

SI-3000C Series

5-Terminal, Multi-Function, Full-Mold, Low Dropout Voltage Dropper Type

■Features

- Compact full-mold package (equivalent to TO220)
- Output current: 1.5A
- Low dropout voltage: $V_{DI} \leq 1V$ (at $I_o = 1.5A$)
- Variable output voltage (rise only)
May be used for remote sensing
- Output ON/OFF control terminal is compatible with LS-TTL. (It may be directly driven by LS-TTL or standard CMOS logic.)
- Built-in foldback overcurrent (SI-3033C: Drooping type overcurrent), overvoltage, thermal protection circuits



■Applications

- For stabilization of the secondary stage of switching power supplies
- Electronic equipment

■Absolute Maximum Ratings

(T_a=25°C)

| Parameter | Symbol | Ratings | | | | Unit |
|--|----------------------|---|----------------|----------------|----------|------|
| | | SI-3033C | SI-3050C/3090C | SI-3120C/3150C | SI-3240C | |
| DC Input Voltage | V _{IN} | 20 | 35 | 35 | 45 | V |
| Voltage of Output Control Terminal | V _c | V _{IN} | | | | V |
| DC Output Current | I _o | 1.5 ² | | | | A |
| Power Dissipation | P _{D1} | 18(With infinite heatsink) | | | | W |
| | P _{D2} | 1.5(Without heatsink, stand-alone operation) | | | | W |
| Junction Temperature | T _j | -40 to +125 | | | | °C |
| Ambient Operating Temperature | T _{op} | -30 to +100 | | | | °C |
| Storage Temperature | T _{stg} | -40 to +125 | | | | °C |
| Thermal Resistance (junction to case) | R _{th(j-c)} | 5.5 | | | | °C/W |
| Thermal Resistance (junction to ambient air) | R _{th(j-a)} | 66.7(Without heatsink, stand-alone operation) | | | | °C/W |

■Electrical Characteristics

(Ta=25°C unless otherwise specified)

