GENERAL DESCRIPTION

The BM9209 is the improvement version of CM2838 in Iq , in dropout , also in PSRR for portable wireless products. BM9209 family is a positive voltage linear regulator developed utilizing CMOS technology featured low quiescent current (5μA typ.) and 0.1uA standby current, lowest dropout voltage, and high output voltage accuracy, making them ideal for battery applications. EN input connected to CMOS has low bias current. Integrated current limit and temperature limit protection circuit.
These rugged devices have both Thermal Shutdown, and Current Fold-back to prevent device failure under the "Worst" of operating conditions.

In application requiring a low noise, regulated supply, place a 1000pF capacitor between Bypass and Ground.

The BM9209 is stable with an output capacitance of 1.0μF or greater.

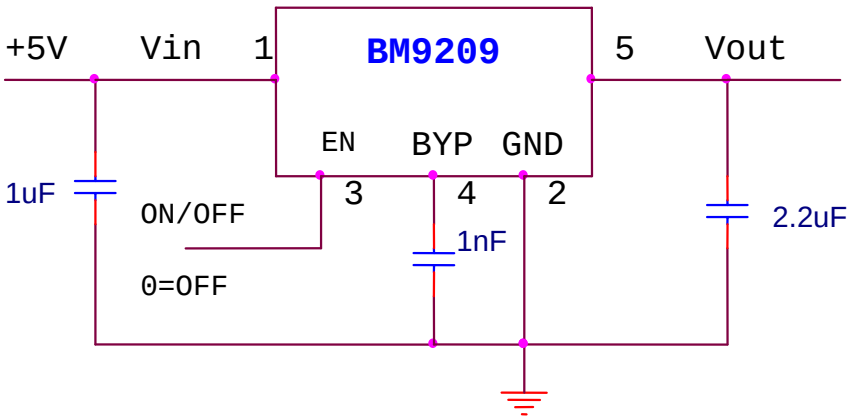
FEATURES

- Very Low Dropout Voltage : 160mV @200mA
- Low Current Consumption: 5μA
- Output Voltage: 1.8V, 2.5V, 2.8V, 3.0V, 3.3V
- High Accuracy Output Voltage: +/- 1.5%
- Guaranteed 300mA Output
- Input Range up to 7.0V
- Thermal Shutdown and Current Limiting
- Fast enable turn-on time of 20us (typ.)
- Compact Package: SOT-23-5
- Factory Pre-set Output Voltages
- Short Circuit Current Fold-Back
- Low standby(off) current : 0.1uA
- Higher PSRR : 60dB (1KHz)
- Improved from RT9193 , CM2838 and RT9167

APPLICATIONS

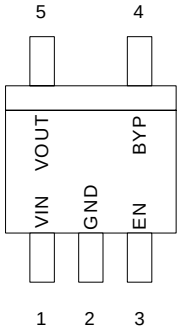
- PHS , mobile phone
- Wireless lan
- Wireless telephone
- Digital Camera
- Portable GPS
- MP4 , portable DVD

