SI-8000SD Series — Surface Mount, Separate Excitation Step-down Switching Mode Regulator ICs

■Features

- Surface-mount package (TO263-5)
- Output current: 3.0A
- High efficiency: 79% typ. (SI-8033SD), 84% typ. (SI-8050SD)
- Requires only 4 discrete external components
- Internally-adjusted phase correction and output voltage
- Built-in reference oscillator (60kHz)
- Built-in overcurrent and thermal protection circuits
- Output ON/OFF available
- Soft start available by S.S pin

■Applications

- Power supplies for telecommunication equipment
- Onboard local power supplies

■Lineup

Part Number	SI-8033SD	SI-8050SD
V_O (V)	3.3	5.0
I_O (A)	3	

■Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
DC Input Voltage	V_{IN}	43*1	V	
Power Dissipation*2	P_D	3	W	When mounted on glass-epoxy board 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)	$\theta_{j\text{-}c}$	3	°C/W	
Thermal Resistance (Junction to Ambient Air)	$\theta_{j\text{-}a}$	33.3	°C/W	When mounted on glass-epoxy board 40 × 40 mm (copper area: 100%)

*1: 35V for SI-8033SD
*2: Limited by thermal protection circuit.

■Recommended Operating Conditions

Parameter	Symbol	Ratings		Unit
		SI-8033SD	SI-8050SD	
DC Input Voltage Range	V_{IN1}	5.5 to 28	7 to 40	V
Output Current Range*	I_O	0 to 3.0		A
Operating Junction Temperature Range	T_{jop}	–30 to +125		°C
Operating Temperature Range*	T_{op}	–30 to +125		°C

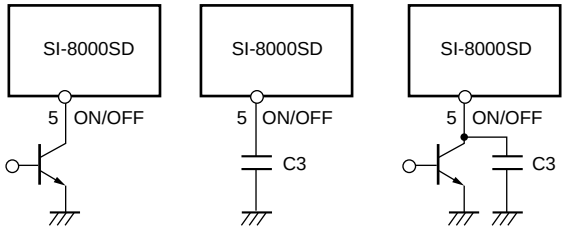
*: Limited by Ta-P_D characteristics.

■Electrical Characteristics

(T_a=25°C)

Parameter		Symbol	Ratings						Unit
			SI-8033SD			SI-8050SD			
			min.	typ.	max.	min.	typ.	max.	
Output Voltage		V_O	3.17	3.3	3.43	4.8	5.0	5.2	V
		Conditions	V_{IN}=15V, I_O=1A			V_{IN}=20V, I_O=1A			
Efficiency		η		79			84		%
		Conditions	V_{IN}=15V, I_O=1A			V_{IN}=20V, I_O=1A			
Oscillation Frequency		f		60			60		kHz
		Conditions	V_{IN}=15V, I_O=1A			V_{IN}=20V, I_O=1A			
Line Regulation		ΔV_{OLINE}		25	80		40	100	mV
		Conditions	V_{IN}=8 to 28V, I_O=1A			V_{IN}=10 to 30V, I_O=1A			
Load Regulation		ΔV_{OLOAD}		10	30		10	40	mV
		Conditions	V_{IN}=15V, I_O=0.5 to 1.5A			V_{IN}=20V, I_O=0.5 to 1.5A			
Temperature Coefficient of Output Voltage		$\Delta V_O/\Delta T_a$		±0.5			±0.5		mV/°C
Overcurrent Protection Starting Current		I_{S1}	3.1			3.1			A
		Conditions	V_{IN}=15V			V_{IN}=20V			
Soft Start Pin*	Low-Level Voltage	V_{SSL}		0.2			0.2		V
	Outflow Current at Low Voltage	I_{SSL}	20	30	40	20	30	40	μA
		Conditions	V_{SSL}=0.2V						

