SemTron Microtech Corporation

SMC6603

300mA Ultra Low Quiescent Current Linear Regulator

DESCRIPTION

The SMC6603 series is a 300mA low iq and fast transient response liner regulator fix output voltage and ultra-low dropout voltage.
SMC6603 is consists of a bandgap voltage reference, an error amplifier, a P-MOSFET. It also integrates many protection circuitry, like current limit protection module.
The SMC6603 has been designed to be used with low cost ceramic capacitors and requires a minimum output capacitor of 1.0uF . the devices are available in SOT-23, SOT-89 packing .

FEATURES

- ◆Low Consumption Current: 6μA
- ◆Operating Voltage Range 1.8 ~ 6.5V
- ◆Low Dropout Voltage: 190mV(Typical)@100mA
- ◆Thermal Overload Shutdown Protection
- ◆Short-circuit Protection.
- ◆Low ESR Capacitor Compatible

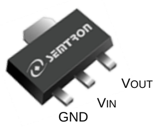
APPLICATIONS

- ◆Battery Powered Equipment
- ◆Set-Top Box
- ◆PCMCIA & New Card
- ◆Mini PCI & PCI-Express Cards
- ◆Laptop, Palmtops, Notebook Computers

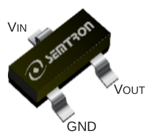
PART NUMBER INFORMATION

SMC 6603 - XX SN – TR G
a b c d e f

a: Company name.
b: Product Serial number.
c: Voltage code XX: 12=1.2V, 18=1.8V
33=3.3V, 50=5.0V
d: Package code K: SOT-89 SN: SOT-23
e: Handling code TR:Tape&Reel
f: Green produce code G:*RoHS Compliant*



SOT-89



SOT-23

ABSOLUTE MAXIMUM RATINGS *(T_A=25°C Unless otherwise noted)*

Symbol	Parameter	Rating	Units
V_{IN}	Input Voltage	-0.3~+6.5V	V
V_{OUT}	EN, FB, SW Pin Voltage	V_{IN}-0.3~V_{IN}+0.3	V
T_J	Operating Temperature Range	-40~+85	°C
T_{STG}	Storage Temperature Range	-55~+150	°C
ESD	HBM (Human Body Mode)	2	KV
	MM (Machine Mode)	200	V
T_{SDR}	Maximum Lead Soldering Temperature (10 Seconds)	260	°C

Note: Exceeding these limits may damage the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.

THERMAL RESISTANCE

Symbol	Parameter	Typ	Max	Units
$R_{\theta JA}$	Thermal Resistance Junction to Ambient		163	°C/W
$R_{\theta JC}$	Thermal Resistance Junction to Case		55	

PIN DESCRIPTION

Symbol	SOT-89	SOT-23	Description
GND	1	1	Input Voltage supply pin
V_{IN}	2	3	Ground pin
V_{OUT}	3	2	Output Voltage of regulator

ELECTRICAL CHARACTERISTICS *(Typical values are at T_A=25°C)*

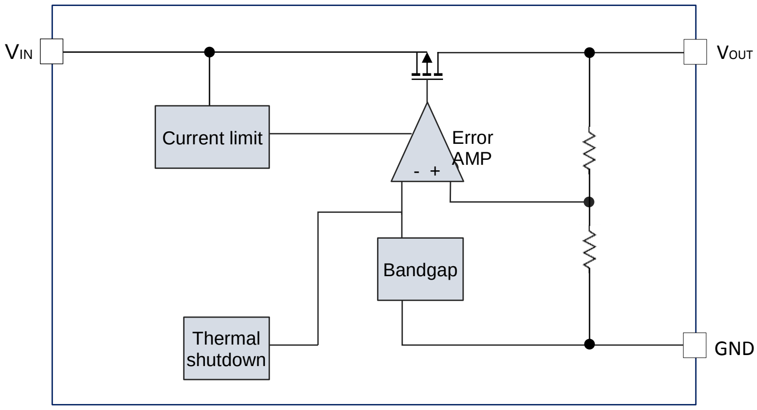
V_{IN} = V_{OUT}+1V, C_{IN}=2.2μF, C_{OUT}=2.2μF, unless otherwise specified.

