▧ *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: $V_{DIF} \leq 1V$ (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	V$_O$	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	
	Conditions		V$_{IN}$=5V, I$_O$=1.0A			V$_{IN}$=8V, I$_O$=1.0A			V$_{IN}$=12V, I$_O$=1.0A			
Dropout Voltage		V$_{DIF}$			0.5			0.5			0.5	V
	Conditions		I$_O$≤1.0A									
					1.0			1.0			1.0	
	Conditions		I$_O$≤1.5A									
Line 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			
Load Regulation		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			
Temperature Coefficient of Output Voltage		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			
Ripple Rejection		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			
Quiescent Circuit Current		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			
Overcurrent Protection Starting Current*4,6		I$_{S1}$	1.6			1.6			1.6			A
	Conditions		V$_{IN}$=5V			V$_{IN}$=8V			V$_{IN}$=12V			
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									

*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	SI-3120C			SI-3150C			SI-3240C			Unit
			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]	V_O	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	
	Conditions		V_{IN}=15V, I_O=1.0A			V_{IN}=18V, I_O=1.0A			V_{IN}=27V, I_O=1.0A			
Dropout Voltage		V_{DIF}			0.5			0.5			0.5	V
	Conditions		I_O≤1.0A									
					1.0			1.0			1.0	
	Conditions		I_O≤1.5A									
Line Regulation		ΔV_{OLINE}		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_{OLOAD}		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		$\Delta V_O/\Delta T_a$		±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									

*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 $P_{D(max)}=(V_{IN}-V_O)\cdot I_O=18(W)$.

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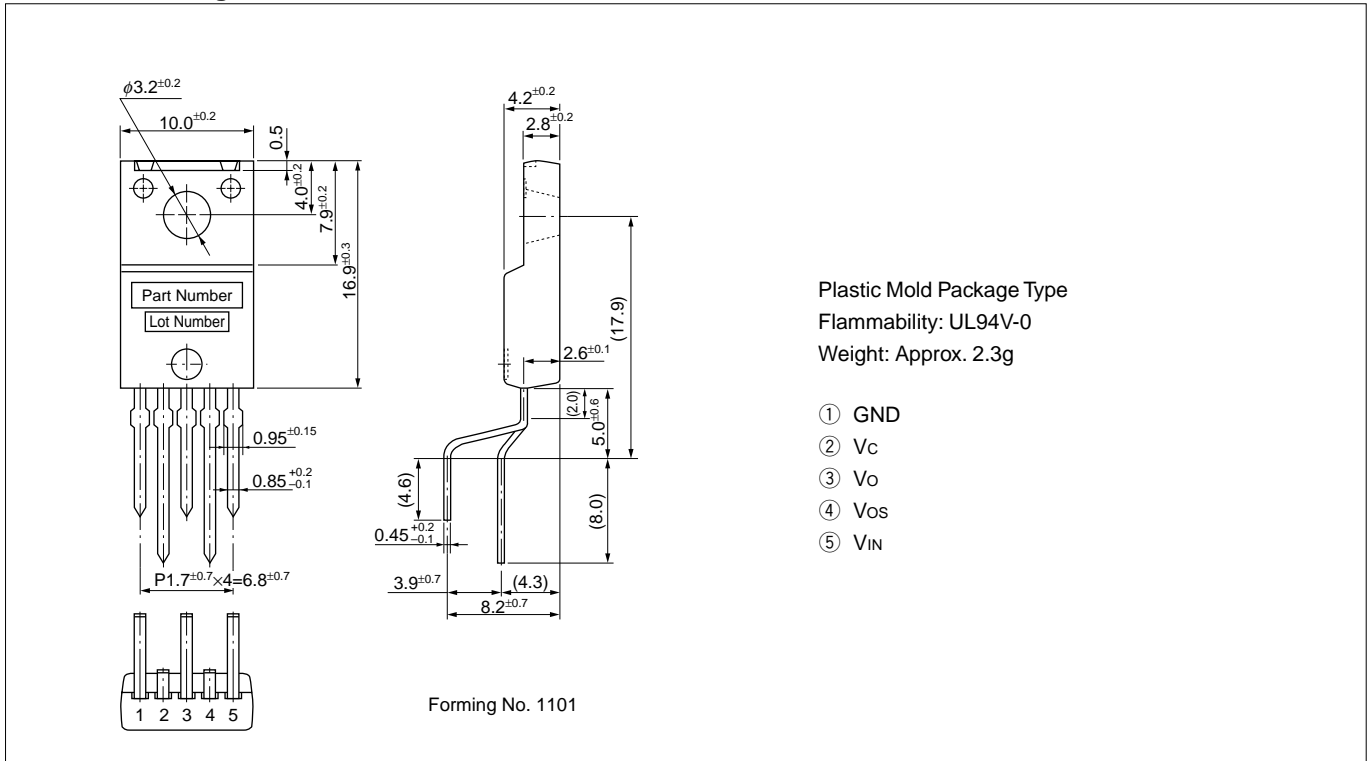
*5: Output is ON even when output control terminal V_C is open. Each input level is equivalent to LS-TTL. Therefore, it may be directly driven by an LS-TTL circuit.

