# LX5510B

## InGaP HBT 2.4 – 2.5 GHz Power Amplifier

**PRODUCTION DATA SHEET**

## DESCRIPTION

The LX5510B is a power amplifier optimized for WLAN applications in the 2.4-2.5 GHz frequency range. The PA is implemented as a two-stage monolithic microwave integrated circuit (MMIC) with active bias and input/output pre-matching.

The device is manufactured with an InGaP/GaAs Heterojunction Bipolar Transistor (HBT) IC process (MOCVD). With a single supply of 3.3 volts and a low quiescent current of 70mA the power gain is 19dB 2.4 – 2.5GHz.

For +19dBm OFDM output power (64QAM, 54Mbps), the PA provides a low EVM (Error-Vector Magnitude) of 3.0%, and consumes 135mA total DC current with the nominal 3.3V bias.

The LX5510B is available in a 16-pin 3mmx3mm micro-lead package (MLP). The compact footprint, low profile, and excellent thermal capability of the MLP package makes the LX5510B an ideal solution for medium-gain power amplifier requirements for IEEE 802.11b/g applications

**IMPORTANT:** For the most current data, consult *MICROSEMI*'s website: **http://www.microsemi.com**

## KEY FEATURES

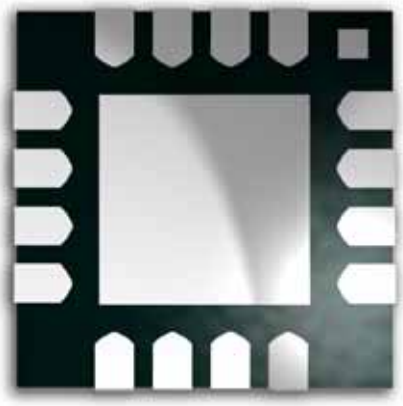
- Advanced InGaP HBT
- 2.4 – 2.5GHz Operation
- Single-Polarity 3.3V Supply
- Low Quiescent Current $I_{CQ}$ ~70mA
- Power Gain ~19dB @ 2.45GHz and Pout = 19dBm
- Total Current 135mA for Pout = 19dBm @ 2.45GHz OFDM
- EVM ~ 3.0% for 64QAM / 54Mbps and Pout = 19dBm
- Small Footprint (3 x 3 $mm^2$)
- Low Profile (0.9mm)

## APPLICATIONS

- IEEE 802.11b/g

## PRODUCT HIGHLIGHT



## PACKAGE ORDER INFO

| $T_A$ (°C) | **LQ** Plastic MLPQ 16 pin RoHS Compliant / Pb-free |
|---|---|
| 0 to 70 | **LX5510BLQ** |

Note: Available in Tape & Reel. Append the letters "TR" to the part number. (i.e. LX5510BLQ-TR)

This device is classified as EDS Level 1 in accordance with MIL-STD-883, Method 3015 (HBM) testing. Appropriate ESD procedures should be used when handling this device.

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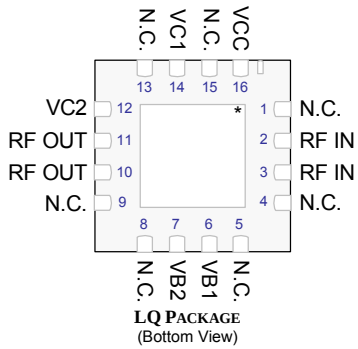
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## ABSOLUTE MAXIMUM RATINGS

DC Supply Voltage, RF off ..... 6V
Collector Current ..... 400mA
Total Power Dissipation ..... 2W
RF Input Power ..... 15dBm
Operation Ambient Temperature ..... -40°C to +85°C
Storage Temperature ..... -65°C to +150°C
Package Peak Temp. for Solder Reflow (40 seconds maximum exposure) ..... 260°(+0, -5)

Note: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of specified terminal.

