

# **ST7 FAMILY**

## **8-BIT MCUs**

### **PRODUCT OVERVIEW**

**SEPTEMBER 1999**

USE IN LIFE SUPPORT DEVICES OR SYSTEMS MUST BE EXPRESSLY AUTHORIZED.  
STMicroelectronics PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN  
LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF  
STMicroelectronics. As used herein:

1. Life support devices or systems are those which (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided with the product, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can reasonably be expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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# Product Overview

## ST7 PRODUCT FINDER

ROM Device	Program Memory Type			Memory Size (bytes)			Peripherals				Package	Additional Features	
	EPROM	OTP/FLASH	FAST ROM	Prog Mem	R A M	Data EEPROM	ADC resol (Inputs)	Timers	Serial Interface	I/Os (High Sink)			
BASIC	ST72101G1	ST72E251G2	OTP	Yes	4K	256	-	-	1x7-Bit WDG 1x16-Bit	SPI	22(8)	SDIP32/ SO28	POR
	ST72101G2	ST72E251G2	OTP	Yes	8K	256	-	-	1x7-Bit WDG 1x16-Bit	SPI	22(8)	SDIP32/ SO28	
	ST72104G1	-	FLASH	Yes	4K	256	-	-	1x7-Bit WDG 1x16-Bit	SPI	22(8)	SDIP32/ SO28	3 level LVD, RC Oscillator, CSS, ISP, ROP
	ST72104G2	-	FLASH	Yes	8K	256	-	-	1x7-Bit WDG 1x16-Bit	SPI	22(8)	SDIP32/ SO28	
	ST72121J2 <sup>1)</sup>	ST72E311J4	OTP	Yes	8K	384	-	-	1x7-Bit WDG 2x16-Bit	SPI/ SCI	32(4)	SDIP42/ TQFP44	POR
	ST72121J4 <sup>1)</sup>	ST72E311J4	OTP	Yes	16K	512	-	-	1x7-Bit WDG 2x16-Bit	SPI/ SCI	32(4)	SDIP42/ TQFP44	
	ST72124J2	ST72E311J4	FLASH	Yes	8K	384	-	-	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI	32(4)	SDIP42/ TQFP44	3 level LVD, Active Halt, RC Oscillator, CSS, Beep, ISP, ROP
	ST72124J4	-	FLASH	Yes	16K	512	-	-	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI	32(4)	SDIP42/ TQFP44	
ADC	ST72212G2	ST72E251G2	OTP	Yes	8K	256	-	8-Bit (6)	1x7-Bit WDG 2x16-Bit	SPI	22(8)	SDIP32/ SO28	POR
	ST72213G1	ST72E251G2	OTP	Yes	4K	256	-	8-Bit (6)	1x7-Bit WDG 1x16-Bit	SPI	22(8)	SDIP32/ SO28	
	ST72215G2	-	FLASH	Yes	8K	256	-	8-Bit (6)	1x7-Bit WDG 2x16-Bit	SPI	22(8)	SDIP32/ SO28	3 level LVD, RC Oscillator, CSS, ISP, ROP
	ST72216G1	-	FLASH	Yes	4K	256	-	8-Bit (6)	1x7-Bit WDG 2x16-Bit	SPI	22(8)	SDIP32/ SO28	
	ST72311J2 <sup>2)</sup>	ST72E311J4	OTP	Yes	8K	384	-	8-Bit (6)	1x7-Bit WDG 2x16-Bit	SPI/ SCI	32(4)	SDIP42/ TQFP44	LVD
	ST72311J4 <sup>2)</sup>	ST72E311J4	OTP	Yes	16K	512	-	8-Bit (6)	1x7-Bit WDG 2x16-Bit	SPI/ SCI	32(4)	SDIP42/ TQFP44	
	ST72314J2	-	FLASH	Yes	8K	384	-	8-Bit (6)	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI	32(4)	SDIP32/ TQFP44	3 level LVD, Active Halt, RC Oscillator, CSS, Beep, ISP, ROP
	ST72314J4	-	FLASH	Yes	16K	512	-	8-Bit (6)	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI	32(4)	SDIP32/ TQFP44	
	ST72311N2 <sup>2)</sup>	ST72E311N4	OTP	Yes	8K	384	-	8-Bit (8)	1x7-Bit WDG 2x16-Bit	SPI/ SCI	44(8)	SDIP56/ TQFP64	LVD
	ST72311N4 <sup>2)</sup>	ST72E311N4	OTP	Yes	16K	512	-	8-Bit (8)	1x7-Bit WDG 2x16-Bit	SPI/ SCI	44(8)	SDIP56/ TQFP64	
	ST72314N2	-	FLASH	Yes	8K	384	-	8-Bit (8)	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI	44(8)	SDIP56/ TQFP64	3 level LVD, Active Halt, RC Oscillator, CSS, Beep, ISP, ROP
	ST72314N4	-	FLASH	Yes	16K	512	-	8-Bit (8)	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI	44(8)	SDIP56/ TQFP64	
	ST72311R6	ST72E511R9	OTP	Yes	32K	1024	-	8-Bit (8)	1x7-Bit WDG 2x16-Bit 1x8-Bit - RTB	SPI/ SCI	48(12)	TQFP64	4 PWM, Nested Interrupts, LVD, Active Halt, CSS, Beep, ROP
ST72311R7	ST72E511R9	OTP	Yes	48K	1536	-	8-Bit (8)	1x7-Bit WDG 2x16-Bit 1x8-Bit - RTB	SPI/ SCI	48(12)	TQFP64		
ST72311R9	ST72E511R9	OTP	Yes	60K	2048	-	8-Bit (8)	1x7-Bit WDG 2x16-Bit 1x8-Bit - RTB	SPI/ SCI	48(12)	TQFP64		

