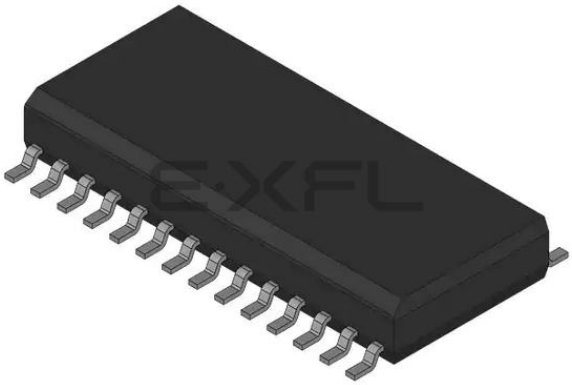

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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	RS08
Core Size	8-Bit
Speed	20MHz
Connectivity	SCI
Peripherals	LCD, LVD, POR, PWM, WDT
Number of I/O	26
Program Memory Size	4KB (4K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	256 x 8
Voltage - Supply (Vcc/Vdd)	2.7V ~ 5.5V
Data Converters	A/D 8x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C
Mounting Type	Surface Mount
Package / Case	28-SOIC (0.295", 7.50mm Width)
Supplier Device Package	28-SOIC
Purchase URL	https://www.e-xfl.com/pro/item?MUrl=&PartUrl=mc9rs08le4cwl

Table of Contents

Revision History

To provide the most up-to-date information, the revision of our documents on the World Wide Web will be the most current. Your printed copy may be an earlier revision. To verify you have the latest information available, refer to:

http://freescale.com/

The following revision history table summarizes changes contained in this document.

Revision	Date	Description of Changes
1	10/6/2008	Initial public release.
2	11/3/2008	In Table 8, updated the WIDD, added the maximum of RIDD and SIDD at 5 V and deleted RTI adder from stop with 32.768 kHz crystal external clock source reference enabled. Added maximum of I_{OLT} in Table 7.
3	12/4/2009	Updated the part number information.

Related Documentation

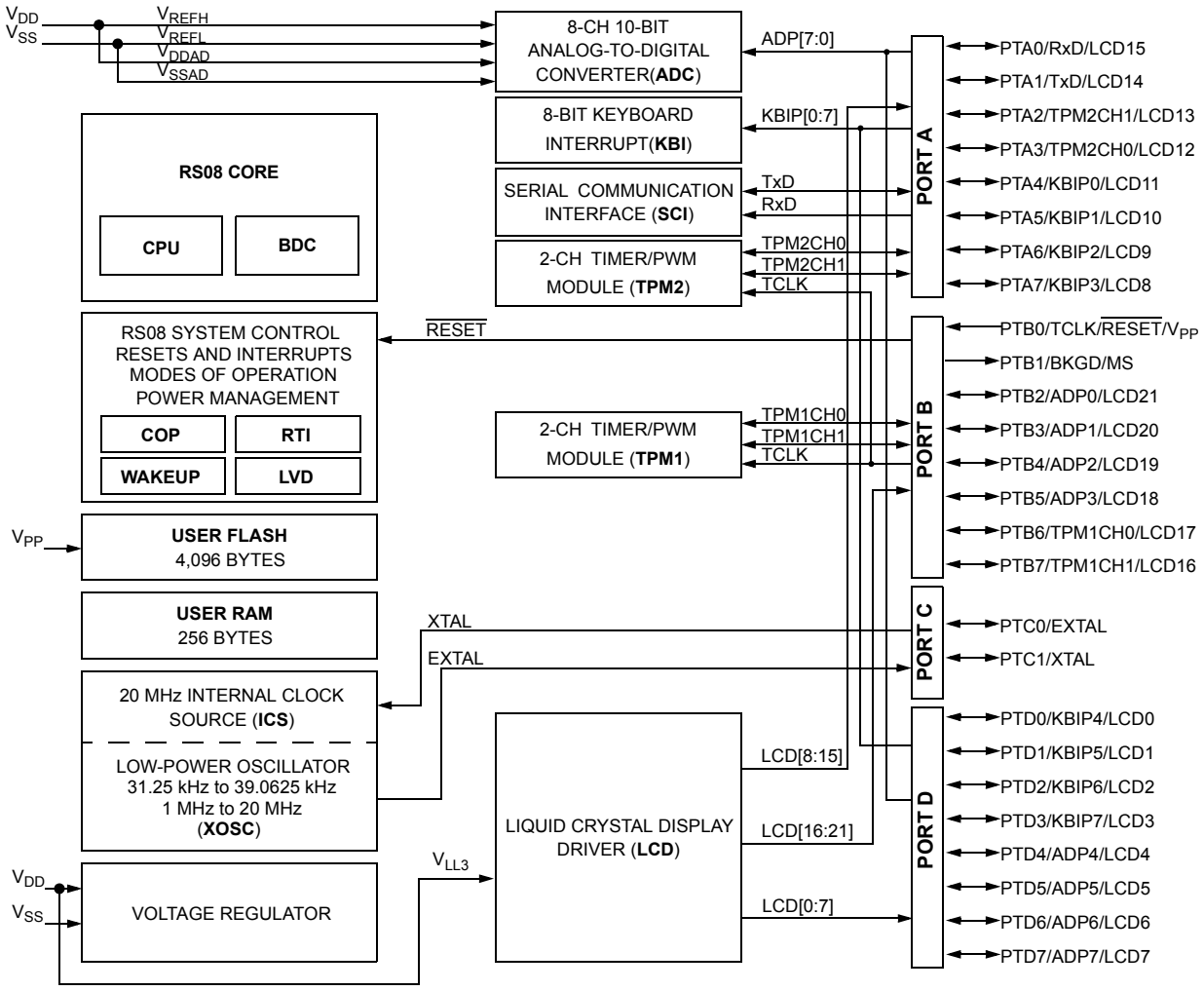
Find the most current versions of all documents at: http://www.freescale.com

Reference Manual (MC9RS08LE4RM)

Contains extensive product information including modes of operation, memory, resets and interrupts, register definition, port pins, CPU, and all module information.

1 MCU Block Diagram

The block diagram, Figure 1, shows the structure of the MC9RS08LE4 MCU.



NOTES:

1. PTB0/TCLK/$\overline{\text{RESET}}$/V_{PP} is an input-only pin when used as port pin
2. PTB1/BKGD/MS is an output-only pin

Figure 1. MC9RS08LE4 Block Diagram

2 Pin Assignments

This section shows the pin assignments in the packages available for the MC9RS08LE4.

