

# BODY CONTROL APPLICATIONS

Join the market leader



BIG IDEAS  
FOR EVERY SPACE

# 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 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

16-bit			
RL78/			
F12	F13	F14	F15
8 – 64	16 – 128	48 – 256	128 – 512
0.5 – 4	1 – 8	4 – 20	10 – 32
4	4	4 – 8	8 – 16
20 – 64	20 – 80	30 – 100	48 – 144
–	–	–	–
–	–	–	–
–	–	–	–
–	0 – 1	1	2
–	–	–	–
1	1	1 – 2	2 – 3
2 – 4	1 – 2	2	2 – 3
2 – 7	2 – 4	3 – 4	4 – 6
1 – 7	2 – 5	3 – 5	5
4 – 12	4 – 20	10 – 31	18 – 31
–	–	–	–
4 – 7	7 – 16	11 – 20	15 – 27
9	17 – 21	21 – 25	25 – 33
–	–	–	–
32	32	32	32
1,8	2,7	2,7	2,7
5,5	5,5	5,5	5,5
-40	-40	-40	-40
+125	+150	+150	+125
–	–	–	–
–	–	–	–
–	–	–	–
–	–	–	–
–	–	–	–

<b>Basics</b>	Flash (Kbytes)
	RAM (Kbytes)
	Data Flash (Kbytes)
	Package pins/balls

<b>Peripherals</b>	Ethernet
	Flexray
	Security (cryptographic)
	CAN
	CAN FD
	LIN
	UART
	CSI
	I <sup>2</sup> C
	ADC 10-bit
	ADC 12-bit
	PWM
	16-bit timer
32-bit timer	

<b>Supply</b>	Max. CPU clock (MHZ)
	Min. voltage (V)
	Max. voltage (V)
<b>Temperature</b>	Min. temperature (°C)
	Max. temperature (°C)

<b>Support</b>	AUTOSAR MCAL
	Functional Safety
	- FMEDA
	- Design
	- ASIL



# 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

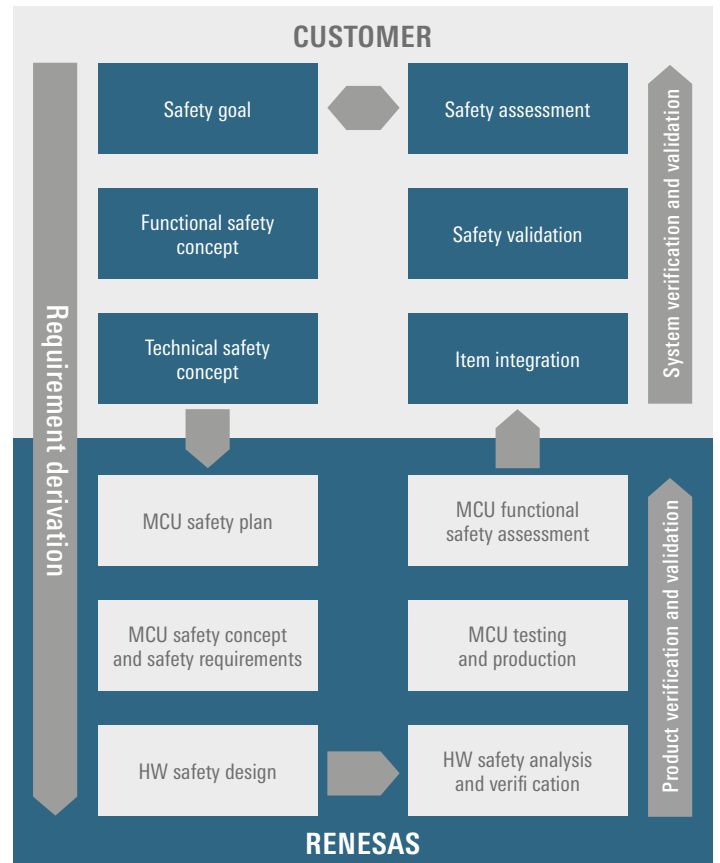
- Renesas decided to offer Functional Safety support for all new MCU products

