

INTRODUCTION

This document supplements the PSpice model DM6V6.INC, and provides some background operation to the operation of the model along with details of functionality modelled or not modelled as the case may be.

Whilst every care has been taken to duplicate the functionality of the modelled device as described here, it should be stressed that modelling is not a substitution for breadboarding or other prototyping methods.

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MODELLED FUNCTIONS

Inter-electrode capacitance, screen current, grid current.

FUNCTIONS NOT MODELLED

A heater model is not implemented at this stage.

MODEL PERFORMANCE

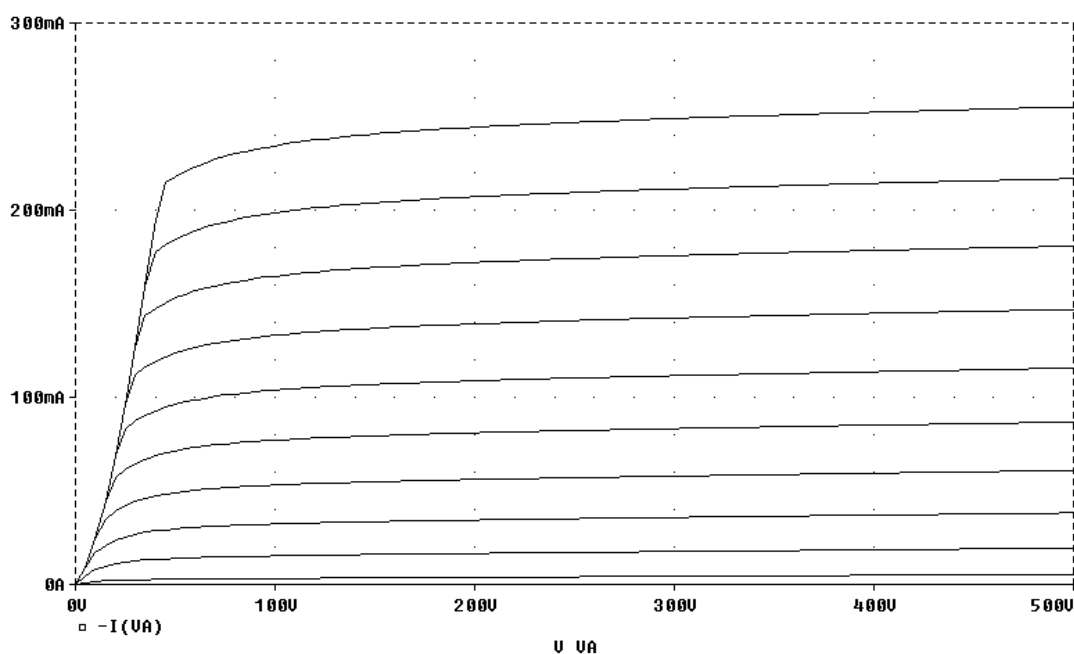


Figure 1: Anode current

The diagram above shows anode current against swept anode voltage for a range of grid voltages between -30 and +20V in steps of 5V. Screen voltage in this instance is 250V.

Note how the left-hand side of each trace reaches a saturation point, or knee, accurately reflecting the true device behaviour.

The next diagram shows screen current overlaid on the anode current chart. Grid voltage and screen voltages are the same as the previous diagram.

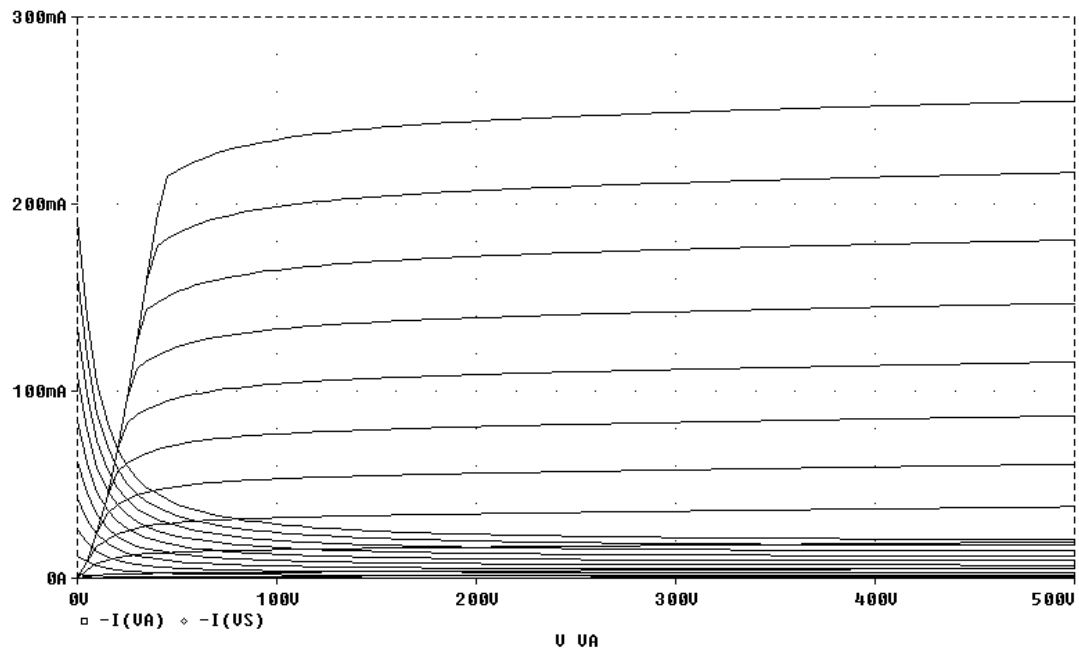


Figure 2: Anode and screen current together

As can be clearly seen, the screen current rises sharply as conduction approaches the knee.

