

## Introduction

This document presents test results from an evaluation of an RZ/G series device, conducted by our company in a specific environment.

Due to environmental variations, Renesas does NOT guarantee that all users will fully reproduce these results. Renesas bears no responsibility for any discrepancies or reliance on this information. Users are advised to conduct their own assessments to verify the applicability of these results to their individual circumstances.

## Target Device

RZ/G2H

RZ/G2M

RZ/G2N

RZ/G2E

RZ/G2L

RZ/G2LC

RZ/G2UL

RZ/G3S

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# 1. Performance testing results

For hardware and software information about the board, as well as test details, please refer to the section of “Environment and Testing information”.

## 1.1 eMMC

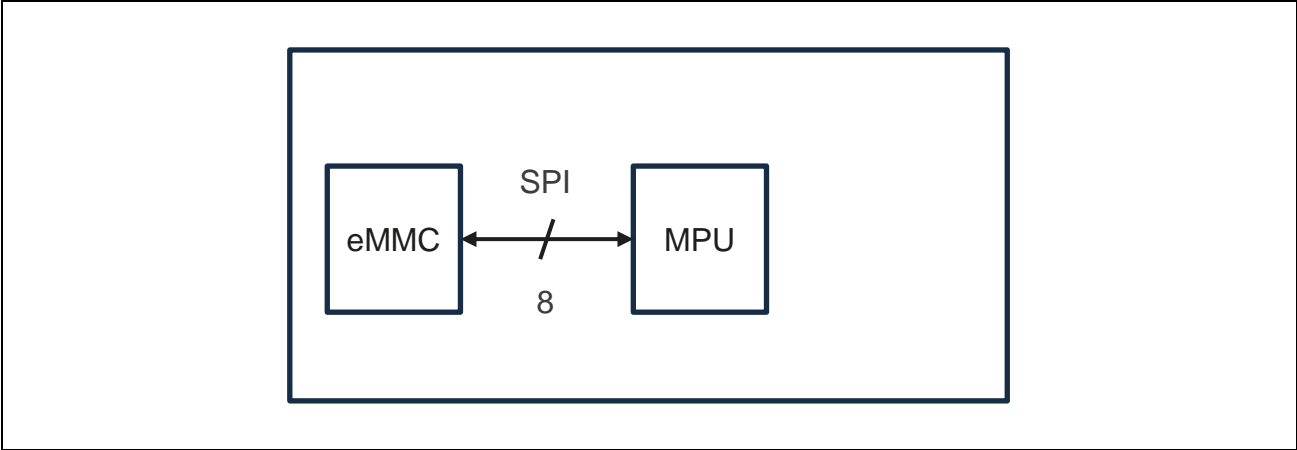


Figure 1.1 eMMC Interface Block Diagram

Write/read speed of eMMC device:

- Specification:
  - RZ/G2H, RZ/G2M, RZ/G2N, RZ/G2E: HS400
  - RZ/G2L, RZ/G2LC, RZ/G2UL, RZ/G3S: HS200
- Benchmark: fio; Condition: Block size: 8 MB
- For eMMC the specification, please refer to the “Board and testing environment” section.

Table 1.1 Read/write speed test results for eMMC

Device	Write speed (MB/s)	Read speed (MB/s)
RZ/G2H	70.0	199.0
RZ/G2M	83.0	200.0
RZ/G2N	86.0	160.0
RZ/G2E	45.0	196.0
RZ/G2L	75.0	90.0
RZ/G2LC	76.0	89.0
RZ/G2UL	75.0	79.0
RZ/G3S	86.0	94.0

NOTE

eMMC performance is limited by the specific device installed on each EVK, despite MPU compliance with HS200 or HS400 standards. For exact specifications, please refer to the respective eMMC datasheets.

1.2 DDR

RZ/G2H, RZ/G2M:

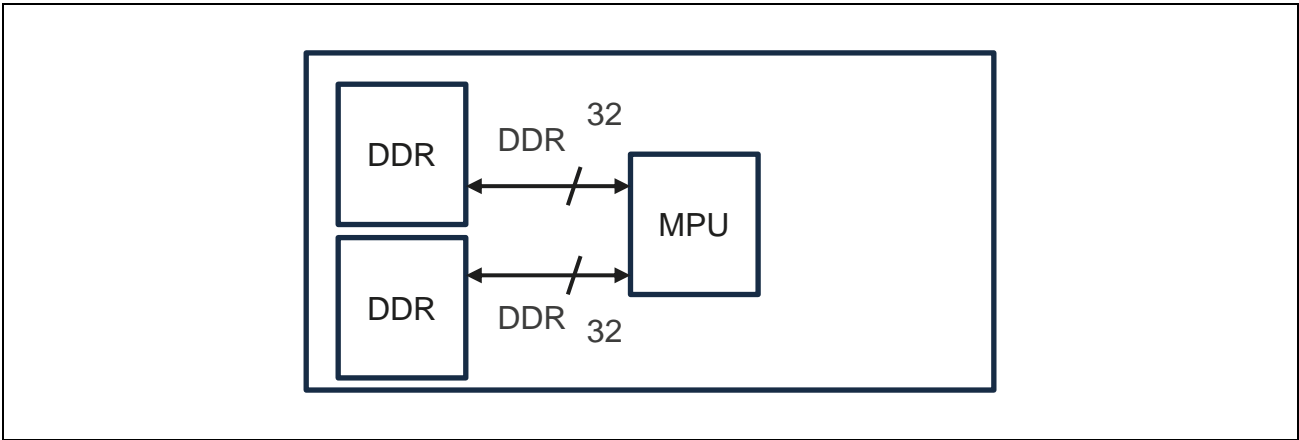


Figure 1.2 Dual-Channel 32-bit DDR Memory Interface Block Diagram

RZ/G2N, RZ/G2E:

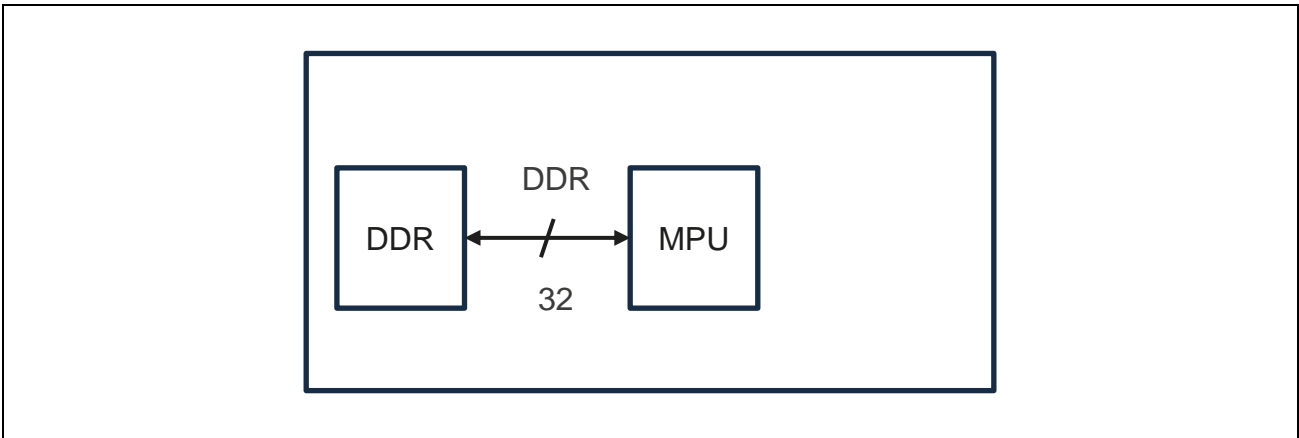


Figure 1.3 Single-Channel 32-bit DDR Memory Interface Block Diagram

RZ/G2L, RZ/G2UL, RZ/G2LC, RZ/G3S:

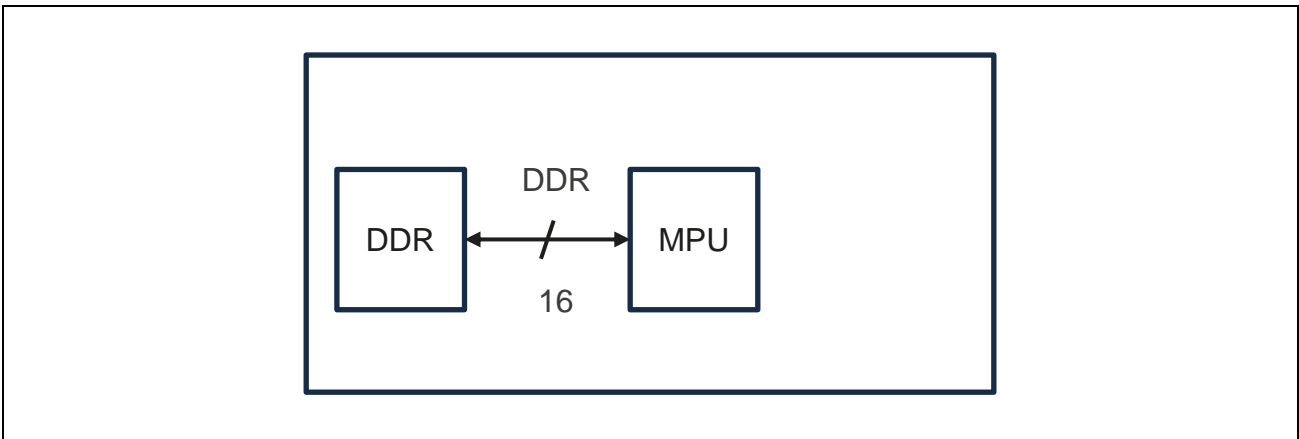


Figure 1.4 Single-Channel 16-bit DDR Memory Interface Block Diagram

- Result of “Sysbench” application to measure DDR performance:

Table 1.2 DDR performance testing result for single thread

Device	DDR Memory Structure & Theoretical memory transfer speed (MB/s)	Memory transfer speed (MB/s) (Benchmark result)
RZ/G2H	32bit LPDDR4-3200 × 2ch = 25600	3938.3
RZ/G2M	32bit LPDDR4-3200 × 2ch = 25600	3824.3
RZ/G2N	32bit LPDDR4-3200 × 1ch = 12800	3838.6
RZ/G2E	32bit DDR3L-1866 × 1ch = 7464	2229.8
RZ/G2L	16bit DDR4-1600 × 1ch = 3200	2208.3
RZ/G2LC	16bit DDR4-1600 × 1ch = 3200	2217.3
RZ/G2UL	16bit DDR4-1600 × 1ch = 3200	1825.4
RZ/G3S	16bit LPDDR4-1600 × 1ch = 3200	2003.1

## NOTE

The specifications shown in the table represent external interface capabilities. The actual performance of some MPUs may be limited by internal bus constraints.

