

SI-3000KS Series Surface-Mount, Low Current Consumption, Low Dropout Voltage Linear Regulator ICs

■ Features

- Compact surface-mount package (SOP8)
- Output current: 1.0 A
- Compatible with low ESR capacitor
- Low circuit current at output OFF $I_q \leq 350 \mu\text{A}$ ($I_o = 0 \text{ A}$, $V_c = 2 \text{ V}$)
- Low current consumption $I_q (\text{OFF}) \leq 1 \mu\text{A}$ ($V_c = 0 \text{ V}$)
- Low dropout voltage $V_{\text{DIF}} \leq 0.6 \text{ V}$ ($I_o = 1 \text{ A}$)
- 3 types of output voltages (2.5 V, 3.3 V, and variable type) available
- Output ON/OFF control terminal voltage compatible with LS-TTL
- Built-in drooping-type-overcurrent and thermal protection circuits

■ Absolute Maximum Ratings

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

| Parameter | Symbol | Ratings | Unit |
|---|----------------------|-----------------|--------------------|
| DC Input Voltage | V_{IN}^{*1} | 17 | V |
| Output Control Terminal Voltage | V_c | V_{IN} | V |
| DC Output Current | I_o^{*1} | 1.0 | A |
| Power Dissipation | $P_D^{*1, *2}$ | 0.76 | W |
| Junction Temperature | T_j | -40 to +125 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | -40 to +125 | $^\circ\text{C}$ |
| Thermal Resistance (Junction to Ambient Air) | θ_{JA} | 130 | $^\circ\text{C/W}$ |
| Thermal resistance (Junction to Lead (pin 7)) | θ_{JL} | 22 | $^\circ\text{C/W}$ |

*1: V_{IN} (max) and I_o (max) are restricted by the relation $P_D = (V_{\text{IN}} - V_o) \times I_o$. Please calculate these values referring to the Copper laminate area vs. Power dissipation data as shown hereinafter.

*2: When mounted on a glass epoxy board of 1600 mm² (copper laminate area 2%).

■ Applications

- Local power supplies
- Battery-driven electronic equipment

■ Electrical Characteristics

($T_a=25^\circ\text{C}$, $V_c=2 \text{ V}$ unless otherwise specified)

