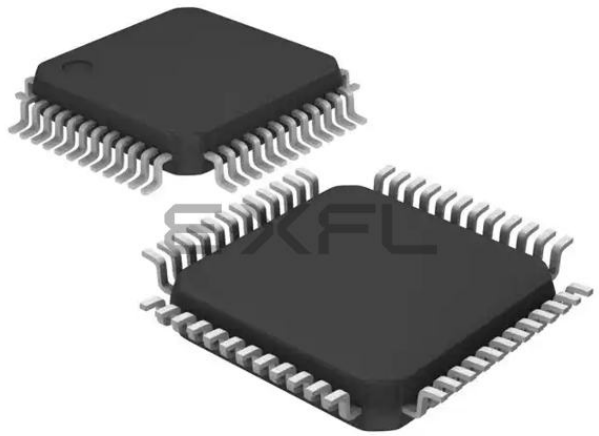

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Number of I/O	39
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Program Memory Type	FLASH
EEPROM Size	-
RAM Size	6K x 8
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Chapter 13
Serial Peripheral Interface (S08SPIV3)

6.5.1.5 Port A Drive Strength Selection Register (PTADS)

	7	6	5	4	3	2	1	0
R W	PTADS7	PTADS6	PTADS5	PTADS4	PTADS3	PTADS2	PTADS1	PTADS0
Reset:	0	0	0	0	0	0	0	0

Figure 6-7. Drive Strength Selection for Port A Register (PTADS)

Table 6-5. PTADS Register Field Descriptions

Field	Description
7:0 PTADS[7:0]	**Output Drive Strength Selection for Port A Bits** — Each of these control bits selects between low and high output drive for the associated PTA pin. For port A pins that are configured as inputs, these bits have no effect. 0 Low output drive strength selected for port A bit n. 1 High output drive strength selected for port A bit n.

6.5.1.6 Port A Interrupt Status and Control Register (PTASC)

	7	6	5	4	3	2	1	0
R	0	0	0	0	PTAIF	0	PTAIE	PTAMOD
W						PTAACK		
Reset:	0	0	0	0	0	0	0	0

= Unimplemented or Reserved

Figure 6-8. Port A Interrupt Status and Control Register (PTASC)

Table 6-6. PTASC Register Field Descriptions

Field	Description
3 PTAIF	**Port A Interrupt Flag** — PTAIF indicates when a port A interrupt is detected. Writes have no effect on PTAIF. 0 No port A interrupt detected. 1 Port A interrupt detected.
2 PTAACK	**Port A Interrupt Acknowledge** — Writing a 1 to PTAACK is part of the flag clearing mechanism. PTAACK always reads as 0.
1 PTAIE	**Port A Interrupt Enable** — PTAIE determines whether a port A interrupt is requested. 0 Port A interrupt request not enabled. 1 Port A interrupt request enabled.
0 PTAMOD	**Port A Detection Mode** — PTAMOD (along with the PTAES bits) controls the detection mode of the port A interrupt pins. 0 Port A pins detect edges only. 1 Port A pins detect both edges and levels.

6.5.2 Port B Registers

Port B is controlled by the registers listed below.

6.5.2.1 Port B Data Register (PTBD)

	7	6	5	4	3	2	1	0
R W	PTBD7	PTBD6	PTBD5	PTBD4	PTBD3	PTBD2	PTBD1	PTBD0
Reset:	0	0	0	0	0	0	0	0

Figure 6-11. Port B Data Register (PTBD)

Table 6-9. PTBD Register Field Descriptions

Field	Description
7:0 PTBD[7:0]	**Port B Data Register Bits** — For port B pins that are inputs, reads return the logic level on the pin. For port B pins that are configured as outputs, reads return the last value written to this register. Writes are latched into all bits of this register. For port B pins that are configured as outputs, the logic level is driven out the corresponding MCU pin. Reset forces PTBD to all 0s, but these 0s are not driven out the corresponding pins because reset also configures all port pins as high-impedance inputs with pull-ups/pull-downs disabled.

6.5.2.2 Port B Data Direction Register (PTBDD)

	7	6	5	4	3	2	1	0
R W	PTBDD7	PTBDD6	PTBDD5	PTBDD4	PTBDD3	PTBDD2	PTBDD1	PTBDD0
Reset:	0	0	0	0	0	0	0	0

Figure 6-12. Port B Data Direction Register (PTBDD)

Table 6-10. PTBDD Register Field Descriptions

Field	Description
7:0 PTBDD[7:0]	**Data Direction for Port B Bits** — These read/write bits control the direction of port B pins and what is read for PTBD reads. 0 Input (output driver disabled) and reads return the pin value. 1 Output driver enabled for port B bit n and PTBD reads return the contents of PTBDn.

6.5.7 Port G Registers

Port G is controlled by the registers listed below.

6.5.7.1 Port G Data Register (PTGD)

	7	6	5	4	3	2	1	0
R W	PTGD7	PTGD6	PTGD5	PTGD4	PTGD3	PTGD2	PTGD1	PTGD0
Reset:	0	0	0	0	0	0	0	0

Figure 6-42. Port G Data Register (PTGD)

Table 6-40. PTGD Register Field Descriptions

Field	Description
7:0 PTGD[7:0]	**Port G Data Register Bits** — For port G pins that are inputs, reads return the logic level on the pin. For port G pins that are configured as outputs, reads return the last value written to this register. Writes are latched into all bits of this register. For port G pins that are configured as outputs, the logic level is driven out the corresponding MCU pin. Reset forces PTGD to all 0s, but these 0s are not driven out the corresponding pins because reset also configures all port pins as high-impedance inputs with pull-ups disabled.

