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Step-Up Current Mode PWM Converter

GENERAL DESCRIPTION

The PW5300 is a current mode boost DC-DC converter. Its PWM circuitry with built-in 0.2Ω power MOSFET make this regulator highly power efficient. The internal compensation network also minimizes as much as 6 external component counts. The non-inverting input of error amplifier connects to a 0.6V precision reference voltage and internal soft-start function can reduce the inrush current. The PW5300 is available in the SOT23-6L package and provides space-saving PCB for the application fields.

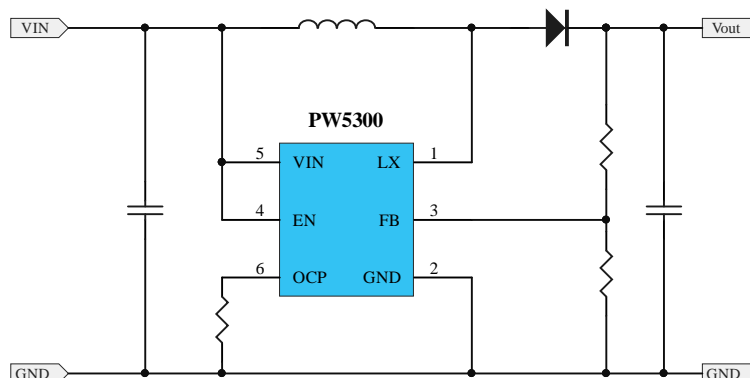
FEATURES

- Adjustable Output up to 12V
- Internal Fixed PWM frequency: 1.0MHz
- Precision Feedback Reference Voltage: 0.6V ($\pm 2\%$)
- Internal 0.2Ω, 2.5A, 16V Power MOSFET
- Shutdown Current: 0.1μA
- Over Temperature Protection
- Over Voltage Protection
- Adjustable Over Current Protection: 0.5A ~ 2.5A (Vin)
- Typical application:
VIN=3V ~4.2V, Vout=5V, Iout=1A;
VIN=3V ~4.2V, Vout=9V, Iout=0.5A

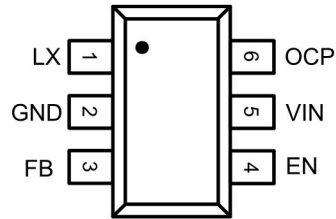
APPLICATIONS

- Chargers
- LCD Displays
- Digital Cameras
- Handheld Devices
- Portable Products

TYPICAL APPLICATION CIRCUIT



PIN ASSIGNMENT/DESCRIPTION



Pin Number	Pin Name	Function
1	LX	Power Switch Output
2	GND	IC Ground
3	FB	Error Amplifier Inverting Input
4	EN	Enable Control (Active High)
5	VIN	IC Power Supply
6	OCP	Adjustable Current Limit (Floating Available)

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	VIN		0		6	V
LX Voltage	VLX		0		16	V
EN,FB Voltage			0		6	V
Power Dissipation	PD	TA=25°C			455	mW
Thermal Resistance (Note1)	θJA				+220	°C / W
Junction Temperature	TJ				+150	°C
Operating Temperature	TOP		-40		+85	°C
Storage Temperature	TST		-65		+150	°C
Lead Temperature		(soldering, 10 sec)			+260	°C

