

## SI-3000LU Series

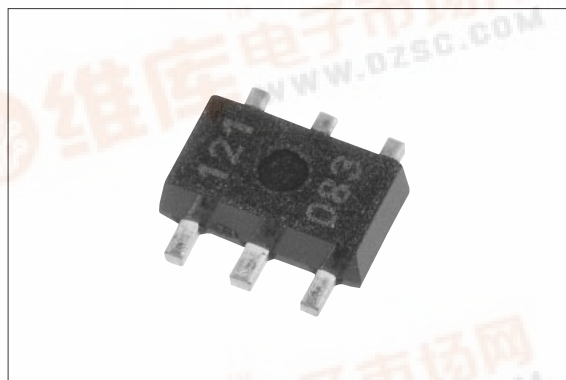
### Surface-Mount, Low Current Consumption, Low Dropout Voltage Dropper Type

#### ■Features

- Compact surface-mount package (SOT-89-5)
- Output current: 250 mA
- Low current consumption  $I_q$  (OFF)  $\leq 1\mu\text{A}$  ( $V_c = 0\text{ V}$ )
- Low dropout voltage:  $V_{DIF} \leq 0.5\text{ V}$  (at  $I_o = 250\text{ mA}$ )
- 5 types of output voltages (Adj, 1.8 V, 2.5 V, 3.3 V, 5.0 V) available
- Built-in dropping type overcurrent, thermal protection circuits

#### ■Applications

- Auxiliary power supply for PC
- Battery-driven electronic equipment



#### ■Absolute Maximum Ratings

(Ta=25°C)

| Parameter                                    | Symbol              | Ratings     | Unit |
|----------------------------------------------|---------------------|-------------|------|
| DC Input Voltage                             | $V_{IN}$            | 18          | V    |
| DC Output Current                            | $I_o$               | 250         | mA   |
| Power Dissipation                            | $P_D^{*1}$          | 0.75        | W    |
| Junction Temperature                         | $T_J^{*2}$          | -40 to +135 | °C   |
| Storage Temperature                          | $T_{op}^{*2}$       | -40 to +125 | °C   |
| Thermal Resistance (Junction to Ambient Air) | $\theta_{j-a}^{*1}$ | 146         | °C/W |

\*1: When mounted on glass-epoxy board 40 × 40 mm (copper laminate area 2%)

\*2: Thermal protection circuits may operate if the junction temperature exceeds 135°C

#### ■Recommended Operating Conditions

| Parameter                     | Symbol   | Ratings |                | Unit |
|-------------------------------|----------|---------|----------------|------|
|                               |          | min.    | max.           |      |
| Input Voltage                 | $V_{IN}$ | *2, *3  | $V_o + 2^{*1}$ | V    |
| DC Output Current             | $I_o$    | 0       | 250            | mA   |
| Ambient Operating Temperature | $T_{op}$ | -20     | 85             | °C   |

\*1:  $V_{IN}$  (max) and  $I_o$  (max) are restricted by the relationship  $P_D = (V_{IN} - V_o) \times I_o$ .

Calculate these values referring to the reference data.

\*2: Refer to the dropout voltage section.

\*3: For the SI-3012LU, set the input voltage to at least 2.4 V, and secure the minimum voltage as explained in Setting DC Input Voltage, Dropper Type Application Note.

## ■Electrical Characteristics

(T<sub>a</sub>=25°C, V<sub>c</sub>=2V unless otherwise specified)

