SI-8000GL Series Compact, Separate Excitation Step-down Switching Mode

■Features

- DIP 8 pin package
- Output current: 1.5A
- High efficiency: 86% (at V_{IN} = 20V, I_O = 1A, V_O = 5V)
- Capable of downsize a choke-coil due to IC's high switching frequency (250kHz). (Compared with conventional Sanken devices)
- The output-voltage-variable type can vary its output voltage from 1V to 14V because of its low reference voltage (Vref) of 1V.
- Wide Input Voltage Range (8 to 50V)
- Output ON/OFF available
- Built-in overcurrent protection and thermal protection circuits

■Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
DC Input Voltage	V_{IN}	53	V
Power Dissipation	P_D*1	1	W
Junction Temperature	T_j	+125	°C
Storage Temperature	T_{stg}	–40 to +125	°C
Thermal Resistance (junction to case)	$\theta_{j\text{-}c}$	28	°C/W
Thermal Resistance (junction to ambient air)	$\theta_{j\text{-}a}$	100	°C/W

*1: Limited by thermal protection.

■Applications

- Onboard local power supplies
- OA equipment
- For stabilization of the secondary-side output voltage of switching power supplies

■Recommended Operating Conditions

Parameter	Symbol	Ratings	Unit
		SI-8010GL	
DC Input Voltage Range	V_{IN}	(8 or V_O+3)*1 to 50	V
Output Voltage Range	V_O	1 to 14	V
Output Current Range*2	I_O	0.02 to 1.5*2	A
Operating Junction Temperature Range	T_{jop}	–30 to +125	°C
Operating Temperature Range	T_{op}	–30 to +125	°C

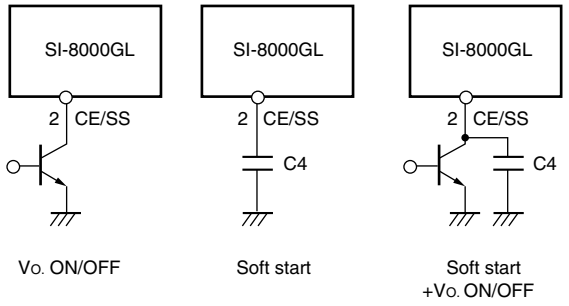
*1: The minimum value of an input voltage range is the higher of either 8V or V_O+3V.
*2: Please be sure to let the output current run more than 20 mA. When using by less than 20 mA, there is a possibility that the output voltage becomes unstable.

■Electrical Characteristics

(T_a=25°C)

Parameter		Symbol	Ratings SI-8010GL (Variable type) min.	typ.	max.	Unit
Reference Voltage		V_{REF}	0.97	1.00	1.03	V
		Conditions		V_{IN}=12V, I_O=1A		
Efficiency		Eff		86		%
		Conditions		V_{IN}=20V, I_O=1A, V_O=5V		
Oscillation Frequency		F_{OSC}		250		kHz
		Conditions		V_{IN}=12V, I_O=1A		
Line Regulation		ΔV_{OLINE}		20	40	mV
		Conditions		V_{IN}=10 to 30V, I_O=1A		
Load Regulation		ΔV_{OLOAD}		10	30	mV
		Conditions		V_{IN}=12V, I_O=0.1 to 1.5A		
Temperature Coefficient of Reference Voltage		$\Delta V_{REF}/\Delta T_a$		±0.5		mV/°C
Overcurrent Protection Starting Current		I_S	1.6			A
		Conditions		V_{IN}=12V		
Quiescent Circuit Current		I_q		7		mA
		Conditions		V_{IN}=12V, I_O=0A		
Circuit Current at Output OFF		$I_{q(OFF)}$			400	μA
		Conditions		V_{IN}=12V, $V_{ON/OFF}$=0.3V		
CE/SS* Terminal	Low Level Voltage	V_{SSL}			0.5	V
	Terminal Outflow Current at Low Voltage	I_{SSL}			50	μA
		Conditions		V_{SSL}=0V		

