Steca Solarix MPPT

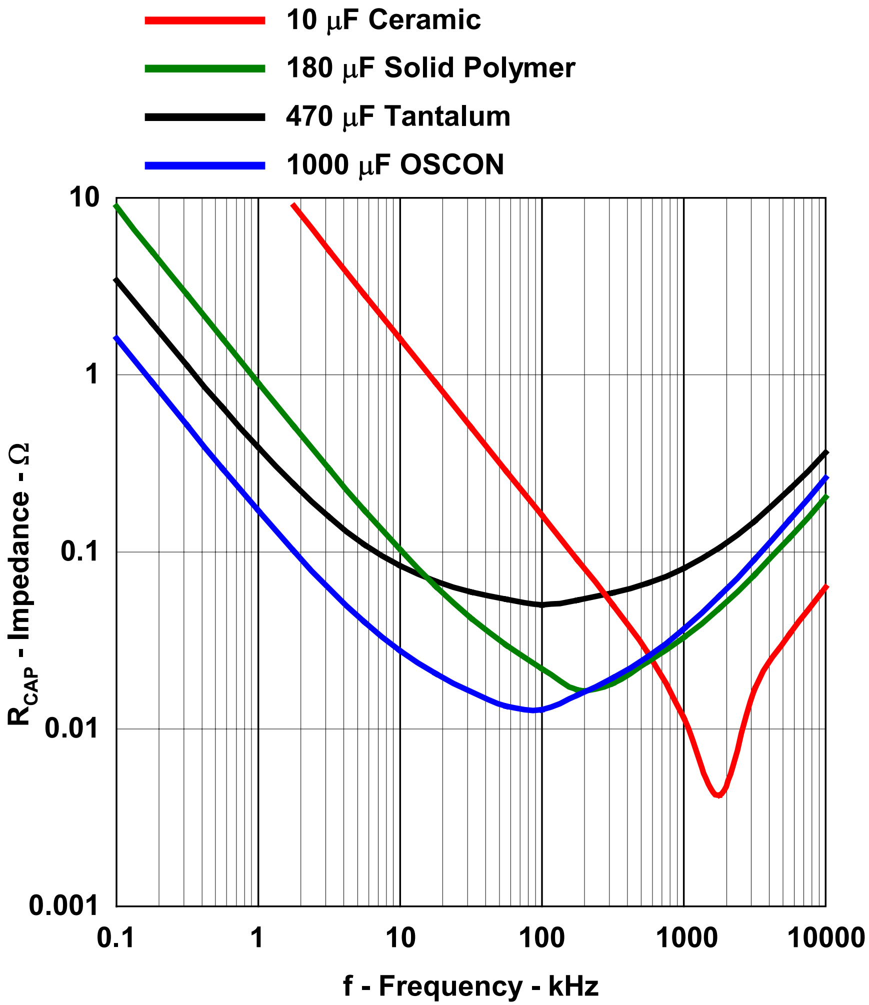
Kapitel 5

Passive Components

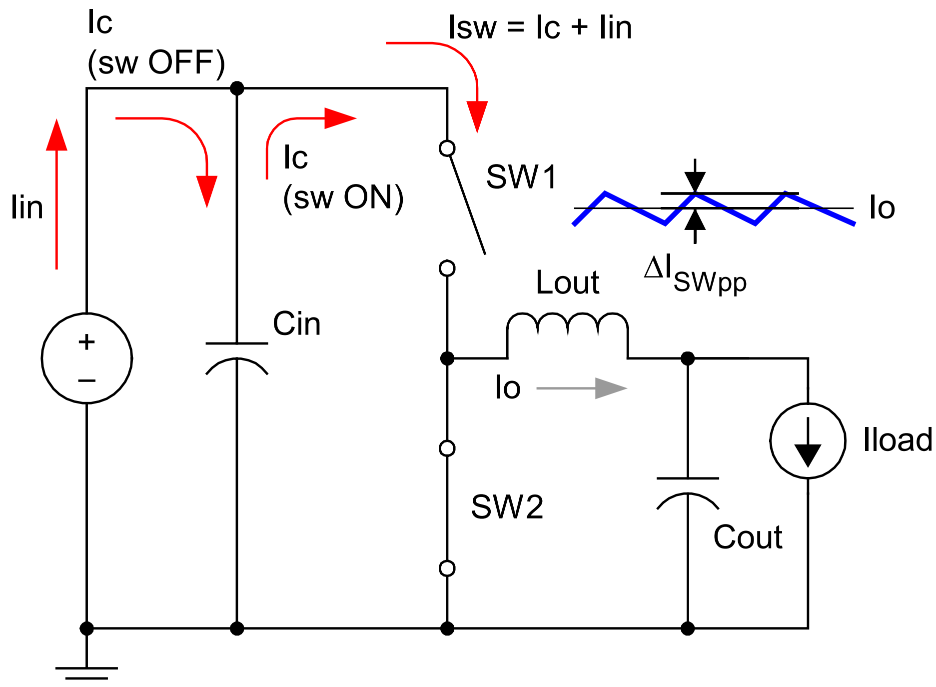
Power Capacitors

- Selection Considerations
  - Power Dissipation
    - ESR
  - Ripple Performance
    - ESR
  - Transient Performance
    - ESR
    - Capacitance
    - ESL
  - Cost
  - Size
  - Reliability

