



Low Power Dual Voltage Comparators

LM393

General Description

The LM393 series consists of two independent precision voltage comparators with an offset voltage specification as low as 2mV. It can operate from a single supply or dual supply, and its current is not affected by the magnitude of the 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.

The LM393 series are available in 2 Packages:
DIP-8 and SOP-8.

Features

- Wide Supply Voltage Range
 - Single Supply: 2.0V to 36V
 - Dual Supplies: $\pm 1.0V$ to $\pm 18V$
- Very Low Supply Current Drain: 0.8mA
 - Independent of Supply Voltage
- Low Input Bias Current: 25nA (Typical)
- Low Input Offset Current: $\pm 5nA$ (Typical)
- Low Input Offset Voltage: $\pm 5mV$ (Typical)
- Differential input voltage range equal to the supply voltage
- TTL, DTL, ECL, MOS, CMOS compatible outputs

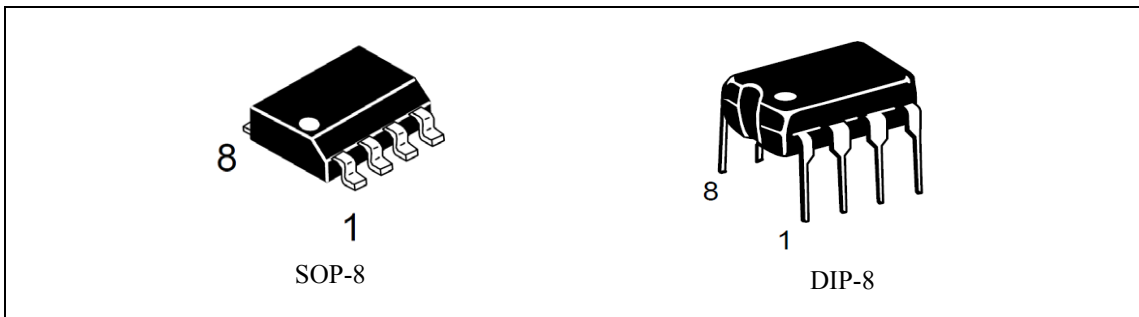


Figure 1. Package Types of LM393

Pin Configuration

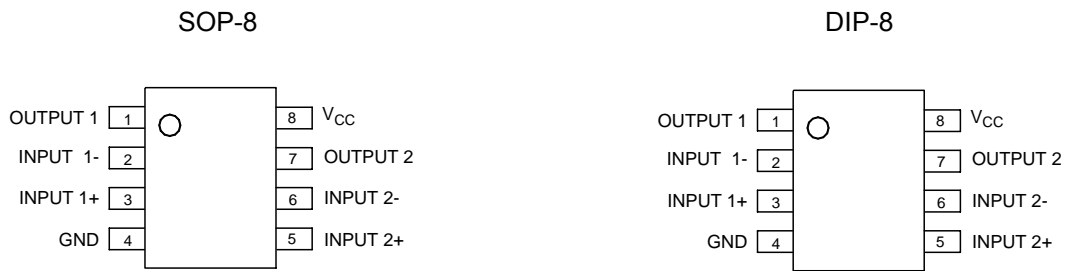


Figure 2. Pin Configuration of LM393 (Top View)

Functional Block Diagram

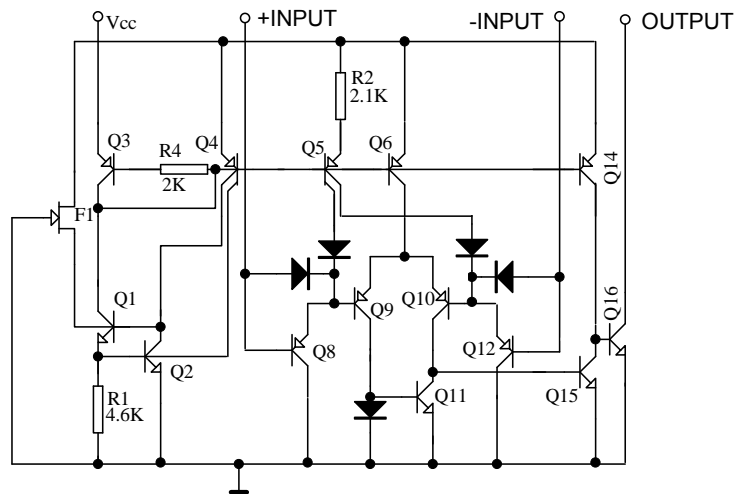


Figure 3. Functional Block Diagram of LM393
(Each Comparator)

