Elektronische Bauelemente

S5M2111

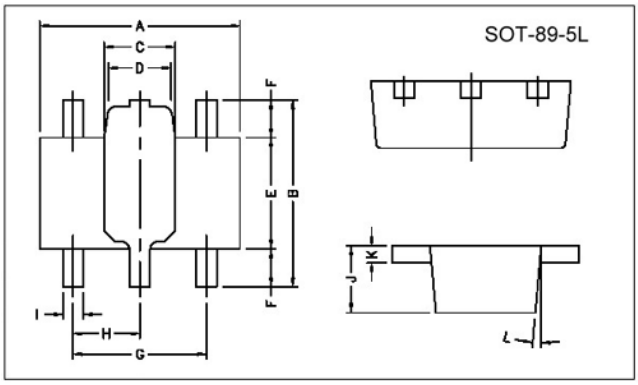
CMOS

Positive Voltage Regulator

RoHS Compliant Product

Description

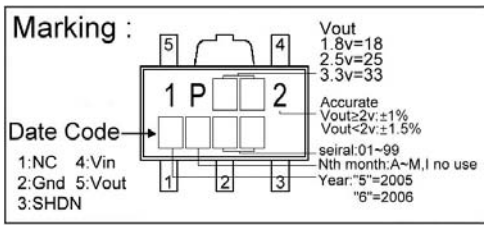
The S5M2111 series positive,linear regulators feature low quiescent current (50μA typ.) with low dropout voltage, voltage and excellent PSRR, thus making them ideal for Telecommunications and other battery applications. These rugged devices have both Thermal Shut-down, and Current Fold-back to prevent device failure under the "Worst" of operating conditions. As an additional feature, the S5M2111 is stable with an output capacitance of just extended 0.22μF or greater.



REF.	Millimeter		REF.	Dimensions
	Min.	Max.		Millimeter
A	4.40	4.60	G	3.00 REF.
B	4.05	4.25	H	1.50 REF.
C	1.50	1.70	I	0.40 0.52
D	1.30	1.50	J	1.40 1.60
E	2.40	2.60	K	0.35 0.41
F	0.80	-	L	5 ° TYP.

Features

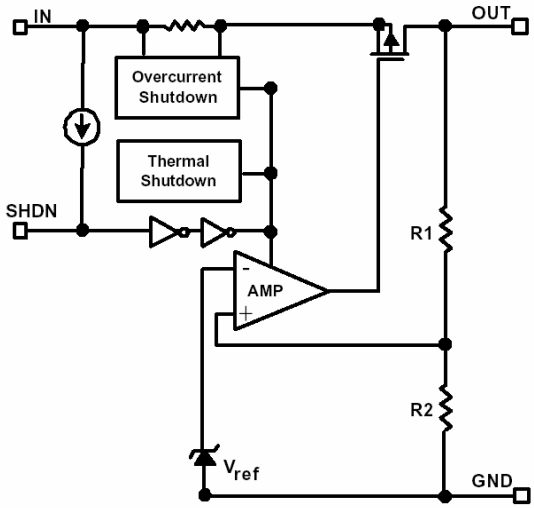
* Excellent PSRR Type 70dB
* Over-Temperature Shutdown
* Factor Per-Set Output Voltage
* Very Low Dropout Voltage
* Noise Reduction Bypass Capacitor
* Short Circuit Current Fold-back
* Guaranteed 150mA output
* Current Limiting
* Power-Saving Shutdown Mode



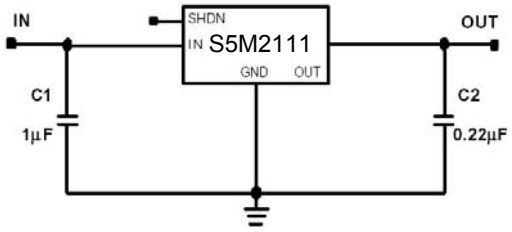
Applications

* PC Peripherals
* Wireless Devices
* Portable Electronics
* Battery Powered Widgets
* Instrumentation
* Cameras
* Cellular Phones
* Telecommunications
* Electronic Scales
* Cordless Phones

