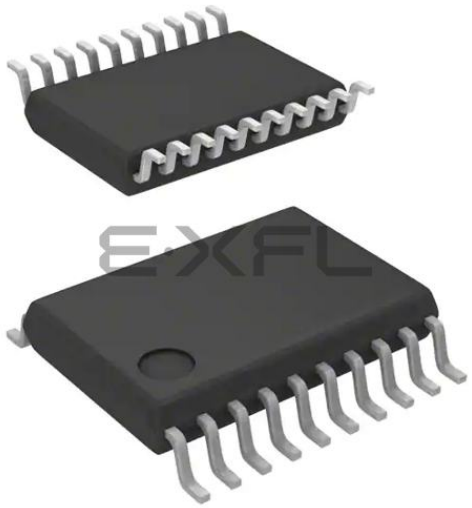
Renesas Electronics America Inc - R5F21143SP#U0 Datasheet



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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	Obsolete
Core Processor	R8C
Core Size	16-Bit
Speed	20MHz
Connectivity	SIO, SSU, UART/USART
Peripherals	LED, POR, Voltage Detect, WDT
Number of I/O	13
Program Memory Size	12KB (12K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	768 x 8
Voltage - Supply (Vcc/Vdd)	2.7V ~ 5.5V
Data Converters	A/D 4x10b
Oscillator Type	Internal
Operating Temperature	-20°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	20-LSSOP (0.173", 4.40mm Width)
Supplier Device Package	20-LSSOP
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f21143sp-u0

1.2 Performance Overview

Table 1.1 lists the Performance Outline of the R8C/14 Group and Table 1.2 lists the Performance Outline of the R8C/15 Group.

Table 1.1 Performance Outline of the R8C/14 Group

Item		Performance
CPU	Number of Basic Instructions	89 instructions
	Minimum Instruction Execution Time	50ns(f(XIN)=20MHz, VCC=3.0 to 5.5V) 100ns(f(XIN)=10MHz, VCC=2.7 to 5.5V)
	Operating Mode	Single-chip
	Memory Space	1 Mbyte
	Memory Capacity	See **Table 1.3 R8C/14 Group Product Information**
Peripheral Function	Port	I/O port : 13 pins (including LED drive port), Input : 2 pins
	LED Drive Port	I/O port: 4 pins
	Timer	Timer X: 8 bits × 1 channel, Timer Z: 8 bits × 1 channel (Each timer equipped with 8-bit prescaler) Timer C: 16 bits × 1 channel (Circuits of input capture and output compare)
	Serial Interface	1 channel Clock synchronous serial I/O, UART
	Chip-Select Clock Synchronous Serial I/O (SSU)	1 channel
	A/D Converter	10-bit A/D converter: 1 circuit, 4 channels
	Watchdog Timer	15 bits ×1 channel (with prescaler) Reset start selectable, Count source protection mode
	Interrupt	Internal: 9 factors, External: 4 factors, Software: 4 factors, Priority level: 7 levels
	Clock Generation Circuit	2 circuits • Main clock oscillation circuit (Equipped with a built-in feedback resistor) • On-chip oscillator (high speed, low speed) Equipped with frequency adjustment function on high-speed on-chip oscillator
	Oscillation Stop Detection Function	Main clock oscillation stop detection function
	Voltage Detection Circuit	Included
	Power-On Reset Circuit	Included
Electric Characteristics	Supply Voltage	VCC=3.0 to 5.5V (f(XIN)=20MHz) VCC=2.7 to 5.5V (f(XIN)=10MHz)
	Power Consumption	Typ. 9mA (VCC=5.0V, f(XIN)=20MHz) Typ. 5mA (VCC=3.0V, f(XIN)=10MHz) Typ. 35μA (VCC=3.0V, wait mode, peripheral clock off)

