

## IP Phone–LM3S9D96

### Stellaris® IP Phone

#### TARGET APPLICATIONS

- IP Phone*
- IP Intercom*
- SIP Phone*
- ATA*

#### OVERVIEW

*Adaptive Digital's Stellaris® IP*

*Phone solution is a complete application which combines*

*Texas Instruments' LM3S9D96*

*DSP (Stellaris ARM® Cortex™*

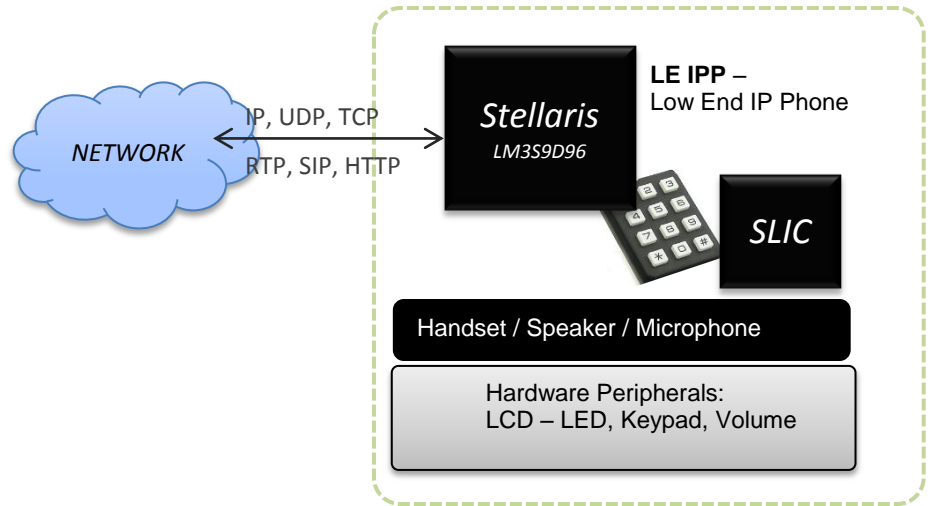
*M-3) with our field proven*

*software including call control,*

*protocol stack (SIP, RTP),*

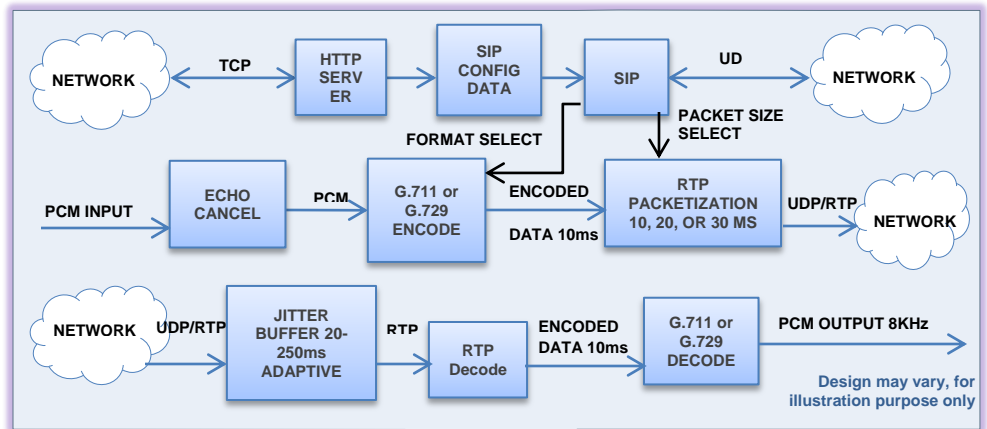
*G.711, G.729AB, G.722, and*

*acoustic echo control.*



#### SOFTWARE FEATURES

- Single voice channel with G.711 and G.729AB codecs
- Push-to talk
- RTP packetization with configurable periods of 10, 20, and 30 msec
- Hands-free support with Acoustic Echo Control
- Configurable 100 millisecond jitter buffer
- Tone generation - DTMF or fixed tone for echoing key presses on keypad
- Packet loss concealment compliant with G.711 appendix I