6.5.7.2 Port G Data Direction Register (PTGDD)

	7	6	5	4	3	2	1	0
R W	PTGDD7	PTGDD6	PTGDD5	PTGDD4	PTGDD3	PTGDD2	PTGDD1	PTGDD0
Reset:	0	0	0	0	0	0	0	0

Figure 6-43. Port G Data Direction Register (PTGDD)

Table 6-41. PTGDD Register Field Descriptions

Field	Description
7:0 PTGDD[7:0]	**Data Direction for Port G Bits** — These read/write bits control the direction of port G pins and what is read for PTGD reads. 0 Input (output driver disabled) and reads return the pin value. 1 Output driver enabled for port G bit n and PTGD reads return the contents of PTGDn.

8.5 Initialization / Application Information

This section describes how to initialize and configure the MCG module in application. The following sections include examples on how to initialize the MCG and properly switch between the various available modes.

8.5.1 MCG Module Initialization Sequence

The MCG comes out of reset configured for FEI mode with the BDIV set for divide-by-2. The internal reference will stabilize in t_{irefst} microseconds before the FLL can acquire lock. As soon as the internal reference is stable, the FLL will acquire lock in $t_{fll\_acquire}$ milliseconds.

NOTE

If the internal reference is not already trimmed, the BDIV value should not be changed to divide-by-1 without first trimming the internal reference. Failure to do so could result in the MCU running out of specification.

8.5.1.1 Initializing the MCG

Because the MCG comes out of reset in FEI mode, the only MCG modes which can be directly switched to upon reset are FEE, FBE, and FBI modes (see Figure 8-9). Reaching any of the other modes requires first configuring the MCG for one of these three initial modes. Care must be taken to check relevant status bits in the MCGSC register reflecting all configuration changes within each mode.

To change from FEI mode to FEE or FBE modes, follow this procedure:

1. Enable the external clock source by setting the appropriate bits in MCGC2.
2. If the RANGE bit (bit 5) in MCGC2 is set, set DIV32 in MCGC3 to allow access to the proper RDIV values.
3. Write to MCGC1 to select the clock mode.
   - If entering FEE mode, set RDIV appropriately, clear the IREFS bit to switch to the external reference, and leave the CLKS bits at %00 so that the output of the FLL is selected as the system clock source.
   - If entering FBE, clear the IREFS bit to switch to the external reference and change the CLKS bits to %10 so that the external reference clock is selected as the system clock source. The RDIV bits should also be set appropriately here according to the external reference frequency because although the FLL is bypassed, it is still on in FBE mode.
   - The internal reference can optionally be kept running by setting the IRCLKEN bit. This is useful if the application will switch back and forth between internal and external modes. For minimum power consumption, leave the internal reference disabled while in an external clock mode.
4. Once the proper configuration bits have been set, wait for the affected bits in the MCGSC register to be changed appropriately, reflecting that the MCG has moved into the proper mode.