## PACKAGE PIN OUT




LQ PACKAGE
(Bottom View)

RoHS / Pb-free 100% Matte Tin Lead Finish

## THERMAL DATA

**LQ** Plastic MLPQ 16-Pin

| | |
|---|---|
| THERMAL RESISTANCE-JUNCTION TO CASE, $\theta_{JC}$ | 10°C/W |
| THERMAL RESISTANCE-JUNCTION TO AMBIENT, $\theta_{JA}$ | 50°C/W |

## FUNCTIONAL PIN DESCRIPTION

| Name | Description |
|---|---|
| RF IN | RF input for the power amplifier. This pin is DC-shorted to GND but AC-coupled to the transistor base of the first stage. |
| VB1 | Bias current control voltage for the first stage. |
| VB2 | Bias current control voltage for the second stage. The VB2 pin can be connected with the first stage control voltage (VB1) into a single reference voltage (referred to as $V_{REF}$) through an external resistor bridge. |
| VCC | Supply voltage for the bias reference and control circuits. This pin can be combined with both VC1 and VC2 pins, resulting in a single supply voltage (referred to as $V_C$). |
| RF OUT | RF output for the power amplifier. |
| VC1 | Power supply for first stage amplifier. The VC1 feed line should be terminated with a 3.9pF bypass capacitor 50 mil apart from the device, followed by a 8.2nH blocking inductor at the supply side. This pin can be combined with VC2 and VCC pins, resulting in a single supply voltage (referred to as $V_C$). |
| VC2 | Power supply for second stage amplifier. The VC2 feed line should be driven with a 8.2nH AC blocking inductor and 1µF bypass capacitor. This pin can be combined with VC1 and VCC pins, resulting in a single supply voltage (referred to as $V_C$). |
| GND | The center metal base of the MLP package provides both DC and RF ground as well as heat sink for the power amplifier. |



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## ELECTRICAL CHARACTERISTICS

Unless otherwise specified, the following specifications apply over the operating ambient temperature 0°C ≤ $T_A$ ≤ 70°C except where otherwise noted and the following test conditions: $V_C$ = 3.3V, $V_{REF}$ = 2.88V, $I_{CQ}$ = 70mA, $T_A$ = 25°C

| Parameter | Symbol | Test Conditions | LX5510B | | | Units |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| **SECTION HEADER** | | | | | | |
| Frequency Range | f | | 2.4 | | 2.5 | GHz |
| Power Gain at $P_{OUT}$= 19dBm | $G_P$ | | | 19 | | dB |
| EVM at Pout = 19dBm | | 64QAM / 54Mbps OFDM | | 3.0 | | % |
| Total Current @ $P_{OUT}$ = 19dBm | $I_{C_TOTAL}$ | | | 135 | | mA |
| Quiescent Current | $I_{CQ}$ | | | 70 | | mA |
| Bias Control Reference Current | $I_{REF}$ | For $I_{CQ}$ = 70mA | | 1.5 | | mA |
| Small-Signal Gain | S21 | | | 19 | | dB |
| Gain Flatness | ΔS21 | Over 100MHz | | ±0.5 | | dB |
| Gain Variation Over Temperature | ΔS21 | 0°C to +70°C | | ±0.5 | | dB |
| Input Return Loss | S11 | | | 10 | | dB |
| Output Return Loss | S22 | | | 10 | | dB |
| Reverse Isolation | S12 | | | 40 | | dB |
| Second Harmonic | | Pout = 19dBm | | -55 | | dBc |
| Third Harmonic | | Pout = 19dbm | | -55 | | dBc |
| $2^{nd}$ Side Lobe | | 23 dBm 11 Mbps CCK | | -50 | | dBc |
| Total current Pout=23 dBm | | 11 Mbps CCK | | 190 | | mA |
| Ramp-On Time | $t_{ON}$ | 10 ~ 90% | | | 100 | ns |

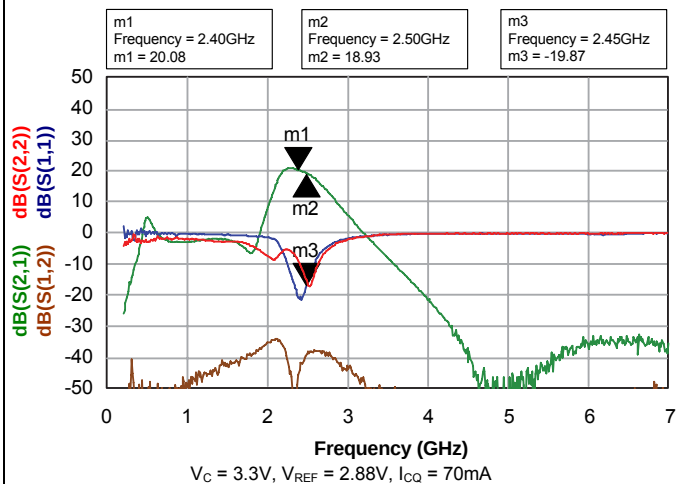
Note: All measured data was obtained on a 10 mil GETEK evaluation board without heat sink.



