SULR1730

Technical Data
Data Sheet N1582, Rev. -

150mA, Low Noise, Low Dropout Linear Regulator

Description:

The SULR1730 is a 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 $\overline{\text{SHDN}}$ pin is set to logic high level. A low dropout voltage of 90mV at 50mA load current is performed. 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 provide enhanced performance for critical applications. The noise bypass pin can be connected an external capacitor to reduce the output noise level.

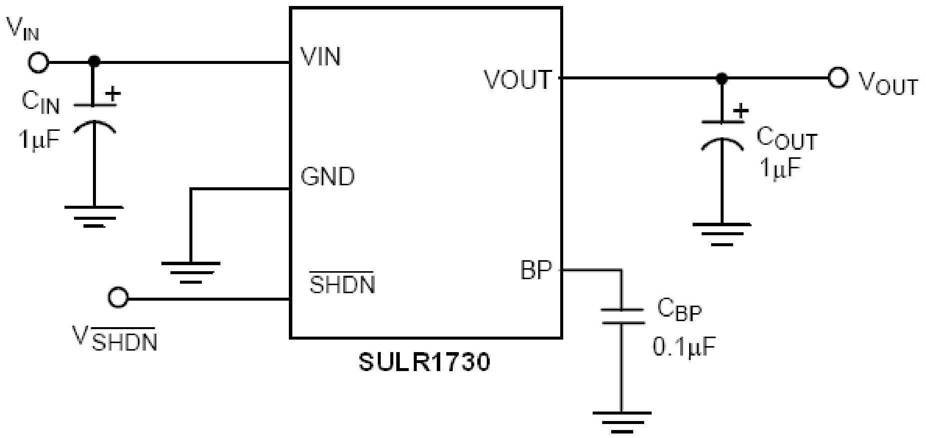
Features:

- **Very Low Quiescent Current, 55μA**
- **Very Low Dropout Voltage, 90mV @ 50mA.**
- **Short Circuit and Thermal Protection.**
- **Available in ±2% Output Tolerance.**
- **1.8V to 3.3V Output Voltage with 0.1V Increment.**
- **Active Low Shutdown Control.**
- **Low Noise.**
- **Low Profile Package: SOT-23-5**

Applications:

- **Cellular Telephones.**
- **Pagers.**
- **Personal Communication Equipment.**
- **Cordless Telephones.**
- **Portable Instrumentation.**
- **Portable Consumer Equipment.**
- **Radio Control Systems.**
- **Low Voltage Systems.**
- **Battery Powered Systems.**

Typical application circuit:



Low Noise Low Dropout Linear Regulator

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Ordering Information:

SULR1730-XXXXX

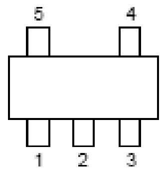
PACKING TYPE
TB: TUBE
TR: TAPING & REEL

PACKAGING TYPE
D: SOT-23-5

OUTPUT VOLTAGE
18: 1.8V
.
.
285: 2.85V
.
.
33: 3.3V
The output voltage is available by 0.1V per step.

PIN CONFIGURATION

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



Marking Diagram:

Part No.	Marking
SULR1730-18DTR	**EC18G**
SULR1730-33DTR	**EC33G**
SULR1730-285DTR	**EC2JG**

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Absolute Maximum Ratings:

Supply Voltage ……….................……………………………………………………………….12V
Shutdown Terminal Voltage……………………............……………………………………….…12V
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 TYPICAL APPLICATION CIRCUIT

Electrical Characteristics(C_{IN} = 1μF , C_{out} = 10μF, T_J=25℃, unless otherwise specified)(Note 1)

