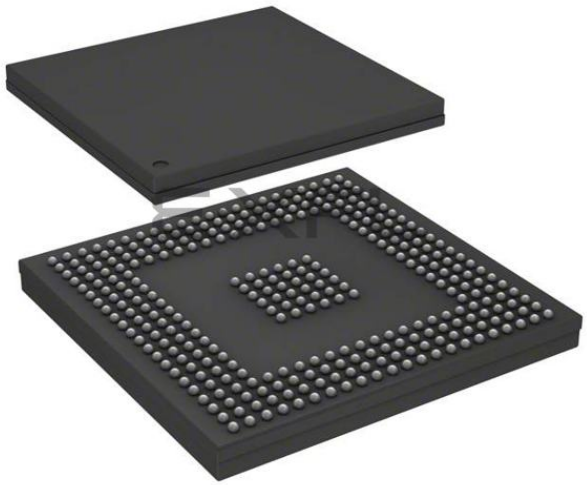

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Product Status	Active
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Speed	132MHz
Connectivity	CANbus, EBI/EMI, Ethernet, SCI, SPI
Peripherals	DMA, POR, PWM, WDT
Number of I/O	238
Program Memory Size	2MB (2M x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	80K x 8
Voltage - Supply (Vcc/Vdd)	1.35V ~ 1.65V
Data Converters	A/D 40x12b
Oscillator Type	External
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	324-BBGA
Supplier Device Package	324-PBGA (23x23)
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/spc5567mvz132

[2] The lowest ambient operating temperature is referenced by T_L; the highest ambient operating temperature is referenced by T_H.

[3] Speed is the nominal maximum frequency. Max. speed is the maximum speed allowed including frequency modulation (FM). 82 MHz parts allow for 80 MHz system clock + 2% FM; 114 MHz parts allow for 112 MHz system clock + 2% FM; and 135 MHz parts allow for 132 MHz system clock + 2% FM.

3 Electrical Characteristics

This section contains detailed information on power considerations, DC/AC electrical characteristics, and AC timing specifications for the MCU.

3.1 Maximum Ratings

Table 2. Absolute Maximum Ratings [1]

Spec	Characteristic	Symbol	Min.	Max.	Unit
1	1.5 V core supply voltage [2]	V_{DD}	–0.3	1.7	V
2	Flash program/erase voltage	V_{PP}	–0.3	6.5	V
4	Flash read voltage	V_{FLASH}	–0.3	4.6	V
5	SRAM standby voltage	V_{STBY}	–0.3	1.7	V
6	Clock synthesizer voltage	V_{DDSYN}	–0.3	4.6	V
7	3.3 V I/O buffer voltage	V_{DD33}	–0.3	4.6	V
8	Voltage regulator control input voltage	V_{RC33}	–0.3	4.6	V
9	Analog supply voltage (reference to V_{SSA})	V_{DDA}	–0.3	5.5	V
10	I/O supply voltage (fast I/O pads) [3]	V_{DDE}	–0.3	4.6	V
11	I/O supply voltage (slow and medium I/O pads) [3]	V_{DDEH}	–0.3	6.5	V
12	DC input voltage [4] V_{DDEH} powered I/O pads V_{DDE} powered I/O pads	V_{IN}	 –1.0 [5] –1.0 [5]	 6.5 [6] 4.6 [7]	V
13	Analog reference high voltage (reference to V_{RL})	V_{RH}	–0.3	5.5	V
14	V_{SS} to V_{SSA} differential voltage	$V_{SS} – V_{SSA}$	–0.1	0.1	V
15	V_{DD} to V_{DDA} differential voltage	$V_{DD} – V_{DDA}$	$–V_{DDA}$	V_{DD}	V
16	V_{REF} differential voltage	$V_{RH} – V_{RL}$	–0.3	5.5	V
17	V_{RH} to V_{DDA} differential voltage	$V_{RH} – V_{DDA}$	–5.5	5.5	V
18	V_{RL} to V_{SSA} differential voltage	$V_{RL} – V_{SSA}$	–0.3	0.3	V
19	V_{DDEH} to V_{DDA} differential voltage	$V_{DDEH} – V_{DDA}$	$–V_{DDA}$	V_{DDEH}	V
20	V_{DDF} to V_{DD} differential voltage	$V_{DDF} – V_{DD}$	–0.3	0.3	V
21	V_{RC33} to V_{DDSYN} differential voltage spec has been moved to Table 9 DC Electrical Specifications, Spec 43a.				
22	V_{SSSYN} to V_{SS} differential voltage	$V_{SSSYN} – V_{SS}$	–0.1	0.1	V
23	V_{RCVSS} to V_{SS} differential voltage	$V_{RCVSS} – V_{SS}$	–0.1	0.1	V
24	Maximum DC digital input current [8] (per pin, applies to all digital pins) [4]	I_{MAXD}	–2	2	mA
25	Maximum DC analog input current [9] (per pin, applies to all analog pins)	I_{MAXA}	–3	3	mA

The thermal characterization parameter is measured in compliance with the JESD51-2 specification using a 40-gauge type T thermocouple epoxied to the top center of the package case. Position the thermocouple so that the thermocouple junction rests on the package. Place a small amount of epoxy on the thermocouple junction and approximately 1 mm of wire extending from the junction. Place the thermocouple wire flat against the package case to avoid measurement errors caused by the cooling effects of the thermocouple wire.

References:

Semiconductor Equipment and Materials International
3081 Zanker Rd.
San Jose, CA., 95134
(408) 943-6900

MIL-SPEC and EIA/JESD (JEDEC) specifications are available from Global Engineering Documents at 800-854-7179 or 303-397-7956.

JEDEC specifications are available on the web at http://www.jedec.org.

1. C.E. Triplett and B. Joiner, “An Experimental Characterization of a 272 PBGA Within an Automotive Engine Controller Module,” Proceedings of SemiTherm, San Diego, 1998, pp. 47–54.
2. G. Kromann, S. Shidore, and S. Addison, “Thermal Modeling of a PBGA for Air-Cooled Applications,” Electronic Packaging and Production, pp. 53–58, March 1998.
3. B. Joiner and V. Adams, “Measurement and Simulation of Junction to Board Thermal Resistance and Its Application in Thermal Modeling,” Proceedings of SemiTherm, San Diego, 1999, pp. 212–220.

3.3 Package

The MPC5567 is available in packaged form. Read the package options in Section 2, “Ordering Information.” Refer to Section 4, “Mechanicals,” for pinouts and package drawings.

3.4 EMI (Electromagnetic Interference) Characteristics

Table 4. EMI Testing Specifications [1]

Spec	Characteristic	Minimum	Typical	Maximum	Unit
1	Scan range	0.15	—	1000	MHz
2	Operating frequency	—	—	f_{MAX}	MHz
3	V_{DD} operating voltages	—	1.5	—	V
4	V_{DDSYN}, V_{RC33}, V_{DD33}, V_{FLASH}, V_{DDE} operating voltages	—	3.3	—	V
5	V_{PP}, V_{DDEH}, V_{DDA} operating voltages	—	5.0	—	V
6	Maximum amplitude	—	—	14 [2] 32 [3]	dBuV
7	Operating temperature	—	—	25	°C

1 EMI testing and I/O port waveforms per SAE J1752/3 issued 1995-03. Qualification testing was performed on the MPC5554 and applied to the MPC5500 family as generic EMI performance data.

