

Halftone Phase Shift-Type Photomask Blank, Method of Manufacturing thereof, and
Halftone Phase Shift-Type Photomask

ABSTRACT

5 A halftone phase shift-type photomask blank including a transparent substrate, and
a halftone phase shift film formed on the substrate, and including at least one layer
composed of silicon, nitrogen and oxygen is provided. The halftone phase shift film has a
phase shift of at least 150° and up to 200° and a transmittance of at least 20%, with respect
to exposure light having a wavelength of up to 200 nm, and a film surface having a surface
10 roughness RMS of up to 0.8 nm, and an in-plane variation of transmittance calculated from
the maximum transmittance $T_{\max}$ and the minimum transmittance $T_{\min}$ within a mask
pattern forming area by the expression: $(T_{\max}-T_{\min})/(T_{\max}+T_{\min})\times 100$ is up to 2%.
[Fig. 4]