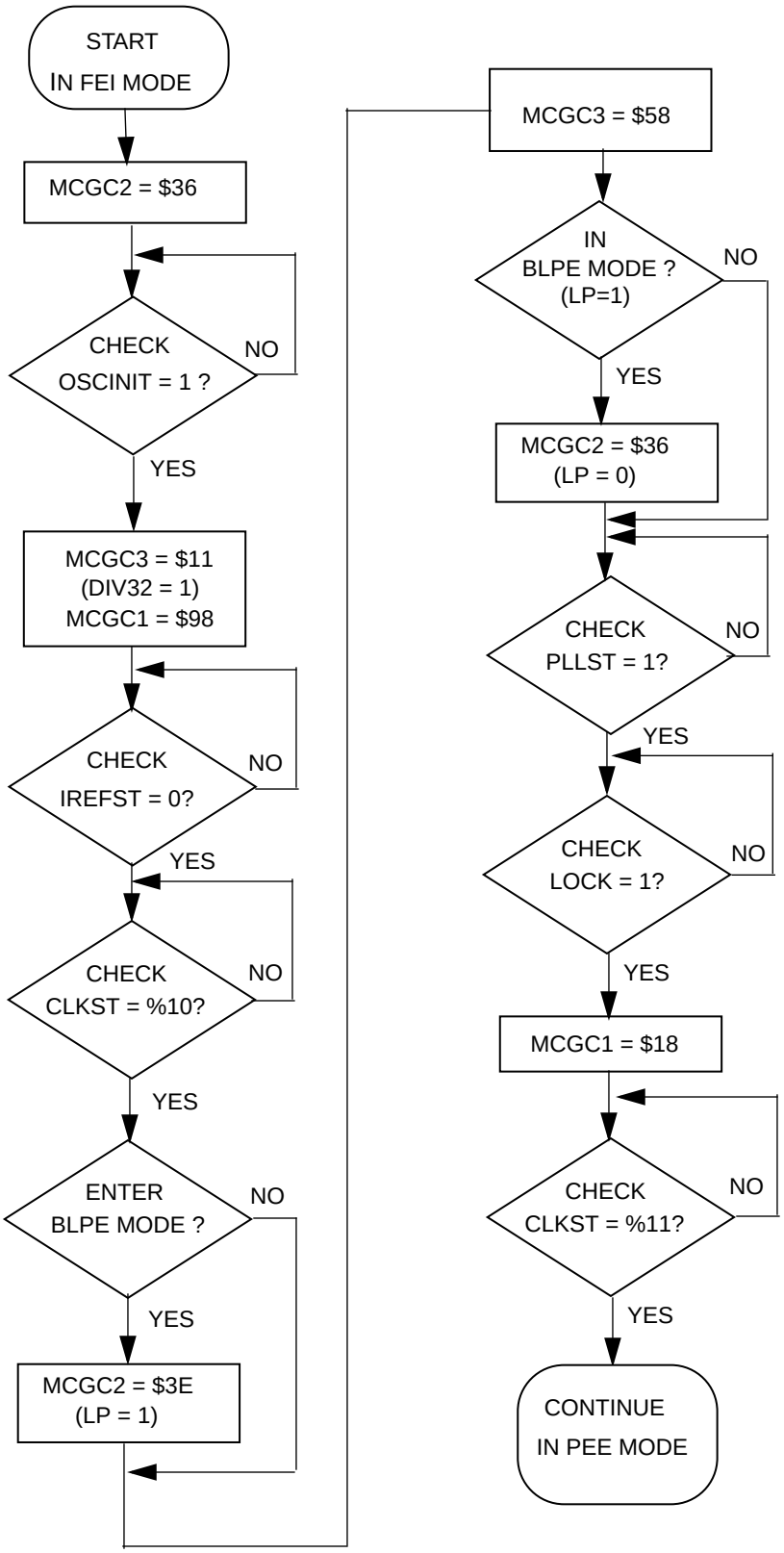


Figure 8-10. Flowchart of FEI to PEE Mode Transition using an 8 MHz crystal

ADHTS, in the SOPT2 register. The RTC or IRQ can be configured to cause a hardware trigger in run, wait, and stop3 modes.

10.1.5 Temperature Sensor

To use the on-chip temperature sensor, the user must perform the following:

- Configure ADC for long sample with a maximum of 1 MHz clock
- Convert the bandgap voltage reference channel (AD27)
  - By converting the digital value of the bandgap voltage reference channel using the value of V_{BG} the user can determine V_{DD}. For value of bandgap voltage, see Section A.6, “DC Characteristics”.
- Convert the temperature sensor channel (AD26)
  - By using the calculated value of V_{DD}, convert the digital value of AD26 into a voltage, V_{TEMP}

Equation 10-1 provides an approximate transfer function of the temperature sensor.

$$Temp = 25 - ((V_{TEMP} - V_{TEMP25}) \div m) \qquad \textit{Eqn. 10-1}$$

where:

- V_{TEMP} is the voltage of the temperature sensor channel at the ambient temperature.
- V_{TEMP25} is the voltage of the temperature sensor channel at 25°C.
- m is the hot or cold voltage versus temperature slope in V/°C.

For temperature calculations, use the V_{TEMP25} and m values from the ADC Electricals table.

In application code, the user reads the temperature sensor channel, calculates V_{TEMP}, and compares to V_{TEMP25}. If V_{TEMP} is greater than V_{TEMP25} the cold slope value is applied in Equation 10-1. If V_{TEMP} is less than V_{TEMP25} the hot slope value is applied in Equation 10-1.

To improve accuracy the user should calibrate the bandgap voltage reference and temperature sensor.

Calibrating at 25°C will improve accuracy to ± 4.5°C.

Calibration at three points, -40°C, 25°C, and 125°C will improve accuracy to ± 2.5°C. Once calibration has been completed, the user will need to calculate the slope for both hot and cold. In application code, the user would then calculate the temperature using Equation 10-1 as detailed above and then determine if the temperature is above or below 25°C. Once determined if the temperature is above or below 25°C, the user can recalculate the temperature using the hot or cold slope value obtained during calibration.

Table 11-3. IICxF Field Descriptions

Field	Description
7–6 MULT	**IIC Multiplier Factor**. The MULT bits define the multiplier factor, mul. This factor, along with the SCL divider, generates the IIC baud rate. The multiplier factor mul as defined by the MULT bits is provided below. 00 mul = 01 01 mul = 02 10 mul = 04 11 Reserved
5–0 ICR	**IIC Clock Rate**. The ICR bits are used to prescale the bus clock for bit rate selection. These bits and the MULT bits determine the IIC baud rate, the SDA hold time, the SCL Start hold time, and the SCL Stop hold time. Table 11-5 provides the SCL divider and hold values for corresponding values of the ICR. The SCL divider multiplied by multiplier factor mul generates IIC baud rate. $$\text{IIC baud rate} = \frac{\text{bus speed (Hz)}}{\text{mul} \times \text{SCLdivider}}$$ ***Eqn. 11-1*** SDA hold time is the delay from the falling edge of SCL (IIC clock) to the changing of SDA (IIC data). $$\text{SDA hold time} = \text{bus period (s)} \times \text{mul} \times \text{SDA hold value}$$ Eqn. 11-2 SCL start hold time is the delay from the falling edge of SDA (IIC data) while SCL is high (Start condition) to the falling edge of SCL (IIC clock). $$\text{SCL Start hold time} = \text{bus period (s)} \times \text{mul} \times \text{SCL Start hold value}$$ Eqn. 11-3 SCL stop hold time is the delay from the rising edge of SCL (IIC clock) to the rising edge of SDA SDA (IIC data) while SCL is high (Stop condition). $$\text{SCL Stop hold time} = \text{bus period (s)} \times \text{mul} \times \text{SCL Stop hold value}$$ Eqn. 11-4

For example, if the bus speed is 8 MHz, the table below shows the possible hold time values with different ICR and MULT selections to achieve an IIC baud rate of 100kbps.

