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Details	
Product Status	Active
Core Processor	e200z3
Core Size	32-Bit Single-Core
Speed	80MHz
Connectivity	CANbus, EBI/EMI, LINbus, SCI, SPI, UART/USART
Peripherals	DMA, POR, PWM, WDT
Number of I/O	80
Program Memory Size	1MB (1M x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	64K x 8
Voltage - Supply (Vcc/Vdd)	4.5V ~ 5.25V
Data Converters	A/D 34x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	176-LQFP
Supplier Device Package	176-LQFP (24x24)
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/spc5633mf2mlu80

1 Addendum List for Revision 9

Table 1. MPC5634M Rev 9 Addendum

Location	Description
Section 4.11, “Temperature Sensor Electrical Characteristics”, Page 81	In “Temperature Sensor Electrical Characteristics” table, update the Min and Max value of “Accuracy” parameter to -20^{o}C and +20^{o}C, respectively.

2 Revision History

Table 2 provides a revision history for this datasheet addendum document.

Table 2. Revision History Table

Rev. Number	Substantive Changes	Date of Release
1.0	Initial release.	12/2014

3.6 Signal summary

Table 2. MPC563xM signal properties

Name	Function[1]	Pad Config. Register (PCR)[2]	PCR PA Field[3]	I/O Type	Voltage[4] / Pad Type	Reset State[5]	Function / State After Reset[6]		Pin No.		
									144 LQFP	176 LQFP	208 MAPBGA
Dedicated GPIO											
GPIO[98]	GPIO	PCR[98]	—	I/O	VDDEH7 Slow	– / Up	GPIO[98]/Up		—	141[7]	J15[8]
GPIO[99]	GPIO	PCR[99]	—	I/O	VDDEH7 Slow	– / Up	GPIO[99]/Up		—	142[7]	H13[8]
GPIO[206][9]	GPIO	PCR[206]	—	I/O	VDDEH7 Slow	– / Up	GPIO[206]/Up		—	143[7]	R4[8]
GPIO[207][9]	GPIO	PCR[207]	—	I/O	VDDEH7 Slow	– / Up	GPIO[207]/Up		—	144[7]	P5[8]
Reset / Configuration											
$\overline{\text{RESET}}$	External Reset Input	—	—	I	VDDEH6a Slow	I / Up	$\overline{\text{RESET}}$ / Up		80	97	L16
$\overline{\text{RSTOUT}}$	External Reset Output	PCR[230]	—	O	VDDEH6a Slow	$\overline{\text{RSTOUT}}$/ Low	$\overline{\text{RSTOUT}}$/ High		85	102	K15
PLLREF $\overline{\text{IRQ}}$[4] ETRIG[2] GPIO[208]	FMPLL Mode Selection External Interrupt Request eQADC Trigger Input GPIO	PCR[208]	011 010 100 000	I I I I/O	VDDEH6a Slow	PLLREF / Up	– / Up		68	83	M14
$\overline{\text{BOOTCFG}}$1 $\overline{\text{IRQ}}$[3] ETRIG[3] GPIO[212]	Boot Config. Input External Interrupt Request eQADC Trigger Input GPIO	PCR[212]	011 010 100 000	I I I I/O	VDDEH6a Slow	BOOTCFG1 / Down	– / Down		70	85	M15
$\overline{\text{WKPCFG}}$ $\overline{\text{NMI}}$ DSPI_B_SOUT GPIO[213]	Weak Pull Config. Input Non-Maskable Interrupt DSPI_B Data Output GPIO	PCR[213]	01 11 10 00	I I O I/O	VDDEH6a Slow	WKPCFG / Up	– / Up		71	86	L15
Calibration[10]											
CAL_ADDR[12:15][11]	Calibration Address Bus	PCR[340]	—	O	VDDE12 Fast	O / Low	CAL_ADDR / Low		—	—	—

Table 2. MPC563xM signal properties (continued)

Name	Function[1]	Pad Config. Register (PCR)[2]	PCR PA Field[3]	I/O Type	Voltage[4] / Pad Type	Reset State[5]	Function / State After Reset[6]	Pin No.			
									144 LQFP	176 LQFP	208 MAPBGA
CAL_ADDR[16][21] ALT_MDO[0][12]	Calibration Address Bus Nexus Msg Data Out	PCR[345]	—	O O	VDDE12[13] VDDE7[14] Fast	O / Low[15]	MDO / ALT_ADDR[12] / Low		—	17	A14
CAL_ADDR[17][21] ALT_MDO[1][12]	Calibration Address Bus Nexus Msg Data Out	PCR[345]	—	O O	VDDE12[13] VDDE7[14] Fast	O / Low[15]	ALT_MDO / CAL_ADDR[12] / Low		—	18	B14
CAL_ADDR[18][21] ALT_MDO[2][12]	Calibration Address Bus Nexus Msg Data Out	PCR[345]	—	O O	VDDE12[13] VDDE7[14] Fast	O / Low[15]	ALT_MDO / CAL_ADDR[12] / Low		—	19	A13
CAL_ADDR[19][21] ALT_MDO[3][12]	Calibration Address Bus Nexus Msg Data Out	PCR[345]	—	O O	VDDE12[13] VDDE7[14] Fast	O / Low[15]	ALT_MDO / CAL_ADDR[12] / Low		—	20	B13
CAL_ADDR[20:27] ALT_MDO[4:11]	Calibration Address Bus Nexus Msg Data Out	PCR[345]	—	O O	VDDE12[13] Fast	O / Low	ALT_MDO / CAL_ADDR[16] / Low		—	—	—
CAL_ADDR[28][21] ALT_$\overline{\text{MSEO}}$[0][12]	Calibration Address Bus Nexus Msg Start/End Out	PCR[345]	—	O O	VDDE12[13] VDDE7[14] Fast	O / Low[17]	ALT_$\overline{\text{MSEO}}$[16] / CAL_ADDR[17]/ Low		—	118	C15
CAL_ADDR[29][21] ALT_$\overline{\text{MSEO}}$[1][12]	Calibration Address Bus Nexus Msg Start/End Out	PCR[345]	—	O O	VDDE12[13] VDDE7[14] Fast	O / Low[17]	ALT_$\overline{\text{MSEO}}$[16] / CAL_ADDR[17]/ Low		—	117	E16
CAL_ADDR[30][21] ALT_$\overline{\text{EVTI}}$[12]	Calibration Address Bus Nexus Event In	PCR[345]	—	O I	VDDE12[13] VDDE7[14] Fast	—[18]	ALT_$\overline{\text{EVTI}}$ / CAL_ADDR[19]		—	116	E15
ALT_$\overline{\text{EVTO}}$	Nexus Event Out	PCR[344]	—	O	VDDE12[13] VDDE7[14] Fast	O / Low	ALT_$\overline{\text{EVTO}}$ / High		—	120	D15
ALT_MCKO	Nexus Msg Clock Out	PCR[344]	—	O	VDDE12[13] VDDE7[14] Fast	O / Low	ALT_MCKO / Enabled		—	14	F15
NEXUSCFG[11]	Nexus/Calibration bus selector	—	—	I	VDDE12 Fast	I / Down	NEXUSCFG / Down		—	—	—
CAL_$\overline{\text{CS}}$[0][11]	Calibration Chip Selects	PCR[336]	—	O	VDDE12 Fast	O / High	CAL_$\overline{\text{CS}}$ / High		—	—	—
CAL_$\overline{\text{CS}}$[2][11] CAL_ADDR[10]	Calibration Chip Selects Calibration Address Bus	PCR[338]	11 10	O O	VDDE12 Fast	O / High	CAL_$\overline{\text{CS}}$ / High		—	—	—

