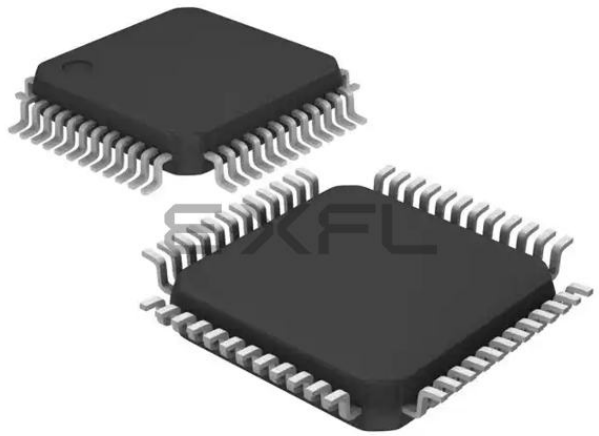

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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	12V1
Core Size	16-Bit
Speed	25MHz
Connectivity	CANbus, IrDA, LINbus, SCI, SPI
Peripherals	LVD, POR, PWM, WDT
Number of I/O	40
Program Memory Size	192KB (192K x 8)
Program Memory Type	FLASH
EEPROM Size	4K x 8
RAM Size	11K x 8
Voltage - Supply (Vcc/Vdd)	3.13V ~ 5.5V
Data Converters	A/D 16x12b; D/A 2x8b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	48-LQFP
Supplier Device Package	48-LQFP (7x7)
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/s9s12ga192f0mlfr

Table 1-2. Maximum Peripheral Availability per Package

Peripheral	20 TSSOP	32 LQFP	48 QFN	48 LQFP	64 LQFP	100 LQFP	KGD (Die)
DAC0	—	—	—	Yes	Yes	Yes	Yes
DAC1	—	—	—	Yes	Yes	Yes	Yes
ACMP	Yes	Yes	Yes	Yes	Yes	—	—
Total GPIO	14	26	40	40	54	86	86

1.2.2 Chip-Level Features

On-chip modules available within the family include the following features:

- S12 CPU core
- Up to 240 Kbyte on-chip flash with ECC
- Up to 4 Kbyte EEPROM with ECC
- Up to 11 Kbyte on-chip SRAM
- Phase locked loop (IPLL) frequency multiplier with internal filter
- 4–16 MHz amplitude controlled Pierce oscillator
- 1 MHz internal RC oscillator
- Timer module (TIM) supporting up to eight channels that provide a range of 16-bit input capture, output compare, counter, and pulse accumulator functions
- Pulse width modulation (PWM) module with up to eight x 8-bit channels
- Up to 16-channel, 10 or 12-bit resolution successive approximation analog-to-digital converter (ADC)
- Up to two 8-bit digital-to-analog converters (DAC)
- Up to one 5V analog comparator (ACMP)
- Up to three serial peripheral interface (SPI) modules
- Up to three serial communication interface (SCI) modules supporting LIN communications
- Up to one multi-scalable controller area network (MSCAN) module (supporting CAN protocol 2.0A/B)
- On-chip voltage regulator (VREG) for regulation of input supply and all internal voltages
- Autonomous periodic interrupt (API)
- Precision fixed voltage reference for ADC conversions
- Optional reference voltage attenuator module to increase ADC accuracy

1.3 Module Features

The following sections provide more details of the modules implemented on the MC9S12G-Family family.