1.3 Ethernet

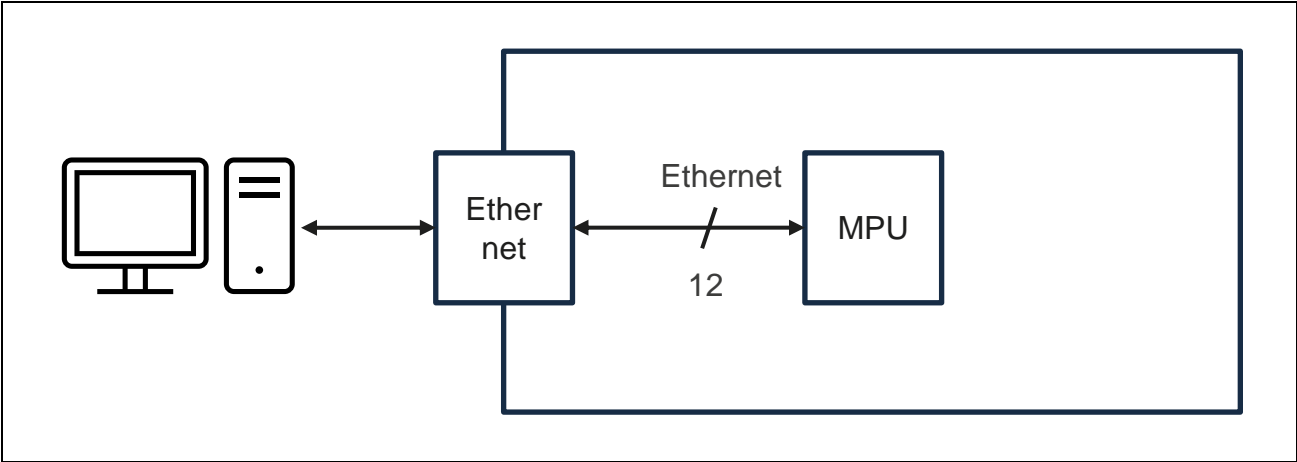


Figure 1.5 Ethernet Network Connection Block Diagram

iperf3 was used to test the upload and download speeds of Ethernet. Also, the CPU load rates during test are shown for reference.

- Upload speed of Ethernet TCP:
- Specifications: Gigabit Ethernet

Table 1.3 TCP upload speed test results and CPU usage for Ethernet

Testing protocol TCP									
Device	Upload (Mbps/s)	CA57 (%)				CA53 (%)			
		CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
RZ/G2H	937	89.1	37.0	11.2	61.0	64.0	64.0	82.0	77.6
RZ/G2M	837	91.5	28.7	—		51.5	61.0	48.2	64.1
RZ/G2N	917	93.6	74.6	—					
RZ/G2E	660	—				83.0	69.8	—	
Device	Upload (Mbps/s)	CA55 (%)							
		CPU0	CPU1	—					
RZ/G2LC	543	88.6	35.5	—					
RZ/G2L	699	88.4	41.5	—					
RZ/G2UL	460	91.0	—						
RZ/G3S	440	86.8	—						

- Download speed of Ethernet TCP:

Table 1.4 TCP download speed test results and CPU usage for Ethernet

Testing protocol TCP									
Device	Download (Mbits/s)	CA57 (%)				CA53 (%)			
		CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
RZ/G2H	933	89.1	37.0	11.2	61.0	64.0	64.0	82.0	77.6
RZ/G2M	933	91.5	28.7	—		51.5	61.0	48.2	64.1
RZ/G2N	934	93.6	74.6	—					
RZ/G2E	929	—				83.0	69.8	—	
Device	Download (Mbits/s)	CA55 (%)							
		CPU0	CPU1	—					
RZ/G2LC	515	88.6	35.5	—					
RZ/G2L	436	88.4	41.5	—					
RZ/G2UL	307	91.0	—						
RZ/G3S	327	86.8	—						

- Upload speed of Ethernet UDP:

Table 1.5 UDP upload speed test results and CPU usage for Ethernet

Testing protocol UDP									
Device	Upload (Mbits/s)	CA57 (%)				CA53 (%)			
		CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
RZ/G2H	695	90.8	20.7	40.7	63.4	64.1	64.1	73.0	73.0
RZ/G2M	674	92.1	25.1	—		35.0	56.5	50.6	60.0
RZ/G2N	785	90.3	67.8	—					
RZ/G2E	670	—				88.2	46.5	—	
Device	Upload (Mbits/s)	CA55 (%)							
		CPU0	CPU1	—					
RZ/G2LC	530	86.3	44.9	—					
RZ/G2L	510	88.4	30.1	—					
RZ/G2UL	418	88.3	—						
RZ/G3S	542	91.3	—						

- Download speed of Ethernet UDP:

Table 1.6 UDP download speed test results and CPU usage for Ethernet

Testing protocol UDP									
Device	Download (Mbits/s)	CA57 (%)				CA53 (%)			
		CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
RZ/G2H	949	90.8	20.7	40.7	63.4	64.1	64.1	73.0	73.0
RZ/G2M	949	92.1	25.1	—		35.0	56.5	50.6	60.0
RZ/G2N	949	90.3	67.8	—					
RZ/G2E	949	—				88.2	46.5	—	
Device	Download (Mbits/s)	CA55 (%)							
		CPU0	CPU1	—					
RZ/G2LC	949	86.3	44.9	—					
RZ/G2L	947	88.4	30.1	—					
RZ/G2UL	949	88.3	—						
RZ/G3S	949	91.3	—						



## 1.4 CPU

- Specification:
  - RZ/G2H: 4 × 1.5 GHz CA57, 4 × 1.2 GHz CA53
  - RZ/G2M: 2 × 1.5 GHz CA57, 4 × 1.2 GHz CA53
  - RZ/G2N: 2 × 1.5 GHz CA57
  - RZ/G2E: 2 × 1.2 GHz CA53
  - RZ/G2L, RZ/G2LC: 2 × 1.2 GHz CA55
  - RZ/G2UL: 1 × 1.0 GHz CA55
  - RZ/G3S: 1 × 1.1 GHz CA55
- Result of “Coremark” application to measure CPU performance:

Table 1.7 Coremark performance and loads per core

Device	CPU Coremark performance (Iterations/s)								
	Total	CA57				CA53			
		CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
RZ/G2H	44,834	7,245	7,239	7,253	7,250	3,961	3,961	3,962	3,962
RZ/G2M	30,315	7,227	7,245	—		3,961	3,961	3,961	3,960
RZ/G2N	14,435	7,204	7,231	—					
RZ/G2E	7,915	—				3,955	3,959	—	
Device	Total	CA55							
		CPU0	CPU1	—					
RZ/G2L	9,088	4,543	4,545	—					
RZ/G2LC	9,088	4,543	4,545	—					
RZ/G2UL	3,753	3,739	—						
RZ/G3S	4,140	4,144	—						

- Result of “crypt” application to measure CPU performance:

Table 1.8 Crypt performance and loads per core

Device	CPU crypt performance (Bogo/s)								
	Total	CA57				CA53			
		CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
RZ/G2H	12,061	1,961	1,966	1,957	1,961	1,055	1,058	1,059	1,056
RZ/G2M	8,137	1,947	1,962	—		1,060	1,058	1,060	1,058
RZ/G2N	3,848	1,915	1,918	—					
RZ/G2E	2,105	—				1,055	1,053	—	
Device	Total	CA55							
		CPU0	CPU1	—					
RZ/G2L	2,194	1,098	1,109	—					
RZ/G2LC	2,190	1,096	1,103	—					
RZ/G2UL	909	916	—						
RZ/G3S	1,007	1,010	—						

- Result of “Dhrystone” application to measure CPU performance:

Table 1.9 Dhrystone performance and loads per core

Device	CPU Dhrystone performance (k Dhrystones/s)								
	Total	CA57				CA53			
		CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
RZ/G2H	72,286	12,479	12,695	12,682	12,696	5,446	5,421	5,421	5,446
RZ/G2M	47,035	12,671	12,682	—		5,421	5,421	5,420	5,421
RZ/G2N	25,160	12,480	12,680	—					
RZ/G2E	11,607	—				5,822	5,785	—	
Device	Total	CA55							
		CPU0	CPU1	—					
RZ/G2L	12,198	6,033	6,165	—					
RZ/G2LC	12,056	6,034	6,022	—					
RZ/G2UL	4,989	4,989	—						
RZ/G3S	5,648	5,648	—						

