



APPLICATION NOTE

# PDK Setup for TSMC Decks

This application note describes the required setup for TSMC deck to be able to run Calibre xRC and xACT.

**SIEMENS**

# Table of Contents

TSMC Deck Setup	3
LVS Decks	3
LVS Setup	3
RC Extraction Decks	5
RC Extraction Setup	5
Extraction Run Setup	6
Creating a Run Directory	6
Creating a Run Script	6
Creating a Top Rules File	7
Modifying Installed Decks	8

## APPLICATION NOTE

# TSMC Deck Setup

To run Calibre extraction tools both LVS and RC extraction decks must be obtained from TSMC. To obtain these decks a request must be made to TSMC, and then the rule files are downloaded. This document describes in detail the steps required after downloading the decks to set them up successfully to run Calibre extraction.

## LVS Decks

### LVS Setup

LVS decks contains the layer derivations along with device definitions and parameters that are required for running extraction. Below are the steps to install the LVS decks.

- Once LVS decks are downloaded they will come in a **.zip** file that needs to be unzipped. Create a new directory named **lvs**, to contain all the lvs related decks, then move the zipped file inside and unzip it using the following command: **unzip <package\_name>**
- After unzipping the file a **\*.tar.gz** file is extracted where it needs to be un-tared using the following command: **tar -xvzf <\*.tar.gz>**
- This will produce another **.tar** file that also needs to be un-tared using the following command: **tar -xvzf <\*.tar.gz>**
- After un-taring the file, you will find an **LVS\_Install.pl** installation script that should be ran to install the required LVS rule decks based on the flow and the metal scheme. Use the following command to run the script: **./LVS\_Install.pl**

After running the script, the script prompts the user for some input. The first prompt is which tool will the user use “Calibre + xRC (or xACT)” or “Calibre +StarRC (CCI flow)”:

```
142 $ omaela36@orw-omaela36-r8: tn40c1ls001c1_2_0_1l 142 % ./LVS_Install.pl
**INFO: Calibre mode detected
**INFO: CCI mode detected
**INFO: T-N40-CL-LS-001-C1 (N40LP/N40LPG) Version v2.0_1l
**INFO: switch FLICKER_CORNER_EXTRACTION detected
Please select the tool:
  0. Calibre + xRC (or xACT)
  1. Calibre + StarRC ( CCI flow )
>
```

*Figure 1: LVS Setup "Select tool"*

After selecting the desired flow, the user is then prompted to select the number of metals needed (based on the design):

```
Please select the number of metal:
 4. 4M
 5. 5M
 6. 6M
 7. 7M
 8. 8M
 9. 9M
10. 10M
>
```

*Figure 2: LVS Setup "Select Number of Metal"*

Then the user is prompted to select the required metal scheme:

```
Please select the metal scheme:
 0. 10M_5X2Y2Z
 1. 10M_6X1Y1Z1U
 2. 10M_6X1Y2Z
 3. 10M_6X2Z1U
 4. 10M_6X3R
 5. 10M_7X1Y1U
 6. 10M_7X1Z1U
 7. 10M_7X2R
 8. 10M_7X2Y
 9. 10M_7X2Z
>
```

*Figure 3: LVS Setup "Select Metal Scheme"*

Then the user is prompted with the following questions:

```
Use eDRAM RC techfile? (Y/N):
>n
Turn on FLICKER_CORNER_EXTRACTION?:
 0. No
 1. Yes. Enable FLICKER_CORNER_EXTRACTION.
>1
```

*Figure 4: LVS Setup "Extract Flicker Corner or not"*

Then a confirmation with the setup selected:

```
* Process is N40LP/N40LPG
* Metal scheme is 1P10M_7X1Z1U
* Not using eDRAM RC techfile
* FLICKER_CORNER_EXTRACTION : on
Is it correct? (Y/N):
>Y
```

Figure 5: LVS Setup "Confirm Selections"

After confirming the selected setup, a new directory is created "DFM" containing all the related lvs rules required for running RC extraction.

