Spansion® FM Family: ARM® Cortex®-M based Microcontrollers
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CORE&CODE

Technical Tips for System Designers

Core & Code offers technical expertise and content tailored for embedded system designers. Published on a quarterly basis, Core & Code features articles, “how-to” design pieces, application notes, new products and more from Spansion and other industry thought leaders on embedded technologies, products, issues and best practices for designing products in automotive, industrial, consumer and networking markets. This platform provides a forum to share knowledge on the industry and recommendations to ease the design process.

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The Spansion® FM microcontrollers (MCUs) incorporate the latest ARM® Cortex® standard cores (M0+, M3 and M4), offering users the optimal product for a wide range of industrial and consumer applications.

The scalable platform ranges from low-pin-count, low-power microcontrollers to high-performance products with a rich set of peripherals (including CAN, USB and Ethernet) and up to 2MB flash memory. The high-speed, embedded flash process technology offers the endurance of 100K erase/write cycles and up to 20 years of data retention.

### ARM Cortex-M CPU Comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>M0</th>
<th>M0+ (used in FM0+)</th>
<th>M3 (used in FM3)</th>
<th>M4 (used in FM4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power consumption (CPU)</strong></td>
<td>16µW/MHz</td>
<td>11.2µW/MHz</td>
<td>0.1mW/MHz</td>
<td>-</td>
</tr>
<tr>
<td><strong>Performance</strong></td>
<td>0.84 DMIPS/MHz</td>
<td>0.93 DMIPS/MHz</td>
<td>1.25 DMIPS/MHz</td>
<td>Same as M3</td>
</tr>
<tr>
<td><strong>IRQs</strong></td>
<td>NMI + 32</td>
<td>NMI + 32</td>
<td>NMI + 240</td>
<td>Same as M3</td>
</tr>
<tr>
<td><strong>Pipeline</strong></td>
<td>3 stage</td>
<td>2 stage</td>
<td>3 stage + branch speculation</td>
<td>Same as M3</td>
</tr>
<tr>
<td><strong>Instruction set</strong></td>
<td>Thumb®/Thumb-2 subset</td>
<td>Thumb®/Thumb-2 subset</td>
<td>Thumb®/Thumb-2</td>
<td>Same as M3</td>
</tr>
<tr>
<td><strong>Single cycle multiply 32x32</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Same as M3</td>
</tr>
<tr>
<td><strong>Hardware divided (2-12 cycles)</strong></td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>Same as M3</td>
</tr>
<tr>
<td><strong>Debug</strong></td>
<td>Up to 4 Breakpoints and 2 Watchpoints</td>
<td>Up to 4 Breakpoints and 2 Watchpoints</td>
<td>Up to 8 Breakpoints and 4 Watchpoints</td>
<td>Same as M3</td>
</tr>
<tr>
<td><strong>Trace</strong></td>
<td>-</td>
<td>Micro trace buffer</td>
<td>ETM</td>
<td>Same as M3</td>
</tr>
<tr>
<td><strong>Bit manipulation</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Same as M3</td>
</tr>
<tr>
<td><strong>DSP instructions</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Single precision FPU</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>✓</td>
</tr>
</tbody>
</table>
Key Features

Outstanding Performance
• ARM Cortex-M series core
• High CPU clock frequencies of up to 200MHz (FM4) and 144MHz (FM3)
• Highly reliable, high-speed, secure embedded flash memory
  - True zero-wait-state flash operation at 72MHz
  - Pre-fetch buffer for zero-wait-state operation at 200MHz
• Support for voltages ranging from 1.65-5.5V
  - 1.65–3.6V: low-power products
  - 1.8–5.5V: ultra-low-leakage products
  - 2.7–5.5V: high-performance products
• DMA controller with dedicated bus layer and up to eight independent channels

Functional Safety
• Internal, trimmed RC oscillators as an independent clock source
• Clock supervisor
• Two-stage (interrupt and reset), programmable LVD (low voltage detector)
• CRC hardware module
• MPU (memory protection unit)
• Programmable emergency stop input for PWM motor control
• Self-test library for IEC61508 and IEC60730
• Watchdog timer

High-Performance Flash Memory
• Memory densities up to 2MB flash/256KB RAM
• Highly reliable flash memory
  - 100,000 write/erase cycles endurance
  - Up to 20 years of data retention
• Flash security function
• Dual-operation flash for EEPROM emulation on many devices

Low Power
• Dedicated low-power chip design with clock and power gating
• Multiple low-power options for finely grained power-saving modes
• Dedicated power domain for deep standby modes
• Low-power, low-leakage products for handheld, battery-powered applications

I/O Ports
• Internal pull-up resistors (enable/disable)
• Flexible resource relocation: most peripheral functions can be routed to two or more MCU pins
• 12mA general-purpose IOs
• Readable external pin state

Connectivity
• Up to two channels CAN controller
• CAN-FD controller on some series
• Full-speed USB host/device, up to two channels each
• Up to two channels Ethernet MAC
• Flexible, multi-function serial interfaces covering SPI, CAN (up to 20 Mbps), LIN and UART
  - I²C/SPI/LIN/UART selectable within each channel
• 8/16-bit external bus interface with support for SRAM, NOR-, NAND-flash and SDRAM (FM4)
• HDMI-CEC macro (with IR receive macro)

Advanced Peripherals
• Up to three multifunction timers (for motor control)
  - Includes waveform generator with dead time insertion
  - Includes advanced A/D converter trigger unit
• Quadrature decoder unit for motor-control feedback and HMI input devices, multi-turn capability
• Base timer (PWM, PWC, PPG and reload timer)
• Sub-clock option
• Up to three independent (synchronously triggerable), high-speed
  12-bit A/D converters, conversion time: 0.5μs on FM4, 1μs on FM3
• Up to two channels, 12-bit D/A converters

Debug Interface
• JTAG and SWJ debug interfaces
• Embedded trace macro-cell on many devices

Applications

Spansion FM microcontrollers are appropriate for a wide variety of applications, including:
• Industrial
• Motor control and other inverter applications
• Factory automation
• White goods
• Home appliances
• Home automation and sensor control
• Power tools
• Medical and healthcare applications
• Handheld devices
The Spansion FM MCU lineup consists of three families—FM0+, FM3 and FM4—each of which uses a specific ARM Cortex-M core. Users can easily transition between device types and families because of the compatibility of the instruction sets.
Spansion FM4 family

**Cortex-M4**

**Core Products**

**High Performance**

- For industrial applications
- Higher spec with FPU/DSP
- Quadruple performance in arithmetic program (compared with FM3)
- Max frequency: 200MHz
- Operation voltage: 2.7V-5.5V

The FM4 family of 32-bit, general purpose MCUs is based on the ARM Cortex-M4F processor core. This family, which features DSP and floating point (FPU) functions, covers the highest end of the product range.

The MCUs are designed for applications that require advanced, high-speed computing performance such as general-purpose inverters, servomotors, PLCs and other industrial equipment, as well as inverter-based home appliances such as washing machines and air conditioners.

**Key Features**

- Frequency: up to 200MHz
- Operating voltage: 2.7-5.5V
- Low power consumption: 0.4mA/MHz, 1.5uA RTC mode
- Flash: 256KB-2MB
- Up to 256KB RAM
- 48-216 pin packages
- IP: Ethernet, CAN, USB2.0, motor control

**Applications**

- Inverter motor control
- Factory automation, PLCs
- Highly efficient white goods
- Medical
- Surveillance

**Motor and Inverter**

- High spec vector arithmetic
- Enhanced motor control timer
- High speed sampling A/D converter (conversion speed: 2Msps)

**Networks**

- Enriched communication function (SD I/F, Ethernet, CAN-FD, High speed serial I/F, HS SPI)
- Large size memory
- SDRAM I/F

**FM4 Product Lineup**

![Flash/RAM size chart](chart)

<table>
<thead>
<tr>
<th>Flash/RAM size</th>
<th>2MB/256KB</th>
<th>1.5MB/192KB</th>
<th>1MB/128KB</th>
<th>768KB/96KB</th>
<th>512KB/64KB</th>
<th>384KB/48KB</th>
<th>256KB/32KB</th>
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<td>MB9BFx66R</td>
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</tr>
</tbody>
</table>

**Planning**

- y>C EtherMAC + CAN + USB
- y=2 EtherMAC + CAN
- x=5 CAN + USB
- x=4 CAN
- x=3 USB
- x=1 STD
- EEPROM emu

