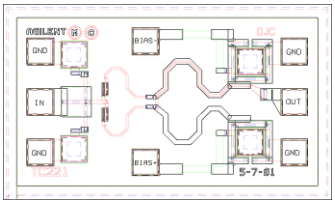
Keysight TC221P
50 GHz Frequency Doubler

HMMC-5635-BLK (Waffle Pack)
HMMC-5635-TR1 (Tape & Reel)

Data Sheet



Features

Conversion Efficiency:
-12 dB Typical

1/2 and 3/2 spurs:
15 dBc Typical

Broad Bandwidth, 20-50 GHz:
Output Frequency

KEYSIGHT TECHNOLOGIES

Description

Vital Stats
Package size:
2x2mm (12 leads)

The TC221P is a passive diode frequency doubler. It is specified to operate with a 20–50 GHz output frequency. Conversion efficiency is usually around -12 dB. The device has low 1/2 and 3/2 spurious output, typically 15 dBc or better. The doubler can be biased through on–chip resistors to allow operation at low input levels. Up to 22 dBm at the input can be accommodated. On–chip DC blocking capacitors are included at the input and output.

Absolute Maximum Ratings [1]

Symbol	Parameter / Condition	Min	Max	Units
$P_{IN,MAX}$	Max Input Power		22	dBm
V_{DC-IN}	DC Voltage at Input	-9	9	V
V_{DC-OUT}	DC Voltage at Output	-9	9	V
$V_{BIAS-MAX}$	Voltage Limits at ± Bias Pads	-4	+4	V
Tthermo [2][3]	Thermocouple temperature		65	°C
Tstg	Storage temperature	-65	150	°C
Tmax [4]	Assembly temperature		260	°C

[1] Operation in excess of any of the values may result in permanent damage to the device.

[2] Cumulative failures < 5% in 10 years and < 50% in 30 years. Operation in excess of Tthermo will reduce part lifetime.

[3] IC reliability is determined based on all HFTC IC's included in a Keysight instrument. Review and signoff on instrument board design is done during the PLC process. Keysight's quality standards are guaranteed for instruments that have been properly reviewed during the PLC process. Operation above the stated max temperature will significantly degrade IC reliability unless it is determined otherwise during the HFTC PLC review.

[4] Refer to JEDEC J-STD-020D for detailed reflow profile, three reflows maximum.

RF Specifications [1]

Symbol	Parameter / Condition	Min	Typ	Max	Units
CE10	Conversion Efficiency at 10.0 GHz Input	-15	-12		dB
CE17	Conversion Efficiency at 10.0 GHz Input	-14	-12		dB
CE25	Conversion Efficiency at 10.0 GHz Input	-14	-12		dB
RLIN	Input Return Loss, 10-25 GHz		10		dB
Fund25	Fund. Feedthru of 25.0 GHz (relative to 50 GHz output)	17	20		dBc

[1] T_A = 25°C, P_{in} = 15 dBm, Z_0 = 50Ω, BIAS+=1.0, adj. for 5mA [~ 1V], BIAS-=0V

Applications

The TC221P frequency doubler is designed for use in microwave instrumentation source applications.

Operation

The TC221P is a passive diode doubler, with "+" and "-" DC bias pads included to optimize performance at low input power levels. Bias can be applied through either the "+" or "-" bias pad or both, with the other pad either grounded or open. The optimum bias will depend on frequency and input power level, and must be empirically optimized for each application.

DC blocking capacitors have been included at the input and output of the device for ease of interface to other devices. The device should be mounted using epoxy or solder to a metal case with thermal conductivity equal to, or better than, aluminum, and the case temperature should not exceed 85°C. This will keep the diode junctions at or below 130°C for an input power of 22 dBm, and will keep the rectified diode currents well within acceptable limits for reliable operation.

Assembly Techniques

Epoxy die–attach using conductive epoxy or solder die–attach using a fluxless AuSu solder preform can be used for assembly. Gold thermosonic wedge bonding with 0.7 mil diameter Au wire is recommended for all bonds. Tool force should be 22 ± 1 gram, stage temperature should be 150 ± 2°C, and ultrasonic power and duration should be 64 ± 1 dB and 76 ± 8 msec, respectively. The bonding pad and chip backside metallization is gold.

