

SI-8511NVS Surface-Mount, Synchronous Rectifier Step-down Switching Mode Control ICs

■Features

- Surface-mount package (TSSOP24)
- High efficiency due to synchronous rectification: 92% (at $V_{IN} = 5V$, $I_O = 1A$, $V_O = 2.5V$)
- Capable of downsize a choke-coil due to IC's high switching frequency (400kHz typ, On Time Control). (Compared with conventional Sanken devices)
- Low reference voltage (V_{ref}) of 1.1V. The output voltage is variable from 1.1V to 6V.
- High-speed response to a load
- Compatible with low ESR capacitors
- Soft start and output ON/OFF available
- Built-in overcurrent and output-overvoltage protection circuits
- PWRGD function to indicate the output voltage status
- High precision reference voltage: $1.1V \pm 1.2\%$

■Absolute Maximum Ratings

Parameter	Symbol	Ratings	($T_a=25^\circ C$)
Control-System DC Input Voltage	V_{CC}	7	V
DC Input Voltage	V_{IN}	25	V
Boost Block Input Voltage	V_H	30	V
EN Terminal Input Voltage	V_{EN}	V_{CC}	V
PWRGD Terminal Applied Voltage	V_{PWRGD}	7	V
Junction Temperature	T_j	+150	$^\circ C$
Storage Temperature	T_{stg}	-40 to +150	$^\circ C$

■Applications

- Power supplies for notebook PCs and mobile devices
- 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
Control System Input Voltage Range	V_{CC}	4.5 to 5.5	V
Input Voltage Range	V_{IN}	3 to 18	V
Output Voltage Range	V_O	1.1 to 6	V
Operating Temperature Range	T_{OP}	-20 to +85	$^\circ C$

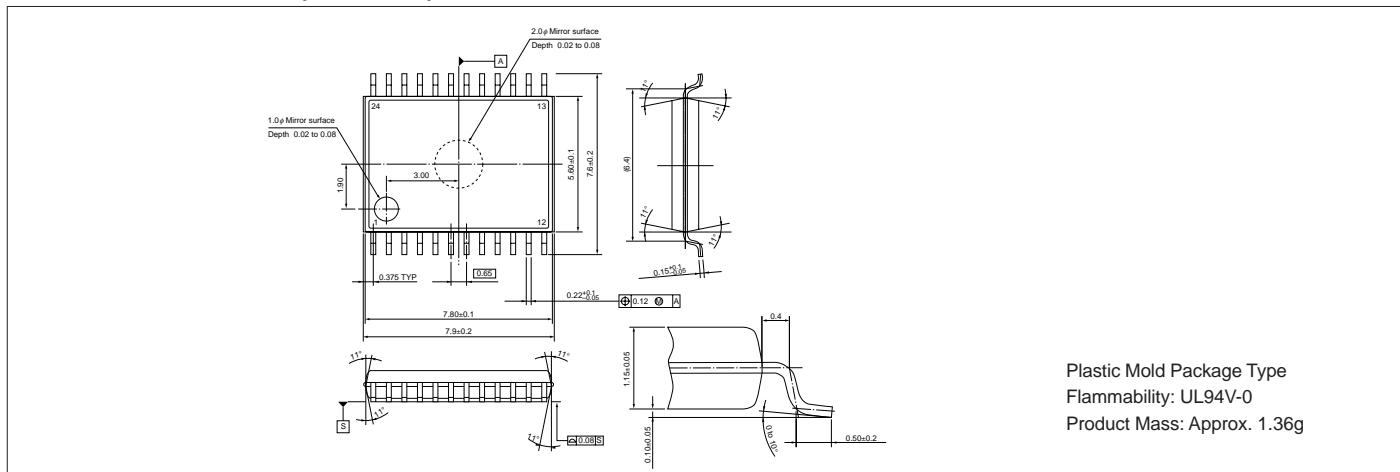
■Electrical Characteristics

(Ta=25°C unless otherwise specified)