Capacitor Impedance



Input Capacitor Current



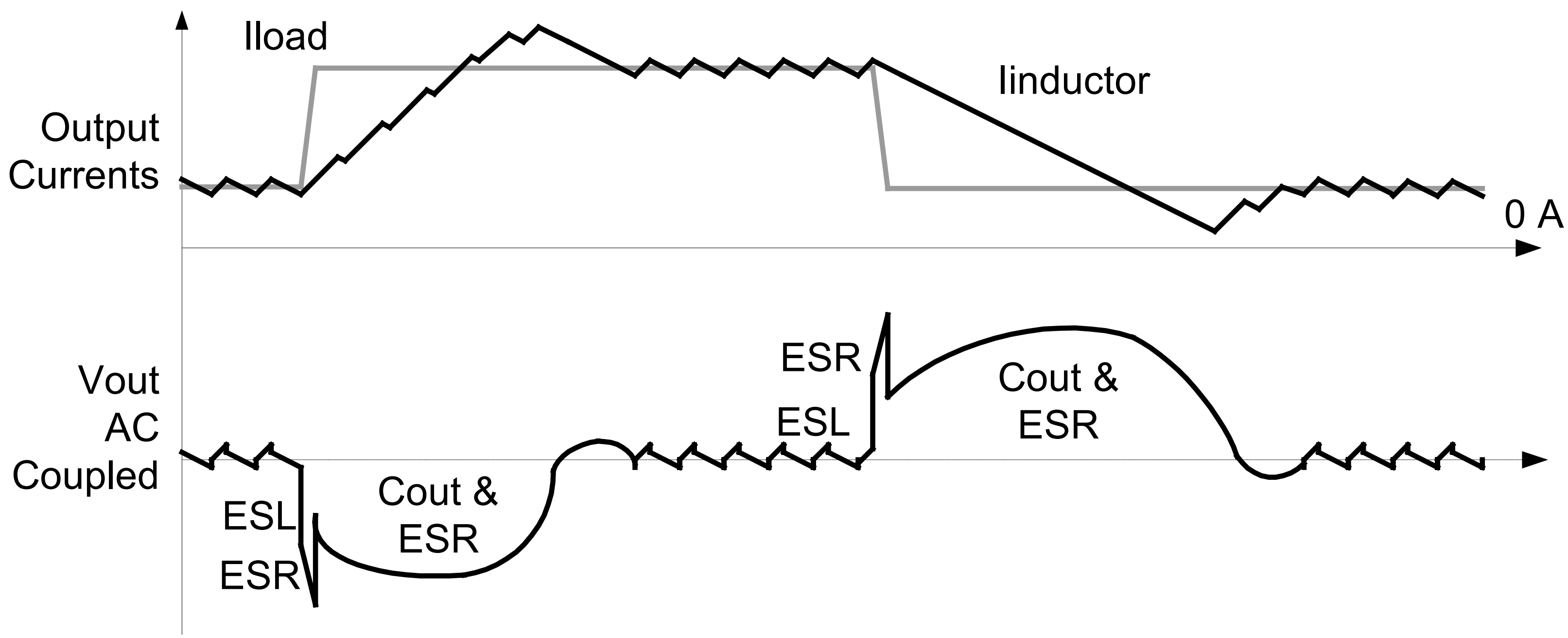
$$P_{cap} = I_{cap_{RMS}}{}^2 \cdot ESR_{cap}$$

$$I_{cap_{RMS}} = \sqrt{\left[(I_{SW_{pk}} - I_{in_{avg}})^2 + \frac{\Delta I_{SW_{pp}}{}^2}{12}\right] \cdot D + I_{in_{avg}}{}^2 \cdot (1 - D)}$$

Output Capacitor Criteria

- Selection Considerations
  - Transient performance
    - Bulk capacitance
    - ESR
    - ESL
  - Output Ripple
    - ESR
    - Bulk value
    - ESL has minor effect

Transient Performance



Kondensatorauslegung

http://www.epcos.com/web/generator/Web/Sections/DesignSupport/Tools/AlCap/Page,locale=en.html

Keyword / Ordering Code

Home > Design Support > Design Tools > Al Caps

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Aluminum Electrolytic Capacitors

AlCap Calculation 7.0 - Web-based Application

The AlCap design tool dimensions capacitor banks and individual capacitors. When you enter the specific parameters of your application such as voltage, current, ambient temperature and cooling method, the tool offers solutions with a range of key data, including useful life, price index and ordering codes. The database used includes all high-voltage screw-terminal and snap-in capacitors listed in the 2011 data book.

What's new?

- All calculations are performed online – no software has to be installed.
- Calculations of life expectancies are possible for individual types.
- Search can be refined to include parameters such as size limits or minimum required life expectancies in order to quickly find optimal solutions.
- Profiles can be defined that occur during operation and represent different loads.
- Solutions can be saved for further processing in a subsequent session.
- Product recommendations contain a link to the respective data sheets.
- The new B43543 series has been added to the data base of AlCap Calculation 7.0.

