

## 1A Adjustable Voltage High Speed LDO Regulators HM6118 Series

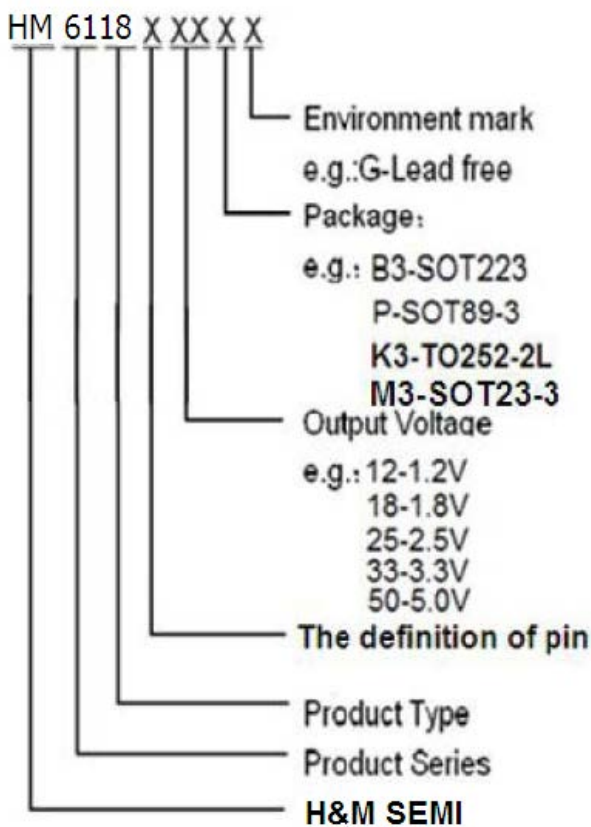
### General Description

The HM6118 series are highly accurate, low noise, LDO Voltage Regulators that are capable of providing an output current that is in excess of 1A with a maximum dropout voltage of 1.3V at 1A (HM6118A33). This series contains four fixed output voltages of 1.2V, 1.8V, 2.5V and 3.3V that have no minimum load requirement to maintain regulation. On chip trimming adjusts the reference/output voltage to within  $\pm 2\%$  accuracy. Internal protection features consist of output current limiting, safe operating area compensation, and thermal shutdown. The HM6118 series can operate with up to 18V input. Devices are available in SOT223.

### Features

- Output Current in Excess of 1A
- Dropout Voltage: 80mV @  $I_{OUT} = 100mA$  (HM6118A33)
- Operating Voltage Range: 2.5V ~ 18V
- Highly Accuracy:  $\pm 2\%$
- Adjustable Output Voltage Option
- Standby Current: 52uA (TYP.)
- High Ripple Rejection: 70dB @ 1KHz (HM6118A33)
- Line Regulation: 2mV (TYP.)
- Temperature Stability  $\leq 0.5\%$
- Thermal Shutdown Protection: 160°C
- Packages: SOT223, SOT89-3, TO252-2L, SOT23-3

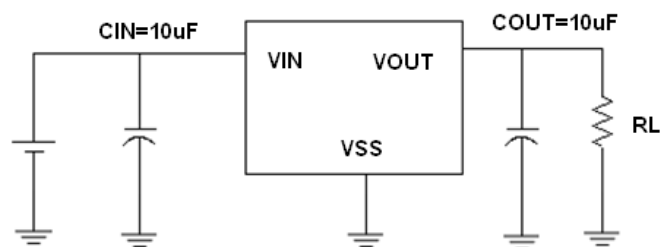
### Selection Guide



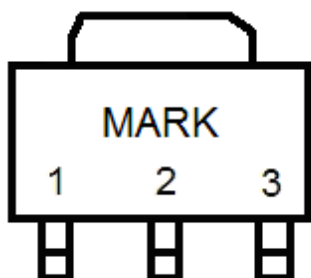
### Typical Application

- Consumer and Industrial Equipment Point of Regulation
- Switching Power Supply Post Regulation
- Hard Drive Controllers
- Battery Chargers

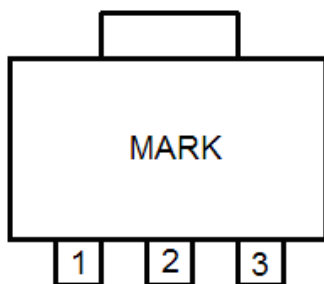
### Typical Application Circuit



**Pin Configuration**



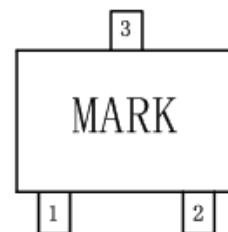
SOT223



SOT89-3



TO252-2L



SOT23-3

**Pin Assignment**

HM6118AXX

| Pin Number |         |          |         | Pin Name         | Functions   |
|------------|---------|----------|---------|------------------|-------------|
| SOT223     | SOT89-3 | TO252-2L | SOT23-3 |                  |             |
| 1          | 1       | 1        | 1       | GND              | Ground      |
| 2          | 3       | 2        | 2       | V <sub>OUT</sub> | Output      |
| 3          | 2       | 3        | 3       | V <sub>IN</sub>  | Power Input |

HM6118EXX

| Pin Number |          | Pin Name         | Functions   |
|------------|----------|------------------|-------------|
| SOT223     | TO252-2L |                  |             |
| 1          | 1        | GND              | Ground      |
| 2          | 2        | V <sub>IN</sub>  | Power Input |
| 3          | 3        | V <sub>OUT</sub> | Output      |

HM6118HXX

| Pin Number |          | Pin Name         | Functions   |
|------------|----------|------------------|-------------|
| SOT223     | TO252-2L |                  |             |
| 1          | 1        | V <sub>OUT</sub> | Output      |
| 2          | 2        | GND              | Ground      |
| 3          | 3        | V <sub>IN</sub>  | Power Input |

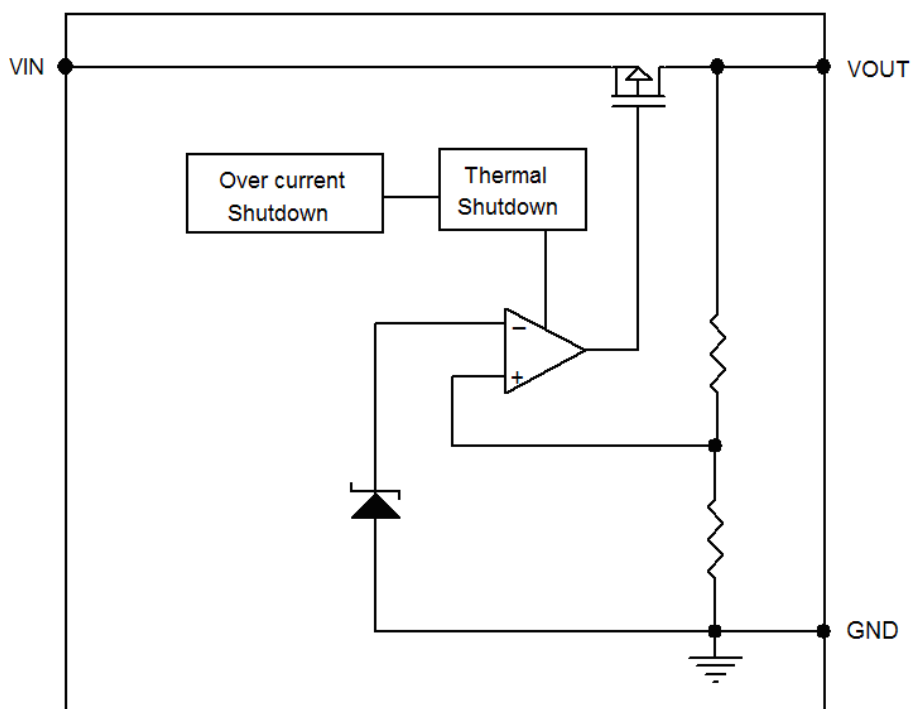
HM6118LXX

| Pin Number |          | Pin Name         | Functions   |
|------------|----------|------------------|-------------|
| SOT223     | TO252-2L |                  |             |
| 1          | 1        | V <sub>IN</sub>  | Power Input |
| 2          | 2        | GND              | Ground      |
| 3          | 3        | V <sub>OUT</sub> | Output      |

