

Data Sheet of RTC6215N FM Tuner

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Revision History

| Version | Content | Effective Date |
|---------|----------------------|----------------|
| 0.1 | Initial version | 2013/3/12 |
| 0.2 | Remove I2C interface | 2013/5/10 |
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General Description

The RTC6215N is a single-chip broadcast FM stereo radio tuner with fully integrated building blocks as LNA, VCO with digital synthesizer, digital channel selection filter, digital FM demodulator and MPX decoder. The RTC6215N integrates the tuner function from antenna input to stereo audio output for worldwide European, US, Japanese and China FM bands. The FM tuner only requires a minimum amount of small and low cost external components to be a very attractive solution for portable devices. RTC6215N does not need external MCU. With a powerful audio engine, the RTC6215N is able to deliver optimum sound quality under hostile channel conditions. With internal audio amps, RTC6215N can drive 32ohm load headsets.

Features

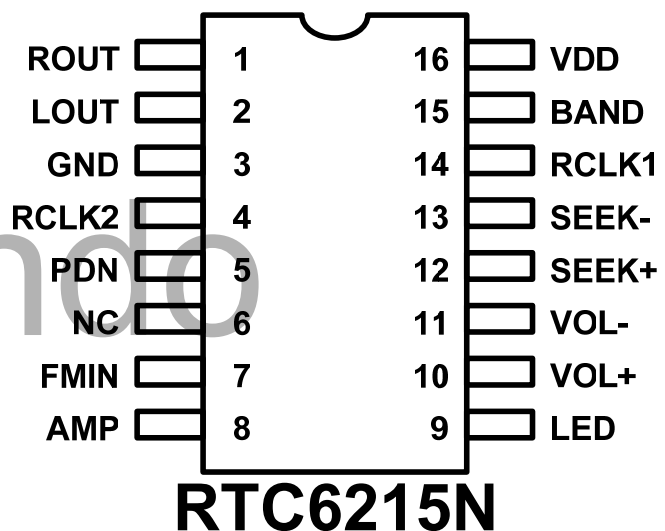
- Worldwide FM band support (64–108 MHz)
- Stand alone working without MCU
- Using push button to execute seek up/seek down function
- Using push button to execute volume control
- Using push button to turn on/off FM
- Built in audio amp for 32ohm load
- Provide one pin to turn on/off external power amp
- 32.768 kHz reference clock
- 2.0 V to 3.6 V supply voltage
- SOP16 package
- Pb-free / RoHS compliant
- Integrated crystal oscillator
- Function indicator with LED (optional)

