

## Power Factor Correction Continuous Conduction Mode Controller

### Features and Benefits

- Continuous conduction mode (CCM) system: low peak current and suitability for high power applications
- Average current control system: no multiplier and few external components allows simple circuit configuration because no input voltage detection required
- PWM and frequency modulation functions: PWM operation frequency fixed at 65 kHz (typ) with superimposed variable frequency according to duty cycle
- Maximum duty cycle 94% (typ)
- Error amplifier reference voltage 3.5 V (typ)
- Built-in high speed load response (HSR) function
- Brown-in/brown-out protection function: protects the power supply at low input voltages

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### Package: 8-pin SOP



*Not to scale*

### Description

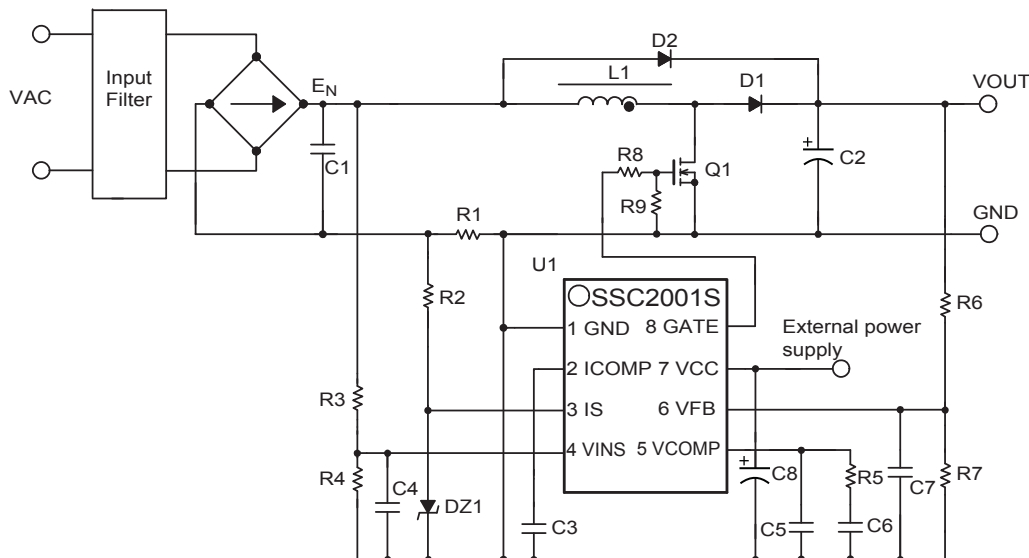
The SSC2001S is a continuous conduction mode (CCM) control IC for power factor correction (PFC). The IC allows the realization of high-power output and high-efficiency power management systems, which require few external components because of the built-in average current control system.

### Applications:

Power factor correction of middle to high power for electronic devices such as:

- AC/DC power supplies
- Digital appliances for large size LCD/PDP television and so forth
- Office automation (OA) equipment for computer, server, monitor, and so forth
- Communication facilities

### Typical Application Diagram



**Features and Benefits (continued)**

- Protection functions:
  - Output overvoltage protection (OVP): turns off gate output on pulse-by-pulse basis, with auto restart
  - Overcurrent protection (OCP): two types, both with auto restart:
    - $V_{IS(OCPL)}$ : limits power by reducing duty cycle of next cycle after detection
    - $V_{IS(OCPH)}$ : turns off gate output on pulse-by-pulse basis
  - Open loop detection (OLD) on output: stops oscillation, and the operation switches to standby mode; auto restart after removal of cause of open loop

The polarity value for current specifies a sink as "+," and a source as "–," referencing the IC.

