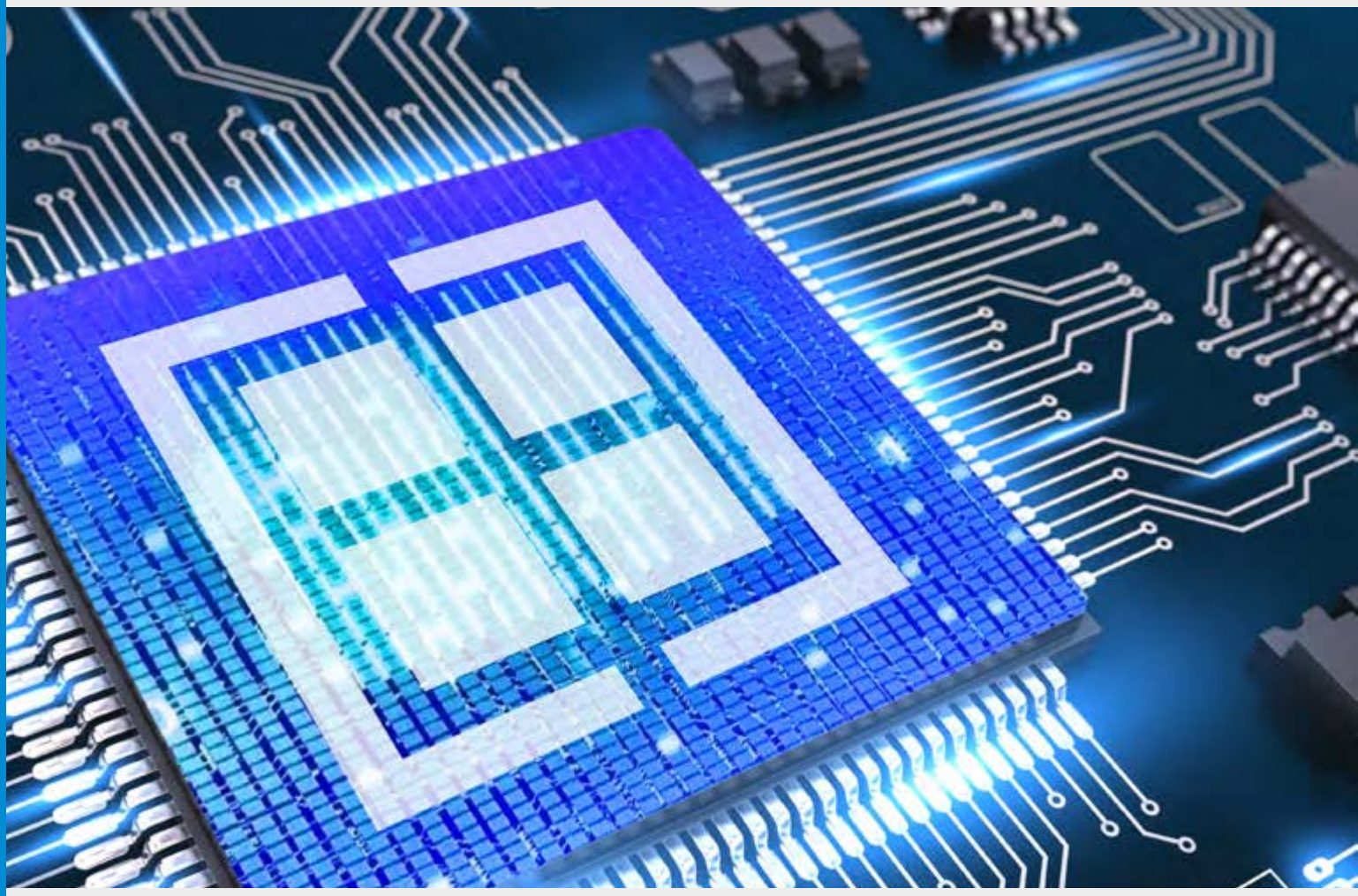
Committed to excellence

RUTRONIK
ELECTRONICS WORLDWIDE

Microcontroller Technologies



V2.0

Microcontrollers, Microprocessors & Tools

Proprietary & Arm® Core Technologies | Industrial & Automotive Applications

Content

Our Product Portfolio

- Semiconductors
- Passive Components
- Electromechanical Components
- Displays & Monitors
- Boards & Systems
- Storage Technologies
- Wireless Technologies

Our Campaigns

RUTRONIK AUTOMOTIVE | RUTRONIK EMBEDDED | RUTRONIK POWER | RUTRONIK SMART

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Committed to Excellence

Consult – Know-how. Built-in.

The Technical Competence from RUTRONIK

Worldwide and individual consulting on the spot: by competent sales staff, application engineers and product specialists.

Components – Variety. Built-in.

The Product Portfolio from RUTRONIK

Wide product range of semiconductors, passive and electro-mechanical components, displays & monitors, boards & systems, storage and wireless technologies for optimum coverage of your needs.

Logistics – Reliability. Built-in.

The Delivery Service from RUTRONIK

Innovative and flexible solutions: from supply chain management to individual logistics systems.

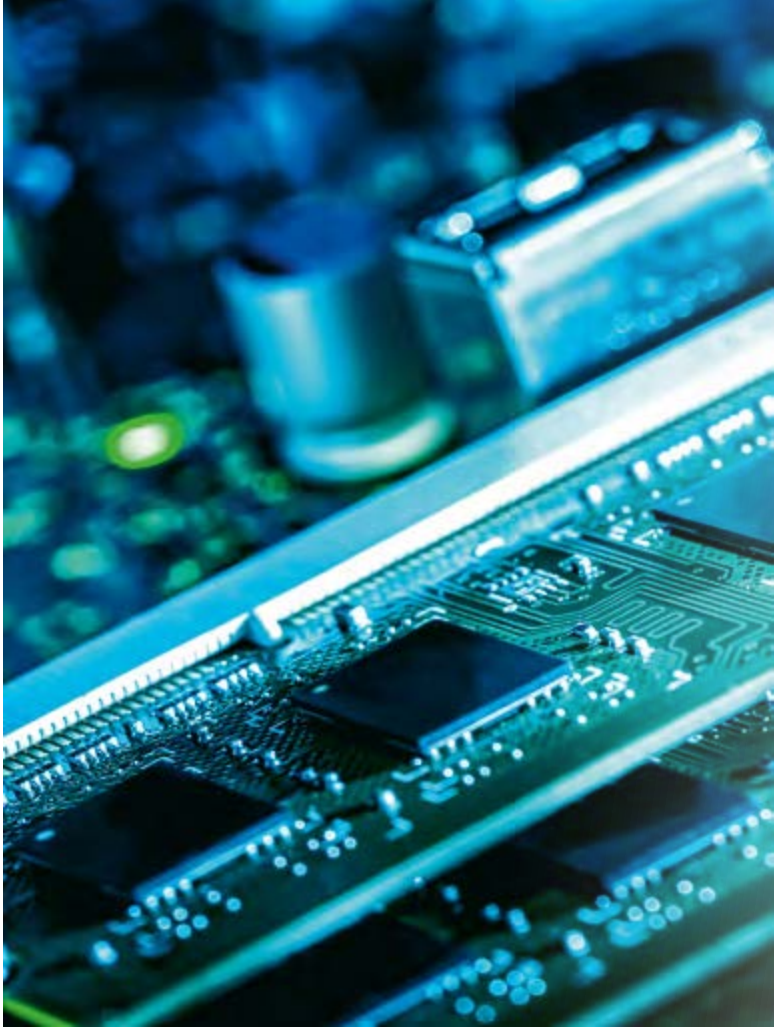
Quality – Security. Built-in.

Quality Management without Compromise

The integrated management system (IMS) encompasses quality control, environmental protection and occupational health and safety.

RUTRONIK & its Microcontroller Solutions

Rutronik offers a wide range of microcontrollers from cost-sensitive 8-bit small pin count solutions to high-performing 32-bit microcontrollers and mircoprocessors, with operating frequencies up to 1.5 GHz.



Microcontrollers, Microprocessors & Tools

In this brochure you will find the highlights of our micro-controllers and microprocessors solutions.

Microcontrollers support and perform in many applications such as automotive (window lifter, mirror control), industrial (motor control, data procession, industrial communication), medical (sensor signal conditioning, HMI), low power (smart metering, sensor networks) and the Internet of Things.

Our portfolio fits in all kinds of applications with different performance requirements. Performance does not only mean to choose the best core technology and most computing power, but also the integrated analog components (AD-converters, Comparators or op amps) and digital components (flash and memory size, timer structures). Performance also relates to the possibilities of reducing power consumption, as well as the availability of different packages.

Alongside the microcontrollers we can also provide complete development toolchains from manufactures and third party suppliers.

Rutronik´s Programming Service

Our „first-class support" fits to your needs and offers an effective and efficient programming service for microcontrollers, memories and quartz products. The service is tailored to customers individual needs and is completely secure.

Secure Programming

- Security during data transmission via e-mail and internet (MD5 checksum, GnuPG crypto)
- Free of charge release samples for verification
- Safety during mass production due to several security checks like conformity, compare, checksum, test vectors, blank check or misinsertion

Linecard – Industrial Technologies & Suppliers

Type			HMI		Communication Interfaces				
			LCD	TFT	USB Host	USB OTG	USB Device	Ethernet	CAN
Renesas									
16-Bit MCU	RL78	RL78/G1			X		X		
		RL78/I1	X						
		RL78/L1	X				X		
		RL78/H1	X						
32-Bit MCU	RX	RX100 Series	X		X	X	X		
		RX200 Series			X		X		X
		RX600 Series		X	X	X	X	X	X
		RX700 Series			X		X	X	X
	Cortex-M23	Synergy S1JA					X		X
	Cortex-M0+	Synergy S124					X		X
		Synergy S128			X	X	X		X
	Cortex-M4	Synergy S3	X		X	X	X		X
		Synergy S5	X	X	X	X	X	X	X
		Synergy S7	X	X	X	X	X	X	X
32-Bit MPU	Cortex-A	RZ/A		X	X	X	X	X	X
		RZ/N		X	X	X	X	X	X
		RZ/G		X	X	X	X	X	X
	Cortex-R	RZ/T			X	X	X	X	X
STMicroelectronics									
8-Bit	STM8	STM8S							X
		STM8L	X						
32-Bit	Cortex-M0	STM32L0	X				X		
	Cortex-M3	STM32L1	X				X		
	Cortex-M4	STM32L4	X		X	X	X		X
	Cortex-M4	STM32L4+		X		X			X
	Cortex-M0	STM32F0					X		X
	Cortex-M3	STM32F1			X	X	X	X	X
		STM32F2			X	X		X	X
	Cortex-M4	STM32F3					X		X
		STM32F4		X	X	X		X	X
	Cortex-M7	STM32F7		X	X	X		X	X
	Cortex-M7	STM32H7		X	X	X		X	X
Infineon									
32-Bit	Cortex-M0	XMC11xx							
		XMC12xx							
		XMC13xx							
		XMC14xx							X
	Cortex-M4	XMC41xx				X	X		X
		XMC42xx				X	X		X
		XMC43xx			X	X	X	X	X
		XMC44xx			X	X	X	X	X
		XMC45xx		X	X	X	X	X	X
		XMC47xx		X		X	X	X	X
		XMC48xx		X		X	X	X	X
Epson									
16-Bit	S1C17	S1C17	X				X		
32-Bit	Cortex-M0+	S1C31	X				X		
Rohm									
32-Bit	Cortex-M0	ML630Q	X				X		
8-Bit	nX-U8/100	ML610Q	X						
16-Bit	nX-U16/100	ML620Q	X						
Toshiba									
32-Bit	Cortex-A9	TZ2100	X		X		X	X	
	Cortex-M0/M3/M4	TX Family	X		X		X		X
	Cortex-M0/M3/M4	TXZ Family							
Nordic									
32-Bit	Cortex-M0	nRF51xxx							
32-Bit	Cortex-M4	nRF52xxx							

Analog Features					Memory			Specials					
(BLDC) Motor Control	DAC	Compa-rator	PGA / OP AMP	Delta Sigma ADC	Data Flash	EEPROM	External Memory Interface	Ultra Low Power	3V	5V	125°C	>125°C	BLE
X	X	X	X		X			X	X	X			X
	X	X	X	X	X			X	X	X	X		
	X	X	X		X			X	X	X			
	X		X	X	X			X	X	X			
X	X	X			X				X	X			
X	X	X	X		X		X		X	X			
X	X	X	X		X		X		X	X			
X	X				X		X		X	X			
X	X	X	X	X	X		X	X	X	X			
X	X	X			X		X	X	X	X			
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X	X	X	X		X		X		X	X			
X	X	X	X		X		X		X	X			
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	X				X			X	X				
X		X			X			X	X	X			
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							X		X				
	X			X					X	X			
	X	X			X		X		X	X			
		X			X				X				X
		X			X			X	X				X

RX 32-bit Microcontrollers

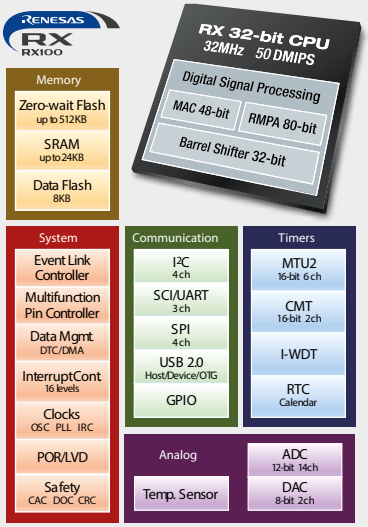
RX100 | RX200 | RX600 | RX700 Series

RX100 Series

Advanced Low Power, Low Voltage Applications

The RX100 Series is the low pin count, fast wake-up and low power series of the RX family.

This product series is positioned at even lower pin counts, smaller capacity flash, and lower price than the RX200 Series.



Powerful 32-bit RX CPU Core

- 1.56 DMIPs/MHz
- Single cycle Multiply Accumulate Unit (MAC)

Performance

- 32 MHz Flash operation without wait states

Power Consumption

- 1.8 – 3.6 V operation (program and erase)
- 110 µA / MHz operation
- 0.65 µA RTC mode

Line Up

- 8 kB - 512 kB Flash
- 36 pin - 100 pin package

Integration

- Up to 5 Serial interfaces
- Powerful 16-bit Timers
- 12-bit ADC, temperatur sensor, comparators

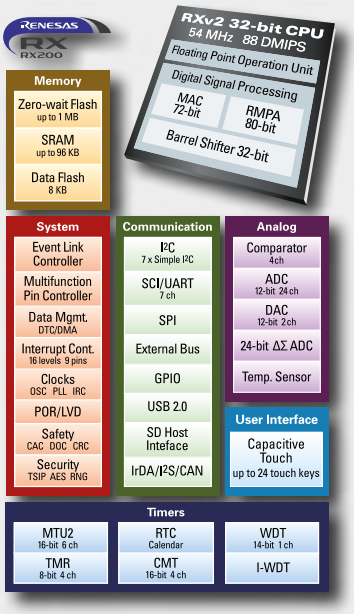
Unique Peripherals

- DOC, ELC, MFC, CRC, CAC

RX200 Series

for Advanced Low Power, Low Voltage Applications

The RX21A with an on-chip high resolution ADC provides an ideal solution both for power meters and for a range of other applications where the accurate measurement of analogue signals is required. A simple chart exploring some of the features of the RX family is shown above.



Powerful 32-bit RX CPU Core

- 1.64 DMIPs/MHz
- Single cycle Multiply Accumulate Unit (MAC)

Performance

- 50 MHz Flash operation without wait states

Power Consumption

- 1.62 – 5.5 V operation (program and erase)
- 0.21 mA/DMIPS operation
- 1.2 µA RTC mode
- 0.3 µA standby

Line Up

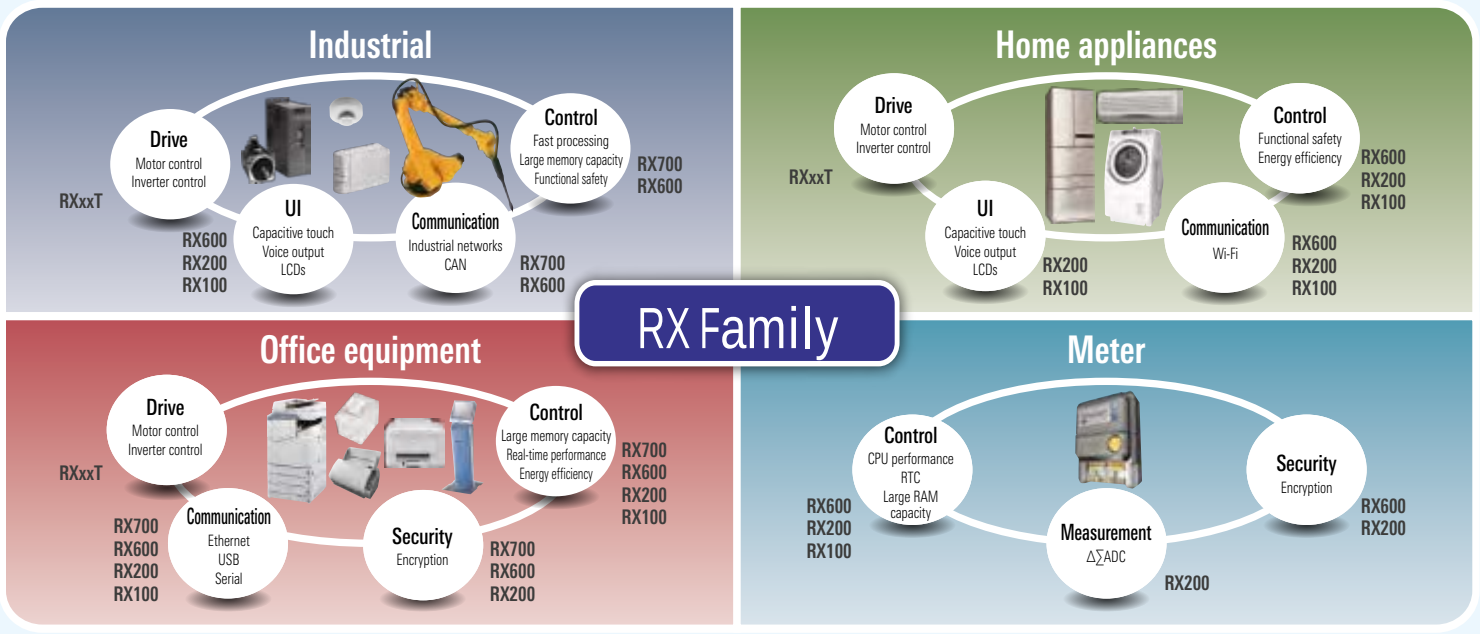
- 32 kB - 1 MB Flash
- 48 pin - 145 pin package

Integration

- Up to 9 Serial interfaces
- Powerful 16-bit Timers
- RTC with alarm calibration and tamper
- 12-bit ADC, temperatur sensor, comparators

Unique Peripherals

- DOC, ELC, MFC, CRC, CAC

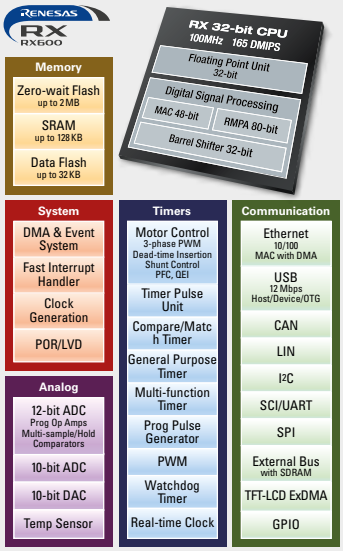


RX600 Series

for High Performance & Power-efficient Applications

The RX600 connectivity devices provide solutions for devices requirement features such as CAN, USB and Ethernet.

The RX62T & RX63T families provide true single chip cost-effective solutions for many motor control and inverter applications.



Powerful 32-bit RX CPU Core

- 4.55 Coremark/MHz; 2.0 DMIPs/MHz
- IEEE-754 compliant Single precision Floating point unit
- Single cycle Multiply Accumulate Unit (MAC)

Performance

- 120 MHz Flash operation without wait states

Power Consumption

- 2.7 – 3.6 V and 4.5 - 5.5 V operation (program and erase)
- 500 µA / MHz operation
- 0.9 µA standby mode

Line Up

- 32 kB - 4 MB Flash
- 48 pin - 177 pin package

Integration

- Powerful connectivity features
  - Up to 2ch Ethernet
  - Up to 2 x USB (Device, Host, OTG)
  - 3 x CAN
  - 13 x USART
- Powerful 16-bit Timers
- 12-bit ADC with Gain Amplifier, comparator

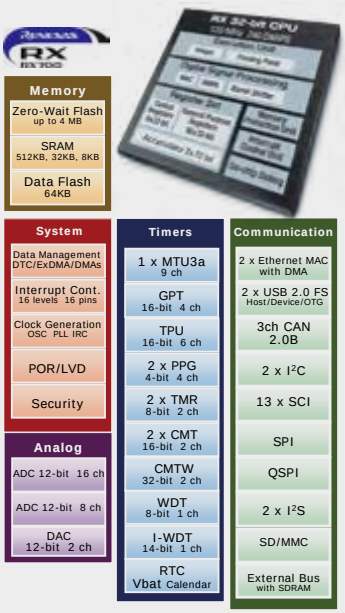
Unique Peripherals

- MCK, battery back up, MPC
- RTC with tamper, temperature sensor

RX700 Series

for High Performance & Power-efficient Applications

The RX700 provides the perfect high performance microcontroller solution for HMI and connectivity applications. This series offers market leading levels of CPU performance, peripherals and memory integration.



Powerful 32-bit RX CPU Core

- 4.35 Coremark/MHz (@240MHz); 2.0 DMIPs/ MHz
- IEEE-754 compliant single precision floating point unit
- Single cycle Multiply Accumulate Unit (MAC)

Performance

- 240 MHz operation
- Power Consumption
- 2.7 – 3.6 V (program and erase)
- 300 µA / MHz operation
- 52 mA @ 240 MHz

Line Up

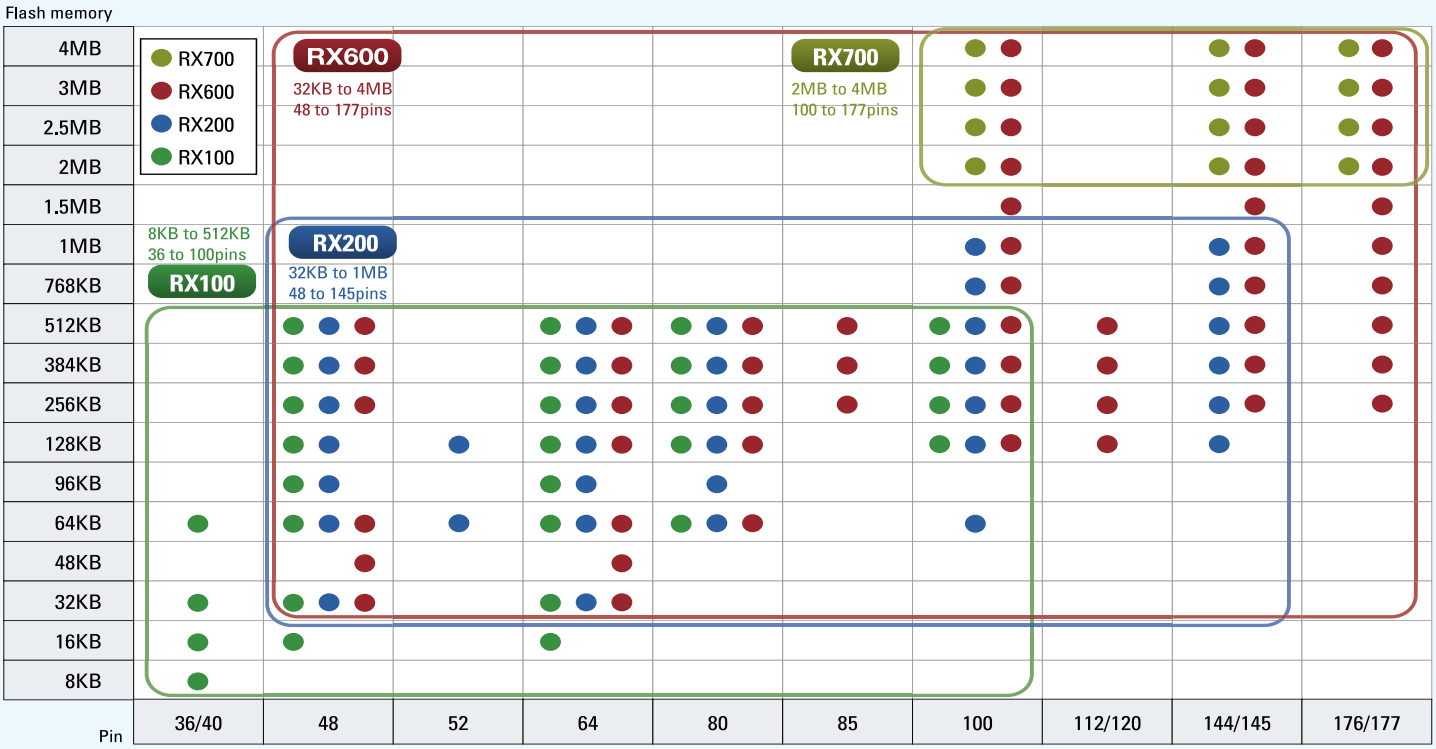
- 2 MB - 4 MB Flash
- 100 pin - 177 pin package

Integration

- Powerful connectivity features
  - Up to 2ch Ethernet
  - Up to 1 x USB FS
  - Up to 1 x USB HS
  - 3 x CAN
  - 13 x USART
- Powerful 16-bit Timers
- 12-bit ADC with Gain Amplifier, comparator

Unique Peripherals

- MPC, ELC, RTC with tamper, temperature sensor, Trusted Memory, Encryption Unit



Development Kits for RX

RENESAS

Part Number:
YDISPLAY-IT-RX

RX Direct-drive Solutions for TFT-LCD

A quick and easy solution to add colour TFT-LCD to your design

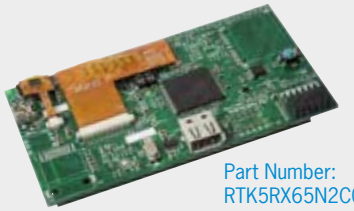
- Low-cost 32-bit solution to drive colour TFT-LCD panels up to WQVGA resolution
- Only 5% loading on CPU when refreshing the TFT-LCD panel at 60 Hz
- Free graphics API library and examples for evaluating graphics
- Third-party support

Part Number:
YROTATE-IT-RX23T

RX23T Motor Control Solution

A solid evaluation and development platform for motor control

- Drive sensorless PMAC motors
- Field oriented control, 3-phases
- High-freq. modulation >20 kHz
- Demo code and library
- Compact & small board USB powered
- E1, e2studio, Renesas compiler 128 kB code size limit after 60 days



Part Number:
RTK5RX65N2C00000BR

RX65N Envision Kit

RX65N HMI solution for TFT_LCD

- 32-bit RX65N MCU with 2 MB Code Flash Memory and 640 kB RAM embedded
- 4.3-inch WQVGA TFT panel with capacitive touch function
- E2 Emulator Lite circuit
- Segger emWin GUI software package can be used by RX651/RX65N customers

Renesas RX Starter Kit (RSK)

It contains all the development environment elements needed for MCU evaluationand initial implementation. Since all of the MCU's control signals are output, the board can be connected to the system under development for easy debugging.

Components of Renesas Starter Kit

- CPU board
- On-chip debugging emulator E1
- Evaluation version of C/C++ Compiler Package for RX Family (incl. Simulator)
- Evaluation version of Flash Development Toolkit (Programming software)
- High-performance Embedded Workshop etc.

RSK Part Number	Family
R0K505210S003BE	RX210
R0K505220S000BE	RX220
R0K505231S000BE	RX231
R0K50562GS000BE	RX62G
R0K505630S000BE	RX630
R0K50571MS000BE	RX71M
R0K556100S000BE	RX610
R0K5562N0S000BE	RX62N
R0K5562T0S000BE	RX62T
YR0K505111S000BE	RX111
YR0K505113S000BE	RX113
YR0K505231S000BE	RX231
YR0K50563NS010BE	RX63N
YR0K50564MS000BE	RX64M
YRTK500565NS00000BE	RX65N (1MB)
YRTK50565N2S00010BE	RX65N (2MB)
YR0K50571MS000BE	RX130
YRTK500524TS00000BE	RX24T

Debugging, Emulation & Programming

On-chip debugging of an RX-based application is performed via JTAG or FINE connection to the target and USB connection to the Windows-based IDE. E1 and J-Link offer thorough CPU control and visibility. E20 adds high-speed tracing for some RX600.

Renesas E1
YR0E000010KCE00-EE

Renesas E20
R0E000200KCT00

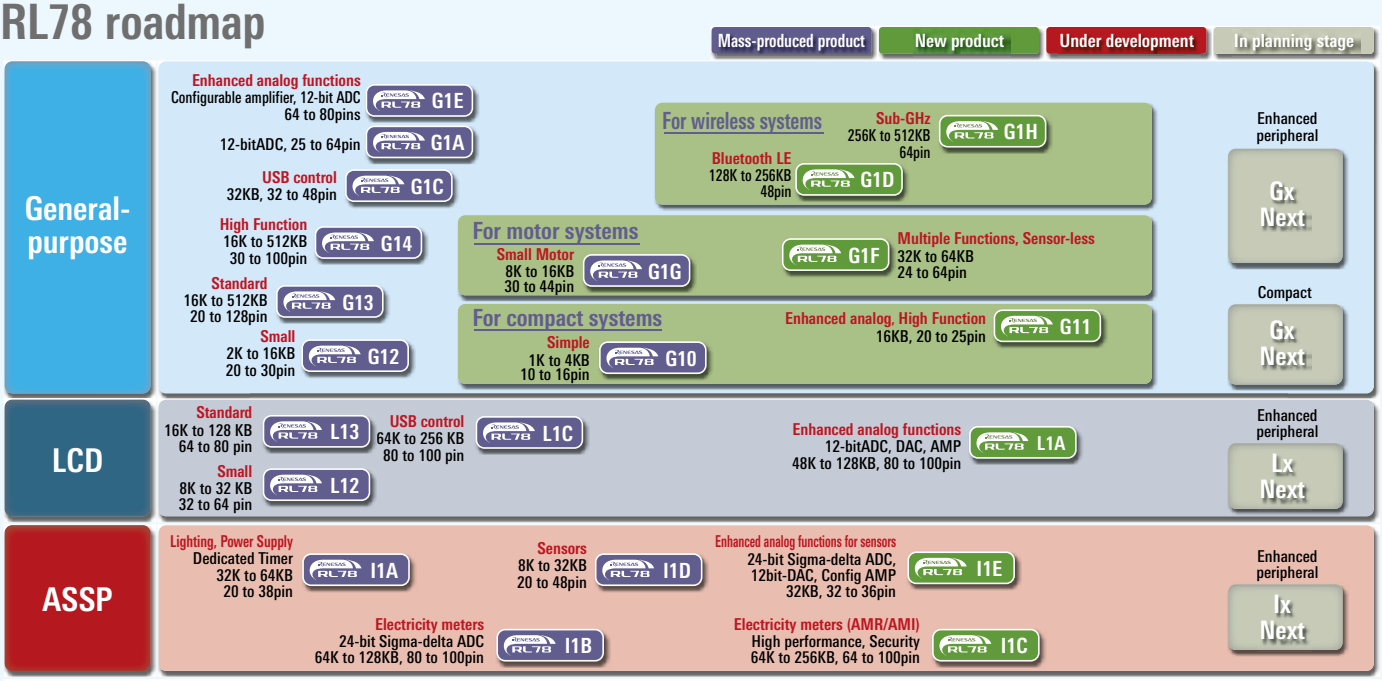
SEGGER
J-Link

Software supported by SEGGER

Short Selection Guide

Type	Part Number	Max. Frequency (MHz)	FLASH size (kB)	Data Flash (kB)	RAM size (kB)	A/D Converter	I/O	16-bit timers	32-bit timers	CAN	Ethernet	UART	LIN	USB	SPI	I²C	SSI	Package
RX100																		
RX110	R5F5110xxxx#xx	32	8-128	-	8-16	7-14x12 bit	25-54	6	-	-	-	3	-	-	4	4	-	LQFP 48-64; LGA 36-64; QFN 40-48
RX111	R5F5111xxxx#xx	32	16-512	8	8-64	7-14x12 bit	21-50	8	-	-	-	3	-	Host (FS) + Device (FS) + OTG	4	4	-	LQFP 48-64; LGA 36-64; QFN 40-48
RX113	R5F5113xxxx#xx	32	128-512	8	32-64	11-17x12 bit	48-84	10	-	-	-	7-9	0-7	Host (FS) + Device (FS) + OTG	7-9	7-9	-	LQFP 64-100; LGA 100
RX130	R5F5130xxxx#xx	32	64-128	8	10-16	10-17x12 bit	39-69	9	-	-	-	5	1	-	5	5	-	LQFP 48-80; QFN 48
RX200																		
RX210	R5F5210xxxxx#xx	50	64-1024	8	12-96	8-16x12 bit	35-123	10-16	-	-	-	5-13	-	-	6-14	6-14	-	LQFP 48-144; LGA 100-145
RX220	R5F5220xxxxx#xx	32	32-256	8	4-16	8-16x12 bit	35-85	10	-	-	-	4-5	-	-	5-6	5-6	-	LQFP 48-100
RX230	R5F5230xxxxx#xx	54	128-256	8	32	8-24x12 bit	35-84	17	-	-	-	5-7	-	-	6-8	6-8	-	QFP48-100 QFN48-64 LGA64-100
RX231	R5F5231xxxxx#xx	54	128-512	8	32-64	8-24x12 bit	31-80	17	-	0-1	-	5-7	-	Host (FS) + Device (FS)	6-8	6-8	-	LQFP 48-100; LGA 64-100; QFN48-64
RX23T	R5F523Txxxxx#xx	40	64-128	-	10	10x12 bit	37-50	10	-	-	-	2	-	-	3	3	-	LQFP 48-64
RX24T	R5F524Txxxxx#xx	80	128-512	8	16-32	12-22x12 bit	48-80	13-17	-	0-1	-	3	-	-	4	4	-	QFP64-100
RX24U	R5F524Uxxxxx#xx	80	256-512	8	32	20-22x12 bit	79-110	17	-	1	-	4-6	-	-	5-7	5-7	-	QFP100-144
RX600																		
RX610	R5F5610xxxxx#xx	100	768-2048	32	128	16x10 bit	117-140	16	-	-	-	7	-	-	-	2	-	LQFP 144; BGA 176
RX630	R5F5630xxxxx#xx	100	384-2048	32	64-128	11-21x12 bit	79-149	16-22	-	0-3	-	6-13	-	Device (FS)	8-16	8-17	-	LQFP 80-176; BGA 176; LGA 100-177
RX634	R5F5634xxxxx#xx	54	1024-2048	32	128	16x12 bit	123	16	-	-	-	13	0	-	15	16	-	LFQFP 144
RX62G	R5F562Gxxxxx#xx	100	128-256	8-32	8-16	8x12 bit	76-82	16	-	0-1	-	3	1	-	1	1	-	LQFP 100-112
RX621	R5F5621xxxxx#xx	100	256-512	32	64-96	8x12 bit	60-128	16	-	1	-	6	-	Host (FS) + Device (FS) + OTG	2	1-2	-	LFBGA 176
RX62N	R5F562Nxxxxx#xx	100	256-512	32	64-96	8x12 bit	74-128	16	-	0-1	1	6	-	Host (FS) + Device (FS) + OTG	2	1-2	-	LQFP 100-144; LGA 85-145
RX63N	R5F563Nxxxxx#xx	100	256-2048	32	128	21x12 bit	79-134	22	-	0-3	1	9-13	-	Host (FS) + Device (FS) + OTG	11-16	11-17	-	LFBGA 176
RX631	R5F5631xxxxx#xx	100	0-2048	32	64-256	8-21x12 bit	30-134	16-22	-	0-3	-	5-13	-	Host (FS) + Device (FS) + OTG	7-16	6-17	-	LQFP 48-176; LGA 64-177
RX64M	R5F564Mxxxxx#xx	120	2048-4096	64	552	22-29x12 bit	79-128	22	3	2-3	1	9-13	-	Host (FS) + Device (FS)	8-10	9-11	1	LQFP 100-176; BGA 176; LGA 100-177
RX65N	R5F565Nxxxxx#xx	120	512-2048	-	256	22-29x12 bit	79-112	18	3	2	1	11-13	-	Host (FS) + Device (FS) + OTG	14-16	13-15	-	QFP100-144 LGA100-145
RX651	R5F5651xxxxx#xx	120	512 - 1024	-	256	22-29x12 bit	79-112	18	3	2	-	11-13	-	Host (FS) + Device (FS) + OTG	14-16	13-15	-	QFP100-144 LGA100-145
RX700																		
RX71M	R5F571Mxxxxx#xx	240	2048-4096	64	552	22-29x12 bit	78-127	34	3	2-3	1	9-13	-	Host (FS) + Device (FS)	9-11	9-11	1	LQFP 100-176; BGA 176; LGA 100-177

RL78 roadmap



RL78

The True Low Power Microcontroller Platform

Why RL78? RL78 from Renesas Electronics is an advanced family of general purpose and application specific microcontrollers (MCUs) combining true low power and high performance operation. The RL78 is designed specifically for ultra low power applications. RL78's innovative Snooze mode allows serial communication and ADC operation in standby, which makes it best in class for battery powered designs.

Choose RL78 for your Application

Industrial automation

- Small package
- 105-125°C support
- Industrial quality grade
- Strong immunity (300 V)

Sensors and Home Autom.

- Long battery life down to 1,6 V
- Rich analog features
- Small packages

Power tools

- RL78/G1F Rotor position detection
- Small packages
- High integration: comparator, PGA, DAC

Metering

- Rich analog for smart meter: 24-bit ADC, IrDA, temp sensor
- Industrial quality grade
- Best average consumption
- Long product life

Motor control

- Low cost– RL78/G14, G1G, G1F
- High integrated analog features
- Overcurrent detection
- 3-ph complementaire driver-easy BLDC implementation

Whitegoods

- IEC60730
- 105-125°C availability
- Extensive family lineup

RL78 – Application Benefits

Low Power

- Battery operation down to 1,6 V
- Active: down to 46 µA @ 1 MHz
- HALT: down to 300 nA
- Stop: down 230 nA
- SNOOZE function: ADC and UART operation while standby
- RAM data retention in STOP mode

High Quality and Safety

- Flash memory with ECC
- IEC 60730 Safety functions
- CRC calculation
- RAM/SFR write protection
- Support +105°C and +125°C

Intelligent Peripherals

- Direct Transfer Controller (DTC)
- Direct Memory Access (DMA)
- Direct Operation Controller (DOC) combined with DTC/DMAC enables useful operations without CPU
- Event Link Controller (ELC)

Scalability

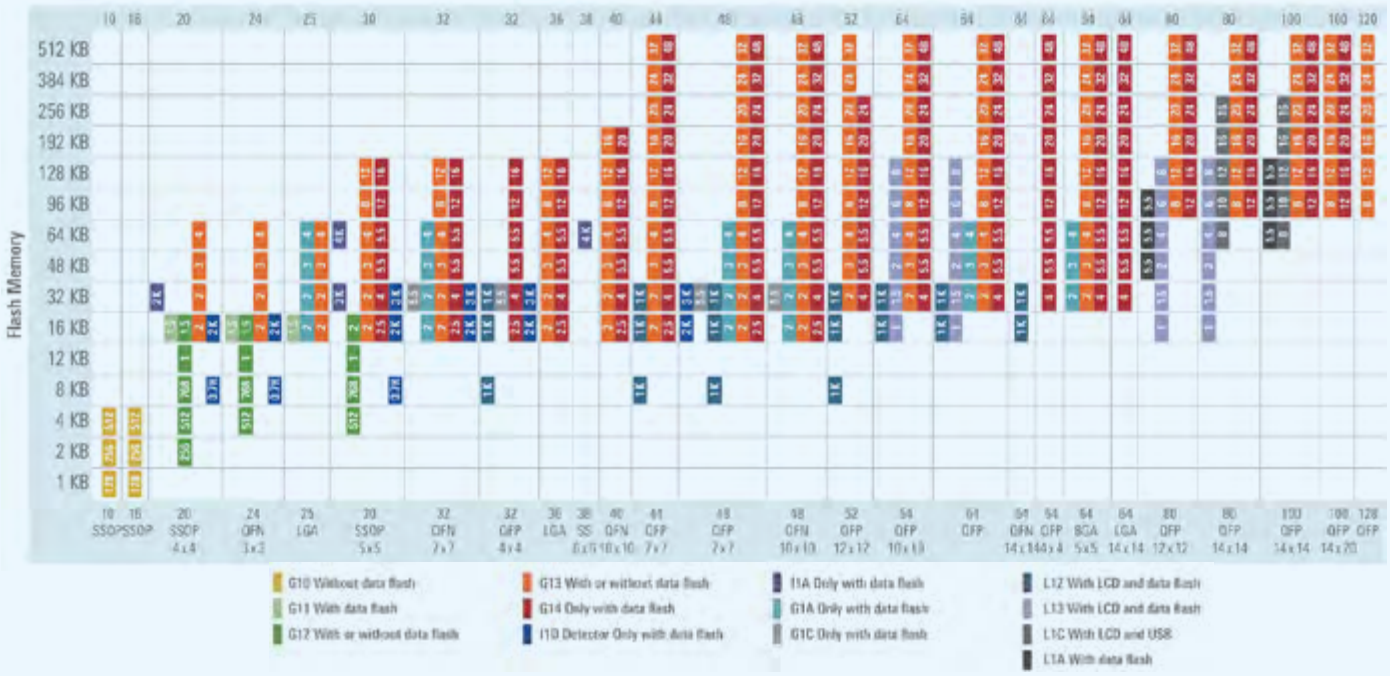
- Compatible Line-up
- +550 devices
- Wide package range: 10pin to 128pin
- Broad memory: 1 kB to 512 kB

Special Features

- ±1% 64/32/24 MHz OCO (over temp and voltage range)
- 3ph Motor control at 64Mhz
- 24-bit ∑Δ ADC
- LCD Driver
- USB, CAN

Extensive Ecosystem

- Comprehensive development tools
- 3rd party support
- Free E2 Studio GNU IDE
- Quick implementation with free Applilet peripheral driver



RENESAS

Development Tools & Kits

Renesas Electronics and selected partners offer a comprehensive suite of hardware and software tools for the rapid evaluation and development of embedded systems built with RL78.

Order No:
YRPBRL78G14

RL78/G14 RPB Board

- Demo the high performance of RL78
- Evaluate and measure the low power modes
- PC software included (GUI, drivers)
- IAR Kickstart included (16 kB code limited)
- Applilet device code generator

Order No:
YR0K5104PS000BE

RL78/G14 Starter Kit

- Allows full system development
- LCD panel for diagnostic connection
- Program using E1 On Chip Debugger
- C/C++ compiler included
- Trial E2Studio IDE included
- Applilet device code generator
- Sample peripheral code

Order No:
YRMCKITRL78G14

RL78/G14 Motor Control Kit

- Allows MC evaluation
- Field orientated sensorless vector control
- Royalty free MC software
- 3 shunt detection
- IEC60730 compliance

Order No:
YR0K5010RLS000BE

RL78/L12 Starter Kit

- Allows full system development
- LCD panel for diagnostic connection
- Program using E1 On Chip Debugger
- Trial C/C++ compiler included
- Trial E2Studio IDE included
- Applilet device code generator
- Sample peripheral code

Order No:
YR0E000010KCE00-E

E1 on-chip debugging emulator

- Universal Renesas On Chip Debugger
- Debugger or Flash programmer interface
- Single wire connection to RL78 device
- Assembler and C source stepping
- Software and hardware breakpoints

Order No:
QB-RL78G13-ZZZ-EE

IECUBE Full In-circuit emulator

- USB 2.0 interface
- Break functions
- Trace functions
- Real time RAM monitor function
- Time measurement

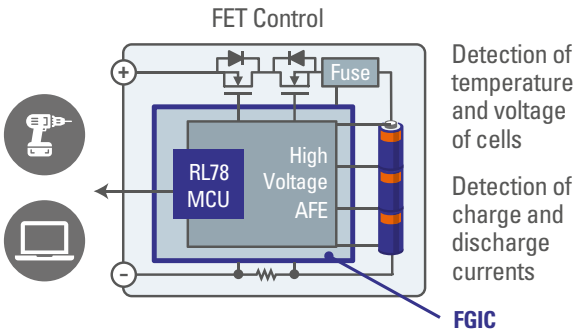
More Development Tools and Kits available

Software supported by SEGGER

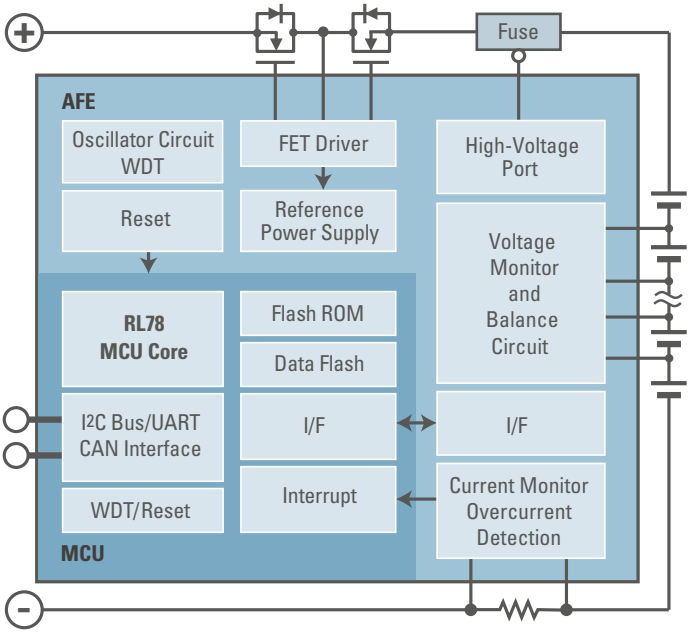
Short Selection Guide

RENESAS

Series	Part Number	Max. Frequency (MHz)	FLASH size (kB)	Data Flash (kB)	RAM size (kB)	A/D Converter	I/O	16-bit timers	32-bit timers	CAN	Ethernet	UART	LIN	USB	SPI	I²C	SSI	Package
RL78/G1x																		
RL78/G10	R5F10Yxxxxx#xx	20	1-4	-	0.125-0.5	4-8x10 bit	8-14	2-4	-	-	-	1	-	-	-	1-2	-	SSOP 10-16
RL78/G11	R5F105xxxxx#xx	24	16	2	1.5	10-11x10 bit	17-21	5	-	-	-	2	1	-	-	5-6	-	QFN24 LGA25 SOP20
RL78/G12	R5F10xxxxx#xx	24	2-16	0-2	0.25-2	8-11x10 bit	18-26	4-8	-	-	-	1-3	-	-	-	1-4	-	QFN 24; SSOP 20-30
RL78/G13	R5F10xxxxx#xx	32	16-512	0-8	2-32	10-26x10 bit	16-120	8-16	-	-	-	2-4	0-1	-	-	2-10	-	LQFP 44-128; SSOP 20-30; BGA 64; LGA 25-36; QFN 24-48
RL78/G14	R5F104xxxxx#xx	32	16-512	4-8	2.5-48	8-20x10 bit	26-92	8-12	-	-	-	3-4	1	-	-	4-10	-	LQFP 32-100; SSOP 30; LGA 36-64; QFN 32-48
RL78/G1A	R5F10Exxxxx#xx	32	16-64	4	2-4	13-28x12 bit	19-56	8	-	-	-	2-3	0-1	-	-	3-7	-	LFQFP 48-64; BGA 64; LGA 25; QFN 32-48
RL78/G1C	R5F10xxxxx#xx	24	32	2	5.5	8-9x10 bit	22-38	4	-	-	-	1	0	Host (FS) + Device (FS)	-	3	-	LQFP 32-48; QFN 32-48
RL78/G1D	R5F11Axxxxx#xx	32	128-256	2	12-20	8x10 bit	32	8	-	-	-	2	-	-	-	3	-	QFN 48
RL78/G1F	R5F11Bxxxxx#xx	32	32-64	4	5.5	8-17x10 bit	20-58	9	-	-	-	3	1	-	-	4-7	-	LQFP 32-64; LGA 36; QFN 24
RL78/G1G	R5F11Exxxxx#xx	24	8-16	-	1.5	8-12x10 bit	26-40	7	-	-	-	2	-	-	-	1	-	LQFP 32-44; SSOP 30
RL78/G1H	R5F11Fxxxxx#xx	32	256-512	8	24-48	6x10 bit	41	9	-	-	-	2	-	-	-	2	-	QFN64
RL78/I1x																		
RL78/I1A	R5F107xxxxx#xx	32	32-64	4	2-4	6-11x10 bit	16-34	11-12	-	-	-	2-3	1	-	-	1	-	SSOP 20-38
RL78/I1C	R5F10Nxxxxx#xx	24	64-128	2	6-16	4x10 bit	35-68	8	-	-	-	3	1	-	-	3	-	LFQLP64 LFQFP100
RL78/I1D	R5F117xxxxx#xx	24	8-32	2	0.7-3	6-17x12 bit	14-42	4	-	-	-	1	-	-	0-1	1-2	-	LQFP 32-48; SSOP20-30; QFN 24-32
RL78/I1E	R5F11Cxxxxx#xx	32	32	4	8	8-12x10 bit	10-14	8	-	-	-	2	-	-	-	2	-	HVQFN32 TFBGA64
RL78/L1x																		
RL78/L12	R5F10Rxxxxx#xx	24	8-32	2	1-1.5	4-10x10 bit	20-47	8	-	-	-	1	1	-	-	1	-	LQFP 32-64; QFN 64
RL78/L13	R5F10Wxxxxx#xx	24	16-128	4	1-8	9-12x10 bit	49-65	8	-	-	-	3-4	1	-	2	2	-	LQFP 64-80
RL78/L1A	R5F11Mxxxxx#xx	24	48-128	8	5.5	10-14x10 bit	59-79	8	-	-	-	4	1	-	1	5	-	LFQFP 80-100
RL78/L1C	R5F10xxxxx#xx	24	64-256	8	8-16	7-13x12 bit	59-77	8	-	-	-	4	1	1 Ch	4	5	-	LQFP 80-100; LGA 85



FGIC Battery Pack System Diagram



Battery Management

Battery Fuel Gauge ICs (FGIC)

RENESAS

Dedicated 1-package solution with MCU and AFE for Battery Management System provides intelligent battery system by constantly monitoring the battery state.

