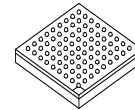


MCF5251



Package Information
MAPBGA-225

MCF5251 ColdFire® Microprocessor Data Sheet

Ordering Information: See [Table 1 on page 2](#)

1 Introduction

This document provides an overview of the MCF5251 ColdFire processor and general descriptions of the MCF5251 features and modules. Also provided are electrical specifications, pin assignments, and package diagrams for MCF5251 ColdFire® processor. For functional characteristics, refer to the *MCF5251 Reference Manual* (MCF5251RM).

The MCF5251 is a system controller/decoder for compressed audio music players addressing both portable and automotive solutions supporting CD, HDD and USB based systems. The 32-bit ColdFire core with enhanced multiply and accumulate (eMAC) unit provides optimum performance and code density for the combination of control code and signal processing required for compressed audio decode, file management, and system control.

The MCF5251 is a general purpose system controller with over 125 Dhrystone 2.1 MIPS @ 140 MHz performance. The integrated peripherals and EMAC allow the MCF5251 to replace both the microcontroller

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Introduction

and the DSP in certain applications. Most peripheral pins can also be remapped as general purpose I/O pins.

Low power features include flexible PLL (with power-down mode) with dynamic clock switching, a hardwired CD ROM decoder, advanced 0.13 μm CMOS process technology, 1.2 V core power supply, and on-chip 128K-byte SRAM.

MP3 decode requires less than 20 MHz CPU bandwidth and runs from on-chip SRAM.

For additional information regarding software drivers and applications, refer to <http://www.freescale.com/coldfire>.

1.1 Orderable Part Numbers

Table 1 lists the orderable part numbers for the MCF5251 processor.

Table 1. Orderable Part Numbers

| Orderable Part Number | Maximum Clock Frequency | Package Type | Operating Temperature Range | MP3 Royalty | Part Status |
|-----------------------|-------------------------|--------------|-----------------------------|-------------|-------------|
| MCF5251VM140 | 140 MHz | 225 MAPBGA | -20 to +70°C | N/A | Lead free |
| MCF5251CVM140 | | | -40 to +85°C | N/A | |

1.2 Block Diagram

Figure 1 illustrates the functional block diagram of the MCF5251 processor.

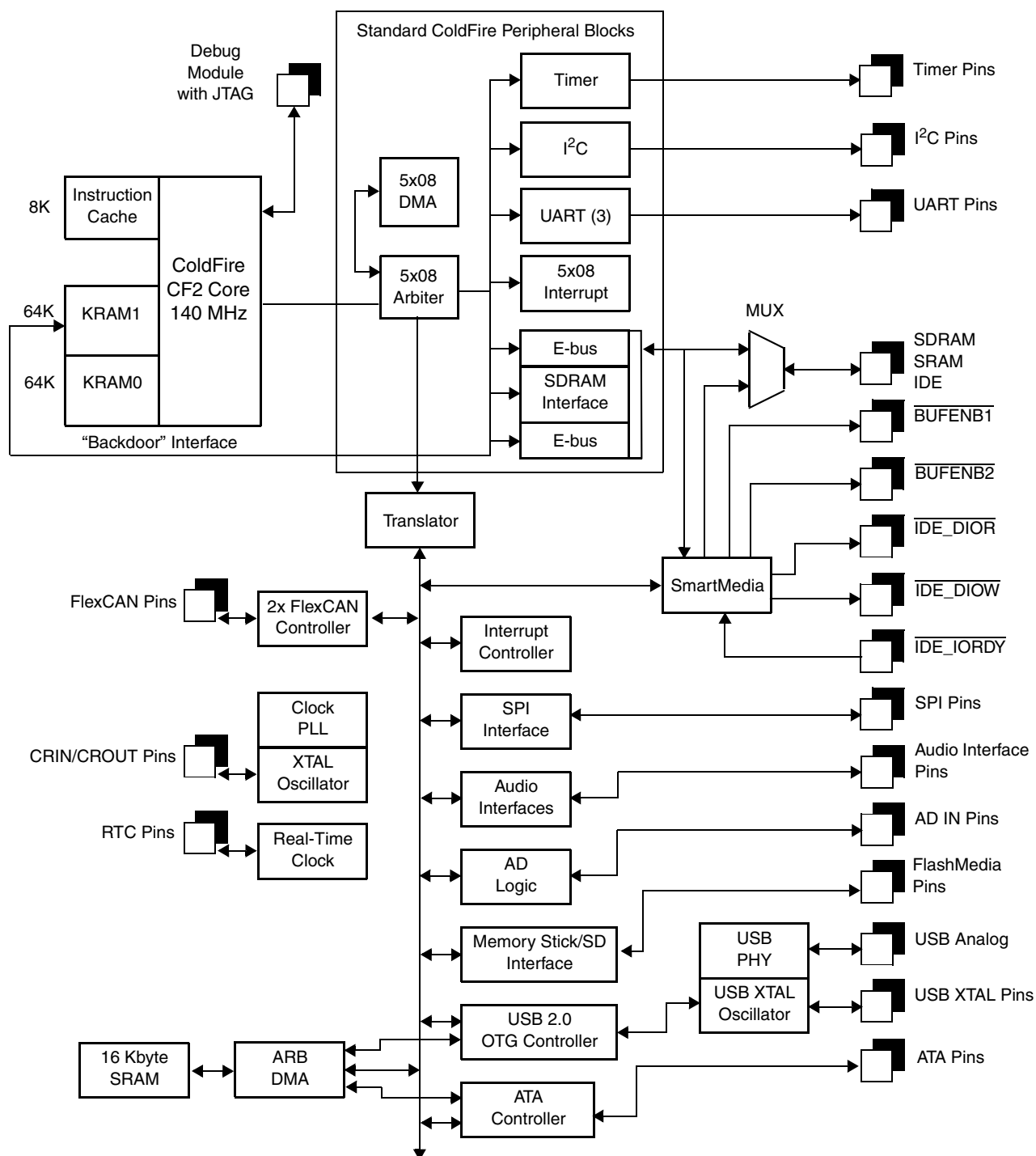


Figure 1. MCF5251 Block Diagram

2 Functional Description

2.1 Version 2 ColdFire Core

The Version 2 ColdFire (CF2) core consists of two independent, decoupled pipeline structures to maximize performance while minimizing core size. The instruction fetch pipeline (IFP) is a two-stage pipeline for prefetching instructions. The prefetched instruction stream is then gated into the two-stage operand execution pipeline (OEP), which decodes the instruction, fetches the required operands, and then executes the required function.

2.2 Module Inventory

Table 2 shows an alphabetical listing of the modules in the processor.

Table 2. Digital and Analog Modules

| Block Mnemonic | Block Name | Functional Grouping | Brief Description |
|----------------|--|-----------------------------|---|
| ATA | Advanced Technology Attachment Controller | Connectivity Peripheral | The ATA block is an AT attachment host interface. Its main use is to interface with IDE hard disc drives and ATAPI optical disc drives. |
| ADC | Battery Level/Keypad Analog/Digital Converter | Analog Input | The six-channel ADC is based on the Sigma-Delta concept with 12-bit resolution. Both the analog comparator and digital sections are integrated in the MCF5251. |
| AB | Audio Bus | Audio Interface | The audio interfaces connect to an internal bus that carries all audio data. Each receiver places its received data on the audio bus and each transmitter takes data from the audio bus for transmission. |
| AIM | Audio Interface | Audio Interface | The audio interface module provides the necessary input and output features to receive and transmit digital audio signals over serial audio interfaces (IIS/EIAJ) and over digital audio interfaces (IEC958). |
| BROM | Bootloader | Boot ROM | The MCF5251 incorporates a ROM Bootloader, which enables booting from UART, I2C, SPI, or IDE devices. |
| FlexCAN | Twin Controller Area Network 2.0B Communication Unit | Connectivity Peripheral | The FlexCan module is a full implementation of the Bosch CAN protocol specification 2.0B, which supports both standard and extended message frames. |
| CSM | Chip Select Module | Connectivity Peripheral | Three programmable chip-select outputs ($\overline{CS0/CS4}$, $\overline{CS1}$, and $\overline{CS2}$) provide signals that enable glueless connection to external memory and peripheral circuits. |
| DMAC | Direct Memory Access Controller Module | Connectivity Peripheral | There are four fully programmable DMA channels for quick data transfer. |
| eMAC | enhanced Multiply Accumulate Module | Core | The integrated eMAC unit provides a common set of DSP operations and enhances the integer multiply instructions in the ColdFire architecture. |
| MBUS | Memory Bus Interface | Bus Operation | The bus interface controller transfers data between the ColdFire core or DMA and memory, peripherals, or other devices on the external bus. |
| MMC/SD | Multimedia Card/Secure Digital Interface | Flash Memory Card Interface | The interface is Sony® Memory Stick®, SecureDigital, and Multi-Media card compatible. Note: The Sony Memory Interface does not support Sony MagicGate™. |

Table 2. Digital and Analog Modules (continued)

| Block Mnemonic | Block Name | Functional Grouping | Brief Description |
|------------------|---------------------------------------|-------------------------|--|
| GPIO | General Purpose I/O Interface | System integration | GPIO signals are multiplexed with various other signals. |
| GPT | General Timer Module | Timer peripheral | The timer module includes two general-purpose timers, each of which contains a free-running 16-bit timer. |
| IDE | Integrated Drive Electronics | Connectivity peripheral | The IDE hardware consists of bus buffers for address and data and are intended to reduce the load on the bus and prevent SDRAM and Flash accesses from propagating to the IDE bus. |
| INC | Instruction Cache | Core | The instruction cache improves system performance by providing cached instructions to the execution unit in a single clock cycle. |
| I ² C | Inter IC Communication Module | Connectivity peripheral | The two-wire I ² C bus interfaces, compliant with the Philips I ² C bus standard, are bidirectional serial buses that exchange data between devices. |
| SRAM | Internal 128-KB SRAM | Internal memory | The 128-Kbyte on-chip SRAM is split over two banks, SRAM0 (64K) and SRAM1 (64K). It provides single clock-cycle access for the ColdFire core. |
| LIN | Internal Voltage Regulator | Linear regulator | An internal 1.2 V regulator is used to supply the CPU and PLL sections of the MCF5251, reducing the number of external components required and allowing operation from a single supply rail, typically 3.3 volts. |
| JTAG | Joint Test Action Group | Test and debug | To help with system diagnostics and manufacturing testing, the MCF5251 includes dedicated user-accessible test logic that complies with the IEEE 1149.1A standard for boundary scan testability, often referred to as Joint Test Action Group, or JTAG. |
| QSPI | Queued Serial Peripheral Interface | Connectivity Interface | The QSPI module provides a serial peripheral interface with queued transfer capability. |
| RTC | Real-Time Clock | Timer Peripheral | The RTC is a clock that keeps track of the current time even if the clock is turned off. |
| BDM | Background Debug Interface | Test and debug | A background-debug mode (BDM) interface provides system debug. |
| SDRAMC | Synchronous DRAM Memory Controller | Peripheral Interface | The SDRAM controller provides a glueless interface for one bank of SDRAM, and can address up to 32MB. The controller supports a 16-bit data bus. The controller operates in page mode, non-page mode, and burst-page mode and supports SDRAMs. |
| SIM | System Integration Module | System Integration | The SIM provides overall control of the internal and external buses and serves as the interface between the ColdFire core and the internal peripherals or external devices. The SIM is responsible for the two interrupt controllers (setting priorities and levels). And it also configures the GPIO ports. |
| PLL | System Oscillator and Phase Lock Loop | System Clocking | The oscillator operates from an external crystal connected across CRIN and CROUT. The circuit can also operate from an external clock connected to CRIN. The on-chip programmable PLL, which generates the processor clock, allows the use of almost any low frequency external clock (5–35 MHz). |

Table 2. Digital and Analog Modules (continued)

| Block Mnemonic | Block Name | Functional Grouping | Brief Description |
|----------------|---|-------------------------|--|
| UART | Universal Asynchronous Receiver /Transmitter Module | Connectivity Peripheral | Three UARTs handle asynchronous serial communication. |
| USBOTG | USB 2.0 High-Speed On-The-Go | Connectivity Peripheral | The USB module is used for communication to a PC or communication to slave devices; for example, to download data from a hard disc player to a flash player, and to other devices. |

3 Signal Description

This chapter describes the MCF5251 input and output signals. The signal descriptions as shown in [Table 3](#) are grouped according to relevant functionality. For additional signal information, see “Chapter 2, Signal Description” in the MCF5251 reference manual.

