



300mA, Ultra-low Noise LDO Regulator

General Description

The LP3986 is designed for portable applications with demanding performance and space requirements. The LP3986 performance is optimized for battery-powered systems to deliver ultra low noise and low quiescent current. Regulator ground current increases only slightly in dropout, further prolonging the battery life. The LP3986 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. Available in the 3-lead of SOT23-3 and SOT89-3 packages

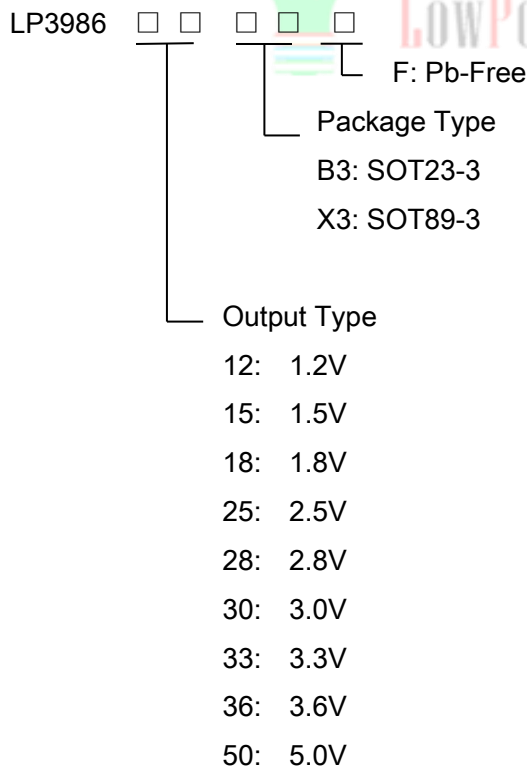
Features

- ◆ Ultra-Low-Noise for RF Application
- ◆ 2.5V- 6V Input Voltage Range
- ◆ Low Dropout : 220mV @ 300mA
- ◆ Ultra-Fast Response in Line/Load Transient
- ◆ Current Limiting and Thermal Shutdown Protection

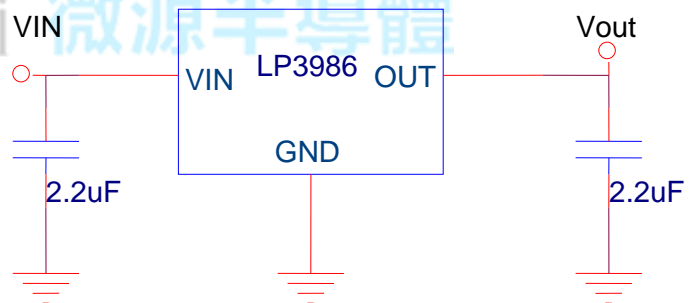
Applications

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

Order Information



Typical Application Circuit





Marking Information

| Device | Marking | Shipping | Device | Marking | Shipping |
|--------------|--------------|----------|--------------|--------------|----------|
| LP3986-12B3F | LPS 6BYWX | 3K/REEL | LP3986-30B3F | LPS 6GYWX | 3K/REEL |
| LP3986-15B3F | LPS 6NYWX | | LP3986-33B3F | LPS 6EYWX | |
| LP3986-18B3F | LPS 6CYWX | | LP3986-36B3F | LPS 6LYWX | |
| LP3986-25B3F | LPS 6DYWX | | LP3986-50B3F | LPS 6KYWX | |
| LP3986-28B3F | LPS 6HYWX | | LP3986-18X3F | LPS 6CYWX | |

Marking indication:

Y: Year code .W: W is week code. X: X is series number.

