

#### VRS51L2070 & VRS51L3074

High performance Versa 8051 MCUs

#### RAMTRON

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## Fast + Flexible = Cost-efficient

- The VRS51L2070 and VRS51L3074 meet the current market demand for a high performance MCU, without a costly investment in new architecture and code
  - Has the power and speed to compete with a 16-bit MCU without migrating from an 8-bit device
  - Compatible with 8051-based architecture, code and development environment
- Comprehensive set of highly configurable digital peripherals enables full integration and eases the load on the processor



- Solid and versatile device that can be used to develop a wide array of products and applications
  - Ideal for embedded data acquisition, sensor and control applications in the industrial, medical, consumer, instrumentation and automotive markets

RAMTRON Design to a higher standard

#### High Performance Single-Cycle 8051 Processor with 40 MHz Operation

- Order of magnitude faster than standard 8051s: One of the fastest processors on the market
- Same instruction set as standard 8051s, for easy device migration



- Up to 40 MIPS of processing power
- Allows the VRS51L2070 and VRS51L3074 to "muscle" into 16-bit MCU territory at an 8-bit MCU price



### VRS51L3074: The First FRAM-Enhanced 8051 MCU

- The VRS51L3074 integrates 8K Bytes of FRAM memory for a quick, reliable nonvolatile data storage & processing system
  - Virtually unlimited endurance
  - No need for battery or super cap for data retention
  - Accessed like XRAM
    - Unlike Flash, content of individual FRAM cell can be modified without having to perform a sector erase
  - Fast write access compared to EEPROM
    - Byte write 366 nanoseconds
  - Fast read access
    - Byte read 760 nanoseconds



FRAM **simplifies the design cycle** by eliminating the limited endurance issues accompanying EEPROM/Flash data storage

### MULT/ACCU/DIV Unit with Barrel Shifter

- Significantly outperforms 8-bit processors when executing DSP operations
- Hardware-based calculation engine that performs:
  - 16-bit signed division (5 cycles)
  - 16-bit signed multiplication (**1 cycle**)
  - 32-bit addition (1 cycle)
- 32-bit barrel shifter enables logic/arithmetic shift operations (scale result upward/downward)
- Access to MULT/ACCU/DIV unit via SFR registers
- Used to implement: FIR filtering, sensor output linearization, multiple bytes arithmetic operations, etc.



## JTAG Interface for Programming/ Debugging/Emulation

- User-friendly and quick device programming
- Real-time in-circuit debugging of user application without a costly emulator
- Can be used for boundary scan operations to detect system faults





## **40MHz Precision Internal Oscillator**

- No need for an external oscillator, cutting costs
- Provides 2% accuracy
- Internal and external oscillators can be swapped on the fly



# **Clock Configuration**

- Highly configurable system clock
  - System clock can be dynamically adjusted from Fosc/1 to Fosc/32768
  - Dynamic clock control significantly saves power



### **Dual UARTs with Baud Rate Generator**

- UARTs can operate at up to 1.25 Mbps
- Each UART includes a dedicated baud rate generator that features 16-bit resolution and 4-bit micro baud rate adjustment
  - Frees the internal timers for other uses
  - Can be used as general purpose, 16-bit timers if the corresponding UART is not used



#### **Enhanced SPI Interface**

- Communication speed is configurable up to **20 Mbps**
- Transaction size is **adjustable from 1 to 32 bits**
- Transmit/receive in MSB or LSB first format
- Supports all four standard SPI modes
- Operates in master or slave modes
- Can control up to 4 devices
  - CS lines are controlled automatically
- Provides many configuration options



# **Other Features**

- 64KB ISP/IAP Flash, 4KB RAM
- 8KB FRAM (VRS51L3074)
- I<sup>2</sup>C Interface (Master/Slave)
- Pulse Width Counter Modules
- Three 16-bit Timers
- 8 PWMs (adjustable resolution)
- Watchdog Timer
- 49 Interrupts that share 16 Interrupt Vectors
- Port Change and Pin Change Interrupt





