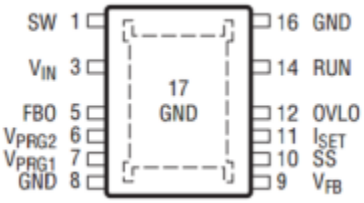
Electronics-LTC3639

Buck regulators are used for reducing the input voltage coming from a power supply to safely power microprocessors, gate drive circuitry, and other circuits. Today, I will show you how to use the LTC3639 – a buck regulator that can receive up to 150V- which comes with under-voltage and over-voltage lockout.

The LTC3639 should allows you to to easily change the output voltage, undervoltage lockout, overvoltage lockout, switching frequency, and the maximum peak current. I built 15V power supply using the LTC3639 and the DC1901A development board from Linear Technology.

Pin Functions



- SW (Pin 1): Connects to the drain of the LTC3639's internal MOSFET.
- Vin (Pin 3): Supply pin for the IC
- FBO (Pin 5): Feedback comparator output. Connect to VFB of other LTC3639's in order to increase the output current. Otherwise, leave FBO floating.
- VPRG2, VPRG1 (Pins 6, 7): Used for configuring the output of the LTC3639. These pins can be connected to either ground or the LTC3639's SS pin.

VPRG2	VPRG1	Vout
GND	GND	Adjustable
GND	SS	5V
SS	GND	3.3V
SS	SS	1.8V

- GND (Pins 8, 16, 17): Ground connection. Pin 17 must be soldered to the PCB ground plane for rated thermal performance.

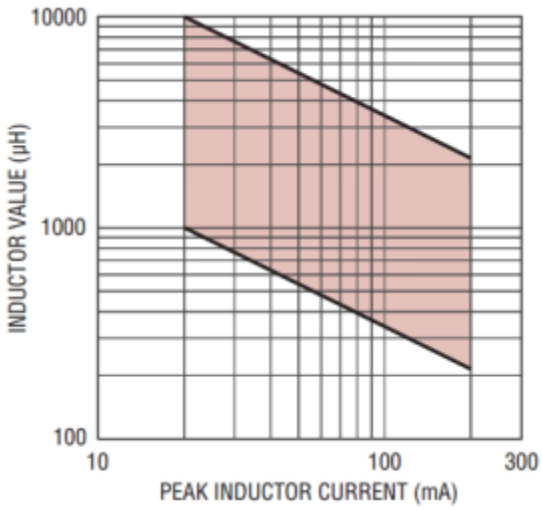
- VFB (Pin 9): Output voltage feedback. Connect to output voltage's resistive divider for an adjustable output. Connect this pin to Vout for fixed output configurations.
- SS (Pin 10): By connecting a capacitor from this pin to ground, the voltage ramp up time can be set. Leave floating to use internal 1ms soft start.
- Iset (Pin 11): Leave this pin floating for 230ma peak current. Short this pin to ground for 25ma peak current. For a configurable peak current, connect a resistor from this pin to ground.
- OVLO (Pin 12): Can be used to configure the overvoltage lockout using a resistive divider connected from the input supply. If the voltage on this pin is greater than 1.21V, then the overvoltage lockout is activated. The chip resumes operation when the voltage on the OVLO pin is less than 1.10V.
- Run (Pin 14): Activates the chip when the voltage on this pin is greater than 1.21V. This pin shuts off the chip when the pin's voltage is less than .7V. The Run pin is also used for setting the under voltage lockout.

  Leaving pin 12 floating sets the peak current to 230ma, while shorting this pin to ground sets the peak current to 25ma. For a different current peak current limit, a resistor should be connected from pin 11 to ground. The peak current cannot exceed 230ma and cannot be less than 20ma. The peak current is also twice the average current. The value of the peak current resistor can be found using the following equation…

  The inductor is used to determine the LTC3639's switching frequency when it is operating in burst mode, or when the LTC3639 is lightly loaded. The following equation is used for determining the inductance during burst mode.

