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Details	
Product Status	Active
Core Processor	12V1
Core Size	16-Bit
Speed	25MHz
Connectivity	CANbus, IrDA, LINbus, SCI, SPI
Peripherals	LVD, POR, PWM, WDT
Number of I/O	86
Program Memory Size	192KB (192K x 8)
Program Memory Type	FLASH
EEPROM Size	4K x 8
RAM Size	11K x 8
Voltage - Supply (Vcc/Vdd)	3.13V ~ 5.5V
Data Converters	A/D 16x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	100-LQFP
Supplier Device Package	100-LQFP (14x14)
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/s9s12g192f0vllr

Table 1-14. 64-Pin LQFP Pinout for S12GN48

	Function <----lowest-----PRIORITY-----highest---->					Power Supply	Internal Pull Resistor	
Package Pin	Pin	2nd Func.	3rd Func.	4th Func	5th Func		CTRL	Reset State
28	PT4	IOC4	—	—	—	V_{DDX}	PERT/PPST	Disabled
29	PT3	IOC3	—	—	—	V_{DDX}	PERT/PPST	Disabled
30	PT2	IOC2	—	—	—	V_{DDX}	PERT/PPST	Disabled
31	PT1	IOC1	$\overline{IRQ}$	—	—	V_{DDX}	PERT/PPST	Disabled
32	PT0	IOC0	$\overline{XIRQ}$	—	—	V_{DDX}	PERT/PPST	Disabled
33	PAD0	KWAD0	AN0	—	—	V_{DDA}	PER1AD/PPS1AD	Disabled
34	PAD8	KWAD8	AN8	—	—	V_{DDA}	PER0AD/PPS0AD	Disabled
35	PAD1	KWAD1	AN1	—	—	V_{DDA}	PER1AD/PPS1AD	Disabled
36	PAD9	KWAD9	AN9	ACMPO	—	V_{DDA}	PER0ADPPS0AD	Disabled
37	PAD2	KWAD2	AN2	—	—	V_{DDA}	PER1AD/PPS1AD	Disabled
38	PAD10	KWAD10	AN10	ACMPP	—	V_{DDA}	PER0AD/PPS0AD	Disabled
39	PAD3	KWAD3	AN3	—	—	V_{DDA}	PER1AD/PPS1AD	Disabled
40	PAD11	KWAD11	AN11	ACMPM	—	V_{DDA}	PER0AD/PPS0AD	Disabled
41	PAD4	KWAD4	AN4	—	—	V_{DDA}	PER1AD/PPS1AD	Disabled
42	PAD12	KWAD12	—	—	—	V_{DDA}	PER0AD/PPS0AD	Disabled
43	PAD5	KWAD5	AN5	—	—	V_{DDA}	PER1AD/PPS1AD	Disabled
44	PAD13	KWAD13	—	—	—	V_{DDA}	PER0AD/PPS0AD	Disabled
45	PAD6	KWAD6	AN6	—	—	V_{DDA}	PER1AD/PPS1AD	Disabled
46	PAD14	KWAD14	—		—	V_{DDA}	PER0AD/PPS0AD	Disabled
47	PAD7	KWAD7	AN7	—	—	V_{DDA}	PER1AD/PPS1AD	Disabled
48	PAD15	KWAD15	—		—	V_{DDA}	PER0AD/PPS0AD	Disabled
49	VRH	—	—	—	—	—	—	—
50	VDDA	—	—	—	—	—	—	—
51	VSSA	—	—	—	—	—	—	—
52	PS0	RXD0	—	—	—	V_{DDX}	PERS/PPSS	Up
53	PS1	TXD0	—	—	—	V_{DDX}	PERS/PPSS	Up
54	PS2	RXD1	—	—	—	V_{DDX}	PERS/PPSS	Up
55	PS3	TXD1	—	—	—	V_{DDX}	PERS/PPSS	Up
56	PS4	MISO0	—	—	—	V_{DDX}	PERS/PPSS	Up

Table 1-22. 100-Pin LQFP Pinout for S12G96 and S12G128

	Function <----lowest-----PRIORITY-----highest---->				Power Supply	Internal Pull Resistor	
Package Pin	Pin	2nd Func.	3rd Func.	4th Func.		CTRL	Reset State
86	PS4	MISO0	—	—	V_{DDX}	PERS/PPSS	Up
87	PS5	MOSI0	—	—	V_{DDX}	PERS/PPSS	Up
88	PS6	SCK0	—	—	V_{DDX}	PERS/PPSS	Up
89	PS7	API_EXTCLK	$\overline{SS0}$	—	V_{DDX}	PERS/PPSS	Up
90	VSSX2	—	—	—	—	—	—
91	VDDX2	—	—	—	—	—	—
92	PM0	RXCAN	—	—	V_{DDX}	PERM/PPSM	Disabled
93	PM1	TXCAN	—	—	V_{DDX}	PERM/PPSM	Disabled
94	PD4	—	—	—	V_{DDX}	PUCR/PUPDE	Disabled
95	PD5	—	—	—	V_{DDX}	PUCR/PUPDE	Disabled
96	PD6	—	—	—	V_{DDX}	PUCR/PUPDE	Disabled
97	PD7	—	—	—	V_{DDX}	PUCR/PUPDE	Disabled
98	PM2	RXD2	—	—	V_{DDX}	PERM/PPSM	Disabled
99	PM3	TXD2	—	—	V_{DDX}	PERM/PPSM	Disabled
100	PJ7	KWJ7	$\overline{SS2}$	—	V_{DDX}	PERJ/PPSJ	Up

[1] The regular I/O characteristics (see Section A.2, “I/O Characteristics”) apply if the EXTAL/XTAL function is disabled

