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What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	Coldfire V1
Core Size	32-Bit Single-Core
Speed	50MHz
Connectivity	CANbus, I²C, SCI, SPI, USB OTG
Peripherals	LVD, PWM, WDT
Number of I/O	51
Program Memory Size	128KB (128K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	16K x 8
Voltage - Supply (Vcc/Vdd)	2.7V ~ 5.5V
Data Converters	A/D 12x12b
Oscillator Type	External
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	64-LQFP
Supplier Device Package	64-LQFP (10x10)
Purchase URL	https://www.e-xfl.com/pro/item?MUrl=&PartUrl=mcf51jm128evlh

1 MCF51JM128 Family Configurations

1.1 Device Comparison

The MCF51JM128 series consists of the devices compared in Table 1.

Table 1. MCF51JM128 Series Device Comparison

Feature	MCF51JM128			MCF51JM64			MCF51JM32		
	80-pin	64-pin	44-pin	80-pin	64-pin	44-pin	80-pin	64-pin	44-pin
Flash memory size (KB)	128			64			32		
RAM size (KB)	16			16			16		
V1 ColdFire core with BDM (background debug module)	Yes								
ACMP (analog comparator)	Yes								
ADC channels (12-bit)	12		8	12		8	12		8
CAN (controller area network)	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
RNGA + CAU	Yes[1]								
CMT (carrier modulator timer)	Yes								
COP (computer operating properly)	Yes								
IIC1 (inter-integrated circuit)	Yes								
IIC2	Yes	No		Yes	No		Yes	No	
IRQ (interrupt request input)	Yes								
KBI (keyboard interrupts)	8	8	6	8	8	6	8	8	6
LVD (low-voltage detector)	Yes								
MCG (multipurpose clock generator)	Yes								
Port I/O[2]	66	51	33	66	51	33	66	51	33
RGPIO (rapid general-purpose I/O)	16	6	0	16	6	0	16	6	0
RTC (real-time counter)	Yes								
SCI1 (serial communications interface)	Yes								
SCI2	Yes								
SPI1 (serial peripheral interface)	Yes								
SPI2	Yes								
TPM1 (timer/pulse-width modulator) channels	6	6	4	6	6	4	6	6	4
TPM2 channels	2								
USBOTG (USB On-The-Go dual-role controller)	Yes								
XOSC (crystal oscillator)	Yes								

1 Only existed on special part number

2 Up to 16 pins on Ports A, H, and J are shared with the ColdFire Rapid GPIO module.

1.2 Block Diagram

Figure 1 shows the connections between the MCF51JM128 series pins and modules.

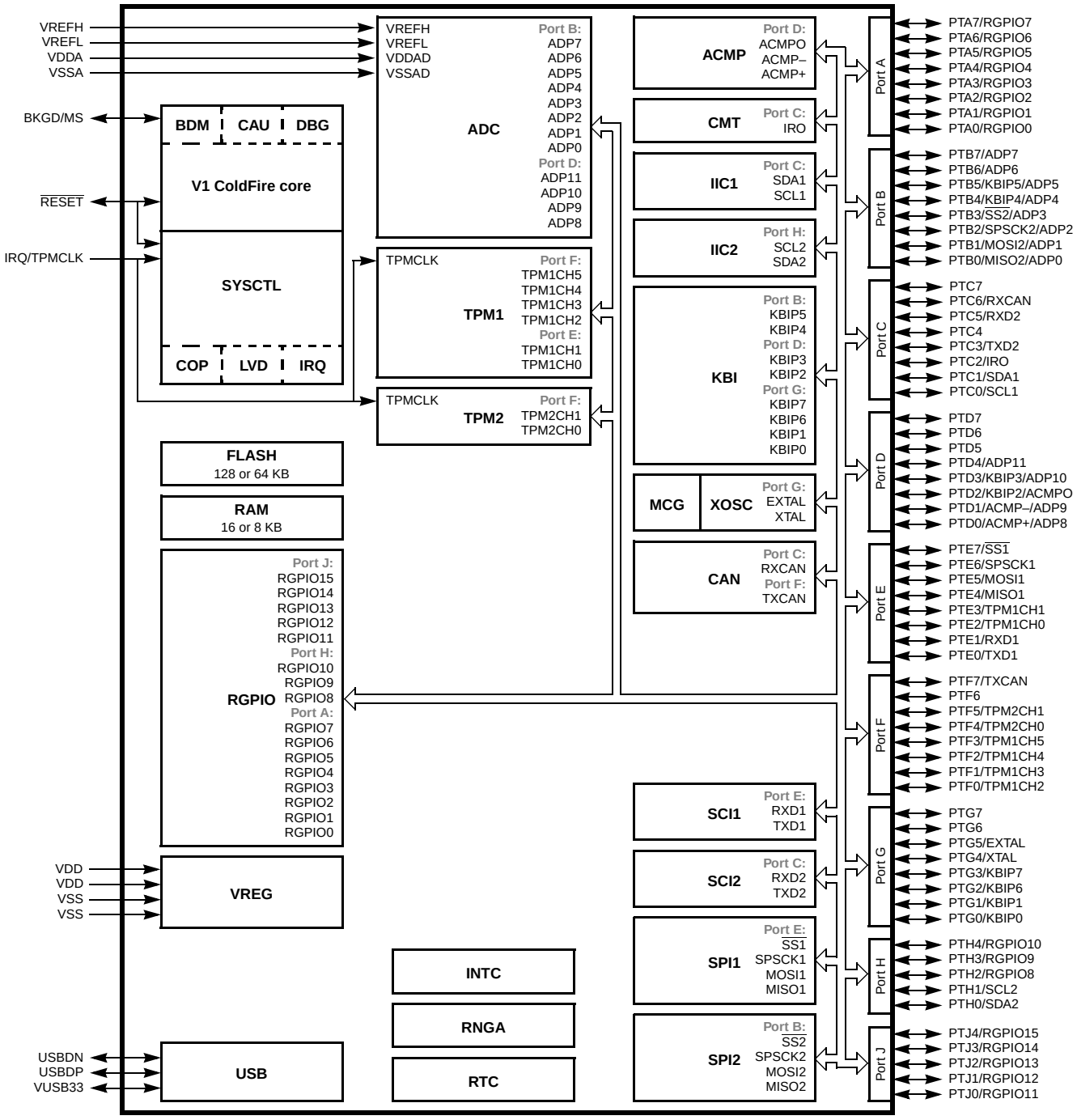


Figure 1. MCF51JM128 Block Diagram

- RTC
  - 8-bit modulus counter with binary- or decimal-based prescaler
  - External clock source for precise time base, time-of-day, calendar or task scheduling functions
  - Free running on-chip low power oscillator (1 kHz) for cyclic wake-up without external components
- Carrier modulator timer (CMT)
  - carrier generator, modulator, and transmitter drive the infrared out (IRO) pin
  - operation in independent high/low time control, baseband, FSK, and direct IRO control modes
- Input/Output
  - 66 GPIOs
  - Eight keyboard interrupt pins with selectable polarity
  - Hysteresis and configurable pull-up device on all input pins; configurable slew rate and drive strength on all output pins
  - 16 bits of Rapid GPIO connected to the processor's local 32-bit platform bus with set, clear, and faster toggle functionality

