# 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 Iq ≤ 350 μA ($I_O$ = 0 A, $V_C$ = 2 V)
- Low current consumption Iq (OFF) ≤ 1 μA ($V_C$ = 0 V)
- Low dropout voltage $V_{DIF}$ ≤ 0.6 V ($I_O$ = 1 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

## ■Applications

- Local power supplies
- Battery-driven electronic equipment

## ■Absolute Maximum Ratings

($T_a$=25°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 | °C |
| Storage Temperature | $T_{stg}$ | –40 to +125 | °C |
| Thermal Resistance (Junction to Ambient Air) | $\theta_{j\text{-}a}$* | 130 | °C/W |
| Thermal resistance (Junction to Lead (pin 7)) | $\theta_{j\text{-}l}$ | 22 | °C/W |

*1: $V_{IN}$ (max) and $I_O$ (max) are restricted by the relation PD = ($V_{IN}$ - $V_O$) × $I_O$. 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 $mm^2$ (copper laminate area 2%).

## ■Electrical Characteristics

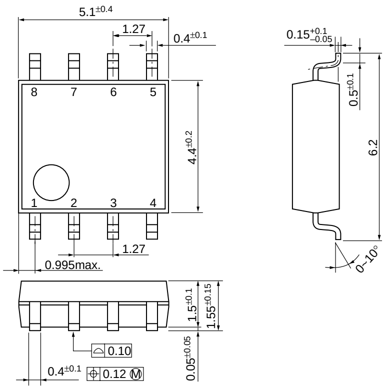
($T_a$=25°C, $V_c$=2 V unless otherwise specified)

| Parameter | | Symbol | SI-3012KS (variable type) min. | SI-3012KS typ. | SI-3012KS max. | SI-3025KS min. | SI-3025KS typ. | SI-3025KS max. | SI-3033KS min. | SI-3033KS typ. | SI-3033KS max. | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Input Voltage | | $V_{IN}$ | 2.4 | | | *1 | | | *1 | | | V |
| Output Voltage (Reference voltage $V_{ADJ}$ for SI-3012KS) | | $V_O$ ($V_{ADJ}$) | 1.24 | 1.28 | 1.32 | 2.45 | 2.50 | 2.55 | 3.234 | 3.300 | 3.366 | V |
| | | Conditions | $V_{IN}$=3.3V, $I_O$=10mA | | | $V_{IN}$=3.3V, $I_O$=10mA | | | $V_{IN}$=5V, $I_O$=10mA | | | |
| Dropout Voltage | | $V_{DIF}$ | | | 0.3 | | | 0.4 | | | 0.4 | V |
| | | Conditions | $I_O$=0.5A ($V_O$=2.5V) | | | $I_O$=0.5A | | | $I_O$=0.5A | | | |
| | | | | | 0.6 | | | 0.6 | | | 0.6 | |
| | | Conditions | $I_O$=1A ($V_O$=2.5V) | | | $I_O$=1A | | | $I_O$=1A | | | |
| Line Regulation | | $\Delta V_{OLINE}$ | | | 10 | | | 10 | | | 15 | mV |
| | | Conditions | $V_{IN}$=3.3 to 8V, $I_O$=10mA ($V_O$=2.5V) | | | $V_{IN}$=3.3 to 8V, $I_O$=10mA | | | $V_{IN}$=5 to 10V, $I_O$=10mA | | | |
| Load Regulation | | $\Delta V_{OLOAD}$ | | | 40 | | | 40 | | | 50 | mV |
| | | Conditions | $V_{IN}$=3.3V, $I_O$=0 to 1A ($V_O$=2.5V) | | | $V_{IN}$=3.3V, $I_O$=0 to 1A | | | $V_{IN}$=5V, $I_O$=0 to 1A | | | |
| Quiescent Circuit Current | | $I_q$ | | | 350 | | | 350 | | | 350 | μA |
| | | Conditions | $V_{IN}$=3.3V, $I_O$=0A, $V_C$=2V, R2=24kΩ | | | $V_{IN}$=3.3V, $I_O$=0A, $V_C$=2V | | | $V_{IN}$=5V, $I_O$=0A, $V_C$=2V | | | |
| Circuit Current at Output OFF | | $I_q$ (OFF) | | | 1 | | | 1 | | | 1 | μA |
| | | Conditions | $V_{IN}$=3.3V, $V_C$=0V | | | $V_{IN}$=3.3V, $V_C$=0V | | | $V_{IN}$=5V, $V_C$=0V | | | |
| Temperature Coefficient of Output Voltage | | $\Delta V_O/\Delta T_a$ | | ±0.3 | | | ±0.3 | | | ±0.3 | | mV/°C |
| | | Conditions | $T_j$=0 to 100°C ($V_O$=2.5V) | | | $T_j$=0 to 100°C | | | $T_j$=0 to 100°C | | | |
| Ripple Rejection | | $R_{REJ}$ | | 55 | | | 55 | | | 55 | | dB |
| | | Conditions | $V_{IN}$=3.3V, f=100 to 120Hz ($V_O$=2.5V) | | | $V_{IN}$=3.3V, f=100 to 120Hz | | | $V_{IN}$=5V, f=100 to 120Hz | | | |
| Overcurrent Protection Starting Current*2 | | $I_{S1}$ | 1.2 | | | 1.2 | | | 1.2 | | | A |
| | | Conditions | $V_{IN}$=3.3V ($V_O$=2.5V) | | | $V_{IN}$=3.3V | | | $V_{IN}$=5V | | | |
| $V_C$ 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 | V |
| | Control Current (Output ON) | $I_{C, IH}$ | | | 40 | | | 40 | | | 40 | μA |
| | | Conditions | $V_C$=2V | | | | | | | | | |
| | Control Current (Output OFF) | $I_{C, IL}$ | –5 | 0 | | –5 | 0 | | –5 | 0 | | μA |
| | | Conditions | $V_C$=0V | | | | | | | | | |