*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:
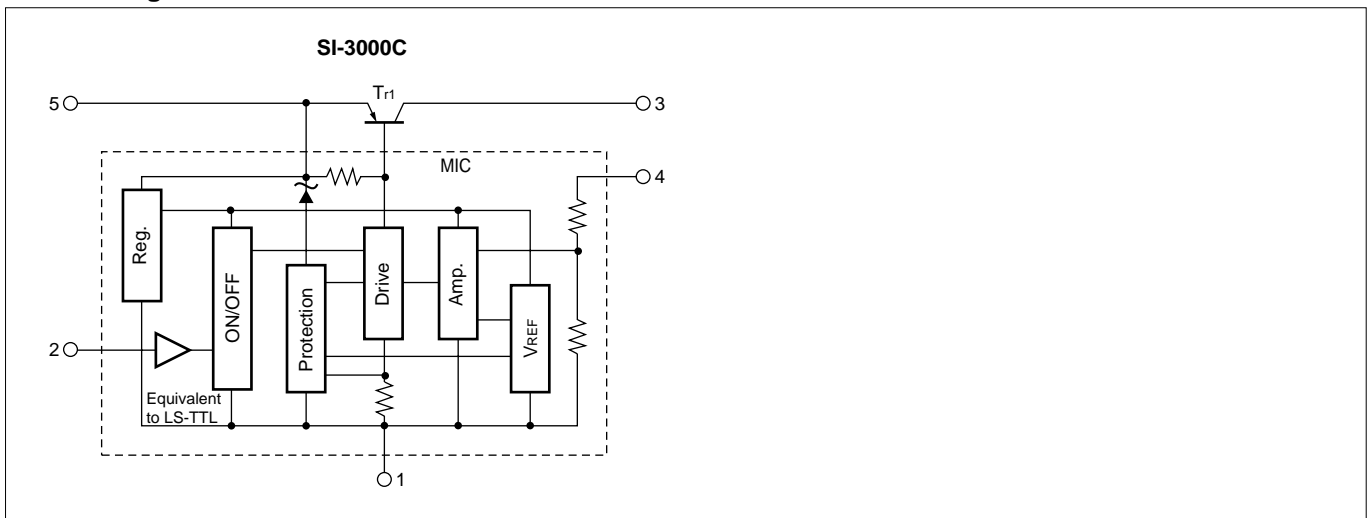
(1) Constant current load (2) Plus/minus power (3) Series power (4) V_O adjustment by raising ground voltage
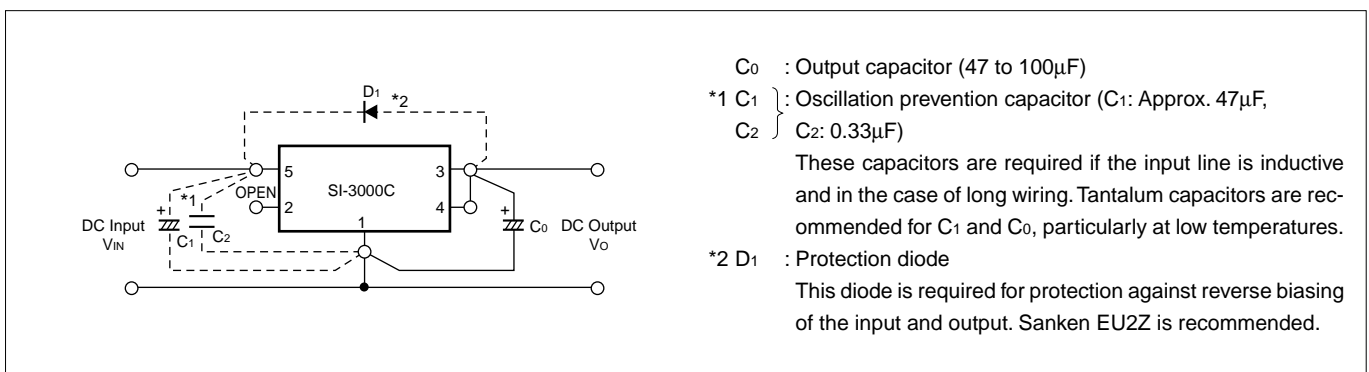
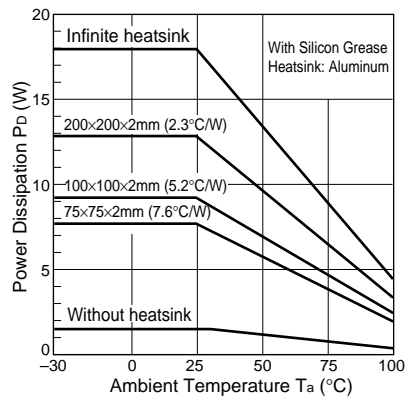## ■Outline Drawing

