CR6842

Green-Power PWM Controller with Freq. Jittering

Features

- Low Cost, Green-Power Burst-Mode PWM
- Very Low Start-up Current (about 7.5μA)
- Low Operating Current (about 3.0mA)
- Current Mode Operation
- Under Voltage Lockout (UVLO)
- VDD Over Voltage Protection(OVP)
- programmable over-temperature protection
- Internal Latch Circuit(OTP,OVP)
- Built-in soft start with 1ms
- Built-in Frequency jitter for better EMI Signature
- Soft Clamped gate output voltage 16.5V

- VDD over voltage protect 25.5V
- Cycle-by-cycle current limiting
- Sense Fault Protection
- Output SCP (Short circuit Protection)
- Built-in Synchronized Slope Compensation
- Leading-edge blanking on Sense input
- Programmable PWM Frequency
- High-Voltage CMOS Process with ESD
- DIP-8 & SOP-8 Pb-Free Package
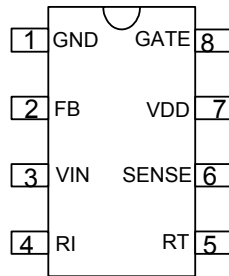- **Compatible with SG6842J&LD7552&OB2269**

Applications

- Power Adaptor
- Battery Charger Adapter

- Open Frame Switching Power Supply
- LCD Monitor

General Description

The CR6842 is a low startup current , low cost, current mode PWM controller with Green-Power & burst-mode power-saving operation. The integrated functions such as the leading-edge blanking of the current sensing, internal slope compensation provide the users a high efficiency, low external component counts, and low cost solution for AC/DC power applications. The special Green-Power function provides off-time modulation to linearly decrease the switching frequency under light-load conditions. And under zero-load conditions, the power supply enters burst-mode to further reduce power consumption by

shutting off PWM output. When the output of power supply is short or over loaded, the FB voltage will increase ,and if the FB voltage is higher than 5.2V for longer than 56msec the PWM output will be turned off. A external NTC resistor connected from pin RT to ground can be applied to over-temperature protection. Pulse by pulse current limit ensures a constant output current even under short circuit. PWM output will be disabled as long as VDD exceeds a threshold. When internal latch circuit is used to latch-off the controller, the latch will be reset when the power supply VDD is disabled.

Chengdu Chip-Rail Tech.Co.,Ltd

Pin Assignment & Description


Name	Description
GND	GND Pin
FB	Voltage feedback pin. The PWM duty cycle is determined by FB and Sense.
VIN	This pin is pulled high to the rectified line input through a large resistor for start-up. This pin is also used to detect line voltage to compensate for constant output power limit for universal AC input.
RI	By connecting a resistor to ground to set the switching freq.. Increasing the resistor will reduce the switching freq..
RT	An NTC resistor is connected from this pin to ground for over-temperature protection.
SENSE	Current sense pin, The sensed voltage is used for current-mode control and pulse-by-pulse current limiting.
VDD	Power supply voltage pin.
GATE	Gate drive output to drive the external MOSFET.A soft driving waveform is implemented to improve EMI.

