Technical Data
Data Sheet N1586, REV. A

300mA, Low Dropout Linear Regulator with Shutdown

Description

The SULR1731 is a 300mA low noise, low dropout linear regulator, and is housed in a small SOT-23-5 package. The device is in the “ON” state when the $\overline{SHDN}$ pin is set to logic high level. An internal P MOSFET pass transistor is used to achieve 470mV low dropout voltage at 300mA load current. It offers high precision output voltage of ±2%. The quality of low quiescent current and low dropout voltage makes this device ideal for battery power applications. The internal reverse bias protection eliminates the requirement for a reverse voltage protection diode. The high ripple rejection and low noise of SULR1731 provide enhanced performance for critical applications. The noise bypass pin can be connected an external capacitor to reduce the output noise level.

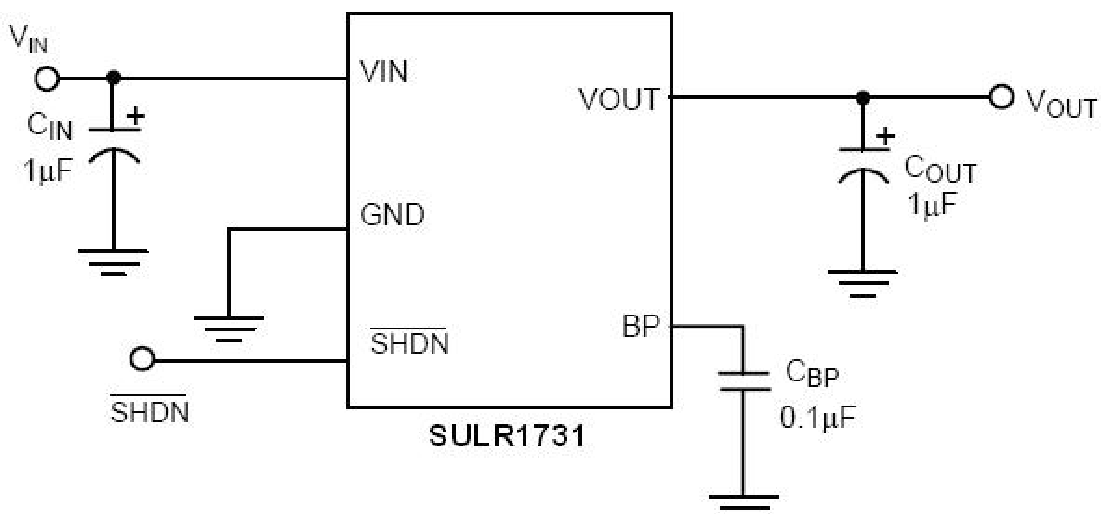
Features

- Active Low Shutdown Control.
- Very Low Quiescent Current.
- Very Low Dropout Voltage of 470mV at 300mA Output Current (3.0V Output Version)
- 1.3V, 1.5V, 1.8V, 2.5V, 2.8V, 3.0V, 3.3V Output Voltage.
- Short Circuit and Thermal Protection.
- ±2% Output Tolerance.
- Miniature Package: SOT-23-5.

Applications

- PDA
- DSC
- Notebook
- Pagers
- Personal Communication Equipment
- Cordless Telephones
- Portable Instrumentation
- Portable Consumer Equipment
- Battery Powered Systems

Typical application circuit



Low Noise Low Dropout Linear Regulator

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Ordering Information

SULR1731-XXXXX

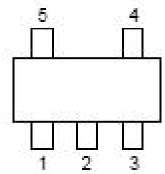
PACKING TYPE
TB: TUBE
TR: TAPING & REEL

PACKAGING TYPE
D: SOT-23-5

OUTPUT VOLTAGE
13: 1.3V
15: 1.5V
18: 1.8V
25: 2.5V
28: 2.8V
30: 3.0V
33: 3.3V

PIN CONFIGURATION

SOT-23-5
TOP VIEW
1: VIN
2: GND
3: $\overline{SHDN}$
4: BP
5: VOUT



Marking Diagram:

Part No.	Marking
SULR1731-15DTR	ED15G
SULR1731-18DTR	ED18G
SULR1731-25DTR	ED25G
SULR1731-30DTR	ED30G
SULR1731-33DTR	ED33G

