FH6211

Very High PSRR Low Noise 500mA RF LDO

Features

- Wide Input Voltage Range: 2.0V to 6.0V
- Up to 500mA Load Current
- Output Voltage Options Available on Request
- Very Low IQ: 40μA
- Very High PSRR: 75db at 1KHz
- Ultra Low Noise: 45uVrms at 1.2V output
- Ultra-FastStart-Up Time: 25μs
- Excellent Load/Line Transient Response
- Line Regulation: 0.03% typical
- Standard Fixed Output Voltage Options: 1.2V, 1.5V, 1.6V, 1.8V, 2.5V, 2.8V, 3.0V, and 3.3V,etc
- Ultra Low Dropout: 250mV at 300mA Load@VOUT= 2.8V

Description

The FH6211 family of low-dropout (LDO), low-power linear regulators offers very high power supply rejection ratio (PSRR) while maintaining very low 40μA ground current,suitable for RF applications. The family uses an advanced CMOS process and a PMOSFET pass device to achieve fast start-up, very low noise, excellent transient response, and excellent PSRR performance. The FH6211 is stable with a 1.0μF ceramic output capacitor, and uses a precision voltage reference and feedback loop to achieve a worst-case accuracy of 2% over all load, line, process, and temperature variations. It is fully specified from TJ= –40°C to +150°C and is offered in a small DFN4 package, which is ideal for small form factor portable equipment such as wireless handsets and PDAs.

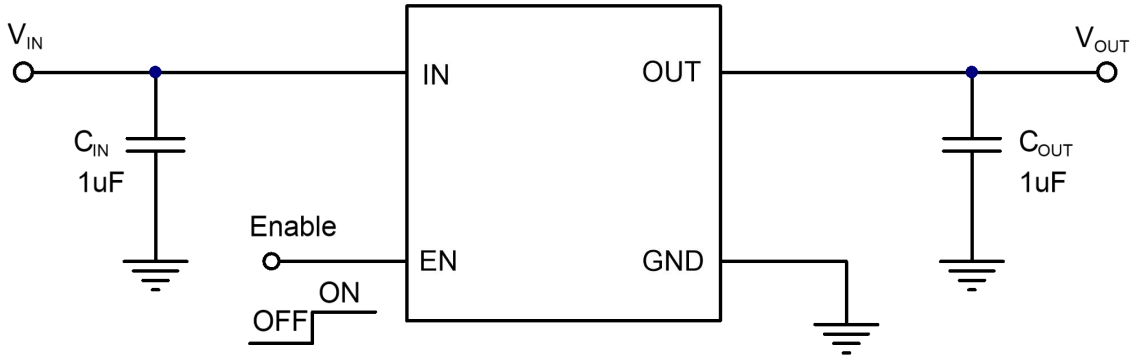
Applications

- Digital Still Cameras
- Portable instruments
- MP3/MP4 Player
- Smart Phones and Cellular Phones

Part No	Package	MSL
FH6211	SOT23-5	Level 1

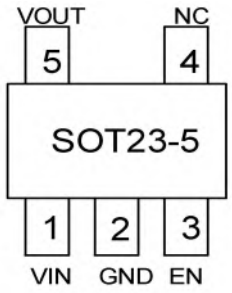
(1) For all available packages, see the orderable addendum at the end of the data sheet.

Typical Application



Low Noise 500mA RF LDO

Pin Configuration and Functions



Pin Functions

Pin No.	Pin Name	Pin Function
1	IN	Supply input pin. Must be closely decoupled to GND with a 1μF or greater ceramic capacitor
2	GND	Ground pin
3	EN	Enable control input, active high. Do not leave EN floating
4	NC	No Connection
5	OUT	Output pin. Bypass a 1μF ceramic capacitor from this pin to ground

Absolute Maximum Ratings

Parameter	Rating	Unit
IN Voltage	-0.3 to 6.5	V
Other Pin Voltage	-0.3 to V_{IN}+0.3	V
Maximum Load Current	500	mA
Operating Junction Temperature	-40 to 150	°C
Storage Temperature	-65 to 150	°C
Lead Temperature (Soldering, 10 sec)	300	°C

Note:

exceeding the range specified by the rated parameters will cause damage to the chip, and the working state of the chip beyond the range of rated parameters cannot be guaranteed. Exposure outside the rated parameter range will affect the reliability of the chip.

