

SPI-8000A Series Surface Mount, Separate Excitation Step-down Switching Mode

Features

- Surface-mount 16 pin package
- Output current: 3.0A
- High efficiency: 91% (at $V_{IN} = 10V$, $I_o = 1A$, $V_o = 5V$)
- Capable of downsizing a choke-coil due to IC's high switching frequency (125kHz). (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 (V_{ref}) of 1V.
- Wide Input Voltage Range (8 to 50V)
- Output ON/OFF available
- Built-in overcurrent and thermal protection circuits

Absolute Maximum Ratings

($T_a=25^\circ C$)

Parameter	Symbol	Ratings	Unit
DC Input Voltage	V_{IN}	53	V
Power Dissipation	$P_D^{*1, *2}$	2.4	W
Junction Temperature	T_j	+125	$^\circ C$
Storage Temperature	T_{stg}	-40 to +125	$^\circ C$
Thermal Resistance (junction to case)	θ_{j-c}^{*2}	18	$^\circ C/W$
Thermal Resistance (junction to ambient air)	θ_{j-a}^{*2}	50	$^\circ C/W$

*1: Limited due to thermal protection.

*2: When mounted on glass-epoxy board 700cm² (copper laminate area 30.8cm²).

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
		SPI-8010A		
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 3.0 ^{*2}		A
Operating Junction Temperature Range	T_{jop}	-30 to +125		$^\circ C$
Operating Temperature Range	T_{op}	-30 to +125		$^\circ C$

*1: The minimum value of an input voltage range is the higher of either 8V or V_o+3V .

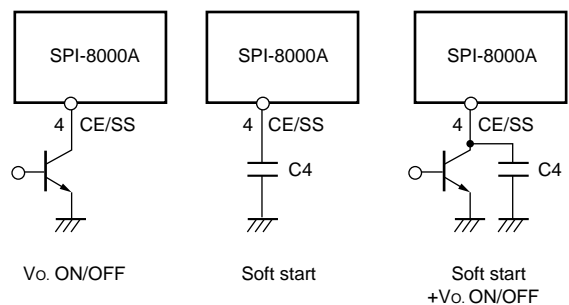
*2: Please be sure to let the output current run more than 20 mA. When using by less than 20 mA, there is a possibility that the output voltage becomes unstable.

Electrical Characteristics

($T_a=25^\circ C$)

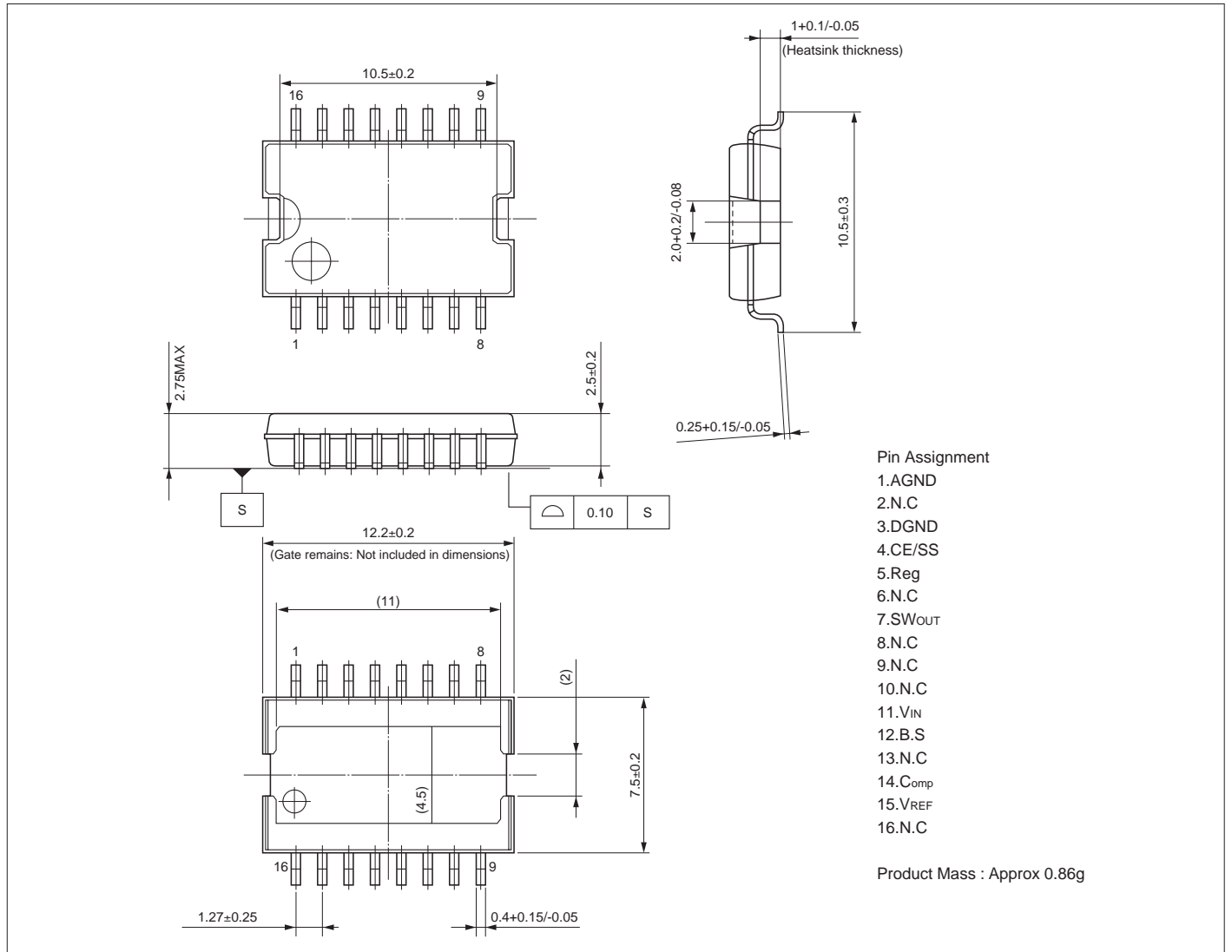
Parameter	Symbol	Rating			Unit
		SPI-8010A (Variable type)			
		min.	typ.	max.	
Reference Voltage	V_{REF}	0.97	1.00	1.03	V
	Conditions	$V_{IN}=12V, I_o=1A$			
Efficiency	Eff		86		%
	Conditions	$V_{IN}=20V, I_o=1A, V_o=5V$			
Oscillation Frequency	F_{OSC}		250		kHz
	Conditions	$V_{IN}=12V, I_o=1A$			
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/ $^\circ C$
Overcurrent Protection Starting Current	I_s	3.1			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
	Outflow Current at Low Voltage	I_{SSL}		50	μA
	Conditions	$V_{SSL}=0V$			

