PFC CCM application SW example

TODO: SRS-SW-XMC-PRODUCT-0001

Software Requirements Specification

rev 1.0 21.03.2016

Microcontrollers

Edition 21.03.2016
Published by Infineon Technologies AG,
81726 Munich, Germany.
© 2016 Infineon Technologies AG
All Rights Reserved.

LEGAL DISCLAIMER

THE INFORMATION GIVEN IN THIS APPLICATION NOTE IS GIVEN AS A HINT FOR THE IMPLEMENTATION OF THE INFINEON TECHNOLOGIES COMPONENT ONLY AND SHALL NOT BE REGARDED AS ANY DESCRIPTION OR WARRANTY OF A CERTAIN FUNCTIONALITY, CONDITION OR QUALITY OF THE INFINEON TECHNOLOGIES COMPONENT. THE RECIPIENT OF THIS APPLICATION NOTE MUST VERIFY ANY FUNCTION DESCRIBED HEREIN IN THE REAL APPLICATION. INFINEON TECHNOLOGIES HEREBY DISCLAIMS ANY AND ALL WARRANTIES AND LIABILITIES OF ANY KIND (INCLUDING WITHOUT LIMITATION WARRANTIES OF NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF ANY THIRD PARTY) WITH RESPECT TO ANY AND ALL INFORMATION GIVEN IN THIS APPLICATION NOTE.

Information

For further information on technology, delivery terms and conditions and prices, please contact the nearest Infineon Technologies Office (**www.infineon.com**).

Warnings

Due to technical requirements, components may contain dangerous substances. For information on the types in question, please contact the nearest Infineon Technologies Office.

Infineon Technologies components may be used in life-support devices or systems only with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

For Internal Use Only

Trademarks of Infineon Technologies AG

AURIX™, C166™, CanPAK™, CIPOS™, CIPURSE™, EconoPACK™, CoolMOS™, CoolSET™, CORECONTROL™, CROSSAVE™, DAVE™, DI-POL™, EasyPIM™, EconoBRIDGE™, EconoDUAL™, EconoPIM™, EconoPACK™, EiceDRIVER™, eupec™, FCOS™, HITFET™, HybridPACK™, I²RF™, ISOFACE™, IsoPACK™, MIPAQ™, ModSTACK™, my-d™, NovalithIC™, OptiMOS™, ORIGA™, POWERCODE™; PRIMARION™, PrimePACK™, PrimeSTACK™, PRO-SIL™, PROFET™, RASIC™, ReverSave™, SatRIC™, SIEGET™, SINDRION™, SIPMOS™, SmartLEWIS™, SOLID FLASH™, TEMPFET™, thinQ!™, TRENCHSTOP™, TriCore™.

Other Trademarks

Advance Design System™ (ADS) of Agilent Technologies, AMBA™, ARM™, MULTI-ICE™, KEIL™, PRIMECELL™, REALVIEW™, THUMB™, µVision™ of ARM Limited, UK. AUTOSAR™ is licensed by AUTOSAR development partnership. Bluetooth™ of Bluetooth SIG Inc. CAT-iq™ of DECT Forum. COLOSSUS™, FirstGPS™ of Trimble Navigation Ltd. EMV™ of EMVCo, LLC (Visa Holdings Inc.). EPCOS™ of Epcos AG. FLEXGO™ of Microsoft Corporation. FlexRay™ is licensed by FlexRay Consortium. HYPERTERMINAL™ of Hilgraeve Incorporated. IEC™ of Commission Electrotechnique Internationale. IrDA™ of Infrared Data Association Corporation. ISO™ of INTERNATIONAL ORGANIZATION FOR STANDARDIZATION. MATLAB™ of MathWorks, Inc. MAXIM™ of Maxim Integrated Products, Inc. MICROTEC™, NUCLEUS™ of Mentor Graphics Corporation. MIPI™ of MIPI Alliance, Inc. MIPS™ of MIPS Technologies, Inc., USA. muRata™ of MURATA MANUFACTURING CO., MICROWAVE OFFICE™ (MWO) of Applied Wave Research Inc., OmniVision™ of OmniVision Technologies, Inc. Openwave™ Openwave Systems Inc. RED HAT™ Red Hat, Inc. RFMD™ RF Micro Devices, Inc. SIRIUS™ of Sirius Satellite Radio Inc. SOLARIS™ of Sun Microsystems, Inc. SPANSION™ of Spansion LLC Ltd. Symbian™ of Symbian Software Limited. TAIYO YUDEN™ of Taiyo Yuden Co. TEAKLITE™ of CEVA, Inc. TEKTRONIX™ of Tektronix Inc. TOKO™ of TOKO KABUSHIKI KAISHA TA. UNIX™ of X/Open Company Limited. VERILOG™, PALLADIUM™ of Cadence Design Systems, Inc. VLYNQ™ of Texas Instruments Incorporated. VXWORKS™, WIND RIVER™ of WIND RIVER SYSTEMS, INC. ZETEX™ of Diodes Zetex Limited.

