



## GATED J-K MASTER SLAVE FLIP-FLOP

- 16MHz TOGGLE RATE (Typ.) at  $V_{DD} - V_{SS} = 10V$
- GATED INPUTS
- QUIESCENT CURRENT SPECIFIED UP TO 20V
- 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"



### ORDER CODES

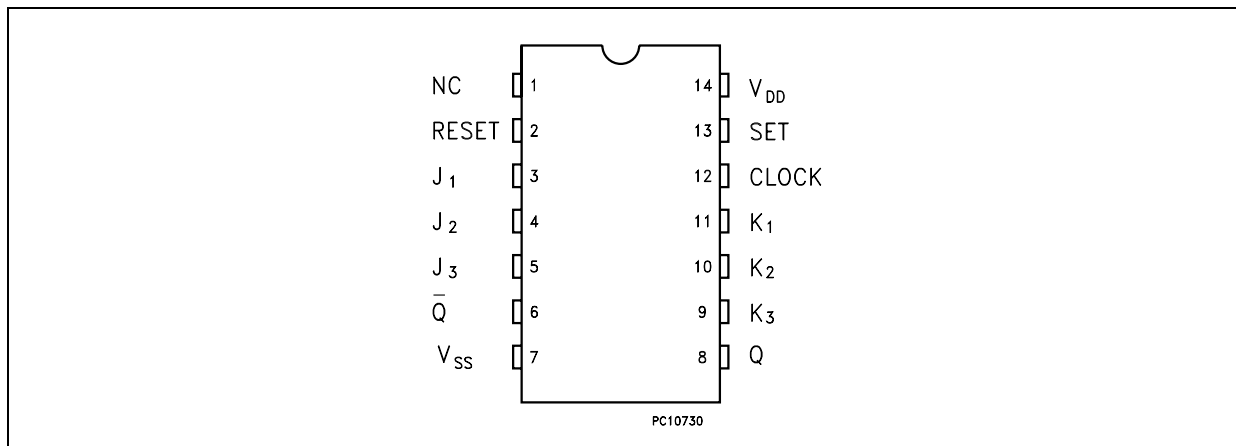
PACKAGE	TUBE	T & R
DIP	HCF4095BEY	
SOP	HCF4095BM1	HCF4095M013TR

### DESCRIPTION

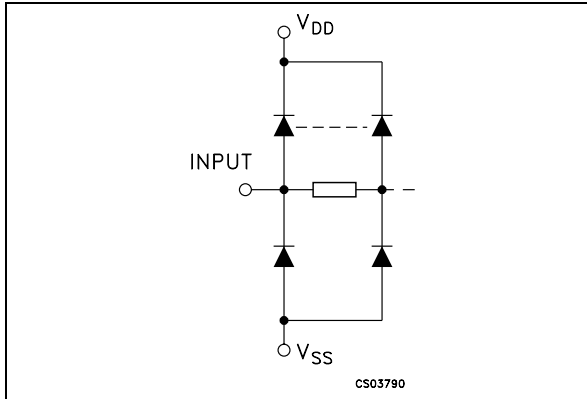
HCF4095B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages. HCF4095B is J-K Master-Slave Flip-Flops featuring separate AND gating of multiple J and K inputs. The gated J-K input control transfers

information into the master section during clocked operation. Information on the J-K inputs is transferred to the Q and  $\bar{Q}$  outputs on the positive edge of the clock pulse. SET and RESET inputs (active high) are provided for asynchronous operation.

### PIN CONNECTION



INPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
3, 4, 5	J1 to J3	J Inputs
11, 10, 9	K1 to K3	K Inputs
8	Q	Q Output
6	Q	Q Output
13	SET (S)	Set Inputs(Active High)
2	RESET (R)	Reset Inputs(Active High)
12	CLOCK	Clock Inputs
1	NC	Not Connected
7	V <sub>SS</sub>	Negative Supply Voltage
14	V <sub>DD</sub>	Positive Supply Voltage

TRUTH TABLE : SYNCHRONOUS OPERATION (S=0 R=0)

INPUTS BEFORE POSITIVE CLOCK TRANSITION		OUTPUTS AFTER POSITIVE CLOCK TRANSITION	
J*	K*	Q	$\bar{Q}$
L	L	NO CHANGE	
L	H	L	H
H	L	H	L
H	H	TOGGLES	

