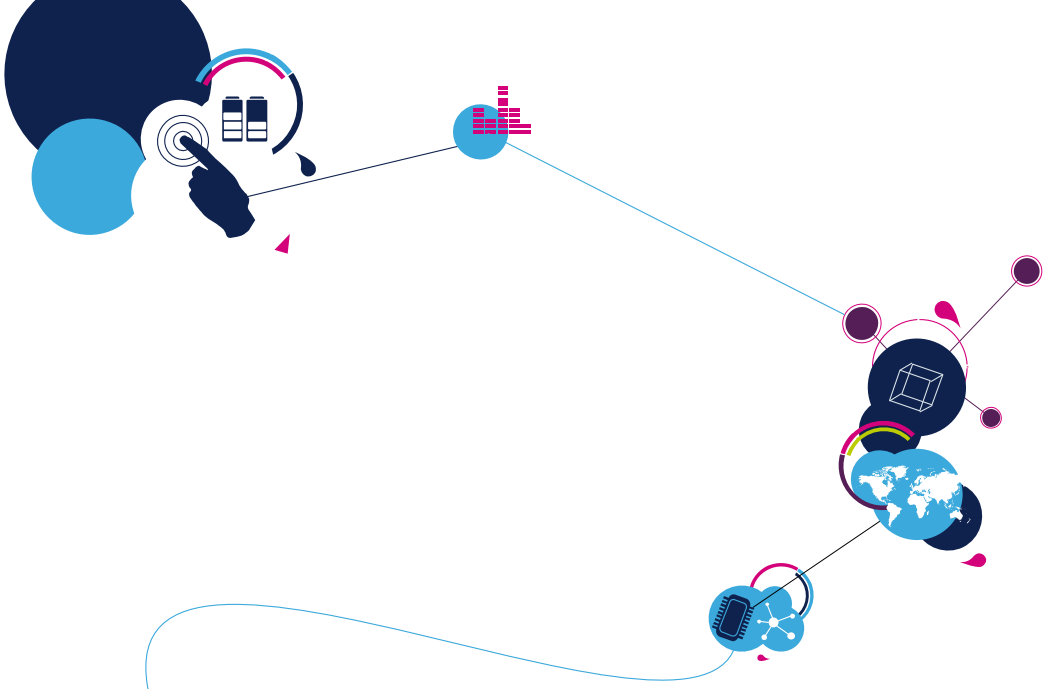

FDSOI – C028FDSOI

Spice Models

ESD LowCap protections documentation

Model Maturity:	*Preliminary*
Design Kit Release:	*DK1.2_RF_mmW*
Document Revision:	*1.1*

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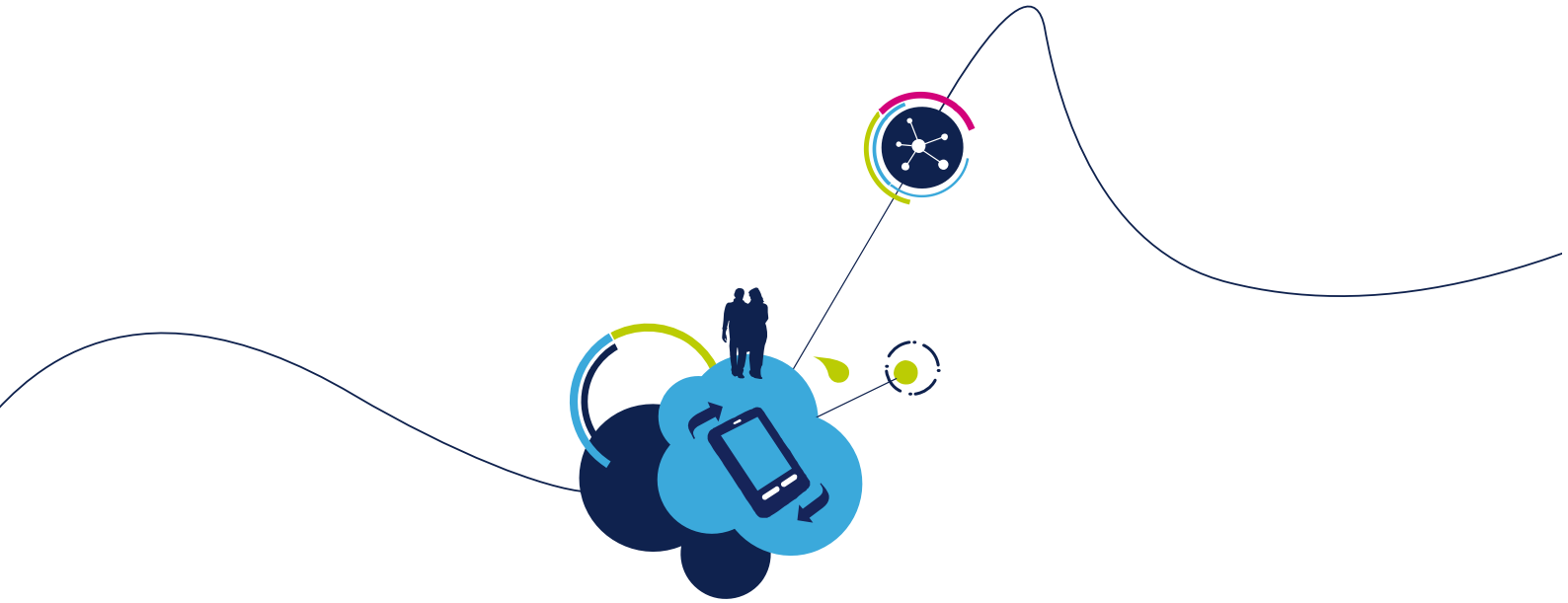

