


**SOT-223**

**TO-252-3L**

**TO-220F-3L**

## ORDERING INFORMATION

| Product   | Marking   | Package    |
|-----------|-----------|------------|
| S78DMxxQ  | S78DMxxQ  | SOT-223    |
| S78DMxxD  | S78DMxxD  | TO-252-3L  |
| S78DMxxPI | S78DMxxPI | TO-220F-3L |

### ▲ Marking Detail Information

[ SOT-223 PKG Marking ]

S78DMxxx ①  
GYWW②

① Device Code

② Grade & Year & Week Code

[ TO-220F-3L & TO-253-3L PKG Marking ]

AUK①  
G△YWW ②  
S78DMxxx ③

① AUK Logo

② Grade & M Code & Year & Week Code

③ Device Code

# S78DMxxx

## Low Dropout Voltage Regulator (0.5A Series)

### Description

The S78DMxxx is an efficient linear low dropout voltage regulator for various electronic equipment. It is designed to provide very low dropout voltage, and better than 2.4% output voltage accuracy.

And the S78DMxxx has various key features such as current limiting, over temperature shut-down, over voltage protection, and low noise performance with an low noise option.

Furthermore, it is available in adjustable or fixed output voltages in SOT-223, TO-252-3L and TO-220F-3L packages.

### Application

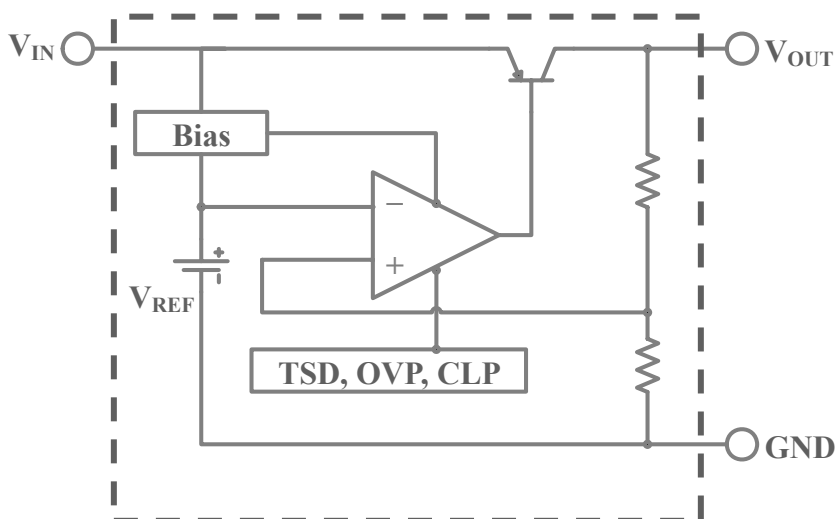
- ◆ Consumer and personal electronics
- ◆ SMPS post-regulator / dc-to-dc modules
- ◆ High-efficiency linear power supplies

### Features and Benefits

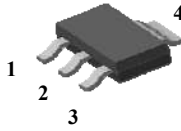
- ◆ Low Dropout Voltage for 0.5A Output : [ Max. 500mV].
- ◆ Built in Thermal shut down circuit.
- ◆ Built in OVP, CLP circuit.
- ◆ Low Quiescent Current : [Typ. 2.0mA]
- ◆ Ultra High level of ESD [ Built in ESD Protection Cell ]

