EXPONENTIAL COUNTER

GENERAL DESCRIPTION

The MMC 391 is a CMOS aluminium gate, BCD up-exponential counter, design to be used in every application where it is necessary a threshold counting where the last bits are negligible. It is provided with a wide selection of ranges: 0÷999; 1000÷9999; 10000÷99999; 100000÷999999.
The counting capability is up to 10^7 and a warning is outpulsed when a threshold is reached (four thresholds available). The typical application is in portable individual particle detectors. The display drivers are not part of the circuit.

FEATURES

- capacity up to 10^7
- wide selection of range options: 10^3, 10^4, 10^5, 10^6
- low power consumption
- exponential displaying of the output
- wide supply range 3 V to 18 V

APPLICATIONS

- dosimetric
- data counting
- industrial aplications

ABSOLUTE MAXIMUM RATINGS

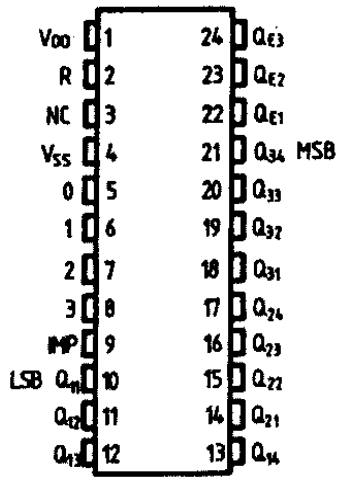
V_{DD}*	Supply voltage: G and H types	-0.5 to	20	V
	E and F types	-0.5 to	18	V
V_i	Input voltage	-0.5 to	V_{DD}+0.5	V
I_I	DC input current (any one input)		±10	mA
P_{tot}	Total power dissipation (per package)		200	mW
	Dissipation per output transistor for T_A = full package-temperature range		100	mW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

