LM393

Dual Differential comparator

Description

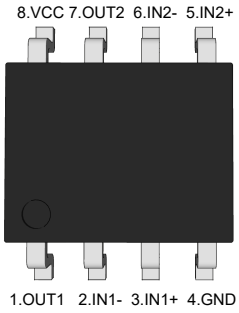
The LM393 consists of two independent and accurate voltage comparators with offset voltage is no more than 2.0mV. It can work under single power supply or dual power supply, and the magnitude of current is not affected by the magnitude of the power supply voltage. a unique feature of these comparators is that the input common-mode voltage range can reach zero level even when operating on a single power supply.It's mostly used in consumer and industrial electronic products.

Features

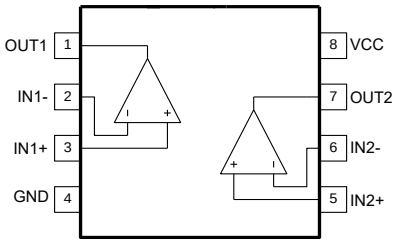
- Wide Power Supply Range:
  Single Supply: 2V ~ 36V; Dual Supplies: ±1V ~±18V
- Power Current: 0.8mA (Independent of The Supply Voltage)
- Low Input Bias Current: 25nA
- Low Input Offset Current: 5nA
- Low Input Offset Voltage: 5mV(Max.)
- Differential Input Voltage Range Equal to the Power Supply Voltage
- Output Voltage Compatible with TTL, DTL, ECL, MOS and CMOS
- Available in SOP-8 Package.

Pin Distribution

SOP-8



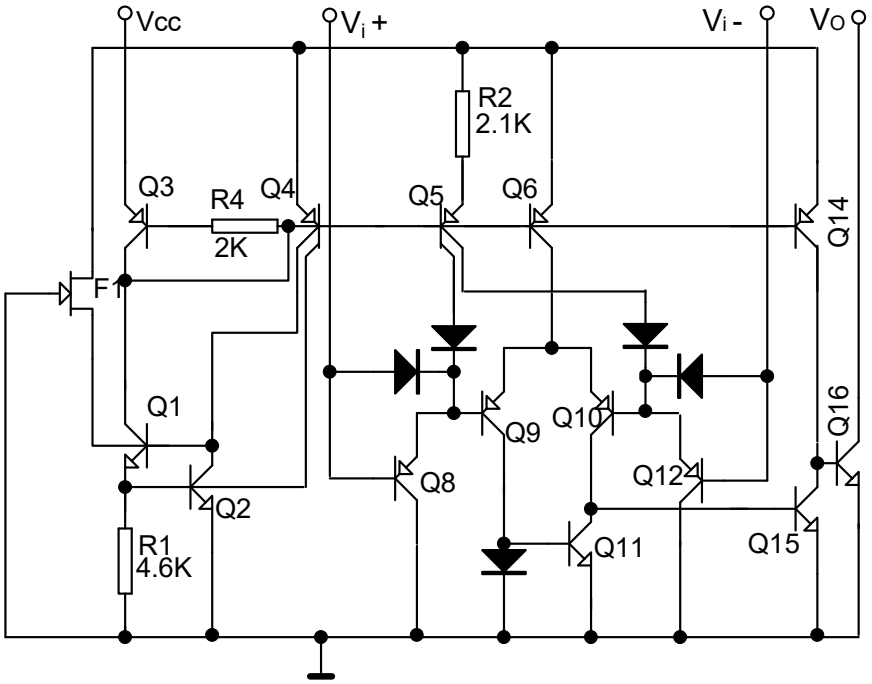
(Top View)



Pin Function

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	OUT1	The output of the first comparator	5	IN2+	The non-inverting intput of the second comparator
2	IN1-	The inverting intput of the first comparator	6	IN2-	The inverting intput of the second comparator
3	IN1+	The non-inverting intput of the first comparator	7	OUT2	The output of the second comparator
4	GND	ground	8	VCC	the power supply

Block Diagram



Absolute Maximum Ratings (at T_A = 25°C)

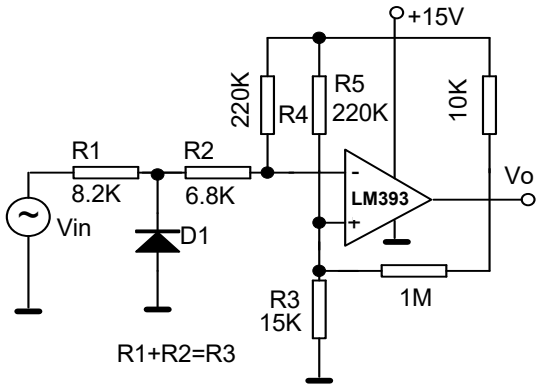
Parameter		Symbol	Value	Unit
Supply Voltage	Single	V_{CC}	36	V
	Dual		±18	
Differential Input Voltage		$V_{I(DIFF)}$	36	V
Common-mode Input Voltage		V_{ICR}	-0.3~36	V
Short-circuit Output Current to Ground		I_{OG}	20	mA
Maximum Power Dissipation		P_D	270	mW
Junction Temperature		T_J	125	°C
Operating Ambient Temperature Range		T_{OPR}	0~70	°C
Storage Temperature Range		T_{STG}	-65~150	°C

