

Laser Test Report V2.0
Laser Test of the S2803R3S DC/DC Converter
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Test Date(s): May 11, 2010

I. Introduction

This study was undertaken to determine the single event destructive and transient susceptibility of the International Rectifier (IR) S2803R3S DC/DC Converters, for transient interruptions in the output signal and for destructive events induced by exposing it to a one photon laser beam at the Naval Research Laboratory in Washington, DC. This test was performed for the potential use in electronic circuitry for the Magnetospheric Multiscale (MMS) project. MMS is one of the missions of the Solar Terrestrial Probes (STP) Program of NASA's Science Mission Directorate Heliophysics Division. MMS comprises of four identically instrumented spacecraft that will use Earth's magnetosphere as a laboratory to study the microphysics of three fundamental plasma processes: magnetic reconnection, energetic particle acceleration, and turbulence. These processes occur in all astrophysical plasma systems but can be studied in situ only in our solar system and most efficiently only in Earth's magnetosphere, where they control the dynamics of the geospace environment and play an important role in the processes known as space weather.

II. Devices Tested

The sample size of Device Under Test (DUT) for testing was two. Each device was exposed to the laser beam and the results will be compared for verification. The test samples code markings are S/N 0310117 & S/N 0310118 with both devices with D/C 0324.

The S-Series of DC-DC converters are low power radiation-hardened, high reliability devices designed for hostile radiation environments such as those encountered by geostationary earth orbit satellites, deep space probes and communication systems. Features include small size, high efficiency, low weight and a high tolerance to total ionizing dose, single event effects, and environmental stresses such as temperature extremes, mechanical shock, and vibration.

III. Test Facility

Facility: Naval Research Laboratory
Laser: One-Photon-Absorption

IV. Test Conditions and Error Modes

Test Temperature: Room Temperature
Bias conditions $V_{in} = 28V$, $V_{out} = 3.3V$

See Figure 2 for detailed conditions

	Vsupply (V)	Isupply (mA)	Vin (V)	Loading %
DUT 1	3.3	174	28V	30
DUT 2	3.3	174	28V	30
DUT 1	3.3	313	28V	70
DUT 2	3.3	315	28V	70

Table 1: Test conditions

PARAMETERS OF INTEREST: Power supply currents, output voltage

Laser Conditions: SET

- SET test on 2 parts with laser beam for each of the loading conditions in Table 1.

V. Test Methods

The block diagram, as shown in Figure 1, for the DC-DC Converters contains a power supply for input voltage, an electronic load, a DUT board for the test circuitry and devices, a computer for GPIB control of measurement equipment, and a digital scope to capture any output anomalies, and after the desired voltage input is applied, each of the two device outputs will display on the digital scope, which is set to trigger on voltages that are above or below a predetermined threshold (set to 250 mV). Each device output was tested one after each other. Table 1, shows the test conditions where tests were conducted for an input nominal voltage of 28V. Figure 2, shows the internal circuitry for laser testing of the S2803R3S DC/DC Converters at NRL and Figure 3 shows the test schematic circuitry.

