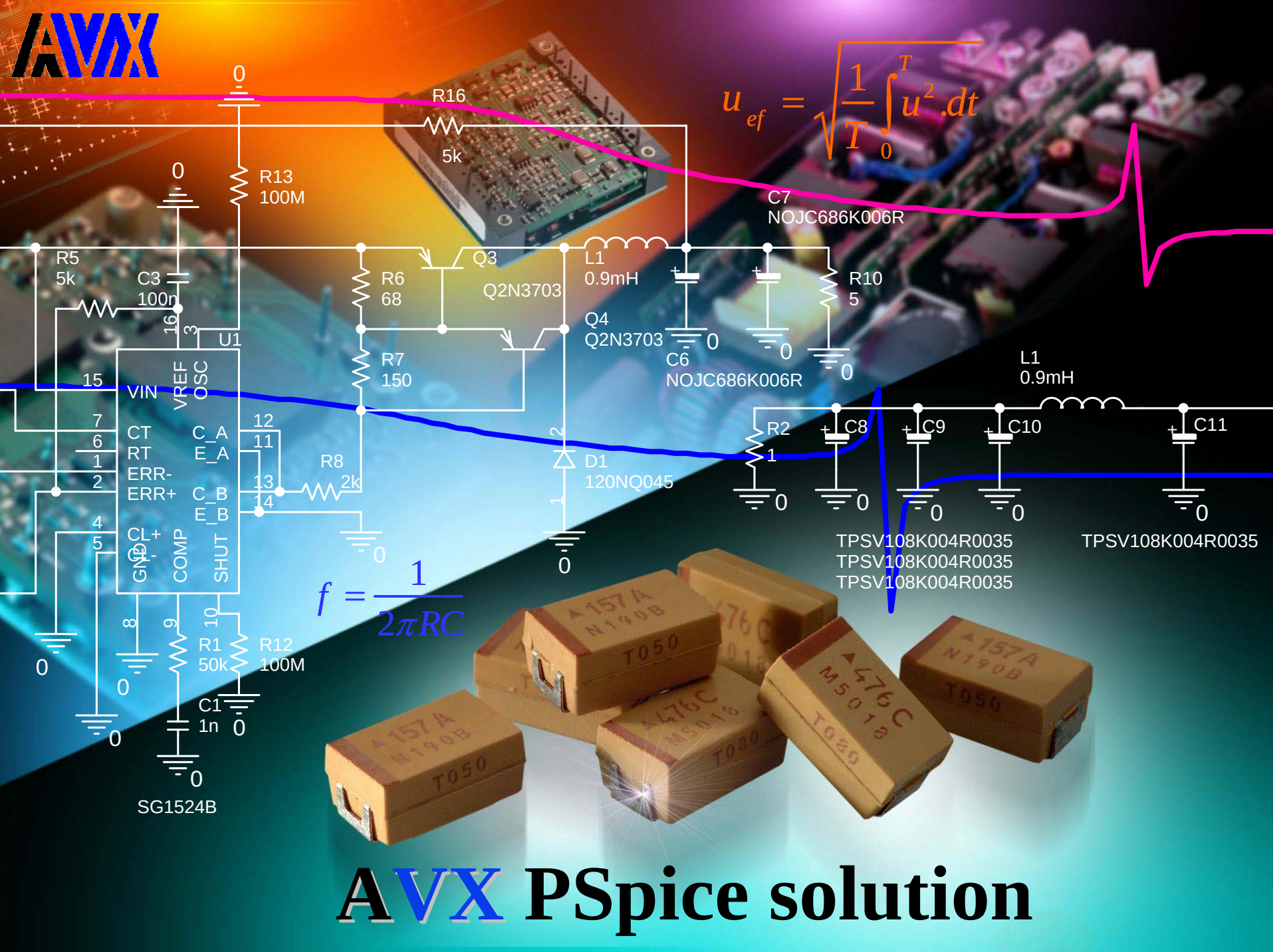
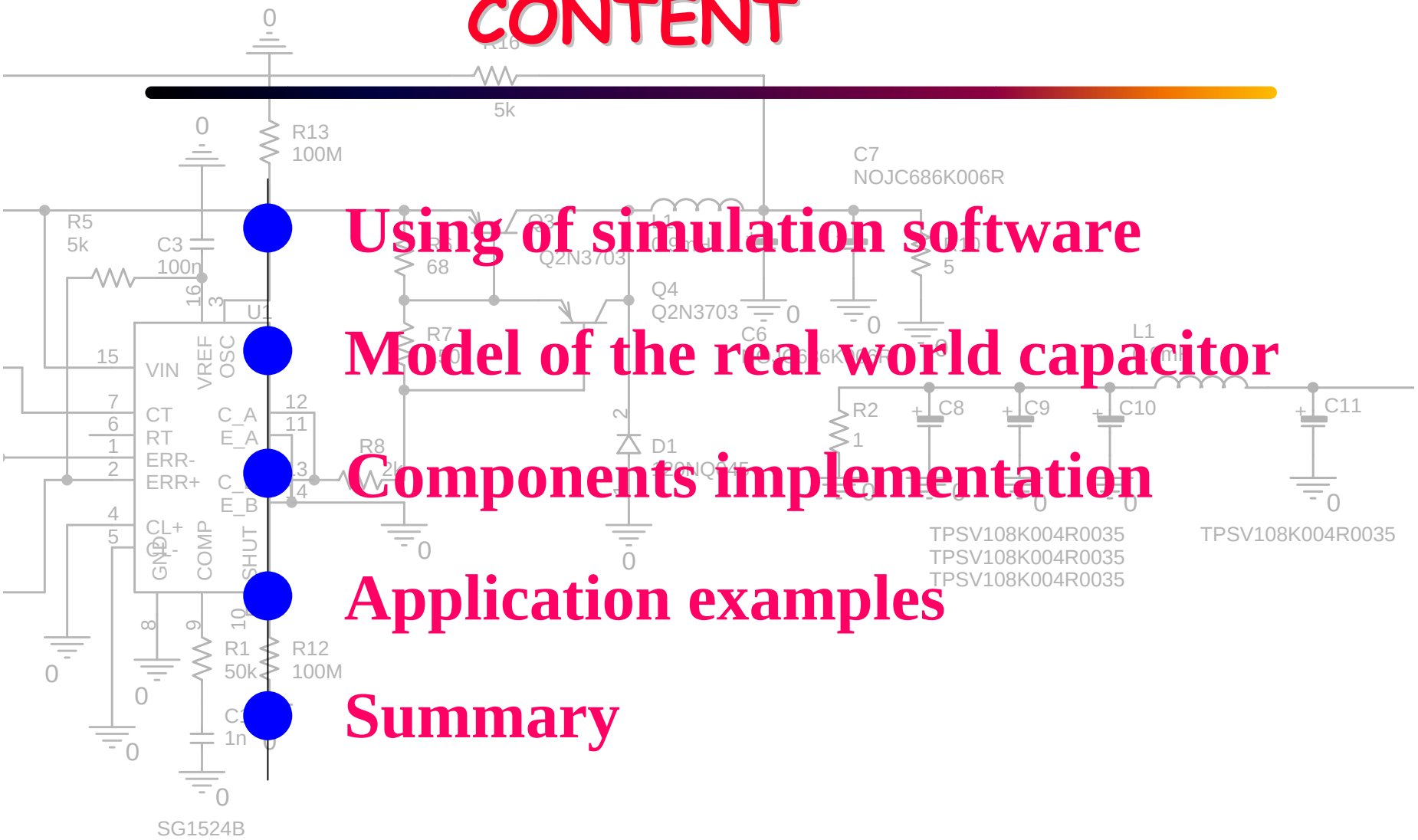
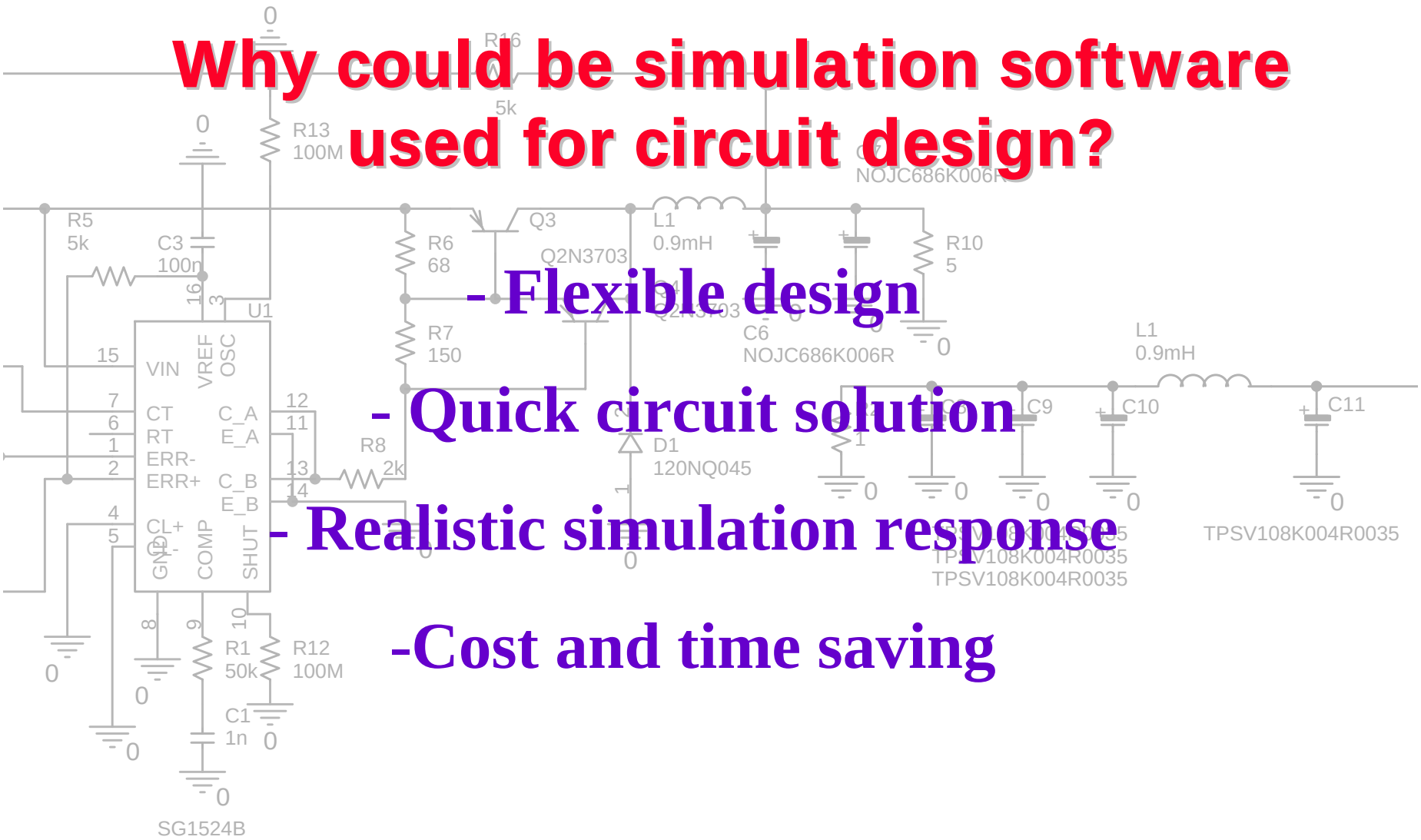

