



**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

FEATURES

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

- 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)

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

ABSOLUTE MAXIMUM RATINGS

V_{DD}^*	Supply voltage: G and H types E and F types	-0.5 to 20 -0.5 to 18	V 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) Dissipation per output transistor for $T_A =$ full package-temperature range	200	mW
T_A	Operating temperature : G and H types E and F types	-55 to 125 -40 to 85	$^{\circ}C$ $^{\circ}C$
T_{stg}	Storage temperature	-65 to 150	$^{\circ}C$

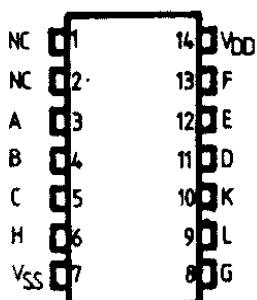
* All voltage values are referred to V_{SS} pin voltage

RECOMMENDED OPERATING CONDITIONS

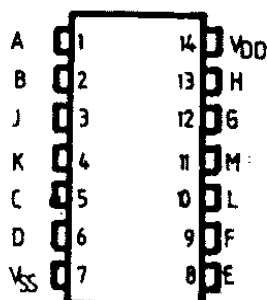
V_{DD}^*	Supply voltage: G and H types E and F types	3 to 18 3 to 15	V V
V_i	Input voltage	0 to V_{DD}	V
T_A	Operating temperature : G and H types E and F types	-55 to 125 -40 to 85	$^{\circ}C$ $^{\circ}C$

CONNECTION DIAGRAMS

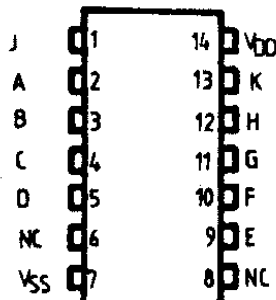
MMC 4000



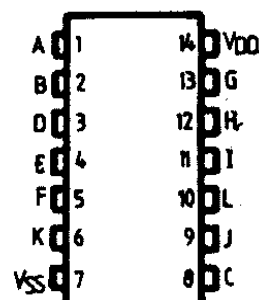
MMC 4001



MMC 4002



MMC 4025



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 0/15			10 15		2 4		0.01 0.01	2 4		15 30	
V _{OH} Output high voltage		0/5 0/10 0/15		<1 <1 <1	5 10 15	4.95 9.95 14.95		4.95 9.95 14.95		4.95 9.95 14.95		V	
V _{OL} Output low voltage		5/0 10/0 15/0		<1 <1 <1	5 10 15		0.05 0.05 0.05		0.05 0.05 0.05		0.05 0.05 0.05	V	
V _{IH} Input high voltage			0.5/4.5 1/9 1.5/13.5	<1 <1 <1	5 10 15	3.5 7 11		3.5 7 11		3.5 7 11		V	
V _{IL} Input low voltage			4.5/0.5 9/1 13.5/1.5	<1 <1 <1	5 10 15		1.5 3 4		1.5 3 4		1.5 3 4	V	
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 0/10 0/15	4.6 9.5 13.5		5 10 15	-0.52 -1.3 -3.6		-0.44 -1.1 -3.0	-1 -2.6 -6.8		-0.36 -0.9 -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		\pm 0.1		\pm 10 ⁻⁵	\pm 0.1		\pm 1	μ A
	E, F types	0/15			15		\pm 0.3		\pm 10 ⁻⁵	\pm 0.3		\pm 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

