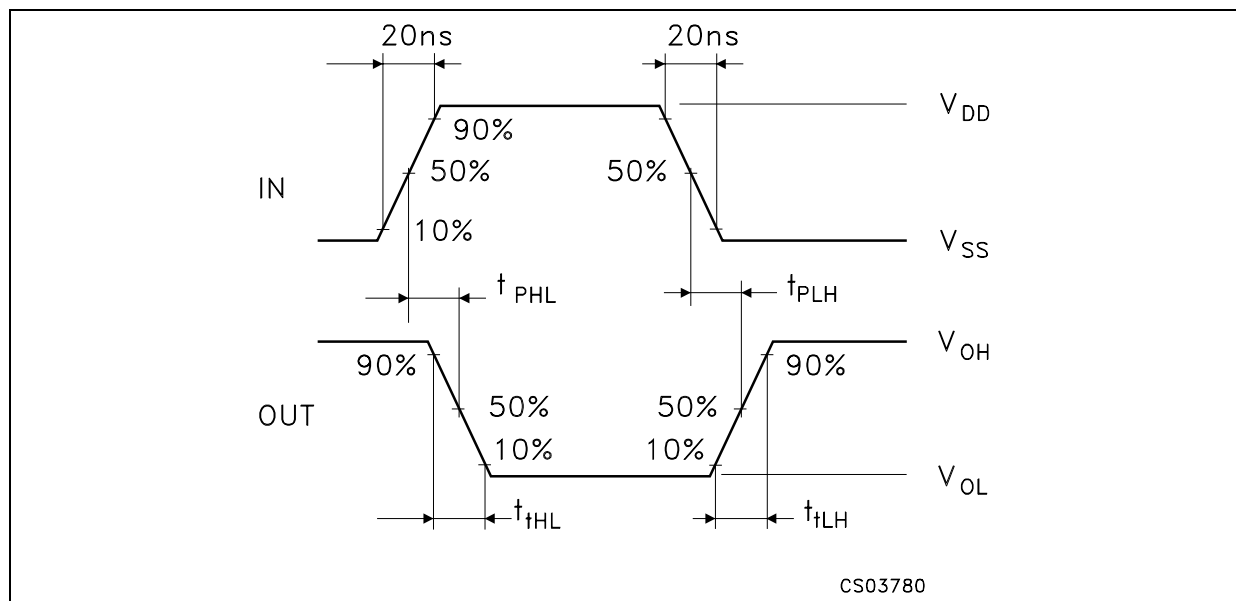
(\*) Typical temperature coefficient for all  $V_{DD}$  value is 0.3 %/°C.

### TEST CIRCUIT



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

### WAVEFORM : PROPAGATION DELAY TIMES ( $f=1MHz$ ; 50% duty cycle)



<b>Plastic DIP-14 MECHANICAL DATA</b>						
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DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100



**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

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