AVX
R16
5k
R13
100M
C7
NOJC686K006R
R5
5k
C3
100n
U1
R6
68
Q3
Q2N3703
L1
0.9mH
R10
5
Q4
Q2N3703
C6
NOJC686K006R
R7
150
L1
0.9mH
R2
1
C8
C9
C10
C11
R8
2k
D1
120NQ045
TPSV108K004R0035
TPSV108K004R0035
TPSV108K004R0035
TPSV108K004R0035
VIN
VREF
OSC
CT
RT
ERR-
ERR+
C_A
E_A
C_B
E_B
CL+
CL-
GND
COMP
SHUT
R1
50k
R12
100M
C1
1n
SG1524B
$u_{ef} = \sqrt{\frac{1}{T}\int_0^T u^2 .dt}$
$f = \frac{1}{2\pi RC}$
AVX PSpice solution

CONTENT


Using of simulation software
Model of the real world capacitor
Components implementation
Application examples
Summary
R16
5k
R13
100M
C7
NOJC686K006R
R5
5k
C3
100n
U1
R7
68
Q3
Q2N3703
L1
Q4
Q2N3703
C6
R10
5
R2
C8
C9
C10
C11
TPSV108K004R0035
TPSV108K004R0035
TPSV108K004R0035
TPSV108K004R0035
R8
2k
D1
R1
50k
R12
100M
C1
1n
SG1524B

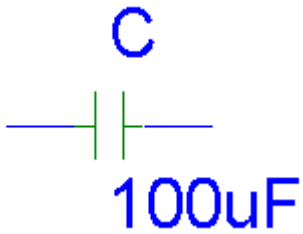
Why could be simulation software used for circuit design?

- Flexible design
- Quick circuit solution
- Realistic simulation response
- Cost and time saving



Comparison of ideal and real world capacitor

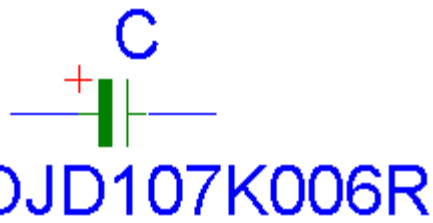
Ideal capacitor



ESR=0,
ESL=0,
DCL=0

Doesn't exist!!

