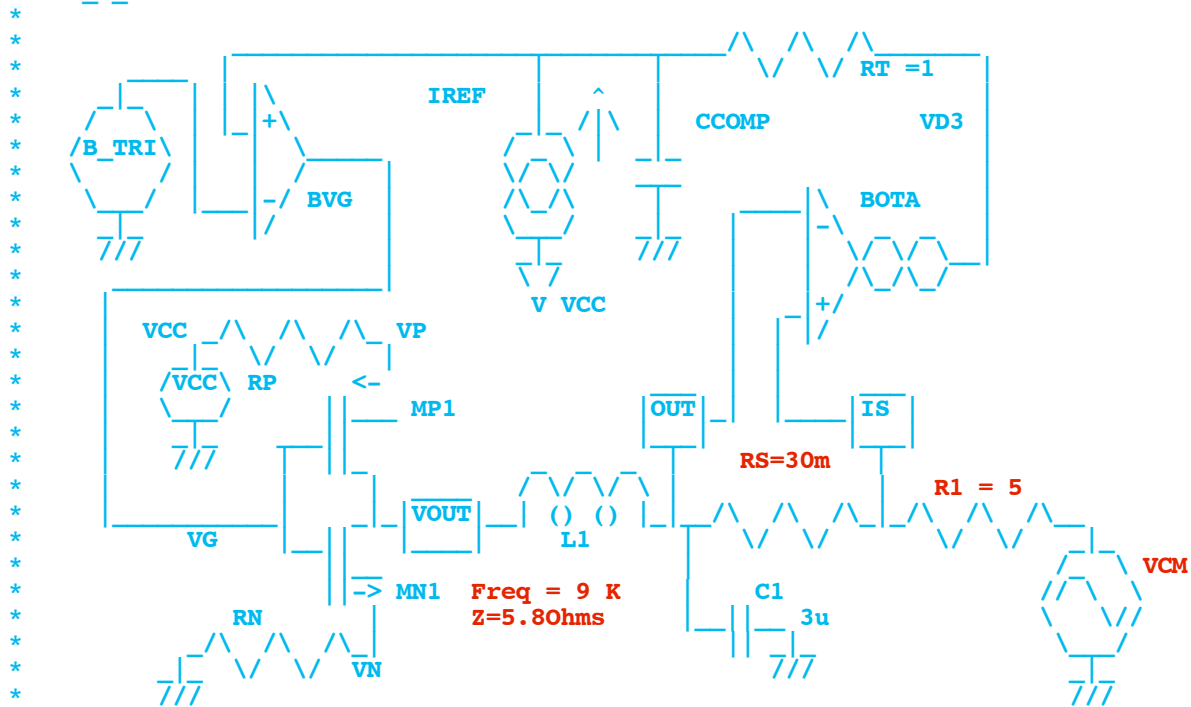


***=====Class_D_Current_Sources=====**

One common application for a Class D output stage is to drive LEDs. But keeping output current constant does require some feedback, and Class D output stages provide some stability challenges when used in feedback.

This feedback example is limited to an open loop gain of 100 in the feedback loop. A high feedback loop makes it possible to keep the voltage across **RL constant**. To check this, a **1volt peak to peak 50Hz** signal is applied to **VCM**.

