32-BIT - Motor control development support

Fujitsu's range of microcontroller products, tooling and support dedicated to motor control applications.

Fujitsu supports customers in designing their applications. A wide range of application notes and software examples are available free of charge, covering a variety of applications and MCU peripherals. Starter kits and evaluation boards are available for nearly all microcontrollers. Additionally, a strong local support team is available for questions and gives hints regarding hardware and software design whenever needed. The team is in constant touch with designers in Fujitsu's European Design Centre (EMDC), in case a deeper look into the chip itself becomes necessary. The complete tool chain (compiler, assembler, linker) is free of charge in Europe and comes without any limitations in code size or runtime.

Motor control microcontrollers

Fujitsu Microelectronics offers a line-up of microcontrollers dedicated to motor control applications. It ranges from 8-bit F²MC-8FX products with flexible timers to drive brushed DC motors, several series of 16-bit microcontrollers (MB90560, MB90460, MB90820) with 3-phase motor drive functionality, up to powerful 32-bit dedicated motor control microcontrollers like the MB91260, MB91265 and MB91470/480 series. All 32-bit motor control MCUs include multiple ADC units, one or two multi-function timers with waveform generator and six PWM output channels each. The MAC unit supports the CPU in many algorithms typical for control applications, for example filters or control loops.

The MB91F267(N) is Fujitsu's current 32-bit entry level motor control MCU, featuring a flexible 3-phase motor timer, MAC-unit, two 10bit/1.2µs ADCs as well as a CAN controller with 32 message buffers. 128kB of dual operation Flash can execute code while writing or erasing Flash memory, allowing easy parameter and data storage without external memory.

The MB91470/480 series offers higher performance and advanced peripherals, such as the 32-bit wide MAC unit, six high-speed (up to 8Mbit) USART interfaces with SPI and I²C-compatible modes, enhanced ADCs and a second motor timer. Four base timers can be used as PPG (Programmable Pulse Generators), PWM (Pulse Width Modulation), PWC (Pulse Width Count) and reload timer. The four channels can be combined to two 32-bit timers in reload or PWC mode, allowing high-precision time measurements.
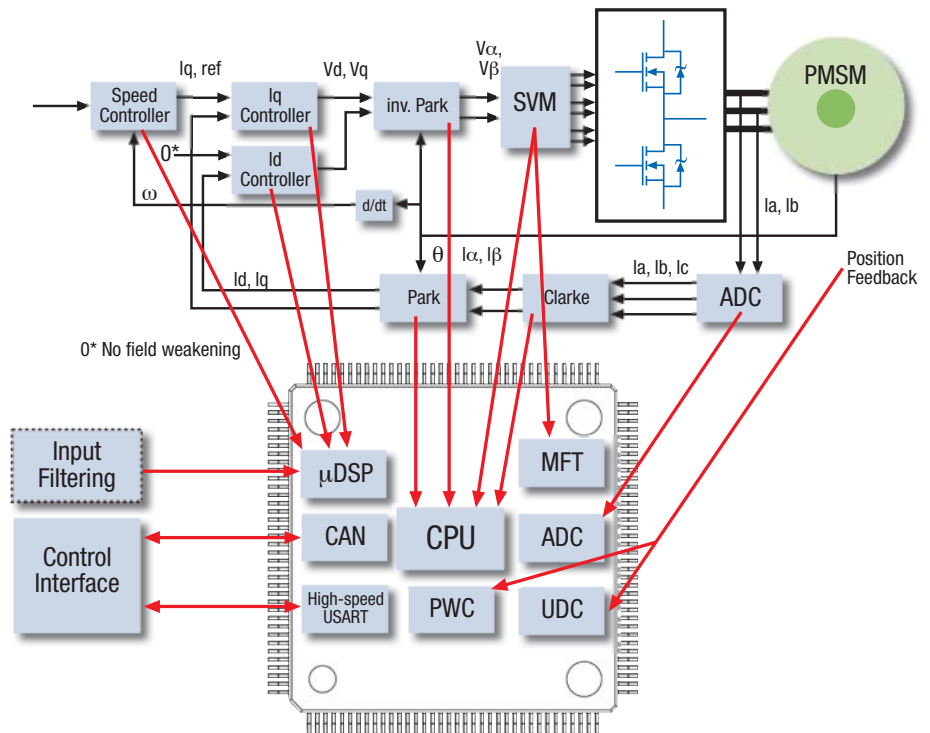
Peripherals used for motor control.