Functional Pin Description

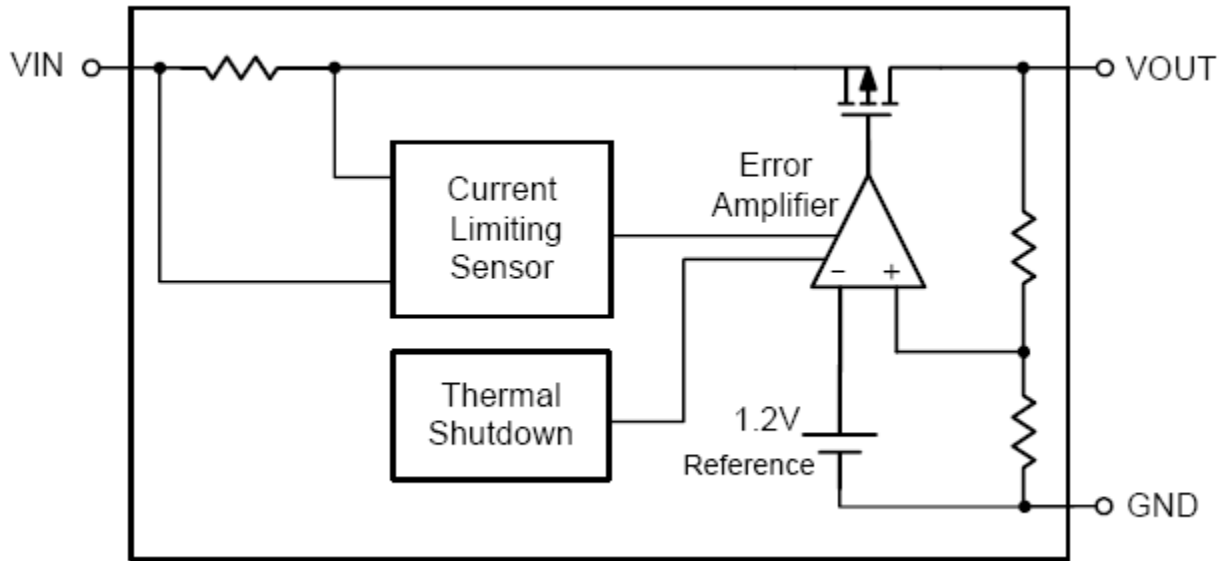
| Package Type | Pin Configurations |
|--------------|--------------------|
| SOT23 | |

Pin Description

| Pin | | Name | Description |
|---------|---------|------|------------------|
| SOT89-3 | SOT23-3 | | |
| 1 | 1 | GND | Ground. |
| 2 | 3 | VIN | Power Input Pin. |
| 3 | 2 | OUT | Output Pin. |



Function Diagram



Absolute Maximum Ratings

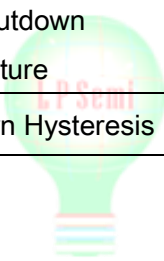
- ◇ Supply Input Voltage ----- 7V
Power Dissipation, PD @ TA = 25°C
- ◇ SOT-23-3 ----- 350mW
- ◇ SOT89-3 ----- 550mW
Package Thermal Resistance
- ◇ SOT-23-3, θ_{JA} ----- 350°C/W
- ◇ SOT89-3, θ_{JA} ----- 180°C/W
- ◇ Lead Temperature (Soldering, 10 sec.) ----- 260°C
- ◇ Storage Temperature Range ----- -65°C to 165°C
- ESD Susceptibility
- ◇ HBM (Human Body Mode) ----- 2kV
- ◇ MM(Machine-Mode) ----- 200V
- Recommended Operating Conditions
- ◇ Supply Input Voltage ----- 2.5V to 6V
- ◇ Operation Junction Temperature Range ----- -40°C to 125°C
- ◇ Operation Ambient Temperature Range ----- -40°C to 85°C