## Product Overview

ROM Device	Program Memory Type			Memory Size (bytes)			Peripherals				Package	Additional Features		
	EPROM	OTP/FLASH	FAST ROM	Prog Mem	R A M	Data EEPROM	ADC resol (Inputs)	Timers	Serial Interface	I/Os (High Sink)				
ADC+EEPROM	ST72331J2 <sup>3)</sup>	ST72E331J4	OTP	Yes	8K	384	256	8-Bit (6)	1x7-Bit WDG 2x16-Bit	SPI/ SCI	32(4)	SDIP42/ TQFP44	LVD	
	ST72331J4 <sup>3)</sup>	ST72E331J4	OTP	Yes	16K	512	256	8-Bit (6)	1x7-Bit WDG 2x16-Bit	SPI/ SCI	32(4)	SDIP42/ TQFP44		
	ST72334J2	-	FLASH	Yes	8K	384	256	8-Bit (6)	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI	32(4)	SDIP42/ TQFP44	3 level LVD, Active Halt, RC Oscillator, CSS, Beep, ISP, ROP	
	ST72334J4	-	FLASH	Yes	16K	512	256	8-Bit (6)	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI	32(4)	SDIP42/ TQFP44		
	ST72331N2 <sup>3)</sup>	ST72E331N4	OTP	Yes	8K	384	256	8-Bit (8)	1x7-Bit WDG 2x16-Bit	SPI/ SCI	44(8)	SDIP56/ TQFP64	LVD	
	ST72331N4 <sup>3)</sup>	ST72E331N4	OTP	Yes	16K	512	256	8-Bit (8)	1x7-Bit WDG 2x16-Bit	SPI/ SCI	44(8)	SDIP56/ TQFP64		
	ST72334N2	-	FLASH	Yes	8K	384	256	8-Bit (8)	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI	44(8)	SDIP56/ TQFP64	3 level LVD, Active Halt, RC Oscillator, CSS, Beep, ISP, ROP	
ST72334N4	-	FLASH	Yes	16K	512	256	8-Bit (8)	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI	44(8)	SDIP56/ TQFP64			
I <sup>2</sup> C	ST72272K2	ST72E272K4	OTP	-	8K	384	-	8-Bit (4)	1x7-Bit WDG 1x16-Bit	I <sup>2</sup> C	24(4)	SDIP32/ SO34	DAC with PWM outputs	
	ST72272K4	ST72E272K4	OTP	-	16K	512	-	8-Bit (4)	1x7-Bit WDG 1x16-Bit	I <sup>2</sup> C	24(4)	SDIP32/ SO34		
	ST72372J4	ST72E371J4	OTP	-	16K	512	-	8-Bit (4)	1x7-Bit WDG 1x16-Bit	I <sup>2</sup> C	30(6)	SDIP42/ TQFP44		
	ST72371N4	ST72E371N4	OTP	-	16K	512	-	8-Bit (8)	1x7-Bit WDG 1x16-Bit	SCI/I <sup>2</sup> C	39(8)	SDIP56/ TQFP64	-	
	ST72251G1	ST72E251G2	OTP	Yes	4K	256	-	8-Bit (6)	1x7-Bit WDG 2x16-Bit	SPI/I <sup>2</sup> C	22(8)	SDIP32/ SO28		
	ST72251G2	ST72E251G2	OTP	Yes	8K	256	-	8-Bit (6)	1x7-Bit WDG 2x16-Bit	SPI/I <sup>2</sup> C	22(8)	SDIP32/ SO28		
	ST72254G1	-	FLASH	Yes	4K	256	-	8-Bit (6)	1x7-Bit WDG 2x16-Bit	SPI/I <sup>2</sup> C	22(8)	SDIP32/ SO28		3 level LVD, RC Oscillator, CSS, ISP, ROP
	ST72254G2	-	FLASH	Yes	8K	256	-	8-Bit (6)	1x7-Bit WDG 2x16-Bit	SPI/I <sup>2</sup> C	22(8)	SDIP32/ SO28		
CAN	ST72511R6	ST72E511R9	OTP	-	32K	1024	-	8-Bit (8)	1x7-Bit WDG 2x16-Bit 1x8-Bit PWM-AR - RTB	SPI/ SCI/ CAN	48(12)	TQFP64	CAN interface, PWM, LVD, Active Halt, Beep	
	ST72511R7	ST72E511R9	OTP	-	48K	1536	-	8-Bit (8)	1x7-Bit WDG 2x16-Bit 1x8-Bit PWM-AR - RTB	SPI/ SCI/ CAN	48(12)	TQFP64		
	ST72511R9	ST72E511R9	OTP	-	60K	2048	-	8-Bit (8)	1x7-Bit WDG 2x16-Bit 1x8-Bit PWM-AR - RTB	SPI/ SCI/ CAN	48(12)	TQFP64		
	ST72512J2	-	FLASH	-	8K	512	-	8-Bit (6)	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI/ CAN	48(12)	TQFP44	CAN interface, Nested Interrupts, LVD, Active Halt, Beep	
	ST72512R4	ST72E511R9	OTP	-	16K	1024	-	8-Bit (8)	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI/ CAN	48(12)	TQFP64		
	ST72532J2	-	FLASH	-	8K	512	256	8-Bit (6)	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI/ CAN	48(12)	TQFP44		
	ST72532J4	-	FLASH	-	16K	1024	256	8-Bit (6)	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI/ CAN	48(12)	TQFP44		
	ST72532R4	ST72E511R9	OTP	-	16K	1024	256	8-Bit (8)	1x7-Bit WDG 2x16-Bit - RTB	SPI/ SCI/ CAN	48(12)	TQFP64		

## Product Overview

ROM Device	Program Memory Type			Memory Size (bytes)			Peripherals				Package	Additional Features	
	EPROM	OTP/FLASH	FAST ROM	Prog Mem	R A M	Data EEPROM	ADC resol (Inputs)	Timers	Serial Interface	I/Os (High Sink)			
USB	ST72633K1	ST72E631K4	OTP	Yes	4K	256	-	8-Bit (8)	1x7-Bit WDG 1x16-Bit	USB	19(10)	SDIP32/ SO34	USB peripheral
	ST72632K2	ST72E631K4	OTP	Yes	8K	256	-	8-Bit (8)	1x7-Bit WDG 1x16-Bit	SCI/ USB	19(10)	SDIP32/ SO34	
	ST72631K4	ST72E631K4	OTP	Yes	16K	512	-	8-Bit (8)	1x7-Bit WDG 1x16-Bit	I <sup>2</sup> C/ SCI/ USB	19(10)	SDIP32/ SO34	
Dedicated	ST72411R2	ST72E411R2	FLASH	-	4K	256	-	-	1x8-Bit	3 or 5V Smart Card	11(0)	Die/ TQFP64	32x4 LCD Display
	ST72141K2	ST72E141K2	OTP	Yes	8K	256	-	8-Bit (8)	1x7-Bit WDG 2x16-Bit	SPI	26(3)	SDIP32/ SO34	LVD, PMDC Motor Control
	ST72171K2	-	FLASH	Yes	8K	256	-	8-Bit (8)	1x7-Bit WDG 1x8-Bit	SPI/ SCI	24(3)	SDIP32/ SO34	LVD, 2 Program- mable Operational Amplifiers

- 1) The ROM versions are supported by the ST72124 family.
- 2) The ROM versions are supported by the ST72314 family.
- 3) The ROM versions are supported by the ST72334 family.

Please contact your nearest sales office for further information.

