

## 1 Over View

RAA305315GBM is general-purpose OIS driver IC. This is a small size single chip IC constituted by the control block built in 32 bits RISC microcomputer and DSP, and by the driver block built in hall signal processing circuit and VCM driver.

Supports open/closed loop AF control.

## 2 Features

### Applications

Smart phone, Tablet

### Driver Block

#### [IS]

- (1) Built-in 2 channels H-bridge drivers  
Composition : ISX, ISY
- (2) Built-in 2 channels Hall signal processing circuits  
Composition :  
Constant Current Bias --- 2 channels  
Gain Amp --- 2 channels (with gain resistor)
- (3) Built-in 12bit-ADC with 6 channels input selector
- (4) Configurable for VCM/Piezo/SMA drive
- (5) PWM/Linear drive

#### [AF]

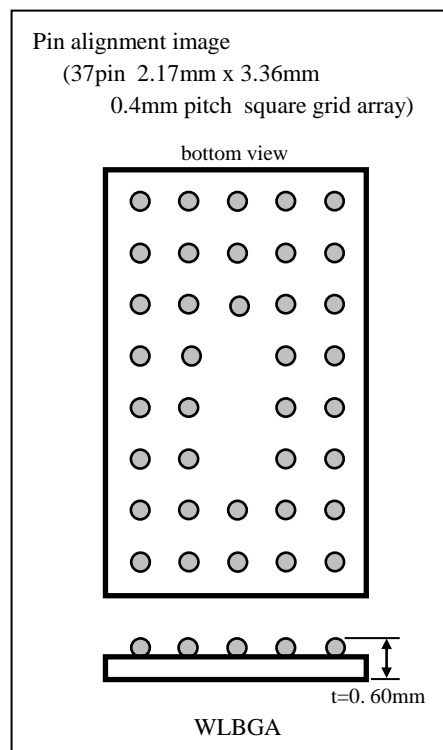
- (1) Built-in H-bridge AF driver for Bi-direction setting
- (2) Built-in 1 channels Hall signal processing circuits  
Supports open/closed loop AF control
- (3) Configurable for VCM drive
- (4) Linear drive

### Controller

- (1) Built-in 32bit RISC CPU : Arm® Cortex®-M0+  
Manufactured by Renesas Technology Corp. under license from ARM Limited
- (2) Built-in Code Flash ROM(32KB)
- (3) Built-in RAM(4KB) for program
- (4) Built-in DSP(GREEN\_DSP\_V2)
- (5) Built-in SPI for gyro sensor
- (6) Built-in Timer (16bit) 4 channels
- (7) Built-in IIC serial interface 1 channel
- (8) Built-in General purpose I/O 8lines (with interruption function)
- (9) Clock frequency : Built-in PLL (x4, x6, x8, x12, x16)  
For system clock ----- 32.4MHz(Max)  
For PWM clock of motor control ----- 162MHz(Max)  
For SPI serial clock ----- 4MHz(Max)  
For IIC serial clock ----- 1MHz(Max, Fast Mode+)

### Others

- (1) Built in POR(power on reset), TSD(thermal shut down)
- (2) Built in Power save mode
- (3) Built in IS/AF Driver control synchronized signal from Image Sensor



## ABSOLUTE MAXIMUM RATING (Ta=25 degrees C)

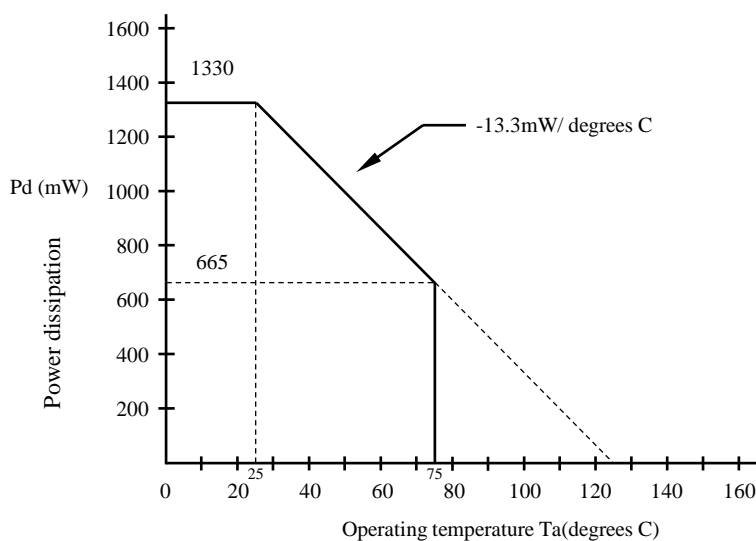
ITEM	SYMBOL	RATING	UNIT	NOTES
Power dissipation	Pd	1330	mW	note1 (Ta=25 degrees C)
Thermal derating	Kθ	-13.3	mW/degrees C	note1 (Ta=25 degrees C)
Maximum junction temperature	Tj	125	degrees C	
Storage temperature	Tstg	-40 to 125	degrees C	
Power supply 1	VDD	4.6	V	note2
Power supply 2	VCC	4.6	V	note2
Power supply 3	VM	4.6	V	note2
Input voltage of terminals	Vin	-0.3 to VDD + 0.3	V	note3
DC output current	Iout	+/- 600	mA	note4
Peak output current	Iop	+/- 800	mA	note4 pulse width<10ms,Duty<=20%

Notes note1 : Glass epoxy board: 76mm × 114mm × 1.6mm 4layers board(Cu cover rate:1-layer 20%,2-layer 100%,3-layer 100%,4-layer 20%)

note2 : Don't impress a power supply conversely in principle.

note3 : Don't impress more than power supply voltage and below GND voltage in principle.

note4 : Don't exceed the specification of output current, when more than one CH use them, turning on at the same time.



Notes The power consumption of this IC has the dominant electric power which each output transistor consumes.

### Output transistor power consumption formula

$$(\text{Output current})^2 \times R_{on} \quad (\text{ex.}) (400\text{mA})^2 \times 3.3 \text{ ohm} = 528\text{mW}$$

When ambient air temperature is 25 degrees C or more, please install a heat sink with reference to the above figure if needed.

## RECOMMENDED OPERATING CONDITIONS (Ta=25 degrees C)

ITEM	SYMBOL	RATING	UNIT	NOTES
Power supply 1	VDD	1.7 to 3.3	V	
Power supply 2	VCC	2.7 to 3.3	V	note1
Power supply 3	VM	2.7 to 3.3	V	note1

note1 : VCC and VM are designed on the assumption that it is used on the same voltage except the reset mode.

However, there is no problem if the voltage difference is less than 0.2V.

## RATED POWER SUPPLY VOLTAGE (Ta=25 degrees C)

ITEM	SYMBOL	RATING	UNIT	NOTES
Power supply 1	VDD	1.8	V	
Power supply 2	VCC	2.8	V	
Power supply 3	VM	2.8	V	

## OPERATING TEMPERATURE

ITEM	SYMBOL	RATING	UNIT	NOTES
Operating temperature	Topr	-20 to 75	degrees C	note1

note1 : Flash write / erase : -10 to 50 degrees C

## PIN LOCATION

Bottom View

	5	4	3	2	1
A	RESET_N	VDD	SPI_CS	SPI_MOSI	SPI_MISO
B	TEST2	EXCLK	SWCLK	SPI_SCK	IMGHD
C	SCL	VSS	MON (analog monitor)	SWDIO	TEST1
D	SDA	VCC		HAI SX_INN	HDISX_OUT
E	AD2	HAAF_INN		HDISY_OUT	HAI SX_INP
F	TEST3	HAAF_INP		HAI SY_INN	HAI SY_INP
G	RSENS	OUTAF_A	OUTISX_B	PGND	HDAF_OUT
H	VM	OUTAF_B	OUTISX_A	OUTISY_A	OUTISY_B

Power Supply
GND
Driver
Sensing circuit
Controller
RENESAS TEST (Don't Connect)