Table 1.10 Dhrystone-VAX MIPS rating performance and loads per core

Device	CPU Dhrystone performance VAX MIPS rating								
	Total	CA57				CA53			
		CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
RZ/G2H	41,142	7,102	7,226	7,218	7,226	3,100	3,085	3,085	3,099
RZ/G2M	26,770	7,212	7,218	—		3,085	3,085	3,085	3,085
RZ/G2N	14,320	7,103	7,217	—					
RZ/G2E	6,607	—				3,314	3,293	—	
Device	Total	CA55							
		CPU0	CPU1	—					
RZ/G2L	6,943	3,434	3,509	—					
RZ/G2LC	6,862	3,434	3,427	—					
RZ/G2UL	2,839	2,839	—						
RZ/G3S	3,214	3,214	—						

- Result of “Sysbench” application to measure CPU performance:

Table 1.11 Sysbench testing result

Device	Events/s
RZ/G2H	304.1
RZ/G2M	205.3
RZ/G2N	98.3
RZ/G2E	53.3
RZ/G2LC	52.9
RZ/G2L	53.0
RZ/G2UL	22.0
RZ/G3S	24.3

1.5 Camera

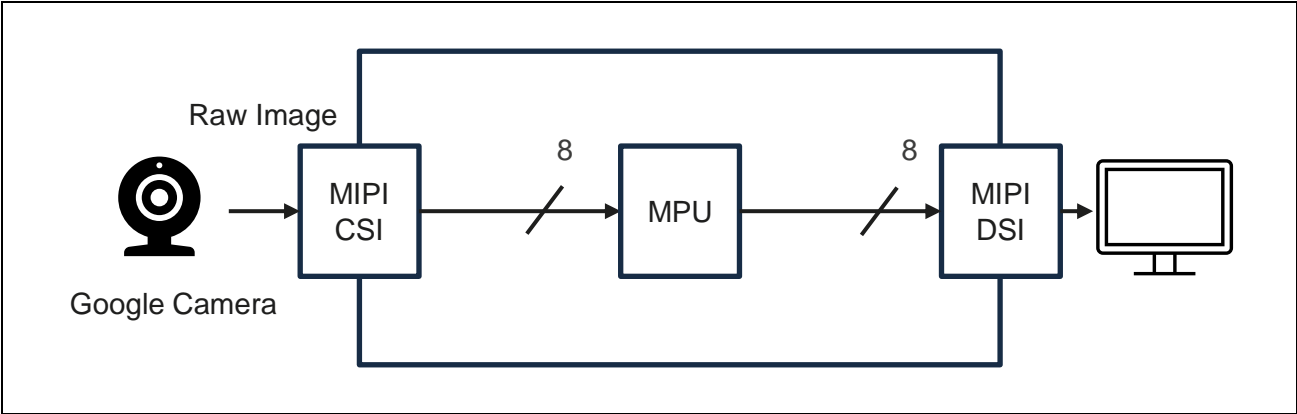


Figure 1.6 MIPI Camera Image Processing Pipeline Block Diagram

- Result of Camera performance:
- Tested with MIPI Adapter boards at 3 resolutions: 1280 × 960 (30 FPS), 1920 × 1080 (30 FPS), 2592 × 1944 (15 FPS)

Table 1.12 Camera performance test rest result

Device	Resolution (pixel)	Frame rate (FPS)
RZ/G2H	1280 × 960	30
RZ/G2M		30
RZ/G2N		30
RZ/G2E		30
RZ/G2L		30
RZ/G2H	1920 × 1080	30
RZ/G2M		30
RZ/G2N		30
RZ/G2E		30
RZ/G2L		30
RZ/G2H	2592 × 1944	15
RZ/G2M		15
RZ/G2N		15
RZ/G2E		15
RZ/G2L		15

1.6 Video decoding performances

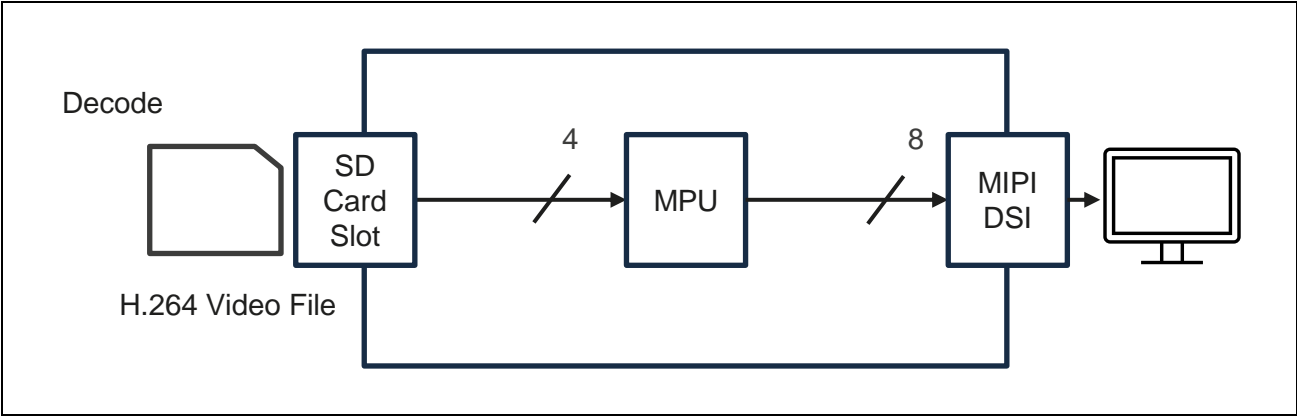


Figure 1.7 H.264 Video Decoding and Display Flow Block Diagram

- Specification: H.264: 1920 × 1080p × 120 FPS

Table 1.13 Result of Video H.264 decoding performance of RZ/G2H (Resolution < HD)

Condition				CPU Usage							
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	30	1	30	2.6	3.0	2.7	2.9	2.7	3.3	4.1	3.0
		2	30	3.5	3.1	4.3	5.3	5.8	3.4	4.0	3.0
		3	30	5.0	4.0	4.4	4.9	7.0	6.5	5.8	5.6
		4	30	6.9	6.1	5.7	5.3	7.8	7.2	6.7	6.3
		6	30	8.4	8.4	7.7	8.0	10.5	10.0	10.2	9.7
		9	30	12.5	10.6	10.0	11.0	13.9	13.8	14.1	12.9
VGA 640 × 480	30	1	30	3.6	2.8	2.2	2.1	2.8	3.5	4.2	2.8
		2	30	4.2	3.7	3.6	3.7	4.9	4.3	5.5	4.7
		3	30	5.5	5.4	4.8	4.5	5.6	7.2	6.8	5.8
		4	30	7.9	5.1	5.7	5.2	7.9	7.0	8.7	7.7
		6	30	9.7	7.5	7.9	8.8	11.8	11.3	10.3	10.4
		9	30	13.2	11.3	11.3	11.2	13.9	14.2	13.4	13.2

Table 1.14 Result of Video H.264 decoding performance of RZ/G2H (Resolution &gt;= HD)

Condition				CPU Usage							
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HD 1280 × 720	30	1	30	2.8	2.6	3.5	2.6	3.0	3.1	3.5	2.8
		2	30	4.2	2.8	3.8	4.0	4.6	6.1	5.4	5.1
		3	30	5.6	6.1	4.3	4.8	7.1	6.3	6.4	6.5
		4	30	6.8	6.7	5.3	5.5	9.2	7.8	7.2	8.5
		6	30	10.0	8.7	8.1	8.3	10.6	9.9	10.6	10.3
		9	30	14.7	12.4	12.5	12.3	15.5	15.0	14.3	14.1
XGA 1280 × 960	30	1	30	3.3	2.2	2.3	3.5	3.1	3.5	3.8	4.5
		2	30	5.2	3.7	3.4	4.3	4.2	6.0	5.8	4.9
		3	30	6.4	5.3	6.8	4.8	6.6	6.3	6.5	5.8
		4	30	7.3	6.3	6.9	7.1	8.8	8.7	7.1	7.7
		6	30	11.1	8.2	8.3	9.5	11.0	10.7	10.7	9.9
		9	30	14.7	12.6	13.0	12.4	15.3	15.9	15.0	14.7
Full HD 1920 × 1080	30	1	30	2.9	1.7	3.3	2.5	4.4	3.7	5.9	5.3
		2	30	5.3	5.6	3.8	5.2	5.8	5.6	6.4	5.2
		3	30	6.6	6.2	5.7	5.6	7.2	7.8	7.4	7.8
		4	30	8.1	6.3	5.9	5.7	9.2	9.7	8.7	9.5

