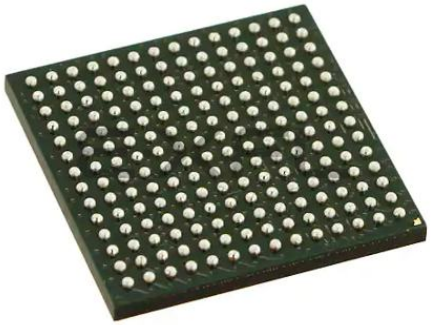

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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Not For New Designs
Core Processor	Coldfire V3
Core Size	32-Bit Single-Core
Speed	240MHz
Connectivity	EBI/EMI, Ethernet, I²C, SPI, SSI, UART/USART, USB, USB OTG
Peripherals	DMA, POR, PWM, WDT
Number of I/O	62
Program Memory Size	-
Program Memory Type	ROMless
EEPROM Size	-
RAM Size	32K x 8
Voltage - Supply (Vcc/Vdd)	1.4V ~ 3.6V
Data Converters	-
Oscillator Type	External
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	196-LBGA
Supplier Device Package	196-LBGA (15x15)
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/mcf5373lcvm240

Table of Contents

Table 1. MCF537*x* Family Configurations (continued)

Module	MCF5372	MCF5372L	MCF53721	MCF5373	MCF5373L
Static RAM (SRAM)	32 Kbytes				
SDR/DDR SDRAM Controller	•	•	•	•	•
USB 2.0 Host	—	•	•	—	•
USB 2.0 On-the-Go	—	•	•	—	•
Synchronous Serial Interface (SSI)	•	•	•	•	•
Fast Ethernet Controller (FEC)	•	•	•	•	•
Cryptography Hardware Accelerators	—	—	—	•	•
Embedded Voice-over-IP System Solution	—	—	•	—	—
FlexCAN 2.0B communication module	—	—	•	—	—
UARTs	3	3	3	3	3
I^2C	•	•	•	•	•
QSPI	•	•	•	•	•
PWM Module	—	•	•	—	•
Real Time Clock	•	•	•	•	•
32-bit DMA Timers	4	4	4	4	4
Watchdog Timer (WDT)	•	•	•	•	•
Periodic Interrupt Timers (PIT)	4	4	4	4	4
Edge Port Module (EPORT)	•	•	•	•	•
Interrupt Controllers (INTC)	2	2	2	2	2
16-channel Direct Memory Access (DMA)	•	•	•	•	•
FlexBus External Interface	•	•	•	•	•
General Purpose I/O (GPIO)	up to 46	up to 62	up to 62	up to 46	up to 62
JTAG - IEEE® 1149.1 Test Access Port	•	•	•	•	•
Package	160 QFP	196 MAPBGA	196 MAPBGA	160 QFP	196 MAPBGA

2 Ordering Information

Table 2. Orderable Part Numbers

Freescale Part Number	Description	Package	Speed	Temperature
MCF5372CAB180	MCF5372 RISC Microprocessor	160 QFP	180 MHz	–40° to +85° C
MCF5372LCVM240	MCF5372 RISC Microprocessor	196 MAPBGA	240 MHz	–40° to +85° C
MCF53721CVM240	MCF53721 RISC Microprocessor	196 MAPBGA	240 MHz	–40° to +85° C
MCF5373CAB180	MCF5373 RISC Microprocessor	160 QFP	180 MHz	–40° to +85° C
MCF5373LCVM240	MCF5373 RISC Microprocessor	196 MAPBGA	240 MHz	–40° to +85° C

Table 3. MCF5372/3 Signal Information and Muxing (continued)

Signal Name	GPIO	Alternate 1	Alternate 2	Dir.[1]	Voltage Domain	MCF5372 MCF5373 160 QFP	MCF5372L MCF53721 MCF5373L 196 MAPBGA
USB Host & USB On-the-Go							
USBOTG_M	—	—	—	I/O	USB VDD	—	H14
USBOTG_P	—	—	—	I/O	USB VDD	—	H13
USBHOST_M	—	—	—	I/O	USB VDD	—	J13
USBHOST_P	—	—	—	I/O	USB VDD	—	J12
FlexCAN (MCF53721 only)							
CANRX and CANTX do not have dedicated bond pads. Please refer to the following pins for muxing: I2C_SDA for CANRX and I2C_SCL for CANTX.							
PWM							
PWM7	PPWM7	—	—	I/O	EVDD	—	E13
PWM5	PPWM5	—	—	I/O	EVDD	—	E12
PWM3	PPWM3	DT3OUT	DT3IN	I/O	EVDD	—	E11
PWM1	PPWM1	DT2OUT	DT2IN	I/O	EVDD	—	F14
SSI							
The SSI signals do not have dedicated bond pads. Please refer to the following pins for muxing: $\overline{\text{IRQ4}}$ for SSI_MCLK, $\overline{\text{IRQ1}}$ for SSI_CLKIN, $\overline{\text{U1CTS}}$ for SSI_BCLK, $\overline{\text{U1RTS}}$ for SSI_FS, U1RXD for SSI_RXD, and U1TXD for SSI_TXD							
I²C							
I2C_SCL[2]	PFECI2C1	CANTX[6]	U2TXD	I/O	EVDD	—	E3
I2C_SDA[2]	PFECI2C0	CANRX[6]	U2RXD	I/O	EVDD	—	E4
DMA							
$\overline{\text{DACK}}$[1:0] and $\overline{\text{DREQ}}$[1:0] do not have dedicated bond pads. Please refer to the following pins for muxing: $\overline{\text{TS}}$ for $\overline{\text{DACK0}}$, DT0IN for $\overline{\text{DREQ0}}$, DT1IN for $\overline{\text{DACK1}}$, and $\overline{\text{IRQ1}}$ for $\overline{\text{DREQ1}}$.							
QSPI							
QSPI_CS2	PQSPI5	$\overline{\text{U2RTS}}$	—	O	EVDD	78	N12
QSPI_CS1	PQSPI4	PWM7	USBOTG_PU_EN	O	EVDD	—	M12
QSPI_CS0	PQSPI3	PWM5	—	O	EVDD	—	M11
QSPI_CLK	PQSPI2	I2C_SCL[2]	—	O	EVDD	77	P12
QSPI_DIN	PQSPI1	$\overline{\text{U2CTS}}$	—	I	EVDD	75	P11
QSPI_DOUT	PQSPI0	I2C_SDA[2]	—	O	EVDD	76	N11

Table 3. MCF5372/3 Signal Information and Muxing (continued)

Signal Name	GPIO	Alternate 1	Alternate 2	Dir.[1]	Voltage Domain	MCF5372 MCF5373 160 QFP	MCF5372L MCF53721 MCF5373L 196 MAPBGA
Test							
TEST[8]	—	—	—	I	EVDD	124	E10
Power Supplies							
EVDD	—	—	—	—	—	9, 69, 71, 81, 94, 103, 139, 160	E6, E7, F5–F7, G5, H10, J8, K8–K9
IVDD	—	—	—	—	—	36, 79, 97, 125, 156	E5, J9, K5, K10
PLL_VDD	—	—	—	—	—	99	J10
SD_VDD	—	—	—	—	—	11, 39, 41, 67, 105, 121, 137	E8–E9, F8–F10, J4–J7, H5, K6, K7
USB_VDD	—	—	—	—	—	—	H12
VSS	—	—	—	—	—	10, 42, 68, 82, 89, 104, 122, 138, 159	G6–G9, H6–H9
PLL_VSS	—	—	—	—	—	98	H11
USB_VSS	—	—	—	—	—	—	J14

1 Refers to pin's primary function.

2 Pull-up enabled internally on this signal for this mode.

3 The SDRAM functions of these signals are not programmable by the user. They are dynamically switched by the processor when accessing SDRAM memory space and are included here for completeness.

