

AMFRA3009

Single-Chip Voice Recording & Playback Device for Single 20 to 30 Second Message

Features

- ◆ Single-chip, high quality voice recording & playback solution
 - No external ICs required
 - Minimum external components
- ◆ Non-volatile Flash memory technology
 - No battery backup required
 - 100K record cycles (typical)
 - 100-year message retention (typical)
- ◆ Single message of 20 to 30 seconds, with external resistor selection
- ◆ User-friendly, easy-to-use operation
 - Programming & development systems not required
 - Level-activated recording & edge-activated playback switches
- ◆ Low power consumption
 - Operating current: 25mA (typical, no load)
 - Standby current: 1uA (typical, no load)
- ◆ Automatic power-down feature for longer battery life
- ◆ Chip enable pin for simple message expansion
- ◆ Single 5V power supply

General Description

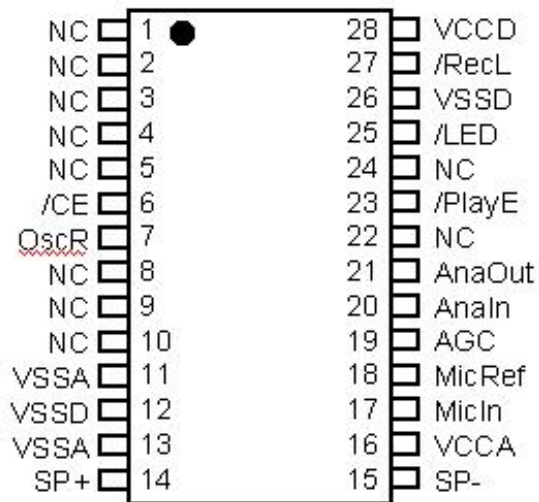
The AMFRA3009 device offers true single-chip solid-state storage capability and requires no software or microcontroller support. It provides high-quality recording and playback with a single 20- to 30-second message. It is ideal for portable voice recorders, toys, and many other consumer and industrial applications.

Alpha's proprietary analog/multi-level storage technology is implemented in advanced Flash non-volatile memory cells, each of which can typically store more than 256 voltage levels. The AMFRA3009 device stores and reproduces voice signals in their natural forms, eliminating distortion that is often introduced by encoding and compression. The device combines a small size with low power consumption, non-volatility, and ease-of-use for a cost effective solution to voice recording and playback

