IDEC Chip Design Contest

900-GHz Wideband Frequency Tripler in 250-nm InP HBT Technology

Kyeongho Yeom, Iljin Lee, and Sanggeun Jeon
School of Electrical Engineering, Korea University, Seoul 136-713, Korea

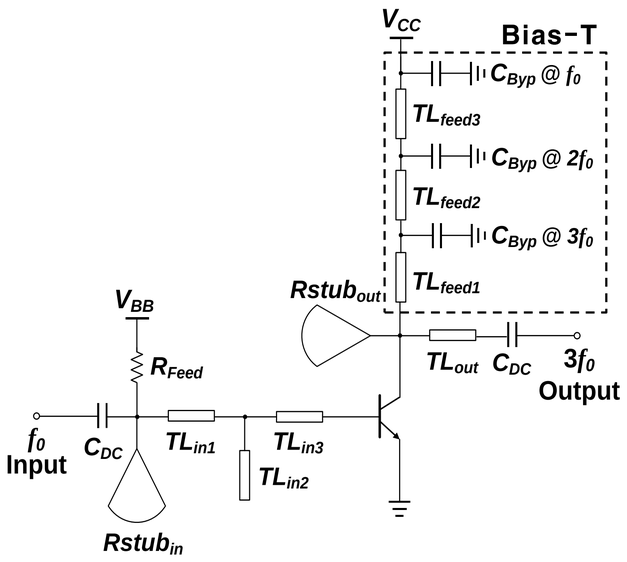
Motivation

- THz frequency band is a key resource of the future.
- THz applications such as high-speed wireless communication and high-resolution imaging have gradually emerged.
- These systems commonly require the THz signal sources offering the broad bandwidth and the high output power.

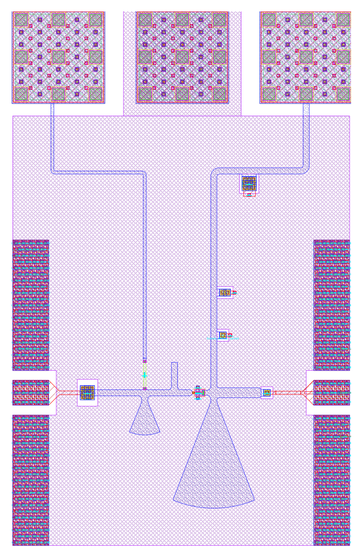
[THz applications for communication and imaging]

Design

- The proposed frequency tripler is fabricated in the Teledyne 250-nm InP HBT Technology.
- The topology of the circuit is a 1-stage common-emitter to achieve a high stability operation.
- The input conjugate matching is optimized by the series $TL_{in1,3}$ and the shunt TL_{in2} at 300 GHz
- The output matching is used by the simple configuration, that is only TL_{out} at 900 GHz.
- The bias-T line is designed to avoid the loss of the desired signal and to reduce the unwanted leakage.



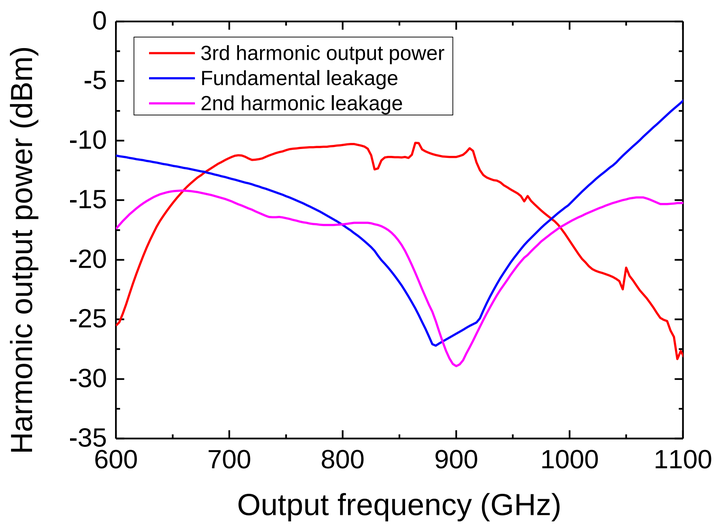
[Schematic]



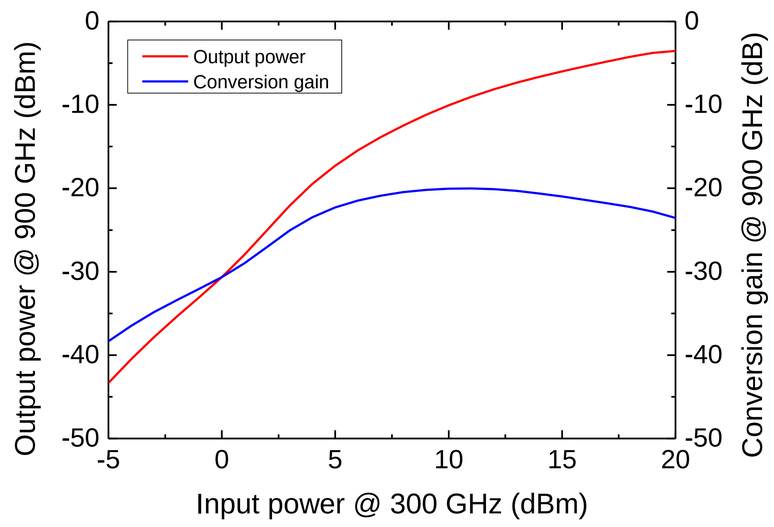
[Layout]

Simulation Results

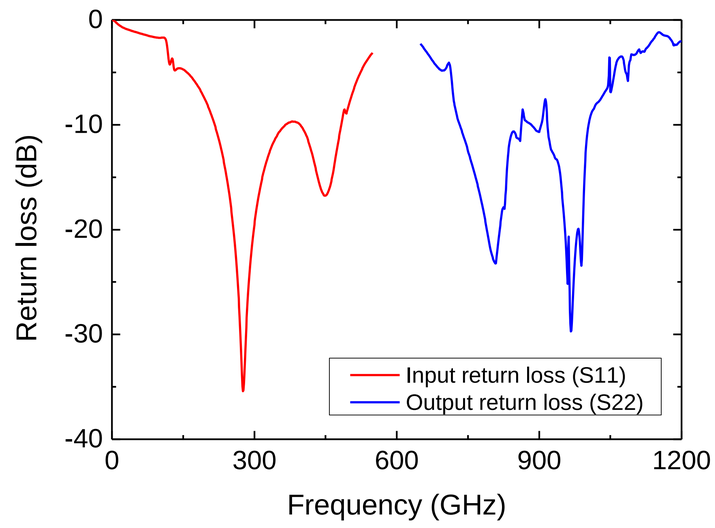
- A peak third harmonic output power is -10 dBm at 858 GHz with input power of 9 dBm at 286.
- A 3-dB bandwidth is 246 GHz from 675 to 921 GHz.
- A conversion gain is -20.6 dB at 900 GHz by the input power of 11 dBm at 300 GHz.
- The -10 dB input and output matching range is 262 GHz and 271 GHz, respectively.
- A total chip size is 273 × 460 μm^2, including the rf and DC probing pads.



[3rd harmonic P_{out} and leakage]



[P_{out} and conversion gain]



[Input and output return loss]

Conclusion

- The wideband frequency tripler will be useful as an LO or transmitting signal source for emerging terahertz applications.

The chip using a Teledyne 250-nm InP DHBT process is supported by the IDEC, Korea.

반도체설계교육센터 IC DESIGN EDUCATION CENTER