PARAMETER	TEST CONDITIONS		SYMBOL	MIN.	TYP.	MAX.	UNIT
Quiescent Current	I_{OUT} = 0mA, V_{IN} = 3.6~12V		I_Q		55	80	μA
Standby Current	V_{IN} = 3.6~8V, output OFF		I_{STBY}			0.1	μA
GND Pin Current	I_{OUT} = 0.1~150mA		I_{GND}		55	80	μA
Continuous Output Current	V_{IN} = V_{OUT} + 1V		I_{OUT}			150	mA
Output Current Limit	V_{IN} = V_{OUT} + 1V, V_{OUT} = 0V		I_{IL}	150	220		mA
Output Voltage Tolerance	V_{IN} = V_{OUT} + 1V, no load		V_{OUT}	-2		2	%
Temperature Coefficient			TC		50	150	ppm/ºC
Line Regulation	V_{IN} = $V_{OUT(TYP)}$ + 1V to $V_{OUT(TYP)}$ + 6V		ΔV_{LIR}		2	7	mV
Load Regulation	V_{IN} = 5V, I_{OUT} = 0.1~150mA		ΔV_{LOR}		7	25	mV
Dropout Voltage (1)	I_{OUT} = 50 mA	V_{OUT}≥2.5V	V_{DROP1}		90	160	mV
	I_{OUT} = 100 mA				140	230	mV
	I_{OUT} = 150 mA				200	350	mV
Dropout Voltage (2)	I_{OUT}=150 mA	V_{OUT} <2.5V	V_{DROP2}			700	mV
Noise Bypass Terminal Voltage			V_{REF}		1.23		V
Output Noise	C_{BP} = 0.1μF, f = 1KHz V_{IN} = 5V		Δn		0.46		$\frac{\mu V}{\sqrt{Hz}}$
SHUTDOWN TERMINAL SPECIFICATIONS							
Shutdown Pin Current			$I_{\overline{SHDN}}$			0.1	μA
Shutdown Pin Voltage (ON)	Output ON		$V_{\overline{SHDN}}$ (ON)	1.6			V
Shutdown Pin Voltage (OFF)	Output OFF		$V_{\overline{SHDN}}$ (OFF)			0.6	V
Shutdown Exit Delay Time	C_{BP} = 0.1μF, C_{OUT} = 1μF, I_{OUT}=30mA		Δt		300		μS
THERMAL PROTECTION							
Thermal Shutdown Temperature			T_{SD}		155		ºC
Thermal Shutdown Hysteresis	Guaranteed by design		T_{HYST}		20		ºC

