

HMI设计的理想选择

RZ/A1嵌入式ARM®微处理器



RZ/A1嵌入式ARM® 微处理器

创新的架构&先进的集成性

瑞萨电子RZ/A1系列微处理器(MPUs), 提供基于内嵌ARM® Cortex®-A9处理器和业界领先最大至10MB的片上存储器的创新架构。RZ/A1 MPUs可以1000 DMIPS的性能执行大容量片上存储器中或者低成本的外部QSPI flash(支持in-place片上运行)存储器中的代码。仅仅使用片上存储器即可实现支持WXGA(1280x800)分辨率的图形功能。内部存储器带宽128bit, 可实现相比于外置DDR存储器的系统更高的内存吞吐率。RZ/A1系列产品在BOM成本、性能、功耗和系统开发周期方面提供了巨大的优势, 是人机界面(HMI)和其他片上系统应用的理想选择。

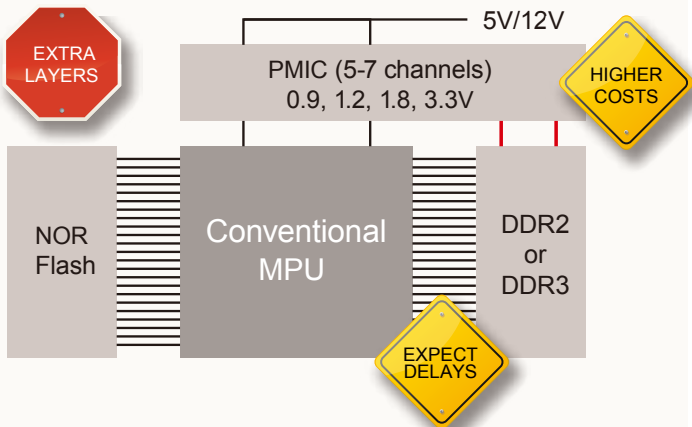


- ARM® Cortex®-A9 处理器, 1000 DMIPS性能
- 最大可达10MB的片上存储器, 无需外部RAM
- 可直接从QSPI flash(Execute-In-Place)运行代码
- 支持两路Camera输入, 可实现视频与图像融合
- 具有四种容量的片上RAM可供选择的: 2MB(RZ / A1LC), 3MB(RZ / A1L或者RZ / A1LU), 5 MB(RZ / A1M)和10 MB(RZ / A1H)
- 可连接多达两个独立的LCD显示屏(WXGA(1280x800)分辨率), 实现出色的图形用户界面

瑞萨电子RZ/A1方案简化了电路设计的同时降低了BOM成本

常规解决方案

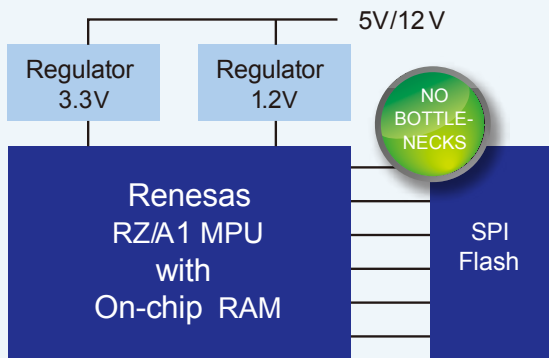
- 复杂的电源管理和PCB布局
- 内存带宽被代码和图形数据共用



BOM组件	常规方案
Flash	\$\$\$ (NOR Flash)
RAM	\$\$\$ (DDR2)
Regulators	\$\$\$ (5-7PMIC channels)
PCB layers	\$\$\$ (DDR2 supplies, routing)
Total BOM cost	\$\$\$