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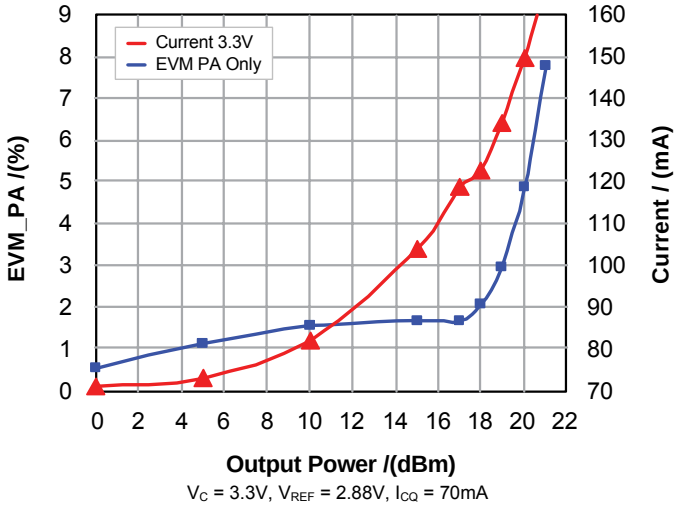
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## S PARAMETER DATA



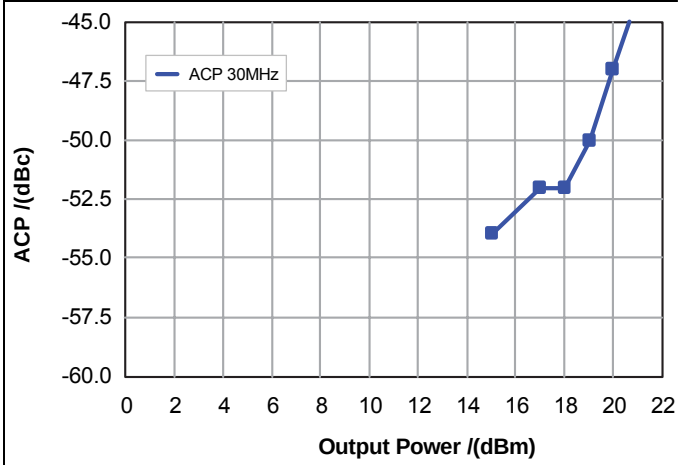

$V_C$ = 3.3V, $V_{REF}$ = 2.88V, $I_{CQ}$ = 70mA

## EVM DATA WITH 54MB/S64QAM OFDM



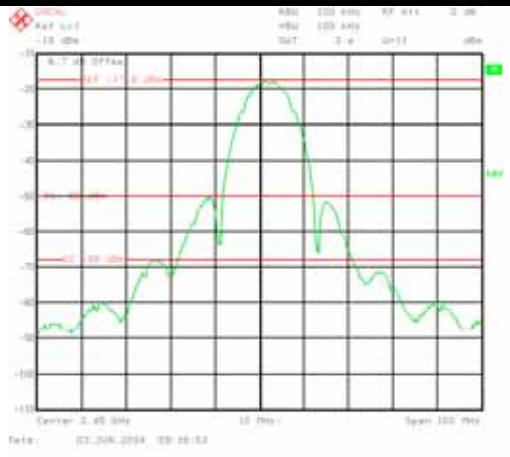

$V_C$ = 3.3V, $V_{REF}$ = 2.88V, $I_{CQ}$ = 70mA

## ACP DATA WITH 54MB/S 64 QAM OFDM



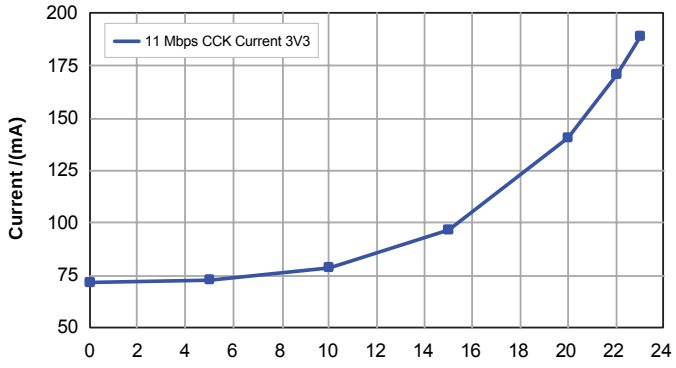

$V_C$ = 3.3V, $V_{REF}$ = 2.88V, $I_{CQ}$ = 70mA

## SPECTRUM WITH 23DBM 11MB/S CCK



$V_C$ = 3.3V, $V_{REF}$ = 2.88V, $I_{CQ}$ = 70mA, $I_C$ = 190mA

## SUPPLY CURRENT WITH 11MB/S CCK



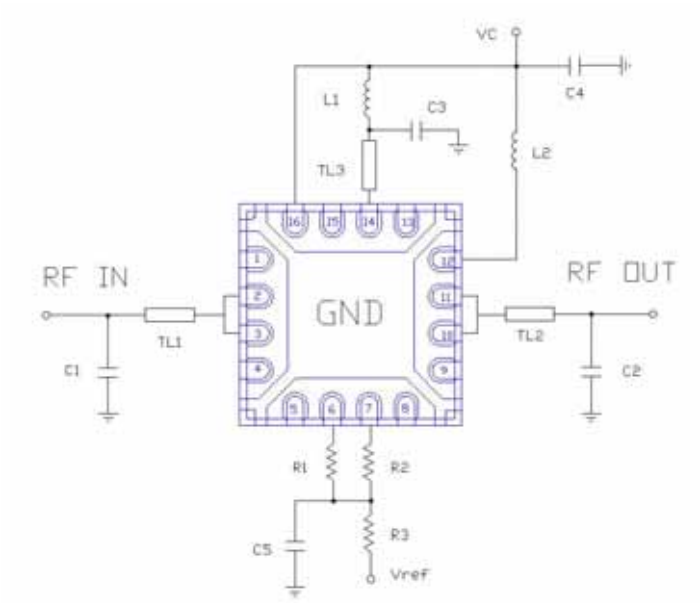

