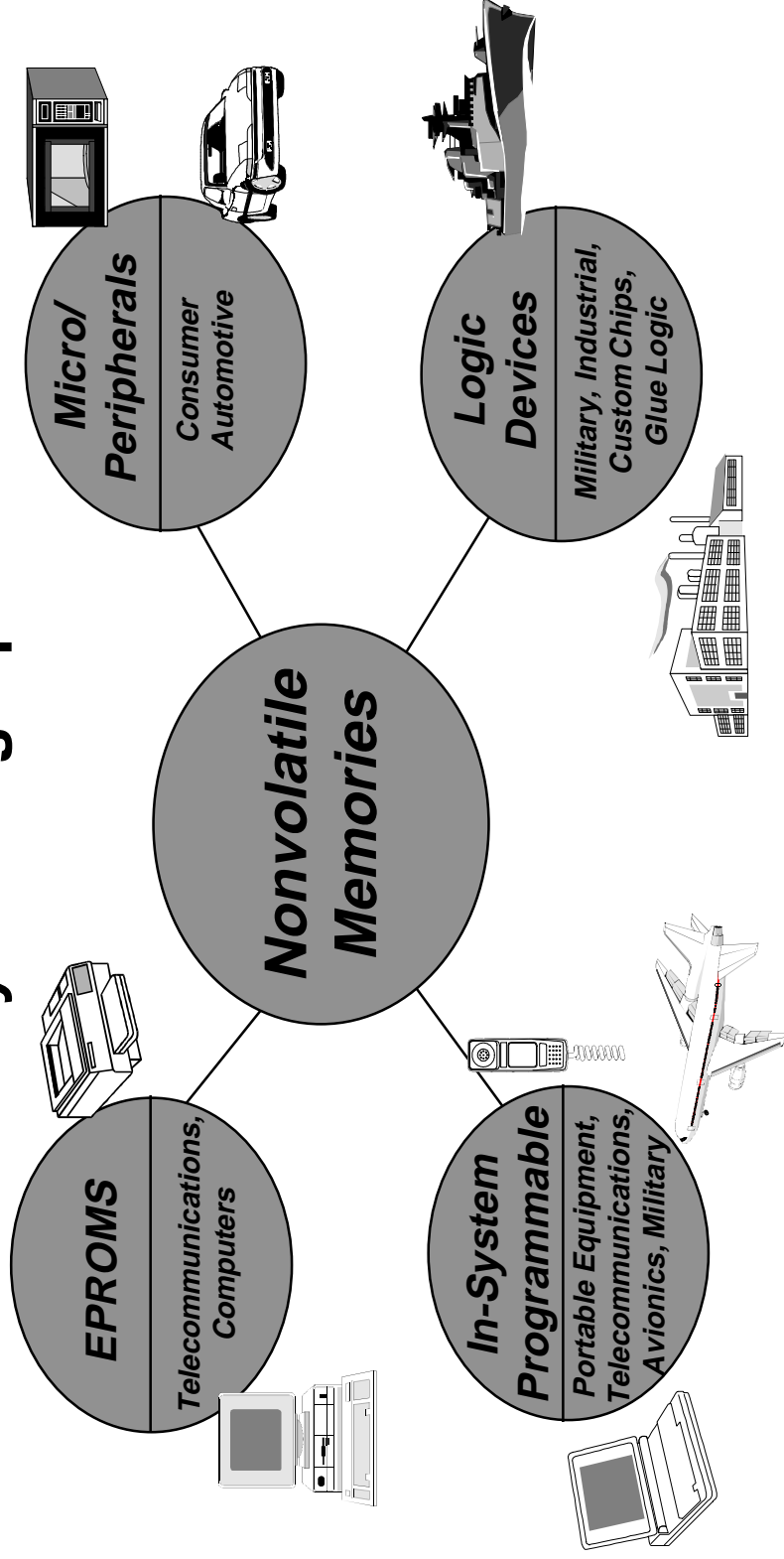


# ATMEL

**FLASH-BASED  
MICROCONTROLLERS**

# STRATEGY

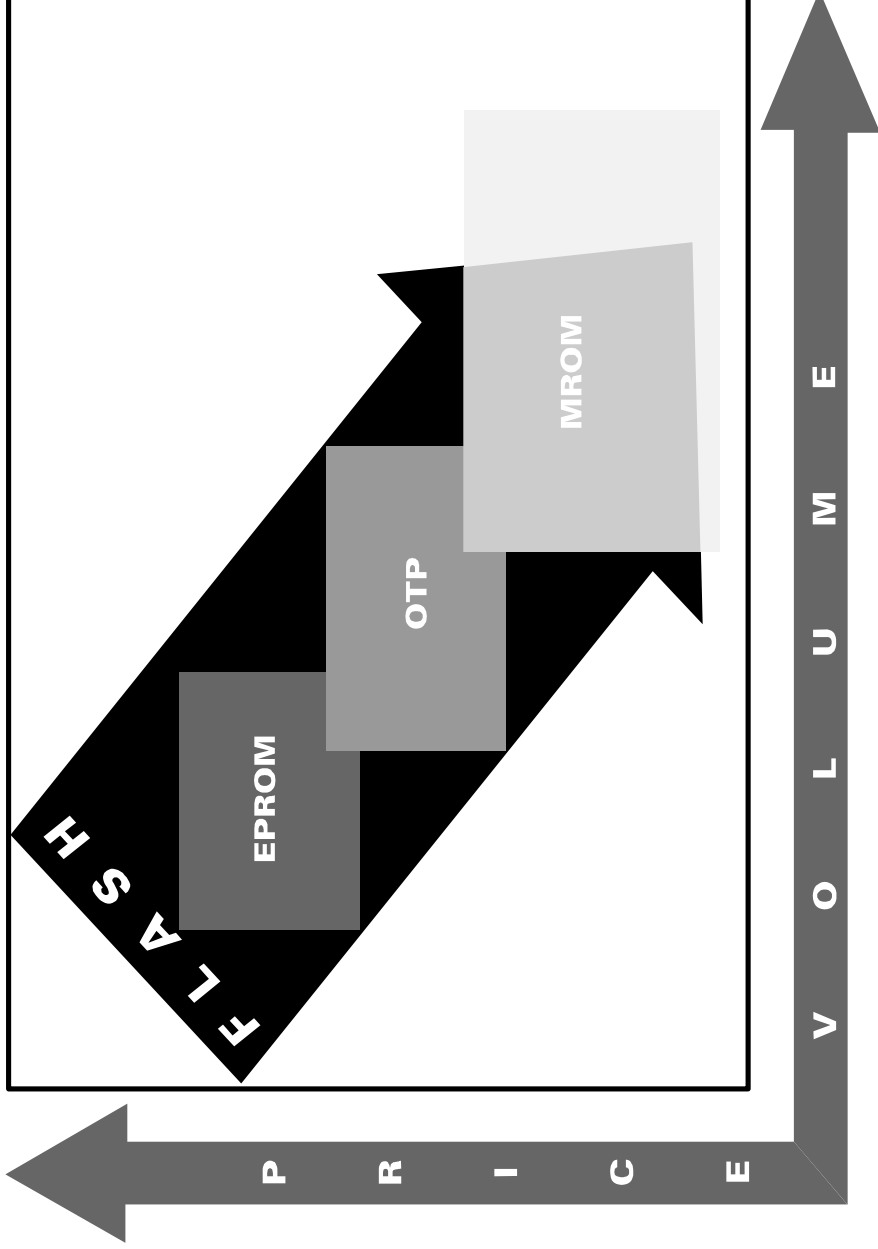
Leverage core NVM competency into unique memory and logic products.





# MARKET STRATEGY

Microcontrollers





## **HISTORY**

- **INTRODUCED AT89C51 IN MAY 1993**
  - **BASED ON DATABASE RECEIVED FROM INTEL**
- **REVENUES TOPPED \$30M IN 1995**
- **ATMEL IS STILL ONLY COMPANY SHIPPING LARGE VOLUMES OF LOW COST FLASH-BASED MICROCONTROLLERS**
  - **SECRET IS ATMEL'S FLASH TECHNOLOGY**



# ATMEL'S FLASH MEMORY TECHNOLOGY

- **USES TUNNELING TO PROGRAM**
  - BASED ON EEPROM CELL NOT EPROM CELL
  - NO DC CURRENT REQUIRED TO PROGRAM
- **DOES NOT NEED COMPLICATED ALGORITHMS TO ERASE OR WRITE**
  - SIMPLE ONE-STEP PROGRAMMING
- **NEEDS ONLY SINGLE VOLTAGE**
  - 3V OR 5V ERASE AND WRITE
- **PROCESS COMPATIBLE WITH LOGIC ON SAME CHIP**



## FLASH VERSUS OTP

- EPROM CELL IS SMALLER THAN FLASH CELL
  - MEMORY ARRAY IS SMALL PORTION OF MCU CHIP
- ATMEL IS A MEMORY COMPANY
  - FLASH MCU PROCESS IS BASED ON ADVANCED FLASH MEMORY TECHNOLOGY
- ATMEL'S FLASH-BASED MCU IS A SMALLER DIE THAN COMPETITORS' OTP VERSIONS