Typical Application Circuit
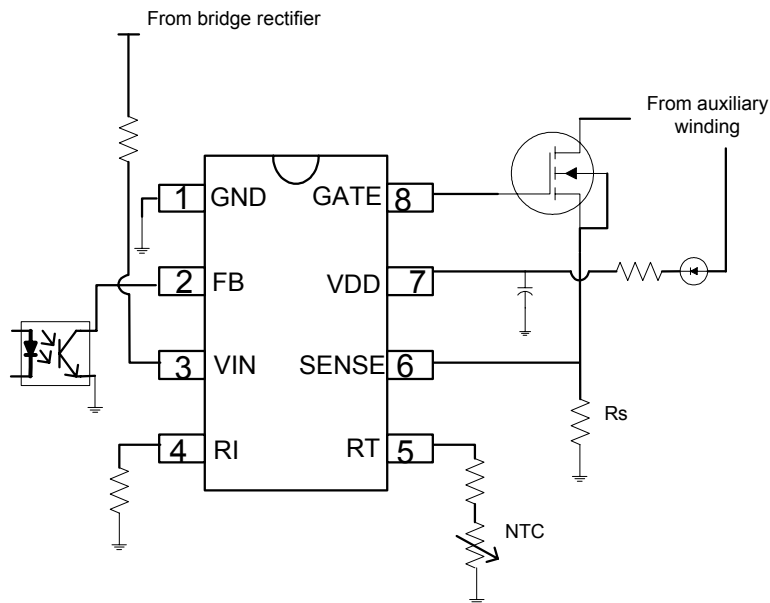
CR6842

Block Diagram
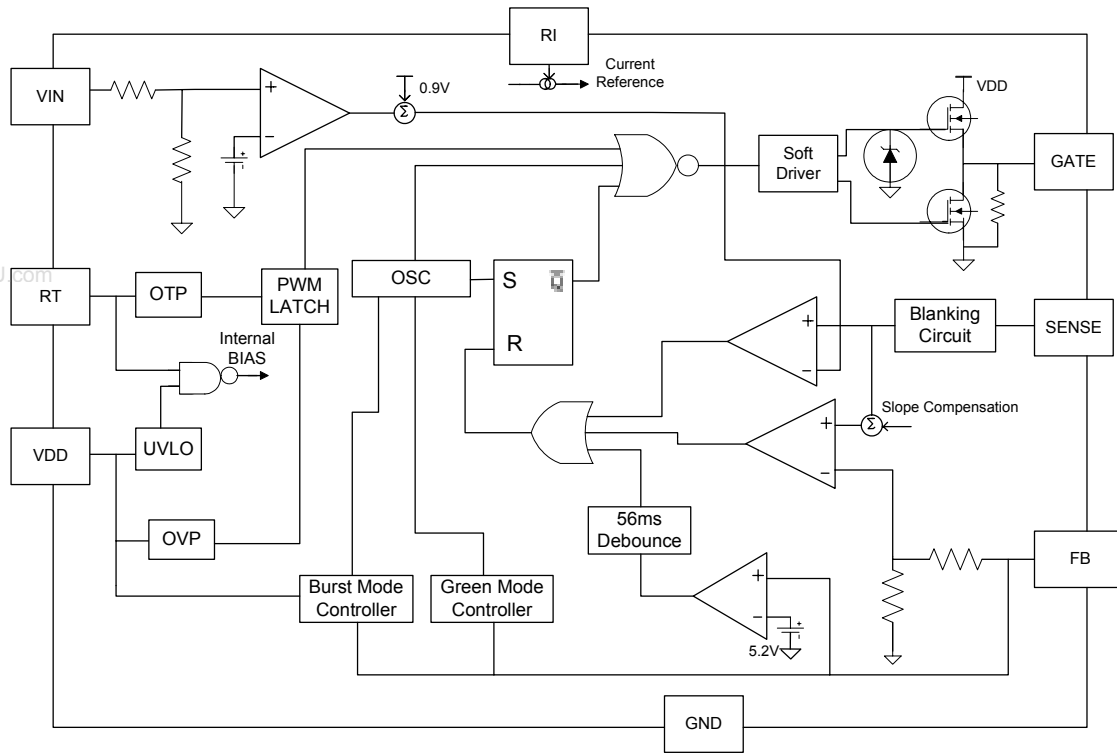
Absolute Maximum Ratings

Symbol	Parameter		Rating	Unit
V_{DD}	Supply voltage Pin Voltage		40	V
V_{FB}	Input Voltage to FB Pin		-0.3 to 6V	V
V_{Sense}	Input Voltage to SENSE Pin		-0.3 to 6V	V
P_D	Power Dissipation		1000	mW
	ESD Capability, HBM Model		2000	V
	ESD Capability, Machine Model		200	V
T_L	Lead Temperature(Soldering)	DIP-8　10sec	260	
		SOP-8　10sec	230	
T_{STG}	Storage Temperature Range		-55 to + 150	

