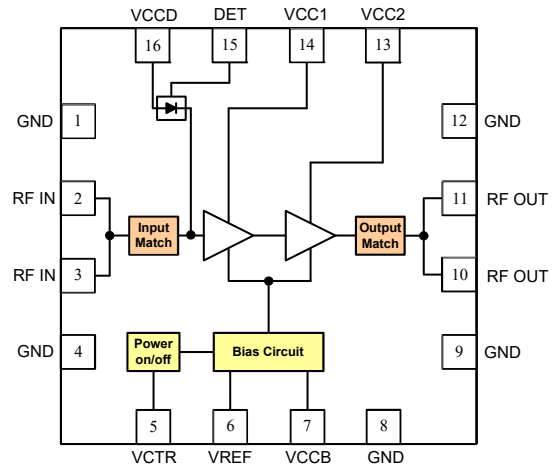


## Features

- 4.0~5.9GHz Frequency Range
- 3.3V~5.5V Supply Voltage
- 3.0% EVM@24dBm for 802.11a 54Mbps, 5.5V
- 3.0% EVM@22.5dBm for 802.11a 54Mbps, 5V
- 2.5% EVM@18dBm for 802.11a 54Mbps, 3.3V
- 240mA Quiescent Current
- 22dB Gain (Typ.)
- >20dB Input Return Loss@5.8GHz
- On-Chip Power Detector



**Functional Block Diagram**

## Applications

- IEEE 802.11a/n WLAN
- IEEE 802.16 WiMax
- 5.8GHz RFID
- Spread-Spectrum and MMDS Systems

## Product Description

The YP552228 is a 2-stage 4.0-5.9GHz high efficiency, high linearity power amplifier based on InGaP/GaAs HBT technology, which is optimized for the applications in bands from 5200MHz to 5800MHz (It needs different matching circuit for different frequency range). The amplifier provides a typical gain of 22 dB and P1dB power of 30.5 dBm, typical bias condition is 5.5V at 240 mA. The input and output are internally matched to 50Ω and require a minimum of external matching components to cover the entire 4.0GHz to 5.9GHz. The YP552228 is assembled in a 16-pin, 4mm×4mm, QFN package.

## Ordering Information

- YP552228                    5.8GHz Linear Power Amplifier
- YP552228EVB-1        5.2GHz to 5.8GHz Evaluation PCB
- YP552228EVB-2        5.6GHz to 5.9GHz Evaluation PCB

**Pin Description**

Pin No.	Symbol	Description
1, 4, 8, 9, 12	NC/GND	No connection or Ground connection
2, 3	RF IN	RF input
5	VCTR	Power on/off control voltage. Apply >2.5VDC to power down the power amplifier stages. Apply 0VDC to power up. If function is not desired, pin5 may be connected to GND
6	VREF	Bias voltage
7	VCCB	Supply voltage for bias
10, 11	RF OUT	RF output
13 / 14	VCC2 / VCC1	Supply voltage for the 2 <sup>nd</sup> / 1 <sup>st</sup> stage
15	DET	Provides an output voltage proportional to the RF level
16	VCCD	Supply voltage for power detector
PKG Base	GND	Ground connection

**Absolute Maximum Ratings**

Parameter	Symbol	Rating	Unit
Input RF Power	RF IN	+14	dBm
Supply Voltage	VCC1,VCC2, VCCB	-0.5 to +7.0	V
Reference Voltage	VREF	-0.5 to +4.0	V
Operating Ambient Temperature	T <sub>OP</sub>	-40 to +85	°C
Storage Temperature	T <sub>ST</sub>	-40 to +150	°C


**Caution! ESD sensitive device.**

ESD Rating: Class1C  
 Value: Passes ≥1000V min.  
 Test: Human Body Model (HBM)  
 Standard: JEDEC Standard JESD22-A114

ESD Rating: Class IV  
 Value: Passes ≥1000V min.  
 Test: Charged Device Model (CDM)  
 Standard: JEDEC Standard JESD22-C101

MSL Rating: Level 3 at +260 °C convection reflow  
 Standard: JEDEC Standard J-STD-020

**Electrical Specifications**
**Table 1-1 Test Frequency: 5.6 to 5.9GHz, Supply Voltage=5.5V**

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Compliance and Nominal Conditions					VCC1=VCC2=VCCB=5.5V, ICQ=240mA, T <sub>OP</sub> = +25°C, Freq=5.6GHz to 5.9GHz
Frequency Range	5.6	5.8	5.9	GHz	
Output Power@1dB Compression		30.5		dBm	5.8 GHz
Gain		21.5		dB	5.8 GHz
EVM		3.0	3.2	%	@Pout=+24dBm, 5.8 GHz 802.11a, 54 Mbps, 64QAM
<b>Power Supply</b>					
Reference Voltage, VREF		2.83		V	
Quiescent Current (Total), ICQ		240		mA	

**Table 1-2 Test Frequency: 5.6 to 5.9GHz, Supply Voltage=5V**

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Compliance and Nominal Conditions					VCC1=VCC2=VCCB=5V, ICQ =240mA, T <sub>OP</sub> =+25°C, Freq=5.6GHz to 5.9GHz
Frequency Range	5.6	5.8	5.9	GHz	
Output Power@1dB Compression		29.5		dBm	5.8 GHz
Gain		22		dB	5.8 GHz
EVM		3.0		%	@Pout=+22.5dBm, 5.8 GHz 802.11a, 54 Mbps, 64QAM
<b>Power Supply</b>					
Reference Voltage, VREF		2.87		V	
Quiescent Current (Total), ICQ		240		mA	

**Table 2-1 Test Frequency: 5.2 to 5.8GHz, Supply Voltage=5V**

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Compliance and Nominal Conditions					VCC1=VCC2=VCCB=5V, ICQ=300mA, T <sub>OP</sub> =+25°C, Freq=5.2GHz to 5.8GHz
Frequency Range	5.2	5.5	5.8	GHz	
Output Power		28	28.5	dBm	5.5 GHz
Gain		22		dB	5.5 GHz
EVM		3.2		%	@Pout=+27dBm, 5.5 GHz 802.16d, 64QAM
		3.2		%	@Pout=+22dBm, 5.5 GHz 802.11a, 54 Mbps, 64QAM
		3.3		%	@Pout=+22dBm, 5.5 GHz 802.11n, 81 Mbps, QPSK
<b>Power Supply</b>					
Reference Voltage, VREF		3.0		V	
Quiescent Current (Total), ICQ		300		mA	

