RENESAS

BODY CONTROL APPLICATIONS

Join the market leader

BIG IDEAS
FOR EVERY SPACE

2016.02

RL78/F1X FEATURE LINE-UP.

- 16-bit device technology shrunk to 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 up to + 150 °C
- Improved Data Flash memory with minimum 100 k 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

		16-bit			
		RL78/			
		F12	F13	F14	F15
Basics	Flash (Kbytes)	8 – 64	16 – 128	48 – 256	128 – 512
	RAM (Kbytes)	0.5 – 4	1 – 8	4 – 20	10 – 32
	Data Flash (Kbytes)	4	4	4 – 8	8 – 16
	Package pins/balls	20 – 64	20 – 80	30 – 100	48 – 144
Peripherals	Ethernet	–	–	–	–
	Flexray	–	–	–	–
	Security (cryptographic)	–	–	–	–
	CAN	–	0 – 1	1	2
	CAN FD	–	–	–	–
	LIN	1	1	1 – 2	2 – 3
	UART	2 – 4	1 – 2	2	2 – 3
	CSI	2 – 7	2 – 4	3 – 4	4 – 6
	I²C	1 – 7	2 – 5	3 – 5	5
	ADC 10-bit	4 – 12	4 – 20	10 – 31	18 – 31
	ADC 12-bit	–	–	–	–
	PWM	4 – 7	7 – 16	11 – 20	15 – 27
	16-bit timer	9	17 – 21	21 – 25	25 – 33
	32-bit timer	–	–	–	–
Supply	Max. CPU clock (MHZ)	32	32	32	32
	Min. voltage (V)	1,8	2,7	2,7	2,7
	Max. voltage (V)	5,5	5,5	5,5	5,5
Temperature	Min. temperature (°C)	- 40	- 40	- 40	- 40
	Max. temperature (°C)	+ 125	+ 150	+ 150	+ 125
Support	AUTOSAR MCAL	–	–	–	–
	Functional Safety	–	–	–	–
	- FMEDA	–	–	–	–
	- Design	–	–	–	–
	- ASIL	–	–	–	–

RH850/F1X FEATURE LINE-UP.

- 32-bit device technology shrunk to 40 nm
- Huge scalability with more than 80 derivatives
- New and many energy saving features integrated
- Super low power
  – RUN mode: typ. 0,3 mA / MHz and max. 0,75 mA / MHz
- High performance CPU with up to 3,04 DMIPS / MHz
- Ambient temperature up to + 125 °C supported
- Improved Data Flash memory with minimum 125 k write / erase cycles
- Full coverage of body networking interfaces supported
  – CAN, CAN FD, LIN
  – FlexRay, Ethernet AVB

		32-bit								
		RH850/								
		F1L			F1M		F1H	F1K		
		ECO	ADVANCED	PREMIUM	ECO	ADVANCED	ECO	ECO	ADVANCED	PREMIUM
Basics	**Flash (Kbytes / Mbytes)**	256 – 2 MB	768 – 2 MB	1,5 – 2 MB	3 – 4 MB	3 – 4 MB	3 – 6 MB	768 – 2 MB	768 – 2 MB	768 – 2 MB
	RAM (Kbytes)	32	32	64	256 – 320	256 – 320	320 – 756	96 – 192	96 – 192	96 – 192
	Data Flash (Kbytes)	32	32	64	64	64	64	64	64	64
	Package pins/balls	48 – 176	64 – 176	144 – 176	144 – 233	144 – 233	176 – 272	144 – 176	100 – 176	100 – 176
Peripherals	**Ethernet**	–	–	–	–	–	✓	–	–	–
	Flexray	–	–	–	✓	✓	✓	–	–	–
	Security (cryptographic)	–	✓	✓	✓	✓	✓	✓	✓	✓
	CAN	1 – 6	1 – 6	1 – 6	6	6	7 – 8	6 – 7	6 – 7	6 – 7
	CAN FD	–	–	–	–	–	–	–	–	6
	LIN	3 – 16	3 – 16	3 – 16	12 – 16	12 – 16	12 – 18	12 – 16	7 – 16	7 – 16
	UART	1 – 6	1 – 6	1 – 6	6	6	2 – 6	6	4 – 6	4 – 6
	CSI	2 – 6	2 – 6	2 – 6	6	6	6 – 8	6	5 – 6	5 – 6
	I²C	1	1	1	1	1	1	1	1	1
	ADC 10-bit	4 – 28	4 – 28	4 – 28	22 – 34	22 – 34	26 – 38	24 – 28	20 – 28	20 – 28
	ADC 12-bit	8 – 32	8 – 32	8 – 32	24	24	32	24 – 32	16 – 32	16 – 32
	PWM	13 – 72	13 – 72	13 – 72	64 – 80	64 – 80	40 – 96	64 – 72	48 – 72	48 – 72
	16-bit timer	16 – 48	16 – 48	16 – 48	21 – 48	21 – 48	32 – 48	32 – 48	32 – 48	32 – 48
	32-bit timer	5 – 9	5 – 9	5 – 9	13	13	18	13	13	13
Supply	**Max. CPU clock (MHZ)**	80	96	96	120	120	2 x 120	80	120	120
	Min. voltage (V)	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0
	Max. voltage (V)	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5
Temperature	**Min. temperature (°C)**	- 40	- 40	- 40	- 40	- 40	- 40	- 40	- 40	- 40
	Max. temperature (°C)	+ 125	+ 125	+ 125	+ 125	+ 125	+ 125	+ 125	+ 125	+ 125
Support	**AUTOSAR MCAL**	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Functional Safety	✓	✓	✓	✓	✓	✓	✓	✓	✓
	- FMEDA	✓	✓	✓	✓	✓	✓	✓	✓	✓
	- Design	✓	✓	✓	✓	✓	✓	✓	✓	✓
	- ASIL	B	B	B	B	B	B	B	B	B