2015

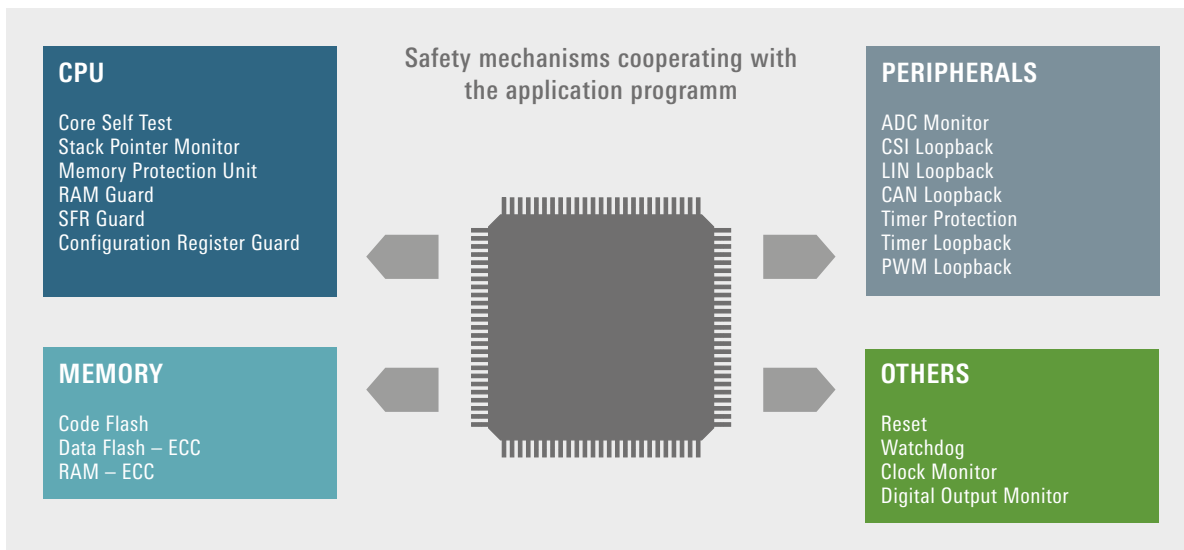
- All new MCU products to be released will be compliant to ISO 26262



## FUNCTIONAL SAFETY LIFECYCLE



## FUNCTIONAL SAFETY IMPLEMENTATION



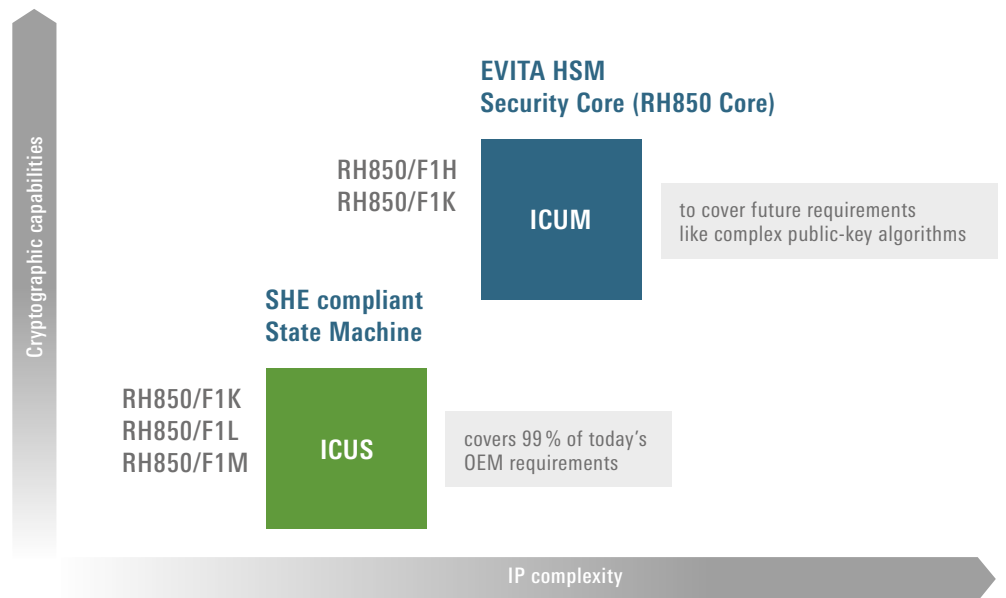
# SECURITY.

