

- Write transfer to a read-only register.
- Read or write access to a register space beyond the last populated register of the SSI in its memory map (up until the end of the allocated memory address range of the SSI).

61.8.8.3 Clock Rate

The Peripheral Bus clock frequency must be at least five times the serial bit clock frequency.

61.8.9 Reset

The SSI is affected by the following types of reset:

- Power-on Reset-The Power-on reset clears the SSIEN bit in SSI.SCR, which disables the SSI. All other status and control bits in the SSI are affected as described in SSI Programming Model in the "Memory Map and Register Definition section".
- SSI Reset-The SSI reset is generated when the SSIEN bit in the SSI.SCR is cleared. The SSI status bits are preset to the same state produced by the Power-on reset. The SSI control bits are unaffected. The control bits in the SSI.SCR are also unaffected. The SSI reset is useful for selective reset of the SSI without changing the present SSI control bits and without affecting the other peripherals.

61.9 SSI Memory Map/Register Definition

SSI memory map

| Absolute address (hex) | Register name | Width (in bits) | Access | Reset value | Section/ page |
|------------------------|---|-----------------|--------|-------------|-----------------------------|
| 202_8000 | SSI Transmit Data Register n (SSI1_STX0) | 32 | R/W | 0000_0000h | 61.9.1/5130 |
| 202_8004 | SSI Transmit Data Register n (SSI1_STX1) | 32 | R/W | 0000_0000h | 61.9.1/5130 |
| 202_8008 | SSI Receive Data Register n (SSI1_SRX0) | 32 | R | 0000_0000h | 61.9.2/5130 |
| 202_800C | SSI Receive Data Register n (SSI1_SRX1) | 32 | R | 0000_0000h | 61.9.2/5130 |
| 202_8010 | SSI Control Register (SSI1_SCR) | 32 | R/W | 0000_0000h | 61.9.3/5131 |
| 202_8014 | SSI Interrupt Status Register (SSI1_SISR) | 32 | w1c | 0000_3003h | 61.9.4/5133 |
| 202_8018 | SSI Interrupt Enable Register (SSI1_SIER) | 32 | R/W | 0000_3003h | 61.9.5/5139 |
| 202_801C | SSI Transmit Configuration Register (SSI1_STCR) | 32 | R/W | 0000_0200h | 61.9.6/5143 |
| 202_8020 | SSI Receive Configuration Register (SSI1_SRCR) | 32 | R/W | 0000_0200h | 61.9.7/5145 |

Table continues on the next page...

SSI memory map (continued)

| Absolute address (hex) | Register name | Width (in bits) | Access | Reset value | Section/ page |
|------------------------|---|-----------------|--------|-------------|------------------------------|
| 202_8024 | SSI Transmit Clock Control Register (SSI1_STCCR) | 32 | R/W | 0004_0000h | 61.9.8/5147 |
| 202_8028 | SSI Receive Clock Control Register (SSI1_SRCCR) | 32 | R/W | 0004_0000h | 61.9.9/5149 |
| 202_802C | SSI FIFO Control/Status Register (SSI1_SFCSR) | 32 | R/W | 0081_0081h | 61.9.10/5150 |
| 202_8038 | SSI AC97 Control Register (SSI1_SACNT) | 32 | R/W | 0000_0000h | 61.9.11/5154 |
| 202_803C | SSI AC97 Command Address Register (SSI1_SACADD) | 32 | R/W | 0000_0000h | 61.9.12/5155 |
| 202_8040 | SSI AC97 Command Data Register (SSI1_SACDAT) | 32 | R/W | 0000_0000h | 61.9.13/5155 |
| 202_8044 | SSI AC97 Tag Register (SSI1_SATAG) | 32 | R/W | 0000_0000h | 61.9.14/5156 |
| 202_8048 | SSI Transmit Time Slot Mask Register (SSI1_STMSK) | 32 | R/W | 0000_0000h | 61.9.15/5156 |
| 202_804C | SSI Receive Time Slot Mask Register (SSI1_SRMSK) | 32 | R/W | 0000_0000h | 61.9.16/5157 |
| 202_8050 | SSI AC97 Channel Status Register (SSI1_SACCST) | 32 | R | 0000_0000h | 61.9.17/5157 |
| 202_8054 | SSI AC97 Channel Enable Register (SSI1_SACCEN) | 32 | W | 0000_0000h | 61.9.18/5158 |
| 202_8058 | SSI AC97 Channel Disable Register (SSI1_SACCDIS) | 32 | W | 0000_0000h | 61.9.19/5158 |
| 202_C000 | SSI Transmit Data Register n (SSI2_STX0) | 32 | R/W | 0000_0000h | 61.9.1/5130 |
| 202_C004 | SSI Transmit Data Register n (SSI2_STX1) | 32 | R/W | 0000_0000h | 61.9.1/5130 |
| 202_C008 | SSI Receive Data Register n (SSI2_SRX0) | 32 | R | 0000_0000h | 61.9.2/5130 |
| 202_C00C | SSI Receive Data Register n (SSI2_SRX1) | 32 | R | 0000_0000h | 61.9.2/5130 |
| 202_C010 | SSI Control Register (SSI2_SCR) | 32 | R/W | 0000_0000h | 61.9.3/5131 |
| 202_C014 | SSI Interrupt Status Register (SSI2_SISR) | 32 | w1c | 0000_3003h | 61.9.4/5133 |
| 202_C018 | SSI Interrupt Enable Register (SSI2_SIER) | 32 | R/W | 0000_3003h | 61.9.5/5139 |
| 202_C01C | SSI Transmit Configuration Register (SSI2_STCR) | 32 | R/W | 0000_0200h | 61.9.6/5143 |
| 202_C020 | SSI Receive Configuration Register (SSI2_SRCCR) | 32 | R/W | 0000_0200h | 61.9.7/5145 |
| 202_C024 | SSI Transmit Clock Control Register (SSI2_STCCR) | 32 | R/W | 0004_0000h | 61.9.8/5147 |
| 202_C028 | SSI Receive Clock Control Register (SSI2_SRCCR) | 32 | R/W | 0004_0000h | 61.9.9/5149 |
| 202_C02C | SSI FIFO Control/Status Register (SSI2_SFCSR) | 32 | R/W | 0081_0081h | 61.9.10/5150 |
| 202_C038 | SSI AC97 Control Register (SSI2_SACNT) | 32 | R/W | 0000_0000h | 61.9.11/5154 |
| 202_C03C | SSI AC97 Command Address Register (SSI2_SACADD) | 32 | R/W | 0000_0000h | 61.9.12/5155 |
| 202_C040 | SSI AC97 Command Data Register (SSI2_SACDAT) | 32 | R/W | 0000_0000h | 61.9.13/5155 |

Table continues on the next page...

SSI memory map (continued)

| Absolute address (hex) | Register name | Width (in bits) | Access | Reset value | Section/page |
|------------------------|---|-----------------|--------|-------------|-------------------------------|
| 202_C044 | SSI AC97 Tag Register (SSI2_SATAG) | 32 | R/W | 0000_0000h | 61.9.14/ 5156 |
| 202_C048 | SSI Transmit Time Slot Mask Register (SSI2_STMSK) | 32 | R/W | 0000_0000h | 61.9.15/ 5156 |
| 202_C04C | SSI Receive Time Slot Mask Register (SSI2_SRMSK) | 32 | R/W | 0000_0000h | 61.9.16/ 5157 |
| 202_C050 | SSI AC97 Channel Status Register (SSI2_SACCST) | 32 | R | 0000_0000h | 61.9.17/ 5157 |
| 202_C054 | SSI AC97 Channel Enable Register (SSI2_SACCEN) | 32 | W | 0000_0000h | 61.9.18/ 5158 |
| 202_C058 | SSI AC97 Channel Disable Register (SSI2_SACCDIS) | 32 | W | 0000_0000h | 61.9.19/ 5158 |
| 203_0000 | SSI Transmit Data Register n (SSI3_STX0) | 32 | R/W | 0000_0000h | 61.9.1/5130 |
| 203_0004 | SSI Transmit Data Register n (SSI3_STX1) | 32 | R/W | 0000_0000h | 61.9.1/5130 |
| 203_0008 | SSI Receive Data Register n (SSI3_SRX0) | 32 | R | 0000_0000h | 61.9.2/5130 |
| 203_000C | SSI Receive Data Register n (SSI3_SRX1) | 32 | R | 0000_0000h | 61.9.2/5130 |
| 203_0010 | SSI Control Register (SSI3_SCR) | 32 | R/W | 0000_0000h | 61.9.3/5131 |
| 203_0014 | SSI Interrupt Status Register (SSI3_SISR) | 32 | w1c | 0000_3003h | 61.9.4/5133 |
| 203_0018 | SSI Interrupt Enable Register (SSI3_SIER) | 32 | R/W | 0000_3003h | 61.9.5/5139 |
| 203_001C | SSI Transmit Configuration Register (SSI3_STCR) | 32 | R/W | 0000_0200h | 61.9.6/5143 |
| 203_0020 | SSI Receive Configuration Register (SSI3_SRCCR) | 32 | R/W | 0000_0200h | 61.9.7/5145 |
| 203_0024 | SSI Transmit Clock Control Register (SSI3_STCCR) | 32 | R/W | 0004_0000h | 61.9.8/5147 |
| 203_0028 | SSI Receive Clock Control Register (SSI3_SRCCR) | 32 | R/W | 0004_0000h | 61.9.9/5149 |
| 203_002C | SSI FIFO Control/Status Register (SSI3_SFCSR) | 32 | R/W | 0081_0081h | 61.9.10/ 5150 |
| 203_0038 | SSI AC97 Control Register (SSI3_SACNT) | 32 | R/W | 0000_0000h | 61.9.11/ 5154 |
| 203_003C | SSI AC97 Command Address Register (SSI3_SACADD) | 32 | R/W | 0000_0000h | 61.9.12/ 5155 |
| 203_0040 | SSI AC97 Command Data Register (SSI3_SACDAT) | 32 | R/W | 0000_0000h | 61.9.13/ 5155 |
| 203_0044 | SSI AC97 Tag Register (SSI3_SATAG) | 32 | R/W | 0000_0000h | 61.9.14/ 5156 |
| 203_0048 | SSI Transmit Time Slot Mask Register (SSI3_STMSK) | 32 | R/W | 0000_0000h | 61.9.15/ 5156 |
| 203_004C | SSI Receive Time Slot Mask Register (SSI3_SRMSK) | 32 | R/W | 0000_0000h | 61.9.16/ 5157 |
| 203_0050 | SSI AC97 Channel Status Register (SSI3_SACCST) | 32 | R | 0000_0000h | 61.9.17/ 5157 |
| 203_0054 | SSI AC97 Channel Enable Register (SSI3_SACCEN) | 32 | W | 0000_0000h | 61.9.18/ 5158 |
| 203_0058 | SSI AC97 Channel Disable Register (SSI3_SACCDIS) | 32 | W | 0000_0000h | 61.9.19/ 5158 |

61.9.1 SSI Transmit Data Register n (SSIx_STXn)

NOTE

Enable SSI (SSIEN=1) before writing to SSI Transmit Data Registers.