Real world capacitor

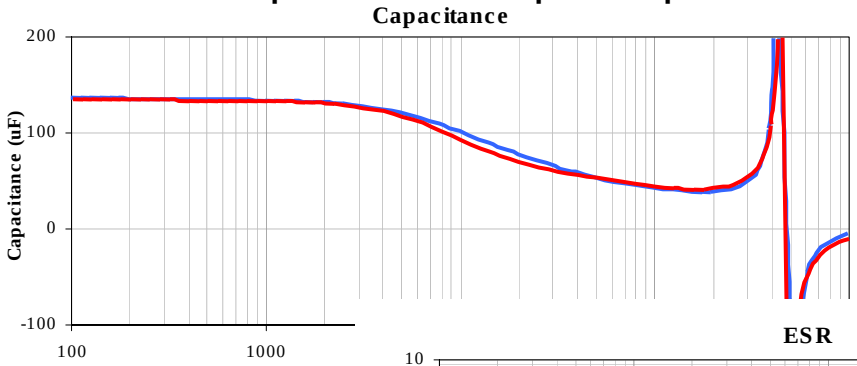


Defined
C, ESR, ESL,
DCL,
Temperature

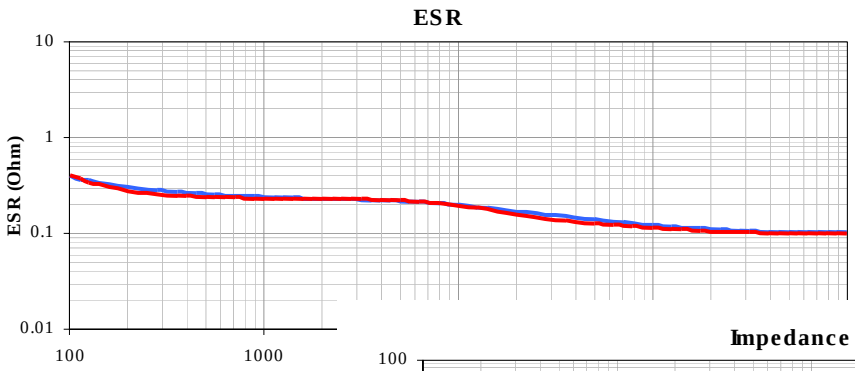
It is impossible to expect realistic response into simulation with ideal capacitor

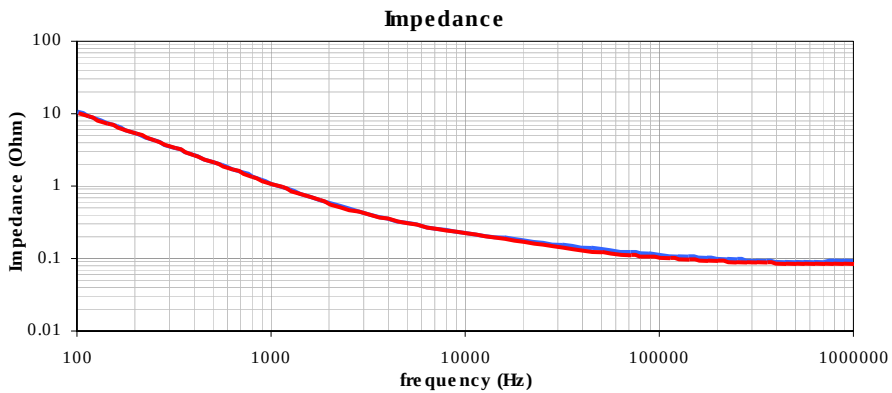
OxiCap™ equivalent circuit diagram creation

Example of OxiCap™ equivalent- NOJC157K004R

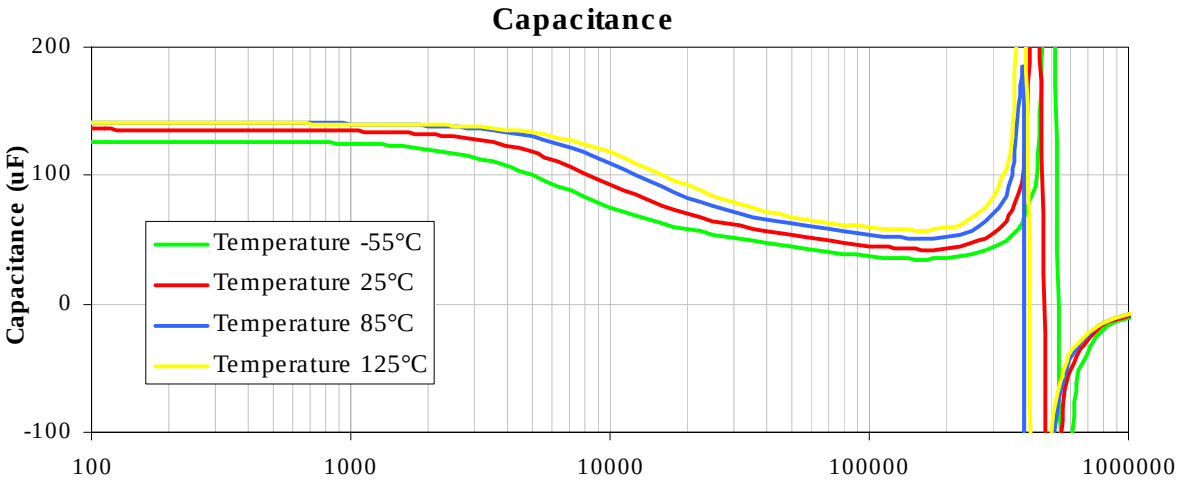


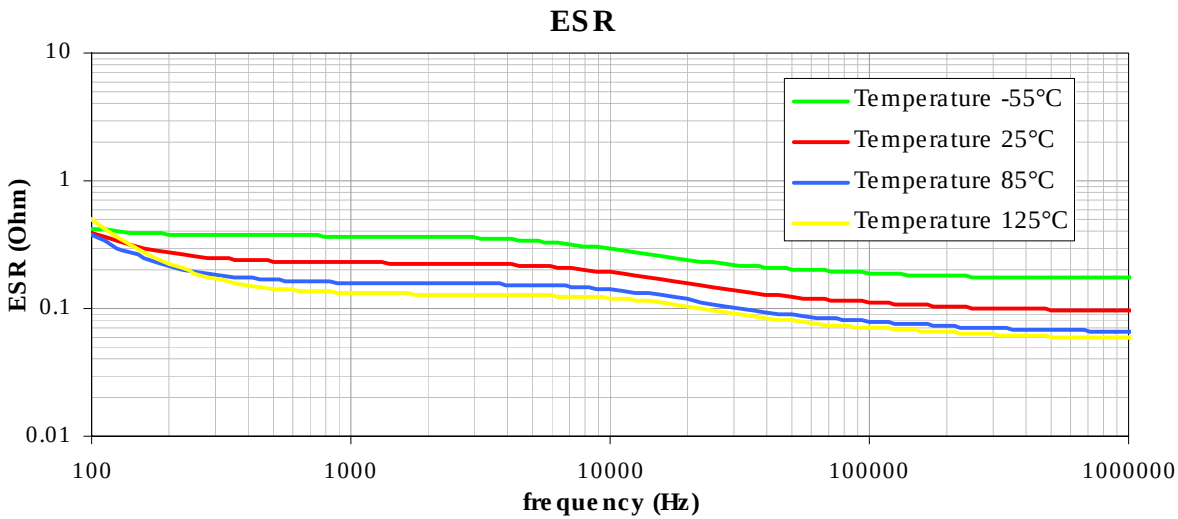
- measurement result
- simulation result