Safety & Protection Control
- Over/under voltage
- Charge/discharge current
- FET control when error detected
- Chemical fuse control
- Cell balancing

Remaining Capacity Management
- Current/voltage detection
- Precise coulomb counter
- Deterioration detection
- Calculation and learning of battery capacity
- Fault detection/history management

Voltage & Current Measurement by Independent A/D Converters
- Current detection: 153 µA/LSB resolution (18-bit 5 m shunt resistor)
- Support for continuous measurement
- Voltage/temp. measurement: 15-bit ADC

Few Parts, Low System Cost
- Supports large-current discharge with N-channel FET drivers
- Integrated pull-up resistors for thermistor

Extended Battery Life
- Low power mode with consumption of 25 µA or less and cell balance circuit to maximize battery capacity (RAJ240090 and RAJ240100)

High Reliability & High Integration
- Built-in FET protection for overcurrent or short circuit conditions
- Redundant fault detection by both MCU and AFE
- Ability to set lifecycle related limits and maintain battery parameter
- Operation history using data flash guaranteed for 100,000 erase/write cycles
- Integrated CAN interface and RTC (Real Time Clock) circuit for industrial apps
- ICs can manage date and time in a single device (RAJ240090 and RAJ240100)

Cells		Pack Voltage (V)	Part No.	Flash ROM (kB)	RAM (kB)	ADC Port	Serial I/F	I/O	Features	Package
Min.	Max.									
2	4	4 to 25	RAJ240045	64	4.0	2-ch	I²C, UART	12	Compact package (4mm×4mm)	QFN 32
2	5	4 to 25	RAJ240075	64	4.0	3-ch	I²C, UART	11	Compact package (4mm×4mm) 5 cell support	QFN 32
2	5	4 to 28	RAJ240080	64	5.5	3-ch	I²C, UART	22	GPIO: I/O×18, input×2, NOD×2	LQFP 48
3	8	4 to 50	RAJ240090	128	7	4-ch	I²C, UART, CAN	31	High voltage tolerance, on-chip CAN, low power consumption (25 µA)	LQFP 64
3	10	4 to 50	RAJ240100	128	7	4-ch	I²C, UART, CAN	31	High voltage tolerance, on-chip CAN, low power consumption (25 µA)	LQFP 64

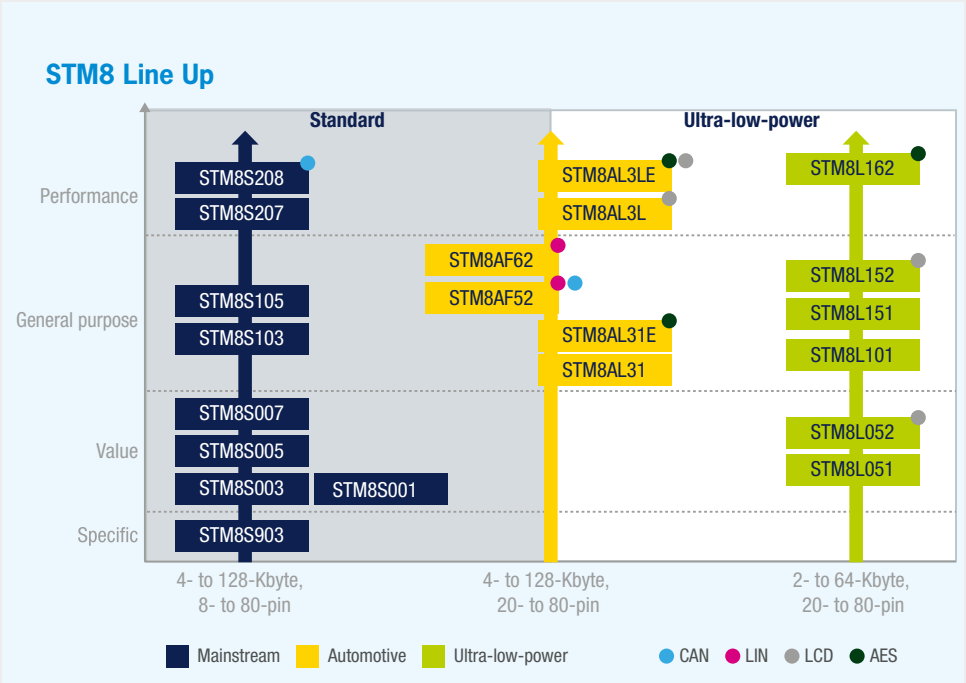
STM8 8-bit MCU

Come Grow with Us! Simply Smarter

ST's 8-bit microcontroller platform is implemented around a high-performance 8-bit core and a state-of-the-art set of peripherals.
This platform is manufactured using an ST-proprietary 130 nm embedded non-volatile memory technology.

The STM8 allows fast and safe development through enhanced stack pointer operations, advanced addressing modes and new instructions. The STM8 platform supports three product series:

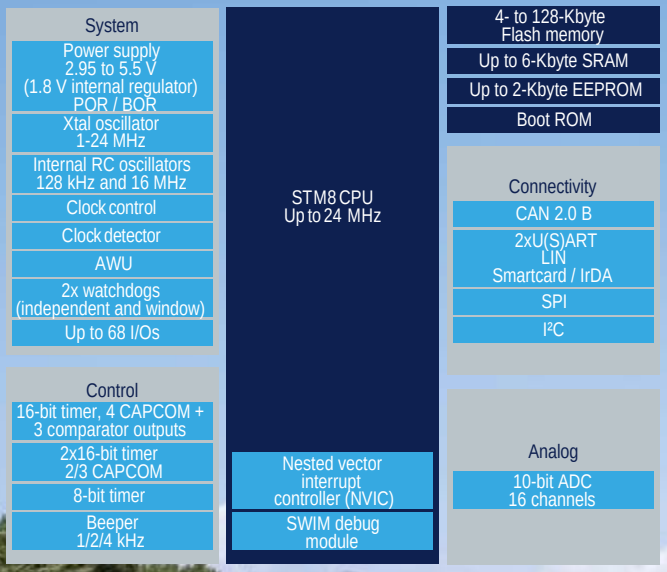
- STM8S, mainstream MCU
- STM8AF and STM8AL, automotive MCUs
- STM8L, ultra-low-power MCU

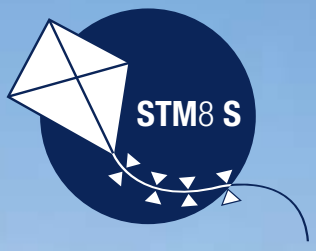


One million units delivered worldwide every day!

We plan for longevity with a sustainable growth.

STM8S Block Diagram





life.augmented

STM8S

Mainstream Series

ST's STM8S series of mainstream 8-bit microcontrollers covers a large variety of applications in the industrial, consumer and computer markets, particularly where large volumes are concerned. Based on the STM8 proprietary core, the STM8S series benefits from ST's 130 nm technology and advanced core architecture performing up to 20 MIPS at 24 MHz. Embedded EEPROM, RC oscillators and a full set of standard peripherals provide a robust and reliable solution for designers. The associated toolchain, from affordable Discovery kits to more complex evaluation kits and third-party tools, make it easy to develop with STM8S microcontrollers.

The STM8S series consists of four lines with differentiated features but full compatibility and upgradability to simplify future design changes.

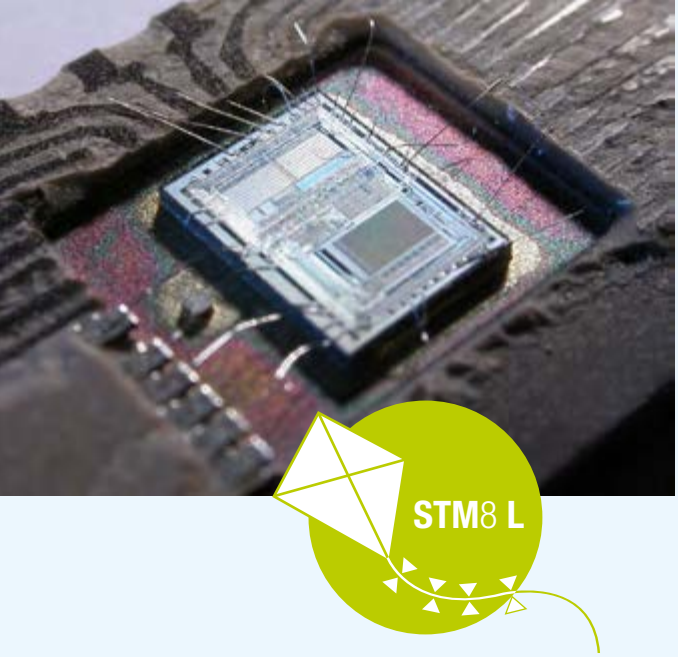
- The STM8S001/003/005/007 Value line is the entry-level series with a basic feature set
- The STM8S103/105 Access line offers more features and a larger variety of packages
- The STM8S207/208 Performance line features a full set of peripherals and provides performance for medium- to higher-end applications
- The STM8S Application specific line provides more analog features and dedicated firmware solutions

STM8S Core

Product lines	F_{CPU} (MHz)	Flash memory (kB)	RAM (kB)	Data EEPROM (bytes)	CAN 2.0B	2nd UART	Additional analog channels	LNB firmware
STM8S001/003/005/007 Value line	16	8 to 64	1 to 6	128				
STM8S103/105	16	4 to 32	1 to 2	640 to 1024				
STM8S207/208	24	32 to 128	6	1024 to 2048	x	x	x	
STM8S Application-specific line	16	8	1	640			x	x

Up to 24 MHz

- 10-bit ADC
- USART, SPI, I²C
- 8- and 16-bit timers
- 16 MHz crystal oscillator
- 128 kHz internal RC oscillators
- SWIM debug module



STM8L Core

Product lines	Flash memory (kB)	RAM (kB)	Data EEPROM (bytes)	Four DMA channels	LCD Interface	AES 128-bit crypto
STM8L051/052 Value line	8 to 64	1 to 4	256	x	x	
STM8L101	2 to 8	1.5				
STM8L151/152	4 to 64	1 to 4	256 to 2048	x	x	
STM8L162	64	4	2048	x	x	x

Up to 16MHz

- 12-bit ADC
- 12-bit DAC
- USART, SPI, I²C
- RTC with 32 kHz oscillators
- 8- and 16-bit timers
- Temperature sensor
- Comparator
- SWIM debug module

STM8L

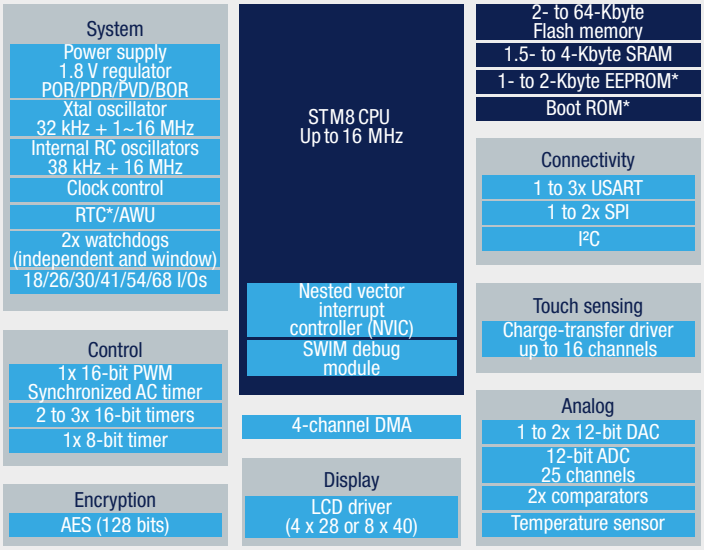
Ultra-Low-Power Series

ST's ultra-low-power product lines support a wide number of applications where consumption is critical, such as in portable devices. The STM8L, based on the 8-bit STM8 core, benefits from our proprietary ultra-low-leakage process, shared with the STM32L family, and features an ultra-low power consumption of 0.30 µA with the lowest power mode.
This family is available in four different lines making the STM8L an optimal family to support many applications requiring special care on power savings.

Applications

- Medical equipment
  - Glucose meters, insulin pumps
  - Blood pressure and colesterol monitors
  - Patient monitoring
- Metering
  - Electricity/gas/water/heat meters, scales
- Alarm systems
  - Central units, sensors, door locks, fire alarms
- GP portable devices
  - Mobile phones, accessories
  - Gaming, remote controls
- GPS watches, sports equipment

STM8L Block Diagram



STM8L101 Line

- Lowest power mode: 0.30 µA
- Dynamic run mode: 150 µA/MHz

STM8L162 Line

- Lowest power mode: 0.35 µA
- Dynamic run mode: 180 µA/MHz

STM8L151/152 Line

- Lowest power mode: 0.35 µA
- Dynamic run mode: 180 µA/MHz

STM8L051/052 Value Line

- Lowest power mode: 0.35 µA
- Dynamic run mode: 180 µA/MHz

Development Environment

STM8CubeMX Eases Configuration

As part of the STMCube™ initiative to reduce development effort, time and cost for engineers, ST offers STM8CubeMX, a user-friendly software tool that uses graphical wizards to configure STM8 microcontrollers

To help developers better understand STM8 features and functions, STM8CubeMX includes several intuitive wizards that make it easier to:

- Select the STM8 MCU that best fits application requirements
- Organize pinouts with automatic conflict resolution
- Manage the clock tree with dynamic validation of the selected configuration
- Evaluate different power consumption scenarios

In the end, the user can generate and share a configuration report with colleagues about achievable results, therefore improving overall team efficiency.

Features

- Intuitive microcontroller selector
- Graphical configuration of STM8 pinout with automatic conflict resolver
- Graphical configuration of STM8 clock system with solver
- Graphical evaluation of power consumption
- Create and share reports
- Available for Windows®, Linux® and macOS™ operating systems

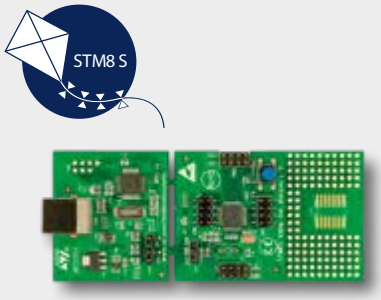
Discovery Board Order Information

Order No.	Description
STM8S-DISCOVERY	Discovery kit for STM8S series with STM8S105C6 MCU
STM8SVLDISCOVERY	Discovery kit for STM8S Value Line with STM8S003K3 MCU
STM8L-DISCOVERY	Discovery kit for STM8L series with STM8L152C6 MCU

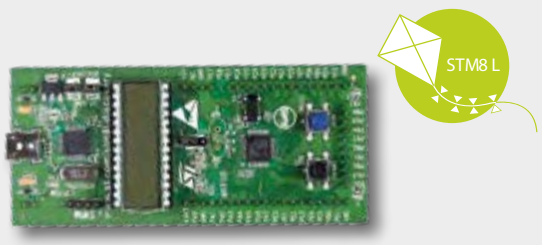
Free Tools Suites, Software Libraries and Examples

Development environment	C-Compilers	IDE
life.augmented	NA	STVD

STM8S-DISCOVERY

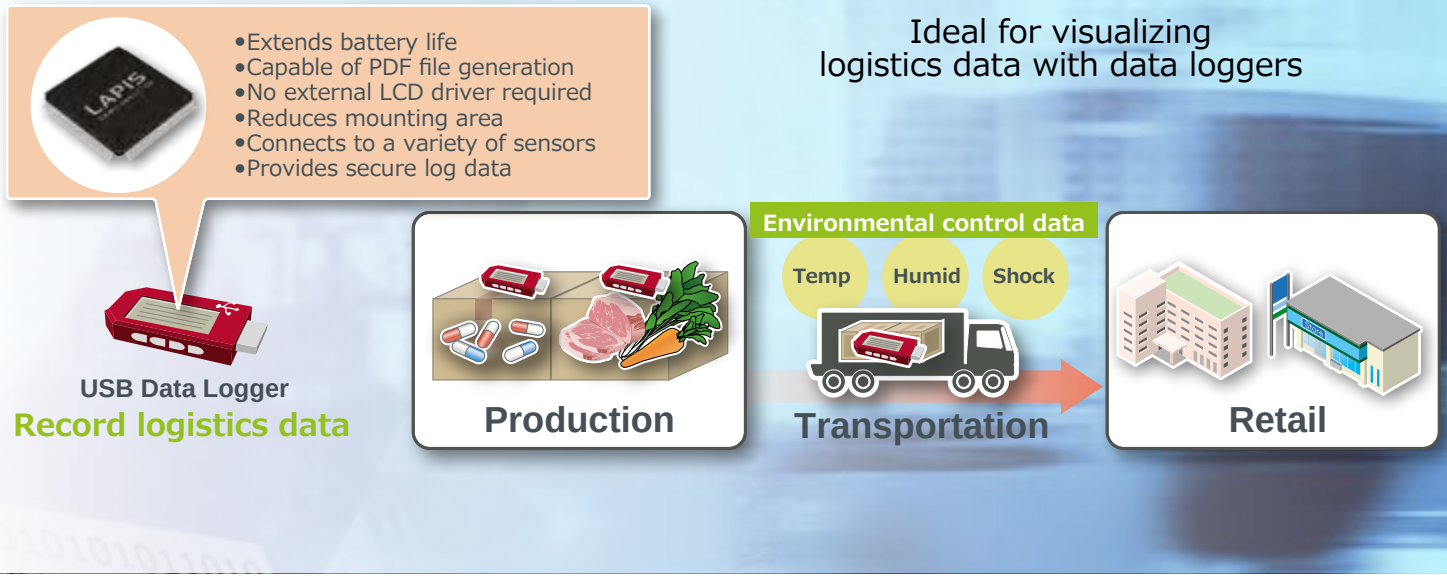


STM8SVLDISCOVERY



STM8L-DISCOVERY

Software supported by SEGGER



Ideal for visualizing
logistics data with data loggers

ML630Q464 / ML630Q464 for Data Logger

Logistics for Acquisition & Package Shipment Management

Core

- Arm® Cortex® M0+ CPU core

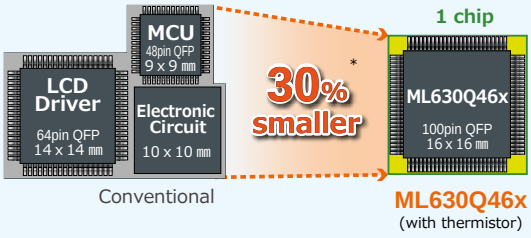
Smaller Size

- 30% less board space, because all major USB data logger functions are integrated – including USB Full Speed, LCD driver, high-speed clock generator and 24-bit ADC
- Further board space reduction caused by unconventional ADC measurements by means of thermistor and resistor/capacitor

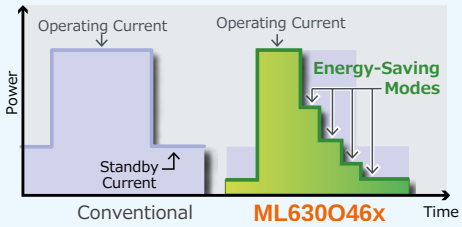
Higher Functionality

- ADC temperature measurement accuracy of ±0.5 °C
- A4 page PDF file creation with 2,500 measurement points within 4 seconds
- Built-in AES function and RNG to create password-protected PDF files
- Best-in-class standby current consumption of 0.8 µA by supporting 4 low power modes
- Typical operation for up to 380 days utilizing a single coin battery (CR2032) - 1/3rd the capacity of conventional batteries required for MCUs used in conventional data loggers

Integrating all primary functions on a single chip reduces board area by 30%

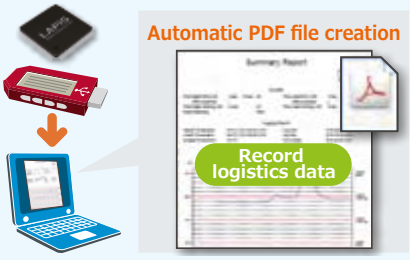


4 optimized low power modes compensate for increased power usage during high-speed processing to reduce overall energy consumption



USB Data Logger Reference Kit

PDF Generation Software



The Application Background

Data Logger with a Service Life of One Year

Application/Market/Targets

- Concerns about the safety and security of foods and medicines
- Logistics systems to maintain cold temperatures (cold chain) w/o interruption from production to transportation to consumption – for perishables/pharmaceuticals
- Solution for safety and security concerns of foods and medicines
- Quality aspects temperature, humidity, and shock/vibration in transportation environment
- Size/cost reduction by utilizing smaller batteries along with fewer parts
- Market growth for Data loggers as management tools expected by ca. 10% p.a

Key Requirements

- Reliable recording of package conditions during transport
- Output of uneditable PDF files to prevent tampering of records (log data)
- Based on regulation FDA*2 for cold chain and GDP*3

ML640Q464/466

Provide PDF file generation, integrate key functions for USB data logging on single chip in combination with low power consumption, high noise immunity, and high performance (LAPIS semiconductor).

Operating Conditions

Operating voltage (V)	1.8 to 3.6
Operating Frequency (Max.)	Low speed: 32.768kHz (Internal RC oscillation/Crystal oscillation), High speed: 16MHz/(Internal RC oscillation) 24MHz/(PLL)
Min. Exec Time	41.7 ns/30.5 µs
Current Consumption (Typ@ Ultra Deep HALT 25 °C)	0,80 µA
Operating Temperature (°C)	-40 to +85

ROM/RAM

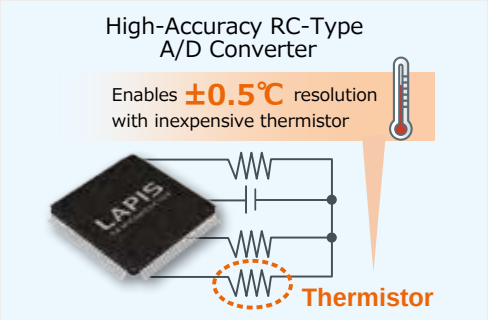
ROM type	Flash
ROM capacity (kB)	64
DataFlash capacity (kB)	2
RAM capacity (kB)	8

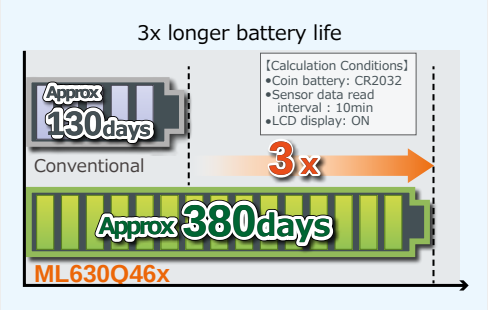
Others

Package	P-TQFP100-1414-0.50

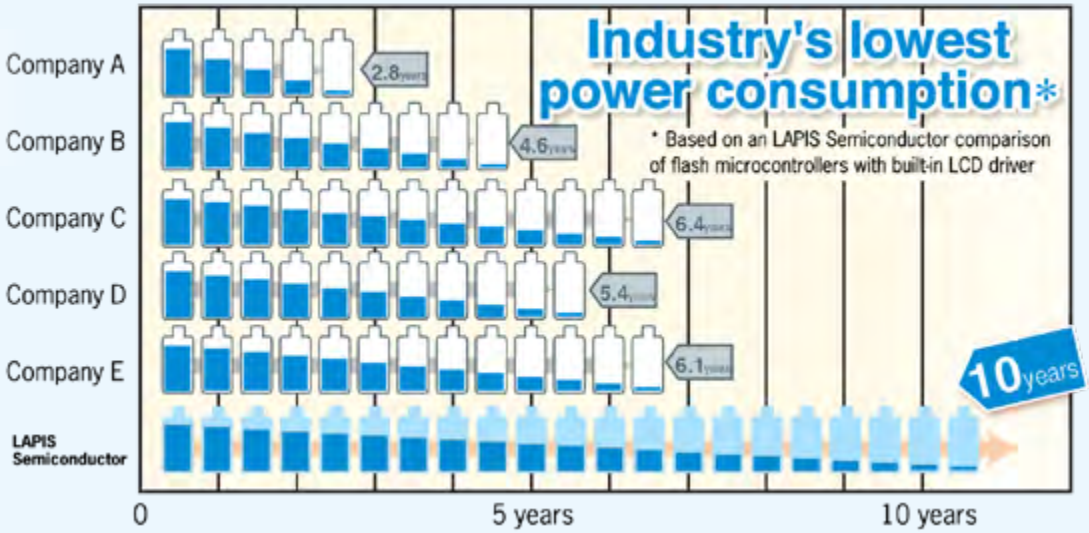
Function/Features

Input	-
Output	-
InputOutput	38
8-bit timer	8
1K timer	4
PWM	16-bit x 4 (use 16-bit timer)
Capture	16-bit x 4 (use 16-bit timer)
WDT	1
ADC	12-bit x 12 (SA type)
	2 (RC type)
I²C	2
UART	1
Voltage detection	VLSx1LLD×1
LCD driver	max. 400dot 50seg. × 8com.





LAPIS Semiconductor (ROHM Group company) offers a large selection of ultra low power MCUs based on proprietary low power technology.
The low power consumption and a large set of peripherals like embedded LCD drivers, sound playback or encryption functions make them perfect choice for any battery operated application.



*Calculation condition: MCU powered by lithium coin battery (3 V) and performing low/high speed operations and sleep (HALT) every 5 seconds in the following order:
1) low speed (32 kHz) operation for 1,500 ms | 2) high speed (1 MHz) operation for 10 ms | 3) suspend (HALT) for 3,490 ms

ML610400 Series: 8-Bit Ultra-Low-Power MCU

For Battery-powered Applications with Extremely Long Durations

The ML610400 series is equipped with LAPIS Semiconductor's original RISC 8-bit CPU "U8 Core". The CPU core is capable of instruction execution in just one clock cycle by using a 3-stage pipelined architecture. The clock generation circuit enables high/low-speed mode and power-saving mode. The complete series features flash memory which operates down to 1 V based on LAPIS Semiconductor's proprietary low power process. Advanced power management, along with a high efficient CPU in the RISC architecture, further reduces the power consumption. With built-in LCD driver this series is suitable for small portable devices with LCD display, such as wrist watch, pedometer, heart rate monitor and thermostat.

Single-battery drive with remarkably low current consumption

	Conventional		ROHM
	8-Bit Flash Microcontroller		Lapis Semiconductors Low Power 8-Bit Flash MCU
Operating Voltage	1.8 to 3.6 V		1.1 V to 3.6 V
Suspend (HALT) current	2.0 µA		20 µA
Standby (STOP) current	0.8 µA		0.15 µA
Operating current	50 µA (32kHz CPU operation) 6 mA (4MHz CPU operation)	max. 86% reduced	5 µA (32kHz CPU operation) 0.8 mA (4MHz CPU operation)

Key Features

- Ultra low power, on-chip 1 V operative Flash memory & Sleep(Halt) current 0.5 µA Popular for the battery-driven applications
- Rich set of peripheral including dot matrix and segment type LCD drivers, RC oscillation type A/D converter, Successive Approximation-type A/D converter, Real Time Clock, Battery Level Detect, 16-bit PWM, Melody output, etc.

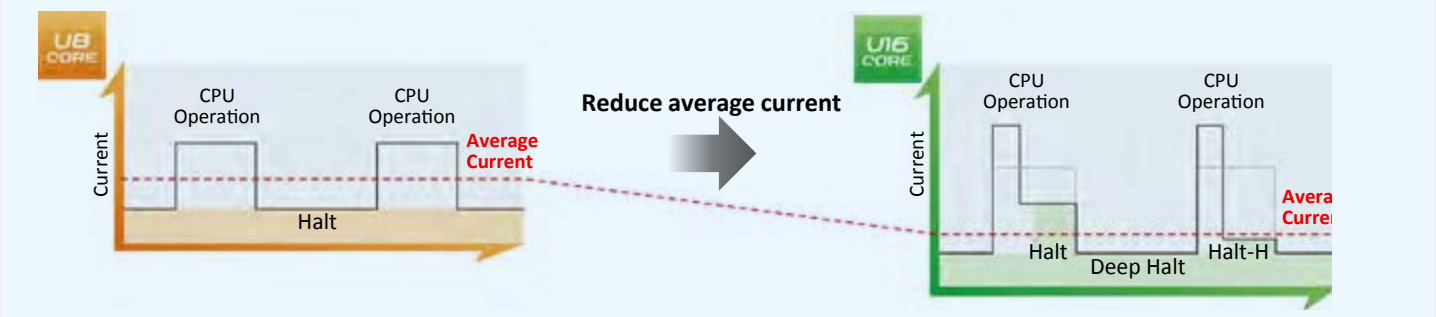
Short Selection Guide

Part Number	Max. Frequency (MHz)	FLASH size (kB)	Data Flash (kB)	RAM size (kB)	A/D Converter (Bit)	I/O	16-bit timers (bit)	32-bit timers	CAN	Ethernet	UART	LIN	USB	SPI	I²C	SSI	Package
ML610400	0.5 - 4.096	6 - 128	0 - 4	0.1875 - 7	1-2x 12-24	7-22	1-3 x16	-	-	-	1	-	-	-	0-1	-	QFP 48-144

ML620400/ML620500 Series: 16 Bit Ultra-Low-Power MCU

Improved Performance

The ML620400 series and ML620500 series are LAPIS's new high performance and ultra-low-power 16-bit microcontrollers equipped with LAPIS Semiconductor's original 16-bit RISC CPU „U16 Core". These microcontroller series performs ultra low power consumption such as 0.45 µA in HALT mode and 250 µA/MHz in operating mode up to 16 MHz-operating frequency. All MCUs of this series feature embedded Flash memory for storing customer's program and data with self-programming feature. In addition LAPIS just released the new ML620100 though MCU series which adds 5V support, high temperature support (105°C) and improved noise resistance compliant with IEC61000 4-2 noise test Class4 (±30kV)



Key Benefits

High performance helps to reduce average current consumption in addition to its low power consumption in HALT mode.

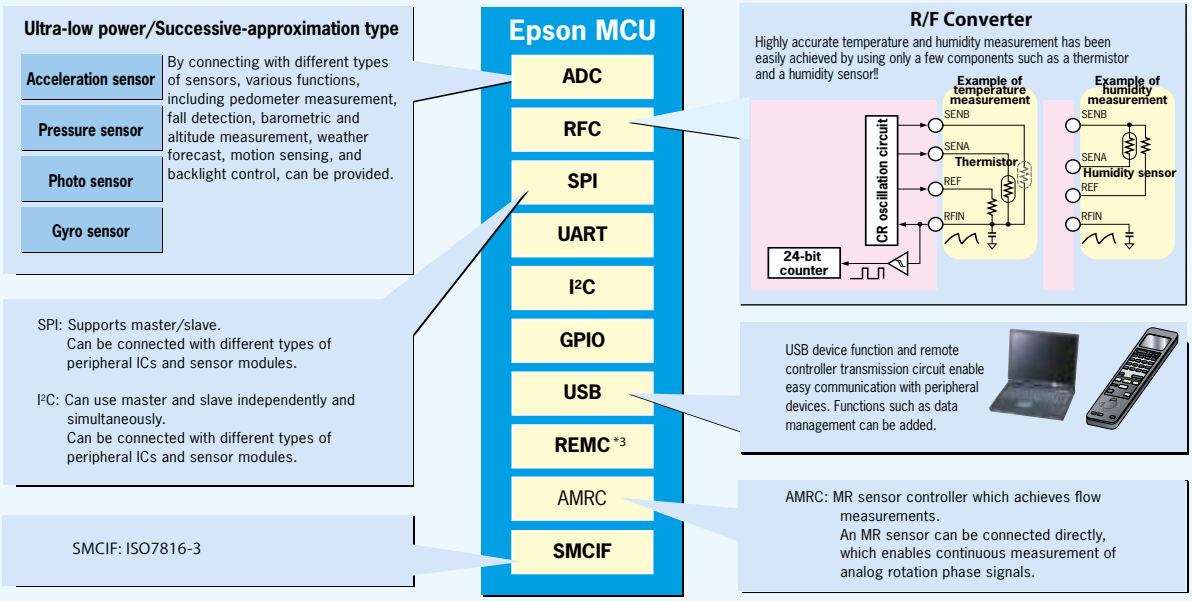
Key Features

- 0.45 µA current consumption in HALT mode; & 250 µA/MHz in operating mode
- Operating frequency: 16 MHz(max.)
- Supply Voltage: 1.8 V to 3.6 V (ML620400/500 series); 1.8 V to 5.5 V(ML620100 series)
- Build-in noise protection (ML620100 series)
- Rich set of peripherals including Successive approximation type 12-bit A/D converter, RC oscillation-type 24-bit A/D converter, I²C, SPI, UART, Build-in LCD Driver (The ML620400 series)

Short Selection Guide

Part Number	Max. Freq. (MHz)	FLASH size (kB)	Data Flash (kB)	RAM size (kB)	A/D Converter	I/O	16-bit timers	32-bit timers	CAN	Ethernet	UART	LIN	USB	SPI	I²C	SSI	Package
ML620400	16	128-256	4	16	12x12 bit	52	4x16 bit	-	-	-	3	-	-	-	3	-	QFP 48-100
ML620500	16	32-256	2	2-20	12-20x10-12 bit	36-88	4-6x16 bit	-	-	-	2-5	1	-	-	2	-	QFP 48-100
ML620100	16	32-64	2	2	10bit×6	10-14	4-6x16 bit	-	-	-	2-5	1	-	-	1	-	QFN16,SSOP16,TSSOP20

A Large Number of Different Types of Interfaces Are Included



S1C17 Family 16-Bit Microcontroller

Features Power Consumption, Display Driving & Sensor Interface

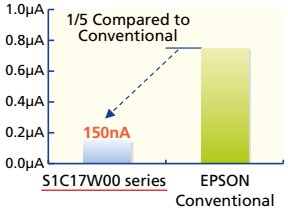
EPSON
EXCEED YOUR VISION

In most cases, the S1C17 Family of products will allow customers currently using 8-bit microcontrollers to enjoy higher performance with the same power consumption. In addition, it will enable customers already using 16-bit/32-bit microcontrollers to benefit from longer battery life as a result of low operating voltage.

Lowest Current Consumption in Industry

Standby

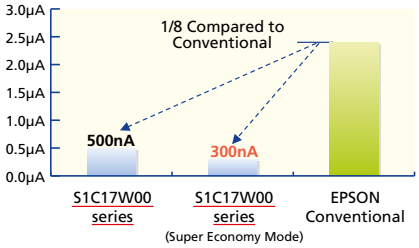
Current Consumption in SLEEP Mode
CLK=OFF, RTC=OFF, CPU=OFF



RTC Execution

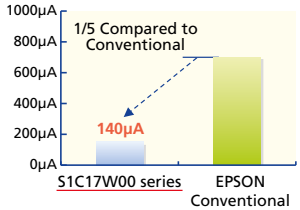
Conditions : Typ. VDD=3.0V, Ta=25°C

Current Consumption in HALT Mode
CLK=32kHz, RTC=ON, CPU=OFF



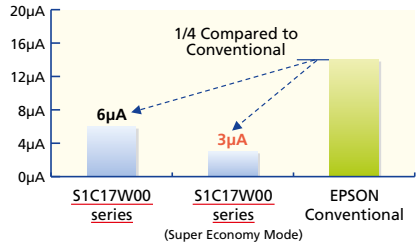
High-speed Execution

Current Consumption in RUN Mode (1MHz)
CLK=1MHz, RTC=ON, CPU=1MHz



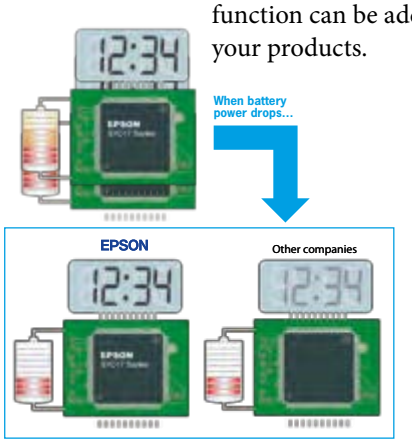
Low-speed Execution

Current Consumption in RUN Mode (32 kHz)
CLK=32kHz, RTC=ON, CPU=32kHz



When Battery Power drops...

Even when battery power level drops, the contrast level is not affected. The same level of display quality as that of a new machine can be maintained until battery power has been completely consumed. The battery power level is detected by the Supply Voltage Detector (SVD) circuit, so you do not have to be concerned about the level during operation.
In addition, a software-based function is included that allows the user to finely adjust contrast. You can use this function to match voltage with liquid crystal panel. Also, a contrast adjustment function can be added to your products.



Development Tool Chain

ICD mini Ver 1.0 to 2.0

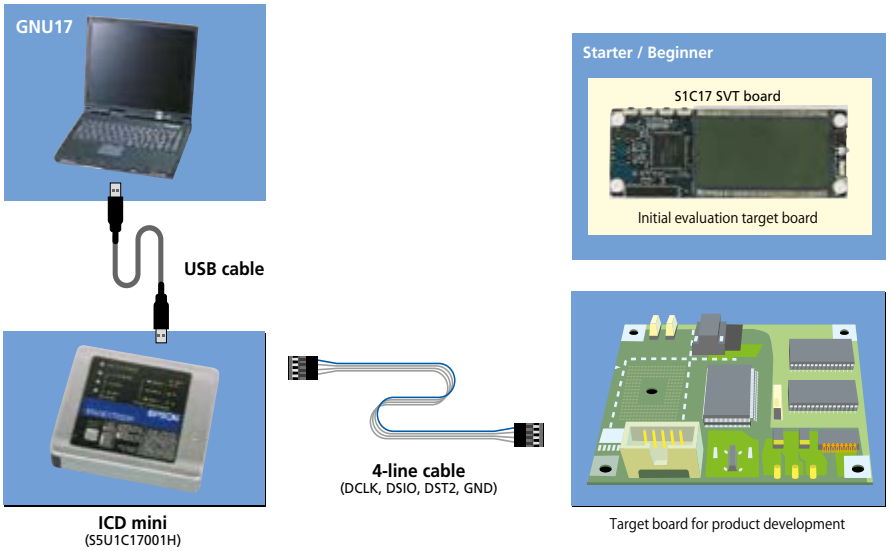
ICD mini Ver. 3.0

GNU17package

- Optimized C compiler supporting 16 MB space
- Assembler, linker, and ANSI library
- GUI-based debugger
- Eclipse integrated environment

ICD mini

- On-chip ICE, S1C17 Family products supported
- Connects with a target board via 4 pins (3 signal pins and 1 GND pin)
- Includes execution time measurement function
- Uses USB bus power
- Can function as a single on-chip flash writer *1
- Can be used as a GangWriter in multiple units *1
- Includes firmware update function.
- Power supply function for target devices of 3.3 V or 1.8 V *2



*1: Installs it in hardware Ver2.0 or less.

*2: Installs it in hardware Ver2.0. Up to each power supply and 100mA or less. Hardware Ver 3.0 is powered by 3.3 V alone.

Short Selection Guide

Part Number	Max. Frequency (MHz)	FLASH size (kB)	Data E²PROM (Byte)	RAM size (kB)	A/D Converter (bit)	I/O	16 bit timers (bit)	16 bit PWM timers (bit)	LCD-Driver	Power Cons. Sleep (µA)	Power Cons. Halt (µA)	Power Cons. RUN 1MHz (µA)	UART	R/F converter	SPI	I²C	Package
S1C17500 series	16.8-24	128	-	16	4-16x10	40-88	5-6x16	4x6 16	-	0.2-0.8	0.6-2.7	280-450	2-3	-	2-3	1	QFP 64-100; BGA 81
S1C17800 series	33-48	128	-	4-16	4-8x10	69-99	1-2x16	1-2x16	-	1.3-1.4	5-12	6000	1	-	2	1	QFP 100 – 128
S1C17900 series	24	128	-	16	0-6x12	20-24	5x16	4x16	-	1.0	2.9	400	1-2	-	3	1	QFP 64; WCSP 48
S1C17W00 series/ W00 group	4.2	16-32	-	2	6x12	24-35	4x16	2x2 16	-	0.15	0.30	250	2	2	2	1	QFP 48; QFN 32
S1C17100/600 series	4.2-8.2	0-128	-	2-8	0-8x10	12-47	0-3x16	1-3x16	12x4-52x8	0.09-0.75	0.42-2.5	160-410	1-2	0-2	1	0-1	QFP 48 – 128
S1C17700 series	8.2	64-512	-	4-12	0-8x10	28-35	3-5x16	1-4x16	64x16 – 128x32	1.0-1.2	2.0-2.7	400-660	1-2	2	1-3	1	QFP 128 – 216; BGA 96-240
S1C17M00 series	21	126	256	4	0-8x12	66	5x16	3x2 16	26x4 – 80x16	0.16-0.36	0.6-2.35	145-210	1-4	0-2	2	1-2	QFP 32 – 128; QFN 24-32
S1C17W00 series W10/W20/W30 group	4.2	48-384	-	4-16	0-7x12	26-53	2-4x16	2-3x16	18x4 – 64x32	0.15	0.3-0.5	140-250	1-2	1-4	1-3	1	QFP 48 – 176; QFN 48-64
S1C17F00 series	4.2	32	-	2	-	29	-	2x16	64 Seg EPD	0.10	0.55	-	1	1	1	1	Bare Die Chip

RZ Family
Embedded Arm® Microprocessors

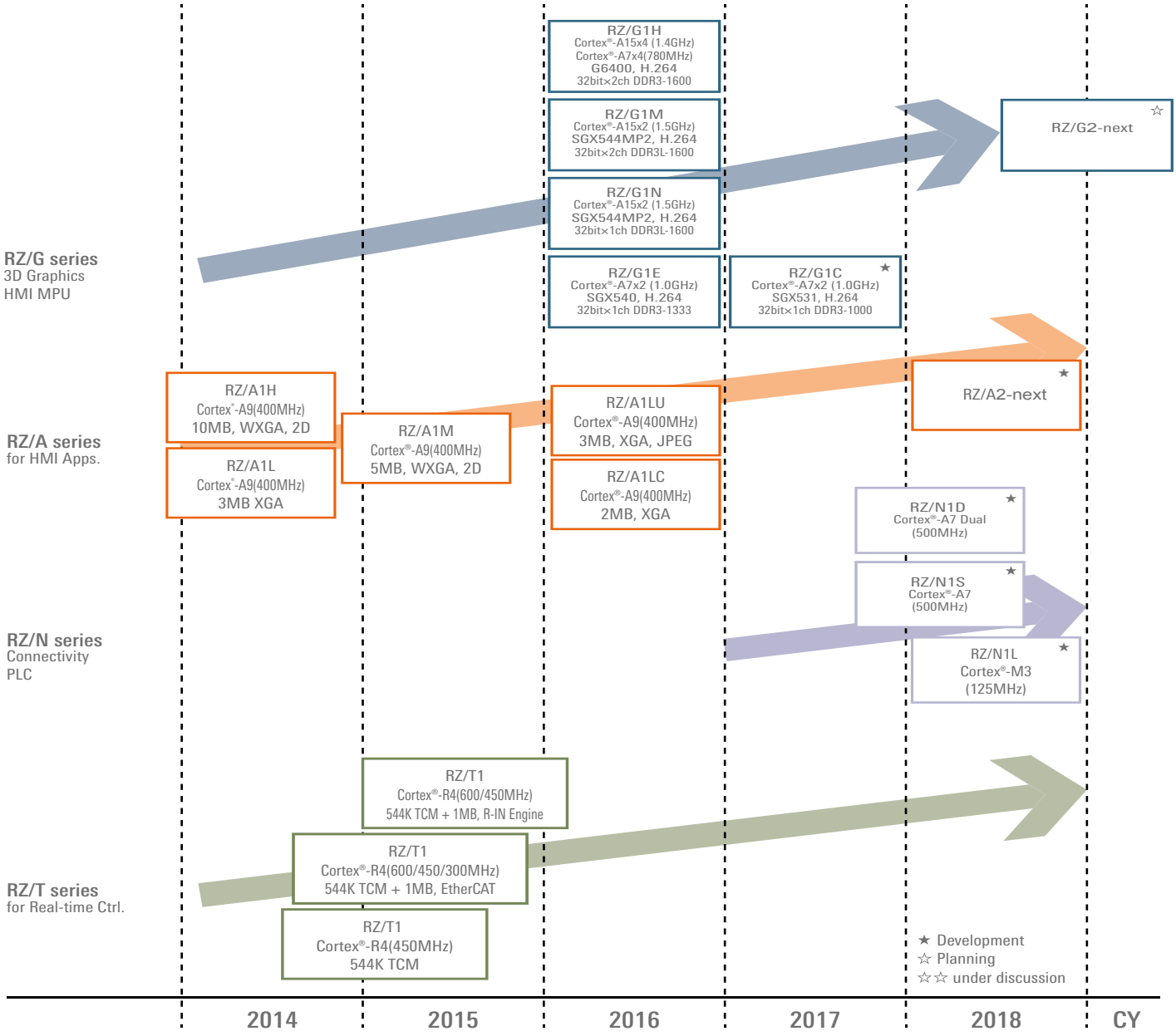
All aspects of everyday life, such as home appliances, industrial equipment, building management, power grid, and transportation, are becoming more technologically advanced, and the emergence of a smart society interconnected through the cloud is high.