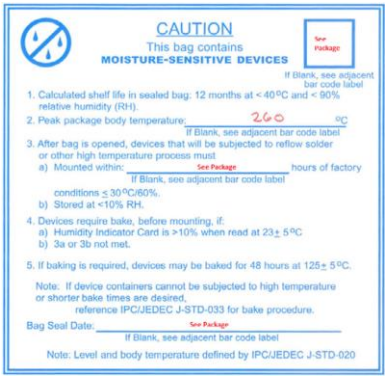
RoHS Compliance

This part is RoHS compliant, meeting the requirements of the EU Restriction of Hazardous Substances Directive 2002/95/EC, commonly known as RoHS. Six substances are regulated: lead, mercury, cadmium, chromium VI (hexavalent chromium), polybrominated biphenyls (PBB), and polybrominated biphenyl ethers (PBDE). RoHS compliance requires that any residual concentration of these substances is below the Directive's maximum concentration values (MCV): cadmium 100ppm by weight and all others 1000ppm by weight.

Moisture Compatibility

Injection mold components like the TC221P in QFN are moisture-sensitive. The product is tested to the Moisture and Reflow Sensitivity Level 3 as per IPC/Jedec J-STD-020 and must be mounted within 168 hours of opening the shipping container. Store and handle parts for reflow and for rework per IPC/Jedec J-STD-033B. An example of the moisture sensitivity label is shown Figure 1.

Figure 1. MSL Label



Tape and Reel

The TC221P is available in tape and reel format to facilitate automatic pick and place manufacturing. See Figure 7.

ESD Handling Precautions

III-V MMICs are ESD sensitive. Damage from ESD events can significantly affect III-IV MMIC performance and reliability. Preventative ESD measures must be employed in all aspects of storage, handling, and assembly, in compliance with the Keysight ESD Control Program. Information on the Keysight ESD Control Program can be found at:

http://emg.communications.keysight.com/quality/esd/

For information on ESD precautions during die attach and bonding, please refer to Keysight application note #54, "III-V MMIC ESD, Die Attach and Bonding Guidelines" pub # 5991-3484.

