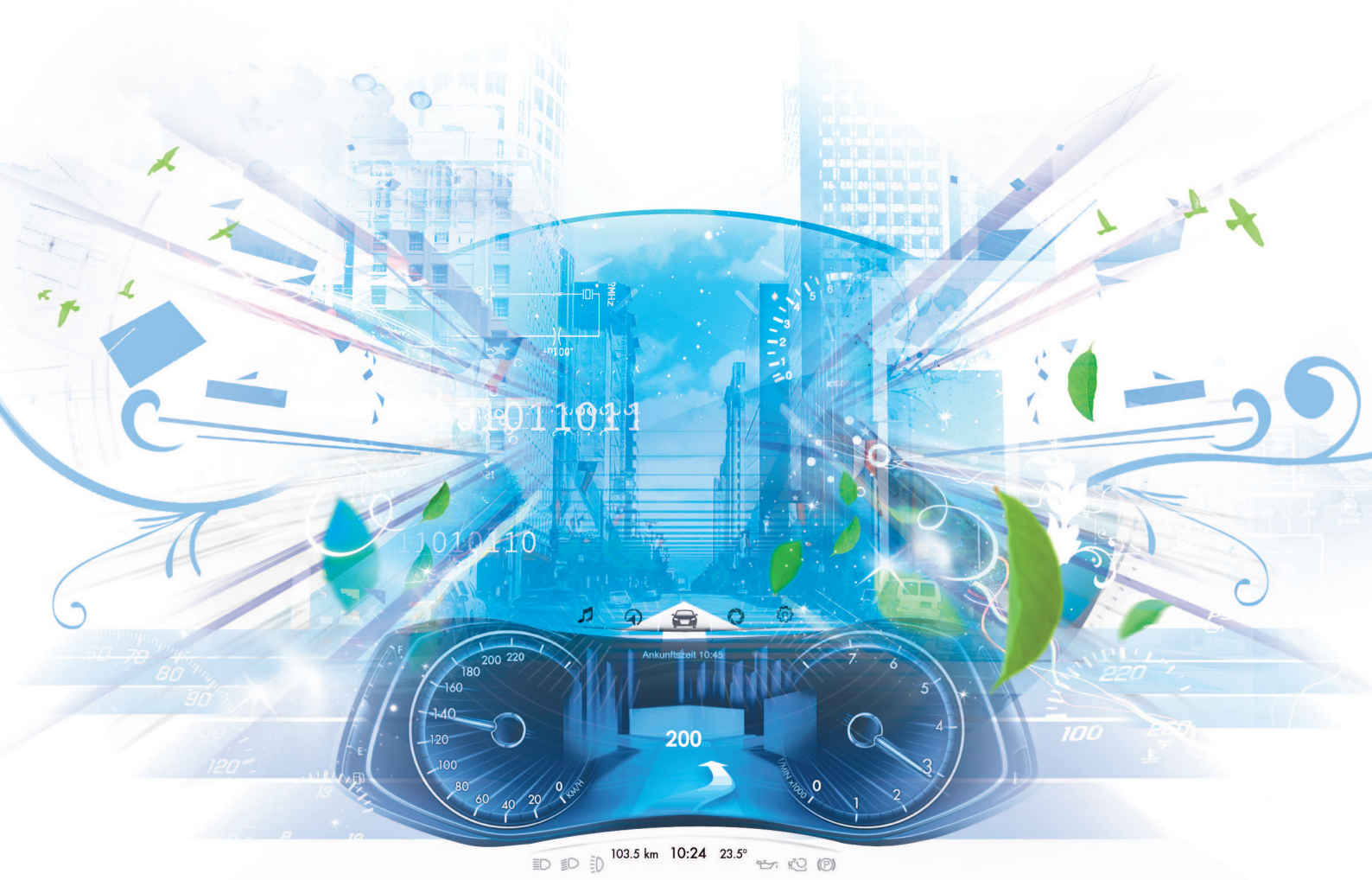
Microcontroller solutions for

Instrument Cluster



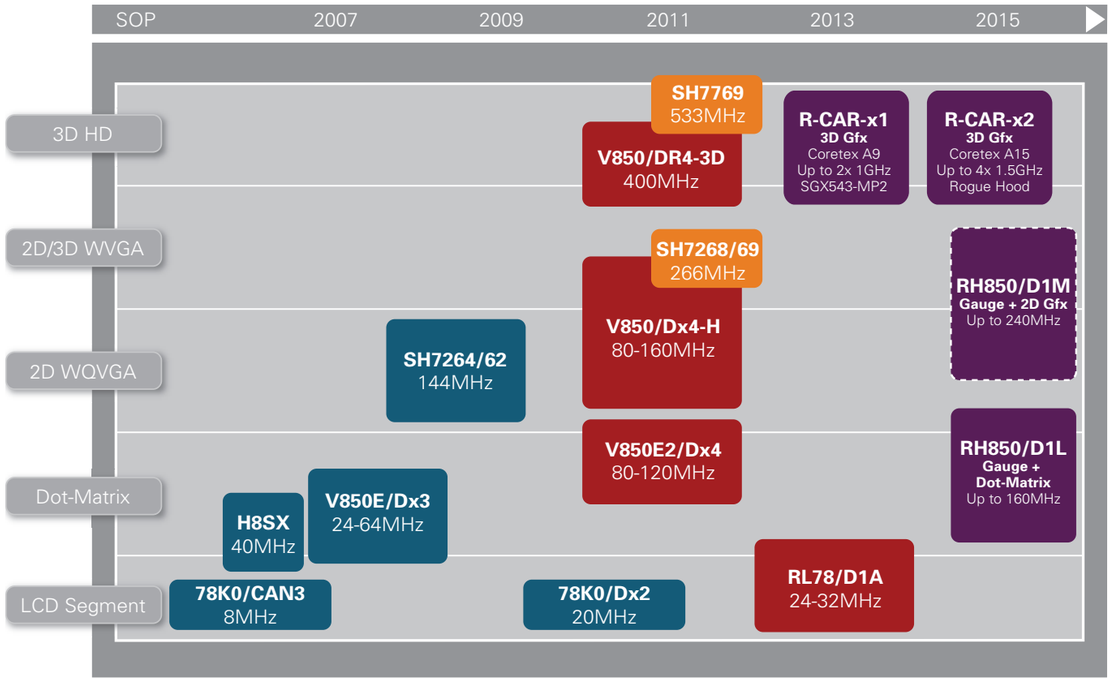
Renesas Electronics
www.renesas.eu

2012.11

Instrument Cluster Solutions

D series is a well established microcontroller series in the market - tailored for dashboard applications.
The ongoing success is obvious: more than every second car on the road is built with a Renesas Dashboard MCU.
You can rely on Renesas' expertise and the ultimate quality we stand for. No matter what your design entails, we can help make it reality.

MCU Roadmap for Cluster Applications



Graphics Competence

Large variety of graphics products for navigation, HMI and dashboard
Cooperation with leading IP suppliers such as IMG, TES, many more