Table 11-4. Hold Time Values for 8 MHz Bus Speed

MULT	ICR	Hold Times (μs)		
		SDA	SCL Start	SCL Stop
0x2	0x00	3.500	3.000	5.500
0x1	0x07	2.500	4.000	5.250
0x1	0x0B	2.250	4.000	5.250
0x0	0x14	2.125	4.250	5.125
0x0	0x18	1.125	4.750	5.125

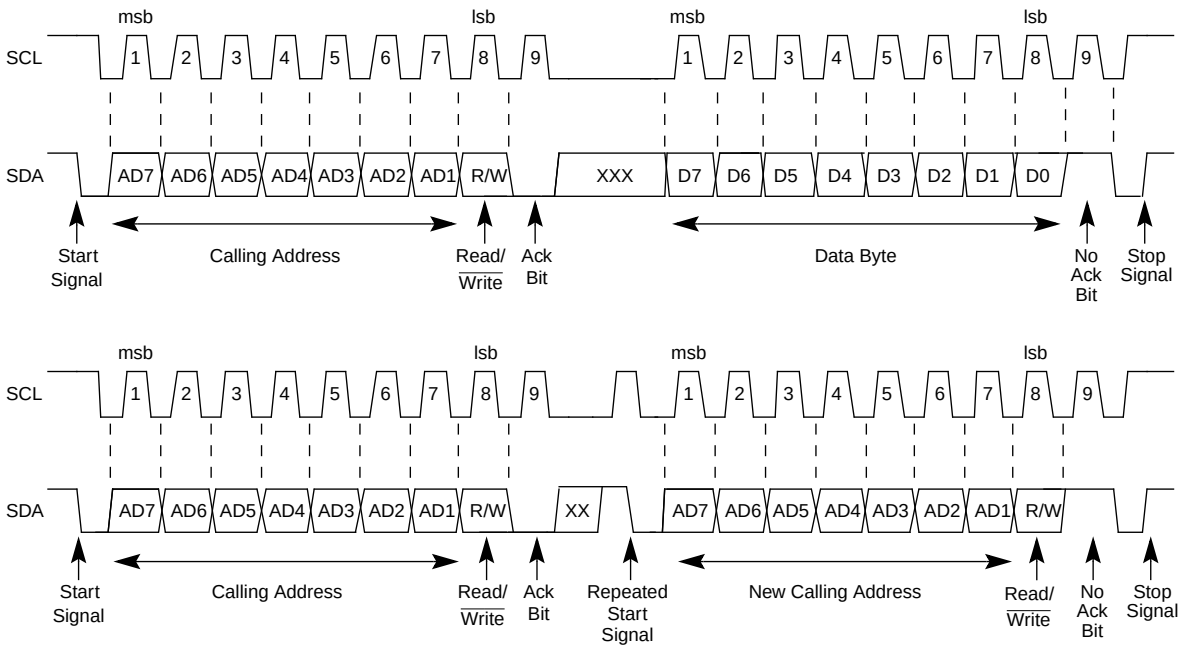


Figure 11-9. IIC Bus Transmission Signals

11.4.1.1 Start Signal

When the bus is free, no master device is engaging the bus (SCL and SDA lines are at logical high), a master may initiate communication by sending a start signal. As shown in Figure 11-9, a start signal is defined as a high-to-low transition of SDA while SCL is high. This signal denotes the beginning of a new data transfer (each data transfer may contain several bytes of data) and brings all slaves out of their idle states.

11.4.1.2 Slave Address Transmission

The first byte of data transferred immediately after the start signal is the slave address transmitted by the master. This is a seven-bit calling address followed by a R/$\overline{W}$ bit. The R/$\overline{W}$ bit tells the slave the desired direction of data transfer.

1 = Read transfer, the slave transmits data to the master.
0 = Write transfer, the master transmits data to the slave.

Only the slave with a calling address that matches the one transmitted by the master responds by sending back an acknowledge bit. This is done by pulling the SDA low at the ninth clock (see Figure 11-9).

No two slaves in the system may have the same address. If the IIC module is the master, it must not transmit an address equal to its own slave address. The IIC cannot be master and slave at the same time. However, if arbitration is lost during an address cycle, the IIC reverts to slave mode and operates correctly even if it is being addressed by another master.

Arbitration is lost in the following circumstances:

- SDA sampled as a low when the master drives a high during an address or data transmit cycle.
- SDA sampled as a low when the master drives a high during the acknowledge bit of a data receive cycle.
- A start cycle is attempted when the bus is busy.
- A repeated start cycle is requested in slave mode.
- A stop condition is detected when the master did not request it.

This bit must be cleared by software writing a 1 to it.

Chapter 12
Freescale's Controller Area Network (S08MSCANV1)

12.1 Introduction

Freescale's controller area network (MSCAN) is a communication controller implementing the CAN 2.0A/B protocol as defined in the Bosch specification dated September 1991. To fully understand the MSCAN specification, it is recommended that the Bosch specification be read first to gain familiarity with the terms and concepts contained within this document.

Though not exclusively intended for automotive applications, CAN protocol is designed to meet the specific requirements of a vehicle serial data bus: real-time processing, reliable operation in the EMI environment of a vehicle, cost-effectiveness, and required bandwidth.

MSCAN uses an advanced buffer arrangement resulting in predictable real-time behavior and simplified application software.

The MSCAN module is available in all devices in the MC9S08DZ128 Series.

