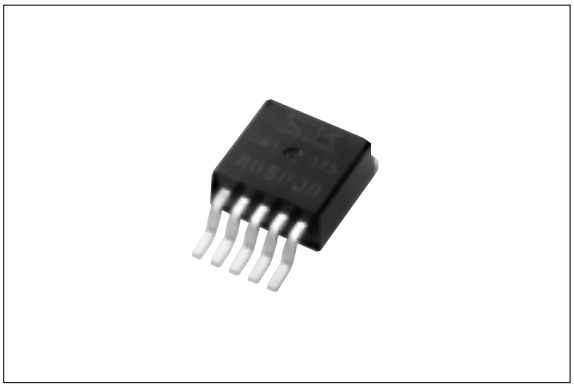
SI-8000JD Series

Surface-Mount, Separate Excitation Switching Type

■Features

- Surface-mount package (TO263-5)
- Output current: 1.5 A
- High efficiency: 77 to 86%
- Requires only 4 external components
- Phase correction and output voltage adjustment performed internally
- Choke coil size can be reduced through the employment of high frequency (125 kHz) design
- Built-in foldback overcurrent protection, thermal protection circuit
- Output ON/OFF possible (OFF state current consumption: 200μA max)
- Soft start possible via ON/OFF pin



■Applications

- Power supplies for telecommunication equipment
- Onboard local power supplies, etc.

■Lineup

Part Number	SI-8033JD	SI-8050JD	SI-8090JD
V_O(V)	3.3	5.0	9.0
I_O(A)	1.5		

■Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
DC Input Voltage	V_{IN}	43	V	
Output Current	I_O	1.5	A	
Power Dissipation*	P_D	3	W	Glass-epoxy board mounting 40 × 40 mm (copper area 100%)
Junction Temperature	T_j	+125	°C	
Storage Temperature	T_{stg}	–40 to +125	°C	
Thermal Resistance (Junction to Case)	$R_{th(j-c)}$	3	°C/W	
Thermal Resistance (Junction to Ambient Air)	$R_{th(j-a)}$	33.3	°C/W	Glass-epoxy board mounting 40 × 40 mm (copper area 100%)

*: Limited by thermal protection circuit

■Recommended Operating Conditions

Parameter	Symbol	Ratings			Unit	Conditions
		SI-8033JD	SI-8050JD	SI-8090JD		
DC Input Voltage Range	V_{IN1}	5.3 to 6.3	7 to 8	11 to 12	V	I_O=0 to 1A
	V_{IN2}	6.3 to 40	8 to 40	12 to 40		I_O=0 to 1.5A
DC Output Current Range*	I_O	0 to 1.5			A	V_{IN}≥V_O+3V
Operating Junction Temperature Range	T_{jop}	–30 to +125			°C	
Operating Temperature Range*	T_{op}	–30 to +125			°C	

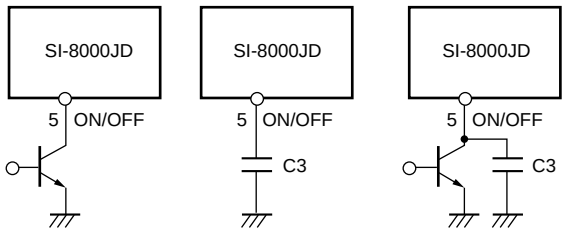
*: Limited by Ta–P_D characteristics

■Electrical Characteristics

(T_a=25°C)