Under design
Key Features

- **High performance**
  - 160MHz/200MHz access with 0wait states by flash accelerator
  - FPU & DSP embedded: 4 times as FM3

- **Low power consumption**
  - Run mode: 0.34mA/MHz
  - RTC mode(VBAT): < 2.0uA

- **Motor control timer**
  - Reinforcement of wave pattern generation

- **Interface**
  - Built-in SD card I/F (SDIO)
  - External bus supports SDRAM I/F

- **Analog circuit**
  - ADC: High speed(2MSPS)
  - DAC: 12bit resolution

- **DSTC**
  - Reduces CPU load

- **Wide range of power supply**
  - 2.7-5.5V system power supply

---

**FM4 Package Lineup**

<table>
<thead>
<tr>
<th>Pin</th>
<th>LQFP</th>
<th>QFP</th>
<th>BGA</th>
<th>QFN</th>
</tr>
</thead>
<tbody>
<tr>
<td>216</td>
<td>24x24mm/0.4mm</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>192</td>
<td>—</td>
<td>—</td>
<td>12x12mm/0.8mm</td>
<td>—</td>
</tr>
<tr>
<td>176</td>
<td>24x24mm/0.5mm</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>144</td>
<td>20x20mm/0.5mm</td>
<td>—</td>
<td>7x7mm/0.5mm</td>
<td>—</td>
</tr>
<tr>
<td>120</td>
<td>16x16mm/0.5mm</td>
<td>—</td>
<td>—</td>
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<tr>
<td>112</td>
<td>—</td>
<td>—</td>
<td>7x7mm/0.5mm</td>
<td>—</td>
</tr>
<tr>
<td>100</td>
<td>14x14mm/0.50mm</td>
<td>14x20mm/0.65m</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>80</td>
<td>14x14mm/0.65mm</td>
<td>12x12mm/0.50mm</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>64</td>
<td>12x12mm/0.65mm</td>
<td>10x10mm/0.50mm</td>
<td>—</td>
<td>9x9mm/0.50mm</td>
</tr>
<tr>
<td>48</td>
<td>7x7mm/0.50mm</td>
<td>—</td>
<td>—</td>
<td>7x7mm/0.50mm</td>
</tr>
</tbody>
</table>

Note: Left value is body size, right value is pin pitch.
• ARM Cortex-M4F CPU Core
  Frequency: up to 200MHz
• Flash 2MB (Maximum)
  - Highly reliable, high-speed, secure embedded flash memory
  - True zero-wait-state flash operation at 72MHz
  - Pre-fetch buffer for zero-wait state operation at 200MHz
• SRAM 256KB (Maximum)

• Advanced Peripherals
  - Multi-function timer 3 units
  - Base timer 16ch
  - PPG 9ch
  - Dual timer
  - QPRC 4ch

• Rich communication interface
  - MFS (UART/SPI/I²C/LIN) 16ch
  - USB (host/function) 2ch
  - High speed quad SPI
  - CAN 2ch/CAN-FD 1ch

• A/D Converter
  Conversion time: 0.5μs (2 Msps)@5V
• D/A Converter
System Block Diagram

- **A/D Converter**
  - Conversion time: 0.5 μs (2 Msps) @ 5V

- **D/A Converter**
Spansion FM3 Family

The FM3 family of 32-bit general-purpose MCUs is based on the ARM Cortex-M3 CPU, providing a scalable platform for many consumer and industrial applications. Popular applications range from motor control, factory automation, white goods and power tools to medical devices, major home appliances, digital consumer devices and office automation equipment.

The MCUs include a host of peripheral features, including multiple motor-control timers, high-speed ADCs, and a variety of communication interfaces. The wide operating voltage range (1.8V to 5.5V) improves the signal-to-noise ratio, resulting in a robust design that is unique among Cortex-M3 microcontroller families. Available packages range from 32 pin to 176 pin with flash memory densities ranging from 64KB to 1.5MB.

The FM3 family, which features a maximum operating frequency of 20-144 MHz, is split into four groups: high-performance, basic, low-power and ultra-low-leakage. All products are based on the same architecture for software compatibility, use the same peripherals and are pin compatible in most cases. The main differences between the groups are the CPU operating frequency and supply voltage.

### Sub-Families

**HIGH PERFORMANCE**
- Up to 144MHz
- 2.7V-5.5V
- Up to 1MB flash
- Up to 128KB RAM
- USB, device and host
- CAN
- Ethernet
- Motor control

**BASIC**
- Up to 72MHz
- 2.7V-5.5V
- Up to 1.5MB flash
- Up to 192KB RAM
- USB, device and host
- CAN
- Motor control
- Optimized cost

**LOW POWER**
- 40MHz
- 1.65V-3.6V
- Separated power domains
- LCD
- USB, device and host

**ULTRA LOW LEAKAGE**
- 20MHz
- 1.8V-5.5V
- Low stop mode current consumption
- LCD, CAN
- Standard set of peripherals

### Applications

- Factory automation
- Building automation
- Motor control
- Home appliances
- Power tools
- Handheld devices
- Medical
Key Features

High Performance MCU
- Integrated global ARM core and Spansion original flash accelerator

High Quality Flash Memory
- Up to 1000K erase cycles
- EEPROM emulation applicable

Sophisticated Motor Control Timer
- Both motor and IGBT controllable

Advanced Analog
- High accuracy ADC suitable for sensors

Analog Circuit
- Many functional safety features
- IEC61508/60730 corresponding

Low Power
- Combined high performance and low power

Wide Supply Voltage Range
- 1.8V/3.3V/5.0V ranges

FM3 Package Lineup

<table>
<thead>
<tr>
<th>Pin</th>
<th>LQFP</th>
<th>QFP</th>
<th>BGA</th>
<th>QFN</th>
</tr>
</thead>
<tbody>
<tr>
<td>192</td>
<td>—</td>
<td>—</td>
<td>12x12mm/0.8mm</td>
<td>—</td>
</tr>
<tr>
<td>176</td>
<td>24x24mm/0.5mm</td>
<td>—</td>
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<td>—</td>
</tr>
<tr>
<td>144</td>
<td>20x20mm/0.5mm</td>
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<td>—</td>
<td>—</td>
</tr>
<tr>
<td>120</td>
<td>16x16mm/0.5mm</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>112</td>
<td>—</td>
<td>—</td>
<td>10x10mm/0.8mm</td>
<td>—</td>
</tr>
<tr>
<td>100</td>
<td>14x14mm/0.50mm</td>
<td>14x20mm/0.65mm</td>
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<td>—</td>
</tr>
<tr>
<td>96</td>
<td>—</td>
<td>—</td>
<td>6x6mm/0.5mm</td>
<td>—</td>
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<tr>
<td>80</td>
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<td>12x12mm/0.50mm</td>
<td>—</td>
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<tr>
<td>64</td>
<td>12x12mm/0.65mm</td>
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<td>9x9mm/0.50mm</td>
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<td>52</td>
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<td>7x7mm/0.80mm</td>
<td>—</td>
<td>—</td>
<td>5x5mm/0.50mm</td>
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</tbody>
</table>

Note: Left value is body size, right value is pin pitch.
FM3 High-Performance Group

MB9BD10S/T

**ARM Cortex-M3 — CPU**

- **144MHz (Max)**
- **2.7-5.5V**

Main CLK: 4MHz
- SUB CLK: 32kHz
- MAIN RC CLK: 100kHz

---

**RC Oscillator +/-2%**

**Clock Supervisor**

**Subclock (option)**

**Low Voltage Detector 2ch**

**Memory Protection Unit**

**SWJ/TPIU/ETM Debug Ports**

**MFS (UART/CSI0/LIN) 8ch**

**USB FS Host+Function 2ch each**

**CAN (32 MSB) 2ch**

**Ethernet MAC 10/100MBit 2ch**

**External Bus Interface 8/16 Data, 19/25*2 Addr, 8CS**

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**Flash/RAM size**

<table>
<thead>
<tr>
<th>Pins</th>
<th>1MB /128KB</th>
<th>768KB /96KB</th>
<th>512KB /64KB</th>
<th>384KB /48KB</th>
<th>256KB /32KB</th>
<th>128KB /32KB</th>
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<td>MB9BFx18S</td>
<td>MB9BFx18S</td>
<td>MB9BFx18S</td>
<td>MB9BFx18S</td>
<td>MB9BFx18S</td>
<td>MB9BFx18S</td>
<td>MB9BFx18S</td>
</tr>
</tbody>
</table>

