

GENERAL DESCRIPTION

The SGM13001A is a low noise amplifier (LNA) for GLONASS, Galileo, Beidou and GPS applications. The device delivers 18.2dB gain at an extremely low noise figure of 0.9dB. It also features high gain and excellent linearity performance that operates from 1160MHz to 1300MHz and 1550MHz to 1615MHz.

The device requires 6.5mA from a single 1.6V to 3.6V supply, dropping to below 2.2µA in power down mode.

No external DC blocking capacitors are required on the RF paths as long as no external DC voltage is applied, which can save PCB area and cost.

The SGM13001A is available in a Green UTDFN-1.1×0.7-6L package.

APPLICATIONS

- Car Navigation
- Personal Navigation Equipment
- Mobile Phone with GPS
- RF Front End Modules
- Digital Video Camera, Digital Camera

FEATURES

- **High Gain:**
 - ♦ 19.2dB at 1176.45MHz
 - ♦ 18.6dB at 1227.6MHz
 - ♦ 18.2dB at 1575.42MHz
- **Low Noise Figure:**
 - ♦ 0.78dB at 1176.45MHz
 - ♦ 0.89dB at 1227.6MHz
 - ♦ 0.90dB at 1575.42MHz
- **Low Operation Current: 6.5mA**
- **Current Less than 2.2µA in Power Down Mode**
- **Operating Frequency Range:**
 - ♦ 1160MHz to 1300MHz
 - ♦ 1550MHz to 1615MHz
- **Single Supply Voltage Range: 1.6V to 3.6V**
- **Low Cost BOM**
- **Lead-Free and RoHS Compliant**
- **Available in a Green UTDFN-1.1×0.7-6L Package**

BLOCK DIAGRAM

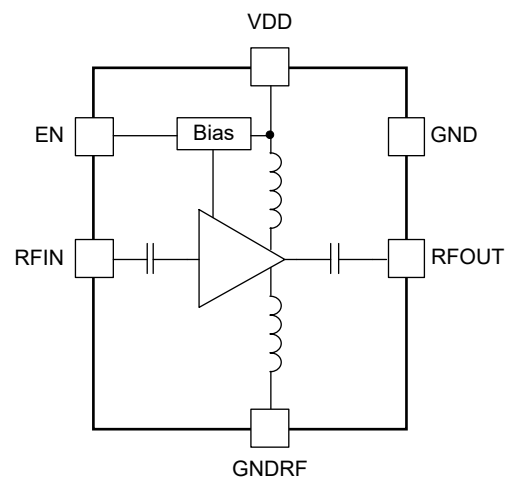


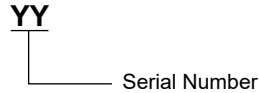
Figure 1. SGM13001A Block Diagram

PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|-----------|---------------------|-----------------------------|--------------------|-----------------|----------------------|
| SGM13001A | UTDFN-1.1×0.7-6L | -40°C to +85°C | SGM13001AYUEC6G/TR | ZY | Tape and Reel, 10000 |

MARKING INFORMATION

NOTE: Fixed character for ZY.



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

| | |
|-----------------------------------|-----------------|
| Supply Voltage, V_{DD} | -0.3V to 4.0V |
| EN to GND | -0.3V to 4.0V |
| RFIN, RFOUT to GND | -0.3V to 0.3V |
| RF Input Power, P_{IN} | 10dBm |
| Junction Temperature | +150°C |
| Storage Temperature Range | -55°C to +150°C |
| Lead Temperature (Soldering, 10s) | +260°C |
| ESD Susceptibility | |
| HBM | 4000V |
| CDM | 500V |

RECOMMENDED OPERATING CONDITIONS

| | |
|------------------------------------|--------------------|
| Operating Temperature Range | -40°C to +85°C |
| Supply Voltage Range, V_{DD} | 1.6V to 3.6V |
| Operating Frequency Range, | |
| f_0 | 1160MHz to 1300MHz |
| f_1 | 1550MHz to 1615MHz |
| Control Voltage High, V_{CTL_H} | 1.35V to V_{DD} |
| Control Voltage Low, V_{CTL_L} | 0V to 0.45V |