Parameter		Symbol	Ratings									Unit
			SI-8033JD			SI-8050JD			SI-8090JD			
			min.	typ.	max.	min.	typ.	max.	min.	typ.	max.	
Output Voltage		V_O	3.234	3.30	3.366	4.90	5.00	5.10	8.82	9.00	9.18	V
		Conditions	V_{IN}=15V, I_O=0.5A			V_{IN}=20V, I_O=0.5A			V_{IN}=21V, I_O=0.5A			
Efficiency		η		77			82			86		%
		Conditions	V_{IN}=15V, I_O=0.5A			V_{IN}=20V, I_O=0.5A			V_{IN}=21V, I_O=0.5A			
Switching Frequency		f		125			125			125		kHz
		Conditions	V_{IN}=15V, I_O=0.5A			V_{IN}=20V, I_O=0.5A			V_{IN}=21V, I_O=0.5A			
Line Regulation		ΔV_{OLINE}		25	80		40	100		50	120	mV
		Conditions	V_{IN}=8 to 30V, I_O=0.5A			V_{IN}=10 to 30V, I_O=0.5A			V_{IN}=15 to 30V, I_O=0.5A			
Load Regulation		ΔV_{OLOAD}		10	30		10	40		10	40	mV
		Conditions	V_{IN}=15V, I_O=0.2 to 0.8A			V_{IN}=20V, I_O=0.2 to 0.8A			V_{IN}=21V, I_O=0.2 to 0.8A			
Temperature Coefficient of Output Voltage		$\Delta V_O/\Delta T_a$		±0.5			±0.5			±1.0		mV/°C
Overcurrent Protection Starting Current		I_{S1}	1.6			1.6			1.6			A
		Conditions	V_{IN}=15V			V_{IN}=20V			V_{IN}=21V			
ON/OFF* Pin	Low Level Voltage	V_{SSL}			0.5			0.5			0.5	V
	Low-State Output Current	I_{SSL}			100			100			100	μA
		Conditions	V_{SSL}=0V									
Quiescent Circuit Current		I_q		7			7			7		mA
		Conditions	V_{IN}=15V, Io=0A			V_{IN}=20V, Io=0A			V_{IN}=21V, Io=0A			
		$I_{q(oFF)}$			200			200			200	μA
		Conditions	V_{IN}=15V, $V_{ON/OFF}$=0.3V			V_{IN}=20V, $V_{ON/OFF}$=0.3V			V_{IN}=21V, $V_{ON/OFF}$=0.3V			

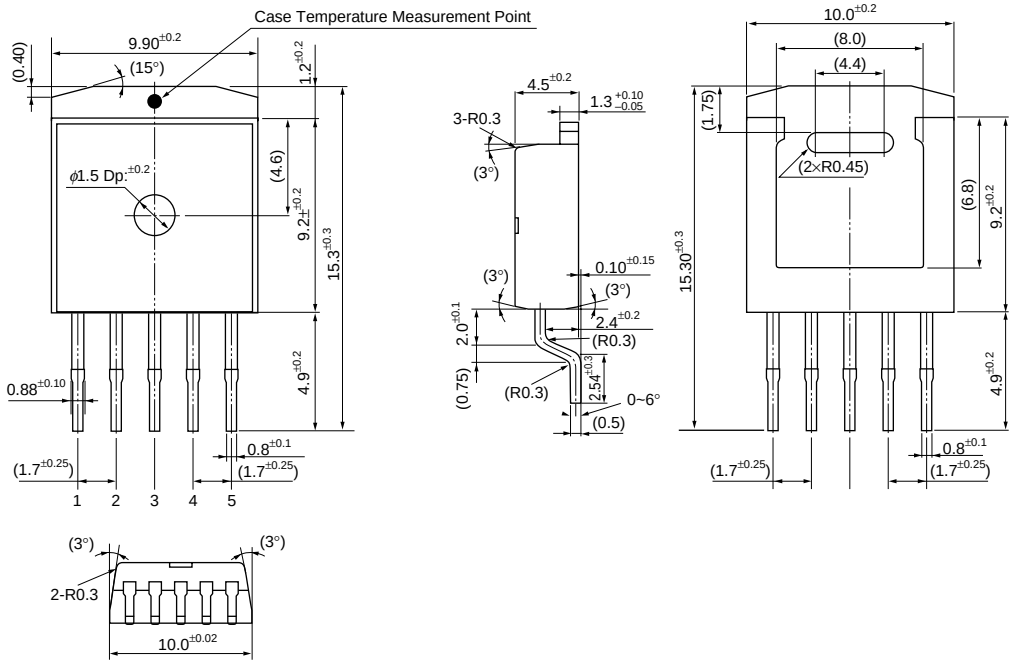
*: Pin 5 is the ON/OFF pin. Connecting a capacitor to this pin enables a soft start at power-on. By using this pin, the output can also be turned on or off. By setting the voltage of this pin to V_{SSL} or lower, the output is stopped. Driving a transistor with an open collector can perform switching of the potential of the ON/OFF pin.
When using both the soft-start and ON/OFF functions together, the discharge current from C3 flows to the ON/OFF control transistor, so ensure that this current is limited for protection. The ON/OFF pin is pulled up to the power supply in the IC, so no external voltage can be applied. If this pin is not used, leave it open.