Table 2. MPC563xM signal properties (continued)

Name	Function[1]	Pad Config. Register (PCR)[2]	PCR PA Field[3]	I/O Type	Voltage[4] / Pad Type	Reset State[5]	Function / State After Reset[6]		Pin No.		
									144 LQFP	176 LQFP	208 MAPBGA
DSPI_B_PCS[5] DSPI_C_PCS[0] GPIO[110]	DSPI_B Periph Chip Select DSPI_C Periph Chip Select GPIO	PCR[110]	01 10 00	O O I/O	VDDEH6b Medium	– / Up	– / Up		87	104	J13
eQADC											
AN[0][27] DAN0+	Single Ended Analog Input Positive Terminal Diff. Input	—	—	I I	VDDA	I / –	AN[0] / –		143	172	B5
AN[1][27] DAN0-	Single Ended Analog Input Negative Terminal Diff. Input	—	—	I I	VDDA	I / –	AN[1] / –		142	171	A6
AN[2][27] DAN1+	Single Ended Analog Input Positive Terminal Diff. Input	—	—	I I	VDDA	I / –	AN[2] / –		141	170	D6
AN[3][27] DAN1-	Single Ended Analog Input Negative Terminal Diff. Input	—	—	I I	VDDA	I / –	AN[3] / –		140	169	C7
AN[4][27] DAN2+	Single Ended Analog Input Positive Terminal Diff. Input	—	—	I I	VDDA	I / –	AN[4] / –		139	168	B6
AN[5][27] DAN2-	Single Ended Analog Input Negative Terminal Diff. Input	—	—	I I	VDDA	I / –	AN[5] / –		138	167	A7
AN[6][27] DAN3+	Single Ended Analog Input Positive Terminal Diff. Input	—	—	I I	VDDA	I / –	AN[6] / –		137	166	D7
AN[7][27] DAN3-	Single Ended Analog Input Negative Terminal Diff. Input	—	—	I I	VDDA	I / –	AN[7] / –		136	165	C8
AN[8]	See AN[38]-AN[8]-ANW										
AN[9] ANX	Single Ended Analog Input External Multiplexed Analog Input	—	—	I I	VDDA	I / –	AN[9] / –		5	5	A2
AN[10]	See AN[39]-AN[10]-ANY										
AN[11] ANZ	Single Ended Analog Input External Multiplexed Analog Input	—	—	I I	VDDA	I / –	AN[11] / –		4	4	A3
AN[12] MA[0] ETPU_A[19] $\overline{SDS}$	Single Ended Analog Input Mux Address ETPU_A Ch. eQADC Serial Data Strobe	PCR[215]	011 010 100 000	I O O O	VDDEH7	I / –	AN[12] / –		119	148	A12

Table 4. Signal details (continued)

Signal	Module or Function	Description
CAL_RD_$\overline{WR}$	Calibration Bus	RD_$\overline{WR}$ indicates whether the current transaction is a read access or a write access.
CAL_$\overline{TS}$_ALE	Calibration Bus	The Transfer Start signal ($\overline{TS}$) is asserted by the MPC5634M to indicate the start of a transfer. The Address Latch Enable (ALE) signal is used to demultiplex the address from the data bus.
CAL_$\overline{EVTO}$	Calibration Bus	Nexus Event Out
CAL_MCKO	Calibration Bus	Nexus Message Clock Out
NEXUSCFG	Nexus/Calibration Bus	Nexus/Calibration Bus selector
eMIOS[0:23]	eMIOS	eMIOS I/O channels
AN[0:39]	eQADC	Single-ended analog inputs for analog-to-digital converter
FCK	eQADC	eQADC free running clock for eQADC SSI.
MA[0:2]	eQADC	These three control bits are output to enable the selection for an external Analog Mux for expansion channels.
REFBYPC	eQADC	Bypass capacitor input
SDI	eQADC	Serial data in
SDO	eQADC	Serial data out
SDS	eQADC	Serial data select
VRH	eQADC	Voltage reference high input
VRL	eQADC	Voltage reference low input
SCI_A_RX SCI_B_RX	eSCI_A – eSCI_B	eSCI receive
SCI_A_TX SCI_B_TX	eSCI_A – eSCI_B	eSCI transmit
ETPU_A[0:31]	eTPU	eTPU I/O channel
CAN_A_TX CAN_C_TX	FlexCan_A – FlexCAN_C	FlexCAN transmit
CAN_A_RX CAN_C_RX	FlexCAN_A – FlexCAN_C	FlexCAN receive
JCOMP	JTAG	Enables the JTAG TAP controller.
TCK	JTAG	Clock input for the on-chip test and debug logic.
TDI	JTAG	Serial test instruction and data input for the on-chip test and debug logic.
TDO	JTAG	Serial test data output for the on-chip test logic.
TMS	JTAG	Controls test mode operations for the on-chip test and debug logic.

