

Conversion and Optimization Flow for Analog IP Porting

Udo Sobe, Achim Graupner and Enno Böhme

Zentrum Mikroelektronik Dresden AG, Grenzstrasse 28, 01109 Dresden, Germany.

{Udo.Sobe, Achim.Graupner, Enno.Boehme}@zmdi.com

Analog IP Porting

During Analog IP (intellectual property) reuse proven design topologies and concepts are recycled by duplication and modification. A lot of manual and interactive iteration tasks dominate the process. **An approach to convert a circuit design from technology A to technology B is proposed.**

Schematic Porting between Different Processes

The migration of circuit schematics between different process technologies and process design kits (PDKs) can be very time-consuming and uncomfortable. At the beginning of – or during – a new design project, it is often necessary to re-use available IP (intellectual property) and circuits from previous projects. Often a new design uses a new or different process technology. Thus, it is necessary to migrate and apply circuit schematics to this new target technology. Consequently, circuit designers very often must adapt schematics to the new process by changing circuit symbols, default values, scaling and other characteristics – a time-consuming and tedious manual effort.

Migrating Analog IP is a Challenge

- Different device parameters (vth, etc.) require adjustment of biasing and small-signal parameters
- W, L shrinking is desirable, but not as simple as digital
- Some devices (mimcaps, inductors, etc.) may or may not be available, or may be of a quite different type
- Circuit topology may need modification
- Layout shrinking in integrated technologies is insufficient

3-Step Schematic Porting, Assessment & Sizing Flow

The source design schematics are adapted primarily using a 3-step flow. These steps also can include iterations where necessary.

1. Schematics are ported and migrated to the new target process using the models and PDK/CDF from the target process technology by use of the **ZMDI in-house Technology to Technology converter T2T**.
2. After migration, the circuit designer assesses the ported IP and adapts the circuit topologies – when necessary – in schematic view.
3. Based on updates of the circuit specifications, the designer analyzes and re-sizes the circuits with the **MunEDA WiCkeD™ Tool Suite** and

verifies results such as circuit functionality, performance, yield, and robustness with **WiCkeD™**, or **zmdAnalyzer**.

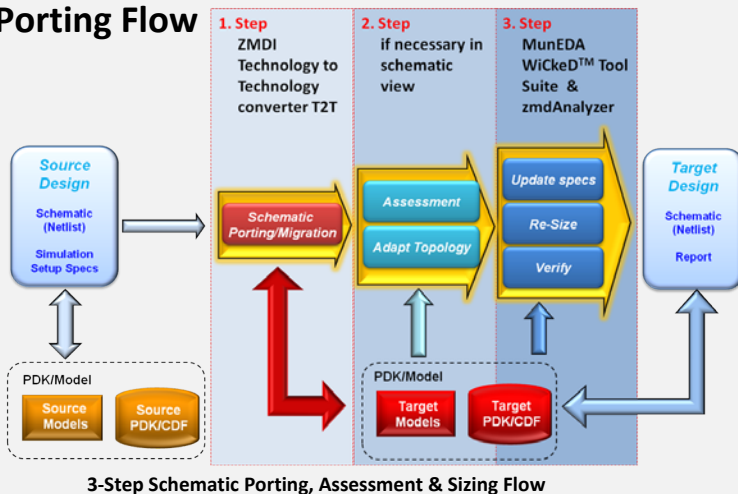
IP Porting Flow - User Benefits

- Consistent IP Porting flow of existing design databases between different process technologies
- Makes sizing process for IP porting faster and more efficient
- Can be applied to individual cells or entire libraries
- Improves designers' productivity and convenience
- Efficient re-sizing in the new target technology

Conclusion

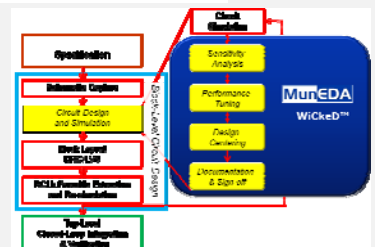
This proposal covers some common problems of porting design databases to other technologies or PDKs. The ZMDI technology to technology (T2T) converter is a convenient tool for converting IP cells in Cadence database format to new technologies or updated PDKs. The T2T converter is in regular productive use at ZMDI, e.g. to transfer an analog front end to a new technology. For re-sizing and adaption on the technology the MunEDA WiCkeD™ Tool Suite was used. Based on the enhanced optimization algorithms used in the WiCkeD™ Tool Suite an efficient re-sizing of the circuit to the target technology was possible.

IP Porting Flow

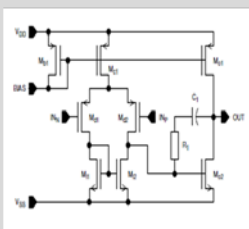


Screenshot T2T converter window and schematic window

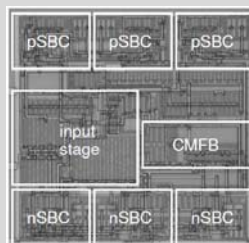
Basic MunEDA WiCkeD™ Tool Suite Flow



IP Porting Example



IP Porting Example: operational transconductance amplifier (OTA)



Chip photograph of realized OTA

IP Porting Step	Design Step	Area	Yield
Source Design	Initial Design (0.6μm)	100%	100%
1. Step	Design after T2T (0.18μm)		0%
3. Step	Yield optimized Design by WiCkeD™	3.2 %	100%

Areas and Yield performance at different stages of conversion between different technologies