



MMC 4027

DUAL J-K MASTER SLAVE FLIP-FLOP

GENERAL DESCRIPTION

The MMC 4027 is a monolithic integrated circuit, available in 16-lead dual in-line plastic or ceramic package.

The MMC 4027 is a single monolithic chip integrated circuit containing two identical complementary-symmetry J-K master-slave flip-flops. Each flip-flop has provisions for individual J, K, Set, Reset and Clock input signals. Buffered Q and $\bar{Q}$ signals are provided as outputs. This input-output arrangement provides for compatible operation with the MMC 4013 dual D-type flip-flop.

The MMC 4027 is useful in performing control, register, and toggle functions. Logic levels present at the J and K inputs along with internal self-steering control the state of each flip-flop; changes in the flip-flop state are synchronous with the positive-going transition of the clock pulse. Set and reset functions are independent of the clock and are initiated when a high level signal is present at either the Set or Reset input.

FEATURES

- Set-Reset capability
- Static flip-flop operation-retains state indefinitely with clock level either „high“ or „low“
- Medium speed operation-16 MHz (typ.) clock toggle rate at 10 V
- 100% tested for quiescent current

APPLICATIONS

- Registers, counters, control circuits

ABSOLUTE MAXIMUM RATINGS

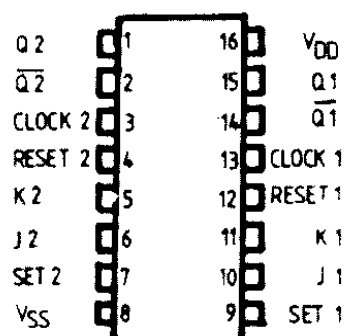
V_{DD}^*	Supply voltage: G and H types	-0.5 to	20	V
	E and F types	-0.5 to	18	V
V_i	Input voltage	-0.5 to	$V_{DD}+0.5$	V
I_i	DC input current (any one input)		± 10	mA
P_{tot}	Total power dissipation (per package)		200	mW
	Dissipation per output transistor for T_A - full package-temperature range		100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

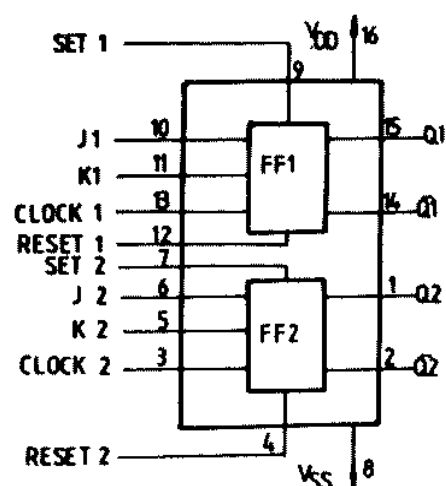
* All voltage values are referred to V_{SS} pin voltage

