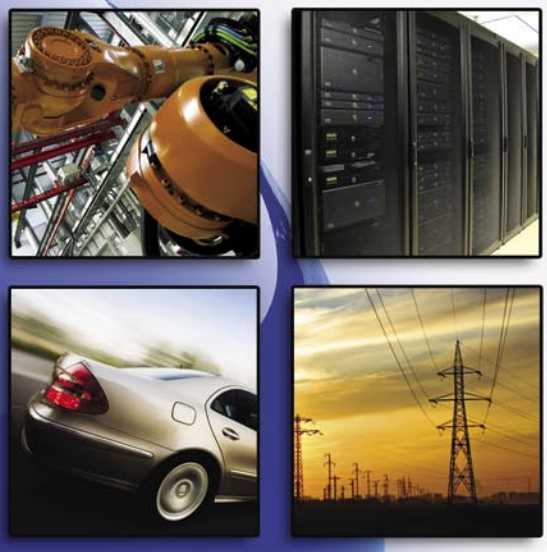
RAMTRON
International Corporation

Ramtron Short Form Catalog
Second Quarter 2008



F-RAM by RAMTRON

Nonvolatile F-RAM ICs for a world of applications

Design to a higher standard

Ramtron's broad line of specialized semiconductor memory, microcontroller and integrated semiconductor solutions are found in a wide range of industries and applications including metering, computing, automotive, and consumer.

Ramtron products are also found in industrial, scientific, and medical applications that thrive on the high-speed, high-endurance, and low power consumption of ferroelectric random access memory, or F-RAM.

Benefits of F-RAM

F-RAM products combine the nonvolatile data storage capability of ROM with the benefits of RAM.

Fast Write Speed
F-RAM performs read and write operations at the same speed. Because F-RAM writes data at bus speed, there are no delays before the written data becomes nonvolatile. Floating gate memories have a long write delay of five milliseconds. F-RAM writes in nanoseconds, essential in applications like auto safety systems.

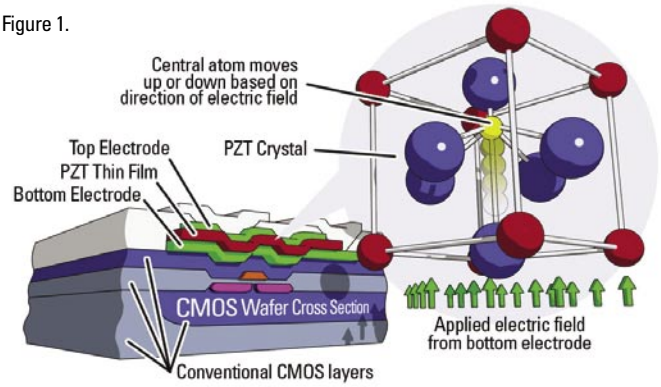
High Endurance
F-RAM offers virtually unlimited write endurance, which means it doesn't wear out like other nonvolatile memory devices. Floating gate devices experience a hard failure and stop writing in as little as 10^5 cycles, making them unsuitable for write intensive applications.

Low Power Consumption
F-RAM operates without a charge pump, enabling low power consumption. Floating gate devices demand high voltage during write operations. F-RAM writes at the native voltage of the manufacturing process: 5V, 3V, or even less on more advanced processes.

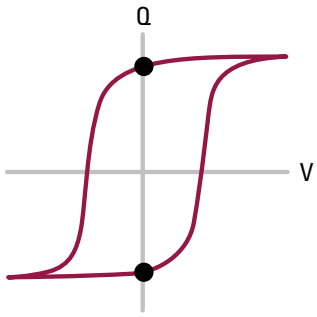
A primer on F-RAM memory

F-RAM offers a unique set of features relative to other semiconductor technologies. Established semiconductor memories can be divided into two categories: volatile and nonvolatile. Volatile memory includes SRAM (static random access memory) and DRAM (dynamic random access memory), among others. RAM type devices are easy to use, offer high performance, but they share a common vulnerability: stored memory is lost when the power supply is removed.

Figure 1.