**Table 2-2 Test Frequency: 5.2 to 5.8GHz, Supply Voltage=3.3V**

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Compliance and Nominal Conditions					VCC1=VCC2=VCCB=3.3V, ICQ=300mA, T <sub>OP</sub> =+25°C, Freq=5.2GHz to 5.8GHz
Frequency Range	5.2	5.5	5.8	GHz	
Output Power		25	25.5	dBm	5.5 GHz
Gain		21		dB	5.5 GHz
EVM		2.6		%	@Pout=+23dBm, 5.5 GHz 802.16d, 64QAM
		2.3		%	@Pout=+18dBm, 5.5 GHz 802.11a, 54 Mbps, 64QAM
		2.4		%	@Pout=+17dBm, 5.5 GHz 802.11n, 81 Mbps, QPSK
<b>Power Supply</b>					
Reference Voltage, VREF		3.2		V	
Quiescent Current (Total), ICQ		300		mA	

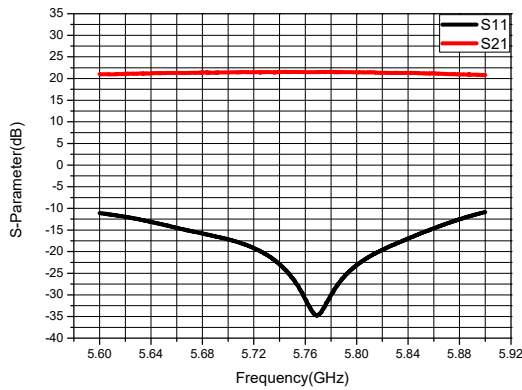


### Typical Performance Data

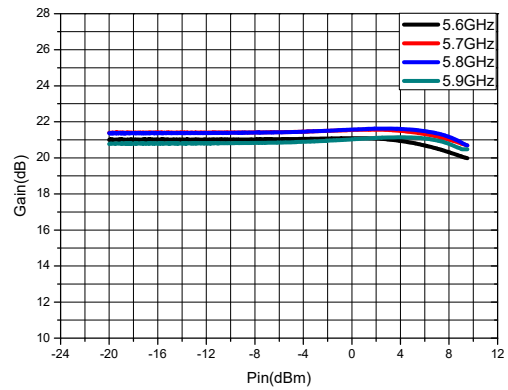
Test Frequency: 5.6 to 5.9GHz

(Test Condition: VCC1=VCC2=VCCB=5.5V, ICQ=240mA, T<sub>OP</sub>=+25°C)

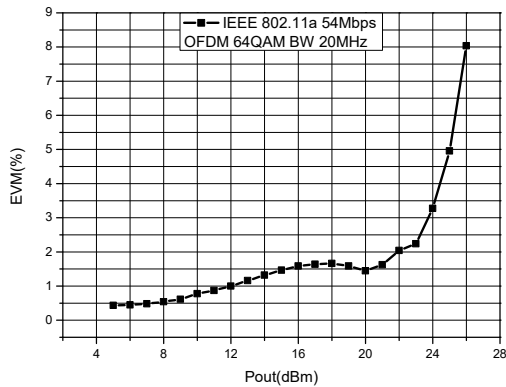
#### Small Signal Parameters



#### Power Gain vs. Input Power



#### 802.11a EVM vs. Output Power @5.8GHz

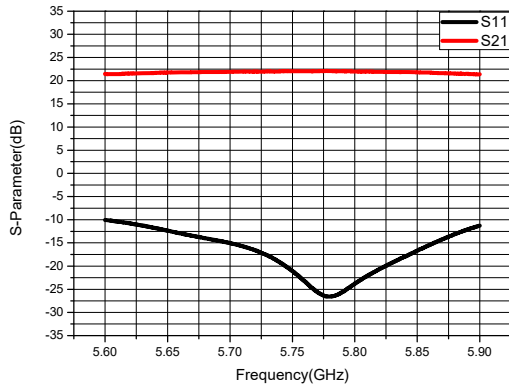




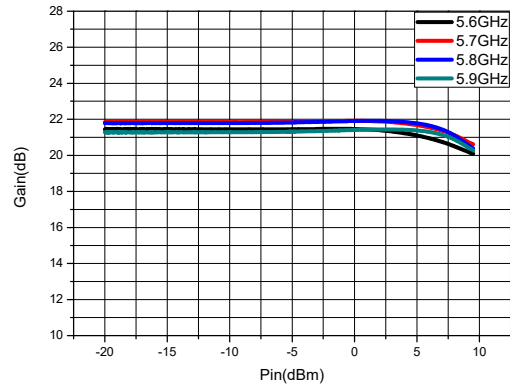
Test Frequency: 5.6 to 5.9GHz

(Test Condition: VCC1=VCC2=VCCB=5V, ICQ=240mA, TOP=+25°C)

