

Sound and Speech Products



OKI

Oki Network Solutions
for a Global Society

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Dear Reader

OKI looks back on more than 100 years of history and experience in producing electric and electronic quality products of repute. OKI established its Electronic Devices Group in 1961 and has been designing and manufacturing high quality ICs such as memories, microcontrollers, telecom ICs and a large variety of speech ICs ever since.

OKI's speech ICs enjoy remarkable popularity worldwide. Their superior speech quality, as a result of the company's refined algorithm, has assured OKI a leading position among suppliers of speech devices.

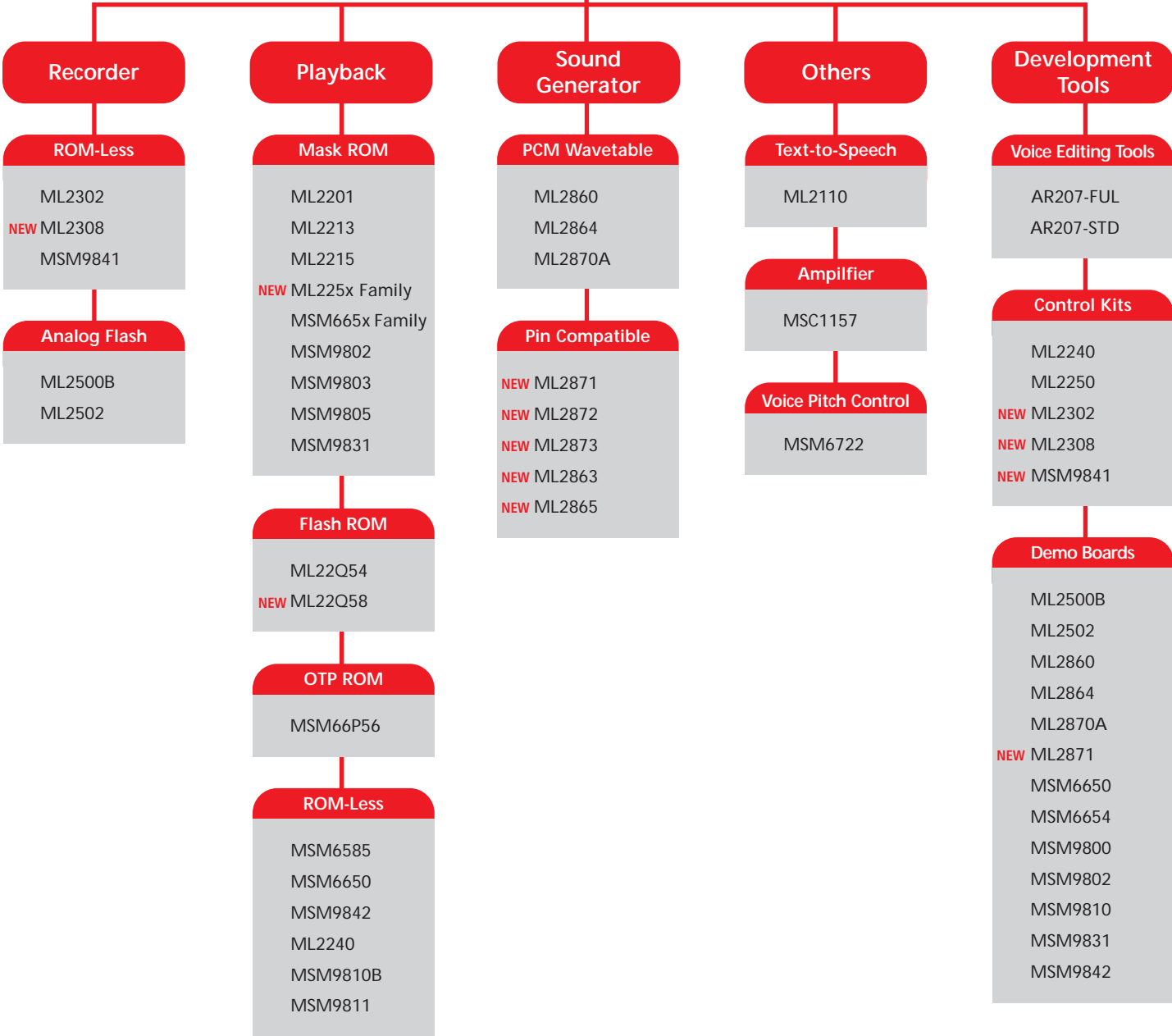
OKI's speech circuits are easy to apply. All analog and digital functions like ADC, DAC, LPF, amplifiers and memory management are integrated. Most devices feature stand-alone mode, where the device is controlled by pushbuttons, as well as a more powerful MCU mode, where the device is controlled by simple commands sent from the MCU. Speech ICs are installed in many familiar products used in every-day life, such as answering machines, mobile phones, clocks, cameras, toys, telephones, greeting cards, office-automation equipment, alarm systems, clinical facilities.

The range of applications is steadily expanding, and now also includes automotive (e.g. car navigation, driver information system) use and the so-called brown and white goods. The facility of speech will be incorporated in an ever increasing number of applications.

Features of OKI Speech

- OkiADPCM/ADPCM2, OkiPCM and Analog Flash Technology
- Suitable for speech and sound effects
- High speech intelligibility and sound naturalness
- Wide range of sampling frequencies
- Easy to apply with only a few external parts
- High design flexibility
- High device quality and reliability
- Various packages:
Through-hole, SMD, BGA, W-CSP
- Low power CMOS process technology
- Typical applications: Handicap aids, medical systems, teaching aids, answering machines, telecommunication, industrial equipment, computer systems, mobiles, driver information systems, consumer goods, toys... and more

Sound and Speech Products



ADPCM/PCM Recorder ICs



ML2308

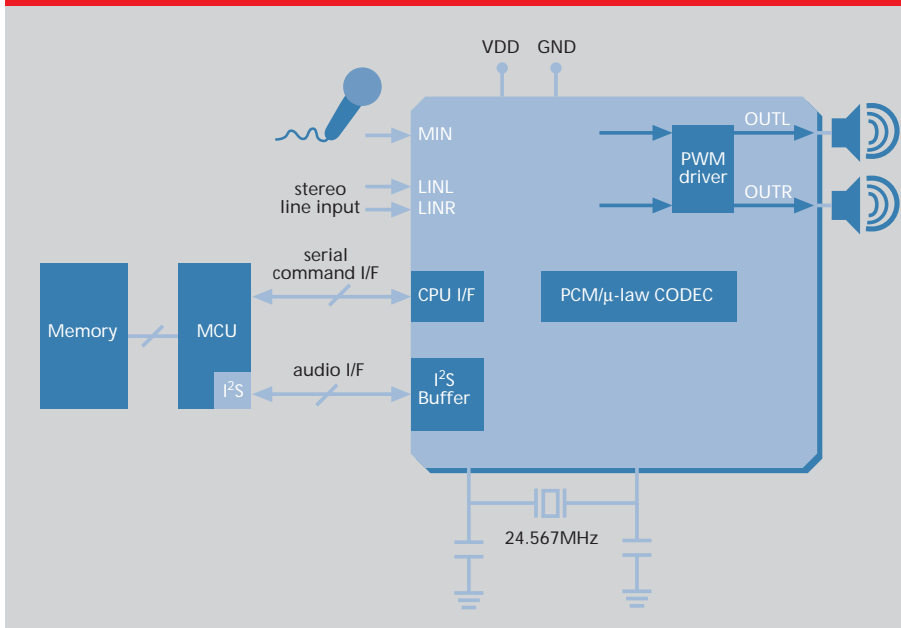
Advantages:

- Sampling frequency up to 32kHz
- I²S digital audio I/F
- μ -law PCM CODEC
- PWM speaker driver
- Dynamic range control

ML2308 is a self-contained stereo audio CODEC for the purpose of voice recording. Analog voice signals input via a microphone or audio line are converted to μ -Law (G.711), ADPCM2 or PCM data and played back. ADPCM2, PCM and G.711 speech coding allow easy editing on PCs without need for special software. Linear PCM data input externally can be converted to 1-bit PWM signals and be replayed. The CODEC incorporates input amplifiers and speaker driver amplifiers and performs nearly all signal processing digitally, such as noise

reduction. This significantly simplifies board design and increases audio performance as compared with mixed analog/digital chips. The ML2308 contains comprehensive function control registers allowing for easy application programming. Since all voice related functions, including fast play, forward, backward, volume control, etc. are controlled by the ML2308, the system MCU is hardly loaded. ML2308 provides two (pin-selectable) CPU interfaces, serial or parallel, respectively.

Application Example (serial I/F) ML2308





MSM9841

Advantages:

- Operating temperature from -40 to +85°C
- DMA controller I/F
- Playback sampling frequency up to 44.1kHz

The MSM9841 comes with an ADPCM speech engine designed to produce highly natural voice quality. This is achieved by OKI's "ADPCM2" compression algorithm, which improves over ADPCM by computing at higher accuracy and can be set to 4, 5, 6, 7 or 8 bits resolution per sample. Besides ADPCM2, three further algorithms can be selected: Standard OkiADPCM, linear 8 or 16 bit PCM, or non-linear 8 bit PCM.

With two on-chip 14 bit DACs and two digital low-pass filters, the part has stereo playback capability. MSM9841 adds an internal

line amplifier and an internal 14 bit ADC to facilitate its recording function. For the use of external ADC and DAC devices 16 bit serial data interfaces with synchronisation are provided.

The MSM9841 incorporates a 1024 bit FIFO (first-in first-out register), which provides 32 ms buffering time at 8 kHz sampling rate. Typical speech data memory can be CD-ROM or other mass-storage medias, such as ATA Flash cards. The device is equipped with 8 and 16 bit parallel bus interfaces, including DMA controller.



