Important application hints for dead time generation with the Capture/Compare Unit.
## Revision History:

**Revision History:**

**Previous Version:** -

<table>
<thead>
<tr>
<th>Page</th>
<th>Subjects (major changes since last revision)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Updated layout to Infineon Corporate Design, updated to release 1.0, Content unchanged!</td>
</tr>
</tbody>
</table>

Controller Area Network (CAN): License of Robert Bosch GmbH

---

**We Listen to Your Comments**

Any information within this document that you feel is wrong, unclear or missing at all? Your feedback will help us to continuously improve the quality of this document. Please send your proposal (including a reference to this document) to:

mcdocu.comments@infineon.com
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 your 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 your nearest Infineon Technologies Office.

Infineon Technologies Components may only be used in life-support devices or systems 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.
## Table of Contents

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>1. Application hints for dead time generation with the Capture / Compare Unit</td>
</tr>
</tbody>
</table>

Application Note 3 V 1.0, 2004-02
1 Application hints for dead time generation with the Capture / Compare Unit

The design of the Capture / Compare Unit (CCU) of the C504 microcontroller allows generation of 7 digital output signals without CPU load. A set of Special Function Registers (SFR, see corresponding tables in C504 User’s Manual) offers to the users extreme flexibility to choose of possible waveforms, such as pulse width modulation (PWM). By appropriate setting of SFRs, frequency (period register), duty cycles (compare registers) and active / passive levels (COINI register) of output signals can be easily controlled.

These features should be used with respect to the application, e.g. motor control using three phase transistor inverters with automatic dead time generation by the CCU. The dead time is implemented with a 16-bit offset register. In order to generate correct output pulse patterns for three phase transistor inverters, passive levels for highside switches must be inverted compared to those of lowside switches.

After each zero-crossing of Compare Timer 1 (CT1), all output signals (CCx, COUTx, with x=0..2) are at passive level (defined in register COINI). Outputs CCx are switched to active level when CT1 value is equal to the pre-programmed value in the corresponding compare register. The switching of COUTx occurs when CT1 value plus offset value equals the compare value. A duty cycle of 0% for COUTx outputs is achieved when the programmed compare value is equal to the offset value.

Basically, the CCU design allows the user to write any values to offset and compare registers. However, in motor control applications, the programmed offset value may not exceed the compare value. This combination is not allowed.

If this condition is violated, the corresponding COUTx output is constantly kept on active level. This can lead to short-circuit current in the corresponding converter's bridge leg. As far as this case is crucial to the target hardware, it is advised (especially at the beginning of software design) to make an additional software check before every change of offset or compare registers.
Example:

```c
if ( offset_d > compare )
    then offset_p = compare;
    else offset_p = offset_d;
```

with:

```plaintext
offset_d = desired offset  
offset_p = programmed offset  
compare = compare value 
```

Such precautions are very helpful for beneficial usage of flexible CCU features in C504-based designs.