



Note:  
R13 and R14 are not part of modification;Don't use they are there only for circuit simulation(contact loads)

Recommended Design Changes, see new circuit:  
Advantages reduced component count PCB footprint smaller,fewer components  
power savings and only one power buss (12Volts)

Remove U1 regulator  
Remove C3 ,C5,R2  
Replace D1 with 12 volt zener  
Replace both 2.2k (R3 & R4) with 5k 5 watt or 3watt resistors  
Replace R1 with two 75k ohm 1/4watt resistors

```
.include power456_ltpice.lib ; HALF_VM + more
.include application.lib
.MODEL tip50 npn
+IS=1.56416e-15 BF=355.152 NF=0.851039 VAF=10
+IKF=0.0598553 ISE=1.24328e-10 NE=1.62606 BR=8.8702
+NR=0.806933 VAR=100 IKR=0.0653249 ISC=1e-16
+NC=1.06812 RB=1.50732 IRB=0.282371 RBM=0.1
+RE=0.000224288 RC=0.00112144 XTB=2.17854 XTI=4
+EG=1.206 CJE=2.62149e-09 VJE=0.659822 MJE=0.332313
+TF=4.71747e-09 XTF=1.5 VTF=0.999973 ITF=1.00001
+CJC=2.99337e-10 VJC=0.599874 MJC=0.410554 XCJC=0.8
+FC=0.524161 CJS=0 VJS=0.75 MJS=0.5
+TR=1e-07 PTF=0 KF=0 AF=1
* Model generated on Dec 22, 2003
* Model format: SPICE3
```