Table 2-1. Pin Availability by Package Pin-Count

Pin Number	<-- Lowest **Priority** --> Highest			
28	**Port Pin**	**Alt 1**	**Alt 2**	**Alt 3**
1	PTD3		KBIP7	LCD3
2	PTD2		KBIP6	LCD2
3	PTD1		KBIP5	LCD1
4	PTD0		KBIP4	LCD0
5				V_{DD}
6				V_{SS}
7	PTC0		EXTAL	
8	PTC1		XTAL	
9	PTB0	TCLK	$\overline{\text{RESET}}$	V_{PP}
10	PTB1		BKGD	MS
11	PTB2		ADP0	LCD21
12	PTB3		ADP1	LCD20
13	PTB4		ADP2	LCD19
14	PTB5		ADP3	LCD18
15	PTB6		TPM1CH0	LCD17
16	PTB7		TPM1CH1	LCD16
17	PTA0		RxD	LCD15
18	PTA1		TxD	LCD14
19	PTA2		TPM2CH1	LCD13
20	PTA3		TPM2CH0	LCD12
21	PTA4		KBIP0	LCD11
22	PTA5		KBIP1	LCD10
23	PTA6		KBIP2	LCD9
24	PTA7		KBIP3	LCD8
25	PTD7		ADP7	LCD7
26	PTD6		ADP6	LCD6
27	PTD5		ADP5	LCD5
28	PTD4		ADP4	LCD4

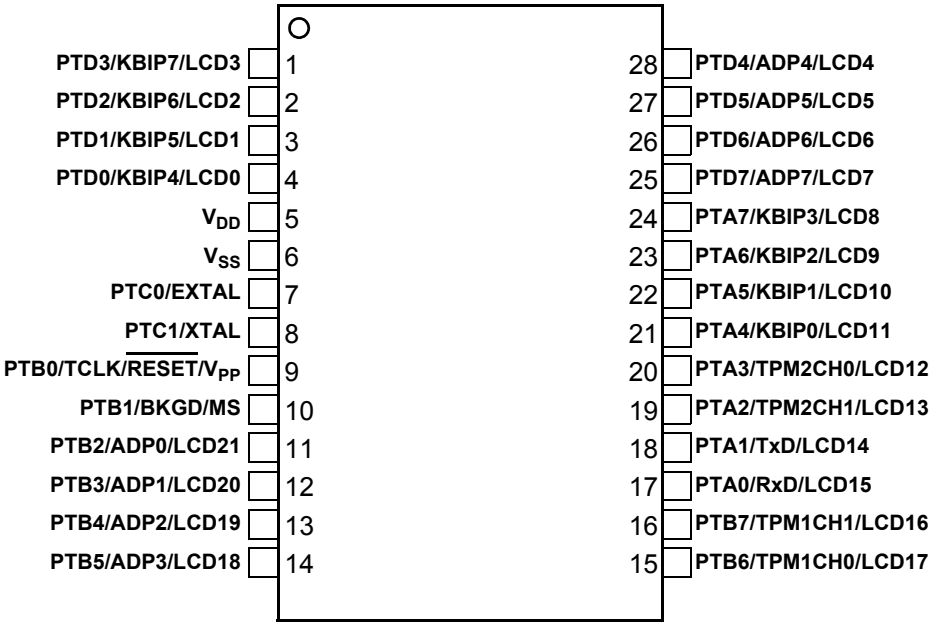


Figure 2. MC9RS08LE4 in 28-Pin SOIC Package

3 Electrical Characteristics

3.1 Introduction

This section contains electrical and timing specifications for the MC9RS08LE4 microcontroller available at the time of publication.

3.2 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 2. 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.

3.3 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 3 may affect device reliability or cause permanent damage to the device. For functional operating conditions, refer to the remaining tables in this chapter.

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, either V_{SS} or V_{DD}) or the programmable pull-up resistor associated with the pin is enabled.

Table 3. Absolute Maximum Ratings

Rating	Symbol	Value	Unit
Supply voltage	V_{DD}	2.7 to 5.5	V
Maximum current into V_{DD}	I_{DD}	120	mA
Digital input voltage	V_{In}	–0.3 to V_{DD} + 0.3	V
Instantaneous maximum current Single pin limit (applies to all port pins)[1, 2, 3]	I_D	±25	mA
Storage temperature range	T_{stg}	–55 to 150	°C

1 Input must be current limited to the value specified. To determine the value of the required current-limiting resistor, calculate resistance values for positive (V_{DD}) and negative (V_{SS}) clamp voltages, then use the larger of the two resistance values.

2 All functional non-supply pins are internally clamped to V_{SS} and V_{DD} except the $\overline{\text{RESET}}/V_{PP}$ pin which is internally clamped to V_{SS} only.

3 Power supply must maintain regulation within operating V_{DD} range during instantaneous and operating maximum current conditions. If positive injection current ($V_{In} > V_{DD}$) is greater than I_{DD}, the injection current may flow out of V_{DD} and could result in external power supply going out of regulation. Ensure external V_{DD} load will shunt current greater than maximum injection current. This will be the greatest risk when the MCU is not consuming power. Examples are: if no system clock is present, or if the clock rate is very low which would reduce overall power consumption.

3.4 Thermal Characteristics

This section provides information about operating temperature range, power dissipation, and package thermal resistance. Power dissipation on I/O pins is usually small compared to the power dissipation in on-chip logic and voltage regulator circuits and it is user-determined rather than being controlled by the MCU design. In order to take PI/O into account in power calculations, determine the difference between actual pin voltage and V_{SS} or V_{DD} and multiply by the pin current for each I/O pin. Except in cases of unusually high pin current (heavy loads), the difference between pin voltage and V_{SS} or V_{DD} will be very small.

Table 4. Thermal Characteristics

Rating	Symbol	Value	Unit
Operating temperature range (packaged)	T_A	T_L to T_H –40 to 85	°C
Maximum junction temperature	T_{JMAX}	105	°C
Thermal resistance Single layer board 28-pin SOIC	θ_{JA}	70	°C/W

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

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

where:

T_A = Ambient temperature, °C

θ_{JA} = Package thermal resistance, junction-to-ambient, °C /W

$P_D = P_{int} + P_{I/O}$

$P_{int} = I_{DD} \times V_{DD}$, 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 neglected. An approximate relationship between PD and TJ (if PI/O is neglected) is:

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

Solving Equation 1 and Equation 2 for K gives:

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

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 equations 1 and 2 iteratively for any value of T_A.

3.5 ESD Protection and Latch-Up Immunity

Although damage from electrostatic discharge (ESD) is much less common on these devices than on early CMOS circuits, normal handling precautions must be used to avoid exposure to static discharge. Qualification tests are performed to ensure that these devices can withstand exposure to reasonable levels of static without suffering any permanent damage.

All ESD testing is in conformity with AEC-Q100 Stress Test Qualification for Automotive Grade Integrated Circuits. During the device qualification ESD stresses were performed for the human body model (HBM), the machine model (MM) and the charge device model (CDM).

