

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

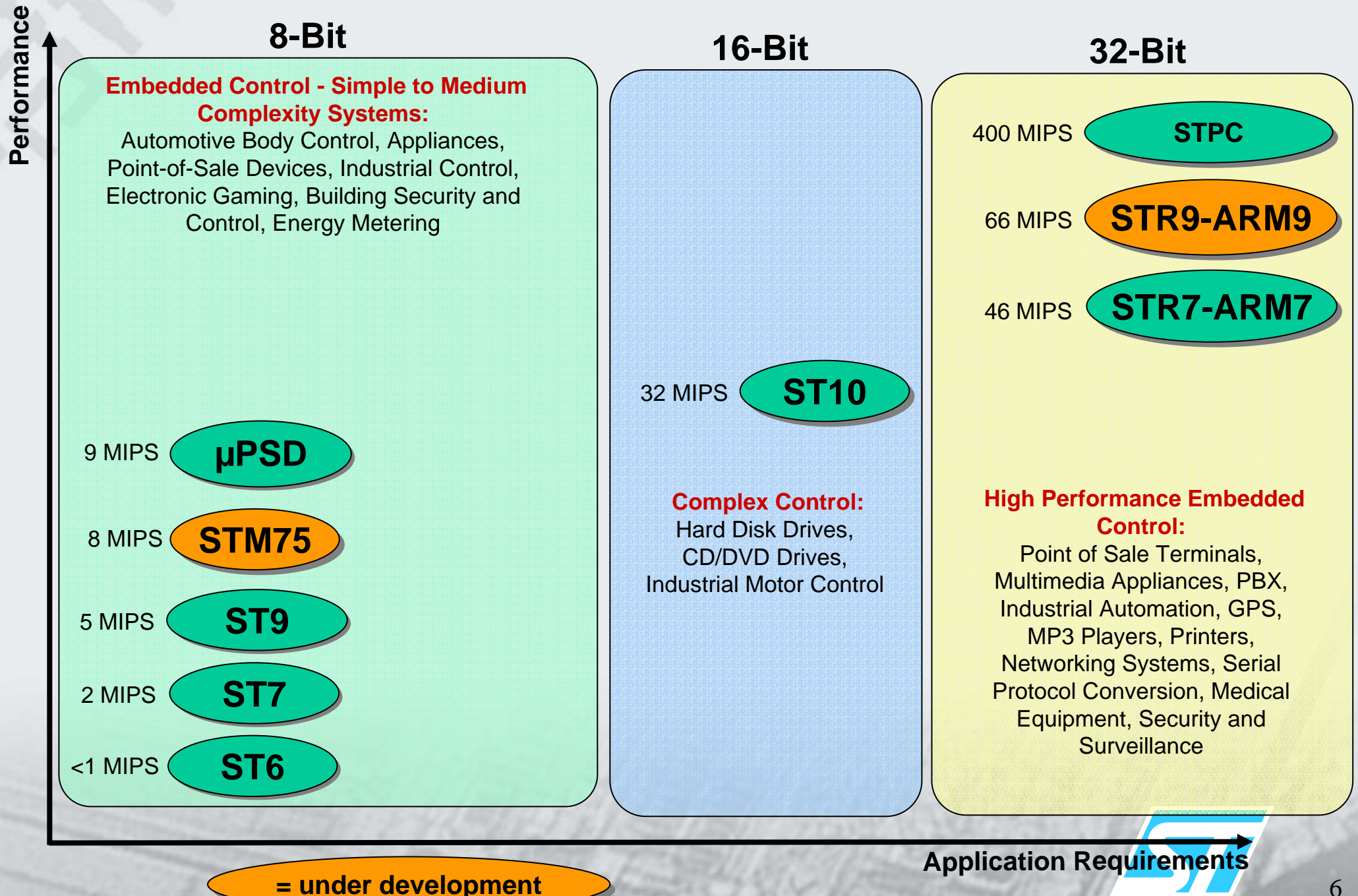


# ST7 MICROCONTROLLER TRAINING

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





# Market Overview

## 2004-2009 All-Bit Microcontrollers

	2004	2005	2006	2007	2008	2009	CAGR %
Revenue (US\$ M)	12189	12472	13721	13618	14204	15137	4.43%
Units (K)	6783	7667	8300	9144	9989	11095	10.34%
ASP US\$	1.8	1.63	1.53	1.49	1.42	1.36	-5.36%