Table 3. MCF5251 Signal Index

| Signal Name | Mnemonic | Function | Input/Output | Reset State |
|-----------------------------------|------------------------------|---|--------------|-------------|
| Address | A[24:1] A[23]/GPO54 | 24 address lines—address 23 is multiplexed with GPO54 and address 24 is multiplexed with A20 (SDRAM access only). | Out | X |
| Read-write control | RW | Bus write enable—indicates if read or write cycle in progress. | Out | H |
| Output enable | \overline{OE} | Output enable for asynchronous memories connected to chip selects | Out | negated |
| Data | D[31:16] | Data bus used to transfer word data | In/Out | Hi-Z |
| Synchronous row address strobe | \overline{SDRAS} /GPIO59 | Row address strobe for external SDRAM | Out | negated |
| Synchronous column address strobe | \overline{SDCAS} /GPIO39 | Column address strobe for external SDRAM | Out | negated |
| SDRAM write enable | \overline{SDWE} /GPIO38 | Write enable for external SDRAM | Out | negated |
| SDRAM upper byte enable | \overline{SDUDQM} /GPO53 | Upper byte enable—indicates during write cycle if high byte is written. | Out | – |
| SDRAM lower byte enable | \overline{SDLDQM} /GPO52 | Lower byte enable—indicates during write cycle if low byte is written. | Out | – |
| SDRAM chip selects | $\overline{SD_CS0}$ /GPIO60 | SDRAM chip select | In/Out | negated |
| SDRAM clock enable | BCLKE/GPIO63 | SDRAM clock enable | Out | – |
| System clock | BCLK/GPIO40 | SDRAM clock output | In/Out | – |

Table 3. MCF5251 Signal Index (continued)

| Signal Name | Mnemonic | Function | Input/Output | Reset State |
|----------------------|---|--|---------------|-------------|
| ISA bus read strobe | $\overline{\text{IDE_DIOR}}/\text{GPIO31}$ (CS2) | 1 ISA bus read strobe and 1 ISA bus write strobe—allow connection of an independent ISA bus peripheral, such as an IDE slave device. | In/Out | – |
| ISA bus write strobe | $\overline{\text{IDE_DIO\overline{W}}}/\text{GPIO32}$ (CS2) | | In/Out | – |
| ISA bus wait signal | $\overline{\text{IDE_JORDY}}/\text{GPIO33}$ | ISA bus wait line available for both busses | In/Out | – |
| Chip Selects[2:0] | $\overline{\text{CS0}}/\text{CS4}$ $\overline{\text{CS1}}/\text{QSPICS3}/\text{GPIO28}$ | Chip selects bits 2 through 0—enable peripherals at programmed addresses. CS0 provides boot ROM selection. | Out In/Out | negated |
| Buffer enable 1 | $\overline{\text{BUFENB1}}/\text{GPIO29}$ | Two programmable buffer enables—allow seamless steering of external buffers to split data and address bus in sections. | In/Out | – |
| Buffer enable 2 | $\overline{\text{BUFENB2}}/\text{GPIO30}$ | | In/Out | – |
| Transfer acknowledge | $\overline{\text{TA}}/\text{GPIO12}$ | Transfer Acknowledge signal. | In/Out | – |
| Wake Up | $\overline{\text{WAKEUP}}/\text{GPIO21}$ | Wake-up signal input | In | – |
| Serial Clock Line | SCL0/SDATA1_BS1/GPIO41 SCL1/TXD1/GPIO10 | Clock signal for Dual I ² C module operation | In/Out | – |
| Serial Data Line | SDA0/SDATA3/GPIO42 SDA1/RXD1/GPIO44 | Serial data port for second I ² C module operation | In/Out | – |
| Receive Data | SDA1/RXD1/GPIO44 RXD0/GPIO46 EF/RXD2/GPIO6 | Receive serial data input for UART | In | – |
| Transmit Data | SCL1/TXD1/GPIO10 TXD0/GPIO45 XTRIM/TXD2/GPIO0 | Transmit serial data output for UART | Out | – |
| Request-To-Send | DDATA3/ $\overline{\text{RTS0}}$ /GPIO4 DDATA1/ $\overline{\text{RTS1}}/\text{SDATA2_BS2}/\text{GPIO2}$ | Signals sent from UART0/1 that it is ready to receive data | Out | – |
| Clear-To-Send | DDATA2/ $\overline{\text{CTS0}}$ /GPIO3 DDATA0/ $\overline{\text{CTS1}}/\text{SDATA0_SDIO1}/\text{GPIO1}$ | Signals sent to UART0/1 that data can be transmitted to peripheral | In | – |
| Timer Output | SDATA01/TOUT0/GPIO18 | Capability of output waveform or pulse generation | Out | – |
| IEC958 inputs | EBUIN1/GPIO36 EBUIN2/SCLKOUT/GPIO13 EBUIN3/CMD_SDIO2/GPIO14 QSPICS0/EBUIN4/GPIO15 | Audio interfaces to IEC958 inputs | In | – |
| IEC958 outputs | EBUOUT1/GPIO37 QSPICS1/EBUOUT2/GPIO16 | Audio interfaces to IEC958 outputs | Out | – |
| Serial data in | SDATA11/GPIO17 SDATAI3/GPIO8 | Audio interfaces to serial data inputs | In | – |

Table 3. MCF5251 Signal Index (continued)

| Signal Name | Mnemonic | Function | Input/ Output | Reset State |
|---|---|---|------------------|----------------|
| Serial data out | SDATA01/TOUT0/GPIO18 SDATA02/GPIO34 | Audio interfaces to serial data outputs | In/Out Out | – |
| Word clock | LRCK1/GPIO19 LRCK2/GPIO23 LRCK3/AUDIOCLOCK/GPIO43 | Audio interfaces to serial word clocks | In/Out | – |
| Bit clock | SCLK1/GPIO20 SCLK2/GPIO22 SCLK3/GPIO35 | Audio interfaces to serial bit clocks | In/Out | – |
| Serial input | EF/RXD2/GPIO6 | Error flag serial in | In/Out | – |
| Serial input | CFLG/GPIO5 | C-flag serial in | In/Out | – |
| Subcode clock | RCK/QSPIDIN/QSPIDOUT/ GPIO26 | Audio interfaces to subcode clock | In/Out | – |
| Subcode sync | QSPIDOUT/SFSY/GPIO27 | Audio interfaces to subcode sync | In/Out | – |
| Subcode data | QSPICLK/SUBR/GPIO25 | Audio interfaces to subcode data | In/Out | – |
| Clock frequency trim | XTRIM/TXD2/GPIO0 | Clock trim control | Out | – |
| Audio clocks out | MCLK1/GPIO11 QSPICS2/MCLK2/GPIO24 | DAC output clocks | Out | – |
| Audio clock in | LRCK3/AUDIOCLOCK/GPIO43 | Optional audio clock input | | – |
| MemoryStick/ SecureDigital interface | EBUIN3/CMD_SDIO2/GPIO14 | Secure Digital command lane— MemoryStick interface 2 data I/O | In/Out | – |
| | EBUIN2/SCLKOUT/GPIO13 | Clock out for both MemoryStick interfaces and for Secure Digital | In/Out | – |
| | DDATA0/ $\overline{\text{CTS}}1$ /SDATA0_SDIO1/GPIO1 | SecureDigital serial data bit 0— MemoryStick interface 1 data I/O | In/Out | – |
| | SCL0/SDATA1_BS1/GPIO41 | SecureDigital serial data bit 1— MemoryStick interface 1 strobe | In/Out | – |
| | DDATA1/ $\overline{\text{RTS}}1$ /SDATA2_BS2/GPIO2 | SecureDigital serial data bit 2— MemoryStick interface 2 strobe Reset output signal | In/Out | – |
| | SDA0/SDATA3/GPIO42 | SecureDigital serial data bit 3 | In/Out | – |

Table 3. MCF5251 Signal Index (continued)

| Signal Name | Mnemonic | Function | Input/ Output | Reset State |
|--|--|---|------------------|----------------|
| AT attachment interface (IDE interface) | ATA_DIOW | ATA write strobe signal | Out | – |
| | ATA_DIOR | ATA read strobe signal | Out | – |
| | ATA_IORDY | ATA I/O ready input | In | – |
| | ATA_DMARQ | ATA DMA request | In | – |
| | ATA_DMACK | ATA DMA acknowledge | Out | – |
| | ATA_INTRQ | ATA interrupt request | In | – |
| | ATA_CS0 | ATA chip select 0 | Out | – |
| | ATA_CS1 | ATA chip select 1 | Out | – |
| | ATA_A[2:0] | 3-bit ATA address bus | Out | – |
| | ATA_D[15:0] | 16-bit ATA data bus | In/Out | – |
| CAN interface | CAN0_TX | CAN 0 transmit | Out | – |
| | CAN0_RX | CAN 0 receive | In | – |
| | CAN1_TX | CAN 1 transmit | Out | – |
| | CAN1_RX | CAN 1 receive | In | – |
| USB PHY interface | USBVBUS | USB Vbus input | In | – |
| | USBID | USB ID input | In | – |
| | USBRES | USB current programming resistor pin | Analog | – |
| | USBDN | USB DM signalling line | In/Out | – |
| | USBDP | USB DP signalling line | In/Out | – |
| USB oscillator | USB_CRIN USB_CROUT | Connections for USB oscillator crystal (24 MHz) | In Out | – |
| RTC oscillator | RTC_CRIN RTCCROUT | Connections for real-time clock crystal (32.768 kHz) | In Out | – |
| AD IN | ADIN0/GPI52 ADIN1/GPI53 ADIN2/GPI54 ADIN3/GPI55 ADIN4/GPI56 ADIN5/GPI57 | Analog-to-Digital Converter input signals | In | – |
| AD OUT | ADREF ADOUT/SCLK4/GPIO58 | Analog-to-Digital Converter output signal—connects to ADREF via integrator network. | In/Out | – |
| QSPI clock | QSPICLK/SUBR/GPIO25 | QSPI clock signal | In/Out | – |
| QSPI data in | RCK/QSPIDIN/QSPIDOUT/GPIO26 | QSPI data input | In/Out | – |