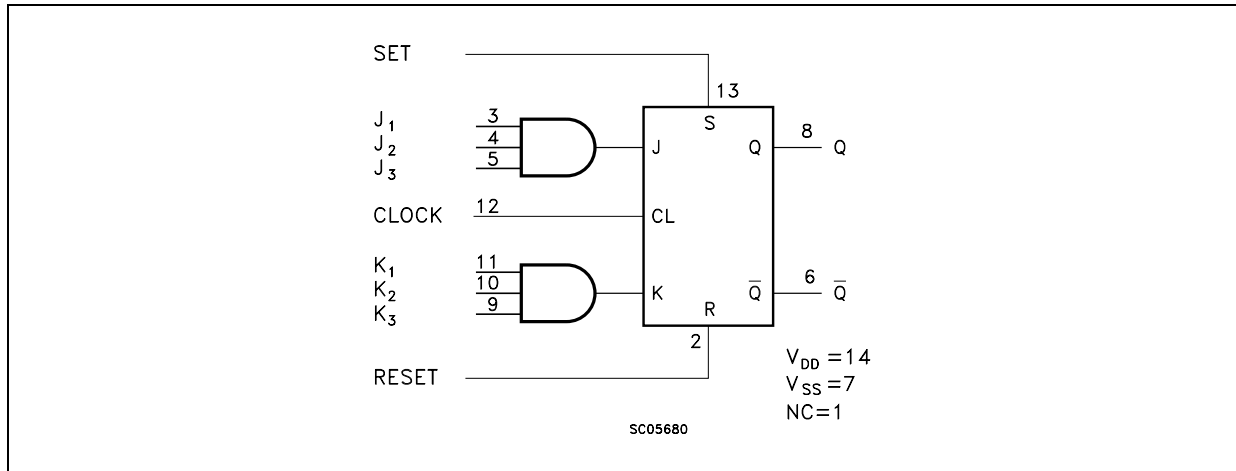
(\*) : J=J1 • J2 • J3, K=K1 • K2 • K3

TRUTH TABLE : ASYNCHRONOUS OPERATION (J and K DON'T CARE)

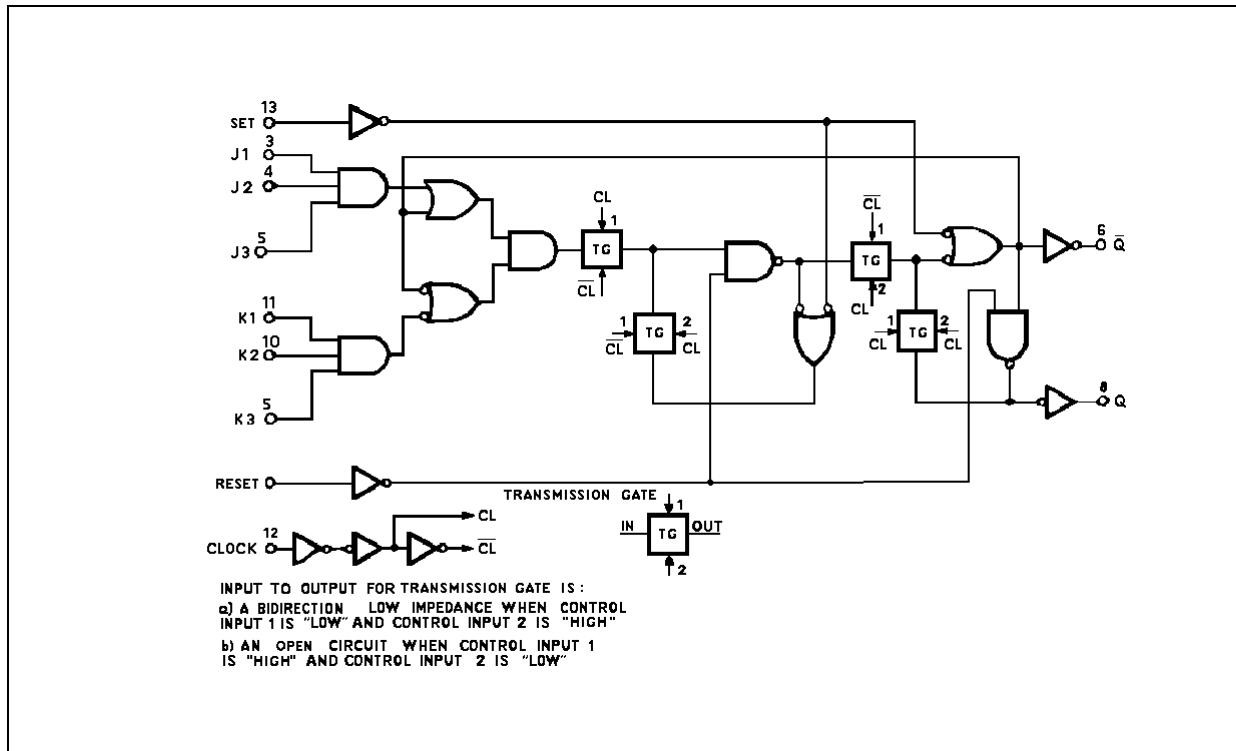
INPUTS BEFORE POSITIVE CLOCK TRANSITION		OUTPUTS AFTER POSITIVE CLOCK TRANSITION	
S	R	Q	$\bar{Q}$
L	L	NO CHANGE	
L	H	L	H
H	L	H	L
H	H	L	L

