LM393
voltage comparators

Description

The LM393 consists of two independent voltage comparators. These 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. The outputs can be connected to other open-collector outputs to achieve wired-AND relationships.

Features

Wide supply voltage range

Low supply current drain independent of supply voltage. Low input biasing current

Low input offset current

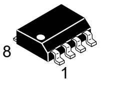
Low input offset voltage

Input common-mode voltage range includes GND

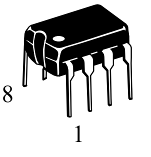
Differential input voltage range equal to the power supply voltage

Low output saturation voltage

Output voltage compatible with TTL, MOS and CMOS logic



SOP-8



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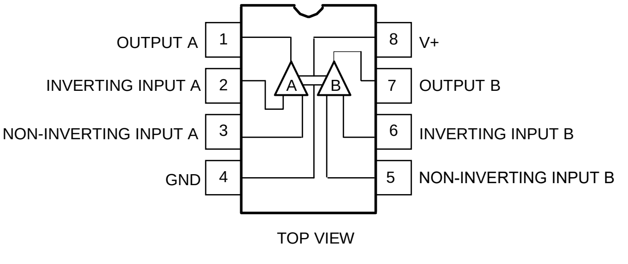
Package

Internal Block Digram



Absolute Maximum Ratings

PARAMETER	SYMBOL	RATINGS	UNITS
Supply Voltage	V_{CC}	±18 or 36	V
Differential Input Voltage	$V_{I(DIFF)}$	36	V
Common-mode Input Voltage	V_{ICR}	-0.3 ~ +36	V
Power Dissipation	P_D	570	mW
Operating Temperature Range	T_{OPR}	-20 ~ +70	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

Electrical Characteristics

at specified free-air temperature, Vcc = 5 V (unless otherwise noted)

Symbol	Parameter	Test conditions*			LM393 Min	LM393 Typ	LM393 Max	Units
V_{IO}	Input offset voltage	Vcc = 5 V to 30V, $V_{IC} = V_{ICR}$ min, Vo=1.4 V		25 °C		1	5	mV
				Full range			9	
I_{IO}	Input offset current	Vo=1.4 V		25 °C		5	50	nA
				Full range			150	
I_{IB}	Input bias current	Vo=1.4 V		25 °C		25	250	nA
				Full range			400	
V_{ICR}	Common-mode input voltage range**			25° C	0		Vcc-1.5	V
				Full range	0		Vcc - 2	
A_{VD}	Large-signal differential voltage amplification	Vcc = 15 V, Vo=1.4V to 11.4 V, $R_L \geq 15$ kΩ to Vcc		25 °C	50	200		V/mV
I_{OH}	High-level output current	V_{OH}=5 V, 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 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	16		mA
I_{CC}	Supply current	$R_L = \infty$	V_{CC} = 5V	25 °C		0.4	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 Charactristics

Vcc=5V, T_A=25 °C

Parameter	Test conditions		Min	Typ	Max	Units
Response time	R_L connected to 5V through 5.1 kΩ, C_L=15pF* (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.

Typical Applications Circuit

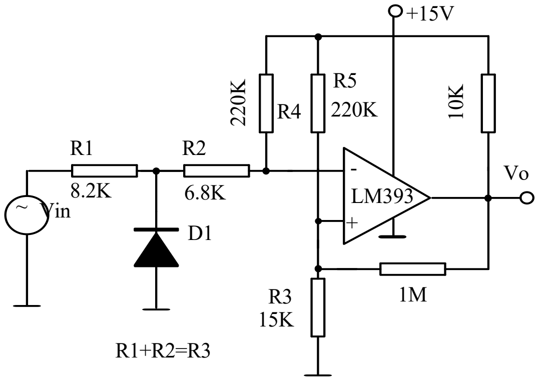


Figure1.Zero Crossing Detector (Single Supply)

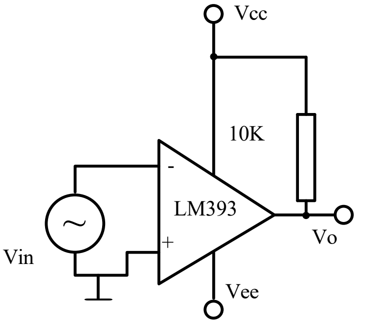


Figure2.Zero Crossing Detector (Split Supply)

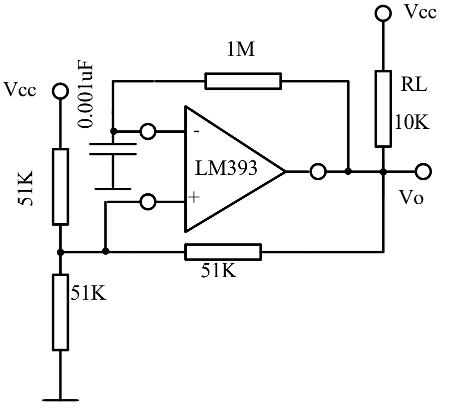


Figure3.Free-running Square- wave Oscillator

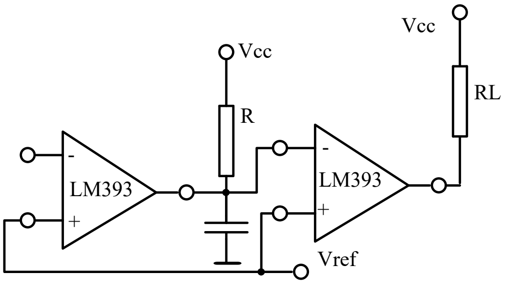


Figure4.Time Delay Generator