FUNCTIONAL SAFETY ISO 26262 FOR MCU@RENESAS.

Full commitment at early stage

2005

- Beginning of the Functional Safety engagement for IEC61508
- Renesas joined the working group 16 of ISO26262 and is member of JSAE and Jaspar

2011

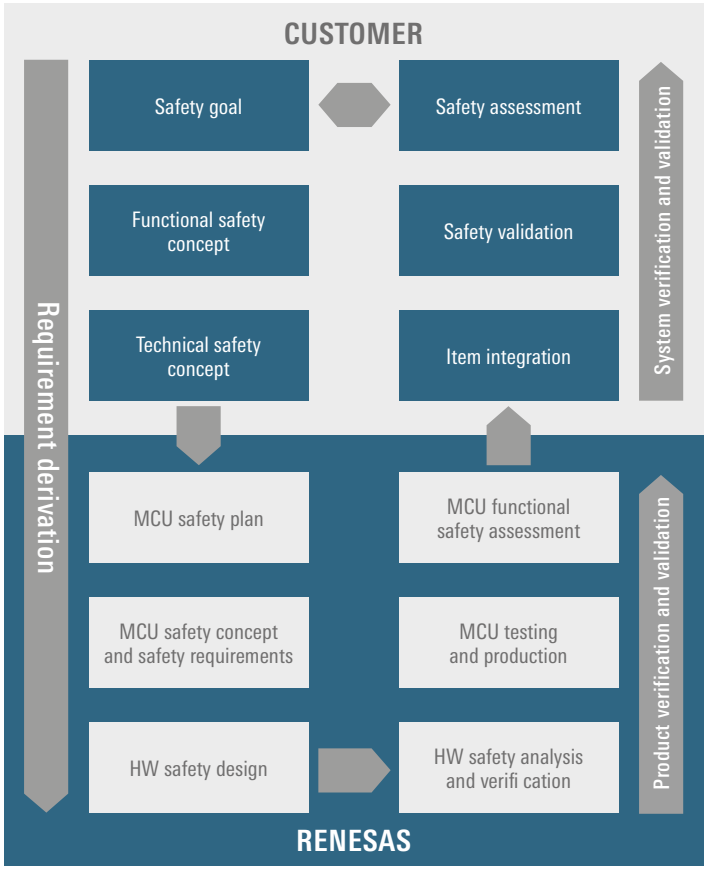
- Renesas decided to offer Functional Safety support for all new MCU products