To meet the demands of this smart society, microprocessors are required to have IT networking capability, human machine interface display capability, faster data processing capability, and so on in addition to providing high performance and power saving control for devices. It was in this environment that the RZ Family was developed as a new lineup of high-end embedded microprocessors that employ an Arm® core.

Industrial Network Support
- Up to 5 port industrial multi-protocol support (RZ/N1)
- Powerful Arm Cortex A7 cores
- Simple exchange between protocols due to consistent communication API
- Scalable products

HMI (Human Machine Interface)
- RZ/A: Camera input, 2D Drawing, resolutions up to WXGA (1280x800 with 32bpp)
- RZ/G: Hardware support for 3D rendering, h.264 video encode/decode and security

High-Speed Real-time Control
- 3-in-1 device - integrated motion control, industrial multi-protocol and encoder interfaces
- Arm Cortex R4 with tightly coupled memory enabling real time performance
- Scalable products



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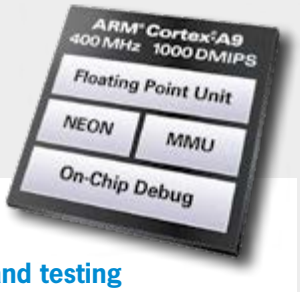
Series	Part No	CPU	Max. Freq (MHz)	SRAM (Byte)	Display	Camera Input	MMU	SDRAM	eMMC	SATA	PCIe 2.0	USB 3.0/2.0	MOST50	EtherCAT	Ethernet (Mbps)	Package	Temp (°C)
RZ/A																	
RZ/A1H	R7S72100xxxxx	Cortex-A9	400	10M	2035 x 1999	1 ch	Yes	SDRAM	Yes	No	No	No/2 ch	1 ch	No	10/100	QFP BGA	85
RZ/A1M	R7S72101xxxxx	Cortex-A9	400	5M	2035 x 1999	1 ch	Yes	SDRAM	Yes	No	No	No/2 ch	1 ch	No	10/100	QFP BGA	85
RZ/A2M	R7S9210xxxxx	Cortex-A9	528	4M	2035 x 1999	1 ch	Yes	SDRAM	Yes	No	No	No/2 ch	1 ch	No	10/100	QFP BGA	85
RZ/A1L	R7S72102xxxxx	Cortex-A9	400	3M	2035 x 1999	1 ch	Yes	SDRAM	Yes	No	No	No/2 ch	1 ch	No	10/100	QFP BGA	85
RZ/A1LU	R7S72103xxxxx	Cortex-A9	400	3M	2035 x 1999	1 ch	Yes	SDRAM	Yes	No	No	No/2 ch	No	No	10/100	QFP BGA	85
RZ/A1LC	R7S721034xxxx	Cortex-A9	400	2M	2035 x 1999	1 ch	Yes	SDRAM	Yes	No	No	No/2 ch	1 ch	No	10/100	QFP BGA	85
RZ/G																	
RZ/G1H	R8A77420HA02BG	Quad Cortex-A15+ Quad Cortex-A7	1400 + 780	332K	1920 x1080	No	Yes	DDR3	Yes	2 ch	1 lane	1/3 Ports	No	No	10/1000	BGA	85
RZ/G1M	R8A77430HA02BG	Dual Cortex-A15	1500	332K	1920 x1080	No	Yes	DDR3L	Yes	2 ch	1 lane	1/2 Ports	No	No	10/1000	BGA	85
RZ/G1N	R8A77440HA02BG	Dual Cortex-A15	1500	332K	1920 x1080	No	Yes	DDR3L	Yes	1 ch	1 lane	1/2 Ports	No	No	10/1000	BGA	85
RZ/G1E	R8A77450HA02BG	Dual Cortex-A7	1000	332K	1920 x1080	No	Yes	DDR3	Yes	No	No	No/2 Ports	No	No	10/1000	BGA	85
RZ/G1C	R8A77470HA02BG	Dual Cortex-A7	1000	332K	1920 x1080	No	Yes	DDR3L	Yes	No	No	No/2 Ports	No	No	10/1000	BGA	85
RZ/T1																	
RZ/T1	R7S9100xxxxx	Cortex-R4 + M3	300 - 600 + 150	0.5 - 1.5M	No	No	No	SDRAM	No	No	No	No/ 1 ch	No	Yes	10/100	BGA QFP	125
RZ/N																	
RZ/N1D	R9A06G032xxxx	Dual Cortex-A7 + M3	500 + 125	2M	1024 x 768	No	Yes	DDR2/ DDR3	2 ch	No	No	No/2 ch	No	max. 3	max. 5	BGA	110
RZ/N1S	R9A06G033xxxx	Cortex A7 + M3	500 + 125	6M	1025 x 768	No	Yes	No	2 ch	No	No	No/2 ch	No	max. 3	max. 5	BGA	110
RZ/N1L	R9A06G034xxxx	Cortex M3	125	6M	No	No	No	No	1 ch	No	No	No/2ch	No	max. 2	max. 3	BGA	110

RZ/A1 Series

Innovative Architecture & Advanced Integration

RENESAS

Renesas RZ/A1 series microprocessors (MPUs) offer an innovative architecture based on the Arm Cortex®-A9 processor and up to an industry-leading 10 MB of on-chip memory. RZ/A1 MPUs can execute code at 1000 DMIPS from the abundant on-chip memory or in-place from inexpensive QSPI memory, while using on-chip memory for graphics buffering up to WXGA (1280x800) resolution. The 128-bit wide internal memory bus with x4 parallel access enables higher through put memory access as compared to systems with external DDR memory. The RZ/A1 series offers enormous advantages in terms of BOM cost, performance, power consumption, and system design time, making it the right choice for Human Machine Interface (HMI) and other system-on-chip applications.

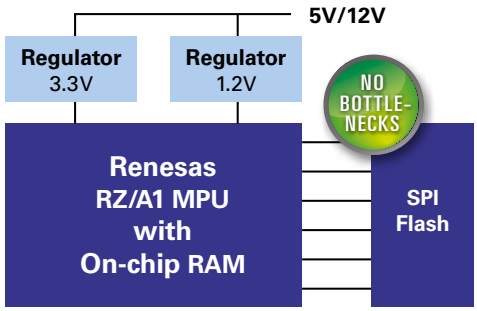


Features & Benefits

- Arm Cortex®-A9 processor that can execute code at 1000 DMIPS
- Remove need for external RAM with up to 10 MBs of on-chip RAM
- Execute-In-Place (XIP) from QSPI memory enabled with three layers of cache
- Up to two camera inputs available for video and graphics blending usages
- Scalable line-up with three sizes of on-chip RAM to choose from: 3 MB (RZ/A1L or RZ/A1LU), 5 MB (RZ/A1M), and 10 MB (RZ/A1H)
- Implement up to two independent LCD displays with WXGA (1280x800) resolution for impressive graphical user interfaces

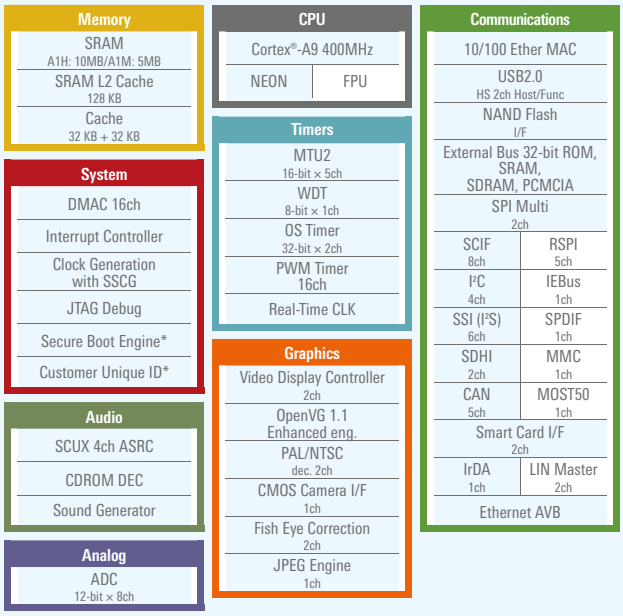
Number of Images in Frame Buffer	QVGA 320x240 16bpp	WQVGA 480x272 16bpp	VGA 640x480 32bpp	WVGA 800x480 32bpp	SVGA 800x600 32bpp	WSVGA 1024x600 32bpp	XGA 1024x768 32bpp	WXGA 1280x800 32bpp
	RZ/A1L		RZ/A1M		RZ/A1H			
4	0.6 MB	1.0 MB	4.7 MB	5.9 MB	7.3 MB	9.4 MB		
3	0.4 MB	0.7 MB	3.5 MB	4.4 MB	5.5 MB	7.0 MB	9.0 MB	
2	0.3 MB	0.5 MB	2.3 MB	2.9 MB	3.7 MB	4.7 MB	6.0 MB	7.8 MB
1	0.1 MB	0.2 MB	1.2 MB	1.5 MB	1.8 MB	2.3 MB	3.0 MB	3.9 MB

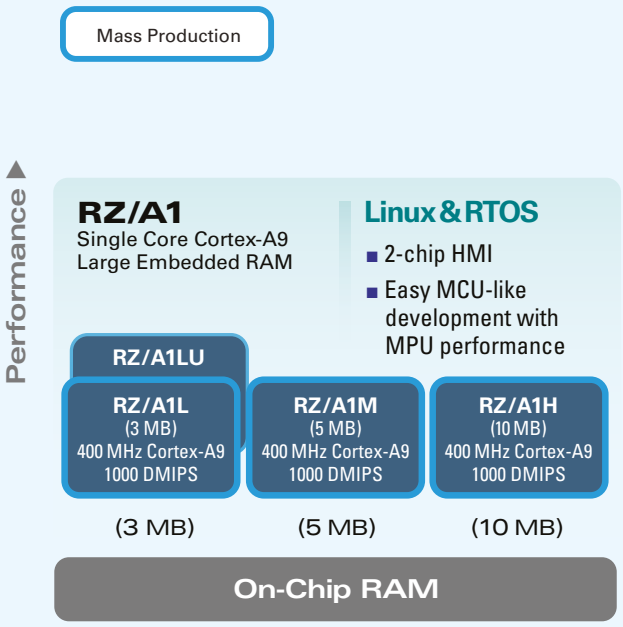
RZ/A1 HMI Solution – Easy system design and testing



BOM Component	RZ/A1 Solution
Flash	$ (SPI Flash)
RAM	n/a (internal)
Regulators	$ (3.3V, 1.2V regulator)
PCB layers	$ (as few as two)
Total BOM cost	$

RZ/A1H,and RZ/A1M block diagram





RZ/A1 Series

Development Environments & Tool

	ARM	IAR SYSTEMS	eSOL	RENESAS
Development environments	• DS-5	• IAR Embedded Workbench® for ARM®	• eBinder	• e²studio*3
Compilers	• ARM CC*1	• IAR C/C++ compiler*2	• ARM CC*1	• GNU tool*4
ICEs	• DSTREAM™ • ULINKpro™ • ULINKproD™ • ULINK2™	• I-jet™/I-jet Trace™ for ARM Cortex®-A/R/M • JTAGjet-Trace	• PARTNER-Jet2 from Kyoto Microcomputer Co., Ltd. • adviceLUNAII from DTS INSIGHT Corporation	• J-Link LITE from Segger • J-Link series from Segger*5

*1. ARM CC is included in DS-5 Starter Kit for RZ/A, which is available free of charge, and in the popularly priced DS-5 RZ/A Edition. There is also a free evaluation version that provides full functionality but is limited to 30 days of use. Contact a DS-5 sales agent for details.
*2. A free evaluation license is available provided the 30-day time-limited evaluation or the permanent 32KB size-limited evaluation (www.iar.com/EWARM)
*3. Eclipse-based development environment from Renesas (http://japan.renesas.com/e2studio)
*4. GNU TOOLS & SUPPORT Website (http://gcc-renesas.com)
*5. Renesas does not handle ICEs from Segger. Contact a sales agent for details.

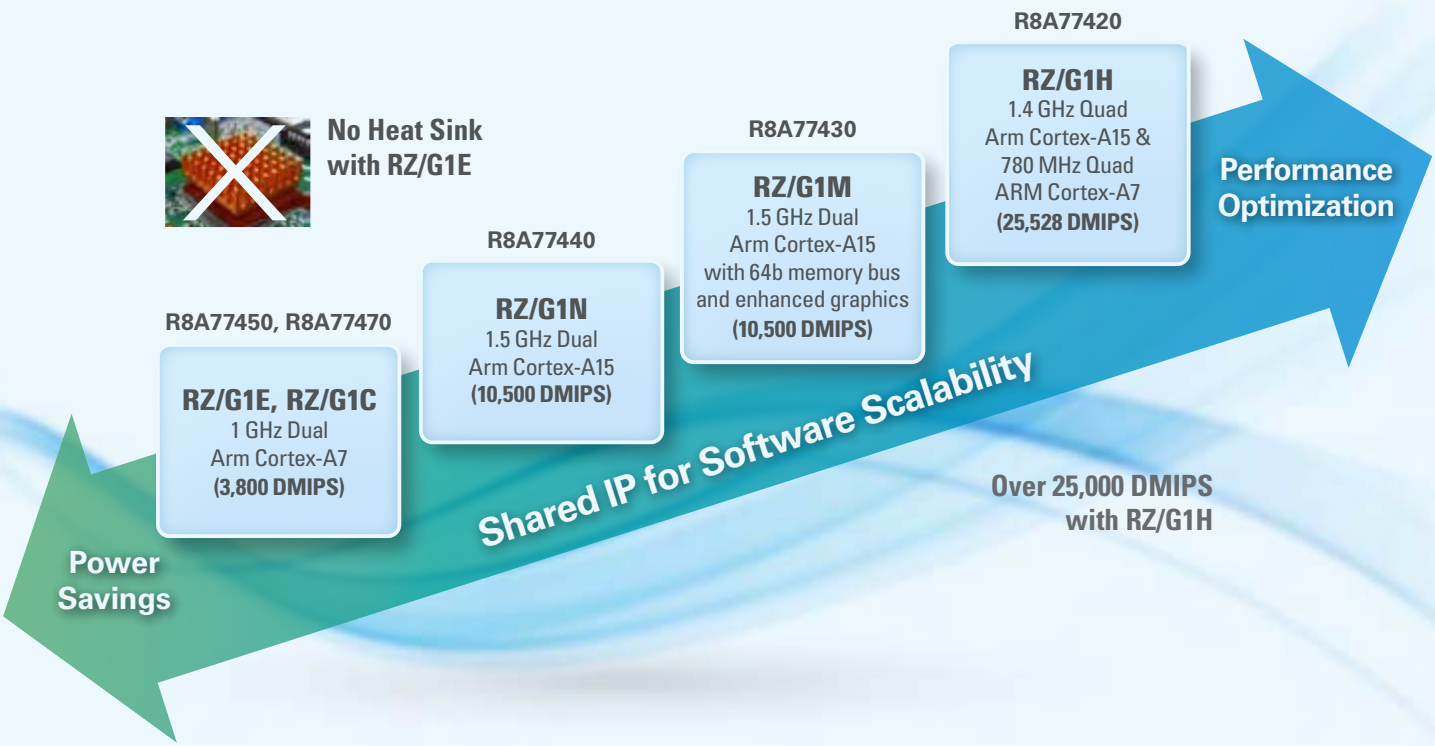
Renesas RZ/A1 Series Starter Kit

Shorten product development cycles with the Renesas Starter Kit (RSK). The RZ/A1 kit includes everything you need to jump-start your system development and ease the design and debug process.

Part Number	TFT LCD	Debugger	IDE
YR0K77210S003BE	Yes	Segger J-LINK Lite	DS-5
YR0K77210S001BE	No	Segger J-LINK Lite	DS-5
YR0K77210S011BE	Yes	Segger J-LINK Lite	e2Studio
YR0K77210S009BE	No	Segger J-LINK Lite	e2Studio
RTK772100BC00000BR	No	Segger J-LINK Lite	e2Studio
YDISPLAY-IT-RZ	Yes	Segger J-LINK Lite	e2Studio
YSTREAM-IT-RZ-V2	Yes	Segger J-LINK Lite	e2Studio

The kit includes

- 800 x 480 touch panel for HMI development (optional)
- Segger JTAG-lite debugger
- Embedded IDE and compiler with evaluation license
- Sample code and peripheral drivers

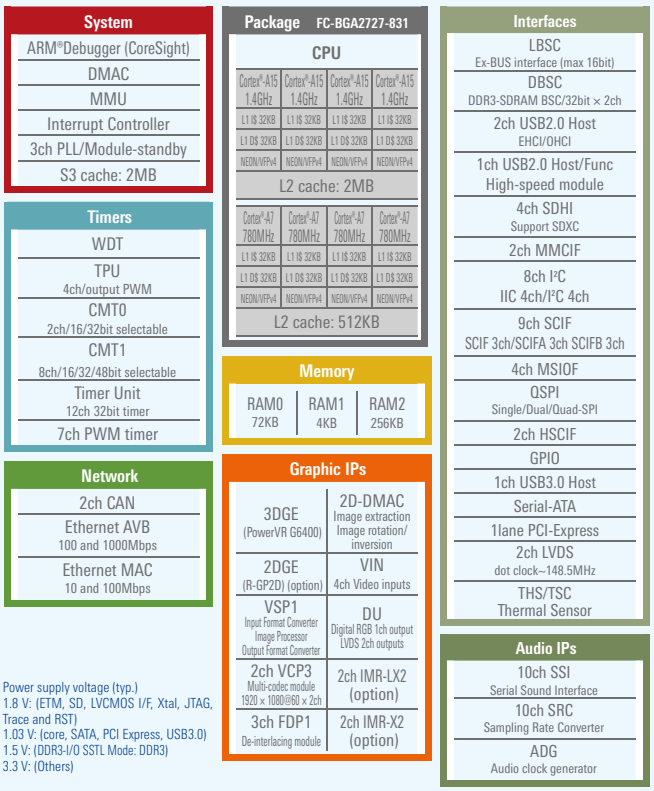


RZ/G1 Series

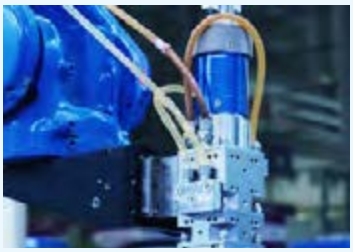
High-End 3D Graphics, Video, Embedded Vision and More

RZ/G Series MPUs extends the capabilities of RZ/A Series to deliver high-end performance for graphics, multi-stream video, and embedded vision thanks to features like camera input, 3D graphics accelerators, Full HD video codec, and GbE. Renesas also offers the RZ/G Linux platform, which is a user-friendly software development environment for customers who wish to lower the barriers and cost of Linux adoption and maintenance. The RZ/G Linux Platform enables super-long-term Civil Infrastructure (CIP) Linux support in an industrial grade verified Linux package, which complements Renesas' high quality silicon.

	RZ/G1C R8A77470	**RZ/G1E** R8A77450	**RZ/G1N** R8A77440	**RZ/G1M** R8A77430	**RZ/G1H** R8A77420
Core	Dual Cortex-A7	Dual Cortex-A7	Dual Cortex-A15	Dual Cortex-A15	Quad Cortex-A15 Quad Cortex-A7
Operating Frequency	1.0 GHz	1.0 GHz	1.5 GHz	1.5 GHz	1.4 GHz 780 MHz
Processing Performance	3,800 DMIPS	3,800 DMIPS	10,500 DMIPS	10,500 DMIPS	25,528 DMIPS
Cache Size	L1 cache I/32 KB D/32 KB L2 cache 512 KB	L1 cache I/32 KB D/32 KB L2 cache 512 KB	L1 cache I/32 KB D/32 KB L2 cache 1 MB	L1 cache I/32 KB D/32 KB L2 cache 1 MB	L1 cache I/32 KB D/32 KB L2 cache 2 MB (A15) 512 KB (A7) S3 cache 2 MB
MMU	Yes				
NEON/VFP	SIMDv2/VFPv4				
3D Graphics	SGX531, 260 Mpx/s	SGX540, 520 Mpx/s	SGX544MP2, 1240 Mpx/s	SGX544MP2, 2080 Mpx/s	SG6400, 4160 Mpx/s
Video Functions	2 ch digital video inputs	2 ch digital video inputs	3 ch digital video inputs		4 ch digital video inputs
	2 ch RGB video display interfaces	2 ch RGB video display interfaces	1 ch RGB video display interface		
	1 ch analog input		1 ch LVDS video output		2 ch LVDS video interfaces
	H.264 – 1920x1080 @ 60 x 1 ch				H.264 – 1920x1080 @ 60 x 2 ch
	Video image processing functions, including color conversion and scaling				



Embedded Vision (e.g., Gesture, Face)



Embedded Vision (Object Recognition)

Networked Video Camera Systems

High-End Human Machine Interface Displays

2-Way Video Telephony

3D Rendering for Medical Imaging

RZ/G1 Series

Development Environment

RENESAS

RZ/G EXTENDS RENESAS RZ MPU FAMILY WITH 3D GRAPHICS, H.264 VIDEO CODEC, AND HIGH-PERFORMANCE DDR3 MEMORY INTERFACES

Software Development Environment

Linux

Android

QNX

Partners & Affiliations

Design Services

Witekio
EMBEDDING SUCCESS

COGENTEMBEDDED

timesys®

System-on-Module (SoM) and Design Services

iWave
Embedding Intelligence

emtrion
embedded systems

MISTRAL
... Partners in Real Time

Graphics

Crank software inc.

Qt

TES
Electronic Solutions

Embedded Vision

embedded VISION ALLIANCE

Uncanny Vision®

Linux Platform

The Verified Linux Package is built with Civil Infrastructure Platform (CIP) Linux with super long-term
(10+ year) support for a given Linux kernel, which eliminates the need for costly upgrades.
https://www.cip-project.org/

Starter Kits

RZ/G1M Starter Kit
Part-No.: YR8A77430S000BE

RZ/G1E Starter Kit
Part No.: YR8A77450S000BE

RZ/N1 Series

The Shortest Route to Industry 4.0

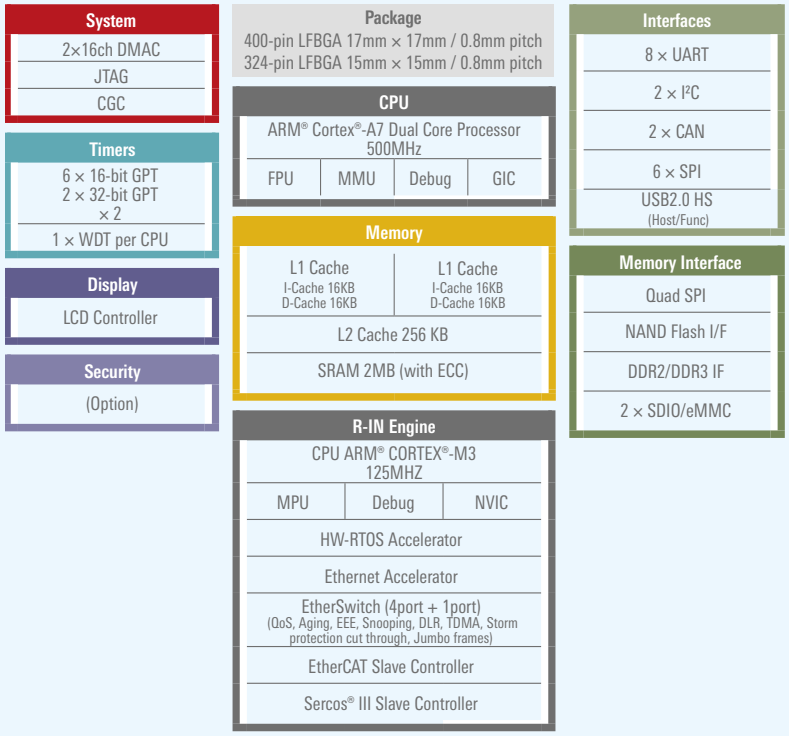
RENESAS

RZ/N1 is a scalable and proven Arm®-based System on Chip (SoC) that can be used in a variety of applications with the Cortex®-A7 Dual core and a high-speed, high-capacity memory interface. It features up to five Ethernet ports and various industrial automation protocols, so it is optimized especially for industrial network equipment such as PLC, industrial IoT gateways or simple HMI devices. Currently there are mainly two types of industrial networks. First one is used in fieldbus networks to ensure real-time control for the various automates such as motors and I/Os. And the other network are used in the control networks in order to ensure reliability of the network for the managed server, controller and so on. In existing networks, a clear separation between fieldbus networks and control networks exists. However, this divergence tends to become thinner as the industry networks evolve towards unified networks following the Industry 4.0 movement. RZ/N1 Series revolutionizes this approach as Industry's one-chip solution that supports all major industrial protocol networks

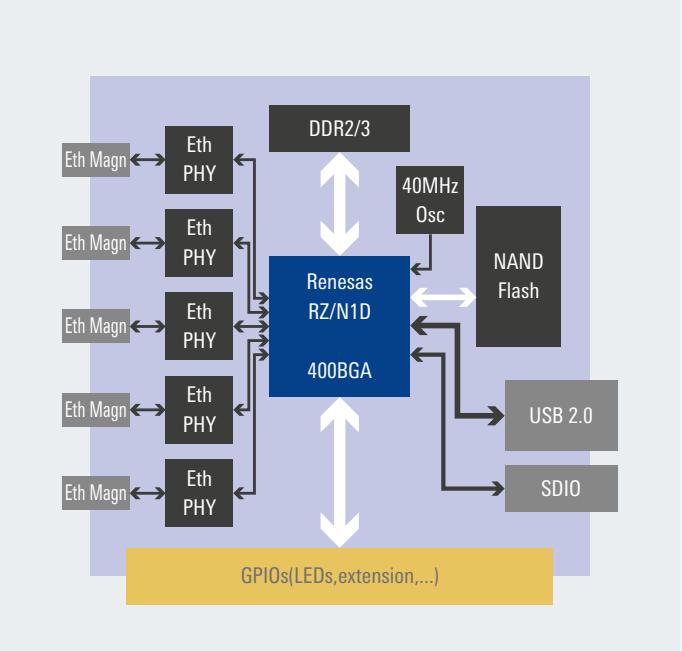
RZ/N1 Development Series

RZ/N1D Group 5 Port Ethernet and latest redundancy protocol supports Industrial Network Master application such as PLC	Cortex®-A7 Cortex®-A7	Ethernet Switch	DDR I/F	LCD
	R-IN Engine	Internal Memory 2MB	HSR/PRP/DLR	USB
RZ/N1S Group Having large size internal RAM will reduce peripherals to realize small PLC and HMI. Also built in R-IN Engine can realize Gateway and Sensor Hub	Cortex®-A7	Ethernet Switch		LCD
	R-IN Engine	Internal Memory 6MB	PRP/DLR	USB
RZ/N1L Group Supports main Industrial Ethernet Protocols by having dedicated HW (EtherCAT and Sercos III) and R-IN engine		Ethernet Switch		
	R-IN Engine	Internal Memory 6MB	DLR	USB

RZ/N1D block diagram



Application example: Programmable logic controller Block diagram



RZ/N1 Series

Development Environment

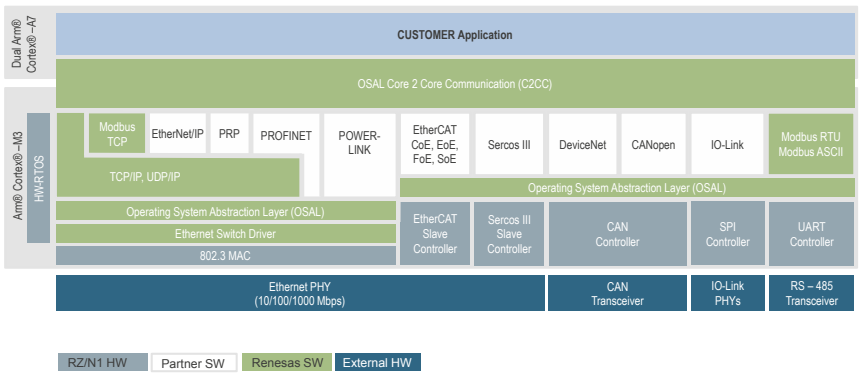
RENESAS

RZ/N1 solution kits include everything that is needed for fast evaluation and rapid prototyping of multiple industrial Ethernet protocols. Numerous industrial Ethernet protocols have been integrated under a unified communication abstraction layer. Transparent for the application software, this abstraction layer has a documented API allowing the application software to be developed without having to worry about the details of industrial Ethernet protocols.
Even more, these protocols can be easily exchanged, with minimal impact on the application software.

Solution Kit

Type	Part Number
RZ/N1D Kit	YCONNECT-IT-RZN1D
RZ/N1S Kit	YCONNECT-IT-RZN1S
RZ/N1L Kit	YCONNECT-IT-RZN1L
RZ/N1 Expansion Board	YCONNECT-IT-RZN1-EB

RZ/N1 Software Structure



Multiple Industrial Ethernet Protocols

SERCOS interface
PROFINET
ETHERNET POWERLINK
EtherNet/IP
EtherCAT
Modbus

RZ/T Series

Industrial Drives Solution including Multi-Protocol Industrial Ethernet

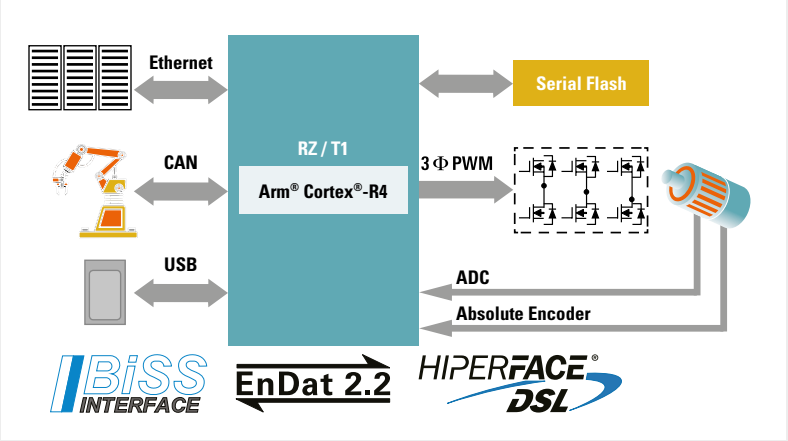
The RZ/T1 Series has the Arm® Cortex®-R4 Processor with FPU core designed for real-time processing and capable of high-speed operation at up to 600 MHz. Code and data access does not need to be performed via caches with their unpredictable latencies memory but through large tightly coupled memories with definitive real-time behavior. An optional internal SRAM extends the on-chip memory resources.

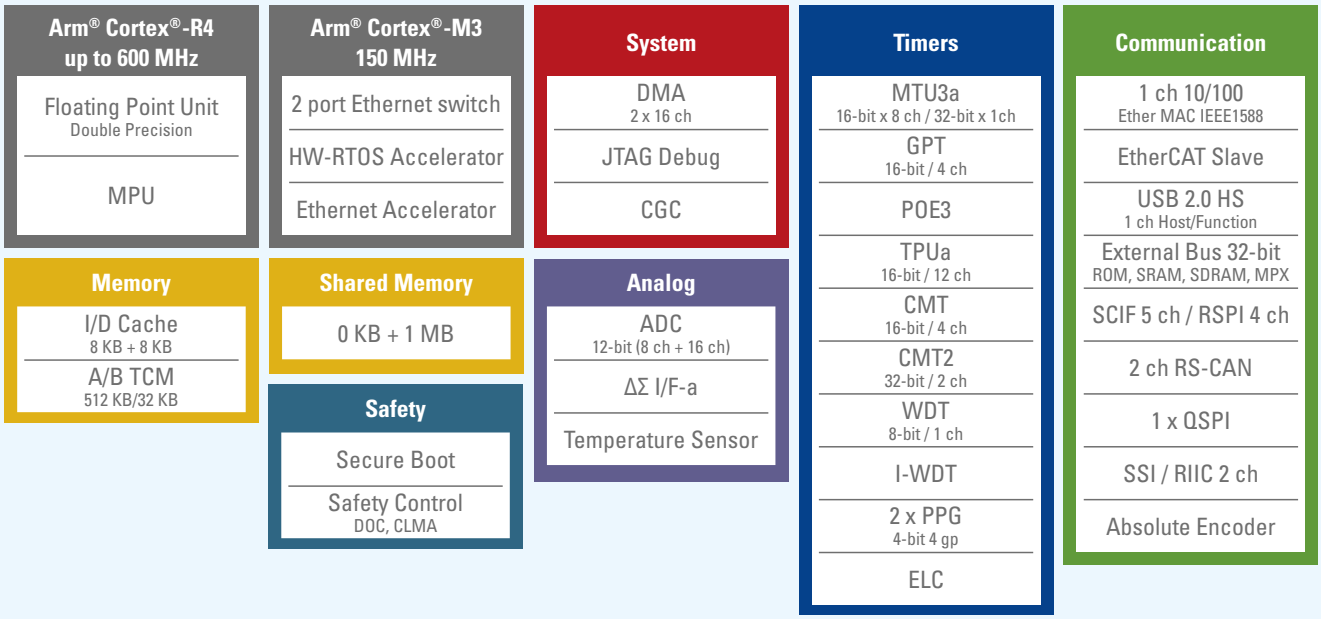
RZ/T1 devices that are equipped with a built-in R-IN engine, an accelerator for industrial Ethernet communications, can perform industrial Ethernet processing without loss of real-time performance by Hardware RTOS (HW-RTOS). The RZ/T1 can as well be equipped with an optional EtherCAT block.

RZ/T1 devices that are equipped with a configurable absolute encoder interface are perfectly suited for precision motion control applications. The range of industry standards that are supported by the configurable encoder interface includes EnDat2.2, BiSS®-C, A-format™, FA-Coder and HIPERFACE® DSL.

Digital Interfaces for AC Servo Solutions

The series includes all relevant industry standard interfaces to support AC servo applications. Especially the integrated digital encoder interfaces like EnDat 2.2 and BiSS allow a simple and low cost implementation of the driver feedback system in a single chip.





RZ/T Series

Solution Kit RZ/T1 for Motion Control

The RZ/T1 Solution Kit provides full access to the single/dual core drive solution with easy access to multiple industrial Ethernet standards and encoder interface protocols. It is the perfect kit for developers who are new to the RZ/T1. The kit includes an a BLDC motor with incremental encoder, CD-ROM with software tools, program examples, documentation and a video. You can start evaluating the RZ/T1 immediately after opening the box.

Part Name	Part Number	RZ/T1-R High-end Device
Renesas Starter Kit+ for RZ/T1 with Segger J-LINK Lite	RTK7910018S00000BE	R7S910018CBG
Renesas Starter Kit+ for RZ/T1 without Segger J-LINK Lite	RTK7910018S90000BE	R7S910018CBG
Drive It! Renesas Solution Kit	YDRIVE-IT-RZT1	R7S910018CBG

Development Environments (Integrated Development Environments)

	IAR SYSTEMS	ARM	RENESAS
Development environments	• IAR Embedded Workbench® for ARM®	• DS-5	• e² studio*1
Compilers	• IAR C/C++ compiler*2	• ARM CC*3	• GNU tool*4
Other tools	• AP4 code generation tool from Renesas is compatible.	• AP4 code generation tool from Renesas is compatible.	• Code generation function available as a plug-in.
ICEs	• I-jet™/I-jet Trace™ for ARM Cortex®-A/R/M • JTAGjet-Trace	• DSTREAM™ • ULINKpro™ • ULINKproD™ • ULINK2™	• J-Link LITE from Segger • J-Link series from Segger*5

*1. Eclipse-based development environment from Renesas (http://japan.renesas.com/e2studio)
*2. A free evaluation license is available provided the 30-day time-limited evaluation or the permanent 32kB size-limited evaluation (www.iar.com/EWARM)
*3. Arm CC is available in a free evaluation version that provides full functionality but is limited to 30 days of use. Contact a DS-5 sales agent for details.
*4. GNU TOOLS & SUPPORT Website (https://gcc-renesas.com)
*5. Renesas does not handle ICEs from Segger. Contact a sales agent for details.

Multiple Industrial Ethernet Protocols

EtherCAT®
PROFINET®
EtherNet/IP™
Modbus®

Renesas Synergy™
The Platform Solution

The Renesas Synergy™ Platform is a complete and qualified platform for the development of embedded and IoT applications. It was designed to provide engineers with a platform that already has basic system elements implemented, configured and tested, so they can eliminate the time normally needed and move almost immediately to product design, reducing time to market by months. Defining feature of Synergy™ is the combination of software and Arm® Cortex ® M based microcontrollers. The Synergy™ families are offering everything for your IoT or Industry 4.0 applications between ultra-low power and high performance.

But where is the difference?

The software is what makes it special. Customers can start programing from API Level upwards, which is saving valuable development time used for standard software. All Synergy™ microcontrollers come along with the software package in source code form, ready for use in a productive environment. When buying the microcontroller products, the customer also acquires the entire Synergy™ Software Package without any additional costs for licenses.

Synergy™ Platform Elements

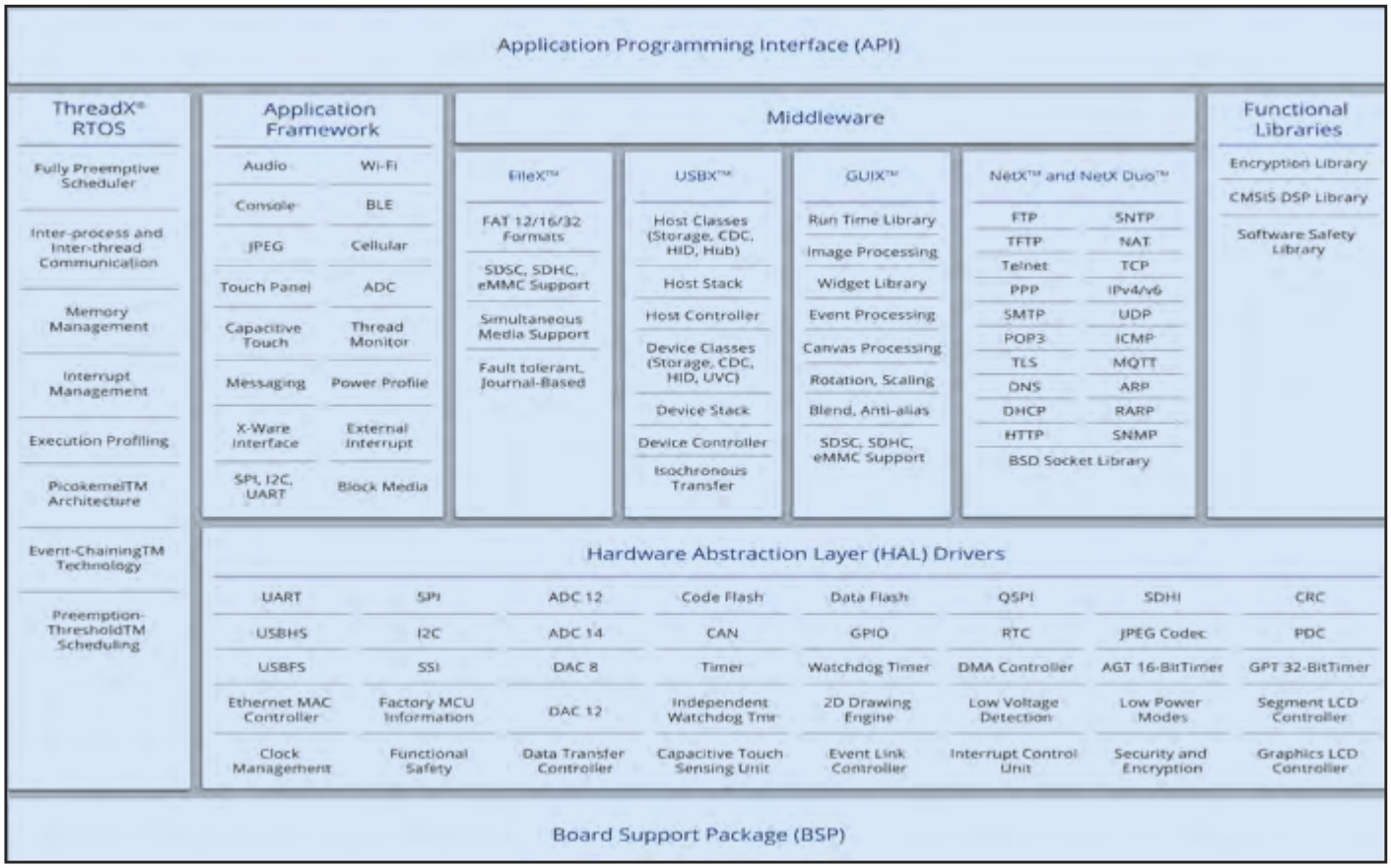
Synergy™ Software
- Qualified Synergy™ Software Package (SSP) for warranted operation
- Complete package fully integrated and maintained
- Applications can be written at the package API level

Synergy™ Microcontrollers
- Wide MCU spectrum based on 32-bit Arm® Cortex®-M processor family
- Completely scalable and pin compatible
- On-chip Flash memory up to 4 MB
- Safety, security & cryptographic acceleration
- Ultra-low power

Synergy™ Tools & Kits
- Integrated Solution Development Environment (ISDE) with configuration guidance and context-aware documentation
- Starter Kits (SK) and Development Kits (DK) enabling immediate access to the entire Synergy™ Software Package

Synergy™ Solutions
- Product Example (PE) kits: Complete design journeys representative of end-product designs
- Application Example (AE) kits: Technology building-block examples to expand upon

Synergy™ Gallery
- Web access to Synergy™ specific software, tools, licensing, plus third party software and services
- Future growth to deliver a complete, secure, cloud-accessed infrastructure for end-products to use



Synergy™ Software

RENESAS synergy™

Through configuration of this platform the user can easily build a custom project with all needed components. What the user should do further is only to write the application software base on it. So it can accelerate embedded development, inspire innovation and enable differentiation.

ThreadX® RTOS

Premium commercial multitasking real-time kernel with preemptive scheduling and small memory footprint. Stable heart-beat of the system.

Stacks & Middleware

X-Ware™ and Renesas-originated specialized software for TCP/IP, USB, color graphics, file sys, DSP, touch, security, safety and more. Completely optimized and integrated.

Board Support Package

Customized for every Synergy™ hardware kit and MCU, easily tailored for end-product.

Software API

Standardized 'C' language APIs for X-Ware™, App. Framework, Middleware, Libraries, DSP, HAL, BSP, and MCU regs. Abstract the dependencies, ensure portability and accelerate product development.

Hardware Abstraction Layer

Efficient low-level drivers for all peripherals and system services. Eliminates need for deep study.

Application Framework

System level services linking RTOS to HAL for inter-process messaging, security services, audio playback, serial comm, power mgmt, JPEG conversion, cap touch, console, more. Saves time.

Qualified Software Add-on

Software components augment the SSP with functionality such as connectivity stacks, specialized security and control algorithms from Renesas. Tested and guaranteed by Renesas.