Address	Module	Size (Bytes)
0x000A–0x000B	MMC (Memory Map Control)	2
0x000C–0x000D	PIM (Port Integration Module)	2
0x000E–0x000F	Reserved	2
0x0010–0x0017	MMC (Memory Map Control)	8
0x0018–0x0019	Reserved	2
0x001A–0x001B	Device ID register	2
0x001C–0x001F	PIM (Port Integration Module)	4
0x0020–0x002F	DBG (Debug Module)	16
0x0030–0x0033	Reserved	4
0x0034–0x003F	CPMU (Clock and Power Management)	12
0x0040–0x006F	TIM (Timer Module <= 8 channels)	48
0x0070–0x009F	ADC (Analog to Digital Converter <= 16 channels)	48
0x00A0–0x00C7	PWM (Pulse-Width Modulator <= 8 channels)	40
0x00C8–0x00CF	SCI0 (Serial Communication Interface)	8
0x00D0–0x00D7	SCI1 (Serial Communication Interface)[1]	8
0x00D8–0x00DF	SPI0 (Serial Peripheral Interface)	8
0x00E0–0x00E7	Reserved	8
0x00E8–0x00EF	SCI2 (Serial Communication Interface)[2]	8
0x00F0–0x00F7	SPI1 (Serial Peripheral Interface)[3]	8
0x00F8–0x00FF	SPI2 (Serial Peripheral Interface)[4]	8
0x0100–0x0113	FTMRG control registers	20
0x0114–0x011F	Reserved	12
0x0120	INT (Interrupt Module)	1
0x0121–0x013F	Reserved	31
0x0140–0x017F	CAN[5]	64
0x0180–0x023F	Reserved	192
0x0240–0x025F	PIM (Port Integration Module)	32
0x0260–0x0261	ACMP (Analog Comparator)[6]	2
0x0262–0x0275	PIM (Port Integration Module)	20
0x0276	RVA (Reference Voltage Attenuator)[7]	1
0x0277–0x027F	PIM (Port Integration Module)	9
0x0280–0x02EF	Reserved	112
0x02F0–0x02FF	CPMU (Clock and Power Management)	16
0x0300–0x03BF	Reserved	192
0x03C0–0x03C7	DAC0 (Digital to Analog Converter)[8]	8

Table 1-21. 64-Pin LQFP Pinout for S12G96 and S12G128

	Function <----lowest-----PRIORITY-----highest---->					Power Supply	Internal Pull Resistor	
Package Pin	**Pin**	**2nd Func.**	**3rd Func.**	**4th Func**	**5th Func**		**CTRL**	**Reset State**
57	PS5	MOSI0	—	—	—	V_{DDX}	PERS/PPSS	Up
58	PS6	SCK0	—	—	—	V_{DDX}	PERS/PPSS	Up
59	PS7	API_EXTCLK	ECLK	$\overline{SS0}$	—	V_{DDX}	PERS/PPSS	Up
60	PM0	RXCAN	—	—	—	V_{DDX}	PERM/PPSM	Disabled
61	PM1	TXCAN	—	—	—	V_{DDX}	PERM/PPSM	Disabled
62	PM2	RXD2	—	—	—	V_{DDX}	PERM/PPSM	Disabled
63	PM3	TXD2	—	—	—	V_{DDX}	PERM/PPSM	Disabled
64	PJ7	KWJ7	$\overline{SS2}$	—	—	V_{DDX}	PERJ/PPSJ	Up

[1] The regular I/O characteristics (see Section A.2, “I/O Characteristics”) apply if the EXTAL/XTAL function is disabled

Table 1-24. 64-Pin LQFP Pinout for S12GA96 and S12GA128

	Function <----lowest-----PRIORITY-----highest---->					Power Supply	Internal Pull Resistor	
Package Pin	**Pin**	**2nd Func.**	**3rd Func.**	**4th Func**	**5th Func**		**CTRL**	**Reset State**
57	PS5	MOSI0	—	—	—	V_{DDX}	PERS/PPSS	Up
58	PS6	SCK0	—	—	—	V_{DDX}	PERS/PPSS	Up
59	PS7	API_EXTCLK	ECLK	$\overline{SS0}$	—	V_{DDX}	PERS/PPSS	Up
60	PM0	RXCAN	—	—	—	V_{DDX}	PERM/PPSM	Disabled
61	PM1	TXCAN	—	—	—	V_{DDX}	PERM/PPSM	Disabled
62	PM2	RXD2	—	—	—	V_{DDX}	PERM/PPSM	Disabled
63	PM3	TXD2	—	—	—	V_{DDX}	PERM/PPSM	Disabled
64	PJ7	KWJ7	$\overline{SS2}$	—	—	V_{DDX}	PERJ/PPSJ	Up

[1] The regular I/O characteristics (see Section A.2, “I/O Characteristics”) apply if the EXTAL/XTAL function is disabled

