

**MMC 4017, MMC 4022**

COUNTER/DIVIDERS: **4017` DECADE COUNTER** **WITH 10 DECODED OUTPUTS** **4022 OCTAL COUNTER** **WITH 8 DECODED OUTPUTS**

GENERAL DESCRIPTION

The MMC 4017 and MMC 4022 are 5-stage and 4 stage Johnson counters having 10 and 8 decoded outputs respectively.

The MMC 4017 and MMC 4022 are monolithic integrated circuits, fabricated in standard Al-gate CMOS technology. Are available in 16-lead dual in-line plastic package.

Inputs include a CLOCK, a RESET and a CLOCK inhibit signal. Schmitt trigger in the CLOCK input circuit provides pulse shaping that allows unlimited clock input pulse rise and fall times. These counters are advanced one count at the positive clock signal transition if the CLOCK INHIBIT signal is low. Counter advancement via the clock line is inhibited when the CLOCK INHIBIT signal is high. A high RESET signal clears the counter to its zero count. Use of the Johnson decade-counter configuration permits high-speed operation, 2-input decimal-decode gating and spike-free decoded outputs. Anti-lock gating is provided, thus assuring proper counting sequence. The

decoded outputs are normally low and go high only at their respective decoded time slot. Each decoded Output remains high for one full clock cycle. A CARRY-OUT signal completes one cycle every 10 clock input cycles in the MMC 4017 or every 8 clock input cycles in the MMC 4022 and is used to ripple-clock the succeeding device in a multi-device counting chain.

FEATURES

- Fully static operation
- Medium speed operation — 12 MHz (typ) at $V_{DD} = 10\text{ V}$

APPLICATIONS

- Decade counter/decimal decode display
- Binary counter/decoder
- Frequency division
- Counter control/timers
- Divide — by — N counting.

ABSOLUTE MAXIMUM RATINGS

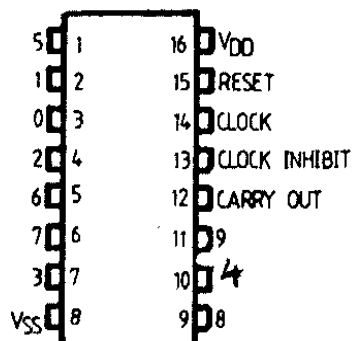
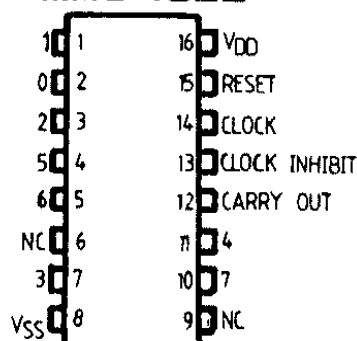
V_{DD}^*	Supply voltage: G and H types	-0.5 to 20	V
	E and F types	-0.5 to 18	V
V_i	Input voltage	-0.5 to $V_{DD}+0.5$	V
I_i	DC input current (any one input)	± 10	mA
P_{tot}	Total power dissipation (per package)	200	mW
	Dissipation per output transistor		
T_A	for $T_A =$ full package-temperature range	100	mW
	Operating		
	temperature: G and H types	-55 to 125	°C
	E and F types	-40 to 85	°C
T_{sto}	Storage temperature	-65 to 150	°C

