

32-bit RISC Microcontroller Reference Manual

Comparator (COMP-D)

Revision 1.0

2026-01

Toshiba Electronic Devices & Storage Corporation

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Preface

Related Document

Document name
Datasheet
Product Information
Clock Control and Operation Mode
Exception

Conventions

- Numeric formats follow the rules as shown below:
 Hexadecimal: 0xABC
 Decimal: 123 or 0d123 - Only when it needs to be explicitly shown that they are decimal numbers.
 Binary: 0b111 - It is possible to omit the "0b" when the number of bits can be distinctly understood from a sentence.
- "_N" is added to the end of signal names to indicate low active signals.
- It is called "assert" that a signal moves to its active level, "deassert" to its inactive level.
- When two or more signal names are referred, they are described like as [m:n].
 Example: S[3:0] shows four signal names S3, S2, S1 and S0 together.
- The characters surrounded by *[]* defines the register.
 Example: *[ABCD]*
- "N" substitutes suffix number of two or more same kind of registers, fields, and bit names.
 Example: *[XYZ1]*, *[XYZ2]*, *[XYZ3]* → *[XYZn]*
- "x" substitutes suffix number or character of units and channels in the register list.
- In case of unit, "x" means A, B, and C, ...
 Example: *[ADACR0]*, *[ADBCR0]*, *[ADCCR0]* → *[ADxCR0]*
- In case of channel, "x" means 0, 1, and 2, ...
 Example: *[T32A0RUNA]*, *[T32A1RUNA]*, *[T32A2RUNA]* → *[T32AxRUNA]*
- The bit range of a register is written like as [m: n].
 Example: Bit[3: 0] expresses the range of bit 3 to 0.
- The configuration value of a register is expressed by either the hexadecimal number or the binary number.
 Example: *[ABCD]<EFG>* = 0x01 (hexadecimal), *[XYZn]<VW>* = 1 (binary)
- Word and byte represent the following bit length.
 Byte: 8 bits
 Half word: 16 bits
 Word: 32 bits
 Double word: 64 bits
- Properties of each bit in a register are expressed as follows:
 R: Read only
 W: Write only
 R/W: Read and write are possible.
- Unless otherwise specified, register access supports only word access.
- The register defined as "Reserved" must not be rewritten. Moreover, do not use the read value.
- The value read from the bit having default value of "-" is unknown.
- When a register containing both of writable bits and read-only bits is written, read-only bits should be written with their default value, In the cases that default is "-", follow the definition of each register.
- Reserved bits of the write-only register should be written with their default value. In the cases that default is "-", follow the definition of each register.
- Do not use read-modified-write processing to the register of a definition which is different by writing and read out.

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Terms and Abbreviation

Some of abbreviations used in this document are as follows:

COMP	Comparator
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1. Outline

Function classification	Function		Operation description
Voltage comparison	Reference voltage		Two reference voltages can be selected.
	Analog input		Three analog inputs can be selected.
	Comparison result monitor		Comparison results between analog input voltage and reference voltage can be monitored.
	Comparison result output	Output signal	The comparison result is output as one of the following signals. COMP interrupt signal OVV detection signal EMG detection signal
		Output condition	Signal output conditions can be selected. Analog input voltage < reference voltage Analog input voltage > reference voltage

2. Configuration

The channel unit configuration is as follows.

"x" represents the channel number. (x = 0 to 7)

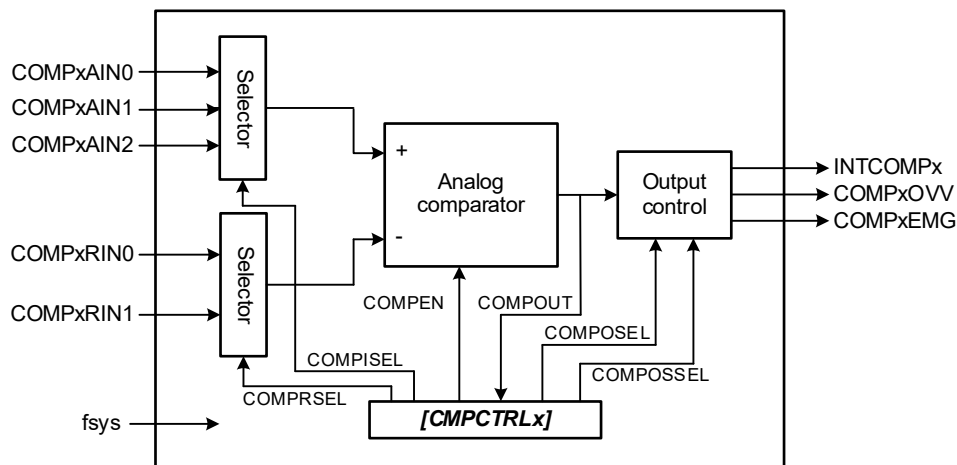


Figure 2.1 COMP Block Diagram

Table 2.1 List of Signals

No	Symbol	Signal name	I/O	Related reference manual
1	fsys	System clock	Input	Clock Control and Operation Mode
2	COMPxAIN0 to 2	Analog input 0 to 2	Input	Product Information
3	COMPxRIN0, 1	Reference voltages 0, 1	Input	Product Information
4	INTCOMPx	COMP interrupt	Output	Exception
5	COMPxOVV	OVV detection	Output	Product Information
6	COMPxEMG	EMG detection	Output	Product Information