---

**OCU 6ch**

**ADT 3ch**

**Multifunction Timer 3 units**

**ICU 4ch**

**FRTim 3ch**

**Waveform Generator**

**PPG 9ch**

**Base Timer 16ch**

**External IRQs 16ch + NMI**

**DMA 8ch**

**CRC 8ch**

**QDU 3ch**

**Watch Counter**

**Resource Pin Relocation**

**Hardware Watchdog**

---

**Package: LQFP144**

1. MB9BD10S: LQFP144
2. MB9BD10T: LQFP176
**Basic Group**

- Frequency: up to 72MHz
- Operating voltage: 2.7-5.5V
- Flash: 64KB-1.5MB
- Up to 192KB RAM
- 32-176 pin packages
- IP: CAN, USB2.0, motor control

**Applications**

- Household appliances
- Motor control
- Office automation
- Power tools
- Factory automation sensors

### FM3 Basic Group

#### Flash/RAM size

<table>
<thead>
<tr>
<th>Size</th>
<th>Flash</th>
<th>SRAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5MB</td>
<td>1MB</td>
<td>16K</td>
</tr>
<tr>
<td>1MB/128KB</td>
<td>512KB/32KB</td>
<td>16K</td>
</tr>
<tr>
<td>384KB/32KB</td>
<td>256KB/32KB</td>
<td>32K</td>
</tr>
<tr>
<td>128KB/16KB</td>
<td>64KB/16KB</td>
<td>64K</td>
</tr>
<tr>
<td>64KB/8KB</td>
<td>64KB/4KB</td>
<td>32K</td>
</tr>
</tbody>
</table>

#### Pins

- y=5 CAN + USB
- y=3 USB
- x=3 STD
- x=1 STD
- EE E2PROM emu

#### MB9A310N

- RC Oscillator +/−2%
- Clock Supervisor
- Subclock (option)
- Low Voltage Detector 2ch
- SWJ/TPIU/ETM Debug Ports
- MFS (UART/SPI/I2C) 8ch
- USB FS Host+Function
- External Bus Interface 8/16 Data, 25 Add, 8CE

### ARM Cortex-M3 — CPU

**40MHz (Max)**

Main CLK: 4MHz

Sub CLK: 32kHz

Main RC CLK: 4MHz

Sub RC CLK: 100kHz

Package: LQFP100, BGAT112

- ARM Cortex-M3
- 2.7-5.5V
- Up to 192KB RAM
- 32-176 pin packages
- IP: CAN, USB2.0, motor control

#### Applications

- Household appliances
- Motor control
- Office automation
- Power tools
- Factory automation sensors

#### Resources

- OCU 6ch
- ADT 3ch
- FRTim 3ch
- Waveform Generator
- Multifunction Timer 2 units
- PPG 6ch
- QDU 2ch
- Base Timer 8ch
- Dual Timer
- External IRQs 16ch + NMI
- DMA 8ch
- CRC
- Watch Counter
- Resource Pin Relocation
- Hardware Watching

#### Ports

- 12-bit ADC 16ch
- 12-bit ADC
Low-Power Group

- Frequency: 40MHz
- Operating voltage: 1.65-3.6V
- Separated power domains
- Low-power current: 200µA/MHZ (typical)
- USB2.0, LCDC, HDMI-CEC

Applications

- Handheld devices
- Metering
- Medical devices
- Battery-powered applications

FM3 Low-Power Group

Flash/RAM size

<table>
<thead>
<tr>
<th>Flash/RAM size</th>
<th>MB9A420K/L</th>
<th>MB9A420L</th>
</tr>
</thead>
<tbody>
<tr>
<td>512KB/64KB</td>
<td>MB9AF155M</td>
<td>MB9AF155N</td>
</tr>
<tr>
<td>384KB/48KB</td>
<td>MB9AF155M</td>
<td>MB9AF155N</td>
</tr>
<tr>
<td>256KB/32KB</td>
<td>MB9AF44L</td>
<td>MB9AF44M</td>
</tr>
<tr>
<td>128KB/16KB</td>
<td>MB9AF42L</td>
<td>MB9AF42M</td>
</tr>
<tr>
<td>64KB/16KB</td>
<td>MB9AF42L</td>
<td>MB9AF42M</td>
</tr>
<tr>
<td>32KB/8KB</td>
<td>MB9AF42L</td>
<td>MB9AF42M</td>
</tr>
</tbody>
</table>

*y* B USB + LCD
*y* A LCD
*x* 3 USB
*x* 1 STD
*E* PROM emu
### MB9AB40M/N

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>ARM Cortex-M3 CPU</td>
<td>40MHz (Max) 1.65-3.6V</td>
</tr>
<tr>
<td>Dual Timer</td>
<td></td>
</tr>
<tr>
<td>Base Timer 8ch</td>
<td></td>
</tr>
<tr>
<td>External IRQs 3/4 + NMI</td>
<td></td>
</tr>
<tr>
<td>RTC y/n/ymn/ymny</td>
<td></td>
</tr>
<tr>
<td>DMA 8ch</td>
<td></td>
</tr>
<tr>
<td>Hardware Watchdog</td>
<td></td>
</tr>
<tr>
<td>CRC</td>
<td></td>
</tr>
<tr>
<td>Resource Pin Relocation</td>
<td></td>
</tr>
<tr>
<td>Dual Timer</td>
<td></td>
</tr>
<tr>
<td>Base Timer 8ch</td>
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<tr>
<td>External IRQs 3/4 + NMI</td>
<td></td>
</tr>
<tr>
<td>External IRQs 3/4 + NMI</td>
<td></td>
</tr>
<tr>
<td>RTC y/n/ymn/ymny</td>
<td></td>
</tr>
<tr>
<td>DMA 8ch</td>
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</tr>
<tr>
<td>Hardware Watchdog</td>
<td></td>
</tr>
<tr>
<td>CRC</td>
<td></td>
</tr>
<tr>
<td>External IRQs 3/4 + NMI</td>
<td></td>
</tr>
<tr>
<td>RTC y/n/ymn/ymny</td>
<td></td>
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<tr>
<td>DMA 8ch</td>
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</tr>
<tr>
<td>Hardware Watchdog</td>
<td></td>
</tr>
<tr>
<td>CRC</td>
<td></td>
</tr>
</tbody>
</table>

#### Package
- LQFP64
- LQFP80
- LQFP100
- BGA112

### MB9A140L

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
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<td>ARM Cortex-M3 CPU</td>
<td>40MHz (Max) 1.65-3.6V</td>
</tr>
<tr>
<td>Dual Timer</td>
<td></td>
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<tr>
<td>Base Timer 8ch</td>
<td></td>
</tr>
<tr>
<td>External IRQs 3/4 + NMI</td>
<td></td>
</tr>
<tr>
<td>RTC y/n/ymn/ymny</td>
<td></td>
</tr>
<tr>
<td>DMA 8ch</td>
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<tr>
<td>Hardware Watchdog</td>
<td></td>
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<tr>
<td>CRC</td>
<td></td>
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<tr>
<td>Resource Pin Relocation</td>
<td></td>
</tr>
<tr>
<td>Dual Timer</td>
<td></td>
</tr>
<tr>
<td>Base Timer 8ch</td>
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<tr>
<td>External IRQs 3/4 + NMI</td>
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<tr>
<td>External IRQs 3/4 + NMI</td>
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<tr>
<td>RTC y/n/ymn/ymny</td>
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<tr>
<td>DMA 8ch</td>
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</tr>
<tr>
<td>Hardware Watchdog</td>
<td></td>
</tr>
<tr>
<td>CRC</td>
<td></td>
</tr>
<tr>
<td>External IRQs 3/4 + NMI</td>
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</tr>
<tr>
<td>RTC y/n/ymn/ymny</td>
<td></td>
</tr>
<tr>
<td>DMA 8ch</td>
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<tr>
<td>Hardware Watchdog</td>
<td></td>
</tr>
<tr>
<td>CRC</td>
<td></td>
</tr>
</tbody>
</table>

#### Package
- LQFP64
- LQFP80
- LQFP100
- BGA112

---

*1 MB9AB40M: LQFP80  *2 MB9AB40N: LQFP100, BGA112

---
### Ultra-Low-Leakage Ggroup

- Frequency: 20MHz
- Operating voltage: 1.8-5.5V
- Low leakage current: ~0.4µA (at DS-Stop mode)
- Low-power-consumption mode
- Various IP: LCDC, HDMI-CEC
- Standard set of peripherals
- Optimized low-leakage process technology