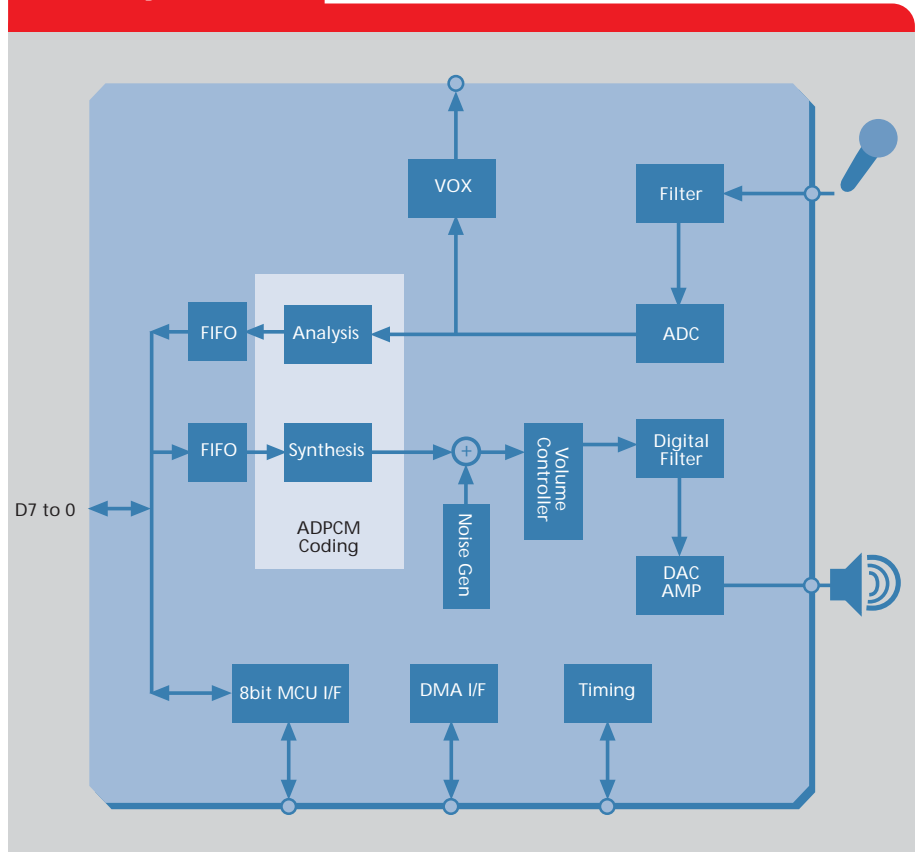
ML2302

Advantages:

- Built-in speaker amplifier
- Fast forward and rewind command
- DMA controller I/F
- Voice level detection

The ML2302 was the first ADPCM speech recording and playback device using 2bit OkiADPCM sampling frequencies ranging from 2.8 to 16 kHz. Alternative 4 bit Oki ADPCM, 4-8 bit OkiADPCM2 or 8 bit linear and non-linear PCM synthesis can be selected. One 1024 bit FIFO for the recording path and one for the playback path are incorporated to buffer speech data. Also implemented are a 14 bit ADC plus analog filter in the recording and one 14 bit DAC with digital LPF in the playback path drive, a DMA interface is provided. Other features include a voice detection circuit and an automatic gain control as well as a built-in speaker amplifier. Programmable speech control functions comprise among others cue and review. This device is ideally suited for e.g. voice memo recorders.

Block Diagram ML2302



Analog Flash Recording ICs



ML2500B

Advantages:

- No external memory required
- Recording of up to 160sec at 6.4kHz

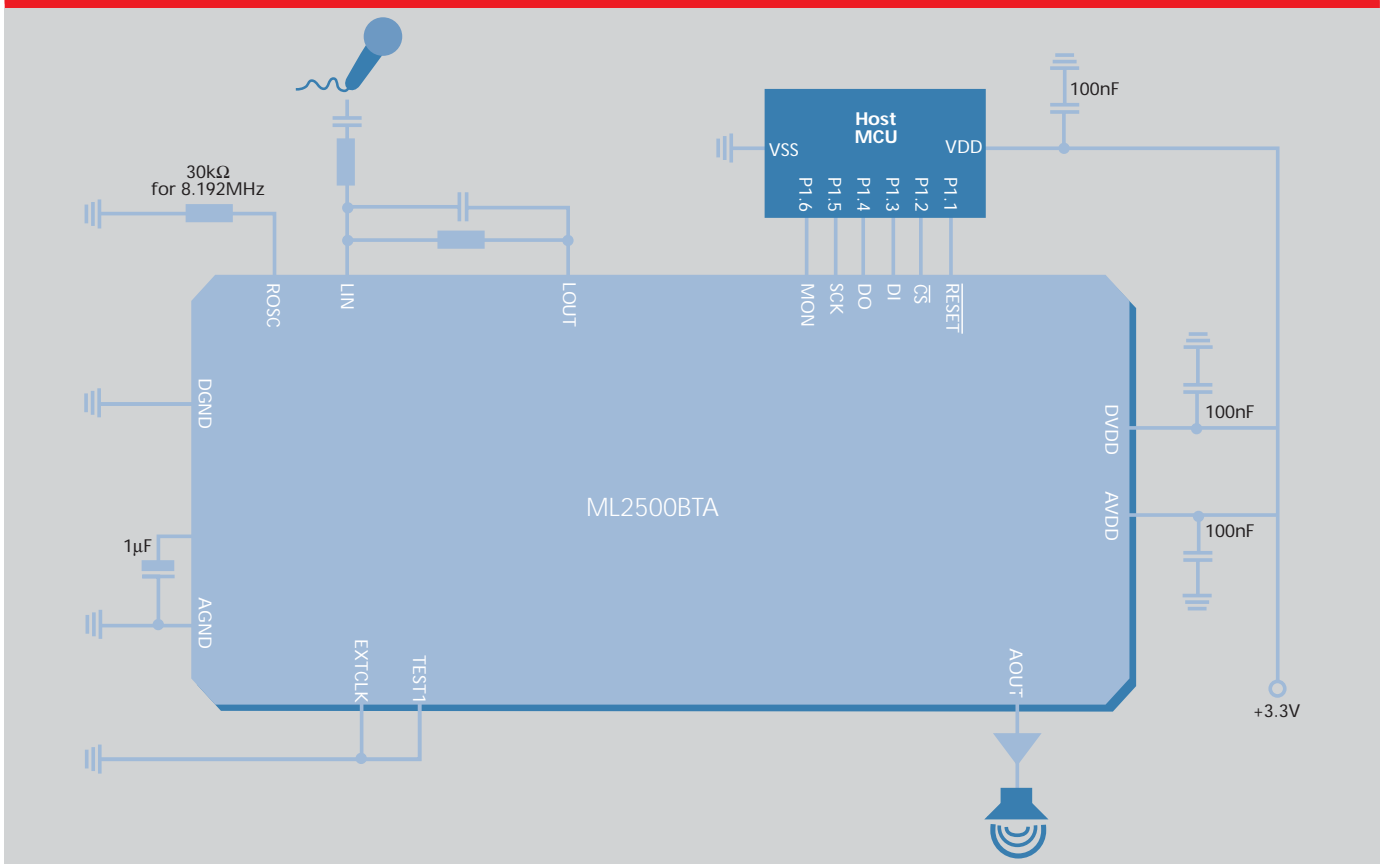
The ML2500B utilises analog storage of speech and sound effects into Flash memory cells. The term "analog" refers to a method that involves the charging of Flash cells analog to the input waveform with an equivalent resolution of 256 charge levels per memory cell. This analog multi-level storage, therefore, requires only 1/8 th of memory compared with ordinary 8 bit PCM.

The ML2500B incorporates over a million cells equivalent to 1 Mega-cell memory. A sampling frequency of 4 kHz provided, 256 seconds recording time are available, while 8 bit PCM data would yield only 32 seconds.

Operation control is facilitated by means of a serial peripheral interface (SPI) which accepts command data and provides status information from and to an external MCU. Command data controls recording, stop, playback, start and stop addresses, sampling frequencies, etc. Up to 320 recording channels can be defined, each recorded at another sampling frequency if desired.

An internal oscillation circuit is included so that the device does not need an external master clock. Alternatively an external clock can be applied.

