GS5805

1MHz Step-Up PWM Converter with a 5.5A Switch

Product Description

The GS5805 is a current-mode boost DC/DC converter with a 5.5A, 0.1Ω internal power MOSFET to provide this regulator highly power efficient.

The GS5805 operates at 1MHz allowing for easy filtering and low noise. Internal compensation makes the user to set system easily, which allows the use of small, low-ESR ceramic output capacitors. Fault protection includes over-current latch off, input UVLO and thermal shutdown. This device uses current mode control scheme that provides fast transient response. In shutdown mode, the supply current is less than 1uA.

The GS5805 is available in an PSOP-8 package, provides a very compact system solution and good thermal conductance.

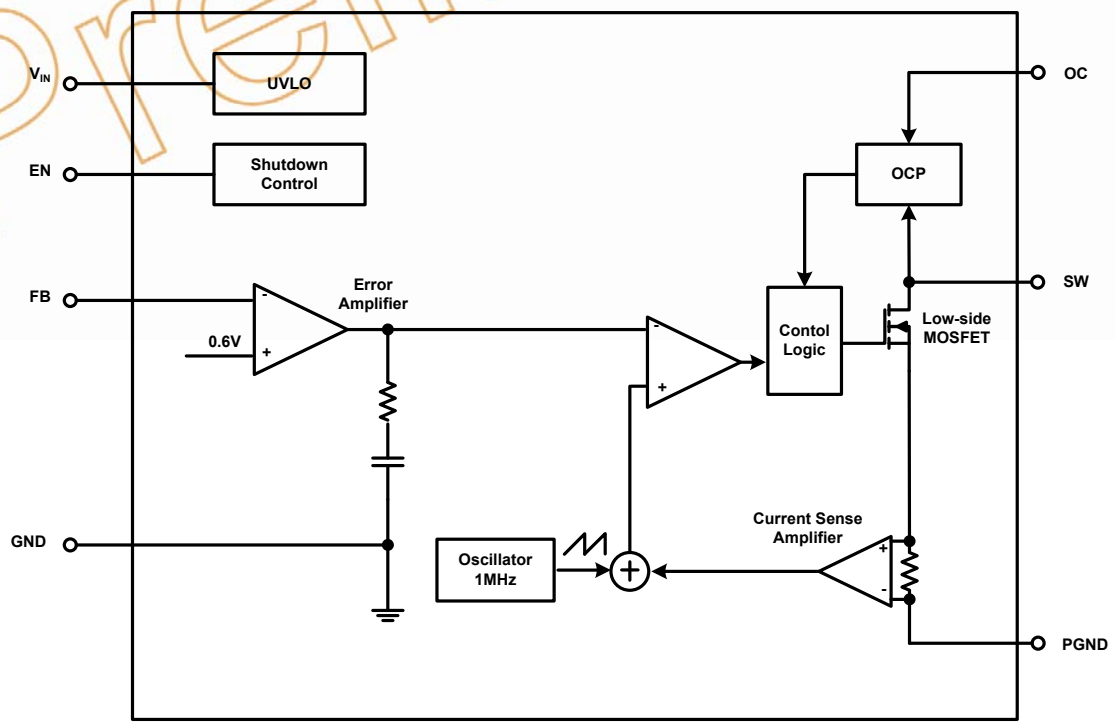
Features

- Adjustable Output Voltage up to 12V
- Internal 0.1Ω, 5.5A, 18V Power MOSFET
- Internal Soft-Start
- Fixed 1MHz Switching Frequency
- Current Mode Operation
- 12V Output at 1A from 5V Input
- Cycle-by-Cycle current limit
- Adjustable Over Current Protection
- Input Under Voltage Lockout
- Over-Temperature Protection
- Thermal Enhanced PSOP-8 Package
- RoHS Compliant, 100%Pb & Halogen Free