The F-RAM chip contains a thin ferroelectric film of lead zirconate titanate [Pb(Zr,Ti)O3], commonly referred to as PZT (Figure 1). The Zr/Ti atoms in the PZT change polarity in an electric field, thereby producing a binary switch. Unlike RAM devices, F-RAM retains its data memory when power is shut off or interrupted, due to the PZT crystal maintaining polarity. This unique property makes F-RAM a low power, nonvolatile memory.



This hysteresis loop shows the switching charge/voltage fundamental of an F-RAM memory cell.

Like F-RAM, ROM (read only memory) is a nonvolatile memory that does not lose its data content when power is removed. Newer generation ROM, like EEPROM (electrically erasable programmable read only memory) and flash memory, can be erased and re-programmed multiple times, but they require high voltage and write very slowly. ROM-based technologies eventually wear out (in as little as 10^5 cycles), making them unsuitable for high-endurance industrial applications.

F-RAM has 10,000 times greater endurance and uses 3,000 times less energy than a typical serial EEPROM device, and nearly 500 times the write speed.

F-RAM combines the best of RAM and ROM into a single package that outperforms other nonvolatile memories with remarkably fast writes, high endurance, and ultra-low power consumption.

Serial F-RAM Memory

F-RAM serial memories provide reliable data collection, perform reads and writes like a RAM, and eliminate the complexities, overhead, and system reliability problems of EEPROM. The I²C serial interface is common and many MCUs implement a dedicated I²C port. The serial peripheral interface (SPI) is capable of higher clock rates up to 20MHz.

RoHS compliant

I²C Serial F-RAM Memory

Part	Density	Package	Max. Bus Speed	Vdd	IDD@fMax
FM24C512	512Kb	EIAJ SOIC8	1MHz	5V	1.5mA
FM24C256	256Kb	EIAJ SOIC8	1MHz	5V	1.2mA
FM24L256	256Kb	SOIC8	1MHz	3V	600uA
FM24CL64	64Kb	SOIC8 or TDFN8	1MHz	3V	400uA
FM24C64*	64Kb	SOIC8	1MHz	5V	1.2mA
FM24CL16*	16Kb	SOIC8 or TDFN8	1MHz	3V	450uA
FM24C16A	16Kb	SOIC8	1MHz	5V	1.0mA
FM24CL04	4Kb	SOIC8	1MHz	3V	300uA
FM24C04A	4Kb	SOIC8	1MHz	5V	1.0mA

SPI Serial F-RAM Memory

Part	Density	Package	Max. Bus Speed	Vdd	IDD@fMax
FM25H20	2Mb	TDFN8	40MHz	3V	10mA
FM25L512	512Kb	TDFN8	20MHz	3V	12mA
FM25L256B	256Kb	SOIC8 or TDFN8	20MHz	3V	10mA
FM25256B	256Kb	SOIC8	20MHz	5V	15mA
FM25CL64-GA**	64Kb	SOIC8	16MHz	3V	7.0mA
FM25CL64	64Kb	SOIC8 or TDFN8	20MHz	3V	10mA
FM25640-GA**	64Kb	SOIC8	4MHz	5V	2.7mA
FM25640*	64Kb	SOIC8	5MHz	5V	3.0mA
FM25L16*	16Kb	SOIC8 or TDFN8	18MHz	3V	5.5mA
FM25C160-GA**	16Kb	SOIC8	15MHz	5V	6.5mA
FM25C160*	16Kb	SOIC8	20MHz	5V	8.0mA
FM25L04-GA**	4Kb	SOIC8	10MHz	3V	2.2mA
FM25L04	4Kb	SOIC8 or TDFN8	14MHz	3V	3.0mA
FM25040A-GA**	4Kb	SOIC8	14MHz	5V	6.0mA
FM25040A	4Kb	SOIC8	20MHz	5V	8.0mA

*AEC-Q100 Grade-3 Qualified (-40˚C to +85˚C) **AEC-Q100 Grade-1 Qualified (-40˚C to +125˚C)

Parallel F-RAM Memory

Ramtron parallel memory offers high-performance reads and writes with true nonvolatility without a battery. F-RAM bytewide devices have standard SRAM pinouts. They operate like SRAMs and store data without battery backup.