4 Primary functionality selected by asserting the DRAMSEL signal (SDR mode). Alternate functionality selected by negating the DRAMSEL signal (DDR mode). The GPIO module is not responsible for assigning these pins.

5 GPIO functionality is determined by the edge port module. The GPIO module is only responsible for assigning the alternate functions.

6 MCF53721 only.

7 If JTAG_EN is asserted, these pins default to Alternate 1 (JTAG) functionality. The GPIO module is not responsible for assigning these pins.

8 Pull-down enabled internally on this signal for this mode.

NOTE

4.3 Pinout—160 QFP

The pinout for the MCF5372CAB180 and MCF5373CAB180 packages is shown below.

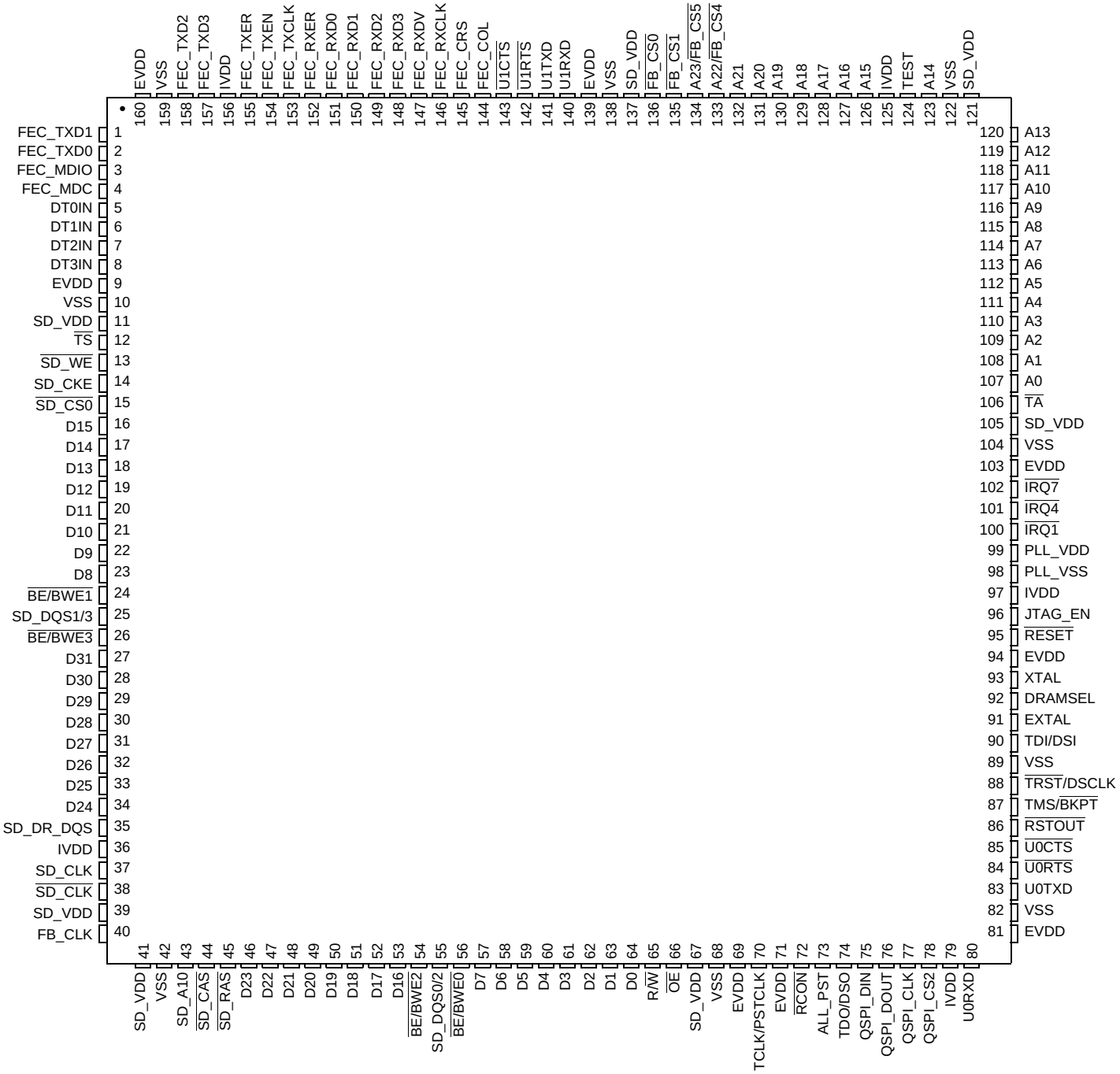

Figure 5. MCF5372CAB180 and MCF5373CAB180 Pinout Top View (160 QFP)

5.2 Thermal Characteristics

Table 5. Thermal Characteristics

Characteristic		Symbol	256MBGA	196MBGA	160QFP	Unit
Junction to ambient, natural convection	Four layer board (2s2p)	θ_{JMA}	37[1,2]	42[1,2]	49[1,2]	°C/W
Junction to ambient (@200 ft/min)	Four layer board (2s2p)	θ_{JMA}	34[1,2]	38[1,2]	44[1,2]	°C/W
Junction to board		θ_{JB}	27[3]	32[3]	40[3]	°C/W
Junction to case		θ_{JC}	16[4]	19[4]	39[4]	°C/W
Junction to top of package		Ψ_{jt}	4[1,5]	5[1,5]	12[1,5]	°C/W
Maximum operating junction temperature		T_j	105	105	105	°C

1 θ_{JMA} and Ψ_{jt} parameters are simulated in conformance with EIA/JESD Standard 51-2 for natural convection. Freescale recommends the use of θ_{JmA} and power dissipation specifications in the system design to prevent device junction temperatures from exceeding the rated specification. System designers should be aware that device junction temperatures can be significantly influenced by board layout and surrounding devices. Conformance to the device junction temperature specification can be verified by physical measurement in the customer's system using the Ψ_{jt} parameter, the device power dissipation, and the method described in EIA/JESD Standard 51-2.

2 Per JEDEC JESD51-6 with the board horizontal.

3 Thermal resistance between the die and the printed circuit board in conformance with JEDEC JESD51-8. Board temperature is measured on the top surface of the board near the package.

4 Thermal resistance between the die and the case top surface as measured by the cold plate method (MIL SPEC-883 Method 1012.1).

5 Thermal characterization parameter indicating the temperature difference between package top and the junction temperature per JEDEC JESD51-2. When Greek letters are not available, the thermal characterization parameter is written in conformance with Psi-JT.