Address: Base address + 0h offset + (4d × i), where i=0d to 1d

SSIx STX n field descriptions

| Field | Description |
|-------|---|
| STXn | <p>SSI Transmit Data. These bits store the data to be transmitted by the SSI. These are implemented as the first word of their respective Tx FIFOs. Data written to these registers is transferred to the Transmit Shift Register (TXSR), when shifting of the previous data is complete. If both FIFOs are in use, data is alternately transferred from STX0 and STX1, to TXSR. Multiple writes to the STX registers will not result in the previous data being over-written by the subsequent data. STX1 can only be used in Two-Channel mode of operation. Protection from over-writing is present irrespective of whether the transmitter is enabled or not.</p> <p>Example 1: If Tx FIFO0 is in use and user writes Data1...Data16 to STX0, Data16 will not over-write Data1. Data1...Data15 are stored in the FIFO while Data16 is discarded.</p> <p>Example 2: If Tx FIFO0 is not in use and user writes Data1, Data2 to STX0, then Data2 will not over-write Data1 and will be discarded.</p> |

61.9.2 SSI Receive Data Register n (SSIx_SRXn)

Address: Base address + 8h offset + (4d × i), where i=0d to 1d

SSIx SRXn field descriptions

| Field | Description |
|-------|--|
| SRXn | SSI Receive Data. These bits store the data received by the SSI. These are implemented as the first word of their respective Rx FIFOs. These bits receive data from the RXSR depending on the mode of operation. In case both FIFOs are in use, data is transferred to each data register alternately. SRX1 can only be used in Two-Channel mode of operation. |

61.9.3 SSI Control Register (SSIx_SCR)

The SSI Control Register (SSI_SCR) sets up the SSI reset is controlled by bit 0 in the SSI_SCR. SSI operating modes are also selected in this register (except AC97 mode which is selected in the SSI_SACNT register).

Address: Base address + 10h offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
|-------|----|----|----|------------|-------------|-------------|---------|--------|------------|----------|-----|-----|----|----|----|-------|
| R | | | | | | | | | 0 | | | | | | | |
| W | | | | | | | | | | | | | | | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| R | | | | 0 | | | | | | | | | | | | |
| W | | | | SYNC_TX_FS | RFR_CLK_DIS | TFR_CLK_DIS | CLK_RST | TCH_EN | SYS_CLK_EN | I2S_MODE | SYN | NET | RE | TE | | SSIEN |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

SSIx_SCR field descriptions

| Field | Description |
|-------------------|---|
| 31–13 Reserved | This read-only field is reserved and always has the value 0. |
| 12 SYNC_TX_FS | <p>SYNC_FS_TX bit provides a safe window for TE to be visible to the internal circuit which is just after FS occurrence. When SYNC_TX_FS is set, TE(SCR[1]) gets latched on FS occurrence & latched TE is used to enable/disable SSI transmitter. TE needs setup of 2 bit-clock cycles before occurrence of FS. If TE is changed within 2 bit-clock cycles of FS occurrence, there is high probability that TE will be latched on next FS.</p> <p>Note: With TFR_CLK_DIS feature on, TE is used directly to enable transmitter in following cases (i) Sync mode & Rx disabled (ii) Async Mode. Latched-TE is used to disable the transmitter.</p> <p>This bit has no relevance in gated mode and AC97 mode.</p> <p>0 TE_NOT_LATCHED — TE not latched with FS occurrence & used directly for transmitter enable/disable.</p> <p>1 TE_LATCHED — TE latched with FS occurrence & latched-TE used for transmitter enable/disable.</p> |
| 11 RFR_CLK_DIS | <p>Receive Frame Clock Disable.</p> <p>This bit provides the option to keep the Frame-sync and Clock enabled or to disable them after the receive frame in which the receiver is disabled. Writing to this bit has effect only when RE is disabled. The receiver is disabled by clearing the RE bit.</p> |

Table continues on the next page...

SSIx_SCR field descriptions (continued)

| Field | Description |
|-------------------|--|
| | <p>0 CONTINUE — Continue Frame-sync/Clock generation after current frame during which RE is cleared. This may be required when Frame-sync and Clocks are required from SSI, even when no data is to be received.</p> <p>1 STOP — Stop Frame-sync/Clock generation at next frame boundary. This will be effective also in case where receiver is already disabled in current or previous frames.</p> |
| 10 TFR_CLK_DIS | <p>Transmit Frame Clock Disable.</p> <p>This bit provide option to keep the Frame-sync and Clock enabled or disabled after current transmit frame, in which transmitter is disabled by clearing TE bit. Writing to this bit has effect only when SSI is enabled TE is disabled.</p> <p>0 CONTINUE — Continue Frame-sync/Clock generation after current frame during which TE is cleared. This may be required when Frame-sync and Clocks are required from SSI, even when no data is to be received.</p> <p>1 STOP — Stop Frame-sync/Clock generation at next frame boundary. This will be effective also in case where transmitter is already disabled in current or previous frames.</p> |
| 9 CLK_IST | <p>Clock Idle State. This bit controls the idle state of the transmit clock port during SSI internal gated mode.</p> <p>Note: When Clock idle state is '1' the clock polarity should always be negedge triggered and when Clock idle = '0' the clock polarity should always be positive edge triggered.</p> <p>0 IDLE_0 — Clock idle state is '0'.</p> <p>1 IDLE_1 — Clock idle state is '1'.</p> |
| 8 TCH_EN | <p>Two-Channel Operation Enable. This bit allows SSI to operate in the two-channel mode. In this mode while receiving, the RXSR transfers data to SRX0 and SRX1 alternately and while transmitting, data is alternately transferred from STX0 and STX1 to TXSR. For an even number of slots, Two-Channel Operation can be enabled to optimize usage of both FIFOs or disabled as in the case of odd number of active slots. This feature is especially useful in I2S mode, where data for Left Speaker can be placed in Tx-FIFO0 and for Right speaker in Tx-FIFO1.</p> <p>0 DISABLED — Two-channel mode disabled.</p> <p>1 ENABLED — Two-channel mode enabled.</p> |
| 7 SYS_CLK_EN | <p>Network Clock (Oversampling Clock) Enable. When set, this bit allows the SSI to output the network clock at the SRCK port, provided that synchronous mode, and transmit internal clock mode are set. The relationship between bit clock and network clock is determined by DIV2, PSR, and PM bits. This feature is especially useful in I2S Master mode to output network clock (oversampling clock) on SRCK port.</p> <p>0 NOT_OUTPUT — network clock not output on SRCK port.</p> <p>1 OUTPUT — network clock output on SRCK port.</p> |
| 6–5 I2S_MODE | I2S Mode Select. These bits allow the SSI to operate in Normal, I2S Master or I2S Slave mode. Refer to I2S Mode for a detailed description of I2S Mode of operation. Refer to Table 61-5 for details regarding settings. |
| 4 SYN | <p>Synchronous Mode. This bit controls whether SSI is in synchronous mode or not. In synchronous mode, the transmit and receive sections of SSI share a common clock port (STCK) and frame sync port (STFS).</p> <p>0 ASYNC_MODE — Asynchronous mode selected.</p> <p>1 SYNC_MODE — Synchronous mode selected.</p> |
| 3 NET | <p>Network Mode. This bit controls whether SSI is in network mode or not.</p> <p>0 DISABLED — Network mode not selected.</p> <p>1 ENABLED — Network mode selected.</p> |

Table continues on the next page...

