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# 4-Port Reciprocal Optical Circulators Employing Photonic Crystals for Integrated Photonics Circuits

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*Abstract:* We present the design of a 4-port photonic crystal-based optical circulator employing ring resonator cross connect filters, suitable for photonic integrated circuits schemes. This unique design allows the operation in both clockwise as well as counterclockwise directions and shows a calculated normalized transmission of over 80%. Since the spectra ranges cover the whole third communication window, any wavelength in these ranges can be circulated through the proposed photonic crystal-based optical circulator even different wavelengths at the same time.

## 1. Introduction

In order to address the future telecommunication network requirements for fast, efficient and low cost information transfer, the currently dominant electrical interconnects should

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