### FM3 Ultra-Low-Leakage Group

<table>
<thead>
<tr>
<th>Flash/RAM size</th>
<th>Pins</th>
</tr>
</thead>
<tbody>
<tr>
<td>256KB/32KB</td>
<td>12</td>
</tr>
<tr>
<td>128KB/16KB</td>
<td>8</td>
</tr>
<tr>
<td>128KB/8KB</td>
<td>64</td>
</tr>
<tr>
<td>64KB/12KB</td>
<td>64</td>
</tr>
<tr>
<td>64KB/4/8KB</td>
<td>64</td>
</tr>
<tr>
<td>32KB/8KB</td>
<td>32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MB9AA30M/N</th>
<th>32KB/8KB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### MB9AA30M/N

**ARM Cortex-M3 — CPU**

- Main CLK: 4MHz
- SUB CLK: 32kHz
- MAIN RC CLK: 4MHz
- SUB RC CLK: 100kHz

- CPU: ARM Cortex-M3
- Frequency: 20MHz (Max)
- Operating voltage: 1.8-5.5V

**Applications**

- Metering
- Mobile devices
- Handheld devices

---

*1 MB9AA30M: LQFP80  *2 MB9AA30N: LQFP100, BGA112
Spansion FM0+ Family

The FM0+ family, which is based on the ARM Cortex-M0+ core, is designed for industrial and cost-sensitive applications with low power requirements such as white goods, sensors, meters, HMI systems and power tools.

The family, which operates at 40MHz, has a run-mode current of 70µA/MHz and an RTC mode current of 0.7µA. The FM0+ family can be easily embedded into systems adopting Spansion’s 8-, 16- or 32-bit MCUs, accelerating product development and reducing development costs. The FM0+ family includes two groups for ultra-low-power and cost-effective applications.

### Ultra-Low-Power Group

- Operating voltage: 1.65-3.6V
- Frequency: 40MHz
- Low power consumption
- EEPROM emulation
- Analog peripherals

### Entry-Level Group

- Operating voltage: 2.7-5.5V
- Frequency: 40MHz
- Flash: 56KB to 88KB
- 6KB RAM
- Cost efficient

S6E1A1

---

* S6E1A1xBOA: LQFP48, QFN48
* S6E1A1xCOA: LQFP32, QFN32
FMO+ Low Power Product Lineup

FMO+ Package Lineup

<table>
<thead>
<tr>
<th>Pin</th>
<th>LQFP</th>
<th>QFP</th>
<th>BGA</th>
<th>QFN</th>
</tr>
</thead>
<tbody>
<tr>
<td>192</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>176</td>
<td>—</td>
<td>—</td>
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<td>—</td>
</tr>
<tr>
<td>144</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>120</td>
<td>16x16mm/0.50mm</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>112</td>
<td>—</td>
<td>—</td>
<td>10x10mm/0.8mm</td>
<td>—</td>
</tr>
<tr>
<td>100</td>
<td>14x14mm/0.50mm</td>
<td>14x20mm/0.65mm</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>96</td>
<td>—</td>
<td>—</td>
<td>6x6mm/0.5m</td>
<td>—</td>
</tr>
<tr>
<td>80</td>
<td>14x14mm/0.65mm, 12x12mm/0.50mm</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>64</td>
<td>12x12mm/0.65mm</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>52</td>
<td>10x10mm/0.65mm</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>48</td>
<td>7x7mm/0.50mm</td>
<td>—</td>
<td>—</td>
<td>7x7mm/0.50mm</td>
</tr>
<tr>
<td>32</td>
<td>7x7mm/0.80mm</td>
<td>—</td>
<td>—</td>
<td>5x5mm/0.50mm</td>
</tr>
</tbody>
</table>

Note: Left value is body size, right value is pin pitch.
## Package Codes

<table>
<thead>
<tr>
<th>Part Number Package Code</th>
<th>Functional Pins</th>
<th>Package</th>
<th>Dimensions in mm (pitch)</th>
<th>Package Code</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPMC</td>
<td>32</td>
<td>LQFP</td>
<td>7x7 (0.8)</td>
<td>FPT-32P-M30</td>
<td><img src="image" alt="JPMC Photo" /></td>
</tr>
<tr>
<td>JWQN</td>
<td>32</td>
<td>QFN</td>
<td>5x5 (0.5)</td>
<td>LCC-32P-M19</td>
<td><img src="image" alt="JWQN Photo" /></td>
</tr>
<tr>
<td>KPMC</td>
<td>48</td>
<td>LQFP</td>
<td>7x7 (0.5)</td>
<td>FPT-48P-M49</td>
<td><img src="image" alt="KPMC Photo" /></td>
</tr>
<tr>
<td>KQN</td>
<td>48</td>
<td>QFN</td>
<td>7x7 (0.5)</td>
<td>LCC-48P-M73</td>
<td><img src="image" alt="KQN Photo" /></td>
</tr>
<tr>
<td>LPMC</td>
<td>64</td>
<td>LQFP</td>
<td>12x12 (0.65)</td>
<td>FPT-64P-M39</td>
<td><img src="image" alt="LPMC Photo" /></td>
</tr>
<tr>
<td>LPMC1</td>
<td>64</td>
<td>LQFP</td>
<td>10x10 (0.5)</td>
<td>FPT-64P-M38</td>
<td><img src="image" alt="LPMC1 Photo" /></td>
</tr>
<tr>
<td>LQN</td>
<td>64</td>
<td>QFN</td>
<td>9x9 (0.5)</td>
<td>LCC-64P-M24</td>
<td><img src="image" alt="LQN Photo" /></td>
</tr>
<tr>
<td>MPMC</td>
<td>80</td>
<td>LQFP</td>
<td>12x12 (0.5)</td>
<td>FPT-80P-M37</td>
<td><img src="image" alt="MPMC Photo" /></td>
</tr>
<tr>
<td>MPMC1</td>
<td>80</td>
<td>LQFP</td>
<td>14x14 (0.65)</td>
<td>FPT-80P-M40</td>
<td><img src="image" alt="MPMC1 Photo" /></td>
</tr>
<tr>
<td>MBGL</td>
<td>80 (96 balls)</td>
<td>BGA</td>
<td>6x6 (0.5)</td>
<td>BGA-96P-M07</td>
<td><img src="image" alt="MBGL Photo" /></td>
</tr>
<tr>
<td>NPF</td>
<td>100</td>
<td>QFP</td>
<td>14x20 (0.65)</td>
<td>FPT100P-M36</td>
<td><img src="image" alt="NPF Photo" /></td>
</tr>
<tr>
<td>NPMC</td>
<td>100</td>
<td>LQFP</td>
<td>14x14 (0.5)</td>
<td>FPT-100P-M23</td>
<td><img src="image" alt="NPMC Photo" /></td>
</tr>
<tr>
<td>NBGL</td>
<td>100 (112 balls)</td>
<td>BGA</td>
<td>10x10 (0.8)</td>
<td>BGA-112P-M04</td>
<td><img src="image" alt="NBGL Photo" /></td>
</tr>
<tr>
<td>NBGL</td>
<td>100 (112 balls)</td>
<td>BGA</td>
<td>7x7 (0.5)</td>
<td>BGA-112P-M05</td>
<td><img src="image" alt="NBGL Photo" /></td>
</tr>
<tr>
<td>RBGL</td>
<td>120 (144 balls)</td>
<td>BGA</td>
<td>7x7 (0.5)</td>
<td>BGA-114P-M09</td>
<td><img src="image" alt="RBGL Photo" /></td>
</tr>
<tr>
<td>RPMC</td>
<td>120</td>
<td>LQFP</td>
<td>16x16 (0.5)</td>
<td>FPT-120P-M37</td>
<td><img src="image" alt="RPMC Photo" /></td>
</tr>
<tr>
<td>SPMC</td>
<td>144</td>
<td>LQFP</td>
<td>20x20 (0.5)</td>
<td>FPT-144P-M08</td>
<td><img src="image" alt="SPMC Photo" /></td>
</tr>
<tr>
<td>TPMC</td>
<td>176</td>
<td>LQFP</td>
<td>24x24 (0.5)</td>
<td>FPT-176P-M07</td>
<td><img src="image" alt="TPMC Photo" /></td>
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<tr>
<td>TBGL</td>
<td>176 (192 balls)</td>
<td>BGA</td>
<td>12x12 (0.8)</td>
<td>BGA-192P-M06</td>
<td><img src="image" alt="TBGL Photo" /></td>
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</table>
**Development Tools**