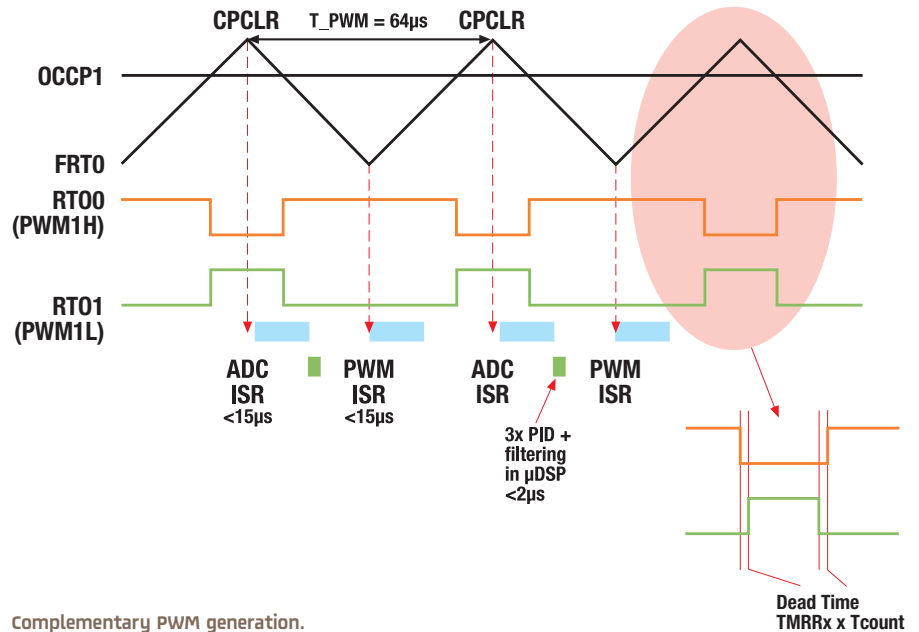|	MB91265 series	MB91470 series	MB91480 series
Flash/RAM size	128kB (Dual-OP) / 4kB	MB91F479: 512kB / 32kB MB91F478: 384kB / 24kB MB91F475: 256kB / 16kB	MB91F487: 512kB/32kB
Operating voltage	5V (4-5.5V)	5V (4-5.5V)	5V (4-5.5V)
Clock frequency	33MHz	80MHz	80MHz
Pin count	64	144	100
Ext. interrupts	8 + NMI	10 + NMI	10 + NMI
Input captures	4	4	8
Output compares	6	6	12
ADC ch./res./conv.time	4ch/10-bit/1.2µs 7ch/10-bit/1.2µs	**2 x 4ch/12-bit/2µs** 12ch/10-bit/1.2µs	2 x 4ch/10-bit/1.2µs 10ch/10-bit/1.2µs
Multi-function timer	1 x 6ch PWM	1 x 6ch PWM	**2 x 6ch PWM**
PPG	4 x 16-bit/8x 8-bit	4 x 16-bit/8 x 8-bit	8 x 16-bit / 16x 8-bit
Base timer	-	4ch 16-bit/2ch 32-bit	4ch 16-bit / 2ch 32-bit
16-bit timers (total)	14	16	26
USART channels	2	**6 (with SPI/I²C mode)**	**3 (with SPI/I²C mode)**
MAC unit	**16 x 16-bit + 40-bit**	**32-bit x 32-bit + 72-bit**	**32-bit x 32-bit + 72-bit**
Other	1ch CAN (32 MSG)	Up/Down counter with ABZ input External bus	Clock monitor

Development tools and support

Software examples and application notes are available free of charge on the web, showing configuration examples for the microcontroller peripherals and their usage for different applications.

