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Electrical characterisation and gain measurement of 50um thick pads LGAD

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This work reports the electrical characterisation and gains measurement of a 50um thick Low Gain Avalanche Detector (LGAD) fabricated at Micron Semiconductor Ltd. Devices with a square pixel of 0.22 x 0.22mm2, 0.5 x 0.5mm2, and 1.0 x 1.0mm2 from wafers with three gains region doping values were studied. The electrical properties of the devices were studied by means of I-V and C-V measurements. Device gain was evaluated using the Transient Current Technique (TCT) with a 1064 nm infrared laser at temperatures between 20 ° to -30 ° C. The I-V profiles in Figure 1(A) show the breakdown voltages were between 150V to 200V. Figure 1(B) indicates the total capacitance at full depletion for the 0.22 x 0.22mm2, 0.5 x 0.5mm2, and 1.0 x 1.0mm2 square pixel devices were approximately 0.3pF, 0.9pF and 2.8pF respectively. The full-depletion voltage (Vfd) calculated from the 1/C2 plots was between 26 to 33 volts. Figure 2(A) shows the 2D and 3D plots of the TCT response for the 0.5 x 0.5mm2 device at 150V bias voltage, corresponding to a gain of 5. The non-uniform nature of the response is understood, and it was due to the structure of the device. Figure 2(B) shows an increasing gain from 3 to 6 measured for a 1-MIP equivalent IR laser input for bias voltages from 120V to 200V.

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