Functional Block Diagram



Typical Application Circuit



Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Input Voltage	V_{IN}	6	V
Output Current	I_{OUT}	$P_D/(V_{IN}-V_O)$	mA
Output Voltage	V_{OUT}	1.5~3.3	V
Operating Ambient Temperature	Topr	-40~+85	°C
Junction Temperature	Tj	-40~+125	°C
Max. Junction Temperature	Tj Max.	150	°C
Power Dissipation (△ T=100°C)	P_D	550	mW
EDS Classification		B	

Electrical Characteristics T_A=25℃ unless otherwise noted

($V_{OUT}(T)$>2.0V $V_{IN}=V_{OUT}(T)+0.5V$; $V_{OUT}(T)\leq 2.0V$ $V_{IN}=V_{OUT}(T)+1V$; $V_{SHDN}=V_{IN}$, $C_{IN}=C_{OUT}$=1uF)

Parameter	Symbol	Condition		Min	TYP	Max	Unit
Output Voltage	$V_{OUT}(E)$ (Note1)	I_O=0.1mA, $V_{OUT}(T)\geq 2.0V$		-1.0	$V_{OUT}(T)$ (Note2)	1.0	%
		I_O=0.1mA, $V_{OUT}(T)<2.0V$		-1.5		1.5	
		I_O=150mA		-2.0		2.0	
Current Limit	I_{LIM}	V_O>800mV		150	200	-	mA
Fold-back Current	I_{FB}	V_O=0V		-	80	-	μA
Load Regulation	REG_{LOAD}	I_O=0.1 to 150mA	V_{OUT}>2.0V $V_{IN}=V_{OUT}(T)+0.5V$	-1	0.5	1	%
			$V_{OUT}\leq 2.0V$ $V_{IN}=V_{OUT}(T)+1V$	-2	-	2	
Dropout Voltage	$V_{DROPOUT}$	I_O=150mA $V_O=V_{OUT}(E)$-2%	$V_{OUT}(T)\geq 2.0V$	-	300	500	mV
			1.8V≤$V_{OUT}(T)$<2.0V	-	700	1000	
			1.5V≤$V_{OUT}(T)$<1.8V	-	900	1300	
Quiescent Current	I_Q	V_{IN}=5V, I_O=0mA		-	60	-	μA
Ground Pin Current	I_{GND}	V_{IN}=5V, I_O=1mA to150mA		-	50	-	μA
Line Regulation	REG_{LINE}	I_O=0.1mA, V_{OUT}>2.0V $V_{IN}=V_{OUT}(T)+0.5V$ to 5.5V		-0.2	0.1	0.2	%
		I_O=0.1mA, $V_{OUT}\leq 2.0V$ $V_{IN}=V_{OUT}(T)+1V$ to 5.5V		-0.4	-	0.4	
Input Voltage	V_{IN}			Note3	-	5.5	V
Over Temperature Shutdown	OTS			-	137	-	℃
Over Temperature Hysterisis	OTH			-	23	-	℃
Output Voltage Temperature Coefficient	TC			-	30	-	ppm/℃
Power Supply Rejection	PSRR	Ro=100Ω,Co=2.2mF, f=1kHz		-	70	-	dB
Output Voltage Noise	eN	f=10Hz~100kHz, Io=10mA, Co=2.2μF		-	30	-	μVrms
SHDN Input Threshold	V_{SHDNH}	V_{SHDN}=0.8* V_{IN}		0.8* V_{IN}	-	V_{IN}	V
	V_{SHDNL}	V_{SHDN}=0.6V		0	-	0.6	V
SHDN Input Bias Current		V_{IN}=5V, EN=0v, or 5V		-	0.01	-	μA
Shutdown Supply Current	I_{SD}	V_{IN}=5V, V_O=0V		-	0.5	1	μA
Shutdown Output Voltage	$V_{O,SD}$	Output Loading≤1200Ω, Vo=0V		0	-	0.4	V

Note 1: V_{OUT} (E) =Effective Output Voltage (i.e. the output voltage when "$V_{OUT}(T)$>2.0V $V_{IN}=V_{OUT}(T)+0.5V$; $V_{OUT}(T)\leq 2.0V$ $V_{IN}=V_{OUT}(T)+1V$; $V_{SHDN}=V_{IN}$" is provided at the V_{IN} pin while maintaining a certain I_{OUT} value).