Application Example ML2500B





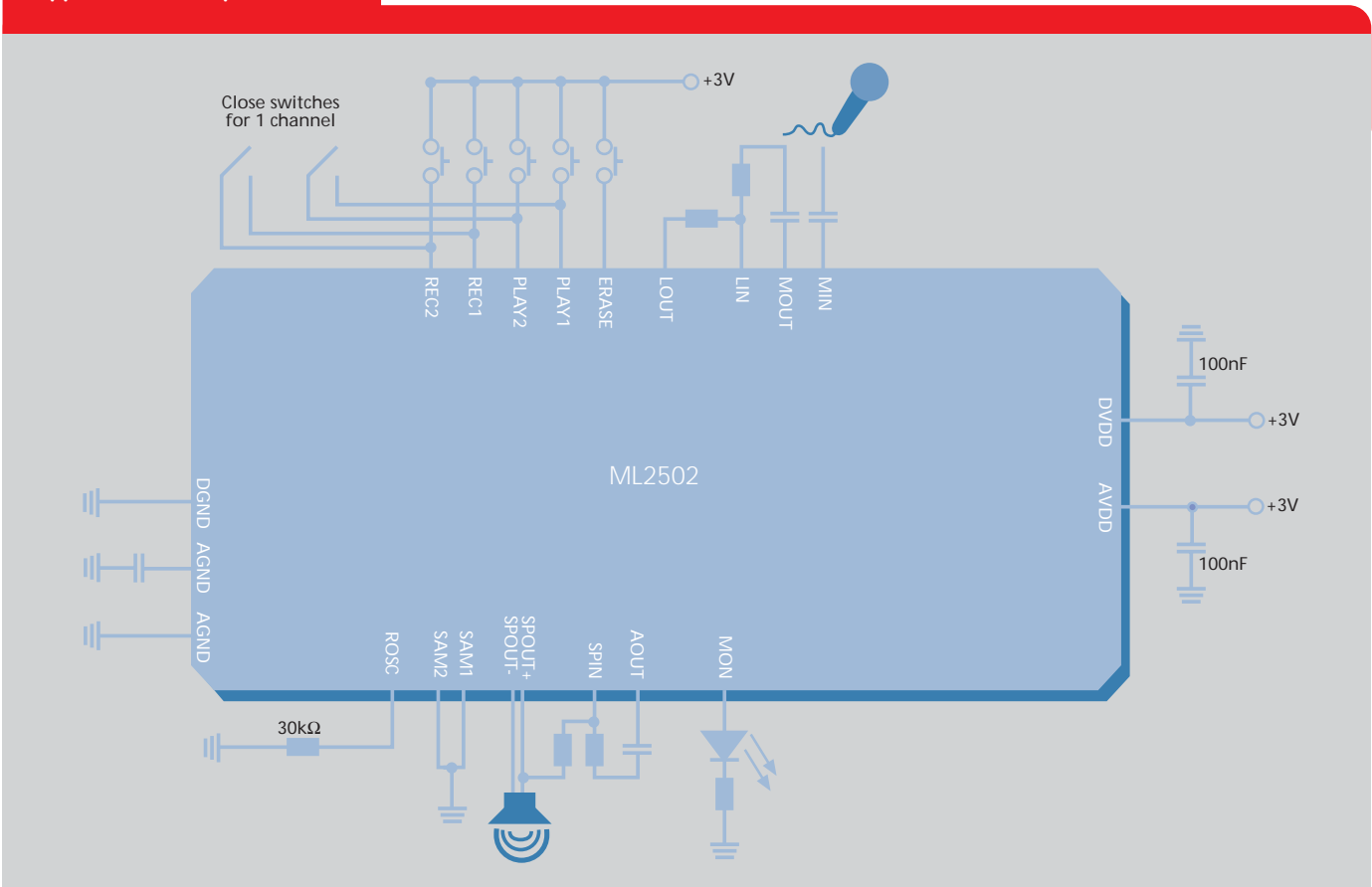
ML2502

Advantages:

- One-chip recorder
- No external memory required
- No MCU required
- Built-in speaker driver

The ML2502 includes 128 Kilocell Flash memory. It is optimized for short-message recordings for such applications as voice memos, message cards or toys. It allows to record 1 or 2 phrases with max. recording time of 32 sec (@4 kHz), has a built-in microphone amplifier with AGC (Automatic Gain Control), and a built-in speaker driver for dynamic and piezo speakers.

Application Example ML2502



ADPCM/PCM Playback ICs



ML2251/52/ 53/54/56/Q54/Q58

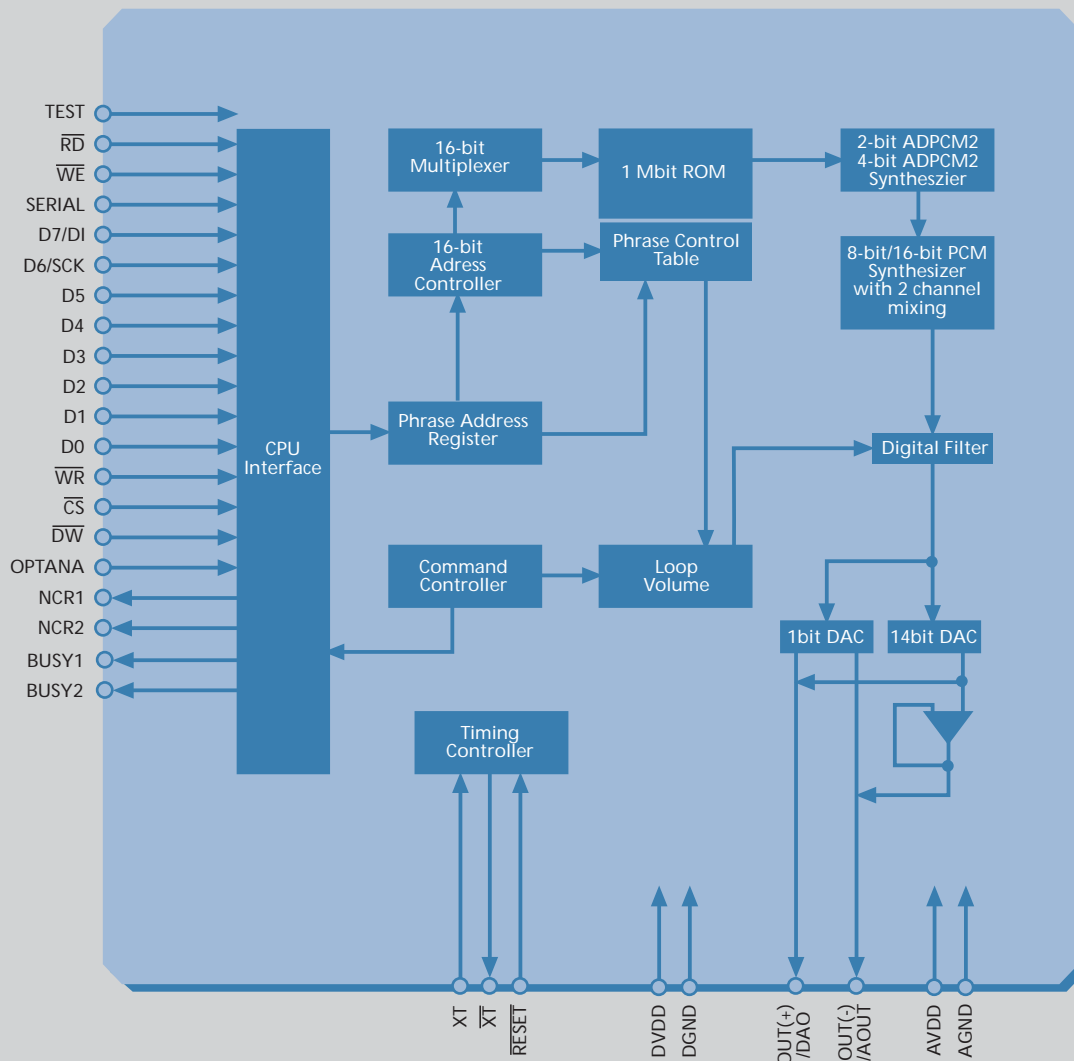
Advantages:

- Mask and Flash ROM versions available
- OKI's biggest internal ROM size for Speech ICs
- 2-channel mixing function
- Loop-playback function
- Successor to the MSM6650 family

The ML2251/56 has 512Kbit/6Mbit of internal mask ROM and a two-channel mixing function, with each channel's volume independently controllable, from -60dB to 0dB in 2dB steps. To save memory space a pause-less loop function is implemented. Interfacing with the system microcontroller is facilitated easily using the serial or parallel interface. Five algorithms (2/4bit OKI ADPCM2, 8bit OKI non-linear PCM and 16bit PCM) combined with its wide range of sampling frequencies, up to 48 kHz, allows the user to optimize playback time

and sound quality. Sound quality is also enhanced by an internal 14-bit D/A converter combined with a digital low-pass filter and OKI's high precision ADPCM2 algorithm. The ML22Q54/Q58 with 4/8Mbit Flash are designed for prototyping and allow on-board programming and storage of digital data. This new family of high-quality multifunction speech synthesizers are ideal for high-end applications such as warning systems, car sound effects and voice guidance systems and many more.

Block Diagram ML2252





ML2240

Advantages:

- ROM-less member of the ML2250 family
- 4-channel mixing function
- Stereo output
- Successor to the MSM6650

The ML2240 is an ADPCM/PCM speech synthesizer with four-channel mixing capability and interface for external ROM or EPROM up to 128 Mbit.

The high audio quality over four channels in stereo plus a wide selection of sampling

frequencies differently adjustable for each phrase makes it the ideal device for game machines and similar, to name only a few.



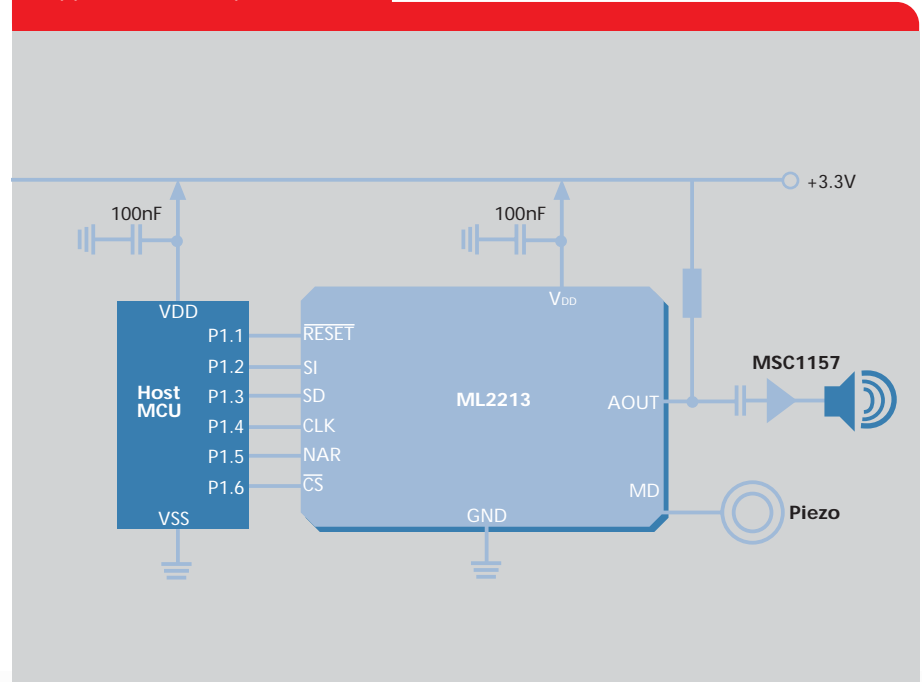
ML2213/15

Advantages:

- Beep tone melody generator function
- Internal mask ROM
- Small package
- Piezo-speaker driver

ML2213 and ML2215 are speech playback ICs which store compressed voice or sound effect data on internal ROM (1.5 Mbit or 3 Mbit). Additionally, they include a simple melody generator. Selectable synthesis algorithms include 4-bit OkiADPCM and linear and non-linear 8-bit PCM. In OkiADPCM mode and 4 kHz sampling rate provided (4 to 16 kHz selectable), the ML2213 outputs 90 sec speech (ML2215, 180 sec). Up to 247 different speech phrases can be defined. The ICs are particularly suited for small devices for the purpose of providing voice guidance, sound feedbacks and more.

