Timberwolf Digital Signal Processor family, powered by *AcuEdge*™ Technology
Advanced Multi-Channel Super Wideband Audio Processor
ZL38042
Product Brief

Description

The ZL38042 is part of Microsemi's new Timberwolf audio processor family of products that feature the company's innovative *AcuEdge* acoustic technology, which is a set of highly-complex and integrated algorithms. These algorithms are incorporated into a powerful DSP platform that allow the user to extract intelligible information from the audio environment.

The ZL38042 device supports 4 digital microphones and provides advanced Acoustic Echo Cancellation (AEC) and stationary Noise Reduction (NR) for up to 3 parallel microphone paths for Super Wideband conference phone applications. For additional mics, a ZL38042 device can be configured as a master to control up to 4 slave ZL38042 devices.

The Microsemi *AcuEdge* Technology license-free, royalty-free intelligent audio Firmware provides AEC, NR and a variety of other voice enhancements to improve both the intelligibility and subjective quality of voice in harsh acoustic environments.

Microsemi offers additional tools to speed up the product development cycle. The *MiTuner™* ZLS38508 or ZLS38508LITE GUI software packages allow a user to interactively configure the ZL38042 device. The optional *MiTuner* ZLE38470BADA Automatic Tuning Kit provides automatic tuning and easy control for manual fine tuning adjustments.

Applications

- Wideband Conference phone with satellite microphones (one slave ZL38042 shown below)
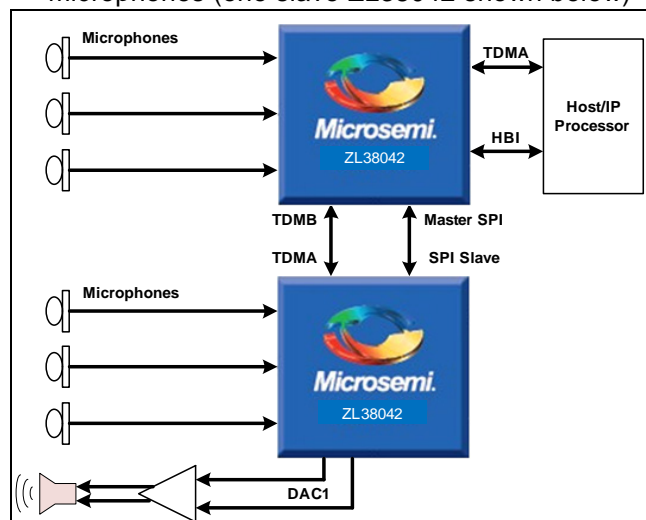
Ordering Information

Device OPN	Package	Packing
ZL38042LDF1	64-pin QFN (9x9)	Tape & Reel
ZL38042LDG1	64-pin QFN (9x9)	Tray

These packages meet RoHS 2 Directive 2011/65/EU of the European Council to minimize the environmental impact of electrical equipment.

Microsemi *AcuEdge* Technology ZLS38042 Firmware

- Super Wideband, Wideband and Narrowband Acoustic Echo Cancellation (of 3 microphone paths simultaneously)
- Up to 15 microphones can be supported by using multiple ZL38042 devices
- Full or Half duplex operation
- AEC supports long tail length:
  - 256 ms for Narrowband and Wideband
  - 170 ms for Super Wideband
- Howling detection/cancellation
  - Prevents oscillation in the AEC audio paths
- Non-Linear AEC provides higher tolerance for speaker distortions
- Audio Compressor/Limiter/Expander
- Stationary noise reduction reduces background noise from the near-end speech signal
- Provisions for 48 kHz stereo audio mixing and stereo music record and playback with 8/16/24 kHz voice processing
- Comfort noise generation
- Programmable tone generation (DTMF)
- Various encoding/decoding options:
  - 16-bit linear
  - G.722
  - G.711 A/μ law
- Send and receive path 8-band parametric equalizers
- 48 kHz bypass mode
- Cross Point Switch provides signal mixing

