Low power dual voltage comparators

Descriptions

- LM393 is an integrated circuit comprising two independent, high-precision voltage comparators, characterized by low offset voltage, with a maximum of 2.0mV. It is designed to operate over a wide voltage range with single-supply voltage, though it can also function with dual-supply voltage configurations. Moreover, it maintains low power consumption regardless of the supply voltage magnitude. One of its distinctive features is its ability to operate with a single-supply voltage, with the common-mode input voltage range of the comparators approaching ground level.

- The main applications of the LM393 include limiters, simple analog-to-digital converters, pulse generators, square wave generators, delay generators, wideband voltage-controlled oscillators, MOS clock timers, multi-frequency oscillators, and high-level digital logic gate circuits. The LM393 is designed for direct connection to TTL and CMOS logic circuits. When powered by dual supplies, it is compatible with MOS logic circuits—highlighting a unique advantage of the low-power LM393 over standard comparators.

Advantages

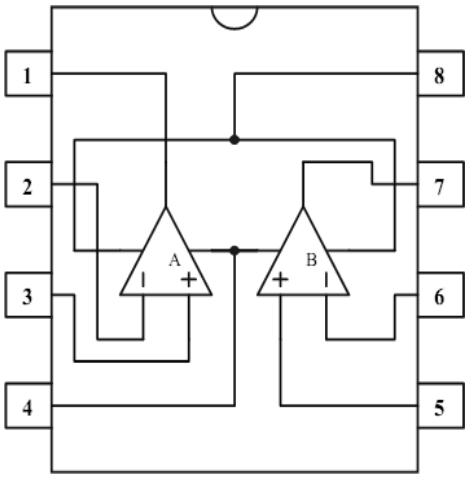
- High-precision comparator;
- Minimizes offset voltage drift caused by temperature variations;
- Operates with single-supply voltage;
- Input common-mode voltage range approaches ground level;
- Compatible with logic circuits.

Features

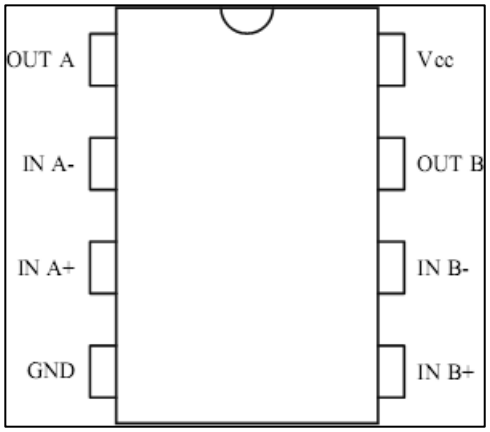
- Wide supply voltage range: Single supply: 2.0V to 36V
- Dual supply: ±1.0V to ±18V
- Low supply current consumption (0.4mA)
- Low input bias current: 25nA
- Low input offset current: ±5nA
- Maximum input offset voltage: ±3mV
- Input common-mode voltage range approaches ground level
- Differential input voltage range equals the supply voltage
- Low output saturation voltage: 250mV @ 4mA
- Output levels compatible with TTL, DTL, ECL, MOS, and CMOS logic systems

Device Marking and Package Information		
Device	**Package**	**Marking**
LM393	SOP-8	LM393
LM393P	DIP-8	LM393P

Pin Functions Diagram



Pin Configuration (top view)



Pin Number	Pin Name	Description
1	OUT A	output A
2	IN A-	Inverting input A
3	IN A+	Non inverting input A
4	GND	ground
5	IN B+	Non inverting input B
6	IN B-	Inverting input B
7	OUT B	input B
8	V_{CC}	power supply voltage