## Absolute Maximum Ratings

| Parameter                   | Symbol    | Ratings                        | Units       |    |
|-----------------------------|-----------|--------------------------------|-------------|----|
| Input Voltage               | $V_{IN}$  | 18                             | V           |    |
| Output Current              | $I_{OUT}$ | 1.1                            | A           |    |
| Output Voltage              | $V_{OUT}$ | $V_{SS}-0.3 \sim V_{IN} + 0.3$ | V           |    |
| Power Dissipation           | SOT223    | $P_D$                          | 750         | mW |
|                             | SOT89-3   |                                | 500         |    |
|                             | TO252-2L  |                                | 2000        |    |
|                             | SOT23-3   |                                | 300         |    |
| Operating Temperature Range | $T_{OPR}$ | $-40 \sim +125$                | $^{\circ}C$ |    |
| Storage Temperature Range   | $T_{STG}$ | $-40 \sim +150$                | $^{\circ}C$ |    |
| Lead Temperature            |           | $260^{\circ}C, 4sec$           |             |    |

## Block Diagram



## Electrical Characteristics

**HM6118A12/E12/H12/L12** (Packages:SOT223 , SOT89-3,TO252-2L)

( $V_{IN}=V_{OUT}+1.3V$ ,  $C_{IN}=C_L=10\mu F$ ,  $T_a=25^{\circ}C$ , unless otherwise noted)

| Parameter                   | Symbol                   | Conditions   | Min.   | Typ.                     | Max.   | Units       |
|-----------------------------|--------------------------|--|--------|--------------------------|--------|-------------|
| Output Voltage              | $V_{OUT(E)}$<br>(Note 2) | $I_{OUT}=10mA$ ,<br>$V_{IN}=V_{OUT}+1.3V$                | X 0.98 | $V_{OUT(T)}$<br>(Note 1) | X 1.02 | V           |
| Maximum Output Current      | $I_{OUTMAX}$             | $V_{IN}=V_{OUT}+1.3V$                                    |        | 800                      |        | mA          |
| Load Regulation             | $\Delta V_{OUT}$         | $V_{IN}=V_{OUT}+1.3V$ ,<br>$1mA \leq I_{OUT} \leq 800mA$ |        | 3                        |        | mV          |
| Dropout Voltage<br>(Note 3) | $V_{DIF1}$               | $I_{OUT}=100mA$  |        | 195                      |        | mV          |
|                             | $V_{DIF2}$               | $I_{OUT}=400mA$  |        | 665                      |        | mV          |
|                             | $V_{DIF3}$               | $I_{OUT}=800mA$  |        | 1250                     |        | mV          |
|                             | $V_{DIF4}$               | $I_{OUT}=1000mA$   |        | 1600                     |        | mV          |
| Quiescent Current           | $I_{SS}$                 | $V_{IN}=V_{OUT}+1.3V$                                    |        | 53                       |        | $\mu A$     |
| Line Regulation             | $\Delta V_{OUT}$         | $I_{OUT}=0mA$<br>$V_{OUT}+1.3V \leq V_{IN} \leq 18V$     |        | 2                        |        | mV          |
| Thermal Shutdown Protection | $T_{SD}$                 | $I_{OUT}=10mA$ ,<br>$V_{IN}=V_{OUT}+1.3V$                |        | 155                      |        | $^{\circ}C$ |
| Over Current Protection     | $I_{LIMIT}$              | $V_{IN}=3V$  |        | 1.1                      |        | A           |

**HM6118A18/E18/H18/L18** (Packages:SOT223 , SOT89-3,TO252-2L)

( $V_{IN}=V_{OUT}+1.2V$ ,  $C_{IN}=C_L=10\mu F$ ,  $T_a=25^{\circ}C$ , unless otherwise noted)

| Parameter                   | Symbol                   | Conditions   | Min.   | Typ.                     | Max.   | Units       |
|-----------------------------|--------------------------|--|--------|--------------------------|--------|-------------|
| Output Voltage              | $V_{OUT(E)}$<br>(Note 2) | $I_{OUT}=10mA$<br>$V_{IN}=V_{OUT}+1.2V$                  | X 0.98 | $V_{OUT(T)}$<br>(Note 1) | X 1.02 | V           |
| Maximum Output Current      | $I_{OUTMAX}$             | $V_{IN}=V_{OUT}+1.2V$                                    |        | 800                      |        | mA          |
| Load Regulation             | $\Delta V_{OUT}$         | $V_{IN}=V_{OUT}+1.2V$ ,<br>$1mA \leq I_{OUT} \leq 800mA$ |        | 5                        |        | mV          |
| Dropout Voltage<br>(Note 3) | $V_{DIF1}$               | $I_{OUT}=100mA$  |        | 115                      |        | mV          |
|                             | $V_{DIF2}$               | $I_{OUT}=400mA$  |        | 450                      |        | mV          |
|                             | $V_{DIF3}$               | $I_{OUT}=800mA$  |        | 940                      |        | mV          |
|                             | $V_{DIF4}$               | $I_{OUT}=1000mA$   |        | 1600                     |        | mV          |
| Quiescent Current           | $I_{SS}$                 | $V_{IN}=V_{OUT}+1.2V$                                    |        | 52                       |        | $\mu A$     |
| Line Regulation             | $\Delta V_{OUT}$         | $I_{OUT}=0mA$<br>$V_{OUT}+1.2V \leq V_{IN} \leq 18V$     |        | 2                        |        | mV          |
| Thermal Shutdown Protection | $T_{SD}$                 | $I_{OUT}=10mA$<br>$V_{IN}=V_{OUT}+1.2V$                  |        | 160                      |        | $^{\circ}C$ |

|                         |             |               |  |     |  |   |
|-------------------------|-------------|---------------|--|-----|--|---|
| Over Current Protection | $I_{limit}$ | $V_{IN}=3.5V$ |  | 1.1 |  | A |
|-------------------------|-------------|---------------|--|-----|--|---|

### HM6118A25/E25/H25/L25 (Packages:SOT223 , SOT89-3,TO252-2L)

( $V_{IN}=V_{OUT}+1.2V$ ,  $C_{IN}=C_L=10\mu F$ ,  $T_a=25^{\circ}C$ , unless otherwise noted)

| Parameter                   | Symbol                   | Conditions   | Min.   | Typ.                     | Max.   | Units       |
|-----------------------------|--------------------------|--|--------|--------------------------|--------|-------------|
| Output Voltage              | $V_{OUT(E)}$<br>(Note 2) | $I_{OUT}=10mA$ ,<br>$V_{IN}=V_{OUT}+1.2V$                | X 0.98 | $V_{OUT(T)}$<br>(Note 1) | X 1.02 | V           |
| Maximum Output Current      | $I_{OUTMAX}$             | $V_{IN}=V_{OUT}+1.2V$                                    |        | 800                      |        | mA          |
| Load Regulation             | $\Delta V_{OUT}$         | $V_{IN}=V_{OUT}+1.2V$ ,<br>$1mA \leq I_{OUT} \leq 800mA$ |        | 5                        |        | mV          |
| Dropout Voltage<br>(Note 3) | $V_{DIF1}$               | $I_{OUT}=100mA$  |        | 90                       |        | mV          |
|                             | $V_{DIF2}$               | $I_{OUT}=500mA$  |        | 450                      |        | mV          |
|                             | $V_{DIF3}$               | $I_{OUT}=800mA$  |        | 790                      |        | mV          |
|                             | $V_{DIF4}$               | $I_{OUT}=1000mA$   |        | 1300                     |        | mV          |
| Quiescent Current           | $I_{SS}$                 | $V_{IN}=V_{OUT}+1.2V$                                    |        | 53                       |        | $\mu A$     |
| Line Regulation             | $\Delta V_{OUT}$         | $I_{OUT}=0mA$<br>$V_{OUT}+1.2V \leq V_{IN} \leq 18V$     |        | 2                        |        | mV          |
| Thermal Shutdown Protection | $T_{sd}$                 | $I_{OUT}=10mA$ ,<br>$V_{IN}=V_{OUT}+1.2V$                |        | 160                      |        | $^{\circ}C$ |
| Over Current Protection     | $I_{limit}$              | $V_{IN}=4.0V$  |        | 1.1                      |        | A           |