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

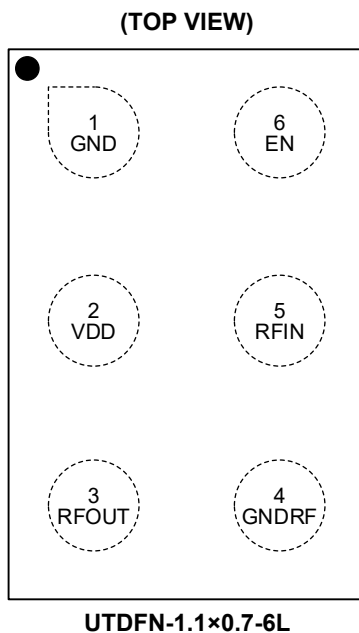
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATION



PIN DESCRIPTION

| PIN | NAME | FUNCTION |
|-----|-------|---|
| 1 | GND | Analog Ground. |
| 2 | VDD | Power Supply. |
| 3 | RFOUT | LNA Output. |
| 4 | GNDRF | RF Ground. |
| 5 | RFIN | LNA Input from Antenna. |
| 6 | EN | Active High Enable Input for the Device. Pull high enable, pull low into power down mode. |

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, V_{DD} = 1.6V to 3.6V, f = 1160MHz to 1215MHz, typical values are at V_{DD} = 2.8V, f = 1176.45MHz, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|-----------------------------------|--------------------|--|------|---------|-----------------|-------|
| DC Characteristics | | | | | | |
| Supply Voltage | V _{DD} | | 1.6 | | 3.6 | V |
| Supply Current | I _{VDD} | EN = High | | 6.5 | 10.3 | mA |
| | I _{SD} | EN = Low | 0 | 0.16 | 2.2 | µA |
| Control Voltage | V _{CTL_H} | High | 1.35 | 1.8 | V _{DD} | V |
| | V _{CTL_L} | Low | 0 | 0 | 0.45 | |
| Turn-On Time | t _{ON} | Time from EN on to 90% of the gain | | 0.5 | | µs |
| Turn-Off Time | t _{OFF} | Time from EN off to 10% of the gain | | 0.1 | | µs |
| RF Characteristics | | | | | | |
| RF Frequency Range | f ₀ | None | | 1176.45 | | MHz |
| Power Gain | S21 | | | 19.2 | | dB |
| Noise Figure | NF | | | 0.78 | | dB |
| Input Return Loss | S11 | | | -3 | | dB |
| Output Return Loss | S22 | | | -11 | | dB |
| Reverse Isolation | S12 | | | -33 | | dB |
| Stability | Kf | Frequency range from 500MHz to 5GHz | 1 | | | |
| Input Power 1dB Compression Point | P _{1dB} | | | -12 | | dBm |
| Input In-Band IP3 | IIP3_inb | f ₁ = 1176MHz, f ₂ = 1177MHz, -30dBm | | -6 | | dBm |
| Input Out-Band IP3 | IIP3_outb | f ₁ = 1785MHz, -20dBm, f ₂ = 2400MHz, -65dBm, IP3 = (2 × P1 + P2 + Gain 1170MHz - IM3)/2 | | 7 | | dBm |

(T_A = +25°C, V_{DD} = 1.6V to 3.6V, f = 1160MHz to 1215MHz, typical values are at V_{DD} = 1.8V, f = 1176.45MHz, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|-----------------------------------|--------------------|--|------|---------|-----------------|-------|
| DC Characteristics | | | | | | |
| Supply Voltage | V _{DD} | | 1.6 | | 3.6 | V |
| Supply Current | I _{VDD} | EN = High | | 6.3 | 10.3 | mA |
| | I _{SD} | EN = Low | 0 | 0.10 | 2.2 | µA |
| Control Voltage | V _{CTL_H} | High | 1.35 | 1.8 | V _{DD} | V |
| | V _{CTL_L} | Low | 0 | 0 | 0.45 | |
| Turn-On Time | t _{ON} | Time from EN on to 90% of the gain | | 0.5 | | µs |
| Turn-Off Time | t _{OFF} | Time from EN off to 10% of the gain | | 0.1 | | µs |
| RF Characteristics | | | | | | |
| RF Frequency Range | f ₀ | None | | 1176.45 | | MHz |
| Power Gain | S21 | | | 18.8 | | dB |
| Noise Figure | NF | | | 0.78 | | dB |
| Input Return Loss | S11 | | | -3 | | dB |
| Output Return Loss | S22 | | | -11 | | dB |
| Reverse Isolation | S12 | | | -32 | | dB |
| Stability | Kf | Frequency range from 500MHz to 5GHz | 1 | | | |
| Input Power 1dB Compression Point | P _{1dB} | | | -15 | | dBm |
| Input In-Band IP3 | IIP3_inb | f ₁ = 1176MHz, f ₂ = 1177MHz, -30dBm | | -6 | | dBm |
| Input Out-Band IP3 | IIP3_outb | f ₁ = 1785MHz, -20dBm, f ₂ = 2400MHz, -65dBm, IP3 = (2 × P1 + P2 + Gain 1170MHz - IM3)/2 | | 7 | | dBm |