**ATMEL'S FLASH-BASED MCUS ARE LESS EXPENSIVE THAN OTPS**



## **ISP DOWNLOADABLE MCUS**

**CHANGE FLASH MEMORY VIA 4-PIN CONNECTOR**

- **ACCELERATE PRODUCT DEVELOPMENT**
- **ELIMINATE SOCKETS**
- **SIMPLIFY PRODUCT TESTING**
- **UP-DATE PRODUCTION WITHOUT STOPPING LINE**
- **MANUFACTURE CUSTOMER SPECIFIC PRODUCTS**
- **UP-GRADE REMOTELY**



## **PRODUCT OFFERINGS**

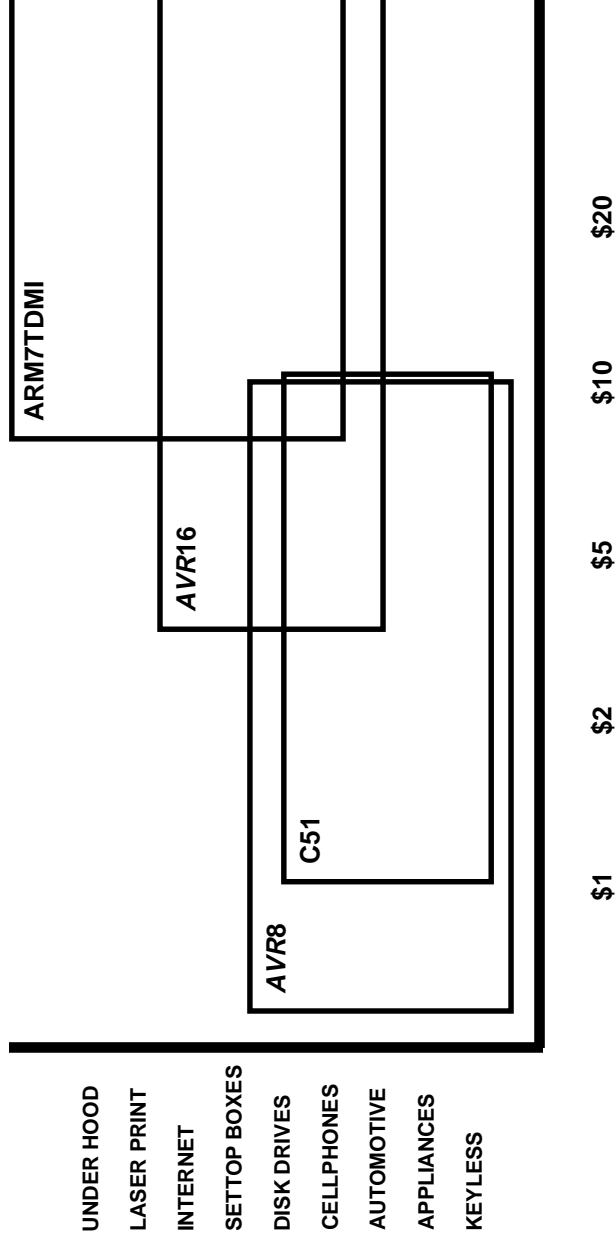
- **AT89 8XC51 SERIES**
  - COMPATIBLE WITH INDUSTRY STANDARD
  - AIMED AT BROAD MARKET
- **AT90 AVR™ SERIES**
  - PROPRIETARY HIGH PERFORMANCE ARCHITECTURE
  - INITIALLY AIMED AT NARROW HIGH VOLUME MARKET
- **ARM7TDMI 32-BIT RISC SERIES**
  - LOW COST, HIGH PERFORMANCE EMBEDDED CORE
  - AIMED AT COMPUTE INTENSIVE APPLICATIONS