ZL38042 Hardware Features

- DSP with Voice Hardware Accelerators
- Dual $\Delta\Sigma$ 16-bit digital-to-analog converters (DAC)
  - Sampling up to 48 kHz and internal output drivers
  - Headphone amps capable of 4 single-ended or 2 differential outputs
  - 32 mW output drive power into 16 ohms
  - Impulse pop/click protection
- 2 Digital Microphone inputs supporting up to 4 Microphones
- 2 TDM ports shared between PCM and Inter-IC Sound (I^2S)
  - Each port supports delayed and non-delayed (GCI) timing and I^2S normal and left justified modes
  - Each port provides sample rate conversion and synchronous TDM bus operation
- SPI or I^2C Slave port for host processor interface
- General purpose UART port for debug
- Master SPI port for serial Flash interface
- Boots from SPI or Flash
  - Can run unattended (controllerless), self-booting into a configured operational state
  - Flash firmware can be updated from SPI Slave
- 14 General Purpose Input/Output (GPIO) pins
- 2 low power modes controlled by reset

Performance

- 3 AEC channels, Tail Length:
  - 256 ms in Narrowband and Wideband modes
  - 170 ms in Super Wideband mode
- AEC sampling rates: 8 kHz, 16 kHz, or 24 kHz
- Single-Talk Weighted Terminal Coupling Loss (TCLw): > 60 dB
- Double Talk TCLw: > 40 dB
- Double Talk Attenuation: > 3 d

The *MiTuner*™ Automatic Tuning Kit and ZLS38508 MiTuner GUI

Microsemi's Automatic Tuning Kit option includes:
- Audio Interface Box hardware
- Microphone and Speaker
- ZLS38508 *MiTuner* GUI software
  - Allows tuning of Microsemi's *AcuEdge* Technology Audio Processor

The ZLS38508 software features:
- Auto Tuning and Subjective Tuning support
- Allows tuning of key parameters of the system design
- Provides visual representations of the audio paths with drop-down menus to program parameters, allowing:
  - Control of the audio routing configuration
  - Programming of key building blocks in the transmit (Tx) and receive (Rx) audio paths
  - Setting analog and digital gains
- Configuration parameters allow users to "fine tune" the overall performance

Tools

- ZLK38000 Evaluation Kit
- *MiTuner™* ZLS38508 and ZLS38508LITE GUI
- *MiTuner™* ZLE38470BADA Automatic Tuning Kit

Overview

The Microsemi *AcuEdge™* Technology ZL38042 is an advanced audio processing device with peripherals and interfaces tuned for multi-microphone conference phones. The ZL38042 will automatically switch between each microphone to provide a low noise path to users situated at different places in a room. The microphones may be fixed in a single unit or may be mobile and tethered only by a cable.

Additionally, ZL38042 devices are configured to operate in a slave and master mode where up to four slave ZL38042 devices may be interconnected to a ZL38042 master, allowing for more than three microphones in a system. The connected devices act as one device, allowing a single Flash loading of the system.

The Microsemi *AcuEdge™* Technology ZLS38042 Firmware offers a sophisticated audio compressor/limiter/ expander with adjustable attack and decay time. Three microphone audio paths may be routed to the voice processing algorithms for simultaneous AEC processing. The ZL38042 provides super wideband (>10 kHz bandwidth) communication which utilizes a sampling rate of 24 kHz.