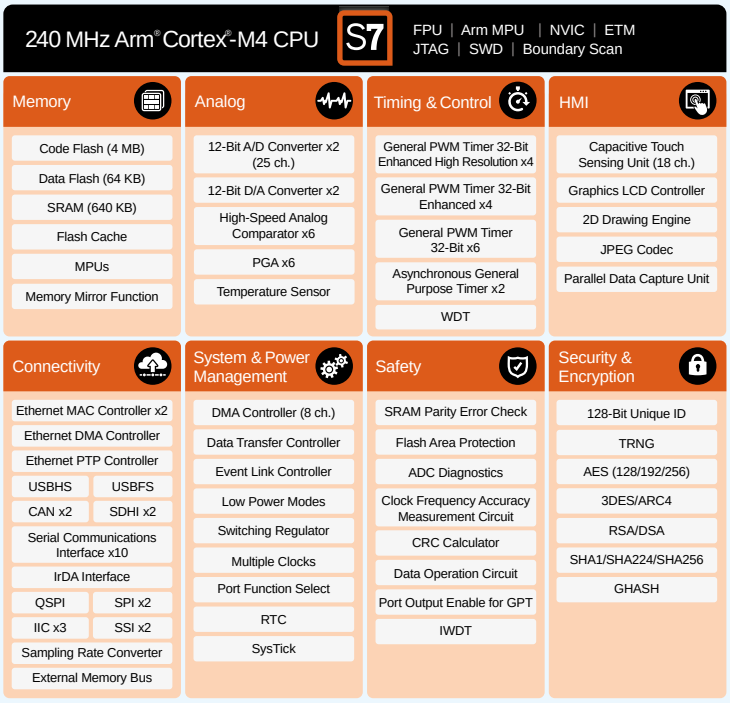
IDE
Integrated Development Environment
GNU Comliper/IAR Compiler

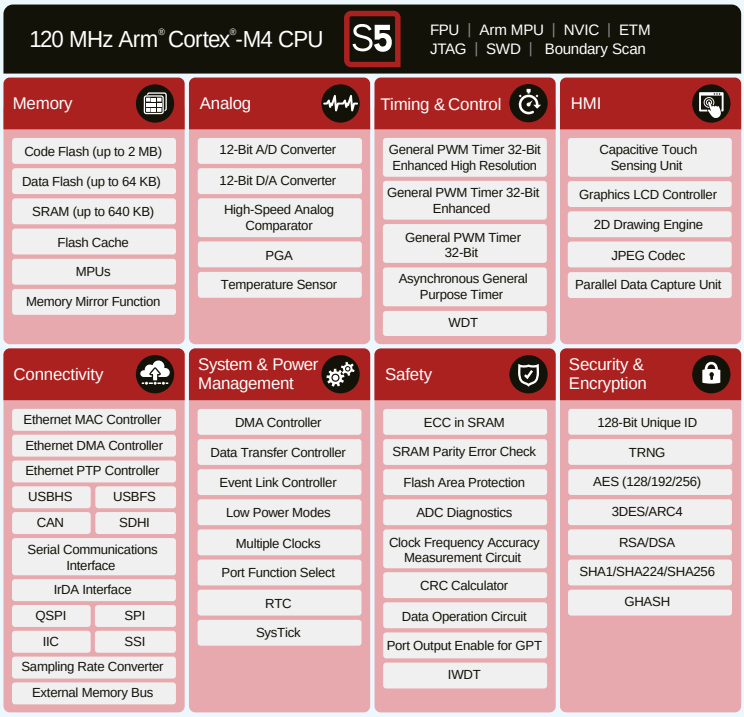
+

Renesas Synergy™
Solution-Oriented Components

=

ISDE
Integrated Solution Development Environment





Synergy Microcontrollers

S7 | S5 | S3 | S1

RENESAS synergy™

S7

The high-performance 240 MHz S7 Series MCUs feature secure connectivity and industry-leading flash memory density.

S5

The highly integrated 120 MHz S5 Series MCUs balance processing performance with large memory and an extensive array of built-in features.

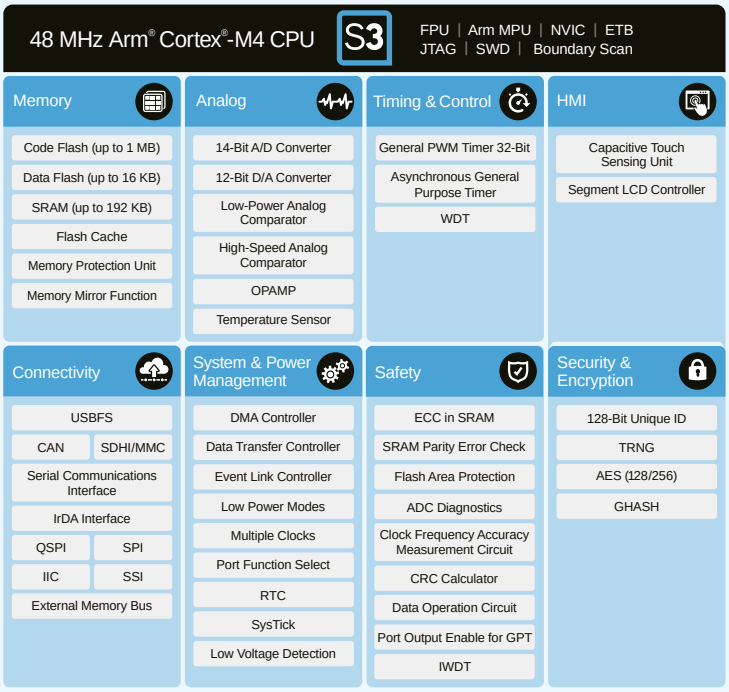
S3

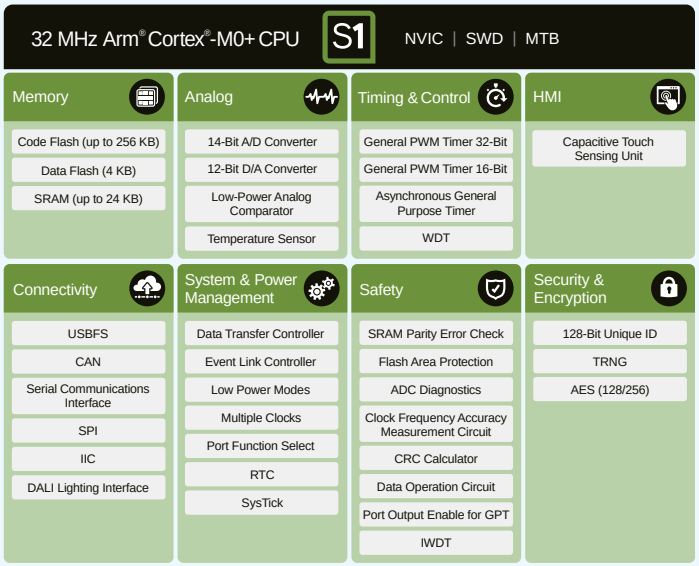
High-efficiency 48 MHz S3 Series MCUs are low-power chips that integrate up to 1 MB of Flash and 192 kB of SRAM.

S1

Ultra-low-power 32 MHz S1 Series MCUs operate down to 1.6 V and feature low-power operating modes and fast wake-up times.

Family	Series	Part Number	Max. Freq. (MHz)	Flash Size (kB)	Data Flash (kB)	RAM Size (kB)	A/D Converter	I/O	16-bit Timer (ch)	32-bit Timer (ch)	CAN	Ethernet	UART	USB HS/FS	QSPI/SPI	I²C	SSI	Package
S1	S124	R7FS1247xxx	32	64 - 128	4	16	(11- 18) x 14 Bit	25 - 51	4 - 6	1	1	NO	3	NO/YES	NO/2.0	2	NO	LFQFP, HWQFN, WFLGA
	S128	R7FS12878xxx	32	256	4	24	(10 -21) x 14 Bit	24 - 53	1 - 3	1	1	NO	3	NO/YES	NO/1-2	1 - 2	NO	QFN, LQFP, LGA
S3	S3A1	R7FS3A17Cxxx	48	1024	8	192	(18-28) x 14 Bit	64 - 145	6	4	1	NO	6	NO/YES	Optional/2	6	0 - 1	QFN, LQFP, LGA
	S3A3	R7FS3A37Axxx	48	512	8	96	(18-28) x 14 Bit	52 - 126	6	4	1	NO	6	NO/YES	NO/2	2	0 - 1	QFN, LQFP, LGA, BGA
	S3A6	R7FS3A678xxx	48	256	8	32	(11-25) x 14 Bit	28 - 84	2 - 6	2	1	NO	4	NO/YES	NO/2	2	0 - 1	HWQFN, LFQFP, TFLGA
S5	S5D5	R7FS5D57xxx	120	512 - 1024	32	384	(9-22) x 12 Bit	79 - 110	NO	4	2	YES	10	NO/YES	YES/2.0	2 - 3	1	LFQFP, TFLGA
	S5D9	R7FS5D97xxx	120	1024 - 2048	64	640	(19-24) x 12 Bit	76 - 133	NO	5 - 6	2	YES	10	Optional/YES	YES/2.0	2 - 3	1 - 2	LFQFP, TFLGA, LFBGA
S7	S7G2	R7FS7G27xxx	240	3072 - 4096	64	640	(16-25) x 12 Bit	70 - 172	NO	5 - 6	2	YES	10	Optional/YES	YES/2.0	2 - 3	1	LQFP, LGA, BGA

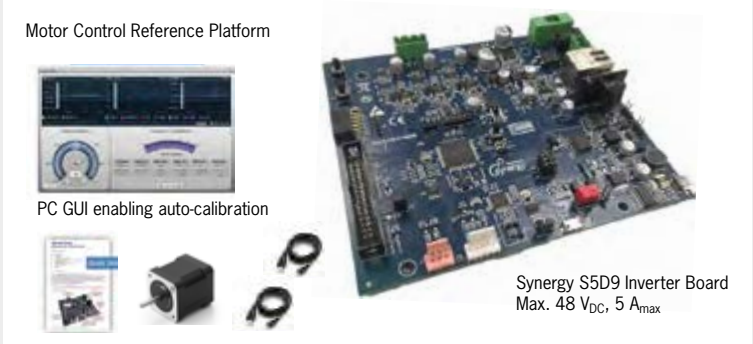




Development Tools & Kits

RENESAS synergy™

Capacitive Touch – AE-CAP1
Part No. YSAECAP1S11

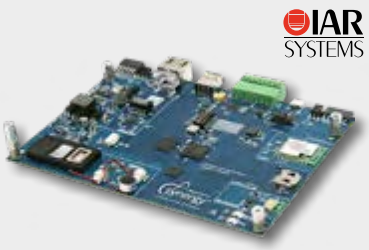


S5 Synergy Inverter Kit YROTATE-IT-S5D9
Part No. YROTATE-IT-S5D9

Development Kit – S7G2
Part No. YSDKS7G2S30

Starter Kit – S5D9
Part No. YSPKS5D9E10

IAR Compiler now included!



Human Machine Interface PE-HMI1 – S7G2
Part No. YSPEHMI1S20WS2

Synergy Cloud Example AE-CLOUD1 – S5D9
Part No. YSAECLOUD1

STM32 – 32-bit Arm® Cortex® MCUs

Releasing Your Creativity

The STM32 family of 32-bit Flash microcontrollers based on the Arm® Cortex®-M processor is designed to offer new degrees of freedom to MCU users. It offers a 32-bit product range that combines high performance, real-time capabilities, digital signal processing, and low-power, low-voltage operation, while maintaining full integration and ease of development.

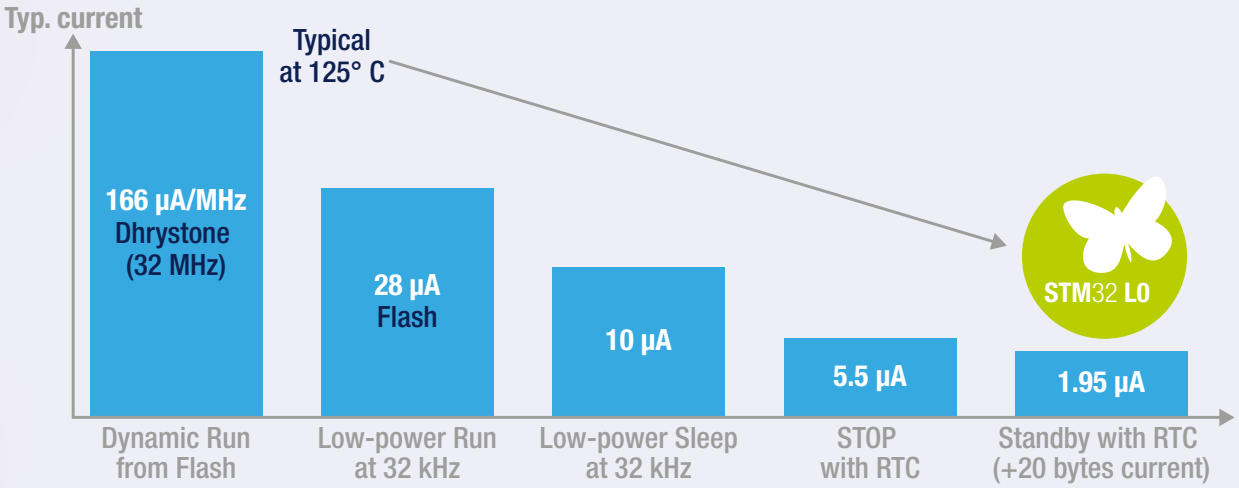
The unparalleled and large range of STM32 devices, based on an industry-standard core and accompanied by a vast choice of tools and software, makes this family of products the ideal choice, both for small projects and for entire platform decisions.

STM32 THE LEADING CORTEX-M PORTFOLIO

Common core peripherals and architecture:	High-performance	Mainstream	Ultra-Low-Power
Communication peripherals: USART, SPI, I²C	400 MHz Cortex-M7 L1-Cache / 216 MHz Cortex-M7 L1-Cache / Up to 180 MHz Cortex-M4 / 120 MHz Cortex-M3 CPU	72 MHz Cortex-M4 / Up to 72 MHz Cortex-M3 CPU / 48 MHz Cortex-M0 CPU	120 MHz Cortex-M4 CPU / 80 MHz Cortex-M4 CPU / 32 MHz Cortex-M3 CPU / 32 MHz Cortex-M0+ CPU
Multiple general-purpose timers	Up to 2-Mbyte dual-bank Flash / Up to 1-Mbyte Flash	Up to 512-Kbyte Flash / Up to 256-Kbyte Flash	Up to 2-Mbyte dual-bank Flash / Up to 1-Mbyte dual-bank Flash / Up to 512-Kbyte Flash / Up to 192-Kbyte SRAM
Integrated reset and brown-out warning	Up to 1-Mbyte SRAM / Up to 512-Kbyte SRAM / Up to 384-Kbyte SRAM / Up to 128-Kbyte SRAM	Up to 80-Kbyte SRAM CCM-RAM / Up to 96-Kbyte SRAM	Up to 640-Kbyte SRAM / Up to 320-Kbyte SRAM / Up to 80-Kbyte SRAM / Up to 20-Kbyte SRAM
Multiple DMA	2x USB 2.0 OTG FS/HS / USB 2.0 FS device Crystal less	USB 2.0 FS / USB 2.0 OTG FS	USB 2.0 OTG Crystal less / USB 2.0 OTG FS / USB 2.0 FS Device
2x watchdogs Real-time clock	2x 16-bit advanced MC timer / HR timer	3x 16-bit advanced MC timer	2x 16-bit advanced MC timer
Integrated regulator PLL and clock circuit	DFSDM HDMI-CEC Ethernet S/PDIF / Ethernet	3x DAC 7x comp. 4x PGA / HDMI-CEC Ethernet	DFSDM Op-amps comp. / Op-amps comp. / Comp. HDMI-CEC
Up to 3x 12-bit DAC	Quad-SPI FMC MDIO Camera IF SDIO / FSMC Camera IF SDIO / FSMC SDIO	FSMC CAN / FSMC SDIO	2x Octo-SPI FSMC SDIO 2x SAI / Quad-SPI FSMC SDIO 2x SAI / CAN DAC
Up to 4x 12-bit ADC (Up to 5 MSPS) or Up to 3x 16-bit ADC (Up to 3.6 MSPS) Depending on series	Crypto-hash TRNG Up to 3x CAN / Crypto-hash TRNG Up to 2x CAN / 2x I²S	HR-Timer / 2x I²S 2x CAN	SHA-256 AES-256 TRNG CAN / SHA-256 AES-256 TRNG 2x CAN / AES-128 / TRNG AES-128
Main oscillator and 32 kHz oscillator	4x SAI 3x I²S 2x FDCAN LCD-TFT / 2x SAI 2x I²S LCD-TFT MIPI-DSI / 2x SAI 5x I²S LCD-TFT MIPI-DSI	ADC 3x 16-bit ΣΔ 4x 12-bit (5 MSPS)	MIPI-DSI LCD-TFT Chrom-GRC™ / Up to LCD 8x40 / LCD 8x48 / 4x52
Low- and high-speed internal RC oscillators	3x 16-bit-ADC 16-bit Op-amps comp.		
-40 to +85 °C and up to 125 °C operating temperature range			
Low voltage 2.0 to 3.6 V or 1.65/1.7 to 3.6 V Depending on series			
Temperature sensor			

STM32L0 - WORLD CHAMPION AT HIGH TEMPERATURE (125 °C)

Fast Wakeup time:
- Stop to Run from Flash: 5 µs (3.5 µs from RAM)
- Standby to Run: 50 µs



STM32L0 Series Cortex®-M0+ MCUs

Arm® Cortex®-M0+ Core and STM32 Ultra-Low-Power Features

The exclusive combination. The result is a genuine ultra-low-power MCU product line STM32L0 with record breaking performances. Combining a genuine ultra-low-power architecture with low-current analog peripherals and four low-power modes, the STM32L0 is ideal for applications such as mice, keyboards, gas/water meters, building automation, alarms, detectors and health care or fitness applications.

For applications that require a 15 to 20 year life duration, or need to run in extremely high temperature conditions, here again the STM32L0 is the best choice thanks to ST's process technology.

Cortex®-M0+ (32 MHz with MPU)

- Low voltage 1.65 to 3.6 V
- Dynamic voltage scaling
- 5 clock sources
- Advanced RTC w/ calibration
- 12-16-bit more ADC 1Msps down to 1.65 V
- Multiple USART, SPI, I²C
- Multiple 16-bit timers
- Operating temp. - 40 to 125°C
- 2 watchdogs
- Program voltage detector
- Reset circuitry
- AES-128

Low-Power Timer (DOWN TO STOP MODE)

- Ultra-low-power consumption
- Low-power pulse counter (available in Stop mode)
- Independent 16-bit timer, available also in Stop mode
- Pulse counter with no clock running or clocked by LSE, LSI, HSI, APB
- System wakeup from Stop mode
- Programmable digital glitch filter
- Encoder mode
- Low-power UART & ADC

Product lines		Flash (kB)	RAM (kB)	EEPROM (kB)	12-bit ADC 1.14 MSPS	LP UART	LP 16-bit timer	12-bit DAC	Touch sense	True RNG	USB 2.0 FS Crystalless	Segment LCD Driver
Access	STM32L0x1	Up to 192	Up to 20	Up to 6	x	x	x					
USB	STM32L0x2	Up to 192	Up to 20	Up to 6	x	x	x	x	x	x	x	
USB & LCD	STM32L0x3	Up to 192	Up to 20	Up to 6	x	x	x	x	x	x	x	Up to 4x52 or 8x48

Hardware Evaluation Boards & Software Development Tools

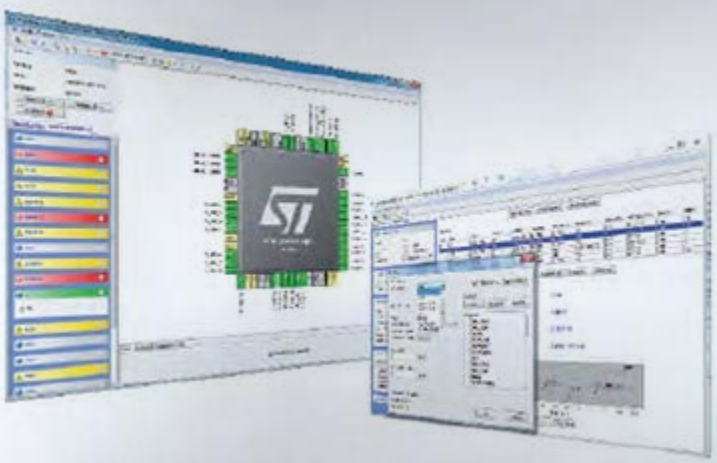
ARM mbed enabled

LONGEVITY 10 YEARS COMMITMENT

Discovery Kit
Creative demos
Order No.:
STM32L0538-DISCO

STM32CubeMX
featuring power consumption calculation

www.st.com/stm32cube
www.st.com/stm32snippets



Discovery Kit
Order No.:
STM32L152C-DISCO

STM32 L1

STM32L1 Series Cortex®-M3 MCUs

STM32 Ultra-Low-Leakage MCUs

ST's Arm® Cortex®-M3-based STM32 L1 series uses ST's proprietary ultra-low-leakage process technology with an innovative autonomous dynamic voltage scaling and 5 low-power modes offering unprecedented platform flexibility to fit any application. The STM32 L1 series extends the ultra-low-power concept with no compromise on performance.

As for the STM32 L0 and STM8 L, the STM32 L1 offers dynamic voltage scaling, an ultra-low-power clock oscillator, LCD interface, comparator, DAC and hardware encryption.

More than just ultra-low-power MCUs, the STM32 L1 series offers a wide portfolio of features, memory sizes and package pin counts. Combining ultra-low-power and performance, the portfolio covers from 32 to 512 Kbytes of Flash memory (with up to 80 Kbytes of SDRAM and 16 Kbytes of true embedded EEPROM) and from 48 to 144 pins.

This innovative architecture (voltage scaling, ultra-low-power MSI oscillator) gives your design more performance for a very low power budget. The large number of embedded peripherals, such as USB, LCD interface, op amp, comparators, ADC with fast on/off mode, DAC, capacitive touch and AES, makes the STM32 L1 series an expandable platform to fit all your requirements.

STM32L1 Block Diagram

Product lines	Flash (kB)	RAM (kB)	EEPROM (kB)	Memory I/F	Op Amp	Comp.	Temp. Sensor	Capacitive touch	Segment LCD Driver	AES-128
STM32L100 Value line	32 to 256	4 to 16	2						Up to 8 x 28	
STM32L151	31 to 512	15 to 80	3 to 16	SDIO FSMC	x	x	x	x		
STM32L152	32 to 512	16 to 80	4 to 16	SDIO FSMC	x	x	x	x	Up to 8 x 40	
STM32L162	256 to 512	Up to 20	8 to 16	SDIO FSMC	x	x	x	x	Up to 8 x 40	x

Arm® Cortex®-M3 (32 MHz with MPU)

- Low voltage 1.65 to 3.6 V
- Dynamic voltage scaling
- 5 clock sources
- Advanced RTC w/ calibration
- Multiple USART, SPI, I²C
- 16- and 32-bit timers
- - 40 to 85°C oper. temp. up to 105°C in LP modes
- 2 watchdogs
- Brown-out reset
- Programmable voltage detector (PVD)
- DMA
- Reset circuitry POR/PDR
- 12-bit ADC, 1 MSPS
- 12-bit DAC

OUTSTANDING LOW-POWER MODES

Wake-up time		
250 µs	VBAT	2 nA / 200 nA*
14 µs	Shutdown	8 nA / 200 nA*
14 µs	Standby	28 nA / 280 nA*
5 µs	Standby + 16-Kbytes RAM	200 nA / 450 nA*
4 µs	Stop 2 (full retention)	1.0 µA / 1.28 µA*
6 cycles	Stop 1 (full retention)	4.3 µA / 4.7 µA*
	Sleep	10 µA / MHz**
	Run at 24 MHz	36 µA / MHz**
	Run at 80 MHz	38 µA / MHz**

* without RTC / with RTC ** ext SMPS

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STM32 L4

STM32L4 Series Cortex®-M4 MCUs

32-bit MCUs with Ultra-Low-Power at 100 DMIPS with DSP and FPU

ST has built a new architecture to reach best-in-class ultra-low-power figures thanks to its high flexibility. STM32L4 MCUs have scored 150 (world record) in the standardized EEMBC™ ULPBench® tests that compare the efficiency of ultra-low-power microcontrollers. Moreover, the STM32L4 series shatters performance limits in the ultra-low-power world. It delivers 100 DMIPS based on its Arm® Cortex®-M4 core with FPU and ST ART Accelerator™ at 80 MHz.

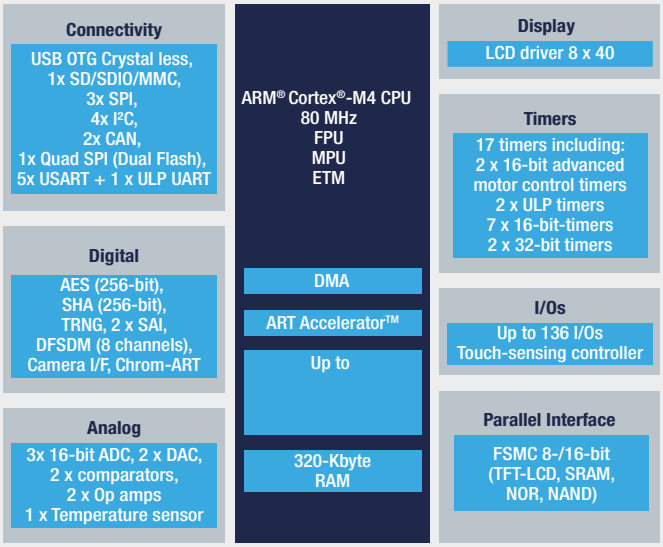
Arm® Cortex®-M4 (DSP + FPU) - 80 MHz

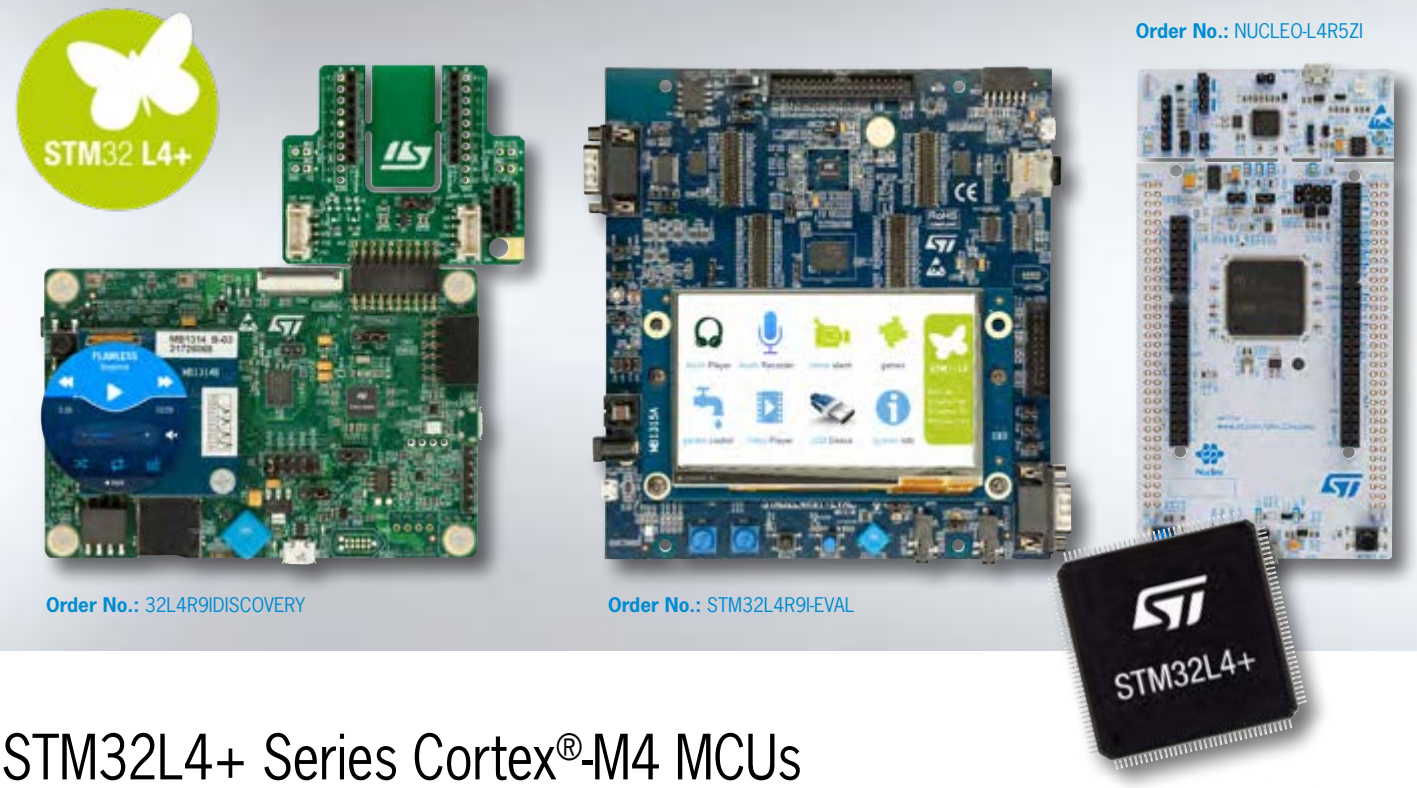
- ART Accelerator™
- USART, SPI, I²C
- Quad-SPI
- 16- and 32-bit timers
- SAI + audio PLL
- SWP
- 2x CAN
- 2x 12-bit DACs
- Temperature sensor
- Low voltage 1.71 to 3.6 V
- VBAT mode
- Unique ID
- Capacitive touch-sensing
- AES 128/256
- SHA-256

Product lines	Flash (kB)	RAM (kB)	Memory I/F FSMC	Op Amp	CAN	Sigma Delta I/F	12-bit ADC 5 MSPS 16-bit HW oversampling	DAC	SAI	USB 2.0 OTG FS	USB Device	Segment LCD Driver	Chrom-ART
STM32L4x6 - USB OTG + Segment LCD lines													
STM32L496**	512 to 1024	320	x	2	2	8 x ch	3	2	2	x		Up to 8 x 40	x
STM32L476*	256 to 1024	128	x	2	1	8 x ch	3	2	2	x		Up to 8 x 40	
STM32L4x5 - USB OTG lines													
STM32L475	256 to 1024	128	x	2	1	8 x ch	3	2	2	x			
STM32L4x3 - USB Device + Segment LCD lines													
STM32L433*	128 to 256	54		1	1		1	2	1		x	Up to 8 x 40	
STM32L4x2 - USB Device lines													
STM32L452*	256 to 512	160		1	1	4 x ch	1	1	1		x		
STM32L432*	128 to 256	64		1	1		1	2	1		x		
STM32L4x1 - Access lines													
STM32L471	512 to 1024	128	x	2	1	8 x ch	3	2	2				
STM32L451	256 to 512	160		1	1	4 x ch	1	1	1				
STM32L431	128 to 256	64		1	1		1	2	1				

Note: * HW crypto/hash functions are available on STM32L486, STM32L443, STM32L462 and STM32L442 - ** on STM32L4A6

STM32L4 Block Diagram





Order No.: NUCLEO-L4R5ZI

Order No.: 32L4R9IDISCOVERY

Order No.: STM32L4R9I-EVAL

STM32L4+ Series Cortex®-M4 MCUs

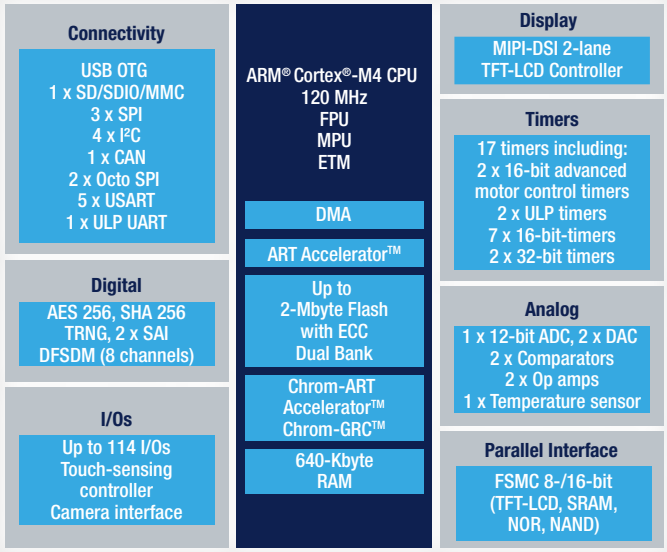
A Great Extension of the Ultra-Low-Power Family

STM32L4+ MCU series stretches the state-of-art in ultra-low-power technology to provide more performance. Successfully mixing ultra-low power capabilities with advanced processing capabilities, 2D-graphic acceleration, significantly large memory integration and rich connectivity, the new STM32 product series will help you develop richer functionalities and superior user experience in consumer, medical and industrial battery powered applications. The STM32L4+ products support up to 125°C ambient temperature and are available with 640 Kbytes of internal SRAM, 1 Mbyte to 2 Mbytes internal Flash memory and in packages offering from 100 to 169 pins.

Features

- CPU: Arm® 32-bit Cortex®-M4 with FPU on 120 MHz
- Memory: up to 2 MB Flash and 640 kB RAM
- Low voltage: 1.71 V to 3.6 V
- 20 serial interfaces and CAN, OctoSPI, USB OTG 2.0 FS
- 12-bit ADC with 5 Msps, PGAs and comparators
- MIPI® DSI Host Controller up to 500 Mbits/s
- Temperature range: - 40 °C to +125°C
- Tools: NUCLEO-L4R5ZI, 32L4R9IDISCOVERY, STM32L4R9I-EVAL

STM32L4R9 Block Diagram



STM32L4+ vs other STM32L4

Unit Parameters	STM32L47x	STM32L49x	STM32L4Rx
Max. Freq. (MHz)	80	80	120
FLASH Size (kB)	1024	1024	2048
SRAM Size (kB)	128	320	640
QPI	Single Flash	Double Flash	2x Octo SPI for FLASH and RAM
Chrom ART	-	1	Chrom GRC (circular display)
TFT Controller	-	1	MIPI DSI

Part Number	Max. Freq. (MHz)	FLASH size (kB)	Data Flash (kB)	RAM size (kB)	A/D Converter	I/O	16-bit Timer	32-bit Timer	CAN	Ethernet	UART	LIN	USB	SPI	I²C	SSI	Package
STM32L4Rx	120	1024-2048	-	640	16x12 bit	77-140	11x16 bit	2	1	-	6	-	USB OTG FS	3	4	-	UFBGA 132-169 LQFP 100-144 WLCSP 144

TYPICAL CONSUMPTION VALUES ACROSS STM32F0 POWER MODES

VBAT	**0.5 µA**	at 1.65 V with LSE clock @32 kHz, RTC on
STANDBY	**2.5 µA**	at 2 V
STOP no RTC	**4.9 µA**	RAM retention at 2 V, oscillator off, V_{DDA} monitoring
STOP with RTC	**5.4 µA**	RAM retention at 2 V, oscillator off, V_{DDA} monitoring
SLEEP	**500 µA**	with HSI clock at 8 MHz, PLL off
RUN	**250 µA/MHz**	at f_{CPU}=48 MHz, peripherals off

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Discovery Kit
Order No.: STM32F072B-DISCO

STM32F0 Series Cortex®-M0 MCUs

STM32 Entry-Level MCUs

With the new Value line of STM32 F0 microcontrollers, the STM32 Cortex®-M family reduces prices to unprecedented levels. The STM32F030 Value line is a low-cost product line, pin-to-pin compatible with the STM32 F1 and F3 product lines. Based on the Arm® Cortex®-M0 core running at 48 MHz, the STM32F030 Value line is intended for cost-sensitive applications traditionally addressed by 8-/16-bit microcontrollers while providing the essential features and performance of the STM32 F0 product line.

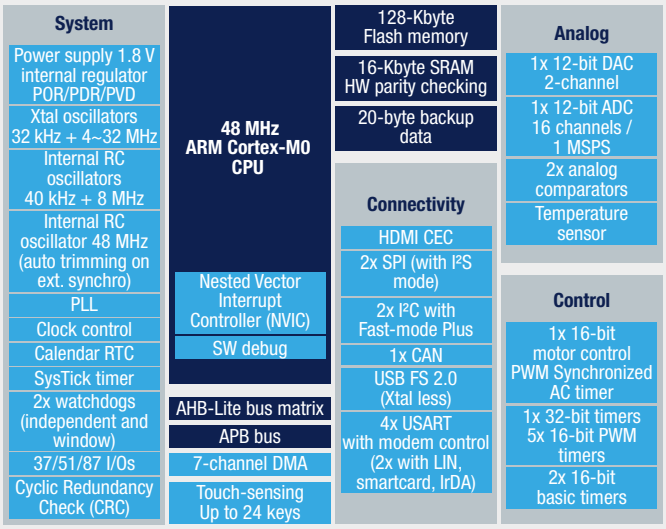
Faster Time-to-Market
- Faster device selection decisions
- From 16 to 64 kB embedded Flash
- From 20 to 64 pin TSSOP or LQFP packages
- Easy migration: pin-to-pin compatibility with STM32 F0, F1 and F3
- STM32F030 Value line discovery kit

Free Tool Suite

Wider Performances
- Arm® Cortex®-M0 at 48 MHz
- 5-channel DMA
- Advanced timers
- 12-bit 1 MSPS ADC

Greater Robustness
- HW RAM parity check
- Clock monitoring (CSS)
- 2 watchdogs
- Cyclic redundancy check (CRC)

STM32F0 Block Diagram



Product lines	Flash (kB)	RAM (kB)	Power supply	20byte backup data	12-bit DAC	Comp.	Touch sense	Up to 2x SPI/I2S, 2x I²C	USART	CEC	CAN	USB
STM32F0x0 Value line	16 to 256	4 to 32	2.4 to 3.6 V					x	6			x
STM32F0x1 Access line	16 to 256	4 to 32	2.0 to 3.6 V	x	x	x	x	x	8	x	x	
STM32F0x2 USB line	16 to 128	4 to 16	2.0 to 3.6 V	x	x	x	x	x	4	x	x	x*
STM32F0x8 Low-voltage line	32 to 256	4 to 32	1.8V ± 8%	x	x	x	x	x	8	x		x*

* crystal-less USB

Arm® Cortex®-M0 48 MHz

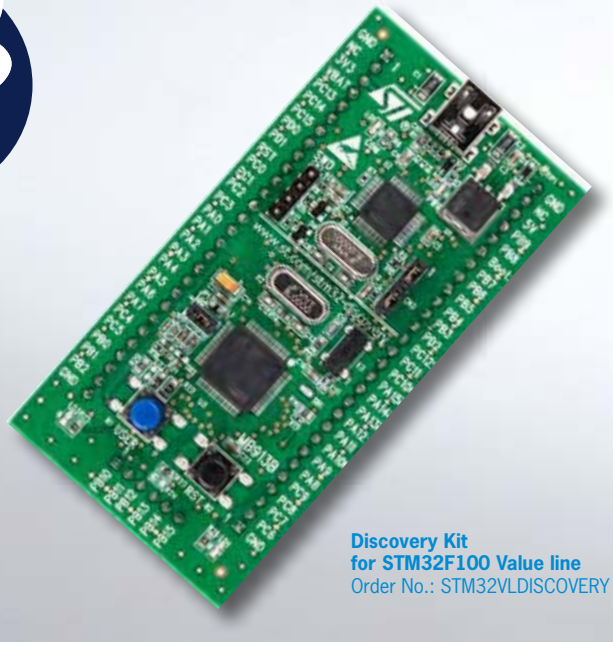
- Reset POR/PDR
- 2x watchdogs
- Hardware CRC
- Internal RC
- Crystal oscillators
- PLL
- RTC calendar
- 16- and 32-bit timers
- 1x12-bit ADC
- Temperature sensor
- Multiple-channel DMA
- Single-wire debug
- Unique ID

STM32F1 – 5 Product Lines

Pin-to-pin, Peripheral & Software compatible

Series	Max. Frequency (MHz)	Description
STM32F100 Value line	24 MHz CPU	with motor control and CEC functions
STM32F101	36 MHz CPU	up to 1 Mbyte of Flash
STM32F102	48 MHz CPU	with USB FS
STM32F103	72 MHz	up to 1 Mbyte of Flash with motor control, USB and CAN
STM32F105/107	72 MHz CPU	with Ethernet MAC, CAN and USB 2.0 OTG

Product lines	FCPU (MHz)	Flash (kB)	RAM (kB)	USB 2.0 FS	USB 2.0 FS OTG	FSMC	CAN 2.0B	3-phase MC Timer	I2S	SDIO	Ethernet IEEE1588	HDMI CEC
STM32F100 Value line	24	16 to 512	4 to 32			x		x				x
STM32F101	36	16 to 1M	4 to 80			x						
STM32F102	48	16 to 128	4 to 16	x								
STM32F103	72	16 to 1M	4 to 96	x		x	x	x	x	x		
STM32F105 STM32F107	72	64 to 256	64		x	x	x	x	x		x	



Discovery Kit for STM32F100 Value line
Order No.: STM32VLDISCOVERY

STM32F1 Series Cortex®-M3 MCUs

STM32 Mainstream MCUs

ST's STM32 F1 series of mainstream MCUs covers the needs of a large variety of applications in the industrial, medical and consumer markets. With this series, ST has pioneered the world of Arm® Cortex®-M microcontrollers and set a milestone in the history of embedded applications. High performance with first-class peripherals and low-power, low-voltage operation is paired with a high level of integration at accessible prices with a simple architecture and easy-to-use tools.

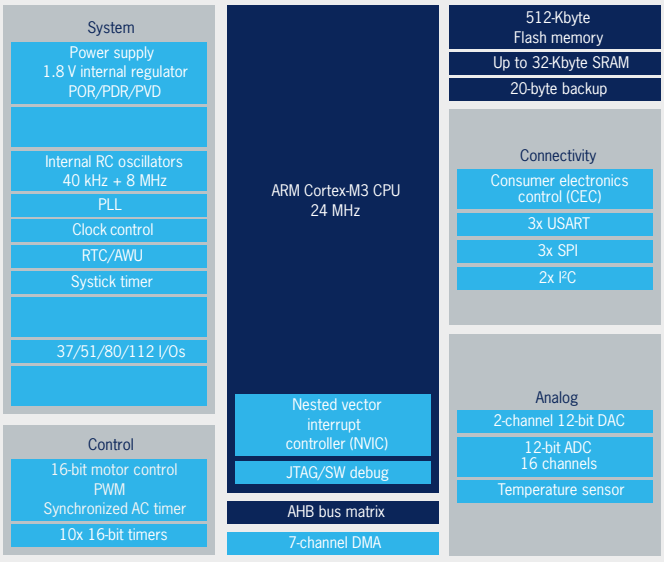
STM32F100 Value Line for Cost-Sensitive Applications

The STM32F100 Value line complements our STM32 Cortex™-M3 microcontroller product portfolio by offering a low-cost product line that is pin-to-pin compatible with the STM32 portfolio.
It brings features such as 16-bit timers and CEC function to expand the range of applications addressed in consumer, appliance and industrial segments. Based on the Arm® Cortex®-M3 core running at up to 24 MHz, the STM32 Value line offers excellent cost-performance-peripherals trade-off.
It provides all the essential features to make it the perfect choice to develop cost-effective applications traditionally addressed by 16-bit microcontrollers.

Benefits

- Perfect fit for control applications
- Ideal for appliance control applications including induction cooking
- Decreased total system cost
- Reduced design complexity and minimized CPU, peripheral and memory use
- Extensive connectivity capability
- Achieves superior performance with 16-bit code density
- Eases Flash memory integrity check
- System cost reduction

STM32F1 Block Diagram



Arm® Cortex®-M3 (DSP + FPU) Up to 72 MHz

- -40 to 105°C range
- USART, SPI, I²C
- 16- and 32-bit times
- Temperature sensor
- Up to 3x12-bit ADC
- Dual 12-bit ADC
- Low voltage 2.0 to 3.6 V (5 V tolerant I/Os)

STM32 F2 Key Features & Benefits

Real-time performance

+ ART Accelerator, Multi-AHB bus matrix, Excellent real-time 120 MHz/150 DMIPS zero-wait state execution performance from Flash

Outstanding power efficiency

RTC in V_{BAT} mode, ultra-low dynamic power consumption 1.7 to 3.6 V V_{DD}

Superior and innovative peripherals

USB-OTG High Speed, camera interface, Ethernet, CAN, crypto/hash processor, external memory interface

Maximum integration

1-Mbyte Flash, 128-Kbyte SRAM, 512 OTP bytes, 4-Kbyte backup SRAM, reset circuitry, voltage regulator, internal RC oscillator, PLL

Extensive tools and software

Various IDE starter kits, libraries, RTOS and stacks

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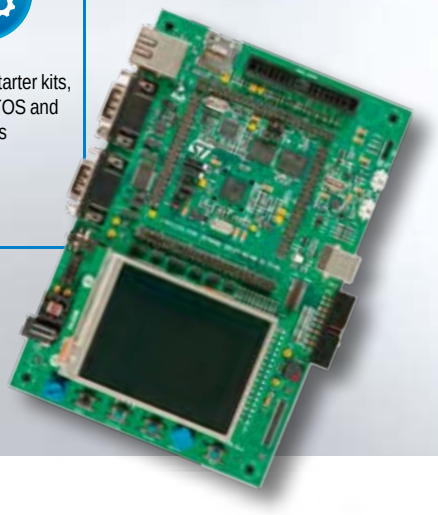


STM32 F2

Evaluation Board
Order No.: STM3221G-EVAL

STM32F2 Series Cortex®-M3 MCUs

STM32 Series of High-Performance MCUs

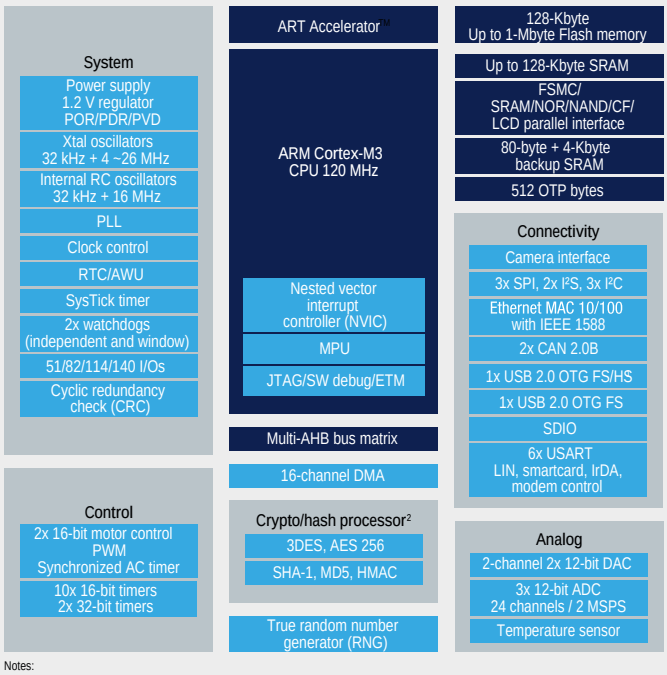
The Arm® Cortex™-M3-based STM32 F2 series uses ST's advanced 90 nm NVM process technology with the innovative adaptive real-time memory accelerator (ART Accelerator™) and multi-layer bus matrix. This offers an unprecedented trade-off in price and performance. The ART Accelerator™ allows a performance equivalent to zero wait state execution from Flash using adaptive real-time technology.

The series is characterized by a high degree of integration combining up to 1 Mbyte of Flash memory and up to 128 Kbytes of SRAM with Ethernet MAC, USB 2.0 HS OTG, camera interface, hardware encryption support and external memory interface.

ST's acceleration technology enables these MCUs to achieve up to 150 DMIPS/398 CoreMark at 120 MHz FCPU, which is equivalent to zero wait state execution, while keeping the dynamic current consumption at the outstandingly low level of 175 µA/MHz.

