Surface Mount Ceramic Chip Antennas for 400 MHz

The VJ5301M400 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.

Features
- Small outline (35 mm x 5 mm x 1.2 mm)
- 50Ω unbalanced tuning interface (max. -8.7 dBi gain)
- Assembled onto a PCB in the standard reflow process
- 120 MHz half-power tuned bandwidth (360 to 480 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)
- Two way radio communication
- Land mobile services
- Industrial and medical band applications

QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>SERIES</th>
<th>FREQUENCY (MHz)</th>
<th>MAX. GAIN (dBi)</th>
<th>AVERAGE GAIN (dBi)</th>
<th>BANDWIDTH (-10 dB) (MHz)</th>
<th>BANDWIDTH (-3 dB) (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VJ5301M400MXBSR</td>
<td>400</td>
<td>-8.7</td>
<td>-11.7</td>
<td>48</td>
<td>120</td>
</tr>
</tbody>
</table>

CHIP ANTENNA PERFORMANCE

<table>
<thead>
<tr>
<th>NOMINAL FREQUENCY (MHz)</th>
<th>NOMINAL IMPEDANCE (Ω)</th>
<th>400 MHZ AVERAGE GAIN (dBi)</th>
<th>400 MHZ PEAK GAIN (dBi)</th>
<th>REFLECTED POWER COEFFICIENT S11</th>
<th>400 MHZ REFLECTED POWER LOSS</th>
<th>-3 dB BANDWIDTH 360 MHz to 480 MHz</th>
<th>-3 dB REFLECTED POWER LOSS</th>
<th>-10 dB BANDWIDTH 386 MHz to 431 MHz</th>
<th>-10 dB REFLECTED POWER LOSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>50</td>
<td>-11.7</td>
<td>-8.7</td>
<td>&lt; -23 dB</td>
<td>&lt; 0.5 %</td>
<td>120</td>
<td>50 %</td>
<td>45</td>
<td>10 %</td>
</tr>
</tbody>
</table>

Table 1 of quick reference data and chip antenna performance

1 See Figures 1 through 6 for more details on the radiation pattern (antenna gain) at 400 MHz; the PCB board ground is shorted to earth ground for tuning.
2 Electrical characteristics at +25 °C unless otherwise specified. Antenna performance is measured at 400 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.

For technical questions, contact: chipantenna@vishay.com www.vishay.com

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VJ5301M400MXBSR Tuning

Final tuning configuration and component values for L₁, L₂, and C₁ depend on customer PCB layout. Optimal tuning is possible with just a few standard components. The nominal values shown are for a tuned VJ5301M400MXBEK kit.

Figure 1 Tuning example with inductors L₁, L₂ and capacitor C₁

Figure 2 VJ5301M400 tuned to 400 MHz with > 99% power coupled

Figure 3 VJ5301M400 PCB mounting and coordinate directions

<table>
<thead>
<tr>
<th>Rotation Plane</th>
<th>φ = 0° Receiver Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>XY</td>
<td>Y-axis</td>
</tr>
<tr>
<td>YZ</td>
<td>Z-axis</td>
</tr>
<tr>
<td>XZ</td>
<td>Z-axis</td>
</tr>
</tbody>
</table>

The radiation patterns reference the elevation θ that is perpendicular to the azimuth pole rotation in φ.

Figure 4 VJ5301M400MXBSR XY Radiation Pattern

Figure 5 VJ5301M400MXBSR YZ Radiation Pattern

Figure 6 VJ5301M400MXBSR XZ Radiation Pattern

VJ5301M400MXBSR

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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 VJ5301M400 footprint, chip antenna mechanical dimensions, and PCB layout dimensions](image)

<table>
<thead>
<tr>
<th>DIMENSIONS</th>
<th>(mm)</th>
</tr>
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<tbody>
<tr>
<td>Length</td>
<td>35 +/- 0.5</td>
</tr>
<tr>
<td>Width</td>
<td>5 +/- 0.5</td>
</tr>
<tr>
<td>Height</td>
<td>1.2 +/- 0.1</td>
</tr>
</tbody>
</table>

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VJ5301M400 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.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>VISHAY MATERIAL</th>
<th>PACKAGING QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>VJ5301M400 Chip Antenna</td>
<td>VJ5301M400MXBSR</td>
</tr>
<tr>
<td>VJ5301M400 Evaluation Kit</td>
<td>VJ5301M400MXBEK</td>
</tr>
</tbody>
</table>

3 The VJ5301M400 Kit is available for evaluation. For samples, please contact mlcc-samples@vishay.com.
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