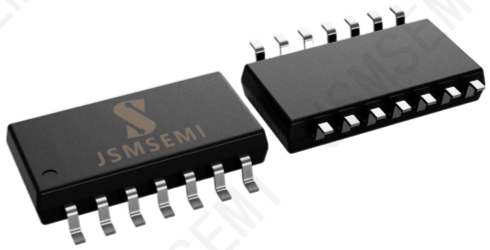
1 Descriptions

The MC14093 is a quad 2-input NAND gate with Schmitt-trigger inputs. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC}. Schmitt trigger inputs transform slowly changing input signals into sharply defined jitter-free output signals.

The MC14093 is available in Green SOP14 packages. It operates over an ambient temperature range of - 40°C to 125°C.



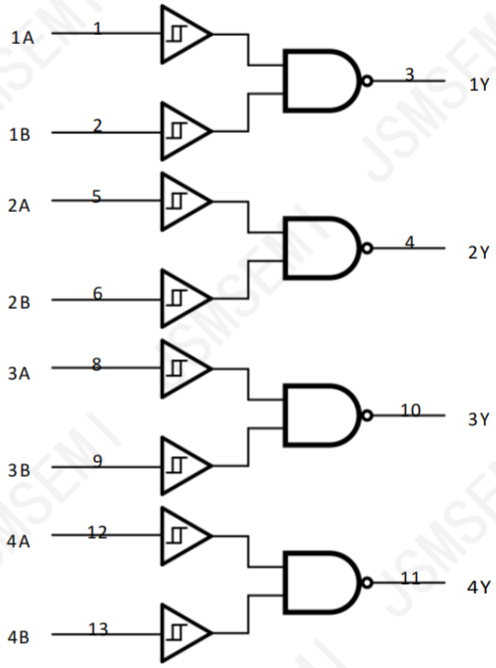
2 Features

- Schmitt Trigger Input Discrimination
- Fully Static Operation
- 5V, 10V, and 15V Parametric Ratings
- Wide Supply Voltage Range from 3V to 15V
- CMOS Low Power Dissipation
- High Noise Immunity
- Standardized Symmetrical Output Characteristics
- Operating Temperature Range: -40 °C to 125 °C
- Packages: SOP-14

3 Applications

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

Functional Block Diagram



4 FUNCTION TABLE

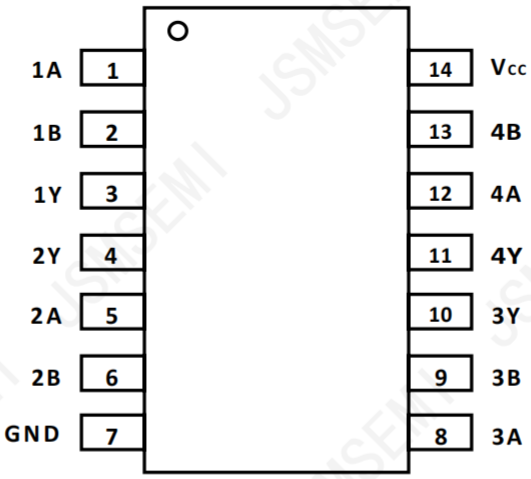
INPUT		OUTPUT
nA	nB	nY
L	L	H
L	H	H
H	L	H
H	H	L

H=High Voltage Level L=Low Voltage Level

Ordering Information

Order number	Package	Marking	Operation Temperature Range	MSL Grade	Ship,Quantity	Green
MC14093BDR2G-JSM	SSOP-28	14093B	-40 to 125°C	3	T&R,2500	Rohs

5 PIN Configuration



SOP-14

TOP VIEW

PIN Descriptions

PIN	NAME	I/O TYPE (1)	FUNCTION
SOP14			
1	1A	I	Input
2	1B	I	Input
3	1Y	O	Output
4	2Y	O	Output
5	2A	I	Input
6	2B	I	Input
7	GND	P	Ground (0V)
8	3A	I	Input
9	3B	I	Input
10	3Y	O	Output
11	4Y	O	Output
12	4A	I	Input
13	4B	I	Input
14	Vcc	P	Supply voltage

(1) I=input, O=output, P=power.