  If the LTC3639 will not be lightly loaded, then the inductor must meet the following two conditions…

  Although the previous equations provide some insight on how the inductor will affect the switching frequency of the LTC3639, figure 2 gives a range of recommended inductor values given peak current for maximum efficiency.



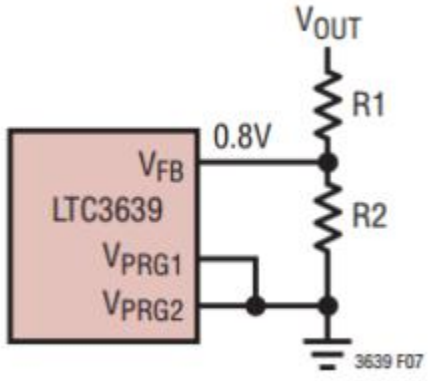
It is recommended to use ferrite core inductors for their ability to handle a high switching frequency, and low core loss.

An input capacitor is necessary for filtering the trapezoidal current going into the source of the LTC3639's internal high side MOSFET. If the maximum input voltage ripple is given, then the following equation can be used.

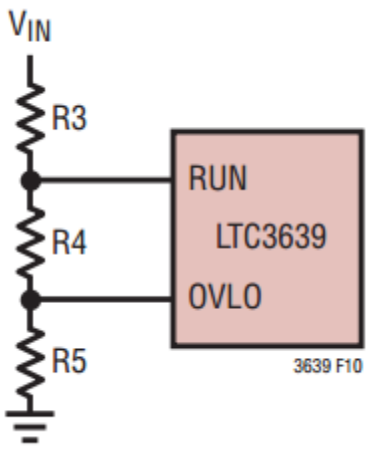
The output capacitor is needed to filter the inductor's ripple current. If the desired output voltage ripple is given, the output capacitor can be selected as long as it follows the following two conditions…

How the output voltage is configured depends on the configuration of VPRG2 and VPRG1. For an adjustable output voltage, short VPRG2 and VPRG1 to ground, and connect VFB to an external resistive divider from the output. The output voltage can be set according to the following equation.

The only requirement on the resistive divider is to keep R2 less than 200K in order to keep output voltage variation less than 1%.



The undervoltage, and overvoltage lockout can be set using a three resistor divider.

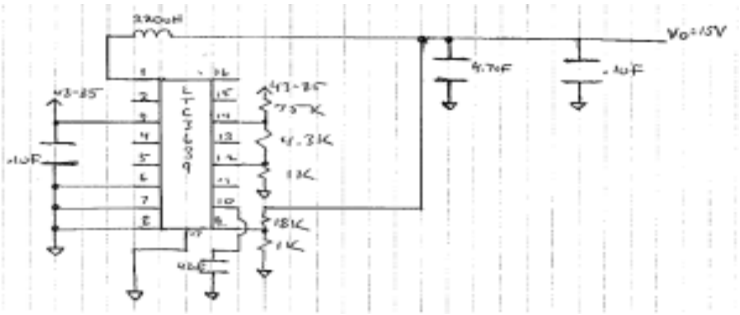


All three resistors must satisfy the following condition…

V_(in(MAX))*(R5/(R3+R4+R5))<6V

By leaving pin 10 floating, the output voltage ramp time will typically be 1ms. If a longer ramp time is required, then connect a capacitor from pin 10 to ground. The value of capacitor can be computed from the following equation…

Although the ramp time can be calculated from C_ss, it must fulfill the following condition…



I used the LTC3639 to assemble 15V power supply circuit to power a gate drive circuit I was working on. The 15V power supply must perform according to the following requirements…

Vo=15V

Ipeak=230ma

Overvoltage Lockout=97V

Undervoltage Lockout=18V

One of the first tests performed on the 15V circuit was loading it with a 100ma load and observing the start up time. It took 12ms for the output to start up after immediately applying 43V and 85V to the 15V power supply circuit.

Source: http://coolcapengineer.wordpress.com/2013/12/23/electronics-ltc3639/