



# Surface Mount Ceramic Chip Antennas for 433 MHz



VJ5301M433MXBSR chip antenna product

RoHS COMPLIANT

The VJ5301M433 series are small form-factor, high-performance chip-antennas optimized for industrial, automotive, and medical applications.

Utilizing unique Vishay™ materials and manufacturing technologies, these products when properly tuned also comply with the MBRAI standard for portable communication.

Vishay™ VJ5301M433MXBSR chip antennas are covered by one or more of the following patents:

WO2008250262 (A1), US2008303720 (A1), US2008305750 (A1), WO2008154173 (A1).

Other patents are pending.

## ELECTRICAL SPECIFICATIONS<sup>2</sup>

Operating Temperature: -40 °C to + 85 °C  
Frequency Range (Transmission/Reception): 370 to 510 MHz

## DESCRIPTION

The VJ5301M433MXBSR ceramic chip antenna is a small form-factor, high-performance, chip-antenna designed for operation at 433 MHz. It allows manufacturers to design high quality products that do not bear the penalty of a large external antenna, and is designed to be assembled onto a PC board using a standard reflow process.

The VJ5301M433 is the latest in a family of products developed by Vishay™, a world leader in manufacturing of discrete and passive components.

## Features

- Small outline (35 mm x 5 mm x 1.2 mm)
- 50Ω unbalanced tuning interface (max. -5.7 dBi gain<sup>1</sup>)
- Assembled onto a PCB in the standard reflow process
- 140 MHz half-power tuned bandwidth (370 to 510 MHz)
- High-reliability ceramic-oxide body construction
- Low-RF-loss, high-Q ceramic
- Lead (Pb)-free / wet build process
- Reliable Noble Metal Electrode (NME) system
- Compliant to RoHS Directive 2002/95/EC
- Halogen-free per IEC 61249-2-21
- Wide operating temperature range (-40 °C to + 85 °C)

## Applications

- Medical Telemetry (internal/external)
- Broadband transmission and reception
- Automotive (TPMS, etc.)
- Industrial and medical band applications

QUICK REFERENCE DATA					
SERIES	FREQUENCY (MHz)	MAX. GAIN (dBi)	AVERAGE GAIN (dBi)	BANDWIDTH (- 10 dB) (MHz)	BANDWIDTH (- 3 dB) (MHz)
VJ5301M433MXBSR	433	-5.7	- 8.7	58	120

CHIP ANTENNA PERFORMANCE									
NOMINAL FREQUENCY (MHz)	NOMINAL IMPEDANCE (Ω)	433 MHz AVERAGE GAIN (dBi)	433 MHz PEAK GAIN (dBi)	REFLECTED POWER COEFFICIENT S11	433 MHz REFLECTED POWER LOSS	- 3 dB BANDWIDTH 370 MHz to 510 MHz	- 3 dB REFLECTED POWER LOSS	- 10 dB BANDWIDTH 397 MHz to 455 MHz	- 10 dB REFLECTED POWER LOSS
433	50	- 8.7	-5.7	< -18 dB	1.6 %	140	50 %	58	10 %
				1.6 %	< 0.07 dB		3 dB		0.46 dB

Table 1 of quick reference data and chip antenna performance

<sup>1</sup> See Figures 1 through 6 for more details on the radiation pattern (antenna gain) at 433 MHz; the PCB board ground is shorted to earth ground for tuning.

<sup>2</sup> Electrical characteristics at +25 °C unless otherwise specified. Antenna performance is measured at 433 MHz and 50 Ohm impedance unless otherwise specified. The best results are obtained by mounting the chip following the layout guidelines application note for the evaluation kit.

### VJ5301M433MXBSR Tuning

Final tuning configuration and component values for  $L_1$ ,  $L_2$ , and  $C_1$  depend on customer PCB layout. Optimal tuning is possible with just a few standard components. **The nominal values shown are for a tuned VJ5301M433MXBEK kit.**

