ESD3V3U4ULC

SPICE3 Model Documentation

Technical Report

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RF and Protection Devices

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Revision History

ESD3V3U4ULC

Revision History: September 22, 2011, Rev. 1.0

Previous Version:

Page	Subjects (major changes since last revision)
All	Creation of document.

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Last Trademarks Update 2009-10-19

1 Model Description

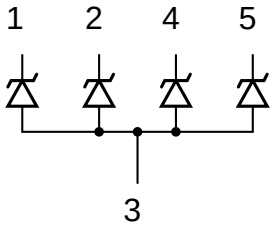


Figure 1: Pin definition. Note that all single diodes are equal, but the bond wires may be different. Diodes at pin 1 and pin 5 have equal properties. Diodes at pin 2 and pin 4 have equal properties.

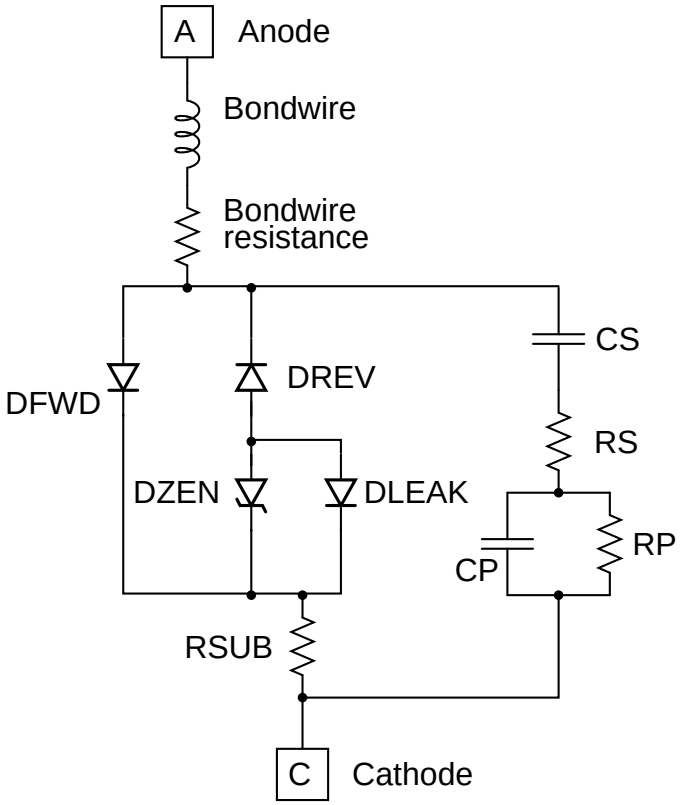


Figure 2: Subcircuit of single ESD diode

2 Model Performance

The results of parameter extraction are shown in this chapter. Red boxes indicate measurement data. Blue lines indicate simulated data. Measurement and simulation temperature was 27 degC. Note that the product includes four single diodes. The figures below are valid for the diode between pin1 and pin3.

