# SINGLE-CHIP VOICE RECORD / PLAYBACK DEVICES

## 1. GENERAL DESCRIPTION

GPCR20A is a highly integrated circuit that contains all of the necessary functions for providing high quality voice recording and playback. In order to provide the high quality voice, 4 times over sampling and 19 level digital filter technology are used to reduce the noise level. Easy-to-use, low power consumption and compact size are the tremendous features of GPCR20A. Total of 512K bits SRAM are capable of storing approximately 20 seconds of audio or speech voice (@ 6KHz sampling rate). PWM speaker driver offers the simplest output solution for users. Furthermore, the wide operating power supply (2.4V - 5.5V) provides various battery options to select. The development team of GPCR20A designs especially for compact message recorder, recordable toys and other similar products. It is welling to provide the best cost/performance ratio for users.

## 2. FEATURES

- Nature, high-quality playback suitable for voice, music, and tones.
- Single-chip voice record and playback device.
- Microphone differential input and preamplifier output
- Low pass amplifier input
- Automatic gain control
- PWM speaker driver
- Built in 128Kx4bits SRAM, address space (0-1FFFF)
- Wide operating voltage range: 2.4V - 5.5V
- Frequency of playing and recording: 4K - 10KHz
- 20 sec recording time @ 6.0KHz
- One voice box with 20 sec or 2 voice boxes with10 sec (Bonding option select one or two voice box)
- Edge or level-hold recording trigger (Bonding option select edge or level trigger)
- Prompt beep sound (Bonding option select beep or not)
- LEDs indication for recording starting and ending or playing starting and ending.
- Edge trigger for playback triggers.
- Auto-playback function after ending of recording (Bonding option select auto-playback or not).

## 3. SIGNAL DESCRIPTIONS

| Mnemonic | PIN No. | Type | Description |
|---|---|---|---|
| ROSC | 10 | I | The "ROSC" pin connects with an external resistor to VDD. To cooperate with a variable resistor, the frequency for recording and playing are adjustable to fulfill user's specifications. |
| $\overline{\text{REC0}}$ | 20 | I | The record-request pin for one voice box (20 sec) or the 1'st box of al 2 boxes (10 sec for each). $\overline{\text{REC0}}$ with pull high resistor, is active in low and start recording to 1'st voice box |
| $\overline{\text{REC1}}$ | 21 | I | $\overline{\text{REC1}}$, The record-request pin for the 2'nd box of 2 boxes (10 sec for each). $\overline{\text{REC1}}$ with pull high resistor, is active in low and start recording to 2'nd voice box. |
| $\overline{\text{PLAY0}}$ | 18 | I | $\overline{\text{PLAY0}}$ The play-request pin for one voice box (20 sec) or the 1'st box of 2 boxes (10 sec for each). $\overline{\text{PLAY0}}$ with pull high resistor, is active in low and start playing from 1'st voice box |
| $\overline{\text{PLAY1}}$ | 19 | I | $\overline{\text{PLAY1}}$, The play-request pin for the 2'nd box of total 2 boxes (10 sec for each). $\overline{\text{PLAY1}}$ With pull high resistor, is active in low and start playing from 2'nd voice box |
| MICP | 2 | I | Microphone differential positive input |
| MICN | 3 | I | Microphone differential negative input |
| AGC | 5 | I | Automatic gain control input |
| MICOUT | 4 | O | Analog output of MIC preamplifier |
| ADIP | 6 | I | Analog input of low pass filter |
| $\overline{\text{REC\_BUSY}}$ | 17 | O | The state of this pin will be low while recording. |
| AUDP | 23 | O | PWM driver positive output |
| AUDN | 24 | O | PWM driver negative output |
| PVDD, PVSS | 22, 25 | Power | PWM power and ground |
| AVDD, AVSS | 8, 1 | Power | Analog power and ground |
| VDD, VSS | 13, 11 | Power | Digital power and ground |
| $\overline{\text{PLAY\_BUSY}}$ | 16 | O | The state of this pin is low while playing. |
| KEY_OPT (*1) | 7 | I | Bounding option for select one voice box or two voice boxes |
| EDGE_OPT (*2) | 12 | I | Bounding option for KEY is active in level trigger or edge trigger |
| AUTO_OPT (*3) | 7 | I | Bounding option for REC KEY auto-play-back function when record is finished. |
| BEEP_OPT (*4) | 9 | I | Bounding option for BEEP sound is enable or disable |
| TEST | 15 | I | TEST pin active high is in test mode |

(*1) KEY_OPT: Bounding option for select one voice box or two voice boxes,
IF KEY_OPT = 0 ➔ One voice box mode 512K.
IF KEY_OPT = 1 ➔ Two voice box mode 256K for each.
Default setting is 0

