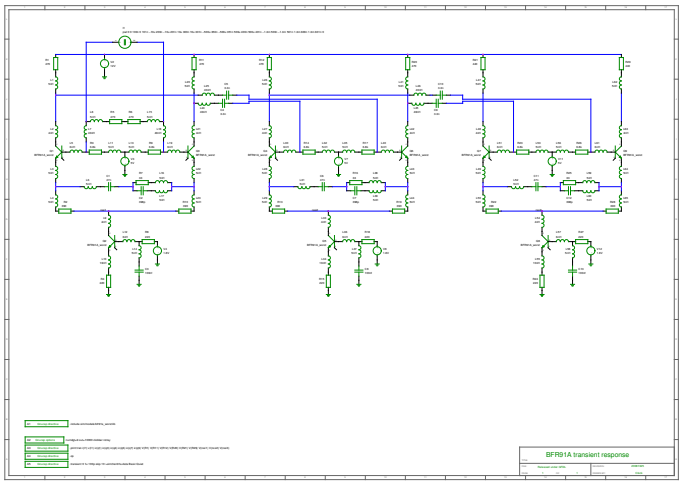

.model BFR91A_sp1 NPN( Is=14.34f Xti=3 Eg=1.11 Vaf=74.03 Bf=144.9 Ne=1.307 Ise=14.34f Ikf=0.4 Xtb=1.5 Br=4.092 Nc=2 Isc=0 Ikr=0 Rc=1.5 Cjc=2.2p Mjc=0.3333 Vjc=0.65 Fc=0.5 Cje=2.5p Mje=0.3333 Vje=0.65 Tr=1n Tf=17.47p Itf=0.4 Vtf=2 Xtf=3 Rb=10 Irb=1m Rbm=5 Re=0.6 Ptf=0 Xcjc=0.5 Cjs=0 Vjs=0.75 Mjs=0.333 Fe=0.5 Vceo=20 Icrating=50m mfg=Philips )

| | | |
|---|---|---|
| Vin | Sinusoidal Waveform | amplitude=0.5 frequency=1k offset=0 phase=0 delay=0 damping=0 |
| Vcc | Sinusoidal Waveform | amplitude=12 frequency=1k offset=0 phase=0 delay=0 damping=0 |
| Vbb | Sinusoidal Waveform | amplitude=0.75 frequency=1k offset=0 phase=0 delay=0 damping=0 |
| Vbb1 | Sinusoidal Waveform | amplitude=0.75 frequency=1k offset=0 phase=0 delay=0 damping=0 |
| Vbb2 | Sinusoidal Waveform | amplitude=0.75 frequency=1k offset=0 phase=0 delay=0 damping=0 |

.tran 0 5m 0 1u uic

.options gmin=1e-12 abstol=1e-12 vntol=1e-6 reltol=0.001 rshunt=1e12 itl1=200 itl2=100 itl4=20 maxord=2 method=gear

.model BFR91A_sp1 NPN( Is=14.34f Xti=3 Eg=1.11 Vaf=74.03 Bf=144.9 Ne=1.307 Ise=14.34f Ikf=0.4 Xtb=1.5 Br=4.092 Nc=2 Isc=0 Ikr=0 Rc=1.5 Cjc=2.2p Mjc=0.3333 Vjc=0.65 Fc=0.5 Cje=2.5p Mje=0.3333 Vje=0.65 Tr=1n Tf=17.47p Itf=0.4 Vtf=2 Xtf=3 Rb=10 Irb=1m Rbm=5 Re=0.6 Ptf=0 Xcjc=0.5 Cjs=0 Vjs=0.75 Mjs=0.333 Fe=0.5 Vceo=20 Icrating=50m mfg=Philips )

.model BFR91A_sp1 NPN( Is=14.34f Xti=3 Eg=1.11 Vaf=74.03 Bf=144.9 Ne=1.307 Ise=14.34f Ikf=0.4 Xtb=1.5 Br=4.092 Nc=2 Isc=0 Ikr=0 Rc=1.5 Cjc=2.2p Mjc=0.3333 Vjc=0.65 Fc=0.5 Cje=2.5p Mje=0.3333 Vje=0.65 Tr=1n Tf=17.47p Itf=0.4 Vtf=2 Xtf=3 Rb=10 Irb=1m Rbm=5 Re=0.6 Ptf=0 Xcjc=0.5 Cjs=0 Vjs=0.75 Mjs=0.333 Fe=0.5 Vceo=20 Icrating=50m mfg=Philips )

.model BFR91A_sp1 NPN( Is=14.34f Xti=3 Eg=1.11 Vaf=74.03 Bf=144.9 Ne=1.307 Ise=14.34f Ikf=0.4 Xtb=1.5 Br=4.092 Nc=2 Isc=0 Ikr=0 Rc=1.5 Cjc=2.2p Mjc=0.3333 Vjc=0.65 Fc=0.5 Cje=2.5p Mje=0.3333 Vje=0.65 Tr=1n Tf=17.47p Itf=0.4 Vtf=2 Xtf=3 Rb=10 Irb=1m Rbm=5 Re=0.6 Ptf=0 Xcjc=0.5 Cjs=0 Vjs=0.75 Mjs=0.333 Fe=0.5 Vceo=20 Icrating=50m mfg=Philips )

# BFR91A transient response

| | |
|---|---|
| Title | |
| Size: A4 | Document Number: Rev: 1.0 |
| Date: Tuesday, January 20, 2026 | Sheet: 1 of 1 |
| File: C:\Users\Documents\Circuits\BFR91A_Transient.sch | Drawn By: Circuit Designer |