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	2.0 to 6.0	V
I_{OUT}	Output Current	0 to 500	mA
T_A	Operating Ambient Temperature	-40 to 85	°C
C_{IN}	Effective Input Ceramic Capacitor Value	0.47 to 4.7	uF
C_{OUT}	Effective Output Ceramic Capacitor Value	0.47 to 4.7	uF
ESR	Input and Output Capacitor Equivalent Series Resistance	5 to 100	mΩ

Electrical Characteristics

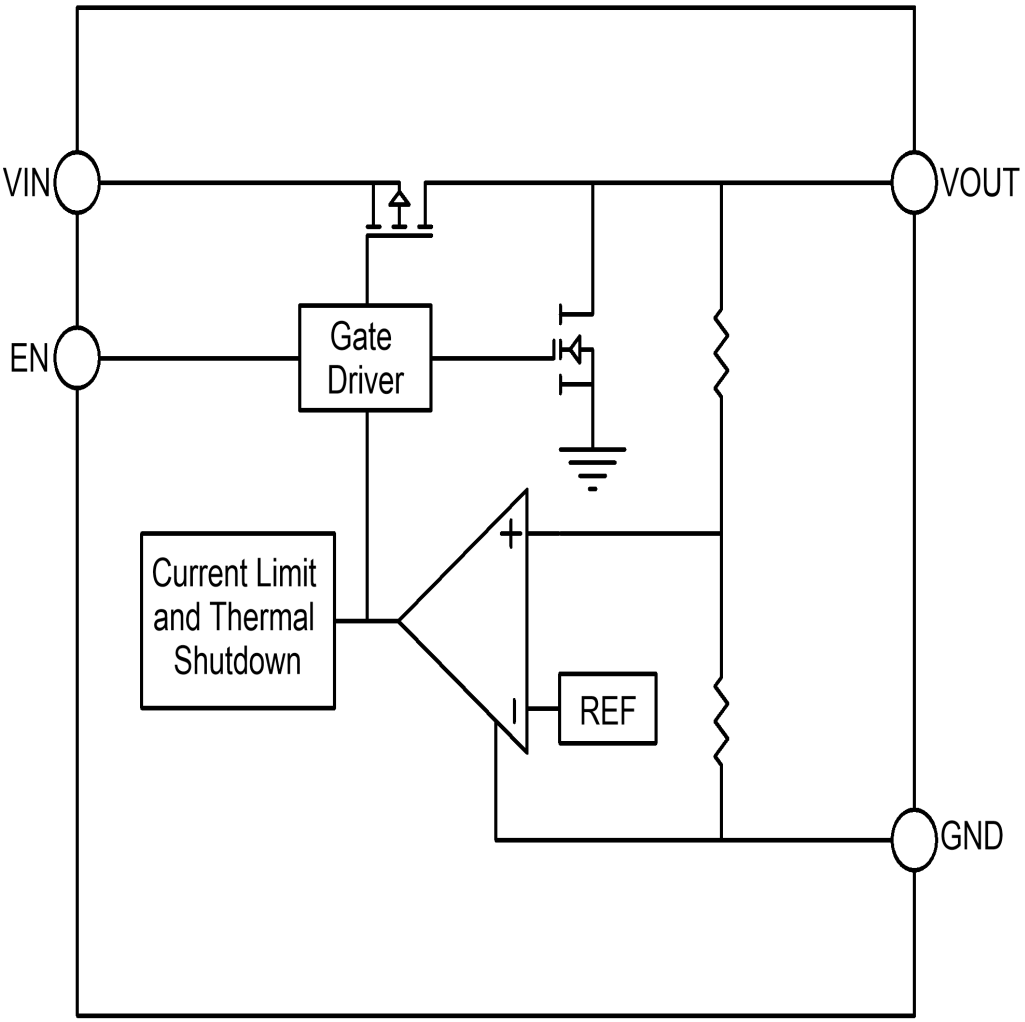
(V_{IN}=V_{EN}=V_{OUT}+1.0V, I_{OUT}=1mA, C_{IN}=1μF,C_{OUT}=1μF, Typical values are at T_A=25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Operation Range	V_{IN}		2.0		6.0	V
Dropout Voltage	V_{DROP}	V_{OUT} = 1.05V, I_{OUT} = 300mA		750	850	mV
		V_{OUT} = 1.2V, I_{OUT} = 300mA		700	800	
		V_{OUT} = 1.3V, I_{OUT} = 300mA		700	800	
		V_{OUT} = 1.5V, I_{OUT} = 300mA		600	730	
		V_{OUT} = 1.6V, I_{OUT} = 300mA		500	650	
		V_{OUT} = 1.7V, I_{OUT} = 150mA		450	620	
		V_{OUT} = 1.8V, I_{OUT} = 300mA		380	520	
		V_{OUT} = 2.2V, I_{OUT} = 300mA		350	490	
		V_{OUT} = 2.5V, I_{OUT} = 300mA		280	450	
		V_{OUT} = 2.8V, I_{OUT} = 300mA		250	400	
		V_{OUT} = 2.9V, I_{OUT} = 300mA		250	400	
		V_{OUT} = 3.0V, I_{OUT} = 300mA		240	390	
		V_{OUT} = 3.3V, I_{OUT} = 300mA		210	360	
		V_{OUT} = 3.45V, I_{OUT} =300mA		200	350	
DC Supply Quiescent Current	I_{Q_ON}	Active mode: V_{EN}=V_{IN}		36	60	μA