| Parameter | Symbol | Ratings | | | | | | | | | Unit | |
|---|----------------------------------|--|----------------------|------------------|--|------|------------------|---|------|------------------|-------|----|
| | | SI-3033C | | | SI-3050C | | | SI-3090C | | | | |
| | | min. | typ. | max. | min. | typ. | max. | min. | typ. | max. | | |
| Input Voltage | V _{IN} | *3 | | 15 ^{*2} | 6 ^{*3} | | 30 ^{*2} | 10 ^{*3} | | 30 ^{*2} | V | |
| Output Voltage | SI-3000C ^{*1} | 3.168 | 3.300 | 3.432 | 4.80 | 5.00 | 5.20 | 8.64 | 9.00 | 9.36 | V | |
| | SI-3000CA | 3.234 | 3.300 | 3.366 | 4.90 | 5.00 | 5.10 | 8.82 | 9.00 | 9.18 | | |
| Dropout Voltage | Conditions | V _{IN} =5V, I _O =1.0A | | | V _{IN} =8V, I _O =1.0A | | | V _{IN} =12V, I _O =1.0A | | | V | |
| | V _{DIF} | | | 0.5 | | | 0.5 | | | 0.5 | | |
| | Conditions | I _O ≤1.0A | | | | | | | | | | |
| Line Regulation | Conditions | | | 1.0 | | | 1.0 | | | 1.0 | mV | |
| | Conditions | I _O ≤1.5A | | | | | | | | | | |
| Load Regulation | ΔV _{OLINE} | | 10 | 30 | | 10 | 30 | | 18 | 48 | mV | |
| | Conditions | V _{IN} =4.5 to 12V, I _O =1.0A | | | V _{IN} =6 to 15V, I _O =1.0A | | | V _{IN} =10 to 20V, I _O =1.0A | | | | |
| Temperature Coefficient of Output Voltage | ΔV _{OLOAD} | | 40 | 100 | | 40 | 100 | | 70 | 180 | mV | |
| | Conditions | V _{IN} =5V, I _O =0 to 1.5A | | | V _{IN} =8V, I _O =0 to 1.5A | | | V _{IN} =12V, I _O =0 to 1.5A | | | | |
| Ripple Rejection | ΔV _O /ΔT _a | | ±0.5 | | | ±0.5 | | | ±1.0 | | mV/°C | |
| | Conditions | V _{IN} =5V, I _O =5mA, T _J =0 to 100°C | | | V _{IN} =8V, I _O =5mA, T _J =0 to 100°C | | | V _{IN} =12V, I _O =5mA, T _J =0 to 100°C | | | | |
| Quiescent Circuit Current | R _{REJ} | | 54 | | | 54 | | | 54 | | dB | |
| | Conditions | V _{IN} =5V, f=100 to 120Hz | | | V _{IN} =8V, f=100 to 120Hz | | | V _{IN} =12V, f=100 to 120Hz | | | | |
| Overcurrent Protection Starting Current ^{*4,6} | I _q | | 3 | 10 | | 5 | 10 | | 5 | 10 | mA | |
| | Conditions | V _{IN} =5V, I _O =0A | | | V _{IN} =8V, I _O =0A | | | V _{IN} =12V, I _O =0A | | | | |
| V _c Terminal ^{*5} | I _{s1} | 1.6 | | | 1.6 | | | 1.6 | | | A | |
| | Conditions | V _{IN} =5V | | | V _{IN} =8V | | | V _{IN} =12V | | | | |
| Control Voltage (Output ON) | V _c IH | 2.0 | | | 2.0 | | | 2.0 | | | V | |
| | V _c IL | | | 0.8 | | | 0.8 | | | 0.8 | | |
| | Control Current (Output ON) | I _c IH | | | 20 | | | 20 | | | 20 | μA |
| | | Conditions | V _c =2.7V | | | | | | | | | |
| Control Current (Output OFF) | I _c IL | | | -0.3 | | | -0.3 | | | -0.3 | mA | |
| | Conditions | V _c =0.4V | | | | | | | | | | |

*1: "A" may be indicated to the right of the Sanken logo.

*2: V_{IN(max)} and I_{O(max)} are restricted by the relation P_{D(max)}=(V_{IN}-V_O)•I_O=18(W).

*3: Refer to the dropout voltage.(Refer to Setting DC Input Voltage on page 7.)

*4: I_{s1} is specified at -5(%) drop point of output voltage V_O on the condition that V_{IN}=V_O+3V, I_O=0.5A.

*5: Output is ON even when output control terminal V_c is open. Each input level is equivalent to LS-TTL. Therefore, it may be directly driven by an LS-TTL circuit.

*6: A foldback type overcurrent protection circuit is built into the I_c regulator (excluding SI-3033C). Therefore, avoid using it for the following applications as it may cause starting errors:

- (1) Constant current load (2) Plus/minus power (3) Series power (4) V_O adjustment by raising ground voltage

■Electrical Characteristics

(Ta=25°C unless otherwise specified)