Software Block diagram

**Software Features Continued**

- Acoustic gain control (AGC)
- Comfort noise generation
- Allows for any configurable sequence of tones to be generated towards the phone or network or both
- Voice Activity Detection
- Support for a single Ethernet interface, 3x4 keypad, hook-switch and other control switches, LEDs, and a 2x24 or similar LCD
- Call control & management
- Supports RFC 3261 and 3550 SIP signaling and RTP media stream protocols
- Supports SIP authentication, INVITE, RING, ACK, OK, BYE and termination messages
- Supports configurable unique SIP username and password (credentials) in non-volatile memory
- Fast time to market
- Turn-key software
- Migration path to future IP IPhone solutions



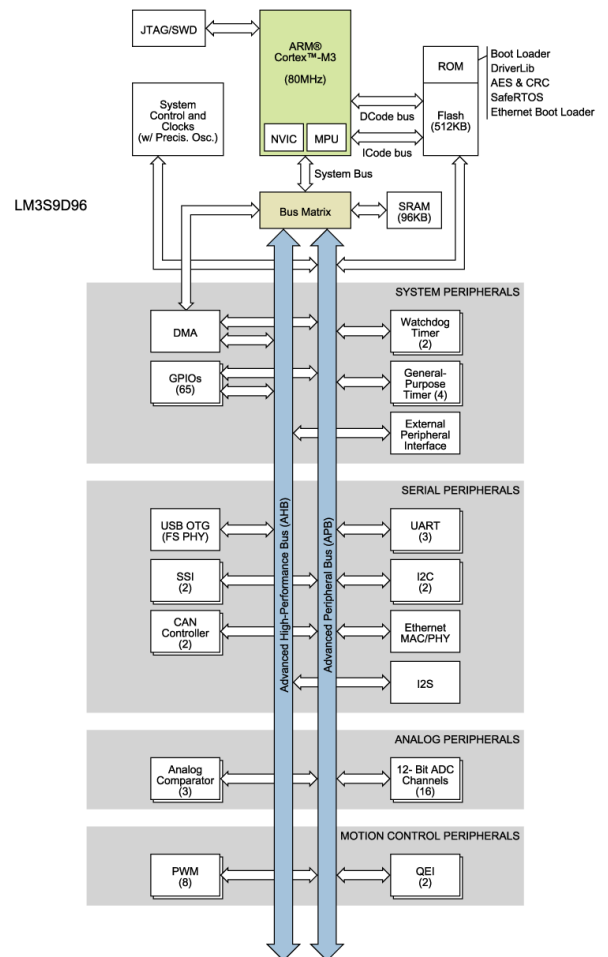
**Adaptive Digital Software includes:**

Protocols: SIP, RTP  
 Signal Processing  
 Compression algorithms: G.711 with packet loss concealment and DTX, G.729AB, G.722, SIP  
 Voice Processing: Acoustic Echo Control, Acoustic Echo Cancellation

**HARDWARE FEATURES**

The Stellaris LM3S9D96 microcontroller combines complex integration and high performance with the following feature highlights:

- ARM Cortex-M3 Processor Core
- High Performance: 80-MHz operation; 100 DMIPS performance
- 512 KB single-cycle Flash memory
- 96 KB single-cycle SRAM
- Internal ROM loaded with StellarisWare® software
- External Peripheral Interface (EPI)
- Advanced Communication Interfaces: UART, SSI, I2C, I2S, CAN, Ethernet MAC and PHY, USB
- System Integration: general-purpose timers, watchdog timers, DMA, general-purpose I/Os



- Advanced motion control using PWMs, fault inputs, and quadrature encoder inputs
- Analog support: analog and digital comparators, Analog-to-Digital Converters (ADC), on-chip voltage regulator
- JTAG and ARM Serial Wire Debug (SWD)
- 100-pin LQFP package
- 108-ball BGA package
- Industrial (-40° C to 85° C) temperature range

#### ARM Cortex-M3 Processor Core

All members of the Stellaris product family, including the LM3S9D96 microcontroller, are designed around an ARM Cortex-M3 processor core. The ARM Cortex-M3 processor provides the core for a high-performance, low-cost platform that meets the needs of minimal memory implementation, reduced pin count, and low power consumption, while delivering outstanding computational performance and exceptional system response to interrupts.