Best embedded 3D through full support of OpenGL standards at highest performance
Large pool of graphics IPs providing you the best fitting IPs for any application
Own development of graphics IPs enducing optimum automotive features
Own development of graphics drivers thoroughly adapted to automotive needs
Full tool chain for graphics s/w development, from content to final code generation

32-bit Cluster MCU: RH850/D1x & R-Car

Next Generation – a quick Preview!

RH850/D1x will be the next-generation cluster MCU family, significantly improving features and performance compared to V850/Dx4:

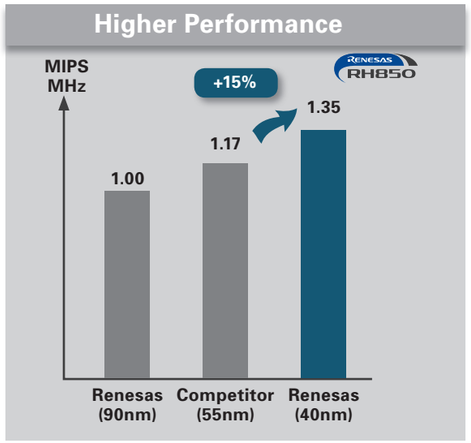
- > Higher CPU performance
- > Increased memory size (Flash, iRAM, vRAM)
- > Improved safety and security concept
- > Drastically reduced power consumption
- > Software compatible with V850/Dx4.