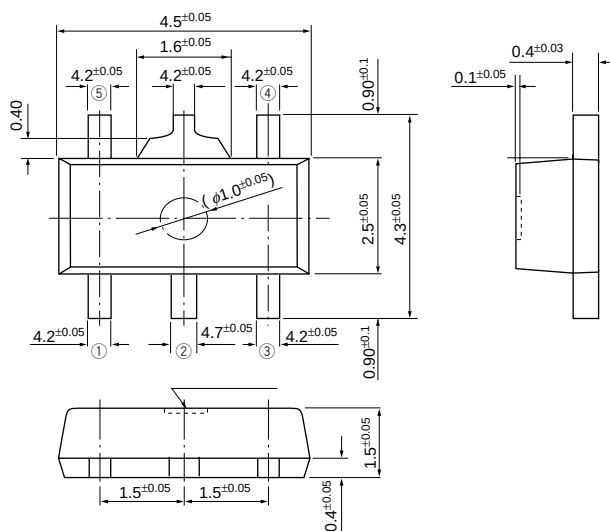
| Parameter                                             |                                            | Symbol                           | Ratings                                                                                               |       |       |                                                                  |       |       |                                                                   |       |       |                                                                 |       |       |                                                                 |       |       | Unit  |  |
|-------------------------------------------------------|--------------------------------------------|----------------------------------|-------------------------------------------------------------------------------------------------------|-------|-------|------------------------------------------------------------------|-------|-------|-------------------------------------------------------------------|-------|-------|-----------------------------------------------------------------|-------|-------|-----------------------------------------------------------------|-------|-------|-------|--|
|                                                       |                                            |                                  | SI-3012LU                                                                                             |       |       | SI-3018LU <sup>(Under development)</sup>                         |       |       | SI-3025LU <sup>(Under development)</sup>                          |       |       | SI-3033LU                                                       |       |       | SI-3050LU <sup>(Under development)</sup>                        |       |       |       |  |
|                                                       |                                            |                                  | min.                                                                                                  | typ.  | max.  | min.                                                             | typ.  | max.  | min.                                                              | typ.  | max.  | min.                                                            | typ.  | max.  | min.                                                            | typ.  | max.  |       |  |
| Output Voltage                                        |                                            | V <sub>O</sub>                   | 1.210                                                                                                 | 1.250 | 1.290 | 1.764                                                            | 1.800 | 1.836 | 2.450                                                             | 2.500 | 2.550 | 3.234                                                           | 3.300 | 3.366 | 4.900                                                           | 5.000 | 5.100 | V     |  |
|                                                       |                                            | Conditions                       | V <sub>IN</sub> =V <sub>O</sub> +1V, I <sub>O</sub> =10mA                                             |       |       | V <sub>IN</sub> =3.3V, I <sub>O</sub> =10mA                      |       |       | V <sub>IN</sub> =3.3V, I <sub>O</sub> =10mA                       |       |       | V <sub>IN</sub> =5V, I <sub>O</sub> =10mA                       |       |       | V <sub>IN</sub> =6V, I <sub>O</sub> =10mA                       |       |       |       |  |
| Dropout Voltage                                       |                                            | V <sub>DIF</sub>                 |                                                                                                       |       | 0.3   |                                                                  |       | 0.5   |                                                                   |       | 0.3   |                                                                 |       | 0.3   |                                                                 |       | 0.3   | V     |  |
|                                                       |                                            | Conditions                       | I <sub>O</sub> =100mA(V <sub>O</sub> =3.3V)                                                           |       |       | I <sub>O</sub> =100mA                                            |       |       |                                                                   |       |       |                                                                 |       |       |                                                                 |       |       |       |  |
|                                                       |                                            |                                  |                                                                                                       |       | 0.5   |                                                                  |       | 0.5   |                                                                   |       | 0.5   |                                                                 |       | 0.5   |                                                                 |       | 0.5   |       |  |
|                                                       |                                            | Conditions                       | I <sub>O</sub> =250mA(V <sub>O</sub> =3.3V)                                                           |       |       | I <sub>O</sub> =250mA                                            |       |       |                                                                   |       |       |                                                                 |       |       |                                                                 |       |       |       |  |