4 Electrical characteristics

This section contains detailed information on power considerations, DC/AC electrical characteristics, and AC timing specifications for the MPC5634M series of MCUs.

The electrical specifications are preliminary and are from previous designs, design simulations, or initial evaluation. These specifications may not be fully tested or guaranteed at this early stage of the product life cycle, however for production silicon these specifications will be met. Finalized specifications will be published after complete characterization and device qualifications have been completed.

In the tables where the device logic provides signals with their respective timing characteristics, the symbol “CC” for Controller Characteristics is included in the Symbol column.

In the tables where the external system must provide signals with their respective timing characteristics to the device, the symbol “SR” for System Requirement is included in the Symbol column.

4.1 Parameter classification

The electrical parameters shown in this document are guaranteed by various methods. To provide a better understanding, the classifications listed in Table 6 are used and the parameters are tagged accordingly in the tables. Note that only controller characteristics (“CC”) are classified. System requirements (“SR”) are operating conditions that must be provided to ensure normal device operation.

Table 6. Parameter classifications

Classification tag	Tag description
P	Those parameters are guaranteed during production testing on each individual device.
C	Those parameters are achieved by the design characterization by measuring a statistically relevant sample size across process variations.
T	Those parameters are achieved by design characterization on a small sample size from typical devices under typical conditions unless otherwise noted. All values shown in the typical column are within this category.
D	Those parameters are derived mainly from simulations.

NOTE

The classification is shown in the column labeled “C” in the parameter tables where appropriate.

4.2 Maximum ratings

Table 7. Absolute maximum ratings[1]

Symbol		Parameter	Conditions	Value		Unit
				min	max	
V_{DD}	SR	1.2 V core supply voltage[2]		– 0.3	1.32	V
V_{FLASH}	SR	Flash core voltage[3]		– 0.3	5.5	V
V_{STBY}	SR	SRAM standby voltage[4]		– 0.3	5.5	V
V_{DDPLL}	SR	Clock synthesizer voltage		– 0.3	1.32	V
V_{RC33}[5]	SR	Voltage regulator control input voltage		– 0.3	3.6	V

- 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.

4.4 Electromagnetic Interference (EMI) characteristics

Table 11. EMI testing specifications[1]

Symbol	Parameter	Conditions	f_{OSC}/f_{BUS}	Frequency	Level (Typ)	Unit
Radiated Emissions	V_{EME}	Device Configuration, test conditions and EM testing per standard IEC61967-2; Supply Voltage = 5.0V DC, Ambient Temperature = 25°C, Worst-case Orientation	Oscillator Frequency = 8 MHz; System Bus Frequency = 80 MHz; No PLL Frequency Modulation	150 kHz – 50 MHz	26	dBμV
				50–150 MHz	24	
				150–500 MHz	24	
				500–1000 MHz	21	
				IEC Level	K	—
			Oscillator Frequency = 8 MHz; System Bus Frequency = 80 MHz; 1% PLL Frequency Modulation	150 kHz – 50 MHz	20	dBμV
				50–150 MHz	19	
				150–500 MHz	14	
				500–1000 MHz	7	
				IEC Level	L	—

1 IEC Classification Level: L = 24dBuV; K = 30dBuV.

4.5 Electromagnetic static discharge (ESD) characteristics

Table 12. ESD ratings[1,2]

Symbol		Parameter	Conditions	Value	Unit
—	SR	ESD for Human Body Model (HBM)	—	2000	V
R1	SR	HBM circuit description	—	1500	Ω
C	SR		—	100	pF
—	SR	ESD for field induced charge Model (FCDM)	All pins	500	V
			Corner pins	750	
—	SR	Number of pulses per pin	Positive pulses (HBM)	1	—
			Negative pulses (HBM)	1	—
—	SR	Number of pulses	—	1	—

1 All ESD testing is in conformity with 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.”

4.6 Power Management Control (PMC) and Power On Reset (POR) electrical specifications

Table 13. PMC Operating conditions and external regulators supply voltage

ID	Name		C	Parameter	Min	Typ	Max	Unit
1	Jtemp	SR	—	Junction temperature	–40	27	150	°C
2	Vddreg	SR	—	PMC 5 V supply voltage VDDREG	4.75[1]	5	5.25	V
3	Vdd	SR	—	Core supply voltage 1.2 V VDD when external regulator is used without disabling the internal regulator (PMC unit turned on, LVI monitor active)[2]	1.26[3]	1.3	1.32	V
3a	—	SR	—	Core supply voltage 1.2 V VDD when external regulator is used with a disabled internal regulator (PMC unit turned-off, LVI monitor disabled)	1.14	1.2	1.32	V
4	Ivdd	SR	—	Voltage regulator core supply maximum DC output current[4]	400	—	—	mA
5	Vdd33	SR	—	Regulated 3.3 V supply voltage when external regulator is used without disabling the internal regulator (PMC unit turned-on, internal 3.3V regulator enabled, LVI monitor active)[5]	3.3	3.45	3.6	V
5a	—	SR	—	Regulated 3.3 V supply voltage when external regulator is used with a disabled internal regulator (PMC unit turned-off, LVI monitor disabled)	3	3.3	3.6	V
6	—	SR	—	Voltage regulator 3.3 V supply maximum required DC output current	80	—	—	mA