## Full range cryptographic support

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

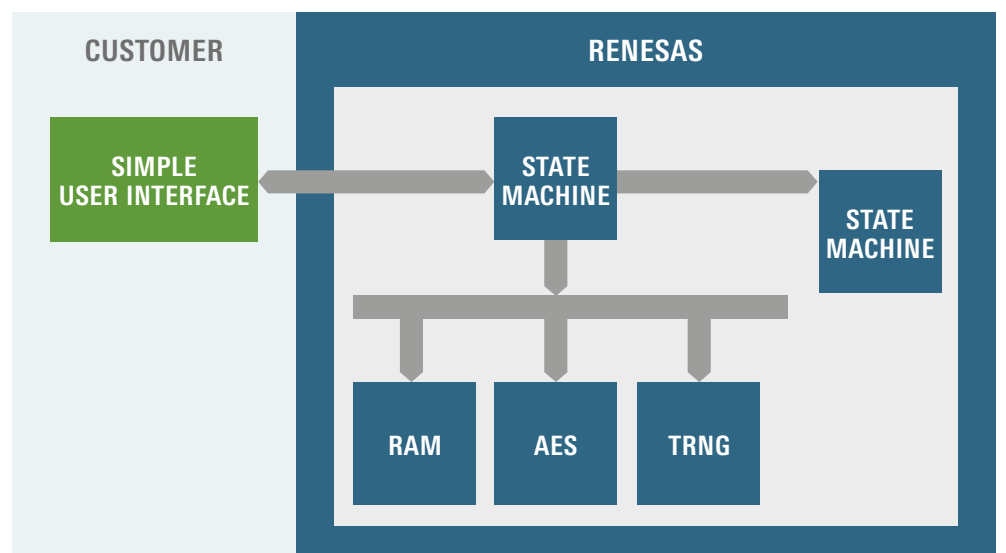
Two types of these peripherals – Intelligent Cryptographic Unit (ICU) – coexist to address different application needs

- 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.



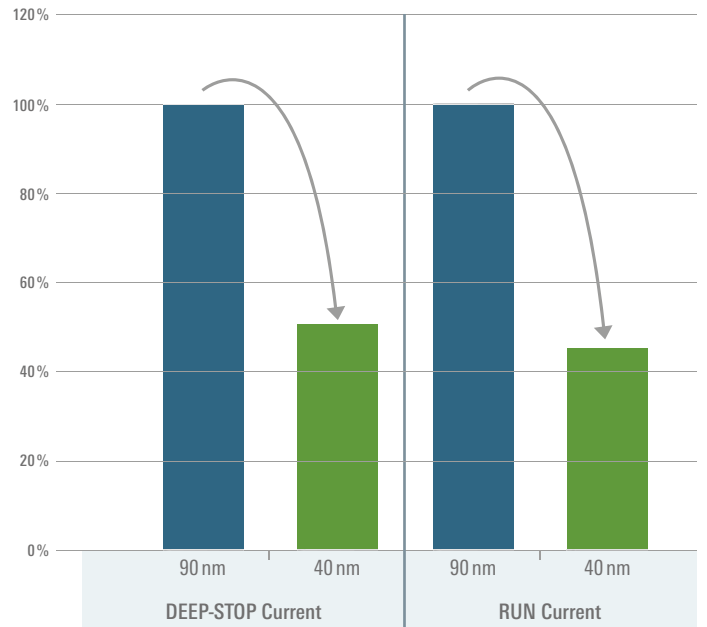
# POWER CONCEPT.