Last Trademarks Update 2011-11-11

For Internal Use Only

Revision History

Major changes since previous revision

Date	Version	Changed By	Change Description
20-June-2016	1.0	Alfredo Medina Garcia	Initial release

We Listen to Your Comments

Is there any information in this document that you feel is wrong, unclear or missing? Your feedback will help us to continuously improve the quality of our documentation. Please send your proposal (including a reference to this document title/number) to:

ctdd@infineon.com

For Internal Use Only

Table of Contents

1 Introduction 6
1.1 Purpose and Scope 6
1.2 Intended Audience 6
1.3 References 6
2 PFC CCM application SW example overview 7
2.1 Scope and Typical Usage 7
2.2 Key Features and Use Cases 7
2.3 Value Proposition 7
2.4 Assumptions and Limitations 7
3 Functional Specification 8
3.1 General Behavior 8
3.2 Conflict handling 8
3.3 Required APPs modifications 8
4 Nonfunctional Requirements 10
4.1 Size and Performance 10
4.2 Standards compliance 10
4.3 Software Quality Attributes 10
5 Acceptance Test Criteria 11

1 Introduction

This is the Software Requirements Specification of the PFC CCM SW example. This specification describes the modifications to be done to an existing SW example with APPs for a XMC1300:

- Port the code to XMC1400
- Improvements respect to existing example

1.1 Purpose and Scope

The purpose of this document is to define the modifications to be done to the existing example prototype and the required tests for acceptance.

1.2 Intended Audience

All stakeholders involved in specification preparation and execution of the tasks.

1.3 References

Application test report of the SW prototypeTest

[1] *TODO: Add references to related documentation*

2 PFC CCM application SW example overview

PFC CCM converters are one of the basic blocks in power conversion, having a SW example with a generic concept and modular code is the base for reusability. The existing example prototype for XMC1300 with APPS is the base for this work. Changes on the PWM generation and ADC conversion are added to improve the loop reaction time and PWM resolution.

2.1 Scope and Typical Usage

The final scope is to have a SW example easy to reuse in a new PFC CCM board, using Apps helps such code portability.

2.2 Key Features and Use Cases

2.2.1 Features

Supports PFC CCM and DCM operation mode with reduced Ithd performance.

2.2.2 Use Cases

Demonstrate a PFC CCM power converter to our customers.

2.3 Value Proposition

Allow promotion of XMC in power conversion arena.

2.4 Assumptions and Limitations

N/A

3 Functional Specification

3.1 General Behavior

[PFC_CCM_application_SW_example_00001] The resulting code shall work on a XMC1402 device running @ 48MHz, and 96MHz peripheral clock.

[PFC_CCM_application_SW_example_00002] All HW peripheral configurations have to be done using Apps, i.e.:

- CCU used for PWM
- CCU used to trigger Interrupt
- ADC
- HW comparators
- …

[PFC_CCM_application_SW_example_00003] the name of the variables used in the control loop should be maintain to ensure the compatibility with existing uC-Probe examples.

[PFC_CCM_application_SW_example_00004] the existing APPs from the given example shall be kept unmodified unless mentioned in this document.

[PFC_CCM_application_SW_example_00005] Redundant code sections, from application point of view, have to be removed, i.e. unused variables, unnecessary peripheral configuration (ie. debug code).

[PFC_CCM_application_SW_example_00006] In general, the control loop interrupt shall not be modified, only the additional compare value for ADC conversion has to be added.

3.2 Conflict handling

[PFC_CCM_application_SW_example_00007] For those values required by the peripherals which are coming from macros contained in PFC_CCM.h and will be as well generated by Apps, the value that should prevail is the one in the header file PFC_CCM.h, the App generated value should be replaced in the function PFC_Start() according to the header file.

3.3 Required APPs modifications

[PFC_CCM_application_SW_example_00008] The PWM, ADC and interrupt APPs shall follow the configuration of the peripherals according to Figure 1.

