



FOR IMMEDIATE RELEASE

**D2S INTRODUCES GPU-ACCELERATED DEEP LEARNING KIT TAILORED FOR
PHOTOMASK AND SEMICONDUCTOR MANUFACTURING R&D TEAMS**

TrueMask® DLK includes rigorous eBeam mask and ArF/EUV lithography simulators from OEM partners for deep learning training

SAN JOSE, Calif., April 15, 2019—D2S, a supplier of GPU-accelerated solutions for semiconductor manufacturing, today introduced TrueMask® DLK, a GPU-accelerated deep learning kit designed to boost the R&D capabilities of photomask and semiconductor manufacturers working on new and complex product designs. TrueMask DLK utilizes a GPU-accelerated computational design platform and embedded mask and lithography simulators tuned to complex features and processes, such as curvilinear mask shapes and mask 3D effects, to provide a deep learning engine and pre-trained deep learning neural networks that can enable these manufacturers to accelerate their R&D efforts.

Deep learning revolutionizes semiconductor manufacturing

Deep learning is the exciting subset of machine learning and artificial intelligence that has enabled machines to beat the best humans in chess, Go, object recognition, and many other tasks. By leveraging the tremendous computing power available in GPUs and other single instruction multiple data (SIMD) computing devices, deep learning acts as a very sophisticated pattern recognition and matching machinery that can mimic intricate details of vast amounts of data transformation behavior.

While deep learning has been shown to have a broad range of applicability in semiconductor design and manufacturing, it requires significant training with a large amount of data covering a broad range of geometric configurations. Since taking any more than thousands of SEM pictures is impractical, augmenting training data through simulation is the only way to make deep learning robust. In addition, all real mask or wafer data is curvilinear. Simulation-based generation of training data therefore requires curvilinear processing. GPU acceleration enables fast full-chip processing of curvilinear simulation of mask and wafer data. TrueMask DLK from D2S combines all of these capabilities to enable deep learning for photomask and semiconductor manufacturing, and may include rigorous eBeam simulation from aBeam Technologies, and rigorous ArF and EUV simulation including mask 3D effects from Fastlitho.

The Center for Deep Learning in Electronics Manufacturing (CDLe) – a partnership of NuFlare, Mycronic and D2S – is an early adopter of TrueMask DLK. According to Ajay Baranwal, director of the CDLe, “No matter the industry, simulation is essential for generating the training data that deep learning needs in order for it to learn to deal with unusual situations particularly well. In the autonomous driving world, for example, having a billion miles of driving video does not provide enough anomalous data because real-life driving is thankfully too safe. Electronics manufacturing is much the same, where the relatively few defect occurrences in mask and wafer fabs are insufficient for training a deep learning neural network. Deep learning on mask and wafer shapes requires simulation of curvilinear data, which TrueMask DLK provides.”

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TrueMask DLK offers state-of-the-art hardware and software capabilities to enable fast and accurate deep learning for mask and semiconductor applications:

- ***D2S TrueMask MDP GPU-accelerated, model-based mask data preparation (MB-MDP) solution*** for complex masks, which includes native curvilinear mask and lithography simulators, as well as geometry libraries and verification checks
- ***Additional mask and wafer simulation capabilities from D2S partners***, including a rigorous eBeam simulator from aBeam Technologies, and a rigorous ArF/EUV lithography simulator that includes mask 3D effects from Fastlitho
- ***Pre-trained deep learning neural network model*** for mask and wafer fabrication
- ***D2S Computational Design Platform***, now the sixth-generation CDP using the NVIDIA Tesla V100 GPU accelerator

“Deep learning is clearly a critical success factor for any semiconductor manufacturing business, whether a fab, mask shop, equipment or service supplier, or a fabless customer,” stated Aki Fujimura, CEO of D2S. “Because data is the new currency in the Deep Learning era, it is critical for every company to value its own data. In addition, since deep learning must be a strategic initiative for every company, every company needs to be enabled to do deep learning on its own data. D2S wants to help in that process by providing TrueMask DLK as a quick-start kit to accelerate our customers’ ability to ramp up on deep learning.”

A video highlighting the application of deep learning for photomask and semiconductor manufacturing, including the TrueMask DLK concept, can be viewed at <https://www.youtube.com/watch?v=lixaWWAvu5M>

Additional quotes from executives at aBeam Technologies and Fastlitho on this exciting new development can be read at <https://design2silicon.com/products/truemask-dlk/>.

About D2S

D2S is a supplier of GPU-accelerated solutions for semiconductor manufacturing. The company provides simulation-based custom solutions to leading equipment partners. D2S TrueMask® solutions use the D2S Computational Design Platform to enable advanced photomask designs using complex shapes for superior wafer quality but within practical, cost-effective write-times. D2S is the managing sponsor of the eBeam Initiative and a founding member of the Center for Deep Learning in Electronics Manufacturing (CDLe). Headquartered in San Jose, Calif., the company was founded in 2007. For more information, see: www.design2silicon.com.

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