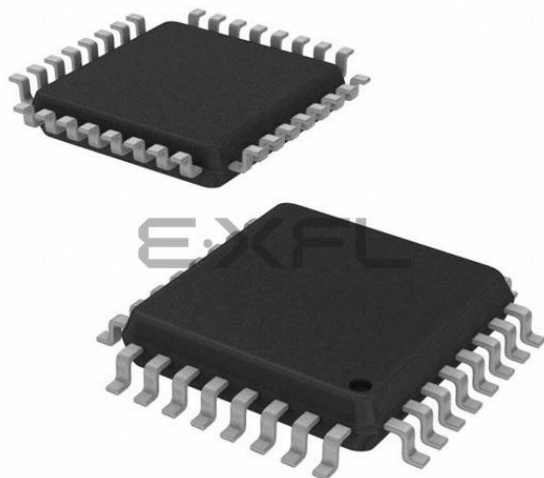




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"[Embedded - Microcontrollers](#)" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable 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	S08
Core Size	8-Bit
Speed	20MHz
Connectivity	I ² C, LINbus, SPI, UART/USART
Peripherals	LVD, POR, PWM, WDT
Number of I/O	26
Program Memory Size	60KB (60K x 8)
Program Memory Type	FLASH
EEPROM Size	256 x 8
RAM Size	4K x 8
Voltage - Supply (Vcc/Vdd)	2.7V ~ 5.5V
Data Converters	A/D 16x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	32-LQFP
Supplier Device Package	32-LQFP (7x7)
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/s9s08rna60w1mlc

- Input/Output
 - Up to 55 GPIOs including one output-only pin
 - Two 8-bit keyboard interrupt modules (KBI)
 - Two true open-drain output pins
 - Eight, ultra-high current sink pins supporting 20 mA source/sink current
- Package options
 - 64-pin LQFP
 - 48-pin LQFP
 - 32-pin LQFP

Table of Contents

1 Ordering parts.....	4	5.2.2 Debug trace timing specifications.....	17
1.1 Determining valid orderable parts.....	4	5.2.3 FTM module timing.....	17
2 Part identification.....	4	5.3 Thermal specifications.....	18
2.1 Description.....	4	5.3.1 Thermal characteristics.....	18
2.2 Format.....	4	6 Peripheral operating requirements and behaviors.....	19
2.3 Fields.....	4	6.1 External oscillator (XOSC) and ICS characteristics.....	20
2.4 Example.....	5	6.2 NVM specifications.....	21
3 Parameter Classification.....	5	6.3 Analog.....	23
4 Ratings.....	5	6.3.1 ADC characteristics.....	23
4.1 Thermal handling ratings.....	5	6.3.2 Analog comparator (ACMP) electricals.....	25
4.2 Moisture handling ratings.....	6	6.4 Communication interfaces.....	26
4.3 ESD handling ratings.....	6	6.4.1 SPI switching specifications.....	26
4.4 Voltage and current operating ratings.....	6	6.5 Human-machine interfaces (HMI).....	29
5 General.....	7	6.5.1 TSI electrical specifications.....	29
5.1 Nonswitching electrical specifications.....	7	7 Dimensions.....	29
5.1.1 DC characteristics.....	7	7.1 Obtaining package dimensions.....	29
5.1.2 Supply current characteristics.....	14	8 Pinout.....	30
5.1.3 EMC performance.....	15	8.1 Signal multiplexing and pin assignments.....	30
5.2 Switching specifications.....	16	8.2 Device pin assignment.....	33
5.2.1 Control timing.....	16	9 Revision history.....	35

1 Ordering parts

1.1 Determining valid orderable parts

Valid orderable part numbers are provided on the web. To determine the orderable part numbers for this device, go to www.freescale.com and perform a part number search for the following device numbers: RN60, RN48 and RN32.

2 Part identification

2.1 Description

Part numbers for the chip have fields that identify the specific part. You can use the values of these fields to determine the specific part you have received.

2.2 Format

Part numbers for this device have the following format:

S 9 S08 RN AA F1 B CC

2.3 Fields

This table lists the possible values for each field in the part number (not all combinations are valid):

Field	Description	Values
S	Qualification status	• S = fully qualified, general market flow
9	Memory	• 9 = flash based
S08	Core	• S08 = 8-bit CPU
RN	Device family	• RN
AA	Approximate flash size in KB	• 60 = 60 KB • 48 = 48 KB • 32 = 32 KB
F1	Fab and mask set identifier	• W1
B	Temperature range (°C)	• M = -40 to 125

Table continues on the next page...

Field	Description	Values
CC	Package designator	- LH = 64-pin LQFP - LF = 48-pin LQFP - LC = 32-pin LQFP

2.4 Example

This is an example part number:

S9S08RN60W1MLH

3 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 1. 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.

4 Ratings

4.1 Thermal handling ratings

Symbol	Description	Min.	Max.	Unit	Notes
T _{STG}	Storage temperature	–55	150	°C	1
T _{SDR}	Solder temperature, lead-free	—	260	°C	2

1. Determined according to JEDEC Standard JESD22-A103, *High Temperature Storage Life*.

- Determined according to IPC/JEDEC Standard J-STD-020, *Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices*.

4.2 Moisture handling ratings

Symbol	Description	Min.	Max.	Unit	Notes
MSL	Moisture sensitivity level	—	3	—	1

- Determined according to IPC/JEDEC Standard J-STD-020, *Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices*.

4.3 ESD handling ratings

Symbol	Description	Min.	Max.	Unit	Notes
V_{HBM}	Electrostatic discharge voltage, human body model	-6000	+6000	V	1
V_{CDM}	Electrostatic discharge voltage, charged-device model	-500	+500	V	2
I_{LAT}	Latch-up current at ambient temperature of 125°C	-100	+100	mA	

- Determined according to JEDEC Standard JESD22-A114, *Electrostatic Discharge (ESD) Sensitivity Testing Human Body Model (HBM)*.
- Determined according to JEDEC Standard JESD22-C101, *Field-Induced Charged-Device Model Test Method for Electrostatic-Discharge-Withstand Thresholds of Microelectronic Components*.

4.4 Voltage and current operating ratings

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

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 pullup resistor associated with the pin is enabled.

Symbol	Description	Min.	Max.	Unit
V_{DD}	Supply voltage	-0.3	5.8	V
I_{DD}	Maximum current into V_{DD}	—	120	mA

Table continues on the next page...