**Absolute Maximum Ratings**, valid at  $T_A = 25^\circ\text{C}$ 

Characteristic	Symbol	Pins	Rating	Unit
VCC Pin Voltage	$V_{CC}$	7-1	-0.3 to 30	V
VINS Pin Voltage	$V_{INS}$	4-1	-0.3 to 5.5	V
ICOMP Pin Voltage	$V_{ICOMP}$	2-1	-0.3 to 5.5	V
IS Pin Voltage	$V_{IS}$	3-1	-5.5 to 0.3	V
IS Pin Current	$I_{IS}$	3-1	-1 to 1	mA
VFB Pin Voltage	$V_{FB}$	6-1	-0.3 to 5.5	V
VFB Pin Current	$I_{FB}$	6-1	-1 to 1	mA
VCOMP Pin voltage	$V_{VCOMP}$	5-1	-0.3 to 5.5	V
GATE Pin voltage	$V_{GATE}$	8-1	-0.3 to 30	V
Frame Temperature during Operation	$T_{FOP}$	–	-40 to 110	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	–	-40 to 125	$^\circ\text{C}$
Junction Temperature	$T_J$	–	-40 to 150	$^\circ\text{C}$

### Electrical Characteristics

Unless specifically noted,  $T_A$  is 25°C,  $V_{CC} = 15\text{ V}$

Characteristic	Symbol	Test Conditions	Pins	Min.	Typ.	Max.	Unit
<b>Power Supply Start-up Operation</b>							
Operation Start Voltage	$V_{CC(ON)}$		7-1	10.5	11.3	12.1	V
Operation Stop Voltage	$V_{CC(OFF)}$		7-1	9.5	10.3	11.1	V
Operation Voltage Hysteresis	$V_{CC(HYS)}$		7-1	0.7	0.9	1.1	V
Circuit Current in Non-Operation	$I_{CC(OFF)}$	$V_{CC} = 10\text{ V}$	7-1	30	100	200	$\mu\text{A}$
Circuit Current in Operation	$I_{CC(ON)}$		7-1	6.0	9.0	12.0	mA
Circuit Current in Standby	$I_{CC(STANDBY)}$	$V_{FB} = 0.5\text{ V}$	7-1	2.0	4.0	6.0	mA
<b>Oscillator Operation</b>							
Oscillating Frequency	$f_{OSC}$	$V_{IS} = 0\text{ V}, V_{VCOMP} = 4\text{ V}$	8-1	57	65	70	kHz
Maximum Duty Cycle	$D_{MAX}$	$V_{IS} = 0\text{ V}, V_{VCOMP} = 4\text{ V}$	8-1	90	94	99.3	%
Minimum Duty Cycle	$D_{MIN}$	$V_{IS} = 0.5\text{ V}, V_{VCOMP} = 0\text{ V}$	8-1	-	-	0	%
Minimum Off-Time*	$t_{OFFMIN}$		8-1	150	250	350	ns
<b>Protection Operation</b>							
VFB Pin Open Loop Detection Threshold Voltage	$V_{FB(OLD)}$		6-1	0.51	0.55	0.59	V
VFB Pin Overvoltage Protection Threshold Voltage	$V_{FB(OVP)}$		6-1	3.57	3.745	3.85	V
IS Pin Overcurrent Protection High Threshold Voltage	$V_{IS(OCPH)}$		3-1	-0.81	-0.75	-0.69	V
IS Pin Overcurrent Protection Low Threshold Voltage	$V_{IS(OCPL)}$		3-1	-0.54	-0.5	-0.46	V
VINS Pin Input Undervoltage Protection Low Threshold Voltage	$V_{INS(L)}$	$V_{VINS} = 0\text{ V}$	4-1	0.51	0.55	0.59	V
VINS Pin Input Undervoltage Protection High Threshold Voltage	$V_{INS(H)}$		4-1	0.94	1.0	1.08	V
VINS Pin Input Undervoltage Protection Bias Current	$I_{VINS(BIAS)}$		4-1	-1.0	-	0	$\mu\text{A}$
<b>Current Loop</b>							
Current Amplifier Transconductance Gain	$g_{mCA}$		-	1.1	1.4	1.7	ms
Current Amplifier Output Source Current*	$I_{CA(SO)}$		-	-	-50	-	$\mu\text{A}$
Current Amplifier Output Sink Current*	$I_{CA(SK)}$		-	-	50	-	$\mu\text{A}$
ICOMP Pin Output Open Loop Detection Threshold Voltage	$V_{ICOMP(OLD)}$	$V_{FB}=0.5\text{V}$	2-1	3.6	4.0	4.3	V