2 Measured with the single-chip EMI program.

3 Measured with the expanded EMI program.

3.5 ESD (Electromagnetic Static Discharge) Characteristics

Table 5. ESD Ratings [1, 2]

Characteristic	Symbol	Value	Unit
ESD for human body model (HBM)		2000	V
HBM circuit description	R1	1500	Ω
	C	100	pF
ESD for field induced charge model (FDCM)		500 (all pins) 750 (corner pins)	V
Number of pulses per pin: Positive pulses (HBM) Negative pulses (HBM)	 — —	 1 1	 — —
Interval of pulses	—	1	second

1 All ESD testing conforms to CDF-AEC-Q100 Stress Test Qualification for Automotive Grade Integrated Circuits.

2 Device failure is defined as: 'If after exposure to ESD pulses, the device does not meet the device specification requirements, which includes the complete DC parametric and functional testing at room temperature and hot temperature.

3.6 Voltage Regulator Controller (V_{RC}) and Power-On Reset (POR) Electrical Specifications

The following table lists the V_{RC} and POR electrical specifications:

Table 6. V_{RC} and POR Electrical Specifications

Spec	Characteristic		Symbol	Min.	Max.	Units
1	1.5 V (V_{DD}) POR [1]	Negated (ramp up) Asserted (ramp down)	V_{POR15}	1.1 1.1	1.35 1.35	V
2	3.3 V (V_{DDSYN}) POR [1]	Asserted (ramp up) Negated (ramp up) Asserted (ramp down) Negated (ramp down)	V_{POR33}	0.0 2.0 2.0 0.0	0.30 2.85 2.85 0.30	V
3	$\overline{\text{RESET}}$ pin supply (V_{DDEH6}) POR [1, 2]	Negated (ramp up) Asserted (ramp down)	V_{POR5}	2.0 2.0	2.85 2.85	V
4	V_{RC33} voltage	Before V_{RC} allows the pass transistor to start turning on	V_{TRANS_START}	1.0	2.0	V
5		When V_{RC} allows the pass transistor to completely turn on [3, 4]	V_{TRANS_ON}	2.0	2.85	V
6		When the voltage is greater than the voltage at which the V_{RC} keeps the 1.5 V supply in regulation [5, 6]	$V_{VRC33REG}$	3.0	—	V
7	Current can be sourced by V_{RCCTL} at Tj:	–40° C 25° C 150° C	I_{VRCCTL} [7]	11.0 9.0 7.5	— — —	mA mA mA
8	Voltage differential during power up such that: V_{DD33} can lag V_{DDSYN} or V_{DDEH6} before V_{DDSYN} and V_{DDEH6} reach the V_{POR33} and V_{POR5} minimums respectively.		V_{DD33_LAG}	—	1.0	V

3.7.1 Input Value of Pins During POR Dependent on V_{DD33}

When powering up the device, V_{DD33} must not lag the latest V_{DDSYN} *or* $\overline{\text{RESET}}$ power pin (V_{DDEH6}) by more than the V_{DD33} lag specification listed in Table 6, spec 8. This avoids accidentally selecting the bypass clock mode because the internal versions of PLLCFG[0:1] and $\overline{\text{RSTCFG}}$ are not powered and therefore cannot read the default state when POR negates. V_{DD33} can lag V_{DDSYN} *or* the $\overline{\text{RESET}}$ power pin (V_{DDEH6}), but cannot lag both by more than the V_{DD33} lag specification. This V_{DD33} lag specification applies during power up only. V_{DD33} has no lead or lag requirements when powering down.

3.7.2 Power-Up Sequence (V_{RC33} Grounded)

The 1.5 V V_{DD} power supply must rise to 1.35 V before the 3.3 V V_{DDSYN} power supply and the $\overline{\text{RESET}}$ power supply rises above 2.0 V. This ensures that digital logic in the PLL for the 1.5 V power supply does not begin to operate below the specified operation range lower limit of 1.35 V. Because the internal 1.5 V POR is disabled, the internal 3.3 V POR or the $\overline{\text{RESET}}$ power POR must hold the device in reset. Since they can negate as low as 2.0 V, V_{DD} must be within specification before the 3.3 V POR and the $\overline{\text{RESET}}$ POR negate.

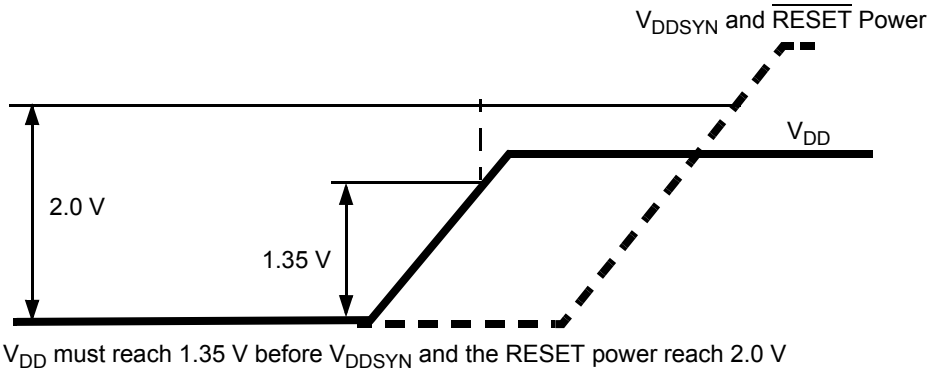

Figure 3. Power-Up Sequence (V_{RC33} Grounded)

3.7.3 Power-Down Sequence (V_{RC33} Grounded)

The only requirement for the power-down sequence with V_{RC33} grounded is if V_{DD} decreases to less than its operating range, V_{DDSYN} or the $\overline{\text{RESET}}$ power must decrease to less than 2.0 V before the V_{DD} power increases to its operating range. This ensures that the digital 1.5 V logic, which is reset only by an ORed POR and can cause the 1.5 V supply to decrease less than its specification value, resets correctly. See Table 6, footnote 1.