Symbol	Description	Min.	Max.	Unit
V_{DIO}	Digital input voltage (except RESET, EXTAL, XTAL, or true open drain pin PTA2 and PTA3)	-0.3	$V_{DD} + 0.3$	V
	Digital input voltage (true open drain pin PTA2 and PTA3)	-0.3	6	V
V_{AIO}	Analog ¹ , RESET, EXTAL, and XTAL input voltage	-0.3	$V_{DD} + 0.3$	V
I_D	Instantaneous maximum current single pin limit (applies to all port pins)	-25	25	mA
V_{DDA}	Analog supply voltage	$V_{DD} - 0.3$	$V_{DD} + 0.3$	V

1. All digital I/O pins, except open-drain pin PTA2 and PTA3, are internally clamped to V_{SS} and V_{DD} . PTA2 and PTA3 is only clamped to V_{SS} .

5 General

5.1 Nonswitching electrical specifications

5.1.1 DC characteristics

This section includes information about power supply requirements and I/O pin characteristics.

Table 2. DC characteristics

Symbol	C	Descriptions			Min	Typical ¹	Max	Unit
—	—	Operating voltage			2.7	—	5.5	V
V_{OH}	C	Output high voltage	All I/O pins, standard-drive strength	5 V, $I_{load} = -5$ mA	$V_{DD} - 0.8$	—	—	V
	C			3 V, $I_{load} = -2.5$ mA	$V_{DD} - 0.8$	—	—	V
	C	High current drive pins, high-drive strength ^{2, 2}		5 V, $I_{load} = -20$ mA	$V_{DD} - 0.8$	—	—	V
	C			3 V, $I_{load} = -10$ mA	$V_{DD} - 0.8$	—	—	V
I_{OHT}	D	Output high current	Max total I_{OH} for all ports	5 V	—	—	-100	mA
				3 V	—	—	-50	
V_{OL}	C	Output low voltage	All I/O pins, standard-drive strength	5 V, $I_{load} = 5$ mA	—	—	0.8	V
	C			3 V, $I_{load} = 2.5$ mA	—	—	0.8	V
	C	High current drive pins, high-drive strength ²		5 V, $I_{load} = 20$ mA	—	—	0.8	V
	C			3 V, $I_{load} = 10$ mA	—	—	0.8	V

Table continues on the next page...

Typical I_{OH} Vs. $V_{DD}-V_{OH}$ (low drive strength) ($V_{DD} = 5\text{ V}$)

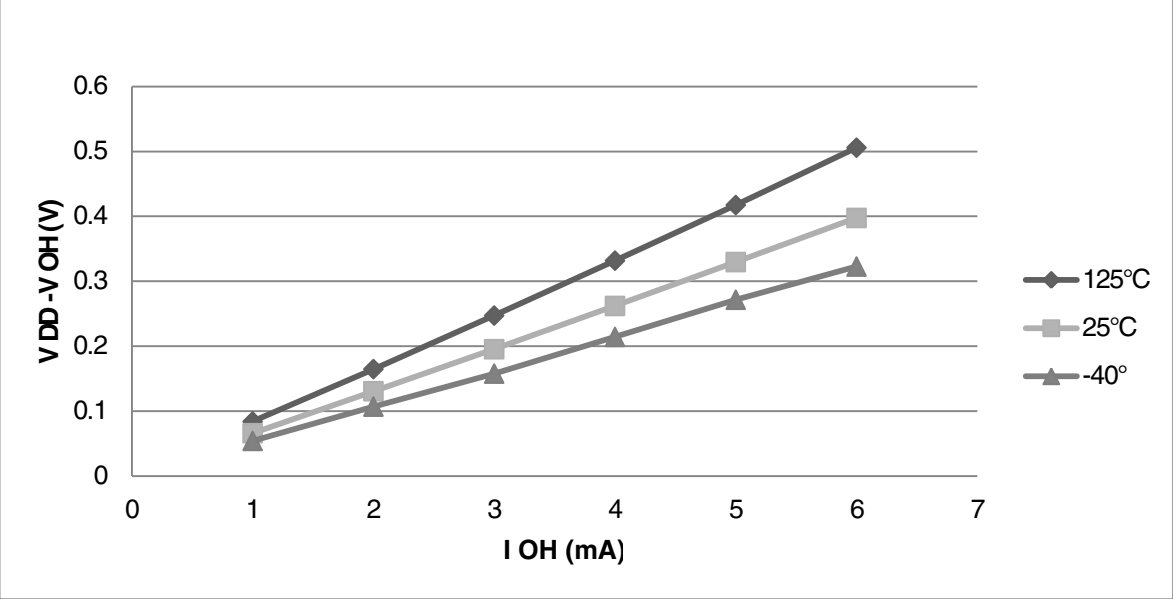


Figure 1. Typical I_{OH} Vs. $V_{DD}-V_{OH}$ (standard drive strength) ($V_{DD} = 5\text{ V}$)

Typical I_{OH} Vs. $V_{DD}-V_{OH}$ (low drive strength) ($V_{DD} = 3\text{ V}$)

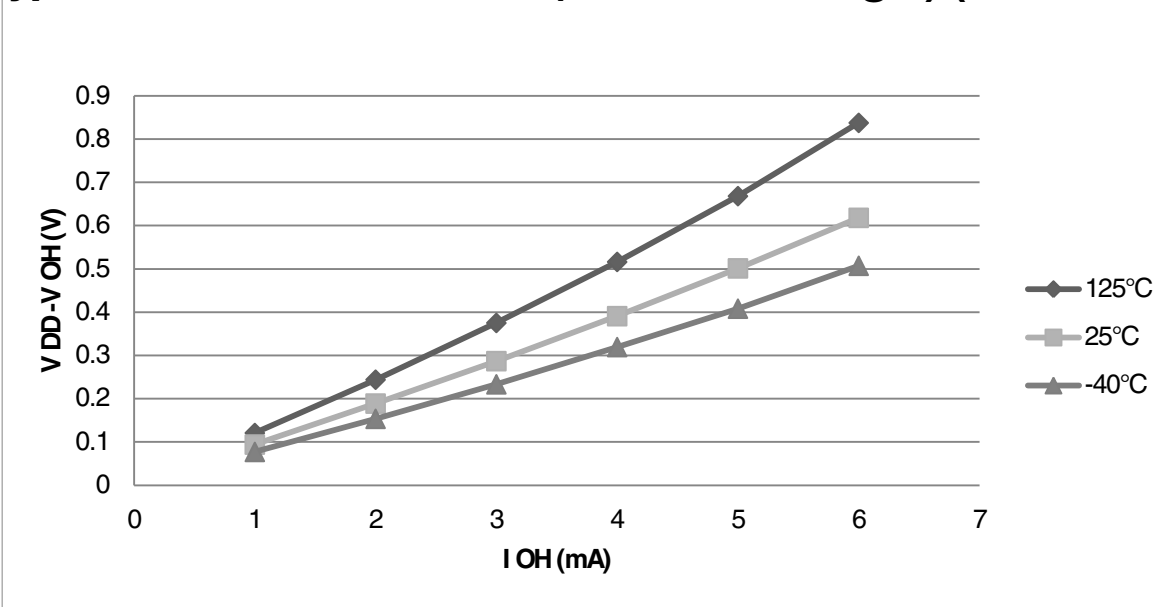


Figure 2. Typical I_{OH} Vs. $V_{DD}-V_{OH}$ (standard drive strength) ($V_{DD} = 3\text{ V}$)