(*2) EDGE_OPT: Bounding option for REC KEY auto-play-back function when record is finished.
IF EDGE_OPT = 0 ➔ level trigger.
IF EDGE_OPT = 1 ➔ edge trigger.
Default setting is 0

(*3) AUTO_OPT: Bounding option for REC KEY auto-play-back function when record is finished.
IF AUTO_OPT = 0 ➔ No auto play when record is finished.
IF AUTO_OPT = 1 ➔ Auto play when record is finished.
Default setting is 0

(*4) BEEP_OPT: Bounding option for BEEP sound is enable or disable.
IF BEEP_OPT = 0 ➔ No beep mode.
IF BEEP_OPT = 1 ➔ Beep mode
Default setting is 0

If there's no bounding option selected, the default setting will be kept low.

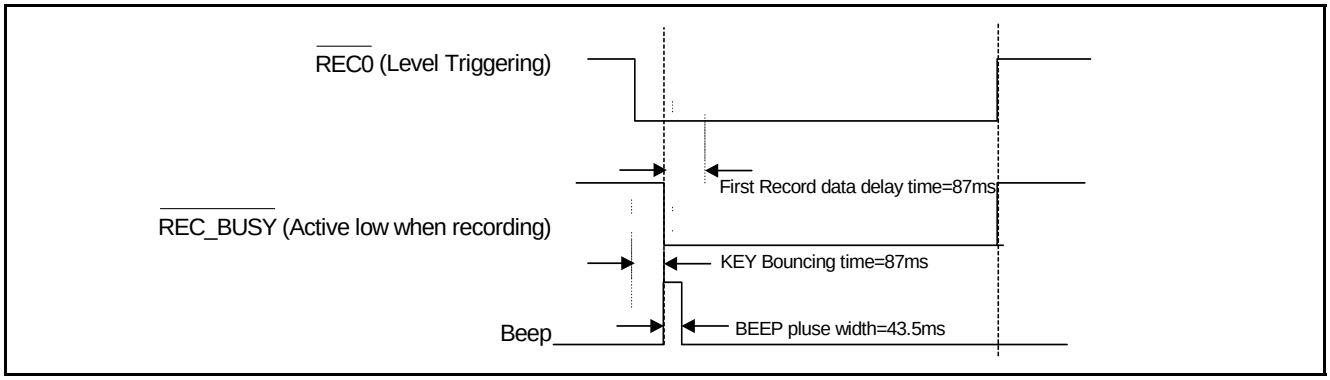
## 4. FUNCTIONAL DESCRIPTIONS

EDGE_OPT is low (level trigger mode)

KEY_OPT is low (one voice box mode)

AUTO_OPT is low (no auto play when rec is finished)

BEEP_OPT is high (beep mode)




Explain: GPCR20A in level trigger mode, when REC0 is pressed, REC0 is active at low voltage.

Bouncing after KEY_ bouncing time (87ms), a BEEP sound is played.

Waiting delay time (87ms), GPCR20A start recording.

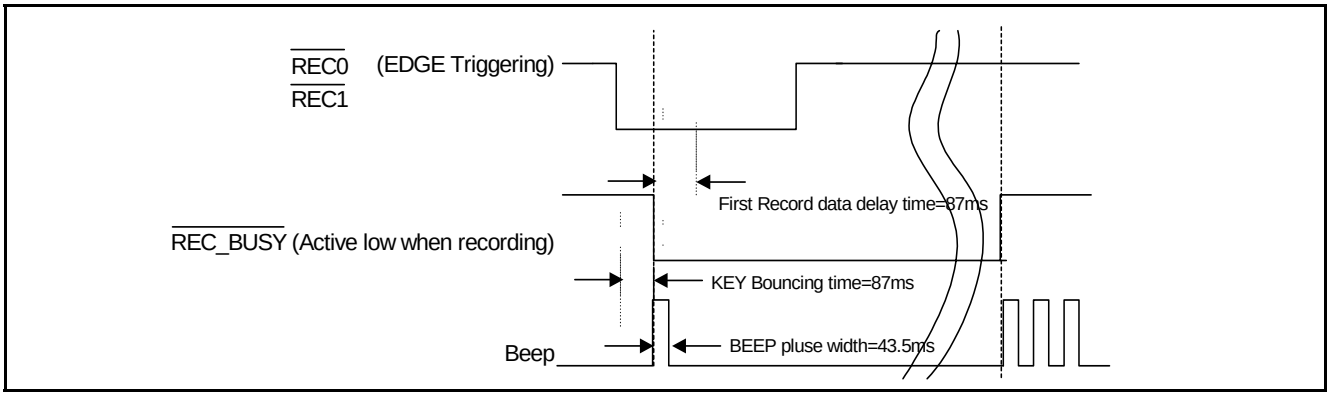
When REC0 is released, REC0 is not active, GPCR20A stop recording.

