
**TO-252-5L**

**TO-220F-4SL**

## ORDERING INFORMATION

| Product   | Marking   | Package     |
|-----------|-----------|-------------|
| S52DxxD   | S52DxxD   | TO-252-5L   |
| S52DxxPIC | S52DxxPIC | TO-220F-4SL |

### ▲ Marking Detail Information

[ TO-220F-4SL & TO-252-5L PKG Marking ]



- ① AUK Logo
- ② Grade & M Code & Year & Week Code
- ③ Device Code

# S52Dxxx

## Low Dropout Voltage Regulator (1.0A Series)

### Description

The S52Dxxx 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 S52Dxxx has various key features such as current limiting, over temperature shut-down, over voltage protection, enable pin, and low noise performance with an low noise option.

Furthermore, it is available in adjustable or fixed output voltages in SOP-8, TO-252-5L, TO-220F-4SL packages.

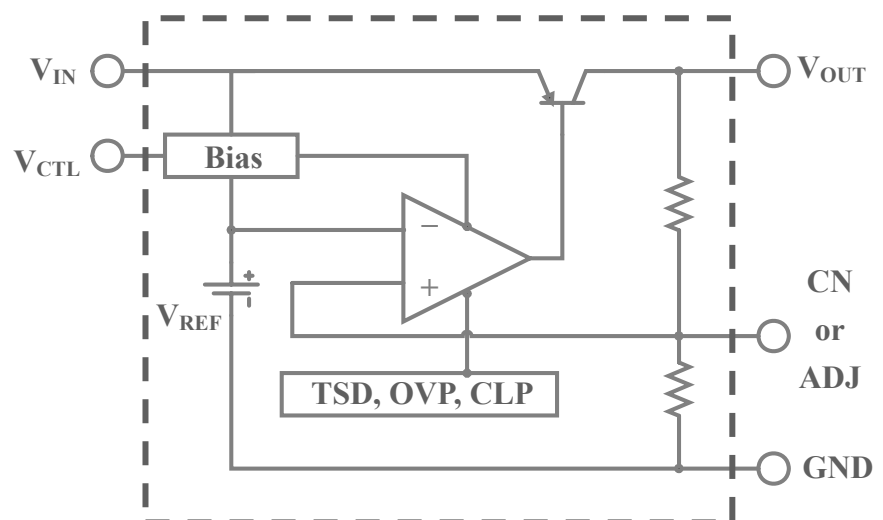
### Application

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

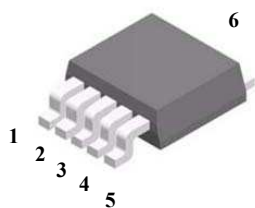
### Features and Benefits

- ◆ Low Dropout Voltage for 1.0A 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

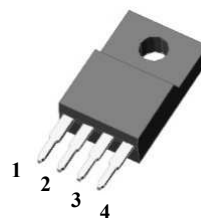


## ◆ Pin Configuration



TO-252-5L

- 1:  $V_{IN}$
- 2:  $V_{CTL}$
- 3:  $V_{OUT}$
- 4: ADJ/CN
- 5: GND
- 6:  $V_{OUT}$



TO-220F-4SL

- | Fixed $V_{OUT}$ | ADJ $V_{OUT}$ |
|-----------------|---------------|
| 1: $V_{IN}$     | 1: $V_{IN}$   |
| 2: $V_{OUT}$    | 2: $V_{OUT}$  |
| 3: GND          | 3: GND        |
| 4: $V_{CTL}$    | 4: ADJ        |

## ◆ Product Line-up

| Product Name | $V_{OUT}$ | Operating Temperature | Package     |
|--------------|-----------|-----------------------|-------------|
| S52D00D      | ADJ.      | -30~125°C             | TO-252-5L   |
| S52D18D      | 1.8V      | -30~125°C             | TO-252-5L   |
| S52D25D      | 2.5V      | -30~125°C             | TO-252-5L   |
| S52D33D      | 3.3V      | -30~125°C             | TO-252-5L   |
| S52D50D      | 5.0V      | -30~125°C             | TO-252-5L   |
| S52D00PIC    | ADJ.      | -30~125°C             | TO-220F-4SL |
| S52D18PIC    | 1.8V      | -30~125°C             | TO-220F-4SL |
| S52D25PIC    | 2.5V      | -30~125°C             | TO-220F-4SL |
| S52D33PIC    | 3.3V      | -30~125°C             | TO-220F-4SL |
| S52D50PIC    | 5.0V      | -30~125°C             | TO-220F-4SL |