Table 2-14. Port P Pins PP7-0 (continued)

PP3-PP2	• Except 20 TSSOP: The PWM channels 3 and 2 signal are mapped to these pins when used with the PWM function. The enabled PWM channel forces the I/O state to be an output. • Except 20 TSSOP: The ADC ETRIG 3 and 2 signal are mapped to these pins when used with the ADC function. The enabled external trigger function has no effect on the I/O state. Refer to Section 2.6.4, “ADC External Triggers ETRIG3-0”. • Except 20 TSSOP: Pin interrupts can be generated if enabled in input or output mode. • Signal priority: Except 20 TSSOP: PWM > GPO
PP1	• Except 20 TSSOP: The PWM channel 1 signal is mapped to this pin when used with the PWM function. The enabled PWM channel forces the I/O state to be an output. • Except 100 LQFP and 20 TSSOP: The ECLKX2 signal is mapped to this pin when used with the external clock function. The enabled ECLKX2 forces the I/O state to an output. • Except 20 TSSOP: The ADC ETRIG1 signal is mapped to this pin when used with the ADC function. The enabled external trigger function has no effect on the I/O state. Refer to Section 2.6.4, “ADC External Triggers ETRIG3-0”. • Except 20 TSSOP: Pin interrupts can be generated if enabled in input or output mode. • Signal priority: Except 100 LQFP and 20 TSSOP: PWM1 > ECLKX2 > GPO 100 LQFP: PWM1 > GPO
PP0	• Except 20 TSSOP: The PWM channel 0 signal is mapped to this pin when used with the PWM function. The enabled PWM channel forces the I/O state to be an output. • Except 100 LQFP and 20 TSSOP: The API_EXTCLK signal is mapped to this pin when used with the external clock function. If the Autonomous Periodic Interrupt clock is enabled and routed here the I/O state is forced to output. • Except 20 TSSOP: The ADC ETRIG0 signal is mapped to this pin when used with the ADC function. The enabled external trigger function has no effect on the I/O state. Refer to Section 2.6.4, “ADC External Triggers ETRIG3-0”. • Except 20 TSSOP: Pin interrupts can be generated if enabled in input or output mode. • Signal priority: Except 100 LQFP and 20 TSSOP: PWM0 > API_EXTCLK > GPO 100 LQFP: PWM0 > GPO

Table 2-19. Block Register Map (G1) (continued)

Global Address Register Name		Bit 7	6	5	4	3	2	1	Bit 0
0x0255 PPSM	R	0	0	0	0	PPSM3	PPSM2	PPSM1	PPSM0
	W								
0x0256 WOMM	R	0	0	0	0	WOMM3	WOMM2	WOMM1	WOMM0
	W								
0x0257 PKGCR	R	APICLKS7	0	0	0	0	PKGCR2	PKGCR1	PKGCR0
	W								
0x0258 PTP	R	PTP7	PTP6	PTP5	PTP4	PTP3	PTP2	PTP1	PTP0
	W								
0x0259 PTIP	R	PTIP7	PTIP6	PTIP5	PTIP4	PTIP3	PTIP2	PTIP1	PTIP0
	W								
0x025A DDRP	R	DDRP7	DDRP6	DDRP5	DDRP4	DDRP3	DDRP2	DDRP1	DDRP0
	W								
0x025B Reserved	R	0	0	0	0	0	0	0	0
	W								
0x025C PERP	R	PERP7	PERP6	PERP5	PERP4	PERP3	PERP2	PERP1	PERP0
	W								
0x025D PPSP	R	PPSP7	PPSP6	PPSP5	PPSP4	PPSP3	PPSP2	PPSP1	PPSP0
	W								
0x025E PIEP	R	PIEP7	PIEP6	PIEP5	PIEP4	PIEP3	PIEP2	PIEP1	PIEP0
	W								
0x025F PIFP	R	PIFP7	PIFP6	PIFP5	PIFP4	PIFP3	PIFP2	PIFP1	PIFP0
	W								
0x0260–0x0267 Reserved	R	0	0	0	0	0	0	0	0
	W								
0x0268 PTJ	R	PTJ7	PTJ6	PTJ5	PTJ4	PTJ3	PTJ2	PTJ1	PTJ0
	W								
0x0269 PTIJ	R	PTIJ7	PTIJ6	PTIJ5	PTIJ4	PTIJ3	PTIJ2	PTIJ1	PTIJ0
	W								
0x026A DDRJ	R	DDRJ7	DDRJ6	DDRJ5	DDRJ4	DDRJ3	DDRJ2	DDRJ1	DDRJ0
	W								

