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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 clok 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 succeding device in a multi-device counting chain.

FEATURES

- Fully static operation
- Medium speed operation −12 MHz (typ) at V_{DD} = 10 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 for T_A = full package-temperature range			100	mW
T_A	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

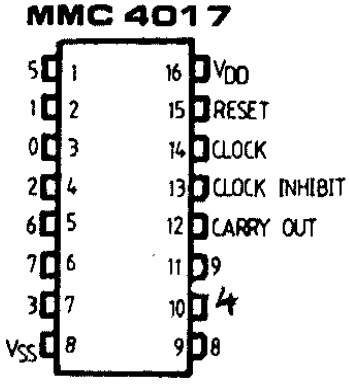
* All voltage values are referred to V_{SS} pin voltage

RECOMMENDED OPERATING CONDITIONS

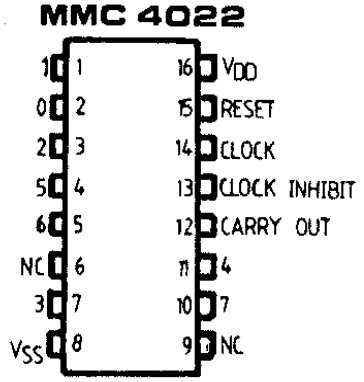
V_{DD}*	Supply voltage:	G and H types	3 to	18	V
		E and F types	3 to	15	V
V_I	Input voltage		0 to	V_{DD}	V
T_A	Operating temperature :	G and H types	-55 to	125	°C
		E and F types	-40 to	85	°C