*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 $V_{IN}$ = $V_O$ + 1 V, and $I_O$ = 10 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)



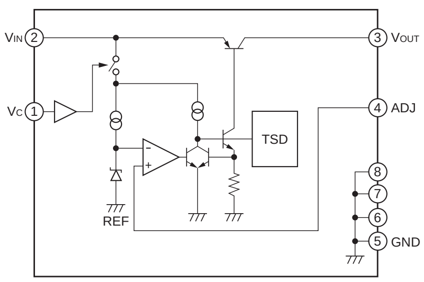

Pin Assignment

① $V_C$
② $V_{IN}$
③ $V_O$
④ Sence (ADJ for SI-3012KS)
⑤ GND
⑥ GND
⑦ GND
⑧ GND

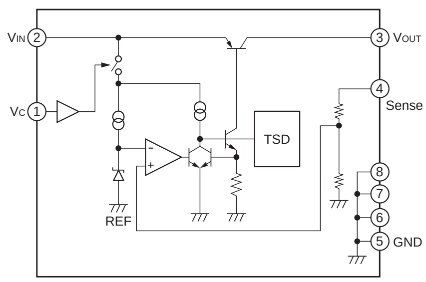
Plastic Mold Package Type
Flammability: UL 94V-0
Product Mass: Approx. 0.1 g

## ■Block Diagram

**●SI-3012KS**

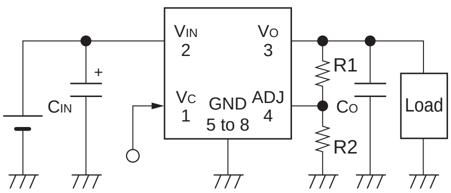



**●SI-3025KS, SI-3033KS**

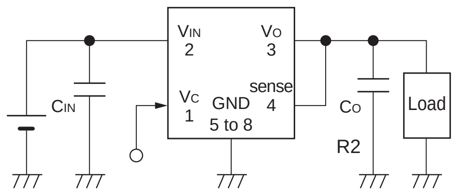



## ■Typical Connection Diagram

**●SI-3012KS**




**●SI-3025KS, SI-3033KS**



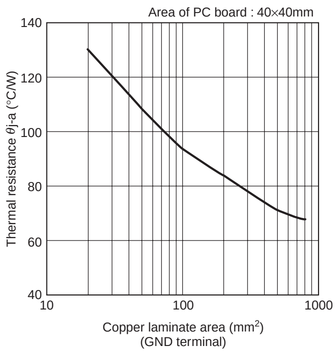

$R_1$, $R_2$: Output voltage setting resistors
The output voltage can be set by connecting $R_1$ and $R_2$ as shown above.
The recommended value of $R_2$ is 24 kΩ .