A device is defined as a failure if after exposure to ESD pulses the device no longer meets the device specification. Complete DC parametric and functional testing is performed per the applicable device

Table 7. DC Characteristics (Temperature Range = –40 to 85°C Ambient) (continued)

Num	C	Parameter	Symbol	Min	Typical	Max	Unit
6	C	Input low voltage (V_{DD} > 2.3 V) (all digital inputs)	V_{IL}	—	—	0.30 × V_{DD}	V
		Input low voltage (1.8 V ≤ V_{DD} ≤ 2.3 V) (all digital inputs)		—	—	0.30 × V_{DD}	V
7	C	Input hysteresis (all digital inputs)	V_{hys}	0.06 × V_{DD}	—	—	V
8	P	Input leakage current (per pin) V_{In} = V_{DD} or V_{SS}, all input only pins	$\|I_{In}\|$	—	0.025	1.0	μA
9	P	High impedance (off-state) leakage current (per pin) V_{In} = V_{DD} or V_{SS}, all input/output	$\|I_{OZ}\|$	—	0.025	1.0	μA
10	P	Internal pullup/pulldown resistors[2] (all port pins)	R_{PU}	20	45	65	kΩ
11	C	Output high voltage (port A) I_{OH} = –5 mA (V_{DD} ≥ 4.5 V) I_{OH} = –3 mA (V_{DD} ≥ 3 V) I_{OH} = –2 mA (V_{DD} ≥ 1.8 V)	V_{OH}	V_{DD} – 0.8	— — —	— — —	V
12	C	Maximum total I_{OH} for all port pins	$\|I_{OHT}\|$	—	—	40	mA
13	C	Output low voltage (port A) I_{OL} = 5 mA (V_{DD} ≥ 4.5 V) I_{OL} = 3 mA (V_{DD} ≥ 3 V) I_{OL} = 2 mA (V_{DD} ≥ 1.8 V)	V_{OL}	— — —	— — —	0.8 0.8 0.8	V
14	C	Maximum total I_{OL} for all port pins	I_{OLT}	—	—	100	mA
15	C	dc injection current[3, 4, 5, 6] V_{In} < V_{SS}, V_{In} > V_{DD} Single pin limit Total MCU limit, includes sum of all stressed pins	—	— —	— —	0.2 0.8	mA mA
16	C	Input capacitance (all non-supply pins)	C_{In}	—	—	7	pF

1 This parameter is characterized and not tested on each device.

2 Measurement condition for pull resistors: V_{In} = V_{SS} for pullup and V_{In} = V_{DD} for pulldown.

3 All functional non-supply pins are internally clamped to V_{SS} and V_{DD} except the $\overline{\text{RESET}}/V_{PP}$ which is internally clamped to V_{SS} only

4 Input must be current limited to the value specified. To determine the value of the required current-limiting resistor, calculate resistance values for positive and negative clamp voltages, then use the larger of the two values.

5 Input must be current limited to the value specified. To determine the value of the required current-limiting resistor, calculate resistance values for positive and negative clamp voltages, then use the larger of the two values.

6 This parameter is characterized and not tested on each device.

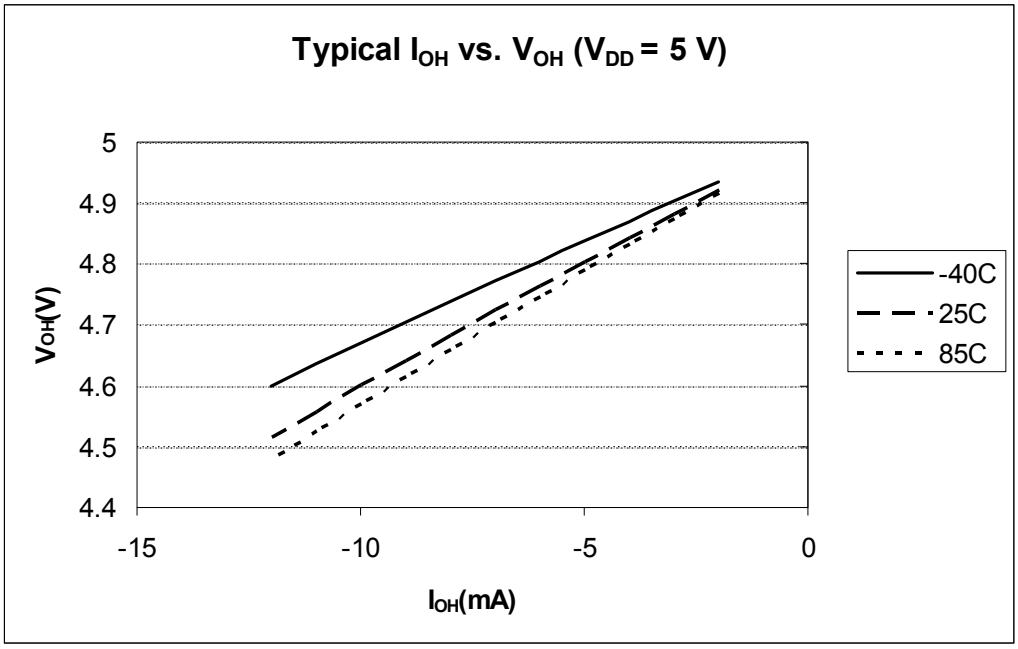


Figure 3. Typical I_{OH} vs. V_{OH} (V_{DD} = 5 V)

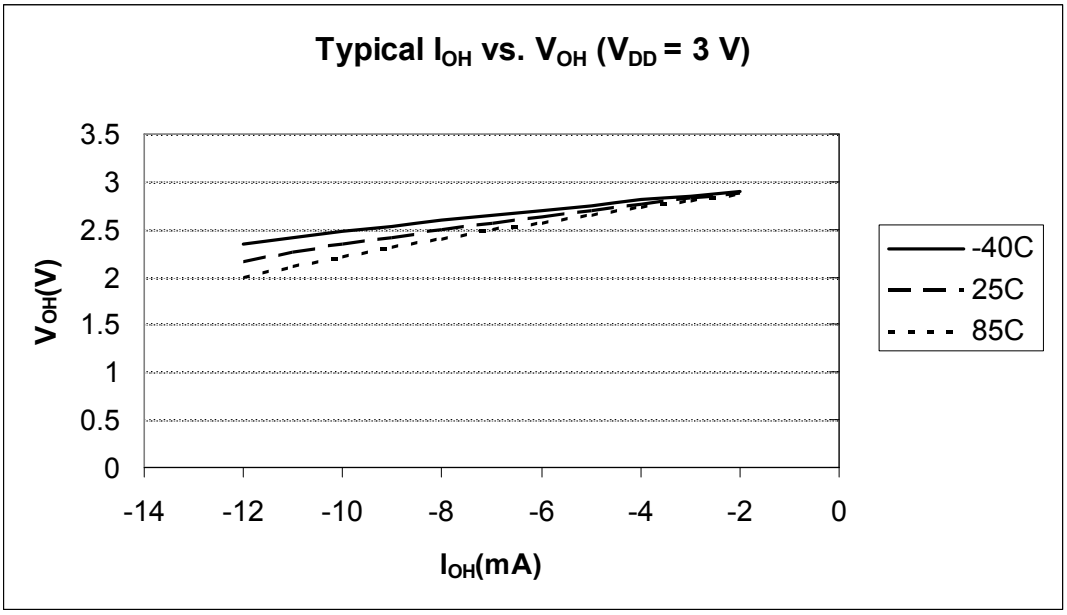


Figure 4. Typical I_{OH} vs. V_{OH} (V_{DD} = 3 V)