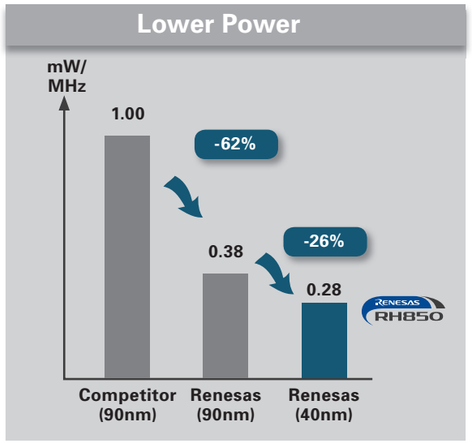
Priority on Graphics

- > Up to 27x higher graphics performance
- > Warping and JPEG/RLE decompression fully in hardware
- > Dedicated vRAM saving features (sprite engine, compression support, RAM wrapper)
- > Increased memory bandwidth (external Flash & RAM)
- > Enhanced RGL graphics libraries
- > OpenVG 1.1 & HMI tool support
- > Option for 3D / OpenGL-ES 2.0 under planning

RH850 – Renesas' New Microcontroller Generation for Automotive

The next cluster controller family D1x is utilizing Renesas' embedded 40nm Flash technology that delivers low power consumption and high performance. High-speed flash access and reduced operating power as well as reduced stand-by power consumption contribute to reduce fuel consumption and helps minimize overall power consumption of automobiles. Each mA saved translates into 0.3 mg less CO_2. Thus we get a bit closer to the realization of environment-friendly vehicles and smart cars.





32-bit Cluster MCU: V850/Dx4

Renesas' Dx4 family is the right choice to meet today's requirements for a wide range of TFT displays: from QVGA and lower resolutions to HUXGA.

The Dx4 controllers are designed to support both the classical dashboard features, such as stepper motors, sound and LCD segment drivers, and 2D graphic animation.

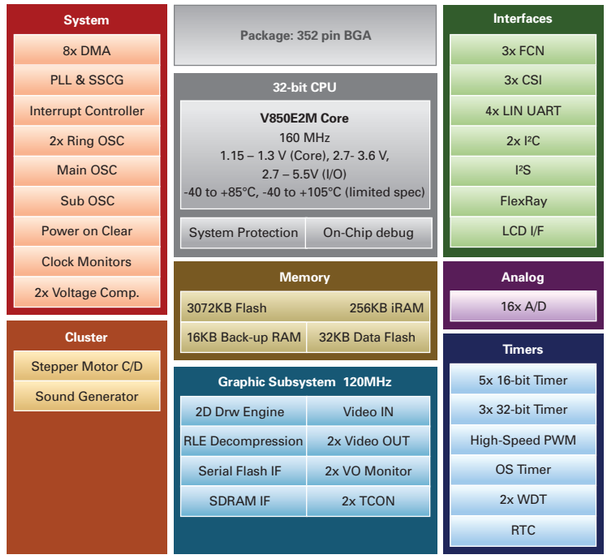
Benefits

One CPU core for the complete Series Same powerful V850E2 core independent from operating frequency	**One architecture** for the complete product range offers full flexibility even for different performance classes
Common basic peripheral set Timers / A/D converter / communication interfaces identical	**One standard base software** package supports all devices within Dx4
System Protection Function Memory Protection Unit plus System Register Protection / Timing Supervision / Peripheral Protection	**Real protection** of different application parts within one micro which enable best support for development and failure analysis
Embedded 2D Drawing Color TFT direct drive from QVGA to WVGA	**2 in 1 solution** enables cost-effective approach from low-end to very high-end with optimized graphic performances
Enhanced communication interfaces CAN with 64 message bufferFlexRay based on mature Bosch IP with 8kB message buffer	**Support of all automotive standard interfaces** with maximum performance and reduced CPU interruption