MM : 400V ↑ / HBM 3KV ↑

### Equivalent Circuit

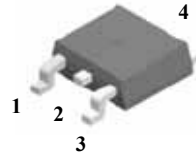


## ◆ Pin Configuration



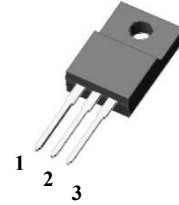
**SOT-223**

- 1:  $V_{IN}$
- 2: GND
- 3:  $V_{OUT}$
- 4: GND



**TO-252-3L**

- 1:  $V_{IN}$
- 2: GND
- 3:  $V_{OUT}$
- 4: GND



**TO-220F-3L**

- 1:  $V_{IN}$
- 2: GND
- 3:  $V_{OUT}$

## ◆ Product Line-up

| Product Name | $V_{OUT}$ | Operating Temperature | Package    |
|--------------|-----------|-----------------------|------------|
| S78DM18Q     | 1.8V      | -30~125°C             | SOT-223    |
| S78DM25Q     | 2.5V      | -30~125°C             | SOT-223    |
| S78DM33Q     | 3.3V      | -30~125°C             | SOT-223    |
| S78DM50Q     | 5.0V      | -30~125°C             | SOT-223    |
| S78DM18D     | 1.8V      | -30~125°C             | TO-252-3L  |
| S78DM25D     | 2.5V      | -30~125°C             | TO-252-3L  |
| S78DM33D     | 3.3V      | -30~125°C             | TO-252-3L  |
| S78DM50D     | 5.0V      | -30~125°C             | TO-252-3L  |
| S78DM18PI    | 1.8V      | -30~125°C             | TO-220F-3L |
| S78DM25PI    | 2.5V      | -30~125°C             | TO-220F-3L |
| S78DM33PI    | 3.3V      | -30~125°C             | TO-220F-3L |
| S78DM50PI    | 5.0V      | -30~125°C             | TO-220F-3L |

◆ **Absolute Maximum Ratings ( Ta = 25°C )**

| Parameter                 |            | Symbol           | Limits     | Unit |
|---------------------------|------------|------------------|------------|------|
| Input Voltage             |            | V <sub>IN</sub>  | 23.0       | V    |
| Power Dissipation         | SOT-223    | P <sub>d</sub>   | 1.0(Note1) | W    |
|                           | TO-252-3L  |                  | 1.3(Note2) |      |
|                           | TO-220F-3L |                  | 2.0(Note2) |      |
| Junction Temperature      |            | T <sub>J</sub>   | 150        | °C   |
| Operate Temperature Range |            | T <sub>opr</sub> | -30 ~ +125 | °C   |
| Storage Temperature Range |            | T <sub>stg</sub> | -55 ~ +150 | °C   |

Note 1 : Mount on a glass epoxy circuit board of 36x18mm pad dimension of 50mm<sup>2</sup>

Note 2 : No Heat-Sink

Absolute maximum ratings indicate limits beyond which damage to the component may occur. Electrical specifications do not apply when operating the device outside of its operating ratings. The maximum allowable power dissipation is a function of the maximum junction temperature, T<sub>J(max)</sub>, the junction-to-ambient thermal resistance, θ<sub>JA</sub>, and the ambient temperature, T<sub>A</sub>.

The maximum allowable power dissipation at any ambient temperature is calculated using:

PD(max) = (T<sub>J(max)</sub> – T<sub>A</sub>) ÷ θ<sub>JA</sub>. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown.

◆ **Guaranteed Operating Conditions ( Ta = 25°C )**

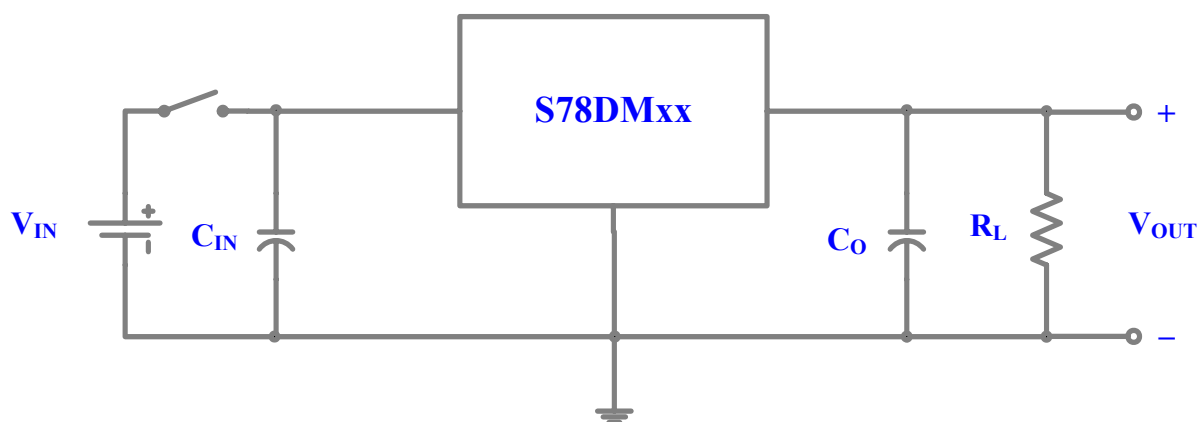
| Parameter            | Symbol           | Limits                 | Unit |
|----------------------|------------------|------------------------|------|
| Supply Input Voltage | V <sub>IN</sub>  | V <sub>O</sub> +0.5~20 | V    |
| Output Current       | I <sub>OUT</sub> | 0.5                    | A    |

