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

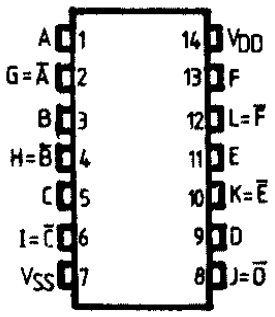
V_{DD}*	Supply voltage: G and H types	-0.5 to	20	V
	E and F types	-0.5 to	18	V
V_I	Input voltage	-0.5 to	V_{DD}+0.5	V
I_I	DC input current (any one input)		±10	mA
P_{tot}	Total power dissipation (per package)		200	mW
	Dissipation per output transistor for T_A = full package-temperature range		100	mW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

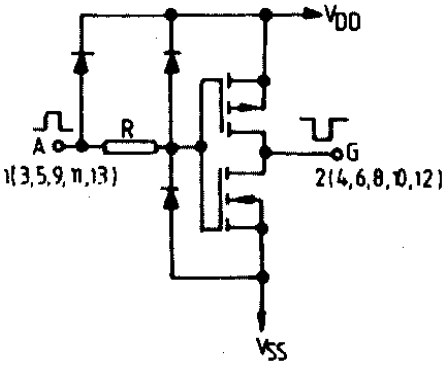
RECOMMENDED OPERATING CONDITIONS

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)	$\|I_O\|$ (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		0.25		0.01	0.25		7.5	μA
			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			15		0.05			0.05		0.05	
V_I	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}	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

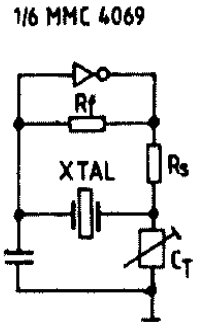
DYNAMIC ELECTRICAL CHARACTERISTICS

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

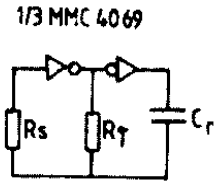
PARAMETER	TEST CONDITIONS	VALUES			UNIT
	V_{DD} (V)	min.	typ.	max.	
t_{PLH}, t_{PHL} Propagation delay time	5		55	110	ns
	10		30	60	
	15		25	50	
t_{TLH}, t_{THL} Transition time	5		100	200	ns
	10		50	100	
	15		40	80	

APPLICATIONS

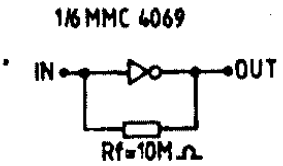
Typical crystal oscillator circuit



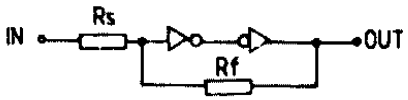
Typical RC oscillator circuit



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

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

$R_f > R_S$