LM393 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC}	±18	V
		36	
Differential Input Voltage	V_{IDR}	36	V
Input Common Mode Voltage	V_{ICR}	-0.3 to 36	V
Output short circuit current to ground	I_{OG}	20	mA
Power Dissipation ($T_A=25^\circ\text{C}$)	P_D	570	mW
Operating Junction Temperature	T_J	125	$^\circ\text{C}$
Storage Temperature Range	T_{STG}	-65 to 150	$^\circ\text{C}$
Operating Temperature Range	T_A	0 to 70	$^\circ\text{C}$

Electrical Characteristics

$V_{CC}=5\text{V}$, $T_A=25^\circ\text{C}$, unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Unit
Input Offset Voltage	$T_A=25^\circ\text{C}$		±3.0	±5.0	mV
	$0^\circ\text{C}\leq T_A\leq 70^\circ\text{C}$			±5.0	
Input Bias Current	$T_A=25^\circ\text{C}$		25	250	nA
	$0^\circ\text{C}\leq T_A\leq 70^\circ\text{C}$			400	
Input Offset Current	$T_A=25^\circ\text{C}$		±5.0	±50	nA
	$0^\circ\text{C}\leq T_A\leq 70^\circ\text{C}$			±150	
Input Common Mode Voltage Range	$T_A=25^\circ\text{C}$	0		$V_{CC}-1.5$	V
	$0^\circ\text{C}\leq T_A\leq 70^\circ\text{C}$	0		$V_{CC}-2.0$	
Supply Current	$R_L=\infty$, $V_{CC}=5\text{V}$		0.4	1.0	mA
	$R_L=\infty$, $V_{CC}=30\text{V}$			2.5	
Voltage Gain	$R_L\geq 15\text{k}\Omega$, $V_{CC}=15\text{V}$	50	200		V/mV
Large Signal Response Time	$V_{IN}=\text{TTL logic swing}$, $V_{REF}=1.4\text{V}$, $V_{RL}=5\text{V}$, $R_L=5.1\text{k}\Omega$		300		ns
Response Time	$V_{RL}=5\text{V}$, $R_L=5.1\text{k}\Omega$		1.3		μs
Differential Input Voltage				V_{CC}	V
Output Sink Current	$V_{IN^-}\geq 1\text{V}$, $V_{IN^+}=0$, $V_O\leq 1.5\text{V}$	6.0	16		mA
Saturation Voltage	$V_{IN^-}\geq 1\text{V}$, $V_{IN^+}=0$, $I_{SINK}\leq 4\text{mA}$		150	400	mV
	$V_{IN^-}\geq 1\text{V}$, $V_{IN^+}=0$, $I_{SINK}\leq 4\text{mA}$ $0^\circ\text{C}\leq T_A\leq 70^\circ\text{C}$			700	
Output Leakage Current	$V_{IN^-}\geq 0$, $V_{IN^+}=1\text{V}$, $V_O=5\text{V}$		0.1		nA
	$V_{IN^-}\geq 0$, $V_{IN^+}=1\text{V}$, $V_O=5\text{V}$ $0^\circ\text{C}\leq T_A\leq 70^\circ\text{C}$			1000	

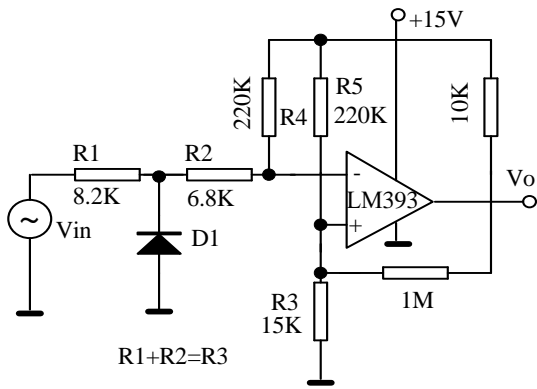


Figure 9. Zero crossing detector (single power supply)

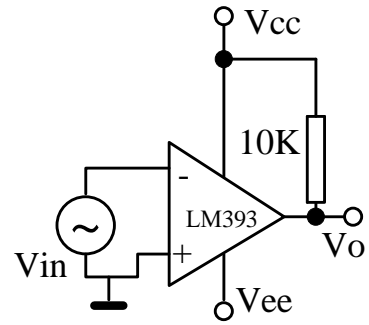


Figure 9. Zero crossing detector (dual power supply)