Pinout Diagram

Figure 1 shows the pinouts for the AMFRA3009

Figure 1 AMFRA3009 Pinout Diagram*

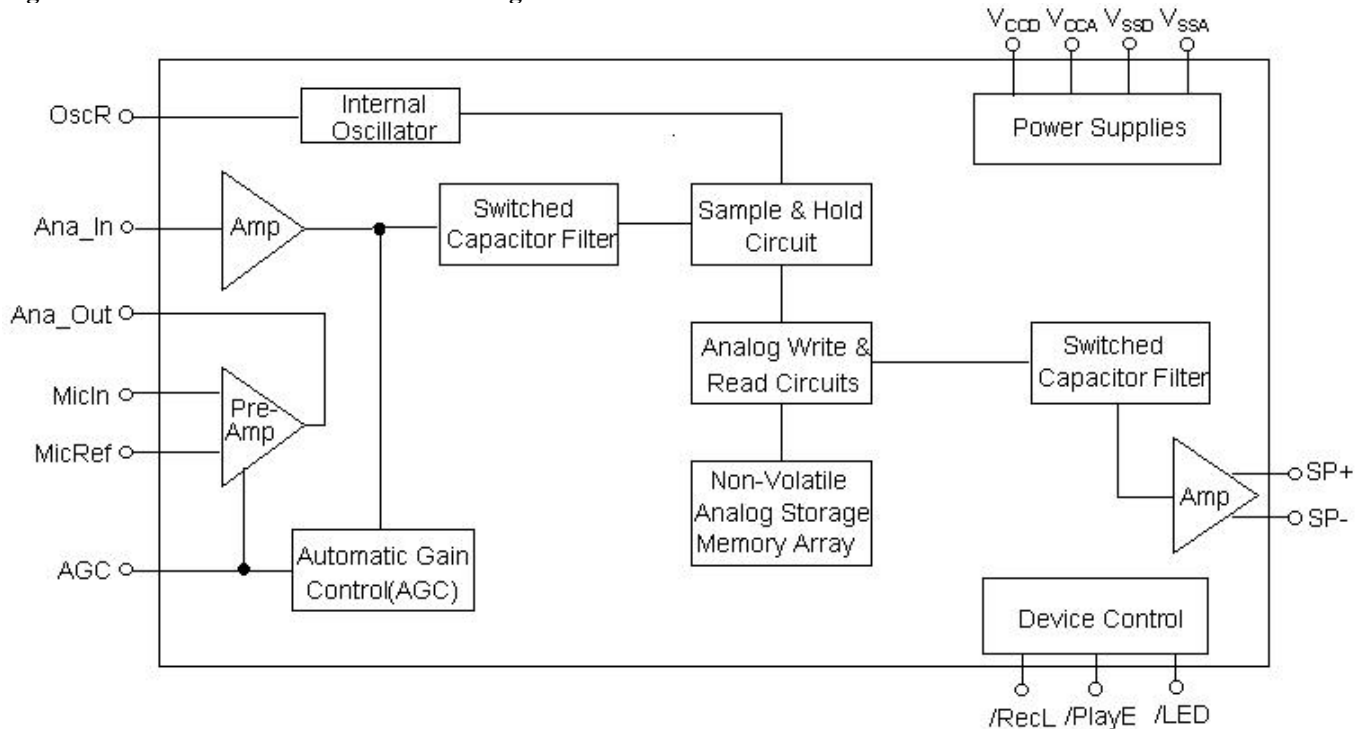


*NC=No Connect (must be floating)

Functional Block Diagram

Figure 2 shows the functional block diagram for the AMFRA3009 device.

Figure 2 AMFRA3009 Functional Block Diagram



Sample Application

Figure 3 shows the diagram for a single, 20-second message recording and playback application using the AMFRA3009 device. When pins are connected as shown in this example, the operating modes are as follows:

Record Mode (Level-Activated)

A single voice message of up to 20 seconds can be recorded. The /LED pin will go low during the actual recording process to provide a visual indication if an LED light is connected to this pin. The chip is in record mode as long as the /RecL pin stays low (level-activated). If the message lasts longer than 20 seconds, recording will terminate automatically after the last available memory cell is written. If the message is shorter than 20 seconds, the recording operation will stop when the /RecL pin goes high. The speaker driver is automatically tristated during the recording operation.

Messages of up to 30 seconds can be recorded by using different OscR resistor values (see Table 1).

Playback Mode (Edge-Activated)