If completed correctly the directory should contain the following files: *xrc\_mapping*, *DFM*, *DFM\_LVS\_\**.



Figure 6: LVS Setup "Final Directory"

# RC Extraction Decks

## RC Extraction Setup

RC extraction decks contains the physical characteristics for the technology that is used in the extraction run. Below are the steps to install the extraction decks.

- Once RC extraction decks are downloaded, they will come in a **.zip** file that needs to be unzipped. Create a new directory named **pex**, to contain all the PEX related decks, then move the zipped file inside and unzip it using the following command: **unzip <package\_name>**.
- After unzipping the file, a **.tar.gz** file is extracted where it needs to be un-tared using the following command: **tar -xvzf <\*.tar.gz>**. This is going to create a **.tar.gz** file for each corner containing their respective decks.
- Make a directory for each corner and move the **.tar.gz** to their respective directories. Then un-tar the **.tar.gz** file inside the required corner directory using the following command: **tar -xvzf <\*.tar.gz>**

The directory should look similar to the below:

```

COPYRIGHT
QA_Cf_Cco.report
QAreport.lx_10x
QAreport.allpattern_error10
QAreport.analog
QAreport.cc
Reference/
Reference/GDS/
Reference/GDS/M1.gds
Reference/GDS/M1P01.gds
Reference/GDS/M2.gds
Reference/GDS/M2M1M3.gds
Reference/GDS/cln40lp_1p09m+alrdl_6x2z_typical.gds
Reference/bin/
Reference/bin/run
Reference/bin/xCalibre.xlvs
Reference/bin/xrc_mapping
Reference/bin/net_name
Reference/bin/rules
Reference/bin/crn40lp_1p06m+ut-alrdl_4x1u_typical.res
Reference/bin/density
Reference/bin/cln40lp_1p09m+alrdl_6x2z_typical.res
Reference/bin/lvs.rep.ext
Reference/Netlist/
Reference/Netlist/net.M1.dist.pex
Reference/Netlist/net.M1P01.dist.pex
Reference/Netlist/net.M2.dist.pex
Reference/Netlist/net.M2M1M3.dist.pex
rules
cln40lp_1p09m+alrdl_6x2z_typical.res
cln40lp_1p09m+alrdl_6x2z_typical.mipt

```

Figure 7: RC Setup "Final Directory"

Now you have successfully installed the required RC decks and ready to create the Calibre extraction setup.

# Extraction Run Setup

## Creating a Run Directory

The run directory is going to contain all the required files for RC extraction to run.

- Start by creating a new directory called "**run\_dir**".
- Copy inside "**run\_dir**/" the "**lvs**" directory, that was previously created.
- Copy inside "**run\_dir/lvs**/" the "**rules**" file found in the "**pex/<used\_corner>**" directory that was previously created.
- Copy inside "**run\_dir/lvs**/" the "**\*.res**" file found in the "**pex/<used\_corner>**"

Now the running directory is setup successfully.

## Creating a Run Script

The run script is going to be used to get Calibre extraction running, the following example shows an example format of the run script that runs LVS then xACT.

- First start by creating a "**run.csh**" file which is going to house removing the "svdb" directory, in case you are running multiple runs in the same directory, using the following command: `\rm -rf svdb/`

- Next you create a variable for the lvs deck directory. Use the following command to set the required variables: **setenv lvs\_dir** (path for LVS directory setup)
- After creating the required variable Calibre run commands are used along with the required options. In this example Calibre LVS and xRC are used ran using the following commands:
  - o **calibre -lvs -hier -turbo top\_rules |& tee lvs.log**
  - o **calibre -xrc -pdb -rcc -turbo top\_rules |& tee pdb.log,**
  - o **calibre -xrc -fmt -rcc top\_rules |& tee fmt.logt**

Below is an example of what the run script should look like:

```
#!/bin/csh -f
\rm -rf svdb

setenv lvs_dir /wv/omaela36/PDK_setup/lvs/

calibre -lvs -hier      -turbo top_rules |& tee lvs.log
calibre -xrc -pdb -rcc -turbo top_rules |& tee pdb.log
calibre -xrc -fmt -rcc      top_rules |& tee fmt.log
```

Figure 8: Run Setup "Run Script Example"

## Creating a Top Rules File

A top rules file is created and used to include the rules that was setup before (lvs) along with specifying the layout and source. Create a new text file named **top\_rules** and add the required SVRF statements. The following statements are the basic SVRF statements that are required to run extraction.

