200mA,Ultra-low Noise LDO Regulator

General Description

The LP3993 is designed for portable applications with demanding performance and space requirements. The LP3993 performance is optimized for high voltage systems to deliver ultra low noise and low quiescent current. Regulator ground current increases only slightly in dropout, further prolonging the input system life. The LP3993 also works with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications, critical in hand-held wireless devices. The other features include ultra low dropout voltage, high output accuracy, current limiting protection, and high ripple rejection ratio.

Features

- Ultra-Low-Noise for RF Application
- Input Voltage up to 24V
- Low Dropout : 300mV @ 100mA
- Output Current 200mA
- Ultra-Fast Response in Line/Load Transient
- Current Limiting and Thermal Shutdown Protection

Applications

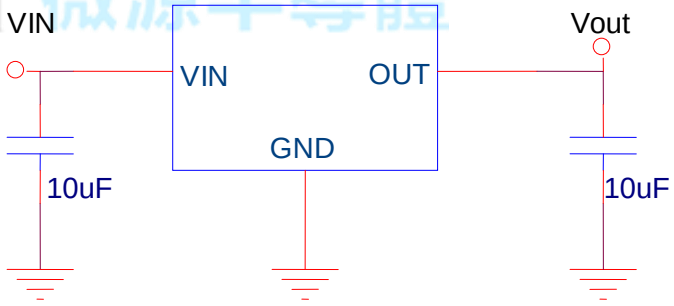
- PMP/PDA/MP3 players
- Cellular and Mobile phone
- RF Module
- Sensor Module

Order Information

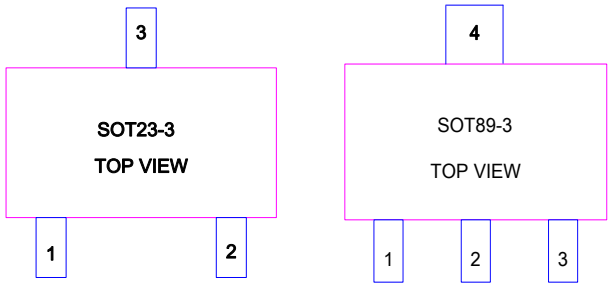
LP3993 □ □ □ □ □

- F: Pb-Free
- Package Type
  - B3: SOT23-3
  - X3: SOT89-3
- Output Type
  - 33: 3.3V
  - 36: 3.6V
  - 50: 5.0V

Typical Application Circuit



Functional Pin Description

Package Type	Pin Configurations
SOT-23-3 / SOT89-3	

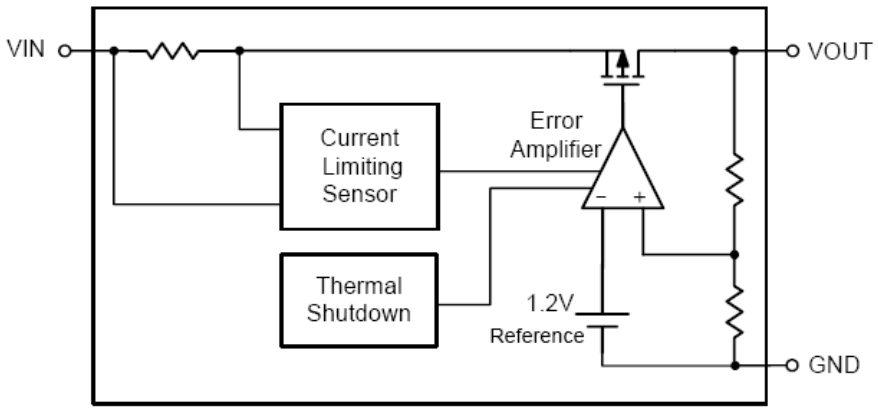
Pin Description

Pin		Name	Description
SOT23-3	SOT89-3		
1	1	GND	Ground.
3	2/4	Vin	Power Input Pin
2	3	Vout	Output Pin.