Chengdu Chip-Rail Tech.Co.,Ltd

CR6842

Electrical Characteristics ($Ta=27°C$ unless otherwise noted, $V_{DD} = 15V$.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage (V_{DD} Pin)						
I_{ST}	Startup Current	VDD=17		7.5	30	μA
I_{SS}	Operating Current	$V_{FB}= V_{SENSE} = 0V$ VDD=15		3.0	5	mA
$V_{TH(ON)}$	Start Threshold Voltage	--	16.0	16.5	17.0	V
$V_{TH(OFF)}$	Min. Operating Voltage	--	10.4	10.8	11.2	V
VDD-OVP	VDD Over Voltage Protection(Latch off)		23.0	24.5	25.0	V
VDD-th-g	VDD Low-Threshold Voltage to Exit Green-OFF Mode		11.0	12.0	13.0	V
Voltage Feedback (FB Pin)						
I_{FB}	Short Circuit Current	$V_{FB}=0V$			1.42	mA
V_{FB}	Open Loop Voltage	$V_{FB}=Open$		6.00		V
Current Sensing (SEN Pin)						
V_{TH}	Threshold voltage for current limit	$I_{VIN} =0$		0.76	0.9	V
T_{PD}	Delay to Output			115	200	nsec
Z_{CS}	Input Impedance			13		KΩ
B_{nk}	Leading Edge Blanking Time		260	354	460	nsec
Oscillator (RI Pin)						
F_{OSC}	Frequency in nominal mode	RI=26KΩ	63	67	70	KHz
$F_{OSC-green}$	Frequency in green mode	RI=26 KΩ	25	27	29	KHz
V_N	Beginning of frequency reducing at FB Voltage	VDD=15V	1.95	2.05	2.15	V
V_G	End of frequency reducing at FB voltage	VDD=15V	1.50	1.54	1.60	V_G
	Frequency Temp. Stability	-30-85		5.0		%
GATE Drive Output (GATE Pin)						
V_{OL}	Output Low Level	$V_{DD}=12V$, $I_O=50mA$		0.32	0.60	V
V_{OH}	Output High Level	$V_{DD}=12V$, $I_O=50mA$	7.2	8.00		V
T_R	Rising Time	VDD=15V,C_L=1nF	200	240	280	ns
T_F	Falling Time	VDD=13V,C_L=1nF	30	80	90	ns
DC_{MAX}	Maximum Duty Cycle		84	86	88	
Over-Temperature Protection Section						
I_{RT}	Output current of pin RT	RI=26KΩ	65	70	75	μA
V_{OTP}	Threshold voltage for over-temperature protection.		1.00	1.05	1.10	V
RI Section						
RI_{NOR}	RI Operating Range		15.5	26	36	KΩ
RI_{MAX}	Max RI value for Protection			216		KΩ
RI_{MIN}				6		KΩ

Chengdu Chip-Rail Tech.Co.,Ltd

OPERATION DESCRIPTION

Start-Up Current & Operating Current

The typical start-up current is only 8µA. This allows a high resistance, low-wattage start-up resistor to be used, to minimize power loss. A 1.5MOhms, 0.25W, start-up resistor and a 10µF/40V VDD hold-up capacitor would be sufficient for an AC/DC adapter with a universal input range.

The required operating current has been reduced to 3.4mA. This results in higher efficiency and reduces the VDD hold-up capacitance requirement.

Green-Power Mode Operation

The proprietary green-power mode function provides off-time modulation to continuously decrease the PWM frequency under light-load conditions. To avoid acoustic-noise problem, the minimum PWM frequency set above 25KHz. This green-power mode function dramatically reduces power consumption under light-load and zero-load conditions. Power supplies using a CR6842 controller can easily meet even the most restrictive international regulations regarding standby power consumption.

Oscillator Operation

A resistor connected from the RI pin to GND pin generates a constant current source for the CR6842 controller. This current is used to determine the center PWM frequency. Increasing the resistance will reduce PWM frequency. Using a 26KΩ resistor R_I results in a corresponding 67KHz PWM frequency. The relationship between R_I and the switching frequency is:

$$f_{PWM} = \frac{1742}{R_I(K\Omega)}(KHz)$$

CR6842 also integrates frequency jittering function internally. The frequency variation ranges from around 63KHz to 70KHz for a center frequency 67kHz. The frequency jittering function helps reduce EMI emission of a power supply with minimum line filters.

$$I_{RT} = \frac{70\mu A}{R_I(K\Omega)} * 26$$

Leading Edge Blanking

Each time the power MOSFET is switched on, a turn-on spike will inevitably occur at the sense-resistor. To avoid premature termination of the switching pulse, a leading-edge blanking time is built in. During this blanking period, the current-limit comparator is disabled, and it cannot switch off the gate drive.

Under-Voltage Lockout (UVLO)

The turn-on/turn-off thresholds are fixed internally at 12.4V/16.5V. To enable a CR6842 controller during start-up, the hold-up capacitor must first be charged to 16.5V through the start-up resistor.

The hold-up capacitor will continue to supply VDD before energy can be delivered from the auxiliary winding of the main transformer. VDD must not drop below 12.4V during this start-up process. This UVLO

Chengdu Chip-Rail Tech.Co.,Ltd

hysteresis window ensures that the hold-up capacitor can adequately supply VDD during start-up.

Gate Output / Soft Driving

The CR6842 output stage is a fast totem pole gate driver. Cross-conduction has been avoided to minimize heat dissipation, increase efficiency, and enhance reliability. The output driver is clamped by an internal 18V Zener diode in order to protect the power MOSFET transistors from any harmful over-voltage gate signals. A soft driving waveform is implemented to minimize EMI.

