

Making Simple Diode Models from Data Sheet Graphs

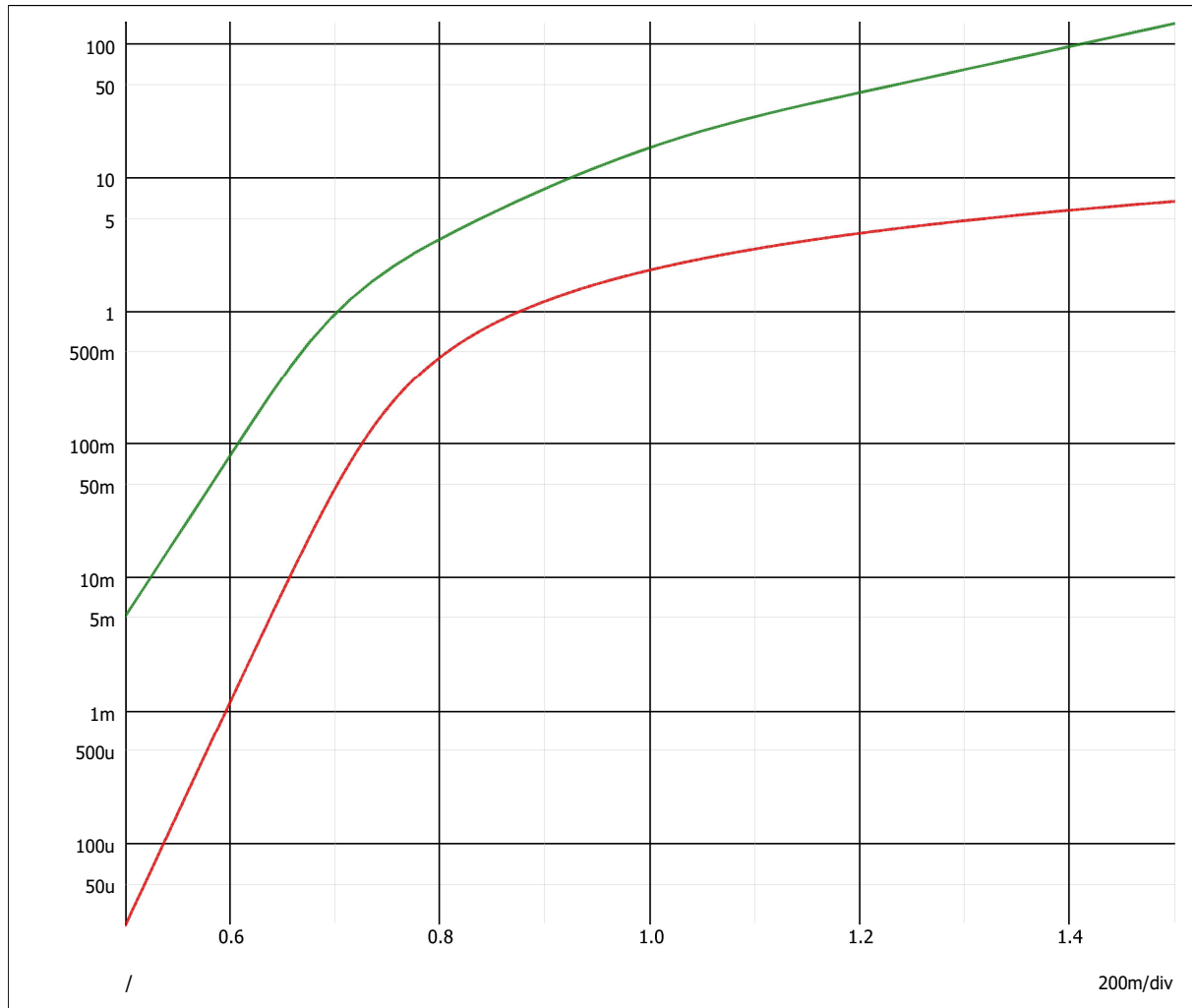
Procedure

1. If the data sheet graphs are in PDF format, you must first extract images in .PNG, .JPG or .BMP format. You can do this using screen capture. In some cases you can extract the image directly from the PDF file.
2. Once you have the graph images, you need to extract data from them. You can do this using the Digitise Data Sheet Curve feature in SIMetrix Pro and Elite. Select schematic menu **Tools | Digitise Data Sheet Curve....** Make sure the Global Variable option is selected. Extract the data from the curve using the instructions given here:
http://help.simetrix.co.uk/8.2/simetrix/user_manual/topics/parts_creatingmodels.htm#Digitising Data Sheet Curves

You need to extract data for the I_d -vs- V_d graph. Additionally you can also extract data for capacitance vs reverse voltage if this available. The attached image file diode-I-V.png may be used as an example.

3. When the data is extracted, press the 'Q' button. You should see a curve plotted. You can use this as the reference curve for creating a model.
4. Open the test schematic dc-test.sxsch
5. Run the simulation. This plots the diode voltage drop on a logarithmic scale from 1uA to 1A. If you need a different current range adjust the simulation parameters then rerun the simulation.
6. You must now superimpose the extracted data over the simulated graph. In step 3 above you will have plotted this by pressing 'Q'. Switch to that plot select the curve then menu Edit | Copy Selected Curve. Switch back to the simulated graph plot then menu Edit Past Selected Curve. It's possible that the new curve will plot on a new axis. In this case you will need to select and move the curve using the graph menu Curve | Move Selected Curves.

