

DATA SHEET

AR1019 Single Chip FM Radio

Single Chip FM Radio

The logo for Airoha Technology Corp. features the word "AIROHA" in a bold, blue, sans-serif font. The letter "H" is stylized with a horizontal bar that extends to the right and then curves downwards, resembling a radio antenna or a signal wave.

Airoha Technology Corp.

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Revision History

| Version | Change Summary | Date | Author |
|---------|----------------|-------------|------------|
| 0.10 | Created | 27-Aug-2010 | Adrian. Wu |
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1 Features

- Worldwide FM band support: 64MHz~108MHz
- Highest integration level with minimized external BOM cost
- Frequency synthesizer with integrated VCO and Automatic Frequency Control (AFC)
- Integrated XO with external reference clock input (32.768KHz, 32KHz, 4.5MHz, 12MHz, 13MHz, 19.2MHz, 24MHz, 26Mhz, 27MHz, 38.4MHz) or external 32.768KHz crystal
- Automatic Gain Control (AGC) on LNA/VGA amplifiers
- Signal strength measurement
- Programmable de-emphasis time constant (50/75us)
- Adaptive noise suppression
- Analog output with volume control and Line-level outputs
- Serial control interface for 2-wire mode
- Embedded Seek tuning function
- Integrated LDO regulators support 2.2V to 3.6 V supply voltage
- Support 32Ω output load resistance
- MSOP 3x4.9x1mm 10-pin package

2 Description

AR1019 is a highly integrated single chip stereo FM radio receiver for all kinds of applications. AR1019 supports worldwide FM bands from 64MHz to 108MHz. It integrates LNA, Mixer, Oscillator and LDO regulator to minimize the external BOM cost. The built-in FM signal processing unit with noise reduction mechanism provides optimum sound quality. A simple 2-wire interface allows easy control from the host.

3 Pin Assignment

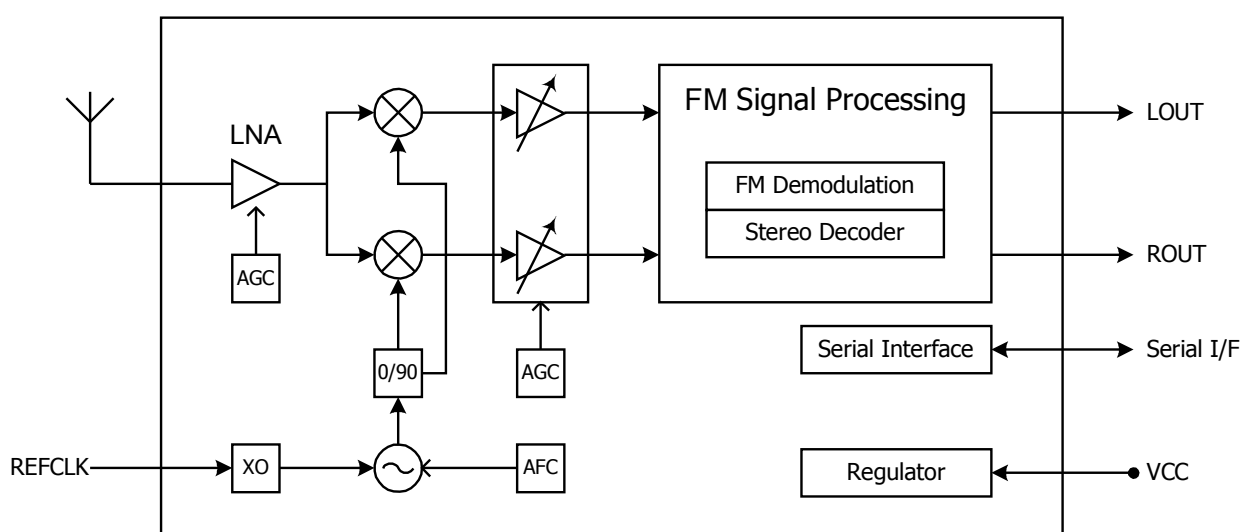


1.1 Pin Name Description

| PIN | SIGNAL | TYPE | DESCRIPTION |
|------------|---------------|------------------------|--|
| 1 | DATAIO | Input/Output, Digital | Serial Interface |
| 2 | VCC | VCC Supply | Supply Voltage |
| 3 | LOUT | Output, Analog | Left Audio Output |
| 4 | ROUT | Output, Analog | Right Audio Output |
| 5 | GND | GND | Analog Ground |
| 6 | NC | NC | Not Connected/The pin must be floating |
| 7 | GNDRF | GND | RF Ground |
| 8 | RFIN | Input, Analog | RF Input |
| 9 | CLOCK | Input, Digital Control | Serial Interface |
| 10 | XTAL | Analog | XTAL Input/External REFCLK input |

4 Block Diagram and Description

1.2 General Description



AR1019 is a single chip FM radio receiver IC, which supports full 64MHz to 108MHz band. AR1019 integrates on-chip LNA, Mixer, VGA, XO, FM signal processing unit, serial digital I/O interfaces and regulator. The highest integration level minimizes external BOM cost and provides optimum sound quality.