2: V_{OUT} (T) =Specified Output Voltage

3: $V_{IN\ (MIN)}=V_{OUT}+V_{DROPOUT}$

Ordering Information(contd.)

Part Number	Marking	Output Voltage	Part Number	Marking	Output Voltage
S5M2111-15	1P152 XXXX	1.5V	S5M2111-18	1P182 XXXX	1.8V
S5M2111-20	1P202 XXXX	2.0V	S5M2111-25	1P252 XXXX	2.5V
S5M2111-27	1P272 XXXX	2.7V	S5M2111-28	1P282 XXXX	2.8V
S5M2111-2H	1P2H2 XXXX	2.85V	S5M2111-30	1P302 XXXX	3.0V
S5M2111-32	1P322 XXXX	3.2V	S5M2111-33	1P332 XXXX	3.3V

Detailed Description

The G5M2111 series of COMS regulators contain a PMOS pass transistor, voltage reference, error amplifier, over-current protection, and thermal shutdown.

The P-channel pass transistor receives data from the error amplifier, over-current shutdown, and thermal protection circuits. During normal operation, the error amplifier compares the output voltage to a precision reference. Over-current and Thermal shutdown circuits become active when the junction temperature exceeds 150℃, or the current exceeds 150mA. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 120℃.

The G5M2111 switches from voltage mode to current mode when the load exceeds the rated output current. This prevents over-stress. The G5M2111 also incorporates current fold-back to reduce power dissipation when the output is short circuited. This feature becomes active when the output drops below 0.8 volts, and reduces the current flow by 65%. Full current is restored when the voltage exceeds 0.8 volts.

External Capacitors

The G5M2111 is stable with an output capacitance to ground of 0.22μF or greater. Ceramic capacitors have the lowest ESR, and will offer the best AC performance. Conversely, Aluminum Electrolytic capacitors exhibit the highest ESR, resulting in the poorest AC response.

A second capacitor is recommended between the input and ground to stabilize Vin. The input capacitor should be at least 1μF to have a beneficial effect.

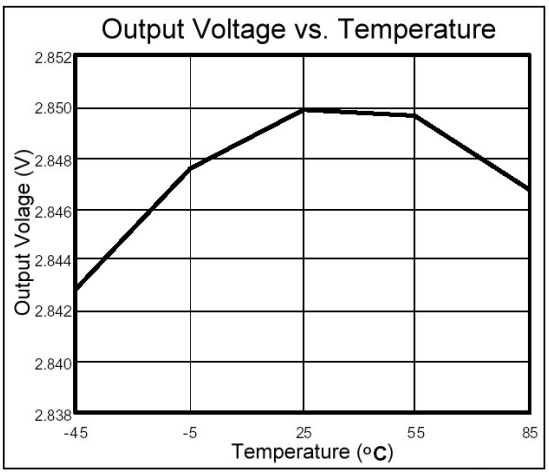
A large capacitor improves the AC ripple rejection, but also makes the output come up slowly. This “Soft” turn-on is desirable in some applications to limit turn-on surges.

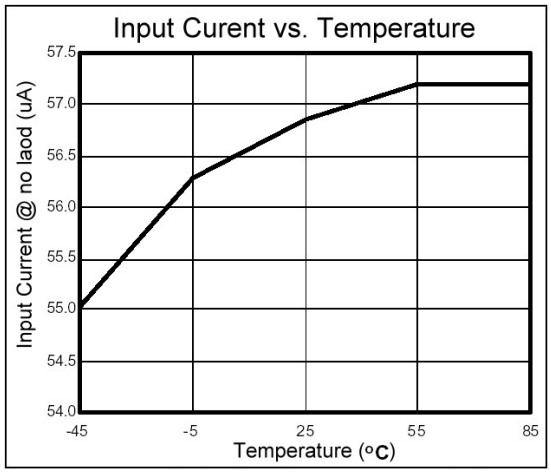
All capacitors should be placed in close proximity to the pins. A “Quiet” ground termination is desirable. This can be achieved with a “Star” connection.

