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°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	°C
Storage Temperature	T_{stg}	−	−40 to 125	°C
Junction Temperature	T_J	−	−40 to 150	°C

Electrical Characteristics Unless specifically noted, T_A is 25°C, V_{CC} = 15 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 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 V	7−1	2.0	4.0	6.0	mA
Oscillator Operation							
Oscillating Frequency	f_{OSC}	V_{IS} = 0 V, V_{VCOMP} = 4 V	8−1	57	65	70	kHz
Maximum Duty Cycle	D_{MAX}	V_{IS} = 0 V, V_{VCOMP} = 4 V	8−1	90	94	99.3	%
Minimum Duty Cycle	D_{MIN}	V_{IS} = 0.5 V, V_{VCOMP} = 0 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 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	gm_{CA}		−	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	$V_{ICOMP(OLD)}$	VFB=0.5V	2−1	3.6	4.0	4.3	V

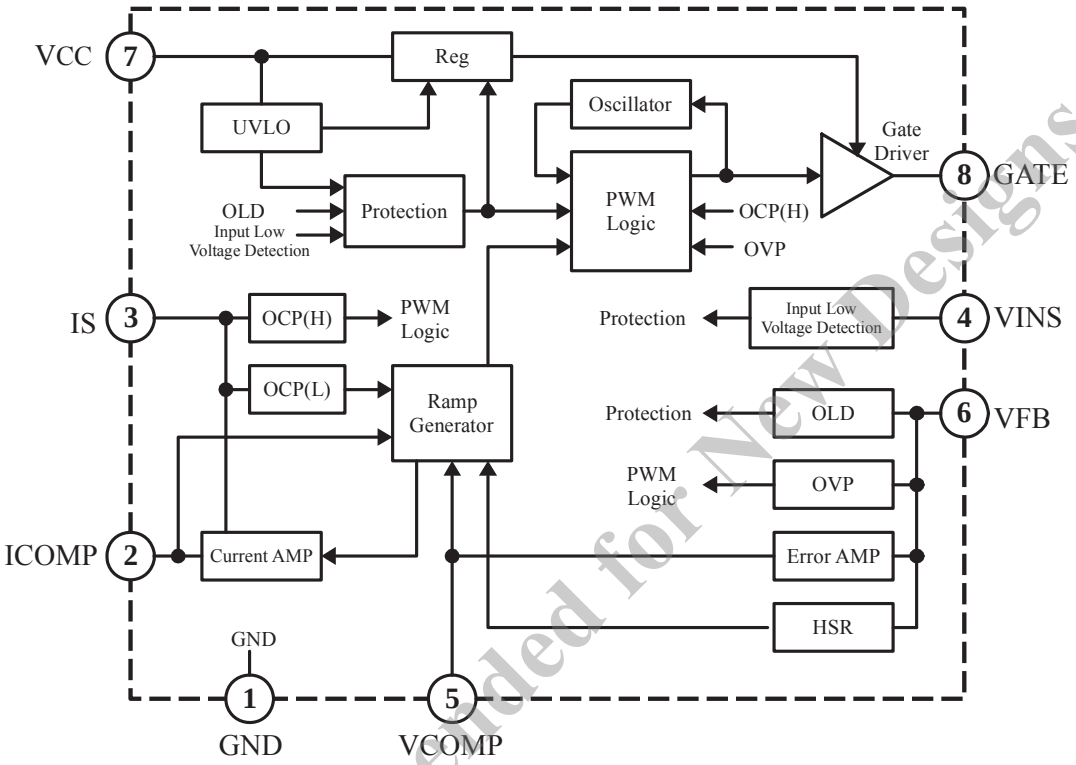
Continued on the next page…

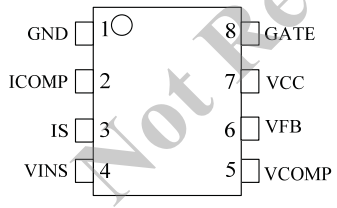
Electrical Characteristics (continued) Unless specifically noted, T_A is 25°C, V_{CC} = 15 V

Characteristic	Symbol	Test Conditions	Pins	Min.	Typ.	Max.	Unit
Voltage Loop							
Error Amplifier Reference Voltage	$V_{FB(REF)}$	I_{VCOMP} = 0 µA	6−1	3.4	3.5	3.6	V
Error Amplifier Transconductance Gain	gm_{EA}		−	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 V	5−1	0.60	1.03	1.40	V
Drive Circuit							
GATE Pin Voltage (Low)	$V_{GATE(L)}$	I_{GATE} = −20 mA	8−1	−	−	0.4	V
GATE Pin Voltage (High)	$V_{GATE(H)}$	V_{CC} = 11 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