Marking Information

Device	Marking	Package	Shipping
LP3993-33B3F	LPS 2EYWX	SOT23-3	3K/REEL
LP3993-33X3F	LPS 3993 33YWX	SOT89-3	1K/REEL
LP3993-36B3F	LPS 2LYWX	SOT23-3	3K/REEL
LP3993-36X3F	LPS 36YWX	SOT89-3	1K/REEL
LP3993-50B3F	LPS 2KYWX	SOT23-3	3K/REEL
LP3993-50X3F	LPS 3993 50YWX	SOT89-3	1K/REEL
Marking indication: Y:Production year W:Production week X: Series Number			

Function Diagram



Absolute Maximum Ratings

- ✧ Supply Input Voltage ---------- -0.3V to 30V
- ✧ Other pin to GND ---------- -0.3V to 8V
- ✧ Maximum Junction Temperature ---------- 150°C
- ✧ Maximum Soldering Temperature (at leads, 10 sec) ---------- 260°C
- ✧ Operating Junction Temperature Range (T_J) ---------- -40℃ to 85°C
- ✧ Storage Temperature ---------- -65℃ to 165°C

Power Dissipation, PD @ TA = 25°C

- ✧ SOT23-3 ---------- 450mW
- ✧ SOT89-3 ---------- 700mW

Package Thermal Resistance

- ✧ SOT23-3, θJA ---------- 250°C/W
- ✧ SOT89-3, θJA ---------- 165°C/W

ESD Susceptibility

- ✧ HBM (Human Body Mode) ---------- 2kV
- ✧ MM(Machine-Mode) ---------- 200V

Recommended Operating Conditions

✧ Supply Input Voltage ---------- Vout+1V to 24V

Electrical Characteristics

(CIN = 10μF, COUT =10uF，Vin=Vout+1V，TA = 25° C, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ.	Max	Units
Output Voltage Accuracy	ΔV_{OUT}	I_{OUT} = 1mA	−2	--	+2	%
Output Loading Current	Iout			200		mA
Current Limit	I_{LIM}	R_{LOAD} = 1Ω	250			
Quiescent Current	I_Q	IOUT = 0mA		5		μA
Dropout Voltage	V_{DROP}	I_{OUT} = 100mA, V_{OUT} =3.3V		300		mV
Linear Regulation	ΔV_{LINE}	V_{IN} = (V_{OUT} + 1V) to 12V, I_{OUT} = 1mA			0.2	%
Load Regulation	ΔV_{LOAD}	1mA < IOUT < 150mA			2	%
\Thermal Shutdown Temperature	T_{SD}			150		°C
Thermal Shutdown Hysteresis				25		°C

Applications Information

Like any low-dropout regulator, the external capacitors used with the LP3993 must be carefully selected for regulator stability and performance. Using a capacitor whose value is ≥ 10μF on the LP3993 input. The input capacitor must be located a distance of not more than 0.5 inch from the input pin of the IC and returned to a clean analog ground. Any good quality ceramic or tantalum can be used for this capacitor. The capacitor with larger value and lower ESR (equivalent series resistance) provides better PSRR and line-transient response. The output capacitor must meet both requirements for minimum amount of capacitance and ESR in all LDO`s application. The LP3993 is designed specifically to work with low ESR ceramic output capacitor in space-saving and performance consideration. Using a ceramic capacitor whose value is at least 10μF with ESR is > 25mΩ on the LP3993 output ensures stability. The LP3993 still works well with output capacitor of other types due to the wide stable ESR range. Output capacitor of larger capacitance can reduce noise and improve load transient response, stability, and PSRR. The output capacitor should be located not more than 0.5 inch from the V_{OUT} pin of the LP3993 and returned to a clean analog ground.

Thermal Considerations

Thermal protection limits power dissipation in LP3993. When the operation junction temperature exceeds 150°C, the OTP circuit starts the thermal shutdown function turn the pass element off. The pass element turns on again after the junction temperature cools by 25°C.