Applications

- Portable radios
- Gift

Reference

- RTC6215N EVB User's Guide



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1. Functional Description

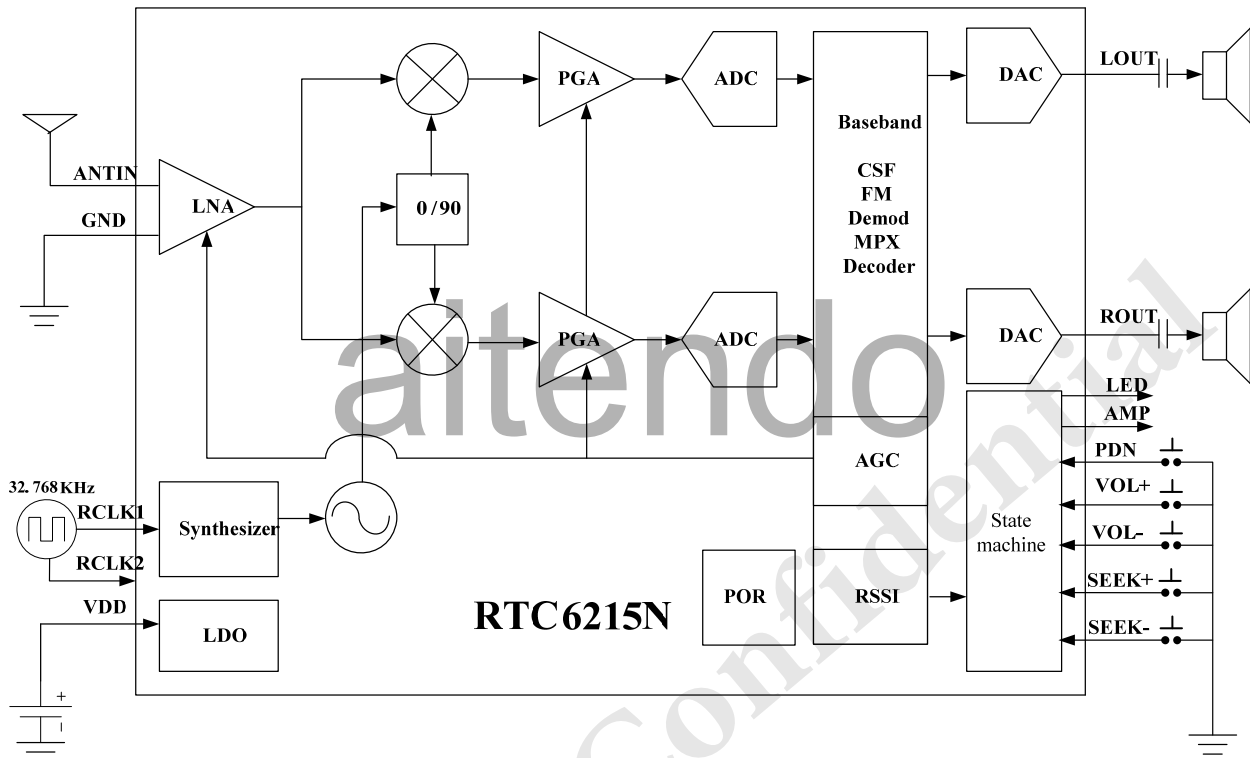


Figure 1. RTC6215N FM receiver block diagram

1.1. Overview

The RTC6215N is a monolithic FM receiver. It requires only one external bypass capacitor to minimize BOM cost and design easily for the miniature application.

With an integrated regulator, it doesn't need an external regulator, and it is allowed to directly supply 2 to 3.6 V from battery.

RTC6215N builds in a state machine to do power on/off FM, volume control and seek up/down function, no external MCU is required.

1.2. Reset

RTC6215N has no reset pin, it builds in a POR to do reset function. When VDD first applied, POR generates reset signal to reset state machine. After reset, state machine is in FM off state.

1.3. BAND select

BAND pin is used for band selection. When BAND pin is tied to GND, 87.5MHz~108MHz is selected. When BAND pin is tied to VDD, 76MHz~91MHz is selected. When BAND pin is floating, 64MHz~108MHz is selected.

1.4. Power on/off FM

When PDN pin is pull down by push button, crystal oscillator will be turned on. If PDN pull down time is less than 1 second, state machine will go back to FM off state and turn off crystal. If PDN pull down time is more than 1 second, FM will turn on and tune to a channel depending on BAND pin. If FM is set to certain channel last time before it turning off, turning on FM again will tune to that channel automatically. The volume setup will also be the same with the previous setting too.

When FM is on, you need to pull PDN down more than 1 second to turn FM off, and at the same time, current channel and volume settings will be stored.

Besides, if chip is under seeking mode, pull down PDN will stop seek function.

If short PDN to VDD, FM chips will turn on automatically when power is applied.

1.5. Volume control

When FM is off, pull down VOL+ or VOL- has no function. Pull down VOL+ or VOL- once will increase/decrease volume by one step when FM is on. However, if FM is under seeking mode, pull down VOL+ or VOL- will stop seek function. If VOL+ or VOL- pull down more than 2s, volume will be increased/decreased step by step every 250ms.

VOL+ and VOL- pull down simultaneously will be no function.

If short VOL+ and VOL- to VDD, FM chips will work in maximum volume mode when power is applied.

1.6. Seeking

When FM is off, pull down SEEK+ or SEEK- has no function. Pull down SEEK+ or SEEK- will do seek up/down function when FM is on. But if FM is under seeking mode, pull down SEEK+ or SEEK- will stop seek function. Extra pull up resistor 10Kohm is required for SEEK+ and SEEK-.

SEEK+ and SEEK- pull down simultaneously will be no function.

1.7. External audio amp control

AMP pin is designed to control external audio amp. When FM is off, AMP output level is high (VDD); when FM is on, AMP output level is low (GND).

1.8. Crystal oscillator

RCLK1 and RCLK2 is used to form 32.768K crystal oscillator circuit. When FM is off, crystal oscillator circuit will be turned off at the same time to reduce power consumption. When FM is turned on, crystal oscillator circuit will be turned on too.