The series consists of two product lines which are fully pin-to-pin, peripheral and software compatible. The series also offers close pin-to-pin compatibility with the other STM32 products.
STM32F205/215 – with advanced connectivity and encryption
STM32F207/217 –with advanced connectivity and encryption, also Ethernet MAC and camera interface as well as more GPIOs and additional features on larger packages

STM32F2 Block Diagram



Notes:
1. HS requires an external PHY connected to the ULPI interface
2. Crypto/hash processor on STM32F217 and STM32F215

Arm® Cortex®-M3 120 MHz

- ART Accelerator™
- 2x USB 2.0 OTG
- SDIO
- USART, SPI, I²C
- 2x CAN
- I²S + Audio PLL
- 16- and 32-bit timers
- 3x12-bit ADC (0.5 µs)
- Low voltage 1.7 to 3.6 V
- RTC calendar

Product lines	Flash (kB)	RAM (kB)	Hardware Crypto/ hash	2x 12-bit DAC	Ethernet I/F IEEE1588	Camera I/F	FSMC
STM32F215	128 to 1024	Up to 128	x	x	x		x
STM32F205							
STM32F217	512 to 1024	Up to 128	x	x	x	x	x
STM32F207							

STM32F3 Product Lines

Mixed-Signals

STM32F303

STM32F302

STM32F301 $0.89

Precise measurement
3x 16-bit ADC
sigma Delta

STM32F373

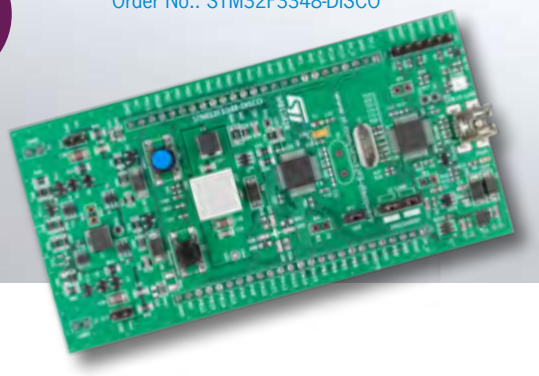
Digital power
High resolution (217ps) and
complex waveform builder

STM32F334

General Purpose | **Applications Specific**

Note: The same devices are found in the STM32F3x8 line and operate at 1.8 V.

Discovery Kit
Order No.: STM32F3348-DISCO



STM32F3 Series Positioning

- STM32F3 series combines Cortex®-M4 core with rich analog peripherals set to deliver high-performance System-on-Chip solutions at competitive cost
- The STM32F3 is the upgraded version of the successful STM32F1 with Cortex®-M4 and renewed digital IPs

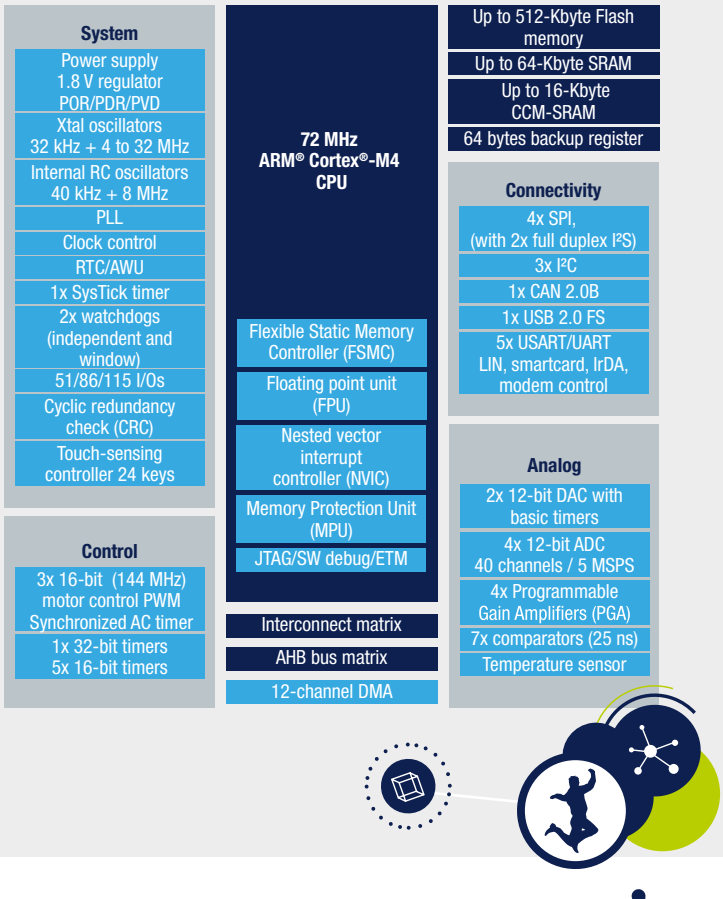
STM32F3 Series Cortex®-M4 MCUs

STM32 Series with DSP Instructions, FPU and Optimum Analog Integration

The STM32F3 series of microcontrollers combines a 32-bit Arm® Cortex™-M4 core with DSP and FPU instructions running at 72 MHz with advanced analog peripherals for more flexibility at a competitive cost.

The STM32F3 series innovates in embedded digital signal control (DSC) design by combining a Cortex®-M4 core with fast 12-bit, 5 MSPS and precise 16-bit sigma-delta ADCs, programmable gain amplifiers, fast comparators and versatile time control units, giving optimum integration.

STM32F3 Block Diagram

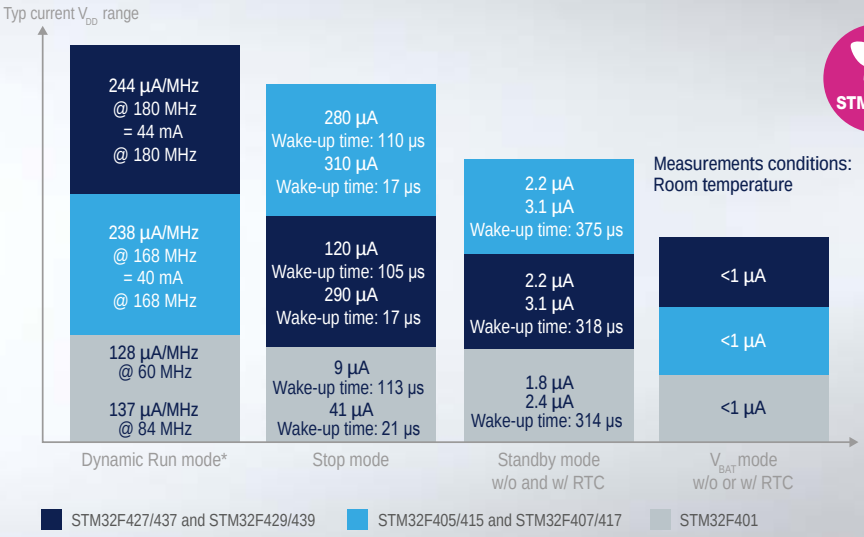


Arm® Cortex®-M4 (DSP + FPU) - 72 MHz

- Routine booster (CCM)
- Interconnect Matrix
- DMA
- USART, SPI, I²C, I2S, USB and CAN
- 16- and 32-bit timers
- Hardware CRC
- SRAM with Parity check
- Low- and high-speed oscillator
- Reset + BOR PVD
- RTC
- Temperature sensor
- Capacitive touch sensing

Product lines	Flash (kB)	RAM (kB)	CCM-SRAM	Power supply	12-bit ADC	16-bit ADC	12-bit DAC	Fast Comparator	Op amp (PGA)	Advanced 16-bit PMW Timer	High Resolution Timer
STM32F301 Access	32 to 64	16		2.0 to 3.6 V	Up to 2		1	3	1	1	
STM32F302 USB & CAN	32 to 512	16 to 64		2.0 to 3.6 V	Up to 2		1	Up to 4	Up to 2	1	
STM32F303 Performance	32 to 512	16 to 80	x	2.0 to 3.6 V	Up to 4		Up to 3	Up to 7	Up to 4	Up to 3	
STM32F3x4 Digital Power	16 to 64	16	x	2.0 to 3.6 V	2		3	2 (Ultra Fast)	1	1	x 10 ch
STM32F373 Precision measurement	64 to 256	32		2.0 to 3.6 V	1	3	3	2			
STM32F3x8 1.8 V ±8%	64 to 512	16 to 80	x	1.8 V ± 8%	Up to 4		Up to 3	Up to 7	Up to 4	Up to 3	

STM32 DYNAMIC EFFICIENCY™ – Less dynamic power. More performance.



Discovery Kit
Order No.: STM32F429I-DISCO

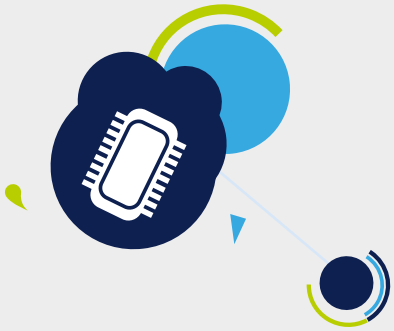
STM32F4 Series Cortex®-M4 MCUs

STM32 Series with DSP and FPU with High-performance MCUs

The Arm® Cortex®-M4-based STM32F4 series MCUs leverage ST's NVM technology and ST's ART Accelerator™ to reach the industry's highest benchmark scores for Cortex®-M-based MCUs with up to 225 DMIPS/608 CoreMark executing from flash memory at up to 180 MHz operating frequency.

Arm® Cortex®-M3 (DSP + FPU)
Up to 72 MHz

- ART Accelerator™ enabling 0 wait state executing from internal flash
- Up to 2x USB 2.0 OTG FS/HS (except access lines)
- SDIO
- USART, SPI, I²C
- I2S + audio PLL
- 16 and 32-bit timers
- Up to 3x 12-bit ADC (0.41 µs)
- Up to 2x 12-bit DAC
- External memory controller
- Low voltage 1.71 to 3.6 V



Product lines	FCPU (MHz)	Flash (bytes)	RAM (kB)	Ethernet IEEE1588	2x CAN	Camera I/F	SDRAM I/F	Dual Quad-SPI	SAI3 I/F	SPDIF RX	Chrom-ART Graphic Accelerator™	TFT LCD Controller	MIPI DSI
Advanced Lines													
STM32F469	180	512 K to 2 M	384	x	x	x	x	x	x		x	x	x
STM32F429	180	512 K to 2 M	256	x	x	x	x		x		x	x	
STM32F427	180	1 M to 2 M	256	x	x	x	x		x		x		
Foundation Lines													
STM32F446	180	256K to 512K	128		x	x	x	x	x	x			
STM32F407	168	256K to 1M	192	x	x	x							
STM32F405	168	256K to 1M	192		x								

Product lines	FCPU (MHz)	Flash (kB)	RAM (kB)	RUN Current (µA/MHz)	STOP current (µA)	FSMC (NOR/ PSRAM/ LCD (Support)	QSPI	DFSDM	CAN 2.0B	DAC	TRNG	DMA Batch Aquisition mode	USB 2.0 OTG FS
Access Lines													
STM32F401	84	128 to 512	up to 96	Down to 128	Down to 10								x
STM32F410	100	64 to 128	32	Down to 89	Down to 6					x	x	BAM	-
STM32F411	100	256 to 512	128	Down to 100	Down to 12							BAM	x
STM32F412	100	512 to 1024	256	Down to 112	Down to 18	x	x	x	x		x	BAM	x + LPM
STM32F413	100	1024 to 1536	320	Down to 115	Down to 18	x	x	x	x	x	x	BAM	x + LPM

Discovery Kit
Order No.: STM32F779I-EVAL

Arm® Cortex®-M7 - 216MHz

Acceleration
- ART Accelerator™
- L1 Cache: data and instruction cache
- Chrom-ART Accelerator™
- Floating Point Unit

Connectitity
- Up to 2x USB 2.0 OTG
- SDIO
- USART, UART, SPI, I²C
- CAN2.0
- HDMI-CEC
- Ethernet IEEE 1588
- FMC
- MDIO slave
- Camera I/F
- Dual mode Quad-SPI

Audio
- I2S + Audio PLL
- 2x SAI
- 2x 12-bit DAC
- SPDIF-RX

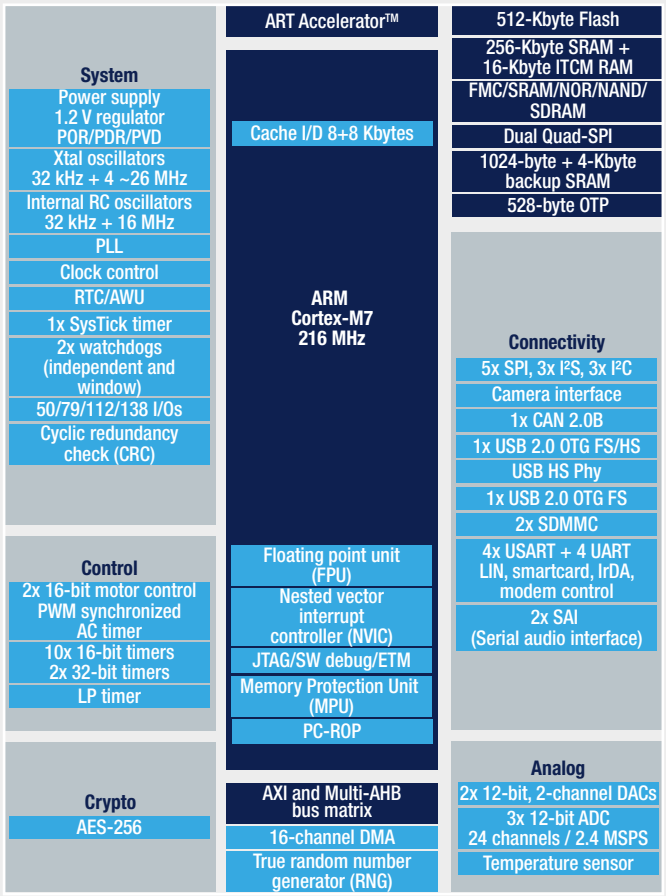
Other
- 16- and 32-bit timers
- Up to 3x 12-bit ADC 2.4 MSPS
- Low voltage 1.7 to 3.6 V
- 85 °C and 105 °C ranges

STM32F7 Series Cortex®-M7 MCUs

STM32 Series High Performance with the Cortex®-M7 Core MCUs

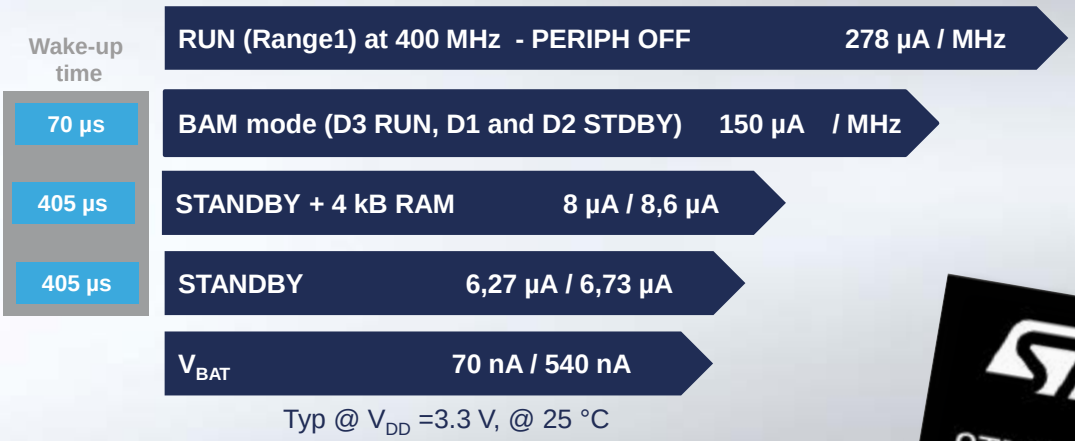
Taking advantage of ST's ART Accelerator™ as well as an L1 cache, STM32F7 devices deliver the maximum theoretical performance of the Cortex®-M7 no matter whether code is executed from embedded flash or external memory: 1082 CoreMark /462 DMIPS at 216 MHz CPU.

STM32F779 Block Diagram



Product lines	FCPU (MHz)	L1 cache(I/D)	FPU	Flash (bytes)	RAM (Kbytes) + 16K ITCM + 4K backup	JPEG codec	CAN	DF SDM	TFT LCD controller	MIPI-DSI
Advanced lines										
STM32F7x9 STM32F7x8	216	16K+16K	Double Precision	1M to 2M (RWW)	512K (incl. 128K DTCM)	x	3	x	x	x
STM32F7x7	216	16K+16K	Double Precision	1M to 2M (RWW)	512K (incl. 128K DTCM)	x	3	x	x	
STM32F7x6	216	4K+4K	Single Precision	512K to 1M	320K (incl. 128K DTCM)		2		x	
STM32F765	216	16K+16K	Double Precision	1M to 2M (RWW)	512K (incl. 128K DTCM)		3	x		
STM32F745	216	4K+4K	Single Precision	512K to 1M	320K (incl. 128K DTCM)		2			

Product lines	FCPU (MHz)	L1 cache (I/D)	FPU	Flash (kbytes)	RAM (Kbytes) + 16K ITCM + 4K backup	JPEG codec	CAN	DF SDM	PC-ROP (protected code execution)	USB HS PHY
Foundation lines										
STM32F7x3	216	8K+8K	Single Precision	256K to 512K	256K (incl. 128K DTCM)		1		x	x
STM32F7x2	216	8K+8K	Single Precision	256K to 512K	256K (incl. 128K DTCM)		1		x	
Value lines										
STM32F730	216	8K+8K	Single Precision	64K	256K (incl. 64K DTCM)		1	x		x
STM32F750	216	4K+4K	Single Precision	64K	320K (incl. 64K DTCM)		2		x	



STM32H7 Series Cortex®-M7 MCUs

STM32H7 Series Maximum Performance with Arm® Cortex®-M7 Core MCUs

The STM32H743/753 lines offer the performance of the Cortex-M7 core running up to 400 MHz. Combined with a smart architecture based on a multi-power domain, developers can always use the best configuration to optimize data transfers and CPU load while staying gentle on the power budget when needed.
The embedded hardware accelerators and the extensive digital and analog peripheral set make the STM32H743/753 very well suited for industrial applications where fast reaction time is key or HMI applications where the graphic and audio support will allow an unprecedented user experience with an embedded microcontroller.

Core, Memories and Acceleration
- Cortex-M7 core @ 400 MHz
- 16 kB+16 kB I/D L1 Cache
- Double-precision FPU
- 4 x DMA controllers
- Up to 2MB Flash / 1MB RAM

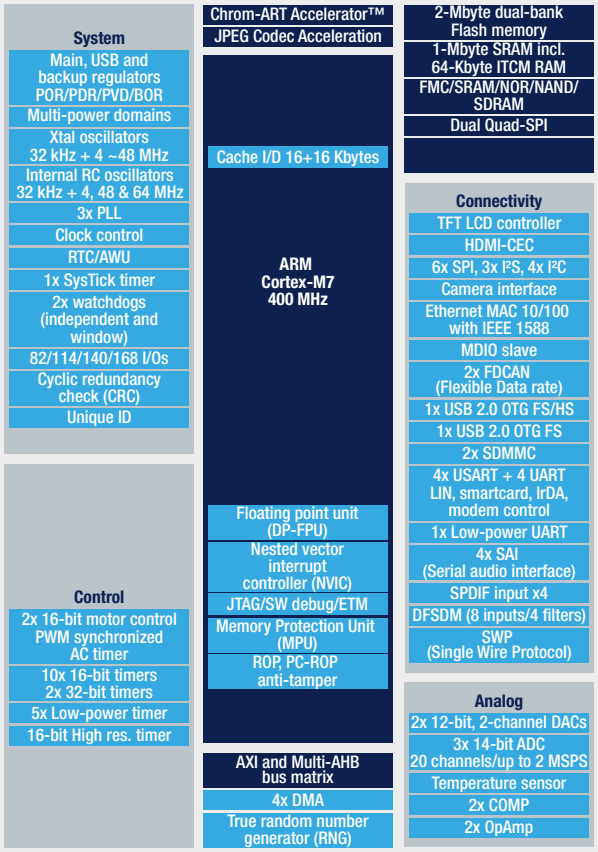
Connectivity
- 2 x USB2.0 OTG FS/HS
- USART, UART, SPI, and I²C
- 2 x CAN (1 x FD and 1 x TT/FD)
- Ethernet MAC
- FMC and QuadSPI
- 2 x SDMMC

Audio
- 3 x I²S + audio PLL
- 4 x SAI
- 2 x 12-bit DAC
- SPDIF-RX

Graphics
- LCD TFT controller
- JPEG Codec
- Chrom-ART Accelerator™

Other
- Optional crypto
- DFSDM
- 16- and 32-bit timers
- 3 x 14-bit ADC (2 MSPS)
- Analog (comp, AOP)
- Power supply 1.7 to 3.6 V

STM32H7 Block Diagram



Order No.: STM32H753I-EVAL

Evaluation board with STM32H753XI MCU

Order No.: NUCLEO-H743ZI

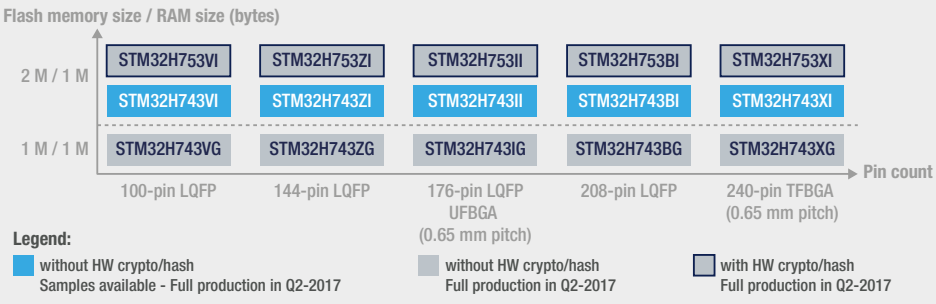
STM32 Nucleo-144 development board with STM32H743ZI MCU, supports Arduino, ST Zio and morpho connectivity

STM32 H7

STM32H7 Series

STM32H7 Series Maximum Performance with Arm® Cortex®-M7 Core MCUs

STM32H7 Portfolio



Power Efficient STM32H7

- Three power domains for maximum flexibility
- To allow the shutdown of unused domains and minimize current consumption
- Power efficiency in RUN mode thanks to 40nm process, dynamic voltage scaling
- Batch Acquisition Mode Domain for always ON tasks, Including V_{BAT} subdomain with RTC and backup RAM

Product lines	FCPU(MHz)	Core	Flash	RAM	Dual Quad-SPI	Ethernet I/F IEEE 1588	Camera I/F	Security Services & Crypto
STM32H7x7				Available in 2019				
STM32H7x5				Available in 2019				
STM32H753	400	Cortex-M7	Up to 2 MB (dual bank)	1MB (incl. 128K DTCM) + 64 kB bckup1 + 4 kB bckup2	x	x	x	x
STM32H743	400	Cortex-M7	Up to 2 MB (dual bank)	1MB (incl. 128K DTCM) + 64 kB bckup1 + 4 kB bckup2	x	x	x	
STM32H750	400	Cortex-M7	128kB	1MB (incl. 128K DTCM) + 64kB bckup1 + 4kB bckup2	x	x	x	

Arm® Cortex®-M7 - 400MHz

Core, Memories and Acceleration

- Cortex-M7 core @400 MHz
- 16kB +16kB I/D L1 Cache
- Double-precision FPU
- 4x DMA

Connectitity

- 2x USB 2.0 OTG FS/HS
- 2x SDMMC
- USART, UART, SPI, I²C
- 2x CAN (1x FD and 1x TT/FD
- HDMI-CEC
- FMC
- Analog (comp, AOP)
- AUDIO
- 3x I²S + Audio PLL
- 4x SAI
- 2x 12-bit DAC
- SPDIF-RX

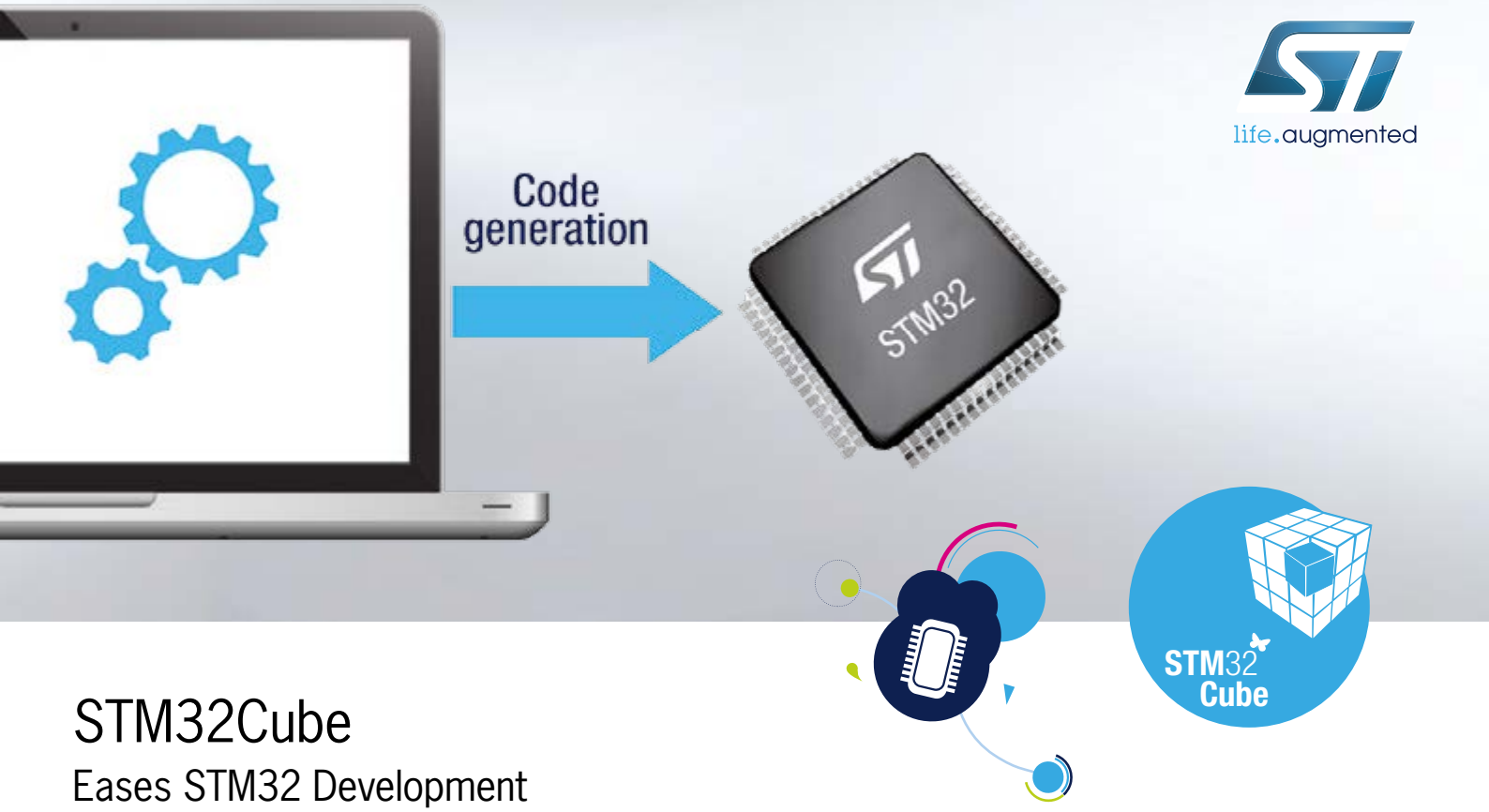
Graphic

- LCD TFT controller
- JPEG Codec
- ChormART Accelerator™

Other

- TRNG
- DFSDM
- 16- and 32-bit timers
- 3x 12-bit ADC 3.6 MSPS
- Multi power domains
- -40°C to 85°C temperature range

Software supported by SEGGER



STM32Cube

Eases STM32 Development

ST Provides a Comprehensive Software Offer, Significantly Reducing Development Effort, Time and Cost

The STM32Cube is a comprehensive software solution, combining embedded software bricks with the power of a PC-based software development tool, STM32CubeMX. Embedded software not only covers all STM32 microcontrollers with highly portable Hardware Abstraction Layer (HAL) and performance oriented Low-Layer (LL) low-level drivers, but comes with a collection of middleware components such as RTOS, USB, TCP/IP, touch sensing, file system or graphics.

STM32CubeMX helps the user configure the STM32 MCU (pinout, clock system, and peripherals) and the software stacks. It can also help evaluate different power consumption scenarios thanks to its power consumption calculator.

The STM32Cube HAL and STM32CubeMX code generator/configurator can be used independently of each other, but their full potential is reached when they are used together; once the MCU is configured, the user can generate initialization C code based on his choices!

Features

- STM32CubeMX tool
  - Intuitive microcontroller selection
  - Graphical configuration (pinout solver, clock tree, power consumption calculator, peripherals and middleware settings)
  - C code generation covering initialization code for most standard toolchains
  - Standalone or as Eclipse plug-in
  - Available for Windows®, Linux® and macOS® operating systems
- STM32Cube embedded software libraries
  - Consistent and complete offer
  - Maximized portability between all STM32 series thanks to HAL APIs
  - Smallest footprint and maximum performance thanks to LL APIs
  - Hundreds of examples
  - High-quality HAL and LL using CodeSonar® static analysis tool
  - Middleware such as USB, TCP/IP, Touch sensing, RTOS, FAT, …
  - Business-friendly license terms

STM32Cube Embedded Software: A Layered And Complete Offer

- Open-source TCP/IP stack (lwIP)
- USB Host and Device library from ST
- STemWin graphical stack library from ST and SEGGER
- Open-source FAT file system (FatFs)
- Open-source real-time OS (FreeRTOS)
- Touch-sensing library
- Dozens of examples
- Abstraction of STM32 MCU through Hardware Abstraction Layer (HAL) portable APIs
- High-performance, light-weight Low-Layer (LL) APIs
- High coverage for most STM32 peripherals
- Production-ready using CodeSonar® static analysis tool
- Hundreds of examples
- Open-source BSD license

Five Reasons to Choose the STM32 Platform

Real-time performance	Outstanding power efficiency	Superior and innovative peripherals	Maximum integration	Extensive ecosystem
ART Accelerator, Chrom-ART Accelerator, CCM-SRAM, Multi-AHB bus matrix, excellent real-time up to 180 MHz/225 DMIPS zero-wait state execution performance from Flash	< 1 µA RTC in V_{BAT} mode, ultra-low dynamic power consumption 137 µA/MHz 1.65 to 3.6 V V_{DD}, 0.45 µA Stop mode and 0.3 µA Standby mode	USB-OTG High Speed, camera interface, Ethernet, CAN, LCD-TFT controller, crypto/hash processor, SDRAM, PGA, sigma-delta 16-bit ADC and 12-bit ADC (up to 5 MSPS), external memory interface, CEC	Reset circuitry, voltage regulator, internal RC oscillator, PLL, WLCSP packages	Arm® + ST ecosystem (eval boards, discovery kits, Nucleo, STM32CubeMx software libraries, RTOS)

Development Platform for Flexible Prototyping

Evaluation Boards & Kits | Hardware & Software Development Tools

life.augmented

Very low-cost Discovery kits are the cheapest and most complete solution to start easily and quickly with STM32 MCUs. Featurerich evaluation boards provide the means to evaluate all of the peripherals of the different STM32 MCUs. To complete this portfolio, STM32 MCUs are supported by starter kits from 3rd-parties and dedicated demonstration boards or kits to highlight specific features, such as low-power or performance in specific applications such as motor control.

Start with STM32-Discovery Kits

Discovery kits are the cheapest and quickest way to discover the STM32 family. These quick-start evaluation boards embed an ST-LINK or ST-LINK/V2 debug probe and are supported by IDE from Altium (TASKING), Atollic (TrueSTUDIO), Keil (MDK-Arm), IAR (EWArm) and Farnell (CooCox).

- **STM32F3DISCOVERY** the target is the entry level for Cortex®-M4, includes also ST's MEMS gyroscope and e-compass
- **STM32F429I-DISCO** and **STM32F401C-DISCO** based on Cortex®-M4, includes the STM32 F4 series performance with audio (input, output) and USB Host capabilities
- **STM32VLDISCOVERY** based on the STM32 F1 series Value line, it will satisfy hobbyists, first-time developers and students
- **STM32F0308-DISCO** and **STM32F072B-DISCO** the STM32 F0 series based on the Cortex®-M0 core. A prototyping board is included for easy connection of additional components and modules
- **STM32L152C-DISCO** and **STM32L100C-DISCO** based on Cortex®-M3, the STM32L-Discovery kit includes a 6-digit LCD display, a touch-sensing slider, 2 LEDs, a user button and current measurement

STM32H753I-EVAL

Evaluation Boards for STM32

Evaluation boards from ST implement the complete range of device peripherals for STM32 devices.

Part number	Featured product
STM32401G-EVAL	STM32F407IGH6
STM32303C-EVAL	STM32F303VCT6
STM32373C-EVAL	STM32F373VCT6
STM32201G-EVAL	STM32F207IGH6
STM3210C-EVAL	STM32F107VCT6
STM3210E-EVAL	STM32F103ZGT6
STM32100E-EVAL	STM32F100ZET6B
STM320518-EVAL	STM32F051R8T6
STM32L152D-EVAL	STM32L152ZDT6
STM32429I-EVAL	STM32F429NI
STM32439I-EVAL	STM32F439NI
STM3241G-EVAL	STM32F417IG


STM320518-EVAL


STM32L152D-EVAL

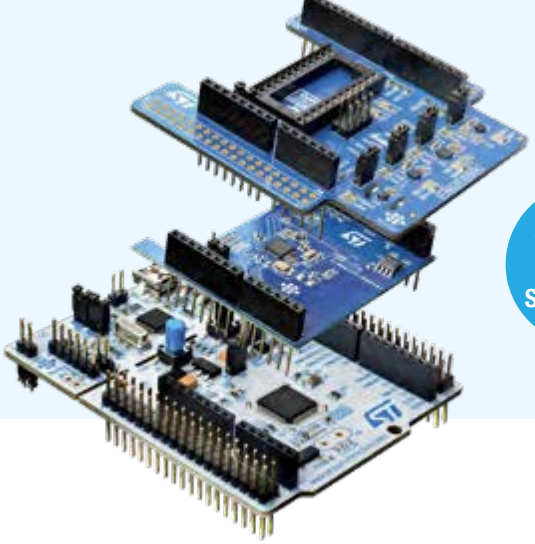

STM32F373-EVAL

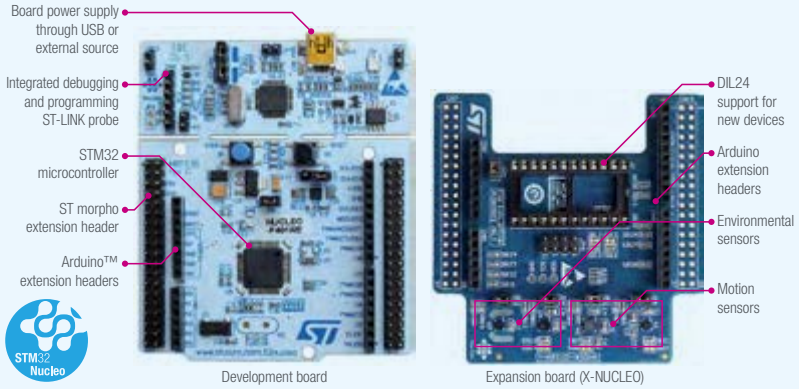

STM32429I-EVAL

STM32 Software Development Tools

Development and debug of STM32 applications is made even easier with MicroXplorer, a free graphical tool to configure ST MCUs, and STM-STUDIO, a free tool to monitor and visualize variables at run-time. Third-party solutions come complete with IDE, C/C++ compiler and JTAG debug probes.

Software supported by SEGGER





Sharing Arduino™ connectors and ST morpho headers, STM32 Nucleo boards can easily be extended with a large number of expansion boards available. Stack as many boards as you need to create the functionality required.

Nucleo – Open STM32 Development Environment

The highly affordable STM32 Nucleo boards allow anyone to try out new ideas and to quickly create prototypes with any STM32 MCU. Sharing the same connectors, STM32 Nucleo boards can easily be extended with a large number of specialized application hardware add-ons (Nucleo-64 include Arduino Uno rev3 & ST morpho connectors, Nucleo-32 include Arduino Nano connectors).

The STM32 Nucleo boards integrate an ST-Link debugger/ programmer, so there is no need for a separate probe.
A comprehensive STM32 software HAL library together with various software examples are provided with the STM32 Nucleo boards, and seamlessly work with a wide range of development environments including IAR EWArm, Keil MDK-Arm, mbed and GCC/LLVM-based IDEs.
All STM32 Nucleo users have free access to the mbed online resources (compiler, C/C++ SDK, and developer community) at www.mbed.org allowing to build a complete application in only a few minutes.
The STM32 Open Development Environment is an open, flexible, easy and affordable way to develop innovative devices and applications based on the STM32 microcontroller family combined with other state-of-the-art components connected via expansion boards. It enables fast prototyping with leading-edge components that can quickly be transformed into final designs. ST offers reference designs for many applications to make the transition from prototype to final product even smoother.

Key Features

- Includes one STM32 microcontroller
- On-board ST-LINK/V2-1 debugger/ programmer:
  - Virtual com port
  - Mass storage
- Wide extension capabilities with specialized shields:
  - Arduino Uno rev3 connectors on Nucleo-64
  - Access to MCU pins through ST morpho connectros on Nucleo-64
  - Arduino-Nano connectors on Nucleo-32
- Direct access to mbed online resources.
- Supported by IAR, Keil, Arm mbed online, and GCC/LLVM-based IDEs(AC6, Atollic, Coocox, Emprog, Keolabs, Rowley, Segger, Tasking...)

STM32 NUCLEO Expansion Boards

Motor Control	Motion MEMS & Environmental	Proximity & Gesture	Bluetooth Low Energy	Dynamic NFC Tag	Digital MEMS Microphones
					
X-NUCLEO-IHM14A1	X-NUCLEO-IKS01A2	X-NUCLEO-53L1A1	X-NUCLEO-IDB04A1	X-NUCLEO-NFC04A1	X-NUCLEO-CCA02M1

XMC™ – One Microcontroller Platform

Countless Solutions

Infineon has taken its wealth of know-how in microcontroller design for real-time applications to combine it with all benefits of an industry standard core. The XMC™ microcontroller portfolio features a wide range of products from low-end, low-pin-count up to advanced industrial applications striving for energy-efficient solutions, high quality standards, long product life times and high temperature robustness. Common peripherals and development tools across the family bear a high level of scalability and compatibility between family members.

XMC1000

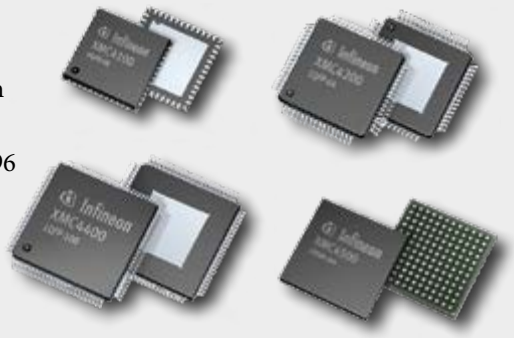
Cortex®-M0

- 32-48 MHz
- Up to 200 kB flash
- Package
  - LQFP-64
  - TSSOP-16/28/38
  - VQFN-24/40/48/64

XMC4000

Cortex®-M4F

- 80-144 MHz
- Up to 2 MB flash
- Package
  - LFBGA-144/196
  - LQFP-100/144
  - TQFP-64
  - VQFN-48



Applications

Motor Control

(eBikes, Power Tools)

- CCU8 PWM Unit
- POSIF Interface (hall sensor and incremental encoder connection)
- 12-Bit ADC with on-chip adjustable gain of X1, X3, X6 or X12

Switched Mode Power Supplies

- 2x CAN node, 4x USIC (configurable to SPI, I²C, I²S, UART), USB FS
- 4x 12-bit ADC (70 ns sample time)
- Analog comparators 3 mV Input offset, propagation delay 30 ns

Industrial I/O

- With 200 kB Flash, 2 CAN Nodes, 4 serial channel, 3x64 LED Matrix control, 9 ch. LED BCCU, 12-bit ADC (2x S&H), 4x Comparators, 16x PWM channel, ideal for actuators & sensor control IP

Smart Lighting

(Led Lighting)

- BCCU (brightness and color compare unit)
- Flicker Free Dimming trough 9 output channels
- DALI or DMX communication capability

Applications

Motor Control

- Industrial Drives
- Hall & Encoder I/F
- Delta Sigma Demodulator

Switched Mode Power Supplies

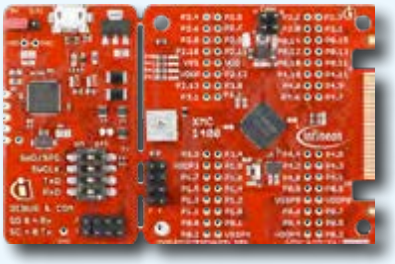
- HRPWM (High Resolution PWM) timer 150 ps (XMC4200/XMC4400)
- Extended Temperature Range up to 125°C

Industrial I/O (EtherCAT®)

- Industry's first-ever microcontroller with integrated EtherCAT node (XMC4300/XMC4800)
- MultiCAN up to 6 nodes

XMC1400 Boot Kit

- XMC1400 MCU series, Arm® Cortex®-M0
- On board CAN node
- Hardware compatible to XMC LED Lighting Cards and motor control board



Order No.: KIT_XMC14_BOOT_001

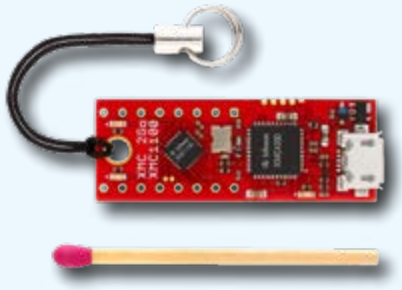
RGB LED Lighting Shield with XMC1202 for Arduino

- XMC1200 MCU series with Brightness and Color Control Unit (BCCU)
- 3 independent output channels for flicker-free, high-quality LED lighting solutions
- Compatible with Arduino Uno R3 and XMC1100 Boot Kit

Order No.: KIT_LED_XMC1202_AS_01

XMC™ 2Go

- XMC1100 (Arm® Cortex™-M0 based)
- On-board J-Link Lite Debugger (Realized with XMC4200 Microcontroller)
- Power over USB (Micro USB)
- ESD and reverse current protection
- 2 x user LED
- Pin Header 2x8 Pins suitable for Breadbord



Order No.: KIT_XMC_2GO_XMC1100_V1

XMC1000

Optimized Peripherals for Real-Time Success

XMC1000 microcontrollers bring together the Arm® Cortex®-M0 core and market proven and differentiating peripherals in a leading-edge 65nm manufacturing process. XMC1000 is the number one choice to bring traditional 8-bit designs to the next level addressing a broad application spectrum from typical 8-bit applications up to digital power conversion and even field oriented motor control.

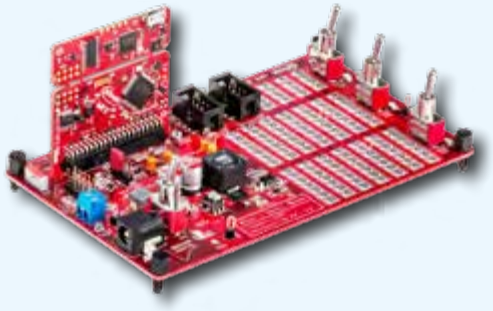
Key Features

- The MATH co-processor adds additional functionality, such as trigonometric operations or divisions, to the standard Cortex®-M0 instruction set, enabling high-resolution PARK transformation with 24-bit.
- The BCCU (Brightness and Color Control Unit) automatically runs light control algorithmus for optimized dimming and color mixing. This significantly reduces the software development outlay for LED lighting applications.
- AC/DC power factor correction can be efficiently realized with high-performance and configurable analog comparators. With a propagation delay of only 30 ns and peripheral interconnection to the PWM timer, zero-current crossing in the coil is deterministic control loop executed with a very low CPU load.
- The secure boot loader mode allows embedded code to be programmed to flash memory in a protected way using AES 128-bit cryptography. This helps to protect IP if manufacturing is outsourced, for example.

Arm® Cortex®-M0	MATH Co-processor	Clocks		Memory	Analog			Timer/PWM				Connectivity		Package
		Frequency (MHz)	Peripherals (MHz)		ADC 12 bit/S&H	Number of channels	Analog comparators	CCU4	CCU8	POSIF	BCCU	USIC	CAN2.0B	
XMC11x	-	32	64	Flash 8-64 kB RAM 16 kB	1/1	up to 12	-	1x	-	-	-	2x	-	VQFN-24/40 TSSOP-16/38
XMC12x	-	32	64	Flash 8-64 kB RAM 16 kB	1/2	up to 12	up to 3	1x	-	-	x	2x	-	VQFN-24/40 TSSOP-16/28/38
XMC13x	x	32	64	Flash 8-64 kB RAM 16 kB	1/2	up to 12	up to 3	1x	1x	x	x	2x	-	VQFN-24/40 TSSOP-16/38
XMC14x	x	48	96	Flash 8-64 kB RAM 16 kB	1/2	up to 12	up to 4	2x	2x	x	x	4x	x	VQFN-40/48/64 TSSOP-64
Supply voltage range 1.8 to 5.5 V														
Temperature range -40 °C ... 85 °C/105 °C														

XMC Digital Power

- Easy entry into digital power control with XMC MCUs
- 2 different control card options XMC1300 and XMC4200
- High resolution PWM (150 ps) and smart analog comparators on XMC4200
- Synchronous buck converter board with BSC0924NDI dual n-channel OptiMOS and IRS2011S gate driver



Order No.: KIT_XMC_DP_EXP_01

Isolated Debug Probe, Based on SEGGER J-Link Technology

XMC™ link is a functionally isolated debug probe for all XMC™ microcontrollers. Its technology is based on SEGGER J-Link and can therefore be used with all well-known Arm® Cortex® compiler/IDEs and tools chains, as well as DAVE™.

Order No.: KIT_XMC_LINK_SEGGER_V1

XMC4000

Advanced Industrial Control & Connectivity

All XMC4000 devices are powered by Arm® Cortex®-M4 with a built-in DSP instruction set. The single-precision floating-point unit, Direct Memory Access (DMA) feature and Memory Protection Unit (MPU) are state-of-the-art for all devices – even the smallest XMC4000 runs with up to 144 MHz in core and peripherals. They come with a comprehensive set of common, fast and precise analog/mixed signal, timer/PWM and communication peripherals.

Key Features

- 125°C ambient temperature for the ultimate robustness in harsh environments. A comprehensive set of highly flexible timers/PWMs, fast and accurate ADCs and position interfaces in combination with a programmable hardware interconnect matrix enable deterministic behavior and full application control.
- 150 ps high-resolution PWM and smart analog comparator for achieving the highest energy-efficiency class for digital power conversion. Delta-sigma demodulator with integrated for cost- and size-efficient galvanic-iso-lated current measurement.
- The XMC4300 and XMC4800 are the industry´s first-ever microcontrollers with an integrated EtherCAT® node on an Arm® Cortex®-M controller with on-chip flash and analog/mixed signal capabilities. This enables the most compact designs, eliminating the need for a dedicated EtherCAT® ASIC, external memory and crystal.

