Features

- 500mA guaranteed output current
- Wide input voltage range: 1.6V to 6.0V
- Adjustable output voltage range: 0.6V to 4.6V
- Ultra low dropout voltage: 320mV @ 500mA
- ±2% initial voltage accuracy
- Low quiescent current 40μA
- Fast transient response over line and load transient
- <1μA shutdown current
- Over current protection and current fold-back
- Short-circuit protection
- Over-temperature protection
- High PSRR: -70dB @ 1kHz
- Build-in internal soft start
- Low inrush current during soft start
- Stable with 1μF minimum ceramic output capacitor
- Green Product RoHS Compliant and Halogen Free

Description

The ITE9101 is a CMOS linear regulator featuring low quiescent current, low output voltage noise, low dropout voltage and fast transient response. It guarantees delivery of 500mA output current, and it is available in adjustable output voltage range from 0.6V ~ 4.6V.

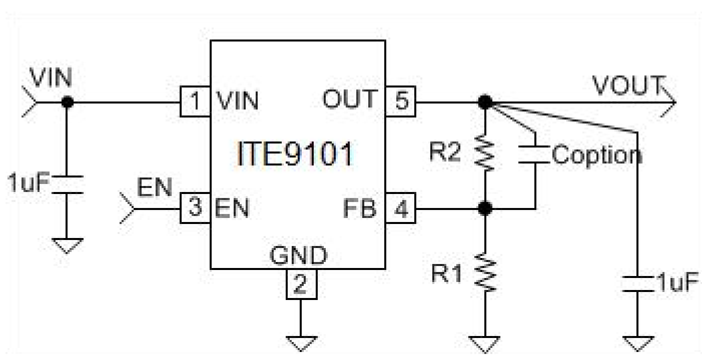
Based on its low quiescent current consumption and its less than 1μA shutdown mode, the ITE9101 is ideal for battery-powered applications. The high power supply rejection ratio of the ITE9101 holds well for low input voltages typically encountered in battery-operated systems. The regulator is stable with small ceramic capacitor loads (1μF typical).

The ITE9101 is available in SOT23-5L package.

Applications

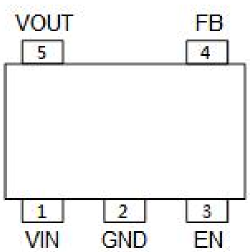
- CDMA / GSM
- Portable Communication Equipment
- Camera Modules
- Battery Powered Systems
- Portable Device

Application Diagram



Typical Application Schematic of ITE9101

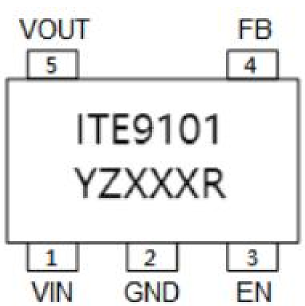
Pin Description



SOT23-5L

NO.	NAME	DESCRIPTION
1	VIN	IC Power Supply.
2	GND	IC Ground.
3	EN	Enable pin, active high.
4	FB	Feedback input pin. Feedback voltage is set to be 0.6V. The output voltage can be expressed by the equation: $\mathrm{VOUT} = \frac{0.6\mathrm{V}}{\mathrm{R1}} \times (\mathrm{R1} + \mathrm{R2})$.
5	VOUT	IC output.

Marking Information



PACKAGE	MARKING	MARKING DESCRIPTION
LEFT	ITE9101	Model
	Y	Year
	Z	Period
	XXX	Batch number
	R	Code