◆ **Absolute Maximum Ratings ( Ta = 25℃ )**

| Parameter                 |             | Symbol           | Limits     | Unit |
|---------------------------|-------------|------------------|------------|------|
| Input Voltage             |             | V <sub>IN</sub>  | 23.0       | V    |
| Power Dissipation         | SOP-8       | P <sub>d</sub>   | 0.6(Note1) | W    |
|                           | TO-220F-4SL |                  | 2.0(Note1) |      |
|                           | TO-252-5L   |                  | 1.5(Note1) |      |
| Junction Temperature      |             | T <sub>J</sub>   | 150        | ℃    |
| Operate Temperature Range |             | T <sub>opr</sub> | -30 ~ +125 | ℃    |
| Storage Temperature Range |             | T <sub>stg</sub> | -55 ~ +150 | ℃    |

Note 1 : 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,  $\theta_{JA}$ , and the ambient temperature, T<sub>A</sub>.

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

$PD(max) = (T_{J(max)} - T_A) \div \theta_{JA}$ . 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℃ )**

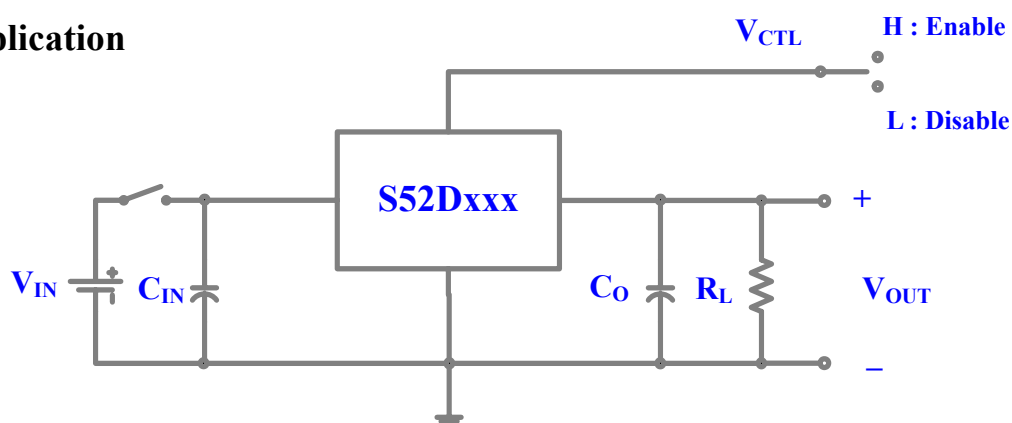
| Parameter            | Symbol           | Limits                 | Unit |
|----------------------|------------------|------------------------|------|
| Supply Input Voltage | V <sub>IN</sub>  | V <sub>O</sub> +0.5~20 | V    |
| Enable Input Voltage | V <sub>CTL</sub> | 0~ V <sub>IN</sub>     | V    |
| Output Current       | I <sub>OUT</sub> | 0~ 1.0                 | 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                 | S52D00x        | $V_{OUT}$ | Variation from nominal $V_{OUT}$                                    | 1.215         | 1.240 | 1.265 | V             |
|    |                                | S52D18x        |           |                                                                     | 1.764         | 1.800 | 1.836 | V             |
|    |                                | S52D25x        |           |                                                                     | 2.450         | 2.500 | 2.550 | V             |
|    |                                | S52D33x        |           |                                                                     | 3.234         | 3.300 | 3.366 | V             |
|    |                                | S52D50x        |           |                                                                     | 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 1A                        | -             | 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               | $R \cdot R$    |           | $I_{OUT}=50mA$ , $f=120Hz$                                          | 53.0          | 65.0  | -     | dB            |
| 6  | Dropout Voltage                | $V_{DROP}$     |           | $I_{OUT}=1.0A$                                                      | -             | -     | 0.5   | V             |
| 7  | Current Limit                  | $I_{LIMIT}$    |           | $V_{IN}=V_{OUT}+1V$                                                 | 1100          | 1300  | -     | mA            |
| 8  | Output Noise Voltage           | $V_{NO}$       |           | $V_{IN}=V_{OUT}+1V$ , $I_{OUT}=50mA$ ,<br>$10Hz \leq f \leq 100kHz$ | -             | 100   | -     | $\mu V_{rms}$ |
| 9  | Output On state for $V_{CTL}$  | $V_{CTL(ON)}$  |           | -                                                                   | 2.0           | -     | -     | V             |
| 10 | Output OFF state for $V_{CTL}$ | $V_{CTL(OFF)}$ |           | -                                                                   | -             | -     | 0.8   | V             |
| 11 | Output On state for $I_{CTL}$  | $I_{CTL(ON)}$  |           | $V_{CTL}=2.0V$                                                      | -             | -     | 20    | $\mu A$       |
| 12 | Output OFF state for $I_{CTL}$ | $I_{CTL(OFF)}$ |           | $V_{CTL}=0.8V$                                                      | -             | -     | 0.1   | $\mu A$       |

