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ST7MC1K2-Auto, ST7MC1K6-Auto ST7MC2S4-Auto, ST7MC2S6-Auto

8-bit MCU for automotive with nested interrupts, Flash, 10-bit ADC, brushless motor control, 5 timers, SPI, LINSCI™

Features

■ Memories

- 8 to 32 Kbyte dual voltage Flash program memory or ROM with read-out protection capability, in-application programming and in-circuit programming
- 384 to 1 Kbyte RAM
- HDFlash endurance: 100 cycles, data retention 40 years at 85°C

■ Clock, reset and supply management

- Enhanced reset system
- Enhanced low voltage supervisor (LVD) for main supply and auxiliary voltage detector (AVD) with interrupt capability
- Clock sources: crystal/ceramic resonator oscillators and by-pass for external clock, clock security system.
- 4 power saving modes: Halt, Active Halt, Wait and Slow

■ Interrupt management

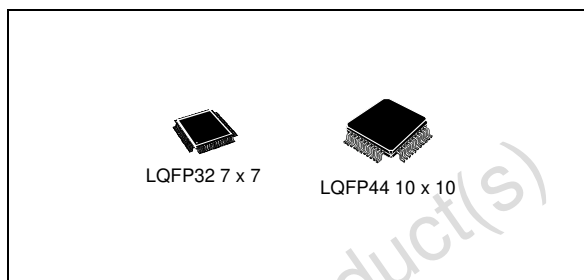
- Nested interrupt controller
- 14 interrupt vectors plus TRAP and reset
- MCES top level interrupt pin
- 16 external interrupt lines (on 3 vectors)

■ Up to 34 I/O ports

- Up to 34 multifunctional bidirectional I/O lines
- Up to 10 high sink outputs

■ 5 timers

- Main clock controller with: real-time base, beep and clock-out capabilities
- Configurable window watchdog timer
- Two 16-bit timers with: 2 input captures, 2 output compares, external clock input, PWM and pulse generator modes
- 8-bit PWM auto-reload timer with: 2 input captures, 4 PWM outputs, output compare and time base interrupt, external clock with event detector



■ 2 communication interfaces

- SPI synchronous serial interface
- LINSCI™ asynchronous serial interface

■ Brushless motor control peripheral

- 6 high sink PWM output channels for sine wave or trapezoidal inverter control
- Motor safety including asynchronous emergency stop and write-once registers
- 4 analog inputs for rotor position detection (sensorless/hall/tacho/encoder)
- Permanent magnet motor coprocessor including multiplier, programmable filters, blanking windows and event counters
- Operational amplifier and comparator for current/voltage mode regulation and limitation

■ Analog peripheral

- 10-bit ADC with up to 11 input pins

■ In-circuit debug

■ Instruction set

- 8-bit data manipulation
- 63 basic instructions with illegal opcode detection
- 17 main addressing modes
- 8x8 unsigned multiply instruction
- True bit manipulation

■ Development tools

- Full hardware/software development package

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1 Description

The ST7MC1K2-Auto, ST7MC1K6-Auto, ST7MC2S4-Auto, and ST7MC2S6-Auto devices are members of the ST7 microcontroller family designed for mid-range automotive applications with a motor control dedicated peripheral.

All devices are based on a common industry-standard 8-bit core, featuring an enhanced instruction set and are available with Flash, ROM or FASTROM program memory.

Under software control, all devices can be placed in Wait, Slow, Active Halt or Halt mode, reducing power consumption when the application is in idle or stand-by state.

