

Linux Interface Specification Device Driver WDT

User's Manual: Software

RZ/G2L Group, RZ/V2L Group, RZ/V2N Group,
RZ/G3E Group and RZ/Five

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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.

How to Use This Manual

1. Purpose and Target Readers

This manual is designed to provide the user with an understanding of the hardware functions and electrical characteristics of the MPU. It is intended for users designing application systems incorporating the MPU.. It is intended for users developing software incorporating the processors. A basic knowledge of software development and Linux systems is necessary in order to use this document.

Particular attention should be paid to the precautionary notes when using the manual. These notes occur within the body of the text, at the end of each section, and in the Usage Notes section.

The revision history summarizes the locations of revisions and additions. It does not list all revisions. Refer to the text of the manual for details.

The following documents apply to the RZ/G2L Group, RZ/V2L Group, RZ/V2N Group, RZ/G3E Group and RZ/Five Group. Make sure to refer to the latest versions of these documents. The newest versions of the documents listed may be obtained from the Renesas Electronics Web site.

Document Type	Description	Document Title	Document No.
User's manual for Hardware	Hardware specifications (pin assignments, memory maps, peripheral function specifications, electrical characteristics, timing charts) and operation description Note: Refer to the application notes for details on using peripheral functions.	RZ/G2L Group User's Manual: Hardware	---
		RZ/V2L Group User's Manual: Hardware	---
		RZ/V2N Group User's Manual: Hardware	---
		RZ/G3E Group User's Manual: Hardware	---
		RZ/Five Group User's Manual: Hardware	---
User's manual for Software	Software specifications (basic function of Linux kernel, memory maps, interrupt, clock, pins mux, device tree)	Linux interface Specification Device Driver Watchdog	This User's manual
Application Note	Information on using peripheral functions and application examples Sample programs Information on writing programs in assembly language and C	Available from Renesas Electronics Web site.	
Renesas Technical Update	Product specifications, updates on documents, etc.		

2. Notation of Numbers and Symbols

3. Register Notation

4. List of Abbreviations and Acronyms

Abbreviation	Full Form
WDT	Watchdog Timer

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1. Overview

1.1 Overview

This manual explains the Linux Watchdog device driver in RZ/G2L and RZ/V2L Group, 2nd Generation, RZ/V2N Group, RZ/G3E Group and RZ/Five.

Note: Currently, the devices that support this function are RZ/G2L, RZ/G2LC, RZG2UL, RZ/V2L, RZ/V2N, RZ/G3E and RZ/Five.

It supports two kernel versions v5.10 and v6.1 as shown below:

- v5.10: RZ/G2L Group, RZ/V2L group and RZ/Five.
- v6.1: RZ/G2L, RZ/G2LC, RZ/V2N, RZ/G3E.

1.2 Function

This device driver supports the following functions:

- Timer start and stop support.
- Set timer out support.
- Reboot system

1.3 Reference

1.3.1 Standard

There is no reference document on standards.

1.3.2 Related documents

There are no related documents.

1.4 Restrictions

There is no restriction in this module.

1.5 Notice

There is no restriction in this module.

2. Terminology

The following table shows the terminology related to this module.

Terms	Explanation
WDT_CLK	Watchdog clock
CLK_RATE	CPG clock rate
WDTRSTB	Reset request signal

The following table shows the terminology related to the module of RZ/V2N

Terms	Explanation
WDT0_CLKP	CWDT loco clock
WDT0_CLK_LO CO	Bus clock
WDT0_RESET	Clock reset-WDT

3. Operating Environment

3.1 Hardware Environment

The following table shows the hardware needed to use this module.

Table 3-1 Hardware environment (RZ/G2L, RZ/V2L, and RZ/Five)

Name	Version	Manufacture
RZ/G2L Evaluation Board Kit	SMARC module: v01 Carrier board: v03	Renesas Electronics Europe GmbH
RZ/G2LC Evaluation Board Kit	SMARC module: v01 Carrier board: v03	Renesas Electronics Europe GmbH
RZ/G2UL Evaluation Board Kit	SMARC module: v01 Carrier board: v03	Renesas Electronics Europe GmbH
RZ/V2L Evaluation Board Kit	SMARC module: v01 Carrier board: v03	Renesas Electronics Europe GmbH
RZ/Five Evaluation Board Kit	SMARC module: v01 Carrier board: v03	Renesas Electronics Europe GmbH

Table 3-2 Hardware environment (RZ/V2N and RZ/G3E)

Name	Product number
RZ/V2N Evaluation Kit	RTK0EF0186C03000BJ
RZ/G3E SMARC Evaluation Board Kit	RTK9947E57S01000BE

3.2 Module Configuration

The following figure shows the configuration of this module.