1.3 Radio Receiver

The Radio Receiver part comprises a LNA, a Low-IF mixer and a VGA. The front-end gain of the LNA could be adjusted automatically and thus optimize the received signal-to-noise ratio. The RF signal is then converted to Low-IF band and amplified by the VGA, which is also automatically adjusted. After then the received signal is fed into the FM signal processing unit.

An internal reference oscillator is integrated, so only an external 32.768KHz crystal or a REFCLK signal is required. (32.768KHz, 32KHz, 4.5MHz, 12MHz, 13MHz, 19.2MHz, 24MHz, 26Mhz, 27MHz, 38.4MHz)

1.4 FM signal processing Unit

The main function of the FM signal processing unit includes FM Demodulation and Stereo Decoding . The received FM signal at VGA output is first demodulated into stereo multiplexed signals (Left+Right and Left–Right) and then decoded into Left and Right signals individually by the stereo decoder. Two time constants (50 μ s or 75 μ s) of de-emphasis are provided and programmable through the serial interface.

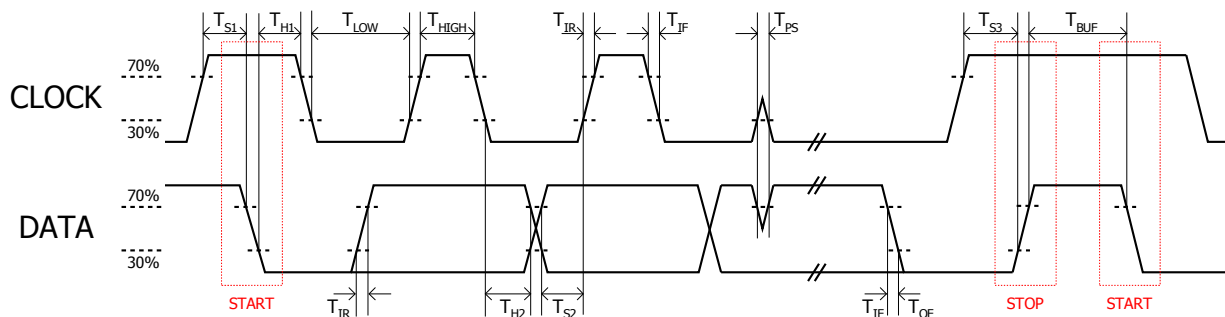
The decoded stereo signals are output to the LOUT and ROUT pins. The output volume could be adjusted or mute through the serial interface. The stereo output could be blocked and only mono signal is output under weak signals.

1.5 Serial 2-Wire Interface

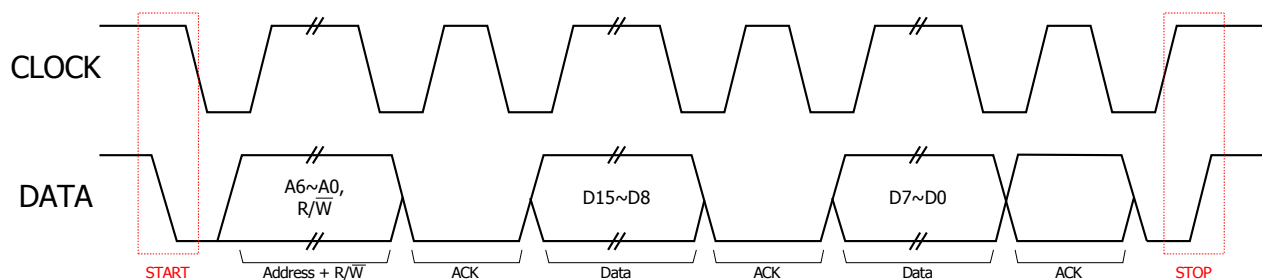
Serial 2-wire interfaces are provided to read and write the control registers.