ELECTRICAL CHARACTERISTICS (continued)

(T_A = +25°C, V_{DD} = 1.6V to 3.6V, f = 1215MHz to 1300MHz, typical values are at V_{DD} = 2.8V, f = 1227.6MHz, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|-----------------------------------|--------------------|--|------|--------|-----------------|-------|
| DC Characteristics | | | | | | |
| Supply Voltage | V _{DD} | | 1.6 | | 3.6 | V |
| Supply Current | I _{VDD} | EN = High | | 6.5 | 10.3 | mA |
| | I _{SD} | EN = Low | 0 | 0.16 | 2.2 | µA |
| Control Voltage | V _{CTL_H} | High | 1.35 | 1.8 | V _{DD} | V |
| | V _{CTL_L} | Low | 0 | 0 | 0.45 | |
| Turn-On Time | t _{ON} | Time from EN on to 90% of the gain | | 0.5 | | µs |
| Turn-Off Time | t _{OFF} | Time from EN off to 10% of the gain | | 0.1 | | µs |
| RF Characteristics | | | | | | |
| RF Frequency Range | f ₀ | None | | 1227.6 | | MHz |
| Power Gain | S21 | | | 18.6 | | dB |
| Noise Figure | NF | | | 0.89 | | dB |
| Input Return Loss | S11 | | | -3 | | dB |
| Output Return Loss | S22 | | | -12 | | dB |
| Reverse Isolation | S12 | | | -34 | | dB |
| Stability | Kf | Frequency range from 500MHz to 5GHz | 1 | | | |
| Input Power 1dB Compression Point | P _{1dB} | | | -11 | | dBm |
| Input In-Band IP3 | IIP3_inb | f ₁ = 1227MHz, f ₂ = 1228MHz, -30dBm | | -2 | | dBm |
| Input Out-Band IP3 | IIP3_outb | f ₁ = 1850MHz, -20dBm, f ₂ = 2480MHz, -65dBm, IP3 = (2 × P1 + P2 + Gain 1220MHz - IM3)/2 | | 7 | | dBm |

(T_A = +25°C, V_{DD} = 1.6V to 3.6V, f = 1215MHz to 1300MHz, typical values are at V_{DD} = 1.8V, f = 1227.6MHz, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|-----------------------------------|--------------------|--|------|--------|-----------------|-------|
| DC Characteristics | | | | | | |
| Supply Voltage | V _{DD} | | 1.6 | | 3.6 | V |
| Supply Current | I _{VDD} | EN = High | | 6.3 | 10.3 | mA |
| | I _{SD} | EN = Low | 0 | 0.10 | 2.2 | µA |
| Control Voltage | V _{CTL_H} | High | 1.35 | 1.8 | V _{DD} | V |
| | V _{CTL_L} | Low | 0 | 0 | 0.45 | |
| Turn-On Time | t _{ON} | Time from EN on to 90% of the gain | | 0.5 | | µs |
| Turn-Off Time | t _{OFF} | Time from EN off to 10% of the gain | | 0.1 | | µs |
| RF Characteristics | | | | | | |
| RF Frequency Range | f ₀ | None | | 1227.6 | | MHz |
| Power Gain | S21 | | | 18.1 | | dB |
| Noise Figure | NF | | | 0.89 | | dB |
| Input Return Loss | S11 | | | -3 | | dB |
| Output Return Loss | S22 | | | -12 | | dB |
| Reverse Isolation | S12 | | | -33 | | dB |
| Stability | Kf | Frequency range from 500MHz to 5GHz | 1 | | | |
| Input Power 1dB Compression Point | P _{1dB} | | | -15 | | dBm |
| Input In-Band IP3 | IIP3_inb | f ₁ = 1227MHz, f ₂ = 1228MHz, -30dBm | | -2 | | dBm |
| Input Out-Band IP3 | IIP3_outb | f ₁ = 1850MHz, -20dBm, f ₂ = 2480MHz, -65dBm, IP3 = (2 × P1 + P2 + Gain 1220MHz - IM3)/2 | | 7 | | dBm |