2015

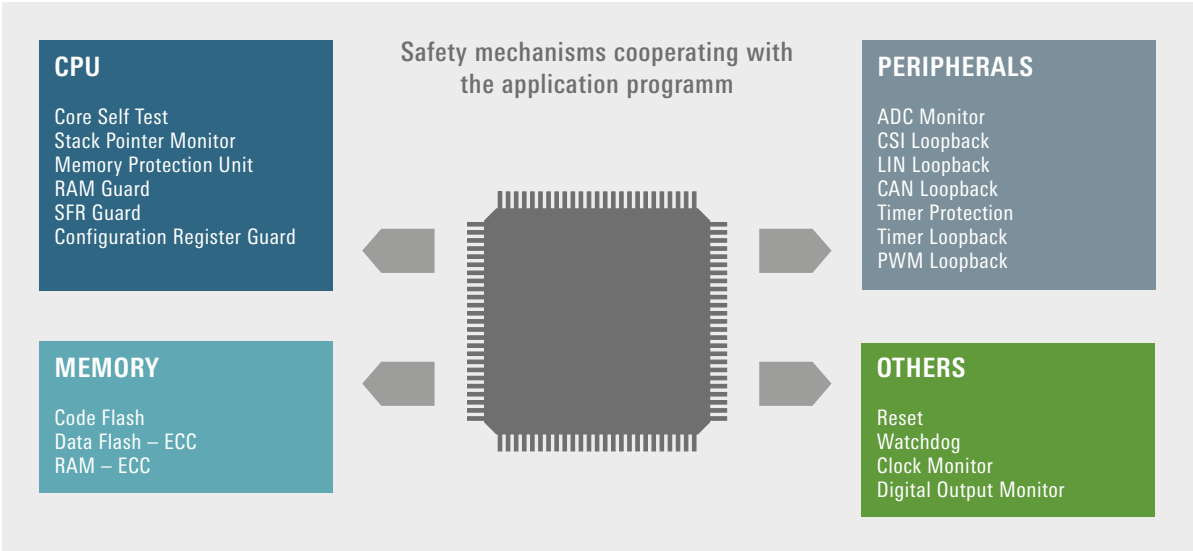
- All new MCU products to be released will be compliant to ISO 26262

F Series

FUNCTIONAL SAFETY LIFECYCLE



FUNCTIONAL SAFEY IMPLEMENTATION



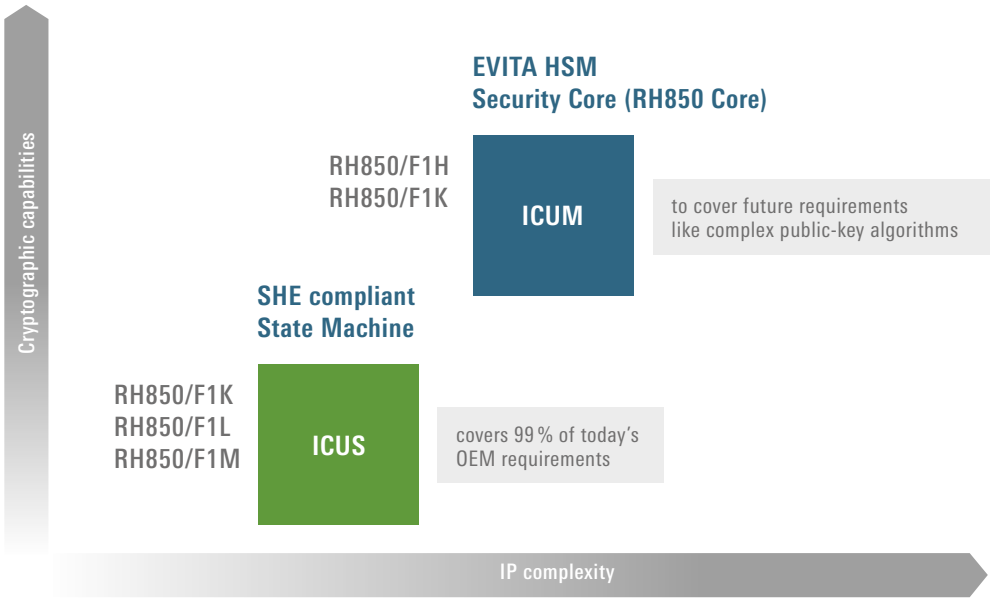
SECURITY.

