

# Qucs

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## Test Report

SPICE to Qucs conversion: Test File 1

Mike Brinson

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# Introduction

## Title

DC and independent voltage pulse generator test.

## Test file name

## SPICE specification

Format:

**VX N+ N- [[DC] DC/TRAN VALUE] [AC [ACMAG [ACPHASE]]]**

Notes:

1. Characters [ and ] enclose optional items
2. Character / denotes OR
3. Independent voltage source names begin with the letter V
4. X denotes name of source
5. N+ and N- are the positive and negative nodes respectively
6. Voltage sources need not be grounded

Specification of SPICE statement being tested:

**VX N+ N- [[DC] VALUE] [PULSE(V1 V2 [ TD [ TR [ TF [ PW [PER]]]]]]] Notes:**

1. PULSE generates a periodic pulse, where
2. V1 is the initial value; default: must be specified
3. V2 is the pulsed value; default: must be specified
4. TD is the delay time; default value = TSTEP
5. TR is the rise time; default value = TSTEP
6. TF is the fall time; default value = TSTEP
7. PW is the pulse width; default value = TSTOP
8. PER is the period; default value = TSTOP

## Test code and schematic

SPICE code: File S2Q\_test1.cir

```
* SPICE to Qucs syntax test file 1.
* DC and independent voltage pulse sources , plus resistors .
*
.subckt S2Q_test1 p01 p02 p03 p04 p05 p06 p07 p08 p09 p10 p11
v1 p01 0 1v
r1 p01 0 10k
*
v2 p02 0 dc 1v
r2 p02 0 10k
*
v3 p03 0 pulse(0 5)
r3 p03 0 10k
*
v4 p04 0 pulse( 0 5 20n)
r4 p04 0 10k
*
v5 p05 0 pulse(0 5 20n 10n)
r5 p05 0 10k
*
v6 p06 0 pulse(0 5 20n 10n 10n)
r6 p06 0 10k
*
v7 p07 0 pulse(0 5 20n 10n 10n 50n)
r7 p07 0 10k
*
v8 p08 0 pulse(0 5 20n 10n 10n 50n 100n)
r8 p08 0 10k
*
v9 p09 0 pulse(0 5 20n 1n 1n 20n 40n)
r9 p09 0 10k
*
v10 p10 0 pulse(0 5 20n 0.1n 0.1n 5n 50n)
r10 p10 0 10k
*
v11 p11 0 dc 5v pulse(0 5 20n 0.5n 0.5n 10n 20n)
r11 p11 0 10k
.ends
.end
```