| Parameter | Symbol | Ratings | | | | | | | | | Unit | |
|---|----------------------------------|---|----------------------|------------------|---|-------|------------------|---|-------|------------------|-------|----|
| | | SI-3120C | | | SI-3150C | | | SI-3240C | | | | |
| | | min. | typ. | max. | min. | typ. | max. | min. | typ. | max. | | |
| Input Voltage | V _{IN} | 13 ^{*3} | | 30 ^{*2} | 16 ^{*3} | | 30 ^{*2} | 25 ^{*3} | | 40 ^{*2} | V | |
| Output Voltage | SI-3000C ^{*1} | 11.52 | 12.00 | 12.48 | 14.40 | 15.00 | 15.60 | 23.04 | 24.00 | 24.96 | V | |
| | SI-3000CA | 11.76 | 12.00 | 12.24 | 14.70 | 15.00 | 15.30 | 23.52 | 24.00 | 24.48 | | |
| Dropout Voltage | Conditions | V _{IN} =15V, I _o =1.0A | | | V _{IN} =18V, I _o =1.0A | | | V _{IN} =27V, I _o =1.0A | | | V | |
| | V _{DIF} | | | 0.5 | | | 0.5 | | | 0.5 | | |
| | Conditions | I _o ≤1.0A | | | | | | | | | | |
| Line Regulation | ΔV _{LINE} | | 24 | 64 | | 30 | 90 | | 48 | 128 | mV | |
| | Conditions | V _{IN} =13 to 25V, I _o =1.0A | | | V _{IN} =16 to 25V, I _o =1.0A | | | V _{IN} =25 to 38V, I _o =1.0A | | | | |
| Load Regulation | ΔV _{LOAD} | | 93 | 240 | | 120 | 300 | | 120 | 300 | mV | |
| | Conditions | V _{IN} =15V, I _o =0 to 1.5A | | | V _{IN} =18V, I _o =0 to 1.5A | | | V _{IN} =27V, I _o =0 to 1.5A | | | | |
| Temperature Coefficient of Output Voltage | ΔV _o /ΔT _a | | ±1.5 | | | ±1.5 | | | ±2.5 | | mV/°C | |
| | Conditions | V _{IN} =15V, I _o =5mA, T _j =0 to 100°C | | | V _{IN} =18V, I _o =5mA, T _j =0 to 100°C | | | V _{IN} =27V, I _o =5mA, T _j =0 to 100°C | | | | |
| Ripple Rejection | R _{REJ} | | 54 | | | 54 | | | 54 | | dB | |
| | Conditions | V _{IN} =15V, f=100 to 120Hz | | | V _{IN} =18V, f=100 to 120Hz | | | V _{IN} =27V, f=100 to 120Hz | | | | |
| Quiescent Circuit Current | I _q | | 5 | 10 | | 5 | 10 | | 5 | 10 | mA | |
| | Conditions | V _{IN} =15V, I _o =0A | | | V _{IN} =18V, I _o =0A | | | V _{IN} =27V, I _o =0A | | | | |
| Overcurrent Protection Starting Current ^{*4,6} | I _{s1} | 1.6 | | | 1.6 | | | 1.6 | | | A | |
| | Conditions | V _{IN} =15V | | | V _{IN} =18V | | | V _{IN} =27V | | | | |
| V _c Terminal ^{*5} | Control Voltage (Output ON) | 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 | | | 20 | | | 20 | | | 20 | μA |
| | | Conditions | V _c =2.7V | | | | | | | | | |
| | Control Current (Output OFF) | I _c IL | | | -0.3 | | | -0.3 | | | -0.3 | mA |
| Conditions | | V _c =0.4V | | | | | | | | | | |

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*2: V_{IN(max)} and I_{O(max)} are restricted by the relation P_{D(max)}=(V_{IN}-V_O)•I_O=18(W).

*3: Refer to the dropout voltage.(Refer to Setting DC Input Voltage on page 7.)

*4: I_{s1} is specified at -5(%) drop point of output voltage V_O on the condition that V_{IN}=V_O+3V, I_o=0.5A.