The power dissipation definition in device is:

$$P_D = (V_{IN}-V_{OUT}) \times I_{OUT} + V_{IN} \times I_Q$$

The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surroundings airflow and temperature difference between junction and ambient.

The maximum power dissipation can be calculated by following formula:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

Where $T_{J(MAX)}$ is the maximum operation junction temperature 125°C, T_A is the ambient temperature and the θ_{JA} is the junction to ambient thermal resistance. For recommended operating conditions specification of LP3993, the junction to ambient thermal resistance (θ_{JA} is layout dependent) for LP3993 showed below.

SOT23-3 : 250℃/W

SOT89-3 : 165℃/W

And ,

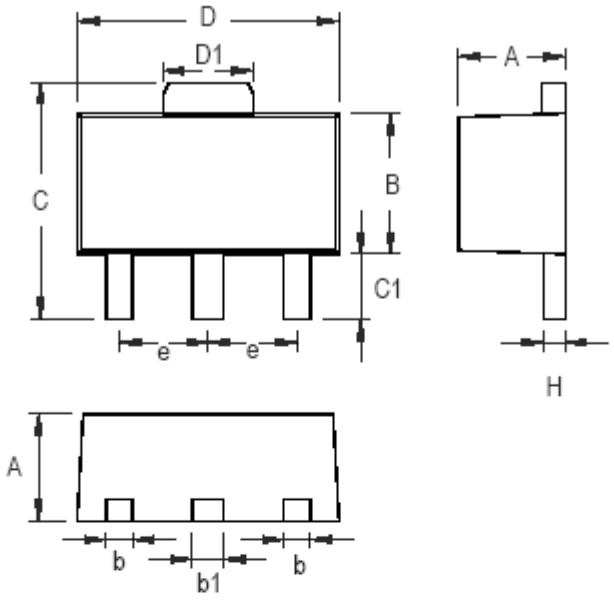
P_D=(125°C−25°C)/250℃/W= 400mW (SOT23-3)

P_D=(125°C−25°C)/165℃/W= 600mW (SOT89-3)

The maximum power dissipation depends on operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance θ_{JA}.

Packaging Information

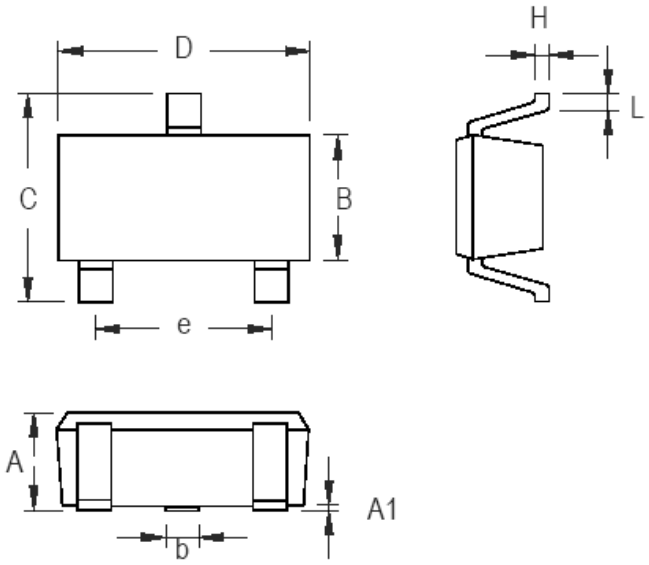
SOT-89



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.397	1.600	0.055	0.063
b	0.356	0.483	0.014	0.019
B	2.388	2.591	0.094	0.102
b1	0.406	0.533	0.016	0.021
C	3.937	4.242	0.155	0.167
C1	0.787	1.194	0.031	0.047
D	4.394	4.597	0.173	0.181
D1	1.397	1.753	0.055	0.069
e	1.448	1.549	0.057	0.061
H	0.356	0.432	0.014	0.017

3-Lead SOT-89 Surface Mount Package

SOT23-3



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.035	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.356	0.508	0.014	0.020
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	1.803	2.007	0.071	0.079
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

SOT-23 Surface Mount Package