MULTIFUNCTION EXPANDABLE 8-INPUT GATE

GENERAL DESCRIPTION

The MMC 4048 (intermediate or extended temperature range) are monolithic integrated circuit, available in 16-lead dual in-line plastic or ceramic package. The MMC 4018 is an 8-input gate having four control inputs. Three binary control inputs' Ka, Kb, and Kc provide the implementation of eight different logic functions. These functions are OR, NOR, AND, NAND, OR/AND, OR/NAND, AND/OR and AND/NOR. A fourth control input' Kd' provides the user with a 3-state output. When control input Kd is high the output is either a logic 1 or logic 0 depending on the inner states. When control input Kd is low, the output is an open circuit. This feature enables the user to connect this device to a common bus line. In addition to the eight input lines, an EXPAND input is provided that permits the user to increase the number of inputs to one MMC 4048. For example, two MMC 4048 can be cascaded to provide a 16-input multifunction gate. When the EXPAND input is not used, it should be connected to V_{SS}.

FEATURES

- Three-state output
- Many logic functions available in one package.

ABSOLUTE MAXIMUM RATINGS

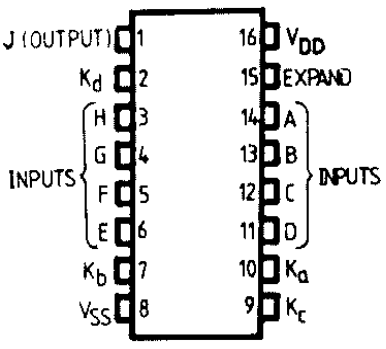
V_{DD}*	Supply voltage:	G and H types	-0.5 to	20	V
		E and F types	-0.5 to	18	V
V_I	Input voltage		-0.5 to	V_{DD}+0.5	V
I_I	DC input current (any one input)			±10	mA
P_{tot}	Total power dissipation (per package)			200	mW
	Dissipation per output transistor for T_A = full package-temperature range			100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

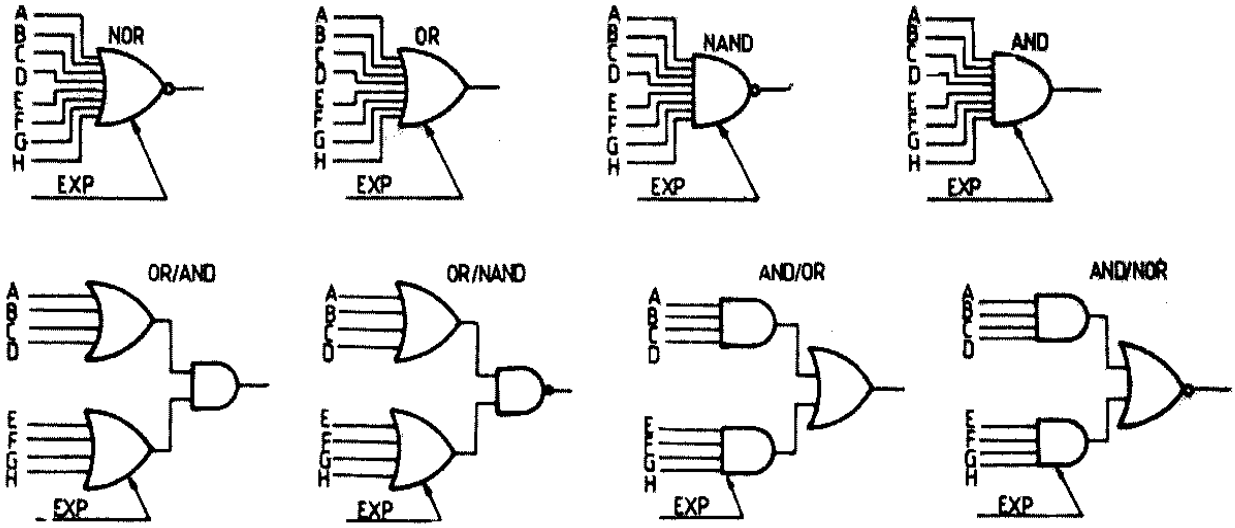
RECOMMENDED OPERATING CONDITIONS

V_{DD}*	Supply voltage:	G and H types	3 to	18	V
		E and F types	3 to	15	V
V_I	Imput 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