In-stat

## 2004-2009 All-Bit Microcontrollers

	2004	2005	2006	2007	2008	2009	CAGR %
Revenue (US\$ M)	3788	4439	4700	5085	5390	5892	9.23%
Units (K)	4705	4956	4794	4881	4905	5008	1.25%
ASP US\$	1.242	1.116	1.02	0.96	0.91	0.85	6.44%

In-stat



# ST7 Portfolio



**LOW END**



**MID-RANGE**



**RF**



**USB**



**MOTOR**

**From Mass Market to Application Specific Standard Micros**

## **ST7Lite**

1K-8K FLASH  
/ ROM  
16 to 28 pins  
ADC8 - ADC10  
RC1% - E<sup>2</sup>  
SPI - SCI - I<sup>2</sup>C  
Dali  
LNB

## **ST723xx**

4K-60K FLASH  
/ ROM  
32 to 64 pins  
ADC10 - PWM  
SPI - SCI - I<sup>2</sup>C-  
CAN

## **ST7234x**

4K-16K Single  
Volt. + E<sup>2</sup>

## **ST7WIND**

24K ROM  
48 pins  
2.5K Patch RAM  
2 RX - 27Mhz  
SPI

## **ST726XX**

4-32 K FLASH  
/ ROM  
20 to 64 pins  
Low-speed / Full-  
speed /  
High-speed  
ADC8 - PWM  
SPI - SCI

## **ST7MC**

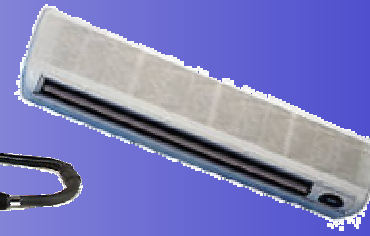
8-60K FLASH  
/ ROM  
32 to 64 pins  
Brushless Motor  
ADC10 - PWM  
x 10 - SPI - SCI



# Key Applications

•**Home Appliance** – White and small appliances,  
Air conditioning.

Whirlpool, Invensys, Electrolux,  
SEB/Moulinex, Gree, Galanz, Kelon



ST7lite  
ST7232A  
ST72325  
ST7FMC

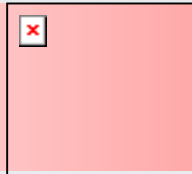
ST7Lite  
ST72321B  
ST72324B  
ST72361



•**Industrial** - Automation, Networking,  
Connectivity, POS, building security.  
Schneider, Rockwell, Agilent, Tyco

•**Consumer** - Printer/Fax, Portable players,  
Power tools.

HP, Black & Decker, Creative



ST7lite  
ST72324L  
ST72324B

ST7lite  
ST72324B  
ST72344



•**Power Management** - UPS, Power supply,  
Metering.