Electrical Characteristics(Continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
DC Supply Shutdown Current	$I_{Q\ OFF}$	V_{EN}=0V		0.01	1	μA
Regulated Output Voltage	V_{OUT}	I_{OUT}=1mA, -40°C≤T_A≤85°C	-2		2	%
Output Voltage Line Regulation	Reg_{LINE}	V_{IN} = V_{OUT} +1V to 5.5V, I_{OUT} = 10mA		0.03	0.2	%
Output Voltage Load Regulation	Reg_{LOAD}	I_{OUT} from 1mA to 300mA		0.2	0.7	%
Current Limit	I_{LIM}		300			mA
Power Supply Rejection Ratio	PSRR	f=1kHz, C_{OUT}=1μF, I_{OUT}=20mA		75		dB
		f=10kHz, C_{OUT}=1μF, I_{OUT}=30mA		65		
Output Noise	e_N	10Hz to 100kHz, I_{OUT} =200mA,V_{OUT}=2.8V, C_{OUT} = 1μF		70		μV_{RMS}
		10Hz to 100kHz, I_{OUT} =200mA,V_{OUT}=1.2V, C_{OUT} = 1μF		45		
Soft-start Time	T_{ON}	From Enable to Power On		25		μs
EN Low Threshold	V_{ENL}				0.3	V
EN High Threshold	V_{ENH}		1.5			V
EN pull-down resistance	R_{PD}		0.8	1	1.3	MΩ
Over-temperature Shutdown Threshold	T_{TSD}			155		°C
Over-temperature Shutdown Hysteresis	T_{TSR}			20		°C