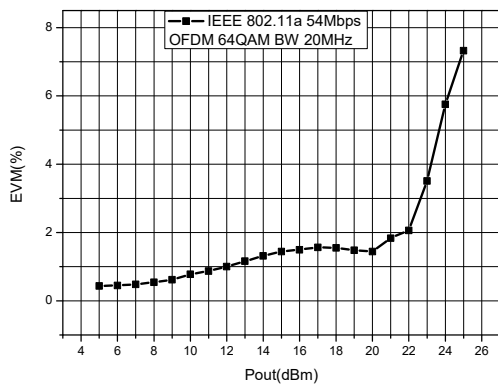
### Small Signal Parameters



### Power Gain vs. Input Power



### 802.11a EVM vs. Output Power @5.8GHz

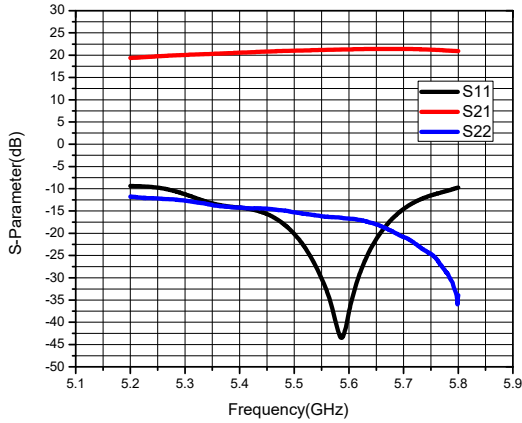


**Typical Performance Data**

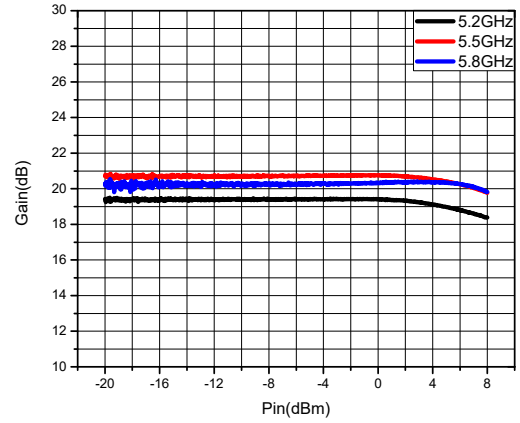
Test Frequency: 5.2 GHz to 5.8GHz

(Test Condition: VCC1=VCC2=VCCB=5.0V, ICQ=300mA, T<sub>OP</sub>=+25°C)

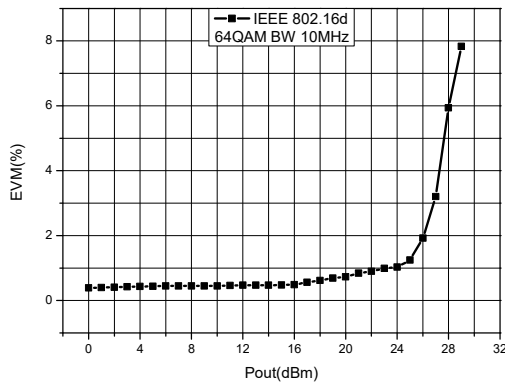
**Small Signal Parameters**



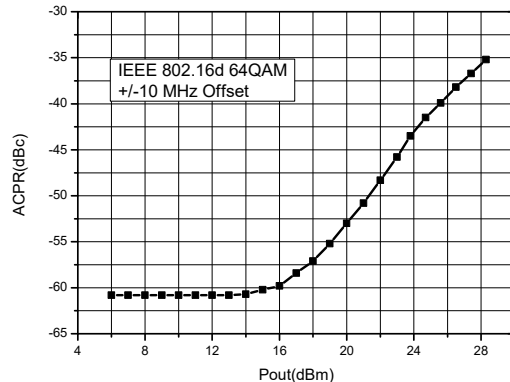
**Power Gain vs. Input Power**



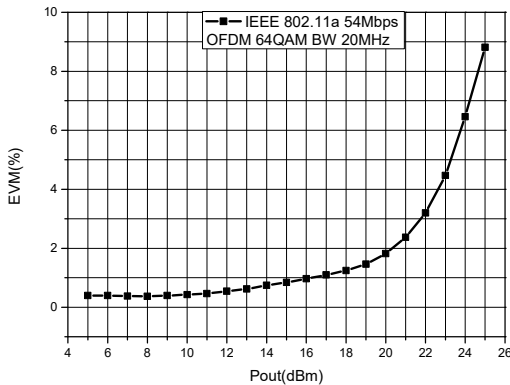
**802.16d EVM vs. Output Power @5.5GHz**



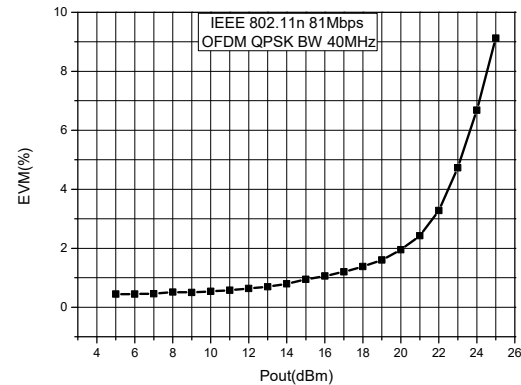
**802.16d ACPR vs. Output Power @5.5GHz**



**802.11a EVM vs. Output Power @5.5GHz**



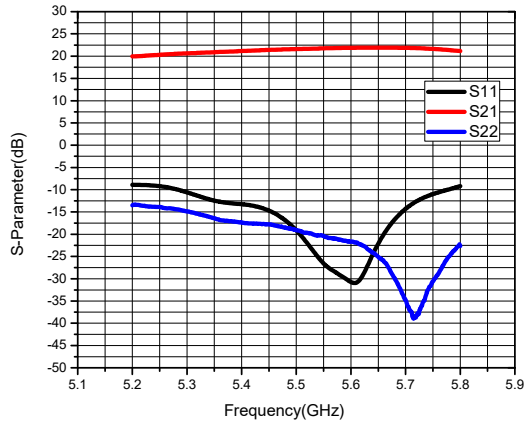
**802.11n EVM vs. Output Power @5.5GHz**



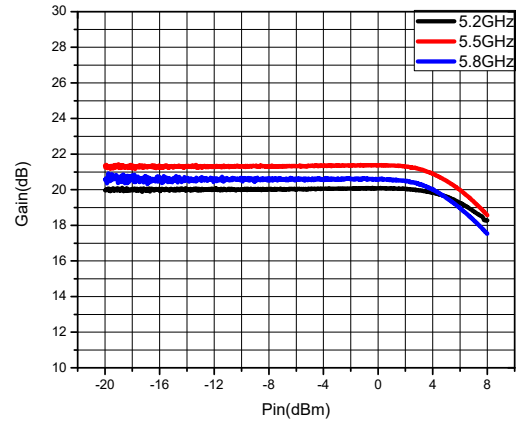
Test Frequency: 5.2 GHz to 5.8GHz

(Test Condition: VCC1=VCC2=VCCB=3.3V, ICQ=300mA, T<sub>OP</sub>=+25°C)