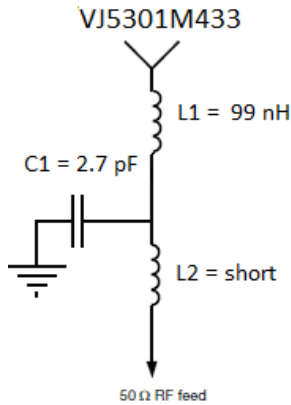


Figure 1 Tuning example with inductors  $L_1$ ,  $L_2$  and capacitor  $C_1$

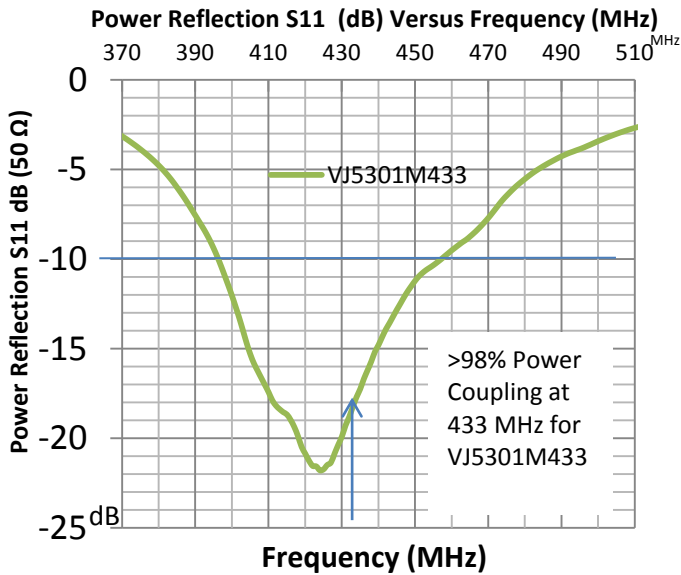


Figure 2 VJ5301M433 tuned to 433 MHz with > 98% power coupled

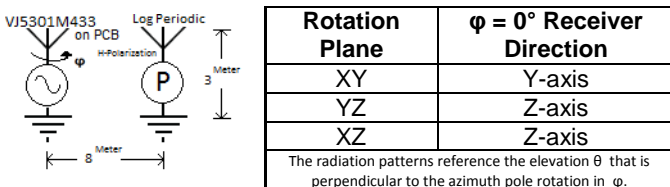


Figure 3 VJ5301M433 PCB mounting and coordinate directions

Figure 4 VJ5301M433MXBSR XY Radiation Pattern

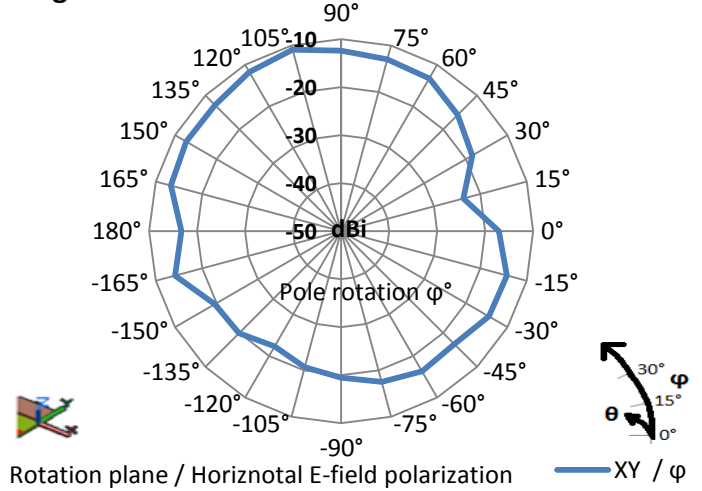


Figure 5 VJ5301M433MXBSR YZ Radiation Pattern

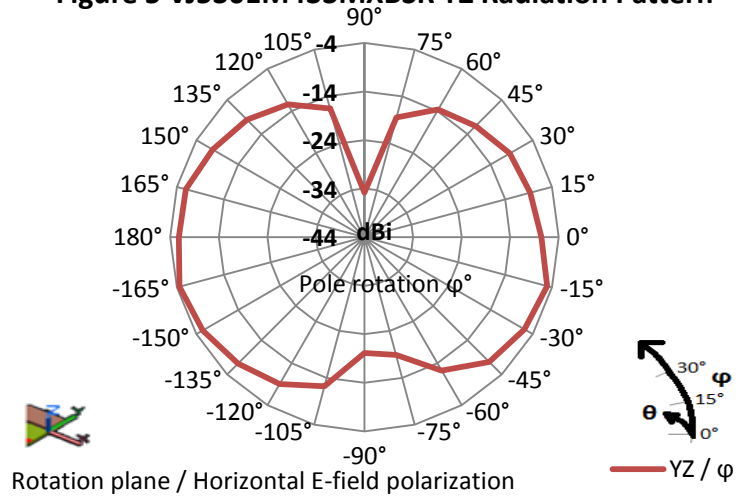
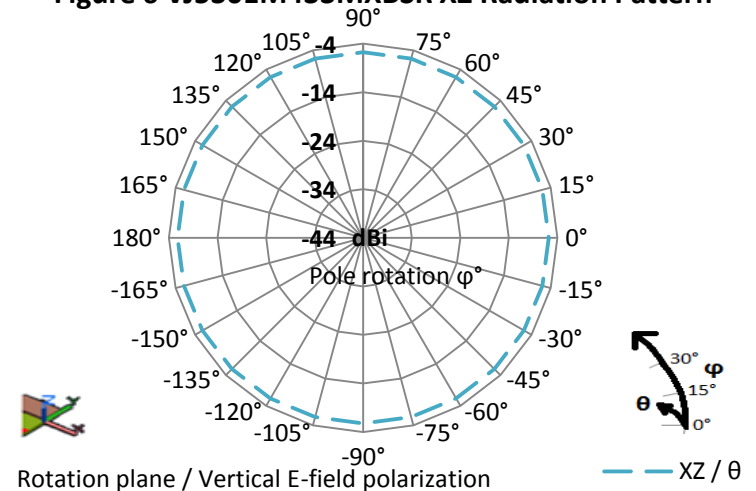