Applications

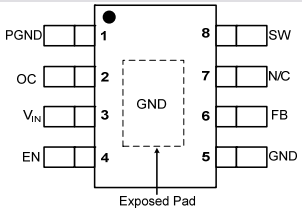
- LCD Displays
- Chargers
- Portable Products
- Digital Cameras
- Handheld Computers and PADs

Block Diagram



Packages & Pin Assignments

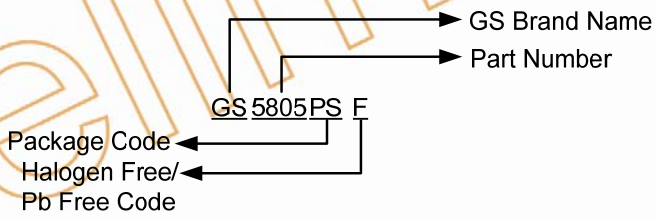
GS5805PSF (PSOP-8)



Top View

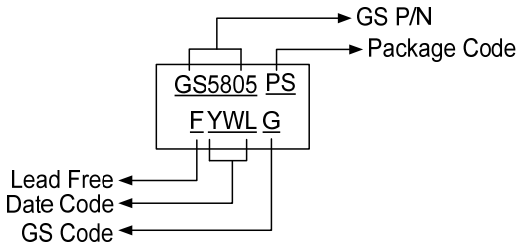
Pin No	Pin Name	Description
1	PGND	Ground Pin.
2	OC	Current Limit Setting Pin. Connect a resistor from OC to GND to set the peak switching current. It can be left floating.
3	V_{IN}	Power Supply Input Pin. Connecting a ceramic bypass capacitor between V_{IN} and GND to eliminate noise.
4	EN	Enable Input Pin. This pin provides a digital control to turn the converter on or off. Connect to V_{IN} with a 100KΩ resistor for self-startup. EN cannot be left floating.
5/EP	GND	Ground Pin. The exposed pad is connected to GND.
6	FB	Voltage Feedback Input Pin. Connecting FB and V_{OUT} with a resistive voltage divider. This IC senses feedback voltage via FB and regulate it at 0.6V.
7	N/C	Not connected
8	SW	Power Switch Output. It is the output pin that internal MOSFET. Connect the inductor and output rectifier to SW.

Ordering Information



GS Complete P/N	Package	Q'ty / Reel
GS5805PSF	PSOP-8	4000 PCS

Marking Information



Absolute Maximum Ratings (1)

Symbol	Parameter	Maximum Rating	Units
V_{IN}	Input Voltage	0 ~ 6	V
V_{SW}	SW Voltage	0 ~ 18	
	All Other Pins Voltage	0 ~ 6	
T_J	Maximum Junction Temperature	150	°C
T_{STG}	Storage Temperature	-65 ~150	°C
T_{LEAD}	Lead Temperature (Soldering 10 sec)	260	°C
HBM	ESD Classification	Class 2	

Recommended Operating Conditions (2)

Symbol	Parameter	Maximum Rating	
V_{IN}	Input Supply Voltage	2.6 ~ 5.5	V
T_A	Ambient Temperature	-40 ~85	°C
θ_{JA}	Thermal Resistance Junction to Ambient	75	°C/W
θ_{JC}	Thermal Resistance Junction to Case	15	°C/W

Note 1: Stresses exceed those ratings may damage the device.

Note 2: If out of its operation conditions, the device is not guaranteed to function.