RoHS compliant

Part	Organization	Package	Access Time	Vdd	IDD@fMax Cycle
FM22L16	256K x 16	TSOP-II-44	55ns	3V	18mA
FM21L16	128K x 16	TSOP-II-44	60ns	3V	18mA
FM20L08	128K x 8	TSOP-I-32	60ns	3V	22mA
FM18L08	32K x 8	SOIC28, PDIP28, TSOP-I-32	70ns	3V	15mA
FM1808	32K x 8	SOIC28 or PDIP28	70ns	5V	25mA
FM1608	8K x 8	SOIC28 or PDIP28	120ns	5V	15mA

F-RAM Processor Companion

Ramtron Processor Companions are complete support and peripheral solutions with highly integrated mixed signal (analog and digital) functions for processor-based systems. Never before has a solution combined the fast read/write performance and unlimited endurance of nonvolatile F-RAM with a real-time clock (RTC), processor supervisor, and other common peripherals.

RoHS compliant

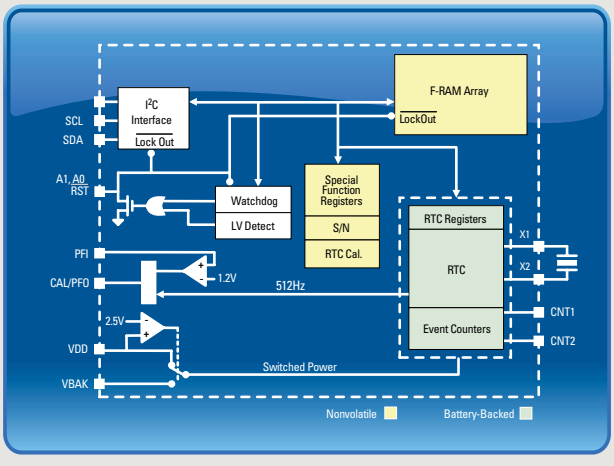
SPI F-RAM Processor Companion

Part	Vdd	Memory	RTC	RTC Alarm	Power Monitor	Watch Dog	Early Power Fail	Serial Number	Battery Switch Over	Event Detect	Package
FM33256	3V	256Kb	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM3316	3V	16Kb	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Count	SOIC14

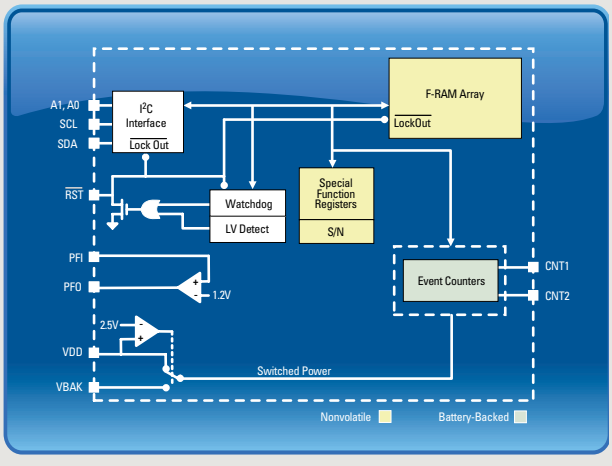
I²C F-RAM Processor Companion

Part	Vdd	Memory	RTC	RTC Alarm	Power Monitor	Watch Dog	Early Power Fail	Serial Number	Battery Switch Over	Event Detect	Package
FM31L278	3V	256Kb	Yes	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM31L276	3V	64Kb	Yes	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM31L274	3V	16Kb	Yes	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM31L272	3V	4Kb	Yes	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM31278	5V	256Kb	Yes	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM31276	5V	64Kb	Yes	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM31274	5V	16Kb	Yes	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM31272	5V	4Kb	Yes	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM3130	3V	64Kb	Yes	Yes	No	No	No	No	Yes	--	SOIC 8 or TDFN
FM3135 w/Xtal	3V	64Kb	Yes	Yes	No	No	No	No	Yes	--	SOIC 20
FM32L278	3V	256Kb	No	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM32L276	3V	64Kb	No	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM32L274	3V	16Kb	No	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM32L272	3V	4Kb	No	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM32278	5V	256Kb	No	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM32276	5V	64Kb	No	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM32274	5V	16Kb	No	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM32272	5V	4Kb	No	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14
FM4005	5V	--	Yes	No	Yes	Yes	Yes	Yes	Yes	Count	SOIC14