MICROCONTROLLERS

# ATMEL'S MCU FAMILIES PRICE VS PERFORMANCE





**MICROCONTROLLERS**

---

# **AT89 SERIES**

**8XC51 COMPATIBLE  
MICROCONTROLLERS**



## SOCKET DROP-INS

	AT89C51	AT89C52	AT89C55
FLASH	4K	8K	20K
SRAM	128	256	256
T/Cs	2	3	3
SPEED	0-24	0-24	0-28
AVAIL	NOW	NOW	NOW



**MICROCONTROLLERS**

---

## **SMALL FOOTPRINT MCUS**

**AT89C1051**

**AT89C2051**

**PACKAGE 20 PIN**

**20 PIN**

**FLASH 1K**

**2K**

**SRAM 64**

**128**

**T/Cs 1**

**2**

**COMPARATOR 1**

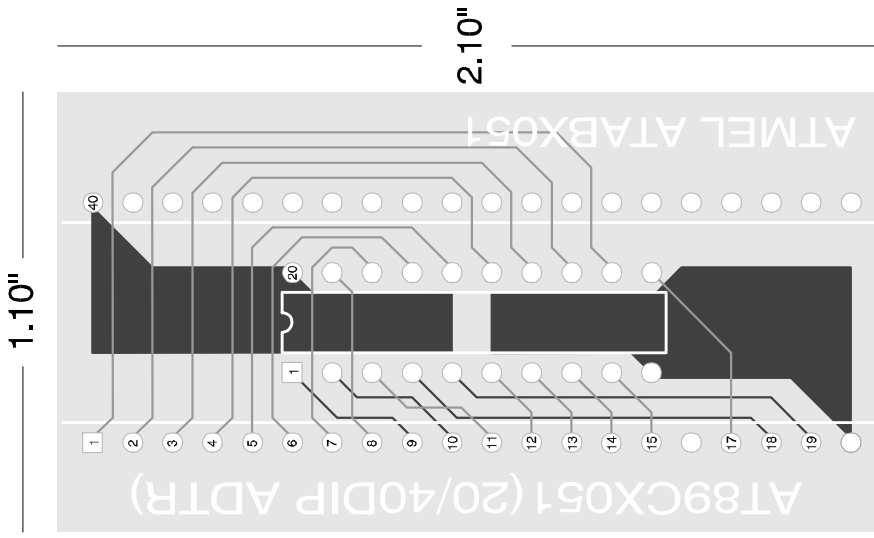
**1**

**IOL DRIVE 20mA**

**20mA**

**ATMEL SHIPPED 1MU IN FIRST YEAR!!!!**

# ATABX051



- **TWO WAY ADAPTER BOARD FOR IN CIRCUIT EMULATION**
- **CONVERTS 40 PIN SOCKETS TO X051 FOOTPRINT AND 20 PIN TO 40 PIN**
- **ORDER AS PART NUMBER ATABX051**



