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## Mixed Signal Mobile Embedded Flash ARC EC BC-Link/ VLPC Base Component

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### Product Features

- 3.3V Operation
- ACPI Compliant
- LPC Interface
  - LPC I/O and Trusted Cycles Decoded
- VTR (standby) and VBAT (Power Planes)
  - Low Standby Current in Sleep Mode
- Configuration Register Set
  - Compatible with ISA Plug-and-Play Standard
  - EC-Programmable Base Address
- ARC-625D Embedded Controller (EC)
  - 16 KB Single Cycle 32-bit Wide Dual-ported SRAM, Accessible as Closely Coupled Data Memory and Instruction Memory
  - 2 KB Instruction Cache and AHB Memory-mapped SPI Flash Read Controller
  - 32 x 32 x 64 Fast Multiply
  - Divide Assist and Saturation Arithmetic
  - Maskable Interrupt Aggregator/Accelerator Interface
  - Maskable Hardware Wake-Up Events
  - Sleep mode
  - JTAG Debug Port, Includes JTAG Master
  - MCU Serial Debug Port
  - 8-Channel DMA Interface Supports SMBus Controllers and EC/Host GP-SPI Controllers
- Embedded Flash
  - 192 KB user space + 2kB info block, 32-bit Access, 35ns Access Time, 1 K Cycles Endurance
  - Programmable by LPC, EC and JTAG Interfaces
  - Flash Security Enhancements
    - 4K Boot Block Protection
    - Direct JTAG and Direct LPC-protected (2) Pages at or Near Top of Memory for Password Protection
- Legacy Support
  - Fast GATEA20 & Fast CPU\_RESET
- System to EC Message Interface
  - 8042 Style Host Interface
- Embedded Memory Interface
  - Host Serial or Parallel IRQ Source
  - Provides Two Windows to On-Chip SRAM for Host Access
  - Two Register Mailbox Command Interface
  - Host Access of Virtual Registers Without EC Intervention
- Mailbox Registers Interface
  - Thirty-two 8-Bit Scratch Registers
  - Two Register Mailbox Command Interface
  - Two Register SMI Source Interface
- ACPI Embedded Controller Interface
  - Four Instances
  - 1 or 4 Byte Data transfer capable
- ACPI Power Management Interface
  - SCI Event-Generating Functions
- Battery Backed Resources
  - Power-Fail Status Register
  - 32 KHz Clock Generator
  - Week Alarm Timer Interface with Programmable Wake-up from 1ms to 45 Days
  - VBAT-Powered Control Interface
  - VBAT-Backed 64 Byte Memory
- Three EC-based SMBus 2.0 Host Controllers
  - Allows Master or Dual Slave Operation
  - Controllers are Fully Operational on Standby Power
  - DMA-driven I<sup>2</sup>C Network Layer Hardware
  - I<sup>2</sup>C Datalink Compatibility Mode
  - Multi-Master Capable
  - Supports Clock Stretching
  - Programmable Bus Speeds
  - 400 KHz Capable
  - Hardware Bus Access "Fairness" Interface
  - SMBus Time-outs Interface
  - 8 x 3 x 3 Port Multiplexing
- PECl Interface 2.0
- 18 x 8 Interrupt Capable Multiplexed Keyboard Scan Matrix
- Three independent Hardware Driven PS/2 Ports
  - Fully functional on Main and/or Suspend Power
  - PS/2 Edge Wake Capable
- 115 General Purpose I/O Pins
  - 8 GPIO Pass-Through Port (GPTP)

