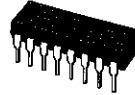




## BINARY RATE MULTIPLIER

- CASCADABLE IN MULTIPLES OF 4-BITS
- SET TO "15" INPUT AND "15" DETECT OUTPUT
- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- INPUT CURRENT OF 100nA AT 18V AND 25°C FOR HCC DEVICE
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC TENTATIVE STANDARD N<sup>o</sup>. 13A, "STANDARD SPECIFICATIONS FOR DESCRIPTION OF "B" SERIES CMOS DEVICES"



### DESCRIPTION

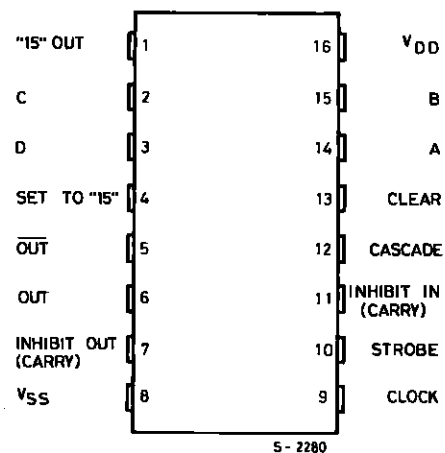
The **CC4089** (extended temperature range) and **CC4089** (intermediate temperature range) are monolithic integrated circuit available in 16-lead dual in-line plastic or ceramic package.

The **CC4089** is a low-power 4-bit digital rate multiplier that provides an output pulse rate that is the clock-input-pulse rate multiplied by 1/16 times the binary input. For example, when the binary input number is 13, there will be 13 output pulses for every 16 input pulses.

The **CC4089** has an internal synchronous 4-bit counter which, together with one of the four binary input bits, produces pulse trains as shown in timing diagram.

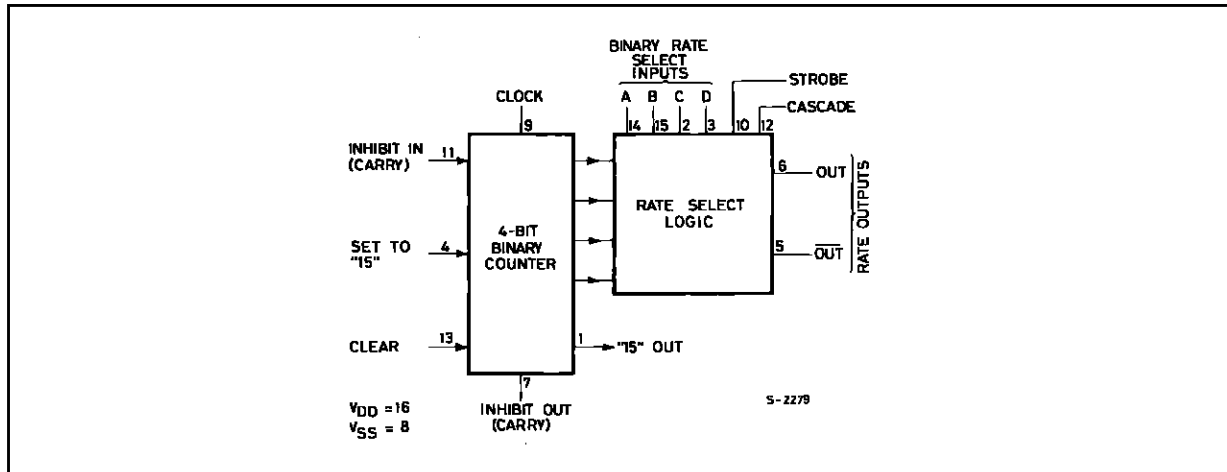
If more than one binary input bit is high, the resulting pulse train is a combination of the above separate pulse trains. This device may be used to perform arithmetic operations (add, subtract, divide, raise to a power), solve algebraic and differential equations, generate natural logarithms and trigonometric functions, A/D and D/A conversions, and frequency division.

### PIN CONNECTIONS



S - 2280

FUNCTIONAL DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{DD}^*$	Supply Voltage :	- 0.5 to + 20	V
$V_i$	Input Voltage	- 0.5 to $V_{DD} + 0.5$	V
$I_i$	DC Input Current (any one input)	$\pm 10$	mA
$P_{tot}$	Total Power Dissipation (per package)	200	mW
	Dissipation per Output Transistor for $T_{op}$ = Full Package-temperature Range	100	mW
$T_{op}$	Operating Temperature :	- 55 to + 125	$^{\circ}C$
			$^{\circ}C$
$T_{stg}$	Storage Temperature	- 65 to + 150	$^{\circ}C$