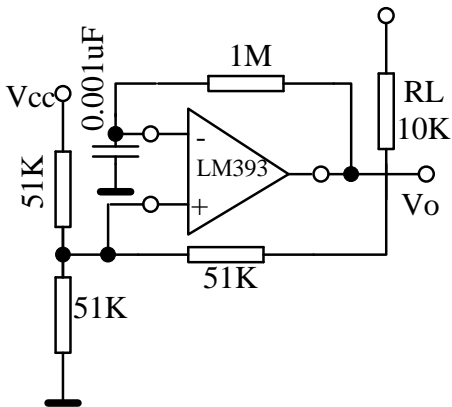


Figure 11. Squarewave oscillator

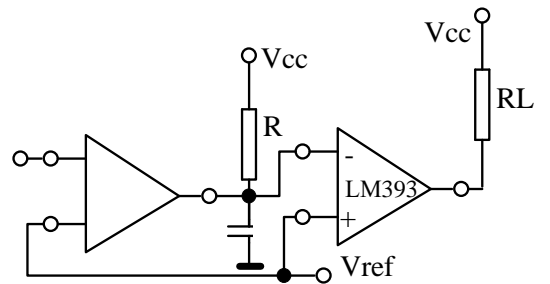
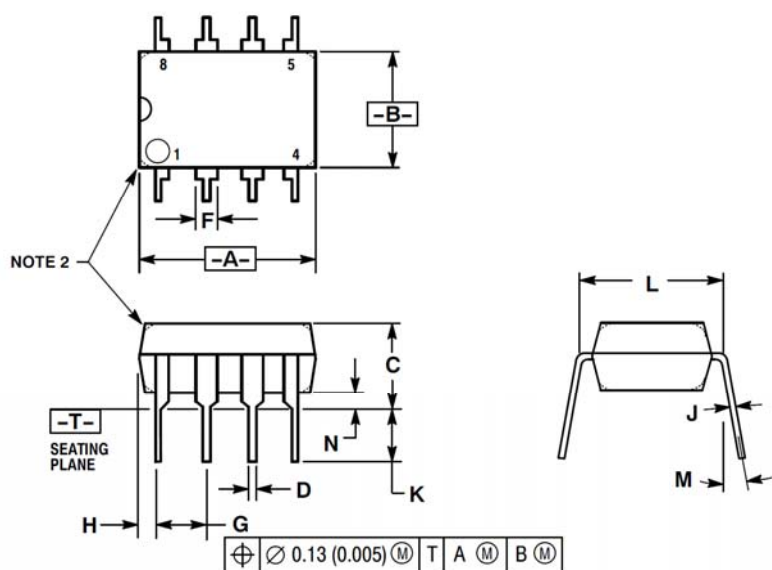


Figure 12. Delay generator

Package Outline Dimensions

Unit: mm(inch)

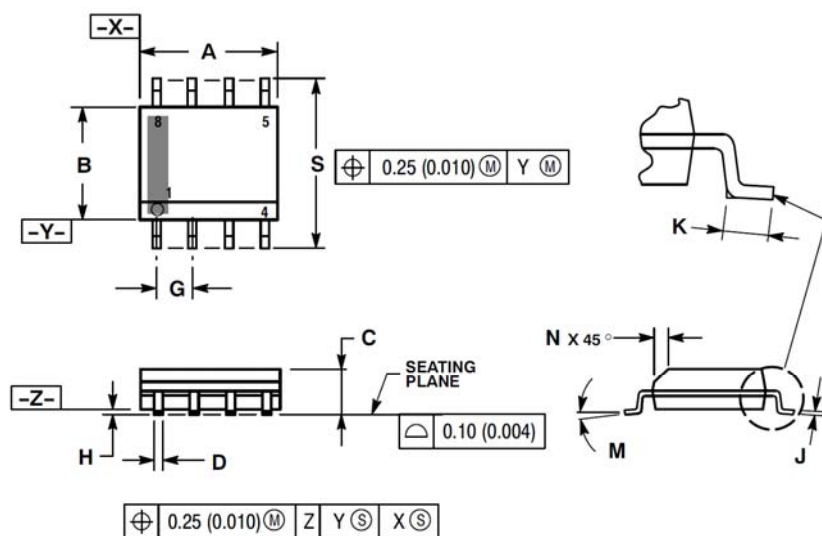


DIP8

NOTES:

1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	---	10°	---	10°
N	0.76	1.01	0.030	0.040



SOP8

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

DISCLAIMER

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