$V_{OUT.}$ ON/OFF | Soft Start | Soft Start +$V_{OUT.}$ ON/OFF

■External Dimensions

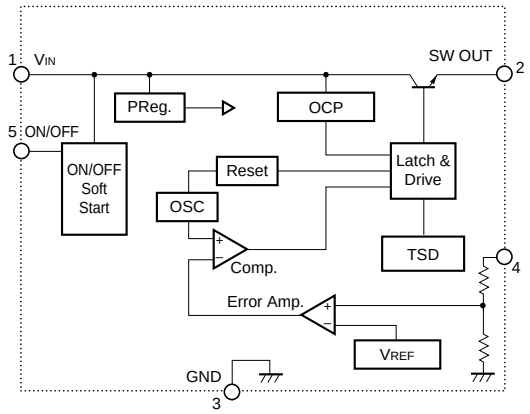
(Unit : mm)



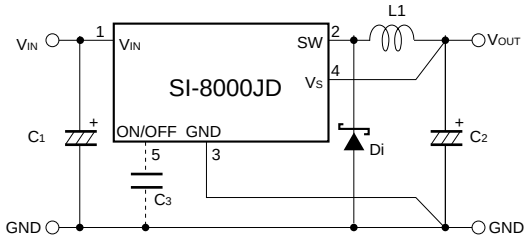
Pin Arrangement
① V_{IN}
② SW_{OUT}
③ GND
④ V_{OS}
⑤ ON/OFF

Plastic Mold Package Type
Flammability: 94V-0
Weight: Approx. 1.48g

■Block Diagram



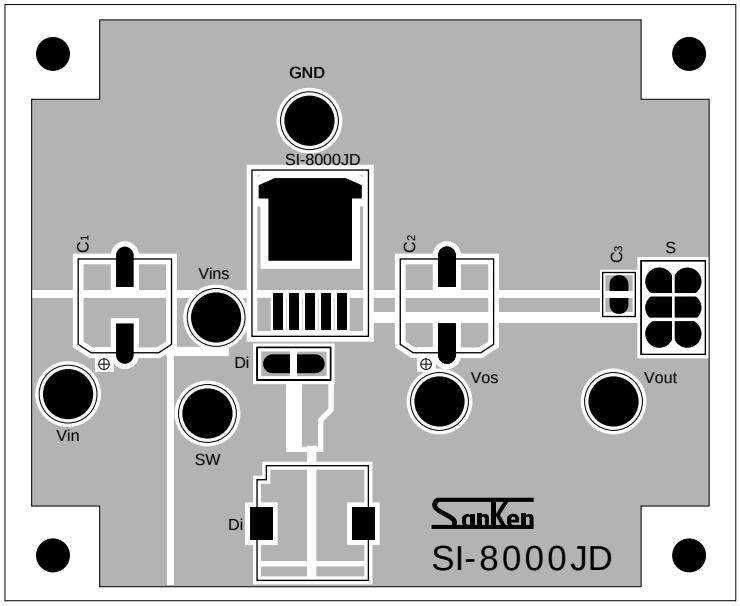
■Standard External Circuit



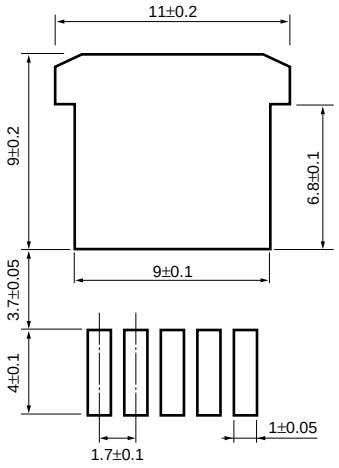
C1 : 50V/220μF
C2 : 25V/470μF
C3 : 10V/0.47μF (when using soft-start function)
L1 : 100μH
Di : SFPB-66 (Sanken)