(\*) : L = V<sub>ss</sub>, H = V<sub>dd</sub>

FUNCTIONAL DIAGRAM



LOGIC DIAGRAM



**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 referred to V<sub>SS</sub> pin voltage.

**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	-55 to 125	°C

**DC SPECIFICATIONS**

Symbol	Parameter	Test Condition				Value						Unit	
		V <sub>I</sub> (V)	V <sub>O</sub> (V)	I <sub>oI</sub>   (µA)	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	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 <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		

Symbol	Parameter	Test Condition				Value						Unit	
		V <sub>I</sub> (V)	V <sub>O</sub> (V)	I <sub>oI</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>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

#### DYNAMIC ELECTRICAL CHARACTERISTICS (T<sub>amb</sub> = 25°C, C<sub>L</sub> = 50pF, R<sub>L</sub> = 200K $\Omega$ , t<sub>r</sub> = t<sub>f</sub> = 20 ns)

Symbol	Parameter	Test Condition		Value (*)			Unit
		V <sub>DD</sub> (V)		Min.	Typ.	Max.	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time	5			250	500	ns
		10			100	200	
		15			75	150	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time (Set or Reset)	5			150	300	ns
		10			75	150	
		15			50	100	
t <sub>TLH</sub> t <sub>THL</sub>	Transition Time	5			100	200	ns
		10			50	100	
		15			40	80	
f <sub>CL</sub>	Maximum Clock Input Frequency	5		3.5	7		MHz
		10		8	16		
		15		12	24		
t <sub>w</sub>	Clock Pulse Width	5		140	70		ns
		10		60	30		
		15		40	20		
t <sub>r</sub> , t <sub>f</sub>	Clock input Rise or Fall Time	5				15	$\mu$ s
		10				5	
		15				5	
t <sub>w</sub>	Set or Reset Pulse Width	5		200	100		ns
		10		100	50		
		15		50	25		
t <sub>setup</sub>	Data Setup Time	5		400	200		ns
		10		160	80		
		15		100	50		