### HM6118A33/E33/H33/L33 (Packages:SOT223 , SOT89-3,TO252-2L)

( $V_{IN}=V_{OUT}+1.2V$ ,  $C_{IN}=C_L=10\mu F$ ,  $T_a=25^{\circ}C$ , unless otherwise noted)

| Parameter                   | Symbol                   | Conditions   | Min.   | Typ.                     | Max.   | Units       |
|-----------------------------|--------------------------|--|--------|--------------------------|--------|-------------|
| Output Voltage              | $V_{OUT(E)}$<br>(Note 2) | $I_{OUT}=10mA$ ,<br>$V_{IN}=V_{OUT}+1.2V$                | X 0.98 | $V_{OUT(T)}$<br>(Note 1) | X 1.02 | V           |
| Maximum Output Current      | $I_{OUTMAX}$             | $V_{IN}=V_{OUT}+1.2V$                                    |        | 800                      |        | mA          |
| Load Regulation             | $\Delta V_{OUT}$         | $V_{IN}=V_{OUT}+1.2V$ ,<br>$1mA \leq I_{OUT} \leq 800mA$ |        | 7                        |        | mV          |
| Dropout Voltage<br>(Note 3) | $V_{DIF1}$               | $I_{OUT}=100mA$  |        | 80                       |        | mV          |
|                             | $V_{DIF2}$               | $I_{OUT}=500mA$  |        | 400                      |        | mV          |
|                             | $V_{DIF3}$               | $I_{OUT}=800mA$  |        | 680                      |        | mV          |
|                             | $V_{DIF4}$               | $I_{OUT}=1000mA$   |        | 1300                     |        | mV          |
| Quiescent Current           | $I_{SS}$                 | $V_{IN}=V_{OUT}+1.2V$                                    |        | 53                       |        | $\mu A$     |
| Line Regulation             | $\Delta V_{OUT}$         | $I_{OUT}=0mA$<br>$V_{OUT}+1.2V \leq V_{IN} \leq 18V$     |        | 2                        |        | mV          |
| Thermal Shutdown            | $T_{sd}$                 | $I_{OUT}=10mA$ ,   |        | 160                      |        | $^{\circ}C$ |

|                         |             |                           |  |     |  |   |
|-------------------------|-------------|---------------------------|--|-----|--|---|
| Protection              |             | $V_{IN} = V_{OUT} + 1.2V$ |  |     |  |   |
| Over Current Protection | $I_{limit}$ | $V_{IN} = 5.0V$           |  | 1.1 |  | A |

### HM6118A33 (Package: SOT23-3)

( $V_{IN} = V_{OUT} + 1.2V$ ,  $C_{IN} = C_L = 10\mu F$ ,  $T_a = 25^\circ C$ , unless otherwise noted)

| Parameter                   | Symbol                   | Conditions   | Min.   | Typ.                     | Max.   | Units      |
|-----------------------------|--------------------------|--|--------|--------------------------|--------|------------|
| Output Voltage              | $V_{OUT(E)}$<br>(Note 2) | $I_{OUT} = 10mA$ ,<br>$V_{IN} = V_{OUT} + 1.2V$              | X 0.98 | $V_{OUT(T)}$<br>(Note 1) | X 1.02 | V          |
| Maximum Output Current      | $I_{OUTMAX}$             | $V_{IN} = V_{OUT} + 1.2V$                                    |        | 500                      | 600    | mA         |
| Load Regulation             | $\Delta V_{OUT}$         | $V_{IN} = V_{OUT} + 1.2V$ ,<br>$1mA \leq I_{OUT} \leq 500mA$ |        | 10                       |        | mV         |
| Dropout Voltage<br>(Note 3) | $V_{DIF1}$               | $I_{OUT} = 100mA$  |        | 70                       |        | mV         |
|                             | $V_{DIF2}$               | $I_{OUT} = 300mA$  |        | 220                      |        | mV         |
|                             | $V_{DIF3}$               | $I_{OUT} = 500mA$  |        | 385                      |        | mV         |
| Quiescent Current           | $I_{SS}$                 | $V_{IN} = V_{OUT} + 1.2V$                                    |        | 53                       |        | $\mu A$    |
| Line Regulation             | $\Delta V_{OUT}$         | $I_{OUT} = 0mA$<br>$V_{OUT} + 1.2V \leq V_{IN} \leq 18V$     |        | 2                        |        | mV         |
| Thermal Shutdown Protection | $T_{sd}$                 | $I_{OUT} = 10mA$ ,<br>$V_{IN} = V_{OUT} + 1.2V$              |        | 160                      |        | $^\circ C$ |
| Over Current Protection     | $I_{limit}$              | $V_{IN} = 5.0V$  |        | 1.1                      |        | A          |

### HM6118A50/E50/H50/L50 (Packages: SOT223, SOT89-3, TO252-2L)

( $V_{IN} = V_{OUT} + 1.2V$ ,  $C_{IN} = C_L = 10\mu F$ ,  $T_a = 25^\circ C$ , unless otherwise noted)

| Parameter                   | Symbol                   | Conditions   | Min.   | Typ.                     | Max.   | Units      |
|-----------------------------|--------------------------|--|--------|--------------------------|--------|------------|
| Output Voltage              | $V_{OUT(E)}$<br>(Note 2) | $I_{OUT} = 10mA$ ,<br>$V_{IN} = V_{OUT} + 1.2V$              | X 0.98 | $V_{OUT(T)}$<br>(Note 1) | X 1.02 | V          |
| Maximum Output Current      | $I_{OUTMAX}$             | $V_{IN} = V_{OUT} + 1.2V$                                    |        | 800                      |        | mA         |
| Load Regulation             | $\Delta V_{OUT}$         | $V_{IN} = V_{OUT} + 1.2V$ ,<br>$1mA \leq I_{OUT} \leq 800mA$ |        | 8                        |        | mV         |
| Dropout Voltage<br>(Note 3) | $V_{DIF1}$               | $I_{OUT} = 100mA$  |        | 60                       |        | mV         |
|                             | $V_{DIF2}$               | $I_{OUT} = 500mA$  |        | 300                      |        | mV         |
|                             | $V_{DIF3}$               | $I_{OUT} = 800mA$  |        | 500                      |        | mV         |
|                             | $V_{DIF4}$               | $I_{OUT} = 1000mA$   |        | 900                      |        | mV         |
| Quiescent Current           | $I_{SS}$                 | $V_{IN} = V_{OUT} + 1.2V$                                    |        | 53                       |        | $\mu A$    |
| Line Regulation             | $\Delta V_{OUT}$         | $I_{OUT} = 0mA$<br>$V_{OUT} + 1.2V \leq V_{IN} \leq 18V$     |        | 2                        |        | mV         |
| Thermal Shutdown            | $T_{sd}$                 | $I_{OUT} = 10mA$ ,   |        | 160                      |        | $^\circ C$ |

|                         |             |                           |  |     |  |   |
|-------------------------|-------------|---------------------------|--|-----|--|---|
| Protection              |             | $V_{IN} = V_{OUT} + 1.2V$ |  |     |  |   |
| Over Current Protection | $I_{limit}$ | $V_{IN} = 6.5V$           |  | 1.1 |  | A |

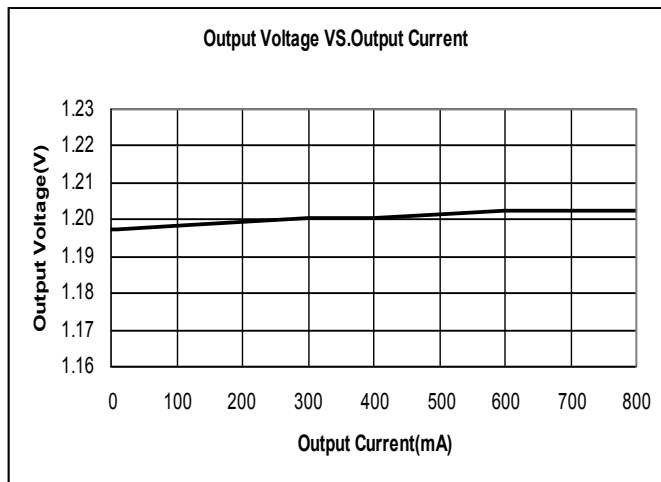
Note :

1.  $V_{OUT}(T)$  : Specified Output Voltage
2.  $V_{OUT}(E)$  : Effective Output Voltage ( ie. The output voltage when " $V_{OUT}(T) + 1.2V$ " is provided at the Vin pin while maintaining a certain lout value.)
3.  $V_{DIF} = V_{IN1} - V_{OUT}(E)'$   
 $V_{IN1}$  : The input voltage when  $V_{OUT}(E)'$  appears as input voltage is gradually decreased.  
 $V_{OUT}(E)'$  = A voltage equal to 98% of the output voltage whenever an amply stabilized lout and  $\{V_{OUT}(T) + 1.2V\}$  is input.