31x Processor Companion Block Diagram



32x Processor Companion Block Diagram



Dual and Quad Nonvolatile State Saver

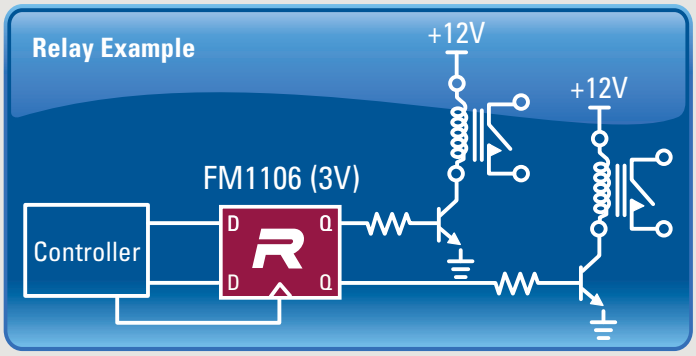
The Ramtron low-power nonvolatile state saver is a logic building block that provides continuous access to nonvolatile system settings without reading a memory. It enables storage of signals that may change frequently and without notice, and it allows the nonvolatile storage of system settings without the system overhead of a serial memory.

These Ramtron F-RAM-based devices save the state of signals on demand and automatically restore signals to their correct state upon power up. Ramtron nonvolatile state savers:

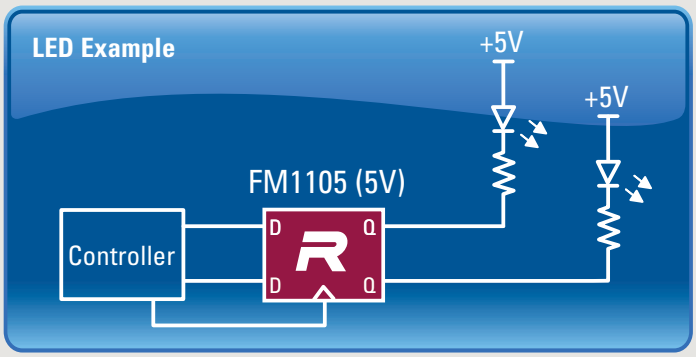
- Provide continuous access to nonvolatile system settings without performing a memory read operation
- Enable storage of signals that may change frequently and without notice
- Allow the nonvolatile storage of a system setting without the system overhead of a serial memory

Part	Operating Current	Savers	Output Current	Standby Current	Package
FM1105	5V	2	10mA	15uA	SOT23-8
FM1106	3V	2	10mA	5uA	SOT23-8
FM1107	3V	2	10mA	0.5uA	SOT23-8
FM1110	5V	4	10mA	30uA	QFN16
FM1112	3V	4	10mA	10uA	QFN16
FM1114	3V	4	10mA	0.5uA	QFN16

F-RAM State Saver Application Examples



Restores switches and relays
Ramtron nonvolatile state savers restore the state of switches and relays on power up.



Restore the state of LEDs
Ramtron nonvolatile state savers restore the state of LEDs on power up.

Need help?
Contact a technical applications engineer at framinfo@ramtron.com or download a datasheet at www.ramtron.com

8051 Microcontrollers

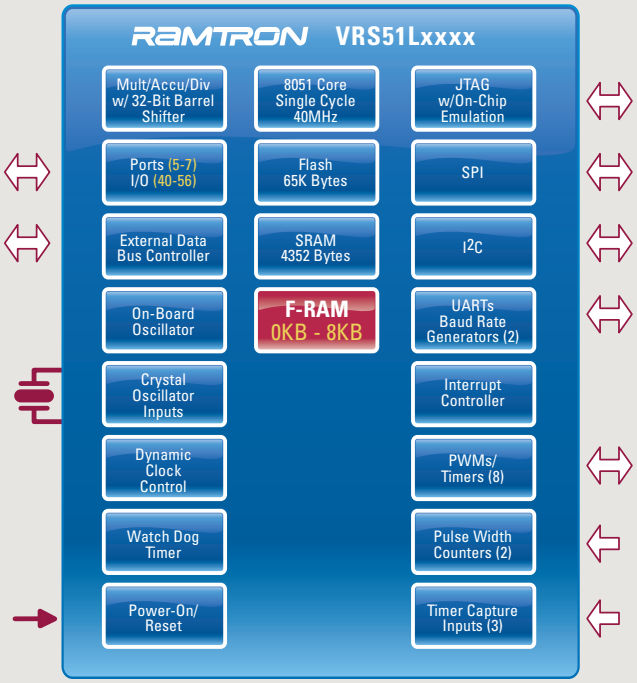
Ramtron microcontrollers (MCUs) are fully integrated, high-performance, 8-bit MCUs based on an advanced 40 MIPs platform with JTAG interface for Flash programming/debugging. Our MCUs are the ideal system-on-chip solution for the embedded data acquisition markets, including instrumentation, industrial control applications, imaging, security, automotive, medical devices, and more.