1.4 Part Numbers

Table 3. Orderable Part Number Summary

Freescale Part Number	Description	Flash / SRAM (KB)	Package	Temperature
MCF51JM128EVLK	MCF51JM128 ColdFire Microcontroller with CAU and RNGA Enabled	128 / 16	80 LQFP	–40 to +105 °C
MCF51JM128VLK	MCF51JM128 ColdFire Microcontroller	128 / 16	80 LQFP	–40 to +105 °C
MCF51JM128EVLH	MCF51JM128 ColdFire Microcontroller with CAU and RNGA Enabled	128 / 16	64 LQFP	–40 to +105 °C
MCF51JM128VLH	MCF51JM128 ColdFire Microcontroller	128 / 16	64 LQFP	–40 to +105 °C
MCF51JM128EVQH	MCF51JM128 ColdFire Microcontroller with CAU and RNGA Enabled	128 / 16	64 QFP	–40 to +105 °C
MCF51JM128VQH	MCF51JM128 ColdFire Microcontroller	128 / 16	64 QFP	–40 to +105 °C
MCF51JM128EVLD	MCF51JM128 ColdFire Microcontroller with CAU and RNGA Enabled	128 / 16	44 LQFP	–40 to +105 °C
MCF51JM128VLD	MCF51JM128 ColdFire Microcontroller	128 / 16	44 LQFP	–40 to +105 °C
MCF51JM64EVLK	MCF51JM64 ColdFire Microcontroller with CAU and RNGA Enabled	64 / 16	80 LQFP	–40 to +105 °C
MCF51JM64VLK	MCF51JM64 ColdFire Microcontroller	64 / 16	80 LQFP	–40 to +105 °C
MCF51JM64EVLH	MCF51JM64 ColdFire Microcontroller with CAU and RNGA Enabled	64 / 16	64 LQFP	–40 to +105 °C
MCF51JM64VLH	MCF51JM64 ColdFire Microcontroller	64 / 16	64 LQFP	–40 to +105 °C
MCF51JM64EVQH	MCF51JM64 ColdFire Microcontroller with CAU and RNGA Enabled	64 / 16	64 QFP	–40 to +105 °C
MCF51JM64VQH	MCF51JM64 ColdFire Microcontroller	64 / 16	64 QFP	–40 to +105 °C

Table 3. Orderable Part Number Summary (continued)

MCF51JM64EVLD	MCF51JM64 ColdFire Microcontroller with CAU and RNGA Enabled	64 / 16	44 LQFP	–40 to +105 °C
MCF51JM64VLD	MCF51JM64 ColdFire Microcontroller	64 / 16	44 LQFP	–40 to +105 °C
MCF51JM32EVLK	MCF51JM32 ColdFire Microcontroller with CAU and RNGA Enabled	32 / 16	80 LQFP	–40 to +105 °C
MCF51JM32VLK	MCF51JM32 ColdFire Microcontroller	32 / 16	80 LQFP	–40 to +105 °C
MCF51JM32EVLH	MCF51JM32 ColdFire Microcontroller with CAU and RNGA Enabled	32 / 16	64 LQFP	–40 to +105 °C
MCF51JM32VLH	MCF51JM32 ColdFire Microcontroller	32 / 16	64 LQFP	–40 to +105 °C
MCF51JM32EVQH	MCF51JM32 ColdFire Microcontroller with CAU and RNGA Enabled	32 / 16	64 QFP	–40 to +105 °C
MCF51JM32VQH	MCF51JM32 ColdFire Microcontroller	32 / 16	64 QFP	–40 to +105 °C
MCF51JM32EVLD	MCF51JM32 ColdFire Microcontroller with CAU and RNGA Enabled	32 / 16	44 LQFP	–40 to +105 °C
MCF51JM32VLD	MCF51JM32 ColdFire Microcontroller	32 / 16	44 LQFP	–40 to +105 °C

1.5 Pinouts and Packaging

Figure 2 shows the pinout of the 80-pin LQFP.

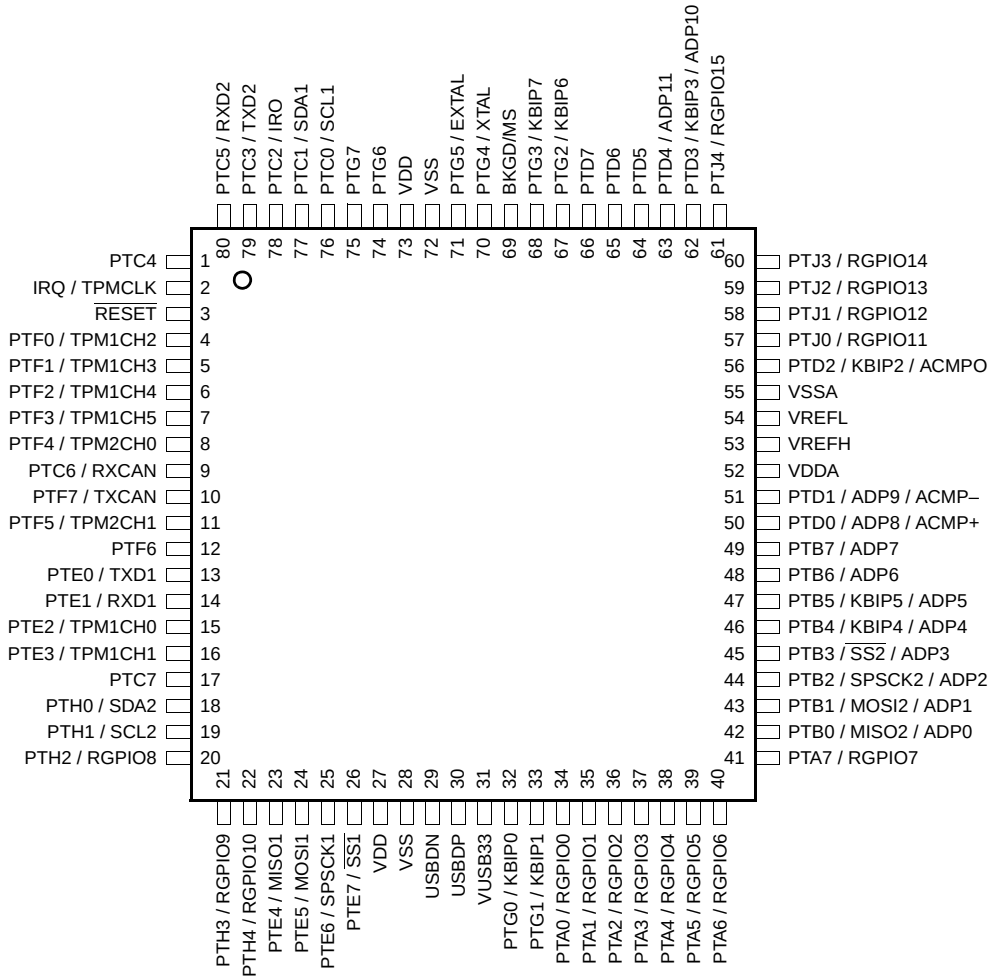


Figure 2. 80-pin LQFP

Figure 3 shows the pinout of the 64-pin LQFP and QFP.

