Freescale Semiconductor’s 56F8013 combines, on a single chip, the processing power of a digital signal processor (DSP) and the functionality of a microcontroller. With a flexible set of peripherals, the 56F8013 provides a cost-effective, high performance 16-bit solution for motor control applications that require a greater number of pulse-width modulators (PWMs).

Because of its configuration flexibility and compact program code, the cost-effective 56F8013 is well suited for many applications. The 56F8013 is a member of the 56800E core-based family of digital signal controllers which utilizes a Harvard architecture consisting of three execution units operating in parallel, allowing as many as six operations per instruction cycle. The microprocessor-style programming model and optimized instruction set allow straightforward generation of efficient, compact code for both DSP and MCU applications.

**Target Applications**
- Industrial motor control
- Appliance motor control
- Dimming lamp ballasts
- Soft-switching PFC
- DC-DC power supplies

**56800E Core Features**
- Up to 32 MIPS at a guaranteed 32 MHz execution frequency
- DSP and MCU functionality in a unified, C-efficient architecture
- JTAG/Enhanced On-Chip Emulation (EOnCE) for unobtrusive, real-time debugging
- Four 36-bit accumulators
- 16- and 32-bit bidirectional barrel shifter
- Parallel instruction set with unique addressing modes
- Hardware DO and REP loops available
- Three internal address buses
- Four internal data buses
- MCU-style software stack support
- Controller-style addressing modes and instructions
- Single-cycle 16 x 16-bit parallel multiplier-accumulator (MAC)

**Benefits**
- Hybrid architecture facilitates implementation of both control and signal processing functions in a single device
- Proven to deliver more control functionality with a smaller memory footprint than competing architectures
- High performance with 16-bit code density
- On-chip voltage regulator and power management reduce overall system cost
- Flexible power saving modes
- System-on-a-chip integration of flexible peripherals eliminates external components, improves system reliability and minimizes system cost
- High-performance PWM with programmable fault capability simplifies design and promotes compliance with safety regulations
- PWM, ADC and quad timers modules are tightly coupled to reduce processing overhead
- Low-voltage interrupts (LVIs) protect the system from brownout or power failure
- Simple in-application Flash memory programming via Enhanced OnCE™ or serial communication
- PWM and timers can be clocked at up to 96 MHz
**Memory Features**
- Architecture permits as many as three simultaneous accesses to program and data memory
- On-chip memory includes high-speed volatile and nonvolatile components
  - 16 KB of Program Flash
  - 4 KB of unified data/program RAM
- Extended temperature range allows for operation of nonvolatile memory in harsh environments
- All memories operate at 32 MHz (zero wait states) over temperature range (-40°C to +105°C), with no software tricks or hardware accelerators required
- Flash security feature prevents unauthorized accesses to its content
- Flash protection prevents accidental modifications
- Flash memory emulation of EEPROM eliminates the need for external nonvolatile memory

**5658013 Peripheral Circuit Features**
- High-speed pulse-width modulator (PWM) that can be clocked at up to 96 MHz
- Serial peripheral interface (SPI)
- Serial communication interface (SCI) with LIN slave functionality
- Four 16-bit timers that can be clocked at up to 96 MHz
- Software-programmable Phase-Lock Loop (PLL)
- Two 12-bit high-performance analog-to-digital converters (ADCs) with six inputs at rates up to 1.1 µs per sequential or simultaneous conversion
- Up to 26 general purpose input output (GPIO) pins
- Computer operating properly (COP)
- Integrated power-on reset and low-voltage interrupt module
- I²C communication module supporting slave, master and multimaster mode
- On-chip oscillator

**Product Documentation**
- **56F8000 Peripheral Reference Manual**
  - Order Number: MC56F8000RM
- **56F8013 Technical Data Sheet**
  - Order Number: MC56F8013
- **56F8013 Product Brief**
  - Order Number: MC56F8013PB
- **DSP56800E Reference Manual**
  - Order Number: DSP56800ERM

**Ordering Information**
- **Part**: MC56F8013
- **Package**: 32 LQFP
- **Order Number**: MC56F8013VFAE
- **Temperature Range**: -40°C to +105°C

**Award-Winning Development Environment**
- Processor Expert™ (PE) technology provides a rapid application design (RAD) tool that combines easy-to-use component-based software application creation with an expert knowledge system.
- The CodeWarrior™ Integrated Development Environment (IDE) is a sophisticated tool for code navigation, compiling and debugging. A complete set of evaluation modules (EVMs) and development system cards will support concurrent engineering. Together, PE, CodeWarrior tools and EVMs create a complete, scalable tools solution for easy, fast and efficient development.

**Learn More:** For more information about Freescale products, please visit www.freescale.com.