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

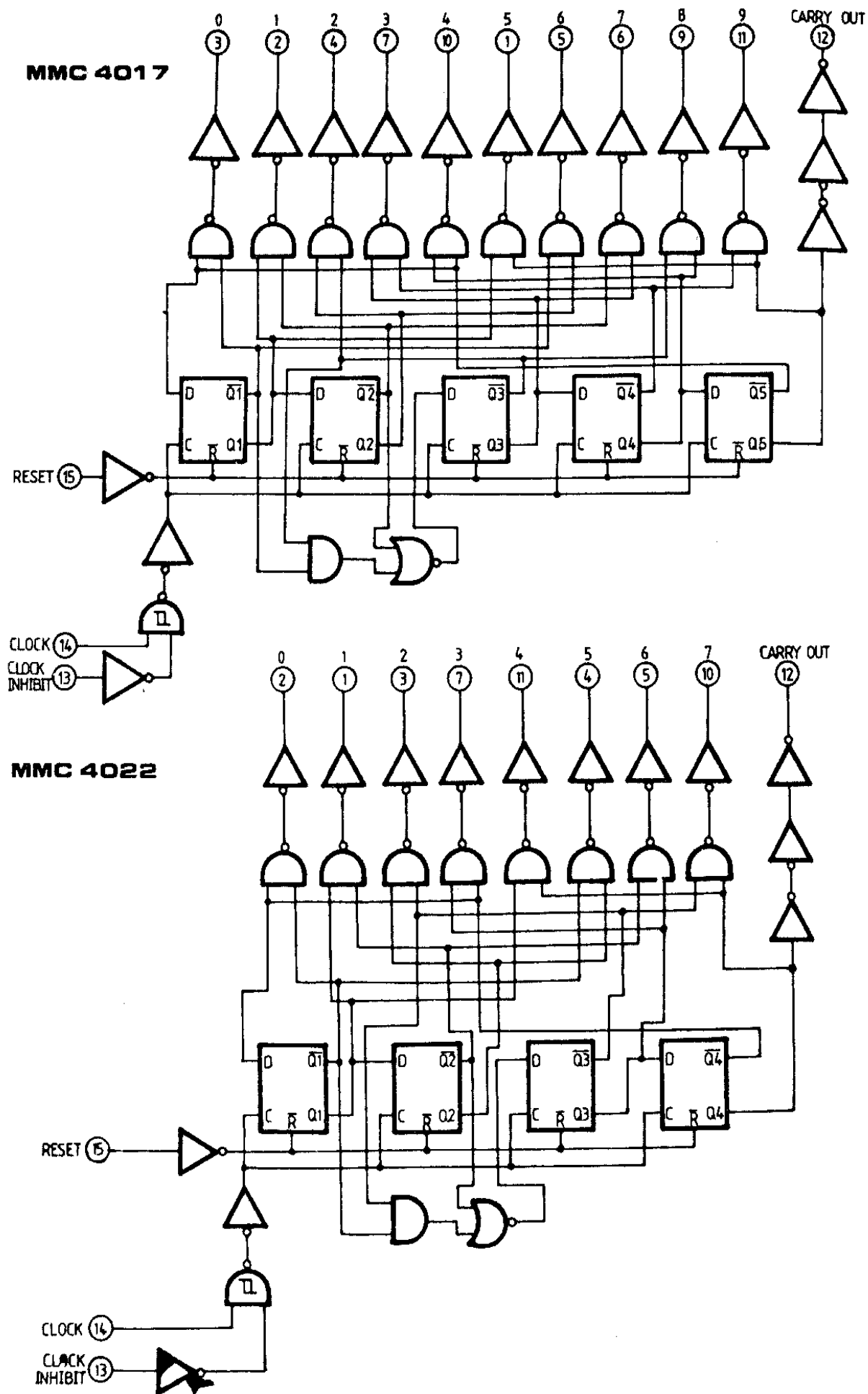
RECOMMENDED OPERATING CONDITIONS

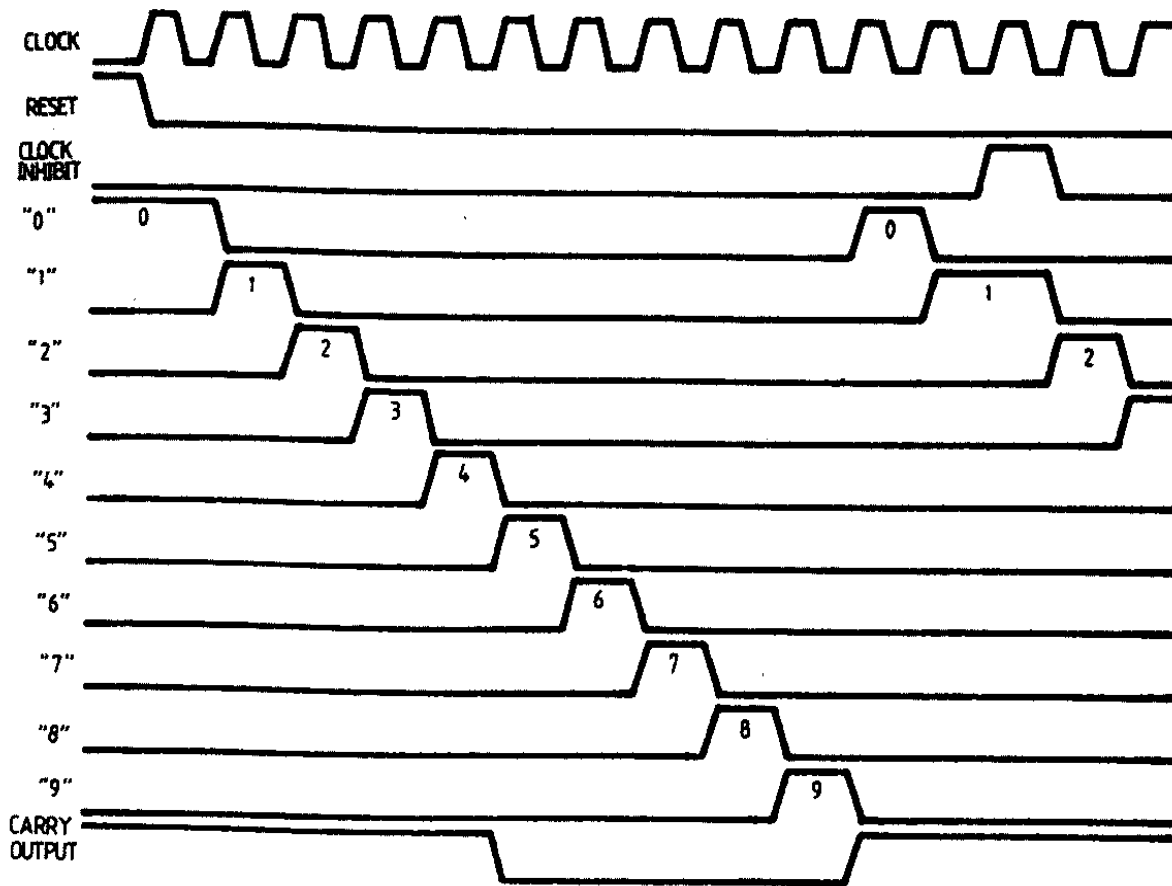
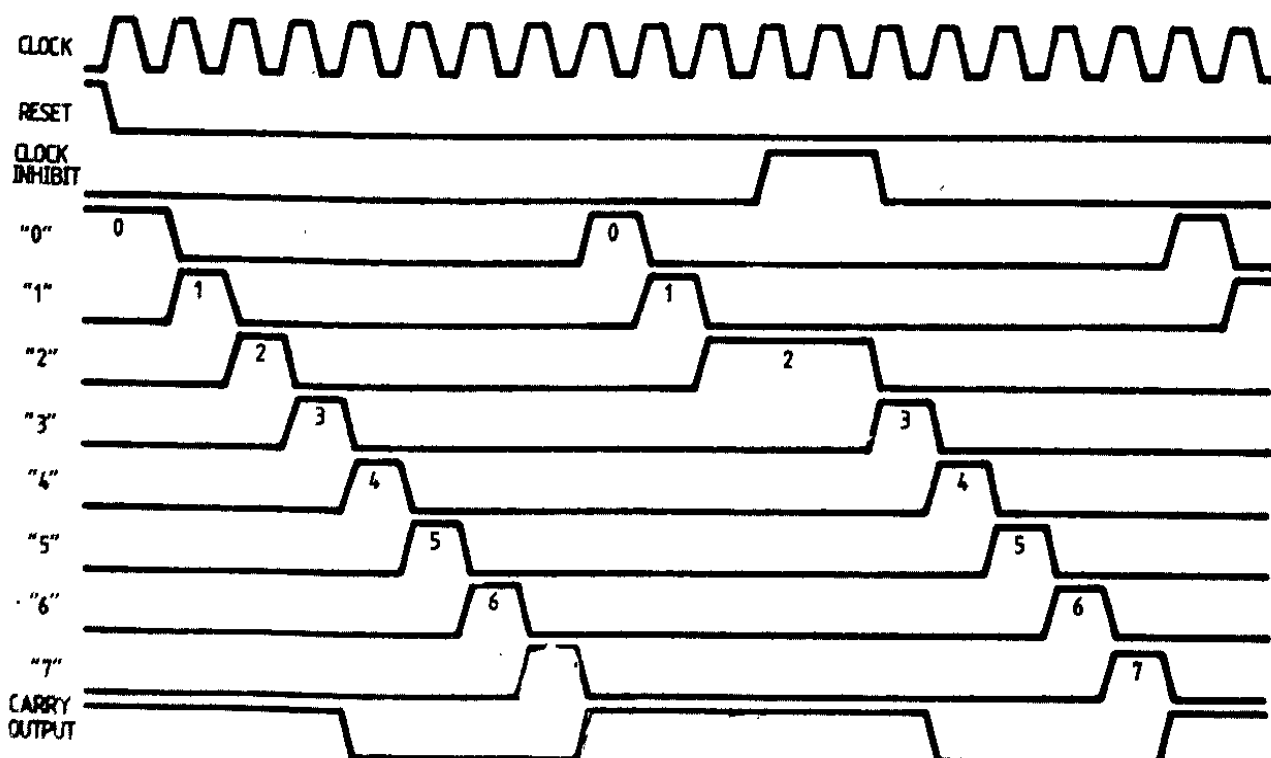
V_{DD}^*	Supply voltage: G and H types	3 to 18	V
	E and F types	3 to 15	V
V_i	Input voltage	0 to V_{DD}	V
T_A	Operating		
	temperature: G and H types	-55 to 125	°C
	E and F types	-40 to 85	°C