Full range cryptographic support

To tackle the need for security in automotive applications, Renesas presents dedicated MCU peripherals for cryptographic operations

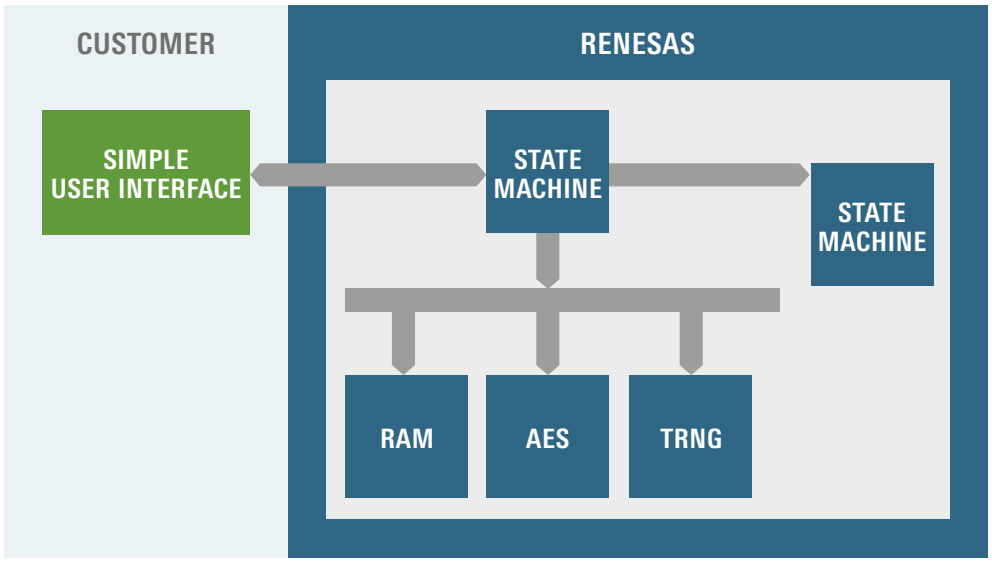
Two types of these peripherals – Intelligent Cryptographic Unit (ICU) – coexist to address different application needs

- ICU Slave (ICUS)
- ICU Master (ICUM)
- Security Hardware Extension (SHE)
- Hardware Security Module (HSM)



Security to go

- No encryption-/decryption software stack necessary
- Simple user interface to setup security features
- Secure boot function
- Software individualization based on device ID
- Protected data flash for device IDs, secret keys etc.



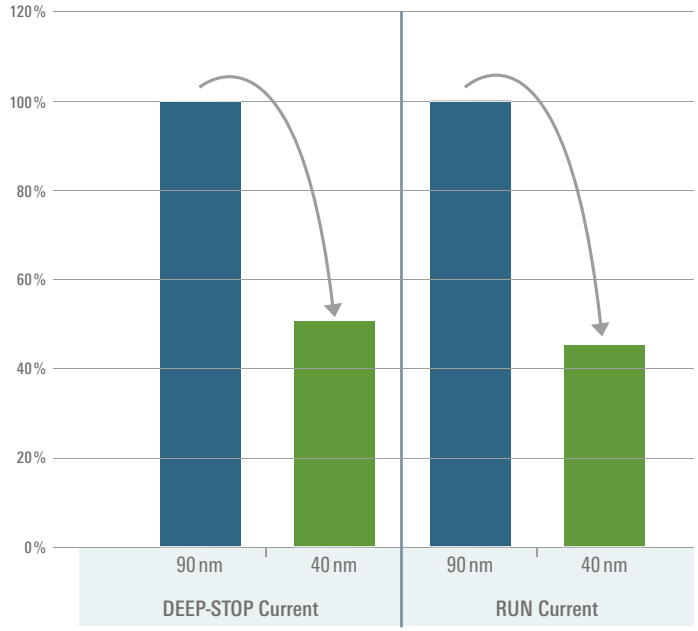
POWER CONCEPT.

- Full support to reduce current consumption and keep system cost under control.

The demand of the automotive industry to reduce CO_2 emission is further increasing. This leads also to strong requirement to reduce the current consumption of all electronic modules. The RH850/F1x series offers a set of features to increase the power efficiency in all typical use cases for modern body control applications.

