

Fully-integrated 2.4G Low Noise Amplifier with Bypass Switch

Features

- Ultra low current=2.7 mA
- Low noise figure(NF)=2.0 dB
- High power gain=14 dB
- High input 1dB-compression point=-4 dBm
- Integrated input matching inductor
- Supply voltage: 1.65 V to 1.95 V
- Operating frequencies: 2400~2500 MHz
- FCDFN 1.1 mm X 0.9 mm X 0.37 mm-6L package
- ± 1 kV HBM ESD protection (including RFIN and RFOUT pin)

Applications

- Smart phones, feature phones
- Tablet PCs
- RF Front End modules
- 2.4 GHz Bluetooth
- BLE wearable devices

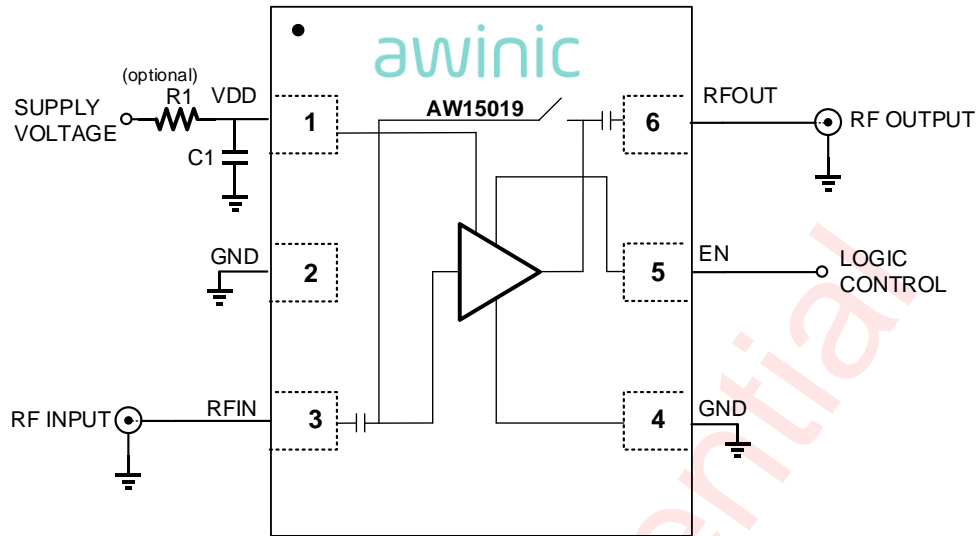
General Description

The AW15019 is a Low Noise Amplifier with bypass switch designed for 2.4GHz ISM Band application. With on-chip DC blocking capacitors at RFIN and RFOUT, the AW15019 can be close to the antenna. The AW15019 doesn't requires any external matching inductor, which can reduce assembly complexity and the PCB area, enabling a cost-effective solution.

The AW15019 with patented Smart Linearity Technology (SLT) achieves low noise figure, high linearity, high gain, over a wide range of supply voltages from 1.65 V up to 1.95 V. All these features make AW15019 an excellent choice for wireless transceiver solutions with ISM band as it improves sensitivity with low noise figure and high gain, provides better immunity against out-of-band jammer signals with high linearity, reduces filtering requirement of preceding stage and hence reduces the overall cost of the transceiver.

The AW15019 is available in a small lead-free, RoHS-Compliant, FCDFN 1.1 mm X 0.9 mm X 0.37 mm-6L package.