SSIx_SCR field descriptions (continued)

| Field | Description |
|------------|---|
| 2 RE | <p>Receive Enable. This control bit enables the receive section of the SSI. When this bit is enabled, data reception starts with the arrival of the next frame sync. If data is being received when this bit is cleared, data reception continues until the end of the current frame and then stops. If this bit is set again before the second to last bit of the last time slot in the current frame, then reception continues without interruption. RE should not be toggled in the same frame.</p> <p>0 DISABLED — Receive section disabled. 1 ENABLED — Receive section enabled.</p> |
| 1 TE | <p>Transmit Enable. This control bit enables the transmit section of the SSI. It enables the transfer of the contents of the STX registers to the TXSR and also enables the internal transmit clock. The transmit section is enabled when this bit is set and a frame boundary is detected. When this bit is cleared, the transmitter continues to send data until the end of the current frame and then stops. Data can be written to the STX registers with the TE bit cleared (the corresponding TDE bit will be cleared). If the TE bit is cleared and then set again before the second to last bit of the last time slot in the current frame, data transmission continues without interruption. The normal transmit enable sequence is to write data to the STX register(s) and then set the TE bit. The normal disable sequence is to clear the TE and TIE bits after the TDE bit is set.</p> <p>In gated clock mode, clearing the TE bit results in the clock stopping after the data currently in TXSR has shifted out. When the TE bit is set, the clock starts immediately (for internal gated clock mode). TE should not be toggled in the same frame.</p> <p>After enabling/disabling transmission, SSI expects 4 setup clock cycles before arrival of frame-sync for frame-sync to be accepted/rejected by In case of fewer clock cycles, there is high probability of the frame-sync to get missed.</p> <p>Note: If continuous clock is not provided, SSI expects 6 clock cycles before arrival of frame-sync for frame-sync to be accepted by the SSI.</p> <p>0 DISABLED — Transmit section disabled. 1 ENABLED — Transmit section enabled.</p> |
| 0 SSIEN | <p>SSIEN - SSI Enable</p> <p>This bit is used to enable/disable the SSI. When disabled, all SSI status bits are preset to the same state produced by the power-on reset, all control bits are unaffected, the contents of Tx and Rx FIFOs are cleared. When SSI is disabled, all internal clocks are disabled (except register access clock).</p> <p>0 DISABLED — SSI is disabled. 1 ENABLED — SSI is enabled.</p> |

61.9.4 SSI Interrupt Status Register (SSIx_SISR)

The SSI Interrupt Status Register (SSI_SISR) is used to monitor the SSI. This register is used by the core to interrogate the status of the SSI. In gated mode of operation the TFS, RFS, TLS, RLS, TFRC and RFRC bits of AISR register are not generated. The status bits are described in the following table.

- SSI Status flags are valid when SSI is enabled.

SSI Memory Map/Register Definition

- See [Receive Interrupt Enable Bit Description](#) and [Transmit Interrupt Enable Bit Description](#) for interrupt source mapping.
- All the flags in the SSI_SISR are updated after the first bit of the next SSI word has completed transmission or reception. Certain status bits (ROE0/1 and TUE0/1) are cleared by writing 1 to the corresponding interrupt status bit in SSI_SISR.

Address: Base address + 14h offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
|-------|------|------|------|------|------|------|------|------|------|------|-----|-----|------|-------|-------|------|
| R | | | | | | | | | RFRC | TFRC | | | 0 | CMDAU | CMDDU | RXT |
| W | | | | | | | | | | | | | | | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| R | RDR1 | RDR0 | TDE1 | TDE0 | ROE1 | ROE0 | TUE1 | TUE0 | TFS | RFS | TLS | RLS | RFF1 | RFF0 | TFF1 | TFEO |
| W | | | | | w1c | w1c | w1c | w1c | | | | | | | | |
| Reset | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |

SSIx_SISR field descriptions

| Field | Description |
|-------------------|--|
| 31–25 Reserved | This read-only field is reserved and always has the value 0. |
| 24 RFRC | Receive Frame Complete. This flag is set at the end of the frame during which Receiver is disabled. If Receive Frame & Clock are not disabled in the same frame, this flag is also set at the end of the frame in which Receive Frame & Clock are disabled. See the description of RFR_CLK_DIS bit for more details on how to disable Receive Frame & Clock or keep them enabled after receiver is disabled. |

Table continues on the next page...

SSIx_SISR field descriptions (continued)

| Field | Description |
|----------------|--|
| | <p>0 End of Frame not reached 1 End of frame reached after disabling RE or disabling RFR_CLK_DIS, when receiver is already disabled.</p> |
| 23 TFRC | <p>Transmit Frame Complete. This flag is set at the end of the frame during which Transmitter is disabled. If Transmit Frame & Clock are not disabled in the same frame, this flag is also set at the end of the frame in which Transmit Frame & Clock are disabled. See description of TFR_CLK_DIS bit for more details on how to disable Transmit Frame & Clock or keep them enabled after transmitter is disabled.</p> <p>0 End of Frame not reached 1 End of frame reached after disabling TE or disabling TFR_CLK_DIS, when transmitter is already disabled.</p> |
| 22–19 Reserved | This read-only field is reserved and always has the value 0. |
| 18 CMDAU | <p>Command Address Register Updated. This bit causes the Command Address Updated interrupt (when CMDAU_EN bit is set). This status bit is set each time there is a difference in the previous and current value of the received Command Address. This bit is cleared on reading the SACADD register.</p> <p>0 No change in SACADD register. 1 SACADD register updated with different value.</p> |
| 17 CMDDU | <p>Command Data Register Updated. This bit causes the Command Data Updated interrupt (when CMDDU_EN bit is set). This status bit is set each time there is a difference in the previous and current value of the received Command Data. This bit is cleared on reading the SACDAT register.</p> <p>0 No change in SACDAT register. 1 SACDAT register updated with different value.</p> |
| 16 RXT | <p>Receive Tag Updated. This status bit is set each time there is a difference in the previous and current value of the received tag. It causes the Receive Tag Interrupt (if RXT_EN bit is set). This bit is cleared on reading the SATAG register.</p> <p>0 No change in SATAG register. 1 SATAG register updated with different value.</p> |
| 15 RDR1 | <p>Receive Data Ready 1. This flag bit is set when SRX1 or Rx FIFO 1 is loaded with a new value and Two-Channel mode is selected.</p> <p>RDR1 is cleared when the Core reads the SRX1 register. If Rx FIFO 1 is enabled, RDR1 is cleared when the FIFO is empty.</p> <p>If RIE and RDR1_EN are set, a Receive Data 1 interrupt request is issued on setting of RDR1 bit in case Rx FIFO1 is disabled, if the FIFO is enabled, the interrupt is issued on RFF1 assertion. The RDR1 bit is cleared by POR and SSI reset.</p> <p>0 No new data for Core to read. 1 New data for Core to read.</p> |
| 14 RDR0 | <p>Receive Data Ready 0. This flag bit is set when SRX0 or Rx FIFO 0 is loaded with a new value.</p> <p>RDR0 is cleared when the Core reads the SRX0 register. If Rx FIFO 0 is enabled, RDR0 is cleared when the FIFO is empty.</p> <p>If RIE and RDR0_EN are set, a Receive Data 0 interrupt request is issued on setting of RDR0 bit in case Rx FIFO0 is disabled, if the FIFO is enabled, the interrupt is issued on RFF0 assertion. The RDR0 bit is cleared by POR and SSI reset.</p> <p>0 No new data for Core to read. 1 New data for Core to read.</p> |

Table continues on the next page...

SSIx_SISR field descriptions (continued)

| Field | Description |
|------------|--|
| 13 TDE1 | <p>Transmit Data Register Empty 1. This flag is set whenever data is transferred to TXSR from STX1 register and Two-Channel mode is selected.</p> <p>If Tx FIFO1 is enabled, this occurs when there is at least one empty slot in STX1 or Tx FIFO1. If Tx FIFO1 is not enabled, this occurs when the contents of STX1 are transferred to TXSR.</p> <p>The TDE1 bit is cleared when the Core writes to STX1. If TIE and TDE1_EN are set, an SSI Transmit Data 1 interrupt request is issued on setting of TDE1 bit. The TDE1 bit is cleared by POR and SSI reset.</p> <p>0 Data available for transmission. 1 Data needs to be written by the Core for transmission.</p> |
| 12 TDE0 | <p>Transmit Data Register Empty 0. This flag is set whenever data is transferred to TXSR from STX0 register.</p> <p>If Tx FIFO 0 is enabled, this occurs when there is at least one empty slot in STX0 or Tx FIFO 0. If Tx FIFO 0 is not enabled, this occurs when the contents of STX0 are transferred to TXSR.</p> <p>The TDE0 bit is cleared when the Core writes to STX0. If TIE and TDE0_EN are set, an SSI Transmit Data 0 interrupt request is issued on setting of TDE0 bit. The TDE0 bit is cleared by POR and SSI reset.</p> <p>0 Data available for transmission. 1 Data needs to be written by the Core for transmission.</p> |
| 11 ROE1 | <p>Receiver Overrun Error 1. This flag is set when the RXSR is filled and ready to transfer to SRX1 register or to Rx FIFO 1 (when enabled) and these are already full and Two-Channel mode is selected. If Rx FIFO 1 is enabled, this is indicated by RFF1 flag, else this is indicated by the RDR1 flag. The RXSR is not transferred in this case.</p> <p>The ROE1 flag causes an interrupt if RIE and ROE1_EN are set.</p> <p>The ROE1 bit is cleared by POR and SSI reset. It is also cleared by writing '1' to this bit. Clearing the RE bit does not affect the ROE1 bit.</p> <p>0 Default interrupt issued to the Core. 1 Exception interrupt issued to the Core.</p> |
| 10 ROE0 | <p>Receiver Overrun Error 0. This flag is set when the RXSR is filled and ready to transfer to SRX0 register or to Rx FIFO 0 (when enabled) and these are already full. If Rx FIFO 0 is enabled, this is indicated by RFF0 flag, else this is indicated by the RDR0 flag. The RXSR is not transferred in this case.</p> <p>The ROE0 flag causes an interrupt if RIE and ROE0_EN are set.</p> <p>The ROE0 bit is cleared by POR and SSI reset. It is also cleared by writing '1' to this bit. Clearing the RE bit does not affect the ROE0 bit.</p> <p>0 Default interrupt issued to the Core. 1 Exception interrupt issued to the Core.</p> |
| 9 TUE1 | <p>Transmitter Underrun Error 1. This flag is set when the TXSR is empty (no data to be transmitted), the TDE1 flag is set, a transmit time slot occurs and the SSI is in Two-Channel mode. When a transmit underrun error occurs, the previous data is retransmitted. In Network mode, each time slot requires data transmission (unless masked through STMSK register), when the transmitter is enabled (TE is set).</p> <p>The TUE1 flag causes an interrupt if TIE and TUE1_EN are set.</p> <p>The TUE1 bit is cleared by POR and SSI reset. It is also cleared by writing '1' to this bit.</p> <p>0 Default interrupt issued to the Core. 1 Exception interrupt issued to the Core.</p> |
| 8 TUE0 | <p>Transmitter Underrun Error 0. This flag is set when the TXSR is empty (no data to be transmitted), the TDE0 flag is set and a transmit time slot occurs. When a transmit underrun error occurs, the previous data</p> |

Table continues on the next page...