1 During start up operation the minimum required voltage to come out of reset state is 4.6 V.

2 An internal regulator controller can be used to regulate core supply.

3 The minimum supply required for the part to exit reset and enter in normal run mode is 1.28 V.

4 The onchip regulator can support a minimum of 400 ma although the worst case core current is 180 ma.

5 An internal regulator can be used to regulate 3.3 V supply.

Table 14. PMC electrical characteristics

ID	Name		C	Parameter	Min	Typ	Max	Unit	Notes
1	Vbg	CC	C	Nominal bandgap voltage reference	—	1.219	—	V	
1a	—	CC	P	Untrimmed bandgap reference voltage	Vbg–7%	Vbg	Vbg+6%	V	
1b	—	CC	P	Trimmed bandgap reference voltage (5 V, 27 °C)[1]	Vbg–10mV	Vbg	Vbg+10mV	V	
1c	—	CC	C	Bandgap reference temperature variation	—	100	—	ppm /°C	

Table 14. PMC electrical characteristics (continued)

ID	Name		C	Parameter	Min	Typ	Max	Unit	Notes
1d	—	CC	C	Bandgap reference supply voltage variation	—	3000	—	ppm /V	
2	Vdd	CC	C	Nominal VDD core supply internal regulator target DC output voltage[2]	—	1.28	—	V	
2a	—	CC	P	Nominal VDD core supply internal regulator target DC output voltage variation at power-on reset	Vdd – 6%	Vdd	Vdd + 10%	V	
2b	—	CC	P	Nominal VDD core supply internal regulator target DC output voltage variation after power-on reset	Vdd – 10[3]	Vdd	Vdd + 3%	V	
2c	—	CC	C	Trimming step Vdd	—	20	—	mV	
2d	Ivrcctl	CC	C	Voltage regulator controller for core supply maximum DC output current	20	—	—	mA	
3	Lvi1p2	CC	C	Nominal LVI for rising core supply[4,5]	—	1.160	—	V	
3a	—	CC	C	Variation of LVI for rising core supply at power-on reset[5,6]	1.120	1.200	1.280	V	
3b	—	CC	C	Variation of LVI for rising core supply after power-on reset[5,6]	Lvi1p2–3%	Lvi1p2	Lvi1p2+3%	V	
3c	—	CC	C	Trimming step LVI core supply[5]	—	20	—	mV	
3d	Lvi1p2_h	CC	C	LVI core supply hysteresis[5]	—	40	—	mV	
4	Por1.2V_r	CC	C	POR 1.2 V rising	—	0.709	—	V	
4a	—	CC	C	POR 1.2 V rising variation	Por1.2V_r– 35%	Por1.2V_r	Por1.2V_r+ 35%	V	
4b	Por1.2V_f	CC	C	POR 1.2 V falling	—	0.638	—	V	
4c	—	CC	C	POR 1.2 V falling variation	Por1.2V_f– 35%	Por1.2V_f	Por1.2V_f+ 35%	V	
5	Vdd33	CC	C	Nominal 3.3 V supply internal regulator DC output voltage	—	3.39	—	V	
5a	—	CC	P	Nominal 3.3 V supply internal regulator DC output voltage variation at power-on reset[6]	Vdd33 – 8.5%	Vdd33	Vdd3 + 7%	V	

4.6.2 Recommended power transistors

The following NPN transistors are recommended for use with the on-chip voltage regulator controller: ON Semiconductor™ BCP68T1 or NJD2873 as well as Philips Semiconductor™ BCP68. The collector of the external transistor is preferably connected to the same voltage supply source as the output stage of the regulator.

Table 19. Recommended operating characteristics

Symbol	Parameter	Value	Unit
h_{FE} (β)	DC current gain (Beta)	60 – 550	—
P_D	Absolute minimum power dissipation	>1.0 (1.5 preferred)	W
I_{CMaxDC}	Minimum peak collector current	1.0	A
VCE_{SAT}	Collector-to-emitter saturation voltage	200–600[1]	mV
V_{BE}	Base-to-emitter voltage	0.4–1.0	V

[1] Adjust resistor at bipolar transistor collector for 3.3 V/5.0 V to avoid VCE < VCE_{SAT}

4.7 Power up/down sequencing

There is no power sequencing required among power sources during power up and power down, in order to operate within specification but use of the following sequence is strongly recommended when the internal regulator is bypassed:

5 V → 3.3 V and 1.2 V

This is also the normal sequence when the internal regulator is enabled.

Although there are no power up/down sequencing requirements to prevent issues like latch-up, excessive current spikes, etc., the state of the I/O pins during power up/down varies according to table Table 20 for all pins with fast pads and Table 21 for all pins with medium, slow and multi-voltage pads.[1]

Table 20. Power sequence pin states for fast pads

V_{DDE}	V_{RC33}	V_{DD}	Fast (pad_fc)
LOW	X	X	LOW
V_{DDE}	LOW	X	HIGH
V_{DDE}	V_{RC33}	LOW	HIGH IMPEDANCE
V_{DDE}	V_{RC33}	V_{DD}	FUNCTIONAL

Table 21. Power sequence pin states for medium, slow and multi-voltage pads

V_{DDEH}	V_{DD}	Medium (pad_msr_hv) Slow (pad_ssr_hv) Multi-voltage (pad_multv_hv)
LOW	X	LOW
V_{DDEH}	LOW	HIGH IMPEDANCE
V_{DDEH}	V_{DD}	FUNCTIONAL

1.If an external 3.3V external regulator is used to supply current to the 1.2V pass transistor and this supply also supplies current for the other 3.3V supplies, then the 5V supply must always be greater than or equal to the external 3.3V supply.