6 SPECIFICATIONS

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) (1) (2)

			MIN	MAX	UNIT
V_{CC}	Supply voltage range		-0.5	18	V
V_I	Input voltage range (2)		-0.5	V_{CC}+0.5	V
V_O	Voltage range applied to any output in the high-impedance or power-off state (2)		-0.5	18	V
V_O	Voltage range applied to any output in the high or low state (2) (3)		-0.5	V_{CC}+0.5	V
I_{IK}	Input clamp current	V_I<-0.5V		-50	mA
I_{OK}	Output clamp current	V_O<0 or V_O >V_{CC}+0.5V		±50	mA
I_O	Continuous output current			±25	mA
	Continuous current through V_{CC} or GND			±50	mA
θ_{JA}	Package thermal impedance (4)	SOP14		105	°C/W
T_J	Junction temperature (5)		-65	150	°C
T_{stg}	Storage temperature		-65	150	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
(3) The value of V_{CC} is provided in the Recommended Operating Conditions table.
(4) The package thermal impedance is calculated in accordance with JESD-51.
(5) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / R_{\theta JA}$. All numbers apply for packages soldered directly onto a PCB.

6.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

		VALUE	UNIT
$V_{(ESD)}$ Electrostatic discharge	Human-Body Model (HBM)	±2000	V
	Charged-Device Model (CDM)	±1000	
	Machine Model (MM)	±200	

7 Electrical Characteristics

over recommended operating free-air temperature range (TYP values are at T_A = +25°C, Full=-40°C to 125°C, unless otherwise noted.) (1)

7.1 Recommended Operating Conditions

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
Supply Voltage	V_{CC}		3	15	V
Input Voltage	V_I		0	15	V
Output Voltage	V_O		0	V_{CC}	V
Operating Temperature	T_A		-40	125	°C

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

7.2 DC Characteristics

over recommended operating free-air temperature range (unless otherwise noted.) (1)

PARAMETER		TEST CONDITIONS	Vcc	TEMP	MIN(2)	TYP(3)	MAX(2)	UNIT
V_{T+}	Positive Going Input Threshold Voltage		5V	Full	2		3.5	V
			10V		3.7		7	
			15V		4.9		11	
V_{T-}	Negative Going Input Threshold Voltage		5V	Full	1.5		3	V
			10V		3		6.3	
			15V		4		10	
ΔV_T	Hysteresis (V_{T+}-V_{T-})		5V	Full	0.5			V
			10V		0.7			
			15V		0.9			
V_{OH}		I_{OH} = -10μA	3V to 15V	Full	V_{CC}-0.1			V
		I_{OH} = -0.36mA	5V		4.6			
		I_{OH} = -0.5mA			4.55			
		I_{OH} = -0.64mA			4.5			
		I_{OH} = -1.1mA			4.3			
		I_{OH} = -1.4mA			4.15			
		I_{OH} = -1.7mA			4			
		I_{OH} = -0.9mA	10V		9.55			
		I_{OH} = -1.3mA			9.35			
		I_{OH} = -1.6mA			9.2			
		I_{OH} = -2.4mA	15V		14.45			
		I_{OH} = -3.4mA			14.2			
		I_{OH} = -4.2mA			14			
V_{OL}		I_{OL} = 10μA	3V to 15V	Full			0.1	V
		I_{OL} = 0.36mA	5V				0.4	
		I_{OL} = 0.5mA					0.45	
		I_{OL} = 0.64mA					0.5	
		I_{OL} = 0.9mA	10V				0.45	
		I_{OL} = 1.3mA					0.65	
		I_{OL} = 1.6mA					0.8	
		I_{OL} = 2.4mA	15V				0.55	
		I_{OL} = 3.4mA					0.8	
		I_{OL} = 4.2mA					1	
I_I	A input	V_I=15V or GND	15V	25°C		±0.1	±1	μA
				Full			±2	
I_{CC}		V_I=V_{CC} or GND, I_O=0A	5V	25°C		0.1	1	μA
				Full			5	
			10V	25°C		0.5	1	μA
				Full			15	
			15V	25°C		1	1.5	μA
				Full			20	

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.
(2) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.
(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

7.3 AC Characteristics

PARAMETER	SYMBOL	TEST CONDITIONS		TEMP	MIN(2)	TYP(3)	MAX(2)	UNIT
Propagation Delay	t_{pd}	V_{CC}=5V, C_L=50pF		Full		21.5	38.7	ns
		V_{CC}= 10V, C_L=50pF				11.2	19.2	
		V_{CC}= 15V, C_L=50pF				9.2	15	
LOW to HIGH Output Transition Time	t_r	V_{CC}=5V, C_L=50pF		Full		21.5	38.4	ns
		V_{CC}= 10V, C_L=50pF				11.5	17.2	
		V_{CC}= 15V, C_L=50pF				7	13.5	
HIGH to LOW Output Transition Time	t_f	V_{CC}=5V, C_L=50pF		Full		19.5	32.3	ns
		V_{CC}= 10V, C_L=50pF				11	18.2	
		V_{CC}= 15V, C_L=50pF				8	16.1	
Input Capacitance	C_i	V_{CC}=5V		25oC		4		pF
Power Dissipation Capacitance Per Out	C_{pd}	V_{CC}=5V	f=10MHz	25oC		7.5		pF
		V_{CC}= 10V				10		
		V_{CC}= 15V				12		