Table 3. MCF5251 Signal Index (continued)

| Signal Name | Mnemonic | Function | Input/ Output | Reset State |
|--|--|--|------------------|----------------|
| QSPI data out | RCK/QSPIDIN/QSPIDOUT/GPIO26 QSPIDOUT/SFSY/GPIO27 | QSPI data out | In/Out | – |
| QSPI chip selects | QSPICS0/EBUIN4/GPIO15 QSPICS1/EBUOUT2/GPIO16 QSPICS2/MCLK2/GPIO24 $\overline{CS1}$ /QSPICS3/GPIO28 | QSPI chip selects | In/Out | – |
| System oscillator in | CRIN | System input | In | – |
| System oscillator out | CROUT | System output | Out | – |
| Reset In | \overline{RSTI} | Processor reset input | In | – |
| Freescaler Test Mode | TEST[2:0] | TEST pins. | In | – |
| Linear regulator output | LINOUT | Output of 1.2 V to supply core | Out | – |
| Linear regulator input | LININ | Input, typically I/O supply (3.3V) | In | – |
| Linear regulator ground | LINGND | | | – |
| High Impedance | $\overline{HI_Z}$ | Assertion tri-states output signal pins | In | |
| Debug Data | DDATA0/ $\overline{CTS1}$ /SDATA0_SDIO1/GPIO1 DDATA1/ $\overline{RTS1}$ /SDATA2_BS2/GPIO2 DDATA2/ $\overline{CTS0}$ /GPIO3 DDATA3/ $\overline{RTS0}$ /GPIO4 | Display of captured processor data and break-point statuses | In/Out | Hi-Z |
| Processor Status | PST0/GPIO50 PST1/GPIO49 PST2/INTMON2/GPIO48 PST3/INTMON1/GPIO47 | Indication of internal processor status. | In/Out | Hi-Z |
| Processor clock | PSTCLK/GPIO51 | Processor clock output | Out | – |
| Test Clock | TCK | Clock signal for IEEE 1149.1A JTAG | In | – |
| Test Reset/ Development Serial Clock | DSCLK/ \overline{TRST} | Multiplexed signal that is asynchronous reset for JTAG controller. Also, clock input for debug module. | In | – |
| Test Mode Select/Break Point | TMS/ \overline{BKPT} | Multiplexed signal that is test mode select in JTAG mode and a hardware break-point in debug mode | In | – |
| Test Data Input/ Development Serial Input | TDI/DSI | Multiplexed serial input for the JTAG or background debug module. | In | – |
| Test Data Output/Development Serial Output | TDO/DSO | Multiplexed serial output for the JTAG or background debug module | Out | – |

4 Electrical Specifications

Table 4 through Table 10 provide the electrical characteristics for the MCF5251 processor. The remaining figures and tables in this section provide the timing diagrams and the timing parameters for the MCF5251 processor.

Table 4 provides the maximum rating parameters for the MCF5251 processor.

Table 4. Maximum Ratings

| Rating | Symbol | Value | Units |
|--------------------------------|-----------|--------------|-------|
| Supply Core Voltage | V_{CC} | -0.5 to +2.5 | V |
| Maximum Core Operating Voltage | V_{CC} | +1.32 | V |
| Minimum Core Operating Voltage | V_{CC} | +1.08 | V |
| Supply I/O Voltage | V_{CC} | -0.5 to +4.6 | V |
| Maximum I/O Operating Voltage | V_{CC} | +3.6 | V |
| Minimum I/O Operating Voltage | V_{CC} | +3.0 | V |
| Input Voltage | V_{in} | -0.5 to +6.0 | V |
| Storage Temperature Range | T_{stg} | -65 to +150 | °C |

Table 5 provides the recommended operating temperatures for the MCF5251 processor.

Table 5. Operating Temperature

| Characteristic | Symbol | Value | Units |
|---------------------------------------|------------|------------------|-------|
| Maximum Operating Ambient Temperature | T_{Amax} | +85 ¹ | °C |
| Minimum Operating Ambient Temperature | T_{Amin} | -40 | °C |

¹ This published maximum operating ambient temperature should be used only as a system design guideline. All device operating parameters are guaranteed only when the junction temperature does not exceed 125° C.

Table 6 provides the recommended operating supply voltages for the MCF5251 processor.

Table 6. Recommended Operating Supply Voltages

| Pin Name | Min | Typ | Max | Unit |
|-----------|------|-----|------|------|
| COREVDD | 1.08 | 1.2 | 1.32 | V |
| PADVDD | 3.0 | 3.3 | 3.6 | V |
| ADVDD | 3.0 | 3.3 | 3.6 | V |
| ADGND | – | GND | – | V |
| OSCPADVDD | 3.0 | 3.3 | 3.6 | V |
| OSCPADGND | – | GND | – | V |
| USBVDD | – | 3.3 | – | V |
| USBVDDP | – | 1.2 | – | V |

Table 6. Recommended Operating Supply Voltages (continued)

| Pin Name | Min | Typ | Max | Unit |
|------------|------|-----|------|------|
| USBGND | – | GND | – | V |
| RTCVDDA | 3.0 | – | 4.2 | V |
| RTCVSSA | – | GND | – | V |
| PLLCOREVDD | 1.08 | 1.2 | 1.32 | V |
| PLLCOREGND | – | GND | – | V |
| LININ | 3.0 | 3.3 | 3.6 | V |
| GND | – | GND | – | V |

Table 7 provides the operating parameters for the linear regulator.

Table 7. Linear Regulator Operating Parameters

| Characteristic | Symbol | Min | Typ | Max | Units |
|--|------------------|------|-----|------|-------|
| Input Voltage (LININ) | V _{in} | 3.0 | 3.3 | 3.6 | V |
| Output Voltage (LINOUT) | V _{out} | 1.08 | 1.2 | 1.32 | V |
| Output Current | I _{out} | – | 100 | 150 | mA |
| Power Dissipation | P _d | – | – | 500 | mW |
| Load Regulation 10% I _{out} ≥ 90% I _{out} | – | – | 50 | 60 | mV |
| Power Supply Rejection | PSRR | – | 40 | – | dB |

NOTE

A pmos regulator is used as a current source in this linear regulator, so a 10 μ F capacitor (ESR 0... 5 Ohm) is needed on the output pin (LINOUT) to integrate the current. Typically, this requires the use of a tantalum type capacitor.

Table 8 provides the measured parameters related to temperature for the linear regulator.

Table 8. Linear Regulator—Measured Parameters Related to Temperature

| Characteristic | Symbol | Min | Typ | Max | Units |
|--|------------------|--------------|-------------|--------------|-------|
| Input Voltage (LININ) | V _{in} | 2.97 | 3.3 | 3.63 | V |
| Output Voltage (LINOUT) 100 mA load | V _{out} | 125 °C: 1.16 | 25 °C: 1.19 | -40 °C: 1.22 | V |
| Current Consumption | I _{cc} | -40 °C: 44 | 25 °C: 56 | 125 °C: 68 | mA |
| Power Dissipation | P _d | -40 °C: 131 | 25 °C: 185 | 125 °C: 247 | mW |
| Load Regulation 10% I _{out} ≥ 90% I _{out} | – | -40 °C: 46 | 25 °C: 57 | 125 °C: 70 | mV |

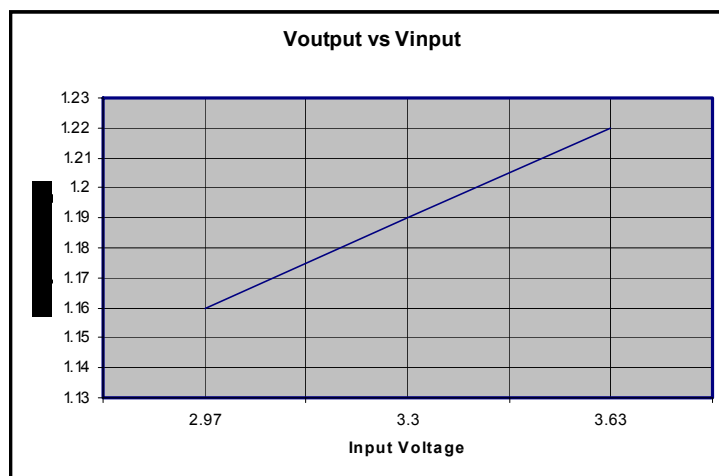


Figure 2. Linear Regulator—Voutput vs Vinput

Table 9 provides the operating parameters for the ADC DC electrical characteristics.

Table 9. Operating Parameters for ADC DC Electrical Characteristics

| Characteristic | Symbol | Min | Typ | Max | Units |
|------------------------------------|---------------------|------|------|-----------|-------|
| Operation Voltage Range for ADC | ADVDD | 3 | – | 3.6 | V |
| Common Mode Rejection | CMR | 0 | – | ADVDD–1.1 | v |
| Reference Voltage (external) | ADREF | 0 | – | ADVDD–1.1 | v |
| Input offset voltage | V_{offset} | – | 10 | – | mV |
| Input Hysteresis (ADINx = ADVDD/2) | V_{hyst} | 0.73 | 0.78 | 0.85 | mV |
| ADC Input Linear Operating Range | ADINx | 0 | – | ADVDD–1.1 | V |
| AD Converter Error | | 2 | | | LSB |

Note: Software and hardware sampling time is dependent on the external RC network used and the internal CPU Frequency and AD Converter clock divider. See Section 12.4.1 in the *MCF5251 Reference Manual* for more information.

Table 10 provides the DC electrical specifications for the digital pins.

Table 10. DC Electrical Specifications (I/O Vcc = 3.3 Vdc ± 0.3 Vdc)

| Characteristic | Symbol | Min | Max | Units |
|---------------------------------|-----------------|------|-----|-------|
| Operation Voltage Range for I/O | V_{cc} | 3.0 | 3.6 | V |
| Input High Voltage | V_{IH} | 2 | 5.5 | V |
| Input Low Voltage | V_{IL} | -0.3 | 0.8 | V |
| Reset Threshold Voltage - High | RtH | 2.0 | – | V |
| Reset Threshold Voltage - Low | TtL | – | 0.8 | V |
| Reset Input Rise Time | nS | 10 | – | – |
| Reset Input Fall Time | nS | 10 | – | – |

