# 1.2MHz,30V/1A High Performance, Boost Converter

General Description

The LP3315 is a 1.2MHz PWM boost switching regulator designed for constant-voltage boost applications. The LP3315 can drive a string of up to 30V. The LP3315 implements a constant frequency 1.2MHz PWM control scheme. The high frequency PWM operation also saves board space by reducing external component sizes. To improve efficiency, the feedback voltage is set to 1250mV, which reduces the power dissipation in the voltage setting resistor. Highly integration and internal compensation network minimizes as 5 external component counts. Optimized operation frequency can meet the requirement of small LC filters value and low operation current with high efficiency.

Ordering Information

LP3315 ☐☐ ☐

F: Pb-Free
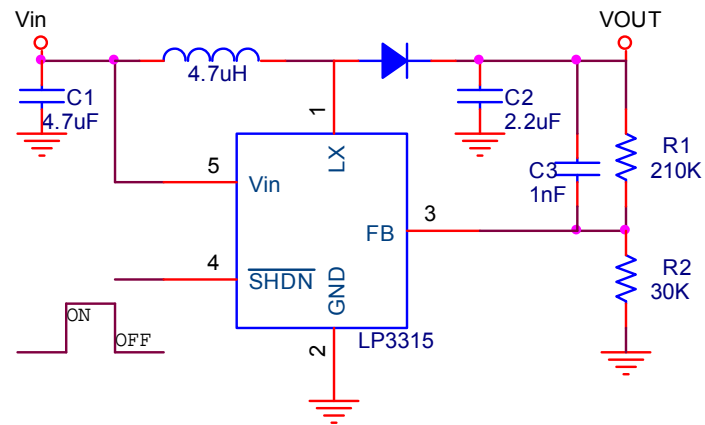
Package:
B5: SOT23-5
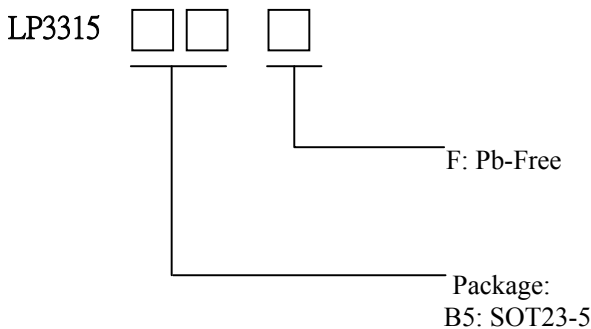
Pin Configurations
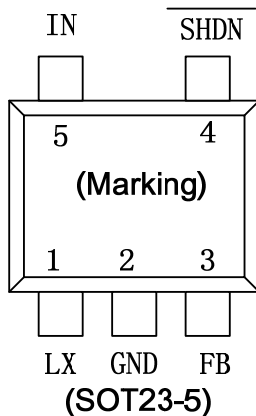
(SOT23-5)

Features

✧ High Efficiency: 90%
✧ 1.2MHzFixed-Frequency PWM Operation
✧ Maximum Output Voltage up to 30V
✧ Guaranteed 13V/200mA Output with 5V input
✧ Operating Range : 2.7V to 5.5V
✧ Shutdown Supply Current:<1uA
✧ Programmable Soft-star
✧ Available in SOT23-6/SOT23-5 Package
✧ Minimize the External Component
✧ RoHS Compliant and 100% Lead (Pb)-Free

Applications

✧ Panel Bais Voltage supply
✧ OLED Backlight driver
✧ Notebook Computers
✧ Portable Applications
✧ MID/PTV

Typical Application Circuit


Marking information

Please view website.

Device No.	Marking	Package	Shipping
LP3315B5F	LPS Fbxxx	SOT23-5	3K/Reel

x represents the date(year month day)of the producing day of the products.