EDGE_OPT is high (edge trigger mode)

KEY_OPT is high (two voice box mode)

AUTO_OPT is low (no auto play when rec is finished)

BEEP_OPT is high (beep mode)

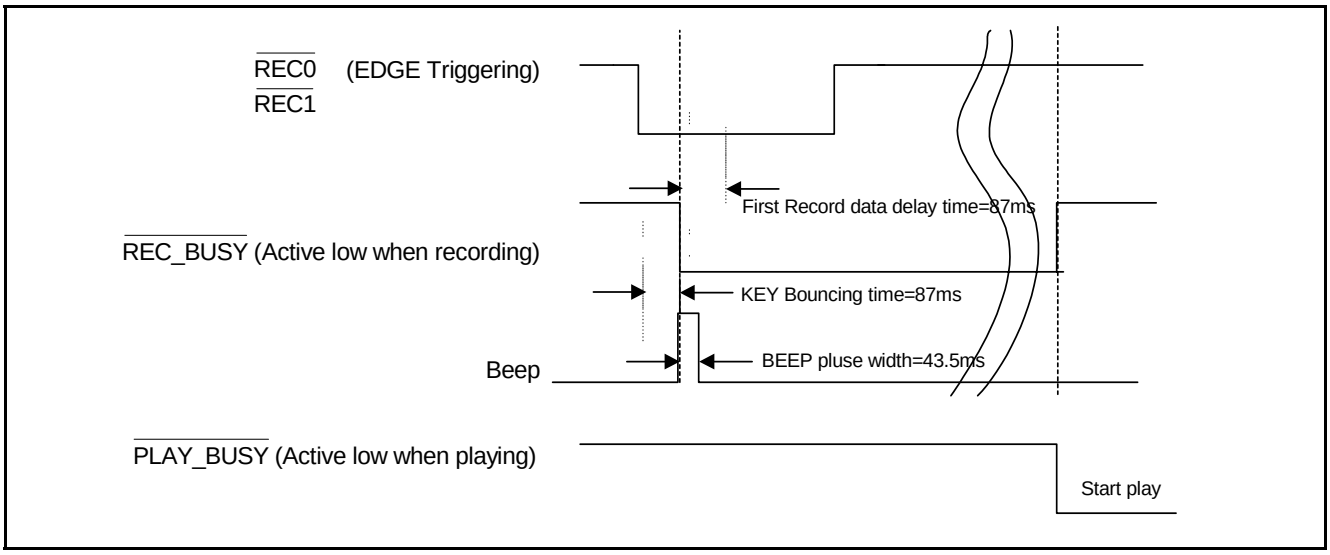



Explain: GPCR20A in edge trigger mode, when REC0 is pressed, REC0 B is active at low voltage.

Bouncing after KEY_ bouncing time (87ms), a BEEP sound is played.

Waiting delay time (87ms), GPCR20A start recording.

When REC0 is released, GPCR20A continue to record until sound data in voice box is full.




Explain: GPCR20A in edge trigger and auto-playback mode,

REC0 is pressed; REC0 is active at low voltage.

After KEY_ bouncing time (87ms), a BEEP sound is played.

Waiting delay time (87ms), GPCR20A start recording.

REC0 is released, GPCR20A continue to record until sound data in voice box is full.

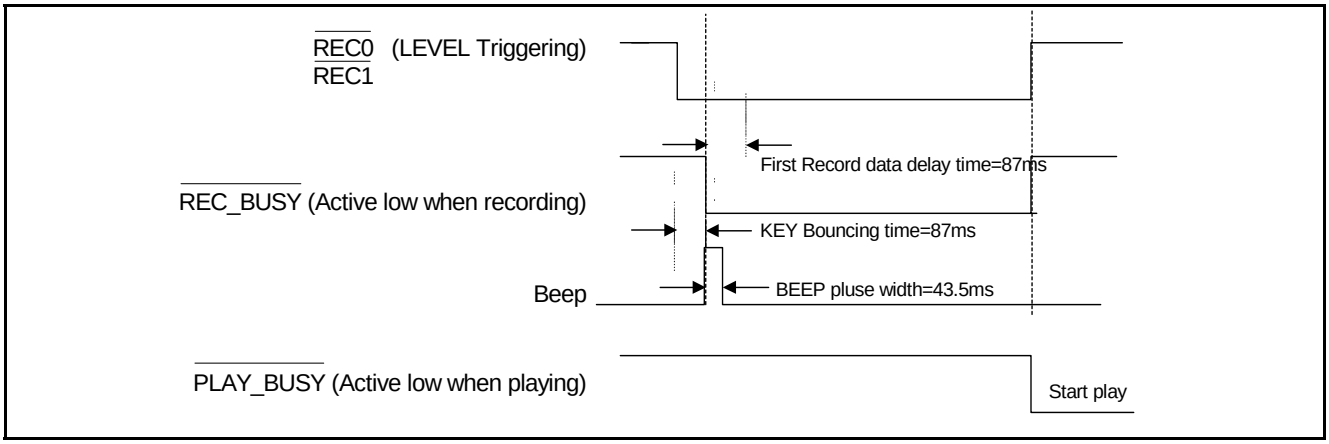
Then GPCR20A start to play-back sound recorded in 1'st voice box.

