

## SI-3000J Series

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

### ■Features

- Compact full-mold package (equivalent to TO220)
- Output current: 2.0A
- Low dropout voltage:  $V_{DIF} \leq 1V$  (at  $I_o = 2.0A$ )
- 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, overvoltage, thermal protection circuits

### ■Applications

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



### ■Absolute Maximum Ratings

( $T_a = 25^\circ C$ )

Parameter	Symbol	Ratings			Unit
		SI-3050J	SI-3090J	SI-3120J/3150J	
DC Input Voltage	$V_{IN}$	25	30	35	V
Voltage of Output Control Terminal	$V_c$	$V_{IN}$			V
DC Output Current	$I_o$	$2.0^{*1}$			A
Power Dissipation	$P_{D1}$	20(With infinite heatsink)			W
	$P_{D2}$	1.5(Without heatsink, stand-alone operation)			W
Junction Temperature	$T_j$	-40 to +125			$^\circ C$
Ambient Operating Temperature	$T_{op}$	-30 to +100			$^\circ C$
Storage Temperature	$T_{stg}$	-40 to +125			$^\circ C$
Thermal Resistance (junction to case)	$R_{th(j-c)}$	5.0			$^\circ C/W$
Thermal Resistance (junction to ambient air)	$R_{th(j-a)}$	66.7(Without heatsink, stand-alone operation)			$^\circ C/W$

■Electrical Characteristics

(Ta=25°C unless otherwise specified)

Parameter	Symbol	Ratings												Unit	
		SI-3050J			SI-3090J			SI-3120J			SI-3150J				
		min.	typ.	max.	min.	typ.	max.	min.	typ.	max.	min.	typ.	max.		
Input Voltage	V <sub>IN</sub>	6 <sup>2</sup>		15 <sup>1</sup>	10 <sup>2</sup>		25 <sup>1</sup>	13 <sup>2</sup>		27 <sup>1</sup>	16 <sup>2</sup>		27 <sup>1</sup>	V	
Output Voltage	V <sub>O</sub>	4.90	5.00	5.10	8.82	9.00	9.18	11.76	12.00	12.24	14.70	15.00	15.30	V	
	Conditions	V <sub>IN</sub> =8V, I <sub>O</sub> =1.0A			V <sub>IN</sub> =12V, I <sub>O</sub> =1.0A			V <sub>IN</sub> =15V, I <sub>O</sub> =1.0A			V <sub>IN</sub> =18V, I <sub>O</sub> =1.0A				
Dropout Voltage	V <sub>DIF</sub>			0.5			0.5			0.5			0.5	V	
	Conditions	I <sub>O</sub> ≤1.5A													
	Conditions			1.0			1.0			1.0			1.0		
Line Regulation	ΔV <sub>OLINE</sub>		10	30		18	48		24	64		30	90	mV	
	Conditions	V <sub>IN</sub> =6 to 15V, I <sub>O</sub> =1.0A			V <sub>IN</sub> =10 to 20V, I <sub>O</sub> =1.0A			V <sub>IN</sub> =13 to 25V, I <sub>O</sub> =1.0A			V <sub>IN</sub> =16 to 25V, I <sub>O</sub> =1.0A				
Load Regulation	ΔV <sub>OLOAD</sub>		40	100		70	180		93	240		120	300	mV	
	Conditions	V <sub>IN</sub> =8V, I <sub>O</sub> =0 to 2.0A			V <sub>IN</sub> =12V, I <sub>O</sub> =0 to 2.0A			V <sub>IN</sub> =15V, I <sub>O</sub> =0 to 2.0A			V <sub>IN</sub> =18V, I <sub>O</sub> =0 to 2.0A				
Temperature Coefficient of Output Voltage	ΔV <sub>O</sub> /ΔT <sub>a</sub>		±0.5			±1.0			±1.5			±1.5		mV/°C	
	Conditions	V <sub>IN</sub> =8V, I <sub>O</sub> =5mA, T <sub>J</sub> =0 to 100°C			V <sub>IN</sub> =12V, I <sub>O</sub> =5mA, T <sub>J</sub> =0 to 100°C			V <sub>IN</sub> =15V, I <sub>O</sub> =5mA, T <sub>J</sub> =0 to 100°C			V <sub>IN</sub> =18V, I <sub>O</sub> =5mA, T <sub>J</sub> =0 to 100°C				
Ripple Rejection	R <sub>REJ</sub>		54			54			54			54		dB	
	Conditions	V <sub>IN</sub> =8V, f=100 to 120Hz			V <sub>IN</sub> =12V, f=100 to 120Hz			V <sub>IN</sub> =15V, f=100 to 120Hz			V <sub>IN</sub> =18V, f=100 to 120Hz				
Quiescent Circuit Current	I <sub>q</sub>		3	10		3	10		3	10		3	10	mA	
	Conditions	V <sub>IN</sub> =8V, I <sub>O</sub> =0A													
	I <sub>q</sub> (off)		0.5	1.0		0.5	1.0		0.5	1.0		0.5	1.0	mA	
Conditions	V <sub>IN</sub> =8V, I <sub>O</sub> =0A, V <sub>C</sub> =0.4V														
Overcurrent Protection Starting Current <sup>*3,5</sup>	I <sub>S1</sub>	2.1			2.1			2.1			2.1			A	
	Conditions	V <sub>IN</sub> =8V			V <sub>IN</sub> =12V			V <sub>IN</sub> =15V			V <sub>IN</sub> =18V				
V <sub>C</sub> Terminal <sup>*4</sup>	Control Voltage (Output ON)	V <sub>C</sub> IH	2.0			2.0			2.0			2.0		V	
	Control Voltage (Output OFF)	V <sub>C</sub> IL			0.8			0.8			0.8		0.8		
	Control Current (Output ON)	I <sub>C</sub> IH			20			20			20			20	μA
		Conditions	V <sub>C</sub> =2.7V												
	Control Current (Output OFF)	I <sub>C</sub> IL			-0.3			-0.3			-0.3			-0.3	mA
Conditions		V <sub>C</sub> =0.4V													