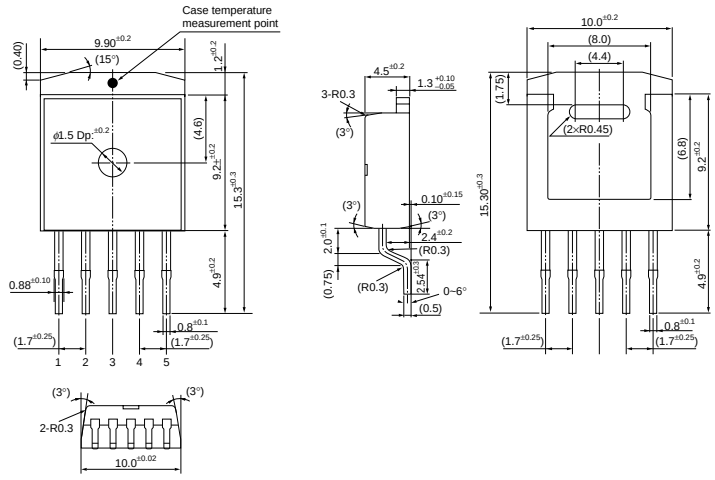
* Pin 5 is a soft start pin. Soft start at power on can be performed with a capacitor connected to this pin.
The output can also be turned ON/OFF with this pin.
The output is stopped by setting the voltage of this pin to V_{SSL} or lower.
Soft-start pin voltage can be changed with an open-collector drive circuit of a transistor.
When using both the soft-start and ON/OFF functions together, the discharge current from C_3 flows into the ON/OFF control transistor. Therefore, limit the current securely to protect the transistor if C_3 capacitance is large.
The ON/OFF pin is pulled up to the power supply in the IC, so applying the external voltage is prohibited.
If this pin is not used, leave it open.



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

■External Dimensions (TO263-5)

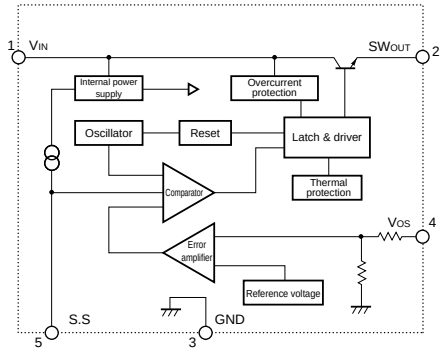
(Unit : mm)



Pin Assignment
① V_{IN}
② SW_{OUT}
③ GND
④ V_{OS}
⑤ S.S

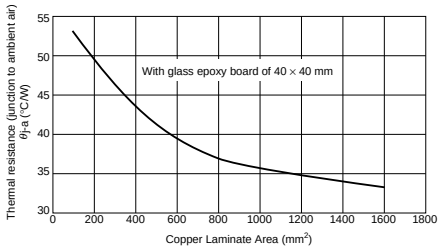
Plastic Mold Package Type
Flammability: 94V-0
Product Mass: Approx. 1.48g

■Block Diagram

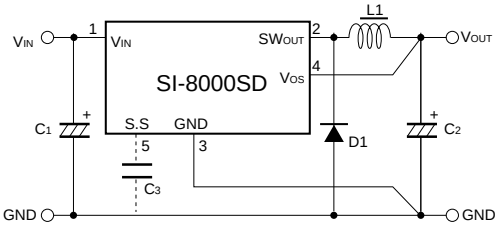


■Reference Data

Copper Laminate Area on Glass Epoxy Board vs. thermal resistance (junction to ambient air) (Typical Value)



■Typical Connection Diagram



C_1 : 50V/1000μF
C_2 : 50V/1000μF
C_3 : 0.01μF
(only when soft start function is used)
L_1 : 150μH
D_1 : SPB-G56 (Sanken)

Diode D_1

- Be sure to use Schottky-barrier diode as D_1.
  If other diodes like fast recovery diodes are used, ICs may be destroyed because of the reverse voltage generated by the recovery voltage or ON voltage.

Choke coil L_1

- If the winding resistance of the choke coil is too high, the efficiency may drop below the rated value.
- As the overcurrent protection starting current is about 3.5 A, take care concerning heat radiation from the choke coil caused by magnetic saturation due to overload or short-circuited load.