瑞萨电子RZ/A1 HMI方案

- 简化了系统设计和测试

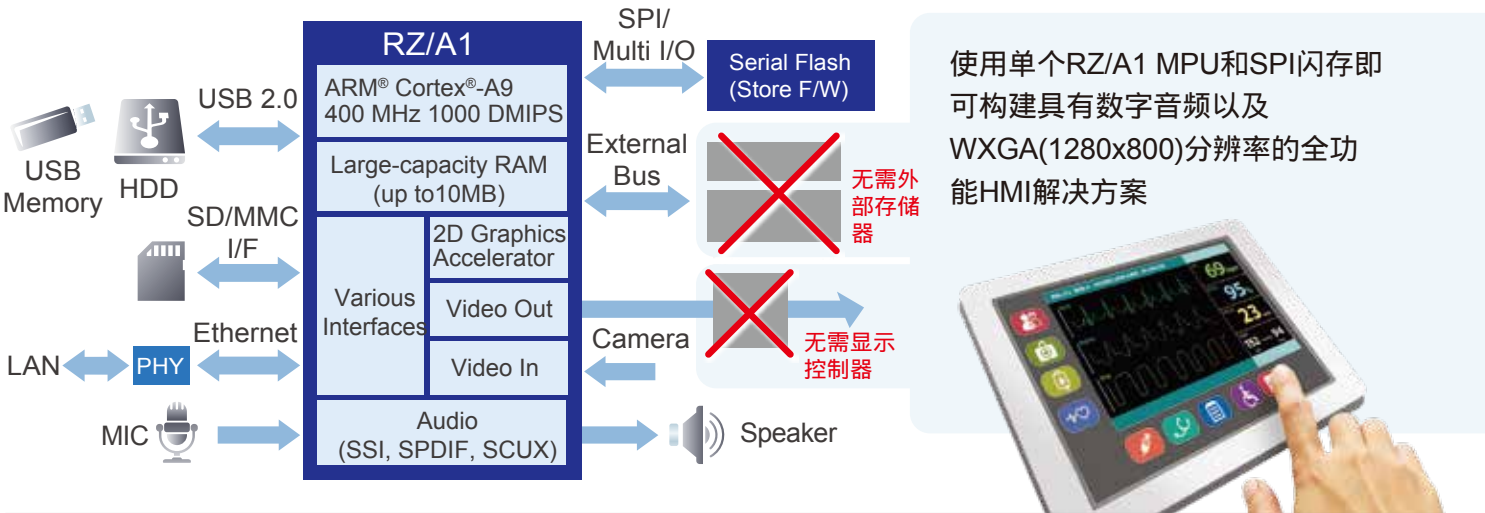


BOM组件	RZ/A1方案
Flash	\$ (SPI Flash)
RAM	n/a (internal)
Regulators	\$ (3.3V, 1.2V regulator)
PCB layers	\$ (as few as two)
Total BOM cost	\$

更少的开发周期，更优的HMI方案

RZ/A1 MPU提供的丰富的片上功能降低了BOM成本，节省了电路板空间并最小化了任务集成。如下所示的典型应用可充分利用瑞萨电子丰富的IP组合以及一系列内置外设，包括：CMOS摄像头接口，JPEG编解码器，12位ADC和OpenVG 2D图形引擎等等。

RZ/A1系列系统框图



特点

最大至10MB的片上RAM

- 用于代码执行/数据缓冲

128-bit内存带宽

- 并行(X4)访问提供卓越的内存吞吐量

支持连接原地执行(Execute-In-Place (XIP))低成本的QSPI Flash

- 3层缓存

LCD 控制器驱动两路独立的WXGA分辨率的显示

- 用于生动的图形显示

图像能力

	RZ/A1L		RZ/A1LU		RZ/A1LC		RZ/A1M		RZ/A1H	
	QVGA	WQVGA	VGA	WVGA	SVGA	WSVGA	XGA	WXGA		
4	320x240	480x272	640x480	800x480	800x600	1024x600	1024x768	1280x800		
3	16bpp	16bpp	32bpp	32bpp	32bpp	32bpp	32bpp	32bpp		
2										
1										
帧缓冲器中的图像数	0.6 MB	1.0 MB	4.7 MB	5.9 MB	7.3 MB	9.4 MB				
	0.4 MB	0.7 MB	3.5 MB	4.4 MB	5.5 MB	7.0 MB	9.0 MB			
	0.3 MB	0.5 MB	2.3 MB	2.9 MB	3.7 MB	4.7 MB	6.0 MB	7.8 MB		
	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 MPU支持的显示分辨率