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

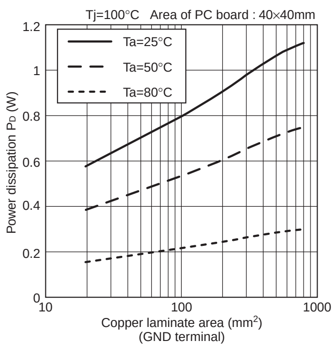
$C_{IN}$: Input capacitor (22 $\mu$F or larger)
$C_O$: Output capacitor (22 $\mu$F or larger)
For SI-3000KS series, Co has to be a low ESR capacitor.
When using the electrolytic capacitor, the SI-3000KS series may oscillate at a low temperature.

## ■Reference Data

**Copper Laminate Area vs. Thermal Resistance**



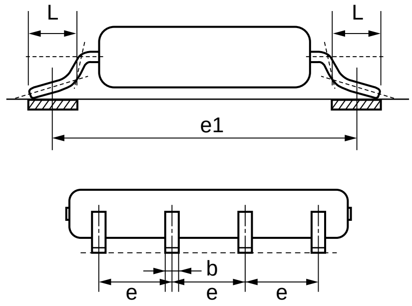

**Copper Laminate Area vs. Power Dissipation**

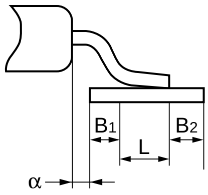


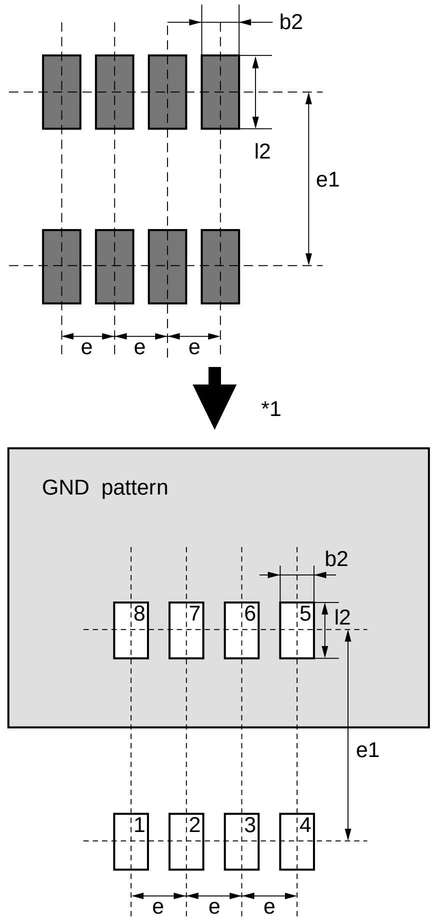

- Obtaining the junction temperature
  Measure the temperature $T_L$ at the lead part of the GND pin (pin 7) with a thermocouple, etc. Then, substitute this value in the following formula to obtain the junction temperature.

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

## ■Example of Solder Pattern Design



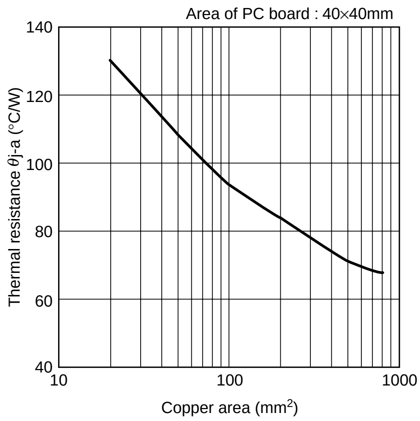

| Symbol | Dimensions (mm) |
|---|---|
| e1 | 5.72 |
| e | 1.27±0.15 |
| $\alpha$ | 0.2 |
| $\beta$1 | 0.2 to 0.5 |
| $\beta$2 | 0.2 |
| L | 0.6 |
| b2 | 0.76 |
| l2 | L+$\beta$1+$\beta$2 |

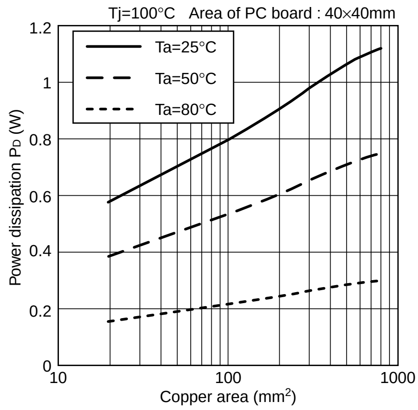
(Reference value conforming to EIAJ Standard ED-7402-1)

*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 TL 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.

