



SOUTHWEST RESEARCH INSTITUTE

High-Voltage Optocoupler for Space Environments

Southwest Research Institute® (SwRI®) developed the 100SW1502/1602 to address the need for a space-grade high-voltage (HV) optocoupler. To ensure high reliability, the device pairs a custom glass-passivated multi-junction HV diode with a glass-lensed LED array. The optocoupler is designed to prevent leakage and operate from -40°C to 100°C. To protect against contamination, the device meets NASA requirements for low outgassing.

The optocoupler can be configured to suit the client’s application, as ~2.6 V or ~5.4 V forward voltage @ 200 mA. Both options have internal parallel sets of two LEDs in series for increased reliability through redundancy. The LED heat is ejected through the copper LED leads by coupling to a board thermal plane, while the HV section ejects heat via 0.040-inch diameter solid silver leads. The high-current LED array allows the optocoupler to achieve a very high stepping slew rate (e.g., from 0 V to 10 kV @ 100 M and 40 pF in only 23.4 µsec).



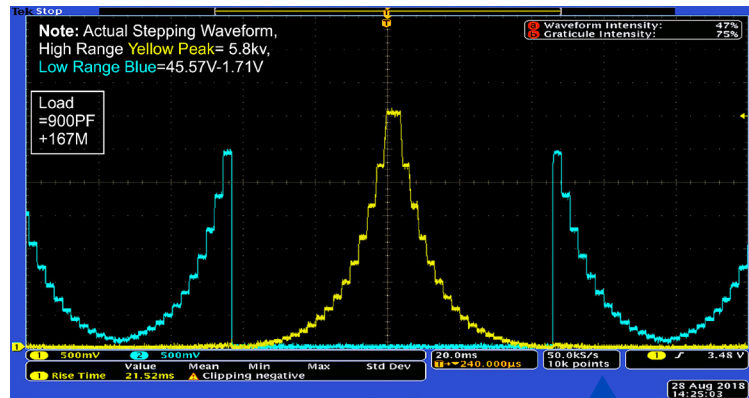
Optocoupler installed on circuit board

Features

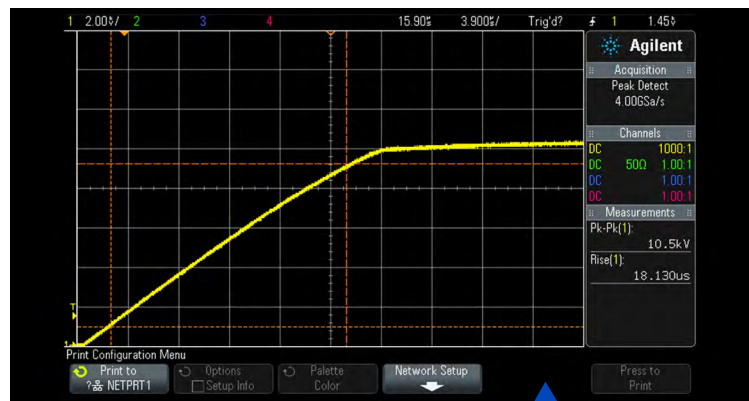
- Dual internal LED drive paths for high reliability
- High reliability to 6 kV (NASA standard) without additional insulation
- High reliability to 10.5 kV with additional Parylene coating
- 15 kV internal HV diode (derated to 10.5 kV)
- 15 kV internal isolation (HV to LV, derated)
- Current transfer ratio ~0.5% to 1.0% at 500 V and ~25°C (depending on LED configuration)
- Low dark current (across HV diode) and isolation current (HV to LV) for low leakage
- Hetero-junction LED structure resistant to proton displacement damage
- Internal electrostatic discharge (ESD) protection diode (100SW1502 only)
- Designed to prevent cold failures due to coefficient expansion
- Vacuum poured to eliminate defects causing discharge
- Large LED structure to inhibit noise from uneven illumination

100SW1602 Additional Features

- Two separate LED drive paths
- Additional thermal and HV return pins
- Outer surface spacing to 8 kV (NASA standard) without additional insulation
- 16 kV internal isolation (HV to LV, derated)
- U-bend stress relief on low-voltage pins