| Line Regulation                                       |                                            | ΔV <sub>LINE</sub>               |                                                                                                       |       | 10    |                                                                  |       | 10    |                                                                   |       | 10    |                                                                 |       | 10    |                                                                 |       | 15    | mV    |  |
|                                                       |                                            | Conditions                       | V <sub>IN</sub> =V <sub>O</sub> +1 to V <sub>O</sub> +5V, I <sub>O</sub> =10mA( V <sub>O</sub> =3.3V) |       |       | V <sub>IN</sub> =2.5 to 5V, I <sub>O</sub> =10mA                 |       |       | V <sub>IN</sub> =3.3 to 5V, I <sub>O</sub> =10mA                  |       |       | V <sub>IN</sub> =4.5 to 8V, I <sub>O</sub> =10mA                |       |       | V <sub>IN</sub> =6 to 10V, I <sub>O</sub> =10mA                 |       |       |       |  |
| Load Regulation                                       |                                            | ΔV <sub>LOAD</sub>               |                                                                                                       |       | 20    |                                                                  |       | 20    |                                                                   |       | 40    |                                                                 |       | 40    |                                                                 |       | 40    | mV    |  |
|                                                       |                                            | Conditions                       | V <sub>IN</sub> =V <sub>O</sub> +1V, I <sub>O</sub> =1 to 250mA( V <sub>O</sub> =3.3V)                |       |       | V <sub>IN</sub> =3.3V, I <sub>O</sub> =1 to 250mA                |       |       | V <sub>IN</sub> =3.3V, I <sub>O</sub> =0 to 250mA                 |       |       | V <sub>IN</sub> =5V, I <sub>O</sub> =0 to 250mA                 |       |       | V <sub>IN</sub> =6V, I <sub>O</sub> =0 to 250mA                 |       |       |       |  |
| Temperature Coefficient of Output Voltage             |                                            | ΔV <sub>O</sub> /ΔT <sub>a</sub> |                                                                                                       | ±0.3  |       |                                                                  | ±0.2  |       |                                                                   | ±0.25 |       |                                                                 | ±0.3  |       |                                                                 | ±0.3  |       | mV/°C |  |
|                                                       |                                            | Conditions                       | T <sub>J</sub> =0 to 100°C                                                                            |       |       |                                                                  |       |       |                                                                   |       |       |                                                                 |       |       |                                                                 |       |       |       |  |
| Ripple Rejection                                      |                                            | R <sub>REJ</sub>                 |                                                                                                       | 55    |       |                                                                  | 55    |       |                                                                   | 55    |       |                                                                 | 55    |       |                                                                 | 55    |       | dB    |  |
|                                                       |                                            | Conditions                       | V <sub>IN</sub> =V <sub>O</sub> +1V, f=100 to 120Hz( V <sub>O</sub> =3.3V)                            |       |       | V <sub>IN</sub> =3.3V, f=100 to 120Hz                            |       |       | V <sub>IN</sub> =3.3V, f=100 to 120Hz                             |       |       | V <sub>IN</sub> =5V, f=100 to 120Hz                             |       |       | V <sub>IN</sub> =6V, f=100 to 120Hz                             |       |       |       |  |
| Quiescent Circuit Current                             |                                            | I <sub>q</sub>                   |                                                                                                       |       | 150   |                                                                  |       | 150   |                                                                   |       | 150   |                                                                 |       | 150   |                                                                 |       | 150   | μA    |  |
|                                                       |                                            | Conditions                       | V <sub>IN</sub> =V <sub>O</sub> +1V, I <sub>O</sub> =0mA<br>V <sub>C</sub> =2V, R <sub>2</sub> =100kΩ |       |       | V <sub>IN</sub> =3.3V, I <sub>O</sub> =0mA<br>V <sub>C</sub> =2V |       |       | V <sub>IN</sub> =3.3V, I <sub>O</sub> =0mA,<br>V <sub>C</sub> =2V |       |       | V <sub>IN</sub> =5V, I <sub>O</sub> =0mA,<br>V <sub>C</sub> =2V |       |       | V <sub>IN</sub> =6V, I <sub>O</sub> =0mA,<br>V <sub>C</sub> =2V |       |       |       |  |
| OFF Circuit Current                                   |                                            | I <sub>q</sub> (OFF)             |                                                                                                       |       | 1     |                                                                  |       | 1     |                                                                   |       | 1     |                                                                 |       | 1     |                                                                 |       | 1     | μA    |  |