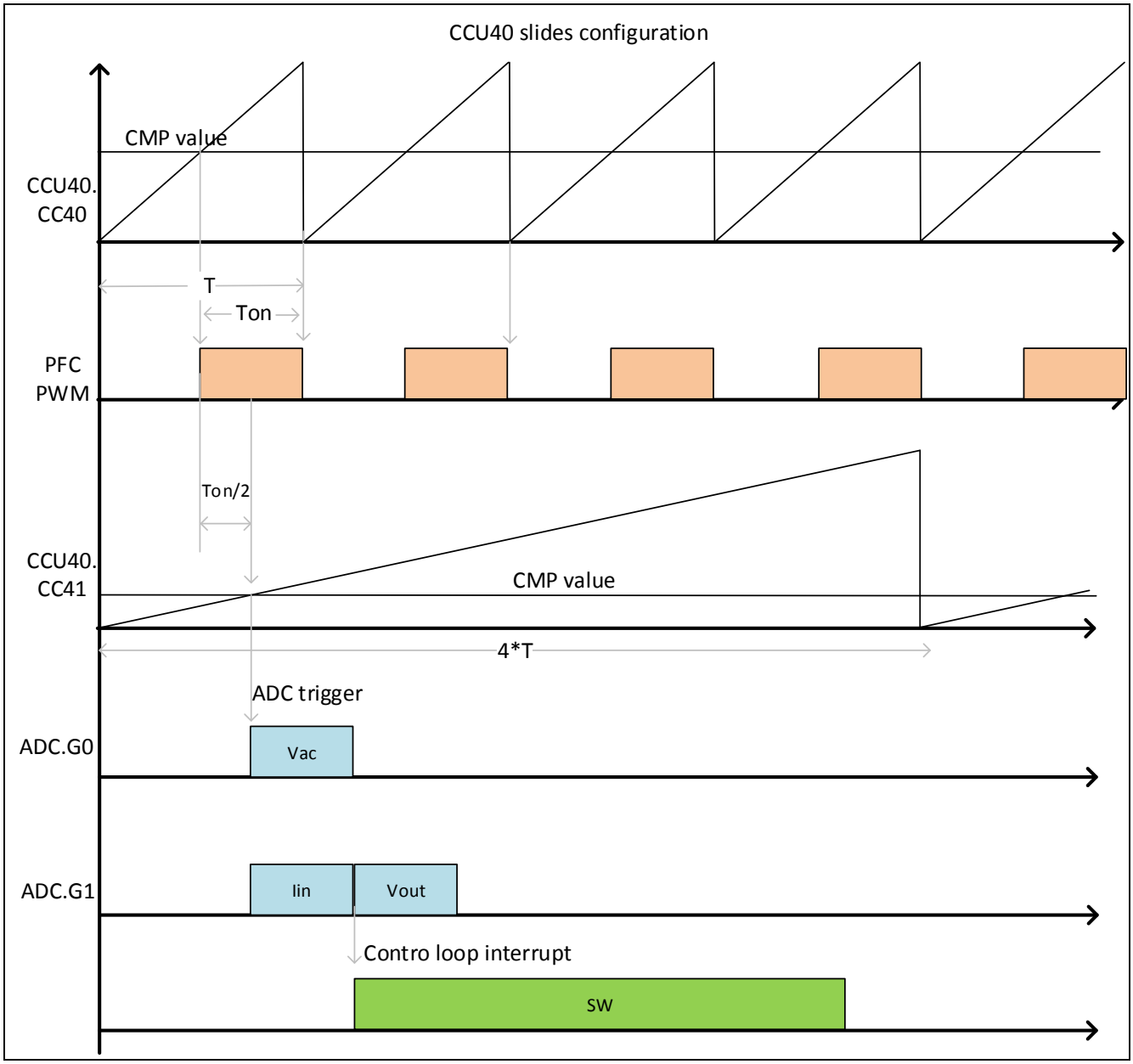

Figure 1 Peripherals configuration

[PFC_CCM_application_SW_example_00009] The 2 slides indicated in Figure 1, shall start synchronized.

Slide 1: shall be used to generate the PWM required for the PFC mosfet, with the given period and calculated PWM value from the control loop (compare value).

Slide 2: shall have a period multiple of the first slide and a compare value of half the value of the slide 1, to ensure capture of the average current.

[PFC_CCM_application_SW_example_00010] The trigger of the ADC conversion shall be done upon compare match of the second slide.

Three conversions have to be done:

- 1) Iin connected to P2.4 G1.ch6
- 2) Vac connected to P2.0 G0.ch5
- 3) Vout connected to P2.3 G1.ch5

Iin and Vac should be done in parallel and finished at the same time (different groups, same sampling time), and Vout after Iin.

[PFC_CCM_application_SW_example_00011] The call of the control loop interrupt shall be done upon conversion finish of In or Vac.

4 Nonfunctional Requirements

This section elaborates nonfunctional requirements that need to be taken into account for architecture definition and implementation.

4.1 Size and Performance

4.1.1 Size

N/A

4.1.2 Performance

Considering the same clock speed, only the additional compare value calculation and writing for ADC conversion in slide 2 will affect the performance.

The resulting CPU performance of such change will be accepted; any other change on CPU performance should be discussed and agreed.

4.2 Standards compliance

The code must follow the coding guidelines proposed by the XMC group as long as the functionality and performance in terms of speed and size of the code is not hindered

4.3 Software Quality Attributes

4.3.1 Reliability

N/A

4.3.2 Availability

N/A

4.3.3 Security

N/A

4.3.4 Maintainability

N/A

4.3.5 Portability

N/A

5 Acceptance Test Criteria

The resulting modified example should perform the same way or better from an application point of view than the provided SW prototype, nevertheless since the existing example is based on XMC1300, a review of the provided code is as well required for acceptance.

w w w . i n f i n e o n . c o m

Published by Infineon Technologies AG