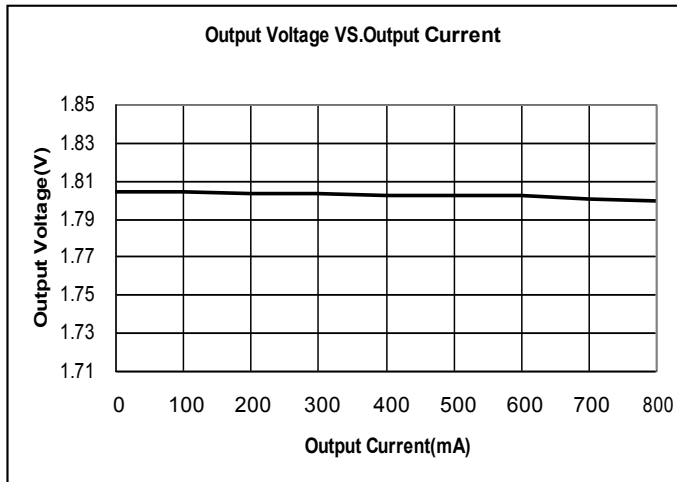
## Type Characteristics

### (1) Output Voltage VS. Output Current

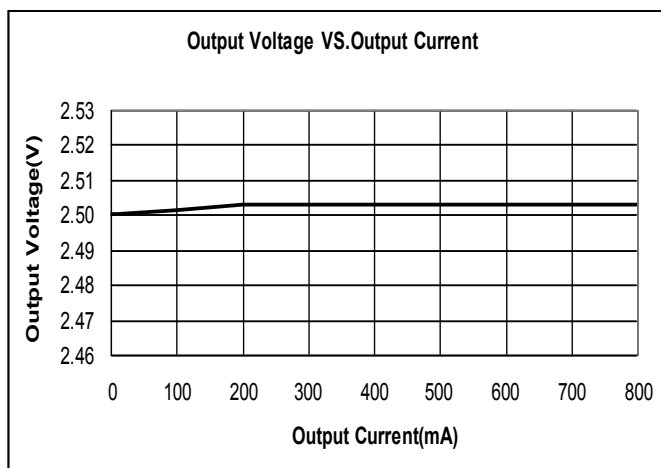
**HM6118A12B3G** ( $V_{IN}=V_{OUT}+1.3V$ )



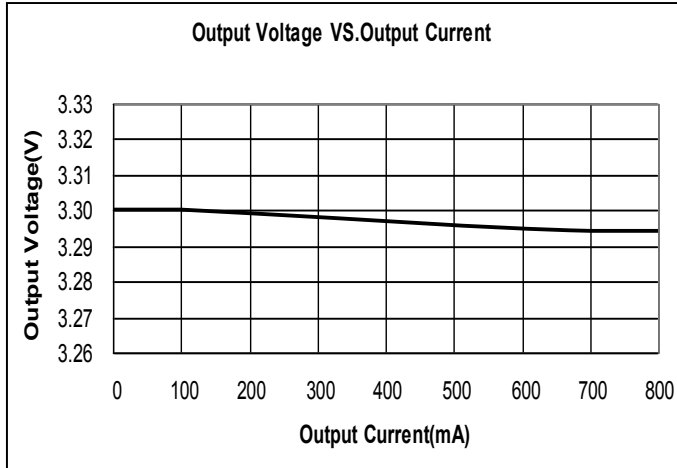
**HM6118A18B3G** ( $V_{IN}=V_{OUT}+1.2V$ )