4.8 DC electrical specifications

Table 22. DC electrical specifications[1]

Symbol		C	Parameter	Conditions	Value[2]			Unit
					min	typ	max	
V_{DD}	SR	—	Core supply voltage	—	1.14	—	1.32	V
V_{DDE}	SR	—	I/O supply voltage	—	1.62	—	3.6[3]	V
V_{DDEH}	SR	—	I/O supply voltage	—	3.0	—	5.25	V
V_{RC33}	SR	—	3.3 V external voltage[4]	—	3.0	—	3.6	V
V_{DDA}	SR	—	Analog supply voltage	—	4.75[5]	—	5.25	V
V_{INDC}	SR	—	Analog input voltage[6]	—	V_{SSA} – 0.3	—	V_{DDA}+0.3	V
$V_{SS} – V_{SSA}$	SR	—	V_{SS} differential voltage	—	–100	—	100	mV
V_{RL}	SR	—	Analog reference low voltage	—	V_{SSA}	—	V_{SSA}+0.1	V
$V_{RL} – V_{SSA}$	SR	—	V_{RL} differential voltage	—	–100	—	100	mV
V_{RH}	SR	—	Analog reference high voltage	—	V_{DDA} – 0.1	—	V_{DDA}	V
$V_{RH} – V_{RL}$	SR	—	V_{REF} differential voltage	—	4.75	—	5.25	V
V_{DDF}	SR	—	Flash operating voltage [7]	—	1.14	—	1.32	V
V_{FLASH}[8]	SR	—	Flash read voltage	—	4.75	—	5.25	V
V_{STBY}	SR	—	SRAM standby voltage	Unregulated mode	0.95	—	1.2	V
				Regulated mode	2.0	—	5.5	
V_{DDREG}	SR	—	Voltage regulator supply voltage[9]	—	4.75	—	5.25	V
V_{DDPLL}	SR	—	Clock synthesizer operating voltage	—	1.14	—	1.32	V
$V_{SSPLL} – V_{SS}$	SR	—	V_{SSPLL} to V_{SS} differential voltage	—	–100	—	100	mV
V_{IL_S}	CC	C	Slow/medium pad I/O input low voltage	Hysteresis enabled	V_{SS}–0.3	—	0.35*V_{DDEH}	V
		P		hysteresis disabled	V_{SS}–0.3	—	0.40*V_{DDEH}	
V_{IL_F}	CC	C	Fast pad I/O input low voltage	Hysteresis enabled	V_{SS}–0.3	—	0.35*V_{DDE}	V
		P		hysteresis disabled	V_{SS}–0.3	—	0.40*V_{DDE}	

4.9 I/O Pad current specifications

NOTE

MPC5634M devices use two sets of I/O pads (5 V and 3.3 V). See Table 2 and Table 3 in Section 3.6, "Signal summary, for the pad type associated with each signal.

The power consumption of an I/O segment depends on the usage of the pins on a particular segment. The power consumption is the sum of all output pin currents for a particular segment. The output pin current can be calculated from Table 23 based on the voltage, frequency, and load on the pin. Use linear scaling to calculate pin currents for voltage, frequency, and load parameters that fall outside the values given in Table 23.

Table 23. I/O pad average I_{DDE} specifications[1]

Pad Type	Symbol		C	Period (ns)	Load[2] (pF)	V_{DDE} (V)	Drive/Slew Rate Select	I_{DDE} Avg (mA)[3]	I_{DDE} RMS (mA)
Slow	$I_{DRV\_SSR\_HV}$	CC	D	37	50	5.25	11	9	—
		CC	D	130	50	5.25	01	2.5	—
		CC	D	650	50	5.25	00	0.5	—
		CC	D	840	200	5.25	00	1.5	—
Medium	$I_{DRV\_MSR\_HV}$	CC	D	24	50	5.25	11	14	—
		CC	D	62	50	5.25	01	5.3	—
		CC	D	317	50	5.25	00	1.1	—
		CC	D	425	200	5.25	00	3	—
Fast	I_{DRV_FC}	CC	D	10	50	3.6	11	22.7	68.3
		CC	D	10	30	3.6	10	12.1	41.1
		CC	D	10	20	3.6	01	8.3	27.7
		CC	D	10	10	3.6	00	4.44	14.3
		CC	D	10	50	1.98	11	12.5	31
		CC	D	10	30	1.98	10	7.3	18.6
		CC	D	10	20	1.98	01	5.42	12.6
		CC	D	10	10	1.98	00	2.84	6.4
MultiV (High Swing Mode)	$I_{DRV\_MULTV\_HV}$	CC	D	15	50	5.25	11	21.2[4]	—
		CC	D	30	50	5.25	10	—[5]	—
		CC	D	50	50	5.25	01	6.2[4]	—
		CC	D	300	50	5.25	00	1.1[4]	—
		CC	D	300	200	5.25	00	4.0[4]	—
MultiV (Low Swing Mode)	$I_{DRV\_MULTV\_HV}$	CC	D	15	30	5.25	11	20.2[6]	—
		CC	D	30	30	5.25	11	NA	—

1 Numbers from simulations at best case process, 150 °C.

2 All loads are lumped.

3 Average current is for pad configured as output only.

[4] Exceeding limit may cause conversion error on stressed channels and on unstressed channels. Transitions within the limit do not affect device reliability or cause permanent damage.

[5] 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.

[6] Condition applies to two adjacent pins at injection limits.

[7] Performance expected with production silicon.

[8] All channels have same 10 kΩ < Rs < 100 kΩ; Channel under test has Rs=10 kΩ; $I_{INJ}=I_{INJMAX}, I_{INJMIN}$.

[9] TUE is tested by averaging 10 samples.

[10] TUE is tested by averaging three samples.

[11] These values can be significantly improved by using three samples of averaging. Input frequency of 1 kHz was used as the reference for the Signal to Noise Ratio.

[12] Variable gain is controlled by setting the PRE_GAIN bits in the ADC_ACR1-8 registers to select a gain factor of ×1, ×2, or ×4. Settings are for differential input only. Tested at ×1 gain. Values for other settings are guaranteed by as indicated.

[13] At $V_{RH} - V_{RL} = 5.12$ V, one LSB = 1.25 mV.