The average chip-junction temperature (T_J) in °C can be obtained from:

$$T_J = T_A + (P_D \times \Theta_{JMA}) \quad \textit{Eqn. 1}$$

Where:

T_A = Ambient Temperature, °C
Q_{JMA} = Package Thermal Resistance, Junction-to-Ambient, °C/W
P_D = P_{INT} + $P_{I/O}$
P_{INT} = I_{DD} × IV_{DD}, Watts - Chip Internal Power
$P_{I/O}$ = Power Dissipation on Input and Output Pins — User Determined

For most applications $P_{I/O} < P_{INT}$ and can be ignored. An approximate relationship between P_D and T_J (if $P_{I/O}$ is neglected) is:

$$P_D = \frac{K}{(T_J + 273°C)} \quad \textit{Eqn. 2}$$

Solving equations 1 and 2 for K gives:

$$K = P_D \times (T_A \times 273°C) + Q_{JMA} \times P_D^2 \quad \textit{Eqn. 3}$$

where K is a constant pertaining to the particular part. K can be determined from Equation 3 by measuring P_D (at equilibrium) for a known T_A. Using this value of K, the values of P_D and T_J can be obtained by solving Equation 1 and Equation 2 iteratively for any value of T_A.

5.3 ESD Protection

Table 6. ESD Protection Characteristics[1, 2]

Characteristics	Symbol	Value	Units
ESD Target for Human Body Model	HBM	2000	V

1 All ESD testing is in conformity with CDF-AEC-Q100 Stress Test Qualification for Automotive Grade Integrated Circuits.

2 A device is defined as a failure if after exposure to ESD pulses the device no longer meets the device specification requirements. Complete DC parametric and functional testing is performed per applicable device specification at room temperature followed by hot temperature, unless specified otherwise in the device specification.

5.4 DC Electrical Specifications

Table 7. DC Electrical Specifications

Characteristic	Symbol	Min	Max	Unit
Core Supply Voltage	IV_{DD}	1.4	1.6	V
PLL Supply Voltage	$PLLV_{DD}$	1.4	1.6	V
CMOS Pad Supply Voltage	EV_{DD}	3.0	3.6	V
SDRAM and FlexBus Supply Voltage Mobile DDR/Bus Pad Supply Voltage (nominal 1.8V) DDR/Bus Pad Supply Voltage (nominal 2.5V) SDR/Bus Pad Supply Voltage (nominal 3.3V)	SDV_{DD}	 1.70 2.25 3.0	 1.95 2.75 3.6	V
USB Supply Voltage	$USBV_{DD}$	3.0	3.6	V
CMOS Input High Voltage	EV_{IH}	2	EV_{DD} + 0.3	V
CMOS Input Low Voltage	EV_{IL}	V_{SS} – 0.3	0.8	V
CMOS Output High Voltage I_{OH} = –5.0 mA	EV_{OH}	EV_{DD} _ 0.4	—	V
CMOS Output Low Voltage I_{OL} = 5.0 mA	EV_{OL}	—	0.4	V
SDRAM and FlexBus Input High Voltage Mobile DDR/Bus Input High Voltage (nominal 1.8V) DDR/Bus Pad Supply Voltage (nominal 2.5V) SDR/Bus Pad Supply Voltage (nominal 3.3V)	SDV_{IH}	 1.35 1.7 2	 SDV_{DD} + 0.3 SDV_{DD} + 0.3 SDV_{DD} + 0.3	V
SDRAM and FlexBus Input Low Voltage Mobile DDR/Bus Input High Voltage (nominal 1.8V) DDR/Bus Pad Supply Voltage (nominal 2.5V) SDR/Bus Pad Supply Voltage (nominal 3.3V)	SDV_{IL}	 V_{SS} – 0.3 V_{SS} – 0.3 V_{SS} – 0.3	 0.45 0.8 0.8	V
SDRAM and FlexBus Output High Voltage Mobile DDR/Bus Input High Voltage (nominal 1.8V) DDR/Bus Pad Supply Voltage (nominal 2.5V) SDR/Bus Pad Supply Voltage (nominal 3.3V) I_{OH} = –5.0 mA for all modes	SDV_{OH}	 SDV_{DD} – 0.35 2.1 2.4	 — — —	V

Table 8. PLL Electrical Characteristics (continued)

Num	Characteristic	Symbol	Min. Value	Max. Value	Unit
14	Discrete load capacitance for EXTAL	C_{L_EXTAL}		$2*C_L - C_{S\_EXTAL} - C_{PCB\_EXTAL}$ [7]	pF
17	CLKOUT Period Jitter, [3, 4, 7, 8, 9] Measured at f_{SYS} Max Peak-to-peak Jitter (Clock edge to clock edge) Long Term Jitter	C_{jitter}	 — —	 10 TBD	 % $f_{sys/3}$ % $f_{sys/3}$
18	Frequency Modulation Range Limit [3, 10, 11] (f_{sys}Max must not be exceeded)	C_{mod}	0.8	2.2	%$f_{sys/3}$
19	VCO Frequency. $f_{vco} = (f_{ref} * PFD)/4$	f_{vco}	350	540	MHz

1 The maximum allowable input clock frequency when booting with the PLL enabled is 24MHz. For higher input clock frequencies the processor must boot in LIMP mode to avoid violating the maximum allowable CPU frequency.

2 All internal registers retain data at 0 Hz.

3 This parameter is guaranteed by characterization before qualification rather than 100% tested.

4 Proper PC board layout procedures must be followed to achieve specifications.

5 This parameter is guaranteed by design rather than 100% tested.

6 This specification is the PLL lock time only and does not include oscillator start-up time.

7 C_{PCB_EXTAL} and C_{PCB_XTAL} are the measured PCB stray capacitances on EXTAL and XTAL, respectively.

8 Jitter is the average deviation from the programmed frequency measured over the specified interval at maximum f_{sys}. Measurements are made with the device powered by filtered supplies and clocked by a stable external clock signal. Noise injected into the PLL circuitry via PLL V_{DD}, EV_{DD}, and V_{SS} and variation in crystal oscillator frequency increase the Cjitter percentage for a given interval.

9 Values are with frequency modulation disabled. If frequency modulation is enabled, jitter is the sum of Cjitter+Cmod.

10 Modulation percentage applies over an interval of 10 μs, or equivalently the modulation rate is 100 KHz.

11 Modulation range determined by hardware design.

5.6 External Interface Timing Characteristics

Table 9 lists processor bus input timings.

NOTE

All processor bus timings are synchronous; that is, input setup/hold and output delay with respect to the rising edge of a reference clock. The reference clock is the FB_CLK output.

All other timing relationships can be derived from these values. Timings listed in Table 9 are shown in Figure 7 and Figure 8.

Table 9. FlexBus AC Timing Specifications (continued)

Num	Characteristic	Symbol	Min	Max	Unit
FB4	Data Input Setup	t_{DVFBCH}	3.5	—	ns
FB5	Data Input Hold	t_{DIFBCH}	0	—	ns
FB6	Transfer Acknowledge ($\overline{TA}$) Input Setup	t_{CVFBCH}	4	—	ns
FB7	Transfer Acknowledge ($\overline{TA}$) Input Hold	t_{CIFBCH}	0	—	ns

1 Timing for chip selects only applies to the $\overline{FB\_CS}$[5:0] signals. Please see Section 5.7.2, "DDR SDRAM AC Timing Characteristics" for SD_CS[3:0] timing.

2 The FlexBus supports programming an extension of the address hold. Please consult the *Reference Manual* for more information.

NOTE

The processor drives the data lines during the first clock cycle of the transfer with the full 32-bit address. This may be ignored by standard connected devices using non-multiplexed address and data buses. However, some applications may find this feature beneficial.

