Power Cycle Testing in Power Semiconductors

It is no secret that semiconductors are the basic component of most electronic devices and essential for our modern way of life. Semiconductors are so abundant in today's society that it would perhaps be more difficult to find an electronic component or product that *doesn't* contain a semiconductor in it's components than it would be to find one that does.

In recent years, "power semiconductors" have been making headway due to their role in energy saving and environmental preservation. Power semiconductors are different from regular semiconductors in that they can handle much higher voltages and much larger currents without sustaining damage. However, failures can occur when handling these large amounts of power due to high levels of power loss, resulting in the generation of unnecessary heat. Proper testing is vital through all stages of semiconductor development and manufacturing in order to minimize these effects.

Challenge

One of the most important tests when it comes to the development of power semiconductors like MOSFET and IGBT modules are power cycling tests. Power cycling tests are used to ensure the reliability and quality of semiconductors and are performed by being connected to a DC power supply and rapidly turning the current output ON/OFF to keep the DUT under a desired temperature. This process is repeated over and over for a set period of time to test the durability of the semiconductor.

In these tests, it is very important that that the device sending commands to the power supply and the power supply itself be in perfect synchronization with one another with as little delay in communication as possible. A delay as small as a mere milisecond can result in overshoot in the current applied to the DUT resulting in an undesired temperature level and may even significantly damage the semiconductor. It is absolutely vital that the power supply being used has the fastest communication response time possible.

Solution

DC power supplies such as the PWX or PWR-01 series are equipped with LAN (LXI) as a standard interface and ensure some of the fastest communication response time in the power supply market. The PWX/PWR-01 series response speed when using LAN communication is extremely fast, has virtually no delay, and provides a stable output of current that is easily maintained and ideal for power cycle testing with power semiconductors. When compared to these products, competing brands have a much slower response time and therefore have a much harder time maintaining a set temperature in power cycle tests for an extended period of time. The ultra-fast LAN communication response is one of the trademark benefits of using the PWX/PWR-01 wide range DC power supplies.

a. PWR-01 Wide Range DC Power Supply

b. PWX Rack-mount DC Power Supply

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Solution (cont'd)

Figure 1. Rise time of competing power supply (2 V - 20 V)

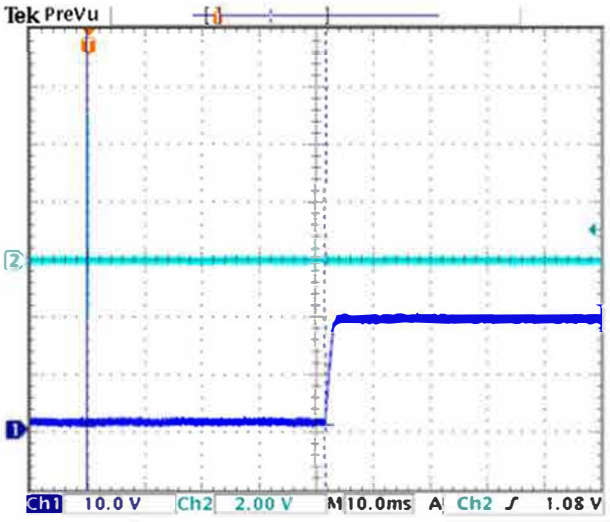
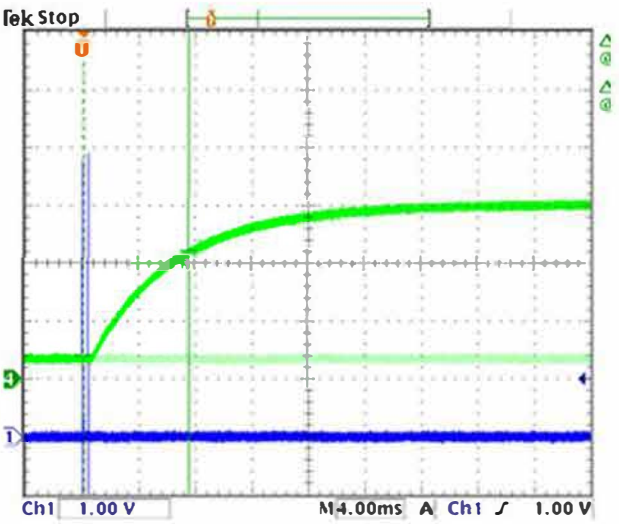


Figure 2. Rise time of PWX/PWR-01 power supplies (3 V - 30 V)



When using competing power supplies as seen in Figure 1, the rise time from 2 V to 20 V took 42ms. In the world of power cycle testing where a few extra miliseconds of prolonged heat exposure can result in severe damage to the DUT, this is a very slow response time. When using the PWX/PWR-01 wide range DC power supplies as seen in Figure 2, the rise time from 3 V to 30 V is a mere 0.36ms. This communication response time is approximately *117 times* faster than the competing DC power supply.

Summary

As seen in Figure 3, the PWX (and PWR-01) LAN communication speed results in a much more thorough power cycle test with far less current overshoot and damage sustained by the DUT. When conducting power cycle tests on DUTs such as power semiconductors, it is essential that you utilize the power supply with the fastest communication speed at your disposal. With DC power supplies such as the PWX/PWR-01 there is close to zero delay in communication resulting in accurate power cycle tests for reliable, efficient semiconductors.