MDI's Proton Rad Hard DC-DC Converters

MDI's Proton Rad Hard converters eliminate the use of optocouplers, which are the primary components that are affected by proton radiation.

In a typical DC-DC Converter application, there must be galvanic isolation between the power supply pins and the output pins. The reasons for this concern safety, noise reduction or circuit operation. In most applications, the various grounds within a system are ultimately connected to a single point ground. In other applications, the outputs of the converter are referenced to a potential different from ground.

Previously, MDI offered radiation hardened DC-DC Converters which used an internal radiation hardened optocoupler for input/output isolation. Now, in order to provide an even higher level of radiation resistance, and one that is less susceptible to unit-to-unit variations in the optocoupler, the isolation function has been replaced by an amplitude modulated RF link. This RF link transmits the amplified error signal across the galvanic isolation barrier through a small transformer. On the other side of the galvanic barrier, the RF signal is demodulated and applies the error voltage to the PWM control circuit.

Comparing the Proton Rad Hard parts to rad hard units with an optocoupler: radiation resistance is improved since the aging and parametric degradation of the optocoupler is eliminated. The efficiency of the proton rad hard converters is slightly lower (1 to 2%), since the output magnetic modulator consumes slightly more power than the optocoupler and drive currents throughout the converter have been increased for additional radiation resistance. Operating life of the proton rad hard DC-DC Converters, even without radiation, is improved over the optocoupler units, since there is no LED output degradation over time as found in the optocoupler type.

Because the magnetic modulator in the proton rad hard DC-DC Converters contains an RF oscillator, the output noise of the proton rad hard DC-DC Converters is slightly higher than that of the optocoupler types. The higher noise is in the form of a very low level 2 MHz signal uncorrelated with the output ripple. The 2 MHz signal is normally at least 20 dB lower than the output ripple.

Comparing transient response of the proton rad hard DC-DC Converters with that of the optocoupler types, the load application, load removal and response to line transients is better in the proton rad hard version. The reason for this is that the optocouplers vary considerably in initial current transfer ratio, and also over life and radiation. This means that the optocoupler units have to be compensated for a much wider range of conditions than the magnetically isolated proton rad hard units. The compensation being more conservative, the closed loop bandwidth of the optocoupler types tends to be

approximately half as much as the bandwidth of the proton rad hard units. Since the recovery times from transient events is inversely proportional to bandwidth, the proton rad hard converters have better transient response.

Similarly, the turn on overshoot of the proton rad hard DC-DC Converters is essentially non existent because the circuit topology and wider bandwidth.

Wattage	28 VDC	50 VDC	70 VDC	100 VDC
6.5W	5690	7690	8690	9690
20W	5107	7107	8107	9107
30W	5680	7680	8680	9680
40W	5193	7193	8193	9193
80W	5031	7031	8031	9031