

Low Power Low Offset Voltage Dual Comparators

Features

- Wide Supply Voltage Range
Single Supply: 2.0V to 36V
Dual Supplies: $\pm 1.0\text{V}$ to $\pm 18\text{V}$
- Low Supply Current Drain: 0.6mA
- Low Input Bias Current: 25nA (Typical)
- Low Input Offset Current: $\pm 5.0\text{nA}$ (Typical)
- Low Input Offset Voltage: 1.0mV (Typical)
- Input Common Mode Voltage Range
Includes Ground
- Differential Input Voltage Range Equals to the Power Supply Voltage
- Low Output Saturation Voltage: 200mV at 4mA
- Open Collector Output

Applications

- Battery Charger
- Cordless Telephone
- Switching Power Supply
- DC-DC Module
- PC Motherboard
- Communication Equipment

General Description

The LM293/LM393 consist of four independent precision voltage comparators with a typical offset voltage of 1.0mV and high gain. They are specifically designed to operate from a single power supply over wide range of voltage. Operation from split power supply is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

The LM293/LM393 series are compatible with industry standard 393. The LM293 has more stringent input offset voltage than the LM393.

The LM393 is available in SOIC-8(SOP-8) and MSOP-8, TSSOP8 package, and the LM293 is available in SOIC-8(SOP-8) package.

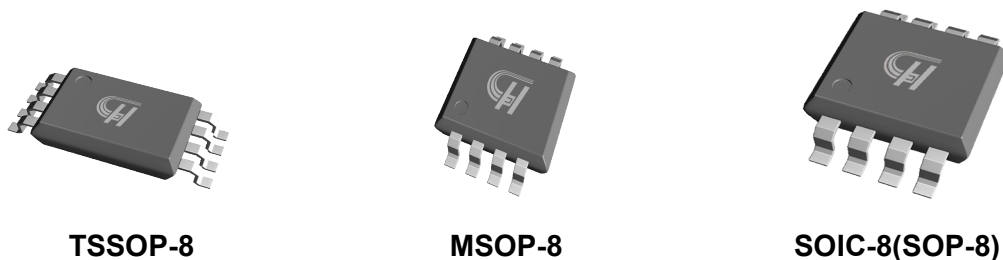


Figure 1. Package Type of LM293/LM393

Low Power Low Offset Voltage Dual Comparators

Pin Configuration

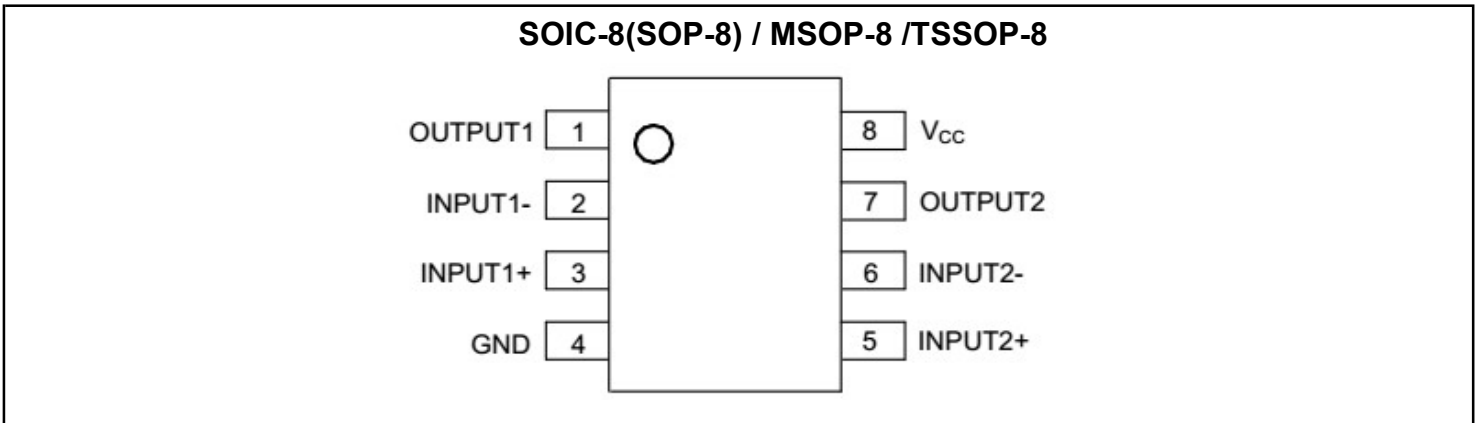
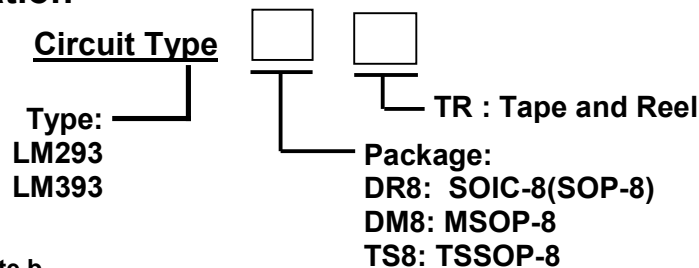


Figure 2. Pin Configuration of LM293/LM393 (Top View)

Pin Function Table

SOIC-8 (SOP-8)	MSOP-8 /TSSOP-8	Name	Function Description
1,7	1,7	Output 1/Output 2	Outputs
4	4	GND	Negative Power Supply
3,5	3,5	Input 1+/Input 2+	Non-inverting Inputs
2,6	2,6	Input 1-/Input 2-	Inverting Inputs
8	8	+VCC	Positive Power Supply