[14] Guaranteed 10-bit monotonicity.

[15] Voltages between VRL and VRH will not cause damage to the pins. However, they may not be converted accurately if the differential voltage is above the maximum differential voltage. In addition, conversion errors may occur if the common mode voltage of the differential signal violates the Differential Input common mode voltage specification.

4.13 Platform flash controller electrical characteristics

Table 30. APC, RWSC, WWSC settings vs. frequency of operation[1]

Target Max Frequency (MHz)	APC[2]	RWSC[2]	WWSC
21[3]	000	000	01
41[3]	001	001	01
62[3]	010	010	01
82[3]	011	011	01
All	111	111	111

1 Illegal combinations exist, all entries must be taken from the same row

2 APC must be equal to RWSC

3 Maximum Frequency includes FM modulation

4.14 Flash memory electrical characteristics

Table 31. Program and erase specifications

Symbol		Parameter	Min Value	Typical Value[1]	Initial Max[2]	Max[3]	Unit
$T_{dwprogram}$	P	Double Word (64 bits) Program Time[4]	—	22	50	500	µs
$T_{16kpperase}$	P	16 KB Block Pre-program and Erase Time	—	300	500	5000	ms
$T_{32kpperase}$	P	32 KB Block Pre-program and Erase Time	—	400	600	5000	ms
$T_{64kpperase}$	P	64 KB Block Pre-program and Erase Time	—	600	900	5000	ms
$T_{128kpperase}$	P	128 KB Block Pre-program and Erase Time	—	800	1300	7500	ms

1 Typical program and erase times assume nominal supply values and operation at 25 °C. All times are subject to change pending device characterization.

2 Initial factory condition: < 100 program/erase cycles, 25 °C, typical supply voltage.

3 The maximum program & erase times occur after the specified number of program/erase cycles. These maximum values are characterized but not guaranteed.

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

Table 32. Flash module life

Symbol		Parameter	Conditions	Value		Unit
				Min	Typ	
P/E	C	Number of program/erase cycles per block for 16 Kbyte blocks over the operating temperature range (T_J)	—	100,000	—	cycles
P/E	C	Number of program/erase cycles per block for 32 and 64 Kbyte blocks over operating temperature range (T_J)	—	10,000	100,000	cycles
P/E	C	Number of program/erase cycles per block for 128 Kbyte blocks over the operating temperature range (T_J)	—	1,000	100,000	cycles
Retention	C	Minimum data retention at 85 °C average ambient temperature[1]	Blocks with 0 – 1,000 P/E cycles	20	—	years
			Blocks with 10,000 P/E cycles	10	—	years
			Blocks with 100,000 P/E cycles	5	—	years

1 Ambient temperature averaged over duration of application, not to exceed recommended product operating temperature range.

3 This parameter is supplied for reference and is not guaranteed by design and not tested.
4 Delay and rise/fall are measured to 20% or 80% of the respective signal.
5 This parameter is guaranteed by characterization before qualification rather than 100% tested.
6 In high swing mode, high/low swing pad Vol and Voh values are the same as those of the slew controlled output pads
7 Medium Slew-Rate Controlled Output buffer. Contains an input buffer and weak pullup/pulldown.
8 Output delay is shown in Figure 8. Add a maximum of one system clock to the output delay for delay with respect to system clock.
9 Can be used on the tester.
10 This drive select value is not supported. If selected, it will be approximately equal to 11.
11 Slow Slew-Rate Controlled Output buffer. Contains an input buffer and weak pullup/pulldown.
12 Selectable high/low swing IO pad with selectable slew in high swing mode only.
13 Fast pads are 3.3 V pads.
14 Stand alone input buffer. Also has weak pull-up/pull-down.

Table 34. Pad AC specifications (3.3 V)[1]

Pad Type		C	Output Delay (ns)[2,3] Low-to-High / High-to-Low		Rise/Fall Edge (ns)[3,4]		Drive Load (pF)	SRC/DSC
			Min	Max	Min	Max		MSB,LSB
Medium[5,6,7]	CC	D	5.8/4.4	18/17	2.7/2.1	10/10	50	11[8]
	CC	D	16/13	46/49	11.2/8.6	34/34	200	
	N/A							10[9]
	CC	D	14/16	37/45	6.5/6.7	19/19	50	01
	CC	D	27/27	69/82	15/13	43/43	200	
	CC	D	83/86	200/210	38/38	86/86	50	00
	CC	D	113/109	270/285	53/46	120/120	200	
Slow[7,10]	CC	D	9.2/6.9	27/28	5.5/4.1	20/20	50	11
	CC	D	30/23	81/87	21/16	63/63	200	
	N/A							10[9]
	CC	D	31/31	80/90	15.4/15.4	42/42	50	01
	CC	D	58/52	144/155	32/26	82/85	200	
	CC	D	162/168	415/415	80/82	190/190	50	00
	CC	D	216/205	533/540	106/95	250/250	200	
MultiV[7,11] (High Swing Mode)	CC	D		3.7/3.1		10/10	30	11[8]
	CC	D		46/49		37/37	200	
	N/A							10[9]
	CC	D		32		15/15	50	01
	CC	D		72		46/46	200	
	CC	D		210		100/100	50	00
	CC	D		295		134/134	200	

4.16.4 eMIOS timing

Table 39. eMIOS timing[1]

#	Symbol		C	Characteristic	Min. Value	Max. Value	Unit
1	t_{MIPW}	CC	D	eMIOS Input Pulse Width	4	—	t_{CYC}
2	t_{MOPW}	CC	D	eMIOS Output Pulse Width	1	—	t_{CYC}

[1] eMIOS timing specified at f_{SYS} = 80 MHz, V_{DD} = 1.14 V to 1.32 V, V_{DDEH} = 4.5 V to 5.25 V, $T_A = T_L$ to T_H, and C_L = 50 pF with SRC = 0b00.

