300mA,Ultra-low noise, Small Package Ultra-Fast CMOS LDO Regulator

General Description

The LP3981 is designed for portable RF and wireless applications demanding performance and space requirements. The LP3981 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 LP3981 also works with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications, critical in hand-held wireless devices. The LP3981 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. It is available in 5-lead of SOT23-5 packages.

Order Information

LP3981 □□ □□ □

- □ : F: Pb-Free
- □□ : Package Type
  - B5: SOT23-5
- □□ : Output Voltage Type
  - 12: 1.2V
  - 13: 1.3V
  - 15: 1.5V
  - 18: 1.8V
  - 25: 2.5V
  - 28: 2.8V
  - 30: 3.0V
  - 33: 3.3V

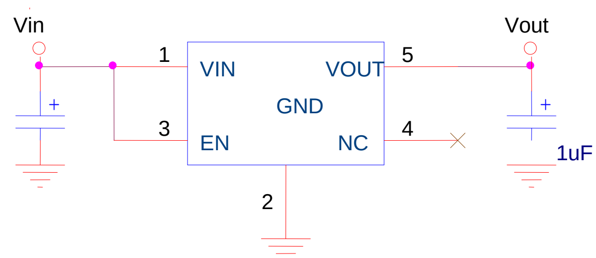
Features

- Ultra-Low-Noise for RF Application
- 2V- 6.5V Input Voltage Range
- Low Dropout : 220mV @ 300mA
- 1.2V, 1.5V, 1.8V, 2.5V, 2.8V 3.0V and 3.3V Fixed
- 300mA Output Current, 550mA Peak Current
- High PSSR:-76dB at 1KHz
- < 0.01uA Standby Current When Shutdown
- Available in SOT23-5 Package
- TTL-Logic-Controlled Shutdown Input
- Ultra-Fast Response in Line/Load transient
- Current Limiting and Thermal Shutdown Protection
- Quick start-up (typically 50uS)

Applications

- Portable Media Players/MP3 players
- Cellular and Smart mobile phone
- LCD
- DSC Sensor
- Wireless Card

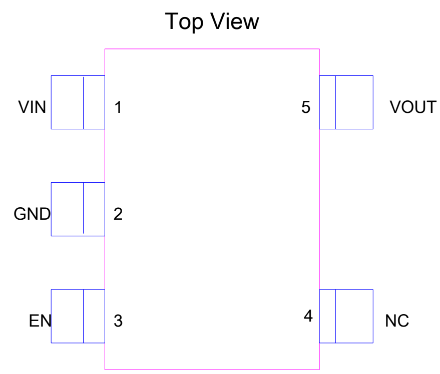
Typical Application Circuit



Marking Information

Device	Marking	Package	Shipping
LP3981		SOT23-5	3K/REEL

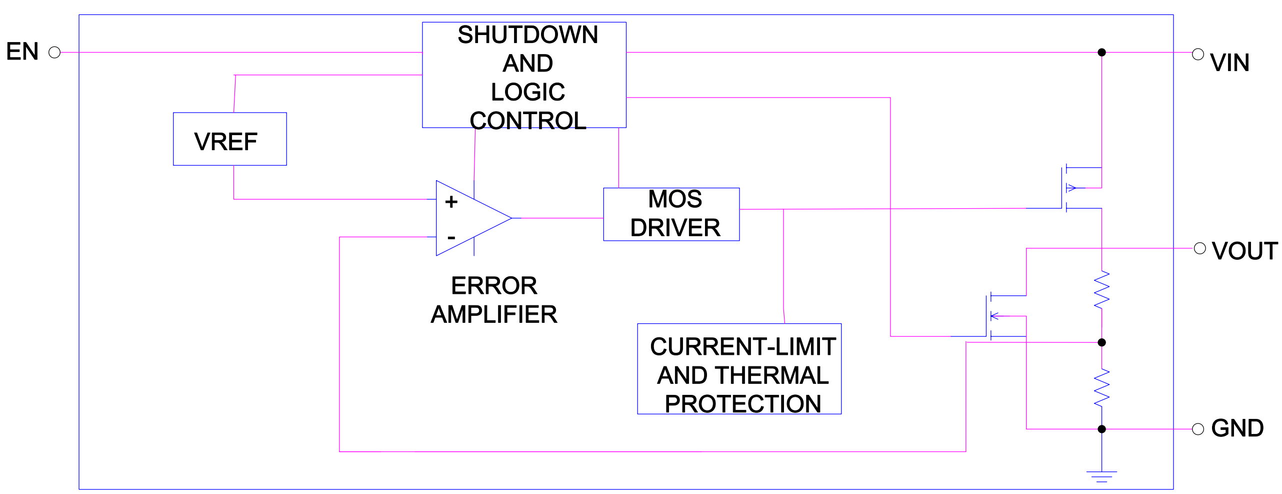
Functional Pin Description

Package Type	Pin Configurations
SOT23-5	

Pin Description

Pin	Name	Description
1	VIN	Power Input Voltage
2	GND	Ground
3	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.
4	NC	NC
5	VOUT	Output Voltage

