# Appendix A

## The Usage of MIM w/i under Devices

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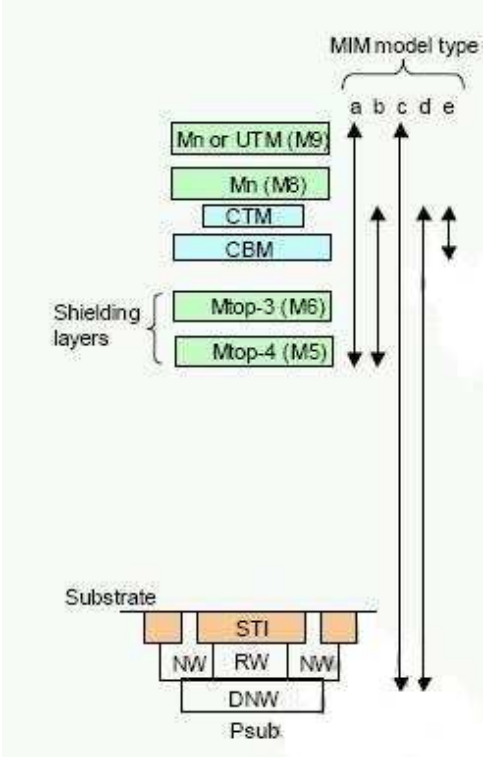
# Accordance

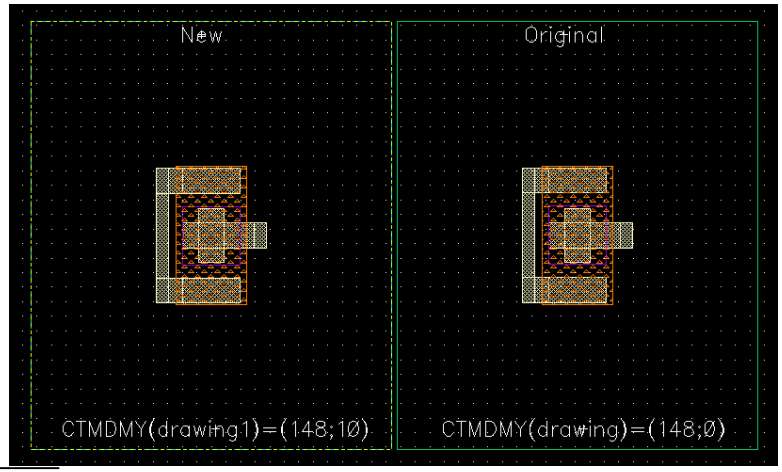
- Based on N65nm Design Rule Manual (DRM) “T-N65-CL-DR-001 v1.4”, DRM allow customer to put routing and devices under two kinds of mimcaps: 2T baseband mimcap and 3T w/i shielding RF mimcap.



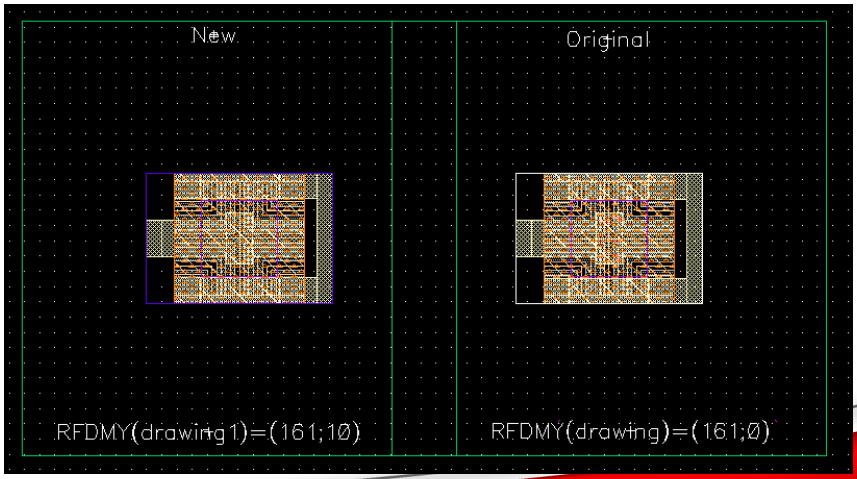

- For RF mimcap w/i shielding metals: (type-a)
  - Devices must put under shielding metals(Mx, top-2).
    For example: if shield metal is metal5 or metal6, under devices should use metals below metal4 to avoid short issues.
- For BB mimcap (2-terminals): (type-e)
  - Only support devices under 2T BB mimcaps, and we suggest it would be better to put devices under shielding metals(Mx,top-2).
  - Because 3T BB mimcaps allowed to use Nwell or Substrate to be BULK terminal and it has risk when mimcaps and under devices use different BULK signal information.
    - For example: if 3T BB mimcap use VSS as BULK, and under pmos use VDD as BULK, it will cause well soft-connect issues in LVS flow.
  - Model will not guarantee accuracy(such as: coupling, parasitics) for putting devices under 3T mimcaps.

# New MiMCAPs(1)

- We register two new dummy layers for new created mimcaps:
  - For RF w/i shielding mimcaps:
    Original mimcaps use RFDMY(drawing) = **(161;0)** ,
    New mimcaps use RFDMY(drawing1) = **(161;10)**.
  - For BB 2T mimcaps:
    Original mimcaps use CTMDMY(drawing) = **(148;0)** ,
    New mimcaps use CTMDMY(drawing1) = **(148;10)**.
- Both original mimcaps and new mimcaps are existed in one LVS decks to not impact original customer's design. Customer can only use original mimcaps if they don't want to put devices under mimcaps.




BB MiMCaps




RF MiMCaps

# New MiMCAPs(2)

- For these new mimcaps, PDK will create new option in p-cells to replace dummy layers. Customer needs to modify dummy layers by themselves before updated PDK releases officially.
- New mimcaps still use same LVS name:
  - For RF w/i shield mimcaps, it named “mimcap_um_sin_rf”, mimflag=1,2,3 means 1p0,1p5,2p0
  - For BB 2T mimcaps, it named “mimcap_sin” in LVS decks, mimflag=1,2,3 means 1p0,1p5,2p0
  - Use (CTMDMY; dummy3/dummy1/dumm2) = (148; 110/115/120) for capacitance 1p0,1p5,2p0.

| MiM / Under Dev | RF MiMCaps w/i shielding | | BB 2T mimcaps | |
|---|---|---|---|---|
| | Original | New dummy | Original | New dummy |
| RF devices | Recognized | Recognized | Failed | Recognized |
| LO devices | Failed | Recognized | Recognized | Recognized |

- Although original RF mimcaps can recognize under RF devices, and original BB 2T mimcaps can recognize under LO devices. We still suggest customer use new dummy mimcaps for usage of putting devices under mimcaps**.**
- We also don’t suggest customer to mixed use original and new mimcaps, especially use them overlapped.

# New MiMCAPs(3)

- We had tested the following devices put under RF w/i shielding mimcap and BB 2T mimcaps:
  - **Logic:** N/P MOS, N/P DIODE, 2T PO/OD RES, 3T PO/OD RES, PNP/NPN, RTMOM
  - **RF:** N/P MOS, 3T PO RES, MOSVAR, XJVAR, RTMOM, SBD
  - When put RTMOM devices under mimcaps, please make sure stm~spm layers of RTMOM MUST below shielding metals of RF mimcaps.
  - Inductors use top “metal ~ top-2 metal” and it can not be put under MiMCaps.
  - RF Lowcpad use “metal1 ~ metal top” and it can not be put under MiMCaps.