Typical I_{OH} Vs. $V_{DD}-V_{OH}$ (high drive strength) ($V_{DD} = 5\text{ V}$)

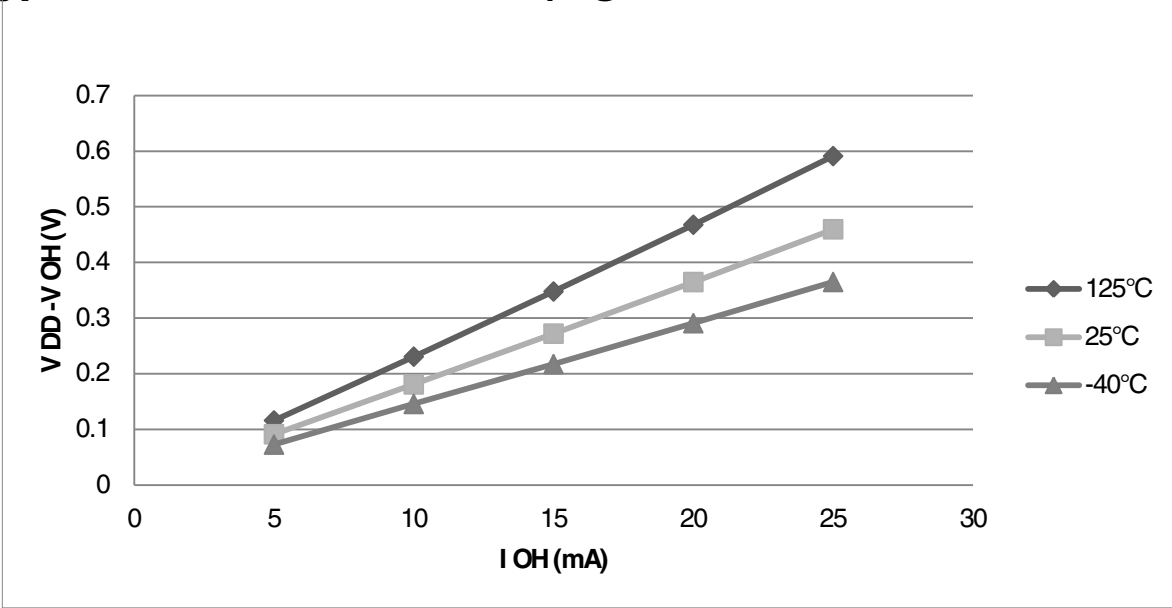


Figure 3. Typical I_{OH} Vs. $V_{DD}-V_{OH}$ (high drive strength) ($V_{DD} = 5\text{ V}$)

Typical I_{OH} Vs. $V_{DD}-V_{OH}$ (high drive strength) ($V_{DD} = 3\text{ V}$)

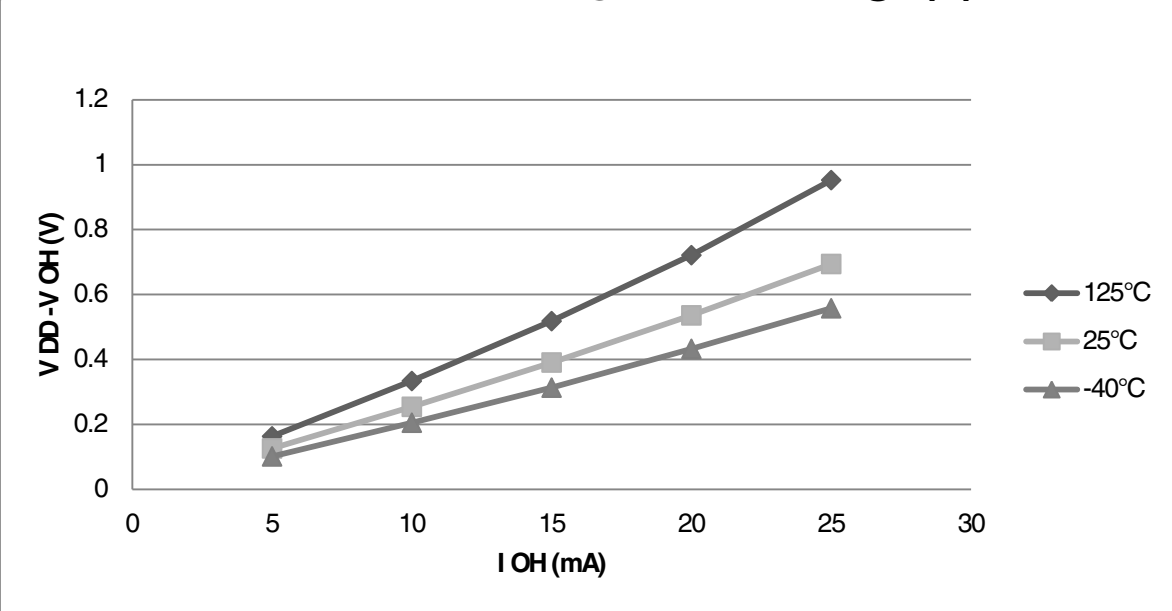


Figure 4. Typical I_{OH} Vs. $V_{DD}-V_{OH}$ (high drive strength) ($V_{DD} = 3\text{ V}$)