Table 1.4 Product Information of R8C/15 Group **As of Jan 2006**

Type No.	ROM capacity		RAM capacity	Package type	Remarks
	Program ROM	Data flash			
R5F21152SP	8 Kbytes	1 Kbyte × 2	512 bytes	PLSP0020JB-A	Flash memory version
R5F21153SP	12 Kbytes	1 Kbyte × 2	768 bytes	PLSP0020JB-A	
R5F21154SP	16 Kbytes	1 Kbyte × 2	1 Kbyte	PLSP0020JB-A	
R5F21152DSP	8 Kbytes	1 Kbyte × 2	512 bytes	PLSP0020JB-A	D version
R5F21153DSP	12 Kbytes	1 Kbyte × 2	768 bytes	PLSP0020JB-A	
R5F21154DSP	16 Kbytes	1 Kbyte × 2	1 Kbyte	PLSP0020JB-A	

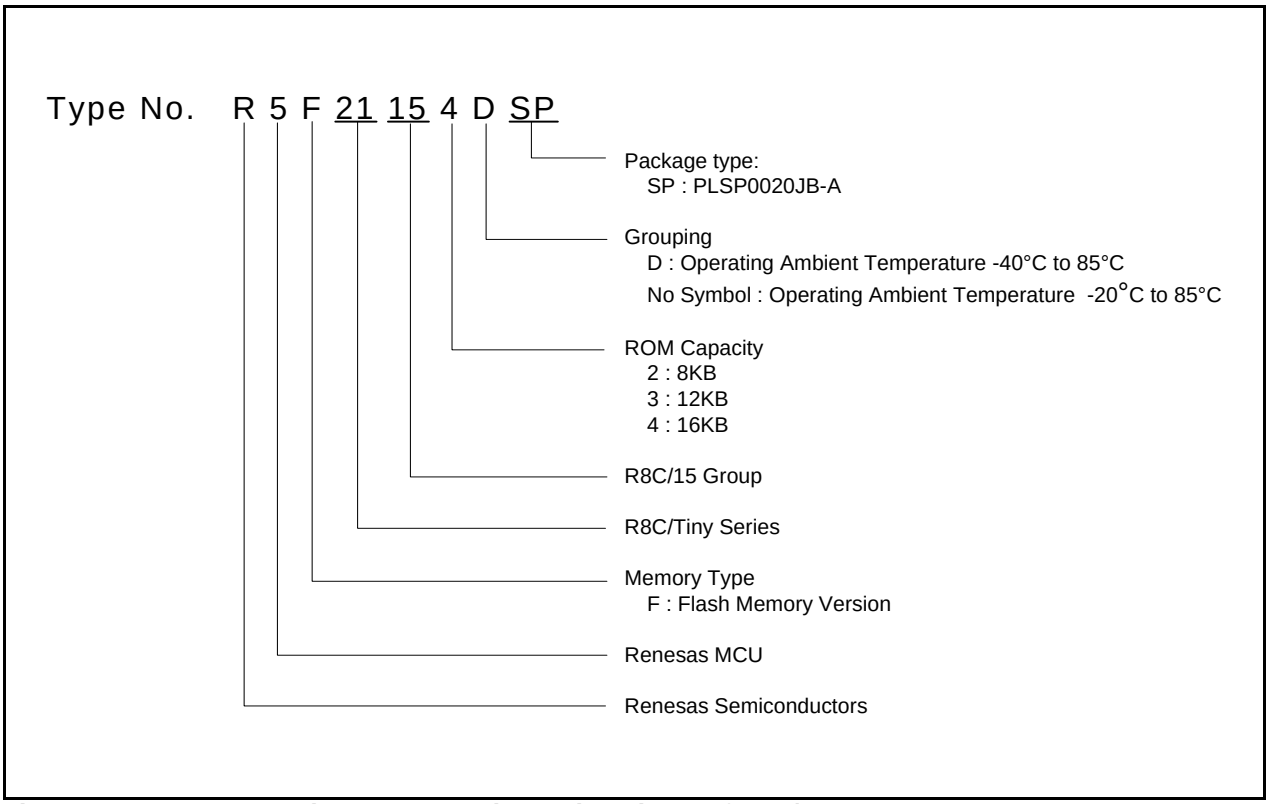


Figure 1.3 Part Number, Memory Size and Package of R8C/15 Group

1.6 Pin Description

Table 1.5 lists the Pin Description and Table 1.6 lists the Pin Name Information by Pin Number.