# MEC1609/MEC1609i

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- 3-pin LED Interface
  - Programmable Blink Rates
  - Breathing LED Output
  - Operational in EC Sleep State
- Programmable 16-bit Counter/Timer Interface
  - Four Wake-capable 16-bit Auto-reloading Counter/Timer Instances
  - Four Operating Modes per Instance: Timer, One-shot, Event and Measurement.
  - 4 External Inputs, 4 External Outputs
- Hibernation Timer Interface
  - Two 32.768 KHz Driven Timers
  - Programmable Wake-up from 0.5ms to 128 Minutes
- System Watch Dog Timer (WDT)
- Input Capture and Compare Timer
  - 32-bit Free-running timer
  - Six 32-bit Capture Registers
  - Two 32-bit Compare Registers
  - Capture, Compare and Overflow Interrupts
- Microchip's Multipoint VLPC™ Serial Interconnect Bus Master
  - Forwards LPC transactions to VLPC peripherals
  - Forwards ARC transactions to VLPC peripherals
- BC-Link™ Interconnection Bus
  - Three High Speed and one Low Speed Bus Masters Controllers
- Two General Purpose Serial Peripheral Interface Controllers (ECGP-SPI)
  - One 3-pin EC-driven Full Duplex Serial Communication Interface
  - One 4-pin EC/Host-driven Full Duplex Serial Communication Interface to SPI Flash Interface
  - Flexible Clock Rates
  - SPI Burst Capable
- SPI Flash Read Controller
  - 4 MB AHB Memory-Mapped address space
  - Supports 2 KB EC Instruction Cache
- FAN Support
  - 8 Programmable Pulse-Width Modulator Outputs
    - Multiple Clock Rates
    - 16-Bit 'On' & 16-Bit 'Off' Counters
  - Four Fan Tachometer Inputs
  - 6 x 2 Capture/Compare Timer Interface
- ADC Interface
  - 10-bit Conversion in 10μs
  - 16 Channels
  - Integral Non-Linearity of ±0.5 LSB; Differential Non-Linearity of ±0.5 LSB
- Two Pin Debug Port with Standard 16C550A Register Interface
  - Accessible from Host and EC
  - Programmable Input/output Pin Polarity Inversion
  - Programmable Main Power or Standby Power Functionality
  - Standard Baud Rates to 115.2 Kbps, Custom Baud Rates to 2 Mbps
- Resistor/Capacitor Identification Detection (RC\_ID)
  - Single Pin Interface to External Inexpensive RC Circuit
  - Replacement for Multiple GPIO's
  - Provides 8 Quantized States on One Pin
- Integrated Standby Power Reset Generator
- Clock Generator
  - 32.768 KHz-input Clock
  - operational on Suspend Power
  - Programmable Clock Power Management Control & Distribution
  - 64.52 MHz ±2% Accuracy
- Packages
  - 144 Pin LFBGA RoHS Compliant package
  - 144 Pin TFBGA RoHS Compliant package
- Operating Temperature
  - The MEC1609 supports the commercial temperature range of 0° C to +70° C
  - The MEC1609i supports the industrial temperature range of -40° C to +85° C

## Description

The MEC1609/MEC1609i is the mixed signal base component of a multi-device advanced I/O controller architecture. The MEC1609/MEC1609i incorporates a high-performance 32-bit ARC 625 embedded microcontroller with a 192 Kilobyte embedded Flash subsystem, 16 Kilobytes of SRAM and 2 Kilobytes of instruction cache with an AHB memory-mapped SPI Flash Read Controller. The MEC1609 communicates with the system host using the Intel® Low Pin Count bus.

There are two distinct protocols that provide communication between the MEC1609/MEC1609i base component and companion components: BC-Link™ and VLPC™. BC-Link™ in the MEC1609/MEC1609i can access up to four companion components. The BC-Link™ protocol is peer-to-peer providing communication between the MEC1609/MEC1609i embedded controller and registers located in a companion. VLPC™ is a multi-drop protocol that matches the MEC1609/MEC1609i with up to three untrusted companion components and one trusted companion component. The MEC1609/MEC1609i accepts LPC Host (ICH/PCH) transactions targeting blocks internal to the MEC1609/MEC1609i and blocks physically located in VLPC™ companions. The ARC 625 embedded microcontroller can also access blocks that are physically located in VLPC™ companion components.

The MEC1609/MEC1609i is directly powered by two separate suspend supply planes (VBAT and VTR) and senses a third runtime power plane (VCC) to provide “instant on” and system power management functions. The MEC1609/MEC1609i also contains an integrated VTR Reset Interface and a system Power Management Interface that supports low-power states and can drive state changes as a result of hardware wake events as defined by the MEC1609/MEC1609i Wake Interface.