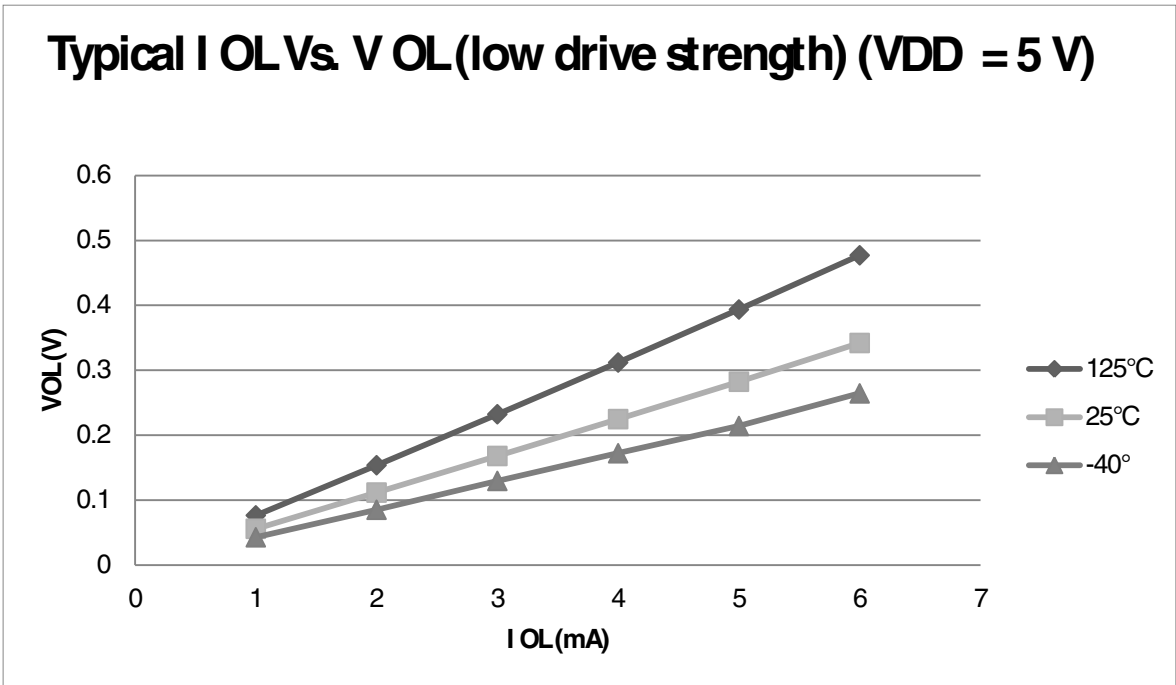


Figure 5. Typical I_{OL} Vs. V_{OL} (standard drive strength) ($V_{DD} = 5\text{ V}$)

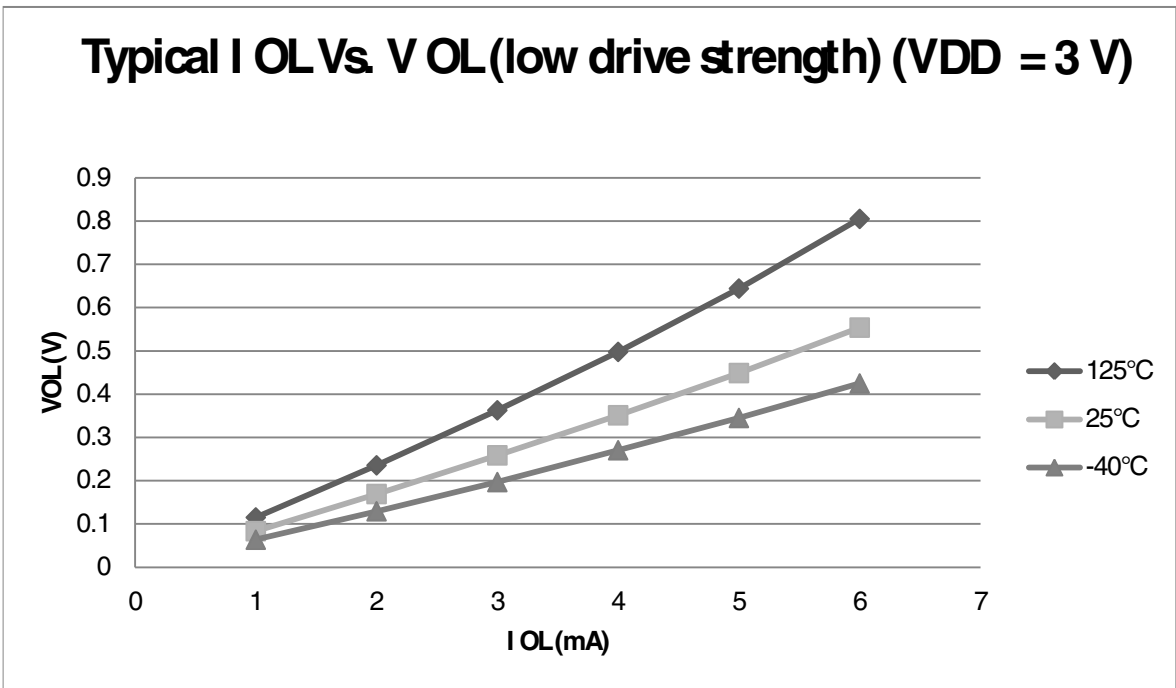


Figure 6. Typical I_{OL} Vs. V_{OL} (standard drive strength) ($V_{DD} = 3\text{ V}$)

5.1.2 Supply current characteristics

This section includes information about power supply current in various operating modes.

Table 4. Supply current characteristics

Num	C	Parameter	Symbol	Bus Freq	V _{DD} (V)	Typical ¹	Max	Unit	Temp
1	C	Run supply current FEI mode, all modules on; run from flash	RI _{DD}	20 MHz	5	12.6	—	mA	-40 to 125 °C
	C			10 MHz		7.2	—		
	C			1 MHz		2.4	—		
	C			20 MHz	3	9.6	—		
	C			10 MHz		6.1	—		
	C			1 MHz		2.1	—		
2	C	Run supply current FEI mode, all modules off & gated; run from flash	RI _{DD}	20 MHz	5	10.5	—	mA	-40 to 125 °C
	C			10 MHz		6.2	—		
	C			1 MHz		2.3	—		
	C			20 MHz	3	7.4	—		
	C			10 MHz		5.0	—		
	C			1 MHz		2.0	—		
3	P	Run supply current FBE mode, all modules on; run from RAM	RI _{DD}	20 MHz	5	12.1	14.8	mA	-40 to 125 °C
	C			10 MHz		6.5	—		
	C			1 MHz		1.8	—		
	P			20 MHz	3	9.1	11.8		
	C			10 MHz		5.5	—		
	C			1 MHz		1.5	—		
4	P	Run supply current FBE mode, all modules off & gated; run from RAM	RI _{DD}	20 MHz	5	9.8	12.3	mA	-40 to 125 °C
	C			10 MHz		5.4	—		
	C			1 MHz		1.6	—		
	P			20 MHz	3	6.9	9.2		
	C			10 MHz		4.4	—		
	C			1 MHz		1.4	—		
5	C	Wait mode current FEI mode, all modules on	WI _{DD}	20 MHz	5	7.8	—	mA	-40 to 125 °C
	C			10 MHz		4.5	—		
	C			1 MHz		1.3	—		
	C			20 MHz	3	5.1	—		
	C			10 MHz		3.5	—		
	C			1 MHz		1.2	—		
6	C	Stop3 mode supply current no clocks active (except 1 kHz LPO clock) ^{2,3}	S3I _{DD}	—	5	3.8	—	μA	-40 to 125 °C
	C			—	3	3	—		-40 to 125 °C

Table continues on the next page...