### Abbreviations:

**ADC** = Analog to Digital Converter

**AR** = Auto-Reload

**Beep** = audio square wave frequency generator

**CAN** = Controller Area Network

**CSS** = Clock Security System

**DAC** = Digital to Analog Converter

**DMA** = Direct Memory Access

**IC/OC** = Input Capture/Output Compare

**I<sup>2</sup>C** = Inter Integrated Circuit

**ISP** = In-System (or In-Situ) Programming

**LCD** = Liquid Crystal Display

**LVD** = Low Voltage Detector

**LED** = Light Emitting Diode

**MAC** = Multiply Accumulator

**PEC** = Peripheral Event Controller

**PLL** = Phase Locked Loop

**PMDC** = Permanent Magnet Direct Current

**POR** = Power On Reset

**PWM** = Pulse Width Modulation

**OSG** = Oscillator Safe Guard

**ROP** = Read-out Protection

**RTB** = Real Time Base

High Sink involve the Direct LED/Triac Driving

**SCI** = Serial Communications Interface

**SPI** = Serial Peripheral Interface

**SSC** = Single-Cycle Switching Support

**SSP** = Synchronous Serial Port

**UART** = Universal Asynchronous Receiver/Transmitter

**USART** = Universal Synchronous/Asynchronous Receiver/Transmitter

**USB** = Universal Serial Bus

**WDG** = Watchdog timer

### Packages:

**DIP** = Dual In Line Package

**LCC** = Leaded Chip Carrier

**PQFP** = Plastic Quad Flat Pack

**QFP** = Quad Flat Pack

**SDIP** = Shrink Dual In Line

**SO** = Small Outline

**SSOP** = Shrink Small Outline Package

**TQFP** = Thin Quad Flat Pack

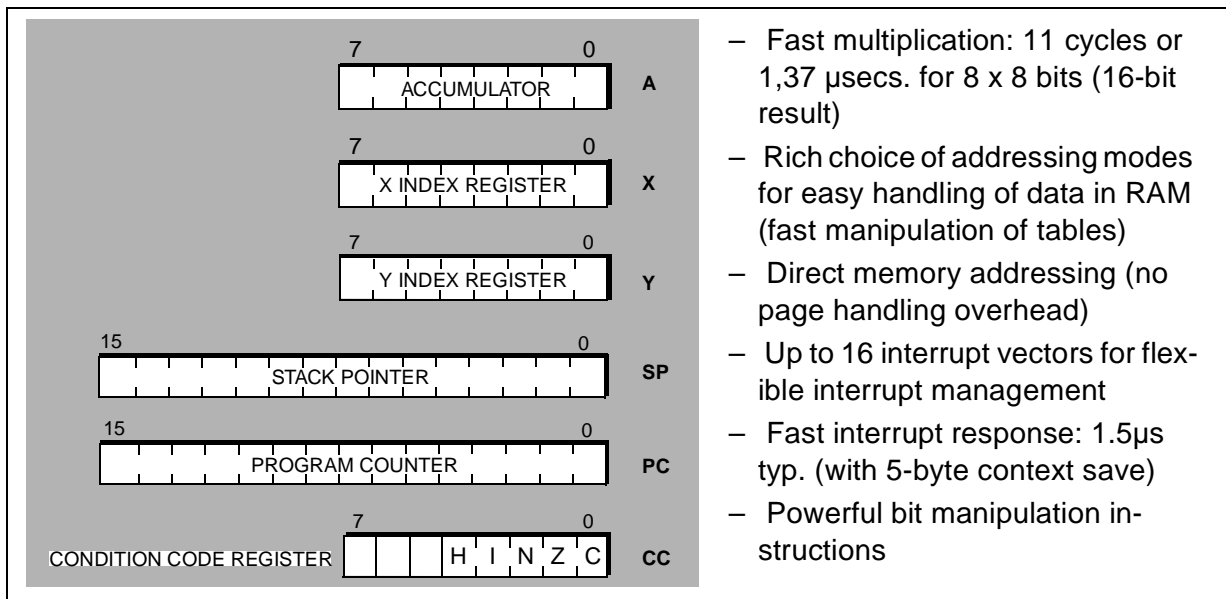
## Product Overview

### ENHANCED 8-BIT ARCHITECTURE FOR PERFORMANCE AND FLEXIBILITY

The ST7 core is based on an industry-standard 8-bit architecture, extended by STMicroelectronics to improve support for high level language programming and to provide additional interrupt handling features.

The accumulator-based core has 6 internal registers including a 16-bit program counter. The instruction set has 63 instructions with 17 addressing modes offering 8x8 bit unsigned multiply, true bit manipulation, various bit/byte transfer modes and powerful branching logic. Peripheral resources are handled via dedicated interrupts and registers.

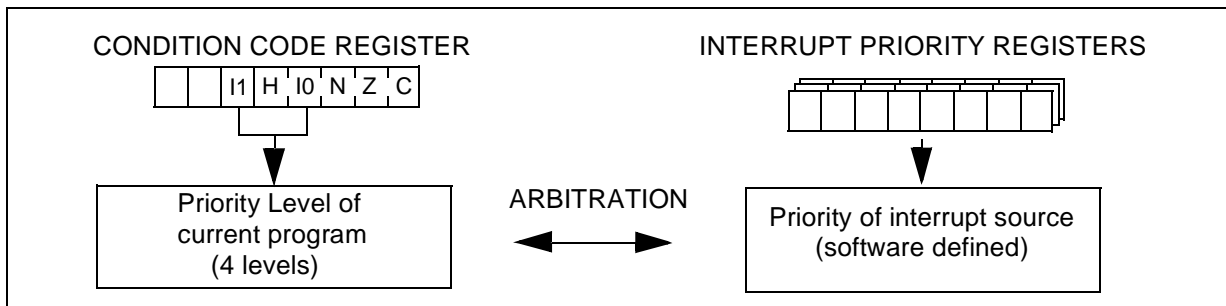
**Figure 1. ST7 CPU Registers**



### NESTED INTERRUPTS

In ST725xx devices, user software can dynamically assign priority levels to each of the 16 maskable interrupts. In this case, the current routine will only be interrupted by an event with higher priority. This nested interrupt, can itself be interrupted by another, higher priority interrupt and so on. Four software defined priority levels are available. To manage the interrupt nesting, the core uses a second interrupt bit in the condition code register and priority registers for the interrupt sources. See Figure 2.

**Figure 2. Arbitration of Nested Interrupts**



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## Product Overview

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### **ELECTROMAGNETIC COMPLIANCE (EMC)**

ST7 microcontroller products are designed to be used in domestic, automotive and office appliances, in conformance with international EMC regulations. To become a leader in these markets, STMicroelectronics has applied a long-term, coherent EMC approach, that has become part of the microcontroller design process, from initial concept and pinout definition, to customer and application requirements.

EMC performance is measured during product qualification, using 5 tests that have been developed jointly with customers in accordance with official norms.