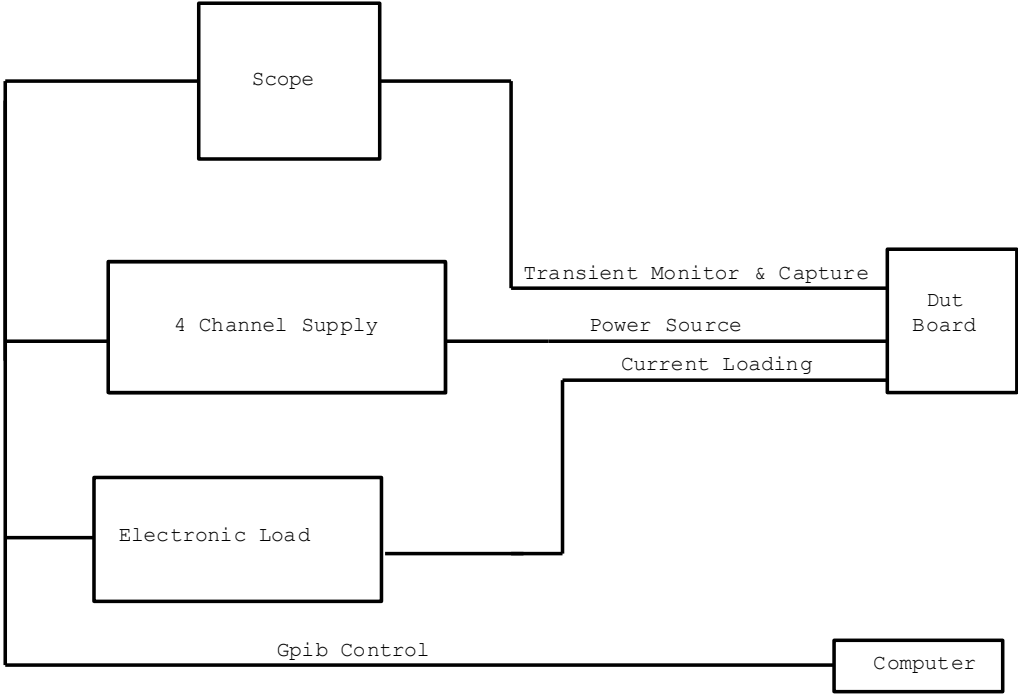


Figure 1. S2803R3 DC-DC Converter Overall Block Diagram for laser testing

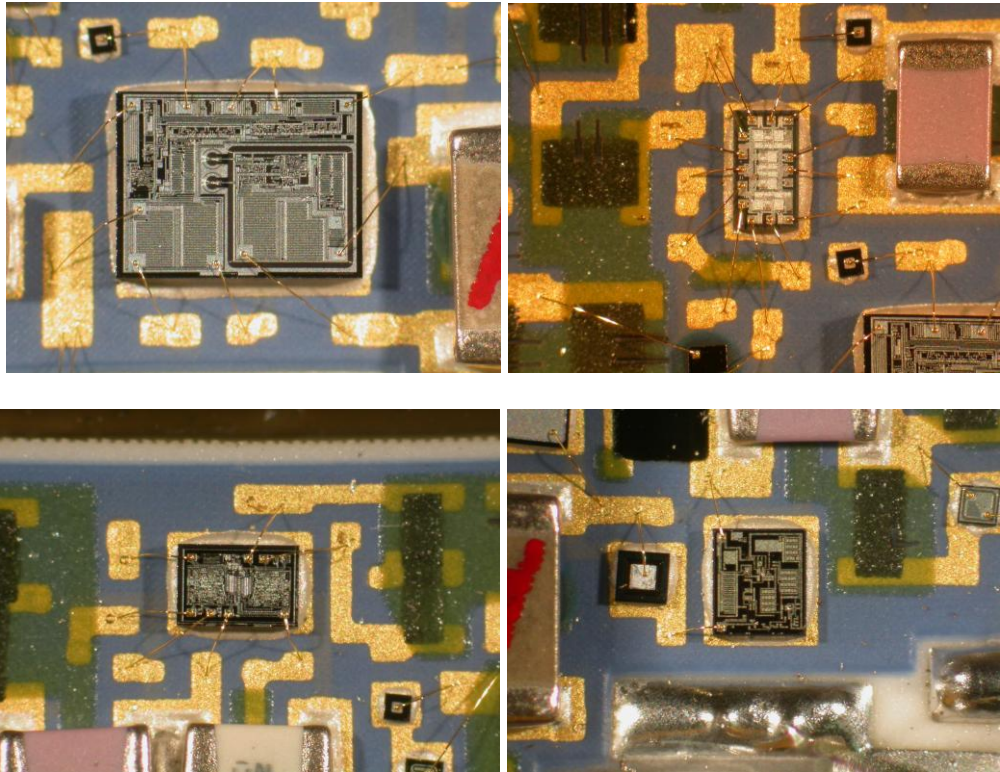


Figure 2. S2803R3 DC-DC Converter internal circuitry for laser testing

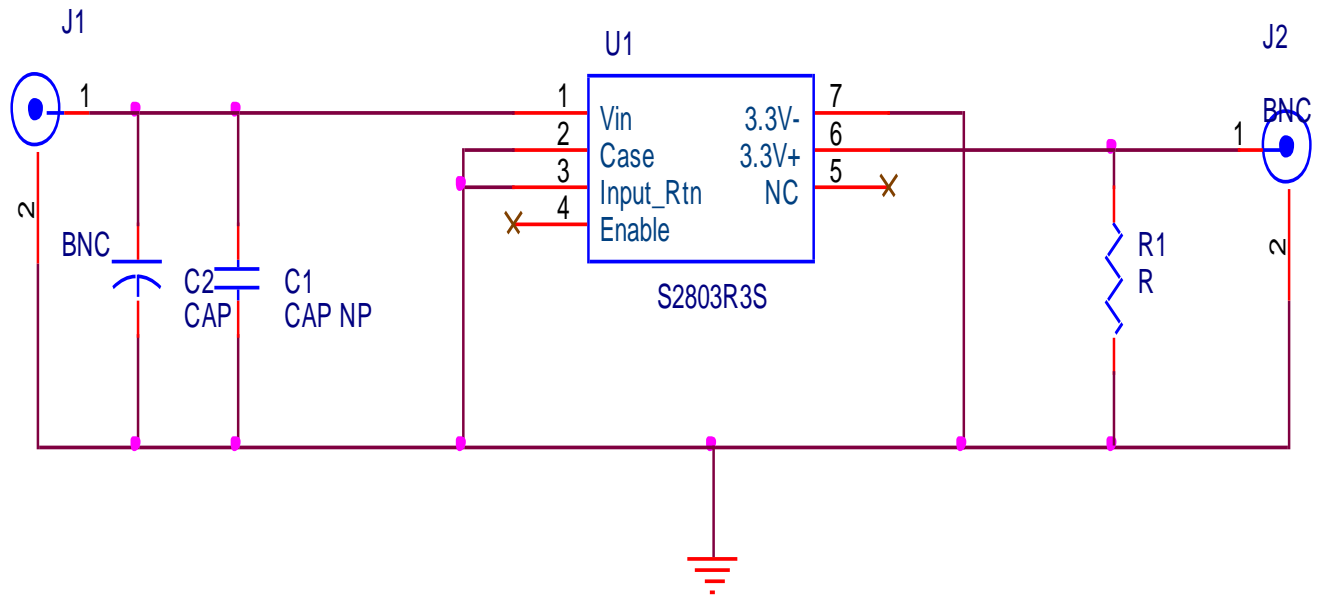


Figure 3. S2803R3 DC-DC Test Schematic Circuit

VI. Test Results

A summary of results are plotted in Chart 1 below. The devices were exposed to a one photon absorption laser beam. Transient observations