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Title:Ultrahigh sensitive plasmonic terahertz detector based on an asymmetric dual-grating gate HEMT structure

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Abstract:We report on ultrahigh sensitive, broadband terahertz (THz) detectors based on asymmetric dual-grating-gate (A-DGG) high electron mobility transistors, demonstrating a record responsivity of 2.2kV/W at 1THz with a superior low noise equivalent power of 15pW/√Hz using InGaAs/InAlAs/InP material systems. When THz radiation is absorbed strong THz photocurrent is first generated by the nonlinearity of the plasmon modes resonantly excited in undepleted portions of the 2D electron channel under the high-biased sub-grating of the A-DGG (as a quadratic nature of the product of local carrier density and velocity perturbations), then the THz photovoltaic response is read out at high-impedance parts of 2D channel under the other sub-grating biased at the level close to the threshold. Extraordinary enhancement by more than two orders of magnitude of the responsivity is verified with respect to that for a symmetric DGG structure. [All rights reserved Elsevier].

Number of references:30

Inspec controlled terms:aluminium compounds - gallium arsenide - high electron mobility transistors - III-V semiconductors - indium compounds - plasmonics - submillimetre wave transistors - terahertz wave detectors

Uncontrolled terms:ultrahigh sensitive plasmonic terahertz detector - asymmetric dual-grating gate HEMT structure - ultrahigh sensitive broadband terahertz detectors - asymmetric dual-grating-gate high electron mobility transistors - A-DGG high electron mobility transistors - material systems - terahertz photocurrent - terahertz radiation - plasmon mode nonlinearity - 2D electron channel - velocity perturbations - local carrier density product - terahertz photovoltaic response - symmetric DGG structure - frequency 1 THz - InGaAs-InAlAs-InP

Inspec classification codes:B7230 Sensing devices and transducers - B2560S Other field effect devices - B1350F Solid-state microwave circuits and devices

Numerical data indexing:frequency 1.0E+12 Hz

Chemical indexing:InGaAs-InAlAs-InP/int InAlAs/int InGaAs/int InP/int Al/int As/int Ga/int In/int P/int InAlAs/ss InGaAs/ss Al/ss As/ss Ga/ss In/ss InP/bin In/bin P/bin

Treatment:Practical (PRA)

Discipline:Electrical/Electronic engineering (B)

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