300mA,Ultra-LowNoise Ultra-fast CMOS LDO Regrlator

General Description

The LP3986 is designed for portable RF and wireless 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. A noise bypass pin is available for further reduction of output noise. 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 LP3986 consumes less than 0.01μA in shutdown mode and has fast turn-on time less than 50μs. The other features include ultra low dropout voltage, high output accuracy, current limiting protection, and high ripple rejection ratio. Available in the 5-lead of SOT-23 packages.

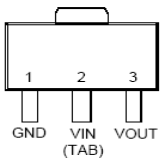
Features

- Ultra-Low-Noise for RF Application
- 2.5V- 6V Input Voltage Range
- Low Dropout : 220mV @ 300mA
- High PSSR:-80dB at 1KHz
- < 0.01μA Standby Current When Shutdown
- TTL-Logic-Controlled Shutdown Input
- Custom Voltage Available
- Ultra-Fast Response in Line/Load Transient
- Quick Start-Up (Typically 50μs)
- Current Limiting and Thermal Shutdown Protection

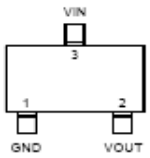
Applications

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

Pin Configurations

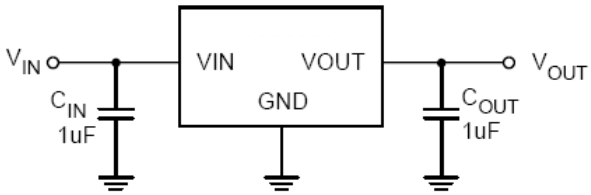


SOT-89



SOT-23

Typical Application Circuit



Ordering Information

LP3986 - □□ □ □□

F:PB-Free

Package Type

X3: SOT-89

B3: SOT-23

Output Voltage:

SOT89(X3) Type:								
Type	A	B	C	D	E	H	F	G
Voltage(V)	1.5	1.8	2.5	2.7	2.8	2.85	3.0	3.3
SOT23 (B3) Type:								
Type	A	B	C	D	E	H	F	G
Voltage(V)	1.5	1.8	2.0	2.1	2.5	2.8	3.0	3.3

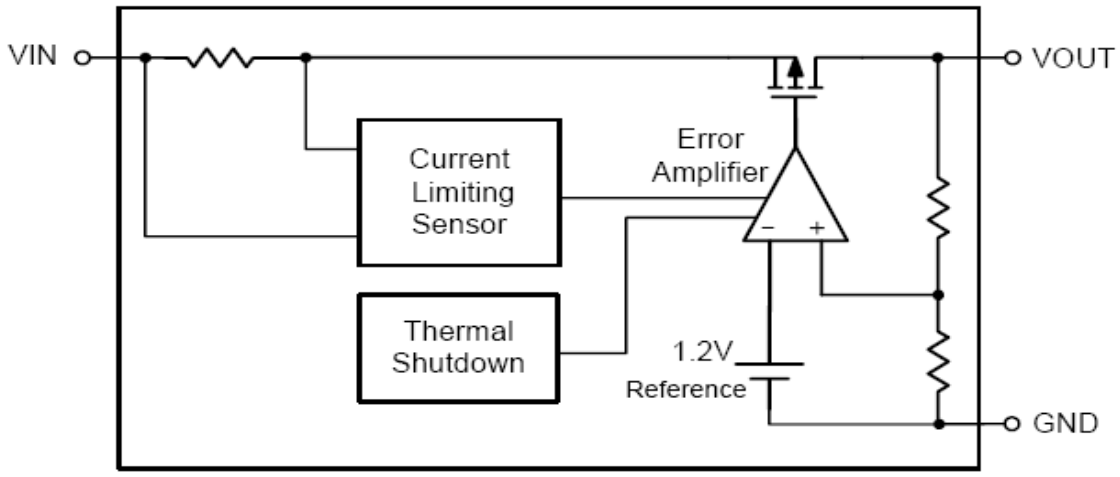
Note:

Output Voltage range from 1.5V to 3.3V.