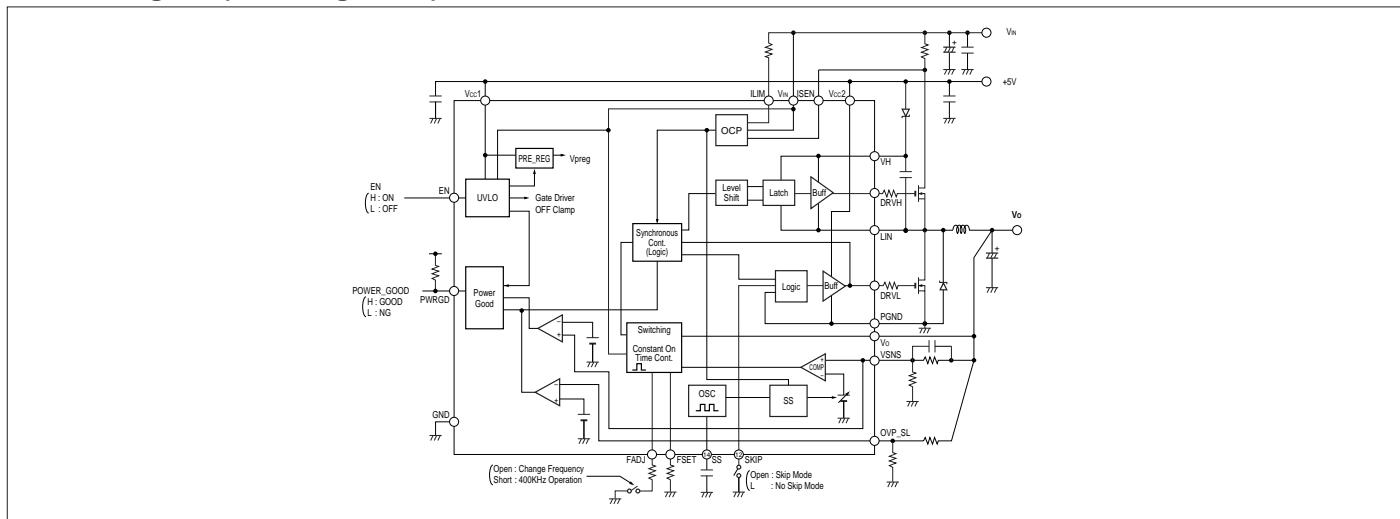
Parameter	Symbol	Ratings			Unit	Conditions
		min.	typ.	max.		
Dynamic Characteristics	Output Voltage	V_O	-1.2%	1.1	+1.2%	V
	Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$		± 0.03	$mV/^\circ C$	$V_{IN}=5V, V_{CC}=5V, VSNS$ connected to $V_O, I_O=0A$
Circuit Current	Circuit Current (Vcc Terminal)	I_{OP}		6	mA	$V_{IN}=5V, V_{CC}=5V, VSNS$ connected to $V_O, I_O=0A, T_a=0$ to $85^\circ C$
	Circuit Current (VIN Terminal)	I_{OP}		1	mA	$V_{IN}=5V, EN=H$
Undervoltage Lockout	Standby Current 1 (Vcc Terminal)	I_{STD1}		100	μA	$V_{CC}=5V, EN=L$
	Standby Current 2 (VIN Terminal)	I_{STD2}		50	μA	$V_{IN}=5V, EN=L$
On Time Control	UVLO Operating Voltage 1 (Vcc Terminal)	V_{UVLO1}	3.7		4.45	V
	UVLO Operating Voltage 2 (VIN Terminal)	V_{UVLO2}	2.5		2.9	V
High Side Drive	On Time	T_{ON}		1.27	μs	$V_{IN}=5V, V_{CC}=5V, V_O=2.5V$
	Minimum Off Time	T_{OFF}		0.7	μs	$V_{CC}=5V$
Low Side Drive	REF Terminal Voltage	V_{REF}	1.1	1.2	1.3	V
	REF Terminal Source Current	I_{REF}		100	μA	$V_{CC}=5V$
Bootstrap	On Resistance (high side)	R_{ONHH}		5.5	Ω	$VH-VLIN=5V$
	On Resistance (low side)	R_{ONHL}		5.5	Ω	$VH-VLIN=5V$
Protection System	On Resistance (high side)	R_{ONLH}		5.5	Ω	$V_{CC}=5V$
	On Resistance (low side)	R_{ONLL}		5.5	Ω	$V_{CC}=5V$
Protection System	Bootstrap Voltage	$VH-VLIN$	4.5	5	5.5	V
	Current for Current Limit Detection	I_{IM}	90	100	110	μA
	Soft Start Terminal Current	I_{SS}		± 20	μA	$V_{CC}=5V$
	EN Low Level Voltage	V_{CELO}	0		0.8	V
	EN High Level Voltage	V_{CEHI}	2.4		V_{CC}	V
	EN Bias Level Current	I_{CE}		5	μA	$V_{CC}=5V, EN=5V$
	PWRGD Good Voltage (high side)	V_{SENS}		1.32	V	$V_{CC}=5V$
	PWRGD Good Voltage (low side)	V_{SENS}		0.88	V	$V_{CC}=5V$
	PWRGD Low Output Voltage	V_{PWRGD}		0.4	V	$V_{CC}=5V, I_{PWRGD}=120\mu A$
	PWRGD Terminal Current	I_{PWRGD}		120	μA	$V_{CC}=5V, V_{PWRGD}=0.4V$
	PWRGD Leakage Current	I_{PWRGD}		5	μA	$V_{PWRGD}=5V$