Ordering Information



Ordering Code ^{note b}

Part Number	Marking ID	Temperature Range	Package	Package Type
LM393DR8TR	LM393XX	-40'C to +85'C	SOIC-8 (SOP-8)	2500pcs/TR
LM393DM8TR	LM393XX	-40'C to +85'C	MSOP-8	3000pcs/TR
LM393TS8TR	GG3CXX	-40'C to +85'C	TSSOP-8	4000pcs/TR
LM293DR8TR	LM293XX	-40'C to +125'C	SOIC-8 (SOP-8)	2500pcs/TR

note a. marking information: XX, the 1ST X is date code-Year(A=2010, B=2011,...)

the 2nd X is date code-month(A=Jan, B=Feb,...L=Dec). for example: S5BBA (2011,January)

Low Power Low Offset Voltage Dual Comparators

Absolute Maximum Ratings ^{Note 1}

Parameter		Symbol	Value	Unit
Supply Voltage		V _{CC}	40	V
Difference Input Voltage		V _{ID}	±40	V
Input Voltage Range		V _{IN}	-0.3 to 40	V
Input Current (V _{IN} < -0.3V)		I _{IK}	-50	mA
Output Voltage		V _O	40	V
Output Short-Circuit to Ground		-	Continuous	-
Power Dissipation @T _A =+25°C	SOIC-8 (SOP-8)	P _D	660	mW
	MSOP-8		450	
	TSSOP-8		570	
Output Current		I _O	20	mA
Storage Temperature Range		T _{STG}	-65 to 150	°C
Operating Junction Temperature		T _J	+150	°C
Lead Temperature (Soldering, 10s)		T _{LEAD}	+260	°C
ESD Class(Human Body Model)		HMB	2000	V
ESD Class(Machine Model)		MM	200	

Note 1: Stresses above those listed under "Maximum Ratings" may cause permanent damage to the device.

This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter		Symbol	Min	Max	Unit
Supply Voltage		V _{CC}	2	36	V
Operating Temperature Range	LM293	T _A	-40	+125	°C
	LM393		-40	+85	°C

Low Power Low Offset Voltage Dual Comparators

Electrical Characteristics:

(Limits in standard typeface are for TA=25 °C, bold typeface applies over TA=-40°C to +85°C^{note2} VCC=5V, GND=0V, unless otherwise noted.)

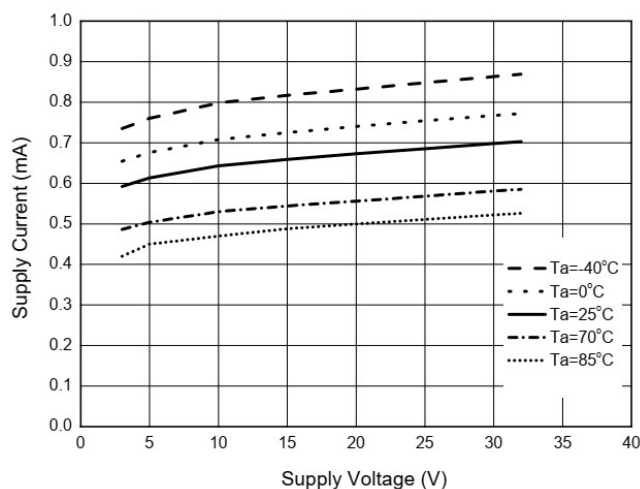
Parameter	Symbol	Conditions	Min	Type	Max	Unit
Input Offset Voltage	V _{OS}	LM393	-	1.0	5.0	mV
				-	7	
		LM293	-	1.0	3.0	
				-	5	
Input Bias Current	I _B	I _{IN+} or I _{IN-} with output in linear Range, V _{CM} =0V	-	25	250	nA
			-	-	400	
Input Offset Current	I _{OS}	I _{IN+} - I _{IN-} , V _{CM} = 0V	-	5.0	50	nA
			-	-	200	
Input Common Mode Voltage Range ^{note3}	V _{CM}	V _{CC} =30V	0	-	V _{CC} -1.5	V
Supply Current	I _O	V _{CC} =5V RL = ∞ V _{CC} =30V	-	0.4	1.0	mA
			-	-	2.0	
			-	0.7	1.7	
			-	-	3.0	
Voltage Gain	AVD	RL>=15KΩ, V _{CC} =15V, V _O =1V to 11V	50	200	-	V/mV
Large Signal Response Time	Tr	V _{IN} =TTL Logic Swing, V _{REF} =1.4V, V _{RL} =5V, RL=5.1KΩ	-	200	-	ns
Response Time	TR _S	V _{RL} =5V, RL=5.1KΩ	-	1.3	-	us
Output Sink Current	I _{SC}	V _{IN-} =1V, V _{IN+} =0, V _O =1.5V	6.0	16	-	mA
Output Leakage Current	I _{Leakage}	V _{IN-} =0V, V _{IN+} =1V, V _O =5V	-	0.1	-	nA
		V _{IN-} =0V, V _{IN+} =1V, V _O =30V	-	-	1.0	uA
Saturation Voltage	V _{SAT}	V _{IN-} =1V, V _{IN+} =0, I _{SINK} <=4mA	-	200	400	mV
			-	-	500	
Thermal Resistance (Junction to Case)	θ _{JC}	SOIC-8(SOP-8)	-	9	-	'C/W
		MSOP-8	-	24	-	
		TSSOP-8	-	15	-	
Thermal Resistance (Junction to Ambient)	θ _{JA}	SOIC-8(SOP-8)	-	108	-	'C/W
		MSOP-8	-	151	-	
		TSSOP-8	-	179	-	

note 2. Limites over the full temperature are guaranteed by design, but not tested in production.