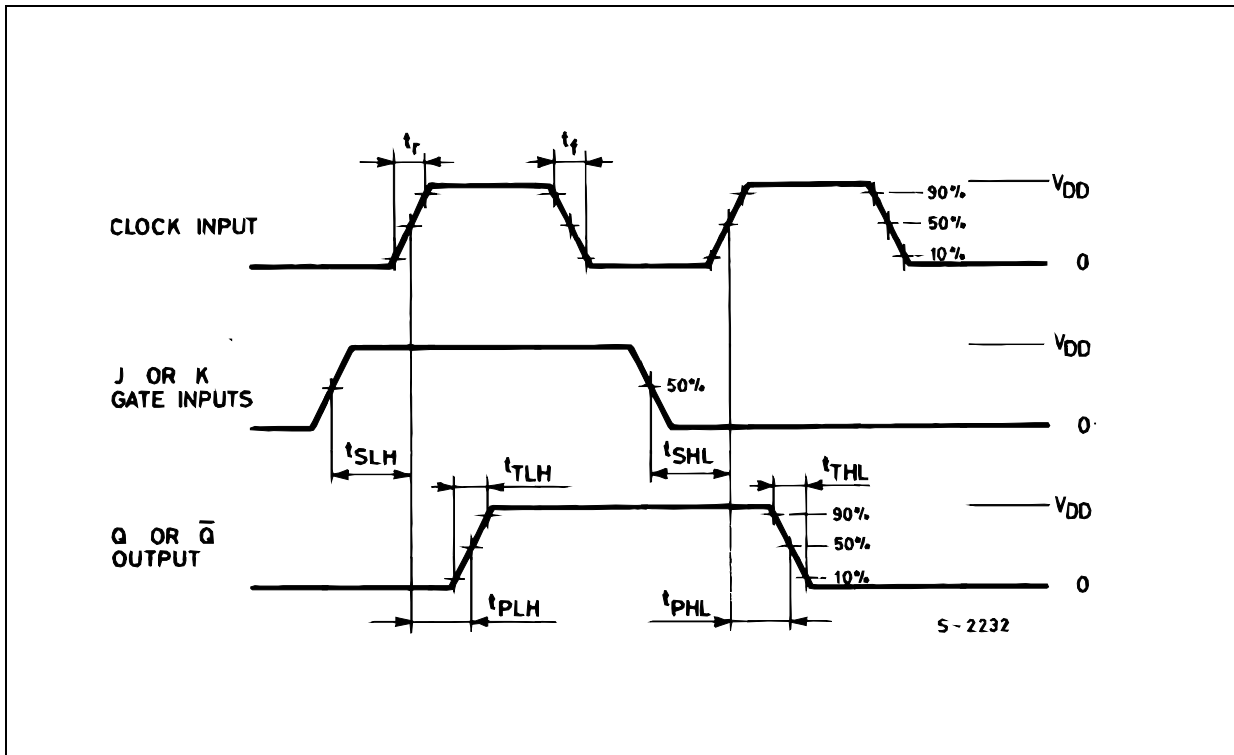
(\*) Typical temperature coefficient for all V<sub>DD</sub> value is 0.3 %/°C.

TEST CIRCUIT

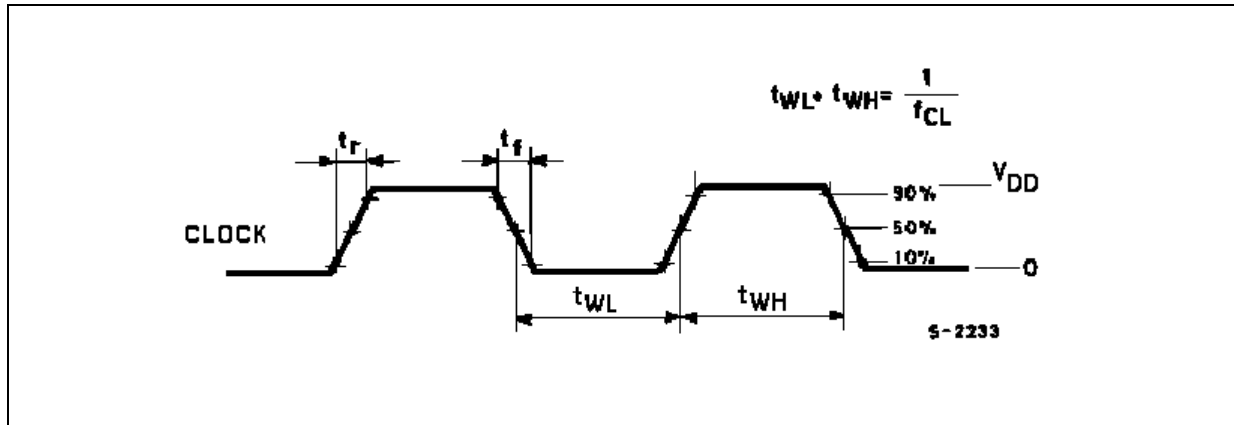


$C_L = 50\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_L = 200\text{K}\Omega$   
 $R_T = Z_{\text{OUT}}$  of pulse generator (typically  $50\Omega$ )

