Simple_OTA_VCR

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```
*
*                            ->   R_equiv = (.052/IABC)*(R1+R2)/R1
*
*    VIN        R0        :
*        ___/\ /\ /_____      OUT
*       |   \/  \/  \/      :             |
*       |              ->    IABC= 1mA->0 |
*     _ _                  |\             |\
*    / _ \          _|     INP \/\/\     _| \
*   //_\ \         \\       /\/\/ _____| /  VOUT
*   \ \/// _        _|_/                 |/
*    \ _ /    INN|     B_OTA1                 B_BUF1
*     7/7       R1          R2             |
*        ___/\ /\ /\_ _/\ /\ /_____ |
*       |_|  \/  \/    \/  \/              |
*        7/7
*
```
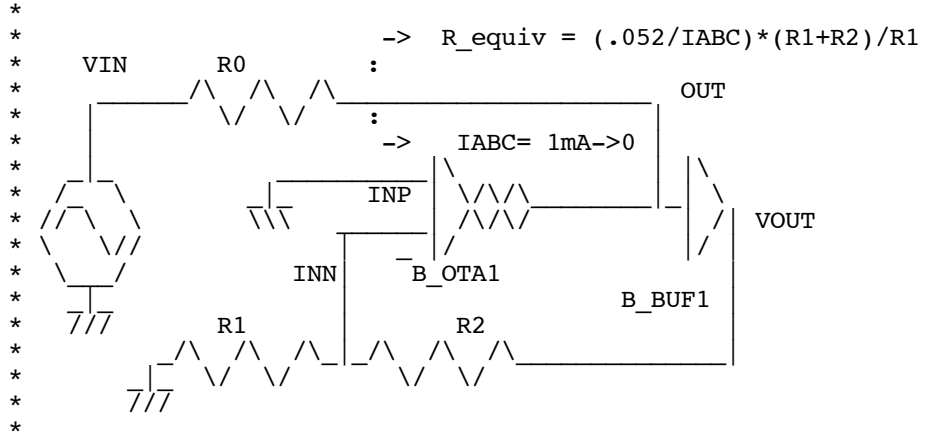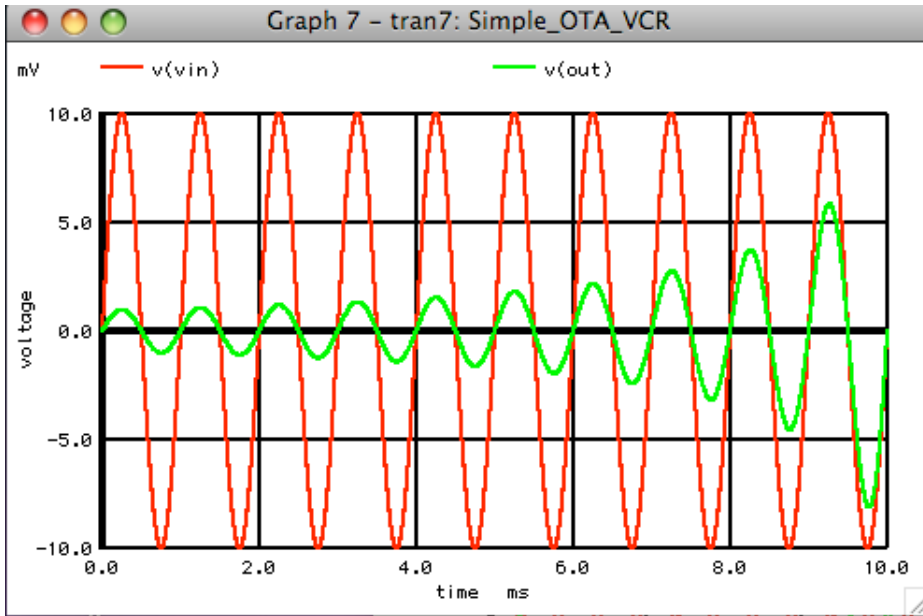
```
VIN       VIN          0     SIN(   0     10m    1000   )
R0        VIN          OUT   1K
R1        INN          0     2k
R2        VOUT         INN   2k
B_OTA1    OUT          0     I =    -1*v(VIABC)*tanh(( -v(INN) )/.052)
B_BUF1    VOUT         0     V =     v(OUT)
V_Iabc    VIABC        0     PWL   ( 0 1m 10m 0 )
.tran     1u           10m   0      1u

.control
run
set       pensize = 2
plot      v(vin)    v(out)
.endc

.end
```

=====================END_OF_SPICE============================

FIGURE 8. Voltage Controlled Resistor, Single-Ended

Up until the LM13600/LM13700, it was not as convenient for
customers to have full flexibility over all voltage to
current relationships inside their circuits. The flexiblity
really required the use of external transistors.
Even with the LM3080, there still was time now and again
when an external buffer was needed.

```
*                              ->  R_equiv = (.052/IABC)*(R1+R2)/R1
*     VIN       R0 1K     :
*           ____ /\  /\  /_____         OUT
*          |      \/  \/      :                     |
*          |                  :                     |
*          |              ->    IABC= 1mA->0        |
*    _           _        ||\                      ||\
*   /   \      _|!_  INP  | \/\/_____          | \
*  //‾\  \    \!!!     |  | /\/\/       |__|   \   | VOUT
*  \  \ \//            |  | /           |   |   /  |
*   \    /     INN|    _||/             | B_BUF1  /
*    _||_          |   ‾B_OTA1          |
*   /!/            |                  B_BUF1
*          R1      |  R2
*        _ /\  /\  /\_|_/\  /\  /_____
*       |_| \/  \/  \/    \/  \/  \/
*        /!/
*
```

B_OTA1   OUT   0   I =   -1*v(VIABC)*tanh((-v(INN))/.052)
V_Iabc   VIABC 0   PWL   (0 1m 10m 0)

The voltage controlled resistor example shows how OTAs
allowed a response current to an applied input
voltage to be electronically controllable. In this
application, IABC is defined to go from 1mA to zero over
10 msec.

At 1mA, the equivalent resistance looks to be around 100 Ohms and it increases as IABC drops in level. In this case the buffer is simulated to have zero offset. The DataSheet shows the buffers being used with a DC blocking cap.