Typical Application Circuit



Typical Application Circuit of AW15019

All trademarks are the property of their respective owner

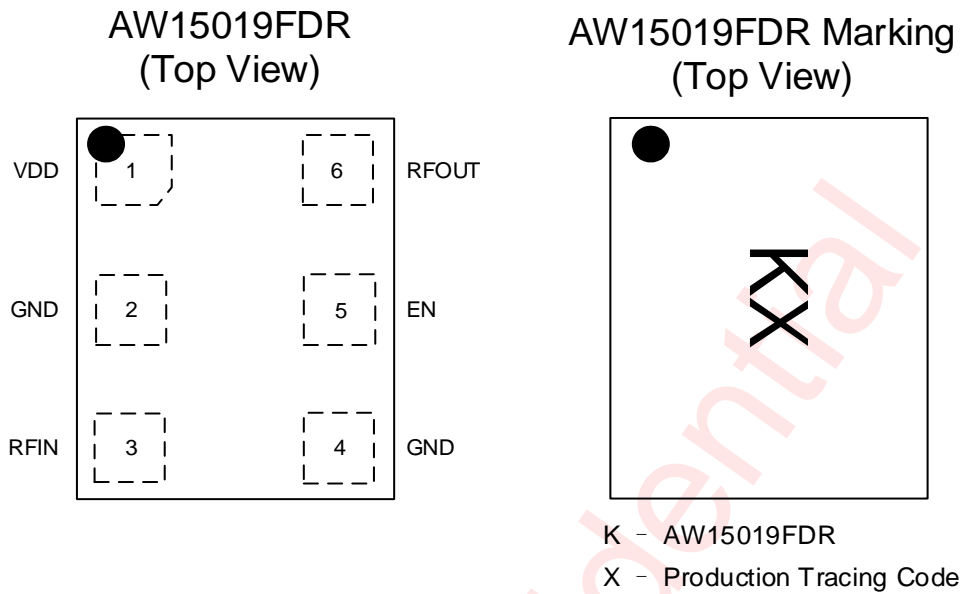
Recommended Components List

Table1 list the recommended components types and values.

Table1: list of components

| Component | Part Number | Capacitance | Rated Voltage | Supplier | Size |
|-----------|-------------|-------------|---------------|----------|------|
| C1 | GRM155 | 1nF | 50V | Murata | 0402 |

Pin Configuration And Top Mark

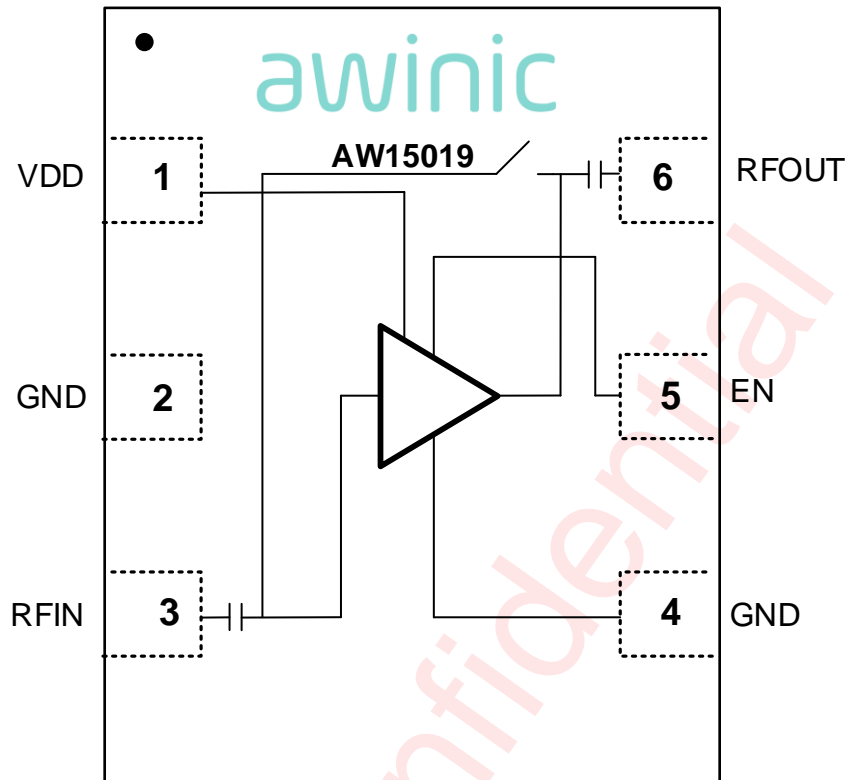


Pin Configuration and Top Mark

Pin Definition

| No. | NAME | DESCRIPTION |
|-----|-------|---------------|
| 1 | VDD | DC Supply |
| 2 | GND | Ground |
| 3 | RFIN | LNA input |
| 4 | GND | Ground |
| 5 | EN | Logic control |
| 6 | RFOUT | LNA output |

Functional Block Diagram



Functional Block Diagram

Ordering Information

| Part Number | Temperature | Package | Marking | Moisture Sensitivity Level | Environmental Information | Delivery Form |
|-------------|--------------|---------------------------------------|---------|----------------------------|---------------------------|------------------------------|
| AW15019FDR | -40°C ~ 85°C | FCDFN 1.1 mm X 0.9 mm X 0.37 mm-6L | K | MSL1 | ROHS+HF | 4500 units/ Tape and Reel |