\*1: V<sub>IN(max)</sub> and I<sub>O(max)</sub> are restricted by the relation P<sub>D(max)</sub>=(V<sub>IN</sub>-V<sub>O</sub>)•I<sub>O</sub>=20(W).

\*2: Refer to the dropout voltage.(Refer to Setting DC Input Voltage on page 7.)

\*3: I<sub>S1</sub> is specified at -5(%) drop point of output voltage V<sub>O</sub> on the condition that V<sub>IN</sub>=V<sub>O</sub>+3V, I<sub>O</sub>=0.5A.

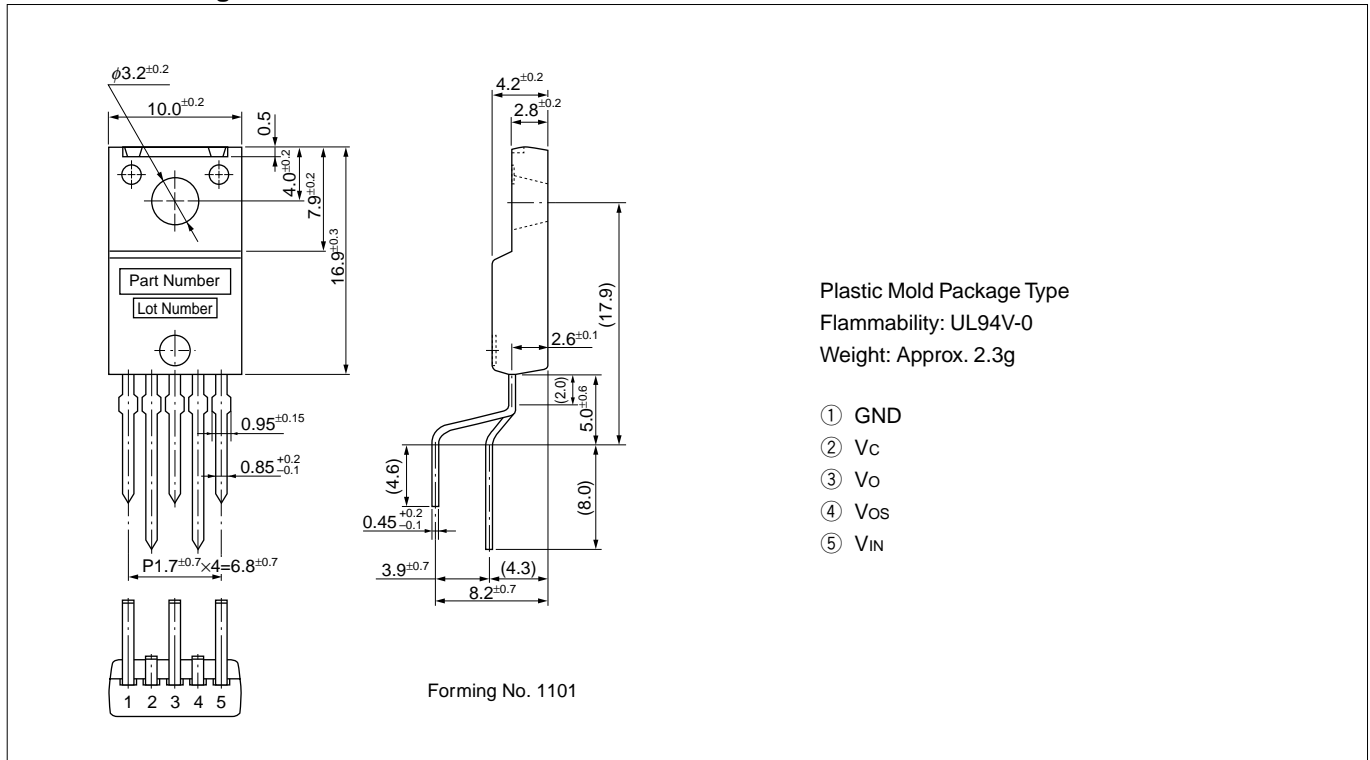
\*4: Output is ON even when output control terminal V<sub>C</sub> is open. Each input level is equivalent to LS-TTL. Therefore, it may be directly driven by an LS-TTL circuit.

