

CALCULATION TOOL FOR A POWER FACTOR CORRECTION BOOST CONVERTER WITH BORDERLINE CONTROL

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Abstract: This paper presents a calculation tool implemented in Matlab. The developed design tool is used to compute the components value of a boost converter with power factor correction (PFC). We built a friendly graphical user interface as a communication bridge between the software and the user, which can select the specialised integrated circuit and the input and output parameters of the chosen power converter. The software displays the schematic of PFC preregulator and computes the values of the components.

Key words: PFC, boost converter, design tool, graphical user interface.

1. INTRODUCTION

Power converters with borderline control work at boundary between discontinuous conduction mode (DCM) and continuous conduction mode (CCM). This type of control is a particular case of hysteretic control. The switching frequency is variable and switch on time is constant as in hysteretic current mode control. The current reference is proportional with input voltage. In this way, the average input current has the same waveform with input voltage. Borderline current mode control has some advantages. Because the boost converter works at boundary between CCM and DCM, the switching losses decrease. Another important advantage consist in a simple control scheme, because is not necessary a current error amplifier and no need a compensation ramp. The major disadvantages of borderline control consist in a variable switching frequency (function of load current and instantaneous line voltage) and it is necessary to detect inductor current zeroing.

2. DESCRIPTION OF THE PROPOSED INSTRUMENT

The proposed tool is a software instrument developed in Matlab. This is a useful instrument in designing process of power factor boost converters and it is a useful tool for students. The developed design tool is use to compute the components values of a boost converter with power factor correction (PFC).

In the first step, the user must select one of the specialized IC TDA4814 or TDA4863. After this, the software displays the scheme of the boost converter and reads

the input and output parameters of the boost converter. Input parameters are RMS values of lowest and highest input voltage, output power, minimum switching frequency, efficiency (estimated values), output voltage, minimum output voltage, maximum hold-up time.

When the “Calculate” button is pressed, the developed software calculates and displays the computed values of the different parameters and components. On the screen will appear: input power, amplitude of input current, maximum inductor peak current, calculate value of shunt resistor (R_{SUNT}), calculate resistor values from input divider, calculate resistor values from output divider, calculate value of output capacitor, calculate value of boost inductor, etc. At the next step, the computed values of the resistors are normalized.

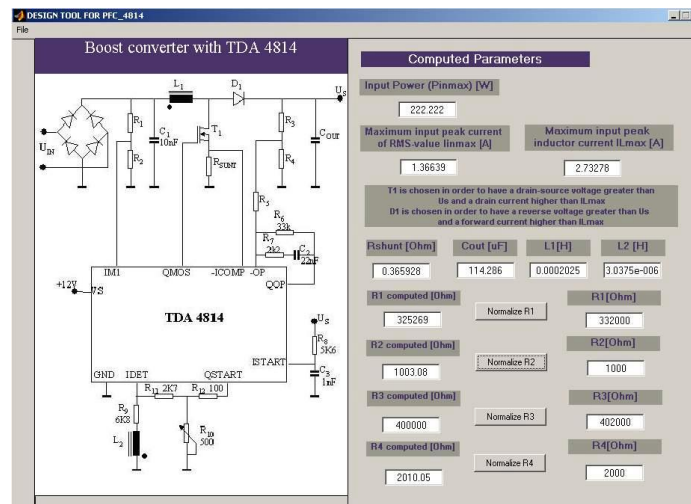


Figure 1 – Graphical user interface of design tool.

3. CONCLUSIONS

We build a design tool in Matlab to design a boost converter with power factor correction (PFC). We built a friendly graphical user interface as a communication bridge between the software and the user. The user selects the specialised integrated circuit and the input and output parameters of the power converter. The software displays the schematic of PFC preregulator and computes the value of components.

The proposed tool is a useful tool in design process of PFC preregulators or to verify the designed preregulator. Also, this tool can be used as instrument for didactic activities.

4. REFERENCES

1. Farcas C., Petreus D., Palaghita N., (2003), *Îmbunătățirea factorului de putere în sistemele moderne de alimentare*, Risoprint Publisher.
2. Infineon Technologies, (2002), *TDA4863 – Power Factor Controller IC for High Power Factor and Low THD*, Data Sheet, pp. 1-14.
3. Wolfgang F., (2003), *Calculation Tool for PFC-Preconverter using TDA4863*, Application Note, Infineon Technologies, pp. 1-8.