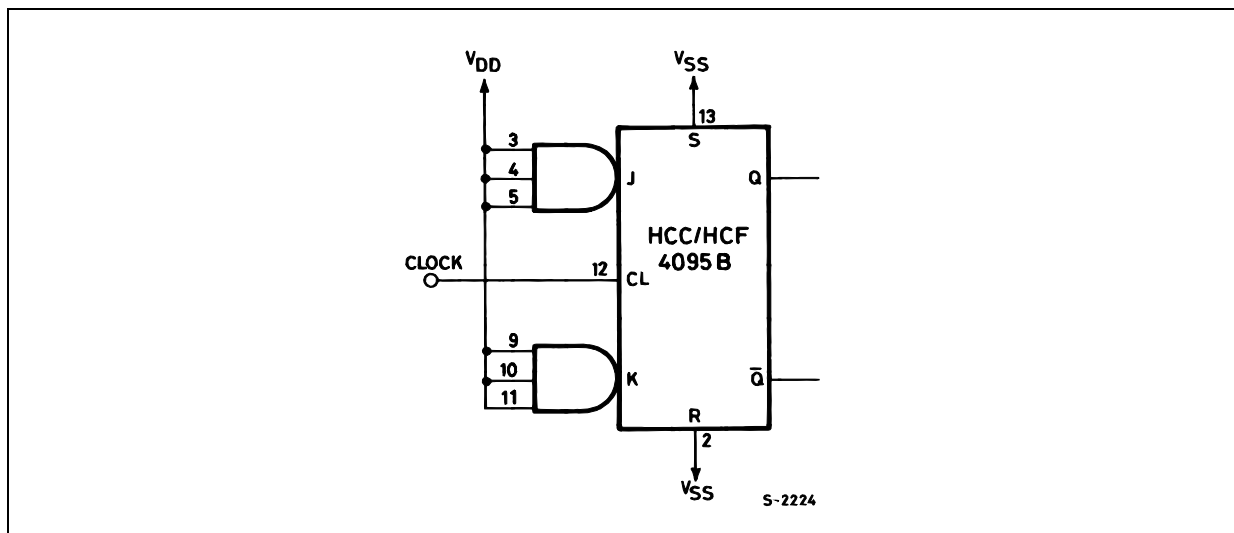
WAVEFORM : PROPAGATION DELAY, TRANSITION AND SETUP TIME



## WAVEFORM : CLOCK PULSE, RISE AND FALL TIME

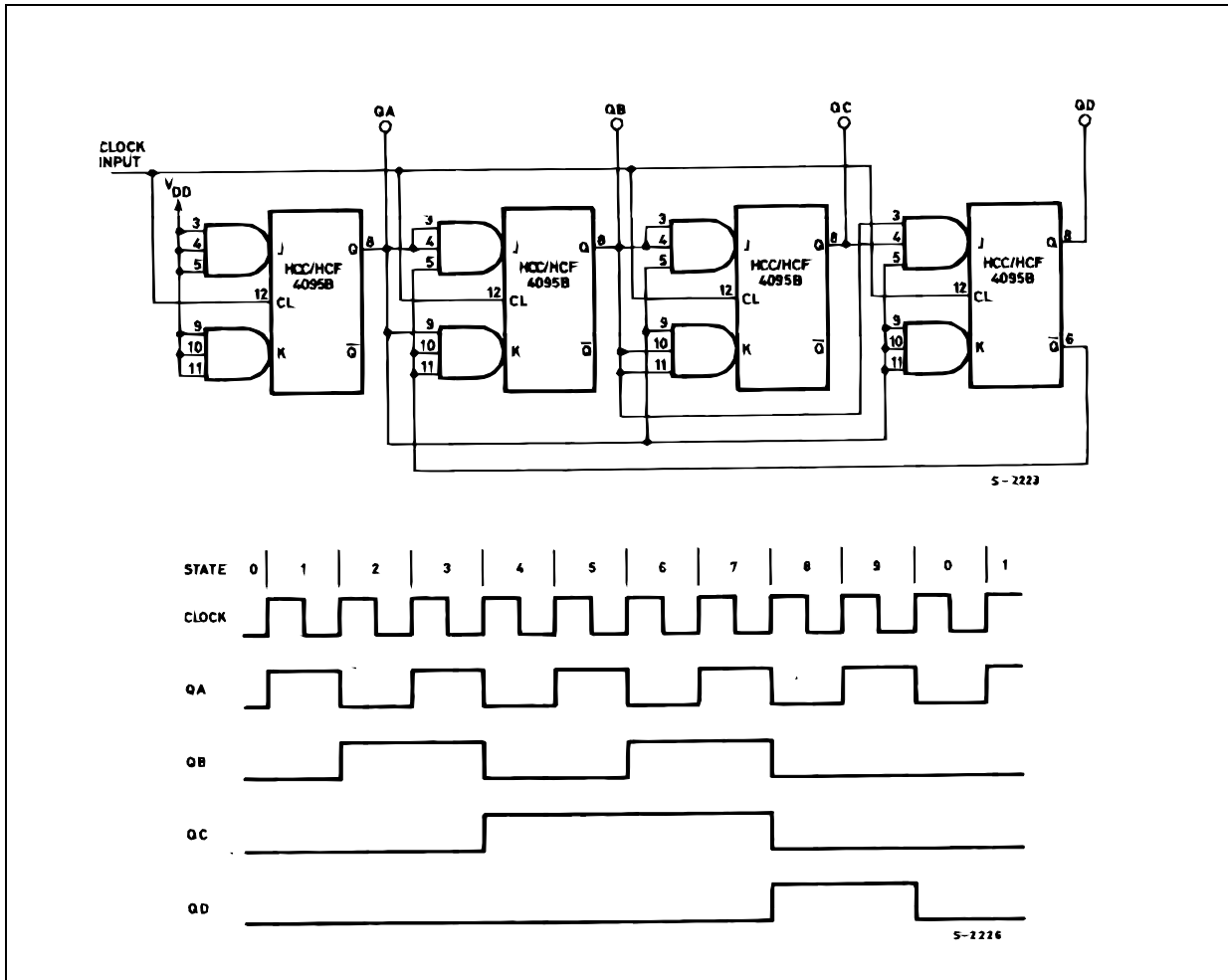


## TYPICAL APPLICATION: T-TYPE FLIP-FLOP



# HCF4095B