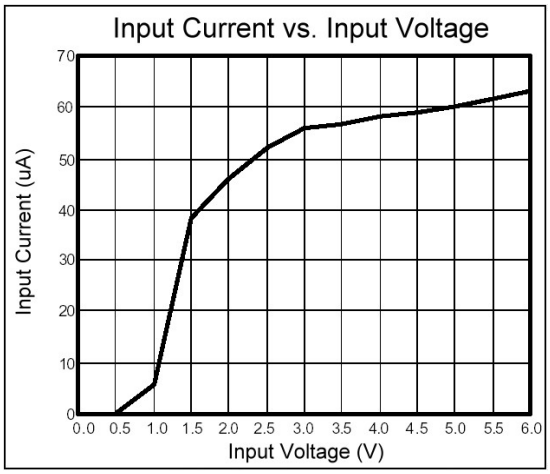
Shutdown

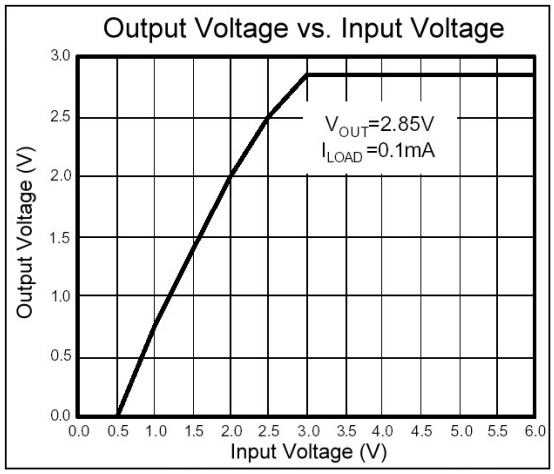
When actively, pulled low, the PMOS pass transistor shuts off, and all internal circuits are powered down. In this state, the quiescent current is less than 1μA. This pin behaves much like an electronic switch.