Slope Compensation

The sensed voltage across the current sense resistor is used for peak-current-mode control and cycle-by-cycle current limiting. The built-in slope compensation function improves power supply stability and prevents peak-current-mode control from causing sub-harmonic oscillations. Within every switching cycle, the CR6842 controller produces a positively sloped, synchronized ramp signal.

Constant Output Power Limit

When the SENSE voltage across the sense resistor R_S reaches the threshold voltage, the output GATE drive will be turned off following a small propagation delay T_{PD}. This propagation delay will result in an additional current proportional to $T_{PD}*V_{IN}/L_P$. The propagation delay is nearly constant regardless of the input line voltage V_{IN}. Higher input line voltages will result in larger additional currents. Thus, under high input-line voltages the output power limit will be higher than under low input-line voltages.

The output power limit variation can be significant over a wide range of AC input voltages. To compensate for this, the threshold voltage is adjusted by the current I_{IN}. Since the pin VIN is connected to the rectified input line voltage through the start-up resistor, a higher line voltage will result in a higher current I_{IN} through the pin VIN.

The threshold voltage decreases if the current I_{IN} increases. A small threshold voltage will force the output GATE drive to terminate earlier, thus reducing total PWM turn-on time, and making the output power equal to that of the low line input. This proprietary internal compensation feature ensures a constant output power limit over a wide range of AC input voltages (90VAC to 264VAC).

VDD Over-voltage Protection

VDD over-voltage protection has been built in to prevent damage due to over voltage conditions. When the voltage VDD exceeds the internal threshold due to abnormal conditions, PWM output will be turned off. Over-voltage conditions are usually caused by open feedback loops.

Limited Power Control

The FB voltage will increase every time the output of the power supply is shorted or over-loaded. If the FB voltage remains higher than a built-in threshold for longer than T_{LPS}, PWM output will then be turned off. As PWM output is turned off, the supply voltage VDD will also begin decreasing.

When VDD goes below the turn-off threshold (eg, 12.4V) the controller will be totally shut down. VDD

Chengdu Chip-Rail Tech.Co.,Ltd

CR6842

will be charged up to the turn-on threshold voltage of 16.5V through the start-up resistor until PWM output is restarted. This protection feature will continue to be activated as long as the over-loading condition persists. This will prevent the power supply from overheating due to over loading conditions.

Thermal Protection

An external NTC thermistor can be connected from the RT pin to ground. A fixed current I_{RT} is sourced from the RT pin. Because the impedance of the NTC will decrease at high temperatures, when the voltage of the RT pin drops below 1.065V, PWM output will be disabled. The RT pin output current is related to the PWM frequency programming resistor R_I

Noise Immunity

Noise from the current sense or the control signal may cause significant pulse width jitter, particularly in continuous-conduction mode. Slope compensation helps alleviate this problem. Good placement and layout practices should be followed. The designer should avoiding long PCB traces and component leads. Compensation and filter components should be located near the CR6842. Finally, increasing the power-MOS gate resistance is advised.