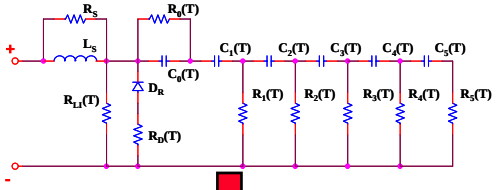


Example of OxiCap™ capacitance and ESR temperature dependences





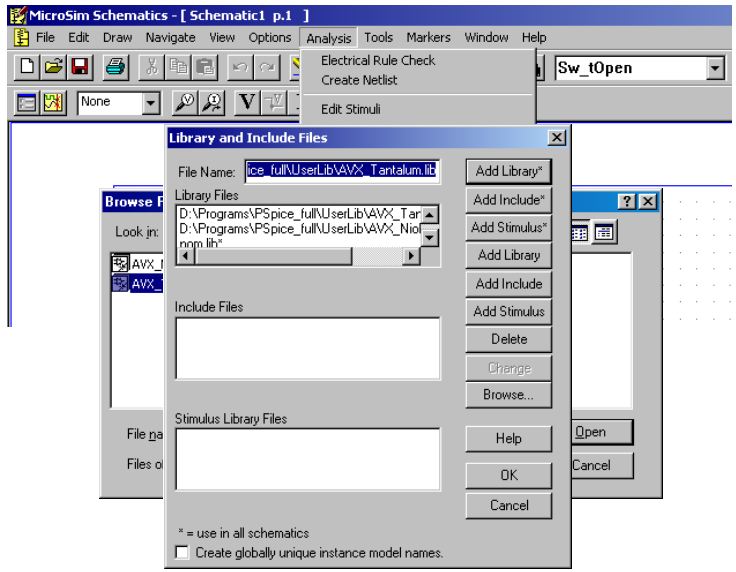
The model implementation into simulation software

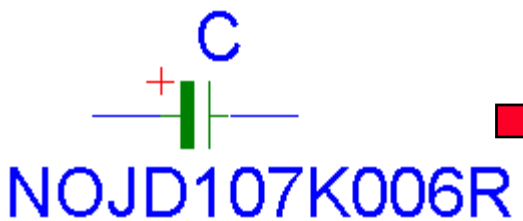


```
*parasitic inductance
Lesl 1 2 1.800000e-009
Rels 1 2 10

*leakage current & reverse bias effects
Rp 2 9 1.100000e+009
Dp 9 2 DFWD

*RC-ladder model of frequency effects
R1 2 3 RMOD1 5.596420e+001
C1 2 3 CMOD1 9.643955e-006
R2 3 4 RMOD2 1.100000e-004
C2 4 9 CMOD2 3.229476e-009
R3 4 5 RMOD3 1.047093e+001
C3 5 9 CMOD3 6.459859e-009
R4 5 6 RMOD4 1.100000e-004
C4 6 9 CMOD4 1.291719e-008
R5 6 7 RMOD5 1.100000e-004
C5 7 9 CMOD5 2.583581e-008
R6 7 8 RMOD6 3.022301e+001
C6 8 9 CMOD6 5.167161e-008

.MODEL CMOD1 CAP (T_MEASURED=25 TC1=1.463615e-003 TC2=-4.147800e-005)
.MODEL CMOD2 CAP (T_MEASURED=25 TC1=3.749220e-004 TC2=2.806000e-006)
.MODEL CMOD3 CAP (T_MEASURED=25 TC1=3.749220e-004 TC2=2.806000e-006)
.MODEL CMOD4 CAP (T_MEASURED=25 TC1=3.749220e-004 TC2=2.806000e-006)
.MODEL CMOD5 CAP (T_MEASURED=25 TC1=3.749220e-004 TC2=2.806000e-006)
.MODEL CMOD6 CAP (T_MEASURED=25 TC1=3.749220e-004 TC2=2.806000e-006)
.MODEL RMOD1 RES (T_MEASURED=25 TC1=5.948893e-003 TC2=5.337100e-005)
.MODEL RMOD2 RES (T_MEASURED=25 TC1=-1.778074e-003 TC2=1.281300e-005)
.MODEL RMOD3 RES (T_MEASURED=25 TC1=-7.138201e-003 TC2=2.153200e-005)
.MODEL RMOD4 RES (T_MEASURED=25 TC1=-7.138201e-003 TC2=2.153200e-005)
.MODEL RMOD5 RES (T_MEASURED=25 TC1=-7.138201e-003 TC2=2.153200e-005)
.MODEL RMOD6 RES (T_MEASURED=25 TC1=-7.138201e-003 TC2=2.153200e-005)
.MODEL DFWD D (RS=0.1 IS=1e-25 M=2.5 XTI=0 EG=0.1)

.ENDS
```