EDGE_OPT is low (level trigger mode)

KEY_OPT is high (two voice box mode)

AUTO_OPT is high (auto play mode)

BEEP_OPT is high (beep mode)




Explain: GPCR20A in level trigger and auto-playback mode,

REC0 is pressed, REC0 is active at low voltage.

After KEY_ bouncing time (87ms), a BEEP sound is played.

Waiting delay time (87ms), GPCR20A start recording.

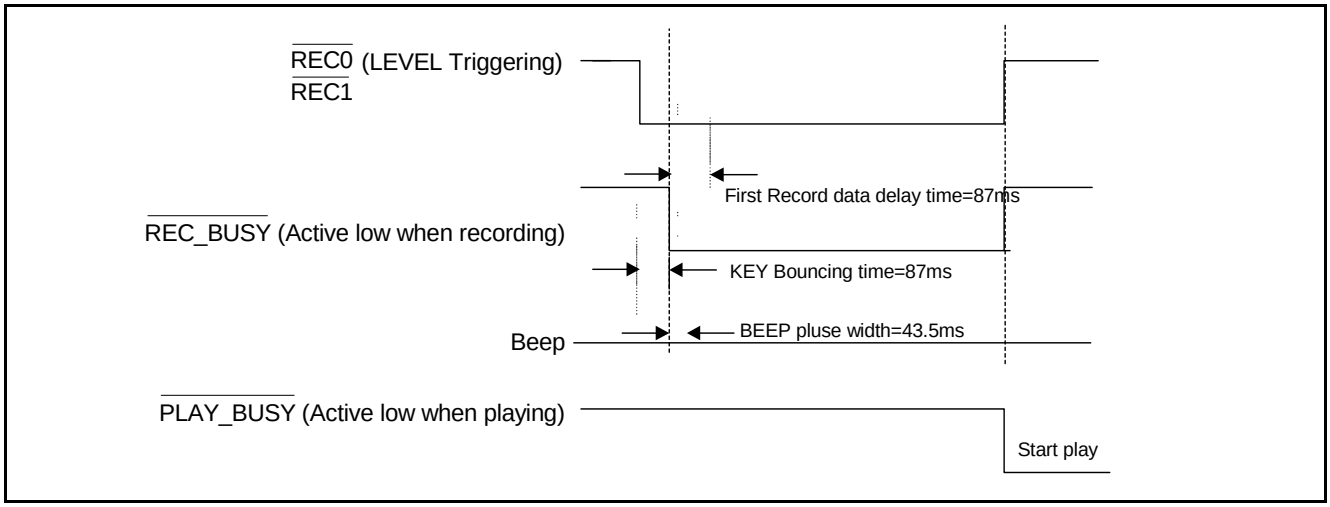
REC0 is released, GPCR20A start to play-back sound recorded in 1'st voice box.

EDGE_OPT is low (level trigger mode)

KEY_OPT is high (two voice box mode)

AUTO_OPT is high (auto play mode)

BEEP_OPT is low (no mode)




