

Selecting Appropriate Compensation: Type-II or Type-III

Part Number: Any Sipex controller requiring Type-II or Type-III compensation

Application Description: buck converter utilizing external compensation

Circuit Description:

Sipex buck controllers in general require either a Type-II or Type-III compensation. Type-II requires fewer components and corresponding compensation calculations are relatively easy. However, it can only be used in converters where output filter capacitor has a relatively high ESR. Where output capacitor ESR is low a Type-III compensation is usually necessary.

This report outlines a procedure for determining which one of the two compensation types is appropriate for a given application. Schematic of Type-II and Type-III compensation are also shown for reference.

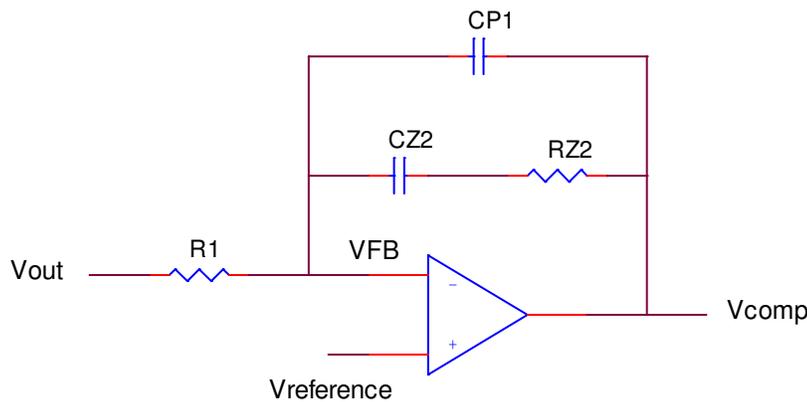


Figure 1: Type-II compensation showing controller’s internal Error Amplifier

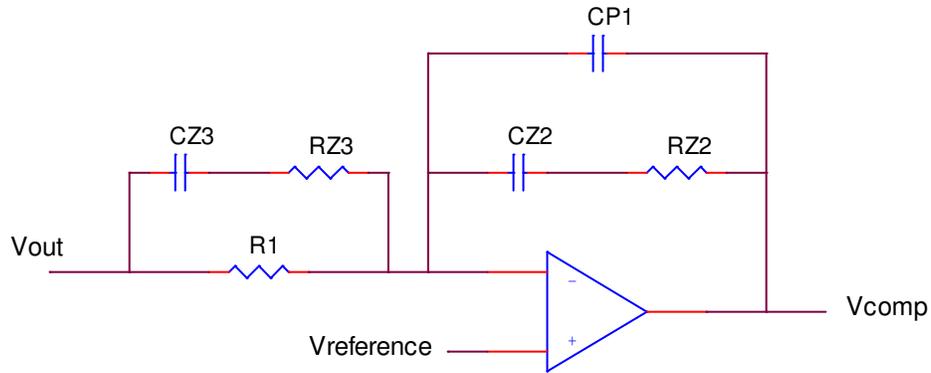


Figure 2: Type-III compensation showing controller's internal Error Amplifier

Note: Type II Calculations discussed in this application note can be quickly iterated with the Type II compensation Calculator on the web at:

<http://www.sipex.com/files/ApplicationNotes/TypeIICalculator.xls>

Note: Type III Calculations discussed in this application note can be quickly iterated with the Type III compensation Calculator on the web at:

<http://www.sipex.com/files/ApplicationNotes/TypeIIICalculator.xls>

Procedure for selecting Type-II or Type-III compensation

Calculate the double-pole frequency of converter's output filter from:

$$f_{LC} = \frac{1}{2\pi\sqrt{LC}}$$

Where:

L is the output filter inductor

C is the output filter capacitor

Calculate the ESR ZERO frequency of the output capacitor from:

$$f_{ESR} = \frac{1}{2\pi \cdot C \cdot ESR}$$

Where:

C is the output filter capacitor

ESR is the Equivalent Series Resistance of output capacitor

If f_{ESR}/f_{LC} is equal to or greater than 5 then use a Type-III compensation and follow guidelines in Sipex Application Note or Design Manual to derive appropriate component value. If f_{ESR}/f_{LC} is less than 5 then use a Type-II compensation

Note: If following the above procedure a Type-II compensation is implemented but proves to have insufficient phase-margin then use a Type-III.

For further assistance:

Email: Sipexsupport@sipex.com
WWW Support page: <http://www.sipex.com/content.aspx?p=support>
Live Technical Chat: <http://www.geolink-group.com/sipex/>
Sipex Application Notes: <http://www.sipex.com/applicationNotes.aspx>
Type III Calculator: <http://www.sipex.com/files/ApplicationNotes/TypeIIICalculator.xls>
Type II Calculator: <http://www.sipex.com/files/ApplicationNotes/TypeIICalculator.xls>



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