The majority of the signal processing (AEC, Equalization, Noise Reduction etc.) runs in the Audio Processor Block. Each of the audio inputs (Digital Mics, I^2S/TDM) and outputs (DACs, I^2S/TDM) can be routed amongst themselves or to the Audio Processor via a highly configurable Cross Point Switch.
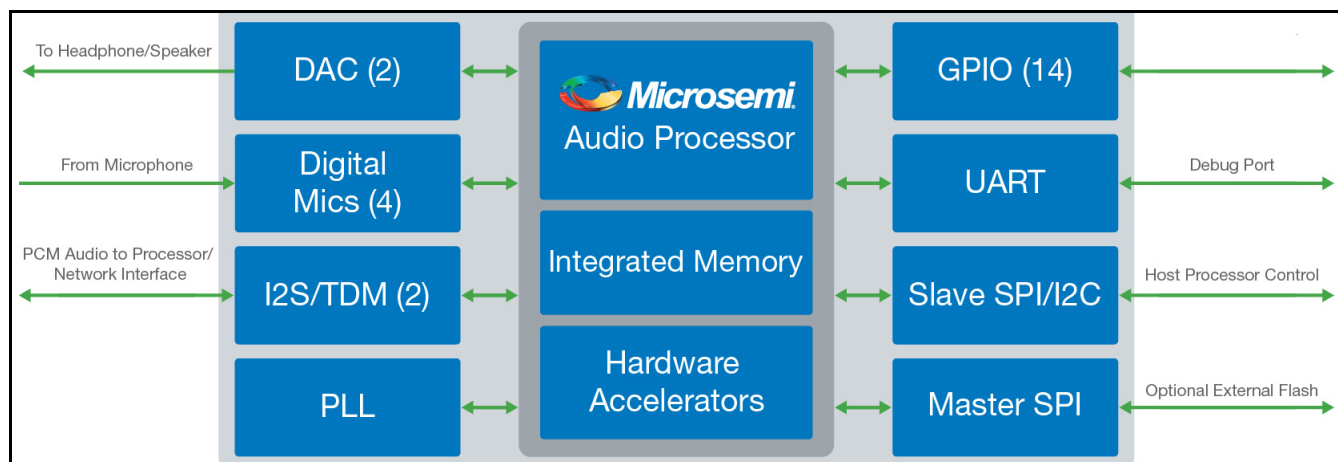
**ZL38042 Super Wideband Audio Processor Block Diagram**
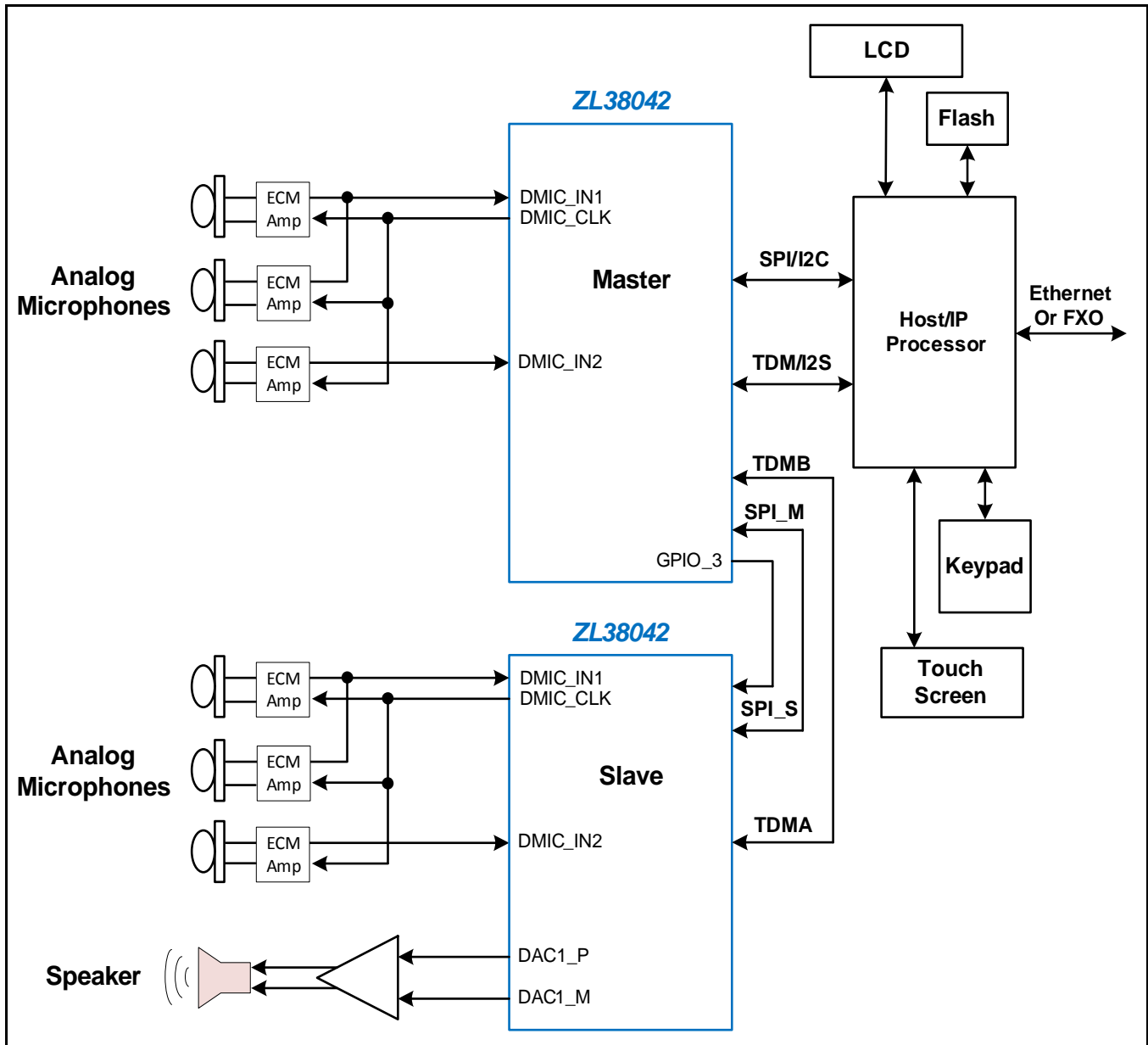
Six Input Conference Phone Application using Two ZL38042 Devices