Tantalum.lib

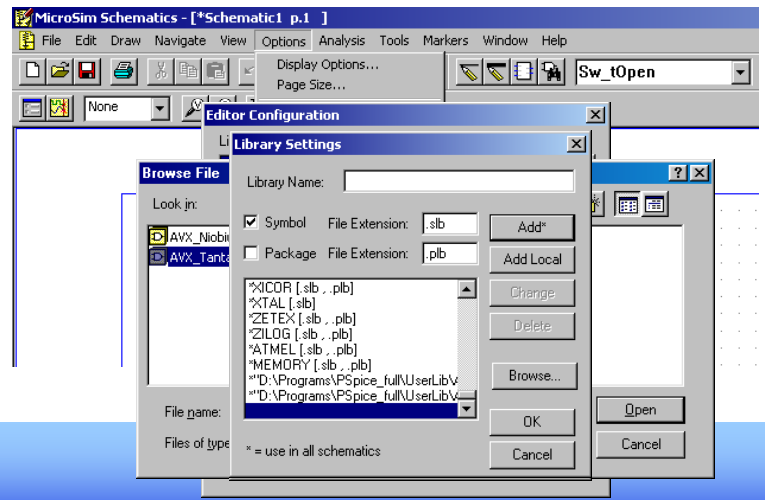
OxiCapTM.lib



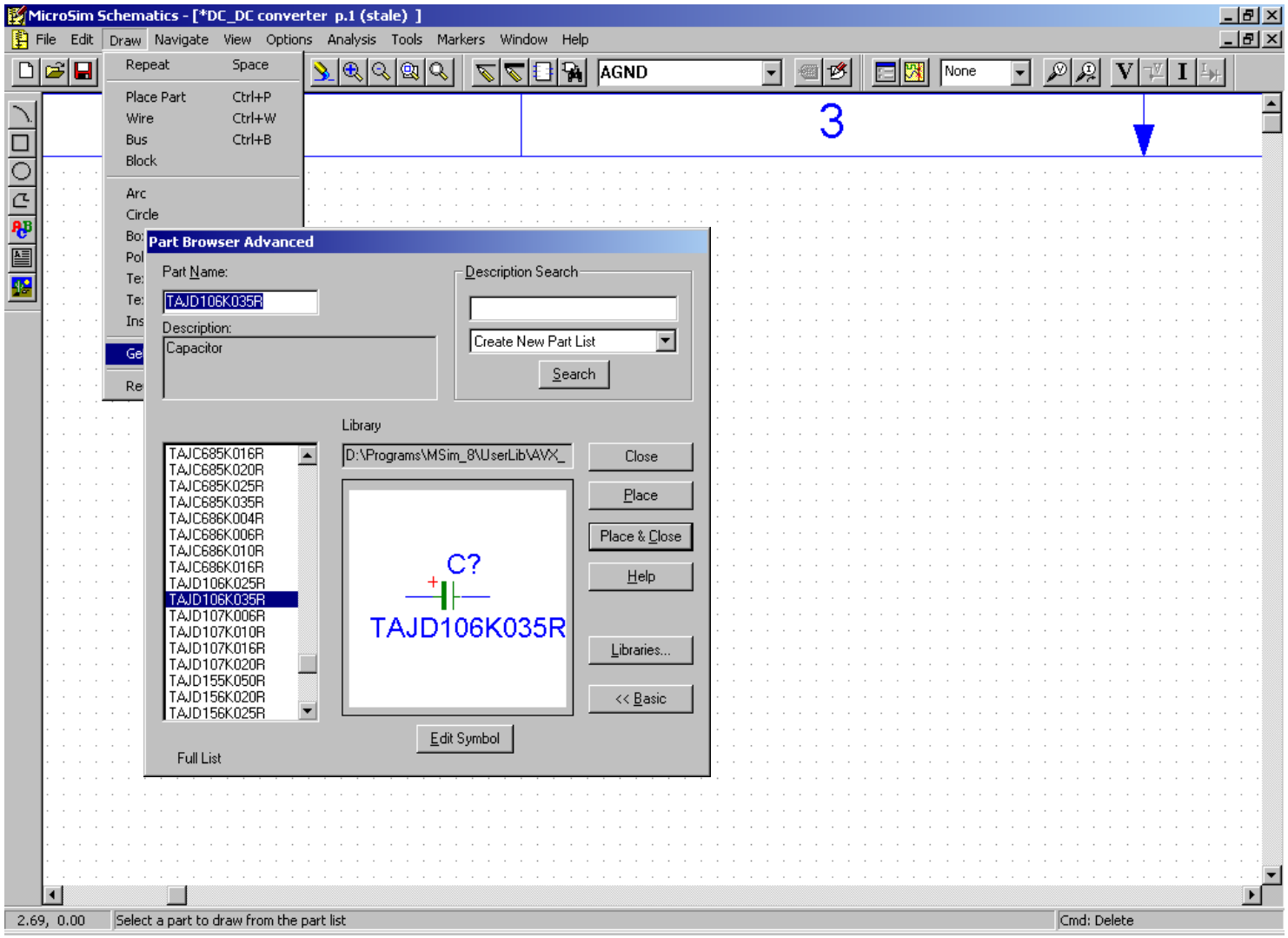


Tantalum.slb

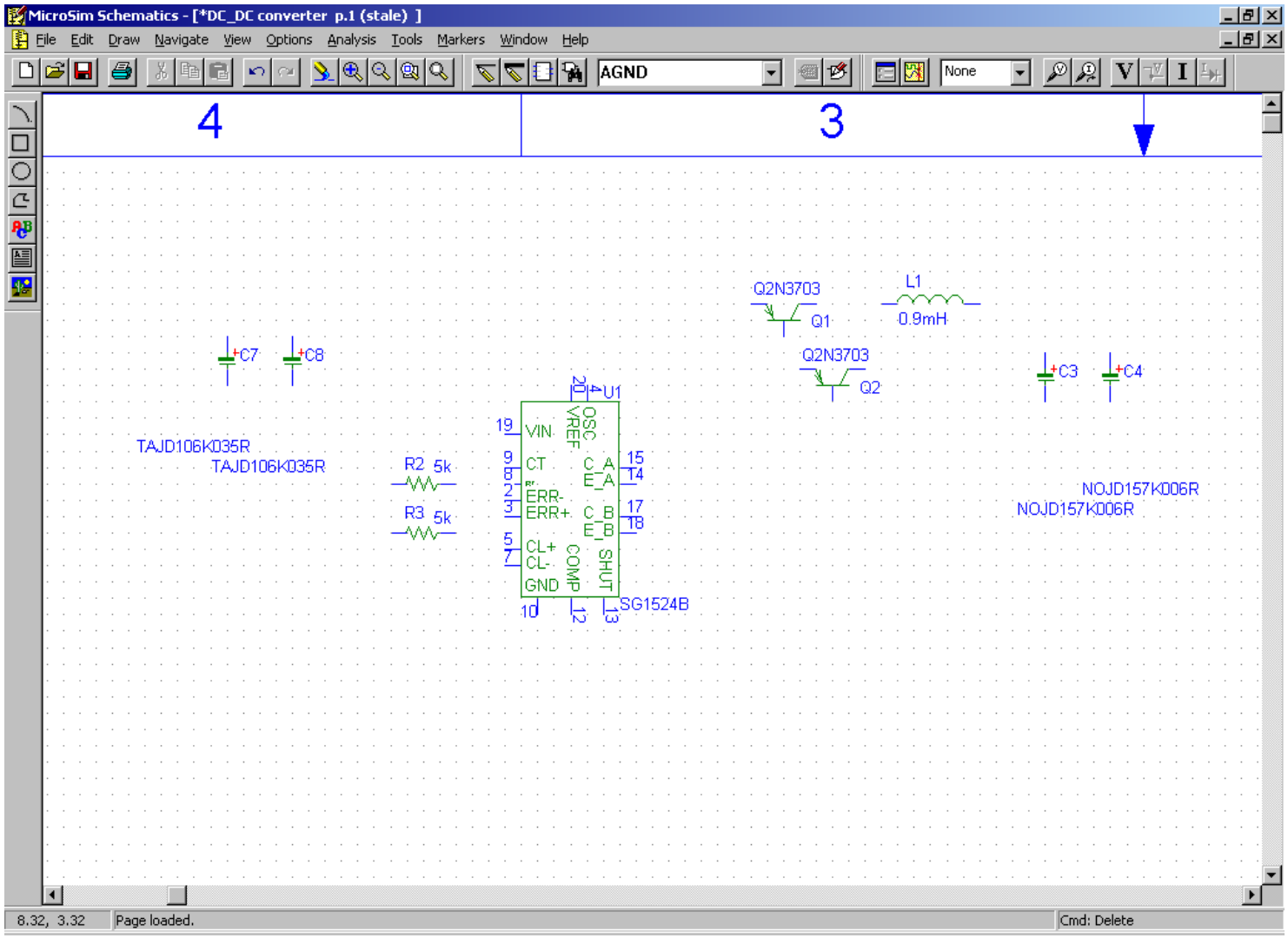
OxiCapTM.slb



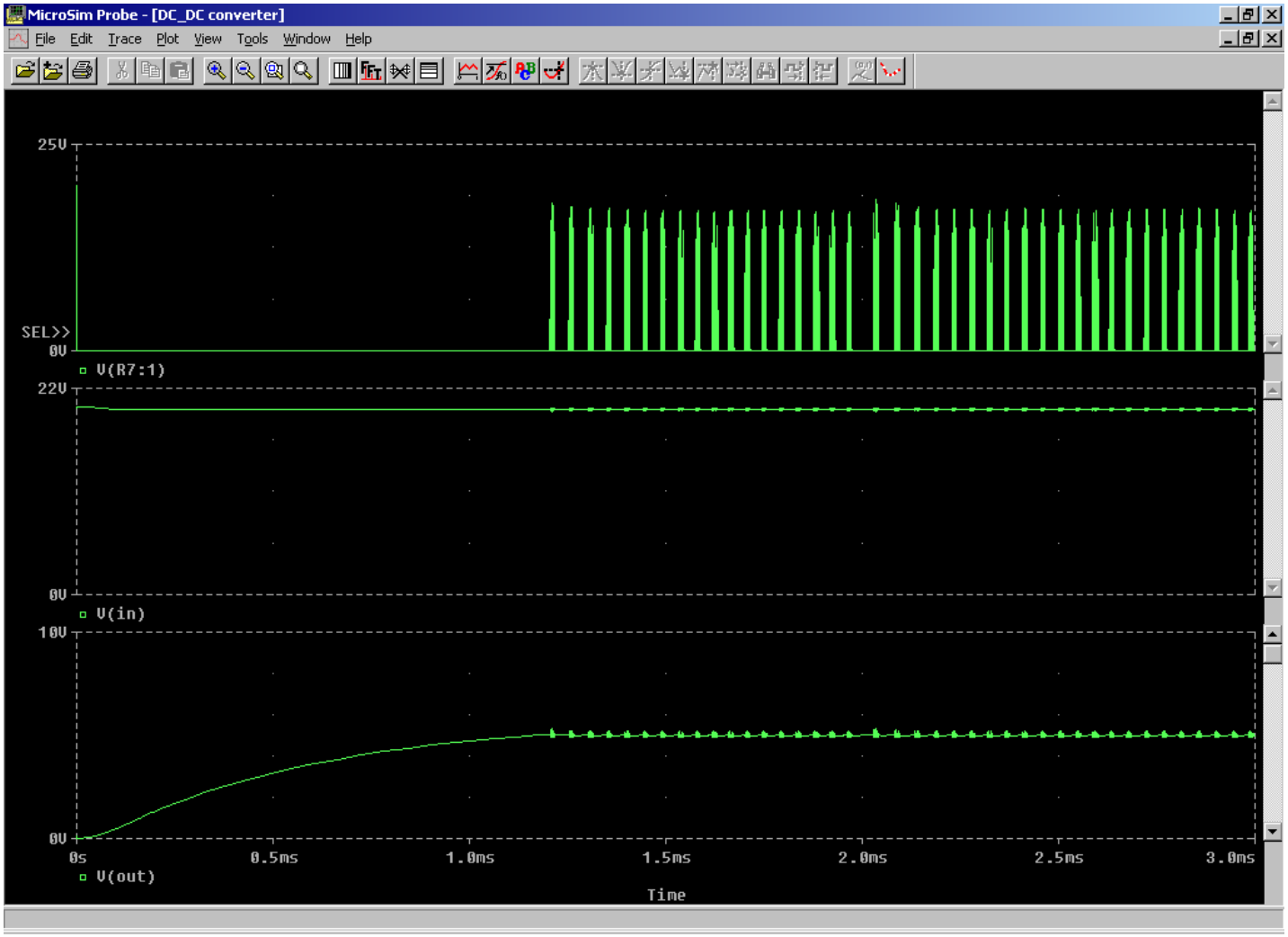
Creation of a circuit diagram