MMC 4000 MMC 4001 MMC 4002 MMC 4025

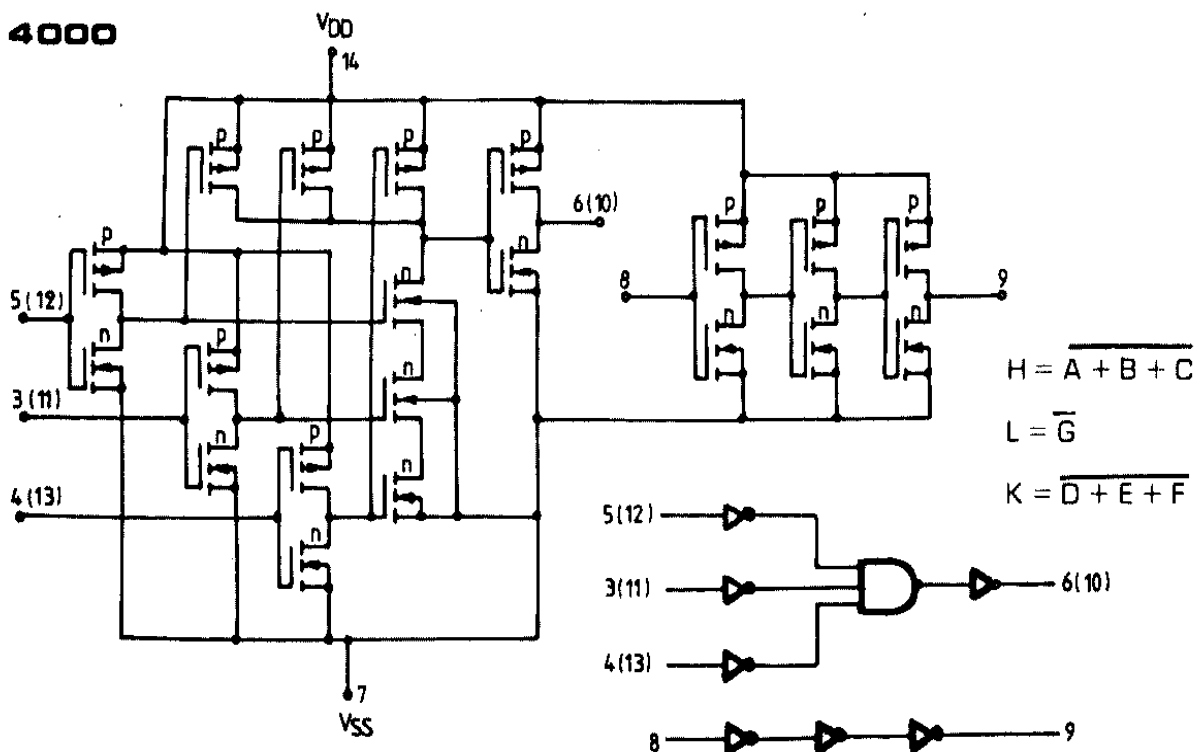
DYNAMIC ELECTRICAL CHARACTERISTICS

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

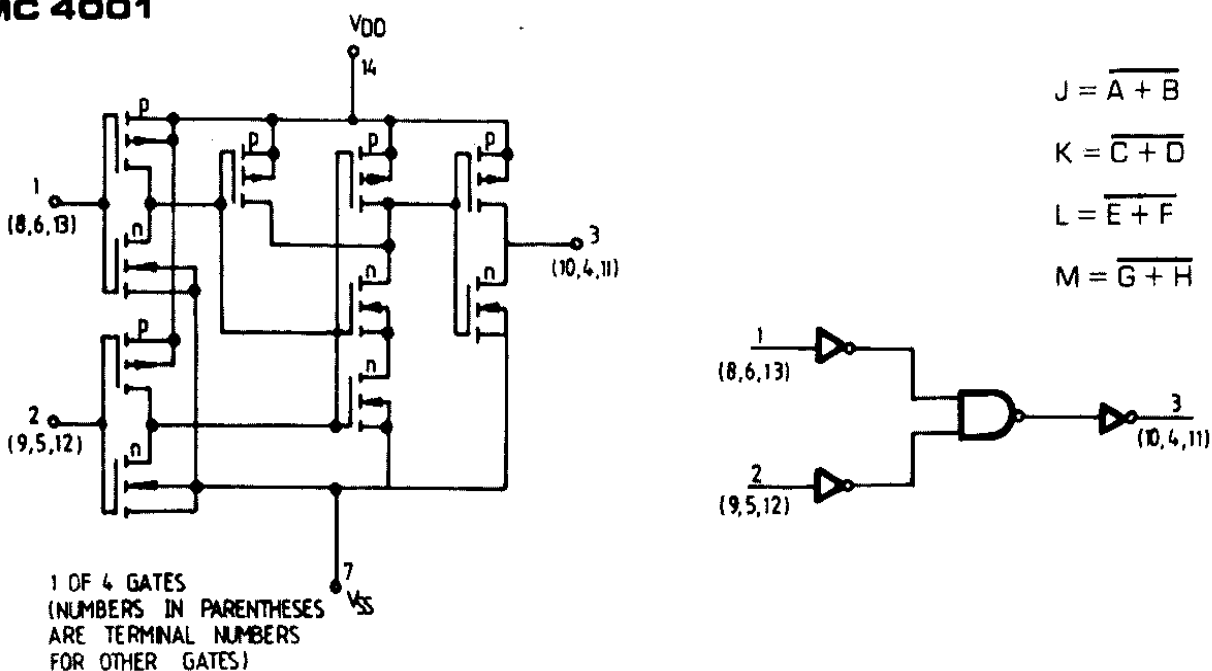
PARAMETER	TEST CONDITIONS	VALUES			UNIT	
		V_{DD} (V)	min	typ		max
t_{PLH} t_{PHL}	Propagation delay time	5		125	250	ns
		10		60	120	
		15		45	90	
t_{THL} t_{TLH}	Transition time	5		100	200	ns [†]
		10		50	100	
		15		40	80	