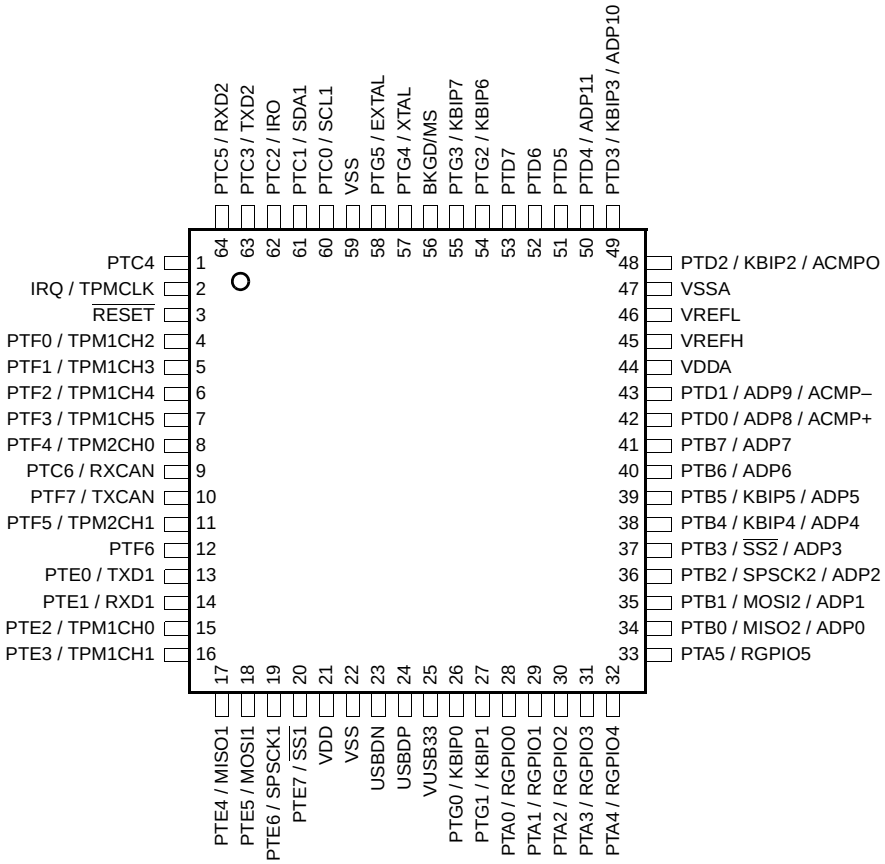


Figure 3. 64-pin QFP and LQFP

Figure 4 shows the pinout of the 44-pin LQFP.

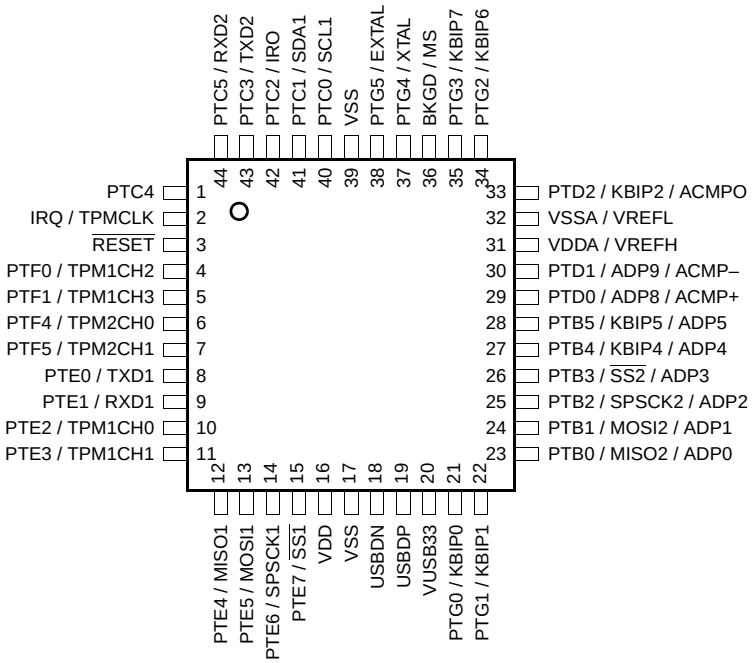


Figure 4. 44-pin LQFP

Table 4 shows the package pin assignments.

Table 4. Pin Assignments by Package and Pin Sharing Priority

Pin Number			<-- Lowest **Priority** --> Highest		
80	**64**	**44**	**Port Pin**	**Alt 1**	**Alt 2**
1	1	1	PTC4		—
2	2	2	—	IRQ	TPMCLK
3	3	3	—	$\overline{\text{RESET}}$	—
4	4	4	PTF0	TPM1CH2	—
5	5	5	PTF1	TPM1CH3	—
6	6	—	PTF2	TPM1CH4	—
7	7	—	PTF3	TPM1CH5	—
8	8	6	PTF4	TPM2CH0	BUSCLK_OUT
9	9	—	PTC6	RXCAN	—
10	10	—	PTF7	TXCAN	—
11	11	7	PTF5	TPM2CH1	—
12	12	—	PTF6	—	—
13	13	8	PTE0	TXD1	—
14	14	9	PTE1	RXD1	—
15	15	10	PTE2	TPM1CH0	—

2 Preliminary Electrical Characteristics

This section contains electrical specification tables and reference timing diagrams for the MCF51JM128 microcontroller, including detailed information on power considerations, DC/AC electrical characteristics, and AC timing specifications.

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

NOTE

The parameters specified in this data sheet supersede any values found in the module specifications.

2.1 Parameter Classification

The electrical parameters shown in this supplement are guaranteed by various methods. To give the customer a better understanding the following classification is used and the parameters are tagged accordingly in the tables where appropriate:

Table 5. Parameter Classifications

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.