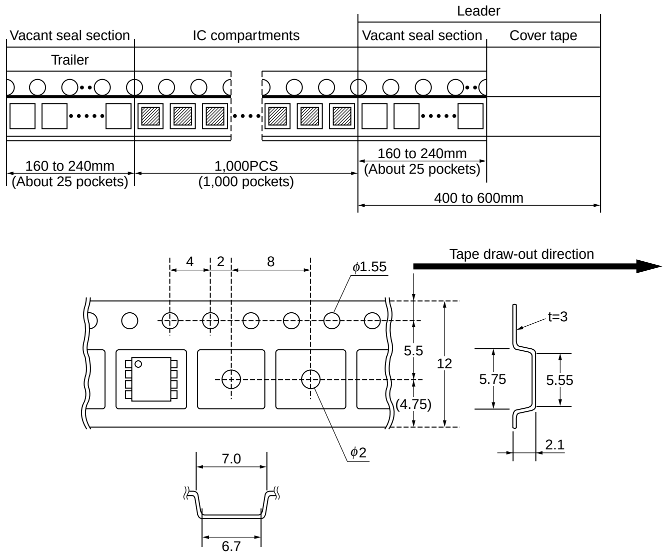
$$T_j = P_D \times \theta_{j-L} + T_L \qquad (\theta_{j-L} = 22^\circ C/W)$$

## ■Taping Specifications

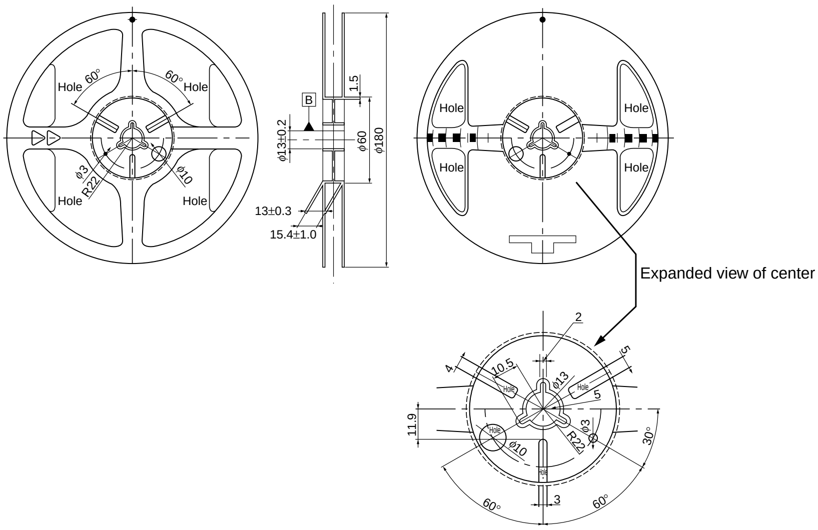
**Carrier tape**

**Surface resistance of embossed tape: 100 kΩ maximum (among 10 pockets)**

(Unit : mm)



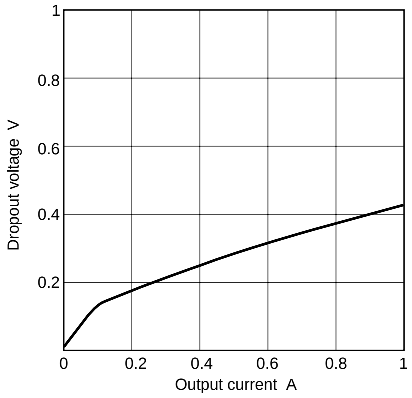

**Reel: Number of packed products: 1000**



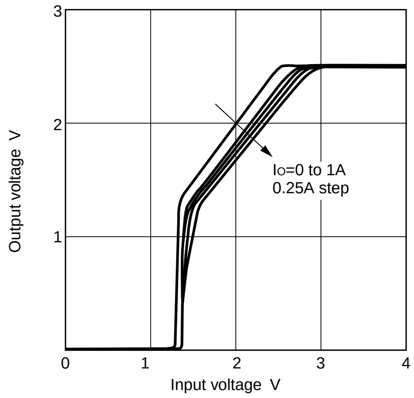
## ■Typical Characteristics Examples of SI-3012KS and SI-3025KS

($T_a$=25°C) *$V_{out}$=2.5 V for SI-3012KS (RS=24 kΩ)