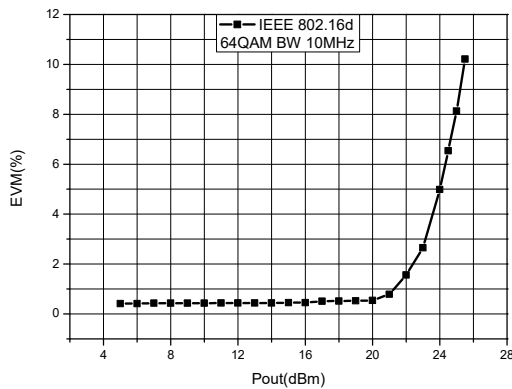
**Small Signal Parameters**



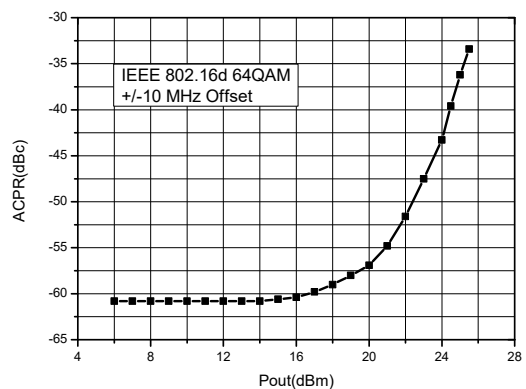
**Power Gain vs. Input Power**



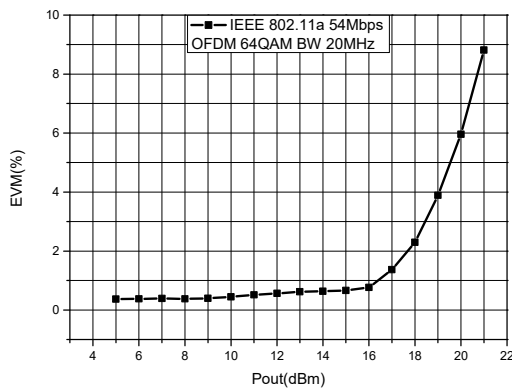
**802.16d EVM vs. Output Power @5.5GHz**



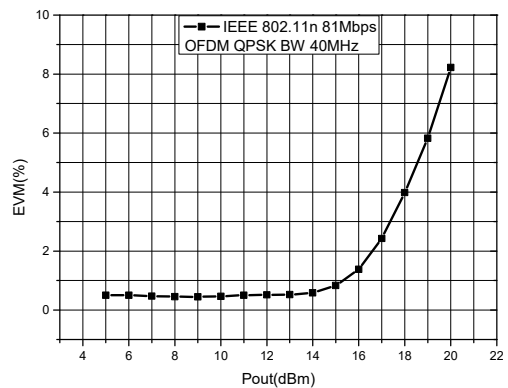
**802.16d ACPR vs. Output Power @5.5GHz**