Functional pin description

SOT-23-5	Pin Name	Pin Function
1	LX	Switch Pin. Connect this Pin to inductor and catch diode. Minimize the track area to reduce EMI.
2	GND	Ground Pin
3	FB	Feedback Reference Voltage Pin. Series connect a resistor between Vout and ground as a voltage sense. The feedback voltage is 1250mV.
4	$\overline{\text{SHDN}}$	Chip Enable (Active High). Voltage sensing input to trigger the function of over voltage protection. Note that this pin is high impedance. There should be a pull low 100k Ω resistor connected to GND when the control signal is floating.
5	Vin	Supply Input Voltage Pin. Bypass 1uF capacitor to GND to reduce the input noise.

Function Block Diagram
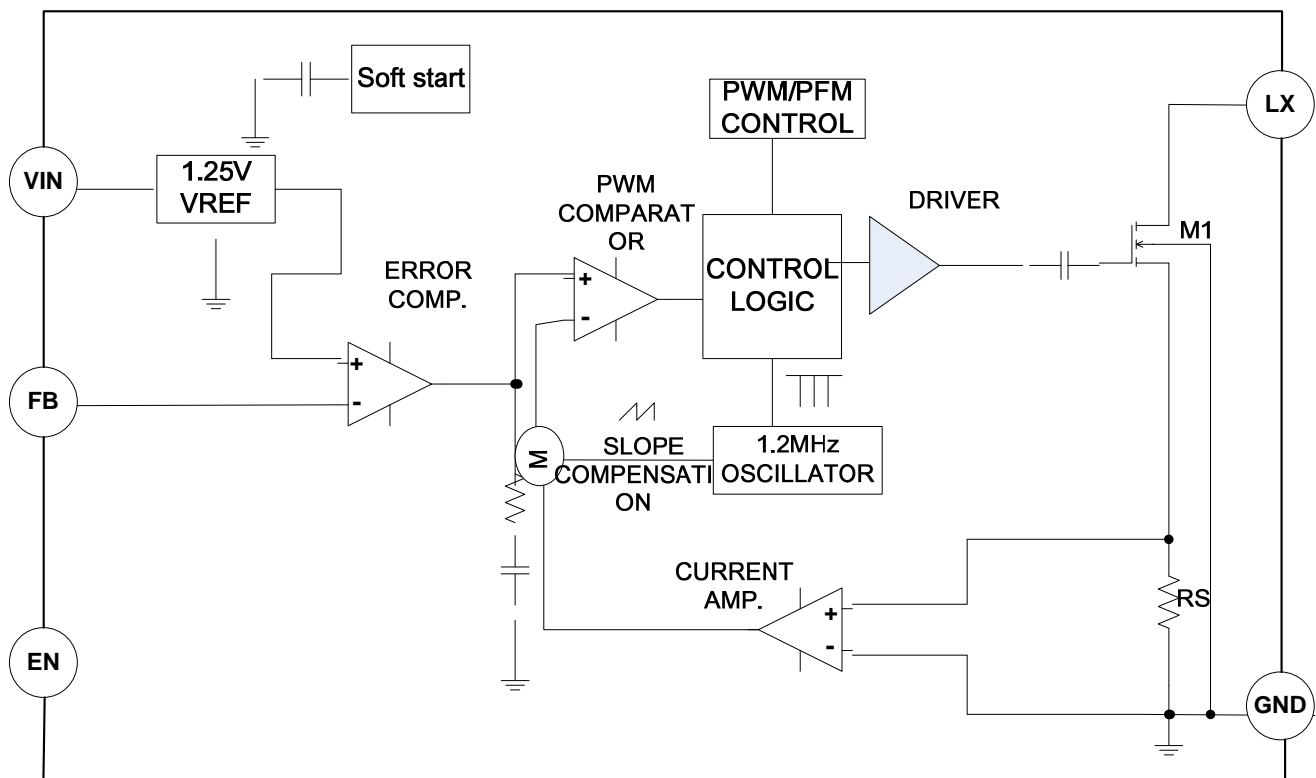
Absolute Maximum Ratings