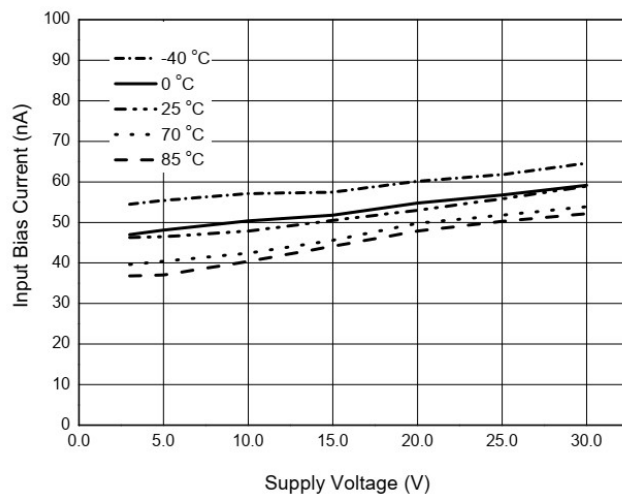
3. The input common-mode voltage of either input signal should not be allowed to go negatively by more than 0.3V (at +25°C). The upper end of the common-mode voltage range is V_{CC}-1.5V (at +25°C), but either or both inputs can go to +36V without damages, independent of the magnitude of the V_{CC}.

Low Power Low Offset Voltage Dual Comparators

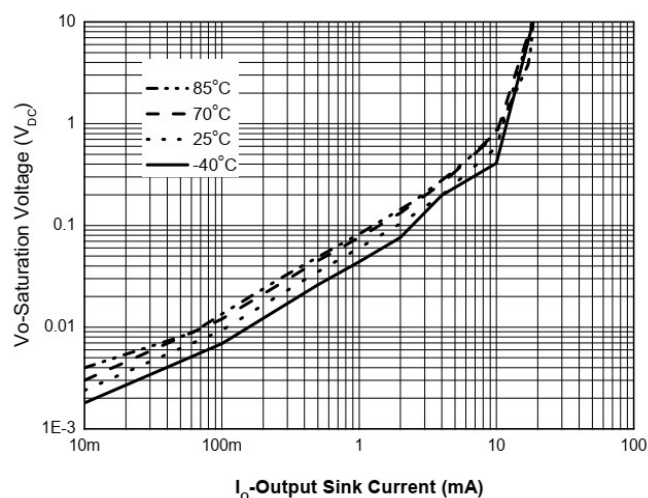
Performance Characteristics (Unless Otherwise Specified.)