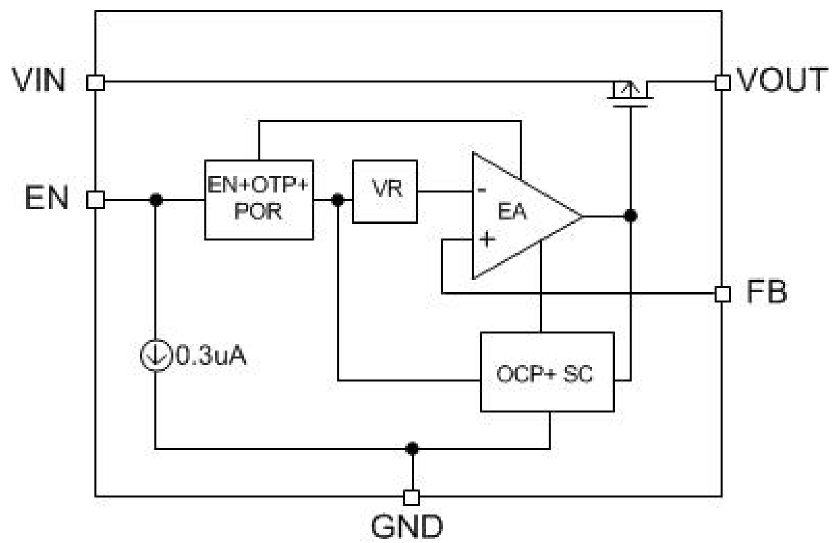
Universal Naming Convention

<u>ITE</u> <u>9101</u>
① ②

①: Brand code

②: Model

Functional Block Diagram



Absolute Maximum Ratings (Note 1)

PARAMETER	SYMBOL	LIMIT	UNIT
V_{IN} to GND	V_{IN}	-0.3 < V_{IN} < 6	V
Output Voltage	V_{OUT}	-0.3 < V_{OUT} < V_{IN}+0.3	V
Enable Range	V_{EN}	-0.3 < V_{EN} < 6	V
FB Voltage	V_{FB}	-0.3 < V_{FB} < 6	V
Package Power Dissipation	PD_SOT-23-5, T_A≦25°C	455	mW
Junction Temperature	T_J	-45 ~ +150	℃
Storage Temperature	T_{STG}	-65 ~ +150	℃
Lead Temperature (Soldering) 10s	T_{LEAD}	260	℃
ESD (Machine Model) (Note 2)	V_{ESD_MM}	200	V
ESD (Human Body Model) (Note 2)	V_{ESD_HBM}	2k	V

Thermal Information (Note 3)

PARAMETER	SYMBOL	LIMIT	UNIT
Thermal Resistance Junction to Ambient	$\theta_{JA\_SOT-23-5}$	220	℃/W

Recommended Operating Conditions (Note 4)

PARAMETER	SYMBOL	LIMIT	UNIT
Power Supply to Ground	V_{IN}	1.6 to 6	V
Enable Range	V_{EN}	0 to VIN	V
Operation Temperature Range	T_A	-40 ~ 85	℃
Junction Temperature	T_J	-40 ~ 125	℃

Electrical Characteristics

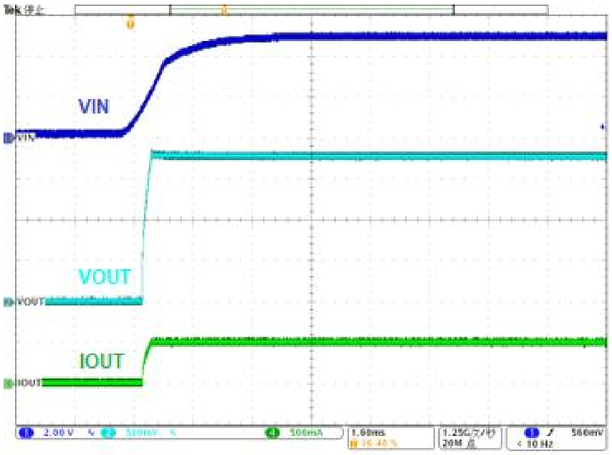
Values are at $V_{IN} = V_{OUT(NOM)} + 1V$, $C_{IN} = C_{OUT} = 1\mu F$, $I_{OUT} = 1mA$ and $T_A = 25^{\circ}C$, unless otherwise noted.