The address and data busses are muxed between the FlexBus and SDRAM controller. At the end of the read and write bus cycles the address signals are indeterminate.

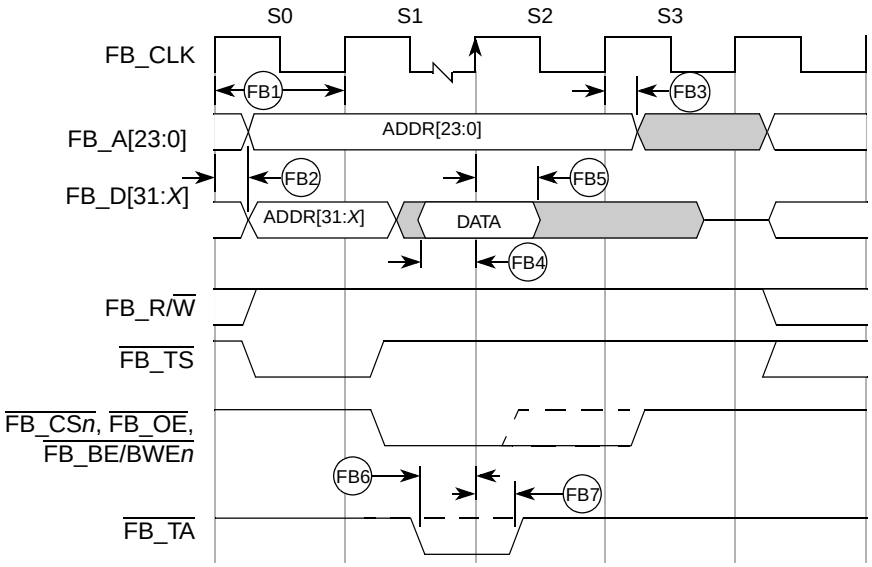

Figure 7. FlexBus Read Timing

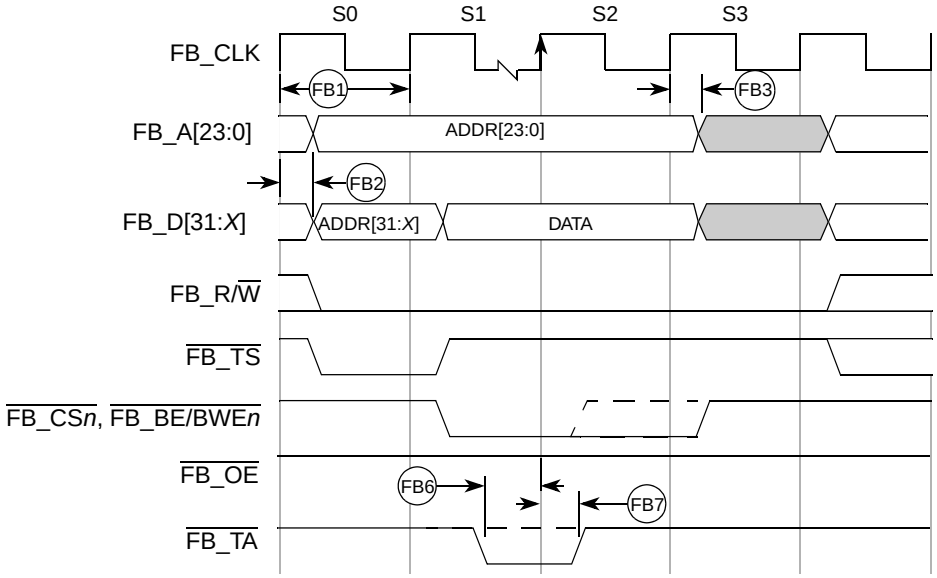

Figure 8. FlexBus Write Timing

5.7 SDRAM Bus

The SDRAM controller supports accesses to main SDRAM memory from any internal master. It supports standard SDRAM or double data rate (DDR) SDRAM, but it does not support both at the same time.

5.7.1 SDR SDRAM AC Timing Characteristics

The following timing numbers indicate when data is latched or driven onto the external bus, relative to the memory bus clock, when operating in SDR mode on write cycles and relative to SD_DQS on read cycles. The device's SDRAM controller is a DDR controller that has an SDR mode. Because it is designed to support DDR, a DQS pulse must remain supplied to the device for each data beat of an SDR read. The processor accomplishes this by asserting a signal named SD_SDR_DQS during read cycles. Care must be taken during board design to adhere to the following guidelines and specs with regard to the SD_SDR_DQS signal and its usage.

Table 10. SDR Timing Specifications

Symbol	Characteristic	Symbol	Min	Max	Unit
•	Frequency of Operation[1]	•	60	80	MHz
SD1	Clock Period[2]	t_{SDCK}	12.5	16.67	ns
SD3	Pulse Width High[3]	t_{SDCKH}	0.45	0.55	SD_CLK
SD4	Pulse Width Low[4]	t_{SDCKH}	0.45	0.55	SD_CLK
SD5	Address, SD_CKE, $\overline{\text{SD\_CAS}}$, $\overline{\text{SD\_RAS}}$, $\overline{\text{SD\_WE}}$, SD_BA, SD_CS[1:0] - Output Valid	$t_{SDCHACV}$	—	0.5 × SD_CLK + 1.0	ns
SD6	Address, SD_CKE, $\overline{\text{SD\_CAS}}$, $\overline{\text{SD\_RAS}}$, $\overline{\text{SD\_WE}}$, SD_BA, SD_CS[1:0] - Output Hold	$t_{SDCHACI}$	2.0	—	ns
SD7	SD_SDR_DQS Output Valid[5]	t_{DQSOV}	—	Self timed	ns
SD8	SD_DQS[3:0] input setup relative to SD_CLK[6]	$t_{DQVSDCH}$	0.25 × SD_CLK	0.40 × SD_CLK	ns

Table 11. DDR Timing Specifications (continued)

Num	Characteristic	Symbol	Min	Max	Unit
DD8	Data and Data Mask Output Hold (DQS-->DQ) Relative to DQS (DDR Write Mode)[6]	t_{DQDMI}	1.0	—	ns
DD9	Input Data Skew Relative to DQS (Input Setup)[7]	t_{DVDQ}	—	1	ns
DD10	Input Data Hold Relative to DQS[8]	t_{DIDQ}	0.25 × SD_CLK + 0.5ns	—	ns
DD11	DQS falling edge from SDCLK rising (output hold time)	$t_{DQLSDCH}$	0.5	—	ns
DD12	DQS input read preamble width	t_{DQRPRE}	0.9	1.1	SD_CLK
DD13	DQS input read postamble width	t_{DQRPST}	0.4	0.6	SD_CLK
DD14	DQS output write preamble width	t_{DQWPRE}	0.25		SD_CLK
DD15	DQS output write postamble width	t_{DQWPST}	0.4	0.6	SD_CLK

1 SD_CLK is one SDRAM clock in (ns).

2 Pulse width high plus pulse width low cannot exceed min and max clock period.

3 Command output valid should be 1/2 the memory bus clock (SD_CLK) plus some minor adjustments for process, temperature, and voltage variations.

4 This specification relates to the required input setup time of today's DDR memories. The processor's output setup should be larger than the input setup of the DDR memories. If it is not larger, the input setup on the memory is in violation. MEM_DATA[31:24] is relative to MEM_DQS[3], MEM_DATA[23:16] is relative to MEM_DQS[2], MEM_DATA[15:8] is relative to MEM_DQS[1], and MEM_[7:0] is relative MEM_DQS[0].

