



Principles:

Given:

[1] The Maximum Power Transfer Theorem.

[2] The Property of Equality of Exponential Functions (-1 in this case, inverse).

[3] The Definition of Isc; conversion of a constant photon flux to a constant current flow of a PV cell at zero volts characteristic (Isc constant for small changes in V).

[4] The summation of the Series Conductance Equation.

Assertions:

The maximum power transferred will be when the small signal impedance of the generator matches the large signal impedance of the load by [1].

The maximum power is also transferred when the small signal conductance of the generator matches the large signal conductance of the load by [2].

As the voltage across a PV cell approaches zero, its conductance approaches zero by [3].

For any number of PV cells in series, the conductance of the entire string of PV cells approaches zero if the voltage across any individual cell approaches zero by [4].

Therefore:

A) For small signal conductance greater than zero, every individual cell must have a voltage greater than zero across it.

B) For large signal conductance greater than zero and small signal conductance made equal to the large signal conductance, the maximum power available is transferred without the possibility of reverse biasing any PV cell.

References:

[1] http://en.wikipedia.org/wiki/Maximum_power_transfer_theorem

[2] http://hotmath.com/hotmath_help/topics/solving-exponential-equations.html

[3] http://en.wikipedia.org/wiki/Theory_of_solar_cells

[4] http://en.wikibooks.org/wiki/A-level_Physics_%28Advancing_Physics%29/Resistance_and_Conductance

Definitions:

Small signal impedance: The ac voltage resulting from an ac current over the ac current when the ac current approaches zero.

Small Signal conductance: The ac current resulting from an ac voltage over the ac voltage when the ac voltage approaches zero.

Large signal impedance: The dc voltage resulting from an applied dc current divided by the dc current.

Large signal conductance: The dc current resulting from an applied dc voltage divided by the dc voltage.

Given z_a & z_b are >0 then :

$$S_{total} = \frac{1}{\sum_{i=1}^n \left(\frac{1}{S_i}\right)}$$

$$z_a = z_b, z_a^{-1} = z_b^{-1}, z^{-1} = s, S_a = S_b$$
$$\lim_{S_{any} \rightarrow 0} \left[\frac{1}{S_{any}} \right] \rightarrow \infty \therefore \frac{1}{\sum_{i=1}^n \left(\frac{1}{S_i}\right)} \rightarrow 0$$