Electrical Specifications

Table 10. DC Electrical Specifications (I/O Vcc = 3.3 Vdc ± 0.3 Vdc) (continued)

| Characteristic | Symbol | Min | Max | Units |
|---|-----------|------|------|-------|
| Input Leakage Current @ 0.0 V/3.3 V During Normal Operation | I_{in} | – | ±1 | μA |
| Hi-Impedance (Three-State) Leakage Current @ 0.0 V/3.3 V During Normal Operation | I_{TSL} | – | ±1 | μA |
| Output High Voltage $I_{OH} = 11.9 \text{ mA}^1, 6.3 \text{ mA}^2, 3.1 \text{ mA}^3$ | V_{OH} | 2.4 | – | V |
| Output Low Voltage $I_{OL} = 7.1 \text{ mA}^1, 3.5 \text{ mA}^2, 1.8 \text{ mA}^3$ | V_{OL} | – | 0.4 | V |
| Schmitt Trigger Low to High Threshold Point ⁴ | V_{T+} | 1.67 | 1.79 | V |
| Schmitt Trigger High to Low Threshold Point ⁴ | V_{T-} | 1.01 | 1.15 | V |
| Load Capacitance: D[31:16], SCLK[4:1], SCLKOUT, EBUOUT[2:1], LRCK[3:1], SDATAO[2:1], CFLG, EF, IDE_DIOR, IDE_DIOW, IDE_IORDY, MCLK1, MCLK2 | C_L | – | 50 | pF |
| Load Capacitance: A[24:9], ATA_CS0, ATA_CS1, ATA_A[2:0], ATA_DIOR, ATA_DIOW, ATA_DMACK, ATA_D[15:0], SDATAI[3,1] | C_L | 15 | 40 | pF |
| Load Capacitance: A[8:1], ADOUT, $\overline{\text{ATA_RST}}$ BCLK, BCLKE, SDCAS, SDRAS, $\overline{\text{SDL DQM}}$, $\overline{\text{SDCS0}}$, $\overline{\text{SDUDQM}}$, $\overline{\text{SDWE}}$, $\overline{\text{BUFENB}}[2:1]$, CAN0_TX, CAN1_TX, EBUIN1, RXD[2:0] | C_L | – | 30 | pF |
| Load Capacitance: SDA0, SDA1, SCL0, SCL1, CMD_SDIO2, SDATA2_BS2, SDATA1_BS1, SDATA0_SDIO1, $\overline{\text{CS0/CS4}}$, $\overline{\text{CS1}}$, $\overline{\text{OE}}$, RW, TA, TXD[2:0], XTRIM, TDO/DSO, RCK, SFSY, SUBR, SDATA3, TOUT0, QSPID_OUT, QSPICS[3:0], QSPICLK, GPIO[6:5] | C_L | – | 20 | pF |
| Load Capacitance: DDATA[3:0], PST[3:0], PSTCLK | C_L | – | 15 | pF |
| Capacitance ⁵ , $V_{in} = 0 \text{ V}$, $f = 1 \text{ MHz}$ | C_{IN} | – | 6 | pF |

¹ **8.0 mA:** SCL0, SDA0, SCL1, SDA1, PST[3:0], DDATA[3:0], TDSO, RW, $\overline{\text{ATA_RST}}$, MCLK1, QSPICS2_MCLK2

² **4.0 mA:** $\overline{\text{BUFENB1}}$, $\overline{\text{BUFENB2}}$, EBUOUT1, SCLKOUT, CMDSDIO, $\overline{\text{IDE_DIOR}}$, $\overline{\text{IDE_DIOW}}$, TOUT0, $\overline{\text{RTS}}[1:0]$, TXD[1:0], SCLK[4:1], LRCK[4:1], SDATAO1, SDATAO2, QSPICLK, QSPICS0, QSPICS1_EBUOUT2, QSPICS3, QSPIDOUT, RCK, XTRIM, A[8:1], ATA_CS0, ATA_CS1, ATA_A[2:0]

³ **2.0 mA:** TMS/ $\overline{\text{BKPT}}$, DSI/TDI, $\overline{\text{TRST/DSCLK}}$

⁴ SCLK[4:1], SCL0, SCL1, SDA0, SDA1, ATA_DMARQ, ATA_INTRQ, ATA_IORDY

⁵ Capacitance C_{IN} is periodically sampled rather than 100% tested.

Figure 3 and Table 11 provide the clock timing diagram and timing parameters.

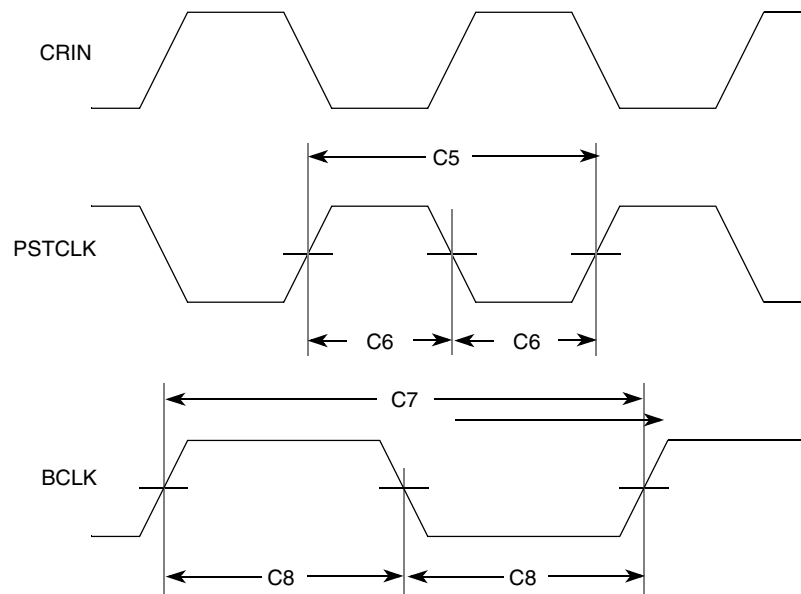


Figure 3. Clock Timing Definition

NOTE

Signals shown in Figure 3 are in relation to the SYSCLK clock. No relationship between signals is implied or intended.

Table 11 shows the clock timing parameters.

Table 11. Clock Timing Parameters

| ID | Characteristic | 140 MHz CPU | | Units |
|----|---|-------------|-------|-------|
| | | Min | Max | |
| – | CRIN Frequency with external oscillator | 5.00 | 33.86 | MHz |
| – | CRIN Frequency with internal oscillator | 5 | 16.94 | MHz |
| C5 | PSTCLK cycle time | 7 | – | ns |
| C6 | PSTCLK duty cycle | 40 | 60 | % |
| C7 | BCLK cycle time | 14.0 | – | ns |
| C8 | BCLK duty cycle | 35 | 65 | % |

Table 12 shows the CRIN Crystal suggested parameters.

Table 12. CRIN Crystal Suggested Parameters

| Parameter | Min | Typ | Max | Unit |
|--|-----|-----|-------|------|
| Frequency | 5 | – | 16.94 | MHz |
| Frequency Tolerance | – | – | ±50 | ppm |
| Frequency Stability Over Operating Temperature Range | – | – | ±50 | ppm |
| ESR | – | 40 | – | Ω |
| Shunt Capacitance | – | 7 | – | pF |
| Load Capacitance | – | 18 | – | pF |

4.1 SDRAM Bus Timing

The SDRAM bus is a synchronous bus. Propagation delays, set-up times and hold times with respect to the SDRAM clock BCLK are shown in Figure 4 and the parameters provided in Table 13. When BCLK clock is not active, SDRAM interface is not valid and the external bus cannot be used.

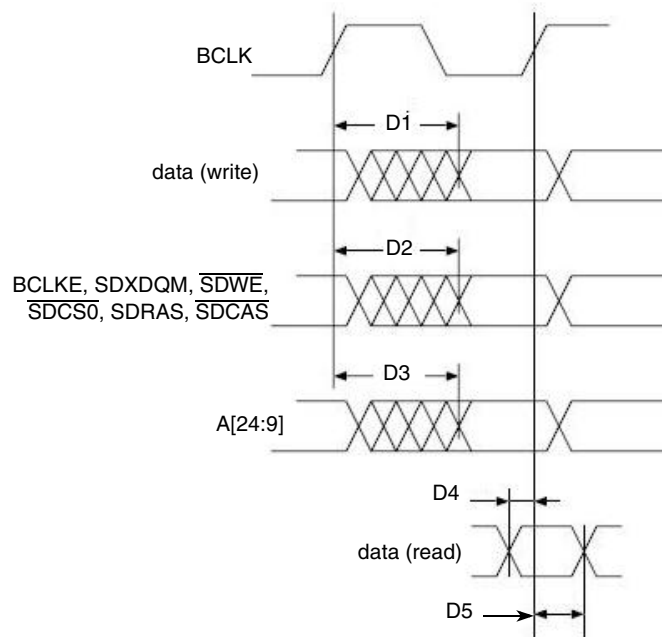


Figure 4. SDRAM Bus Timing Diagram

Table 13. SDRAM Bus Timing Parameters

| ID | Characteristic | Timing to 50% Points Maximum | | | Units |
|----|--|------------------------------|------------|------------|-------|
| | | 30 pF Load | 40 pF Load | 50 pF Load | |
| D1 | Propagation delay BCLK rising to data valid | 7.88 | 8.8 | 9.6 | ns |
| D2 | Propagation delay BCLK rising to BCLKE, $\overline{\text{SDLDQM}}$, $\overline{\text{SDUDQM}}$, $\overline{\text{SDWE}}$, $\overline{\text{SDCS0}}$, $\overline{\text{SDRAS}}$, $\overline{\text{SDCAS}}$ valid | 8.7 | – | – | ns |
| D3 | Propagation delay BCLK rising to A[24:9] valid | 8.3 | 9.2 | – | ns |
| D4 | Set-up time data valid to BCLK rising | 0 | 0 | 0 | ns |
| D5 | Hold time BCLK rising to data valid | 0.7 | 0.7 | 0.7 | ns |

4.2 SPDIF Timing

The Sony/Philips Digital Interface (SPDIF) timing parameters are provided in Table 14. SPDIF timing is totally asynchronous, therefore there is no need for relationship with the clock. Table 14 shows the differences between high-low and low-high propagation delay which is called the skew.

Table 14. SPDIF Propagation Skew and Transition Parameters

| Characteristic | Pin Load | Prop Delay Maximum | Skew ¹ Maximum | Transition ² Rise Maximum | Transition Fall Maximum | Units |
|---|----------|--------------------|---------------------------|--------------------------------------|-------------------------|-------|
| EBUIN1, EBUIN2, EBUIN3, EBUIN4: asynchronous inputs, no specs apply | – | – | 0.7 | – | – | ns |
| EBUOUT1, EBUOUT2 output | 40 pF | – | 1.5 | 24.2 | 31.3 | ns |
| EBUOUT1, EBUOUT2 output | 20 pF | – | 1.5 | 13.6 | 18.0 | ns |

¹ Skew value does not include the skew introduced by different rise and fall times.

² Transition times between 10% V_{dd} and 90% V_{dd}.

4.3 Serial Audio Interface Timing

The Serial Audio Interface fully complies with the Industry standard Philips IIS (InterIC Serial Audio Bus) timings.

4.4 DDATA/PST/PSTCLK Debug Interface

Table 15 provides the timing parameters.

Table 15. DDATA/PST/PSTCLK Debug Interface Timing Parameters

| Characteristic | Pin Load | Min | Max | Units |
|--|----------|------|-----|-------|
| PSTCLK clock rise edge to DDATA/PSTDATA ¹ invalid | 15 pF | –1.0 | – | ns |
| PSTCLK clock rise edge to DDATA/PSTDATA ² valid | 15 pF | – | 4.0 | ns |

Electrical Specifications

- ¹ Note that output data may go invalid *before* rising edge of the clock. To clock data in reliably, you need to sample data, for example, 2 ns before rising edge of clock.
- ² Timing figure given takes 50% margin for noise and uncertainty on pin capacitance. Simulated clock-to-data, not taking noise effects into account is 2.7 ns.

4.5 BDM and JTAG Timing

Table 16 provides the BDM timing parameters.

Table 16. BDM Interface Timing Parameters

| Characteristic | Min | Max | Units |
|---|------|-----------|-------|
| Clock period for DSCLK clock | — | $5T^1$ | ns |
| Set-up time DSI, \overline{BKPT} , to DSCLK rising edge | 4.0 | — | ns |
| Hold time DSI, \overline{BKPT} to DSCLK rising edge | — | $T + 4.0$ | ns |
| Propagation delay DSCLK rising edge to TDO/DSO change | $3T$ | $4T + 32$ | ns |

¹ T denotes the CPU clock period. E.g. if the CPU is running at 100 MHz, $T = 10$ ns

Figure 5 provides the JTAG timing diagram and Table 17 provides the JTAG timing parameters.