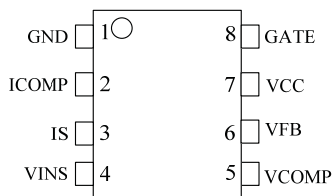
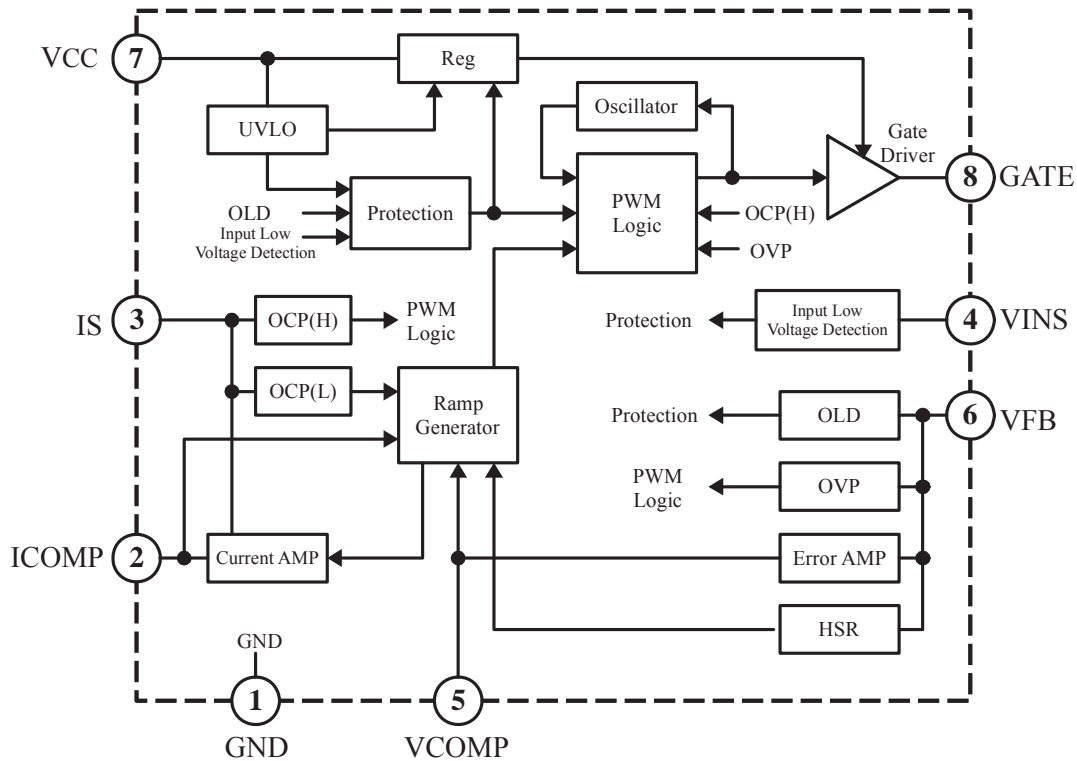
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**Electrical Characteristics (continued)** Unless specifically noted,  $T_A$  is 25°C,  $V_{CC} = 15\text{ V}$ 