#### **EMS (Susceptibility) Tests:**

- Dynamic latch-up (IEC 1000-4-2)
- Burst of Fast-Transient Voltages (IEC 1000-4-4)
- ESD Functional (IEC 1000-4-4)

#### **EMI (Emission) Tests:**

- RF Noise in supply current (VDE 767.14)
- Radiated Electromagnetic field (SAEJ1752/3)

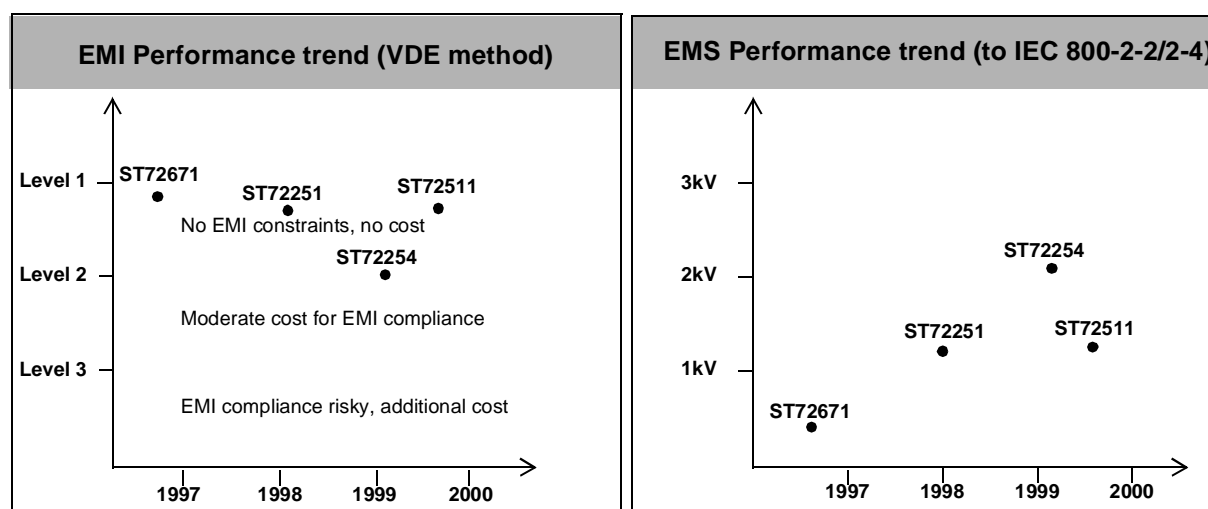
At design level, EMC performance has been significantly improved by focusing on the following areas:

- Low voltage detector, for handling a drop in the supply voltage caused by outside disturbance.
- Full set of watchdog features, to recover if a disturbance causes a hang-up
- Clock frequency scaled to application needs (higher frequencies downgrade EMC performance, so no faster than necessary)
- Physical pin layout optimised for EMC
- Package size (for EMC, small is better)
- Separate pins for A/D converter supply



## Product Overview

For further details and EMC design techniques, see Application Notes AN901 and AN1015.



### FLASH PROGRAM MEMORY AND REMOTE ISP MODE

Using remote In-Situ Programming (ISP), ST7 devices with FLASH program memory can be programmed using a low-cost 5-pin connector on the application board.

Instead of having to extract the ST7 from the application board and plug it into a socket on the programmer, an interface cable from the programmer to the application board, allows you to switch the ST7 to programming mode and program it “in-situ” as often as needed. This speeds up the development phase and improves the flexibility of the application, simplifying firmware updating and lowering inventory and rework costs.

Remote ISP mode can also be used to download test programs into the RAM of the ST7 for executing factory or field test routines.

### PROGRAM MEMORY READ-OUT PROTECTION

On ST7 devices with read-out protection, the user firmware in ROM or FLASH program memory is protected from piracy by a chip-internal read-out protection. To allow application development and debugging, the read-out protection of FLASH or OTP devices is only enabled if the user selects this option when programming the device. Removing the read-out protection is always possible using the programming device, however the entire program memory will be erased at the same time and the ST7 must be reprogrammed.

### LOW POWER MODES

For applications to be small and low cost, they must also draw as little power as possible. The ST7 microcontrollers provide the application with various ways of reducing power dynamically when the application is in idle or stand-by state. Under software control, the ST7 can switch from Run mode to Slow, Halt or Wait mode.

In Slow mode, the clock frequency is reduced by 50%. Slow mode is entered and exited under application program control by writing a control bit in one of the ST7 hardware registers.

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## Product Overview

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HALT mode is lowest power mode of the ST7. By using the HALT instruction, the internal clock of the ST7 and all on-chip processes are stopped. Power consumption drops to a very low level (several  $\mu\text{A}$  only). To resume operation, the ST7 must be reset or woken up by an external interrupt.

In WAIT mode, the CPU clock is stopped but the peripheral clock stays active. This means for example, that the timer keeps running and continues counting.

Entry into Wait mode is controlled by user software executing a WFI (Wait for Interrupt) instruction. When an interrupt (or a reset) is received, the ST7 core wakes up and returns to normal operation (Run mode).

### LOW VOLTAGE DETECTOR (LVD)

For any type of microcontroller application, MCU manufacturers require you to provide an external reset supervisor circuit to control the power up and power down phases. The ST7 on-chip Low Voltage Detector, reduces the system cost by eliminating these external components.

The purpose of the LVD is to generate a reset during application power up and power down, and in any situation when power drops partially or temporarily due to an outside disturbance. This is essential because different parts of a microcontroller become operable or cease operating correctly at different  $V_{\text{DD}}$  levels. The LVD guarantees that  $V_{\text{DD}}$  will always be at a sufficient level for all of the ST7s components to be operable, otherwise it generates a reset signal, ensuring that no processing is done while any part of the micro is in an undefined state.

### WATCHDOG

All the ST7 devices include a watchdog timer for monitoring the correct functioning of the application.

This watchdog can have a number of features that enhance the protection it offers. For example, it can be permanently enabled by hardware (as opposed to relying on software to enable it).

Different choices are possible in terms of how the Watchdog treats the HALT instruction. It may prevent the ST7 from entering Halt mode and generate a reset, or it may allow the ST7 to enter Halt mode, thus freezing the Watchdog counter until the ST7 wakes up again.

On some ST7 types, if a watchdog reset occurs, hardware sets a flag to indicate that this was the source of the reset (as opposed to the external reset pin or power-on reset). This is extremely useful for application debugging and failure analysis.