1.9. LED control (Optional)

LED function is following:

1. FM off: LED is turn off.
2. FM on: LED is light up.
3. Seeking: LED blank fast.
4. Find valid channel: LED is light up.

Note: LED pin must pull down by 10K resistor, and then chip can work correctly.

2. Electrical Characteristic

Table 1. Recommended operating conditions

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT |
|----------------------|--------|-----|-----|-----|------|
| Power Supply Voltage | VDD | 2 | | 3.6 | V |
| Ambient Temperature | TA | -20 | 25 | 85 | °C |

Table 2. Absolute maximum ratings

| PARAMETER | SYMBOL | VALUE | UNIT |
|-----------------------------|--------|---------------------|-----------------|
| Power Supply Voltage | VDD | -0.5 to 3.9 | V |
| Input Current ¹ | IIN | ±10 | mA |
| Input Voltage ¹ | VIN | -0.3 to (VDD + 0.3) | V |
| Operating Temperature | TOP | -40 to 95 | °C |
| Storage Temperature | TSTG | -40 to 125 | °C |
| RF Input Level ² | | 0.4 | V _{PK} |

Notes:

- For input pins SEEK+, SEEK-, RCLK1, RCLK2, VOL+, VOL- and PDN
- At RF input pins.

Table 3. DC electrical characteristics

(VDD = 2.0 to 3.6V, TA = -20 to 85 °C)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--|--------|---------------------------|-----------|------|-----------|------|
| Power Supply Current ¹ | IVDD | Turn on FM | | 17 | | mA |
| Power Down Current ¹ | IVDD | Turn off FM | --- | 5 | 20 | uA |
| Logic High Input Voltage ² | VIH | | 0.7 x VDD | | VDD+ 0.3 | V |
| Logic Low Input Voltage ² | VIL | | | | 0.3 x VDD | V |
| Logic High Input Current ² | IHH | VIN = 3.6V VDD = 3.6 V | -10 | | +10 | uA |
| Logic Low Input Current ² | IIL | VIN = 0V VDD = 3.6 V | -10 | | +10 | uA |
| Logic High Output Voltage ³ | VOH | IOUT = 500 μA | 0.8 x VDD | | | V |
| Logic Low Output Voltage ³ | VOL | IOUT = -500 μA | | | 0.2 x VDD | V |

Notes:

- Refer to turn on/off FM
- For input pins SEEK+, SEEK-, RCLK1, RCLK2, VOL+, VOL- and PDN.
- For output pins AMP and LED

Table4. FM receiver characteristics

(VDD = 2.0 to 3.6 V, TA = -20 to 85 °C)

| PARAMETER | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---------------------------------------|--------|-----------------------------|------|------|------|----------|
| Input Frequency | | Pin15-BAND | | | | MHz |
| | | Pull-high | 76 | --- | 91 | |
| | | Pull-low | 87.5 | --- | 108 | |
| | | Float | 64 | --- | 108 | |
| Usable Sensitivity | | (S+N)/N=26dB | --- | 1.6 | 2.0 | μV EMF |
| Adjacent Channel Selectivity | | ± 200kHz | 35 | 50 | --- | dB |
| Alternate Channel Selectivity | | ± 400kHz | 50 | 60 | --- | dB |
| IIP3 | | Δf1=200 kHz, Δf2=400 kHz | --- | 91 | --- | dBuV EMF |
| IIP3 | | Δf1=400 kHz, Δf2=800 kHz | --- | 97 | --- | dBuV EMF |
| Audio Output Voltage | | Load 10KΩ 10pF | --- | 151 | --- | mVrms |
| Audio Frequency Response | | 0 to -3dB | 30 | --- | 15K | Hz |
| Audio (S+N)/N | | | 58 | 60 | --- | dB |
| Stereo Separation | | | --- | 42.3 | --- | dB |
| Audio Total Harmonic Distortion (THD) | | Stereo | --- | 0.1 | 0.5 | % |
| Power-up Time | | From Power-off to audio out | --- | 150 | --- | ms |
| Tuning/Seeking Time | | | --- | 30 | --- | ms |