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

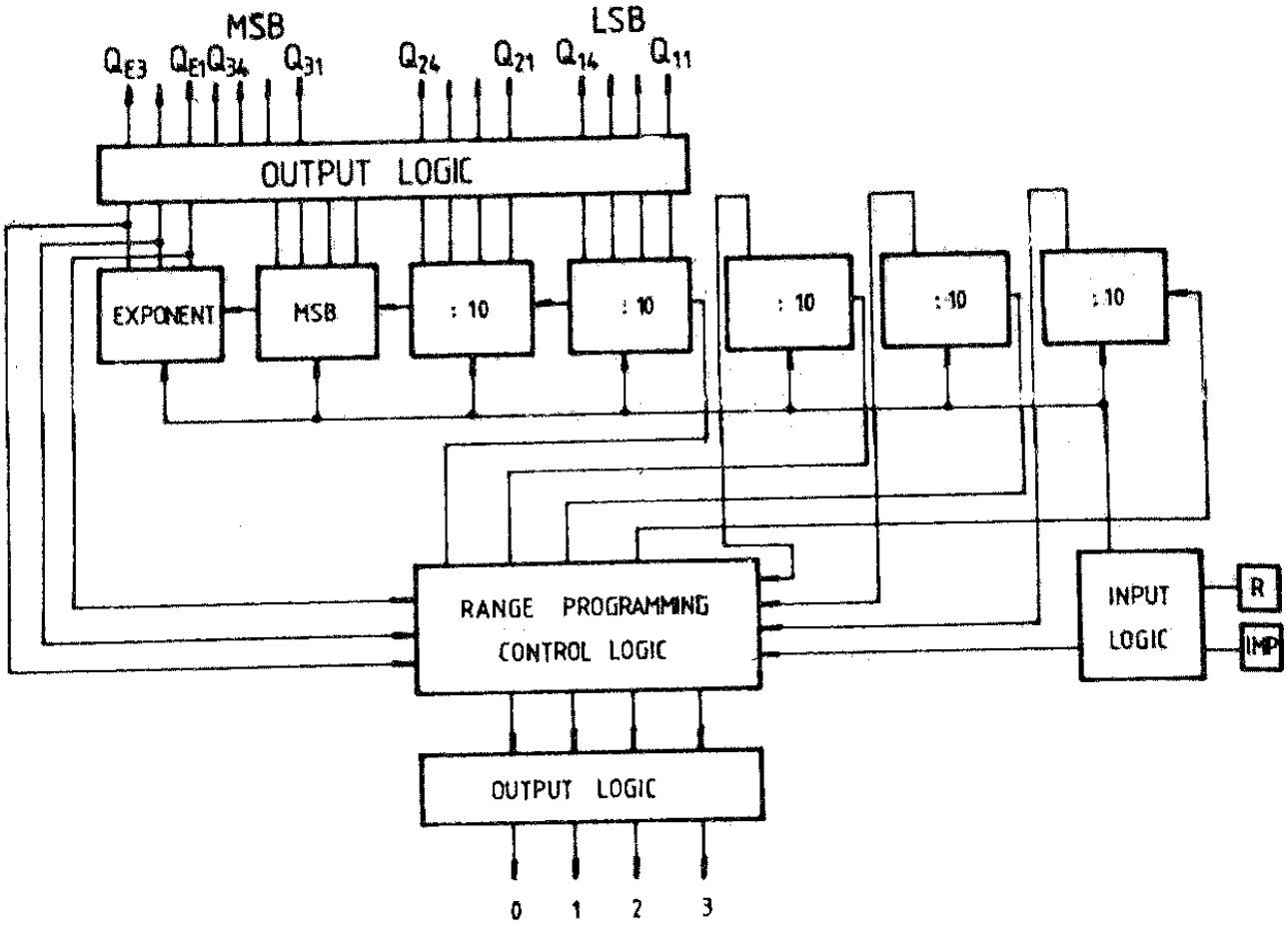
RECOMMENDED OPERATING CONDITIONS

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 DIAGRAM



BLOCK DIAGRAM



STATIC ELECTRICAL CHARACTERISTICS

(over recommended operating conditions)

PARAMETER			TEST CONDITIONS				VALUES							UNIT
			V_I (V)	V_O (V)	I_O (μA)	V_{DD} (V)	T^*_{LOW} min.	T^*_{LOW} max.	25°C min.	25°C typ	25°C max.	T^*_{HIGH} min.	T^*_{HIGH} max.	
I_L	Quiescent current	G, H types	0/ 5			5		5		0.04	5		150	
			0/10			10		10		0.04	10		300	
			0/15			15		20		0.04	20		600	
			0/20			20		100		0.08	100		3000	μA
		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		
			0/10		< 1	10	9.95		9.95			9.95		V
			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	
			10/0		< 1	10		0.05			0.05		0.05	V
			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		
				1/9	< 1	10	7		7			7		V
				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	
				9/1	< 1	10		3			3		3	V
				13.5/1.5	< 1	15		4			4		4	

PARAMETER			TEST CONDITIONS				VALUES							UNIT
			V_I (V)	V_O (V)	I_O (μA)	V_{DD} (V)	T^*_{LOW} min	T^*_{LOW} max	25°C min	25°C typ	25°C max	T^*_{HIGH} min	T^*_{HIGH} max	
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	μA
		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 V
2 V min. with V_{DD} = 10 V
2.5 V min. with V_{DD} = 15 V

DYNAMIC ELECTRICAL CHARACTERISTICS

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

	PARAMETER	TEST CONDITIONS	VALUES			UNIT
		VI (V)	min.	typ.	max.	
f_{max}	Maximum operating frequency	5		2		MHz
		15		6		
t_d	Propagation delay time (IMP to outputs)	5		270		ns
		10		150		
		15		75		
t_r	Output rise time	5		75		ns
		10		40		
		15		35		
t_f	Output fall time	5		125		ns
		10		70		
		15		50		
t_{DR}	RESET to outputs delay	5		350		ns
		10		150		
		15		100		
t_{WR}	RESET pulse width	5		300		ns
		10		100		
		15		70		

TYPICAL APPLICATION