

Optical Transceivers and Functional Modules

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Abstract

Optical transceivers and functional devices are the key elements that enable photonic networks to handle broadband, which makes the handling of large volumes of information, such as video, possible. These modules are required in every area where there are optical subscriber lines, metropolitan area networks and core networks. The functions include optical switches that change the optical path of the selected input optical signals to one of multiple optical outputs, optical transceivers that transmit and receive optical signals and optical modulators that convert high-speed electrical signals to optical signals that are highly tolerant of transmission distortion in optical fibers. These modules make it possible to create a highly efficient network that supports transmission of a large volume of information data. We are researching new technologies that will offer innovative improvements in the module performance to achieve high-speed data transmission and a high level of functionality, together with the benefits of decreased size and low power consumption. Three recent achievements of our research are presented below.

Technology

• Large-scale optical switches

To realize reliable, large-scale optical switches with over 200 input/output ports and high-speed switching using our specially developed MEMS mirrors (Micro-Electro Mechanical Systems), we have developed an optical fabric that features reliable optical coupling over a wide temperature range using the electrical drive system of the MEMS mirrors with a switching time of 1 ms.^(*)

• Compact optical transceiver for gigabit optical access

G-PON (Gigabit Passive Optical Network) is an economical, 1 Gb/s high-speed access system that connects a central office with multiple subscribers. In this system, receivers at the central office need to receive signals that have large disparities in power from different subscribers. We developed specially designed LSIs that receive signals that differ in intensity by a factor of over 1000.

• High-speed and low-drive-voltage optical modulators

To realize 40-Gb/s high-speed large-capacity optical transmission, we have developed compact optical modulators with a low drive voltage in the RZ-DQPSK modulation format using integration technology for two optical modulators, for RZ and DQPSK modulation, in one chip. The modulators have a new optical waveguide having a small-radius U-configuration made of lithium niobate (LiNbO₃) electro-optic crystal.^(*)

Examples of Application

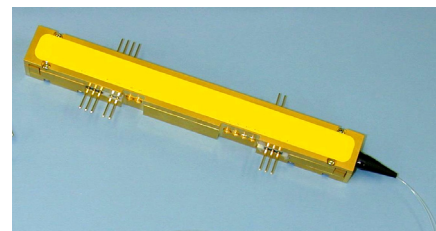
- Large-scale MEMS optical-switch module with 256 input ports × 256 output ports with fast switching for core networks (2005)
- Compact optical transceivers for high-performance G-PON optical transmission in optical subscriber lines (2007)
- Compact optical modulators with low drive voltage for 40-Gb/s the RZ-DQPSK modulation format for core and metro area transmissions (2007)



Large-scale optical switch with 256 input ports × 256 output ports



Compact optical transceiver for G-PON optical access



Integrated optical modulator for 40-Gb/s RZ-DQPSK modulation format

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