Victory Device

2D/3D Device Simulation

SILVACO

Victory Device provides versatile simulation capabilities for physically based two-dimensional (2D) and three-dimensional (3D) semiconductor devices, performing DC, AC, and transient analysis of silicon, binary, ternary, and quaternary material-based devices.

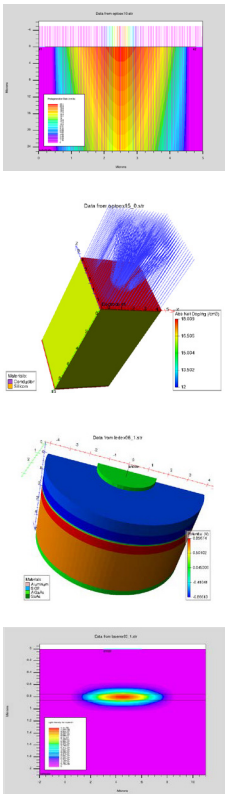
Victory Device is a physics-based platform that is modular, easy to use, and scalable. A tetrahedral meshing engine is used for fast and accurate simulation of complex 3D geometries. Efficient and robust multi-threaded operation significantly reduces simulation time on parallel CPU machines while maintaining high accuracy.

Key Features

- Tetrahedral mesh for accurate 3D geometry representation
- Voronoi discretization for conformal and Delaunay meshes
- Advanced physical models with user-customizable material database for silicon and compound materials
- Stress-dependent mobility and bandgap models
- Highly customizable physical models using the C-Interpreter or dynamically linked libraries
- DC, AC, and transient analysis
- Drift-diffusion and energy balance transport equations
- Self-consistent simulation of self-heating effects including heat generation, heat flow, lattice heating, heat sinks, and temperature-dependent material parameters
- Methods to simulate the electrochemical reaction and transport of an arbitrary number of chemical species
- Advanced multi-threaded numerical solver library
- Atlas-compatible
- C-Interpreter included – C-based user defined model development interface
- Silvaco's strong encryption is available to protect valuable customer and third-party intellectual property

Optical – Photoelectric Devices and Light Absorption Simulation Module

The Optical Module is a 2D and 3D simulation module specializing in light absorption and photoelectric effects modeling of nonplanar semiconductor devices. This module allows you to account for any shape, internal and external reflections and refractions, polarization, and scattering.



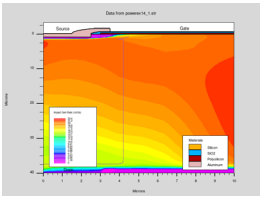
Optical methods include: geometric ray tracing which provides an accurate solution for common light sources; optical transfer matrix analysis of coherence effects in multilayered devices; Beam propagation methods can also be used to simulate coherence effects and diffraction; Finite Difference Time Domain (FDTD) correctly models the wave propagation, including reflection, diffraction, and interference effects.

Applications include:

- Solar Cells
- Photo-detectors
- Image Sensors (CMOS, CCD, Visible, LWIR)
- LEDs
- Lasers
- Lenslets

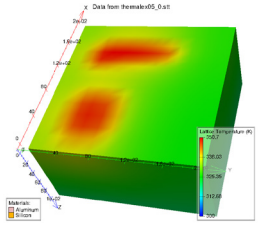
Giga – Device Thermal Analysis Simulation Module

The Giga Module is a 2D and 3D simulation module that analyzes the effects of self-heating into a device simulation. Giga includes models for heat sources, heat sinks, heat capacity and thermal conduction. Physical and model parameters become dependent on the local lattice temperature where appropriate, allowing the self-consistent coupling between the semiconductor device equations and the lattice temperature.



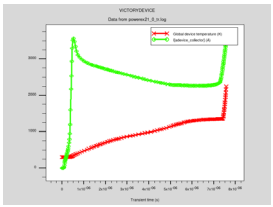
Applications include:

- Heat generation
- Heat flow
- Lattice heating
- Heat sinks
- And temperature-dependent material parameters

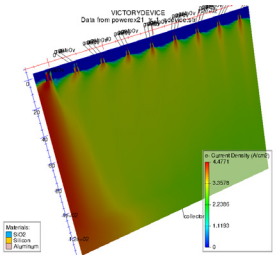


MixedMode - Device and Circuit Mixing Simulation Module

The MixedMode Module is a 2D / 3D circuit simulator that includes physically based devices in addition to compact analytical models. Physically based devices are used when accurate compact models do not exist, or when devices that play a critical role must be simulated with very high accuracy.

