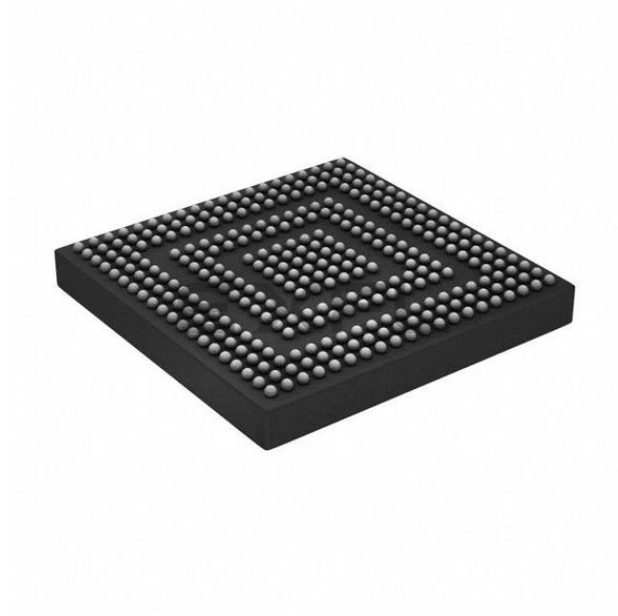
Renesas Electronics America Inc - R7S910015CBG#AC0 Datasheet



Welcome to E-XFL.COM

What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	ARM® Cortex®-R4F
Core Size	32-Bit Single-Core
Speed	450MHz
Connectivity	CANbus, CSI, EBI/EMI, Ethernet, I²C, SPI, UART/USART, USB
Peripherals	DMA, POR, PWM, WDT
Number of I/O	209
Program Memory Size	-
Program Memory Type	ROMless
EEPROM Size	-
RAM Size	1.5M x 8
Voltage - Supply (Vcc/Vdd)	1.14V ~ 3.6V
Data Converters	A/D 24x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	320-FBGA
Supplier Device Package	320-FBGA (17x17)
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/r7s910015cbg-ac0

Table 1.1 Outline of Specifications (6 / 7)

Classification	Module/Function	Description
Communication function	Serial peripheral interface (RSPIa)	• 4 channels • RSPI transfer facility Using the MOSI (master out slave in), MISO (master in slave out), SSL (slave select), and RSPCK (RSPI clock) signals enables serial transfer through SPI operation (four lines) or clock-synchronous operation (three lines) Capable of handling serial transfer as a master or slave • Data formats Switching between MSB first and LSB first The number of bits in each transfer can be changed to any number of bits from 8 to 16, or 20, 24, or 32 bits. 128-bit buffers for transmission and reception Up to four frames can be transmitted or received in a single transfer operation (with each frame having up to 32 bits) • Buffered structure Double buffers for both transmission and reception • RSPCK can be stopped automatically with the reception buffer full for master reception • Event linking by the ELC
	SPI multi I/O bus controller (SPIBSC)	• 1 channel • One serial flash memory with multiple I/O bus sizes (single/dual/quad) can be connected. • External address space read mode (built-in read cache) • SPI operating mode • Clock polarity and clock phase can be selected. • Maximum transfer rate: 300 Mbps (for quad)
Serial sound interface (SSI)		• 1 channel • Duplex communication • Support of various serial audio formats • Support of master and slave functions • Generation of programmable word clock and bit clock • Support of 8, 16, 18, 20, 22, 24, and 32-bit data formats • Support of eight-stage FIFO for transmission and reception • Support of WS continue mode in which the SSIWS signal is not stopped.
ΔΣ interface (DSMIF)		• 4 channels • Up to 4 ΔΣ modulators are externally connectable • Sync filter can be selected as first, second or third order
12-bit A/D converter (S12ADCa)		• 12 bits × 2 units (unit 0: 8 channels, unit 1: 16 channels)*1 • 12-bit resolution • Conversion time Unit 0: 0.483 µs per channel Unit 1: 0.883 µs per channel • Operating mode Scan mode (single scan mode, continuous scan mode, or group scan mode) Group A priority control (only for group scan mode) • Sample-and-hold function Common sample-and-hold circuit included In addition, channel-dedicated sample-and-hold function (4 channels: in unit 0 only) included • Sampling variable Sampling time can be set up for each channel • Self-diagnostic function The self-diagnostic function internally generates three analog input voltages (unit 0: VREFL0, VREFH0 × 1/2, VREFH0; unit 1: VREFL1, VREFH1 × 1/2, VREFH1) • Double trigger mode (A/D conversion data duplicated) • Detection of analog input disconnection • Three ways to start A/D conversion Software trigger, timer (MTU3a, GPTa, TPUa) trigger, external trigger • Event linking by the ELC
Temperature sensor		• 1 channel • Relative precision: ±1°C • The voltage of the temperature is converted into a digital value by the 12-bit A/D converter (unit 0).

Table 1.4 Pin Functions (4 / 7)

Classifications	Pin Name	I/O	Description
16-bit timer pulse unit (TPUa)	TIOCA0, TIOCB0, TIOCC0, TIOCD0	I/O	TPU0.TGRA0 to TPU0.TGRD0 input capture input/output compare output/PWM output pins
	TIOCA1, TIOCB1	I/O	TPU0.TGRA1 and TPU0.TGRB1 input capture input/output compare output/PWM output pins
	TIOCA2, TIOCB2	I/O	TPU0.TGRA2 and TPU0.TGRB2 input capture input/output compare output/PWM output pins
	TIOCA3, TIOCB3 TIOCC3, TIOCD3	I/O	TPU0.TGRA3 to TPU0.TGRD3 input capture input/output compare output/PWM output pins
	TIOCA4, TIOCB4	I/O	TPU0.TGRA4 and TPU0.TGRB4 input capture input/output compare output/PWM output pins
	TIOCA5, TIOCB5	I/O	TPU0.TGRA5 and TPU0.TGRB5 input capture input/output compare output/PWM output pins
	TCLKA, TCLKB TCLKC, TCLKD	Input	External clock input pins for TPU0
	TIOCA6, TIOCB6 TIOCC6, TIOCD6	I/O	TPU1.TGRA0 to TPU1.TGRD0 input capture input/output compare output/PWM output pins
	TIOCA7, TIOCB7	I/O	TPU1.TGRA1 and TPU1.TGRB1 input capture input/output compare output/PWM output pins
	TIOCA8, TIOCB8	I/O	TPU1.TGRA2 and TPU1.TGRB2 input capture input/output compare output/PWM output pins
	TIOCA9, TIOCB9 TIOCC9, TIOCD9	I/O	TPU1.TGRA3 to TPU1.TGRD3 input capture input/output compare output/PWM output pins
	TIOCA10, TIOCB10	I/O	TPU1.TGRA4 and TPU1.TGRB4 input capture input/output compare output/PWM output pins
	TIOCA11, TIOCB11	I/O	TPU1.TGRA5 and TPU1.TGRB5 input capture input/output compare output/PWM output pins
	TCLKE, TCLKF TCLKG, TCLKH	Input	External clock input pins for TPU1
Programmable pulse generator (PPG)	PO0 to PO31	Output	Pulse output pins
Compare match timer W (CMTW)	TIC0 to TIC3	Input	CMTW input capture input pins
	TOC0 to TOC3	Output	CMTW output compare output pins
Serial communication interface with FIFO (SCIFA)	SCK0 to SCK4	I/O	Clock I/O pins
	RXD0 to RXD4	Input	Input the receive data.
	TXD0 to TXD4	Output	Output the transmit data.
	CTS0# to CTS4#	I/O	Hardware flow control input (transmission enable signal)/general output
	RTS0# to RTS4#	Output	Hardware flow control output (transmission request signal)/general output
I^2C bus interface (RIICa)	SCL0, SCL1	I/O	Clock I/O pins. The bus can be directly driven by the N-channel open drain.
	SDA0, SDA1	I/O	Data I/O pins. The bus can be directly driven by the N-channel open drain.