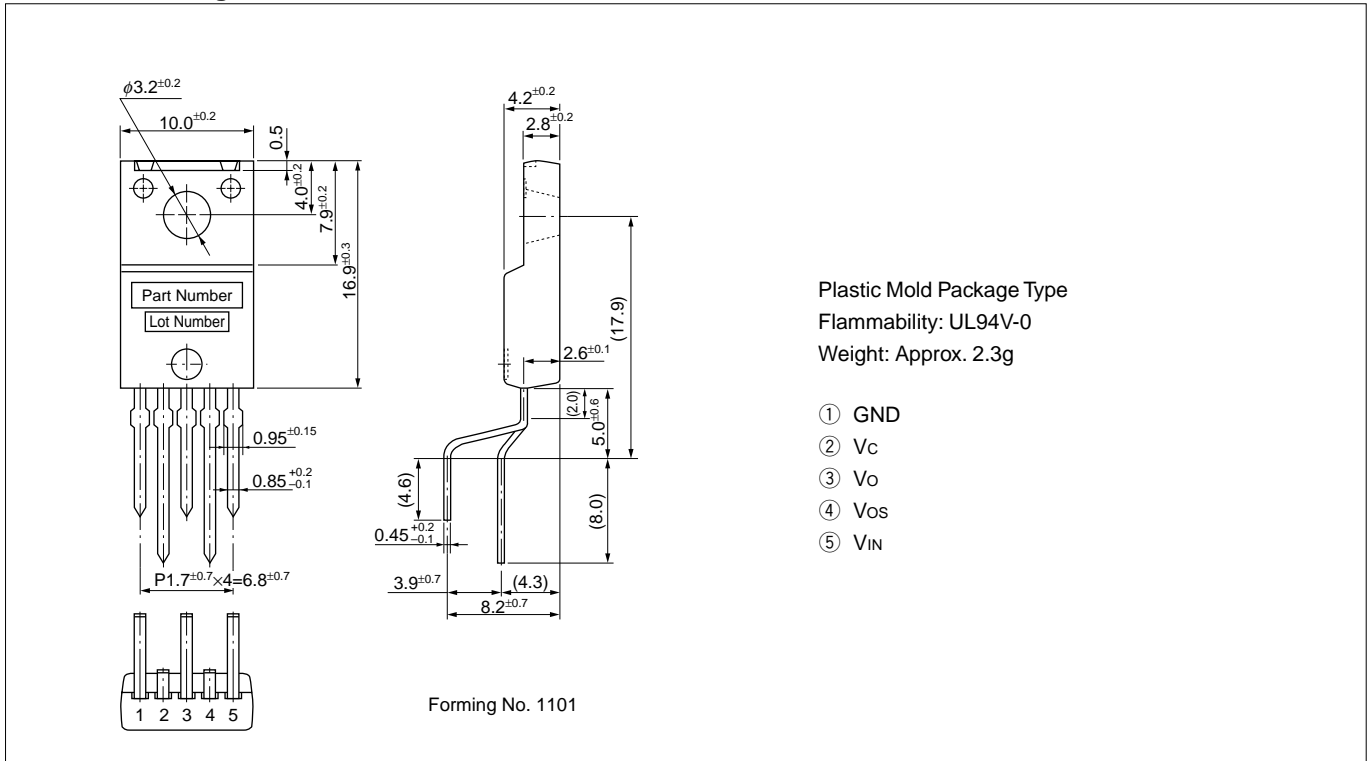
*5: Output is ON even when output control terminal V_c is open. Each input level is equivalent to LS-TTL. Therefore, it may be directly driven by an LS-TTL circuit.

*6: A foldback type overcurrent protection circuit is built into the I_c regulator (excluding SI-3033C). Therefore, avoid using it for the following applications as it may cause starting errors:

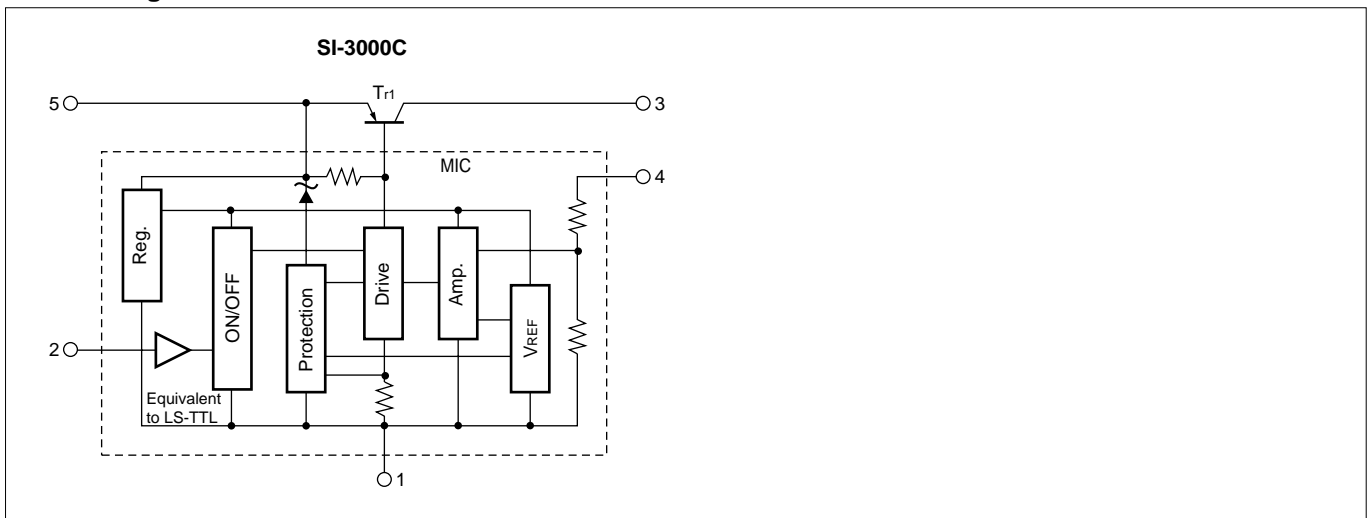
- (1) Constant current load (2) Plus/minus power (3) Series power (4) V_O adjustment by raising ground voltage

■Outline Drawing

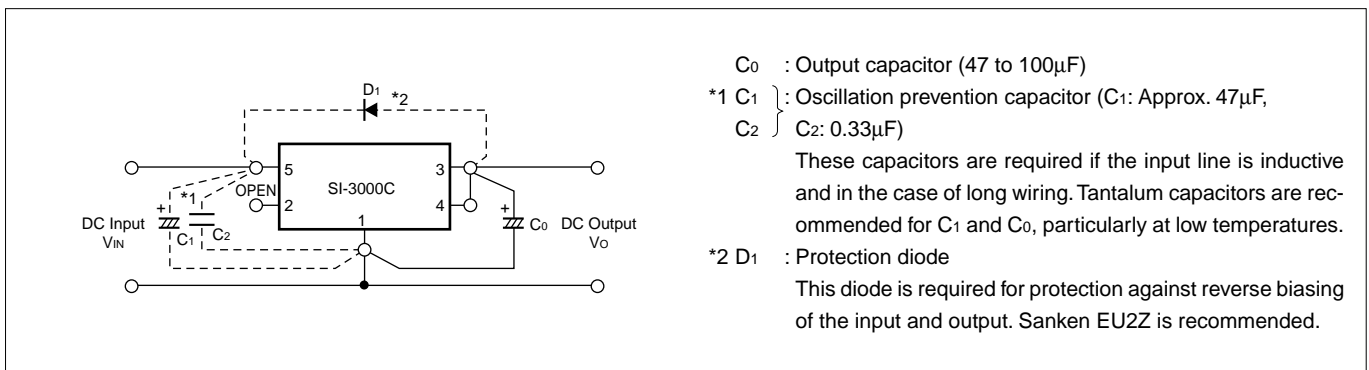
(unit:mm)