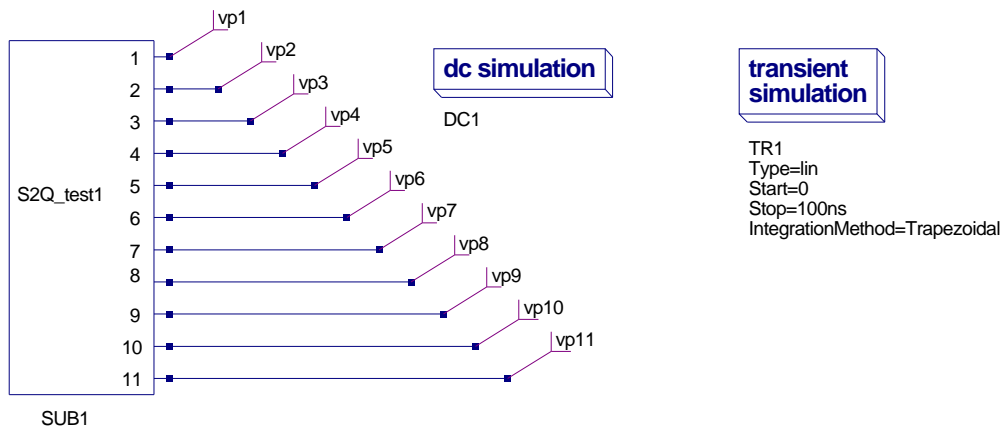


Figure 1: SPICE to Qucs conversion: Test1

## History of simulation results

### March 8 2007, Simulation tests by Mike Brinson

1. Test 1 : Vp1.Vt; Pass correct result.
2. Test 2 : Vp2.Vt; Pass correct result.
3. Test 3 : Vp3.Vt; **Fail** TR and TF should default to TSTEP [TSTEP=1nS in test]
4. Test 4 : Vp4.Vt; **Fail** TR and TF should default to TSTEP [TSTEP=1nS in test]
5. Test 5 : Vp5.Vt; Pass.
6. Test 6 : Vp6.Vt; Pass.
7. Test 7 : Vp7.Vt; Pass.
8. Test 8 : Vp8.Vt; Pass.
9. Test 9 : Vp9.Vt; **Fail** - waveform should repeat after 60ns.
10. Test 10 : Vp10.Vt; **Fail** - waveform should repeat after 70ns.
11. Test 11 : Vp11.Vt; **Fail**
  1. waveform should repeat after 40ns,
  2. Vdc:V11 \_cnet8 \_ref U="0" incorrect,  
should be Vdc:V11 \_cnet8 \_ref U="5"

```

# Qucs 0.0.11 /media/hda2/spice_to_qucs_prj/s2Q(test1).sch

.Def:S2Q_test1 _net0 _net1 _net2 _net3 _net4 _net5 _net6
        _net7 _net8 _net9 _net10
Sub:X1 _net0 _net1 _net2 _net3 _net4 _net5 _net6 _net7
        _net8 _net9 _net10 gnd Type="S2Q_test1_cir"
.Def:End

.Def:S2Q_test1_cir _netP01 _netP02 _netP03 _netP04 _netP05
        _netP06 _netP07 _netP08 _netP09 _netP10 _netP11 _ref
        .Def:S2Q_TEST1 _ref _netP01 _netP02 _netP03 _netP04 _netP05
        _netP06 _netP07 _netP08 _netP09 _netP10 _netP11
Vpulse:V11 _netP11 _cnet8 U1="0" U2="5" T1="20n"
        Tr="0.5n" Tf="0.5n" T2="3.1e-08"
Vpulse:V10 _netP10 _cnet7 U1="0" U2="5" T1="20n"
        Tr="0.1n" Tf="0.1n" T2="2.52e-08"
Vpulse:V9 _netP09 _cnet6 U1="0" U2="5" T1="20n"
        Tr="1n" Tf="1n" T2="4.2e-08"
Vpulse:V8 _netP08 _cnet5 U1="0" U2="5" T1="20n"
