Startup using E-loads

One advantage of RediSem LED driver designs is that they have very small output capacitors, which results in fast turn-on and turn-off times. This feature can also lead to trouble with some electronic loadbanks (E-loads) that are too slow to respond. This application note describes the problem and offers possible solutions. Note that the driver will always start up with an LED load and most E-loads, this problem only occurs with some slow E-loads.

The Problem

The transient response of some E-loads is slow, which means that the RediSem driver has started up and taken the output voltage very high before the E-load has responded. If, for example, an E-load is set to 40V, the output voltage passes 40V and the E-load does not respond. The output voltage continues to climb up to 45V and the IC's VFB voltage to rise above 1.2V, so that, after a short while, the IC latches an Open-Circuit fault. This can all take a few milliseconds. Then, after a few more milliseconds the E-load senses that the voltage across its terminals is 45V and it turns on to reduce the voltage down to 40V. Because the E-load does this after many milliseconds, the LED driver has already latched an open-circuit fault and waits for a long time before the cycle repeats.

With high ripple flyback-type converters, the output capacitors are typically very large. The result is that it takes a long time for the driver to pull the output voltage above the E-Load setting so that the E-Load has much more time to apply a load before the driver detects a fault or goes into standby.

An example of an E-load that exhibits this problem is the IT8512. The upgraded IT8512+ is better suited for RediSem applications and does not have this problem.

Normal LED Startup

RediSem LED drivers start up with very little current overshoot. They drive the output capacitor up within a few milliseconds, the LED turns on to full brightness instantly and the driver regulates the correct current immediately. A picture of normal startup with an LED load is shown in figure 1 below:

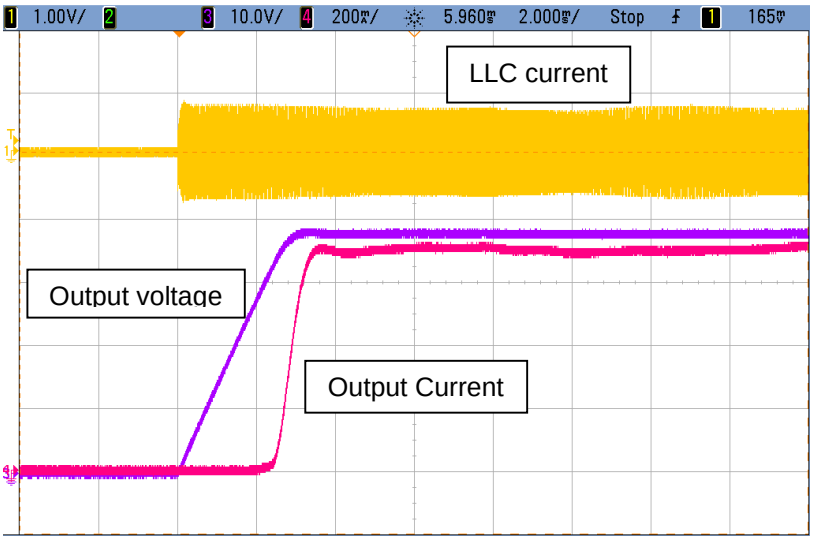

Figure 1: Normal startup with an LED load

Unfortunately, E-Loads do not always show the same response as an LED. If you have an E-Load with an LED mode that includes the resistance and voltage similar to a real LED, then this is more likely to work correctly. If in doubt, always try the driver on a real LED load.

Startup with an E-load set to CV mode

A picture of the output voltage, output current and LLC current is shown in figure 1 below:

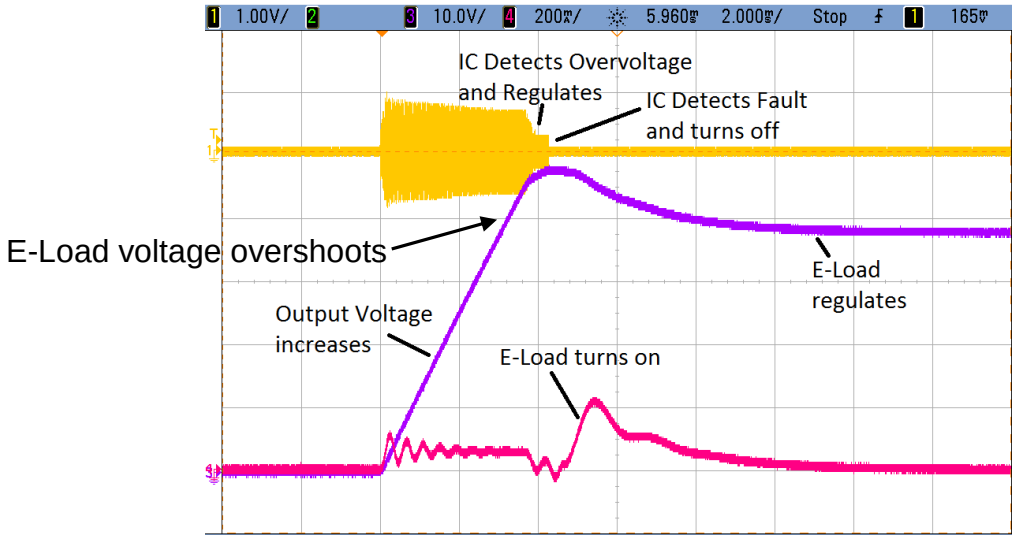

Figure 2: E-Load overshoot at startup

From the above plot, the output voltage (purple) can be seen to rise linearly before it flattens off. The LLC current (yellow) also shows a constant current until the output voltage flattens off. The LLC current then reduces and the IC latches a fault. At this stage the output voltage is around 47V, even though the CV load has been set to 40V. After a while the E-load current (pink) turns on, but this is after the driver has already latched a fault. The E-load then pulls the output voltage below the required 40V setting, but the driver remains off with a latched fault.