ELECTRICAL CHARACTERISTICS (continued)

(T_A = +25°C, V_{DD} = 1.6V to 3.6V, f = 1550MHz to 1615MHz, typical values are at V_{DD} = 2.8V, f = 1575.42MHz, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|-----------------------------------|--------------------|--|------|---------|-----------------|-------|
| DC Characteristics | | | | | | |
| Supply Voltage | V _{DD} | | 1.6 | | 3.6 | V |
| Supply Current | I _{VDD} | EN = High | | 6.5 | 10.3 | mA |
| | I _{SD} | EN = Low | 0 | 0.16 | 2.2 | μA |
| Control Voltage | V _{CTL_H} | High | 1.35 | 1.8 | V _{DD} | V |
| | V _{CTL_L} | Low | 0 | 0 | 0.45 | |
| Turn-On Time | t _{ON} | Time from EN on to 90% of the gain | | 0.5 | | μs |
| Turn-Off Time | t _{OFF} | Time from EN off to 10% of the gain | | 0.1 | | μs |
| RF Characteristics | | | | | | |
| RF Frequency Range | f ₀ | None | | 1575.42 | | MHz |
| Power Gain | S21 | | 17.0 | 18.2 | 19.8 | dB |
| Noise Figure | NF | | | 0.90 | | dB |
| Input Return Loss | S11 | | | -4 | | dB |
| Output Return Loss | S22 | | | -16 | | dB |
| Reverse Isolation | S12 | | | -31 | | dB |
| Stability | Kf | Frequency range from 500MHz to 5GHz | 1 | | | |
| Input Power 1dB Compression Point | P _{1dB} | | | -10 | | dBm |
| Input In-Band IP3 | IIP3_inb | f ₁ = 1574.5MHz, f ₂ = 1575.5MHz, -30dBm | | 0 | | dBm |
| Input Out-Band IP3 | IIP3_outb | f ₁ = 1712.7MHz, -30dBm, f ₂ = 1850MHz, -30dBm, IP3 = (2 × P1 + P2 + Gain 1575MHz - IM3)/2 | | 0 | | dBm |

(T_A = +25°C, V_{DD} = 1.6V to 3.6V, f = 1550MHz to 1615MHz, typical values are at V_{DD} = 1.8V, f = 1575.42MHz, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|-----------------------------------|--------------------|--|------|---------|-----------------|-------|
| DC Characteristics | | | | | | |
| Supply Voltage | V _{DD} | | 1.6 | | 3.6 | V |
| Supply Current | I _{VDD} | EN = High | | 6.3 | 10.3 | mA |
| | I _{SD} | EN = Low | 0 | 0.10 | 2.2 | μA |
| Control Voltage | V _{CTL_H} | High | 1.35 | 1.8 | V _{DD} | V |
| | V _{CTL_L} | Low | 0 | 0 | 0.45 | |
| Turn-On Time | t _{ON} | Time from EN on to 90% of the gain | | 0.5 | | μs |
| Turn-Off Time | t _{OFF} | Time from EN off to 10% of the gain | | 0.1 | | μs |
| RF Characteristics | | | | | | |
| RF Frequency Range | f ₀ | None | | 1575.42 | | MHz |
| Power Gain | S21 | | 16.7 | 17.7 | 19.2 | dB |
| Noise Figure | NF | | | 0.90 | | dB |
| Input Return Loss | S11 | | | -4 | | dB |
| Output Return Loss | S22 | | | -15 | | dB |
| Reverse Isolation | S12 | | | -30 | | dB |
| Stability | Kf | Frequency range from 500MHz to 5GHz | 1 | | | |
| Input Power 1dB Compression Point | P _{1dB} | | | -14 | | dBm |
| Input In-Band IP3 | IIP3_inb | f ₁ = 1574.5MHz, f ₂ = 1575.5MHz, -30dBm | | -2 | | dBm |
| Input Out-Band IP3 | IIP3_outb | f ₁ = 1712.7MHz, -30dBm, f ₂ = 1850MHz, -30dBm, IP3 = (2 × P1 + P2 + Gain 1575MHz - IM3)/2 | | -1 | | dBm |