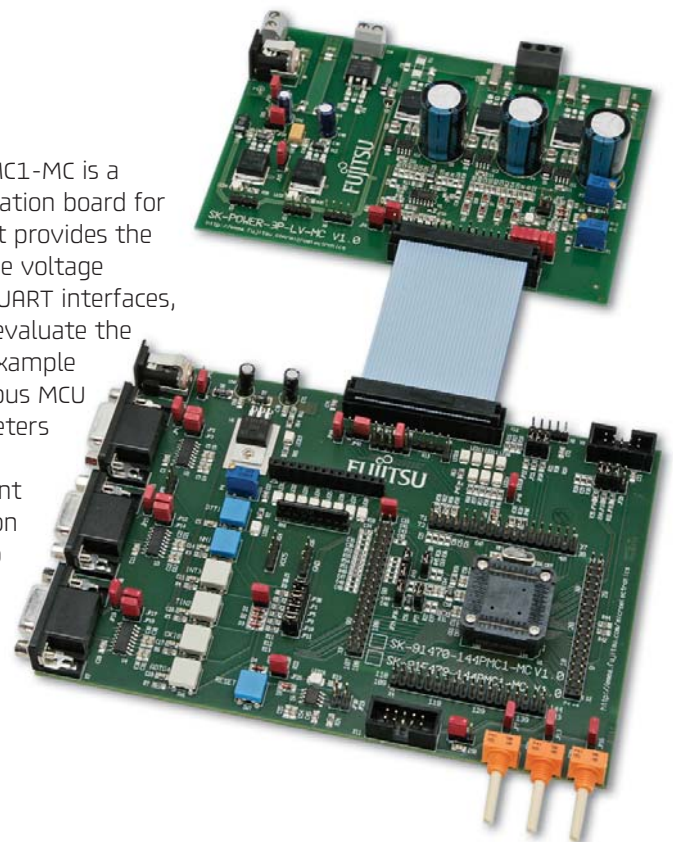Example software or application notes are available for:

- BLDC (Brushless DC) or PMAC (Permanent Magnet AC) motor with Hall sensors
- Sinusoidal PMAC drive with Hall sensors
- Sinusoidal PMAC drive with incremental encoder
- PMAC vector control
- Digital filtering using the MAC (Multiply-ACumulate) unit
- PID control loops with and without MAC unit support
- Dual-operation Flash
- Up/Down counter
- Peripherals such as ADC, UART, PPG
- … tbc

On the hardware side, starter kits and evaluation boards are available for nearly all Fujitsu microcontrollers, either general-purpose or application specific. This makes it easy to start with software development without waiting for the prototypes. Even the small, low-cost design-in kits such as the Phase3-Kit already come with the unrestricted version of the fully-featured Softune Workbench IDE (Integrated Development Environment).

The SK-91470-144PMC1-MC is a general-purpose evaluation board for the MB91470 series. It provides the basic infrastructure like voltage supply, oscillator and UART interfaces, but also hardware to evaluate the MCU peripherals, for example push-buttons for various MCU inputs and potentiometers connected to the ADC. Additionally, all relevant signals are combined on a 34-pin connector, to allow easy connection to an inverter board such as the SK-POWER-3P-LV-MC.

Complementary PWM generation.

SK-91470-144PMC1-MC (with SK-POWER-3P-LV-MC).

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THE POSSIBILITIES ARE INFINITE

Development tools and support

MB2198-O1 emulator system

The MB2198-O1 emulator system is Fujitsu's real-time ICE (In-Circuit Emulator) for all 32-bit FR family devices. It provides a full set of debugging features, such as:

- Connection to PC via RS232, USB or LAN
- High-level language debugging with in-line assembler
- 5 hardware + 4096 software breakpoints
- 2 code event/2 data event breakpoints
- External trigger break

Softune Workbench

The Softune Workbench is an IDE (Integrated Development Environment) for Fujitsu microcontrollers. It combines C/C++-compiler, assembler, linker, as well as simulator, emulator and monitor debugger functions in one GUI.

- Full version free of charge in EU
- C-compiler (also supports C++ for 32-bit MCUs), assembler, linker
- Simulator, emulator, monitor debugger
- Example projects
- Freeware Flash programming tool for RS232

Accemic MDE debugger

- In-system debugging for many Fujitsu MCUs
- No additional hardware required
- Numerous debugging features at a reasonable price