Absolute Maximum Ratings^[1]

| PARAMETERS | Symbol | Values | | | Unit |
|--|--------------------|--------|------|------|------|
| | | Min. | Typ. | Max. | |
| Supply Voltage at pin VCC | VCC | -0.3 | - | 3.6 | V |
| Voltage at pin EN ^[2] | V _{EN} | -0.3 | - | 3.6 | V |
| Current into pin VCC | I _{CC} | - | - | 10 | mA |
| RF input power in RX mode ^[3] | P _{IN@RX} | - | - | 15 | dBm |
| RF output power in RX mode(@1.8V) ^[3] | P _{OUT} | - | - | 10 | dBm |
| RF input power in TX mode ^[3] | P _{IN@TX} | - | - | 26 | dBm |
| Junction temperature | T _J | - | - | 150 | °C |
| Storage temperature range | T _{STG} | -65 | - | 150 | °C |
| Ambient temperature range | T _{amb} | -40 | - | 85 | °C |
| Solder temperature(10s) | | - | 260 | - | °C |
| ESD range | | | | | |
| HBM ^[4] | | | ±1 | | kV |
| CDM ^[5] | | | ±0.5 | | kV |

NOTE1: Conditions out of those ranges listed in "absolute maximum ratings" may cause permanent damages to the device. In spite of the limits above, functional operation conditions of the device should within the ranges listed in "recommended operating conditions". Exposure to absolute-maximum-rated conditions for prolonged periods may affect device reliability.

NOTE2: Warning: due to internal ESD diode protection, the applied DC voltage should not exceed 3.6V in order to avoid excess current.

NOTE3: The RF input and RF output are AC coupled through internal DC blocking capacitor.

NOTE4: HBM standard: ESDA/JEDEC JS-001-2017.

NOTE5: CDM standard: ESDA/JEDEC JS-002-2018.

Electrical Characteristics

AW15019 EVB; Typical values are $V_{CC}=1.8\text{ V}$ and $T_A=25^\circ\text{C}$, $f=2450\text{MHz}$, unless otherwise noted

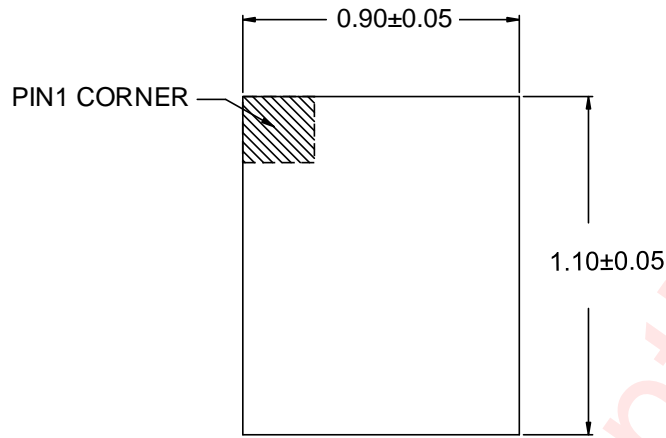
| PARAMETER | TEST CONDITION | MIN | TYP | MAX | UNIT | |
|---|---|----------------------------|-------|------|------|---------------|
| DC ELECTRICAL CHARACTERISTICS | | | | | | |
| V_{CC} | Supply Voltage | 1.65 | - | 1.95 | V | |
| I_{TX} | TX Current | EN=Low | - | 10 | 30 | μA |
| I_{RX} | RX Current | EN=High | - | 2.7 | 4.2 | mA |
| V_{EN} | Digital Input-Logic High | 1.0 | - | - | V | |
| V_{EN} | Digital Input-Logic Low | - | - | 0.4 | V | |
| I_{EN} | Control current | EN=1.8V | - | - | 7 | μA |
| | | EN=0.4V | - | - | 5 | μA |
| AC ELECTRICAL CHARACTERISTICS(Rx Mode) | | | | | | |
| G_p | Power Gain | EN=High | 10.5 | 14 | 16.5 | dB |
| $G_{(Var)}$ | Gain Variation | EN=High | -2 | - | 2 | dB |
| $G_{(flat)}$ | Gain flatness (Over any 2MHz BW) | EN=High | -0.25 | - | 0.25 | dB |
| RL_{in} | Input Return Loss | EN=High | 8 | 15 | - | dB |
| RL_{out} | Output Return Loss | EN=High | 8 | 13 | - | dB |
| ISL | Reverse Isolation | EN=High | 20 | 25 | - | dB |
| $G_{p_{oob}}$ | Out of Band Gain | 824-915MHz | - | -12 | -6.5 | dB |
| | | 1710-1910MHz | - | 7 | 14.5 | dB |
| | | 2300-2370MHz | - | 12 | 16.5 | dB |
| | | 3400-4400MHz | - | 7 | 12.5 | dB |
| | | 5150-5825MHz | - | -6 | -0.5 | dB |
| | | 5925-7150MHz | - | -11 | -5.5 | dB |
| NF | Noise Figure ^[1] | Zs=50 ohm; No jammer | - | 2.0 | 2.8 | dB |
| P_b | Power of blocker (gain reduce 1dB) | 824-915MHz | -10 | -8 | - | dBm |
| | | 1710-1910MHz | -14 | -12 | - | dBm |
| | | 2570-2620 MHz | -14 | -12 | - | dBm |
| | | 3400-4400MHz | -10 | -8 | - | dBm |
| | | 5150-7150 MHz | -10 | -8 | - | dBm |
| Kf | Stability factor | f=0.1-10GHz | 1 | - | - | |
| IP1dB | Inband input 1dB-compression point | f=2450MHz | -12 | -4 | - | dBm |
| IIP3 _{ib} | Inband input 3 rd -order intercept point ^[2] | f1=2450MHz; f2=2451MHz; | -5 | 0 | - | dBm |
| t_{on} | turn-on time | Tx to Rx | - | 0.8 | 1.2 | μs |
| t_{off} | turn-off time | Rx to Tx | - | 0.2 | 1 | μs |
| AC ELECTRICAL CHARACTERISTICS(Tx Mode) | | | | | | |
| IL | Insertion loss | EN=Low | - | 0.8 | 1.0 | dB |