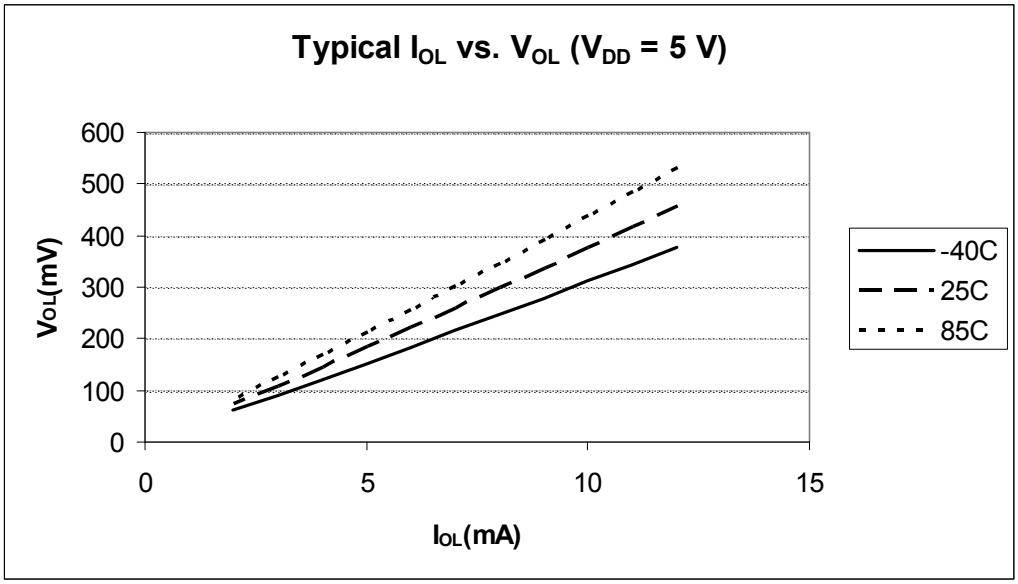


Figure 5. Typical I_{OL} vs. V_{OL} (V_{DD} = 5 V)

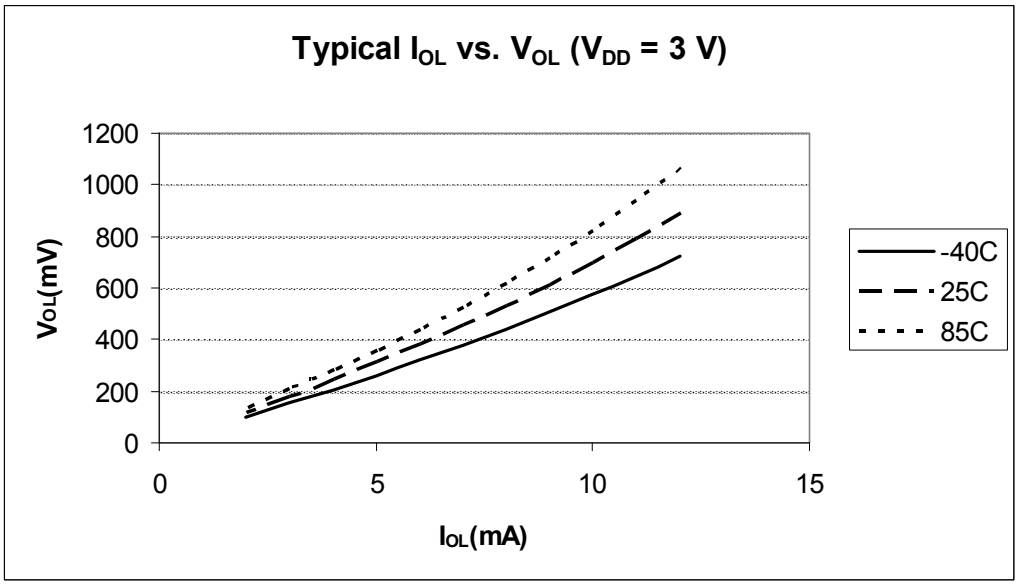


Figure 6. Typical I_{OL} vs. V_{OL} (V_{DD} = 3 V)

3.7 Supply Current Characteristics

Table 8. Supply Current Characteristics

Num	C	Parameter	Symbol	Bus Freq. (MHz)	V_{DD} (V)	Temp. (°C)	Typical	Max[1]	Unit
1	P	Run supply current[2]	RIDD	10	5	–40 25 85	3.78 3.81 3.83	20	mA
	C				3	–40 25 85	3.70 3.76 3.77	—	
	T			1.25	5	–40 25 85	0.94 0.95 0.95	— — —	
	T				3	–40 25 85	0.94 0.94 0.94	— — —	
2	T	Wait supply current[2]	WIDD	2	5	–40 25 85	932 943 947	— — —	µA
	T				3	–40 25 85	940 959 954	— — —	
	T			1	5	–40 25 85	712 714 717	— — —	
	T				3	–40 25 85	718 716 715	— — —	
3	P	Stop mode supply current	SIDD	—	5	–40 25 85	1.14 1.43 3.75	15	µA
	C			—	3	–40 25 85	0.61 0.88 2.96	— — —	
4	T	ADC adder to stop[3]	—	—	5	–40 25 85	119.85 128.72 131.70	— — —	µA
	T			—	3	–40 25 85	115.28 123.86 126.60	— — —	
5	T	RTI adder from stop with 1 kHz clock source enabled	—	—	5	–40 25 85	0.10 0.11 0.12	— — —	µA
	T			—	3	–40 25 85	0.11 0.11 0.12	— — —	

Table 8. Supply Current Characteristics (continued)

Num	C	Parameter	Symbol	Bus Freq. (MHz)	V_{DD} (V)	Temp. (°C)	Typical	Max[1]	Unit
6	T	LVI adder from stop (LVDE = 1 and LVDSE = 1)	—	—	5	–40 25 85	69.40 72.07 73.29	— — —	µA
	T			—	3	–40 25 85	69.74 72.19 72.67	— — —	

1 Maximum value is measured at the nominal V_{DD} voltage times 10% tolerance. Values given here are preliminary estimates prior to completing characterization