- Specification: H.265: 1920 × 1080p × 120 FPS

Table 1.15 Result of Video H.265 decoding performance of RZ/G2H (Resolution &lt; HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	15	1	15	2.3	2.0	5.2	1.8	1.7	2.0	3.3	2.2
		2	15	3.2	2.7	3.5	5.0	3.2	2.7	3.2	3.0
		3	15	4.4	3.6	5.0	5.0	4.3	4.4	3.3	4.0
		4	15	6.3	4.8	6.3	4.9	5.5	5.3	4.9	4.9
		6	15	7.7	4.5	5.3	5.8	5.8	5.9	5.2	5.7
		9	15	8.0	7.0	7.7	6.4	8.8	8.7	8.7	7.1
	30	1	30	4.6	4.2	2.7	3.6	3.9	3.7	3.2	2.7
		2	30	3.8	5.5	5.3	5.4	3.9	4.4	3.8	4.2
		3	30	6.8	5.8	7.8	5.0	4.8	5.2	7.1	4.8
		4	30	6.7	6.0	6.4	6.2	7.0	6.6	6.4	6.6
		6	30	8.3	8.9	8.3	7.2	10.3	9.5	9.6	9.0
		9	30	15.4	11.9	12.0	11.2	14.2	13.1	12.5	12.1
VGA 640 × 480	15	1	15	2.3	2.0	5.2	1.8	1.7	2.0	3.3	2.2
		2	15	3.2	2.7	3.5	5.0	3.2	2.7	3.2	3.0
		3	15	4.4	3.6	5.0	5.0	4.3	4.4	3.3	4.0
		4	15	6.3	4.8	6.3	4.9	5.5	5.3	4.9	4.9
		6	15	7.7	4.5	5.3	5.8	5.8	5.9	5.2	5.7
		9	15	8.0	7.0	7.7	6.4	8.8	8.7	8.7	7.1
	30	1	30	5.0	2.8	2.7	4.5	2.7	2.2	1.8	2.7
		2	30	4.6	4.8	7.5	5.0	6.4	5.5	5.7	6.6
		3	30	4.8	3.5	5.5	4.6	5.6	5.2	5.3	5.2
		4	30	7.4	5.9	6.1	8.1	8.4	8.9	8.5	7.3
		6	30	10.5	9.0	8.1	9.0	11.4	10.6	11.1	10.2
		9	30	15.8	13.7	14.4	13.0	16.3	16.7	16.3	15.3

Table 1.16 Result of Video H.265 decoding performance of RZ/G2H (Resolution &gt;= HD)

Condition				CPU Usage							
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HD 1280 × 720	15	1	15	3.1	2.3	3.8	4.1	3.5	2.6	2.8	2.8
		2	15	3.4	4.1	4.8	4.2	3.5	3.0	3.0	3.3
		3	15	3.7	3.5	7.0	3.9	4.7	3.9	3.3	3.1
		4	15	5.6	3.9	5.0	4.4	5.3	4.6	4.9	4.6
		6	15	6.2	5.5	5.0	8.9	6.9	6.6	6.9	6.2
		9	15	8.3	7.2	7.4	7.8	8.7	9.1	9.0	8.5
	30	1	30	5.7	4.7	4.2	4.7	3.8	3.5	3.7	3.1
		2	30	5.3	5.7	5.4	4.4	6.1	4.8	5.0	5.3
		3	30	5.8	6.6	4.6	4.9	5.2	5.1	5.9	4.8
		4	30	8.5	8.2	7.4	6.4	8.4	8.7	8.0	8.6
		6	30	9.6	8.1	8.8	7.5	10.5	10.8	9.5	9.3
		9	30	14.4	12.3	13.1	12.4	14.9	14.8	14.6	13.9
	60	1	60	5.3	8.5	6.4	5.0	4.8	4.0	4.3	4.0
		2	60	9.1	8.3	8.7	8.4	7.7	6.9	7.8	6.4
		3	60	13.8	12.4	12.2	11.4	10.8	11.1	10.2	9.2
		4	60	15.2	15.6	12.7	12.2	15.9	14.9	13.3	14.2
FHD 1920 × 1080	15	1	15	2.5	2.4	5.4	1.8	2.4	2.7	2.7	2.5
		2	15	5.3	3.0	2.9	4.5	4.0	3.5	4.2	3.5
		3	15	6.0	5.3	3.8	3.5	4.7	4.2	5.0	4.7
		4	15	6.7	5.0	6.4	5.5	6.0	6.5	6.3	5.9
		6	15	8.1	7.0	7.4	6.8	7.6	7.8	7.7	7.3
	30	1	30	4.6	4.3	4.7	4.9	5.9	4.8	3.9	5.0
		2	30	6.5	5.3	3.7	3.6	6.5	6.8	7.1	5.6
		3	30	6.4	8.3	5.9	6.2	7.6	8.0	7.9	7.5
		4	30	8.5	7.4	7.6	9.0	9.6	9.7	9.1	8.8
	60	1	60	4.4	6.5	4.5	3.8	4.8	5.4	5.5	5.1
		2	60	7.6	8.2	8.1	7.0	8.3	6.9	6.9	6.9
4K 3840 × 2160	30	1	30	4.6	4.3	5.5	4.5	4.2	4.1	3.7	4.5

- Specification: H.264: 1920 × 1080p × 120 FPS

Table 1.17 Result of Video H.264 decoding performance of RZ/G2M (Resolution &lt; HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	30	1	30	5.4	3.6	—	—	6.2	5.8	5.1	3.6
		2	30	6.3	6.6	—	—	9.4	7.2	6.2	6.7
		3	30	8.6	7.6	—	—	10.8	10.2	8.6	9.7
		4	30	9.2	8.7	—	—	12.5	12.0	11.4	11.2
		6	30	15.2	12.5	—	—	15.9	15.8	15.3	15.2
		9	30	18.9	17.0	—	—	20.4	20.7	21.8	20.5
VGA 640 × 480	30	1	30	4.8	2.4	—	—	6.7	5.3	6.2	5.5
		2	30	7.0	5.6	—	—	8.7	8.5	7.5	7.0
		3	30	7.7	6.0	—	—	11.0	11.0	9.7	10.1
		4	30	10.3	9.8	—	—	13.4	11.6	11.7	11.6
		6	30	14.5	13.7	—	—	16.4	15.4	15.5	15.0
		9	30	19.3	16.7	—	—	21.4	21.7	21.3	21.7

Table 1.18 Result of Video H.264 decoding performance of RZ/G2M (Resolution ≥ HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HD 1280 × 720	30	1	30	4.6	3.6	—	—	5.7	6.0	7.0	5.8
		2	30	7.7	6.7	—	—	10.4	8.2	8.4	9.4
		3	30	9.2	6.5	—	—	11.8	10.5	10.0	9.4
		4	30	10.8	8.6	—	—	12.6	12.5	12.9	12.1
		6	30	14.9	12.9	—	—	18.8	18.6	18.4	17.9
		9	30	22.0	17.7	—	—	24.0	23.3	25.1	23.3
XGA 1280 × 960	30	1	30	4.9	11.0	—	—	6.9	5.1	5.7	6.9
		2	30	6.7	6.8	—	—	9.8	8.3	8.0	8.1
		3	30	8.9	8.1	—	—	10.4	10.5	11.1	9.1
		4	30	10.7	9.4	—	—	12.1	11.9	12.4	12.8
		6	30	16.0	13.5	—	—	19.3	21.3	19.4	19.8
		9	30	20.0	19.2	—	—	26.4	24.8	22.9	24.0
XGA 1920 × 1080	30	1	30	6.1	2.5	—	—	6.5	5.2	6.7	5.9
		2	30	7.7	6.8	—	—	9.6	9.3	8.8	8.5
		3	30	9.7	8.0	—	—	13.4	12.1	11.2	11.4
		4	30	10.7	9.5	—	—	13.4	14.0	13.6	12.4



- Specification: H.265: 1920 × 1080p × 120 FPS

Table 1.19 Result of Video H.265 decoding performance of RZ/G2M (Resolution &lt; HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	15	1	15	3.4	4.8	—	—	3.1	3.5	3.7	3.7
		2	15	4.5	5.6	—	—	6.2	4.5	4.9	3.8
		3	15	5.1	6.3	—	—	6.5	5.2	5.5	4.9
		4	15	7.0	7.7	—	—	8.3	7.9	6.5	7.0
		6	15	9.8	9.2	—	—	10.6	10.3	9.6	9.5
		9	15	10.3	10.5	—	—	11.5	11.7	11.5	11.9
	30	1	30	5.2	4.0	—	—	7.6	4.9	4.3	4.1
		2	30	7.2	6.0	—	—	6.0	5.6	6.2	7.1
		3	30	7.4	8.5	—	—	10.4	8.6	10.1	9.8
		4	30	10.7	8.1	—	—	11.1	10.7	10.1	10.2
		6	30	10.8	12.2	—	—	12.7	12.3	11.9	12.1
		9	30	18.7	16.6	—	—	20.7	20.9	20.2	20.4
VGA 640 × 480	15	1	15	4.4	2.3	—	—	4.9	4.5	2.8	2.8
		2	15	6.9	4.8	—	—	5.5	5.4	5.9	4.8
		3	15	5.1	7.3	—	—	5.4	5.9	6.1	5.5
		4	15	7.8	5.2	—	—	8.6	7.6	8.0	7.3
		6	15	8.5	8.9	—	—	9.1	9.2	8.7	8.2
		9	15	12.0	10.1	—	—	12.5	12.7	11.7	11.5
	30	1	30	5.0	6.2	—	—	5.2	6.1	6.0	5.4
		2	30	6.5	7.2	—	—	7.2	6.6	6.5	5.9
		3	30	8.8	6.4	—	—	12.0	11.7	11.4	11.3
		4	30	12.2	9.0	—	—	12.4	12.2	11.8	11.8
		6	30	13.2	12.1	—	—	15.0	14.8	14.6	13.9
		9	30	20.8	18.8	—	—	21.2	21.6	21.7	21.7

Table 1.20 Result of Video H.265 decoding performance of RZ/G2M (Resolution &gt;= HD)