        Tr="10n" Tf="10n" T2="9e-08"
Vpulse:V7 _netP07 _cnet4 U1="0" U2="5" T1="20n"
        Tr="10n" Tf="10n" T2="9e-08"
Vpulse:V6 _netP06 _cnet3 U1="0" U2="5" T1="20n"
        Tr="10n" Tf="10n" T2="4e-08"
Vpulse:V5 _netP05 _cnet2 U1="0" U2="5"
        T1="20n" Tr="10n" T2="3e-08"
Vpulse:V4 _netP04 _cnet1 U1="0" U2="5"
        T1="20n" T2="2e-08"
Vpulse:V3 _netP03 _cnet0 U1="0"
        U2="5" T2="0" T1="0"
Vdc:V1 _netP01 _ref U="1V"
R:R1 _netP01 _ref R="10k"
Vdc:V2 _netP02 _ref U="1V"
R:R2 _netP02 _ref R="10k"
Vdc:V3 _cnet0 _ref U="0"
R:R3 _netP03 _ref R="10k"
Vdc:V4 _cnet1 _ref U="0"
R:R4 _netP04 _ref R="10k"
Vdc:V5 _cnet2 _ref U="0"
R:R5 _netP05 _ref R="10k"
Vdc:V6 _cnet3 _ref U="0"
R:R6 _netP06 _ref R="10k"
Vdc:V7 _cnet4 _ref U="0"
R:R7 _netP07 _ref R="10k"
Vdc:V8 _cnet5 _ref U="0"
R:R8 _netP08 _ref R="10k"
Vdc:V9 _cnet6 _ref U="0"
R:R9 _netP09 _ref R="10k"
Vdc:V10 _cnet7 _ref U="0"
R:R10 _netP10 _ref R="10k"
Vdc:V11 _cnet8 _ref U="0"
R:R11 _netP11 _ref R="10k"
        .Def:End
Sub:X1 _ref _netP01 _netP02 _netP03 _netP04 _netP05
        _netP06 _netP07 _netP08 _netP09 _netP10 _netP11 Type="S2Q_TEST1"
.Def:End

.DC:DC1 Temp="26.85" reltol="0.001" abstol="1_pA" vntol="1_uV"
saveOPs="no" MaxIter="150" saveAll="no" convHelper="none" Solver="CroutLU"
Sub:SUB1 vp1 vp2 vp3 vp4 vp5 vp6 vp7 vp8 vp9 vp10 vp11 Type="S2Q_test1"
.TR:TR1 Type="lin" Start="0" Stop="100ns" Points="500"
IntegrationMethod="Trapezoidal" Order="2" InitialStep="1_ns"
MinStep="1e-16" MaxIter="150" reltol="0.001" abstol="1_pA"
vntol="1_uV" Temp="26.85" LTEreltol="1e-3" LTEabstol="1e-6" LTEfactor="1"
Solver="CroutLU" relaxTSR="no" initialDC="yes" MaxStep="0"