2.3.11 Pins PJ7-0

Table 2-15. Port J Pins PJ7-0

PJ7	• 64/100 LQFP: The SPI2 $\overline{SS}$ signal is mapped to this pin when used with the SPI function. Depending on the configuration of the enabled SPI2 the I/O state is forced to be input or output. • 64/100 LQFP: Pin interrupts can be generated if enabled in input or output mode. • Signal priority: 64/100 LQFP: $\overline{SS2}$ > GPO
PJ6	• 64/100 LQFP: The SPI2 SCK signal is mapped to this pin when used with the SPI function. Depending on the configuration of the enabled SPI2 the I/O state is forced to be input or output. • 64/100 LQFP: Pin interrupts can be generated if enabled in input or output mode. • Signal priority: 64/100 LQFP: SCK2 > GPO
PJ5	• 64/100 LQFP: The SPI2 MOSI signal is mapped to this pin when used with the SPI function. Depending on the configuration of the enabled SPI2 the I/O state is forced to be input or output. • 64/100 LQFP: Pin interrupts can be generated if enabled in input or output mode. • Signal priority: 64/100 LQFP: MOSI2 > GPO
PJ4	• 64/100 LQFP: The SPI2 MISO signal is mapped to this pin when used with the SPI function.Depending on the configuration of the enabled SPI2 the I/O state is forced to be input or output. • 64/100 LQFP: Pin interrupts can be generated if enabled in input or output mode. • Signal priority: 64/100 LQFP: MISO2 > GPO
PJ3	• Except 20 TSSOP and 32 LQFP: The SPI1 $\overline{SS}$ signal is mapped to this pin when used with the SPI function. Depending on the configuration of the enabled SPI1 the I/O state is forced to be input or output. • 48 LQFP: The PWM channel 7 signal is mapped to this pin when used with the PWM function. The enabled PWM channel forces the I/O state to be an output. • Except 20 TSSOP and 32 LQFP: Pin interrupts can be generated if enabled in input or output mode. • Signal priority: 48 LQFP: $\overline{SS1}$ > PWM7 > GPO 64/100 LQFP: $\overline{SS1}$ > GPO
PJ2	• Except 20 TSSOP and 32 LQFP: The SPI1 SCK signal is mapped to this pin when used with the SPI function. Depending on the configuration of the enabled SPI1 the I/O state is forced to be input or output. • 48 LQFP: The TIM channel 7 signal is mapped to this pin when used with the TIM function. The TIM forces the I/O state to be an output for a timer port associated with an enabled output. • Except 20 TSSOP and 32 LQFP: Pin interrupts can be generated if enabled in input or output mode. • Signal priority: 48 LQFP: SCK1 > IOC7 > GPO 64/100 LQFP: SCK1 > GPO

- GO_UNTIL command
- Hardware handshake protocol to increase the performance of the serial communication
- Active out of reset in special single chip mode
- Nine hardware commands using free cycles, if available, for minimal CPU intervention
- Hardware commands not requiring active BDM
- 14 firmware commands execute from the standard BDM firmware lookup table
- Software control of BDM operation during wait mode
- When secured, hardware commands are allowed to access the register space in special single chip mode, if the Flash erase tests fail.
- Family ID readable from BDM ROM at global address 0x3_FF0F in active BDM (value for devices with HCS12S core is 0xC2)
- BDM hardware commands are operational until system stop mode is entered

7.1.2 Modes of Operation

BDM is available in all operating modes but must be enabled before firmware commands are executed. Some systems may have a control bit that allows suspending the function during background debug mode.

7.1.2.1 Regular Run Modes

All of these operations refer to the part in run mode and not being secured. The BDM does not provide controls to conserve power during run mode.

- Normal modes

  General operation of the BDM is available and operates the same in all normal modes.
- Special single chip mode

  In special single chip mode, background operation is enabled and active out of reset. This allows programming a system with blank memory.

7.1.2.2 Secure Mode Operation

If the device is in secure mode, the operation of the BDM is reduced to a small subset of its regular run mode operation. Secure operation prevents access to Flash other than allowing erasure. For more information please see Section 7.4.1, “Security”.

7.1.2.3 Low-Power Modes

The BDM can be used until stop mode is entered. When CPU is in wait mode all BDM firmware commands as well as the hardware BACKGROUND command cannot be used and are ignored. In this case the CPU can not enter BDM active mode, and only hardware read and write commands are available. Also the CPU can not enter a low power mode (stop or wait) during BDM active mode.

In stop mode the BDM clocks are stopped. When BDM clocks are disabled and stop mode is exited, the BDM clocks will restart and BDM will have a soft reset (clearing the instruction register, any command in progress and disable the ACK function). The BDM is now ready to receive a new command.

Tag: Tags can be attached to CPU opcodes as they enter the instruction pipe. If the tagged opcode reaches the execution stage a tag hit occurs.

8.1.2 Overview

The comparators monitor the bus activity of the CPU module. A match can initiate a state sequencer transition. On a transition to the Final State, bus tracing is triggered and/or a breakpoint can be generated.

Independent of comparator matches a transition to Final State with associated tracing and breakpoint can be triggered immediately by writing to the TRIG control bit.

The trace buffer is visible through a 2-byte window in the register address map and can be read out using standard 16-bit word reads. Tracing is disabled when the MCU system is secured.

