Micro Power Analog Group

ST7 MICROCONTROLLER TRAINING

Application Lab Team
TRAINING OBJECTIVES

• To have a thorough knowledge of ST7 core and peripherals
• To learn the ST7 development tools usage
• To be able to write efficient assembly and C code for ST7
• To set up an application environment for a quick start
TRAINING AGENDA 1

• DAY 1
  ✓ Welcome
  ✓ ST7 Marketing Presentation
  ✓ ST7 Core, Flash, ICC protocol
  ✓ ST7 Assembly toolchain

• DAY 2
  ✓ STVD7 debugger
  ✓ SOFTEC : InDart kit presentation
  ✓ ST Tools
  ✓ Realizer II + exercise
TRAINING AGENDA 2

- **DAY 3**
  - ✓ C day with Cosmic and Metrowerks

- **DAY 4**
  - ✓ Peripherals
  - ✓ Exercises: assembly & C

- **DAY 5 (Morning only)**
  - ✓ Evaluation
  - ✓ FAQs
  - ✓ Conclusion
ST7 MICROCONTROLLER TRAINING

1. INTRODUCTION
2. CORE
3. ADDRESSING MODES
4. ASSEMBLY TOOLCHAIN
5. STVD7 DEBUGGER
6. HARDWARE TOOLS
7. PERIPHERALS
8. ST-REALIZER II
9. C TOOLCHAINS
ST MCU: 8-bit to 32-bit Cores

8-Bit

- Embedded Control - Simple to Medium Complexity Systems:
  - Automotive Body Control, Appliances, Point-of-Sale Devices, Industrial Control, Electronic Gaming, Building Security and Control, Energy Metering

- 9 MIPS: µPSD
- 8 MIPS: STM75
- 5 MIPS: ST9
- 2 MIPS: ST7
- <1 MIPS: ST6

16-Bit

- Complex Control:
  - Hard Disk Drives, CD/DVD Drives, Industrial Motor Control

- 32 MIPS: ST10

32-Bit

- High Performance Embedded Control:
  - Point of Sale Terminals, Multimedia Appliances, PBX, Industrial Automation, GPS, MP3 Players, Printers, Networking Systems, Serial Protocol Conversion, Medical Equipment, Security and Surveillance

- 400 MIPS: STPC
- 66 MIPS: STR9-ARM9
- 46 MIPS: STR7-ARM7

= under development
## Market Overview

### 2004-2009 All-Bit Microcontrollers

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>CAGR %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue (US$ M)</strong></td>
<td>12189</td>
<td>12472</td>
<td>13721</td>
<td>13618</td>
<td>14204</td>
<td>15137</td>
<td>4.43%</td>
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<tr>
<td><strong>Units (K)</strong></td>
<td>6783</td>
<td>7667</td>
<td>8300</td>
<td>9144</td>
<td>9989</td>
<td>11095</td>
<td>10.34%</td>
</tr>
<tr>
<td><strong>ASP US$</strong></td>
<td>1.8</td>
<td>1.63</td>
<td>1.53</td>
<td>1.49</td>
<td>1.42</td>
<td>1.36</td>
<td>-5.36%</td>
</tr>
</tbody>
</table>

In-stat

### 2004-2009 All-Bit Microcontrollers

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>CAGR %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue (US$ M)</strong></td>
<td>3788</td>
<td>4439</td>
<td>4700</td>
<td>5085</td>
<td>5390</td>
<td>5892</td>
<td>9.23%</td>
</tr>
<tr>
<td><strong>Units (K)</strong></td>
<td>4705</td>
<td>4956</td>
<td>4794</td>
<td>4881</td>
<td>4905</td>
<td>5008</td>
<td>1.25%</td>
</tr>
<tr>
<td><strong>ASP US$</strong></td>
<td>1.242</td>
<td>1.116</td>
<td>1.02</td>
<td>0.96</td>
<td>0.91</td>
<td>0.85</td>
<td>6.44%</td>
</tr>
</tbody>
</table>