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNIT |
|------------|---|------|-----|-----|------|
| | CLOCK Frequency | 0 | | 400 | KHz |
| T_{S1} | CLOCK Input to DATA N-edge Setup time (START) | 600 | | | ns |
| T_{H1} | CLOCK Input to DATA N-edge Hold time (START) | 600 | | | ns |
| T_{S2} | DATA Input to CLOCK P-edge Setup time | 100 | | | ns |
| T_{H2} | DATA Input to CLOCK N-edge Hold time | 0 | | 900 | ns |
| T_{S3} | CLOCK Input to DATA P-edge Setup time (STOP) | 600 | | | ns |
| T_{BUF} | STOP to START time | 1300 | | | ns |
| T_{OF} | DATA Output Fall time | 20 | | 250 | ns |
| T_{IR} | DATA Input & CLOCK Rise time | 20 | | 300 | ns |
| T_{IF} | DATA Input & CLOCK Fall time | 20 | | 300 | ns |
| T_{HIGH} | CLOCK HIGH duration | 600 | | | ns |
| T_{LOW} | CLOCK LOW duration | 1300 | | | ns |
| T_{PS} | Input Filter Pulse Suppression | | | 50 | ns |

2-Wire Interface Read and Write Timing Parameters



2-Wire Interface Read and Write Procedure



5 Electrical Characteristics

1.6 Absolute Maximum Ratings

AR1019 could be damaged by any stress in excess of the absolute maximum ratings listed below.

| ITEM | MIN. | MAX. |
|----------------------------|--------|--------------------|
| Power supply voltage (VCC) | - 0.3V | 3.6V |
| Pin voltage | - 0.3V | HOST_IO_VCC + 0.3V |
| Maximum power dissipation | - | 1W |
| Operating temperature | - 40°C | +85°C |
| Storage temperature | - 65°C | +150°C |
| LNA input level | - | +10 dBm |

1.7 DC Electrical Specifications

Recommended operating ambient temperature range $T_A = -20$ to 85°C

| Item | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---------------------------------------|-----------|------------------------------|-----------|------|-----------|---------------|
| VCC Supply Voltage | VCC | | 2.2 | | 3.6 | V |
| VCC Supply Current | I_{VCC} | ENABLE=1 | | 15.5 | | mA |
| Power Down Current | I_{VCC} | ENABLE=0 | | 7 | 20 | μA |
| Digital Input Voltage – High Level | V_{IH} | | $0.7*VCC$ | | $VCC+0.3$ | V |
| Digital Input Voltage – Low Level | V_{IL} | | - 0.3 | | $0.3*VCC$ | V |
| Digital Input Current – High Level | I_{IH} | $V_{IN}=VCC=3.6V$ | -10 | | 10 | μA |
| Digital Input Current – Low Level | I_{IL} | $V_{IN}=0V, VCC=3.6V$ | -10 | | 10 | μA |
| Interface Output Voltage – High Level | V_{OH} | $I_{OUT} = 500\mu\text{A}$ | $0.8*VCC$ | | | V |
| Interface Output Voltage – Low Level | V_{OL} | $I_{OUT} = - 500\mu\text{A}$ | | | $0.2*VCC$ | V |

1.8 AC Electrical Specification

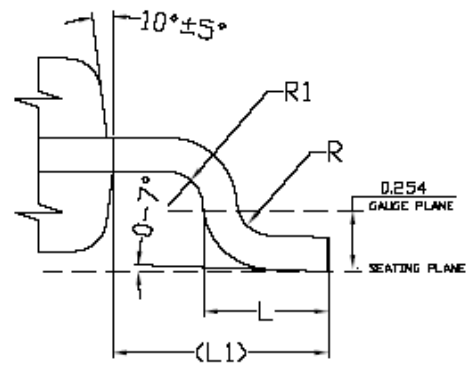
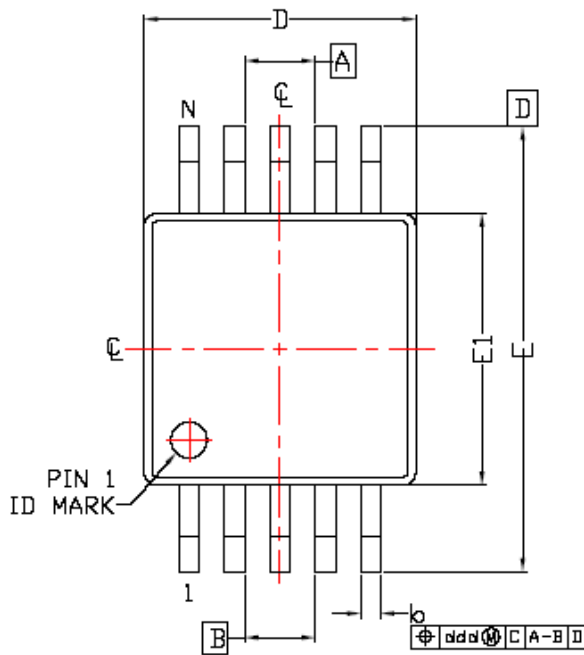
Typical values are tested under VCC=3.3V, Ta=25°C unless otherwise specified