优点

更低的BOM成本

- 无需外部SDRAM和LCD控制器
- 更多简单的电压调节器
- 减少PCB层数

提高性能

- 400 MHz主频，1000 DMIPS性能
- 6倍于333 MHz 16-bit DDR2的吞吐量

降低功耗

- 更少的电路板组件
- 无需将代码从Flash拷贝到RAM

加速产品上市时间

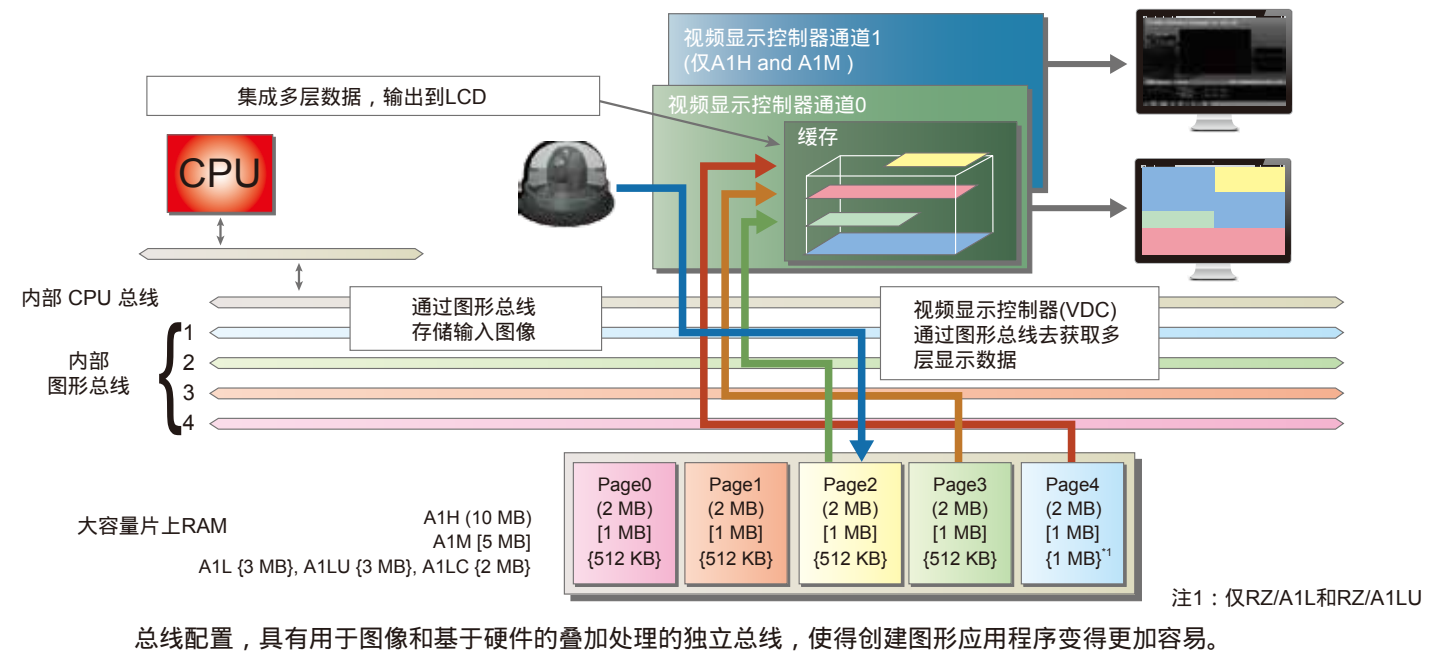
- 更简单的PCB设计
- 更少的外围布线以减少EMI干扰
- 避免了DDR供货问题



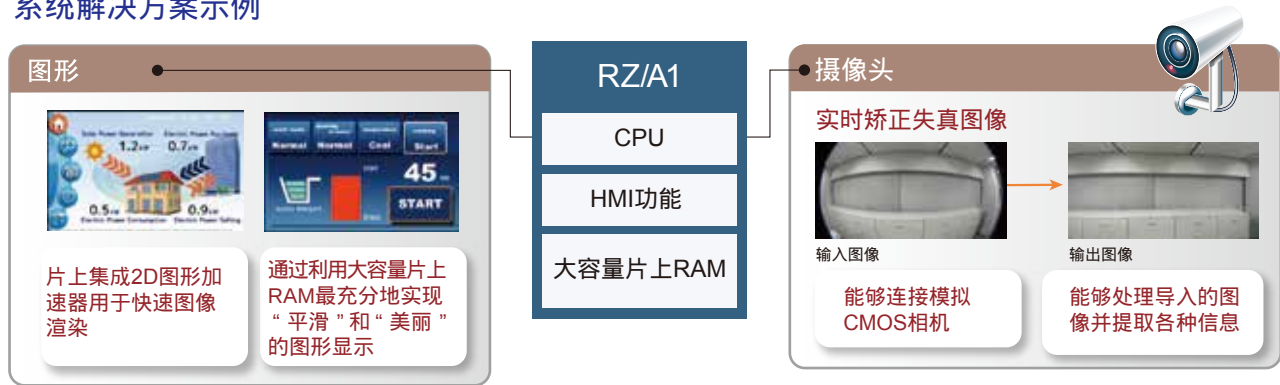
RZ/A1 MPU可以容纳整个软件栈(包含库、操作系统和应用程序代码)以及一个图形帧缓冲器