In-stat
# ST7 Portfolio

From Mass Market to Application Specific Standard Micros

<table>
<thead>
<tr>
<th>Category</th>
<th>Model</th>
<th>Flash/Rom</th>
<th>Pins</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOW END</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST7Lite</td>
<td>1K-8K FLASH / ROM</td>
<td>16 to 28 pins</td>
<td>ADC8 - ADC10, RC1% - E², SPI - SCI - I²C, Dali, LNB</td>
<td></td>
</tr>
<tr>
<td>ST723xx</td>
<td>4K-60K FLASH / ROM</td>
<td>32 to 64 pins</td>
<td>ADC10 – PWM, SPI - SCI – I²C- CAN</td>
<td></td>
</tr>
<tr>
<td>ST7234x</td>
<td>4K-16K Single Volt. + E²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MID-RANGE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST7MC</td>
<td>8-60K FLASH / ROM</td>
<td>32 to 64 pins</td>
<td>Brushless Motor, ADC10 - PWM x 10 - SPI - SCI</td>
<td></td>
</tr>
<tr>
<td>ST7WIND</td>
<td>24K ROM</td>
<td>48 pins</td>
<td>2.5K Patch RAM, 2 RX – 27Mhz SPI</td>
<td></td>
</tr>
<tr>
<td><strong>RF</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>USB</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MOTOR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
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# Key Applications

<table>
<thead>
<tr>
<th>Applications</th>
<th>Products</th>
<th>ST Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PC Peripherals</strong></td>
<td>Gaming, Keyboard, Mouse, U-Disk, POS</td>
<td>ST7263B, ST72324L, ST7SCR</td>
</tr>
<tr>
<td><strong>Industrial</strong></td>
<td>Automation, Networking, Connectivity, POS, building security. Schneider, Rockwell, Agilent, Tyco</td>
<td>ST7Lite, ST72322A, ST72325, ST7FMC</td>
</tr>
<tr>
<td><strong>Home Appliance</strong></td>
<td>White and small appliances, Air conditioning. Whirlpool, Invensys, Electrolux, SEB/Moulinex, Gree, Galanz, Kelon</td>
<td>ST7Lite, ST72321B, ST72324B, ST72361</td>
</tr>
<tr>
<td><strong>Consumer</strong></td>
<td>Printer/Fax, Portable players, Power tools. HP, Black &amp; Decker, Creative</td>
<td>ST7Lite, ST72324L, ST72324B</td>
</tr>
<tr>
<td><strong>Power Management</strong></td>
<td>UPS, Power supply, Metering. APC, Tripplite, Delta, Cyberpower</td>
<td>ST7263B, ST72324L, ST7SCR</td>
</tr>
</tbody>
</table>
8-Bit µC – General Purpose line

- ST7lite
- ST72F324B
- ST72F361
- ST72F561
- ST72F321B/5
- ST72F521
- ST72F34x
- ST72F2x
- ST765
- ST7263B
- ST7FMC
- ST7SCR
- ST7LNB

- Memory (KB)
- Complexity

- E²Dara Single V Flash
- I²C
- USB FS/LS ADC
- SMM
- beCAN

- Cost effective
- 8 pin
- 2 UART
- Single Volt

- ST7232A
- ST7FMC
- ST7LNB
Introduction to ST7

- **Mainstream 8 bit microcontroller** product line for STMicroelectronics. (MCU division, Automotive, Smart Card...)
- **Industry standard** 8 bit Core based on CISC architecture, easy hands on.
- **Ideal for platform integration**, core and peripheral compatibility from 1K to 60K program memory as well as compatible package configuration.
- **Recognized for best in class EMC behavior.**
- **Flash, ROM and FAST ROM** to accommodate production ramp-up and economy of scale.
- **From 2.4V to 5V** Range in order to support different voltage environments.
- **Cost Effective** with models in Flash starting @ $US0.50 ball park
- **High reliability** supported by the most demanding quality standards, The best Flash Data-retention specification.
- **Complete tools offer**
  - from low cost development tools > $60 to $300 up to very high end emulators
  - Various demonstration boards, and software library for an quick and easy hands on.
  - In Circuit debugging module for fast verification.
  - Production tools for Flash including Gang Programmer, or software DLL for ICP.
- **Worldwide support**
- **Aggressive technology road map** down to 0.18um
ST7 benefits