APC, Tripplite, Delta, Cyberpower

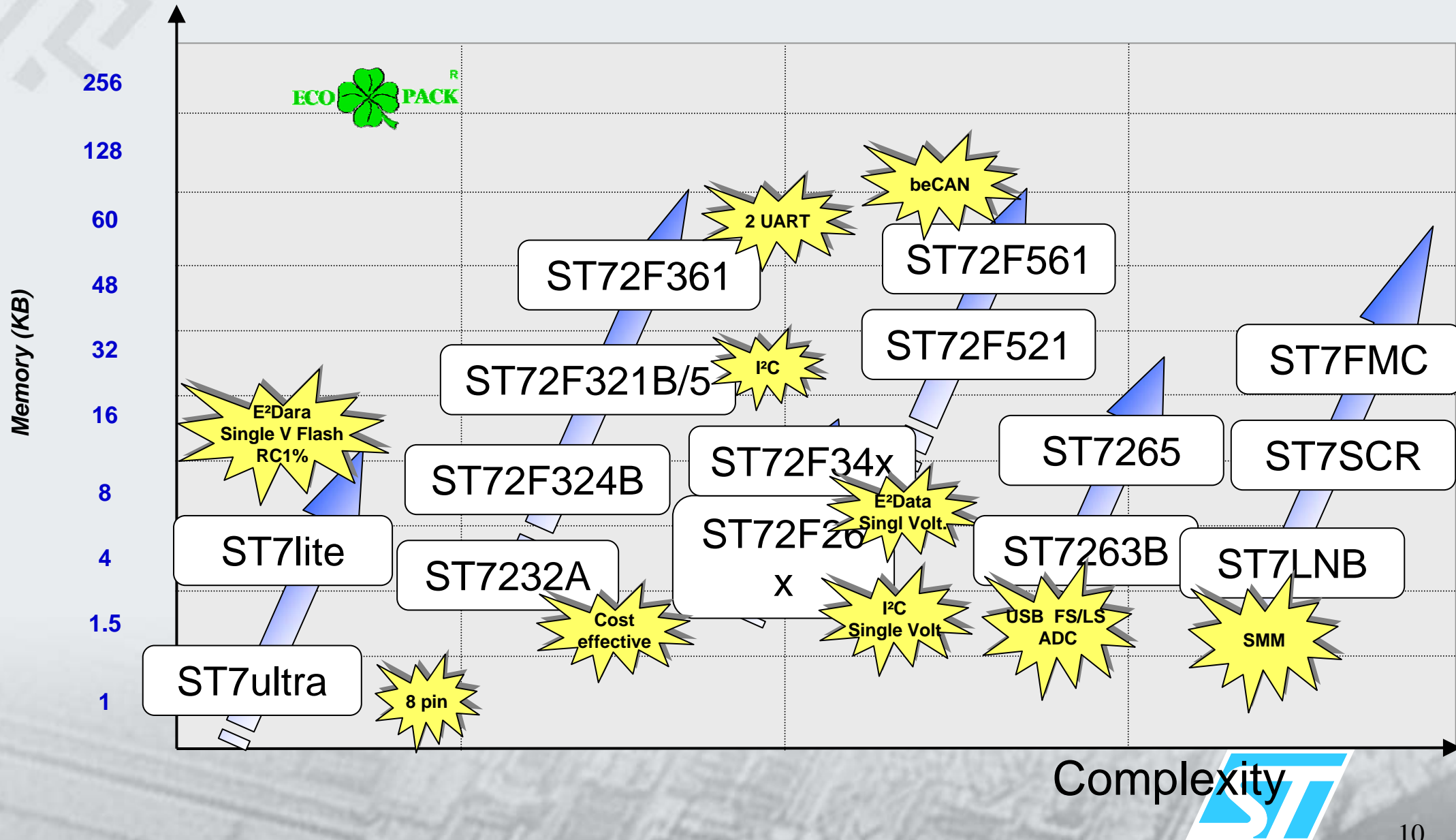
•**PC Peripherals** - Gaming, Keyboard,  
Mouse, U-Disk, POS  
Logitech, Microsoft, Netac