**802.11a EVM vs. Output Power @5.5GHz**



**802.11n EVM vs. Output Power @5.5GHz**

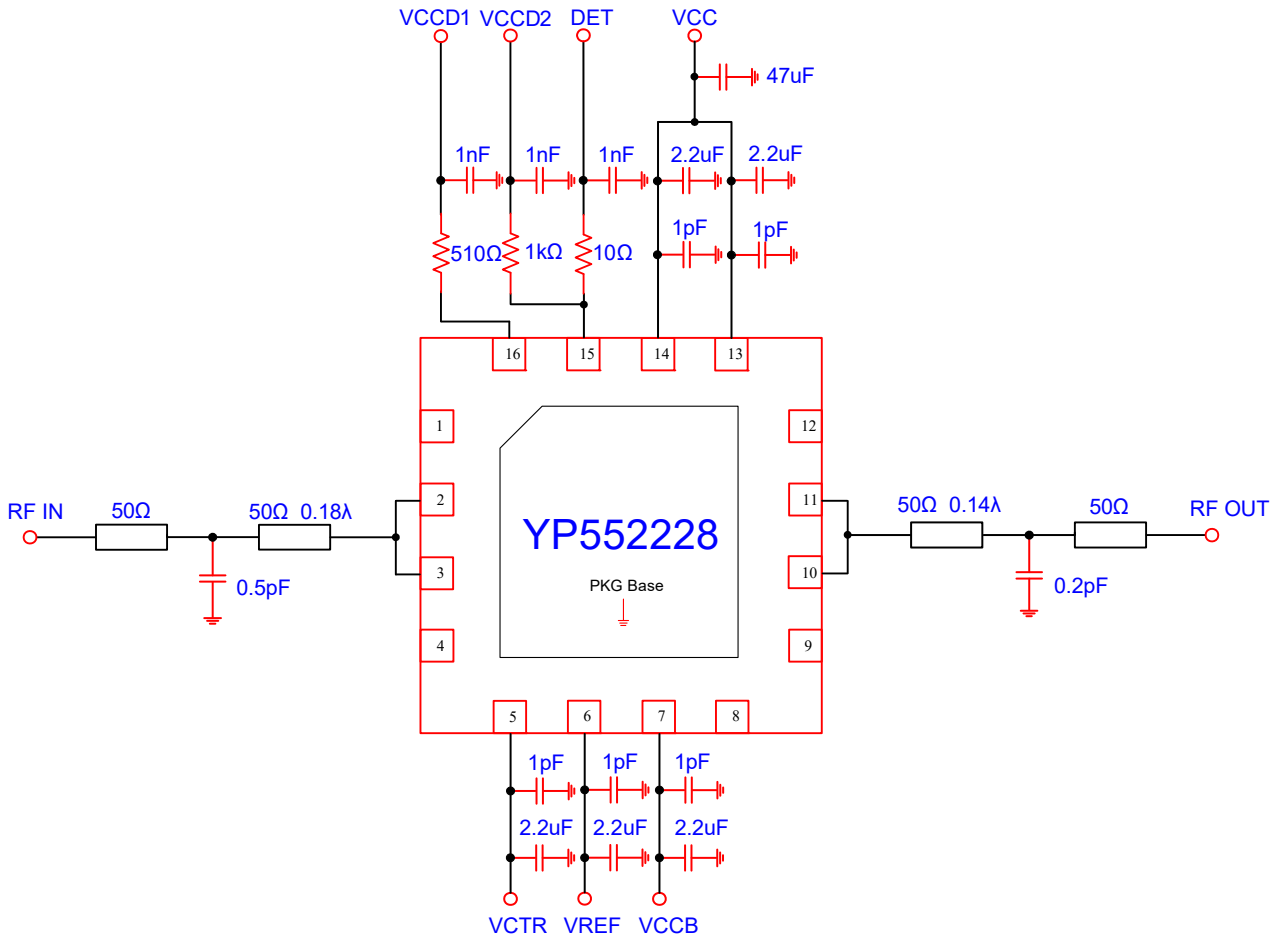




### Evaluation Board Schematic

Test Frequency: 5.6 to 5.9GHz

(Supply & Reference Voltage Value refer to Table 1-1 & 1-2 )



**Notes:**

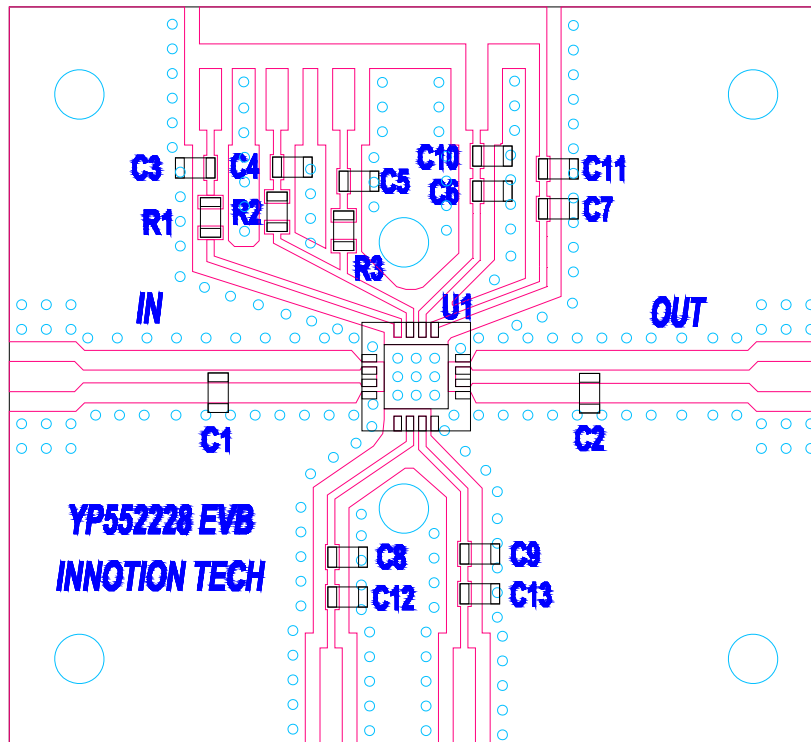
1. Pin5 is power down pin. Apply  $>2.5 V_{DC}$  to power down the three power amplifier stages. Apply  $0V_{DC}$  to power up. If function is not desired, pin5 may be connected to GND.
2. Pin15, 16 are active power detection circuit ports, if function is not desired, pin16, 16 may be connected to GND.

## Evaluation Board Layout

Test Frequency: 5.6 to 5.9GHz

Board Size: 33mm×30mm

Board Thickness: 0.4 mm, Board Material: FR-4 ( $\epsilon_r=4.5$ )