Application Example ML2213



ADPCM/PCM Playback ICs



MSM9831

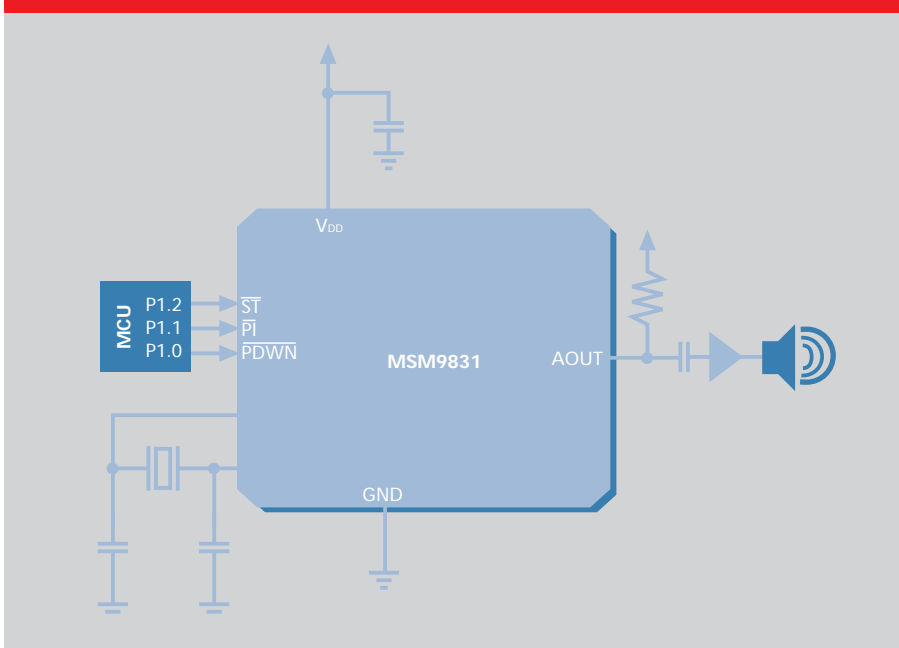
Advantages:

- Smallest pin count
- Internal mask ROM
- 2-line playback control I/F

The MSM9831 can be used for a broad range of applications including voice guidance systems, and mechanical sound effects for digital appliances to improve the functionality of many existing electronic equipment.

As the world becomes increasingly digital, many of the sounds emitted by electronic appliances, sounds we have grown accustomed to, will begin to disappear. The MSM9831 has the ability to put these sounds back into electronic equipment, and allows manufacturers to make transition to digital technology as seamlessly as possible.

Application Example MSM9831



The non-linear 8 bit PCM algorithm of OKI enables the MSM9831 to produce the sound quality equivalent of a 10 bit straight PCM. The available sampling frequencies range from 4 to 16 kHz. Manufacturers are free to select a voice quality and playback time, which suits the application best. With up to 31 playback channels, the MSM9831 provides up to 12 seconds playback time at 4.0 kHz. Using a special serial interface configuration, OKI has succeeded to cut the number of used pins in half compared with MSM980X family. This made the device small enough to fit into many portable appliances such as digital cameras, PDAs and portable CD players. The 8-pin small outline package (SOP) measures 6.8 x 5.0 mm and contains a 10 bit DAC, a low-pass filter (LPF) and 384 Kbit Mask ROM on a single chip. The power supply ranges from 2.0 to 5.5V, offering different voltage specifications for various application demands.



MSM9802/03/05

Advantages:

- Stand-alone mode selectable
- Internal mask ROM
- Random-playback function

These speech and sound synthesizers are designed for astounding signal quality for relatively short output times and differ from other OKI synthesizer products as they do not use OkiADPCM but PCM reproduction. Two methods are selectable, linear 8 bit PCM or non-linear 8 bit OkiPCM. The latter is a refined algorithm and provides a quality comparable with 10 bit linear PCM. The devices come with built-in 512 kBit to 2 MBit ROM and address consumer and professional applications requiring high speech

and sound fidelity as much as simplicity in use. In fact, only a few external components and a power amplifier (or transistor) are required to establish a high quality speech playback unit. Both manual switch and MCU control modes are available by means of mask option. Integrated on-chip is a phrase control table function by which means it is possible to define complete sentences for playback by applying only a single address.



MSM9842

Advantages:

- ROM-less for infinite playback duration
- Built-in FIFO
- DMA controller I/F
- External DAC I/F
- Stereo output

The MSM9842 comes with an ADPCM speech engine designed to produce highly natural voice quality. This is achieved by OKI's ADPCM2 compression algorithm, which improves over ADPCM by computing at higher accuracy and can be set to 4, 5, 6, 7 or 8 bits resolution per sample. Besides ADPCM2, three further algorithms can be selected: Standard OkiADPCM, linear 8 or 16 bit PCM, or non-linear 8 bit PCM. The choice of sampling frequencies is 4.0 to 44.1 kHz, thus allowing to set various bit-rates in conjunction with available bit resolutions.

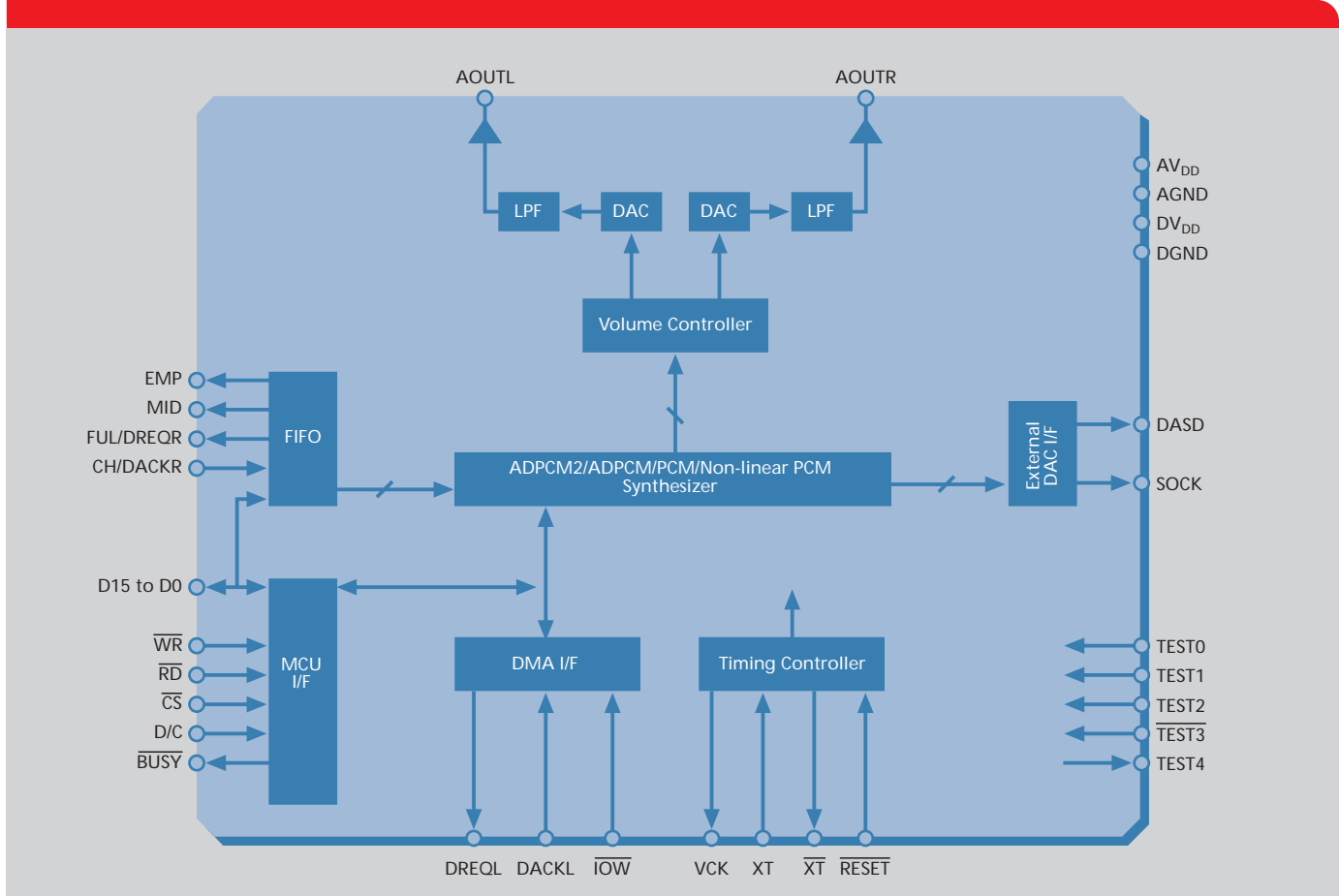
With two on-chip 14 bit DACs and two digital low-pass filters, the parts have quasi stereo playback capability. For cases where external DAC are used, 16 bit serial data input and

output, including synchronisation are provided.

Unlike other OKI speech playback devices, MSM9842 incorporates a 1024 bit FIFO (first-in first-out register). This buffer provides 64 ms buffering time at 8 kHz sampling rate. Typical speech data memory can be CD-ROM or other mass storage medias, such as ATA Flash cards. The device is equipped with 8 and 16 bit parallel bus interfaces, including DMA controller.

MSM9842 is the ideal part for car navigation or telematic systems. In noisy environments, such as the cabin of a vehicle, it produces highly intelligible speech. Major purposes are for voice user prompts and voice information related to traffic guidance.