■Example of Pattern on PC Board

Recommended Pattern



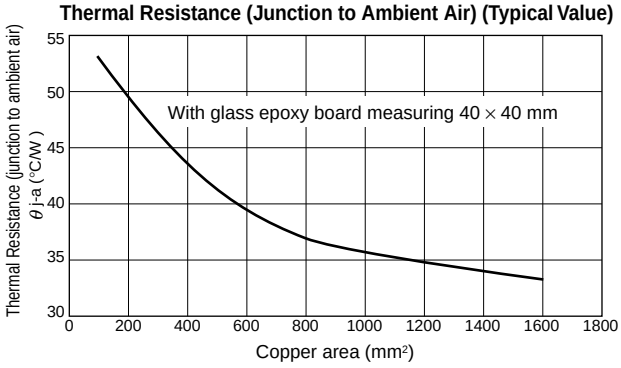
Recommended Land Pattern



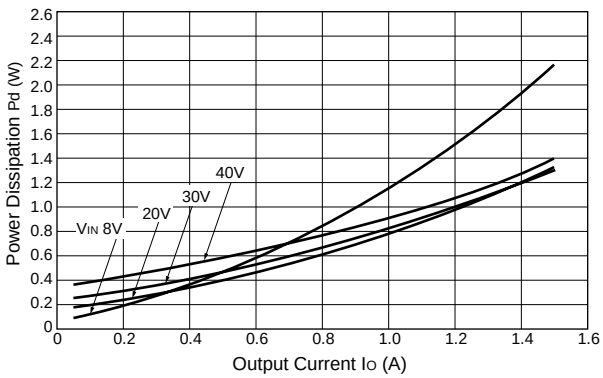
Unit : mm

* For the optimum operating conditions, use one-point GND wiring centering on pin 3, and place each component as closely as possible.

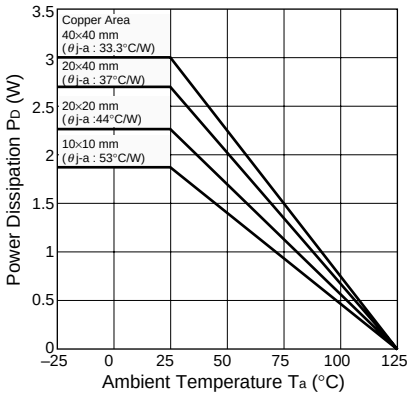
Area of Copper on Glass Epoxy Board vs. Thermal Resistance (Junction to Ambient Air) (Typical Value)



Output Current vs. Power Dissipation (Typical)



■T_a-P_D Characteristics



$$P_D = V_O \bullet I_O \left(\frac{100}{\eta\chi} - 1 \right) - V_F \bullet I_O \left(1 - \frac{V_O}{V_{IN}} \right)$$

The efficiency depends on the input voltage and the output current. Therefore, obtain the value from the efficiency characteristic curve and substitute the percentage in the formula above.

V_O : Output Voltage
V_{IN}: Input Voltage
I_O : Output Current
$\eta\chi$: Efficiency (%)
V_F : D_1 forward voltage
0.4V(I_O=2A)(SFPB-66)

Thermal design for D_1 must be done separately.