Functional Pin Description

Pin Name	Pin Function
EN	Chip Enable (Active High). Note that this pin is high impedance. There should be a pull low 100kΩ resistor connected to GND when the control signal is floating.
BP	Reference Noise Bypass
GND	Ground
VOUT	Output Voltage
VIN	Power Input Voltage

Function Block Diagram



Absolute Maximum Ratings

Supply Input Voltage----------**6V**

Power Dissipation, PD @ TA = 25°C

SOT-89 ----------**600mW**

Package Thermal Resistance

SOT-89, θJA ----------**250°C/W**

Lead Temperature (Soldering, 10 sec.) ----------**260°C**

Storage Temperature Range ----------**−65°C to 150°C**

ESD Susceptibility

HBM (Human Body Mode) ----------**2kV**

MM(Machine-Mode)----------**200V**

Recommended Operating Conditions

Supply Input Voltage----------**2.5V to 5.5V**

EN Input Voltage ----------**0V to 5.5V**

Operation Junction Temperature Range ----------**−40°C to 125°C**

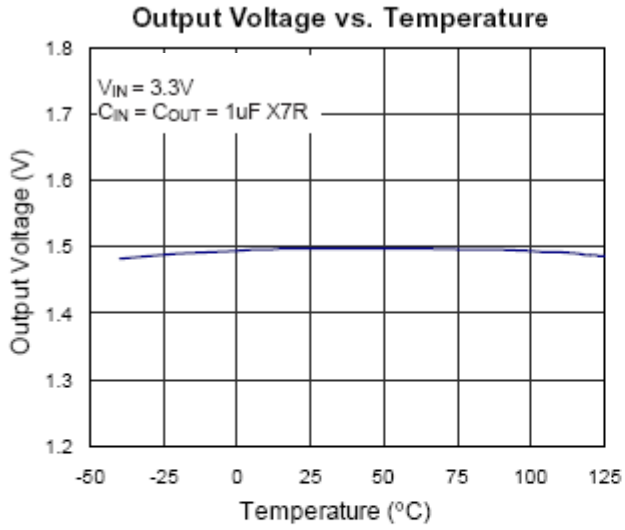
Operation Ambient Temperature Range----------**−40°C to 85°C**