Electrical Characteristics

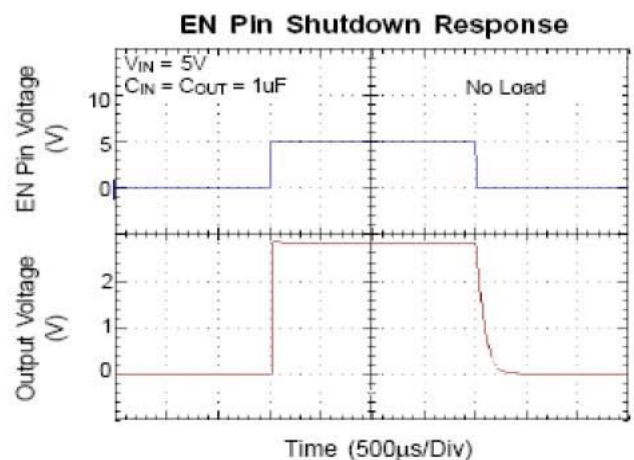
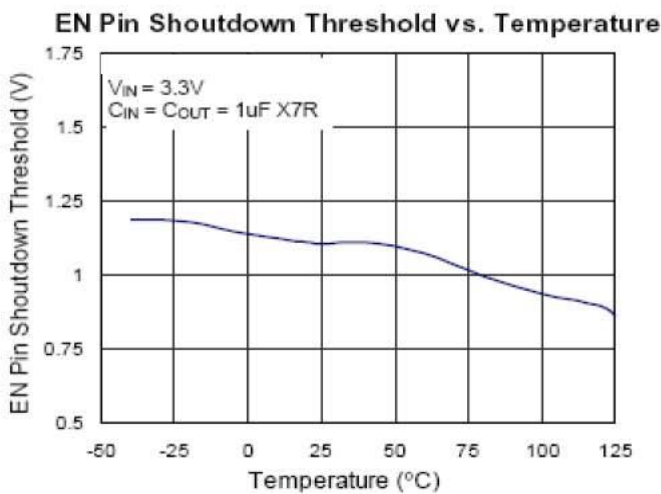
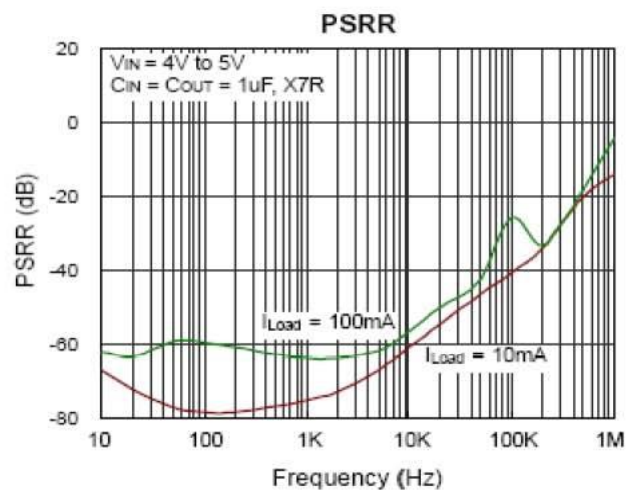
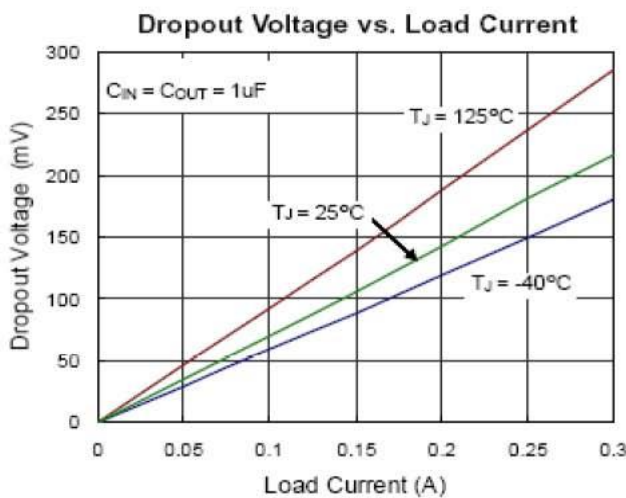
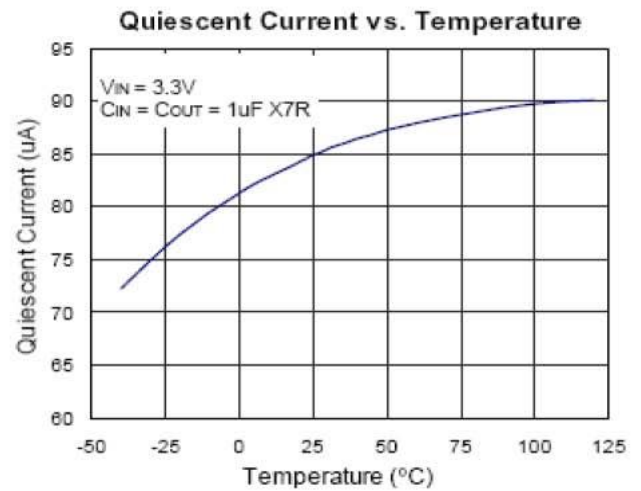
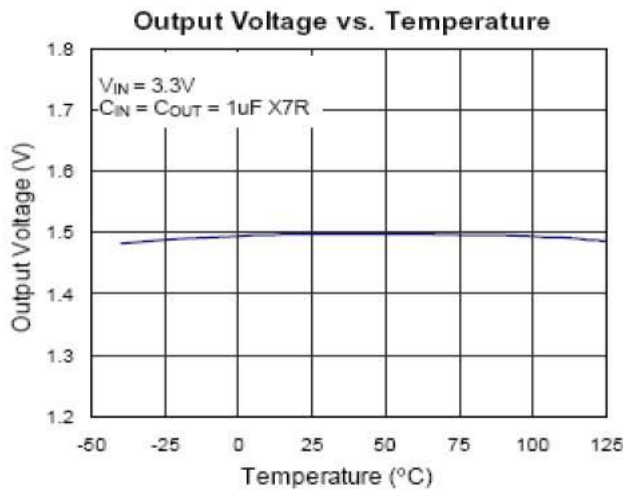
(LP3986-33B3F, VIN = VOUT + 1V, CIN = COUT = 2.2μF, TA = 25° C, unless otherwise specified)

