

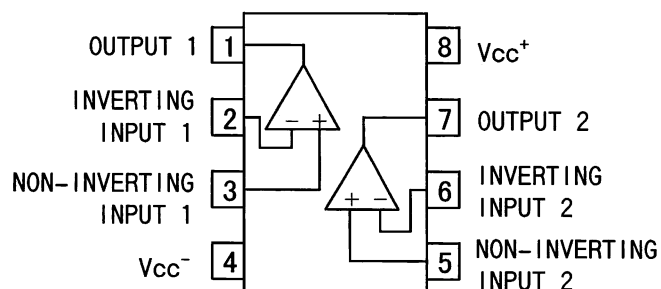
STRUCTURE SILICON MONOLITHIC INTEGRATED CIRCUIT

FUNCTION SIGNATURE SERIES GROUND SENSE DUAL COMPARATORS

PRODUCT SERIES **LM393DT LM393PT LM393ST**
LM393WDT LM393WPT

- FEATURES
- Operating temperature range 0[°C] to +70[°C] (Commercial grade)
 - Open collector output stage
 - Single supply or dual supply
 - Wide range of supply voltage
Single supply +2.0[V] to +36[V]
Dual supply ± 1.0 [V] to ± 18 [V]
 - Low supply current 0.4[mA] Typ
 - Low input bias current 25[nA] Typ
 - Low input offset current ± 5 [nA] Typ
 - Common-mode Voltage range includes ground
 - Low output saturation voltage 250[mV] ($I_O=4$ [mA])
 - Output compatible with TTL,MOS,CMOS

○BLOCK DIAGRAM

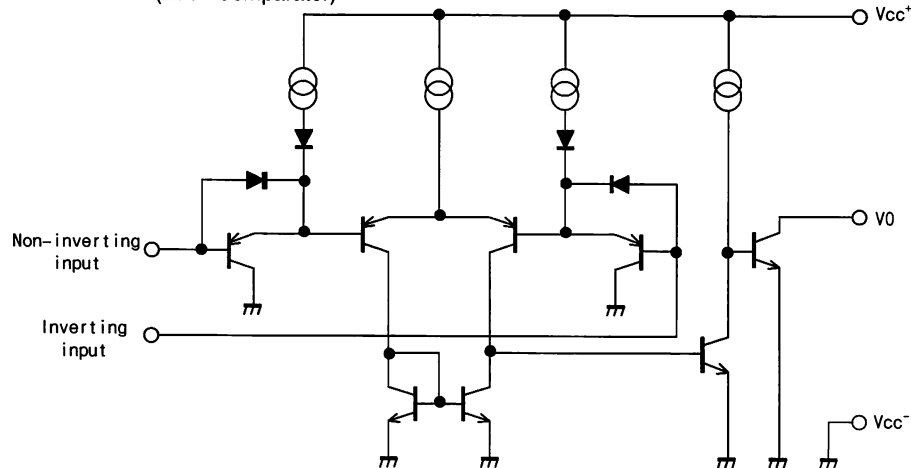


○PIN No. PIN NAME

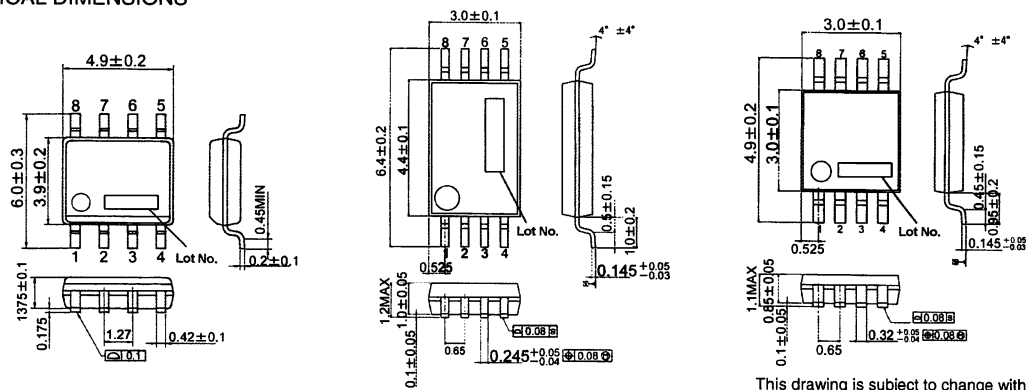
PIN No.	PIN NAME
1	OUTPUT 1
2	INVERTING INPUT 1
3	NON-INVERTING INPUT 1
4	Vcc ⁻
5	NON-INVERTING INPUT 2
6	INVERTING INPUT 2
7	OUTPUT 2
8	Vcc ⁺



○SCHEMATIC DIAGRAM(Each Comparator)



○PHYSICAL DIMENSIONS



This drawing is subject to change without notice.