The MEC1609/MEC1609i defines a software development system interface that includes an MCU Serial Debug Port, a two pin serial debug port with a 16C550A register interface that is accessible to the EC or to the LPC host and can operate up to 2 MB/s, a flexible Flash programming interface and a JTAG interface. The EC can also drive the JTAG interface as a master.

A top-level block diagram of the MEC1609/MEC1609i is shown in [FIGURE 1: MEC1609/MEC1609i Top-Level Block Diagram on page 5](#). An example of system level connection is shown in [FIGURE 2: Example of MEC1609/MEC1609i's Connections to System Components on page 6](#).

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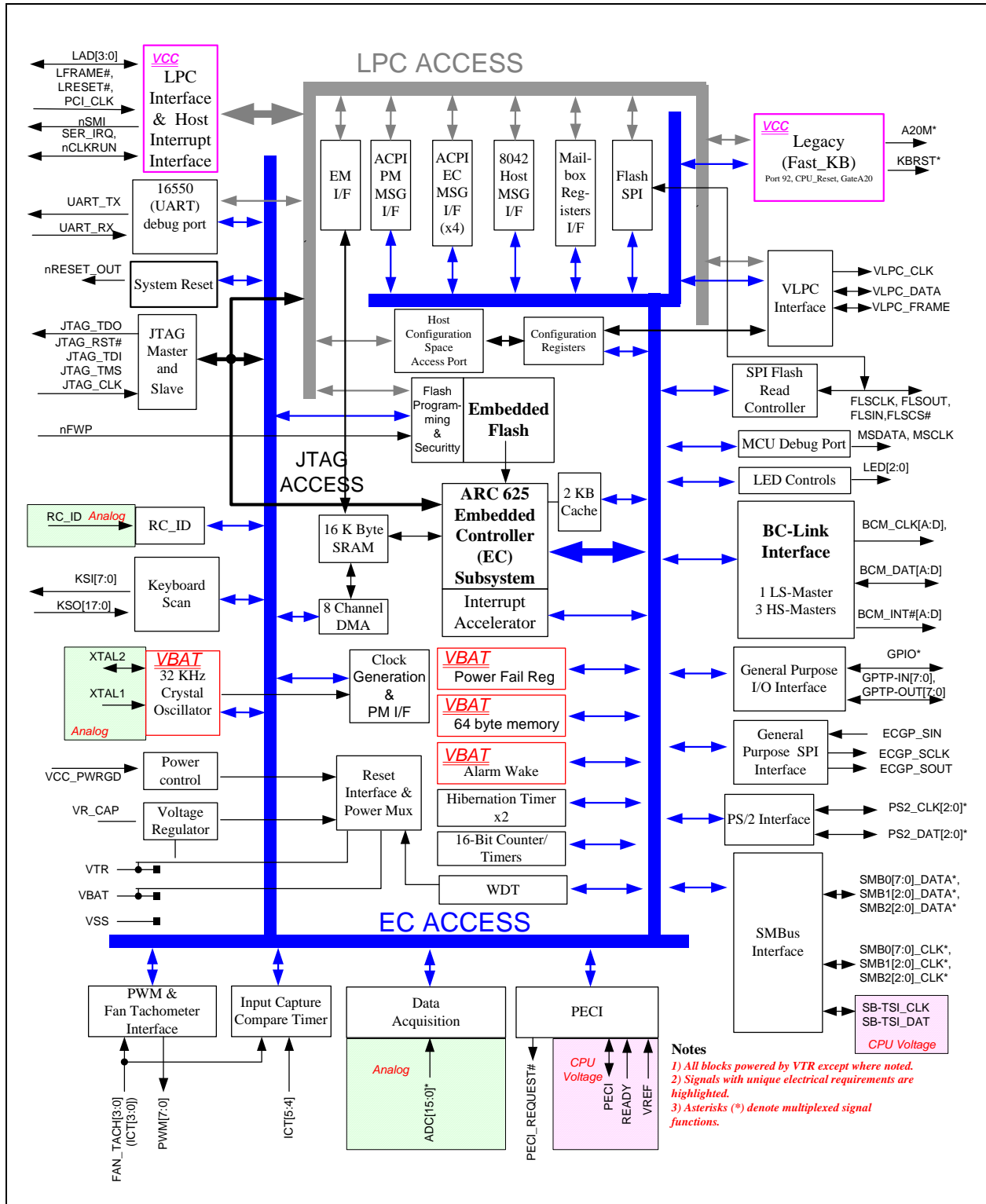
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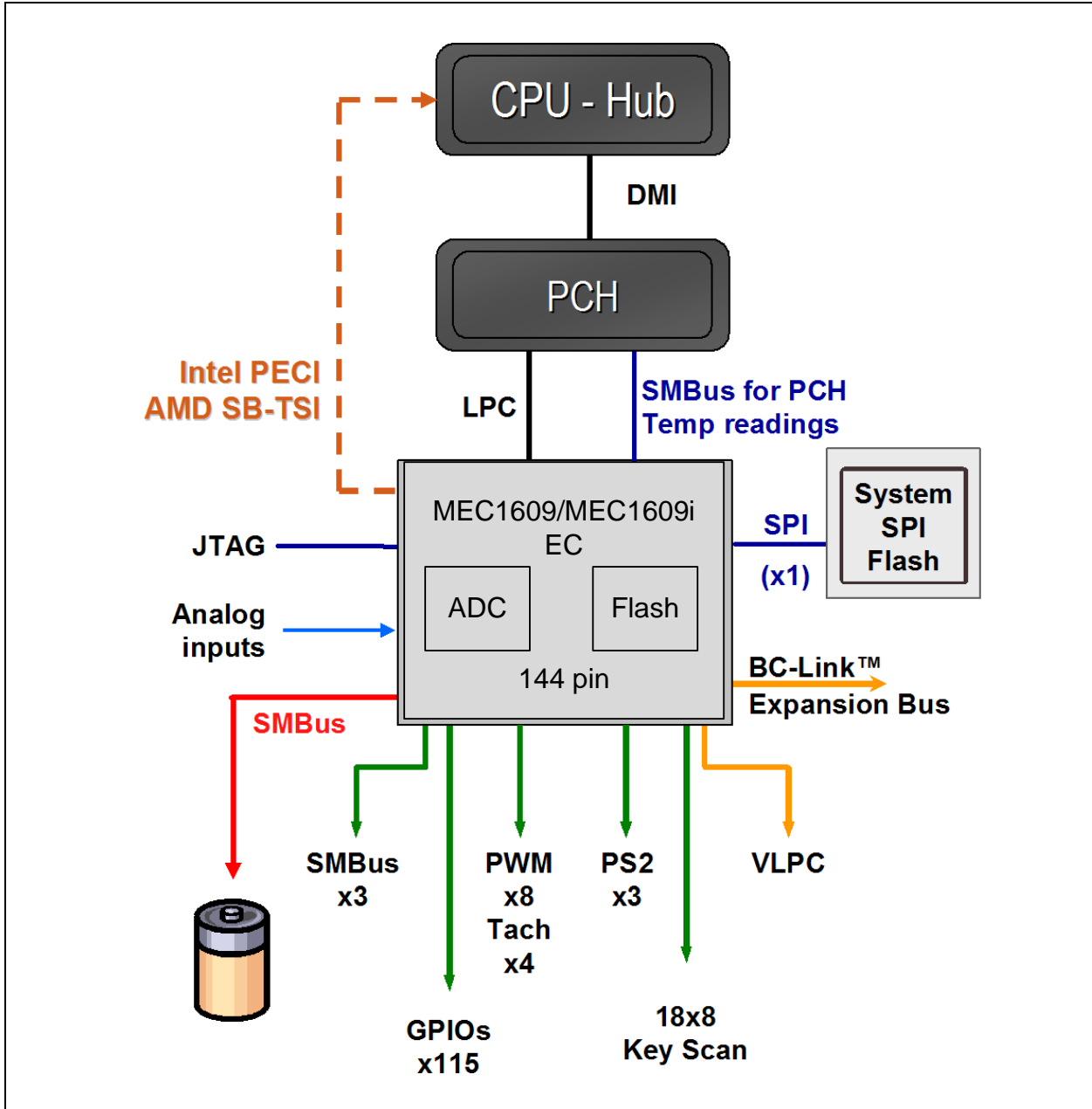
## BLOCK DIAGRAM