= Unimplemented or Reserved

Chapter 10
S12 Clock, Reset and Power Management Unit (S12CPMU)

Revision History

Version Number	Revision Date	Effective Date	Author	Description of Changes
V04.03	29 Jan 10	29 Jan 10		Added Note in section 10.3.2.16/10-380 to precise description of API behavior after feature enable for the first time-out period.
V04.04	03 Mar 10	03 Mar 10		Corrected typos.
V04.05	23. Mar 10	23 Mar 10		Corrected typos.
V04.06	13 Apr 10	13 Apr 10		Corrected typo in Table 10-6
V04.07	28 Apr 10	28 Apr 10		Major rework fixing typos, figures and tables and improved description of Adaptive Oscillator Filter.
V04.08	03 May 10	03 Mail 10		Improved pin description in Section 10.2, “Signal Description
V04.09	22 Jun 10	22 Jun 10		Changed IP-Name from OSCLCP to XOSCLCP, added OSCCLK_LCP clock name intoFigure 10-1 and Figure 10-2 updated description of Section 10.2.2, “EXTAL and XTAL.
V04.10	01 Jul 10	01 Jul 10		Added TC trimming to feature list
V04.11	23 Aug 10	23 Aug 10		Removed feature of adaptive oscillator filter. Register bits 6 and 4to 0in the CPMUOSC register are marked reserved and do not alter.
V04.12	27 April 12	27 April 12		Corrected wording for API interrupt flag Changed notation of IRC trim values for 0x00000 to 0b00000
V04.13	6 Mar 13	6 Mar 13		Table 10-19. correction: substituted f_{ACLK} by ACLK Clock Period

10.1 Introduction

This specification describes the function of the Clock, Reset and Power Management Unit (S12CPMU).

- The Pierce oscillator (XOSCLCP) provides a robust, low-noise and low-power external clock source. It is designed for optimal start-up margin with typical quartz crystals and ceramic resonators.
- The Voltage regulator (IVREG) operates from the range 3.13V to 5.5V. It provides all the required chip internal voltages and voltage monitors.
- The Phase Locked Loop (PLL) provides a highly accurate frequency multiplier with internal filter.

12.3.2 Register Descriptions

This section describes in address order all the ADC12B8C registers and their individual bits.

12.3.2.1 ATD Control Register 0 (ATDCTL0)

Writes to this register will abort current conversion sequence.

Module Base + 0x0000

	7	6	5	4	3	2	1	0
R	Reserved	0	0	0	WRAP3	WRAP2	WRAP1	WRAP0
W								
Reset	0	0	0	0	1	1	1	1

= Unimplemented or Reserved

Figure 12-3. ATD Control Register 0 (ATDCTL0)

Read: Anytime

Write: Anytime, in special modes always write 0 to Reserved Bit 7.

Table 12-1. ATDCTL0 Field Descriptions

Field	Description
3-0 WRAP[3-0]	**Wrap Around Channel Select Bits** — These bits determine the channel for wrap around when doing multi-channel conversions. The coding is summarized in Table 12-2.

Table 12-2. Multi-Channel Wrap Around Coding

WRAP3	WRAP2	WRAP1	WRAP0	Multiple Channel Conversions (MULT = 1) Wraparound to AN0 after Converting
0	0	0	0	Reserved[1]
0	0	0	1	AN1
0	0	1	0	AN2
0	0	1	1	AN3
0	1	0	0	AN4
0	1	0	1	AN5
0	1	1	0	AN6
0	1	1	1	AN7
1	0	0	0	AN7
1	0	0	1	AN7
1	0	1	0	AN7
1	0	1	1	AN7
1	1	0	0	AN7
1	1	0	1	AN7
1	1	1	0	AN7
1	1	1	1	AN7

12.3.2.9 ATD Status Register 2 (ATDSTAT2)

This read-only register contains the Conversion Complete Flags CCF[7:0].