|                                                       |                                            | Conditions                       | V <sub>IN</sub> =V <sub>O</sub> +1V, V <sub>C</sub> =0V                                               |       |       | V <sub>IN</sub> =3.3V, V <sub>C</sub> =0V                        |       |       | V <sub>IN</sub> =3.3V, V <sub>C</sub> =0V                         |       |       | V <sub>IN</sub> =5V, V <sub>C</sub> =0V                         |       |       | V <sub>IN</sub> =6V, V <sub>C</sub> =0V                         |       |       |       |  |
| Overcurrent Protection Starting Current* <sup>1</sup> |                                            | I <sub>S1</sub>                  | 260                                                                                                   |       |       | 260                                                              |       |       | 260                                                               |       |       | 260                                                             |       |       | 260                                                             |       |       | mA    |  |
|                                                       |                                            | Conditions                       | V <sub>IN</sub> =V <sub>O</sub> +1V                                                                   |       |       | V <sub>IN</sub> =3.3V                                            |       |       | V <sub>IN</sub> =3.3V                                             |       |       | V <sub>IN</sub> =5V                                             |       |       | V <sub>IN</sub> =6V                                             |       |       |       |  |
| V <sub>C</sub> Pin                                    | Control Voltage (Output ON)* <sup>2</sup>  | V <sub>C</sub> , I <sub>H</sub>  | 2.0                                                                                                   |       |       | 2.0                                                              |       |       | 2.0                                                               |       |       | 2.0                                                             |       |       | 2.0                                                             |       |       | V     |  |
|                                                       | Control Voltage (Output OFF)* <sup>2</sup> | V <sub>C</sub> , I <sub>L</sub>  |                                                                                                       |       | 0.8   |                                                                  |       | 0.8   |                                                                   |       | 0.8   |                                                                 |       | 0.8   |                                                                 |       | 0.8   |       |  |
|                                                       | Control Current (Output ON)                | I <sub>C</sub> , I <sub>H</sub>  |                                                                                                       |       | 40    |                                                                  |       | 40    |                                                                   |       | 40    |                                                                 |       | 40    |                                                                 |       | 40    | μA    |  |
|                                                       | Conditions                                 | V <sub>C</sub> =2V               |                                                                                                       |       |       |                                                                  |       |       |                                                                   |       |       |                                                                 |       |       |                                                                 |       |       |       |  |
|                                                       | Control Current (Output OFF)               | I <sub>C</sub> , I <sub>L</sub>  |                                                                                                       | 0     | -5    |                                                                  | 0     | -5    |                                                                   | 0     | -5    |                                                                 | 0     | -5    |                                                                 | 0     | -5    | μA    |  |
| Conditions                                            | V <sub>C</sub> =0V                         |                                  |                                                                                                       |       |       |                                                                  |       |       |                                                                   |       |       |                                                                 |       |       |                                                                 |       |       |       |  |
| Output OFF Voltage                                    |                                            | V <sub>O</sub>                   |                                                                                                       |       | 0.5   |                                                                  |       | 0.5   |                                                                   |       | 0.5   |                                                                 |       | 0.5   |                                                                 |       | 0.5   | V     |  |

