Dual 200mA CMOS LDO Voltage Regulator (Preliminary)

SE5221

Description

SE5221 is a dual-channel low dropout regulator supplying up to 200mA at each channel. The output voltages are selectable between 2.8V/3.3V for Channel-1 and 1.3V/1.8V for Channel-2 with 3% accuracy.

The SE5221 uses internal PMOS transistors as the pass devices to regulate the output voltages. The IC consumes 120µA supply current when both channels are turned on, and is nearly independent of load currents and dropout conditions. The EN1 and EN2 pins allows for individual channel controls. When both outputs are shut down simultaneously, the chip will be turned off and consumes nearly zero operating current which is suitable for battery-power devices. Other features include a current limiting, and over temperature protection.

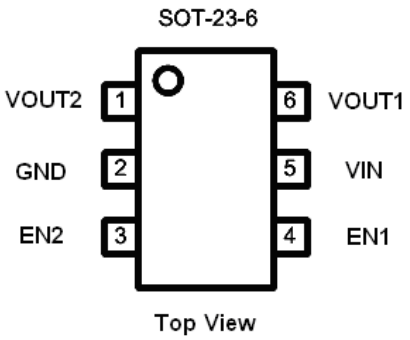
Features

- Typical 256mV Dropout Voltage at 200mA
- Up to 200mA Output Current (Each Channel)
- Low Ground Current at 120uA (Typ.)
- Dual Shutdown Pins to Control Each Output
- Current Limiting and Thermal Protection
- Two LDOs in SOT-23-6L Package
- 100% Lead (Pb)-Free

Application

- Cellular Phones.
- Laptop, Notebook, and Palmtop Computers.
- Battery-Powered Equipments.
- Hand-held Equipments.
- Wireless LAN Devices.

Pin Configuration

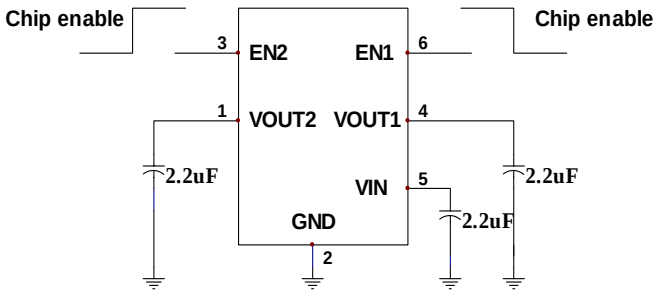


Ordering Information

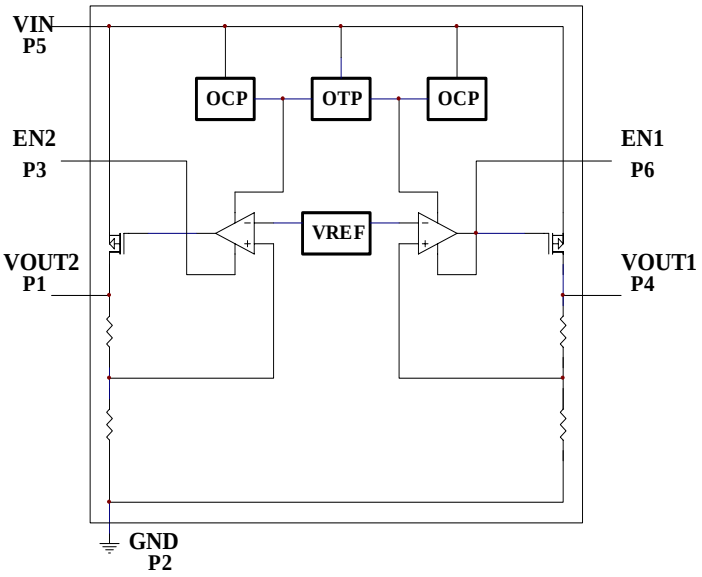
SE5221 _ _ L G

- Pin (1=>6):
  - G: V_{out2}/GND/EN2/EN1/V_{IN}/V_{OUT1}
  - L: SOT23-6L
- D: V_{OUT2} = 1.8V
  - G: V_{OUT2} = 1.3V
- A: V_{OUT1} = 3.3V
  - B: V_{OUT1} = 2.8V