### ◆ Electrical characteristics

(  $V_{IN}=V_{OUT}+1.0V$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=47\mu F$ ,  $I_{OUT}=5mA$ ,  $T_J=25^{\circ}C$  ; unless noted )

| NO | Characteristics      |          | Symbol      | Condition                                                           | Specification |       |       | Unit          |
|----|----------------------|----------|-------------|---------------------------------------------------------------------|---------------|-------|-------|---------------|
|    |                      |          |             |                                                                     | MIN.          | TYP.  | MAX.  |               |
| 1  | Output Voltage       | S78DM18x | $V_{OUT}$   | Variation from nominal $V_{OUT}$                                    | 1.764         | 1.800 | 1.836 | V             |
|    |                      | S78DM25x |             |                                                                     | 2.450         | 2.500 | 2.550 | V             |
|    |                      | S78DM33x |             |                                                                     | 3.234         | 3.300 | 3.366 | V             |
|    |                      | S78DM50x |             |                                                                     | 4.900         | 5.000 | 5.100 | V             |
| 2  | Line Regulation      |          | $V_{LINE}$  | $V_{IN}=V_{OUT}+1V$ to 12V,<br>$I_{OUT}=5mA$                        | -             | 0.05  | 0.5   | %             |
| 3  | Load Regulation      |          | $V_{LOAD}$  | $V_{IN}=V_{OUT}+1V$ ,<br>$I_{OUT}=5mA$ to 0.5A                      | -             | 0.1   | 1.0   | %             |
| 4  | Quiescent Current    |          | $I_{QC}$    | $V_{IN}=V_{OUT}+1V$ to 20V,<br>$I_{OUT}=0mA$                        | -             | 2.0   | 5.0   | mA            |
| 5  | Ripple Rejection     |          | $R \cdot R$ | $I_{OUT}=50mA$ , $f=120Hz$                                          | 55.0          | 65.0  | -     | dB            |
| 6  | Output Noise Voltage |          | $V_{NO}$    | $V_{IN}=V_{OUT}+1V$ , $I_{OUT}=50mA$ ,<br>$10Hz \leq f \leq 100kHz$ | -             | 100   | -     | $\mu V_{rms}$ |
| 7  | Dropout Voltage      |          | $V_{DROP}$  | $I_{OUT}=0.5A$                                                      | -             | -     | 0.5   | V             |
| 8  | Current Limit        |          | $I_{LIMIT}$ | $V_{IN}=V_{OUT}+1V$                                                 | 1100          | 1300  | -     | mA            |

### Typical Application



- 1)  $C_{IN}$  should be required if regulators are located far from power supply filter
- 2)  $C_O$  improves output stability and transient response (  $C_O \geq 47\mu F$  )