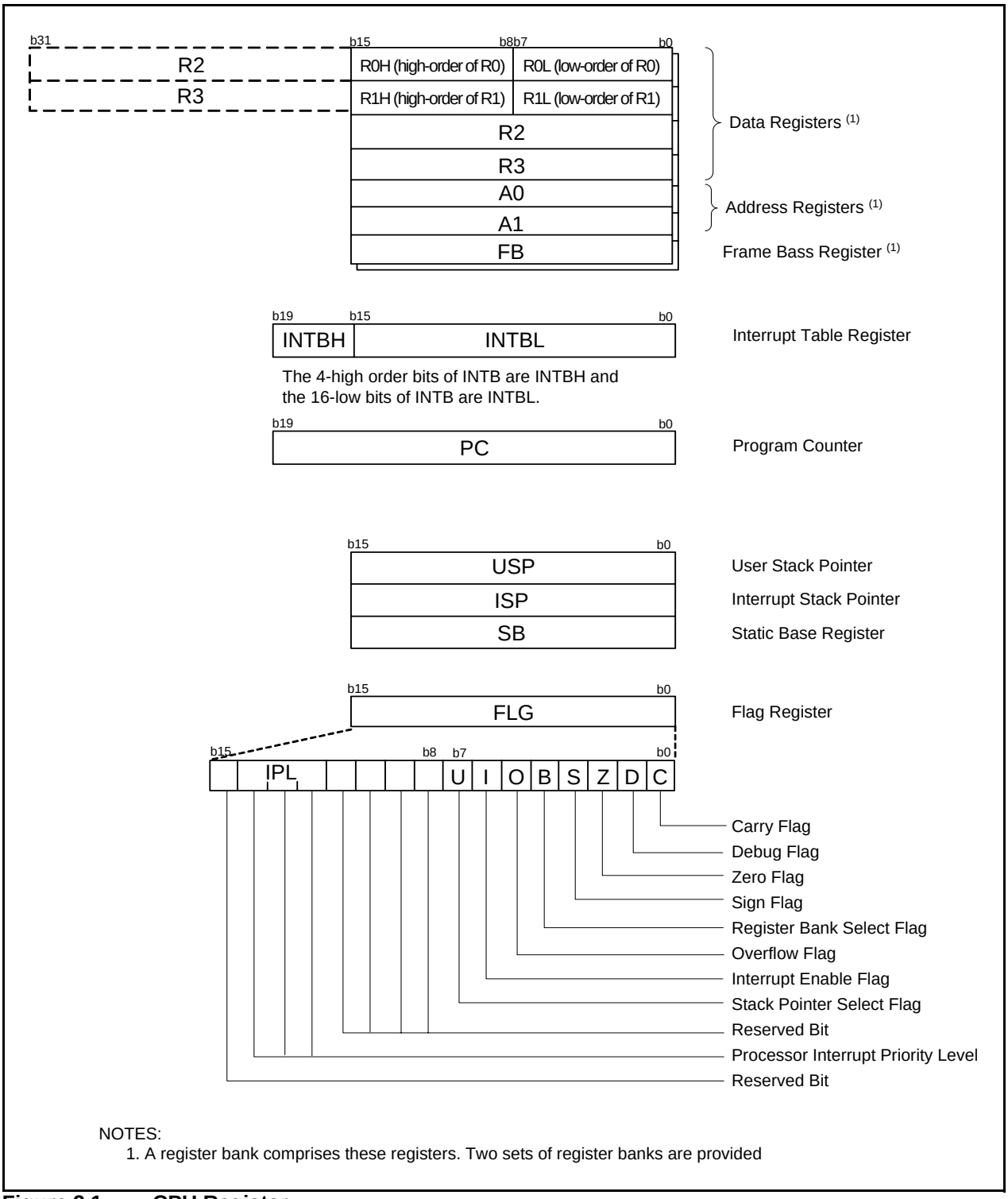
Table 1.5 Pin Description

Function	Pin name	I/O type	Description
Power Supply Input	VCC VSS	I	Apply 2.7V to 5.5V to the VCC pin. Apply 0V to the VSS pin
Analog Power Supply Input	AVCC AVSS	I	Power supply input pins to A/D converter. Connect AVCC to VCC. Apply 0V to AVSS. Connect a capacitor between AVCC and AVSS.
Reset Input	$\overline{\text{RESET}}$	I	Input “L” on this pin resets the MCU
MODE	MODE	I	Connect this pin to VCC via a resistor
Main Clock Input	XIN	I	These pins are provided for the main clock generation circuit I/O. Connect a ceramic resonator or a crystal oscillator between the XIN and XOUT pins. To use an externally derived clock, input it to the XIN pin and leave the XOUT pin open.
Main Clock Output	XOUT	O	
$\overline{\text{INT}}$ Interrupt	$\overline{\text{INT0}}$, $\overline{\text{INT1}}$, $\overline{\text{INT3}}$	I	INT interrupt input pins
Key Input Interrupt	$\overline{\text{KI0}}$ to $\overline{\text{KI3}}$	I	Key input interrupt input pins
Timer X	CNTR0	I/O	Timer X I/O pin
	$\overline{\text{CNTR0}}$	O	Timer X output pin.
Timer Z	TZOUT	O	Timer Z output pin
Timer C	TCIN	I	Timer C input pin
	CMP0_0 to CMP0_2, CMP1_0 to CMP1_2	O	Timer C output pins.
Serial Interface	CLK0	I/O	Transfer clock I/O pin.
	RXD0	I	Serial data input pin.
	TXD0	O	Serial data output pin.
SSU	SSI	I/O	Data I/O pin.
	$\overline{\text{SCS}}$	I/O	Chip-select signal I/O pin.
	SSCK	I/O	Clock I/O pin.
	SSO	I/O	Data I/O pin.
Reference Voltage Input	VREF	I	Reference voltage input pin to A/D converter Connect VREF to VCC
A/D Converter	AN8 to AN11	I	Analog input pins to A/D converter
I/O Port	P1_0 to P1_7, P3_3 to P3_5, P3_7, P4_5	I/O	These are CMOS I/O ports. Each port contains an I/O select direction register, allowing each pin in that port to be directed for input or output individually. Any port set to input can select whether to use a pull-up resistor or not by program. P1_0 to P1_3 also function as LED drive ports.
Input Port	P4_6, P4_7	I	Port for input-only

I: Input O: Output I/O: Input and output

2. Central Processing Unit (CPU)

Figure 2.1 shows the CPU Register. The CPU contains 13 registers. Of these, R0, R1, R2, R3, A0, A1 and FB comprise a register bank. Two sets of register banks are provided.

