Panasonic Develops A Gallium Nitride (GaN) Terahertz Detector with High Sensitivity

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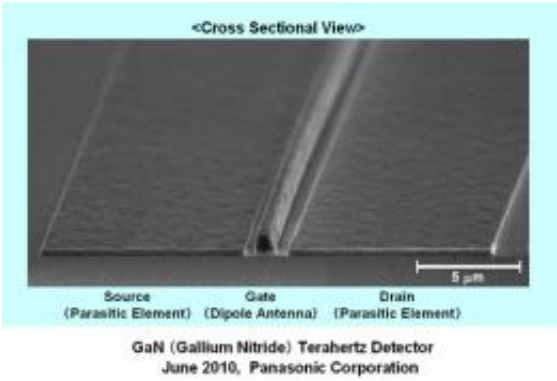

GaN (Gallium Nitride) Terahertz Detector

Panasonic today announced the development of a new terahertz (THz) detector using a Gallium Nitride (GaN) transistor. The detector exhibits the world highest sensitivity at room temperature. The GaN-based THz detector is applicable to a variety of security or analyzing systems, which will greatly help the wide-spread use of such THz applications in the future.

The GaN detector forms a so-called plasma wave of the electrons, in which the electron density is fluctuated as a wave. The plasma wave resonates with the incident THz wave, which is detected as an electric signal at the GaN transistor. The use of GaN with high electron velocity effectively increases the amplitude of the plasma wave and the extracted

electric signal.

The detector uses the gate electrode itself as a dipole antenna free from the loss in the transmission lines. In addition, the source and the drain electrodes of the GaN transistor are designed to work as parasitic elements for the antenna, which effectively confine the incident THz wave in the vicinity of the gate. Note that the employed metal-oxide-semiconductor (MOS) gate structure reduces the gate leakage current suppressing the leakage of the plasma wave around the gate antenna. The choice of the material together with a novel antenna structure successfully increases the sensitivity of the THz detector.

The fabricated THz detector using Panasonic's proprietary GaN technologies achieves a very high sensitivity of 1100 V/W at room temperature, while a conventional detector utilizing thermal conversion requires cooling of the device down to -270°C to maintain high enough sensitivity. The developed GaN-based THz detector free from such cooling systems can make the THz systems very compact keeping high sensitivity.

Applications for 9 domestic and 1 overseas patents have been filed. These research and development results have been presented at 68th Device Research Conference, held in South Bend, Indiana, U.S. from June 21 to 23, 2010.

Source: Panasonic