SSIx_SISR field descriptions (continued)

| Field | Description |
|-----------|---|
| | <p>is retransmitted. In Network mode, each time slot requires data transmission (unless masked through STMSK register), when the transmitter is enabled (TE is set).</p> <p>The TUE0 flag causes an interrupt if TIE and TUE0_EN are set.</p> <p>The TUE0 bit is cleared by POR and SSI reset. It is also cleared by writing '1' to this bit.</p> <p>0 Default interrupt issued to the Core. 1 Exception interrupt issued to the Core.</p> |
| 7 TFS | <p>Transmit Frame Sync. This flag indicates the occurrence of transmit frame sync. Data written to the STX registers during the time slot when the TFS flag is set, is sent during the second time slot (in Network mode) or in the next first time slot (in Normal mode). In Network mode, the TFS bit is set during transmission of the first time slot of the frame and is then cleared when starting transmission of the next time slot. In Normal mode, this bit is high for the first time slot. This flag causes an interrupt if TIE and TFS_EN are set. The TFS bit is cleared by POR and SSI reset.</p> <p>0 No Occurrence of Transmit frame sync. 1 Transmit frame sync occurred during transmission of last word written to STX registers.</p> |
| 6 RFS | <p>Receive Frame Sync. This flag indicates the occurrence of receive frame sync. In Network mode, the RFS bit is set when the first slot of the frame is being received. It is cleared when the next slot begins to be received. In Normal mode, this bit is always high (When DC = 0). This flag causes an interrupt if RIE and RFS_EN are set. The RFS bit is cleared by POR and SSI reset.</p> <p>0 No Occurrence of Receive frame sync. 1 Receive frame sync occurred during reception of next word in SRX registers.</p> |
| 5 TLS | <p>Transmit Last Time Slot. This flag indicates the last time slot in a frame. When set, it indicates that the current time slot is the last time slot of the frame. TLS is set at the start of the last transmit time slot and causes the SSI to issue an interrupt (if TIE and TLS_EN are set). TLS is not generated when frame rate is 1 in normal mode of operation. TLS is cleared when the SISR is read with this bit set. The TLS bit is cleared by POR and SSI reset.</p> <p>0 Current time slot is not last time slot of frame. 1 Current time slot is the last transmit time slot of frame.</p> |
| 4 RLS | <p>Receive Last Time Slot. This flag indicates the last time slot in a frame. When set, it indicates that the current time slot is the last receive time slot of the frame. RLS is set at the end of the last time slot and causes the SSI to issue an interrupt (if RIE and RLS_EN are set). RLS is cleared when the SISR is read with this bit set. The RLS bit is cleared by POR and SSI reset.</p> <p>0 Current time slot is not last time slot of frame. 1 Current time slot is the last receive time slot of frame.</p> |
| 3 RFF1 | <p>Receive FIFO Full 1. This flag is set when Rx FIFO1 is enabled, the data level in Rx FIFO1 reaches the selected Rx FIFO WaterMark 1 (RFWM1) threshold and the SSI is in Two-Channel mode. The setting of RFF1 only causes an interrupt when RIE and RFF1_EN are set, Rx FIFO1 is enabled and the Two-Channel mode is selected. RFF1 is automatically cleared when the amount of data in Rx FIFO1 falls below the threshold. The RFF1 bit is cleared by POR and SSI reset.</p> <p>When Rx FIFO1 contains 15 words, the maximum it can hold, all further data received (for storage in this FIFO) is ignored until the FIFO contents are read.</p> <p>0 NOT_FULL — Space available in Receive FIFO1. 1 FULL — Receive FIFO1 is full.</p> |
| 2 RFF0 | Receive FIFO Full 0. This flag is set when Rx FIFO0 is enabled and the data level in Rx FIFO0 reaches the selected Rx FIFO WaterMark 0 (RFWM0) threshold. The setting of RFF0 only causes an interrupt |

Table continues on the next page...

SSIx_SISR field descriptions (continued)

| Field | Description |
|-----------|--|
| | <p>when RIE and RFF0_EN are set and Rx FIFO0 is enabled. RFF0 is automatically cleared when the amount of data in Rx FIFO0 falls below the threshold. The RFF0 bit is cleared by POR and SSI reset.</p> <p>When Rx FIFO0 contains 15 words, the maximum it can hold, all further data received (for storage in this FIFO) is ignored until the FIFO contents are read.</p> <p>0 NOT_FULL — Space available in Receive FIFO0. 1 FULL — Receive FIFO0 is full.</p> |
| 1 TFE1 | <p>Transmit FIFO Empty 1. This flag is set when the empty slots in Tx FIFO exceed or are equal to the selected Tx FIFO WaterMark 1 (TFWM1) threshold and the Two-Channel mode is selected. The setting of TFE1 only causes an interrupt when TIE and TFE1_EN are set, Tx FIFO1 is enabled and Two-Channel mode is selected. The TFE1 bit is automatically cleared when the data level in Tx FIFO1 becomes more than the amount specified by the watermark bits. The TFE1 bit is set by POR and SSI reset.</p> <p>0 HAS_DATA — Transmit FIFO1 has data for transmission. 1 EMPTY — Transmit FIFO1 is empty.</p> |
| 0 TFE0 | <p>Transmit FIFO Empty 0. This flag is set when the empty slots in Tx FIFO exceed or are equal to the selected Tx FIFO WaterMark 0 (TFWM0) threshold. The setting of TFE0 only causes an interrupt when TIE and TFE0_EN are set and Tx FIFO0 is enabled. The TFE0 bit is automatically cleared when the data level in Tx FIFO0 becomes more than the amount specified by the watermark bits. The TFE0 bit is set by POR and SSI reset.</p> <p>0 HAS_DATA — Transmit FIFO0 has data for transmission. 1 EMPTY — Transmit FIFO0 is empty.</p> |

61.9.5 SSI Interrupt Enable Register (SSIx_SIER)

The SSI Interrupt Enable Register (SIER) is a 25-bit register used to set up the SSI interrupts and DMA requests.

Address: Base address + 18h offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | |
|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|-------|--------|--------|---------|---------|-------|
| R | | | | | | | | 0 | | | | | | | | | |
| W | | | | | | | | | RFRCIE | TFRCIE | RDMAE | RIE | TDMAE | TIE | CMDAUIE | CMDDUIE | RXTIE |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
| R | RDR1IE | RDR0IE | TDE1IE | TDE0IE | ROE1IE | ROE0IE | TUE1IE | TUE0IE | TFSIE | RFSIE | TLSIE | RLSIE | RFF1IE | RFF0IE | TFE1IE | TFE0IE | |
| W | | | | | | | | | | | | | | | | | |
| Reset | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | |

SSIx_SIER field descriptions

| Field | Description |
|-------------------|---|
| 31–25 Reserved | This read-only field is reserved and always has the value 0. |
| 24 RFRCIE | Receive Frame Complete Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not. 0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt. |
| 23 TFRCIE | Transmit Frame Complete Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not. |

Table continues on the next page...

SSIx_SIER field descriptions (continued)

| Field | Description |
|------------|--|
| | <p>0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt.</p> |
| 22 RDMAE | <p>Receive DMA Enable. This bit allows SSI to request for DMA transfers. When enabled, DMA requests are generated when any of the RFF0/1 bits in the SISR are set and if the corresponding RFEN bit is also set. If the corresponding FIFO is disabled, a DMA request is generated when the corresponding RDR bit is set.</p> <p>0 SSI Receiver DMA requests disabled. 1 SSI Receiver DMA requests enabled.</p> |
| 21 RIE | <p>Receive Interrupt Enable. This control bit allows the SSI to issue receiver related interrupts to the Core. Refer to Receive Interrupt Enable Bit Description for a detailed description of this bit.</p> <p>0 SSI Receiver Interrupt requests disabled. 1 SSI Receiver Interrupt requests enabled.</p> |
| 20 TDMAE | <p>Transmit DMA Enable. This bit allows SSI to request for DMA transfers. When enabled, DMA requests are generated when any of the TFE0/1 bits in the SISR are set and if the corresponding TFEN bit is also set. If the corresponding FIFO is disabled, a DMA request is generated when the corresponding TDE bit is set.</p> <p>0 SSI Transmitter DMA requests disabled. 1 SSI Transmitter DMA requests enabled.</p> |
| 19 TIE | <p>Transmit Interrupt Enable. This control bit allows the SSI to issue transmitter data related interrupts to the Core. Refer to Transmit Interrupt Enable Bit Description for a detailed description of this bit.</p> <p>0 SSI Transmitter Interrupt requests disabled. 1 SSI Transmitter Interrupt requests enabled.</p> |
| 18 CMDAUIE | <p>Command Address Register Updated Interrupt Enable.</p> <p>Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not.</p> <p>0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt.</p> |
| 17 CMDDUIE | <p>Command Data Register Updated Interrupt Enable.</p> <p>Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not.</p> <p>0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt.</p> |
| 16 RXTIE | <p>Receive Tag Updated Interrupt Enable.</p> <p>Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not.</p> <p>0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt.</p> |
| 15 RDR1IE | <p>Receive Data Ready 1 Interrupt Enable.</p> <p>Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not.</p> <p>0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt.</p> |
| 14 RDR0IE | <p>Receive Data Ready 0 Interrupt Enable.</p> <p>Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not.</p> |

Table continues on the next page...