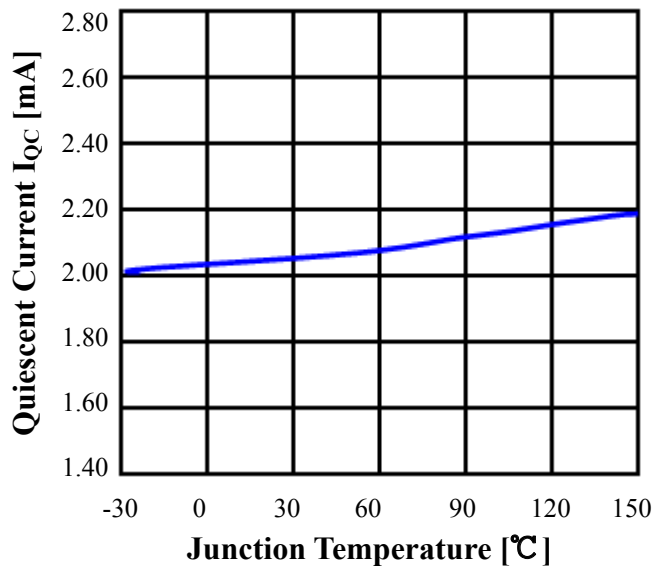
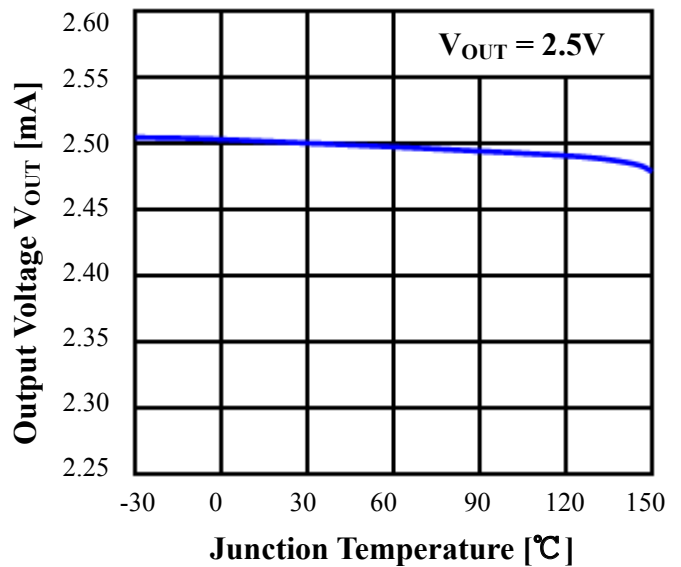
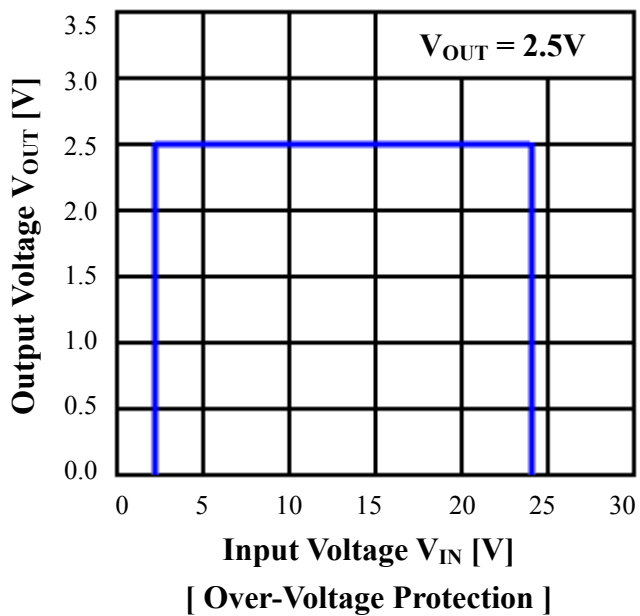
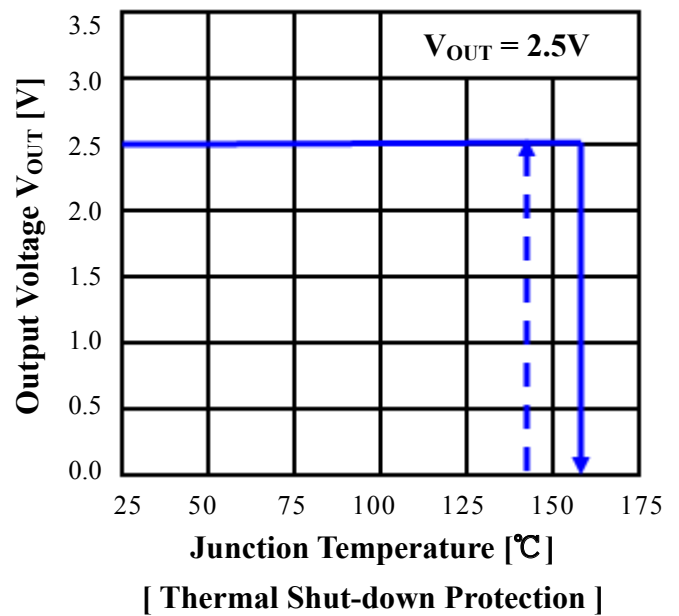
Fig1.  $I_{QC} - T_J$ Fig2.  $V_{OUT} - T_J$ Fig3.  $V_{OUT} - V_{IN}$ Fig4.  $V_{OUT} - T_J$ 

