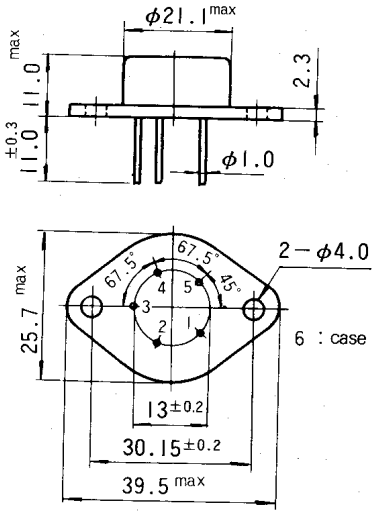
SI-8000B Series

Switching Voltage Regulator

Features:
Wide DC input voltage (~55V)
High power conversion efficiency (91% for SI-8243B)
Precise setting voltage (1% for SI-8053B)
Output power control by external components
High-reliability passivated power chip and flip-chip control circuit

Outline Drawings Unit: mm



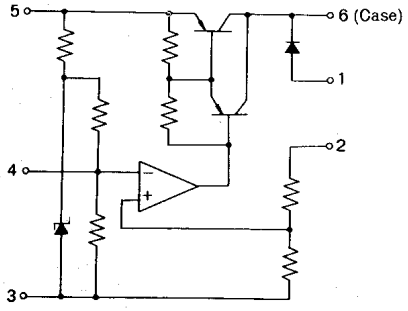
Absolute Maximum Ratings (Ta=25°C)

Description \ Type No.	SI-8053B	SI-8093B	SI-8123B	SI-8153B	SI-8243B
DC Input Voltage (V)	60				
Output current (A)	3.5				
Power Dissipation (W)	28 (Tc=25°C) 2.5 (Without heat sink)				
Thermal Resistance (°C/W)	3.5				
Junction Temperature (°C)	−30~+125				
Operational Temperature (°C)	−20~+80				
Storage Temperature (°C)	−30~+125				

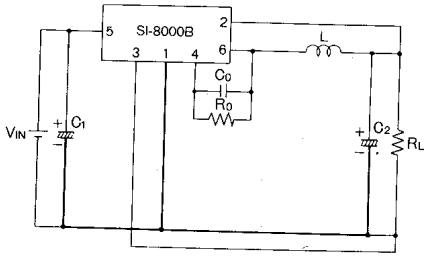
Electrical Characteristics (Ta=25°C)

Description \ Type No.	SI-8053B			SI-8093B			SI-8123B			SI-8153B			SI-8243B		
	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
DC Input Voltage (V)	15		55	18		55	20		55	20		55	30		55
Conditions	3A			3A			3A			3A			3A		
Output Voltage (V)	4.95	5.05	5.15	8.85	9.05	9.25	11.85	12.05	12.25	14.85	15.05	15.25	23.85	24.04	24.25
Conditions	30V,2A			30V,2A			30V,2A			30V,2A			40V,2A		
Output Current (A)			3			3			3			3			3
Efficiency (%)		74			83			86			89			91	
Conditions	30V,2A			30V,2A			30V,2A			30V,2A			40V,2A		
Line Regulation (mV)		30			80			90			100			100	
Input Volt.	25~35V			25~35V			25~35V			25~35V			35~45V		
Output Curr.	2A			2A			2A			2A			2A		
Load Regulation (mV)		15			15			15			15			15	
Input Volt.	30V			30V			30V			30V			40V		
*Output Curr.	0.5~3.0A			0.5~3.0A			0.5~3.0A			0.5~3.0A			0.5~3.0A		
Temperature Coefficient of Output Voltage (mV/°C)		±1			±2			±2			±2			±3	

Equivalent Circuit



External Wiring



Co, Ro : External capacitor and resistor for self oscillation circuit
C1 : Protection capacitor against parasitic oscillation
C2, L : Capacitor and inductor for output filter

Note for Wiring

The wiring between input capacitor C1 and input terminal 5 shall be as short as possible.
AC filter capacitor can be used as the substitute of input capacitor if the wiring between filter capacitor and input terminal is short like a few cm.
Thick solid line of "External Wiring" indicates that good conductor (e.g., short and thick cables or PCB conductors) shall be used.
The wiring between pin 4 and C_O, R_O shall be as short as possible.