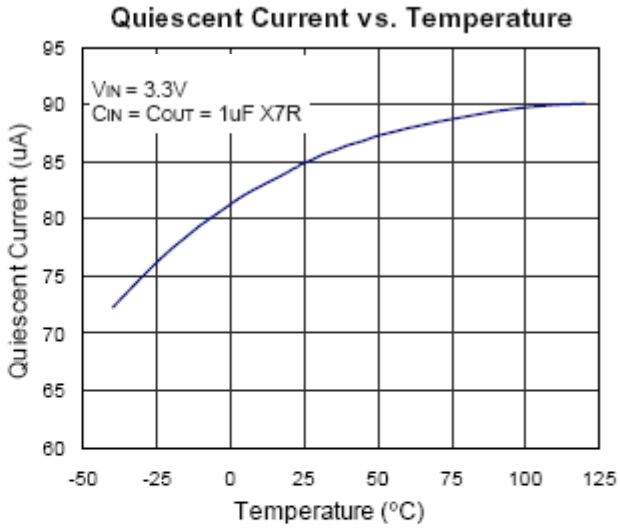
Electrical Characteristics

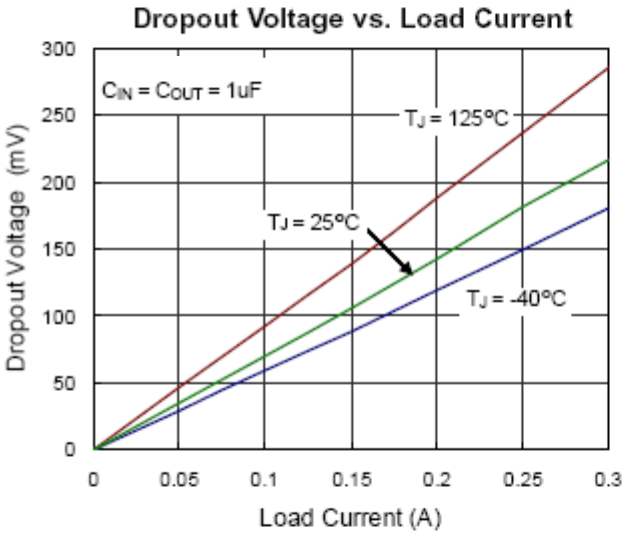
(VIN = VOUT + 1V, CIN = COUT = 1µF, CBP = 22nF, TA = 25° C, unless otherwise specified)

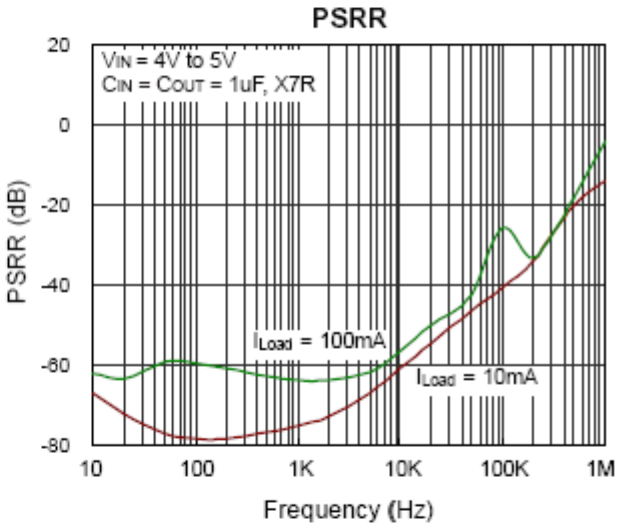
Parameter		Symbol	Test Conditions	Min	Typ	Max	Units
Output Voltage Accuracy		ΔVOUT	IOUT = 1mA	−2	--	+2	%
Current Limit		ILIM	RLOAD = 1Ω	360	400		mA
Quiescent Current		IQ	VEN ≥ 1.2V, IOUT = 0mA		90	130	µA
Dropout Voltage		VDROP	IOUT = 200mA, VOUT > 2.8V		170	200	mV
			IOUT = 300mA, VOUT > 2.8V		220	300	
Line Regulation		ΔVLINE	VIN = (VOUT + 1V) to 5.5V, IOUT = 1mA			0.3	%
Load Regulation		ΔVLOAD	1mA < IOUT < 300mA			0.6	%
Standby Current		ISTBY	VEN = GND, Shutdown		0.01	1	µA
EN Input Bias Current		IIBSD	VEN = GND or VIN		0	100	nA
EN Threshold	Logic-Low Voltage	VIL	VIN = 3V to 5.5V, Shutdown			0.4	V
	Logic-High Voltage	VIH	VIN = 3V to 5.5V, Start-Up	1.2			
Output Noise Voltage		eNO	10Hz to 100kHz, IOUT = 200mA COUT = 1µF		100		µ VRMS
Power Supply Rejection Rate	f = 100Hz	PSRR	COUT = 1µF, IOUT = 10mA		−80		dB
	f = 10kHz				−55		
Thermal Shutdown Temperature		TSD			165		° C