Condition				CPU Usage							
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HD 1280 × 720	15	1	15	3.6	4.0	—	—	3.6	2.9	4.0	4.1
		2	15	6.5	4.3	—	—	5.7	5.1	5.1	5.1
		3	15	6.7	5.6	—	—	7.3	6.3	6.9	6.1
		4	15	7.9	5.2	—	—	8.6	8.0	7.8	7.6
		6	15	9.2	10.4	—	—	10.4	10.7	10.4	10.1
		9	15	13.6	11.3	—	—	13.9	13.3	13.1	12.8
	30	1	30	4.9	4.1	—	—	5.4	4.9	4.6	4.2
		2	30	8.5	6.6	—	—	8.9	8.3	8.1	8.8
		3	30	8.9	7.1	—	—	9.1	9.1	8.7	8.4
		4	30	11.2	8.5	—	—	12.1	11.5	11.0	11.5
		6	30	14.8	14.1	—	—	15.6	15.1	14.9	14.2
		9	30	17.2	15.8	—	—	19.9	19.4	20.5	19.5
	60	1	60	10.6	10.0	—	—	11.3	10.3	10.0	10.2
		2	60	11.4	9.6	—	—	17.8	12.6	13.5	10.6
		3	60	16.9	15.5	—	—	18.4	17.3	17.1	16.4
		4	60	22.3	18.6	—	—	22.9	22.1	22.7	21.7
FHD 1920 × 1080	15	1	15	2.7	4.9	—	—	3.7	4.3	4.8	3.1
		2	15	7.1	2.9	—	—	5.6	5.0	5.2	4.5
		3	15	7.6	6.3	—	—	6.6	6.9	6.5	6.2
		4	15	7.6	5.5	—	—	8.5	8.9	8.1	7.8
		6	15	11.1	11.4	—	—	12.1	11.2	10.5	10.6
	30	1	30	8.2	4.4	—	—	7.0	6.5	6.6	6.8
		2	30	9.0	4.2	—	—	9.7	8.5	7.3	7.2
		3	30	8.6	8.1	—	—	10.5	11.0	9.8	9.5
		4	30	14.7	12.4	—	—	14.7	12.5	13.3	12.8
	60	1	60	6.8	8.0	—	—	8.8	9.0	8.1	8.5
		2	60	11.7	10.6	—	—	12.0	11.3	11.4	10.6
4K 3840 × 2160	30	1	30	7.4	5.4	—	—	8.4	8.0	8.3	8.9

- Specification: H.264: 1920 × 1080p × 120 FPS

Table 1.21 Result of Video H.264 decoding performance of RZ/G2N (Resolution &lt; HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	30	1	30	11.4	11.4	—	—	—	—	—	—
		2	30	17.2	16.6	—	—	—	—	—	—
		3	30	27.3	24.5	—	—	—	—	—	—
		4	30	31.1	29.7	—	—	—	—	—	—
		6	30	35.2	34.4	—	—	—	—	—	—
		9	30	52.9	50.8	—	—	—	—	—	—
VGA 640 × 480	30	1	30	17.5	15.3	—	—	—	—	—	—
		2	30	20.8	20.3	—	—	—	—	—	—
		3	30	28.2	23.6	—	—	—	—	—	—
		4	30	32.3	30.1	—	—	—	—	—	—
		6	30	41.4	38.3	—	—	—	—	—	—
		9	30	52.1	50.1	—	—	—	—	—	—

Table 1.22 Result of Video H.264 decoding performance of RZ/G2N (Resolution ≥ HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HD 1280 × 720	30	1	30	16.9	15.1	—	—	—	—	—	—
		2	30	17.4	17.0	—	—	—	—	—	—
		3	30	24.1	22.9	—	—	—	—	—	—
		4	30	29.8	29.2	—	—	—	—	—	—
		6	30	39.0	38.1	—	—	—	—	—	—
		9	30	54.9	53.5	—	—	—	—	—	—
XGA 1280 × 960	30	1	30	13.3	12.4	—	—	—	—	—	—
		2	30	19.3	18.2	—	—	—	—	—	—
		3	30	24.9	23.9	—	—	—	—	—	—
		4	30	30.3	29.4	—	—	—	—	—	—
		6	30	40.6	40.0	—	—	—	—	—	—
		9	30	57.4	56.3	—	—	—	—	—	—
Full HD 1920 × 1080	30	1	30	13.3	16.4	—	—	—	—	—	—
		2	30	18.1	17.3	—	—	—	—	—	—
		3	30	25.8	24.7	—	—	—	—	—	—
		4	30	30.6	29.7	—	—	—	—	—	—

- Specification: H.265: 1920 × 1080p × 120 FPS

Table 1.23 Result of Video H.265 decoding performance of RZ/G2N (Resolution &lt; HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	15	1	15	8.1	7.9	—	—	—	—	—	—
		2	15	13.2	11.9	—	—	—	—	—	—
		3	15	13.4	15.6	—	—	—	—	—	—
		4	15	19.1	20.0	—	—	—	—	—	—
		6	15	22.7	21.2	—	—	—	—	—	—
		9	15	30.2	30.2	—	—	—	—	—	—
	30	1	30	12.5	15.7	—	—	—	—	—	—
		2	30	19.9	21.2	—	—	—	—	—	—
		3	30	24.0	24.1	—	—	—	—	—	—
		4	30	28.4	28.3	—	—	—	—	—	—
		6	30	39.4	38.6	—	—	—	—	—	—
		9	30	51.0	49.3	—	—	—	—	—	—
VGA 640 × 480	15	1	15	8.4	9.0	—	—	—	—	—	—
		2	15	11.8	10.4	—	—	—	—	—	—
		3	15	12.8	13.0	—	—	—	—	—	—
		4	15	16.3	17.4	—	—	—	—	—	—
		6	15	21.5	19.9	—	—	—	—	—	—
		9	15	31.2	30.1	—	—	—	—	—	—
	30	1	30	10.0	12.6	—	—	—	—	—	—
		2	30	19.6	17.9	—	—	—	—	—	—
		3	30	24.4	24.3	—	—	—	—	—	—
		4	30	27.6	27.9	—	—	—	—	—	—

Table 1.24 Result of Video H.265 decoding performance of RZ/G2N (Resolution &gt;= HD)

Condition				CPU Usage							
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HD 1280 × 720	15	1	15	8.9	9.9	—	—	—	—	—	—
		2	15	12.1	12.6	—	—	—	—	—	—
		3	15	18.6	14.8	—	—	—	—	—	—
		4	15	19.1	19.8	—	—	—	—	—	—
		6	15	26.1	24.8	—	—	—	—	—	—
		9	15	34.1	34.3	—	—	—	—	—	—
	30	1	30	13.9	14.1	—	—	—	—	—	—
		2	30	20.8	21.5	—	—	—	—	—	—
		3	30	23.4	23.7	—	—	—	—	—	—
		4	30	29.1	29.4	—	—	—	—	—	—
		6	30	38.5	38.0	—	—	—	—	—	—
	60	1	60	21.2	23.2	—	—	—	—	—	—
FHD 1920 × 1080	15	1	15	11.2	10.5	—	—	—	—	—	—
		2	15	16.7	16.3	—	—	—	—	—	—
		3	15	19.9	16.5	—	—	—	—	—	—
		4	15	19.6	20.1	—	—	—	—	—	—
		6	15	28.4	28.0	—	—	—	—	—	—
	30	1	30	12.9	11.7	—	—	—	—	—	—
		2	30	17.0	17.2	—	—	—	—	—	—
		3	30	27.6	26.9	—	—	—	—	—	—
		4	30	35.0	35.0	—	—	—	—	—	—
	60	1	60	20.0	20.1	—	—	—	—	—	—
4K 3840 × 2160	30	1	30	15.9	15.2	—	—	—	—	—	—

- Specification: H.264: 1920 × 1080p × 60 FPS

Table 1.25 Result of Video H.264 decoding performance of RZ/G2E (Resolution &lt; HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	30	1	30	—	—	—	—	23.3	18.8	—	—
		2	30	—	—	—	—	35.2	33.6	—	—
		3	30	—	—	—	—	44.8	41.0	—	—
		4	30	—	—	—	—	46.4	42.7	—	—
		6	30	—	—	—	—	75.8	71.2	—	—
VGA 640 × 480	30	1	30	—	—	—	—	25.1	23.6	—	—
		2	30	—	—	—	—	31.6	31.6	—	—
		3	30	—	—	—	—	44.9	43.3	—	—
		4	30	—	—	—	—	56.3	53.8	—	—
		6	30	—	—	—	—	76.1	73.4	—	—

Table 1.26 Result of Video H.264 decoding performance of RZ/G2E (Resolution ≥ HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HD 1280 × 720	30	1	30	—	—	—	—	24.1	25.7	—	—
		2	30	—	—	—	—	34.1	34.7	—	—
		3	30	—	—	—	—	46.3	45.1	—	—
		4	30	—	—	—	—	58.7	55.9	—	—
XGA 1280 × 960	30	1	30	—	—	—	—	25.8	24.1	—	—
		2	30	—	—	—	—	35.3	34.0	—	—
		3	30	—	—	—	—	48.6	46.9	—	—
Full HD 1920 × 1080	30	1	30	—	—	—	—	26.5	26.0	—	—

- Specification: H.265: 1920 × 1080p × 60 FPS

Table 1.27 Result of Video H.265 decoding performance of RZ/G2E (Resolution &lt; HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	15	1	15	—	—	—	—	17.7	18.9	—	—
		2	15	—	—	—	—	26.7	25.2	—	—
		3	15	—	—	—	—	32.6	33.0	—	—
		4	15	—	—	—	—	35.0	35.3	—	—
	30	1	30	—	—	—	—	26.2	27.5	—	—
		2	30	—	—	—	—	37.8	34.1	—	—
		3	30	—	—	—	—	48.2	48.0	—	—
		4	30	—	—	—	—	60.8	59.8	—	—
VGA 640 × 480	15	1	15	—	—	—	—	18.3	17.7	—	—
		2	15	—	—	—	—	26.5	26.3	—	—
		3	15	—	—	—	—	33.2	33.1	—	—
		4	15	—	—	—	—	40.4	39.6	—	—
	30	1	30	—	—	—	—	24.3	25.0	—	—
		2	30	—	—	—	—	40.0	39.6	—	—
		3	30	—	—	—	—	51.4	47.8	—	—
		4	30	—	—	—	—	62.2	60.3	—	—