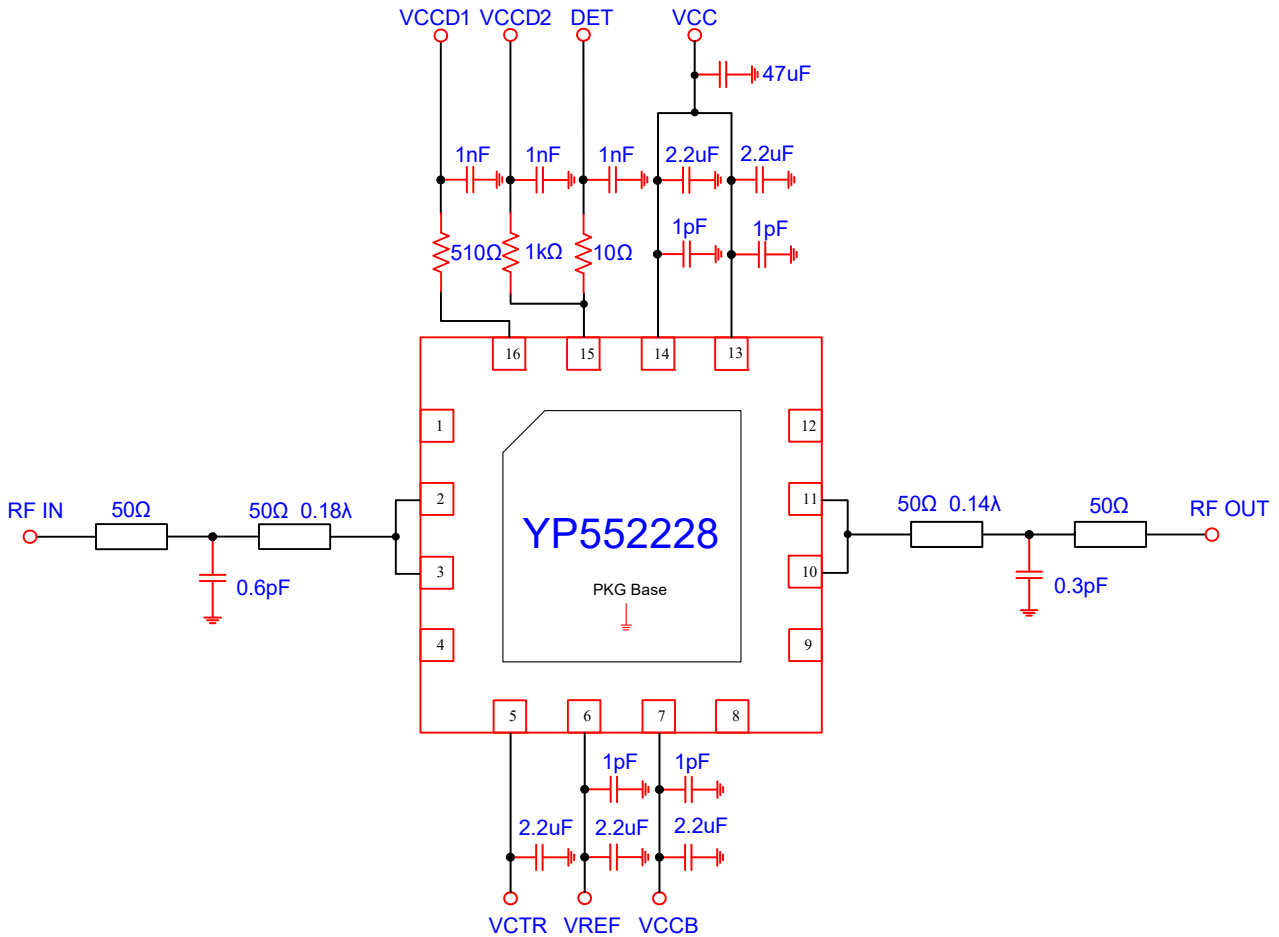


■ Table 3: Circuit Component Designations and Values

Component	Description	Manufacturer
C1	0.5pF Chip Capacitor	ATC
C2	0.2pF Chip Capacitor	ATC
C3,C4,C5	1nF Chip Capacitor	TDK
C6,C7,C8,C9	1pF Chip Capacitor	TDK
C10,C11,C12,C13	2.2uF Chip Capacitor	TDK
R1	510Ω Chip Resistor	YAGEO
R2	1kΩ Chip Resistor	YAGEO
R3	10Ω Chip Resistor	YAGEO
U1	YP552228	INNOTION

### Evaluation Board Schematic

**Test Frequency: 5.2 to 5.8GHz**  
**(Supply & Reference Voltage Value refer to Table 2-1 & 2-2)**



**Notes:**

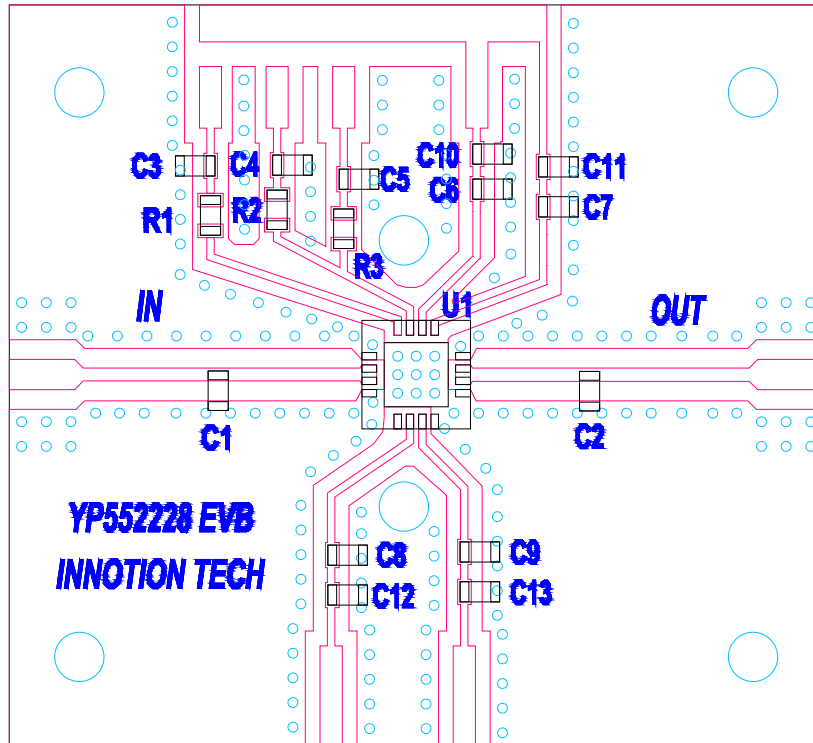
1. Pin5 is power down pin. Apply >2.5 V<sub>DC</sub> to power down the three power amplifier stages. Apply 0V<sub>DC</sub> to power up. If function is not desired, pin5 may be connected to GND.
2. Pin15, 16 are active power detection circuit ports, if function is not desired, pin16, 16 may be connected to GND.

## Evaluation Board Layout

Test Frequency: 5.2 to 5.8GHz

Board Size: 33mm×30mm

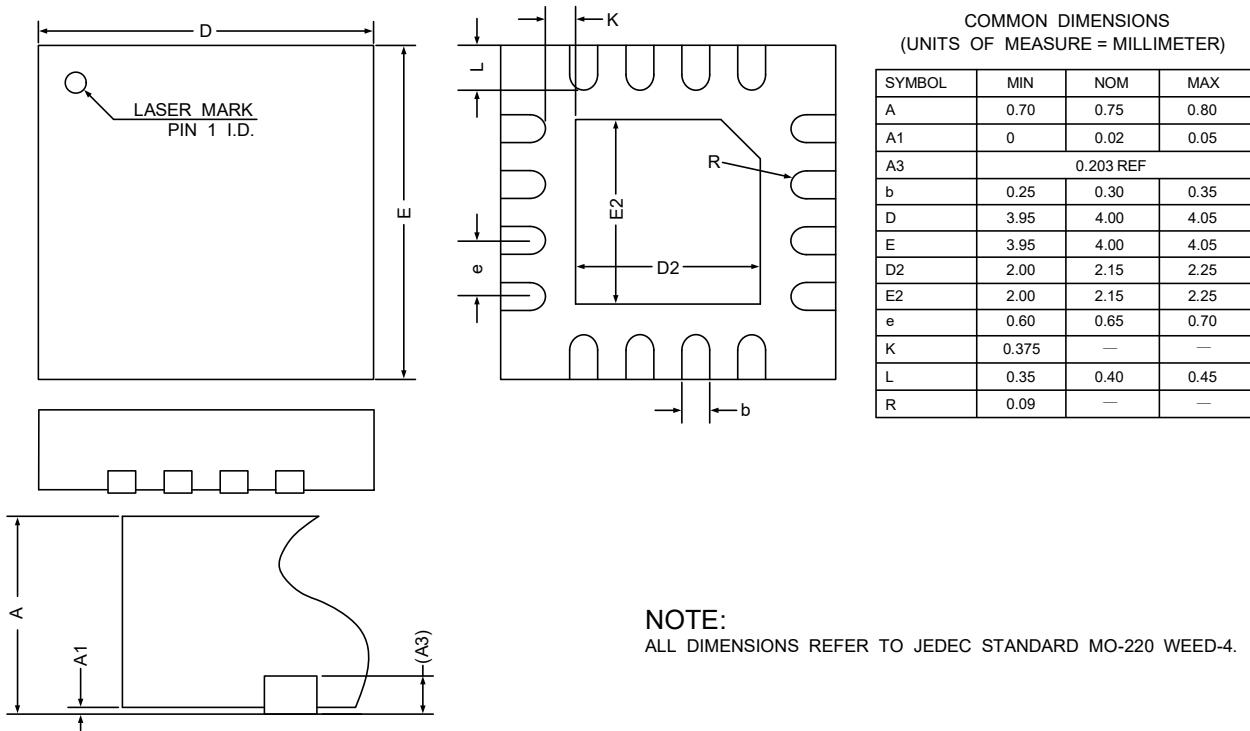
Board Thickness: 0.4mm, Board Material: FR-4 ( $\epsilon_r=4.5$ )



