Optoelectronic Devices Introduction

The use of optoelectronic devices, fiber-optic connectors and fiber-optic cables in military system designs is increasing. Fiber-optic systems are relatively immune to an Electromagnetic Pulse (EMP) and do not produce electromagnetic radiation which, along with their intrinsic high speed response, makes them ideal for low signal level and fast response time applications. Tiny optic-fibers comprise the basis for photo-emitters, photo-detectors, and optical cables in these fiber-optic systems. A variety of discrete components, such as PIN diodes, light emitting diodes (LEDs) optical couplers, etc., are employed in these systems. Recommended de-rating values and other reliability and application information are discussed in this section.

CONTACTS & COMMENTS

Contacts

TBS

Closing Comments

The selection of an LED or laser diode light *source* depends upon the required information bandwidth, transmission distance, fiber attenuation, coupling efficiency, and pulse broadening considerations. Diode power and radiance are determined by fiber attenuation and coupling efficiency. Assuming that fiber dispersion is the limiting factor, pulse broadening dictates the broadest acceptable spectral bandwidth[3]. In the case of fiber optic communications for long distance applications, the laser diode would likely be the preferred source due to its narrow spectral bandwidth and high radiance, while the LED would be preferred for short distance data-rate applications because of its reduced temperature sensitivity and simple construction.

It is important to select a cable that will adequately protect the optical fibers. MIL-PRF-85045 provides guidelines, which can assist the user in selecting the appropriate cable for a given application. Optical fibers, although inherently reliable, are susceptible to failure from physical abuse. Selecting a cable best suited for the environment that the optical fiber will experience needs to consider the following for specific optical fiber applications:

a. Low attenuation to maximize repeater spacing or eliminate repeaters.

b. Ease of coupling to inexpensive large area emitters.

c. Large tolerances to allow for inexpensive connectors.

d. Transmission wavelength.

e. Flexibility of the fiber.

f. Maximization of transmission bandwidth or speed.

g. Cost.

h. Tolerance of extreme temperatures or other environmental conditions.

The slow response of phototransistor *detectors* limits their use to systems below the megahertz range. Phototransistors are ideal for short-distance, low speed transmission. Faster phototransistors operational characteristics are possible with heterojunction devices (e.g. GaAs). The speed and sensitivity of photodiodes are more than adequate for many fiber optic applications; however, they are not as well suited to the needs of low-cost, low-speed fiber systems.

It is recommended that manufacturers of high reliability, military level optoelectronic components be given first consideration for part selection. In addition to the recommendations already provided, caution is urged in the consideration of new and untried designs, commercial quality product, and product from new, unfamiliar sources. Also risky is continued procurement without periodic re-assessment, availability of a special/unique design from a single source, and dealing with a supplier that is having financial difficulties.

[3] Fink, D. and Christiansen, D., Electronic Engineers' Handbook, Third Edition, McGraw-Hill, 1989