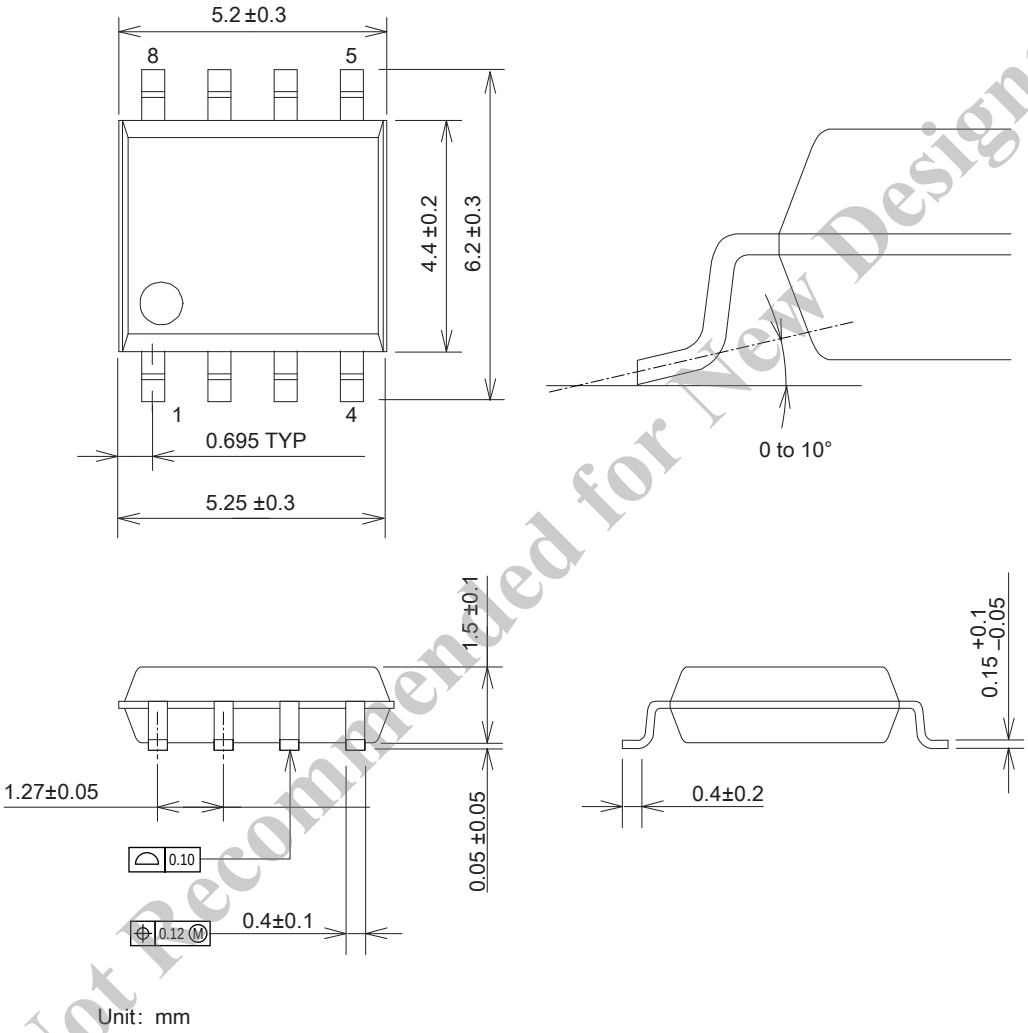


Pin List Table

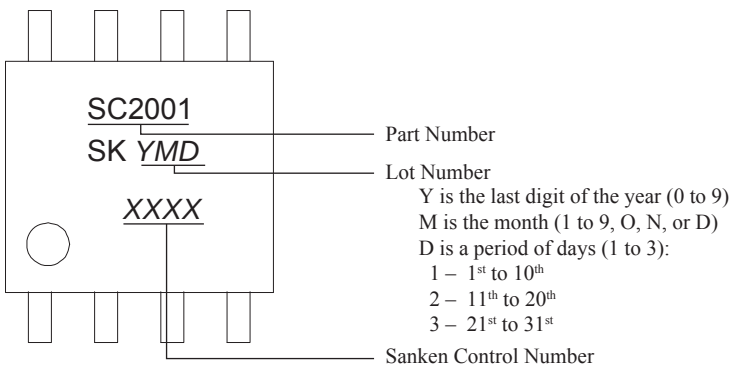
Name	Number	Function
1	GND	Ground
2	ICOMP	Current amplifier output
3	IS	Overcurrent detection signal input
4	VINS	Low-voltage detection signal input (brown-in/brown-out protection function)
5	VCOMP	Error amplifier output/phase compensation
6	VFB	Output constant voltage control signal/output overvoltage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

Package Diagram

SOP8



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



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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