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Absolute Maximum Ratings

Supply Voltage ………………………………………………………………………………12V
Shutdown Terminal Voltage……………………………………………………………… 8V
Noise Bypass Terminal Voltage ………………………………………………………………5V
Operating Temperature Range ……………………………………………………… –40°C to 85°C
Maximum Junction Temperature ……………………………………………………………125°C
Storage Temperature Range ………………………………………………………–65°C ~ 150°C
Lead Temperature (Soldering) 10 sec. ……………………………………………………260°C
Thermal Resistance Junction to Case SOT-23-5 ……………………………………………130°C/W
Thermal Resistance Junction to Ambient SOT-23-5………………………………………220°C/W
(Assume no ambient airflow, no heatsink)

Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

Test Circuit

Refer to the TYPICAL APPLICATION CIRCUIT.

300mA, Low Dropout Linear Regulator with Shutdown

Electrical Characteristics

(C_{IN} = 1μF , C_{out} = 4.7μF, T_J=25℃, unless otherwise specified)(Note 1)

PARAMETER	TEST CONDITIONS		SYMBOL	MIN.	TYP.	MAX.	UNIT
Quiescent Current	I_{OUT} = 0mA, V_{IN} = 3.6~7V		I_Q		35	50	μA
Standby Current	V_{IN} = 3.6~7V, output OFF		I_{STBY}			0.1	μA
GND Pin Current	I_{OUT} = 0.1~300mA		I_{GND}		30	50	μA
Continuous Output Current	V_{IN} = 5V		I_{OUT}			300	mA
Output Current Limit	V_{IN} = 5V, V_{OUT} = 0V		I_{IL}	300	450		mA
Output Voltage Tolerance	V_{IN} = 5V, no load		V_{OUT}	-2		2	%
Temperature Coefficient			TC		50	150	ppm/°C
Line Regulation	V_{IN} = $V_{OUT(TYP)}$ + 1V to 7V		ΔV_{LIR}		3	10	mV
Load Regulation	V_{IN} = V_{OUT} + 1.2V (Vout≥ 2.0V) V_{IN} = V_{OUT} + 1.7V (Vout≤ 1.9V) I_{OUT} = 0.1~300mA		ΔV_{LOR}		10	30	mV
Dropout Voltage	I_L=300mA	3.0V≤V_{OUT}≤3.3V 2.5V≤V_{OUT}≤2.9V 2.0V≤V_{OUT}≤2.4V 1.3V≤V_{OUT}≤1.9V	V_{DROP}		470 570 800 1260	870 970 1200 1660	mV
Noise Bypass Terminal Voltage			V_{REF}		1.23		V
Output Noise	C_{BP} = 0.1μF, f = 1KHz,V_{IN} = 5V		Δn		0.46		$\frac{\mu V}{\sqrt{Hz}}$
Ripple Rejection	f = 1KHz, Ripple = 0.5V_{P-P}, C_{BP} = 0.1μF		RR		55		dB
Shutdown Pin Current			$I_{\overline{SHDN}}$			0.1	μA
Shutdown Pin Voltage (ON)	Output ON			1.6			V
Shutdown Pin Voltage (OFF)	Output OFF					0.6	V
Shutdown Exit Delay Time	C_{BP}=0.1μF, C_{OUT}=1μF, I_{OUT}=30mA		Δt		300		μS
Thermal Shutdown Temperature			T_{SD}		155		°C

Note: 1. To avoid output oscillation, aluminum electrolytic output capacitor is recommended and ceramic capacitor is not suggested.

2. Specifications are production tested at T_A=25°C. Specifications over the -40°C to 85°C operating temperature range are assured by design, characterization and correlation with Statistical Quality Controls (SQC).

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Typical Performance Characteristics