FIGURE 1: MEC1609/MEC1609i TOP-LEVEL BLOCK DIAGRAM



# MEC1609/MEC1609i

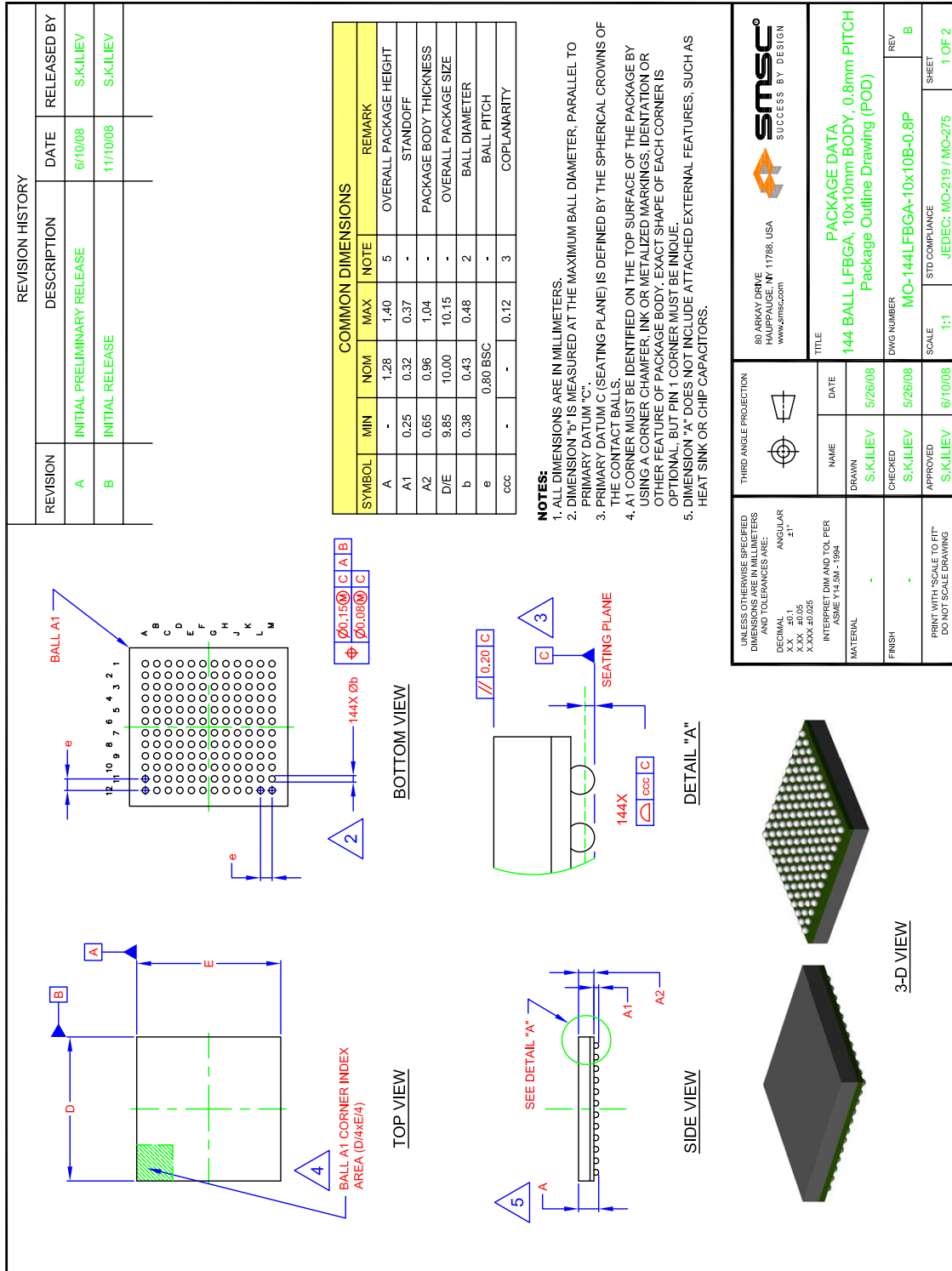
FIGURE 2: EXAMPLE OF MEC1609/MEC1609i'S CONNECTIONS TO SYSTEM COMPONENTS