Electrical Characteristics

(V_{IN}=3.3V, T_A=25℃, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min	TYP	Max	Units
V_{IN}	Input Supply Voltage		2.6		5.5	V
I_{IN}	Input average Supply Current	V_{EN} = V_{IN}, No loading		400		uA
I_S	Shutdown Supply Current	V_{EN} = 0V		0.5	3	uA
V_{FB}	Feedback Voltage		0.588	0.6	0.612	V
V_{OUT}	Output Voltage	V_{OUT}=5V	-3		3	%
$R_{DS(ON)}$	Low-side MOSFET On Resistance (3)	I_{SW}=1A		100		mΩ
I_{LIMIT}	Low-Side MOSFET Current Limit (3)			5.5		A
I_{OC}	Adjustable Over Current (3)	With External Resistor: 20k~43k	2.1		4.9	
F_{OSC}	Oscillation frequency		0.8	1	1.2	MHz
D_{MAX}	Maximum Duty Cycle			90		%
V_{UVLO}	Input UVLO Threshold	V_{IN} Rising		2.4		V
	Under Voltage Lockout Threshold Hysteresis			200		mV
V_{EN}	EN Shutdown Threshold Voltage			0.85	0.96	V
T_{SD}	Thermal Shutdown Threshold (3)			150		°C

Note 3: Not production tested.