SSIx_SIER field descriptions (continued)

| Field | Description |
|--------------|---|
| | 0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt. |
| 13 TDE1IE | Transmit Data Register Empty 1 Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not. 0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt. |
| 12 TDE0IE | Transmit Data Register Empty 0 Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not. 0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt. |
| 11 ROE1IE | Receiver Overrun Error 1 Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not. 0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt. |
| 10 ROE0IE | Receiver Overrun Error 0 Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not. 0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt. |
| 9 TUE1IE | Transmitter Underrun Error 1 Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not. 0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt. |
| 8 TUE0IE | Transmitter Underrun Error 0 Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not. 0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt. |
| 7 TFSIE | Transmit Frame Sync Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not. 0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt. |
| 6 RFSIE | Receive Frame Sync Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not. 0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt. |
| 5 TLSIE | Transmit Last Time Slot Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not. |

Table continues on the next page...

SSIx_SIER field descriptions (continued)

| Field | Description |
|----------|--|
| | <p>0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt.</p> |
| 4 RLSIE | <p>Receive Last Time Slot Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not.</p> <p>0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt.</p> |
| 3 RFF1IE | <p>Receive FIFO Full 1 Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not.</p> <p>0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt.</p> |
| 2 RFF0IE | <p>Receive FIFO Full 0 Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not.</p> <p>0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt.</p> |
| 1 TFE1IE | <p>Transmit FIFO Empty 1 Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not.</p> <p>0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt.</p> |
| 0 TFE0IE | <p>Transmit FIFO Empty 0 Interrupt Enable. Enable Bit. Controls whether the corresponding status bit in SISR can issue an interrupt to the core or not.</p> <p>0 Corresponding status bit cannot issue interrupt. 1 Corresponding status bit can issue interrupt.</p> |

61.9.6 SSI Transmit Configuration Register (SSI_x_STCR)

The SSI Transmit Configuration Register (SSI_STCR) is a read/write control register used to direct the transmit operation of the STCR controls the direction of the bit clock and frame sync ports, STCK and STFS. Interrupt enable bit for the transmit sections is provided in this control register. The Power-on reset clears all SSI_STCR bits. However, SSI reset does not affect the SSI_STCR bits. The SSI_STCR bits are described in the following paragraphs. See the Programmable Registers section for the programming model of the SSI. The SSI Control Register (SSI_SCR) must first be set to enable interrupts. Next, the SSI interrupt bit in the Interrupt Enable Register (SSI_SIER) must be set to enable the interrupt. Finally, the interrupt can be enabled from within the SSI.

Address: Base address + 1Ch offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
|-------|----|----|----|----|----|----|--------|-------|-------|-------|-------|-------|-------|------|------|------|
| R | | | | | | | | | 0 | | | | | | | |
| W | | | | | | | | | | | | | | | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| R | | | | 0 | | | TXBIT0 | TFEN1 | TFENO | TFDIR | TXDIR | TSHFD | TSCKP | TFSI | TFSL | TEFS |
| W | | | | | | | | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

SSI_x_STCR field descriptions

| Field | Description |
|-------------------|--|
| 31–10 Reserved | This read-only field is reserved and always has the value 0. |
| 9 TXBIT0 | Transmit Bit 0. This control bit allows SSI to transmit the data word from bit position 0 or 15/31 in the transmit shift register. The shifting data direction can be MSB or LSB first, controlled by the TSHFD bit. 0 MSB_ALIGNED — Shifting with respect to bit 31 (if word length = 16, 18, 20, 22 or 24) or bit 15 (if word length = 8, 10 or 12) of transmit shift register (MSB aligned). 1 LSB_ALIGNED — Shifting with respect to bit 0 of transmit shift register (LSB aligned). |
| 8 TFEN1 | Transmit FIFO Enable 1. This bit enables transmit FIFO 1. When enabled, the FIFO allows 15 samples to be transmitted by the SSI (per channel) (a 9th sample can be shifting out) before TDE1 bit is set. When the FIFO is disabled, an interrupt is generated when a single sample is transferred to the transmit shift register (provided the interrupt is enabled). 0 Transmit FIFO 1 disabled. 1 Transmit FIFO 1 enabled. |

Table continues on the next page...

SSI_x_STCR field descriptions (continued)

| Field | Description |
|------------|--|
| 7 TFEN0 | Transmit FIFO Enable 0. This bit enables transmit FIFO 0. When enabled, the FIFO allows 15 samples to be transmitted by the SSI per channel (a 9th sample can be shifting out) before TDE0 bit is set. When the FIFO is disabled, an interrupt is generated when a single sample is transferred to the transmit shift register (provided the interrupt is enabled). 0 Transmit FIFO 0 disabled. 1 Transmit FIFO 0 enabled. |
| 6 TDIR | Transmit Frame Direction. This bit controls the direction and source of the transmit frame sync signal. Internally generated frame sync signal is sent out through the STFS port and external frame sync is taken from the same port. 0 EXTERNAL — Frame Sync is external. 1 INTERNAL — Frame Sync generated internally. |
| 5 TXDIR | Transmit Clock Direction. This bit controls the direction and source of the clock signal used to clock the TXSR. Internally generated clock is output through the STCK port. External clock is taken from this port. Refer to Table 61-2 for details of clock pin configurations. 0 EXTERNAL — Transmit Clock is external. 1 INTERNAL — Transmit Clock generated internally. |
| 4 TSHFD | Transmit Shift Direction. This bit controls whether the MSB or LSB will be transmitted first in a sample. NOTE: The CODEC device labels the MSB as bit 0, whereas the Core labels the LSB as bit 0. Therefore, when using a standard CODEC, Core MSB (CODEC LSB) is shifted in first (TSHFD cleared). 0 MSB_FIRST — Data transmitted MSB first. 1 LSB_FIRST — Data transmitted LSB first. |
| 3 TSCKP | Transmit Clock Polarity. This bit controls which bit clock edge is used to clock out data for the transmit section. Note: TSCKP is 0 CLK_IST = 0; TSCKP is 1 CLK_IST = 1 0 RISING_EDGE — Data clocked out on rising edge of bit clock. 1 FALLING_EDGE — Data clocked out on falling edge of bit clock. |
| 2 TFSI | Transmit Frame Sync Invert. This bit controls the active state of the frame sync I/O signal for the transmit section of SSI. 0 ACTIVE_HIGH — Transmit frame sync is active high. 1 ACTIVE_LOW — Transmit frame sync is active low. |
| 1 TFSL | Transmit Frame Sync Length. This bit controls the length of the frame sync signal to be generated or recognized for the transmit section. The length of a word-long frame sync is same as the length of the data word selected by WL[3:0]. 0 ONE_WORD — Transmit frame sync is one-word long. 1 ONE_CLOCK_BIT — Transmit frame sync is one-clock-bit long. |
| 0 TEFS | Transmit Early Frame Sync. This bit controls when the frame sync is initiated for the transmit section. The frame sync signal is deasserted after one bit-for-bit length frame sync and after one word-for-word length frame sync. In case of synchronous operation, the frame sync can also be initiated on receiving the first bit of data. 0 FIRST_BIT — Transmit frame sync initiated as the first bit of data is transmitted. 1 ONE_BIT_BEFORE — Transmit frame sync is initiated one bit before the data is transmitted. |

61.9.7 SSI Receive Configuration Register (SSIx_SRCSR)

The SSI Receive Configuration Register (SSI_SRCSR) is a read/write control register used to direct the receive operation of the SSI. SSI.SRCSR controls the direction of the bit clock and frame sync ports, SRCK and SRFS. Interrupt enable bit for the transmit sections is provided in this control register. The Power-on reset clears all SSI_SRCSR bits. However, SSI reset does not affect the SSI_SRCSR bits.

Address: Base address + 20h offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
|-------|----|----|----|----|----|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|
| R | | | | | | | | | 0 | | | | | | | |
| W | | | | | | | | | | | | | | | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| R | | | | | | RXEXT | RXBTO | RFEN1 | RFENO | RFDIR | RXDIF | RSHFD | RSCKP | RFSI | RFSL | REFS |
| W | | | | | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

SSIx_SRCSR field descriptions

| Field | Description |
|-------------------|---|
| 31–11 Reserved | This read-only field is reserved and always has the value 0. |
| 10 RXEXT | Receive Data Extension. This control bit allows SSI to store the received data word in sign extended form. This bit affects data storage only in case received data is LSB aligned (SRCSR[9]=1) 0 OFF — Sign extension turned off. 1 ON — Sign extension turned on. |
| 9 RXBTO | Receive Bit 0. This control bit allows SSI to receive the data word at bit position 0 or 15/31 in the receive shift register. The shifting data direction can be MSB or LSB first, controlled by the RSHFD bit. 0 MSB_ALIGNED — Shifting with respect to bit 31 (if word length = 16, 18, 20, 22 or 24) or bit 15 (if word length = 8, 10 or 12) of receive shift register (MSB aligned). 1 LSB_ALIGNED — Shifting with respect to bit 0 of receive shift register (LSB aligned). |
| 8 RFEN1 | Receive FIFO Enable 1. This bit enables receive FIFO 1. When enabled, the FIFO allows 15 samples to be received by the SSI per channel (a 16th sample can be shifting in) before RDR1 bit is set. When the FIFO is disabled, an interrupt is generated when a single sample is received by the SSI (provided the interrupt is enabled). 0 Receive FIFO 1 disabled. 1 Receive FIFO 1 enabled. |

Table continues on the next page...

