



MMC 4007

# DUAL COMPLEMENTARY PAIR PLUS INVERTER

## GENERAL DESCRIPTION

The MMC 4007 (G and H types) and MMC 4007 (E and F types) are monolithic integrated circuit, available in 14-lead dual in-line plastic or ceramic package. The MMC 4007 types are comprised of three n-channel and three p-channel enhancement-type MOS transistors. The transistor elements are accessible through the package terminals to provide a convenient means for constructing the various typical circuits as shown in typical applications. More complex functions are possible using multiple packages. Numbers shown in parantheses indicate terminals that are connected together to form the various configuration listed.

## FEATURES

- Standardized symmetrical output characteristics
- Medium speed operation  $t_{PHL}, t_{PLH} = 30$  ns (typ.) at 10 V
- Quiescent current specified to 20 V for G and H types
- Input current of 100 nA at 18 V and 25° C for G and H types
- 100% tested for quiescent current

## ABSOLUTE MAXIMUM RATINGS

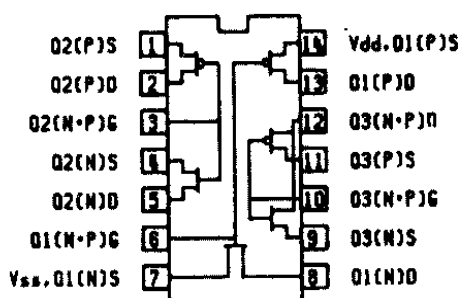
$V_{DD}^*$	Supply voltage: G and H types E and F types	-0.5 to 20 -0.5 to 18 -0.5 to $V_{DD}+0.5$	20 18 $V_{DD}+0.5$	V V V
$V_i$	Input voltage	-0.5 to $V_{DD}+0.5$		V
$I_i$	DC input current (any one input)		$\pm 10$	mA
$P_{tot}$	Total power dissipation (per package) Dissipation per output transistor 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	125 85	°C °C
$T_{stg}$	Storage temperature	-65 to 150	150	°C

