



**MICROCIRCUIT DATA SHEET**

**MNCD4093BM-X REV 1A0**

Original Creation Date: 10/12/95  
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**QUAD 2-INPUT NAND SCHMITT TRIGGER**

**General Description**

The CD4093B consists of four Schmitt-trigger circuits. Each circuit functions as a 2-input NAND gate with Schmitt-trigger action on both inputs. The gate switches at different points for positive and negative-going signals. The difference between the positive (Vt+) and the negative voltage (Vt-) is defined as hysteresis voltage (Vh).

All outputs have equal source and sink currents and conform to standard B-series output drive (See Static Electrical Characteristics).

**Industry Part Number**

CD4093BM

**NS Part Numbers**

CD4093BMJ/883\*  
 CD4093BMW/883\*\*

**Prime Die**

CD4093BM

**Controlling Document**

7704601CA\*, 7704601DA\*\*

**Processing**

MIL-STD-883, Method 5004

**Quality Conformance Inspection**

MIL-STD-883, Method 5005

Subgrp	Description	Temp ( °C)
1	Static tests at	+25
2	Static tests at	+125
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	-55

**Features**

- Wide supply voltage range 3.0V to 15V
- Schmitt-trigger on each input with no external components
- Noise immunity greater than 50%
- Equal source and sink currents
- No limit on input rise and fall time
- Standard B-series output drive
- Hysteresis voltage (any input) TA = 25 C
  - Typical           Vdd = 5.0V       Vh = 1.5V
  - Vdd = 10V       Vh = 2.2V
  - Vdd = 15V       Vh = 2.7V
  - Guaranteed                   Vh = 0.1Vdd
- Standard Military Drawing (SMD)
  - CD4093: 7704601CA\*, DA\*\*

**Applications**

- Wave and pulse shapers
- High-noise-environment systems
- Monostable multivibrators
- Astable multivibrators
- NAND logic

**(Absolute Maximum Ratings)**

(Note 1, 2)

DC Supply Voltage (Vdd)	-0.5 to +18Vdc
Input Voltage (Vin)	-0.5 to Vdd +0.5Vdc
Storage Temperature Range (Ts)	-65 C to +150 C
Power Dissipation (Pd)	
Dual-In-Line	700mW
Small Outline	500mW
Lead Temperature (Tl)	
(Soldering, 10 seconds)	260 C

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of "Recommended Operating Conditions" and "Electrical Characteristics" provides conditions for actual device operation.

Note 2: Vss = 0V unless otherwise specified.

**Recommended Operating Conditions**

(Note 1)

DC Supply Voltage (Vdd)	3 to 15Vdc
Input Voltage (Vin)	0 to Vdd Vdc
Operating Temperature Range (TA)	
CD4093BM	-55 C to +125 C

Note 1: Vss = 0V unless otherwise specified.

## Electrical Characteristics

### DC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)  
DC:  $V_{ss} = 0V$

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
I <sub>dd</sub>	Quiescent Device Current	V <sub>dd</sub> = 5V			0.25		uA	1, 3
					7.5		uA	2
		V <sub>dd</sub> = 10V			0.5		uA	1, 3
					15		uA	2
		V <sub>dd</sub> = 15V			1		uA	1, 3
					30		uA	2
V <sub>ol</sub>	Logical "0" Output Voltage	V <sub>dd</sub> = 5V, V <sub>in</sub> = V <sub>dd</sub> , I <sub>out</sub> < 1uA			0.05		V	1, 2, 3
		V <sub>dd</sub> = 10V, V <sub>in</sub> = V <sub>dd</sub> , I <sub>out</sub> < 1uA			0.05		V	1, 2, 3
		V <sub>dd</sub> = 15V, V <sub>in</sub> = V <sub>dd</sub> , I <sub>out</sub> < 1uA			0.05		V	1, 2, 3
V <sub>oh</sub>	Logical "1" Output Voltage	V <sub>dd</sub> = 5V, V <sub>in</sub> = V <sub>ss</sub> , I <sub>out</sub> < 1uA			4.95		V	1, 2, 3
		V <sub>dd</sub> = 10V, V <sub>in</sub> = V <sub>ss</sub> , I <sub>out</sub> < 1uA			9.95		V	1, 2, 3
		V <sub>dd</sub> = 15V, V <sub>in</sub> = V <sub>ss</sub> , I <sub>out</sub> < 1uA			14.95		V	1, 2, 3
V <sub>t-</sub>	Threshold Voltage (Any Input): Negative-Going	V <sub>dd</sub> = 5V, V <sub>out</sub> = 4.5V, I <sub>out</sub> < 1uA			1.5	2.25	V	1
					1.5	2.3	V	2
					1.3	2.25	V	3
		V <sub>dd</sub> = 10V, V <sub>out</sub> = 9V, I <sub>out</sub> < 1uA			3	4.5	V	1
					3	4.65	V	2
					2.85	4.5	V	3
		V <sub>dd</sub> = 15V, V <sub>out</sub> = 13.5V, I <sub>out</sub> < 1uA			4.5	6.75	V	1
					4.5	6.9	V	2
					4.35	6.75	V	3