Explain: GPCR20A in level trigger, auto-playback mode and NO beep mode,

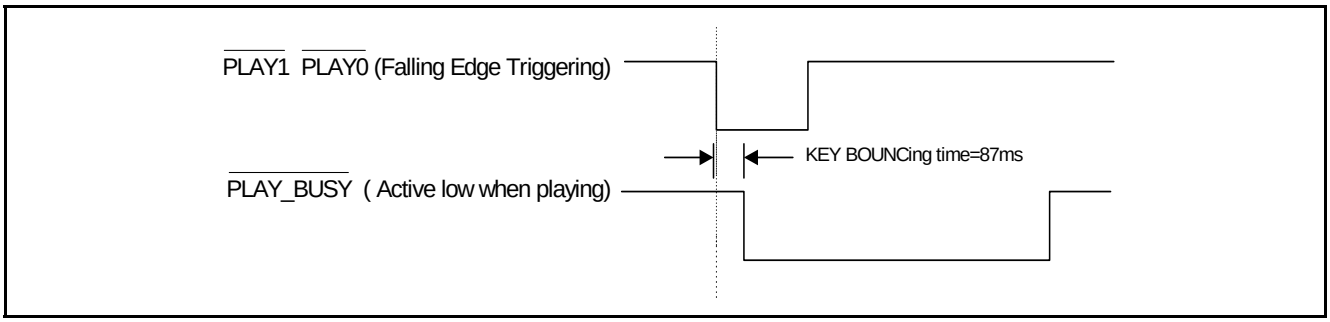
REC0 is pressed; REC0 is active at low voltage.

After KEY_ bouncing time (87ms), none BEEP sound is played.

Waiting delay time (87ms), GPCR20A start recording.

REC0 is released, GPCR20A start to play-back sound recorded in 1'st voice box.

KEY_OPT is high (two voice box mode)



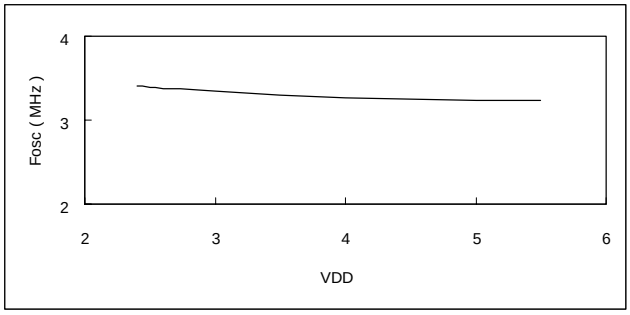

Explain: PLAY0 is pressed; PLAY0 is active at low voltage.

After KEY_ bouncing time (87ms), GPCR20A start to play sound recorded in 1'st voice box.

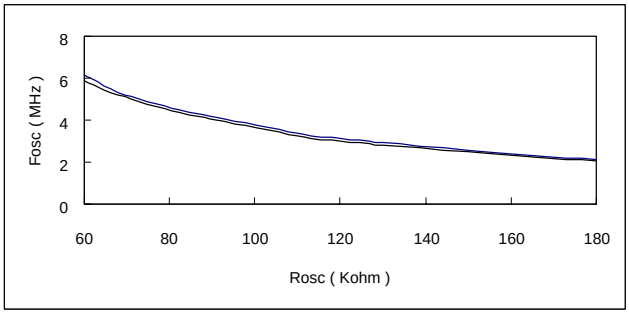
## 5. ELECTRICAL SPECIFICATIONS

| Characteristics | Symbol | Limit | | | Unit | Test condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Operating Temperature | TEMP | -10 | 25 | 70 | ℃ | - |
| Operating Voltage | VDD | 2.4 | - | 5.5 | V | Temperature = 25°C |
| Operating Current | $I_{CC1}$ | - | 60 | - | mA | No load, VDD = 3.0V |
| | $I_{CC2}$ | - | - | 120 | | 8Ω Speaker, VDD = 3.0V |
| Standby Current | $I_{SB}$ | - | 1.0 | 10 | μA | VDD = 3.0V |
| Input High Voltage | $V_{IH}$ | 0.7 x VDD | - | VDD | V | - |
| Input Low Voltage | $V_{IL}$ | VSS | - | 0.2 x VDD | V | - |
| Input pull high Resistor | $R_I$ | | 300 | - | KΩ | VDD = 3.0V |
| Output High Voltage | $V_{OH}$ | 2.6 | - | - | V | VDD = 3.0V, $I_{OH}$ = 2mA |
| Output Low Voltage | $V_{OL}$ | - | - | 0.4 | V | VDD = 3.0V, $I_{OL}$ = -4mA |
| Sample Rate | $F_S$ | 4.0K | 6.0K | 10K | Sa/Sec | VDD = 3.0V |
| Current of high voltage | $I_{OH}$ | - | 2.0 | - | mA | VDD = 3.0V |
| Current of low voltage | $I_{OL}$ | - | -4.0 | - | mA | VDD = 3.0V |
| Oscillation Resistor | $R_{OSC}$ | 180K | 110K | 62K | Ω | VDD = 3.0V |