Figure 2. TC221P Simplified Schematic

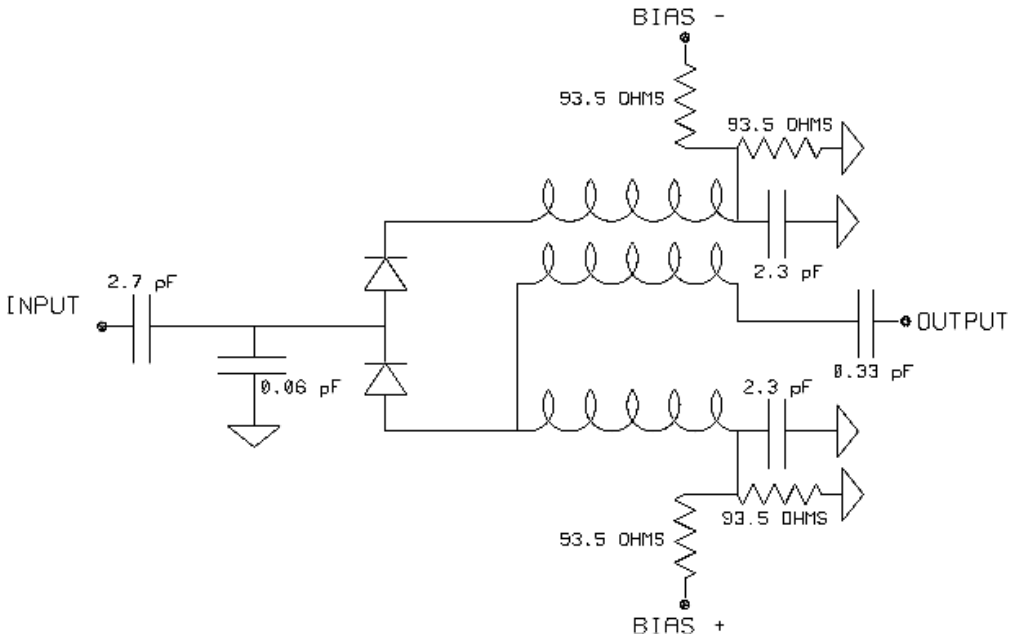


Figure 3. TC221P Bond Pad Locations and Chip Dimensions