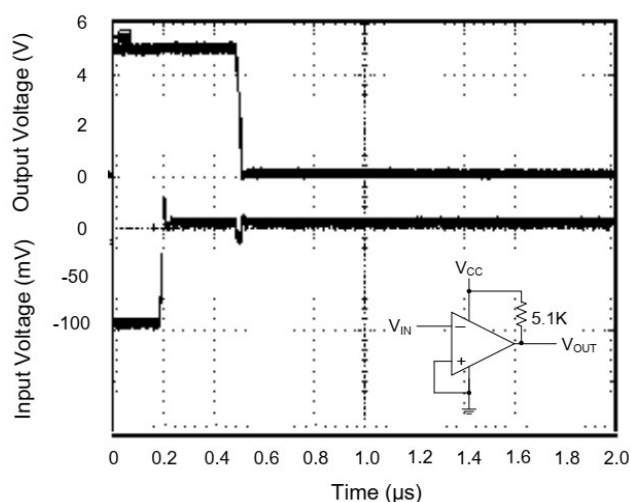
Supply Voltage vs. Supply Current



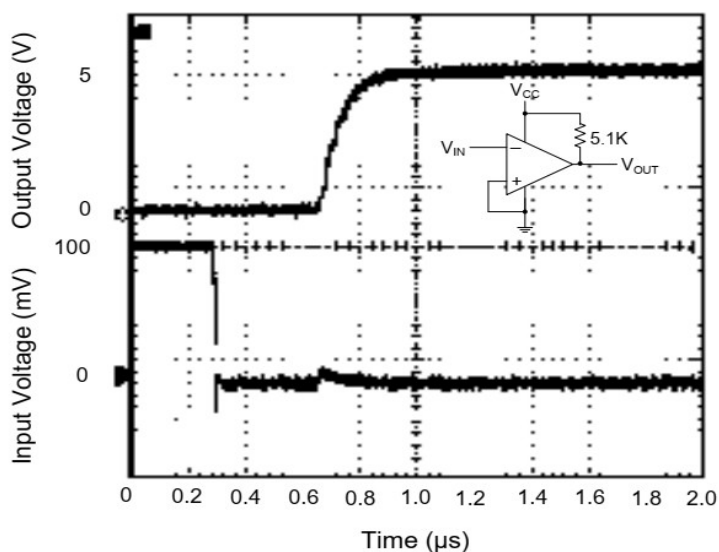
Supply Voltage vs. Input Bias Current



Output Sink Current vs. Saturation Voltage



Response Time for 5mV Input Overdrive-Negative Transition