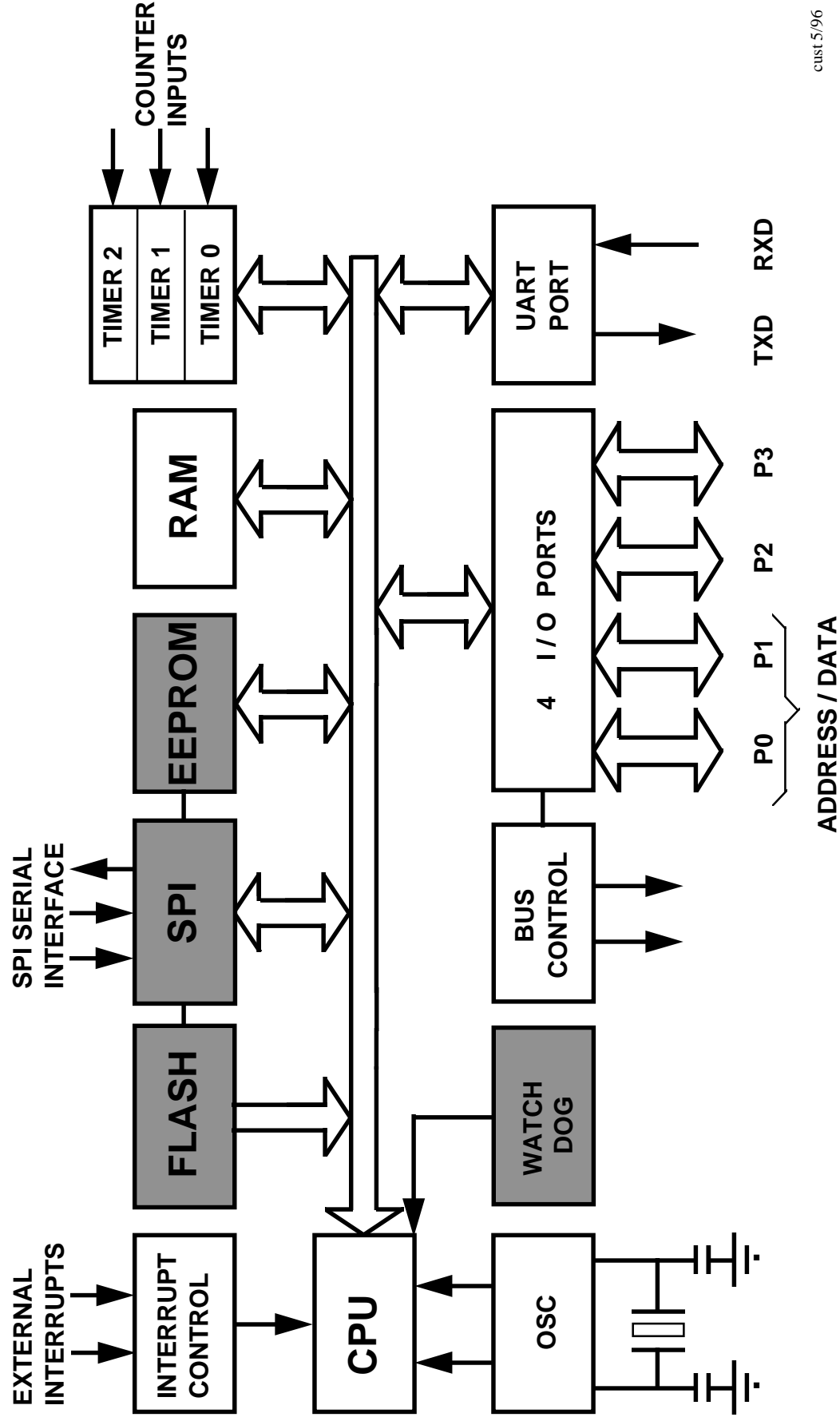
# AT89S8252

## ISP DOWNLOADABLE

- CPU IS ENHANCED '52 CORE
  - INTERRUPT RECOVERY FROM POWER DOWN
  - WATCHDOG TIMER
  - DUAL DATA POINTER
  - SPI SERIAL INTERFACE
- AWAKE™ MEMORY ARCHITECTURE
  - 8K BYTES DOWNLOADABLE FLASH VIA SPI
  - 2K BYTES ON-BOARD EEPROM WITH 100K ERASE/WRITE CYCLES
  - CAN EXECUTE FROM FLASH WHILE WRITING TO EEPROM
- STANDARD AND LV PARTS AVAILABLE Q296



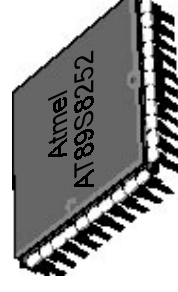
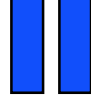
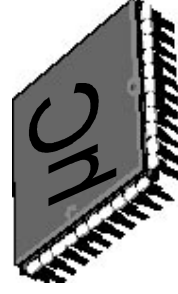
# AT89S8252 BLOCK DIAGRAM





## 2KB HIGH-ENDURANCE ON-CHIP E<sup>2</sup>

- 100,000 READ/WRITE CYCLES
  - IDEAL FOR DATA-LOGGING, SYSTEM CALIBRATION, & CUSTOMER-SPECIFIC DATA APPLICATIONS
- DATA SECURITY
  - ON-CHIP EEPROM KEEPS DATA FROM PRYING EYES
- HIGHER INTEGRATION
  - REDUCES CHIP COUNT, SAVES BOARD SPACE
  - FREES I/Os FOR OTHER FUNCTIONS

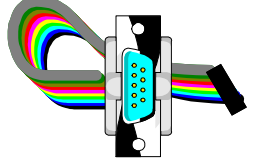
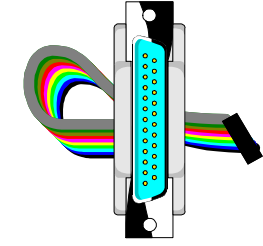
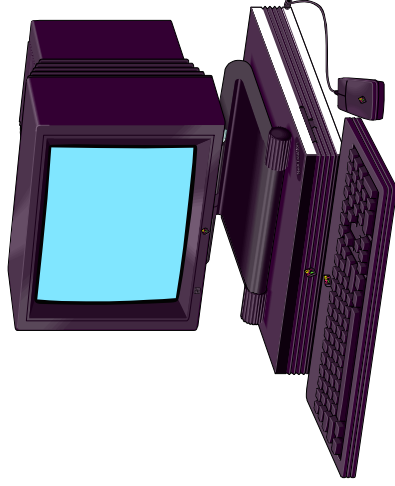




