To improve the quality of prosthetic vision, it is desirable to understand how targeted retinal neurons respond to stimulation. Unfortunately, the factors that shape the response of a single neuron to stimulation are not well understood. A dense band of voltage-gated sodium channels within the proximal axon of retinal ganglion cells is the site most sensitive to electric stimulation, suggesting that band properties are likely to influence the response to stimulation. Here, we examined how three band properties influence sensitivity using a morphologically realistic ganglion cell model in NEURON. Longer bands were more sensitive to short-duration pulses than shorter bands and increasing the distance between band and soma also increased sensitivity. Simulations using the known limits of band length and location resulted in a sensitivity difference of approximately 2. Additional simulations tested how changes to sodium channel conductance within the band influenced threshold and found that the sensitivity difference increased to a factor of nearly 3. This is close to the factor of 5 difference measured in physiological studies suggesting that band properties contribute significantly to the sensitivity differences found between different types of retinal neurons.