SSI_x_SRCR field descriptions (continued)

| Field | Description |
|------------|--|
| 7 RFEN0 | Receive FIFO Enable 0. This bit enables receive FIFO 0. When enabled, the FIFO allows 15 samples to be received by the SSI (per channel) (a 16th sample can be shifting in) before RDR0 bit is set. When the FIFO is disabled, an interrupt is generated when a single sample is received by the SSI (provided the interrupt is enabled). 0 Receive FIFO 0 disabled. 1 Receive FIFO 0 enabled. |
| 6 RFDIR | Receive Frame Direction. This bit controls the direction and source of the receive frame sync signal. Internally generated frame sync signal is sent out through the SRFS port and external frame sync is taken from the same port. 0 EXTERNAL — Frame Sync is external. 1 INTERNAL — Frame Sync generated internally. |
| 5 RXDIR | Receive Clock Direction. This bit controls the direction and source of the clock signal used to clock the RXSR. Internally generated clock is output through the SRCK port. External clock is taken from this port. Refer to Table 61-2 for details on clock pin configurations. 0 EXTERNAL — Receive Clock is external. 1 INTERNAL — Receive Clock generated internally. |
| 4 RSHFD | Receive Shift Direction. This bit controls whether the MSB or LSB will be received first in a sample. NOTE: The CODEC device labels the MSB as bit 0, whereas the Core labels the LSB as bit 0. Therefore, when using a standard CODEC, Core MSB (CODEC LSB) is shifted in first (RSHFD cleared). 0 MSB_FIRST — Data received MSB first. 1 LSB_FIRST — Data received LSB first. |
| 3 RSCKP | Receive Clock Polarity. This bit controls which bit clock edge is used to latch in data for the receive section. 0 FALLING_EDGE — Data latched on falling edge of bit clock. 1 RISING_EDGE — Data latched on rising edge of bit clock. |
| 2 RFSI | Receive Frame Sync Invert. This bit controls the active state of the frame sync I/O signal for the receive section of SSI. 0 ACTIVE_HIGH — Receive frame sync is active high. 1 ACTIVE_LOW — Receive frame sync is active low. |
| 1 RFSL | Receive Frame Sync Length. This bit controls the length of the frame sync signal to be generated or recognized for the receive section. The length of a word-long frame sync is same as the length of the data word selected by WL[3:0]. 0 ONE_WORD — Receive frame sync is one-word long. 1 ONE_CLOCK_BIT — Receive frame sync is one-clock-bit long. |
| 0 REFS | Receive Early Frame Sync. This bit controls when the frame sync is initiated for the receive section. The frame sync is disabled after one bit-for-bit length frame sync and after one word-for-word length frame sync. 0 FIRST_BIT — Receive frame sync initiated as the first bit of data is received. 1 ONE_BIT_BEFORE — Receive frame sync is initiated one bit before the data is received. |

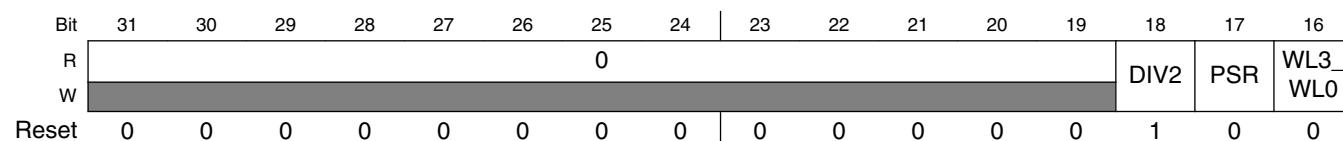
61.9.8 SSI Transmit Clock Control Register (SSI_x_STCCR)

The SSI Transmit and Receive Control (SSI_STCCR and SSI_SRCCR) registers are 19-bit, read/write control registers used to direct the operation of the SSI. The Clock Controller Module (CCM) can source the SSI clock (SSI's sys clock from CCM's `ssi_clk_root`) from multiple sources and perform fractional division to support commonly used audio bit rates. The CCM can maintain the SSI's sys clock frequency at a constant rate even in cases where the `ipg_clk` (from CCM) frequency changes. These registers control the SSI clock generator, bit and frame sync rates, word length, and number of words per frame for the serial data. The SSI_STCCR register is dedicated to the transmit section, and the SSI_SRCCR register is dedicated to the receive section except in Synchronous mode, in which the SSI_STCCR register controls both the receive and transmit sections. Power-on reset clears all SSI_STCCR and SSI_SRCCR bits. SSI reset does not affect the SSI_STCCR and SSI_SRCCR bits. The control bits are described in the following paragraphs. Although the bit patterns of the SSI_STCCR and SSI_SRCCR registers are the same, the contents of these two registers can be programmed differently.

Table 61-52. SSI Data Length

| WL3 | WL2 | WL1 | WL0 | Number of Bits/Word | Supported in Implementation |
|-----|-----|-----|-----|---------------------|-----------------------------|
| 0 | 0 | 0 | 0 | 2 | No |
| 0 | 0 | 0 | 1 | 4 | No |
| 0 | 0 | 1 | 0 | 6 | No |
| 0 | 0 | 1 | 1 | 8 | Yes |
| 0 | 1 | 0 | 0 | 10 | Yes |
| 0 | 1 | 0 | 1 | 12 | Yes |
| 0 | 1 | 1 | 0 | 14 | No |
| 0 | 1 | 1 | 1 | 16 | Yes |
| 1 | 0 | 0 | 0 | 18 | Yes |
| 1 | 0 | 0 | 1 | 20 | Yes |
| 1 | 0 | 1 | 0 | 22 | Yes |
| 1 | 0 | 1 | 1 | 24 | Yes |
| 1 | 1 | 0 | 0 | 26 | No |
| 1 | 1 | 0 | 1 | 28 | No |
| 1 | 1 | 1 | 0 | 30 | No |
| 1 | 1 | 1 | 1 | 32 | No |

Address: Base address + 24h offset



SSI Memory Map/Register Definition

| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|--------|---------|----|----|---------|----|----|---|---|---------|---|---|---|---|---|---|---|
| R W | WL3_WL0 | | | DC4_DC0 | | | | | PM7_PM0 | | | | | | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

SSIx_STCCR field descriptions

| Field | Description |
|-------------------|--|
| 31–19 Reserved | This read-only field is reserved and always has the value 0. |
| 18 DIV2 | Divide By 2. This bit controls a divide-by-two divider in series with the rest of the prescalers. 0 Divider bypassed. 1 Divider used to divide clock by 2. |
| 17 PSR | Prescaler Range. This bit controls a fixed divide-by-eight prescaler in series with the variable prescaler. It extends the range of the prescaler for those cases where a slower bit clock is required. 0 Prescaler bypassed. 1 Prescaler used to divide clock by 8. |
| 16–13 WL3_WL0 | Word Length Control. These bits are used to control the length of the data words being transferred by the SSI. These bits control the Word Length Divider in the Clock Generator. They also control the frame sync pulse length when the FSL bit is cleared. In I2S Master mode, the SSI works with a fixed word length of 32, and the WL bits are used to control the amount of valid data in those 32 bits. In AC97 Mode of operation, if word length is set to any value other than 16 bits, it will result in a word length of 20 bits. |
| 12–8 DC4_DC0 | Frame Rate Divider Control. These bits are used to control the divide ratio for the programmable frame rate dividers. The divide ratio works on the word clock. In Normal mode, this ratio determines the word transfer rate. In Network mode, this ratio sets the number of words per frame. The divide ratio ranges from 1 to 32 in Normal mode and from 2 to 32 in Network mode. In Normal mode, a divide ratio of 1 (DC=00000) provides continuous periodic data word transfer. A bit-length frame sync must be used in this case. These bits can be programmed with values ranging from "00000" to "11111" to control the number of words in a frame. |
| PM7_PM0 | Prescaler Modulus Select. These bits control the prescale divider in the clock generator. This prescaler is used only in Internal Clock mode to divide the internal clock. The bit clock output is available at the clock port. A divide ratio from 1 to 256 (PM[7:0] = 0x00 to 0xFF) can be selected. Refer to DIV2, PSR and PM Bit Description for details regarding settings. |

61.9.9 SSI Receive Clock Control Register (SSIx_SRCCR)

The SSI Transmit and Receive Control (SSI_STCCR and SSI_SRCCR) registers are 19-bit, read/write control registers used to direct the operation of the SSI. The Clock Controller Module (CCM) can source the SSI clock (SSI's sys clock-from CCM's ssi_clk_root) from multiple sources and perform fractional division to support commonly used audio bit rates. The CCM can maintain the SSI's sys clock frequency at a constant rate even in cases where the ipg_clk from CCM frequency changes. These registers control the SSI clock generator, bit and frame sync rates, word length, and number of words per frame for the serial data. The SSI_STCCR register is dedicated to the transmit section, and the SSI_SRCCR register is dedicated to the receive section except in Synchronous mode, in which the SSI_STCCR register controls both the receive and transmit sections. Power-on reset clears all SSI_STCCR and SSI_SRCCR bits. SSI reset does not affect the SSI_STCCR and SSI_SRCCR bits. The control bits are described in the following paragraphs. Although the bit patterns of the SSI_STCCR and SSI_SRCCR registers are the same, the contents of these two registers can be programmed differently.