Supply Input Voltage---−0.3V to 6.0V

LX Input Voltage --−0.3V to 30V

The Other Pins --−0.3V to 5.5V

Power Dissipation, P_D @ T_A = 25°C TSOT-23-5/6--0.455W

Lead Temperature (Soldering, 10 sec.) --- 260°C

Operation Temperature Range --−40°C to 80°C

Storage Temperature Range --−65°C to 150°C

Electrical Characteristics

| Parameter	Symbol	Test Condition	Min	Typ.	Max	Units
System Supply Input						
Operation voltage Range	V_{DD}		2.7		6	V
Under Voltage Lock Out	V_{DD}		2.2	2.4	2.6	V
Supply Current	I_{DD}	FB=1.2V, Switch		430	550	uA
Shut Down Current	I_{DD}	V_{EN} < 0.4V		0.1	1	uA
Line Regulation		V_{IN} : 3.0~4.3V		2		%
Oscillator						
Operation Frequency	F_{OSC}			1.2		MHz
Maximum Duty Cycle			93			%
Feedback Voltage	LP3315		1.22	1.25	1.28	V
MOSFET						
On Resistance of MOSFET	$R_{DS(ON)}$			0.4		Ω
SW Current Limit	ILM			1		A
Protection						
Shut Down Voltage	V_{EN}		0.3			V
Enable on Voltage	V_{EN}				1.0	V

Typical Operating Characteristics
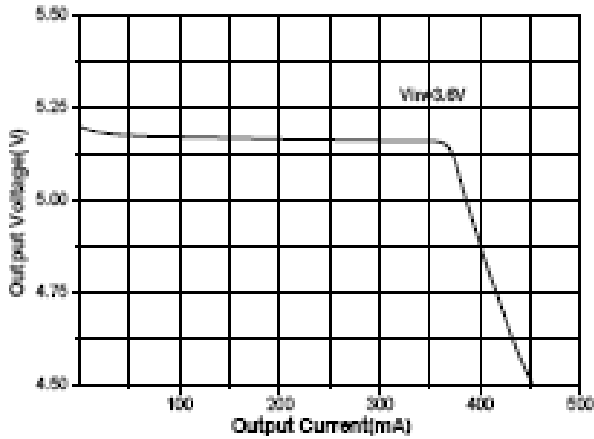
Figure 12.Load Regulation (Vo=5V)