Possible Solutions

The control circuit can be modified to be more suitable for problem E-loads but there are drawbacks. As the drivers work fine with a proper LED load, **it is unnecessary to change the driver circuit**. Possible solutions are offered below:

Use an E-load better suited to fast startup – Use the upgraded IT8512+ as opposed to the older IT8512.

Set the E-load to LED mode – Some E-loads have a setting where it is possible to set the equivalent LED voltage and LED series resistance.

Start up at a lower voltage – With the E-load in CV mode, reduce the setting to the minimum driver output voltage. After it has started, change the setting higher as required.

Add a parallel loading to the driver to help startup – This gives the E-load a longer time to start up. This is shown in more detail in the following section.

Add an extra load

The simplest solution is to add a series capacitor and resistor in parallel with the E-Load. This has the effect of slowing down the output voltage rise to give the E-Load more time to respond. 10Ω and 1000uF are typical values that can be used on a 40V 1A driver. For different voltage applications change the capacitor value proportional to V^2 and keep the RC time constant the same. A diagram of the circuit is shown in figure 3 below:

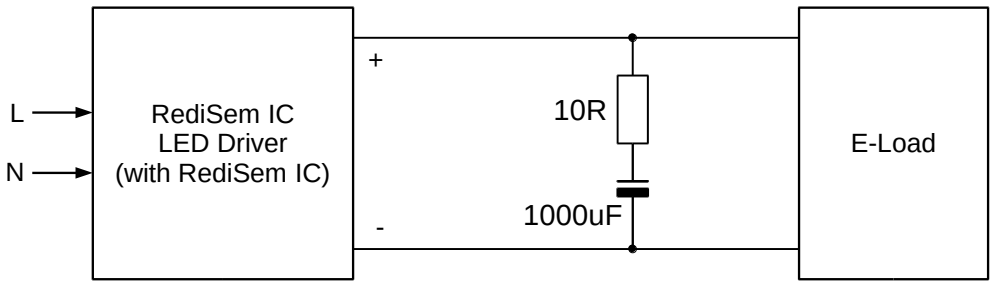

Figure 3: Startup helping circuit

The driver will take longer to start up as some of the IC's protections are triggered, but the E-load has longer to respond once the driver output voltage reaches the load voltage. A plot of the startup is shown in figure 4 below:

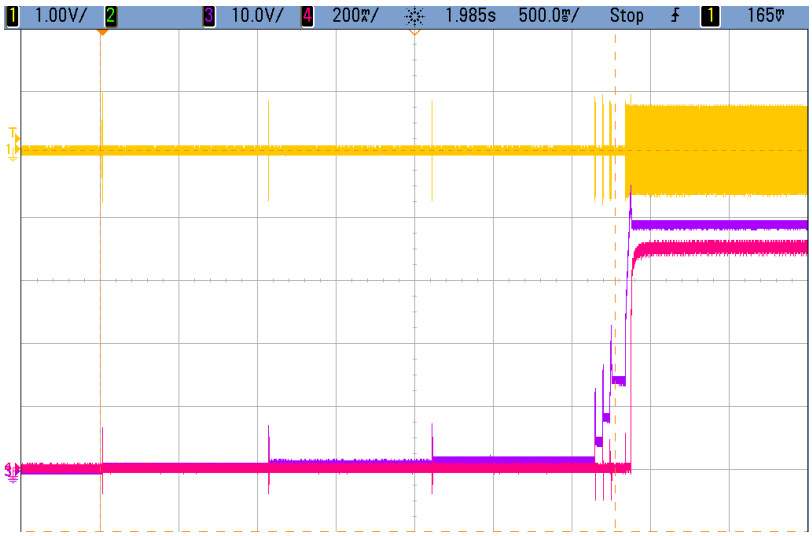

Figure 4: Resulting E-Load response improvement

About RediSem

RediSem designs and supplies semiconductor ICs for energy efficient power management applications. RediSem uniquely combines extensive experience in power electronics with in-depth knowledge of IC design and manufacturing and works with the world's top suppliers and customers. RediSem's unique patented IC and converter technologies deliver maximum efficiency and performance, while reducing overall bill of materials cost through the use of bipolar transistors.

RediSem's range of LED control ICs can be used with RediSem's patented single stage LED control solution to provide very high efficiencies with low EMI – all with a single IC. When combined, these features deliver a low cost, high performance LED driver solution.

RediSem's fluorescent driver controller ICs achieve the advanced performance of MOSFET drivers by using bipolar transistors at a fraction of the BOM cost. RediSem's range of SMPS (Switched Mode Power Supply) control ICs enables low-cost LLC converters with bipolar transistors that deliver very high efficiencies already meeting DoE Level VI regulations, have low standby power and have much lower EMI compared to flyback converters.

All RediSem ICs are supported by comprehensive turn-key application designs enabling rapid time to market. For further information please use our contact details below

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