



MMC 4000 MMC 4001
MMC 4002 MMC 4025

NOR GATES: 4000 DUAL 3 INPUT PLUS INVERTER 4001 QUAD 2 INPUT 4002 DUAL 4 INPUT 4025 TRIPLE 3 INPUT

GENERAL DESCRIPTION

These NOR gates are monolithic complementary MOS (CMOS) integrated circuits. The N and P channel enhancement mode transistors provide a symmetrical circuit with output swings essentially equal to the supply voltage. This results in high noise immunity over a wide supply voltage range. No DC power other than that caused by leakage current is consumed during static conditions. All inputs are protected against static discharge and latching conditions. The MMC 4000, MMC 4001, MMC 4002 and MMC 4025E/F/G/H

NOR gates provide the system designer with direct implementation of the NOR function.

The MMC 4000, MMC 4001, MMC 4002 and MMC 4025E/F/G/H types are supplied in 14-lead hermetic dual-in-line ceramic or plastic packages

FEATURES

- Propagation delay time = 60 ns (typ) at $C_L = 50$ pF $V_{DD} = 10$ V
- Buffered inputs and outputs
- Standardized symmetrical output characteristics
- 100% tested for maximum quiescent current
- 5 V, 10 V and 15 V parametric ratings
- High noise immunity: 0.45 V_{DD} (typical)

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

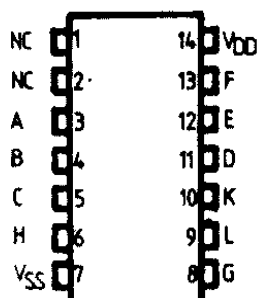
* All voltage values are referred to V_{SS} pin voltage

RECOMMENDED OPERATING CONDITIONS

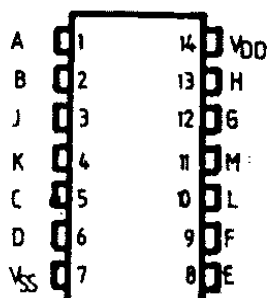
V_{DD}^*	Supply voltage: G and H types	3 to 18	V
	E and F types	3 to 15	V
V_i	Input voltage	0 to V_{DD}	V
T_A	Operating temperature :		
	G and H types	-55 to 125	°C
	E and F types	-40 to 85	°C

CONNECTION DIAGRAMS

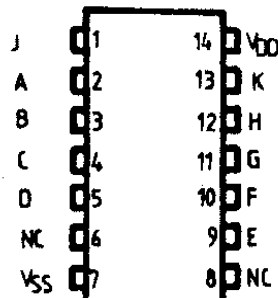
MMC 4000



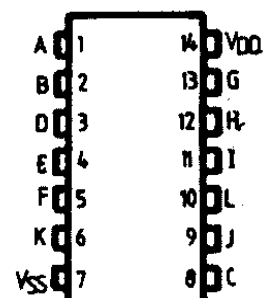
MMC 4001



MMC 4002



MMC 4025



MMC 4000 MMC 4001 MMC 4002 MMC 402B

STATIC ELECTRICAL CHARACTERISTICS

(over recommended operating conditions)

PARAMETER			TEST CONDITIONS				VALUES						UNIT	
			V _I (V)	V _O (V)	I _O (μ A)	V _{OD} (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 _{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		-0.38			
		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	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.