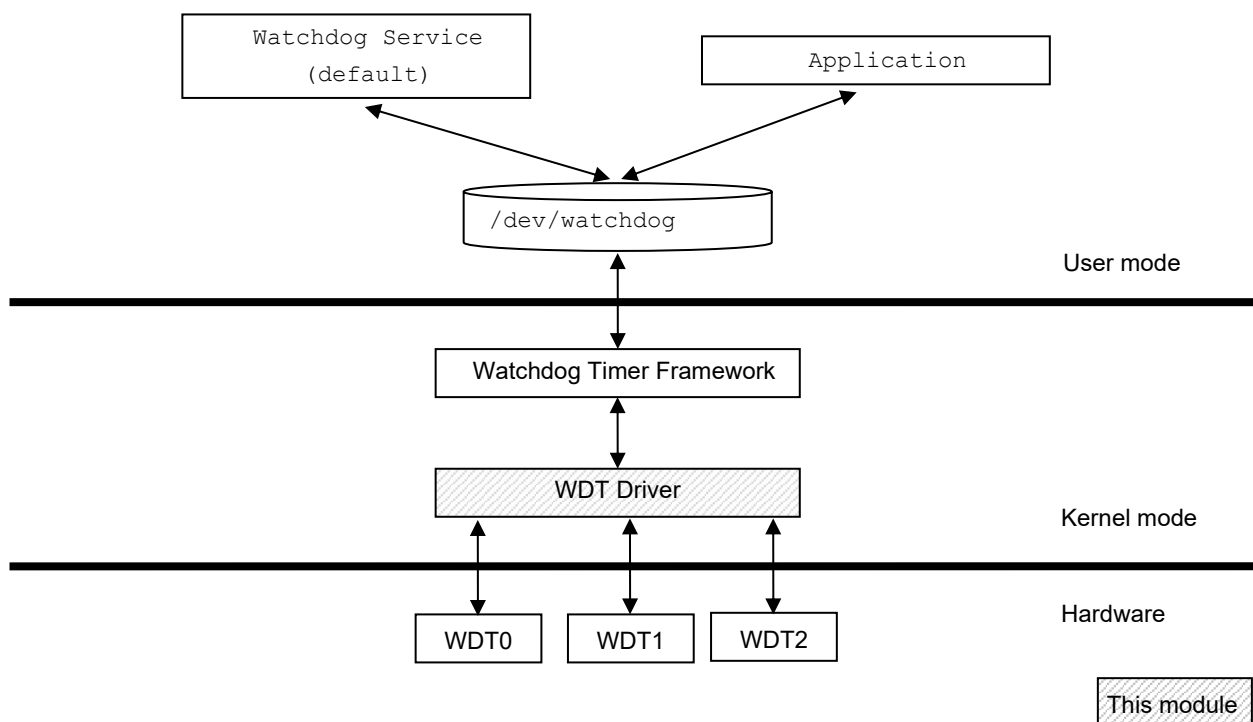


Figure 3-1 Module Configuration

Note) RZ/G2UL only supports WDT0 and WDT2.

RZ/Five and RZ/V2N only support WDT0.

RZ/G3E only support WDT1.

3.3 State Transition Diagram

There is no state transition diagram for this module. The timer state transition is controlled by Watchdog Timer Framework.

4. External Interface

Instead, the user interface is offered by Watchdog timer framework.

User application can control RWDT device via /dev/watchdog by using ioctl system call.

4.1 Device node

The following table shows the device node of this module

Table 4-1 WDT device node

Channel	Device node	Major number	Minor number
WDT0	/dev/watchdog0	245	0
WDT1	/dev/watchdog1	245	1
WDT2	/dev/watchdog2	245	2

4.2 Interface specification

The following table lists Watchdog timer framework's system call interface and the driver interface functions.