Table 1.4 Pin Functions (5 / 7)

Classifications	Pin Name	I/O	Description
Ethernet controller (ETHERC)	ETH0_TXC, ETH1_TXC, ETH2_TXC	Input	Input the 10 M/100 M transmission clock (2.5 MHz/25 MHz).
	ETH0_TXEN, ETH1_TXEN, ETH2_TXEN	Output	Output the transmission enable signal.
	ETH0_TXER, ETH1_TXER, ETH2_TXER	Output	Output the transmission error signal.
	ETH0_TXD0 to 3, ETH1_TXD0 to 3, ETH2_TXD0 to 3	Output	Output the transmission data signal.
	ETH0_RXC, ETH1_RXC, ETH2_RXC	I/O	Receive clock I/O pins
	ETH0_RXDV, ETH1_RXDV, ETH2_RXDV	Input	Input the receive data enable signal.
	ETH0_RXER, ETH1_RXER, ETH2_RXER	Input	Input the receive data error signal.
	ETH0_RXD0 to 3, ETH1_RXD0 to 3 ETH2_RXD0 to 3	Input	Input the receive data signal.
	ETH0_CRS, ETH1_CRS, ETH2_CRS	Input	Input the carrier sense signal.
	ETH0_COL, ETH1_COL, ETH2_COL	Input	Input the collision detection signal.
	ETH_MDC, MII2_MDC	Output	Output the management interface clock.
	ETH_MDIO, MII2_MDIO	I/O	Management data signal I/O pins
	PHYLINK0, PHYLINK1	Input	Input the PHY Link signal.
	ETHSWSECOUT	Output	Event output pin for Ethernet switch per second
	PHYRESETOUT#, PHYRESETOUT2#	Output	Output the PHY RESET signal (PHYRESETOUT#: for Ether0 and Ether1, PHYRESETOUT2#: for Ether2)
EtherCAT slave controller (ECATC) (optional)	CATLEDRUN	Output	Outputs the EtherCAT RUN LED signal.
	CATIRQ	Output	Outputs the EtherCAT IRQ signal.
	CATLEDSTER	Output	Outputs the EtherCAT Dual-color state LED signal.
	CATLEDERR	Output	Outputs the EtherCAT error LED signal.
	CATLINKACT0, CATLINKACT1	Output	Output the EtherCAT link/activity LED signal.
	CATSYNC0, CATSYNC1	Output	Output the EtherCAT SYNC signal.
	CATLATCH0, CATLATCH1	Input	Input the EtherCAT LATCH signal.
	CATI2CCLK	Output	Outputs the EtherCAT EEPROM I^2C clock signal.
	CATI2CDATA	I/O	Inputs/outputs the EtherCAT EEPROM I^2C data signal.

Table 1.4 Pin Functions (7 / 7)

Classifications	Pin Name	I/O	Description
Analog power supply	AVCC1	Input	Analog power supply input pin for the 12-bit A/D converter (unit 1). Connect this pin to the VCCQ33 pin if the 12-bit A/D converter is not to be used.
	AVSS1	Input	Analog ground input pin for the 12-bit A/D converter (unit 1). Connect this pin to the VSS pin if the 12-bit A/D converter is not to be used.
	VREFH1	Input	Reference power supply input pin for the 12-bit A/D converter (unit 1). Connect this pin to the VCCQ33 pin if the 12-bit A/D converter is not to be used.
	VREFL1	Input	Reference ground pin for the 12-bit A/D converter (unit 1). Connect this pin to the VSS pin if the 12-bit A/D converter is not to be used.
I/O ports	P00 to P07	I/O	8-bit I/O pin
	P10 to P17	I/O	8-bit I/O pin
	P20 to P27	I/O	8-bit I/O pins
	P30 to P37	Input, I/O	1-bit input pin (P30), 7-bit I/O pins (P31 to P37) I/O pins
	P40 to P47	I/O	8-bit I/O pins
	P50 to P56	I/O	7-bit I/O pins
	P60 to P67	I/O	8-bit I/O pins
	P70 to P77	I/O	8-bit I/O pins
	P80 to P87	I/O	8-bit I/O pins
	P90 to P97	I/O	8-bit I/O pins
	PA0 to PA7	I/O	8-bit I/O pins
	PB0 to PB7	I/O	8-bit I/O pins
	PC0 to PC7	Input	8-bit input pins
	PD0 to PD7	I/O	8-bit I/O pins
	PE0 to PE7	I/O	8-bit I/O pins
	PF5 to PF7	I/O	3-bit I/O pins
	PG0 to PG7	I/O	8-bit I/O pins
	PH0 to PH7	I/O	8-bit I/O pins
	PJ0 to PJ7	I/O	8-bit I/O pins
	PK0 to PK7	I/O	8-bit I/O pins
	PL0 to PL7	I/O	8-bit I/O pins
	PM0 to PM7	I/O	8-bit I/O pins
	PN0 to PN7	I/O	8-bit I/O pins
	PP0 to PP7	I/O	8-bit I/O pins
	PR0 to PR7	I/O	8-bit I/O pins
	PS0 to PS7	I/O	8-bit I/O pins
	PT0 to PT7	I/O	8-bit I/O pins
	PU0 to PU7	I/O	8-bit I/O pins
Encoder I/F*1	ENCIF00 to ENCIF12	I/O	I/O pins for multi-protocol encoder interface

Note 1. Only in products with the encoder interfaces.