2 Does not include any dc loads on port pins

3 Required asynchronous ADC clock and LVD to be enabled.

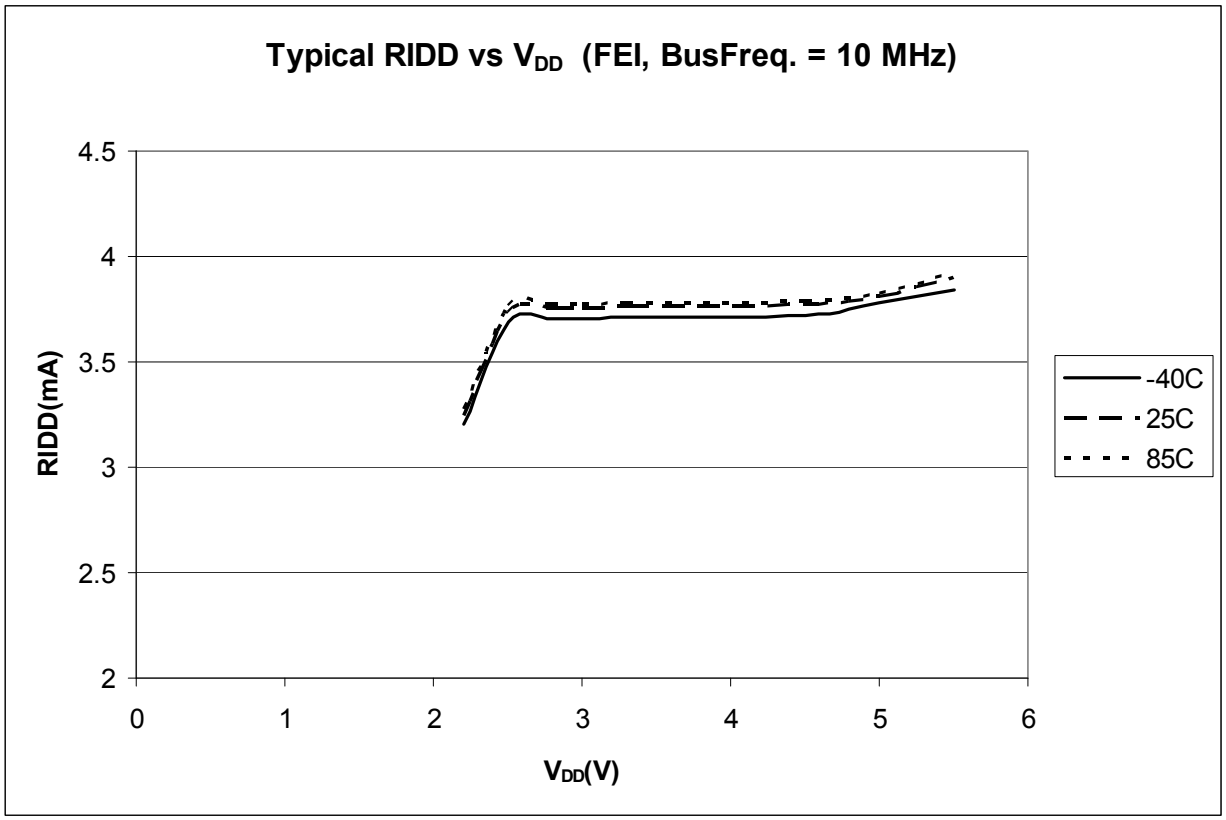


Figure 11. Typical RIDD vs. V_{DD} (FEI, BusFreq. = 10 MHz)

3.8 External Oscillator (XOSC) Characteristics

Refer to Figure 12 for crystal or resonator circuit.

Table 9. External Oscillator Specifications (Temperature Range = –40 to 85°C Ambient)

Num	C	Characteristic	Symbol	Min	Typical[1]	Max	Unit
1	D	Oscillator crystal or resonator (EREFS = 1) Low range, (IREFS = x) High range, FLL bypassed external (CLKS = 10, IREFS = x) High range, FLL engaged external (CLKS = 00, IREFS = 0)	 f_{lo} f_{hi_byp} f_{hi_eng}	 32 1 1	 — — —	 38.4 5 5	 kHz MHz MHz
2	D	Load capacitors	C_1 C_2	See Note [2]			
3	D	Feedback resistor Low range (32 kHz to 100 kHz) High range (1 MHz to 16 MHz)	R_F		 10 1		 MΩ
4	D	Series resistor Low range Low Gain (HGO = 0) High Gain (HGO = 1) High range Low Gain (HGO = 0) High Gain (HGO = 1) ≥ 8 MHz 4 MHz 1 MHz	R_S	 — — — — — —	 0 100 0 0 10 20	 — — — — — —	kΩ
5	D	Crystal start-up time [3, 4] Low range High range	t_{CSTL} t_{CSTH}	 — —	 500 4	 — —	ms

1 Data in Typical column was characterized at 3.0 V, 25 °C or is typical recommended value.

2 See crystal or resonator manufacturer's recommendation.

3 This parameter is characterized and not tested on each device.

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

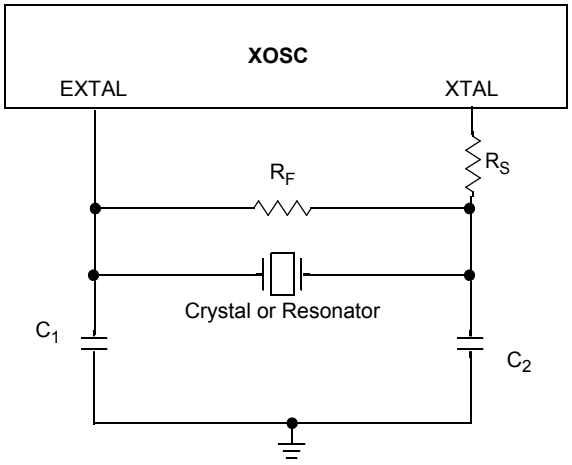


Figure 12. Typical Crystal or Resonator Circuit

3.9 Internal Clock Source (ICS) Characteristics

Table 10. ICS Frequency Specifications (Temperature Range = –40 to 85°C Ambient)

Num	C	Characteristic	Symbol	Min	Typical[1]	Max	Unit
1	C	Square wave input clock frequency (EREFS = 0) FLL bypass external (CLKS = 10) FLL engaged external (CLKS = 00)	f_{extal}	0 0.03125	— —	20 5	MHz
2	C	Average internal reference frequency - untrimmed	f_{int_ut}	25	31.25	41.66	kHz
3	C	Average internal reference frequency - trimmed	f_{int_t}	31.25	31.25	39.0625	kHz
4	C	DCO output frequency range — untrimmed	f_{dco_ut}	12.8	16	21.33	MHz
5	C	DCO output frequency range — trimmed	f_{dco_t}	16	16	20	MHz
6	C	Resolution of trimmed DCO output frequency at fixed voltage and temperature	$\Delta f_{dco\_res\_t}$	—	—	±0.2	$\%f_{dco}$
7	C	Total deviation of trimmed DCO output frequency over voltage and temperature	Δf_{dco_t}	—	—	±2	$\%f_{dco}$
8	C	FLL acquisition time [3,2]	$t_{acquire}$	—	—	1	ms
9	C	Long term Jitter [3] of DCO output clock (averaged over 2 ms interval)	C_{Jitter}	—	—	0.6	$\%f_{dco}$

1 Data in Typical column was characterized at 3.0 V, 25 °C or is typical recommended value.

2 This specification applies to any time the FLL reference source or reference divider is changed, trim value changed or changing from FLL disabled (FBELP, FBILP) to FLL enabled (FEI, FEE, FBE, FBI). If a crystal/resonator is being used as the reference, this specification assumes it is already running.