TYPICAL APPLICATIONS

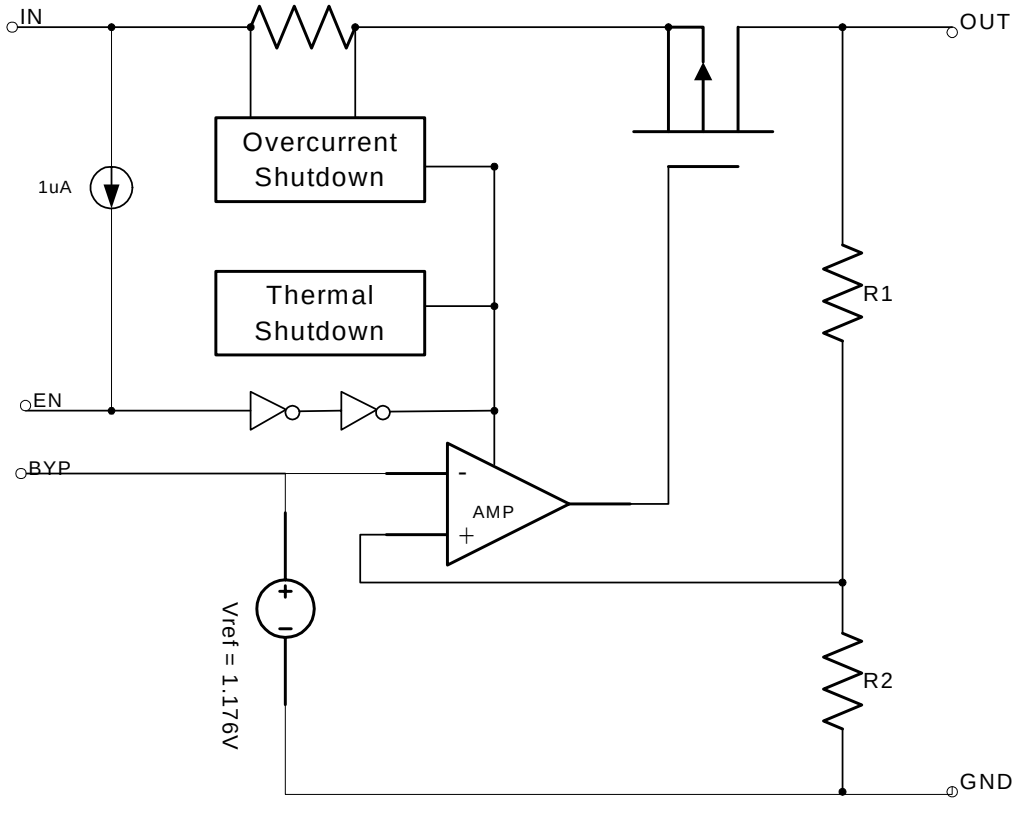


PIN CONFIGURATION

SOT-23-5
Top View



BLOCK DIAGRAM



ORDERING INFORMATION

Part Number	Output Voltage	Temperature Range	Package
BM9209GDIM25	1.8V	-40℃ ~ +85℃	SOT-23-5
BM9209GKIM25	2.5V	-40℃ ~ +85℃	SOT-23-5
BM9209GNIM25	2.8V	-40℃ ~ +85℃	SOT-23-5
BM9209GPIM25	3.0V	-40℃ ~ +85℃	SOT-23-5
BM9209GSIM25	3.3V	-40℃ ~ +85℃	SOT-23-5

Note: For other pre-set output voltage requirements, please contact Bookly Sales office.

ABSOLUTE MAXIMUM RATINGS

Input Voltage …… +8.5V
Output Current …… P_D / (V_{IN} - Vo) mA
Output Voltage …… GND-0.3V to V_{IN}+0.3V
ESD Classification …… B

OPERATING RATINGS

Ambient Temperature Range (T_A) …….. -40℃ to +85℃
Junction Temperature Range …….. -40℃ to +125℃

THERMAL INFORMATION

Parameter		Maximum	Unit
Thermal Resistance (Θ_{jc})	SOT-23-5	160	℃/W
Internal Power Dissipation (P_D) (ΔT = 100℃)	SOT-23-5	320	℃/W
Maximum Junction Temperature		150	℃
Maximum Lead Temperature (10 Sec)		300	℃

Caution: Stress above the listed absolute rating may cause permanent damage to the device.