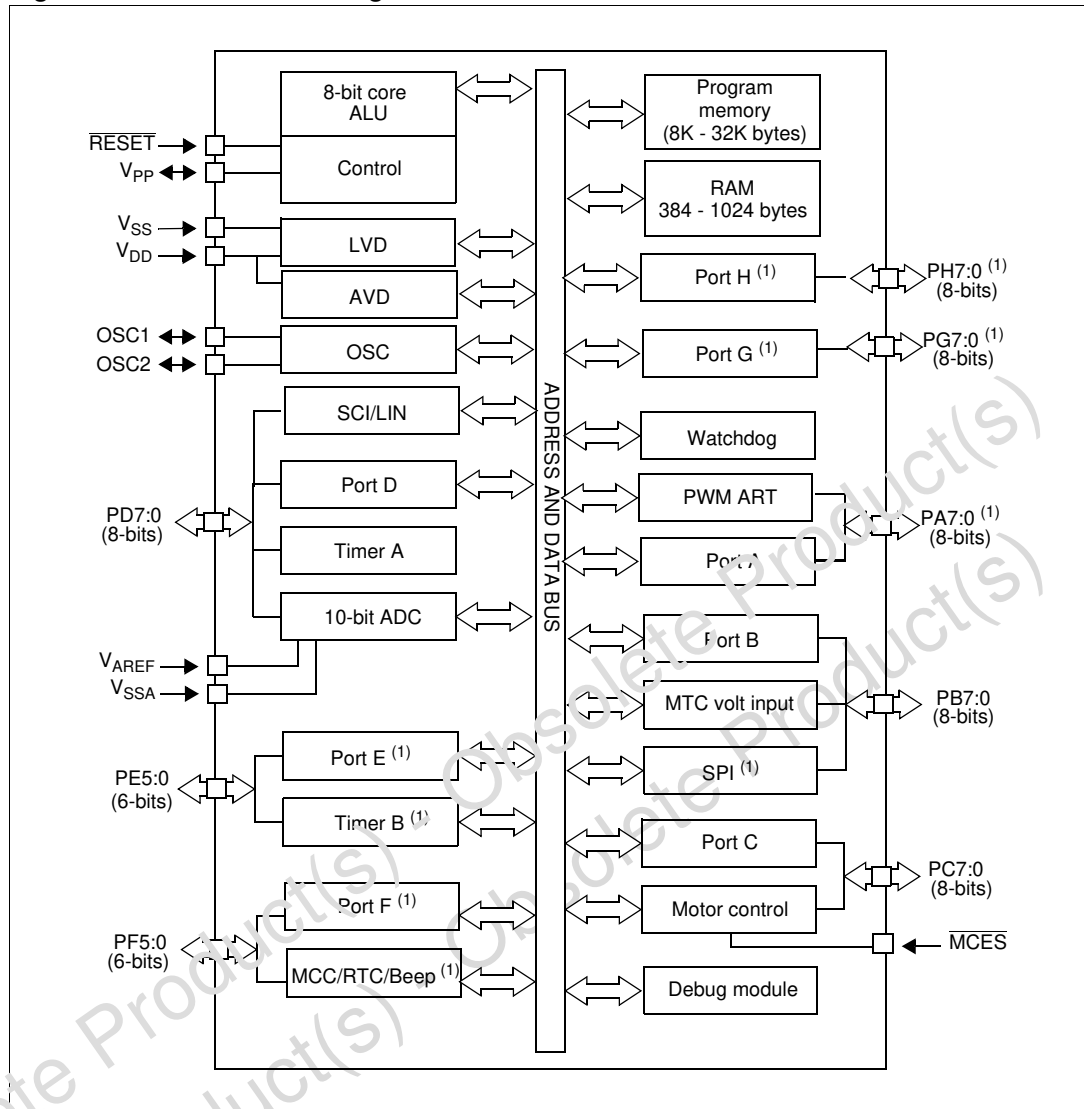
The enhanced instruction set and addressing modes of the ST7 offer both power and flexibility to software developers, enabling the design of highly efficient and compact application code. In addition to standard 8-bit data management, all ST7 microcontrollers feature true bit manipulation, 8x8 unsigned multiplication and indirect addressing modes.

The devices feature an on-chip debug module (DM) to support in-circuit debugging (ICD). For a description of the DM registers, refer to the *ST7 ICC Protocol Reference Manual*.