## Electrical Characteristics

### DC PARAMETERS (Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)  
DC:  $V_{SS} = 0V$

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vt+	Threshold Voltage (Any Input): Positive-Going	Vdd = 5V, Vout = 0.5V, Iout < 1uA			2.75	3.5	V	1
					2.65	3.5	V	2
					2.75	3.65	V	3
		Vdd = 10V, Vout = 1V, Iout < 1uA			5.5	7	V	1
					5.35	7	V	2
					5.5	7.15	V	3
		Vdd = 15V, Vout = 1.5V, Iout < 1uA			8.25	10.5	V	1
					8.1	10.5	V	2
					8.25	10.65	V	3
Vh	Hysteresis (Vt+-Vt-) (Any Inputs)	Vdd = 5V			0.5	2	V	1
					0.35	2	V	2
					0.5	2.35	V	3
		Vdd = 10V			1	4	V	1
					0.7	4	V	2
					1	4.3	V	3
		Vdd = 15V			1.5	6	V	1
					1.2	6	V	2
					1.5	6.3	V	3
Iol	Logical "0" Output Current	Vdd = 5V, Vin = Vdd, Vout = 0.4V			0.51		mA	1
					0.36		mA	2
					0.64		mA	3
		Vdd = 10V, Vin = Vdd, Vout = 0.5V			1.3		mA	1
					0.9		mA	2
					1.6		mA	3
		Vdd = 15V, Vin = Vdd, Vout = 1.5V			3.4		mA	1
					2.4		mA	2
					4.2		mA	3

## Electrical Characteristics

### DC PARAMETERS (Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)  
 DC:  $V_{ss} = 0V$

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Ioh	Logical "1" Output Current	Vdd = 5V, Vin = Vss, Vout = 4.6V			-0.51		mA	1
					-0.36		mA	2
					-0.64		mA	3
		Vdd = 10V, Vin = Vss, Vout = 9.5V			-1.3		mA	1
					-0.9		mA	2
					-1.6		mA	3
		Vdd = 15V, Vin = Vss, Vout = 13.5V			-3.4		mA	1
					-2.4		mA	2
					-4.2		mA	3
Iin	Input Current	Vdd = 15V, Vin = 15V				+0.1	uA	1, 3
						+1	uA	2
		Vdd = 15V, Vin = 0V			-0.1		uA	1, 3
						-1		uA

## Electrical Characteristics

### AC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)  
 AC: Vss = 0V, Input tr, tf = 20nS, Cl = 50pF, Rl = 200K Ohms

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tPHL	Propagation Delay Time:	Vdd = 5V	2		10	600	nS	9
			2			840	nS	10
			2			480	nS	11
		Vdd = 10V	1			300	nS	9
			1			420	nS	10
			1			240	nS	11
		Vdd = 15V	1			240	nS	9
			1			335	nS	10
			1			190	nS	11
tPLH	Propagation Delay Time:	Vdd = 5V	2		10	600	nS	9
			2			840	nS	10
			2			480	nS	11
		Vdd = 10V	1			300	nS	9
			1			420	nS	10
			1			240	nS	11
		Vdd = 15V	1			240	nS	9
			1			335	nS	10
			1			190	nS	11
tTHL	Transition Time:	Vdd = 5V	2		10	200	nS	9
			2			300	nS	10, 11
tTLH	Transition Time:	Vdd = 5V	2		10	200	nS	9
			2			300	nS	10, 11
Cin	Average Input Capacitance		1			7.5	pF	9

Note 1: Guaranteed parameter not tested.

Note 2: Tested at 25 C; guaranteed but not tested at +125 C and -55 C.

**Revision History**

Rev	ECN #	Rel Date	Originator	Changes
1A0	M0002795	05/19/98	Linda Collins	New update: MNCD4093BM-X rev 1A0 Deleted the DC Rad Hard stress tests and the Drift values.