Start AlCap 7.0

Back

Inductor Considerations

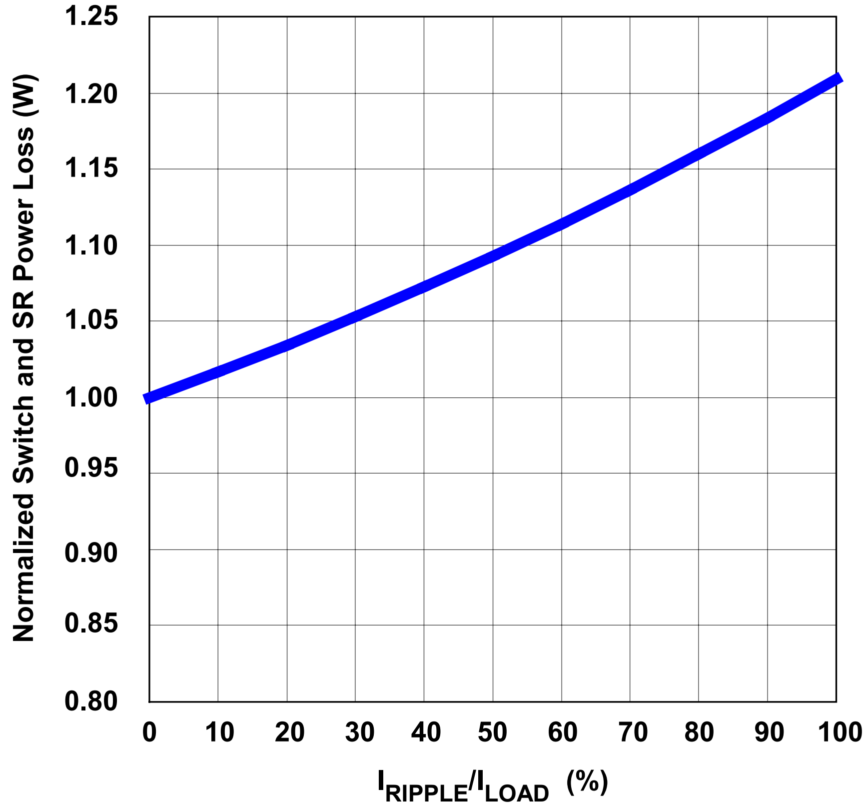
$$B := \frac{Vrms \cdot 10^{8}}{4.44 \cdot Ae \cdot N \cdot f}$$

- Benefits of low L values
  - Lower DCR
  - Higher I_{sat}
  - Higher di/dt
    - Transient response improves
    - Less output capacitance required for given transient performance
- Benefits of high L values
  - Lower ripple current
    - Lower AC losses (skin effect, hysteresis)
    - Lower RMS current in FETs
    - Lower RMS capacitor current (mainly output)
    - Continuous inductor current over broader load range
    - Less C required for equivalent output ripple

General Inductor Guidelines

- Size for ΔIL to be 10% to 30% of full load current
- Winding losses usually dominate

$$PL_{AVG} = IL_{RMS}{}^{2} \cdot RL \ \text{ where } \ IL_{RMS}{}^{2} = \sqrt{I_{out}{}^{2} + \frac{\Delta IL_{pp}{}^{2}}{12}}$$



Inductor and FETs

Increasing ripple increases losses

Similar effect for capacitor ESR loss

Drosselauslegung

http://www.epcos.com/web/generator/Web/Sections/DesignSupport/Tools/Ferrites/Page,locale=en.html

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Ferrites

Ferrite Magnetic Design Tool

The tool allows application-related parameters to be calculated for all available EPCOS ferrites and provides access to their digitized material data including their graphical representation. In its new version 5.2 the tool enables users to define the parameters for their own cores and use them in the calculation. The user manual of the tool contains a detailed description of all functions. The tool can now be run under Windows 7, in addition to Windows XP and Vista.

The ferrite materials in the database include N45, T36 and T66 for broadband transformers as well as N51and N95 for power transformers. Materials N88, N96 and PC47 for medium- and high-frequency switch-mode power supplies have been added. Among the features of the current version are:

- Simulations based on user-defined core parameters
- Database expanded to include Steinmetz coefficients for power losses
- Display of complex permeability and impedance as a function of frequency
- Transmittable power adjusted for skin and proximity effects (from the wire calculation menu)
- Calculation of the distortion factor (third harmonic) under specific circuit conditions at various temperatures
- Calculation of core loss as a function of signal form
- Specification of wire thickness as per AWG
- Performance factor added for materials N95 and N51

To support design-ins you will find the data sheets for all materials by applications under www.epcos.com/ferrite_materials.

Abgabe Bericht

- Bericht
  - Aufgabenstellung
  - Funktionsweise Buck(Diagramme, Kurven)
  - Betriebsbereiche, Wirkunsggrade
  - Passive Komponenten
  - Regel-IC
  - Bescheibung MPPT
  - Layout-Ideen