CONNECTION DIAGRAMS

MMC 4017**MMC 4022**

LOGIC DIAGRAM



TIMING DIAGRAM**MMC 4017****MMC 4022**

STATIC ELECTRICAL CHARACTERISTICS

(over recommended operating conditions)

PARAMETER			TEST CONDITIONS				VALUES						UN	
			V _I (V)	V _O (V)	I _O (μ A)	V _{DD} (V)	T _{LOW}		25°C			T _{HIGH}		
							min.	max.	min.	typ	max.	min.		max.
I _L	Quiescent current	G, H types	0/ 5			5		5		0.04	5		150	μ A
			0/10			10		10		0.04	10		300	
			0/15			15		20		0.04	20		600	
			0/20			20		100		0.08	100		3000	
	E, F types	0/ 5			5		20		0.04	20		150		
		0/10			10		40		0.04	40		300		
			0/15			15		80		0.04	80		600	
V _{OH}	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 _{OL}	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 _{IH}	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 _{IL}	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		4	
I _{OH}	Output drive current	G, H types	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		
	E, F types	0/ 5	2.5		5	-1.53		-1.36	-3.2		-1.1			
		0/ 5	4.6		5	-0.52		-0.44	-1		-0.36			
		0/10	9.5		10	-1.3		-1.1	-2.6		-0.9			
		0/15	13.5		15	-3.6		-3.0	-6.8		-2.4			
I _{OL}	Output sink current	G, H types	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		
	E, F types	0/ 5	0.4		5	0.52		0.44	1		0.36			
		0/10	0.5		10	1.3		1.1	2.6		0.9			
		0/15	1.5		15	3.6		3.0	6.8		2.4			
I _{IH} , I _{IL}	Input leakage current	G, H types	0/18	Any input		18		± 0.1		$\pm 10^{-5}$	± 0.1		± 1	μ A
		E, F types	0/15			15		± 0.3		$\pm 10^{-5}$	± 0.3		± 1	
C _I	Input capacitance			Any input						5	7.5			pF

* T_{LOW} = -55°C for G, H devices; -40°C for E, F devices.* T_{HIGH} = +125°C for G, H devices; +85°C for E, F devices.

The Noise Margin for both "1" and "0" level is:

1 V min. with V_{DD} = 5 V2 V min. with V_{DD} = 10 V2.5 V min. with V_{DD} = 15 V

DYNAMIC ELECTRICAL CHARACTERISTICS

$T_A = 25^\circ\text{C}$, $C_L = 50\text{ pF}$, $R_L = 200\text{ kohm}$, typical temperature coefficient for all $V_{DD} = 0.3\%/^\circ\text{C}$ values, all input rise and fall times = 20 ns)

PARAMETER		TEST CONDITIONS V _{DD} (V)	VALUES			UNIT
			min.	typ.	max.	
Clocked operation						
t _{PLH}	Propagation delay time	5		325	650	ns
t _{PHL}	Decode out	10		135	270	
		15		85	170	
	Carry out	5		300	600	ns
		10		125	250	
		15		80	160	
t _{THL}	Transition time	5		100	200	ns
t _{TLH}	Carry Out or Decoded	10		50	100	
	Out Line	15		40	80	
f _{CL}	Maximum clock input frequency	5	2.5	5	5	MHz
		10	5	10		
		15	5.5	11		
t _w	Minimum clock pulse width	5		100	200	ns
		10		45	90	
		15		30	60	
t _r t _f	Clock input rise or fall time	5	Unlimited			μs
		10				
		15				
t _{setup}	Data setup time	5		115	230	ns
	Minimum clock inhibit	10		50	100	
		15		35	75	

Reset operation

t_{PLH} Propagation delay time	5		265	530	ns
t_{PHL} Carry Out or Decoded	10		115	230	
Out Lines	15		85	170	
t_w Minimum reset pulse width	5		130	260	ns
	10		55	110	
	15		30	60	
t_{rem} Minimum reset removal time	5		200	400	ns
	10		140	280	
	15		75	150	

Divide by N counter ($N \leq 10$) with N decoded outputs

The diagram shows a circuit for generating a clock signal for N=6. It includes an MMC 4017, an MMC 4022, and an MMC 4001. The MMC 4017 is connected to the MMC 4022, which is connected to the MMC 4001. The MMC 4001 is connected to the MMC 4017. The output of the MMC 4017 is labeled C₀ and is connected to the MMC 4022. The output of the MMC 4022 is labeled f = C₀/N. The output of the MMC 4001 is labeled ALTERNATE C₀ FOR N=2 TO 10 f = C₀/N.