Working principle of a 3-port optical circulator

Overview

An optical circulator is a three- or four-port designed such that entering any port exits from the next. This means that if light enters port 1 it is emitted from port 2, but if some of the emitted light is reflected back to the circulator, it does not come out of port 1 but instead exits from port 3. This is analogous to the operation of an electronic. Fiber-optic circulators are used to separate optical signals.

Key Takeaways

A 3-port optical circulator is a non-reciprocal device that routes light sequentially from Port 1 → Port 2 → Port 3, ensuring unidirectional signal flow using Faraday rotation and polarization control.Structure

A typical 3-port optical circulator consists of:

• Input and output ports: Port 1 (input), Port 2 (intermediate output), and Port 3 (final output) for sequential light routing .

• Magneto-optic crystal: Usually Terbium Gallium Garnet (TGG), which induces Faraday rotation of the light's polarization under a magnetic field .

• Polarizing components: Polarizers or birefringent elements that control the polarization state of light, ensuring it follows the designated path .

• Fiber connections: Single-mode or polarization-maintaining fibers (e.g., SMF-28e or PM1550) guide light into and out of the circulator with minimal insertion loss . The device is compact and designed to minimize insertion loss (typically

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Article Content

Optical circulator

An optical circulator is a three- or four-port optical device designed such that light entering any port exits from the next. This means that if light enters port 1 it is emitted from port 2, but if some of the emitted light is reflected back to the circulator, it does not come out of port 1 but instead exits from port 3. This is analogous to the operation of an electronic circulator. Fiber-optic circulators are used to separate optical signals

Faraday Circulators

A Faraday circulator is a non-reciprocal optical device, typically with three or four ports, that directs light sequentially from one port to

3-port optical circulator. (a) the basic function, (b) symbolic ...

It is a 3-port or a 4-port device as illustrated for the former one in Figure 5 a, where "1" denotes the input port, and "2" is the output port.

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