Table 12-1. CANCTL0 Register Field Descriptions

Field	Description
7 RXFRM[1]	**Received Frame Flag** — This bit is read and clear only. It is set when a receiver has received a valid message correctly, independently of the filter configuration. After it is set, it remains set until cleared by software or reset. Clearing is done by writing a 1. Writing a 0 is ignored. This bit is not valid in loopback mode. 0 No valid message was received since last clearing this flag 1 A valid message was received since last clearing of this flag
6 RXACT	**Receiver Active Status** — This read-only flag indicates the MSCAN is receiving a message. The flag is controlled by the receiver front end. This bit is not valid in loopback mode. 0 MSCAN is transmitting or idle[2] 1 MSCAN is receiving a message (including when arbitration is lost)[2]
5 CSWAI[3]	**CAN Stops in Wait Mode** — Enabling this bit allows for lower power consumption in wait mode by disabling all the clocks at the CPU bus interface to the MSCAN module. 0 The module is not affected during wait mode 1 The module ceases to be clocked during wait mode
4 SYNCH	**Synchronized Status** — This read-only flag indicates whether the MSCAN is synchronized to the CAN bus and able to participate in the communication process. It is set and cleared by the MSCAN. 0 MSCAN is not synchronized to the CAN bus 1 MSCAN is synchronized to the CAN bus
3 TIME	**Timer Enable** — This bit activates an internal 16-bit wide free running timer which is clocked by the bit clock rate. If the timer is enabled, a 16-bit time stamp will be assigned to each transmitted/received message within the active TX/RX buffer. As soon as a message is acknowledged on the CAN bus, the time stamp will be written to the highest bytes (0x000E, 0x000F) in the appropriate buffer (see Section 12.4, "Programmer's Model of Message Storage"). The internal timer is reset (all bits set to 0) when disabled. This bit is held low in initialization mode. 0 Disable internal MSCAN timer 1 Enable internal MSCAN timer
2 WUPE[4]	**Wake-Up Enable** — This configuration bit allows the MSCAN to restart from sleep mode when traffic on CAN is detected (see Section 12.5.5.4, "MSCAN Sleep Mode"). This bit must be configured before sleep mode entry for the selected function to take effect. 0 Wake-up disabled — The MSCAN ignores traffic on CAN 1 Wake-up enabled — The MSCAN is able to restart

- Four identifier acceptance filters, each to be applied to
  - a) the 14 most significant bits of the extended identifier plus the SRR and IDE bits of CAN 2.0B messages or
  - b) the 11 bits of the standard identifier, the RTR and IDE bits of CAN 2.0A/B messages. Figure 12-40 shows how the first 32-bit filter bank (CANIDAR0–CANIDA3, CANIDMR0–3CANIDMR) produces filter 0 and 1 hits. Similarly, the second filter bank (CANIDAR4–CANIDAR7, CANIDMR4–CANIDMR7) produces filter 2 and 3 hits.
- Eight identifier acceptance filters, each to be applied to the first 8 bits of the identifier. This mode implements eight independent filters for the first 8 bits of a CAN 2.0A/B compliant standard identifier or a CAN 2.0B compliant extended identifier. Figure 12-41 shows how the first 32-bit filter bank (CANIDAR0–CANIDAR3, CANIDMR0–CANIDMR3) produces filter 0 to 3 hits. Similarly, the second filter bank (CANIDAR4–CANIDAR7, CANIDMR4–CANIDMR7) produces filter 4 to 7 hits.
- Closed filter. No CAN message is copied into the foreground buffer RxFG, and the RXF flag is never set.

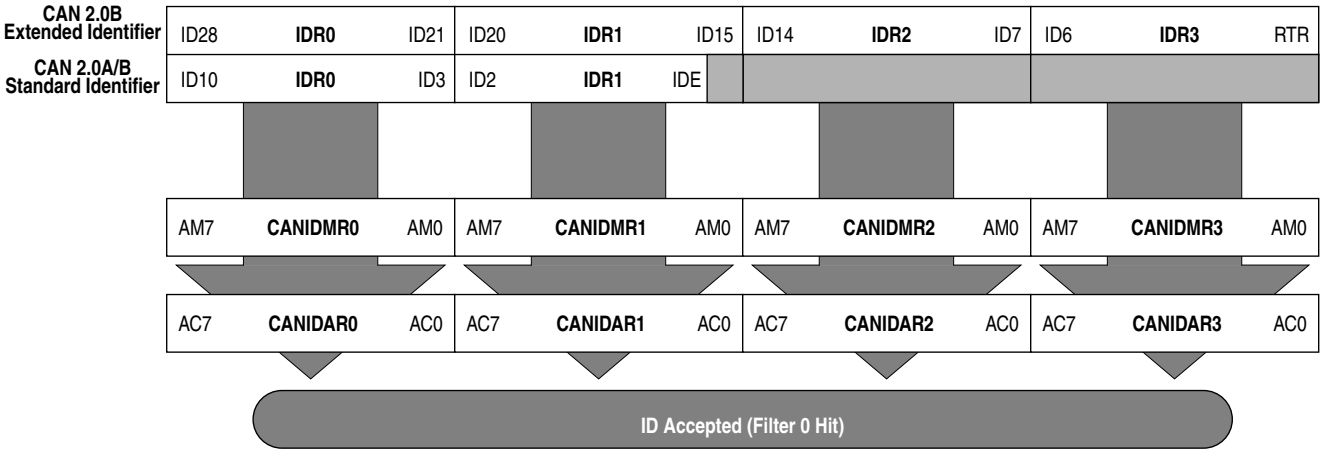


Figure 12-39. 32-bit Maskable Identifier Acceptance Filter

12.5.4.3 Emulation Modes

In all emulation modes, the MSCAN module behaves just like normal system operation modes as described within this specification.

12.5.4.4 Listen-Only Mode

In an optional CAN bus monitoring mode (listen-only), the CAN node is able to receive valid data frames and valid remote frames, but it sends only "recessive" bits on the CAN bus. In addition, it cannot start a transmision. If the MAC sub-layer is required to send a "dominant" bit (ACK bit, overload flag, or active error flag), the bit is rerouted internally so that the MAC sub-layer monitors this "dominant" bit, although the CAN bus may remain in recessive state externally.

12.5.4.5 Security Modes

The MSCAN module has no security features.

12.5.4.6 Loopback Self Test Mode

Loopback self test mode is sometimes used to check software, independent of connections in the external system, to help isolate system problems. In this mode, the transmitter output is internally connected to the receiver input. The RXCAN input pin is ignored and the TXCAN output goes to the recessive state (logic 1). The MSCAN behaves as it does normally when transmitting and treats its own transmitted message as a message received from a remote node. In this state, the MSCAN ignores the bit sent during the ACK slot in the CAN frame acknowledge field to ensure proper reception of its own message. Both transmit and receive interrupts are generated.