| PARAMETER | | TEST CONDITION | MIN | TYP | MAX | UNIT |
|----------------------|---|---|------|-----|-----|------|
| IL _(flat) | Flatness | Over any 1MHz BW | -0.1 | - | 0.1 | dB |
| RL _{in} | Input Return Loss | EN=Low | 9 | 12 | - | dB |
| RL _{out} | Output Return Loss | EN=Low | 9 | 12 | - | dB |
| IPO.1dB | 0.1dB Compression Point | f=2450MHz | 21 | 25 | - | dBm |
| IIP3 | Inband input 3rd-order intercept point | 20MHz two tone space, Pin=18dBm/per tone, in-band | 35 | - | - | dBm |
| 2f ₀ | Second Harmonics | f ₀ =2450MHz Pin=18dBm, CW VSWR=1:1 | - | -50 | -40 | dBm |
| 2f ₀ | Second Harmonics | f ₀ =2450MHz Pin=18dBm, CW VSWR=5:1 | - | -42 | -36 | dBm |
| 3f ₀ | Third Harmonics | f ₀ =2450MHz Pin=18dBm, CW VSWR=1:1 | - | -52 | -40 | dBm |
| 3f ₀ | Third Harmonics | f ₀ =2450MHz Pin=18dBm, CW VSWR=5:1 | - | -39 | -36 | dBm |
| Spurious | All spurious | f ₀ =2450MHz Pin=18dBm, CW VSWR=1:1 | - | - | -40 | dBm |
| Spurious | All spurious | f ₀ =2450MHz Pin=18dBm, CW VSWR=5:1 | - | - | -36 | dBm |

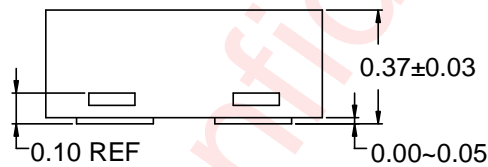
NOTE1: PCB losses are subtracted.