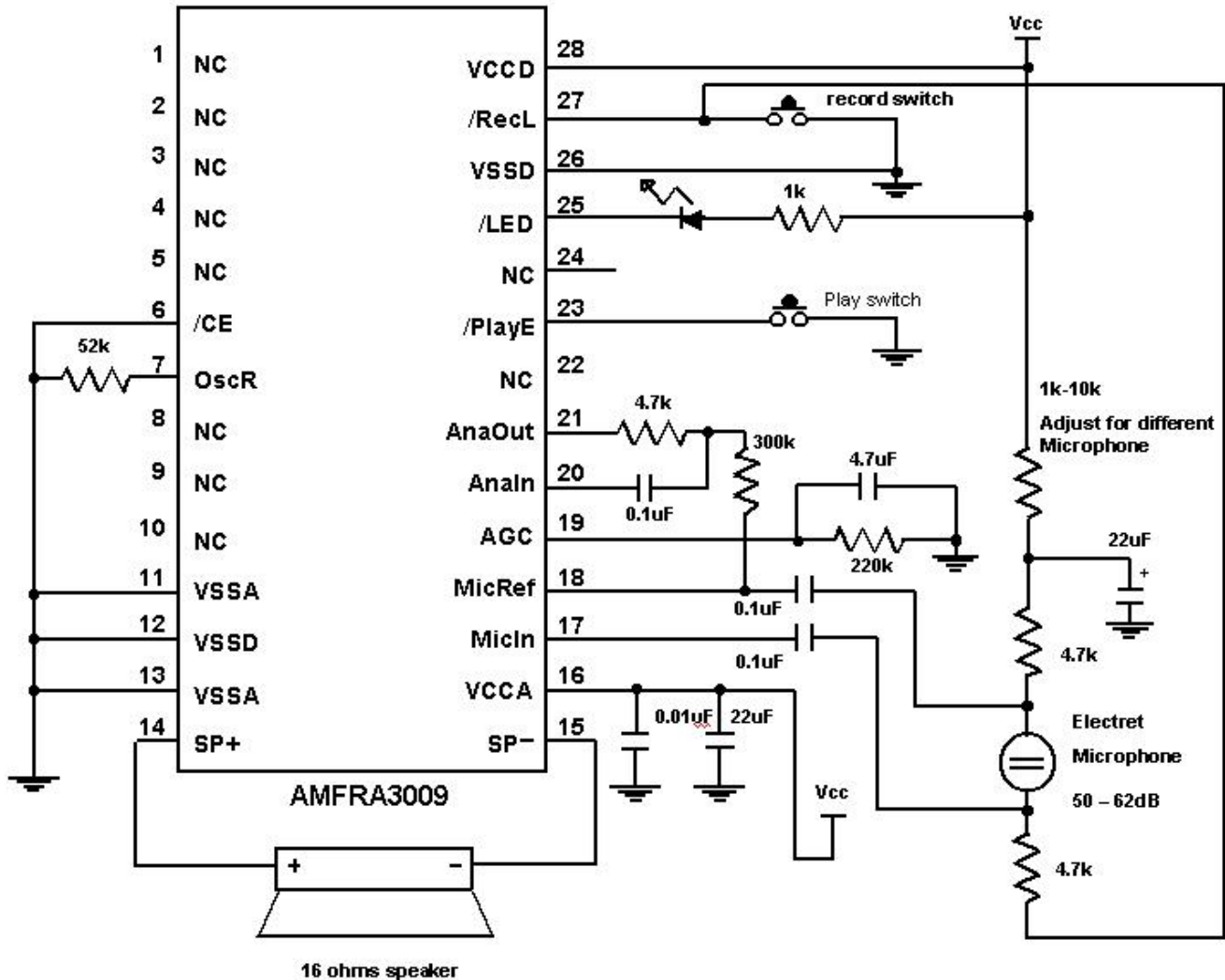
Playback always starts from the beginning of the message. The chip is in playback mode after the /PlayE pin pulses low (edge-activated). Playback will stop immediately when the /PlayE pin pulses low a second time. If the newly recorded message is shorter than the previously recorded message, the remaining portion of the previous message will not be played after the new message is played back. The input preamplifier, AGC, and main amplifier circuits are disabled during playback.

Standby Mode (/CE = "0")

The chip will automatically return to the standby state after recording or playback operation is completed.

Power Down Mode (/CE = "1")

The chip is always in standby state. No recording or playback is allowed. Current consumption is typically less than 1uA.

Figure 3 Sample Application for the AMFRA3009


NC=No Connect (must be floating)

Pins 23 and 27 have internal pull-up resistors.