Spansion’s microcontroller families are supported by development tools, including integrated development environments (IDEs), middleware and evaluation boards that have a proven track record with partner vendors.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IAR SYSTEMS</strong>&lt;br&gt;<a href="http://www.iar.com">http://www.iar.com</a></td>
<td>Offers comprehensive tool solutions including compiler, debugger and starter kit.</td>
</tr>
<tr>
<td><strong>Atollic</strong>&lt;br&gt;<a href="http://www.atollic.com">www.atollic.com</a></td>
<td>Offers development tools based on GNU and Eclipse IDE.</td>
</tr>
<tr>
<td><strong>ARM</strong>&lt;br&gt;<a href="http://www.keil.com/arm/mdk.asp">www.keil.com/arm/mdk.asp</a></td>
<td>Offers comprehensive tools and software solutions for embedded development within uVision IDE KEIL.</td>
</tr>
<tr>
<td><strong>CooCox</strong>&lt;br&gt;<a href="http://www.coocox.org">www.coocox.org</a></td>
<td>Offers a highly-integrated development environment for ARM Cortex M4, M3, M0 and M0+ based microcontrollers, which includes IDE, flash programmer and real-time OS.</td>
</tr>
<tr>
<td><strong>Computex</strong>&lt;br&gt;<a href="http://www.computex.co.jp/eg">www.computex.co.jp/eg</a></td>
<td>Offers JTAG adapter, PALMICE3 and flash programmer, FP-10.</td>
</tr>
<tr>
<td><strong>CONITEC</strong>&lt;br&gt;<a href="http://www.conitec.com">www.conitec.com</a></td>
<td>Offers comprehensive flash programming solutions.</td>
</tr>
<tr>
<td><strong>CMX</strong>&lt;br&gt;<a href="http://www.cmx.com">www.cmx.com</a></td>
<td>Offers RTOS for ARM Cortex M3 and M4 based microcontrollers.</td>
</tr>
<tr>
<td><strong>eForce</strong>&lt;br&gt;<a href="http://www.eforce.co.jp">www.eforce.co.jp</a></td>
<td>Offers uITRON based RTOS and TCP/IP stack for FM3.</td>
</tr>
<tr>
<td><strong>ELNEC</strong>&lt;br&gt;<a href="http://www.elne.com">www.elne.com</a></td>
<td>Offers single, multi and gang programmers.</td>
</tr>
<tr>
<td><strong>Emprog</strong>&lt;br&gt;<a href="http://www.emprog.com">www.emprog.com</a></td>
<td>Offers a complete development tool solution within an embedded Eclipse IDE.</td>
</tr>
<tr>
<td><strong>eSOL</strong>&lt;br&gt;<a href="http://www.esol.com">www.esol.com</a></td>
<td>Offers embedded system software and development tools with core technologies in real-time operating systems.</td>
</tr>
<tr>
<td><strong>Express Logic</strong>&lt;br&gt;<a href="http://www.rtos.com">www.rtos.com</a></td>
<td>Offers RTOS, middleware and tools designed to ease development of embedded real-time applications.</td>
</tr>
<tr>
<td><strong>Falcon Electronics</strong>&lt;br&gt;<a href="http://www.falcon-denshi.co.jp/en">www.falcon-denshi.co.jp/en</a></td>
<td>Offers flash programmers and IC programming service.</td>
</tr>
</tbody>
</table>
## Development Tools

Flash Support Group offers single programmers and on-board programmers.

|---------------------|---------------------|------------------|

GAIO Technology offers software testing tool and simulator products.

<table>
<thead>
<tr>
<th>GAIO Technology</th>
<th><a href="http://www.gaio.com">www.gaio.com</a></th>
<th>Simulator</th>
</tr>
</thead>
</table>

From compiler and debugging environment to realtime OS, Green Hills offers total comprehensive tool solutions.

<table>
<thead>
<tr>
<th>Green Hills Software</th>
<th><a href="http://www.ghs.com">www.ghs.com</a></th>
<th>Simulator</th>
</tr>
</thead>
</table>

GRAPE SYSTEMS offers realtime OS, USB and SD card middleware.

<table>
<thead>
<tr>
<th>GRAPE SYSTEMS</th>
<th><a href="http://www.grape.co.jp/english">www.grape.co.jp/english</a></th>
<th>OS</th>
<th>Middleware</th>
</tr>
</thead>
</table>

Hitex offers debugging environment and realtime OS and middleware products.

<table>
<thead>
<tr>
<th>Hitex</th>
<th><a href="http://www.hitex.com">www.hitex.com</a></th>
<th>Debugger</th>
<th>OS</th>
<th>Middleware</th>
<th>FLASH Programmer</th>
</tr>
</thead>
</table>

iSystem offers complete software development and analysis solutions which are complemented by a unique software test tool (testIDEA), requiring no code instrumentation.

<table>
<thead>
<tr>
<th>iSystem</th>
<th><a href="http://www.isystem.com">www.isystem.com</a></th>
<th>IDE/Compiler</th>
<th>Debugger</th>
<th>OS</th>
<th>Middleware</th>
<th>Simulator</th>
</tr>
</thead>
</table>

Kyoto Microcomputer offers debugging environment, PARTNER-Jet.

<table>
<thead>
<tr>
<th>Kyoto Microcomputer</th>
<th><a href="http://www.kmckk.co.jp/eng">www.kmckk.co.jp/eng</a></th>
<th>Debugger</th>
<th>OS</th>
<th>Middleware</th>
</tr>
</thead>
</table>

Mentor Graphics offers GNU based integrated development environment, Sourcery CodeBench.

<table>
<thead>
<tr>
<th>Mentor Graphics</th>
<th><a href="http://www.mentor.com">www.mentor.com</a></th>
<th>Debugger</th>
<th>OS</th>
<th>Middleware</th>
<th>Simulator</th>
</tr>
</thead>
</table>

Micrium offers realtime OS, USB and TCP/IP stacks.

<table>
<thead>
<tr>
<th>Micrium</th>
<th><a href="http://www.micrium.com">www.micrium.com</a></th>
<th>Debugger</th>
<th>OS</th>
<th>Middleware</th>
</tr>
</thead>
</table>

MINATO ELECTRONICS offers single and gang flash programmers.

<table>
<thead>
<tr>
<th>MINATO ELECTRONICS INC.</th>
<th><a href="http://www.minato.co.jp/en">www.minato.co.jp/en</a></th>
<th>FLASH Programmer</th>
</tr>
</thead>
</table>

NAITO DENSEI MACHIDA MFG offers flash programmers best suited to be burned on production line.

<table>
<thead>
<tr>
<th>NAITO DENSEI MACHIDA MFG</th>
<th><a href="http://www.sys.ndk-m.com">www.sys.ndk-m.com</a></th>
<th>FLASH Programmer</th>
</tr>
</thead>
</table>

PERSONAL MEDIA offers embedded solutions related to T-Kernel and iT-Kernel.

<table>
<thead>
<tr>
<th>PERSONAL MEDIA CORP.</th>
<th><a href="http://www.personal-media.co.jp">www.personal-media.co.jp</a></th>
<th>Debugger</th>
<th>OS</th>
<th>Middleware</th>
</tr>
</thead>
</table>

RoweBots offers tiny Linux.

<table>
<thead>
<tr>
<th>RoweBots</th>
<th><a href="http://www.rowebots.com">www.rowebots.com</a></th>
<th>OS</th>
<th></th>
</tr>
</thead>
</table>

Rowley offers an integrated development environment which includes GNU compiler collection, their own C library, editor, project manager, flash downloader and debugger. Rowley also offers a JTAG adapter and their own RTOS.