Typical Application Circuit

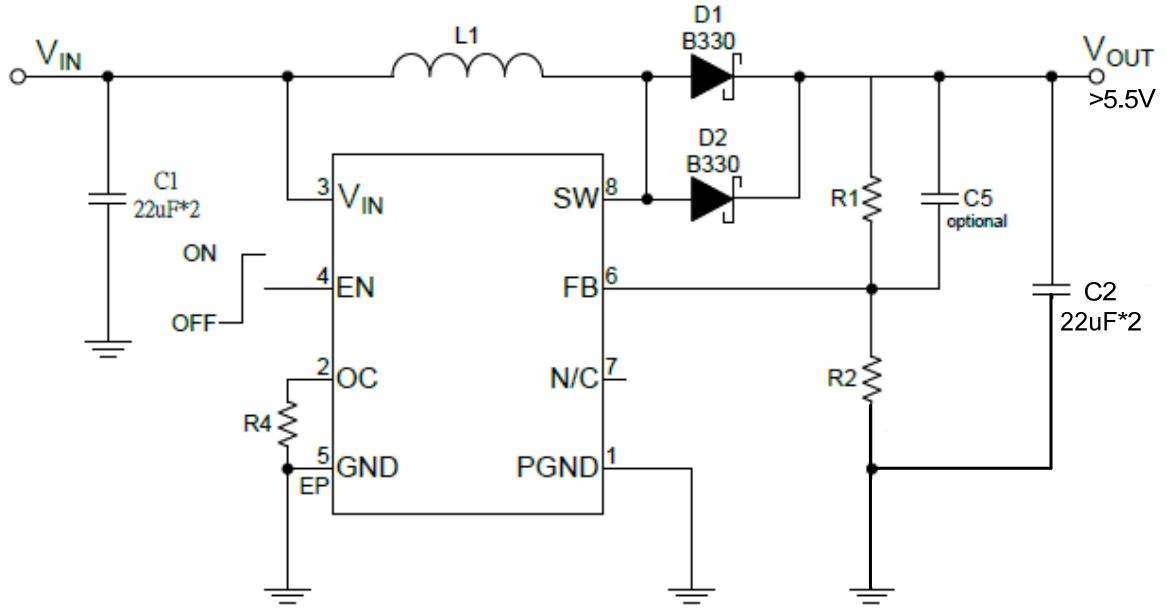


Figure1. For Output voltage exceed 5.5V applications

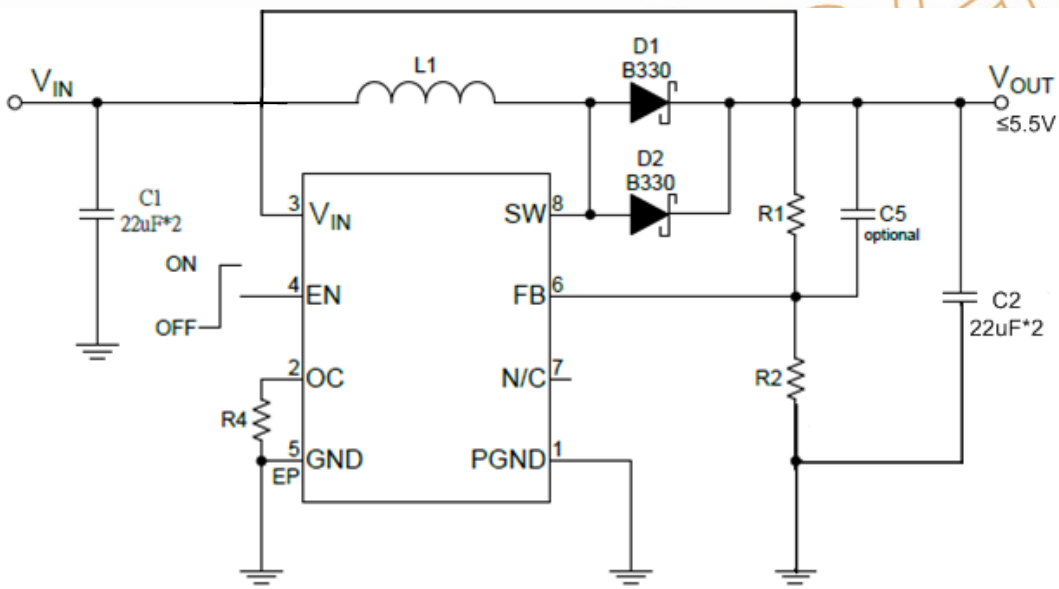


Figure2. For Low Output voltage applications

Application Information

Function Description:

The GS5805 is a constant frequency current mode boost asynchronous DC/DC converter. It regulates input voltage from 2.6V to 5.5V, boost to an output voltage as high as 12V, and can provide up to 2A of continuous load current.

Control Loop

During normal operation, the output voltage is sensed at FB pin through a resistive voltage divider and amplified through the error amplifier. The voltage of error amplifier output is compared to the switch current to controls the RS latch. At each cycle, the low side NMOS would be turned on when the oscillator sets the RS latch and would be turned off when current comparator resets the RS latch.

Enable

The GS5805 EN pin provides digital control to turn on/turn off the regulator. When the voltage of EN exceeds the threshold voltage, the regulator starts the soft start function. If the EN pin voltage is below than the threshold voltage, the regulator will be disable and into the shutdown mode.

Adjustable Peak Switch Current

To select the peak switch current connect a resistor R4 from OC to GND. According to following equation, the peak current I_{OCP} is calculated:

$$I_{OCP}(A) = \frac{105}{R4\ (k\Omega)} - 0.1$$

Input Under Voltage Lockout

When the GS5805 power on, the internal circuits are held inactive until V_{IN} exceeds the input UVLO threshold voltage. And the regulator will be disabled when V_{IN} below the input UVLO threshold voltage. The hysteretic of the UVLO comparator is 200 mV.

Over Current Protection

The GS5805 provides over current protection function to prevent the device damage from over current condition. When the output current is too high, the switching current is limited. Once an over-current lasting more than 50us is sensed, the converter will latch off. Another power sequence is needed to restart the converter.

Over Temperature Protection

The GS5805 incorporates an over temperature protection circuit to protect itself from overheating. When the junction temperature exceeds the thermal shutdown threshold temperature, the regulator will be shutdown.

Application Information(Continue)

Output Voltage Setting

The output voltage V_{OUT} is set by a resistive divider from the output to FB. The FB pin regulated voltage is 0.6V. Thus the output voltage is:

$$V_{OUT} = 0.6V(1+ \frac{R1}{R2})$$

R2 recommended value is 10kΩ, so R1 is determined by:

$$R1=16.67X(V_{OUT}-0.6)\ k\Omega$$

Table1 lists recommended value of R1 and R2 for most used output voltage.

V_{OUT}	R1	R2
12V	190 kΩ	10 kΩ
5V	73.4 kΩ	10 kΩ

Table1 Recommended Resistance Values

Place resistors R1 and R2 close to FB pin to prevent stray pickup.

