

## GENERAL DESCRIPTION

The BM9168 family is a positive voltage linear regulator developed utilizing CMOS technology featured low quiescent current (10uA typ.), low dropout voltage, and high output voltage accuracy. Built-in low on-resistance transistor provides low dropout voltage and large output current. A 1.0μF or greater can be used as an output capacitor.

The SOT-23-3 miniaturized package are recommended for configuring portable devices and large current application, respectively.

These robust devices are designed to prevent device failure under the worst operation condition with both Thermal Shutdown and Current Fold-back.

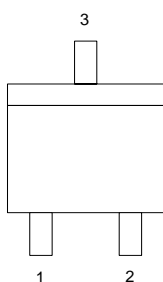
## FEATURES

- ◆ Very Low Dropout Voltage
- ◆ Low Current Consumption: Typ. <20uA
- ◆ Output Voltage: 1.5V, 1.8V , 2.5V , 3.0V, 3.3V
- ◆ High Accuracy Output Voltage: +/- 1.5%
- ◆ Guaranteed >250mA Output
- ◆ Input Range of 1.8V to 7.0V
- ◆ Thermal Shutdown
- ◆ High PSRR to 55dB
- ◆ Compact Package: SOT-23-3, SOT-89
- ◆ Factory Pre-set Output Voltages
- ◆ Short Circuit Current Fold-Back
- ◆ Low Temperature Coefficient

## APPLICATIONS

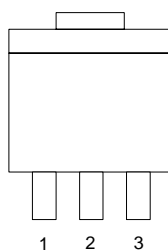
- ◆ Battery-powered devices , like DSC , MP3 , MP4 portable DVD , PHS , Wireless- Lan
- ◆ Personal communication devices
- ◆ Home electric/electronic appliances
- ◆ PC peripherals ( PC card ) , Hard-disc

## Pin define



### SOT23-3

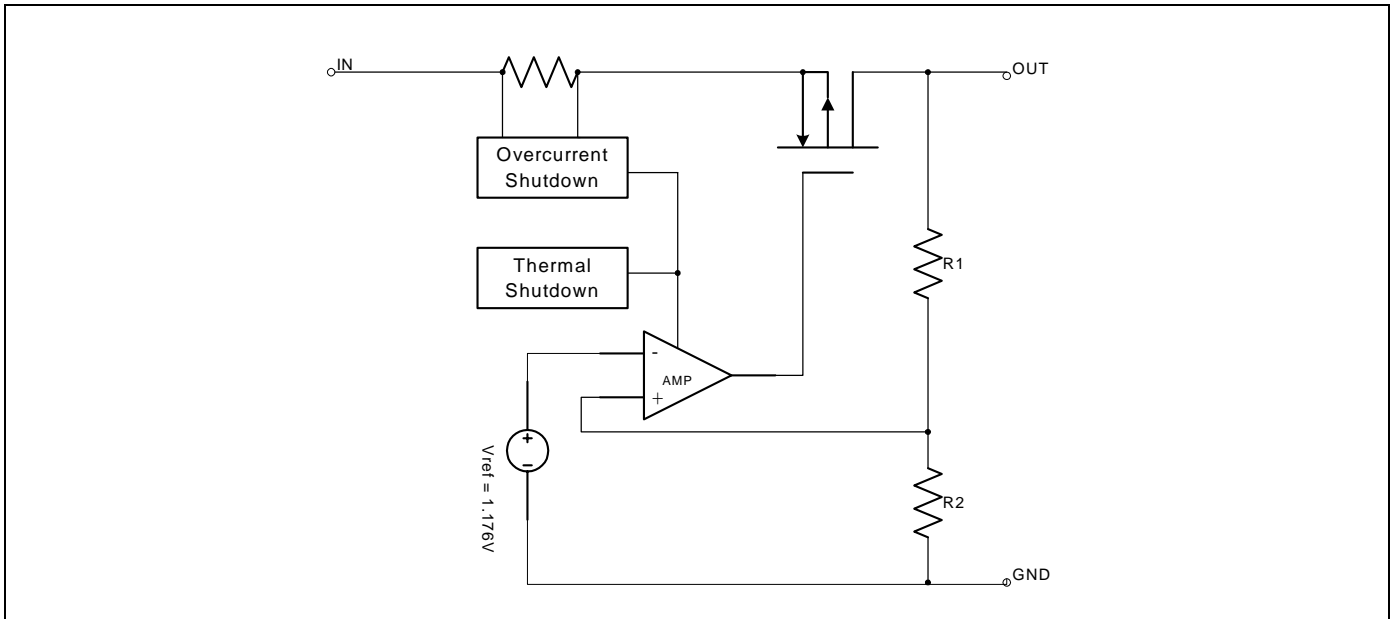
pin1 = GND ,  
pin2 = Vout ,  
Pin3 = Vin ,