ELECTRICAL CHARACTERISTICS

T_A = +25℃; unless otherwise noted

Parameter	Symbol	Test Conditions		BM9209			Unit
				Min.	Typ.	Max.	
Input Voltage	V_{IN}			**Note 1**		8	V
Output Voltage Accuracy	V_{OUT}	I_O = 1mA		-1.5		1.5	%
Dropout Voltage	$V_{DROPOUT}$	I_O = 300mA, $V_{OUT}=V_{O(NOM)}$-2%,	1.2V<$V_{O(NOM)}$<=2.0V		400		mV
			2.0V<$V_{O(NOM)}$<=2.5V		200		
			2.5V<$V_{O(NOM)}$		150		mV
Output Current	I_O	V_{OUT} > 1.2V		250	300		mA
Current Limit	I_{LIM}	V_{OUT} > 1.2V		300	450		mA
Short Circuit Current	I_{SC}	V_{OUT} < 0.95V			400	450	mA
Quiescent Current	I_Q	I_O = 0mA			5	7	μA
Ground Pin Current	I_{GND}	I_O = 1mA to 400mA			5	7	μA
Line Regulation	REG_{LINE}	I_{OUT}=5mA, $V_{IN}=V_{OUT}$+1 to V_{OUT}+2			0.015	0.2	%
Load Regulation	REG_{LOAD}	I_O=1mA to 400mA			0.2	1.5	%
Over Temperature Shutdown	OTS				150		℃
Over Temperature Hysteresis	OTH				30		℃
V_{OUT} Temperature Coefficient	TC				40		ppm/℃
Power Supply Rejection	PSRR	I_O = 100mA, C_O=2.2μF ceramic	f=1kHz		60		dB
			f=10kHz		55		
			f=100kHz		50		
Power Supply Rejection	PSRR	I_O = 100mA, C_O=2.2μF ceramic, C_{BYP}=0.01μF	f=1kHz		65		dB
			f=10kHz		62		
			f=100kHz		60		
Output Voltage Noise	eN	f=10Hz to 100kHz, I_O = 10mA, C_{BYP}=0μF	C_O=2.2μF		20		μVrms
			C_O=100μF		15		
Output Voltage Noise	eN	f=10Hz to 100kHz, I_O = 10mA, C_{BYP}=0.01μF	C_O=2.2μF		17		μVrms
			C_O=100μF		10		
Shutdown Supply Current	I_{SD}	V_{IN}=5.0V, V_{OUT}=0V, V_{EN} < V_{EL}			0.1	0.3	μA
EN Input Bias Current	I_{EH}	$V_{EN}=V_{IN}$, V_{IN}=2.6V to 7V				0.1	μA
	I_{EL}	V_{EN}=0, V_{IN}=2.6V to 7V			0.1	0.3	μA
EN Input Threshold	V_{EH}	V_{IN}=2.6V to 7V		**(Note2)**		V_{IN}	V
	V_{EL}	V_{IN}=2.6V to 7V		0		0.4	V

Note 1. $V_{IN(MIN)} = V_{OUT} + V_{DROPOUT}$

Note 2. Based on our design architecture, the enable input threshold will depend on the input voltage. To ensure the stability of your design application, please set the **$V_{EH\ (MIN)} = V_{IN}/2 + 0.8V$.**

DETAILED DESCRIPTION

The BM9209 family of CMOS regulators contain a PMOS pass transistor, voltage reference, error amplifier, over-current protection, thermal shutdown, and short circuit protection.

The P-channel pass transistor receives data from the error amplifier, over-current shutdown, short output protection, 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 400mA. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 120℃.

The BM9209 switches from voltage mode to current mode when the load exceeds the rated output current. This prevents over-stress. The BM9209 also incorporates current fold-back to reduce power dissipation when the output is short-circuited. This feature becomes active when the output drops below 1.05V, and reduces the current flow by 65%. Full current is restored when the voltage exceeds 0.95V.

ENABLE

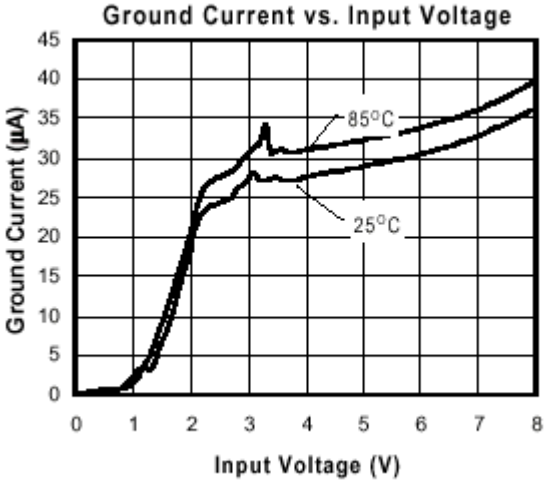
The Enable pin normally floats high. When pulled down low voltage, switch off output , the PMOS pass transistor shut off, and all internal circuits are powered down. In this state, the quiescent current is less than 0.1μA. This pin behaves much like an electronic switch.