SCHEMATIC AND LOGIC DIAGRAMS

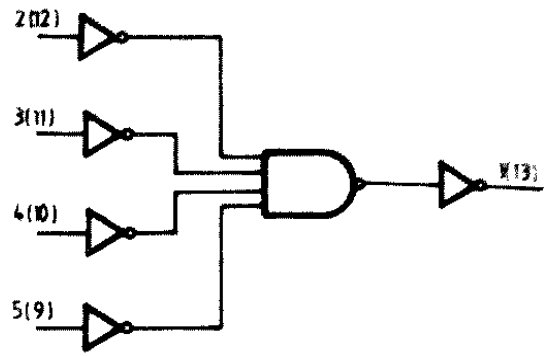
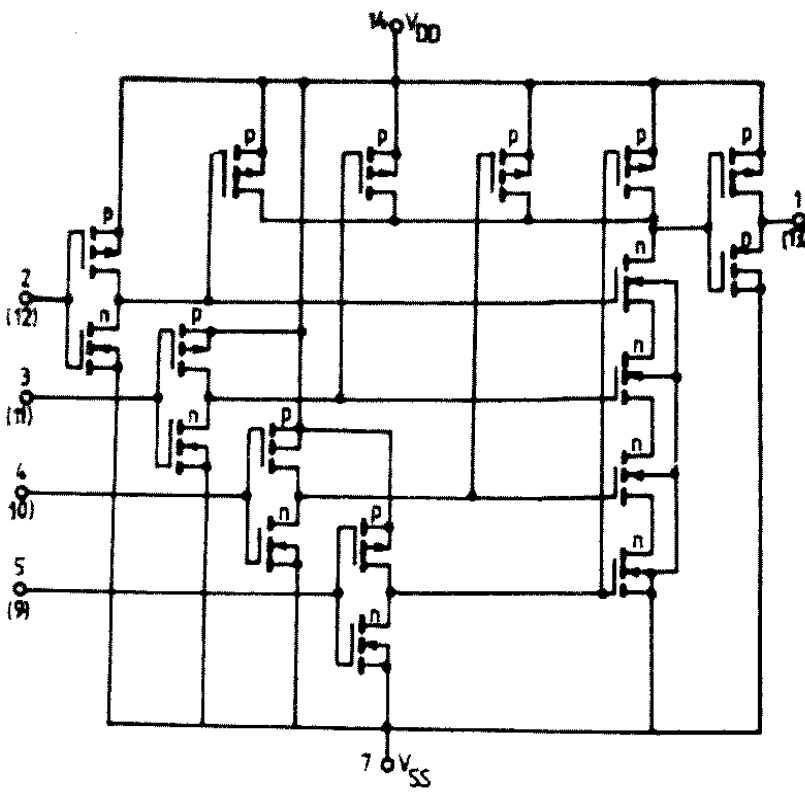
MMC 4000



MMC 4001



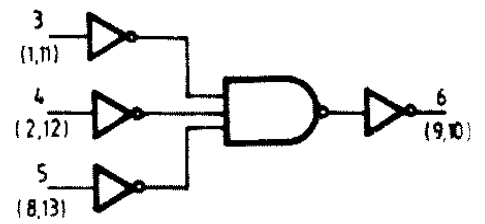
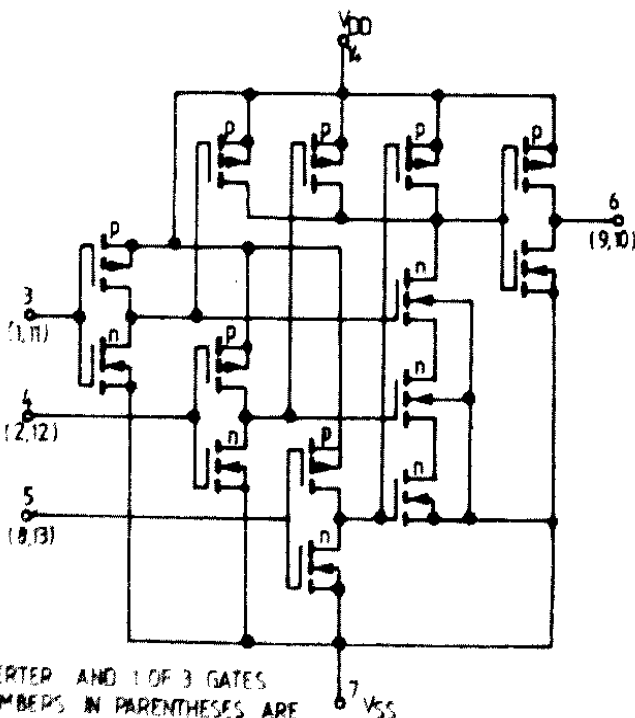
MMC 4002



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

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

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)