TopView

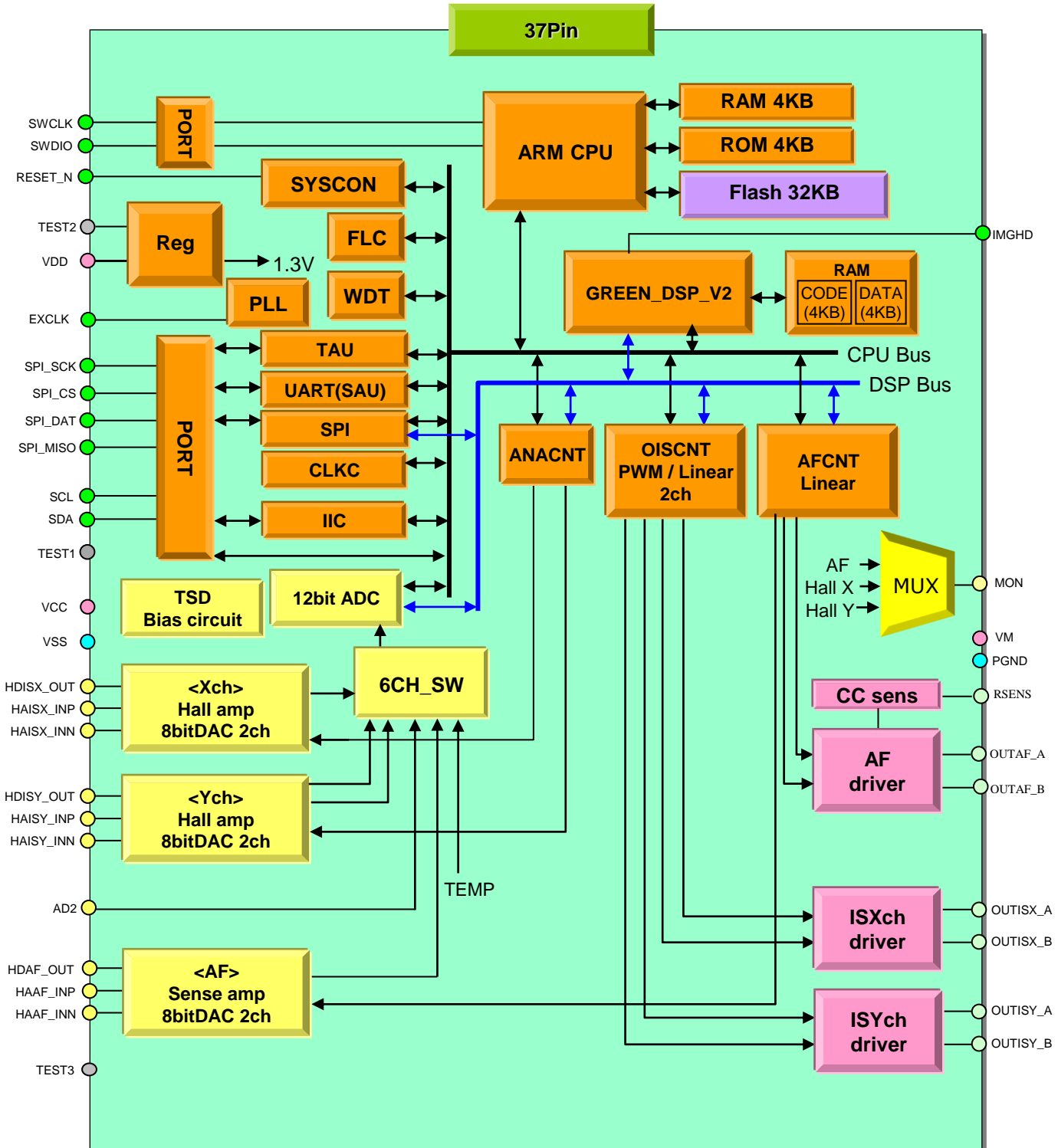
	1	2	3	4	5
A	SPI_MISO	SPI_MOSI	SPI_CS	VDD	RESET_N
B	IMGHD	SPI_SCK	SWCLK	EXCLK	TEST2
C	TEST1	SWDIO	MON (analog monitor)	VSS	SCL
D	HDISX_OUT	HAI SX_INN		VCC	SDA
E	HAI SX_INP	HDISY_OUT		HAAF_INN	AD2
F	HAI SY_INP	HAI SY_INN		HAAF_INP	TEST3
G	HDAF_OUT	PGND	OUTISX_B	OUTAF_A	RSENS
H	OUTISY_B	OUTISY_A	OUTISX_A	OUTAF_B	VM

## Pin Functions

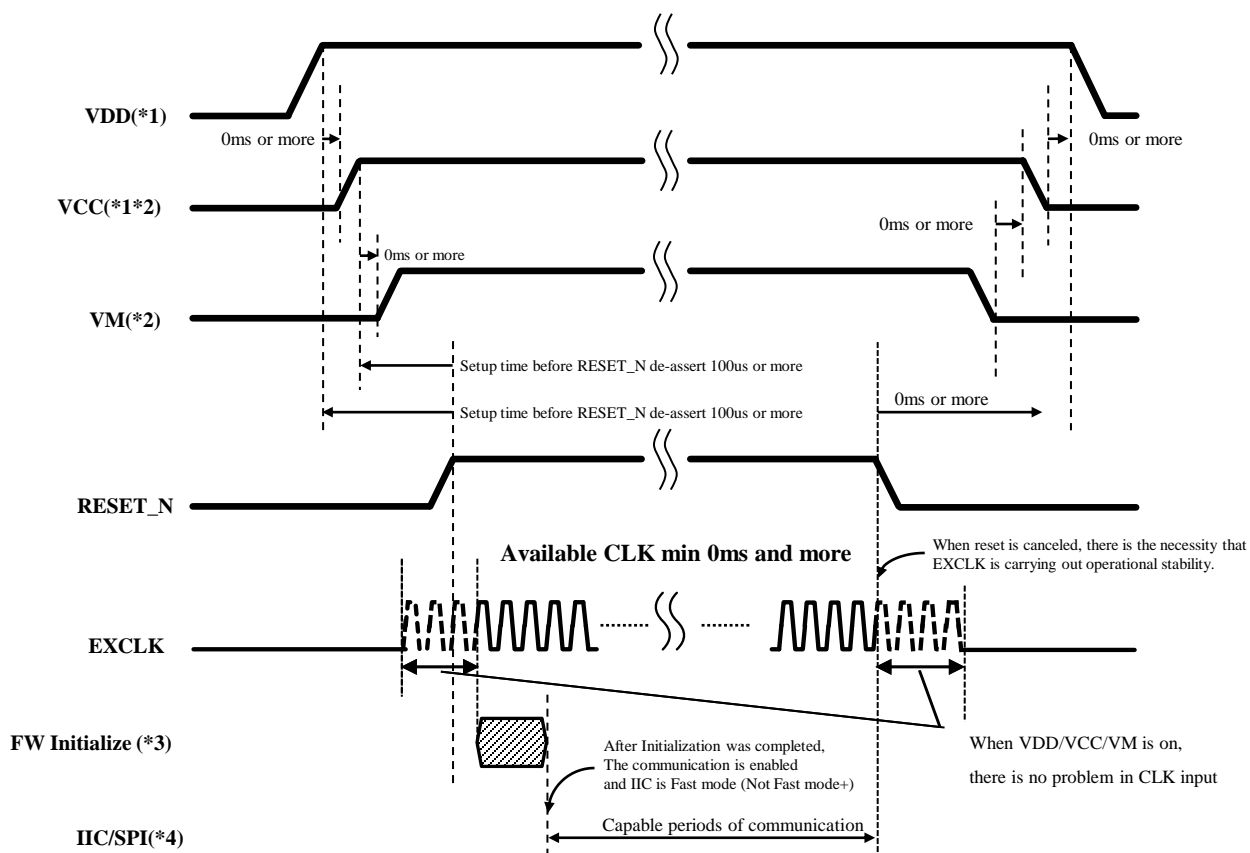
No.	Land Address	Pin	Sub Function GPIO	I/O Level	IN/OUT Power/GND	Initial Condition *4	Function	Termination of unused pin	
1	D4	VCC	-	-	Power supply	-	Power supply for analog block and flash	-	
2	A4	VDD					Power supply for I/O and digital block	-	
3	H5	VM					Power supply for IS/AF driver	-	
4	G2	PGND	-	-	GND	-	Power system GND	-	
5	C4	VSS					Digital and analog GND	-	
6	H3	OUTISX_A	-	VM	OUT	Z	ISXch driver output A	*1	
7	G3	OUTISX_B	-		OUT	Z	ISXch driver output B	*1	
8	H2	OUTISY_A	-		OUT	Z	ISYch driver output A	*1	
9	H1	OUTISY_B	-		OUT	Z	ISYch driver output B	*1	
10	G4	OUTAF_A	-		OUT	Z	AFch driver output A	*1	
11	H4	OUTAF_B	-		OUT	Z	AFch driver output B	*1	
12	G5	RSSENS	-		OUT	Z	AF current monitor	*1	
13	C3	MON	-		OUT	Z	To Monitor Loop Gain	*1	
14	D1	HDISX_OUT	-		OUT	Z	Hall ISXch constant current output	*1	
15	E1	HAISX_INP	-		IN	Z	Hall amplifier ISX non-inverting input	*2	
16	D2	HAISX_INN	-		IN	Z	Hall amplifier ISX inverting input		
17	E2	HDISY_OUT	-	OUT	Z	Hall ISYch constant current output	*1		
18	F1	HAISY_INP	-	IN	Z	Hall amplifier ISY non-inverting input	*2		
19	F2	HAISY_INN	-	IN	Z	Hall amplifier ISY inverting input			
20	G1	HDAF_OUT	-	OUT	Z	AF constant current output	*1		
21	F4	HAAF_INP	-	IN	Z	Hall amplifier AF non-inverting input	*2		
22	E4	HAAF_INN	-	IN	Z	Hall amplifier AF inverting input			
23	E5	AD2	-	IN	Z	ADC input	*2		
24	A5	RESET_N	-	IN	Z	Reset	-		
25	C5	SCL	GPIO00	VDD	IN/OUT	Z	SCL for I2C Interface / GPIO port GPIO00 / UART RXD00 / CPU INTIN0 / DSP IN0	*3	
26	D5	SDA	GPIO01		IN/OUT	Z	SDA for I2C Interface / GPIO port GPIO01 / UART TXD00 / CPU INTIN1 / DSP IN1	*3	
27	B2	SPL_SCK	GPIO02		IN/OUT	Z	CLOCK input or output for SPI (SCK) / GPIO port GPIO02 / CPU INTIN2 / DSP IN2	*3	
28	A2	SPL_MOSI	GPIO03		IN/OUT	Z	Data input for SPI (DAT) / Data output for SPI (MOSI) / GPIO port GPIO03 / CPU INTIN3 / DSP IN3	*3	
29	A1	SPL_MISO	GPIO07		IN/OUT	Z	Data input for SPI (MISO) / GPIO port GPIO07 / CPU INTIN7	*3	
30	A3	SPL_CS	GPIO04		IN/OUT	Z	Chip select input or output for SPI (CS) / GPIO port GPIO04 / TAU TO0, TO1, TO2 / CPU INTIN4	*3	
31	B4	EXCLK	-		IN	Z	External CLOCK input	-	
32	B3	SWCLK	GPIO05		IN/OUT	Z (Pull-up)	Clock input for Debugger / GPIO port GPIO05 / UART RXD00 / TAU TI2 / CPU INTIN5	*3	
33	C2	SWDIO	GPIO06		IN/OUT	Z (Pull-up)	Data input/output for Debugger / GPIO port GPIO06 / UART TXD00 / TAU TI1 / CPU INTIN6	*3	
34	B1	IMGHD	-		IN	Z	Image Sensor Sync signal	*2	
35	C1	TEST1	-		-	IN	Pull-up	TEST for RENESAS	*1
36	B5	TEST2	-		-	OUT	-	TEST for RENESAS	*1
37	F5	TEST3	-		-	IN	Z	TEST for RENESAS	*1

- \*1 Open
- \*2 Connect to VSS
- \*3 'Connect to VSS' or  
'Pin is Open  
,Pin enabled in PORTSEL register  
,Switch to GPIO in PNMOD register  
,Output Enable in GPIOOEE register  
and output data fixed to '0' in GPIOODT register.'
- \*4 An initial value is not influenced by the RESET\_N terminal.

