

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

Continued on the next page...

Package: 8-pin SOP



Not to scale

Description

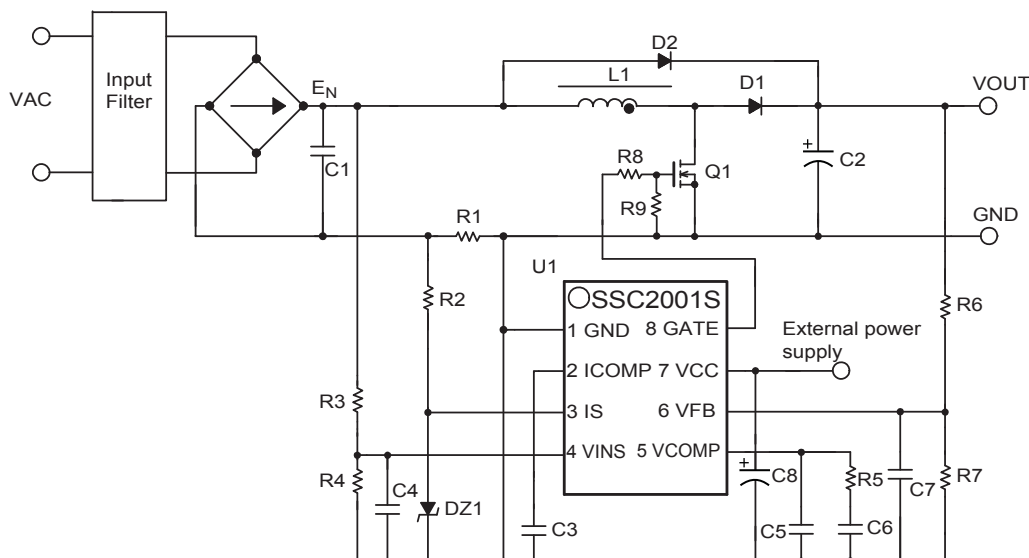
The SSC2001S is a continuous conduction mode (CCM) control IC for power factor correction (PFC). The IC allows the realization of high-power output and high-efficiency power management systems, which require few external components because of the built-in average current control system.

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
Power Supply Start-up Operation							
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	μA
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
Oscillator Operation							
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
Protection Operation							
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	μA
Current Loop							
Current Amplifier Transconductance Gain	g_{mCA}		–	1.1	1.4	1.7	ms
Current Amplifier Output Source Current*	$I_{CA(SO)}$		–	–	–50	–	μA
Current Amplifier Output Sink Current*	$I_{CA(SK)}$		–	–	50	–	μA
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

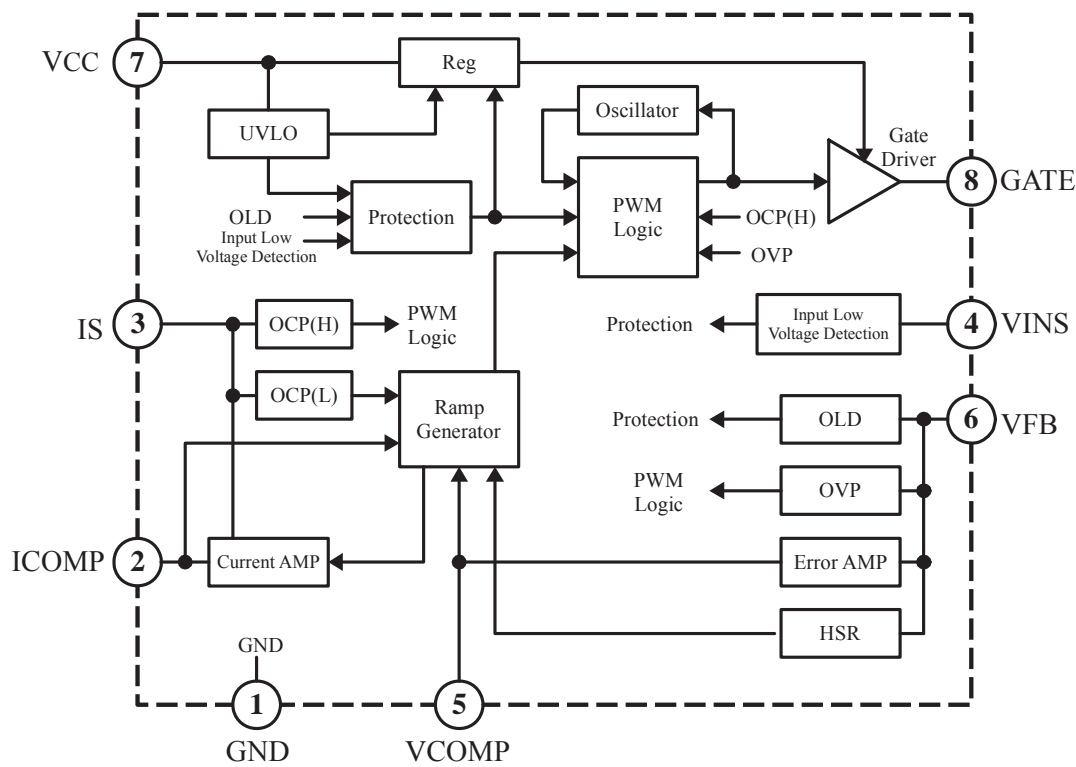
Continued on the next page...