1.5 Pin Assignments

Figure 1.2 and Figure 1.3 show the pin arrangement. Table 1.5 and Table 1.6 show the pin assignments. Table 1.7 and Table 1.8 show the lists of pin functions.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
A	VSS	PC2	PJ3	PJ1	PF7	PB4	PB0	PC0	PF6	VCCQ33	P54	VSS	AN007	AN005	AN002	AVCC0	AVCC1	VREFH1	P17	VSS	A
B	PJ5	PJ4	PC3	PJ2	PJ0	PB5	PB2	PC1	PB7	P86	PD7	P52	AN006	AN003	AN001	AVSS0	AVSS1	VREFL1	P16	P15	B
C	PJ7	PJ6	PU2	PL7	PL5	PB6	PB3	PB1	PF5	P87	PD6	P53	P51	AN004	AN000	VREFL0	VREFH0	PD2	P14	P13	C
D	P81	P80	PU3															PD0	P96	P95	D
E	P84	P82	PU1		PU0	PL6	PL4	PL2	PL0	PK7	PK6	PD5	P56	PD4	VCCQ33	PD1		P97	P94	P93	E
F	PC4	P83	P85		PU4	VSS	VCCQ33	PL3	PL1	PK5	PK4	P55	P50	PD3	PK2	P90		P92	P91	P12	F
G	PU6	PC5	VCCQ33		PU5	PM0									PK3	PA7		PA4	PA3	P11	G
H	PU7	PM1	P35		ERROROUT#	VCCQ33		VDD	VDD	VDD	VDD	VDD	VSS		PA6	PA5		PA2	PK0	PK1	H
J	PM6	PM3	PM2		P33	TRST#		VDD	VSS	VSS	VSS	VSS	VDD		VCCQ33	PA1		PA0	PT7	PT6	J
K	PM7	PM5	PM4		P34	PLLVDD1		VDD	VSS	VSS	VSS	VSS	VDD		VSS	P77		P76	P75	PT5	K
L	MD1	MD2	TMS		TCK	PLLVSS1		VDD	VSS	VSS	VSS	VSS	VDD		VSS	PE7		P72	P73	P74	L
M	XTAL	EXTAL	OSCTH		BSCANP	PLLVDD0		VDD	VSS	VSS	VSS	VSS	VDD		VCCQ33	PE6		P70	PT4	P71	M
N	VSS	MD0	RSTOUT#		RES#	PLLVSS0		VDD	VSS	VDD	VDD	VDD	VDD		PE2	PE4		PE5	PT2	PT3	N
P	VSS_USB	VDD33_USB	USB_REF		P31	VCCQ33									P06	P07		PE3	PT0	PT1	P
R	USB_DP	USB_DM	P30		PN0	PN2	PG0	PG2	PG7	PH2	PH4	PH6	P23	P27	P47	VCCQ33		VCCQ33	PS6	PS7	R
T	DVDD_USB	VDD33_USB	P32		PC6	P37	P36	PG3	PG6	PH3	VCCQ33	PH5	VCCQ33	P26	VCCQ33	VSS		VSS	PE0	PE1	T
U	P60	P63	PN1															P00	P04	P03	U
V	P61	P64	PN3	PN4	PC7	PG1	PG4	PG5	PH0	PH1	PH7	P20	P21	VSS	P45	P46	PS2	P05	P01	P02	V
W	P62	P65	PN5	PN6	PP0	PP2	PP4	PP6	PP7	PR1	PR3	PR5	P24	P22	P44	P43	PS1	PS3	PS4	PS5	W
Y	VSS	P67	P66	PN7	PP1	PP3	PP5	VSS	PR0	PR2	PR4	PR6	PR7	P25	P41	P42	P40	PS0	P10	VSS	Y
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	

Figure 1.2 Pin Arrangement (320-Pin FBGA) (Top View)

Table 1.5 Pin Assignments (320-Pin FBGA) (1 / 8)

Pin Number	Pin Name
A1	VSS
A2	PC2 / ETH0_TXC / ETH1_RXD2 / CATI2CDATA / SDA0
A3	PJ3 / IRQ11 / ETH0_TXD0 / ADTRG0
A4	PJ1 / ETH0_TXD2 / CATLEDSTER / RSPCK3
A5	PF7 / IRQ7 / A25 / ETH0_TXER / RTS3# / SSL30
A6	PB4 / A24 / ETH1_COL / ETH0_RXER / CATSYNC0 / CATLATCH0 / RXD3 / MOSI3 / MDAT0
A7	PB0 / ETH1_RXDV / MTCLKB / TCLKD / TIC3
A8	PC0 / WAIT# / ETH1_RXD2 / GTETRG / SCL1 / MDAT3
A9	PF6 / ETH1_RXD0 / MTIOC3D / GTIOC0B / TOC2
A10	VCCQ33
A11	P54 / CLKOUT25M1 / MOSI2
A12	VSS
A13	AN007
A14	AN005
A15	AN002
A16	AVCC0
A17	AVCC1
A18	VREFH1
A19	P17 / CS5# / ETH1_TXER / PHYRESETOUT# / ADTRG0
A20	VSS
B1	PJ5 / ETH0_RXD1 / TIOCD0 / RXD3
B2	PJ4 / ETH0_RXD0 / TXD3
B3	PC3 / ETH0_RXC / ETH0_RXDV / CATI2CCLK / RXD4 / SCL0 / CRXD1
B4	PJ2 / IRQ10 / ETH0_TXD1 / MISO3
B5	PJ0 / IRQ8 / ETH0_TXD3 / CATLEDERR / MOSI3
B6	PB5 / ETH_MDIO / TCLKB / POE0# / POE10# / CTS3# / RSPCK3
B7	PB2 / ETH1_RXC / ETH0_RXD1 / CATSYNC1 / CATLATCH1 / MTIOC1A / SSL30 / MDAT1
B8	PC1 / IRQ9 / ETH1_RXD3 / PHYLINK0 / SDA1 / MDAT2
B9	PB7 / ETH1_RXD1 / MTIOC3B / GTIOC0A / TOC3
B10	P86 / AN1_ANEX0 / ETH1_TXD0 / MTIOC4B / GTIOC2A / TOC1 / RSPCK2
B11	PD7 / AN115 / ETH1_TXD1 / MTIOC4D / GTIOC2B / TOC0
B12	P52 / ETH0_INT / SSL20
B13	AN006
B14	AN003
B15	AN001
B16	AVSS0
B17	AVSS1
B18	VREFL1
B19	P16 / CS4# / CS2# / MTIOC3B / GTIOC0A / ENCIF12
B20	P15 / CS3# / CKE / MTIOC3D / GTIOC0B / ENCIF11
C1	PJ7 / IRQ15 / ETH0_RXD3 / CATLEDRUN / CTS3#
C2	PJ6 / IRQ14 / ETH0_RXD2 / CATIRQ / SCK3
C3	PU2 / IRQ2 / ETH2_CRS / TIOCD9 / RXD3
C4	PL7 / IRQ15 / ETH2_RXDV

Table 1.5 Pin Assignments (320-Pin FBGA) (3 / 8)

Pin Number	Pin Name
F7	VCCQ33
F8	PL3 / ETH2_RXD0 / TIOCA7
F9	PL1 / ETH2_TXC / TIOCB10
F10	PK5 / ETH2_TXD1 / TIOCB8
F11	PK4 / ETH2_TXER / TIOCB11 / MOSI2
F12	P55 / IRQ5 / A24 / ETHSWSECOUT
F13	P50 / IRQ8 / CS1# / PHYLINK0
F14	PD3 / AN111 / PHYRESETOUT2#
F15	PK2 / A23
F16	P90 / AN100 / RAS# / TIOCA5 / TXD4
F18	P92 / AN102 / CS5# / TOC3 / RXD2
F19	P91 / AN101 / CAS# / TXD2 / ENCIF06
F20	P12 / MTIOC4B / GTIOC2A
G1	PU6 / PHYRESETOUT# / TCLKF / CTS4#
G2	PC5 / CATI2CDATA / TCLKG / SDA0
G3	VCCQ33
G5	PU5 / IRQ13 / MII2_MDIO / TIOCC6 / RTS3#
G6	PM0 / CLKOUT25M2 / TXD4
G15	PK3 / A24
G16	PA7 / IRQ7 / D31 / A22 / MTIOC6B / GTIOC3B / RTS2# / MCLK0
G18	PA4 / D28 / ETH1_INT / TIOCA3 / ADTRG0 / RXD2 / TEND2 / MDAT1
G19	PA3 / D27 / ETHSWSECOUT / GTETRG / TIOCA2 / SCK2 / DACK2 / MCLK2
G20	P11 / IRQ9 / MTIOC4D / GTIOC2B
H1	PU7 / CATIRQ / RXD4
H2	PM1 / CATLEDERR / SCK4
H3	P35 / NMI
H5	ERROROUT#
H6	VCCQ33
H8	VDD
H9	VDD
H10	VDD
H11	VDD
H12	VDD
H13	VSS
H15	PA6 / IRQ6 / D30 / A21 / GTIOC3A / CTS2# / MDAT0
H16	PA5 / D29 / ETH0_INT / ETH1_TXER / TIOCA4 / TXD2 / MCLK1
H18	PA2 / D26 / MTIOC3B / GTIOC0A / SSL02 / DREQ2 / MDAT2/ ENCIF05
H19	PK0 / CAS# / PO31 / ENCIF11
H20	PK1 / CS5# / ENCIF12
J1	PM6 / IRQ6 / CATLINKACT0 / PO19
J2	PM3 / CATSYNC0 / CATLATCH0 / PO16
J3	PM2 / CATSYNC1 / CATLATCH1 / TCLKE / RTS4#
J5	P33 / TDO
J6	TRST#
J8	VDD