Table 1. Device summary

Device	Program memory - bytes	RAM (stack) - bytes	Operating supply vs. frequency	Temp. range	Package	Peripherals	
ST7MC1K2-Auto	Flash/ROM 8 K	384 (256)	4.5 to 5.5 V with $f_{CPU} \leq 8$ MHz	-40°C to 85°C/ -40 to 125°C	LQFP32	Watchdog, 16-bit timer A, LINSICI™, 10-bit ADC, MTC, 8-bit PWM ART, ICD	-
ST7MC1K6-Auto	Flash 32 K	1024 (256)		-40°C to 125°C			
ST7MC2S4-Auto	Flash/ROM 16 K	768 (256)		-40°C to 85°C/ -40°C to 125°C	LQFP44	SPI, 16-bit timer B	
ST7MC2S6-Auto	Flash 32 K	1024 (256)					

Figure 1. Device block diagram



1. On some devices only; see [Table 2: Device pin description on page 23](#)

2 Pin description

Figure 2. 44-pin LQFP package pinouts

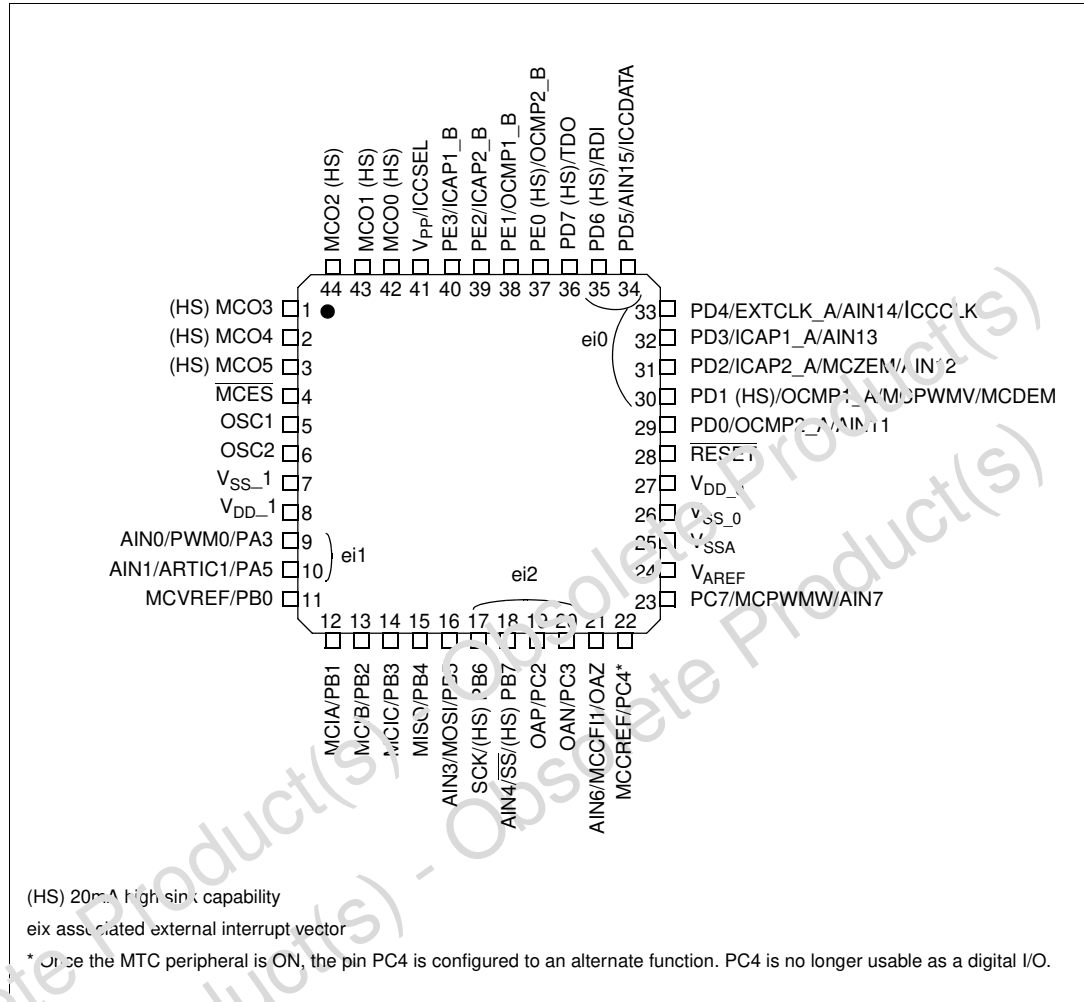
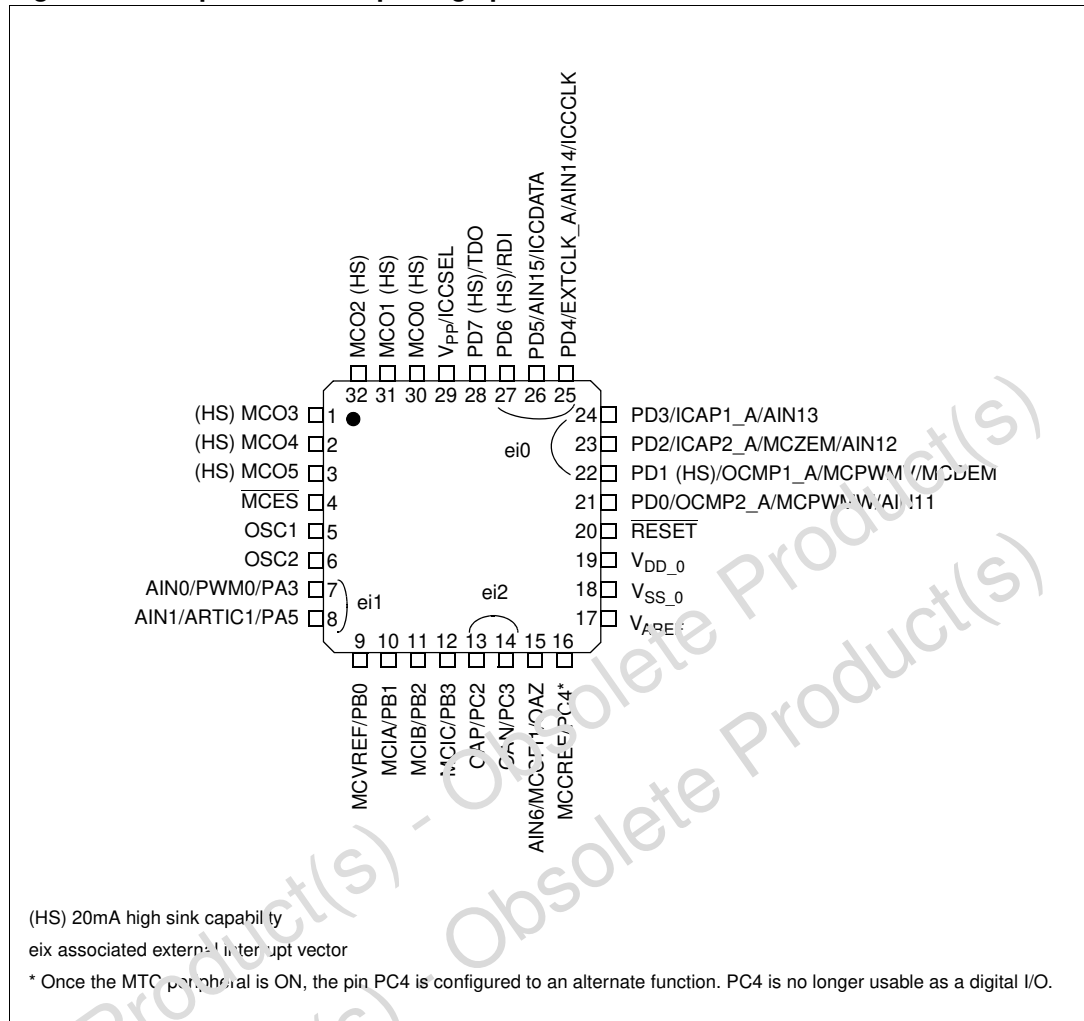


Figure 3. 32-pin LQFP 7x7 package pinout



For external pin connection guidelines, see [Section 12: Electrical characteristics on page 312](#).

