

Re: Relay Suppression Diode Failure

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Mark P wrote:

I trying to determine the cause of a relay suppression diode failure. The diode is built into the relay can (T-05 type) and is a standard switching type diode – according to the manufacturer. The relay coil specs: L=600mH and R=850 ohms. The relay was driven with a 2 second ON pulse followed by 2 seconds OFF. This duty cycle was continued for three minutes. The relay was driven with a transistor switch on the low side. The voltage on the coil was 13V. The relay failed and after it was opened up you could see that the diode was cooked.

When the transistor switch turns OFF the diode suppresses the voltage transient. Is there sufficient energy dissipated in the diode over 3 minutes to cause it to fail? Is there a way to calculate or estimate the diode junction temp rise? The manufacturer has no thermal data on the part.

Just to keep thermal things in perspective:

The average power dumped into the resistance of the coil is close to $1/2 * (V^2/R) = 99 \text{ mW}$. The peak energy dumped into the diode is very approximately 11 mW (15 mA times about .7 volts drop), but the average power dumped into the diode over the 4 second cycle is only about 1.6 uW (by simulation), because most of the stored inductive energy is dissipated in the coil resistance during discharge. So the temperature rise in the diode, is far more likely to be caused by its close proximity to a coil dissipating about 6000 times as much power as the diode is. All this assumes that the diode was not defective, to start with.

Even if you activated the coil every 0.004 second, for 0.002 second on time, the ratio only drops to about 46 to 1.

I think you might measure the copper coil resistance during the test to use it as a temperature monitor.

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