\*1: I<sub>s1</sub> is specified as the 5% drop point of output voltage V<sub>O</sub> on the condition that V<sub>IN</sub> = 3.3 V (5 V for SI-3033LU, 6 V for SI-3050LU), and I<sub>O</sub> = 10 mA.

\*2: Output is OFF when the output control pin (V<sub>c</sub> pin) is open. Each input level is equivalent to that for LS-TTL. Therefore, the device can be driven directly by an LS-TTL circuit.

## ■External Dimensions

(Unit : mm)



### Pin Arrangement

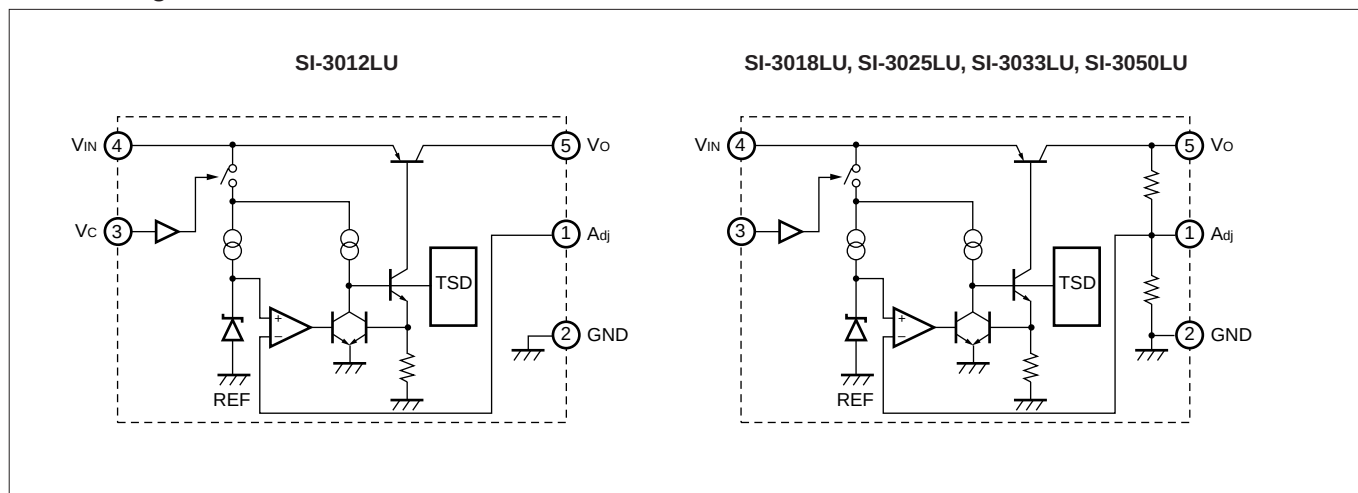
- ① A<sub>DJ</sub>
- ② GND
- ③ V<sub>c</sub>
- ④ V<sub>IN</sub>
- ⑤ V<sub>O</sub>

### Plastic Mold Package Type

Flammability: UL94V-0

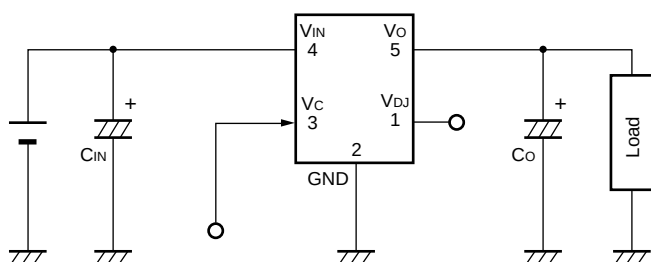
Weight: Approx. 0.05g

## ■Block Diagram



## ■Standard External Circuit

### SI-3018LU, SI-3025LU, SI-3033LU, SI-3050LU



$C_o$  : Output capacitor ( $10\mu\text{F}$  or larger)

The SI-3000LU series can be operated on the circuit even if a low ESR ceramic capacitor is used as the output capacitor.

$C_{IN}$  : Input capacitor ( $0.1$  to  $10\mu\text{F}$ )

This capacitor is required in the case of an inductive input line or long wiring.

●Settings for SI-3012LU output voltage (recommended voltage:  $1.5\text{ V}$  to  $15\text{ V}$ )

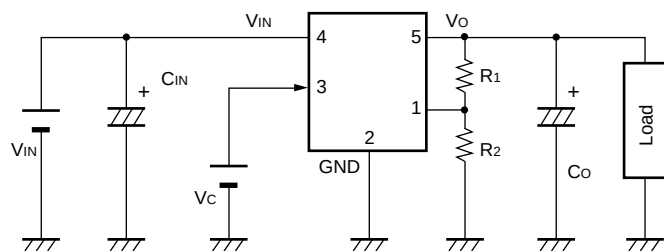
$R_1$  and  $R_2$ : Resistors for output setting

The output voltage can be set by connecting  $R_1$  and  $R_2$  as shown in the diagram on the left.

$R_2$ :  $100\text{ k}\Omega$  is recommended

$$R_1 = (V_O - V_{ADJ}) / (V_{ADJ} / R_2)$$

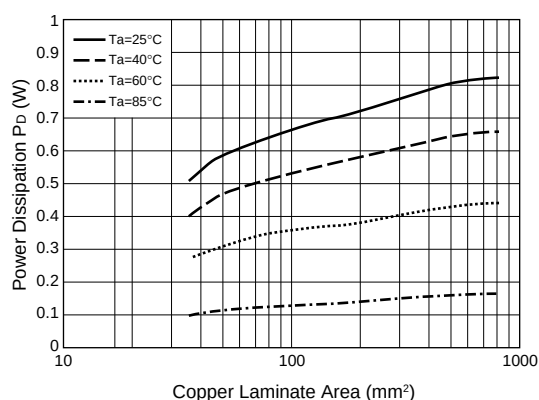
### SI-3012LU



## ■Reference Data

### Copper Laminate Area vs Power Dissipation

$T_j=100^\circ\text{C}$  PWB size  $40\times 40$



- A monolithic IC is mounted. The inner frame stage is connected to the GND pin (pin 2). Therefore, enlarging the copper laminate area leading to the GND pin achieves a heat radiation effect.