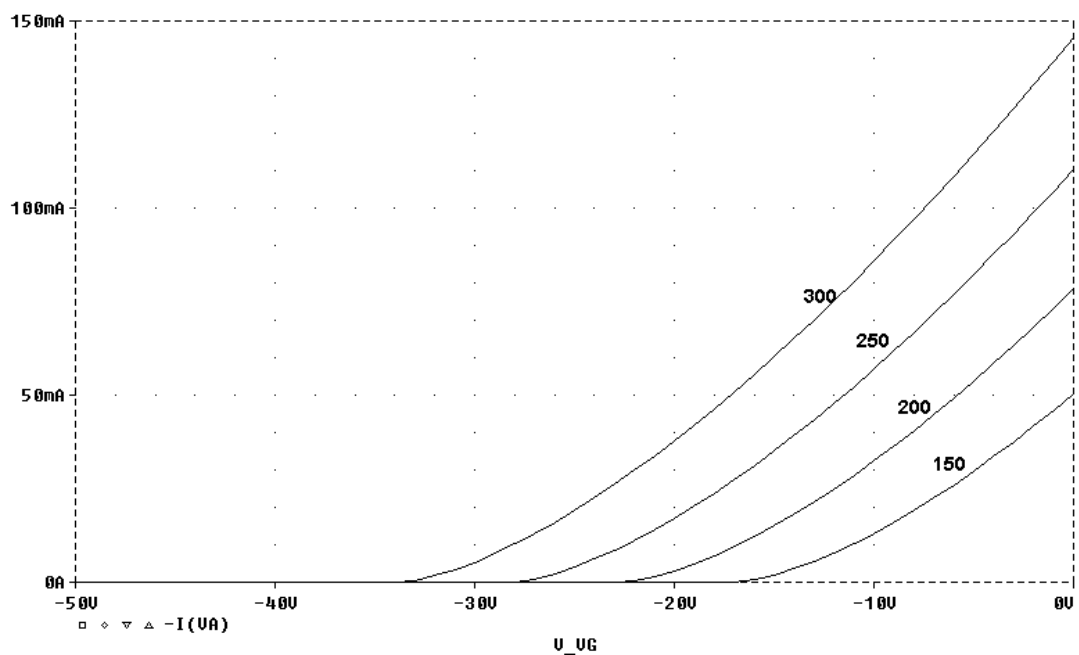


Figure 3: Anode current against grid voltage

The chart above shows anode current against grid voltage. The numbers against each plot show the static screen and anode voltage.

MODEL DESCRIPTION

The following describes the various components of the model and their interaction:

Eat	is the arctangent calculation which causes the fall off in emission at lower anode voltages. This calculation is normally used for pentodes, although for beam tetrodes (such as the 6V6), a sharper knee is applied over the top later on.
Eme	is the slope, which sets the knee value.
Egs	is the emission contribution from the grid and screen, g_1 and g_2 .
Egs2	is Egs after raising to the power of $3/2$ and factored by a constant so that it may be turned directly into a current value.
Ecath	is the cathode current value. This is the current between anode and cathode, although some of this may be diverted by the screen grid. Basically consists of Egs2 multiplied by Eat, and then limited by Eme. Although this causes a sharp knee cut-off (as evident by the charts), it is a "quick and dirty" calculation, which is sufficient for most applications.
Ga	is the actual cathode current. Synonymous with Ecath.
Escrn	is the screen current value.
Gs	is the actual screen current. Synonymous with Escrn.
Gg	is the grid current value.

ALTERING THE MODEL FOR OTHER SIMULATORS

It may be necessary to use the model with other simulators, such as Berkeley SPICE 3f4, in which case some of the PSpice specific items will need to be altered.

The PSpice LIMIT{a,b,c} statement can, in instances where b is zero, be replaced by the SPICE 3f4 statement URAMP(a). Where LIMIT{a,b,c} is used, with b=0 and c=variable, the SPICE 3f4 statement $U(a/c)*c$ can be used.

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10th May 1997

Web page: <http://www.duncanamps.com/>
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MODEL LISTING

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*
* DM6V6.INC - PSpice Subcircuit for 6V6 output beam tetrode
*
* Supported:   screen current and interelectrode capacitances, also grid
*             current with rise at low va.
*
* Unsupported: Heater model.
*
* D.Munro - 04/05/97
*
* 04/05/97 Initial model.
*
* Pins      A Anode
*           S Screen
*           G Grid
*           K Cathode
*
.SUBCKT 6V6 A S G K
*
* Calculate contribution to cathode current
*
Eat      at      0      VALUE={0.636*ATAN(V(A,K)/10)}
Eme      me      0      VALUE={PWR(LIMIT{V(A,K),0,2000},1.5)/1300}
Egs      gs      0      VALUE={LIMIT{V(A,K)/600+V(S,K)/14+V(G,K)*0.65,0,1E6}}
Egs2     gs2     0      VALUE={PWR(V(gs),1.5)*1.45E-3}
Ecath    cc      0      VALUE={LIMIT{V(gs2)*V(at),0,V(me)}}
*
* Calculate anode current
*
Ga      A      K      VALUE={V(cc)}
*
* Calculate screen current
*
Escrn    sc      0      VALUE={0.7*V(gs2)*(1.1-V(at))}
Gs      S      K      VALUE={V(sc)}
*
* Grid current
*
Gg      G      K      VALUE={PWR(LIMIT{V(G,K)+1,0,1E6},1.5)*(1.25-V(at))*650E-6}
*
* Capacitances
*
Cg1      G      K      7.5p
Cak      A      K      9p
Cgla     G      A      0.7p

.ENDS

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