## TYPICAL APPLICATION: SYNCHRONOUS BINARY DIVIDE BY TEN COUNTER



### TRUTH TABLE

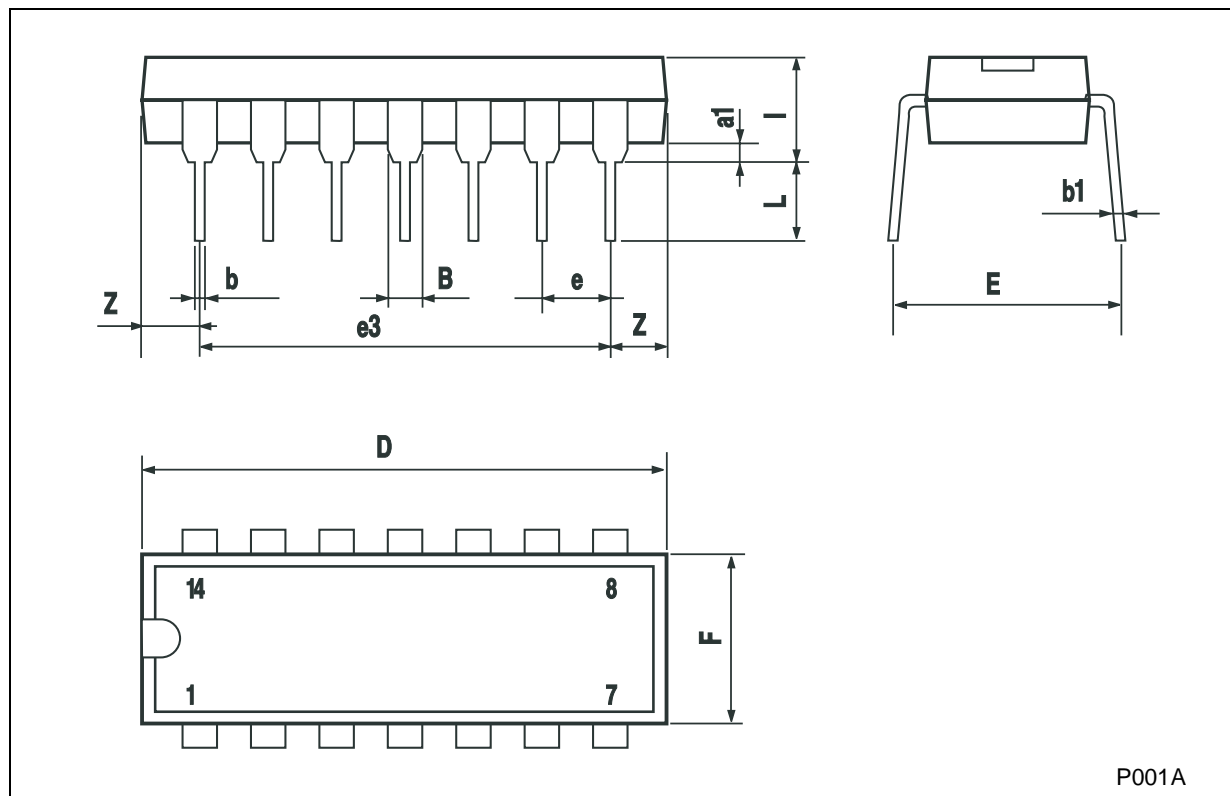
STATE	QA	QB	QC	QD
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	H	H	L
7	H	H	H	L
8	L	L	L	H
9	H	L	L	H