Arm® Cortex®-M4F	Frequency (MHz)	Memory	Analog			Timer/PWM					Connectivity							Package
			ADC 12 bit/S&H	Number of channels	DAC 12-bit	CCU4 (4 ch)	CCU8 (4 ch)	HRPWM (150 ps)	POSIF	ΔΣ demodulator	USIC	CAN2.0B	USB	Ethernet	EtherCAT®	SDIO/SD/MMC	External Bus Unit (EBU)	
XMC41x	80	Flash 64-128 kB RAM 20 kB	2/2	up to 9	2 ch	2x	1x	x	x	-	4x	up to 2	x [1]	-	-	-	-	VQFN-48 TQFP-64
XMC42x	80	Flash 256 kB RAM 40 kB	2/2	up to 9	2 ch	2x	1x	x	x	-	4x	2x	x	-	-	-	-	VQFN-48 TQFP-64
XMC43x	144	Flash 256 kB RAM 128 kB	2/2	14	2 ch	2x	1x	-	-	-	4x	2x	x	x	x	x	-	LQFP-100
XMC44x	120	Flash 256-512 kB RAM 80 kB	4/4	up to 18	2 ch	4x	2x	x	2x	4 ch	4x	2x	x	x	-	-	-	VTQFP-64 LQFP-100
XMC45x	120	Flash 512 kB-1 MB RAM 128-160 kB	4/4	up to 26	2 ch	4x	2x	-	2x	4 ch	4x	up to 3	x	x	-	x	x	LQFP-100/144 LFBGA-144
XMC47x	144	Flash 1.5-2 MB RAM 276-352 kB	4/4	up to 26	2 ch	4x	2x	-	2x	4 ch	6x	6x	x	x	-	x	x	LQFP-100/144 LFBGA-196
XMC48x	144	Flash 1-2 MB RAM 276-352 kB	4/4	up to 26	2 ch	4x	2x	-	2x	4 ch	6x	6x	x	x	x	x	x	LQFP-100/144 LFBGA-196
Supply voltage range 3.13 to 3.63 V																		
Temperature range -40 °C ... 85 °C/125 °C																		

XMC4800 Relax EtherCAT® Kit

- XMC4800 MCU Series, Arm® Cortex®-M4
- EtherCAT® Slave Controller on-chip
- On-Board Ethernet TCP/IP, CAN Node, SD/MMC Card Slot, Quad SPI Flash, RTC

The physical layer for the EtherCAT® communication realized by the add-on XMC EtherCAT® PHY Board

Order No.: KIT_XMC48_RELAX_ECAT_V1

XMC4800 Automation Board

- XMC4800-E196 Microcontroller based on Arm® Cortex®-M4@144 MHZ, integrated
- EtherCAT® Slave Controller, 2 MB Flash and 352 kB RAM
- SPI FRAM (64 kB non-volatile memory)
- SDRAM (64 MBit volatile memory)
- CAN Transceiver
- Real Time Clock crystal

Order No.: KIT_XMC48_AUT_BASE_V2

XMC4800

With Integrated EtherCAT®

Benefits

- First EtherCAT® node integrated on a standard Arm® Cortex®-M controller with on-chip Flash and Analog/Mixed Signal
- Most compact design without need for a dedicated EtherCAT® ASIC, external memory and crystal resulting in cost saving on BOM and PCB space
- Pin and code compatibility with the established XMC4000 microcontroller family offers existing XMC microcontroller customers a seamless upgrade path to EtherCAT®
- Top notch in RAM and Flash size integration for Cortex®-MCU
- First EtherCAT® node running at 125 °C ambient temperature

Key Features

- Arm® Cortex®-M4 at 144 MHz
- EtherCAT®
- Large on-chip memories 2MB Flash, 352 kB RAM
- 6 CAN nodes with 256 message objects
- 125°C extended temp. range
- Safety package supporting SIL-2/3
- Rich industrial and external media connectivity
- Long-term available with > 15 years
- IEC 60730 class B compliant LIB
- Free Dave™ IDE and DAVE Apps

System Performance			
Arm® Cortex®-M4@ 144 MHz	FPU	Programmable interconnect matrix	RTC
	DMA 12 ch	SysTick	CRC engine
	Flash (ECC) up to 2 MB	RAM up to 352 kB	CACHE 8 kB

Communication		
6x CAN 256 MO	USIC 6 ch [SPI/Dual SPI/Quad SPI, SCI/UART, I²C, I²S]	EtherCAT®
10/100 Ethernet MAC (/w IEEE 1588)	USB (FS OTG)	SDIO/SD/ MMV interface
External memory interface (EBU)		

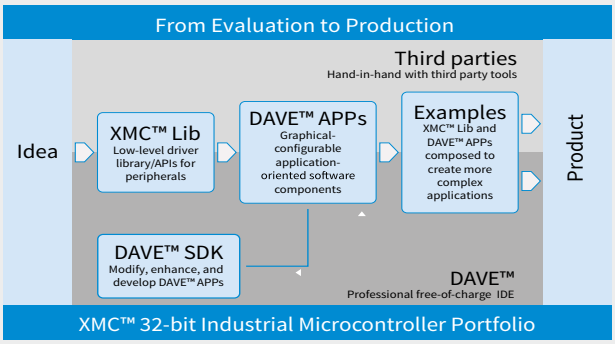
Timer/PWM		
4x PWM timers (CCU4) 16-bit to 64-bit 4 ch	2x PWM timers (CCU8) 16-bit to 64-bit 8 ch + dead-time	2x POSIF (Position interface)

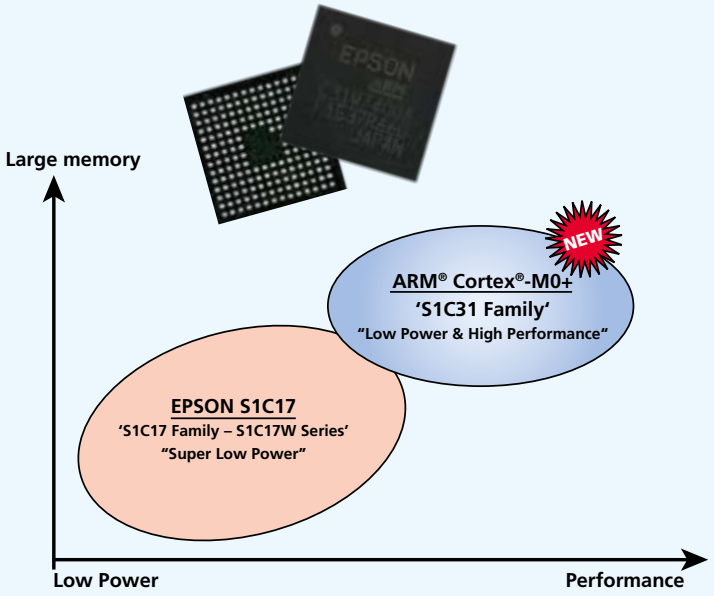
Analog		
4x 8 ch 12-bit ADC/4 Msps	2x 12-bit DAC	4x ΔΣ Demodulator

Packages		
LQFP100 -40 ... 85°C	LQFP144 -40 ... 85°C	LFBGA196 -40 ... 85°C
LQFP100 -40 ... 125°C	LQFP144 -40 ... 125°C	LFBGA196 -40 ... 125°C

DAVE™ – Free IDE

DAVE™ – Free of charge IDE using GNU C-compiler, providing graphical system design methods, a wide and configurable code repository, and automatic code generator for Arm® Cortex®-M XMC™ industrial microcontroller user along the entire process – from evaluation-to-production (E2P).
XMC™ Lib and DAVE™ generated code can be used with other 3rd party tool chains.





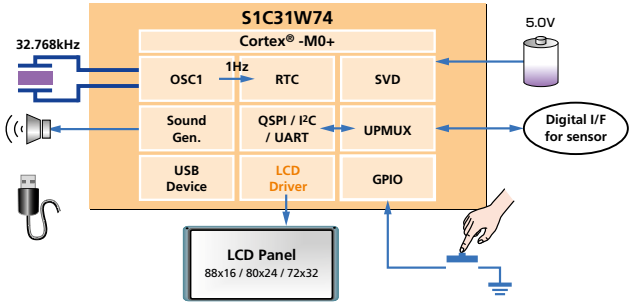
EPSON
EXCEED YOUR VISION

S1C31 32-Bit Arm® Cortex-M0+ Microcontrollers

The S1C31 Family is a 32-bit microcontroller which adopts the Arm® Cortex®-M0+ processor for the CPU core with several built-in features, such as various timers, serial interface functions, LCD driver, USB controller and Flash memory in one chip. The S1C31 family constructed and manufactured with the exceedingly energy efficient Cortex®-M0+ processor, Epson's original super-low leak process and circuit technology, contributes to exceptional performance of various mobile devices and sensor node terminals which perform environmental measurements over a long period while extending battery life.

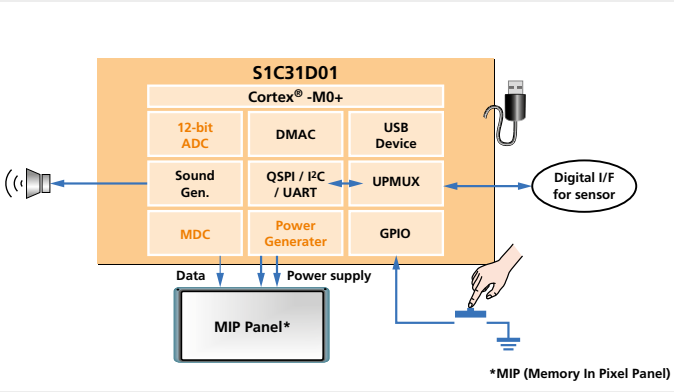
S1C31W00 Series

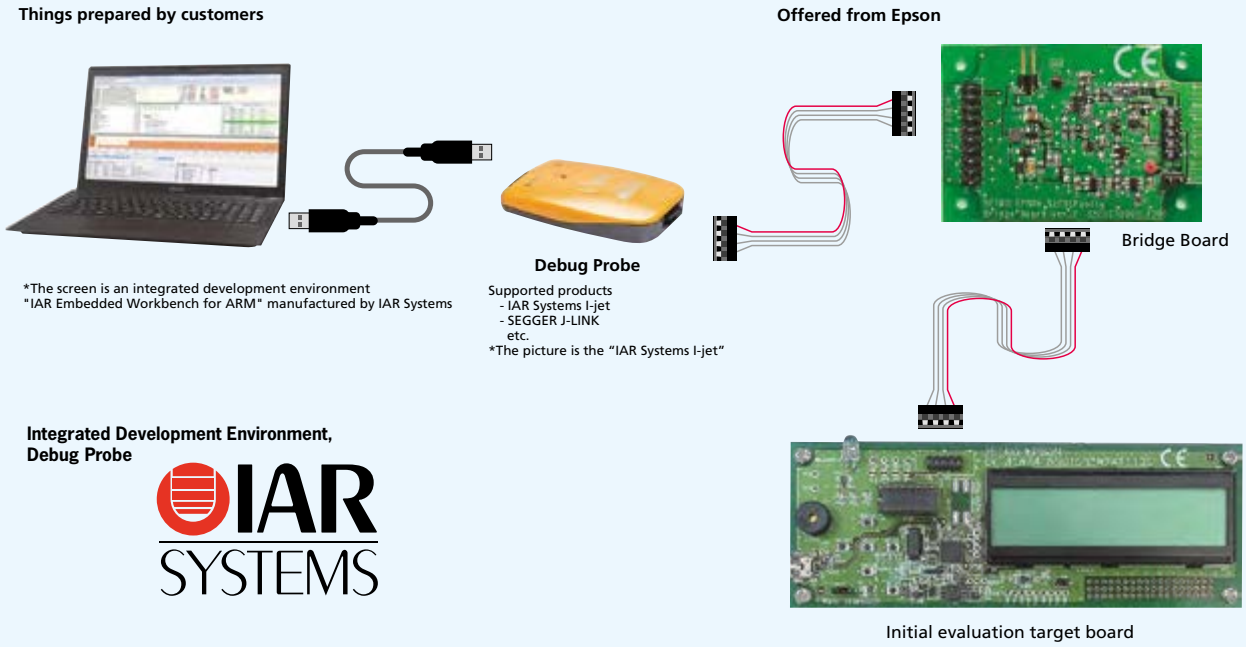
- Arm® 32-bit RISC CPU core Cortex®-M0+
- Embedded 72SEG × 32COM LCD driver
- Embedded 512K-byte Flash memory and 128K-byte RAM
- Various interfaces such as UART, QSPI, I²C, and USB that support DMA transfer



S1C31D00 Series

- Arm®32-bit RISC CPU core Cortex®-M0+
- Embedded 256K-byte flash memory and 96K-byte RAM
- Various interfaces such as UART, QSPI, I²C, and USB that support DMA transfer
- Built-in memory display controller
- Low power memory display voltage booster





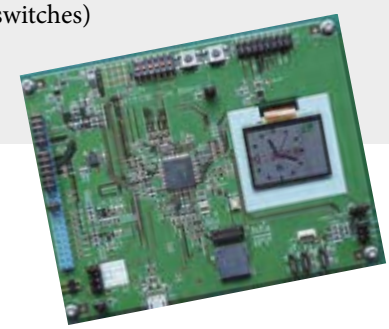
EPSON
EXCEED YOUR VISION

S1C31 32-Bit Arm® Cortex-M0+ Standard Tool Chain

SVT31W74 is Epson's first evaluation board for the S1C31 Microcontroller Family which is based on Arm® Cortex®-M0+ processor to provide exceptional performance while battery lifetime is extended. The combination of the very successful Arm® Cortex®-M0+ processor, the most energy efficient processor from U.K.- based Arm® Ltd. and Epson's ultra-low leak process and circuit technology helps to enable powerful MCUs with very attractive power consumption values.

SVT31D01 Eval Board

- S1C31D01 (MCU)
- Memory LCD module with 240 (H) × 240 (V) res.
- Sensors (gyro, acceleration & geomagnetic)
- Piezoelectric buzzer
- General-purpose switches (one 6-bit DIP switch and two push switches)
- 128MB serial flash memory (32MB × 4)
- Pulse wave detector (photoreflector + OP Amp)
- Power supply regulator (5 V-to-3 V linear regulator, 6.6 V DC/DC boost converter)
- Connector for debugging



SVT31W74 Eval Board

- S1C31W74 (MCU)
- LCD panel
- LED (one for remote-control output and three for indicators)
- Piezoelectric buzzer
- Five tact switches
- Serial flash memory
- Platform for R/F converter
- Power supply regulator
- Connector for debugging

Bridge Board

- Adapter between debug proge (e.g. SEGGER J-Link or IAR I-jet) and target board
- Outputs and controls Vpp Voltage (+7.5 V).
- Supplies +3 V and +5 V power voltages
- Connector figure transformation
- Generate the power for FLASH

Part Number	Max. Freq. (MHz)	FLASH size (kB)	Data E²PROM (Byte)	RAM size (kB)	A/D Converter (bit)	I/O	16 bit timers (bit)	16 bit PWM timers (16 bit)	LCD-Driver	Power Cons. Sleep (µA)	Power Cons. Halt (µA)	Power Cons. RUN 1MHz (µA)	UART	R/F converter	SPI	I²C	Package
S1C31W00 series	21.7	512	-	128	-	71	4x16	2x2	72x32	0.4	1.7	4400	2	1	1	2	BGA 181
S1C31D00 series	21.7	256	-	96	7x12	57	8x16	2x6	MDC	0.46	1.7	4400	3	1	2	2	QFP 80; BGA 81; WCSP 96

TX & TXZ™ Familiy

Creating Microcontroller Solutions

TOSHIBA
Leading Innovation

The TX and TXZ families consist of microcontrollers with an Arm Cortex®-M core. These families feature high energy efficiency and are suitable for real-time control applications.
The TXZ family, a new variant of the TX family, provides an enhanced suite of IP cores and flash memories. The TXZ family also features high-precision analog circuitry, higher speed and lower power consumption.
The TX and TXZ families consist of several series named after the integrated Arm core, which are further subdivided into many groups according to their target applications.

Features of the TXZ Family

Outstanding Basic Performance
- Wide range of operating voltage: 1.62 to 5.5 V
- Operating frequency of up to 200 MHz
- Operating current of 100 µA/MHz and STOP3 (RTC operation) of 0.5 µA
- High-precision on-chip oscillator: 10 MHz±1%

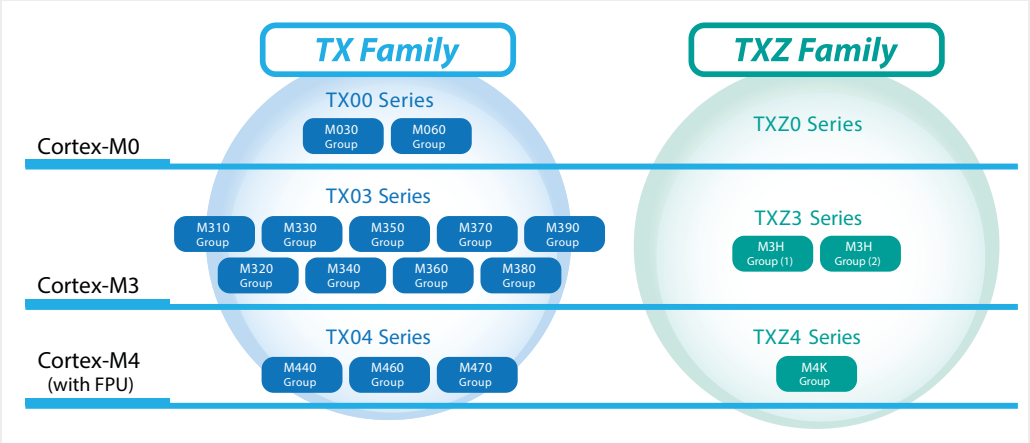
Reliable Safety Functions
- Complaint with the European safety standard for home appliances (IEC 60730)
- Self-diagnostic function
- Enhanced noise resistance

Wide Range of Product Lineup
- Packaging: 32 to 176 pins
- Code memory: 32 kB to 2.2 MB
- Data memory: 8 kB to 64 kB
- RAM: 8 kB to 256 kB

Applications
- Inverter motor control
- Industrial equipment

Powerful Development Environment
- Various development tools provided in partnership with Arm®
- Wide range of CMSIS-compliantdriver software
- Efficient dynamic verification using RAMScope

Enhanced Peripheral Functions
- Advanced Vector Engine Plus (A-VE+), op-amp and comparator for motor control
- Large-capacity data flash memory: 100,000 write-erase cycles
- High-speed AD converter



Arm® Cortex®-M4F

Arm® Cortex®-M3

VECTOR ENGINE

Toshiba's Original Motor Control Technology

TOSHIBA
Leading Innovation

The latest trend in motor control technology is vector control, but for this complicated high-speed calculation and high-level software, development is needed. The Toshiba original vector engine accomplishes easy and low-cost vector control. The vector engine is a co-processor exclusively for motor control. The vector engine executes the typical calculations including transformation of the three-phase motor current to a two-phase and transformation/inverse transformation of the rotational coordinates. These functions help to reduce CPU utilization while user-specified functions like position estimation and speed control are still executed in software. Thus the vector engine keeps a high level of flexibility while providing high performance motor control processing.

Features

Co-processor exclusive for motor control calculation

Reduction of the CPU overhead. Since the motor control process time is reduced, a commanding share of the CPU held by the software is decreased by 72% when two motors are operating

Various scheduling schemes

The vector engine includes Toshiba's original scheduling function. It configures the tasks and their combinations.

Predefined calculation tasks

The impact of development environment and compiler options is reduced.

Benefits

- Total system performance improved based on releasing resources of the CPU to other tasks, e.g. Power Factor Correction (PFC), sensor processing or communication
- Operation in quiet and low-vibration with high speed PWM frequency
- Reduced software development effort and debugging time
- High speed rotation up to 100.000rpm and more

Applications

- Industrial Motors
- Pumps
- E-bikes
- Washing Machines
- Refrigerators
- Fans

Portfolio Overview

Product Category TX03, TXZ3, TX04 & TXZ4	Available ROM Sizes (kB)	Available RAM Sizes (kB)	No. of PMD* Channels	No. of pins (different package variances available)
TMPM4 Series – Cortex M-3	64, 128, 256 & 512	4, 6, 10, 18, 32	1, 2	30, 32, 44, 48, 64, 100
TMPM4 Series – Cortex M-4F (One part with CAN-Bus interface available)	64, 256, & 512	18, 34	1, 2	32, 44, 48, 64, 100

*Programmable Motor Driver

nRF51 & nRF52 Series

Advanced, Flexible, Energy Efficient Wireless MCUs

Nordic Semiconductor offers the nRF51 and nRF52 series wireless MCUs to meet your application's demands. The nRF51 and nRF52 series are based on Arm Cortex M4 and M0 respectively.

nRF51 Series

Nordic Arm Cortex-M0 + Multiprotocol Wireless

High performance Bluetooth Low Energy with great flexibility and energy efficiency

The nRF51® series is a family of wireless MCUs for general purpose connectivity applications. Built around the popular Arm Cortex-M0 CPU they offer highly flexible multiprotocol options with multiple concurrent link support.
nRF51 series are a flash-based MCU family and they support over-the-air firmware upgrades.
nRF51 series have a rich peripheral set and are available in various memory options in WL-CSP or QFN package options.

nRF52 Series

Nordic Arm Cortex-M4 + Multiprotocol Wireless

Advanced performance and energy efficient multiprotocol wireless MCUs

The nRF52® series is a family of high performance wireless MCUs for advanced multiprotocol applications through to baseline Bluetooth connectivity applications. Built around the powerful Arm Cortex-M4 CPU they offer concurrent Bluetooth, ANT and 802.15.4-based multiprotocol options with up to 20 concurrent links supported. They have an extensive set of peripherals and interfaces including USB, NFC, PDM and PWM. The nRF52 series are flash-based and support secure over-the-air firmware upgardes. Devices are available in QFN and CSP packages.

nRF51 Series

Part Number	CPU	Memory FLASH	Memory RAM	Clock HF	Clock LF	Wireless Protocols	Output Power
nRF51822	Arm Cortex-M0	256/128 kB	32/16 kB	16 MHz	32 kHz	Bluetooth Low Energy /2.4 GHz	-20 to +4 dBm
nRF51422	Arm Cortex-M0	256/128 kB	32/16 kB	16 MHz	32 kHz	Bluetooth Low Energy /ANT/2.4 GHz	-20 to +4 dBm
nRF51824	Arm Cortex-M0	256/128 kB	32/16 kB	16 MHz	32 kHz	Bluetooth Low Energy /2.4 GHz	-20 to +4 dBm

nRF52 Series

Part Number	CPU	FPU	Memory FLASH	Memory RAM	Clock HF	Clock LF	Wireless Protocols	Output Power
nRF52840	Arm Cortex-M4	Y	1 MB	256 kB	64 MHz	32 kHz	Bluetooth 5/Bluetooth mesh/Bluetooth Low Energy/Thread/Zigbee/ANT, NFC-Tag A	-20 to +8 dBm
nRF52832	Arm Cortex-M4	Y	512/256 kB	64/32 kB	64 MHz	32 kHz	Bluetooth 5/ Bluetooth mesh/Bluetooth Low Energy /ANT/2.4GHz, NFC-Tag A	-20 to +4 dBm
nRF52810	Arm Cortex-M4	N	192 kB	24 kB	164 Hz	32 kHz	Bluetooth 5/Bluetooth mesh/Bluetooth Low Energy/ANT/2.4GHz	-20 to +4 dBm

NORDIC SEMICONDUCTOR

Software

SDKs

The nRF51 and nRF52 series are supported by the extensive nRF5 SDK to assist in the development of your application. The nRF5 SDK has hundreds of modules and examples to draw from and offers smooth software migration between nRF51 and nRF52 series wireless MCUs.

Protocol Stacks

Nordic protocol stacks are known as SoftDevices, they are pre-compiled, Bluetooth-qualified protocol stacks. SoftDevices offer security, simplicity and safety when developing Bluetooth applications as they are pre-tested stacks that offer the application an API thus ensuring reliable, efficient and predictable stack behaviour.

Development Tools

THREAD

nRF5 SDK for Thread

nRF52840 is supported by the nRF5 SDK for Thread. This is a certified solution for building Thread compliant products.

nRF5 SDK for Mesh

nRF51 and nRF52 series are supported by the nRF5 SDK for mesh. This solution enables development of applications that want to utilize Bluetooth mesh.

HomeKit

nRF5 SDK for HomeKit

The nRF52 Series are suitable for building HomeKit compliant products.
The nRF5 SDK for HomeKit is available to MFi members.

nRF52840 DK

Supports: Bluetooth 5/Bluetooth Low Energy/Bluetooth mesh/ Thread/802.15.4/NFC

nRF52 DK

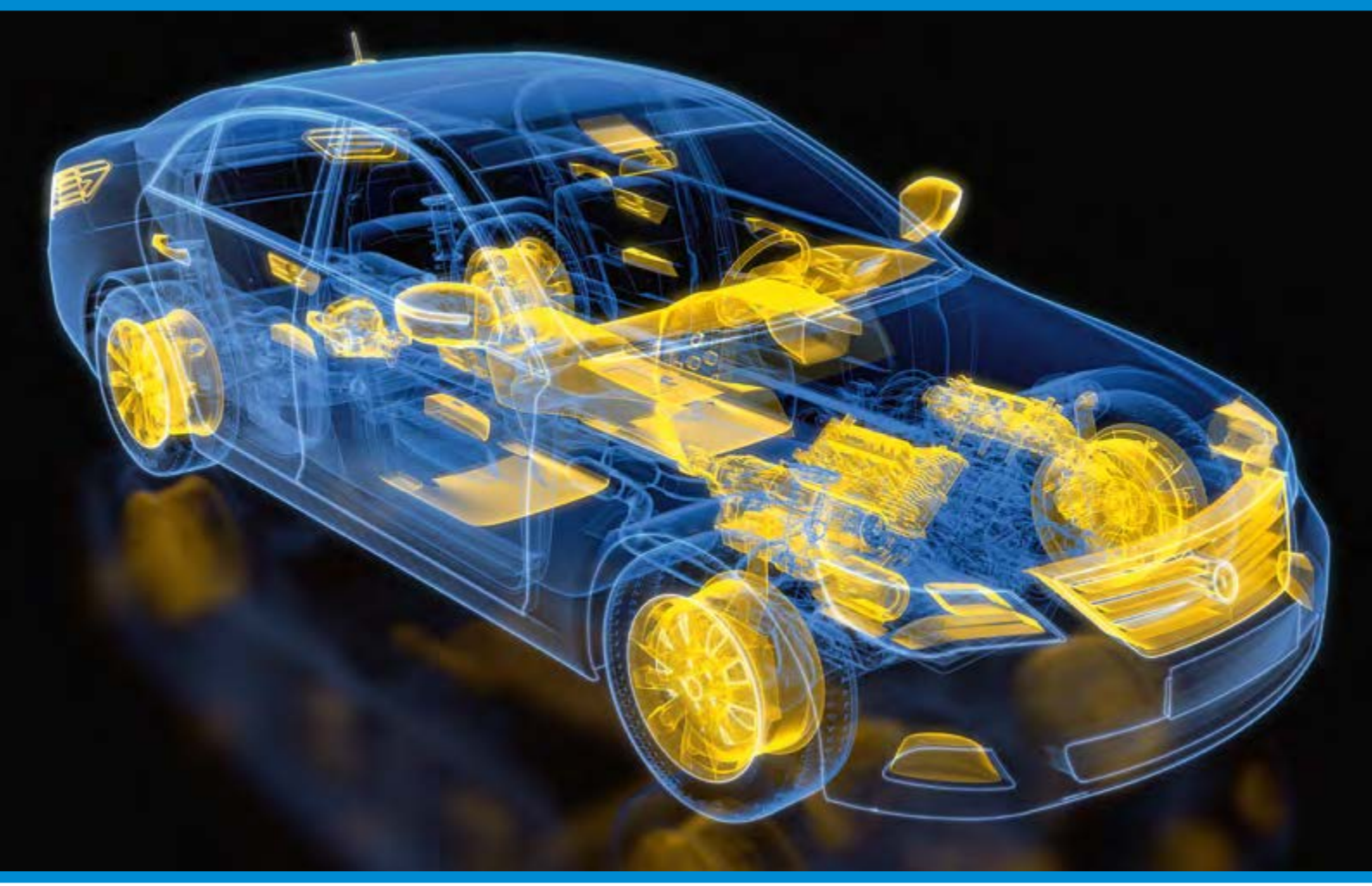
Supports: Bluetooth 5/Bluetooth Low Energy/Bluetooth mesh/NFC.

Power Profiler Kit

Advanced, accurate power measurement kit for nRF51 and nRF52 series.

	Data Rate	I/O	QDEC	SPI	UART	ADC	2-Wire	RTC	Package	Temp Range	Auto Grade
	2/1/0.25 Mbps	31	1	2	1	10-bit	2	1	QFN/CSP	-40 to +105°C	N/A
	2/1/0.25 Mbps	31	1	2	1	10-bit	2	1	QFN/CSP	–40 to +85°C	N/A
	2/1/0.25 Mbps	31	1	2	1	10-bit	2	1	QFN	-40 to +85°C	AEC-Q100 Grade 2

	Bluetooth 5				Arm	I/O	USB	QSPI	SPI	2-Wire	UART	RTC	PWM	PDM	ADC	Package	Temp Range
	2Mbps	Long Range	Adv Ext	CSA #2	Crypto Cell												
	Y	Y	Y	Y	Y	48	Y	Y	4	2	2	3	3	2	12-bit	QFN/CSP	-40 to +85°C
	Y	N	Y	Y	N	32	N	N	3	2	2	3	3	2	12-bit	QFN/CSP	–40 to +85°C
	Y	N	Y	Y	N		N	N		2	2	1		1	12-bit	QFN/CSP	-40 to +85°C



Linecard – Automotive Technologies & Suppliers

Type			HMI		Communication Interfaces					
			LCD	TFT	USB Host USB Host	USB OTG	USB Device	Ethernet	CAN	LIN
Renesas										
16-Bit	RL78	RL78/D	x						x	x
		RL78/F							x	x
STMicroelectronics										
8-Bit	STM8A	STM8AL	x							x
		STM8AF							x	x
32-Bit	e200	SPC56						x	x	x
	e200	SPC57						x	x	x
	e200	SPC58			x		x	x	x	x
Infineon										
32-Bit	TriCore Aurix	TC2xx						x	x	x
		TC3xx						x	x	x
	Cortex-M0	TLE984x								x
		TLE985x								x
	Cortex-M3	TLE986x								x
		TLE987x								x
TDK										
32-Bit	Cortex-M3	HVC 4223F								x

RUTRONIK
ELECTRONICS WORLDWIDE

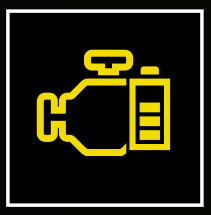
Discover Innovation in Motion

AUTOMOTIVE Products

RUTRONIK AUTOMOTIVE

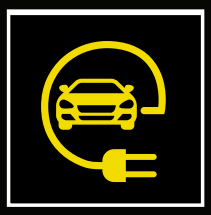
RUTRONIK **AUTOMOTIVE** offers innovative products of leading manufacturers for the automotive industry.
RUTRONIK **AUTOMOTIVE** brings together entire solutions for the following topics:


Body & Convenience


Drive Train


Chassis & Safety


Connected Car


eMobility


Consulting

More information:
www.rutronik.com/automotive

Analog Features					Memory			Specials				
(BDLC) Motor Control	DAC	Compa-rator	PGA / OP AMP	Delta Sigma ADC	Data Flash	EEPROM	External Memory Interface	Ultra Low Power	3V	5V	125°C	>125°C
					x					x		
x	x	x			x				x	x	x	x
x	x	x				x		x	x		x	
x						x				x	x	x
x					x				x	x	x	
x				x	x				x	x	x	x
x				x	x				x	x	x	x
x	x	x	x	x	x		x		x	x	x	x
x	x	x	x	x	x		x		x	x	x	x
x											x	x
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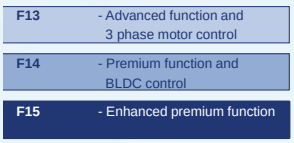
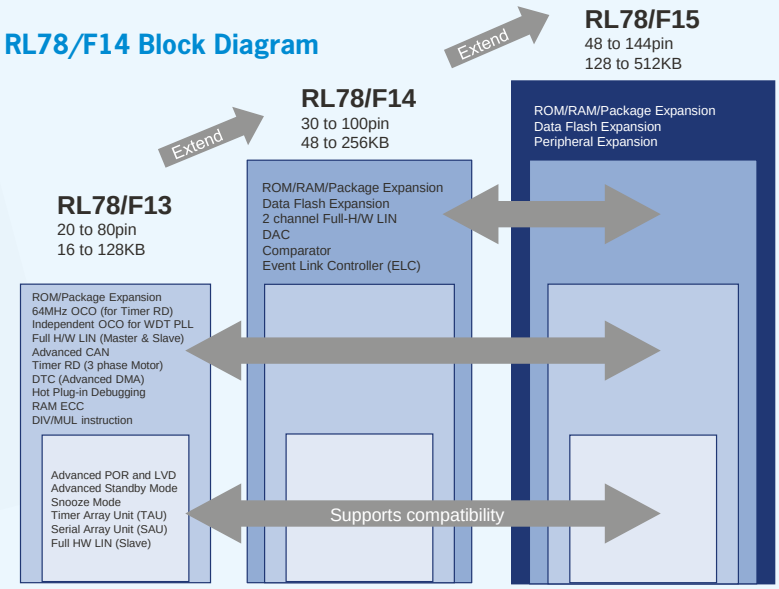
x	x	x	x							x	x	x





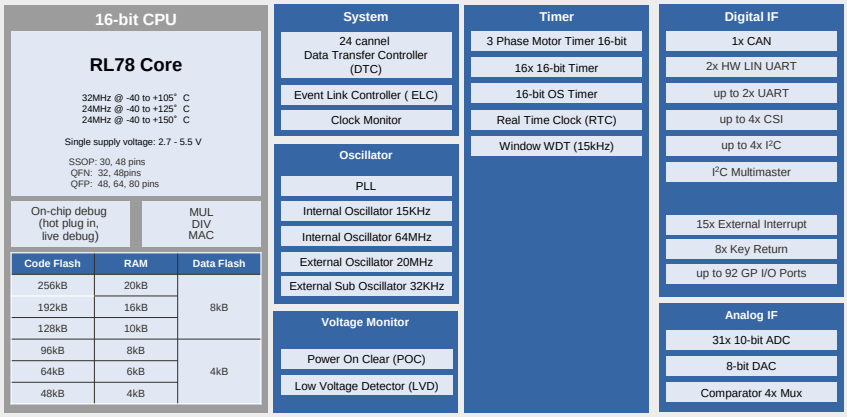
RL78/F1x

The True Low Power Microcontroller for Automotive Applications

The RL78/F1x sophisticated MCU family is the successor of the well known 78K0R/Fx3, R8C/3x and R8C/5x that realize low power consumption and high performance for a broad range of automotive applications such as cost-effective ECUs like switches, remote keyless entry, wiper, HVAC, lighting modules and engine sub controllers.

Features

- 16-bit device technology with 130 nm
- Huge scalability with more than 120 derivatives
- New and many energy saving features integrated
- Ultra low power
  - Reduced to 50% compared to previous generation
  - RUN mode: typ. 0.2 mA/MHz and max. 0.4 mA / MHz
- Strong performance CPU with 1.6 DMIPS/MHz
- Increased ambient temperature T_a up to 150 °C
- Improved Data flash memory with minimum 100k write/erase cycles
- High integration enabling system cost reduction
  - High precision on chip oscillator (± 2% at - 40 to 105 °C) fully suitable for LIN
  - 64 MHz on chip high speed clock for dedicated peripherals

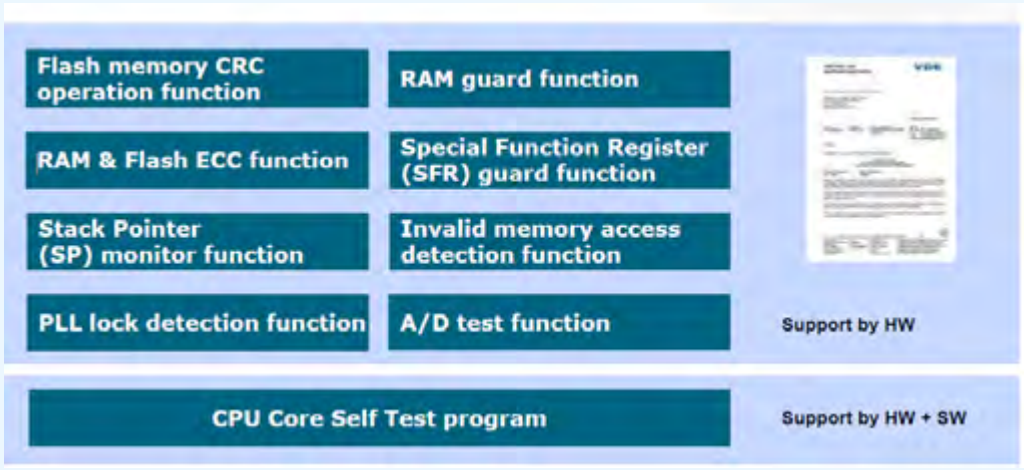


Applications

- Body Control Module
- Various Motor control (Brushless DC Motor Control Solution) Pump, fan, power window, wiper, mirror, seat, adaptive front lighting system (AFS) etc.
- Low-end car audio
- Powertrain (sub-MCU)
- Airbag (sub-MCU)
- Various body control door, switch/ indicator, relay box, clearance sonar, air conditioning, tire pressure monitoring system (TPMS), lighting system (LED, HID) etc.

Series	Part Number	Max. Freq. (MHz)	FLASH size (kB)	Data Flash (kB)	RAM size (kB)	A/D Converter	I/O	16-bit timer	32-bit timer	CAN	Ethernet	UART	LIN	USB	SPI	I²C	SSI	Package
RL78/F13	R5F10Axxxxx#xx R5F10Bxxxxx#xx	24-32	16-128	4	1-8	4 - 20x10 bit	13-68	11-15	-	0-1	-	2-3	1	-	2-4	2-5	-	LQFP 48-80; SSOP 20-30; QFN 32-48
RL78/F14	R5F10Pxxxxx#xx	24-32	48-256	4-8	4-20	10-31x10 bit	23-86	15-19	-	1	-	3-4	1-2	-	2-4	3-5	-	LQFP 48-100; SSOP 30; QFN 32-48
RL78/F15	R5F113xxxxx#xx	24-32	128-512	8-16	10-32	18-31x10 bit	38-130	19-27	-	2	-	2-3	2-3	-	3-4	5	-	LQFP 48-144; QFN 48

RL78/F1x Series Safety Features



RL/F1x series realize Functional Safety concepts according to ISO26262 and support ASILA and ASILB applications. It also has the VDE certification which saves 10K€ and three months.

RENESAS

RL78/D1A

For Automotive Low-End Instrument Clusters

The RL78/D1x is the successor of 78K0/Dx2 or UPD78082x microcontrollers and suited for car instrument cluster, built-in car instrument cluster dedicated features such as Sound Generator, Stepper motor Controller/Driver and LCD Segment Controller/Driver etc.

Benefits

- Ultra-low-power
- High performance CPU (1.27 DMIPS/MHz)
- Wide memory & package scalability
- High integration enabling system cost reduction
- Global top class of flash quality Data flash with 100.000 W/E cycles
- Integrated safety feature support
- Wide operation voltage of 2.7 to 5.5 V

Key Features

- Sound generator module
- Stepper motor controller incl. ZPD function
- Real time clock module incl. clock correction
- LCD segment controller
- Support of dashboard specific standby-mode, watch-mode

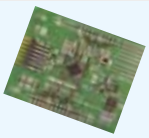
Series	Part Number	Max. Freq. (MHz)	FLASH size (kB)	Data Flash (kB)	RAM size (kB)	A/D Converter	I/O	16-bit timer	32-bit timer	CAN	Ethernet	UART	LIN	USB	SPI	I²C	SSI	Package
RL78/D1A	R5F10xxxxxx#xx	24-32	24-512	8	2-24	5-11x10 bit	38-112	24x16 bit	-	0-2	-	1-3	1-2	-	-	1	-	LQFP 48-128

RL78/F1x & RL78/D1A Development Environment

RL78/F14 Starter Kit

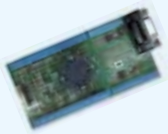
- Equipped with
  - »100-pin device (R5F10PPJ)
  - »CAN & LIN interface
  - »One switch, two LEDs »Breadboard area (2.54 mm pin pitch)
  - »4 MHz main clock resonator
  - »E1 debugging and programming interface
- Package includes
  KickStart Edition of IAR EWRL78 (16 kB)
  - »E1 Debugger
  - »Quick-start guide, user's manual and sample software
- Order code:
  Y-ASK-RL78F14

RL78/F1x Target Boards



- For RL78/F1x evaluation
- Equipped with
  - »RL78/F13 or RL78/F14
  - »E1 debugging and programming interface
  - »CAN & LIN interface
  - »4 or 20 MHz main clock resonator
  - »switch, 2 LEDs
  - »breadboard area (2.54 mm pitch)
- Board dimensions:
  approx. 110 mm x 55 mm
- Order codes:
  QB-R5F10BMG-TB (RL78/F13)
  QB-R5F10PPJ-TB (RL78/F14)

RL78/D1A Target Boards



- For RL78/D1A evaluation
- Equipped with
  - »100-pin socket for R5F10DPJ or 128-pin socket for R5F10DSL (Devices to be ordered separately)
  - »CAN & LIN interface
  - »peripheral board connectors
  - »4 MHz main clock resonator
  - »switch, 3 LEDs
  - »E1 debugging and programming interface
  - »breadboard area (2.54 mm pin pitch)
- Board dimensions: 110 mm x 56 mm
- Order codes: QB-R5F10DPJ-TB (RL78/D1A, 100pin)
  RTE510DSL0TGB00000R (RL78/D1A, 128pin)

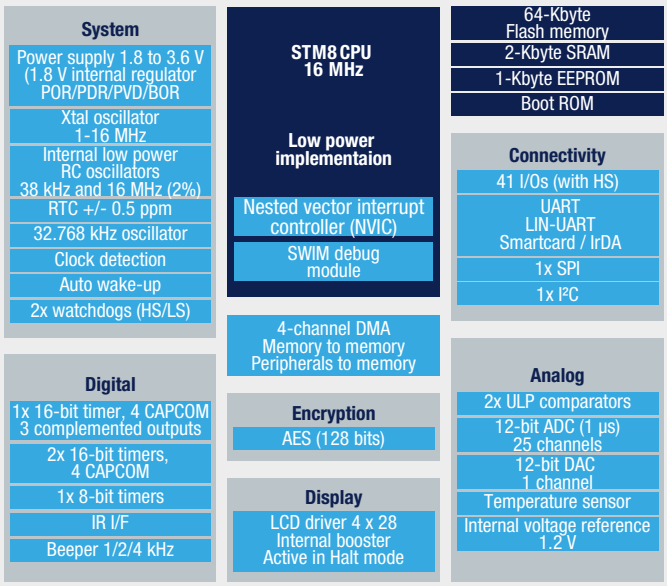
Software supported by SEGGER

STM8AL – Ultra-Low-Power Series for Automotive Applications

ST's STM8AL ultra-low-power series for automotive applications puts green energy, application safety and power efficiency at the forefront.

The STM8AL is particularly suited to battery-operated functions and for applications where power consumption is critical over time: companion microcontroller, immobilizers and sensors. Based on the STM8A embedded features for system cost reduction and reliability, the STM8AL series supports LIN communications and offers more features to increase computation performance, save power consumption and save memory space, using the LCD driver, RTC, DMA, comparators, 12-bit ADC and DAC. It offers a unique combination of flexible, innovative and cost-effective solutions for automotive applications.

STM8AL Block Diagram



STM8AF Automotive 8-bit MCU Series

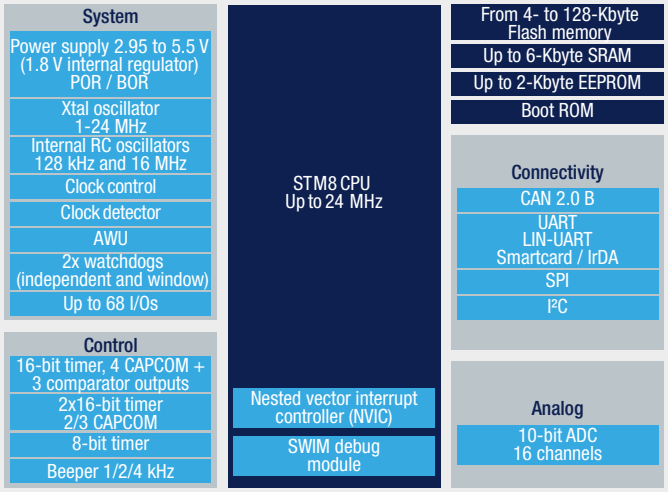
ST's STM8AF series is intended for automotive applications where no compromise on parameters is possible, from reliability to system cost effectiveness.

The STM8AF series is modular, provides high performance and offers the flexibility required for short development cycles. Its true data EEPROM, combined with the capability to withstand up to 150 °C ambient temperature, make the series a sustainable choice for automotive applications.

Applications

- CAN controllers
- LIN nodes
- Actuators
- Sensors
- Safety microcontrollers
- Car radios
- Immobilizers
- DC motor control
- HVAC

STM8AF Block Diagram



Common core peripherals and architecture:
Multiple communication peripherals USART, SPI, I²C
Multiple 16-timers
Internal 16 MHz and Low speed RC oscillators
2x watchdogs
Reset circuitry POR/PDR

STM8AF Series – 3.0 to 5.5V (-40dgC to 150dgC) AEC-Q100 grade 1 and grade 0

STM8 core @ 16/24 MHz	4KB to 128 KB Flash	Up to 6 KB SRAM	20 to 80 pins	BOR	Main osc. input 1-16 MHz	Up to 2 KB data EEPROM	CAN / LIN	16ch. 12-bit ADC (5 µs)

STM8AL Series – 1.8 to 3.6V (-40dgC to 125dgC) AEC-Q100 grade 1

STM8 core @ 16 MHz	8KB to 64 KB Flash	Up to 1 KB SRAM	32 to 48 pins	BOR PVD	Main osc. input 1-16 MHz	Up to 2 KB data EEPROM	RTC	Up to 4 ch DMA	25ch. 12-bit ADC (1 µs)	12-bit DAC	LCD 4x40

STM8A Series

Automotive 8-bit Microcontrollers

Upgrade to a higher or downgrade to a lower memory size or use a different package across lines without changing the initial layout or software.