**HM6118A25B3G** ( $V_{IN}=V_{OUT}+1.2V$ )

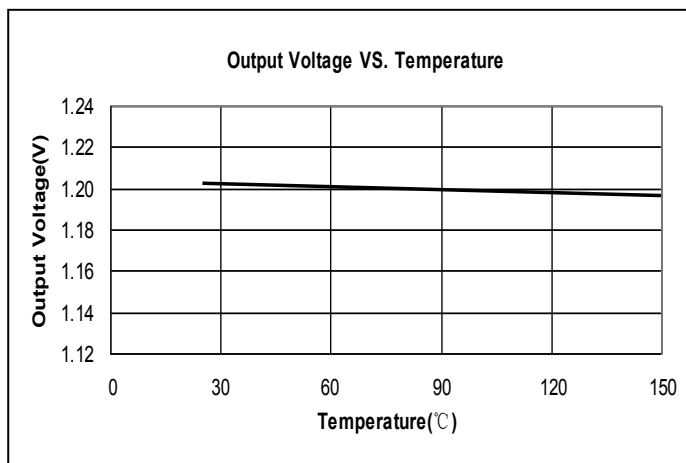


**HM6118A33B3G** ( $V_{IN}=V_{OUT}+1.2V$ )

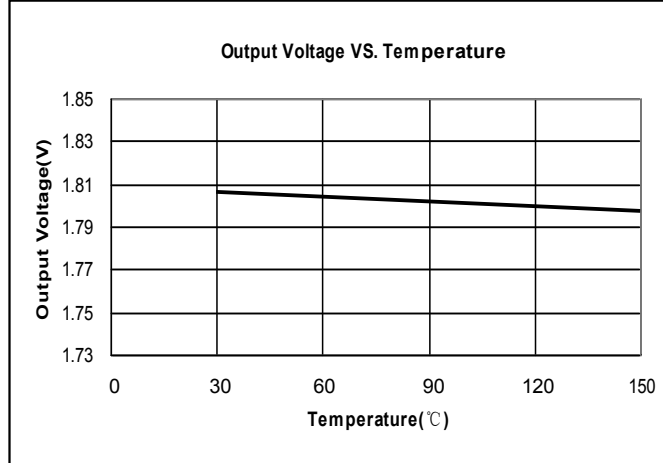


### (2) Output Voltage VS. Temperature

**HM6118A12B3G** ( $V_{IN}=V_{OUT}+1.3V$ ,  $I_{OUT}=10mA$ )

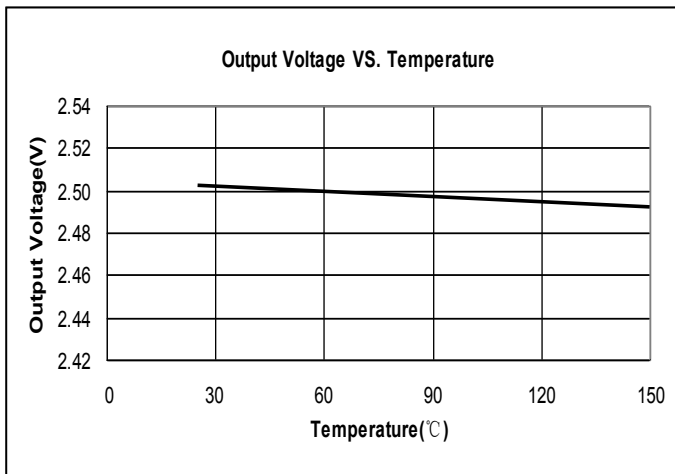


**HM6118A18B3G** ( $V_{IN}=V_{OUT}+1.2V$ ,  $I_{OUT}=10mA$ )

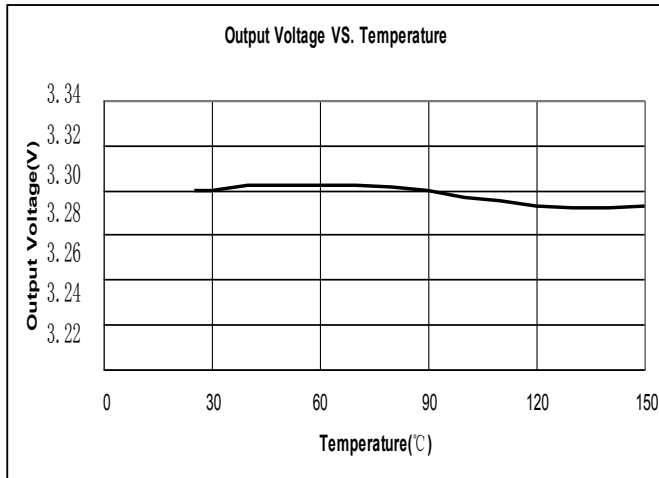




**HM6118A25B3G** ( $V_{IN}=V_{OUT}+1.2V$ ,  $I_{OUT}=10mA$ )

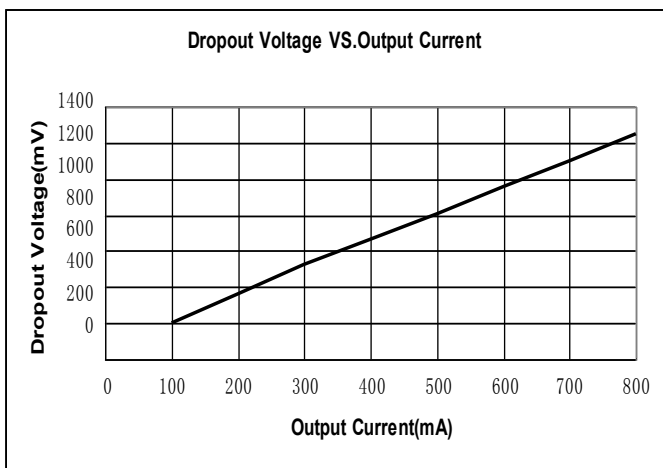


**HM6118A33B3G** ( $V_{IN}=V_{OUT}+1.2V$ ,  $I_{OUT}=10mA$ )

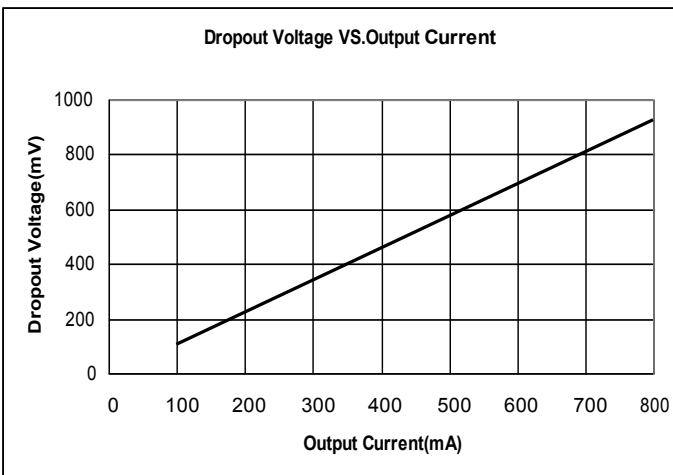


(3) Dropout Voltage VS. Output Current ( $T_a = 25\text{ }^\circ\text{C}$ )

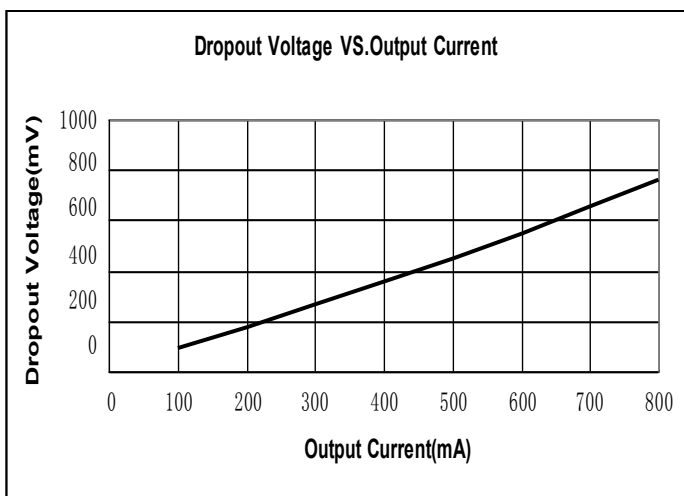
**HM6118A12B3G**



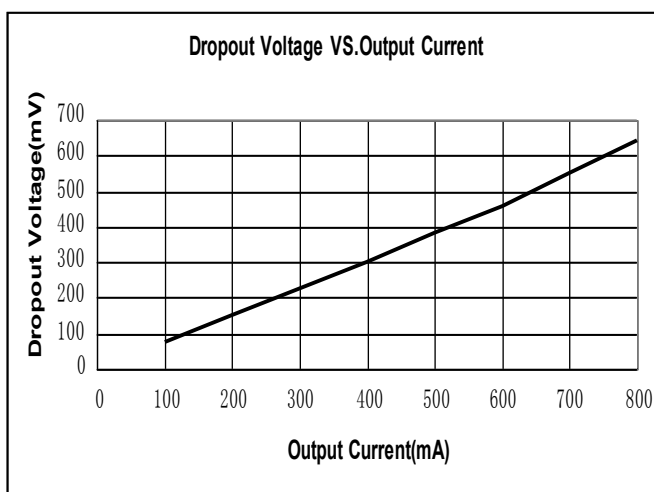
**HM6118A18B3G**



**HM6118A25B3G**

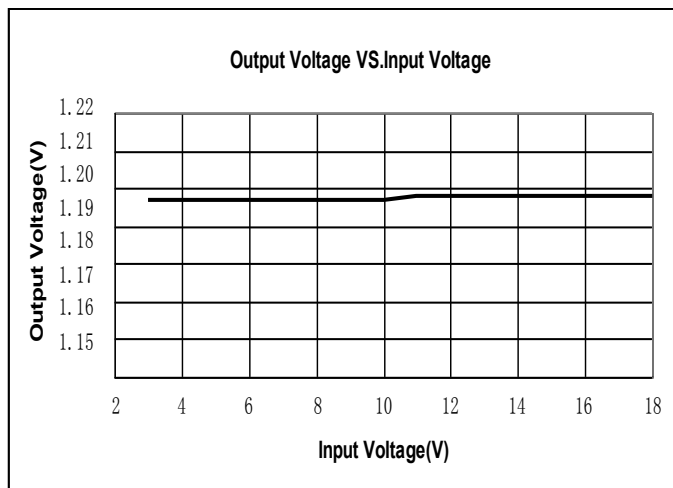


**HM6118A33B3G**

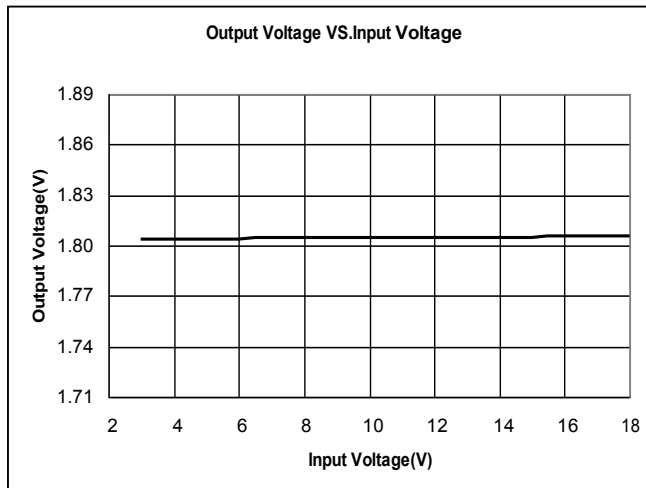


(4) Output Voltage VS. Input Voltage (Ta = 25 °C)