Module Base + 0x000A

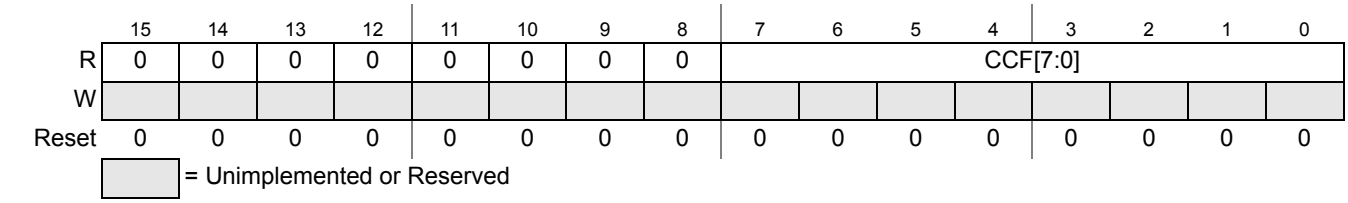

Figure 12-11. ATD Status Register 2 (ATDSTAT2)

Read: Anytime

Write: Anytime (for details see Table 12-18 below)

Table 12-18. ATDSTAT2 Field Descriptions

Field	Description
7–0 CCF[7:0]	**Conversion Complete Flag *n* (*n*= 7, 6, 5, 4, 3, 2, 1, 0) (*n conversion number, NOT channel number!)*—** A conversion complete flag is set at the end of each conversion in a sequence. The flags are associated with the conversion position in a sequence (and also the result register number). Therefore in non-fifo mode, CCF[4] is set when the fifth conversion in a sequence is complete and the result is available in result register ATDDR4; CCF[5] is set when the sixth conversion in a sequence is complete and the result is available in ATDDR5, and so forth. If automatic compare of conversion results is enabled (CMPE[*n*]=1 in ATDCMPE), the conversion complete flag is only set if comparison with ATDDR*n* is true. If ACMPIE=1 a compare interrupt will be requested. In this case, as the ATDDR*n* result register is used to hold the compare value, the result will not be stored there at the end of the conversion but is lost. A flag CCF[*n*] is cleared when one of the following occurs: A) Write to ATDCTL5 (a new conversion sequence is started) B) If AFFC=0, write “1” to CCF[*n*] C) If AFFC=1 and CMPE[*n*]=0, read of result register ATDDR*n* D) If AFFC=1 and CMPE[*n*]=1, write to result register ATDDR*n* In case of a concurrent set and clear on CCF[*n*]: The clearing by method A) will overwrite the set. The clearing by methods B) or C) or D) will be overwritten by the set. 0 Conversion number *n* not completed or successfully compared 1 If (CMPE[*n*]=0): Conversion number *n* has completed. Result is ready in ATDDR*n*. If (CMPE[*n*]=1): Compare for conversion result number *n* with compare value in ATDDR*n*, using compare operator CMPGT[*n*] is true. (No result available in ATDDR*n*)

15.3.2.12 ATD Conversion Result Registers (ATDDR*n*)

The A/D conversion results are stored in 16 result registers. Results are always in unsigned data representation. Left and right justification is selected using the DJM control bit in ATDCTL3.

If automatic compare of conversions results is enabled (CMPE[*n*]=1 in ATDCMPE), these registers must be written with the compare values in left or right justified format depending on the actual value of the DJM bit. In this case, as the ATDDR*n* register is used to hold the compare value, the result will not be stored there at the end of the conversion but is lost.

Attention, n is the conversion number, NOT the channel number!

Read: Anytime

Write: Anytime

NOTE

For conversions not using automatic compare, results are stored in the result registers after each conversion. In this case avoid writing to ATDDRn except for initial values, because an A/D result might be overwritten.

