

300 W Compact Package for X-band Radar GaN HEMT Power Amplifier

1. Outline

In recent years, technological developments have increased the demand for high-performance radar. Electron tubes and low-power, low-frequency semiconductor elements have been used in the past, but gallium nitride high-electron-mobility transistors (GaN HEMTs), which are optimized for high power and high frequency, are being adopted to increase radar detection range and improve accuracy.

Active planar phased array radar is a high-power radar that uses a lattice array of individual element antennas, where the power is synthesized in space after power emission and the excitation phase is changed for beam scanning. Therefore, GaN HEMTs built into the element antennas need to be arrayed at intervals of $1/2$ to $2/3$ of the carrier frequency, and in the X-band, they are spaced at 19 mm at most. This means that the package width must be smaller.

However, conventional X-band radar packages are mainly of the type in which the flange, as shown in Photo 1, is fixed with screws, and if that part is included, the width becomes 24 mm, making high-density mounting with 19 mm spacing impossible. In order to meet the market demand for higher power, smaller radars, we have developed the X-band 300 W GaN HEMT for phased array applications that can be mounted in high-density packages.

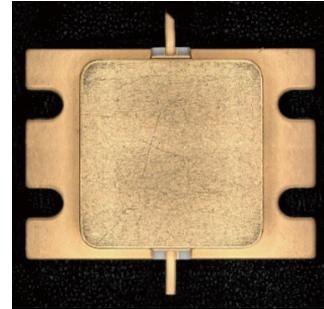


Photo 1. Photo of conventional package

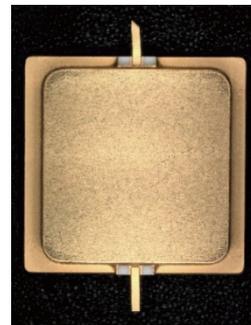


Photo 2. Photo of new package

2. Features

2-1 Package development

The newly developed package eliminates the screw-tightening portion in the flange area and assumes solder mounting on the entire backside. The package size is 17.9×17.4 mm, which is 25% smaller than the conventional product.

The newly developed X-band 300 W GaN HEMT product is shown in Photo 2. The electrical characteristics of the product are equivalent to those of conventional products, and it is compatible with phased arrays in the X-band.

2-2 Device performance

Figure 1 shows the electrical characteristics of this product. The operating conditions are a drain voltage of 50 V, a pulse condition of 1 msec pulse period, and a pulse width of 100 μ sec. A wide frequency bandwidth of 9 to 10 GHz was achieved, and at an input power of 46 dBm, an output power of 55 dBm and a drain efficiency of 40% were achieved.

The company began taking orders for products in July 2024.

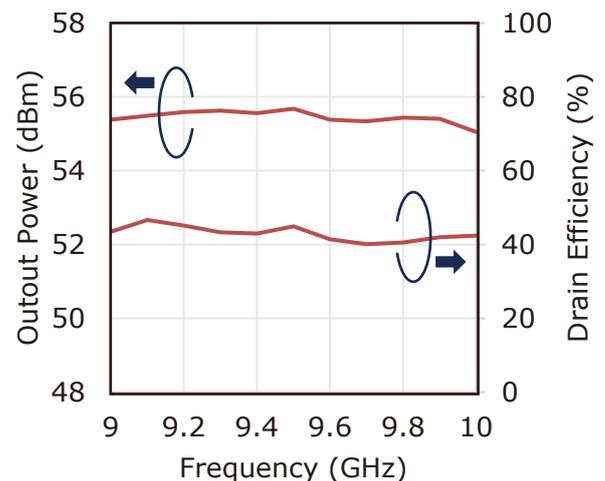


Fig. 1. Electrical characteristics