

# **Cost-effective Production using Electron Projection Lithography for 65-nm Node SoC and Beyond**

H. Yamashita<sup>1</sup>, K. Nakajima<sup>2</sup>, I. Amemiya<sup>3</sup>, S. Kawata<sup>4</sup>, S. Nakatsuka<sup>3</sup>, I. Kimura<sup>3</sup>, T. Fujiwara<sup>4</sup>,  
Y. Yamada<sup>5</sup>, K. Fujii<sup>5</sup>, and M. Yamabe<sup>1</sup>

<sup>1</sup>Research Department 2, Selete, 16-1 Onogawa, Tsukuba, Ibaraki 305-8569, Japan

<sup>2</sup>ULSI Manufacturing Engineering Division, NEC Electronics Corp.

1120 Shimokuzawa, Sagami-hara, Kanagawa 229-1198, Japan

<sup>3</sup>Electronics Development Center, HOYA Corp.

3280 Nakamura, Nagasaka-cho, Kitakoma-gun, Yamanashi 408-8550, Japan

<sup>4</sup>IC Equipment Division, Precision Equipment Company, Nikon Corp.

201-9 Miizumi, Kumagaya, Saitama 360-8559, Japan

<sup>5</sup>Advanced Technology Development Division, NEC Electronics Corp.

1120 Shimokuzawa, Sagami-hara, Kanagawa 229-1198, Japan

We have established EPL and key infrastructure technology aiming for middle-volume production of SoC and demonstrated fabrication of a 65-nm node ULSI. Overlay accuracy ( $3\sigma$ ) for the gate level was less than 30 nm by mix & match and that for the contact level was 20 nm for EPL to EPL. CD uniformity was 6 nm ( $3\sigma$ ). We have also shown its expandability to 45-nm nodes. EPL is promising in cost-effective production of 65-nm and 45-nm nodes less than 3k wafer/mask compared to ArF and F<sub>2</sub>.