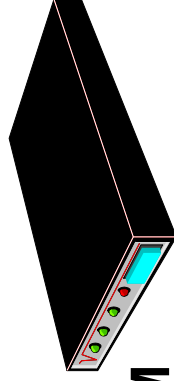


MICROCONTROLLERS

# AT89S8252 IN-SYSTEM PROGRAMMING



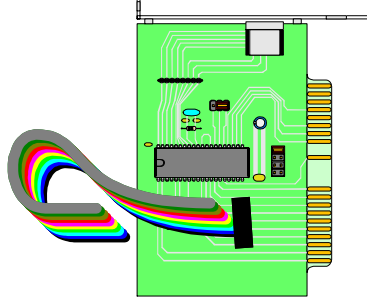
PARALLEL OR SERIAL PORT



MODEM



CABLE

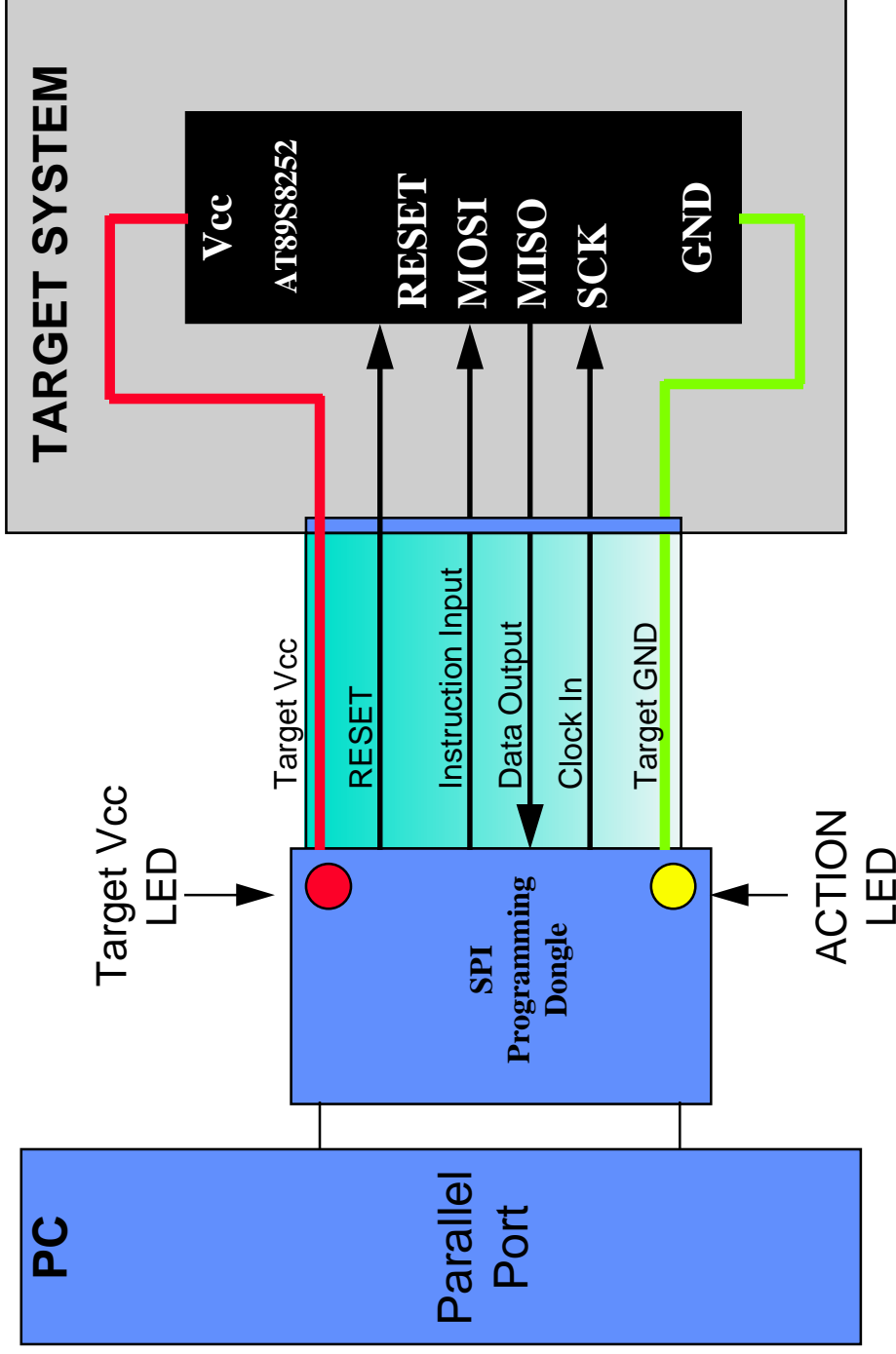


ISP

*UNLEASHES THE IMAGINATION*



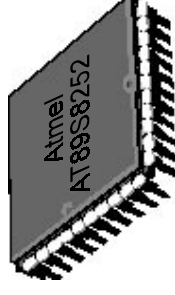
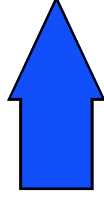
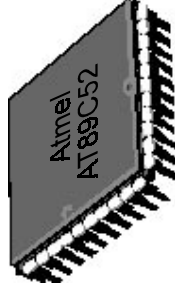
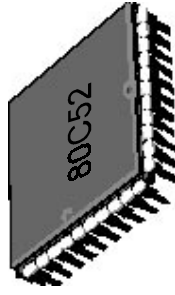
# AT-SPROG-01 ISP PROGRAMMER