EXTERNAL CAPACITOR

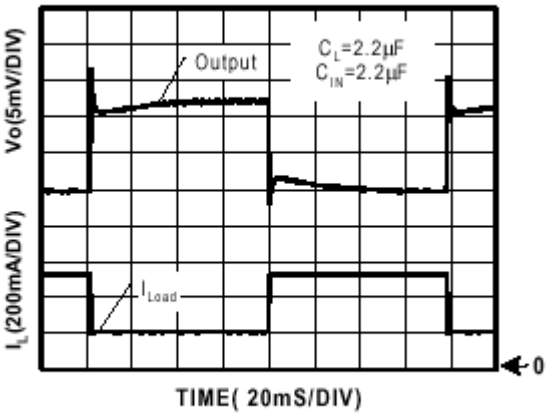
The BM9209 is stable with an output capacitor to ground of 1.0μF or greater. It can keep stable even with higher or poor ESR capacitors. A second capacitor is recommended between the input and ground to stabilize VIN. The input capacitor should be larger than 0.1μF to have a beneficial effect. All capacitors should be placed in close proximity to the pins. A “quiet” ground termination is desirable.

TYPICAL ELECTRICAL CHARACTERISTICS

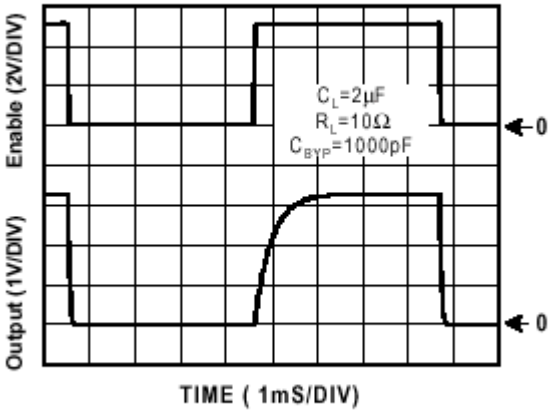
Ground Current vs. Input Voltage



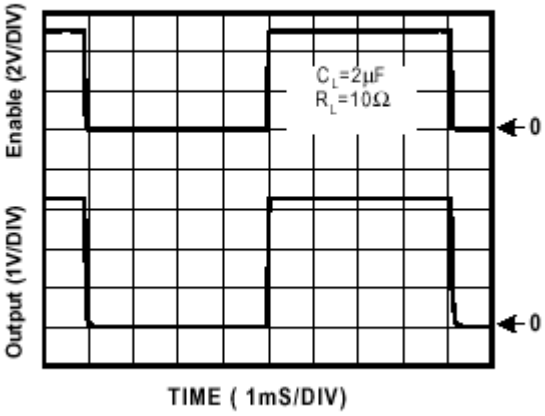
Load Step (1mA-300mA)