## TOTAL BLOCK



## POWER SUPPLY SEQUENCE



### Notes at the time of power-on

- \*1 Please apply VDD before VCC.
- \*2 Please apply VCC before VM.

### Notes at the time of power-down

- \*1 Please power down VCC after VM
- \*2 Please power down VDD after VCC.

### Notes at the time of FW Initialization

- \*3 The periods of FW Initialization is depend on FW.  
CPU initialize the registers of IIC during the periods of FW Initialization.

### Notes at the time of Actuator drive

- \*4 If the clock stops while driving the actuator, the drive current will flow continuously and the actuator may be damaged. Please do not stop the clock while driving.

## Consumption current

If not specified, VDD=1.8V,VCC=VM=2.8V Ta=25degreeC

Item	Symbol	Condition	Standard Value			Unit	Remarks
			min	typ	max		
VDD current	IVDIn	EXCLK=27MHz PLL=162MHz,System Clock=32.4MHz Linear mode	-	10	14	mA	*1
VCC current	IVCIn	All output function without load.HA* DAC setting code 80h,HB*DAC setting code 00h,BTL_IS*DAC & AF_BTL setting Default.	-	4.5	6.75	mA	
VM current	IVMpw	All output function without load.HA* DAC setting code 80h,HB*DAC setting code 00h PWM mode	-	0.8	1.2	mA	*2
VM current	IVMIn	All output function without load.HA* DAC setting code 80h,HB*DAC setting code 00h,BTL_IS*DAC & AF_BTL setting Default.	-	7.6	11.4	mA	

Note \*1:These are reference data. These are depend on FW processing.  
\*2: These are reference , not guaranteed.

## Electrical characteristics (POR threshold)

If not specified, Ta=25degreeC

Item	Symbol	Condition	Standard Value			Unit	Remarks
			min	typ	max		
UVP (Under Voltage Protect)							
PVO detect level	PVO	Check on VCC > Vcore	1.30	1.55	1.67	V	
LVI detect level 2	LVI2	Check on VCC level, LVITH=set at "low level"	2.10	2.40	2.70	V	*1
LVI detect level 3	LVI3	Check on VCC level, LVITH=set at "high level"	2.30	2.60	2.90	V	*1,*2
POR detect level	POR	Check on VDD	1.30	1.60	1.68	V	

Note \*1: These are reference , not guaranteed.  
Note \*2: Use this with VCC=3.0V or more.

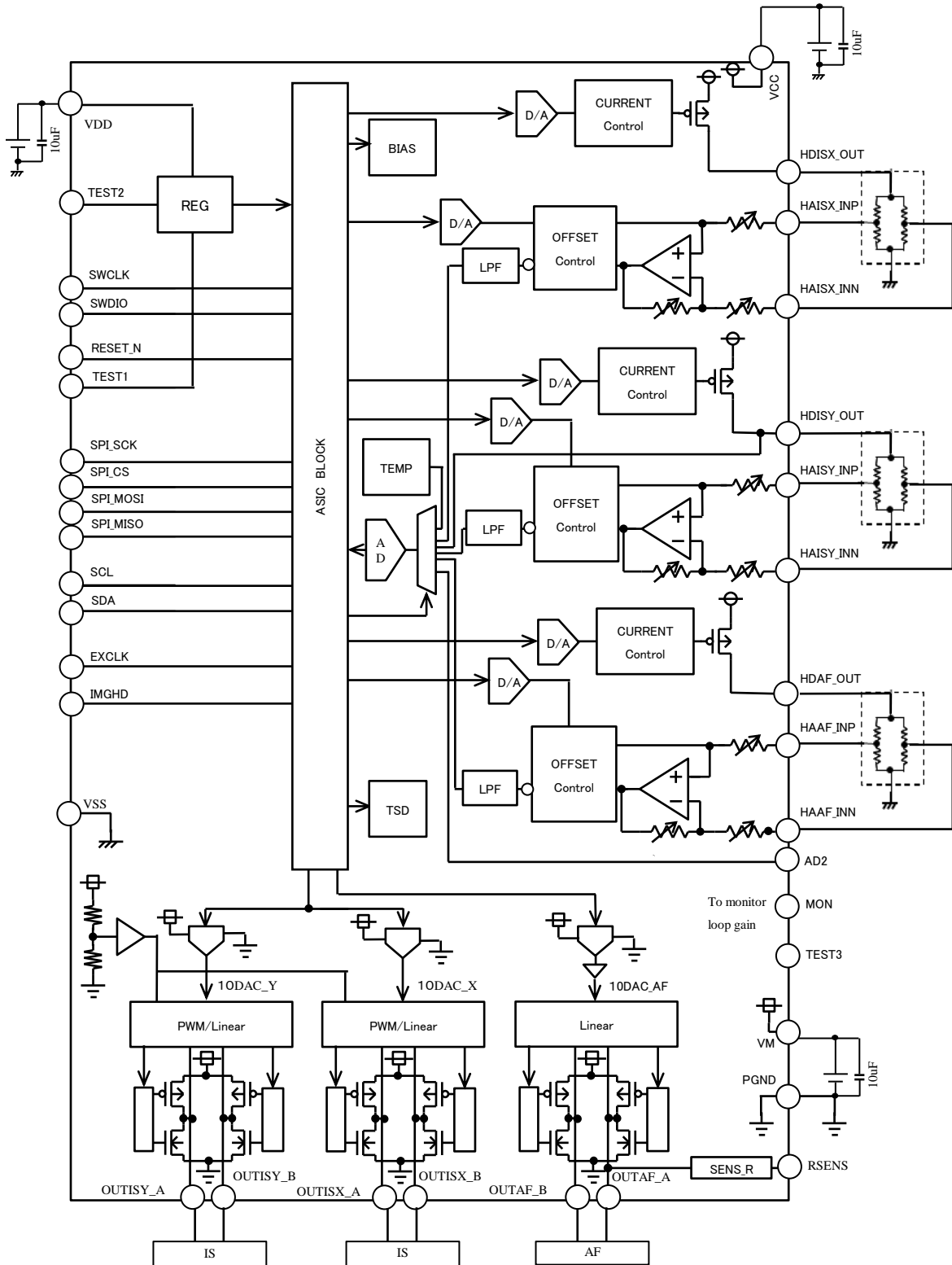


OIS controller

# **RAA305315GBM**

## **(Driver Block)**

## Example for circuit of Driver Block (Analog & Driver)



# RAA305315GBM

## Electrical specification (Analog block) Ta=25 degrees C

If not specified, VCC=VM=2.8V, VDD=1.8V, Ta=25 degrees C

	Item	Symbol	Condition	Standard Value			Unit	Remarks
				min	typ	max		
12bit ADC	Resolution	RES	684uV/LSB @VCC=2.8V	—	12	—	bit	
	Linearity minimum code	DRLAD	about 0.1V	—	—	080h	CODE	
	Linearity maximum code	DRHAD	about VCC-0.1V	F7Fh	—	—	CODE	
	Zero scale input voltage	VINLAD		—	0	—	V	
	Full scale input voltage	VINHAD		—	VCC	—	V	
	Conversion time	TCAD		3.375	—	—	us	
	clock frequency	FCLK		—	—	16	MHz	
Hall Amplifier	Lo output voltage	VOLMN		—	—	0.10	V	
	Hi output voltage	VOHMN		VCC-0.1	—	—	V	
	Differential Gain accuracy	GHS	x20, x30, x40, x50, x80 x120, x160, x100, x150	-12	0	12	%	
	Output LPF cut-off frequency	BWHA	-3dB	—	10	—	kHz	*1
Hall Amplifier offset adjusting 8bit DAC	Resolution	RES	10.9mV/LSB @VCC=2.8V	—	8	—	bit	
	Differential Nonlinearity	DNLDA8	guaranteed monotonic, IO=0mA DAC setting code DRLDA8~DRHDA8	-1	—	1	LSB	*1
	Integral Nonlinearity	INLDA8	IO=0mA DAC setting code DRLDA8~DRHDA8	(Reference value) -2	—	(Reference value) 2	LSB	*1
	Linearity minimum code	DRLDA8	about 0.25V IO=0mA	—	—	15h	CODE	
	Linearity maximum code	DRHDA8	about 2.75V IO=0mA	EBh	—	—	CODE	
	Zero scale output voltage	VOZSDA8	DAC setting code 00h, IO=0mA	—	—	0.1	V	
	Full scale output voltage	VOFSDA8	DAC setting code Ffh, IO=0mA	VCC-0.1	—	—	V	
Output response time	TCDA8	DRLDA8~DRHDA8	—	—	(Reference value) 5	us	*1	
Constant Current Amplifier (OIS)	FET Tr minimum current	IIBMINIC	DAC setting code 00h VIN=0V, ISET[1:0]=01b	—	—	10	uA	
	FET Tr maximum current 1	IIBMAXIC1	DAC setting code D6h VIN=VCC-0.5V, ISET[1:0]=00b	1.0	—	—	mA	
	FET Tr maximum current 2	IIBMAXIC2	DAC setting code D6h VIN=VCC-0.5V, ISET[1:0]=01b	2.0	—	—	mA	
	Internal DAC linearity minimum code	DRLIDA8	RL=0.75kohm, Vb=0, ISET[1:0]=01b	—	—	11h	CODE	
	Internal DAC linearity maximum code	DRHIDA8	RL=0.75kohm, Vb=0, ISET[1:0]=01b	D6h	—	—	CODE	

Note \*1: These are reference , not guaranteed.

