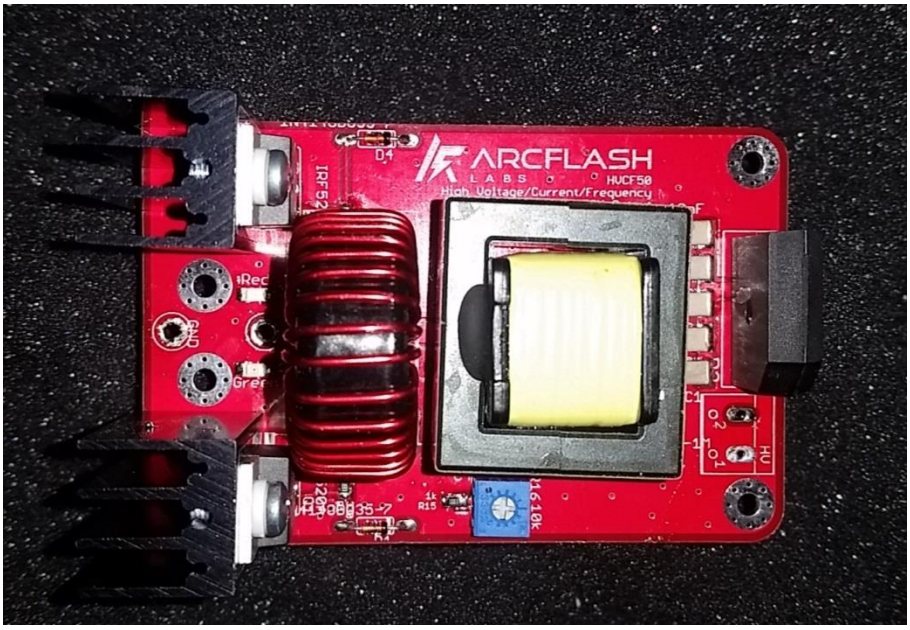
HVFC50

Quasi-resonant DC-DC Flyback Converter

User Manual



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1. Introduction

The Arcflash Labs HVFC50 is an ultra-compact, high power, battery (12-25V) to 700V quasi-resonant DC to DC flyback step-up converter. Its inputs and outputs are NOT isolated with respect to ground. "HVFC" refers to the units' intended operating conditions: High Voltage (up to 700V), High Frequency (up to 100kHz), and High Current (up to 1A output at max power point). The unit is designed to handle input voltages up to 25V and a dead-short condition across the high voltage terminals for short periods of time (<10s).

The HVFC-50 is the most powerful commercial battery-operated capacitor charger in the world. Similar units operate with an older of magnitude lower output power and/or efficiency. The HVFC50 is capable of charging one 12mF capacitor bank up to 500V in approx. 4 seconds. The unit also features a hardware cutoff voltage trimmer which can be adjusted to set the maximum hold voltage. This feature is especially useful in a capacitor charging application as the unit can charge a capacitor up to its maximum rated voltage and will automatically shut down, start up, and hold the capacitor at its set voltage indefinitely without exceeding the setpoint.

While it is not recommended, the HVFC50 can also output high frequency, high voltage and high current AC for use in portable welding equipment such as portable TIG and MIG welding designs by tapping the bridge rectifier across its middle leads.

The HVFC50 is also ideally suited for use in a portable defibrillator application. Its very high voltage makes it a potential replacement for a large bulky capacitor bank in a portable defribrillator. Higher voltage transformers may be installed if unit is ordered in bulk.

- Up to 650W output power @ 100V or up to 350W output power @ 500V
- Adjustable cutoff voltage w/trimmer potentiometer
- Rated for dead-short operation across the high voltage leads for up to 10s
- Simple operation: DC high voltage automatically turned on when low voltage DC is connected.
- Independently heatsinked MOSFETs for optimal thermal characteristics.

1.1 Terminology and Safety

The HVFC50 outputs high voltage/high current DC and some parts are energized with high frequency AC at voltages exceeding 700V. The high voltage AC sections are isolated, but the high voltage DC terminals are NOT ISOLATED.