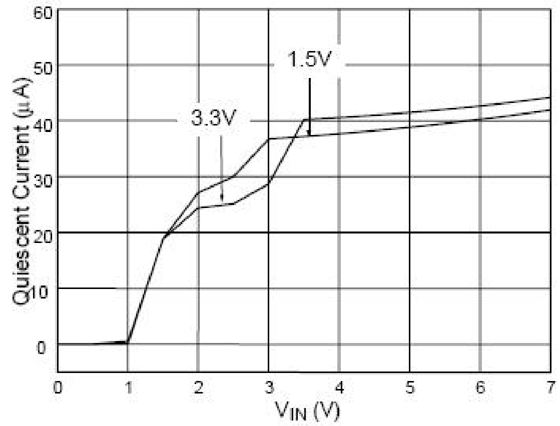

Fig. 1 Quiescent Current vs. V_{IN}

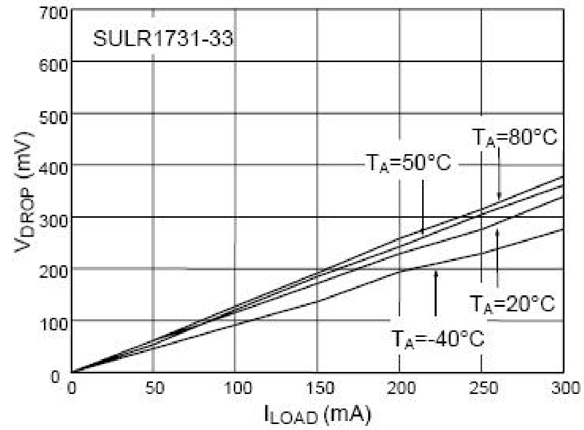

Fig. 2 V_{DROP} vs. I_{LOAD}

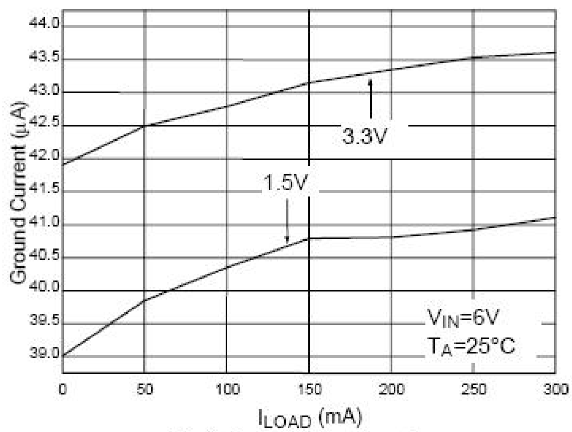

Fig. 3 Ground Current vs. I_{LOAD}

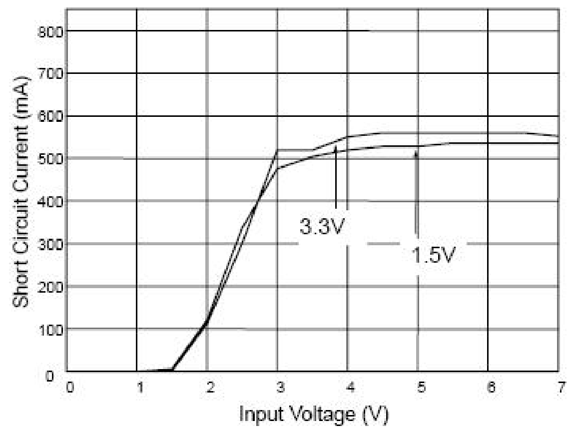

Fig. 4 Input Voltage vs. Short Circuit Current

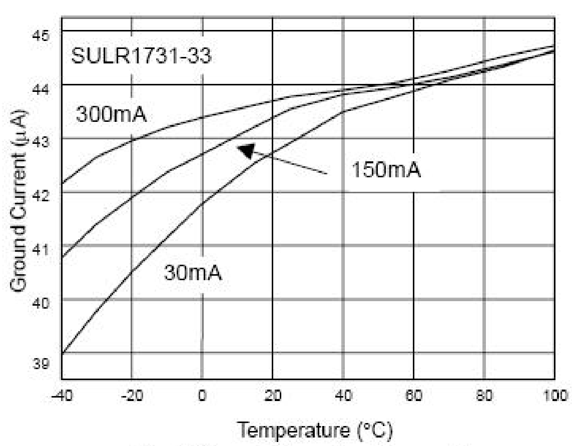

Fig. 5 Ground Current vs. Temperature

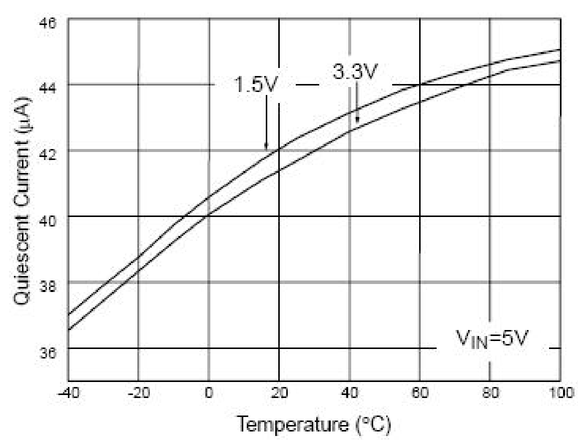

Fig. 6 Quiescent Current vs Temperature

Typical Performance Characteristics (Continued)