2.2 Absolute Maximum Ratings

Absolute maximum ratings are stress ratings only, and functional operation at the maxima is not guaranteed. Stress beyond the limits specified in Table 6 may affect device reliability or cause permanent damage to the device. For functional operating conditions, refer to the remaining tables in this section.

This device contains circuitry protecting against damage due to high static voltage or electrical fields; however, it is advised that normal precautions be taken to avoid application of any voltages higher than maximum-rated voltages to this high-impedance circuit. Reliability of operation is enhanced if unused inputs are tied to an appropriate logic voltage level (for instance, V_{SS} or V_{DD}).

Table 10. DC Characteristics (continued)

Num	C	Parameter	Symbol	Min	Typ[1]	Max	Unit
7	P	Input low voltage; all digital inputs V_{DD} = 5V V_{DD} = 3V	V_{IL}	—	—	 1.75 1.05	V
8	P	Input hysteresis; all digital inputs	V_{hys}	0.06 x V_{DD}			mV
9	P	Input leakage current; input only pins[3]	$\|I_{In}\|$	—	0.1	1	µA
10	P	High Impedance (off-state) leakage current[3]	$\|I_{OZ}\|$	—	0.1	1	µA
11	P	Internal pullup resistors[4]	R_{PU}	20	45	65	kΩ
12	P	Internal pulldown resistors[5]	R_{PD}	20	45	65	kΩ
13		Internal pullup resistor to USBDP (to V_{USB33}) Idle Transmit	R_{PUPD}	 900 1425	 1300 2400	 1575 3090	kΩ
14	C	Input Capacitance; all non-supply pins	C_{In}	—	—	8	pF
15	D	RAM retention voltage[6]	V_{RAM}	—	0.6	1.0	V
16	P	POR rearm voltage	V_{POR}	0.9	1.4	2.0	V
17	D	POR rearm time	t_{POR}	10	—	—	µs
18	P	Low-voltage detection threshold — high range V_{DD} falling V_{DD} rising	V_{LVD1}	 3.9 4.0	 4.0 4.1	 4.1 4.2	V
19	P	Low-voltage detection threshold — low range V_{DD} falling V_{DD} rising	V_{LVD0}	 2.48 2.54	 2.56 2.62	 2.64 2.70	V
20	C	Low-voltage warning threshold — high range 1 V_{DD} falling V_{DD} rising	V_{LVW3}	 4.5 4.6	 4.6 4.7	 4.7 4.8	V
21	P	Low-voltage warning threshold — high range 0 V_{DD} falling V_{DD} rising	V_{LVW2}	 4.2 4.3	 4.3 4.4	 4.4 4.5	V
22	P	Low-voltage warning threshold low range 1 V_{DD} falling V_{DD} rising	V_{LVW1}	 2.84 2.90	 2.92 2.98	 3.00 3.06	V
23	C	Low-voltage warning threshold — low range 0 V_{DD} falling V_{DD} rising	V_{LVW0}	 2.66 2.72	 2.74 2.80	 2.82 2.88	V
24	T	Low-voltage inhibit reset/recover hysteresis 5 V 3 V	V_{hys}	 — —	 100 60	 — —	mV

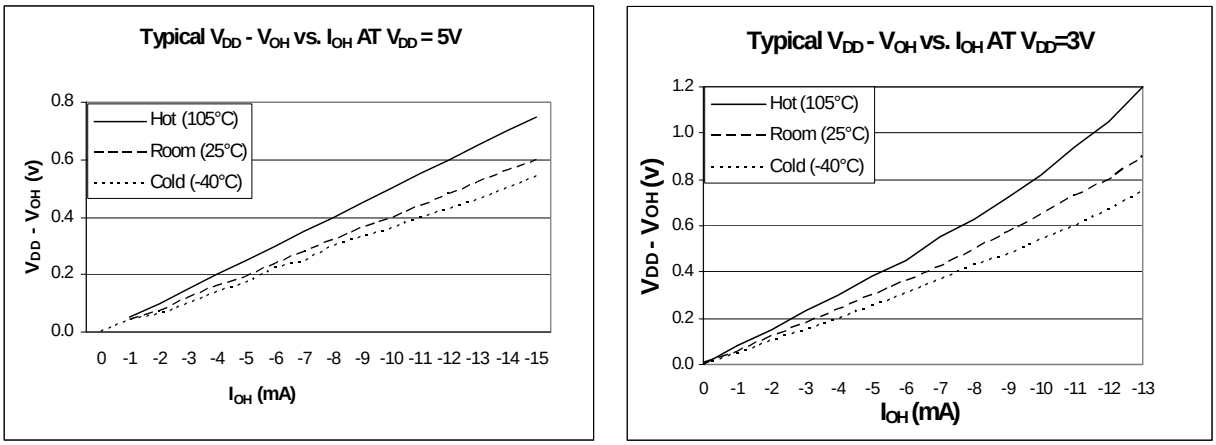


Figure 7. Typical High-side Drive (source) characteristics – High Drive (PTxDSn = 1)

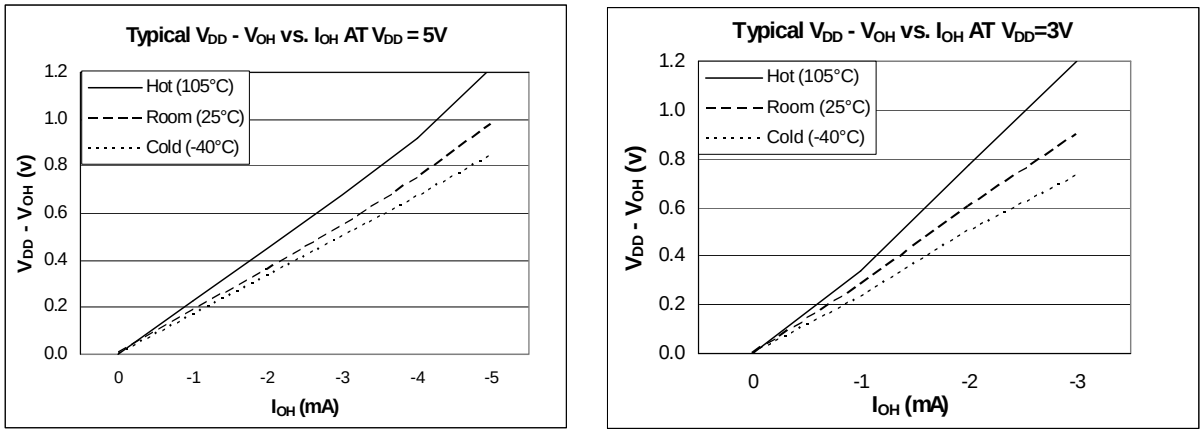


Figure 8. Typical High-side Drive (source) characteristics – Low Drive (PTxDSn = 0)