<table>
<thead>
<tr>
<th>Rowley</th>
<th><a href="http://www.rowley.co.uk">http://www.rowley.co.uk</a></th>
<th>IDE/Compiler</th>
<th>Debugger</th>
<th>OS</th>
<th>FLASH Programmer</th>
<th>Simulator</th>
</tr>
</thead>
</table>
## Development Tools

<table>
<thead>
<tr>
<th>Company</th>
<th>Offers</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEGGER</td>
<td>Debugging tools, real time OS and middleware.</td>
<td><a href="http://www.j-fsg.jp/en/">www.j-fsg.jp/en/</a></td>
</tr>
<tr>
<td>SEVENSTAX</td>
<td>TCP/IP stack.</td>
<td><a href="http://www.sevenstax.de/en/home">www.sevenstax.de/en/home</a></td>
</tr>
<tr>
<td>Sohma &amp; Sophia Technologies</td>
<td>Debugging tools and EJSCATT.</td>
<td><a href="http://www.ss-technologies.co.jp/en">www.ss-technologies.co.jp/en</a></td>
</tr>
<tr>
<td>TASKING</td>
<td>Compiler, debugger, RTOS and TCP/IP middleware.</td>
<td><a href="http://www.tasking.com">www.tasking.com</a></td>
</tr>
<tr>
<td>TECHNO MATHEMATICAL</td>
<td>Audio middleware.</td>
<td><a href="http://www.tmath.co.jp/eng">www.tmath.co.jp/eng</a></td>
</tr>
<tr>
<td>TSUZUKI</td>
<td>Wide support for FM family products from debugging to engineering.</td>
<td>tsuzuki.jp/products/list03.html</td>
</tr>
<tr>
<td>YOKOGAWA</td>
<td>Debugging tools and flash programmers.</td>
<td>www2.yokogawa-digital.com/en/</td>
</tr>
<tr>
<td>Wave Technology</td>
<td>Programmers for mass production.</td>
<td>wavetechnology.co.jp/en/</td>
</tr>
<tr>
<td>XELTEK</td>
<td>In-system, cluster, gang, parallel and automated programmers.</td>
<td><a href="http://www.xeltek.com">www.xeltek.com</a></td>
</tr>
</tbody>
</table>

*Note: Debugger, OS, Middleware, FLASH Programmer, Simulator*
Software Enablement

A diverse range of software enablement components are available, including real-time operating systems, low-level peripheral libraries and protocol stacks. In many cases, the user can choose between commercial and free solutions.

**Spansion Low-level and Middleware Components**
- Peripheral, low-level library
- CMSIS compliant
- USB library
- Ethernet TCP/IP stack, software switch
- Functional safety self-test libraries (IEC60730 – Class B, IEC61508 SIL2)
- EEPROM emulation library
- Motor control platform
- Capacitive touch library
- Virtual starter kit
- Pin and Code Wizard

**Operating Systems**
- FreeRTOS
- Micrium µC/OS-II
- Segger emboss
- Avix/RT

**Partner Middleware Components**
- USB library
- Ethernet TCP/IP stacks and applications layers
- CANopen protocol stacks
Spansion FM Family MCU Simulator

Spansion’s FM family MCU simulator is a virtual starter kit for Spansion’s FM family of MCUs. This tool provides a complete simulation environment allowing users to utilize a software development kit versus evaluation boards. Overall software development time is dramatically shortened due to the efficiency of the debugging and analysis ability of this virtual starter kit.

Applications

Software Development
• Driver development
• Middleware development
• Application development

Software Sequence Evaluation
• Communication protocol with external devices
• Interrupt response sequence
• Task sequence

System Evaluation
• Peripheral behavior
• System behavior

www.spansion.com/Support/microcontrollers/developmentenvironment/Pages/Virtual-Starter-Kit.aspx
This Windows-based tool is for the Spansion FM family of ARM Cortex-M microcontrollers to enable easy configuration of pin assignments for multiplexed options. It allows developers to graphically assign pin functions in an intuitive and simple manner that aids collision avoidance and generates register initialization code.

**Automatic Pin Assignment**
Assign the selected peripherals to pin automatically

**Edit Window**
Customize while reviewing the pin assignment status and display the status of any conflicts

**Project Output**
Project output includes source code file with initialization code for user assigned pin functions

**Features**
- Graphical user interface for assigning pin functions
- Generates register initialization source code for user assigned pin functions
- Automatic collision detection and reporting for error control
- Ability to do manual pin assignments and adjustments
- Generates source code to pre-build projects for supported IDEs

www.spansion.com/pin-code-wizard
Developers can select the right-sized solution from a wide range of MCU evaluation boards. In addition to the basic MCU motherboards, application-specific adapter boards are available. These boards come with sample software and libraries to guarantee an out-of-the-box experience. Some boards are available bundled with a JTAG adapter.

### Evaluation Boards

<table>
<thead>
<tr>
<th>Tool</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SK-FM3-100PMC-MB9BF516N</strong>&lt;br&gt;SK-FM3-100PMC-M9BF516N-JL</td>
<td>Starter Kit with MB9BF516N MCU (100pin MCU)&lt;br&gt;• All MCU pins accessible&lt;br&gt;• CAN, USB Host+Func, RS232&lt;br&gt;• 2 x 7seg LEDs, buttons&lt;br&gt;• 3V and 5V operation&lt;br&gt;• Optionally available with J-Link JTAG adapter&lt;br&gt;Extendable through pin headers (different extension boards available)</td>
</tr>
<tr>
<td><strong>SK-FM3-64PMC1</strong>&lt;br&gt;SK-FM3-64PMC1-JLINK</td>
<td>Starter Kit with MB9AF314L MCU (64pin MCU)&lt;br&gt;• All MCU pins accessible&lt;br&gt;• USB Host+Func, RS232&lt;br&gt;• 2 x 7seg LEDs, buttons&lt;br&gt;• 3V and 5V operation&lt;br&gt;• Optionally available with J-Link JTAG adapter</td>
</tr>
<tr>
<td><strong>SK-FM3-176PMC-ETHERNET</strong></td>
<td>Starter Kit with MB9BFD18T MCU (176pin MCU)&lt;br&gt;• JTAG/USB adapter on board&lt;br&gt;• All MCU pins accessible&lt;br&gt;• Dual EtherMAC I/F&lt;br&gt;• USB Host+Func, RS232&lt;br&gt;• CAN&lt;br&gt;• 2 x 7seg LEDs, buttons, rotary encoder, poti&lt;br&gt;• 3V and 5V operation</td>
</tr>
<tr>
<td><strong>SK-FM3-100PMC-MB9AFB44N</strong></td>
<td>Starter Kit with MB9AFB44N MCU (100pin MCU)&lt;br&gt;• JTAG/USB adapter on board&lt;br&gt;• All MCU pins accessible&lt;br&gt;• Segment LC display&lt;br&gt;• USB Host+Func, RS232&lt;br&gt;• Buzzer&lt;br&gt;• FRAM UHF RFID memory&lt;br&gt;• Capacitive touch buttons&lt;br&gt;• 3V and 5V operation</td>
</tr>
<tr>
<td><strong>SK-FM3-80PMC-MB9BF524M</strong>&lt;br&gt;SK-FM3-48PMC-MB9BF524K</td>
<td>Starter Kit with MB9BF524M/K MCU (80pin/48pin MCU)&lt;br&gt;• All MCU pins accessible&lt;br&gt;• USB Host+Func, RS232&lt;br&gt;• CAN&lt;br&gt;• 2 x 7seg LEDs, buttons&lt;br&gt;• 3V and 5V operation</td>
</tr>
<tr>
<td><strong>SK-FM3-48PMC-USBSTICK</strong></td>
<td>Starter Kit with MB9AF312K MCU (48pin MCU)&lt;br&gt;• All MCU pins accessible&lt;br&gt;• USB Host&lt;br&gt;• USB Device&lt;br&gt;• JTAG debug Interface adapter included&lt;br&gt;• Temp sensor, button, LED</td>
</tr>
<tr>
<td><strong>SK-FM3-9BF516N-TOUCHKIT</strong></td>
<td>Starter Kit with MB9BF516N MCU (100pin MCU) and capacitive touch board&lt;br&gt;• Includes SK-FM3-100PMC-MB9BF516N&lt;br&gt;• Capacitive touch board (4 buttons, slider, circular slider)&lt;br&gt;• Ribbon cable&lt;br&gt;• Capacitive touch software library</td>
</tr>
<tr>
<td><strong>ADA-FM3-100PMC-MC</strong></td>
<td>Adapter board for SK-FM3-100PMC-MB9BF516N&lt;br&gt;• Allows the connection of Spansion’s inverter boards like SK-POWER-3P-LV2-MC (not included) to the starter kit&lt;br&gt;• Extension board for SK-FM3-100PMC-MB9BF516N (not included)&lt;br&gt;Complete evaluation system consists of SK-FM3-100PMC-MB9BF516N, ADA-FM3-100PMC-MC, SK-POWER-3P-LV2-MC and a motor</td>
</tr>
</tbody>
</table>
### Evaluation Boards