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Basic Operation						
V_{FB}	Feedback Voltage (VFB)	$T_A = 25$℃	0.588	0.6	0.612	V
I_{FB}	FB Input Current			0	1	μA
V_{IN}	Supply Voltage		1.6		6	V
I_{VIN}	Supply Current	Unload		40		μA
I_{STBY}	Standby Current	$V_{EN} = 0V$		0	1	μA
I_{OUT}	Output Current(Note 5)		500 (Note6)			mA
T_{SS}	Soft-start time			50		μs
V_{ENH}	EN Input Voltage High	$V_{IN} = 5V$	1.2			V
V_{ENL}	EN Input Voltage Low	$V_{IN} = 5V$			0.4	V
I_{EN}	EN Input Current	$V_{EN} = V_{IN} = 5V$		0.3		μA
V_{DROP}	Dropout Voltage (Note 7)	$I_{OUT} = 300mA$ @ $V_{OUT} = 3.3V$		180		mV
		$I_{OUT} = 500mA$ @ $V_{OUT} = 3.3V$		320		mV
I_{lim}	Limit Current			0.85		A
I_{short}	Short Current	$V_{OUT} < 0.2V$		0.3		A
$\triangle V_{OUT}$	Line Regulation	$V_{IN} = V_{OUT} + 1V$ to $5.5V$, $I_{OUT} = 1mA$		0.03	0.2	%/V
$\triangle V_{OUT}$	Load Regulation	$V_{IN} = V_{OUT} + 1V$, $I_{OUT} = 1mA$ to $500mA$		2	20	mV
PSRR	Power Supply Rejection Ratio	Freq = 1kHz, $I_{OUT} = 30mA$		70		dB
T_{SD}	Thermal Shutdown Temperature	T_J Rising		155		℃
$\triangle T_{SD}$	Thermal Shutdown Returned Temperature			125		℃

Note 1. Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
Note 2. Devices are ESD sensitive. Handling precaution is recommended.
Note 3. θJA is measured in the natural convection at TA=25°C on a high effective thermal conductivity test board (40mm x 40mm x 1.6mm double sided board with 2oz, copper ratio: approx. 50%) of JEDEC 51-7 thermal measurement standard.
Note 4. The device is not guaranteed to function outside its operating conditions.
Note 5. The output current at which the output voltage becomes 95% of VOUT after gradually increasing the output current.
Note 6. The output current can be at least this value. Due to restrictions on the package power dissipation, this value may not be satisfied. Attention should be paid to the power dissipation of the package when the output current is large.
The specification is guaranteed by design.
Note 7. The dropout voltage is defined as VIN - VOUT, which is measured when VOUT is 98%*VOUT.

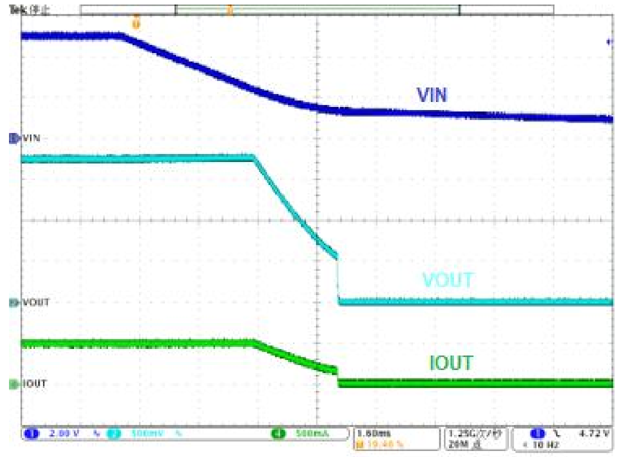
Typical Performance Characteristics

Power On from VIN With RLOAD=3.6ohm



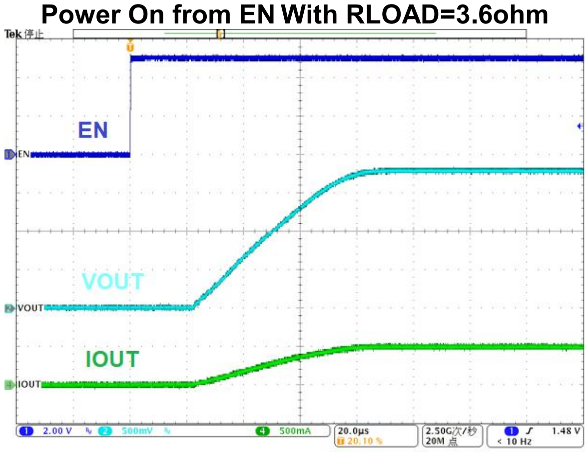
VIN=0V~5.0V, V_{OUT}=1.8V, RLOAD =3.6ohm