Response Time for 5mV Input Overdrive-Positive Transition

Low Power Low Offset Voltage Dual Comparators

Functional Block Diagram

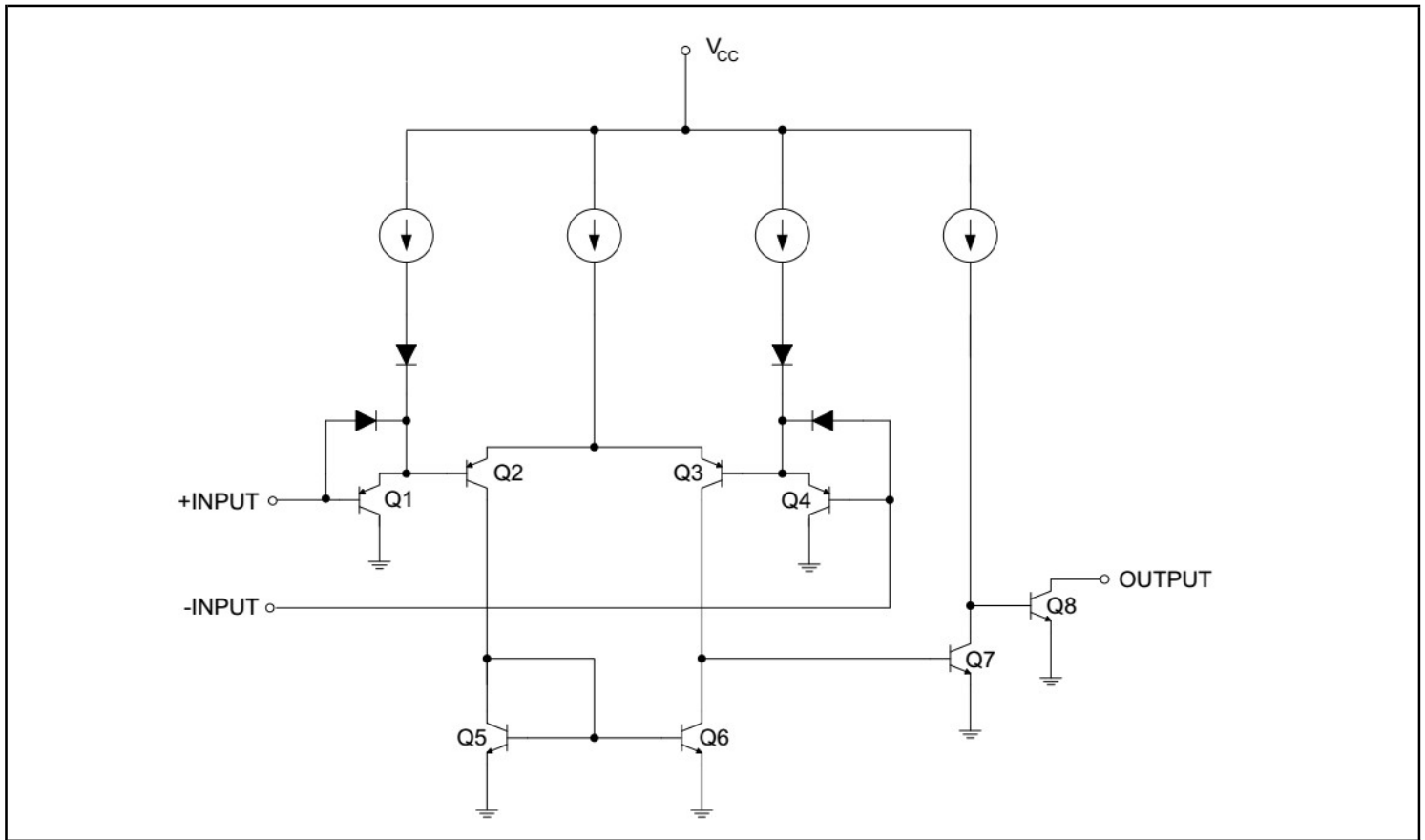


Figure 3. Functional Block Diagram of LM293/LM393

Typical Application Circuit