### 5.1. The Relationship of $F_{OSC}$ vs VDD @ $R_{OSC}$ = 110KΩ




### 5.2. The Relationship of $F_{OSC}$ vs. $R_{OSC}$

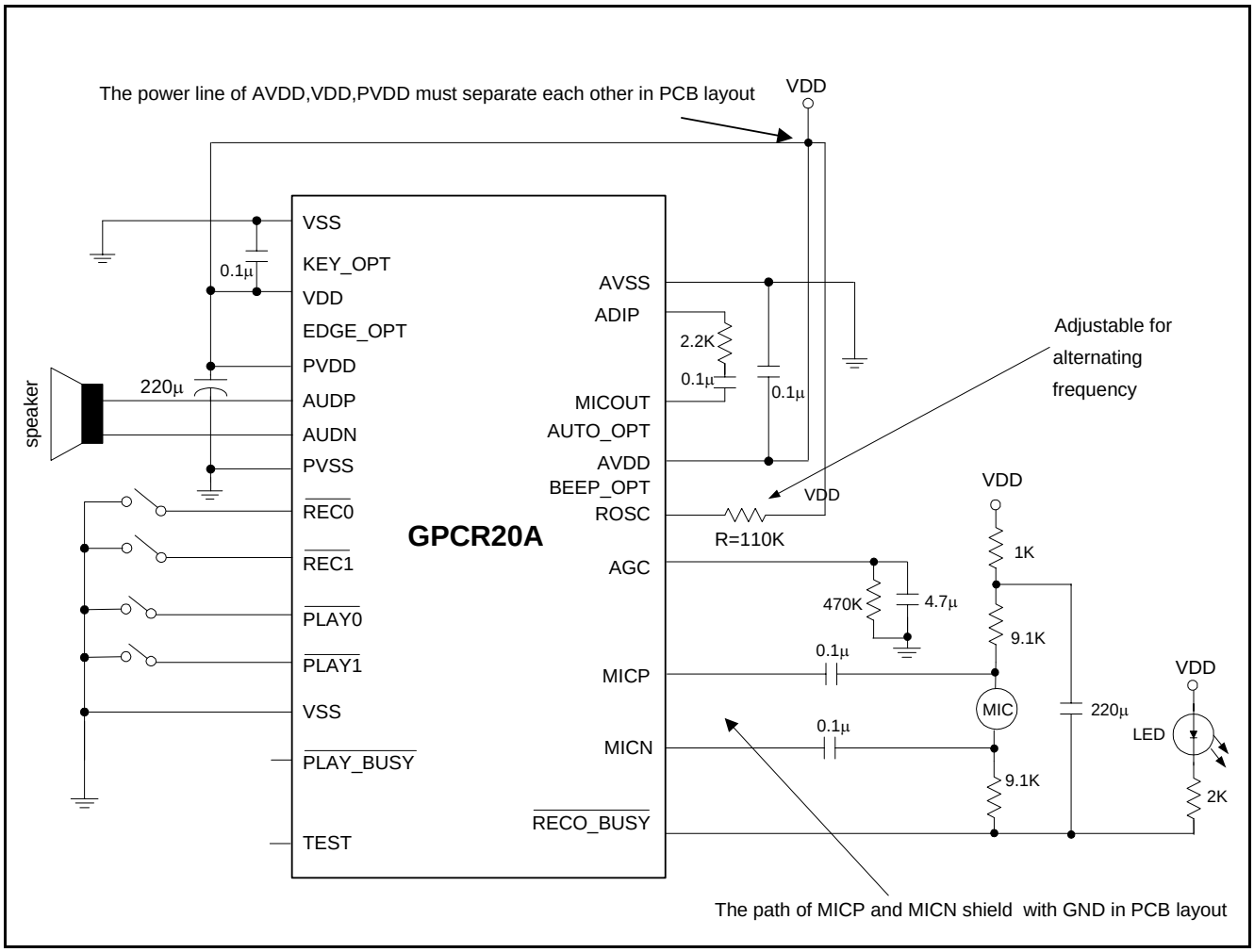


## 6. APPLICATION CIRCUITS

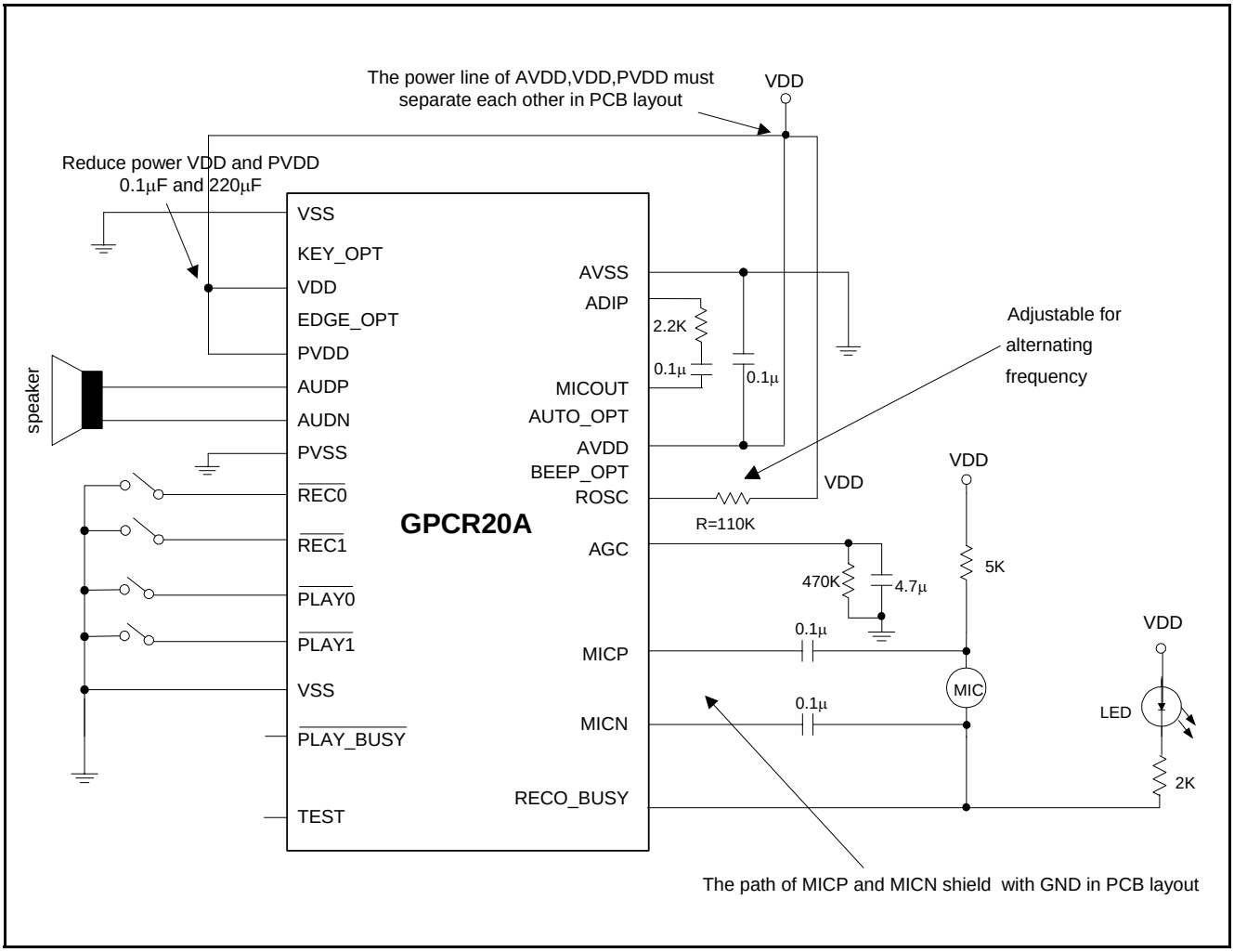
The system is capable of recording as long as the $\overline{\text{RECx}}$ switch is being pressed (level triggering or edge trigger). The recorded message or audio can be played back when the $\overline{\text{PLAYx}}$ switch is pressed (falling edge triggering). When system is recording, the LED light from RELED will be on until the end of recording.

$\overline{\text{RECx}}$ : $\overline{\text{REC0}}$ or $\overline{\text{REC1}}$
$\overline{\text{PLAYx}}$ : $\overline{\text{PLAY0}}$ or $\overline{\text{PLAY1}}$