# RAA305315GBM

## Electrical specification (Analog block) Ta=25 degrees C

If not specified, VCC=VM=2.8V, VDD=1.8V, Ta=25 degrees C

	Item	Symbol	Condition	Standard Value			Unit	Remarks
				min	typ	max		
AF Amplifier	Lo output voltage	VOLAF		—	—	0.10	V	
	Hi output voltage	VOHAF		VCC-0.1	—	—	V	
	Differential Gain accuracy	GHS	x7,x20,x45,x80	-12	0	12	%	
	Reference voltage setting 1	VRFINN1	HAAF_INN setting Low	0.2	0.3	0.4	V	
	Reference voltage setting 2	VRFINN2	HAAF_INN setting Mid1	0.7	0.8	0.9	V	
	Reference voltage setting 3	VRFINN3	HAAF_INN setting Mid2	1.3	1.4	1.5	V	
	Reference voltage setting 4	VRFINN4	HAAF_INN setting High	1.9	2.0	2.1	V	
	Output LPF cut-off frequency	BWHAAF	-3dB	—	10	—	kHz	*1
Constant Current (AF)	FET Tr minimum current	IIBMINICAF	DAC setting code 00h VIN=0V, ISET[1:0]=01b	—	—	10	uA	
	FET Tr maximum current 1	IIBM AXICAF1	DAC setting code D6h VIN=VCC-0.5V, ISET[1:0]=00b	1.0	—	—	mA	
	FET Tr maximum current 2	IIBM AXICAF2	DAC setting code D6h VIN=VCC-0.5V, ISET[1:0]=01b	2.0	—	—	mA	
	Internal DAC linearity minimum code	DRLIDAAF8	RL=0.75kohm, Vb=0, ISET[1:0]=01b	—	—	11h	CODE	
	Internal DAC linearity maximum code	DRHIDAAF8	RL=0.75kohm, Vb=0, ISET[1:0]=01b	D6h	—	—	CODE	

Note \*1: These are reference , not guaranteed.

## Electrical specification (Driver block) Ta=25 degrees C

If not specified, VCC=VM=2.8V, VDD=1.8V, Ta=25 degrees C

	Item	Symbol	Condition	Standard Value			Unit	Remarks
				min	typ	max		
Linear Driver (ISX, ISY, AF)	IS DAC Resolution	RESIS		-	10	-	bit	
	IS internal DAC linearity minimum code	DRLIDA10IS	RL=28ohm	—	—	COh	CODE	*1
	IS internal DAC linearity maximum code	DRHIDA10IS	RL=28ohm	340h	—	—	CODE	*1

Note \*1: These are reference , not guaranteed.

If not specified, VCC=VM=2.8V, VDD=1.8V, Ta=25 degrees C

	Item	Symbol	Condition	Standard Value			Unit	Remarks
				min	typ	max		
IS* PWM driver	On resistance IS	RONIS	Io=100mA, VM=2.8V Total of top and bottom resistance	-	3.6	5.8	ohm	*1
	Turn on time 1	TON1	Threshold 50%, Io=100mA IS slew rate setting=000b	-	0.3	0.45	μs	
	Turn off time 1	TOFF1	Threshold 50%, Io=100mA IS slew rate setting=000b	-	0.12	0.24	μs	
	Rise up time 1	Tr1	From 10% to 90%, Io=100mA IS slew rate setting=000b	-	0.13	0.52	μs	
	Fall downtime 1	Tf1	From 90% to 10%, Io=100mA IS slew rate setting=000b	-	0.05	0.10	μs	
	Turn on time 2	TON2	Threshold 50%, Io=100mA IS slew rate setting=110b	-	0.26	0.39	μs	
	Turn off time 2	TOFF2	Threshold 50%, Io=100mA IS slew rate setting=110b	-	0.12	0.24	μs	
	Rise up time 2	Tr2	From 10% to 90%, Io=100mA IS slew rate setting=110b	-	0.11	0.44	μs	
	Fall downtime 2	Tf2	From 90% to 10%, Io=100mA IS slew rate setting=110b	-	0.05	0.10	μs	
	Turn on time 3	TON3	Threshold 50%, Io=100mA IS slew rate setting=101b	-	0.24	0.36	μs	
	Turn off time 3	TOFF3	Threshold 50%, Io=100mA IS slew rate setting=101b	-	0.12	0.24	μs	
	Rise up time 3	Tr3	From 10% to 90%, Io=100mA IS slew rate setting=101b	-	0.08	0.32	μs	
	Fall downtime 3	Tf3	From 90% to 10%, Io=100mA IS slew rate setting=101b	-	0.05	0.10	μs	

Note \*1: These are reference , not guaranteed.

OIS controller

# **RAA305315GBM**

## **(Controller Block)**

## Controller Block outline

### Block diagram

Block diagram is shown in below.

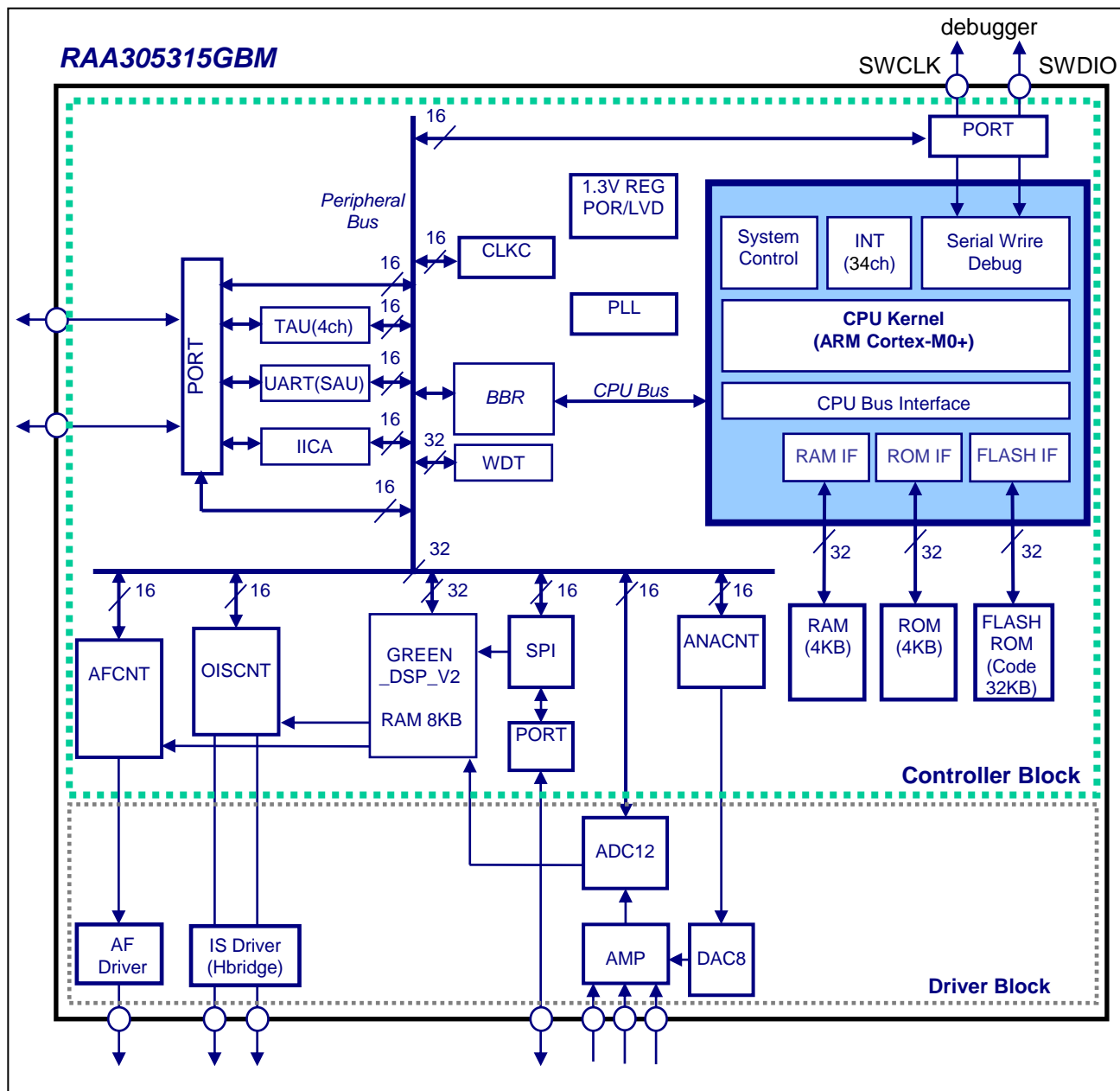


Figure 1.1 RAA305315GBM Block diagram

BBR:Bus BRidge  
TAU:Timer Array Unit

## Controller Features

RAA305315GBM controller peripheral I/O Features shown in Table (1)