| PARAMETER | CONDITION | MIN. | TYP. | MAX. | UNIT |
|-------------------------------|-----------------------------|------|--------|-------|-------------------|
| Input Frequency | | 64 | | 108 | MHz |
| Sensitivity | (S+N)/N=26dB, FD=22.5KHz | | 1.8 | 3.5 | μV _{emf} |
| LNA Input Resistance | | | 126 | | Ω |
| LNA Input Capacitance | | | 3.6 | | pF |
| IIP3 | | | 86 | | dBμV |
| AM Suppression | m=0.3 | | 70 | | dB |
| Adjacent Channel Selectivity | Low-side, -200KHz | | 38 | | dB |
| | Low-side, +200KHz | | 55 | | dB |
| | Low-side, -400KHz | | >60 | | dB |
| | Low-side, +400KHz | | >60 | | dB |
| Spurious Response Rejection | In-band | | 38 | | dB |
| Crystal REFCLK Frequency | | | 32.768 | | KHz |
| External REFCLK Frequency | | 32K | | 38.4M | Hz |
| REFCLK Frequency Tolerance | 25 °C | -20 | | +20 | ppm |
| | -20 °C ~ +85 °C | -150 | | +150 | ppm |
| Audio Output Voltage *1, | FD=22.5KHz, at max. vol. | 90 | 95 | 110 | mV _{RMS} |
| Audio Output L/R Imbalance *1 | FD=75KHz | -0.5 | | 0.5 | dB |
| Audio Stereo Separation *1 | FD=75KHz including 9% pilot | | 40 | | dB |
| Audio S/N *1 | FD=22.5KHz | | 56 | | dB |
| Audio THD *1, | FD=75KHz | | 0.1 | | % |
| De-emphasis Time Constant | | | 75 | | μs |
| | | | 50 | | μs |
| Audio Common-mode Voltage | | | 0.9 | | V |
| Audio Output Load Resistance | Single-end | 32 | | | Ω |

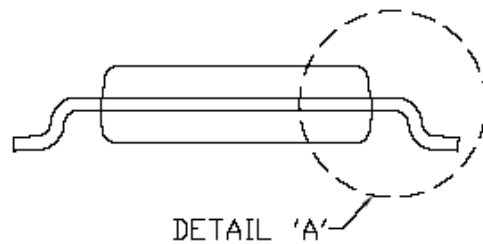
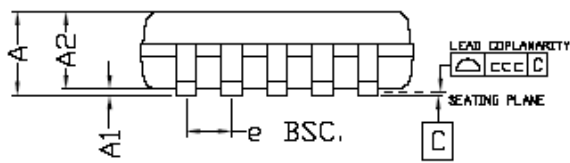
note *1 : VRF=60dBuV

6 Package Dimension

Package:MSOP-10pin/3x4.9x1mm/0.5 pitch,



DETAIL A



DETAIL 'A'