### 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 (  $C_O \geq 47\mu F$  )

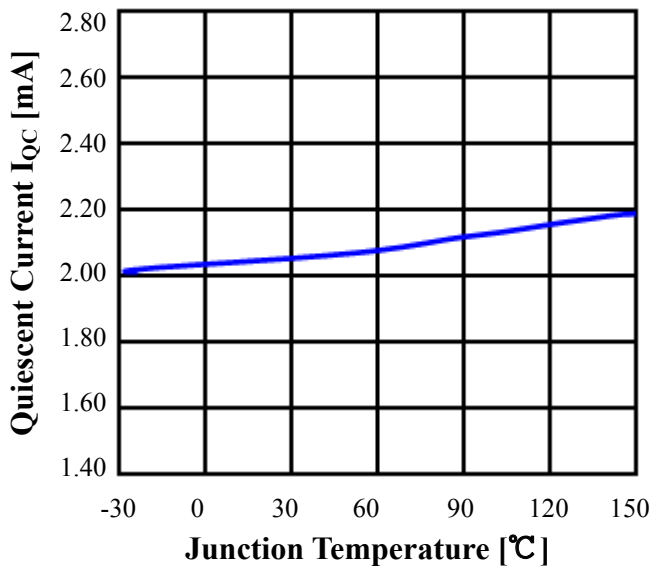
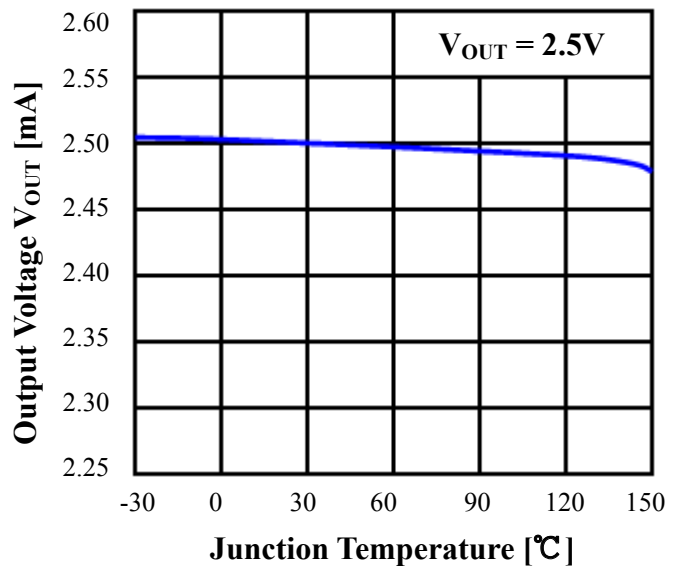
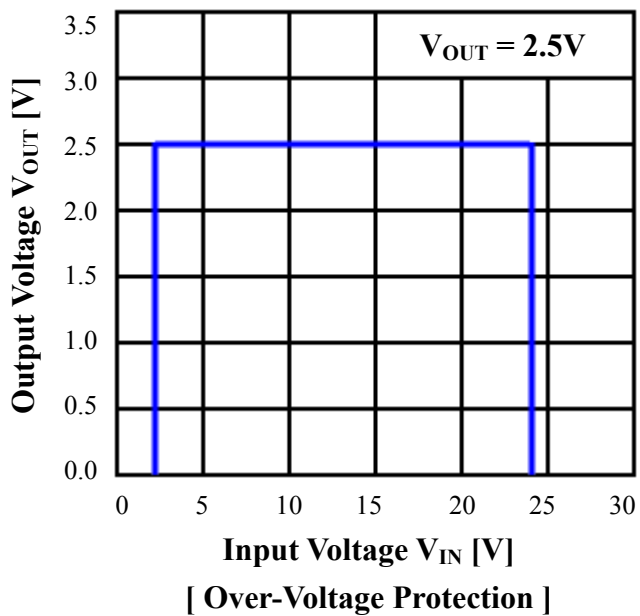
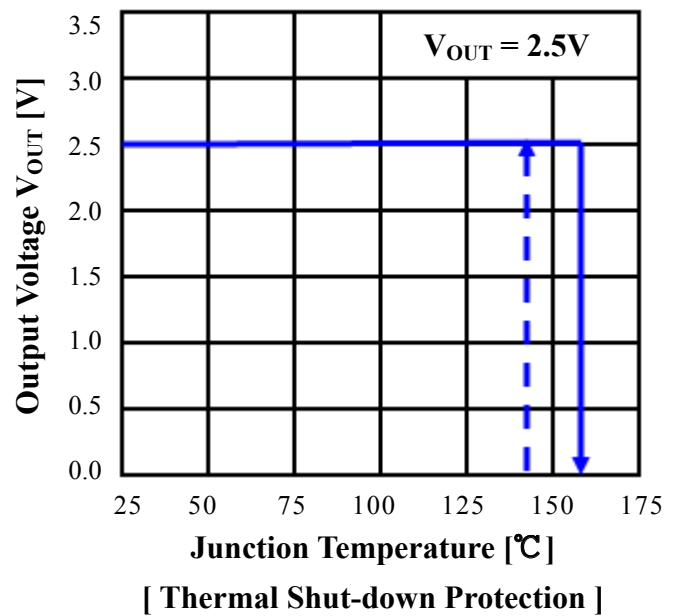
Fig1.  $I_{QC} - T_J$ Fig2.  $V_{OUT} - T_J$ Fig3.  $V_{OUT} - V_{IN}$ Fig4.  $V_{OUT} - T_J$ 