Power Off from VIN With RLOAD=3.6ohm



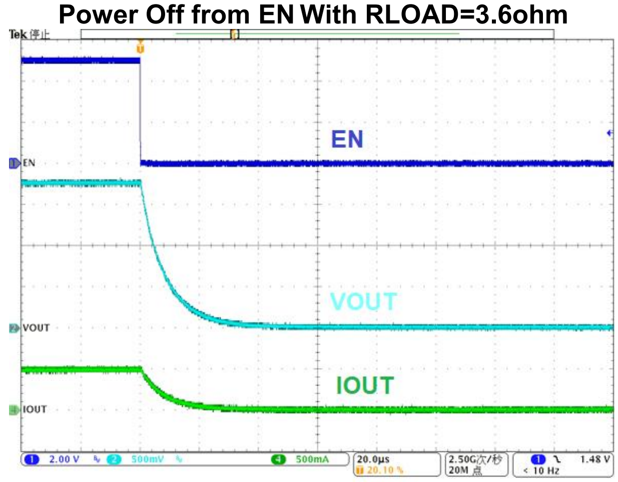
VIN=5.0V~0V, V_{OUT}=1.8V, RLOAD =3.6ohm

Power On from EN With RLOAD=3.6ohm



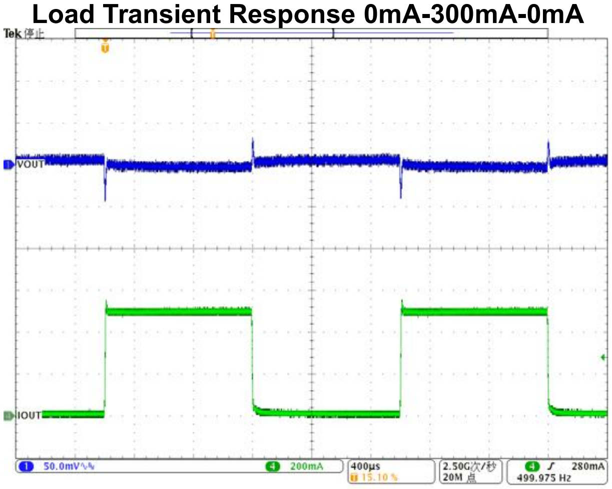
EN=0V~5.0V, V_{OUT}=1.8V, RLOAD =3.6ohm

Power Off from EN With RLOAD=3.6ohm



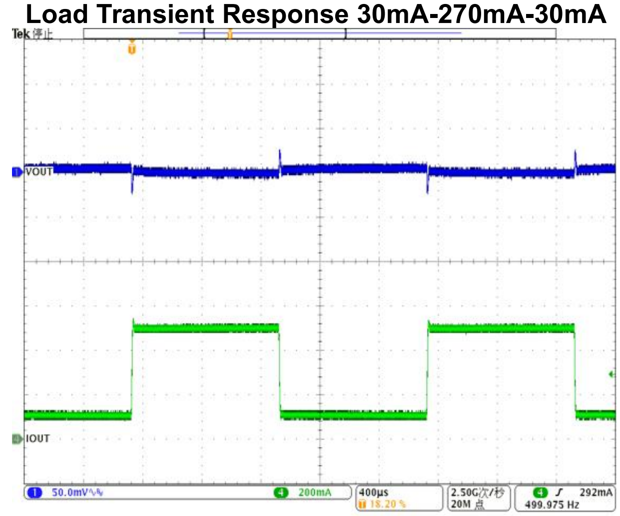
EN=5.0V~0V, V_{OUT}=1.8V, RLOAD =3.6ohm

Load Transient Response 0mA-300mA-0mA



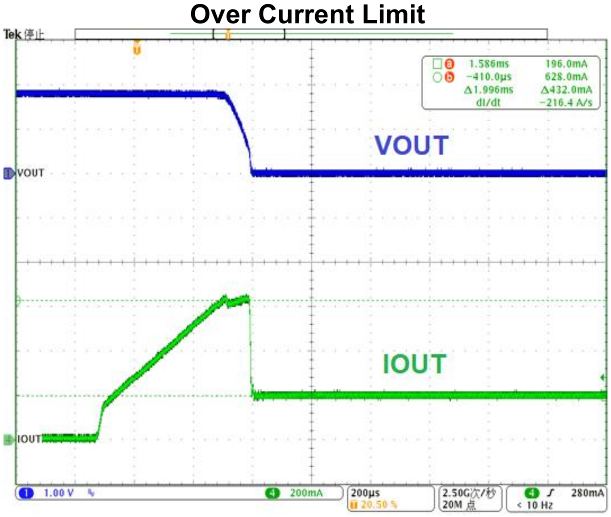
VIN=2.8V, V_{OUT}=1.8V, IOUT=0mA-500mA-0mA

Load Transient Response 30mA-270mA-30mA



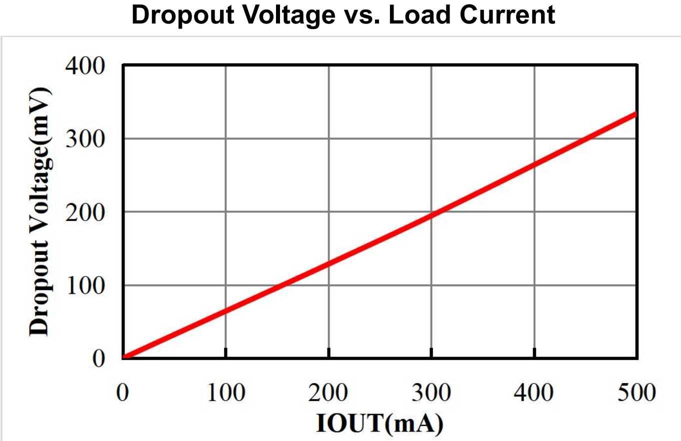
VIN=2.8V, V_{OUT}=1.8V, IOUT=100mA-500mA-100mA