Table 4-2 System call interface

Chapter	Function name	Description
4.2.1	open	Open RWDT device file and start counting.
4.2.2	close	Close RWDT device file.
4.2.3	write	Simple operation of the Watchdog Timer framework.
4.2.4	ioctl(WDIOC_KEEPALIVE)	Refresh the RWDT counter.
4.2.5	ioctl(WDIOC_SETTIMEOUT)	Set timeout (in seconds).
4.2.6	ioctl(WDIOC_GETTIMEOUT)	Get current timeout settings (in seconds).
4.2.7	ioctl(WDIOC_GETSUPPORT)	Get device supported features.
4.2.8	ioctl(WDIOC_SETOPTIONS)	Set/clear module standby.
4.2.9	ioctl(WDIOC_GETBOOTSTATUS)	Get latest boot status.

4.2.1 open

[Overview]	Watchdog Timer initialization and start counting.	
[Function Name]	open	
[Calling format]	int open (const char *device_name, int flags)	
[Arguments]	device_name	: Device name to open (/dev/watchdog)
	flags	: Open mode (O_RDONLY / O_WRONLY / O_RDWR)
[Returns]	Greater than 0	: File descriptor (Operation success)
	Negative value	: Error
[Feature]	Watchdog Timer is initialized and start counting.	
[Remark]	System reset will be occurred if timer is not refreshed after a default timeout duration (default timeout is 60 seconds).	
	Trigger an ioctl system call with WDIOC_KEEPALIVE argument to refresh the timer.	

4.2.2 close

[Overview]	Watchdog Timer de-initialization	
[Function Name]	close	
[Calling format]	int close (int fd)	
[Arguments]	fd	: File descriptor
[Returns]	0	: Success
	Negative value	: Error
[Feature]	Control of Watchdog Timer is ended.	
	RWDT operation is stopped, driver resources are released.	
[Remark]	-	

4.2.3 write

[Overview]	Simple operation of the Watchdog Timer framework		
[Function Name]	write		
[Calling format]	ssize_t write (int fd, const void *buf, size_t count)		
[Arguments]	fd	:	File descriptor
	buf	:	Write data stock area 'V': magic close character handling. Other: keep alive ping reply.
	count	:	Write size
[Returns]	Positive value	:	Success (Write size)
	-1	:	Error
[Feature]	Writing the magic 'V' sequence allows the next close to turn off the watchdog. Other write to a watchdog device is defined as a keep alive ping. Refer to section 4.2.4 ioctl(WDIOC_KEEPAIVE) for 'keep alive ping'.		
[Remark]	-		

4.2.4 ioctl(WDIOC_KEEPAIVE)

[Overview]	Refresh the RWDT counter.		
[Function Name]	ioctl(WDIOC_KEEPAIVE)		
[Calling Format]	int ioctl (int fd, WDIOC_KEEPAIVE, 0)		
[Arguments]	fd	:	File descriptor
[Returns]	0	:	Success
	Negative value	:	Error
[Feature]	Clear the counter to initialized value.		
[Remark]	The third argument is ignored.		

4.2.5 ioctl(WDIOC_SETTIMEOUT)

[Overview]	Set timeout (in seconds).	
[Function Name]	ioctl(WDIOC_SETTIMEOUT)	
[Calling Format]	int ioctl (int fd, WDIOC_SETTIMEOUT, unsigned int *timeout)	
[Arguments]	fd	: File descriptor
	timeout	: Timeout duration [sec]
[Returns]	0	: Success
	Negative value	: Error
[Feature]	Update timeout setting with value in timeout argument. The range of the timeout input value depends on the evaluation board.	
[Remark]	-	

4.2.6 ioctl(WDIOC_GETTIMEOUT)

[Overview]	Get current timeout settings (in seconds).	
[Function Name]	ioctl(WDIOC_GETTIMEOUT)	
[Calling Format]	int ioctl (int fd, WDIOC_GETTIMEOUT, unsigned int *timeout)	
[Arguments]	fd	: File descriptor
	timeout	: To store current timeout setting [sec]
[Returns]	0	: Success
	Negative value	: Error
[Feature]	Retrieve current timeout setting and store into timeout argument.	
[Remark]	-	

4.2.7 ioctl(WDIOC_GETSUPPORT)

