

**Passive Quenching Electrical Model of Silicon Photomultipliers  
(SSPMs)**

by

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## ABSTRACT

SSPM detectors can be studied and improved through electrical modeling of the diode and readout circuit to simulate, characterize, and predict their response for different geometries and configurations. An electrical model was developed to simulate and investigate the effect of increasing diode area on the response of SSPMs. Passive components in the model are extracted from measurements and then used in the model to understand and predict device performance. The avalanche is represented with a switch in series with a voltage source and diode resistor, instead of a current source, which allows the change in potential, current through the diode, and timing of the avalanche to be simulated. Pulse shapes are compared for two different size devices, 1x1 and 3x3 mm<sup>2</sup>, to first validate the model and then demonstrate predictive capability. It is concluded that this electrical model can be used to better understand the design and development of SSPMs, particularly the effects of increasing parasitic capacitance on the timing and magnitude of the readout signal.