Note 1: 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

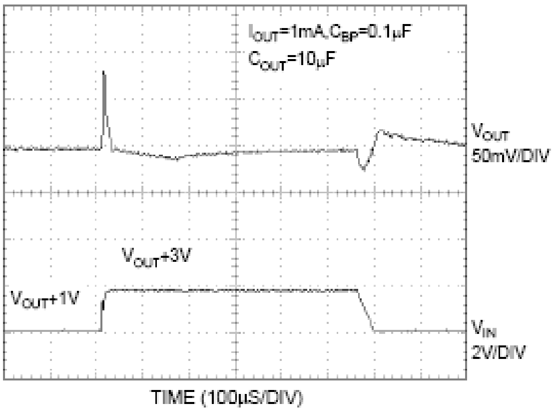

Fig. 1 Line Transient Response

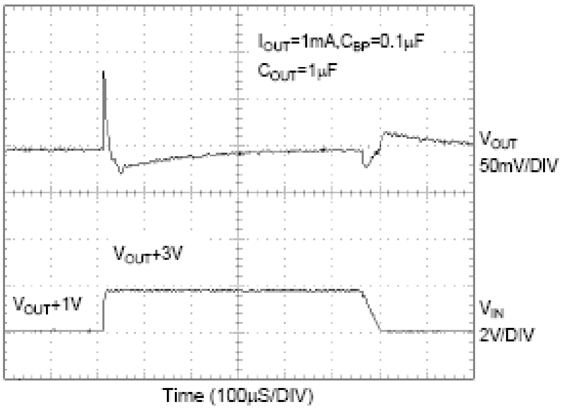

Fig. 2 Line Transient Response

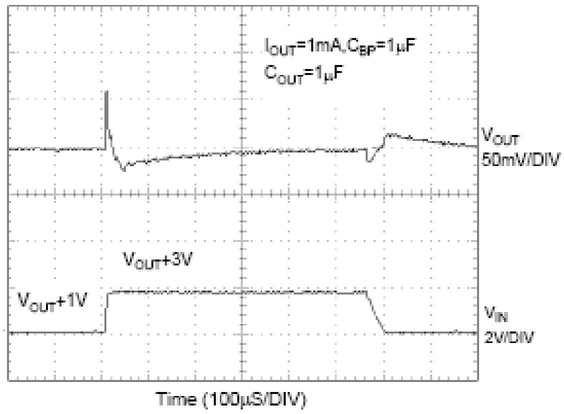

Fig. 3 Line Transient Response

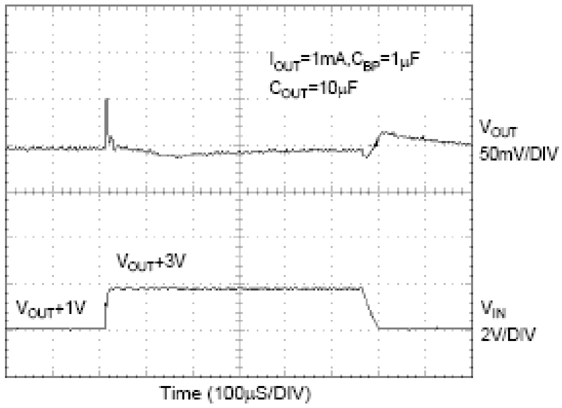

Fig. 4 Line Transient Response

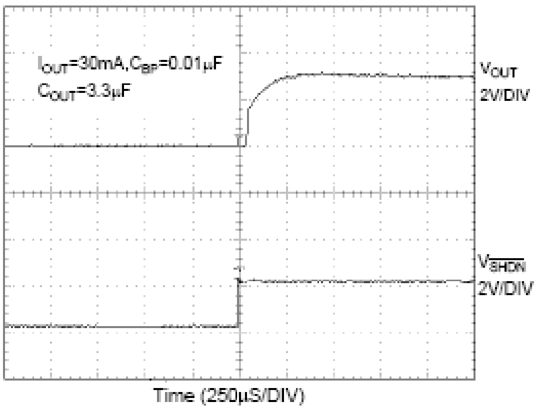

Fig. 5 Shutdown Exit Delay

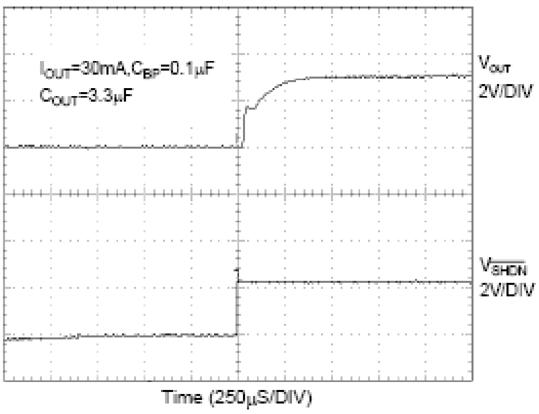

Fig. 6 Shutdown Exit Delay

150mA, Low Noise, Low Dropout Linear Regulator

Typical Performance Characteristics (Continued)

