Abstract: Microelectromechanical systems (MEMS) based piezoelectric (PZT) micropump has been extensively used in medical field for last few years. In this paper, the structural analysis of polydimethylsiloxane (PDMS) membrane has been presented that was performed using ANSYS software. ANSYS parametric design language (APDL) tool has been used for simulation and analysis. The PDMS membrane with length of 30000 μm (9843 μft), width of 10000 μm (3281 μft) and thickness of 500 μm (1640 μft) to 3000 μm (9843 μft) has been used for analysis. The pressure range of 1-4 kPa (0.15-0.58 psi) has been applied on membrane and the effects of stress and deflection have been observed at various thickness parameters. At applied pressure of 1 kPa (0.15 psi), the deflection of 0.053 μm (0.17 μft) and the stress of 0.65 MPa (94 psi) have been observed. At applied pressure of 4 kPa (0.58 psi), total deflection of 0.211 μm (0.7 μft) and stress of 2.62 MPa (380 psi) have been obtained. The stress and deflection variations due to thickness changes have been observed. At 250 μm (820 μft) of membrane thickness, the net deflection is observed to be 1.2 μm (3.9 μft). On the other hand, at 2000 μm (6562 μft) thickness, the deflection decreases up to 0.0029 μm (0.0095 μft). It has been observed that the maximum stress of 2.54 μm (8.3 μft) and 0.128 μm (0.42 μft) have been obtained at 250 μm (820 μft) and 2000 μm (6562 μft) thickness of membrane, respectively. Thickness is most important parameters in micropump actuator and has direct impact of fluid flow through the micropump outlet. The deflection of membrane can be changed by changing its thickness.