8.1.3 Features

- Three comparators (A, B and C)
  - Comparators A compares the full address bus and full 16-bit data bus
  - Comparator A features a data bus mask register
  - Comparators B and C compare the full address bus only
  - Each comparator features selection of read or write access cycles
  - Comparator B allows selection of byte or word access cycles
  - Comparator matches can initiate state sequencer transitions
- Three comparator modes
  - Simple address/data comparator match mode
  - Inside address range mode, Addmin ≤ Address ≤ Addmax
  - Outside address range match mode, Address < Addmin or Address > Addmax
- Two types of matches
  - Tagged — This matches just before a specific instruction begins execution
  - Force — This is valid on the first instruction boundary after a match occurs
- Two types of breakpoints
  - CPU breakpoint entering BDM on breakpoint (BDM)
  - CPU breakpoint executing SWI on breakpoint (SWI)
- Trigger mode independent of comparators
  - TRIG Immediate software trigger
- Four trace modes
  - Normal: change of flow (COF) PC information is stored (see Section 8.4.5.2.1, “Normal Mode) for change of flow definition.
  - Loop1: same as Normal but inhibits consecutive duplicate source address entries
  - Detail: address and data for all cycles except free cycles and opcode fetches are stored
  - Compressed Pure PC: all program counter addresses are stored

CPMUSYNR, CPMUREFDIV, CPMUCLKS, CPMUPLL, CPMUIRCTRIMH/L and CPMUOSC

0x02FB

	7	6	5	4	3	2	1	0
R	0	0	0	0	0	0	0	PROT
W								
Reset	0	0	0	0	0	0	0	0

Figure 10-28. S12CPMU Protection Register (CPMUPROT)

Read: Anytime

Write: Anytime

Field	Description
0 PROT	**Clock Configuration Registers Protection Bit** — This bit protects the clock configuration registers from accidental overwrite (see list of affected registers above): Writing 0x26 to the CPMUPROT register clears the PROT bit, other write accesses set the PROT bit. 0 Protection of clock configuration registers is disabled. 1 Protection of clock configuration registers is enabled. (see list of protected registers above).

10.3.2.21 Reserved Register CPMUTEST2

NOTE

This reserved register is designed for factory test purposes only, and is not intended for general user access. Writing to this register when in Special Mode can alter the S12CPMU's functionality.

0x02FC

	7	6	5	4	3	2	1	0
R	0	0	0	0	0	0	0	0
W								
Reset	0	0	0	0	0	0	0	0

= Unimplemented or Reserved

Figure 10-29. Reserved Register CPMUTEST2

Read: Anytime

Write: Only in Special Mode

11.3.2.10 ATD Input Enable Register (ATDDIEN)

Module Base + 0x000C

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
R	1	1	1	1	1	1	1	1	IEN[7:0]							
W																
Reset	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0

= Unimplemented or Reserved

Figure 11-12. ATD Input Enable Register (ATDDIEN)

Read: Anytime

Write: Anytime

Table 11-19. ATDDIEN Field Descriptions

Field	Description
7–0 IEN[7:0]	**ATD Digital Input Enable on channel *x* (*x*= 7, 6, 5, 4, 3, 2, 1, 0)** — This bit controls the digital input buffer from the analog input pin (AN*x*) to the digital data register. 0 Disable digital input buffer to AN*x* pin 1 Enable digital input buffer on AN*x* pin. **Note:** Setting this bit will enable the corresponding digital input buffer continuously. If this bit is set while simultaneously using it as an analog port, there is potentially increased power consumption because the digital input buffer maybe in the linear region.

11.3.2.11 ATD Compare Higher Than Register (ATDCMPHT)

Writes to this register will abort current conversion sequence.

Read: Anytime

Write: Anytime

Module Base + 0x000E

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
R	0	0	0	0	0	0	0	0	CMPHT[7:0]							
W																
Reset	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

= Unimplemented or Reserved

Figure 11-13. ATD Compare Higher Than Register (ATDCMPHT)

Table 11-20. ATDCMPHT Field Descriptions

Field	Description
7–0 CMPHT[7:0]	**Compare Operation Higher Than Enable for conversion number *n* (*n*= 7, 6, 5, 4, 3, 2, 1, 0) of a Sequence (*n conversion number, NOT channel number!)*** — This bit selects the operator for comparison of conversion results. 0 If result of conversion *n* is **lower or same than** compare value in ATDDR*n*, this is flagged in ATDSTAT2 1 If result of conversion *n* is **higher than** compare value in ATDDR*n*, this is flagged in ATDSTAT2

13.2 Signal Description

This section lists all inputs to the ADC10B12C block.

13.2.1 Detailed Signal Descriptions

13.2.1.1 AN*x* (*x* = 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0)

This pin serves as the analog input Channel *x*. It can also be configured as digital port or external trigger for the ATD conversion.

13.2.1.2 ETRIG3, ETRIG2, ETRIG1, ETRIG0

These inputs can be configured to serve as an external trigger for the ATD conversion.

Refer to device specification for availability and connectivity of these inputs!

13.2.1.3 VRH, VRL

VRH is the high reference voltage, VRL is the low reference voltage for ATD conversion.

13.2.1.4 VDDA, VSSA

These pins are the power supplies for the analog circuitry of the ADC10B12C block.

13.3 Memory Map and Register Definition

This section provides a detailed description of all registers accessible in the ADC10B12C.

13.3.1 Module Memory Map

Figure 13-2 gives an overview on all ADC10B12C registers.

NOTE

Register Address = Base Address + Address Offset, where the Base Address is defined at the MCU level and the Address Offset is defined at the module level.