单芯片实现图形显示和摄像机输入的能力

RZ/A1 MPU具有独特的图形显示和摄像机功能组合，加上其并行访问128位内存总线，使系统具有丰富的图形和视频功能。



系统解决方案示例



目标应用

RZ/A1系列产品结合了ARM® Cortex®-A9的MPU性能和MCU型平台设计的简单性，使之成为各种应用(如下所示)的理想选择。



瑞萨电子RZ/A1封装选择

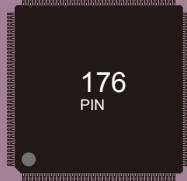
176-LFBGA



176
PIN
(8×8 mm)

Pitch	0.50 mm
Thickness (max.)	1.40 mm
Mounted product	RZ/A1L, A1LU

176-LFQFP



176
PIN
(24×24 mm)

Pitch	0.50 mm
Thickness (max.)	1.70 mm
Mounted product	RZ/A1L, A1LU, A1LC

208-LFQFP



208
PIN
(28×28 mm)

Pitch	0.50 mm
Thickness (max.)	1.70 mm
Mounted product	RZ/A1L, A1LU

256-LFBGA



256
PIN
(11×11 mm)

Pitch	0.50 mm
Thickness (max.)	1.40 mm
Mounted product	RZ/A1H, A1M

324-FBGA



324
PIN
(19×19 mm)

Pitch	0.80 mm
Thickness (max.)	2.10 mm
Mounted product	RZ/A1H, A1M

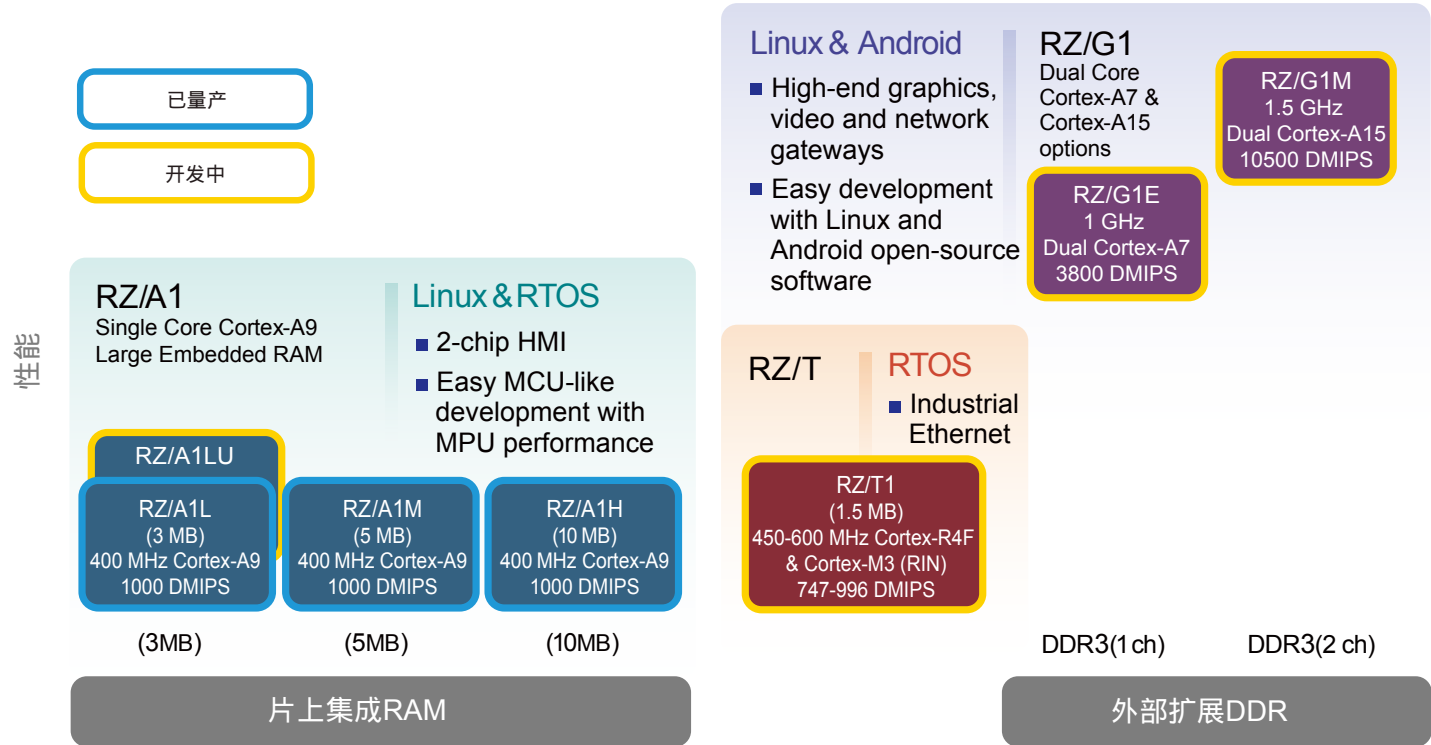
256-LFQFP



256
PIN
(28×28 mm)

Pitch	0.40 mm
Thickness (max.)	1.70 mm
Mounted product	RZ/A1H, A1M

RZ家族基于ARM核MPUs

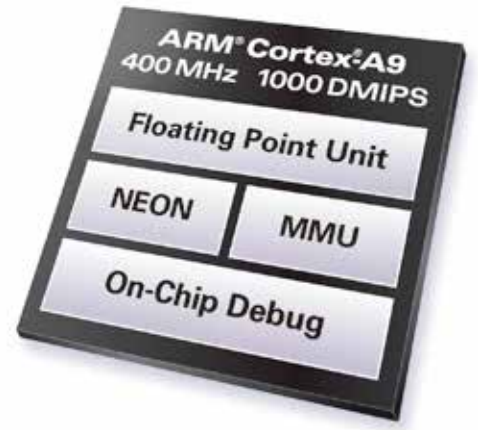


RZ/A1H和RZ/A1M MPUs

高端HMI设计的理想选择 (WXGA 分辨率)

- 使用一个RZ/A1H MPU芯片可以缓冲最多两个独立的 WXGA(1280x800) 图像
- 使用一个RZ/A1M MPU芯片缓冲多达两个WSVGA(1024x600)图像或单个WXGA(1280x800)图像
- 使用片上OpenVG图形引擎可以获得非凡的2D图形加速

