

TWO TRANSFORMER MATCHING OF LASER DIODES FOR INCREASED RF DRIVE EFFICIENCY

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Efficient RF signal excitation of semiconductor laser diodes is becoming critical in Cable Television (CATV) transmission due the increased bandwidth demand of current and future broadband video and data content. In order to transmit higher bandwidth content with the required signal quality, each fiber optic transmitter delivers signal to smaller numbers of subscribers. This transmission architecture requires the use of larger numbers of semiconductor laser diode transmitters that are driven by 75 Ohm RF broadband high power amplifiers. The RF output of each broadband amplifier is divided among large numbers of transmitters. In order to drive the maximum number of transmitters per 75 Ohm RF power amplifier, each laser diode transmitter must be efficiently driven.

Semiconductor laser diodes typically exhibit dynamic resistances of 6 to 8 Ohms. In order to more closely match the S_{22} of 75 Ohm RF broadband high power amplifiers, Distributed Feedback (DFB) laser diodes include a series 25 Ohm resistor built in its laser diode package. For better impedance match to a 75 Ohm RF power amplifier, circuit designers typically use a series 35 to 40 Ohm resistor in series with the packaged 25 Ohm resistor and semiconductor laser diode to yield an acceptable S_{11} of the laser drive circuit to the 75 Ohm RF power amplifier. Unfortunately, using the internal 25 Ohm series matching resistor of the laser diode package results in drive power loss that reduces the RF efficiency of the laser diode package.

RF signal drive efficiency has been increased by using two commercially available broadband RF transformers in series with ratios of 1.5:1 and 4:1 in series with a 6.2 Ohm resistor to drive a coaxially packaged laser diode without an internal resistive matching element. The use of two series matching transformers has resulted in decreasing required RF drive power by 6 dB over drive circuits with the 25 Ohm series matching resistor. The resulting laser diode and its matching network show substantially improved S_{11} over resistive matching (with 25 Ohms) with flat broadband frequency response characteristics.

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