### SOT89

pin1 = GND  
pin2 = Vin  
pin3 = Vout

**BLOCK DIAGRAM**



**ORDERING INFORMATION**

<b>Part Number</b>	<b>Output Voltage</b>	<b>Temperature Range</b>	<b>Package</b>
BM9168EIM23	1.5V	-40°C ~ +85°C	SOT-23-3
BM9168EIM89	1.5V	-40°C ~ +85°C	SOT-89
BM9168DIM23	1.8V	-40°C ~ +85°C	SOT-23-3
BM9168DIM89	1.8V	-40°C ~ +85°C	SOT-89
BM9168CIM23	2.5V	-40°C ~ +85°C	SOT-23-3
BM9168CIM89	2.5V	-40°C ~ +85°C	SOT-89
BM9168BIM23	2.8V	-40°C ~ +85°C	SOT-23-3
BM9168BIM89	2.8V	-40°C ~ +85°C	SOT-89
BM9168FIM23	3.0V	-40°C ~ +85°C	SOT-23-3
BM9168FIM89	3.0V	-40°C ~ +85°C	SOT-89
BM9168AIM23	3.3V	-40°C ~ +85°C	SOT-23-3
BM9168AIM89	3.3V	-40°C ~ +85°C	SOT-89

**ABSOLUTE MAXIMUM RATINGS**

Input Voltage ..... +7V  
 Output Current .....  $P_D / (V_{IN} - V_o)$   
 Output Voltage ..... GND-0.3V to  $V_{IN}+0.3V$   
 ESD Classification ..... B

**OPERATING RATINGS**

Ambient Temperature Range ( $T_A$ ) ..... -40°C to +85°C  
 Junction Temperature Range ..... -40°C to +125°C

**THERMAL INFORMATION**

Parameter		Maximum	Unit
Thermal Resistance ( $\theta_{jc}$ )	SOT-23-3	110	°C/W
	SOT-89	18	
Thermal Resistance ( $\theta_{ja}$ )	SOT-23-3	325	°C/W
	SOT-89	180	
Internal Power Dissipation ( $P_D$ ) ( $\Delta T = 100^\circ C$ )	SOT-23-3	300	mW
	SOT-89	550	
	SOT-89	2750*	
Maximum Junction Temperature		150	°C
Maximum Lead Temperature (10 Sec)		300	°C

\*With Junction sink capable of twice times of  $\theta_{jc}$

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

**ELECTRICAL CHARACTERISTICS**

T<sub>A</sub> = +25°C; unless otherwise noted

Parameter	Test Conditions	BM9168			Unit
		Min.	Typ.	Max.	
Input Voltage		Note 1		7	V
Output Voltage Accuracy	I <sub>o</sub> = 1mA to 250mA	-1.5		1.5	%
Dropout Voltage	I <sub>o</sub> =100mA, V <sub>OUT</sub> =V <sub>OUT</sub> -2.0%, V <sub>OUT</sub> >2.5V		150mV		mV
	I <sub>o</sub> =100mA, V <sub>OUT</sub> =V <sub>OUT</sub> -2.0%, V <sub>OUT</sub> <=2.0V		210mV		mV
Output Current	V <sub>OUT</sub> > 1.2V	250			mA
Short Circuit Current	V <sub>OUT</sub> < 1.05V			350	mA
Current Limit	V <sub>OUT</sub> >1.2V		350		mA
Quiescent Current	V <sub>IN</sub> =5V, No Load	5	10	25	uA
Ground Pin Current	I = 1mA to 250mA		10	25	uA
Line Regulation	I <sub>OUT</sub> =5mA, V <sub>IN</sub> =V <sub>OUT</sub> +1 to V <sub>OUT</sub> +2, V <sub>OUT</sub> <= 3.0V	-0.15	0.03	0.15	%
	I <sub>OUT</sub> =5mA, V <sub>IN</sub> =V <sub>OUT</sub> +1 to V <sub>OUT</sub> +2, V <sub>OUT</sub> > 3.0V	-0.3	0.06	0.3	
Load Regulation	I <sub>o</sub> =1mA to 250mA		0.2	1	%
Power Supply Rejection	I <sub>o</sub> = 100mA C <sub>O</sub> =10μF ceramic	f=1KHz		55	dB
		f=10KHz		51	
		f=100KHz		46	
Over Temperature Shutdown			150		°C
Over Temperature Hystersis			30		°C
Output Noise	F=10Hz to 100kHz, C <sub>O</sub> =10μF, I <sub>o</sub> = 10mA		30		μVrms
Output Voltage Temp. Coeff.			25		ppm/°C