(unit:mm)

Plastic Mold Package Type
Flammability: UL94V-0
Weight: Approx. 2.3g

① GND
② V_C
③ V_O
④ V_{OS}
⑤ V_{IN}

Forming No. 1101

■Block Diagram

SI-3000C

■Standard External Circuit

C_0 : Output capacitor (47 to 100μF)

*1 C_1 C_2 : Oscillation prevention capacitor (C_1: Approx. 47μF, C_2: 0.33μF)

These capacitors are required if the input line is inductive and in the case of long wiring. Tantalum capacitors are recommended for C_1 and C_0, particularly at low temperatures.

*2 D_1 : Protection diode

This diode is required for protection against reverse biasing of the input and output. Sanken EU2Z is recommended.

■T_a-P_D Characteristics

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

External Variable Output Voltage Circuit

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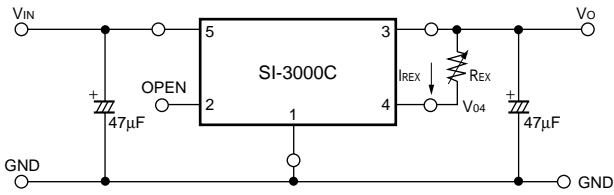
The output voltage may be increased by inserting resistor R_{EX} between terminals No.4 (sensing terminal) and No.3 (output terminal). The current I_{REX} flowing into terminal No.4 is 1mA (typ.)(SI-3033C:0.43mA (typ.)), therefore the adjusted output voltage V_{OUT} is:

$$V_O=V_{04}+I_{REX} \cdot R_{EX}$$ *V_{04}: 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.
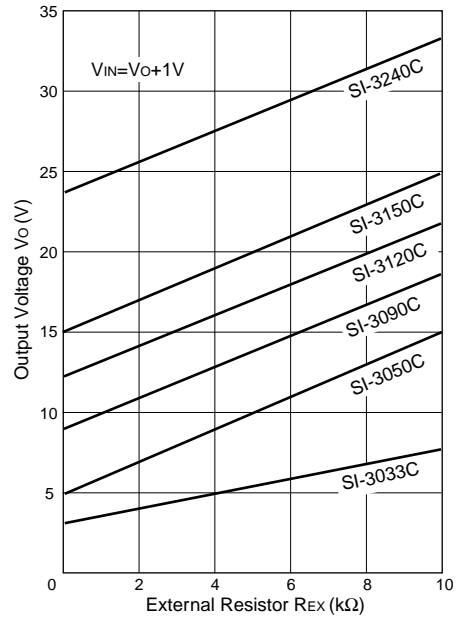
2. Variable output voltage with two external resistors
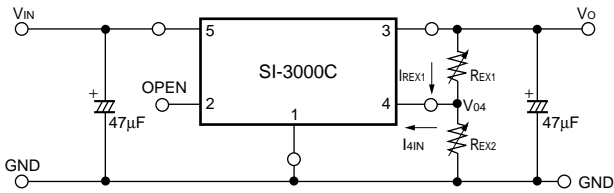
The output voltage may be increased by inserting resistors R_{EX1} between terminals No.4 (sensing terminal) and No.3 (output terminal) and R_{EX2} between terminals No.4 and No.1 (ground terminal).