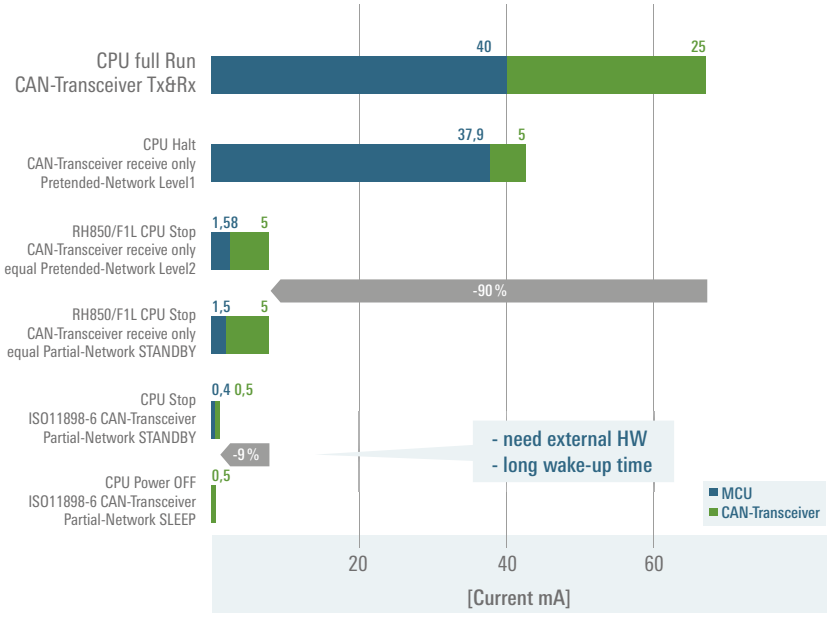
Best in class power consumption

Compared to the former microcontroller generation the current consumption in DEEP-STOP mode could be reduced by 50 % and in RUN mode even by 55 %. The big number of power modes combined with the easy to use power scaling of the CPU offer further optimization possibilities.



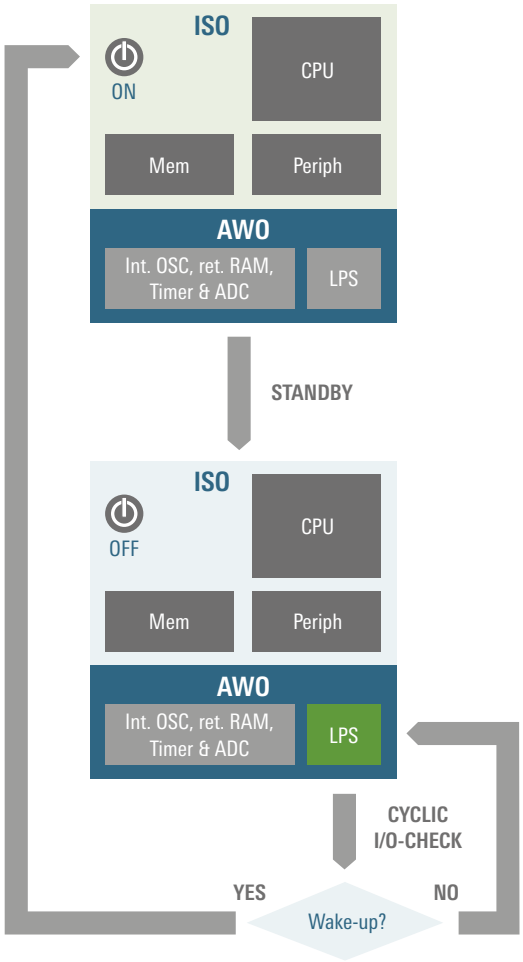
ECU current consumption

Pretended- and Partial Network will be supported with built-in HW solution.
This offers full support of network power management without additional cost.



Low Power Sampler (LPS)

The internal low power sampler will handle cyclic I/O monitoring for digital and analog signals. This will not require any CPU action and results in the lowest power consumption available in the market.