5 The first data beat is valid before the first rising edge of DQS and after the DQS write preamble. The remaining data beats are valid for each subsequent DQS edge.

6 This specification relates to the required hold time of today's DDR memories. MEM_DATA[31:24] is relative to MEM_DQS[3], MEM_DATA[23:16] is relative to MEM_DQS[2], MEM_DATA[15:8] is relative to MEM_DQS[1], and MEM_[7:0] is relative MEM_DQS[0].

7 Data input skew is derived from each DQS clock edge. It begins with a DQS transition and ends when the last data line becomes valid. This input skew must include DDR memory output skew and system level board skew (due to routing or other factors).

8 Data input hold is derived from each DQS clock edge. It begins with a DQS transition and ends when the first data line becomes invalid.

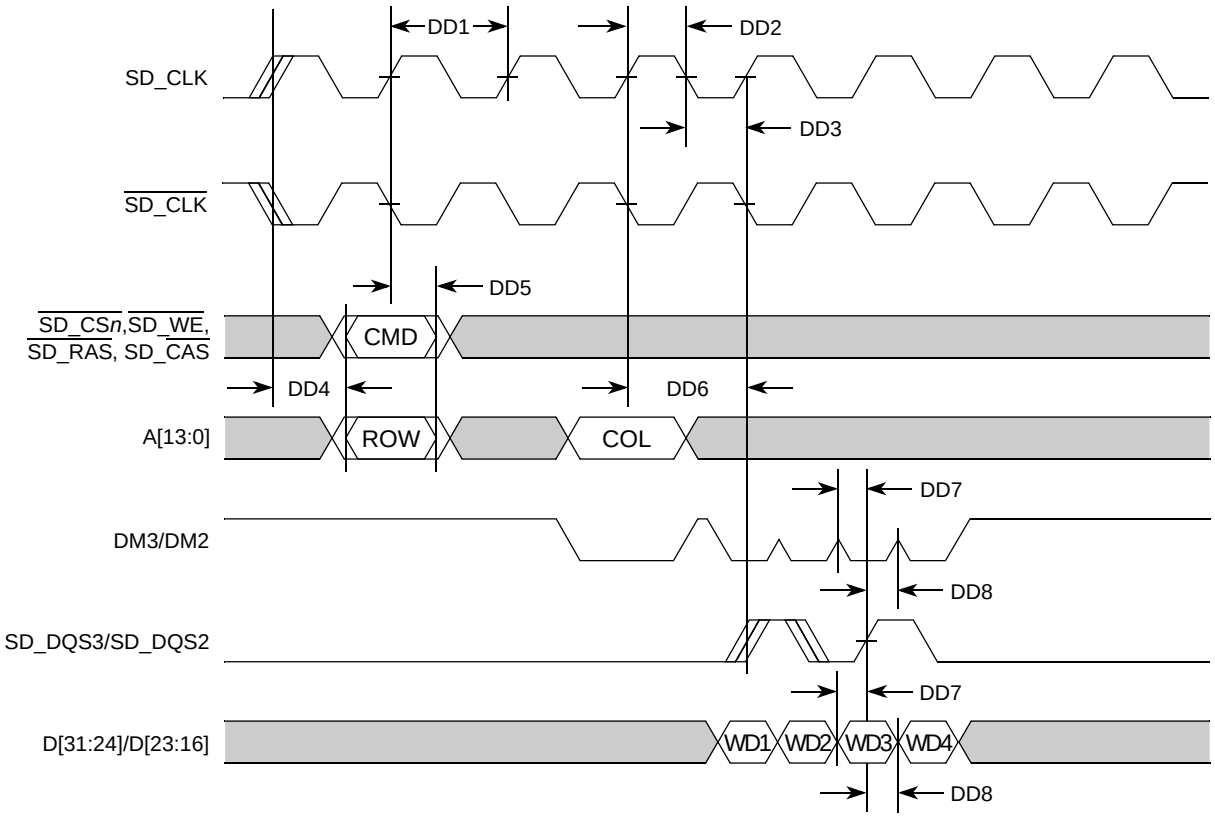

Figure 11. DDR Write Timing

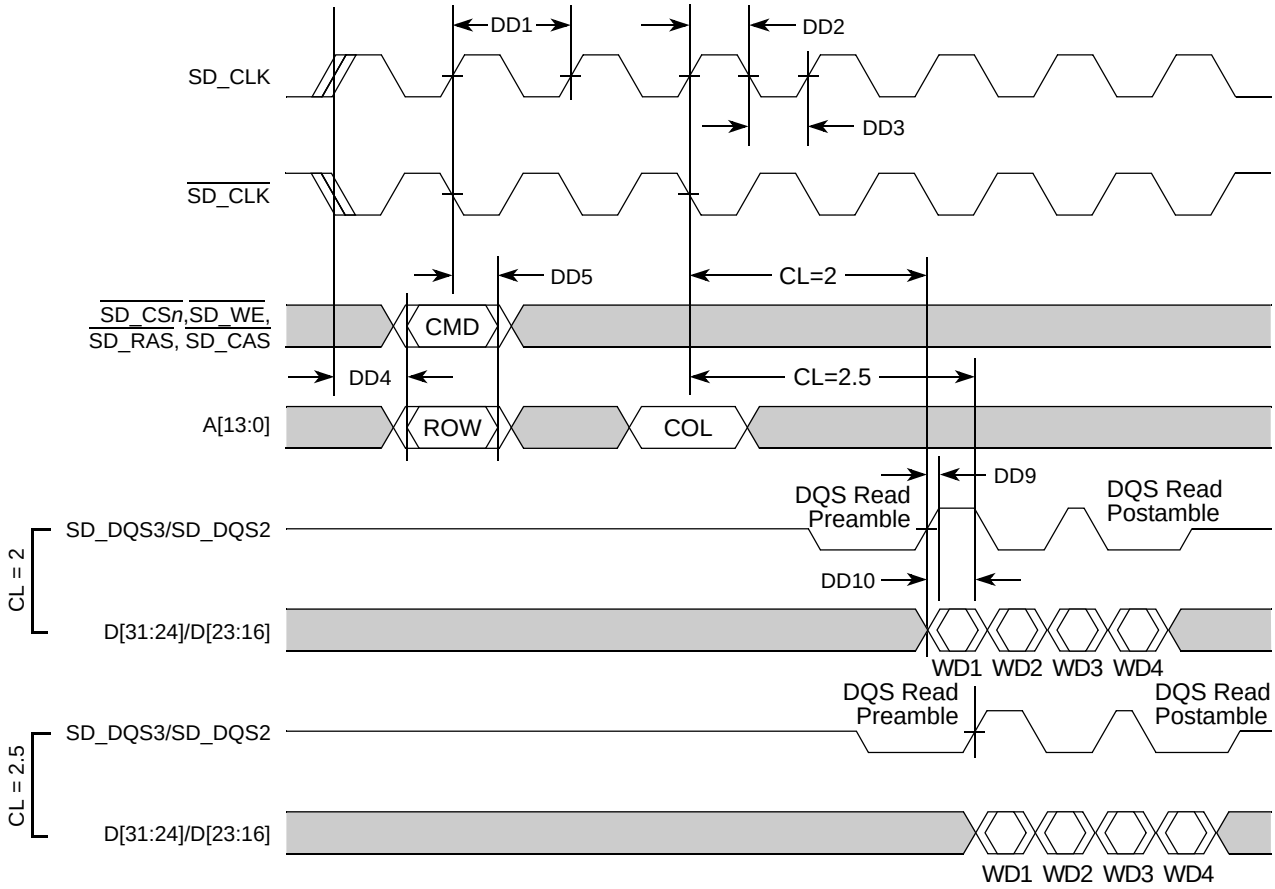

Figure 12. DDR Read Timing

5.8 General Purpose I/O Timing

Table 12. GPIO Timing[1]