■Selecting External Components

1. Inductor L_1
   ① It must be suitable for a switching regulator.
   Do not use inductors such as for noise filters, because they generate excessive heat.
   ② The rated current must be satisfied.
   If the rated current is exceeded, magnetic saturation leads to overcurrent.
2. Capacitor C_1, C_2
   ① The breakdown voltage and allowable ripple current must be satisfied.
   Exceeding the ratings of these capacitors or using them without derating shortens their service lives and may also cause abnormal oscillation of the IC.
   ② Use a low-impedance type capacitor for C_2.
   C_2 must be a low-impedance type capacitor to ensure reduced ripple voltage and a stable switching operation.
   ③ Do not use a capacitor that has an extremely small ESR (equivalent series resistance) such as an OS capacitor or tantalum capacitor.
   ④ C_3 is a capacitor for soft start. When not using soft start, leave pin 5 open. It is pulled up inside the IC.
3. Diode D_1
   The Sanken SFPB-66 diode is recommended for D1. If you intended to use an equivalent diode, be sure to use a Schottkey Barrier diode. If you use a fast recovery diode or any other diode, supplying a reverse voltage generated from the recovery or ON voltage of the diode may damage the IC.

Application

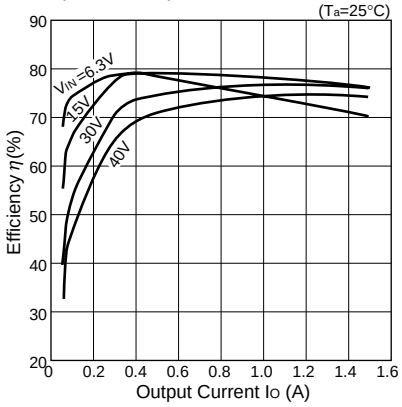
Variable output voltage

Output voltage can be adjusted in the same way as SI-8000S.

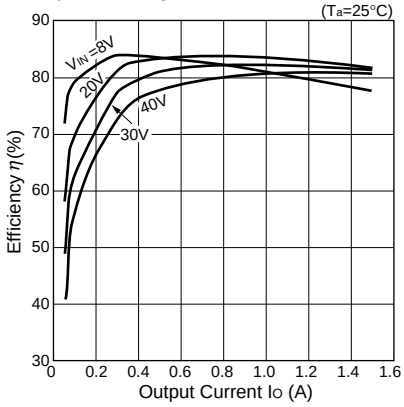
■Typical Characteristics

Efficiency Characteristics

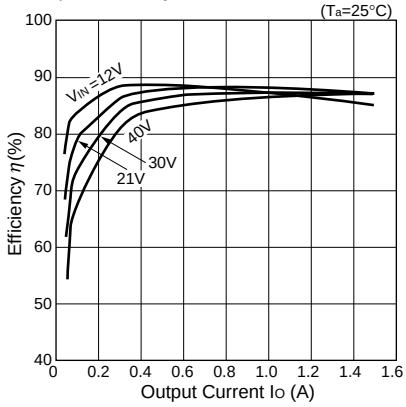
(**SI-8033JD**)



(**SI-8050JD**)

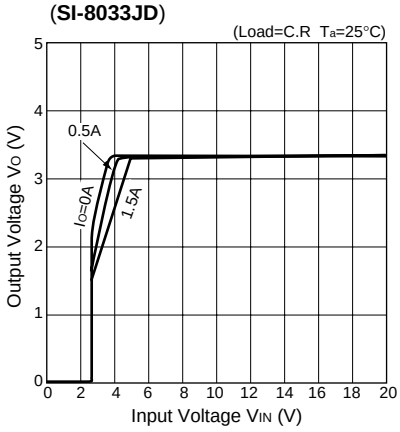


(**SI-8090JD**)