Table 1.5 Pin Assignments (320-Pin FBGA) (5 / 8)

Pin Number	Pin Name
M5	BSCANP
M6	PLLVDD0
M8	VDD
M9	VSS
M10	VSS
M11	VSS
M12	VSS
M13	VDD
M15	VCCQ33
M16	PE6 / IRQ6 / D14 / MTIOC0A / TIOCD0 / RXD1 / MISO0 / TRACEDATA6
M18	P70 / IRQ0 / D16 / MTIOC6D / RTS1# / USB_OVRCUR / TRACECLK / ENCIF00
M19	PT4 / CS3# / PO29
M20	P71 / D17 / POE0# / POE10# / TOC2 / SCK1 / TRACECTL / ENCIF01
N1	VSS
N2	MD0
N3	RSTOUT#
N5	RES#
N6	PLLVSS0
N8	VDD
N9	VSS
N10	VDD
N11	VDD
N12	VDD
N13	VDD
N15	PE2 / IRQ2 / D10 / MTCLKC / TIOCB4 / SSL02 / TRACEDATA2
N16	PE4 / D12 / MTIOC0B / TIOCC0 / RTS1# / SSL00 / TRACEDATA4
N18	PE5 / D13 / MTIOC0C / TIOCC3 / TXD1 / MOSI0 / TRACEDATA5
N19	PT2 / TIOCA1 / TIOCB1 / PO27
N20	PT3 / IRQ11 / TIOCA0 / TIOCB0 / PO28 / CTS2# / ENCIF09
P1	VSS_USB
P2	VDD33_USB
P3	USB_RREF
P5	P31 / USB_VBUSEN
P6	VCCQ33
P15	P06 / D6 / MTIOC2B / TIOCB0
P16	P07 / D7 / MTIOC2A / TIOCB1
P18	PE3 / IRQ3 / D11 / MTIOC0D / TIOCB5 / CTS1# / SSL01 / TRACEDATA3
P19	PT0 / IRQ0 / TIOCA3 / TIOCB3 / PO25 / SCK2 / ENCIF07
P20	PT1 / TIOCA2 / TIOCB2 / PO26 / RTS2# / ENCIF08
R1	USB_DP
R2	USB_DM
R3	P30 / CRXD0 / USB_VBUSIN
R5	PN0 / MTIOC8D / SSL10
R6	PN2 / IRQ10 / MTIOC8B / MOSI1
R7	PG0 / A1 / PO2

Table 1.5 Pin Assignments (320-Pin FBGA) (8 / 8)

Pin Number	Pin Name
Y15	P41 / BS# / SCK0
Y16	P42 / MTIOC7C / RXD0
Y17	P40 / MTIOC8A / TXD0
Y18	PS0 / MTIOC7D / AUDIO_CLK
Y19	P10 / IRQ0 / CKIO / TIOCA0 / TRACECLK
Y20	VSS

Table 1.7 List of Pin and Pin Functions (320-Pin FBGA) (1 / 10)

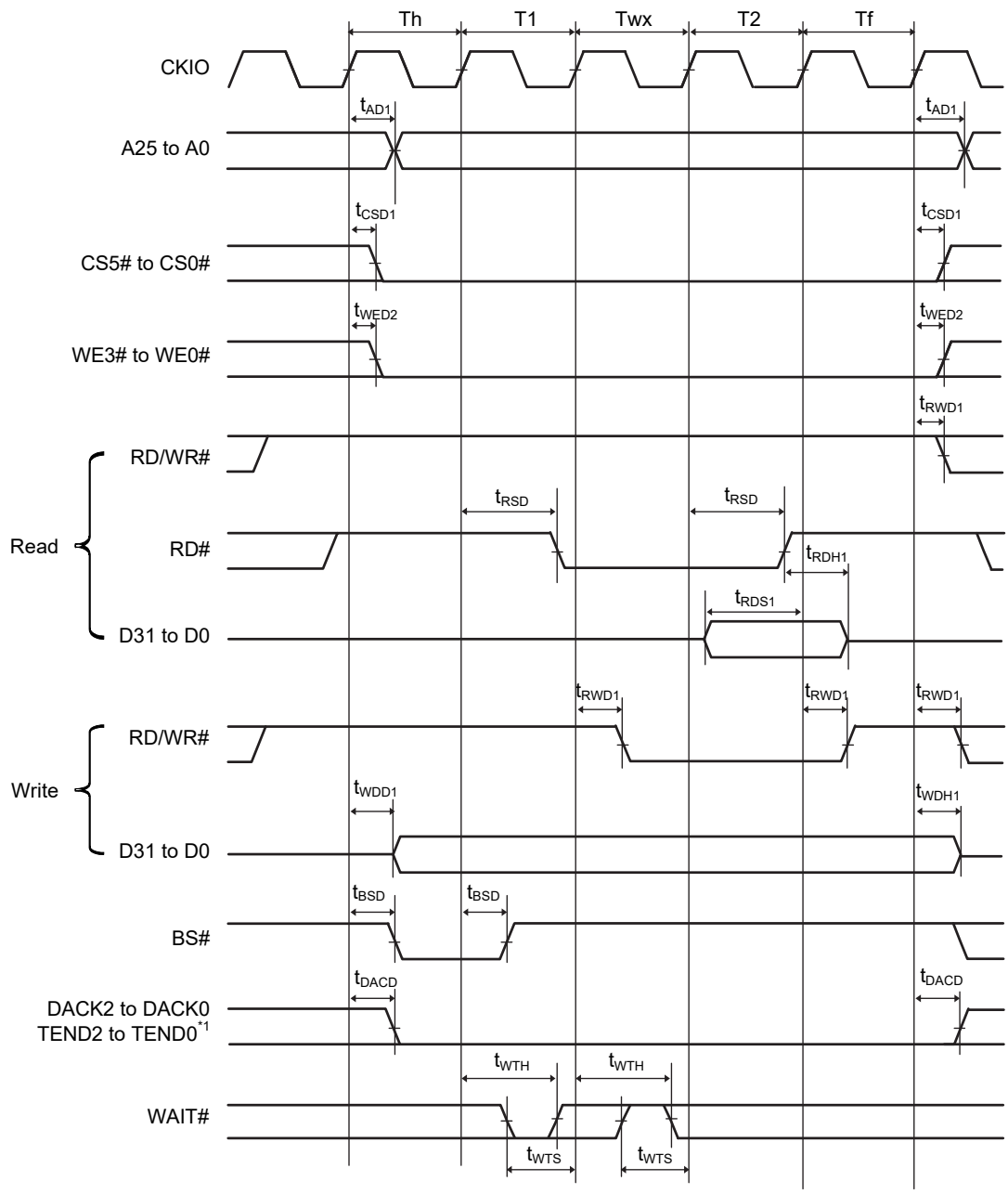
Pin Number 320-Pin FBGA	Power Supply Clock System Control	I/O Port	Bus	Timer (MTU3a, GPTa, TPUa, PPG, POE3, CMTW)	Communication (ETHERC, ECATC*1, SCIFA, RSPIa, RIICa, RSCAN, SPIBSC, USB)	Others (SSI, DSMIF, Encoder I/F)	Interrupt	S12ADCa
A1	VSS							
A2		PC2			ETH0_TXC / ETH1_RXD2 / CATI2CDATA / SDA0			
A3		PJ3			ETH0_TXD0		IRQ11	ADTRG0
A4		PJ1			ETH0_TXD2 / CATLEDSTER / RSPCK3			
A5		PF7	A25		ETH0_TXER / RTS3# / SSL30		IRQ7	
A6		PB4	A24		ETH1_COL / ETH0_RXER / CATSYNC0 / CATLATCH0 / RXD3 / MOSI3	MDAT0		
A7		PB0		MTCLKB / TCLKD / TIC3	ETH1_RXDV			
A8		PC0	WAIT#	GTETRG	ETH1_RXD2 / SCL1	MDAT3		
A9		PF6		MTIOC3D / GTIOC0B / TOC2	ETH1_RXD0			
A10	VCCQ33							
A11		P54			CLKOUT25M1 / MOSI2			
A12	VSS							
A13								AN007
A14								AN005
A15								AN002
A16	AVCC0							
A17	AVCC1							
A18	VREFH1							
A19		P17	CS5#		ETH1_TXER / PHYRESETOUT#			ADTRG0
A20	VSS							
B1		PJ5		TIOCD0	ETH0_RXD1 / RXD3			
B2		PJ4			ETH0_RXD0 / TXD3			
B3		PC3			ETH0_RXC / ETH0_RXDV / CATI2CCLK / RXD4 / SCL0 / CRXD1			
B4		PJ2			ETH0_TXD1 / MISO3		IRQ10	
B5		PJ0			ETH0_TXD3 / CATLEDERR / MOSI3		IRQ8	
B6		PB5		TCLKB / POE0# / POE10#	ETH_MDIO / CTS3# / RSPCK3			