Characteristic	Symbol	Test Conditions	Pins	Min.	Typ.	Max.	Unit
<b>Voltage Loop</b>							
Error Amplifier Reference Voltage	$V_{FB(REF)}$	$I_{VCOMP} = 0\ \mu\text{A}$	6-1	3.4	3.5	3.6	V
Error Amplifier Transconductance Gain	$g_{mEA}$		-	45	60	75	$\mu\text{s}$
Error Amplifier Maximum Source Current	$I_{VCOMP(SO)}$		5-1	-38	-30	-21	$\mu\text{A}$
Error Amplifier Maximum Sink Current	$I_{VCOMP(SK)}$		5-1	21	30	38	$\mu\text{A}$
VFB Pin High Speed Load Response Operation Enable Voltage*	$V_{FB(HSR)ENABLE}$		6-1	-	3.4	-	V
VFB Pin High Speed Load Response Operation Start Voltage	$V_{FB(HSR)ACTIVE}$		6-1	3.24	3.325	3.41	V
VCOMP Pin High Speed Load Response Source Current	$I_{VCOMP(SOHSR)}$		5-1	-127	-100	-72	$\mu\text{A}$
VFB Pin Input Bias Current	$I_{FB(BIAS)}$		6-1	-	-	1	$\mu\text{A}$
VCOMP Pin Output Open Loop Detection Threshold Voltage	$V_{VCOMP(OLD)}$	$V_{FB} = 0.5\text{ V}$	5-1	0.60	1.03	1.40	V
<b>Drive Circuit</b>							
GATE Pin Voltage (Low)	$V_{GATE(L)}$	$I_{GATE} = -20\text{ mA}$	8-1	-	-	0.4	V
GATE Pin Voltage (High)	$V_{GATE(H)}$	$V_{CC} = 11\text{ V}$	8-1	-	10.5	-	V
GATE Pin Rise Time	$t_r$		8-1	-	100	-	ns
GATE Pin Fall Time	$t_f$		8-1	-	50	-	ns
GATE Pin Peak Source Current*	$I_{GATE(SO)}$		8-1	-	-0.5	-	A
GATE Pin Peak Sink Current*	$I_{GATE(SK)}$		8-1	-	1.0	-	A
<b>Thermal Characteristics</b>							
Thermal Resistance from Junction to Frame	$R_{\theta J-F}$	The frame temperature, $T_F$ , is specified by using the temperature at the base of pin 1.	-	-	65	85	°C/W

\*Determined by design, not tested in production.