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

3.10 AC Characteristics

This section describes AC timing characteristics for each peripheral system.

3.10.1 Control Timing

Table 11. Control Timing

Num	C	Parameter	Symbol	Min	Typical	Max	Unit
1	D	Bus frequency ($t_{cyc} = 1/f_{Bus}$)	f_{Bus}	0	—	10	MHz
2	D	Real time interrupt internal oscillator period	t_{RTI}	700	1000	1300	µs
3	D	External $\overline{\text{RESET}}$ pulse width[1]	t_{extrst}	150	—	—	ns
4	D	KBI pulse width[2]	t_{KBIPW}	1.5 t_{cyc}	—	—	ns
5	D	KBI pulse width in stop[1]	t_{KBIPWS}	100	—	—	ns
6	C	Port rise and fall time (load = 50 pF)[3] Slew rate control disabled (PTxSE = 0) Slew rate control enabled (PTxSE = 1)	t_{Rise}, t_{Fall}	— —	11 35	— —	ns

1 This is the shortest pulse that is guaranteed to pass through the pin input filter circuitry. Shorter pulses may or may not be recognized.

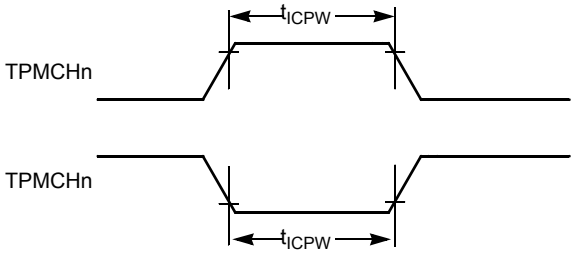


Figure 16. Timer Input Capture Pulse

3.11 ADC Characteristics

Figure 17. 5 Volt 10-bit ADC Operating Conditions

Characteristic	Conditions	Symb	Min	Typical[1]	Max	Unit
Supply voltage	Absolute	V_{DDAD}	1.8	—	5.5	V
	Delta to V_{DD} ($V_{DD} - V_{DDAD}$)[2]	ΔV_{DDAD}	–100	0	100	mV
Ground voltage	Delta to V_{SS} ($V_{SS} - V_{SSAD}$)[2]	ΔV_{SSAD}	–100	0	100	mV
Reference voltage high		V_{REFH}	1.8	V_{DDAD}	V_{DDAD}	V
Reference voltage low		V_{REFL}	V_{SSAD}	V_{SSAD}	V_{SSAD}	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 external to MCU	10 bit mode f_{ADCK} > 4MHz f_{ADCK} < 4MHz	R_{AS}	 — —	 — —	 5 10	kΩ
	8 bit mode (all valid f_{ADCK})		—	—	10	
ADC conversion clock frequency	High speed (ADLPC = 0)	f_{ADCK}	0.4	—	8.0	MHz
	Low power (ADLPC = 1)		0.4	—	4.0	

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

2 DC potential difference.

Table 13. 10-bit ADC Characteristics (V_{REFH} = V_{DDAD}, V_{REFL} = V_{SSAD}) (continued)

Num	C	Characteristic	Conditions	Symb	Min	Typical[1]	Max	Unit
7	P	Conversion time (Including sample time)	Short sample (ADLSMP = 0)	t_{ADC}	—	20	—	ADCK cycles
			Long sample (ADLSMP = 1)		—	40	—	
8	P	Sample time	Short sample (ADLSMP = 0)	t_{ADS}	—	3.5	—	ADCK cycles
			Long sample (ADLSMP = 1)		—	23.5	—	
9	P	Total unadjusted error	10-bit mode	E_{TUE}	—	±1	±2.5	LSB[2]
			8-bit mode		—	±0.5	±1.0	
10	P	Differential non-linearity	10-bit mode	DNL	—	±0.5	±1.0	LSB[2]
			8-bit mode		—	±0.3	±0.5	
			Monotonicity and no-missing-codes guaranteed					
11	C	Integral non-linearity	10-bit mode	INL	—	±0.5	±1.0	LSB[2]
			8-bit mode		—	±0.3	±0.5	
12	P	Zero-scale error	10-bit mode	E_{ZS}	—	±0.5	±1.5	LSB[2]
			8-bit mode		—	±0.5	±0.5	
13	P	Full-scale error V_{ADIN} = V_{DDA}	10-bit mode	E_{FS}	—	±0.5	±1.5	LSB[2]
			8-bit mode		—	±0.5	±0.5	
14	D	Quantization error	10-bit mode	E_Q	—	—	±0.5	LSB[2]
			8-bit mode		—	—	±0.5	
15	D	Input leakage error pad leakage[3] * R_{AS}	10 bit mode	E_{IL}	—	±0.2	±2.5	LSB[2]
			8 bit mode		—	±0.1	±1	

1 Typical values assume V_{DDAD} = 5.0 V, Temp = 25 °C, f_{ADCK} = 1.0 MHz 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 Based on input pad leakage current. Refer to pad electrical.

3.12 Flash Specifications

This section provides details about program/erase times and program-erase endurance for the flash memory. For detailed information about program/erase operations, see the reference manual.

Table 14. Flash Characteristics

Num	C	Characteristic	Symbol	Min	Typical[1]	Max	Unit
1	D	Supply voltage for program/erase	V_{DD}	2.7	—	5.5	V
2	D	Program/Erase voltage	V_{PP}	11.8	12	12.2	V

Table 14. Flash Characteristics (continued)

Num	C	Characteristic	Symbol	Min	Typical[1]	Max	Unit
3	C	V_{PP} current Program Mass erase	 I_{VPP_prog} I_{VPP_erase}	 — —	 — —	 200 100	 µA µA
4	D	Supply voltage for read operation $0 < f_{Bus} < 10$ MHz	V_{Read}	1.8	—	5.5	V
5	P	Byte program time	t_{prog}	20	—	40	µs
6	P	Mass erase time	t_{me}	500	—	—	ms
7	C	Cumulative program HV time[2]	t_{hv}	—	—	8	ms
8	C	Total cumulative HV time (total of t_{me} & t_{hv} applied to device)	t_{hv_total}	—	—	2	hours
9	D	HVEN to program setup time	t_{pgs}	10	—	—	µs
10	D	PGM/MASS to HVEN setup time	t_{nvs}	5	—	—	µs
11	D	HVEN hold time for PGM	t_{nvh}	5	—	—	µs
12	D	HVEN hold time for MASS	t_{nvh1}	100	—	—	µs
13	D	V_{PP} to PGM/MASS setup time	t_{vps}	20	—	—	ns
14	D	HVEN to V_{PP} hold time	t_{vph}	20	—	—	ns
15	D	V_{PP} rise time[3]	t_{vrs}	200	—	—	ns
16	D	Recovery time	t_{rcv}	1	—	—	µs
17	D	Program/erase endurance T_L to T_H = –40°C to 85°C	—	1000	—	—	cycles
18	C	Data retention	t_{D_ret}	100	—	—	years

1 Typicals are measured at 25 °C.

2 t_{hv} is the cumulative high voltage programming time to the same row before next erase. Same address can not be programmed more than twice before next erase.

