RF-MOS Model Structure

- RF-MOS model consists of 6 blocks (setup_rf, stat, Total, TT_RFMOS, TTG_RFMOS, global_RFMOS)
- 4 simulation cases (Total Corner, Global Corner, Local MC only, Global MC + Local MC) are provided
- The selection of Corner (or MC) simulation have to be enabled by totalflag, mismatchflag & globalflag

```
.lib setup_rf                          for initial flag setting
.lib stat                              for random variable setting
.lib Total                             Main Marco model body
.lib TT_RFMOS/FF_RFMOS/SS_RFMOS        for total Corner simulation
.lib TTG_RFMOS/FFG_RFMOS/SSG_RFMOS     for global Corner simulation
.lib global_RFMOS                      for global MC simulation
```

Can't be included at the same time

Toplevel File : Include Library

- There are 12 pre-defined libs to address the most frequently used combination for users.
- 36 individual libs could work well independently, other than 12 pre-defined libs.
- There are no extra libs or flag setting needed by using the lib (pre-defined level or individual) listed in this table.

Simulation case	Top Level File	MOS	MOSCAP	RES	BIP	DIO	DISRES	RTMOM	IND	XJVAR
Total_Corner	top_tt	TTMacro_MOS_MOSCAP		TT_RES_BIP_DIO_DISRES				TT_RTMOM	TT_IND_JVAR	
	top_ss	SSMacro_MOS_MOSCAP		SS_RES_BIP_DIO_DISRES				SS_RTMOM	SS_IND_JVAR	
	top_ff	FFMacro_MOS_MOSCAP		FF_RES_BIP_DIO_DISRES				FF_RTMOM	FF_IND_JVAR	
	top_sf	*SFMacro_MOS_MOSCAP		TT_RES_BIP_DIO_DISRES				TT_RTMOM	TT_IND_JVAR	
	top_fs	*FSMacro_MOS_MOSCAP		TT_RES_BIP_DIO_DISRES				TT_RTMOM	TT_IND_JVAR	
Global Corner + Local MC	top_ttg_localmc	TTGlobalCorner_LocalMC_MOS_MOSCAP		TTGlobalCorner_LocalMC_RES_BIP_DIO_DISRES				TTGlobalCorner_LocalMC_RTMOM	TTGlobalCorner_LocalMC_IND_JVAR	
	top_ssg_localmc	SSGlobalCorner_LocalMC_MOS_MOSCAP		SSGlobalCorner_LocalMC_RES_BIP_DIO_DISRES				SSGlobalCorner_LocalMC_RTMOM	SSGlobalCorner_LocalMC_IND_JVAR	
	top_ffg_localmc	FFGlobalCorner_LocalMC_MOS_MOSCAP		FFGlobalCorner_LocalMC_RES_BIP_DIO_DISRES				FFGlobalCorner_LocalMC_RTMOM	FFGlobalCorner_LocalMC_IND_JVAR	
	top_sfg_localmc	*SFGlobalCorner_LocalMC_MOS_MOSCAP		TTGlobalCorner_LocalMC_RES_BIP_DIO_DISRES				TTGlobalCorner_LocalMC_RTMOM	TTGlobalCorner_LocalMC_IND_JVAR	
	top_fsg_localmc	*FSGlobalCorner_LocalMC_MOS_MOSCAP		TTGlobalCorner_LocalMC_RES_BIP_DIO_DISRES				TTGlobalCorner_LocalMC_RTMOM	TTGlobalCorner_LocalMC_IND_JVAR	
Local MC Only (no global variation)	top_localmconly	LocalMCOnly_MOS_MOSCAP		LocalMCOnly_RES_BIP_DIO_DISRES				LocalMCOnly_RTMOM	LocalMCOnly_IND_JVAR	
Global MC + LocalMC (total MC)	top_globalmc_localmc	GlobalMC_LocalMC_MOS_MOSCAP		GlobalMC_LocalMC_RES_BIP_DIO_DISRES				GlobalMC_LocalMC_RTMOM	GlobalMC_LocalMC_IND_JVAR	

* MOSCAP TT corner is used in the combination

12 pre-defined libs

12+8+8+8 individual libs

Toplevel File for 4 Simulation Case

- The pre-defined TOP_xx is scripted for 4 simulation cases (Total Corner, Global Corner, Local MC only, Global MC + Local MC)
- Sample netlists of hspice & spectre for 4 simulation cases are listed in the following

1. Total Corner (spectre)

```
simulator lang=spectre
global 0
simulatorOptions options reltol=1e-4 vabstol=1e-6 iabstol=1e-12 temp=25
+ tnom=25 digits=7 pivrel=1e-3 gmin=1.0E-18 rawfmt=nutascii
scaleOptions options scale=0.9

include "crn40lp_1d8_v1d0_usage.scs"  section=top_tt

Vgs ( g 0 ) vsource dc=1.1 type=dc
Vss ( s 0)  vsource dc=0.0 type=dc
Vbs ( b 0 ) vsource dc=0.0 type=dc
Vds0 ( d0 0 ) vsource dc=1.1 type=dc

xmdut0 ( d0 g s b ) nmos_rf wr=2.5u lr=0.04u nr=16

idsat dc oppoint=rawfile
```

1. Total Corner (hspice)

```
* Net list for Idsat of DUT
.option  nomod ingold=2
+        newtol numdgt=7 relmos=1e-4 absmos=1e-8 relv=1e-4 relvdc=1e-4
.temp 25.0
.option scale=0.9
.lib “crn40lp_1d8_v1d0_usage.l” TTMacro_MOS_MOSCAP
.lib “crn40lp_1d8_v1d0_usage.l” TT_RES_BIP_DIO_DISRES
.lib “crn40lp_1d8_v1d0_usage.l” TT_RTMOM
.lib “crn40lp_1d8_v1d0_usage.l” TT_IND_JVAR

Vgs g 0 1.1
Vss s 0  0.0
Vbs b 0 0.0

Vds0 d0 0 1.1
xmdut0 d0 g s b nmos_rf wr=2.5u lr=0.04u nr=16
.op
.dc vgs 0 1.1 1.1
.print
+    id_dut0=par('abs(i(Vds0))')
.end
```

2. Global Corner + Local MC (spectre)

```
simulator lang=spectre
global 0
simulatorOptions options reltol=1e-4 vabstol=1e-6 iabstol=1e-12 temp=25
+ tnom=25 digits=7 pivrel=1e-3 gmin=1.0E-18 rawfmt=nutascii
scaleOptions options scale=0.9

include "crn40lp_1d8_v1d0_usage.scs"  section=top_ttg_localmc

Vgs ( g 0 ) vsource dc=1.1 type=dc
Vss ( s 0)  vsource dc=0.0 type=dc
Vbs ( b 0 ) vsource dc=0.0 type=dc
Vds0 ( d0 0 ) vsource dc=1.1 type=dc

xmdut0 ( d0 g s b ) nmos_rf wr=2.5u lr=0.04u nr=16 totalflag=0
mc1 montecarlo appendsd=yes variations=all savefamilyplots=yes seed=1234
+ numruns=1000 saveprocessparams=yes  {
idsat dc oppoint=rawfile
}
```