| Parameter | Symbol | Test Conditions | Min | Typ. | Max | Units |
|------------------------------|-------------------|--|-----|------|-----|-------|
| Output Voltage Accuracy | ΔV_{OUT} | IOUT = 1mA | -3 | -- | +3 | % |
| Output Voltage | VOUT | IOUT = 1mA | | 3.33 | | V |
| Current Limit | ILIM | RLOAD = 1Ω | 350 | | | mA |
| Quiescent Current | IQ | IOUT = 0mA, Vout=3.3V | | 75 | 130 | μA |
| Dropout Voltage | VDROP | IOUT = 300mA, VOUT > 2.8V | | 220 | 300 | mV |
| Line Regulation | ΔV_{LINE} | VIN = (VOUT + 1V) to 5.5V, IOUT = 1mA | | | 0.2 | % |
| Load Regulation | ΔV_{LOAD} | 1mA < IOUT < 300mA | | | 2 | % |
| Power Supply Rejection Reat | PSRR | Iout=100mA F=1KHz | | -76 | | dB |
| | | Iout=100mA F=10KHz | | -65 | | dB |
| Thermal Shutdown Temperature | TSD | | | 150 | | °C |
| Thermal Shutdown Hysteresis | | | | 20 | | °C |



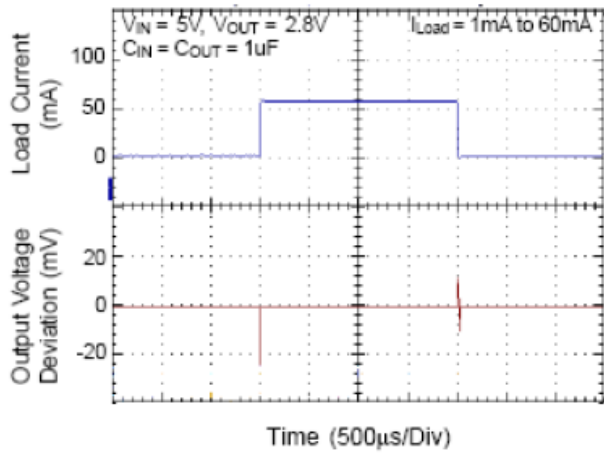


Typical Operating Characteristics

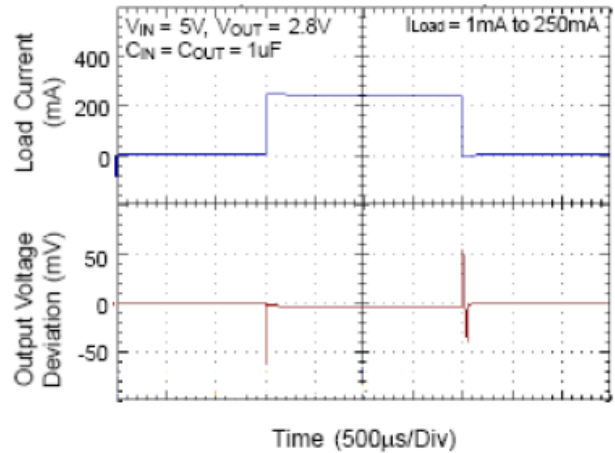




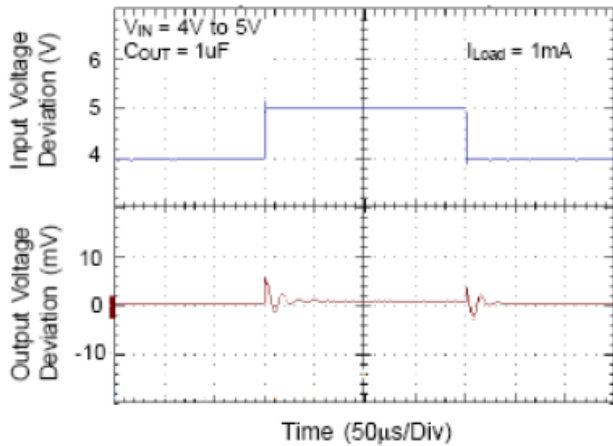
Load Transient Response



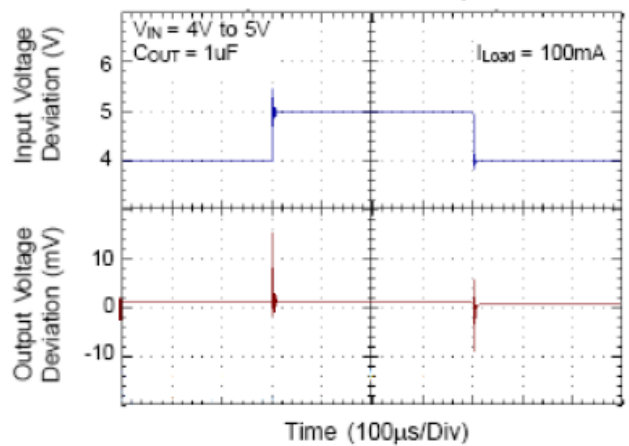
Load Transient Response



Line Transient Response



Line Transient Response





Applications Information

Thermal Considerations