CONNECTION DIAGRAMS

MMC 4017



MMC 4022



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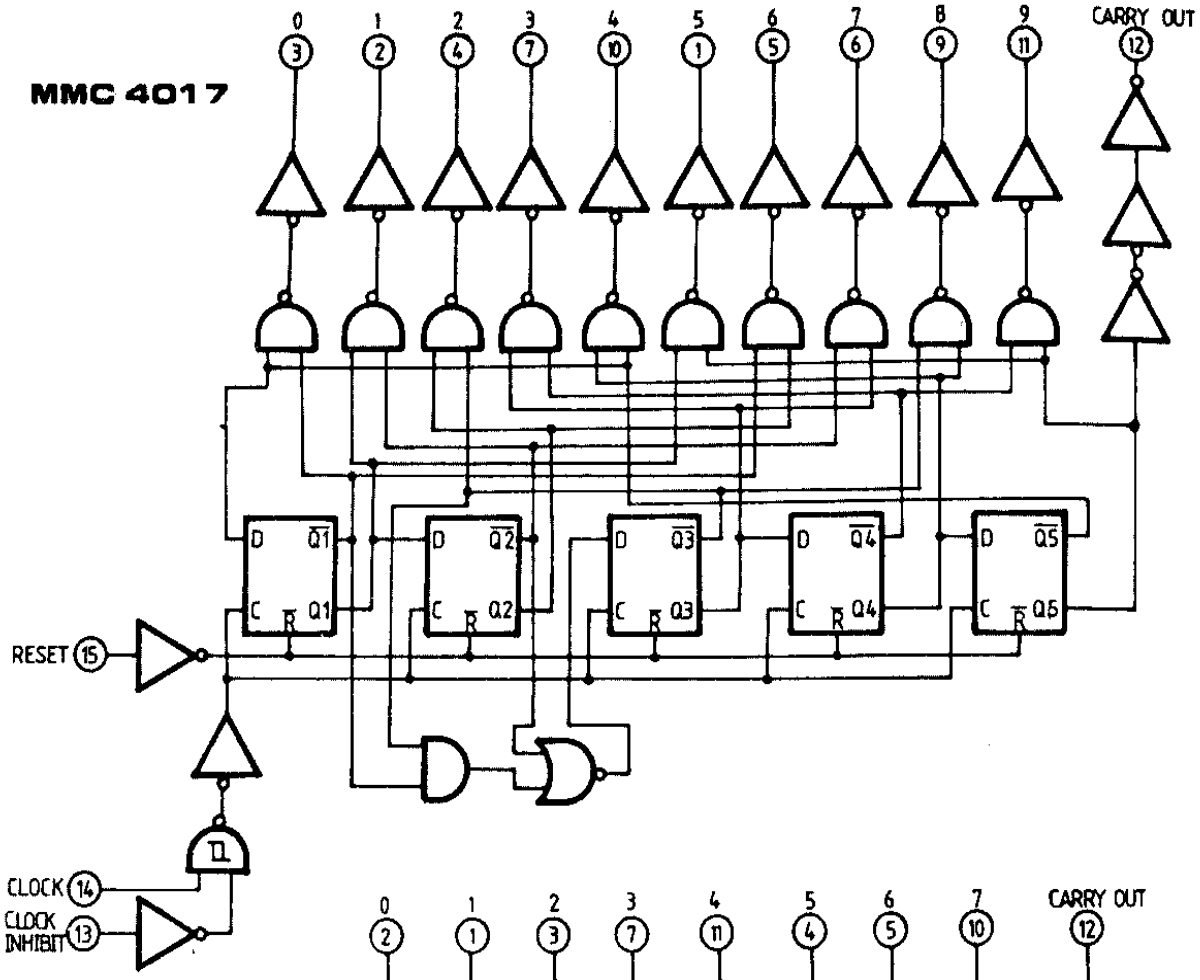
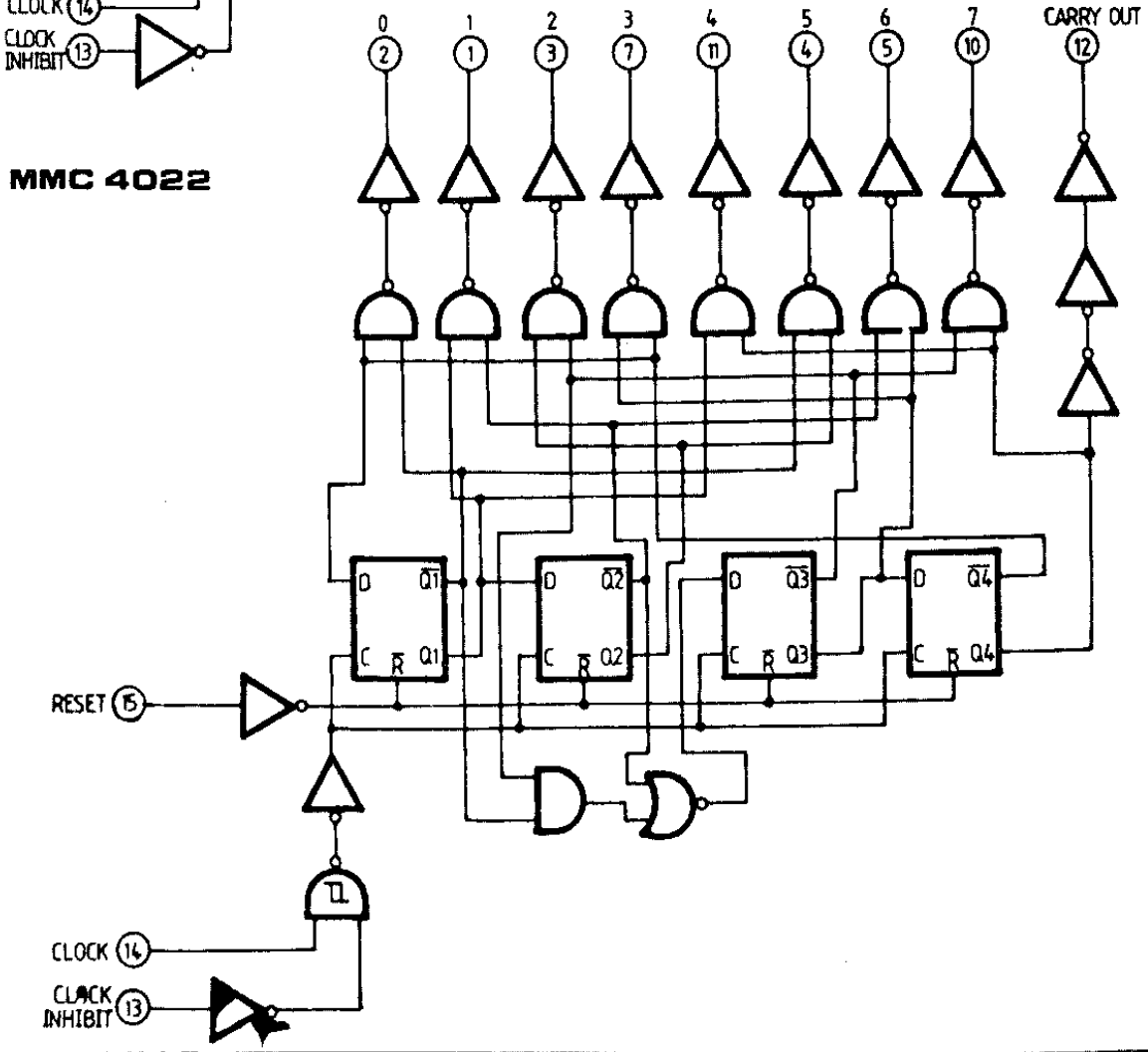
LOGIC DIAGRAM