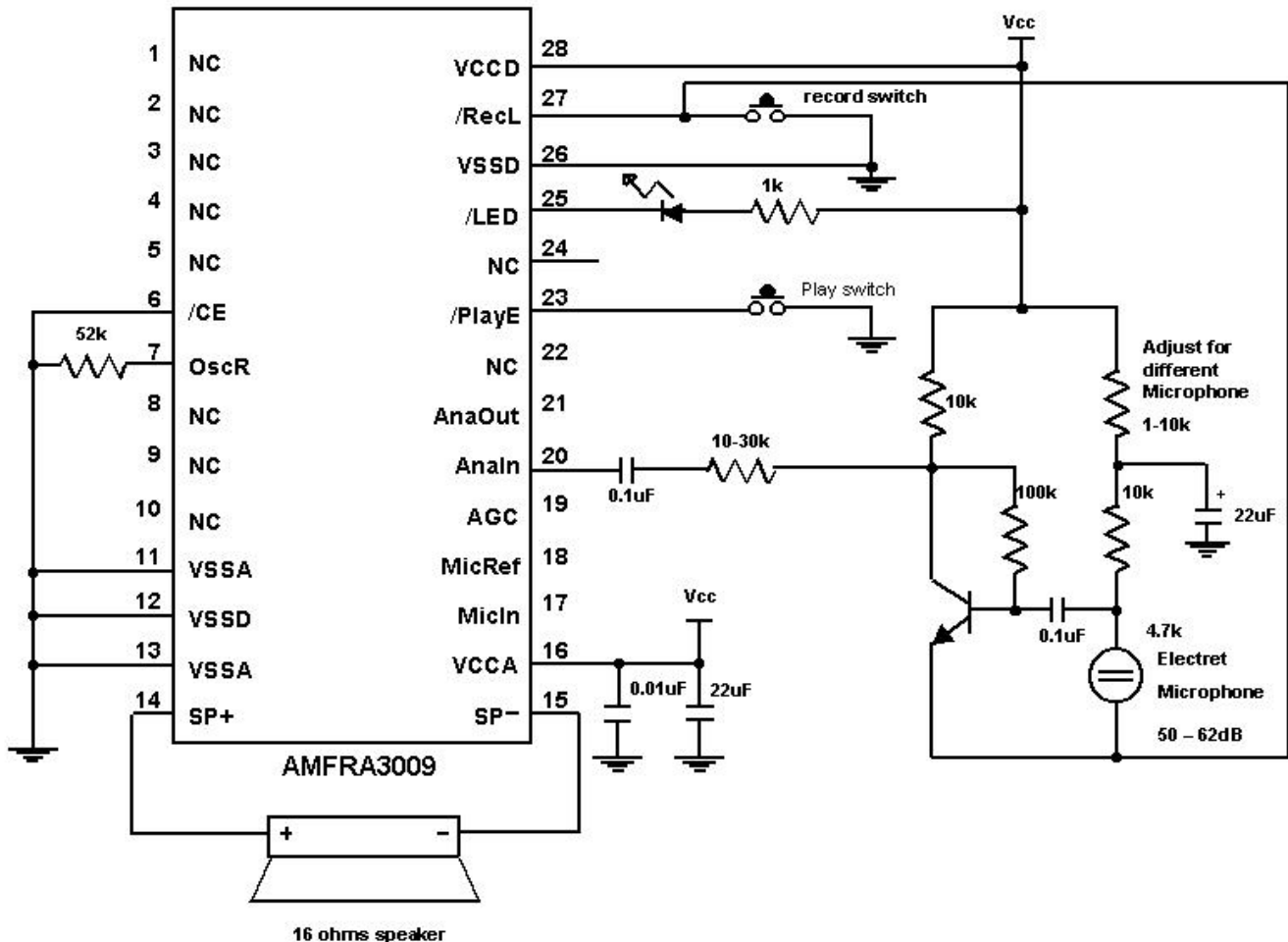
The typical sampling frequency is 6.4kHz with OscR=52k Ω

Table 1 Typical Dependence of Sampling Frequency and Total Voice Duration on OscR Resistor Value
 (VccA = VccD = 5V; VssA = VssD = 0V; TA = 25°C)

Pin 7 OscR value	Sampling Frequency Typical	Cutoff Frequency (3dB Point)	Total Voice Duration Typical	Working Voltage Range
38k Ω	8kHz	3.4kHz	16 seconds	4.5V ~ 6.5V
52k Ω	6.4kHz	2.7kHz	20 seconds	4.5V ~ 6.5V
67k Ω	5.3kHz	2.3kHz	24 seconds	4.8V ~ 6.5V
75k Ω	4.5kHz	2kHz	30 seconds	5.2V ~ 6.5V

Figure 4 shows the same application using external microphone biasing instead of the microphone amplifier on the AMFRA3009 device, thus bypassing the preamplifier portion of the chip function.