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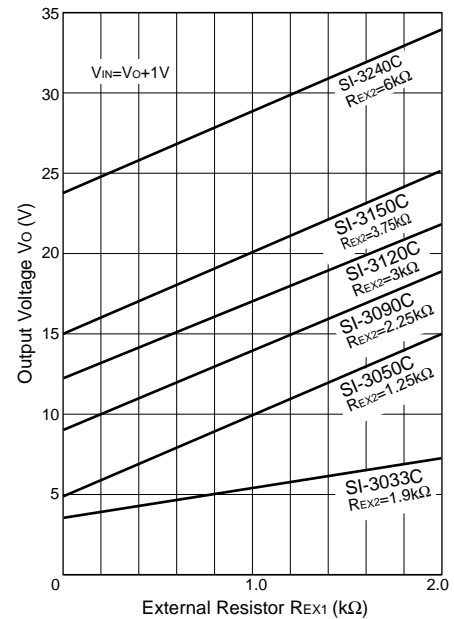
Note: In the SI-3000C series, the output voltage increase can be adjusted as mentioned above. However, when the rise is set to approximately 10V compared to output voltage V_{04}, the necessary output current may not be obtained due to the S.O.A. protection circuit in the SI-3000C series.
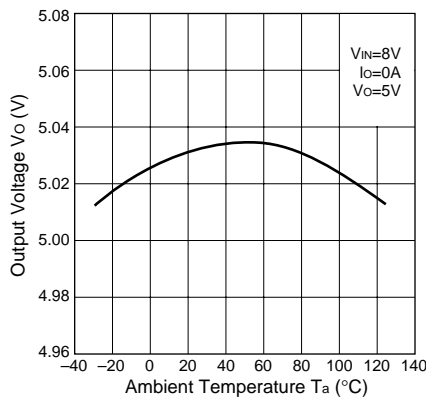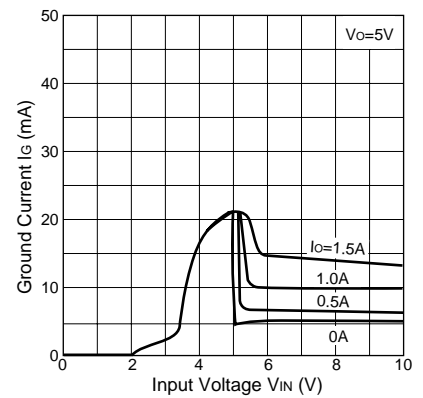
■Typical Characteristics

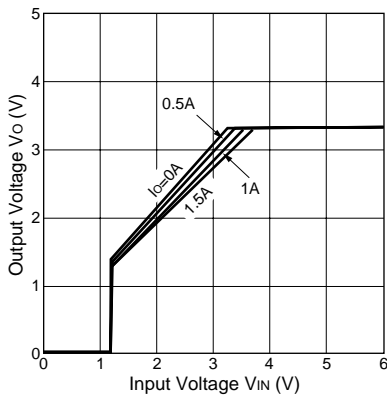(T_a=25°C)