Function block	Features
Interrupt controller (INT)	<ul style="list-style-type: none"> <li>• Internal Interrupts : 26 sources</li> <li>• External interrupts : 8 sources</li> <li>• ICUIN input sense : Edge sense (rise edge, fall edge, both edges)</li> <li>• Priority : Programmable</li> </ul>
TIMER ARRAY UNIT(TAU)	<ul style="list-style-type: none"> <li>• Channels : 4ch</li> <li>• Count bit : 16 bits counter, down counting</li> <li>• Timer scale : <math>f_{CLK}/2^0</math> to <math>f_{CLK}/2^{15}</math></li> </ul>
General purpose I/O & Pin control (PORT)	<ul style="list-style-type: none"> <li>• GPIO number of lines : 8 lines (GPIO)</li> <li>• I/O pins : Can be set to each I/O pin using the corresponds input and output control register bits. : Can be select to each I/O from GPIO and peripheral module Pin mode register 0/1/2/3.</li> <li>• I/O pins control : Each pins can be changed GPIO and other peripheral functions with setting the operation mode register.</li> <li>• I/O pins pull-up : Enables and disables the pull-up resistors.</li> </ul>
Serial Peripheral Interface (SPI)	<ul style="list-style-type: none"> <li>• Number of channels : 1 channel</li> <li>• Character length : 8 bits</li> <li>• Order of transfer : MSB first or LSB first</li> <li>• Shift clock : Internal shift clock</li> <li>• Internal shift clock source : <math>f_{CLK}/2^0</math> to <math>f_{CLK}/2^{15}</math></li> <li>• Baud rate count : 2-256</li> <li>• Transmit interrupt factor : Transmit buffer empty or Transmit end</li> <li>• Receive error detection : Overrun</li> <li>• Chip Select : Chip select signal</li> <li>• DSP register access : Registers are accessible from CPU</li> </ul>



# RAA305315GBM

RAA305315GBM controller peripheral I/O Features shown in Table (2)

Function block	Features
Universal asynchronous Receiver Transmitter (UART)	<ul style="list-style-type: none"> <li>·Channels : 1 channel</li> <li>·Character length : 7/8/9 -bit length can be selected</li> <li>·Transfer order : MSB and LSB first can be selected</li> <li>·Stop bit length : 1 or 2 bit can be selected</li> <li>·Parity check : Can be enabled or disabled</li> <li>·Attribute of parity check : Even or Odd parity can be selected</li> <li>·Internal clock source : Dividable range = : <math>f_{CLK}/2^0</math> to <math>f_{CLK}/2^{15}</math></li> <li>·Baud rate counter : Maximum 2-256</li> <li>·Transmit interrupt factor : Transmit buffer empty or Transmit end can be selected. Error interrupt also.</li> <li>·Error detection : Framing error, Parity error, Overrun error.</li> </ul>
Clock /PLL/ System control	<ul style="list-style-type: none"> <li>·Clock source : External Input (EXCLK)</li> <li>·SYSTEM/DSP clocks : 32.4MHz max</li> <li>·PWM clocks : 162MHz max</li> <li>·Standby Function : SLEEP, DEEP-SLEEP</li> </ul>
	<ul style="list-style-type: none"> <li>·PLL clock(=PWM clocks) : MAX : 162MHz</li> <li>·PLL control : PLL can be stop.</li> <li>·OIS module clock control : OIS module clock control can be stop</li> </ul>
Multi Master & Slave SERIAL INTERFACE IICA (IICA)	<ul style="list-style-type: none"> <li>·Channels : 1 channel</li> <li>·Clock frequency : Standard mode (fastest transfer rate: 100 kbps) : Fast mode (fastest transfer rate: 400 kbps) : Fast mode+ (fastest transfer rate: 1 Mbps)</li> <li>·Transmit interrupt factor : Transfer end interrupt</li> <li>·Error detection : Overrun error Parity error (ACK error)</li> </ul>
OIS Control (OISCNT)	<ul style="list-style-type: none"> <li>·Image stabilizer drive function : 2 channel PWM or Linear (H-bridge)</li> <li>·DSP register access : Registers are accessible through CPU Bus.</li> </ul>
AF Control (AFCNT)	<ul style="list-style-type: none"> <li>·Auto focus drive function : 1 channel Linear (H-bridge)</li> <li>·DSP register access : Registers are accessible through CPU Bus.</li> </ul>

RAA305315GBM controller peripheral I/O Features shown in Table (3)

Function block	Features	
DSP (GREEN_DSP_V2)	<ul style="list-style-type: none"> <li>· Arithmetic operation</li> <li>· Interrupt requests</li> </ul>	<ul style="list-style-type: none"> <li>: Multiplication Signed 32 bits * Signed 32 bits = Signed 32 bits Multiplication results (64 bits) can be shifted right any number of bits</li> <li>: Addition/ Substruct Signed 32 bits + Signed 32 bits = Signed 32 bits Signed 32 bits - Signed 32 bits = Signed 32 bits Internally calculated with 33bits precision.</li> <li>: Limit calculation Upper-/lower-limits can be set.</li> <li>: Capable to generate an interrupt to the CPU at program halt.</li> <li>: When program halts: Executes the STOP, break, and undefined instructions.</li> </ul>
Analog Control (ANACNT)	<ul style="list-style-type: none"> <li>· AMP,DAC8 control</li> <li>· DSP register access</li> </ul>	<ul style="list-style-type: none"> <li>: Control register</li> <li>: Registers are accessible through CPU Bus.</li> </ul>
12bit ADC Control (ADC12)	<ul style="list-style-type: none"> <li>· Resolution</li> <li>· Channels</li> <li>· Conversion mode</li> <li>· DSP register access</li> </ul>	<ul style="list-style-type: none"> <li>: 12bits</li> <li>: 6ch</li> <li>: Single mode, Scan mode</li> <li>: Registers are accessible through CPU Bus.</li> </ul>
POR (Power-on-reset circuit)	<ul style="list-style-type: none"> <li>· Power-on-reset: 1.60V (VDD)</li> </ul>	

## Electrical characteristics (Controller block) Ta=25 degrees C

### DC characteristics

If not specified VDD=1.8V, VCC=VM=2.8V, Ta=25 degrees C

Item	Symbol	Conditions	Limit			Unit	Remarks
			Min	Typ	Max		
'H' output voltage	VOH	IOH=-2mA	VDD*0.8	-	VDD	V	note1
'L' output voltage	VOL	IOL=2mA	0	-	VDD*0.2	V	note1
'H' input current	I <sub>IH</sub>	VI=VDD	-	-	1	uA	note2
'L' input current	I <sub>IL</sub>	VI=0V	-	-	-1	uA	note2
Pull-up resistance	R <sub>up</sub>		10	-	150	Kohm	note3
'H' input voltage	V <sub>IH</sub>		VDD*0.7	-	VDD	V	-
'L' input voltage	V <sub>IL</sub>		0	-	VDD*0.3	V	-

note1. correspondence terminal: SCL, SDA, SPI\_SCK, SPI\_DAT, SPI\_MISO, SPI\_CS, SWCLK, SWDIO

note2. in condition that pull-up resistance is not connected. (The built-in pull-up resistor is disabled by the F/W.)

note3. correspondence terminal: SPI\_SCK, SPI\_DAT, SPI\_MISO, SPI\_CS, SWCLK, SWDIO

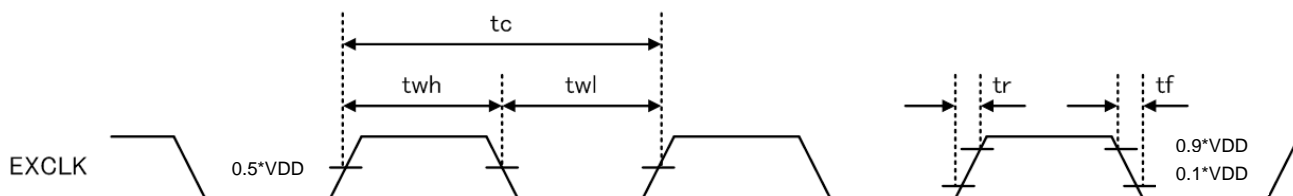
## Electrical characteristics (Controller block) Ta=25 degrees C

### AC characteristics

#### (1) EXTERNAL CLOCK (CLOCK)

If not specified, VDD=1.8V VCC=VM=2.8V Ta=25 degrees C

Items	Symbol	Conditions	Limit		Unit	Remarks
			Min	Max		
Input Frequency	fclk	-	6	29	MHz	-
Input 'H' pulse width	twh	$> 0.5 \cdot VDD$	14	-	ns	-
Input 'L' pulse width	twl	$< 0.5 \cdot VDD$	14	-	ns	-
Input rise time	Tr	VDD voltage 10% to 90%	-	2	ns	-
Input fall time	Tf	VDD voltage 10% to 90%	-	2	ns	-
Cycle-to-cycle period jitter	tjit(CC)	-	-	2	%	-
Period Jitter	tjit(per)	-	-4	4	%	-



## Electrical characteristics (Controller block) Ta=25 degrees C

### AC characteristics

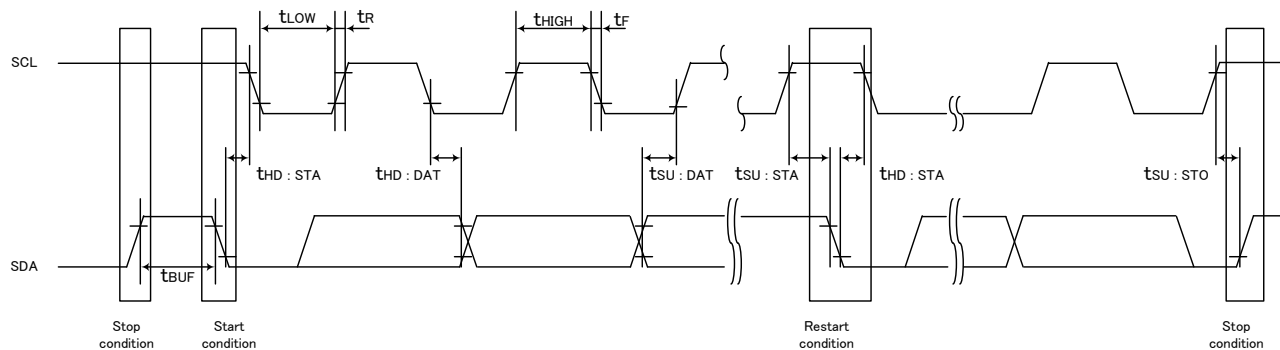
#### (2) IIC input timing

If not specified, VDD=1.8V VCC=VM=2.8V Ta=25 degrees C

Items	Symbol	Conditions	Standard Mode		Fast Mode		Fast Mode Puls		Unit	Remarks
			Min	Max	Min	Max	Min	Max		
SCL clock frequency	fSCL	-	0	100	0	400	0	1000	kHz	-
Setup time of restart condition *1	tSU:STA	-	4.7	-	0.6	-	0.26	-	us	-
Hold time	tHD:STA	-	4.0	-	0.6	-	0.26	-	us	-
Hold time when SCL = "L"	tLOW	-	4.7	-	1.3	-	0.5	-	us	-
Hold time when SCL = "H"	tHIGH	-	4.0	-	0.6	-	0.26	-	us	-
Data setup time (receive)	tSU:DAT	-	250	-	100	-	50	-	ns	-
Data hold time (transmission) *2	tHD:DAT	-	0	3.45	0	0.9	0	-	us	-
Setup time of stop condition	tSU:STO	-	4.0	-	0.6	-	0.26	-	us	-
Bus-free time	tBUF	-	4.7	-	1.3	-	0.5	-	us	-

\*1 The first clock pulse is generated after this period when the start/restart condition is detected.