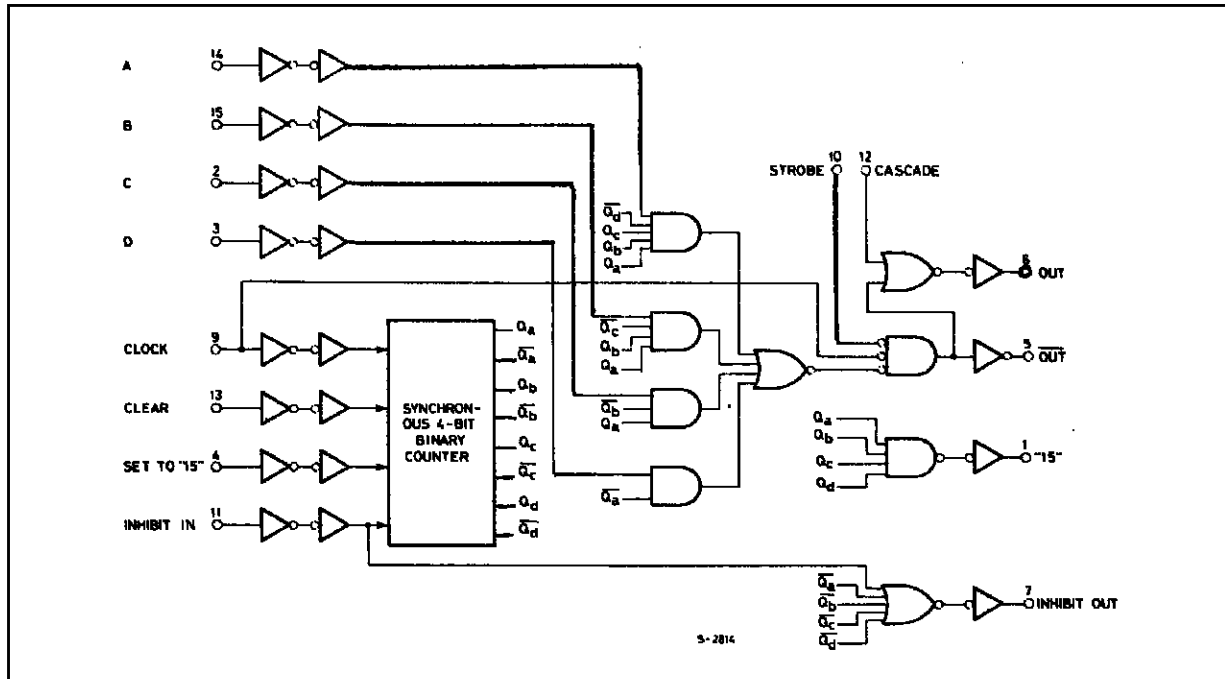
Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for external periods may affect device reliability.

\* All voltage values are referred to  $V_{SS}$  pin voltage.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
$V_{DD}$	Supply Voltage :	3 to 18	V
$V_i$	Input Voltage	0 to $V_{DD}$	V
$T_{op}$	Operating Temperature :	- 55 to + 125	$^{\circ}C$

