



Bay Linear

Inspire the Linear Power

Low Power Low Offset Voltage Dual

Comparators

LM393

Description

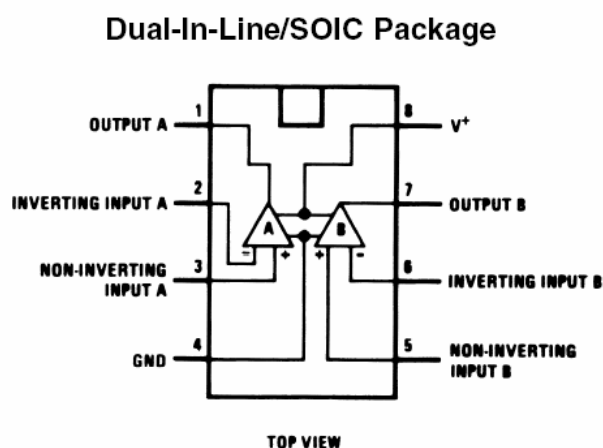
The LM393 consists of two independent precision voltage comparators with an offset voltage specification as low as 2.0 mV max for two comparators which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. These comparators also have a unique characteristic in that the input common-mode voltage range includes ground, even though operated from a single power supply voltage.

Application areas include limit comparators, simple analog to digital converters; pulse, squarewave and time delay generators; wide range VCO; MOS clock timers; multivibrators and high voltage digital logic gates. The LM393 was designed to directly interface with TTL and CMOS. When operated from both plus and minus power supplies, the LM393 will directly interface with MOS logic where their low power drain is a distinct advantage over standard comparators.

Features

- **Wide supply Voltage range: 2.0V to 36V**
Single or dual supplies: $\pm 1.0V$ to $\pm 18V$
- **Very low supply current drain (0.4 mA)**
independent of supply voltage
- **Low input biasing current: 25 nA**
- **Low input offset current: ± 5 nA**
- **Maximum offset voltage: ± 3 mV**
- **Input common- mode voltage range includes ground**
- **Differential input voltage range equal to the power supply voltage**
- **Low output saturation voltage, : 250 mV at 4 mA**
- **Output voltage compatible with TTL, DTL, ECL, MOS and CMOS logic systems**

Pin Connection



Ordering Information

Devices	Package	Temp.
LM393M	SO-8	0 °C to 70 °C
LM393P	8-DIP	0 °C to 70 °C

Absolute Maximum Rating

Parameter	LM393	Unit
Supply Voltage	36	V
Differential Input Voltage	36	V
Input Voltage	-0.3 to 36	V
Input Current	50	mA
Storage Temperature	0 to 70	°C
Lead Temperature (solder 10 Second)	260	°C
ESD	250	V

Electrical Characteristics

($V_{CC} = 5V$; $T_J = 25^\circ C$, unless otherwise specified)

PARAMETER	TEST CONDITIONS*		MIN	TYP	MAX	UNIT
V_{IO} Input offset voltage	$V_{CC} = 5V \text{ to } 30V$, $V_{IC} = V_{ICR \text{ min}}$, $V_O = 1.4V$	25 °C		2	5	mV
		Full range			9	
I_{IO} Input offset current	$V_O = 1.4V$	25 °C		5	50	nA
		Full range			150	
I_{IB} Input bias current	$V_O = 1.4V$	25 °C		-25	-250	nA
		Full range			-400	
V_{ICR} Common-mode input voltage range**		25 °C	0 to $V_{CC} - 1.5$			V
		Full range	0 to $V_{CC} - 2$			
A_{VD} Large-signal differential voltage amplification	$V_{CC} = 15V$, $V_O = 1.4V \text{ to } 11.4V$, $R_L \geq 15 \text{ k}\Omega \text{ to } V_{CC}$	25 °C	50	200		V/mV
I_{OH} High-level output current	$V_{OH} = 5V$, $V_{ID} = 1V$,	25 °C		0.1	50	nA
	$V_{OH} = 30V$, $V_{ID} = 1V$	Full range			1	μA
V_{OL} Low-level output voltage	$I_{OL} = 4 \text{ mA}$, $V_{ID} = -1V$	25 °C		150	400	mV
		Full range			700	
I_{OL} Low-level output current	$V_{OL} = 1.5V$, $V_{ID} = -1V$	25 °C	6			mA
I_{CC} Supply current	$R_L = \infty$	$V_{CC} = 5V$	25 °C	0.8	1	mA
		$V_{CC} = 30V$	Full range		2.5	

* Full range (MIN to MAX), for the LM393 is 0 °C to 70 °C. All characteristics are measured with zero common-mode input voltage unless otherwise specified.

** The voltage at either input or common-mode should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is $V_{CC} - 1.5V$, but either or both inputs can go to 30V without damage.

switching characteristics, $V_{CC} = 5V$, $T_A = 25^\circ C$

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Response time	R_L connected to 5V through 5.1 k Ω , $C_L = 15\text{pF}$ * (See Note 1)	100-mV input step with 5-mV overdrive		1.3		μs
		TTL-level input step		0.3		

* C_L includes probe and jig capacitance.

NOTE 1: The response time specified is the interval between the input step function and the instant when the output crosses 1.4V.

Advance Information- These data sheets contain descriptions of products that are in development. The specifications are based on the engineering calculations, computer simulations and/ or initial prototype evaluation.

Preliminary Information- These data sheets contain minimum and maximum specifications that are based on the initial device characterizations. These limits are subject to change upon the completion of the full characterization over the specified temperature and supply voltage ranges.

The application circuit examples are only to explain the representative applications of the devices and are not intended to guarantee any circuit design or permit any industrial property right to other rights to execute. Bay Linear takes no responsibility for any problems related to any industrial property right resulting from the use of the contents shown in the data book. Typical parameters can and do vary in different applications. Customer's technical experts must validate all operating parameters including "Typical" for each customer application.

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