



## VJ 6040 Layout Design Principles

### LAYOUT DESIGN PRINCIPLES FOR VJ 6040 UHF ANTENNA

VJ 6040 is a multi-layer ceramic chip antenna designed for receiving mobile digital TV transmissions in the UHF band.

The most challenging target application for the VJ 6040 antenna is the cellular phone. For this reason the following document offers design principles that will allow best performance of the VJ 6040 antenna, while maintaining a form factor suitable for most cellular phone designs.

To help in the design-in process, Vishay offers an antenna evaluation kit designed according to the principles described hereafter. The evaluation kit allows designers to test the antenna performance. The evaluation kit measures 40 mm by 90 mm and includes the following:

- VJ 6040 antenna mounted against a 40 mm by 80 mm ground plane
- Active digital tuning circuit controlled by two input lines allowing full coverage of the UHF band 470 to 860 (MHz)
- 50 W SMA termination

Applications that allow larger ground planes can enjoy improved antenna efficiency.

For any technical support please contact: [mlcc@vishay.com](mailto:mlcc@vishay.com)

### ANTENNA ENVIRONMENT

#### General

VJ 6040, like any other antenna, will be affected by any nearby conducting element.

This effect can be helpful, as in the case of the ground plane. However, it can also be harmful.

When the application is being designed, it is crucial to maximize the benefits offered by correct implementation of the ground plane and minimize the potentially harmful effects of other conduction components.

All cellular applications include at least a single antenna designed for the cellular network itself. Because VJ 6040 is similar to most of these antennas, the same design considerations can be applied to both antennas. For this reason we recommend positioning VJ 6040 close to the cellular antenna. By doing so we can achieve the following goals:

- Both antennas will benefit from the same ground plane
- No additional real estate will be required. Both antennas will use the same ground clearance
- Both antennas will enjoy favorable positioning away from the user's hand and other potentially harmful elements such as battery, connectors, buttons etc.
- The cellular antenna can be easily customized to perform well in the presence of VJ 6040
- VJ 6040 will not be significantly affected by the presence of the cellular antenna, provided a minimal gap between it and the neighboring antenna will be kept

#### Ground Plane Configuration

VJ 6040 evaluation kit demonstrates exceptional antenna performance achieved with a 40 mm by 80 mm ground plane. Applications that allow an increase in the overall dimensions of the ground plane will enjoy improved efficiency.

Figure 1 describes two recommended reference ground plane configurations.

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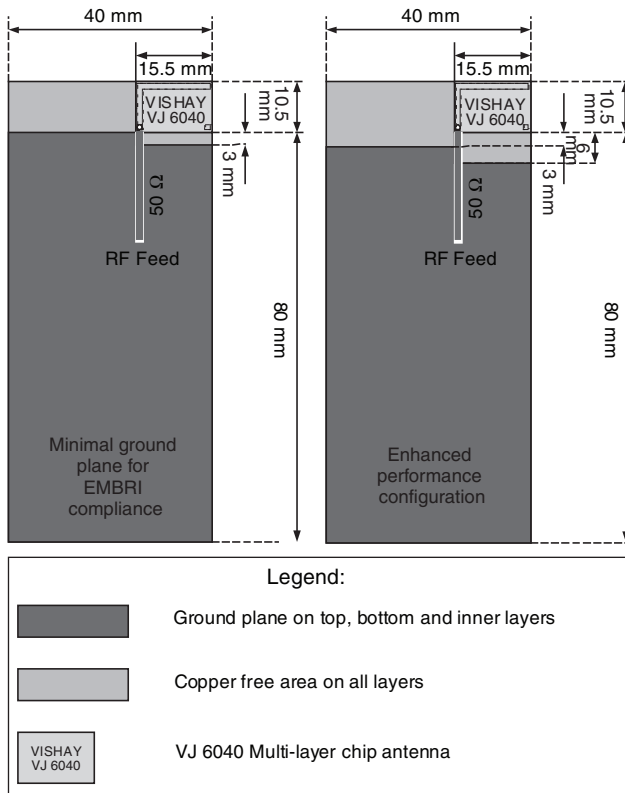


Fig. 1 - Recommended Ground Plane Configurations

The design on the left describes the minimal area required to allow VJ 6040 to comply with the EMBRI standard. This configuration is used by the VJ 6040 evaluation kit. The design on the right describes how to increase the antenna efficiency by approximately 2 dB by enlarging the antenna clearance. Note that antenna tuning will shift up in frequency as antenna clearance increases. This shift should be corrected by modifying the tuning circuit values.

Applications that can support ground planes larger than 80 mm will also benefit from improved antenna parameters.