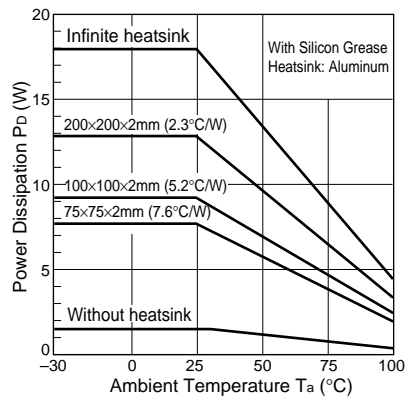


■Block Diagram



■Standard External Circuit

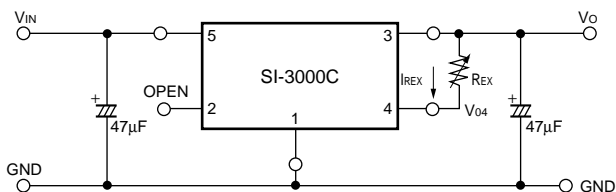


■ T_a - P_D Characteristics

$$P_D = I_O \cdot [V_{IN(\text{mean})} - V_O]$$

External Variable Output Voltage Circuit

1. Variable output voltage with a single external resistor

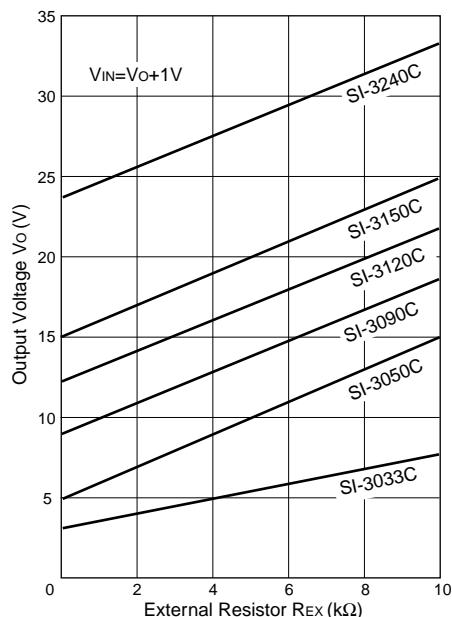


The output voltage may be increased by inserting resistor R_{EX} between terminals No.4 (sensing terminal) and No.3 (output terminal). The current I_{REX} flowing into terminal No.4 is 1mA (typ.)(SI-3033C:0.43mA (typ.)), therefore the adjusted output voltage V_{OUT} is:

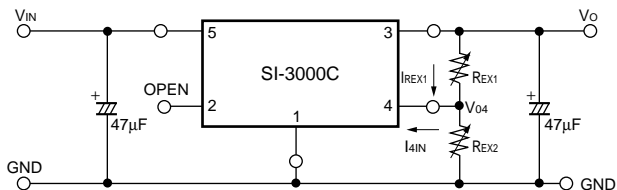
$$V_O = V_{04} + I_{REX} \cdot R_{EX} \quad *V_{04}: \text{output voltage of SI-3000C series}$$

However, the built-in resistor (between terminals No. 4 and No.1) is a semiconductor resistor, which has approximately thermal characteristics of +0.2%/°C.

It is important to keep the thermal characteristics in mind when adjusting the output voltage.



2. Variable output voltage with two external resistors



The output voltage may be increased by inserting resistors R_{EX1} between terminals No.4 (sensing terminal) and No.3 (output terminal) and R_{EX2} between terminals No.4 and No.1 (ground terminal).

The current I_{4IN} flowing into terminal No.4 is 1mA (typ.)(SI-3033C: 0.43mA(typ.)) so the thermal characteristics may be improved compared to the method shown in 1 by setting the external current I_{REX1} at approximately 5 times the value of I_{4IN} (stability coefficient $S=5$).

The adjusted output voltage V_{OUT} in this case is:

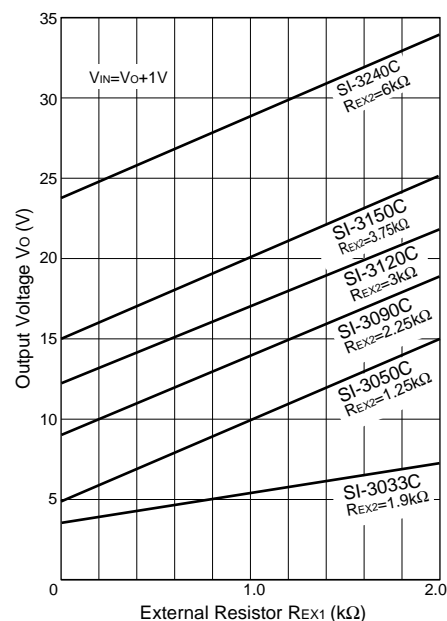
$$\begin{cases} V_O = V_{04} + R_{EX1} \cdot I_{REX1} \\ I_{REX1} = S \cdot I_{4IN} \end{cases}$$

