



MMC 4043 MMC 4044

# QUAD 3-STATE R/S LATCHES: QUAD NOR R/S LATCH-MMC 4043 QUAD NAND R/S LATCH-MMC 4044

## GENERAL DESCRIPTION

The MMC 4043 types are quad cross-coupled 3-state COS/MOS NOR latches and MMC 4044 types are quad cross-coupled 3-state COS/MOS NAND latches. Each latch has a separate Q output and individual SET and RESET inputs. The Q outputs are controlled by a common ENABLE input. A logic „1“ or high on the ENABLE input connects the latch states to the Q outputs. A logic „0“ or low on the ENABLE input disconnects the latch states from the Q outputs, resulting in an open circuit condition on the Q outputs. The open circuit feature allows common busing of the outputs.

The MMC 4043 and MMC 4044 types are supplied in 16 — lead hermetic dual — in — line ceramic or plastic packages.

## FEATURES

- 3-state outputs with common output ENABLE
- Separate SET and RESET inputs for each latch
- NOR and NAND configurations

## APPLICATIONS

- Holding register in multi-register system
- Four-bits of independent storage with output enable
- Strobed register
- General digital logic

## ABSOLUTE MAXIMUM RATINGS

$V_{DD}^*$	Supply voltage: G and H types E and F types	-0.5 to	20	V
$V_i$	Input voltage	-0.5 to	18	V
$I_i$	DC input current (any one input)	-0.5 to	$V_{DD} + 0.5$	V
$P_{tot}$	Total power dissipation (per package) Dissipation per output transistor for $T_A =$ full package-temperature range		$\pm 10$ 200	 mA mW
$T_A$	Operating temperature: G and H types E and F types	-55 to -40 to	125 85	 °C °C
$T_{stg}$	Storage temperature	-65 to	150	°C

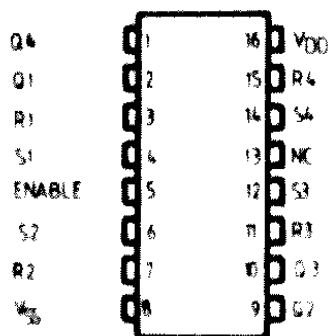
\* All voltage values are referred to  $V_{SS}$  pin voltage

## RECOMMENDED OPERATING CONDITIONS

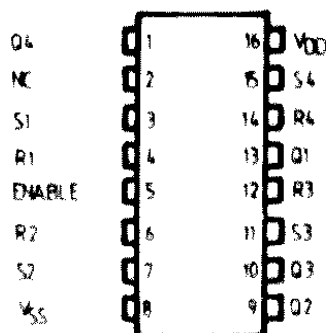
$V_{DD}^*$	Supply voltage: G and H types E and F types	3 to	18	V
$V_i$	Input voltage	3 to	15	V
$T_A$	Operating temperature: G and H types E and F types	0 to	$V_{DD}$	V
		-55 to	125	°C
		-40 to	85	°C