3. Functional Description

3.1. Clock Supply

When using the comparator, it is necessary to set the clock supply. For details, refer to "Clock Supply Setting Function" of "Clock Control and Operation Mode" in the reference manual.

3.2. Voltage Comparison

The analog comparator starts operating when $[CMPCTRLx]/<CMPEN>$ is set to "1".

The analog comparator compares the input voltage with the reference voltage, and outputs "1" if the analog input voltage is higher, or "0" if the reference voltage is higher. The comparison result can be read from $[CMPCTRLx]/<CMPOUT>$.

The reference voltage can be selected from two reference voltages. The setting is made with $[CMPCTRLx]/<CMPRSEL>$. The reference voltage should be enabled before the analog comparator starts operating, and disabled after it stops operating.

The analog input can be selected from three inputs. The setting is made with $[CMPCTRLx]/<CMPSEL[1:0]>$.

For the connection of the reference voltage and analog input, refer to the reference manual "Product Information".

The time of T_{sta} is required from operation setting to starting. The comparison response time is T_{comp} . For information on T_{sta} and T_{comp} , refer to "Electrical Characteristics" in the "Datasheet".

3.3. Output of Comparison Result

The comparison result can be output as interrupt, OVV detection or EMG detection of programmable motor control circuit (PMD). The output is selected with $[CMPCTRLx]/<CMPOSEL[1:0]>$.

The interrupt, OVV detection and EMG detection are all "high" active signals.

The condition for setting the output signal to "High" can be selected from when the analog input is greater than or less than the reference voltage. The setting is made with $[CMPCTRLx]/<CMPOSSEL>$.

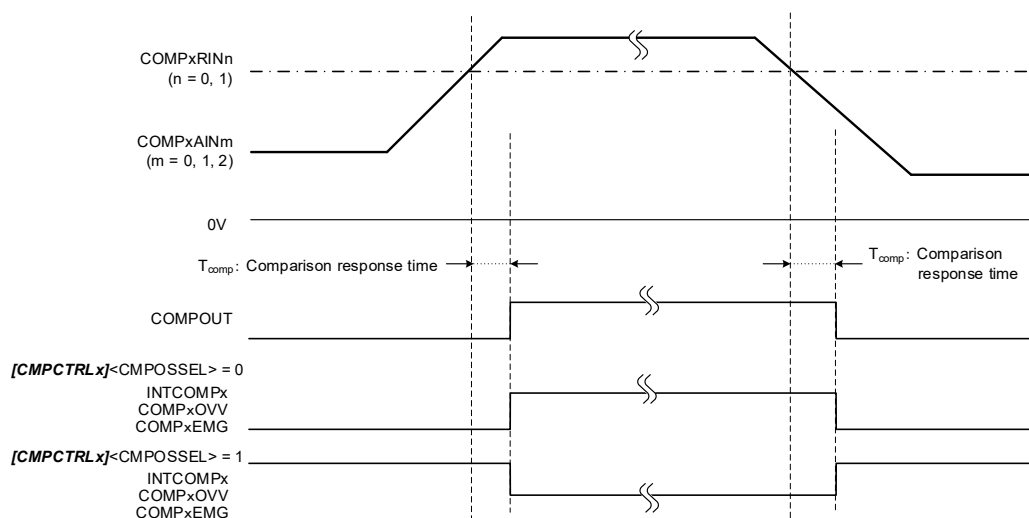


Figure 3.1 COMP Operation

A window comparator can be configured by using two channels of comparators to detect when the upper and lower limits are exceeded.

The following is an example in which the output of channel 0 is "High" when the voltage exceeds the upper voltage limit and the output of channel 1 is "High" when the voltage falls below the lower voltage limit.