CLASS_D_CurrentSource



```

.OPTIONS GMIN=1p          METHOD=trap    ABSTOL=1u      TEMP=27      srcsteps = 1  gminsteps = 1
.OPTIONS RELTOL=.001     ABSTOL=1n     VNTOL=1u      ITL4=500    ITL1=400
*=====Create_Signal=====
VT          VT          0          DC          0          PWL( 0      0      1      1)
Vfreq      Vfreq      0          DC          100k
B_TRI      TRI         0          V =        acos( cos(6.283185*V(VFreq)*V(VT)) )/3.141592
IREF       VCC         VD         .15u
CCOMP      VD          0          30p        IC=.5
VB         VB          0          DC          .5
RB         VD          VBS        96000k
RBS        VBS        VB         1
RT         VD3        VD         1
B_OTA      VD3         0          I          =1u*tanh((tanh(V(OUT)-V(IS))*10)*1)
B_VD2      VD2        0          V          =tanh(u(v(VD))*v(VD) )
B_VG       VG         0          V =        5*u( v(TRI) -v(VD2))
VCC        VCC         0          DC          5
RP         VCC         VP         1u
RN         VN          0          1u
MN1        VOUT       VG         VN          0          NMOSC    W=90000u    L=1u
MP1        VOUT       VG         VP         VCC       PMOSC    W=90000u    L=1u
L1         VOUT       OUT        100u
C1         OUT        0          3u
RS         OUT       IS         30m
Rout       IS         VCM        5
VCM        VCM        0          DC          0          SIN( .5      .5      50      )

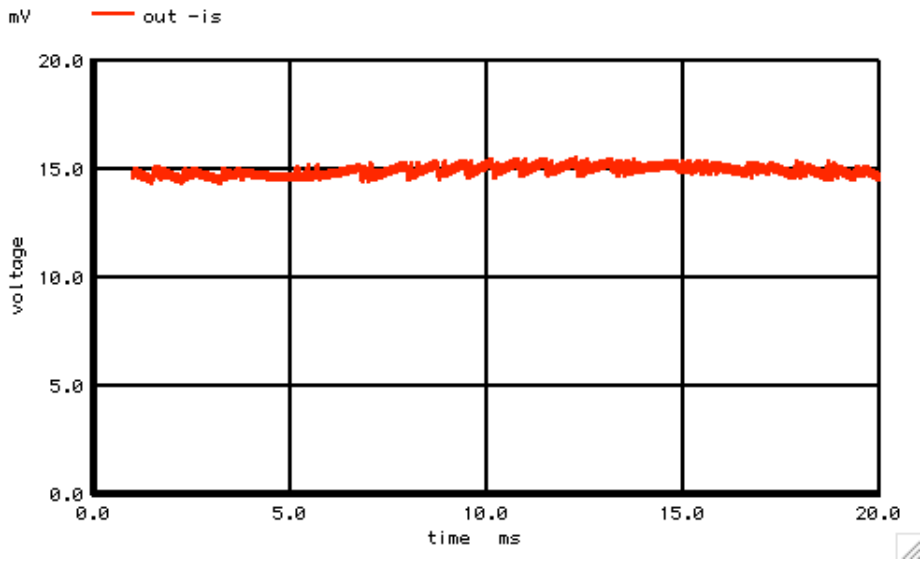
```

```

*TRAN      TSTEP  TSTOP  TSTART TMAX   ?UIC?
.tran      .1u    20m    1m     .1u   UIC
*=====The CMOS Model Files=====
.model    NMOSC          NMOS(Level= 1 Cbs=2f Cbd=2f)
.model    PMOSC          PMOS(Level= 1 Cbs=2f Cbd=2f)
.model    DD              D(      IS=3.15e-18 )
.control
run
set       pensize = 2
plot     out -is ylimit 0 20m

```

A 30mOhm value is being used for RS, and the intention is to maintain a 500mA current through it.



```

let      iota  = mean(vd-vd3)
let      irb   = mean(vbs-vb)
let      ivdt  = iota + irb
let      vdave = mean(vd)
let      vd2ave = mean(vd2)
plot     vcm    out
echo     "iota =${iota} irb =${irb} ivdt =${ivdt} vdave =${vdave} vd2ave =${vd2ave}  "
.endc
.end

```

LEDs need to be more current source driven. It is nice to be able to do this at a high power efficiency.


```

B_VD2    VD2    0    V    = tanh(u(v(VD)))*v(VD) )
BVG      VG     0    V =   5*u( v(TRI) -v(VD2))
VCC      VCC    0    DC    5
RP       VCC    VP    1u
RN       VN     0    1u
MN1      VOUT   VG    VN     0    NMOSC  W=90000u  L=1u
MP1      VOUT   VG    VP    VCC   PMOSC  W=90000u  L=1u
L1       VOUT   OUT   100u
C1       OUT    0     3u
RS       OUT    IS    30m
Rout     IS     VCM   5
VCM      VCM    0     DC    0     SIN( .5 .5 50 )

```

```

*TRAN    TSTEP  TSTOP  TSTART TMAX  ?UIC?
.tran    .1u    20m    1m     .1u   UIC

```

```

*====The_CMOS_Model_Files=====

```

```

.model   NMOSC          NMOS(Level= 1 Cbs=2f Cbd=2f)
.model   PMOSC          PMOS(Level= 1 Cbs=2f Cbd=2f)
.model   DD             D( IS=3.15e-18 )

```

```

.control

```

```

run
set      pensize = 2
plot     out -is ylimit 0 20m

```

```

let      iota = mean(vd-vd3)
let      irb  = mean(vbs-vb)
let      ivdt = iota + irb
let      vdave =mean(vd)
let      vd2ave =mean(vd2)
plot     vcm out

```

```

echo     "iota =${iota} irb =${irb} ivdt =${ivdt} vdave =${vdave} vd2ave =${vd2ave} "

```

```

.endc

```

```

.end

```

```

9.16.10_1.30PM
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Don Sauer

```