ISO: isolated area
AWO: allways on area

Security to go

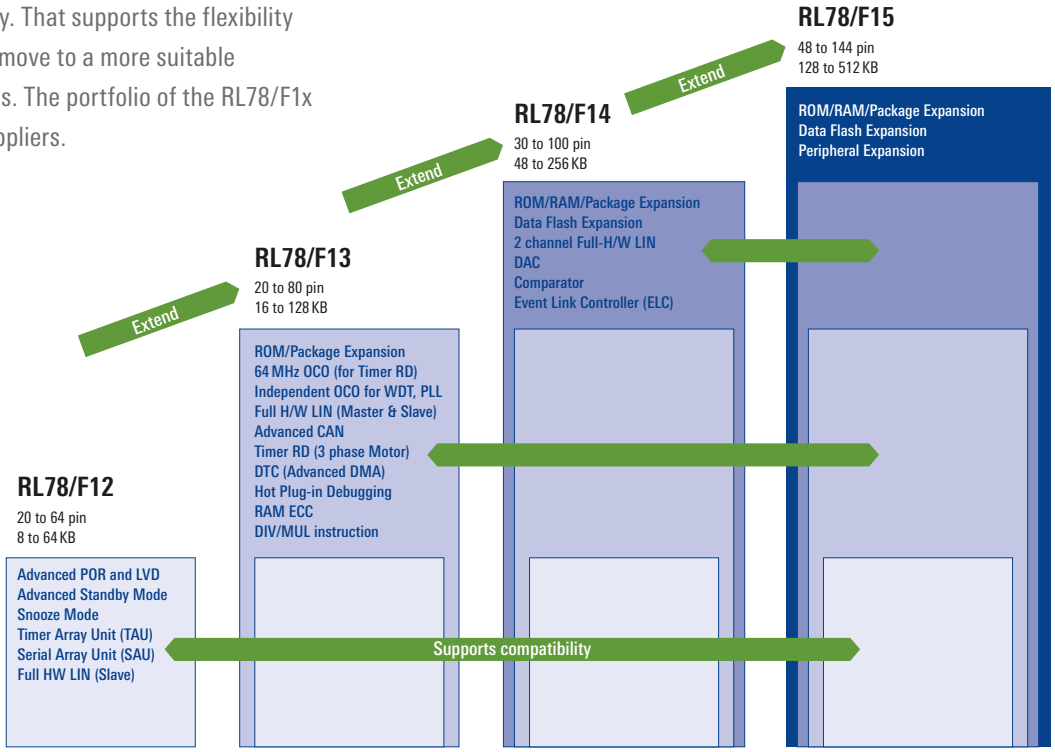
Pretended- and Partial Network will be supported with built-in HW solution. This offers full support of network power management without additional cost.

MARKET REQUIREMENT	RENESAS' SOLUTION
Reduction of max. current Reduce system cost	40 nm Flash technology Low leakage current
Power scaling flexible and easy to use	Multi power modes private CPU clock
Cyclic wake-up support lowest current consumption	Cyclic wake-up support lowest current consumption
Network power management Partial / Pretended NW	Low Power Sampler

16-BIT MCU | RL78/F1X

Device concept

Basis of the concept is the compatibility. That supports the flexibility during the design of the application to move to a more suitable derivative in case of significant changes. The portfolio of the RL78/F1x is the largest among all 16-bit MCU suppliers.



RL78/F15 – 144-PIN QFP

16-bit CPU

RL78 Core

32 MHz @ - 40 to + 105° C
24 MHz @ - 40 to + 125° C

Single supply voltage: 2.7 - 5.5 V

QFN: 48 pins
QFP: 48, 64, 80, 100, 144 pins

On-chip debug (hot plug in, live debug)

Code Flash	RAM	Data Flash
512 KB	32 KB	16 KB
384 KB	26 KB	
256 KB	20 KB	8 KB
192 KB	16 KB	
128 KB	10 KB	

System

- 24 x channel Data Transfer Controller (DTC)
- Event Link Controller
- Clock Monitor

Oscillator

- PLL
- Internal Oscillator 15 KHz
- Internal Oscillator 64 MHz
- External Oscillator 20 MHz
- External Sub Oscillator 32 KHz

Monitor

- Power On Clear (POC)
- Low Voltage Detector (LVD)

Timer

- 3 x Phase Motor Timer 16-bit
- 24 x 16-bit Timer
- 16-bit OS-Timer
- Real Time Clock (RTC)
- Window WDT (15 KHz)