<table>
<thead>
<tr>
<th>Tool</th>
<th>Features</th>
</tr>
</thead>
</table>
| SK-POWER-3P-LV2-MC          | **3-phase MOSFET Power Stage, 24V, 8A max.**  
  - Allows the connection of BLDC or PMSM motors (not included)  
  - Current and voltage measurements  
  - Temperature sensor and overvoltage/current detection with indicator LEDs  
  - Fits ADA-FM3-100PMC-MC, SK-FM3-176PMC-ETHERNET, SK-FM3-176PMC-FA, etc. (not included)  
  Complete evaluation system consists of MCU evaluation board (e.g., SK-FM3-100PMC-MB9BF516N + ADA-FM3-100PMC-MC), SK-POWER-3P-LV2-MC and a motor |
| SK-FM3-100PMC-RFID-TAG1     | **UHF RFID Module with 4KByte FRAM**  
  - Extension board for SK-FM3-100PMC (not included)  
  - Based on dual-interface UHF RFID chip MB97R804B with SPI interface and 4KByte FRAM  
  - The memory can be accessed from the MCU via a SPI interface and via RFID reader/writer devices |
| SK-FM4-U120-98560           | **Starter Kit with FM4 MB9BF568R MCU (120pin MCU)**  
  - All MCU pins accessible  
  - USB device (mini-USB Type B)  
  - CMSIS-DAP JTAG adapter on board  
  - RGB LED  
  - User buttons, potentiometer, reset button  
  - SD-card slot  
  - 3V and 5V operation  
  - Available with external 32MB NAND Flash and 16MB SDRAM (optional) |
| SK-FM3-176PMC-FA            | **Fieldbus Starter Kit with FM3 MB9BF18T MCU (176pin MCU)**  
  - Covers various protocols  
    - EtherCAT  
    - Powerlink  
    - Profinet  
    - MODBUS TCP  
    - Ethernet/IP  
    - 2 x CAN, USB  
  - User interface (push buttons, LCD module, RGB LED)  
  - External RAM and Flash memory  
  - Motor control interface  
  - Debug interface |
| SK-FM3-176PMC-TFT           | **TFT Direct-Drive Starter Kit with FM3 MB9BF18T (176pin) or FM4 MB9BF568R (120pin) MCU**  
  - Includes QVGA color TFT display  
  - Ethernet, USB, CAN interfaces on board  
  - Cap touch buttons  
  - 8MB external Flash and 2MB external RAM |
| SK-FM4-120PMC-TFT           | **Starter Kit with MB9BF506R MCU (120pin MCU) JLINK-ME JTAG adapter**  
  - Limited set of peripherals  
  - USB Host+Func.  
  - Buttons  
  - All MCU pins accessible |
| Keil MCB9BF500UME           | **Starter Kit with MB9BF506R MCU (120pin MCU) J-Link Lite (on board)**  
  - Many peripherals  
  - LCD  
  - SD card slot  
  - CAN, USB, RS232  
  - Motor control power stage |
| IAR Kickstart KSK-MB9BF506  | **IAR KickStart Kit for FM3 MB9BF618T**  
  - All MCU pins accessible  
  - On-board JTAG adapter plus standard JTAG connector  
  - Trace connector  
  - USB Host and Device  
  - Dual Ethernet (2 connectors)  
  - Reset button, user button  
  - Power LED, user LED |
| IAR Kickstart Kit for MB9BF516R | **IAR KickStart Kit for FM3 MB9BF516R**  
  - All MCU pins accessible  
  - On-board JTAG adapter plus standard JTAG connector  
  - Trace connector  
  - USB Host and Device  
  - Reset button, user button  
  - Power LED, user LED |
In addition to other development tools, Spansion offers a range of solutions packages including FM Touch, FM Connect USB, FM Connect Ethernet, FM Inverter, FM Safety and FM Color.

<table>
<thead>
<tr>
<th>FM Touch</th>
<th>FM Connect USB</th>
<th>FM Connect Ethernet</th>
<th>FM Inverter</th>
<th>FM Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Capacitive touch sensors</td>
<td>• USB host and device</td>
<td>• 10/100Mbps IEE802.3 Ethernet</td>
<td>• Dedicated application library available</td>
<td>• IEC60730 class B IEC61508 SIL2</td>
</tr>
<tr>
<td>• Software solution, only one ADC channel per sensor channel</td>
<td>• Low level drivers</td>
<td>• Low-level drive</td>
<td>• Various software examples</td>
<td>• Self test libraries (STL) available</td>
</tr>
<tr>
<td>• Free library available</td>
<td>• Various USB class implementations</td>
<td>• Free TCP/IP stack implementations</td>
<td>• Various motor types supported</td>
<td>• Covers CPU, clock, interrupts, RAM, ROM, IO, ADC</td>
</tr>
<tr>
<td>• Buttons and complex sensors (sliders, wheels)</td>
<td>• Mass storage class, virtual COM port, HID mouse, HID keyboard, LibUSB</td>
<td>• lwIP, uP</td>
<td>• MCU: the majority of FM0+/FM3/FM4 family devices</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Covers embedded as well as PC side</td>
<td>• Application layer, HTTP server, DHCP, SMTP, etc.</td>
<td>• Starter kit available</td>
<td></td>
</tr>
<tr>
<td>• MCUs: all FM family members</td>
<td>• MCUs: large selection of FM3 and FM4 devices</td>
<td>• MCUs: various FM3 high-performance and FM4 devices</td>
<td>• Starter kits and power stage</td>
<td></td>
</tr>
<tr>
<td>• Starter kits available</td>
<td>• Several evaluation boards available</td>
<td>• TwinMAC derivatives available (2 Ethernet MAC on chip)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Starter kit available</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FM Color</th>
<th>FM Connect Fieldbus</th>
<th>FM Thermal Printer</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Low-cost TFT direct drive</td>
<td>• Sample implementation for fieldbus protocol slave supports:</td>
<td>• Reference solution</td>
</tr>
<tr>
<td>• Drives QVGA without external RAM</td>
<td>- Modbus TCP</td>
<td>• 2 inch print heads</td>
</tr>
<tr>
<td>• Frame buffer concept for ‘quasi-static’ content</td>
<td>- Powerlink</td>
<td>• 60mm/s</td>
</tr>
<tr>
<td>• TFT Wizard - code generator</td>
<td>- EtherCAT</td>
<td>• Voltage and heat safeguard</td>
</tr>
<tr>
<td></td>
<td>- Profinet RT</td>
<td>• Printer API</td>
</tr>
<tr>
<td></td>
<td>• Open source stack implementations plus third-party offerings</td>
<td>• Control GUI</td>
</tr>
<tr>
<td></td>
<td>• EtherCAT with ASIC ET1100</td>
<td>• Barcode printing</td>
</tr>
<tr>
<td></td>
<td>• Switch/hub onboard</td>
<td></td>
</tr>
<tr>
<td>• MCUs: FM3 high-performance group, FM4</td>
<td>• Dedicated evaluation boards available: SK-FM3-176PMC-TFT</td>
<td>• MCU: FM3 series M89AF312K</td>
</tr>
<tr>
<td>• Dedicated evaluation boards available: SK-FM3-176PMC-TFT</td>
<td>SK-FM4-120PMC-TFT</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FM Connect Fieldbus</th>
<th>FM Thermal Printer</th>
</tr>
</thead>
<tbody>
<tr>
<td>• MCUs: FM4, FM3 MB9BD105/T, MB9B2105/T, MB9B6105/T series</td>
<td>• MCUs: the majority of FM0+/FM3/FM4 family devices</td>
</tr>
<tr>
<td>• Dedicated evaluation board available: SK-FM3-176PMC-FA</td>
<td>• Starter kit available</td>
</tr>
<tr>
<td></td>
<td>• TwinMAC derivatives available (2 Ethernet MAC on chip)</td>
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<td>• Starter kit available</td>
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<tr>
<td></td>
<td>• Starter kits and power stage</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>FM Thermal Printer</th>
<th>FM Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reference solution</td>
<td>• MCUs: all FM family members</td>
</tr>
<tr>
<td>• 2 inch print heads</td>
<td>• Various HW features implemented on FM family MCUs</td>
</tr>
<tr>
<td>• 60mm/s</td>
<td>• CRC, watchdog, LVD, clock supervisor, etc.</td>
</tr>
<tr>
<td>• Voltage and heat safeguard</td>
<td></td>
</tr>
<tr>
<td>• Printer API</td>
<td></td>
</tr>
<tr>
<td>• Control GUI</td>
<td></td>
</tr>
<tr>
<td>• Barcode printing</td>
<td></td>
</tr>
</tbody>
</table>
Spansion FM Touch

FM Touch is a solutions package for capacitive touch applications based on any member of the FM0+, FM3 and FM4 families. FM Touch consists of a dedicated firmware library as well as a development GUI that runs on Windows PC. Documentation including application notes is available, as is sample software. Dedicated starter kits including initial hardware enable rapid project ramp-up.