Electrical Characteristics

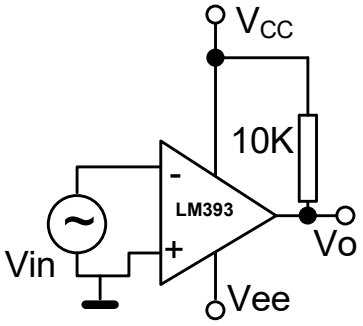
T_J = 25°C, V_{CC}=5V, unless otherwise noted

Parameter	Symbol	Conditions		Value			Unit
				Min.	Typ.	Max.	
Input Offset Voltage	V_{IO}	Ta=25°C		--	±1	±5	mV
		0°C≤ Ta ≤70°C		--	--	±9	
Input Offset Current	I_{IO}	Ta=25°C		--	±5	±50	nA
		0°C≤ Ta ≤70°C		--	--	±150	
Low Input Bias Current	I_{IB}	Ta=25°C		--	25	250	nA
		0°C≤ Ta ≤70°C		--	--	400	
Common-Mode Input Voltage Rang	V_{ICR}	Ta=25°C		0	--	V_{CC}-1.5	V
		0°C≤ Ta ≤70°C		0	--	V_{CC}-2	
Large-Signal Differential Voltage Amplification	A_{VD}	R_L≥15KΩ, V_{CC}=15V		50	200	--	V/mV
Sink Current	I_{SINK}	$V_{IN(-)}$ ≥1V, $V_{IN(+)}$= 0V, V_O ≤1.5V		6	16	--	mA
Output Saturation Voltage	V_{SAT}	$V_{IN(-)}$ ≥1V, $V_{IN(+)}$= 0V, I_{SINK} ≤4mA		--	150	400	mV
		$V_{IN(-)}$ ≥1V, $V_{IN(+)}$= 0V, I_{SINK} ≤4mA 0°C≤ Ta ≤70°C		--	--	700	
Low-Level Output Current	I_{OL}	$V_{IN(+)}$ ≥1V, $V_{IN(-)}$= 0V, V_O=5V		--	0.1	--	nA
		$V_{IN(+)}$ ≥1V, $V_{IN(-)}$= 0V, V_O=30V 0°C≤ Ta ≤70°C		--	--	1000	
Supply Current	I_{CC}	R_L=∞		--	0.4	1	mA
		R_L=∞, V_{CC}=30V		--	--	2.5	
Propagation Delay H to L	T_{PHL}	V_S=5V	RPU=5.1KΩ Overdrive=10mV	--	2.45	--	μs
			RPU=5.1KΩ Overdrive=100mV	--	2.43	--	
		V_S=36V	RPU=5.1KΩ Overdrive=10mV	--	2.46	--	
			RPU=5.1KΩ Overdrive=100mV	--	2.30	--	
Propagation Delay L to H	T_{PLH}	V_S=5V	RPU=5.1KΩ Overdrive=10mV	--	2.37	--	μs
			RPU=5.1KΩ Overdrive=100mV	--	2.34	--	
		V_S=36V	RPU=5.1KΩ Overdrive=10mV	--	2.46	--	
			RPU=5.1KΩ Overdrive=100mV	--	2.44	--	

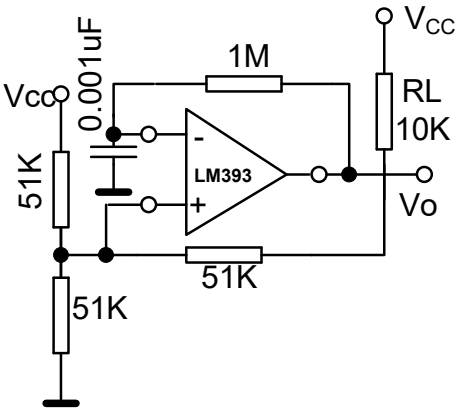
Typical Application Circuit



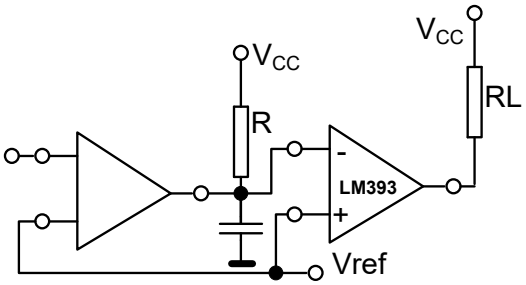
Zero Crossing Detector (Single Supply)