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
Voltage Loop							
Error Amplifier Reference Voltage	$V_{FB(REF)}$	$I_{VCOMP} = 0\text{ }\mu\text{A}$	6-1	3.4	3.5	3.6	V
Error Amplifier Transconductance Gain	g_{mEA}		-	45	60	75	μs
Error Amplifier Maximum Source Current	$I_{VCOMP(SO)}$		5-1	-38	-30	-21	μA
Error Amplifier Maximum Sink Current	$I_{VCOMP(SK)}$		5-1	21	30	38	μA
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	μA
VFB Pin Input Bias Current	$I_{FB(BIAS)}$		6-1	-	-	1	μA
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
Drive Circuit							
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
Thermal Characteristics							
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

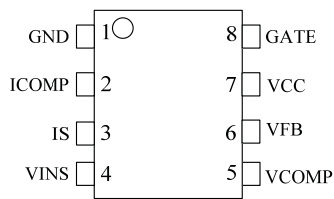
*Determined by design, not tested in production.

Functional Block Diagram



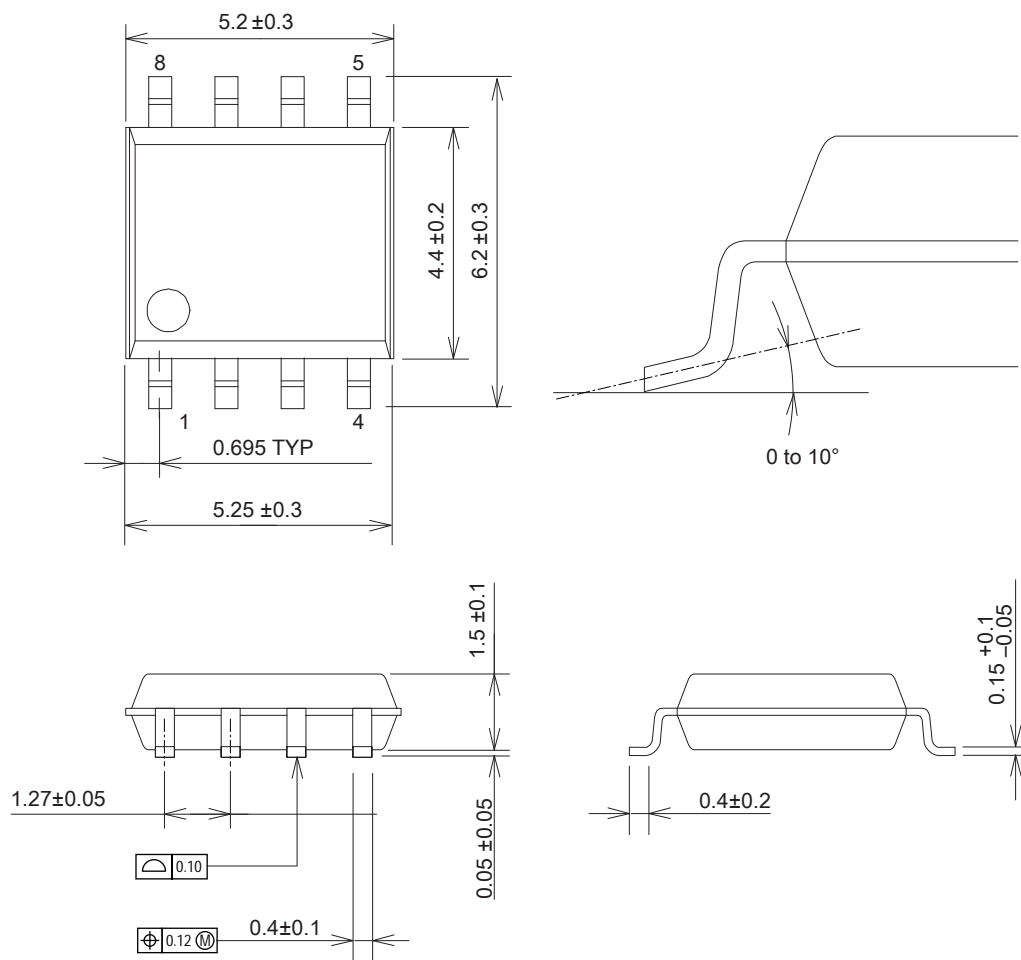
Pin List Table

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

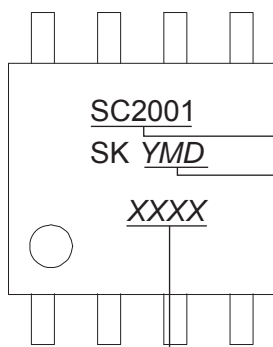


Unit: mm



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 - 1st to 10th

2 - 11th to 20th

3 - 21st to 31st

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.

-
- The contents in this document are subject to changes, for improvement and other purposes, without notice. Make sure that this is the latest revision of the document before use.
 - Application and operation examples described in this document are quoted for the sole purpose of reference for the use of the products herein and Sanken can assume no responsibility for any infringement of industrial property rights, intellectual property rights or any other rights of Sanken or any third party which may result from its use.
 - Although Sanken undertakes to enhance the quality and reliability of its products, the occurrence of failure and defect of semiconductor products at a certain rate is inevitable. Users of Sanken products are requested to take, at their own risk, preventative measures including safety design of the equipment or systems against any possible injury, death, fires or damages to the society due to device failure or malfunction.
 - Sanken products listed in this document are designed and intended for the use as components in general purpose electronic equipment or apparatus (home appliances, office equipment, telecommunication equipment, measuring equipment, etc.).