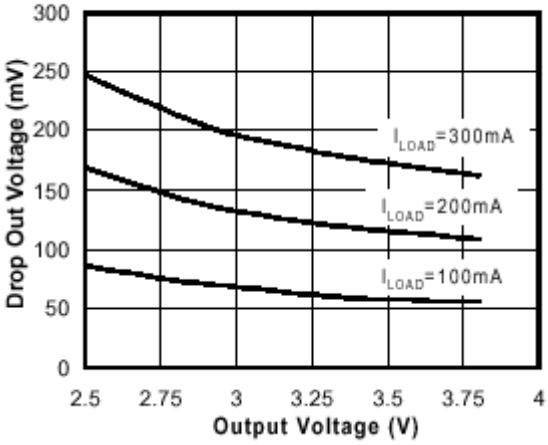
Chip Enable Transient Response



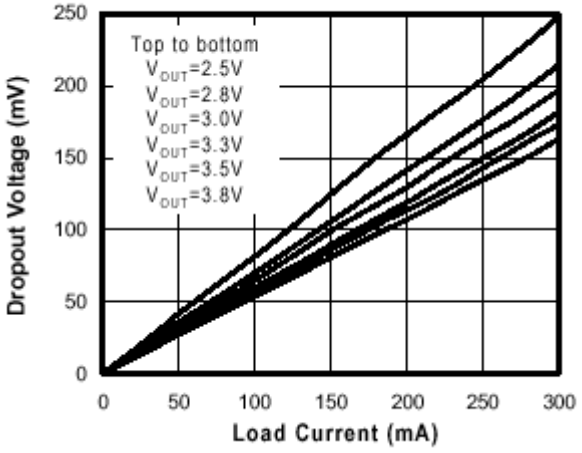
Chip Enable Transient Response



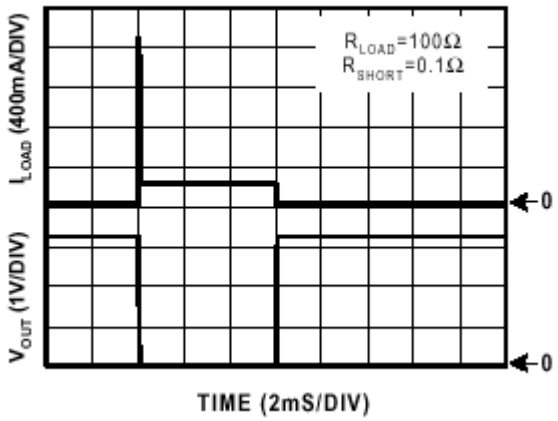
Drop Out Voltage vs Output Voltage



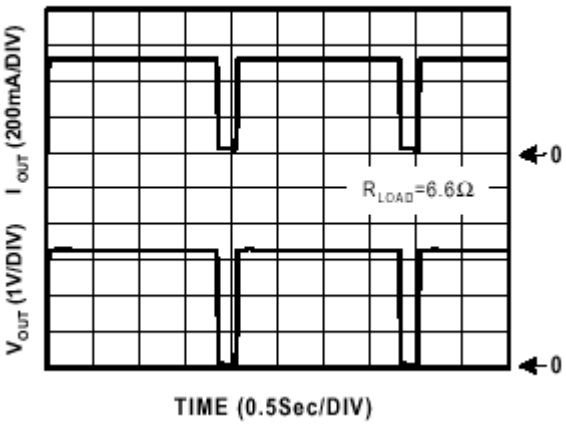
Drop Out Voltage vs Load Current



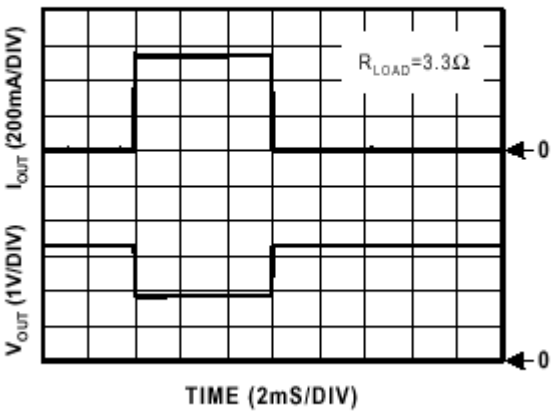
Short Circuit Response



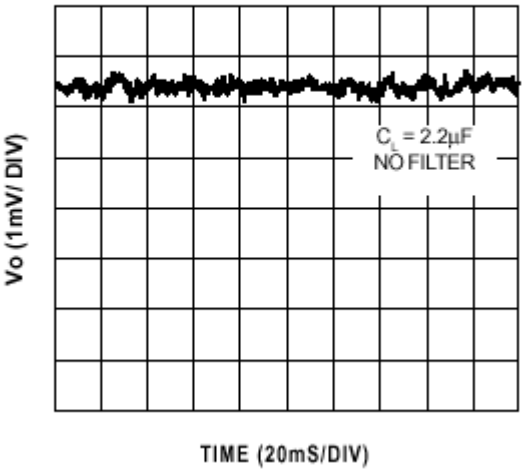
Overtemperature Shutdown



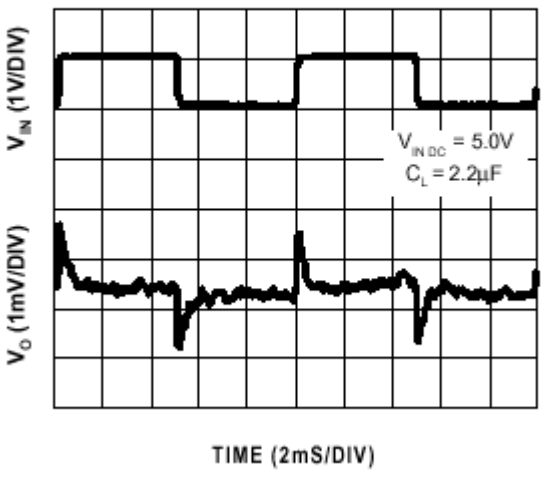
Current Limit Response



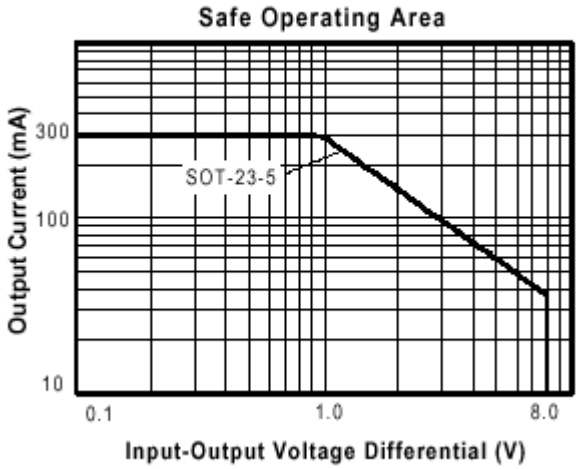
Noise Measurement

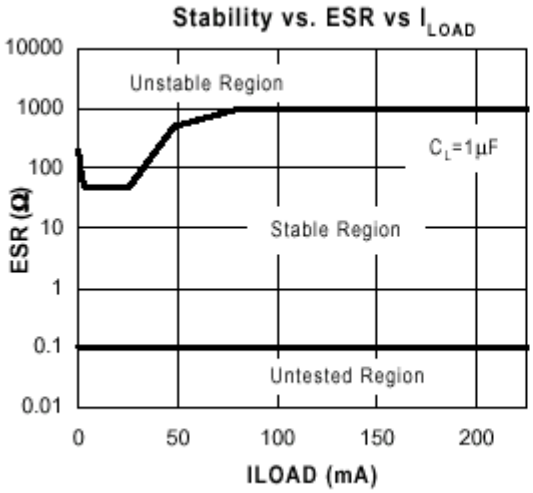


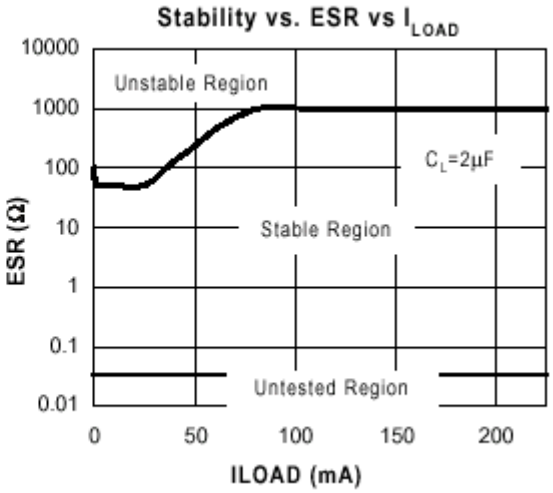
Transient Line Response