5.2 Switching specifications

5.2.1 Control timing

Table 5. Control timing

Num	C	Rating		Symbol	Min	Typical ¹	Max	Unit
1	P	Bus frequency ($t_{cyc} = 1/f_{Bus}$)		f_{Bus}	DC	—	20	MHz
2	P	Internal low power oscillator frequency		f_{LPO}	0.67	1.0	1.25	KHz
3	D	External reset pulse width ^{2, 2}		t_{extrst}	$1.5 \times t_{Self_reset}$	—	—	ns
4	D	Reset low drive		t_{rstdrv}	$34 \times t_{cyc}$	—	—	ns
5	D	BKGD/MS setup time after issuing background debug force reset to enter user or BDM modes		t_{MSSU}	500	—	—	ns
6	D	BKGD/MS hold time after issuing background debug force reset to enter user or BDM modes ³		t_{MSH}	100	—	—	ns
7	D	Keyboard interrupt pulse width	Asynchronous path ²	t_{ILIH}	100	—	—	ns
	D		Synchronous path	t_{IHIL}	$1.5 \times t_{cyc}$	—	—	ns
8	C	Port rise and fall time - Normal drive strength (HDRV_PTXx = 0) (load = 50 pF) ^{4, 4}	—	t_{Rise}	—	10.2	—	ns
	C			t_{Fall}	—	9.5	—	ns
	C	Port rise and fall time - Extreme high drive strength (HDRV_PTXx = 1) (load = 50 pF) ⁴	—	t_{Rise}	—	5.4	—	ns
	C			t_{Fall}	—	4.6	—	ns

1. Typical values are based on characterization data at $V_{DD} = 5.0$ V, 25 °C unless otherwise stated.

2. This is the shortest pulse that is guaranteed to be recognized as a reset pin request.

3. To enter BDM mode following a POR, BKGD/MS must be held low during the powerup and for a hold time of t_{MSH} after V_{DD} rises above V_{LVD} .

4. Timing is shown with respect to 20% V_{DD} and 80% V_{DD} levels. Temperature range -40 °C to 125 °C.

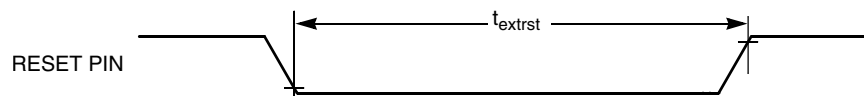


Figure 9. Reset timing

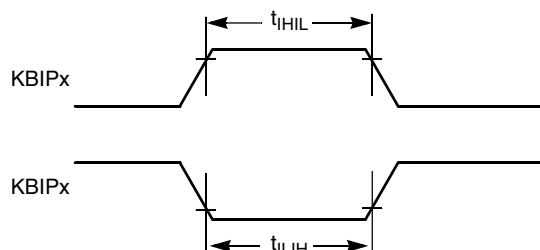


Figure 10. KBIPx timing

Table 8. Thermal characteristics

Rating	Symbol	Value	Unit
Operating temperature range (packaged)	T_A	T_L to T_H -40 to 125	$^{\circ}\text{C}$
Junction temperature range	T_J	-40 to 135	$^{\circ}\text{C}$
Thermal resistance single-layer board			
64-pin LQFP	θ_{JA}	71	$^{\circ}\text{C}/\text{W}$
48-pin LQFP	θ_{JA}	81	$^{\circ}\text{C}/\text{W}$
32-pin LQFP	θ_{JA}	86	$^{\circ}\text{C}/\text{W}$
Thermal resistance four-layer board			
64-pin LQFP	θ_{JA}	53	$^{\circ}\text{C}/\text{W}$
48-pin LQFP	θ_{JA}	57	$^{\circ}\text{C}/\text{W}$
32-pin LQFP	θ_{JA}	57	$^{\circ}\text{C}/\text{W}$

The average chip-junction temperature (T_J) in $^{\circ}\text{C}$ can be obtained from:

$$T_J = T_A + (P_D \times \theta_{JA})$$

Where:

T_A = Ambient temperature, $^{\circ}\text{C}$

θ_{JA} = Package thermal resistance, junction-to-ambient, $^{\circ}\text{C}/\text{W}$

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

$P_{\text{int}} = I_{\text{DD}} \times V_{\text{DD}}$, Watts - chip internal power

$P_{\text{I/O}}$ = Power dissipation on input and output pins - user determined

For most applications, $P_{\text{I/O}} \ll P_{\text{int}}$ and can be neglected. An approximate relationship between P_D and T_J (if $P_{\text{I/O}}$ is neglected) is:

$$P_D = K \div (T_J + 273 \text{ }^{\circ}\text{C})$$

Solving the equations above for K gives:

$$K = P_D \times (T_A + 273 \text{ }^{\circ}\text{C}) + \theta_{JA} \times (P_D)^2$$

where K is a constant pertaining to the particular part. K can be determined 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 the above equations iteratively for any value of T_A .

6 Peripheral operating requirements and behaviors

6.2 NVM specifications

This section provides details about program/erase times and program/erase endurance for the flash and EEPROM memories.

Table 10. Flash characteristics

C	Characteristic	Symbol	Min ¹	Typical ²	Max ³	Unit ⁴
D	Supply voltage for program/erase -40 °C to 125 °C	V _{prog/erase}	2.7	—	5.5	V
D	Supply voltage for read operation	V _{Read}	2.7	—	5.5	V
D	NVM Bus frequency	f _{NVMBUS}	1	—	25	MHz
D	NVM Operating frequency	f _{NVMOP}	0.8	1	1.05	MHz
D	Erase Verify All Blocks	t _{VFYALL}	—	—	17338	t _{cyc}
D	Erase Verify Flash Block	t _{RD1BLK}	—	—	16913	t _{cyc}
D	Erase Verify EEPROM Block	t _{RD1BLK}	—	—	810	t _{cyc}
D	Erase Verify Flash Section	t _{RD1SEC}	—	—	484	t _{cyc}
D	Erase Verify EEPROM Section	t _{DRD1SEC}	—	—	555	t _{cyc}
D	Read Once	t _{RDONCE}	—	—	450	t _{cyc}
D	Program Flash (2 word)	t _{PGM2}	0.12	0.12	0.29	ms
D	Program Flash (4 word)	t _{PGM4}	0.20	0.21	0.46	ms
D	Program Once	t _{PGMONCE}	0.20	0.21	0.21	ms
D	Program EEPROM (1 Byte)	t _{DPGM1}	0.10	0.10	0.27	ms
D	Program EEPROM (2 Byte)	t _{DPGM2}	0.17	0.18	0.43	ms
D	Program EEPROM (3 Byte)	t _{DPGM3}	0.25	0.26	0.60	ms
D	Program EEPROM (4 Byte)	t _{DPGM4}	0.32	0.33	0.77	ms
D	Erase All Blocks	t _{ERSALL}	96.01	100.78	101.49	ms
D	Erase Flash Block	t _{ERSBLK}	95.98	100.75	101.44	ms
D	Erase Flash Sector	t _{ERSPG}	19.10	20.05	20.08	ms
D	Erase EEPROM Sector	t _{DERSPG}	4.81	5.05	20.57	ms
D	Unsecure Flash	t _{UNSECU}	96.01	100.78	101.48	ms
D	Verify Backdoor Access Key	t _{VFYKEY}	—	—	464	t _{cyc}
D	Set User Margin Level	t _{MLOADU}	—	—	407	t _{cyc}
C	FLASH Program/erase endurance T _L to T _H = -40 °C to 125 °C	n _{FLPE}	10 k	100 k	—	Cycles
C	EEPROM Program/erase endurance T _L to T _H = -40 °C to 125 °C	n _{FLPE}	50 k	500 k	—	Cycles
C	Data retention at an average junction temperature of T _{Javg} = 85°C after up to 10,000 program/erase cycles	t _{D_ret}	15	100	—	years