ZLK38000 Evaluation Kit

The ZLK38000 Evaluation Kit includes all the hardware necessary to operate the ZLE38000 Evaluation Board. The Evaluation Board provides a flexible platform to evaluate a single ZL38042 Timberwolf Audio Processor device with *AcuEdge™* Technology Firmware.
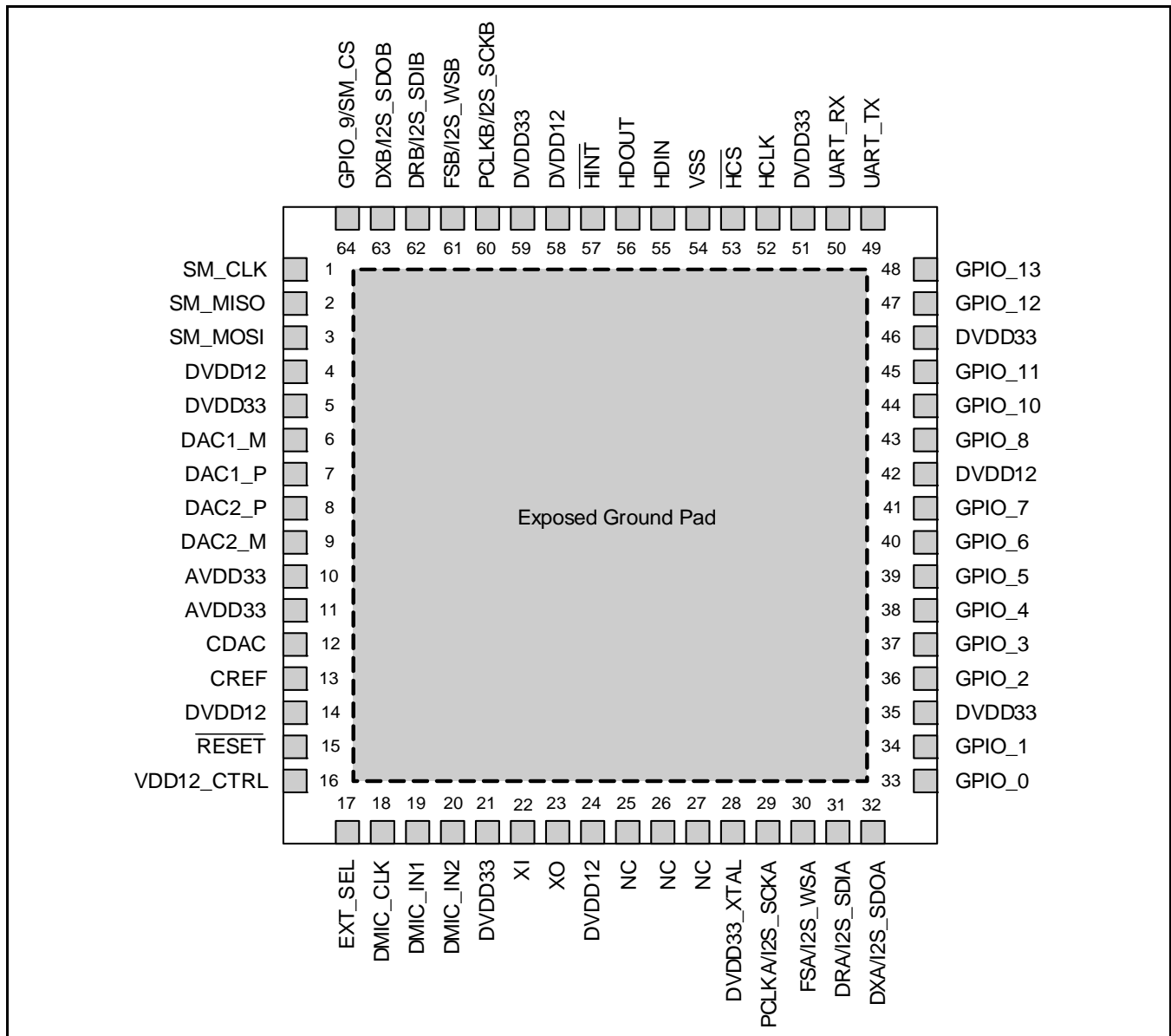