**Note 1.** V<sub>IN(MIN)</sub> = V<sub>OUT</sub> + 0.3V

**DETAILED DESCRIPTION**

The BM9168 family of CMOS regulators contain a PMOS pass transistor, voltage reference, error amplifier, over-current protection, thermal shutdown, and short circuit protection.

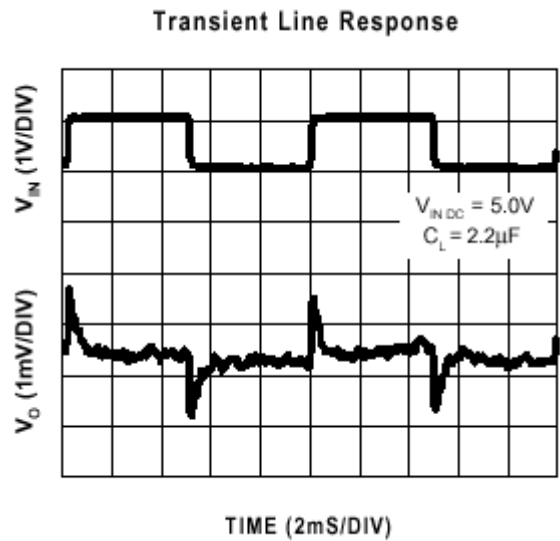
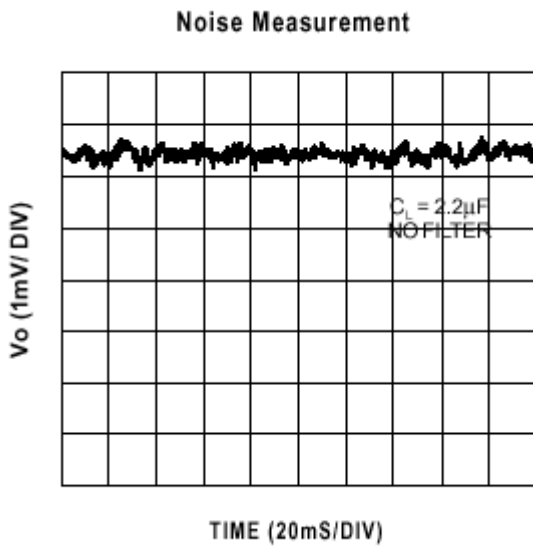
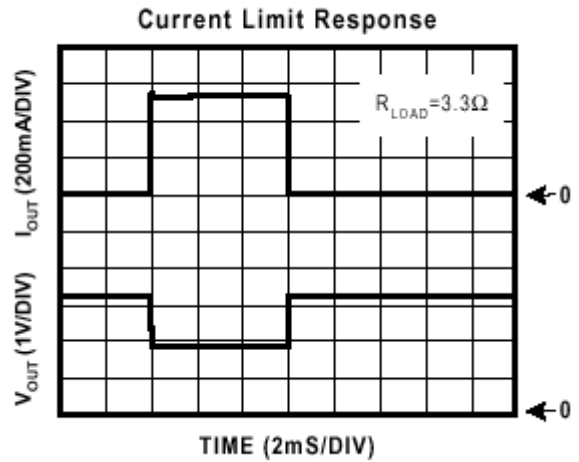
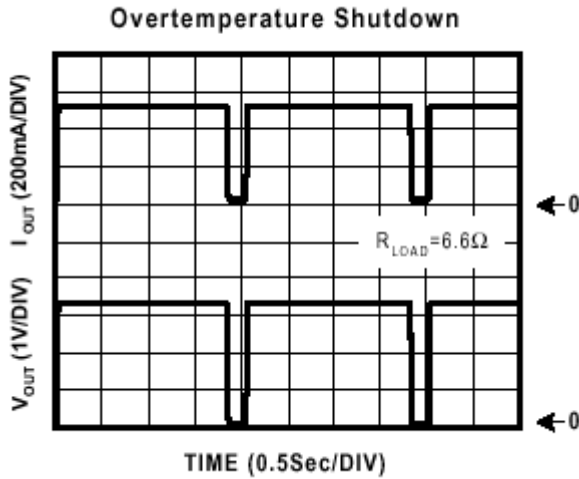
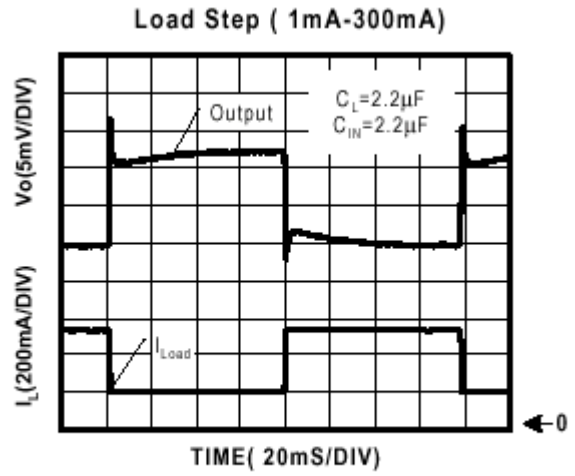
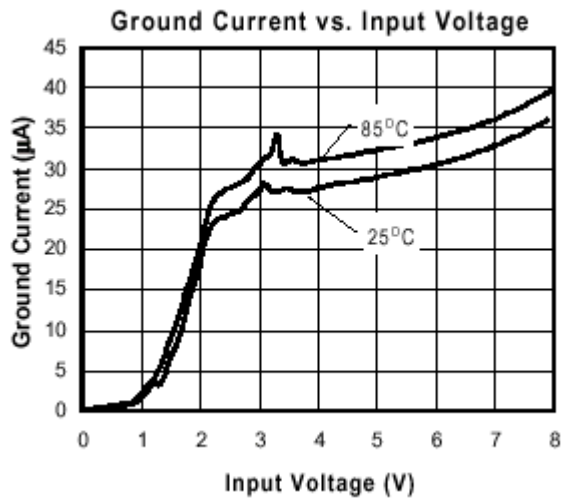
The P-channel pass transistor receives data from the error amplifier, over-current shutdown, short output protection, and thermal protection circuits. During normal operation, the error amplifier compares the output voltage to a precision reference. Over-current and Thermal shutdown circuits become active when the junction temperature exceeds 150°C, or the current exceeds 350mA. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 120°C.

The BM9168 switches from voltage mode to current mode when the load exceeds the rated output current. This prevents over-stress. The BM9168 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 1.05V.