- **Advanced architecture offering**
  - Fast Programming and cost effective High Density Flash memory
  - Rich Interrupt management
  - In-circuit programming
  - Cost effective Solutions
  - Data retention robustness
    - 40 Years@85dgC/ (HDFLASh)
    - 10 years @125dgC (HDFLASh)

- **Robust and safe**
  - Control and Safety features embedded with Watchdog, Low Voltage Detection, Auxiliary Voltage Detection., Clock Security System.
  - Robust to comply Automotive, appliance and industrial environment.
  - Millions of pieces delivered
  - EMC, ESD Latchup report available

- **Rich Peripheral set**:
  - SCI, LINSCI™, CAN 2.0B, SPI, I²C, USB, 16b timer, 8b timer
    - Fast Conversion 10 bit A/D (3us to 7us)
    - Wide choice of combination

- **Scalable solution**
  - from Low to high pin count (8 to 80 pins)
  - small to large memory (4K to 60K)
  - 2.7V and 5V Applications, various Power saving modes

- **Ideal development environment**
  - In Circuit debugging
  - Rich Software library, and strong support.
  - Low cost development tools.
New references introduction

- **ST72F325** (CSS embedded)
  - Samples Available in 16K to 60K version
  - 16K & 32K Flash & ROM in Production now
  - 48K & 60K planned for Q1 06

- **ST72F32A** (low cost series) In production for 32 and 42 pin packages

- **ST72F361** (2x UART) In production now.

- **ST7FULTRALITE** (8-pin device embedding a internal 8MHz RC) In prod Q3 06

- **ST7FLITE1B** (1% internal 1MHz RC, 5 timers) In prod Q2 06

- **ST72F561** (beCAN) 16K version available.

- **ST72F34x** (Single Voltage E²)
  - Samples available in TQFP44 & LFBGA 56 now.
  - Production planned for January 06.

- **ST72F321B** Upgraded version vs 321.
  - Samples available in 8K to 60K version
  - 8K to 32K models in production now

- **ST72F324B** upgraded version vs 324
Hardware tools

- **In house**
  - Evaluation board
  - Starter Kits
  - Development Kit
  - Emulator
  - Programmer
  - In Circuit programmers

- **3rd Party**
  - Evaluation
  - Starter Kits
  - Development Kit
  - Emulator
  - Programmer
  - In Circuit programmers
Software tools

- **Cosmic C- Compiler (recommended)**
  - IDEA
  - C Cross Compiler ; ANSI and ISO C compiler optimized for ST7 core.
  - ZAP (Source level debugger with graphical IF for Simulator, Emulator or Development Kits)
- **Free ST7 Software Library**
  - Set of drivers thoroughly tested
  - Peripherals firmware Integration
  - Device Configuration / Demo.
- **Free ST7 Raisonance Ride**
  - Supporting several ST Cores
  - Ride IDE / Code compressor
  - Application builder
  - Simulator / Assembler
  - C Compiler soon available! (Q2 06)
- **Metrowerks C- Compiler**
  - Selection to be done as Metrowerks is preferably supporting Freescale devices.
  - Contact FAE to get the latest information
- **Free ST7 Visual Develop (STVD7)**
  - To build, debug, program, compatible with 3rd parties and Tools
- **Free ST7 Visual Programmer (STVP7)**
  - To program with ST7-STICK, EPB,DVP and EMU.
Low cost programming tools

- **ST7-STICK ST In-Circuit Communication Kit** (ST7-STICK) is an ideal introduction to the easy-to-use world of Flash programming of ST7 MCUs. ST7 Flash STICK is **low-cost**, **powerful** and **easy-to-use** In-Circuit programming tool. Combined with the ST7 socket boards (ST7SBxxx), the **ST7-STICK** allows on-socket programming for your ST7 microcontrollers.