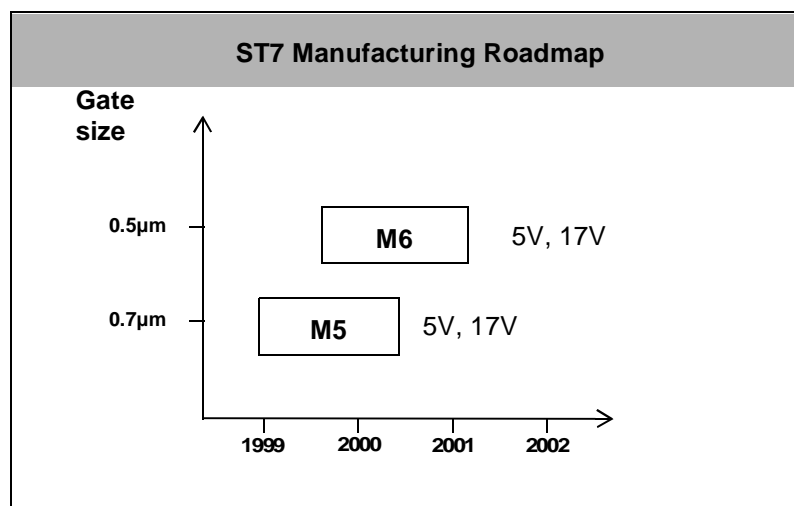
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## Product Overview

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### STATIC CMOS M5/M6 TECHNOLOGY

The ST7 microcontroller family is built in M5 or M6 (multipurpose) static CMOS technology (0.7 to 0.5 $\mu\text{m}$  gate size with two or three metal layers). Combining digital with analog circuits and FLASH memory on the same chip, M technology uses a mixed process that applies different oxide thicknesses to cells with low voltages (less than 5V) and voltages up to 17V.



STMicroelectronics has gained unique experience in this process as the world's number one supplier of mixed analog/digital devices, and has an extensive analog IP library. Analog functions integrated in the ST7 microcontroller family are:

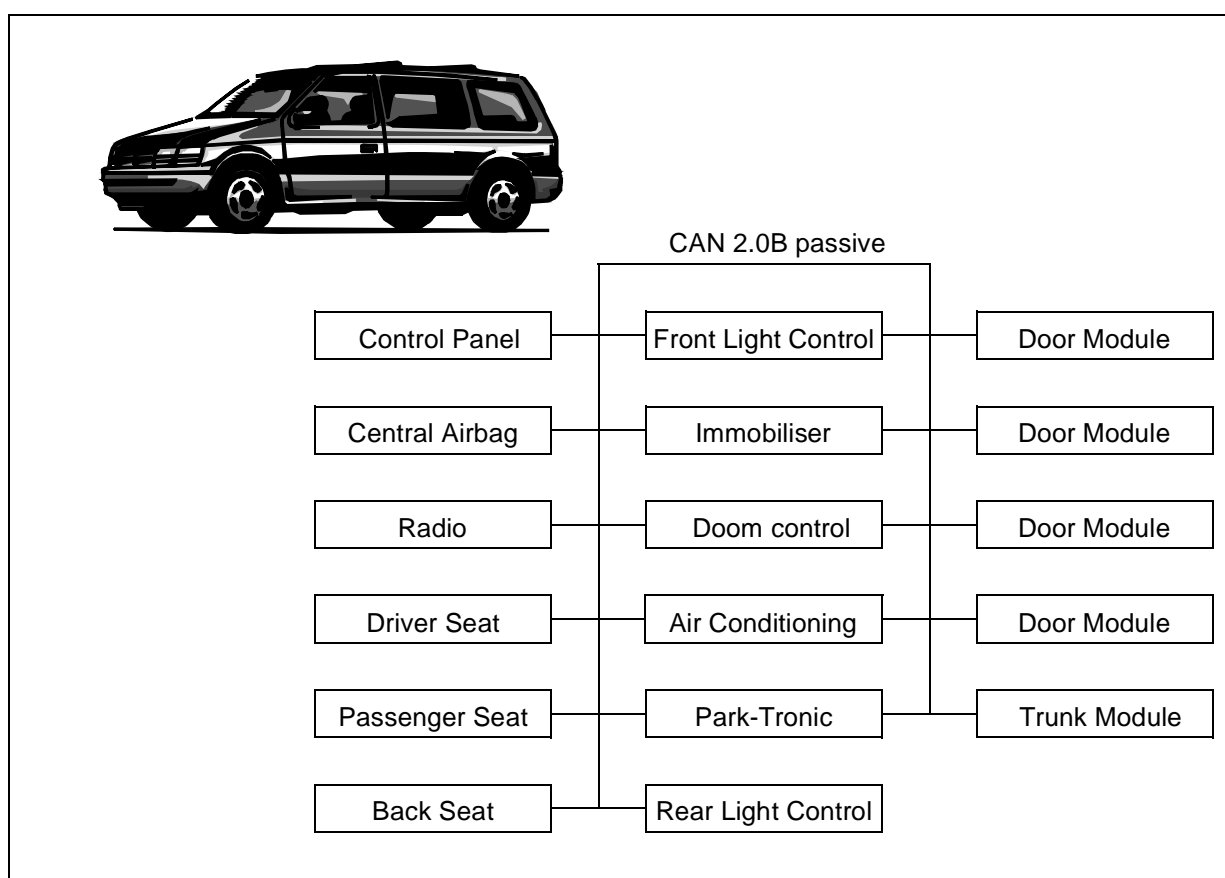
- Low voltage detector
- Voltage regulators (USB)
- Operational Amplifiers
- Analog comparators (Motor controller)

Because the ST7 devices are fully static, no information is lost or altered, even if the supply voltage drops to 0. The device can continue operation relying on the stored values. This feature protects the ST7 against disturbance from noise.

## Product Overview

### CAN NODE CONTROLLER

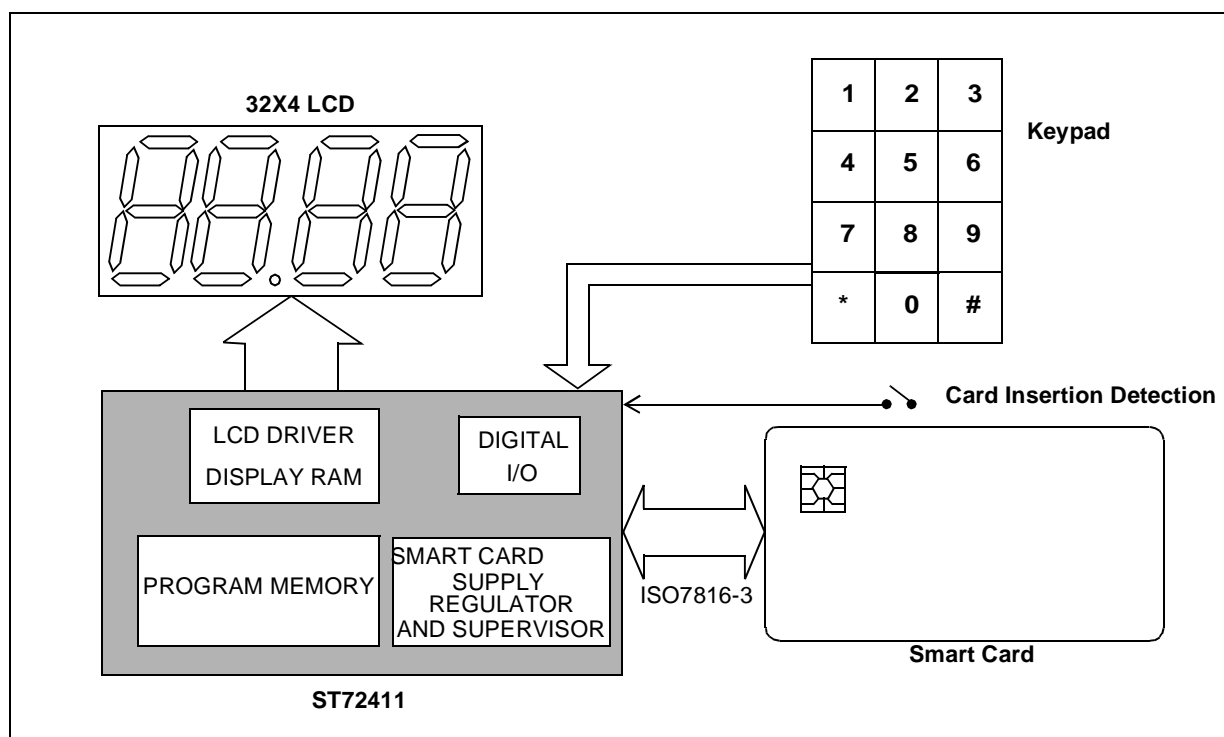
CAN network standard is designed to cover speeds up to 1Mbps in noisy environments. Its robustness stems from powerful error management, multimaster architecture and the specification of its physical layer. It is now used extensively in European automotive and industrial markets. An open operating system is available (Osek/VDX) to handle the application layer (long messages, interrupt management,...). In addition, conformance tests (i.e. Dassault, IVS/C&S) are now available to validate that the nodes operate in compliance with the CAN standard. Two major configurations are in use in the automotive applications: "CAN 2.0B Active" for power train (29-bit identifier supported) and "CAN 2.0B Passive" for body and entertainment (11-bit identifier supported, 29-bit identifier tolerated). The ST72511 CAN interface has "2.0B Passive" capability and is targeted at CAN node applications like those shown below.