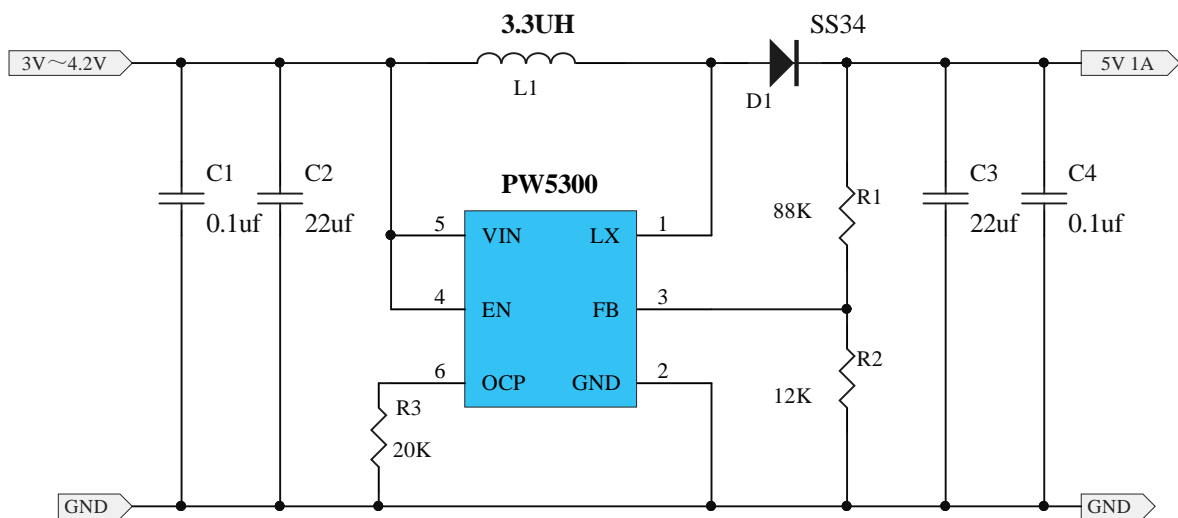
Note 1: θJA is measured in the natural convection at TA=25°C on a low effective thermal conductivity test board of JEDEC 51-3 thermal measurement standard

RECOMMENDED OPERATING RANGE

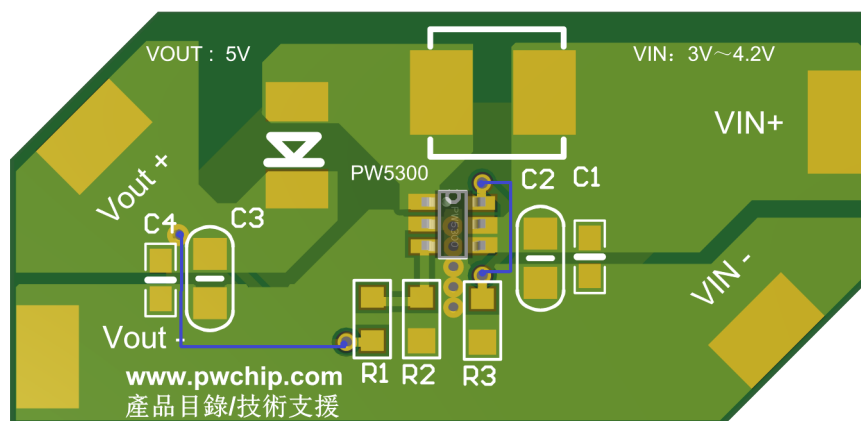
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	VIN		2.6		5.5	V
Operating Temperature Range	TA	Ambient Temperature	-40		+85	°C

Layout Considerations

1. The power traces, consisting of the GND trace, the LX trace and the VIN trace should be kept short, direct and wide.
2. LX、L and D switching node, wide and short trace to reduce EMI.
3. Place CIN near VIN pin as closely as possible to maintain input voltage steady and filter out the pulsing input current.
4. The resistive divider R1 and R2 must be connected to FB pin directly as closely as possible.
5. FB is a sensitive node. Please keep it away from switching node, LX.
6. The GND of the IC, CIN and COUT should be connected close together directly to a ground plane.