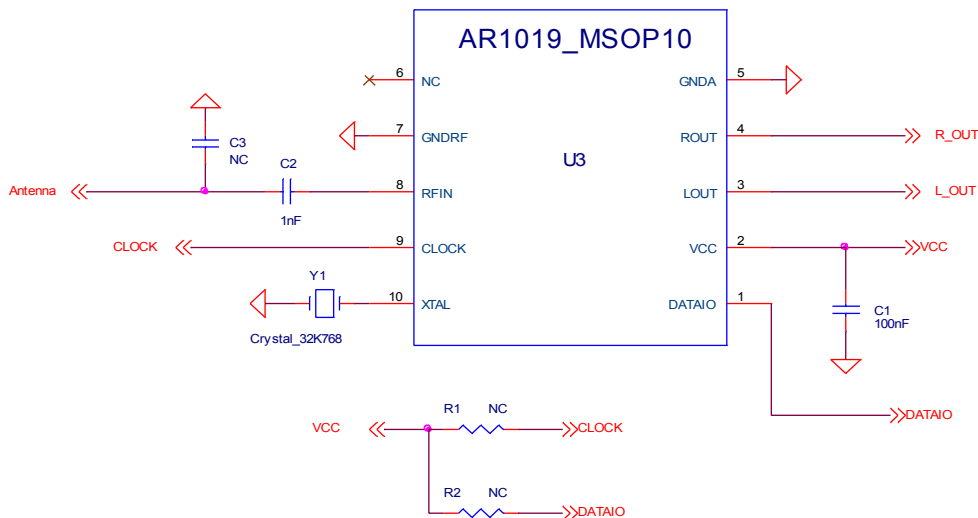
| SYMBOL | 10L MSOP | | |
|--------|----------|------|------|
| | MIN | NOM. | MAX. |
| A | -- | -- | 1.10 |
| A1 | 0.00 | -- | 0.15 |
| A2 | 0.75 | 0.85 | 0.95 |
| b | 0.17 | -- | 0.33 |
| D | 2.90 | 3.00 | 3.10 |
| E | 4.70 | 4.90 | 5.10 |
| E1 | 2.90 | 3.00 | 3.10 |
| R | 0.07 | -- | -- |
| R1 | 0.07 | -- | -- |
| L | 0.40 | 0.55 | 0.70 |
| L1 | 0.95 REF | | |
| e | 0.50 BSC | | |
| ddd | 0.08 | | |
| ccc | 0.10 | | |
| N | 10 | | |

Notes:

1. ALL DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
3. DIMENSION 'D' DOES NOT INCLUDE MOLD FLASH ,PROTRUSIONS OR GATE BURRS.
4. DIMENSION 'E1' DOES NOT INCLUDE INTERNAL FLASH OR PROTRUSION.
5. DIMENSION 'b' DOES NOT INCLUDE DAMBAR PROTRUSION.
6. FOOT LENGTH 'L' IS MEASURED AT GAGE PLANE,AT 0.254 ABOVE THE SEATING PLANE.

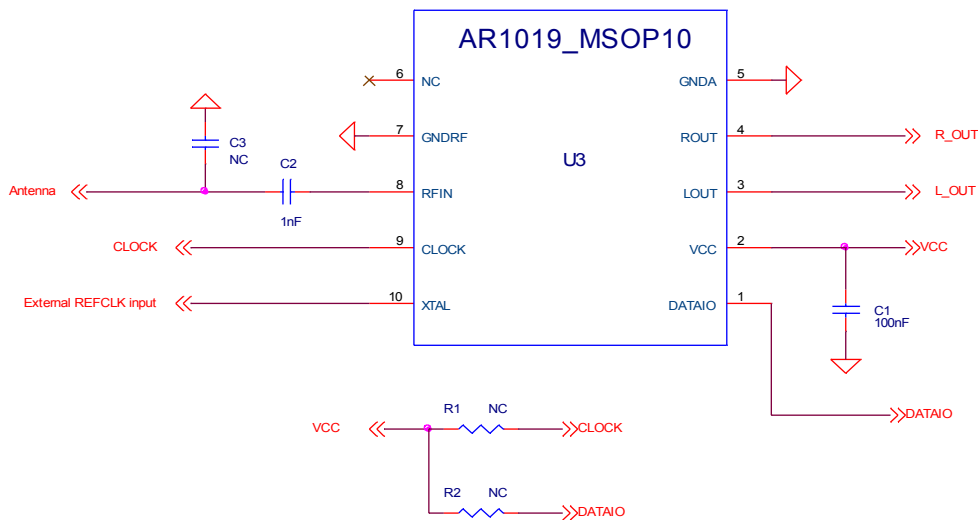
7 Schematic

1.9 Crystal solution



- Note1: The pull-high resistors must be added on 2-wire CLOCK (pin9) & DATAIO (pin1) respectively. The 2.2K ohm is recommended for the pull-high resistors .
- Note2: C1 (100nF) must be as close to VCC (pin2) as possible.
- Note3: The pin6 (NC) must be floating.
- Note4: Please reserve C3 for fine tune.
- Note5: Y1 must be as close to XTAL (pin10) as possible.

1.10 External REFCLK solution



- Note1: The pull-high resistors must be added on 2-wire CLOCK (pin9) & DATAIO (pin1) respectively. The 2.2K ohm is recommended for the pull-high resistors .
- Note2: C1 (100nF) must be as close to VCC (pin2) as possible.
- Note3: The pin6 (NC) must be floating.
- Note4: Please reserve C3 for fine tune.