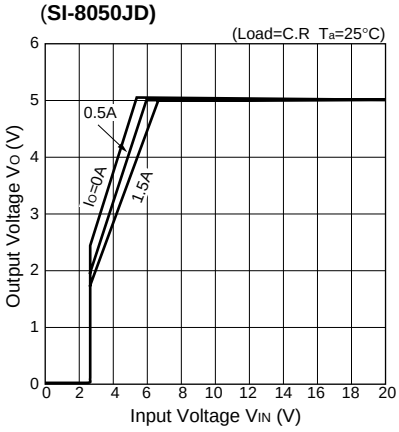


Output Voltage Characteristics

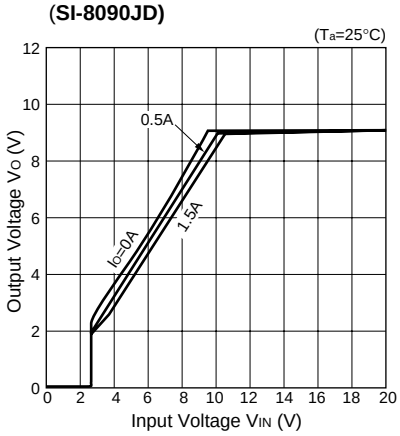
(**SI-8033JD**)



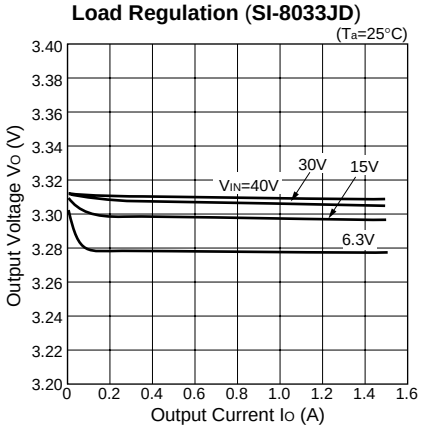
(**SI-8050JD**)



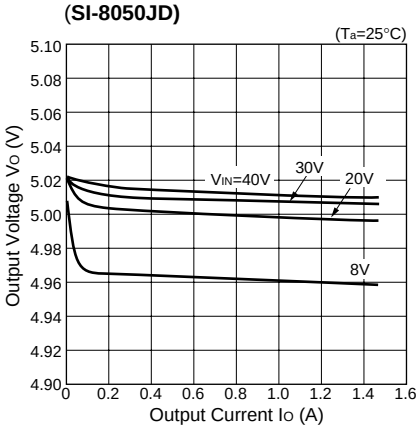
(**SI-8090JD**)



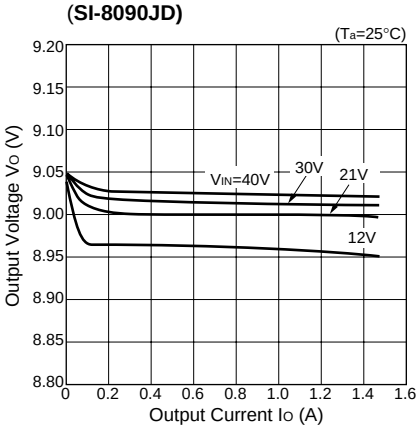
Load Regulation (**SI-8033JD**)



(**SI-8050JD**)

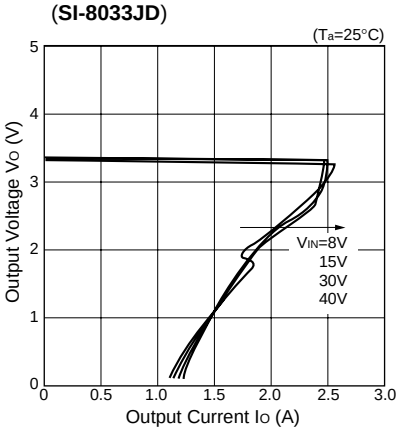


(**SI-8090JD**)

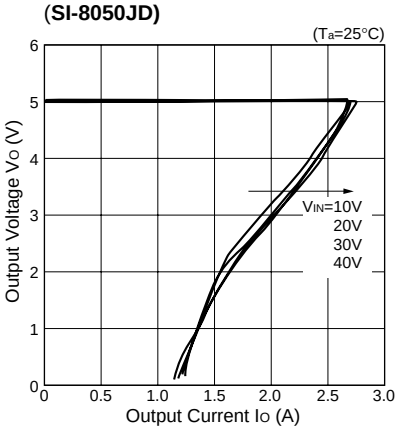


Overcurrent Protection Characteristics

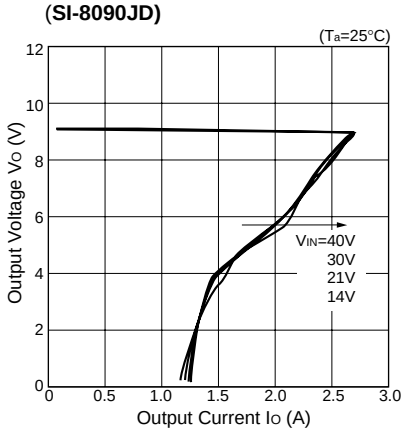
(**SI-8033JD**)