CR6842

PACKAGE INFORMATION

DIP-8L
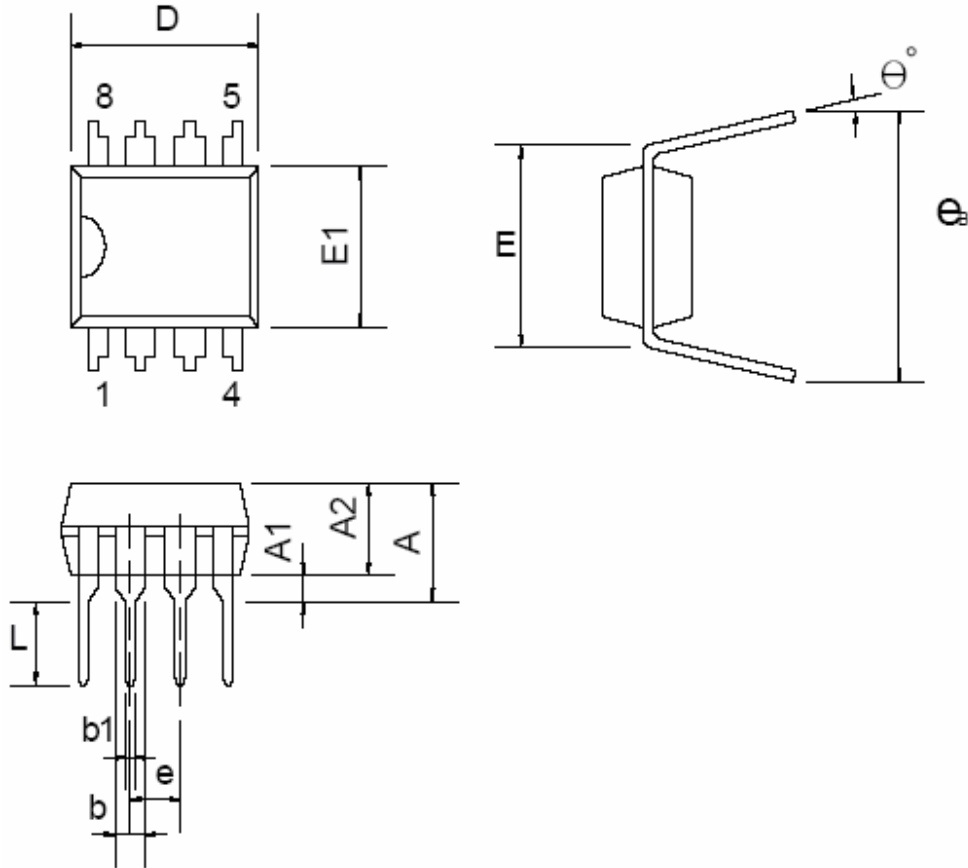
Dimensions

Symbol	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			5.334			0.210
A1	0.381			0.015		
A2	3.175	3.302	3.429	0.125	0.130	0.135
b		1.524			0.060	
b1		0.457			0.018	
D	9.017	9.271	10.160	0.355	0.365	0.400
E		7.620			0.300	
E1	6.223	6.350	6.477	0.245	0.250	0.255
e		2.540			0.100	
L	2.921	3.302	3.810	0.115	0.130	0.150
eB	8.509	9.017	9.525	0.335	0.355	0.375
θ˚	0˚	7˚	15˚	0˚	7˚	15˚

Chengdu Chip-Rail Tech.Co.,Ltd

SOP-8L
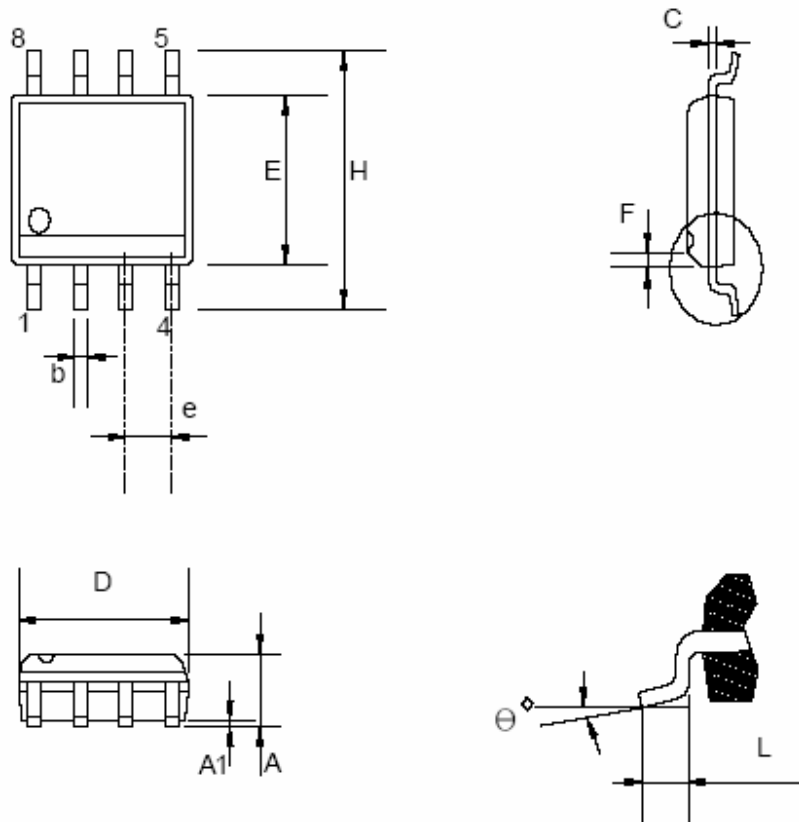
Dimensions DISCLAIMERS

Symbol	Millimeter			Inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	1.346		1.752	0.053		0.069
A1	0.101		0.254	0.004		0.010
b		0.406			0.016	
c		0.203			0.008	
D	4.648		4.978	0.183		0.196
E	3.810		3.987	0.150		0.157
e	1.016	1.270	1.524	0.040	0.050	0.060
F		0.381X45°			0.015X45°	
H	5.791		6.197	0.228		0.244
L	0.406		1.270	0.016		0.050
θ˚	0°		8°	0°		8°

Chengdu Chip-Rail Tech.Co.,Ltd