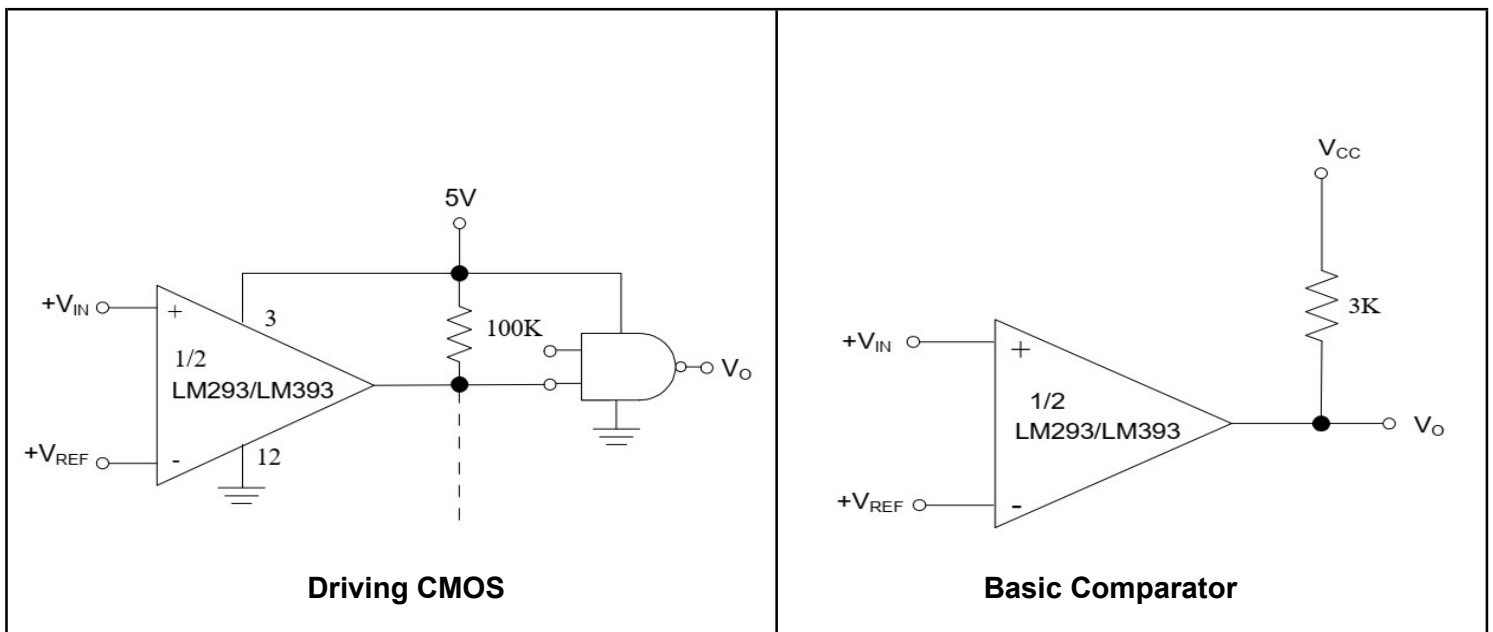


Figure 4-1. Typical Application Circuit of LM293/LM393

Low Power Low Offset Voltage Dual Comparators

Typical Application Circuit (Con.)

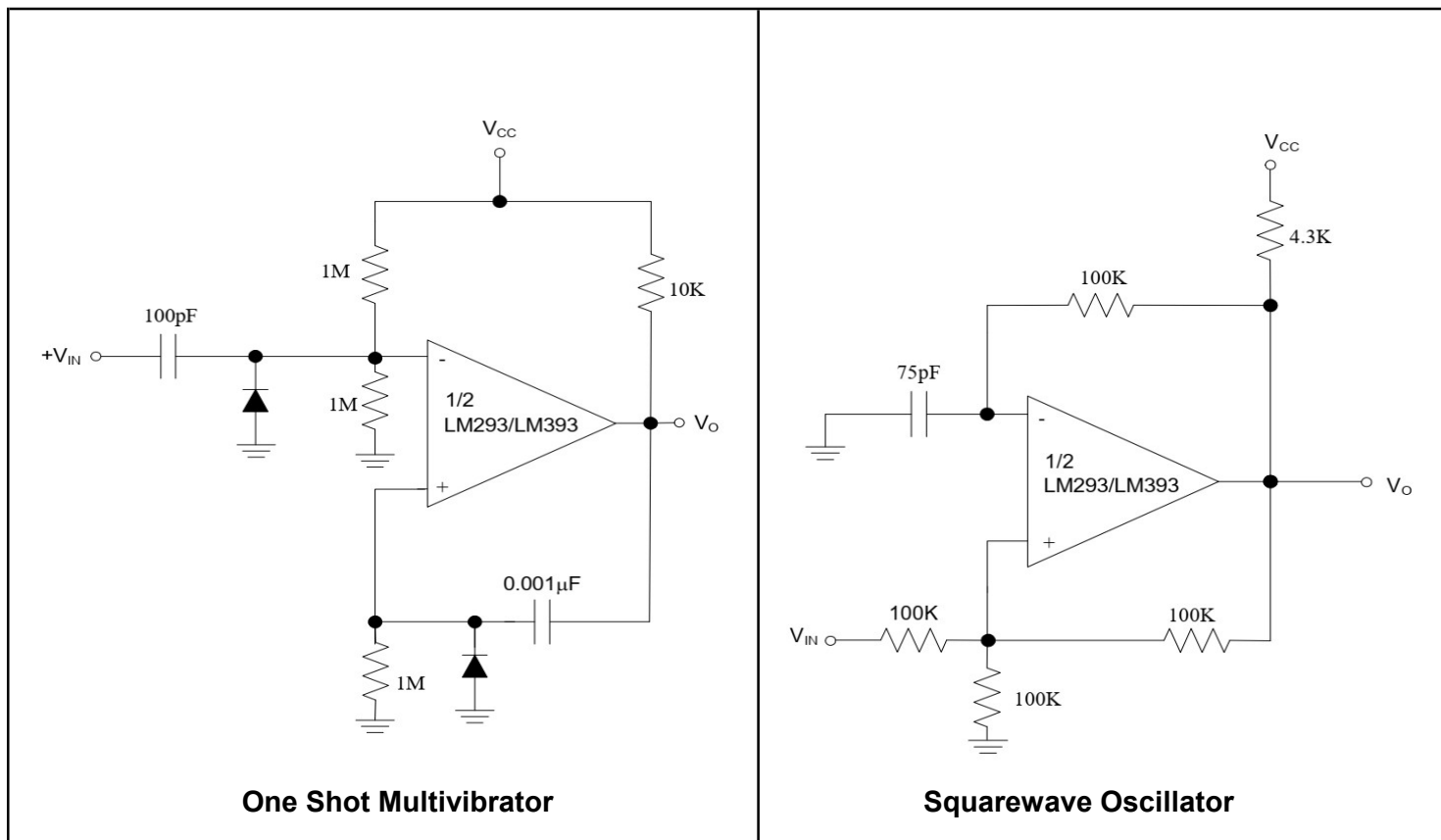
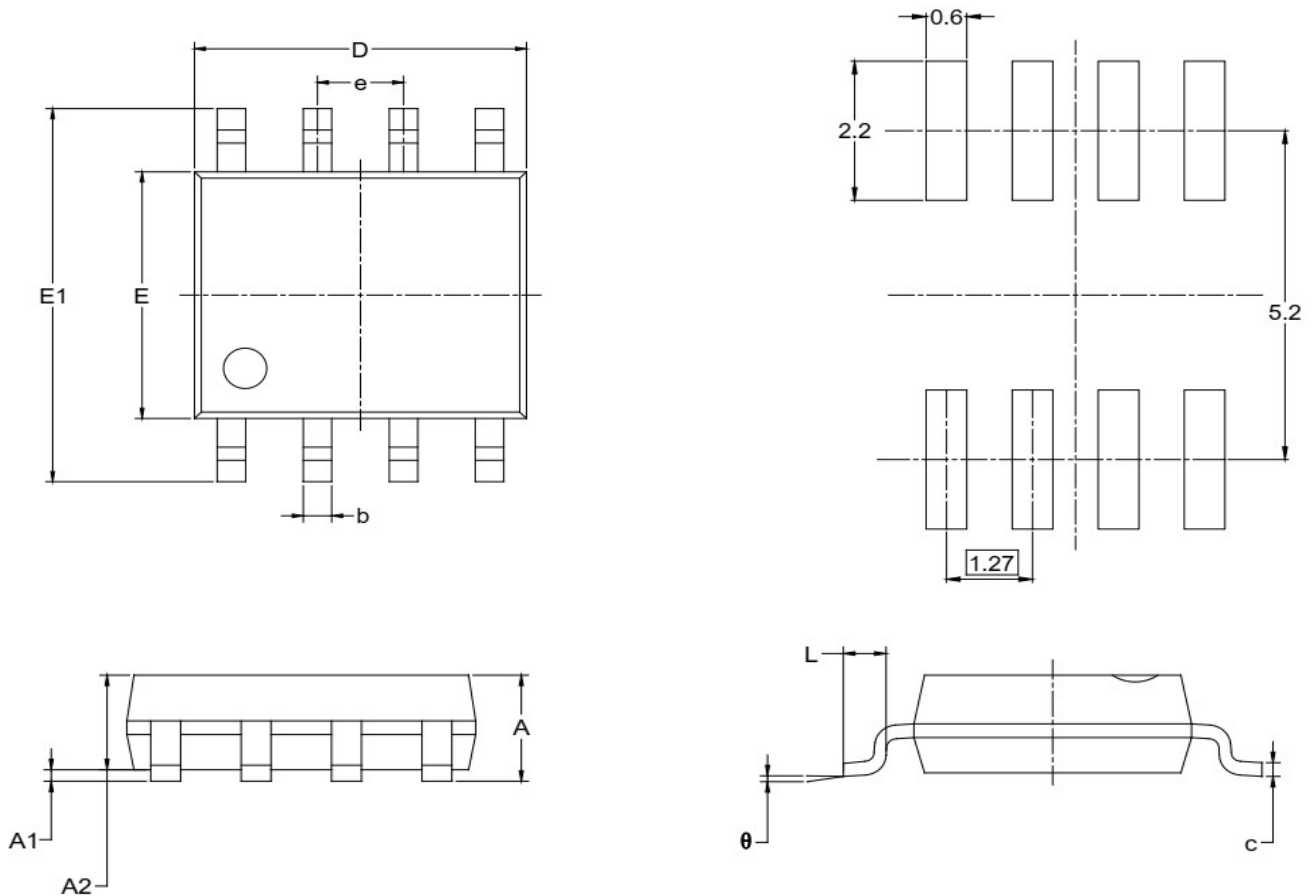