The ZLE38000 Evaluation Board provides a simple analog interface that can be connected to microphones and speakers to allow for subjective testing. The miniature size allows for easy mounting in an existing plastic enclosure.
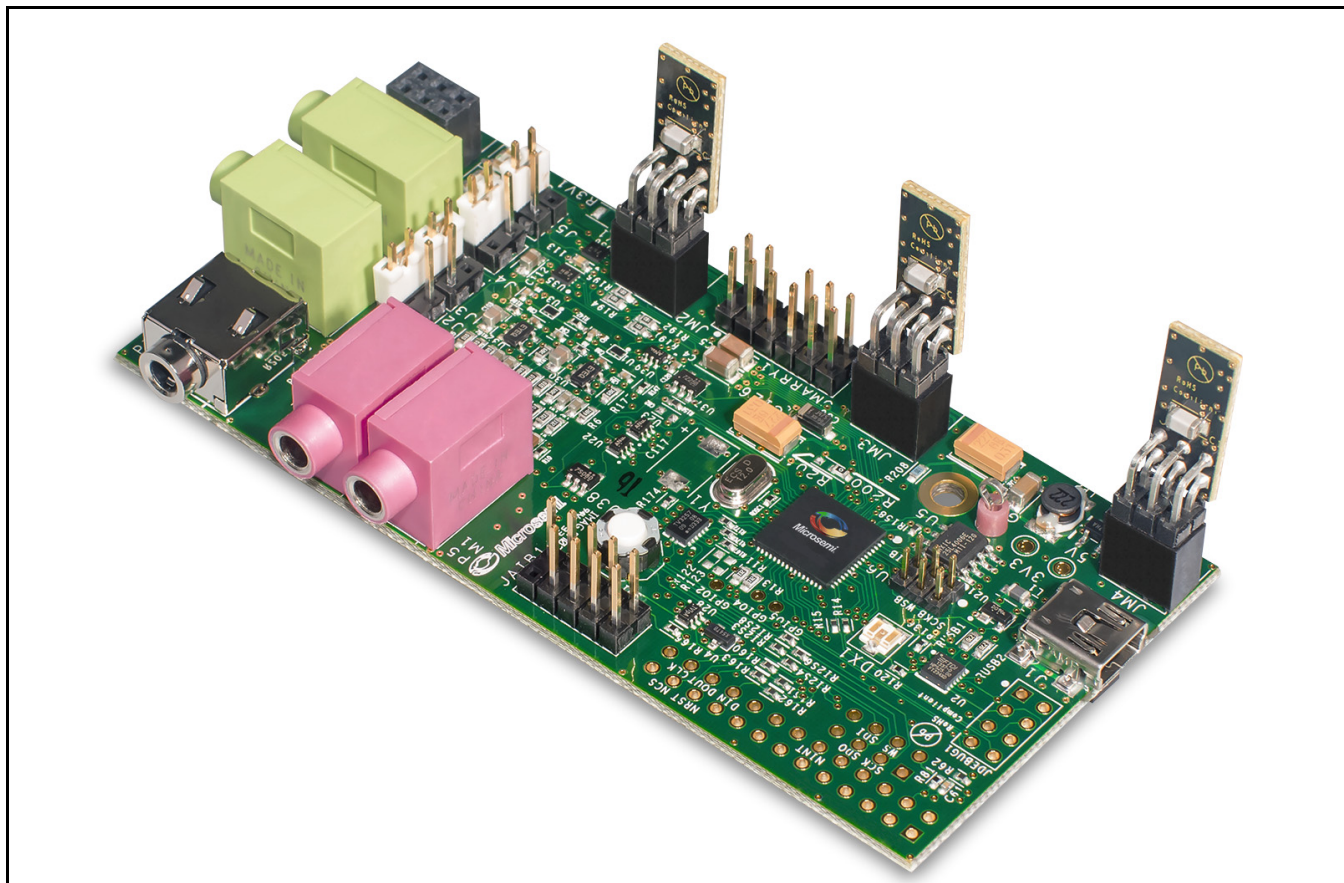
ZLE38000 Evaluation Board