4.16.5 DSPI timing

Table 40. DSPI timing[1,2]

#	Symbol		C	Characteristic	40 MHz		60 MHz		80 MHz		Unit
					Min.	Max.	Min.	Max.	Min.	Max.	
1	t_{SCK}	CC	D	SCK Cycle Time[3,4]	48.8 ns	5.8 ms	28.4 ns	3.5 ms	24.4 ns	2.9 ms	—
2	t_{CSC}	CC	D	PCS to SCK Delay[5]	46	—	26	—	22	—	ns
3	t_{ASC}	CC	D	After SCK Delay[6]	45	—	25	—	21	—	ns
4	t_{SDC}	CC	D	SCK Duty Cycle	$(½t_{SC})-2$	$(½t_{SC})+2$	$(½t_{SC})-2$	$(½t_{SC})+2$	$(½t_{SC})-2$	$(½t_{SC})+2$	ns
5	t_A	CC	D	Slave Access Time ($\overline{SS}$ active to SOUT driven)	—	25	—	25	—	25	ns
6	t_{DIS}	CC	D	Slave SOUT Disable Time ($\overline{SS}$ inactive to SOUT High-Z or invalid)	—	25	—	25	—	25	ns
7	t_{PCSC}	CC	D	PCSx to $\overline{PCSS}$ time	4	—	4	—	4	—	ns
8	t_{PASC}	CC	D	$\overline{PCSS}$ to PCSx time	5	—	5	—	5	—	ns
9	t_{SUI}	CC	Data Setup Time for Inputs								
			D	Master (MTFE = 0)	20	—	20	—	20	—	ns
			D	Slave	2	—	2	—	2	—	
			D	Master (MTFE = 1, CPHA = 0)[7]	–4	—	6	—	8	—	
			D	Master (MTFE = 1, CPHA = 1)	20	—	20	—	20	—	

Table 40. DSPI timing[1,2] (continued)

#	Symbol		C	Characteristic	40 MHz		60 MHz		80 MHz		Unit
					Min.	Max.	Min.	Max.	Min.	Max.	
10	t_{HI}	CC	Data Hold Time for Inputs								
			D	Master (MTFE = 0)	–4	—	–4	—	–4	—	ns
			D	Slave	7	—	7	—	7	—	
			D	Master (MTFE = 1, CPHA = 0)[7]	45	—	25	—	21	—	
			D	Master (MTFE = 1, CPHA = 1)	–4	—	–4	—	–4	—	
11	t_{SUO}	CC	Data Valid (after SCK edge)								
			D	Master (MTFE = 0)	—	6	—	6	—	6	ns
			D	Slave	—	25	—	25	—	25	
			D	Master (MTFE = 1, CPHA=0)	—	45	—	25	—	21	
			D	Master (MTFE = 1, CPHA=1)	—	6	—	6	—	6	
12	t_{HO}	CC	Data Hold Time for Outputs								
			D	Master (MTFE = 0)	–5	—	–5	—	–5	—	ns
			D	Slave	5.5	—	5.5	—	5.5	—	
			D	Master (MTFE = 1, CPHA = 0)	8	—	4	—	3	—	
			D	Master (MTFE = 1, CPHA = 1)	–5	—	–5	—	–5	—	

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 VDDEH = 3.0–5.25 V, TA = TL to TH, 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). 42 MHz parts allow for 40 MHz system clock + 2% FM; 62 MHz parts allow for a 60 MHz system clock + 2% FM, and 82 MHz parts allow for 80 MHz system clock + 2% FM.

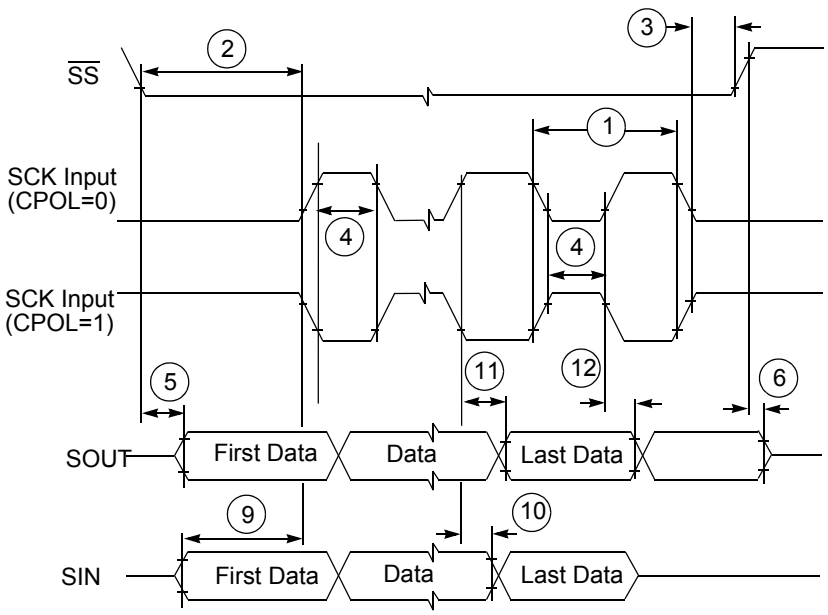
3 The minimum DSPI Cycle Time restricts the baud rate selection for given system clock rate. These numbers are calculated based on two MPC5634M devices communicating over a DSPI link.

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].