■External Dimensions (TSSOP24)

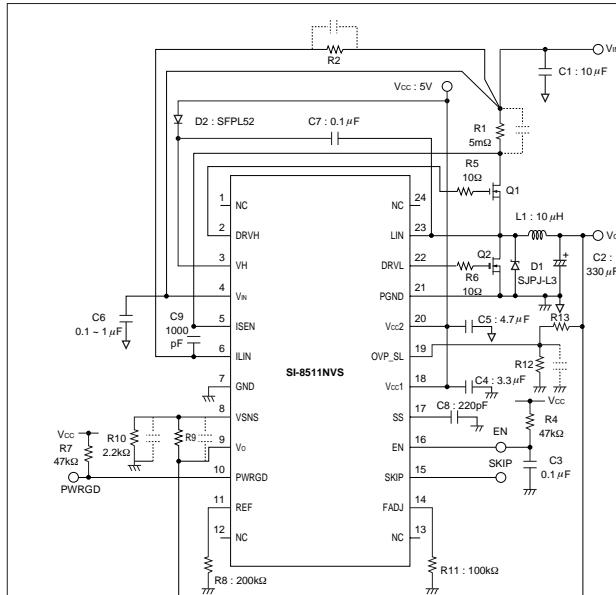
(Unit : mm)



■Block Diagram (Pin Assignment)



■ Typical Connection Diagram



MOS FET Q₁, Q₂

- Be sure to use logic type MOS FET as Q1 and Q2.
If you use a normal power MOS FET type, the ON resistance may not drop to a satisfactory level due to a shortage of V_{GS} . This may deteriorate the efficiency and cause overheating.

Diode D1

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

- If the winding resistance of the choke coil is too high, the efficiency may drop below the rated value.
 - Take care concerning heat radiation from the choke coil caused by magnetic saturation due to overload or short-circuit load.

Capacitor C₁, C₂

- As large ripple currents flow through C1 and C2, use high-frequency and low-impedance capacitors suitable for switching mode power supplies. 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 a ceramic capacitor, which may cause an abnormal oscillation.

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