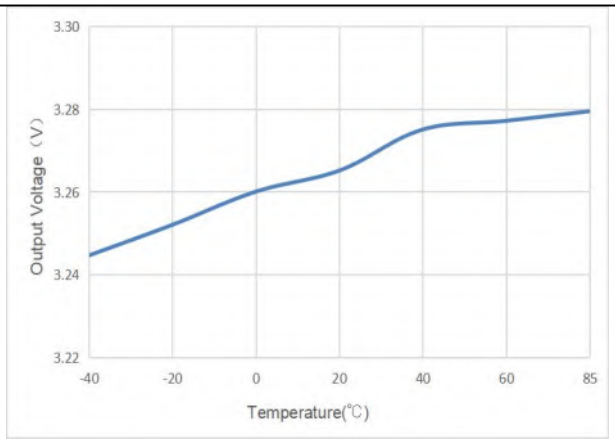
Functional Block Diagram



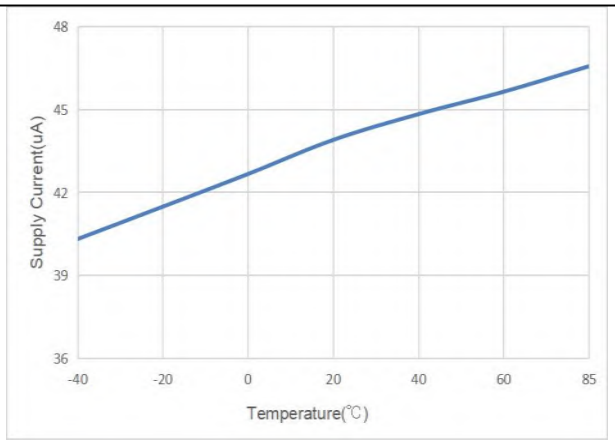
Functional Block Diagram

Typical Characteristics

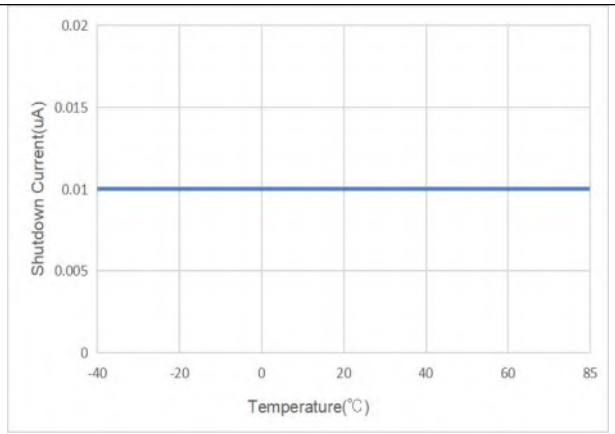
(FH6211, V_{IN} = 4.3V, I_{OUT} = 1mA ,C_{IN} = Ceramic 1.0μF, C_{OUT} = Ceramic 1.0μF,T_A= -40°C~85°C)