| Parameter | Symbol | Ratings | | | | | | | | | Unit |
|--|---|--|-----------|------|---|-----------|------|---|-----------|-------|----------------------|
| | | SI-3012KS (variable type) | | | SI-3025KS | | | SI-3033KS | | | |
| | | min. | typ. | max. | min. | typ. | max. | min. | typ. | max. | |
| Input Voltage | V_{IN} | 2.4 | | | *1 | | | *1 | | | V |
| Output Voltage (Reference voltage V_{ADJ} for SI-3012KS) | $V_o (V_{\text{ADJ}})$ | 1.24 | 1.28 | 1.32 | 2.45 | 2.50 | 2.55 | 3.234 | 3.300 | 3.366 | V |
| Dropout Voltage | V_{DIF} | | | 0.3 | | | 0.4 | | | 0.4 | V |
| | Conditions | $V_{\text{IN}}=3.3\text{V}$, $I_o=10\text{mA}$ | | | $V_{\text{IN}}=3.3\text{V}$, $I_o=10\text{mA}$ | | | $V_{\text{IN}}=5\text{V}$, $I_o=10\text{mA}$ | | | |
| | Conditions | $I_o=0.5\text{A}$ ($V_c=2.5\text{V}$) | | | $I_o=0.5\text{A}$ | | | $I_o=0.5\text{A}$ | | | |
| Line Regulation | ΔV_{OLINE} | | | 10 | | | 10 | | | 15 | mV |
| | Conditions | $V_{\text{IN}}=3.3$ to 8V , $I_o=10\text{mA}$ ($V_c=2.5\text{V}$) | | | $V_{\text{IN}}=3.3$ to 8V , $I_o=10\text{mA}$ | | | $V_{\text{IN}}=5$ to 10V , $I_o=10\text{mA}$ | | | |
| Load Regulation | ΔV_{OLOAD} | | | 40 | | | 40 | | | 50 | mV |
| | Conditions | $V_{\text{IN}}=3.3\text{V}$, $I_o=0$ to 1A ($V_c=2.5\text{V}$) | | | $V_{\text{IN}}=3.3\text{V}$, $I_o=0$ to 1A | | | $V_{\text{IN}}=5\text{V}$, $I_o=0$ to 1A | | | |
| Quiescent Circuit Current | I_q | | | 350 | | | 350 | | | 350 | μA |
| | Conditions | $V_{\text{IN}}=3.3\text{V}$, $I_o=0\text{A}$, $V_c=2\text{V}$, $R_2=24\text{k}\Omega$ | | | $V_{\text{IN}}=3.3\text{V}$, $I_o=0\text{A}$, $V_c=2\text{V}$ | | | $V_{\text{IN}}=5\text{V}$, $I_o=0\text{A}$, $V_c=2\text{V}$ | | | |
| Circuit Current at Output OFF | $I_q (\text{OFF})$ | | | 1 | | | 1 | | | 1 | μA |
| | Conditions | $V_{\text{IN}}=3.3\text{V}$, $V_c=0\text{V}$ | | | $V_{\text{IN}}=3.3\text{V}$, $V_c=0\text{V}$ | | | $V_{\text{IN}}=5\text{V}$, $V_c=0\text{V}$ | | | |
| Temperature Coefficient of Output Voltage | $\Delta V_o/\Delta T_a$ | | ± 0.3 | | | ± 0.3 | | | ± 0.3 | | mV/ $^\circ\text{C}$ |
| | Conditions | $T_j=0$ to 100°C ($V_o=2.5\text{V}$) | | | $T_j=0$ to 100°C | | | $T_j=0$ to 100°C | | | |
| Ripple Rejection | R_{REJ} | | 55 | | | 55 | | | 55 | | dB |
| | Conditions | $V_{\text{IN}}=3.3\text{V}$, $f=100$ to 120Hz ($V_c=2.5\text{V}$) | | | $V_{\text{IN}}=3.3\text{V}$, $f=100$ to 120Hz | | | $V_{\text{IN}}=5\text{V}$, $f=100$ to 120Hz | | | |
| Overcurrent Protection Starting Current ^{*2} | I_{S1} | 1.2 | | | 1.2 | | | 1.2 | | | A |
| | Conditions | $V_{\text{IN}}=3.3\text{V}$ ($V_c=2.5\text{V}$) | | | $V_{\text{IN}}=3.3\text{V}$ | | | $V_{\text{IN}}=5\text{V}$ | | | |
| V_c Terminal | Control Voltage (Output ON) ^{*3} | V_c, IH | 2.0 | | 2.0 | | | 2.0 | | | V |
| | Control Voltage (Output OFF) | V_c, IL | | | 0.8 | | 0.8 | | | 0.8 | |
| | Control Current (Output ON) | I_c, IH | | | 40 | | 40 | | | 40 | μA |
| | Conditions | $V_c=2\text{V}$ | | | | | | | | | |
| | Control Current (Output OFF) | I_c, IL | -5 | 0 | | -5 | 0 | | -5 | 0 | |
| Conditions | $V_c=0\text{V}$ | | | | | | | | | | |

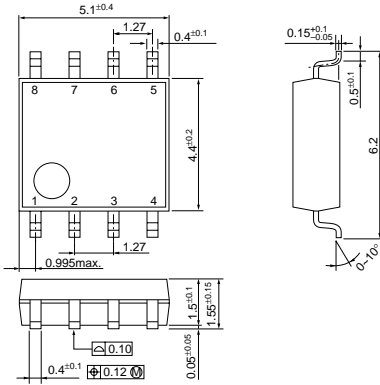
*1: Refer to the Dropout Voltage parameter.

*2: The I_{S1} is specified at the 5% drop point of output voltage V_o on the condition that $V_{\text{IN}} = V_o + 1 \text{ V}$, and $I_o = 10 \text{ mA}$.

*3: Output is OFF when the output control terminal V_c is open. Each input level is equivalent to LS-TTL level. Therefore, the device can be driven directly by LS-TTLs.

