Lasers with an ultrafast response time are crucial elements for many optoelectronics applications. The response time of dielectric surface emitting lasers is limited to hundreds of picoseconds, while using metallic plasmonic structures can significantly reduce the response time. We study the behavior of a plasmonic distributed feedback laser in the large-signal modulation regime. We show that the response time depends strongly and non-monotonically on the size of the pump beam. We demonstrate that for typical experimental parameters, there is an optimal size of the pump beam for which the response time can be reduced to a picosecond.