\*2 tHD:DAT at maximum is a specification in normal output timing, a wait state is inserted in the ACK (acknowledge) timing.



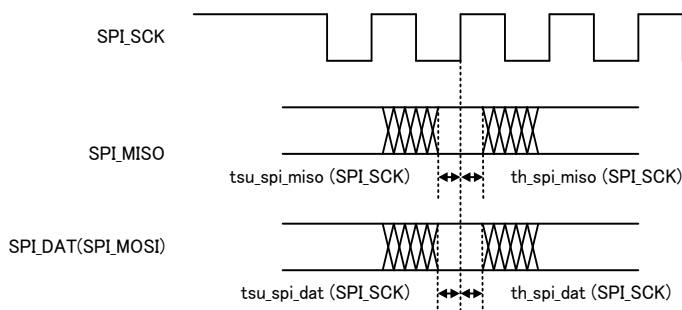
## Electrical characteristics (Controller block) Ta=25 degrees C

### (3) SPI timing (Master Mode)

#### (a) input timing

If not specified, VDD=1.8V VCC=VM=2.8V Ta=25 degrees C

Items	Symbol	Conditions	Limit		Unit	Remarks
			Min	Max		
input setup time SPI_MISO	tsu_spi_miso (SPI_SCK)	-	110	-	ns	-
input hold time SPI_MISO	th_spi_miso (SPI_SCK)	-	19	-	ns	-
input setup time SPI_DAT (SPI_MOSI)	tsu_spi_dat (SPI_SCK)	-	110	-	ns	-
input hold time SPI_DAT (SPI_MOSI)	th_spi_dat (SPI_SCK)	-	19	-	ns	-

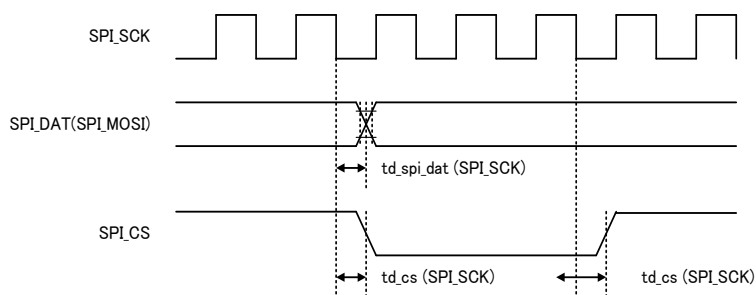


#### (b) output timing

If not specified, VDD=1.8V VCC=VM=2.8V Ta=25 degrees C

Items	Symbol	Conditions	Limit		Unit	Remarks
			Min	Max		
data output delay SPI_DAT (SPI_MOSI)	td_spi_dat (SPI_SCK)	-	-	10	ns	(1)
CS output delay SPI_CS	td_spi_cs (SPI_SCK)	-	-	10	ns	(1)

Note(1): This specification is Design assurance value.



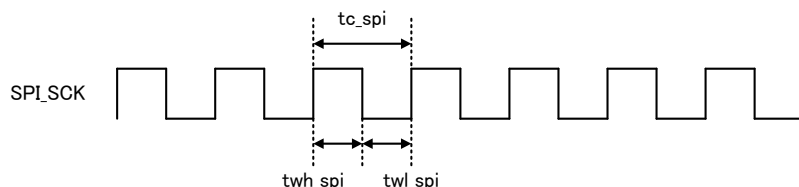
## Electrical characteristics (Controller block) Ta=25 degrees C

### (4) SPI timing (Slave Mode)

#### (a) SPI CLOCK (SPI\_SCK)

If not specified, VDD=1.8V VCC=VM=2.8V Ta=25 degrees C

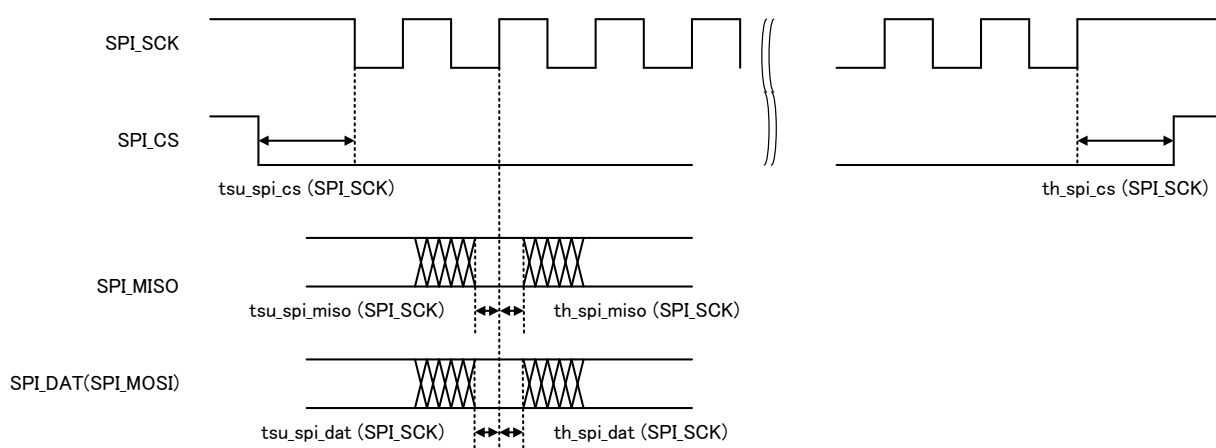
Items	Symbol	Conditions	Limit		Unit	Remarks
			Min	Max		
SPI Clock input cycle time	tc_spi	-	250	-	ns	-
SPI Clock input 'H' pulse width	twh_spi	-	120	-	ns	-
SPI Clock input 'L' pulse width	twl_spi	-	120	-	ns	-



#### (b) input timing

If not specified, VDD=1.8V VCC=VM=2.8V Ta=25 degrees C

Items	Symbol	Conditions	Limit		Unit	Remarks
			Min	Max		
input setup time SPI_CS	tsu_spi_cs (SPI_SCK)	-	200	-	ns	-
input hold time SPI_CS	th_spi_cs (SPI_SCK)	-	232	-	ns	-
input setup time SPI_MISO	tsu_spi_miso (SPI_SCK)	-	62	-	ns	-
input hold time SPI_MISO	th_spi_miso (SPI_SCK)	-	63	-	ns	-
input setup time SPI_DAT (SPI_MOSI)	tsu_spi_dat (SPI_SCK)	-	62	-	ns	-
input hold time SPI_DAT (SPI_MOSI)	th_spi_dat (SPI_SCK)	-	63	-	ns	-



## Electrical characteristics (Controller block) Ta=25 degrees C

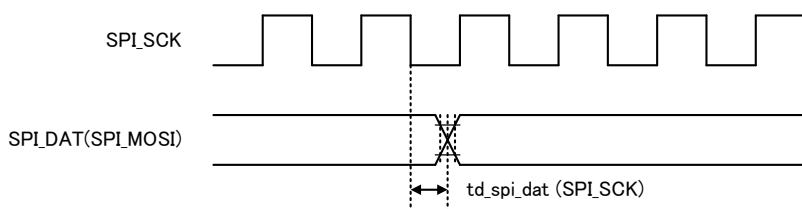
(4) SPI timing (Slave Mode)