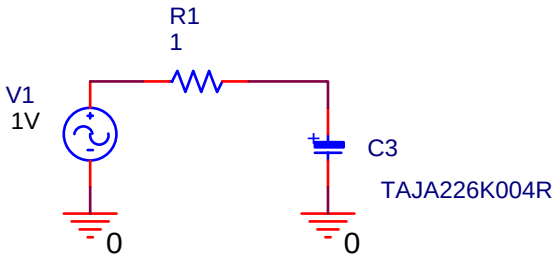
Creation of a circuit diagram



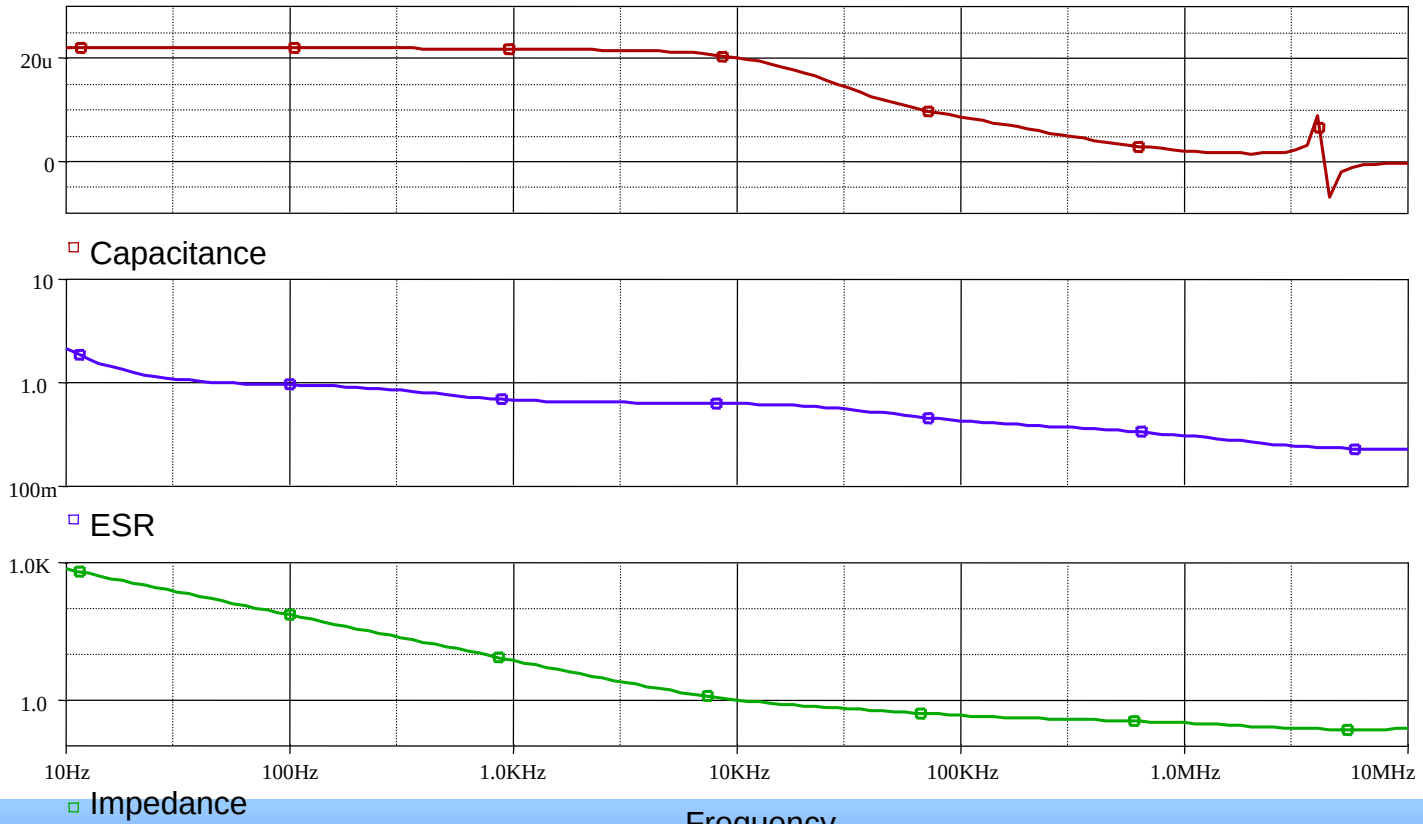
DC/DC converter simulation example



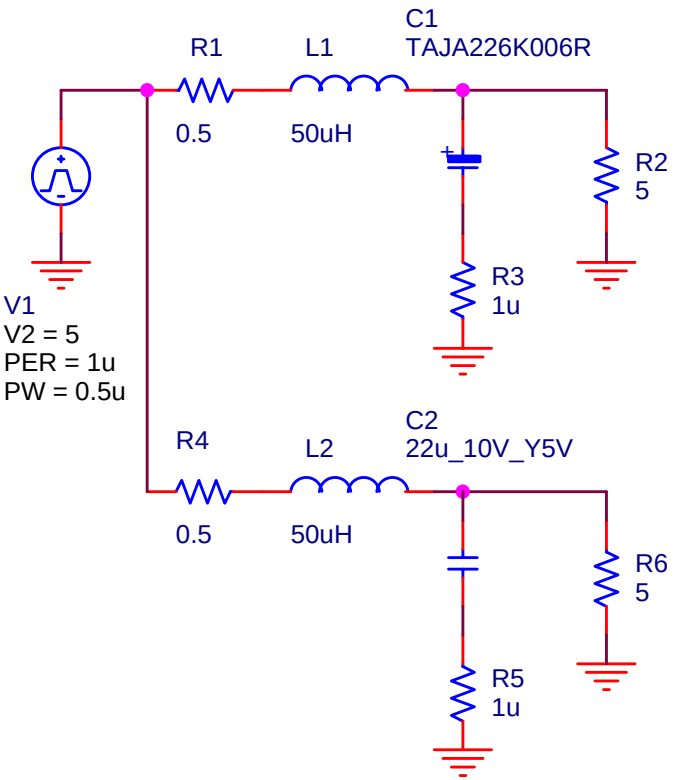
Application example I



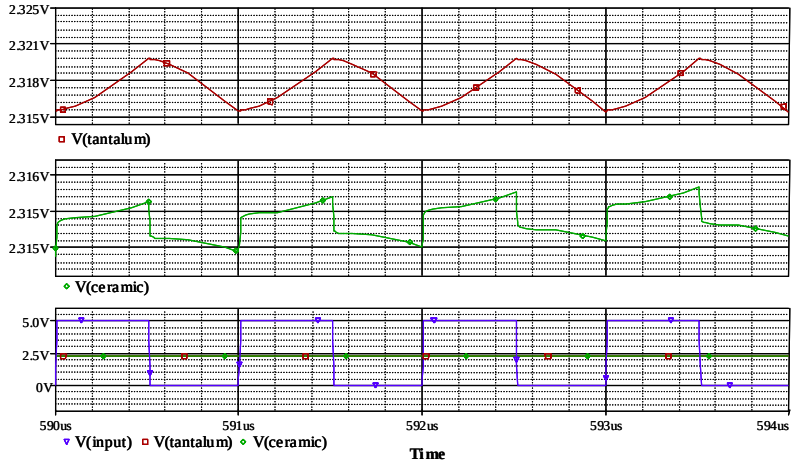