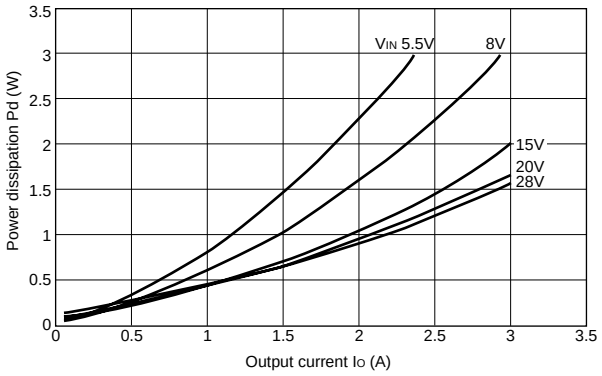
Capacitors C_1, C_2, and C_3

- As large ripple currents flow through C_1 and C_2, use high-frequency and low-impedance capacitors aiming for switching-mode-power-supply use.
  Especially when the impedance of C_2 is high, the switching waveform may become abnormal at low temperatures.
  For C_2, do not use a capacitor with an extremely low equivalent series resistance (ESR) such as an OS capacitor or a tantalum capacitor, which may cause an abnormal oscillation.
- C_3 is a capacitor for soft start. Leave pin 5 open if the soft start function is not used.
  This pin is pulled up with a pull-up resistor inside the ICs.

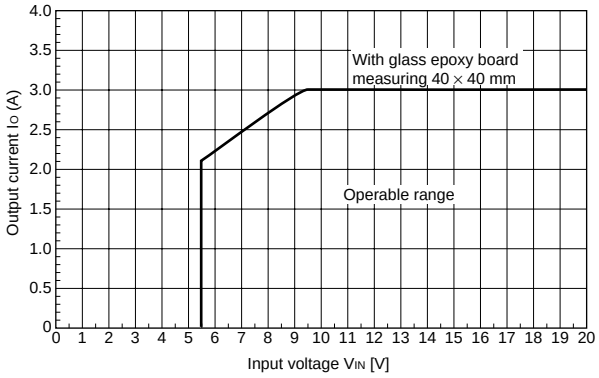
◎To create the optimum operating conditions, place the components as close as possible to each other.

■SI-8033SD

Power dissipation vs. Output current (typical value)

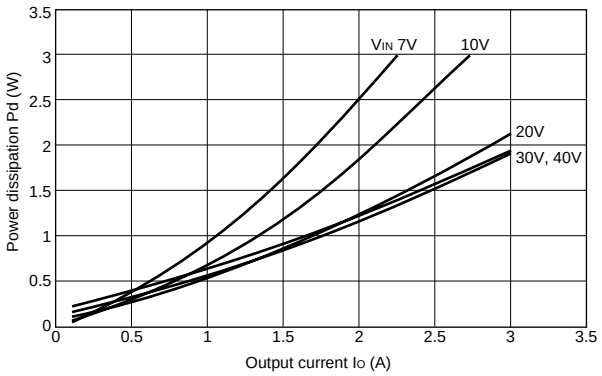


Output current vs. Input voltage (typical value)