Figure 4-2. Typical Application Circuit of LM293/LM393

Low Power Low Offset Voltage Dual Comparators

Mechanical Dimensions

DR8 : SOIC-8/SOP-8
Unit: mm (inch)


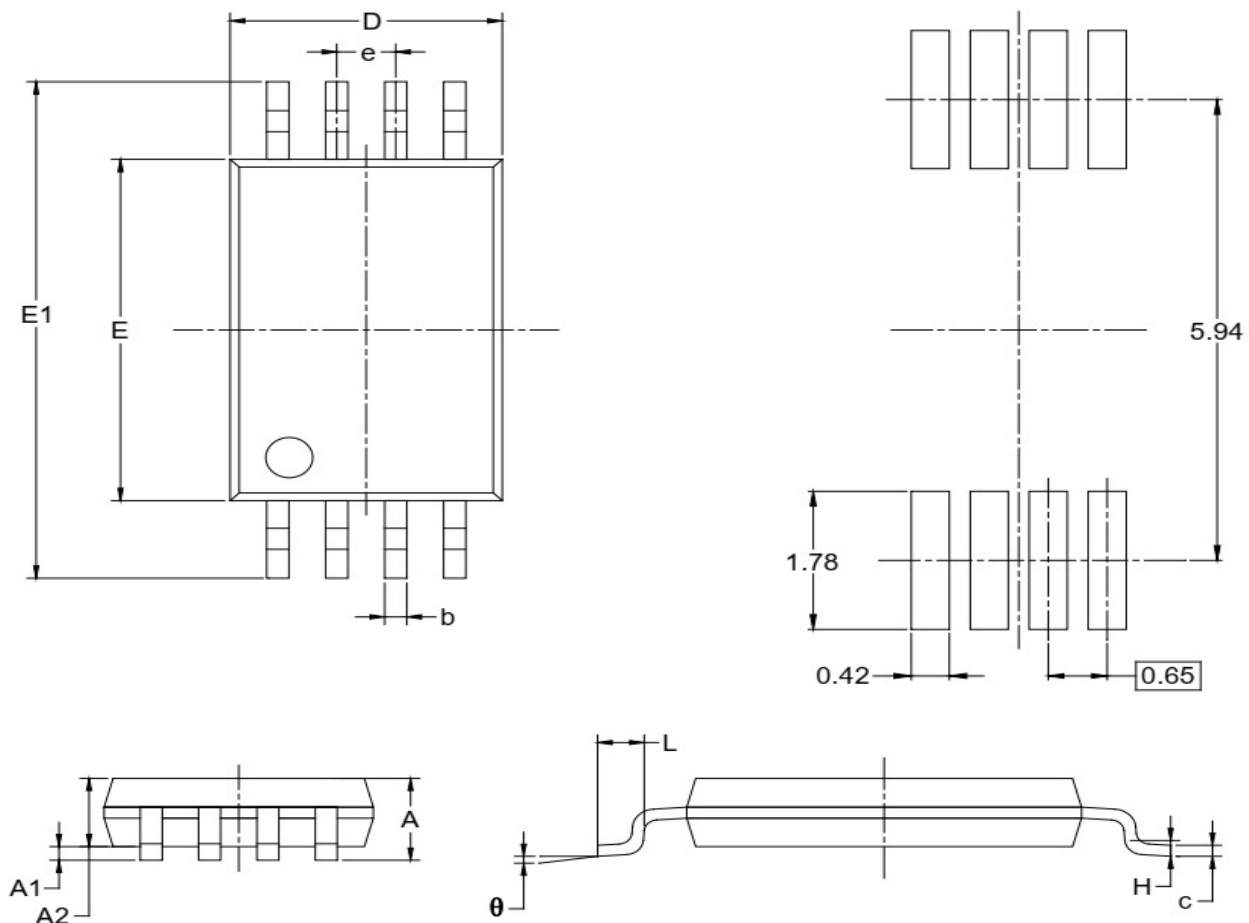
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

NOTES:

1. Body dimensions do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

Low Power Low Offset Voltage Dual Comparators

Mechanical Dimensions(Con.)

TS8 : TSSOP-8
Unit: mm (inch)


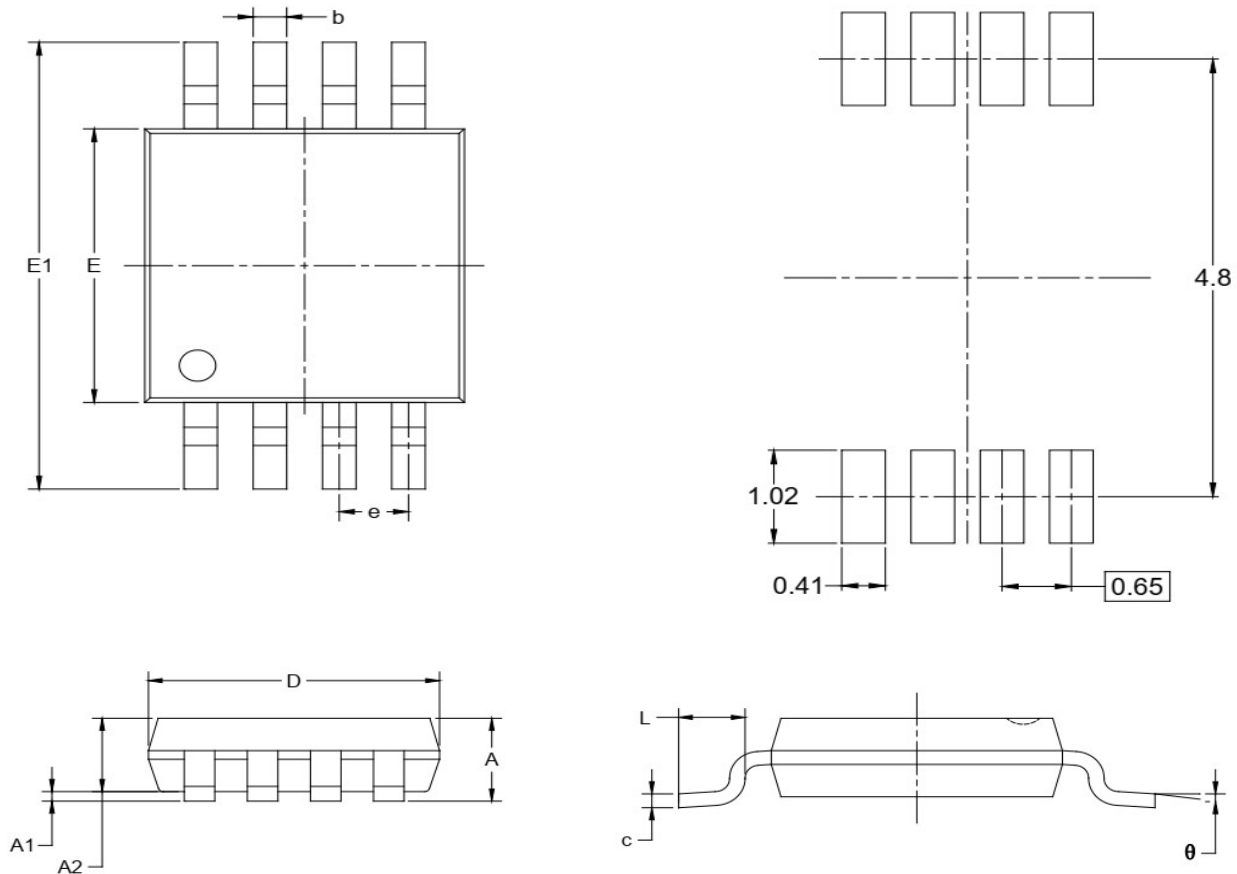
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.100		0.043
A1	0.050	0.150	0.002	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	2.900	3.100	0.114	0.122
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

NOTES:

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2. This drawing is subject to change without notice.