Figure 4 Sample Application Using External Microphone Biasing



Notes:

NC=No Connect (must be floating).

Pins 23 and 27 have internal pull-up resistors.

The typical sampling frequency is 6.4kHz with OscR=52k Ω

NPN bipolar transistor, T1 model #MPS3904 or equivalent.

Electrical Characteristics

Tables 2 through 4 list Absolute Maximum Ratings, Recommended DC Characteristics, and recommended Analog Characteristics for the AMFRA3009 device

Absolute Maximum Ratings

Stresses greater than those listed in Table 2 may cause permanent damage to the device. These specifications represent a stress rating only. Operation of the device at these or any other conditions above those specified in the recommended DC Characteristics or recommended Analog Characteristics of this specification is not implied. Operation of the device at maximum conditions for extended periods may affect reliability.

Table 2 Absolute Maximum Ratings.

Item	Symbol	Condition	Min	Max	Unit
Power Supply Voltage	V _{CC}	T _A = 25°C	4.5	6.5	V
Input Voltage	V _{IN1}	T _A = 25°C	-0.3	V _{CC} + 0.3	V
Input Voltage	V _{IN2}	I _{IN} < 20 mA	-1.0	V _{CC} + 1.0	V
Storage Temperature	T _{STG}	-	-65	150	°C
Temperature Under Bias	T _{BS}	-	-65	125	°C
Lead Temperature	T _{LD}	< 10s	-	300	°C

Table 3 DC Characteristics ^{Note 1}

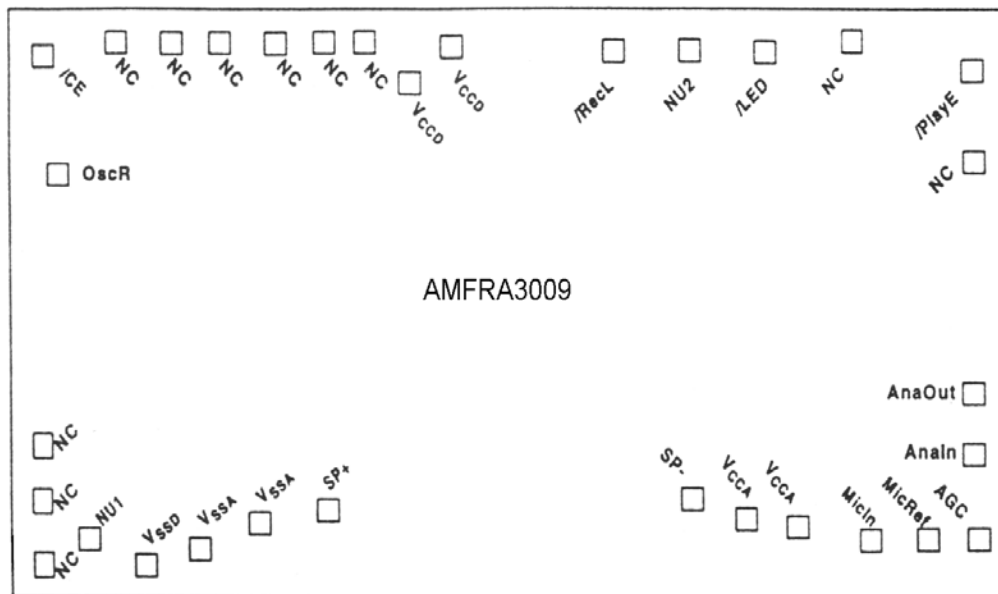
Item	Symbol	Condition	Mm	Typ	Max	Unit
Input High Voltage	V _{IH}	-	0.8 x V _{CC}	-	-	V
Input Low Voltage	V _{IL}	-	-	-	0.8	V
Output High Voltage	V _{OH}	I _{OL} = -1 .6mA	2.4	-	-	V
Output Low Voltage	V _{OL}	I _{OL} = 4.0mA	-	-	0.45	V
Input Leakage Current	I _{IH}	V _{IH} = V _{CC}	-	-	1.0	uA
Input Leakage Current	I _{IL}	V _{IL} = V _{SS} ^{Note 2}	-1.0	-	-	uA
Output Tristate Leakage Current	I _{OZ}	V _{OUT} = V _{CC} or V _{OUT} = V _{SS}	-1.0	-	1.0	uA
Operating Current Consumption	I _{CC}	Internal Clock, No Load	-	25	-	mA
Standby Current Consumption	I _{CCS}	No Load	-	1.0	-	uA

