CCU6
Capture Compare Unit 6

AURIX™ TC3xx Microcontroller Training
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CCU6
Capture Compare Unit 6
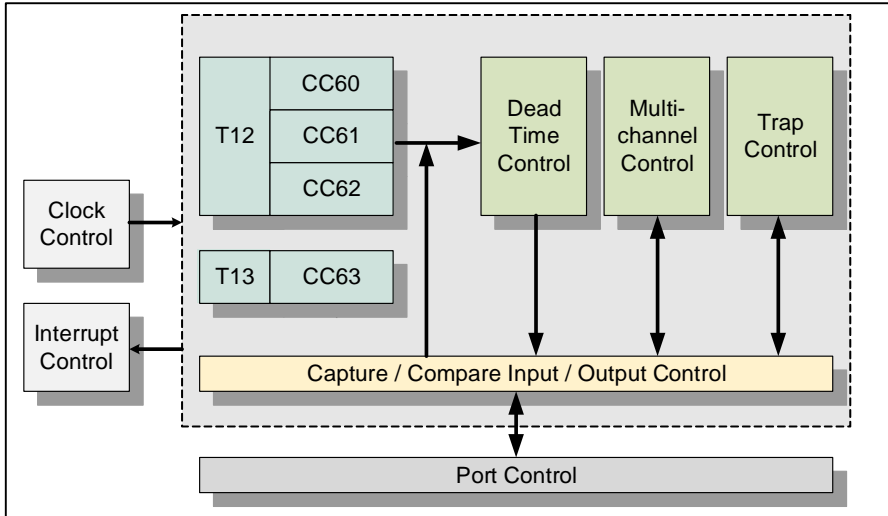
Highlights

› 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

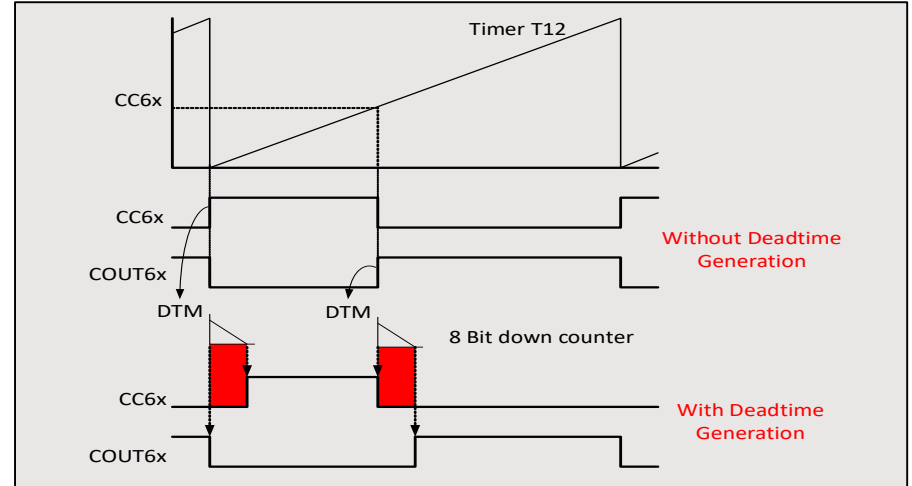## Key Features

Center aligned / edge aligned PWM

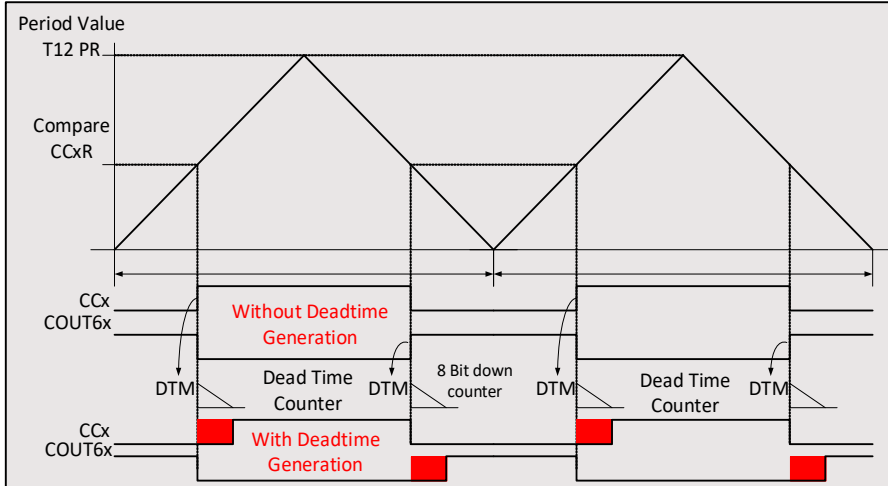Block commutation for brushless DC

Fast emergency stop (/CTRAP)