Figure 6 VJ5301M433MXBSR XZ Radiation Pattern



### FOOTPRINT, MECHANICAL AND PCB DIMENSIONS

The antenna footprint and mechanical dimensions are presented in Figure 7. Optimal tuning is adjusted according to PCB layout.

For additional mechanical support, it is recommended to add one drop of heat curing epoxy glue.

- The glue dot should not overlap with any of the soldering pads.
- Apply the glue dot at the center of the antenna.
- The glue dot area secures the chip firmly to the PCB.

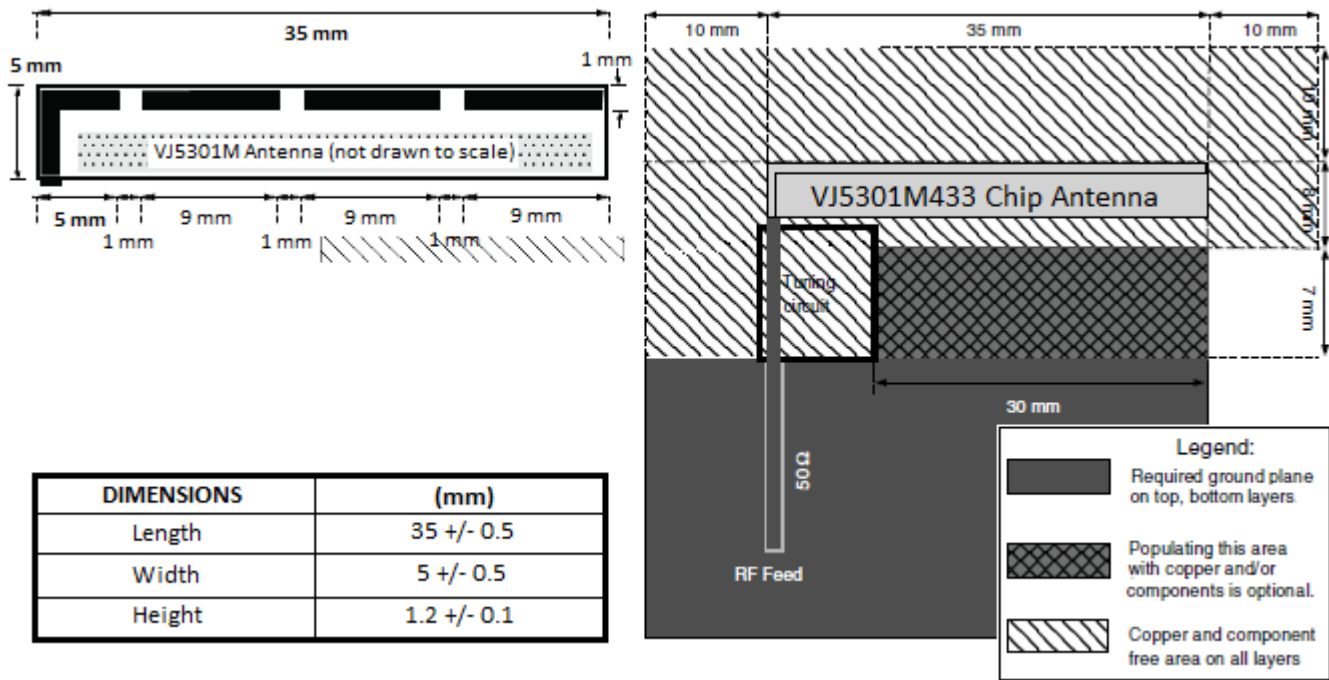


Figure 7 of VJ5301M433 footprint, chip antenna mechanical dimensions, and PCB layout dimensions