Selected features support capacitive touch buttons, sliders, scroll wheels, x/y matrix and proximity sensing
- Uses one ADC input pin per touch channel, no additional hardware required
- High sensitivity (<<10fF), high dynamic range and SNR (signal to noise ratio)
- Solid front panels or a multi-layer front panel possible
- Automatic offset calibration and crosstalk suppression
- Optimized RAM/ROM footprint for embedded applications

![Sensor configuration, status and raw data](image)

![Plot of wheel position and velocity, including touch and position events](image)

![Signal strength and wheel position](image)

![Gesture Extension Library I](image)

![Customer Application](image)

![Gesture Extension Library II](image)

![Signal strength and wheel position](image)
Spansion FM Connect USB

The FM Connect USB platform is a set of hardware and software components, tools and documentation. The package supports multiple, out-of-the-box, embedded USB solutions and both HOST and DEVICE use cases.

Selected FM Connect USB features
- Support for up to two USB interfaces per MCU
- Support for USB host/function or dual role
- USB Wizard, as code generator for USB firmware
- USB device functions, virtual COM, HID mouse/joy stick/data communication, Lib USB COM
- USB host functions, HID mouse/keyboard, USB mass storage
- PC drivers: LibUSB and Windows native driver support
- Can be used with all FM family microcontrollers with on-chip USB hardware
Spansion FM Connect Ethernet

The FM Connect Ethernet package utilizes proven open source components such as the lwIP TCP/IP stack and internal developments such as the L3 FM low-level library. This enables the rapid implementation of solutions such as web-based diagnostic systems or maintenance interfaces for industrial devices.

Selected FM Connect Ethernet features
• Up to 2-channel Ethernet
• Software switch module
• Low-level driver, TCP/IP stacks
• Sample software, web server, etc.
• Commercial products from partners (e.g., Sevenstax)

Spansion FM Color

FM Color, a solution for simple and cost-efficient, full-color HMIs, enables designers to add colored HMI functionality/TFT display control to designs without needing additional hardware. An FM3 or FM4 MCU controls both the application and the TFT display; no dedicated graphic controller is needed. The TFT display can be directly connected to FM3/FM4 MCUs.

Selected FM Color features
• Up to 320x240 pixel, 8-bit color depth with internal RAM
• Up to 480x272, 16-bit color with external SRAM (8-bit or 16-bit external bus)
• Firmware module TFT driver to generate the timing signals to control the TFT display, handle the data flow from RAM to TFT, and synchronize the update of the TFT content with the display timing
• Predefined HMI objects: e.g., simple buttons, checkboxes, text and progress bars
• Control routines for user interaction via buttons, a USB mouse, keyboard or touchscreen
• PC-based, simple scene generator “TFT wizard”
Spansion FM Safety

To help customers obtain relevant safety certifications, Spansion embeds specific hardware components into its FM family of MCUs. Self-test libraries for IEC61508 and IEC60730 standards available.

Software packages: Self-Test Libraries (STL)
• Addresses IEC60730 class B and IEC61508 requirements
• Pre-operation self-test (POST): system startup
• Built-in self-test (BIST): run periodically
• APIs include CPU, Clock, RAM, flash, interrupt, ADC, GPIO test routines
• Utilizes the functional safety hardware features
• IEC60730 STL memory footprint: approximately 4.6KB flash (max.), 80-bytes RAM usage
• IEC61508 (SIL2) version available on request

Spansion FM Inverter

FM Inverter is a solution to drive three-phase motors such as PMSM with the FM family. The package consists of firmware for different motor and control types, a GUI for parameterization, documentation, software examples, dedicated starter kits and support.

Selected FM Inverter features
• Up to 3-channel, flexible 3-phase motor timers on 144MHz FM3 MCUs
• Automatic dead-time insertion, freely programmable ADC trigger
• Up to three independent 12-bit 1Msps ADC units, with up to 32 ADC inputs
• Up to 3-channel ABZ quadrature decoder units
• DTTI input for emergency motor stop
• 3.3V and true 5V single-supply operation
• Dedicated starter kit and power stage extension board available
• Ready-to-run sample software for different motor types
• GUI for PC-based parameterization
• Can be used with all FM3 microcontrollers except the low-power group
Additional Solutions

- Inverter motor control solution for consumer electronics such as air conditioners, refrigerators and washing machines
- RF solution for RF control, sensor control and NFC
- ESL (virtual simulation) to identify fatal errors and to shorten the debugging and development time
- Audio/video solutions

Check Spansion’s seminar page in the news section of our website for workshops and other application-development support.

White Goods
- Products: washing machines, dishwashers, air conditioners
- MCUs: FM0+ and FM3 basic group
  - Cost-optimized products
  - Reliable flash for EEPROM emulation
  - On-chip RC oscillator: = -2%
  - Hardware motor control support
  - 2 or 3 fast, independent, 12-bit ADCs
  - Wide supply voltage range: 2.7-5.5V
  - Operating temperature range between -40°C and +105°C

Factory Automation
- Products: PLCs, motor control, sensors
- MCUs: FM3 high-performance and basic groups, and FM4
  - High performance
  - Up to 200MHz CPU clock
  - DSP functionality on FM4
  - FPU on FM4
  - Faster flash in group: 14ns access + code pre-fetch = OWS at 144MHz
  - Up to 1.5MB flash
  - Wide supply voltage range: 2.7-5.5V
  - Hardware motor control support, up to three motors, including software package
  - Three independent, fast, 12-bit ADCs
  - Many safety features (e.g., MPU, CRC, two-stage LVD)
  - Twin AMC – dual-Ethernet device
  - Scalable lineup, pin compatibility between high-performance and basic groups MCUs to cover a wide range of applications
  - Many devices suitable for extended temperature ranges between -40°C and +105°C

Motor/Inverter Control
- MCUs: FM4 family
  - High-spec vector arithmetic
  - Single-cycle instruction by DSP
  - Enhanced motor control timer
  - Enhanced A/D convertor
  - High-speed sampling (conversion speed: 2Msps)
  - Window comparator

Networking
- MCUs: FM4 and FM3 high-performance families
  - Enriched communication function
  - SD card I/F (SDIO)
  - Ethernet, CAN
  - High-speed 12C fast mode (~1Mbps)
  - High-speed SPI (~20Mbps)
  - Large memory
  - SDRAM I/F
  - DSTC (descriptor system data transfer controller, maximum: 1,024ch)

Medical and Handheld Devices
- MCUs: FM0+ and FM3 low-power and ultra-low-leakage groups
  - Ideal feature mix for HMI (human machine interface)
  - LCD segment controller
  - High-performance, capacitive touch software library
  - USB host and function (OTG functionality), including corresponding software packages
  - Two independent, fast, 12-bit ADCs
  - Low-voltage supply: 1.65-3.6V
  - Low-current consumption and deep standby modes
Why Spansion?

Longevity
- Good track record, 16bit MCUs, shipped for 15 years

Long history in MCUs
- Industrial and automotive MCU development for >25 years

Large scalable line-up
- FM0+, FM3, FM4
- >500 ARM Cortex derivatives

Ready-to-use solutions
- Capacitive touch, motor control, USB, Ethernet, safety

Unique product features
- 5V power supply, 20 years data retention Flash, TwinMAC

Strong support
- Dedicated industrial global teams
ABOUT SPANSION

Spansion (NYSE: CODE) is a global leader in embedded systems solutions. Spansion’s flash memory, microcontrollers, analog and mixed-signal products drive the development of faster, intelligent, secure and energy efficient electronics. Spansion is at the heart of electronics systems, connecting, controlling, storing and powering everything from automotive electronics and industrial systems to the highly interactive and immersive consumer devices that are enriching people’s daily lives.
For more information, visit http://www.spansion.com.

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