## PACKAGE OUTLINES

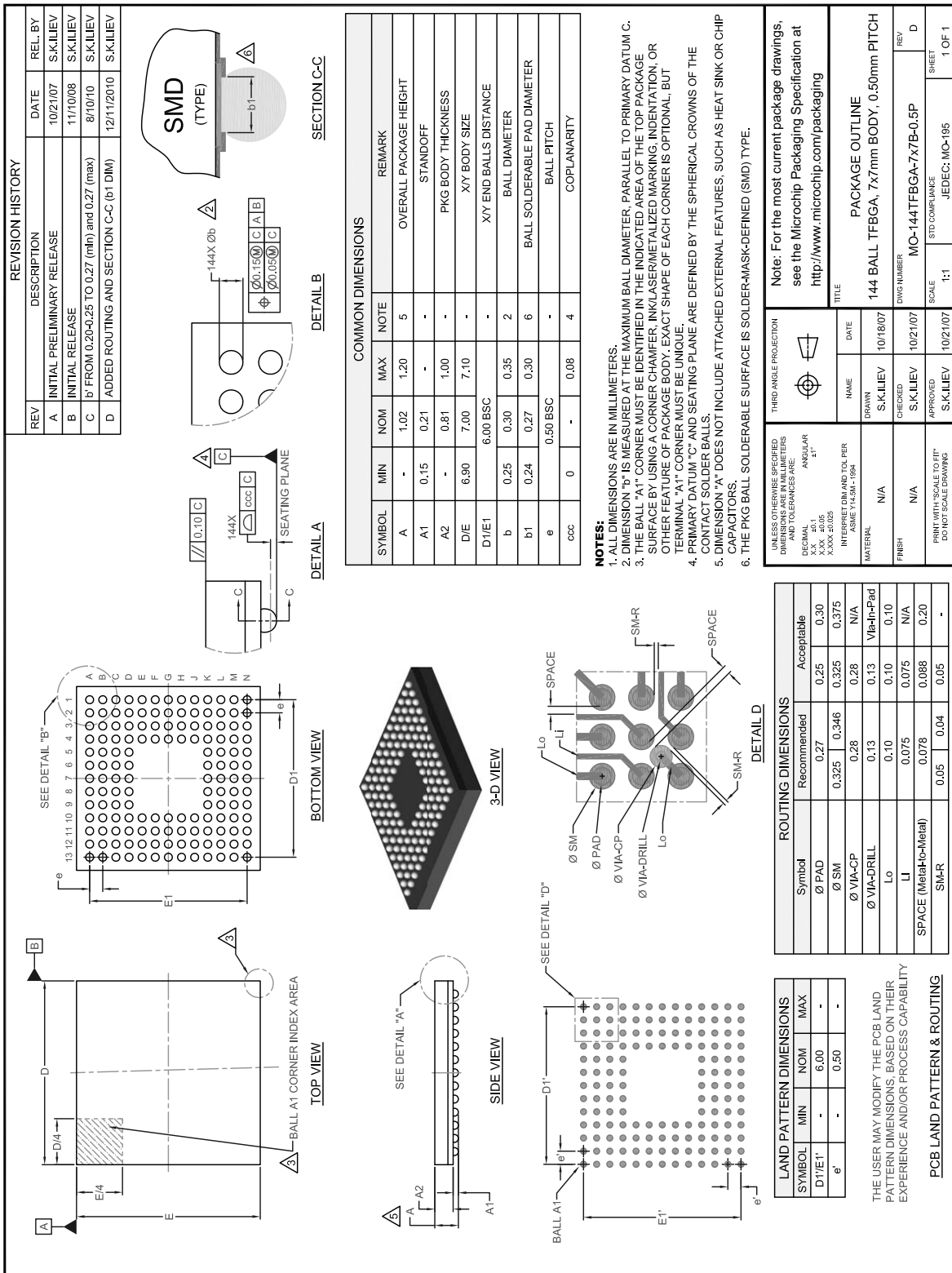
**Note:** For the most current package drawings, see the Microchip Packaging Specification at <http://www.microchip.com/packaging>.