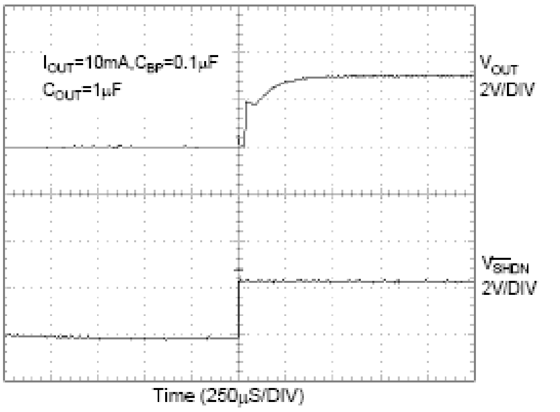

Fig. 7 Shutdown Exit Delay

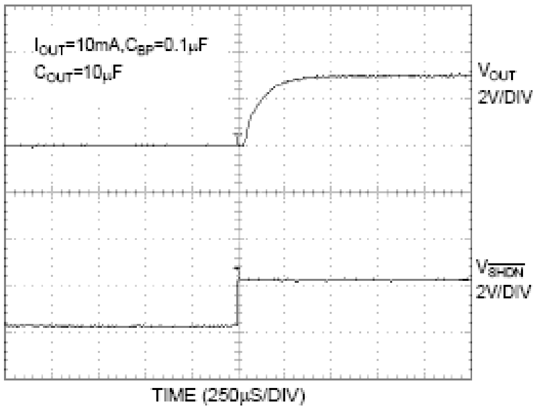

Fig. 8 Shutdown Exit Delay

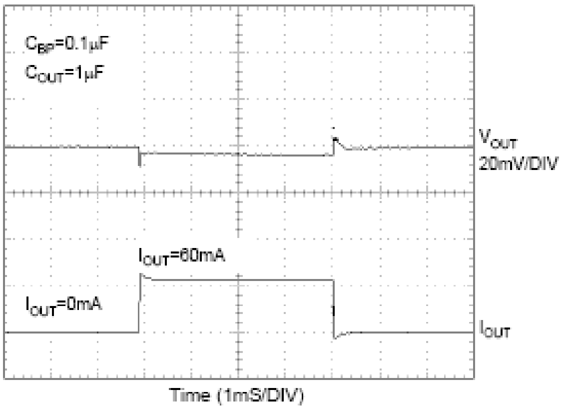

Fig. 9 Load Transient Response

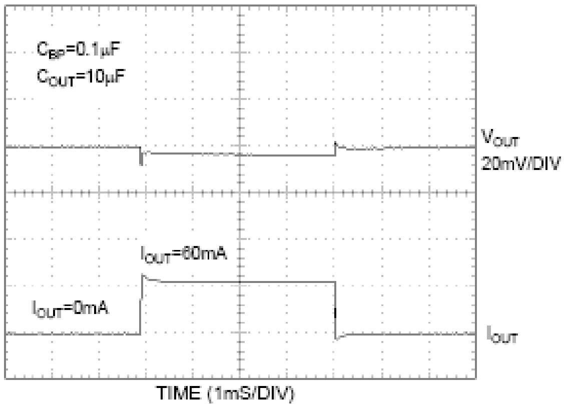

Fig. 10 Load Transient Response

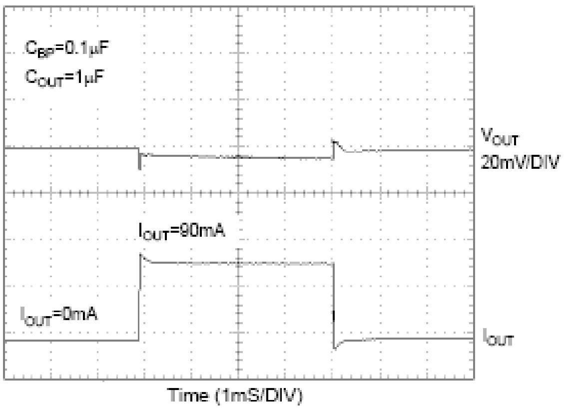

Fig. 11 Load Transient Response

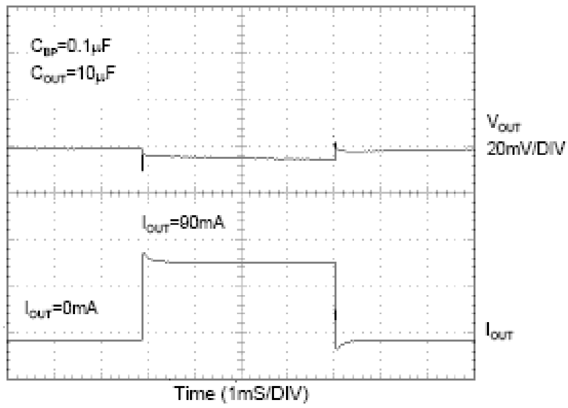

Fig. 12 Load Transient Response

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Typical Performance Characteristics (Continued)

