TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC4093BP,TC4093BF

TC4093B Quad 2-Input NAND Schmitt Triggers

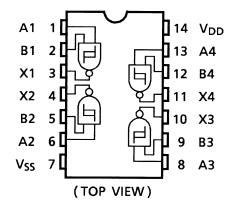
The TC4093B is a quad 2-input NAND gate having Schmitt trigger function for all the input terminals.

Since the circuit threshold voltage varies with rising time and falling time of the input waveform (VP and VN), this gate can be used for a wide variety of applications to line receivers, waveform shaping, astable multivibrators, monosatable multivibrators, etc.

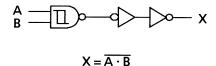
In addtion to regular NAND gates.

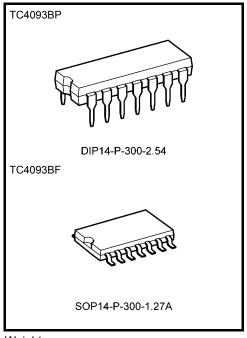
As the TC4093B and the TC4011B are identical in pin assignment, they are compatible each other.

Pin Assignment



Logic Diagram

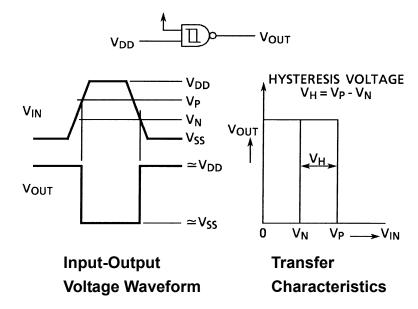




Weight

DIP14-P-300-2.54 : 0.96 g (typ.) SOP14-P-300-1.27A : 0.18 g (typ.)

Input-Output Characteristic



Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
DC supply voltage	V_{DD}	V _{SS} – 0.5~V _{SS} + 20	V
Input voltage	V _{IN}	V _{SS} – 0.5~V _{DD} + 0.5	V
Output voltage	V _{OUT}	V _{SS} – 0.5~V _{DD} + 0.5	V
DC input current	I _{IN}	±10	mA
Power dissipation	PD	300 (DIP)/180 (SOIC)	mW
Operating temperature range	T _{opr}	-40~85	°C
Storage temperature range	T _{stg}	−65 ~ 150	°C

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Operating Ranges $(V_{SS} = 0 \text{ V})$ (Note)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
DC supply voltage	V_{DD}	_	3	_	18	V
Input voltage	V _{IN}		0	_	V _{DD}	V

2

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either V_{DD} or V_{SS} .

Static Electrical Characteristics ($V_{SS} = 0 V$)

		Sym-	Test Condition		-40°C		25°C			85°C		
Charac	cteristics	bol		V _{DD} (V)	Min	Max	Min	Тур.	Max	Min	Max	Unit
High-level voltage	l output	V _{OH}	$ I_{OUT} < 1 \mu A$ $V_{IN} = V_{SS}, V_{DD}$	5 10 15	4.95 9.95 14.95		4.95 9.95 14.95	5.00 10.00 15.00	_ 	4.95 9.95 14.95		V
Low-level voltage	output	V _{OL}	$ I_{OUT} < 1 \mu A$ $V_{IN} = V_{DD}$	5 10 15	_ _ _	0.05 0.05 0.05	_ _ _	0.00 0.00 0.00	0.05 0.05 0.05	_ _ _	0.05 0.05 0.05	V
Output hig	gh current	Іон	$V_{OH} = 4.6 \text{ V}$ $V_{OH} = 2.5 \text{ V}$ $V_{OH} = 9.5 \text{ V}$ $V_{OH} = 13.5 \text{ V}$ $V_{IN} = V_{SS}, V_{DD}$	5 5 10 15	-0.61 -2.50 -1.50 -4.00		-0.51 -2.10 -1.30 -3.40	-1.0 -4.0 -2.2 -9.0		-0.42 -1.70 -1.10 -2.80	1 1 1 1	mA
Output lov	w current	l _{OL}	$V_{OL} = 0.4 \text{ V}$ $V_{OL} = 0.5 \text{ V}$ $V_{OL} = 1.5 \text{ V}$ $V_{IN} = V_{DD}$	5 10 15	0.61 1.5 4.0	 - -	0.51 1.30 3.40	1.5 3.8 15.0	 - -	0.42 1.10 2.80	 - -	mA
High thres	shold	V _P	V _{OUT} = 0.5 V, 4.5 V V _{OUT} = 1.0 V, 9.0 V V _{OUT} = 1.5 V, 13.5 V	5 10 15			2.05 4.10 6.20	2.8 5.3 7.8	3.55 7.00 10.40	— — —		٧
Low thres voltage	hold	V _N	V _{OUT} = 0.5 V, 4.5 V V _{OUT} = 1.0 V, 9.0 V V _{OUT} = 1.5 V, 13.5 V	5 10 15	_ _ _	_ _ _	1.5 3.2 4.8	2.3 4.5 6.6	3.15 6.30 9.30	_ _ _	_ _ _	V
Hysteresis	s voltage	V _H	_	5 10 15			0.20 0.30 0.45	0.5 0.8 1.2	0.85 1.40 1.90	_ _ _		٧
Input current	"H" level	l _{IH}	V _{IH} = 18 V V _{IL} = 0 V	18 18		0.1 -0.1	_ _	10 ⁻⁵	0.1 -0.1		1.0 -1.0	μА
Quiescent current		I _{DD}	V _{IN} = V _{SS} , V _{DD} (Note)	5 10 15	_ _ _	1 2 4	_ _ _	0.001 0.002 0.004	1 2 4	_ _ _	7.5 15.0 30.0	μА

Note: All valid input combinations.