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.
(2) This parameter is ensured by design and/or characterization and is not tested in production.
(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

7.4 Typical Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

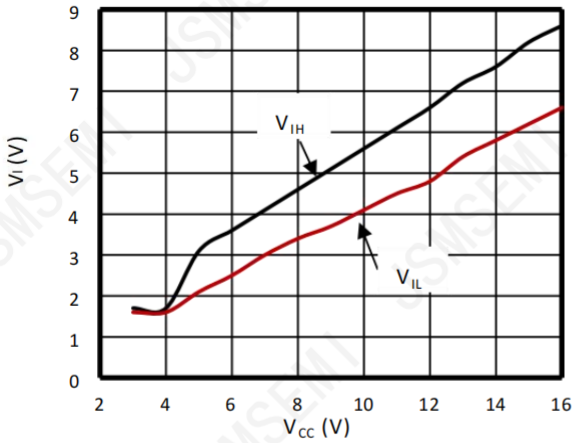


Figure 1. Typical Switching Levels as a Function of Supply Voltage

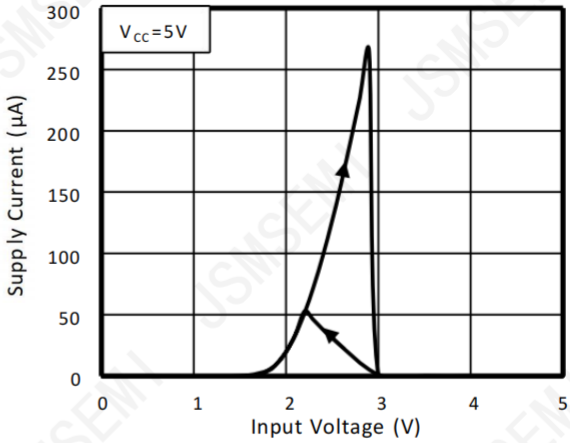


Figure 2. Typical Drain Current as a Function of Input

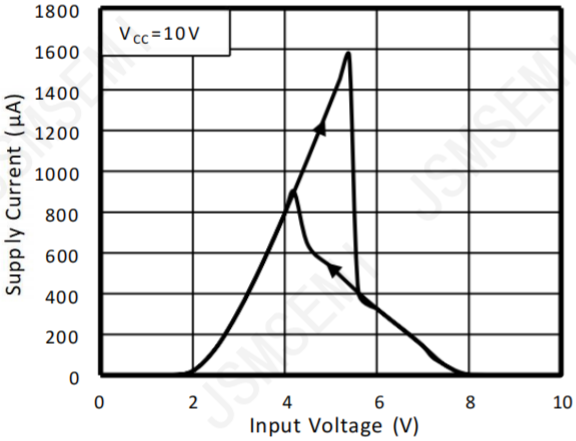


Figure 3. Typical Drain Current as a Function of Input

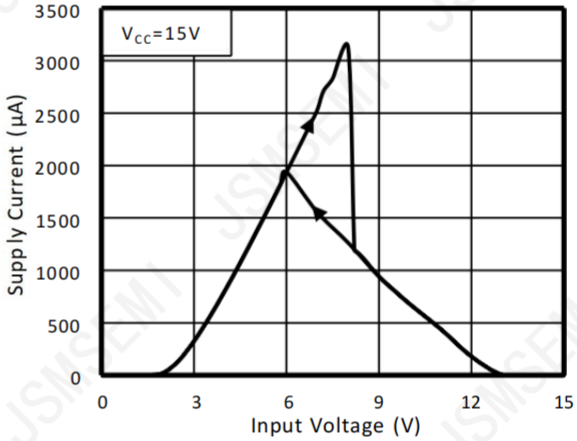
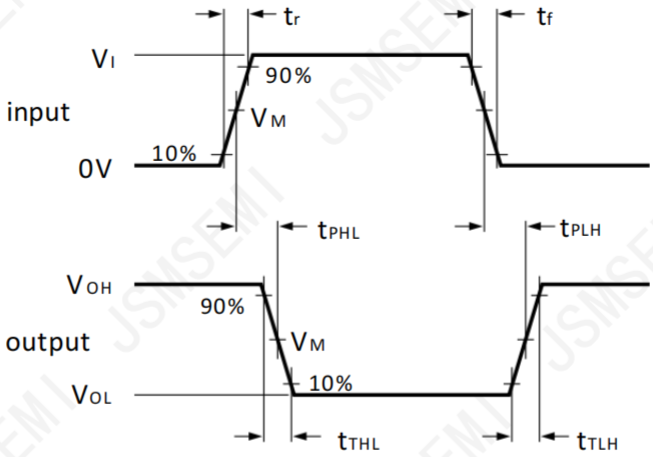