ST7263B  
ST72324L  
ST7SCR



# 8-Bit $\mu$ C – General Purpose line

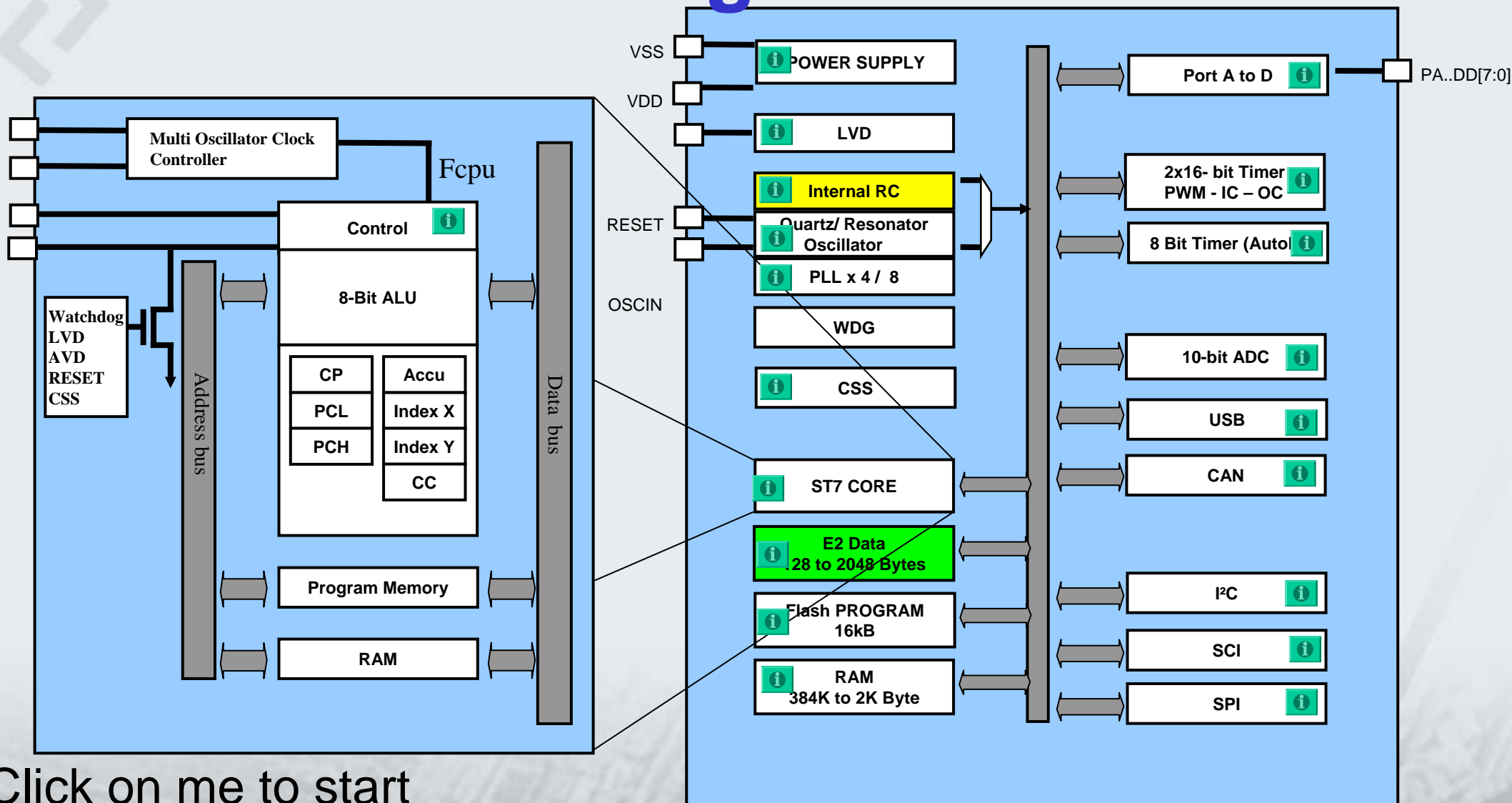


# Introduction to ST7

- **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 Core Architecture & Block Diagram



Click on me to start

Click on me to close the assistant

1Mhz RC1%

E2 Data

Check P/N



# 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 E<sup>2</sup>)
  - 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



- 3<sup>rd</sup> Party

- Evaluation
- Starter Kits
- Development Kit
- Emulator
- Programmer
- In Circuit programmers



# Software tools

Free for output up to  
16KBytes



- **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 3<sup>rd</sup> 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



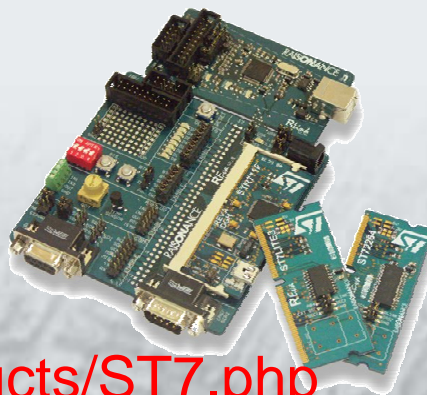
# Low cost development Kit

## 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<sup>2</sup>C 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