Symbol	Parameter	Condition	Min	Typ	Max	Unit
V_{IN}	Input Voltage Range [A]		1.8		6.5	V
V_{OUT}	Output Voltage Accuracy	I_{OUT}=50mA	-2		+2	%V
V_{LINE}	Line Regulation	V_{OUT} + 1V ≤ V_{IN} ≤ 6V		0.05	0.2	%/V
V_{LOAD}	Load Regulation	0μA< I_{OUT}<200mA		12	30	mV
V_{DROP}	Dropout Voltage	I_{OUT}=100mA, V_{OUT}≤1.5V		350	570	mV
		I_{OUT}=100mA, 1.8 ≤ V_{OUT} ≤ 2.0V		280	420	
		I_{OUT}=100mA, V_{OUT}=3.0V 2.8 ≤ V_{OUT} ≤ 5.0V		190	350	
I_{CL}	Current Limit	Vin=V_{OUT}+1.5V		380		mA
I_{OUT}	Maximum Outpur Current[B]	V_{IN}-V_{OUT}=1V		300		mA
I_Q	Quiescent Current	No Load		3	6	μA
I_{SC}	Shutdown Current	V_{IN}=V_{OUT}+1V, V_{EN}=0V, No load			1	μA
T_{SD}	Thermal Shutdown Temperature			150	-	°C
PSRR	Ripple Rejection Ratio	f=1KHz, I_{OUT}=30mA		50	-	dB

Note: A. Minimum V_{IN} is 2.0Vor V_{OUT}+ $V_{DROPOUT}$, whichever is greater.
B. not limited by heat dissipation of package and dropout

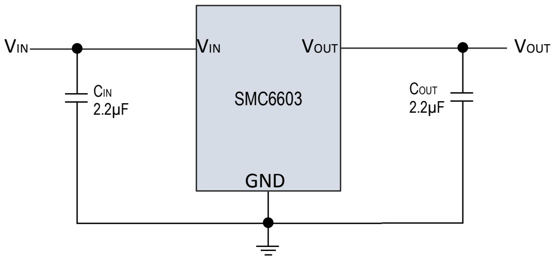
The products and product specifications contained herein are subject to change withoutnotice to improve performance characteristics. Consult us, or our representativesbefore use, to confirm that the information in this datasheet is up to date We assume no responsibility for any infringement of patents, patent rights, or otherrights arising from the use of any information and circuitry in this datasheet.

FUNCTIONAL BLOCK DIAGRAM



Fixed

TYPICAL APPLICATIONS



Fixed

APPLICATION INFORMATION

◆ **Detail Description**

The SMC6603 is a low-dropout linear regulator. The device provides preset 1.2V to 5.0V it is selectable in 0.1V output voltages for output current up to 300mA , it consists of an error amplifier, a P-channel pass transistor and an internal feedback voltage divider.

The bandgap reference for fixed voltage types is connected to the error amplifier, which compares this reference with the feedback voltage and amplifies the voltage difference. If the feedback voltage is lower than the reference voltage, the pass-transistor gate is pulled lower, which allows more current to pass to the output pin and increases the output voltage. If the feedback voltage is too high, the pass transistor gate is pulled up to decrease the output voltage.

The output voltage is feed back through an internal resistive divider connected to out pin. Additional blocks include an output current limiter, thermal sensor logic.

◆ **Internal P-channel Pass Transistor**

The SMC6603 features a P-channel MOSFET pass transistor. Unlike similar designs using PNP pass transistors, P-channel MOSFETs require no base drive, which reduces quiescent current. PNP-based regulators also waste considerable current in dropout when the pass transistor saturates, and use high base-drive currents under large loads. The SMC6603 does not suffer from these problems and consumes only 6μA (Typ.) of current consumption under heavy loads as well as in dropout conditions.

◆ **Current Limit**

The SMC6603 also includes a fold back current limiter. It monitors and controls the pass transistor's gate voltage, estimates the output current, and limits the output current within 300mA.

◆ **Thermal Overload Protection**

Thermal overload protection limits total power dissipation in the SMC6603. When the junction temperature exceeds T_J=+150°C, a thermal sensor turns off the pass transistor, allowing the IC to cool down. The thermal sensor turns the pass transistor on again after the junction temperature cools down by 20°C, resulting in a pulsed output during continuous thermal overload conditions.

Thermal overload protection is designed to protect the SMC6603 in the event of fault conditions. For continuous operation, the absolute maximum operating junction temperature rating of T_J=+125°C hould not be exceeded.

◆ **Operating Region and Power Dissipation**

Maximum power dissipation of the SMC6603 depends on the thermal resistance of the case and circuit board, the temperature difference between the die junction and ambient air, and the rate of airflow. The power dissipation across the devices is $P = I_{OUT} * (V_{IN}-V_{OUT})$.