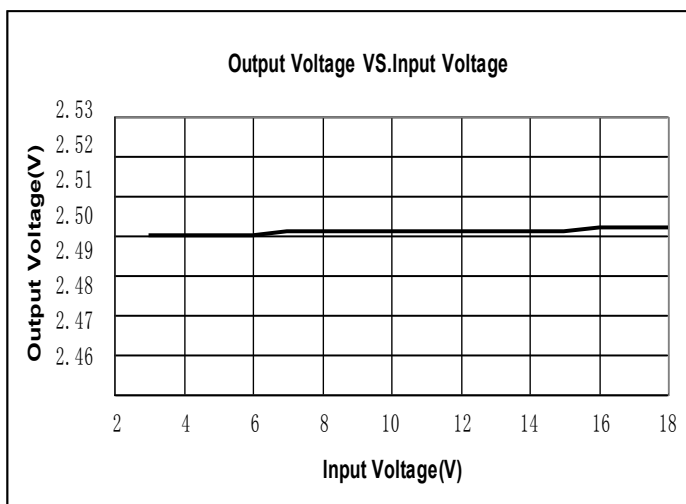
**HM6118A12B3G**



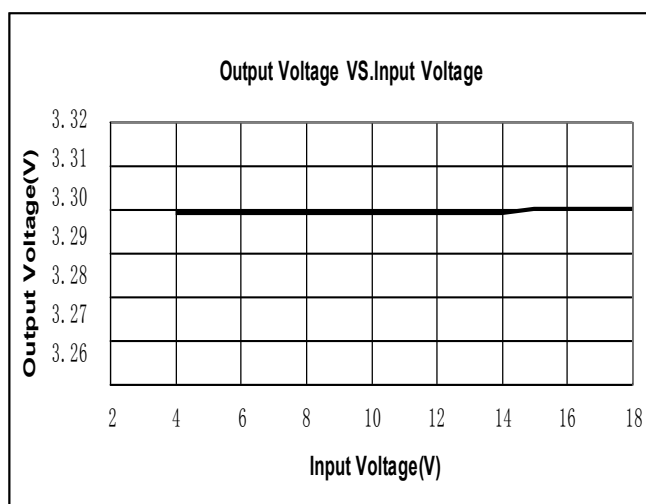
**HM6118A18B3G**



**HM6118A25B3G**

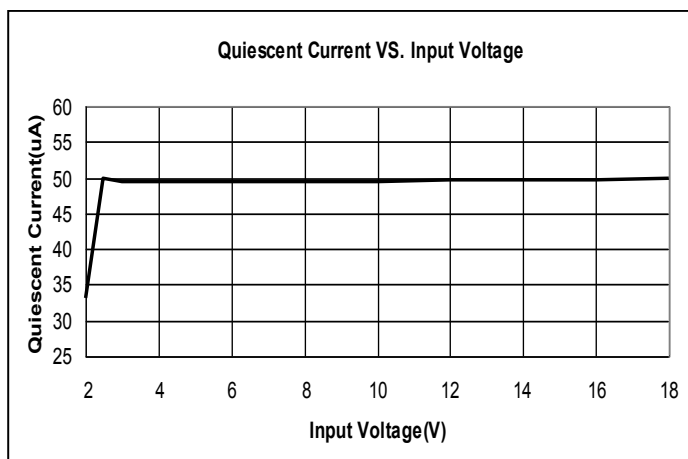


**HM6118A33B3G**

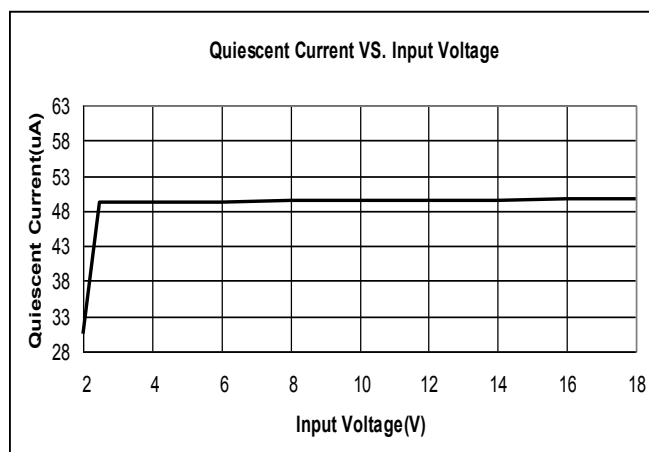


(5) Quiescent Current VS. Input Voltage

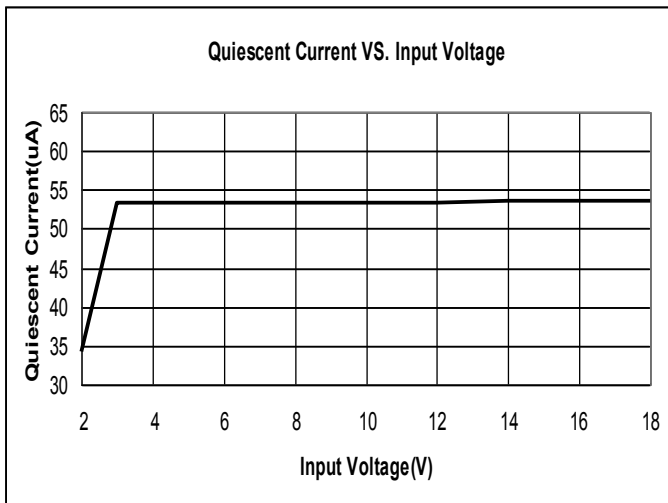
**HM6118A12B3G**



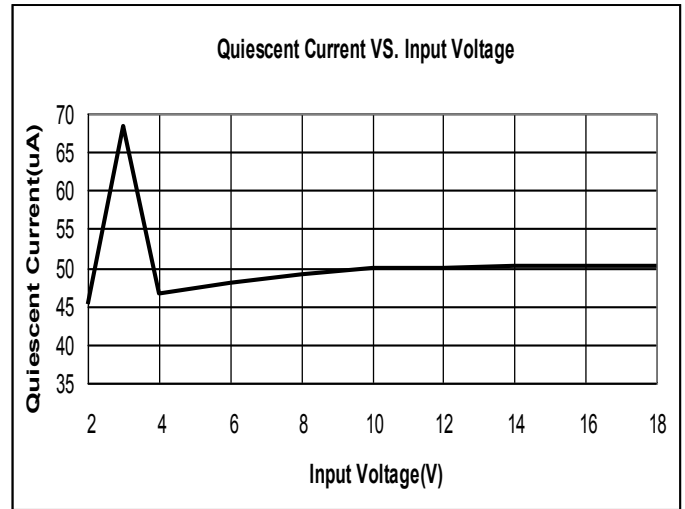
**HM6118A18B3G**



HM6118A25B3G



HM6118A33B3G



## Applications Information

### 1. Input Bypass Capacitor

An input capacitor is recommended. A 10uF tantalum on the input is a suitable input bypassing for almost all applications.

### 2. Output Capacitor

The output capacitor is critical in maintaining regulator stability, and must meet the required conditions for both minimum amount of capacitance and ESR (Equivalent Series Resistance). The minimum output capacitance required by the HM6118 is 10μF, if a tantalum capacitor is used. Any increase of the output capacitance will merely improve the loop stability and transient response. The ESR of the output capacitor should be less than 0.5Ω.

### 3. Load Regulation

The HM6118 regulates the voltage that appears between its output and ground pins, or between its output and adjust pins. In some cases, line resistances can introduce errors to the voltage across the load. To obtain the best load regulation, a few precautions are needed. Figure1, shows a typical application using a fixed output regulator. The Rt1 and Rt2 are the line resistances. It is obvious that the  $V_{LOAD}$  is less than the  $V_{OUT}$  by the sum of the voltage drops along the line resistances. In this case, the load regulation seen at the  $R_{LOAD}$  would be degraded from the datasheet specification. To improve this, the load should be tied directly to the output terminal on the positive side and directly tied to the ground terminal on the negative side.