- 支持连接1~2个独立的LCD 显示
- 丰富的外设，包括：NAND 闪存接口，JPEG编解码器单元，IMR引擎，声音发生器，视频的NTSC / PAL解码器和PWM定时器



高效的32位CPU内核(ARM® Cortex®-A9)

- 400MHz 主频，1000 DMIPS 性能
- ARM NEON 多媒体引擎
- 支持从串行/并行flash中启动

10 MB(RZ/A1H)和5 MB(RZ/ A1M) 内部RAM

- 作为大容量数据缓存或者直接在内部RAM中运行系统
- 采用专用于SRAM的并行总线结构来加速处理

直接从QSPI Flash运行程序 (Execute-In-Place)

- 充分利用性价比高的外部串行闪存
- 简化了程序执行

单精度和双精度浮点单元，符合IEEE754标准

- 加速三角函数相关运算，如缩放和旋转

具有2D图形引擎(OpenVG 1.1)

- 完全支持Khronos™ OpenVG 1.1 API
- 免除了图形渲染、动画以及视频加速操作带来的CPU的负荷

LCD控制器，具有24位RGB和16位LVDS接口

- 可处理4层叠加
- 提供2通道视频输入，2通道显示输出与1通道 LVDS
- 支持 alpha 混合
- 支持色度键控

总线接口控制器 (Bus Interface Controller)

- 直接连接到SRAM，SDRAM和Flash (NOR，NAND，eMMC)以及128 KB L2缓存

多种网络连接接口

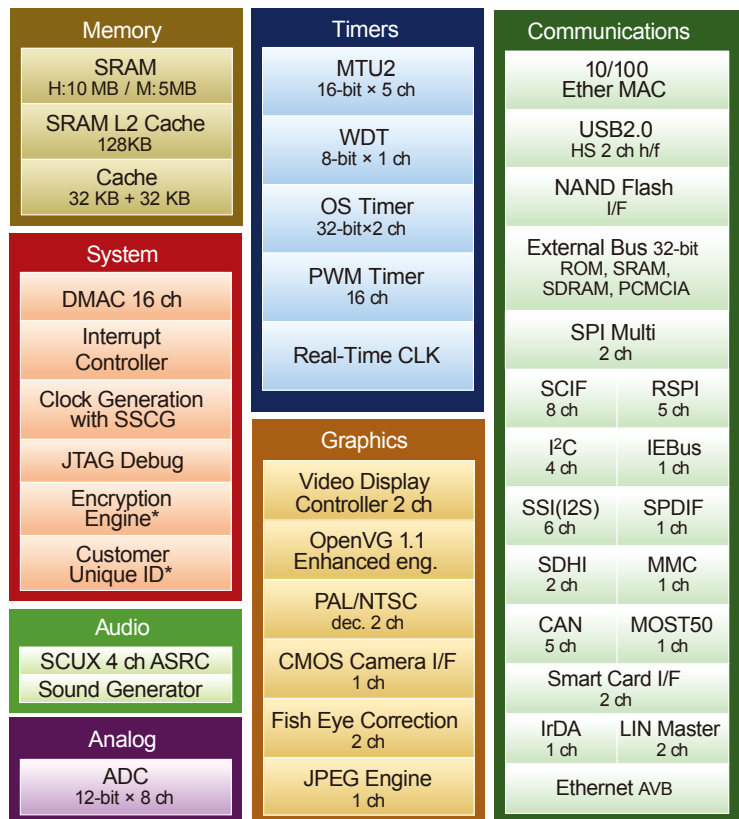
- 集成10/100 EtherMAC 控制器 (1 通道)
- 集成USB收发器的USB 2.0主机和功能控制器(2通道)

- 提供多至5通道的CAN接口

三类封装选择

324-pin BGA (0.8 mm)
256-pin QFP (0.4 mm)
256-pin BGA (0.5 mm)

RZ/A1H与RZ/A1M框图



* =可选

RZ/A1L MPUs

低成本设计的理想解决方案(高达WSVGA分辨率)

- 内部存储器中可缓冲高达WSVGA(1024x600)图像
- 使用ARM NEON™SIMD(单指令，多数据)引擎加速多媒体处理
- 连接单个LCD显示器

高效的32位CPU内核(ARM® Cortex®-A9)

- 400MHz 主频，1000 DMIPS 性能
- ARM NEON 多媒体引擎
- 支持从串行/并行flash中启动

3MB内部RAM

- 作为大容量数据缓存或者直接在内部RAM中运行系统
- 采用专用于SRAM的并行总线结构来加速处理

直接从QSPI Flash运行程序(Execute-In-Place)

- 充分利用性价比高的外部串行闪存
- 简化程序执行

单精度和双精度浮点单元，符合IEEE754标准

- 加速三角函数相关运算，如缩放和旋转

新品 RZ/A1LU MPUs

添加更多特性以扩展系统功能

- 通过可选安全单元实现安全启动与安全通信
- 使用JPEG编解码器简化设计
- 支持Ethernet AVB，传输以太网上的音频和视频
- 使用双数据速率QSI，支持以更高的带宽访问SPI闪存