* Pin 4 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.

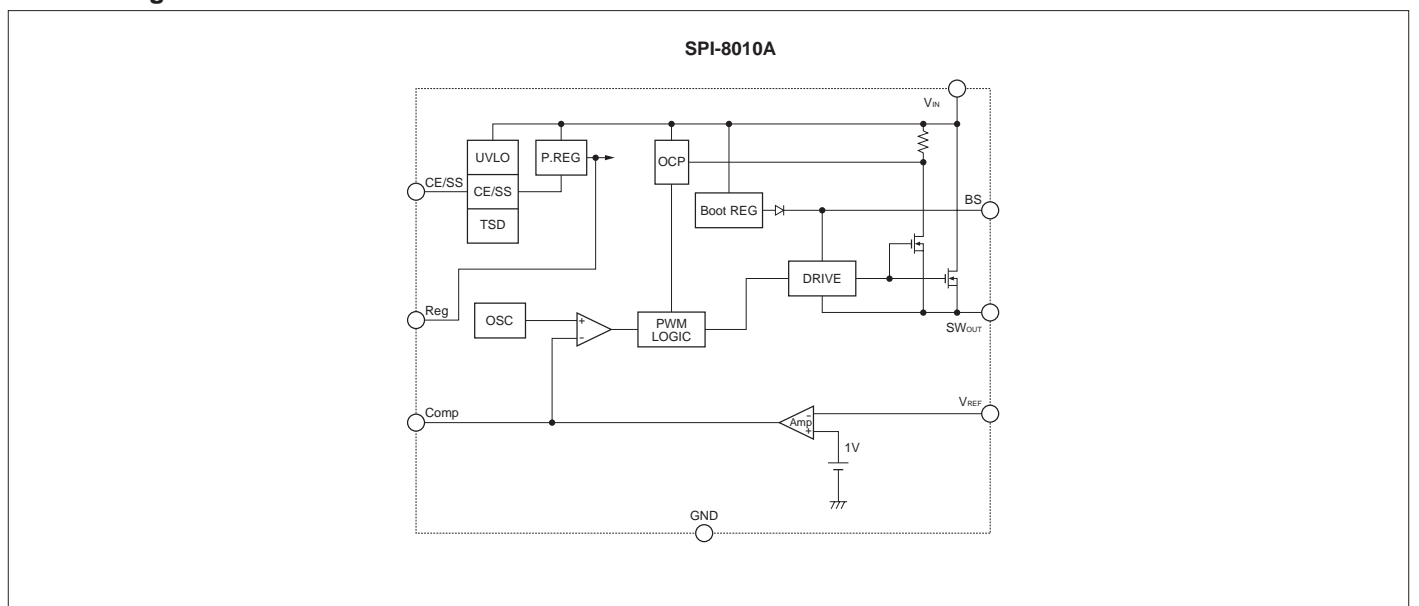


External Dimensions (HSOP16)

(Unit : mm)



Block Diagram



■ Typical Connection Diagram

C1: 220 μ F/63V
 C2: 470 μ F/25V
 C3: 0.1 μ F
 C4: 1000pF
 C5: 0.1 μ F
 C6: 0.047 μ F
 C7: 0.1 μ F
 C8: 0.1 μ F
 R1: 47 Ω
 L1: 47 μ H
 D1: SPB-G56S
 (Sanken)

Diode D1

- Be sure to use a Schottky-barrier diode for D1. 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 L1

- 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 4.5A, take care concerning heat radiation from the choke coil caused by magnetic saturation due to overload or short-circuited load.

Capacitors C1, C2

- As large ripple currents flow through C1 and C2, use high-frequency and low-impedance capacitors aiming for switching-mode-power-supply use. Especially when the impedance of C2 is high, the switching waveform may become abnormal at low temperatures. For C2, 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 R2, R3

- R2 and R3 are the resistors to set the output voltage. Set their values so that IREF becomes approx. 2mA. Obtain R2 and R3 values by the following formula:

$$R2 = \frac{(V_{OUT} - V_{REF})}{I_{REF}} = \frac{(V_{OUT} - 1)}{2 \times 10^{-3}} (\Omega), R3 = \frac{V_{REF}}{I_{REF}} = \frac{1}{2 \times 10^{-3}} \approx 500 (\Omega)$$

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

■ Ta-Pd Characteristics

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

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 D1 must be considered separately.

V_O : Output voltage
 V_{IN} : Input voltage
 I_O : Output current
 η% : Efficiency (%)
 V_F : Diode D1 forward voltage
 SPB-G56S...0.4V(I_O=2A)