Function Diagram



Absolute Maximum Ratings

- ✧ Supply Input Voltage -- 6V
- ✧ Power Dissipation, PD @ TA = 25°C SOT-25 -- 400mW
- ✧ Package Thermal Resistance SOT-25, 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

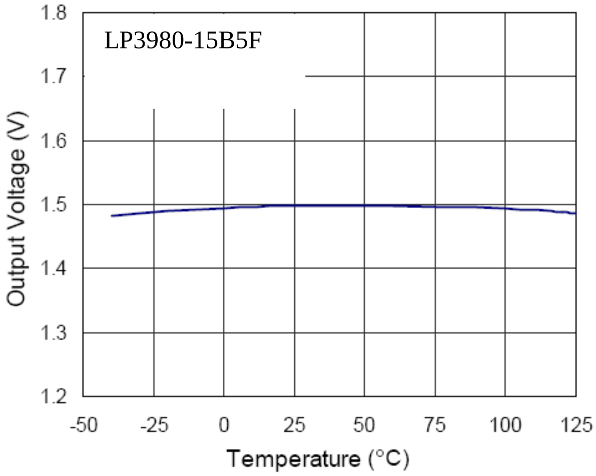
Electrical Characteristics

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

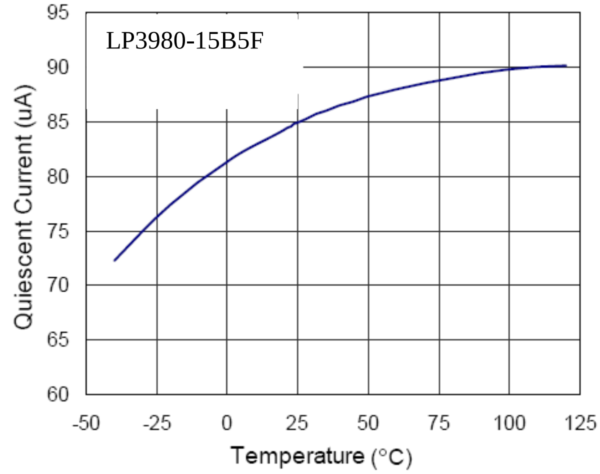
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Output Voltage Accuracy	ΔV_{OUT}	I_{OUT} = 1mA	−2	--	+2	%
Maximum output Current	I_{max}	V_{EN}=V_{IN},V_{IN}>2.5V		300		mA
Current Limit	I_{LIM}	R_{LOAD} = 1Ω	360	400		mA
Quiescent Current	I_Q	V_{EN} ≥ 1.2V, I_{OUT} = 0mA		45	120	μA
Dropout Voltage	V_{DROP}	I_{OUT} = 200mA, V_{OUT} > 2.8V		170	200	mV
		I_{OUT} = 300mA, V_{OUT} > 2.8V		220	300	mV
Line Regulation	ΔV_{LINE}	V_{IN} = (V_{OUT} + 1V) to 5.5V, I_{OUT} = 1mA			0.3	%
Load Regulation	ΔV_{LOAD}	1mA < IOUT < 300mA			2	%
Standby Current	I_{STBY}	V_{EN} = GND, Shutdown		0.01	1	μA
EN Input Bias Current	I_{IBSD}	V_{EN} = GND or V_{IN}		0.01	100	nA
EN Threshold: Logic-Low Voltage	V_{IL}	V_{IN}=3V to 5.5V, Shutdown			0.4	V
EN Threshold: Logic-High Voltage	V_{IH}	V_{IN}=3V to 5.5V, Start-Up	1.2			V
Output Noise Voltage		10Hz to 100kHz, I_{OUT}=200mA C_{OUT}=1μF		100		uVRMS
Power Supply Rejection Rate: f=100Hz	PSRR	C_{OUT}=1μF, I_{OUT}=50mA		−76		dB
Power Supply Rejection Rate: f=10kHz				−73		dB
Thermal Shutdown Temperature	T_{SD}			150		°C