3 Fast V_{PP} rise time may potentially trigger the ESD protection structure, which may result in over-current flowing into the pad and cause permanent damage to the pad. External filtering for the V_{PP} power source is recommended. An example V_{PP} filter is shown in Figure 19.

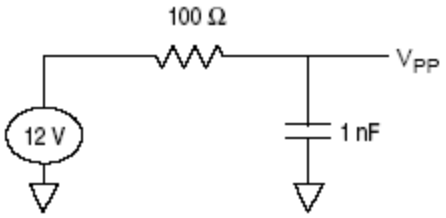
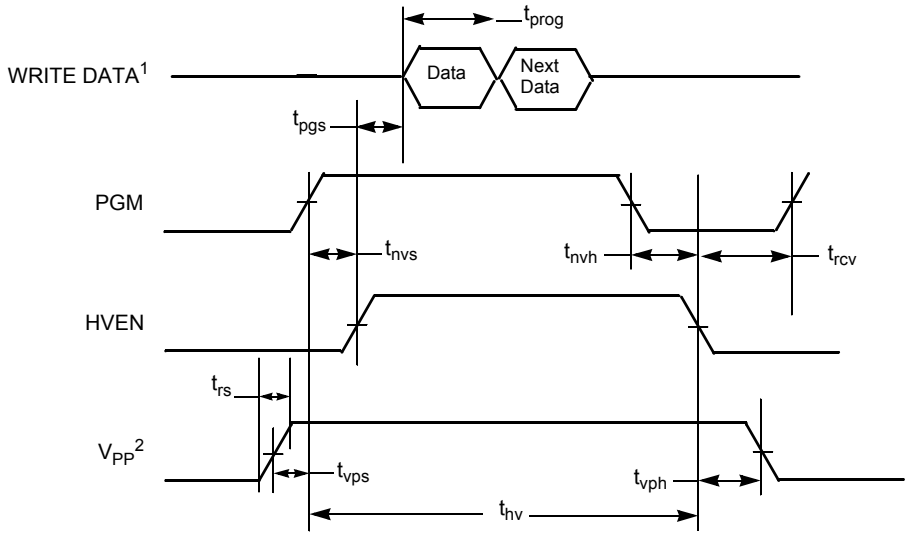
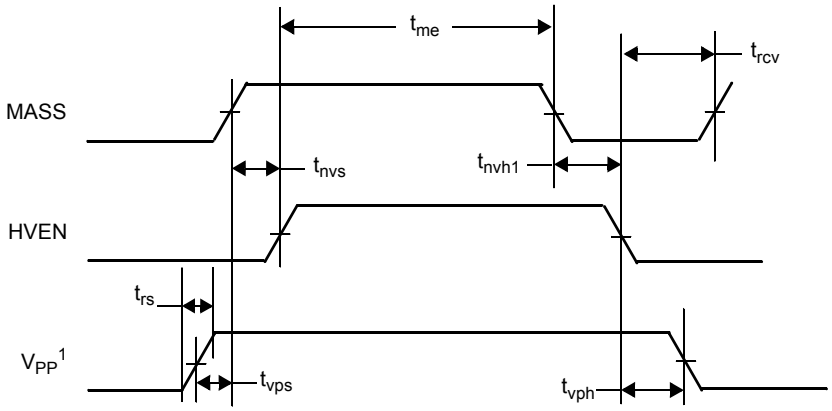


Figure 19. Example V_{PP} Filtering



1 Next Data applies if programming multiple bytes in a single row, refer to *MC9RS08LE4 Reference Manual*.
2 V_{DD} must be at a valid operating voltage before voltage is applied or removed from the V_{PP} pin.

Figure 20. Flash Program Timing



1 V_{DD} must be at a valid operating voltage before voltage is applied or removed from the V_{PP} pin.

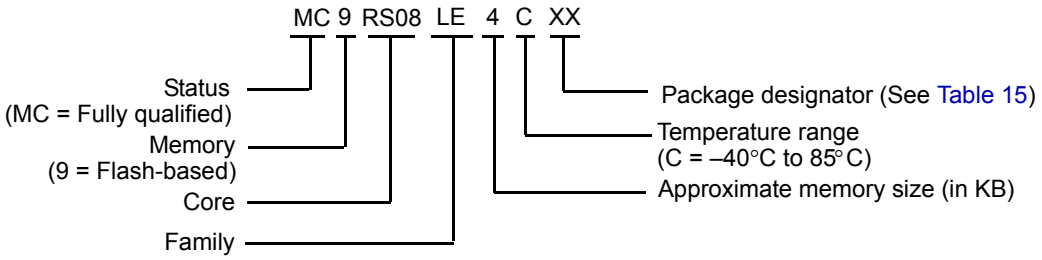
Figure 21. Flash Mass Erase Timing

4 Ordering Information

This section contains ordering numbers for MC9RS08LE4 devices. See below for an example of the device numbering system.