Firmware Code for the ZL38042 can be downloaded into the Evaluation Board using the ZLS38000 Firmware Loader software. The ZLE38000 Evaluation Board can then be controlled using the *MiTuner™* GUI Lite Software (ZLS38508LITE) or the full *MiTuner* GUI Software package (ZLS38508). Microsemi has developed automatic tuning capability into the full *MiTuner* GUI Software to further facilitate and shorten the design process. The ZLS38508 Software package consists of the *MiTuner* GUI Software and the Audio Interface Box (AIB) Evaluation Kit (ZLE38470BADA) hardware, together performing automatic tuning of the Timberwolf Audio Processor on the Evaluation Board or in a system design.

Device Pinout - Top View

Package Outline (64-Pin QFN)

Attribute	Symbol	Mils			mm		
		Min	Nom	Max	Min	Nom	Max
Total thickness	A	31.5	35.43	39.37	0.8	0.9	1.0
Stand off	A1	0	0.79	1.97	0	0.02	0.05
L/frame thickness	A3		7.87			0.2	
lead width	b	5.91	7.87	9.84	0.15	0.2	0.25
Body size X	D		354.33			9.00	
Body size Y	E		354.33			9.00	
lead pitch	e		19.69			0.5	
EP size X	J	287.4	291.34	295.28	7.3	7.4	7.5
EP size Y	K	287.4	291.34	295.28	7.3	7.4	7.5
lead length	L	13.78	15.75	17.72	0.35	0.40	0.45

Microsemi CMPG

TITLE: 64 QFN PACKAGE OUTLINE
BODY SIZE : 9X9X0.90 mm
PITCH : 0.50mm

DWG. NO. CDCA 22-0011
84-06-137-258
REV. Orig.
SIZE A4
SHEET 1 OF 1

NOTES:

1. DIMENSIONING AND TOLERANCE IS IN CONFORMANCE TO ASME Y14.5-1994
   ALL DIMENSIONS ARE IN MILLIMETERS ° IN DEGREES

2. DIMENSION OF LEAD WIDTH APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.15mm AND 0.30mm
   FROM THE TERMINAL TIP (BOTH ROWS). IF THE TERMINAL HAS OPTIONAL RADIUS ON THE END OF THE TERMINAL,
   THE LEAD WIDTH DIMENSION SHOULD NOT BE MEASURED IN THAT RADIUS AREA

7

**For more information about all Microsemi products
visit our website at
www.microsemi.com**

TECHNICAL DOCUMENTATION – NOT FOR RESALE

Microsemi Corporation (NASDAQ: MSCC) offers a comprehensive portfolio of semiconductor solutions for: aerospace, defense and security; enterprise and communications; and industrial and alternative energy markets. Products include mixed-signal ICs, SoCs, and ASICs; programmable logic solutions; power management products; timing and voice processing devices; RF solutions; discrete components; and systems. Microsemi is headquartered in Aliso Viejo, Calif. Learn more at **www.microsemi.com**.