3. Pin Description

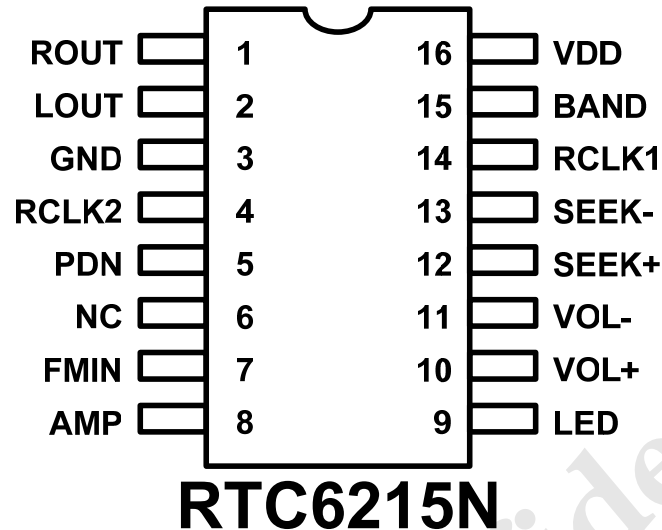


Figure 2. Top View of push-button mode

Table 5. Pin definition

| Pin Number | Name | Description |
|------------|----------------|---|
| 1 | ROUT | Right audio output |
| 2 | LOUT | Left audio output |
| 3 | GND | Ground pin |
| 4 | RCLK2 | 32.768KHz crystal loop |
| 5 | PDN | Power on/off |
| 6 | NC | No connection, keep floating |
| 7 | FMIN | FM RF input. For single-ended operation |
| 8 | AMP | External Audio AMP Control (power on: Low; power off: High), can be pull-high externally |
| 9 | LED (optional) | LED control, 3 modes: 1. When seek up/down the LED will fast blinking; 2. When getting valid FM station, LED is light up, 3. LED is turn off when FM power-down |
| 10 | VOL+ | Volume control |
| 11 | VOL- | Volume control |
| 12 | SEEK+ | Seek up, need external pull up resistor |
| 13 | SEEK- | Seek down, need external pull up resistor |
| 14 | RCLK1 | 32.768KHz crystal loop |
| 15 | BAND | BAND Selection: 1. Pull-high: 76 ~ 91MHz; 2. Pull-low: 87.5 ~ 108MHz 3. Between low to high: 64 ~ 108MHz |
| 16 | VDD | Supply voltage(2~3.6V) |