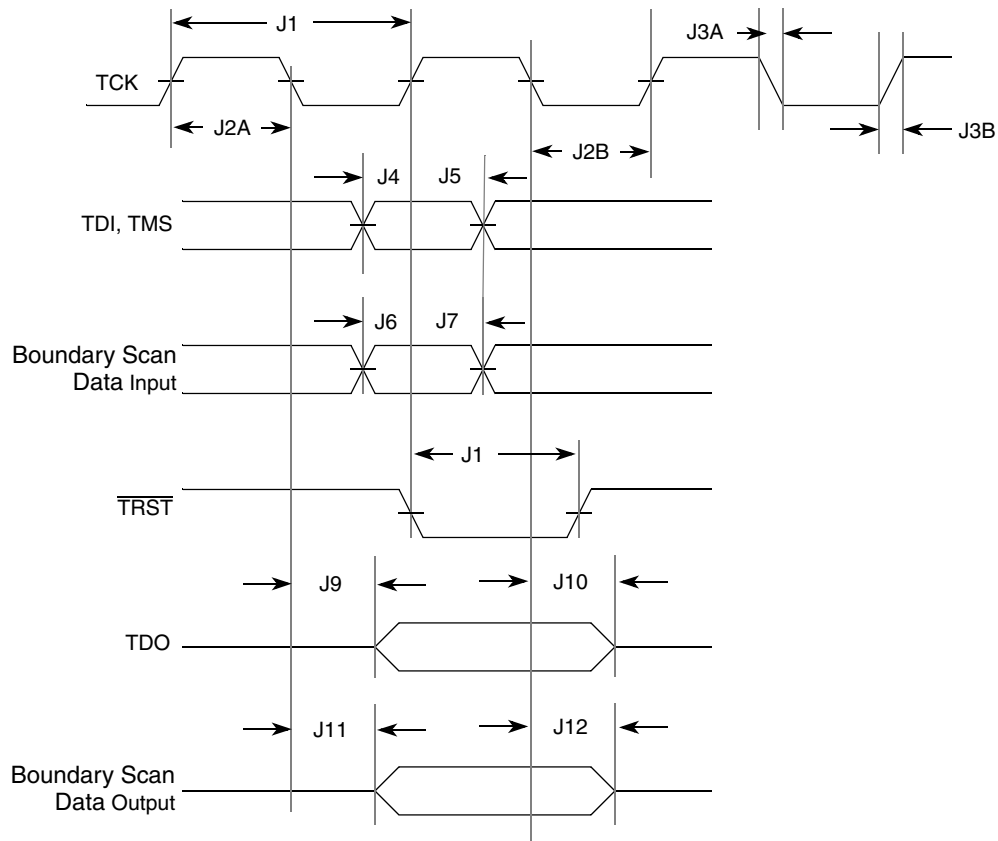


Figure 5. JTAG Timing Diagram

Table 17. JTAG Timing Parameters

| ID | Characteristic | Min | Max | Units |
|-----|---|-----|-----|-------|
| – | TCK Frequency of Operation | 0 | 10 | MHz |
| J1 | TCK Cycle Time | 100 | — | ns |
| J2A | TCK Clock Pulse High Width | 25 | — | ns |
| J2B | TCK Clock Pulse Low Width | 25 | — | ns |
| J3A | TCK Fall Time ($V_{IH}=2.4$ V to $V_{IL}=0.5$ V) | — | 5 | ns |
| J3B | TCK Rise Time ($V_{IL}=0.5$ v to $V_{IH}=2.4$ V) | — | 5 | ns |
| J4 | TDI, TMS to TCK rising (Input Setup) | 8 | — | ns |
| J5 | TCK rising to TDI, TMS Invalid (Hold) | 10 | — | ns |
| J6 | Boundary Scan Data Valid to TCK (Setup) | 1 | — | ns |
| J7 | TCK to Boundary Scan Data Invalid to rising edge (Hold) | 10 | — | ns |
| J8 | \overline{TRST} Pulse Width (asynchronous to clock edges) | 12 | — | ns |
| J9 | TCK falling to TDO Valid (signal from driven or three-state) | — | 15 | ns |
| J10 | TCK falling to TDO High Impedance | 2 | 15 | ns |
| J11 | TCK falling to Boundary Scan Data Valid (signal from driven or three-state) | — | 15 | ns |
| J12 | TCK falling to Boundary Scan. Data High Impedance | 1 | 15 | ns |

5 Package Information and Pinout

This section includes the pin assignment information, contact connection diagram, and the mechanical package drawing.

The MCF5251 device is available in the following package:

- 225 MAPBGA 13 x 13 mm 0.8 mm pitch package as shown in [Figure 6](#).

5.1 Pin Assignment

[Table 18](#) defines all the settings of each pad. See [Figure 7](#) for the ball map of pin locations and [Table 20](#) for the device pin list, sorted by signal identification.

Table 18. 225 MAPBGA Pin Assignment

| Name | Drive Type/ Strength | Load (pF) | 1st Function | 2nd Function | Pinconfig Register Bit | GP Pin | Reset | Notes |
|--------------------|-------------------------|--------------|-----------------|-----------------|------------------------------|-----------|-------|-------|
| Address Bus | | | | | | | | |
| A1 | O / 2 mA | 30 | – | – | – | – | X | – |
| A2 | O / 2 mA | 30 | – | – | – | – | X | – |
| A3 | O / 2 mA | 30 | – | – | – | – | X | – |
| A4 | O / 2 mA | 30 | – | – | – | – | X | – |
| A5 | O / 2 mA | 30 | – | – | – | – | X | – |
| A6 | O / 2 mA | 30 | – | – | – | – | X | – |
| A7 | O / 2 mA | 30 | – | – | – | – | X | – |

Table 18. 225 MAPBGA Pin Assignment (continued)

| Name | Drive Type/ Strength | Load (pF) | 1st Function | 2nd Function | Pinconfig Register Bit | GP Pin | Reset | Notes |
|---------------------------------|-------------------------|--------------|-------------------------|------------------|------------------------------|-----------|---------|--|
| A8 | O / 2 mA | 30 | – | – | – | – | X | – |
| A9 | O / 8 mA | 30 | – | – | – | – | X | – |
| A10 | O / 8 mA | 30 | – | – | – | – | X | – |
| A11 | O / 8 mA | 30 | – | – | – | – | X | – |
| A12 | O / 8 mA | 30 | – | – | – | – | X | – |
| A13 | O / 8 mA | 30 | – | – | – | – | X | – |
| A14 | O / 8 mA | 30 | – | – | – | – | X | – |
| A15 | O / 8 mA | 30 | – | – | – | – | X | – |
| A16 | O / 8 mA | 30 | – | – | – | – | X | – |
| A17 | O / 8 mA | 30 | – | – | – | – | X | – |
| A18 | O / 8 mA | 30 | – | – | – | – | X | – |
| A19 | O / 8 mA | 30 | – | – | – | – | X | – |
| A20/A24 | O / 8 mA | 30 | A20 | A24 | 31 | – | X | Audio Clock Select: 1-LRCK3 pin; 0-CRIN pin |
| A21 | O / 8 mA | 30 | – | – | – | – | X | – |
| A22 | O / 8 mA | 30 | – | – | – | – | X | – |
| A23/GPO54 | O / 8 mA | 30 | A23 | – | – | O54 | X | Boot Mode Select: 1-Memory connected to CS0; 0-Internal boot rom |
| Data Bus | | | | | | | | |
| D16 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D17 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D18 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D19 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D20 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D21 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D22 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D23 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D24 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D25 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D26 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D27 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D28 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D29 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D30 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| D31 | IO / 8 mA | 40 | – | – | – | – | HI_Z | – |
| Bus Control | | | | | | | | |
| \overline{OE} | O / 4 mA | 30 | – | – | – | – | Negated | – |
| RW | O / 4 mA | 30 | – | – | – | – | H | – |
| \overline{TA} /GPIO12 | IO / 2 mA | 30 | \overline{TA} | – | – | IO12 | – | – |
| BUFENB1/GPIO29 | IO / 2 mA | 30 | BUFENB1 | – | – | IO29 | – | – |
| BUFENB2/GPIO30 | IO / 2 mA | 30 | BUFENB2 | – | – | IO30 | – | – |
| $\overline{IDE_DIOR}$ /GPIO31 | IO / 2 mA | 30 | $\overline{IDE_DIOR}$ | – | – | IO31 | – | Controlled by $\overline{CS2}$ registers |
| $\overline{IDE_DIOW}$ /GPIO32 | IO / 2 mA | 30 | $\overline{IDE_DIOW}$ | – | – | IO32 | – | Controlled by $\overline{CS2}$ registers |
| $\overline{IDE_IORDY}$ /GPIO33 | IO / 2 mA | 30 | $\overline{IDE_IORDY}$ | – | – | IO33 | – | – |
| Chip Selects | | | | | | | | |
| $\overline{CS0}/\overline{CS4}$ | O / 4 mA | 30 | $\overline{CS0}$ | $\overline{CS4}$ | – | – | Negated | Boot Mode Select: 1- $\overline{CS0}$; 0- $\overline{CS4}$ |

Table 18. 225 MAPBGA Pin Assignment (continued)

| Name | Drive Type/ Strength | Load (pF) | 1st Function | 2nd Function | Pinconfig Register Bit | GP Pin | Reset | Notes |
|---|-------------------------|--------------|----------------------------|-----------------|------------------------------|-----------|---------|--|
| $\overline{\text{CS1}}$ /QSPICS3/ GPIO28 | IO / 2 mA | 30 | $\overline{\text{CS1}}$ | QSPICS3 | 25 | IO28 | Negated | – |
| SDRAM Controller | | | | | | | | |
| BCLK/GPIO40 | IO / 8 mA | 15 | BCLK | – | – | IO40 | – | – |
| BCLKE/GPIO63 | IO / 8 mA | 20 | BCLKE | – | – | IO63 | – | – |
| $\overline{\text{SDLDQM}}$ /GPO52 | O / 8 mA | 20 | $\overline{\text{SDLDQM}}$ | – | – | O52 | – | – |
| $\overline{\text{SDUDQM}}$ /GPO53 | O / 8 mA | 20 | $\overline{\text{SDUDQM}}$ | – | – | O53 | – | – |
| $\overline{\text{SDWE}}$ /GPIO38 | IO / 8 mA | 20 | $\overline{\text{SDWE}}$ | – | – | IO38 | Negated | – |
| $\overline{\text{SDCS0}}$ /GPIO60 | IO / 8 mA | 20 | $\overline{\text{SDCS0}}$ | – | – | IO60 | Negated | – |
| $\overline{\text{SDRAS}}$ /GPIO59 | IO / 8 mA | 20 | $\overline{\text{SDRAS}}$ | – | – | IO59 | Negated | – |
| $\overline{\text{SDCAS}}$ /GPIO39 | IO / 8 mA | 20 | $\overline{\text{SDCAS}}$ | – | – | IO39 | Negated | – |
| ATA Interface | | | | | | | | |
| ATA_A0 | O / 2 mA | 40 | – | – | – | – | – | – |
| ATA_A1 | O / 2 mA | 40 | – | – | – | – | – | – |
| ATA_A2 | O / 2 mA | 40 | – | – | – | – | – | – |
| ATA_D0 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D1 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D2 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D3 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D4 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D5 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D6 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D7 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D8 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D9 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D10 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D11 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D12 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D13 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D14 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_D15 | IO / 8 mA | 40 | – | – | – | – | – | – |
| ATA_CS0 | O / 2 mA | 40 | – | – | – | – | – | – |
| ATA_CS1 | O / 2 mA | 40 | – | – | – | – | – | – |
| ATA_DIOR | O / 8 mA | 40 | – | – | – | – | – | – |
| ATA_DIOW | O / 8 mA | 40 | – | – | – | – | – | – |
| ATA_IORDY | I | – | – | – | – | – | – | – |
| ATA_INTRQ | I | – | – | – | – | – | – | – |
| ATA_DMARQ | I | – | – | – | – | – | – | – |
| ATA_DMACK | O / 8 mA | 40 | – | – | – | – | – | – |
| ATA_RST | O / 2 mA | 40 | – | – | – | – | – | – |
| Clock Generation | | | | | | | | |
| CRIN | – | – | – | – | – | – | – | Main Processor Clock Input |
| CROUT | – | – | – | – | – | – | – | Main Processor Clock Output |
| RTC_CRIN | A | – | – | – | – | – | – | Real Time Clock (32.768 kHz) Input |
| RTCCROUT | A | – | – | – | – | – | – | Real Time Clock (32.768 kHz) Output |