NOTE2: Input power = -20 dBm for each tone

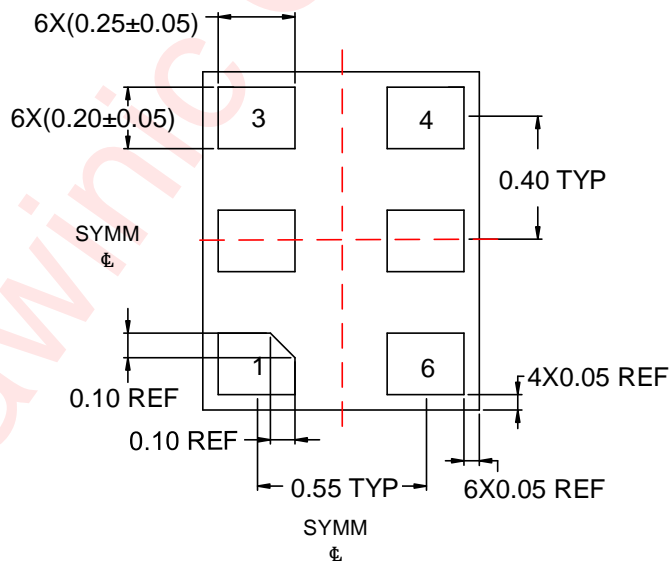
Package Description



Top View



Side View

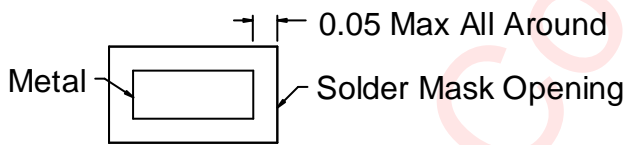
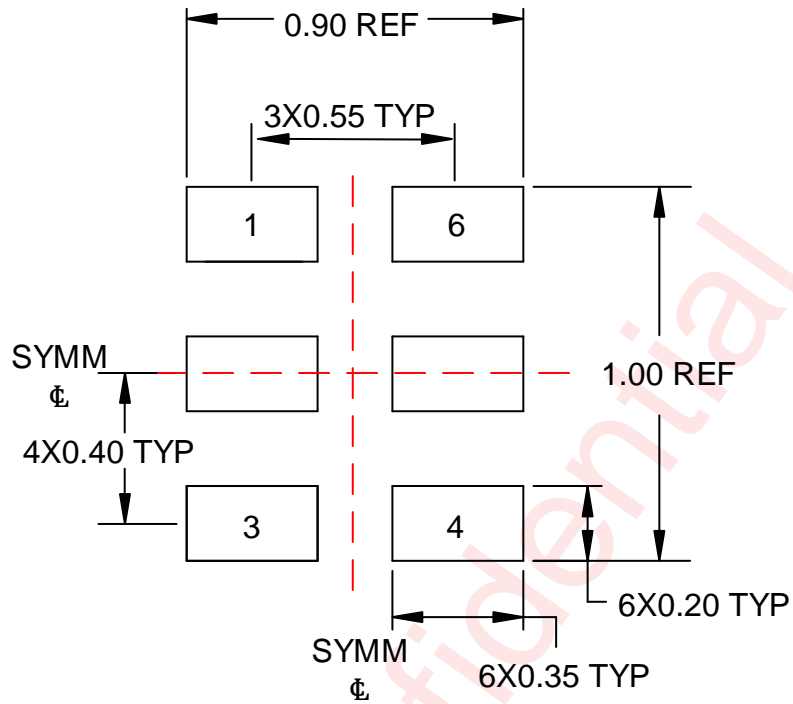