Table 1.28 Result of Video H.265 decoding performance of RZ/G2E (Resolution ≥ HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HD 1280 × 720	15	1	15	—	—	—	—	19.1	19.7	—	—
		2	15	—	—	—	—	28.3	27.7	—	—
		3	15	—	—	—	—	36.0	33.7	—	—
		4	15	—	—	—	—	43.1	42.2	—	—
	30	1	30	—	—	—	—	27.0	27.0	—	—
		2	30	—	—	—	—	39.9	38.6	—	—
		3	30	—	—	—	—	57.5	55.0	—	—
FHD 1920 × 1080	15	1	15	—	—	—	—	21.0	19.6	—	—
		2	15	—	—	—	—	30.9	30.8	—	—
		3	15	—	—	—	—	38.1	36.6	—	—
		4	15	—	—	—	—	48.3	47.4	—	—
	30	1	30	—	—	—	—	31.0	29.5	—	—

- Specification: H.264 1920 × 1080p × 30 FPS

Table 1.29 Result of Video H.264 decoding performance of RZ/G2L (Resolution &lt; HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA55(%)							
Name				CPU0	CPU1	—	—	—	—	—	—
W (pixel) × H (pixel)											
HVGAW 640 × 360	30	1	30	22.2	23.7	—	—	—	—	—	—
		2	30	34.5	34.2	—	—	—	—	—	—
		3	30	45.7	43.0	—	—	—	—	—	—
		4	30	58.8	56.5	—	—	—	—	—	—
VGA 640 × 480	30	1	30	22.1	24.6	—	—	—	—	—	—
		2	30	36.9	36.8	—	—	—	—	—	—
		3	30	48.8	47.3	—	—	—	—	—	—
		4	30	62.9	59.8	—	—	—	—	—	—

- Specification: H.264 1920 × 1080p × 30 FPS

Table 1.30 Result of Video H.264 decoding performance of RZ/G2L (Resolution ≥ HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA55(%)							
Name				CPU0	CPU1	—	—	—	—	—	—
W (pixel) × H (pixel)											
HD 640 × 360	30	1	30	25.0	25.7	—	—	—	—	—	—
		2	30	46.0	44.5	—	—	—	—	—	—
VGA 640 × 480	30	1	30	26.0	26.9	—	—	—	—	—	—
Full HD 1920 × 1080	30	1	30	28.8	29.2	—	—	—	—	—	—



## 1.7 Video encoding performances

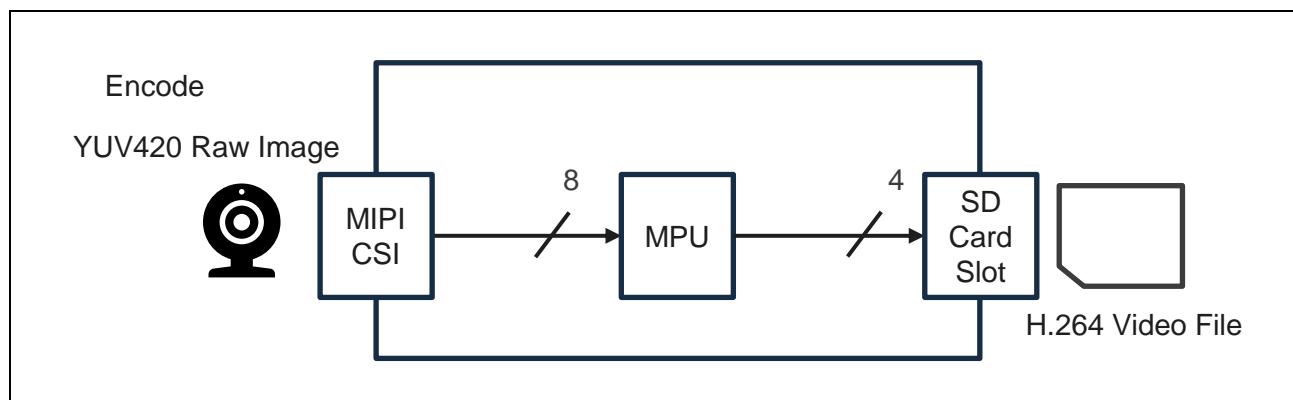


Figure 1.8 YUV420 to H.264 Video Encoding Process Block Diagram

- Specification: H.264: 1920 × 1080p × 120 FPS

Table 1.31 Result of Video H.264 encoding performance of RZ/G2H (Resolution < HD)

Condition				CPU Usage							
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name											
W (pixel) × H (pixel)				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
HVGAW 640 × 360	30	1	30	2.8	6.4	1.5	1.4	1.9	1.2	1.0	2.7
		2	30	2.3	7.1	2.7	0.7	1.2	1.1	5.7	2.4
		3	30	4.6	5.2	2.0	4.8	1.9	1.6	1.7	1.5
		4	30	5.7	4.6	3.2	3.3	2.6	3.2	2.4	2.3
		6	30	5.4	4.9	5.3	3.7	2.7	3.1	3.0	2.5
		9	30	5.6	5.2	4.5	4.8	5.4	4.5	4.9	5.0
VGA 640 × 480	30	1	30	4.3	4.2	0.9	1.4	2.8	4.1	2.7	4.6
		2	30	2.3	1.5	3.7	6.5	3.9	4.1	1.7	2.4
		3	30	3.8	7.3	4.7	3.7	4.2	7.3	1.7	2.0
		4	30	3.3	4.3	2.3	5.1	3.5	3.3	7.1	3.0
		6	30	5.7	8.5	4.4	3.7	3.8	3.2	5.1	3.2
		9	30	7.3	6.7	5.6	6.3	5.5	4.8	5.3	4.5

Table 1.32 Result of Video H.264 encoding performance of RZ/G2H (Resolution &gt;= HD)

Condition				CPU Usage							
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HD 1280 × 720	30	1	30	6.1	5.3	0.3	1.0	4.3	1.5	2.7	1.5
		2	30	5.1	4.0	1.9	1.9	5.4	3.6	2.8	2.1
		3	30	4.8	2.0	3.6	3.6	2.7	3.6	3.5	5.9
		4	30	5.3	6.6	4.0	4.7	2.9	2.6	2.6	3.7
		6	30	5.1	5.3	3.2	5.0	4.3	4.3	4.1	7.5
		9	30	5.3	3.8	7.7	6.7	7.6	4.8	6.5	4.5
XGA 1280 × 960	30	1	30	4.6	6.1	3.5	1.2	0.9	3.6	2.6	2.5
		2	30	2.3	8.0	1.7	2.8	2.6	3.1	4.7	2.5
		3	30	4.9	4.6	5.8	1.5	2.0	3.0	4.6	5.5
		4	30	5.0	7.8	1.9	1.5	2.6	4.4	6.7	4.6
		6	30	5.2	5.8	5.8	4.5	3.8	4.3	3.5	3.5
		9	30	5.9	8.5	4.7	6.4	6.0	6.4	8.1	6.2
Full HD 1920 × 1080	30	1	30	1.9	3.8	7.5	2.3	3.3	6.3	2.2	1.9
		2	30	4.3	4.9	2.8	7.4	2.5	3.0	5.7	3.2
		3	30	5.5	5.5	6.5	6.1	3.7	4.5	3.5	6.7
		4	30	4.3	6.6	10.3	3.5	3.3	3.6	3.8	4.6

- Specification: H.264: 1920 × 1080p × 120 FPS

Table 1.33 Result of Video H.264 encoding performance of RZ/G2M (Resolution &lt; HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	30	1	30	3.8	5.4	—	—	5.8	1.9	2.3	2.0
		2	30	4.8	7.3	—	—	3.5	2.4	2.2	2.9
		3	30	6.2	5.1	—	—	3.8	5.5	3.5	4.1
		4	30	6.1	8.9	—	—	3.8	4.7	3.6	4.6
		6	30	6.9	7.1	—	—	5.6	5.8	5.8	4.2
		9	30	6.9	9.2	—	—	8.9	8.3	7.6	7.3
VGA 640 × 480	30	1	30	5.6	5.8	—	—	2.8	3.8	4.0	8.7
		2	30	5.0	9.4	—	—	2.9	3.2	4.7	5.0
		3	30	6.4	6.1	—	—	4.5	5.1	5.6	4.3
		4	30	4.1	10.1	—	—	5.2	3.5	6.7	3.5
		6	30	7.4	8.3	—	—	6.3	6.4	6.5	6.4
		9	30	9.8	10.5	—	—	8.2	8.5	8.0	7.5