Fig5.  $V_{OUT} - I_{OUT}$

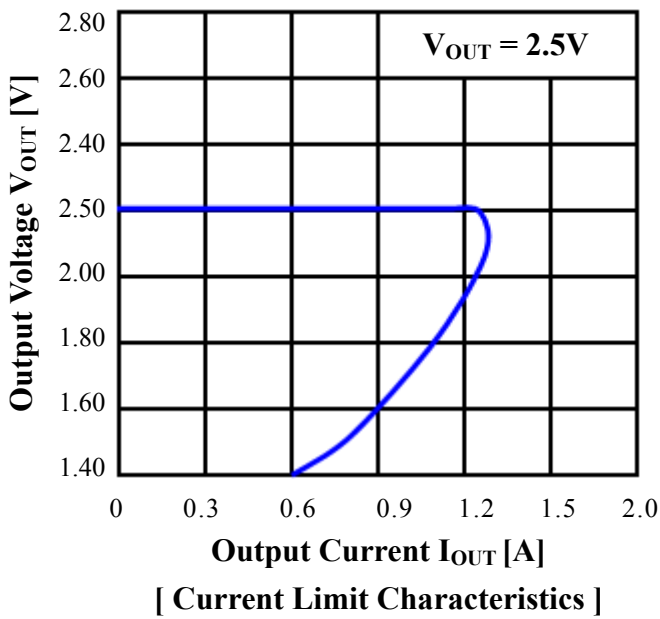


Fig6.  $V_{OUT} - T_J$

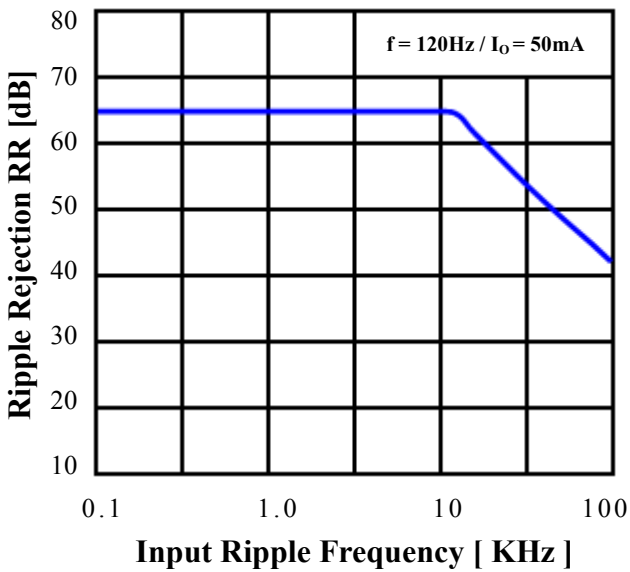


Fig7.  $V_{DROP} - T_J$