2.6 Supply Current Characteristics

Table 11. Supply Current Characteristics

Num	C	Parameter	Symbol	V_{DD} (V)	Typical[1]	Max[2]	Unit
1	C	Run supply current[3] measured at (CPU clock = 2 MHz, f_{Bus} = 1 MHz)	RI_{DD}	5	4.0	7	mA
				3	4.0	7	
2	P	Run supply current[3] measured at (CPU clock = 16 MHz, f_{Bus} = 8 MHz)		5	19	30	mA
				3	18.7	30	
3	C	Run supply current[3] measured at (CPU clock = 48 MHz, f_{Bus} = 24 MHz)		5	45	70	mA
				3	44	70	

2.7 Analog Comparator (ACMP) Electricals

Table 12. Analog Comparator Electrical Specifications

Num	C	Rating	Symbol	Min	Typical	Max	Unit
1		Supply voltage	V_{DD}	2.7	—	5.5	V
2		Supply current (active)	I_{DDAC}	—	20	35	µA
3		Analog input voltage	V_{AIN}	V_{SS} – 0.3	—	V_{DD}	V
4		Analog input offset voltage	V_{AIO}		20	40	mV
5		Analog Comparator hysteresis	V_H	3.0	6.0	20.0	mV
6		Analog input leakage current	I_{ALKG}	--	--	1.0	µA
7		Analog Comparator initialization delay	t_{AINIT}	—	—	1.0	µs
8		Bandgap Voltage Reference Factory trimmed at V_{DD} = 3.0 V, Temp = 25°C	V_{BG}	1.19	1.20	1.21	V

2.8 ADC Characteristics

Table 13. 5 Volt 12-bit ADC Operating Conditions

Characteristic	Conditions	Symb	Min	Typ[1]	Max	Unit	Comment
Supply voltage	Absolute	V_{DDA}	2.7	—	5.5	V	
	Delta to V_{DD} (V_{DD}-V_{DDA})[2]	ΔV_{DDA}	–100	0	+100	mV	
Ground voltage	Delta to V_{SS} (V_{SS}-V_{SSA})[2]	ΔV_{SSA}	–100	0	+100	mV	
Ref Voltage High		V_{REFH}	2.7	V_{DDA}	V_{DDA}	V	
Ref Voltage Low		V_{REFL}	V_{SSA}	V_{SSA}	V_{SSA}	V	
Input Voltage		V_{ADIN}	V_{REFL}	—	V_{REFH}	V	
Input Capacitance		C_{ADIN}	—	4.5	5.5	pF	
Input Resistance		R_{ADIN}	—	3	5	kΩ	
Analog Source Resistance	12 bit mode f_{ADCK} > 4MHz f_{ADCK} < 4MHz	R_{AS}	 — —	 — —	 2 5	kΩ	External to MCU
	10 bit mode f_{ADCK} > 4MHz f_{ADCK} < 4MHz		 — —	 — —	 5 10		
	8 bit mode (all valid f_{ADCK})		—	—	10		
ADC Conversion Clock Freq.	High Speed (ADLPC=0)	f_{ADCK}	0.4	—	8.0	MHz	
	Low Power (ADLPC=1)		0.4	—	4.0		

1 Typical values assume V_{DDA} = 5.0V, Temp = 25°C, f_{ADCK}=1.0MHz unless otherwise stated. Typical values are for reference only and are not tested in production.

2 DC potential difference.

Table 14. 5 Volt 12-bit ADC Characteristics (V_{REFH} = V_{DDA}, V_{REFL} = V_{SSA}) (continued)

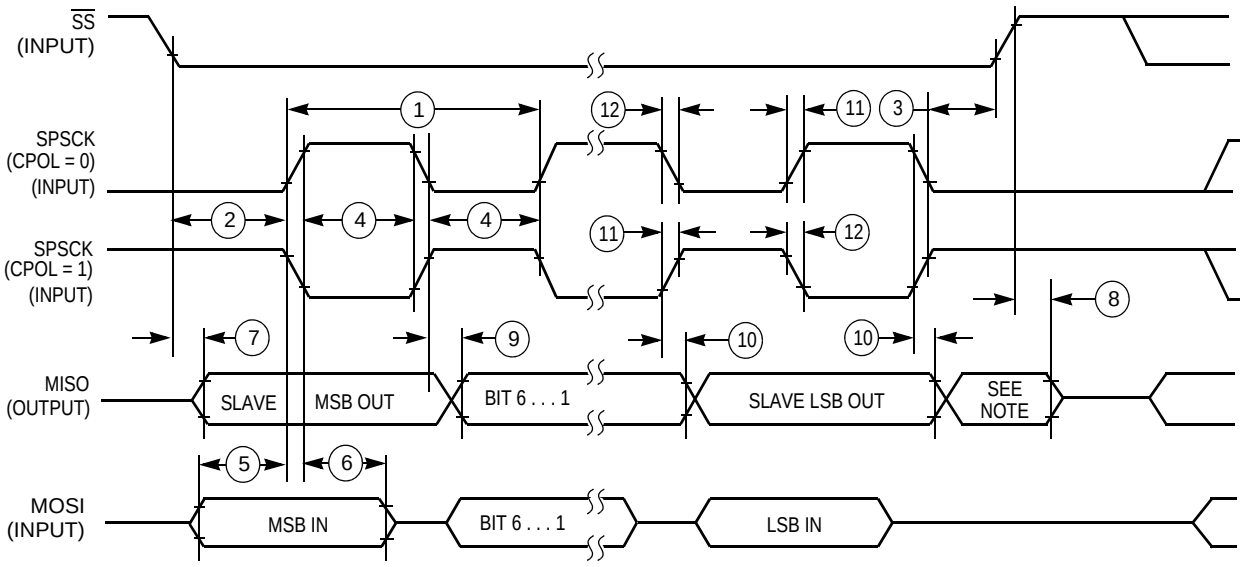
Characteristic	Conditions	C	Symb	Min	Typ[1]	Max	Unit	Comment
Conversion Time (Including sample time)	Short Sample (ADLSMP=0)	T	t_{ADC}	—	20	—	ADCK cycles	See Table 9 for conversion time variances
	Long Sample (ADLSMP=1)			—	40	—		
Sample Time	Short Sample (ADLSMP=0)	T	t_{ADS}	—	3.5	—	ADCK cycles	
	Long Sample (ADLSMP=1)			—	23.5	—		
Total Unadjusted Error	12 bit mode	T	E_{TUE}	—	±3.0	—	LSB[2]	Includes quantization
	10 bit mode	P		—	±1	±2.5		
	8 bit mode	T		—	±0.5	±1.0		
Differential Non-Linearity	12 bit mode	T	DNL	—	±1.75	—	LSB[2]	
	10 bit mode[3]	P		—	±0.5	±1.0		
	8 bit mode[3]	T		—	±0.3	±0.5		
Integral Non-Linearity	12 bit mode	T	INL	—	±1.5	—	LSB[2]	
	10 bit mode	T		—	±0.5	±1.0		
	8 bit mode	T		—	±0.3	±0.5		
Zero-Scale Error	12 bit mode	T	E_{ZS}	—	±1.5	—	LSB[2]	V_{ADIN} = V_{SSAD}
	10 bit mode	P		—	±0.5	±1.5		
	8 bit mode	T		—	±0.5	±0.5		
Full-Scale Error	12 bit mode	T	E_{FS}	—	±1	—	LSB[2]	V_{ADIN} = V_{DDAD}
	10 bit mode	T		—	±0.5	±1		
	8 bit mode	T		—	±0.5	±0.5		
Quantization Error	12 bit mode	D	E_Q	—	-1 to 0	—	LSB[2]	
	10 bit mode			—	—	±0.5		
	8 bit mode			—	—	±0.5		
Input Leakage Error	12 bit mode	D	E_{IL}	—	±1	—	LSB[2]	Pad leakage[4] * R_{AS}
	10 bit mode			—	±0.2	±2.5		
	8 bit mode			—	±0.1	±1		
Temp Sensor Voltage	25°C	D	V_{TEMP25}	—	1.396	—	V	
Temp Sensor Slope	-40°C - 25°C	D	m	—	3.266	—	mV/°C	
	25°C - 125°C			—	3.638	—		