1. Minimum times are based on maximum f_{NVMOP} and maximum f_{NVMBUS}
2. Typical times are based on typical f_{NVMOP} and maximum f_{NVMBUS}
3. Maximum times are based on typical f_{NVMOP} and typical f_{NVMBUS} plus aging
4. t_{cyc} = 1 / f_{NVMBUS}

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

Characteristic	Conditions	C	Symb	Min	Typ ¹	Max	Unit
ADC asynchronous clock source	High speed (ADLPC = 0)	P	f_{ADACK}	2	3.3	5	MHz
	Low power (ADLPC = 1)			1.25	2	3.3	
Conversion time (including sample time)	Short sample (ADLSMP = 0)	T	t_{ADC}	—	20	—	ADCK cycles
	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 ^{2, 2}	12-bit mode	T	E_{TUE}	—	±5.0	—	LSB ^{3, 3}
	10-bit mode	P		—	±1.5	±2.0	
	8-bit mode	P		—	±0.7	±1.0	
Differential Non-Linearity	12-bit mode	T	DNL	—	±1.0	—	LSB ³
	10-bit mode ^{4, 4}	P		—	±0.25	±0.5	
	8-bit mode ⁴	P		—	±0.15	±0.25	
Integral Non-Linearity	12-bit mode	T	INL	—	±1.0	—	LSB ³
	10-bit mode	T		—	±0.3	±0.5	
	8-bit mode	T		—	±0.15	±0.25	
Zero-scale error ^{5, 5}	12-bit mode	C	E_{ZS}	—	±2.0	—	LSB ³
	10-bit mode	P		—	±0.25	±1.0	
	8-bit mode	P		—	±0.65	±1.0	
Full-scale error ⁶	12-bit mode	T	E_{FS}	—	±2.5	—	LSB ³
	10-bit mode	T		—	±0.5	±1.0	
	8-bit mode	T		—	±0.5	±1.0	
Quantization error	≤12 bit modes	D	E_Q	—	—	±0.5	LSB ³
Input leakage error ⁷	all modes	D	E_{IL}	$I_{in} * R_{AS}$			mV
Temp sensor slope	-40°C– 25°C	D	m	—	3.266	—	mV/°C
	25°C– 125°C			—	3.638	—	
Temp sensor voltage	25°C	D	V_{TEMP25}	—	1.396	—	V

1. Typical values assume $V_{DDA} = 5.0$ 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. Includes quantization.
3. $1 \text{ LSB} = (V_{REFH} - V_{REFL})/2^N$
4. Monotonicity and no-missing-codes guaranteed in 10-bit and 8-bit modes
5. $V_{ADIN} = V_{SSA}$
6. $V_{ADIN} = V_{DDA}$
7. I_{in} = leakage current (refer to DC characteristics)

6.3.2 Analog comparator (ACMP) electricals

Table 13. Comparator electrical specifications

C	Characteristic	Symbol	Min	Typical	Max	Unit
D	Supply voltage	V_{DDA}	2.7	—	5.5	V
T	Supply current (Operation mode)	I_{DDA}	—	10	20	μA
D	Analog input voltage	V_{AIN}	$V_{SS} - 0.3$	—	V_{DDA}	V
P	Analog input offset voltage	V_{AIO}	—	—	40	mV
C	Analog comparator hysteresis (HYST=0)	V_H	—	15	20	mV
C	Analog comparator hysteresis (HYST=1)	V_H	—	20	30	mV
T	Supply current (Off mode)	I_{DDAOFF}	—	60	—	nA
C	Propagation Delay	t_D	—	0.4	1	μs

6.4 Communication interfaces

6.4.1 SPI switching specifications

The serial peripheral interface (SPI) provides a synchronous serial bus with master and slave operations. Many of the transfer attributes are programmable. The following tables provide timing characteristics for classic SPI timing modes. Refer to the SPI chapter of the chip's reference manual for information about the modified transfer formats used for communicating with slower peripheral devices. All timing is shown with respect to 20% V_{DD} and 70% V_{DD} , unless noted, and 100 pF load on all SPI pins. All timing assumes slew rate control is disabled and high drive strength is enabled for SPI output pins.

Table 14. SPI master mode timing

Nu m.	Symbol	Description	Min.	Max.	Unit	Comment
1	f_{op}	Frequency of operation	$f_{Bus}/2048$	$f_{Bus}/2$	Hz	f_{Bus} is the bus clock
2	t_{SPSCK}	SPSCK period	$2 \times t_{Bus}$	$2048 \times t_{Bus}$	ns	$t_{Bus} = 1/f_{Bus}$
3	t_{Lead}	Enable lead time	1/2	—	t_{SPSCK}	—
4	t_{Lag}	Enable lag time	1/2	—	t_{SPSCK}	—
5	t_{WSPSCK}	Clock (SPSCK) high or low time	$t_{Bus} - 30$	$1024 \times t_{Bus}$	ns	—
6	t_{SU}	Data setup time (inputs)	15	—	ns	—
7	t_{HI}	Data hold time (inputs)	0	—	ns	—
8	t_v	Data valid (after SPSCK edge)	—	25	ns	—
9	t_{HO}	Data hold time (outputs)	0	—	ns	—