```

Figure 2: Qucs netlist [Edited to fit on page width]

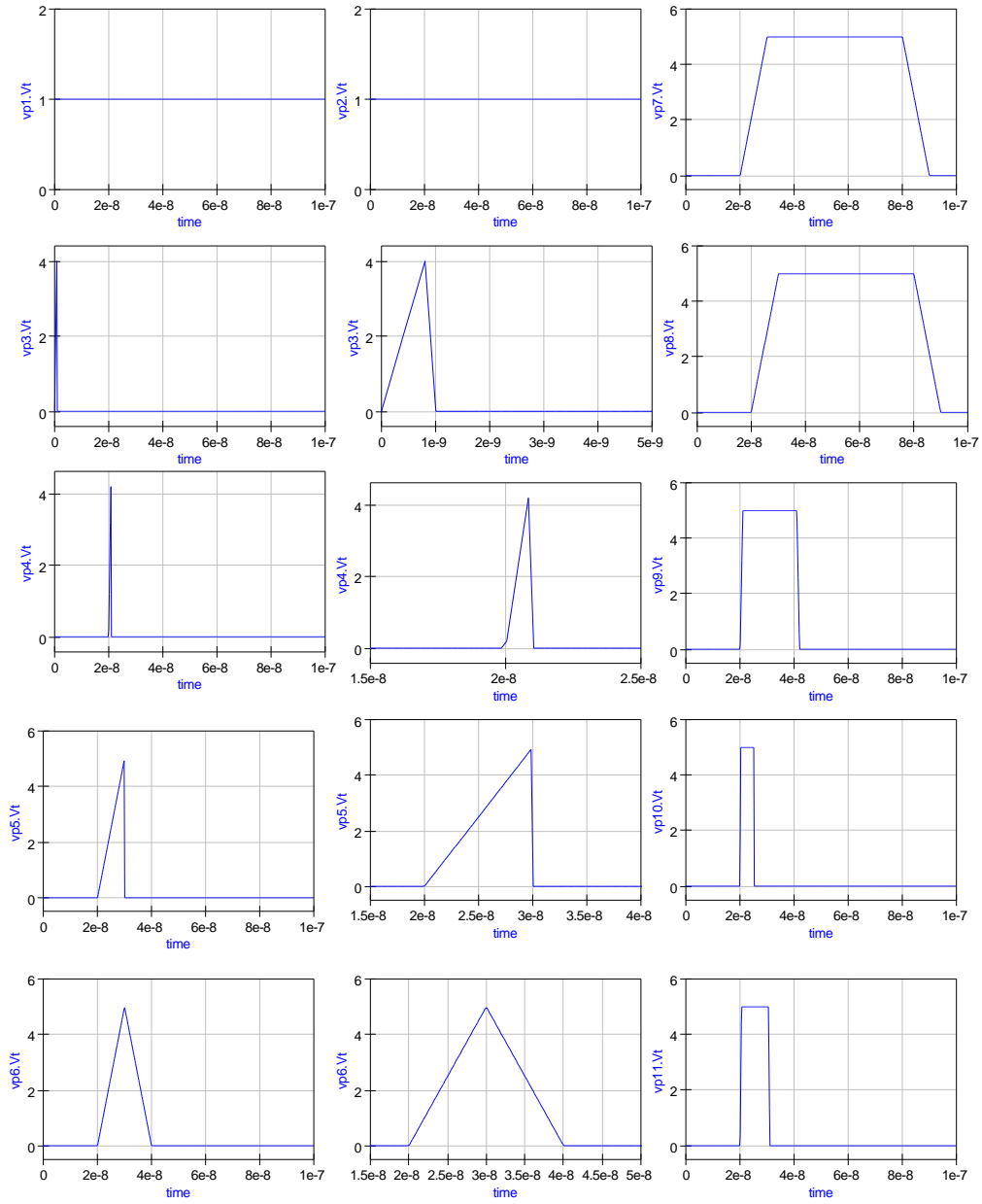


Figure 3: SPICE to Qucs conversion: Test1 simulation waveforms

## March 10 2007, Simulation tests by Mike Brinson

Code modified \* `check_spice.cpp`: Handling periodic pulse sources correctly. Also default Tr/Tf values for these sources to a given .TRAN step value : Stefan Jahn.

Restriction on SPICE code:  $TD + TR + PW + TF < PER$ , otherwise a negative TL time for the repetitive pulse occurs and simulation fails.

SPICE test file `S2Q_test1.cir` modified: Mike Brinson

1. Test 1 : Vp1.Vt; Pass.
2. Test 2 : Vp2.Vt; Pass.
3. Test 3 : Vp3.Vt; Pass
4. Test 4 : Vp4.Vt; Pass
5. Test 5 : Vp5.Vt; Pass.
6. Test 6 : Vp6.Vt; Pass.
7. Test 7 : Vp7.Vt; Pass.
8. Test 8 : Vp8.Vt; Pass.
9. Test 9 : Vp9.Vt; Pass.
10. Test 10 : Vp10.Vt; Pass.
11. Test 11 : Vp11.Vt; Pass

```

* SPICE to Qucs syntax test file 1.
* DC and independent voltage pulse sources , plus resistors .
*
.subckt S2Q_test1 p01 p02 p03 p04 p05 p06 p07 p08 p09 p10 p11
v1 p01 0 1v
r1 p01 0 10k
*
v2 p02 0 dc 1v
r2 p02 0 10k
*
v3 p03 0 pulse(0 5)
r3 p03 0 10k
*
v4 p04 0 pulse( 0 5 20n)
r4 p04 0 10k
*
v5 p05 0 pulse(0 5 20n 10n)
r5 p05 0 10k
*
v6 p06 0 pulse(0 5 20n 10n 10n)
r6 p06 0 10k
*
v7 p07 0 pulse(0 5 20n 10n 10n 50n)
r7 p07 0 10k
*
v8 p08 0 pulse(0 5 20n 10n 10n 50n 100n)
r8 p08 0 10k
*
v9 p09 0 pulse(0 5 10n 1n 1n 20n 40n)
r9 p09 0 10k
*
v10 p10 0 pulse(0 5 20n 0.1n 0.1n 5n 50n)
r10 p10 0 10k
*
v11 p11 0 dc 5v pulse(-3 5 20n 0.5n 0.5n 10n 40n)
r11 p11 0 10k
.ends
.end