Legend/abbreviations for [Table 2](#):

Type

I = input

O = output

S = supply

Input level

C_T = CMOS $0.3V_{DD}/0.7V_{DD}$ with Schmitt trigger

T_T = refer to the G and H ports characteristics in [Section 12.8.1 on page 329](#)

Output level

HS = 20mA high sink (on N-buffer only)

Port and control configuration

Input: float = floating, wpu = weak pull-up, int = interrupt, ana = analog

Output: OD = open drain, PP = push-pull

Refer to [Section 5: Central processing unit on page 37](#) for more details on the software configuration of the I/O ports.

The reset configuration of each pin is shown in bold which is valid as long as the device is in the reset state.

Table 2. Device pin description⁽¹⁾

Pin number	Pin name	Type	Level		Port						Main function (after reset)	Alternate function ⁽²⁾
			input	Output	Input				Output			
					float	wpu	int ⁽³⁾	ana	OD	PP		
1	MCO3 (HS)	O		HS						X	Motor control output 3	
2	MCO4 (HS)	O		HS						X	Motor control output 4	
3	MCO5 (HS)	O		HS						X	Motor control output 5	
4	MCE5 ⁽⁴⁾	I	C_T		X						MTC emergency stop	
(5)	PG0	I/O	T_T		X	X			X	X	Port G0	
	PG1	I/O	T_T		X	X			X	X	Port G1	
	PG2	I/O	T_T		X	X			X	X	Port G2	
	PG3	I/O	T_T		X	X			X	X	Port G3	
5	OSC1 ⁽⁶⁾	I									External clock input or resonator oscillator inverter input	
6	OSC2 ⁽⁶⁾	I/O									Resonator oscillator inverter output	
7	V_{SS_1} ⁽⁷⁾	S									Digital ground voltage	
8	V_{DD_1} ⁽⁷⁾	S									Digital main supply voltage	
(5)	PA0/PWM3	I/O	C_T		X	X			X	X	Port A0	PWM output 3
	PA1/PWM2	I/O	C_T	HS	X	X			X	X	Port A1	PWM output 2
	PA2/PWM1	I/O	C_T		X	X			X	X	Port A2	PWM output 1

Table 2. Device pin description⁽¹⁾ (continued)

Pin number		Pin name	Type	Level		Port						Main function (after reset)	Alternate function ⁽²⁾	
LQFP44	LQFP32			Input	Output	Input				Output				
						float	wpu	int ⁽³⁾	ana	OD	PP			
9	7	PA3/PWM0/AIN0	I/O	C _T		X	ei1	X	X	X	Port A3	PWM output 0	ADC analog input 0	
(5)	(5)	PA4 (HS)/ARTCLK	I/O	C _T	HS	X	X			X	X	Port A4	PWM-ART external clock	
10	8	PA5/ARTIC1/AIN1	I/O	C _T		X	ei1	X	X	X	Port A5	PWM-ART input capture 1	ADC analog input 1	
(5)	(5)	PA6/ARTIC2	I/O	C _T		X	ei1			X	X	Port A6	PWM-ART input capture 2	
		PA7/AIN2	I/O	C _T		X	ei1	X	X	X	Port A7	ADC analog input 2		
11	9	PB0/MCVREF	I/O	C _T		X	X		X	X	X	Port B0	MTC voltage reference	
12	10	PB1/MCIA	I/O	C _T		X	X		X	X	X	Port B1	MTC input A	
13	11	PB2/MCIB	I/O	C _T		X	X		X	X	X	Port B2	MTC input B	
14	12	PB3/MCIC	I/O	C _T		X	X		X	X	X	Port B3	MTC input C	
15	(5)	PB4/MISO	I/O	C _T		X	X			X	X	Port B4	SPI master in/slave out data	
16		PB5/MOSI/AIN3	I/O	C _T		X	X			X	X	Port B5	SPI master out/slave in data	ADC analog input 3
17		PB6/SCK	I/O	C _T	HS	X	ei2			X	X	Port B6	SPI serial clock	
18		PE7/SS/AIN4	I/O	C _T	HS	X	ei2			X	X	Port B7	SPI slave select (active low)	ADC analog input 4
		PG4	I/O	T _T		X	X			X	X	Port G4		
(5)		PG5	I/O	T _T		X	X			X	X	Port G5		
		PG6	I/O	T _T		X	X			X	X	Port G6		
		PG7	I/O	T _T		X	X			X	X	Port G7		
		PC0	I/O	C _T	HS	X	ei2			X	X	Port C0		
(5)		(5)	PC1/MCCFI0 ⁽⁸⁾ /AIN5	I/O	C _T		X	ei2	X	X	X	Port C1	MTC current feedback input 0 ⁽⁸⁾	ADC analog input 5
19	13	PC2/OAP	I/O	C _T		X	ei2	X	X	X	Port C2	Op-amp positive input		
20	14	PC3/OAN	I/O	C _T		X	X	ei2	X	X	Port C3	Op-amp negative input		