Windows-Based ISP Programmer



# AT89S8252 RAISES THE STANDARD



- Code, Footprint-Compatible with Industry Standard 80C51
  - 8KB ROM Program Memory
  - 256B RAM
  - 3 Timer/Counters
  - 1 UART Serial Interface
  - 32 I/O Pins
  - Wide Tools Support
- +
- 80C52 Drop-In Replacement
  - 8KB Flash Program Memory
  - 1,000 Read/Write Cycles
  - Static to 24 MHz Operation
- +
- 4-Wire In-System Programmability
  - 2KB High-Endurance EEPROM
  - SPI Serial Interface
  - Dual Data Pointers
  - Watchdog Timer
  - Interrupt Recovery from Power-Down

**AT89S8252 Has Features Un-Matched by Any Other 8-Bit MCU**



## LOW VOLTAGE MCUS

<b>PART</b>	<b><u>C1051</u></b>	<b><u>C2051</u></b>	<b><u>C51</u></b>	<b><u>C52</u></b>	<b><u>S8252</u></b>	<b><u>C55</u></b>
<b>FLASH</b>	<b>1K</b>	<b>2K</b>	<b>4K</b>	<b>8K</b>	<b>8K</b>	<b>20K</b>
<b>EEPROM</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>2K</b>	<b>NA</b>
<b>SRAM</b>	<b>64</b>	<b>128</b>	<b>128</b>	<b>256</b>	<b>256</b>	<b>256</b>
<b>AVAILABLE</b>	<b>NOW</b>	<b>NOW</b>	<b>NOW</b>	<b>NOW</b>	<b>Q396</b>	<b>Q396</b>

ALL ATMEL LV MICROCONTROLLERS OPERATE AT 2.7 VOLTS



# **FLASH MEMORY ADVANTAGES PRODUCT DEVELOPMENT**

- **PRODUCT DEVELOPMENT TIME IS SHORTER**
  - ERASING TAKES < 1 SECOND USING ELECTRICAL PULSES
  - AT89XXX CAN BE REPROGRAMMED AGAIN AND AGAIN
- **DESIGN FREEDOM IS MAGNIFIED**
  - PROGRAMMING POWER IS LOW
  - ERASING DOES NOT REQUIRE PHYSICAL ACCESS TO PART
  - CODE DOES NOT HAVE TO BE FROZEN UNTIL JUST BEFORE PRODUCTION



# **FLASH MEMORY ADVANTAGES MANUFACTURING COSTS**

- **SUPPORTS JUST-IN-TIME MANUFACTURING**
  - AT89XXX CAN BE PROGRAMMED BY A PROGRAMMER, BOARD TESTER OR IN-SYSTEM JUST BEFORE SHIPMENT
- **REDUCES INVENTORY COSTS**
  - SINGLE PART CAN BE INVENTORIED AND PROGRAMMED AS NEEDED IN A MULTIPLE PRODUCT MANUFACTURING ENVIRONMENT
- **SIMPLIFIES PRODUCT REWORK**
  - DEVICE CAN BE RE-PROGRAMMED AS NEEDED
- **IMPROVES PROGRAMMING YIELD**
  - FLASH CAN BE FULLY TESTED AFTER PACKAGING



## **AT89C5X OTP REPLACEMENT**

- **DESIGNED TO FIT INTO OTP PRODUCTION FLOW**
- **PLUS:**
  - **PROGRAMMING YIELD IS 100%**
  - **CAN BE REPROGRAMMED OVER AND OVER**
- **FLASH MEMORY IS BLOCK ERASED AND PROGRAMMED ONE BYTE AT A TIME**
  - **APPLY ADDRESS, DATA AND PROGRAMMING PULSE**
- **NO CHANGE IS REQUIRED TO EXISTING PROGRAMMING HARDWARE**
- **SOFTWARE DRIVER MUST BE UPDATED TO ADD ERASE CAPABILITY AND INSURE RELIABILITY**
  - **CONTACT YOUR PROGRAMMER COMPANY FOR THE UPDATE**



# AT89C5X MROM REPLACEMENT

- **80C5X MROM FEATURES**
  - ASP IS LOW (\$2 TO \$4)
  - NRE IS HIGH (TYPICALLY \$4K)
  - CODE MUST BE FROZEN 8 WEEKS+ BEFORE SHIPMENT
  - MROM IS NOT CHANGEABLE
  - EACH UNIQUE CODE MUST BE INVENTORIED
- **AT89C5X ADVANTAGES**
  - CODE CAN BE PROGRAMMED 1 MINUTE BEFORE USE
  - DEVICE CAN BE ERASED AND REUSED
  - 1 PART TYPE CAN BE INVENTORIED FOR MANY DIFFERENT PRODUCTION UNITS