Block Diagram MSM9842



Sound Generators - Pin and Software Compatible



**ML2871/73/
72/63/65**



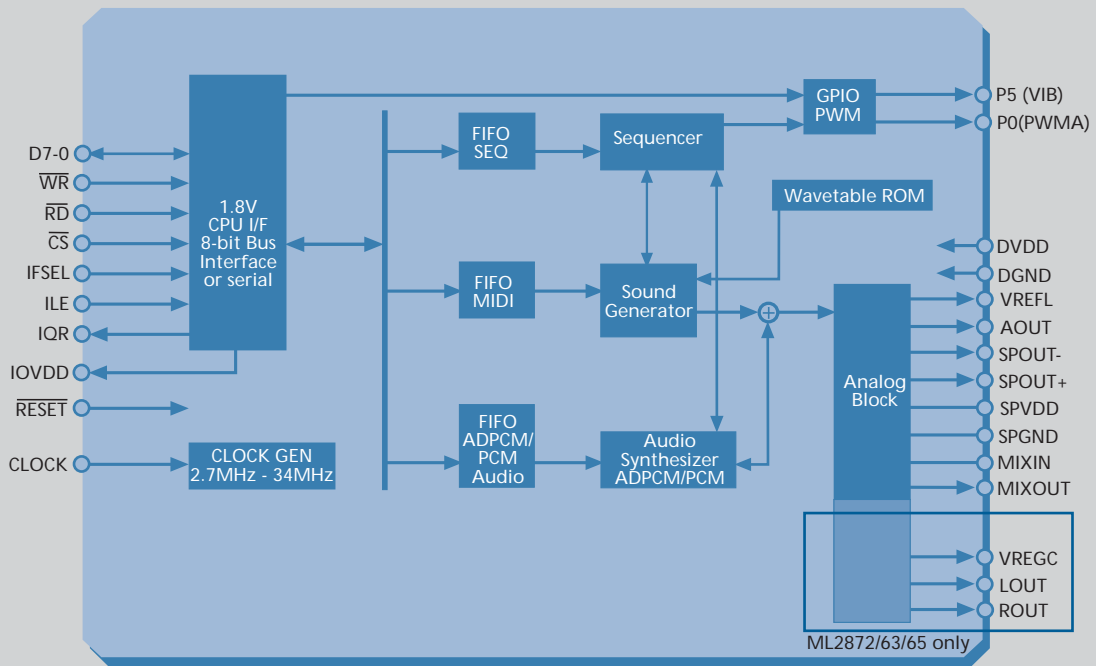
Advantages:

- High quality sound ring tones
- PCM wavetable
- Standard MIDI file (SMF) playback
- ADPCM/PCM playback
- Built-in speaker amplifier
- Driver S/W and API provided

The new pin and software compatible family are highly sophisticated MIDI sound generators based on PCM wavetable primarily designed for mobile phones and PDAs, but not exclusively. They also replay ADPCM and PCM speech and sound data (excluding ML2873). Based on a general MIDI sound set, the family can cover playback of 16 to 64 polyphonic ring tones and music.

Using the on-chip FIFOs and 650mW speaker amplifier, a fantastic music ringer subsystem can readily be built around this chip. Also provided are ports to drive a ringing vibrator and LED. CPU control is possible in both parallel and serial way, while a comprehensive register structure allows easy programming. The chips contain an orchestra of musical instruments, a symphony on silicon.

Block Diagram



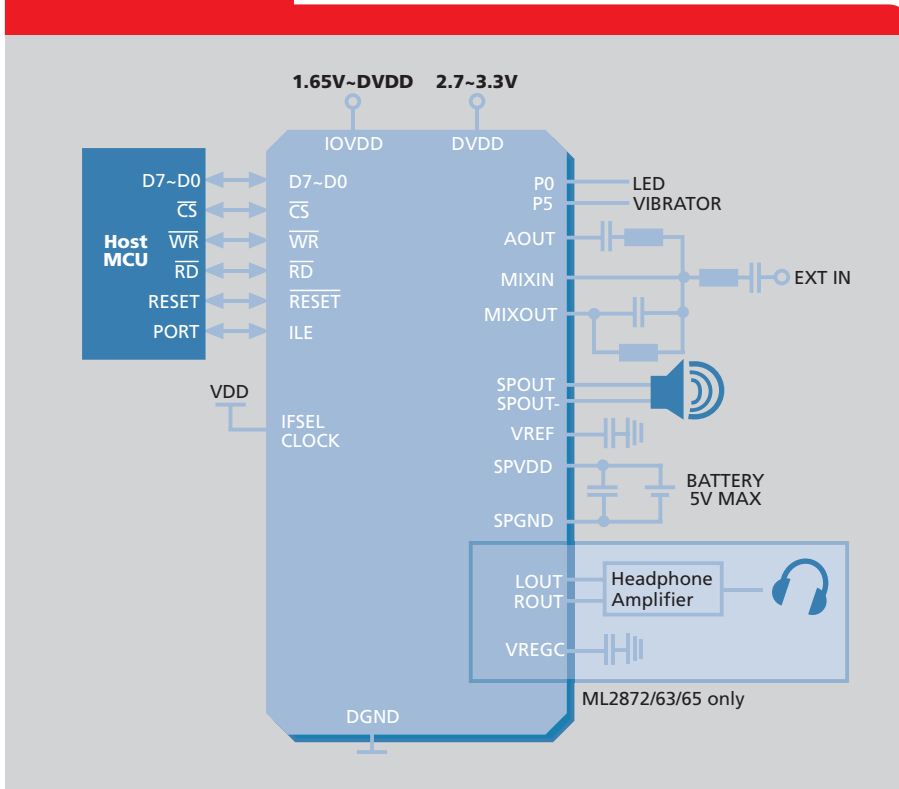
* Swing'n Ringer is our trademark symbolising our range of music ringer chips primarily designed for mobile and cordless phones. The devices are easy to integrate, providing MIDI music with fantastic sound quality.

Sound Generators - Pin and Software Compatible

Comparison Table

Part Number	Wavetable			Sequencer Channel	Number of Poly			Audio output		Stereo head-phone output	Speaker amplifier	Software compatibility	Packages [mm x mm]
	Louder GM	Hi-Fi GM	Chinese instruments		Poly	PCM/ADPCM	Maximum poly	Stereo	Monaural				
ML2873	•		13	1	16	0	16		•	N/A	650mW	•	WCSP 4.6x3.6 QFN 5.0x6.0
ML2871	•		13	1	32	8	40		•	N/A	650mW	•	WCSP 4.6x3.6 QFN 5.0x6.0
ML2863	•		13	1	64	8	72	•		•	650mW	•	WCSP 4.6x3.6 QFN 5.0x6.0
ML2872		•	N/A	1	32	8	40	•		•	650mW	•	WCSP 4.6x3.6 QFN 5.0x6.0
ML2865		•	N/A	1	64	8	72	•		•	650mW	•	WCSP 4.6x3.6 QFN 5.0x6.0

Application Example



Product Tables

Recording ICs

Part Number	Packages	Function	ADC/ DAC	Sampling [kHz]	External Memory	FIFO	Supply Voltage	Max. Current	Clock Frequency	Operating Temperature
ML2302	64-TQFP, 71-W-CSP, Chip	ADPCM/ADPCM2/PCM, FIFO, DMA I/F, speaker amp.	14bit	4~25.6	CD-ROM, other mass media	64ms buffer	+2.7~+3.6V	20mA	16.384MHz	-10~+70°C
NEW ML2308	48-QFN	μ-law G.711/ADPCM2/PCM, data buffer, I ² S I/F, PWM speaker driver	1bit Δ-Σ (stereo)	4~32	CD-ROM, other mass media	32ms buffer	+2.7~+3.6V	40mA	24.576MHz	-20~+70°C
MSM9841	56-QFP, Chip	ADPCM/ADPCM2/PCM, FIFO, DMA I/F, stereo	14bit (Two DACs)	4~16	CD-ROM, other mass media	64ms buffer	+2.7~+5.5V	30mA	4.096MHz/ 5.6448MHz	-40~+85°C

Analog Flash Recording ICs

Part Number	Packages	Function	Sampling [kHz]	External Memory	Max. Rec Time*	Supply Voltage	Max. Current	Clock Frequency	Operating Temperature
ML2500B	32-TSOP I, Chip	Analog Storage recorder; Internal 1 Megacell Flash	4~6.4	not required	4.2min.	+2.7~+3.3V	45mA	Internal RC osc. or 4.0 - 8.192MHz	-40~+70°C
ML2502	30-SSOP, Chip	Analog Storage recorder; Internal 128 Kilocell Flash, stand-alone, speaker driver	4~6.4	not required	32sec.	+2.7~+3.3V	40mA	Internal RC osc.	-10~+70°C

Voice Pitch Control ICs

Part Number	Packages	Function	ADC/DAC	Supply Voltage	Max. Current	Clock Frequency	Operating Temperature
MSM6722	24-SOP, Chip	Real-time voice pitch conversion, 2 octaves	8/9bit	+4.5~+5.5V	12mA	4 - 4.5MHz	-10~+70°C