Application Diagram



Block Diagram



Functional Pin Desciption

Pin No.	Pin Name	Pin Function
1	VOUT2	Channel 2 Output Voltage
2	GND	Common Ground
3	EN2	Chip Enable (Active High)
4	EN1	Chip Enable (Active High)
5	VIN	Supply Input
6	VOU1	Channel 1 Output Voltage

Ordering/Marking Information

Package	Ordering Information		Marking Information	
SOT-23-6 VOUT2 1 — 6 VOUT1 GND 2 — 5 VIN EN2 3 — 4 EN1 Top View	Vout1=3.3V Vout2=1.8V	SE5221ADLG-LF	21ADLz●	The last character is the batch number. A dot on top right corner is for lead-free process. LF: lead free.
	Vout1=2.8V Vout2=1.8V	SE5221BDLG-LF	21BDLz●	
	Vout1=3.3V Vout2=1.3V	SE5221AGLG-LF	21AGLz●	
	Vout1=2.8V Vout2=1.3V	SE5221BGLG-LF	21BGLz●	

Absolute Maximum Rating (1)

Parameter	Symbol	Value	Units
Input Voltage	V_{IN}	6	V
Enable Voltage	V_{EN}	-0.3 to V_{IN}	V
Power Dissipation	P_D	Internally Limited (3)	
Thermal Resistance Junction-to-Ambient	Θ_{JA}	230 (SOT-23-6)	°C/W
Lead Temperature (Soldering, 5 sec.)		260	°C
Junction Temperature	T_J	+150	°C
Storage Temperature	T_S	-40 to +150	°C

Operating Rating (2)

Parameter	Symbol	Value	Units
Supply Input Voltage	V_{IN}	+3.3V to +5.5	V
Junction Temperature	T_J	0 to +125	°C

Electrical Characteristics

V_{IN} =Vout+1V; V_{EN1}=V_{EN2}=V_{IN}; I_{OUT} = 10mA, C_{IN} = 2.2µF; C_{OUT} = 2.2µF; T_J = 25°C; unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OUT}	Output Voltage Accuracy	Channel 1 SE5221 – 2.8V SE5221 – 3.3V	2.716 3.201	2.8 3.3	2.884 3.399	V
		Channel 2 SE5221 – 1.3V SE5221 – 1.8V	1.261 1.746	1.3 1.8	1.339 1.854	
$\Delta V_{OUT}/V_{OUT}$	Line Regulation	Channel 1 V_{IN} = (V_{OUT}+0.4)V to 5.5V	--	0.14	--	%/V
		Channel 2 V_{IN} =(V_{OUT}+0.4)V to 5.5V	--	0.14	--	
$\Delta V_{OUT}/V_{OUT}$	Load Regulation (5)	Channel 1 I_{OUT} = 1mA to 200mA	--	0.66	--	%
		Channel 2 I_{OUT} = 1mA to 200mA	--	1.32	--	

Electrical Characteristics (Continued)

V_{IN} =Vout+1V; V_{EN1}=V_{EN2}=V_{IN}; I_{OUT} = 10mA, C_{IN} = 2.2μF; C_{OUT} = 2.2μF; T_J = 25°C; unless otherwise specified

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$\Delta V_{OUT}/\Delta T$	Output Voltage Temperature Coefficient (4)	Channel 1		--	-0.025	--	mV/°C
		Channel 2		--	-0.63	--	
$V_{IN} - V_{OUT}$	Dropout Voltage (6)	Channel 1	I_{OUT} = 100mA	--	128	--	mV
			I_{OUT} = 200mA	--	256	--	
		Channel 2	I_{OUT} = 100mA	--	237	--	
			I_{OUT} = 200mA	--	427	--	
$T_{PROTECTION}$	Thermal Protection	Thermal Protection Temperature		--	180	--	°C
		Protection Hysterisys		--	30	--	
PSRR	Ripple Rejection	f = 100 Hz, Vin=4.5V,Vp-p=1V,Iout=100mA		--	60	--	dB
I_Q	Quiescent Current	No Load		--	110	--	μA
		I_{OUT} = 100mA (Both Channel)		--	125	--	
$V_{TH(EN)}$	Enable Input Threshold Voltage	Voltage Increasing, Output Turns On, Logic High		1.6	--	--	V
		Voltage Decreasing, Output Turns Off, Logic Low		--	--	0.4	
I_{leak}	Shutdown Supply Current			--		5	uA
I_{MAX}	Current Limit	Channel 1		200		--	mA
		Channel 2		200		--	

Note 1: Exceeding the absolute maximum rating may damage the device.