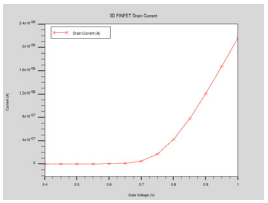


Physically based devices may be simulated using any combination of Victory Device 2D / 3D modules. The physically based devices are placed alongside a circuit description that conforms to the SPICE netlist format. Applications of MixedMode include power circuits, high performance digital circuits, precision analog circuits, high-frequency circuits, thin film transistor circuits, and optoelectronic circuits.

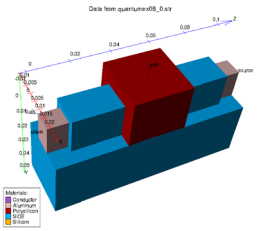


Quantum – Quantum Mechanical Effects Simulation Module

The Quantum Module provides is a 2D and 3D simulation module providing a set of models for simulation of the various effects of quantum confinement and quantum transport of carriers in semiconductor devices. A self-consistent Schrödinger - Poisson solver allows calculation of bound state energies and associated carrier wave function self consistently with electrostatic potential.



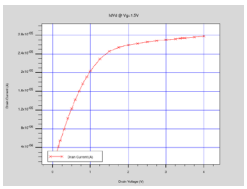
Schrödinger solvers can be combined with Non-equilibrium Green's Function (NEGF) Approach in order to model ballistic quantum transport in 3D devices with strong transverse confinement. An alternative approach to modeling subband transport in nanoscale devices is given by Mode-Space Drift-Diffusion Model, which combines transverse Schrödinger with 1D drift-diffusion equations.



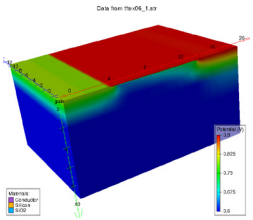
A quantum moment transport model allows simulation of confinement effects on carrier transport and yet keeps the simplicity of a conventional drift diffusion approach. It also allows quantum confinement effects to be included in the energy balance/hydrodynamic transport model. Quantum 3D also models the effects of oxide tunneling.

TFT – Amorphous and Polycrystalline Device Simulation Module

The TFT Module is a 2D and 3D simulation module equipped with the physical models and specialized numerical techniques required to simulate amorphous or polysilicon devices in 2D or 3D. TFT models the electrical effects of the distribution of defect states in the band gap of noncrystalline materials.

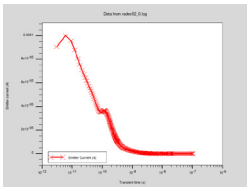


Users can specify the Density Of States (DOS) as a function of energy for amorphous silicon and polysilicon for grain and grain boundaries as well as the capture cross-sections/lifetimes for electrons and holes. Models for mobility, impact ionization and band-to-band tunneling can be modified to accurately predict device performance.

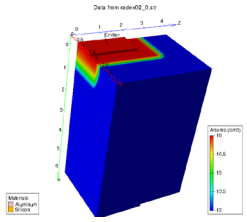


REM / SEE – Radiation Effects and Single Event Effects Simulation Modules

The Radiation Effects Module (REM) and Single Event Effects (SEE) Modlues are 2D and 3D simulation modules which enables modeling of total dose, dose rate, SEU and SEE effects in semiconductors through the generation of defect states, fixed charge, and charge transport within insulating materials.

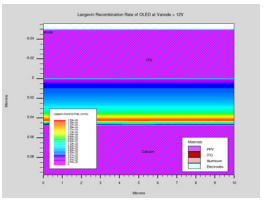


- Total dose effect on insulators – electron and hole-to-generation, recombination, carrier transport, traps, and de-trap
- Single event effect – charge generation as a function of photocurrent density and linear energy transfer
- Dose rate effect – light generation and recombination, and current flow in the device
- Displacement damage modeling – non-ionizing energy loss model that changes material life, more detailed modeling with user-defined lattice defect modeling layers



Chemistry – Electrochemical Reaction and Transport Simulation Module

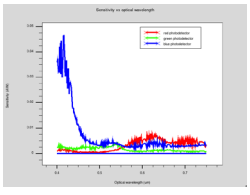
The Chemistry Module enables 2D and 3D modeling of the transport and reaction of chemical species within the body of a semiconductor device. These capabilities may be used for studies of performance degradation, simulation of complex charge-capture mechanisms, and for the simulation of charge-transport by atomic species, as well as for investigating the behavior of novel devices.