RECOMMENDED OPERATING CONDITIONS

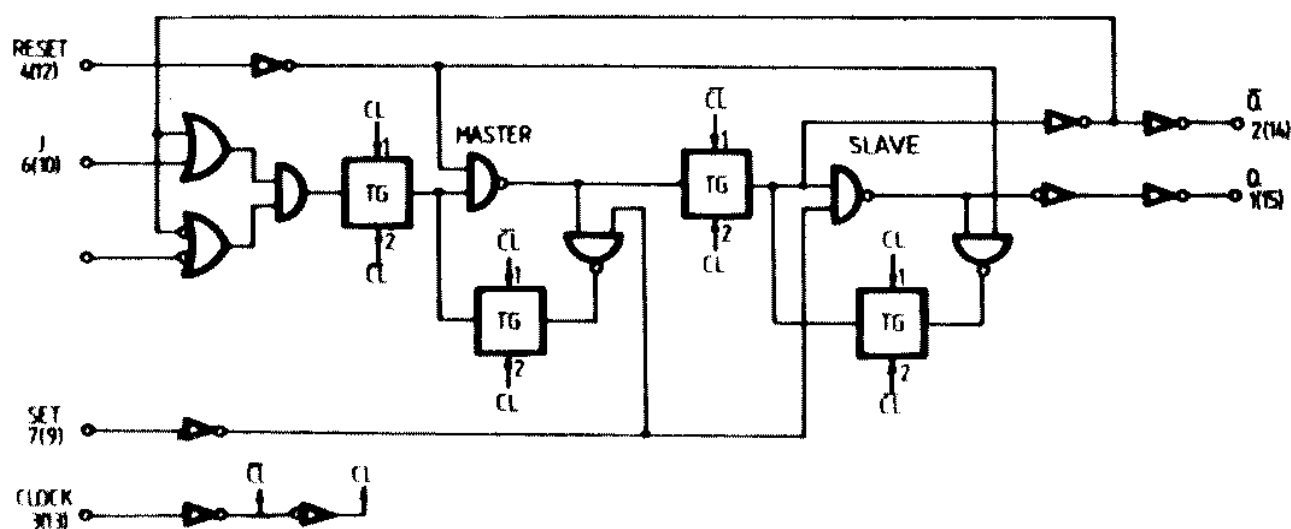
V_{DD}^*	Supply voltage: G and H types	3 to	18	V
	E and F types	3 to	15	V
V_i	Input voltage	0 to	V_{DD}	V
T_A	Operating temperature			
	G and H types	-55 to	125	°C
	E and F types	-40 to	85	°C

CONNECTION DIAGRAM





PRESENT STATE					CL [•]	NEXT STATE		
INPUTS				OUTPUT		OUTPUTS		
J	K	S	R	Q		Q	Q	
1	X	0	0	0		1	0	- NO CHANGE
X	0	0	0	1		1	0	
0	X	0	0	0		0	1	
X	1	0	0	1		0	1	
X	X	0	0	X				
X	X	1	0	X	X	1	0	
X	X	0	1	X	X	0	1	
X	X	1	1	X	X	1	1	



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}		25°C			T _{HIGH}		
							min.	max.	min.	typ	max.	min.	max.	
I _L	Quiescent current	G, H types	0/ 5			5		1		0.02	1		30	μA
			0/10			10		2		0.02	2		60	
			0/15			15		4		0.02	4		120	
			0/20			20		20		0.04	20		600	
		E, F types	0/ 5			5		4		0.02	4		30	
			0/10			10		8		0.02	8		60	
			0/15			15		16		0.02	16		120	
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}	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

DYNAMIC ELECTRICAL CHARACTERISTICS

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

PARAMETER			TEST CONDITIONS	VALUES			UNIT
			$V_{DD}(\text{V})$	Min.	Typ.	Max.	
t_{PLH} t_{PHL}	Propagation delay time	Clock to $\overline{Q}$ or $\overline{Q}$ outputs	5 10 15		150 65 45	300 130 190	ns
t_{PLH}	Propagation delay time	Set to $\overline{Q}$ or Reset to $\overline{Q}$	5 10 15		150 65 45	300 130 90	ns
t_{PHL}	Propagation delay time	Set to $\overline{Q}$ or Reset to $\overline{Q}$	5 10 15		200 85 60	400 170 120	
t_{THL} t_{TLH}	Transition time		5 10 15		100 50 40	200 100 80	ns
t_W	Pulse width	Clock	5 10 15	140 60 40	70 30 20		ns
t_W	Pulse width	Set or Reset	5 10 15	180 80 50	90 40 25		
t_{rp} t_f	Clock input rise or fall time		5 10 15			15 4 1	ns
t_{setup}	Setup time	Data	5 10 15	200 75 50	100 35 25		ns
f_{max}	Maximum clock input frequency*	Toggle mode	5 10 15	3.5 8 12	7 16 24		MHz

* Input t_r , $t_f = 5\text{ ns}$.