## CONNECTION DIAGRAMS

MMC 4043

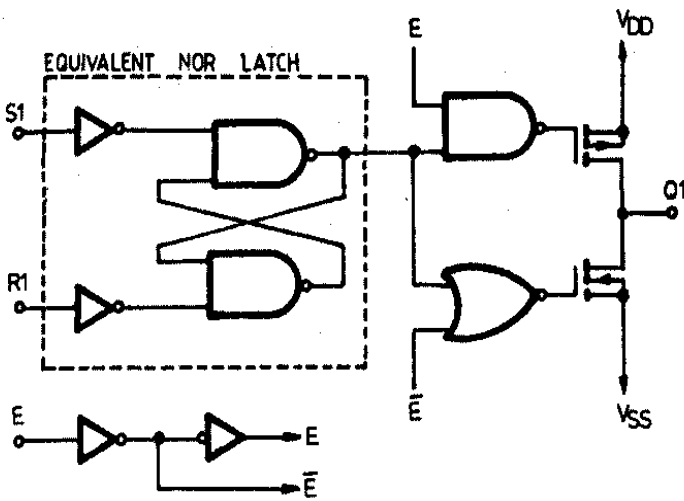


MMC 4044

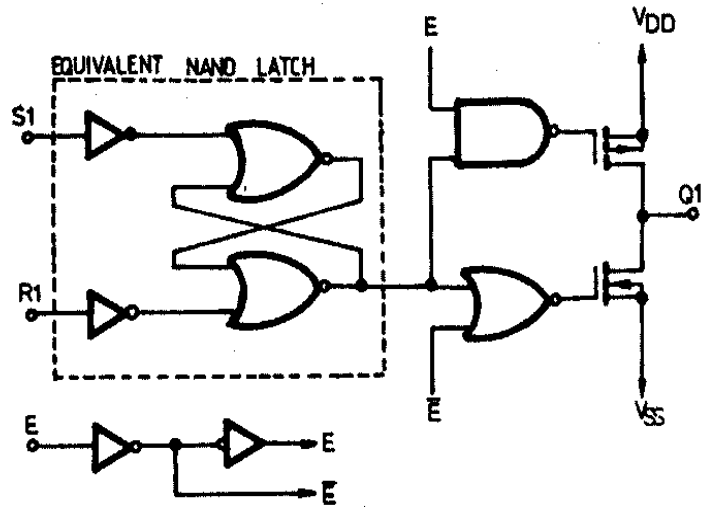


**LOGIC DIAGRAMS**

**MMC 4043**

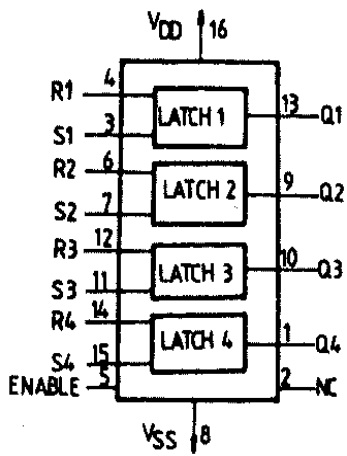


**MMC 4044**

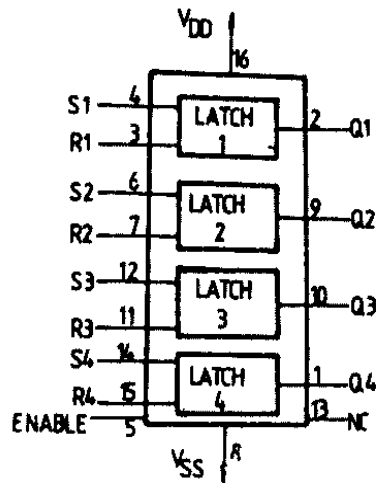


**FUNCTIONAL DIAGRAMS**

**For 4043**



**For 4044**



## STATIC ELECTRICAL CHARACTERISTICS

(over recommended operating conditions)

PARAMETER		TEST CONDITIONS				VALUES						UNIT	
		V <sub>I</sub> (V)	V <sub>O</sub> (V)	I <sub>O</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.
Quiescent current	G, H types	0/5 0/10 0/15 0/20			5 10 15 20		1 2 4 20		0.02 0.02 0.02 0.04	1 2 4 20		30 60 120 600	$\mu$ A
	E, F types	0/5 0/10 0/15			5 10 15		4 8 16		0.02 0.02 0.02	4 8 16		30 60 120	
V <sub>OH</sub>	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 <sub>OL</sub>	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 <sub>IH</sub>	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 <sub>p</sub>
V <sub>IL</sub>	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 <sub>OH</sub>	Output drive current	G, H types	0/5	25		5	-2		-1.6	-3.2		-1.15	mA
			0/5	46		5	-0.64		-0.51	-1		-0.36	
0/10	95			10	-1.6		-1.3	-2.6		-0.9			
0/15	135			15	-4.2		-3.4	-6.8		-2.4			
E, F types	0/5	25		5	-1.53		-1.36	-3.2		-1.1		mA	
	0/5	46		5	-0.52		-0.44	-1		-0.36			
	0/10	95		10	-1.3		-1.1	-2.6		-0.9			
	0/15	135		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	mA		
	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>in, IL</sub>	Input leakage current	G, H types	0/18	Any input	18		$\pm 0.1$		$\pm 10^{-5}$	$\pm 0.1$		$\pm 1$	$\mu$ A
		E, F types	0/15		15		$\pm 0.3$		$\pm 10^{-5}$	$\pm 0.3$		$\pm 1$	
I <sub>OH</sub>	3-state output	G, H types	0/18	0/18	18		$\pm 0.4$		$\pm 10^{-4}$	$\pm 0.4$		$\pm 12$	$\mu$ A
		E, F types	0/15	0/15	15		$\pm 1.0$		$\pm 10^{-4}$	$\pm 1.0$		$\pm 7.5$	