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USER'S MANUAL PURPOSE

The document provides information concerning the C028FDSOI Spice Models - ESD protection Lowcap SCR devices from device description to physics.

DOCUMENT REVISION HISTORY

Date	Revision	Revision information
June, 2018	*1.0*	*First release*
September, 2018	*1.1*	*Update*

AUTHORS

Revision	***Author***
1.0	*DELMAS Antoine*
1.1	*DELMAS Antoine*

TABLE OF CONTENTS

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GENERAL INFORMATION

1. SCOPE

This documentation contains the following types of information:

- Model features and limitations
- Conditions used for device characterization or model extraction
- Model-to-Hardware correlation plots

The version of the models referred in this documentation is C028FDSOI Spice Models – esd_lowcap protection devices V 0.1 unless otherwise specified.

2. ADDITIONAL REFERENCES

Other modelling information can also be found in the following sources:

- Model syntax, input parameter options and basic topology diagrams are included
- Device performance specifications
- Circuit simulator manuals. For ELDO, HSPICE or SPECTRE users, please see the associated user manuals.

3. SIMULATION APPROACH

Lowcap models are built using mainly standard diodes.

4. STATISTICS

The model has dedicated statistics (pre-defined corners) in order to take into account process variations of devices features.

Pre-defined Corners	
Name	Description
TT	Typical performances

ESDBC	Best performances
ESDWC	Worst performances

Table 1 : Pre-defined corners

5. SOA

SOA (Safe Operating Area) are included with the models. SOA libraries are used to alert the user if the device is used out of its operating area. SOAs are activated by default but be deactivated by changing the soa value to 0.

6. NOTES ON CIRCUIT SIMULATORS

The default numerical error controls may be different between simulators, which could affect accuracy of some circuit not others. User may try to tighten error controls if simulation results difference is noticeable.

MODELS OVERVIEW

1. MODEL STATUS

The UltraLowCap ESD protection device model described in this document is ***tentative***.

This section gives a summary about the model with its instance parameters and associated features.

Cellname in DK	Model name	Maturity	Release	Model features								
				Process variations			Mismatch			Post-Layout		
										LPE		
				Pre-defined corners	User-defined corners	Statistical models	Pre-defined corners	User-defined corners	Monte carlo	Resistance	Capacitance	SOA
esd_lowcap	esd_lowcap	Tentative	0.1	✓								✓

Table 2 : Model Status

2. INSTANCE PARAMETERS

Instance parameters					Unit
Name	Description	Value			
		min	default	max	
mult	Multiplication factor	1	1	no	NA
soa	Soa flag	0	1	1	NA

Table 3 : Instance parameters

3. DEVICE DESCRIPTION

3.1. DEVICE DESCRIPTION

Lowcap are ESD devices used for local protection of IO with fail-safe constraints. They are made up of a SCR device with concentric layout and an integrated return diode. In standard configuration, NGATE node is connected to a triggering circuit.