4. Package outline

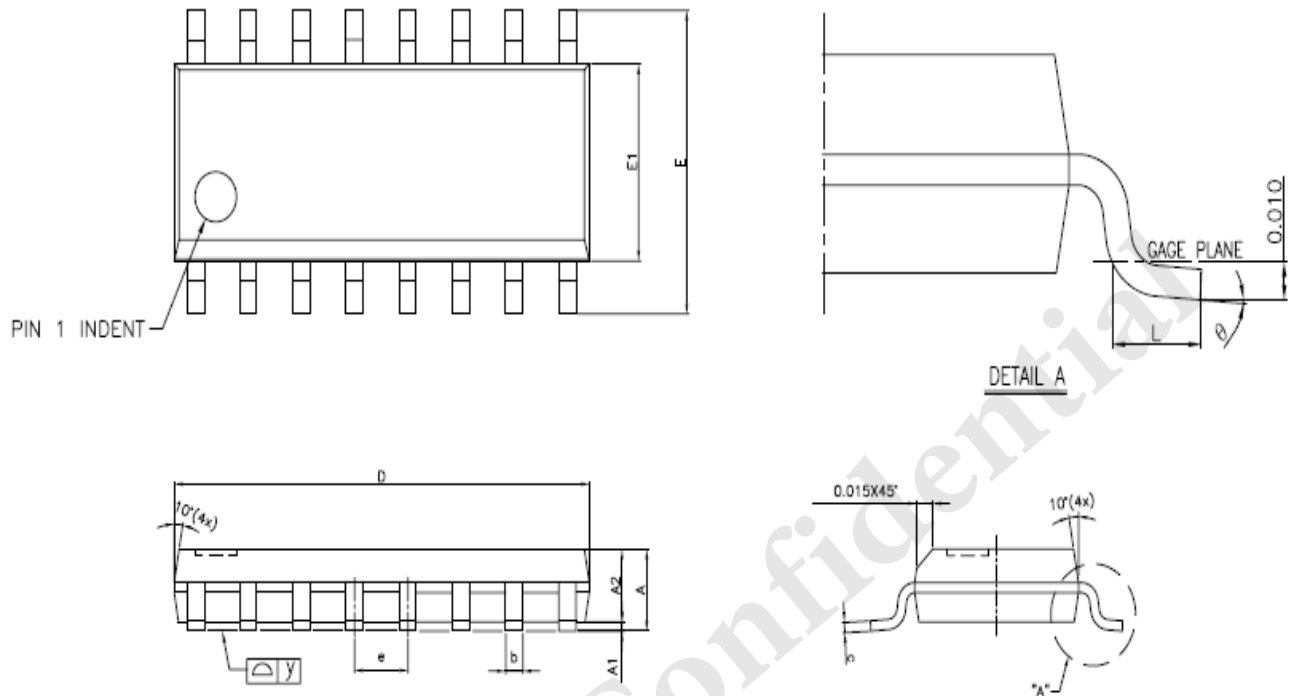


Figure 3. Package outline

Table 6. Package dimensions

| SYMBOLS | DIMENSIONS IN MILLIMETERS | | | DIMENSIONS IN INCHES | | |
|---------|---------------------------|------|-------|----------------------|-------|--------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 1.47 | 1.60 | 1.73 | 0.058 | 0.063 | 0.068 |
| A1 | 0.10 | — | 0.25 | 0.004 | — | 0.010 |
| A2 | — | 1.45 | — | — | 0.057 | — |
| b | 0.33 | 0.41 | 0.51 | 0.013 | 0.016 | 0.020 |
| C | 0.19 | 0.20 | 0.25 | 0.0075 | 0.008 | 0.0098 |
| D | 9.80 | 9.91 | 10.01 | 0.386 | 0.390 | 0.394 |
| E | 5.79 | 5.99 | 6.20 | 0.228 | 0.236 | 0.244 |
| E1 | 3.81 | 3.91 | 3.99 | 0.150 | 0.154 | 0.157 |
| e | — | 1.27 | — | — | 0.050 | — |
| L | 0.38 | 0.71 | 1.27 | 0.015 | 0.028 | 0.050 |
| y | — | — | 0.076 | — | — | 0.003 |
| θ | 0° | — | 8° | 0° | — | 8° |