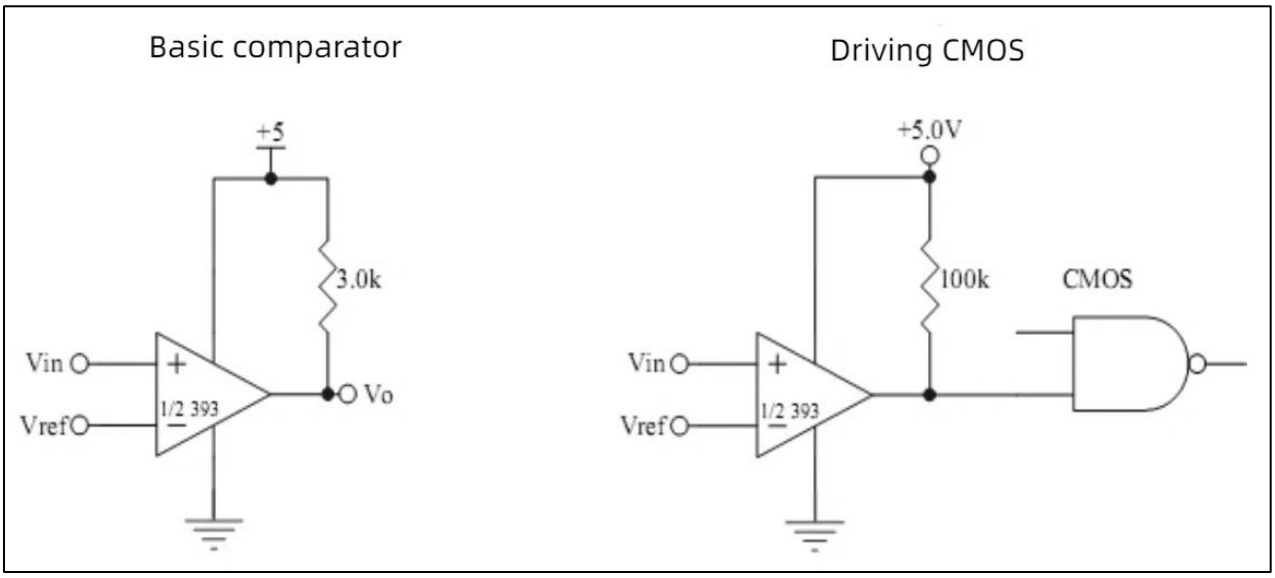
Absolute maximum ratings (unless otherwise specified, parameters are measured at T_A = 25°C)

Symbol	Parameter		Value		Unit
			Min	Max	
V_{CC}	supply voltage	single supply		36	V
		dual supply		±18	V
V_{IDR}	differential input voltage			36	V
V_{IN}	common-mode input voltage		-0.3	36	V
I_{IN}	input current			50	mA
P_D	power consumption	DIP packing		780	mW
		SOP 8		660	
T_{AMB}	operating ambient temperature		0	70	℃
T_{STG}	storage temperature		-65	150	℃

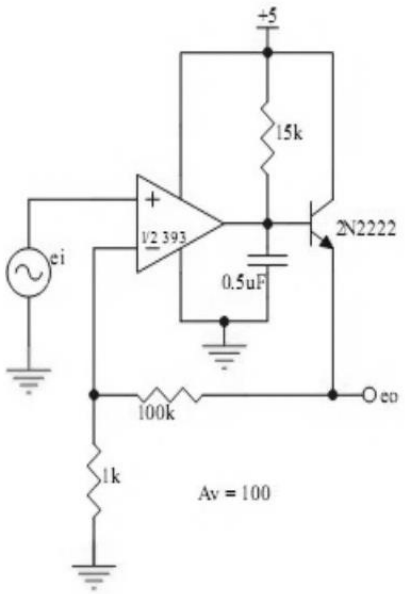
Electrical characteristics (unless otherwise specified, parameters are measured at T_A = 25°C)