\*5: A foldback type overcurrent protection circuit is built into the I<sub>C</sub> regulator. Therefore, avoid using it for the following applications as it may cause starting errors:

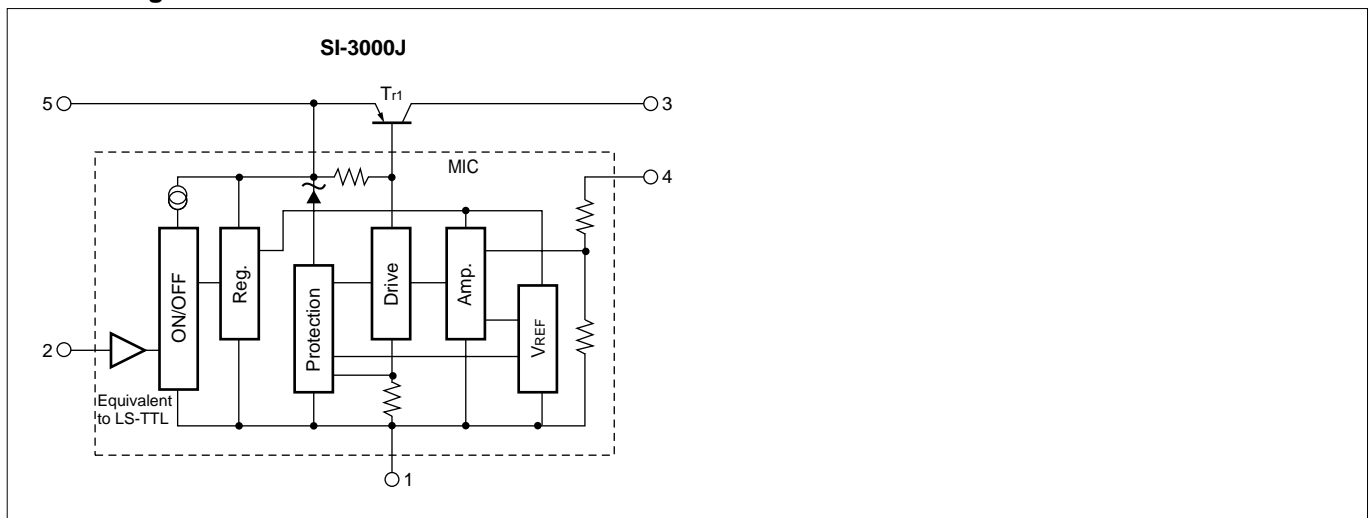
- (1) Constant current load (2) Plus/minus power (3) Series power (4) V<sub>O</sub> adjustment by raising ground voltage