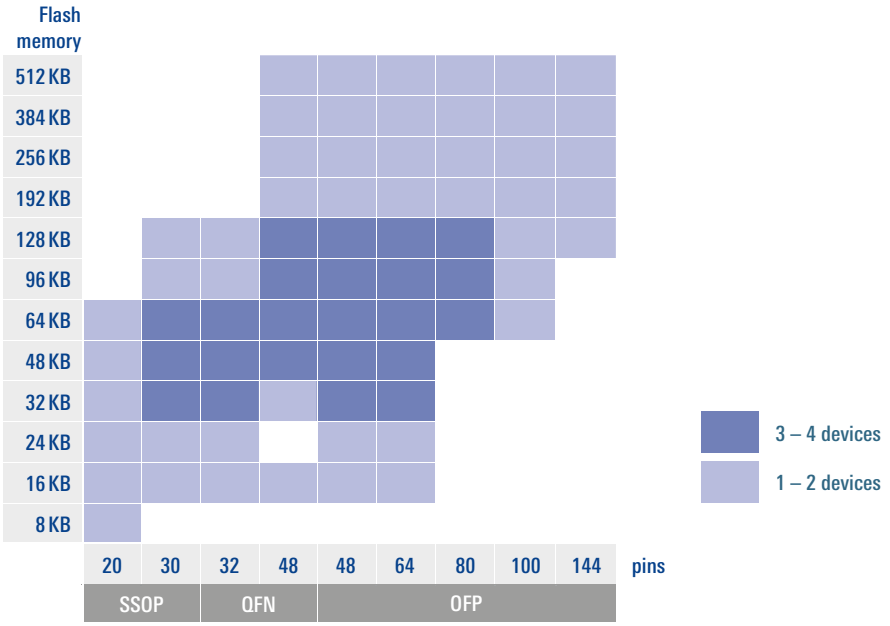
Digital I/F

- 2 x CAN
- 3 x HW LIN UART
- up to 3 x UART
- up to 6 x CSI
- up to 4 x I^2C
- I^2C Multimaster
- IEBus
- 16 x External Interrupt
- 8 x Key Return
- up to 136 GP I/O Ports

Analog IF

- 31 x 10-bit ADC
- 8-bit DAC
- Comparator 4 x Mux

LINE-UP



Hardware development tools

IECUBE
Full functional In-Circuit Emulator

Target Board
Device specific MCU board with on-chip debug connector

E1
On-Chip Debugger and Flasher

Debugger System

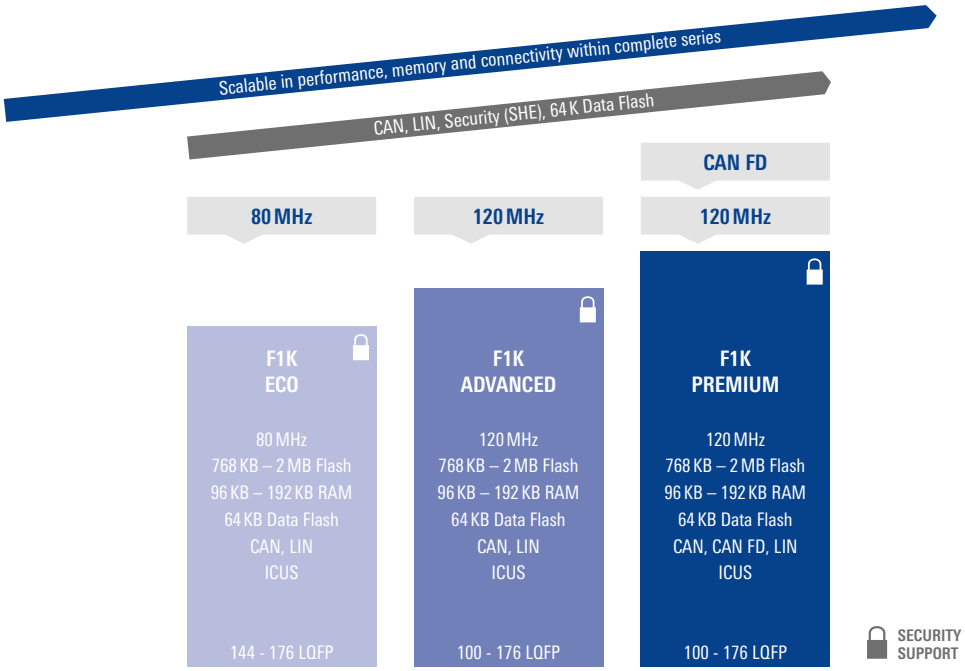
PG-FP5
Flash programmer

Software development tools

REQUIREMENT	SOLUTION	SUPPLIER
C/C++ compiler, Debugger, Editor	IAR, EWRL78 Workbench	IAR
Appilet (device driver generation tool)	Peripheral driver generator software	Renesas
Flash Library (flash self programming, EEPROM emulation)	Flash driver software	Renesas
LIN driver	LIN Communication software	Vector Informatik
CAN driver	CAN Communication software	Vector Informatik, Elektrobit
OSEK	Operating System	Vector Informatik, Elektrobit
Flash Programmer Software	Programmer suitable for PG-FP5 and E1	Renesas

32-BIT MCU | RH850/F1X

The RH850 Family represents the next generation 32-bit RISC Microcontroller to endorse future automotive applications. The F Series products, designed for body applications, provide high scalability, extreme low power consumption and a broad range of networking IPs.