Table 2. Device pin description⁽¹⁾ (continued)

Pin number		Pin name	Type	Level		Port						Main function (after reset)	Alternate function ⁽²⁾	
LQFP44	LQFP32			Input	Output	Input				Output				
						float	wpu	int ⁽³⁾	ana	OD	PP			
21	15	OAZ/MCCF1 ⁽⁸⁾ /AIN6	I/O						X			Op-amp Output	MTC current feedback input 1 ⁽⁸⁾	ADC analog input 6
22	16	PC4/MCCREF	I/O	C _T		X	X		X	X	X	Port C4	MTC current feedback reference ⁽⁹⁾	
(5)	(5)	PC5/MCPWMU	I/O	C _T		X	X			X	X	Port C5	MTC PWM output U	
		PC6/MCPWMV ⁽¹⁰⁾	I/O	C _T		X	X			X	X	Port C6	MTC PWM output V ⁽¹⁰⁾	
23	(5)	PC7/MCPWMW ⁽¹⁰⁾ /AIN7	I/O	C _T		X	X		X	X	X	Port C7	MTC PWM output W ⁽¹⁰⁾	ADC analog input 7
24	17	V _{AREF}	I									Analog reference voltage for ADC		
25	(5)	V _{SSA} ⁽⁷⁾	S									Analog ground voltage		
26	18	V _{SS_0} ⁽⁷⁾	S									Digital ground voltage		
27	19	V _{DD_0} ⁽⁷⁾	S									Digital main supply voltage		
28	20	RESET	I/O	C _T								Top priority non maskable interrupt		
(5)	(5)	PF0/MCDEM ⁽¹¹⁾ /AIN8	I/O	C _T		X	X		X	X	X	Port F0	MTC demagnetization output ⁽¹¹⁾	ADC analog input 8
		PF1/MCZEM ⁽¹¹⁾ /AIN9	I/O	C _T		X	X		X	X	X	Port F1	MTC BEMF output ⁽¹¹⁾	ADC analog input 9
		PF2/MCO/AIN10	I/O	C _T		X	X		X	X	X	Port F2	Main clock out (f _{osc} /2)	ADC analog input 10
		PF3/Beep	I/O	C _T	HS	X	X			X	X	Port F3	Beep signal output	
		PF4	I/O	C _T	HS	X	X			X	X	Port F4		
		PF5	I/O	C _T	HS	X	X			X	X	Port F5		
		PH0	I/O	T _T		X	X			X	X	Port H0		
(5)	(5)	PH1	I/O	T _T		X	X			X	X	Port H1		
		PH2	I/O	T _T		X	X			X	X	Port H2		
		PH3	I/O	T _T		X	X			X	X	Port H3		