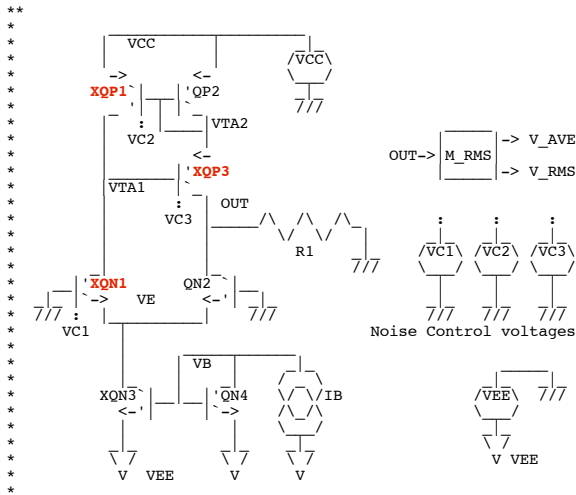


PWL_Noise_OTA



```

.OPTIONS GMIN=1e-12 METHOD=trap srcsteps = 100 gminsteps = 1
.OPTIONS ITL1=400 ITL6=100
-----
VCC VCC 0 DC 2
VEE 0 VEE DC 2
IB1 VE 0 DC 1u
XQN1 VTA1 0 VE VC1 XQN1X
QN2 OUT 0 VE NPN1 1.00

XQP1 VTA1 VTA2 VCC VC2 XQP1X
QP2 VTA2 VTA2 VCC PNP1 1
XQP3 OUT VTA1 VTA2 VC3 XQP1X
R1 OUT 0 1
VC1 VC1 0 DC 1
VC2 VC2 0 DC 0
VC3 VC3 0 DC 0
C1 VTA1 0 10pf

Vstart VS 0 Pulse (0 1 1m 1n 1n 10s 20s)
B2 OUT2 0 V = v(OUT)*v(VS)+1p
XM_RMS OUT2 V_AVE V_RMS M_RMS
.tran 5u 50m 0 5u UIC
    
```

****#0====All_Matched_Transistors_In_An_OTA_Add_Noise====**

.control

****#1====First_Observe_Noise_IN_XQN1_Alone=====**

```

run
plot out2 v_ave v_rms ylimit -.5n .5n title QN1
    
```

****#2====Next_Observe_Noise_IN_XQP1_Alone=====**

```

alter vc1 dc = 0
alter vc2 dc = 1
run
plot out2 v_ave v_rms ylimit -.5n .5n title QP1
    
```

****#2====Last_Observe_Noise_IN_XQP3_Alone=====**

```

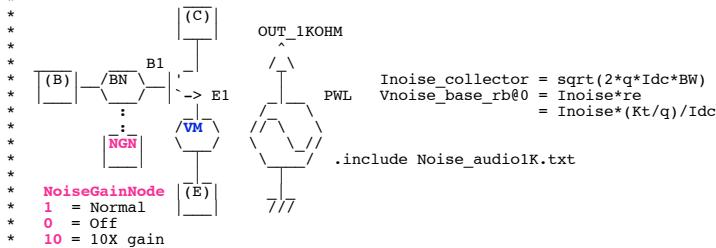
alter vc2 dc = 0
alter vc3 dc = 1
run
plot out2 v_ave v_rms ylimit -.5n .5n title QP3
.endc
    
```

***==== .models Using Near Perfect Transistors =====**

```

.model NPN1 NPN( BF = 1MEG VAF = 1MEG )
.model PNP1 PNP( BF = 1MEG VAF = 1MEG )
    
```

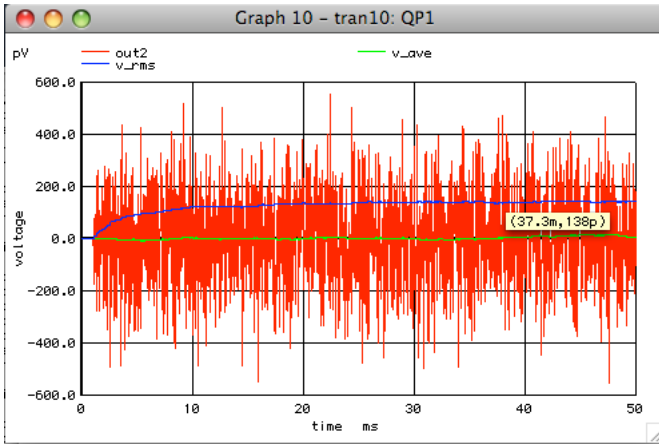
***==== .SUBCKT XQN1X Models Audio Noise to NPN current =====**




```

alter      vc1          dc = 0
alter      vc2          dc = 1
run
plot      out2 v_ave v_rms ylimit -.5n .5n title QP1

```

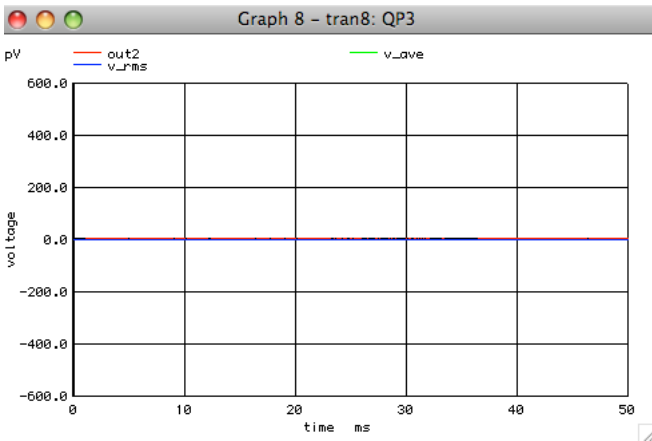


***#3=====Last_Observe_Noise_IN_XQP3_Alone=====

```

alter      vc2          dc = 0
alter      vc3          dc = 1
run
plot      out2 v_ave v_rms ylimit -.5n .5n title QP3

```



**Only the matched pairs add noise
 In the LM3080 architecture,
 eight transistors all add equal shot noise.**