Table 1.7 List of Pin and Pin Functions (320-Pin FBGA) (5 / 10)

Pin Number 320-Pin FBGA	Power Supply Clock System Control	I/O Port	Bus	Timer (MTU3a, GPTa, TPUa, PPG, POE3, CMTW)	Communication (ETHERC, ECATC*1, SCIFA, RSPIa, RIICa, RSCAN, SPIBSC, USB)	Others (SSI, DSMIF, Encoder I/F)	Interrupt	S12ADCa
H12	VDD							
H13	VSS							
H15		PA6	D30 / A21	GTIOC3A	CTS2#	MDAT0	IRQ6	
H16		PA5	D29	TIOCA4	ETH0_INT / ETH1_TXER / TXD2	MCLK1		
H18		PA2	D26 / DREQ2	MTIOC3B / GTIOC0A	SSL02	MDAT2 / ENCIF05		
H19		PK0	CAS#	PO31		ENCIF11		
H20		PK1	CS5#			ENCIF12		
J1		PM6		PO19	CATLINKACT0		IRQ6	
J2		PM3		PO16	CATSYNC0 / CATLATCH0			
J3		PM2		TCLKE	CATSYNC1 / CATLATCH1 / RTS4#			
J5	TDO	P33						
J6	TRST#							
J8	VDD							
J9	VSS							
J10	VSS							
J11	VSS							
J12	VSS							
J13	VDD							
J15	VCCQ33							
J16	TRACEDATA7	PA1	D25	MTIOC3D / GTIOC0B	MISO0	AUDIO_CLK / MCLK3		
J18	TRACEDATA6	PA0	D24	MTIOC4A / GTIOC1A	MOSI0	MDAT3		
J19		PT7	A22 / DACK2			ENCIF10		
J20		PT6	A21 / DREQ2					
K1		PM7		PO20	CATLINKACT1			
K2		PM5		PO18	CATLEDSTER			
K3		PM4		PO17	CATLEDRUN			
K5	TDI	P34						
K6	PLLVDD1							
K8	VDD							
K9	VSS							
K10	VSS							
K11	VSS							
K12	VSS							
K13	VDD							
K15	VSS							
K16	TRACEDATA5	P77	D23	MTIOC4C / GTIOC1B	RSPCK0			

Table 2.3 DC Characteristics (2) [Power Supply]

Item	Type		Symbol	typ	max	Unit	Test Conditions
Normal operation	VDD	600MHz	Vlcc	330	820	mA	Tj = -40 to 125 °C (R7S910018CBG, R7S910118CBG)
				273	752	mA	Tj = -40 to 125 °C (R7S910017CBG, R7S910117CBG)
				265	740	mA	Tj = -40 to 125°C (R7S910028CBG, R7S910128CBG)
				258	731	mA	Tj = -40 to 125 °C (R7S910013CBG, R7S910113CBG)
				209	673	mA	Tj = -40 to 125 °C (R7S910027CBG, R7S910127CBG)
				201	663	mA	Tj = -40 to 125 °C (R7S910007CBG, R7S910107CBG)
		450MHz		310	798	mA	Tj = -40 to 125 °C (R7S910016CBG, R7S910116CBG)
				253	730	mA	Tj = -40 to 125 °C (R7S910015CBG, R7S910115CBG)
				245	718	mA	Tj = -40 to 125 °C (R7S910026CBG, R7S910126CBG)
				238	709	mA	Tj = -40 to 125 °C (R7S910011CBG, R7S910111CBG)
				189	651	mA	Tj = -40 to 125 °C (R7S910025CBG, R7S910125CBG)
				181	641	mA	Tj = -40 to 125 °C (R7S910002CBG, R7S910006CBG, R7S910102CBG, R7S910106CBG)
				180	640	mA	Tj = -40 to 125 °C (R7S910001CFP, R7S910101CFP)
		300MHz		225	696	mA	Tj = -40 to 125 °C (R7S910036CBG, R7S910136CBG)
				169	629	mA	Tj = -40 to 125 °C (R7S910035CBG, R7S910135CBG)
				220	511	mA	Tj = -40 to 110 °C R7S9100022 R7S910023 R7S910122 R7S910123
	PLLVDD0 + PLLVDD1		PLLIcc	3.2	5	mA	
	VCCQ33		V33Icc	19*1, *2	—	mA	
	AVCC0		AV0Icc	2	5	mA	A/D conversion (unit 0)
	AVCC1		AV1Icc	0.7	1.5	mA	A/D conversion (unit 1)



Note 1. DACKn and TENDn are waveforms when “active low” is specified.