TYPICAL APPLICATION CIRCUIT

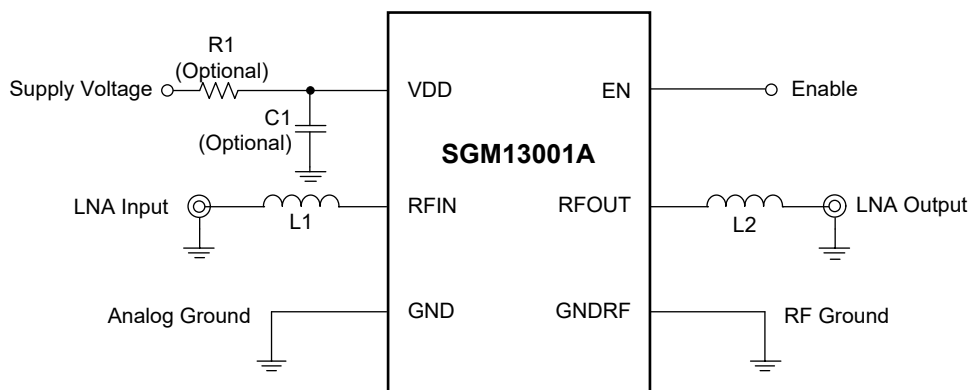


Figure 2. SGM13001A Typical Application Circuit

Table 1. SGM13001A Function Table

| Component | Matching Band | Vendor | Type | Part Number & Value |
|-----------|--------------------|--------|------------------------|---------------------|
| L1 | 1160MHz to 1300MHz | Murata | Wired inductor, high Q | LQW15AN20N, 20nH |
| L2 | 1160MHz to 1300MHz | Murata | Wired inductor, high Q | LQW15AN5N6, 5.6nH |
| L1 | 1550MHz to 1615MHz | Murata | Wired inductor, high Q | LQW15AN9N1, 9.1nH |
| L2 | 1550MHz to 1615MHz | NC | NC | 0 |

EVALUATION BOARD LAYOUT

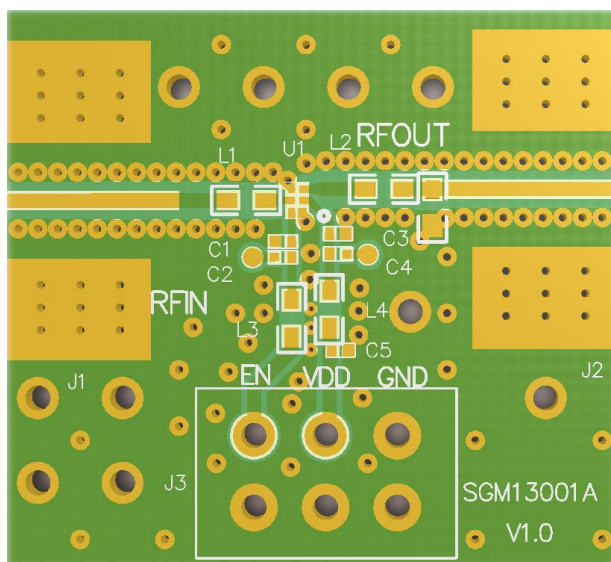


Figure 3. SGM13001A Evaluation Board Layout

REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

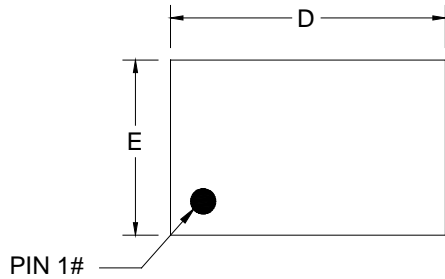
| MARCH 2023 – REV.A to REV.A.1 | Page |
|---|---------------|
| Updated General Description, Features, Absolute Maximum Ratings and Electrical Characteristics sections | 1, 2, 4, 5, 6 |

| Changes from Original (MARCH 2022) to REV.A | Page |
|--|-------------|
| Changed from product preview to production data..... | All |

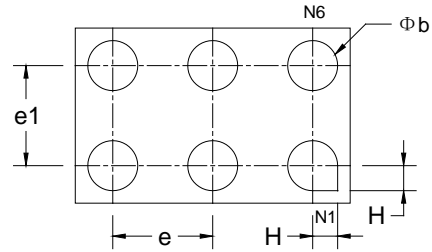
PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

