

HEX INVERTER

GENERAL DESCRIPTION

The MMC 4069 is a monolithic integrated circuit processed in standard Al-gate CMOS technology. The MMC 4069 consists of six CMOS inverter circuits. This device is intended for all general-purpose inverter applications where the medium-power TTL-drive and logic-level-conversion capabilities of circuits such as MMC 4049 Hex Inverter/Buffer are not required.

FEATURES

- Medium-speed operation
 $t_{PHL}, t_{PLH} = 30$ ns (typ.) at 10 V
- Quiescent current specified to 20 V
- 5 V, 10 V, 15 V parametric ratings

ABSOLUTE MAXIMUM RATINGS

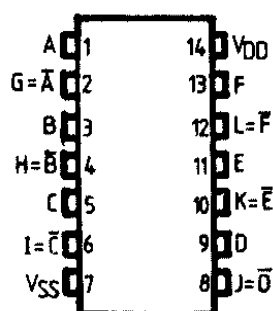
V_{DD}^*	Supply voltage: G and H types	-0.5 to	20	V
	E and F types	-0.5 to	18	V
V_i	Input voltage	-0.5 to	$V_{DD}+0.5$	V
I_i	DC input current (any one input)		± 10	mA
P_{tot}	Total power dissipation (per package)		200	mW
	Dissipation per output transistor for T_A = full package-temperature range		100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

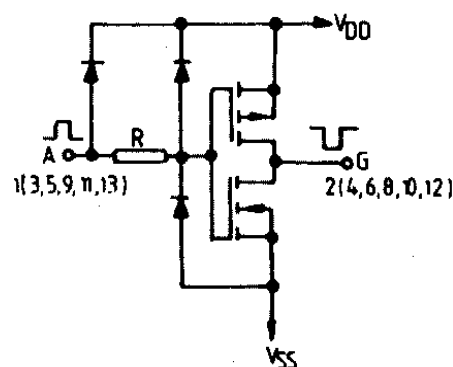
RECOMMENDED OPERATING CONDITIONS

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



SCHEMATIC DIAGRAM



STATIC ELECTRICAL CHARACTERISTICS

(over recommended operating conditions)

PARAMETER			TEST CONDITIONS				VALUES						UNIT	
			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		0.25		0.01	0.25		7.5	μ A
			0/10			10		0.5		0.01	0.5		15	
			0/15			15		1		0.01	1		30	
			0/20			20		5		0.02	5		150	
		E, F types	0/ 5			5		1		0.01	1		7.5	
			0/10			10		2		0.01	2		15	
			0/15			15		4		0.01	4		30	
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 Input high voltage				0.5/ 4.5	< 1	5	4		4			4		V
				1/ 9	< 1	10	8		8			8		
				1.5/ 13.5	< 1	15	12.5		12.5			12.5		
V _{IL} Input low voltage				4.5/ 0.5	< 1	5		1			1		1	V
				9/ 1	< 1	10		2			2		2	
				13.5/ 1.5	< 1	15		2.5			2.5		2.5	
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 _{in} , 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

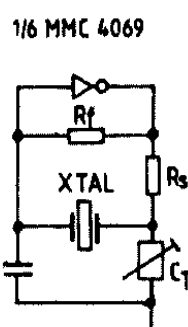
DYNAMIC ELECTRICAL CHARACTERISTICS

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

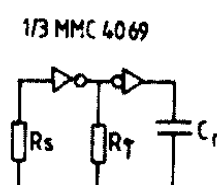
PARAMETER	TEST CONDITIONS	VALUES			UNIT
	V_{DD} (V)	min.	typ.	max.	
t_{PLH} Propagation delay time t_{PHL}	5 10 15		55 30 25	110 60 50	ns
t_{TLH} Transition time t_{THL}	5 10 15		100 50 40	200 100 80	ns

APPLICATIONS

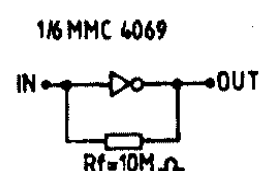
Typical crystal oscillator circuit



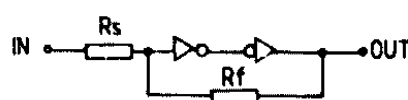
Typical RC oscillator circuit



High-input impedance amplifier



Input pulse shaping circuit (Schmitt trigger)



UPPER SWITCHING POINT

$$V_P = \frac{R_f + R_s}{R_f} \cdot \frac{V_{DD}}{2}$$

LOWER SWITCHING POINT

$$V_N = \frac{R_f - R_s}{R_f} \cdot \frac{V_{DD}}{2}$$

$$R_f > R_s$$