Figure 2.18 SRAM Bus Cycle with Byte Selection (SW = 1 Cycle, HW = 1 Cycle, Asynchronous External Wait 1 Inserted, BAS = 1 (Write Cycle WE Control))

2.4.4 DMAC Timing

Table 2.18 DMAC Timing

Output load conditions: V_{OH} = VCCQ33 × 0.5, V_{OL1} = VCCQ33 × 0.5, C = 30 pF

Item		Symbol	min*1	max	Unit	Test Conditions
DMAC	DREQ pulse width	t_{DRQW}	t_{PBcyc} × 2	—	ns	Figure 2.37
	DACK and TEND delay time	t_{DACD}	0	10	ns	Figure 2.38

Note 1. t_{PBcyc}: PCLKB cycle

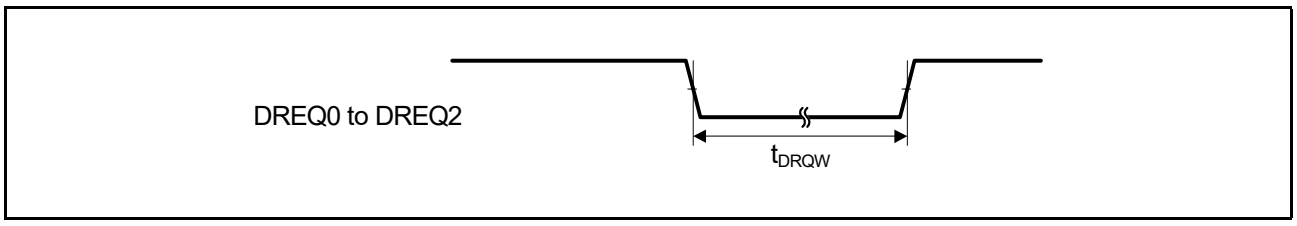


Figure 2.37 DREQ Input Timing

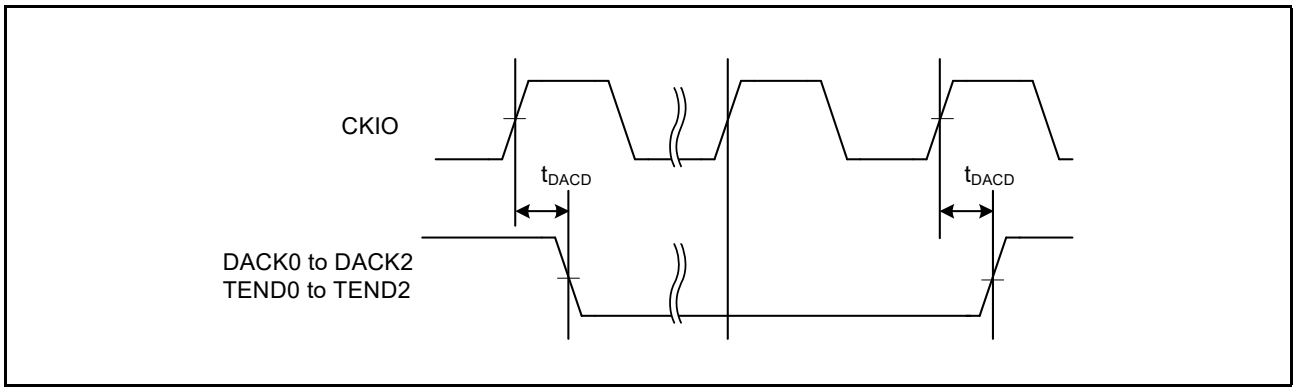


Figure 2.38 DACK and TEND Output Timing

2.4.5.4 MTU3a Timing

Table 2.22 MTU3a Timing

Item			Symbol	min	max	Unit*1	Test Conditions
MTU3a	Input capture input pulse width	Single-edge setting	t_{MTICW}	1.5	—	t_{PCcyc}	Figure 2.43
		Both-edge setting		2.5	—		
	Timer clock pulse width	Single-edge setting	t_{MTCKWH}, t_{MTCKWL}	1.5	—	t_{PCcyc}	Figure 2.44
		Both-edge setting		2.5	—		
		Phase counting mode		2.5	—		

Note 1. t_{PCcyc}: PCLKC cycle

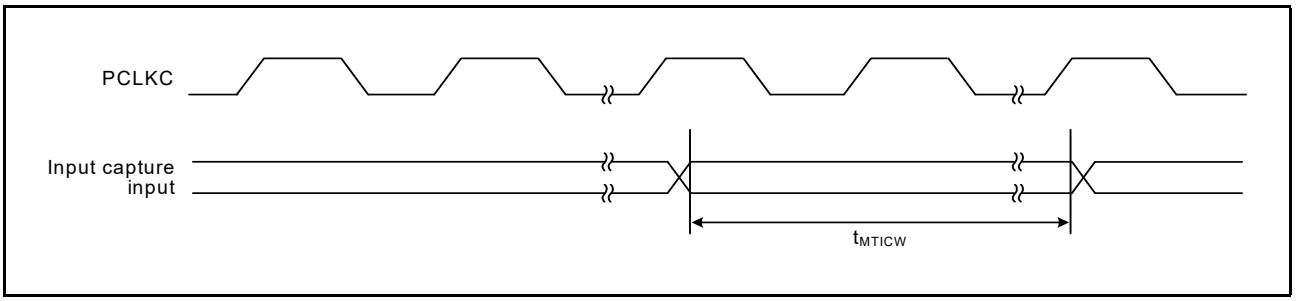


Figure 2.43 MTU3a Input Capture Input Timing

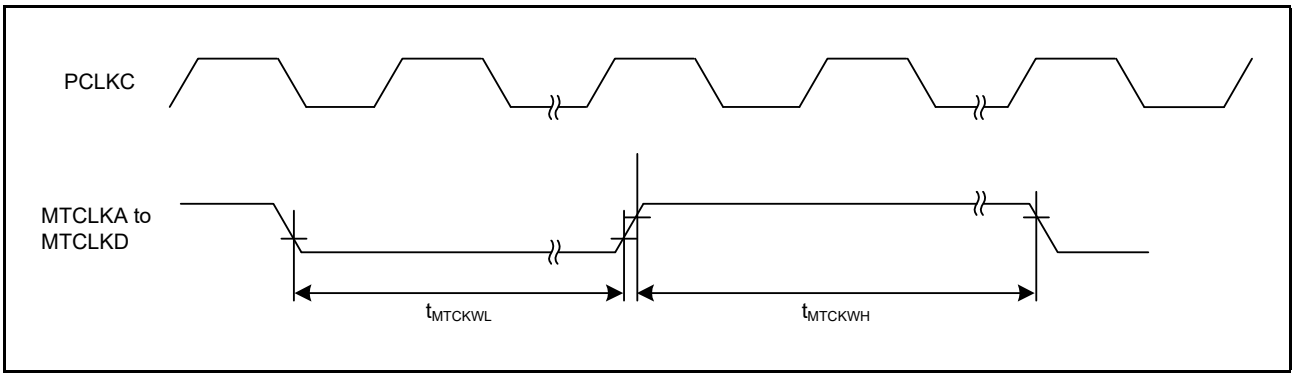


Figure 2.44 MTU3a Clock Input Timing

2.4.5.5 POE3 Timing

Table 2.23 POE3 Timing

Item		Symbol	min	max	Unit*1	Test Conditions
POE3	POEn# input pulse width	t_{POEW}	1.5	—	t_{PDcyc}	Figure 2.45

