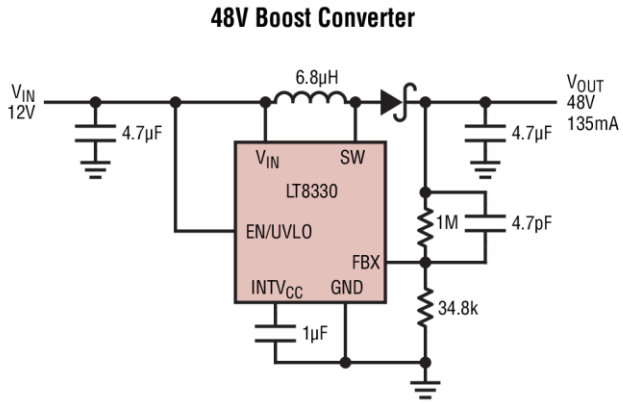
How NOT to Damage Your Switching Regulator Demo Board

A great way to develop a design is to start with an existing demo board and modify it. While this simplifies the process, there are a few pitfalls to be aware of so that you do not have to spend time tracking down and replacing damaged components. Below are four common ways to damage your circuit.

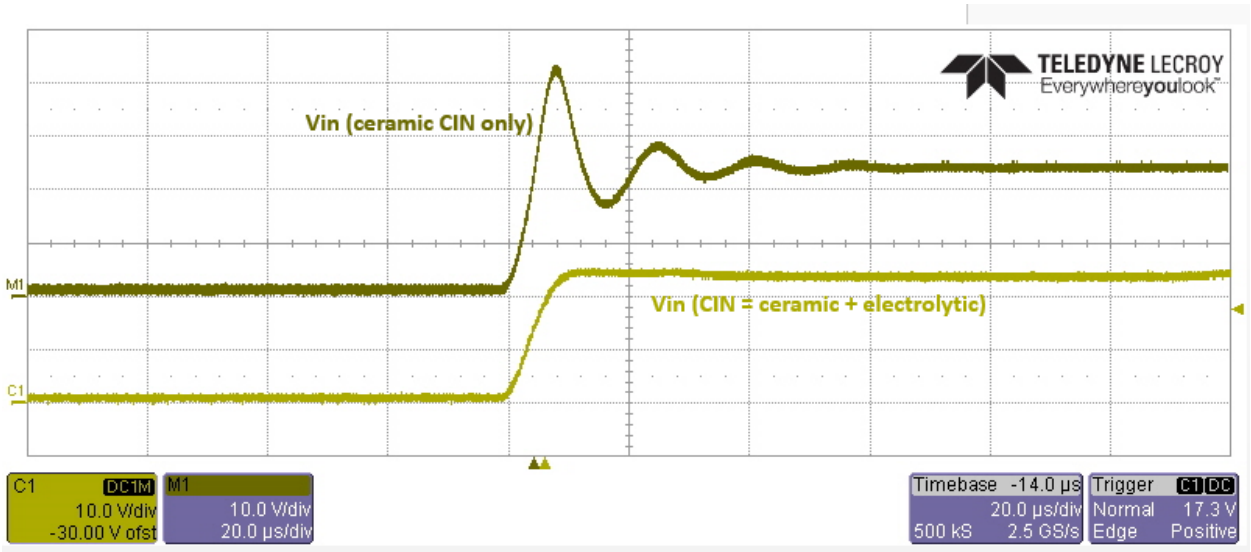
1) Improper Feedback Connection

Looking at the LT8330 boost circuit below, consider what happens if either the 1M Ohm resistor is open or the 34.8K Ohm resistor is shorted to ground. In either case, the FBX will never reach the desired 1.6V, so the LT8330 will continue to push the output higher and higher until something breaks down. This can still be a problem with buck converters; however, the output can only go as high as the input. Either way, it is worth double-checking any changes you make to the feedback network.