*calculated for 4kHz sampling frequency

Playback ICs

Part Number	Packages	Function	Sampling [kHz]	Internal Memory	Play Time*	Internal DAC	Supply Voltage	Max. Current	Clock Frequency	Operating Temperature
ML2201	8-SSOP	Non-linear PCM (shrink of MSM9831)	4~16	384Kbit ROM	12sec	10bit	+2.0~+5.5V	10mA	4.096MHz	-40~+85°C
ML2213	14-SSOP, 24-SOP, Chip	ADPCM/PCM, melody generator	4~16	1.5Mbit ROM	90sec	12bit	+2.2~+5.5V	4mA	4.096,8.192, 16.384MHz	-40~+85°C
ML2215	20-SSOP, 24-SOP, Chip	ADPCM/PCM, melody generator	4~16	3Mbit ROM	180sec	12bit	+2.2~+5.5V	4mA	4.096,8.192, 16.384MHz	-40~+85°C
ML2240	80-TQFP	PCM/ADPCM2, 4-channel mixer, stereo, 128 Mbit ext. ROM	4~48	-	variable	14bit	+2.7~+5.5V	40mA	4.096MHz	-40~+85°C
NEW ML2251	44-QFP	PCM/ADPCM2, 2-channel mixer, volume control, loop function	4~48	512Kbit ROM	31.7sec	14bit	+2.7~+3.6V +4.5~+5.5V	35mA	4.096MHz	-40~+85°C
ML2252	44-QFP	PCM/ADPCM2, 2-channel mixer, volume control, loop function	4~48	1Mbit ROM	64.5sec	14bit	+2.7~+3.6V +4.5~+5.5V	35mA	4.096MHz	-40~+85°C
NEW ML2253	44-QFP, 33-W-CSP	PCM/ADPCM2, 2-channel mixer, volume control, loop function	4~48	3Mbit ROM	195.5sec	14bit	+2.7~+3.6V +4.5~+5.5V	35mA	4.096MHz	-40~+85°C
ML2254	44-QFP, 33-W-CSP	PCM/ADPCM2, 2-channel mixer, volume control, loop function	4~48	4Mbit ROM	261sec	14bit	+2.7~+3.6V +4.5~+5.5V	35mA	4.096MHz	-40~+85°C
NEW ML2256	44-QFP	PCM/ADPCM2, 2-channel mixer, volume control, loop function	4~48	6Mbit ROM	392sec	14bit	+2.7~+3.6V +4.5~+5.5V	35mA	4.096MHz	-40~+85°C
ML22Q54	44-QFP	Internal Flash ROM version for ML225x family	4~48	4Mbit Flash ROM	261sec	14bit	+2.7~+3.6V	35mA	4.096MHz	0~+70°C
NEW ML22Q58	44-QFP	Internal Flash ROM version for ML225x family	4~48	8Mbit ROM	522sec	14bit	+2.7~+3.3V +4.5~+5.5V	35mA	4.096MHz	0~+70°C
MSM6585	18-DIP, 24-SOP, 30-SSOP	ADPCM decoder	4~32	-	variable	12bit	+4.5~+5.5V	10mA	640kHz	-40~+85°C
MSM6650	64-QFP	Eva-chip of MSM665x family	4~32	-	69min	12bit	+2.4~+5.5V	10mA	3.5 - 4.5MHz	-40~+85°C
MSM6652A	18-DIP, 24-SOP, Chip	ADPCM/PCM, 2-channel, melody, beep tone, fading, stand-alone mode	4~32	288Kbit ROM	16.9sec	12bit	+2.4~+5.5V	10mA	3.5 - 4.5MHz	-40~+85°C
MSM6653A	18-DIP, 24-SOP, Chip	ADPCM/PCM, 2-channel, melody, beep tone, fading, stand-alone mode	4~32	544Kbit ROM	31.2sec	12bit	+2.4~+5.5V	10mA	3.5 - 4.5MHz	-40~+85°C
MSM6654A	18-DIP, 24-SOP, Chip	ADPCM/PCM, 2-channel, melody, beep tone, fading, stand-alone mode	4~32	1Mbit ROM	63.8sec	12bit	+2.4~+5.5V	10mA	3.5 - 4.5MHz	-40~+85°C
MSM6655A	18-DIP, 24-SOP, Chip	ADPCM/PCM, 2-channel, melody, beep tone, fading, stand-alone mode	4~32	1.5Mbit ROM	96.5sec	12bit	+2.4~+5.5V	10mA	3.5 - 4.5MHz	-40~+85°C
MSM6656A	18-DIP, 24-SOP, Chip	ADPCM/PCM, 2-channel, melody, beep tone, fading, stand-alone mode	4~32	2Mbit ROM	129.1sec	12bit	+2.4~+5.5V	10mA	3.5 - 4.5MHz	-40~+85°C
MSM6658A	18-DIP, 24-SOP, Chip	ADPCM/PCM, 2-channel, melody, beep tone, fading, stand-alone mode	4~32	4Mbit ROM	260sec	12bit	+3.5~+5.5V	10mA	3.5 - 4.5MHz	-40~+85°C
MSM66P56	20-DIP, 24-SOP	OTP version for MSM665x family	4~32	2Mbit OTP	129.1sec	12bit	+3.5~+5.5V	20mA	3.5 - 4.5MHz	-40~+85°C

*Playback times are based on the lowest bit-rate and the devices own memory address range without expansions, calculated for 4kHz sampling frequency

Playback ICs

Part Number	Packages	Function	Sampling [kHz]	Internal Memory	Play Time*	Internal DAC	Supply Voltage	Max. Current	Clock Frequency	Operating Temperature
MSM9802	18-DIP, 24-SOP, Chip, 30-SSOP	PCM, stand-alone mode	4~16	512Kbit	16sec.	10bit	+2.7~+5.5V	16mA	3.5 - 4.5MHz	-40~+85°C
MSM9803	18-DIP, 24-SOP, Chip, 30-SSOP	PCM, stand-alone mode	4~16	1Mbit	32.4sec.	10bit	+2.7~+5.5V	16mA	3.5 - 4.5MHz	-40~+85°C
MSM9805	18-DIP, 24-SOP, Chip, 30-SSOP	PCM, stand-alone mode	4~16	2Mbit ROM	65.1sec.	10bit	+2.7~+5.5V	16mA	3.5 - 4.5MHz	-40~+85°C
MSM98P05	20-DIP, 24-SOP	OTP version of MSM980x family, samples only **	4~16	2Mbit OTP	65.1sec.	10bit	+2.7~+5.5V	20mA	3.5 - 4.5MHz	-10~+40°C
MSM9810B	64-QFP	PCM/ADPCM 8-channel mixer, stereo, 128 MBit ext. ROM	4~32	-	139min.	14bit	+4.5~+5.5V	15mA	4.096MHz	-40~+85°C
MSM9811	64-QFP	PCM/ADPCM 4-channel mixer, stereo, 128 MBit ext. ROM	4~32	-	139min.	14bit	+4.5~+5.5V	15mA	4.096MHz	-40~+85°C
MSM9831	8-SOP	non-linear PCM	4~16	384Kbit ROM	12sec.	10bit	+2.0~+5.5V	8mA	3.5 - 4.5MHz	-40~+85°C
MSM9842	56-QFP	ADPCM/ADPCM2/PCM, FIFO buffer, stereo	4~44.1	1024bit FIFO	64ms buffering	14bit (Two DACs)	+2.7~+5.5V	30mA	4.096MHz - 5.6448MHz	-40~+85°C

*Playback times are based on the lowest bit-rate and the devices own memory address range without expansions, calculated for 4kHz sampling frequency

**Engineering samples only programmed at OKI-Japan



Swing'n Ringer

Swing'n Ringer is our trademark symbolising our range of music ringer chips primarily designed for mobile and cordless phones. The devices are easy to integrate, providing MIDI music with fantastic sound quality.

Sound Generators

Part Number	Packages	Function	Wavetable	Polyphony	Supply Voltage	Active/Standby Current (max.)	Operating Temperature
ML2860	48-W-CSP	GM sound generator, SMF support, internal headphone amplifier, ADPCM playback	Hi-Fi	24/32	+2.7~+3.3V	60mA/10µA	-20~+85°C
ML2870A	62-W-CSP, 48-QFN	GM sound generator, SMF support, ADPCM playback	Hi-Fi	32	+2.5~+3.6V	36mA/15µA	-20~+85°C
ML2864	49-W-CSP	GM sound generator, SMF support, ADPCM/PCM playback	Hi-Fi	64	+2.7~+3.6V	60mA/18µA	-20~+85°C
NEW ML2863	32-QFN, 35-W-CSP	GM sound generator, 13 additional Chinese instruments, SMF support, ADPCM/PCM playback, speaker amplifier, stereo headphone out	Loud	64	+2.7~+3.6V	45mA/18µA	-20~+85°C
NEW ML2865	32-QFN, 35-W-CSP	as ML2863 but without Chinese instruments	Hi-Fi	64	+2.7~+3.6V	45mA/18µA	-20~+85°C
NEW ML2871	32-QFN, 35-W-CSP	as ML2863 but without stereo headphone out	Loud	32	+2.7~+3.6V	45mA/18µA	-20~+85°C
NEW ML2872	32-QFN, 35-W-CSP	as ML2863 but without Chinese instruments	Hi-Fi	32	+2.7~+3.6V	45mA/18µA	-20~+85°C
NEW ML2873	32-QFN, 35-W-CSP	as ML2863 but without ADPCM/PCM playback and without stereo headphone out	Loud	16	+2.7~+3.6V	45mA/18µA	-20~+85°C

Note: Please appreciate that sound generators are not offered for musical instruments and toy applications, such as keyboards.

Full detailed data sheets are provided against non-disclosure agreement.

Speech Control Processor (Text-To-Speech)

Part Number	Packages	Interface	Input Data	Sampling Frequency	Speech Data Output	Memory Interface	Supply Voltage	Max. Current	Clock Frequency	Operating Temperature	Languages
ML2110	144-LQFP	serial/parallel	ASCII (8bit DOS or ISO8859-1); SAMPA	16kHz	12bit DAC	SRAM, DRAM, ROM, and FLASH	+3.0~+3.6V	120mA	33MHz	-40~+85°C	UK English; French; Spanish; German; Italian; Dutch (all female + male voice); text or sampa phonetic input

Text-To-Speech Memory for ML2110

Part Number	Languages	Packages	Total Capacity	Access [ns]	Organisation	Supply Voltage	Max. Current	Max. Standby
MR27V3202F-6MTP/MA-GEF	German female	44-TSOP II, 44-SOP	32Mbit	120	2M x 16/4M x 8	+2.7~3.6V	40mA	500µA
MR27V3202F-6NTP/MA-GEM	German male	44-TSOP II, 44-SOP	32Mbit	120	2M x 16/4M x 8	+2.7~3.6V	40mA	500µA
MR27V3202F-6PTP/MA-FRF	French female	44-TSOP II, 44-SOP	32Mbit	120	2M x 16/4M x 8	+2.7~3.6V	40mA	500µA
MR27V3202F-6RTP/MA-FRM	French male	44-TSOP II, 44-SOP	32Mbit	120	2M x 16/4M x 8	+2.7~3.6V	40mA	500µA
MR27V3202F-6STP/MA-GBF	UK English female	44-TSOP II, 44-SOP	32Mbit	120	2M x 16/4M x 8	+2.7~3.6V	40mA	500µA
MR27V3202F-6TTP/MA-GBM	UK English male	44-TSOP II, 44-SOP	32Mbit	120	2M x 16/4M x 8	+2.7~3.6V	40mA	500µA
MR27V3202F-6UTP/MA-SPF	Spanish female	44-TSOP II, 44-SOP	32Mbit	120	2M x 16/4M x 8	+2.7~3.6V	40mA	500µA
MR27V3202F-7ATP/MA-SPM	Spanish male	44-TSOP II, 44-SOP	32Mbit	120	2M x 16/4M x 8	+2.7~3.6V	40mA	500µA
MR27V3202F-7BTP/MA-ITF	Italian female	44-TSOP II, 44-SOP	32Mbit	120	2M x 16/4M x 8	+2.7~3.6V	40mA	500µA
MR27V3202F-7CTP/MA-ITM	Italian male	44-TSOP II, 44-SOP	32Mbit	120	2M x 16/4M x 8	+2.7~3.6V	40mA	500µA
MR27V3202F-7DTP/MA-DTF	Dutch female	44-TSOP II, 44-SOP	32Mbit	120	2M x 16/4M x 8	+2.7~3.6V	40mA	500µA
MR27V3202F-7ETP/MA-DTM	Dutch male	44-TSOP II, 44-SOP	32Mbit	120	2M x 16/4M x 8	+2.7~3.6V	40mA	500µA