Table 61-54. SSI Data Length

| WL3 | WL2 | WL1 | WL0 | Number of Bits/Word | Supported in Implementation |
|-----|-----|-----|-----|---------------------|-----------------------------|
| 0 | 0 | 0 | 0 | 2 | No |
| 0 | 0 | 0 | 1 | 4 | No |
| 0 | 0 | 1 | 0 | 6 | No |
| 0 | 0 | 1 | 1 | 8 | Yes |
| 0 | 1 | 0 | 0 | 10 | Yes |
| 0 | 1 | 0 | 1 | 12 | Yes |
| 0 | 1 | 1 | 0 | 14 | No |
| 0 | 1 | 1 | 1 | 16 | Yes |
| 1 | 0 | 0 | 0 | 18 | Yes |
| 1 | 0 | 0 | 1 | 20 | Yes |
| 1 | 0 | 1 | 0 | 22 | Yes |
| 1 | 0 | 1 | 1 | 24 | Yes |
| 1 | 1 | 0 | 0 | 26 | No |
| 1 | 1 | 0 | 1 | 28 | No |
| 1 | 1 | 1 | 0 | 30 | No |
| 1 | 1 | 1 | 1 | 32 | No |

Address: Base address + 28h offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|------|-----|---------|
| R | | | | | | | | 0 | | | | | | DIV2 | PSR | WL3_WL0 |
| W | | | | | | | | | | | | | | | | |

Reset 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0

SSI Memory Map/Register Definition

| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|--------|---------|----|----|----|---------|----|---|---|---------|---|---|---|---|---|---|---|
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| R W | WL3_WL0 | | | | DC4_DC0 | | | | PM7_PM0 | | | | | | | |

SSIx_SRCCR field descriptions

| Field | Description |
|-------------------|--|
| 31–19 Reserved | This read-only field is reserved and always has the value 0. |
| 18 DIV2 | Divide By 2. This bit controls a divide-by-two divider in series with the rest of the prescalers. 0 Divider bypassed. 1 Divider used to divide clock by 2. |
| 17 PSR | Prescaler Range. This bit controls a fixed divide-by-eight prescaler in series with the variable prescaler. It extends the range of the prescaler for those cases where a slower bit clock is required. 0 Prescaler bypassed. 1 Prescaler used to divide clock by 8. |
| 16–13 WL3_WL0 | Word Length Control. These bits are used to control the length of the data words being transferred by the SSI. These bits control the Word Length Divider in the Clock Generator. They also control the frame sync pulse length when the FSL bit is cleared. In I2S Master mode, the SSI works with a fixed word length of 32, and the WL bits are used to control the amount of valid data in those 32 bits. In AC97 Mode of operation, if word length is set to any value other than 16 bits, it will result in a word length of 20 bits. |
| 12–8 DC4_DC0 | Frame Rate Divider Control. These bits are used to control the divide ratio for the programmable frame rate dividers. The divide ratio works on the word clock. In Normal mode, this ratio determines the word transfer rate. In Network mode, this ratio sets the number of words per frame. The divide ratio ranges from 1 to 32 in Normal mode and from 2 to 32 in Network mode. In Normal mode, a divide ratio of 1 (DC=00000) provides continuous periodic data word transfer. A bit-length frame sync must be used in this case. These bits can be programmed with values ranging from "00000" to "11111" to control the number of words in a frame. |
| PM7_PM0 | Prescaler Modulus Select. These bits control the prescale divider in the clock generator. This prescaler is used only in Internal Clock mode to divide the internal clock. The bit clock output is available at the clock port. A divide ratio from 1 to 256 (PM[7:0] = 0x00 to 0xFF) can be selected. Refer to DIV2, PSR and PM Bit Description for details regarding settings. |

61.9.10 SSI FIFO Control/Status Register (SSIx_SFCSR)

The SSI FIFO Control / Status Register indicates the status of the Transmit FIFO Empty flag, with different settings of the Transmit FIFO WaterMark bits and varying amounts of data in the Tx FIFO

.

Table 61-56. Status of Transmit FIFO Empty Flag

| Transmit FIFO Watermark (TFWM) | Number of data in Tx-Fifo | | | | | | | | | | | | | | |
|---|---------------------------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Address: Base address + 2Ch offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------|--------|----|--------|----|-------|----|-------|----|--------|----|--------|----|-------|----|-------|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| R | RFCNT1 | | TFCNT1 | | RFWM1 | | TFWM1 | | RFCNT0 | | TFCNT0 | | RFWM0 | | TFWM0 | | | | | | | | | | | | | | | | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |

SSIx_SFCSR field descriptions

| Field | Description |
|-----------------|--|
| 31–28 RFCNT1 | Receive FIFO Counter1. These bits indicate the number of data words in Receive FIFO 1. 0000 0 data word in receive FIFO 0001 1 data word in receive FIFO 0010 2 data word in receive FIFO 0011 3 data word in receive FIFO 0100 4 data word in receive FIFO 0101 5 data word in receive FIFO 0110 6 data word in receive FIFO 0111 7 data word in receive FIFO 1000 8 data word in receive FIFO 1001 9 data word in receive FIFO 1010 10 data word in receive FIFO 1011 11 data word in receive FIFO 1100 12 data word in receive FIFO 1101 13 data word in receive FIFO |

Table continues on the next page...

SSIx_SFCSR field descriptions (continued)

| Field | Description |
|-----------------|---|
| | 1110 14 data word in receive FIFO 1111 15 data word in receive FIFO |
| 27–24 TFCNT1 | Transmit FIFO Counter1. These bits indicate the number of data words in Transmit FIFO. 0000 0 data word in transmit FIFO 0001 1 data word in transmit FIFO 0010 2 data word in transmit FIFO 0011 3 data word in transmit FIFO 0100 4 data word in transmit FIFO 0101 5 data word in transmit FIFO 0110 6 data word in transmit FIFO 0111 7 data word in transmit FIFO 1000 8 data word in transmit FIFO 1001 9 data word in transmit FIFO 1010 10 data word in transmit FIFO 1011 11 data word in transmit FIFO 1100 12 data word in transmit FIFO 1101 13 data word in transmit FIFO 1110 14 data word in transmit FIFO 1111 15 data word in transmit FIFO |
| 23–20 RFWM1 | Receive FIFO Full WaterMark 1. These bits control the threshold at which the RFF1 flag will be set. The RFF1 flag is set whenever the data level in Rx FIFO 1 reaches the selected threshold. 0000 Reserved 0001 RFF set when at least one data word has been written to the Receive FIFO. Set when RxFIFO = 1,2,...,15 data words 0010 RFF set when 2 or more data words have been written to the Receive FIFO. Set when RxFIFO = 2,3,...,15 data words 0011 RFF set when 3 or more data words have been written to the Receive FIFO. Set when RxFIFO = 3,4,...,15 data words 0100 RFF set when 4 or more data words have been written to the Receive FIFO. Set when RxFIFO = 4,5,...,15 data words 0101 RFF set when 5 or more data words have been written to the Receive FIFO. Set when RxFIFO = 5,6,...,15 data words 0110 RFF set when 6 or more data words have been written to the Receive.. Set when RxFIFO = 6,7,...,15 data words 0111 RFF set when 7 or more data words have been written to the Receive FIFO. Set when RxFIFO = 7,8,...,15 data words 1000 RFF set when 8 or more data words have been written to the Receive FIFO. Set when RxFIFO = 8,9,...,15 data words 1001 RFF set when 9 or more data words have been written to the Receive FIFO. Set when RxFIFO = 9,10,...,15 data words 1010 RFF set when 10 or more data words have been written to the Receive FIFO. Set when RxFIFO = 10,11,...,15 data words 1011 RFF set when 11 or more data words have been written to the Receive FIFO. Set when RxFIFO = 11,12,...,15 data words 1100 RFF set when 12 or more data words have been written to the Receive FIFO. Set when RxFIFO = 12,13,...,15 data words |

Table continues on the next page...

SSIx_SFCSR field descriptions (continued)

| Field | Description |
|-----------------|---|
| | <p>1101 RFF set when 13 or more data words have been written to the Receive FIFO. Set when RxFIFO = 13,14,15data words</p> <p>1110 RFF set when 14 or more data words have been written to the Receive FIFO. Set when RxFIFO = 14,15 data words</p> <p>1111 RFF set when 15 data words have been written to the Receive FIFO (default). Set when RxFIFO = 15 data words</p> |
| 19–16 TFWM1 | <p>Transmit FIFO Empty WaterMark 1. These bits control the threshold at which the TFE1 flag will be set. The TFE1 flag is set whenever the empty slots in Tx FIFO exceed or are equal to the selected threshold.</p> <p>0000 Reserved</p> <p>0001 TFE set when there are more than or equal to 1 empty slots in Transmit FIFO (default). Transmit FIFO empty is set when TxFIFO <= 14 data.</p> <p>0010 TFE set when there are more than or equal to 2 empty slots in Transmit FIFO. Transmit FIFO empty is set when TxFIFO <=13 data.</p> <p>0011 TFE set when there are more than or equal to 3 empty slots in Transmit FIFO. Transmit FIFO empty is set when TxFIFO <=12 data.</p> <p>0100 TFE set when there are more than or equal to 4 empty slots in Transmit FIFO. Transmit FIFO empty is set when TxFIFO <=11 data.</p> <p>0101 TFE set when there are more than or equal to 5 empty slots in Transmit FIFO. Transmit FIFO empty is set when TxFIFO <=10 data.</p> <p>0110 TFE set when there are more than or equal to 6 empty slots in Transmit FIFO. Transmit FIFO empty is set when TxFIFO <=9 data.</p> <p>0111 TFE set when there are more than or equal to 7 empty slots in Transmit FIFO. Transmit FIFO empty is set when TxFIFO <=8 data.</p> <p>1000 TFE set when there are more than or equal to 8 empty slots in Transmit FIFO. Transmit FIFO empty is set when TxFIFO <=7 data.</p> <p>1001 TFE set when there are more than or equal to 9 empty slots in Transmit FIFO. Transmit FIFO empty is set when TxFIFO <= 6 data.</p> <p>1010 TFE set when there are more than or equal to 10 empty slots in Transmit FIFO. Transmit FIFO empty is set when TxFIFO <= 5 data.</p> <p>1011 TFE set when there are more than or equal to 11 empty slots in Transmit FIFO. Transmit FIFO empty is set when TxFIFO <= 4 data.</p> <p>1100 TFE set when there are more than or equal to 12 empty slots in Transmit FIFO. Transmit FIFO empty is set when TxFIFO <= 3 data.</p> <p>1101 TFE set when there are more than or equal to 13 empty slots in Transmit FIFO. Transmit FIFO empty is set when TxFIFO <= 2 data.</p> <p>1110 TFE set when there are more than or equal to 14 empty slots in Transmit FIFO. Transmit FIFO empty is set when TxFIFO <= 1 data.</p> <p>1111 TFE set when there are 15 empty slots in Transmit FIFO. Transmit FIFO empty is set when TxFIFO = 0 data.</p> |
| 15–12 RFCNT0 | Receive FIFO Counter 0. These bits indicate the number of data words in Receive FIFO 0. See SSI_SFCSR[RFCNT1] for details regarding settings for receive FIFO counter bits. |
| 11–8 TFCNT0 | Transmit FIFO Counter 0. These bits indicate the number of data words in Transmit FIFO 0. See SSI_SFCSR[TFCNT1] for details regarding settings for transmit FIFO counter bits. |
| 7–4 RFWM0 | Receive FIFO Full WaterMark 0. These bits control the threshold at which the RFF0 flag will be set. The RFF0 flag is set whenever the data level in Rx FIFO 0 reaches the selected threshold. See SSI_SFCSR[RFWM1] for details regarding settings for receive FIFO watermark bits. |
| TFWM0 | Transmit FIFO Empty WaterMark 0. These bits control the threshold at which the TFE0 flag will be set. The TFE0 flag is set whenever the empty slots in Tx FIFO exceed or are equal to the selected threshold. See SSI_SFCSR[TFWM0] for details regarding settings for transmit FIFO watermark bits. |