(unit:mm)

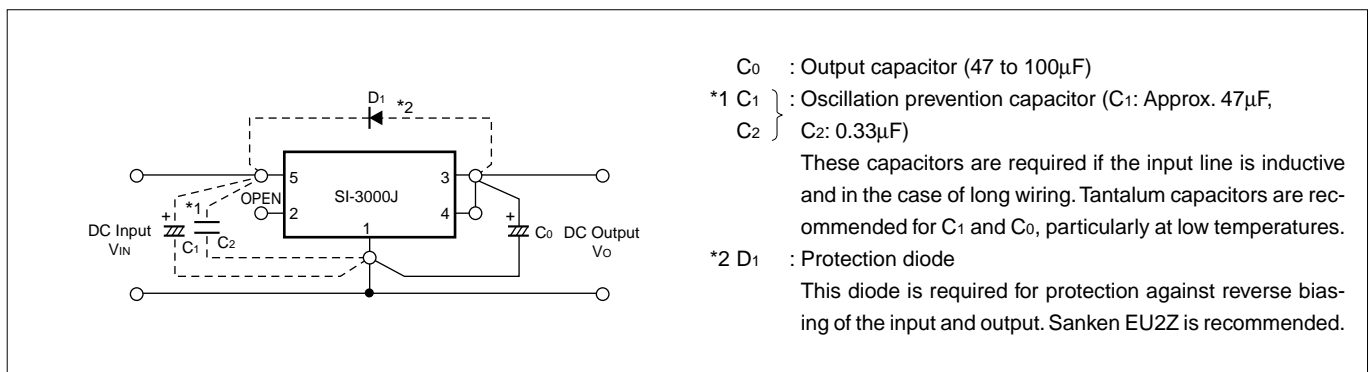
■Outline Drawing



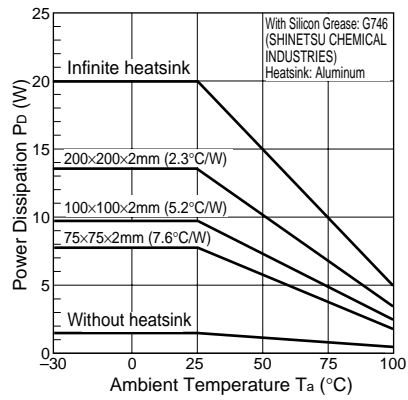
■Block Diagram



■Standard External Circuit



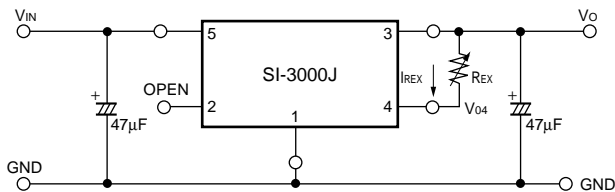
## ■ $T_a$ - $P_D$ Characteristics



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

## External Variable Output Voltage Circuit

### 1. Variable output voltage with a single external resistor

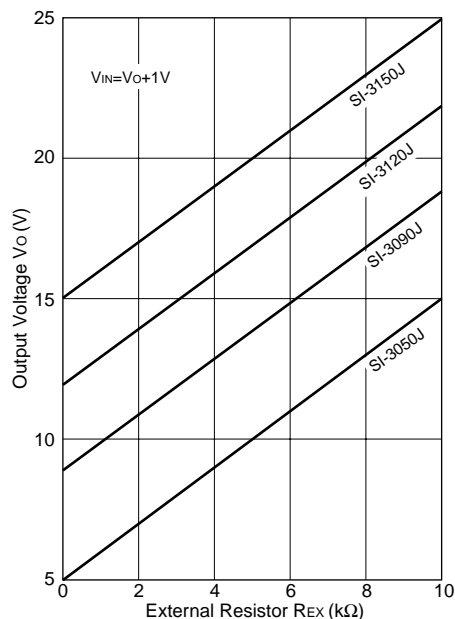


The output voltage may be increased by inserting resistor  $R_{EX}$  between terminals No.4 (sensing terminal) and No.3 (output terminal). The current  $I_{REX}$  flowing into terminal No.4 is 1mA (typ.), therefore the adjusted output voltage  $V_{OUT}$  is:

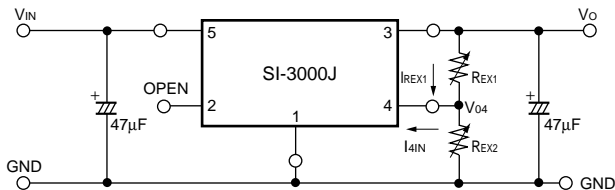
$$V_O = V_{04} + I_{REX} \cdot R_{EX} \quad *V_{04}: \text{output voltage of SI-3000J series}$$

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.) 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:

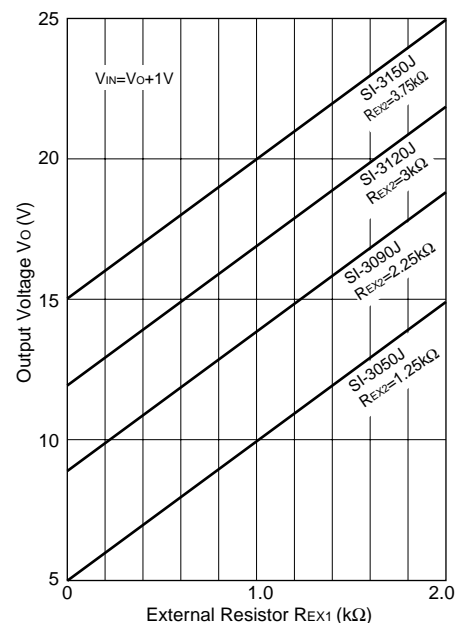
$$\begin{cases} V_O = V_{04} + R_{EX1} \cdot I_{REX1} \\ I_{REX1} = S \cdot I_{4IN} \end{cases}$$

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-3000J series

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

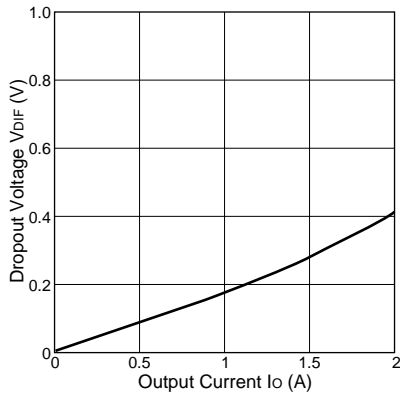


Note: In the SI-3000J series, the output voltage increase can be adjusted as mentioned above. However, when the rise is set to approximately 10V compared to output voltage  $V_{04}$ , the necessary output current may not be obtained due to the S.O.A. protection circuit in the SI-3000J series.

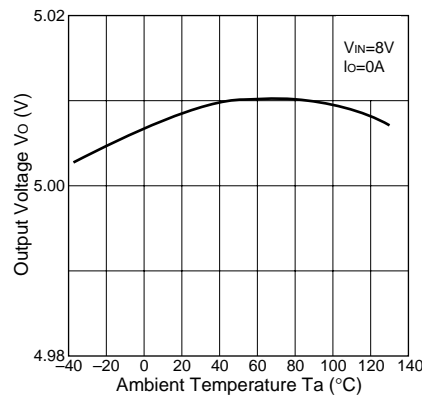
■Typical Characteristics

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

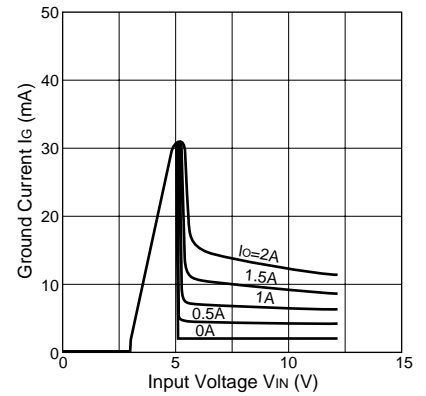
Io vs. VdIF Characteristics



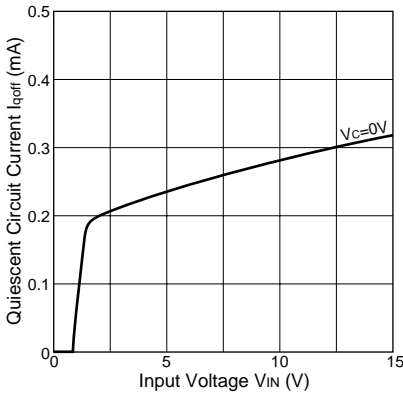
Temperature Coefficient of Output Voltage(SI-3050J)