External Dimensions (SOP8)

(Unit : mm)



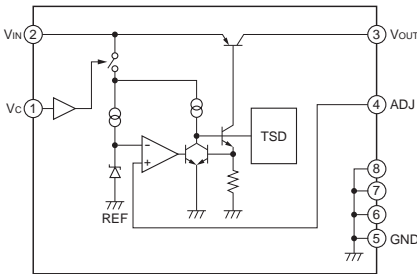
Pin Assignment

- ① Vc
- ② VIN
- ③ Vo
- ④ Sence (ADJ for SI-3012KS)
- ⑤ GND
- ⑥ GND
- ⑦ GND
- ⑧ GND

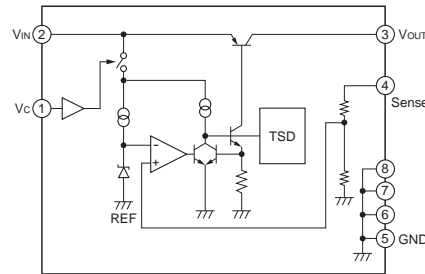
Plastic Mold Package Type
 Flammability: UL 94V-0
 Product Mass: Approx. 0.1 g

Block Diagram

SI-3012KS

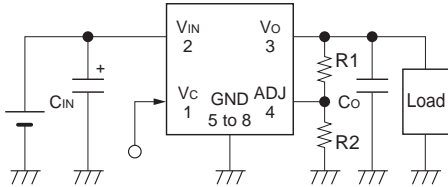


SI-3025KS, SI-3033KS



Typical Connection Diagram

SI-3012KS

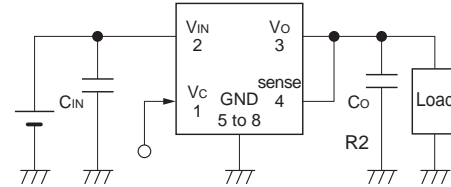


R1, R2: Output voltage setting resistors
 The output voltage can be set by connecting R1 and R2 as shown above.

The recommended value of R2 is 24 kΩ.

$$R1 = (V_O - V_{ADJ}) \div (V_{ADJ} / R2)$$

SI-3025KS, SI-3033KS



CIN: Input capacitor (22 μF or larger)

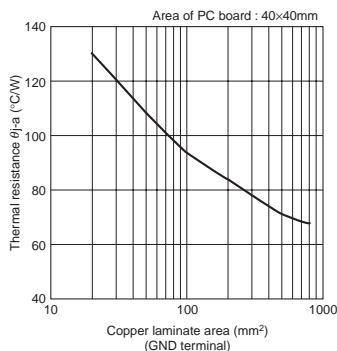
Co: Output capacitor (22 μF or larger)

For SI-3000KS series, Co has to be a low ESR capacitor.

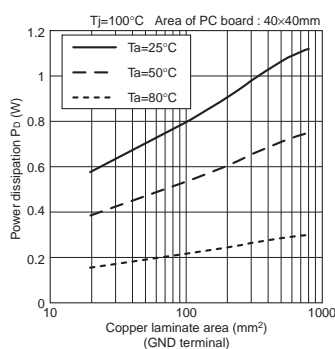
When using the electrolytic capacitor, the SI-3000KS series may oscillate at a low temperature.

Reference Data

Copper Laminate Area vs. Thermal Resistance



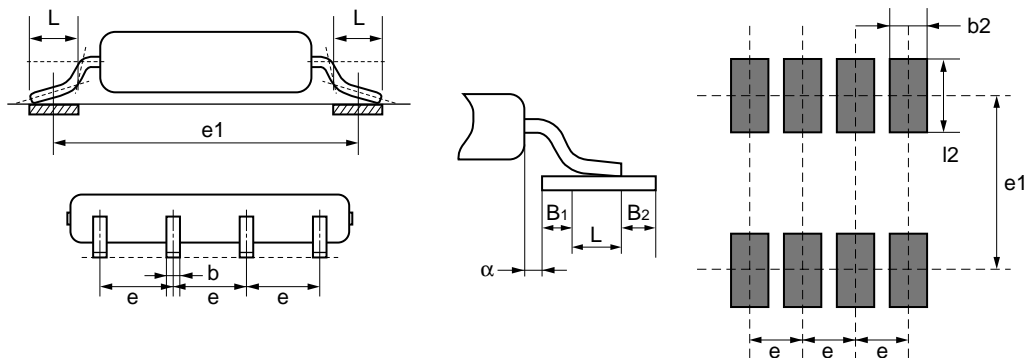
Copper Laminate Area vs. Power Dissipation



- Obtaining the junction temperature
 Measure the temperature T_L at the lead part of the GND pin (pin 7) with a thermocouple, etc. Then, substitute this value in the following formula to obtain the junction temperature.

$$T_J = P_D \times \theta_{J-L} + T_L \quad (\theta_{J-L} = 22^\circ \text{C/W})$$

■Example of Solder Pattern Design



| Symbol | Dimensions (mm) |
|--------|-----------------|
| e1 | 5.72 |
| e | 1.27±0.15 |
| α | 0.2 |
| β1 | 0.2 to 0.5 |
| β2 | 0.2 |
| L | 0.6 |
| b2 | 0.76 |
| l2 | L+β1+β2 |

(Reference value conforming to EIAJ Standard ED-7402-1)

*1 The inner frame stage on which a monolithic IC is mounted is directly connected to the GND pins (pins 5 through 8). By expanding the area of the copper connected to the GND pins, the heat radiation can be improved. It is recommended to design the solder pattern by opening the insulation film of the solder patterns of pins 5, 6, 7, and 8, on the wide GND pattern as shown in Figure 1.