Table 4 Analog Characteristics ^{Note 1}

Item	Symbol	Condition	Mm	Typ	Max	Unit
MicIn Input Voltage	V _{MI}	-	-	-	20	mVp-p
MicIn Input Resistance	R _{MI}	-	-	10	-	kΩ
MicIn Amp Gain (1)	G _{M1}	AGC ≤ 2.2V	-	24	-	dB
MicIn Amp Gain (2)	G _{M2}	AGC ≥ 3.0V	-	-45	-15	dB
AnaIn Input Voltage	V _{ANI}	-	-	-	50	mVp-p
AnaIn Input Resistance	R _{ANI}	-	-	10	-	kΩ
AnaIn Amp Gain	G _{ANI}	AnaIn to SP+/-	-	22	-	dB
AGC Output Resistance	R _{AGC}	-	-	1	-	kΩ
SP+/- Output Power	P _{SP}	R _{SP} +/- = 16Ω	-	12.2	-	mW
Voltage Amplitude Across SP+/-	V _{SP}	R _{SP} +/- ≥ 16Ω	-	1.25	-	Vp-p
Total Harmonic Distortion	THD	@ 1kHz & 20mVp-p input	-	1	-	%

Note 1: Typical Values: V_{CCD} = V_{CCA} = 5V; V_{SSD} = V_{SSA} = 0V; T_A = 25°C

Note 2: Except pins 23 and 27 which have internal pull-up resistors.

Bonding Pad Diagram & Description of Bonding Pad Coordinates
Figure 5 AMFRA3009 Die Bonding Pad Diagram

Notes:

Die diagram is with respect to die center(um)

Die Dimensions:

X=214± 1 mils(5500um)

Y=144± 1 mils(3750um)

Die Thickness:

13.8± 1.0 mils

(350± 25um)

Pad Opening:

4.3mils

110um

*** Connect substrate to ground.**

Table 5 AMFRA3009 Bonding Pad Coordinates

Pin	Pin Name	X Axis ^(Note)	Y Axis ^(Note)
/CE	Chip Enable	-2496.20	1565.80
OscR	Oscillator Frequency-Setting Resistor	-2459.55	729.80
NU1	Connect to Ground	-1808.45	-1496.10
VSSD	Digital Ground Supply	-1564.05	-1572.00
VSSA	Analog Ground Supply	-1384.05	-1548.70
VSSA	Analog Ground Supply	-1204.35	-1477.10
SP+	Non-Inverting Speaker Output	-707.15	-1390.00
SP-	Inverting Speaker Output	479.15	-1389.90
VCCA	Analog Power Supply	976.45	-1492.00
VCCA	Analog Power Supply	1190.40	-1523.70
MinIn	Microphone Input	1619.45	-1551.40
MicRef	Microphone Reference Input	2035.45	-1551.40
AGC	Automatic Gain Control	2487.45	-1551.40
AnaIn	Analog Signal Input	2487.45	-1049.90
AnaOut	Analog Signal Output	2487.45	-648.90
/PlayE	Edge-Activated Playback	2493.65	1371.10
/LED	LED Output	1430.70	1565.80
NU2	Connect to Ground	865.75	1565.80
/RecL	Level-Activated Record	258.15	1565.80
VCCD	Digital Power Supply	-229.40	1579.05
VCCD	Digital Power Supply	-510.80	1541.60

Note: With respect to die center(um)