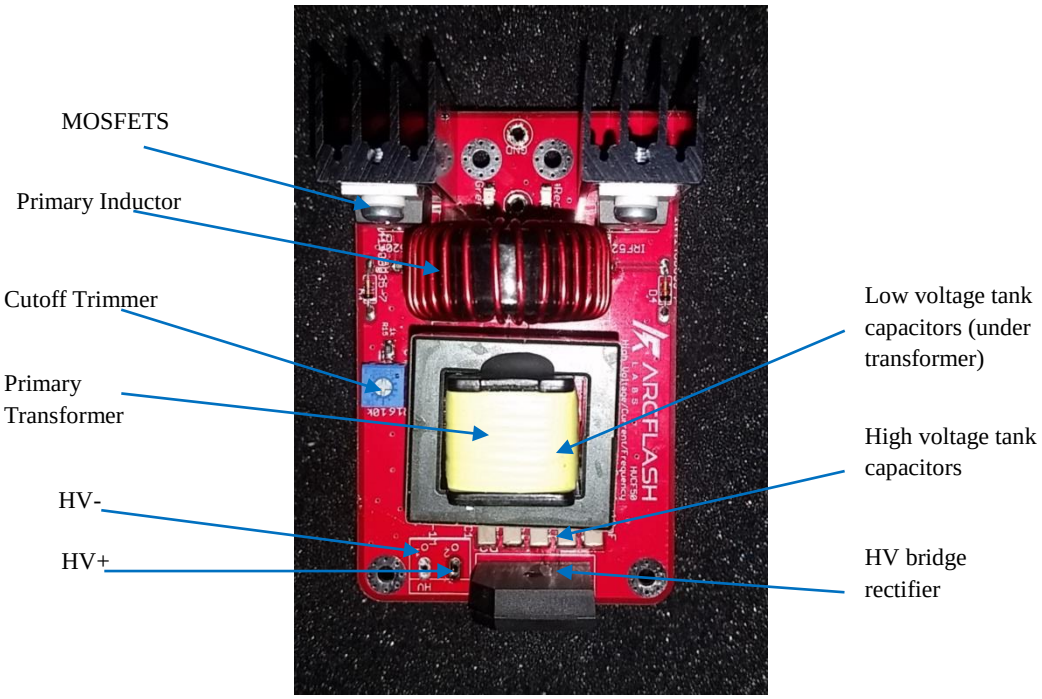
Touching the device while it is operating is as dangerous as touching a live high voltage capacitor. Not only will it kill you dead, it will hurt the whole time you're dying. We're not kidding. This thing scares the living daylights out of us. Use rated electrical gloves at all times when the unit is powered on. While the unit is designed for dead short operation for very short periods during capacitor charging operations, we really don't recommend it. Components start to heat up, and if the MOSFETs get too hot they could cease oscillating and start a fire.

Other components may get hot enough to burn you. Low voltage tank capacitors underneath the main transformer get very hot and will make the bottom of the device hot during operation at DC-input voltages above 16V. The rectifier, inductor, transformer and high voltage tank capacitors also heat up considerably during operation and care should be taken to avoid burns and other serious injury. The following terminology is used throughout this manual to denote hazards and other important safety information:

An operation, procedure, or practice which if not correctly followed could result in personal injury or loss of life.

An operation, procedure, or practice which if not strictly observed, could result in damage to the device and/or voiding of the device's warranty.

2. Overview of components



- Don't touch any part of the unit while it is energized. You will get shocked. It will hurt. This thing puts out enough voltage and current that it could cause SERIOUS INJURY OR DEATH.
- Some parts of the unit get hot during operation and remain hot after unit is de-energized.
- Many parts of the unit are NOT ISOLATED.

- Unit is only designed to handle dead-short operation for short periods of time <10s.
- Blocking MOSFET heat sinks or operating the unit under dead-short conditions for long periods of time may exceed MOSFET thermal characteristics, which could result in DAMAGE TO UNIT, FIRE, PROPERTY DAMAGE, BURNS AND/OR PERSONAL INJURY TO OPERATOR.

3. Operation

1. Connect capacitor with 10kOhm resistor across terminals to HV output. Mount unit on a secure base plate using 4-40 grounded screw terminals.
2. With high voltage-rated protective gloves, connect low voltage input to source of DC electricity. Connect HV output across capacitor to a scope or voltage meter.
3. While wearing protective gloves, observe high voltage output voltage, adjust cutoff trimmer with small screwdriver until desired output voltage is reached.
4. De-energize unit and discharge capacitor. With protective gloves, disconnect capacitor and attach desired output device and re-energize the unit.