Bottom View

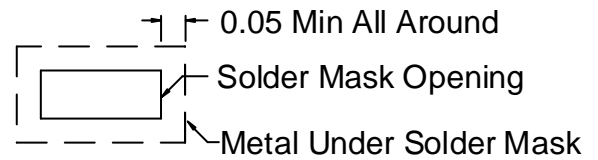
Unit:mm

Package Outline

Land Pattern



Non-solder Mask Defined

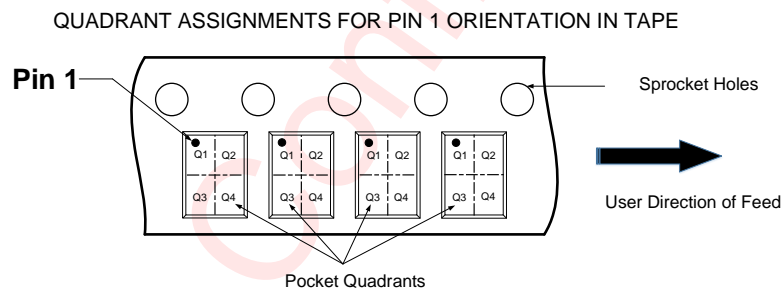
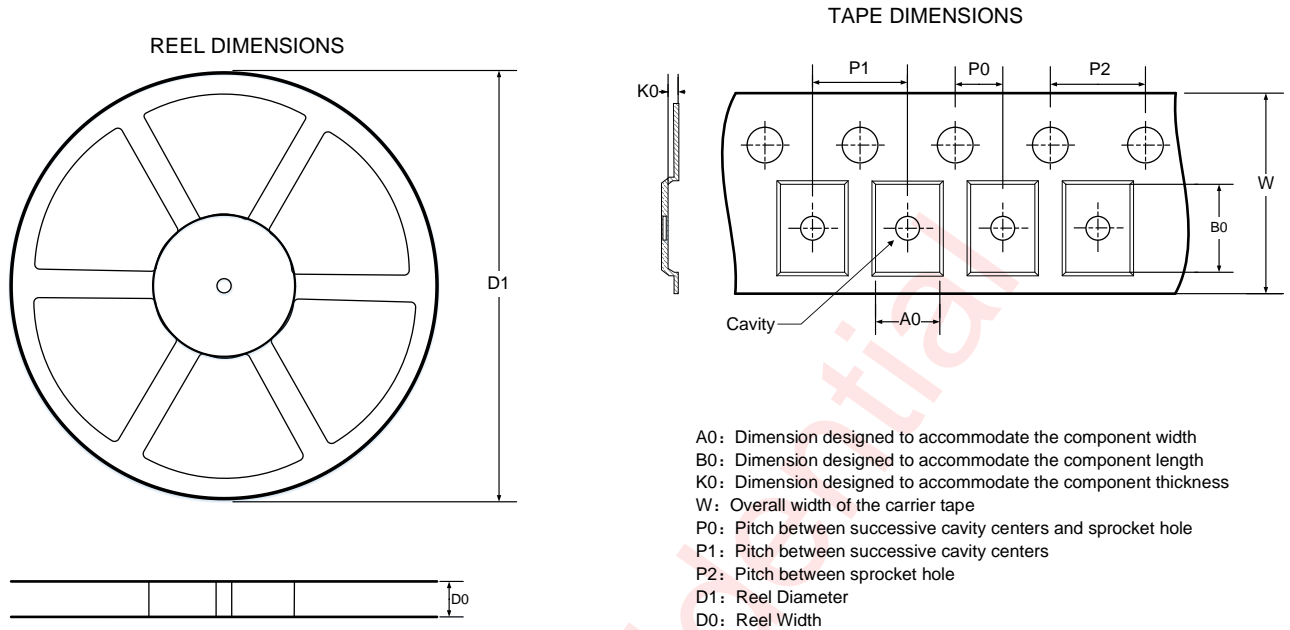


Solder Mask Defined

Unit:mm

Land Pattern

Tape & Reel Description



Note: The above picture is for reference only. Please refer to the value in the table below for the actual size

DIMENSIONS AND PIN1 ORIENTATION

| D1 (mm) | D0 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|---------|---------|---------|---------|---------|---------|---------|---------|--------|---------------|
| 180 | 8.4 | 1.05 | 1.25 | 0.5 | 2 | 4 | 4 | 8 | Q1 |

All dimensions are nominal

Tape & Reel Description

Revision History

| Version | Date | Change Record |
|---------|------------|--|
| V1.0 | Nov. 2020 | Officially Released |
| V1.1 | Apr. 2021 | Update P_{IN} , I_{RX} , V_{EN} , NF and t_{on} ; Add 2f0 and 3f0 for VSWR=5:1 |
| V1.2 | June. 2021 | Update I_{RX} , IL, NF, IP1dB, $G_{p_{oob}}$ |
| V1.3 | Jan. 2022 | Update I_{RX} , Gp, $G_{p_{oob}}$, IP1dB |
| V1.4 | Aug. 2022 | Update format |

awinic Confidential

Disclaimer

All trademarks are the property of their respective owners. Information in this document is believed to be accurate and reliable. However, Shanghai AWINIC Technology Co., Ltd (AWINIC Technology) does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

AWINIC Technology reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. Customers shall obtain the latest relevant information before placing orders and shall verify that such information is current and complete. This document supersedes and replaces all information supplied prior to the publication hereof.

AWINIC Technology products are not designed, authorized or warranted to be suitable for use in medical, military, aircraft, space or life support equipment, nor in applications where failure or malfunction of an AWINIC Technology product can reasonably be expected to result in personal injury, death or severe property or environmental damage. AWINIC Technology accepts no liability for inclusion and/or use of AWINIC Technology products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications that are described herein for any of these products are for illustrative purposes only. AWINIC Technology makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

All products are sold subject to the general terms and conditions of commercial sale supplied at the time of order acknowledgement.

Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Reproduction of AWINIC information in AWINIC data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. AWINIC is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of AWINIC components or services with statements different from or beyond the parameters stated by AWINIC for that component or service voids all express and any implied warranties for the associated AWINIC component or service and is an unfair and deceptive business practice. AWINIC is not responsible or liable for any such statements.