LM393DT/WDT(SO package8) (Unit:[mm])

LM393PT/WPT (TSSOP8) (Unit:[mm])

LM393ST (Mini SO8)(Unit:[mm])

○MAXIMUM RATINGS (Ta=25[°C])

Parameter	Symbol	Rating	Unit
Supply Voltage	Vcc ⁺ — GND	+36	V
Power Dissipation	Pd	LM393DT/LM393WDT	450(*1)(*4) mW
		LM393PT/LM393WPT	500(*2)(*4) mW
		LM393ST	470(*3)(*4) mW
Differential Input Voltage (*5)	Vid	±36	V
Common-mode input voltage range	Vicm	−0.3 to +36	V
Operating Temperature Range	Topr	0 to +70	°C
Storage Temperature Range	Tstg	−65 to +150	°C
Maximum Junction Temperature	Tjmax	+150	°C

(*1) To use at temperature above Ta=25[°C] reduce 3.60[mW]/[°C].

(*2) To use at temperature above Ta=25[°C] reduce 4.00[mW]/[°C].

(*3) To use at temperature above Ta=25[°C] reduce 3.76[mW]/[°C].

(*4) Mounted on a glass epoxy PCB(70[mm]×70[mm]×1.6[mm]).

(*5) The voltage difference between inverting input and non-inverting input is the differential input voltage. Then input terminal voltage is set to more than Vcc[−].

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

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

○ELECTRIC CHARACTERISTICS (Unless otherwise specified $V_{CC}^+ = +5[V]$)

Parameter	Symbol	Temperature Range	Guaranteed Limit			Unit	Condition
			Min	Typ	Max		
Input Offset Voltage (*6)	V _{IO}	25°C	-	1	7	mV	$V_{CC}^+ = 5 \sim 30[V]$, $V_O = 1.4[V]$ $V_{ICM} = 0 \sim -1.5[V]$
		full range	-	-	9		
Input Offset Current (*6)	I _{IO}	25°C	-	5	50	nA	$V_O = 1.4[V]$
		full range	-	-	150		
Input Bias Current (*6)	I _{IB}	25°C	-	25	250	nA	$V_O = 1.4[V]$
		full range	-	-	400		
Large Signal Voltage Gain	AVD	25°C	25	200	-	V/mV	$V_{CC}^+ = 15[V]$, $V_O = 1$ to $11[V]$ $R_L = 15[k\Omega]$
Supply Current	I _{CC}	25°C	-	0.4	1	mA	$V_{CC}^+ = 5V$, no load
		full range	-	1	2.5		$V_{CC}^+ = 30[V]$, no load
Input Common-mode Voltage Range	V _{ICM}	25°C	-	-	$V_{CC}^+ - 1.5$	V	-
		full range	-	-	$V_{CC}^+ - 2.0$		
Differential Input Voltage	V _{ID}	25°C	-	-	V_{CC}^+	V	-
Low Level Output Voltage	V _{OL}	25°C	-	250	400	mV	$V_{ID} = -1[V]$, $I_{sink} = 4[mA]$
		full range	-	-	700		
High Level Output Current	I _{leak}	25°C	-	0.1	-	nA	$V_{CC}^+ = 30[V]$, $V_{ID} = 1[V]$ $V_O = 30[V]$
		full range	-	-	1	μA	
Output Sink Current	I _{sink}	25°C	6	16	-	mA	$V_{ID} = -1[V]$, $V_O = 1.5[V]$
Response Time	T _{re}	25°C	-	1.3	-	μs	$R_L = 5.1[k\Omega]$, $V_{CC}^+ = 5[V]$ $V_{IN} = 100[mVp-p]$, overdrive = $5[mV]$
Large Signal Response Time	T _{rel}		-	300	-	ns	

(*6) 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.

(3) Applied voltage to the input terminal

Regardless of power supply voltage, $V_{CC}^- + 36 [V]$ 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_{CC}^+ and V_{CC}^- . Therefore, the Comparator can be operated under single power supply or dual power supply.

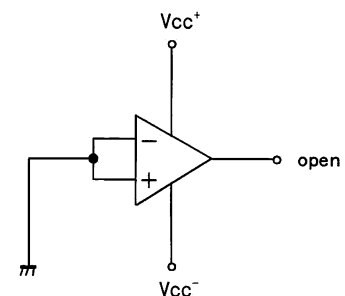


Fig.1 The example of disabled circuit

- (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_{cc}^{+} terminal or V_{cc}^{-} terminal which causes short circuit, the IC may be damaged.
- (7) Output short circuit
If short circuit occurs between the output terminal and V_{cc}^{-} 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_{cc}^{+} terminal and V_{cc}^{-} 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[μ F] in order to prevent the damage mentioned above.

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