**COST OF USE FOR AT89C5X IS FAVORABLE IN  
MANY SYSTEMS USING <20K PARTS/YEAR**





# PRODUCT COMPARISON

	89C5X	80C5X	87C5X	87C5X
<b>MEMORY</b>	<b>FLASH</b>	<b>MASK</b>	<b>OTP</b>	<b>EPROM</b>
<b>ERASABLE</b>	<b>YES</b>	<b>NO</b>	<b>NO</b>	<b>YES</b>
<b>ERASE TIME</b>	<b>1 SEC</b>	<b>NA</b>	<b>NA</b>	<b>20 MIN</b>
<b>REUSABLE</b>	<b>YES</b>	<b>NO</b>	<b>NO</b>	<b>YES</b>
<b>PACKAGES</b>	<b>ALL</b>	<b>ALL</b>	<b>ALL</b>	<b>LIMITED</b>
<b>PRICE</b>	<b>MODERATE</b>	<b>LOW</b>	<b>MODERATE</b>	<b>HIGH</b>
<b>NRE</b>	<b>NO</b>	<b>YES</b>	<b>NO</b>	<b>NO</b>
<b>CODE FREEZE</b>	<b>1 MIN</b>	<b>8WKS+</b>	<b>1 MIN</b>	<b>1 MIN</b>
<b>LEAD TIME</b>				



## **DEVELOPMENT TOOLS**

- **ALL ATMEL MICROCONTROLLERS ARE COMPATIBLE WITH INDUSTRY STANDARD 'C51**
  - **EXISTING ASSEMBLERS AND COMPILERS CAN BE USED**
  - **EXISTING HARDWARE DEVELOPMENT AND EMULATOR TOOLS CAN BE USED**
- **PROGRAMMER SUPPORT IS WIDESPREAD**
  - **ATMEL BBS CONTAINS UPDATED LIST**



# AT89C5X IN-SYSTEM PROGRAMMING

- **PARALLEL PROGRAMMING**
  - NO NEED TO HAVE PHYSICAL ACCESS TO PART
  - ACCESS PROGRAMMING SIGNALS ELECTRICALLY
  - CONNECT A PROGRAMMER OR PC TO PROGRAM THE CHIP
  - APPLICATION NOTE SHOWING HOW TO USE A PC IS AVAILABLE
- **SERIAL PROGRAMMING**
  - ONE AT89C51 CAN BE USED TO RECEIVE SERIAL DATA AND PROGRAM ANOTHER AT89CXX IN SYSTEM
  - APPLICATION NOTE SHOWING HOW TO IMPLEMENT THIS CONCEPT IS AVAILABLE



## **LEADTIMES**

- **MCU LEADTIME WILL REMAIN < 8 WEEKS**
  - **ATMEL DELIVERS WHEN NO ONE ELSE CAN**
- **GREW 600% IN '95 BUT LEADTIMES REMAINED SHORT**
  - **CAPACITY AVAILABLE FOR MCU GROWTH**



## **FAMILY MEMBERS**

<b>PART #</b>	<b>DESCRIPTION</b>
<b>AT89C51</b>	<b>PIN COMPATIBLE WITH 8XC51 (4K FLASH)</b>
<b>AT89LV51</b>	<b>2.7 V VERSION OF AT89C51</b>
<b>AT89C52</b>	<b>DOUBLE MEMORY VERSION (8K FLASH)</b>
<b>AT89LV52</b>	<b>2.7 V VERSION OF AT89C52</b>
<b>AT89C55</b>	<b>PIN COMPATIBLE WITH AT89C52 (20K FLASH)</b>
<b>AT89C2051</b>	<b>2K FLASH/20 PIN PACKAGE</b>
<b>AT89C1051</b>	<b>1K FLASH/20 PIN PACKAGE</b>
<b>AT89S8252</b>	<b>DOWNLOADABLE FLASH</b>

**MORE VERSIONS ARE COMING**



## **MCU INFORMATION**

- **DATA BOOK**
  - PRINT VERSION & CD ROM VERSION
- **WEB SITE**
  - [HTTP://WWW.ATMEL.COM](http://www.atmel.com)
- **ATMEL FAX-BACK (800 292 8635)**
  - DATA SHEETS, APP NOTES AND SUPPORT TOOL LISTS
- **ATMEL BBS (408 436 4309)**
  - APP NOTES SOFTWARE AND SCHEMATICS
  - SUPPORT TOOL LISTS
  - SHAREWARE ASSEMBLER
- **EMAIL**
  - [MCU@ATMEL.COM](mailto:MCU@ATMEL.COM)

# **ATMEL**

## **FLASH-BASED MICROCONTROLLERS**

- **INDUSTRY STANDARD ARCHITECTURE**
- **FLASH PROGRAM MEMORY**
- **PROGRAMMABLE IN-SYSTEM**