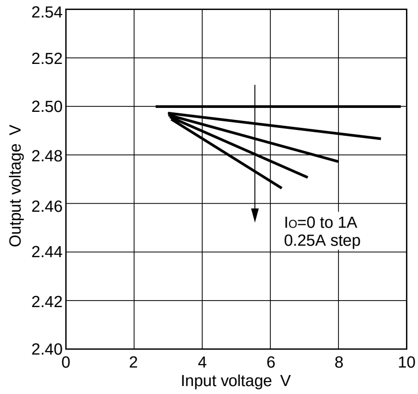
**Dropout voltage**



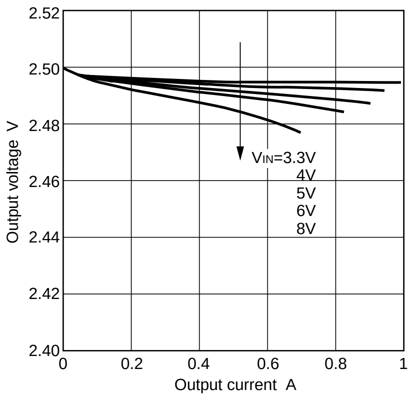

**Rise characteristics**



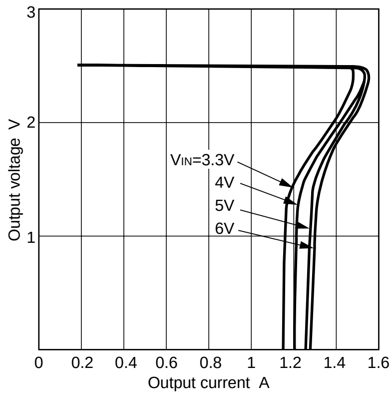

**Line regulation**



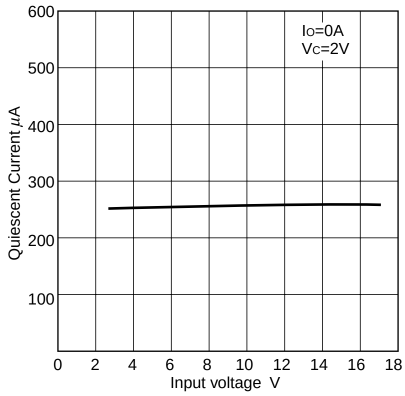

**Load regulation**



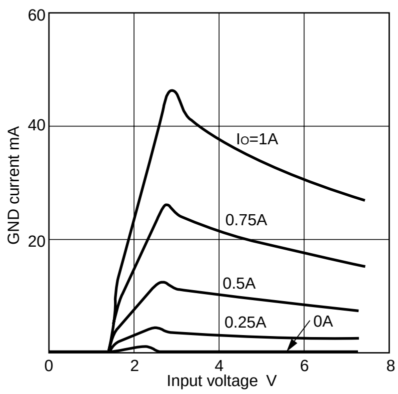

**Overcurrent protection characteristics**



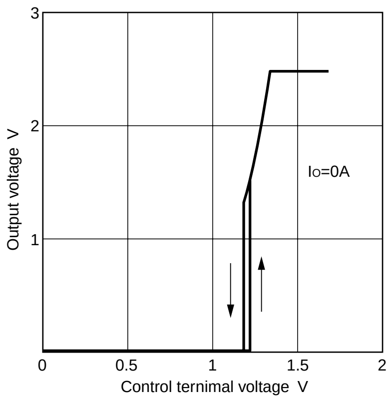

**Input voltage vs. Quiescent current**



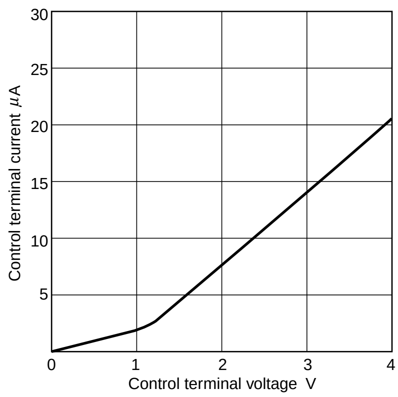

**Circuit current**




**Control terminal voltage vs. Output voltage**



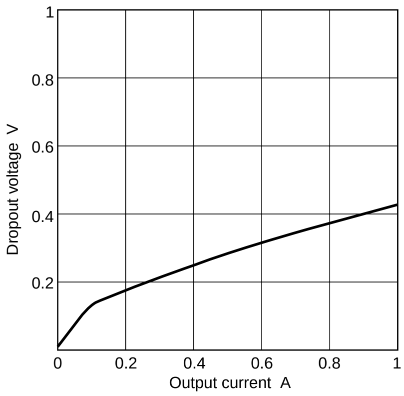

**Control terminal voltage vs. Control terminal current**



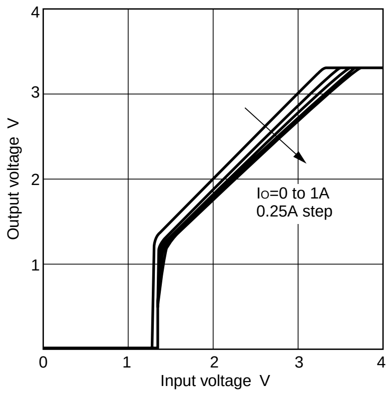