- Setting of Channel 0**
 Select the reference voltage to be used as the upper limit of the voltage by $[CMPCTRL0]<CMPRSEL>$.
 Select the same analog input as channel 1 by $[CMPCTRL0]<CMPISEL[1:0]>$.
 Set "0" (outputs "High" when analog input is higher than the reference voltage) to $[CMPCTRL0]<CMPOSSEL>$.
 Select the same output as channel 1 by $[CMPCTRL0]<CMPOSEL[1:0]>$.
- Setting of Channel 1**
 Select the reference voltage to be used as the lower limit of the voltage by $[CMPCTRL1]<CMPRSEL>$.
 Select the same analog input as channel 0 by $[CMPCTRL1]<CMPISEL[1:0]>$.
 Set "1" (output "High" when analog input is lower than the reference voltage) to $[CMPCTRL1]<CMPOSSEL>$.
 Select the same output as channel 0 by $[CMPCTRL1]<CMPOSEL[1:0]>$.

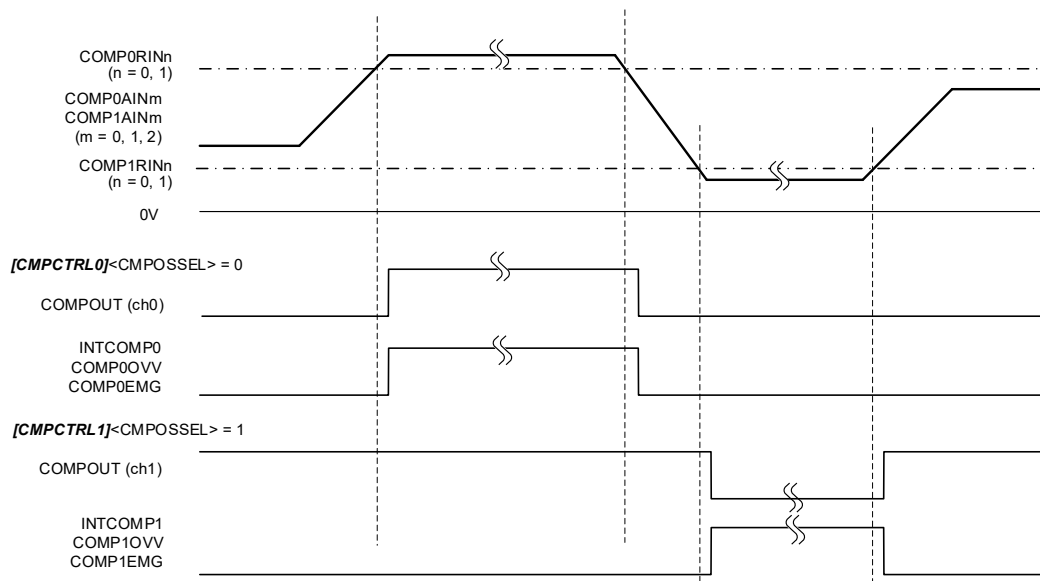


Figure 3.2 COMP Operation Using Two Channels

4. Registers

4.1. List of Register

The control registers and addresses are as follows.

The number of control registers varies depending on the product. For details, refer to the reference manual "Product Information".

Peripheral function		Channel/unit	Base address
			TYPE1
Comparator	COMP	-	0x4005D100

Register name		Address (Base+)
Comparator Control Register 0	[CMPCTRL0]	0x0000
Comparator Control Register 1	[CMPCTRL1]	0x0004
Comparator Control Register 2	[CMPCTRL2]	0x0008
Comparator Control Register 3	[CMPCTRL3]	0x000C
Comparator Control Register 4	[CMPCTRL4]	0x0010
Comparator Control Register 5	[CMPCTRL5]	0x0014
Comparator Control Register 6	[CMPCTRL6]	0x0018
Comparator Control Register 7	[CMPCTRL7]	0x001C

4.2. Details of Registers

4.2.1. [CMPCTRLx] (Comparator Control Register x: x = 0 to 7)

Bit	Bit symbol	After reset	Type	Function
31:8	-	0	R	Read as "0".
7	CMPOUT	0	R	Comparison result 0: Analog input voltage < Reference voltage 1: Analog input voltage > Reference voltage
6:5	CMPOSEL[1:0]	00	R/W	Output signal selection 00: EMG detection signal 01: OVV detection signal 10: COMP interrupt signal 11: Reserved
4	CMPOSSEL	0	R/W	Output condition 0: Outputs "High" when the analog input is higher than the reference voltage 1: Outputs "High" when the analog input is lower than the reference voltage
3	CMPRSEL	0	R/W	Reference voltage selection 0: Select reference voltage 0 1: Select reference voltage 1
2:1	CMPISEL[1:0]	00	R/W	Analog input selection 00: Select analog input 0 01: Select analog input 1 10: Select analog input 2 11: Reserved
0	CMPEN	0	R/W	Operation control 0: Stop 1: Operation

Note: When <CMPEN> = 1, do not change <CMPISEL[1:0]>, <CMPRSEL>, <CMPOSSEL>, and <CMPOSEL[1:0]>.

5. Revision History

Table 5.1 Revision History

Revision	Date	Description
1.0	2026-01-30	- First release

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