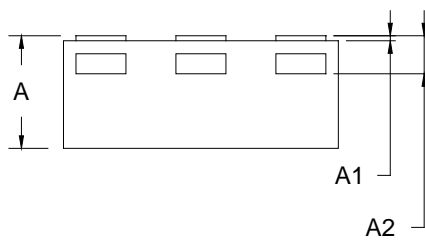
UTDFN-1.1x0.7-6L



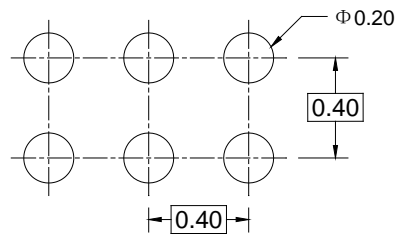
TOP VIEW



BOTTOM VIEW



SIDE VIEW



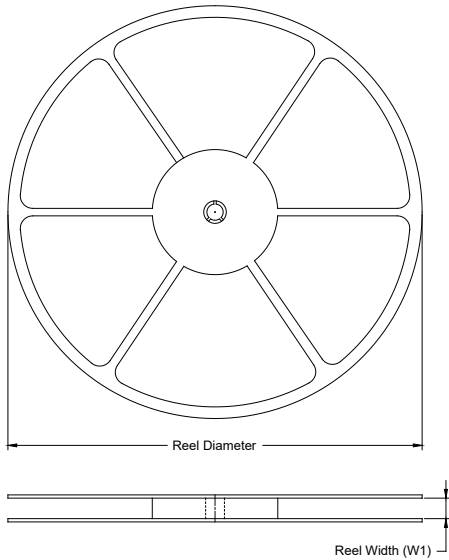
RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol | Dimensions In Millimeters | | |
|--------|---------------------------|-------|-------|
| | MIN | MOD | MAX |
| A | 0.400 | 0.450 | 0.500 |
| A1 | 0.000 | 0.020 | 0.050 |
| A2 | 0.152 REF | | |
| D | 1.050 | 1.100 | 1.150 |
| E | 0.650 | 0.700 | 0.750 |
| b | 0.150 | 0.200 | 0.250 |
| e | 0.300 | 0.400 | 0.500 |
| e1 | 0.300 | 0.400 | 0.500 |
| H | 0.100 REF | | |

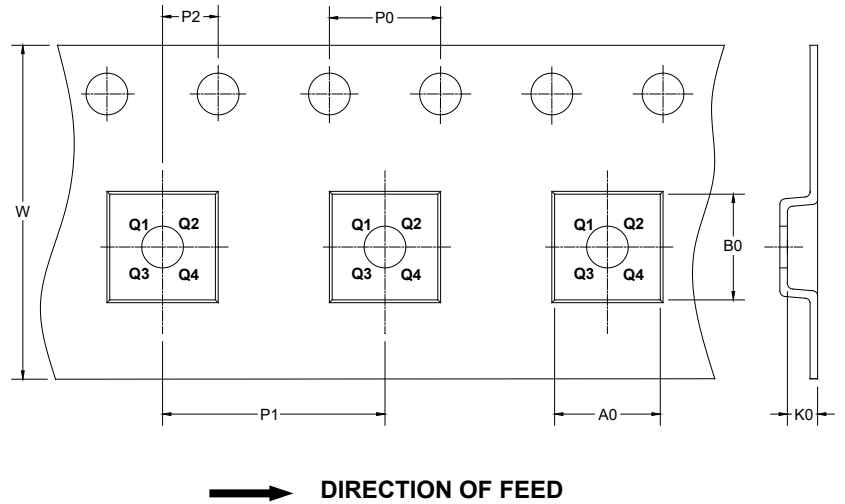
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|------------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| UTDFN-1.1×0.7-6L | 7" | 9.5 | 0.80 | 1.20 | 0.55 | 4.0 | 2.0 | 2.0 | 8.0 | Q1 |

DD00001

PACKAGE INFORMATION

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

| Reel Type | Length (mm) | Width (mm) | Height (mm) | Pizza/Carton |
|-------------|-------------|------------|-------------|--------------|
| 7" (Option) | 368 | 227 | 224 | 8 |
| 7" | 442 | 410 | 224 | 18 |

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