新品 RZ/A1LC MPUs

- 2MB片上RAM，更低成本的方案

LCD控制器，具有24位RGB接口

- 可处理3层叠加
- 提供1通道视频输入，1通显示输出
- 支持 alpha 混合
- 支持色度键控

总线接口控制器

- 直接连接到SRAM，SDRAM和Flash(NOR，NAND，eMMC)以及128 KB L2缓存

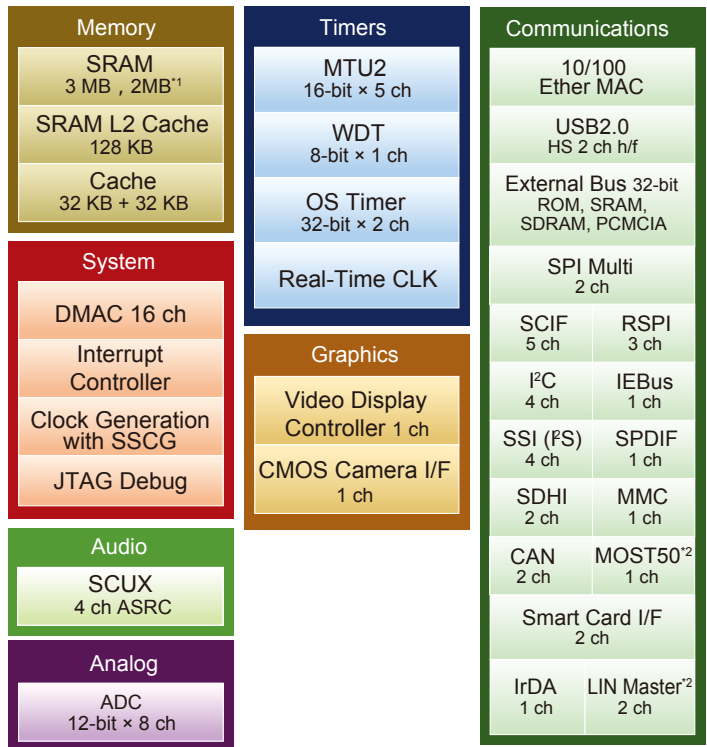
多种网络连接接口

- 集成 10/100 EtherMAC控制器(1通道)
- 集成USB收发器的USB 2.0主机和功能控制器(2通道)
- 提供2通道的CAN接口

三类封装选择

208-pin QFP (0.5 mm)
176-pin QFP (0.5 mm)
176-pin BGA (0.5 mm)