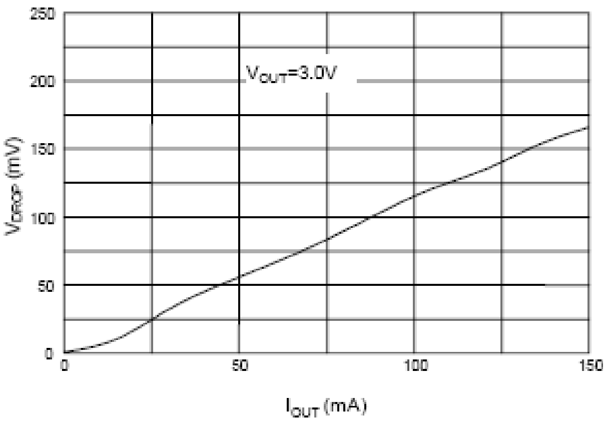

Fig. 13 Dropout Voltage vs. Output Current

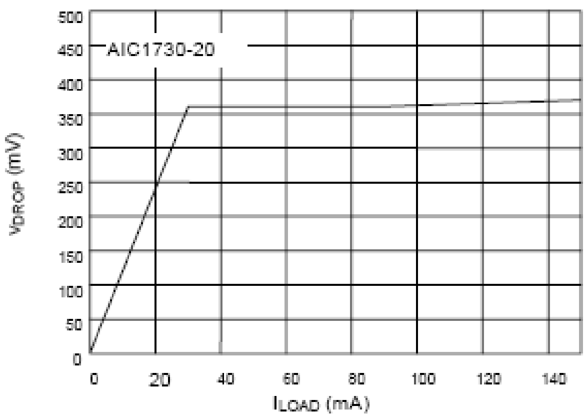

Fig. 14 Dropout Voltage vs. Output Current

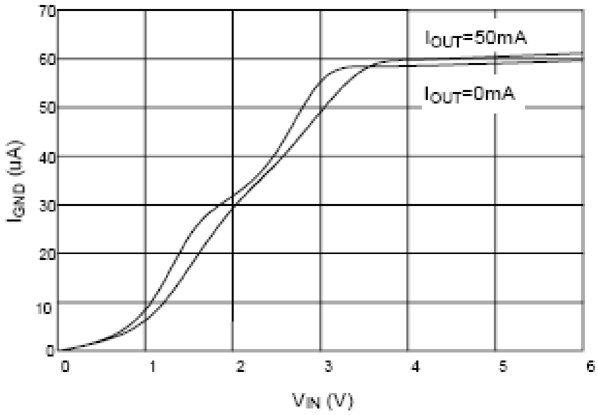

Fig. 15 Ground Current vs. Input Voltage (V_{OUT}=3.0V)