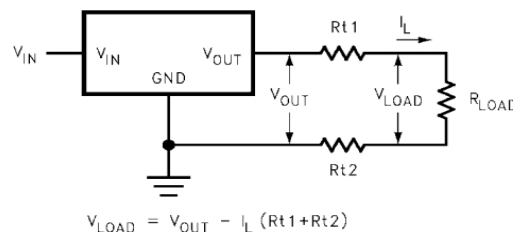
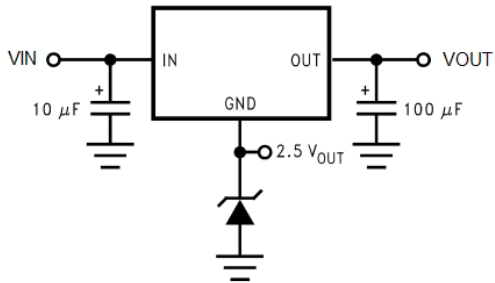


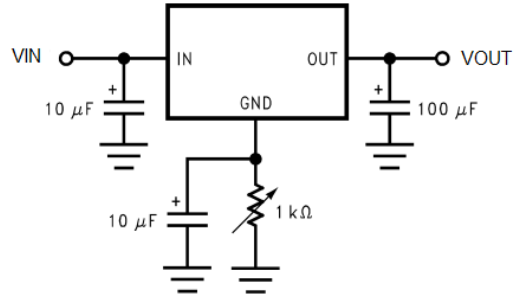
FIGURE 1. Typical Application using Fixed Output Regulator

## Application Circuit

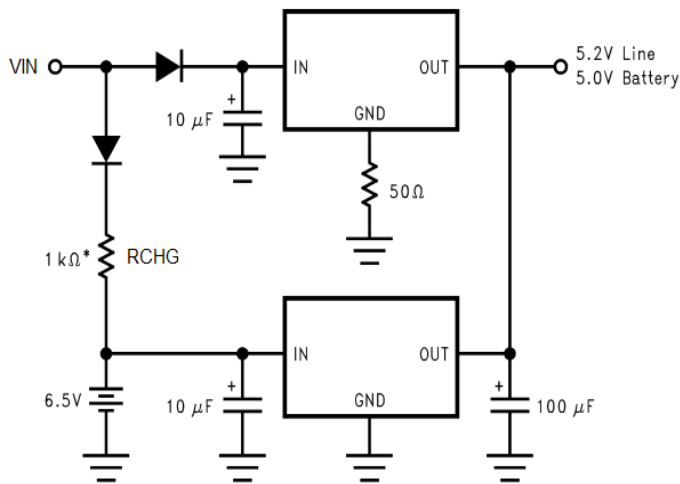
(1) Regulator with Reference



(2) Adjusting Output of Fixed Voltage Regulators

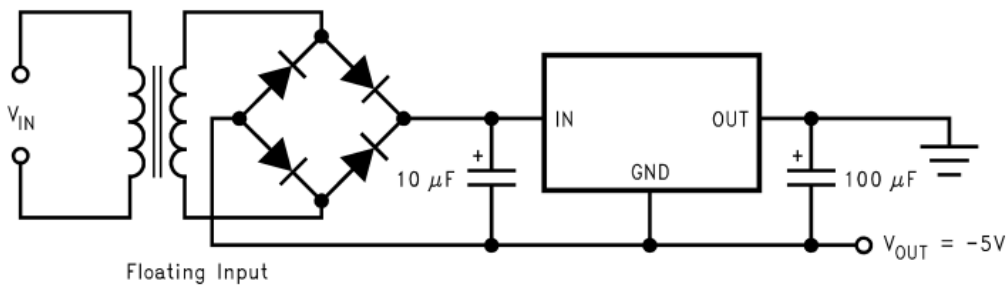


(3) Battery Backed-Up Power Supply



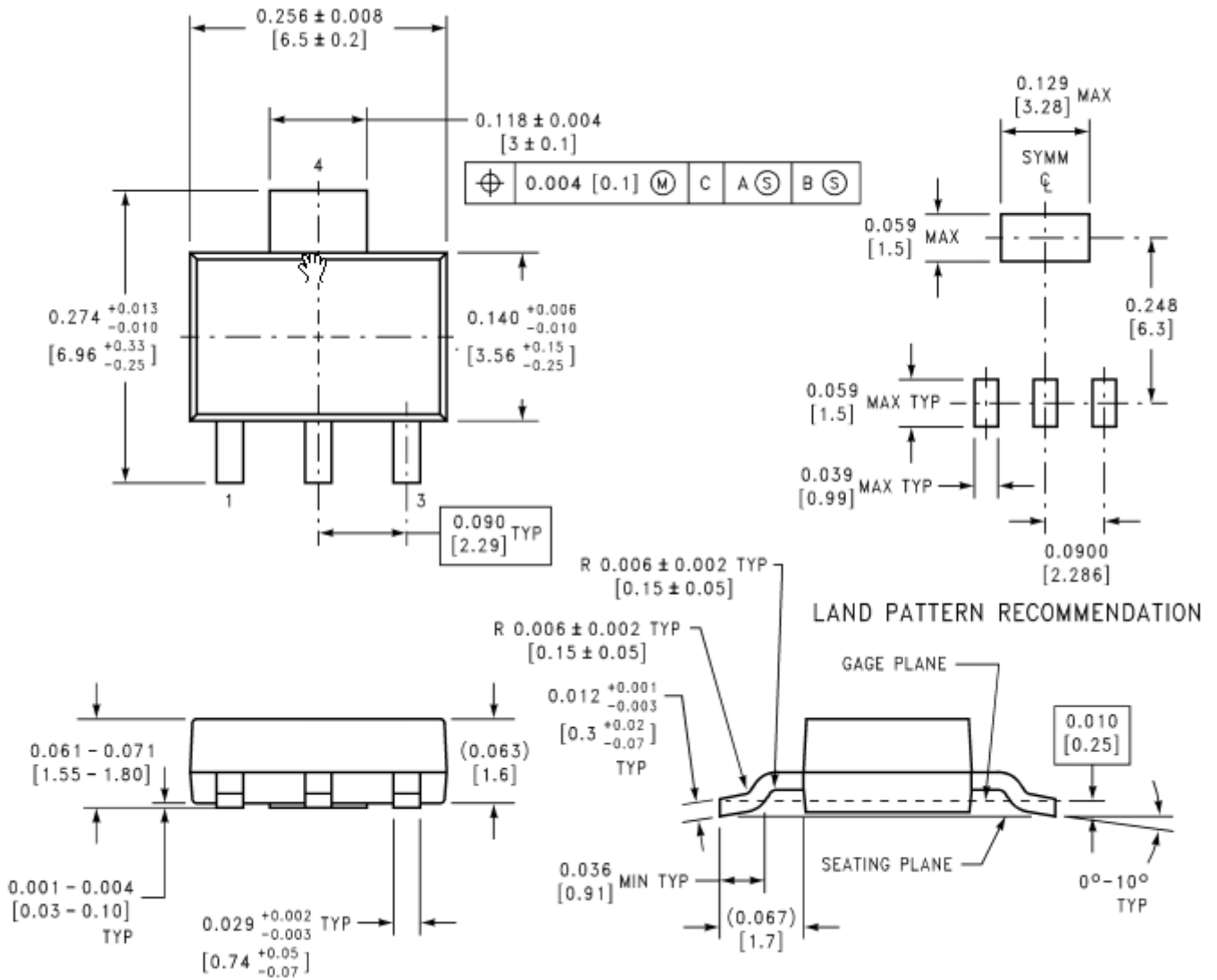
\* Select for charge rate.