4. Software

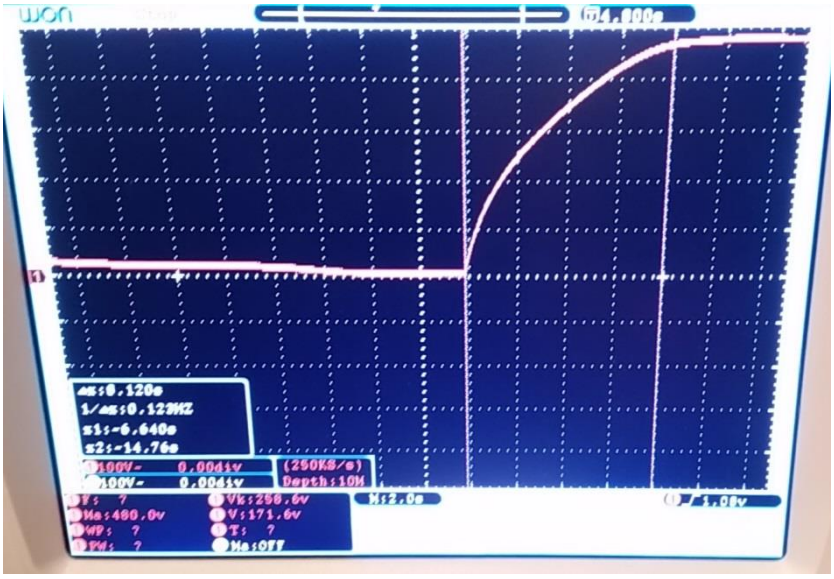
Unit has no microcontroller and does not require software.

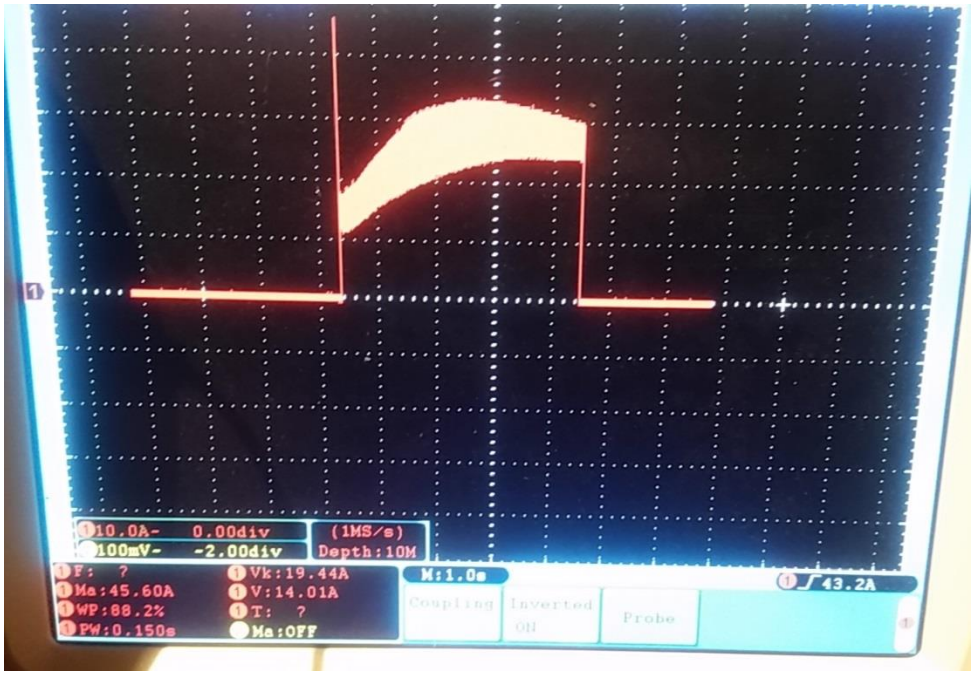
5. Hardware Specifications

Power Supply Input	12-26VDC/40A MAX
Power Supply Output	100-700 VDC
Current Rating	Up to 1A output
Dimensions	3.5” x 2.5” x 1.5”
Weight	139g

6. Electical Characteristics

Load: 12000uF/500V capacitor U37F Series
Input: 6S LiPo Battery @ 25.0V (nominal)
Setpoint: 500V





Time to charge capacitor: 4.0s
Voltage at cutoff: 480V
Average output power: 345W (capacitive load)
Average output power: 450W (resistive load)
Max output power: 650W @ 100V (resistive load)
Max inrush current: 45.6A (25V input across 0.1Ohm shunt w/ 12mF capacitive load on output)
Average input current: 19.4A (25V input across 0.1Ohm shunt w/ 12mF capacitive load on output)
Efficiency: 73%