F1K PREMIUM - 176PIN

32-bit CPU

RH850 Core (G3KH)
120 MHz
3.0 – 5.5 V
Ta = - 40 to + 125 °C
176 pin QFP

Floating Point Unit (Single Precision)	On Chip Debug
Memory Protection Unit	
Security Core ICUS	

Code Flash	RAM	Data Flash
2048 KB	192 KB	64 KB
1536 KB	160 KB	
1024 KB	128 KB	

System & Safety

- 16 x DMA
- Interrupt Controller
- Low Power Sampler
- Key Return
- Cyclic Redundancy Checking
- Error Corecction Coding
- Clock Monitor
- Power On Clear
- Low Voltage Indicator
- Core Voltage Monitor
- Peripheral Bus Guard
- Processor Elemant Guard

Timer

- 1 x TAUD 16 x 16-bit Timer
- 2 x TAUB 16 x 16-bit Timer
- 2 x TAUJ 4 x 32-bit Timer
- 5 x Operating System Timer
- 2 x Watchdog Timer
- Real Time Clock
- Encoder Timer
- Motor Control Timer
- 72 x 12-bit PWM w/ Diagnosis

Digital I/F

- 6 x CAN-FD, 1 x CAN
- SPI: 2 x CSIG, 4 x CSIH
- 6 x UART, LIN
- 10 x LIN (Master)
- I²C
- 150 x GPIO

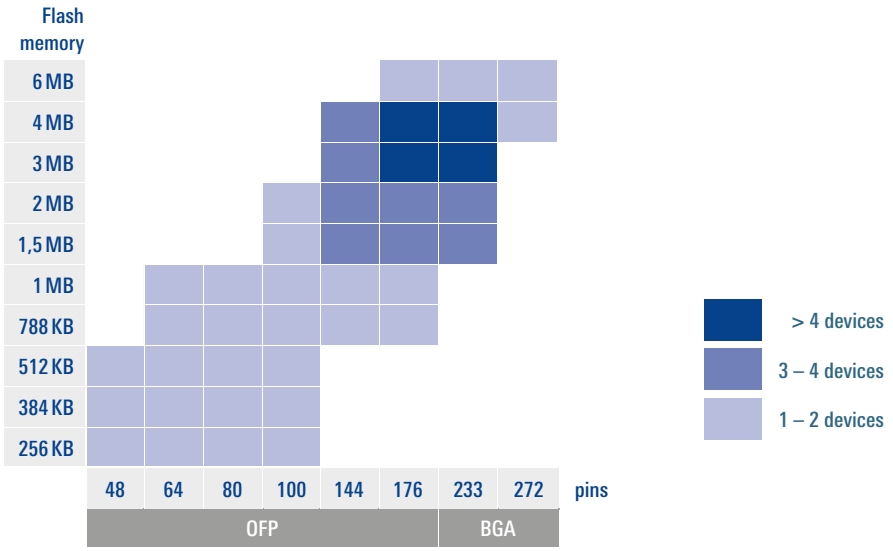
Oscillator

- ext. Main/SUB Oscillator
- int. High/Low Speed Oscillator
- PLL

Analog IF

- 36 x ADC0, 16 x 12-bit, 20 x 10-bit ext. MUX, 6ch T&H
- 24 x ADC1, 16 x 12-bit, 8 x 10-bit

LINE-UP



Hardware development tools

E1
On-Chip Debugger and
Flash programmer

PG-FP5
Flash programmer

RH850 Evaluation platform
with Device/Package
specific MCU piggy board

Debugger System

LAUTERBACH

i SYSTEM

Software development tools

SOFTWARE	TYPE	SUPPLIER
C/C++ compiler, Debugger, Editor	GHS – Multi V800 / IAR – EWV850	Greenhills, IAR
Autosar MCAL 3.x and 4.x	Peripheral driver software	Renesas
LIN driver	LIN Communication software	Vector Informatik
CAN driver	CAN Communication software	Vector Informatik
OSEK	Operating System	Vector Informatik
Flash Programmer Software	RFP Programmer for E1	Renesas

Before purchasing or using any Renesas Electronics products listed herein, please refer to the latest product manual and/or data sheet in advance.

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