Low Power Low Offset Voltage Dual Comparators

Mechanical Dimensions(Con.)

DM8 : MSOP-8
Unit: mm (inch)


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

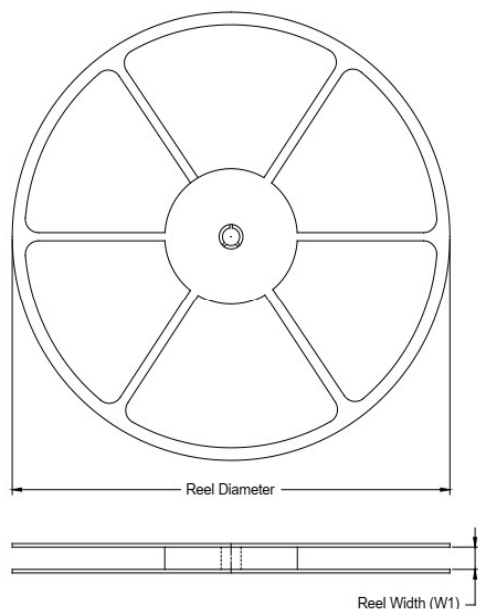
NOTES:

1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

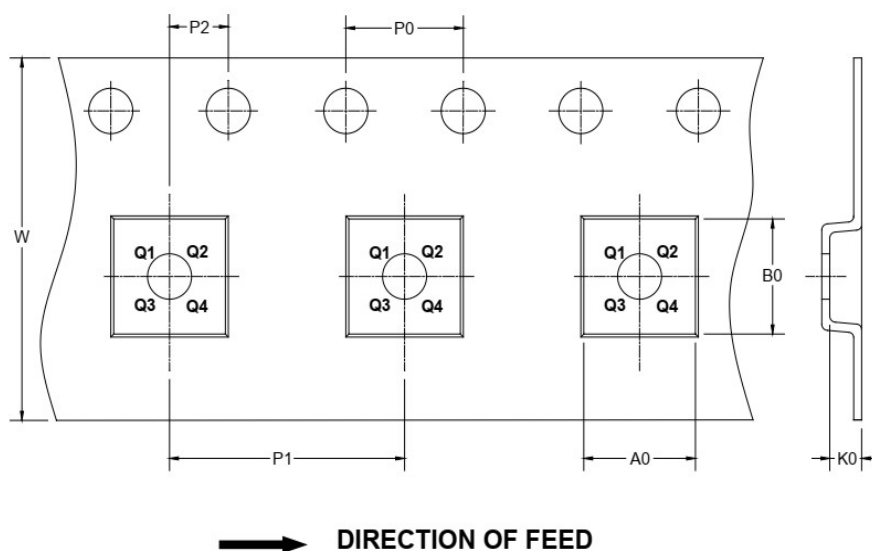
Low Power Low Offset Voltage Dual Comparators

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



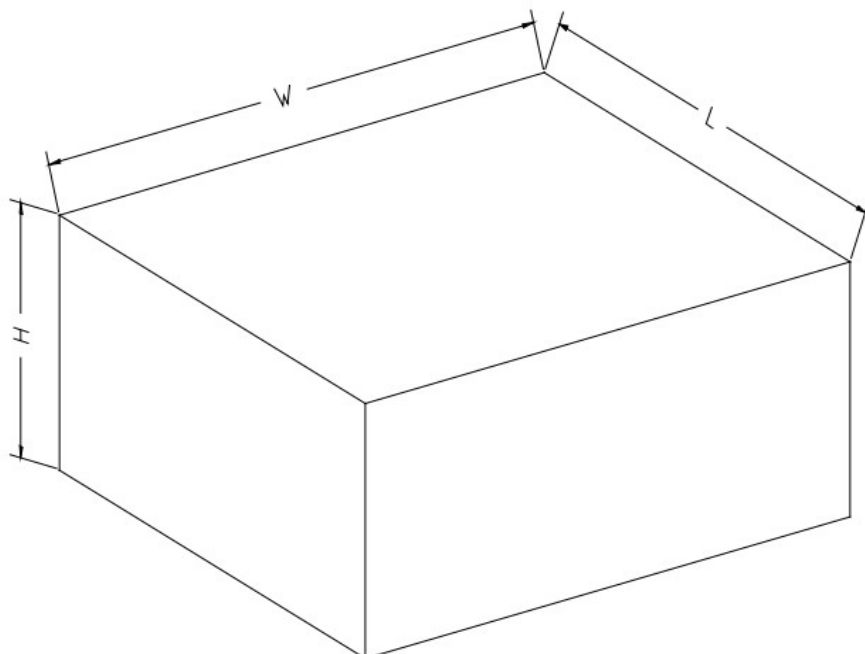
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1	A0	B0	K0	P0	P1	P2	W	Pin1
		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	Quadrant
SOIC-8	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1
MSOP-8	13"	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1
TSSOP-8	13"	12.4	6.76	3.30	1.80	4.0	8.0	2.0	12.0	Q1

Low Power Low Offset Voltage Dual Comparators

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
13"	386	280	370	5