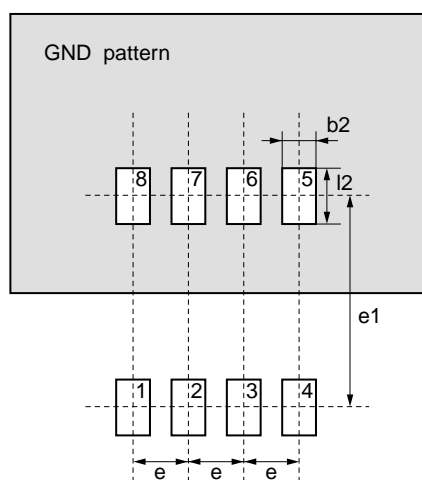
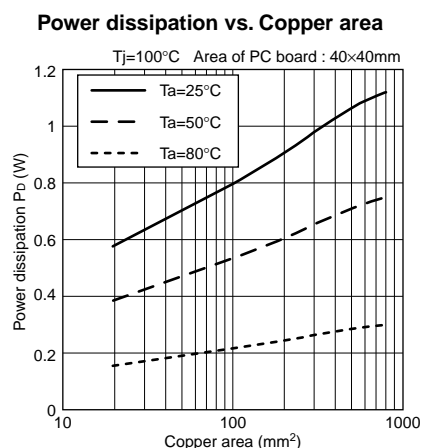
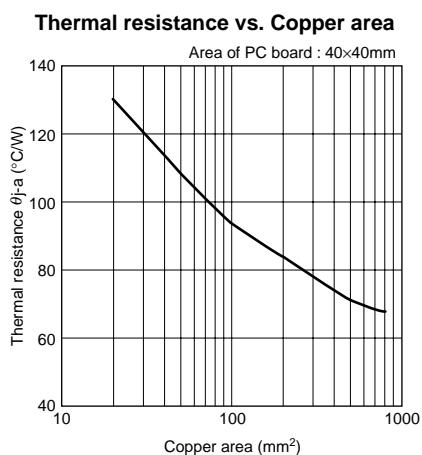


Figure 1

■Reference Data



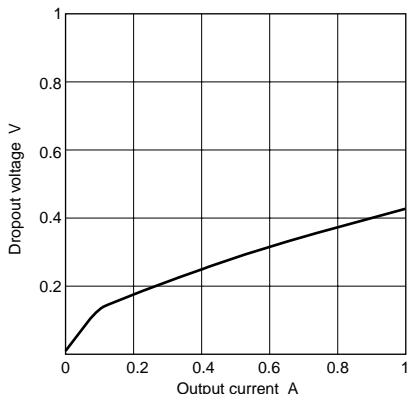
- Calculating junction temperature
Measure the temperature T_L of the lead of the GND pin (pin 7) by using a thermocouple, and substitute the measured value into the following expression to calculate the junction temperature.

$$T_j = P_D \times \theta_{j-L} + T_L \quad (\theta_{j-L} = 22^\circ \text{C/W})$$

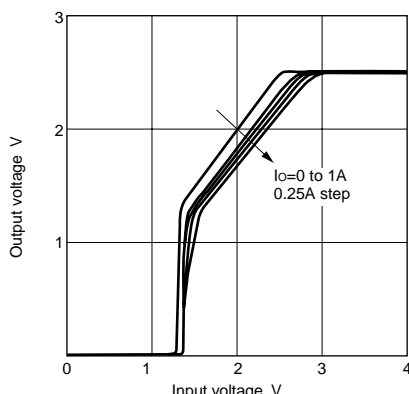
■Typical Characteristics Examples of SI-3012KS and SI-3025KS

($T_a=25^\circ\text{C}$) * $V_{out}=2.5\text{ V}$ for SI-3012KS ($R_S=24\text{ k}\Omega$)