were taken on active regions inside of the device. The worse case peak transient was observed at +/- 150mV with approximately 100us duration that can be mitigated with a filter. This device is suitable for space applications in conjunction with appropriate filter circuitry.

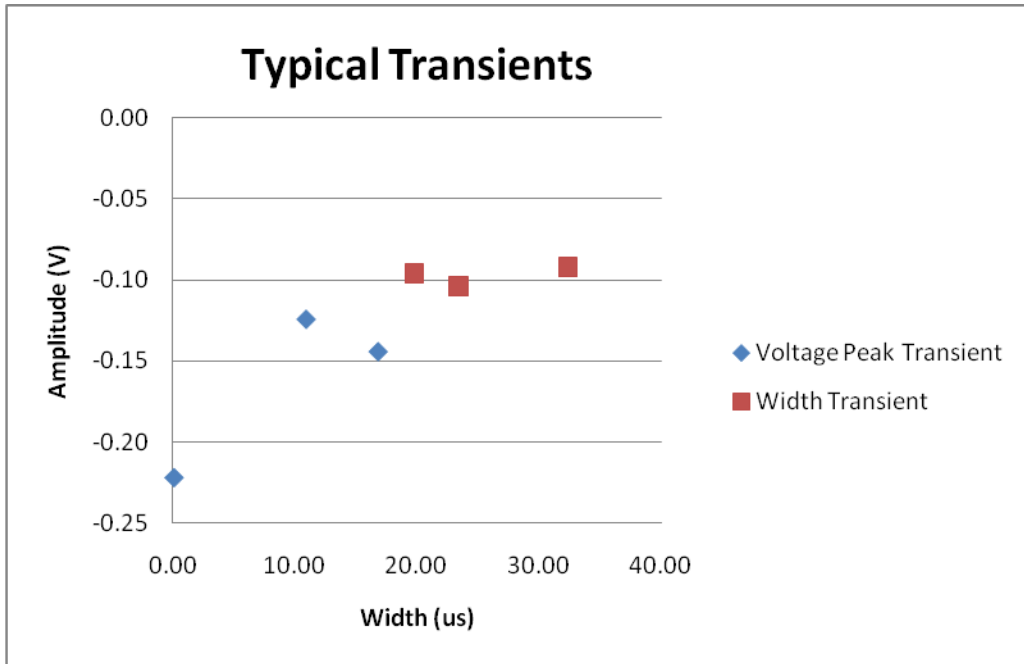


Chart 1. SET Amplitude vs. Duration

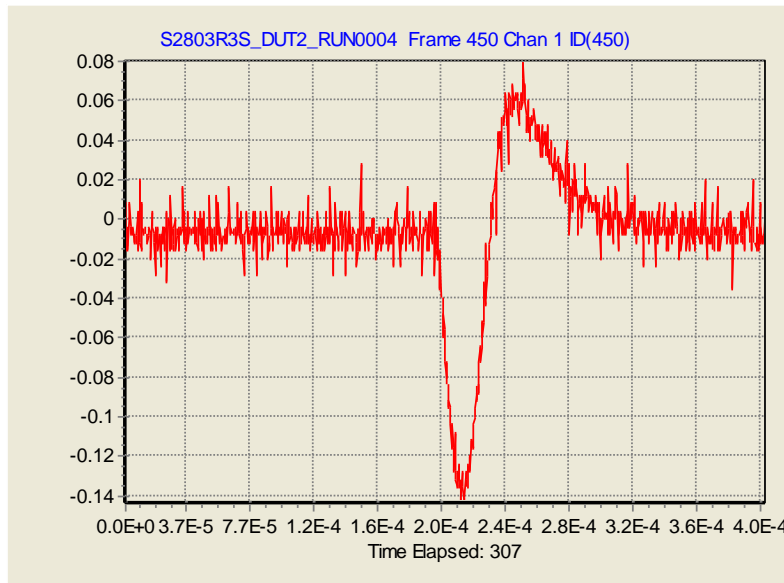


Figure 4. Typical Peak Transient of approx $\pm 150\text{mV}$ with $100\mu\text{s}$