Table 18. 225 MAPBGA Pin Assignment (continued)

| Name | Drive Type/ Strength | Load (pF) | 1st Function | 2nd Function | Pinconfig Register Bit | GP Pin | Reset | Notes |
|------------------------------------|-------------------------|--------------|-----------------|-----------------------|------------------------------|-----------|-------|---|
| USB_CRIN | A | – | – | – | – | – | – | USB Clock (24 MHz) Input |
| USB_CROUT | A | – | – | – | – | – | – | USB Clock (24 MHz) Output |
| XTRIM/TXD2/GPIO0 | IO / 2 mA | 30 | XTRIM | TXD2 | 0 | IO0 | – | Interrupt Capable Input |
| JTAG/BDM/Test | | | | | | | | |
| TDO/DSO | O / 4 mA | 30 | – | – | – | – | – | See TEST0 Description |
| TDI/DSI | I | – | – | – | – | – | – | See TEST0 Description |
| TMS/BKPT | I | – | – | – | – | – | – | See TEST0 Description |
| TCK | I | – | – | – | – | – | – | – |
| TRST/DSCLK | I | – | – | – | – | – | – | See TEST0 Description |
| HI_Z | I | – | – | – | – | – | – | For Normal Operation Tie This Pin High |
| PSTCLK/GPIO51 | IO / 8 mA | 30 | PSTCLK | – | – | IO51 | – | – |
| PST0/GPIO50 | IO / 4 mA | 30 | PST0 | – | – | IO50 | HI_Z | – |
| PST1/GPIO49 | IO / 4 mA | 30 | PST1 | – | – | IO49 | HI_Z | – |
| PST2/INTMON2/ GPIO48 | IO / 4 mA | 30 | PST2 | INTMON2 | 17 | IO48 | HI_Z | – |
| PST3/INTMON1/ GPIO47 | IO / 4 mA | 30 | PST3 | INTMON1 | 18 | IO47 | HI_Z | – |
| DDATA0/CTS1/ SDATA0_SDIO1/GPIO1 | IO / 4 mA | 30 | DDATA0 | CTS1/SDATA 0_SDIO1 | 14,13 | IO1 | HI_Z | Interrupt Capable Input |
| DDATA1/RTS1/ SDATA2_BS2/GPIO2 | IO / 4 mA | 30 | DDATA1 | RTS1/SDATA 2_BS2 | 24,23 | IO2 | HI_Z | Interrupt Capable Input |
| DDATA2/CTS0/GPIO3 | IO / 4 mA | 30 | DDATA2 | CTS0 | 22 | IO3 | HI_Z | Interrupt Capable Input |
| DDATA3/RTS0/GPIO4 | IO / 4 mA | 30 | DDATA3 | RTS0 | 21 | IO4 | HI_Z | Interrupt Capable Input |
| TEST0 | I | – | – | – | – | – | – | BDM/JTAG Select: 1-BDM; 0-JTAG |
| TEST1 | I | – | – | – | – | – | – | For normal operation, tie this pin low. |
| TEST2 | I | – | – | – | – | – | – | For normal operation, tie this pin low. |
| Reset/Wake-up | | | | | | | | |
| RSTI | I | – | – | – | – | – | – | – |
| WAKEUP/GPIO21 | IO / 2 mA | 30 | WAKEUP | – | – | IO21 | – | – |
| USB | | | | | | | | |
| USBDN | A | – | – | – | – | – | – | – |
| USBDP | A | – | – | – | – | – | – | – |
| USBID | I | – | – | – | – | – | – | – |
| USBVBUS | A | – | – | – | – | – | – | – |
| USBRES | A | – | – | – | – | – | – | – |
| TESTOUT ¹ | O | – | – | – | – | – | – | – |
| NC | – | – | – | – | – | – | – | – |
| Audio Interface | | | | | | | | |
| SDATA1/GPIO17 | IO / 2 mA | 30 | SDATA1 | – | – | IO17 | – | – |
| SDATA0/TOUT0/ GPIO18 | IO / 2 mA | 30 | SDATA0 | TOUT0 | 8 | IO18 | – | – |
| SCLK1/GPIO20 | IO / 2 mA | 30 | SCLK1 | – | – | IO20 | – | – |
| LRCK1/GPIO19 | IO / 2 mA | 30 | LRCK1 | – | – | IO19 | – | – |
| SDATA02/GPIO34 | IO / 2 mA | 30 | SDATA02 | – | – | IO34 | – | – |
| SCLK2/GPIO22 | IO / 2 mA | 30 | SCLK2 | – | – | IO22 | – | – |

Table 18. 225 MAPBGA Pin Assignment (continued)

| Name | Drive Type/ Strength | Load (pF) | 1st Function | 2nd Function | Pinconfig Register Bit | GP Pin | Reset | Notes |
|------------------------------------|-------------------------|--------------|-----------------|----------------------|------------------------------|-----------|-------|-------------------------|
| LRCK2/GPIO23 | IO / 2 mA | 30 | LRCK2 | – | – | IO23 | – | – |
| SDATAI3/GPIO8 | IO / 2 mA | 30 | SDATAI3 | – | – | IO8 | – | – |
| SCLK3/GPIO35 | IO / 2 mA | 30 | SCLK3 | – | – | IO35 | – | – |
| LRCK3/AUDIOCLK/ GPIO43 | IO / 2 mA | 30 | LRCK3 | AUDIOCLK | – | IO43 | – | See A20/A24 Description |
| EBUIN1/GPIO36 | IO / 2 mA | 30 | EBUIN1 | – | – | IO36 | – | – |
| EBUIN2/SCLKOUT/ GPIO13 | IO / 2 mA | 30 | EBUIN2 | SCLKOUT | 16 | IO13 | – | – |
| EBUIN3/ CMD_SDIO2/GPIO14 | IO / 2 mA | 30 | EBUIN3 | CMDSDIO2 | 15 | IO14 | – | – |
| QSPICS0/EBUIN4/ GPIO15 | IO / 2 mA | 30 | QSPICS0 | EBUIN4 | 30 | IO15 | – | – |
| EBUOUT1/GPIO37 | IO / 2 mA | 30 | EBUOUT1 | – | – | IO37 | – | – |
| QSPICS1/ EBUOUT2/GPIO16 | IO / 2 mA | 30 | QSPICS1 | EBUOUT2 | 29 | IO16 | – | – |
| CFLG/GPIO5 | IO / 2 mA | 30 | CFLG | – | – | IO5 | – | Interrupt Capable Input |
| EF/RXD2/GPIO6 | IO / 2 mA | 30 | EF | RXD2 | – | IO6 | – | Interrupt Capable Input |
| MCLK1/GPIO11 | IO / 4 mA | 30 | MCLK1 | – | – | IO11 | – | – |
| QSPICS2/MCLK2/ GPIO24 | IO / 4 mA | 30 | QSPICS2 | MCLK2 | 28 | IO24 | – | – |
| Analog-to-Digital Converter | | | | | | | | |
| ADIN0/GPI52 | A | – | ADIN0 | – | – | I52 | – | – |
| ADIN1/GPI53 | A | – | ADIN1 | – | – | I53 | – | – |
| ADIN2/GPI54 | A | – | ADIN2 | – | – | I54 | – | – |
| ADIN3/GPI55 | A | – | ADIN3 | – | – | I55 | – | – |
| ADIN4/GPI56 | A | – | ADIN4 | – | – | I56 | – | – |
| ADIN5/GPI57 | A | – | ADIN5 | – | – | I57 | – | – |
| ADREF | A | – | – | – | – | – | – | – |
| ADOUT/SCLK4/ GPIO58 | IO / 2 mA | 30 | ADOUT | SCLK4 | 9 | IO58 | – | – |
| FlexCAN | | | | | | | | |
| CAN0_TX | O / 8 mA | 30 | – | – | – | – | – | – |
| CAN0_RX | I | – | – | – | – | – | – | – |
| CAN1_TX | O / 8 mA | 30 | – | – | – | – | – | – |
| CAN1_RX | I | – | – | – | – | – | – | – |
| QSPI | | | | | | | | |
| QSPICLK/SUBR/ GPIO25 | IO / 2 mA | 30 | QSPICLK | SUBR | 27 | IO25 | – | – |
| RCK/QSPIDIN/ QSPIDOUT/GPIO26 | IO / 2 mA | 30 | RCK | QSPIDIN/ QSPIDOUT | 26 | IO26 | – | – |
| QSPIDOUT/SFSY/ GPIO27 | IO / 2 mA | 30 | QSPIDOUT | SFSY | 10 | IO27 | – | – |
| I²C | | | | | | | | |
| SDA0/SDATA3/ GPIO42 | IO / 4 mA | 30 | SDA0 | SDATA3 | 11 | IO42 | – | – |
| SCL0/SDATA1_BS1/ GPIO41 | IO / 4 mA | 30 | SCL0 | SDATA1_BS1 | 12 | IO41 | – | – |
| SDA1/RXD1/GPIO44 | IO / 4 mA | 30 | SDA1 | RXD1 | 19 | IO44 | – | – |