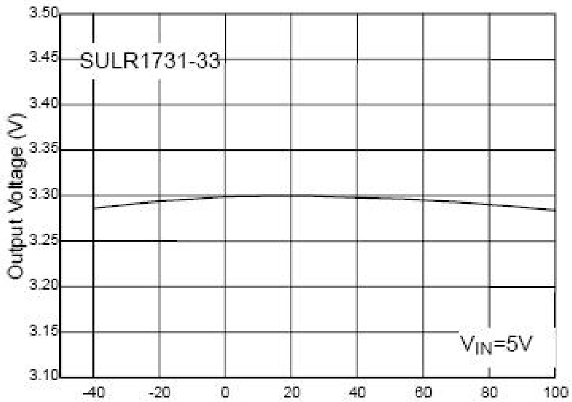

Fig. 7 Output Voltage vs. Temperature

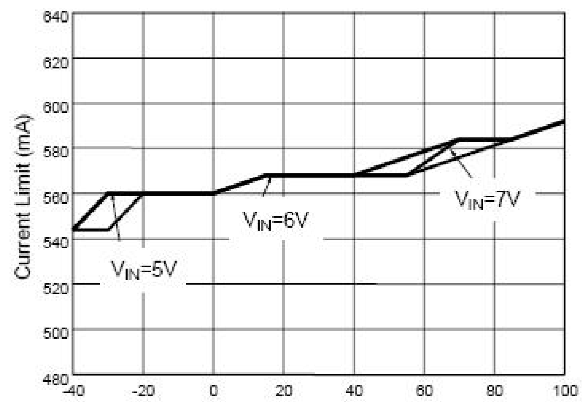

Fig. 8 Current Limit vs. Temperature

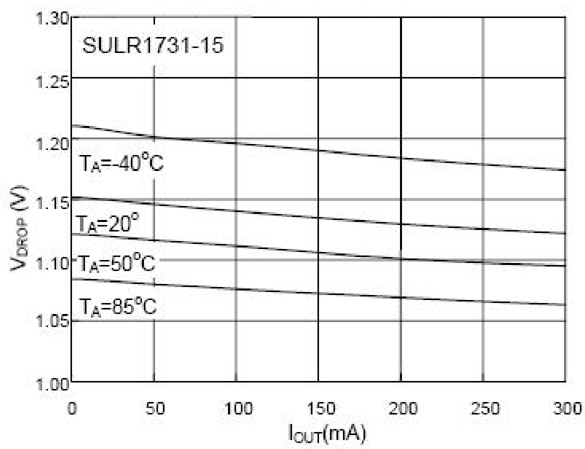

Fig. 9 V_{DROP} vs. I_{LOAD}

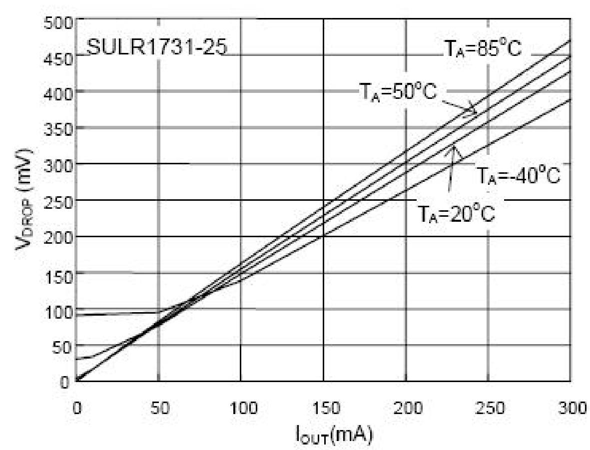

Fig. 10 V_{DROP} vs. I_{LOAD}

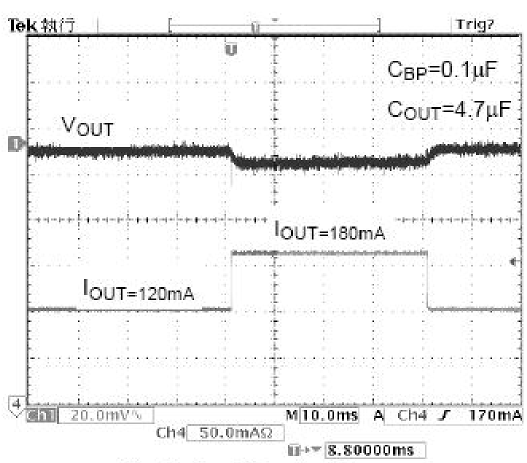

Fig. 11 Load Transient Response

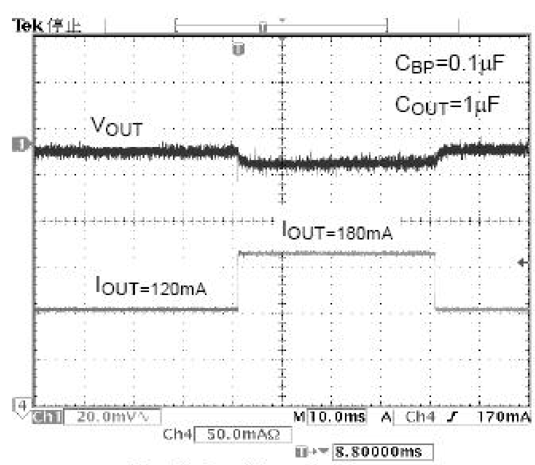

Fig. 12 Load Transient Response

300mA, Low Dropout Linear Regulator with Shutdown

Typical Performance Characteristics (Continued)