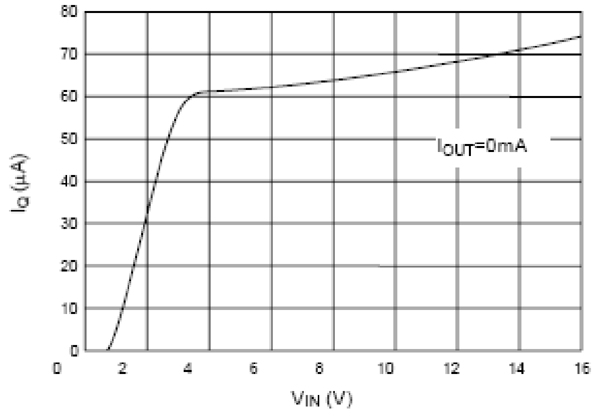

Fig. 16 Quiescent Current (ON Mode) vs. Input Voltage

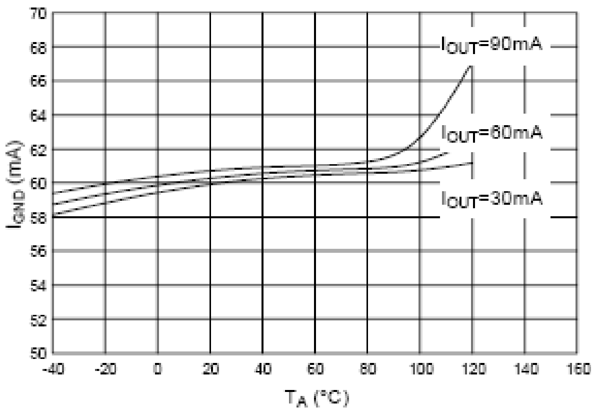

Fig. 17 Ground Current vs. Temperature

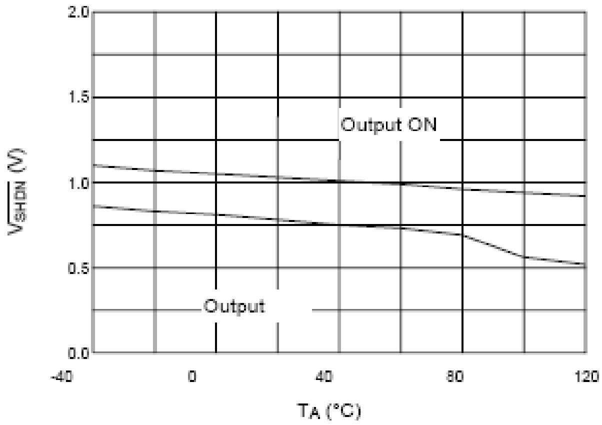

Fig. 18 Shutdown Voltage vs. Temperature

Typical Performance Characteristics (Continued)