3.8 DC Electrical Specifications

Table 9. DC Electrical Specifications ($T_A = T_L$ to T_H)

Spec	Characteristic	Symbol	Min	Max.	Unit
1	Core supply voltage (average DC RMS voltage)	V_{DD}	1.35	1.65	V
2	Input/output supply voltage (fast input/output) [1]	V_{DDE}	1.62	3.6	V
3	Input/output supply voltage (slow and medium input/output)	V_{DDEH}	3.0	5.25	V
4	3.3 V input/output buffer voltage	V_{DD33}	3.0	3.6	V
5	Voltage regulator control input voltage	V_{RC33}	3.0	3.6	V
6	Analog supply voltage [2]	V_{DDA}	4.5	5.25	V
8	Flash programming voltage [3]	V_{PP}	4.5	5.25	V
9	Flash read voltage	V_{FLASH}	3.0	3.6	V
10	SRAM standby voltage [4]	V_{STBY}	0.8	1.2	V
11	Clock synthesizer operating voltage	V_{DDSYN}	3.0	3.6	V
12	Fast I/O input high voltage	V_{IH_F}	$0.65 \times V_{DDE}$	$V_{DDE} + 0.3$	V
13	Fast I/O input low voltage	V_{IL_F}	$V_{SS} - 0.3$	$0.35 \times V_{DDE}$	V
14	Medium and slow I/O input high voltage	V_{IH_S}	$0.65 \times V_{DDEH}$	$V_{DDEH} + 0.3$	V
15	Medium and slow I/O input low voltage	V_{IL_S}	$V_{SS} - 0.3$	$0.35 \times V_{DDEH}$	V
16	Fast input hysteresis	V_{HYS_F}	$0.1 \times V_{DDE}$		V
17	Medium and slow I/O input hysteresis	V_{HYS_S}	$0.1 \times V_{DDEH}$		V
18	Analog input voltage	V_{INDC}	$V_{SSA} - 0.3$	$V_{DDA} + 0.3$	V
19	Fast output high voltage (I_{OH_F} = –2.0 mA)	V_{OH_F}	$0.8 \times V_{DDE}$	—	V
20	Slow and medium output high voltage I_{OH_S} = –2.0 mA I_{OH_S} = –1.0 mA	V_{OH_S}	$0.80 \times V_{DDEH}$ $0.85 \times V_{DDEH}$	—	V
21	Fast output low voltage (I_{OL_F} = 2.0 mA)	V_{OL_F}	—	$0.2 \times V_{DDE}$	V
22	Slow and medium output low voltage I_{OL_S} = 2.0 mA I_{OL_S} = 1.0 mA	V_{OL_S}	—	 $0.20 \times V_{DDEH}$ $0.15 \times V_{DDEH}$	V
23	Load capacitance (fast I/O) [5] DSC (SIU_PCR[8:9]) = 0b00 = 0b01 = 0b10 = 0b11	C_L	 — — — —	 10 20 30 50	 pF pF pF pF
24	Input capacitance (digital pins)	C_{IN}	—	7	pF
25	Input capacitance (analog pins)	C_{IN_A}	—	10	pF
26	Input capacitance: (Shared digital and analog pins AN[12]_MA[0]_$\overline{SDS}$, AN[13]_MA[1]_SDO, AN[14]_MA[2]_SDI, and AN[15]_FCK)	C_{IN_M}	—	12	pF

[2] $|V_{DDA0} - V_{DDA1}|$ must be < 0.1 V.

[3] V_{PP} can drop to 3.0 V during read operations.

[4] If standby operation is not required, connect V_{STBY} to ground.

[5] Applies to CLKOUT, external bus pins, and Nexus pins.

[6] Maximum average RMS DC current.

[7] Average current measured on automotive benchmark.

[8] Peak currents can be higher on specialized code.

[9] High use current measured while running optimized SPE assembly code with all code and data 100% locked in cache (0% miss rate) with all channels of the eMIOS and eTPU running autonomously, plus the eDMA transferring data continuously from SRAM to SRAM. Higher currents are possible if an idle loop that crosses cache lines is run from cache. Write code to avoid this condition.

[10] The current specification relates to average standby operation after SRAM has been loaded with data. For power up current see Section 3.7, “Power-Up/Down Sequencing”, Figure 2.

[11] Power requirements for the V_{DD33} supply depend on the frequency of operation, load of all I/O pins, and the voltages on the I/O segments. Refer to Table 11 for values to calculate the power dissipation for a specific operation.

[12] Power requirements for each I/O segment are dependent on the frequency of operation and load of the I/O pins on a particular I/O segment, and the voltage of the I/O segment. Refer to Table 10 for values to calculate power dissipation for specific operation. The total power consumption of an I/O segment is the sum of the individual power consumptions for each pin on the segment.

[13] Absolute value of current, measured at V_{IL} and V_{IH}.

[14] Weak pullup/down inactive. Measured at V_{DDE} = 3.6 V and V_{DDEH} = 5.25 V. Applies to pad types: pad_fc, pad_sh, and pad_mh.

[15] Maximum leakage occurs at maximum operating temperature. Leakage current decreases by approximately one-half for each 8 ^{o}C to 12 ^{o}C, in the ambient temperature range of 50 ^{o}C to 125 ^{o}C. Applies to pad types: pad_a and pad_ae.

[16] V_{SSA} refers to both V_{SSA0} and V_{SSA1}. $|V_{SSA0} - V_{SSA1}|$ must be < 0.1 V.

[17] Up to 0.6 V during power up and power down.

3.10 eQADC Electrical Characteristics

Table 13. eQADC Conversion Specifications ($T_A = T_L$ to T_H)

Spec	Characteristic	Symbol	Minimum	Maximum	Unit
1	ADC clock (ADCLK) frequency [1]	F_{ADCLK}	1	12	MHz
2	Conversion cycles Differential Single ended	CC	 13 + 2 (15) 14 + 2 (16)	 13 + 128 (141) 14 + 128 (142)	ADCLK cycles
3	Stop mode recovery time [2]	T_{SR}	10	—	µs
4	Resolution [3]	—	1.25	—	mV
5	INL: 6 MHz ADC clock	INL6	–4	4	Counts [3]
6	INL: 12 MHz ADC clock	INL12	–8	8	Counts
7	DNL: 6 MHz ADC clock	DNL6	–3 [4]	3 [4]	Counts
8	DNL: 12 MHz ADC clock	DNL12	–6 [4]	6 [4]	Counts
9	Offset error with calibration	OFFWC	–4 [5]	4 [5]	Counts
10	Full-scale gain error with calibration	GAINWC	–8 [6]	8 [6]	Counts
11	Disruptive input injection current [7, 8, 9, 10]	I_{INJ}	–1	1	mA
12	Incremental error due to injection current. All channels are 10 kΩ < Rs <100 kΩ Channel under test has Rs = 10 kΩ, $I_{INJ} = I_{INJMAX}$, I_{INJMIN}	E_{INJ}	–4	4	Counts
13	Total unadjusted error (TUE) for single ended conversions with calibration [11, 12, 13, 14, 15]	TUE	–4	4	Counts

1 Conversion characteristics vary with F_{ADCLK} rate. Reduced conversion accuracy occurs at maximum F_{ADCLK} rate. The maximum value is based on 800 KS/s and the minimum value is based on 20 MHz oscillator clock frequency divided by a maximum 16 factor.

2 Stop mode recovery time begins when the ADC control register enable bits are set until the ADC is ready to perform conversions.

