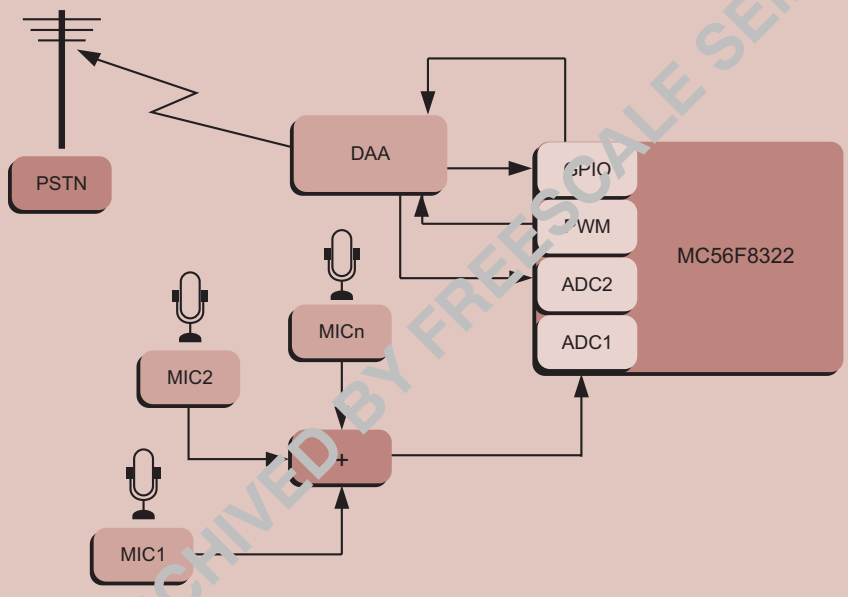
Building Monitoring System with Voice

Overview

Remote monitoring of buildings, such as summer homes, is a valuable activity which can be enabled with the Freescale Semiconductor MC56F8322. A building owner can call the Building Monitoring System (BMS) to obtain a verbal status report on the building. Key events detectable via microphone and analyzed via Digital Signal Processing (DSP) may be alarmed by the BMS. The DSP allows classification of significant audible events, such as glass breakage, for retrieval or active reporting by the system. The telephone interface allows the system to call out for significant audible events or to wait until called to report status via voice. Dual Tone Multiple Frequency (DTMF) input provides robust remote control with voice prompts.

BLOCK DIAGRAM



Key Benefits

> Combines MCU functionality with DSP processing power

> Out-of-the-box software components designed to expedite time-to-market and reduce development costs

> Includes codec-type functionality with PWM and ADC using a single-device solution

> Monitors audible building events remotely

> Supports EEPROM capability for alarm/event storage

> Provides built-in temperature sensing

> Supports network capability

> Offers extremely low-cost start-up tool

freescale semiconductor

Freescale Ordering Information		
Part Number	**Product Highlights**	**Additional Information**
MC56F8300 Family	60 MHz, 60 MIPS, up to 576KB Flash, 36KB RAM and Off-Chip Memory, SCI, SPI, ADC, PWM, Quadrature Decoder, Quad Timer, FlexCAN, GPIO, COP/ Watchdog, PLL, MCU-style software stack support, JTAG/OnCE for debug, temperature sensor	www.freescale.com

Design Challenges

Home security systems can be costly. It had been impossible to create a truly low-cost, easy-to-use building monitor that provides a telephone interface with voice alarm summaries and voice prompts and the capability for real-time analysis of audio inputs for signs of trouble (such as loud voices, or glass breakage), without including a DSP, a telephone codec, a voice codec, and a temperature sensor. A single-chip solution would have required an ASIC or other expensive multi-part solution.

Freescale Semiconductor Solution

The Freescale Semiconductor solution utilizes the MC56F8322. This device contains an on-board temperature sensor, EEPROM capability, analog-to-digital converters for both microphone inputs and telephone DTMF (or voice) input. It includes a GPIO and PWM for voice output to the two-wire telephone circuit without using an extra integrated circuit for that function. It also contains an MCU for control and a DSP for signal processing in one efficient core.

This allows design of a building monitoring system (BMS) that can call out; answer calls; report status in voice; retain alarm data; respond to DTMF commands over the telephone, locally or remotely; and listen to and analyze building sounds in real time, recognizing unusual sounds such as glass breakage.

In the block diagram (page 1), several microphones distributed around a building in strategic locations are summed into ADC Channel 1 (ADC1). ADC Channel 2 (ADC2) is reserved for two-wire telephone circuit use to listen to what is coming over the phone line. The PWM is used to output DTMF tones and voice to the two-wire telephone circuit. The processor detects rings and can go on/off hook with the two GPIO signals. Alarms are detected based on an over-temperature condition, or noises detected such as breaking glass, or other product-specific settings.

When an alarm is detected, the emergency number programmed into the device's Flash memory can be called; this number can be updated remotely. Alarms can be stored in this memory, as if it were EEPROM, for polling by a remote caller. A DTMF security code prevents unauthorized use.

The functions implemented in this design on the MC56F8322 may include:

> Temperature sensing

> DTMF detection

> Voice decompression with software voice codecs to play messages out to the two-wire telephone circuit

> Sound analysis and classification in real time

> DTMF generation for dialing emergency phone numbers

Development Tools			
Tool Type	**Product Name**	**Vendor**	**Description**
Software	CW568X	Freescale Semiconductor	CodeWarrior™ Development Studio for 56800/E Controllers With Processor Expert (Metrowerks)
Hardware	MC56F8300DSK	Freescale Semiconductor	56F8300 Developers Starter Kit
Hardware	MC56F8323EVM	Freescale Semiconductor	Evaluation Module for 56F8322 and 56F8323
Hardware	MC56F8367EVM	Freescale Semiconductor	Evaluation Module for the 56F834x, 56F835x, and 56F836x

Disclaimer

This document may not include all the details necessary to completely develop this design. It is provided as a reference only and is intended to demonstrate the variety of applications for the device.

Notes

Learn More: Contact the Technical Information Center at +1-800-521-6274 or +1-480-768-2130.
For more information about Freescale products, please visit **www.freescale.com**.

SG2049
REV 2
6/2005

June2005