**FIGURE 3: 144-PIN LFBGA 10X10X0.8 MM PACKAGE OUTLINE (1.4 MM HEIGHT)**



# MEC1609/MEC1609i

FIGURE 4: 144-PIN TFBGA 7X7X0.5 MM PACKAGE OUTLINE (1.2 MM HEIGHT)



ROUTING DIMENSIONS	
Symbol	Recommended / Acceptable
Ø PAD	0.27 / 0.30
Ø SM	0.325 / 0.346
Ø VIA-CP	0.28 / 0.28
Ø VIA-DRILL	0.13 / 0.13
Lo	0.10 / 0.10
Li	0.075 / 0.075
SPACE (Metal-to-Metal)	0.078 / 0.088
SM-R	0.05 / 0.04 / 0.05

PRINT WITH SCALE TO FIT - DON'T SCALE DRAWING



## APPENDIX A: PRODUCT BRIEF REVISION HISTORY

TABLE A-1: REVISION HISTORY

Revision	Section/Figure/Entry	Correction
DS00001769A (06-03-14)	Document Release	

# MEC1609/MEC1609i

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<u>PART NO.</u>	<u>[X]</u>	-	<u>XXX</u>	-	<u>[X]<sup>(1)</sup></u>																																										
Device	Temperature Range		Package		Tape and Reel Option																																										
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"><b>Device:</b></td> <td colspan="5">MEC1609, MEC1609i</td> </tr> <tr> <td><b>Temperature Range:</b></td> <td>Blank</td> <td>=</td> <td>0°C to +70°C</td> <td>(Extended Commercial)</td> <td></td> </tr> <tr> <td></td> <td>i</td> <td>=</td> <td>-40°C to +85°C</td> <td>(Industrial)</td> <td></td> </tr> <tr> <td><b>Package:</b></td> <td>PZV</td> <td>=</td> <td>144-pin TFBGA</td> <td></td> <td></td> </tr> <tr> <td></td> <td>PZP</td> <td>=</td> <td>144-pin LFBGA</td> <td></td> <td></td> </tr> <tr> <td><b>Tape and Reel Option:</b></td> <td>Blank</td> <td>=</td> <td>Standard packaging (tray)</td> <td></td> <td></td> </tr> <tr> <td></td> <td>TR</td> <td>=</td> <td>Tape and Reel<sup>(1)</sup></td> <td></td> <td></td> </tr> </table>						<b>Device:</b>	MEC1609, MEC1609i					<b>Temperature Range:</b>	Blank	=	0°C to +70°C	(Extended Commercial)			i	=	-40°C to +85°C	(Industrial)		<b>Package:</b>	PZV	=	144-pin TFBGA				PZP	=	144-pin LFBGA			<b>Tape and Reel Option:</b>	Blank	=	Standard packaging (tray)				TR	=	Tape and Reel <sup>(1)</sup>		
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	TR	=	Tape and Reel <sup>(1)</sup>																																												
<p><b>Examples:</b></p> <ul style="list-style-type: none"> <li>a) MEC1609-PZV 144-pin TFBGA (7mm x 7mm, 0.5 pitch) RoHS Compliant package</li> <li>b) MEC1609-PZP 144-pin TFBGA (10mm x 10mm, 0.8 pitch) RoHS Compliant package</li> <li>c) MEC1609i-PZV Industrial temperature, 144-pin TFBGA (7mm x 7mm, 0.5 pitch) RoHS Compliant package</li> <li>d) MEC1609i-PZP Industrial temperature, 144-pin TFBGA (10mm x 10mm, 0.8 pitch) RoHS Compliant package</li> </ul> <p><b>Note 1:</b> Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option. Reel size is 4,000.</p>																																															

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