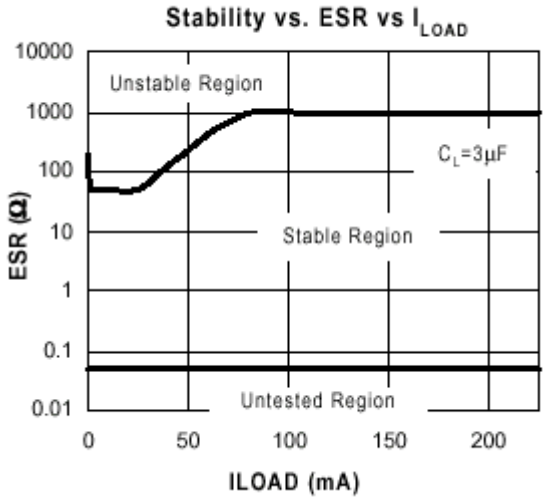


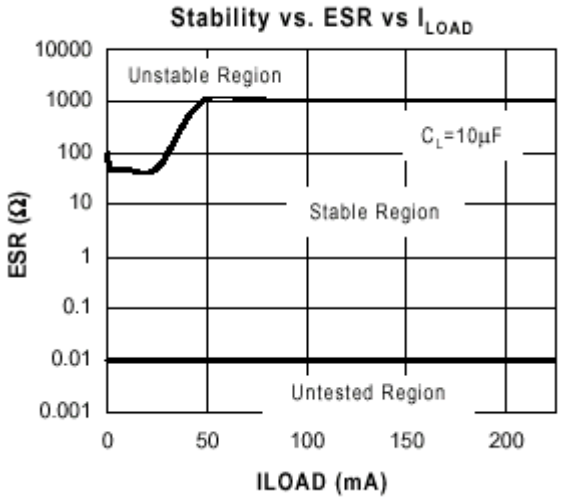
Safe Operating Area




Stability vs. ESR vs I_{LOAD}
Unstable Region
C_L=1µF
Stable Region
Untested Region
ESR (Ω)
ILOAD (mA)
10000
1000
100
10
1
0.1
0.01
0
50
100
150
200

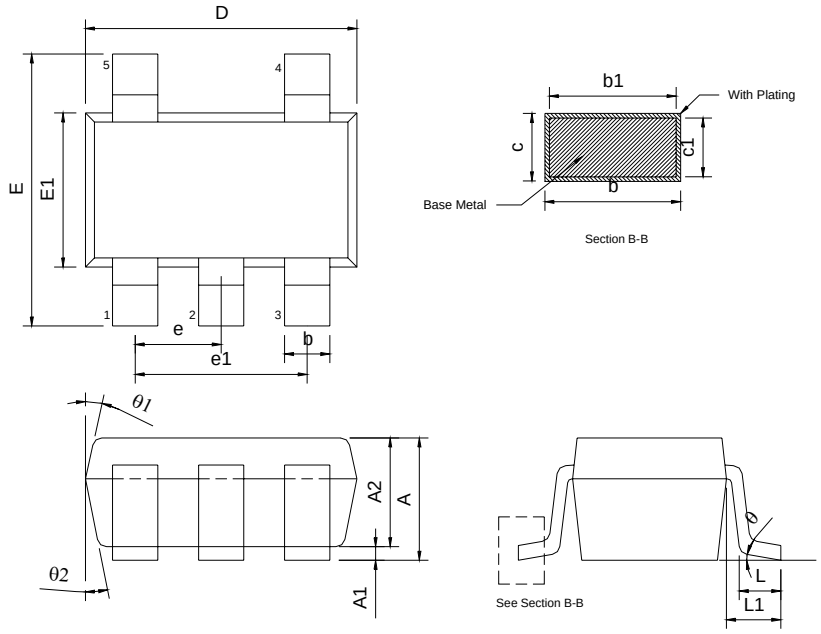

Stability vs. ESR vs I_{LOAD}
Unstable Region
C_L=2µF
Stable Region
Untested Region
ESR (Ω)
ILOAD (mA)
10000
1000
100
10
1
0.1
0.01
0
50
100
150
200


Stability vs. ESR vs I_{LOAD}
Unstable Region
C_L=3µF
Stable Region
Untested Region
ESR (Ω)
ILOAD (mA)
10000
1000
100
10
1
0.1
0.01
0
50
100
150
200


Stability vs. ESR vs I_{LOAD}
Unstable Region
C_L=10µF
Stable Region
Untested Region
ESR (Ω)
ILOAD (mA)
10000
1000
100
10
1
0.1
0.01
0.001
0
50
100
150
200

PACKAGE DIMENSION

SOT-23-5 (M25)



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.05	---	1.35	0.041	---	0.053
A1	0.05	---	0.15	0.002	---	0.006
A2	1.00	1.10	1.20	0.039	0.043	0.047
b	0.25	---	0.50	0.010	---	0.020
b1	0.25	0.40	0.45	0.010	0.016	0.018
c	0.08	---	0.20	0.003	---	0.008
c1	0.08	0.11	0.15	0.003	0.004	0.006
D	2.70	2.90	3.00	0.106	0.114	0.118
E	2.60	2.80	3.00	0.102	0.110	0.118
E1	1.50	1.60	1.70	0.059	0.063	0.067
L	0.35	0.45	0.55	0.014	0.018	0.022
L1	0.60 REF			0.024 REF		
e	0.95 BSC			0.037 BSC		
e1	1.90 BSC			0.075 BSC		
θ	0°	5°	10°	0°	5°	10°
θ1	3°	5°	7°	3°	5°	7°
θ2	6°	8°	10°	6°	8°	10°