Stepping waveform from 1.71 V to 5.8 kV



High-speed waveform from 0 V to 10 kV in 23.4 µsec driving 100 M and 40 pF load

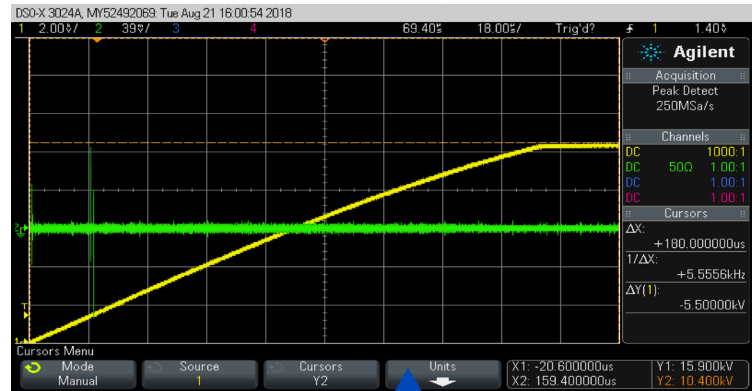
Testing

Unit

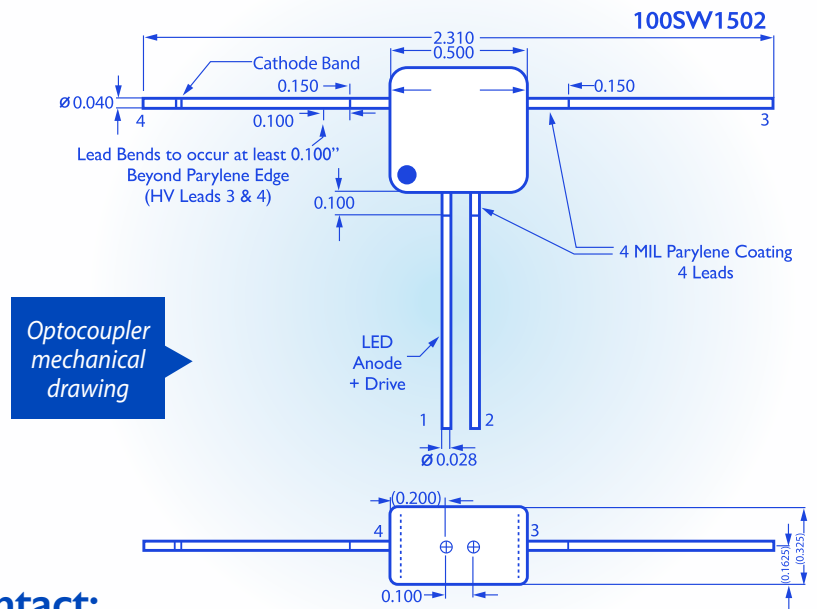
Standard testing for each unit includes visual and radiological inspection of LED, LED assembly, and HV diode

Batch

- Pulse testing of LED assembly alone at 20 mA and 1 A (9 msec each)
- Bare diode high-voltage leakage characterization at 2 kV & 3 temps (80°C, 25°C, -35°C)
- Potted (pre-Parylene) high-voltage leakage characterization at 2 kV and 6 kV at 3 temps (80°C, 25°C, -35°C)
- Post-Parylene high-voltage leakage characterization at 2 kV at 3 temps and 6 kV at 7 temps (between 80°C and -35°C)
- CTR measurement at 500 V and 6 kV
- Single-part tests at room temperature
- High-voltage leakage and high- to low-voltage leakage testing at 6 kV and 8.5 kV



Internal discharge test to 10 kV with 100 pC calibration pulse



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SOUTHWEST RESEARCH INSTITUTE

Southwest Research Institute is a premier independent, nonprofit research and development organization using multidisciplinary services to provide solutions to some of the world's most challenging scientific and engineering problems. Headquartered in San Antonio, Texas, our client-focused, client-funded organization occupies 1,200 acres, providing more than 2 million square feet of laboratories, test facilities, workshops, and offices for nearly 2,600 employees who perform contract work for government and industry clients.

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