<http://www.raisonance.com/products/ST7.php>





# 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

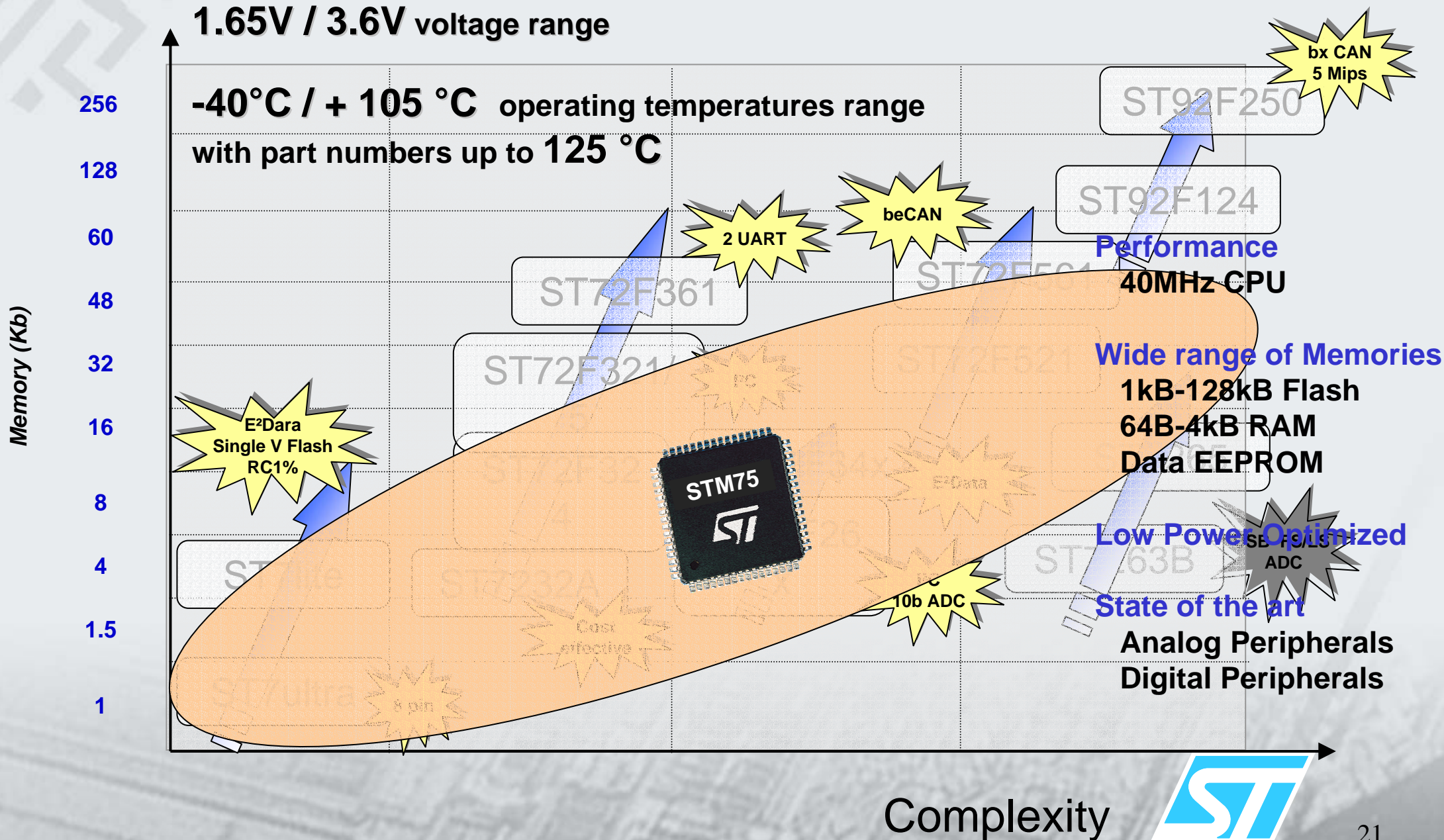
- **Real-time** debugging
- **Unlimited breakpoints** with counter and condition
  - Two (2) **output triggers**
  - Nine (9) external **input triggers**
- A **powerful four-level logic sequencer** allows you to perform specific actions:
  - break,
  - start/stop trace recording,
  - recording of a snapshot 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 $\mu$ C – Road Map





# The rest is there!

8-bit microcontrollers, 16-bit microcontrollers and 32-bit ARM microcontrollers - Microsoft Internet Explorer provided by Corpo

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ST Microcontroller Support Site

Microcontroller Products

- Family Overview -
- Product Selector -

Technical Literature and Support Files

- Product Family -
- Device Type -
- Application -

Detailed content about products and tools

Development Tools

- Selection Guide -

Documents and files

Detailed content about tools

ST7 accessories

ST9 accessories

Highlights

ST's Standard CPU Cores

8-bit ST6 Simple Control Functions

16-bit uPSD ST10 Medium Complexity Systems

32-bit STR7 ARM™ Realtime Applications

STPC

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Chinese Web Site

ST Mission: to offer strategic independence to our

STMicroelectronics 2005

Local intranet

<http://mcu.st.com/mcu/index.php>

The ST Microcontroller chinese Support Site - Microsoft Internet Explorer provided by Corporate Package Fabric@st

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《ST7通用单片机原理及应用》——学习与应用ST7单片机的必读书

意法半导体公司委托北京航空航天大学出版社出版了这本参考读物，为广大学习和使用ST7系列单片机用户提供了一个有益的辅助工具。

本书的内容涉及到从基本的ST7单片机CPU，到以典型系列单片机ST7FLITE和ST72324内部功能模块的介绍，及各种应用的参考例程。对那些熟悉单片机或者初学者来说，都是十分适合的。通过学习本书的相关内容，将有益于那些想将本书作为具体项目应用参考的工程师。

本书涵盖的关键主题有：

- ST7通用单片机简介
- ST7单片机结构及原理
- 指令系统
- 汇编语言程序设计
- 片上外围电路
- 开发工具和开发方法
- 应用实例

本书内容通俗易懂，丰富全面，可供从事单片机开发的技

ST7 通用单片机 原理及应用

张超明 黄文 陈强 田明华 等编著

DAI LIN PC USB UART

Menu ready for use

<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