### 6.1. Best Quality



### 6.2. Best Cost (Reduce Component)

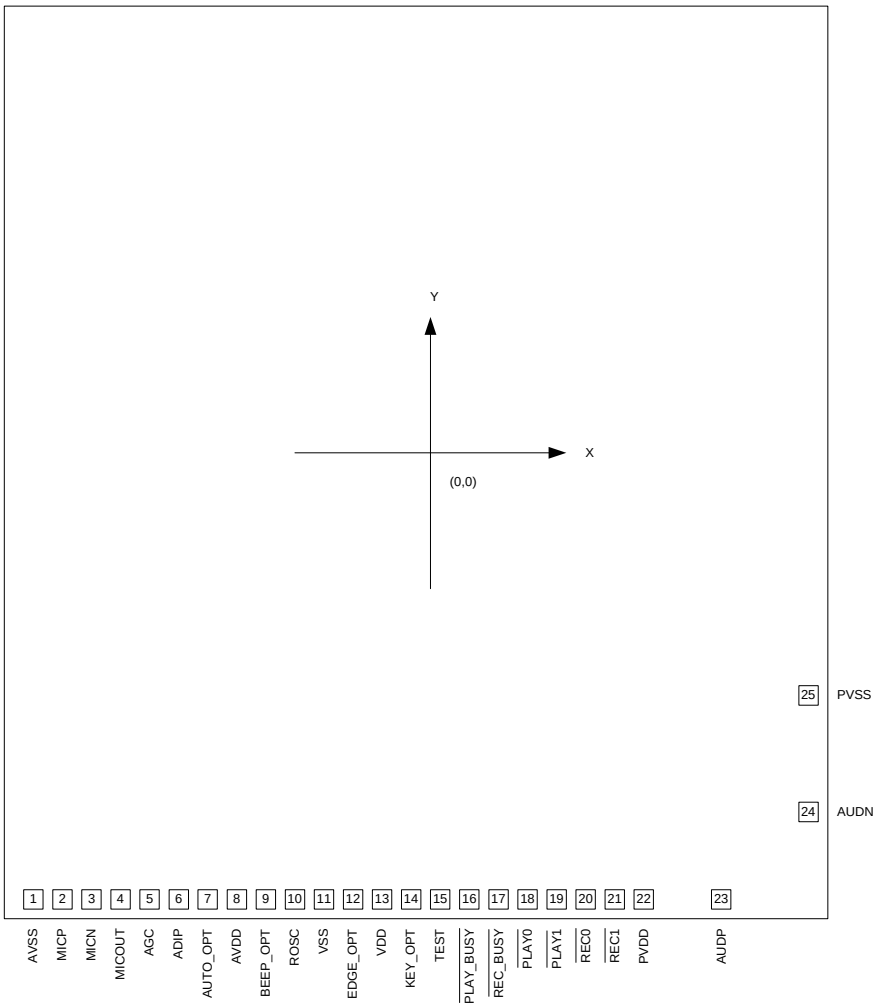



**PCB Layout Note:**

1) The path of MICP and MICN shield with GND (reduce noise comes from MIC)
2) The power line of AVDD, VDD, PVDD, ROSC must separate each other. (Reduce noise comes from Power line)
3) The ground line of AVSS, VSS, PVSS must separate each other. (Reduce noise comes from Ground)

## 7. PACKAGE/PAD LOCATIONS

### 7.1. PAD Assignment




This IC substrate should be connected to VDD

**Note1:** Chip size included scribe line.
**Note2:** To ensure that the IC functions properly, please bond all of VDD and VSS pins.
**Note3:** The 0.1μF capacitor between VDD and VSS should be placed to IC as close as possible.

### 7.2. Ordering Information

| Product number | Package type |
|---|---|
| GPCR20A - C | Chip form |

### 7.3. PAD Locations

| PAD No. | PAD Name | X | Y |
|---|---|---|---|
| 1 | AVSS | -1558 | -1873 |
| 2 | MICP | -1435 | -1873 |
| 3 | MICN | -1315 | -1873 |
| 4 | MICOUT | -1195 | -1873 |
| 5 | AGC | -1075 | -1873 |
| 6 | ADIP | -955 | -1873 |
| 7 | AUTO_OPT | -835 | -1873 |
| 8 | AVDD | -725 | -1873 |
| 9 | BEEP_OPT | -614 | -1873 |
| 10 | ROSC | -492 | -1873 |
| 11 | VSS | -372 | -1873 |
| 12 | EDGE_OPT | -242 | -1873 |
| 13 | VDD | -132 | -1873 |
| 14 | KEY_OPT | -22 | -1873 |
| 15 | TEST | 108 | -1873 |
| 16 | $\overline{\text{PLAY\_BUSY}}$ | 228 | -1873 |
| 17 | $\overline{\text{REC\_BUSY}}$ | 348 | -1873 |
| 18 | $\overline{\text{PLAY0}}$ | 468 | -1873 |
| 19 | $\overline{\text{PLAY1}}$ | 588 | -1873 |
| 20 | $\overline{\text{REC0}}$ | 708 | -1873 |
| 21 | $\overline{\text{REC1}}$ | 828 | -1873 |
| 22 | PVDD | 948 | -1873 |
| 23 | AUDP | 1218 | -1865 |
| 24 | AUDN | 1515 | -1625 |
| 25 | PVSS | 1521 | -1208 |

## 8. DISCLAIMER

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## 9. REVISION HISTORY

| Date | Revision # | Description | Page |
|---|---|---|---|
| MAR. 03, 2005 | 1.1 | Remove Chip Size | 9 |
| JUN. 07, 2004 | 1.0 | Original<br>Note: The GPCR20A data sheet v1.0 is a continued version of SPCR20A data sheet v0.3. | 12 |