NOTE: In all units the Set and Reset are Connected to  $V_{SS}$ .



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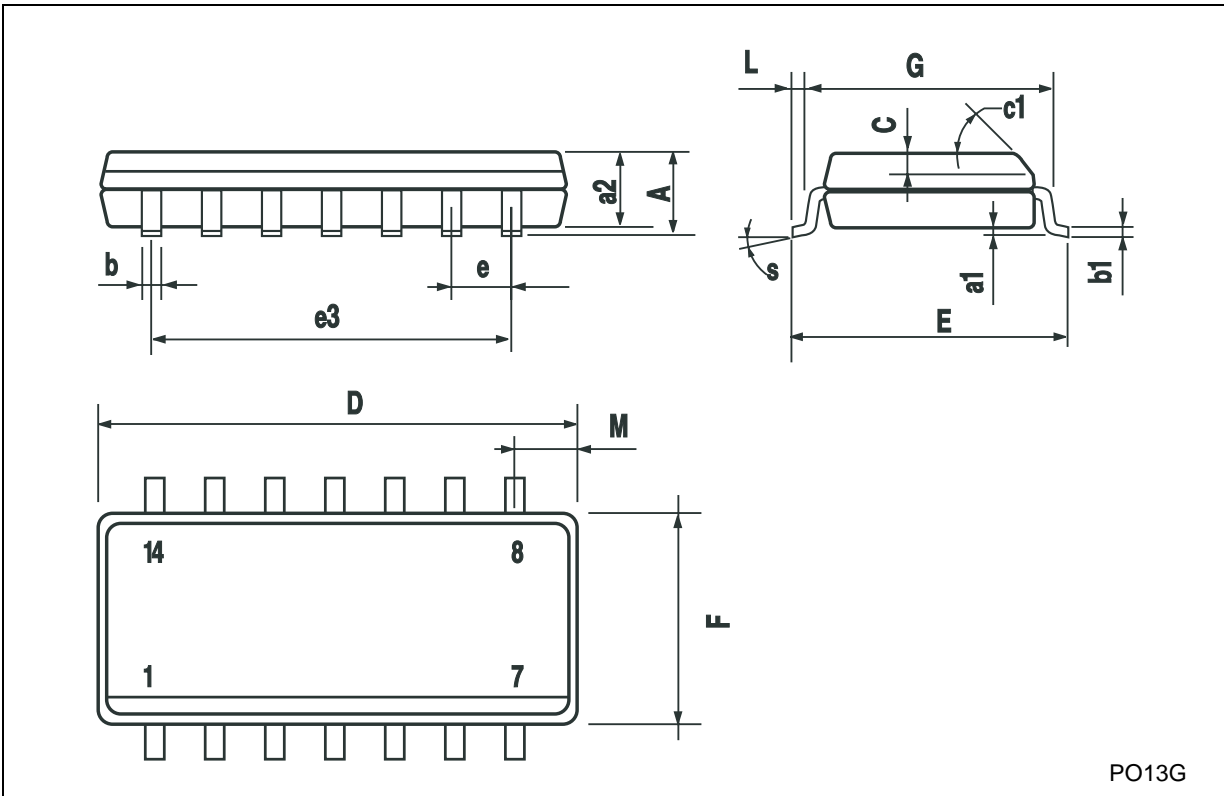
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100



P001A

**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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