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

The demand of the automotive industry to reduce CO<sub>2</sub> 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.

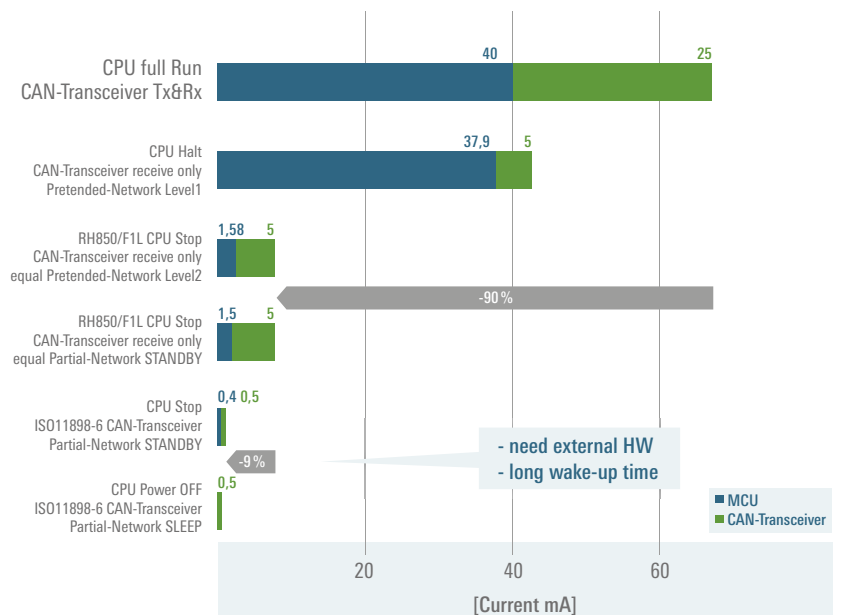
## Best in class power consumption

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

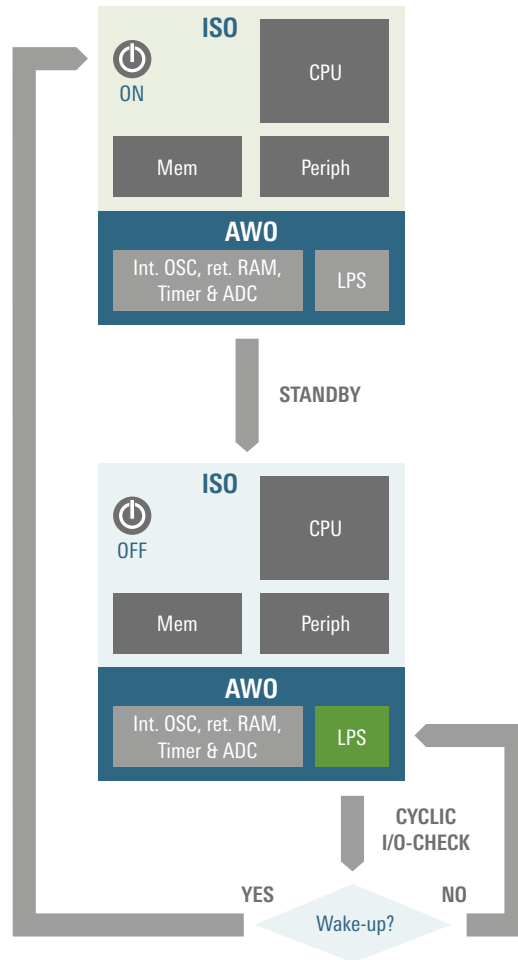
Pretended- and Partial Network will be supported with built-in HW solution. This offers full support of network power management without additional cost.