## Product Overview

### MCU WITH INTEGRATED SMART CARD INTERFACE AND LCD DRIVER

Smart cards, either memory or microprocessor cards, are widely used in many countries for public telephones, vending machines, TV set-top boxes or other types of cashless self-service applications. The ST72411 microcontroller is an integrated solution targeted at the market for low cost smart card terminals. The ST72411 includes an LCD display driver and ten multi-purpose I/O lines for keyboard input, card detection switch or other I/O functions. The on-chip supply regulator and supervisor allows the application to manage the Smart Card supply and, by comparing it with a reference voltage, checks that the reader probe has made contact with the smart card and powered it up.

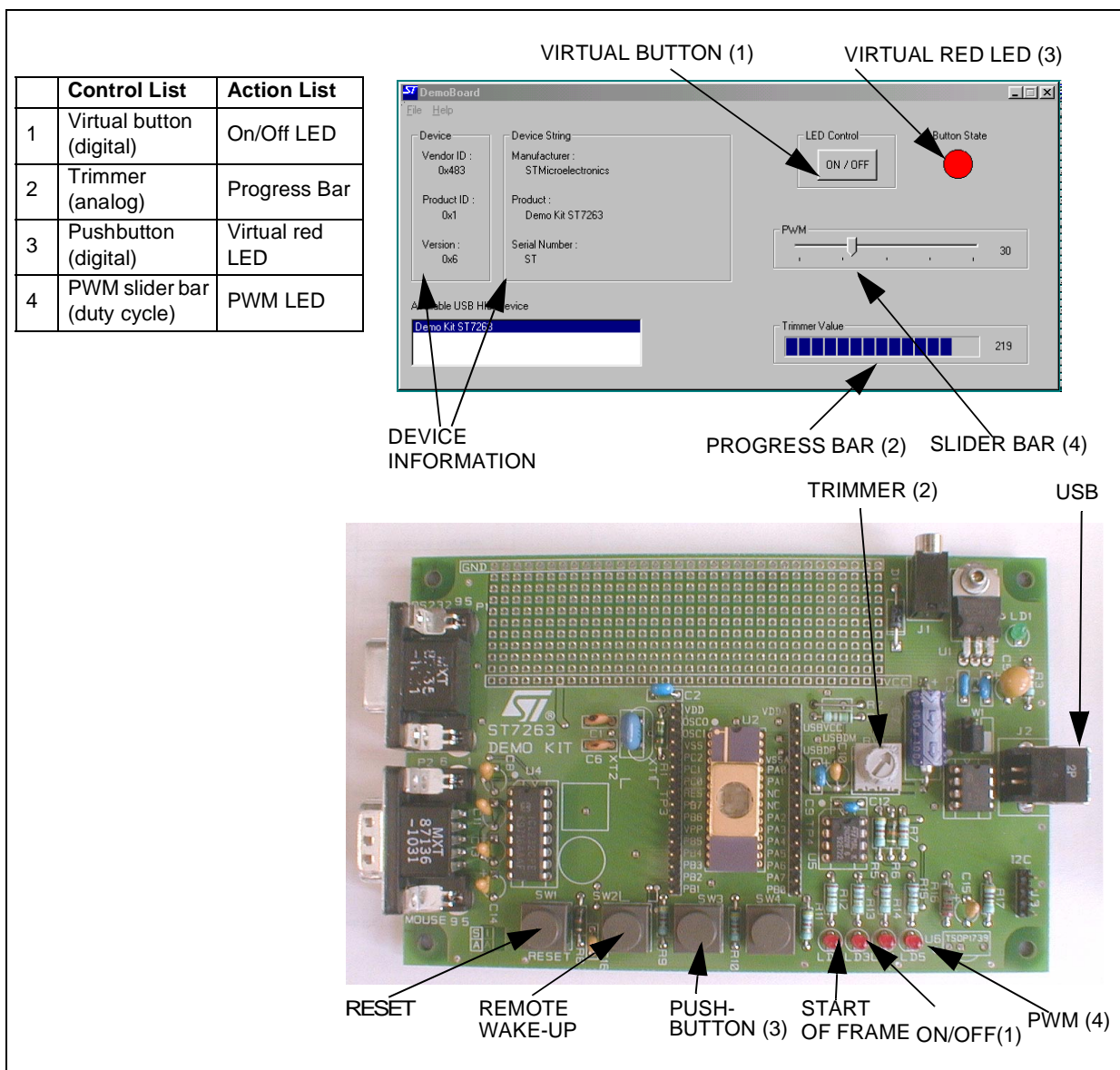


# Product Overview

## MCU WITH USB INTERFACE

The USB (Universal Serial Bus) is an industry standard that brings Plug and Play technology to PC peripherals. Hot plugging allows adding and removing devices without powering down or rebooting, using a single connector for all devices. The ST7263x microcontrollers are targeted at applications that require USB connectivity. The complete USB layer software for the ST7263x have been developed by ST and is available as a software library of C routines. The user only has to develop his application layer and provide the descriptors. For more information on USB application development, refer to application note AN1069. The figure below shows how analog or digital data can be exchanged between the host and the device identification sent to the host.