**$V_C$ = 3.3V, $V_{REF}$ = 2.88V, $I_{CQ}$ = 70MA**



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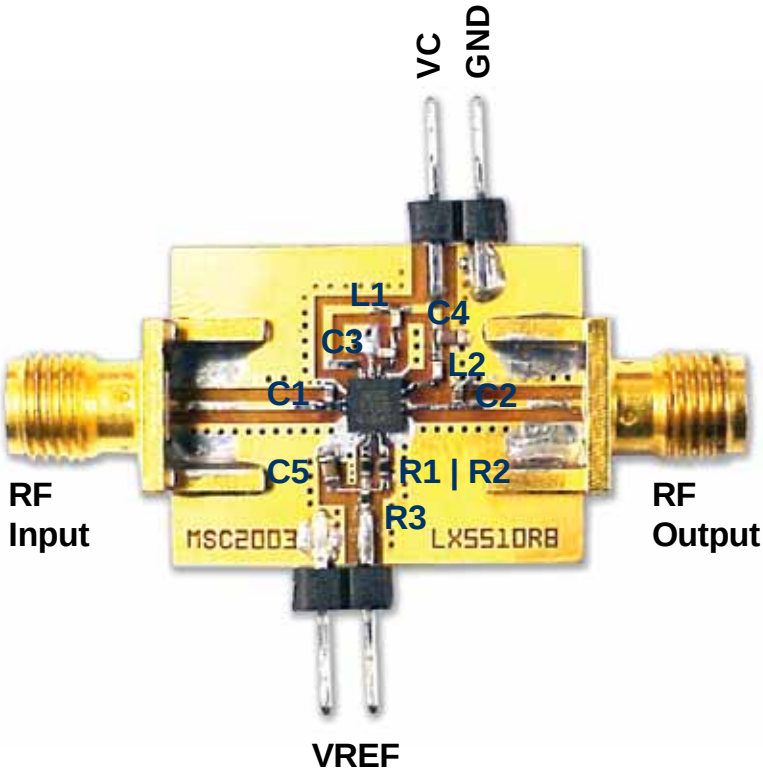

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## EVALUATION BOARD




**Recommended BOM**

| Location | Value |
|---|---|
| C1 | 2.7pF (0402) |
| C2 | 2.4pF (0402) |
| C3 | 3.9pF (0402) |
| C4,C5 | 1µF (0603) |
| L1,L2 | 8.2nH(0402) |
| R1 | 350 Ω (0402) |
| R2<br>R3 | 200 Ω (0402)<br>100 Ω (0402) |
| TL1 | 30/22 mil (L/W) |
| TL2 | 100/10 mil (L/W) |
| TL3 | 60/10 mil (L/W) |
| Substrate | 10 mil GETEK |
| | $\varepsilon_r$ =3.9, tan $\delta$ = 0.01 |
| | 50Ω Microstrip width: 22 mil |