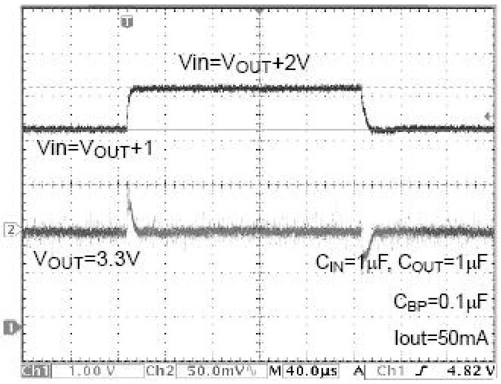

Fig. 13 Line Transient Response

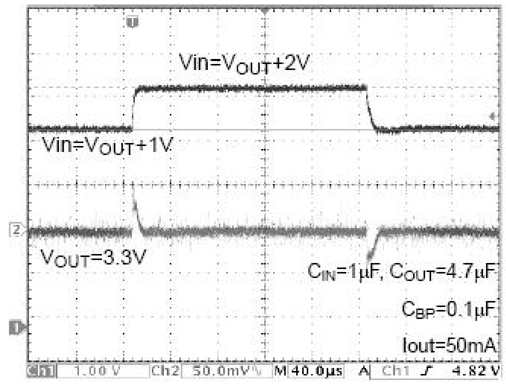

Fig. 14 Line Transient Response

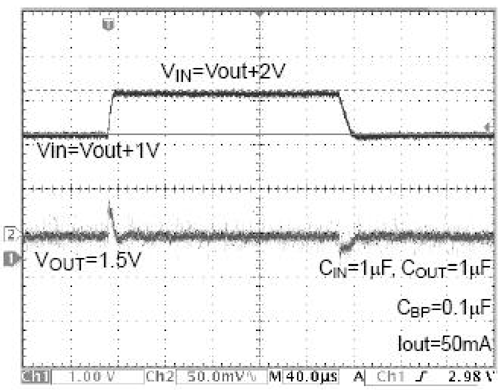

Fig. 15 Line Transient Response

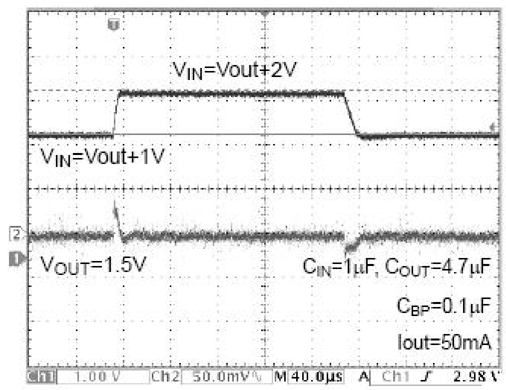

Fig. 16 Line Transient Response

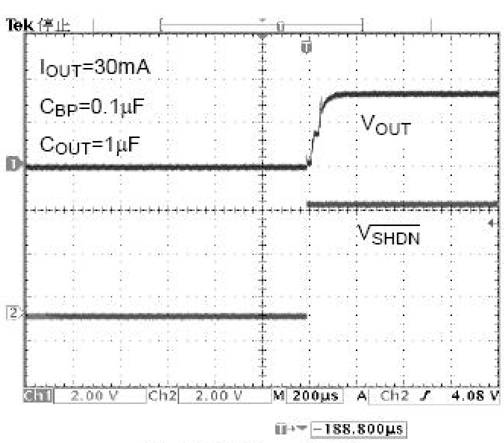

Fig. 17 Shutdown Exit Time

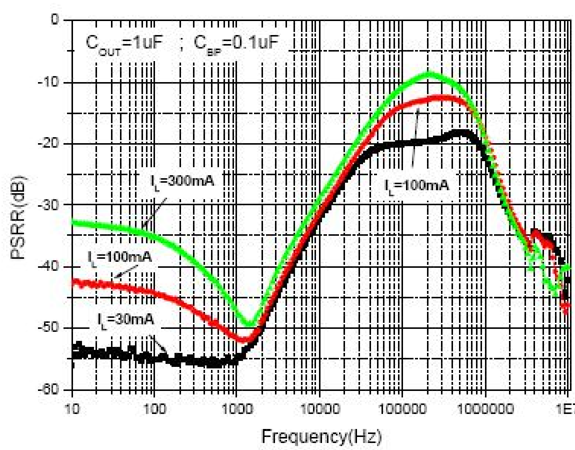

Fig. 18 Ripple Rejection

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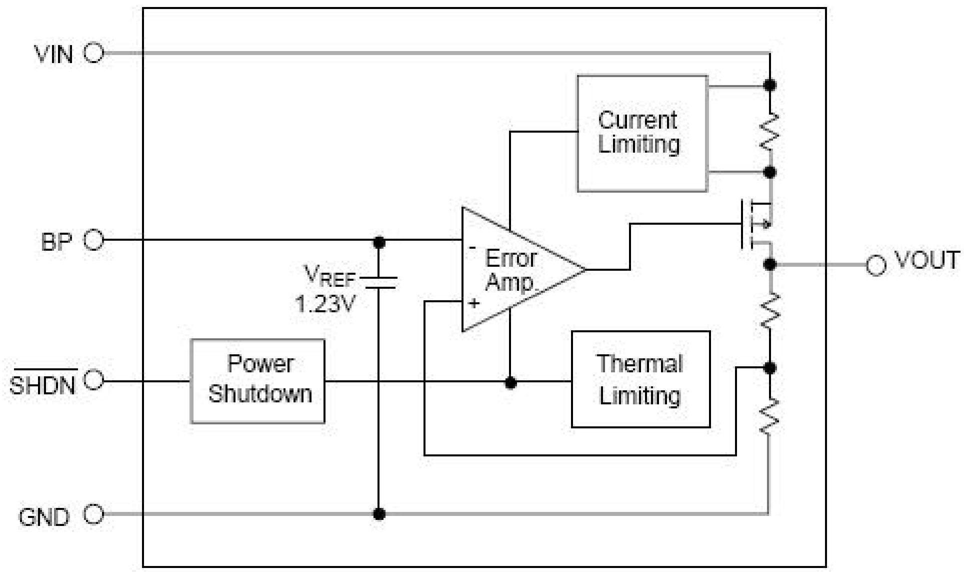
Block Diagram



Pin Descriptions

PIN 1 : VIN - Power supply input pin. Bypass with a 1μF capacitor to GND
PIN 2 : GND - Ground pin.
PIN 3 : $\overline{\text{SHDN}}$ - Active-Low shutdown input pin.
PIN 4 : BP - Noise bypass pin. An external bypass capacitor connecting to BP pin to reduce noises at the output.
PIN 5 : VOUT - Output pin. Sources up to 300mA.

Application Information

INPUT-OUTPUT CAPACITORS

Linear regulators require input and output capacitors to maintain stability. Input capacitor at 1μF with 1uF aluminum electrolytic output capacitor is suggested.

NOISE BYPASS CAPACITOR

0.1μF bypass capacitor at BP pin reduces output voltage noise. And the BP pin has to connect a capacitor to GND.