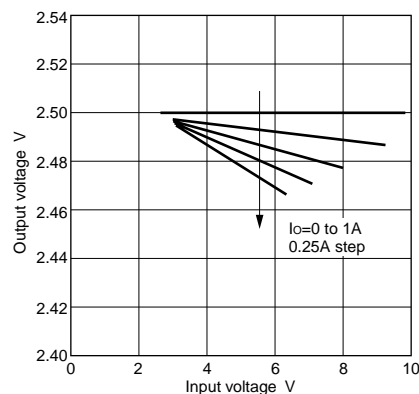
Dropout voltage



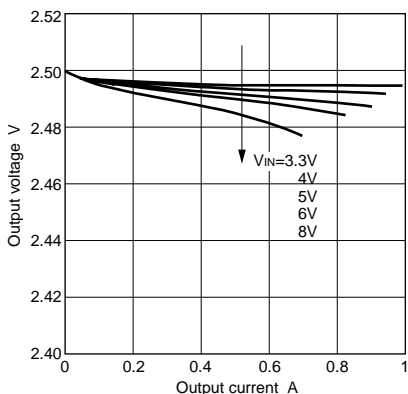
Rise characteristics



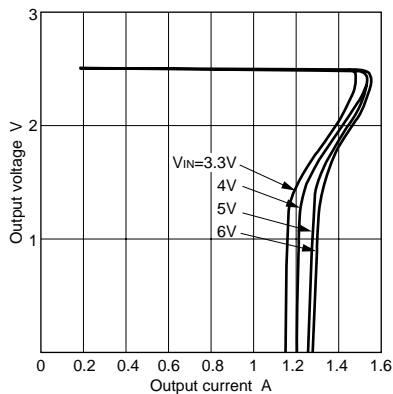
Line regulation



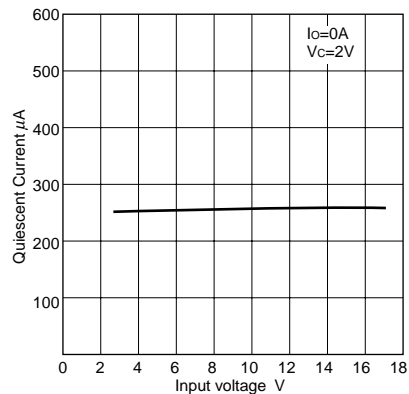
Load regulation



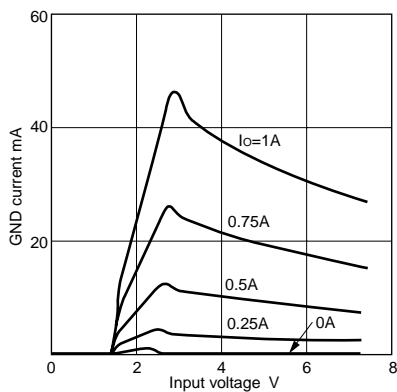
Overcurrent protection characteristics



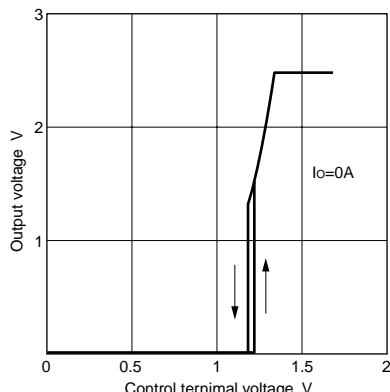
Input voltage vs. Quiescent current



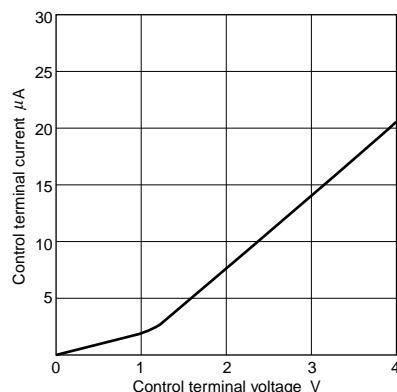
Circuit current



Control terminal voltage vs. Output voltage



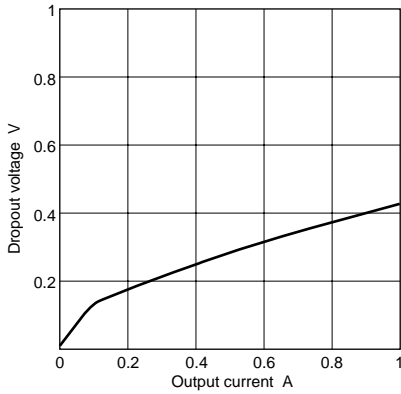
Control terminal voltage vs. Control terminal current