12.5.5 Low-Power Options

If the MSCAN is disabled (CANE = 0), the MSCAN clocks are stopped for power saving.

If the MSCAN is enabled (CANE = 1), the MSCAN has two additional modes with reduced power consumption, compared to normal mode: sleep and power down mode. In sleep mode, power consumption is reduced by stopping all clocks except those to access the registers from the CPU side. In power down mode, all clocks are stopped and no power is consumed.

Table 12-36 summarizes the combinations of MSCAN and CPU modes. A particular combination of modes is entered by the given settings on the CSWAI and SLPRQ/SLPAK bits.

For all modes, an MSCAN wake-up interrupt can occur only if the MSCAN is in sleep mode (SLPRQ = 1 and SLPAK = 1), wake-up functionality is enabled (WUPE = 1), and the wake-up interrupt is enabled (WUPIE = 1).

12.5.5.4 MSCAN Sleep Mode

The CPU can request the MSCAN to enter this low power mode by asserting the SLPRQ bit in the CANCTL0 register. The time when the MSCAN enters sleep mode depends on a fixed synchronization delay and its current activity:

- If there are one or more message buffers scheduled for transmission (TXEx = 0), the MSCAN will continue to transmit until all transmit message buffers are empty (TXEx = 1, transmitted successfully or aborted) and then goes into sleep mode.
- If the MSCAN is receiving, it continues to receive and goes into sleep mode as soon as the CAN bus next becomes idle.
- If the MSCAN is neither transmitting nor receiving, it immediately goes into sleep mode.

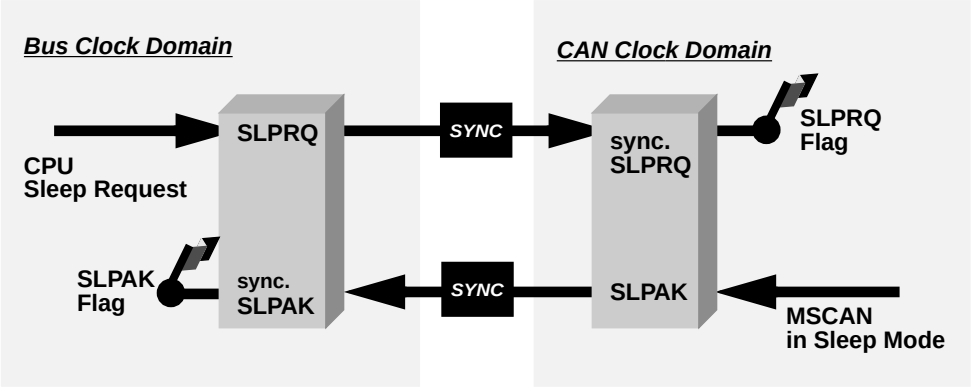


Figure 12-44. Sleep Request / Acknowledge Cycle

NOTE

The application software must avoid setting up a transmission (by clearing one or more TXEx flag(s)) and immediately request sleep mode (by setting SLPRQ). Whether the MSCAN starts transmitting or goes into sleep mode directly depends on the exact sequence of operations.

If sleep mode is active, the SLPRQ and SLPAK bits are set (Figure 12-44). The application software must use SLPAK as a handshake indication for the request (SLPRQ) to go into sleep mode.

When in sleep mode (SLPRQ = 1 and SLPAK = 1), the MSCAN stops its internal clocks. However, clocks that allow register accesses from the CPU side continue to run.

If the MSCAN is in bus-off state, it stops counting the 128 occurrences of 11 consecutive recessive bits due to the stopped clocks. The TXCAN pin remains in a recessive state. If RXF = 1, the message can be read and RXF can be cleared. Shifting a new message into the foreground buffer of the receiver FIFO (RxFG) does not take place while in sleep mode.

It is possible to access the transmit buffers and to clear the associated TXE flags. No message abort takes place while in sleep mode.

Table 13-1. SPIxC1 Field Descriptions (continued)

Field	Description
4 MSTR	**Master/Slave Mode Select** 0 SPI module configured as a slave SPI device 1 SPI module configured as a master SPI device
3 CPOL	**Clock Polarity** — This bit effectively places an inverter in series with the clock signal from a master SPI or to a slave SPI device. Refer to Section 13.5.1, “SPI Clock Formats” for more details. 0 Active-high SPI clock (idles low) 1 Active-low SPI clock (idles high)
2 CPHA	**Clock Phase** — This bit selects one of two clock formats for different kinds of synchronous serial peripheral devices. Refer to Section 13.5.1, “SPI Clock Formats” for more details. 0 First edge on SPSCK occurs at the middle of the first cycle of an 8-cycle data transfer 1 First edge on SPSCK occurs at the start of the first cycle of an 8-cycle data transfer
1 SSOE	**Slave Select Output Enable** — This bit is used in combination with the mode fault enable (MODFEN) bit in SPCR2 and the master/slave (MSTR) control bit to determine the function of the $\overline{SS}$ pin as shown in Table 13-2.
0 LSBFE	**LSB First (Shifter Direction)** 0 SPI serial data transfers start with most significant bit 1 SPI serial data transfers start with least significant bit

Table 13-2. $\overline{SS}$ Pin Function

MODFEN	SSOE	Master Mode	Slave Mode
0	0	General-purpose I/O (not SPI)	Slave select input
0	1	General-purpose I/O (not SPI)	Slave select input
1	0	$\overline{SS}$ input for mode fault	Slave select input
1	1	Automatic $\overline{SS}$ output	Slave select input

NOTE

Ensure that the SPI should not be disabled (SPE=0) at the same time as a bit change to the CPHA bit. These changes should be performed as separate operations or unexpected behavior may occur.