Symbol	Parameter	Text condition	Min	Typ	Max	Unit
V_{IO}	input offset voltage	0℃≤T_a≤70℃		0.8	5.0	mV
					9.0	
I_{IO}	input offset voltage drift	0℃≤T_a≤70℃		2.3	50	nA
					150	
I_{IB}	input bias current	0℃≤T_a≤70℃		4.2	250	nA
					400	
V_{ICR}	input common-mode voltage range	0℃≤T_a≤70℃	0		V_{CC}-1.5	V
			0		V_{CC}-2.0	
I_{CC}	supply current	R_L=∞,V_{cc}=5V		0.59	1.0	mA
		R_L=∞,V_{cc}=36V		0.67	2.5	
G_V	Voltage gain	R_L≥15KΩ,V_{CC}=15V	50	200		V/mV
T_{RES}	Large signal response time	V_{IN}=TTL logic swing, V_{REF}=1.4V,V_{RL}=5V,R_L=5.1KΩ		300		nS
T_{RES}	Response time	V_{RL}=5V,R_L=5.1KΩ		1.3		us
I_{SINK}	Output sink current	V_{IN}(-)=1V,V_{IN}(+)=0，V_O≤1.5V	6.0	43.7		mA
V_{SAT}	Output saturation voltage	V_{IN}(-)=1V, V_{IN}(+)=0， I_{SINK}≤ 4.0mA		47.3	400	mV
		V_{IN}(-)=1V, V_{IN}(+)=0， I_{SINK}≤ 4.0mA，0℃≤T_a≤70℃			700	
I_{OL}	Output leakage current	V_{IN}+=1.0V，V_{IN}-=0V，V_O=5V		0.1		nA
		V_{IN}+=1.0V，V_{IN}-=0V，V_O=30V，0≤T_a≤70℃			1000	
V_{ID}	Differential input voltage				36	V