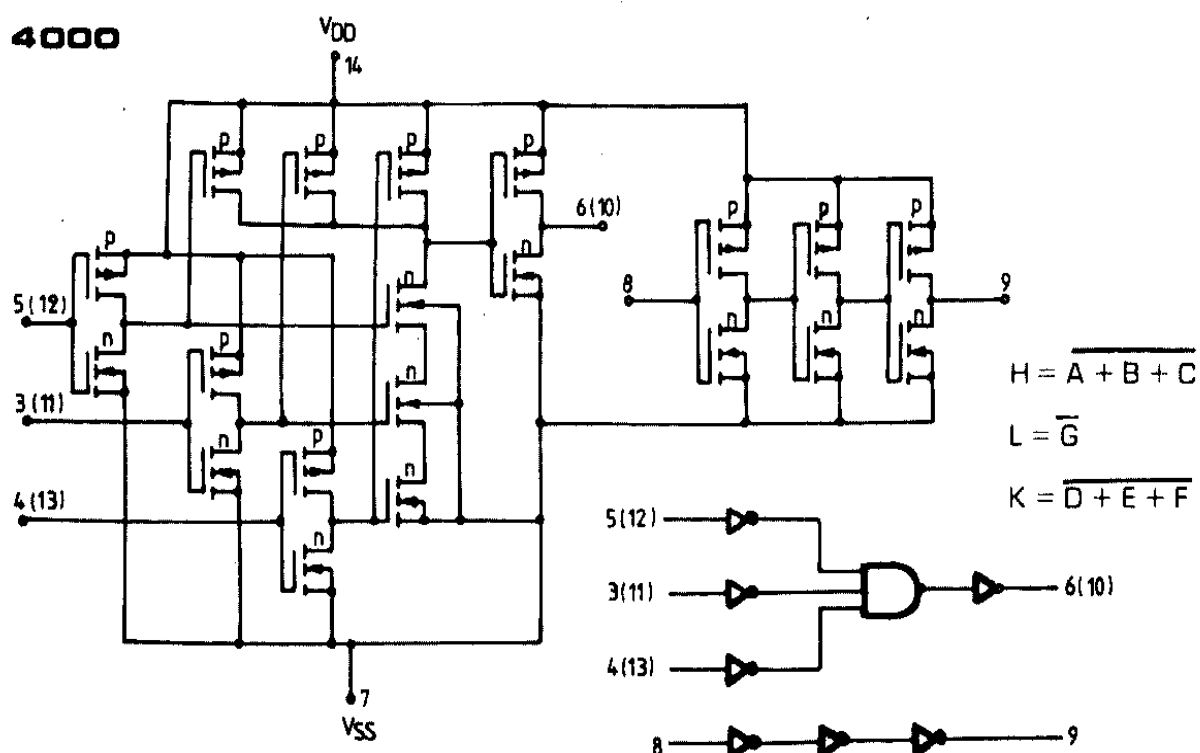
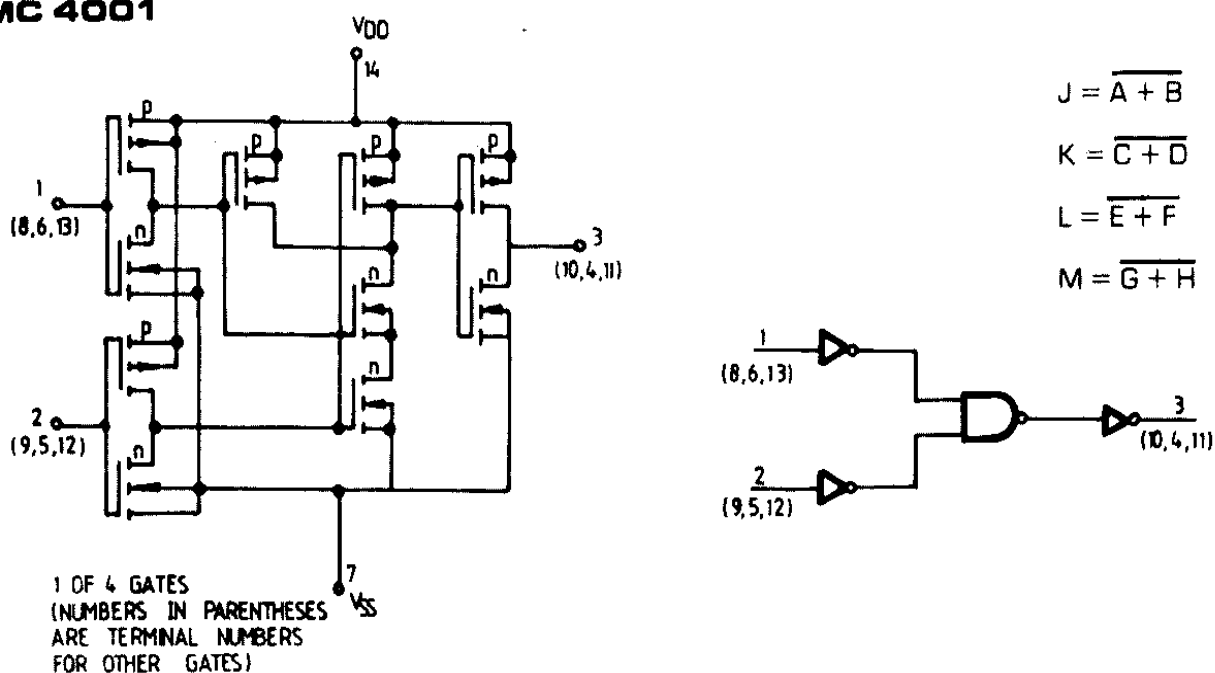
The Noise Margin for both "1" and "0" level is:

1 V min. with V_{DD} = 5 V2 V min. with V_{DD} = 10 V2.5 V min. with V_{DD} = 15 V

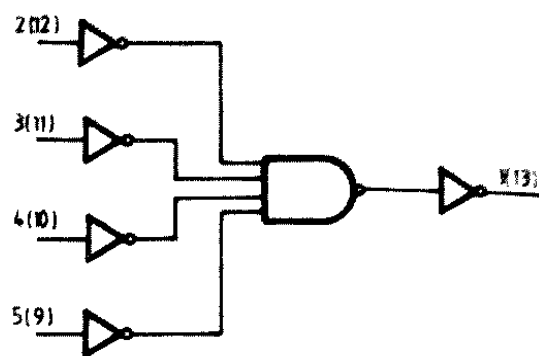
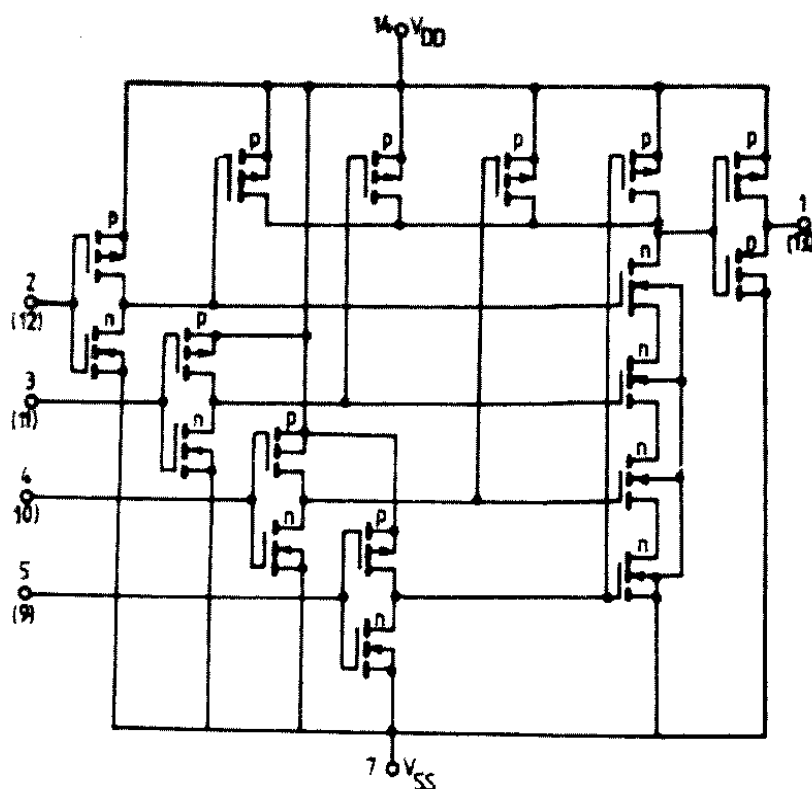
DYNAMIC ELECTRICAL CHARACTERISTICS

($T_A = 25^\circ\text{C}$, $C_L = 50\text{ pF}$, $R_L = 200\text{ k}$, 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} (V)	min	typ	max	
t_{PLH} Propagation delay time	5		125	250	ns
t_{PHL}	10		60	120	
	15		45	90	
t_{THL} Transition time	5		100	200	ns
t_{TLH}	10		50	100	
	15		40	80	

SCHEMATIC AND LOGIC DIAGRAMS**MMC 4000****MMC 4001**

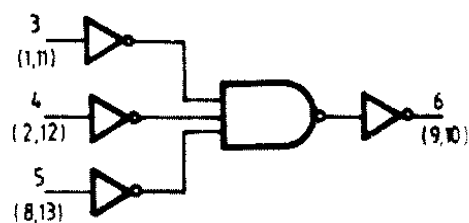
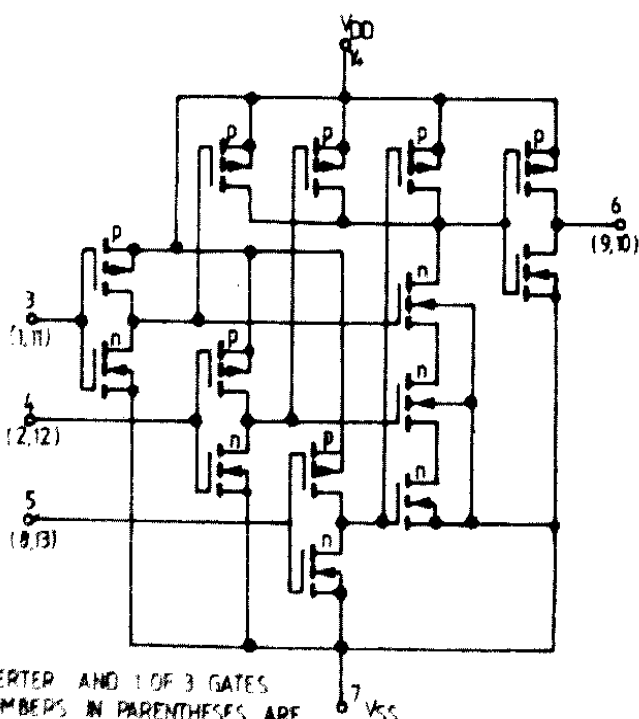
MMC 4002



$$J = \overline{A + B + C + D}$$

$$K = \overline{E + F + G + H}$$

MMC 4025



$$J = \overline{A + B + C}$$

$$K = \overline{D + E + F}$$

$$L = \overline{G + H + I}$$

INVERTER AND 1 OF 3 GATES
(NUMBERS IN PARENTHESES ARE
TERMINAL NUMBERS FOR SECOND GATE)