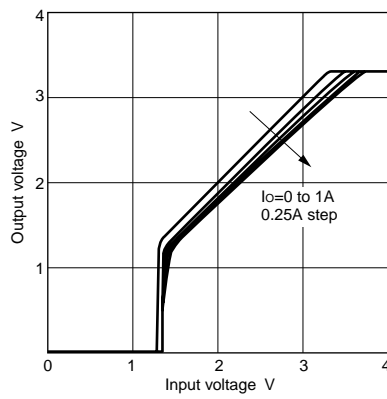
■Typical Characteristics Examples of SI-3033KS

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

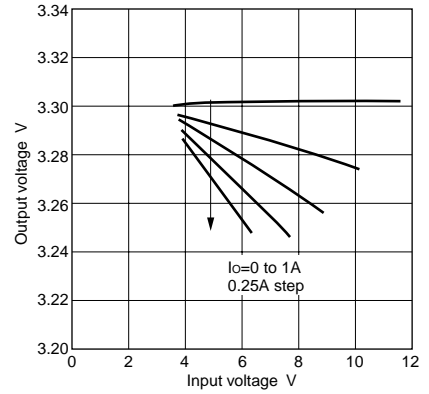
Dropout voltage



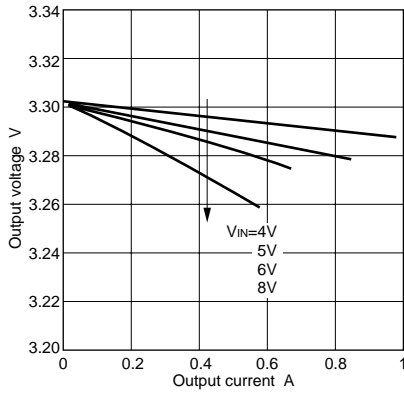
Rise characteristics



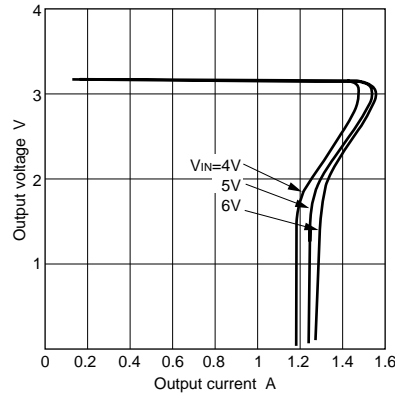
Line regulation



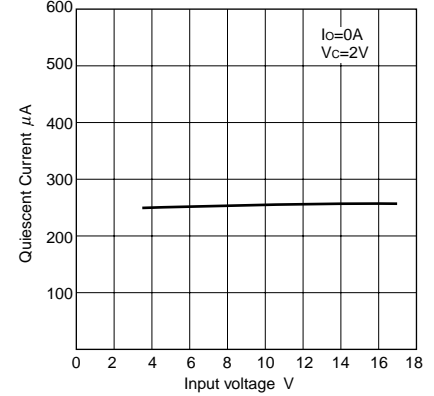
Load regulation



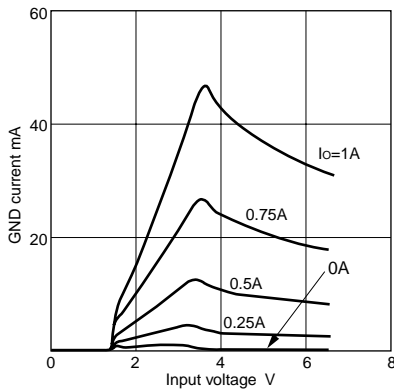
Overcurrent protection characteristics



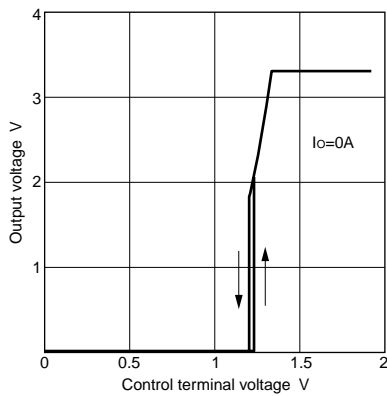
Input voltage vs. Quiescent current



Circuit current



Control terminal voltage vs. Output voltage



Control terminal voltage vs. Control terminal current

