

TOSHIBA

BLDC: Brushless Motor

Proposal for Electric Motor Applications

~ Microcontrollers ~

Toshiba Electronic Devices & Storage Corporation

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Value provided

Helps system development, efficiency up, cost down and downsizing

1 System Development TAT Improvement

- Integrated Motor control hardware (VE, PMD, ADC & Encoder) helps improve system development TAT for vector control.

2 High Efficiency Motor Control

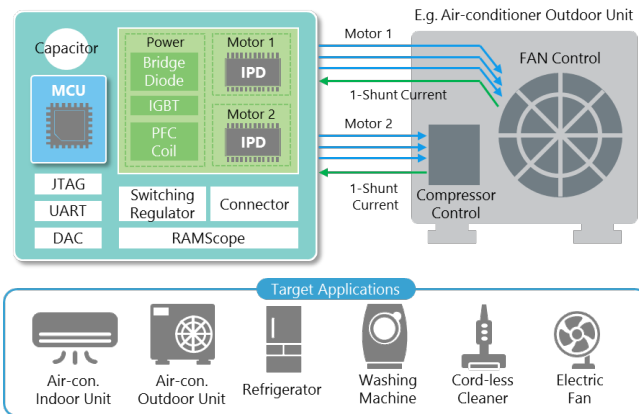
- VE & Encoder reduce CPU load by doing vector calculation & position estimation on behalf of CPU. Vector control improves system efficiency.

3 Cost Down & Downsizing

- Integrating external part (Op-Amp), supporting sensor-less 1-shunt (VE +PMD) and driving multiple Motors (CPU+PMD) optimize total system.

VE : Vector Engine (next page shows details)

PMD : Programmable Motor Driver (next page shows details)



1 MCU can control multiple Motors and other processes (e.g. PFC)

Customer value / Social subject contribution

- High efficiency & stable Motor control and low noise
- Environment friendly
- Contribution to performance up and power saving on equipment

Product lineup

- M370 series : Arm® Cortex®-M3 core with VE
- M470 series : Arm® Cortex®-M4 core with VE
- M4K series : Arm® Cortex®-M4 core with VE

Shorten Development TAT by Motor Control Hardware

3-Phase PWM (PMD)

- ✓ 3-Phase complementary PWM output and AD converter co-working
- ✓ Ease of controlling BLDC Motor

AD Converter (ADC)

- ✓ 12-bit SAR type
- ✓ Conversion synchronizing with Motor control timing

Vector Engine (VE)

- ✓ Vector calculation hardware
- ✓ Co-work with ADC & PMD
- ✓ User-settable current command & Phase

Encoder (ENC)

- ✓ Ease of obtaining Motor position
- ✓ Supports direct-input of incremental encoder and hall sensor

High Efficiency Motor Control

Improve Motor Control Efficiency by Vector Control Hardware

Point 1 Vector Calculation

- Auto-calculation on coordinate transformation, PI control, etc.
- User-programmable on position & speed control.

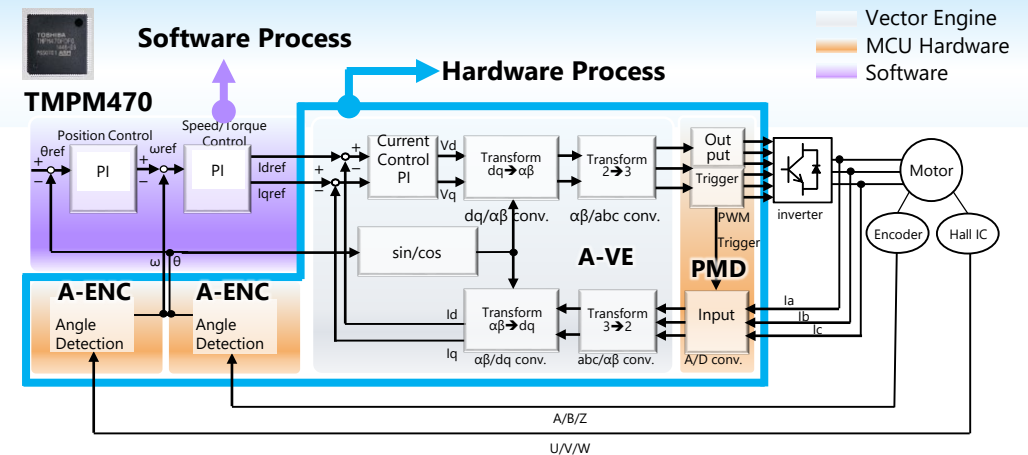
Point 2 Associated Functions

- Vector calculation with 3-Phase PWM output and AD converter reduces CPU processing time significantly.

