

# Waveguide-integrated Graphene Photodetector for High-speed Data Communication

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**Abstract**— The exponential growth of internet users and data traffic necessitates higher bandwidth capabilities in communication systems [1]. Optical transceivers play a pivotal role in meeting this demand, particularly in data centers and broadband access networks [2, 3]. This work focuses on the crucial components of optical transceivers, specifically photodetectors, optimized for a wavelength of 1550 nm, a standard for long-distance communication in optical fibers. This work explores a photothermoelectric (PTE) based TMD encapsulated graphene photodetector on a waveguide to address the above-mentioned challenge. The proposed device combines the photothermoelectric effect with the improved electronic and thermal properties of graphene, achieved through TMD encapsulation, by enhancing both carrier mobility and heat dissipation. Based on a comprehensive analysis of the device’s design, the fabricated photodetectors exhibited a responsivity of up to 13 V/W or 0.12 A/W with a setup limited bandwidth of 110 GHz. PDs also demonstrated direct detection of non-return zero and 4-level pulse amplitude-modulated optical signals up to 120 and 160 Gbps, respectively.

## REFERENCES

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