When considering the use of Sanken products in the applications where higher reliability is required (transportation equipment and its control systems, traffic signal control systems or equipment, fire/crime alarm systems, various safety devices, etc.), and whenever long life expectancy is required even in general purpose electronic equipment or apparatus, please contact your nearest Sanken sales representative to discuss, prior to the use of the products herein.

The use of Sanken products without the written consent of Sanken in the applications where extremely high reliability is required (aerospace equipment, nuclear power control systems, life support systems, etc.) is strictly prohibited.

- In the case that you use Sanken products or design your products by using Sanken products, the reliability largely depends on the degree of derating to be made to the rated values. Derating may be interpreted as a case that an operation range is set by derating the load from each rated value or surge voltage or noise is considered for derating in order to assure or improve the reliability. In general, derating factors include electric stresses such as electric voltage, electric current, electric power etc., environmental stresses such as ambient temperature, humidity etc. and thermal stress caused due to self-heating of semiconductor products. For these stresses, instantaneous values, maximum values and minimum values must be taken into consideration.

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.

- When using the products specified herein by either (i) combining other products or materials therewith or (ii) physically, chemically or otherwise processing or treating the products, please duly consider all possible risks that may result from all such uses in advance and proceed therewith at your own responsibility.
- Anti radioactive ray design is not considered for the products listed herein.
- Sanken assumes no responsibility for any troubles, such as dropping products caused during transportation out of Sanken's distribution network.
- The contents in this document must not be transcribed or copied without Sanken's written consent.