```

Figure 4: Modified SPICE test1 netlist



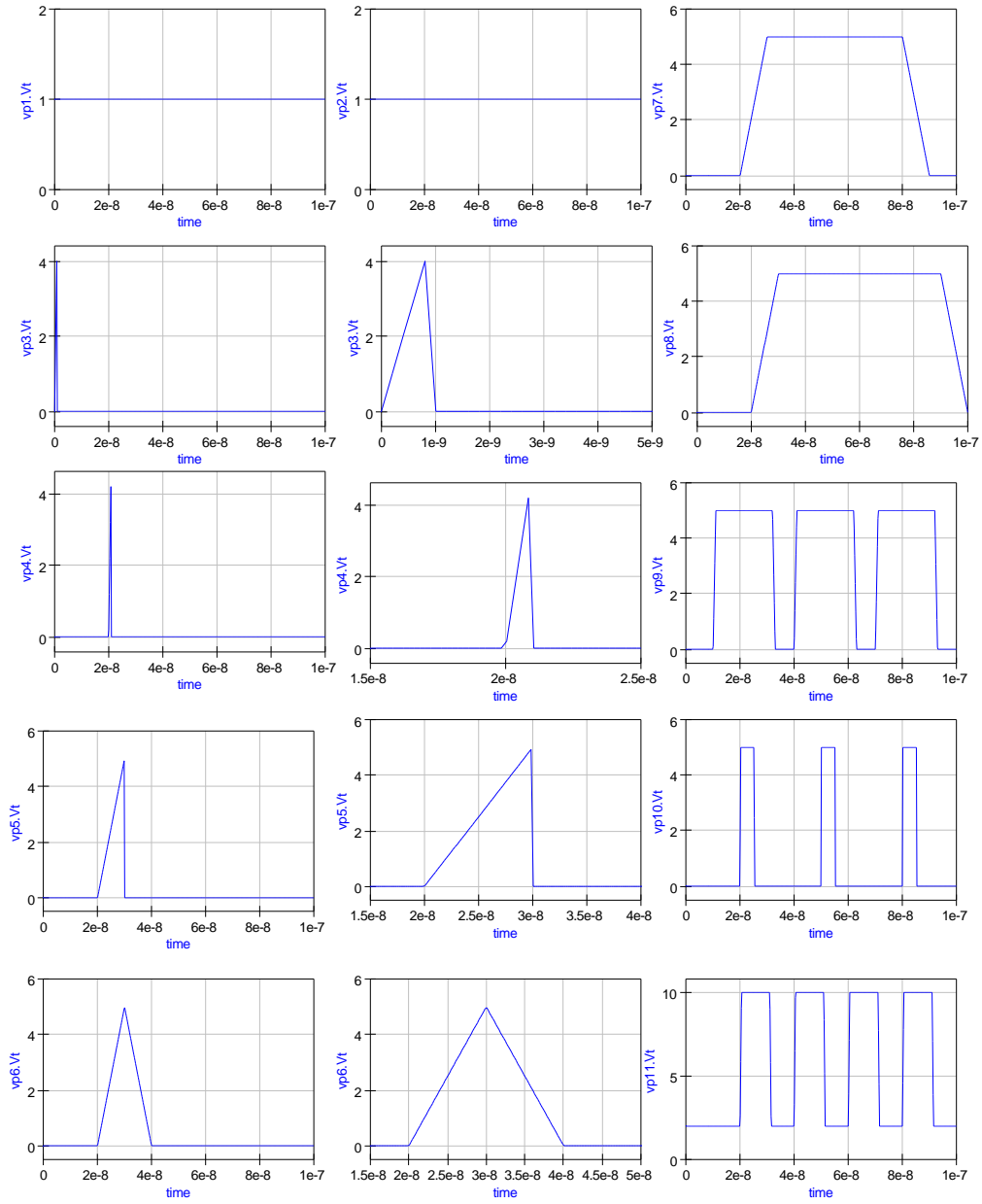


Figure 5: SPICE to Qucs conversion: Modified test1 simulation waveforms

```

# Qucs 0.0.11 /media/hda2/spice_to_qucs_prj/s2Q(test1).sch

.Def:S2Q_test1 _net0 _net5 _net1 _net6 _net2 _net7 _net3
_net8 _net4 _net9 _net10
Sub:X1 _net0 _net5 _net1 _net6 _net2 _net7 _net3 _net8
_net4 _net9 _net10 gnd Type="S2Q_test1_cir"
.Def:End

.Def:S2Q_test1_cir _netP01 _netP02 _netP03 _netP04 _netP05
_netP06 _netP07 _netP08 _netP09 _netP10 _netP11 _ref
.Def:S2Q_TEST1 _ref _netP01 _netP02 _netP03 _netP04
_netP05 _netP06 _netP07 _netP08 _netP09 _netP10 _netP11
Vrect:V11 _netP11 _cnet8 U="8" Td="20n" Tr="0.5n" Tf="0.5n" TH="1.1e-08" TL="9e-09"
Vrect:V10 _netP10 _cnet7 U="5" Td="20n" Tr="0.1n" Tf="0.1n" TH="5.2e-09" TL="2.48e-08"
Vrect:V9 _netP09 _cnet6 U="5" Td="10n" Tr="1n" Tf="1n" TH="2.2e-08" TL="8e-09"
Vrect:V8 _netP08 _cnet5 U="5" Td="20n" Tr="10n" Tf="10n" TH="7e-08" TL="1e-08"
Vpulse:V7 _netP07 _cnet4 U1="0" U2="5" T1="20n" Tr="10n" Tf="10n" T2="9e-08"
Vpulse:V6 _netP06 _cnet3 U1="0" U2="5" T1="20n" Tr="10n" Tf="10n" T2="4e-08"
Vpulse:V5 _netP05 _cnet2 U1="0" U2="5" T1="20n" Tr="10n" T2="3e-08"
Vpulse:V4 _netP04 _cnet1 U1="0" U2="5" T1="20n" T2="2e-08"
Vpulse:V3 _netP03 _cnet0 U1="0" U2="5" T2="0" T1="0"
Vdc:V1 _netP01 _ref U="1V"
R:R1 _netP01 _ref R="10k"
Vdc:V2 _netP02 _ref U="1V"