Address	Name		Bit 7	6	5	4	3	2	1	Bit 0
0x0000	ATDCTL0	R W	Reserved	0	0	0	WRAP3	WRAP2	WRAP1	WRAP0
0x0001	ATDCTL1	R W	ETRIGSEL	SRES1	SRES0	SMP_DIS	ETRIGCH3	ETRIGCH2	ETRIGCH1	ETRIGCH0
0x0002	ATDCTL2	R W	0	AFFC	Reserved	ETRIGLE	ETRIGP	ETRIGE	ASCIE	ACMPIE

= Unimplemented or Reserved

Figure 13-2. ADC10B12C Register Summary (Sheet 1 of 3)

Table 13-6. ATDCTL2 Field Descriptions

Field	Description
6 AFFC	**ATD Fast Flag Clear All** 0 ATD flag clearing done by write 1 to respective CCF[*n*] flag. 1 Changes all ATD conversion complete flags to a fast clear sequence. For compare disabled (CMPE[*n*]=0) a read access to the result register will cause the associated CCF[*n*] flag to clear automatically. For compare enabled (CMPE[*n*]=1) a write access to the result register will cause the associated CCF[*n*] flag to clear automatically.
5 Reserved	Do not alter this bit from its reset value.It is for Manufacturer use only and can change the ATD behavior.
4 ETRIGLE	**External Trigger Level/Edge Control** — This bit controls the sensitivity of the external trigger signal. See Table 13-7 for details.
3 ETRIGP	**External Trigger Polarity** — This bit controls the polarity of the external trigger signal. See Table 13-7 for details.
2 ETRIGE	**External Trigger Mode Enable** — This bit enables the external trigger on one of the AD channels or one of the ETRIG3-0 inputs as described in Table 13-5. If the external trigger source is one of the AD channels, the digital input buffer of this channel is enabled. The external trigger allows to synchronize the start of conversion with external events. 0 Disable external trigger 1 Enable external trigger
1 ASCIE	**ATD Sequence Complete Interrupt Enable** 0 ATD Sequence Complete interrupt requests are disabled. 1 ATD Sequence Complete interrupt will be requested whenever SCF=1 is set.
0 ACMPIE	**ATD Compare Interrupt Enable** — If automatic compare is enabled for conversion *n* (CMPE[*n*]=1 in ATDCMPE register) this bit enables the compare interrupt. If the CCF[*n*] flag is set (showing a successful compare for conversion *n*), the compare interrupt is triggered. 0 ATD Compare interrupt requests are disabled. 1 For the conversions in a sequence for which automatic compare is enabled (CMPE[*n*]=1), an ATD Compare Interrupt will be requested whenever any of the respective CCF flags is set.

Table 13-7. External Trigger Configurations

ETRIGLE	ETRIGP	External Trigger Sensitivity
0	0	Falling edge
0	1	Rising edge
1	0	Low level
1	1	High level

Trying to alter data in any protected area in the P-Flash memory will result in a protection violation error and the FPVIOL bit will be set in the FSTAT register. The block erase of a P-Flash block is not possible if any of the P-Flash sectors contained in the same P-Flash block are protected.

Table 24-17. FPROT Field Descriptions

Field	Description
7 FPOPEN	**Flash Protection Operation Enable** — The FPOPEN bit determines the protection function for program or erase operations as shown in Table 24-18 for the P-Flash block. 0 When FPOPEN is clear, the FPHDIS bit defines an unprotected address range as specified by the FPHS bits 1 When FPOPEN is set, the FPHDIS bit enables protection for the address range specified by the FPHS bits
6 RNV[6]	**Reserved Nonvolatile Bit** — The RNV bit should remain in the erased state for future enhancements.
5 FPHDIS	**Flash Protection Higher Address Range Disable** — The FPHDIS bit determines whether there is a protected/unprotected area in a specific region of the P-Flash memory ending with global address 0x3_FFFF. 0 Protection/Unprotection enabled 1 Protection/Unprotection disabled
4–3 FPHS[1:0]	**Flash Protection Higher Address Size** — The FPHS bits determine the size of the protected/unprotected area in P-Flash memory as shown inTable 24-19. The FPHS bits can only be written to while the FPHDIS bit is set.
2–0 RNV[2:0]	**Reserved Nonvolatile Bits** — These RNV bits should remain in the erased state.

Table 24-18. P-Flash Protection Function

FPOPEN	FPHDIS	Function[1]
1	1	No P-Flash Protection
1	0	Protected High Range
0	1	Full P-Flash Memory Protected
0	0	Unprotected High Range

[1] For range sizes, refer to Table 24-19.

Table 24-19. P-Flash Protection Higher Address Range

FPHS[1:0]	Global Address Range	Protected Size
00	0x3_F800–0x3_FFFF	2 Kbytes
01	0x3_F000–0x3_FFFF	4 Kbytes
10	0x3_E000–0x3_FFFF	8 Kbytes
11	0x3_C000–0x3_FFFF	16 Kbytes

Although the protection scheme is loaded from the Flash memory at global address 0x3_FF0C during the reset sequence, it can be changed by the user. The P-Flash protection scheme can be used by applications requiring reprogramming in single chip mode while providing as much protection as possible if reprogramming is not required.