(**SI-8050JD**)

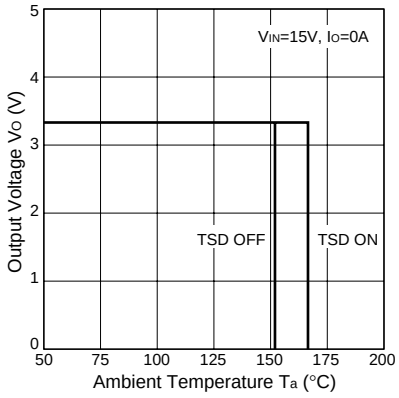


(**SI-8090JD**)

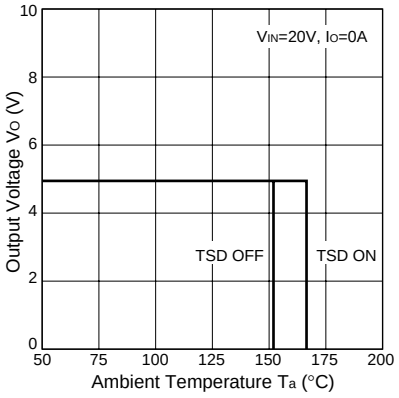


Thermal Protection Characteristics

(**SI-8033JD**)



(**SI-8050JD**)



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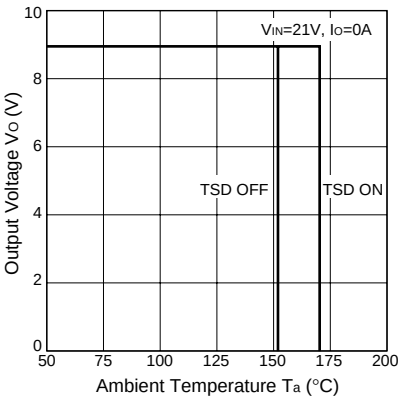
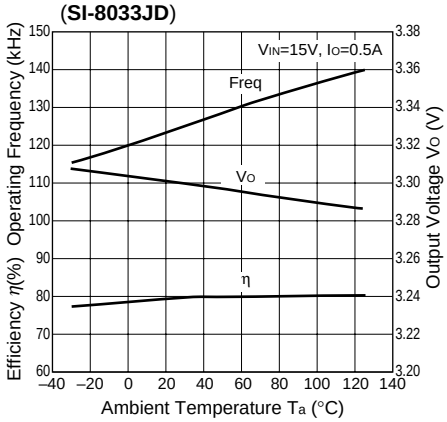


[Note on Thermal Protection]

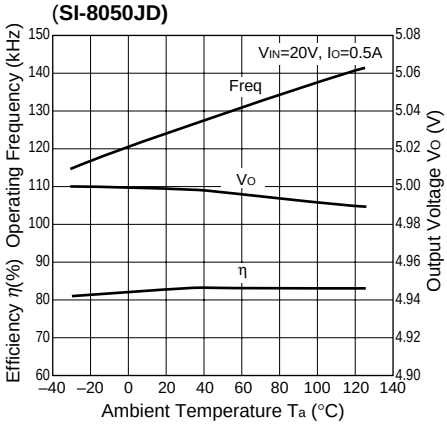
The thermal protection circuit is intended for protection against heat during instantaneous short-circuiting. Its operation is not guaranteed for continuous heating conditions such as short-circuiting over extended periods of time.

Temperature Characteristics

(**SI-8033JD**)



(**SI-8050JD**)



(**SI-8090JD**)