Typical Operating Characteristics

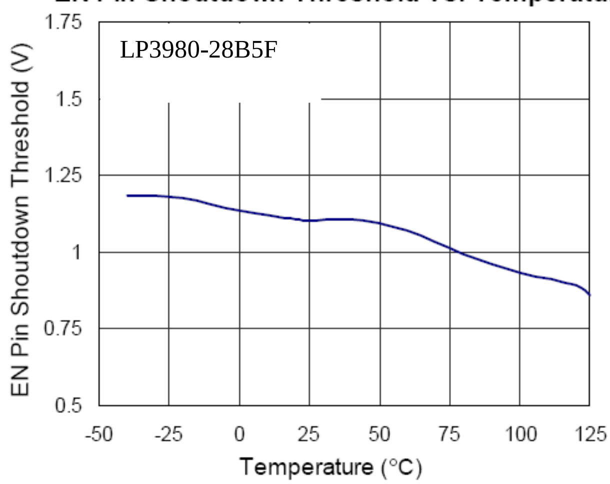
Output Voltage vs. Temperature



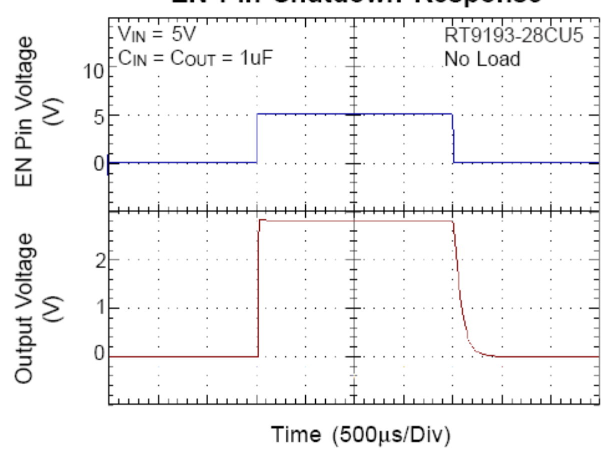
Quiescent Current vs. Temperature

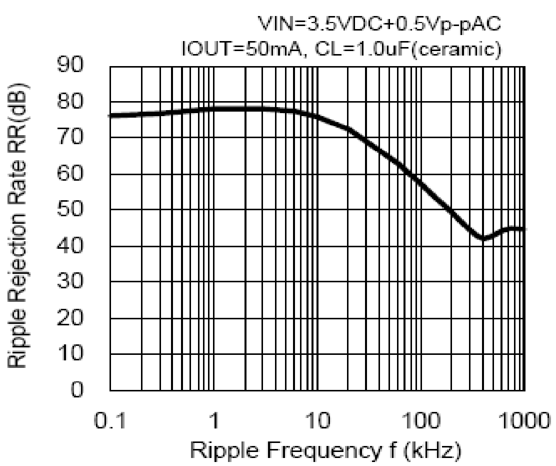


EN Pin Shoutdown Threshold vs. Temperature

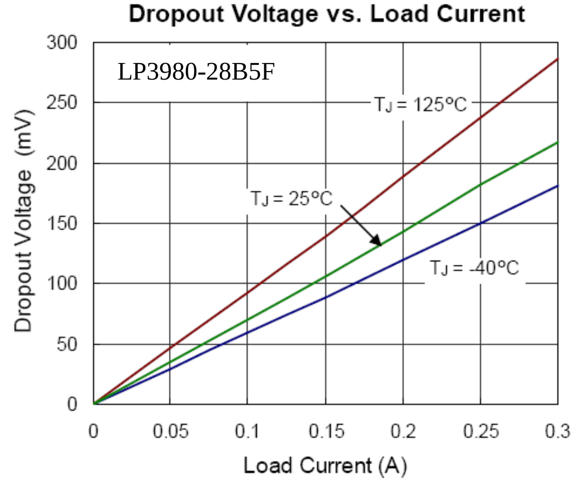


EN Pin Shutdown Response





Dropout Voltage vs. Load Current



Applications Information

Like any low-dropout regulator, the external capacitors used with the LP3981 must be carefully selected for regulator stability and performance. Using a capacitor whose value is > 1μF on the LP3981 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 LP3981 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 LP3981 output ensures stability. The LP3981 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 LP3981 and returned to a clean analog ground.

Start-up Function Enable Function

The LP3981 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 LP3981 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.

Thermal Considerations

Thermal protection limits power dissipation in LP3981. 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 :

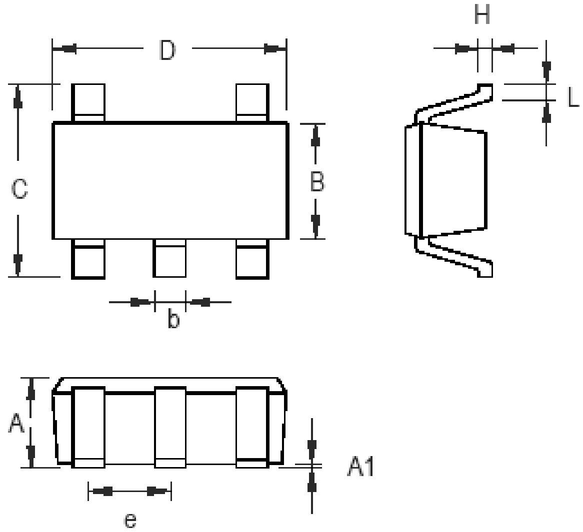
$$PD = (VIN - VOUT) \times IOUT + VIN \times IQ$$

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 :

$$PD(MAX) = (TJ(MAX) - TA) / \theta JA$$

Packaging 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	0.559	0.014	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

SOT- 25 Surface Mount Package

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