3 At $V_{RH} – V_{RL}$ = 5.12 V, one least significant bit (LSB) = 1.25, mV = one count.

4 Guaranteed 10-bit mono tonicity.

5 The absolute value of the offset error without calibration ≤ 100 counts.

6 The absolute value of the full scale gain error without calibration ≤ 120 counts.

7 Below disruptive current conditions, the channel being stressed has conversion values of: 0x3FF for analog inputs greater than V_{RH}, and 0x000 for values less than V_{RL}. This assumes that $V_{RH} \leq V_{DDA}$ and $V_{RL} \geq V_{SSA}$ due to the presence of the sample amplifier. Other channels are not affected by non-disruptive conditions.

8 Exceeding the limit can cause a conversion error on both stressed and unstressed channels. Transitions within the limit do not affect device reliability or cause permanent damage.

9 Input must be current limited to the value specified. To determine the value of the required current-limiting resistor, calculate resistance values using $V_{POSCLAMP} = V_{DDA}$ + 0.5 V and $V_{NEGCLAMP}$ = – 0.3 V, then use the larger of the calculated values.

10 This condition applies to two adjacent pads on the internal pad.

11 The TUE specification is always less than the sum of the INL, DNL, offset, and gain errors due to canceling errors.

12 TUE does not apply to differential conversions.

13 Measured at 6 MHz ADC clock. TUE with a 12 MHz ADC clock is: –16 counts < TUE < 16 counts.

14 TUE includes all internal device errors such as internal reference variation (75% Ref, 25% Ref).

15 Depending on the input impedance, the analog input leakage current (Table 9. DC Electrical Specifications, spec 35a) can affect the actual TUE measured on analog channels AN[12], AN[13], AN[14], AN[15].

3.11 H7Fa Flash Memory Electrical Characteristics

Table 14. Flash Program and Erase Specifications ($T_A = T_L$ to T_H)

Spec	Flash Program Characteristic	Symbol	Min.	Typical [1]	Initial Max. [2]	Max. [3]	Unit
3	Doubleword (64 bits) program time [4]	$T_{dwprogram}$	—	10	—	500	µs
4	Page program time [4]	$T_{pprogram}$	—	22	44 [5]	500	µs
7	16 KB block pre-program and erase time	$T_{16kpperase}$	—	265	400	5000	ms
9	48 KB block pre-program and erase time	$T_{48kpperase}$	—	345	400	5000	ms
10	64 KB block pre-program and erase time	$T_{64kpperase}$	—	415	500	5000	ms
8	128 KB block pre-program and erase time	$T_{128kpperase}$	—	500	1250	7500	ms
11	Minimum operating frequency for program and erase operations [6]	—	25	—	—	—	MHz

1 Typical program and erase times are calculated at 25 ^{o}C operating temperature using nominal supply values.

2 Initial factory condition: ≤ 100 program/erase cycles, 25 ^{o}C, using a typical supply voltage measured at a minimum system frequency of 80 MHz.

3 The maximum erase time occurs after the specified number of program/erase cycles. This maximum value is characterized but not guaranteed.

4 Actual hardware programming times. This does not include software overhead.

5 Page size is 256 bits (8 words).

6 The read frequency of the flash can range up to the maximum operating frequency. There is no minimum read frequency condition.

Table 15. Flash EEPROM Module Life ($T_A = T_L$ to T_H)

Spec	Characteristic	Symbol	Min.	Typical [1]	Unit
1a	Number of program/erase cycles per block for 16 KB, 48 KB, and 64 KB blocks over the operating temperature range (T_J)	P/E	100,000	—	cycles
1b	Number of program/erase cycles per block for 128 KB blocks over the operating temperature range (T_J)	P/E	1000	100,000	cycles
2	Data retention Blocks with 0–1,000 P/E cycles Blocks with 1,001–100,000 P/E cycles	Retention	 20 5	 — —	years

1 Typical endurance is evaluated at 25^{o} C. Product qualification is performed to the minimum specification. For additional information on the Freescale definition of typical endurance, refer to engineering bulletin EB619 Typical Endurance for Nonvolatile Memory.

3.13.3 Nexus Timing

Table 21. Nexus Debug Port Timing [1]

Spec	Characteristic	Symbol	Min.	Max.	Unit
1	MCKO cycle time	t_{MCYC}	1 [2]	8	t_{CYC}
2	MCKO duty cycle	t_{MDC}	40	60	%
3	MCKO low to MDO data valid [3]	t_{MDOV}	–1.5	3.0	ns
4	MCKO low to $\overline{\text{MSEO}}$ data valid [3]	t_{MSEOV}	–1.5	3.0	ns
5	MCKO low to $\overline{\text{EVTO}}$ data valid [3]	t_{EVTOV}	–1.5	3.0	ns
6	$\overline{\text{EVTI}}$ pulse width	t_{EVTIPW}	4.0	—	t_{TCYC}
7	$\overline{\text{EVTO}}$ pulse width	t_{EVTOPW}	1	—	t_{MCYC}
8	TCK cycle time	t_{TCYC}	4 [4]	—	t_{CYC}
9	TCK duty cycle	t_{TDC}	40	60	%
10	TDI, TMS data setup time	t_{NTDIS}, t_{NTMSS}	8	—	ns
11	TDI, TMS data hold time	t_{NTDIH}, t_{NTMSH}	5	—	ns
12	TCK low to TDO data valid V_{DDE} = 2.25–3.0 V V_{DDE} = 3.0–3.6 V	t_{JOV}	 0 0	 12 10	 ns ns
13	$\overline{\text{RDY}}$ valid to MCKO [5]	—	—	—	—

1 JTAG specifications apply when used for debug functionality. All Nexus timing relative to MCKO is measured from 50% of MCKO and 50% of the respective signal. Nexus timing specified at V_{DD} = 1.35–1.65 V, V_{DDE} = 2.25–3.6 V, V_{DD33} and V_{DDSYN} = 3.0–3.6 V, T_A = T_L to T_H, and CL = 30 pF with DSC = 0b10.

2 The Nexus AUX port runs up to 82 MHz. Set NPC_PCR[MCKO_DIV] to divide-by-two if the system frequency is greater than 82 MHz.

3 MDO, $\overline{\text{MSEO}}$, and $\overline{\text{EVTO}}$ data is held valid until the next MCKO low cycle occurs.

4 Limit the maximum frequency to approximately 16 MHz (V_{DDE} = 2.25–3.0 V) or 20 MHz (V_{DDE} = 3.0–3.6 V) to meet the timing specification for t_{JOV} of [0.2 x t_{JCYC}] as outlined in the IEEE-ISTO 5001-2003 specification.