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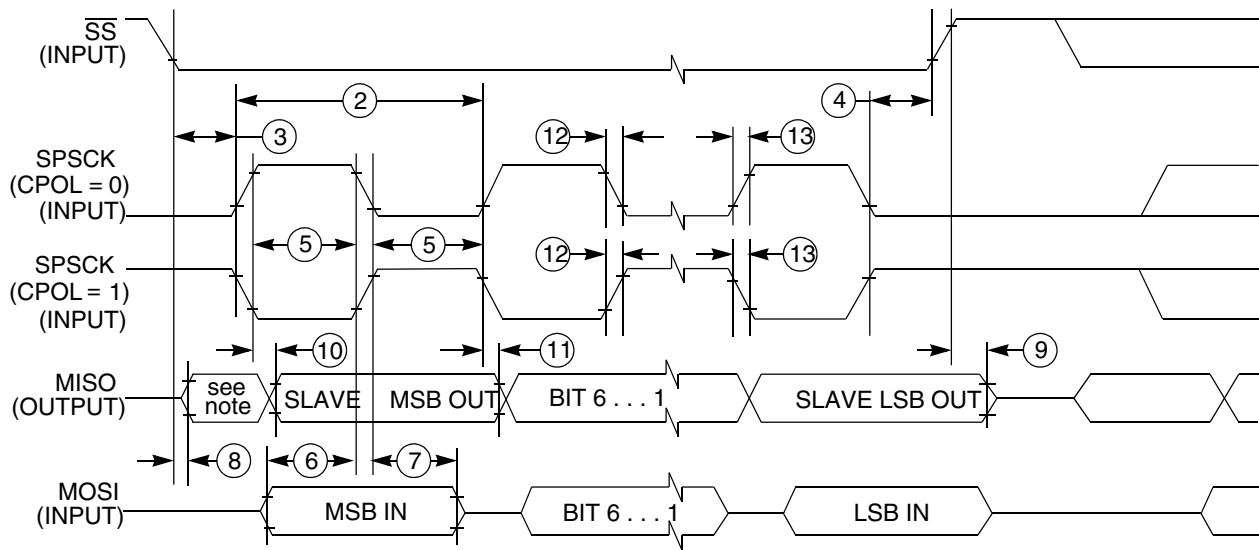


Figure 20. SPI slave mode timing (CPHA=1)

6.5 Human-machine interfaces (HMI)

6.5.1 TSI electrical specifications

Table 16. TSI electrical specifications

Symbol	Description	Min.	Type	Max	Unit
TSI_RUNF	Fixed power consumption in run mode	—	100	—	μA
TSI_RUNV	Variable power consumption in run mode (depends on oscillator's current selection)	1.0	—	128	μA
TSI_EN	Power consumption in enable mode	—	100	—	μA
TSI_DIS	Power consumption in disable mode	—	1.2	—	μA
TSI_TEN	TSI analog enable time	—	66	—	μs
TSI_CREF	TSI reference capacitor	—	1.0	—	pF
TSI_DVOLT	Voltage variation of VP & VM around nominal values	-10	—	10	%

7 Dimensions

7.1 Obtaining package dimensions

Package dimensions are provided in package drawings.

Table 17. Pin availability by package pin-count (continued)

Pin Number			Lowest Priority <-- --> Highest				
64-LQFP	48-LQFP	32-LQFP	Port Pin	Alt 1	Alt 2	Alt 3	Alt 4
20	16	11	PTC3	FTM2CH3	—	ADP11	—
21	17	12	PTC2	FTM2CH2	—	ADP10	—
22	18	—	PTD7	KBI1P7	TXD2	—	—
23	19	—	PTD6	KBI1P6	RXD2	—	—
24	20	—	PTD5	KBI1P5	—	—	—
25	21	13	PTC1	—	FTM2CH1	ADP9	TSI7
26	22	14	PTC0	—	FTM2CH0	ADP8	TSI6
27	—	—	PTF7	—	—	ADP15	—
28	—	—	PTF6	—	—	ADP14	—
29	—	—	PTF5	—	—	ADP13	—
30	—	—	PTF4	—	—	ADP12	—
31	23	15	PTB3	KBI0P7	MOSI0	ADP7	TSI5
32	24	16	PTB2	KBI0P6	SPSCK0	ADP6	TSI4
33	25	17	PTB1	KBI0P5	TXD0	ADP5	TSI3
34	26	18	PTB0	KBI0P4	RXD0	ADP4	TSI2
35	—	—	PTF3	—	—	—	TSI15
36	—	—	PTF2	—	—	—	TSI14
37	27	19	PTA7	FTM2FAULT2	—	ADP3	TSI1
38	28	20	PTA6	FTM2FAULT1	—	ADP2	TSI0
39	29	—	PTE4	—	—	—	—
40	30	—	—	—	—	—	V _{SS}
41	31	—	—	—	—	—	V _{DD}
42	—	—	PTF1	—	—	—	TSI13
43	—	—	PTF0	—	—	—	TSI12
44	32	—	PTD4	KBI1P4	—	—	—
45	33	21	PTD3	KBI1P3	SS1	—	TSI11
46	34	22	PTD2	KBI1P2	MISO1	—	TSI10
47	35	23	PTA3 ^{2, 2}	KBI0P3	TXD0	SCL	—
48	36	24	PTA2 ²	KBI0P2	RXD0	SDA	—
49	37	25	PTA1	KBI0P1	FTM0CH1	ACMP1	ADP1
50	38	26	PTA0	KBI0P0	FTM0CH0	ACMP0	ADP0
51	39	27	PTC7	—	TxD1	—	TSI9
52	40	28	PTC6	—	RxD1	—	TSI8
53	41	—	PTE3	—	SS0	—	—
54	42	—	PTE2	—	MISO0	—	—
55	—	—	PTG3	—	—	—	—
56	—	—	PTG2	—	—	—	—
57	—	—	PTG1	—	—	—	—

Table continues on the next page...

Table 17. Pin availability by package pin-count (continued)

Pin Number			Lowest Priority <-- --> Highest				
64-LQFP	48-LQFP	32-LQFP	Port Pin	Alt 1	Alt 2	Alt 3	Alt 4
58	—	—	PTG0	—	—	—	—
59	43	—	PTE1 ¹	—	MOSI0	—	—
60	44	—	PTE0 ¹	—	SPSCK0	TCLK1	—
61	45	29	PTC5	—	FTM1CH1	—	—
62	46	30	PTC4	—	FTM1CH0	RTCO	—
63	47	31	—	—	—	—	RESET
64	48	32	—	—	—	BKGD	MS

1. This is a high current drive pin when operated as output.
2. This is a true open-drain pin when operated as output.

Note

When an alternative function is first enabled, it is possible to get a spurious edge to the module. User software must clear any associated flags before interrupts are enabled. The table above illustrates the priority if multiple modules are enabled. The highest priority module will have control over the pin. Selecting a higher priority pin function with a lower priority function already enabled can cause spurious edges to the lower priority module. Disable all modules that share a pin before enabling another module.

