

New photon counting detector packages optimized for space debris tracking and near infrared operation

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We are presenting a new family of photon counting detector packages developed for SLR and related applications: optical tracking space debris, Lunar laser ranging, one way optical ranging and similar. The new concept of active gating and passive quenching circuit was developed and tested. Using this control circuit the detector package is capable of operation in two operating modes: the continuous mode is intended for passive optical tracking of orbiting space debris and similar applications. This operation mode provides modest photon detection probability and broad dynamic range of photon fluxes. The gated mode is optimized for laser ranging at rates up to a few kHz rates. The photon detection probability, timing resolution are maximized. The detection delay stability depends on gate width, for gates 1 μ s wide, the timing stability is of the order of units of ps. As a detection sensor various SPAD chips having various active area and breakdown voltage may be used. The Si based SPAD chips 500 μ m diameter SAP500 may be used and operated in visible spectral range. For near infrared the InGaAs/InP detection chip may be used. Its active area diameter is 80 μ m only, its photon detection probability in gated mode reaches 30% at 1064nm and timing resolution as good as 30 ps rms may be achieved. The detector package and the control electronics is built in a standard housing with front collecting optics, which consists of aspheric lens and accepts collimated beam 12 mm in diameter. All the detector and control electronic biases and chip thermoelectric cooling power and control are provided by a compact power supply. Detector housing and power control accepts various detection chips housings cooled by single up to triple stage thermoelectric coolers. The chip operation temperature in a range of -8° to -60°C is stabilized within fractions of degree.