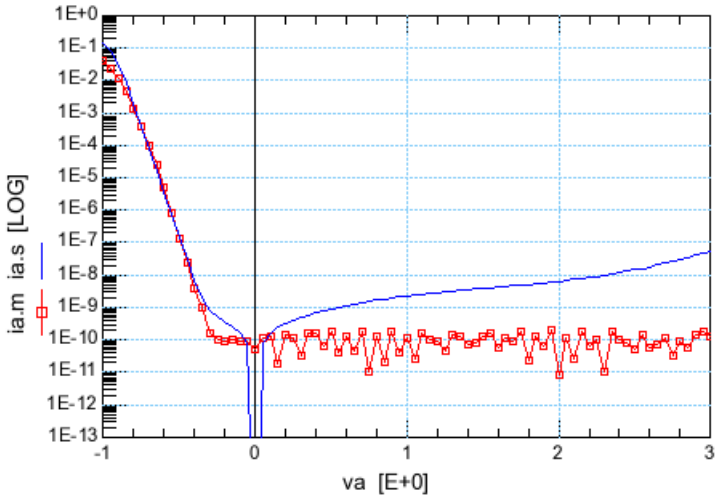


Figure 3: Leakage current

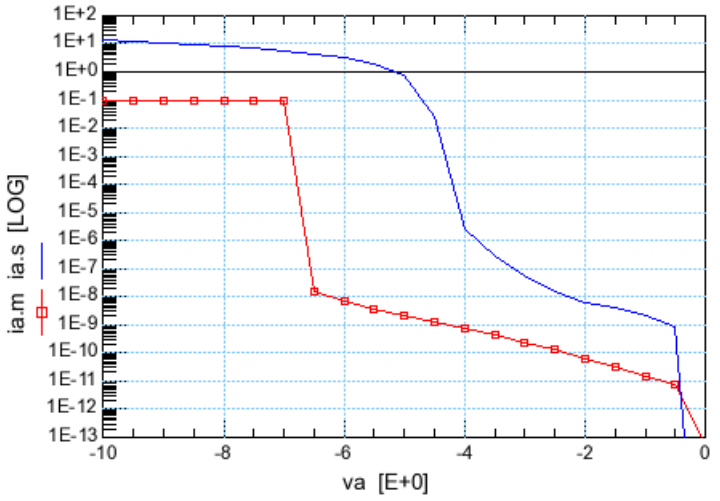


Figure 4: Leakage current

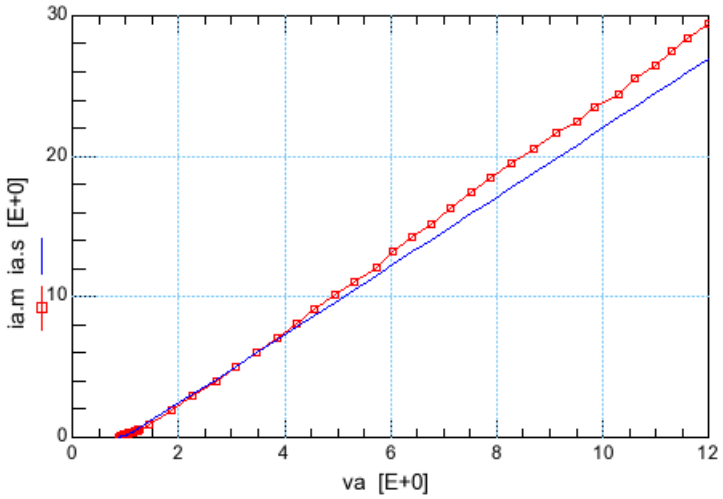


Figure 5: Forward TLP characteristics

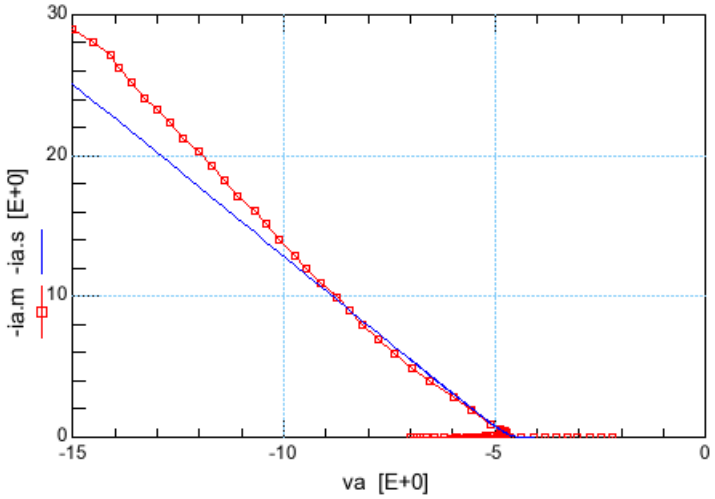


Figure 6: Reverse TLP characteristics

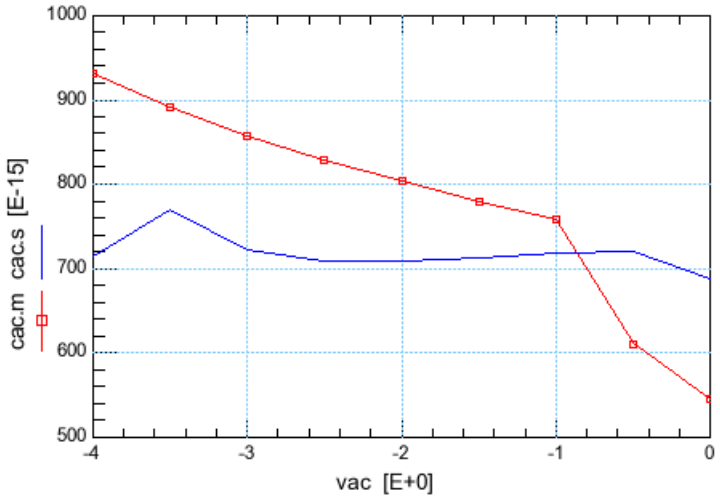


Figure 7: CV curve

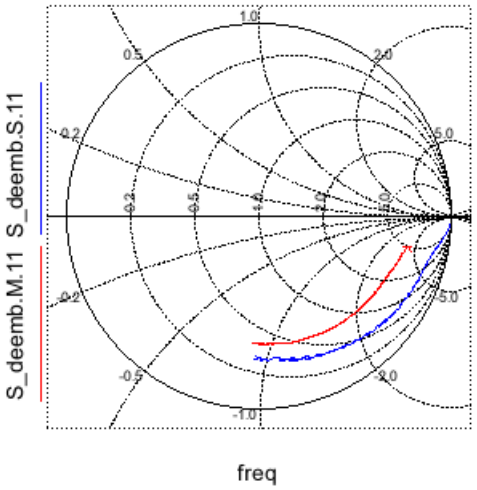


Figure 8: S11, VC=-0.5V (VC=voltage at cathode)