- STM8 up to 24 MHz CPU
- 8 to 128 Kbytes of embedded flash memory, up to 6 Kbytes of SRAM and up to 2 Kbytes of data EEPROM
- Packages up to 80 pins
- Supply voltage: 2.95 to 5.5 V for STM8AF, 1.65 to 3.6 V for STM8AL
- Up to four low-power modes: down to 1 µA with complete context retention
- State-of-the-art digital and analog peripherals
- Up to 150 °C ambient temperature
- Qualified to AEC-Q100
- Certified CAN drivers
- Free certified LIN drivers
- Touch-sensing and LCD lines

Product lines	Flash memory (kB)	RAM (kB)	Data EEPROM (bytes)	CAN 2.0B	LIN 2.1	Additional analog channels	Automotive Grade 0 (150°C)
STM8AF52	32 to 128	6	1024 to 2048	x	x		x
STM8AF62	4 to 128	1 to 6	640 to 2048		x	x	x

Product lines	Flash memory (kB)	RAM (kB)	Data EEPROM (bytes)	Four DMA channels	LCD Interface
STM8AL31	16 to 64	4	2048	x	
STM8AL3L	16 to 64	4	2048	x	x

STM8 core - Up to 24 MHz

- 10-bit ADC
- USART, SPI, I²C
- 8- and 16-bit timers
- 16 MHz crystal oscillator
- 128 kHz internal RC oscillators
- SWIM debug module

STM8 core - Up to 16MHz

- 12-bit ADC
- 12-bit DAC
- USART, SPI, I²C
- RTC with 32 kHz oscillators
- 8- and 16-bit timers
- Temperature sensor
- Comparator
- SWIM debug module
- AES-128 encryption

STM8A-DISCOVERY: Discovery Kit STM8A Automotive series with STM8AF52C6 and STM8AL3L68 MCUS

Software supported by SEGGER

Core	e200z0	e200z3	e200z4d
Pipeline	4	4	5
Issue (instructions/cycle)	Single	Single	Dual
MMU	-	8 pages	16 pages
CPU cache	-	-	Instruction + Data
CPU MHz range	32 to 80 MHz	80 MHz	Up to 150 MHz

SPC5

32-bit Automotive MCUs

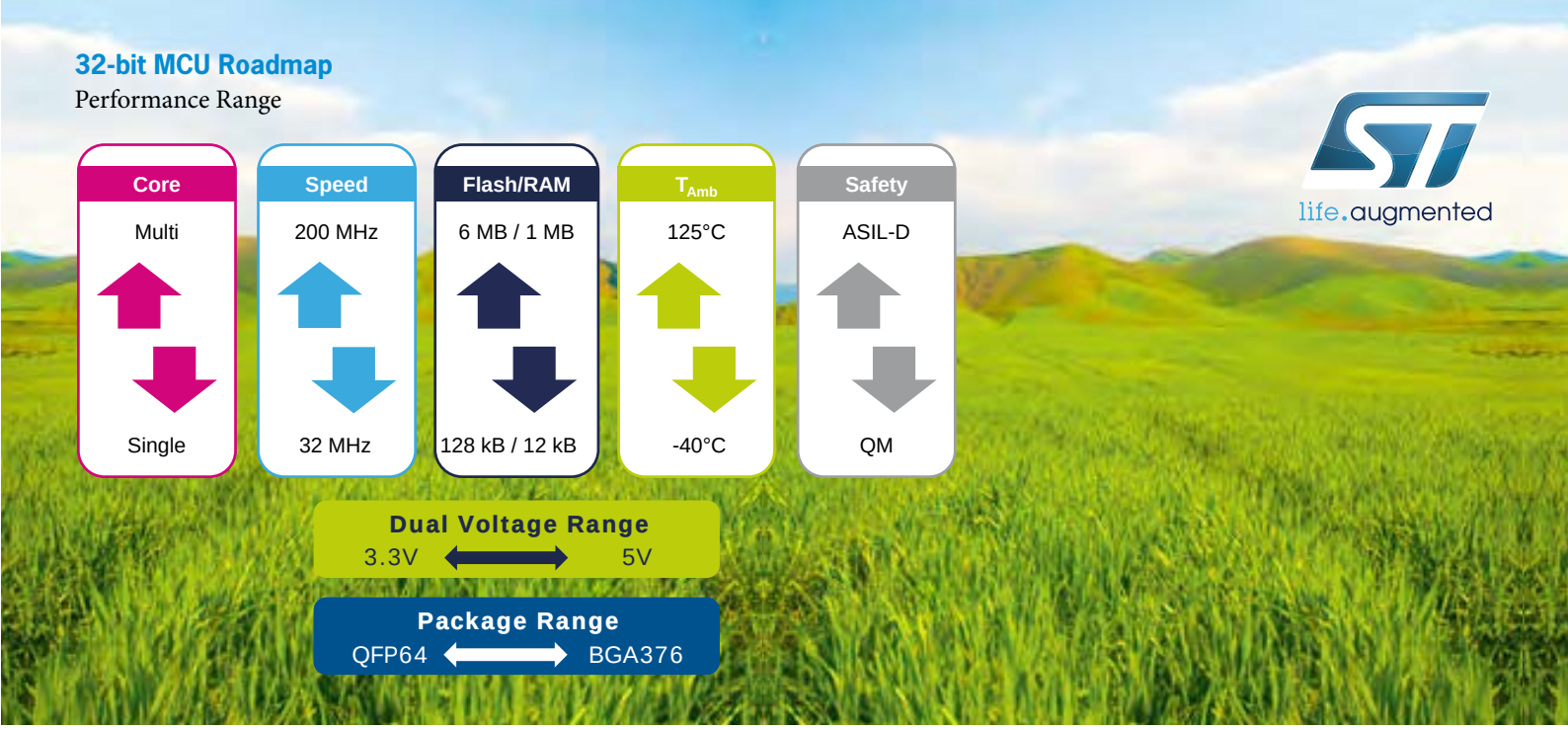
ST's SPC5 32-bit microcontrollers are designed using industry's standard Power Architecture® and ST's proprietary embedded flash technology.

They combine a scalable range of single-, dual- and multi-core solutions (Power Architecture e200z0 to e200z4) with innovative peripheral sets that are optimized for car applications, such as engine management, chassis, safety, body control, advanced driver assistance, and for all applications requiring long-term reliability.

- Single- to multi-core architectures
- Technology range from 90 nm down to 40 nm
- Full performance up to 150 °C
- 15 years product longevity
- High-end peripherals set, including ISO CAN FD
- Internal manufacturing (front-end and back-end) for security of supply
- Safety compliance to standards such as ISO 26262 (up to ASIL-D)
- Data security compliance to standards including SHE (Secure Hardware Extension) and EVITA (e-safety vehicle intrusion protected applications)
- Complete development environment (from free-of-charge IDE, code compiler and low-cost debugger solution up to high-end solutions supporting AUTOSAR designs)

SPC5 Power Architecture® Cores

The SPC5 family of MCUs all use Power Architecture e200 series cores. Automotive applications require a variety of processing power and peripherals, so the SPC5 family ranges from code-efficient e200z0 single-core MCUs, to e200z4d dual-issue processors for applications requiring processing capabilities.
However, across all cores, the same instruction sets, and memory and interrupt maps can be used, so that your software is compatible across the SPC5 family.



SPC5

Device Summary

Line	Family Descriptor	Family Superset	Basis Features					PWM			Network Capability		Data Security			Functional Safety	Applica-tions			
			Core	CPU Clock Frequency max (MHz)	Flash Code max (bytes)	RAM (kB)	Package	eMIOS	FlexPWM /eTimer	GTM	Ethernet	ISO CAN FD	HSM	Crypto graphy	EVITA Level	ASIL-D	Powertrain	Chassis & Safety	Motor Control	Car Body & Gateway
SPC56 D-Line	Body Access	SPC560D	e200z0	48	256K	16	QFP64/100	x												x
SPC56 B-Line	Bolero 1.5M	SPC560B	e200z0	64	1.5M	96	QFP64/100/144	x												x
	Bolero 3M	SPC564B	e200z4	120	3M	192	QFP176/208/ BGA256	x			x			x	Light					x
SPC56 C-Line	Gateway 0.5M	SPC560C	e200z0	64	512K	48	QFP64/100	x												x
	Gateway 3M	SPC56EC	e200z4 + e200z0	120	3M	192	QFP176/208/ BGA256	x			x			x	Light					x
SPC56 P-Line	Pictus 0.5M	SPC560P	e200z0	64	512K	40	QFP64/100/144		x									x	x	
	Pictus 1M	SPC56AP	e200z0 dual core	64	1M	80	QFP100/144		x									x	x	
SPC56 L-Line	Leopard	SPC56EL	e200z4 dual core	120	2M	192	QFP100/144		x							x		x	x	
SPC56 M-Line	Monaco	SPC563M	e200z3	80	1.5M	94	QFP144/176	x									x			
SPC56 A-Line	Andorra	SPC564A	e200z4	150	4M	192	QFP176/BGA324	x									x			
SPC57 S-Line	Velvety	SPC570S	e200z0	80	512K	48	QFP64/100		x							x		x	x	
	Sphaero	SPC574S	e200z4	140	1.5M	128	QFP100/144		x			x				x		x	x	
SPC57 M-Line	Lavaredo	SPC572L	e200z2	80	1.5M	64	QFP80/100			x	x						x			
SPC57 K-Line	K2	SPC574K	e200z4	160	2.5M	176	QFP144/176			x	x	x				x	x	x		
SPC58 B-Line	Chorus 1M	SPC582B	e200z2	80	1M	96	QFN32/ QFP64/100	x				x								x
	Chorus 2M	SPC584B	e200z4	120	2M	192	QFP64/100/ 144/176	x			x	x	x	x	Medium					x
SPC58 C-Line	Chorus 4M	SPC58EC	e200z4 dual core	180	4M	512	QFP64/100/144/ 176/BGA292	x			x	x	x	x	Medium					x
SPC58 G-Line	Chorus 6M	SPC58NG	e200z4 triple core	180	6M	768	QFP144/176/ BGA292	x			x	x	x	x	Medium	x				x
SPC58 E-Line	Eiger 6M	SPC58NE	e200z4 triple core	180	6M	768	QFP144/176/ BGA292			x	x	x	x	x	Medium	x	x	x	x	
SPC58 N-Line	Berina 6M	SPC58NN	e200z4 triple core	200	6M	448	QFP176/BGA292			x	x	x	x	x	Medium	x	x	x	x	

eMIOS(Enhanced Modular Input Output System): Provides the functionality to generate or measure events
eTimer(Enhanced Timer Module): Six 16-bit general purpose up/down timer/counters per module are implemented with features to meet the specific needs of chassis applications
FlexPWM: Four 16-bit channels per module operating at up to core clock frequency with features for controlling most of the motor types.
GTM(Generic Timer Module): Intelligent complex timer module. Hardware support for engine control, motor control and safety related applications
HSM(Hardware security module): Provides robust integrity checking of flash memory, censorship and tamper detection according to Evita

	SPC56 B Line		SPC56 C Line		SPC56 D Line	SPC58 B Line		SPC58 C Line	SPC58 G Line
									
Core	e200z0h @ 64 MHz	e200z4d @120 MHz	e200z0h @ 64 MHz	e200z4d + e200z0h @120 MHz	e200z0h @ 48 MHz	e200z2h @ 80 MHz	e200z4d @ 120 MHz	single or dual e200z4d @ 180 MHz	single, dual or triple e200z4d @ 180 MHz
eFlash Code	256 kB to 1.5MB	1.5 to 3MB	256 to 512 kB	1.5 to 3MB	128 to 256 kB	512 kB to 1MB	1 to 2MB	2 to 4MB	4 to 6MB
ADC	1x10 bit	1x10 bit, 1x12 bit	1x10 bit, 1x12 bit	1x10 bit, 1x12 bit	1x12 bit	1x12 bit	2x12 bit	4x12 bit, 1x10 bit	5x12 bit, 1x10 bit
Networking				ETH		7x ISO CAN FD	8x ISO CAN FD ETH	8x ISO CAN FD ETH	8x ISO CAN FD 2x ETH
Security/Safety				CSE			HSM	HSM	HSM/ ASIL - D

SPC5

MCUs for Interior, Networking and Low-Power Applications

STMicroelectronics SPC56 B, C, D-Line and SPC58 B, C, G-Line are dedicated to the specific needs of body and convenience applications with a focus on networking and security.

Key Benefits

- **Lighting Module Support**
  A module dedicated to the control of car lighting provides real-time diagnostic feedback for 100% of the loads. It extends the capability of existing systems as each channel can be configured on the fly through software for incandescent lamps and LEDs.

- **Power Management**
  A sophisticated low-power management allows for a quantum leap in power saving, avoiding the use of a secondary microcontroller.
  The low-power and wake-up concepts support LIN and CAN communication from stand-by mode. STOP Mode supports Pretended Networking, with consumption less then 4 mA.

- **Data Security**
  The Cryptographic Services Engine (CSE) available on SPC564B/EC products, compliant to security standards SHE and EVITA light, grants the maximum level of data security.

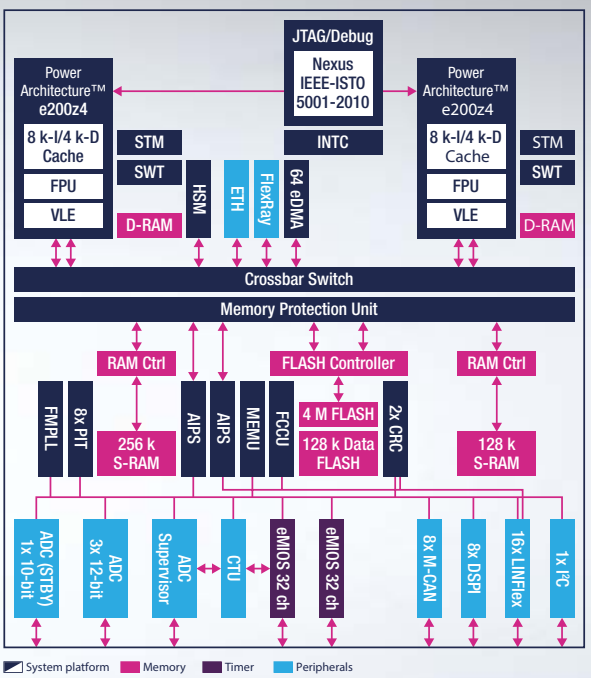
Improved Time to Market
- Standard core for maximum reuse
- Designed for AUTOSAR
- Memory/pin-out/performance scalability
- Compatibility of product family

Reduced System Cost
- EEPROM emulation support
- Improved EMI
- Innovative power management concept
- Dual on-chip RC oscillators

Power and Robustness
- z0h - z4d Power Architecture® Dual-core options
- ECC on all memories
- Memory/register protection functions
- Clock security system/backup oscillator
- CPU clock independent watchdog
- Injection robust I/Os

Focus on Quality
- Zero defects strategy from design to production
- Internal manufacturing for supply assurance
- Latest 90 nm automotive-focused technology

Applications
- Body Control module
- Smart Junction box
- Gateway
- Comfort module
- Door module
- Seat module
- Lighting
- Battery Management
- Control panel
- Lighting module with diagnostics



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Freq. max	Voltage	T_{amb}	ASIL	I/O	Package
180 MHz	5V/3.3V	-40 to 125°C	B	215	eTQFP64/100/144 eLQFP176 LFBGA292

Featured Product: Chorus SPC58 C Line

Built on the legacy of successful SPC56 MCUs in ST's embedded 90 nm flash technology, the new SPC58 product generation in 40 nm Flash technology offers the widest range of compatible and scalable devices from 512 Kbytes up to 6 Mbytes of Flash memory, combined with the latest communication interfaces including ISO CAN FD and Ethernet with Audio Video Bridging (AVB) capability.

Core
- Up to 2x180 MHz Power Architecture™ ISA e200z4 Core (VLE)
- Dual Issue Core with Floating Point Unit
- 8 k-Instruction Cache, 4 k-Data Cache
- 64 k Local d-RAM

Memory
- Up to 4 MB RWW Flash with ECC
- 4x 32 kB Data Flash with ECC
- Up to 512 kB RAM (384 k SRAM, 2x 64 k Local d-RAM) with ECC I/O
- Up to 8x ISO CAN FD
- Up to 18x LINFlex
- 1x Ethernet (100 Mb/s, time stamping, AVB, IPv6 Checksum)
- Dual Channel FlexRay (10 MB/s, 128 buffers)
- Up to 8x DSPI, 1x I^2C, 2x 32 ch eMIOS
- 64 ch CTU (Cross Triggering Unit)
- Up to 95 channel ADC
- 3x 12-bit ADC
- 1x 12-bit ADC Supervisor
- 1x 10-bit Standby ADC

System
- SSWU (Smart Standby Wake-up)
- Security Module: HSM (Evita Medium)
- FM-PLL
- MPU
- 64 Channel eDMA controller
- 2x CRC unit
- Fault Collection & Control unit (incl. error pin)
- 2x PIT/1x STM/1x RTC/API
- Nexus IEEE-ISTO 5001-2010 Class 3+

Rich Set of Automotive Network Protocols
- Up to 8x CAN with ISO CAN FD
- Up to 2x Ethernet 10/100Mb/s
- FlexRay dual channel
- Up to 18x LIN interfaces

Performance
- Up to 6 MB of flash memory
- and 768 Kbytes of RAM
- Single-, dual- and triple-core platform @ 180 MHz
- Data and instruction cache as well as local data RAM to avoid wait-states at maximum frequency

Peripherals
- eMIOS timer with 64 ch combined with Cross Triggering unit
- ADC: Up to 4x12-bit/1x 12-bit supervisor/1x 10-bit standby
- Up to 10 SPI interfaces

Miscellaneous
- Security: HSM

From Bolero to Chorus

Bolero 3M SPC56 B-Line Dual core 120 MHz, Flash 1.5M - 3M	+	Double Performance, ISO CAN-FD, Security Ethernet (AVB), Smart Low Power, ASIL-B	=	**Chorus 4M SPC58 C-Line** Dual core 180MHz, Flash 2M - 4M
Bolero 3M SPC56 B-Line Dual core 120 MHz, Flash 1.5M - 3M	+	Optimized Device, ISO CAN-FD, Ethernet, Smart Low Power, ASIL-B	=	**Chorus 2M SPC58 B-Line** Single core 120MHz, Flash 1M - 2M
Bolero 1.5M SPC56 B-Line Single core 64 MHz, Flash 256K - 1.5M	+	Increased Performance, ISO CAN-FD, ASIL-B, QFN Package	=	**Chorus 1M SPC58 B-Line** Single core 80MHz, Flash 512K - 1M

	SPC56 P Line	SPC56 L Line		SPC57 S Line	
	 				
Core	e200z0h @ 64 MHz	e200z4h @ 120 MHz	e200z4d + e200z4h @120 MHz	Dual e200z0h @ 80 MHz	Dual e200z4h @ 140 MHz
eFlash Code	192 kB to 1MB Code 64 kB data	768 kB to 2 MB Code 192 kB Data	768 kB to 2 MB Code 192 kB Data	256 kB to 512 kB Code 48 kB Data	1 MB to 1.5 MB Code 64 kB Data
ISO26262	ASIL-B	ASIL-B	ASIL-D	ASIL-D	
Note			Lock step, Decoupled parallel modes, MPU, BIST	Delayed Lock step, E2E, ECC, MPU, BIST	

SPC5

MCUs for Safety Critical Applications and Motor Control

STMicroelectronics SPC56 P, L Line and SPC57 S Line are dedicated to the specific needs of chassis and safety applications, with a specific focus on functional safety and advanced three-phase motor control. The unique modularity and scalability of the architecture provides compatible devices covering the wide range of chassis and safety applications with optimum cost, safety and performance trade-offs.

Key Benefits

Efficient and Safe Processing of Application Data

- High-performance, 32-bit Power Architecture® cores: SPC56 P Line e200z0h with VLE for best code efficiency SPC56 L Line, e200z4d dual issue, cache memory, DSP and vector floating point.
- The SPC56 P Line offers low-cost functional safety addressing ASIL-B requirements and variants providing optimized peripherals for electric motor control & airbag systems.
- The SPC56 L Line is an enhanced solution with increased safety implementations such as dual-core architecture working both in Lock Step and Decoupled Parallel modes addressing ISO 26262 requirements. Its safety concept, based on hardware implementation, offers a certified ASIL-D turnkey solution easily extensible to SIL3 compliance.

Improved Time to Market

- Compatibility across families through modular peripheral sets
- AUTOSAR compliant, maximizing software and tools reuse
- Memory/pin-out/performance scalability
- SPC56 A proven safety integrity

Reduced System Cost

- SPC56 L functional safety turnkey
- SIL3/ASIL-D solution based on HW measures – no need for external MCU
- Field-oriented three-phase control for best efficiency and EMI performance
- Sensor-less implementation supported with dedicated library and 32-bit processing performance

Focus on Quality

- Zero defects strategy from design to production
- Internal manufacturing for supply assurance
- Latest 90nm to 55nm automotive-focused technology

Applications

- ABS & ESC
- Active suspension
- Electronic power steering
- Airbags systems
- Safety domain controller
- Braking systems
- Driver assistance
- Advanced motor control

	SPC56 M Line	SPC56 A Line	SPC57 M Line	SPC57 K Line	SPC58 E Line	SPC58 N Line
	SPC56 M	SPC56 A	SPC57 M	SPC57 K	SPC58 E	SPC58 N
Core	e200z3 @ 80 MHz	e200z4d @ 150 MHz	e200z2 @ 80 MHz	e200z4 @ 160 MHz + e200z2 @ 80MHz	single, dual or triple e200z4d @ 180 MHz	single, dual or triple e200z4d @ 200 MHz
eFlash Code	1 MB to 1.5 MB	2 MB to 4 MB	1 MB to 1.5 MB	2 MB to 2.5 MB	4 MB to 6 MB	4 MB to 6 MB
ADC	2x12 bit	2x12 bit	3x12 bit SAR 1xSigma-Delta	5x12 bit SAR 2xSigma-Delta	5x12 bit SAR 3x10 bit SAR 6xSigma-Delta	5x12 bit SAR 3x10 bit SAR 6xSigma-Delta
Real-Time	eTPU + eMOS	eTPU + eMOS	GTM	GTM	GTM	GTM
Networking	2x CAN	3x CAN FlexRay	2x CAN ETH	2x ISO CAN-FD 1x CAN FlexRay ETH	8x ISO CAN FD FlexRay 2x ETH	8x ISO CAN FD FlexRay 1x ETH
Security/Safety	ASIL-B	ASIL-B	ASIL-B	ASIL-D	HSM ASIL-D	HSM ASIL-D

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SPC5

MCUs for High-Performance Applications

SPC56 M, A Line, SPC57 M, A Line and SPC58 E, N Line are dedicated to the specific needs of powertrain applications. With unmatched modularity and compatibility, a new state-of-the-art technology, combined with a high-performance core and tailor-made peripherals, make these MCUs the perfect platform solution, optimizing system cost and performance.

Key Benefits

eTPU2

- Enhanced co-processor designed for timing control. Operating in parallel with the host CPU, the eTPU2 processes instructions and real-time input events, performs output waveform generation and accesses shared data without host intervention. Consequently, for each timer event, the host CPU setup and service times are minimized or eliminated. A powerful timer subsystem is formed by combining the eTPU2 with its own instruction and data RAM. ST's high-level assembler/compiler library allows customers to develop their own functions on the eTPU2.

Tight Emission Control

- High-performance cores integrating digital-signal processing and vector floating-point computation for the SPC563 M product lines, in addition to cache memory and dual-issue pipeline for the SPC564 A line.

- Dual ADCs with variable-gain input amplifier and decimation filter allowing knock detection integration

Improved Time to Market

- Compatibility across families through modular peripheral sets
- AUTOSAR compliant, maximizing software and tools reuse
- Memory/pin-out/performance scalability

Reduced System Cost

- Very high I/O availability in QFP packages
- Innovative calibration concept and tools support
- Requires only one linear 5 V voltage regulator (SPC563 M family)
- On-chip integration of CRC unit and FlexRay controller (SPC564 A family)

Focus on Quality

- Zero defects strategy from design to production
- Internal manufacturing for supply assurance
- Latest 90 nm to 40 nm automotive-focused technology

Applications

- Power train control
- Chassis control
- Transmission control
- Industrial Automation
- Electronic power steering
- Safety domain controller
- Braking system
- Active suspension
- Advanced driver assistance systems

Discovery Kit for SPC57 S line with SPC570S50E1.
Order code: SPC570S-DISP

Discovery+ Kit for SPC56 M line with SPC563M64L.
Order code: SPC563M-DISP

SPC5

Hardware Development Ecosystem

STMicroelectronics SPC56 P, L-Line and SPC57 S-Line are dedicated to the specific needs of chassis and safety applications, with a specific focus on functional safety and advanced three-phase motor control. The unique modularity and scalability of the architecture provides compatible devices covering the wide range of chassis and safety applications with optimum cost, safety and performance trade-offs.

Discovery+ Boards
The Discovery+ boards are designed to cover the higher performance P, L, A and M lines, providing additional connectivity options and extended functions. All I/O ports are always accessible through 0.1" standardized pin array connector, a JTAG connector is available and the main communication interfaces (CAN, LIN, K-LIN, and UART) are directly accessible through dedicated connectors, with an on-board transceiver. The PLS USB/JTAG adapter, already integrated in the P-line, can be optionally plugged through the JTAG connector for the other lines. Other functions for each line can be easily extended using expansion boards through dedicated connectors. The P-line board also implements an Arduino-compatible connector that ensures compatibility with different solutions including the ST Nucleo and third-party shields.

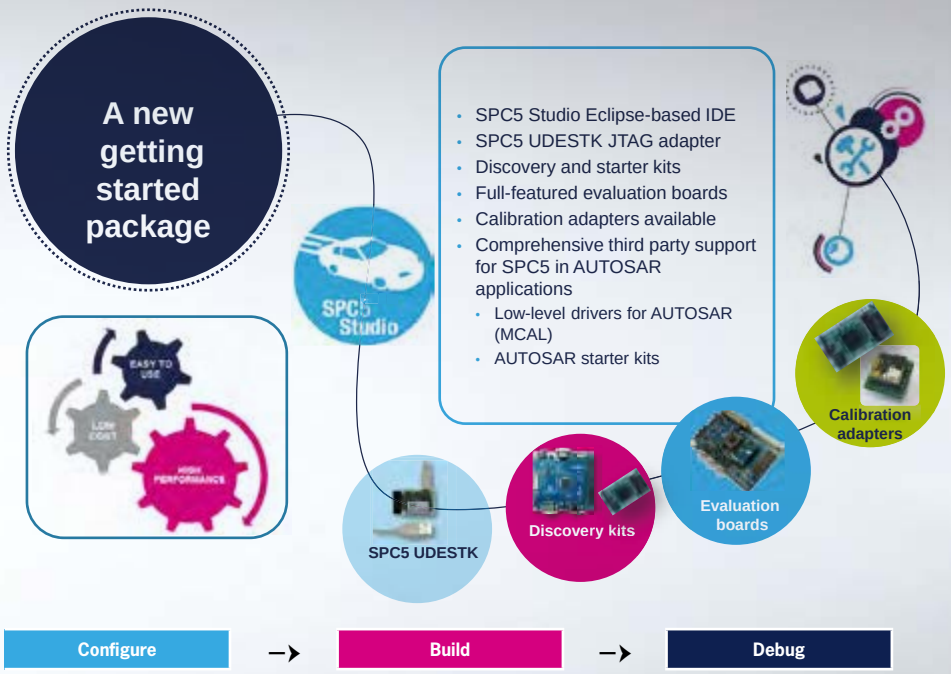
Premium Evaluation Board
The Premium evaluation kit is a full evaluation platform supporting the SPC56 family of microcontrollers. The complete system consists of a motherboard and a mini-module which plugs into the motherboard. Different mini-modules are available for evaluating powertrain, body, chassis and safety applications with different target devices of the family. The evaluation system allows full access to the CPU, all of the CPU's I/O signals and motherboard's peripherals such as CAN, SCI, LIN, Flex-Ray and Ethernet.

Discovery Boards
The Discovery boards are the easiest and most convenient solution to explore and use the Bolero family, D line and B line. They can be used both for evaluation and development activities, thanks to the embedded debugging and programming capabilities (due the integration of the PLS USB/JTAG debugger) and the 0.1" pin array connector giving access to all the I/O ports. The boards are also designed to be used in combination with VIPower / Smart Power expansion boards to offer system solutions.

SPC5-CONNECT

SPC5-UDESTK

Discovery kits	Premium boards
Quick starter kits for early evaluation	Complete HW solutions for advanced development
ST Discovery boards enable the user for a quick evaluation of main device features	ST Premium boards ensure full access to device´s features and functionalities



life.augmented

SPC5 Studio

- Eclipse based open Framework
- Quick application Development
- Easy to get Started and Easy to Use
- Integrates GNU 'C' compiler
- Works with a growing Library of Low-level drivers
- Free on www.st.com

SPC5

Software Development Ecosystem

SPC5-Studio is an integrated development environment providing a comprehensive framework to easily design, build and deploy embedded applications for SPC5 Power Architecture® 32-bit microcontrollers. Based on the open-source Eclipse platform, it lets users add functions by developing their own plugins. SPC5-Studio combines a project editor, a sophisticated code generator, a dedicated High-Tec GNU "C" compiler, a PLS starter kit debugger and several software elements such as code examples, low-level drivers and libraries. The SPC5Studio generated code is optimized due to the use of modern open-source code-generation techniques and can be used as a reference functional implementation; the generated code can be easily modified to the user's needs. A project import / export functions allows easy integration with other tools. SPC5-Studio is available for free and can be downloaded at: **www.st.com/spc5studio**.

Easy Configuration and Support Through Wizards

The environment can be easily configured in a few mouse clicks thanks to intuitive wizards assisting the user through all the required steps and providing help if required.

The Application wizard provides a better-than-ever user experience in getting started in developing your own applications with SPC5 MCU's. It leverages ST's automotive discovery kits, application boards, and all the related software elements to combine software and hardware functions in a few steps, without having to read manuals or write a single line of code.

The Pin Map wizard allows the visual configuration of I/O alternate functions and the automatic generation of initialization code as well as includes an automatic conflict checker. A configuration summary is also provided in XLS format to let customers check the consistency of their application's PCB.

The documentation wizard offers on-line help and access to component documentation.

Wide Variety of Software Library Examples

Executable examples help you get started quickly with SPC5 Discovery kits and microcontrollers. Each example, in the SPC5-Studio, includes source files, the related binary and .elf files to program modify and debug with any environment/ tool. They include SPC5-Studio project files which are easy to import, open and modify using SPC5 Studio configurator wizards.

Facilitates Implementation of Low-Level Drivers

For the Hardware Abstraction Layer (HAL), the first level interacting with the MCU hardware, the SPC5Studio embeds a consistent programming interface across all the product lines, characterized by:

- A unique set of Application Programming Interfaces (API) for the abstraction of hardware-dependent function
- Compatibility across entire SPC5 family
- Support for all key peripherals (general-purpose timer, ADC, ICU/PWM, RTC, SPI, CAN, serial interface, buffered UART, I²C, Flash, EEPROM, External Interrupt, etc.)

AURIX™ – Safety Joins Performance

32-bit Multi-Core TriCore™

AURIX™ is Infineon's brand new family of microcontrollers serving exactly the needs of the industry in terms of performance and safety. Its innovative multi-core architecture, based on up to six independent 32-bit TriCore™ CPUs, has been designed to meet the highest safety standards while increasing the performance at the same time.

Using the AURIX™ platform, automotive developers will be able to control powertrain, body, safety and ADAS applications with one single MCU platform. Developments using AURIX™ will require less effort to achieve the ASIL-D standard than with a classical Lockstep architecture. Customers are now able to cut down their MCU safety development by 30%. By the same token, a performance surplus of 50% up to 100% allows for more functionality and offers a sufficient resource buffer for future requirements, keeping the power consumption on the single-core microcontroller level.

AURIX™ 1st Generation – TC2xx Family Package Scalability

	TQFP-80	TQFP-100	LQFP-144 TQFP-144	LQFP-176	LFBGA-292	BGA-416	LFBGA-516
9x series up to 8 MB					TC297 300 MHz	TC298 300 MHz	TC299 300 MHz
7x series up to 4 MB				TC275 200 MHz	TC277 200 MHz		
6x series up to 2.5 MB			TC264 200 MHz	TC265 200 MHz	TC267 200 MHz		
3x series up to 2 MB		TC233 200 MHz	TC234 200 MHz		TC237 200 MHz		
2x series up to 1 MB	TC222 133 MHz	TC223 133 MHz	TC224 133 MHz				
1x series up to 512 KB	TC212 133 MHz	TC213 133 MHz	TC214 133 MHz				

↕ Upgrade/downgrade with pin-compatible packages

1) The LFBGA-516 package is a superset of the LFBGA-292. Combination PCBs can be designed for I/O and feature upgrades.

To get access to AURIX™ documentation:
1. Please register under myinfineon.com (only company address allowed, no private mail e.g. google, yahoo, …) | 2. Send login name to: AURIX@infineon.com

AURIX™ – scalable family

Performance

- Up to 6x 300 MHz
- Tricore™ 1.6P
- Multi-core technology
- HW accelerators
- Floating-point unit
- Up to 2.3 DMIPS/MHz

Functional safety and security

- ISO26262, IEC61508, ISO25119
- Platform safety concept
- 32-bit programmable security hardware

Scalability

- 1-6 Tricore™ cores 133-300 MHz
- 512 k – 16 MB Flash
  96 k – 6.9 MB RAM
- Pinout compatibility
- Various packages

Enablement

- Expert tools
- Free tool chain
- Technical experts
- Reference designs
- Preferred design
- House support

Automotive quality standards

Long-term supply availability and supply security

AURIX™ – Scalable Family

One Family – Multiple Use Cases

Powertrain

- Powertrain domain controller
- Gasoline direct injection
- Gasoline multi-port injection
- Diesel direct injection
- Automatic transmission
- Transfer case/torque vectoring
- eClutch
- Start/stop alternator
- Auxiliaries
- Motorcycle engine management

(H)EV

- Battery management
- Off-board charging
- Charging station
- Invertera
- Low-voltage DC-DC
- High-voltage DC-DC

Safety

- Chassis domain control
- Electric Power Steering (EPS)
- Active suspension control system
- Advanced airbag system
- Braking ECU
- Multi-purpose camera configuration
- Short-range radar (24 GHz) system
- Long-range radar (76/77 GHz) system
- LIDAR systems
- LED pixel lighting
- Sensor fusion
- eHorizon

Connectivity

- Body domain controller
- Connected gateway
- Advanced body applications
- In-vehicle wireless charger
- Telematics
- V2x communication

Transportation

- Commercial and Agricultural Vehicle (CAV)
- Fun vehicle
- Transportation, Trucks Drones

Industrial & Multimarket

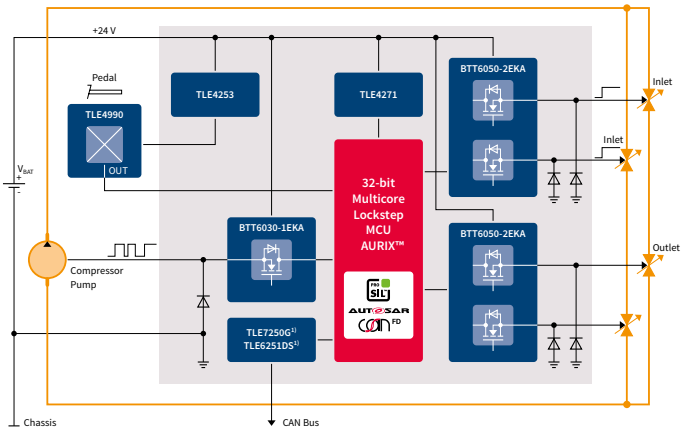
- Mobile controller
- Inverter
- Wind turbine inverter
- Servo drives
- Solar panel

TriCore™ for Transportation Applications Optimized with Scalable AURIX™ Family

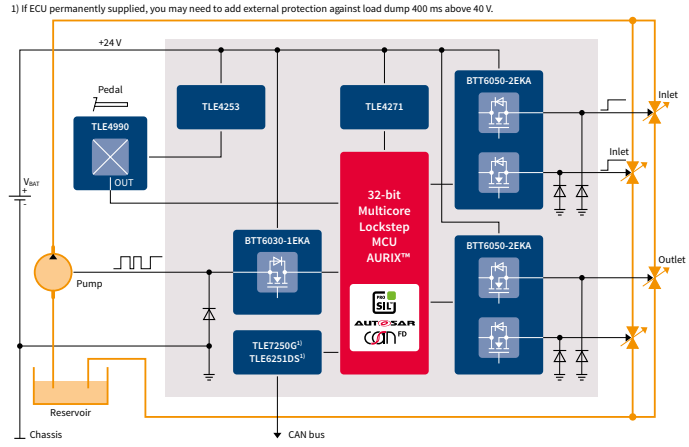
AURIX™ is Infineon's current new family of microcontrollers serving exactly the needs of the 24 V – 60 V industry in terms of performance, memory, scalability, safety and security. Its innovative multi-core architecture supports the latest trends in connectivity, such as Ethernet and CAN FD as well as safety (IEC 61508/ISO 25119/ISO 26262) and security. While supporting high performance, the innovative supply concept with integrated DC/DC converter leads to best-in class power consumption. The scalable AURIX™ family leads to the most optimized cost-performance application fit.

Commercial and Agricultural Vehicles (CAV)

A 24 V complete system solution for hydraulic/pneumatic management systems: power supply, sensors, microcontroller and high-side switches can be used without external protection in a 24 V system. Valves and pumps can be driven via linear activation or demand-controlled via PWM signals. The quad and dual channels are optimized to reduce costs and space for these applications



1) If ECU permanently supplied, you may need to add external protection against load dump 400 ms above 40 V.



1) If ECU permanently supplied, you may need to add external protection against load dump 400 ms above 40 V.

Further System Benefits

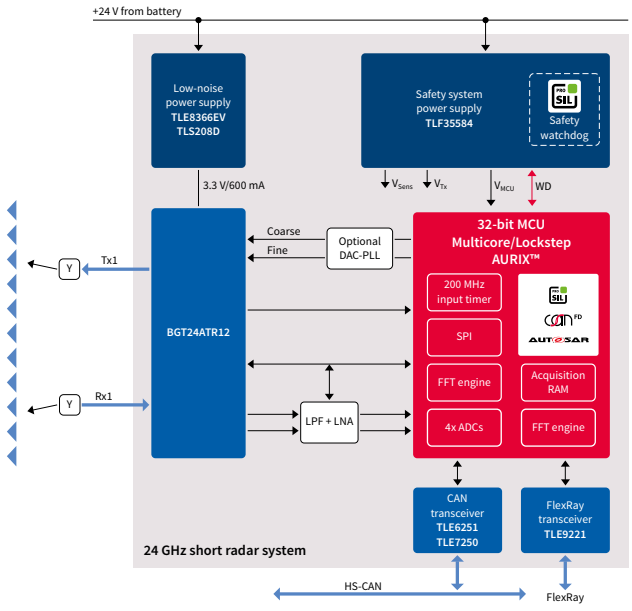
- Pin-to-pin & software compatibility
- ISO 26262/IEC61508 compliant; AECQ-100

Suggested Products

- TC23x / TC22x / TC21x

CAV 24 GHz Radar – Greater productivity, greater safety

Today´s commercial, construction and agricultural vehicles (CAVs) rely on radar systems to improve their productivity, energy efficiency and safety. As the world´s population grows at a record pace, there is increased pressure to plant and harvest more, and to speed up construction projects. But to do so, CAVs need ever more sophisticated system to help them overcome challenges in the field or at a site.

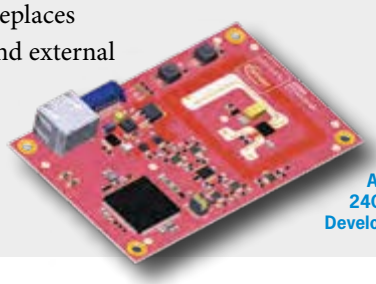


System Benefits

- Highly integrated and scalable chip-set solution
- Small PCB footprint
- Hardware support for ISO 26262 up to ASIL D
- Low cost in BOM as the AURIX™ microcontroller replaces additional DSP and external memory

Suggested Products

- AURIX™ TC264DA microcontroller
- BGT24A RF transceiver IC
- TLF35584 safety power supply



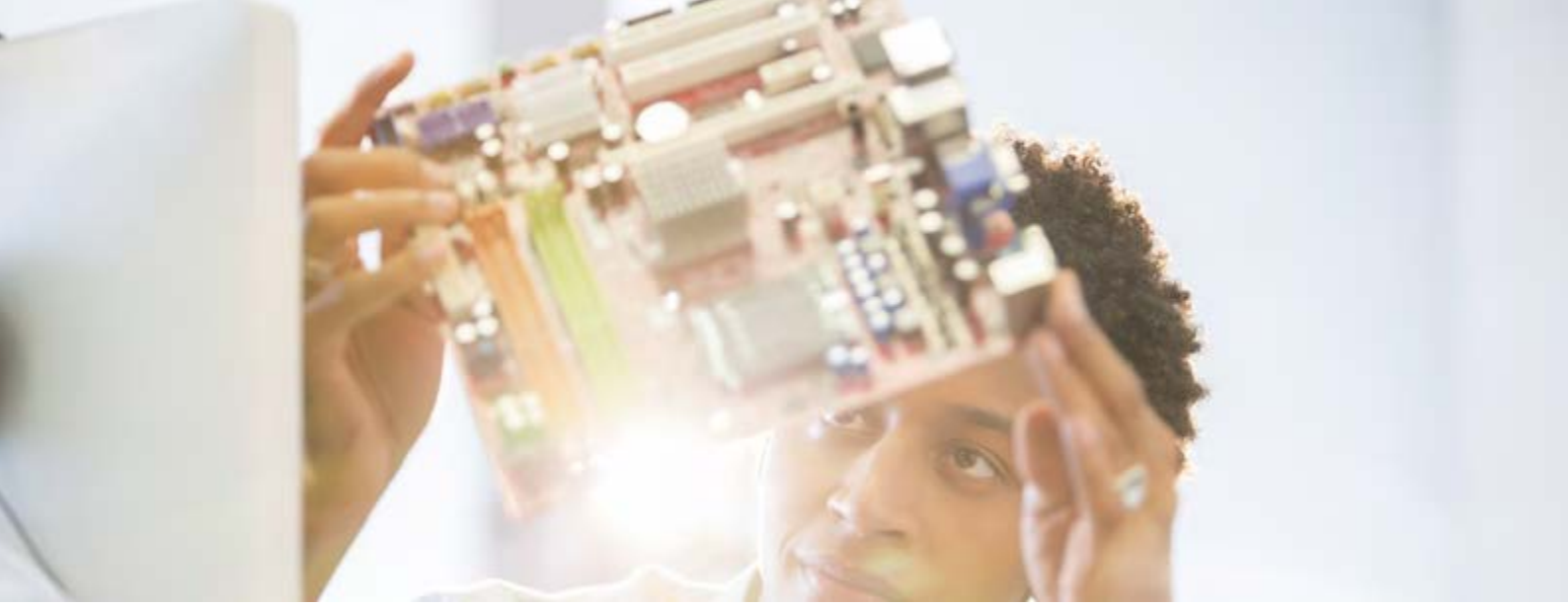
Automative 24GHz Radar Development Kit

AURIX™ – Portfolio

TriCore™ Microcontroller

Product type	Max clock frequency [MHz]	Program memory [kByte]	SRAM (incl. cache) [kByte]	Co-processor [1]	Cores/lockstep	Timed I/O GPI/O	Number of ADC channels	External bus interface	CAN/CAN-FD nodes	Communication interfaces [2]	Temperature ranges [3]	Packages	Additional features/ remarks [4]
AURIX™ – family													
TC299TP	300	8000	728	FPU	3/1	263	84/10 DS	yes	6	4x ASCLIN, 6x QSPI, 3x MSC, 2x I²C, 15x SENT, HSSL, 5x PSI5, 2x FlexRay, Ethernet	K	LFBGA-516	EVR, STBU, HSM
TC299TX	300	8000	2728	FPU	3/1	263	84/10 DS	yes	6	4x ASCLIN, 6x QSPI, 3x MSC, 2x I²C, 15x SENT, HSSL, 5xPSI5, 2xFlexRay, Ethernet	K	LFBGA-516	EVR, STBU, HSM
TC299TP	300	6000	728	FPU	3/1	263	84/10 DS	yes	6	4x ASCLIN, 6x QSPI, 3x MSC, 2x I²C, 15x SENT, HSSL, 5x PSI5, 2x FlexRay, Ethernet	K	LFBGA-516	EVR, STBU, HSM
TC298TP	300	8000	728	FPU	3/1	232	60/10 DS	yes	6	4x ASCLIN, 6x QSPI, 3x MSC, 2x I²C, 15x SENT, HSSL, 5x PSI5, 2x FlexRay, Ethernet	K	LBGA-416	EVR, STBU, HSM
TC298TP	300	6000	728	FPU	3/1	232	60/10 DS	yes	6	4x ASCLIN, 4x QSPI, 3x MSC, 2x I²C, 15x SENT, HSSL, 5x PSI5, 2x FlexRay, Ethernet	K	LBGA-416	EVR, STBU, HSM
TC297TP	300	8000	728	FPU	3/1	169	60/10 DS	no	6	4x ASCLIN, 4x QSPI, 3x MSC, 2x I²C, 15x SENT, HSSL, 5x PSI5, 2x FlexRay, Ethernet	K	LFBGA-292	EVR, STBU, HSM
TC297TP	300	6000	728	FPU	3/1	169	60/10 DS	no	6	4x ASCLIN, 4x QSPI, 3x MSC, 2x I²C, 15x SENT, HSSL, 5xPSI5, 2xFlexRay, Ethernet	K	LFBGA-292	EVR, STBU, HSM
TC297TA	300	8000	2728	FPU, FFT, CIF	3/1	169	60/10 DS	no	6	4x ASCLIN, 4x QSPI, 3x MSC, 2x I²C, 15x SENT, HSSL, 5x PSI5, 2x FlexRay, Ethernet	K	LFBGA-292	EVR, STBU, HSM
TC297TX	300	8000	2728	FPU	3/1	263	60/10 DS	no	6	4x ASCLIN, 4x QSPI, 3x MSC, 2x I²C, 15x SENT, HSSL, 5xPSI5, 2xFlexRay, Ethernet	K	LFBGA-292	EVR, STBU,HSM
TC277TP	200	4000	472	FPU	3/2	169	60/6 DS	no	4	4x ASCLIN, 4x QSPI, 2x MSC,HSSL, I²C, 10x SENT, 3x PSI5, FlexRay, Ethernet	K	LFBGA-292	EVR, WUT, HSM
TC275TP	200	4000	472	FPU	3/2	112	60/6 DS	no	4	4x ASCLIN, 4x QSPI, 2x MSC,HSSL, I²C, 10x SENT, 3x PSI5, FlexRay, Ethernet	K	LQFP-176	EVR, WUT, HSM
TC267D	200	2500	240	FPU	2/1	169	50/3 DS	no	5	4x ASCLIN, 4x QSPI, 2xMSC,I²C, 10x SENT, 3x PSI5, HSSL, FlexRay, Ethernet	K	LFBGA-292	EVR, STBU
TC265D	200	2500	240	FPU	2/1	112	50/3 DS	no	5	4x ASCLIN, 4x QSPI, 2x MSC, I²C, 10x SENT, HSSL, 3xPSI5, FlexRay, Ethernet	K	LQFP-176	EVR, STBU
TC264D	200	2500	240	FPU	2/1	88	40/3 DS	no	5	4xASCLIN, 4xQSPI, 2xMSC, I²C, 10xSENT, HSSL, 3xPSI5, FlexRay, Ethernet	K	LQFP-144	EVR, STBU
TC264DA	200	2500	752	FPU, FFT, CIF	2/1	88	40/3 DS	no	5	4xASCLIN, 4xQSPI, 2xMSC, I²C, 10xSENT, HSSL, 3xPSI5, FlexRay, Ethernet	K	LQFP-144	EVR, STBU
TC234LX	200	2000	704	FPU	1/1	120	24	no	6	2x ASCLIN, 4x QSPI, 4x SENT, FlexRay, Ethernet	K	TQFP-144	EVR, WUT, HSM
TC234LP	200	2000	192	FPU	1/1	120	24	no	6	2x ASCLIN, 4x QSPI, 4x SENT, FlexRay	K	TQFP-144	EVR, WUT, HSM
TC234LA	200	2000	704	FPU, FFT	1/1	120	24	no	6	2x ASCLIN, 4x QSPI, 4x SENT, FlexRay, Ethernet	K	TQFP-144	EVR, WUT, HSM
TC233LP	200	2000	192	FPU	1/1	78	24	no	6	2xASCLIN, 4xQSPI, 4xSENT, FlexRay	K	TQFP-100	EVR, WUT, HSM
TC224L	133	1000	96	FPU	1/1	120	24	no	3	2xASCLIN, 4xQSPI, 4xSENT	K	TQFP-144	EVR, WUT
TC223L	133	1000	96	FPU	1/1	78	24	no	3	2x ASCLIN, 4x QSPI, 4x SENT	K	TQFP-100	EVR, WUT
TC222L	133	1000	96	FPU	1/1	59	24	no	3	2x ASCLIN, 4x QSPI, 4xSENT	K	TQFP-80	EVR, WUT
TC214L	133	500	96	FPU	1/1	120	14	No	3	2x ASCLIN, 4x QSPI, 4x SENT	K	TQFP-144	EVR, WUT
TC213L	133	500	96	FPU	1/1	78	24	no	3	2x ASCLIN, 4x QSPI, 4x SENT	K	TQFP-100	EVR, WUT
TC212L	133	500	96	FPU	1/1	59	24	no	3	2x ASCLIN, 4x QSPI, 4x SENT	K	TQFP-80	EVR, WUT
AURIX™ – bare die													
TC270TP	200	4000	472	FPU	3/2		60/6 DS	no	4	4x ASCLIN, 4x QSPI, 2x MSC,HSSL, I²C, 10x SENT, 3x PSI5, FlexRay, Ethernet	L	Bare Die	EVR, WUT, HSM
TC260D	200	2500	240	FPU	2/1		50/3 DS	no	5	4x ASCLIN, 4x QSPI, 2x MSC,I²C, 10x SENT, 3x PSI5, HSSL, FlexRay, Ethernet	L	Bare Die	EVR, STBU

1) CIF = Camera and external ADC Interface, FFT = Fast Fourier Transform Accelerator, FPU = Floating Point Unit, PCP = Peripheral Control Processor
2) ASC = Asynchronous Serial Channel, ASCLIN = Asyn/Synchronous Local Interconnect Network, HSSL = High Speed serial Link, I²C = Inter-Integrated Circuit, LIN = Local Interconnect Network, MLI = Micro Link Interface, MSC = Micro Second Channel, PSI5 = Peripheral Sensor Interface 5, QSPI = Queued Serial Peripheral Interface, SENT = Single Edge Nibble Transmission, SSC = Synchronous Serial Channel
3) Ambient Temperature Range: A = -40 … 140 °C, B = 0 … 70 °C, F = -40 … 85 °C, H = -40 … 110 °C, K = -40 … 125 °C, L = -40 … 150 °C, X = -40 … 105 °C
4) EVR = Embedded Voltage Regulator, HSM = Hardware Security Module, STBU = Stand-by Control Unit, WUT = Wake-Up Timer



AURIX™ Starter & Application Kits

Starter Kits for 32-bit Microcontrollers

Triboards

Infineon Tricore™ family starter kits are powerful evaluation systems that enable evaluation and development well before the target hardware is available. They offer a solid platform for both hardware and software engineers to evaluate and prototype designs that are closely aligned with their final applications.