15.3.2.12.1 Left Justified Result Data (DJM=0)

Module Base +
0x0010 = ATDDR0, 0x0012 = ATDDR1, 0x0014 = ATDDR2, 0x0016 = ATDDR3
0x0018 = ATDDR4, 0x001A = ATDDR5, 0x001C = ATDDR6, 0x001E = ATDDR7
0x0020 = ATDDR8, 0x0022 = ATDDR9, 0x0024 = ATDDR10, 0x0026 = ATDDR11
0x0028 = ATDDR12, 0x002A = ATDDR13, 0x002C = ATDDR14, 0x002E = ATDDR15

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
R	Result-Bit[11:0]												0	0	0	0
W																
Reset	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

= Unimplemented or Reserved

Figure 15-14. Left justified ATD conversion result register (ATDDR*n*)

Table 15-21 shows how depending on the A/D resolution the conversion result is transferred to the ATD result registers for left justified data. Compare is always done using all 12 bits of both the conversion result and the compare value in ATDDRn.

Table 15-21. Conversion result mapping to ATDDRn

A/D resolution	DJM	conversion result mapping to ATDDR*n*
8-bit data	0	Result-Bit[11:4] = conversion result, Result-Bit[3:0]=0000
10-bit data	0	Result-Bit[11:2] = conversion result, Result-Bit[1:0]=00

16.2 Signal Description

This section lists all inputs to the ADC12B16C block.

16.2.1 Detailed Signal Descriptions

16.2.1.1 AN*x* (*x* = 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0)

This pin serves as the analog input Channel *x*. It can also be configured as digital port or external trigger for the ATD conversion.

16.2.1.2 ETRIG3, ETRIG2, ETRIG1, ETRIG0

These inputs can be configured to serve as an external trigger for the ATD conversion.

Refer to device specification for availability and connectivity of these inputs!

16.2.1.3 VRH, VRL

VRH is the high reference voltage, VRL is the low reference voltage for ATD conversion.

16.2.1.4 VDDA, VSSA

These pins are the power supplies for the analog circuitry of the ADC12B16C block.

16.3 Memory Map and Register Definition

This section provides a detailed description of all registers accessible in the ADC12B16C.

16.3.1 Module Memory Map

Figure 16-2 gives an overview on all ADC12B16C registers.

NOTE

Register Address = Base Address + Address Offset, where the Base Address is defined at the MCU level and the Address Offset is defined at the module level.

Address	Name		Bit 7	6	5	4	3	2	1	Bit 0
0x0000	ATDCTL0	R W	Reserved	0	0	0	WRAP3	WRAP2	WRAP1	WRAP0
0x0001	ATDCTL1	R W	ETRIGSEL	SRES1	SRES0	SMP_DIS	ETRIGCH3	ETRIGCH2	ETRIGCH1	ETRIGCH0
0x0002	ATDCTL2	R W	0	AFFC	Reserved	ETRIGLE	ETRIGP	ETRIGE	ASCIE	ACMPIE

= Unimplemented or Reserved

Figure 16-2. ADC12B16C Register Summary (Sheet 1 of 3)

Table 18-15. CANTARQ Register Field Descriptions

Field	Description
2-0 ABTRQ[2:0]	**Abort Request** — The CPU sets the ABTRQx bit to request that a scheduled message buffer (TXEx = 0) be aborted. The MSCAN grants the request if the message has not already started transmission, or if the transmission is not successful (lost arbitration or error). When a message is aborted, the associated TXE (see Section 18.3.2.7, “MSCAN Transmitter Flag Register (CANTFLG)”) and abort acknowledge flags (ABTAK, see Section 18.3.2.10, “MSCAN Transmitter Message Abort Acknowledge Register (CANTAAK)”) are set and a transmit interrupt occurs if enabled. The CPU cannot reset ABTRQx. ABTRQx is reset whenever the associated TXE flag is set. 0 No abort request 1 Abort request pending

18.3.2.10 MSCAN Transmitter Message Abort Acknowledge Register (CANTAAK)

The CANTAAK register indicates the successful abort of a queued message, if requested by the appropriate bits in the CANTARQ register.