Num	Characteristic	Symbol	Min	Max	Unit
G1	FB_CLK High to GPIO Output Valid	t_{CHPOV}	—	10	ns
G2	FB_CLK High to GPIO Output Invalid	t_{CHPOI}	1.5	—	ns
G3	GPIO Input Valid to FB_CLK High	t_{PVCH}	9	—	ns
G4	FB_CLK High to GPIO Input Invalid	t_{CHPI}	1.5	—	ns

1 GPIO pins include: $\overline{IRQn}$, PWM, UART, FlexCAN, and Timer pins.

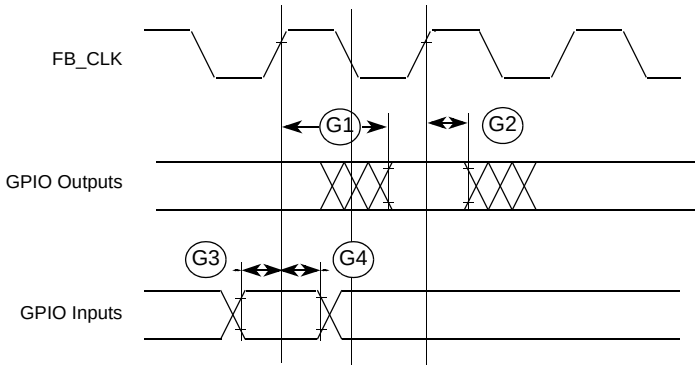

Figure 13. GPIO Timing

5.9 Reset and Configuration Override Timing

Table 13. Reset and Configuration Override Timing

Num	Characteristic	Symbol	Min	Max	Unit
R1	$\overline{\text{RESET}}$ Input valid to FB_CLK High	t_{RVCH}	9	—	ns
R2	FB_CLK High to $\overline{\text{RESET}}$ Input invalid	t_{CHRI}	1.5	—	ns
R3	$\overline{\text{RESET}}$ Input valid Time [1]	t_{RIVT}	5	—	t_{CYC}
R4	FB_CLK High to $\overline{\text{RSTOUT}}$ Valid	t_{CHROV}	—	10	ns
R5	$\overline{\text{RSTOUT}}$ valid to Config. Overrides valid	t_{ROVCV}	0	—	ns
R6	Configuration Override Setup Time to $\overline{\text{RSTOUT}}$ invalid	t_{COS}	20	—	t_{CYC}
R7	Configuration Override Hold Time after $\overline{\text{RSTOUT}}$ invalid	t_{COH}	0	—	ns
R8	$\overline{\text{RSTOUT}}$ invalid to Configuration Override High Impedance	t_{ROICZ}	—	1	t_{CYC}

1 During low power STOP, the synchronizers for the $\overline{\text{RESET}}$ input are bypassed and $\overline{\text{RESET}}$ is asserted asynchronously to the system. Thus, $\overline{\text{RESET}}$ must be held a minimum of 100 ns.

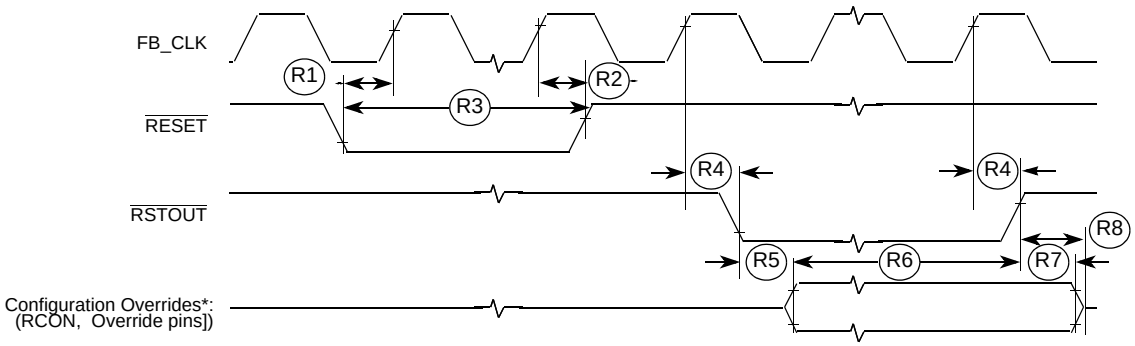

Figure 14. $\overline{\text{RESET}}$ and Configuration Override Timing

NOTE

Refer to the CCM chapter of the *MCF5373 Reference Manual* for more information.

5.10 USB On-The-Go

The MCF5373 device is compliant with industry standard USB 2.0 specification.

5.11 SSI Timing Specifications

This section provides the AC timings for the SSI in master (clocks driven) and slave modes (clocks input). All timings are given for non-inverted serial clock polarity (SSI_TCR[TSCKP] = 0, SSI_RCR[RSCKP] = 0) and a non-inverted frame sync (SSI_TCR[TFSI] = 0, SSI_RCR[RFSI] = 0). If the polarity of the clock and/or the frame sync have been inverted, all the timings remain valid by inverting the clock signal (SSI_BCLK) and/or the frame sync (SSI_FS) shown in the figures below.

Table 14. SSI Timing – Master Modes[1]

Num	Description	Symbol	Min	Max	Units
S1	SSI_MCLK cycle time[2]	t_{MCLK}	$8 \times t_{SYS}$	—	ns
S2	SSI_MCLK pulse width high / low		45%	55%	t_{MCLK}
S3	SSI_BCLK cycle time[3]	t_{BCLK}	$8 \times t_{SYS}$	—	ns
S4	SSI_BCLK pulse width		45%	55%	t_{BCLK}
S5	SSI_BCLK to SSI_FS output valid		—	15	ns
S6	SSI_BCLK to SSI_FS output invalid		-2	—	ns
S7	SSI_BCLK to SSI_TXD valid		—	15	ns
S8	SSI_BCLK to SSI_TXD invalid / high impedence		-4	—	ns
S9	SSI_RXD / SSI_FS input setup before SSI_BCLK		15	—	ns
S10	SSI_RXD / SSI_FS input hold after SSI_BCLK		0	—	ns

1 All timings specified with a capactive load of 25pF.

2 SSI_MCLK can be generated from SSI_CLKIN or a divided version of the internal system clock (SYSCLK).

3 SSI_BCLK can be derived from SSI_CLKIN or a divided version of SYSCLK. If the SYSCLK is used, the minimum divider is 6. If the SSI_CLKIN input is used, the programmable dividers must be set to ensure that SSI_BCLK does not exceed 4 x f_{SYS}.