13.4.2 SPI Control Register 2 (SPIxC2)

This read/write register is used to control optional features of the SPI system. Bits 7, 6, 5, and 2 are not implemented and always read 0.

	7	6	5	4	3	2	1	0
R	0	0	0	MODFEN	BIDIROE	0	SPISWAI	SPC0
W								
Reset	0	0	0	0	0	0	0	0

= Unimplemented or Reserved

Figure 13-6. SPI Control Register 2 (SPIxC2)

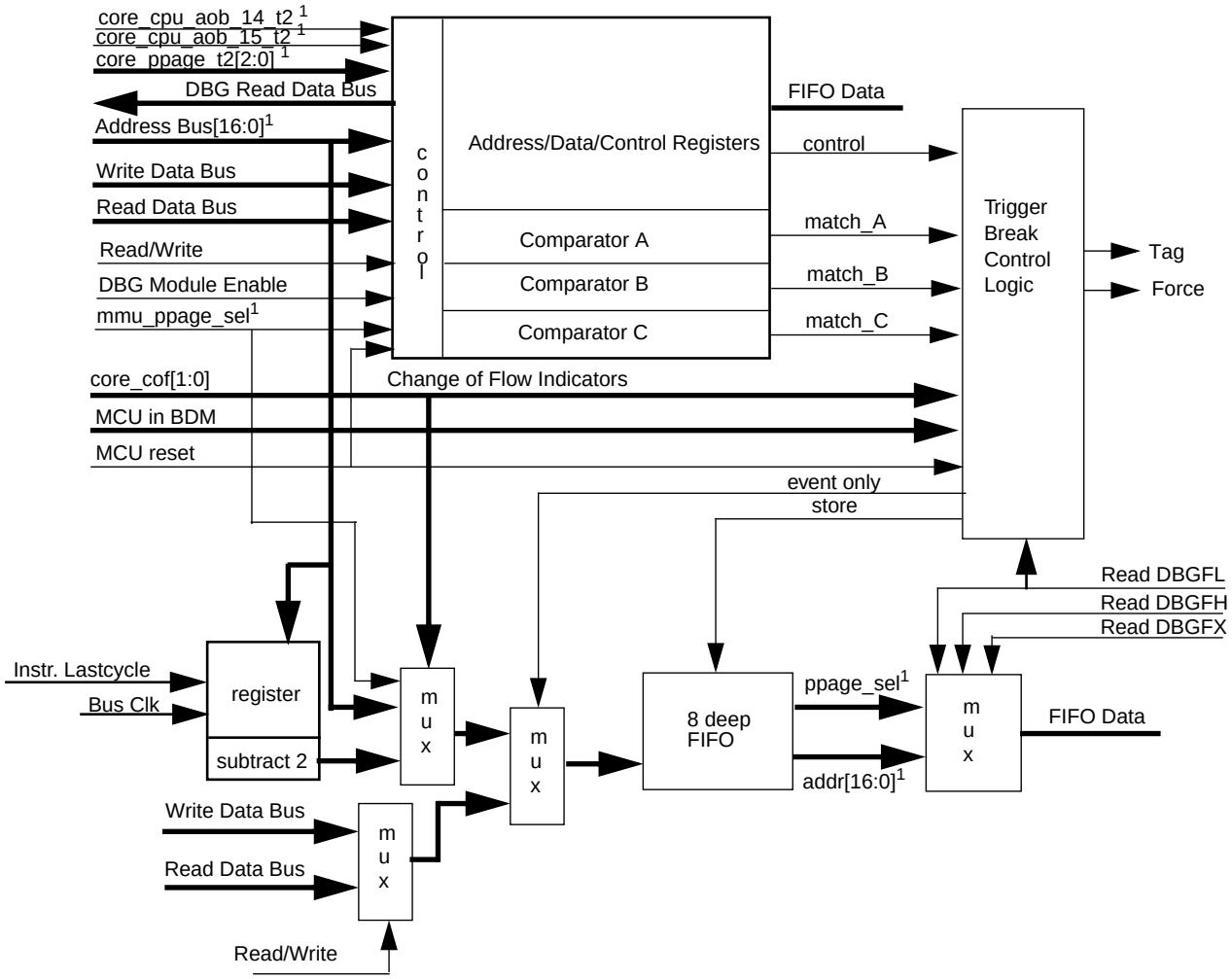
- Ability to End-trace until reset and Begin-trace from reset

18.1.2 Modes of Operation

The on-chip ICE system can be enabled in all MCU functional modes. The DBG module is disabled if the MCU is secure. The DBG module comparators are disabled when executing a Background Debug Mode (BDM) command.

18.1.3 Block Diagram

Figure 18-1 shows the structure of the DBG module.



1. In 64K versions of this module there are only 16 address lines [15:0], there are no core_cpu_aob_14_t2, core_cpu_aob_15_t2, core_ppage_t2[2:0], and ppage_sel signals.

Figure 18-1. DBG Block Diagram

18.2 Signal Description

The DBG module contains no external signals.