Over Current Limit



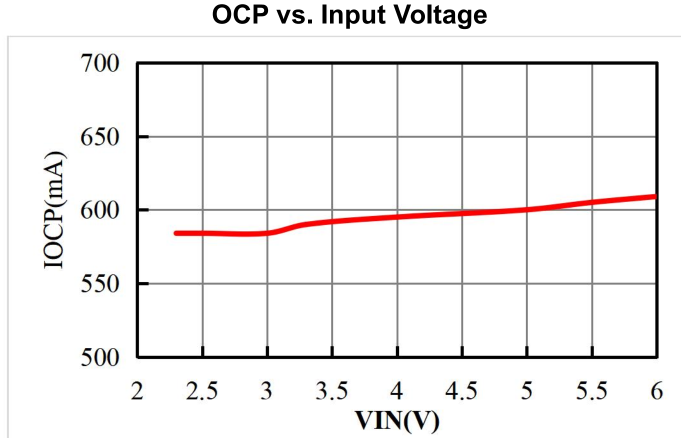
VIN=5.0V, V_{OUT}=1.8V,IOUT=0~800mA

Dropout Voltage vs. Load Current



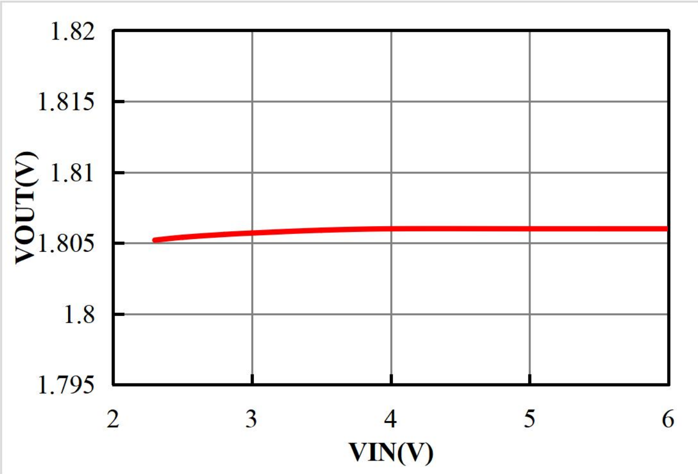
V_{OUT}=3.3V, ILOAD=0-500mA

OCP vs. Input Voltage



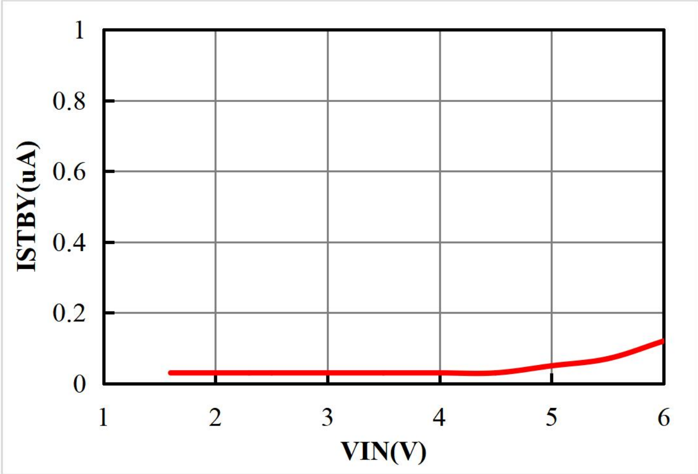
VIN=2.3V-6.0V, V_{OUT}=1.8V

Output Voltage vs. Input Voltage



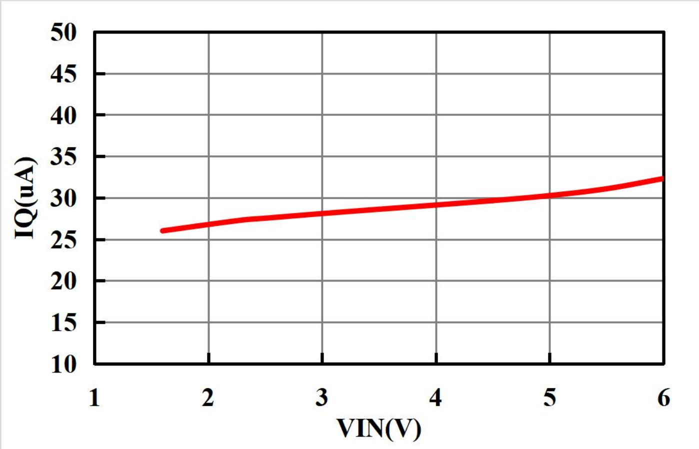
VIN=2.3V-6.0V, V_{OUT}=1.8V, ILOAD=1mA

Standby Current vs. Input Voltage



VIN=1.6V-6.0V, EN=0V

Quiescent Current vs. Input Voltage



VIN=1.6V~6V, V_{OUT}=0.8V, ILOAD=0A

Application Information

A 1uF input capacitor or greater located as close as possible to the IC is necessary to ensure device stability. This capacitor will provide a low impedance path for unwanted AC signals or noise modulated onto the input voltage. The X7R or X5R capacitor should be used for reliable performance over temperature range.

Place the capacitors physically as close as possible to the device with wide and direct PCB traces. A good input capacitor will limit the influence of input trace inductance and source resistance during load current changes.

Output Capacitor

The ITE9101 is specifically designed to employ ceramic output capacitors as low as 1uF, ceramic X7R or X5R type are recommended due to its low capacitance variations over the specified temperature range.

The ceramic output capacitors connected as close as possible to the output and ground pins.

Foldback Current Limit

The device has an internal current limit circuit that protects the regulator during transient high-load current faults or shorting events. Output current is internally limited to 850mA (typical).

The ITE9101 will source this current when the output voltage drops below the nominal output voltage. If the output voltage is less than 0.2V, the short circuit current protection starts and maintains the loading current to 300mA (typical). The current limit and short circuit protection will work properly over the whole temperature and input voltage ranges. There is no limitation for the short circuit duration.