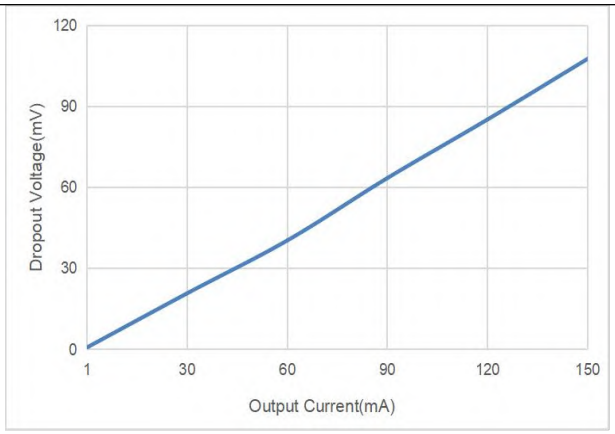
Output Voltage VS Temperature



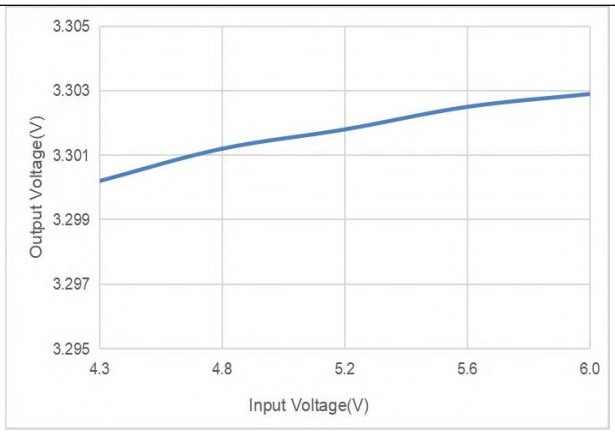
Supply Current VS Temperature



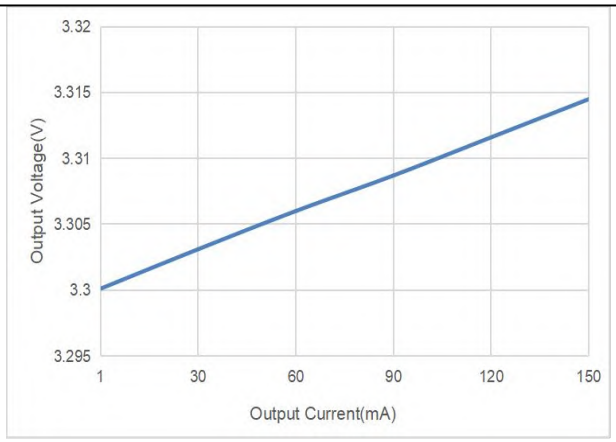
Shutdown Current VS Temperature



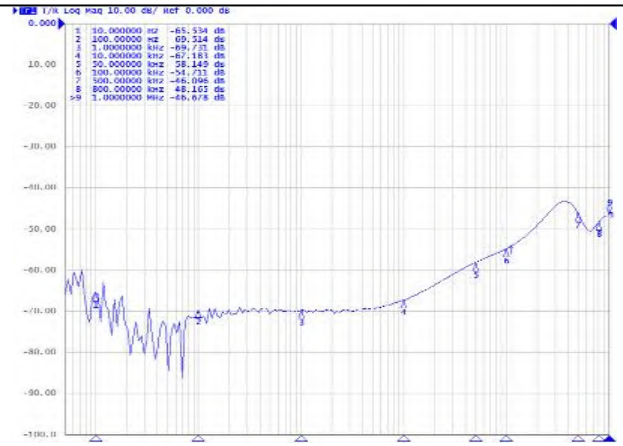
Dropout Voltage VS Output Current



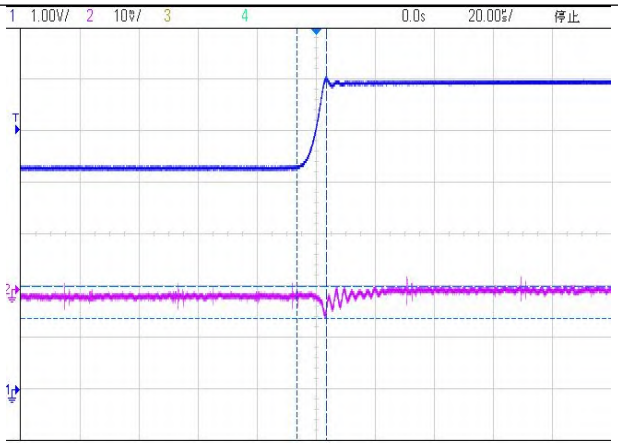
Output Voltage VS V_{IN} Input Voltage



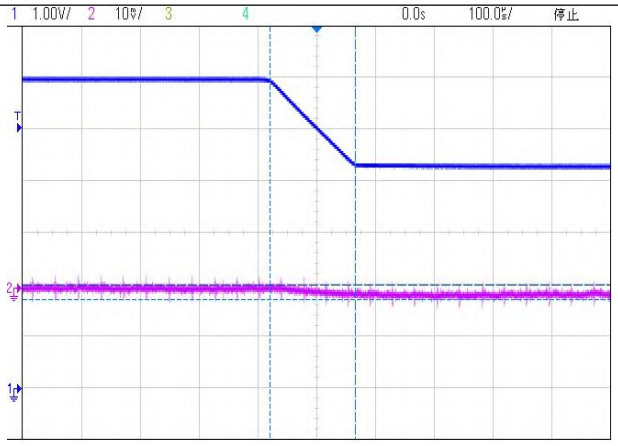
Output Voltage VS Output Current



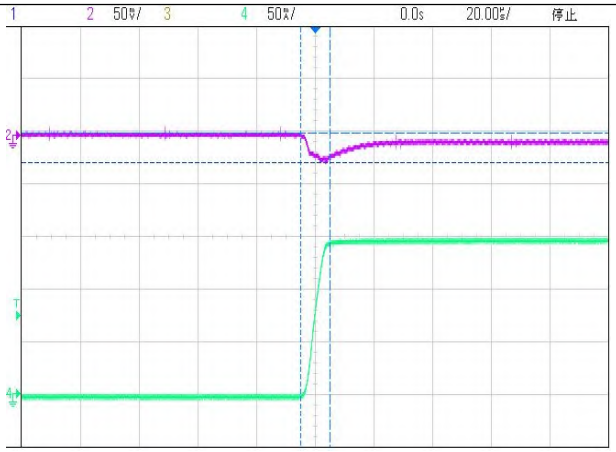
PSRR



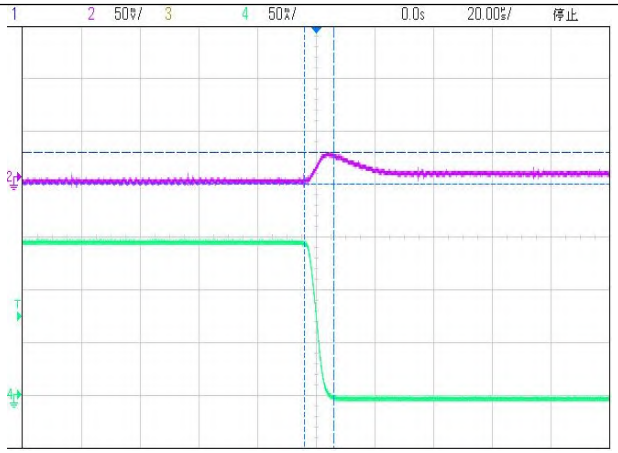
Input Transient(4.3~6V t=10us 10mA)



Input Transient(6~4.3V t=10us 10mA)



Load Transient(1mA~150mA t=10us)



Load Transient(150mA~1mA t=10us)

Detailed Description

Overview

The FH6211 series products are 500mA wide input voltage range linear regulators.

These voltage regulators operate from 2V to 6V DC input voltage with supporting 6V transient input voltage and consume 40μA quiescent current at no load.

The FH6211 series products also provide enable control and Power-Good feature, which is very suitable for the applications needing sequence configuration. Other protection features include the VIN input under-voltage lockout, over current protection, output hard short protection and thermal shutdown protection.

The FH6211 series products are available in fixed voltage versions of 1.2V,1.5V,1.6V,1.8V, 2.5V,2.8V,3.0V and 3.3V with 1% output voltageaccuracy at room temp and 2% output voltage accuracy over operating conditions. The FH6211 is available in standard fixed output voltages of 1.2V, 1.3V , 1.5V , 1.6V , 1.7V , 1.8V, 2.2V ,2.5V 2.8V, 2.9V, 3.0V, 3.3V, 3.45V and custom voltage options (50mV step options between 0.8V and 5.0V are available upon request).

Input Capacitor

A 1μF ceramic capacitor is recommended to connect between VIN and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both VIN and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 1μF to 2.2μF, Equivalent Series Resistance (ESR) is from 5mΩ to 100mΩ, and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to OUT and GND pins.

ON/OFF Input Operation

The FH6211 is turned on by setting the EN pin high, and is turned off by pulling it low. If this feature is not used, the EN pin should be tied to IN pin to keep the regulator output on at all time.