The resulting maximum power dissipation is:

$$P_{MAX} = (T_J-T_A) / (\theta_{JC}+\theta_{CA}) = (T_J-T_A) / \theta_{JA}$$

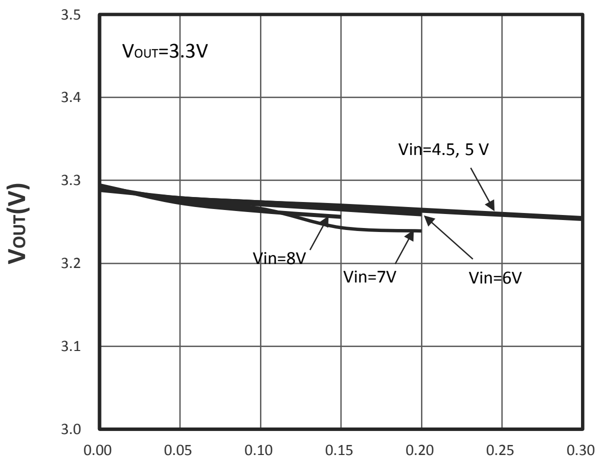
Where (T_J-T_A) is the temperature difference between the SMC6603 die junction and the surrounding air, θ_{JC} is the thermal resistance of the package chosen, and θ_{JA} is the thermal resistance through the printed circuit board, copper traces and other materials to the surrounding air. For better heat-sinking, the copper area should be equally shared between the IN, OUT, and GND pins.

◆ **Dropout Voltage**

A regulator's minimum input-output voltage differential, or dropout voltage, determines the lowest usable supply voltage. In battery-powered systems, this will determine the useful end-of-life battery voltage. The SMC6603 use a P-channel MOSFET pass transistor, its dropout voltage is a function of drain-to-source on-resistance $R_{DS(ON)}$ multiplied by the load current.

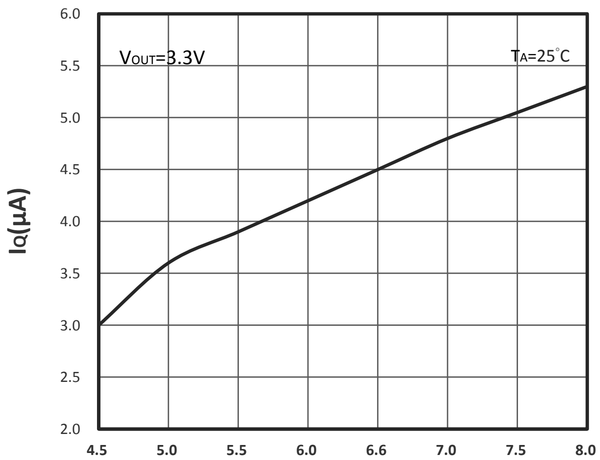
$$V_{DROPOUT} = V_{IN} - V_{OUT} = R_{DS(ON)} * I_{OUT}$$

■*TYPICAL OPERATING CHARACTERISTICS*(*TA=25°C unless otherwise noted)*



VOUT VS VIN

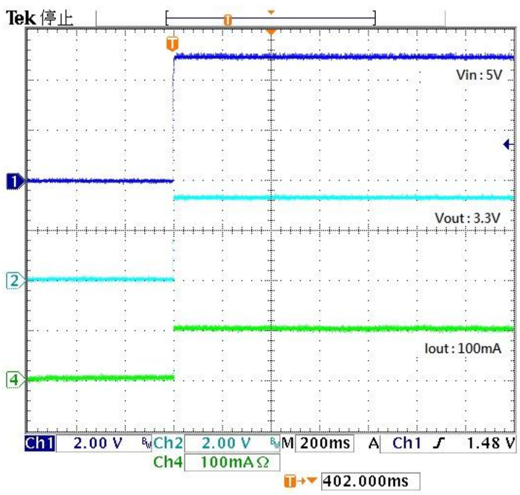
IOUT(A)