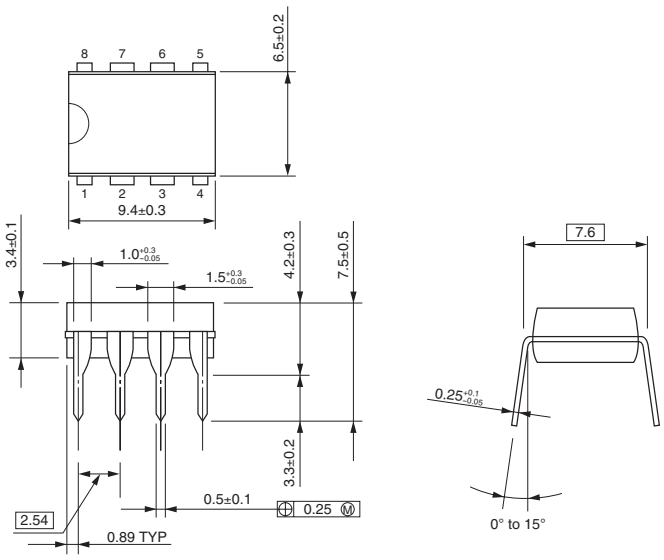
*: Pin 2 is the CE/SS pin. Soft start at power on can be performed with a capacitor connected to this pin.The output can also be turned ON/OFF with this pin. The output is stopped by setting the voltage of this pin to V_{SSL} or lower. CE/SS-pin voltage can be changed with an open-collector drive circuit of a transistor.
When using both the soft-start and ON/OFF functions together, the discharge current from C_4 flows into the ON/OFF control transistor. Therefore, limit the current securely to protect the transistor if C_3 capacitance is large. The CE/SS pin is pulled up to the power supply in the IC, so applying the external voltage is prohibited.



V_O. ON/OFF　Soft start　Soft start +V_O. ON/OFF

■External Dimensions (DIP8)

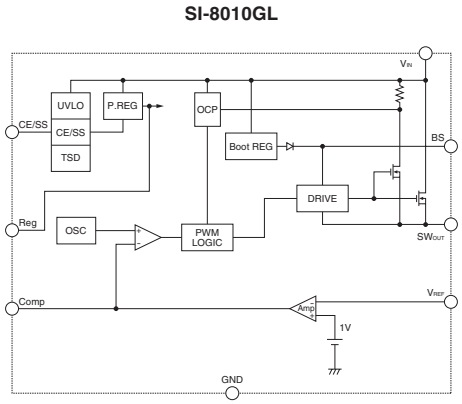
(Unit: mm)



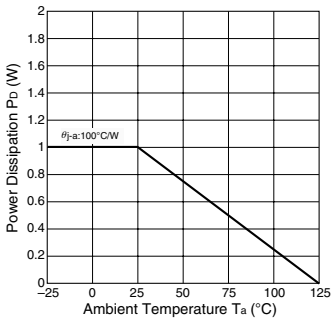
Pin Assignment
1. GND
2. CE/SS
3. Reg
4. SW_{OUT}
5. V_{IN}
6. B.S
7. Comp
8. V_{REF}

Plastic Mold Package Type
Flammability: UL 94V-0
Product Mass: Approx. 0.49 g

■Block Diagram



■T_a-P_D Characteristics



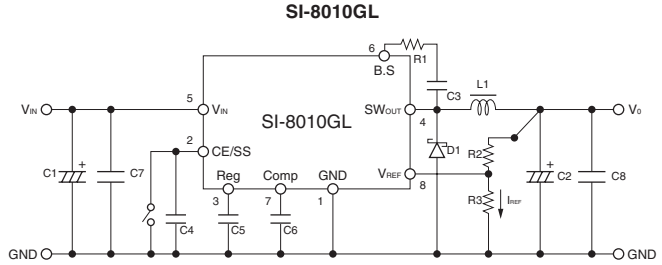
$$P_D = V_O \cdot I_O \left(\frac{100}{\eta\chi} - 1 \right) - V_F \cdot I_O \left(1 - \frac{V_O}{V_{IN}} \right)$$

Note 1: The efficiency depends on the input voltage and the output current. Therefore, obtain the value from the efficiency graph and substitute the percentage in the formula above.

Note 2: Thermal design for D_1 must be considered separately.

V_O : Output voltage
V_{IN} : Input voltage
I_O : Output current
$\eta\chi$: Efficiency
V_F : Diode D_1 forward voltage
RK16···0.4V(I_O=1A)

■Typical Connection Diagram



C1: 220μF/63V
C2: 470μF/25V
C3: 0.1μF
C4: 1000pF
C5: 0.1μF
C6: 0.047μF
C7: 0.1μF
C8: 0.1μF
R1: 47Ω
L1: 47μH
D1: RK16 (Sanken)

$$R2 = \frac{(V_{OUT} - V_{REF})}{I_{REF}} = \frac{(V_{OUT} - 1)}{2\times10^{-3}} (\Omega),\ R3 = \frac{V_{REF}}{I_{REF}} = \frac{1}{2\times10^{-3}} \fallingdotseq 500(\Omega)$$

Diode D_1
- Be sure to use a Schottky-barrier diode as D_1. If other diodes like fast recovery diodes are used, IC 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 approx. 2.5 A, take care concerning heat radiation from the choke coil caused by magnetic saturation due to overload or short-circuited load.

Capacitor C_1, C_2
- 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.

Resistors R_2, R_3
- R_2 and R_3 are the resistors to set the output voltage. Set their values so that I_{REF} becomes approx. 2 mA. Obtain R_2 and R_3 values by the following formula above.

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