1 Typical values assume V_{DDA} = 5.0V, Temp = 25°C, f_{ADCK}=1.0MHz unless otherwise stated. Typical values are for reference only and are not tested in production.

2 1 LSB = $(V_{REFH} - V_{REFL})/2^N$

3 Monotonicity and No-Missing-Codes guaranteed in 10 bit and 8 bit modes

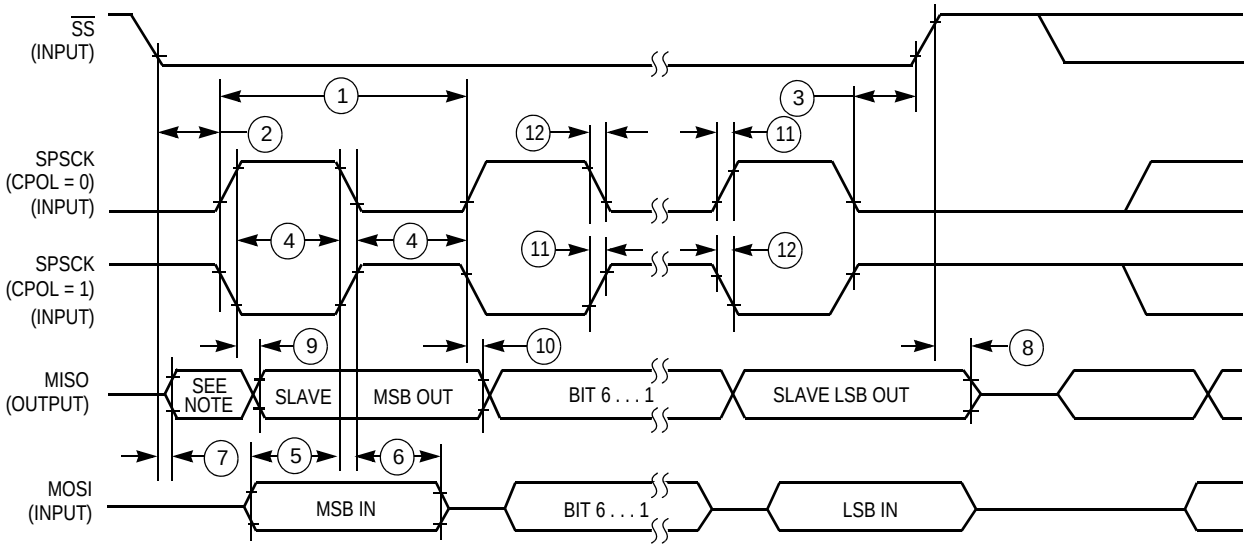
4 Based on input pad leakage current. Refer to pad electricals.



NOTE:

1. Not defined but normally MSB of character just received

Figure 16. SPI Slave Timing (CPHA = 0)



NOTE:

1. Not defined but normally LSB of character just received

Figure 17. SPI Slave Timing (CPHA = 1)