### 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

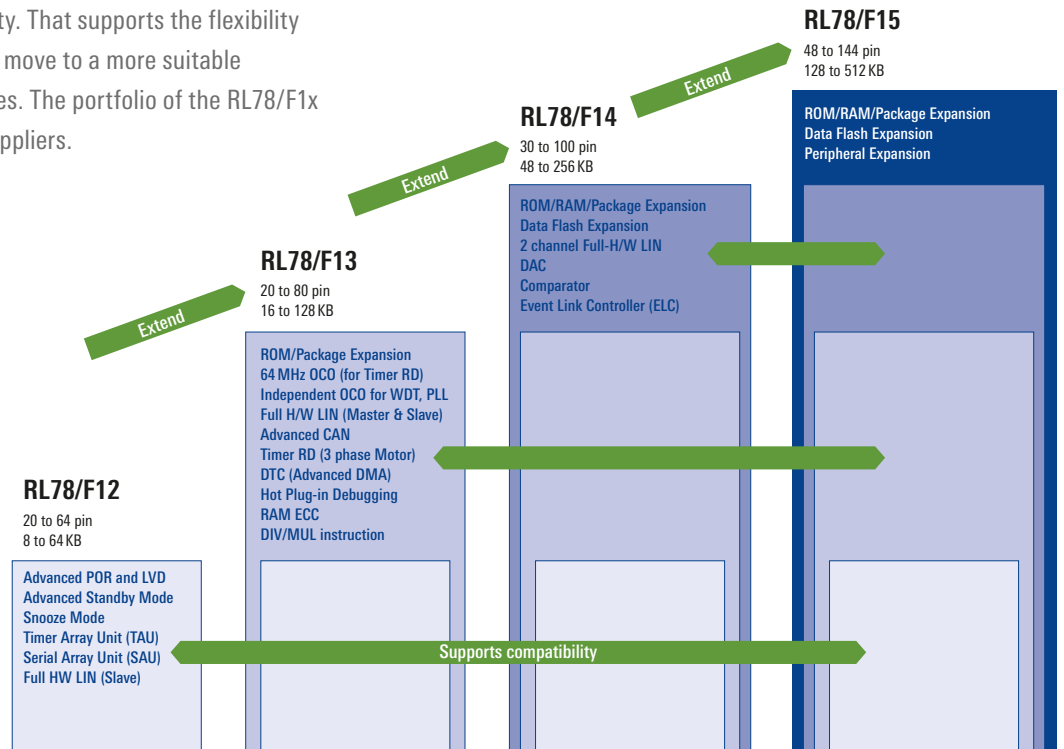
Pretended- and Partial Network will be supported with built-in HW solution. This offers full support of network power management without additional cost.

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.