Table 15. Device Numbering System

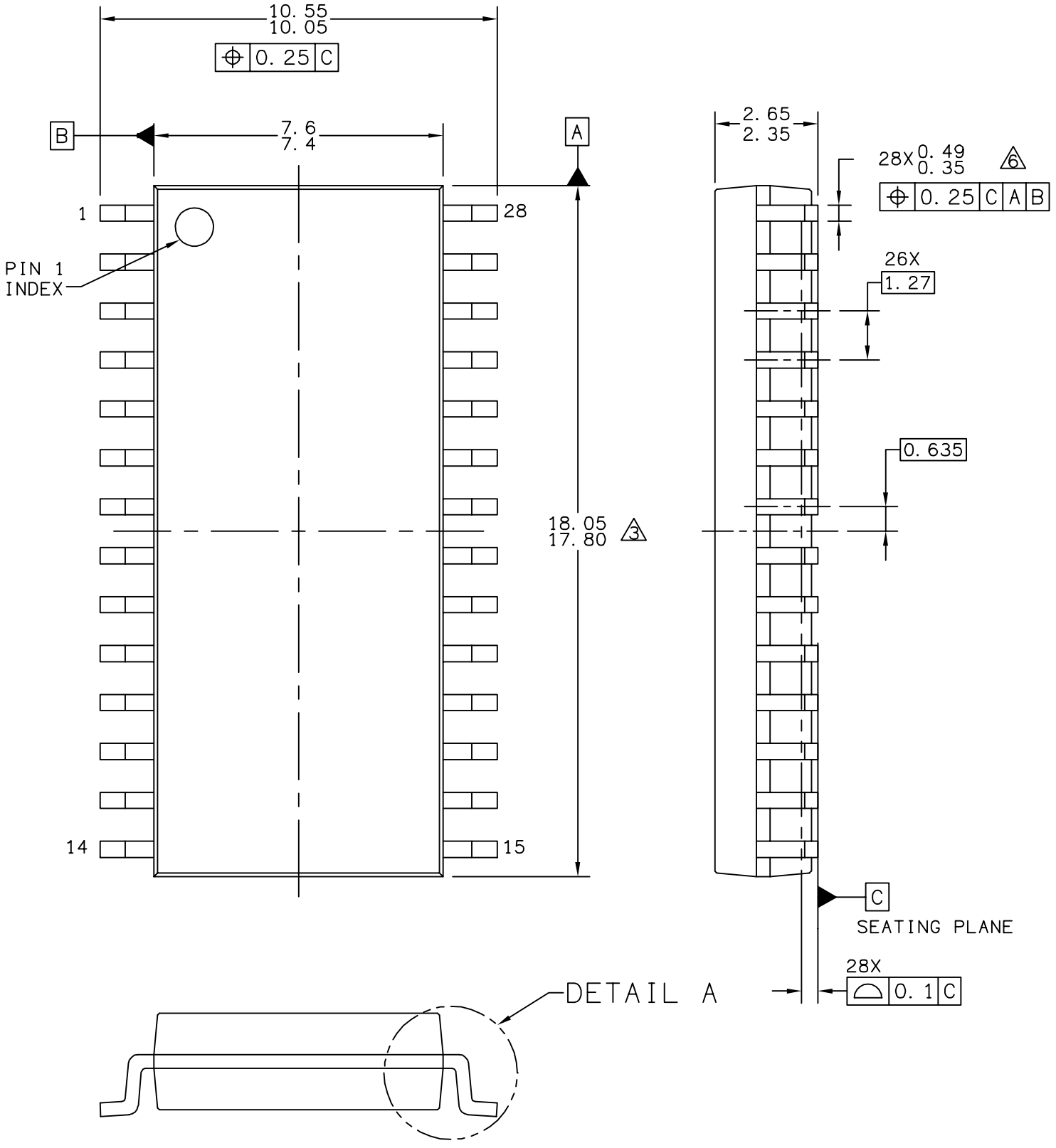
Device Number	Memory		Package		
	Flash	RAM	Type	Designator	Document No.
MC9RS08LE4	4 KB	256 bytes	28 SOIC	WL	98ASB42345B



5 Mechanical Drawings

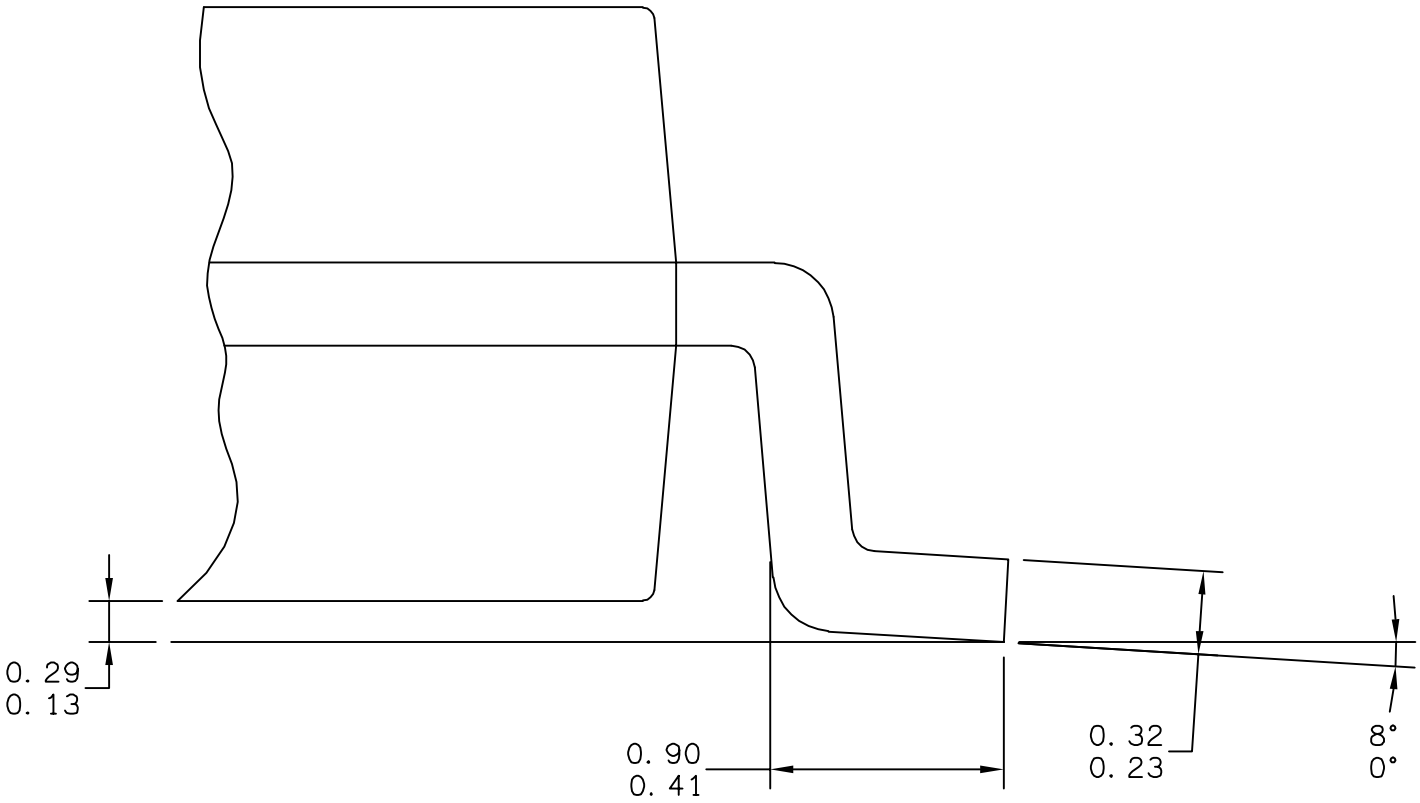
This following pages contain mechanical specifications for MC9RS08LE4 package options.

- 28-pin SOIC (small outline integrated circuit)



MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE

TITLE: SOIC, WIDE BODY, 28 LEAD CASEOUTLINE	DOCUMENT NO: 98ASB42345B	REV: G
	CASE NUMBER: 751F-05	10 MAR 2005
	STANDARD: MS-013AE	



MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE

TITLE: SOIC, WIDE BODY, 28 LEAD CASEOUTLINE	DOCUMENT NO: 98ASB42345B	REV: G
	CASE NUMBER: 751F-05	10 MAR 2005
	STANDARD: MS-013AE	