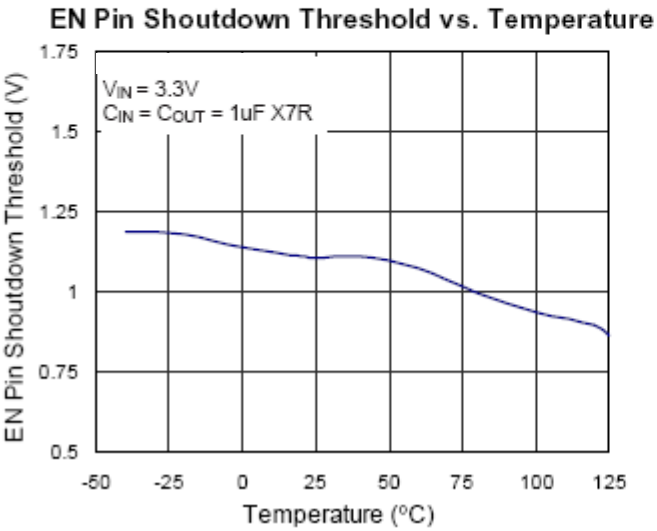
Typical Operating Characteristics

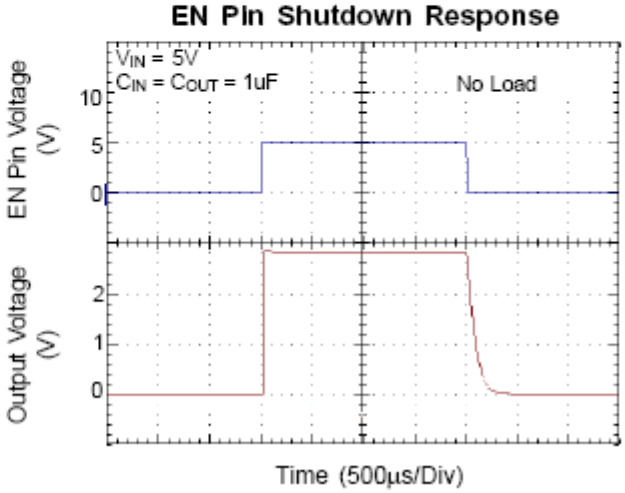




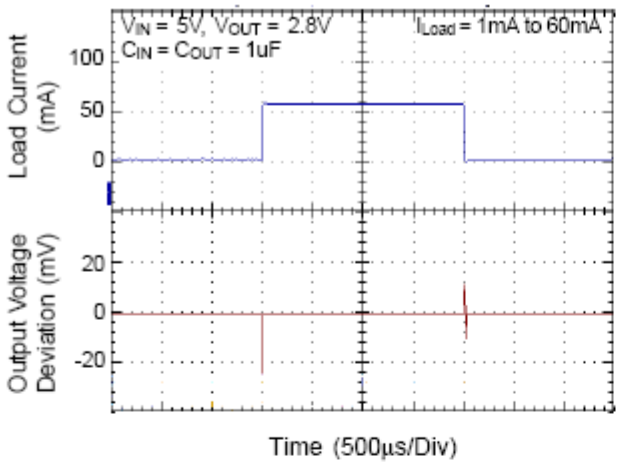




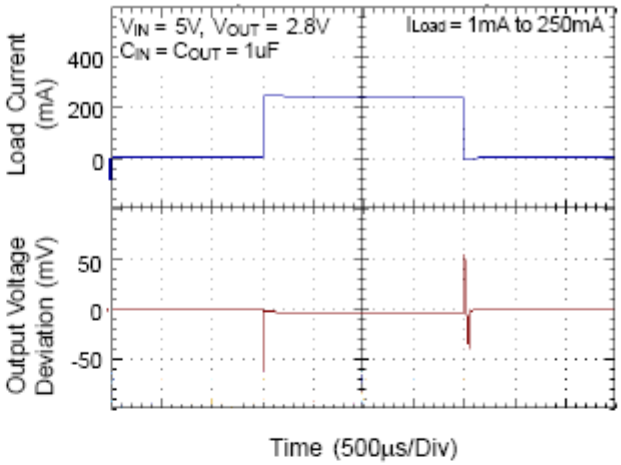




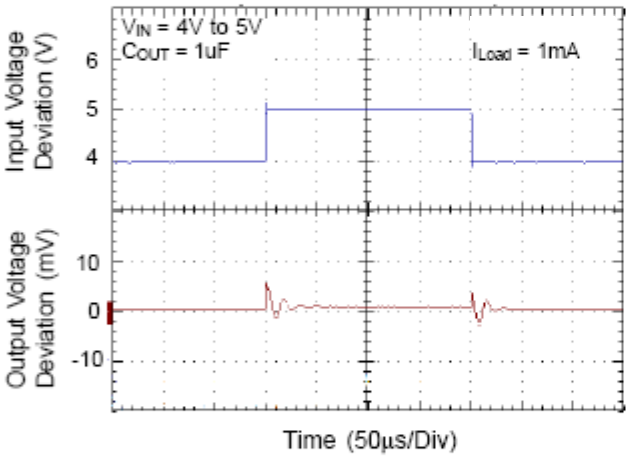
Load Transient Response



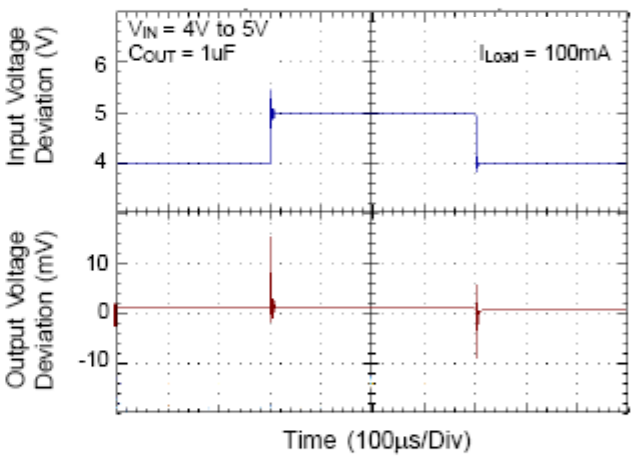
Load Transient Response



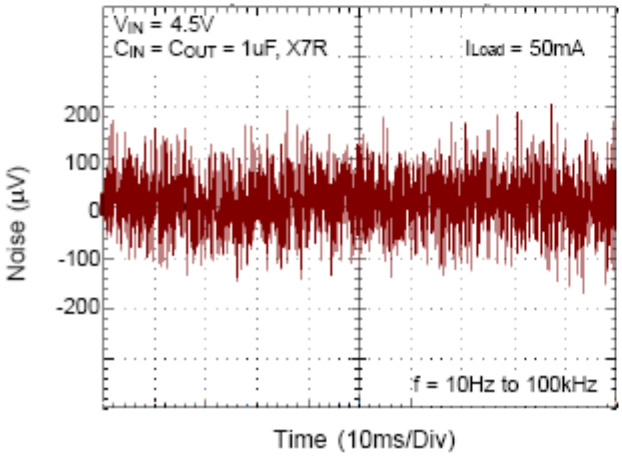
Line Transient Response



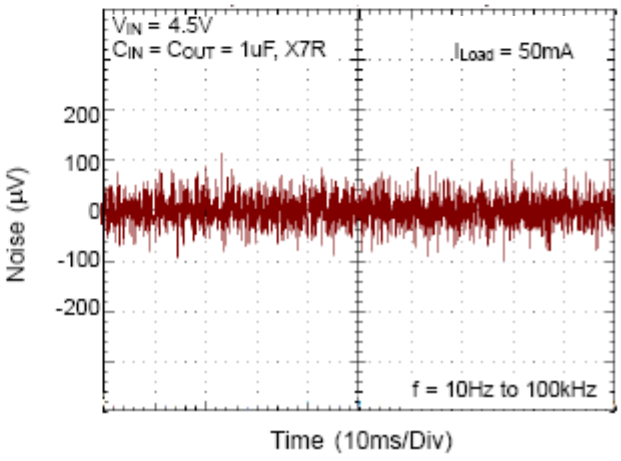
Line Transient Response



Noise



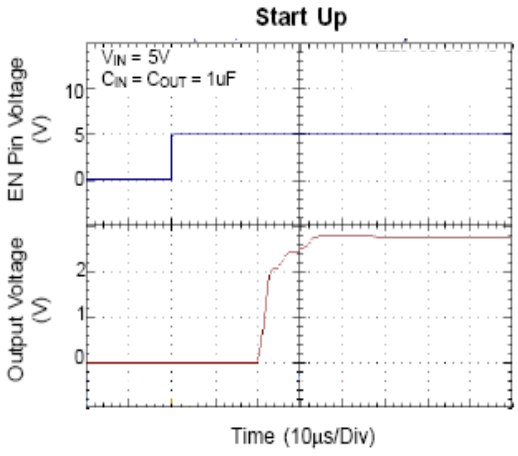
Noise



Applications Information

Like any low-dropout regulator, the external capacitors used with the LP3986 must be carefully selected for regulator stability and performance. Using a capacitor whose value is > 1μF on the LP3986 input and the amount of capacitance can be increased without limit. 