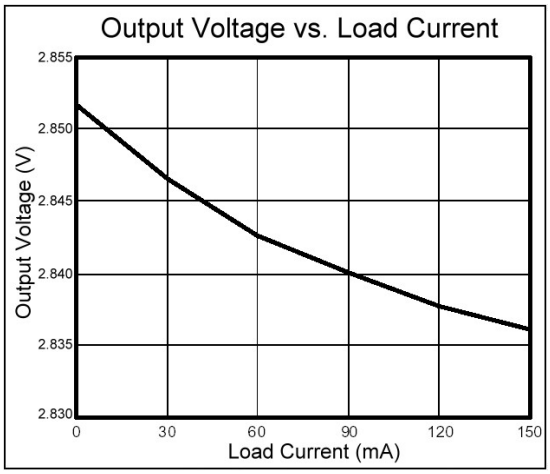
Characteristics Curve

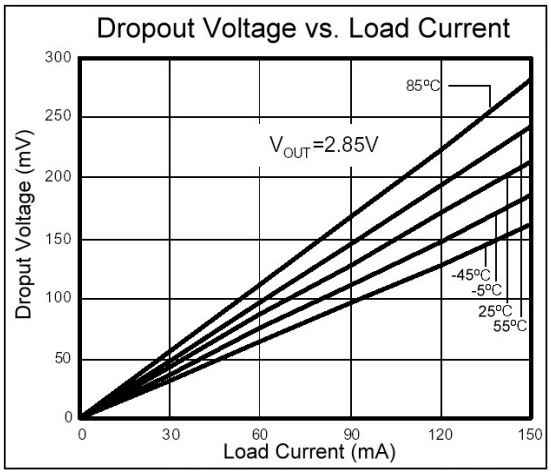


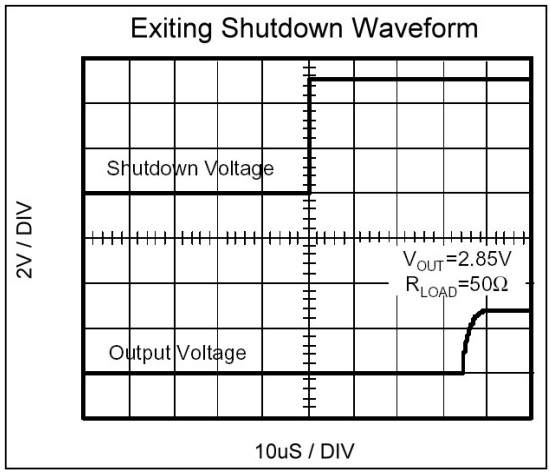


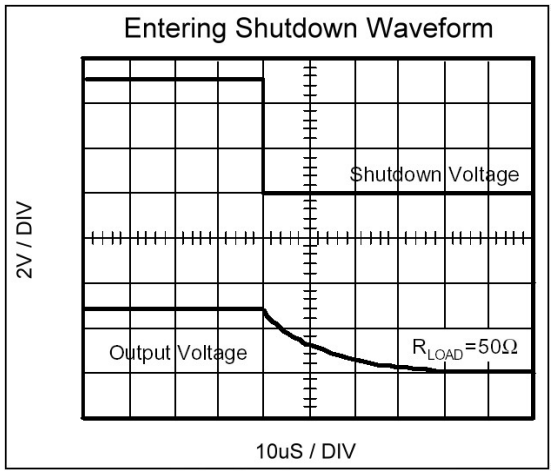

Input Current vs. Input Voltage
Input Current (uA)
Input Voltage (V)

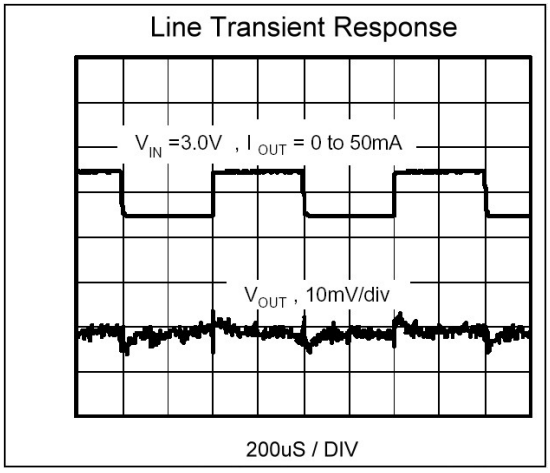

Output Voltage vs. Input Voltage
V_{OUT}=2.85V
I_{LOAD}=0.1mA
Output Voltage (V)
Input Voltage (V)

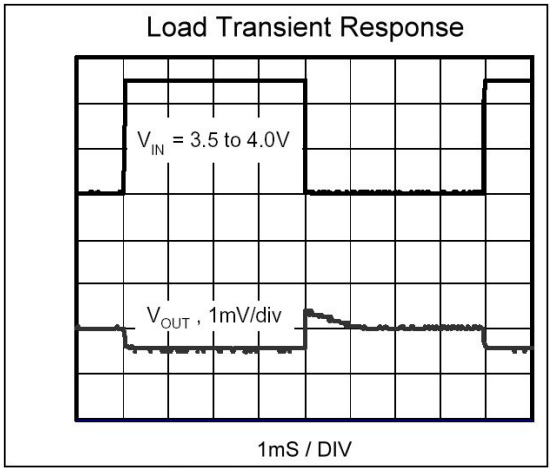

Output Voltage vs. Load Current
Output Voltage (V)
Load Current (mA)

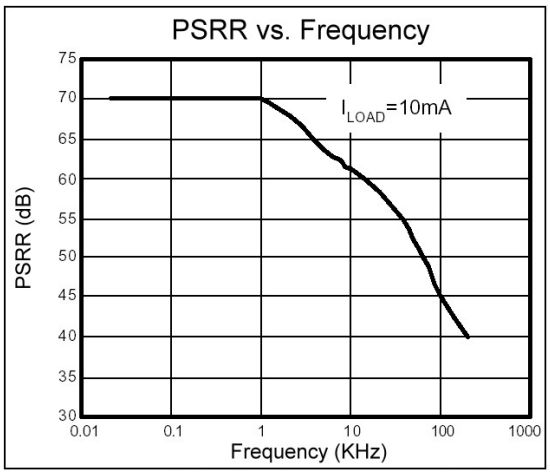

Dropout Voltage vs. Load Current
85ºC
V_{OUT}=2.85V
-45ºC
-5ºC
25ºC
55ºC
Dropout Voltage (mV)
Load Current (mA)

