CCU6
Capture Compare Unit 6

Key Features
- Center aligned / edge aligned PWM
- Block commutation for brushless DC
- Fast emergency stop (/CTRAP)

Highlights
- The CCU6 unit is used to control AC and DC drives
- Special operating modes support the control of Brushless DC-motors using Hall sensors or Back-EMF detection

Customer Benefits
- Fits perfectly to most of all eMotor applications
- The CPU load is reduced due to optimized module implementation
- Easy to configure for block commutation
CCU6
Center aligned/edge aligned PWM

› Center aligned PWM
› Space Vector Modulation fits perfectly to Permanent Magnetic Synchronous Motor applications
› Benefits:
   - EMC is reduced by center aligned PWM
   - Shadow transfer on Period match/zero match
   - The length of the dead time can be programmed individually in order to deal with transient behavior of the MOSFETs

› Edge aligned PWM
› Brushless DC (Block commutation)
› Benefits:
   - Fits perfectly to block commutation
   - Easy to implement
CCU6
Block commutation for brushless DC

› At every correct Hall event, a new Hall pattern with its corresponding output pattern can be loaded
› The sampling of the Hall pattern is done with T12 input clock
› A noise filter can be realized by using the dead time counter DTC0 (6 bit wide)
› The Hall pattern inputs are sampled and compared with the current Hall pattern and the expected next Hall pattern in order to determine the movement direction of the motor. If the values match, no further action is needed.
CCU6
Fast emergency stop (/CTRAP)

› Fast emergency stop without CPU load via external signal (/CTRAP)
  ‒ Switch output channel to a defined state
› TRAP control
  ‒ passive state select bit for each channel
  ‒ initialization bit for each channel
› In TRAP state, all outputs can be switched to selected passive state
› TRAP state can be triggered by SW or HW via a bit field
## CCU6 System integration

### Overview

- Capture/Compare Unit CCU6 generates ADC conversion to measure current
- Position recognition can be realized by Hall sensors (CCU6), encoder (GPT12) and resolver (DSADC)

### Advantages

- No external resources are needed for motor control (all modules are integrated in AURIX™)
- Synchronous triggering of ADC is done by CCU6
- All modules for controlling a PMSM/BLDC are on-chip (AURIX™)

### Table

<table>
<thead>
<tr>
<th>Motor Current ADC</th>
<th>Motor Pattern CCU6</th>
<th>Position Sensor</th>
</tr>
</thead>
</table>
| - Sample Rate < 1 µs  
- ADC is triggered by CCU6  
- Delay generation to avoid spikes  
- Interrupt generation is possible  
- Independent ADC modules are available | - 6 PWM outputs  
- Center/Edge aligned PWM  
- Dead time generation  
- Interrupt generation  
- Generation of trigger events for ADC | - Hall Sensors  
Processed by CCU6 |
|                   |                    | - Encoder  
Processed by GPT12  
(Timer Incremental Mode) |
|                   |                    | - Resolver  
Processed by DSADC |

- 6 PWM outputs
- Center/Edge aligned PWM
- Dead time generation
- Interrupt generation
- Generation of trigger events for ADC

- Hall Sensors
- Encoder
- Resolver

- Processed by CCU6
- Processed by GPT12
- Processed by DSADC

- Sample Rate < 1 µs
- ADC is triggered by CCU6
- Delay generation to avoid spikes
- Interrupt generation is possible
- Independent ADC modules are available

- Copyright © Infineon Technologies AG 2019. All rights reserved.
Overview

› Capture/Compare Unit CCU6 generates PWM pattern to turn the motor

› With the position, provided by the Hall sensors, the next commutation pattern is generated automatically

Advantages

› Generating different PWM patterns with less CPU interaction

› Synchronous triggering of ADC conversions

› Handling of sensor-less brushless DC motor applications
IMPORTANT NOTICE
The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics (“Beschaffenheitsgarantie”).

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, 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.

In addition, any information given in this document is subject to customer’s compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer’s products and any use of the product of Infineon Technologies in customer’s applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer’s technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

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

WARNINGS
Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies’ products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.