Table 18. 225 MAPBGA Pin Assignment (continued)

| Name | Drive Type/ Strength | Load (pF) | 1st Function | 2nd Function | Pinconfig Register Bit | GP Pin | Reset | Notes |
|---|-------------------------|--------------|-----------------|-----------------|------------------------------|-----------|-------|--|
| SCL1/TXD1/GPIO10 | IO / 4 mA | 30 | SCL1 | TXD1 | 20 | IO10 | – | – |
| UART | | | | | | | | |
| TXD0/GPIO45 | IO / 2 mA | 30 | TXD0 | – | – | IO45 | – | – |
| RXD0/GPIO46 | IO / 2 mA | 30 | RXD0 | – | – | IO46 | – | – |
| Power/Ground Pins | | | | | | | | |
| LININ | – | – | – | – | – | – | – | 3.3 Volt Supply Required |
| LINOUT | – | – | – | – | – | – | – | 1.2 Volt Output (Approx 50% Efficient) |
| LINGND | – | – | – | – | – | – | – | – |
| PLLCOREVDD (3 Balls) | – | – | – | – | – | – | – | 1.2 Volt Supply Required (M4, N3, P2) |
| PLLCOREGND (3 Balls) | – | – | – | – | – | – | – | N4,P3,R2 |
| USBVDD (2 Balls) | – | – | – | – | – | – | – | 3.3 Volt Supply Required (L13, M13) |
| USBVDDP | – | – | – | – | – | – | – | 1.2 Volt Supply Required |
| USBGND (3 Balls) | – | – | – | – | – | – | – | K11, L11, M12 |
| OSCPADVDD | – | – | – | – | – | – | – | 3.3 Volt Supply Required |
| OSCPADGND | – | – | – | – | – | – | – | – |
| RTC_VDDA | – | – | – | – | – | – | – | 3.3 Volt Supply Required |
| RTCVSSA | – | – | – | – | – | – | – | – |
| ADVDD | – | – | – | – | – | – | – | 3.3 Volt Supply Required |
| ADGND | – | – | – | – | – | – | – | – |
| PADVDD (10 Balls) | – | – | – | – | – | – | – | 3.3 Volt Supply Required (E7, E9, F10, H8, H11, K5, L6, L8, L10, R13) |
| COREVDD (4 Balls) | – | – | – | – | – | – | – | 1.2 Volt Supply Required (G8, H7, H9, J8) |
| COREVSS/PADVSS (18 Balls) ² | – | – | – | – | – | – | – | A1, A15, E8, E10, F7, G6, G7, G9, G11, J7, J9, J10, J11, L5, L7, L9, R1, R15 |

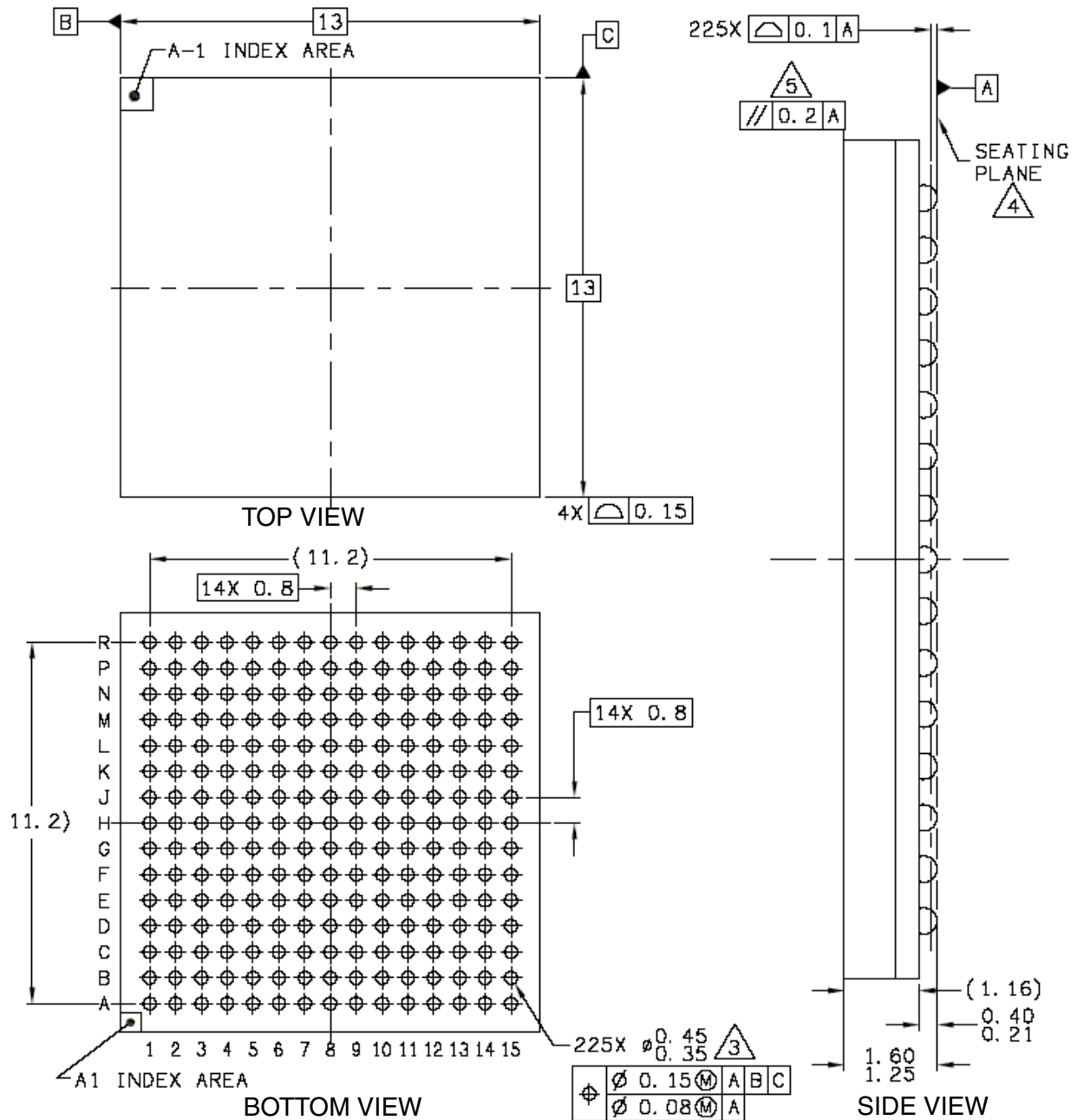
¹ For test purposes only. Leave ball as open circuit.

² These pads are listed as “GND” in the ball map and the rest of the tables.

5.2 Package Drawing

Figure 6 shows the package outline diagram for the MCF5251 processor.

Package Information and Pinout



Notes:

1. All dimensions in millimeters.
2. Dimensioning and tolerancing per ASME Y14. 5M-1994.
3. Maximum solder ball diameter measured parallel to datum A.
4. Datum A, the seating plane, is determined by the spherical crown of the solder balls.
5. Parallelism measurement shall exclude any effect of mark on top surface of package.

Figure 6. MCF5251 Package Drawing

5.2.1 MAPBGA Pinout

Figure 7 shows the MCF5251 ball map of pad locations.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|-----------------|-----------------|-----------------|----------------------|----------------------------|-------------------------------|-------------------------------------|--------------------------------|------------------------------|--|--|---------------------------|-----------------------------|-----------------------------|---------------------|
| GND | D24 | D26 | D30 | SDUDQM/ GPO53 | SDRAS/ GPIO59 | ATA_DMAR Q | ATA_A0 | ATA_D1 | ATA_D6 | ATA_D11 | ATA_D12 | ATA_D10W | LININ | GND |
| D19 | D23 | D25 | D28 | BCLK/ GPIO40 | SDCS0/ GPIO60 | ATA_A1 | ATA_A2 | ATA_D0 | ATA_D4 | ATA_D9 | ATA_D14 | HI_Z | LINOUT | ATA_D10R |
| D16 | D20 | D22 | D27 | D31 | SDLDQM/ GPO52 | SDWE/ GPIO38 | ATA_RST | ATA_CS0 | ATA_D5 | ATA_D10 | ATA_DMACK | LINGND | CAN1_TX | CAN0_TX |
| A22 | A23/GPO54 | A21 | D21 | D29 | SDCAS/ GPIO39 | ATA_IORDY | ATA_INTRQ | ATA_CS1 | ATA_D7 | ATA_D8 | ATA_D15 | CAN0_RX | MCLK1/ GPIO11 | SDATA02/ GPIO34 |
| A14 | A16 | A18 | D17 | D18 | BCLKE/ GPIO63 | PADVDD | GND | PADVDD | GND | ATA_D13 | CAN1_RX | SCLK2/ GPIO22 | LRCK2/ GPIO23 | RSTI |
| A13 | A10 | A12 | A17 | A19 | A20/A24 | GND | ATA_D2 | ATA_D3 | PADVDD | TEST0 | TMS/BKPT | TCK | TRST/ DSCLK | TDI/DSI |
| A5 | A7 | A6 | A15 | A11 | GND | GND | COREVDD | GND | TEST1 | GND | PST1/ GPIO49 | TDO/DSO | PSTCLK/ GPIO51 | PST0/ GPIO50 |
| A3 | A2 | A1 | A8 | A4 | A9 | COREVDD | PADVDD | COREVDD | TEST2 | PADVDD | TXD0/ GPIO45 | PST3/ INTMON1/ GPIO47 | PST2/ INTMON2/ GPIO48 | RXD0/ GPIO46 |
| RTC_CRIN | RTC_VDDA | CS0/CS4 | RW | ADOUT/ SCLK4/ GPIO58 | ADIN5/ GPI57 | GND | COREVDD | GND | GND | GND | DDATA3/ RTS0/ GPIO4 | SCL1/TXD1/ GPIO10 | DDATA2/ CTS0/ GPIO3 | SDA1/RXD /GPIO44 |
| RTCVSSA | RTCCROUT | ADIN0/ GPI52 | ADVDD | PADVDD | BUFENB2/ GPIO30 | EBUIN3/CM D_SDIO2/ GPIO14 | SCLK1/ GPIO20 | SDA0/ SDATA3/ GPIO42 | DDATA0/ CTS1/SDAT A0_SDIO1/ GPIO1 | USBGND | N/C | N/C | N/C | N/C |
| ADIN1/ GPI53 | ADIN2/ GPI54 | ADIN3/ GPI55 | ADGND | GND | PADVDD | GND | PADVDD | GND | PADVDD | USBGND | USBVDDP | USBVDD | USB_CRIN | USB_CROUT |
| ADIN4/ GPI56 | ADREF | CRIN | PLLCORE VDD | IDE_DIOR/ GPIO31 | EBUIN2/ SCLKOUT/ GPIO13 | CS1/ QSPICS3/ GPIO28 | QSPIDOUT/ SFSY/ GPIO27 | CFLG/ GPIO5 | LRCK3/ AUDCLK/ GPIO43 | USBID | USBGND | USBVDD | USBRES | USBDF |
| OSCPAD VDD | CROUT | PLLCORE VDD | PLLCORE GND | TA/GPIO12 | EBUIN1/ GPIO36 | RCK/QSPID IN/QSPIDO UT/GPIO26 | QSPICS1/ EBUOUT2/ GPIO16 | SDATA11/ GPIO17 | SDATA13/ GPIO8 | N/C | N/C | N/C | USBVBUS | USBDFN |
| OSCPAD GND | PLLCORE VDD | PLLCORE GND | IDE_D10W/ GPIO32 | BUFENB1/ GPIO29 | EBUOUT1/ GPIO37 | QSPICLK/ SUBR/ GPIO25 | LRCK1/ GPIO19 | QSPICS2/ MCLK2/ GPIO24 | SCL0/SDAT A1_BS1/ GPIO41 | N/C | N/C | TESTOUT | N/C | N/C |
| GND | PLLCORE GND | OE | IDE_IORDY/ GPIO33 | WAKEUP/ GPIO21 | XTRIM/ TXD2/ GPIO0 | QSPICS0/ EBUIN4/ GPIO15 | SDATA01/ TOUT0/ GPIO18 | EF/RXD2/ GPIO6 | SCLK3/ GPIO35 | DDATA1/RT S1/SDATA2 _BS2/ GPIO2 | N/C | PADVDD | NC | GND |

Figure 7. MCF5251 Ball Map

Table 19 shows the signal color and signal name legend.

