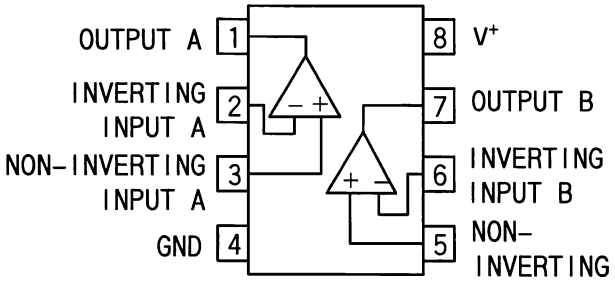
STRUCTURE SILICON MONOLITHIC INTEGRATED CIRCUIT

FUNCTION NOW SERIES GROUND SENSE DUAL COMPARATORS

PRODUCT SERIES **LM393MX**

FEATURES
- Operating temperature range 0[℃] to +70[℃] (commercial grade)
- Open collector output
- Wide operation voltage range
  Single supply +2[V] to +36[V]
  Dual supply ±1[V] to±18[V]
- Low input bias current 25[nA] Typ
- Low input offset current ±5[nA] Typ
- Low input offset voltage ±1[mV] Typ
- Common-mode input voltage range include ground
- Differential input voltage range equal to maximum rated supply voltage
- Low output saturation voltage 250[mV] at 4[mA]
- Output voltage compatible with TTL,DTL,ECL,MOS,CMOS

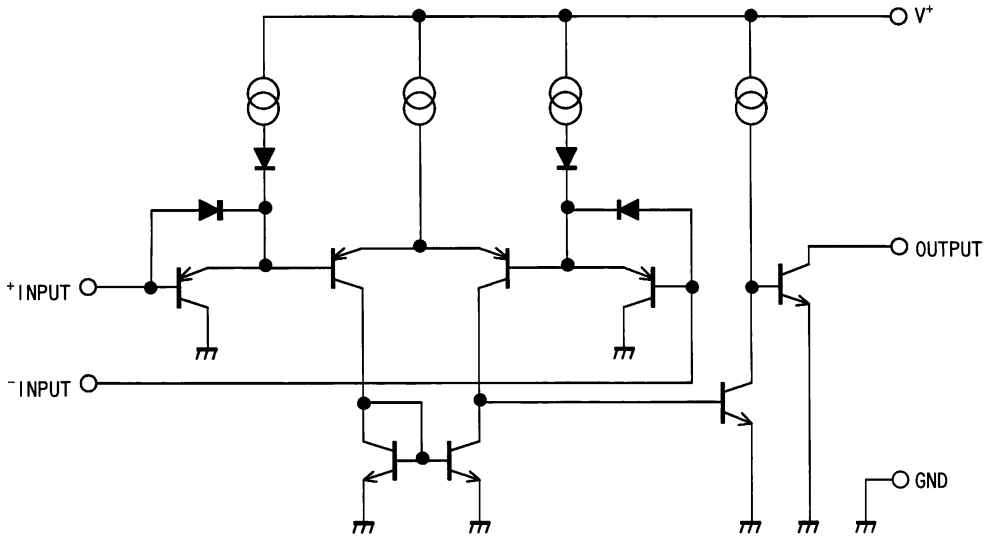
○BLOCK DIAGRAM



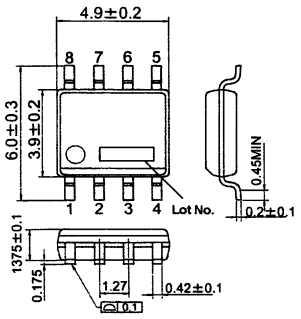
○PIN No. PIN NAME

PIN No.	PIN NAME
1	OUTPUT A
2	INVERTING INPUT A
3	NON-INVERTING INPUT A
4	GND
5	NON-INVERTING INPUT B
6	INVERTING INPUT B
7	OUTPUT B
8	V^+

○SCHEMATIC DIAGRAM(Each Comparator)



○PHYSICAL DIMENSIONS



This drawing is subject to change without notice.

LM393MX (S.O package8) (Unit:[mm])

○MAXIMUM RATINGS(Ta=25[℃])

Parameter	Symbol	Rating	Unit
Supply Voltage	$V^+ - GND$	+36	V
Power Dissipation	Pd	450(*1)(*2)	mW
Differential Input Voltage (*3)	VID	+36	V
Common-mode Input Voltage range	VCM	−0.3 to +36	V
Operating Temperature Range	Topr	0 to +70	℃
Storage Temperature Range	Tstg	−65 to +150	℃

(*1) To use at temperature above Ta=25[℃] reduce 3.60[mW]/[℃].
(*2) Mounted on a glass epoxy PCB(70[mm]×70[mm]×1.6[mm]).
(*3) The voltage difference between inverting input and non-inverting input is the differential input voltage.
Then input terminal voltage is set to more than GND terminal.