LOGIC DIAGRAM



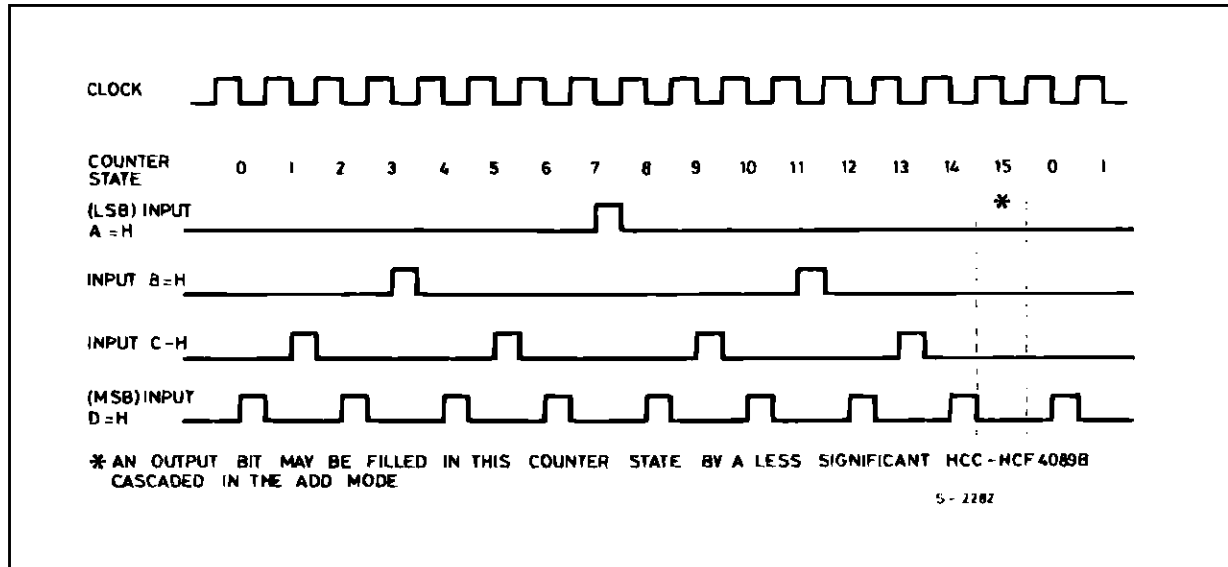
TRUTH TABLE

Inputs										Outputs			
Number of Pulses or Input Logic Level (0 = low ; 1 = high ; X = don't care)										Number of Pulses or Output Logic Level (L = low ; H = high)			
D	C	B	A	CLK	INH IN	STR	CAS	CLR	SET	OUT	$\overline{\text{OUT}}$	INH OUT	"15" OUT
0	0	0	0	16	0	0	0	0	0	L	H	1	1
0	0	0	1	16	0	0	0	0	0	1	1	1	1
0	0	1	0	16	0	0	0	0	0	2	2	1	1
0	0	1	1	16	0	0	0	0	0	3	3	1	1
0	1	0	0	16	0	0	0	0	0	4	4	1	1
0	1	0	1	16	0	0	0	0	0	5	5	1	1
0	1	1	0	16	0	0	0	0	0	6	6	1	1
0	1	1	1	16	0	0	0	0	0	7	7	1	1
1	0	0	0	16	0	0	0	0	0	8	8	1	1
1	0	0	1	16	0	0	0	0	0	9	9	1	1
1	0	1	0	16	0	0	0	0	0	10	10	1	1
1	0	1	1	16	0	0	0	0	0	11	11	1	1
1	1	0	0	16	0	0	0	0	0	12	12	1	1
1	1	0	1	16	0	0	0	0	0	13	13	1	1
1	1	1	0	16	0	0	0	0	0	14	14	1	1
1	1	1	1	16	0	0	0	0	0	15	15	1	1
X	X	X	X	16	1	0	0	0	0	•	•	H	•
X	X	X	X	16	0	1	0	0	0	L	H	1	1
X	X	X	X	16	0	0	1	0	0	H	*	1	1
1	X	X	X	16	0	0	0	1	0	16	16	H	L
0	X	X	X	16	0	0	0	1	0	L	H	H	L
X	X	X	X	16	0	0	0	0	1	L	H	L	H

\* Output same as the first 16 lines of this truth table (depending on values of A, B, C, D).

• Depends on internal state of counter.

TIMING DIAGRAM



STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)

Symbol	Parameter	Test Conditions				Value						Unit	
		V <sub>I</sub> (V)	V <sub>O</sub> (V)	I <sub>O</sub>   ( $\mu$ A)	V <sub>DD</sub> (V)	T <sub>Low</sub> *		25°C			T <sub>High</sub> *		
						Min.	Max.	Min.	Typ.	Max.	Min.		Max.
I <sub>L</sub>	Quiescent Current	0/ 5			5		5		0.04	5		150	$\mu$ A
		0/10			10		10		0.04	10		300	
		0/15			15		20		0.04	20		600	
		0/18			18		100		0.08	100		3000	
V <sub>OH</sub>	Output High 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>	Output Low 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>	Input High 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>	Input Low 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			

## STATIC ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions				Value						Unit		
		V <sub>I</sub> (V)	V <sub>O</sub> (V)	I <sub>O</sub>   ( $\mu$ A)	V <sub>DD</sub> (V)	T <sub>Low</sub> *		25°C			T <sub>High</sub> *			
						Min.	Max.	Min.	Typ.	Max.	Min.		Max.	
I <sub>OH</sub>	Output Drive Current	0/ 5	2.5		5	- 2		- 1.6	- 3.2		- 1.15		mA	
		0/ 5	4.6		5	- 0.64		- 0.51	- 1		- 0.36			
		0/10	9.5		10	- 1.6		- 1.3	- 2.6		- 0.9			
		0/15	13.5		15	- 4.2		- 3.4	- 6.8		- 2.4			
I <sub>OL</sub>	Output Sink Current	0/ 5	0.4		5	0.64		0.51	1		0.36		mA	
		0/10	0.5		10	1.6		1.3	2.6		0.9			
		0/15	1.5		15	4.2		3.4	6.8		2.4			
I <sub>IH</sub> , I <sub>IL</sub>	Input Leakage Current	0/18	Any Input		18		$\pm 0.1$		$\pm 10^{-5}$	$\pm 0.1$		$\pm 1$	$\mu$ A	
C <sub>I</sub>	Input Capacitance		Any Input					5	7.5				pF	

\* T<sub>Low</sub> = -55°C for HCC device : -40°C for HCF device.

\* T<sub>High</sub> = +125°C for HCC device : +85°C for HCF device.

The Noise Margin for both "1" and "0" levels 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.