Note 1. t_{PDcyc}: PCLKD cycle

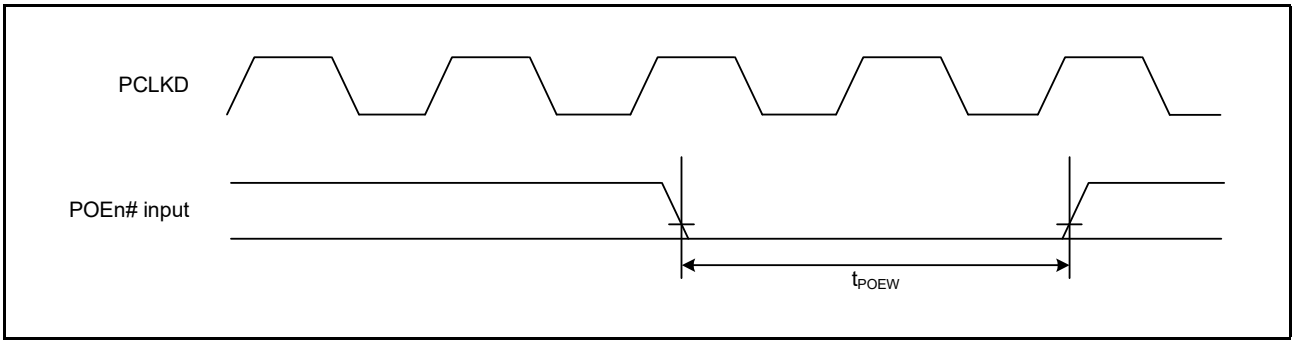


Figure 2.45 POEn# Input Pulse Timing

2.4.5.11 RIICa Timing

Table 2.29 RIICa Timing

Output load conditions: V_{OL2} = 0.4 V, I_{OL2} = 3 mA

Item		symbol	min*2	max*2	Unit*1	Test Conditions
RIICa (Standard-mode)	SCL input cycle time	t_{SCL}	6(12) × t_{IICcyc} + 1300	—	ns	Figure 2.64
	SCL input high pulse width	t_{SCLH}	3(6) × t_{IICcyc} + 300	—	ns	
	SCL input low pulse width	t_{SCLL}	3(6) × t_{IICcyc} + 300	—	ns	
	SCL, SDA input rising time	t_{sr}	—	1000	ns	
	SCL, SDA input falling time	t_{sf}	—	300	ns	
	SCL, SDA input spike pulse removal time	t_{SP}	0	1(4) × t_{IICcyc}	ns	
	SDA input bus free time	t_{BUF}	3(6) × t_{IICcyc} + 300	—	ns	
	Start condition input hold time	t_{STAH}	t_{IICcyc} + 300	—	ns	
	Restart condition input setup time	t_{STAS}	1000	—	ns	
	Stop condition input setup time	t_{STOS}	1000	—	ns	
	Data input setup time	t_{SDAS}	t_{IICcyc} + 50	—	ns	
	Data input hold time	t_{SDAH}	0	—	ns	
	SCL, SDA capacitive load	C_b	—	400	pF	
RIICa (Fast-mode)	SCL input cycle time	t_{SCL}	6(12) × t_{IICcyc} + 600	—	ns	
	SCL input high pulse width	t_{SCLH}	3(6) × t_{IICcyc} + 300	—	ns	
	SCL input low pulse width	t_{SCLL}	3(6) × t_{IICcyc} + 300	—	ns	
	SCL, SDA input rising time	t_{sr}	—*4	300	ns	
	SCL, SDA input falling time	t_{sf}	—*4	300	ns	
	SCL, SDA input spike pulse removal time	t_{SP}	0	1(4) × t_{IICcyc}	ns	
	SDA input bus free time	t_{BUF}	3(6) × t_{IICcyc} + 300	—	ns	
	Start condition input hold time	t_{STAH}	t_{IICcyc} + 300	—	ns	
	Restart condition input setup time	t_{STAS}	300	—	ns	
	Stop condition input setup time	t_{STOS}	300	—	ns	
	Data input setup time	t_{SDAS}	t_{IICcyc} + 50	—	ns	
	Data input hold time	t_{SDAH}	0	—	ns	
	SCL, SDA capacitive load*3	C_b	—	400	pF	

Note 1. t_{IICcyc}: RIIC internal reference clock (IICφ) cycle
Note 2. The value out of parentheses is applicable when the value of the ICMR3.NF[1:0] bits is 00b while the digital filter is enabled by the setting ICFER.NFE = 1. The value within parentheses is applicable when the value of the ICMR3.NF[1:0] bits is 11b while the digital filter is enabled by the setting ICFER.NFE = 1.
Note 3. Cb is the total capacitance of the bus lines.
Note 4. The minimum values are not specified for trs and tst in Fast-mode.