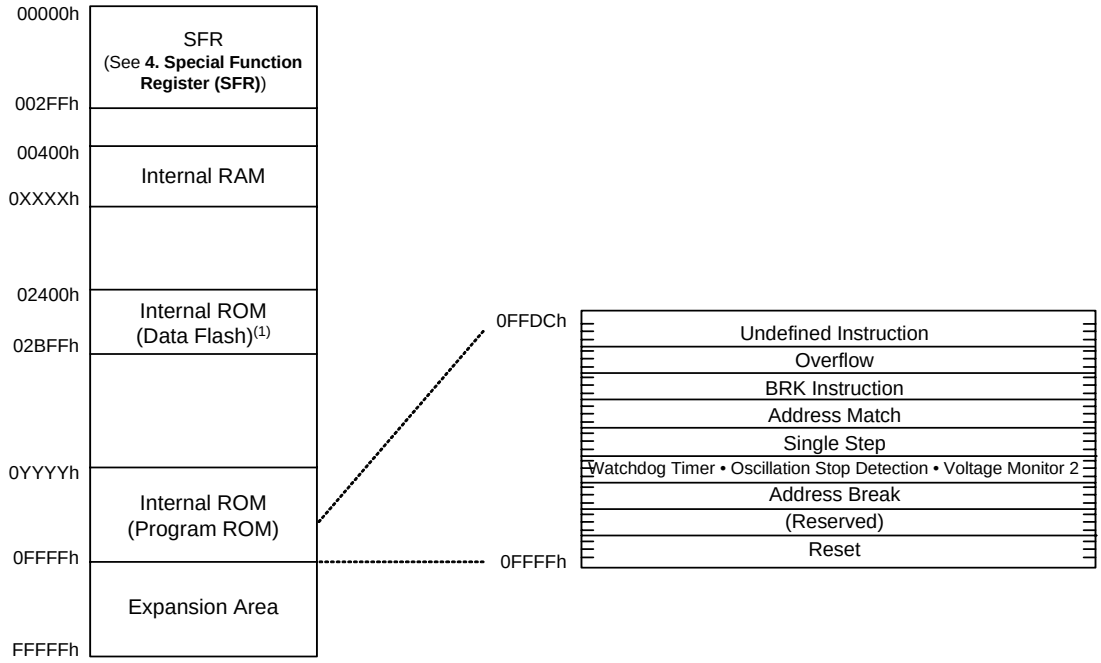


NOTES:
1. A register bank comprises these registers. Two sets of register banks are provided

Figure 2.1 CPU Register

3.2 R8C/15 Group

Figure 3.2 is a Memory Map of R8C/15 Group. The R8C/15 group provides 1-Mbyte address space from addresses 00000h to FFFFFh.
The internal ROM (program ROM) is allocated lower addresses beginning with address 0FFFFh. For example, a 16-Kbyte internal ROM is allocated addresses 0C000h to 0FFFFh.
The fixed interrupt vector table is allocated addresses 0FFDCh to 0FFFFh. They store the starting address of each interrupt routine.
The internal ROM (data flash) is allocated addresses 02400h to 02BFFh.
The internal RAM is allocated higher addresses beginning with address 00400h. For example, a 1-Kbyte internal RAM is allocated addresses 00400h to 007FFh. The internal RAM is used not only for storing data but for calling subroutines and stacks when interrupt request is acknowledged.
Special function registers (SFR) are allocated addresses 00000h to 002FFh. The peripheral function control registers are allocated them. All addresses, which have nothing allocated within the SFR, are reserved area and cannot be accessed by users.



NOTES:
1. The data flash block A (1 Kbyte) and block B (1 Kbyte) are shown.
2. Blank spaces are reserved. No access is allowed.

Part Number	Internal ROM		Internal RAM	
	Size	0YYYYh	Size	0XXXXh
R5F21154SP, R5F21154DSP	16K bytes	0C000h	1K byte	007FFh
R5F21153SP, R5F21153DSP	12K bytes	0D000h	768 bytes	006FFh
R5F21152SP, R5F21152DSP	8K bytes	0E000h	512 bytes	005FFh

Figure 3.2 Memory Map of R8C/15 Group

5. Electrical Characteristics

Table 5.1 Absolute Maximum Ratings

Symbol	Parameter	Condition	Rated value	Unit
V_{CC}	Supply Voltage	V_{CC} = AV_{CC}	-0.3 to 6.5	V
AV_{CC}	Analog Supply Voltage	V_{CC} = AV_{CC}	-0.3 to 6.5	V
V_I	Input Voltage		-0.3 to V_{CC}+0.3	V
V_O	Output Voltage		-0.3 to V_{CC}+0.3	V
P_d	Power Dissipation	T_{opr} = 25°C	300	mW
T_{opr}	Operating Ambient Temperature		-20 to 85 / -40 to 85 (D version)	°C
T_{stg}	Storage Temperature		-65 to 150	°C

