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## CMOS090 MODEL FOR SYMETRICAL INDUCTORS WITH PATTERNED GROUND SHIELD (ind\_dif\_nw)

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Developer:  
RF Team, June 2010

Maturity:  
Tentative data

### **I Measurement and Parameter** **Extraction/Estimation of Typical Model Parameters:**

Cmos090 model is derived from HCMOS9 preliminary model.  
Parameter extraction was performed on HCMOS9 silicon in the following conditions:

Test structure reference:  
ZSS1 to ZSS18

Device Selection:  
Lot: J220BYN  
Wafer: 17

Characterization domain:  
High frequency measurements from 80 MHz to 18 GHz

### **II. Best/Worst Case:**

Statistical and Best/Worst case simulations available  
The criteria is the quality factor  
Some approximations have been made for the definition of Min and Max:  
Min defined with: Ls min, Rs max, Cox max  
Max defined with: Ls max, Rs min, Cox min  
FOR ANY FREQUENCY (approximation)  
Some uniform laws have been used to described process spread

### **III. Simulation with temperature:**

Available from -35 to 125 Celcius Degre

## IV. Model Application guidelines:

### Layout & Model:

- Octagonal shape
- M61T option : Coil in Alucap+M6//M5, underpass in M4
- M72T option : Coil in Alucap+M7//M6//M5, underpass in M4
- Patterned ground shield: patterned shield in Poly fingers (salicided)  
2 pi cells model
- The model takes into account the proximity effects by the use of frequency dependent Resistances
  - for simulator which can cope with frequency use M2 Model  
=> M2 model give the good value of serial resistance at each frequency point.
  - for time domain simulator which can not cope with frequency a configuration providing the frequency  $f_q$  as input parameter has been chosen  
=> use M1 model. M1 model give the serial resistance value accurate only at the frequency point  $f_q$ . The value of this resistance will remain constant with frequency of simulation
- Access to the middle point of the differential inductor. The middle point access line is only modeled by its DC serial resistance

### **Warning:**

The differential inductor model is only valid if the inductor is really used in differential configuration (no RF signal is driving by the middle point access). The middle point access port is a ground (or a virtual ground) in the RF point of view.

### Model Call:

- Scalable inductor model
- Input parameters:
  - d**: internal diameter in  $\mu\text{m}$  from 90 to 250  $\mu\text{m}$   
=> the inductance value is calculated
  - or **ls**: inductance value in H from 0.691e-9 to 17.264E-9  
=> the internal diameter is calculated
  - nbtuns**: number of turns  
from 2 to 6
  - w**: width of coils  
from 8E-6 to 11.99E-6
  - fq**: frequency of use in Hz (only for M1 model)

### Frequency validity:

From DC to cut-off frequency  $F_{\text{max}}$  of quality factor, but in any case the model validity is limited to 10 GHz  
( $F_{\text{max}}$  is the frequency where the quality factor reaches a null value)