Typical Application



Suggested Layout

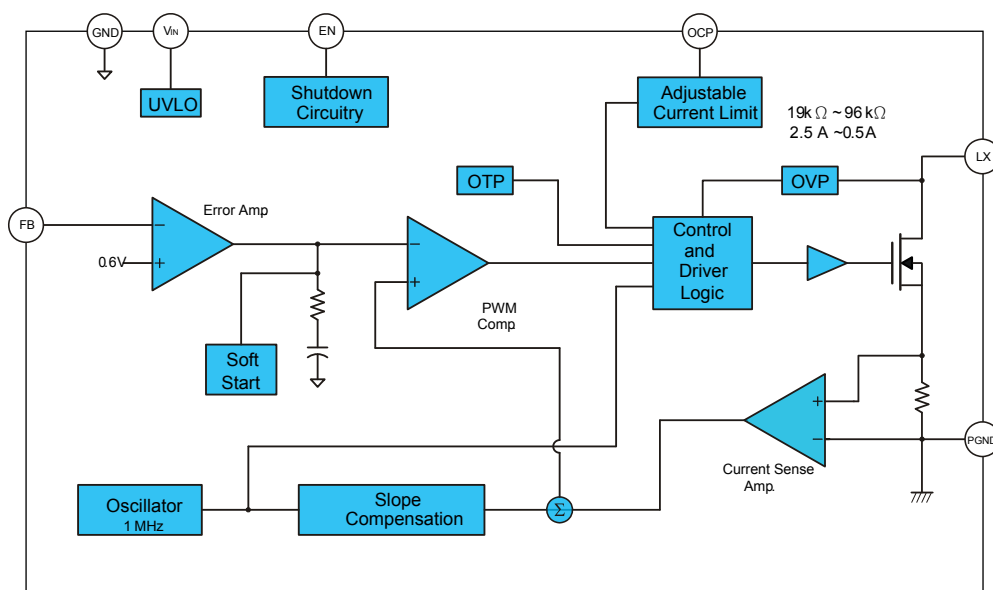


ELECTRICAL CHARACTERISTICS

(VCC=3.3V, TA=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
System Supply Input						
Input Supply Range	V _{IN}		2.6		5.5	V
Under Voltage Lockout	V _{UVLO}			2.2		V
UVLO Hysteresis				0.1		V
Quiescent Current	I _{CC}	V _{FB} =0.66V, No switching		0.19		mA
Average Supply Current	I _{CC}	V _{FB} =0.55V, Switching		2.84		mA
Shutdown Supply Current	I _{CC}	V _{EN} =GND		0.1		μA
Oscillator						
Operation Frequency	F _{OSC}	V _{FB} =1.0V	0.8	1.0	1.2	MHz
Frequency Change with Voltage	Δf / ΔV	V _{CC} =2.6V to 5.5V		5		%
Maximum Duty Cycle	T _{DUTY}			90		%
Reference Voltage						
Reference Voltage	V _{REF}		0.588	0.6	0.612	V
Line Regulation		V _{CC} =2.6V ~ 5.5V		0.2		% / V
Enable Control						
Enable Voltage	V _{EN}		0.96			V
Shutdown Voltage	V _{EN}				0.6	V
MOSFET						
On Resistance of Driver	R _{DS (ON)}	I _{LX} =2A		0.2		Ω
Protection						
OCP Current	I _{OCP}			2.5		A
Adjustable OCP Current	I _{OCP}	With External Resistor : 19k~96k	0.5		2.5	A
OTP Temperature	T _{OTP}			+150		°C

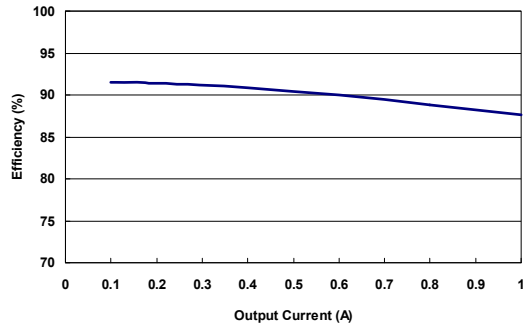
Function Block Diagram



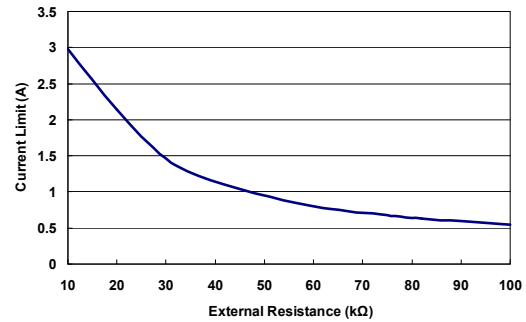


TYPICAL OPERATING CHARACTERISTICS

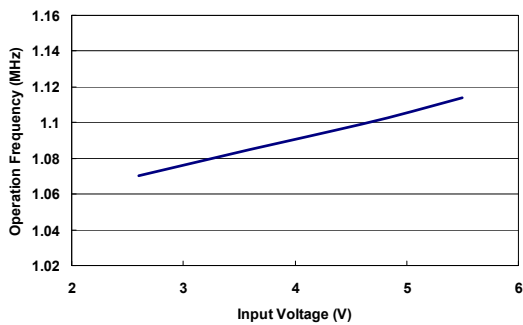
(VCC=3.3V, VOUT=5V, TA= 25°C, unless otherwise noted)