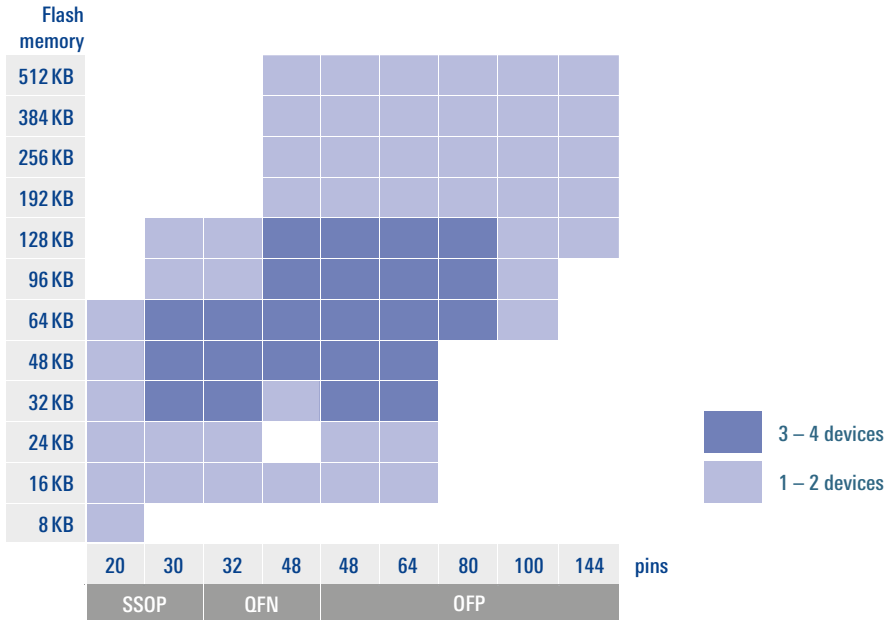


## RL78/F15 – 144-PIN QFP

<b>16-bit CPU</b>  <b>RL78 Core</b> 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)			<b>System</b> 24 x channel Data Transfer Controller (DTC)  Event Link Controller  Clock Monitor		<b>Timer</b> 3 x Phase Motor Timer 16-bit  24 x 16-bit Timer  16-bit OS-Timer  Real Time Clock (RTC)  Window WDT (15 KHz)		<b>Digital I/F</b> 2 x CAN  3 x HW LIN UART  up to 3 x UART  up to 6 x CSI  up to 4 x I <sup>2</sup> C  I <sup>2</sup> C Multimaster  IEBus  16 x External Interrupt  8 x Key Return  up to 136 GP I/O Ports														
<table border="1"> <thead> <tr> <th>Code Flash</th> <th>RAM</th> <th>Data Flash</th> </tr> </thead> <tbody> <tr> <td>512 KB</td> <td>32 KB</td> <td rowspan="2">16 KB</td> </tr> <tr> <td>384 KB</td> <td>26 KB</td> </tr> <tr> <td>256 KB</td> <td>20 KB</td> <td rowspan="3">8 KB</td> </tr> <tr> <td>192 KB</td> <td>16 KB</td> </tr> <tr> <td>128 KB</td> <td>10 KB</td> </tr> </tbody> </table>	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	<b>Oscillator</b> PLL Internal Oscillator 15 KHz Internal Oscillator 64 MHz External Oscillator 20 MHz External Sub Oscillator 32 KHz		<b>Monitor</b> Power On Clear (POC)  Low Voltage Detector (LVD)		<b>Analog I/F</b> 31 x 10-bit ADC  8-bit DAC  Comparator 4 x Mux	
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																				