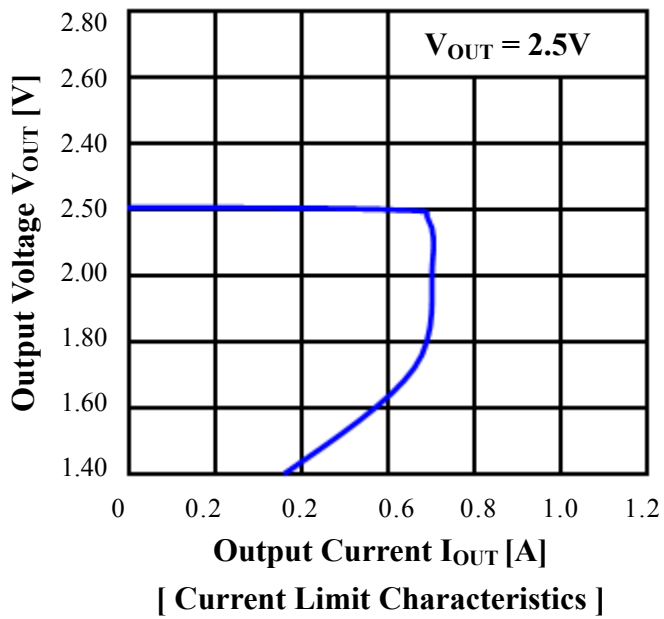
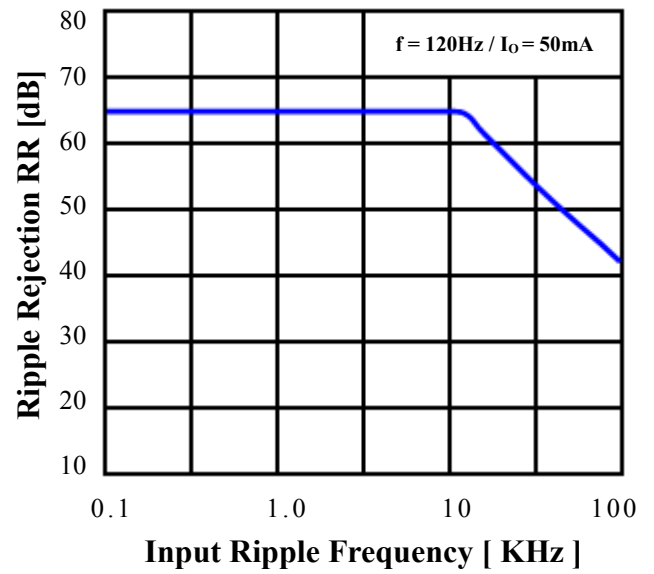
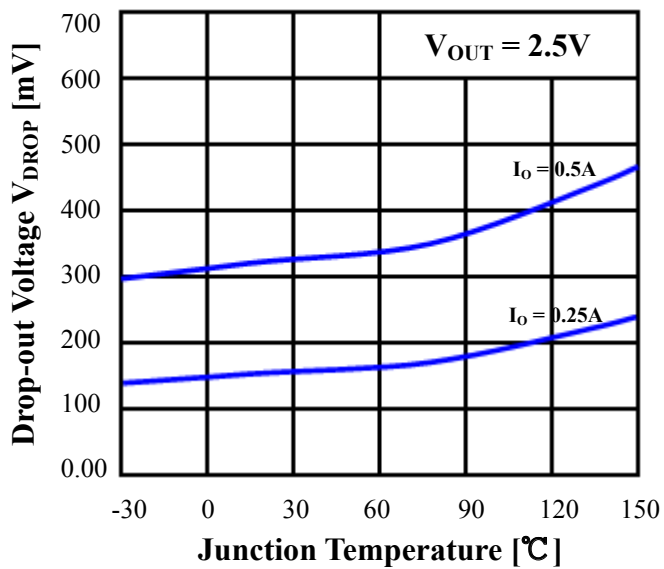
Fig5.  $V_{OUT} - I_{OUT}$ Fig6.  $V_{OUT} - T_J$ Fig7.  $V_{DROP} - T_J$ 