MMC 4017



MMC 4022



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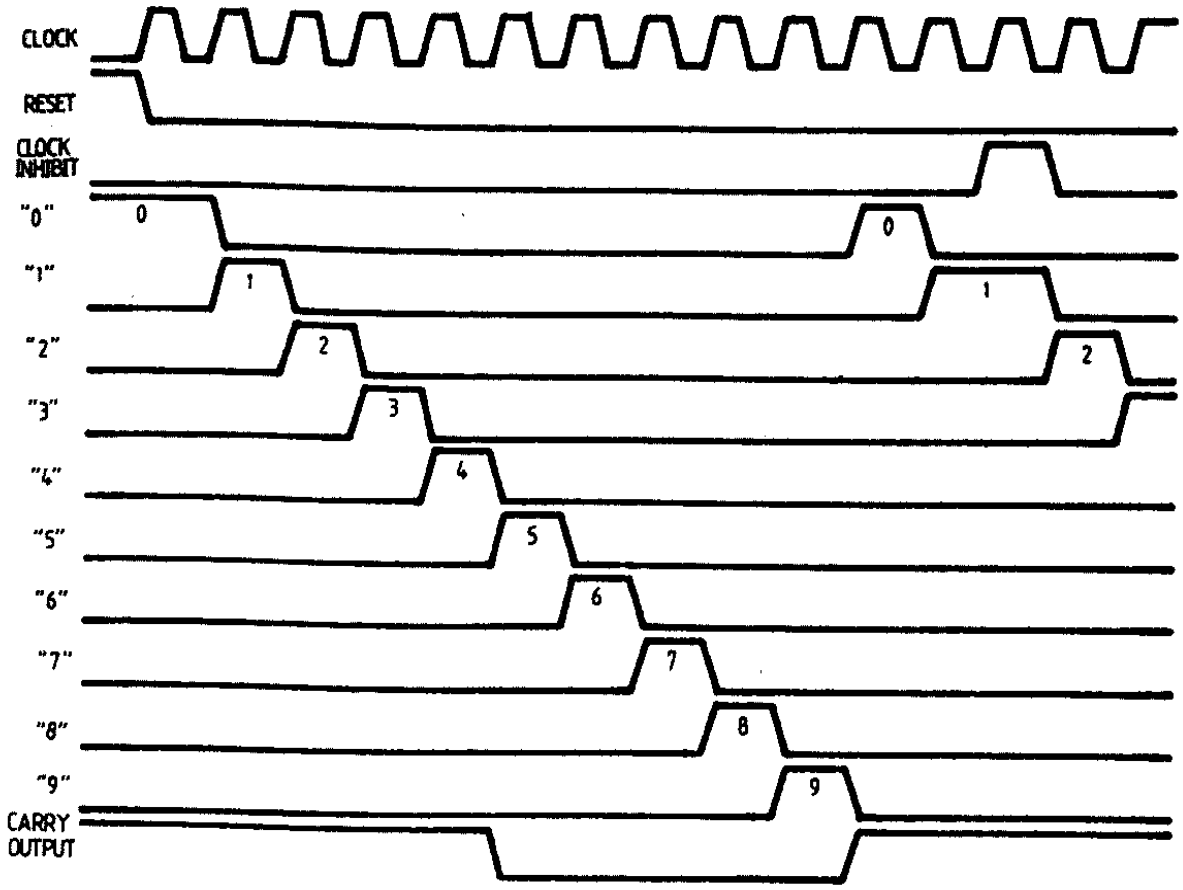
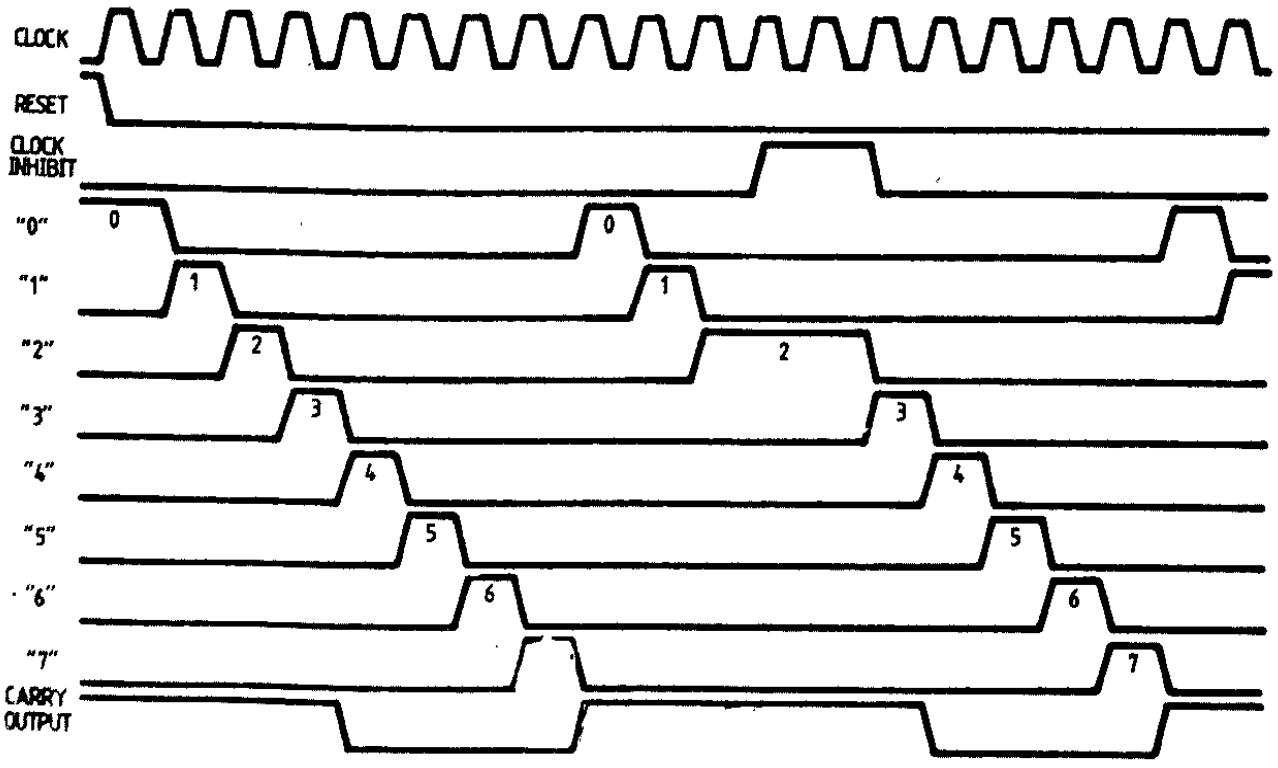
TIMING DIAGRAM