Table 15. SSI Timing – Slave Modes[1]

Num	Description	Symbol	Min	Max	Units
S11	SSI_BCLK cycle time	t_{BCLK}	$8 \times t_{SYS}$	—	ns
S12	SSI_BCLK pulse width high/low		45%	55%	t_{BCLK}
S13	SSI_FS input setup before SSI_BCLK		10	—	ns
S14	SSI_FS input hold after SSI_BCLK		3	—	ns
S15	SSI_BCLK to SSI_TXD/SSI_FS output valid		—	15	ns
S16	SSI_BCLK to SSI_TXD/SSI_FS output invalid/high impedence		-2	—	ns
S17	SSI_RXD setup before SSI_BCLK		10	—	ns
S18	SSI_RXD hold after SSI_BCLK		3	—	ns

1 All timings specified with a capactive load of 25pF.

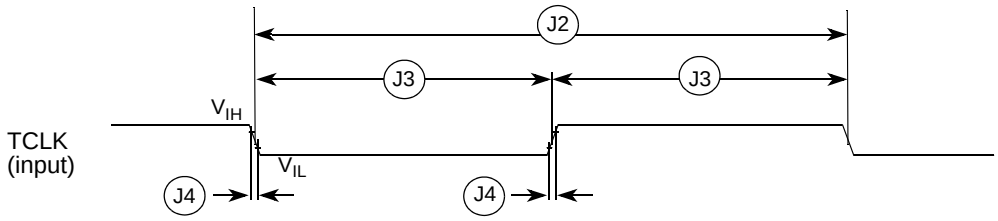

Figure 23. Test Clock Input Timing

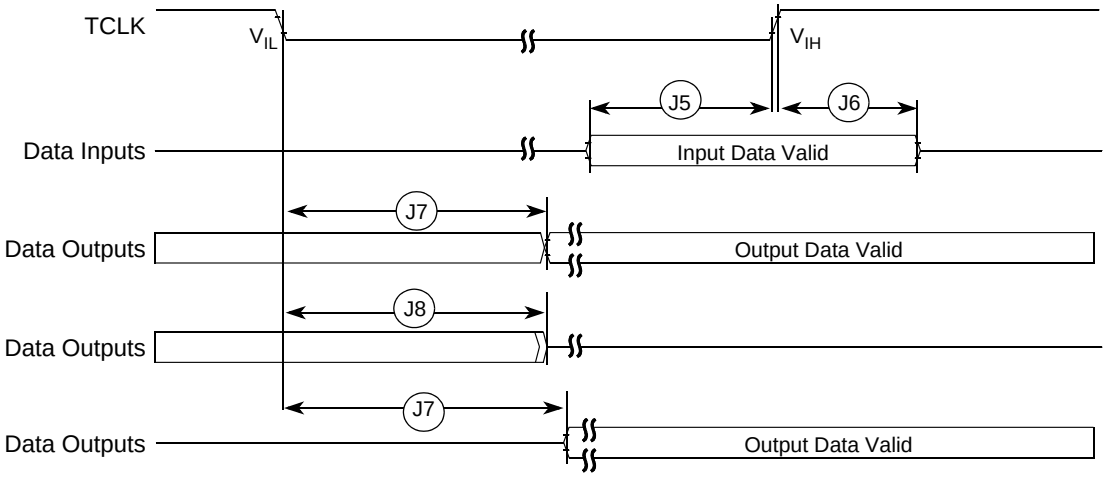

Figure 24. Boundary Scan (JTAG) Timing

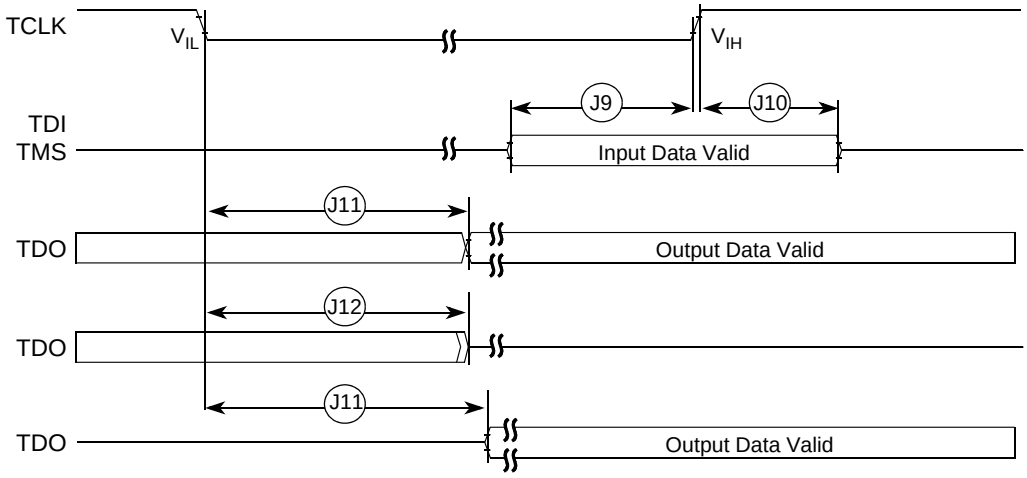

Figure 25. Test Access Port Timing

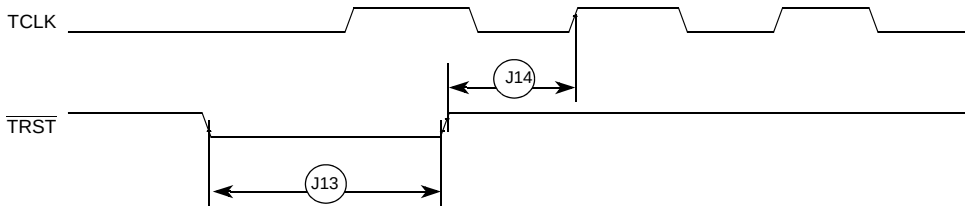

Figure 26. $\overline{\text{TRST}}$ Timing

Table 26. Current Consumption in Low-Power Modes[1,2]

Mode	Voltage	58 MHz (Typ)[3]	64 MHz (Typ)[3]	72 MHz (Typ)[3]	80 MHz (Typ)[3]	80 MHz (Peak)[4]	Units
Stop Mode 3 (Stop 11)[5]	3.3 V	3.9	3.92	4.0	4.0	4.0	mA
	1.5 V	1.04	1.04	1.04	1.04	1.08	
Stop Mode 2 (Stop 10)[4]	3.3 V	4.69	4.72	4.8	4.8	4.8	
	1.5 V	2.69	2.69	2.70	2.70	2.75	
Stop Mode 1(Stop 01)[4]	3.3 V	4.72	4.73	4.81	4.81	4.81	
	1.5 V	15.28	16.44	17.85	19.91	20.42	
Stop Mode 0 (Stop 00)[4]	3.3 V	21.65	21.68	24.33	26.13	26.16	
	1.5 V	15.47	16.63	18.06	20.12	20.67	
Wait/Doze	3.3 V	22.49	22.52	25.21	27.03	39.8	
	1.5 V	26.79	28.85	30.81	34.47	97.4	
Run	3.3 V	33.61	33.61	42.3	50.5	62.6	
	1.5 V	56.3	60.7	65.4	73.4	132.3	

1 All values are measured with a 3.30V EV_{DD}, 3.30V SDV_{DD} and 1.5V IV_{DD} power supplies. Tests performed at room temperature with pins configured for high drive strength.

2 Refer to the Power Management chapter in the *MCF537x Reference Manual* for more information on low-power modes.

3 All peripheral clocks except UART0, FlexBus, INTC0, reset controller, PLL, and edge port off before entering low power mode. All code executed from flash.