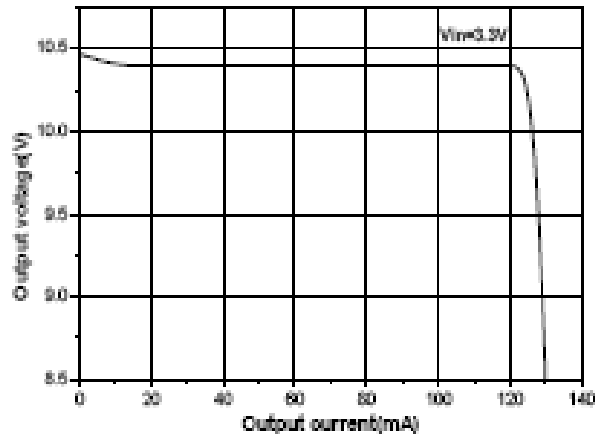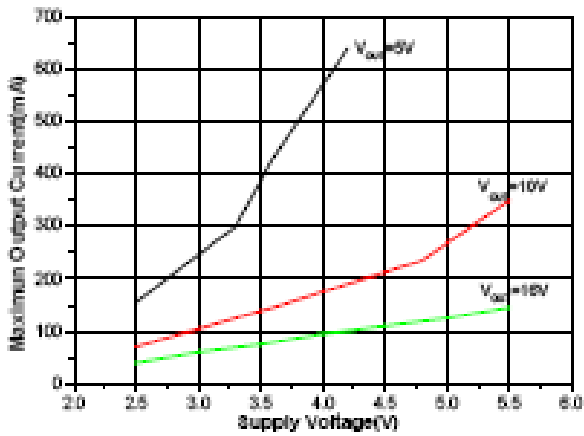

Figure 13. Load Regulation (Vo=10V)
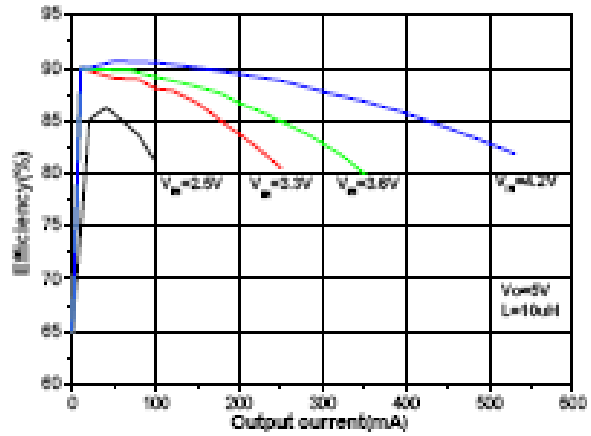

Figure 14. Maximum Output Current vs. Supply Voltage
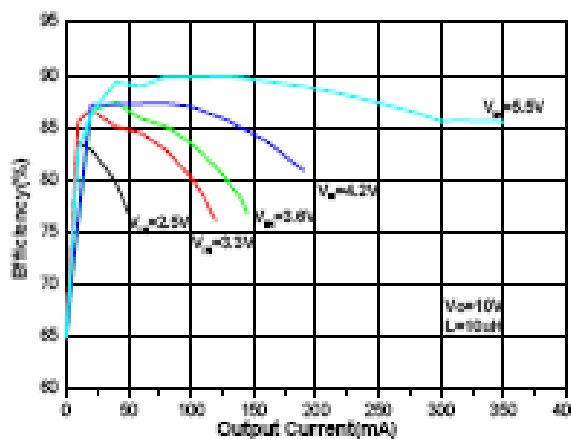

Figure 15. Efficiency vs. Output Current (Vo=5V)
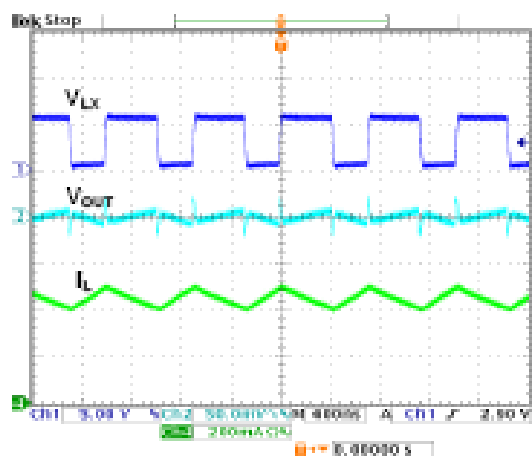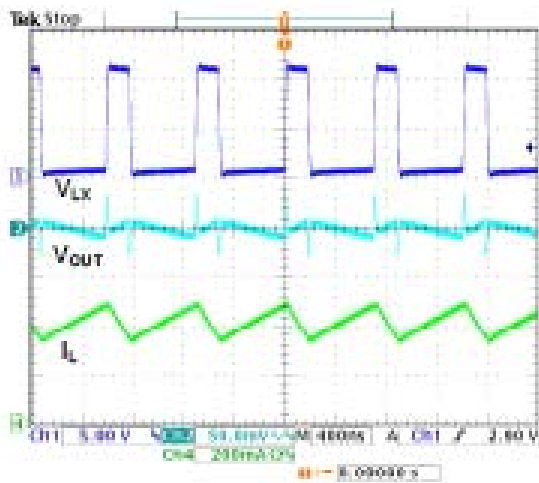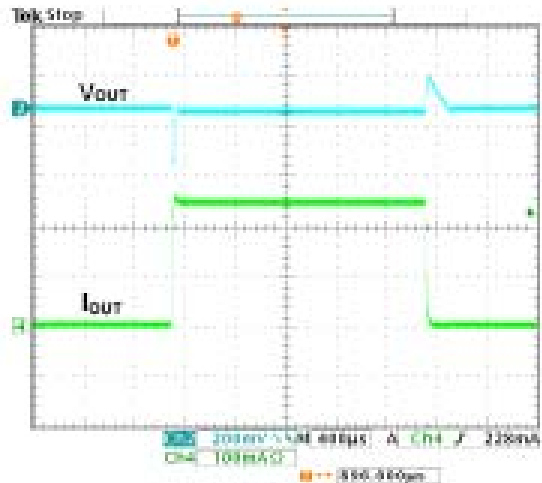