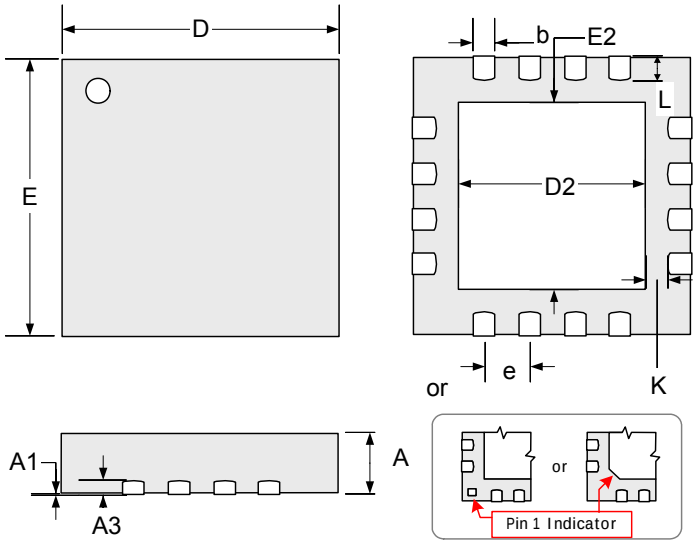



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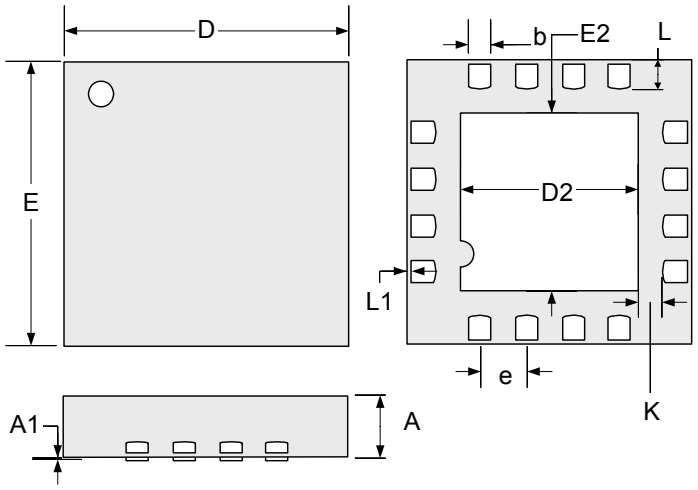
## PACKAGE DIMENSIONS

### LQ 16-Pin MLPQ 3x3




| Dim | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.80 | 1.00 | 0.031 | 0.039 |
| A1 | 0 | 0.05 | 0 | 0.002 |
| A3 | 0.20 REF | | 0.008 REF | |
| b | 0.18 | 0.30 | 0.007 | 0.012 |
| D | 3.00 BSC | | 0.118 BSC | |
| E | 3.00 BSC | | 0.118 BSC | |
| e | 0.50 BSC | | 0.020 BSC | |
| D2 | 1.30 | 1.55 | 0.051 | 0.061 |
| E2 | 1.30 | 1.55 | 0.051 | 0.061 |
| K | 0.2 | - | 0.008 | - |
| L | 0.35 | 0.50 | 0.012 | 0.020 |
| L1 | - | 0.15 | - | 0.006 |

Or




**Note:**

1. Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm(.006") on any side. Lead dimension shall not include solder coverage.
2. Due to multiple qualified assembly sub-contractors either package (with different pin one indicators) may be shipped. Package type will be consistent within the smallest individual container.