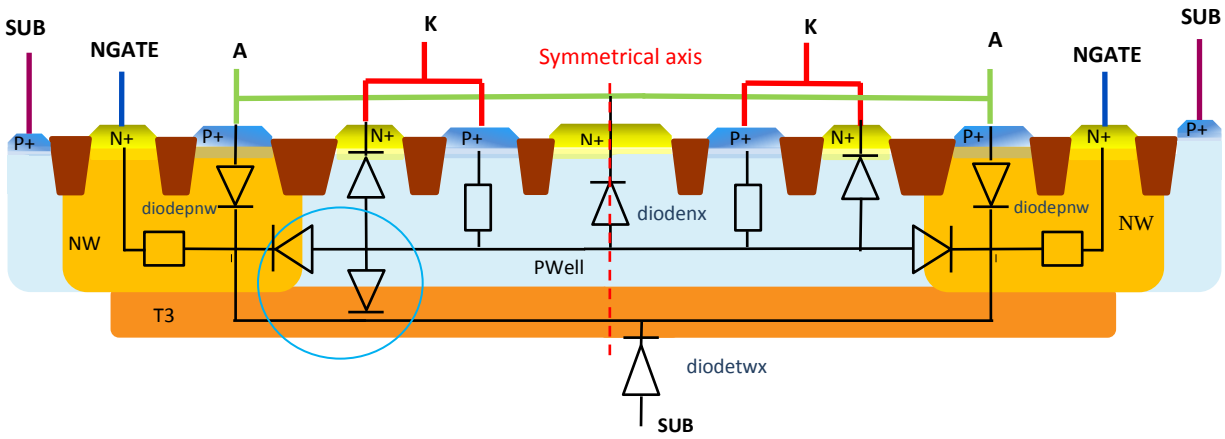

Figure 1 : Cross section of Lowcap devices

MULT: mult is a simple multiplication factor, which multiplies all dimensions equally.

3.2. MODELS DESCRIPTION

Present model covers DC and AC application. A simple model featuring standard diodes and resistors is presented on Fig. 1.

The Lowcap ESD Protection models include:

- Standard junction diode equations for IV and CV characteristics.
- Reverse breakdown.
- Temperature influence (ambient) in DC operating range.
- Corners
- Guard ring impact.

4. SIMULATIONS

In this section, some DC and AC simulations are shown. DC measurement system used does not allow a good precision below 1 nA. AC characteristics were obtained by S-parameter measurements on a network analyser. An artefact is observed from 65 GHz to 80 GHz, which should not be taken into account.

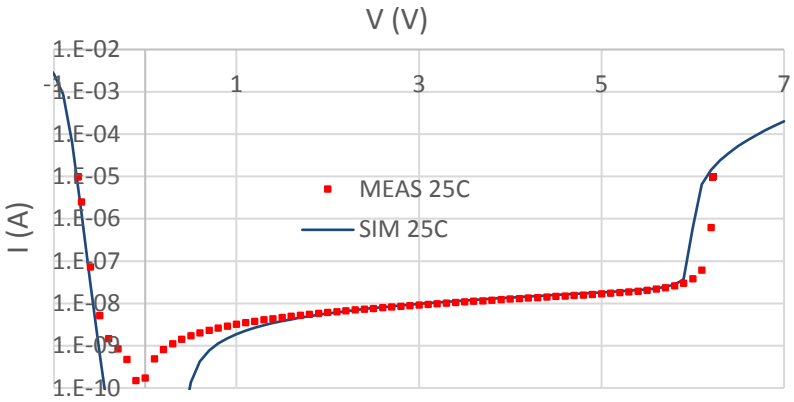

Figure 2 : DC characteristic of RVT ultra low cap devices

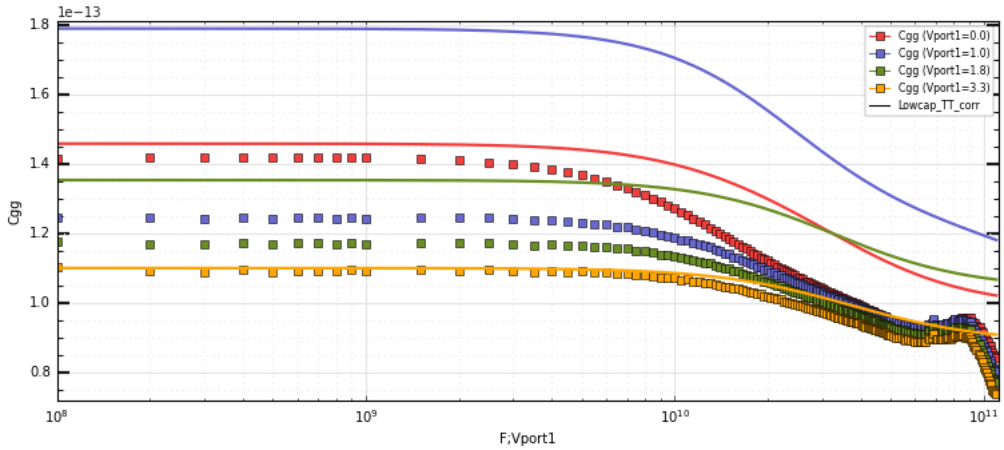

Figure 3 : AC characteristic of Low cap devices

5. MODEL LIMITATIONS

In AC signals, voltage dependence of capacitance is not accurately modeled. Model to measurement error is overestimated by maximum 40%.