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

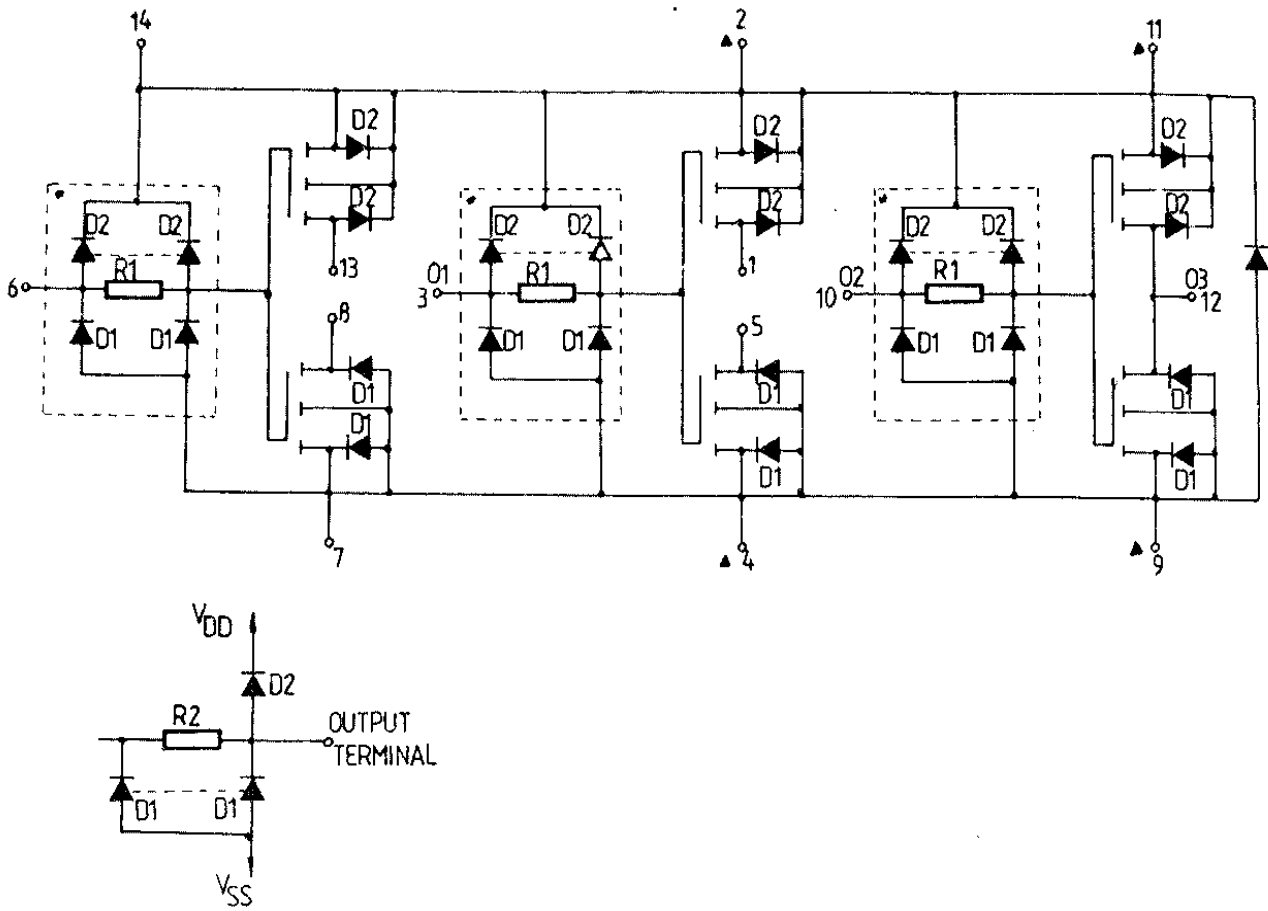
## RECOMMENDED OPERATING CONDITIONS

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

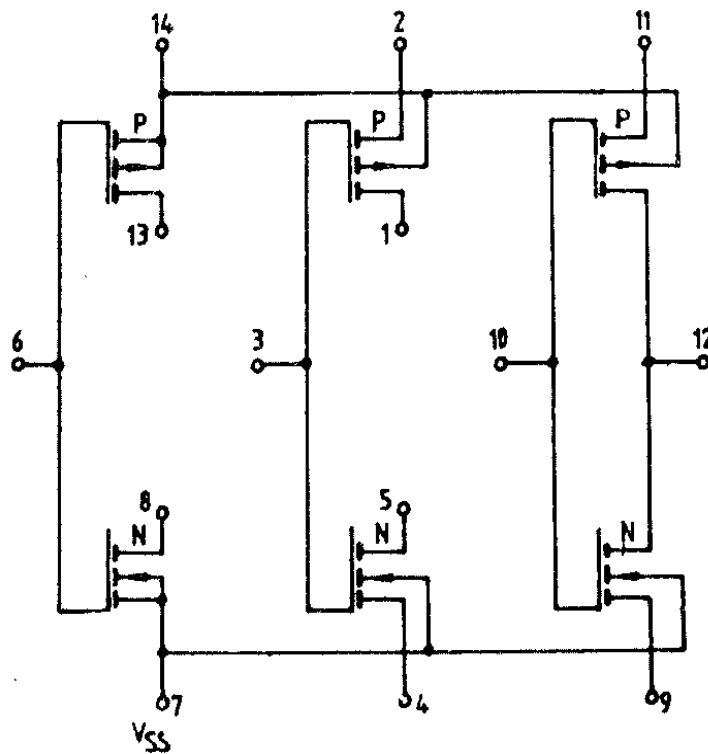
## CONNECTION DIAGRAM



### SCHEMATIC DIAGRAM



### FUNCTIONAL DIAGRAM



**STATIC ELECTRICAL CHARACTERISTICS**

(over recommended operating conditions)