Zero Crossing Detector (Dual Supply)



Free-running Square- wave Oscillator



Time Delay Generator

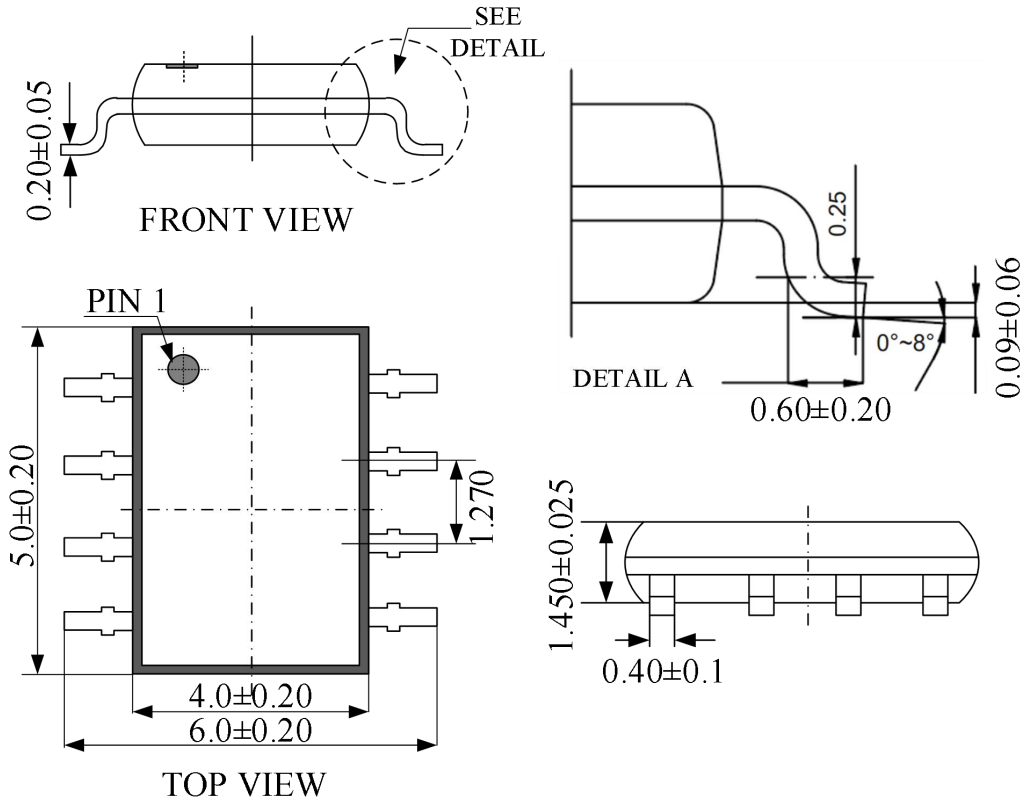
Operation instruction

The LM393 is a high-gain, wide-band device. Like most comparators, if there is parasitic capacitance from output to input, it is easy to produce oscillations. This phenomenon only appears in the gap of output voltage transition when the comparator changes state.Power plus bypass filtering does not solve this problem. Standard PC board designs are helpful in reducing parasitic capacitive coupling between input and output.Reducing the input resistance to less than 10KΩ will reduce the feedback signal, and increasing even a small amount of positive feedback (hysteroses of 1.0 to 10mV) can lead to rapid conversions that make oscillations due to parasitic capacitance impossible.Unless hysteresis is utilized, inserting the IC directly and applying a resistor to the pin will cause the input-output to oscillate over a very short conversion period. If the input signal is a pulse waveform and the rise and fall time is fairly fast, hysteresis will not be required.All unused pins of the comparator must be grounded.

The LM393 bias network establishes that its static current is independent of the supply voltage range of 20 to 30V.Generally the power supply does not require bypass capacitors and the differential input voltage can be greater than VCC without damaging the device.The guard must be able to prevent the input voltage from exceeding -0.3V towards the negative end.

The output part of the LM393 is an open-collector, emitter grounded NPN output transistor, which can be provided or function with multi-collector output.The output load resistor can be connected to any supply voltage within the allowable supply voltage range, regardless of the VCC terminal voltage value.This output can be used as a simple SPS open circuit to the ground (when no load resistor is applied), and the trap current of the output part is limited by the possible driver and device B-values.When the limit current (16mA) is reached, the output transistor will exit and the output voltage will rise quickly.The output saturation voltage is limited by the output transistor's γ SAT of about 60Ω When the load current is low, the low offset voltage of the output transistor (about 1.0mV) allows the output box position to be at zero level.

Outline Drawing – SOP-8(Dimensions in mm)



Package Information

Package Type	Description	Quantity（pcs）	Standard
SOP-8	Reel -13″ tape	4000	EIA-481

Contact Information

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For additional information, please contact your local Sales Representative.

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