[Overview]	Get device supported features.	
[Function Name]	ioctl(WDIOC_GETSUPPORT)	
[Calling Format]	int ioctl (int fd, WDIOC_GETSUPPORT, struct watchdog_info *ident)	
[Arguments]	fd	: File descriptor
	ident	: To store the watchdog_info structure information
[Returns]	0	: Success
	Negative value	: Error
[Feature]	Retrieve the watchdog_info internal structure and store into ident argument. Refer to section 4.3.1 watchdog_info for details.	
[Remark]	-	

4.2.8 ioctl(WDIOC_SETOPTIONS)

[Overview]	Set/clear module standby.	
[Function Name]	ioctl(WDIOC_SETOPTIONS)	
[Calling Format]	int ioctl (int fd, WDIOC_SETOPTIONS, int *mode)	
[Arguments]	fd	: File Descriptor
	mode	: Operation mode (WDIOS_DISABLECARD: Enter module standby mode or WDIOS_ENABLECARD: Exit module standby mode)
[Returns]	0	: Success
	Negative value	: Error
[Feature]	Change operation mode of RWDT device based on value of mode argument. Refer to Table 4-3 Global Constants for supported options for option information.	
[Remark]	-	

4.2.9 ioctl(WDIOC_GETBOOTSTATUS)

[Overview]	Set/clear module standby.		
[Function Name]	ioctl(WDIOC_GETBOOTSTATUS)		
[Calling Format]	int ioctl (int fd, WDIOC_GETBOOTSTATUS, int *status)		
[Arguments]	fd	:	File Descriptor
	status	:	Reboot Status
			0: Power-On-Reset
			Other values: WatchDog resets
[Returns]	0	:	Success
	Negative value	:	Error
[Feature]	Inform the latest boot status of RWDT device.		
[Remark]	-		

4.3 Structure

The structures definitions required of this module are shown as follows.

4.3.1 watchdog_info

```
struct watchdog_info {  
    __u32 options;  
    __u32 firmware_version;  
    __u8 identity[32];  
};
```

options:

Supported options. Refer to **Table 4-3 Global Constants for supported options** for option information.

identity[32]:

Driver ID is fixed as "Renesas WDT Watchdog".

4.4 Global Variables and Constants

4.4.1 Global Variables

There are no global variables for this module.

4.4.2 Global Constants

The global constants are shown below.

Table 4-3 Global Constants for supported options

Global Constant Name	Value	Remark
WDIOF_CARDRESET	0x0020	Card previously reset the CPU
WDIOF_SETTIMEOUT	0x0080	Set timeout (in seconds).
WDIOF_MAGICCLOSE	0x0100	Supports magic close char.
WDIOF_KEEPAVIVEPING	0x8000	Keep alive ping reply.

Table 4-4 Global Constants for ioctl system call

Global Constant Name	Value	Remark
WDIOS_DISABLECARD	0x0001	Turn off the watchdog timer (module standby).
WDIOS_ENABLECARD	0x0002	Turn on the watchdog timer (exit module standby).

4.5 Definitions

4.5.1 Device information in Device Tree

The Watchdog device properties are shown below.

```
wdt0: watchdog@12800800 {
    compatible = "renesas,r9a07g044-wdt",
                 "renesas,rzg2l-wdt";
    reg = <0 0x12800800 0 0x400>;
    clocks = <&cpg CPG_MOD R9A07G044_WDT0_PCLK>,
            <&cpg CPG_MOD R9A07G044_WDT0_CLK>;
    clock-names = "pclk", "oscclk";
    interrupts = <GIC_SPI 49 IRQ_TYPE_LEVEL_HIGH>,
                <GIC_SPI 50 IRQ_TYPE_LEVEL_HIGH>;
    interrupt-names = "wdt", "perROUT";
    resets = <&cpg R9A07G044_WDT0_PRESETN>;
    power-domains = <&cpg>;
    status = "disabled";
};
```

Note: All of the information in the above device tree is used for both RZ/G2L and RZ/V2L except clocks and resets:

The Watchdog device required properties:

compatible:

Must be set to "renesas,r9a07g04{4,3}-wdt" for R9A07G04{4[L,C], UL} (RZ/G2{[L,C], UL}),
and "renesas,r9a07g054-wdt" for R9A07G054L (RZ/V2L) as a fallback.

reg:

Base address and length of the memory resource used by the WDT CH0 Watchdog Timer.

clocks:

slot 1:

The 1st cell is a node or label of CPG clock to be used.