Amplifiers

Part Number	Packages	Output Power	Supply Voltage	Typ/Max. Current	Operating Temperature	Function
MSC1157	8-DIP, 8-SOP, Chip	0.3W	+2.0~+6.0V	1.6/400mA	-20~+70°C	Speaker driver, adjustable gain



AR207

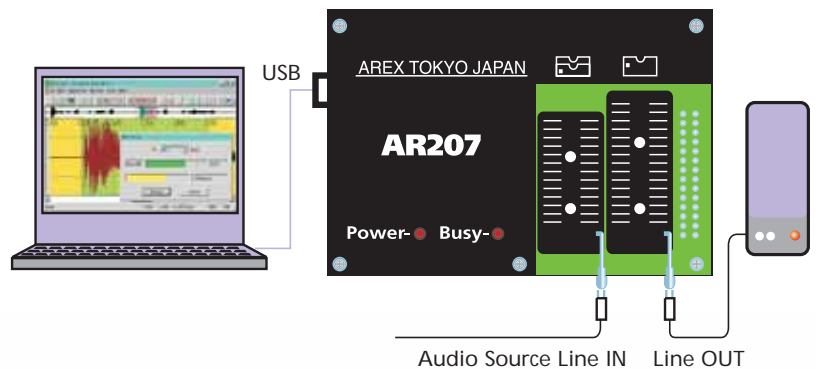
In-House Speech Code Development eliminates the need for expansive analysis charges and gives you the freedom to edit your codes individually whenever and wherever required. Moreover, the ability to write EPROM's and OTPs instantly shortens the code production process quite remarkably.

AR207 is a fully featured development tool covering the entire range of Oki Speech LSIs. It is available as a standard model for ROM conversion and programming, while the full version additionally performs analog functions, wave editing and monitoring. The use of the standard model requires the user to provide a sound capture card and software for the host PC. Both models come with an USB 1.1 port to connect to a host PC and software driver named 'VoicePro3', designed for Windows 98/Me/2000/XP®. The hardware requires no external power supply which is obtained through the USB port of the host PC.



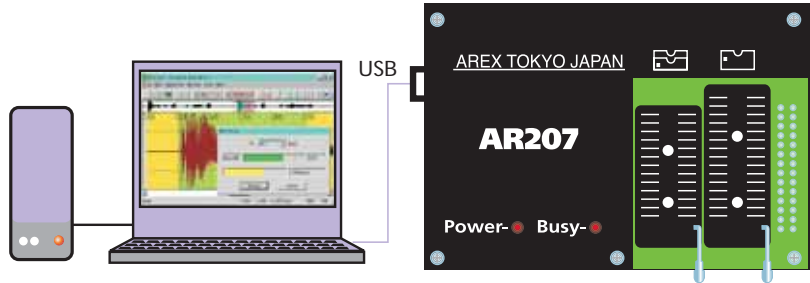
AR207-FUL

An analog-to-digital/digital-to-analog board is attached as a third layer allowing to capture analog inputs, sampling, analysis and editing before the speech code data is written to an OTP speech IC or into EPROM. This model is recommended for users processing studio tapes, CDs or other media containing sound/speech.



AR207-STD

A lower cost solution for users owning a host PC with a sound source board with software that does the sampling editing, etc. Recommended for users who own a database of WAVE files for conversion and OTP Speech LSI/EPROM programming.



Features

Part Number	System (min. requirements)	OS	Software	A/D; D/A Converter	Sampling Frequency	Sound Input	Sound Output	File Formats	Supported ROM/ EPROM
AR207-FUL	IBM PC/AT [®] compatibles with Pentium [®] CPU (23 MHz or faster recommended), 128 MByte RAM, USB 1.1 interface	Windows 98/Me/2000/XP [®] (3.x and NT not supported)	VoicePro3	16 bit x 2 channels	4 to 48 kHz depending on selected ICs	stereo line-in	stereo line-out	OKI PCM, Windows WAVE, HEX	1M, 2M, 4M, 8M [bit]; OKI OTP Speech ICs
AR207-STD	IBM PC/AT [®] compatibles with Pentium [®] CPU (23 MHz or faster recommended), 128 MByte RAM, USB 1.1 interface	Windows 98/Me/2000/XP [®] (3.x and NT not supported)	VoicePro3 (no wave editor and composite playback)	–	–	Windows WAVE	–	OKI PCM, Windows WAVE, HEX	1M, 2M, 4M, 8M [bit]; OKI OTP Speech ICs

Compatibility with previous Development Kits

- AR207 can read Make Files generated by AR204.
- PCM file formats are identical.
- AR207 does not support melody editing and file creation
- AR207 does NOT support older OTP devices: MSM6378A/MSM6379 and MSM63P74

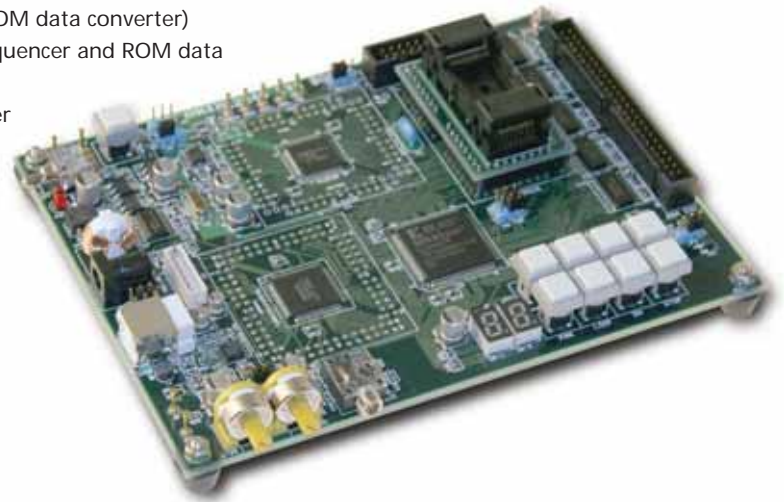


ML2240

The ML2240 Control Kit is provided for the purpose of evaluating speech/sound data playback using the ML2240 as mounted device. The data can be programmed into the board's 32 Mbit Flash ROM. Several keys and jumpers are mounted to set the various playback options when the board is used in stand-alone mode. The software tool provided with the kit allows editing of WAV data (such as recorded using a PC sound card) and performs conversion to ROM data, transfer to the evaluation board and the control of the on-board functions. It also simulates the 4 channel playback function of the ML2240 providing a 4 track sequencer.

- Delivery items:
 - USB cable
 - AC adaptor 100-230V
 - Driver software on CD-ROM
- Software includes:
 - EMU2240 (ROM data converter)
 - CTL2240 (Sequencer and ROM data converter)
 - USB 1.1 driver
 - Manuals

- Operating System:
 - Windows® 95/98/98SE/ME/2000/XP
- Supported Sound File format:
 - Windows® WAV stereo 16-bit PCM files



ML2250

The ML2250 Control Kit is provided for the purpose of programming speech/sound data into the board's memory and audio playback evaluation. This control kit is used to evaluate the whole ML2250 family. An ML22Q54 with 4 Mbit on-chip Flash ROM is mounted serving as memory and playback device.

Several keys and jumpers are mounted to set the various playback options when the board is used in stand-alone mode. Using the bundled software tool sound/speech data can be converted and programmed to the board's memory connecting the kit to a host PC via the USB port.

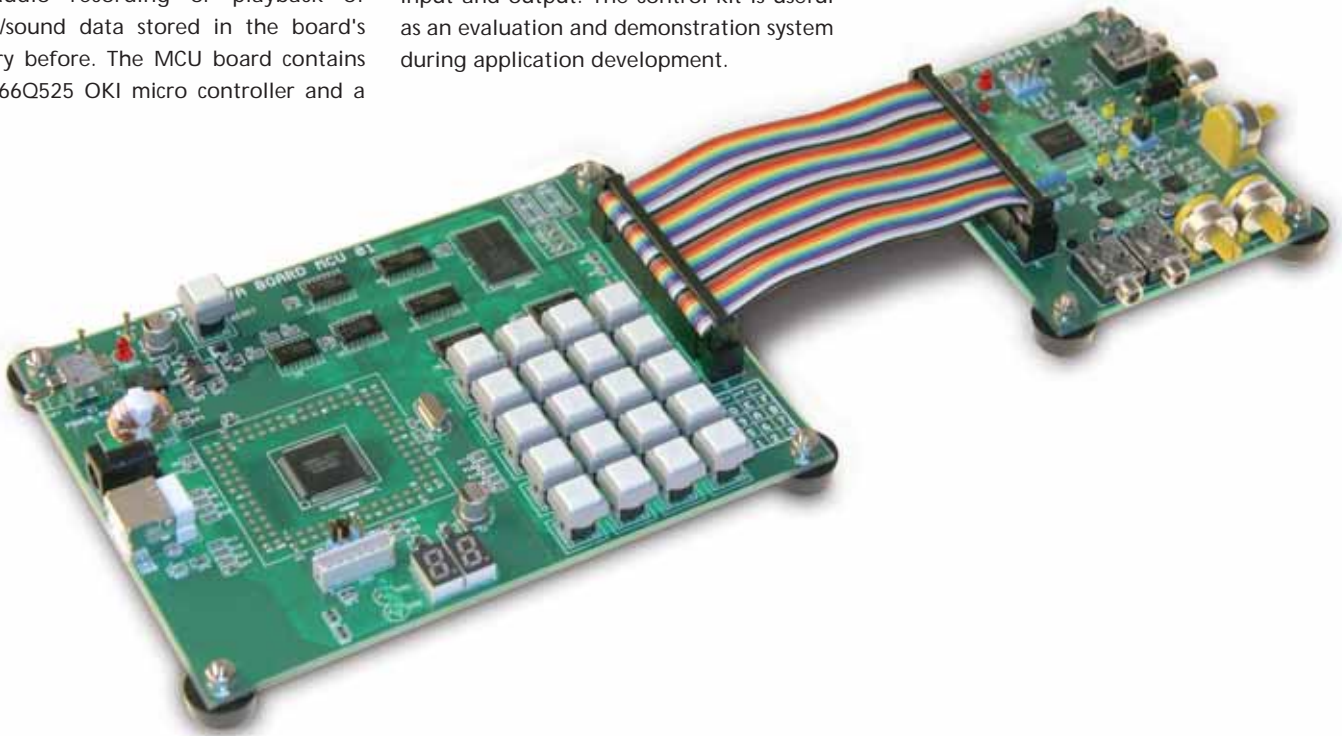
Optionally, the customer can connect an external MCU to evaluate his own control software (incl. in-circuit programming routine) driving the ML22Q54. A piggybacked socket board (ML22Q54PSB) which can be added to program further ML22Q54 samples is optional.