Simulation of Capacitance, ESR and Impedance through frequency range



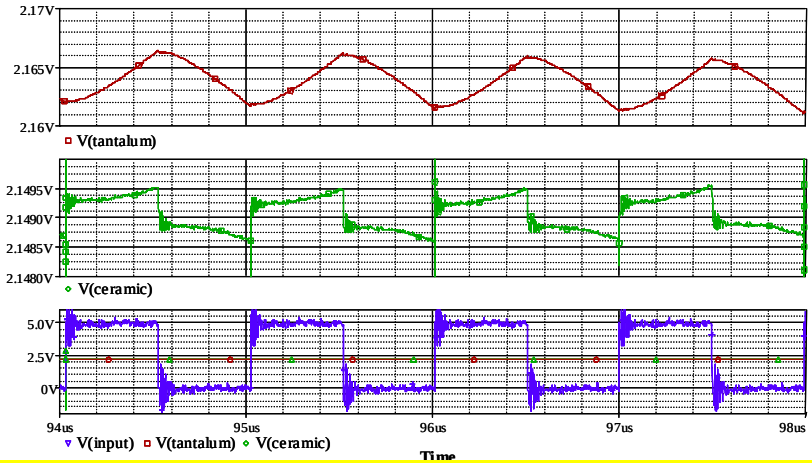
Application example II



Simulation of the output smoothing filter



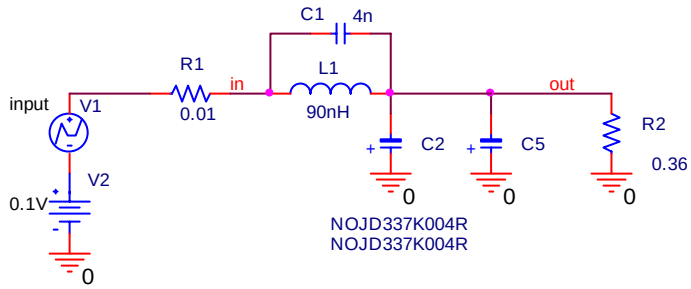
Measurement of the output smoothing filter