## ■Typical Characteristics Examples of SI-3033KS

(Ta=25°C)

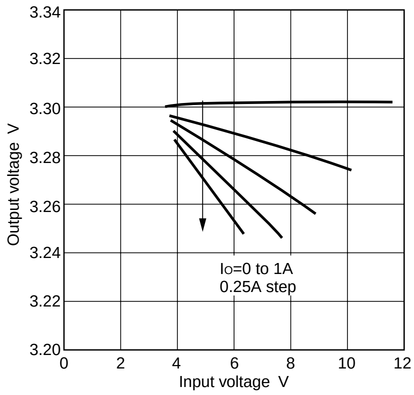
### Dropout voltage



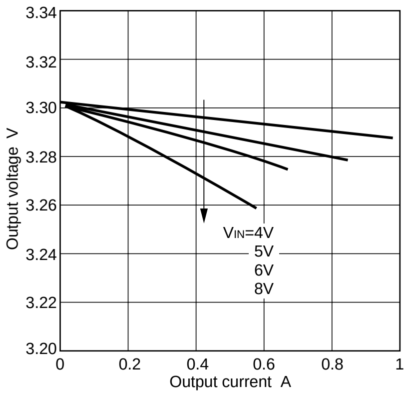

### Rise characteristics



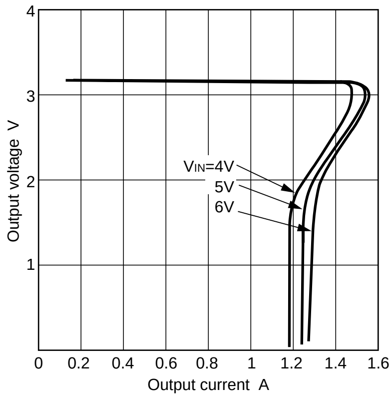

### Line regulation



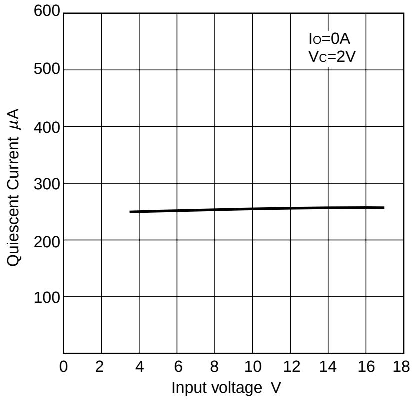

### Load regulation



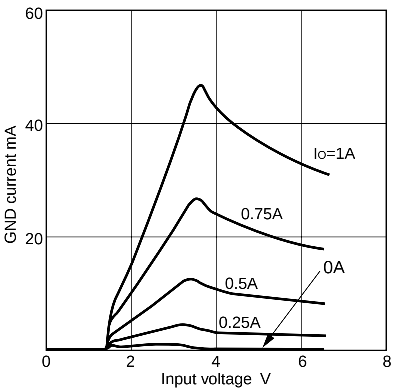

### Overcurrent protection characteristics



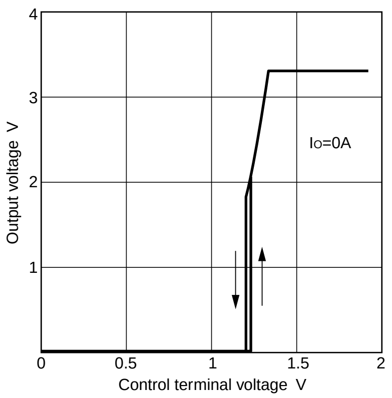

### Input voltage vs. Quiescent current




### Circuit current




### Control terminal voltage vs. Output voltage




### Control terminal voltage vs. Control terminal current