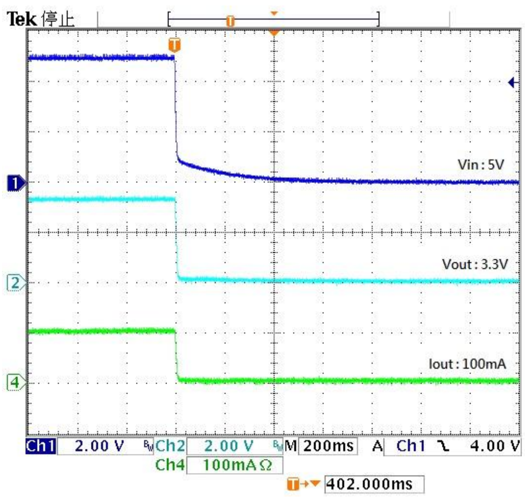
IQ VS VIN

VIN(V)

■*OPERATING WAVEFORMS*(*Typical values are at TA=25°C unless otherwise noted)*

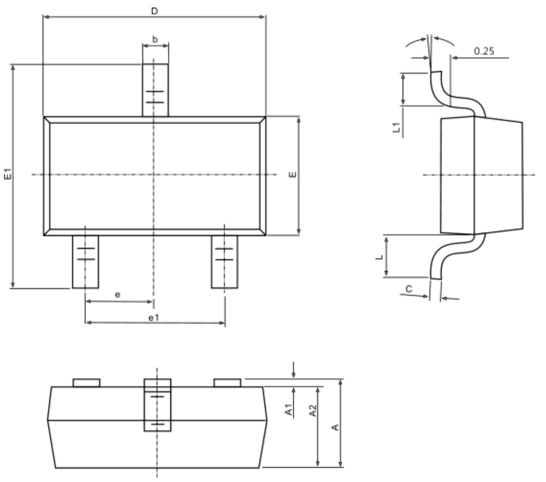


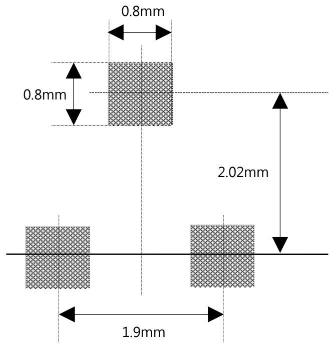
Start-up Waveform



Shutdown Waveform

■SOT-23 PACKAGE DIMENSIONS

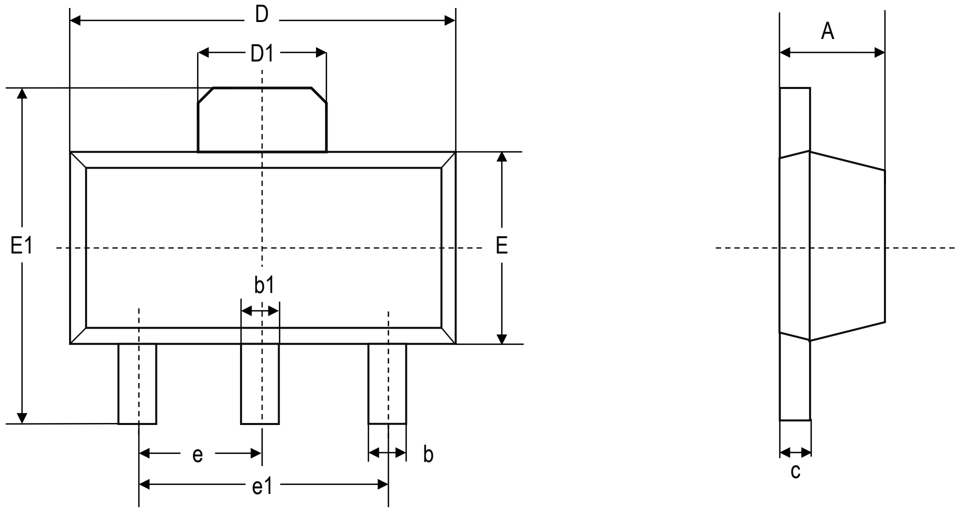




Recommended Land Pattern

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP.		0.037 TYP	
e1	1.800	2.000	0.071	0.079
L	0.550 REF.		0.022 REF.	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°

SOT-89 PACKAGE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.440	1.540	0.567	0.606
b	0.350	0.450	0.138	0.177
b1	0.450	0.550	0.177	0.217
c	0.350	0.450	0.138	0.177
D	4.450	4.550	1.752	0.791
D1	1.650	1.750	0.650	0.689
E	2.450	2.550	0.965	1.004
E1	3.950	4.250	1.555	1.673
e	1.450	1.550	0.571	0.610
e1	2.900	3.100	1.142	1.220
L	0.900	1.200	0.354	0.472
θ	2°	10°	2°	10°