Figure 4. Typical Drain Current as a Function of Input

8 Parameter Measurement Information

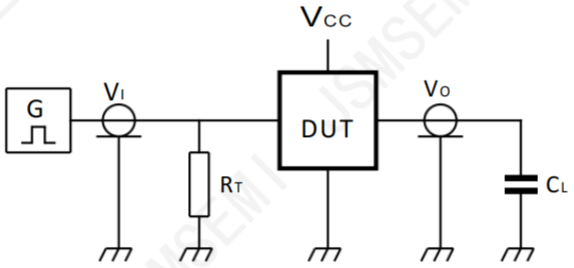


Measurement points are given in Table 1.
Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load. t_r, t_f = input rise and fall times.

Figure 5. Propagation Delay and Output Transition Time

Table 1. Measurement Points

Supply voltage	Input	Output
V_{CC}	**V_M**	**V_M**
5 V to 15 V	0.5 V_{CC}	0.5 V_{CC}



Test data given in Table2.
Definitions for test circuit:

C_L = load capacitance including jig and probe capacitance.
R_T = termination resistance should be equal to the output impedance Zo of the pulse generator.

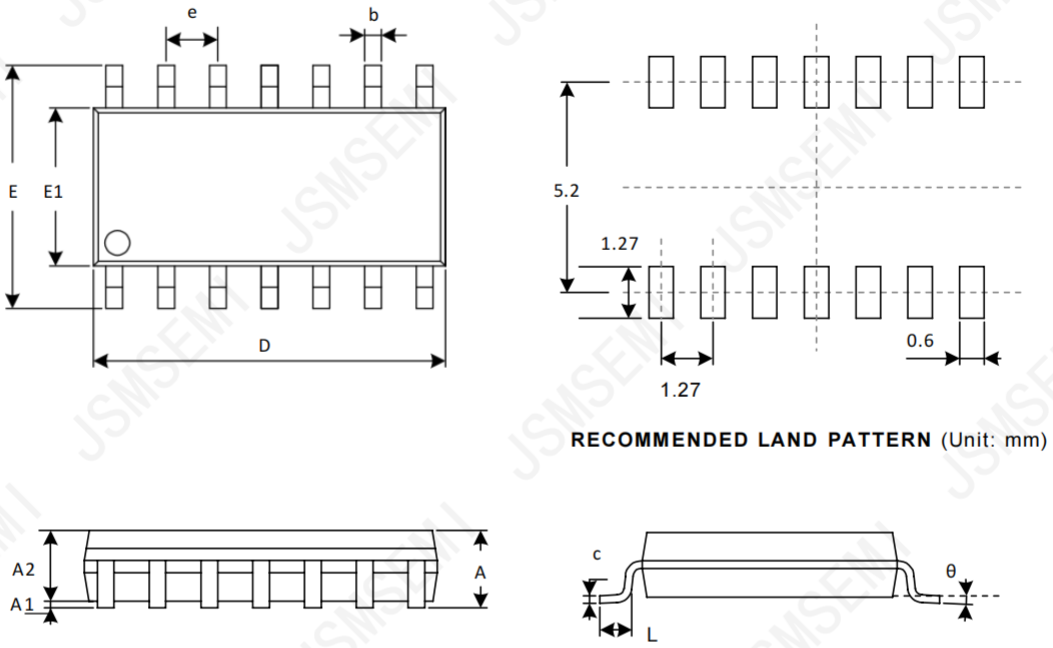
Figure 6. Test Circuit for Measuring Switching Times

Table 2. Test Data

Supply voltage	Input		Load
V_{CC}	**V_I**	**t_r, t_f**	**C_L**
5 V to 15 V	V_{CC} or GND	≤ 20 ns	50 pF

Package Information

SOP-14



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)		1.750		0.069
A1	0.100	0.250	0.004	0.010
A2	1.300	1.500	0.051	0.059
b	0.390	0.470	0.015	0.019
c	0.200	0.240	0.008	0.009
D (1)	8.550	8.750	0.336	0.344
e	1.270(BSC) (2)		0.050(BSC) (2)	
E	5.800	6.200	0.228	0.244
E1 (1)	3.800	4.000	0.150	0.157
L	0.500	0.800	0.020	0.031
θ	0°	8°	0°	8°

NOTE:
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

Revision History

Rev.	Change	Date
V1.0	Initial version	3/17/2023

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