3 Mechanical Outline Drawings

3.1 80-pin LQFP

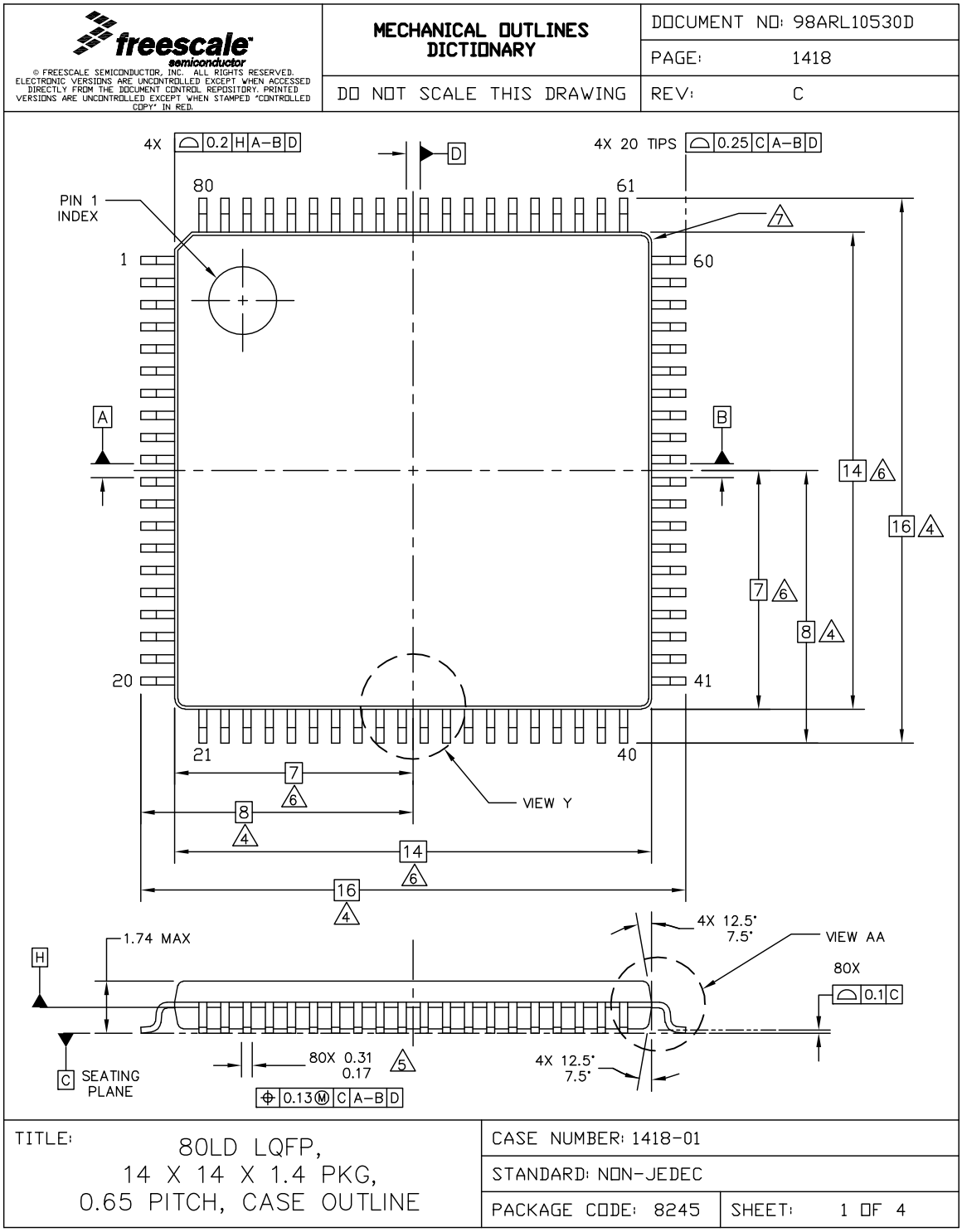


Figure 18. 80-pin LQFP Diagram - I

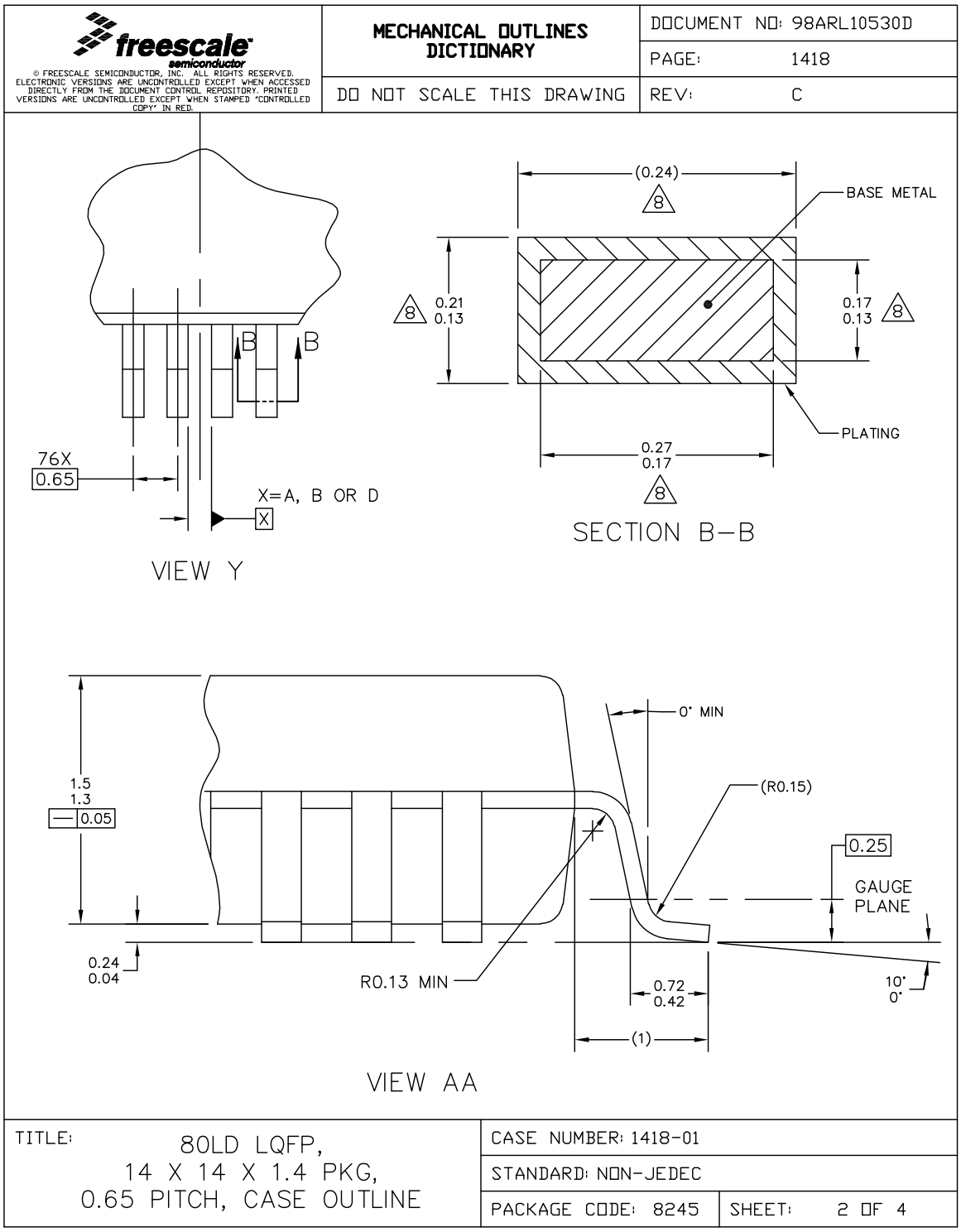


Figure 19. 80-pin LQFP Diagram - II

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		PAGE: 840F
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NOTES:

1. DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M–1994.
3. DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
4. DIMENSIONS TO BE DETERMINED AT SEATING PLANE C.
5. THIS DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL NOT CAUSE THE LEAD WIDTH TO EXCEED THE UPPER LIMIT BY MORE THAN 0.08 mm AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND ADJACENT LEAD SHALL NOT BE LESS THAN 0.07 mm.
6. THIS DIMENSION DOES NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25 mm PER SIDE. THIS DIMENSION IS MAXIMUM PLASTIC BODY SIZE DIMENSION INCLUDING MOLD MISMATCH.
7. EXACT SHAPE OF EACH CORNER IS OPTIONAL.
8. THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.1 mm AND 0.25 mm FROM THE LEAD TIP.