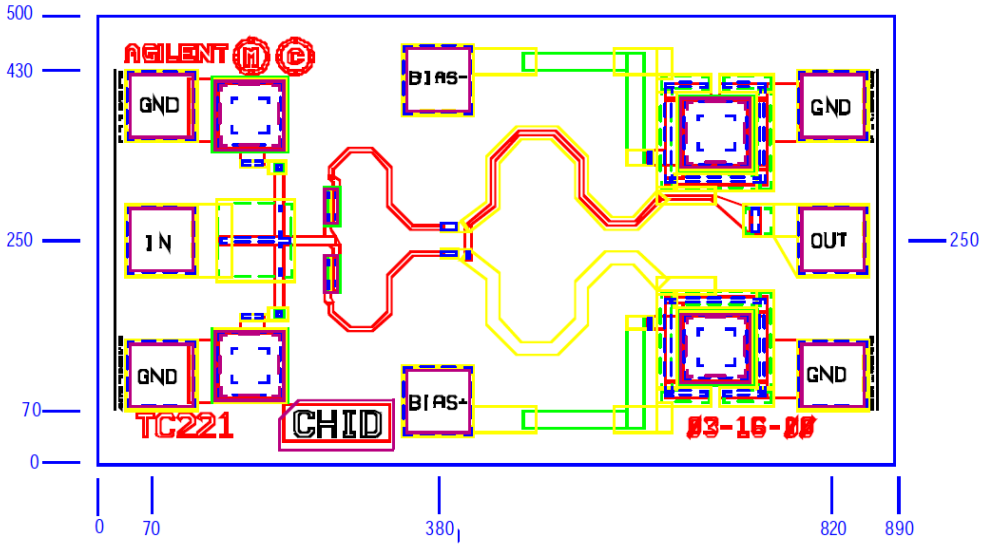


Figure 4. TC221P Pin-out Diagram

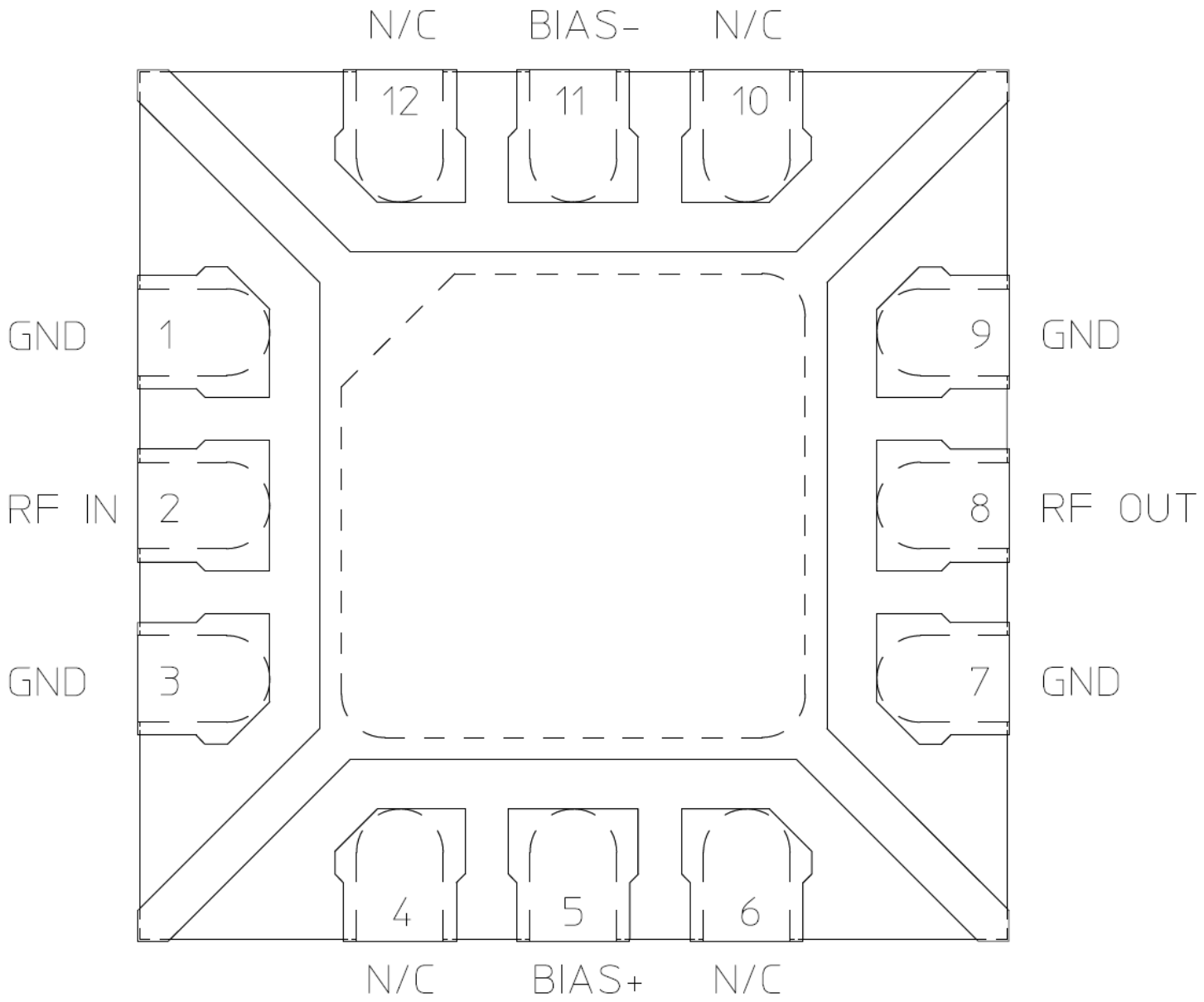


Figure 5. TC221P QFN Footprint Diagram