Figure 16. Efficiency vs. Output Current (Vo=10V)

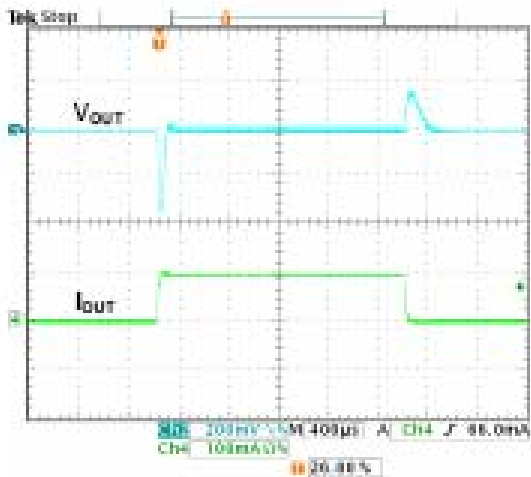V$_{IN}$=3.6V, V$_o$=5V, Io=250mA, L1=10µH

Figure 17. Operation Waveform

V_{IN}=3.3V, Vo=10V, Io=100mA, L1=10μH

Figure 18. Operation Waveform

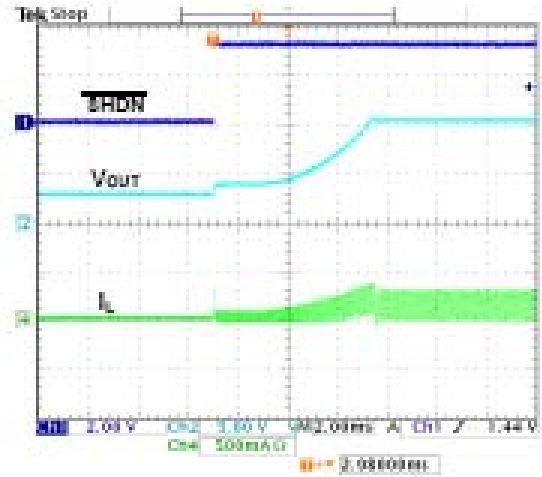V_{IN}=3.6V, V_o=5V, Io=5 to 250mA, CFF=220pF

Figure 19. Load Step Response

V_{IN}=3.3V, V_o=10V, Io=5 to 250mA, CFF=220pF

Figure 20. Load Step Response

V_{IN}=3.3V, V_{OUT}=10V, Io=50mA, CSS=33nF

Figure 21. Start-Up from Shutdown

Applications Information

Inductor Selection

The recommended value of inductor for 30V applications are 4.7 to 22µH. Small size and better efficiency are the major concerns for portable device, such as LP3315 used for mobile phone. The inductor should have low core loss at 1.2MHz and low DCR for better efficiency. To avoid inductor saturation current rating should be considered.