**EXTERNAL CAPACITOR**

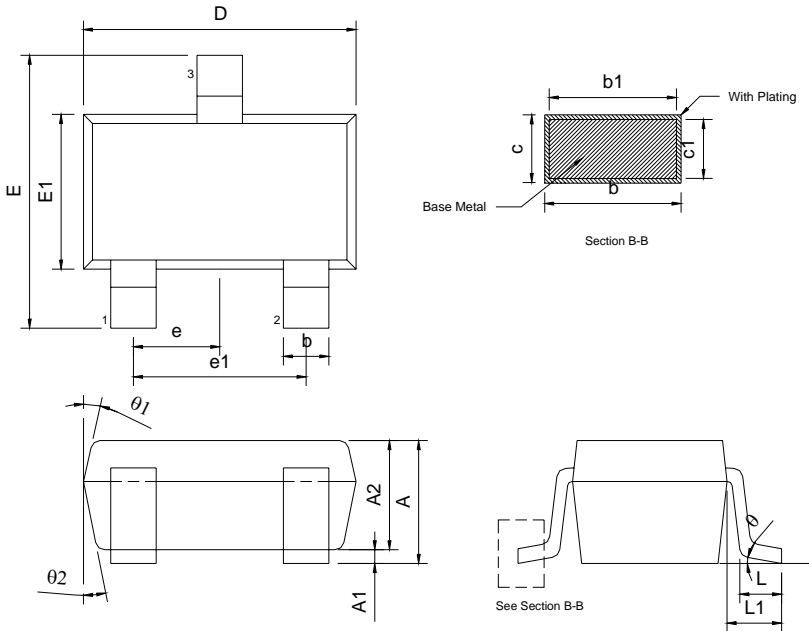
The BM9168 is stable with an output capacitor to ground of 1μF. It can keep stable even with higher or poor ESR capacitors. A second capacitor is recommended between the input and ground to stabilize V<sub>IN</sub>. The input capacitor should be larger than 0.1μF to have a beneficial effect. All capacitors should be placed in close proximity to the pins. A “quiet” ground termination is desirable.

**TYPICAL ELECTRICAL CHARACTERISTICS**



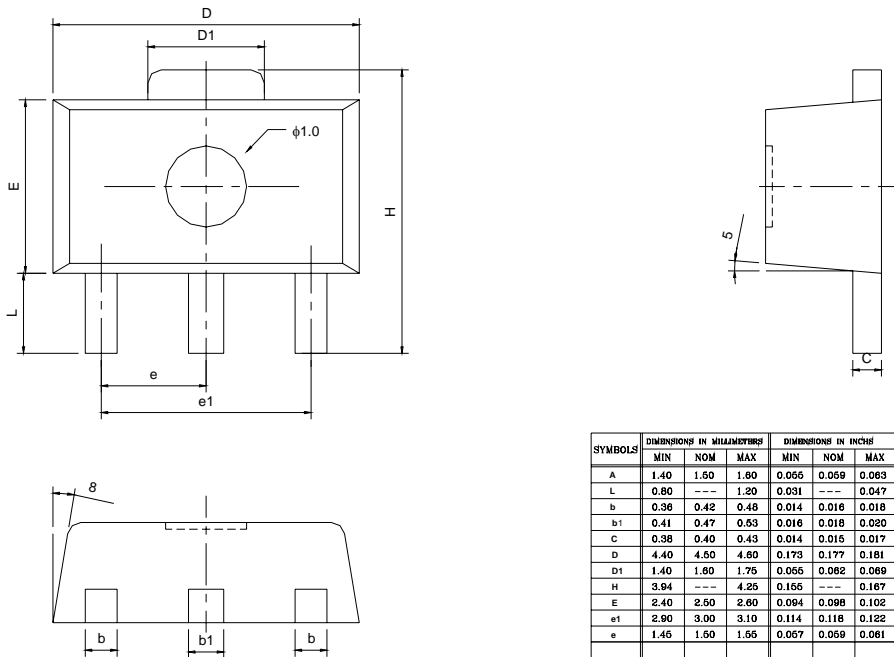
PACKAGE DIMENSION

SOT-23-3 (M23)



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	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		
theta	0°	5°	10°	0°	5°	10°
theta1	3°	5°	7°	3°	5°	7°
theta2	6°	8°	10°	6°	8°	10°

SOT-89 (M89)



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.40	1.50	1.60	0.055	0.059	0.063
L	0.80	---	1.20	0.031	---	0.047
b	0.30	0.42	0.48	0.012	0.016	0.018
b1	0.41	0.47	0.53	0.016	0.018	0.020
C	0.38	0.40	0.43	0.014	0.015	0.017
D	4.40	4.50	4.60	0.173	0.177	0.181
D1	1.40	1.60	1.75	0.055	0.062	0.069
H	3.94	---	4.25	0.155	---	0.167
I	2.40	2.50	2.60	0.094	0.098	0.102
J	2.90	3.00	3.10	0.114	0.118	0.122
e1	2.90	3.00	3.10	0.114	0.118	0.122
e	1.45	1.50	1.55	0.057	0.059	0.061