Technical Information

Optoelectronics Test

Active optoelectronic device characterization requires more than a current source

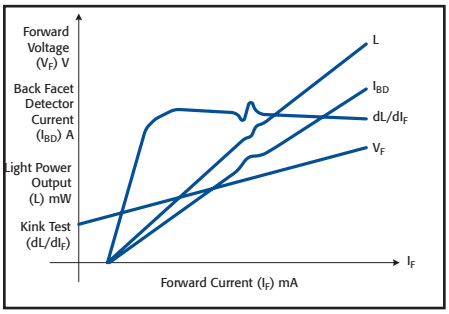

Figure 1. Classic LIV curves associated with semiconductor laser diodes.

Active optoelectronic devices are basic semiconductor junctions. To be fully tested, they require not only forward I-V characterization, but also reverse I-V characterization. While conventional laser diode drivers are valuable for providing drive current in the optics lab, these current sources aren't suitable for developing a complete understanding of a semiconductor device. The SourceMeter® line provides a full range of source and measure capability optimized for semiconductor characterization.

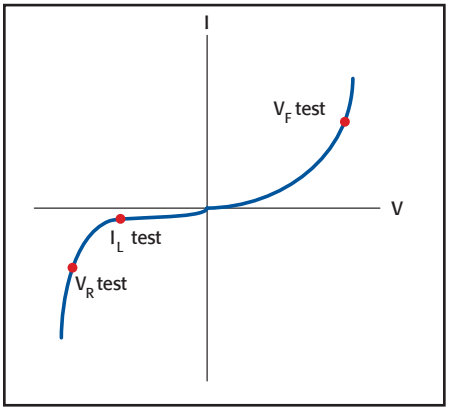

Figure 2. Characterization of semiconductor junctions requires measuring reverse breakdown (V_R), leakage current (I_L), and forward voltage (V_F).

A complete characterization of an active optoelectronic device requires forcing both forward and reverse currents and voltages. For instance, the reverse breakdown test requires sourcing a very small, precise reverse current (10nA) while measuring the voltage. The limited current prevents permanent damage to the device, while allowing a precise breakdown voltage to be measured. Given the breakdown voltage, it's now possible to force a reverse bias that won't harm the device while leakage is measured. This leakage current value is often used to qualify the device for further testing.

Four-quadrant source capabilities

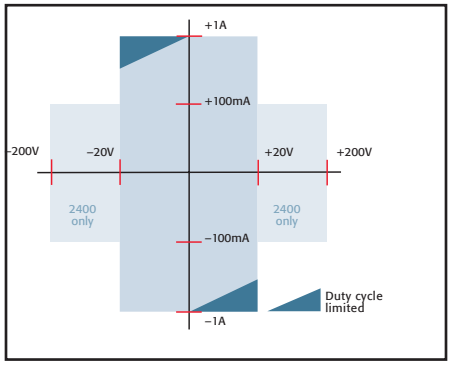

Figure 3. The Model 2400 can source or sink either current or voltage. Other SourceMeter instruments offer different ranges, providing a very wide dynamic range from as low as a 1µA range or 200mV to 5A or 1000V.

The SourceMeter product line combines a full four-quadrant precision source (see Figure 3) with measurement capability. Source and measure ranges provide a very wide dynamic range from as low as a 1µA range or 200mV to 5A or 1000V. These very wide dynamic ranges allow testing diverse devices from delicate AlGaAs laser diodes to silicon avalanche photodiodes.

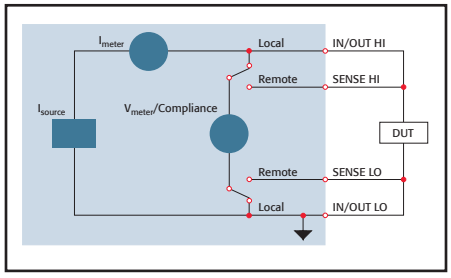

Figure 4. In current source mode, a SourceMeter instrument can force current while measuring voltage. The remote voltage sense ensures the programmable voltage compliance isn't exceeded.

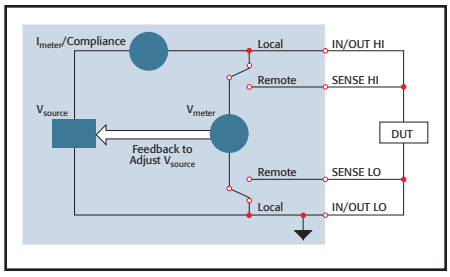

Figure 5. In voltage source mode, a SourceMeter instrument forces a voltage and measures current. Remote sense of the voltage ensures the desired voltage at the DUT.

Verifying device connections

Series 2400 SourceMeter instruments all offer the Contact Check option, which automatically verifies all test leads are connected to the DUT prior to energizing the test leads or executing a test sequence. Figure 6 shows Contact Check identifying a disconnected remote sense test lead. Without the sense test lead connected, the voltage compliance couldn't be controlled during test execution.

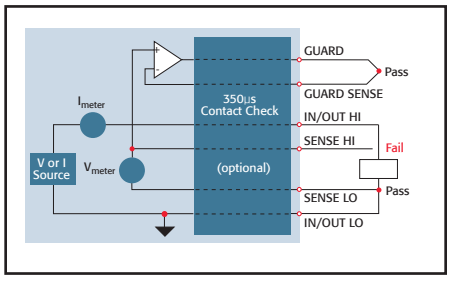

Figure 6. The contact check option verifies the force, sense, and guard test leads are properly connected to the DUT before testing begins.

Remote voltage measurement

SourceMeter instruments offer two- or four-wire measurement configurations. Two-wire voltage measurement shares test leads with the source as shown in Figure 7a. When sourcing high currents, the voltage drop across the test lead becomes significant with respect to the forward voltage across the DUT.