(c) output timing

If not specified, VDD=1.8V VCC=VM=2.8V Ta=25 degrees C

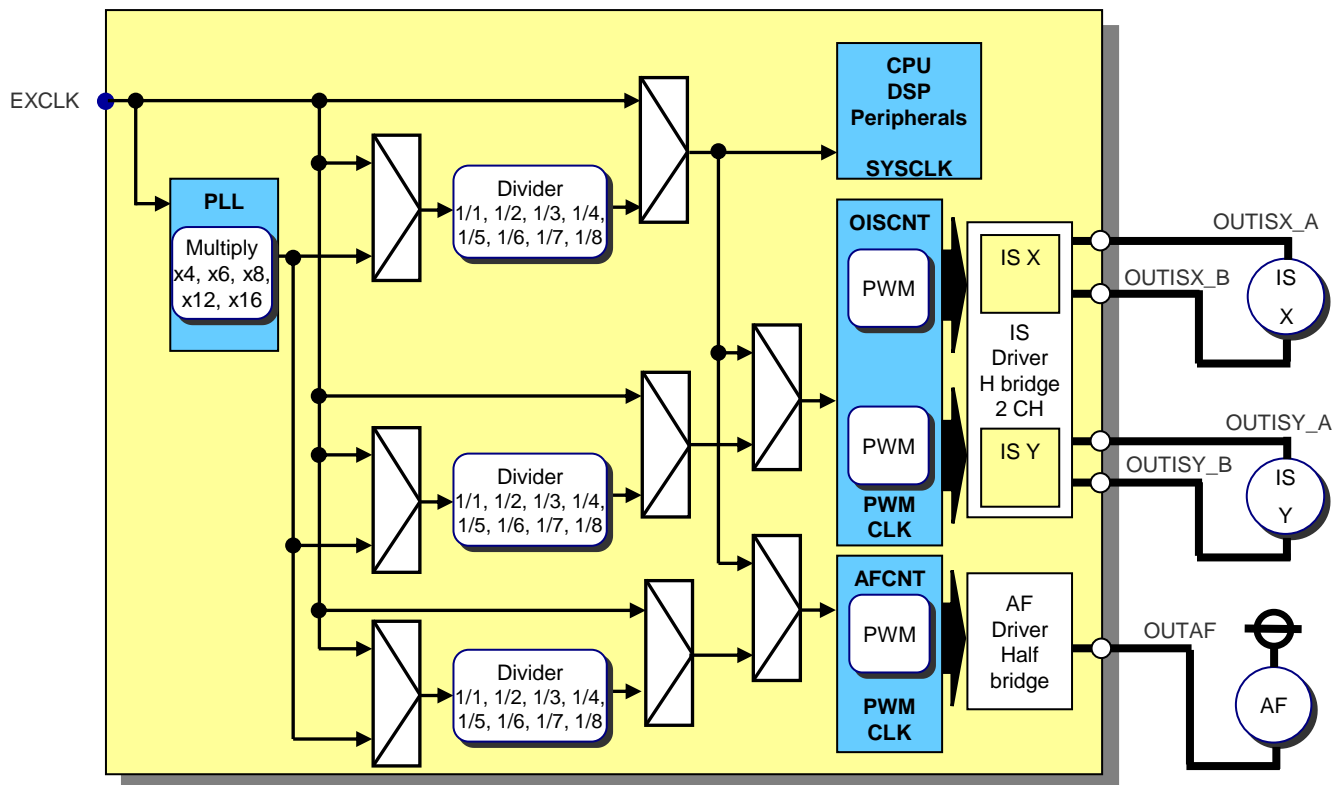
Items	Symbol	Conditions	Limit		Unit	Remarks
			Min	Max		
data output delay SPI_DAT (SPI_MOSI)	td_spi_dat (SPI_SCK)	-	-	100	ns	(1)

Note(1): This specification is Design assurance value.





## Clock Mode



Example of frequency setting (SYSCLK/PWMCLK)

EXCLK Frequency[MHz]	PLL		Clock Divider							
	Multiply	Frequency[MHz]	1	1/2	1/3	1/4	1/5	1/6	1/7	1/8
6	1	6	6.00	3.00	2.00	1.50	1.20	1.00	0.86	0.75
6	4	24	24.00	12.00	8.00	6.00	4.80	4.00	3.43	3.00
6	6	36	36.00	18.00	12.00	9.00	7.20	6.00	5.14	4.50
6	8	48	48.00	24.00	16.00	12.00	9.60	8.00	6.86	6.00
6	12	72	72.00	36.00	24.00	18.00	14.40	12.00	10.29	9.00
6	16	96	96.00	48.00	32.00	24.00	19.20	16.00	13.71	12.00
24	1	24	24.00	12.00	8.00	6.00	4.80	4.00	3.43	3.00
24	4	96	96.00	48.00	32.00	24.00	19.20	16.00	13.71	12.00
24	6	144	144.00	72.00	48.00	36.00	28.80	24.00	20.57	18.00
27	1	27	27.00	13.50	9.00	6.75	5.40	4.50	3.86	3.38
27	4	108	108.00	54.00	36.00	27.00	21.60	18.00	15.43	13.50
27	6	162	162.00	81.00	54.00	40.50	32.40	27.00	23.14	20.25
29	1	29	29.00	14.50	9.67	7.25	5.80	4.83	4.14	3.63
29	4	116	116.00	58.00	38.67	29.00	23.20	19.33	16.57	14.50

SYSCLK/PWMCLK supported. [MHz]

PWMCLK supported. [MHz]

Note ; PLL Lock in time = 500uS (max)

# RAA305315GBM

## Example of PWM carrier frequency \*1

### (1) VCM mode carrier frequency [kHz] (PWM period=10bit)

PWMCLK Frequency[MHz]	High-resolution bit number				
	0	1	2	3	4
162	158.4	316.7	633.4	1266.9	2533.7
144	140.8	281.5	563.0	1126.1	2252.2
116	113.4	226.8	453.6	907.1	1814.3
106	103.6	207.2	414.5	828.9	1657.9
96	93.8	187.7	375.4	750.7	1501.5

### (2) VCM mode carrier frequency [kHz] (PWM period=11bit)

PWMCLK Frequency[MHz]	High-resolution bit number				
	0	1	2	3	4
162	79.1	158.3	316.6	633.1	1266.2
144	70.3	140.7	281.4	562.8	1125.5
116	56.7	113.3	226.7	453.3	906.7
106	51.8	103.6	207.1	414.3	828.5
96	46.9	93.8	187.6	375.2	750.4

### (3) VCM mode carrier frequency [kHz] (PWM period=12bit)

PWMCLK Frequency[MHz]	High-resolution bit number				
	0	1	2	3	4
162	39.6	79.1	158.2	316.5	633.0
144	35.2	70.3	140.7	281.3	562.6
116	28.3	56.7	113.3	226.6	453.2
106	25.9	51.8	103.5	207.1	414.2
96	23.4	46.9	93.8	187.5	375.1

### (4) PIEZO mode carrier frequency [kHz] (PWM period=10bit)

PWMCLK Frequency[MHz]	High-resolution bit number				
	0	1	2	3	4
162	158.4	316.7	633.4	1266.9	2533.7
144	140.8	281.5	563.0	1126.1	2252.2
116	113.4	226.8	453.6	907.1	1814.3
106	103.6	207.2	414.5	828.9	1657.9
96	93.8	187.7	375.4	750.7	1501.5

### (5) PIEZO mode carrier frequency [kHz] (PWM period=11bit)

PWMCLK Frequency[MHz]	High-resolution bit number				
	0	1	2	3	4
162		158.3	316.6	633.1	1266.2
144		140.7	281.4	562.8	1125.5
116		113.3	226.7	453.3	906.7
106		103.6	207.1	414.3	828.5
96		93.8	187.6	375.2	750.4

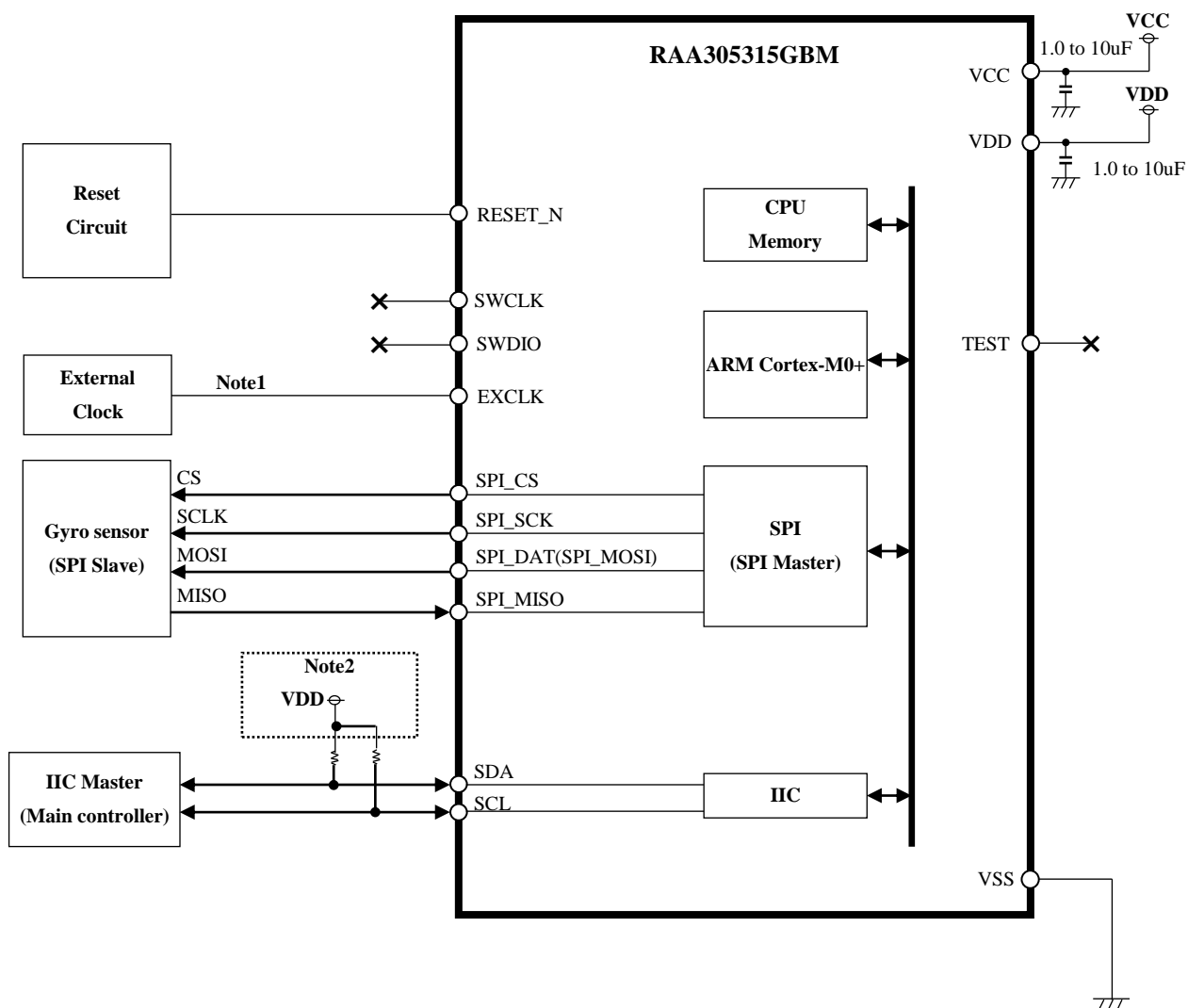
### (6) PIEZO mode carrier frequency [kHz] (PWM period=12bit)

PWMCLK Frequency[MHz]	High-resolution bit number				
	0	1	2	3	4
162			158.2	316.5	633.0
144			140.7	281.3	562.6
116			113.3	226.6	453.2
106			103.5	207.1	414.2
96			93.8	187.5	375.1

\*1 Since the value of PWM carrier frequency is a simple calculated value of a PWM circuit, it is necessary to take the driver characteristic into consideration at the time of use.