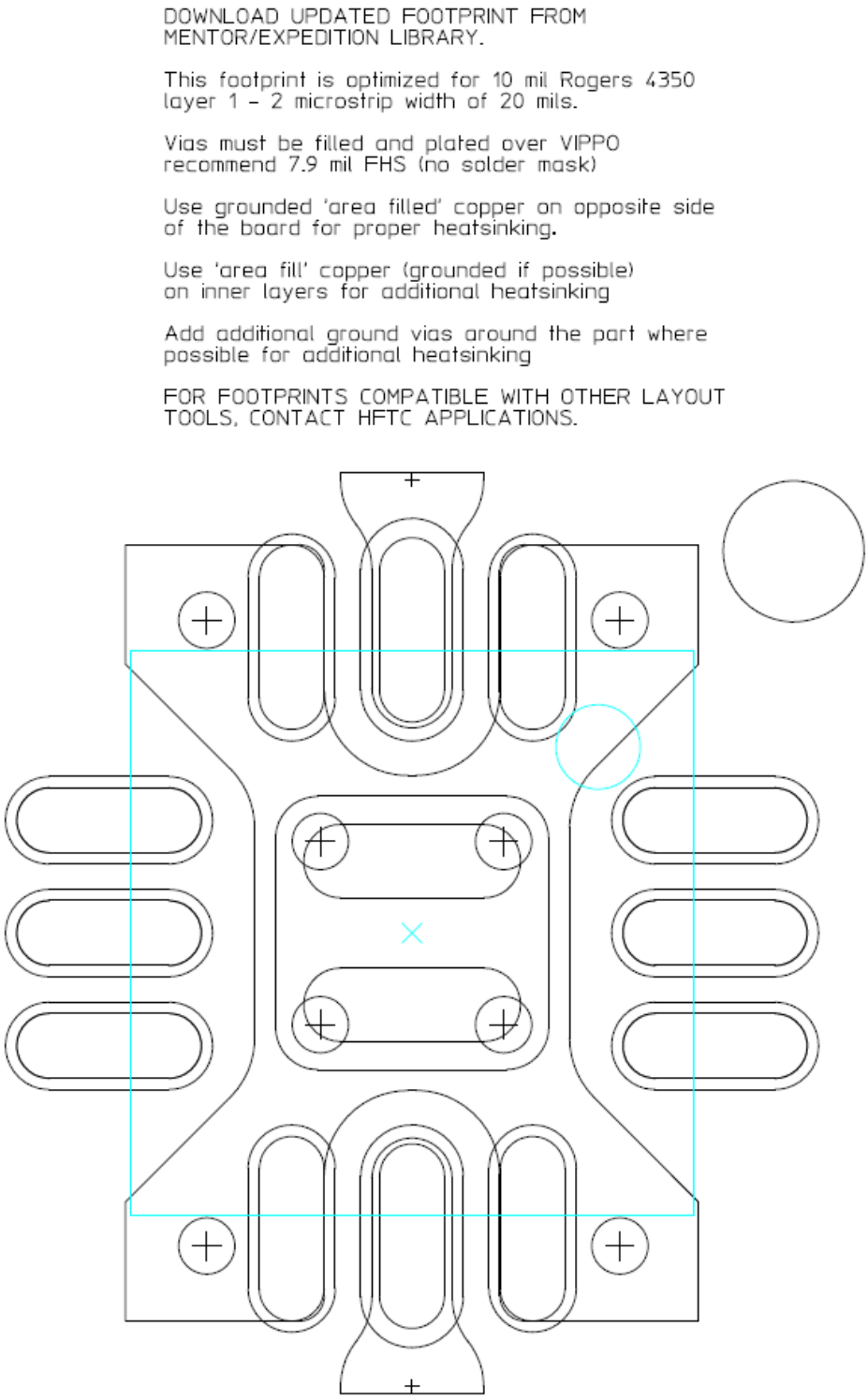


Figure 6. TC221P Dimension Drawing

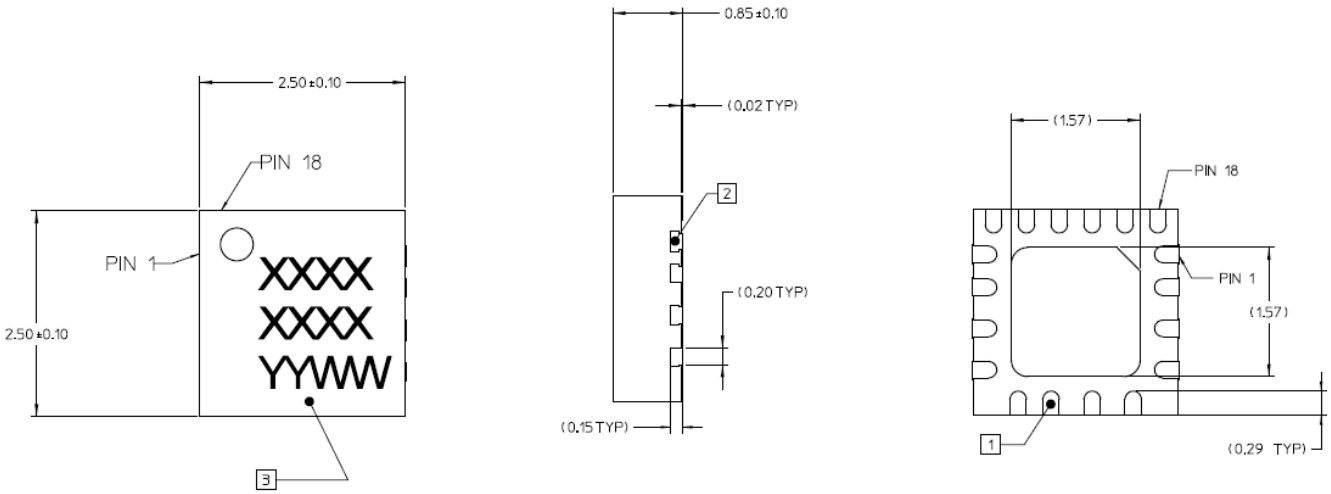
