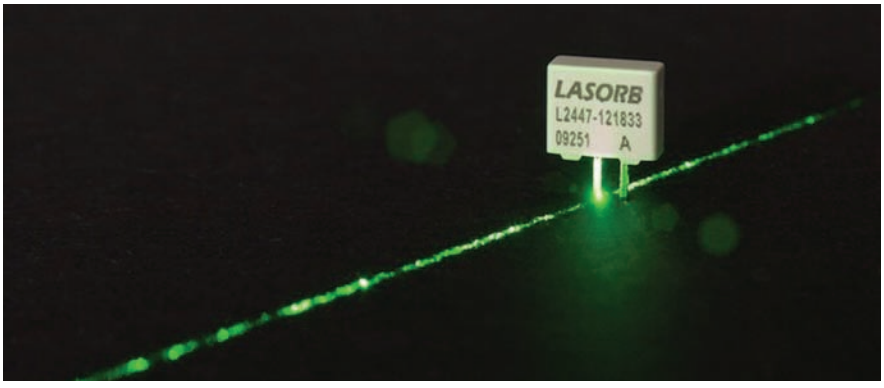
Small device prevents diode death

ORLANDO, Fla. – Electrostatic discharge (ESD), reverse bias and power surges are common causes for the malfunction or premature failure of laser diodes, LEDs and photodiodes.

As a solution, William Benner, president of Pangolin Laser Systems, has devised a component called Lasorb, described as an "ESD absorber," which protects diodes and other optoelectronic equipment. The device could benefit applications in electronics, medicine, and solid-state laser pumping and instrumentation.



Lasorb helps to protect diode function and life expectancy by preventing the electrostatic disruptions and power surges typically caused by touching a device or turning it on or off. During testing, the component was found to be 100 percent effective in defending red and infrared as well as Blu-ray diodes from negative and positive ESD events up to 15 kV.

Triggers

According to Benner, some companies have experienced laser diode performance anomalies without knowing the actual cause. Pangolin, which within the company refers to the Lasorb as a "ghost buster," believes the product solves these mysteries once it's applied. "There can be phantom phenomenon going on inside the laser diode driver that people really don't understand," Benner said, "but when you attach the Lasorb, it tends to moderate most strange behavior."

ESD can be generated in many ways, but it is usually related to human activity, such as touching a device after walking across a carpet or vinyl surface, or repositioning a machine. Depending on how an individual works with the product or where the diode is placed within the device, the voltage produced can reach the diode directly or indirectly.

Electrostatic activity can range from 4000 to 32,000 VDC, but if a laser diode with a terminal voltage of 2.2 V is hit with only 1000 V of ESD, the diode is likely either to expire or have permanent latency, while its lifetime becomes radically reduced.

When a laser diode is powered up, it is vulnerable to overvoltage and overcurrent if the power supply exceeds the voltage parameters of the diode, while powering down has a reverse effect. If the device is continually turned on and off, the effect of power surges accumulates over time and eventually leads to laser diode fatigue and premature failure.

Typically, a normal working laser diode operates effectively under strong forward-bias conditions – that is, the voltage runs through the diode in the typical direction. Yet a reverse-bias condition, which Benner describes as voltage going through a diode the "wrong" way, can significantly harm its performance. "Laser diodes don't like this very much at all and will be damaged by even slight amounts of reverse bias," he said.

According to Benner, Pangolin decided to design the Lasorb after testing many existing laser diode protection devices but finding none that had sufficient defense capabilities against ESD, reverse bias and power surges.

Defense mechanism

Lasorb is intended to prevent the negative polarity of a laser diode while also prohibiting discharge from exceeding the maximum forward-bias conditions. The Lasorb attaches by connecting the LDA and LDK terminals, respectively, to the anode and cathode of the laser diode. Placing the component as close as possible to the diode – no more than a gap of 1 cm – will help to inhibit stray surges from getting past the ESD absorber.

Integrated into the circuit is a "fast acting" diode that is able to protect the laser diode from reverse bias and negative ESD. Unlike Schottky diodes – a common mechanism for electrostatic protection – these fast-acting diodes, Benner discovered, survive ESD events. "The fast-acting diode is formed by a *p-n* junction, so it might be called a 'normal' diode," Benner said. "However, the properties and specifications of this particular diode are beyond the norm."

Also included in the device is a slew-rate detector, which monitors the voltage between the LDA and LDK terminals and can distinguish between normal diode function and ESD or power surges. As voltage strikes, the Lasorb conducts current between the terminals and away from the laser diode, therefore protecting it. Lasorb's reaction time is believed to be below 800 ps, fast enough to catch nanosecond-level ESD events. "This part does something that we haven't seen any other part do," Benner said. Other solutions fail to fully protect laser diodes because their response time is too slow, or their voltage detection range is insufficient for the wide scale of energy derived from electrostatic activity and power surges.

Additional advantages include Lasorb's ability to safeguard a diode whether the entire system is on or off, and whether or not the laser is emitting. "This is one of the most unique benefits of Lasorb," Benner said. "Our tests and demonstration videos show that we can protect a laser diode even while it's lasing."

Amanda D. Francoeur
amanda.francoeur@laurin.com