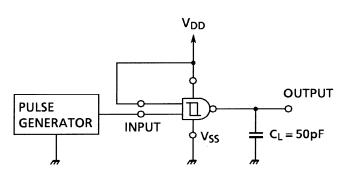
3 2012-02-29

Dynamic Electrical Characteristics (Ta = 25°C, V_{SS} = 0 V, C_L = 50 pF)

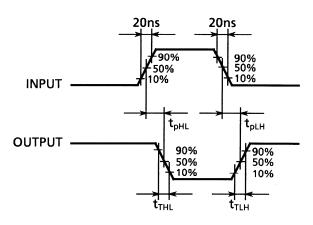
Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit	
Characteristics	Symbol		V _{DD} (V)	IVIIII	ιyp.	IVIAX	Offic
Output transition time	t _{TLH}	_	5	_	80	200	
			10	_	50	100	ns
(low to high)			15	_	40	80	
Output transition time	t _{THL}		5		80	200	
Output transition time		_	10	_	50	100	ns
(high to low)			15	_	40	80	
	t _{pLH} t _{pHL}		5		130	260	
Propagation delay time			10	_	60	120	ns
			15	_	40	80	
Input capacitance	C _{IN}		_	5	7.5	pF	

Circuit and Waveform for Measurement of Dynamic Characteristics

Circuit Waveform

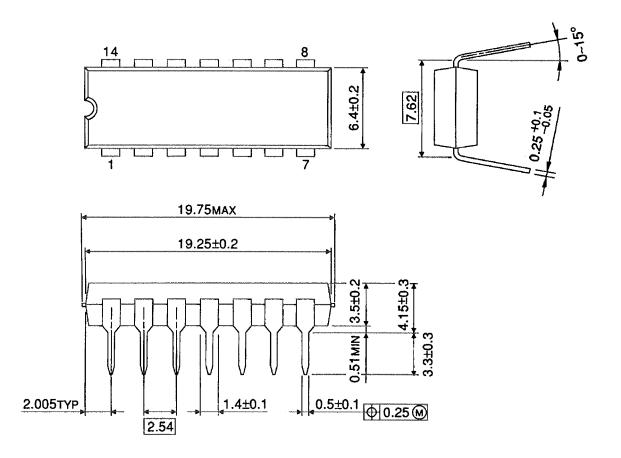


DUTY RATIO = 50%, f = 500kHz



Package Dimensions

DIP14-P-300-2.54 Unit: mm

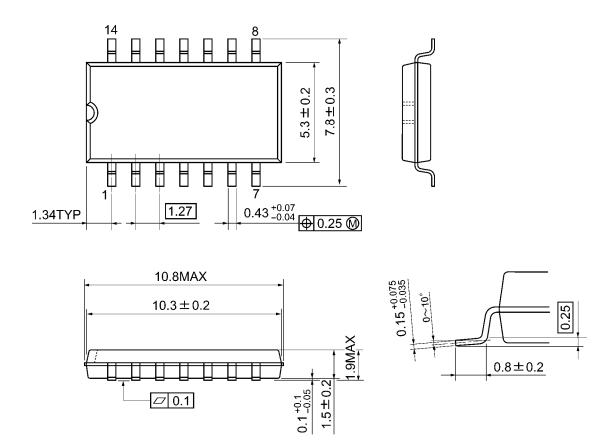


5

Weight: 0.96 g (typ.)

Package Dimensions

SOP14-P-300-1.27A Unit: mm



6

Weight: 0.18 g (typ.)

RESTRICTIONS ON PRODUCT USE

- Toshiba Corporation, and its subsidiaries and affiliates (collectively "TOSHIBA"), reserve the right to make changes to the information in this document, and related hardware, software and systems (collectively "Product") without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.
- PRODUCT IS NEITHER INTENDED NOR WARRANTED FOR USE IN EQUIPMENTS OR SYSTEMS THAT REQUIRE
 EXTRAORDINARILY HIGH LEVELS OF QUALITY AND/OR RELIABILITY, AND/OR A MALFUNCTION OR FAILURE OF WHICH
 MAY CAUSE LOSS OF HUMAN LIFE, BODILY INJURY, SERIOUS PROPERTY DAMAGE AND/OR SERIOUS PUBLIC IMPACT
 ("UNINTENDED USE"). Except for specific applications as expressly stated in this document, Unintended Use includes, without
 limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for
 automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions,
 safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. IF YOU USE
 PRODUCT FOR UNINTENDED USE, TOSHIBA ASSUMES NO LIABILITY FOR PRODUCT. For details, please contact your
 TOSHIBA sales representative.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any
 applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE
 FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY
 WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR
 LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND
 LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO
 SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS
 FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without
 limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile
 technology products (mass destruction weapons). Product and related software and technology may be controlled under the
 applicable export laws and regulations including, without limitation, the Japanese Foreign Exchange and Foreign Trade Law and the
 U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited
 except in compliance with all applicable export laws and regulations.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.
 Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. TOSHIBA ASSUMES NO LIABILITY FOR DAMAGES OR LOSSES
 OCCURRING AS A RESULT OF NONCOMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.