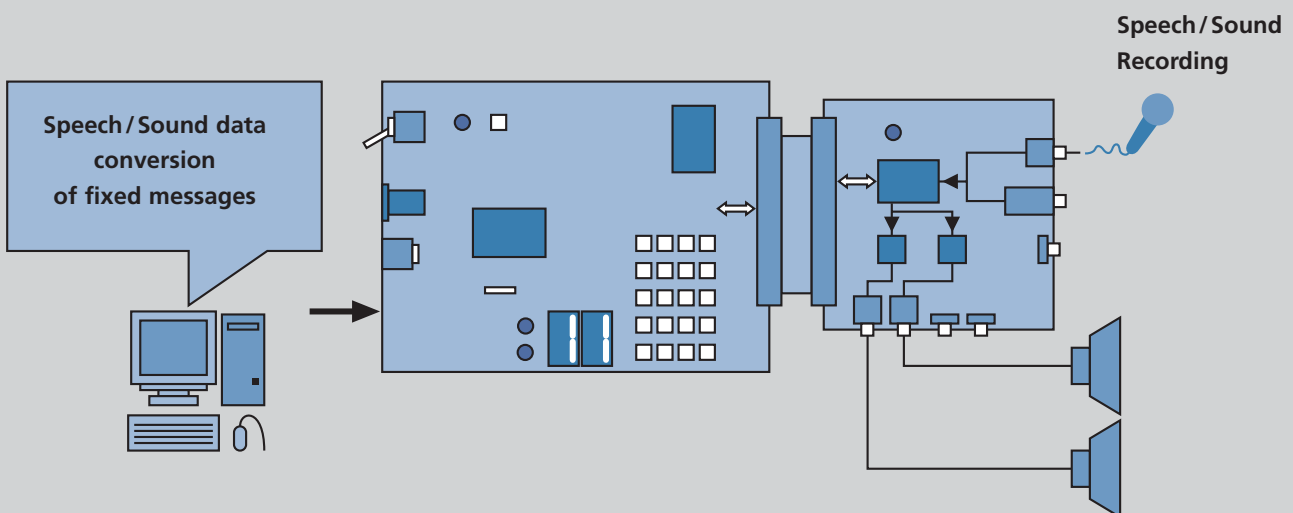
ML2302/MSM9841

Supporting ML2302, MSM9841 and also MSM9842 as sound and speech target devices, this control kit essentially consists of a universal MCU board and an option board incl. the target IC. It is provided for the purpose of software control code evaluation and audio recording or playback of speech/sound data stored in the board's memory before. The MCU board contains an ML66Q525 OKI micro controller and a

40-pin connector for customer's target board, mounted hex keys and Flash memory to store speech/sound data. The option board cores an ML2302 or MSM9841 recording and playback device plus analog and mechanical components for audio input and output. The control kit is useful as an evaluation and demonstration system during application development.



System Configuration



Memory Capacity and Output Time

How to calculate the playback and recording time:

4-bit ADPCM (memory capacity / 4 * Fs [sec])

Memory	32 kHz	16 kHz	12.8 kHz	10.6 kHz	8 kHz	6.4 kHz	5.3 kHz	4 kHz
256Kbit	2	4	5	6	8	10	12.1	16
512Kbit	4	8	10	12.1	16	20	24.2	32
1Mbit	8	16	20	24.2	32	40	48.3	64
2Mbit	16	32	40	48.3	64	80	96.6	128
4Mbit	32	64	80	96.6	128	160	193.2	256
6Mbit	48	96	120	144.9	192	240	289.8	384
8Mbit	64	128	160	193.2	256	320	386.4	512

8-bit PCM (memory capacity / 8 * Fs [sec])

Memory	32 kHz	16 kHz	12.8 kHz	10.6 kHz	8 kHz	6.4 kHz	5.3 kHz	4 kHz
256Kbit	1	2	2.5	3	4	5	6	8
512Kbit	2	4	5	6	8	10	12.1	16
1Mbit	4	8	10	12.1	16	20	24.2	32
2Mbit	8	16	20	24.2	32	40	48.3	64
4Mbit	16	32	40	48.3	64	80	96.6	128
6Mbit	24	48	60	72.5	96	120	144.9	192
8Mbit	32	64	80	96.6	128	160	193.2	256

16-bit PCM (memory capacity / 16 * Fs [sec])

Memory	32 kHz	16 kHz	12.8 kHz	10.6 kHz	8 kHz	6.4 kHz	5.3 kHz	4 kHz
256kBit	0.5	1	1.25	1.5	2	2.5	3	4
512kBit	1	2	2.5	3	4	5	6	8
1MBit	2	4	5	6	8	10	12.1	16
2MBit	4	8	10	12.1	16	20	24.2	32
4MBit	8	16	20	24.2	32	40	48.3	64
6MBit	12	24	30	36.3	48	60	72.5	96
8Mbit	16	32	40	48.4	64	80	96.6	128

To hear the sound quality please visit: www.okisemi.com/jp/english/arex.htm



What is the advantage of the 4-bit ADPCM voice synthesis method?

The 4-bit ADPCM method very effectively processes human and animal voices and natural sounds, reducing voice data storage space. This method offers high sound reproduction quality.

ADPCM, Adaptive Differential Pulse Code Modulation, differs from other methods in that it does not truly synthesise speech, but incorporates digitising, compressing and storing actual analog sounds (digital recording). Thus it represents a waveform coding method which typically compresses 12-bit wide PCM data streams by the factor 3 storing 4 bit ADPCM data per sample which multiplied with the sampling frequency results in the bit-rate. The higher the bit-rate, the higher is the sound quality since more redundancy is contained in the data, however storage memory requirement increases proportionally (bit-rate * time in seconds). Oki has refined the standard ADPCM algorithm (and named it 'OkiADPCM') to improve the sound quality of its speech devices.

What is the advantage of the 4-, 5-, 6-, 7-, or 8-bit ADPCM2 voice synthesis method?

The 4-, 5-, 6-, 7-, or 8-bit ADPCM2 method has higher sound reproduction quality than the ADPCM method. Note: the data used in the 4-bit ADPCM method is not compatible with data in the 4-bit ADPCM2 method. Data conversion for these methods can be made by using the Speech Development Tool AR207.

This is OKI's further development of OkiADPCM achieving improved sound quality due to higher internal computation accuracy and more quantization steps. Oki ADPCM2 is capable of compressing down to 4, 5, 6, 7 or 8 bits per sample, hence offering a rich selection of bit-rates with various audio quality levels and memory requirements.

What is the advantage of the 8- or 16-bit straight PCM method?

This method has the highest sound reproduction characteristics in all frequencies (of 4-, 5-, 6-, 7-bit PCM methods). This method is suitable for sound effects having high frequencies and pulse-like waveforms.

What is the advantage of the 8-bit non-linear PCM voice synthesis method?

This method (OkiPCM) emphasizes the value of the center of each sound wave and processes it with 10-bit perceived accuracy. It is effective in improving the tone quality of frequency low voices and sounds.

Unlike conventional linear PCM, OkiPCM offers non-linear characteristics achieving a quality that is comparable with 10-bit linear resolution, however, with only 8-bit data. It varies the bit resolution between 6 and 10-bit in dependency of the waveform's upper and lower amplitude, 6-bit for large, 8-bit for medium and 10-bit for small values.



● **Oki Electric Industry Co., Ltd.**

Silicon Solutions Company
10-3, Shibaura, 4-chome
Minato-ku, Tokyo 108
Japan
Tel.: +81-(0)3-5445-6327
Fax.: +81-(0)3-5445-6328
<http://www.okisemi.com>

● **OKI Electric Europe GmbH**

Head Office Europe
Hellersbergstrasse 2
D-41460 Neuss
Germany
Tel: +49-(0)2131-15960
Fax: +49-(0)2131-103539
<http://www.okisemi.com/eu>

● **OKI Electric Europe GmbH**

Vertriebsbüro München
Aidenbachstr. 142
D-81479 München
Germany
Tel: +49-(0)89-7488650
Fax: +49-(0)89-782913

● **OKI Semiconductor (UK) Ltd.**

3 Etongate
112 Windsor Road
Slough/Berkshire SL1 2JA
Great Britain
Tel.: +44-(0)1753-787700
Fax: +44-(0)1753-517195
E-Mail: oki-uk@oki.com

● **Oki (France) sarl**

148 Rue de Chevilly
F-94240 L'Hay Les Roses
France
Tel.: +33-(0)1-45600328
Fax: +33-(0)1-49780958
E-Mail: oki-france@oki.com

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