Monolithic integration of tunable aperture and lens for distance sensor

ABSTRACT

A tunable aperture and lens are monolithically fabricated in wafer-level. The tunable aperture inserted in a camera can estimate distance as comparing blur of images by two different size apertures. We design optical system and integrate tunable aperture and first lens of camera. The plano-concave lens is fabricated by anodic bonding and thermal reflow under atmospheric pressure with one mask. The silicon substrate is used as spacer between tunable aperture and lens. Another glass substrate is attached to the silicon substrate by triple anodic bonding for tunable aperture operated by liquid crystal. The lens has diameter of 4.5 mm and sag height of 566 um and the tunable aperture has f-numbers of 1.8 and 4.0. This fabrication can control parameter of lens easily. Also, it can reduce error by alignment and gap among apertures and lenses. This distance sensor can be applied to the Advanced Driver Assistance System (ADAS).