Note 2: The device is not guaranteed to function outside its operating range.

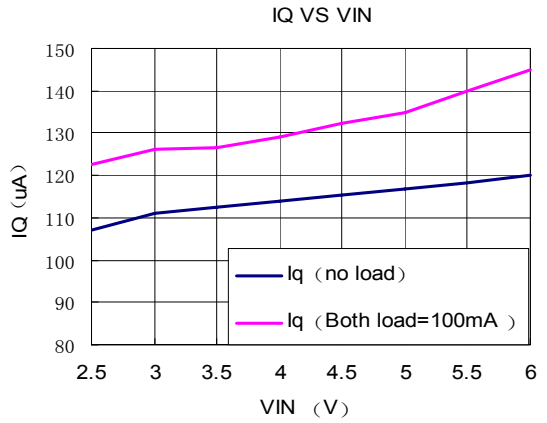
Note 3: The maximum allowable power dissipation at any T_A (ambient temperature) is calculated using: $P_{D(MAX)} = (T_{J(MAX)} - T_A)/\Theta_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown. See "Thermal Consideration" section for details.

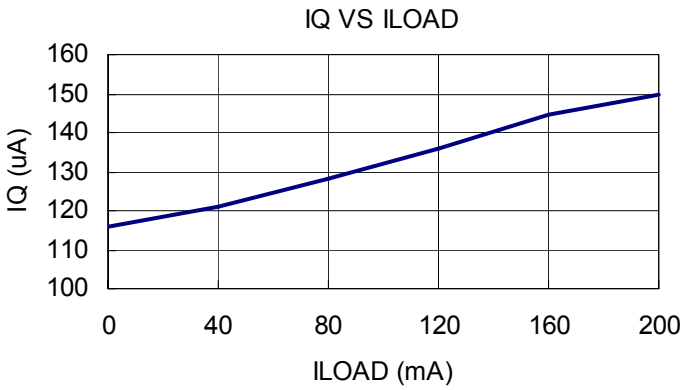
Note 4: Output voltage temperature coefficient is the worst case voltage change divided by the total temperature range.

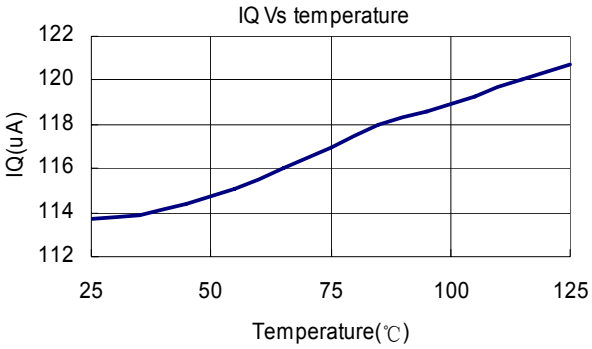
Note 5: Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 10mA to 200mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.

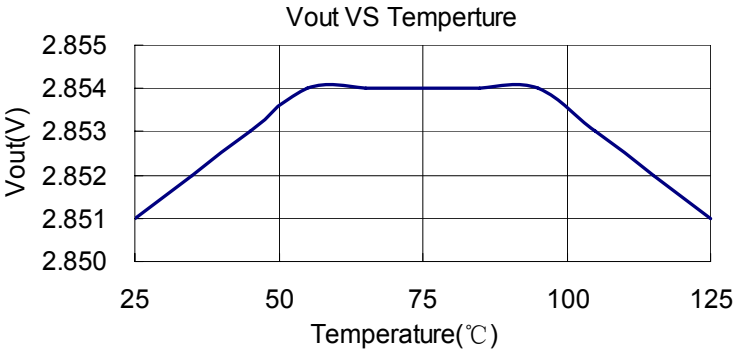
Note 6: Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

