Abstracts

Traveling-wave photodetector theory

K.S. Giboney, J.W. Rodwell and J.E. Bowers. "Traveling-wave photodetector theory." 1997 Transactions on Microwave Theory and Techniques 45.8 (Aug. 1997, Part II [T-MTT]): 1310-1319.

Photodetector efficiency decreases as bandwidth increases, Bandwidth-efficiency limitations of traveling-wave photodetectors (TWPDs) are substantially greater than those of lumped-element photodetectors because the velocity-mismatch bandwidth limitation is independent of device length. TWPDs can be long for high efficiency without significantly compromising bandwidth. The TWPD is modeled by a terminated section of transmission line with a position-dependent photocurrent source propagating on it at the optical group velocity. A wave model for the transmission line confirms the accuracy of an equivalent-circuit model for electrical wave propagation. The velocity-mismatch impulse and frequency response are determined by absorption coefficient and wave velocities rather than junction capacitance and load resistance. The velocity-mismatch bandwidth limitations can be written in a simple form which elucidates the factors affecting device response, A discretized periodic TWPD is described by the same equations as the fully distributed version. This more complicated device offers additional degrees of freedom in design and potentially improved performance.

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