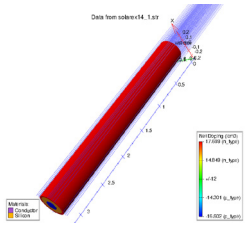


Chemistry is able to simulate the transport and reaction of an arbitrary number of chemical species, limited only by time constraints and the availability of memory in your computer.

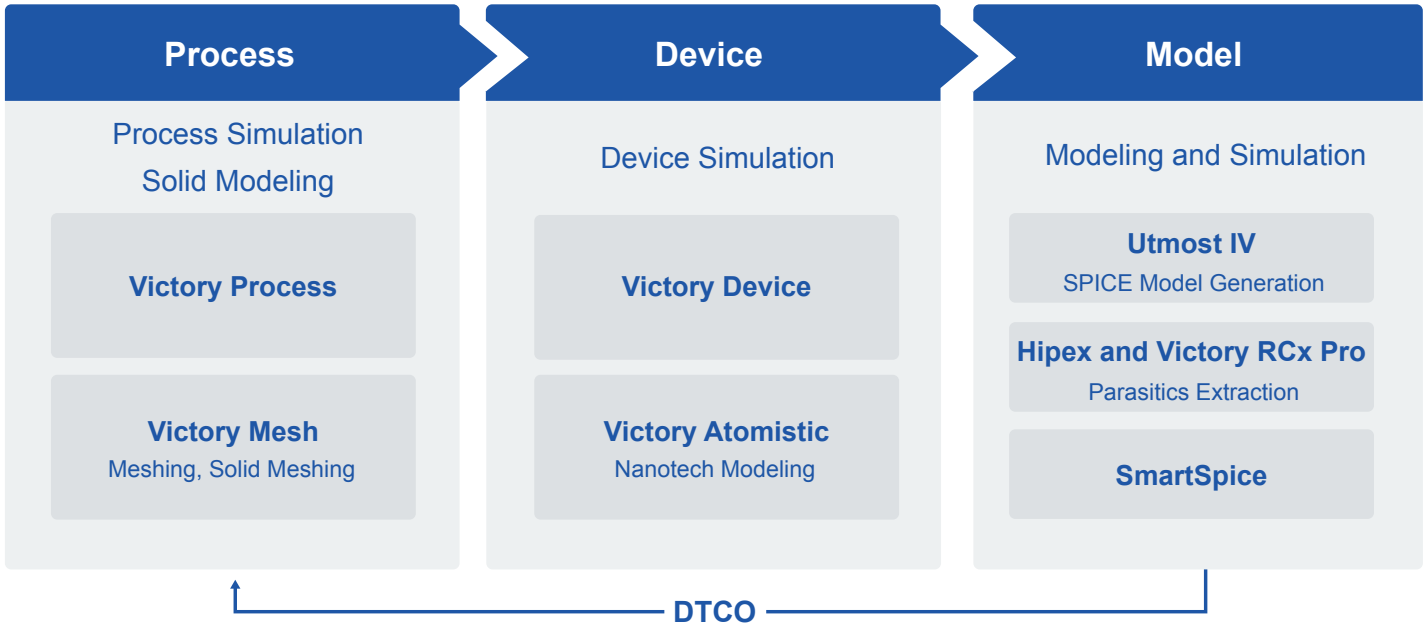
Organic – Organic Semiconductor Devices Simulation Module

The Organic Module enables 2D and 3D simulation of semiconductor devices composed of organic materials. Typical organic-based devices include those used in active displays, such as organic field-effect transistors (OFETs) and organic light-emitting diodes (OLEDs), as well as light-sensitive devices such as solar cells and image sensors.





Victory TCAD Product Solutions



Product Name	Product Code
Victory Device 3D Simulator	11004
Victory Device 2D Simulator	11006
Victory Device 3D SEE	11001
Victory Device 2D SEE	11007
Victory Device 2D MixedMode	11008
Victory Device 3D MixedMode	11009
Victory Device 2D REM	11010
Victory Device 3D REM	11011
Victory Device 2D Optical	11012
Victory Device 3D Optical	11013
Victory Device 2D TFT	11014
Victory Device 3D TFT	11015

Product Name	Product Code
Victory Device 2D Giga	11016
Victory Device 3D Giga	11017
Victory Device 2D Chemistry	11018
Victory Device 3D Chemistry	11019
Victory Device 2D Organic	11020
Victory Device 3D Organic	11021
Victory Device 2D Quantum	11022
Victory Device 3D Quantum	11023
Victory Device 2D LED	11024
Victory Device 3D LED	11025

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