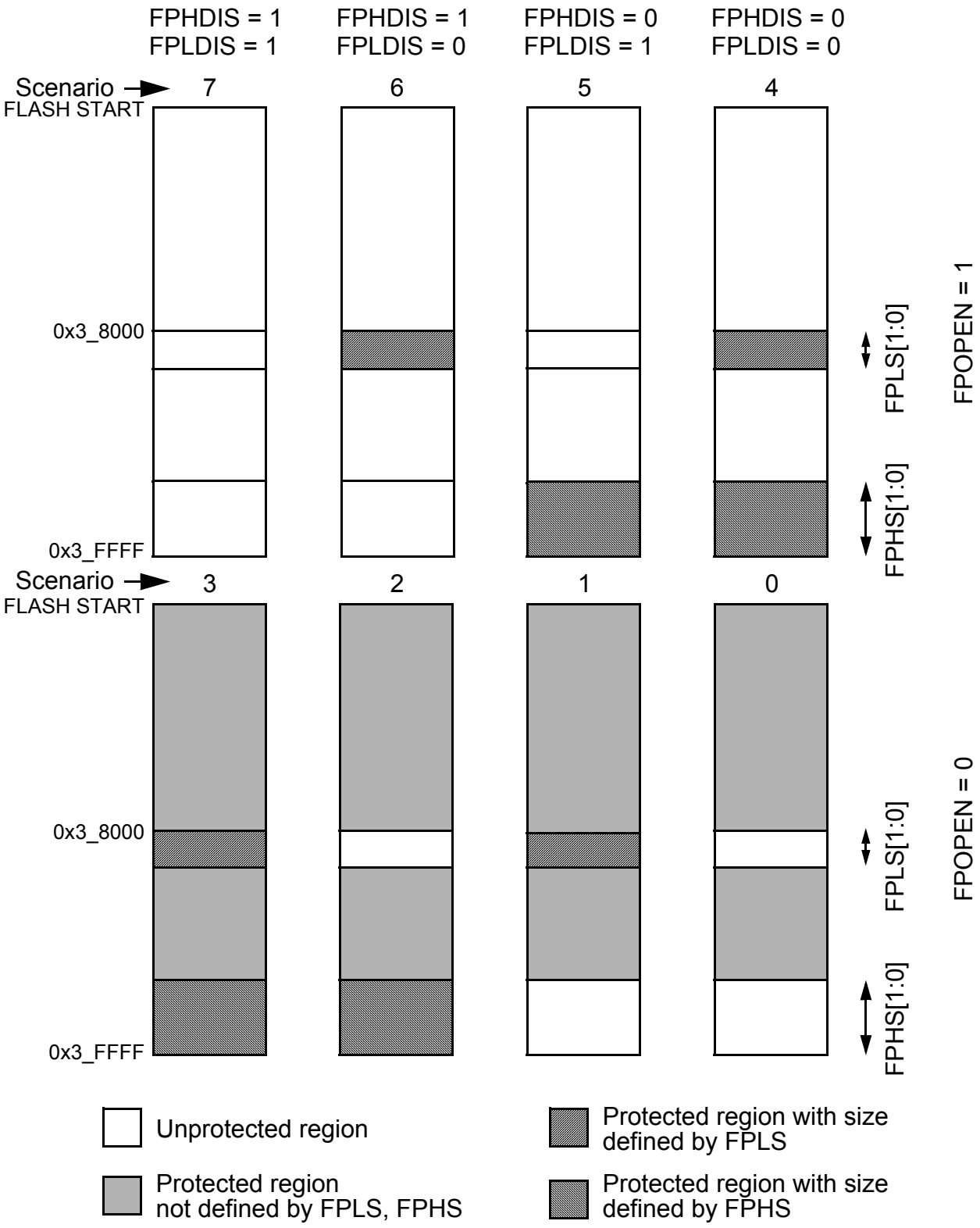


Figure 25-14. P-Flash Protection Scenarios

27.4.4.3 Valid Flash Module Commands

Table 27-27 present the valid Flash commands, as enabled by the combination of the functional MCU mode (Normal SingleChip NS, Special Singlechip SS) with the MCU security state (Unsecured, Secured).

Special Singlechip mode is selected by input mmc_ss_mode_ts2 asserted. MCU Secured state is selected by input mmc_secure input asserted.

Table 27-27. Flash Commands by Mode and Security State

FCMD	Command	Unsecured		Secured	
		NS[1]	SS[2]	NS[3]	SS[4]
0x01	Erase Verify All Blocks	*	*	*	*
0x02	Erase Verify Block	*	*	*	*
0x03	Erase Verify P-Flash Section	*	*	*	
0x04	Read Once	*	*	*	
0x06	Program P-Flash	*	*	*	
0x07	Program Once	*	*	*	
0x08	Erase All Blocks		*		*
0x09	Erase Flash Block	*	*	*	
0x0A	Erase P-Flash Sector	*	*	*	
0x0B	Unsecure Flash		*		*
0x0C	Verify Backdoor Access Key	*		*	
0x0D	Set User Margin Level	*	*	*	
0x0E	Set Field Margin Level		*		
0x10	Erase Verify EEPROM Section	*	*	*	
0x11	Program EEPROM	*	*	*	
0x12	Erase EEPROM Sector	*	*	*	

1 Unsecured Normal Single Chip mode
2 Unsecured Special Single Chip mode.
3 Secured Normal Single Chip mode.
4 Secured Special Single Chip mode.

27.4.4.4 P-Flash Commands

Table 27-28 summarizes the valid P-Flash commands along with the effects of the commands on the P-Flash block and other resources within the Flash module.

Table 27-28. P-Flash Commands

FCMD	Command	Function on P-Flash Memory
0x01	Erase Verify All Blocks	Verify that all P-Flash (and EEPROM) blocks are erased.

Table 28-29. EEPROM Commands

FCMD	Command	Function on EEPROM Memory
0x08	Erase All Blocks	Erase all EEPROM (and P-Flash) blocks. An erase of all Flash blocks is only possible when the FPLDIS, FPHDIS, and FPOPEN bits in the FPROT register and the DPOPEN bit in the EEPROT register are set prior to launching the command.
0x09	Erase Flash Block	Erase a EEPROM (or P-Flash) block. An erase of the full EEPROM block is only possible when DPOPEN bit in the EEPROT register is set prior to launching the command.
0x0B	Unsecure Flash	Supports a method of releasing MCU security by erasing all EEPROM (and P-Flash) blocks and verifying that all EEPROM (and P-Flash) blocks are erased.
0x0D	Set User Margin Level	Specifies a user margin read level for the EEPROM block.
0x0E	Set Field Margin Level	Specifies a field margin read level for the EEPROM block (special modes only).
0x10	Erase Verify EEPROM Section	Verify that a given number of words starting at the address provided are erased.
0x11	Program EEPROM	Program up to four words in the EEPROM block.
0x12	Erase EEPROM Sector	Erase all bytes in a sector of the EEPROM block.

