The single diode equation

Express and as known variables

Solving equation 1 for and

Solving equation 1 for and

Combine equation 2 and 3 to obtain equation 4 and 5

If the term

Equation 5 can be reduced to

Equation 5 is next substituted to equation 2 to obtain

If we assume

Differentiating equation 1 with respect to V and rearranging the terms gives