US$65 Suggested Resale
Low cost development Kit

The REva's key features include:

- Digital and analog I/O evaluation features including on-board LEDs, buttons, switches, external analog connector, temperature sensor and potentiometer,
- On-board $I^2C$ EEPROM and bus extension connector,
- On-board RS232 driver and DB9 connector,
- SPI, CAN and USB connections (depending on the target device),
- Embedded RLink for in-circuit debugging and in-circuit programming,
- USB powered
- VDD settings for 1.8v, 3.3V and 5V

STANDARD KIT FREE! RKit-ST7

- RKit-ST7 Standard Package includes:
  - The RIDE interface for Windows 2000, XP and NT
  - The MA-ST7 Macro-Assembler (full version)
  - The RBuilder-ST7 Application Builder
  - The RL-ST7 Linker
  - The SIMICE-ST7 Simulator/Debugger (full version)
- RKit-ST7 supports third party C Compiler (Cosmic and Metrowerks).

$149 ball park price

Softec development kits

- **Debugging Capabilities**
  - Unlimited number of breakpoints
  - Advanced breakpoints, depending on model (data, access type, access range, stack...)
  - Source level and symbolic debugging (Reset, go, go from reset, go to cursor, stop, step into, step over, step out)
  - Watch variables, registers and peripherals

- **Programming Capabilities**
  - Blank Check/Erase/Program/Read/Verify for Flash memory, EEPROM memory and Option Bytes
  - Free Software based on STVD7
  - Windows 9x/NT/2000/XP compatible

- **Communication**
  - Parallel or USB connection to the host PC
  - ICC (In-circuit Communication) connection to target board

US$300 ball park price
High end development tools

- **Real-time** debugging
- **Unlimited breakpoints** with counter and condition
  - Two (2) **output triggers**
  - Nine (9) external **input triggers**
- A **powerful four-level logic sequencer** allows you to perform specific actions:
  - break,
  - start/stop trace recording,
  - recording of a snapshot in the trace,
  - outputting the two output triggers
  - ...
- On occurrence of a specific event or series of events:
  - on a specific address or range of addresses,
  - a specific data value with bit mask,
  - a read, write or read/write access,
  - stack operation access

- **256K** real-time **trace** recording with timestamp
- **Read/write on the fly**
- **USB, Parallel** and **Ethernet** PC Host interfaces
- Low voltage emulation from 1.8 to 5.5 V
- Programmable Clock frequency From 32 kHz up to 16 MHz
- Performance Analysis
- In Circuit Programming
- In-Circuit Debugging
STM75 µC – Road Map

1.65V / 3.6V voltage range

-40°C / +105°C operating temperatures range
with part numbers up to 125°C

Performance
40MHz CPU

Wide range of Memories
1kB-128kB Flash
64B-4kB RAM
Data EEPROM

Low Power Optimized
State of the art
Analog Peripherals
Digital Peripherals
The rest is there!

http://mcu.stmicroelectronics.com.cn/

Conclusion

- ST microelectronics is fully committed to microcontroller.
- Advanced Process and roadmap down to 0.18um
- ST7 is a industry standard core, easy to work with.
- ST7 family allows Platform development and software re-use for economy of scale and time to market.
- A lot of part numbers to fit as close as possible application needs.
- Proven design regarding robustness versus external perturbation

- Cost effective, the ST7 family allows development for aggressive market.
- Comprehensive truthful documentation
- Software library, reference design for faster development time.
- Best in class development environment
- Worldwide support with local technical FAEs.
- On line documentation