## LINE-UP



## Hardware development tools

**IECUBE**  
Full functional In-Circuit Emulator



**Debugger System**



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



**E1**  
On-Chip Debugger and Flasher



**PG-FP5**  
Flash programmer

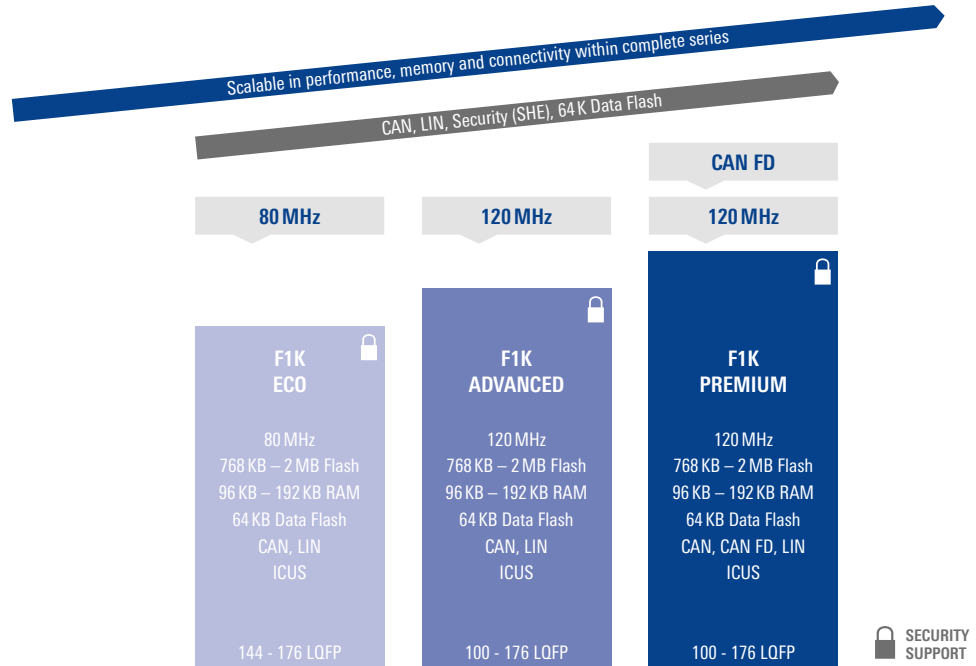


## Software development tools

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, Elektrotbit
OSEK	Operating System	Vector Informatik, Elektrotbit
Flash Programmer Software	Programmer suitable for PG-FP5 and E1	Renesas

# 32-BIT MCU | RH850/F1X

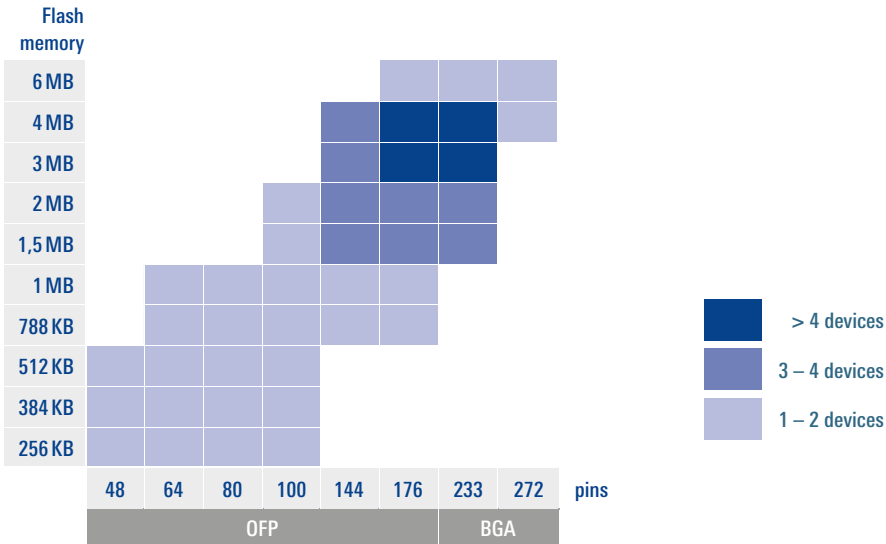
The RH850 Family represents the next generation 32-bit RISC Microcontroller to endorse future automotive applications. The F Series products, designed for body applications, provide high scalability, extreme low power consumption and a broad range of networking IPs.



## F1K PREMIUM - 176PIN

<b>32-bit CPU</b> <b>RH850 Core (G3KH)</b> 120 MHz 3.0 – 5.5 V Ta = -40 to +125 °C 176 pin QFP			<b>System &amp; Safety</b> 16x 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 Element Guard			<b>Timer</b> 1 x TAUD 16x 16-bit Timer 2 x TAUB 16x 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			<b>Digital I/F</b> 6 x CAN-FD, 1 x CAN SPI: 2x CSIG, 4x CSIH 6 x UART, LIN 10 x LIN (Master) I <sup>2</sup> C 150 x GPIO		
Floating Point Unit (Single Precision)		On Chip Debug									
Memory Protection Unit											
Security Core ICUS											
<b>Code Flash</b>	<b>RAM</b>	<b>Data Flash</b>									
2048 KB	192 KB	64 KB									
1536 KB	160 KB										
1024 KB	128 KB										
			<b>Oscillator</b> ext. Main/SUB Oscillator int. High/Low Speed Oscillator PLL			<b>Analog I/F</b> 36x ADC0, 16x12-bit, 20x10-bit ext. MUX, 6ch T&H 24x ADC1, 16x 12-bit, 8x 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



## Software development tools

SOFTWARE	TYPE	SUPPLIER
C/C++ compiler, Debugger, Editor	GHS – Multi V800 / IAR – EWW850	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

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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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