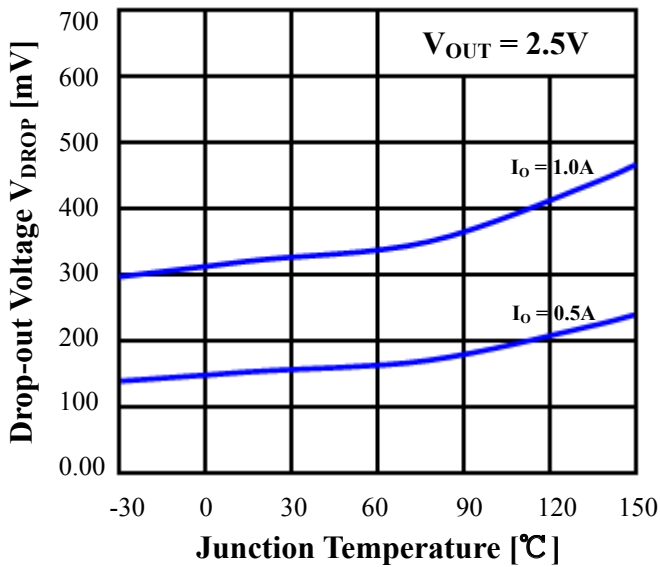


Fig.8 Line Transient Response

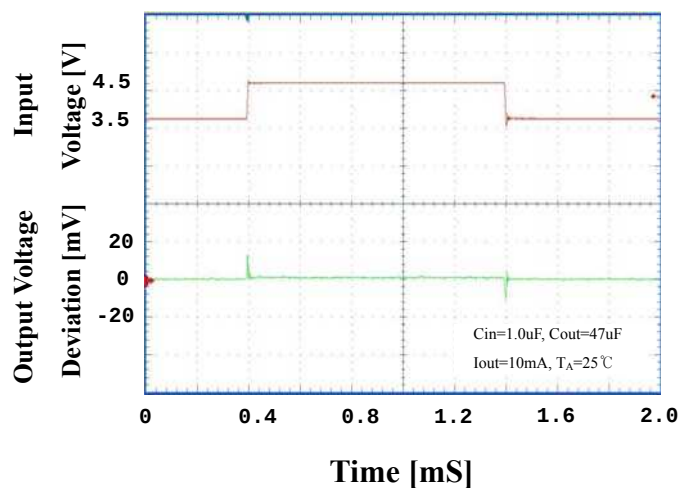


Fig.9 Line Transient Response

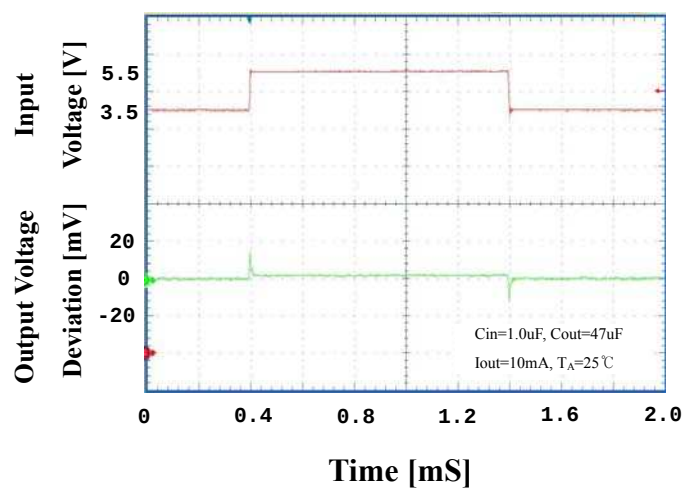