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 LDOs application. The LP3986 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 1μF with ESR is > 25mΩ on the LP3986 output ensures stability. The LP3986 still works well with output capacitor of other types due to the wide stable ESR range. Figure 1 shows the curves of allowable ESR range as a function of load current for various output capacitor values. 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 VOUT pin of the LP3986 and returned to a clean analog ground.

Start-up Function



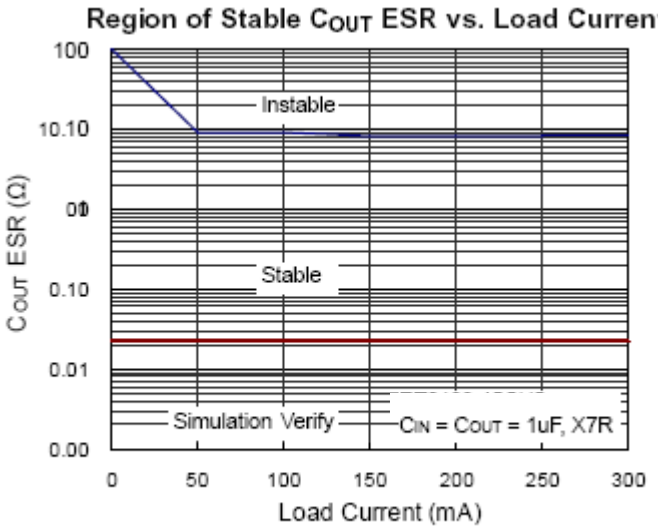


Figure 1

Enable Function

The LP3986 features an LDO regulator enable/disable function. To assure the LDO regulator will switch on, the EN turn on control level must be greater than 1.2 volts. The LDO regulator will go into the shutdown mode when the voltage on the EN pin falls below 0.4 volts. For to protecting the system, the LP3986 have a quick-discharge function. If the enable function is not needed in a specific application, it may be tied to VIN to keep the LDO regulator in a continuously on state.

Bypass Capacitor and Low Noise

Connecting a 22nF between the BP pin and GND pin significantly reduces noise on the regulator output, it is critical that the capacitor connection between the BP pin and GND pin be direct and PCB traces should be as short as possible. There is a relationship between the bypass capacitor value and the LDO regulator turn on time. DC leakage on this pin can affect the LDO regulator output noise and voltage regulation performance.

Thermal Considerations

Thermal protection limits power dissipation in LP3986. When the operation junction temperature exceeds 165°C, the OTP circuit starts the thermal shutdown function turn the pass element off. The pass element turn on again after the junction temperature cools by 30°C.