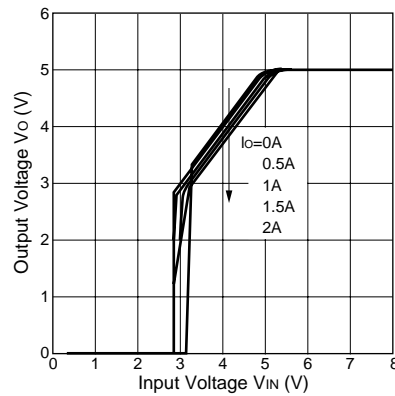
Circuit Current(SI-3050J)



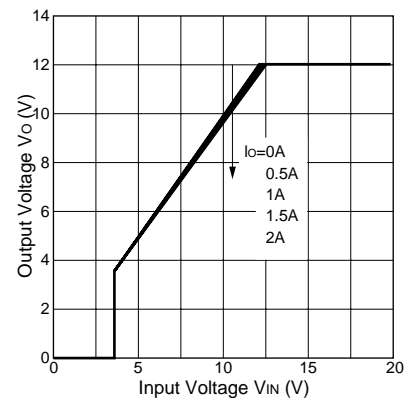
Quiescent Circuit Current(SI-3050J)



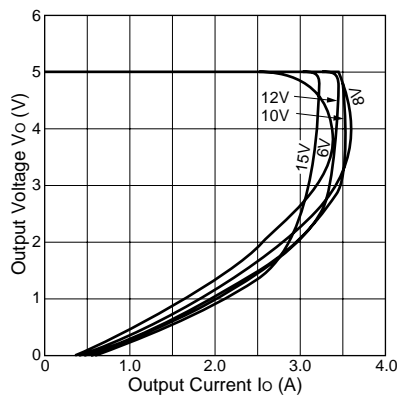
Rise Characteristics(SI-3050J)



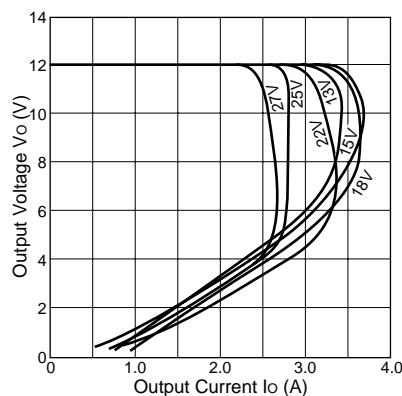
Rise Characteristics(SI-3120J)



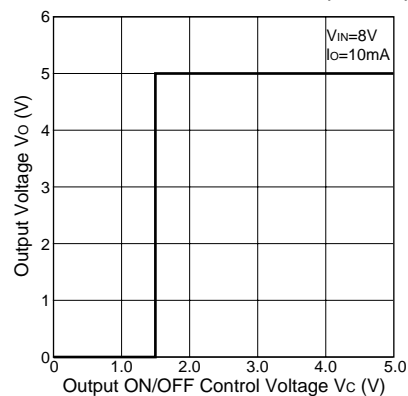
Overcurrent Protection Characteristics(SI-3050J)



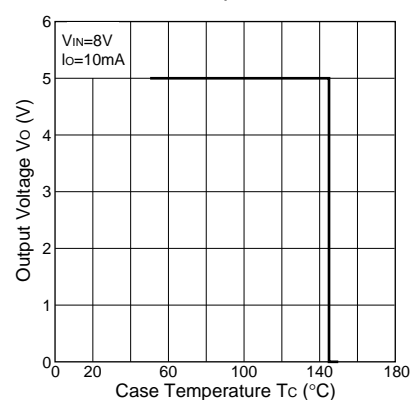
Overcurrent Protection Characteristics(SI-3120J)



ON/OFF Control Characteristics(SI-3050J)



Thermal Protection(CharacteristicsSI-3050J)



**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.