The 2nd cell must be set to CPG_MOD.

The 3rd cell must be set to CPG_MOD R9A07G04{4,3}_WDT0_PCLK (RZ/G2{[L,C], UL}) or R9A07G054_WDT0_PCLK (RZ/V2L).

slot 2:

The 1st cell is a node or label of CPG clock to be used.

The 2nd cell must be set to CPG_MOD.

The 3rd cell must be set to CPG_MOD R9A07G04{4,3}_WDT0_CLK (RZ/G2{[L,C], UL}) or R9A07G054_WDT0_CLK (RZ/V2L).

interrupt:

slot 1: GIC_SPI 49 IRQ_TYPE_LEVEL_HIGH

slot 2: GIC_SPI 50 IRQ_TYPE_LEVEL_HIGH

reset:

release reset state: R9A07G04{4,3}_WDT0_PRESETN (RZ/G2{[L,C], UL})
or R9A07G054_WDT0_PRESETN (RZ/V2L).

power domain: Must be set to always on.

Please set Watchdog default timer out 60 second to "timeout-sec" of device tree file (rzg2l-smarc.dtsi or r9a09g056.dtsi with RZ/V2N) in arch/arm64/boot/dts/renesas directory.

```
&wdt0 {  
    status = "okay";  
    timeout-sec = <60>;  
};  
  
&wdt1 {  
    status = "okay";  
    timeout-sec = <60>;  
};  
  
&wdt2 {  
    status = "okay";  
    timeout-sec = <60>;  
};
```

- RZ/Five: WDT nodes: arch/riscv/boot/dts/renesas/r9a07g043f.dtsi

```
wdt0: watchdog@12800800 {  
    compatible = "renesas,r9a07g043-wdt",  
                "renesas,rzg2l-wdt";  
    reg = <0 0x12800800 0 0x400>;  
    clocks = <&cpg CPG_MOD R9A07G043_WDT0_PCLK>,  
            <&cpg CPG_MOD R9A07G043_WDT0_CLK>;  
    clock-names = "pclk", "oscclk";  
    interrupts = <GIC_SPI 49 IRQ_TYPE_LEVEL_HIGH>,  
                <GIC_SPI 50 IRQ_TYPE_LEVEL_HIGH>;  
    interrupt-names = "wdt", "perROUT";  
    resets = <&cpg R9A07G043_WDT0_PRESETN>;  
    power-domains = <&cpg>;  
    status = "disabled";  
};
```

- RZ/V2N: WDT nodes: arch/arm64/boot/dts/renesas/r9a09g056.dtsi
- RZ/G3E: WDT nodes: arch/arm64/boot/dts/renesas/r9a09g047.dtsi

```
wdt0: watchdog@11C04000 {
    compatible = "renesas,r9a09g056-wdt";
    reg = <0 0x11C00400 0 0x400>;
    clocks = <&cpg CPG_MOD 0x4B>,
            <&cpg CPG_MOD 0x4C>;
    clock-names = "pclk", "oscclk";
    resets = <&cpg 0x75>;
    power-domains = <&cpg>;
    status = "disabled";
};
```

Note: All the information in the above device tree is used for RZ/V2N and RZ/G3E.

The Watchdog device required properties:

compatible:

Must be set to "renesas,r9a09g047-wdt" for R9A09G047 (RZ/G3E).

Must be set to "renesas,r9a09g056-wdt" for R9A09G056 (RZ/V2N).

reg:

Base address and length of the memory resource used by the WDT CH0 Watchdog Timer.

clocks:

slot 1:

The 1st cell is a node or label of CPG clock to be used.

The 2nd cell must be set to CPG_MOD.

The 3rd cell must be set to CPG_MOD clock index (0x4B for RZ/V2N and RZ/G3E).

slot 2:

The 1st cell is a node or label of CPG clock to be used.

The 2nd cell must be set to CPG_MOD.

The 3rd cell must be set to CPG_MOD clock index (0x4C for RZ/V2N and RZ/G3E).

reset:

release reset state: R9A09G056 RESET INDEX (0x75 for RZ/V2N and RZ/G3E).

power domain: Must be set to always on.