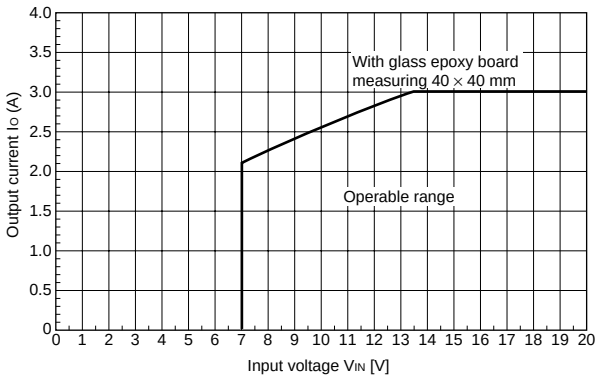


■SI-8050SD

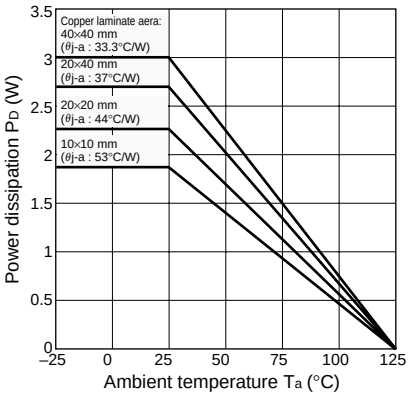
Power dissipation vs. Output current (typical value)



Output current vs. Input voltage (typical value)



■PD-Ta Characteristics



When mounted on glass epoxy board measuring 40 × 40 mm

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

Find the efficiency from the efficiency curve and substitute in the percentage, because the efficiency varies depending on the input voltage and output current.

V_O : Output voltage
V_{IN}: Input voltage
I_O : Output current
$\eta\chi$: Efficiency
V_F : Forward voltage of D_1
0.4V (I_O=2A) ··· SPB-G56S (Sanken)

Thermal design for D_1 must be performed separately.

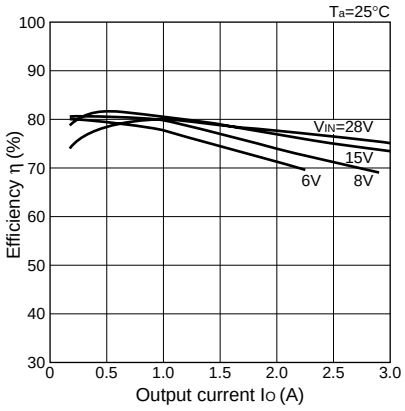
Applications

Varying output voltage

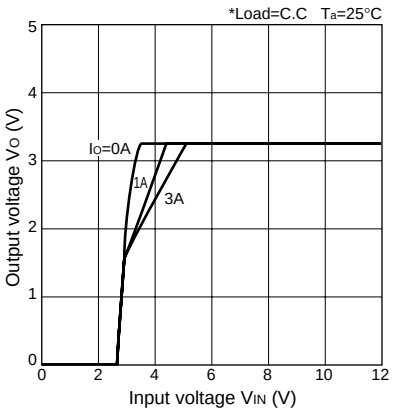
The output voltage can be varied in the same manner as SI-8000S. Refer of the catalog.

■Typical Characteristics Examples (SI-8033SD)

