

239. Title: Prospects of photo-sensitive indium phosphide based top-mounted and flip-chip IMPATT oscillators for application in terahertz regime

Author: Mukherjee M. Mazumder N. Roy SK.

Source: International Journal of Electronics

Volume:98

Issue:4

Publication year 2011

Pages: 449-58

Abstract: The prospects of using double-drift-region (DDR) flat and single-low-high-low (SLHL) type InP based impact-ionisation-avalanche-transit-time (IMPATT) diodes as terahertz sources are studied and compared for the first time. Extensive simulation indicates that the devices are capable of generating RF power of 146.8-241.8 mW at around the 0.5 THz frequency. The effects of parasitic series resistance on the THz performance of the devices are further simulated. It is interesting to note that the presence of a charge bump in flatly doped DDR structures reduces the value of parasitic series resistance by 29.5%. The effects of photo-illumination on the top-mounted (TM) and flip-chip (FC) IMPATT devices are also investigated using a modified double iterative simulation technique. Under photo-illumination the negative conductance and the negative resistance of the devices (both flat and SLHL) decrease along with an upward shift in operating frequency. The upward shift in operating frequency is found to be more (at least 22.0 GHz) when the performance of the InP based IMPATT is controlled by the hole dominated saturation current rather than by the electron dominated saturation current. The overall effects of photo-irradiation on the SLHL diodes are found to be much more prominent than for their flat-profile counterparts. These studies reveal the potential of InP IMPATTs as optically controlled high-speed terahertz switching tools.