- First the following SVRF statements are used to setup the layout path, type and the top cell:

```
LAYOUT PATH "M0FOX.gds"
LAYOUT SYSTEM GDSII
LAYOUT PRIMARY "M0FOX"
```

Figure 9: Run Setup "Layout SVRF Statements"

- If the extraction run uses a source netlist, or in case LVS is used instead of the phdb stage then the following statements should be used to include the source netlist:

```
SOURCE PRIMARY "lvs_top"
SOURCE PATH "lvs_top.cdl"
SOURCE SYSTEM SPICE
```

Figure 10: Run Setup "Source SVRF Statements"

- Then SVRF **PEX NETLIST** is used to specify the name, netlist type, and layout or source names. Example:

```
PEX NETLIST "netlist.dspf" DSPF LAYOUTNAMES
```

Figure 11: Run Setup "Netlist SVRF Statements"

- To use the LVS decks for extraction an RC extraction variable should be set. Check the variable name inside the **"LVS/RC\_DFM switch option"** section in the LVS decks **"\$lvs\_dir/DFM\_LVS\_\***". To set the RC extraction variable the statement should be either uncommented, by removing **"//"** OR it could be set in the top rules using the **"#Define <var\_name>"** statement. Example:

```
#Define RC_DECK
```

Figure 12: Run Setup "Variable Define Statement"

It is recommended after using the above statements to use **DRC ICSTATION YES** which gives the above commands higher precedence in case, they are used in any of the included rules.

- The last step in setting-up a **top\_rules** file is to include the LVS deck and the **"\*.res"** file.
  - o To include the LVS deck, use the **lvs\_dir** variable set in the run script. Example: **"include \$lvs\_dir/DFM\_LVS\_\***"
  - o To include the **"\*.res"** file, use the **lvs\_dir** variable set in the run script. Example: **"include \$lvs\_dir/\*.res"**

Here is an example of what a top rules file should look like where only the run is based on layout names thus the source statements are commented.

```
LAYOUT PATH "M0FOX.gds"
LAYOUT SYSTEM GDSII
LAYOUT PRIMARY "M0FOX"

//SOURCE PRIMARY "lvs_top"
//SOURCE PATH "lvs_top.cdl"
//SOURCE SYSTEM SPICE

PEX NETLIST "netlist.dspf" DSPF LAYOUTNAMES

#Define RC_DECK

DRC ICSTATION YES

include $lvs_dir/DFM_LVS_RC_CALIBRE_N5_1p15M_1X1Xb1xe1Ya1yB5y2Yy2R_ALRDL.1.1b

include $lvs_dir/cln22ulp_1p10m+ut-alrd1_6x3z_cbest.res
```

Figure 13: Run Setup "Top Rules Example"

## Modifying Installed Decks

Before you can run extraction there are some modifications that should be made to the installed decks according to the usage.

- Inside the **"LVS/RC\_DFM switch option"** section in the LVS decks **"\$lvs\_dir/DFM\_LVS\_\***" there are a list of variables along with their explanation. To set any of these variables the statement should be uncommented by removing the **"//"** or by setting it in the top rules using the **"#Define"** statement.

After uncommenting the required statements, you can now use the run script to run Calibre extraction.



# Summary

In this document, we described the how to set up TSMC decks to be able to run Calibre's RC extraction. The document covers both the LVS and RC deck setup along with the setup required by Calibre extraction providing examples along the setup process.