■ Table 4: Circuit Component Designations and Values

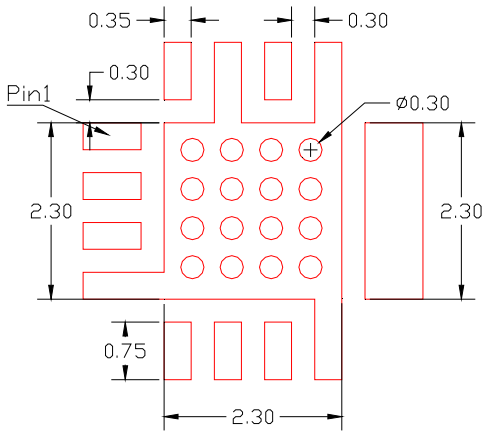
Component	Description	Manufacturer
C1	0.6pF Chip Capacitor	ATC
C2	0.3pF Chip Capacitor	ATC
C3,C4,C5	1nF Chip Capacitor	TDK
C6,C7,C8,C9	1pF Chip Capacitor	TDK
C10,C11,C12,C13	2.2uF Chip Capacitor	TDK
R1	510Ω Chip Resistor	YAGEO
R2	1kΩ Chip Resistor	YAGEO
R3	10Ω Chip Resistor	YAGEO
U1	YP552228	INNOTION

**Packaging Diagram**

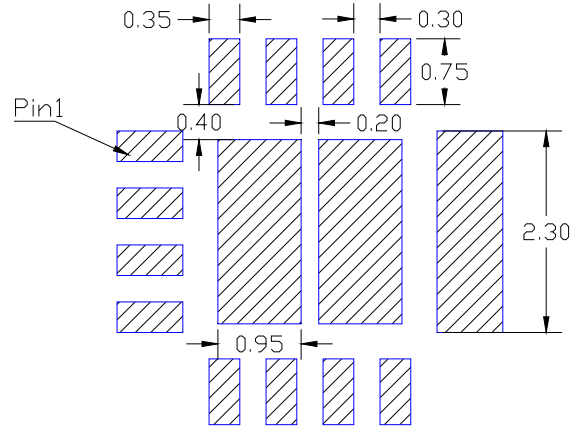


**PCB Land Pattern and Stencil Outline**

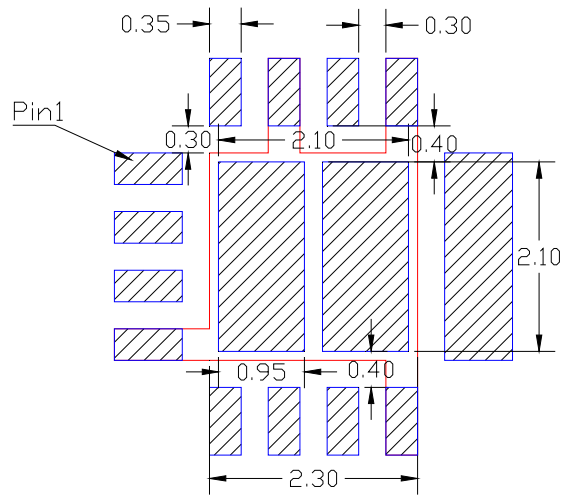
(Units: millimeters)