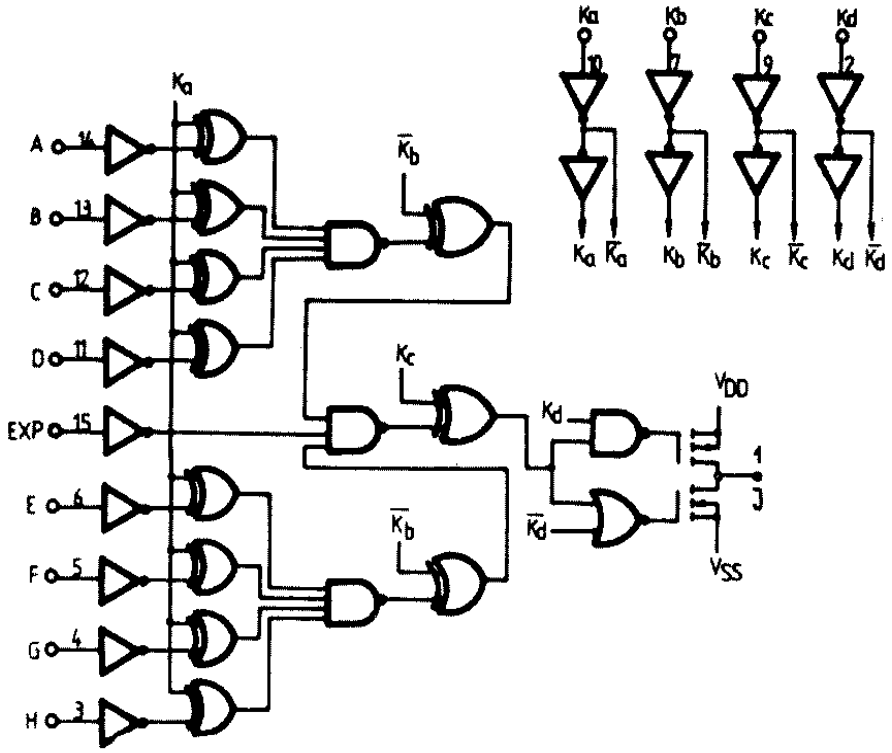
CONNECTION DIAGRAM



BASIC LOGIC CONFIGURATIONS



LOGIC DIAGRAM



FUNCTION TRUTH TABLE

OUTPUT FUNCTION	BOOLEAN EXPRESION	Ka	Kb	Kc	UNUSED INPUT
NOR	$J = \overline{A + B + C + D + E + F + G + H}$	0	0	0	V_{SS}
OR	$J = A + B + C + D + E + F + G + H$	0	0	1	V_{SS}
OR/AND	$J = (A + B + C + D) \cdot (E + F + G + H)$	0	1	0	V_{SS}
OR/NAND	$J = \overline{(A + B + C + D) \cdot (E + F + G + H)}$	0	1	1	V_{SS}
AND	$J = ABCDEFGH$	1	0	0	V_{DD}
NAND	$J = \overline{ABCDEFGH}$	1	0	1	V_{DD}
AND/NOR	$J = \overline{ABCD + EFGH}$	1	1	0	V_{DD}
AND/OR	$J = ABCD + EFGH$	1	1	1	V_{DD}

Kd = 1 Normal Inverter Action
Kd = 0 High Impedance Output

EXPAND Input = o

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} min.	T^*_{LOW} max.	25 °C min.	25 °C typ	25 °C max.	T^*_{HIGH} min.	T^*_{HIGH} 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		< 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} 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		$\pm10^{-5}$	±0.1		±1	μA
	E, F types	0/15			15		±0.3		$\pm10^{-5}$	±0.3		±1	
I_{OH} 3—state output	G, H types	0/18	0/18		18		±0.4		$\pm10^{-4}$	±0.4		±12	μA
	E, F types	0/15	0/15		15		±1.0		$\pm10^{-4}$	±1.0		±7.5	

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.	
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 = 200 kohm, typical temperature coefficient for all V_{DD} = 0.3%/°C values, all input rise and fall time = 20 ns)

PARAMETER		TEST CONDITIONS	VALUES			UNIT
			V_{DD} (V)	min.	typ.	max.	
t_{PHL}, t_{PLH}	Propagation delay time Inputs to output and Ka to Output		5		300	600	ns
			10		150	300	
			15		120	240	
	Kb to Output		5		225	450	ns
			10		85	170	
			15		55	110	
	Kc to Output		5		140	280	ns
			10		50	100	
			15		40	80	
	Expand Input to Output		5		190	380	ns
			10		90	180	
			15		65	130	
t_{PHZ}, t_{PLZ}, t_{PZH}, t_{PZL}	3-state propagation delay time Kd to Output	R_L = 1 k	5		80	160	ns
			10		35	75	
			15		25	50	
t_{THL}, t_{TLH}	Transition time		5		100	200	ns
			10		50	100	
			15		40	80	
3-state output capacitance					5	10	pF