5 The $\overline{\text{RDY}}$ pin timing is asynchronous to MCKO and is guaranteed by design to function correctly.

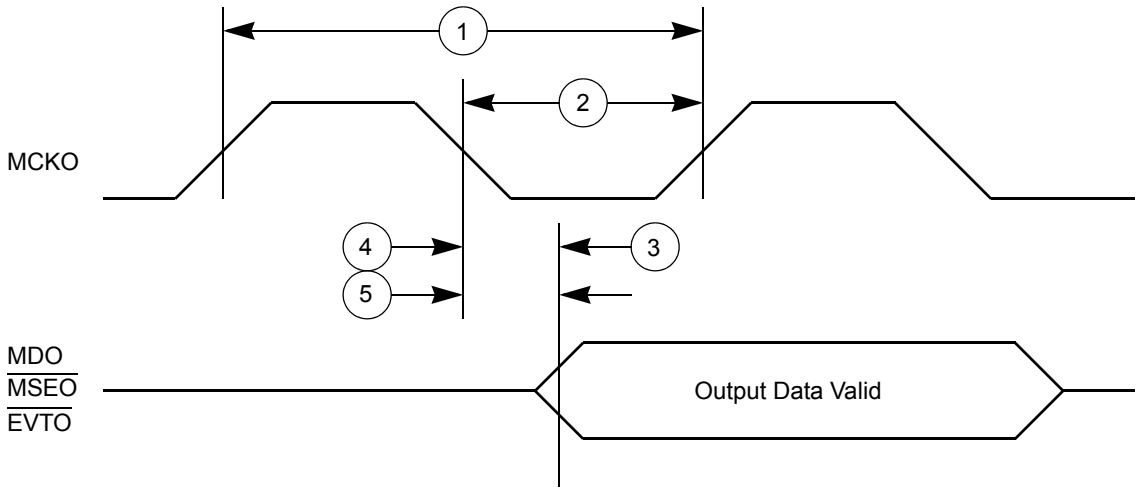

Figure 10. Nexus Output Timing

3.13.4 External Bus Interface (EBI) Timing

Table 22 lists the timing information for the external bus interface (EBI).

Table 22. Bus Operation Timing[1]

Spec	Characteristic and Description	Symbol	External Bus Frequency [2, 3]						Unit	Notes
			40 MHz		56 MHz		66 MHz			
			Min.	Max.	Min.	Max.	Min.	Max.		
1	CLKOUT period	T_C	24.4	—	17.5	—	14.9	—	ns	Signals are measured at 50% V_{DDE}.
2	CLKOUT duty cycle	t_{CDC}	45%	55%	45%	55%	45%	55%	T_C	
3	CLKOUT rise time	t_{CRT}	—	—[4]	—	—[4]	—	—[4]	ns	
4	CLKOUT fall time	t_{CFT}	—	—[4]	—	—[4]	—	—[4]	ns	
5	CLKOUT positive edge to output signal *invalid* or Hi-Z (hold time) External bus interface CS[0:3] ADDR[8:31] DATA[0:31] BDIP OE RD_WR TA TEA TS WE/BE[0:3]	t_{COH}	1.0[5] 1.5	—	1.0[5] 1.5	—	1.0[5] 1.5	—	ns	EBTS = 0 EBTS = 1 Hold time selectable via SIU_ECCR [EBTS] bit.
	CLKOUT positive edge to output signal *invalid* or Hi-Z (hold time) Calibration bus interface CAL_CS[0, 2:3] CAL_ADDR[10:30] CAL_DATA[0:15] CAL_OE CAL_RD_WR CAL_TS CAL_WE/BE[0:1]	t_{CCOH}	1.0[5] 1.5	—	1.0[5] 1.5	—	1.0[5] 1.5	—	ns	EBTS = 0 EBTS = 1 Hold time selectable via SIU_ECCR [EBTS] bit.

Table 22. Bus Operation Timing[1] (continued)

Spec	Characteristic and Description	Symbol	External Bus Frequency [2, 3]						Unit	Notes
			40 MHz		56 MHz		66 MHz			
			Min.	Max.	Min.	Max.	Min.	Max.		
8	CLKOUT positive edge to input signal *invalid* (hold time) External bus interface ADDR[8:31] DATA[0:31] RD_WR TA TEA TS	t_{CIH}	1.0	—	1.0	—	1.0	—	ns	
	CLKOUT positive edge to input signal *invalid* (hold time) Calibration bus interface CAL_ADDR[10:30] CAL_DATA[0:15] CAL_RD_WR CAL_TS	t_{CCIH}	1.0	—	1.0	—	1.0	—	ns	

1 EBI timing specified at: V_{DDE} = 1.6–3.6 V (unless stated otherwise); $T_A = T_L$ to T_H; and CL = 30 pF with DSC = 0b10.

2 Speed is the nominal maximum frequency. Max. speed is the maximum speed allowed including frequency modulation (FM). 82 MHz parts allow for 80 MHz system clock + 2% FM; 114 MHz parts allow for 112 MHz system clock + 2% FM; and 135 MHz parts allow for 132 MHz system clock + 2% FM.

3 The external bus is limited to half the speed of the internal bus.

4 Refer to fast pad timing in Table 17 and Table 18 (different values for 1.8 V and 3.3 V).

5 SIU_ECCR[EBTS] = 0 timings are tested and valid at V_{DDE} = 2.25–3.6 V only; SIU_ECCR[EBTS] = 1 timings are tested and valid at V_{DDE} = 1.6–3.6 V.