Fig.8 Line Transient Response

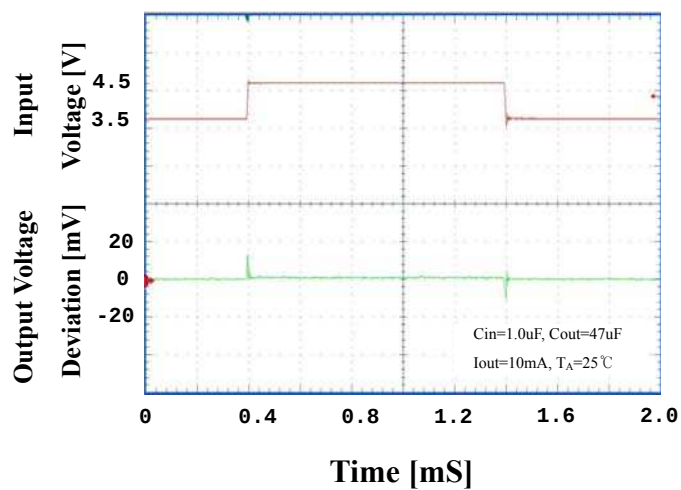


Fig.9 Line Transient Response

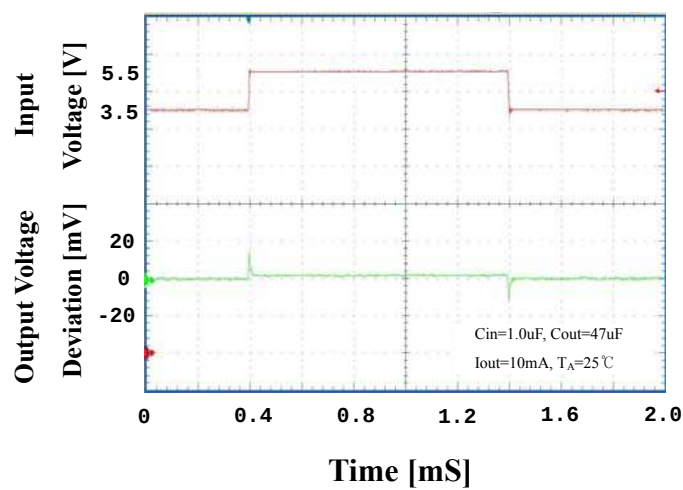


Fig.10 Load Transient Response

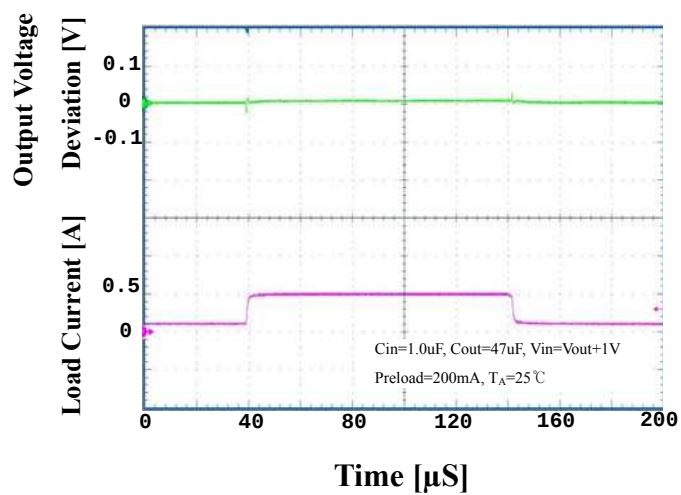
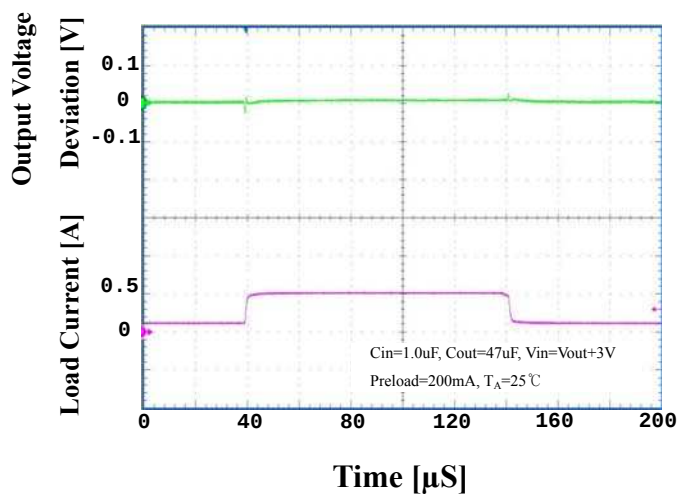
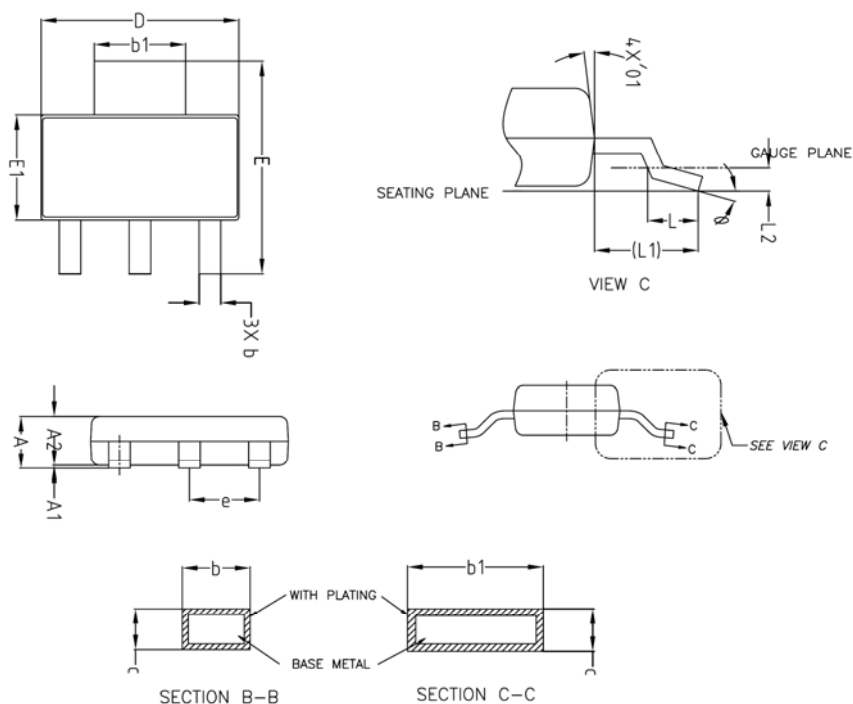