18.3.3.11 Debug Comparator C Extension Register (DBGCCX)

Module Base + 0x000A

	7	6	5	4	3	2	1	0
R	RWCEN	RWC	PAGSEL	0	0	0	0	Bit 16
W								
POR or non-end-run	0	0	0	0	0	0	0	0
Reset end-run[1]	U	U	U	0	0	0	0	U

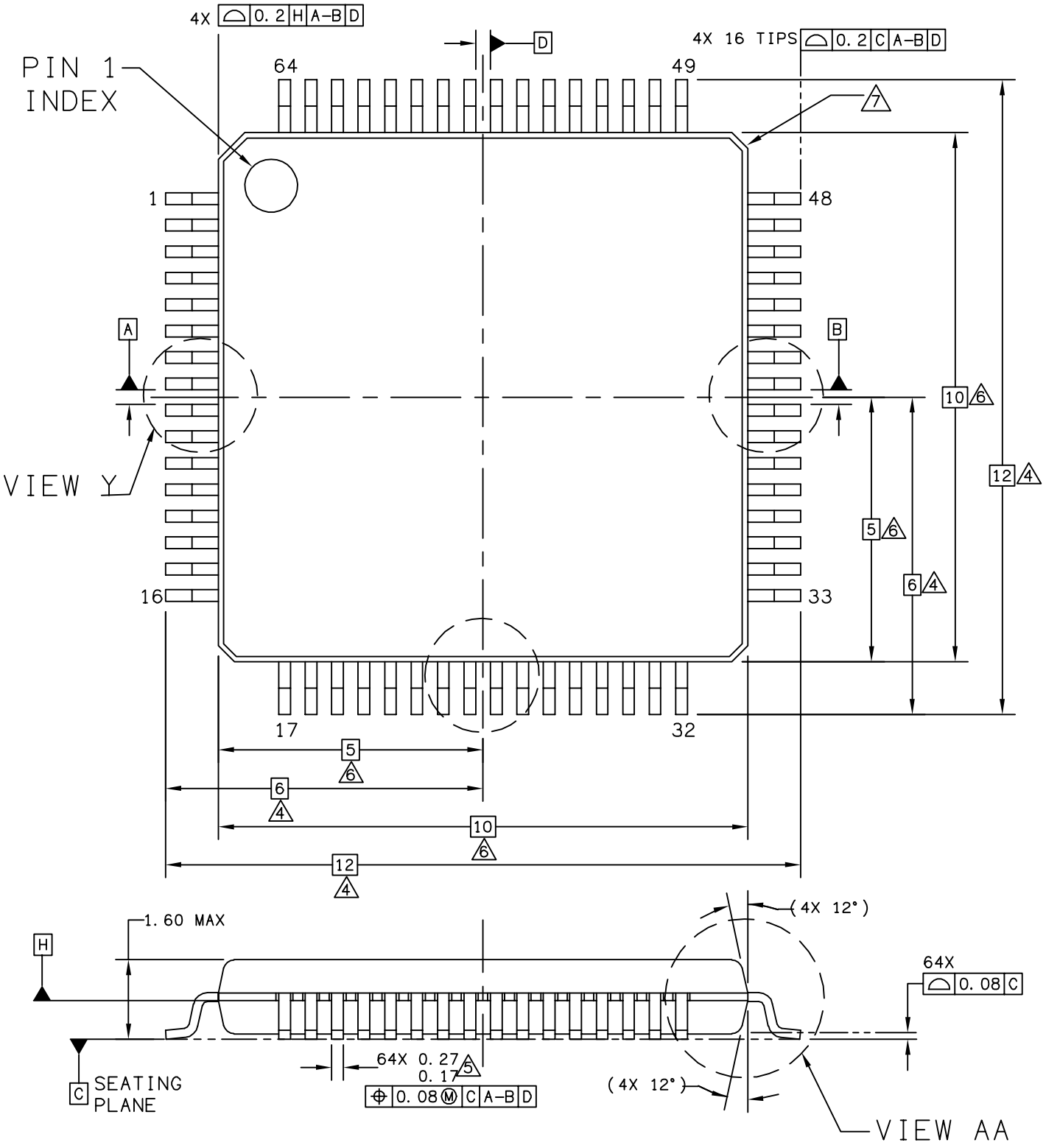
= Unimplemented or Reserved

Figure 18-12. Debug Comparator C Extension Register (DBGCCX)

1 In the case of an end-trace to reset where DBGEN=1 and BEGIN=0, the bits in this register do not change after reset.

Table 18-13. DBGCCX Field Descriptions

Field	Description
7 RWCEN	**Read/Write Comparator C Enable Bit** — The RWCEN bit controls whether read or write comparison is enabled for Comparator C. 0 Read/Write is not used in comparison 1 Read/Write is used in comparison
6 RWC	**Read/Write Comparator C Value Bit** — The RWC bit controls whether read or write is used in compare for Comparator C. The RWC bit is not used if RWCEN = 0. 0 Write cycle will be matched 1 Read cycle will be matched
5 PAGSEL	**Comparator C Page Select Bit** — This PAGSEL bit controls whether Comparator C will be qualified with the internal signal (mmu_papge_sel) that indicates an extended access through the PPAGE mechanism. When mmu_ppage_sel = 1, the 17-bit core address is a paged program access, and the 17-bit core address is made up of PPAGE[2:0]:addr[13:0]. When mmu_papge_sel = 0, the 17-bit core address is either a 16-bit CPU address with a leading 0 in bit 16, or a 17-bit linear address pointer value. 0 Match qualified by mmu_ppage_sel = 0 so address bits [16:0] correspond to a 17-bit CPU address with a leading zero at bit 16, or a 17-bit linear address pointer address 1 Match qualified by mmu_ppage_sel = 1 so address bits [16:0] compare to flash memory address made up of PPAGE[2:0]:addr[13:0]
0 Bit 16	**Comparator C Extended Address Bit 16 Compare Bit** — The Comparator C bit 16 compare bit controls whether Comparator C will compare the core address bus bit 16 to a logic 1 or logic 0. 0 Compare corresponding address bit to a logic 0 1 Compare corresponding address bit to a logic 1



MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE

TITLE: 64LD LQFP, 10 X 10 X 1.4 PKG, 0.5 PITCH, CASE OUTLINE	DOCUMENT NO: 98ASS23234W	REV: E
	CASE NUMBER: 840F-02	11 AUG 2006
	STANDARD: JEDEC MS-026 BCD	