Table 1.34 Result of Video H.264 encoding performance of RZ/G2M (Resolution ≥ HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HD 1280 × 720	30	1	30	2.8	7.1	—	—	4.4	4.4	4.4	2.9
		2	30	3.5	8.6	—	—	3.2	5.6	5.1	3.0
		3	30	6.3	7.5	—	—	4.6	3.7	3.6	4.6
		4	30	7.4	8.1	—	—	3.8	4.2	3.5	5.6
		6	30	8.3	7.1	—	—	5.9	8.3	7.0	6.3
		9	30	8.6	9.8	—	—	9.4	8.9	8.0	8.4
XGA 1280 × 960	30	1	30	3.6	5.7	—	—	3.7	3.4	3.2	5.9
		2	30	5.7	6.4	—	—	6.0	4.5	2.7	4.1
		3	30	5.9	6.8	—	—	4.5	4.7	5.4	4.3
		4	30	8.5	6.0	—	—	4.7	3.9	6.0	6.2
		6	30	8.5	10.3	—	—	5.6	6.6	5.7	8.1
		9	30	11.4	8.8	—	—	9.2	8.5	9.4	9.6
Full HD 1920 × 1080	30	1	30	4.6	8.2	—	—	6.0	3.8	4.2	4.4
		2	30	7.8	8.6	—	—	5.3	4.0	5.8	5.0
		3	30	6.9	8.7	—	—	4.6	6.5	7.9	6.7
		4	30	8.0	9.8	—	—	7.6	10.2	5.2	6.9

- Specification: H.264: 1920 × 1080p × 120 FPS

Table 1.35 Result of Video H.264 encoding performance of RZ/G2N (Resolution &lt; HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	30	1	30	11.0	8.1	—	—	—	—	—	—
		2	30	11.5	10.0	—	—	—	—	—	—
		3	30	11.7	12.9	—	—	—	—	—	—
		4	30	15.0	13.1	—	—	—	—	—	—
		6	30	16.3	16.7	—	—	—	—	—	—
		9	30	21.8	21.4	—	—	—	—	—	—
VGA 640 × 480	30	1	30	8.5	12.6	—	—	—	—	—	—
		2	30	11.2	13.7	—	—	—	—	—	—
		3	30	15.2	12.5	—	—	—	—	—	—
		4	30	15.0	16.2	—	—	—	—	—	—
		6	30	16.6	19.5	—	—	—	—	—	—
		9	30	22.3	23.8	—	—	—	—	—	—

Table 1.36 Result of Video H.264 encoding performance of RZ/G2N (Resolution ≥ HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HD 1280 × 720	30	1	30	11.6	9.3	—	—	—	—	—	—
		2	30	9.4	14.7	—	—	—	—	—	—
		3	30	17.1	12.5	—	—	—	—	—	—
		4	30	14.0	16.5	—	—	—	—	—	—
		6	30	17.2	19.7	—	—	—	—	—	—
		9	30	21.4	24.9	—	—	—	—	—	—
XGA 1280 × 960	30	1	30	7.6	12.0	—	—	—	—	—	—
		2	30	11.0	16.4	—	—	—	—	—	—
		3	30	16.5	11.8	—	—	—	—	—	—
		4	30	14.5	14.9	—	—	—	—	—	—
		6	30	17.9	21.4	—	—	—	—	—	—
		9	30	28.5	24.1	—	—	—	—	—	—
Full HD 1920 × 1080	30	1	30	6.8	18.0	—	—	—	—	—	—
		2	30	13.2	16.4	—	—	—	—	—	—
		3	30	15.7	20.3	—	—	—	—	—	—
		4	30	18.0	22.4	—	—	—	—	—	—

- Specification: H.264: 1920 × 1080p × 60 FPS

Table 1.37 Result of Video H.264 encoding performance of RZ/G2E (Resolution &lt; HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	30	1	30	—	—	—	—	19.3	17.8	—	—
		2	30	—	—	—	—	22.7	28.0	—	—
		3	30	—	—	—	—	27.8	26.5	—	—
		4	30	—	—	—	—	31.7	30.5	—	—
		6	30	—	—	—	—	38.6	37.8	—	—
		9	30	—	—	—	—	50.6	50.1	—	—
VGA 640 × 460	30	1	30	—	—	—	—	21.4	18.8	—	—
		2	30	—	—	—	—	26.5	24.4	—	—
		3	30	—	—	—	—	30.1	27.7	—	—
		4	30	—	—	—	—	33.3	34.5	—	—
		6	30	—	—	—	—	43.5	40.2	—	—

Table 1.38 Result of Video H.264 encoding performance of RZ/G2E (Resolution ≥ HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HD 1280 × 720	30	1	30	—	—	—	—	17.1	23.7	—	—
		2	30	—	—	—	—	27.9	24.0	—	—
		3	30	—	—	—	—	31.7	29.2	—	—
		4	30	—	—	—	—	35.4	34.7	—	—
XGA 1280 × 960	30	1	30	—	—	—	—	16.3	24.1	—	—
		2	30	—	—	—	—	26.5	24.2	—	—
		3	30	—	—	—	—	30.3	29.0	—	—
Full HD 1920 × 1080	30	1	30	—	—	—	—	20.8	29.4	—	—

- Specification: H.264 1920 × 1080p × 30 FPS

Table 1.39 Result of Video H.264 encoding performance of RZ/G2L (Resolution &lt; HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA55(%)							
Name				CPU0	CPU1	—	—	—	—	—	—
W (pixel) × H (pixel)											
HVGAW 640 × 360	30	1	30	9.6	10.7	—	—	—	—	—	—
		2	30	14.2	15.4	—	—	—	—	—	—
		3	30	19.7	19.9	—	—	—	—	—	—
		4	30	23.8	24.4	—	—	—	—	—	—
		6	30	34.4	33.9	—	—	—	—	—	—
		9	30	49.3	49.7	—	—	—	—	—	—
VGA 640 × 480	30	1	30	14.2	12.0	—	—	—	—	—	—
		2	30	15.6	17.1	—	—	—	—	—	—
		3	30	23.9	23.4	—	—	—	—	—	—
		4	30	30.4	28.1	—	—	—	—	—	—
		6	30	41.6	42.0	—	—	—	—	—	—

Table 1.40 Result of Video H.264 encoding performance of RZ/G2L (Resolution ≥ HD)

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA55(%)							
Name				CPU0	CPU1	—	—	—	—	—	—
W (pixel) × H (pixel)											
HD 1280 × 720	30	1	30	13.6	10.8	—	—	—	—	—	—
		2	30	23.3	23.0	—	—	—	—	—	—
XGA 1280 × 960	30	1	30	11.0	14.0	—	—	—	—	—	—
Full HD 1920 × 1080	30	1	30	18.3	13.6	—	—	—	—	—	—

1.8 Video codec performances

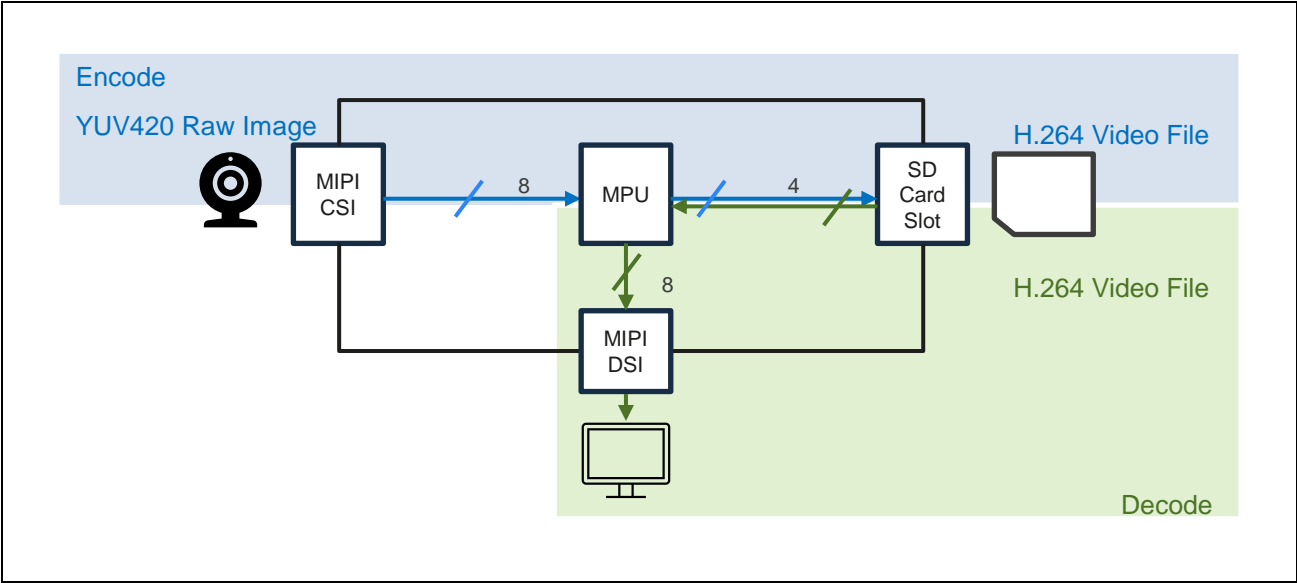


Figure 1.9 Combined Video Encode and Decode System Block Diagram

- Specification: H.264 1920 × 1080p × 120 FPS

Table 1.41 Result of Video H.264 codec performance of RZ/G2H

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	30	1	30	6.4	6.7	5.1	5.9	4.9	4.4	3.4	3.9
VGA 640 × 480	30	1	30	5.7	5.9	5.9	5.8	5.2	6.6	4.6	4.8
HD 1280 × 720	30	1	30	6.2	7.2	5.2	4.2	4.9	5.8	7.4	4.8
XGA 1280 × 960	30	1	30	6.6	6.9	5.2	4.6	5.2	5.9	7.5	6.3
Full HD 1920 × 1080	30	1	30	6.4	7.3	7.0	5.6	8.2	8.2	6.7	9.0