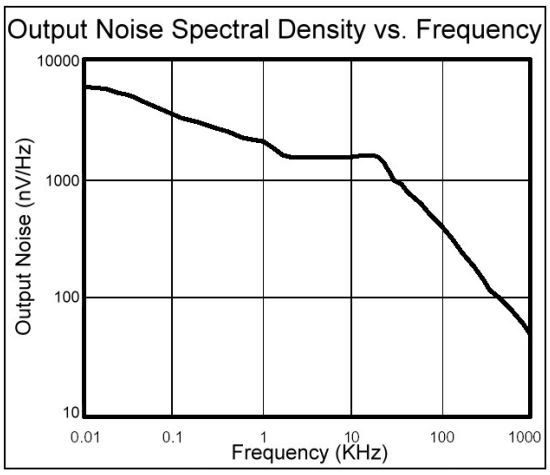

Exiting Shutdown Waveform
Shutdown Voltage
V_{OUT}=2.85V
R_{LOAD}=50Ω
Output Voltage
2V / DIV
10uS / DIV

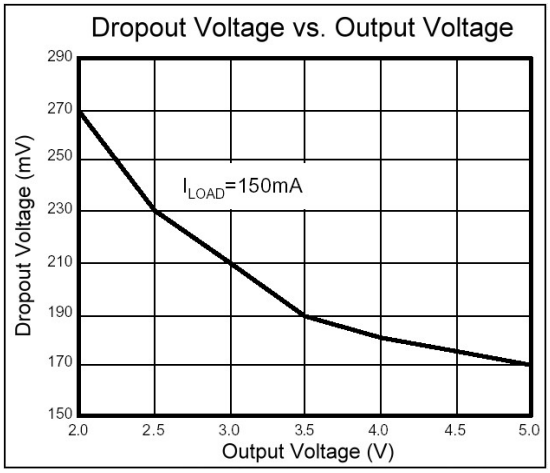

Entering Shutdown Waveform
Shutdown Voltage
Output Voltage
R_{LOAD}=50Ω
2V / DIV
10uS / DIV

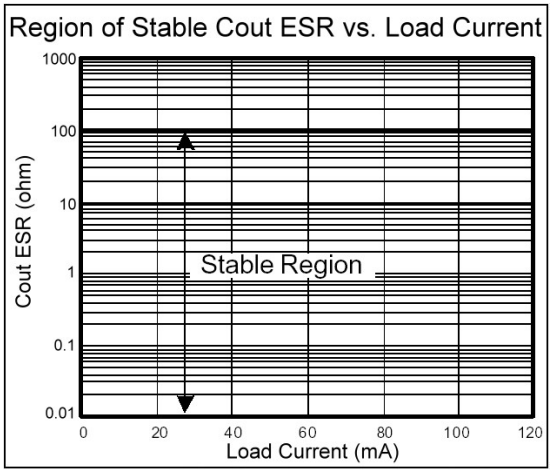

Line Transient Response
V_{IN} =3.0V , I_{OUT} = 0 to 50mA
V_{OUT} , 10mV/div
200uS / DIV


Load Transient Response
V_{IN} = 3.5 to 4.0V
V_{OUT} , 1mV/div
1mS / DIV


PSRR vs. Frequency
I_{LOAD}=10mA
PSRR (dB)
75
70
65
60
55
50
45
40
35
30
0.01
0.1
1
10
100
1000
Frequency (KHz)


Output Noise Spectral Density vs. Frequency
Output Noise (nV/Hz)
10000
1000
100
10
0.01
0.1
1
10
100
1000
Frequency (KHz)


Dropout Voltage vs. Output Voltage
I_{LOAD}=150mA
Dropout Voltage (mV)
290
270
250
230
210
190
170
150
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Output Voltage (V)


Region of Stable Cout ESR vs. Load Current
Cout ESR (ohm)
1000
100
10
1
0.1
0.01
Stable Region
0
20
40
60
80
100
120
Load Current (mA)