Constant Output Voltage Control

The output voltage of the LP3315 can be adjusted by the divider circuit on the FB pin. Typical FB voltage is 1250mV. The output voltage can be calculated by the following Equations.

$$V_{OUT} = V_{REF} \times \frac{R1+R2}{R2} \; ; R2 > 10k$$

Power Sequence

In order to assure the normal soft start function for suppressing the inrush current the input voltage should be ready before EN pulls high.

Soft-Start

The function of soft-start is made for suppressing the inrush current to an acceptable value at the beginning of power on. The LP3315 provides a built-in soft-start function by clamping the output voltage of error amplifier so that the duty cycle of the PWM will be increased gradually in the soft-start period.

Current Limiting

The current flow through inductor as charging period is detected by a current sensing circuit. As the value comes across the current limiting threshold, the N-MOSFET will be turned off so that the inductor will be forced to leave charging stage and enter discharging stage. Therefore, the inductor current will not increase over the current limiting threshold.

OVP/UVLO/OTP

The Over Voltage Protection is detected by a junction breakdown detecting circuit. Once VOUT goes over the detecting voltage, LX pin stops switching and the power N-MOSFET will be turned off. Then, the VOUT will be clamped to be near VOVP. As the output voltage is higher than a specified value or input voltage is lower than a specified value, the chip will enter protection mode to

prevent abnormal function. As the die temperature is higher then 160°C, the chip also will enter protection mode. The power MOSFET will be turned off during protection mode to prevent abnormal operation.

Thermal Considerations

For continuous operation, do not exceed absolute maximum operation junction temperature. The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surroundings airflow and temperature difference between junction to ambient. The maximum power dissipation can be calculated by following formula :

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

Where TJ(MAX) is the maximum operation junction temperature, TA is the ambient temperature and the qJA is the

junction to ambient thermal resistance.

For the recommended operating conditions specification of LP3315, the maximum junction temperature of the die is 125°C. The junction to ambient thermal resistance Qja is layout dependent. The junction to ambient thermal resistance for SOT23-5 package is 255°C/W and for WDFN-8L 2x2 package is 165°C/W on the standard JEDEC 51-3 single layer thermal test board. The maximum power dissipation at TA = 25°C can be calculated by following formula :

$$P_{D(MAX)} = (125°C - 25°C) / (165°C/W) = 0.606W \text{ for}$$
WDFN-8L 2x2 packages

$$P_{D(MAX)} = (125°C - 25°C) / (255°C/W) = 0.392W \text{ for}$$
TSOT-23-6 packages

Layout Consideration

For best performance of the LP3315, the following

guidelines must be strictly followed.

- Input and Output capacitors should be placed close to the IC and connected to ground plane to reduce noise coupling.

- The GND and Exposed Pad should be connected to a strong ground plane for heat sinking and noise protection.

- Keep the main current traces as possible as short and wide.

- LX node of DC-DC converter is with high frequency voltage swing. It should be kept at a small area.

- Place the feedback components as close as possible to the IC and keep away from the noisy devices.

Power LowPowerSemi 微源半導體

Packing information
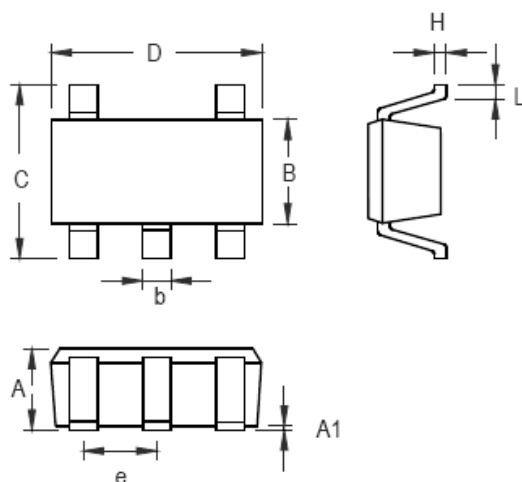
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.035	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.356	0.559	0.014	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

SOT-23-5 Surface Mount Package