- Specification: H.264 1920 × 1080p × 120 FPS

Table 1.42 Result of Video H.264 codec performance of RZ/G2M

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	30	1	30	7.9	7.6	—	—	9.6	8.5	8.5	8.3
VGA 640 × 480	30	1	30	6.5	10.5	—	—	12.2	10.1	7.6	7.3
HD 1280 × 720	30	1	30	8.3	10.1	—	—	10.1	8.3	8.1	9.0
XGA 1280 × 960	30	1	30	6.6	9.7	—	—	11.0	9.9	10.0	8.3
Full HD 1920 × 1080	30	1	30	8.3	9.1	—	—	13.9	13.1	10.9	12.1

- Specification: H.264 1920 × 1080p × 120 FPS

Table 1.43 Result of Video H.264 codec performance of RZ/G2N

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	30	1	30	21.5	20.4	—	—	—	—	—	—
VGA 640 × 480	30	1	30	24.1	19.4	—	—	—	—	—	—
HD 1280 × 720	30	1	30	22.7	22.7	—	—	—	—	—	—
XGA 1280 × 960	30	1	30	26.1	19.6	—	—	—	—	—	—
Full HD 1920 × 1080	30	1	30	29.0	25.2	—	—	—	—	—	—



- Specification: H.264 1920 × 1080p × 60 FPS

Table 1.44 Result of Video H.264 codec performance of RZ/G2E

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA57(%)				CA53(%)			
Name				CPU0	CPU1	CPU2	CPU3	CPU0	CPU1	CPU2	CPU3
W (pixel) × H (pixel)											
HVGAW 640 × 360	30	1	30	—	—	—	—	40.0	41.0	—	—
VGA 640 × 480	30	1	30	—	—	—	—	41.7	38.7	—	—
HD 1280 × 720	30	1	30	—	—	—	—	39.4	40.7	—	—
XGA 1280 × 960	30	1	30	—	—	—	—	42.0	38.3	—	—
Full HD 1920 × 1080	30	1	30	—	—	—	—	49.4	52.3	—	—

- Specification: H.264 1920 × 1080p × 30 FPS

Table 1.45 Result of Video H.264 codec performance of RZ/G2L

Condition			CPU Usage								
Resolution	Frame Rate (FPS)	Channel	FPS	CA55(%)							
Name				CPU0	CPU1	—	—	—	—	—	—
W (pixel) × H (pixel)											
HVGAW 640 × 360	30	1	30	36.4	35.1	—	—	—	—	—	—
VGA 640 × 480	30	1	30	37.5	38.4	—	—	—	—	—	—
HD 1280 × 720	30	1	30	39.4	40.7	—	—	—	—	—	—

## 1.9 Glmark2 performance

- Result of Glmark2 performance:
- Benchmark: Glmark2; Condition: --off-screen

Table 1.46 Glmark2 testing result for each resolution

Device	Resolution		
	640 × 480	1280 × 720	1920 × 1080
RZ/G2H	1435	841	486
RZ/G2M	1244	710	403
RZ/G2N	808	425	222
RZ/G2E	393	234	133
RZ/G2L	268	148	78
RZ/G2LC	274	150	80

## 2. Environment and Testing information

This material shows the results of performance measurement of DDR, Ethernet, USB, SD, MMC, SATA, CPU, and Camera, and Video decoding benchmarks on the RZ/G2 (G2H/M/N/E/L/LC/UL) and RZ/G3S boards. It also explains the detailed guideline of the procedure to setup hardware/software and run test scripts to get benchmarking results.

### 2.1 Board and testing environment

Table 2.1 Boards software and hardware information:

Devices	Boards	Memory	eMMC model	VLP version	Linux kernel
RZ/G2H	hihope-rzg2h Revision 4 - LSI 1.3	DDR4-3200	Micron MTFC32GAKAECN- AIT 32GB	VLP3.0.5	5.10.184-cip36
RZ/G2M	hihope-rzg2m Revision 4 - LSI 3.0	DDR4-3200		VLP3.0.5	5.10.184-cip36
RZ/G2N	hihope-rzg2n revision 4 - LSI 1.3	DDR4-3200		VLP3.0.5	5.10.184-cip36
RZ/G2E	Silicon Linux RZ/G2E EK874 Revision E	DDR3-1866	KIOXIA THGBMJG7C1LBAIL	VLP3.0.5	5.10.184-cip36
RZ/G2L	RZ SMARC carrier ver 2, SOM (WS2.0)	DDR4-1600	Micron MTFC64GASAQHD- IT 64GB	VLP3.0.5	5.10.184-cip36
RZ/G2LC	RZ SMARC carrier ver 2, SOM (WS2.0)	DDR4-1600	Micron MTFC64GASAQHD- IT 64GB	VLP3.0.5	5.10.184-cip36
RZ/G2UL	RZ SMARC carrier ver 2, SOM - PMIC	DDR4-1600	Micron MTFC64GASAQHD- IT 64GB	VLP3.0.5	5.10.184-cip36
RZ/G3S	RZ SMARC carrier ver 2, SOM (WS2.0)	LPDDR4-1600	Micron MTFC64GASAQHD- IT 64GB	VLP3.0.5	5.10.184-cip36

Table 2.2 External device information:

Devices	Class	Hardware Notes
SD card	UHS-I	MicroSDXC SanDisk Extreme Pro 64G Write Speed: 90 MB/s Read Speed: 200 MB/s
Ethernet cable	CAT6	Upload Speed: 1 Gbps Download Speed: 1 Gbps

## 2.2 eMMC

- Benchmark software: fio
- Version: BusyBox v1.30.1
- Test file size: 8 MB
- Test command: Refer test script files eMMC\_fio/write\_read\_\*.sh
- Device: All

## 2.3 DDR

- Benchmark software: Sysbench
- Version: v0.4.12
- Test file size: 100 GB
- Test command: Refer test script files DDR\_sysbench/02\_run\_DDR\_sysbench\_\*.sh
- Device: All

## 2.4 Ethernet

- Benchmark software: iperf3
- Version: v3.7
- Test file size: —
- Test command: Refer test script files Ethernet/01\_run\_Ethernet\_iperf\_\*.sh
- Device: All

## 2.5 CPU

- Benchmark software: coremark, crypt, dhrystone, sysbench
- Version:
- Test file size: —
- Test command: Refer test script files CPU\_sysbench/02\_run\_CPU\_\*.sh
- Device: All

## 2.6 Camera

- Benchmark software: gstreamer
- Version: VLP3.0.5
- Interface: MIPI
- Resolution:  $1280 \times 960$ ,  $1920 \times 1080$ ,  $2592 \times 1944$
- Test command: Refer test script files Camera\_FPS\_v03/02\_run\_camera\_fps\_\*.sh
- Device: G2H, G2M, G2N, G2E, G2L



## 2.7 Video decoding performance

- Benchmark software: gstreamer
- Version: VLP3.0.5
- Resolution:  $640 \times 360$ ,  $640 \times 480$ ,  $1280 \times 720$ ,  $1280 \times 960$ ,  $1920 \times 1080$ ,  $2592 \times 1944$ ,  $3840 \times 2160$
- Test command: Refer test script files Video\_codec\*/Test\_program/Video\_decode/test\_case\_\*
- Device: G2H, G2M, G2N, G2E, G2L

## 2.8 Video encoding performance

- Benchmark software: gstreamer
- Version: VLP3.0.5
- Resolution:  $640 \times 360$ ,  $640 \times 480$ ,  $1280 \times 720$ ,  $1280 \times 960$ ,  $1920 \times 1080$ ,  $2592 \times 1944$ ,  $3840 \times 2160$
- Test command: Refer test script files Video\_codec\*/Test\_program/Video\_encode/test\_case\_\*
- Device: G2H, G2M, G2N, G2E, G2L

## 2.9 Video codec performance

- Bench mark software: gstreamer
- Version: VLP3.0.5
- Resolution:  $640 \times 360$ ,  $640 \times 80$ ,  $1280 \times 720$ ,  $1280 \times 960$ ,  $1920 \times 1080$ ,  $2592 \times 1944$ ,  $3840 \times 2160$
- Test command: Refer test scri[t files Video\_codec\*/Test\_program/Video\_codec/test\_case\_\*
- Device: G2H, G2M, G2N, G2E, G2L

## 2.10 Glmark2 performance

- Benchmark software: glmark2
- Version: <https://github.com/glmark2/glmark2.git> (2023.01)
- Resolution:  $640 \times 360$ ,  $640 \times 480$ ,  $1280 \times 720$ ,  $1920 \times 1080$
- Test command: Refer test script files GPU\_glmark2/02\_run\_glmark2\_\*.sh
- Device: G2H, G2M, G2N, G2E, G2L, G2LC

REVISION HISTORY	RZ/G Series Performance Guide
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Rev.	Date	Description	
		Page	Summary
1.00	Nov. 10, 2023	—	First edition issued
1.01	Nov. 24, 2023	All	Modify the title
		6, 7, 8, 9	Add unit of CPU usage (%)
		6, 7, 8, 9	Fix error in filling out Ethernet table RZ/G2M CPU usage
		27, 28, 37, 38	Add "—" to the CPU line in the table
1.02	Dec. 19, 2023	All	Modify the test result
1.03	July. 31, 2024	All	Update all test results. Add specification and illustrations.
1.04	Sep. 06, 2024	All	The overall format of the document was improved.

# General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

## 1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

## 2. Processing at power-on

The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.

## 3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements.

Follow the guideline for input signal during power-off state as described in your product documentation.

## 4. Handling of unused pins

Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

## 5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

## 6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between  $V_{IL}$  (Max.) and  $V_{IH}$  (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between  $V_{IL}$  (Max.) and  $V_{IH}$  (Min.).

## 7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

## 8. Differences between products

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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