Implantable Distributed Biomedical Photonic Devices

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In this paper, we demonstrate an implantable distributed biomedical photonic device that is based on a dedicated complementary metal-oxide-semiconductor (CMOS) image sensor architecture to measure fluorescence by implantation into the deep brain of an untethered mouse. To reduce tissue damage during implantation, an ultrasmall chip is fabricated using a standard 0.35 µm CMOS technology. The chip has an area of 547 × 700 µm² and 60×60 pixels and is demonstrated to capture images. An implantable device is fabricated using three microchips, and the fundamental operation of the device is validated. The device successfully detected fluorescence from fluorescent beads excited externally. In addition, the device achieved simultaneous operation of the three microchips with a delay of less than 15 µs.

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