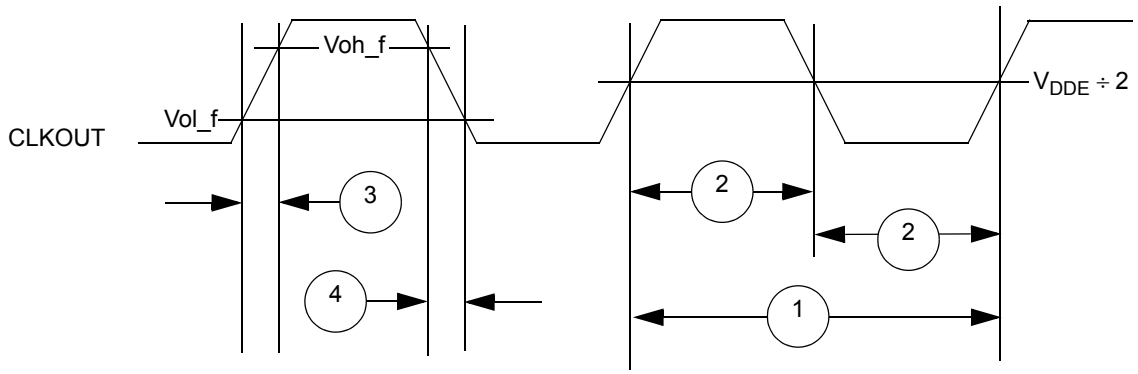

Figure 12. CLKOUT Timing

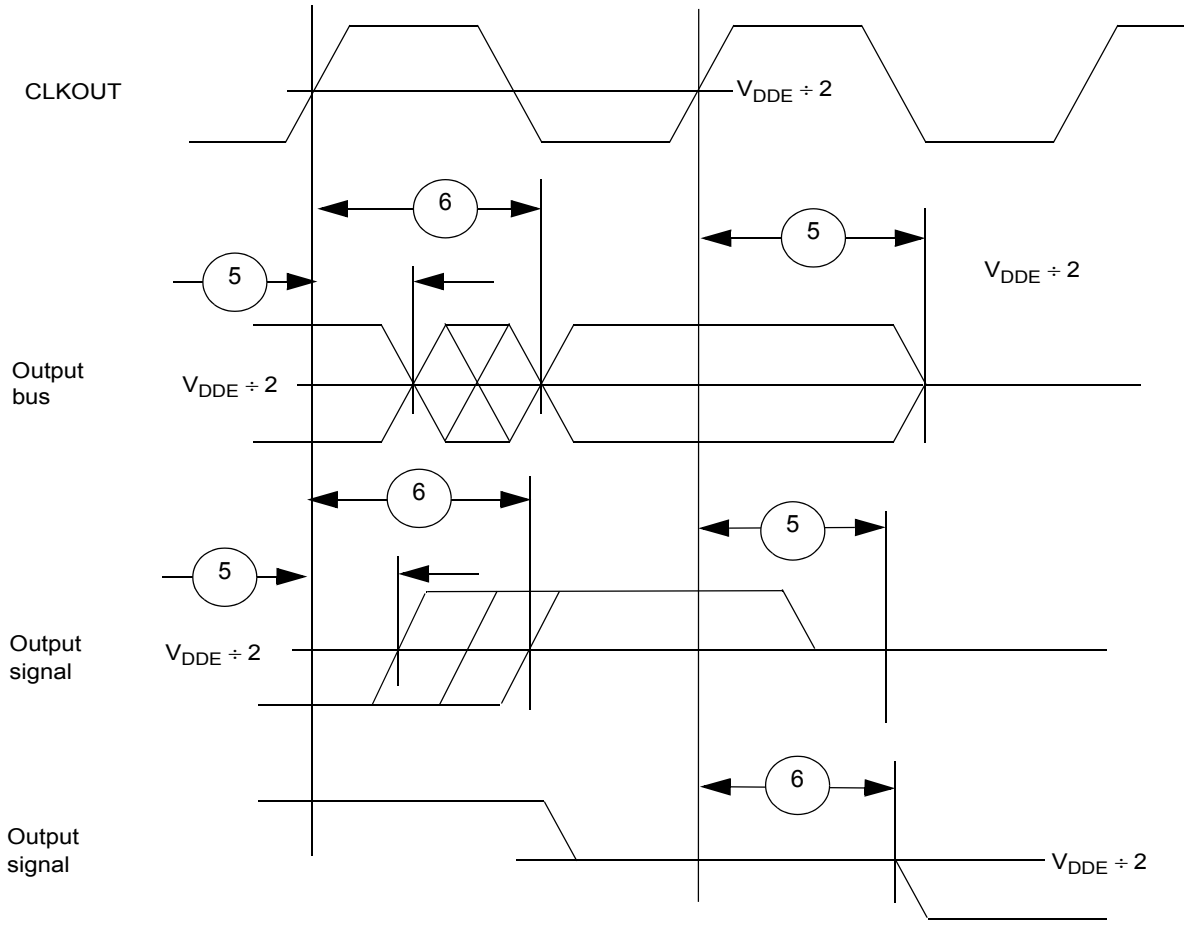

Figure 13. Synchronous Output Timing

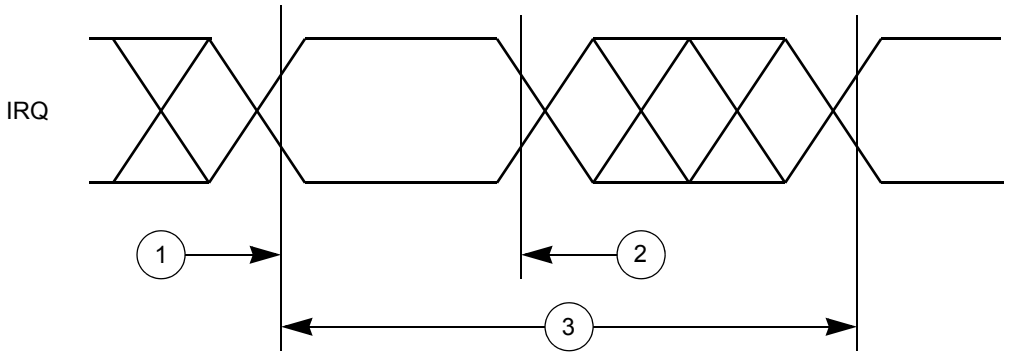

Figure 15. External Interrupt Timing

3.13.6 eTPU Timing

Table 24. eTPU Timing [1]

Spec	Characteristic	Symbol	Min.	Max	Unit
1	eTPU input channel pulse width	t_{ICPW}	4	—	t_{CYC}
2	eTPU output channel pulse width	t_{OCPW}	2 [2]	—	t_{CYC}

1 eTPU timing specified at: V_{DDEH} = 3.0–5.25 V and $T_A = T_L$ to T_H.

2 This specification does not include the rise and fall times. When calculating the minimum eTPU pulse width, include the rise and fall times defined in the slew rate control fields (SRC) of the pad configuration registers (PCR).

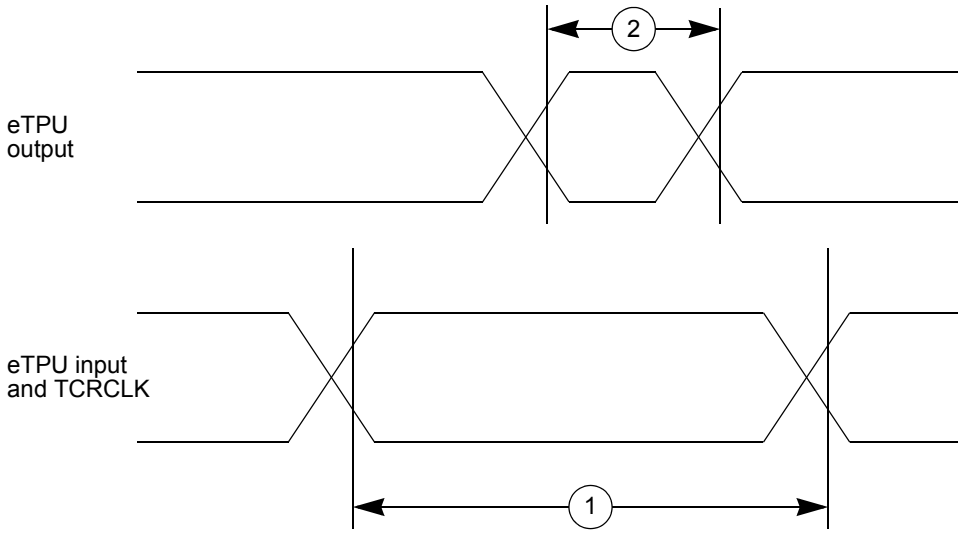

Figure 16. eTPU Timing

Table 26. DSPI Timing[1, 2] (continued)