The value of the external resistors may be obtained as follows:

$$R_{EX1} = \frac{V_O - V_{04}}{S \cdot I_{4IN}}, \quad R_{EX2} = \frac{V_{04}}{(S-1) \cdot I_{4IN}}$$

* V_{04} : Output voltage of SI-3000C series

S: Stability coefficient of I_{4IN} (may be set to any value)

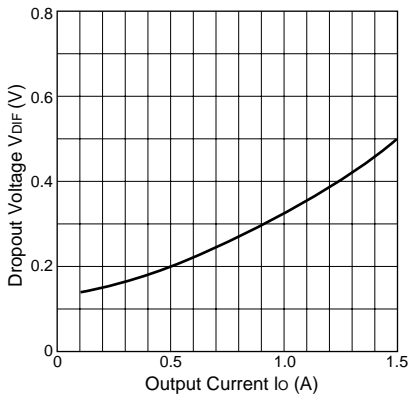


Note: In the SI-3000C series, the output voltage increase can be adjusted as mentioned above. However, when the rise is set to approximately 10V compared to output voltage V_{04} , the necessary output current may not be obtained due to the S.O.A. protection circuit in the SI-3000C series.

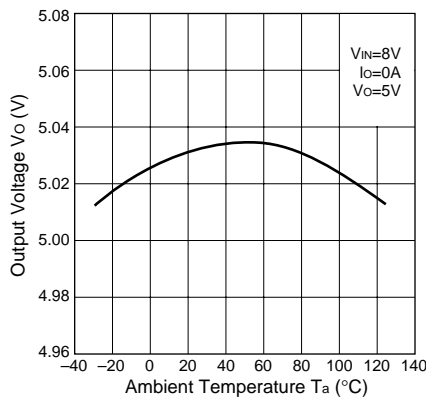
■Typical Characteristics

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

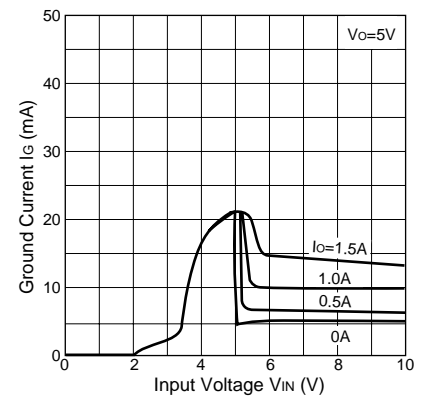
Io vs. VDIF Characteristics



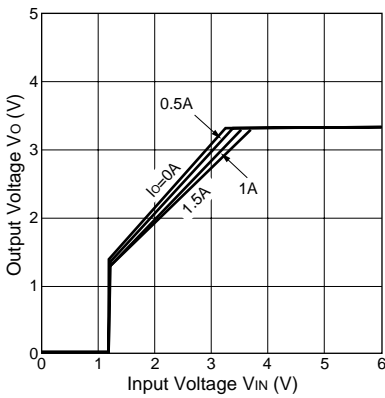
Temperature Coefficient of Output Voltage(SI-3050C)



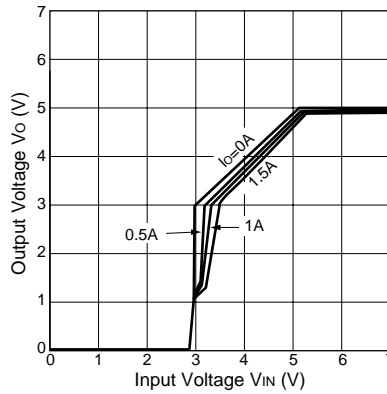
Circuit Current(SI-3050C)