Table 5.2 Recommended Operating Conditions

Symbol	Parameter		Conditions	Standard			Unit
				Min.	Typ.	Max.	
V_{CC}	Supply Voltage			2.7	–	5.5	V
AV_{CC}	Analog Supply Voltage			–	V_{CC}(3)	–	V
V_{SS}	Supply Voltage			–	0	–	V
AV_{SS}	Analog Supply Voltage			–	0	–	V
V_{IH}	Input “H” Voltage			0.8V_{CC}	–	V_{CC}	V
V_{IL}	Input “L” Voltage			0	–	0.2V_{CC}	V
$I_{OH(sum)}$	Peak Sum Output “H” Current	Sum of All Pins $I_{OH\ (peak)}$		–	–	-60	mA
$I_{OH(peak)}$	Peak Output “H” Current			–	–	-10	mA
$I_{OH(avg)}$	Average Output “H” Current			–	–	-5	mA
$I_{OL(sum)}$	Peak Sum Output “L” Currents	Sum of All Pins $I_{OL\ (peak)}$		–	–	60	mA
$I_{OL(peak)}$	Peak Output “L” Currents	Except P1_0 to P1_3		–	–	10	mA
		P1_0 to P1_3	Drive Capacity HIGH	–	–	30	mA
			Drive Capacity LOW	–	–	10	mA
$I_{OL(avg)}$	Average Output “L” Current	Except P1_0 to P1_3		–	–	5	mA
		P1_0 to P1_3	Drive Capacity HIGH	–	–	15	mA
			Drive Capacity LOW	–	–	5	mA
$f_{(XIN)}$	Main Clock Input Oscillation Frequency		3.0V ≤ V_{CC} ≤ 5.5V	0	–	20	MHz
			2.7V ≤ V_{CC} < 3.0V	0	–	10	MHz

NOTES:
1. V_{CC} = AV_{CC} = 2.7 to 5.5V at T_{opr} = -20 to 85 °C / -40 to 85 °C, unless otherwise specified.
2. The typical values when average output current is 100ms.
3. Hold V_{CC} = AV_{CC}.