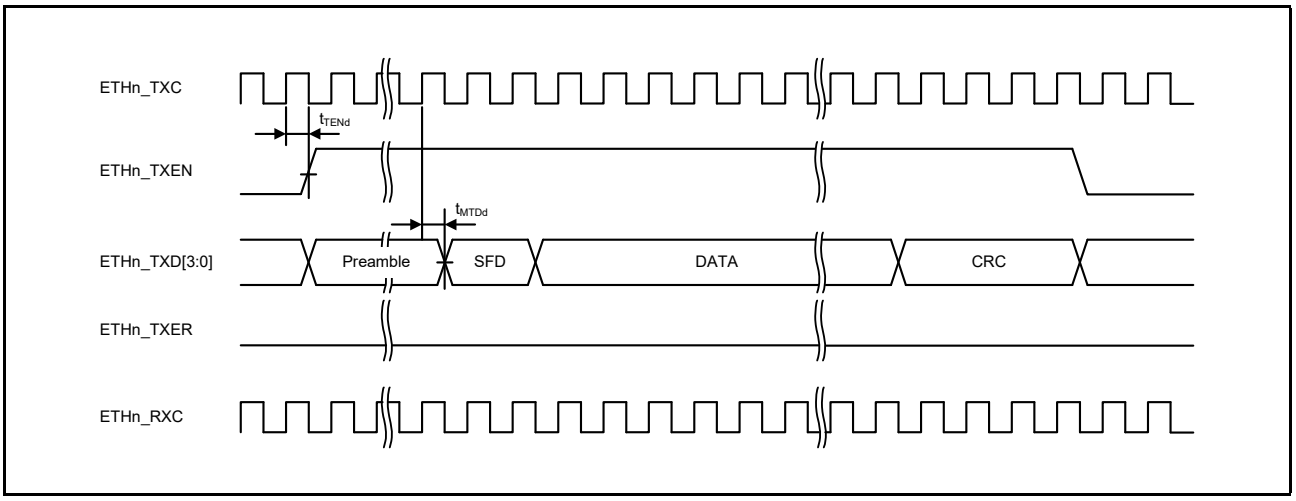


Figure 2.74 MII Transmission Timing

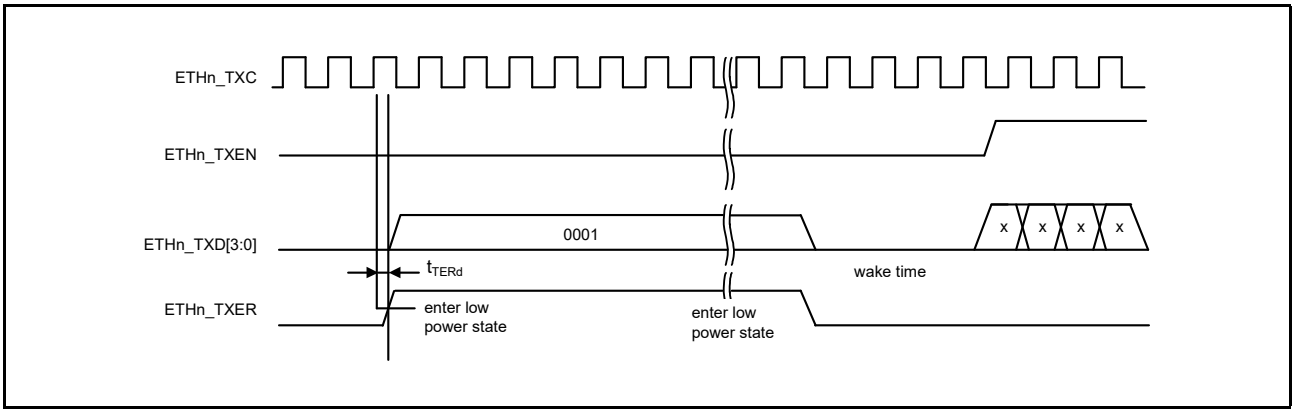


Figure 2.75 MII Transmission Timing

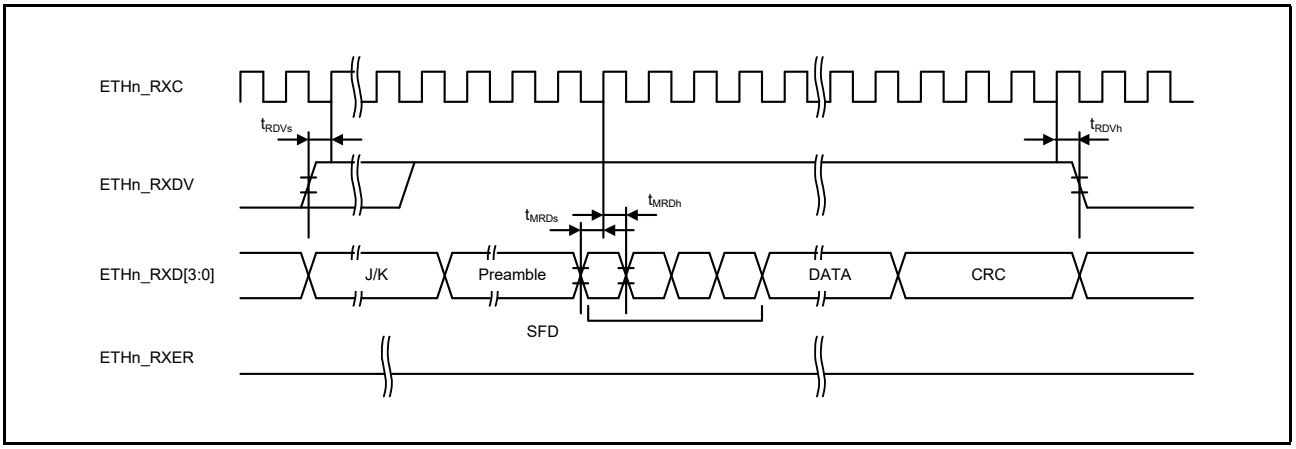


Figure 2.76 MII Reception Timing (Normal Operation)

2.5 USB Characteristics

- Conditions: VDD = PLLVDD0 = PLLVDD1 = DVDD_USB = 1.14 to 1.26 V,
  VCCQ33 = AVCC0 = AVCC1 = VREFH0 = VREFH1 = VDD33_USB = 3.0 to 3.6 V
  VSS = PLLVSS0 = PLLVSS1 = AVSS0 = AVSS1 = VREFL0 = VREFL1 = VSS_USB = 0 V,
  Tj = –40 to 125 °C

Note: The 176-pin HLQFP does not have pins AVCC1, AVSS1, VREFH1, and VREFL1.

Table 2.35 On-chip USB Full-Speed Characteristics (USB_DP, USB_DM Pin Characteristics)

Item	Symbol	min	typ	max	Unit	Test Conditions
Rising time	t_{FR}	4	—	20	ns	Figure 2.82
Falling time	t_{FF}	4	—	20	ns	
Rising/falling time ratio	t_{FR} / t_{FF}	90	—	111.11	%	t_{FR} / t_{FF}

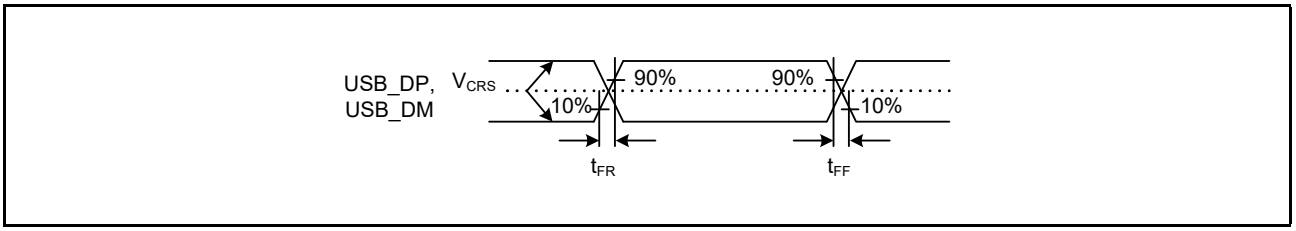


Figure 2.82 USB_DP, USB_DM Output Timing (Full Speed)

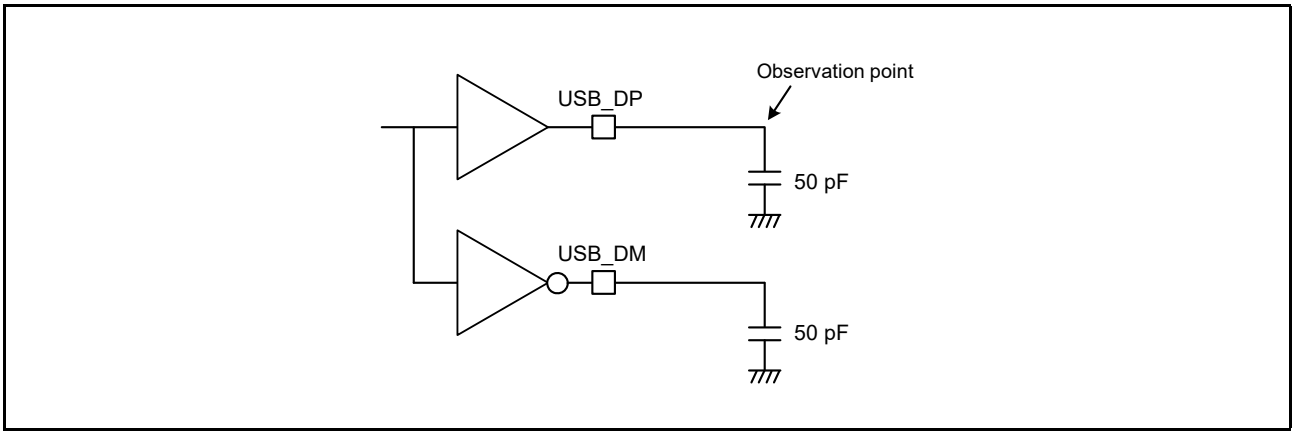


Figure 2.83 Measurement Circuit (Full Speed)

General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU 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. 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 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. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

   The state of the product is undefined at the moment 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 moment 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 moment 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 moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

   Access to reserved addresses is prohibited.

   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has 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. Moreover, 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.

5. Differences between Products

   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

   — The characteristics of an MPU or MCU in the same group but having a different part number may differ in terms of the 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.