- How to calculate the junction temperature

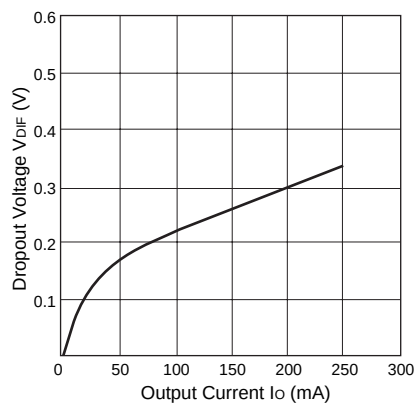
Measure the temperature ( $T_c$ ) of the GND pin (pin 2) lead section using a thermistor, etc. Substitute this value in the following formula and calculate the junction temperature.

$$T_j = P_D \times \theta_{j-c} + T_c \quad (\theta_{j-c} = 5^\circ\text{C/W})$$

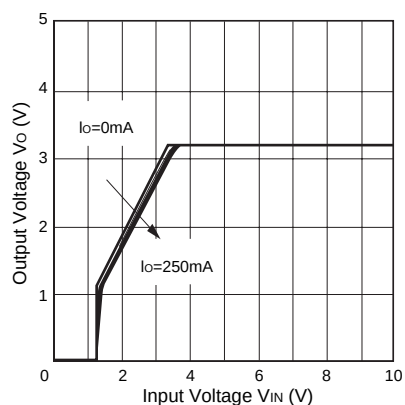
## ■Typical Characteristics of SI-3033LU

( $T_a=25^\circ\text{C}$ )

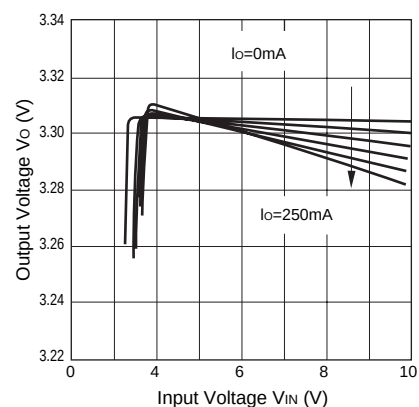
**$I_o$  vs.  $V_{DIF}$  Characteristics**



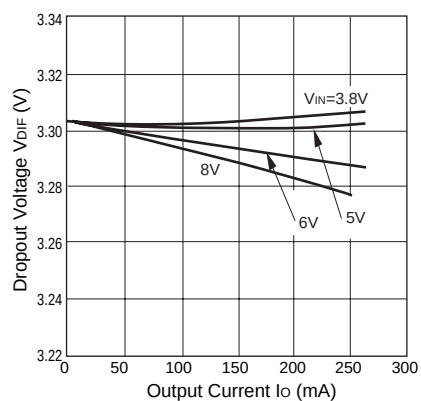
**Output Voltage Characteristics**



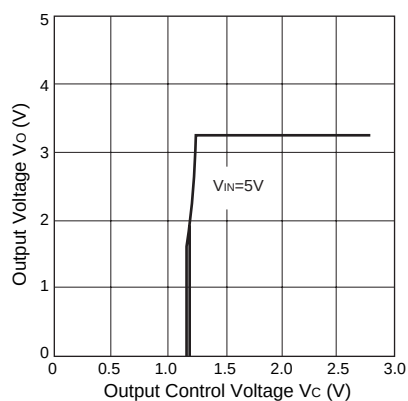
**Line Regulation**



**Load Regulation**



**Output ON/OFF Control**



**Overcurrent Protection Characteristics**

