

# World's first 40 to 60 Gbps silicon photonics modulator using advanced modulation formats

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In collaboration with Fujikura Ltd., researchers from Singapore's A\*STAR Institute of Microelectronics (IME) have pioneered the world's first 40 to 60 Gbps silicon-based optical modulators with advanced multilevel modulation formats for high speed long-haul data transmission. This represents a major advance towards low cost, ultra-high bandwidth and small footprint optical communications on silicon platform.

The adoption of multilevel modulations, in a simple Quadrature phase-shift keying (QPSK) and differential-QPSK (DQPSK) format, significantly increases the [information capacity](#) and thus total data communication throughput for a given optical channel.

Comprising a set of [silicon](#) phase-shifters that are integrated in a nested Mach-Zehnder configuration, the modulator has demonstrated high communication speeds of more than 40 Gbps and more than 60Gbps for DQPSK and QPSK respectively. For instance, for a channel grid spacing of 50 GHz, 40G DQPSK results in a [spectral efficiency](#) that is 2 times that of 20G with conventional on-off keying (OOK) format which is widely used commercially at present. Compared to conventional Lithium Niobate modulators, the new modulator is much smaller in footprint and is significantly cheaper to fabricate as it is CMOS-compatible.

This significant breakthrough is a progressive effort of years of strategic

partnership between IME and Fujikura since 2006 to develop [optical telecommunications](#) component technologies. In the last 2 years, this joint effort has resulted in the release of an evaluation module of 10 Gbps silicon modulator that features excellent performance for mass production. The development in the silicon optical modulator made by IME and Fujikura demonstrates that reaching ultra-high performance levels on silicon platform technology is now a reality, thus providing a huge impetus towards driving future ultra-[high bandwidth](#) optical communications.

"We are proud to have jointly achieved this breakthrough with Fujikura," said Prof. Dim-Lee Kwong, Executive Director, IME. "This will fuel the design and development prospects of next-generation long-haul telecommunication systems as well as truly bring low cost, high performance optical communications to the masses."

"This joint effort is an excellent proof of strong synergy between IME and Fujikura. We open the door to expand silicon based modulators in next-generation optical telecommunication networks. Fujikura will accelerate the product development to meet the needs of increase in transmission capacity," said Kenji Nishide, General Manager of Optics and Electronics Laboratory, Fujikura.

This remarkable achievement was recently reported on 20 March, 2013 at OFC/NEOEC 2013, the largest global conference and exposition on [optical communications](#) and networking that was held in Anaheim, CA, USA.

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