Spec	Characteristic	Symbol	80 MHz		112 MHz		132 MHz		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	
9	Data setup time for inputs Master (MTFE = 0) Slave Master (MTFE = 1, CPHA = 0)[7] Master (MTFE = 1, CPHA = 1)	t_{SUI}	 20 2 –4 20	 — — — —	 20 2 3 20	 — — — —	 20 2 6 20	 — — — —	 ns ns ns ns
10	Data hold time for inputs Master (MTFE = 0) Slave Master (MTFE = 1, CPHA = 0)[7] Master (MTFE = 1, CPHA = 1)	t_{HI}	 –4 7 21 –4	 — — — —	 –4 7 14 –4	 — — — —	 –4 7 12 –4	 — — — —	 ns ns ns ns
11	Data valid (after SCK edge) Master (MTFE = 0) Slave Master (MTFE = 1, CPHA = 0) Master (MTFE = 1, CPHA = 1)	t_{SUO}	 — — — —	 5 25 18 5	 — — — —	 5 25 14 5	 — — — —	 5 25 13 5	 ns ns ns ns
12	Data hold time for outputs Master (MTFE = 0) Slave Master (MTFE = 1, CPHA = 0) Master (MTFE = 1, CPHA = 1)	t_{HO}	 –5 5.5 8 –5	 — — — —	 –5 5.5 4 –5	 — — — —	 –5 5.5 3 –5	 — — — —	 ns ns ns ns

1 All DSPI timing specifications use the fastest slew rate (SRC = 0b11) on pad type M or MH. DSPI signals using pad types of S or SH have an additional delay based on the slew rate. DSPI timing is specified at: V_{DDEH} = 3.0–5.25 V;T_A = T_L to T_H; and CL = 50 pF with SRC = 0b11.

2 Speed is the nominal maximum frequency. Max. speed is the maximum speed allowed including frequency modulation (FM). 82 MHz parts allow for 80 MHz system clock + 2% FM; 114 MHz parts allow for 112 MHz system clock + 2% FM; and 135 MHz parts allow for 132 MHz system clock + 2% FM.

3 The minimum SCK cycle time restricts the baud rate selection for the given system clock rate. These numbers are calculated based on two MPC55xx devices communicating over a DSPI link.

4 The actual minimum SCK cycle time is limited by pad performance.

5 The maximum value is programmable in DSPI_CTARx[PSSCK] and DSPI_CTARx[CSSCK].

6 The maximum value is programmable in DSPI_CTARx[PASC] and DSPI_CTARx[ASC].

7 This number is calculated using the SMPL_PT field in DSPI_MCR set to 0b10.

3.13.9 eQADC SSI Timing

Table 27. EQADC SSI Timing Characteristics

Spec	Rating	Symbol	Minimum	Typical	Maximum	Unit
2	FCK period ($t_{FCK} = 1 \div f_{FCK}$) [1, 2]	t_{FCK}	2	—	17	t_{SYS_CLK}
3	Clock (FCK) high time	t_{FCKHT}	$t_{SYS\_CLK} - 6.5$	—	$9 \times (t_{SYS\_CLK} + 6.5)$	ns
4	Clock (FCK) low time	t_{FCKLT}	$t_{SYS\_CLK} - 6.5$	—	$8 \times (t_{SYS\_CLK} + 6.5)$	ns
5	SDS lead / lag time	t_{SDS_LL}	–7.5	—	+7.5	ns
6	SDO lead / lag time	t_{SDO_LL}	–7.5	—	+7.5	ns
7	EQADC data setup time (inputs)	t_{EQ_SU}	22	—	—	ns
8	EQADC data hold time (inputs)	t_{EQ_HO}	1	—	—	ns

1 $\overline{SS}$ timing specified at V_{DDEH} = 3.0–5.25 V, $T_A = T_L$ to T_H, and CL = 25 pF with SRC = 0b11. Maximum operating frequency varies depending on track delays, master pad delays, and slave pad delays.