OTP Protection

A Thermal shutdown protection circuit disables the ITE9101 when the junction temperature of the pass transistor rises to 155℃ (typical). Thermal shutdown hysteresis assures that the device resets (turns on) when the temperature falls to 125℃ (typical).

The thermal shutdown feature provides the protection against overheating due to some application failure and it is not intended to be used as a normal working function.

Enable

The LDO uses the EN pin to enable its operation. If the EN pin voltage is < 0.4 V the regulator will be turned off, reducing the supply current to less than 1uA. If the EN pin voltage is > 1.2 V, the regulator will be turned on. The EN pin has an internal pull−down current source with value of 0.3uA (typical), which assures the device is turned off when the EN pin is unconnected.

Power Dissipation

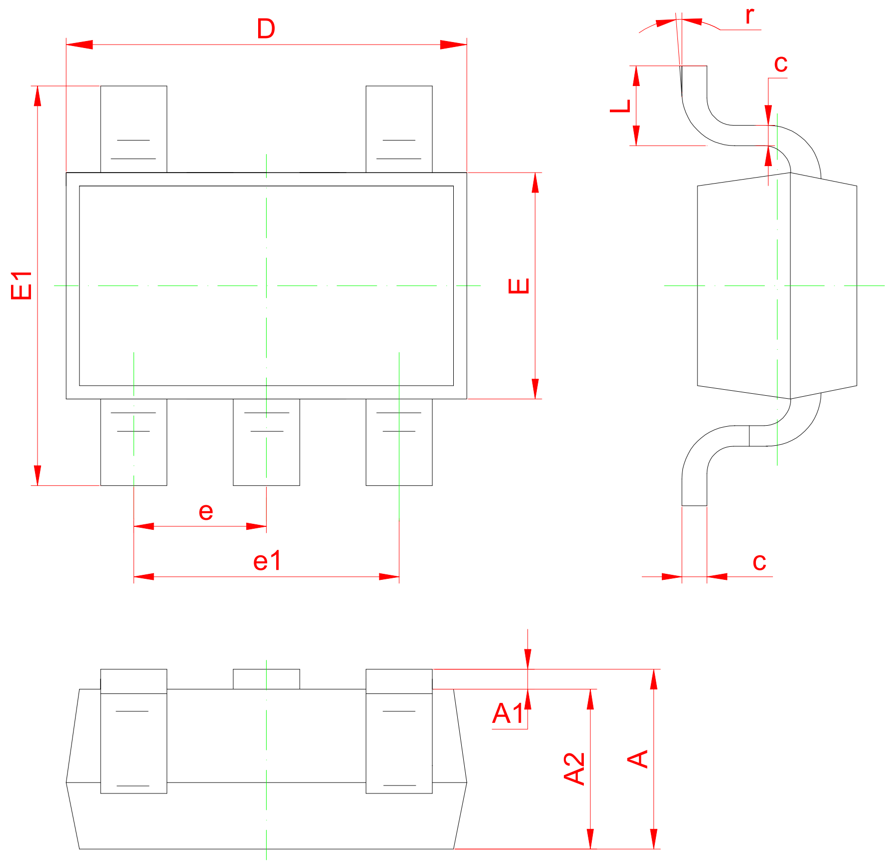
Power dissipation caused by voltage drop across the LDO and by the output current flowing through the device needs to be dissipated out from the chip. The maximum power dissipation is dependent on the PCB layout, number of used Cu layers, Cu layers thickness and the ambient temperature.

Power dissipation in the regulator depends on the input-to-output voltage difference and load conditions.

$$PD = (V_{IN} - V_{OUT}) \times I_{OUT}$$

Power dissipation can be minimized, and thus greater efficiency achieved, by proper selection of the system voltage rails. To avoid thermally overloading the ITE9101, refrain from exceeding the absolute maximum junction temperature rating of 155 ℃ under continuous operating condition. Over-stressing the regulator with high loading currents and elevated input-to-output differential voltages can increase the IC die temperature significantly.

Package Outline: SOT-23-5L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 (BSC)		0.037 (BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
r	0º	8º	0º	8º