Module Base + 0x0009 Access: User read/write[1]

	7	6	5	4	3	2	1	0
R	0	0	0	0	0	ABTAK2	ABTAK1	ABTAK0
W								
Reset:	0	0	0	0	0	0	0	0

= Unimplemented

Figure 18-13. MSCAN Transmitter Message Abort Acknowledge Register (CANTAAK)

[1] Read: Anytime
Write: Unimplemented

NOTE

The CANTAAK register is held in the reset state when the initialization mode is active (INITRQ = 1 and INITAK = 1).

Table 18-16. CANTAAK Register Field Descriptions

Field	Description
2-0 ABTAK[2:0]	**Abort Acknowledge** — This flag acknowledges that a message was aborted due to a pending abort request from the CPU. After a particular message buffer is flagged empty, this flag can be used by the application software to identify whether the message was aborted successfully or was sent anyway. The ABTAKx flag is cleared whenever the corresponding TXE flag is cleared. 0 The message was not aborted. 1 The message was aborted.

18.3.2.11 MSCAN Transmit Buffer Selection Register (CANTBSEL)

The CANTBSEL register allows the selection of the actual transmit message buffer, which then will be accessible in the CANTXFG register space.

Table 20-12. SCISR2 Field Descriptions (continued)

Field	Description
3 RXPOL	**Receive Polarity** — This bit control the polarity of the received data. In NRZ format, a one is represented by a mark and a zero is represented by a space for normal polarity, and the opposite for inverted polarity. In IrDA format, a zero is represented by short high pulse in the middle of a bit time remaining idle low for a one for normal polarity, and a zero is represented by short low pulse in the middle of a bit time remaining idle high for a one for inverted polarity. 0 Normal polarity 1 Inverted polarity
2 BRK13	**Break Transmit Character Length** — This bit determines whether the transmit break character is 10 or 11 bit respectively 13 or 14 bits long. The detection of a framing error is not affected by this bit. 0 Break character is 10 or 11 bit long 1 Break character is 13 or 14 bit long
1 TXDIR	**Transmitter Pin Data Direction in Single-Wire Mode** — This bit determines whether the TXD pin is going to be used as an input or output, in the single-wire mode of operation. This bit is only relevant in the single-wire mode of operation. 0 TXD pin to be used as an input in single-wire mode 1 TXD pin to be used as an output in single-wire mode
0 RAF	**Receiver Active Flag** — RAF is set when the receiver detects a logic 0 during the RT1 time period of the start bit search. RAF is cleared when the receiver detects an idle character. 0 No reception in progress 1 Reception in progress

20.3.2.9 SCI Data Registers (SCIDRH, SCIDRL)

Module Base + 0x0006

	7	6	5	4	3	2	1	0
R	R8	T8	0	0	0	0	0	0
W								
Reset	0	0	0	0	0	0	0	0

= Unimplemented or Reserved

Figure 20-12. SCI Data Registers (SCIDRH)

Module Base + 0x0007

	7	6	5	4	3	2	1	0
R	R7	R6	R5	R4	R3	R2	R1	R0
W	T7	T6	T5	T4	T3	T2	T1	T0
Reset	0	0	0	0	0	0	0	0

Figure 20-13. SCI Data Registers (SCIDRL)

Read: Anytime; reading accesses SCI receive data register

Write: Anytime; writing accesses SCI transmit data register; writing to R8 has no effect

20.4.4 Baud Rate Generation

A 13-bit modulus counter in the baud rate generator derives the baud rate for both the receiver and the transmitter. The value from 0 to 8191 written to the SBR12:SBR0 bits determines the bus clock divisor. The SBR bits are in the SCI baud rate registers (SCIBDH and SCIBDL). The baud rate clock is synchronized with the bus clock and drives the receiver. The baud rate clock divided by 16 drives the transmitter. The receiver has an acquisition rate of 16 samples per bit time.

Baud rate generation is subject to one source of error:

- Integer division of the bus clock may not give the exact target frequency.

Table 20-16 lists some examples of achieving target baud rates with a bus clock frequency of 25 MHz.