RoHS compliant

8051 Microcontrollers

Part	Speed	Power Supply	Flash & F-RAM Memory	SRAM	I/O	Package
VRS51L3074	40MHz	3.3V	64KB & 8KB F-RAM	4352B	56	QFP-64
VRS51L3174	40MHz	3.3V	64KB & 8KB F-RAM	4352B	40	QFP-44
VRS51L3072	40MHz	3.3V	64KB & 2KB F-RAM	4352B	56	QFP-64
VRS51L2070	40MHz	3.3V	64KB & 0KB F-RAM	4352B	56	QFP-64

VRS51Lxxxx Functional Diagram



High-Performance MCU with embedded F-RAM for data acquisition

- 8KB F-RAM (VRS51L3174, VRS51L3074)
- 2KB F-RAM (VRS51L3072)
- 64KB ISP/IAP Flash, 4KB SRAM
- 40MHz, Single-Cycle 8051 Processor
- Enhanced MULT/ACCU/DIV Unit with 32-bit Barrel Shifter
- 40MHz Internal Oscillator
- JTAG Interface for In-Circuit Programming & Debugging
- Dual UARTs with Baud Rate Generator
- Enhanced SPI, 2-Wire Serial Interface
- 2 Pulse Width Counters with 4 inputs
- 8 Pulse Width Modulators with adjustable resolution
- QFP-64 package (VRS51L3074, VRS51L3072, VRS51L2070)
- QFP-44 package (VRS51L3174)
- Operates at 3.3 volts over the entire industrial temperature range (-40°C to +85°C)

VRS51L2070 (40MHz; 7 Ports, 56 I/O)
VRS51L3072 (40MHz; 7 Ports, 56 I/O; 2KB F-RAM)
VRS51L3074 (40MHz; 7 Ports, 56 I/O; 8KB F-RAM)
VRS51L3174 (40MHz; 5 Ports, 40 I/O; 8KB F-RAM)

F-RAM Event Data Recorder

Part	Power Supply	Event Memory	User F-RAM	RTC	PFI	Count	Com. Interface	Package
FM6124-QG	3.0V-3.6V	1000 to 4000 events	0 to 24KB	Yes	Yes	Yes	I2C	QFP-44

FM6124 Event Data Recorder Highlights

Automatic Event Monitor

- Monitors 12 digital inputs
- Continuous monitoring for state changes
- Capable of edge detection
- Records up to 4000 separate events

Interrupt Output on Events

- Buffer half full/full
- Pin change state
- Programmable high/low trip points for event and data alarms

RTC Alarm Timestamp & Nonvolatile Storage

- Built-in real-time clock with time base
- Schedule retained without a battery
- 24KB nonvolatile store for user data