Fig.10 Load Transient Response

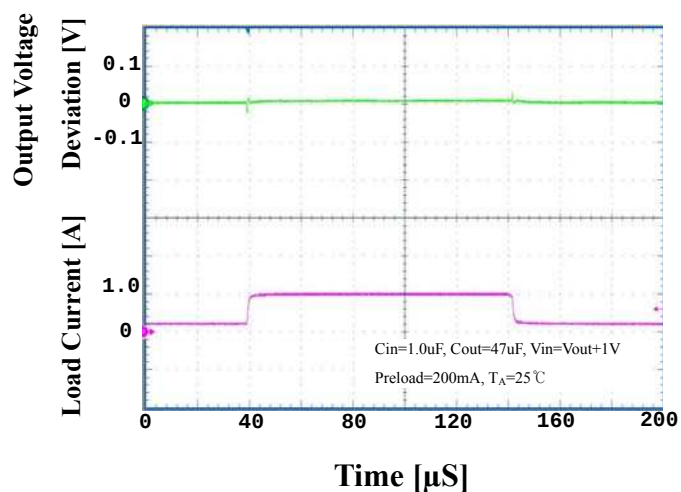
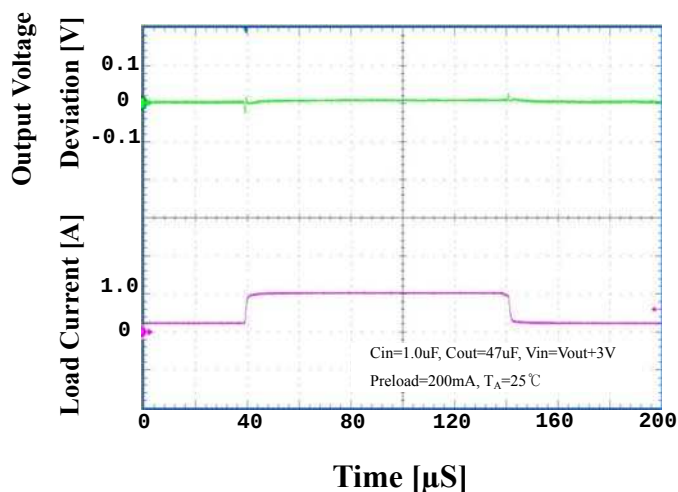
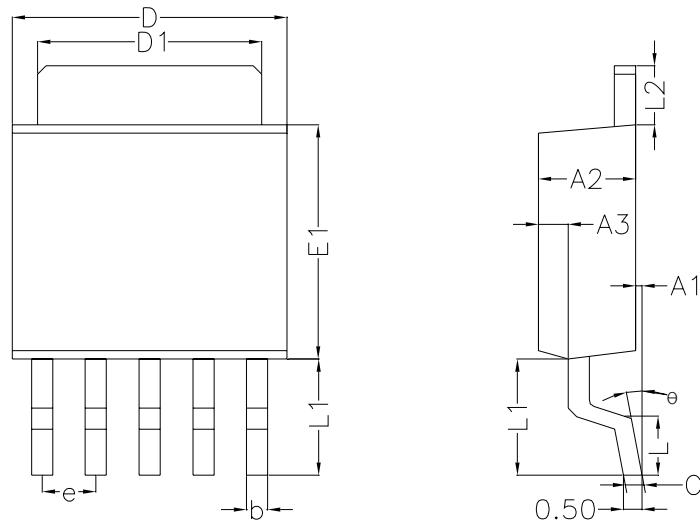