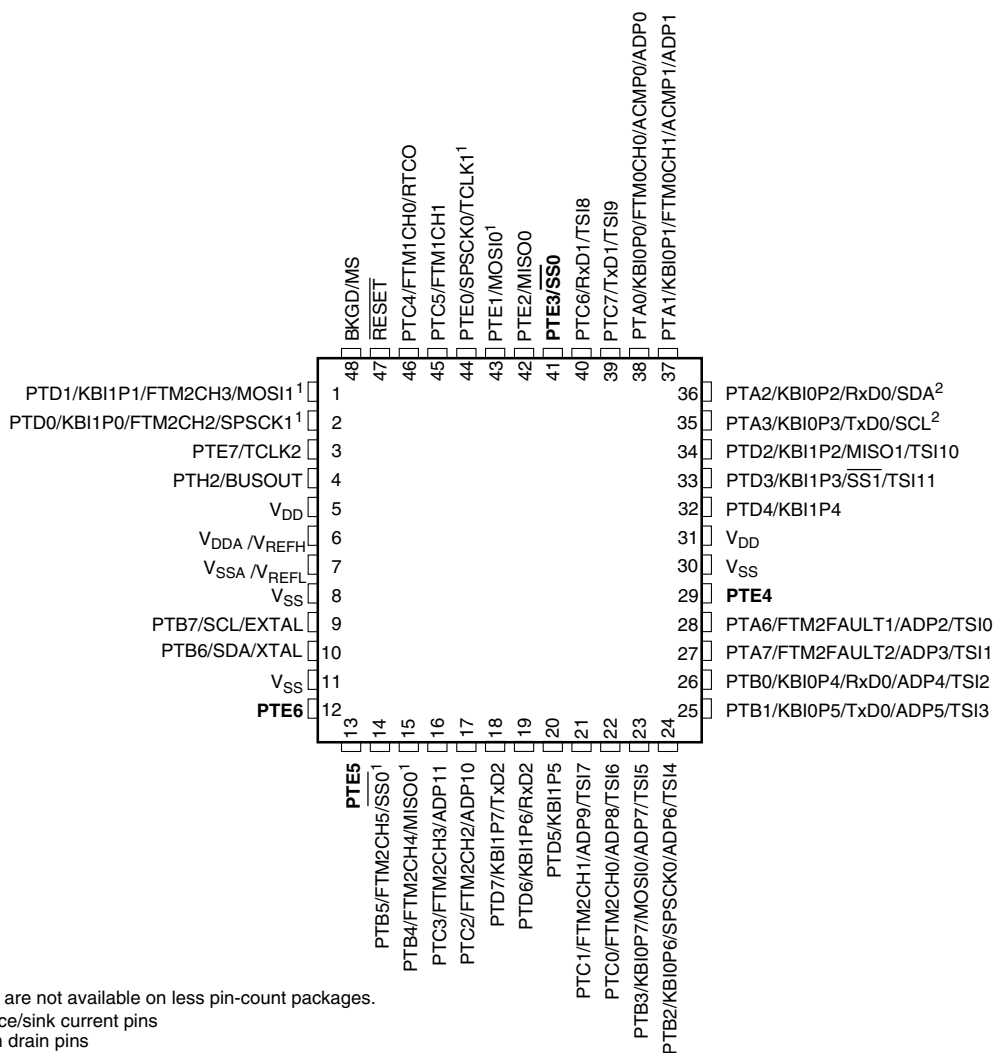


Figure 22. S9S08RN60 48-pin LQFP package

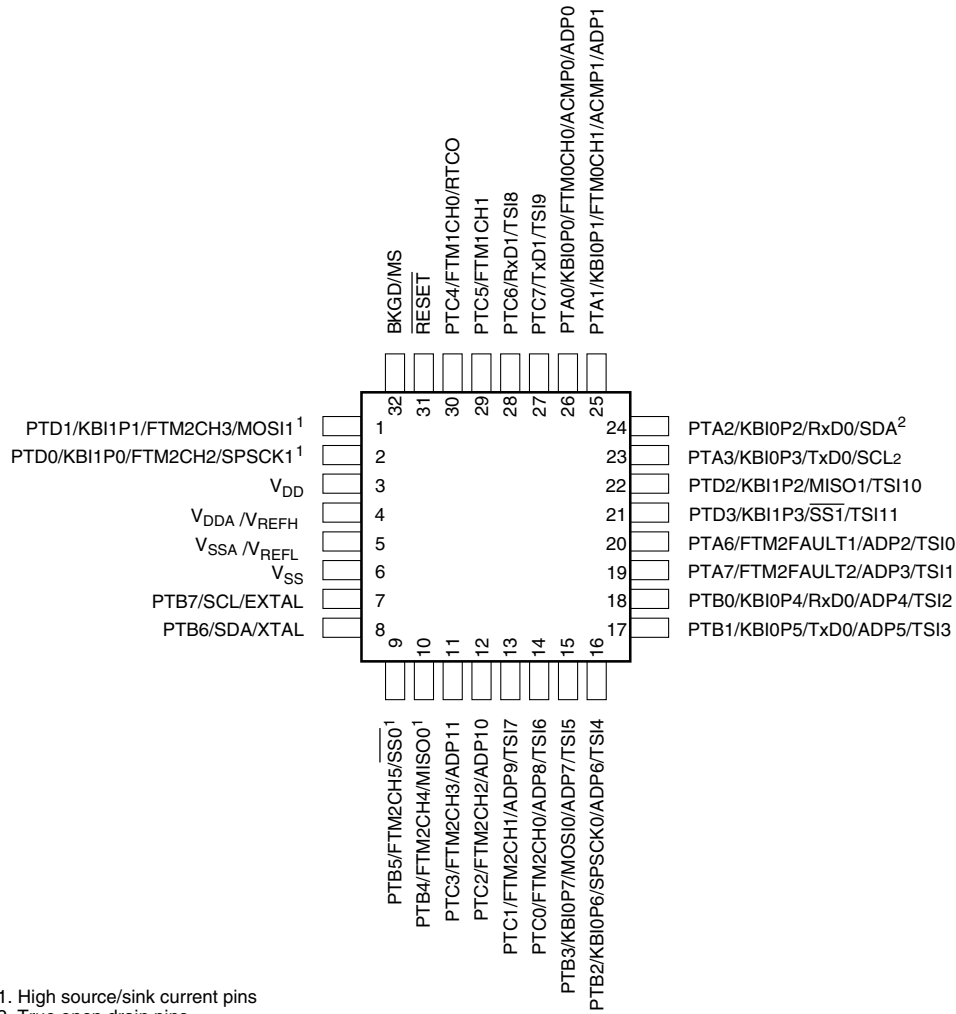


Figure 23. S9S08RN60 32-pin LQFP package

9 Revision history

The following table provides a revision history for this document.

Table 18. Revision history

Rev. No.	Date	Substantial Changes
1	01/2014	Initial Release