Thermal protection limits power dissipation in LP3986. 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. For continue operation, do not exceed absolute maximum operation junction temperature 125°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 to 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 LP3986, where $T_{J(MAX)}$ is the maximum junction temperature of the die

(125°C) and T_A is the maximum ambient temperature. The junction to ambient thermal resistance (θ_{JA} is layout dependent) for SOT89 package is 180°C/W.

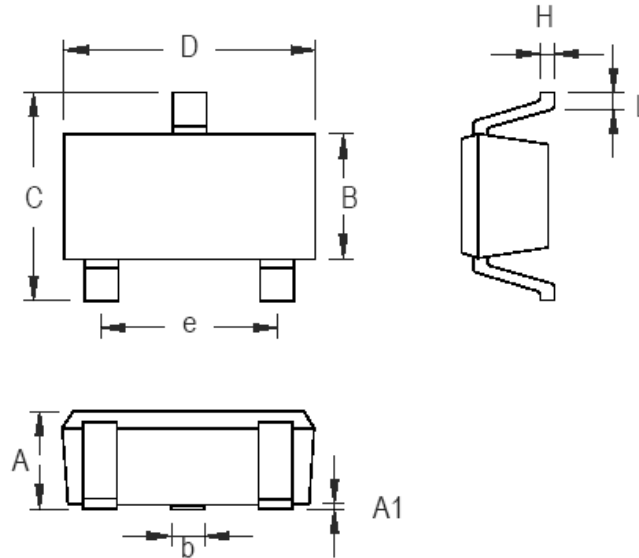
$$P_{D(MAX)} = (125^\circ\text{C} - 25^\circ\text{C}) / 180^\circ\text{C} = 550\text{mW (SOT89)}$$

The maximum power dissipation depends on operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance θ_{JA} . When considering the thermal characteristic of PCB it may be larger than 550mW.



Packaging Information

SOT23-3

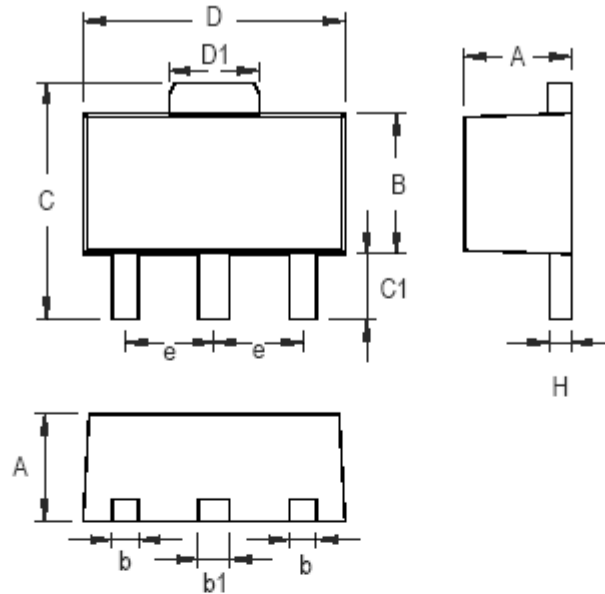


| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min | Max | Min | Max |
| A | 0.889 | 1.350 | 0.035 | 0.053 |
| A1 | 0.000 | 0.152 | 0.000 | 0.006 |
| B | 1.100 | 1.803 | 0.043 | 0.071 |
| b | 0.300 | 0.508 | 0.012 | 0.020 |
| C | 2.100 | 2.997 | 0.083 | 0.118 |
| D | 2.692 | 3.120 | 0.106 | 0.123 |
| e | 1.800 | 2.007 | 0.071 | 0.079 |
| H | 0.080 | 0.254 | 0.003 | 0.010 |
| L | 0.200 | 0.610 | 0.008 | 0.024 |

SOT-23 Surface Mount Package



SOT89-3



| 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