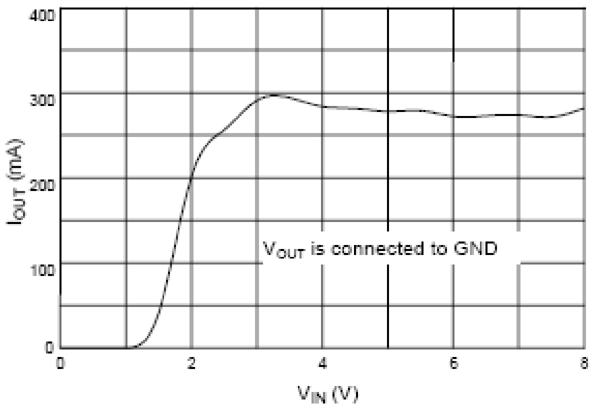

Fig. 19 Short Circuit Current vs. Input Voltage

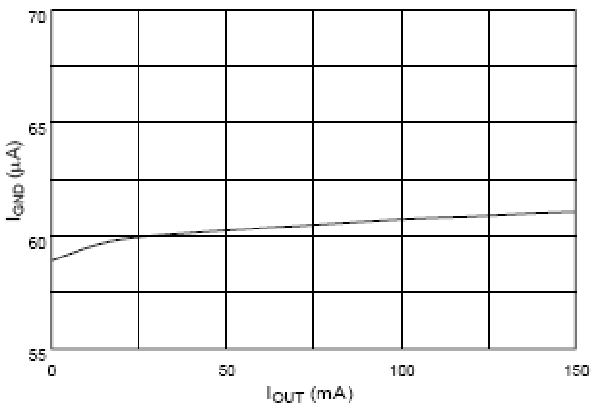

Fig. 20 Ground Current vs. Output Current

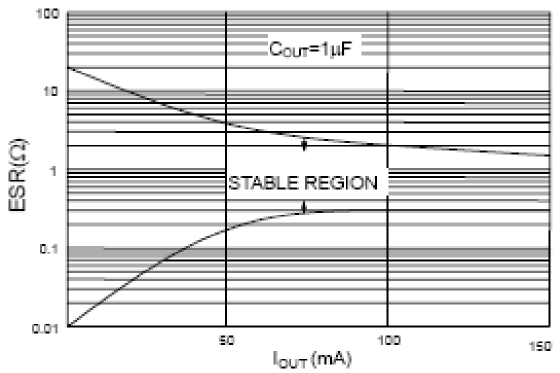

Fig. 21 Max Power Dissipation, C_{OUT}=1μF

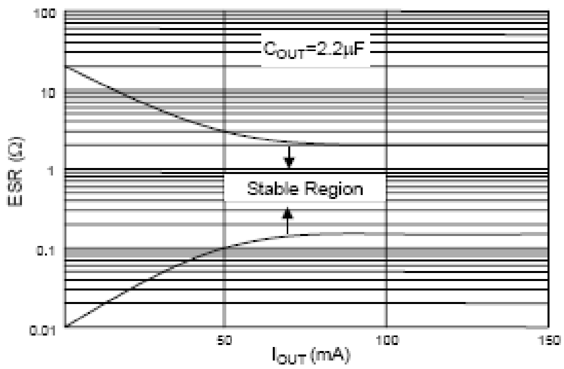

Fig. 22 Max Power Dissipation, C_{OUT}=2.2μF

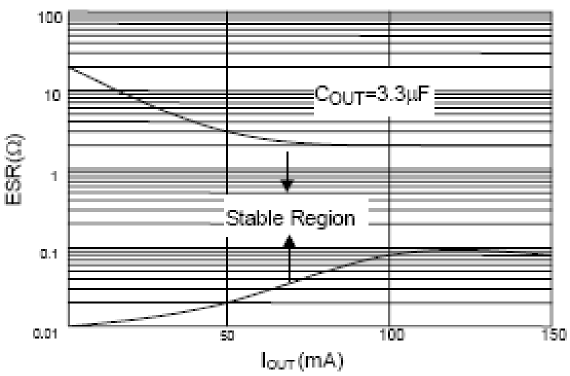

Fig. 23 Max Power Dissipation, C_{OUT}=3.3μF

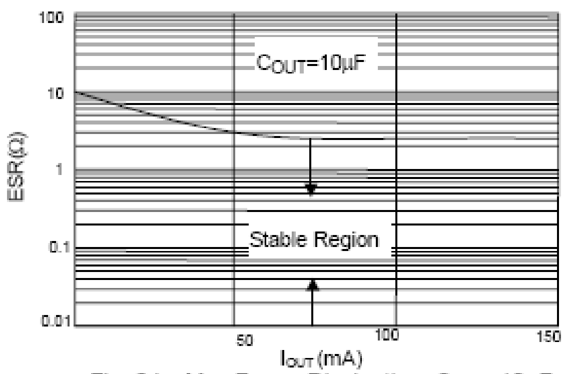

Fig. 24 Max Power Dissipation, C_{OUT}=10μF

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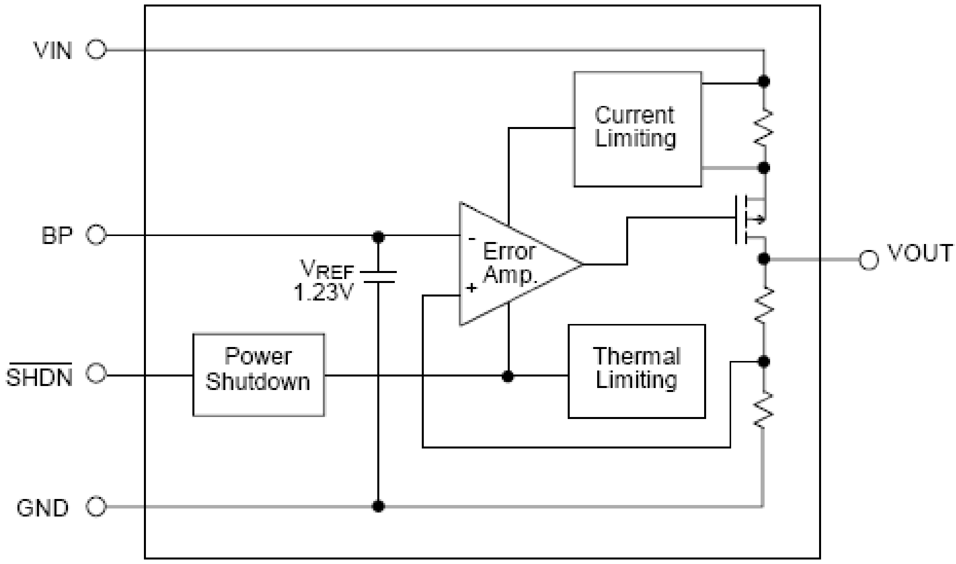
Block Diagram