## Example circuit for Controller block

Recommended circuit connection with normal mode



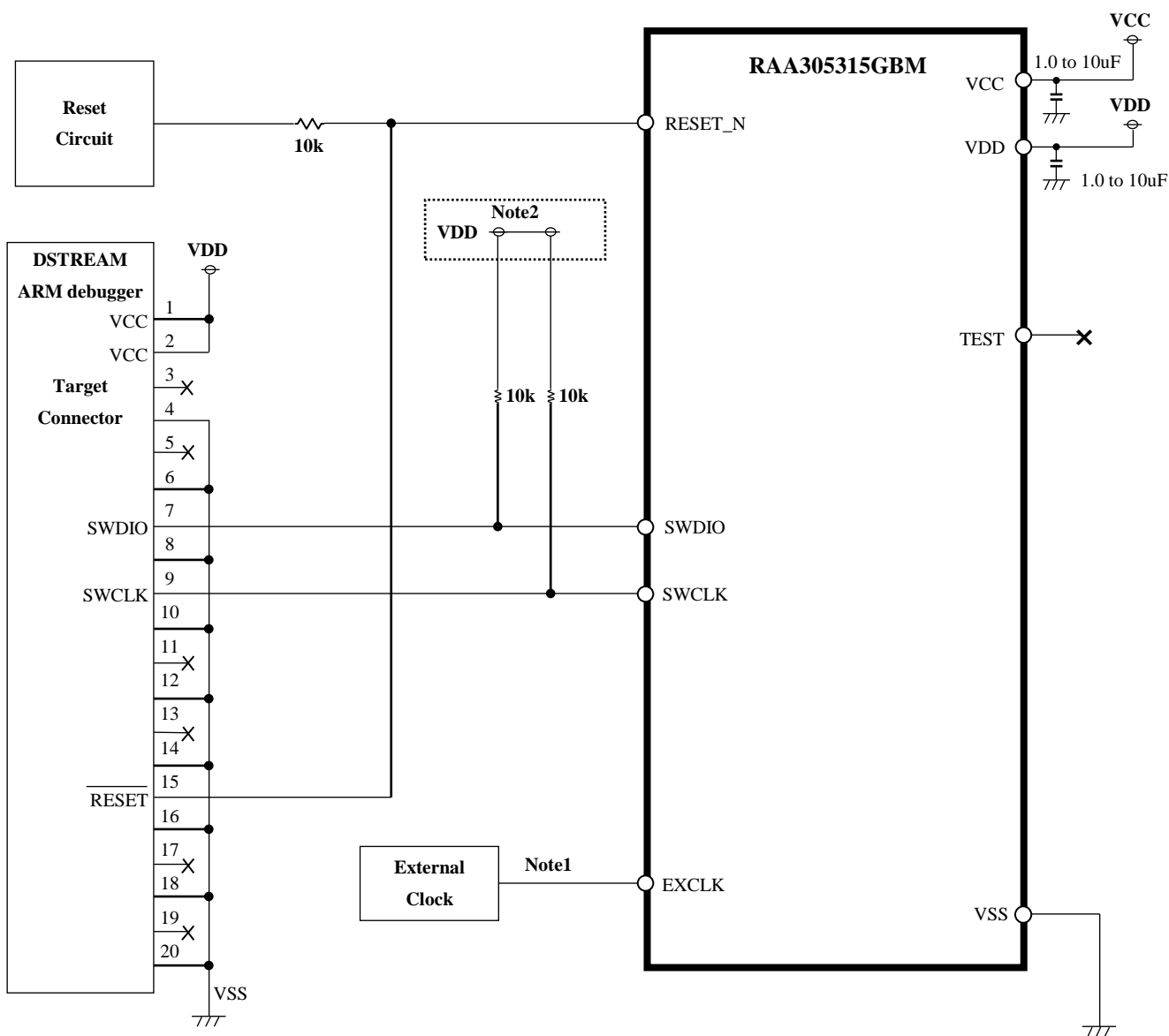
Note1. When IS driver using PWM mode, EXCLK clock source must use base clock of Image sensor.

If not use PWM mode, not need use base clock of Image sensor.

2. It is necessary to make the same the power supply (VDD) for IIC lines(SDA, SCL), and the power supply(VDD) for RAA305315GBM.

## Example circuit for Controller block (Debug mode)

Recommended circuit connection to DSTREAM(ARM debugger) with debug mode



Note1. When IS driver using PWM mode, EXCLK clock source must use base clock of Image sensor.

If not use PWM mode, not need use base clock of Image sensor.

2. It is necessary to make the same the power supply (VDD) for debugger lines(SWDIO, SWCLK), and the power supply(VDD) for RAA305315GBM.

## 外形図 Outline Drawing (SWBG0037LA-A)

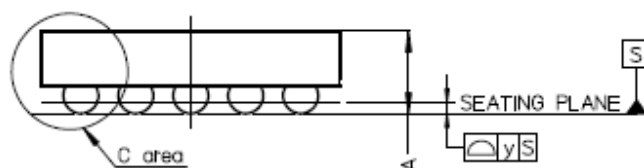
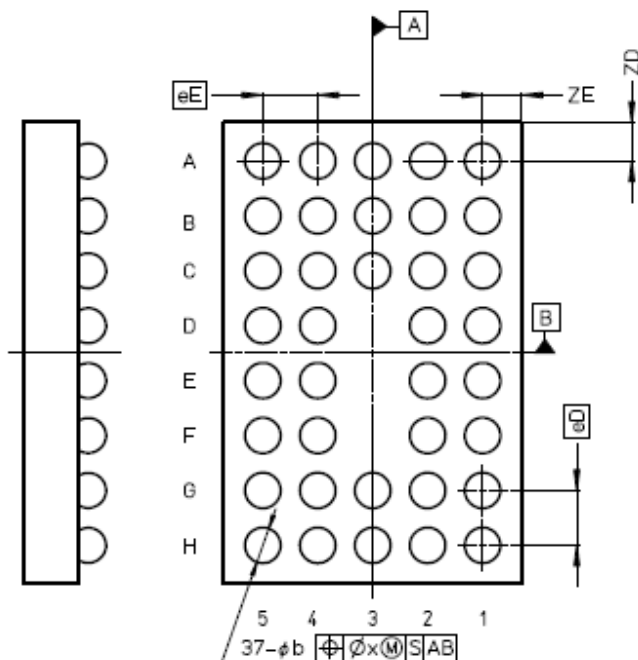
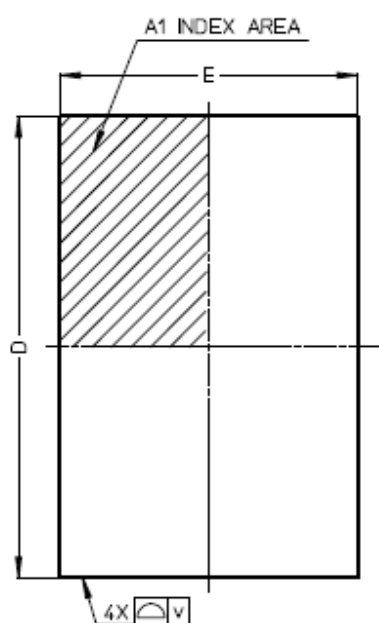
RDK-G-001024-1

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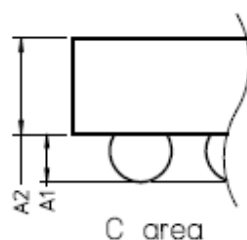
ルネサス エレクトロニクス株式会社  
Renesas Electronics Corporation

JEITA Package code	RENESAS Code	Previous Code	MASS(TYP.)[g]
S-WFBGA37-2.17x3.36-0.40	SWBG0037LA-A	—	0.01

Unit : mm



SIDE VIEW

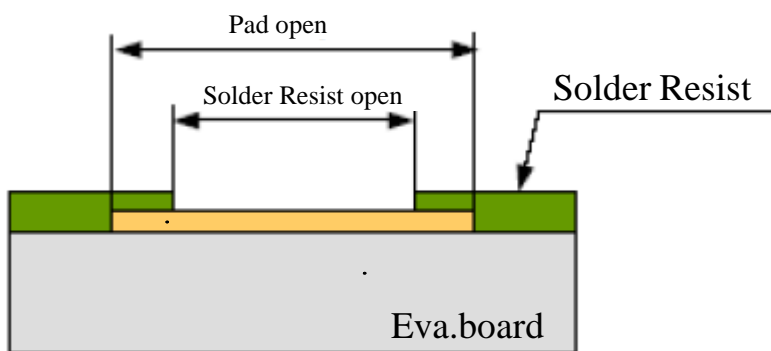


Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	3.31	3.36	3.41
E	2.12	2.17	2.22
ZD	0.23	0.28	0.33
ZE	0.235	0.285	0.335
A	—	—	0.70
A1	0.16	0.20	0.24
A2	0.36	0.40	0.44
b	0.21	0.26	0.31
eD	—	0.4	—
eE	—	0.4	—
v	—	—	0.05
x	—	—	0.05
y	—	—	0.08

## Recommended Land Pattern(WLBGA)

Solder Resist open size:  $\Phi 0.22\text{mm}$

Pad open size:  $\Phi 0.32\text{mm}$



SMD type

## Revision History

Rev	Date	Description	
		Page	Summary
Rev 1.06	9 <sup>th</sup> . Dec. 2020	-	New

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