4 All peripheral clocks on before entering low power mode. All code is executed from flash.

5 See the description of the low-power control register (LCPR) in the *MCF537x Reference Manual* for more information on stop modes 0–3.

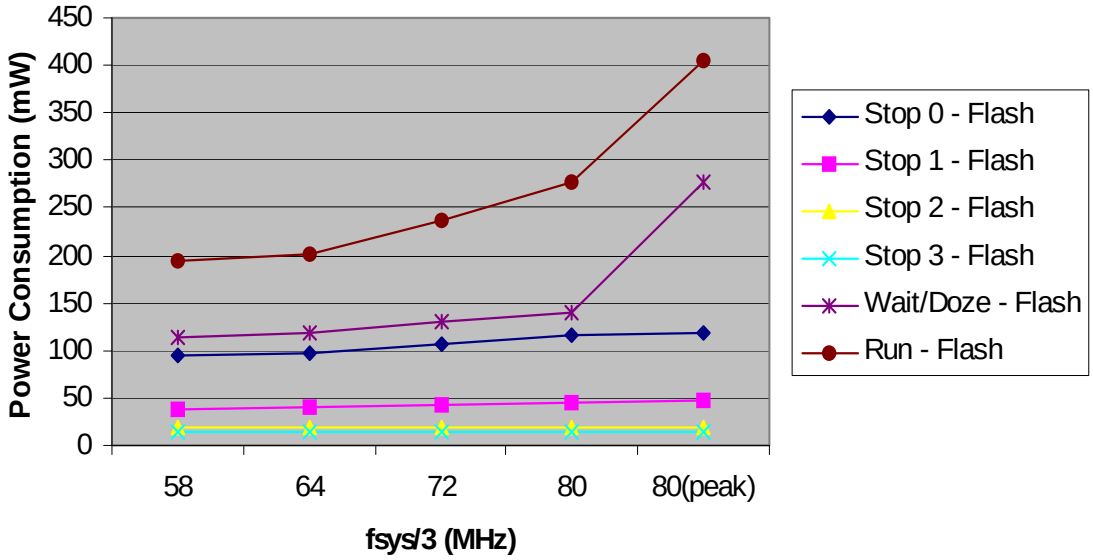

Figure 29. Current Consumption in Low-Power Modes

7.2 Package Dimensions—160 QFP

Figure 32 and Figure 33 show the MCF5372CAB180 and MCF5373CAB180 package dimensions.

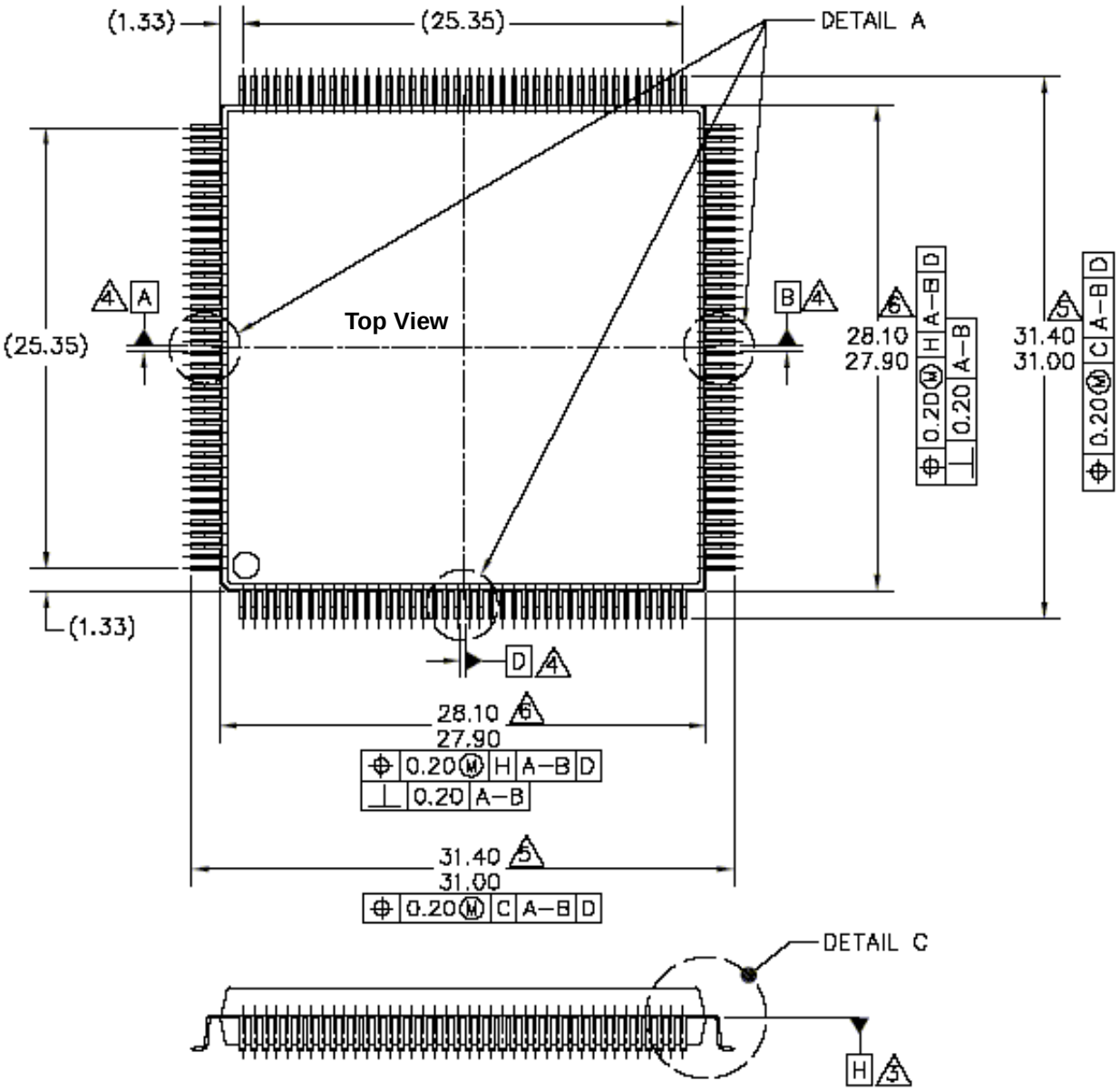

Figure 32. 160QFP Package Dimensions (Sheet 1 of 2)

Table 28. MCF5373DS Document Revision History (continued)

Rev. No.	Substantive Changes	Date of Release
3	• Removed cryptography from Table 1 for the MCF53721 device. • Corrected D0 spec in Table 25 from 1.5 x t_{sys} to 2 x t_{sys} for min and max balues. • Updated FlexBus read and write timing diagrams in Figure 7 and Figure 8. • Corrected package information in Table 2 for MCF5373LCVM240 device from “256 MAPBGA” to “196 MAPBGA”. • Removed footnote 2 from the IRQ[7:1] alternate functions USBHOST VBUS_EN, USBHOST VBUS_OC, SSI_MCLK, USB_CLKIN, and SSI_CLKIN signals in Table 6.	4/2008
4	Changed the following specs in Table 10 and Table 11: • Minimum frequency of operation from TBD to 60MHz • Maximum clock period from TBD to 16.67 ns Added FlexCAN for the MCF53721 device in features list, block diagram, Signal Information and Muxing table, and GPIO timing diagram	11/2008