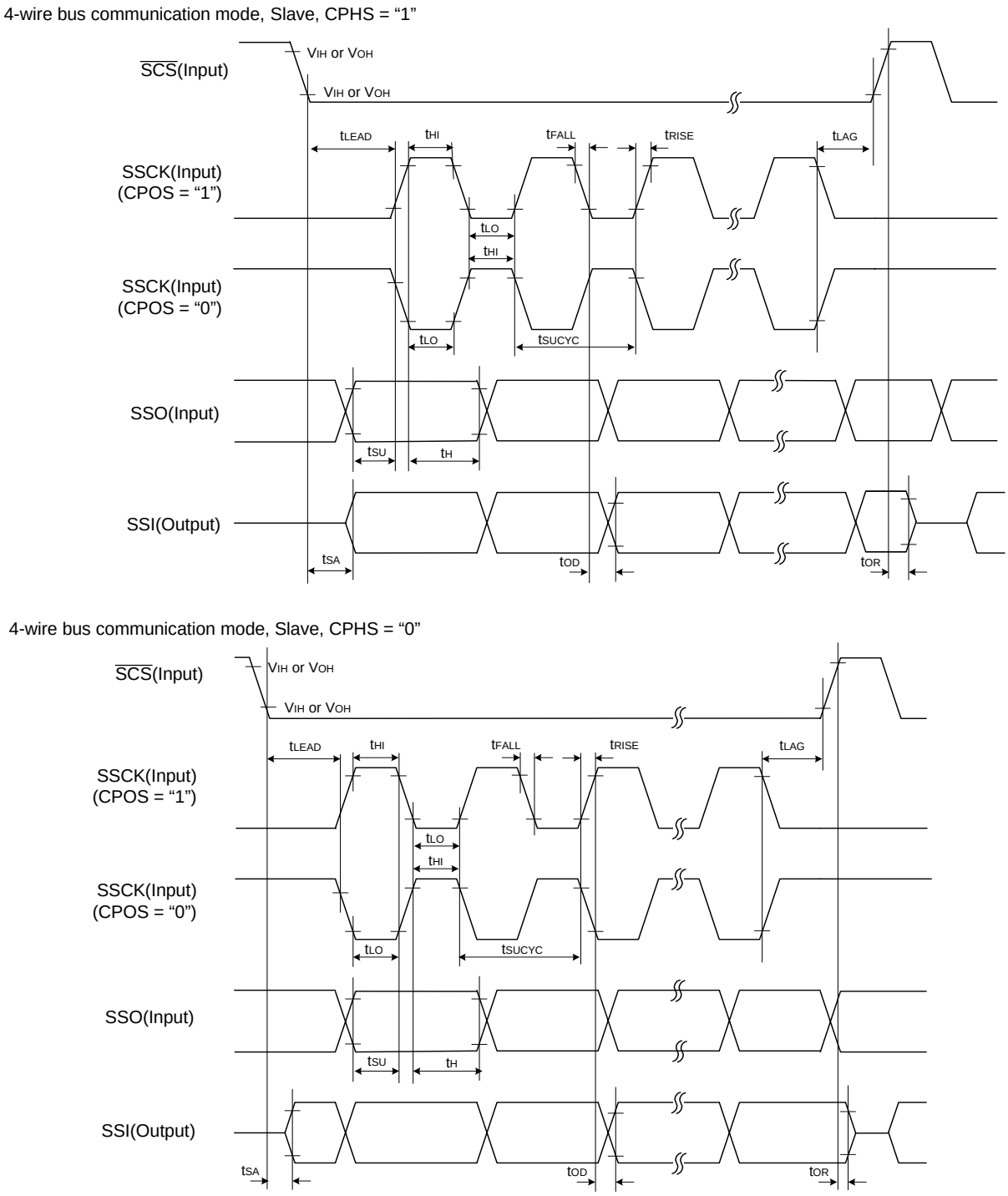


Figure 5.5 I/O Timing of Clock Synchronous Serial I/O (SSU) with Chip Select (Slave)