## Functional Block Diagram

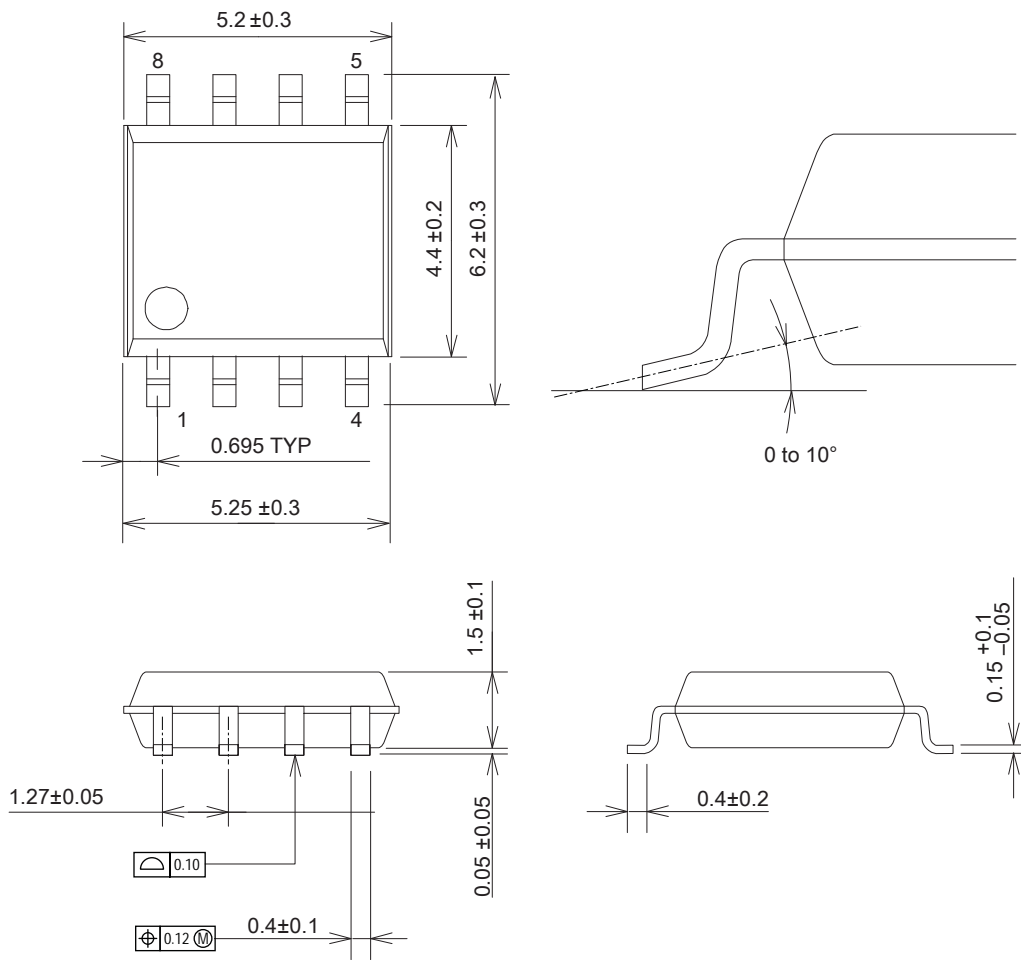


**Pin List Table**

Name	Number	Function
1	GND	Ground
2	ICOMP	Current amplifier output
3	IS	Overcurrent detection signal input
4	VINS	Low-voltage detection signal input (brown-in/brown-out protection function)
5	VCOMP	Error amplifier output/phase compensation
6	VFB	Output constant voltage control signal/output overvoltage signal/output open loop detection signal input
7	VCC	Control circuit power supply input
8	GATE	Gate drive output

## Package Diagram

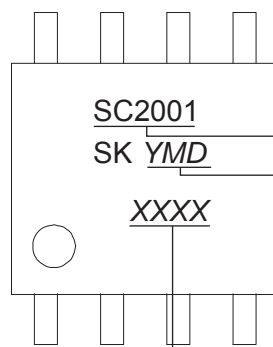
SOP8



Unit: mm



*Pb-free.*  
*Device composition compliant*  
*with the RoHS directive.*



Part Number

Lot Number

Y is the last digit of the year (0 to 9)

M is the month (1 to 9, O, N, or D)

D is a period of days (1 to 3):

1 - 1<sup>st</sup> to 10<sup>th</sup>

2 - 11<sup>th</sup> to 20<sup>th</sup>

3 - 21<sup>st</sup> to 31<sup>st</sup>

Sanken Control Number

Because reliability can be affected adversely by improper storage environments and handling methods, please observe the following cautions.

**Cautions for Storage**

- Ensure that storage conditions comply with the standard temperature (5°C to 35°C) and the standard relative humidity (around 40% to 75%); avoid storage locations that experience extreme changes in temperature or humidity.
- Avoid locations where dust or harmful gases are present and avoid direct sunlight.
- Reinspect for rust on leads and solderability of the products that have been stored for a long time.

**Cautions for Testing and Handling**

When tests are carried out during inspection testing and other standard test periods, protect the products from power surges from the testing device, shorts between the product pins, and wrong connections. Ensure all test parameters are within the ratings specified by Sanken for the products.

**Soldering**

When soldering the products, please be sure to minimize the working time, within the following limits:

- 260 ± 5°C 10±1 s (Flow, 2 times)
- 380±10°C 3.5±0.5 s (Soldering iron, 1 time)

**Electrostatic Discharge**

- When handling the products, the operator must be grounded. Grounded wrist straps worn should have at least 1 MΩ of resistance from the operator to ground to prevent shock hazard, and it should be placed near the operator.
- Workbenches where the products are handled should be grounded and be provided with conductive table and floor mats.
- When using measuring equipment such as a curve tracer, the equipment should be grounded.
- When soldering the products, the head of soldering irons or the solder bath must be grounded in order to prevent leak voltages generated by them from being applied to the products.
- The products should always be stored and transported in Sanken shipping containers or conductive containers, or be wrapped in aluminum foil.

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In addition, it should be noted that since power devices or IC's including power devices have large self-heating value, the degree of derating of junction temperature affects the reliability significantly.

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