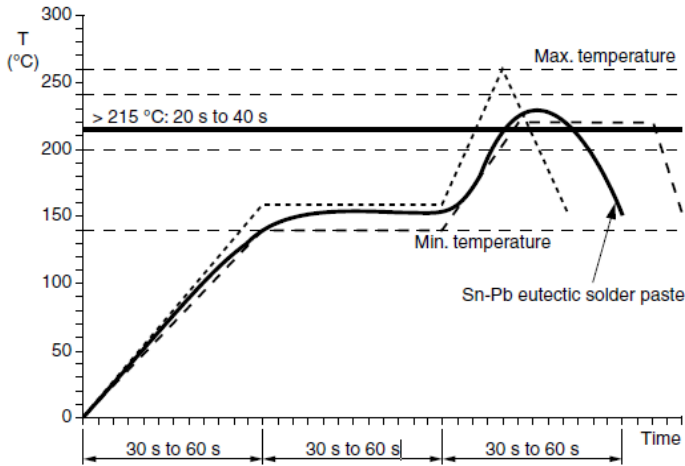


Figure 8 Soldering IR Reflow with SnPb Solder

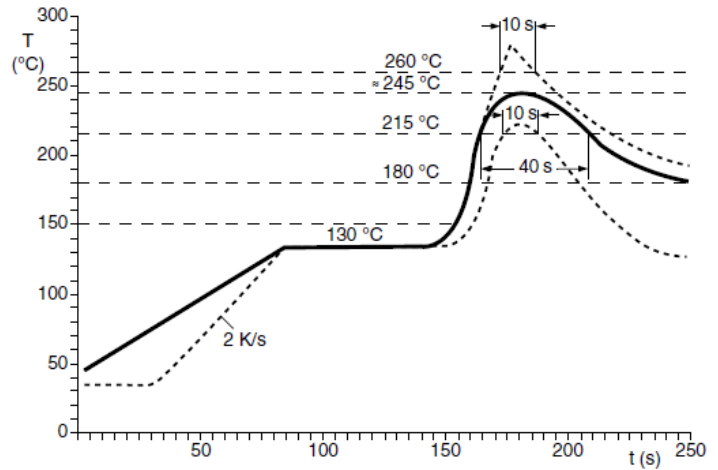


Figure 9 Soldering Reflow with Sn Solder

### VJ5301M433 ASSEMBLY GUIDELINES

1. Mounting of antennas on a printed circuit board should be done by reflow soldering using the profiles shown (Figures 8, 9, and 10).
2. In order to provide the adequate strength between the antenna and the PCB apply of a dot of heat cured epoxy glue in the center of the footprint of the antenna prior to soldering the antenna to the board. An example for such glue is Heraeus PD 860002 SA. The weight of the dot should be 5 mg to 10 mg.

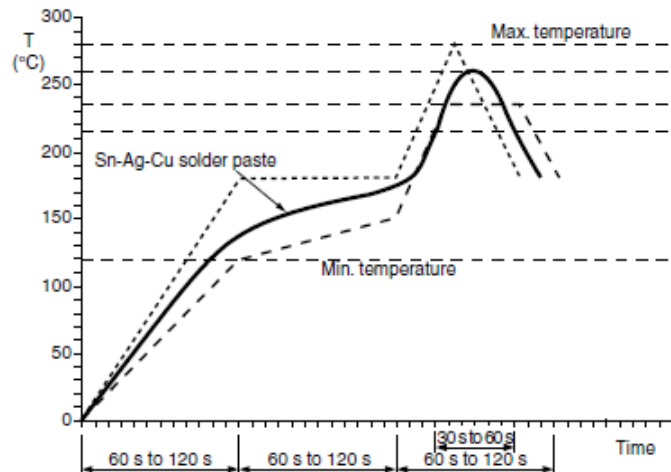


Figure 10 Soldering IR Reflow with SnAgCu Solder

ORDERING INFORMATION	VISHAY MATERIAL	PACKAGING QUANTITY
VJ5301M433 Chip Antenna	VJ5301M433MXBSR	1000 pieces
VJ5301M433 Evaluation Kit <sup>3</sup>	VJ5301M433MXBEK	1 kit

<sup>3</sup> The VJ5301M433 Kit is available for evaluation. For samples, please contact [mlcc-samples@vishay.com](mailto:mlcc-samples@vishay.com).



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