High PSRR and Low Noise

RF circuits such as LNA (low-noise amplifier), up/down-converter, mixer, PLL, VCO, and IF stage, require low noise and high PSRR LDOs. The temperature-compensated crystal oscillator circuit requires very high PSRR at RF power amplifier burst frequency. For instance, minimum 65dB PSRR at 217Hz is recommended for the GSM handsets.

The FH6211, with PSRR of 75dB at 1KHz, is suitable for most of these applications that require high PSRR and low noise.

Ultra Fast Start-up

After enabled, the FH6211 is able to provide full power in as little as tens of microseconds, typically 25μs.

This feature will help load circuitry move in and out of standby mode in real time, eventually extend battery life for mobile phones and other portable devices.

Fast Transient Response

Fast transient response LDOs can also extend battery life. To meet this load requirement, the LDO must react very quickly without a large voltage drop or overshoot — a requirement that cannot be met with conventional, general-purpose LDOs.

The FH6211's fast transient response from 0 to 150mA provides stable voltage supply for fast DSP and GSM chipset with fast changing load.

Low Quiescent Current

The FH6211, consuming only around 40μA for all input range and output loading, provides great power saving in portable and low power applications.

Current Limit Protection

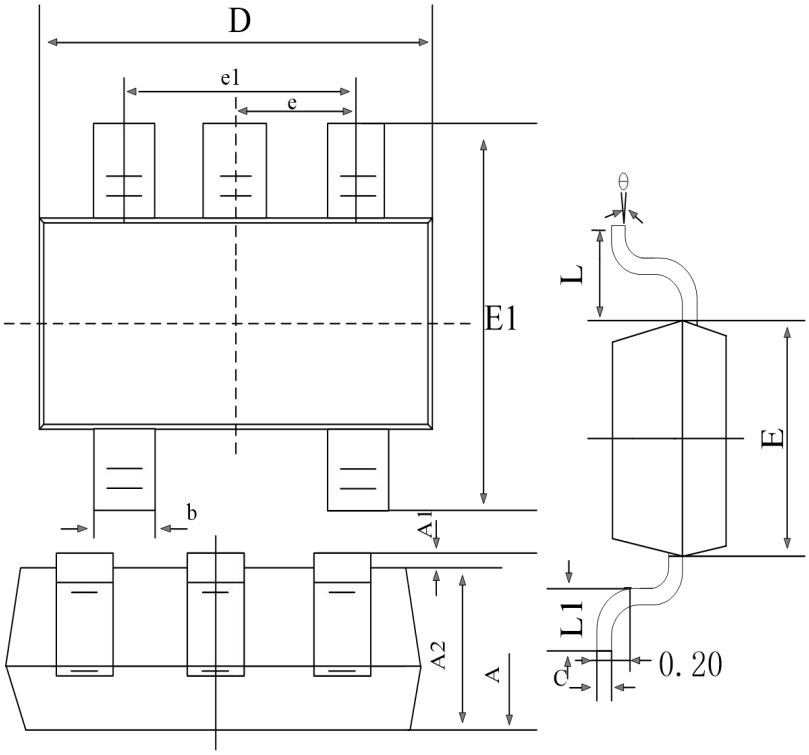
When output current at the OUT pin is higher than current limit threshold or the OUT pin is short-circuit to GND, the current limit protection will be triggered and clamp the output current to approximately 500mA to prevent over-current and to protect the regulator from damage due to overheating.

Thermal Shutdown Protection

Thermal protection disables the output when the junction temperature rises to approximately +155°C, allowing the device to cool down. When the junction temperature reduces to approximately +130°C the output circuitry is enabled again. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits the heat dissipation of the regulator, protecting it from damage due to overheating.

Package Dimension

SOT23-5



REF.	Millimeter	
	Min.	Max.
A	1.05	1.25
A1	0	0.1
A2	1.05	1.15
b	0.3	0.5
c	0.1	0.2
D	2.85	3.05
E	1.5	1.7
E1	2.65	2.95
e	0.95(BSC)	
e1	1.8	2.0
L	0.3	0.6
θ	0^0	8^0