Io vs. VDIF Characteristics
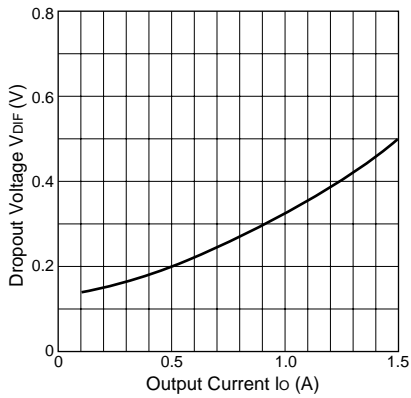
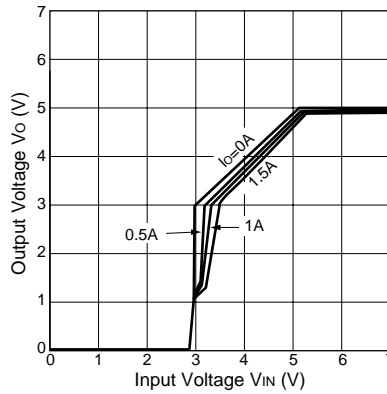**Temperature Coefficient of Output Voltage(SI-3050C)**
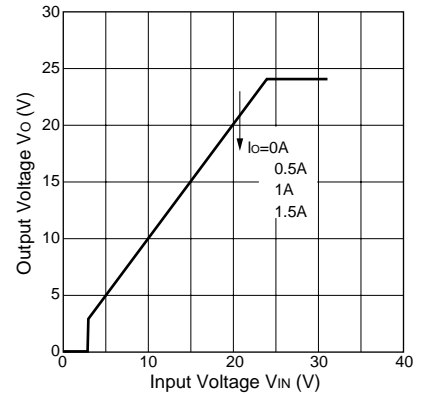

Circuit Current(SI-3050C)

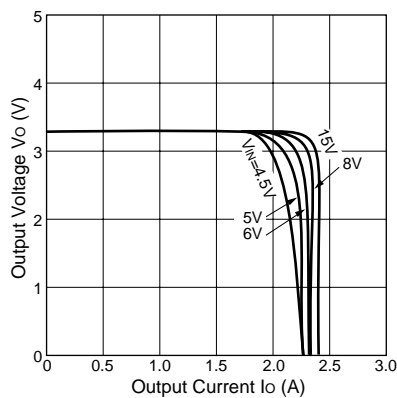**Rise Characteristics(SI-3033C)**

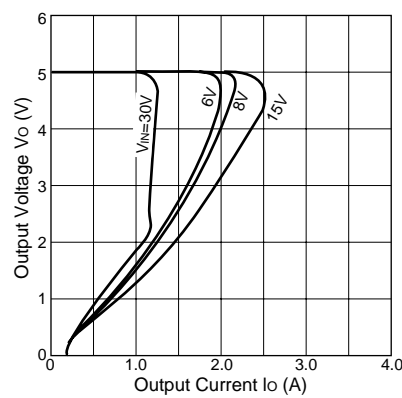**Rise Characteristics(SI-3050C)**
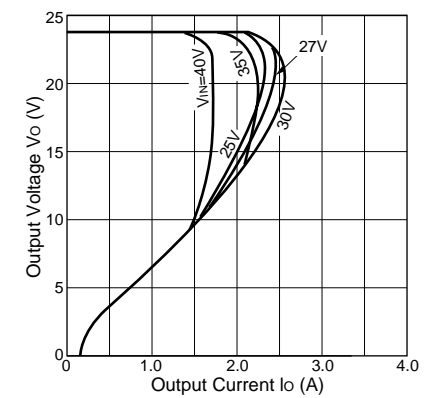

Rise Characteristics(SI-3240C)

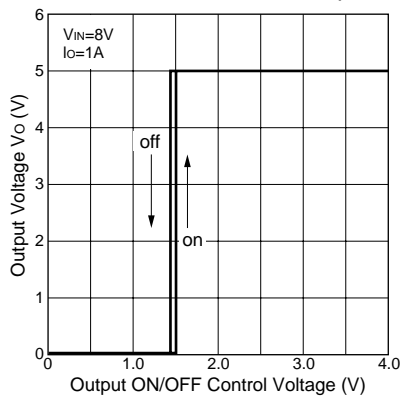**Overcurrent Protection Characteristics(SI-3033C)**

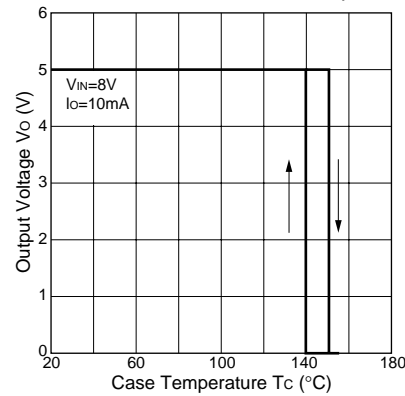**Overcurrent ProtectionCharacteristics(SI-3050C)**

Overcurrent Protection Characteristics(SI-3240C)

ON/OFF Control Characteristics(SI-3050C)

Thermal ProtectionCharacteristics(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.

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