7. Once you have the graphs setup, you should have something like this.



The red curve is the simulated curve, the green curve is the data sheet curve. We must now adjust the parameters so that the curves match as closely as possible.

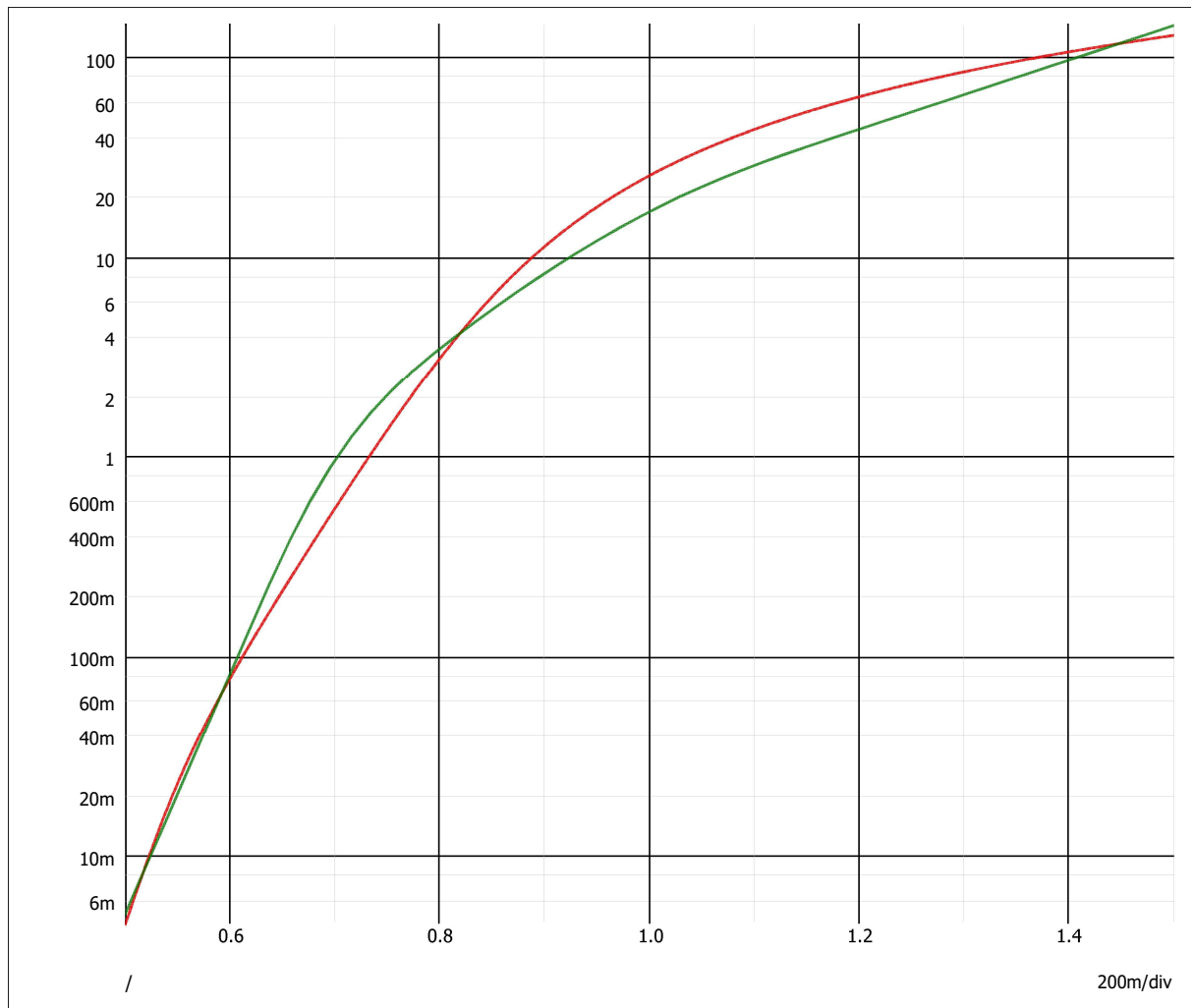
8. In the schematic editor press F11. You should see an edit box with these contents:

```
.model DUT d IS=1e-13 RS=0.1 CJO=120p VJ=0.3 M=0.75 IKF=0
```

We will adjust the parameters, IS, RS and IKF

9. IS adjusts the low current voltage drop, RS adjusts the series resistance of the diode and IKF adjusts the behaviour at middle currents. IS is usually in the range $1e-10$ – $1e-15$ for silicon junction diodes. Higher values are used for larger diodes with a lower voltage drop. For schottky diodes the values may be much higher. RS may be 1.0 for a signal diode and less than 1m for a large power diode. IKF is typically in the range 0.01 to 10 – larger values for larger diodes.

For our example we use, IS=2e-11 RS=0.004 IKF=0.03 and this gives the response below



10. If you have capacitance – vs – reverse voltage data available, you can use the cap-test schematic in a similar way to set the capacitance parameters. If you don't have a graph with this data, just set CJO to the capacitance at zero volts – this is often quoted in the tabular data sheet values. Set VJ to 0.3 and M to 0.75. If you don't have any capacitance data at all, you can make an intelligent guess. A small signal diode will usually have a capacitance in the region of 5pF while a 1A rectifier diode might have a capacitance of 50-100pF.

If you do have full C-vs-V data, CJO sets the capacitance at zero volts, while VJ and M control the shape of the curve for higher reverse voltages. M must not be greater than 1.0 and neither value should be less than zero.