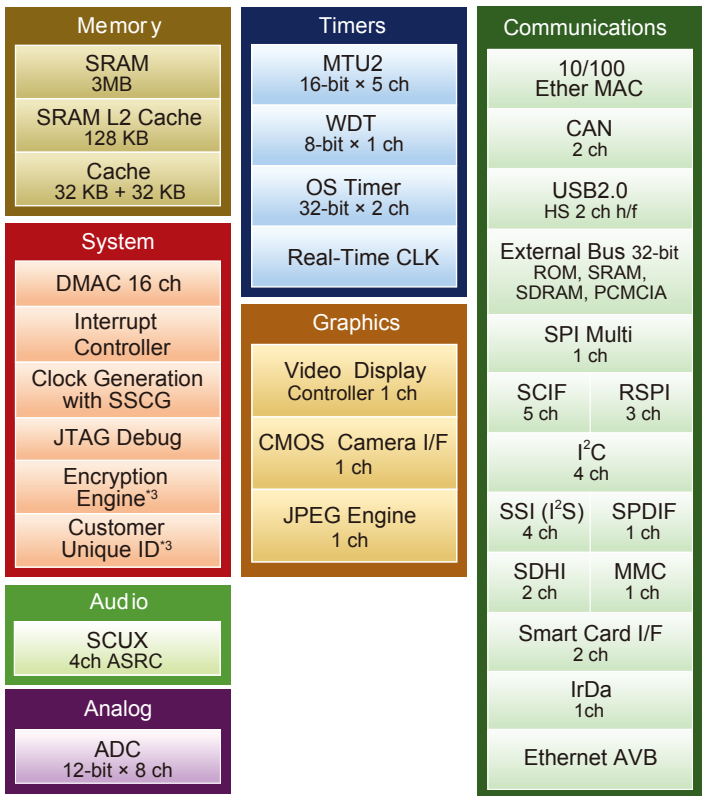
RZ/A1L, RZ/A1LC框图



*1=仅RZ/A1LC

*2=仅RZ/A1L

RZ/A1LU框图



*3=Option

瑞萨电子RZ/A1器件选型表

	RZ/A1H					RZ/A1M					RZ/A1L ^{*1}					RZ/A1LU				
Pin count	256-pin			324-pin		256-pin			324-pin		176-pin			208-pin		176-pin			208-pin	
Product name	R7S7210 00VCBG	R7S7210 00VCFP	R7S7210 00VLFP	R7S7210 01VCBG	R7S7210 01VLBG	R7S7210 10VCBG	R7S7210 10VCFP	R7S7210 10VLFP	R7S7210 11VCBG	R7S7210 11VLBG	R7S7210 20VCBG	R7S7210 20VCFP	R7S7210 20VLFP	R7S7210 21VCFP	R7S7210 21VLFP	R7S7210 30VCBG	R7S7210 30VCFP	R7S7210 30VLFP	R7S7210 31VCFP	R7S7210 31VLFP
CPU core	ARM® Cortex®-A9																			
RAM	10 MB					5 MB					3 MB					3 MB				
Cache memory	Primary cache: 64 KB (instruction 32 KB/data32 KB), TLB128 Secondary cache: 128 KB (Corelink™ Level 2 Cache Controller L2C-310)																			
Max. operating frequency (MHz)	400																			
Subclock (external: 32.768kHz)	Yes																			
PLL	Yes																			
Real-time clock	Yes																			
Power-on reset	Yes																			
Floating-point unit	Yes																			
DMA	DMAC × 16 ch																			
External memory interfaces	Serial flash (eXecute-In-Place (XIP) support), SRAM, SDRAM, burst ROM, NAND flash					Serial flash (eXecute-In-Place (XIP) support), SRAM, SDRAM, burst ROM, NAND flash					Serial flash (eXecute-In-Place (XIP) support), SRAM, SDRAM, burst ROM					Serial flash (eXecute-In-Place (XIP) support), SRAM, SDRAM, burst ROM				
External interrupt pins	148			180		148			180		109			131		109			131	
I/O ports	139			171		139			171		100			122		100			122	
16-/32-bit timer(ch)											5/2									
Watchdog timer(ch)	1					1					–					1				
Other timers	Motor Controll PWM Timer × 8					Motor Controll PWM Timer × 8					–					–				
PWM output	16					16					–					–				
3-phase PWM output function	Yes					Yes					–					–				
12-bit A/D converter (channels)	8																			
CAN (channels)	5					5					2					2				
Ethernet	Yes																			
Ethernet AVB	Yes					Yes					–					Yes				
USB host function	Yes																			
USB peripheral function	Yes																			
USB (channels)	2																			
USB High Speed support	Yes																			
USB endpoints	16																			
USB isochronous transfer support	Yes																			
USB additional information	Low-speed Support (host only)																			
SD host interface (channels)	2																			
MMC host interface (channels)	1																			
Clock-synchronous serial interface(ch)	17					17					12					12				
SPI (channels)	5					5					5					3				
UART (channels)	8					8					8					5				
I ² C (channels)	4																			
LIN (channels)	2					2					2					–				
IEBus (channels)	1					1					1					–				
Serial additional information	SCIF(CSI: 8 ch/UART: 8 ch), SCI (CSI: 2 ch), RSPI(SPI: 5 ch), SPI multi (SPI: 2 ch), SSI (CSI: 6 ch), SPDIF(CSI: 1 ch)					SCIF(CSI: 8 ch/UART: 8 ch), SCI (CSI: 2 ch), RSPI(SPI: 5 ch), SPI multi(SPI: 2 ch), SSI(CSI: 6 ch), SPDIF(CSI: 1 ch)					SCIF(CSI: 5 ch/UART: 5 ch), SCI(CSI: 2 ch), RSPI(SPI: 2 ch), SPI multi(SPI: 1 ch), SSI(CSI: 4 ch), SPDIF(CSI: 1 ch)					SCIF(CSI: 5 ch/UART: 5 ch), SCI(CSI: 2 ch), RSPI(SPI: 2 ch), SPI multi(SPI: 1 ch), SSI(CSI: 4 ch), SPDIF(CSI: 1 ch)				
Other display functions	VDC5: WXGA (1280 × 768), JPEG Engine, OpenVG Accelerator (2D)					VDC5: WXG(1280 × 768), JPEG Engine, OpenVG Accelerator (2D)					VDC5: XGA (1024 × 768)					VDC5: XGA (1024 × 768), JPEG Engine				
Power supply voltage (V)	3.3V/1.18V																			
Power supplies	VCC = PLLVCC = LVDSPLLCC = USBAVCC = USBUVCC = USBDVCC = 1.10 to 1.26 V, PVCC = AVCC = USBAPVCC = VDAVCC = LVDSAPVCC = USBDPVCC = 3.0 to 3.6 V, VSS = AVSS = 0 V																			
Operating temp(°C)	TA = -40 to +85°C																			
Package (size [mm])	256-LFBGA (11 × 11 mm)	256-LFQFP (28 × 28 mm)	324-FBGA (19 × 19 mm)	256-LFBGA (11 × 11 mm)	256-LFQFP (28 × 28 mm)	324-FBGA (19 × 19 mm)	176-LFBGA (8×8 mm)	176-LFQFP (24×24 mm)	208-LFQFP (28×28 mm)	176-LFBGA (8×8 mm)	176-LFQFP (24×24 mm)	208-LFQFP (28×28 mm)	176-LFBGA (8×8 mm)	176-LFQFP (24×24 mm)	208-LFQFP (28×28 mm)					