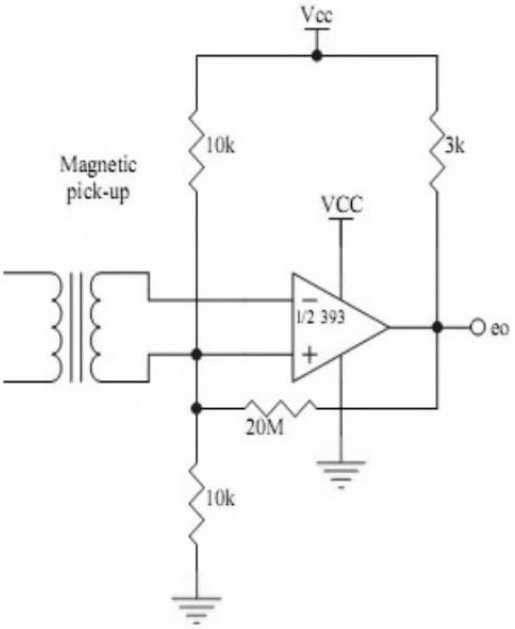
Circuit diagram



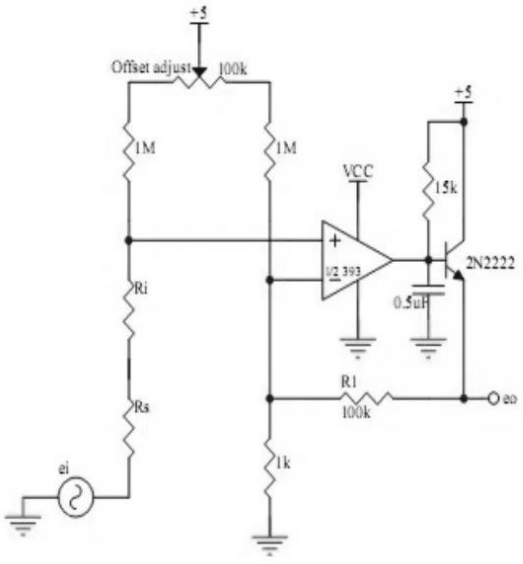
Low-frequency operational amplifier



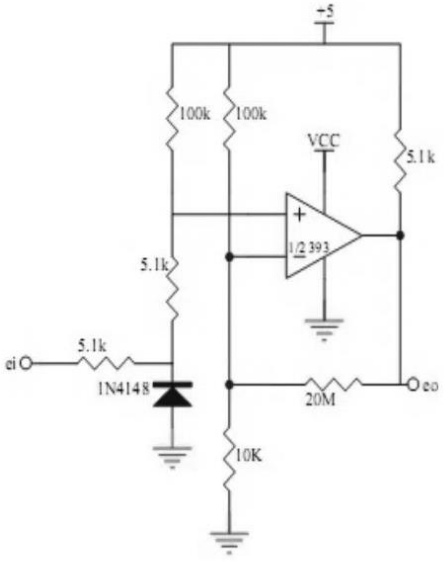
Transducer amplifier



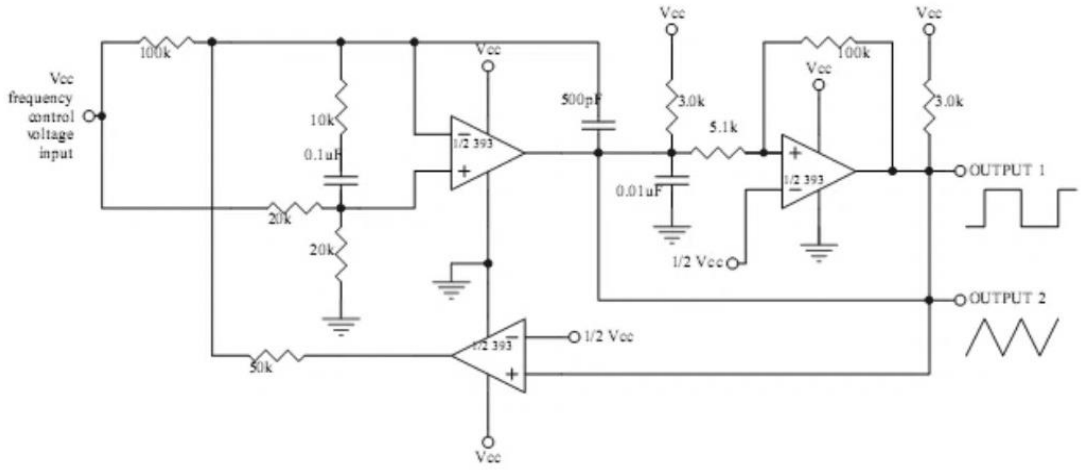
Low-frequency operational amplifier with offset adjustment



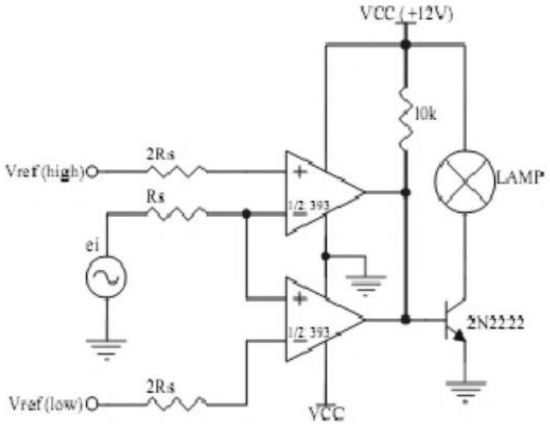
Zero-crossing detector (single-supply)



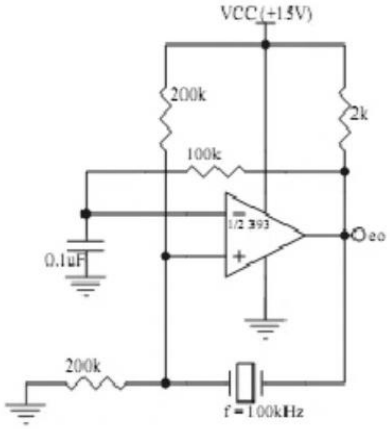
Two-stage high-frequency voltage-controlled oscillator