Selection of output filter capacitor C_2 and choke coil L

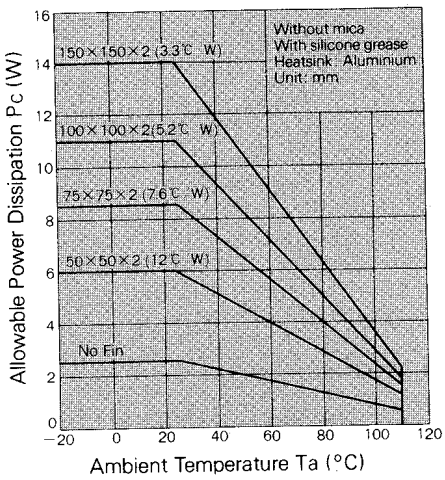
Ripple current Irip through the capacitor C_2 is given by:

$$Irip = \frac{(V_{IN} - V_O) \cdot V_O}{L \cdot V_{IN} \cdot f}$$

where f = Oscillation frequency
Inductance L shall be selected to meet
$Irip/2 = I_{O\ min.}$

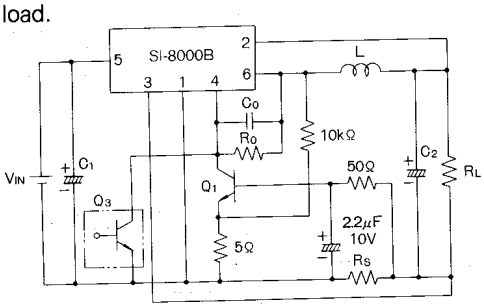
Design consideration shall be made on the heat dissipation from the filtering troidal inductance due to the ripple current and on the ripple current rating of output capacitor.

Derating



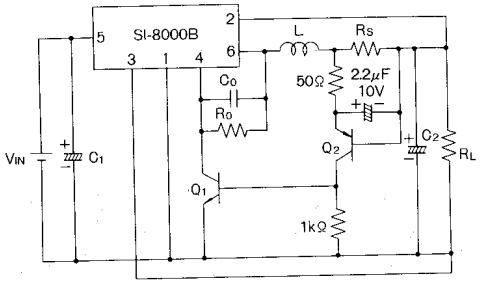
Over Current Protection Circuit (1)

The circuit diagram below is an external current limitter which has a current detecting resistor inserted between minus output and load.



Over Current Protection Circuit (2)

The circuit diagram below is an external current limitter which has a current detecting resistor inserted between plus output and load.



Calculation of power dissipation Pc

Power dissipation Pc is given by the following.

$$P_C = \left(\frac{100}{\eta'} - 1\right) P_O$$

where: η': Efficiency $\left(\frac{P_O}{P_{IN}} \times 100\right)$

P_O: Output power ($V_O \times I_O$)

$$\eta' = \eta + \alpha\,(V_{IN} - V'_{IN})$$

where: η': Efficiency
V'_{IN}: Average value of maximum operation input voltage
V_{IN}, α:

	V_{IN}	α
SI-8053B	30V	0.3
SI-8093B SI-8123B SI-8153B	30V	0.2
SI-8243B	40V	0.2

The efficiency η is measured at switching frequency $f \fallingdotseq 20$kHz. When f increases, the effiency will be decreased.

Selection of Overcurrent Sensing Resistor Rs

Short-circuit protection starting current I_{S1} shall be determined so that $R_S \cdot I_S \simeq 0.5$.

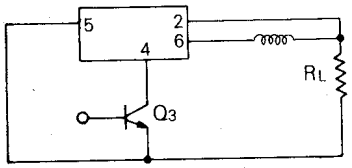
Appropriate power resistor R_S shall be used to manage the power $R_S \cdot I_{S2}$.

Selection of resistor R_O and capacitor C_O

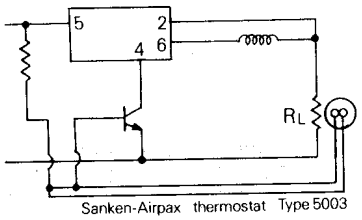
SI-8000B series are self-exciting switching regulators and the switching frequency f is changed by the fluctuation of V_{IN} and I_O. So, R_O is to be selected around a few hundred kΩ so that the switching frequency f may be about 20kHz. The switching frequency f will be raised by increasing R_O and reduced by decreasing R_O.
Considering the switching frequency f is changed by the fluctuation of V_{IN} and I_O, select suitable R_O which keeps the switching frequency f to be 20kHz at the lowest.
R_O shall be also changed in accordance with L and C_2.
Then attach C_O of 100pF.
If the rising characteristics of switching waveform is not desirable, replace it by a capacitor of 200pF.

OF-OFF control by external signal

The circuit diagram below is an external on-off control of output voltage.



The circuit below is a thermal shut down circuit against overload.



Sanken-Airpax thermostat Type 5003

Specifications of rectifier diodes, transistors and choke coils

The following part numbers are for your reference.

Products	Part numbers	Makers
Rectifier diodes	RM4Z (Descrete diode)	Sanken
Rectifier diodes	CTM-21S (Centertap. Cathode common)	Sanken
Rectifier diodes	CTM-21R (Centertap. Anode common)	Sanken
Rectifier diodes	RB402 (Bridge)	Sanken
Transistor Q_1, Q_3	2SC945	NEC
	MPS8098	MOTA
Transistor Q_2	2SA733	NEC
	MPS8598	MOTA
Thermostat Th_1	5003-F-105°CM	Sanken
Choke coils	SN-10-500 (110μH, 3A)	TOHOKU
	SF-T10-50 (110μH, 3A)	TDK