^{*1} =RZ/A1LC，型号：R7S721034VCBG，片上2M RAM,不带LIN，IEBus和MLB，其它功能模块与RZ/A1L一致

瑞萨电子RZ/A1系列入门套件

使用瑞萨电子的入门套件(RSK)，可显著缩短产品的开发周期。RZ/A1套件包括您需要的一切，帮助您快速启动系统开发、简化设计和调试过程。

套件包含：

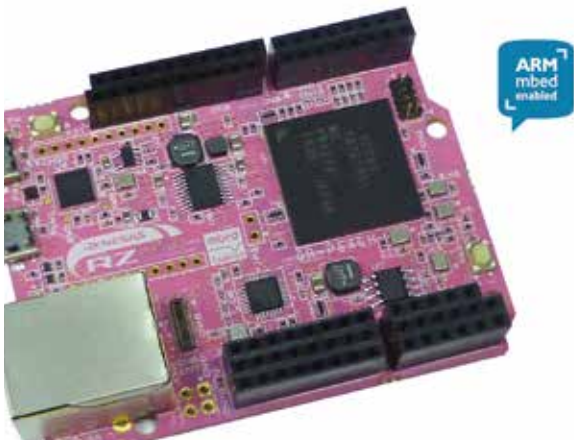
- 800 x 480用于HMI方案开发的触摸屏 (可选)
- Segger JTAG-lite调试器
- 嵌入式IDE和编译器(带评估许可协议)
- 例程和外设驱动

Part Number	TFT Display	Debugger	IDE
YR0K77210S001BE	No	Yes	ARM DS-5
YR0K77210S003BE	Yes	Yes	ARM DS-5
YR0K77210S009BE	No	Yes	e2studio
YR0K77210S011BE	Yes	Yes	e2studio



瑞萨电子(GR-PEACH)ARM® mbed™ 开发平台

来自瑞萨电子的GR-PEACH是一个兼容mbed的平台，结合了mbed生态系统和Arduino form-factor的优势。它是第一个也是当前唯一一个基于 Cortex®-A MPU的ARM mbed平台。



特点

- 8MB Flash
- 2xUSB Host/Device 接口, 1x Ethernet
- 3xSPI, 3xI²C, 8xUART, 7x12-bits ADC, 2xCAN
- 2xCamera输入

Arduino form-factor

- 兼容广泛的商业护屏(外壳)
- 内置USB“拖放”Flash编程器

mbed.org 开发者网站

- 在线编译
- 高级C/C++ SDK
- 活跃的开发社区

<https://developer.mbed.org/platforms/Renesas-GR-Peach/>

Part Number	Description
YGRPEACHFULL	GR-PEACH
YGRPEACHAUDIOCAMERASHIELD	GR-PEACH Audio Camera Shield
YGRPEACHLCDSHIELD	GR-PEACH LCD Shield

RZ/A1丰富的生态系统助力客户系统开发

Integrated Software Development Environments



IAR Embedded Workbench®

- Integrated development environment and optimized compiler for RZ/A1 MPUs
- Project management tools and editor
- Configuration files for all RZ devices
- Emulator debugger support
- Run-time libraries



ARM

- The ARM DS-5™ Development Studio, Renesas RZ Edition, is a complete software development environment for systems that use RZ/A1 MPUs.
- This IDE provides the DS-5's code editor, compiler, debugger and performance analyzer. These tools seamlessly generate, debug and optimize code for the powerful ARM Cortex-A9 CPU built into RZ/A1 series chips.



Renesas e² studio

- Based on the popular Eclipse open-source environment
- Complete IDE supports IAR and free GNU compilers
- Powerful project management
- Download free at: am.renesas.com/e2studio



Green Hills Software

- Green Hills Software supports Renesas RZ/A1 MPUs with its MULTI® IDE, C/C++ optimizing compilers, Probe debugger, and many other development tools. These products let system engineers generate fast, compact code, quickly find and fix bugs, and make sense of complex systems.

Real-Time Operating Systems



ThreadX®
www.expresslogic.com



µC/OS-III®
www.micrium.com



FreeRTOS
www.freertos.com



Linux BSP
oss.renesas.com



RTX
www.keil.com



embOS®
www.segger.com



SMX® RTOS
www.smxrtos.com



Unison RTOS
www.rowebots.com

Graphics Packages



GUIX™
www.expresslogic.com



Guiliani
www.tes-dst.com



Crank Storyboard™ Suite
www.cranksoftware.com



emWin™
www.segger.com



MicroEJ®
www.microej.com



DeepScreen®
www.altia.com



www.qt.io

H.264 Solution



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