PARAMETER		TEST CONDITIONS				VALUES						UNIT			
		V <sub>I</sub> (V)	V <sub>O</sub> (V)	I <sub>ol</sub>   ( $\mu$ A)	V <sub>DD</sub> (V)	T <sub>LOW</sub> *		25°C			T <sub>HIGH</sub> *				
						min.	max.	min.	typ	max.	min.		max.		
I <sub>L</sub>	Quiescent current	G, H types	0/ 5			5		0.25		0.01	0.25		7.5	$\mu$ 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 <sub>OH</sub>	Output high voltage													V	
		0/ 5		< 1	5	4.95		4.95			4.95				
		0/10		< 1	10	9.95		9.95			9.95				
		0/15		< 1	15	14.95		14.95			14.95				
V <sub>OL</sub>	Output low voltage													V	
		5 / 0		< 1	5		0.05			0.05		0.05			
		10/ 0		< 1	10		0.05			0.05		0.05			
		15/ 0		< 1	15		0.05			0.05		0.05			
V <sub>IH</sub>	-Input high voltage													V	
			0.5/4.5	< 1	5	4		4			4				
			1/9	< 1	10	8		8			8				
			1.5/13.5	< 1	15	12		12			12				
V <sub>IL</sub>	-Input low voltage													V	
			4.5/0.5	< 1	5		1			1		1			
			9/1	< 1	10		2			2		2			
			13.5/1.5	< 1	15		2.5			2.5		2.5			
I <sub>OH</sub>	-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 <sub>OL</sub>	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 <sub>IH</sub> , I <sub>IL</sub>	Input leakage current	G, H types	0/18	Any input				$\pm 0.1$		$\pm 10^{-5}$	$\pm 0.1$		$\pm 1$	$\mu$ A	
		E, F types	0/15					$\pm 0.3$		$\pm 10^{-5}$	$\pm 0.3$		$\pm 1$		
C <sub>I</sub>	Input capacitance		Any input							5	7.5		$\mu$ F		

\* T<sub>LOW</sub> = -55°C for G, H devices; -40°C for E, F devices.\* T<sub>HIGH</sub> = +125°C for G, H devices; +85°C for E, F devices.

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

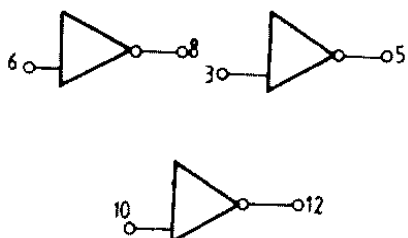
1 V min. with V<sub>DD</sub> = 5 V2 V min. with V<sub>DD</sub> = 10 V2.5 V min. with V<sub>DD</sub> = 15 V

**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 =  $20\text{ ns}$ )

PARAMETER	TEST CONDITIONS	VALUES			Unit	
		$V_{DD}$ (V)	Min.	Typ.		Max.
$t_{PLH}$ Propagation delay time $t_{PHL}$		5		65	110	ns
		10		30	60	
		15		25	50	
$t_{TLH}$ Transition time $t_{THL}$		5		100	200	ns
		10		50	100	
		15		40	80	

**TYPICAL APPLICATIONS** (sample CMOS logic circuit arrangements using type 4007)

Triple inverters. (14,2,11); (8,13);



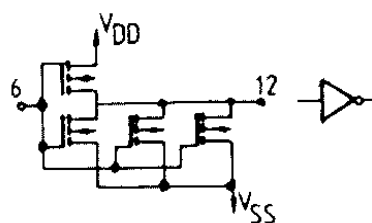
3-input NOR gate (13,2); (1,11); (12,5,8); (7,4,9);



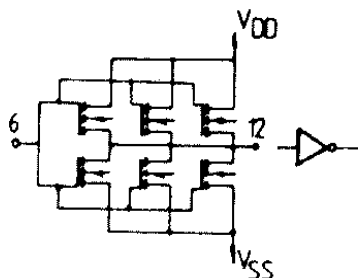
3-input NAND gate (1,12,13); (2,14,11)  
(4,8); (5,9);



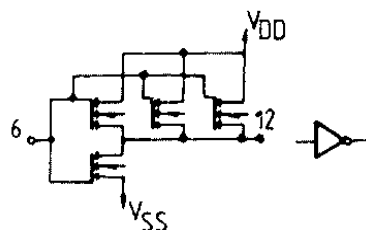
High sink-current driver. (6,3,10); (8,5,12); (11,14);  
(7,4,9);



High sink-and source-current driver. (6,3,10); (14,2,11);  
(7,4,9); (13,8,1,5,12)



High source-current driver. (6,3,10); (13,1,12);  
(14,2,11); (7,9);



Dual bi-directional transmission gating. (1,5,12); (2,9);  
(11,4); (8,13,10); (6,3)