For continue operation, do not exceed absolute

maximum operation junction temperature 125°C. The power dissipation definition in device is :

PD = (VIN−VOUT) x IOUT + VIN x IQ 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 :

PD(MAX) = (TJ(MAX) − TA) /θJA Where TJ(MAX) is the maximum operation junction temperature 125°C, TA is the ambient temperature and the θJA is the junction to ambient thermal resistance.

For recommended operating conditions specification of LP3986, where TJ(MAX) is the maximum junction temperature of the die (125°C) and TA is the maximum ambient temperature. The junction to ambient thermal resistance (θJA is layout dependent) for SOT-23-5 package is 250°C/W.

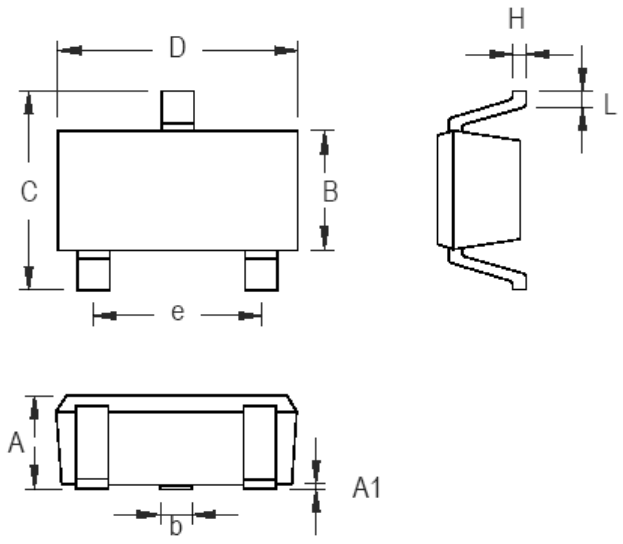
PD(MAX) = (125°C−25°C) / 250 = 400mW (SOT-23-5)

PD(MAX) = (125°C−25°C) / 165 = 606mW

The maximum power dissipation depends on operating

ambient temperature for fixed TJ(MAX) and thermal resistance θJA.

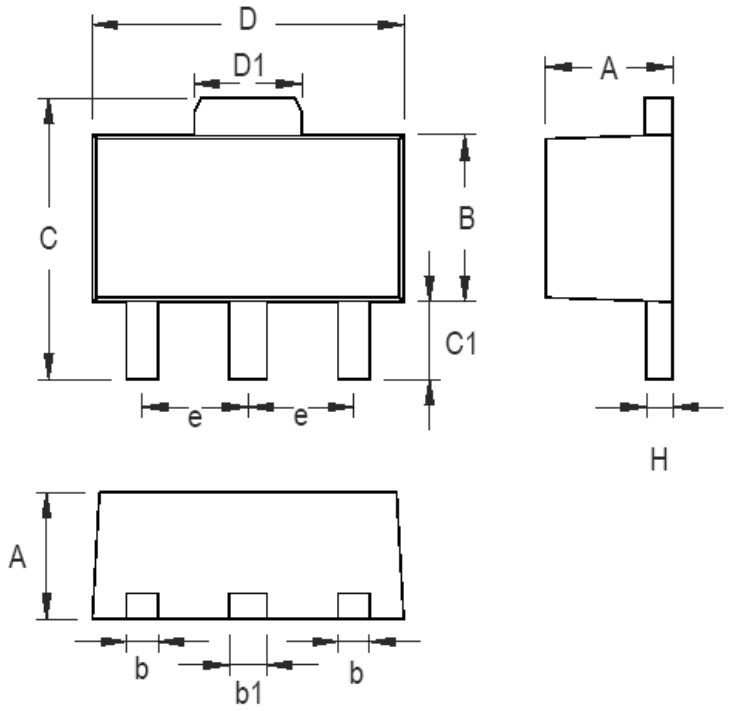
Package Information



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

Package Information



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