28.4.5 Allowed Simultaneous P-Flash and EEPROM Operations

Only the operations marked ‘OK’ in Table 28-30 are permitted to be run simultaneously on the Program Flash and EEPROM blocks. Some operations cannot be executed simultaneously because certain hardware resources are shared by the two memories. The priority has been placed on permitting Program Flash reads while program and erase operations execute on the EEPROM, providing read (P-Flash) while write (EEPROM) functionality.

Table 28-30. Allowed P-Flash and EEPROM Simultaneous Operations

	EEPROM				
Program Flash	**Read**	**Margin Read[1]**	**Program**	**Sector Erase**	**Mass Erase[2]**
Read		OK	OK	OK	
Margin Read[1]					
Program					
Sector Erase					
Mass Erase[2]					OK

1 A ‘Margin Read’ is any read after executing the margin setting commands ‘Set User Margin Level’ or ‘Set Field Margin Level’ with anything but the ‘normal’ level specified. See the Note on margin settings in Section 28.4.6.12 and Section 28.4.6.13.

2 The ‘Mass Erase’ operations are commands ‘Erase All Blocks’ and ‘Erase Flash Block’

31.3.2 Register Descriptions

The Flash module contains a set of 20 control and status registers located between Flash module base + 0x0000 and 0x0013.

In the case of the writable registers, the write accesses are forbidden during Fash command execution (for more detail, see Caution note in Section 31.3).

A summary of the Flash module registers is given in Figure 31-4 with detailed descriptions in the following subsections.

Address & Name		7	6	5	4	3	2	1	0
0x0000 FCLKDIV	R	FDIVLD	FDIVLCK	FDIV5	FDIV4	FDIV3	FDIV2	FDIV1	FDIV0
	W								
0x0001 FSEC	R	KEYEN1	KEYEN0	RNV5	RNV4	RNV3	RNV2	SEC1	SEC0
	W								
0x0002 FCCOBIX	R	0	0	0	0	0	CCOBIX2	CCOBIX1	CCOBIX0
	W								
0x0003 FRSV0	R	0	0	0	0	0	0	0	0
	W								
0x0004 FCNFG	R	CCIE	0	0	IGNSF	0	0	FDFD	FSFD
	W								
0x0005 FERCNFG	R	0	0	0	0	0	0	DFDIE	SFDIE
	W								
0x0006 FSTAT	R	CCIF	0	ACCERR	FPVIOL	MGBUSY	RSVD	MGSTAT1	MGSTAT0
	W								
0x0007 FERSTAT	R	0	0	0	0	0	0	DFDIF	SFDIF
	W								
0x0008 FPROT	R	FPOPEN	RNV6	FPHDIS	FPHS1	FPHS0	FPLDIS	FPLS1	FPLS0
	W								
0x0009 EEPROT	R	DPOPEN	DPS6	DPS5	DPS4	DPS3	DPS2	DPS1	DPS0
	W								

Figure 31-4. FTMRG240K2 Register Summary

Table A-7. 3.3-V I/O Characteristics (Junction Temperature From +150°C To +160°C)

Conditions are 3.15 V < V_{DD35} < 3.6 V junction temperature from +150°C to +160°C, unless otherwise noted I/O Characteristics for all I/O pins except EXTAL, XTAL,TEST and supply pins.							
Num	**C**	**Rating**	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
1	M	Input high voltage	V_{IH}	0.65*V_{DD35}	—	—	V
2	T	Input high voltage	V_{IH}	—	—	V_{DD35}+0.3	V
3	M	Input low voltage	V_{IL}	—	—	0.35*V_{DD35}	V
4	T	Input low voltage	V_{IL}	V_{SS35} – 0.3	—	—	V
5	C	Input hysteresis	V_{HYS}	0.06*V_{DD35}	—	0.3*V_{DD35}	mV
6	M	Input leakage current (pins in high impedance input mode)[1] V_{in} = V_{DD35} or V_{SS35}	I_{in}	-1	—	1	µA
7	P	Output high voltage (pins in output mode) I_{OH} = –1.75 mA	V_{OH}	V_{DD35}-0.4	—	—	V
8	C	Output low voltage (pins in output mode) I_{OL} = +1.75 mA	V_{OL}	—	—	0.4	V
9	M	Internal pull up device current V_{IH} min > input voltage > V_{IL} max	I_{PUL}	-1	—	–70	µA
10	M	Internal pull down device current V_{IH} min > input voltage > V_{IL} max	I_{PDH}	1	—	70	µA
11	D	Input capacitance	C_{in}	—	7	—	pF
12	T	Injection current[2] Single pin limit Total device limit, sum of all injected currents	 I_{ICS} I_{ICP}	 –2.5 –25	—	 2.5 25	mA

1 Maximum leakage current occurs at maximum operating temperature. Current decreases by approximately one-half for each 8°°C to 12°C° in the temperature range from 50°C to 125°C.