**Figure 3. ST7263x USB Communications Example.**



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## Product Overview

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### MCU FOR PERMANENT MAGNET DC MOTORS

The ST72141 is optimised for driving Permanent Magnet (PM) DC motors or Brushless (BL) induction motors in six-step mode with or without a tachometer sensor. These types of motor are increasingly being used in cost-sensitive automotive and home appliance applications.

The ST72141 features a patented back-EMF detection unit and an auto-calibrating timer that enables accurate speed regulation for PM DC motors without requiring sensors. The timer has a step frequency of 0.24Hz up to 23.5kHz and an accuracy better than 1.2% over the whole range.

A 16-bit auto-reload timer is used for high frequency PWM generation or setting the current reference in current mode.

The powerful motor control peripheral handles the major control tasks automatically, freeing the microcontroller core for handling the PID regulation or variable speed regulation using fuzzy rules.



## Product Overview

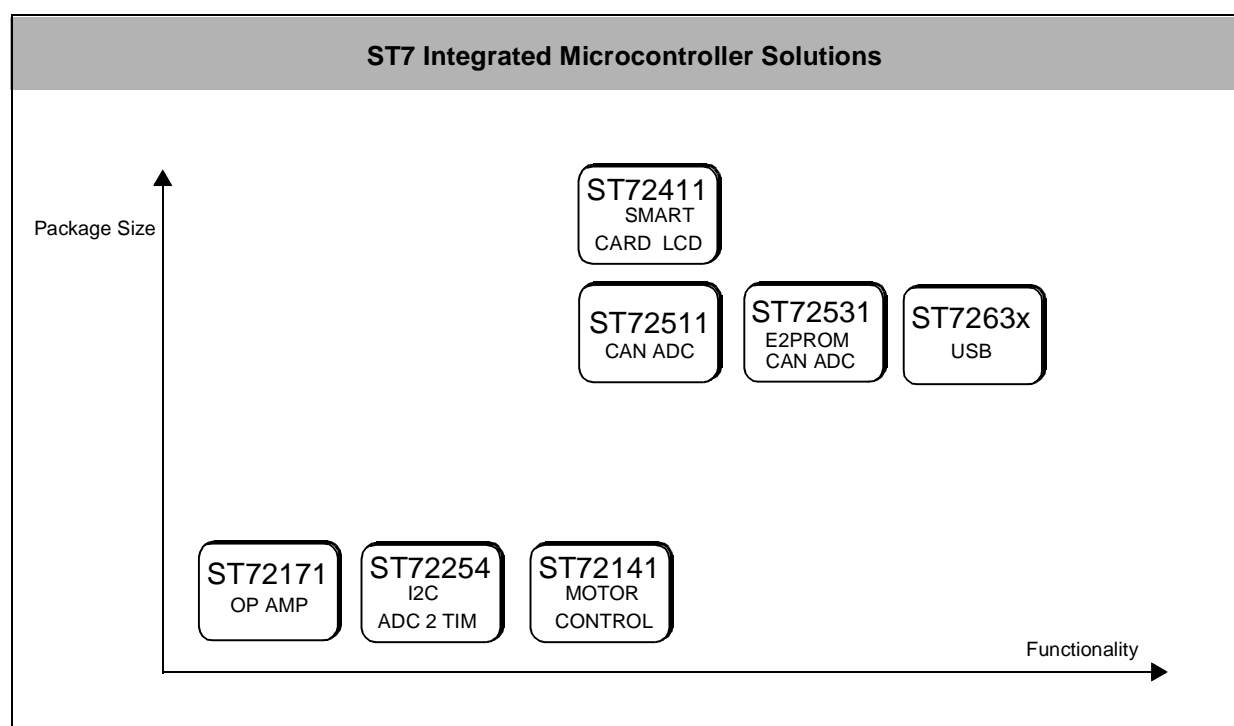
### MCU WITH DUAL OP-AMP

The ST72171 MCU includes:

Two rail-to-rail, programmable gain operational amplifiers, that may be externally connected using I/O pins.

It is designed to cover most types of microcontroller applications where analog signal amplifiers like the 741 are used. The voltage reference can be selectable by software from one of eight level. The other peripherals are 2 PWM/DAC channels, an eight ADC channels, a 16-bit timer, an autoreload timer, SPI and SCI interfaces.

The ST72171 may be used to perform a variety of functions such as: differential voltage amplifier, comparator/threshold detector, ADC zooming, peak voltage detector, general purpose operational amplifier.



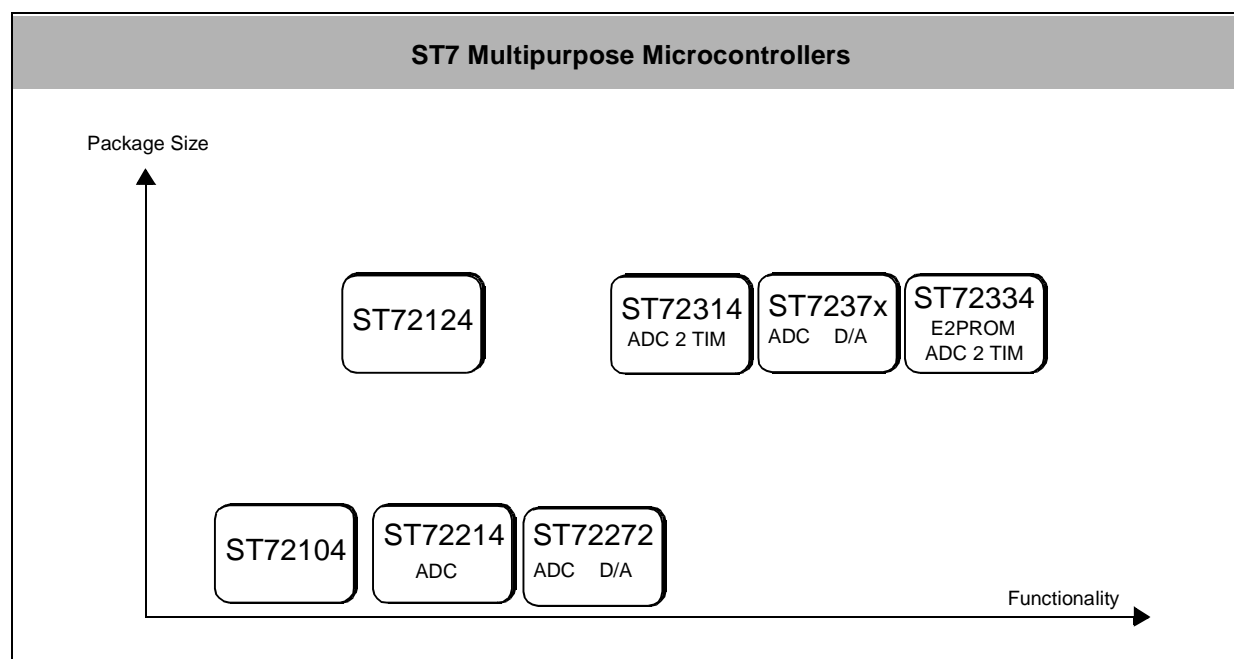


## Product Overview

### A WIDE RANGE OF MULTIPURPOSE MCUS

Six SMD and pin-through packages are available (28, 32, 42, 44, 56 or 64-pin) with a broad mix of on-chip resources giving designers considerable choice (over 50 device types!) when selecting components and determining overall hardware cost.