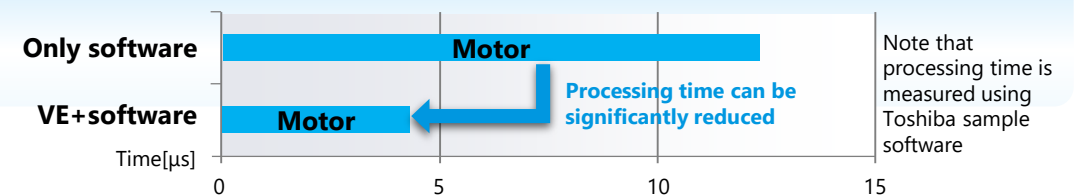
Point 3 Encoder & Hall Sensor

- Support 2- & 3-Phase incremental encoder with high accuracy count using both edges, rotation direction detection.
- Support hall sensor with direction, speed and RPM detection.

Structure of Motor Control (Vector Control)



Processing Time of Software (CPU clock 120MHz)



Significantly reduce CPU load,
High speed PWM & high accuracy vector control

Optimize Motor Control by Integration, 1-Shunt and Multi-Motor

Point 1 Built-in Op-Amp

- Built-in functions such as Op-Amp to amplify shunt current for vector control
- high accuracy oscillator and data flash reduce BOM

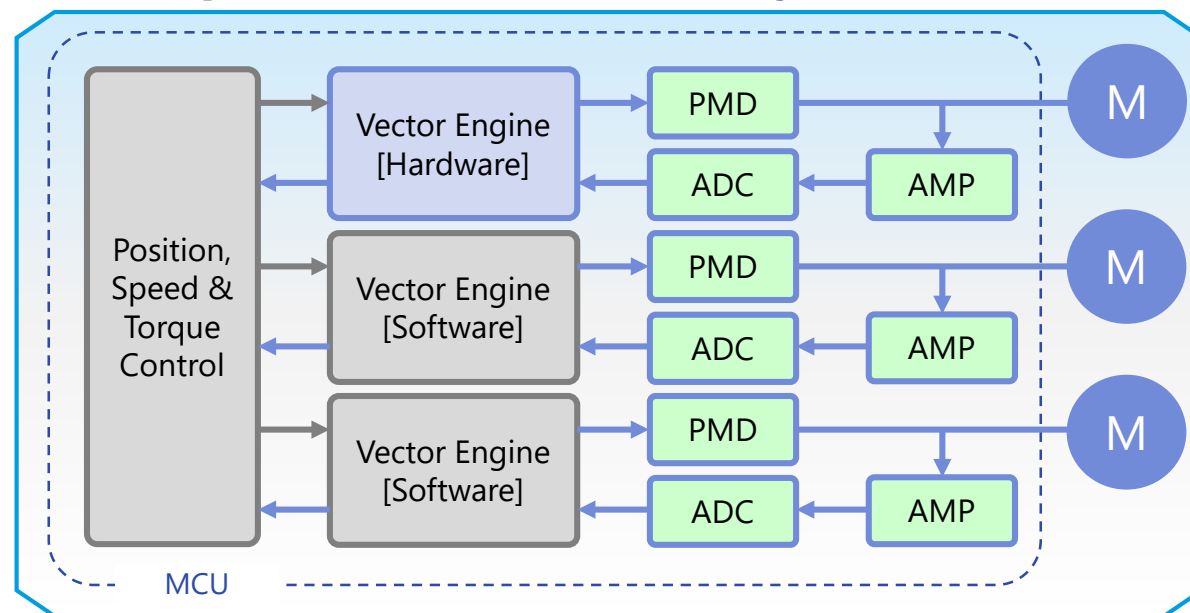
Point 2 1-Shunt Support

- PMD, a function to generate ADC trigger based on PWM waveform, supports 3-shunt as well as 1-shunt.

Point 3 Multi-Motor Control

- High speed CPU, vector engine and multiple PMDs support max. 3 Motor control.

Example : 3 Motor Control by M4K



Multi-Motor Support

1-Shunt Support

Built-in Op-Amp

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