2 Refer to Section A.1.4, “Current Injection” for more details

Table A-24. ADC Conversion Performance 5V range (Junction Temperature From +150°C To +160°C)

S12GN16, S12GN32								
Supply voltage 4.5V < V_{DDA} < 5.5 V, 150°C < T_J < 160°C, V_{REF} = V_{RH} - V_{RL} = V_{DDA}, f_{ADCCLK} = 8.0MHz The values are tested to be valid with no port AD output drivers switching simultaneous with conversions.								
Num	**C**	**Rating**[1]		**Symbol**	**Min**	**Typ**	**Max**	**Unit**
1	M	Resolution	10-Bit	LSB		5		mV
2	M	Differential Nonlinearity	10-Bit	DNL		±0.5		counts
3	M	Integral Nonlinearity	10-Bit	INL		±1		counts
4	M	Absolute Error[2]	10-Bit[3] 10-Bit[4]	AE		±2 ±2		counts
5	C	Resolution	8-Bit	LSB		20		mV
6	C	Differential Nonlinearity	8-Bit	DNL		±0.3		counts
7	C	Integral Nonlinearity	8-Bit	INL		±0.5		counts
8	C	Absolute Error[2]	8-Bit	AE		±1		counts

1 The 8-bit mode operation is structurally tested in production test. Absolute values are tested in 10-bit mode.

2 These values include the quantization error which is inherently 1/2 count for any A/D converter.

3 LQFP 48 and bigger

4 LQFP 32 and smaller

Table A-25. ADC Conversion Performance 3.3V range (Junction Temperature From –40°C To +150°C)

S12GNA16, S12GNA32, S12GAS48, S12GA64, S12GA96, S12GA128, S12GA192 and S12GA240								
Supply voltage 3.13V < V_{DDA} < 4.5 V, -40°C < T_J < 150°C, V_{REF} = V_{RH} - V_{RL} = V_{DDA}, f_{ADCCLK} = 8.0MHz The values are tested to be valid with no port AD output drivers switching simultaneous with conversions.								
Num	**C**	**Rating**[1]		**Symbol**	**Min**	**Typ**	**Max**	**Unit**
1	P	Resolution	12-Bit	LSB		0.80		mV
2	P	Differential Nonlinearity	12-Bit	DNL	-6	±3	6	counts
3	P	Integral Nonlinearity	12-Bit	INL	-7	±3	7	counts
4	P	Absolute Error[2]	12-Bit	AE	-8	±4	8	counts
5	C	Resolution	10-Bit	LSB		3.22		mV
6	C	Differential Nonlinearity	10-Bit	DNL	-1.5	±1	1.5	counts
7	C	Integral Nonlinearity	10-Bit	INL	-2	±1	2	counts
8	C	Absolute Error[2]	10-Bit	AE	-3	±2	3	counts
9	C	Resolution	8-Bit	LSB		12.89		mV
10	C	Differential Nonlinearity	8-Bit	DNL	-0.5	±0.3	0.5	counts
11	C	Integral Nonlinearity	8-Bit	INL	-1	±0.5	1	counts
12	C	Absolute Error[2]	8-Bit	AE	-1.5	±1	1.5	counts

1 The 8-bit and 10-bit mode operation is structurally tested in production test. Absolute values are tested in 12-bit mode.