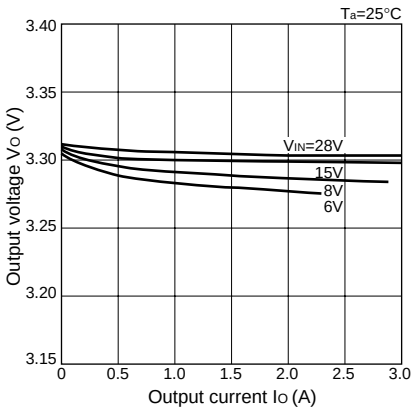
Efficiency



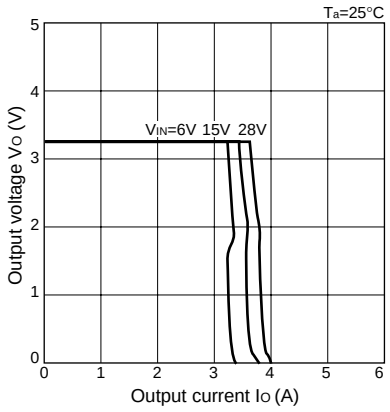
Output voltage rise



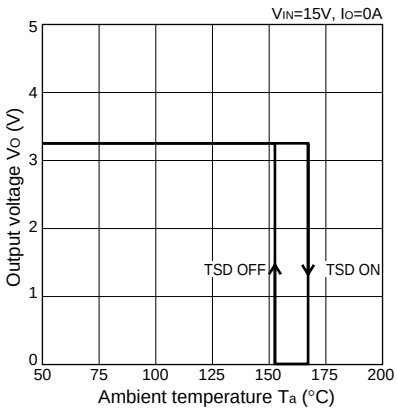
Load regulation



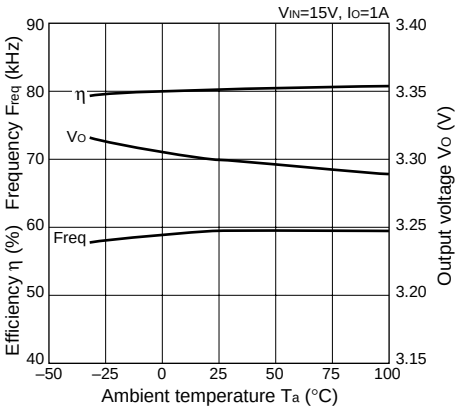
Overcurrent protection characteristics



Thermal protection

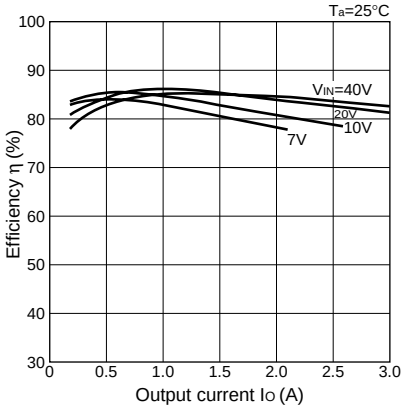


Temperature characteristics

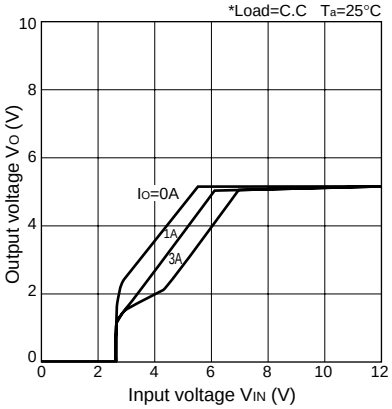


■Typical Characteristics Example (SI-8050SD)

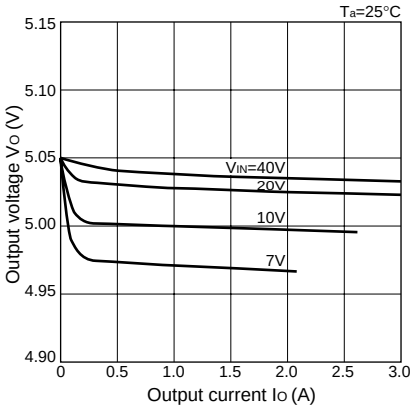
Efficiency



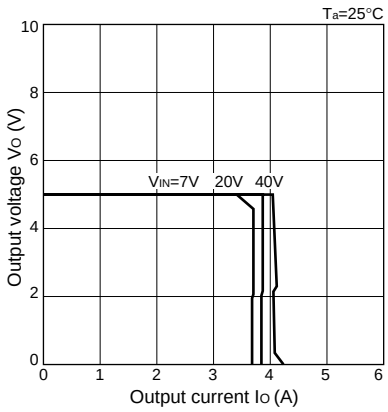
Output voltage rise



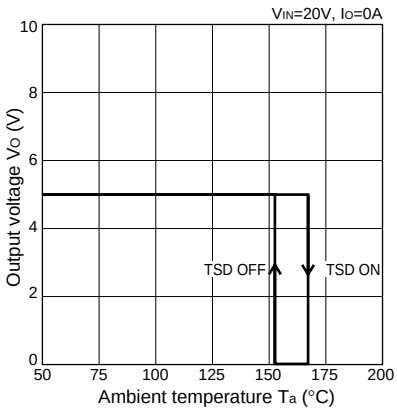
Load regulation



Overcurrent protection characteristics



Thermal protection



Temperature characteristics