Fig.11 Load Transient Response

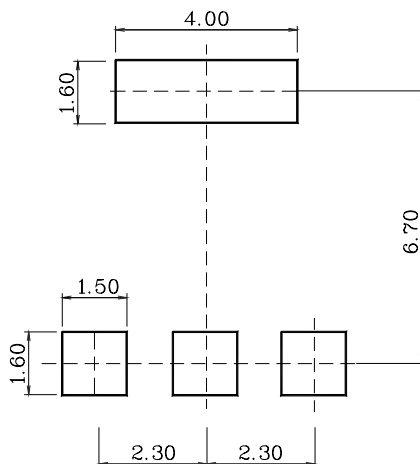


◆ SOT-223 Outline Dimension (Unit : mm)

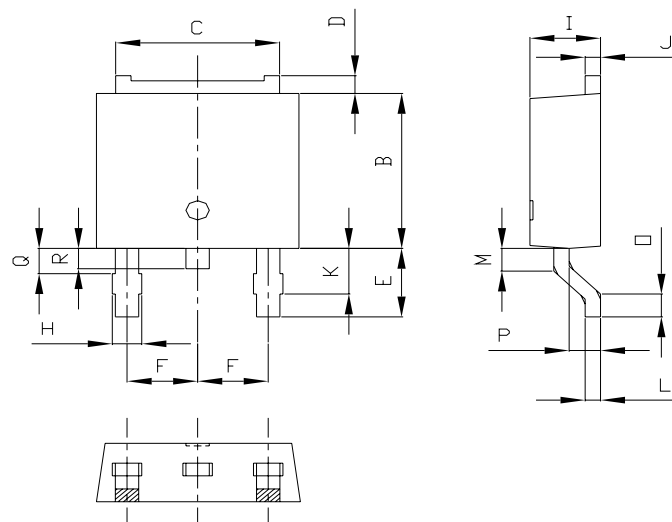


| SYMBOL | MILLIMETERS |         |         | NOTE |
|--------|-------------|---------|---------|------|
|        | MINIMUM     | NOMINAL | MAXIMUM |      |
| A      | —           | —       | 1.80    |      |
| A1     | 0.00        | —       | 0.10    |      |
| A2     | 1.60        | 1.65    | 1.70    |      |
| b      | 0.68        | —       | 0.76    |      |
| b1     | 2.95        | —       | 3.07    |      |
| c      | 0.23        | —       | 0.28    |      |
| D      | 6.40        | 6.50    | 6.60    |      |
| E      | 6.80        | 7.00    | 7.20    |      |
| E1     | 3.40        | 3.50    | 3.60    |      |
| e      | 2.30 BSC    |         |         |      |
| L      | 0.45        | —       | 0.65    |      |
| L1     | 1.75 REF    |         |         |      |
| L2     | 0.10 BSC    |         |         |      |
| θ      | 0°          | —       | 10°     |      |
| θ1     | 5°          | —       | 10°     |      |

※ Recommend PCB solder land [Unit: mm]

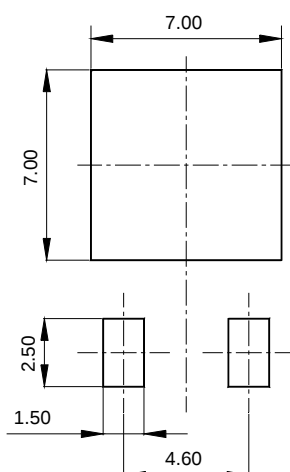


◆ TO-252-3L Outline Dimension (Unit : mm)