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 **P**ermanent **M**agnetic **S**ynchronous **M**otor 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
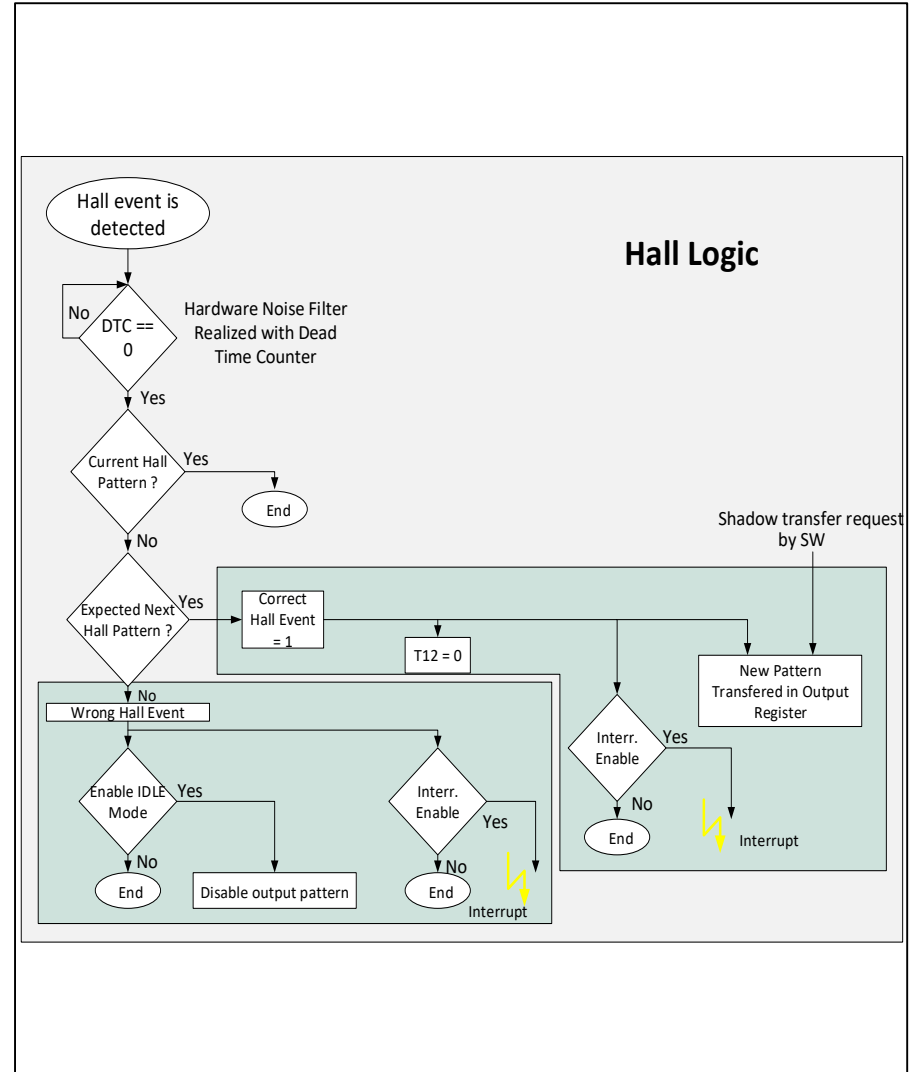
CCU6
Fast emergency stop (/CTRAP)

› 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

Motor Current ADC	Motor Pattern CCU6	Position Sensor
• 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

Overview
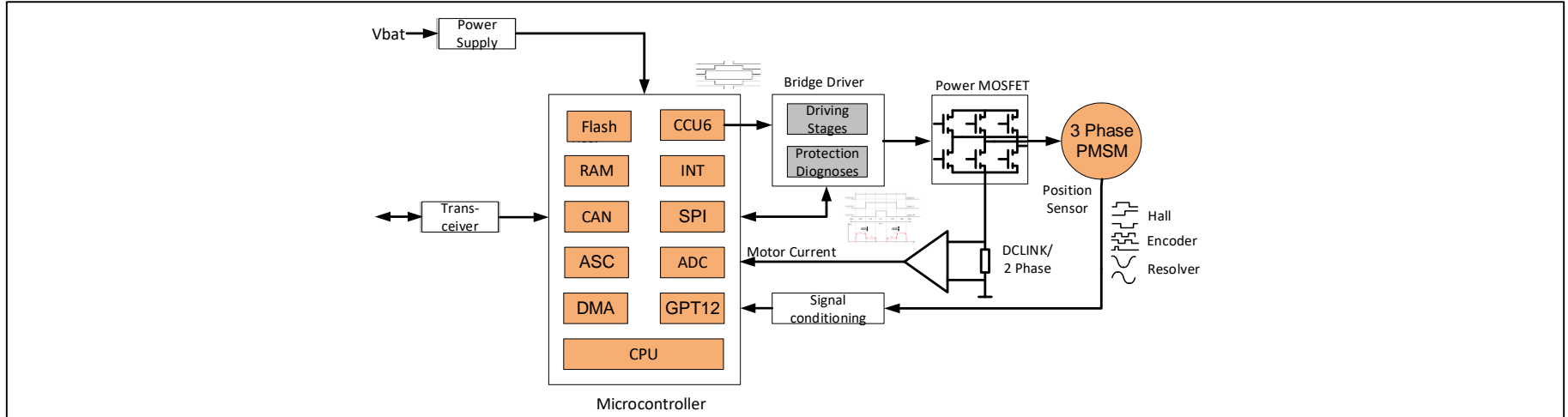
› Capture/Compare Unit CCU6 generates ADC conversion to measure current

› 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™)

Application example
Brushless DC drive application

Overview

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

› With the position, provided by the Hall sensors, the next comutation 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

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