61.9.11 SSI AC97 Control Register (SSIx_SACNT)

Address: Base address + 38h offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
|-------|----|----|----|----|----|----|----|----|--|----|----|----|----|----|-----|----|--------|
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| R | 0 | | | | | | | | | | | | WR | RD | TIF | FV | AC97EN |
| W | | | | | | | | | | | | | | | | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

SSIx_SACNT field descriptions

| Field | Description |
|-------------------|--|
| 31–11 Reserved | This read-only field is reserved and always has the value 0. |
| 10–5 FRDIV | Frame Rate Divider. These bits control the frequency of AC97 data transmission/reception. They are programmed with the number of frames for which the SSI should be idle, after operating in one frame. Through these bits, AC97 frequency of operation, from 48 KHz (000000) to 1 KHz (101111) can be achieved. Sample Value: 001010 (10 Decimal) = SSI will operate once every 11 frames. |
| 4 WR | Write Command. This bit specifies whether the next frame will carry an AC97 Write Command or not. The programmer should take care that only one of the bits (WR or RD) is set at a time. When this bit is set, the corresponding tag bits (corresponding to Command Address and Command Data slots of the next Tx frame) are automatically set. This bit is automatically cleared by the SSI after completing transmission of a frame. 0 Next frame will not have a Write Command. 1 Next frame will have a Write Command. |
| 3 RD | Read Command. This bit specifies whether the next frame will carry an AC97 Read Command or not. The programmer should take care that only one of the bits (WR or RD) is set at a time. When this bit is set, the corresponding tag bit (corresponding to Command Address slot of the next Tx frame) is automatically set. This bit is automatically cleared by the SSI after completing transmission of a frame. 0 Next frame will not have a Read Command. 1 Next frame will have a Read Command. |
| 2 TIF | Tag in FIFO. This bit controls the destination of the information received in AC97 tag slot (Slot #0). 0 SATAG_REGISTER — Tag info stored in SATAG register. 1 RX_FIFO0 — Tag info stored in Rx FIFO 0. |
| 1 FV | Fixed/Variable Operation. This bit selects whether the SSI is in AC97 Fixed mode or AC97 Variable mode. |

Table continues on the next page...

SSIx_SACNT field descriptions (continued)

| Field | Description |
|-------------|--|
| | 0 FIXED — AC97 Fixed Mode. 1 VARIABLE — AC97 Variable Mode. |
| 0 AC97EN | AC97 Mode Enable. This bit is used to enable SSI AC97 operation. Refer to AC97 Mode for details of AC97 operation. 0 AC97 mode disabled. 1 SSI in AC97 mode. |

61.9.12 SSI AC97 Command Address Register (SSIx_SACADD)

Address: Base address + 3Ch offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| R | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |

SSIx_SACADD field descriptions

| Field | Description |
|-------------------|--|
| 31–19 Reserved | This read-only field is reserved and always has the value 0. |
| SACADD | AC97 Command Address. These bits store the Command Address Slot information (bit 19 of the slot is sent in accordance with the Read and Write Command bits in SSI_SACNT register). These bits can be updated by a direct write from the Core. They are also updated with the information received in the incoming Command Address Slot. If the contents of these bits change due to an update, the CMDAU bit in SISR is set. |

61.9.13 SSI AC97 Command Data Register (SSIx_SACDAT)

Address: Base address + 40h offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| R | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |

SSIx_SACDAT field descriptions

| Field | Description |
|-------------------|---|
| 31–20 Reserved | This read-only field is reserved and always has the value 0. |
| SACDAT | AC97 Command Data. The outgoing Command Data Slot carries the information contained in these bits. These bits can be updated by a direct write from the Core. They are also updated with the information received in the incoming Command Data Slot. If the contents of these bits change due to an update, the |

Table continues on the next page...

SSIx_SACDAT field descriptions (continued)

| Field | Description |
|-------|--|
| | CMDDU bit in SISR is set. These bits are transmitted only during AC97 Write Command. During AC97 Read Command, 0x00000 is transmitted in time slot #2. |

61.9.14 SSI AC97 Tag Register (SSIx_SATAG)

Address: Base address + 44h offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|--|--|
| R | | | | | | | | | | | | | | | | | 0 | | | | | | | | | | | | | | | | | |
| W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |

SSIx_SATAG field descriptions

| Field | Description |
|-------------------|--|
| 31–16 Reserved | This read-only field is reserved and always has the value 0. |
| SATAG | AC97 Tag Value. Writing to this register (by the Core) sets the value of the Tx-Tag in AC97 fixed mode of operation. On a read, the Core gets the Rx-Tag Value received (in the last frame) from the Codec. If TIF bit in SSI_SACNT register is set, the TAG value is also stored in Rx-FIFO in addition to SATAG register. When the received Tag value changes, the RXT bit in SISR register is set. Bits SATAG[1:0] convey the Codec -ID. In current implementation only Primary Codecs are supported. Thus writing value 2'b00 to this field is mandatory. |

61.9.15 SSI Transmit Time Slot Mask Register (SSIx_STMSK)

Address: Base address + 48h offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|--|--|
| R | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |

SSIx_STMSK field descriptions

| Field | Description |
|-------|--|
| STMSK | Transmit Mask. These bits indicate which slot has been masked in the current frame. The Core can write to this register to control the time slots in which the SSI transmits data. Each bit has info corresponding to the respective time slot in the frame. Transmit mask bits should not be used in I2S Slave mode of operation. SSI_STMSK register value must be set before enabling Transmission. 0 Valid Time Slot. 1 Time Slot masked (no data transmitted in this time slot). |

61.9.16 SSI Receive Time Slot Mask Register (SSIx_SRMSK)

Address: Base address + 4Ch offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| R | | | | | | | | | | | | | | | | | SRMSK | | | | | | | | | | | | | | | | |
| W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |

SSIx_SRMSK field descriptions

| Field | Description |
|-------|--|
| SRMSK | <p>Receive Mask. These bits indicate which slot has been masked in the current frame. The Core can write to this register to control the time slots in which the SSI receives data. Each bit has info corresponding to the respective time slot in the frame. SSI_SRMSK register value must be set before enabling Receiver. Receive mask bits should not be used in I2S Slave mode of operation.</p> <p>0 Valid Time Slot. 1 Time Slot masked (no data received in this time slot).</p> |

61.9.17 SSI AC97 Channel Status Register (SSIx_SACCST)

Address: Base address + 50h offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|--------|
| R | | | | | | | | | | | | | | | | | 0 | | | | | | | | | | | | | | | | SACCST |
| W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |

SSIx_SACCST field descriptions

| Field | Description |
|-------------------|---|
| 31–10 Reserved | This read-only field is reserved and always has the value 0. |
| SACCST | <p>AC97 Channel Status. These bits indicate which data slot has been enabled in AC97 variable mode operation. This register is updated in case the core enables/disables a channel through a write to SSI_SACCEN/SSI_SACCDIS register or the external codec enables a channel by sending a '1' in the corresponding SLOTREQ bit. Bit [0] corresponds to the first data slot in an AC97 frame (Slot #3) and Bit [9] corresponds to the tenth data slot (slot #12). The contents of this register only have relevance while the SSI is operating in AC97 variable mode. Writes to this register result in an error response on the block interface.</p> <p>0 Data channel disabled. 1 Data channel enabled.</p> |

61.9.18 SSI AC97 Channel Enable Register (SSI_x_SACCEN)

Address: Base address + 54h offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|--------|---|--|
| R | | | | | | | | | | | | | | | | | 0 | | | | | | | | | | | | | | | | |
| W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | SACCEN | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |

SSI_x_SACCEN field descriptions

| Field | Description |
|-------------------|--|
| 31–10 Reserved | This read-only field is reserved and always has the value 0. |
| SACCEN | AC97 Channel Enable. The Core writes a '1' to these bits to enable an AC97 data channel. Writing a '0' has no effect. Bit [0] corresponds to the first data slot in an AC97 frame (Slot #3) and Bit [9] corresponds to the tenth data slot (slot #12). Writes to these bits only have effect in the AC97 Variable mode of operation. These bits are always read as '0' by the Core. 0 Write Has no effect. 1 Write Enables the corresponding data channel. |

61.9.19 SSI AC97 Channel Disable Register (SSI_x_SACCDIS)

Address: Base address + 58h offset

| Bit | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---------|---|--|
| R | | | | | | | | | | | | | | | | | 0 | | | | | | | | | | | | | | | | |
| W | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | SACCDIS | | |
| Reset | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |

SSI_x_SACCDIS field descriptions

| Field | Description |
|-------------------|---|
| 31–10 Reserved | This read-only field is reserved and always has the value 0. |
| SACCDIS | AC97 Channel Disable. The Core writes a '1' to these bits to disable an AC97 data channel. Writing a '0' has no effect. Bit [0] corresponds to the first data slot in an AC97 frame (Slot #3) and Bit [9] corresponds to the tenth data slot (slot #12). Writes to these bits only have effect in the AC97 Variable mode of operation. These bits are always read as '0' by the Core. 0 Write Has no effect. 1 Write Disables the corresponding data channel. |