### SPECIFICATIONS

Product Number/Silicon	Channel Count	Description

### DETAILED DESCRIPTION

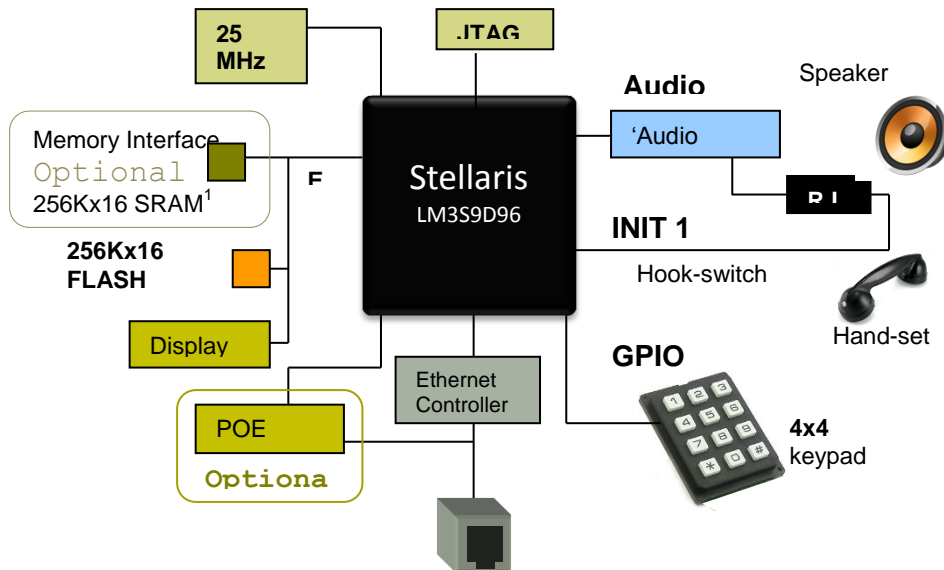
Adaptive Digital Technologies has leveraged its field proven VoIP software and the highly integrated Texas Instruments Stellaris LM3S9D96 microcontroller to bring high quality IP telephony to ultra-low cost IP phones and analog terminal adapters (ATAs.) Used in both types of equipment, the Stellaris LM3S9D96 ARM® Cortex™ M-3 microcontroller brings with it not only an ARM CPU but also on-chip flash memory, RAM, and an Ethernet MAC and PHY. That’s almost as integrated as an IP phone chip can get. The Cortex-M3 is capable of running the Adaptive Digital’s complete IP Phone application, including SIP, STUN, UDP/IP, RTP, G.711, G.729AB, and acoustic echo cancellation, using only on-chip flash memory and RAM.

By adding a Silicon Labs Si32178 ProSLIC, the low-cost advantage extends into the ATA market. The ProSLIC, also highly integrated, combines an FXS interface, codec, tone detection and generation, caller ID, and protection circuitry on a single chip. Plus, it has a SPI interface that can connect directly to the Stellaris SPI interface.

Adaptive Digital’s ATA and IP Phone software solutions share a similar base set of protocols and algorithms while separately addressing the features that are unique to these two solutions.

Adaptive Digital is currently demonstrating both solutions using the TI Stellaris EVM board (DK-LM3S9D96) and the Silicon Labs SLIC EVM (Si32176PB10SLO-EVB.) IP Phone and ATA equipment manufacturers can leverage existing reference circuitry on these EVM boards to speed up their hardware design. Similarly, Adaptive Digital’s sample IP Phone and ATA applications are available in source code format to enable equipment manufacturers to leverage existing software and still customize it as needed. Adaptive Digital’s protocol stacks and algorithm libraries are available in object code format. You take the schematics and software and mold them into a market ready product.

The Stellaris® ARM® Cortex™ M-3 microcontroller brings high-performance 32-bit computing to cost-sensitive embedded microcontroller applications. It is because of the high degree of integration that the Stellaris achieves that drives down the manufacturing cost of the IP phone and ATA.



*Diagram for reference only your design may vary.*

**REFERENCES**

1. Adaptive Digital Technologies Stellaris IP Phone Users Guide
2. Texas Instruments LM 3S9D96 Fixed-Point Digital Signal Processor (literature number DS- LM 3S9D96-11425.)
3. Silicon Labs Single-Chip ProSLIC — Si3217x + Si32911/19 (Si3217x-Si3291x-short.pdf)

**Deliverables**

The deliverable items are platform dependent. In general, there is a single DSP-downloadable binary image along with host API software in C source code format. Also included in the deliverables is product documentation, which includes a users guide and usually includes release notes. Sample/test code may be included as well.

*Adaptive Digital is a member of the Texas Instruments Developer Network, and ARM Connected Community.*

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