PARAMETER	TEST CONDITIONS				VALUES						UNIT	
	V <sub>I</sub> (V)	V <sub>O</sub> (V)	I <sub>O</sub> (μA)	V <sub>DD</sub> (V)	T <sub>LOW</sub>		25°C			T <sub>HIGH</sub>		
					min.	max.	min.	typ.	max.	min.		max.
C <sub>i</sub> Input capacitance		Any input						5	7.5			pF

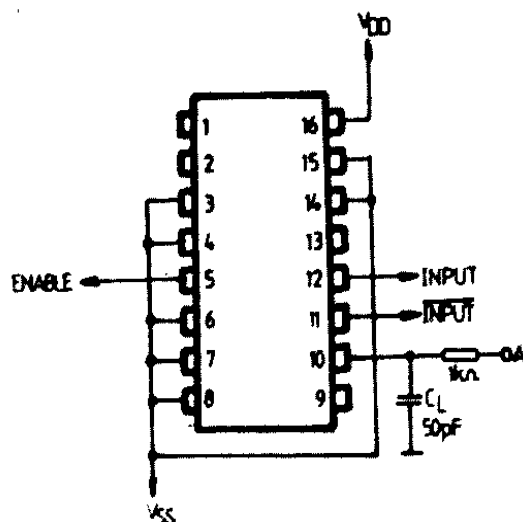
- T<sub>LOW</sub> = -55°C for G, H devices; -40°C for E, F devices.
  - T<sub>HIGH</sub> = +125°C for G, H devices; +85°C for E, F devices.
- The Noise Margin for both "1" and "0" level is:
- 1 V min. with V<sub>DD</sub> = 5 V
  - 2 V min. with V<sub>DD</sub> = 10 V
  - 2.5 V min. with V<sub>DD</sub> = 15 V

**DYNAMIC ELECTRICAL CHARACTERISTICS**

(T<sub>A</sub> = 25°C, input t<sub>r</sub>, t<sub>f</sub> = 20ns, C<sub>L</sub> = 50 pF, R<sub>L</sub> = 200 kΩ)

PARAMETER	V <sub>DD</sub> (V)	VALUES		UNITS
		typ.	max.	
t <sub>PLH</sub> t <sub>PHL</sub> Propagation delay time (SET or RESET to Q)	5 10 15	150 70 50	300 140 100	ns
t <sub>PHZ</sub> t <sub>PZH</sub> 3-state propagation delay time (ENABLE to Q)	5 10 15	115 55 40	230 110 80	ns
t <sub>PLZ</sub> t <sub>PZL</sub> 3-state propagation delay time	5 10 15	90 50 35	180 100 70	ns
t <sub>THL</sub> t <sub>TLH</sub> Transition time	5 10 15	100 50 40	200 100 80	ns
t <sub>w</sub> SET or RESET pulse width	5 10 15	80 40 20	160 80 40	ns

TEST CIRCUITS ENABLE propagation delay time and waveforms



TEST	IN	IN	A
t <sub>PHZ</sub>	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>
t <sub>PLZ</sub>	V <sub>SS</sub>	V <sub>DD</sub>	V <sub>DD</sub>
t <sub>PZH</sub>	V <sub>DD</sub>	V <sub>SS</sub>	V <sub>SS</sub>
t <sub>PZL</sub>	V <sub>SS</sub>	V <sub>DD</sub>	V <sub>DD</sub>

Z = HIGH IMPEDANCE