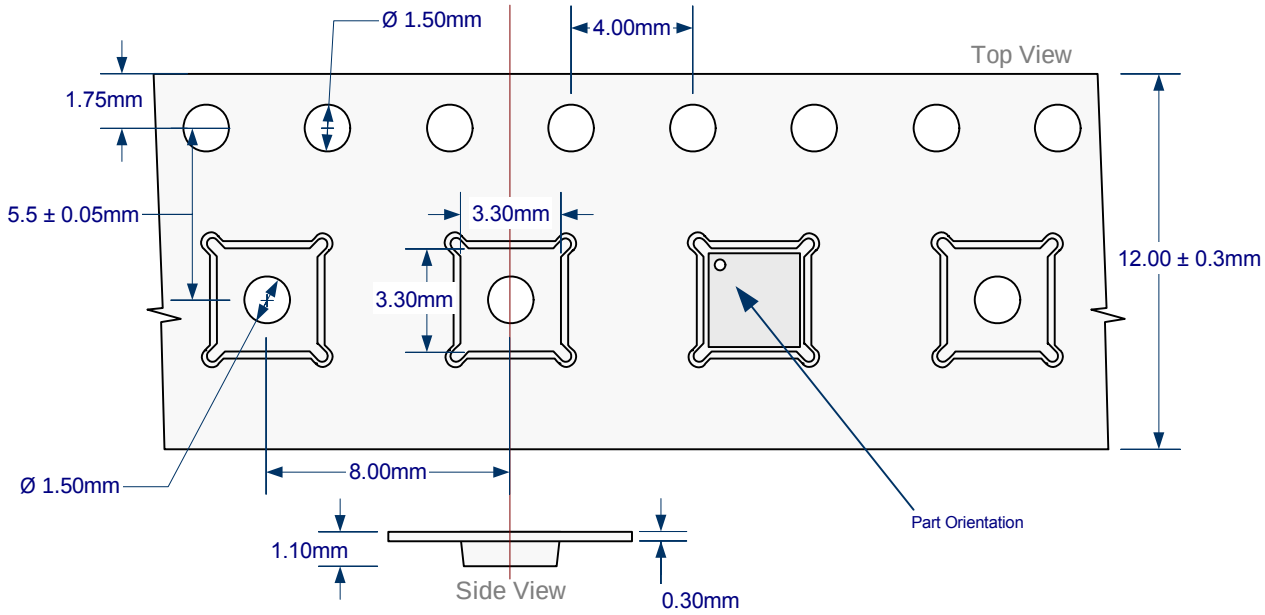


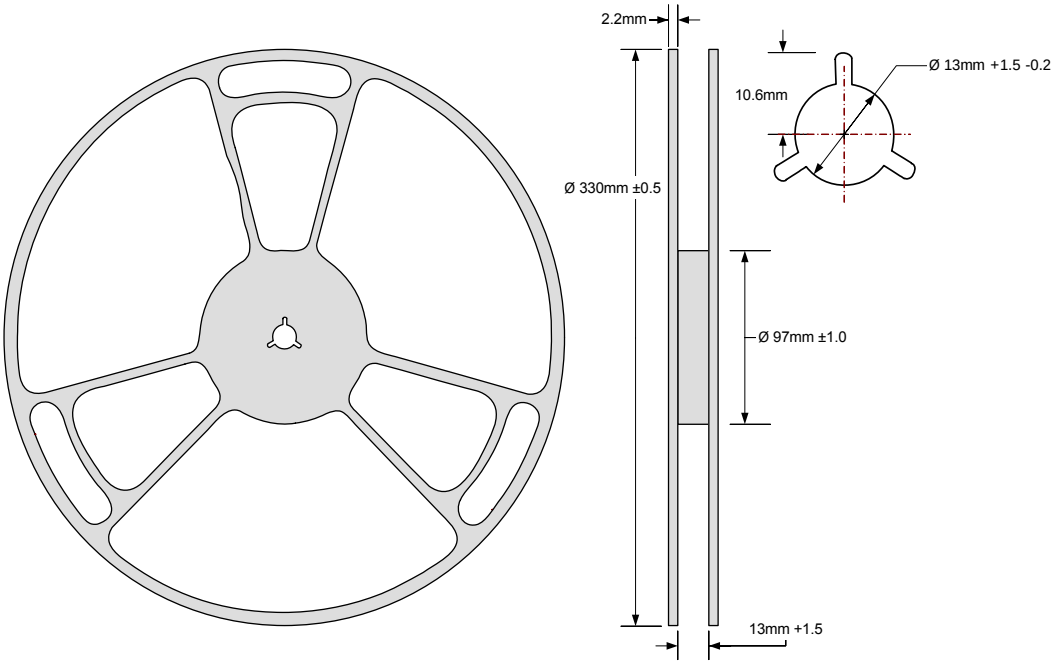
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## TAPE AND REEL

### Tape And Reel Specification






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