#### **RAMTRON** Design to a higher standard

# VersaKit-20xx/30xx

- VersaKit-20xx/30xx includes:
  - Development Board
  - JTAG Programming/Debugging Interface
- Versa Ware JTAG Software:
  - In-Circuit Programming
  - In-Circuit Debugging Interface
- Most standard 8051 ASM and C Compilers can be used to develop code for the VRS51L2070 and the VRS51L3074



| on Edit Yew Breakpoint Watch Window Help   |   | -  |         |           |     |        |             | 1 |
|--|---|--|---------|-----------|-----|--------|-------------|---|
|  | <b>SBB</b>  | 1  |         |           |     |        |             |   |
| it unsigned int dacidate BP1: Program 0x0000 BP2: DP5 DP3 DP3 not ret.   |   | and the second s |         |           |     | _      |             | ł |
| Your_Application.itix  | - C X   | FAM  |         |           |     |        | - 10        |   |
| C [213] PIRCEG = 0x17: //Point to MSB MID  | ^   | Name   | Address | Bin       | Dec | Hex    | ASOL        | l |
| 00DD nov _PGECFG,#Dx17   | 100   |  | 0x2D    | 0000 0000 | 0   | 0+00   |             | ŧ |
| C [214] PHEDATA = #x82; //   |   |  | 0x2E    | 0000 0000 | 0   | 0x00   |             | Í |
| D 00E0 nov _PWMDATA,#0xA2  |   |  | 0x2F    | 0000 0000 | 0   | 0,00   | P           | į |
| C [215]  |   | char fircoethE   | 0x30    | 0000 0010 | 2   | 0x02   |             | í |
| C [216] PinKFG = 0x02; //Point to LSB HID  |   | +-)  | Dx31    | 0000 0100 | 4   | 0x04   | F           | i |
| 0 00E3 hov _PM0CF0,#0x07   |   | +-2  | 0x32    | 0000 1000 | 8   | 0x08   | ſ           | i |
| C [217] PIRDATA = 0xC2;  |   | +-2  | 0x33    | 0000 1101 | 13  | 0,00   |             |   |
| 0 00E6 BOY _PWEDATA, FOXC2   |   | 10   | 0x34    | 0001 0010 | 18  | 0.12   | -           |   |
| C [218]  |   | The second state of the second state   |         |           |     |        | -           |   |
| C [219]  |   | STR Page 0   |         |           |     |        | - 10        |   |
| C [220] //Configure and Enable Full as timer interrupt to monito   | nan a   | None   | Address | Bin       | Dec | Hex    | ASCI        |   |
| Presi interve - wer //retrict ther mouse interrupt   | 1.00  | P0   | 0x80    | 1111 1111 | - 4 | 0xFF   | · · · · · j | 1 |
| 100EA WUT TRIPHCS'ACKDA  | 4   | SP   | Ox81    | 0000.0111 | 7   | 0+07   | 1           | 1 |
|  | 200   | OPL0   | 0x82    | 0000 0000 | 0   | 0+00   | 1           | į |
| Your Application r   |   | DPH0   | 0x83    | 0000 0000 | 0   | 0,00   | 1           | i |
|  |   | DPL1   | 0x84    | 0000 0000 | 0   | 0,00   |             |   |
|  | -   | DEHI   | 0.65    | 0000.0000 | 0   | 0.00   |             |   |
| //Configure PUNT as Timer (will be monitored by interrunt  | 342 63  | DPS  | 0.66    | 0000.0000 | 0   | 0.00   |             |   |
| the second se  | 2.0   | PCON   | 0.07    | 0110 0000 | 00  | 0.00   | -           |   |
| // PWN Timer 7 counts from 0000 to AlCah   |   |  | 1 1000  |           |     | 100-01 |             |   |
| PWMCFG = 0x17: //Point to MSB MID  | 1   | 🗷 Watch  |         |           |     |        |             |   |
| PWHDATA = OxA2; //   |   | Name   |         | Memory    | Add | 1012   | Value       |   |
| SUMPRO - Duble |   | +-3  |         | IRAM      | 0   | M68    |             |   |
| PUNDATA = DVC2   |   | *9   |         | IRAM      | 0   | M69    |             |   |
|  |   | ***  |         | IRAM      | 0   | 100    |             |   |
|  | 1. 10 - 10 - 10 - 10 - 10 - 10 - 10 - 10  | *-2  |         | IRAM      | 0   | M6C    |             |   |
| //Configure and Enable PWM as timer Interrupt to monitor   | PWMS or   | *->  |         | IRAM      | 0   | 46D    |             |   |
| INTSRC2 6= 0xDF: //PWW7:4 Timer module Interrupt   |   | ***  |         | IRAM      | 0   | NUL    |             |   |
| IPINSENSI = OxDF: // pensitive on high Level(0)  | ALL 1 101 M   | Dimigned int da  | odata   | IRAM      | ŏ   | ×70    | 0           |   |
|  | PROPERTY AND ADDRESS OF ADDRESS OF ADDRESS ADDRESS ADDRESS ADDRESS ADDRESS ADDRESS ADDRESS ADDRESS ADDRESS ADDR |  |         | IDAM      |     | 101    |             | ŝ |