Key Features

- Up to 6 stepper motors for traditional clusters incl. automatic zero point detection
- LCD segment driver – up to 6 times multiplexing for large segment count
- Sound playback from simple tone to stereo I2S
- Embedded 2D drawing engine
- Up to 2 independent video outputs
- Integrated digital camera/video input interface
- PCB cost benefit with QFP package & integrated Video RAM for low-end TFT
- Flexible video RAM interface for high-end applications

Dx4-H block diagram

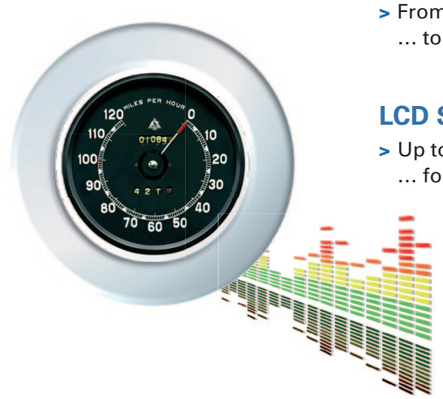


What you can expect from V850/Dx4

Core Dashboard Functionality

Intelligent Stepper Motor Unit

- Coprocessor for driving stepper motors
- Programmable motor characteristics
- Modelling physical behaviour
- Automatic zero point detection
- Electrical drive of all typical motors



Sound Playback

- From simple tone … to stereo I²S

LCD Segment Drivers

- Up to 6 times multiplexing … for large segment count

Design for Functional Safety

CPU Protection

MPU, Peripherals, execution time

Debug Protection

Authorised debugging only

Memory Supervision

Error corrective ECC

Logic Protection

Soft Error hardening

System Protection

All system masters access control

Video Monitoring

Output content check

Clock Monitoring

All clocks controlled

Supply Monitoring

Power supply control

Design for minimum electromagnetic interference with the car

Spread Spectrum Clocks

SSCG PLLs

Slew Rate Controlled I/O

Buffers drive a controllable energy

Pinout EMI Optimised

Integrated memories

EMI evaluation

Measurement of final products

Low Energy Clock Trees

Chip design controlled

On-Chip Capacitances

Filter chip noise

Low Impedance On-Chip Power Mesh

Chip design controlled

EMI Design Guidance

ECU design support

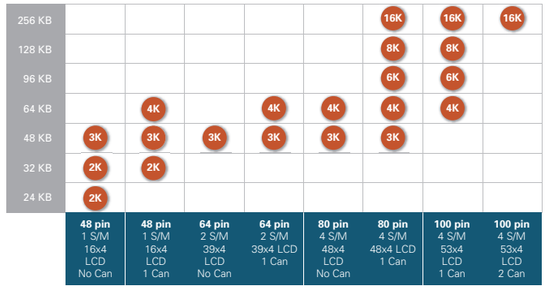
16-bit Cluster MCU: RL78/D1A

RL78/D1A as an optimized solution for the BRICs and low-end dashboard markets. It's outstanding features are the ultra low power consumption and the wide variation of products designed to help reduce system cost as external components such as EEPROM, on-chip oscillator or watch-dog are not needed any more.

Highlights

- 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 1.000.000 W/E cycles (target)
- Integrated safety feature support
- Wide operation voltage of 2.7 to 5.5V

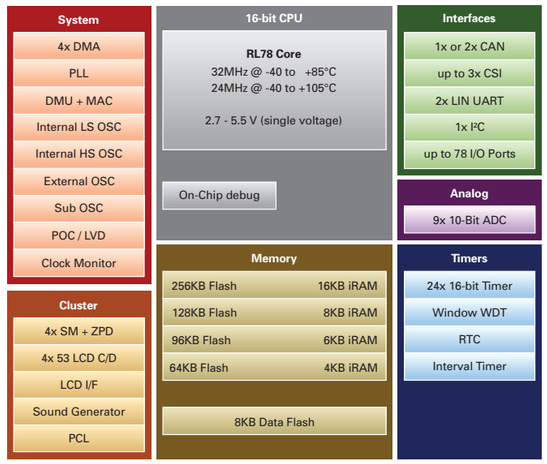
RL78/D1A line-up



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
- Dedicated dashboard specific DMAC trigger configuration
- Autonomous ADC based power-fail function