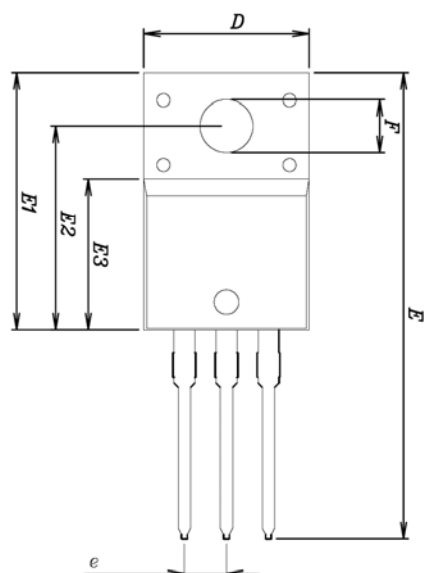


| SYMBOL | MILLIMETERS |         |         | NOTE |
|--------|-------------|---------|---------|------|
|        | MINIMUM     | NOMINAL | MAXIMUM |      |
| A      | 6.40        | 6.60    | 6.80    |      |
| B      | 5.90        | 6.10    | 6.30    |      |
| C      | 5.04        | 5.34    | 5.64    |      |
| D      | 0.50        | 0.70    | 0.90    |      |
| E      | 2.50        | 2.70    | 2.90    |      |
| F      | 2.10        | 2.30    | 2.50    |      |
| H      | 0.96 MAX    |         |         |      |
| I      | 2.20        | 2.30    | 2.40    |      |
| J      | 0.40        | 0.50    | 0.60    |      |
| K      | 1.60        | 1.80    | 2.00    |      |
| L      | 0.40        | 0.50    | 0.60    |      |
| M      | 0.81        | 0.91    | 1.01    |      |
| O      | 0.80        | 0.90    | 1.00    |      |
| P      | 0.90        | 1.00    | 1.10    |      |
| Q      | 0.95 MAX    |         |         |      |
| R      | 0.60        | 0.80    | 1.00    |      |

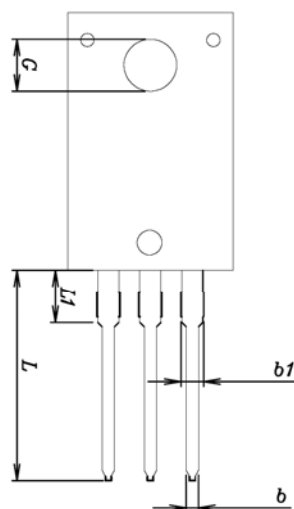
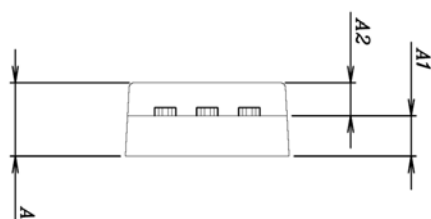
※ Recommend PCB solder land [Unit: mm]



◆ TO-220F-3L Outline Dimension (Unit : mm)



| SYMBOL | MILLIMETERS |         |         | NOTE |
|--------|-------------|---------|---------|------|
|        | MINIMUM     | NOMINAL | MAXIMUM |      |
| A      | —           | —       | 4.60    |      |
| A1     | 2.45        | 2.50    | 2.55    |      |
| A2     | 1.95        | 2.00    | 2.05    |      |
| b      | 0.65        | 0.75    | 0.85    |      |
| b1     | 1.07        | 1.27    | 1.47    |      |
| C      | 0.40        | 0.50    | 0.60    |      |
| C1     | 2.70        | 2.80    | 2.90    |      |
| D      | 9.90        | 10.00   | 10.10   |      |
| E      | 28.00       | —       | 28.60   |      |
| E1     | 15.50       | 15.60   | 15.70   |      |
| E2     | 12.30       | 12.40   | 12.50   |      |
| E3     | 9.15        | 9.20    | 9.25    |      |
| F      | 3.10        | 3.20    | 3.30    |      |
| G      | 3.30        | 3.40    | 3.50    |      |
| e      | 2.54 BSC    |         |         |      |
| L      | 12.40       | —       | 13.00   |      |
| L1     | 3.46 BSC    |         |         |      |



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