Capacitor Selection

The output capacitor is used to keep the DC output voltage and supply the load transient current. Low ESR capacitors are preferred. Ceramic, tantalum or low ESR electrolytic capacitors can be used, depends on the output ripple requirement. Ceramic capacitor of X5R and X7R are recommended, which have low ESR and wider operation temperature range.

Inductor Selection

The inductor is used for store energy and filter output ripple current. 2.2uH to 4.7uH inductor is recommended for general application circuit.

Diode Selection

Schottky diodes with low forward voltages and fast recovery times are recommended for better efficiency. The diode average and peak current rating must be larger than the average output current and peak switching current. And the reverse breakdown voltage must exceed the output voltage.

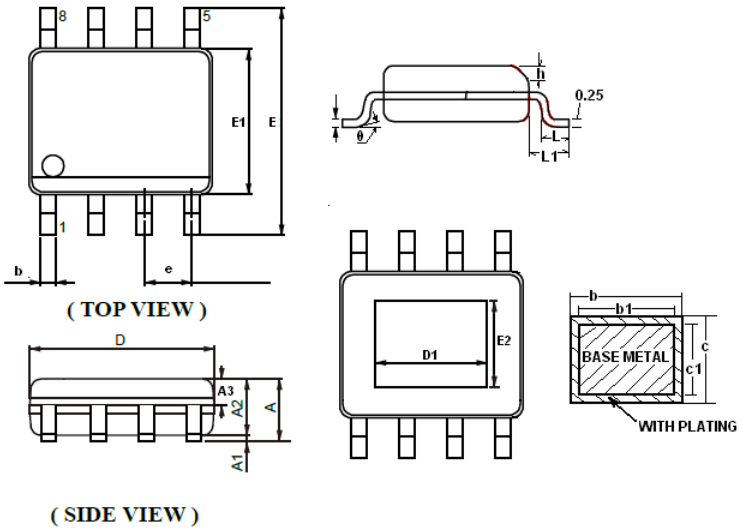
PCB Layout Recommendation

The device's performance and stability is dramatically affected by PCB layout. It is recommended to follow these general guidelines show bellow:

1. Place the input capacitors, output capacitors as close to the device as possible. Trace to these capacitors should be as short and wide as possible to minimize parasitic inductance and resistance.
2. The SW trace (include SW, Inductor and Diode switching node) should be kept short and wide to reduce parasitic resistance and EMI.
3. Place V_{IN} bypass capacitors close to the IN pin.
4. Place feedback resistors close to the FB pin.
5. Keep the sensitive FB trace away from the switching signal (SW).
6. The exposed pad of the package should be soldered to an equivalent area of metal on the PCB. This area should connect to the GND plane and have multiple via connections to the back of the PCB as well as connections to intermediate PCB layers. The GND plane area connects to the exposed pad should be maximized to improve thermal performance.
7. Multi-layer PCB design is recommended.

Package Dimension

(PSOP-8)



Dimensions

SYMBOL	Millimeters			Inches		
	MIN	NOM	MAX	MIN	NOM	MAX
A	-	-	1.75	-	-	0.069
A1	0.05	-	0.15	0.002	-	0.006
A2	1.3	1.4	1.5	0.051	0.055	0.059
A3	0.6	0.65	0.7	0.024	0.026	0.028
b	0.39	-	0.48	0.015	-	0.019
b1	0.38	0.41	0.43	0.015	0.016	0.017
c	0.21	-	0.26	0.008	-	0.010
c1	0.19	0.2	0.21	0.007	0.008	0.008
D	4.84	-	5.025	0.189	-	0.196
D1	2.8	2.90	3.0	0.102	0.114	0.118
E	5.8	6	6.2	0.228	0.236	0.244
E1	3.7	3.9	4.1	0.146	0.154	0.161
E2	1.9	2.0	2.1	0.075	0.079	0.083
e	1.27 BSC			0.050		
h	0.25	-	0.5	0.010	-	0.020
L	0.5	-	0.8	0.020	-	0.031
L1	1.05 BSC			0.041		
θ	0	-	8	0	-	8

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