RL78/D1A block diagram



Device Overview

Device		Memory			Interfaces								Other Peripherals					Miscellaneous Information				
Nickname	Partnumber	Flash (kB)	iRAM (kB)	Video RAM (kB)	CAN	FlexRay	MLB	Ethernet	UART	CSI	I²C	I²S	8/16/32-bit Timer Ch.	Stepper Motor C/D	ADC	Graphics Support	Other	CPU Core	CPU Frequ.	Pin/Package	Power Supply
V850E2 DJ4	μPD70F3522	256	24	-	3	-	-	-	2	3	2	-	92	6	16 x 12 bit	96 x 6 LCD C/D LCF I/F	RTC, Sound gen.	V850E2	80 MHz	144 QFP	3.0 - 5.5 V
	μPD70F3523	512	48																		
	μPD70F3524	1024	96									1							120 MHz		
	μPD70F3525	2048	192																		
	μPD70F3526	3072	256																		
V850E2 DK4-H	μPD70F3529	2048	96	592	3	-	-	-	2	2	2	1	52	4	12 x 12bit	2D Gfx 1 Video OUT serial Flash I/F	RTC, Sound gen.		80 MHz	176 QFP	3.0 - 5.5V
V850E2 DN4-H	μPD70F3532	3072	256	-	3	1	-	-	4	3	2	1	92	6	16 x 12 bit	2D Gfx 2 Video OUT 1 Video IN serial Flash I/F SDRAM I/F	LCD I/F, RTC, Sound gen.		160 MHz	352 BGA	3.0 - 5.5V (I/O) 1.1 - 1.3V (CPU)
V850E2 DP4-H	μPD70F3535	3072	256	3MB	3	1	-	-	4	3	2	1	92	6	16 x 12 bit	2D Gfx, 2 Video OUT 1 Video IN serial Flash I/F	LCD I/F, RTC, Sound gen.		160 MHz	408 BGA	3.0 - 5.5V (I/O) 1.1 - 1.3V (CPU)
	μPD70F3536	3072	256	5MB																	
	μPD70F3537	3072	256	8MB																	
RL78 D1A	R5F10CGB	24	2	-	-	-	-	-	1	2	1	-	24	1	5 x 10bit	4 x 27 LCD C/D	RTC, Sound gen.	RL78	32 MHz	48 QFP	2.7...5.5V
	R5F10CGC	32																			
	R5F10CGD	48	3																		
	R5F10CLD	48	3	-	-	-	-	-	2	2	1	-	24	2	5 x 10bit	4 x 39 LCD C/D	RTC, Sound gen.		32 MHz	64 QFP	2.7...5.5V
	R5F10CMD	48	3	-	-	-	-	-	2	2	1	-	24	4	8 x 10bit	4 x 48 LCD C/D	RTC, Sound gen.		32 MHz	80 QFP	2.7...5.5V
	R5F10CME	64	4																		
	R5F10DGC	32	2	-	1	-	-	-	1	2	1	-	24	1	5 x 10bit	4 x 27 LCD C/D	RTC, Sound gen.		32 MHz	48 QFP	2.7...5.5V
	R5F10DGD	48	3																		
	R5F10DGE	64	4																		
	R5F10DLD	48	3	-	1	-	-	-	2	2	1	-	24	2	5 x 10bit	4 x 39 LCD C/D	RTC, Sound gen.		32 MHz	64 QFP	2.7...5.5V
	R5F10DLE	64	4																		
	R5F10DMD	48	3	-	1	-	-	-	2	2	1	-	24	4	8 x 10bit	4 x 48 LCD C/D	RTC, Sound gen.		32 MHz	80 QFP	2.7...5.5V
	R5F10DME	64	4																		
	R5F10DMF	96	6																		
	R5F10DMG	128	8																		
	R5F10DMJ	256	16																		
	R5F10DPE	64	4	-	1	-	-	-	2	2	1	-	24	4	9 x 10bit	4 x 53 LCD C/D	RTC, Sound gen.		32 MHz	100 QFP	2.7...5.5V
	R5F10DPF	96	6																		
	R5F10DPG	128	8																		
	R5F10TPJ	256	16																		
	R5F10DPJ	256	16		2																

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

Renesas Electronics Europe
www.renesas.eu

Document No. R01PF0033ED0100