Limit comparator

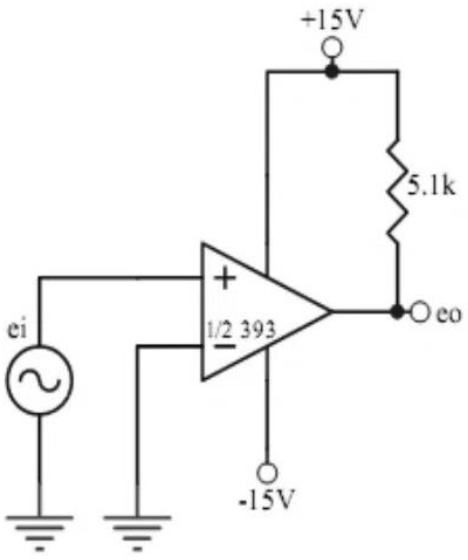


Crystal-controlled oscillator

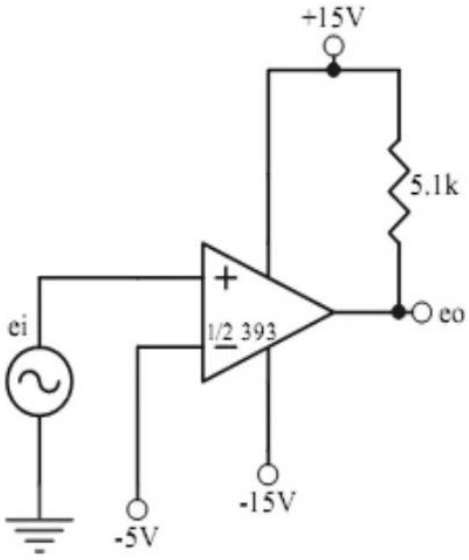


Dual supply application

Zero-crossing detector

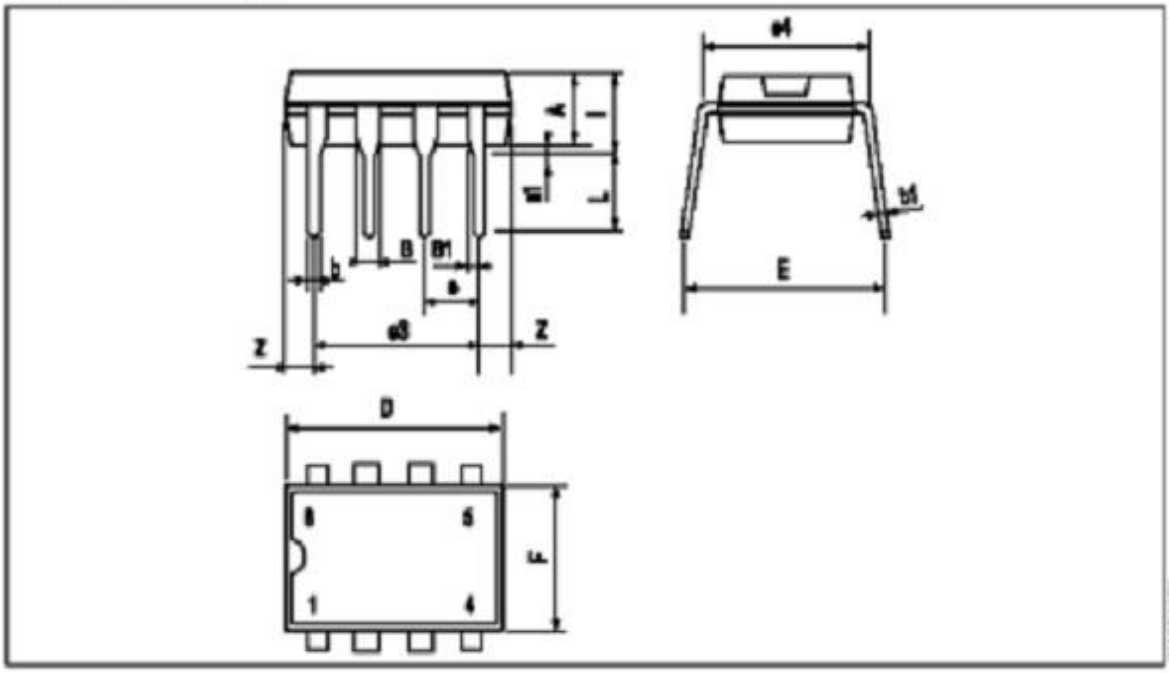


Comparator with negative reference voltage



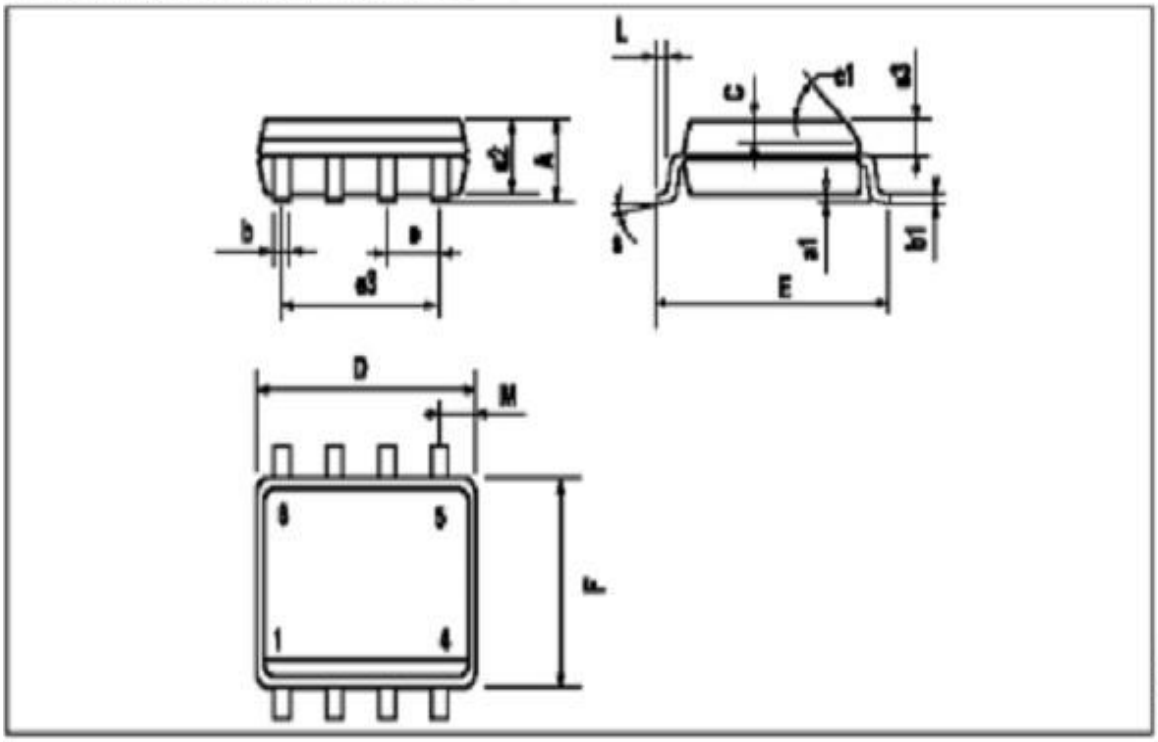
Package dimensions and outline drawing

8 PINS - PLASTIC DIP



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0260
I			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060

8 PINS - PLASTIC MICROPACKAGE SOP



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45° (typ.)					
D	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.150		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max.)					