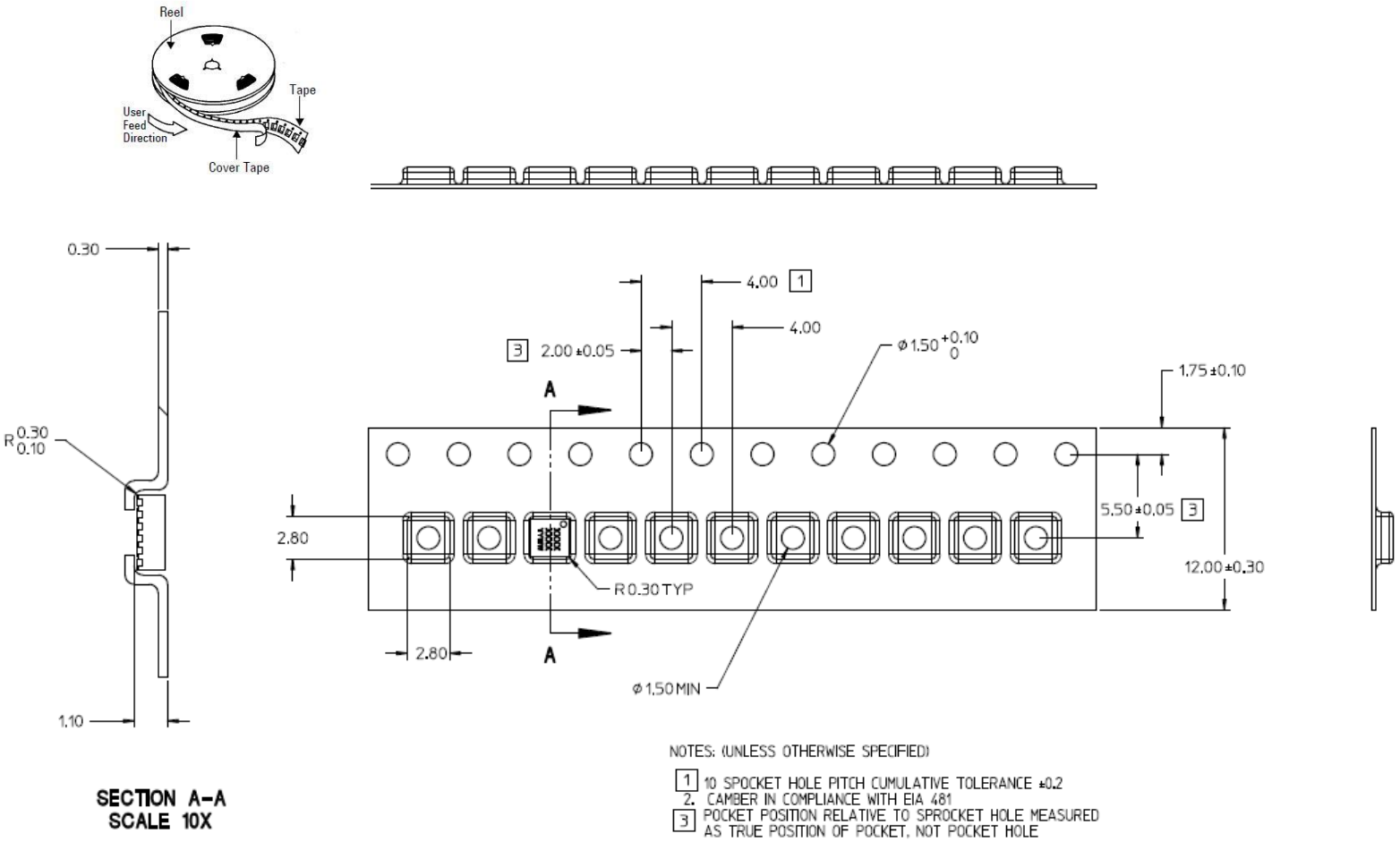


Figure 7. TC221P Tape and Reel Information



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