(4) Low Dropout Negative Supply

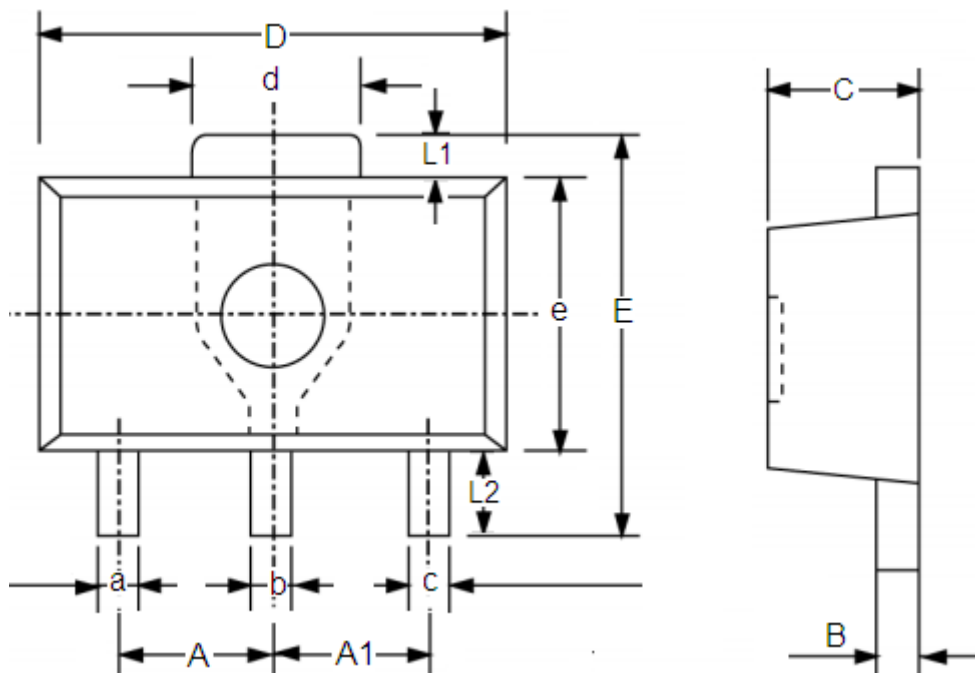


Packaging Information

● SOT223

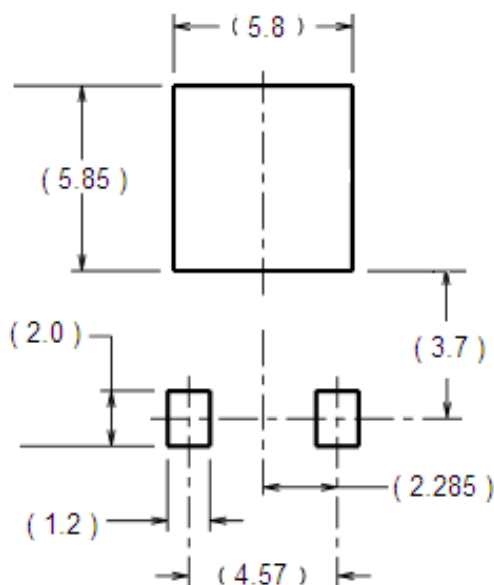
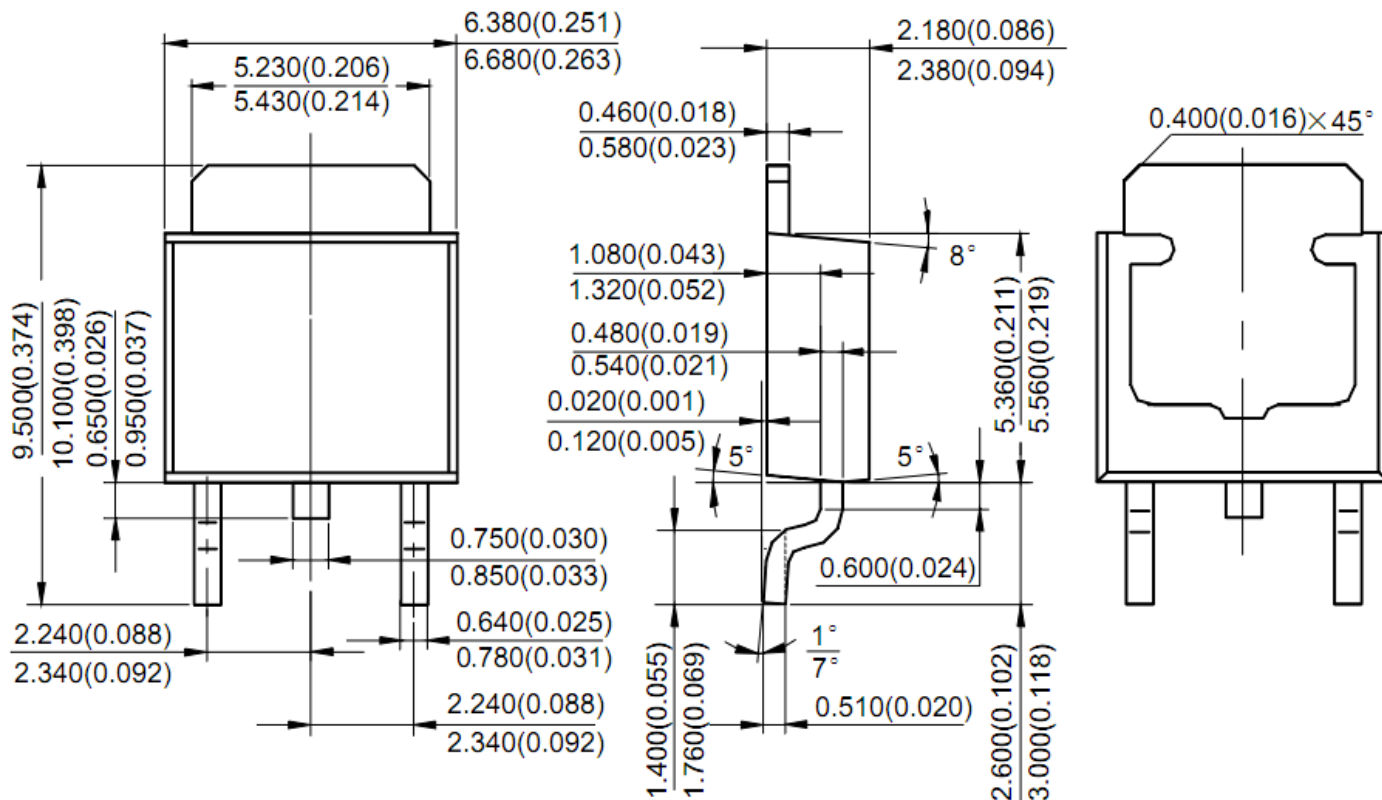


● SOT89-3



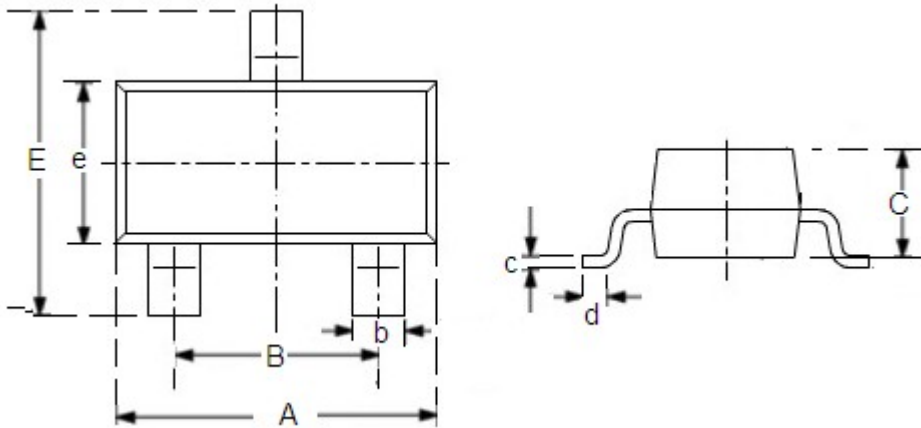
| DIM | Millimeters |      | Inches |        |
|-----|-------------|------|--------|--------|
|     | Min         | Max  | Min    | Max    |
| A   | 1.4         | 1.6  | 0.0551 | 0.0630 |
| A1  | 1.4         | 1.6  | 0.0551 | 0.0630 |
| a   | 0.36        | 0.48 | 0.0142 | 0.0189 |
| b   | 0.41        | 0.53 | 0.0161 | 0.0209 |
| c   | 0.36        | 0.48 | 0.0142 | 0.0189 |
| d   | 1.4         | 1.75 | 0.0551 | 0.0689 |
| B   | 0.38        | 0.43 | 0.015  | 0.0169 |
| C   | 1.4         | 1.6  | 0.0551 | 0.0630 |
| D   | 4.4         | 4.6  | 0.1732 | 0.181  |
| E   | -           | 4.25 | -      | 0.1673 |
| e   | 2.4         | 2.6  | 0.0945 | 0.1023 |
| L1  | 0.4         | -    | 0.0157 | -      |
| L2  | 0.8         | -    | 0.0315 | -      |

● TO252-2L



LAND PATTERN RECOMMENDATION

● SOT23-3



| DIM | Millimeters |      | Inches |        |
|-----|-------------|------|--------|--------|
|     | Min         | Max  | Min    | Max    |
| A   | 2.7         | 3.1  | 0.1063 | 0.122  |
| B   | 1.7         | 2.1  | 0.0669 | 0.0827 |
| b   | 0.35        | 0.5  | 0.0138 | 0.0197 |
| C   | 1.0         | 1.2  | 0.0394 | 0.0472 |
| c   | 0.1         | 0.25 | 0.0039 | 0.0098 |
| d   | 0.2         | -    | 0.0079 | -      |
| E   | 2.6         | 3.0  | 0.1023 | 0.1181 |
| e   | 1.5         | 1.8  | 0.059  | 0.0708 |