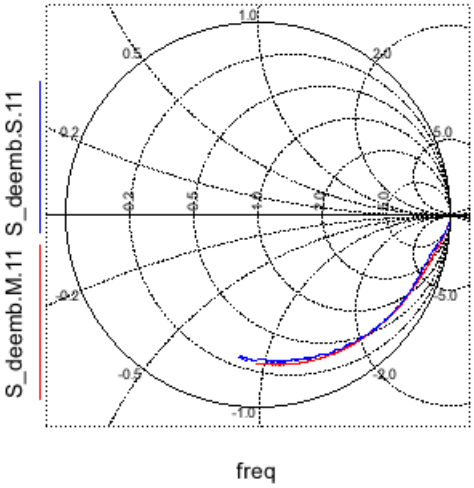


Figure 9: S11, VC=0V (VC=voltage at cathode)

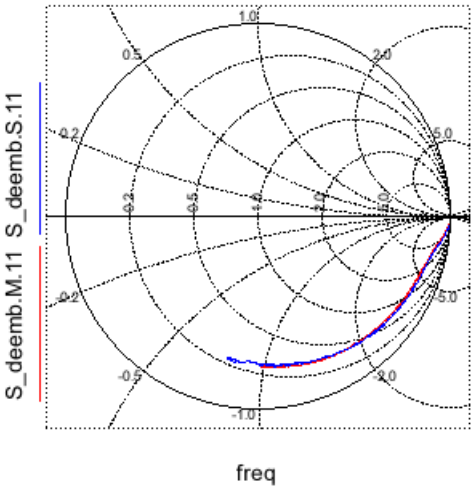


Figure 10: S11, VC=3V (VC=voltage at cathode)

3 Model Code

```
.options
+ gmin=1.0e-09
+ TNOM = 27
+ TEMP = 27

.SUBCKT ESD3V3U4ULC 1 2 3 4 5
X1 1   3  ESD3V3U4U_LC_spice3_long
X2 2   3  ESD3V3U4U_LC_spice3_short
X3 4   3  ESD3V3U4U_LC_spice3_short
X4 5   3  ESD3V3U4U_LC_spice3_long
.ENDS

.SUBCKT ESD3V3U4U_LC_spice3_short 1 2
.MODEL DFWD D
+ TNOM = 27
+ IS = 2.248E-14
+ N = 1.231
+ CJO = 6.026E-14
+ M = -0.3903
+ VJ = 1.812
+ FC = 0.5
+ TT = 1E-10
.MODEL DREV D
+ TNOM = 27
+ IS = 3E-16
+ N = 1
+ CJO = 3E-13
+ M = 0.4
+ VJ = 0.7
+ FC = 0.5
+ TT = 1E-10
.MODEL DZEN D
+ TNOM = 27
+ IS = 1E-16
+ N = 1
+ BV = 3.7
+ IBV = 0.1
+ CJO = 3E-13
+ M = 0.4
+ VJ = 0.7
+ FC = 0.5
+ TT = 1E-10
.MODEL DLEAK D
+ TNOM = 27
+ IS = 4.107E-12
+ N = 10
+ BV = 0.1
+ IBV = 1.6E-11
+ CJO = 3E-13
+ M = 0.4
+ VJ = 0.7
+ FC = 0.5
+ TT = 1E-10
D1 11 31
+ DFWD
D2 91 11
+ DREV
D3 91 31
+ DZEN
```

```
D4 91 31
+ DLEAK
RSUB 31 1 0.35
CS 11 51 4.286E-13
RS 51 52 156.9
CP 52 1 1.787E-13
RP 52 1 448.4
* bond wire resistor
RBOND 2 21 0.02723
* bond wire inductor
LBOND 21 22 1.868E-10
* skin effekt
LSKIN 11 22 9.333E-12
RSKIN 11 22 0.09037
.ENDS

.SUBCKT ESD3V3U4U_LC_spice3_long 1 2
.MODEL DFWD D
+ TNOM = 27
+ IS = 2.248E-14
+ N = 1.231
+ CJO = 6.026E-14
+ M = -0.3903
+ VJ = 1.812
+ FC = 0.5
+ TT = 1E-10
.MODEL DREV D
+ TNOM = 27
+ IS = 3E-16
+ N = 1
+ CJO = 3E-13
+ M = 0.4
+ VJ = 0.7
+ FC = 0.5
+ TT = 1E-10
.MODEL DZEN D
+ TNOM = 27
+ IS = 1E-16
+ N = 1
+ BV = 3.7
+ IBV = 0.1
+ CJO = 3E-13
+ M = 0.4
+ VJ = 0.7
+ FC = 0.5
+ TT = 1E-10
.MODEL DLEAK D
+ TNOM = 27
+ IS = 4.107E-12
+ N = 10
+ BV = 0.1
+ IBV = 1.6E-11
+ CJO = 3E-13
+ M = 0.4
+ VJ = 0.7
+ FC = 0.5
+ TT = 1E-10
D1 11 31
+ DFWD
D2 91 11
+ DREV
```

```
D3 91 31
+ DZEN
D4 91 31
+ DLEAK
RSUB 31 1 0.35
CS 11 51 4.286E-13
RS 51 52 156.9
CP 52 1 1.787E-13
RP 52 1 448.4
* bond wire resistor
RBOND 2 21 0.05409
* bond wire inductor
LBOND 21 22 3.721E-10
* skin effekt
LSKIN 11 22 1.971E-11
RSKIN 11 22 0.1584
.ENDS
```

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