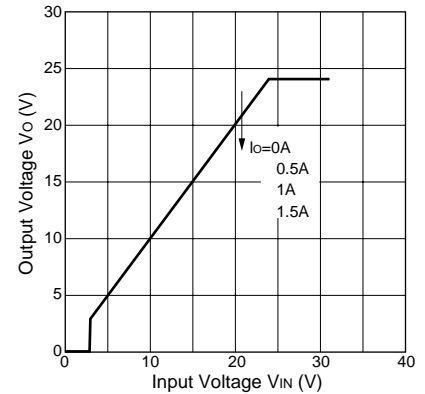
Rise Characteristics(SI-3033C)



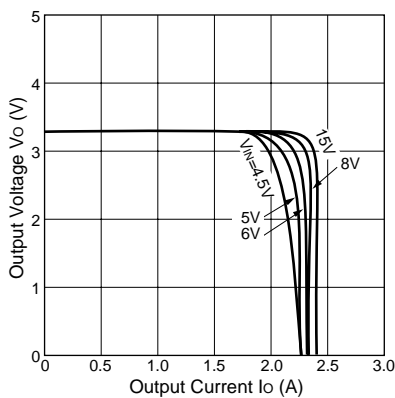
Rise Characteristics(SI-3050C)



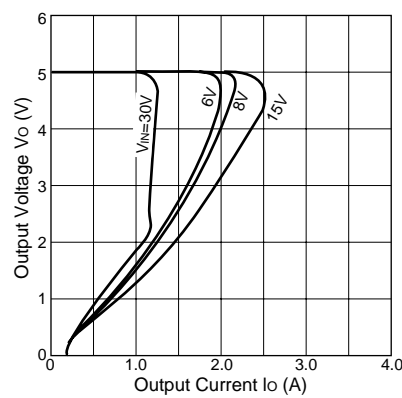
Rise Characteristics(SI-3240C)



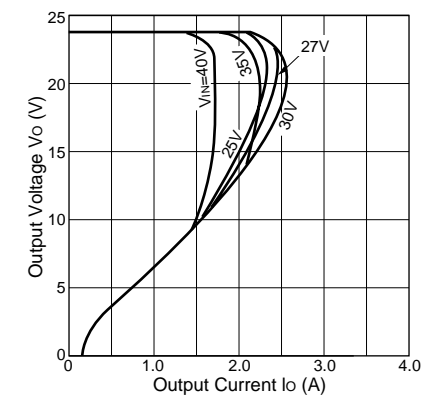
Overcurrent Protection Characteristics(SI-3033C)



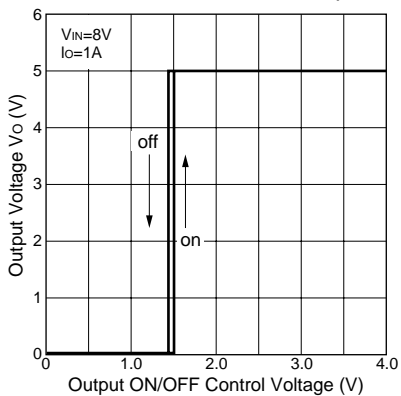
Overcurrent Protection Characteristics(SI-3050C)



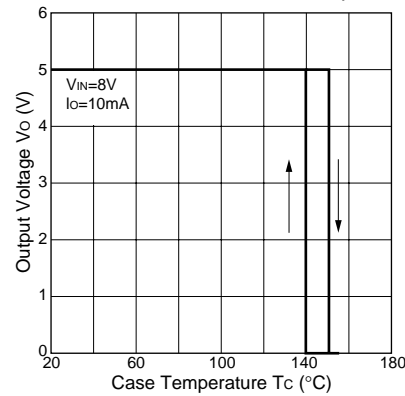
Overcurrent Protection Characteristics(SI-3240C)



ON/OFF Control Characteristics(SI-3050C)



Thermal Protection Characteristics(SI-3050C)



Note on Thermal Protection:

The thermal protection circuit is intended for protection against heat during instantaneous short-circuiting. Its operation is not guaranteed for short-circuiting over extended periods of time.