All devices are available in a wide range of program and data memory sizes. ROM program memory is available for high volume production. On ROM devices the customer's program code is mask programmed by STMicroelectronics during the device manufacture.



FLASH and OTP (One Time Programmable) versions are particularly adapted to small and medium production volumes, as well as to products using different firmware versions or with code that is frequently updated. FLASH and OTP devices are programmable by the customer using STMicroelectronics or third-party EPROM programmers. EPROM versions can be used during development and prototyping as the program memory can be erased and programmed as often as required.

Available on-chip peripherals include a 16-bit Timer, Watchdog timer, A/D converter, D/A converter, asynchronous communications interface, SPI, I<sup>2</sup>C, USB and CAN interfaces. On-chip EEPROM is available on some devices.

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## Product Overview

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### DEVELOPMENT TOOLS

STmicroelectronics offers a full range of hardware and software development tools for the ST7 microcontroller family either developed by ST or by third party manufacturers. A complete and detailed list of tools can be obtained from the ST Internet web site <http://st7.st.com> as well as latest news, datasheets, application notes and free software for the ST7.

The following tools are available from STMicroelectronics:

- **MCUonCD:** This CD, released every 3 months and shipped with every ST7 product from ST, contains all the free software for ST7 and demo versions of most of the others including third party products, it includes also useful datasheets and application notes on the ST7. The complete software package released on the CD includes:
  - Assembly tool chain
  - Source level debugger with simulator target (Windows 95, 98 and NT). This debugger is also used for ST DVPs and emulator targets.
  - Winee EPROMer (Windows 95, 98 and NT) to be used with STMicroelectronics EPBs and DVPs. It supports ISP<sup>1</sup>.
- **EPB<sup>2</sup>:** EPROM programming capability for all packages and ISP
- **KANDA Starter Kit:**
  - Limited In-Circuit emulation (typically not real-time)
  - EPROM programming capability for DIP packages only
  - IDE (Integrated Development Environment) and application builder included
- **Development Kit (DVP):**
  - Real-Time In-Circuit emulation with limited trace and limited emulation of analog behaviour.
  - EPROM programming capability for most packages and ISP
- **Emulator:** Real-Time In-Circuit emulation. Complex trace triggering and logical analyzer capabilities. Full emulation of analog behaviour.
- **ST-Realizer II:** Graphical CASE tool (Windows 95, 98 and NT) for developing real ST7 applications, letting the user focus on the main algorithm. The ST7 specific functions are generated automatically by the tool. Support for interrupts is provided allowing time critical applications to be completely designed and validated using the ST-REALIZER II.

Tools available from third parties include C/C++ compiler, full-featured emulators, simulators, development kits, demonstration kits dedicated to typical peripherals, starter kits, engineering and production programmers.

- 1 In Situ Programming for FLASH devices
- 2 EPROM Programming Board

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## Product Overview

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ST7 Development Kit

## Product Overview

### Hardware Development Tools

The following table provides the references for ST hardware tools supporting the ST7 microcontroller family. For more information or to place an order, please contact your nearest distributor or sales office.

Device	Starter Kit	Dev. Kit	Single E.Prog.	Complete Gang	Complete Emulator
ST72101	ST7MDT1-KIT	ST7MDT1-DVP	ST7MDT1-EPB2	Third Parties Only	ST7MDT1-EMU2
ST72104	-	ST7MDT1-DVP2	ST7MDT1-EPB2	Third Parties Only	ST7MDT1-EMU2B
ST72121	ST7MDT2-KIT	ST7MDT2-DVP	ST7MDT2-EPB2	Third Parties Only	ST7MDT2-EMU2
ST7221X	ST7MDT1-KIT	ST7MDT1-DVP	ST7MDT1-EPB2	Third Parties Only	ST7MDT1-EMU2
ST72215	-	ST7MDT1-DVP2	ST7MDT1-EPB2	Third Parties Only	ST7MDT1-EMU2B
ST72216	-	ST7MDT1-DVP2	ST7MDT1-EPB2	Third Parties Only	ST7MDT1-EMU2B
ST72251	ST7MDT1-KIT	ST7MDT1-DVP	ST7MDT1-EPB2	Third Parties Only	ST7MDT1-EMU2
ST72254	-	ST7MDT1-DVP2	ST7MDT1-EPB2	Third Parties Only	ST7MDT1-EMU2B
ST72272	ST7MDT4-KIT		ST7MDT4-EPB	Third Parties Only	ST7MDT4-EMU2
ST72311	ST7MDT2-KIT	ST7MDT2-DVP	ST7MDT2-EPB2	Third Parties Only	ST7MDT2-EMU2
ST72311R	-	ST7MDT2-DVP2	ST7MDT2-EPB2	Third Parties Only	ST7MDT2-EMU2B
ST72331	ST7MDT2-KIT	ST7MDT2-DVP	ST7MDT2-EPB2	Third Parties Only	ST7MDT2-EMU2
ST72334	-	ST7MDT2-DVP2	ST7MDT2-EPB2	Third Parties Only	ST7MDT2-EMU2B
ST7237X	ST7MDT4-KIT		ST7MDT4-EPB	Third Parties Only	ST7MDT4-EMU2
ST7251X	ST7MDT2-KIT		ST7MDT2-EPB2	Third Parties Only	ST7MDT2-EMU2B
ST72511R	-	ST7MDT2-DVP2	ST7MDT2-EPB2	Third Parties Only	ST7MDT2-EMU2B
ST72512R	-	ST7MDT2-DVP2	ST7MDT2-EPB2	Third Parties Only	ST7MDT2-EMU2B
ST7253X	ST7MDT2-KIT		ST7MDT2-EPB2	Third Parties Only	ST7MDT2-EMU2B
ST72532R	-	ST7MDT2-DVP2	ST7MDT2-EPB2	Third Parties Only	ST7MDT2-EMU2B
ST72671	ST7MDT4-KIT		ST7MDT4-EPB	Third Parties Only	ST7MDT4-EMU2

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Purchase of I<sup>2</sup>C Components by STMicroelectronics conveys a license under the Philips I<sup>2</sup>C Patent. Rights to use these components in an I<sup>2</sup>C system is granted provided that the system conforms to the I<sup>2</sup>C Standard Specification as defined by Philips.

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