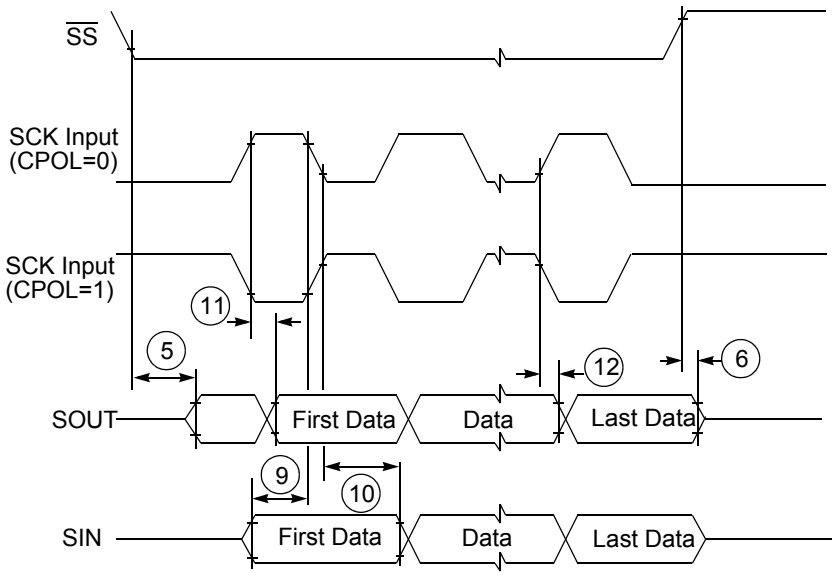
6 The maximum value is programmable in DSPI_CTARx[PASC] and DSPI_CTARx[ASC].

7 This number is calculated assuming the SMPL_PT bitfield in DSPI_MCR is set to 0b10.



These numbers reference Table 40.

Figure 26. DSPI modified transfer format timing – slave, CPHA =0



These numbers reference Table 40.

Figure 27. DSPI modified transfer format timing – slave, CPHA =1

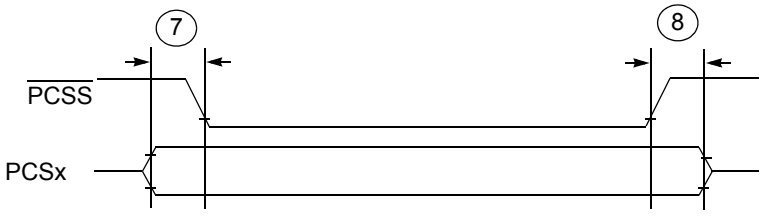


Figure 28. DSPI PCS strobe ($\overline{\text{PCSS}}$) timing

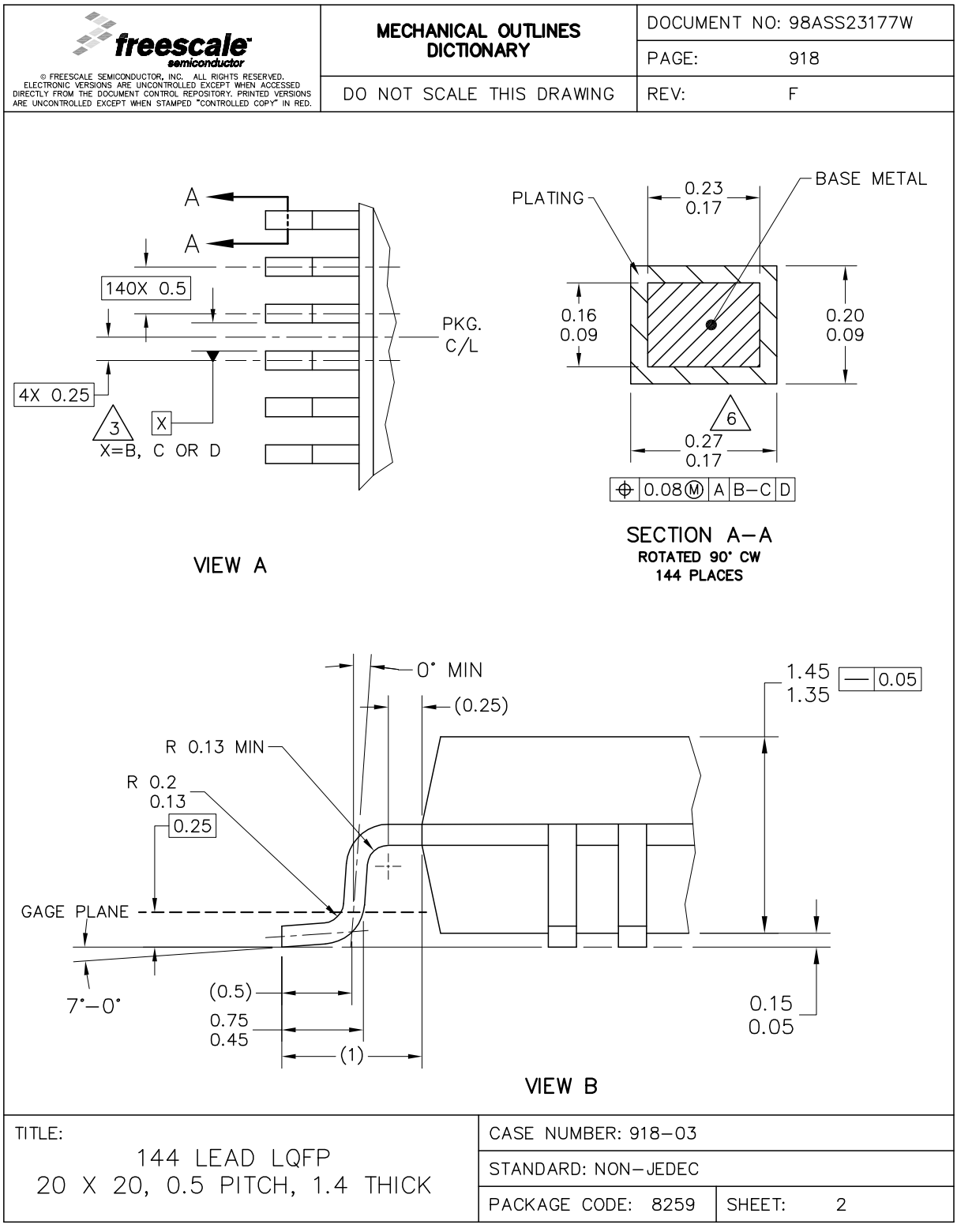


Figure 31. 144 LQFP package mechanical drawing (part 2)