**PCB Land Pattern (Top View)**

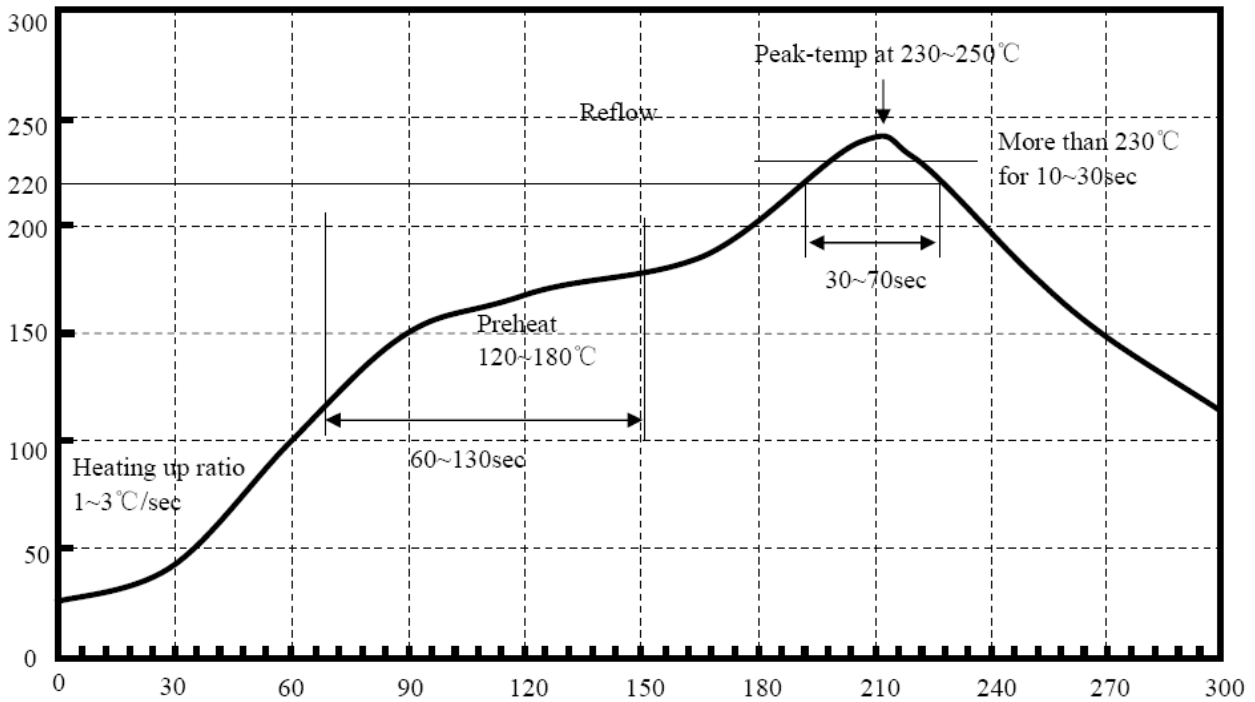


**Stencil Outline**



**Combined PCB Land Pattern and Stencil Outline**

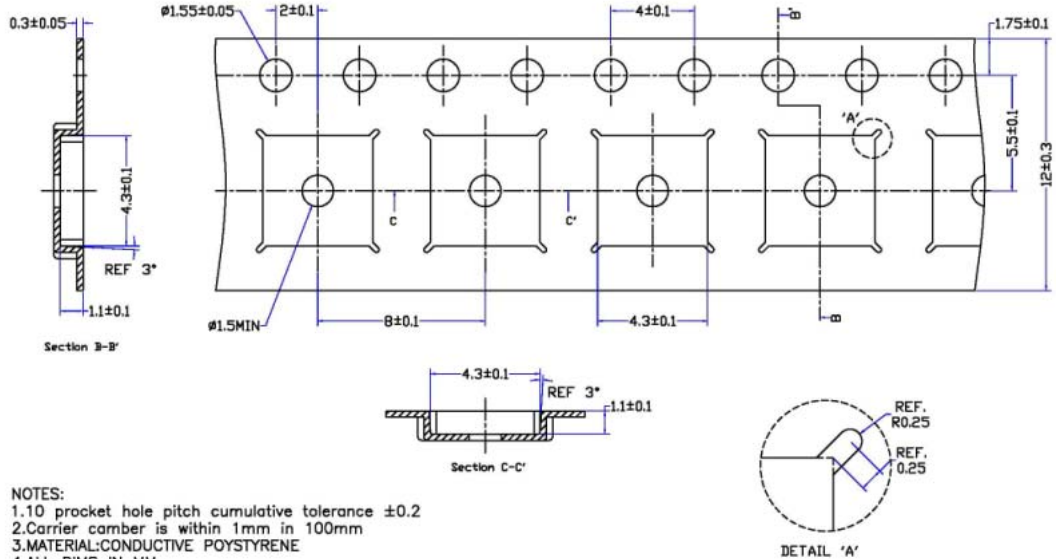
**Recommended Solder Temperature**



**Recommended Temperature**

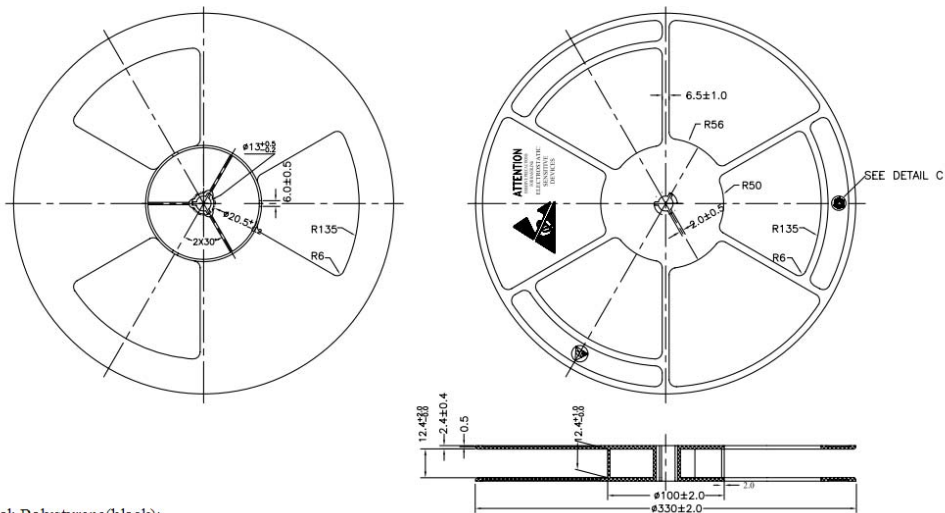
**Sn95.5Ag4.0Cu0.5**

**Tape dimensions and Orientation**



- NOTES:**
- 1.10 pocket hole pitch cumulative tolerance  $\pm 0.2$
  - 2.Carrier camber is within 1mm in 100mm
  - 3.MATERIAL:CONDUCTIVE POYSTYRENE
  - 4.ALL DIMS IN MM
  - 5.There must not be foreign body adhesion and the state of the surface must be excellent
  - 6.17" PAPER-Reel, 51875pockets
  - 7.Surface resistance 1X10E11(max) OHMS/SQ

**Reel dimensions and Orientation**



- Notes:**
1. Material: Polystyrene(black);
  2. Surface flatness: Maximum permissible error is 3mm;
  3. Dimensions in millimeters;
  4. Surface resistance: 10<sup>5</sup> TO 10<sup>10</sup>/OHMS/SQ;
  5. General tolerances:  $\pm 0.25$