PSpice Model   EF86

INTRODUCTION

This document supplements the PSpice model EF86.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.

No warranty of any kind is provided for this model, and no liability is assumed for any damage or loss arising out of the use of this model, or application of the results of this model. All trademarks acknowledged. The model is copyright ©1997-2003 Duncan Amplification, and is made available for educational or non-profit use.

MODELLED FUNCTIONS

Inter-electrode capacitance and screen current.

FUNCTIONS NOT MODELLED

A heater model is not implemented at this stage, neither has any model been provided for grid current.

MODEL PERFORMANCE

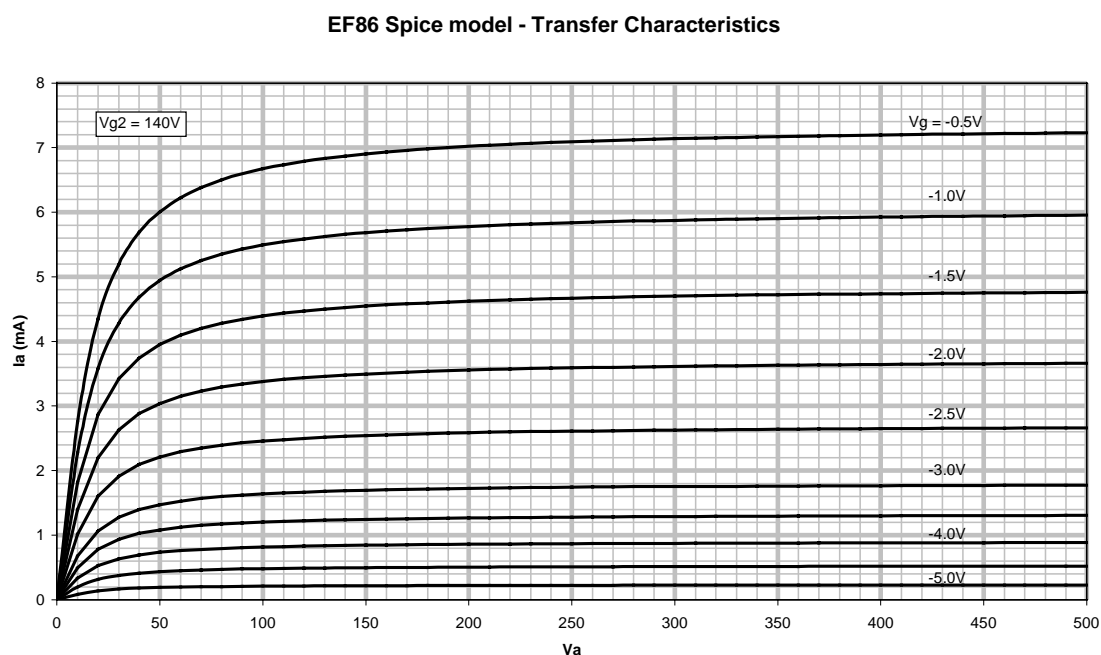**EF86 Spice model - Transfer Characteristics**

Figure 1: Anode current

Figure 1 above shows anode current against swept anode voltage for a range of grid voltages between -5.0V and -0.5V in steps of 0.5V. Screen voltage in this instance is 140V.

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.
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.
Ga	is the actual cathode current. Synonymous with Ecath.
Escrn	is the screen current value.
Gs	is the actual screen current. Synonymous with Escrn.

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.

Duncan Munro
17th May 1997

Web page:	http://www.duncanamps.com/
Forum:	http://forum.duncanamps.com/
Email:	postmaster@duncanmps.com

PSpice Model   EF86

MODEL LISTING

```
*---------------------------------------------------------------
* Filename:          EF86.inc  17/5/97 (Version 3)
* Simulator:         PSpice
* Device type:       Pentode
* Device model:        EF86
*
* Author:            Duncan Munro
* Date:              16/5/97
* Copyright:         (C)1997-2003 Duncan Amplification
*
* The following parameters are not modelled:
*
*   (1) Heater
*   (2) Grid current
*
* Please note that this model is provided "as is" and
* no warranty is provided in respect of its suitability
* for any application.
*
* This model is provided for educational and non-profit use.
*
* Email queries to postmaster@duncanamps.com
*
* Pins   A  Anode
*        S  Screen
*        G  Grid
*        K  Cathode
*
*---------------------------------------------------------------

.SUBCKT EF86 A S G K

*
* Calculate reduction in mu when Vg < -3V
*
Emu    mu    0       VALUE={LIMIT{V(G,K),-3,999}+LIMIT{V(G,K)+3,-999,0}*0.714}
*
* Calculate contribution to cathode current
*
Eat    at    0       VALUE={0.636*ATAN(V(A,K)/15)}
Egs    gs    0       VALUE={LIMIT{V(S,K)/27.5+V(mu)*1.32+1,0,1E6}}
Egs2   gs2   0       VALUE={PWRS(V(gs),1.5)}
Ecath  cc    0       VALUE={V(gs2)*V(at)}
*
* Calculate anode current
*
Ga     A     K       VALUE={5.83E-4*V(cc)}
*
* Calculate screen current
*
Escrn  sc    0       VALUE={V(gs2)*(1.1-V(at))}
Gs     S     K       VALUE={0.5E-3*V(sc)}
*
* Capacitances
*
Cg1    G     K       3.8p
Cak    A     K       5.3p
Cg1a   G     A       0.05p

.ENDS
```