TITLE: 64LD LQFP, 10 X 10 X 1.4 PKG, 0.5 PITCH, CASE OUTLINE	CASE NUMBER: 840F–02	
	STANDARD: JEDEC MS–026 BCD	
	PACKAGE CODE: 8426	SHEET: 3

Figure 23. 64-pin LQFP Diagram - III

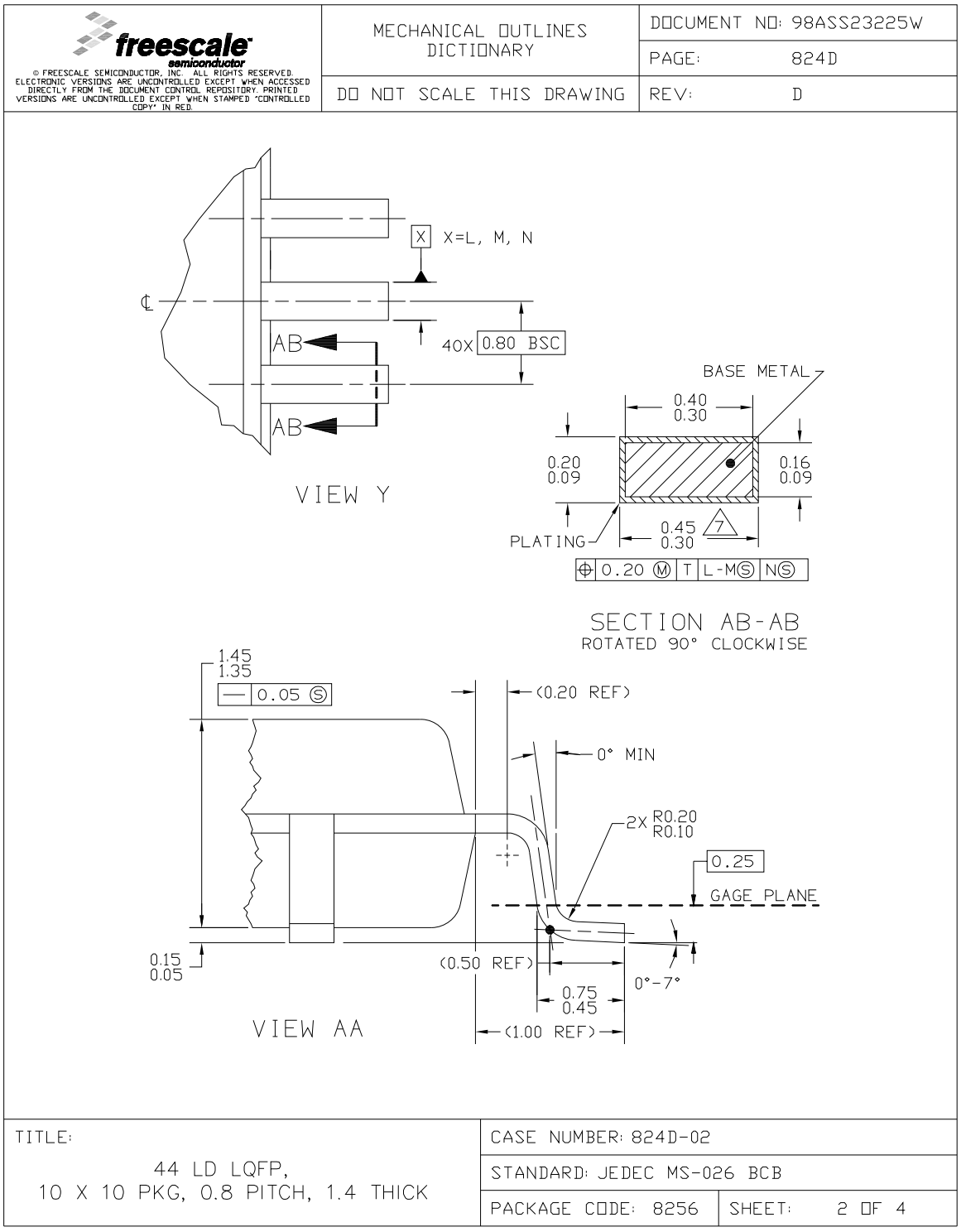

Figure 28. 44-pin LQFP Diagram - II

freescale semiconductor	MECHANICAL OUTLINES DICTIONARY	DOCUMENT NO: 98ASS23225W
		PAGE: 824D
	DO NOT SCALE THIS DRAWING	REV: D

NOTES:

1. DIMENSIONS AND TOLERANCING PER ASME Y14.5M–1994.
2. CONTROLLING DIMENSION: MILLIMETER
3. DATUM PLANE H IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
4. DATUMS L, M AND N TO BE DETERMINED AT DATUM PLANE H.
5. DIMENSIONS TO BE DETERMINED AT SEATING PLANE T.
6. DIMENSIONS DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25 PER SIDE. DIMENSIONS DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE H.
7. DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT CAUSE THE DIMENSION TO EXCEED 0.53. MINIMUM SPACE BETWEEN PROTRUSION AND ADJACENT LEAD OR PROTRUSION 0.07.

TITLE: 44 LD LQFP, 10 X 10 PKG, 0.8 PITCH, 1.4 THICK	CASE NUMBER: 824D-02	
	STANDARD: JEDEC MS-026 BCB	
	PACKAGE CODE: 8256	SHEET: 3 OF 4

Figure 29. 44-pin LQFP Diagram - III

4 Revision History

This section lists major changes between versions of the MCF51JM128 Data Sheet document.

Table 23. Changes Between Revisions

Revision	Description
1	Updated features list Updated the figures Typical Low-side Drive (sink) characteristics – High Drive (PTxDSn = 1), Typical Low-side Drive (sink) characteristics – Low Drive (PTxDSn = 0), and Typical High-side Drive (source) characteristics – High Drive (PTxDSn = 1) Added the figure Typical High-side Drive (source) characteristics – Low Drive (PTxDSn = 0) Updated the table Supply Current Characteristics Updated the table Oscillator Electrical Specifications (Temperature Range = –40 to 105×C Ambient) Updated the table SPI Electrical Characteristic, DC Characteristics
2	Updated the table Orderable Part Number Summary, DC Characteristics, and Supply Current Characteristics
3	Updated the table Orderable Part Number Summary, MCG Characteristics, SPI Characteristics, and Supply Current Characteristics Changed V_{DDAD} to V_{DDA}, V_{SSAD} to V_{SSA} Updated the table Device comparison
4	Added “RAM retention voltage” parameter in “DC Characteristics” table, alongwith a table note. Added “Temp sensor voltage” parameter in “5 Volt 12-bit ADC Characteristics (V_{REFH} = V_{DDA}, V_{REFL} = V_{SSA})” table. Added “ “Temp sensor slope” parameter in 5 Volt 12-bit ADC Characteristics (V_{REFH} = V_{DDA}, V_{REFL} = V_{SSA}) table. Also, corrected unit of “Temp sensor voltage” parameter in 5 Volt 12-bit ADC Characteristics (V_{REFH} = V_{DDA}, V_{REFL} = V_{SSA}) table.

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