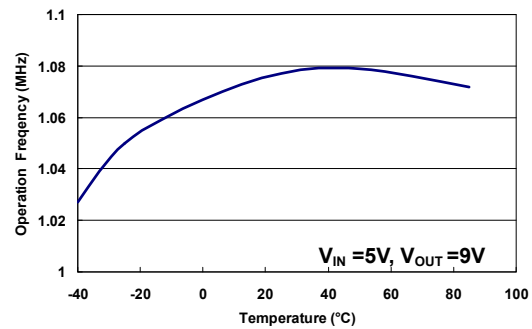
Efficiency vs. Output Current



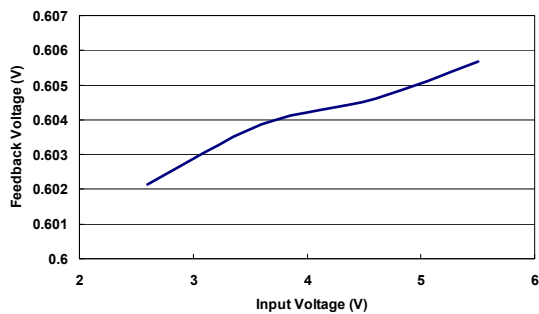
Current Limit vs. External Resistance (Roc)



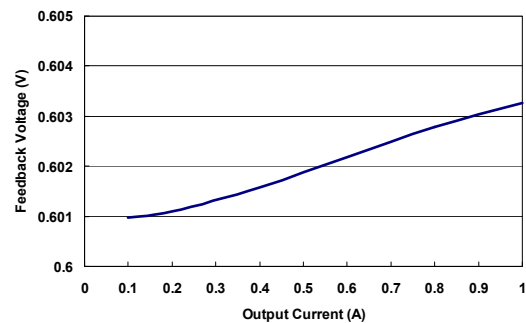
Operation Frequency vs. Input Voltage



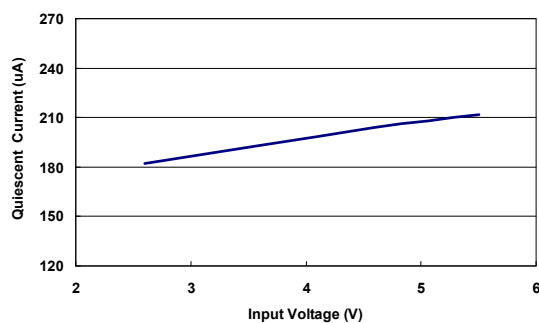
Operation Frequency vs. Temperature



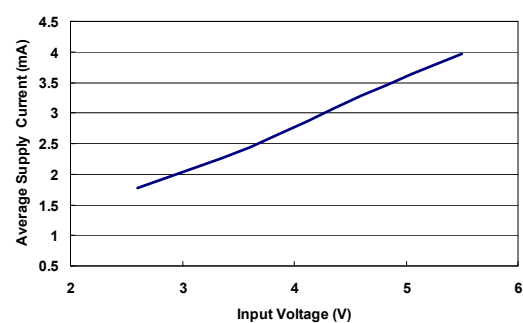
Reference Voltage vs. Input Voltage



Reference Voltage vs. Output Current



Quiescent Current vs. Input Voltage



Average Supply Current vs. Input Voltage

Function Description

The PW5300 is a current mode boost converter. The constant switching frequency is 1MHz and operates with pulse width modulation (PWM). Build-in 16V / 2.5A MOSFET provides a high output voltage. The control loop architecture is peak current mode control; therefore slope compensation circuit is added to the current signal to allow stable operation for duty cycles larger than 50%.