Fig.11 Load Transient Response

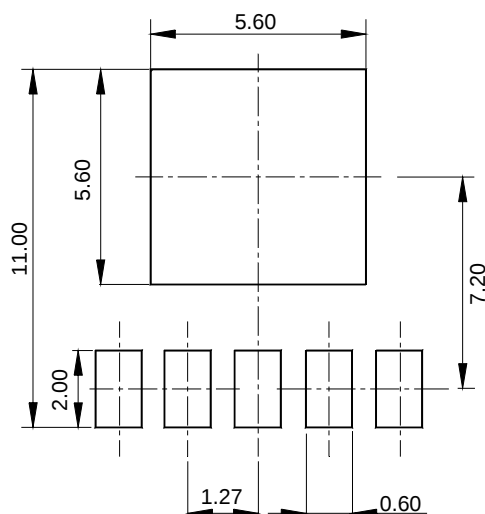


◆ TO-252-5L Outline Dimension (Unit : mm)

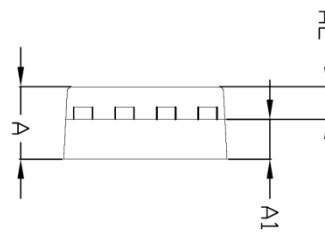
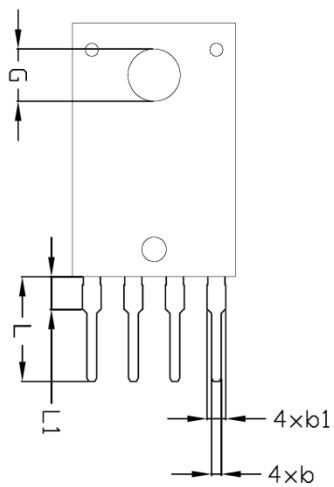
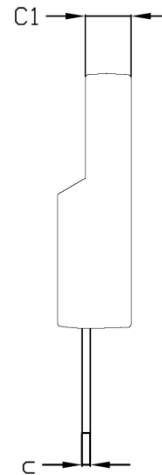
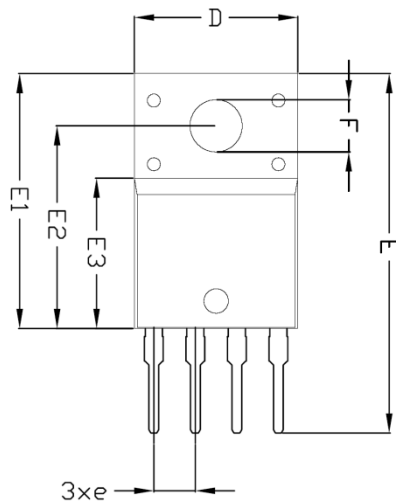


| SYMBOL   | MILLIMETER(mm) |         |         | NOTE |
|----------|----------------|---------|---------|------|
|          | MINIMUM        | NOMINAL | MAXIMUM |      |
| A1       | 0.05           | 0.15    | 0.25    |      |
| A2       | 2.10           | 2.30    | 2.50    |      |
| A3       | 0.50           | 0.60    | 0.70    |      |
| b        | 0.46           | —       | 0.60    |      |
| C        | 0.49           | —       | 0.56    |      |
| D        | 6.30           | 6.50    | 6.70    |      |
| D1       | 5.30REF        |         |         |      |
| E1       | 5.30           | 5.50    | 5.70    |      |
| e        | 1.27BSC        |         |         |      |
| L        | 1.40           | 1.50    | 1.60    |      |
| L1       | 3.00           | 3.10    | 3.20    |      |
| L2       | 1.40BSC        |         |         |      |
| $\theta$ | 0 °            | —       | 8 °     |      |

※ Recommend PCB solder land [Unit: mm]



◆ TO-220F-4SL 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      | 0.50        | 0.60    | 0.70    |      |
| b1     | 0.85        | 1.05    | 1.25    |      |
| c      | 0.40        | 0.50    | 0.60    |      |
| c1     | 2.70        | 2.80    | 2.90    |      |
| D      | 9.90        | 10.00   | 10.10   |      |
| E      | 20.80       | -       | 21.40   |      |
| 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      | 5.20        | -       | 5.80    |      |
| L1     | 2.00 BSC    |         |         |      |

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