○OPERATING CONDITION (Ta=0[℃] to +70[℃])

Parameter	Symbol	Rating	Unit
Supply Voltage	V^+	+2.0 to +36.0 (Single Supply)	V
		±1.0 to ±18.0 (Dual Supply)	

○ELECTRIC CHARACTORE (Unless otherwise specified V^+=+5[V])

Parameter	Symbol	Temperature Range	Guaranteed Limit Min	Typ	Max	Unit	Condition
Input Offset Voltage (*4)	VIO	25℃	-	1	7	mV	V^+=5 to 30[V],VO=1.4[V],RS=0[Ω] VCM=0[V] to V^+-1.5[V]
		full range	-	-	9		
Input Bias Current (*4)	IIB	25℃	-	25	250	nA	IIN(+) or IIN(-) VCM=0[V]
		full range	-	-	400		
Input Offset Current (*4)	IIO	25℃	-	5	50	nA	IIN(+)-IIN(-),VCM=0[V]
		full range	-	-	150		
Common-mode Input Voltage Range	VCM	25℃	0	-	V^+-1.5	V	V^+=30[V]
		full range	0	-	V^+-2.0		
Supply Current	ICC	25℃	-	0.4	1	mA	RL=∞,V^+=5[V]
			-	1	2.5		RL=∞,V^+=36[V]
Large Signal Voltage Gain	AVD	25℃	25	200	-	V/mV	V^+=15[V],VO=1[V] to 11[V] RL≧15[kΩ]
Large Signal Response Time	tREL	25℃	-	300	-	ns	VIN=TTL logic swing, Vref=1.4[V] VRL=5[V],RL=5.1[kΩ]
Response Time	tRE	25℃		1.3	-	μs	VRL=5[V],RL=5.1[kΩ] VIN=100[mVp-p], Overdrive=5[mV]
Output Sink Current	ISINK	25℃	6	16	-	mA	VIN(-)=1[V],VIN(+)=0[V] VO≦1.5[V]
Saturation voltage	VOL	25℃	-	250	400	mV	VIN(-)=1[V],VIN(+)=0[V] ISINK≦4[mA]
		full range	-	-	700		
Output Leakage Current	Ileak	25℃	-	0.1	-	nA	VIN(-)=0[V],VIN(+)=1[V] VO=5[V]
		full range	-	-	1	μA	
Differential Input Voltage	VID	full range	-	-	36	V	Keep All Vin's≧0[V]

(*4) Absolute value

○APPLICATION EXAMPLE

(1) Absolute maximum ratings

Absolute maximum ratings are the values, which indicate the limits, within which the given voltage range can be safely charged to the terminal. However, it does not guarantee the circuit operation.

(2) The example of disabled circuit application

When there is a circuit not in use, it is recommended to make the non-inverting input terminal be the potential in the common-mode input voltage range like in Fig.1.

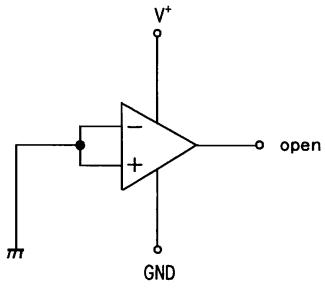


Fig.1 The example of disable circuit

(3) Applied voltage to the input terminal

Regardless of power supply voltage, GND+36 [V] can be applied to input terminals without deterioration or destruction of its characteristics. However, this does not guarantee a circuit operation. Note that circuits do not operate normally with input voltage not within input common mode voltage in terms of the electrical characteristics.

(4) Operating power supply (single power supply/dual power supply)

The Comparator operates if a given level of voltage is applied between V^+ and GND. Therefore, the Comparator can be operated under single power supply or dual power supply.

(5) Power dissipation (Pd)

If the IC is used under excessive power dissipation. An increase in the chip temperature will cause deterioration of the radical characteristics of IC.
For example, reduction of current capability. Take consideration of the effective power dissipation and thermal design with a sufficient margin. Pd is reference to the provided power dissipation curve.

(6) Short circuits between pins and incorrect mounting

Short circuits between pins and incorrect mounting when mounting the IC on a printed circuits board, take notice of the direction and positioning of the IC.
If IC is mounted erroneously, It may be damaged. Also, when a foreign object is inserted between output, between output and V^+ terminal or GND terminal which causes short circuit, the IC may be damaged.

(7) Output short circuit

If short circuit occurs between the output terminal and GND terminal, excessive in output current may flow and generate heat, causing destruction of the IC. Take due care.

(8) Using under strong electromagnetic field

Be careful when using the IC under strong electromagnetic field because it may malfunction.

(9) Usage of IC

When stress is applied to the IC through warp of the printed circuit board,
The characteristics may fluctuate due to the piezo effect.
Be careful of the warp of the printed circuit board.

(10) Testing IC on the set board

When testing IC on the set board, in cases where the capacitor is connected to the low impedance, make sure to discharge per fabrication because there is a possibility that IC may be damaged by stress.
When removing IC from the set board, it is essential to cut supply voltage.
As a countermeasure against the static electricity, observe proper grounding during fabrication process and take due care when carrying and storage it.

(11) Output terminal capacitor

Transistor in circuits may be damaged when V^+ terminal and GND terminal is shorted with the charged output terminal capacitor.
When IC is used as a comparator or as an application circuit, where oscillation is not activated by an output capacitor,the output capacitor must be kept below 10[μF] in order to prevent the damage mentioned above.

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Japan /
(Internal Sales)

Tokyo 2-1-1, Yaesu, Chuo-ku, Tokyo 104-0082
TEL : +81(3)5203-0321 FAX : +81(3)5203-0300

Yokohama 2-4-8, Shin Yokohama, Kohoku-ku, Yokohama, Kanagawa 222-8575
TEL : +81(45)476-2131 FAX : +81(45)476-2128

Nagoya Dainagayo Building 9F 3-28-12, Meieki, Nakamura-ku, Nagoya,Aichi 450-0002
TEL : +81(52)581-8521 FAX : +81(52)561-2173

Kyoto 579-32 Higashi Shiokouji-cho, Karasuma Nishi-iru, Shiokoujidori, Shimogyo-ku, Kyoto 600-8216
TEL : +81(75)311-2121 FAX : +81(75)314-6559

(Contact address for overseas customers in Japan)

Yokohama TEL : +81(45)476-9270 FAX : +81(045)476-9271

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