Table 19. Signal Color/Name Legend



| Color | Name |
|---|-----------------------|
| None | Signal name as listed |
|  | GND |
|  | PADVDD |

Table 19. Signal Color/Name Legend (continued)

| Color | Name |
|-------|---------|
| | COREVDD |
| | USBGND |

Table 20 shows the device pin list, sorted by signal identification.

Table 20. MCF5251 13 x 13 BGA (225 Signal ID by Pad Grid Location)

| Signal ID | Pad Location |
|--------------------|--------------|
| A1 | H03 |
| A10 | F02 |
| A11 | G05 |
| A12 | F03 |
| A13 | F01 |
| A14 | E01 |
| A15 | G04 |
| A16 | E02 |
| A17 | F04 |
| A18 | E03 |
| A19 | F05 |
| A2 | H02 |
| A20/A24 | F06 |
| A21 | D03 |
| A22 | D01 |
| A23/GPO54 | D02 |
| A3 | H01 |
| A4 | H05 |
| A5 | G01 |
| A6 | G03 |
| A7 | G02 |
| A8 | H04 |
| A9 | H06 |
| ADGND | L04 |
| ADIN0/GPI52 | K03 |
| ADIN1/GPI53 | L01 |
| ADIN2/GPI54 | L02 |
| ADIN3/GPI55 | L03 |
| ADIN4/GPI56 | M01 |
| ADIN5/GPI57 | J06 |
| ADOUT/SCLK4/GPIO58 | J05 |
| ADREF | M02 |
| ADVDD | K04 |
| ATA_A0 | A08 |
| ATA_A1 | B07 |
| ATA_A2 | B08 |
| ATA_CS0 | C09 |
| ATA_CS1 | D09 |

Table 20. MCF5251 13 x 13 BGA (225 Signal ID by Pad Grid Location) (continued)

| Signal ID | Pad Location |
|---|--------------|
| ATA_D0 | B09 |
| ATA_D1 | A09 |
| ATA_D10 | C11 |
| ATA_D11 | A11 |
| ATA_D12 | A12 |
| ATA_D13 | E11 |
| ATA_D14 | B12 |
| ATA_D15 | D12 |
| ATA_D2 | F08 |
| ATA_D3 | F09 |
| ATA_D4 | B10 |
| ATA_D5 | C10 |
| ATA_D6 | A10 |
| ATA_D7 | D10 |
| ATA_D8 | D11 |
| ATA_D9 | B11 |
| ATA_DIOR | B15 |
| ATA_DIOW | A13 |
| ATA_DMACK | C12 |
| ATA_DMARQ | A07 |
| ATA_INTRQ | D08 |
| ATA_IORDY | D07 |
| $\overline{\text{ATA_RST}}$ | C08 |
| BCLK/GPIO40 | B05 |
| BCLKE/GPIO63 | E06 |
| $\overline{\text{BUFENB1}}$ /GPIO29 | P05 |
| $\overline{\text{BUFENB2}}$ /GPIO30 | K06 |
| CAN0_RX | D13 |
| CAN0_TX | C15 |
| CAN1_RX | E12 |
| CAN1_TX | C14 |
| CFLG/GPIO5 | M09 |
| COREVDD | G08 |
| COREVDD | H07 |
| COREVDD | H09 |
| COREVDD | J08 |
| CRIN | M03 |
| CROUT | N02 |
| $\overline{\text{CS0}}$ / $\overline{\text{CS4}}$ | J03 |
| $\overline{\text{CS1}}$ /QSPICS3/GPIO28 | M07 |
| D16 | C01 |
| D17 | E04 |
| D18 | E05 |
| D19 | B01 |
| D20 | C02 |
| D21 | D04 |

Table 20. MCF5251 13 x 13 BGA (225 Signal ID by Pad Grid Location) (continued)

| Signal ID | Pad Location |
|--|--------------|
| D22 | C03 |
| D23 | B02 |
| D24 | A02 |
| D25 | B03 |
| D26 | A03 |
| D27 | C04 |
| D28 | B04 |
| D29 | D05 |
| D30 | A04 |
| D31 | C05 |
| DDATA0/ $\overline{\text{CTS1}}$ /SDATA0_SDIO1/GPIO1 | K10 |
| DDATA1/ $\overline{\text{RTS1}}$ /SDATA2_BS2/GPIO2 | R11 |
| DDATA2/ $\overline{\text{CTS0}}$ /GPIO3 | J14 |
| DDATA3/ $\overline{\text{RTS0}}$ /GPIO4 | J12 |
| EBUIN1/GPIO36 | N06 |
| EBUIN2/SCLKOUT/GPIO13 | M06 |
| EBUIN3/CMD_SDIO2/GPIO14 | K07 |
| EBUOUT1/GPIO37 | P06 |
| EF/RXD2/GPIO6 | R09 |
| GND | A01 |
| GND | A15 |
| GND | E08 |
| GND | E10 |
| GND | F07 |
| GND | G06 |
| GND | G07 |
| GND | G09 |
| GND | G11 |
| GND | J07 |
| GND | J09 |
| GND | J10 |
| GND | J11 |
| GND | L05 |
| GND | L07 |
| GND | L09 |
| GND | R01 |
| GND | R15 |
| $\overline{\text{HI_Z}}$ | B13 |
| $\overline{\text{IDE_DIOR}}$ /GPIO31 | M05 |
| $\overline{\text{IDE_DIOW}}$ /GPIO32 | P04 |
| $\overline{\text{IDE_IORDY}}$ /GPIO33 | R04 |
| LINGND | C13 |
| LININ | A14 |
| LINOUT | B14 |
| LRCK1/GPIO19 | P08 |
| LRCK2/GPIO23 | E14 |

Table 20. MCF5251 13 x 13 BGA (225 Signal ID by Pad Grid Location) (continued)

| Signal ID | Pad Location |
|-----------------------------|--------------|
| LRCK3/AUDIOCLK/GPIO43 | M10 |
| MCLK1/GPIO11 | D14 |
| NC | R14 |
| \overline{OE} | R03 |
| OSCPADGND | P01 |
| OSCPADVDD | N01 |
| PADVDD | E07 |
| PADVDD | E09 |
| PADVDD | F10 |
| PADVDD | H08 |
| PADVDD | H11 |
| PADVDD | K05 |
| PADVDD | L06 |
| PADVDD | L08 |
| PADVDD | L10 |
| PADVDD | R13 |
| PLLAVDD | M04 |
| PLLCOREGND | N04 |
| PLLCOREGND | P03 |
| PLLCOREGND | R02 |
| PLLCOREVDD | N03 |
| PLLCOREVDD | P02 |
| PST0/GPIO50 | G15 |
| PST1/GPIO49 | G12 |
| PST2/INTMON2/GPIO48 | H14 |
| PST3/INTMON1/GPIO47 | H13 |
| PSTCLK/GPIO51 | G14 |
| QSPICLK/SUBR/GPIO25 | P07 |
| QSPICS0/EBUIN4/GPIO15 | R07 |
| QSPICS1/EBUOUT2/GPIO16 | N08 |
| QSPICS2/MCLK2/GPIO24 | P09 |
| QSPIDOUT/SFSY/GPIO27 | M08 |
| RCK/QSPIDIN/QSPIDOUT/GPIO26 | N07 |
| RSTI | E15 |
| RTC_CRIN | J01 |
| RTC_VDDA | J02 |
| RTCCROUT | K02 |
| RTCVSSA | K01 |
| RW | J04 |
| RXD0/GPIO46 | H15 |
| SCL0/SDATA1_BS1/GPIO41 | P10 |
| SCL1/TXD1/GPIO10 | J13 |
| SCLK1/GPIO20 | K08 |
| SCLK2/GPIO22 | E13 |
| SCLK3/GPIO35 | R10 |
| SDA0/SDATA3/GPIO42 | K09 |

Table 20. MCF5251 13 x 13 BGA (225 Signal ID by Pad Grid Location) (continued)

| Signal ID | Pad Location |
|-----------------------|--------------|
| SDA1/RXD1/GPIO44 | J15 |
| SDATA11/GPIO17 | N09 |
| SDATAI3/GPIO8 | N10 |
| SDATAO1/TOOUT0/GPIO18 | R08 |
| SDATAO2/GPIO34 | D15 |
| SDCAS/GPIO39 | D06 |
| SDCS0/GPIO60 | B06 |
| SDLQDM/GPIO52 | C06 |
| SDRAS/GPIO59 | A06 |
| SDUDQM/GPIO53 | A05 |
| SDWE/GPIO38 | C07 |
| T̄A/GPIO12 | N05 |
| TCK | F13 |
| TDI/DSI | F15 |
| TDO/DSO | G13 |
| TEST0 | F11 |
| TEST1 | G10 |
| TEST2 | H10 |

How to Reach Us:

Home Page:
www.freescale.com

E-mail:
support@freescale.com

USA/Europe or Locations Not Listed:
Freescale Semiconductor
Technical Information Center, CH370
1300 N. Alma School Road
Chandler, Arizona 85224
+1-800-521-6274 or +1-480-768-2130
support@freescale.com

Europe, Middle East, and Africa:
Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
support@freescale.com

Japan:
Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064, Japan
0120 191014 or +81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:
Freescale Semiconductor Hong Kong Ltd.
Technical Information Center
2 Dai King Street
Tai Po Industrial Estate
Tai Po, N.T., Hong Kong
+800 2666 8080
support.asia@freescale.com

For Literature Requests Only:
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Table 20. MCF5251 13 x 13 BGA (225 Signal ID by Pad Grid Location) (continued)

| Signal ID | Pad Location |
|------------------------------------|--------------|
| TESTOUT | P13 |
| TMS/BKPT | F12 |
| $\overline{\text{TRST}}$ /DSCLK | F14 |
| TXD0/GPIO45 | H12 |
| USB_CRIN | L14 |
| USB_CROUT | L15 |
| USBDN | N15 |
| USBDP | M15 |
| USBGND | K11 |
| USBGND | L11 |
| USBGND | M12 |
| USBID | M11 |
| USBRES | M14 |
| USBVBUS | N14 |
| USBVDD | L13 |
| USBVDD | M13 |
| USBVDDP | L12 |
| $\overline{\text{WAKEUP}}$ /GPIO21 | R05 |
| XTRIM/TXD2/GPIO0 | R06 |

6 Product Documentation

This section includes the related product documentation and references to information posted on Freescale's external web page.

This document is labeled as the type: Data Sheet: Technical Data. Definitions for all Freescale document types are available at: <http://www.freescale.com>.

You can also obtain information on the mechanical characteristics of the MCF5251 integrated microprocessor at <http://www.freescale.com/digitalaudio>.

The following documents are required for a complete description of the device and are necessary for proper design:

MCF5251 Reference Manual (order number: MCF5251RM)

MCF5251 Product Brief (order number: MCF5251PB)

6.1 Revision History

Table 21 summarizes revisions to this document since the release of Rev. 2.1.

Table 21. Revision History

| Location | Revision |
|----------|---|
| Table 1 | Removed MCF5251CDVM140, MCF5251CEVM140, MCF5251DVM140, MCF5251EVM140. |