When IREN = 0 then,

SCI baud rate = SCI bus clock / (16 * SCIBR[12:0])

Table 20-16. Baud Rates (Example: Bus Clock = 25 MHz)

Bits SBR[12:0]	Receiver Clock (Hz)	Transmitter Clock (Hz)	Target Baud Rate	Error (%)
41	609,756.1	38,109.8	38,400	.76
81	308,642.0	19,290.1	19,200	.47
163	153,374.2	9585.9	9,600	.16
326	76,687.1	4792.9	4,800	.15
651	38,402.5	2400.2	2,400	.01
1302	19,201.2	1200.1	1,200	.01
2604	9600.6	600.0	600	.00
5208	4800.0	300.0	300	.00

Offset Module Base + 0x0012

	7	6	5	4	3	2	1	0
R	0	0	0	0	0	0	0	0
W								
Reset	0	0	0	0	0	0	0	0

= Unimplemented or Reserved

Figure 24-23. Flash Reserved6 Register (FRSV6)

All bits in the FRSV6 register read 0 and are not writable.

24.3.2.19 Flash Reserved7 Register (FRSV7)

This Flash register is reserved for factory testing.

Offset Module Base + 0x0013

	7	6	5	4	3	2	1	0
R	0	0	0	0	0	0	0	0
W								
Reset	0	0	0	0	0	0	0	0

= Unimplemented or Reserved

Figure 24-24. Flash Reserved7 Register (FRSV7)

All bits in the FRSV7 register read 0 and are not writable.

- VERNUM: Version number. The first version is number 0b_0001 with both 0b_0000 and 0b_1111 meaning ‘none’.

25.4.3 Internal NVM resource (NVMRES)

IFR is an internal NVM resource readable by CPU , when NVMRES is active. The IFR fields are shown in Table 25-5.

The NVMRES global address map is shown in Table 25-6.

25.4.4 Flash Command Operations

Flash command operations are used to modify Flash memory contents.

The next sections describe:

- How to write the FCLKDIV register that is used to generate a time base (FCLK) derived from BUSCLK for Flash program and erase command operations
- The command write sequence used to set Flash command parameters and launch execution
- Valid Flash commands available for execution, according to MCU functional mode and MCU security state.

25.4.4.1 Writing the FCLKDIV Register

Prior to issuing any Flash program or erase command after a reset, the user is required to write the FCLKDIV register to divide BUSCLK down to a target FCLK of 1 MHz. Table 25-8 shows recommended values for the FDIV field based on BUSCLK frequency.

NOTE

Programming or erasing the Flash memory cannot be performed if the bus clock runs at less than 0.8 MHz. Setting FDIV too high can destroy the Flash memory due to overstress. Setting FDIV too low can result in incomplete programming or erasure of the Flash memory cells.

When the FCLKDIV register is written, the FDIVLD bit is set automatically. If the FDIVLD bit is 0, the FCLKDIV register has not been written since the last reset. If the FCLKDIV register has not been written, any Flash program or erase command loaded during a command write sequence will not execute and the ACCERR bit in the FSTAT register will set.

25.4.4.2 Command Write Sequence

The Memory Controller will launch all valid Flash commands entered using a command write sequence.

Before launching a command, the ACCERR and FPVIOL bits in the FSTAT register must be clear (see Section 25.3.2.7) and the CCIF flag should be tested to determine the status of the current command write sequence. If CCIF is 0, the previous command write sequence is still active, a new command write sequence cannot be started, and all writes to the FCCOB register are ignored.

If a reset occurs while any Flash command is in progress, that command will be immediately aborted. The state of the word being programmed or the sector/block being erased is not guaranteed.

Table A-4. Operating Conditions

Rating	Symbol	Min	Typ	Max	Unit
Temperature Option V Operating ambient temperature range[1] Operating junction temperature range	 T_A T_J	 –40 –40	 27 —	 105 125	°C
Temperature Option M Operating ambient temperature range[1] Operating junction temperature range	 T_A T_J	 –40 –40	 27 —	 125 150	°C
Temperature Option W Operating ambient temperature range[1] Operating junction temperature range	 T_A T_J	 –40 –40	 27 —	 150 160	°C

1 Please refer to Section A.1.8, “Power Dissipation and Thermal Characteristics” for more details about the relation between ambient temperature T_A and device junction temperature T_J.

NOTE

Operation is guaranteed when powering down until low voltage reset assertion.