5. Watchdog Service

Watchdog service update based on watchdog service from poky. In both VLP v3.0.x and v4.0.x environment, there is a Watchdog Service in the user space that automatically runs background to reboot board when the system is frozen. This service takes control of WDT watchdog driver immediately.

If this is not expected, and user wants to control WDT watchdog driver manually, please stop it or disable it follow below instruction.

5.1 Background Task

Watchdog Service is a systemd service, which is used to generate a reset when the system is frozen due to malfunction.

It is automatically loaded in root filesystem and runs background during operation with binary file:

/usr/sbin/watchdog

5.2 Interface Specification

To control Watchdog Service interface, we can refer similar commands of systemd service on linux. The following table shows supported commands:

Table 5-1 Watchdog Service commands

Number	Command	Description
1	systemctl stop watchdog	Stop running Watchdog Service
2	systemctl start watchdog	Start running Watchdog Service
3	systemctl restart watchdog	Restart Watchdog Service
4	systemctl disable watchdog	Disable Watchdog Service in root filesystem
5	systemctl enable watchdog	Enable Watchdog Service in root filesystem
6	Systemctl status watchdog	Status running Watchdog Service

To turn off Watchdog Service and use the WDT device as your purpose:

Stop watchdog service: Turn off only once. If you reset/turn off board, watchdog service still starts again.

- systemctl stop watchdog

Disable watchdog service: Turn off completely. If you reset/turn off board, watchdog service does not start.

- systemctl disable watchdog

6. Integration

6.1 Directory Configuration

The directory configuration shows below.

```
——— drivers/watchdog/ ——— rzg2l_wdt.c : RCLK Watchdog Timer source file
```

Figure 6-1 Directory Configuration

```
——— drivers/watchdog/ ——— rzv2h_wdt.c : Watchdog Timer source file
```

Figure 6-2 Directory Configuration for RZ/V2N and RZ/G3E

6.2 Integration Procedure

To enable the function of this module, make the following setting with kernel configuration.

```
Device Drivers --->
[*] Watchdog Timer Support --->
<*> Renesas RZ/G2L WDT Watchdog
```

Figure 6-3 Kernel configuration

```
Device Drivers --->
[*] Watchdog Timer Support --->
<*> Renesas RZ/V2H(P) WDT Watchdog
```

Figure 6-4 Kernel configuration RZ/V2N and RZ/G3E

Lists the kernel config symbols to support WDTs for RZ/G2L and RZ/V2L Group.

```
CONFIG_RENESAS_G2LWDT=y
```

Figure 6-5 Kernel config symbols

```
CONFIG_RENESAS_RZV2HWDT=y
```

Figure 6-6 Kernel config symbols (RZ/V2N and RZ/G3E)

6.3 Option Setting

6.3.1 Module parameters

There are no module parameters.

6.3.2 Kernel parameters

There are no kernel parameters.

REVISION HISTORY	Linux Interface Specification Device Driver WDT User's Manual: Software
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Rev.	Date	Description	
		Page	Summary
0.50	Apr. 31, 2021	—	First Edition issued
1.0	Jul. 15, 2021	—	No modification, keep version to keep consistent with other documents
1.1	Sep. 15, 2021	—	Merge RZ/G2L driver manual with RZ/V2L
1.2	Feb. 15, 2022	—	Add RZ/G2UL, RZ/G2LC device
1.3	Mar. 31, 2022	12	Update information for Devicetree
		14	Correct Kernel config symbols
1.4	May. 31, 2022	—	No modification, change version to keep consistent with other documents
1.5	June. 24, 2022	—	Add RZ/Five device
1.6	Sep. 15, 2022	—	Update information for WDT and Update Watchdog service
1.7	Dec. 15, 2022	—	No modification, change version to keep consistent with other documents
1.8	Mar. 15, 2023	—	No modification, change version to keep consistent with other documents
1.9	May. 30, 2025	1	Update list of abbreviations and acronyms Add MPU information support for both kernel versions v5.10 and v6.1.
		14	Remove watchdog-test replace with watchdog service from poky Add systemctl status watchdog
		15	Correct figure 6-1,6-2,6-3
1.10	Jun. 30, 2025	—	Add RZ/V2N support information
1.11	Jul. 22, 2025	—	Add RZ/G3E support information

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