For best antenna performance, it is recommended to keep the copper free area, marked in green, free of any conducting elements such as SMT components, connectors, batteries, wires etc. Applications that cannot comply with this recommendation, due to insufficient space, should follow the guidelines presented in figure 2.

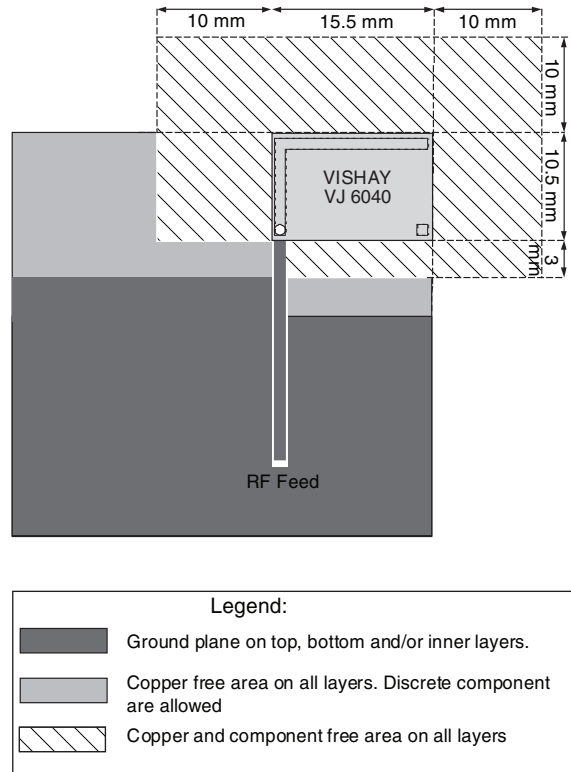


Fig. 2 - Component Free Area Description

The areas marked in green are less sensitive to the presence of conducting bodies than the areas marked by the diagonal pattern. In cases where the ground clearance must be utilized, it is recommended positioning small discrete components in these areas. The discrete components should be connected using the thinnest wires possible. Large conducting components such as batteries, connectors or buttons should be avoided.

The areas closest to the antenna, marked by the diagonal pattern, are sensitive to the presence of any conducting body. Violating this clearance might result in antenna detuning or loss of radiation efficiency.

In cases where the antenna clearance is shared by both VJ 6040 and an additional antenna, it is recommended to maintain maximum distance between the antennas. Most cellular antennas are mounted on a plastic carrier and are not soldered directly to the main PCB. In these cases, the plastic carrier can be designed to meet the recommended clearance as described above.

Technical support for antenna integration is provided by Vishay Vitramon division.

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### Z AXIS DESIGN PRINCIPLES

The following section deals with the recommended clearance required by VJ 6040 in the Z axis. As in the case of the PCB clearance, the area closest to the antenna is sensitive to the presence of any conducting materials. The following figure provides recommendations for the clearance required in elevation:

Plastic housing materials, or any other non-conducting materials, will have negligible effect on the antenna provided that they do not physically touch it. A distance greater than 1 mm should be maintained between the plastic housing and the antenna.

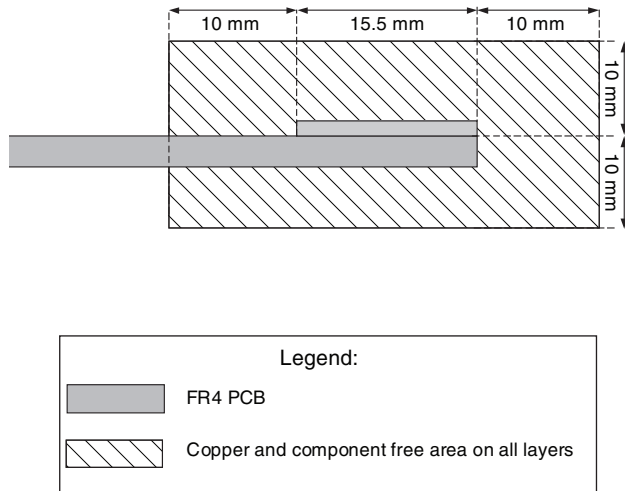


Fig. 3 - Side View of Antenna assembled on PCB

Features are subject to revisions or changes without notification

The company's products are covered by one or more of the following:  
 WO2008250262 (A1), US2008303720 (A1), US2008305750 (A1), WO2008154173 (A1). Other patents pending.

ORDERING INFORMATION	VISHAY MATERIAL	PACKAGING QUANTITY
VJ 6040	VJ6040M011SXISRA0	1000 pieces