Application Kits

To simplify the development of your own application, the kit is supplied with a variety of on-board components including a highly-integrated software development environment that gives you everything you need to compile, debug, and flash your AURIX™ multicore application.

System Application Kits

The system application kits provides quick jump in start to typical microcontroller applications like motor control, radar, etc. These reference design kits provide faster design-in suport for end applications by providing reference board, application software, tooling and documentation

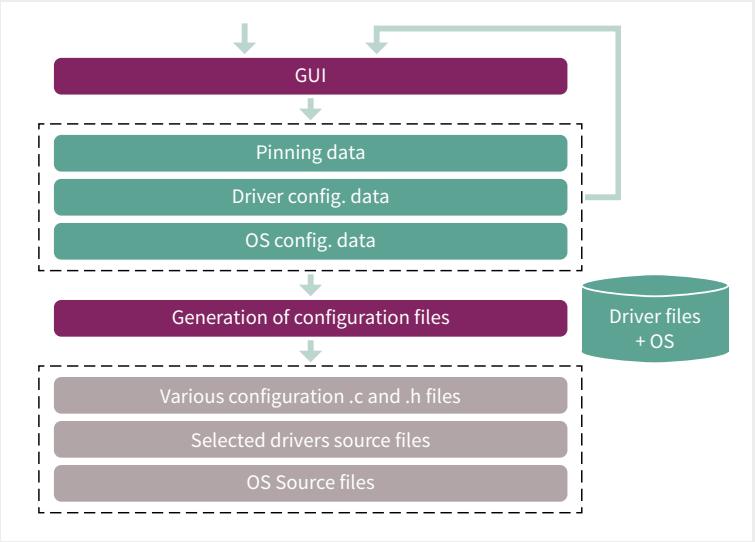
AURIX™ – Free Tool Chain & Support Partners

ACT– AURIX™ Configuration Tool

ACT is a powerful tool that helps engineers to quick jump-start programming of Infineon microcontrollers.

Key Feature
Altium TASKING VX TriCore™ lite version including build-in
- AURIX™ pin mapping incl. interactive package view
- AURIX™ iLLD (Low-Level Driver)
- AURIX™ OSEK

For further information on TriCore™ tools, please visit:
www.infineon.com/aurix-tools



Free TriCore™ Entry Tool Chain

This free of charge tooling entry tool chain provides all required features to develop and test software for TriCore™ and AURIX™. The tool can be used with all available TriCore™ and AURIX™ starter kit and application boards.

For further information on TriCore™ tools, please visit:
www.infineon.com/aurix-tools

Key Features
- Eclipse based IDE
- Project wizard to easily define the project properties for device and board support
- High performance GNU C compiler
- Integrated source level debugger
- On-chip flash programming support

Preferred Design Houses (PDH)

Optimized open market customer support set up for systems using AURIX™, including software and other Infineon products such as power products, sensor products and modules. They are trained to provide application- and product-specific support

Classic (Free of charge)	▪ 1st level customer support ensuring Infineon products/solutions ▪ Technical interface and support to the customer	▪ Driving design @ customer ▪ Basic training for design teams @ customer ▪ 24 h response time to the customer
Premium (Consultancy mode) To be agreed between customers and PDH	▪ Project management & project-specific application support ▪ Specification of general SW architecture, defining required layers, control and data flow structure etc. ▪ Specification and implementation of custom device drivers ▪ Optimization of software components with regard to speed/code size	▪ Software testing ▪ Support of project-specific functional safety engineering ▪ Project-specific support of security solution ▪ Safety support ▪ Security support ▪ Multicore support

Design House

AVL · Blue Wind · Embedded Office · escrypt · ETAS · FROBAS · e-fense · HIGHTEC · hitex · Infineon · MecTronik · Mixed Mode · Neutronics · PiNTeam · RDM Group · sst · ULMA

AURIX™ 2nd Generation – TC3xx

With its up to hexa-core high performance architecture and, its advanced features for connectivity, security and functional safety, the AURIX™ microcontroller TC3xx family is ideally suited for a wide field of automotive and industrial applications. In addition to engine management and transmission control, targeted powertrain applications include new systems in electrical and hybrid drives. Specifically hybrid domain control, inverter control, battery management, and DC-DC converters will benefit from the new architecture. The AURIX™ TC3xx microcontrollers are well-suited to safety-critical applications ranging from airbag, braking and power steering to sensor based systems using radar or camera technologies. The combination of performance and a powerful safety architecture makes the family ideal fit for domain control and data fusion applications supporting the next levels of autonomous driving.

AURIX™ TC3xx Package Scalability

Flash \ Package	TQFP 80	TQFP 100	T/LQFP 144	BGA 180	LQFP 176	LFBGA 292	LFBGA 516
9x Series up to 16 MB						TC397Xx TC397Qx 300MHz	TC399Xx 300MHz
8x Series up to 12 MB						TC387QX 300MHz	
8x Series up to 10MB						TC387Q 300MHz	TC389Q 300MHz
7xX Series up to 6MB						TC377TX 300 MHz	
7x Series up to 6MB					TC375T 300 MHz	TC377T 300 MHz	
6x Series up to 4MB			TC364D 300 MHz	TC366D 300 MHz	TC365D 300 MHz	TC367D 300 MHz	
5xA Series up to 4MB				TC356TA 300 MHz		TC357TA 300 MHz	
3xA Series up to 2 MB				TC336DA 200 MHz		TC337DA 200 MHz	
3x Series up to 2 MB	TC332L 200 MHz	TC333L 200 MHz	TC334L 200 MHz	TC336L 200 MHz		TC337L 200 MHz	
2x Series up to 1 MB	TC322L 160 MHz	TC323L 160 MHz	TC324L 160 MHz			TC327L 160 MHz	

L - Single Lockstep Core D - Dual Core T - Triple Core Q - Quadruple Core X - Sextuple Core

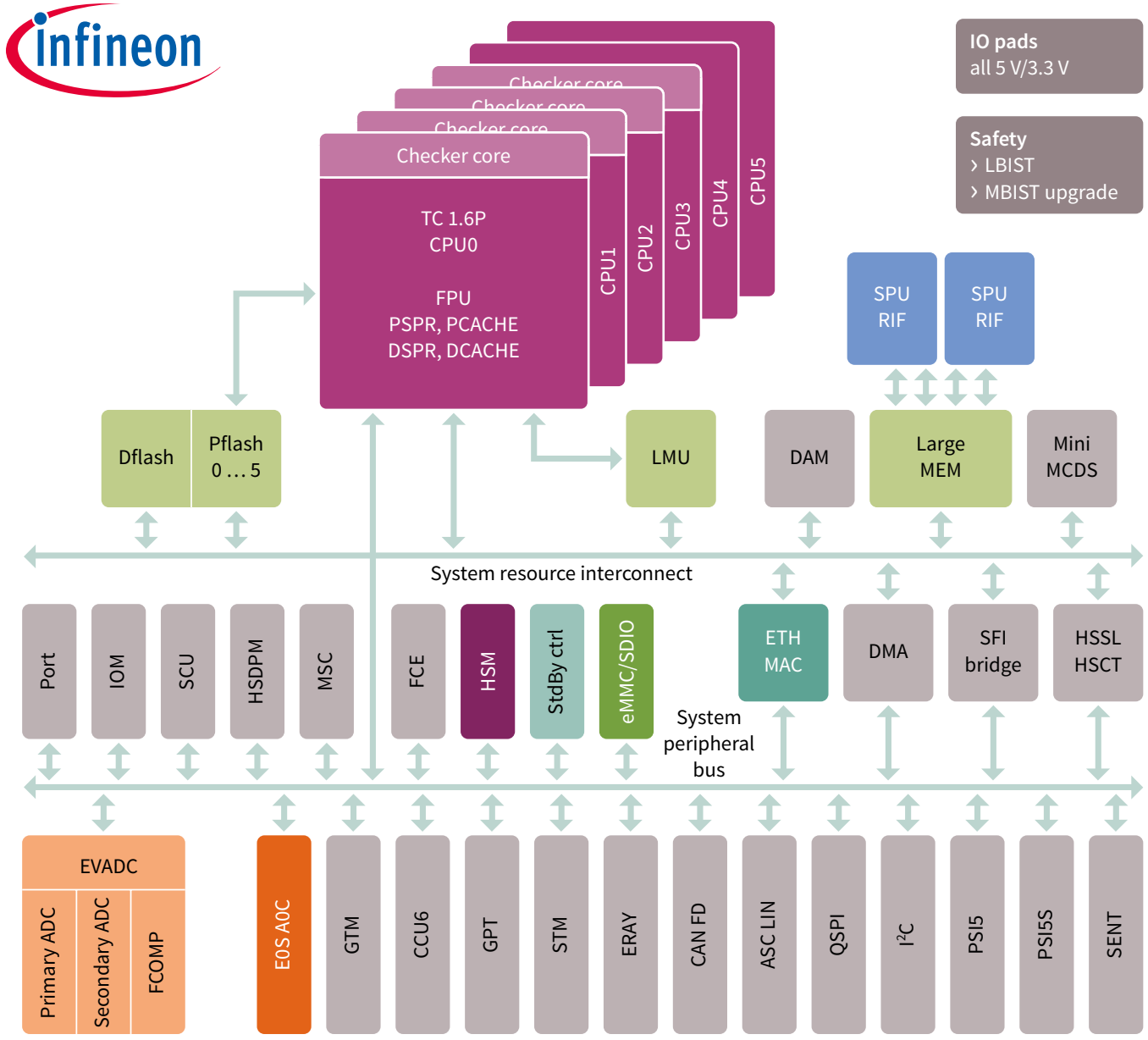
MCU Scalability
- Performance and flash
- Pin compatibility
- Binary-compatible coresPower

Safety/Security Concept AURIX
- ISO 26262 compliance
- Hardware security support
- IEC61508 compliant

Power Consumption
- On-chip SC DC-DC high-efficiency power supply
- Integrated stand-by controller

Connectivity
- Ethernet: up to 2x 1 GB
- CAN FD: up to 12 channels
- LIN: up to 24 channels
- e·MMC IF

AURIX™ TC3xx Architecture Evolution from TC2xx to TC3xx



Performance
› New TriCore™ 162 generation
› New instructions
› Up to 6 CPUs at 300 MHz
› New direct flash access path

ADC
› Improvement of existing ADC
› Reduction of capacitive load

Stand-by control unit
› Low-power modes

HSM: Full EVITA compliance
› New accelerators ECC256/SHA256
› Available on all devices

Delta-sigma
› Enhanced concept

Ethernet
› 1 Gbit/s ETH
› QoS services
› Remote DMA

ADAS
› New HW accelerator concept - SPU (Signal Processing Unit)

Memories
› Larger SRAM
› SRAM/flash ratio increased
› Enhanced MPU

eMMC/SDIO
› External NAND flash IF

Infineon Embedded Power ICs (System-on-Chip)

High-Integrated Solutions for Compact Motor Control Designs

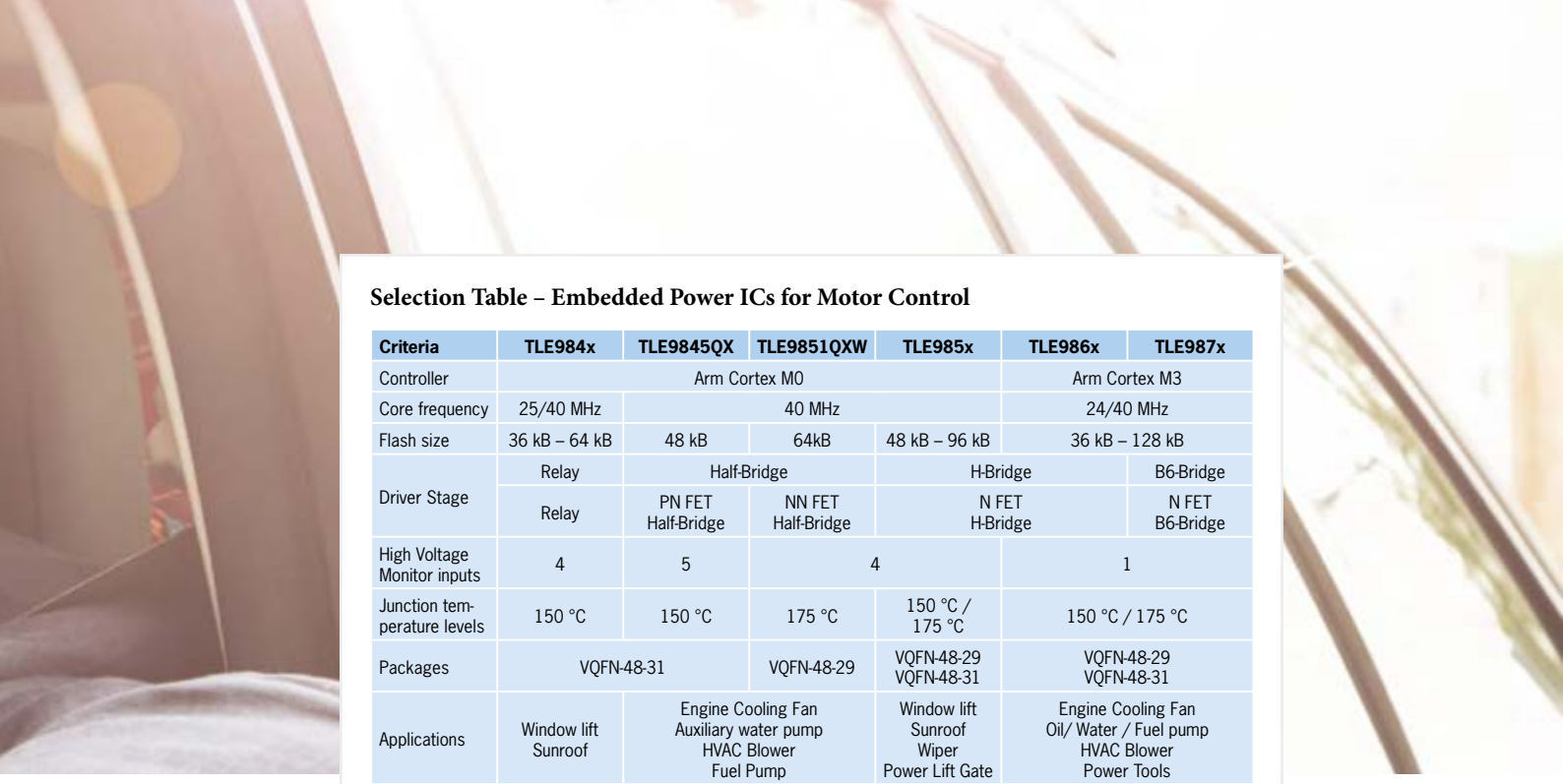
Infineon Embedded Power ICs are specifically designed to enable mechatronic motor control solutions for a range of motor control applications, where a small package form factor and a minimum number of external components are essential. Such applications include window lift, sunroof, wiper, fuel pump, HVAC fans, engine cooling fan and water pumps, to name but a few.
Produced on Infineon's first-in-industry automotive-qualified Smart Power technologies, the Infineon Embedded Power System-on-Chip (SoC) solutions offer an unmatched level of integration of all functions required to sense, control and actuate a motor. The Infineon Embedded Power ICs integrate on single die the microcontroller, the non-volatile flash memory, the analog and mixed signal peripherals, the communication interfaces along with the driving stages needed for either relay, half-bridge or full-bridge DC and BLDC motor applications. All Embedded Power ICs are offered in a space saving VQFN-48 package.

TLE984x: Relay Driver ICs based on Arm®-Cortex®-M0

- Two protected low-side switches (min. 270 mA)
- Up to two protected high-side switches
- Up to five high-voltage inputs with wake-up functionality
- Integrated LIN transceiver compatible with LIN 2.2 and compliant to SAE J2602
- Two full duplex serial interface (UART) with LIN support
- Two Synchronous Serial Channel (SSC), compatible with SPI
- On-chip oscillator and PLL for clock generation with loss-of-lock detection
- Measurement unit:
  - 8-bit ADC module with 7 multiplexed inputs for system supervision
  - 10-bit ADC module with 13 multiplexed inputs
  - Two on chip temperature and battery voltage measurement units

TLE985x: H-Bridge Driver ICs based on Arm®-Cortex®-M0

- MOSFET Driver including charge pump for H-bridge motor applications with programmable current settings
- One protected high-side switch
- Integrated LIN transceiver compatible with LIN 2.2 and compliant to SAE J2602
- Two full duplex serial interface (UART) with LIN support
- Two Synchronous Serial Channel (SSC)
- On-chip OSC and PLL for clock generation with loss-of-lock detection
- Four high-voltage monitoring input with wake-up functionality
- High-speed OpAmp for motor current sensing via shunt (CSA)
- Measurement unit
  - 8-bit ADC module with 9 multiplexed inputs
  - 10-bit ADC module with 7 multiplexed inputs, 5 external analog inputs
  - Two on chip temperature and battery voltage measurement units
  - Math Co-Processor Unit with Divider Unit for signed and unsigned 32-bit division operations



Selection Table – Embedded Power ICs for Motor Control

Criteria	TLE984x	TLE9845QX	TLE9851QXW	TLE985x	TLE986x	TLE987x
Controller	Arm Cortex M0				Arm Cortex M3	
Core frequency	25/40 MHz	40 MHz			24/40 MHz	
Flash size	36 kB – 64 kB	48 kB	64kB	48 kB – 96 kB	36 kB – 128 kB	
Driver Stage	Relay	Half-Bridge		H-Bridge		B6-Bridge
	Relay	PN FET Half-Bridge	NN FET Half-Bridge	N FET H-Bridge		N FET B6-Bridge
High Voltage Monitor inputs	4	5	4		1	
Junction temperature levels	150 °C	150 °C	175 °C	150 °C / 175 °C	150 °C / 175 °C	
Packages	VQFN-48-31		VQFN-48-29	VQFN-48-29 VQFN-48-31	VQFN-48-29 VQFN-48-31	
Applications	Window lift Sunroof	Engine Cooling Fan Auxiliary water pump HVAC Blower Fuel Pump		Window lift Sunroof Wiper Power Lift Gate	Engine Cooling Fan Oil/ Water / Fuel pump HVAC Blower Power Tools	

Key Benefits

- Enable cost and board space improvements – our system-on-chip solution integrates data processing, actuation and sensing. The chip comes in a leadless VQFN package with 7 x 7 mm footprint and enables PCB space saving. The Embedded Power IC families allow driving relays and MOSFETs at VBATT ≥ 6 V without external components, providing a very cost effective solution on a system level.
- Enabling high levels of system reliability – extensive diagnostics and protections are embedded within the system-on-chip, more than a discrete approach can offer. In addition both the Embedded Power IC and the external MOFESTs can be protected.
- Support multiple and flexible designs with minimal effort – all Embedded Power ICs are software compatible, maximizing a single design through scalability.

TLE986x/7x: 3-Phase Bridge Driver ICs based on Arm®-Cortex®-M3

- MOSFET Driver including charge pump for H-bridge motor applications with programmable current settings
- Integrated LIN transceiver compatible with LIN 2.2 and compliant to SAE J2602
- Two full duplex serial interface (UART) with LIN support
- Two Synchronous Serial Channel (SSC)
- On-chip OSC and PLL for clock generation with loss-of-lock detection
- One high-voltage monitoring input with wake-up functionality
- High-speed OpAMP for motor current sensing via shunt
- Measurement unit
  - 8-bit ADC module with 10 multiplexed inputs
  - 10-bit ADC module with 8 multiplexed inputs, 5 external analog inputs
  - On chip temperature and battery voltage measurement unit

General Characteristics & Features

- 32-bit Arm® Cortex®-M0/M3 Core, up to 40 MHz clock freq.
- Up to 128kB flash memory, up to 6 kB RAM
- Boot ROM for startup firmware, bootstrap loader and flash routines
- Up to nine 16-bit timers
- Capture/compare unit for PWM signal generation (CCU6) with 2 x 16-bit timers
- Operating supply voltage VS = 5.5 to 28 V, maximum rating 40 V
- Extended operating range VS = 3.0 to 28 V, MCU/flash fully functional
- Wide operating temperature range: Tj: up to 150 °/175 °C
- External supply (VDDEXT): 5 V ±2% @ 20 mA
- Independent programmable window watchdog
- 5 V/1.5 V internal supplies
- Power saving modes: MCU slow-down mode, Sleep mode, Stop mode, Cyclic wake-up sleep mode
- Overtemperature poretection

Infineon Embedded Power ICs (System-on-Chip)

Selection Guide

Relay Driver ICs with Integrated Arm® Cortex®-M0

Product Name	Arm® Cortex®	Flash (kB)	RAM (kB)	EEPROM in Flash included (kB)	Frequency (MHz)	High-side Switch	High Voltage Monitor Input	GPIO	Analog Inputs	Interface	Package
TLE9842QX	M0	36	2	4	25	1	4	10	6	PWM + LIN	VQFN-48
TLE9842-2QX	M0	40	2	4	40	2	5	10	6	PWM + LIN	VQFN-48
TLE9843QX	M0	48	4	4	25	1	4	10	6	PWM + LIN	VQFN-48
TLE9843-2QX	M0	52	4	4	40	2	5	10	6	PWM + LIN	VQFN-48
TLE9844QX	M0	64	4	4	25	1	4	10	6	PWM + LIN	VQFN-48
TLE9844-2QX	M0	64	4	4	40	2	5	10	6	PWM + LIN	VQFN-48

Halfbridge Driver ICs with Integrated Arm® Cortex®-M0

Product Name	Arm® Cortex®	Flash (kB)	RAM (kB)	EEPROM in Flash included (kB)	Frequency (MHz)	High-side Switch	High Voltage Monitor Input	GPIO	Analog Inputs	MOS driver	Operation Temp.	Interface	Package
TLE9845QX	M0	48	4	4	40	2	5	10	6	PN	150°C	PWM + LIN	VQFN-48
TLE9851QXW	M0	64	4	4	40	1	4	10	5	NN	175°C	PWM + LIN	VQFN-48

H-Bridge Driver ICs with Integrated Arm® Cortex M0 / M3

Product Name	Arm® Cortex®	Frequency (MHz)	Interface	RAM (kB)	Flash (kB)	EEPROM Emulation (kB)	OP-AMP	Low-side MOSFET Driver	High-side MOSFET Driver	Package
32-bit µC with H-Bridge MOSFET Gate Driver for DC Motors										
TLE9853QX	M0	40	PWM + LIN	4	48	4	Y	2	2	VQFN-48
TLE9854QX	M0	40	PWM + LIN	4	64	4	Y	2	2	VQFN-48
TLE9855QX	M0	40	PWM + LIN	4	96	4	Y	2	2	VQFN-48
TLE9861QXA20	M3	24	PWM	3	36	4	Y	2	2	VQFN-48
TLE9867QXA20	M3	24	PWM + LIN	6	64	4	Y	2	2	VQFN-48
TLE9867QXA40	M3	40	PWM + LIN	6	64	4	Y	2	2	VQFN-48
TLE9869QXA20	M3	24	PWM + LIN	6	128	4	Y	2	2	VQFN-48
32-bit µC with H-Bridge MOSFET Gate Driver for DC Motors (Grade-0, Tj = 175°C)										
TLE9854QXW	M0	40	PWM + LIN	4	64	4	Y	2	2	VQFN-48
TLE9867QXW20	M3	24	PWM + LIN	6	64	4	Y	2	2	VQFN-48

3-Phase Bridge driver ICs with Integrated Arm® Cortex®-M3

Product Name	Frequency (MHz)	Interface	RAM (kB)	Flash (kB)	EEPROM Emulation (kB)	OP-AMP	Low-side MOSFET Driver	High-side MOSFET Driver	Sigma-Delta ADC	Package
32-bit µC with 3-phase MOSFET Gate Driver for BLDC Motors										
TLE9871QXA20	24	PWM	3	36	4	Y	3	3	N	VQFN-48
TLE9877QXA20	24	PWM + LIN	6	64	4	Y	3	3	N	VQFN-48
TLE9877QXA40	40	PWM + LIN	6	64	4	Y	3	3	N	VQFN-48
TLE9879QXA20	24	PWM + LIN	6	128	4	Y	3	3	N	VQFN-48
TLE9879QXA40	40	PWM + LIN	6	128	4	Y	3	3	N	VQFN-48
TLE9879-2QXA40	40	PWM + LIN	6	128	4	Y	3	3	Y	VQFN-48
32-bit µC with 3-phase NFET Gate Driver for DC Motors (Grade-0, Tj = 175°C)										
TLE9873QXW40	40	PWM + LIN	3	48	4	Y	3	3	N	VQFN-48
TLE9877QXW40	40	PWM + LIN	6	64	4	Y	3	3	N	VQFN-48
TLE9879QXW40	40	PWM + LIN	6	128	4	Y	3	3	N	VQFN-48

Toolchain Installation Steps

STEP 1	STEP 2	STEP 3	STEP 4
Download and install **Keil µVision5**	Download **IFXConfigWizard**	Download and install **Segger J-Link Driver**	Download the **SDK via µVision5 Pack Installer** (See Step 1)

Infineon Embedded Power ICs are supported by a complete development tool chain provided by Infineon and third party vendors. The tool chain includes compilers, debuggers, several evaluation boards, LIN low level drivers and configuration tools as well as variety of example software code. For each Embedded Power IC family we offer evaluation boards to evaluate all functions and peripherals providing access to all device I/Os. In addition evaluation and applications boards are available which are space and cost optimized to demonstrate application near solutions

Tools for Embedded Power ICs

Kit 1: TLE9845 EVALBOARD

The TLE9845 Evaluation Board offers complete evaluation of all functions and peripherals of the TLE9845QX variant of the TLE984x product family. The respective TLE98450x product has to be ordered separately.

Order No.:
TLE9845 EVALBOARD

Kit 2: TLE9844-2QX_APPKIT

The TLE9844-2QX Appkit is designed to evaluate relay driven DC motor applications. The two layers PCB is space and cost optimized to demonstrate an application near solution.

- Automotive qualified relay driver IC (TLE9844-2QX) with integrated high-side switches
- 2-channel relay
- Onboard debug interface

Order No.:
TLE9844-2QX_APPKIT

Kit 3: TLE986X EVALB_JLINK

The TLE986X EVALB_JLINK offers complete evaluation of all functions and peripherals of the TLE986x product family and allows direct connection to a DC motor via MOSFETS in H-Bridge configuration, it includes: H-Bridge for DC motor drive, UART and LIN for communication, direct access to all device I/Os and a J-Link debugger. The respective TLE986x product has to be ordered separately.

Order No.: TLE986X EVALB_JLINK

Kit 4: TLE9879 EVALKIT

The TLE9879 EvalKit offers complete evaluation of all functions and peripherals of the TLE9879QXA40 and allows direct connection to a BLDC motor via MOSFETS in B6- Bridge configuration, it includes: B6-Bridge for BLDC motor drive, UART and LIN for communication, direct access to all device I/Os and a J-Link debugger.

Order No.: TLE9879 EVALKIT

HVC 4223F

Full Integrated Embedded Motor Controller

TDK

Direct and Universal Brush-/Brushless-DC/Stepper Motor Control (sensored/sensorless)
- Integrated half-bridges for small motors up to 1 Amp
- Virtual star point and comparators
- Current scaling and shaping

Direct V_{bat}-Supply up to 18 V
- Automotive OEM requirements including load-dump 40 V
- Switchable BVDD power supply output

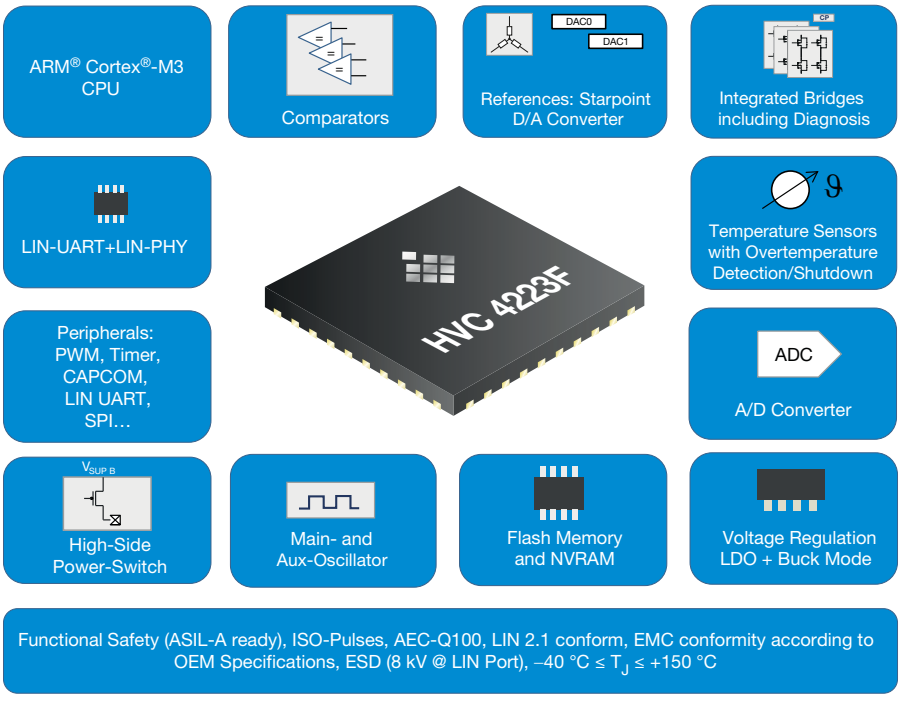
32-bit Arm® Cortex® M3 and Toolchain
- 32 kB Flash, 2 kB RAM, 512 byte of EEPROM
- Extensive support to supervise, generate and store diagnostic data
- On-chip oscillator with active EMI suppression

Built-in Safety Features
- Protection logic, supply/clock/temp supervision, Start-stop retention mode
- Several diagnostic features to supervise internal as well as application status
- Functional safety support

Host Interface
- LIN 2.1 & SAE J2602-2 compliant transceiver
- PWM, UART, Analog

PQFN40 6 x 6 mm Package
- Operation -40 to 150 °C ambient temperature

Target Applications
- AGM/AGS (Grille Shutter)
- Adaptive Headlights & Fan
- HVAC flap control
- EPS force feedback
- Automatic Flap
- Exhaust Gas / Re-circle
- Cover of Rear View Camera
- Milimetric Wave Radar Unit



HVC 4223F

Tool Chain – SW and Documentation

Boards & Software

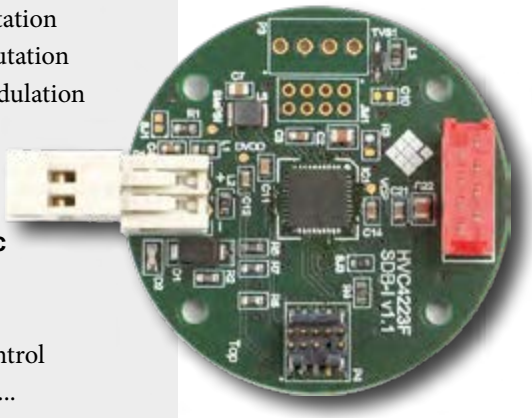
Application notes / SW

- Stepper motor
- Sensored BLDC Motor Six Step Commutation
- Sensorless BLDC Motor Six Step Commutation
- Sensored BLDC Motor Space Vector Modulation
- LIN demo software
- Software snippets

Production-ready Firmware by NewTec

- Professional SW stack implemented by professional engineering house
- Covering the entire embedded motor control functionality following ASPICE/MISRA ...
- Widely configurable and parametrizable, addressing small and smart BLDC- and Stepper motors

SDB-I



APB

Compiler – KEIL MDK for Arm Cortex-M3

Debugger/Programmer

J-Link

ULINK-ME

ULINK2

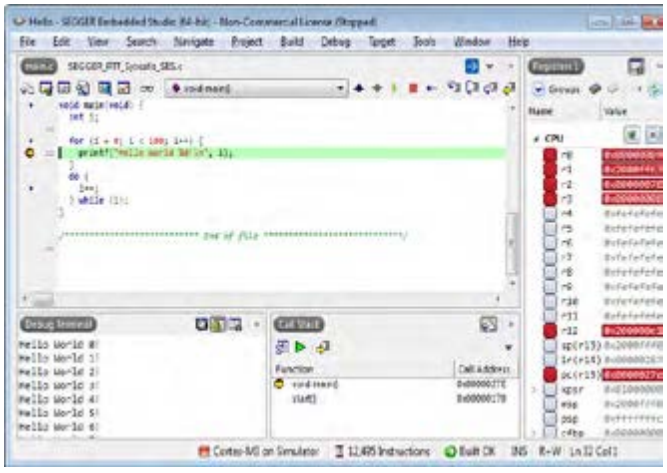
SEGGER Embedded Studio

Professional IDE Solution for Embedded C/C++ Programming

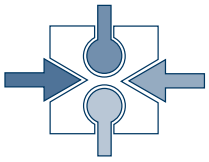
Embedded Studio is a powerful C/C++ IDE (Integrated Development Environment) for microcontrollers. It is specifically designed to provide users with everything needed for professional embedded C programming and development: An all-in-one solution providing stability and a continuous workflow for any development environment.

Features

- Professional IDE solution for embedded C/C++ programming
- Cross-Platform: Runs on Windows, macOS, and Linux
- Clang/LLVM, and GCC C/C++ Compilers included
- Highly optimized run-time library for best performance and smallest code size
- Feature-packed debugger with seamless J-Link integration
- Powerful Project Manager, even for huge projects
- Package-based project generator for all common microcontrollers
- Multi-Threaded build minimizes build times
- FREE for any non-commercial use like education- and evaluation purpose, without any limitations



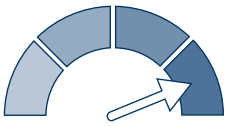
Availability



Embedded Studio offers support for Arm and RISC-V based microcontroller.

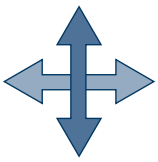
CPU Support Packages Provide everything to get you started easily.

Efficiency



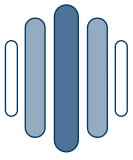
Fast startup, short project load time, and parallel build, minimize the wait time you spend waiting, and improve your efficiency. With J-Link's debug technology, you can analyze and debug you systems in no time.

Portability



Embedded Studio is available on Windows, macOS and Linux. Similar look and feel on all platforms and fully portable projects enable efficient development on the operating system of your choice.

Flexibility



Embedded Studio comes with two toolchains: GCC and LLVM - ready-to-run.

External toolchains, such as the IAR or Arm/KEIL compiler can also be used to build your applications.

SEGGER

RTOS & Embedded Software Solutions

World Leading RTOS & Middleware Solutions for Embedded Systems

RTOS

embOS – embOS is a priority-controlled real-time operating system, designed to be used as foundation for the development of embedded applications.

embOS-MPU – embOS-MPU offers memory protection on top of the capabilities of embOS.

embOS-Safe – embOS-Safe is the functional safety certified version of embOS.

Middleware – Code Libraries

emFile – emFile is a file system for embedded applications that can be used on any media for which basic hardware access functions can be provided.

emWin – emWin is designed to provide an efficient, processor- and LCD controller-independent graphical user interface (GUI) for any application that operates with a graphical LCD.

emLoad – emLoad allows straightforward updates of embedded applications either with a USB stick, with an SD card or via USB-connection to a PC - or else via a serial connection (type RS-232, RS-485).

emCompress – emCompress is a compression system that is able to reduce the storage requirements of data that must be embedded into an application. Compress on the host in advance, decompress in the target on demand.

Middleware – Connectivity

embOS/IP – embOS/IP is a high-performance TCP/IP stack that has been optimized for speed, versatility and a small memory footprint. It is written in ANSI C and can be used on virtually any CPU

emUSB-Host – emUSB-Host implements full USB host functionality, including external hub support, and optionally provides device class drivers. It enables developers to easily add USB host functionality to embedded systems

emUSB-Device – emUSB-Device is a high speed USB device stack specifically designed for embedded systems. The Software is written in ANSI C and can run on any platform. A large variety of target drivers are already available.

emModbus – emModbus is SEGGER's implementation of the Modbus protocol. It supports communication via UART (ASCII, RTU) and Ethernet (Modbus/TCP and Modbus/UDP) and is capable to communicate with any Modbus compliant device.

Middleware – Crypto & Security

emSecure – emSecure is a software solution to securely authenticate digital assets. It can be used to secure products against hacking and cloning at no per unit cost.

emSSH – emSSH is a software library that enables secure login to your embedded system. emSSH offers the possibility to establish a secured connection to any server application in your product. It can be used in target independent native computer applications as well as in embedded targets/applications.

emSSL – emSSL is a software library that enables secure connections across the Internet. emSSL offers both client ans server capability. SSL/TLS is a must-have in nearly every application which is connected to the internet. IoT products, smart grid or home automation markets benefit from securing their communication.

Middleware – Crypto & Security

emCrypt – emCrypt is a state-of-the-art cryptographic algorithm library that scales from constrained devices to workstations.

emLib – emLib is a collection of data confidentially and integrity algorithms which are easily deployed into an embedded system. AES and DES encrypt and decrypt data at rest or in flight, assuring confidentially. CRC identifies errors in received or stored data, but does not correct them. ECC identifies and corrects common errors in transmitted or stored data, ensuring data integrity.

Middleware – Internet of Things

Internet of Things – Software IP components from SEGGER such as emSSL, emSSH, emSecure Crypto libraries, HTTP Web server, and embOS/IP to name a few, can be used as foundations for your securely connected IoT device. Our Software works on any MCU.

SEGGER

Debug & Trace Probes

Market Leading Development Tools – J-Link and J-Trace PRO

The J-Link debug probes with their outstanding performance, robustness, and ease of use are the market leading debug probes today. The J-Trace PRO sets a benchmark for instruction tracing with its streaming trace function that enables unlimited tracing at full clock speed.

J-Link - The Market Leading Debug Probe

Order No.:
8.12.00

Features

- All popular debuggers and IDEs are supported
- Cross platform support (Windows, Linux, Mac)
- Ultra-fast download speed into RAM and flash memory
- Unlimited breakpoints in flash memory
- Unique Real-Time Transfer technology (RTT)
- Multiple CPUs supported:
  8051, PIC32, RX, Arm7/9/11, Cortex-M/R/A, RISC-V, complete list
- Free software updates
- Built-in VCOM functionality

J-Trace PRO Family - Streaming Trace Probes

Order No.:
8.20.0

Features

- Real-time streaming trace at full System Clock
- Tune your application with live code profiling
- Satisfy regulatory requirements with instruction-level code coverage
- Isolate and identify hard-to-find code defects with unlimited trace
- Full J-Link debug functionality
- No instrumentation required

Device	Arm7	Arm9	Arm11	Arm Cortex-A	Arm Cortex-M0	Arm Cortex-M0+	Arm Cortex-M1	Arm Cortex-M3	Arm Cortex-M4	Arm Cortex-M7	Arm Cortex-R	Renesas RX Core
J-Link BASE	D	D	D	D	D	D	D	D	D	D	D	D
J-Link PLUS	D	D	D	D	D	D	D	D	D	D	D	D
J-Link ULTRA+	D	D	D	D	D	D	D	D	D	D	D	D
J-Link PRO	D	D	D	D	D	D	D	D	D	D	D	D
J-Trace PRO for Cortex-M	-	-	-	-	D	D	D	D T	D T	D T	-	-
J-Trace PRO Cortex	-	-	-	D T	D	D	D	D T	D T	D T	D T	-

D = Debug supported | T = Trace supported | - = not supported

Flasher / In-Circuit Programmer

In-Circuit Programmers Easily Integrated Into Any Production Environment

SEGGER's in-circuit flash programming solutions are ultra-fast and reliable, making them the perfect choice for mass production environments. The portfolio includes devices specialized for service environments and prototype programming.

Flasher PRO

Order No.:
5.17.01

Features

Flasher PRO is a programming tool for microcontrollers with on-chip or external Flash memory and Arm, RX or PPC core. This professional production programmer is designed for programming flash targets with the J-Flash software or stand-alone.

- Stand-alone JTAG/SWD programmer (Once set up, Flasher can be controlled without the use of PC program)
- Ethernet interface
- Supports internal and external flash devices
- Wide range of devices are supported
- Free firmware updates
- 128 MB internal NAND flash (storing config. & data files)
- Serial in target programming supported

Flasher ATE

Order No.:
5.18.01

Features

Flasher ATE is perfectly suited for high volume mass production environments. The modular system uses a communication main board at its heart, that distributes the commands received from an ATE, ICT or a similar automated production handler system to the programming modules. Each programming module can be set up with individual configurations and firmware.

- In-System Programmer (ISP)
- Ultra fast programming
- Control interfaces for ATEs and similar production process handlers
- Switchable target power
- J-Flash for an easy setup
- Scalable solution with up to 10 individual channels
- Parallel channels, no demultiplexing required

Device	Arm7	Arm9	Arm11	Arm Cortex-A	Arm Cortex-M	Arm Cortex-R	Renesas RX	Renesas RL78	e200z0 (PowerPC)	STM8 Core
Flasher ATE	x	x	x	-	x	-	x	x	x	x
Flasher Secure	x	x	x	x	x	x	x	-	x	-
Flasher PRO	x	x	x	x	x	x	x	x	x	x
Flasher Portable PLUS	x	x	x	x	x	x	x	x	x	x
Flasher ARM	x	x	x	x	x	x	-	-	-	-
Flasher STM8	-	-	-	-	-	-	-	-	-	x

x = supported | - = not supported

Committed to excellence

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ELECTRONICS WORLDWIDE

Germany – Headquarters

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RUSOL ENERGY

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