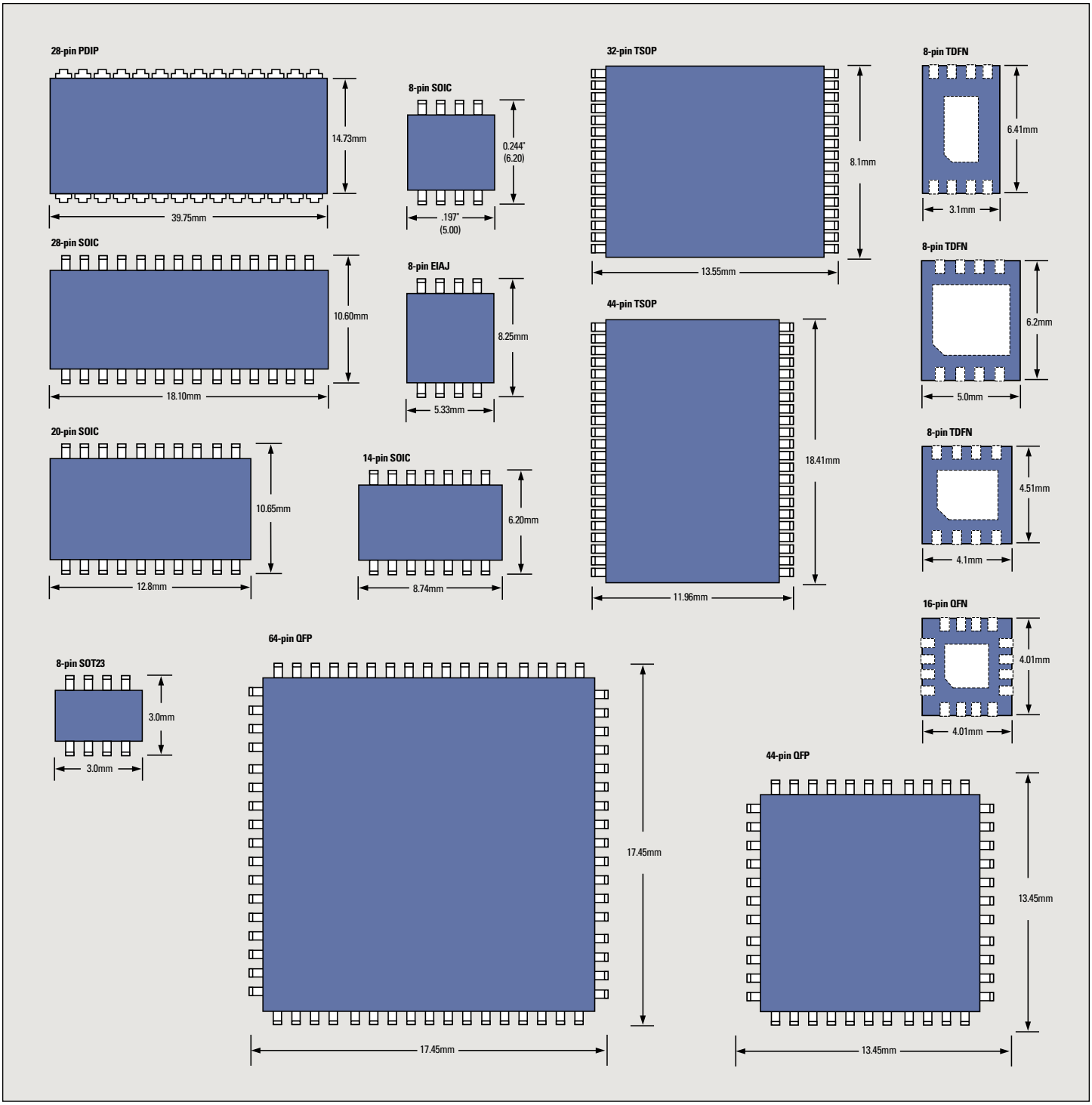
Micro Peripheral

- I2C interface to host MCU
- Reads external pins via serial interface

Contact your local representative for a **free sample**.

Package Dimensions

For quick reference only. Please refer to product datasheet for compete package dimension information.



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About Ramtron International Corporation

Ramtron International Corporation is a fabless semiconductor company that designs, develops, and markets specialized semiconductor memory and integrated semiconductor solutions for a broad range of applications across targeted vertical markets. Founded in 1984, Ramtron pioneered the integration of ferroelectric materials into semiconductor products, which enabled the development of a new class of nonvolatile memory products called ferroelectric random access memory (F-RAM) products.

Since its inception, Ramtron has supplied over 175-million F-RAM products worldwide, fueling the company's product revenue growth from US$2.4 million in 2001 to more than $49 million in 2007.

Ramtron is traded on The Nasdaq Global Stock Market under the symbol RMTR.

For Ramtron corporate and financial information contact the company at 719-481-7000 and ask for Ramtron Investor Relations.

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