POWER DISSIPATION

The SULR1731 obtains thermal-limiting circuitry, which is designed to protect the device against overload condition. For continuous load condition, maximum rating of junction temperature must not be exceeded. It is important to pay more attention in thermal resistance. It includes junction to case, junction to ambient. The maximum power dissipation of SULR1730 depends on the thermal resistance of its case and circuit board, the temperature difference between the die junction and ambient air, and the rate of airflow. The rate of temperature rise is greatly affected by the mounting pad configuration on the PCB, the board material, and the ambient temperature. When the IC mounting with good thermal conductivity is used, the junction temperature will be low even when large power dissipation applies.

The power dissipation across the device is $P = I_{OUT}(V_{IN}-V_{OUT})$.

The maximum power dissipation is:

$$P_{MAX} = \frac{(T_{J\text{-}MAX} - T_A)}{R_{\Theta JA}}$$

Where $T_{J\text{-}max}$ is the maximum allowable junction temperature (125°C), and T_A is the ambient temperature suitable in application.

As a general rule, the lower temperature is, the better reliability of the device is. So the PCB mounting pad should provide maximum thermal conductivity to maintain low device temperature. GND pin performs a dual function of providing an electrical connection to ground and channeling heat away. Therefore, connecting the GND pin to ground with a large pad or ground plane would increase the power dissipation and reduce the device temperature.

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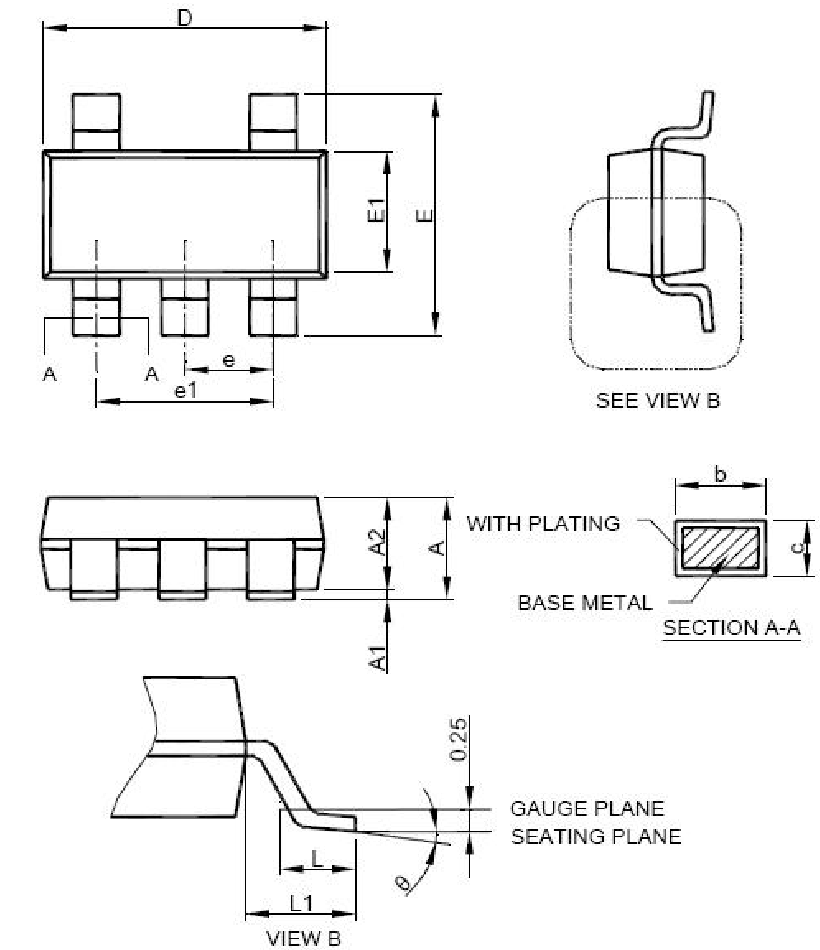
Physical Dimensions

SOT-23-5 (unit: mm)



SYMBOL	SOT-23-5	
	MILLIMETERS	
	MIN.	MAX.
A	0.95	1.45
A1	0.05	0.15
A2	0.90	1.30
b	0.30	0.50
c	0.08	0.22
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.70
e	0.95 BSC	
e1	1.90 BSC	
L	0.30	0.60
L1	0.60 REF	
q	0°	8°

Note: 1. Refer to JEDEC MO-178AA.
2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 10 mil per side.
3. Dimension "E1" does not include inter-lead flash or protrusions.
4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

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