MMC 4017



MMC 4022



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STATIC ELECTRICAL CHARACTERISTICS

(over recommended operating conditions)

PARAMETER			TEST CONDITIONS V_I (V)	V_O (V)	$\|I_O\|$ (μA)	V_{DD} (V)	VALUES T^*_{LOW} min.	T^*_{LOW} max.	25°C min.	25°C typ	25°C max.	T^*_{HIGH} min.	T^*_{HIGH} max.	UN
I_L	Quiescent current	G, H types	0/ 5			5		5		0.04	5		150	μA
			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		$±10^{-5}$	±0.1		±1	μA
		E, F types	0/15			15		±0.3		$±10^{-5}$	±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 V

2 V min. with V_{DD} = 10 V

2.5 V min. with V_{DD} = 15 V

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DYNAMIC ELECTRICAL CHARACTERISTICS

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

	PARAMETER	TEST CONDITIONS V_{DD}(V)	VALUES min.	typ.	max.	UNIT
Clocked operation						
t_{PLH}, t_{PHL}	Propagation delay time Decode out	5		325	650	ns
		10		135	270	
		15		85	170	
	Carry out	5		300	600	ns
		10		125	250	
		15		80	160	
t_{THL}, t_{TLH}	Transition time Carry Out or Decoded Out Line	5		100	200	ns
		10		50	100	
		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 Minimum clock inhibit	5		115	230	ns
		10		50	100	
		15		35	75	
Reset operation						
t_{PLH}, t_{PHL}	Propagation delay time Carry Out or Decoded Out Lines	5		265	530	ns
		10		115	230	
		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	

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TYPICAL APPLICATIONS

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

When the N^{th} decoded output is reached (N^{th} clock pulse) the R—S flip-flop (constructed from two NOR gates of MMC 4001) generates a reset pulse which clears the MMC 4017 to its zero count. At this time, if the N^{th} decoded output is greater than or equal to 6, the C_{OUT} line goes high to clock the next MMC 4017 counter section. The "0" decoded output also goes high at this time. Coincidence of the clock low and decoded "0" output high resets the R—S flip-flop to enable the MMC 4017. If the N^{th} decoded output is less than 6, the C_{OUT} line will not go high and, therefore, cannot be used. In this case "0" decoded output may be used to perform the clocking function for the next counter.