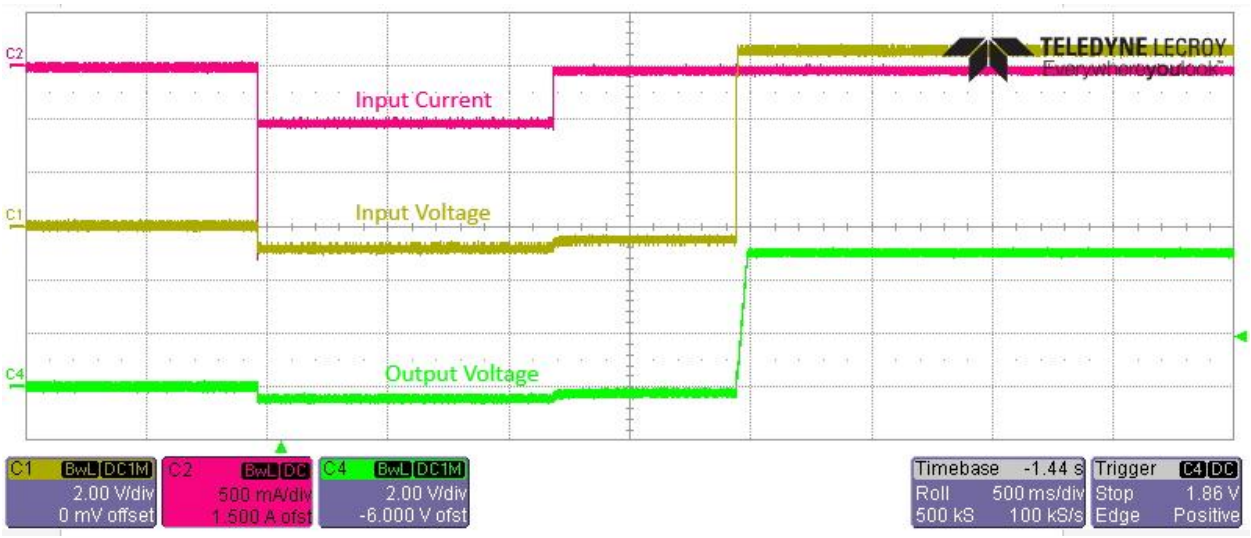
2) Hot-plugging an Underdamped Input

This is such a common issue that we have an entire application note devoted to the topic (AN88). It is a short document and definitely worth reading, but the point is this: hot-plugging a circuit can produce a large voltage spike on the input, particularly when using only ceramic input capacitors. If the transient voltage exceeds the part's absolute maximum voltage, it can potentially damage the regulator. The solution is to provide some way to damp the transient, either with an electrolytic capacitor or a ceramic capacitor with a small resistor in series. The scope shot below shows the improvement made by adding an electrolytic capacitor from Vin to ground. The good news is that nearly all of our demo boards have one of these options already populated.



3) Reverse Input Voltage

I still occasionally swap the input leads, applying a negative input voltage and potentially damaging the part. By limiting the current of my input supply to a few amps, the power dissipation can be minimized in the event that I reverse the input. You can see waveforms of a part surviving below. The input voltage is set to 6.5V with a 0.5A limit. When the reverse voltage is applied, Vin is applied across a diode internal to the regulator, basically shorting the supply. Since the input current is limited to 0.5A, the part dissipates 0.5A times the forward drop of the internal diode. The part starts as expected after applying the input voltage correctly.



4) Internal Regulator(s) Overvoltage

There is often more than one way to power a regulator's internal circuitry, allowing the internal linear regulators to be powered from a lower voltage to reduce power dissipation. Because of this, it is important when increasing the output voltage to be aware of any VCC connections. For example, the DC1523A (LTC3789) is set for 12Vout and EXVCC is connected to Vout. Modifying the output voltage

above approximately 13V without changing the EXTVCC connection could result in a damaged part. (This is terribly obvious, but it is a mistake that I still make.)

Hopefully this will help you avoid the most common ways of damaging a demo board and be able to finish your designs more quickly.

Did I miss the most common way you damage a board? If so, I would like to hear it. Email me at cjarboe@linear.com.