R:R2 _netP02 _ref R="10k"
Vdc:V3 _cnet0 _ref U="0"
R:R3 _netP03 _ref R="10k"
Vdc:V4 _cnet1 _ref U="0"
R:R4 _netP04 _ref R="10k"
Vdc:V5 _cnet2 _ref U="0"
R:R5 _netP05 _ref R="10k"
Vdc:V6 _cnet3 _ref U="0"
R:R6 _netP06 _ref R="10k"
Vdc:V7 _cnet4 _ref U="0"
R:R7 _netP07 _ref R="10k"
Vdc:V8 _cnet5 _ref U="0"
R:R8 _netP08 _ref R="10k"
Vdc:V9 _cnet6 _ref U="0"
R:R9 _netP09 _ref R="10k"
Vdc:V10 _cnet7 _ref U="0"
R:R10 _netP10 _ref R="10k"
Vdc:V11 _cnet8 _ref U="2"
R:R11 _netP11 _ref R="10k"
.Def:End
Sub:X1 _ref _netP01 _netP02 _netP03 _netP04 _netP05 _netP06
_netP07 _netP08 _netP09 _netP10 _netP11 Type="S2Q_TEST1"
.Def:End

.DC:DC1 Temp="26.85" reltol="0.001" abstol="1_pA" vntol="1_uV"
saveOPs="no" MaxIter="150" saveAll="no" convHelper="none" Solver="CroutLU"
.TR:TR1 Type="lin" Start="0" Stop="100ns" Points="500"
IntegrationMethod="Trapezoidal" Order="2" InitialStep="1_μs"
MinStep="1e-16" MaxIter="150" reltol="0.001" abstol="1_pA"
vntol="1_uV" Temp="26.85" LTEreltol="1e-3" LTEabstol="1e-6"
LTEfactor="1" Solver="CroutLU" relaxTSR="no" initialDC="yes" MaxStep="0"
Sub:SUB1 vp1 vp2 vp3 vp4 vp5 vp6 vp7 vp8 vp9 vp10 vp11 Type="S2Q_test1"

```

Figure 6: Qucs netlist for modified test1 SPICE netlist [Edited to fit on page width]

## References

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3. Andrei Vladimirescu, THE SPICE book,1994, John Wiley and Sons. Inc., ISBN 0-471-609-26-9.