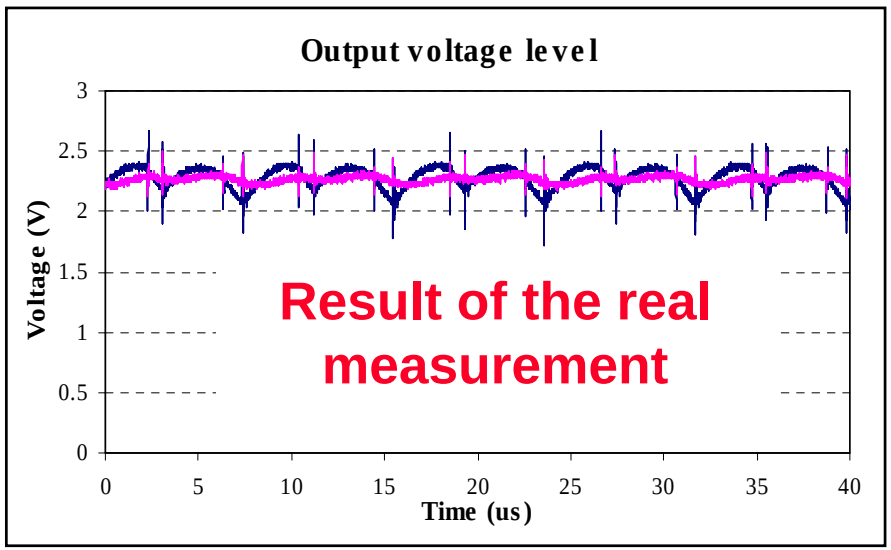


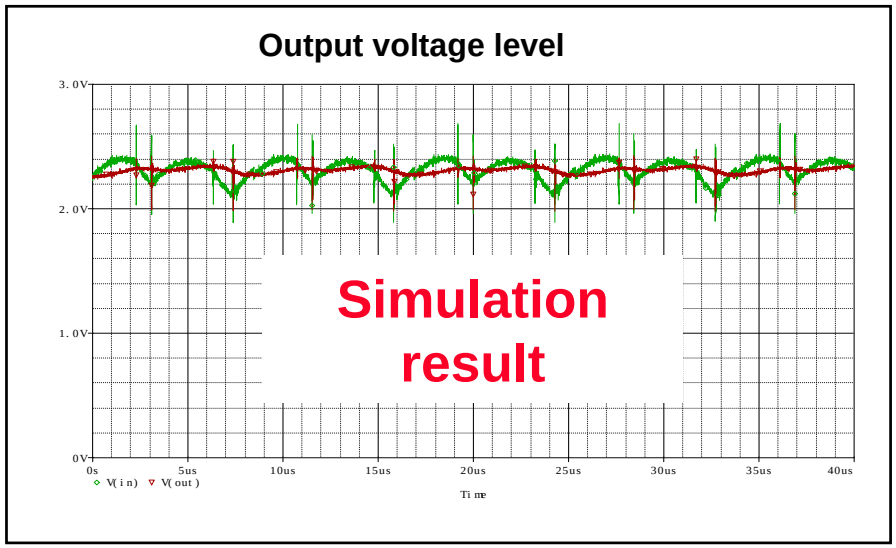
Simulation = Measurement

Application example III

Overloaded DC/DC converter with 2.2V output voltage level

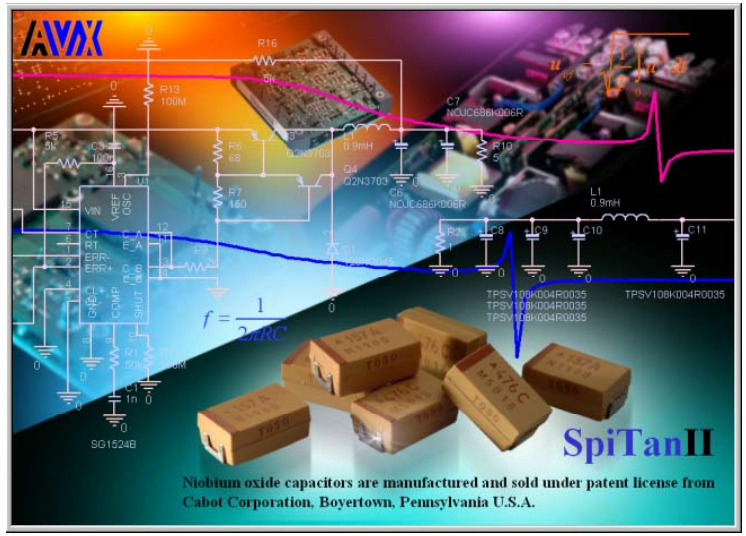






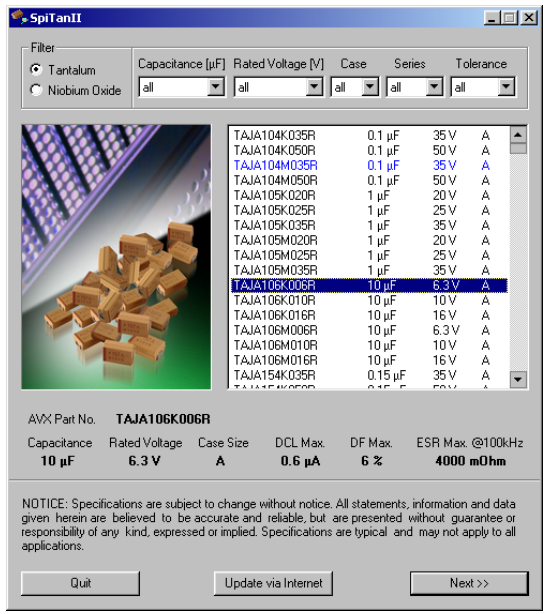
Measurement = Simulation

SpiTanII
preview tool



INPUT PARAMETERS

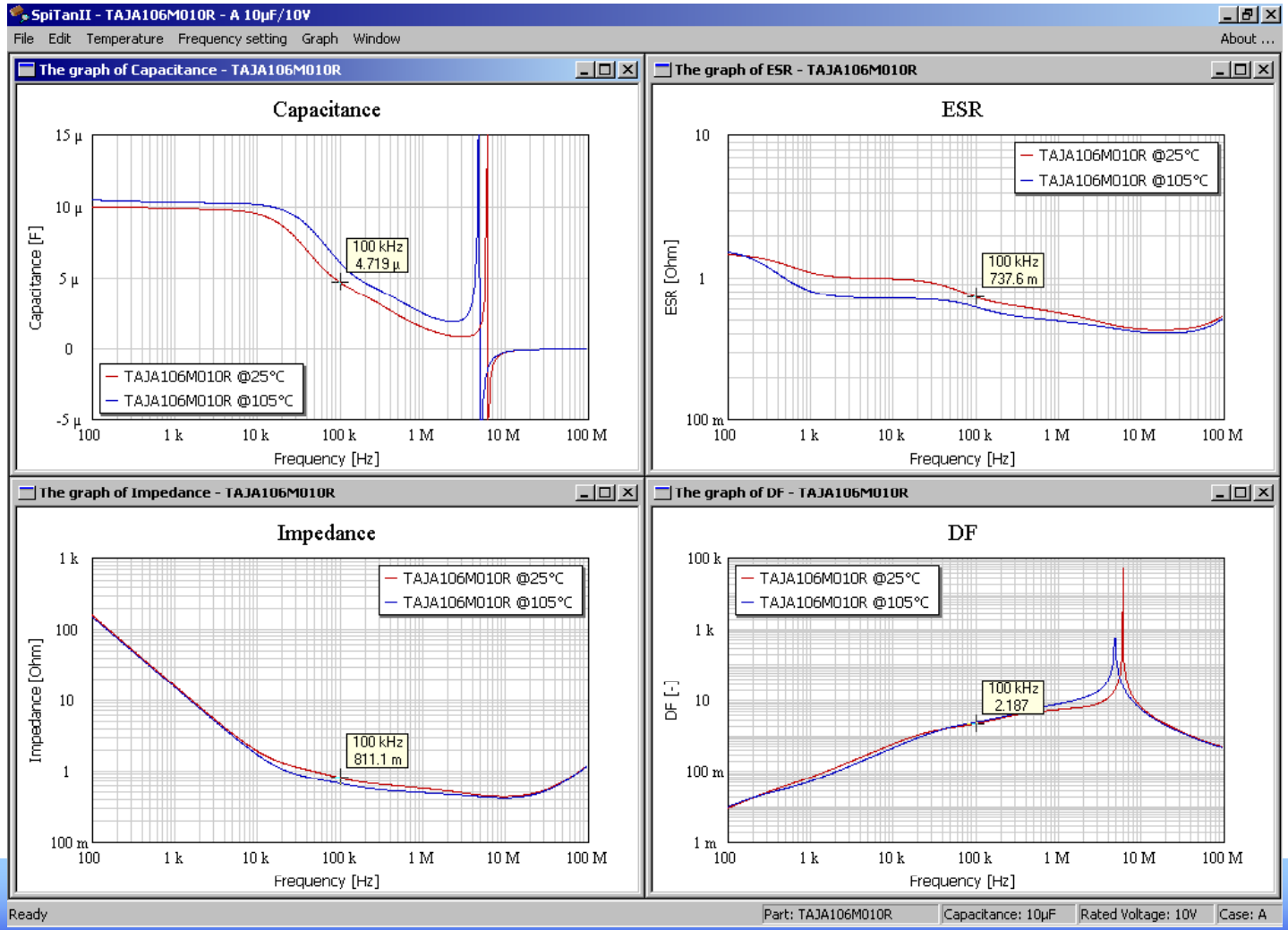
Selected component
-Tantalum capacitor
-Niobium Oxide capacitor



OUTPUT PARAMETERS

-Description of basic parameters
-Capacitance, ESR, Impedance and DF frequency characteristics
-Temperature dependences of those characteristics

Capacitance, ESR, Impedance, DF temperature over frequency



Summary

- Using real world component models in simulation software gives quick and realistic response of simulated circuit diagram

- No needs to use samples at the beginning stage for testing of evaluated PCB

- Every change could be done only by simulation of the circuit diagram

- PCB assembly and measurement could be required only for confirmation of the final functionality