2 FCK duty cycle is not 50% when it is generated through the division of the system clock by an odd number.

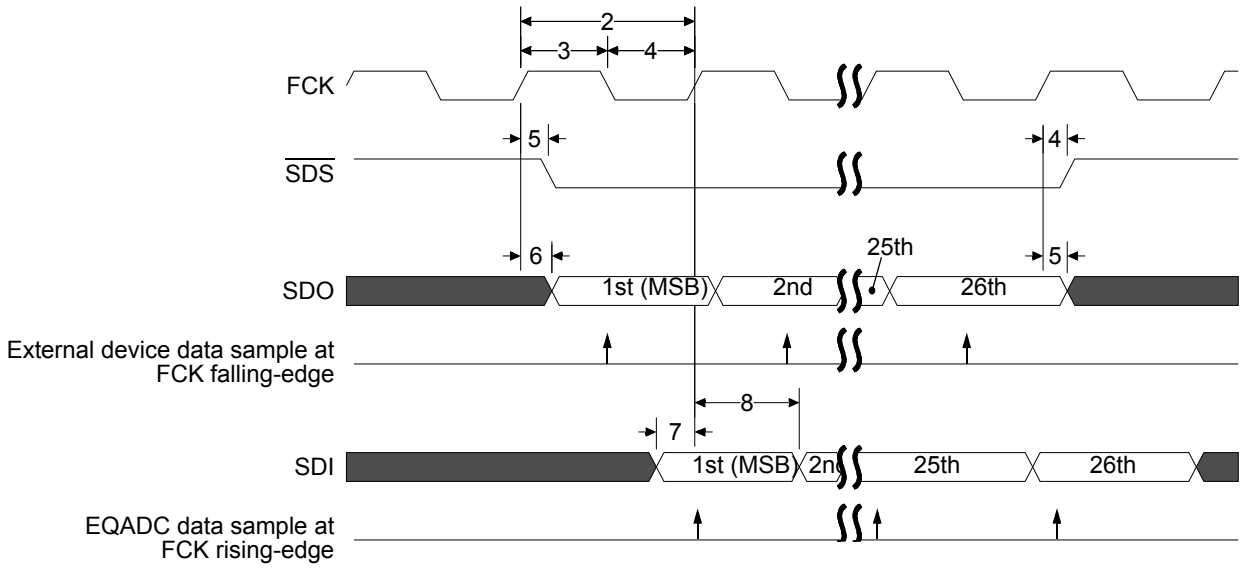

Figure 27. EQADC SSI Timing

	1	2	3	4	5	6	7	8	9	10	11	12	13
A	VSS	VSTBY	AN37	AN11	VDDA1	AN16	AN1	AN5	VRH	AN23	AN27	AN28	AN35
B	VDD	VSS	AN36	AN39	AN19	AN20	AN0	AN4	REF BYPC	AN22	AN26	AN31	AN32
C	VDD33	VDD	VSS	AN8	AN17	VSSA1	AN21	AN3	AN7	VRL	AN25	AN30	AN33
D	ETPUA 30	ETPUA 31	VDD	VSS	AN38	AN9	AN10	AN18	AN2	AN6	AN24	AN29	AN34
E	ETPUA 28	ETPUA 29	VDDEH 1	VDD									
F	ETPUA 24	ETPUA 27	ETPUA 26	VDDEH 1									
G	ETPUA 23	ETPUA 22	ETPUA 25	ETPUA 21									
H	ETPUA 20	ETPUA 19	ETPUA 18	ETPUA 17									
J	ETPUA 16	ETPUA 15	ETPUA 14	ETPUA 13									
K	ETPUA 12	ETPUA 11	ETPUA 10	ETPUA 9						VSS	VSS	VSS	VSS
L	ETPUA 8	ETPUA 7	ETPUA 6	ETPUA 5						VSS	VSS	VSS	VSS
M	ETPUA 4	ETPUA 3	ETPUA 2	ETPUA 1						VDDE2	VDDE2	VSS	VSS
N	BDIP	TEA	ETPUA 0	TCRCLK A						VDDE2	VDDE2	VSS	VSS
P	CS3	CS2	CS1	CS0						VDDE2	VDDE2	VSS	VSS
R	WE3	WE2	WE1	WE0						VDDE2	VDDE2	VSS	VSS
T	VDDE2	TSIZ0	RD_WR	VDDE2						VDDE2	VSS	VDDE2	VDDE2
U	ADDR 16	TSIZ1	TA	VDD33						VSS	VDDE2	VDDE2	VDDE2
V	ADDR 18	ADDR 17	TS	ADDR 8									
W	ADDR 20	ADDR 19	ADDR 9	ADDR 10									
Y	ADDR 22	ADDR 21	ADDR 11	VDDE2									
AA	ADDR 24	ADDR 23	ADDR 13	ADDR 12									
AB	VDDE2	ADDR 25	ADDR 15	ADDR 14									
AC	ADDR 26	ADDR 27	ADDR 31	VSS	VDD	DATA 26	DATA 28	VDDE2	DATA 30	DATA 31	DATA 8	DATA 10	VDDE2
AD	ADDR 28	ADDR 30	VSS	VDD	DATA 24	DATA 25	DATA 27	DATA 29	VDD33	GPIO 207	DATA 9	DATA 11	DATA 13
AE	ADDR 29	VSS	VDD	DATA 17	DATA 19	DATA 21	DATA 23	DATA 0	DATA 2	DATA 4	DATA 6	OE	BR
AF	VSS	VDD	DATA 16	DATA 18	VDDE2	DATA 20	DATA 22	GPIO 206	DATA 1	DATA 3	VDDE2	DATA 5	DATA 7
	1	2	3	4	5	6	7	8	9	10	11	12	13

Figure 34. MPC5567 416 Package Left Side (view 1 of 2)

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 CROWNS OF THE SOLDER BALLS.
5. PARALLELISM MEASUREMENT SHALL EXCLUDE ANY EFFECT OF MARK ON TOP SURFACE OF PACKAGE.

MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE

TITLE:	DOCUMENT NO: 98ASS23840W	REV: D
PBGA, 324 I/O, 23 X 23 PKG, 1 MM PITCH (OMPAC)	CASE NUMBER: 1158–03	26 APR 2006
	STANDARD: JEDEC MS–034 AAJ–1	

Figure 37. MPC5567 324 TEPBGA Package (continued)

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 CROWNS OF THE SOLDER BALLS.

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TITLE: 416 I/O, PBGA 27 X 27 PKG, 1 MM PITCH (OMPAC)	DOCUMENT NO: 98ARE10523D	REV: A
	CASE NUMBER: 1494–01	13 JUL 2005
	STANDARD: JEDEC MS–034 AAL–1	

Figure 38. MPC5567 416 TEPBGA Package (continued)

Table 35. Table and Figure Changes Between Rev. 0.0 and 1.0

Location	Description of Changes
Figure 1 MPC5500 Family Part Numbers:	• Removed the 2 in the tape and reel designator in both the graphic and in the Tape and Reel Status text. • Changed Qualification Status by adding ‘, general market flow’ to the M designator, and added an ‘S’ designator with the description of ‘Fully spec. qualified, automotive flow. • Removed temperature code A for -55 C to 125 C.
Table 1 Orderable Part Numbers:	• Changed the 132 MHz maximum operating frequency to 135 MHz. • Reordered rows to group devices by lead-free package types in descending frequency order, and leaded package types. • Footnote 1 added that reads: All devices are PPC5567, rather than MPC5567 or SPC5567, until product qualifications are complete. Not all configurations are available in the PPC parts. • Footnote 2 added that reads:’ The lowest ambient operating temperature is referenced by T_L; the highest ambient operating temperature is referenced by T_H.’ • Footnote 3 added that reads: ‘Speed is the nominal maximum frequency. Max speed is the maximum speed allowed including frequency modulation (FM). 82 MHz parts allow for 80 MHz system clock + 2% FM; 114 MHz parts allow for 112 MHz system clock + 2% FM; and 135 MHz parts allow for 132 MHz system clock + 2% FM.’
Table 2 Absolute Maximum Ratings:	• Deleted Spec 3, “Flash core voltage.” • Spec 12 “DC Input Voltage”: Deleted from second line‘. . .except for eTPUB15 and SINB (DSPI_B_SIN)’ leaving V_{DDEH} powered I/O pads. Deleted third line ‘V_{DDEH} powered by I/O pads (eTPUB15 and SINB), including the min and max values of -0.3 and 6.5 respectively, and deleted old footnote 7. • Spec 12 “DC Input Voltage”: Added footnote 8 to second line “V_{DDE} powered I/O pads” that reads: ‘Internal structures hold the input voltage less than the maximum voltage on all pads powered by the V_{DDE} supplies, if the maximum injection current specification is met (s mA for all pins) and V_{DDE} is within the operating voltage specifications. • Spec 14, column 2, changed: ‘V_{SS} differential voltage’ to ‘V_{SS} to V_{SSA} differential voltage.’ • Spec 15, column 2, changed: ‘V_{DD} differential voltage’ to ‘V_{DD} to V_{DDA} differential voltage.’ • Spec 21, Added the name of the spec, ‘*V_{RC33} to V_{DDSYN} differential voltage,’* as well as the name and cross reference to Table 9, *DC Electrical Specification*s, to which the Spec was moved. • Spec 26. Changed -40 to T_L in the Min. column. • Spec 28 “Maximum Solder Temperature”: Added two lines: Lead free (PbFree) and Leaded (SnPb) with maximum values of 260 C and 245 C respectively. • Footnote 1, added: ‘any of’ between ‘beyond’ and ‘the listed maxima.’ • Deleted footnote 2: ‘Absolute maximum voltages are currently maximum burn-in voltages. Absolute maximum specifications for device stress have not yet been determined.’Spec 26 “Maximum Operating Temperature Range”: replaced -40 C with. • Footnote 6 (now footnote 5): Changed to the following sentence to the end, “Internal structures hold the input voltage greater than -1.0 V if the injection current limit of 2 mA is met. Keep the negative DC voltage greater than -0.6 V on eTPU[15] and on SINB during the internal power-on reset (POR) state.”
Table 3 MPC5567 Thermal Characteristics: Moved the Unit column to the far right column in the table.	
Table 4 EMI Testing Specifications:	• Changed the maximum operating frequency to from 132 to f_{MAX}. • Footnote 2: Deleted ‘Refer to Table 1 for the maximum operating frequency.’

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