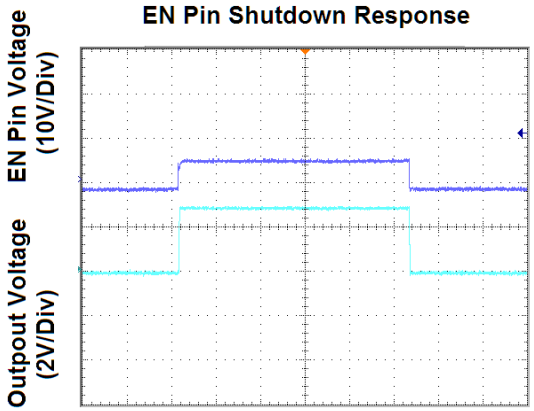
Typical Operating Characteristics

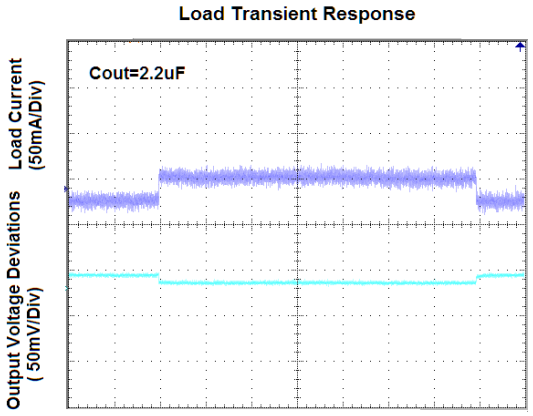


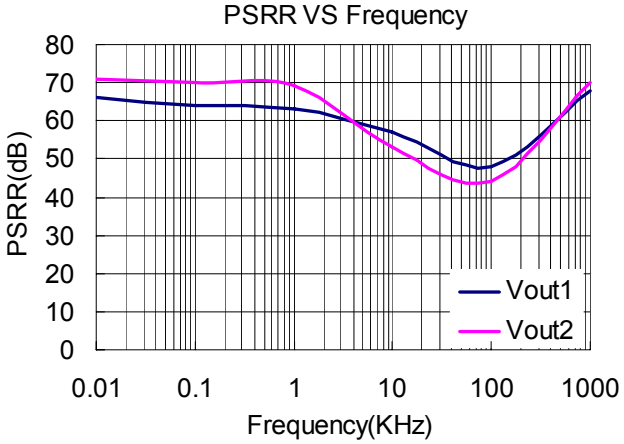












Application Hints

Like any low dropout regulator, SE5221 requires external capacitors to ensure stability. The external capacitors must be carefully selected to ensure performance.

Input Capacitor

An input capacitor of at least 1μF is required. Electrolytic or Ceramic or Tantalum can be used. The value can be increased without upper limit.

Output Capacitor

An output capacitor is required for stability. It must be placed no more than 1 cm away from the V_{OUT} pin, and connected directly between V_{OUT} and GND pins. Electrolytic or Ceramic or Tantalum can be used. The minimum value is 1μF but may be increased without limit.

Thermal Considerations

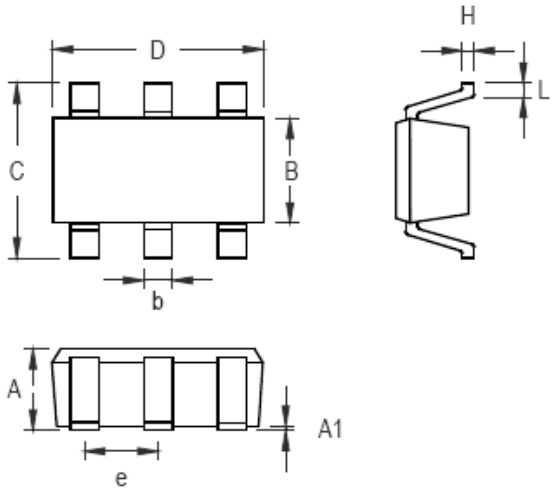
It is important that the thermal limit of the package is not exceeded. The SE5221 has built-in thermal protection. When the thermal limit is exceeded, the IC will enter protection, and V_{OUT} will be gradually pulled to ground as load continued to increase. The power dissipation for a given application can be calculated as following:

The power dissipation (P_D) is

$P_D = I_{OUT} * [V_{IN} – V_{OUT}]$

The thermal limit of the package is then limited to $P_{D(MAX)} = [T_J – T_A]/\Theta_{JA}$ where T_J is the junction temperature, TA is the ambient temperature, and Θ_{JA} for SOT-23-6 is around 230°C/W for SE5221. SE5221 is designed to enter thermal protection at 120°C. For example, if T_A is 25°C then the maximum P_D is limited to about 0.4W. In other words, if $I_{OUT(MAX)}$ = 200mA, then $[V_{IN} – V_{OUT}]$ cannot exceed 2V.

OUTLINE DRAWING SOT-23-6L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.031	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.250	0.560	0.010	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

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