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 150mA.

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 recommended. And it should be selected within the Equivalent Series Resistance (ESR) range as shown in the figure 21, 22, 23, and 24. ESR of ceramic capacitor is lower and its electrical characteristics (capacitance and ESR) vary widely over temperature. In general, tantalum or electric output capacitor is suggested for heavy load.
Normally, the output capacitor should be 1μF (aluminum electrolytic) at least and rates for operating temperature range. Note that it's important to check selected manufactures electrical characteristics (capacitance and ESR) over temperature.

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 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:

$$P_{MAX} = \frac{(T_J - T_A)}{(R_{\Theta JB} + R_{\Theta BA})}$$

Where T_J-T_A is the temperature difference between the die junction and the surrounding air, $R_{\theta JB}$ is the thermal resistance of the package, and $R_{\theta BA}$ is the thermal resistance through the PCB, copper traces, and other materials to the surrounding air.
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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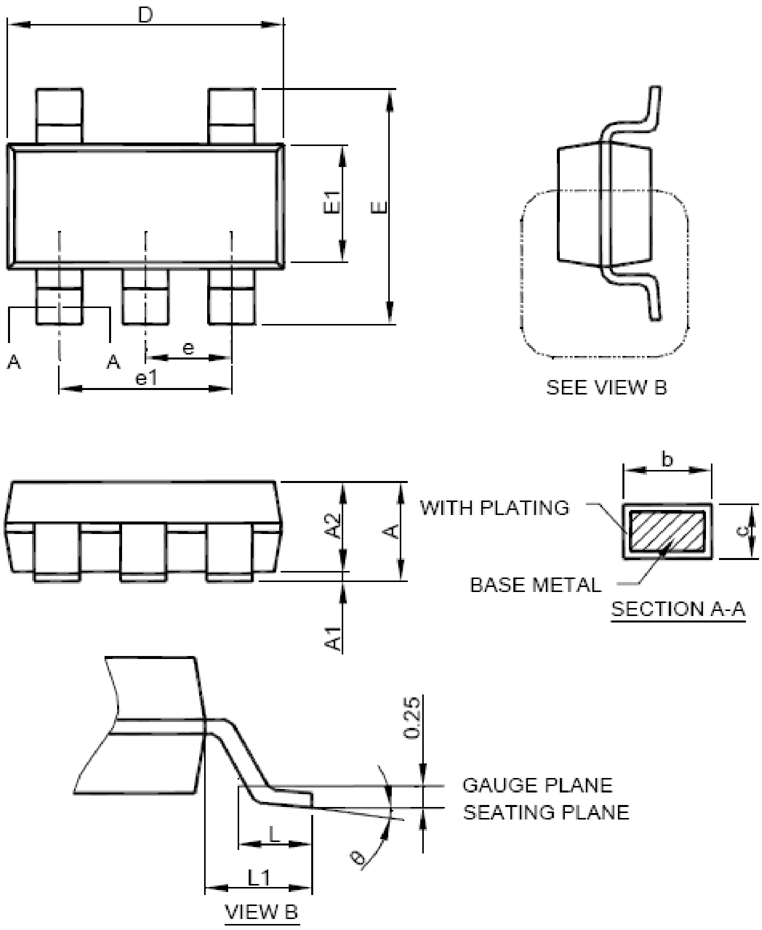
Physical Dimensions

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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