Liberty Release Notes
Version 2017.06

These release notes present the latest information about Liberty version 2017.06. New modeling syntax and enhancements are described in the following sections:

- New LVF Models
- Partial Voltage Swing in Timing Arcs

For detailed information about these enhancements, see the *Liberty User Guide, Vol. 1*.

New LVF Models

The following new LVF models are introduced:

- OCV Models for Retain Arc Delay and Transition
- Statistical Moments-Based LVF Models For Ultra-Low Voltage Designs

OCV Models for Retain Arc Delay and Transition

A retain arc models how long an output port retains its current logic value after a voltage rise or fall at a related input port. The Liberty syntax now supports new Liberty Variation Format (LVF) models in `timing` groups for on-chip variation (OCV) in delay and transition times of retain arcs.

To model the retain arc OCV delay, use the new `ocv_sigma_retaining_rise` and `ocv_sigma_retaining_fall` groups. Each of these groups specify a lookup table for the delay variation at the standard deviation (σ) value from the nominal retain arc rise and fall delays, respectively. Use the `sigma_type` attribute to define the type of arrival time in the lookup table.

To model the retain arc OCV transition, use the new `ocv_sigma_retain_rise_slew` and `ocv_sigma_retain_fall_slew` groups. Each of these groups specify a lookup table for the transition variation at the standard deviation (σ) value from the nominal retain arc rise and fall transitions, respectively.

Statistical Moments-Based LVF Models For Ultra-Low Voltage Designs

The LVF models for OCV now support asymmetric, biased, or non-Gaussian distributions of timing variation. This is useful to accurately model ultra-low voltage libraries. To capture the shape of a biased timing variation distribution, the LVF models use the statistical moments including the mean, standard deviation, and skewness of the distribution.

The syntax includes Liberty groups with lookup tables to store the moments-based variation values of the cell delays, cell transitions, cell timing constraints, retain arc delays, and retain arc transitions at one-sigma (σ) deviation. These lookup tables can be scalar, one, two, or three-dimensional and are defined under the `timing` group together with the nominal timing tables. The lookup table template for these groups are defined at the library-level using the `lu_table_template` group.

LVF OCV Mean Shift Groups

The new `ocv_mean_shift_cell_rise`, `ocv_mean_shift_cell_fall`, `ocv_mean_shift_rise_transition`, `ocv_mean_shift_fall_transition`, `ocv_mean_shift_retaining_rise`, `ocv_mean_shift_retaining_fall`, `ocv_mean_shift_retain_rise_slew`, `ocv_mean_shift_retain_fall_slew`, `ocv_mean_shift_rise_constraint`, and `ocv_mean_shift_fall_constraint` lookup tables specify the offset value from the mean of the timing variation distribution to the nominal value.

LVF OCV Standard Deviation Groups

The new `ocv_std_dev_cell_rise`, `ocv_std_dev_cell_fall`, `ocv_std_dev_rise_transition`, `ocv_std_dev_fall_transition`, `ocv_std_dev_retaining_rise`, `ocv_std_dev_retaining_fall`, `ocv_std_dev_retain_rise_slew`, `ocv_std_dev_retain_fall_slew`, `ocv_std_dev_rise_constraint`, and `ocv_std_dev_fall_constraint` look up tables store the values of standard deviation of the timing variation distribution.

LVF OCV Skewness Groups

The new `ocv_skewness_cell_rise`, `ocv_skewness_cell_fall`, `ocv_skewness_rise_transition`, `ocv_skewness_fall_transition`, `ocv_skewness_retaining_rise`, `ocv_skewness_retaining_fall`, `ocv_skewness_retain_rise_slew`, `ocv_skewness_retain_fall_slew`, `ocv_skewness_rise_constraint`, `ocv_skewness_fall_constraint` lookup tables specify the skewness values of the timing variation distribution.

Partial Voltage Swing in Timing Arcs

You can now specify the partial voltage swing for a specific timing arc. To do so, define the `output_signal_level_low` and `output_signal_level_high` attributes in the `timing` group. These attributes specify the actual output voltages of an output pin after a transition through a timing arc.

You specify these attributes in the `timing` group when the following occur together:

- The cell output exhibits partial voltage swing (and not rail-to-rail swing).
- The voltages are different in different timing arcs.