Soft Start Function

Soft start circuitry is integrated into PW5300 to avoid inrush current during power on. After the IC is enabled, the output of error amplifier is clamped by the internal soft-start function, which causes PWM pulse width increasing slowly and thus reducing input surge current.

Current Limit Program

A resistor between OCP and GND pin programs peak switch current. The resistor value should be between 19k and 96k. The current limit will be set from 2.5A to 0.5A. Keep traces at this pin as short as possible. Do not put capacitance at this pin. To set the over current trip point according to the following equation:

$$\frac{48000}{R3} = I_{ocp}$$

Over Temperature Protection (OTP)

PW5300 will turn off the power MOSFET automatically when the internal junction temperature is over 150°C. The power MOSFET wake up when the junction temperature drops 30°C under the OTP threshold temperature.

Over Voltage Protection (OVP)

In some condition, the resistive divider may be unconnected, which will cause PWM signal to operate with maximum duty cycle and output voltage is boosted higher and higher. The power MOSFET will be turned off immediately, when the output voltage exceeds the OVP threshold level. The PW5300's OVP threshold is 16V.

Application Information

Inductor Selection

Inductance value is decided based on different condition. 3.3uH to 4.7μH inductor value is recommended for general application circuit. There are three important inductor specifications, DC resistance, saturation current and core loss. Low DC resistance has better power efficiency. Also, it avoid inductor saturation which will cause circuit system unstable and lower core loss at 1 MHz.

Capacitor Selection

The output capacitor is required to maintain the DC voltage. Low ESR capacitors are preferred to reduce the output voltage ripple. Ceramic capacitor of X5R and X7R are recommended, which have low equivalent series resistance (ESR) and wider operation temperature range.



Diode Selection

Schottky diodes with fast recovery times and low forward voltages are recommended. Ensure the diode average and peak current rating exceed the average output current and peak inductor current. In addition, the diode's reverse breakdown voltage must exceed the output voltage.

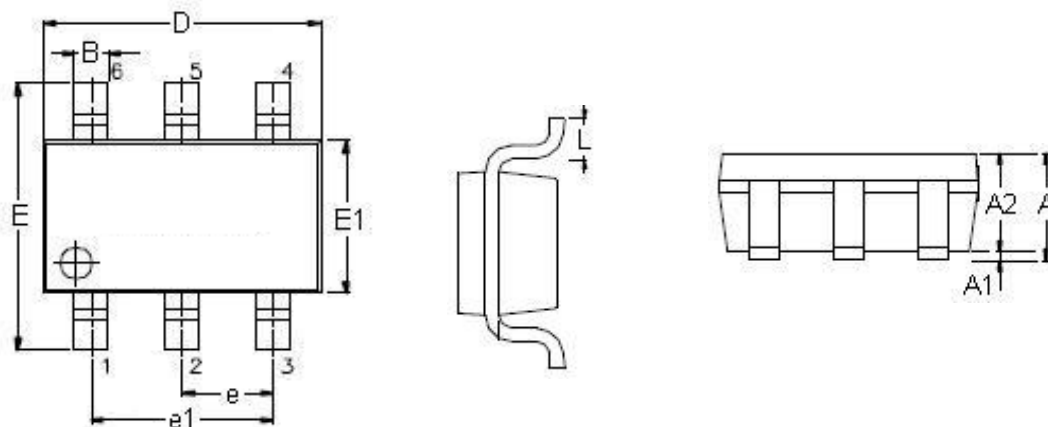
Output Voltage Programming

The output voltage is set by a resistive voltage divider from the output voltage to FB. The output voltage is:

$$\left(1 + \frac{R1}{R2}\right) * 0.6V = V_{out}$$

PACKAGE DESCRIPTION

SOT23-6L Package (Unit: mm)



SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	0.90	1.45
A1	0.05	0.15
A2	0.90	1.30
B	0.30	0.50
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.70
e	0.90	1.00
e1	1.80	2.00
L	0.30	0.60