5. PCB Land Pattern

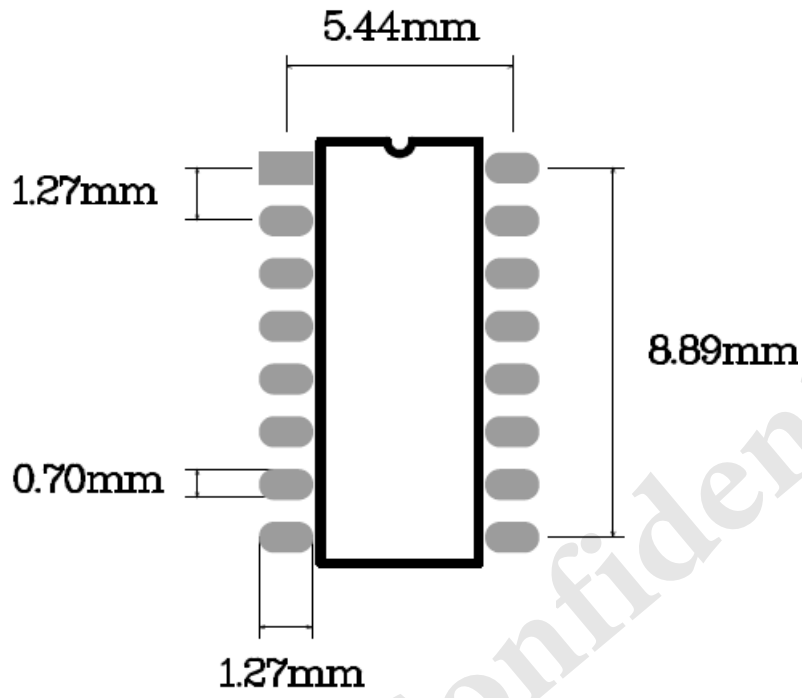
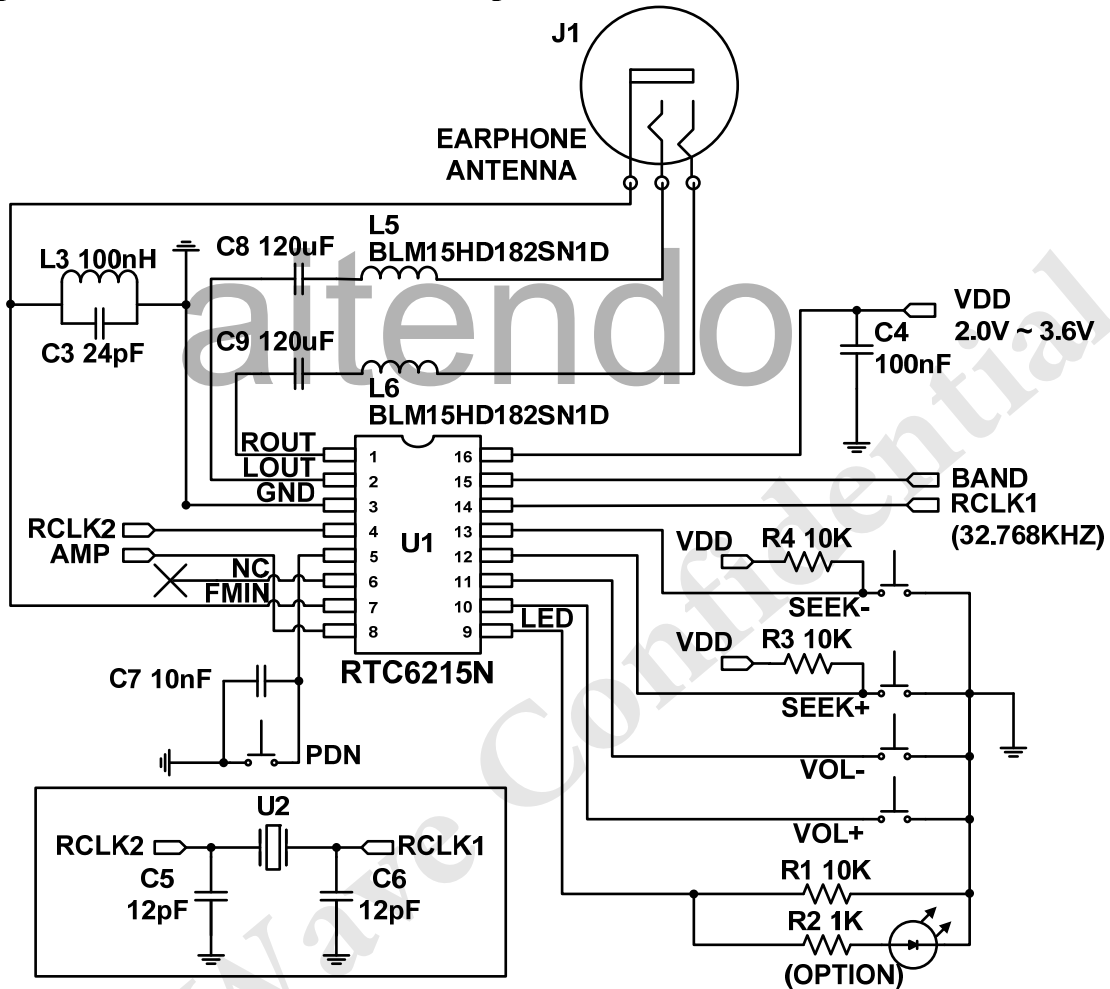


Figure 4. PCB land pattern

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6 Application Schematic

6.1 Application circuit for XTAL and headphone



Notes:

1. Pin 6 is no connected and should be left floating
2. Place C4 closed to VDD pin
3. Pin 9 must pull down by R1(10K) to let chip work correctly

6.1.1 Bill Of Materials

| Part Type | Component | Value/Description | Supplier |
|------------------|-----------|--|----------|
| RTC6215N | U1 | RTC6215N FM Radio Tuner | RichWave |
| 32.768KH Crystal | U2 | Crystal oscillator 32.768KHz ≤ 50 ppm | |
| 120uF | C8,C9 | Audio AC couple capacitors | |
| 24pF/100nH | C3/L3 | LC choke for LNA input | |
| BLM15HD182SN1D | L5, L6 | Ferrite bead keep high-impedance for RF path | |
| 100nF | C4 | Supply bypass capacitor ,100nF , $\pm 20\%$,Z5U/X7R | |
| 12pF | C5,C6 | Load cap for XTAL | |
| 10nF | C7 | De-bounce capacitor | |
| 10K | R3, R4 | Pull-high resistor | |
| 10K | R1 | Pull-down resistor | |
| 1K | R2 | LED current limit resistor | |