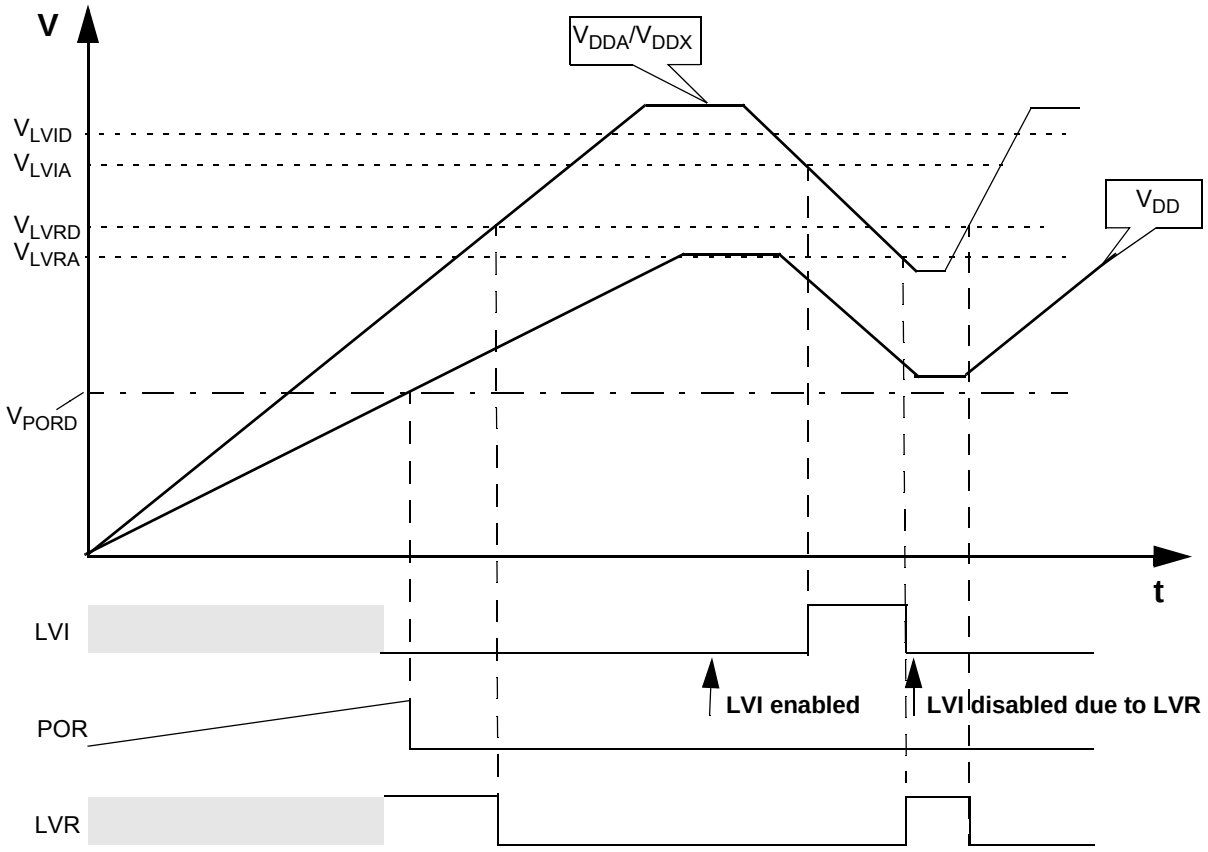
NOTE

The LVR monitors the voltages V_{DD}, V_{DDF} and V_{DDX}. As soon as voltage drops on these supplies which would prohibit the correct function of the microcontroller, the LVR is triggering a reset.

A.13 Chip Power-up and Voltage Drops

LVI (low voltage interrupt), POR (power-on reset) and LVRs (low voltage reset) handle chip power-up or drops of the supply voltage.

Figure A-6. Chip Power-up and Voltage Drops



0x0180–0x023F Reserved

Address	Name		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x0180-0x023F	Reserved	R	0	0	0	0	0	0	0	0
		W								

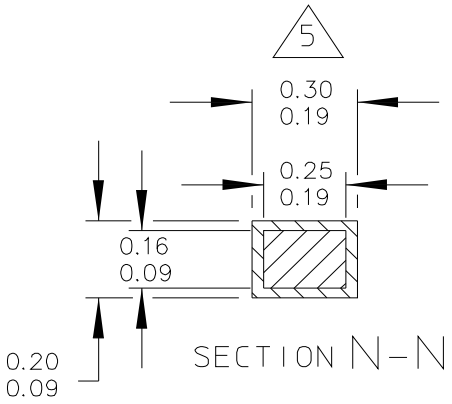
0x0240–0x025F Port Integration Module (PIM) Map 4 of 6

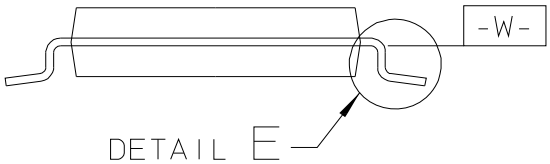
Address	Name		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x0240	PTT	R	PTT7	PTT6	PTT5	PTT4	PTT3	PTT2	PTT1	PTT0
		W								
0x0241	PTIT	R	PTIT7	PTIT6	PTIT5	PTIT4	PTIT3	PTIT2	PTIT1	PTIT0
		W								
0x0242	DDRT	R	DDRT7	DDRT6	DDRT5	DDRT4	DDRT3	DDRT2	DDRT1	DDRT0
		W								
0x0243	Reserved	R	0	0	0	0	0	0	0	0
		W								
0x0244	PERT	R	PERT7	PERT6	PERT5	PERT4	PERT3	PERT2	PERT1	PERT0
		W								
0x0245	PPST	R	PPST7	PPST6	PPST5	PPST4	PPST3	PPST2	PPST1	PPST0
		W								
0x0246-0x0247	Reserved	R	0	0	0	0	0	0	0	0
		W								
0x0248	PTS	R	PTS7	PTS6	PTS5	PTS4	PTS3	PTS2	PTS1	PTS0
		W								
0x0249	PTIS	R	PTIS7	PTIS6	PTIS5	PTIS4	PTIS3	PTIS2	PTIS1	PTIS0
		W								
0x024A	DDRS	R	DDRS7	DDRS6	DDRS5	DDRS4	DDRS3	DDRS2	DDRS1	DDRS0
		W								
0x024B	Reserved	R	0	0	0	0	0	0	0	0
		W								
0x024C	PERS	R	PERS7	PERS6	PERS5	PERS4	PERS3	PERS2	PERS1	PERS0
		W								
0x024D	PPSS	R	PPSS7	PPSS6	PPSS5	PPSS4	PPSS3	PPSS2	PPSS1	PPSS0
		W								
0x024E	WOMS	R	WOMS7	WOMS6	WOMS5	WOMS4	WOMS3	WOMS2	WOMS1	WOMS0
		W								
0x024F	PRR0	R	PRR0P3	PRR0P2	PRR0T31	PRR0T30	PRR0T21	PRR0T20	PRR0S1	PRR0S0
		W								
0x0250	PTM	R	0	0	0	0	PTM3	PTM2	PTM1	PTM0
		W								
0x0251	PTIM	R	0	0	0	0	PTIM3	PTIM2	PTIM1	PTIM0
		W								
0x0252	DDRM	R	0	0	0	0	DDRM3	DDRM2	DDRM1	DDRM0
		W								
0x0253	Reserved	R	0	0	0	0	0	0	0	0
		W								

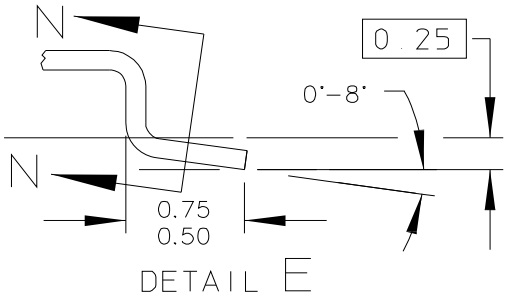
Appendix D
Package and Die Information

Revision History

Version Number	Revision Date	Description of Changes
Rev 0.01	2-Jan-2009	Initial release
Rev 0.02	25-Jan-2013	• Added D.7, “KGD Information”
Rev 0.03	31-Jan-2013	• Updated , “Bondpad Coordinates”







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