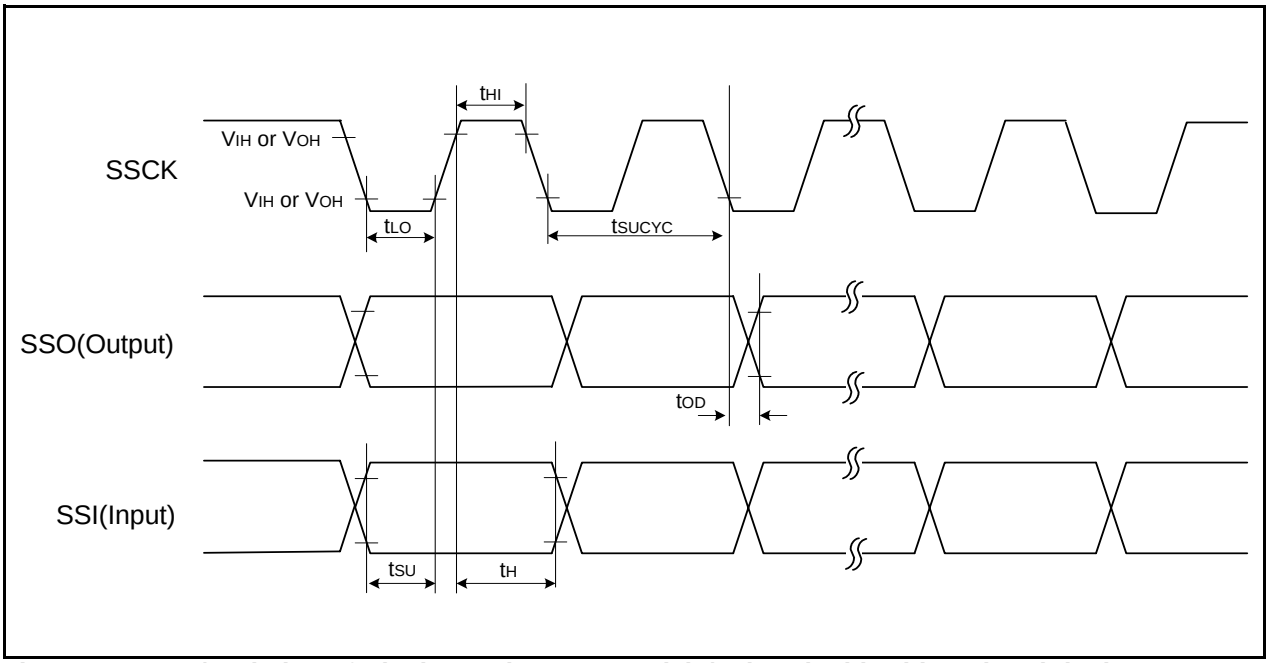


Figure 5.6 I/O Timing of Clock Synchronous Serial I/O (SSU) with Chip Select (Clock Synchronous Communication Mode)