Introduction

Broadband device (PA) is necessary to support current various communication methods.

Problems of Reported Wideband PA
- Large area, Insufficient output power, etc.

To Reduce Off-chip Component

Characteristics of Proposed Circuit

Output Impedance Tuning

If \( r_{ds} \ll \), \( Z_{out} = \frac{R_s + R_L}{g_m R_s + 1} \frac{1}{\imath f_C} \frac{1}{\imath f_C} \)

When \( f = \frac{1}{2\pi \sqrt{LC}} \) (Resonance freq.)

\( Z_{out} = \frac{R_s}{g_m R_s + 1} \frac{1}{\imath f_C} \frac{1}{\imath f_C} \)

- Tune \( C \) to cancel imaginary part of \( Z_{out} \)
- Tune \( R_L \) to match \( Z_{out} \) to 50 \( \Omega \)

In fact, \( r_{ds} \) is small...
Solution: • Cascode topology

Cascode & Thick-oxide Transistor

- Low breakdown voltage of transistor
  - In submicron CMOS process, \( V_{DD} = 1 \sim 2V \)
  - Output power \( \propto (\text{Voltage})^2 \)

Solution: • Use thick-oxide transistor
- Apply cascode topology and share output voltage

Measurement Results

- Input and output losses are calibrated from results.

Schematic & Chip Micrograph

[Image of the proposed PA & Prototype by 0.18\( \mu \)m CMOS]

Summary

- Realization of an isolator-less PA
- \( Z_{out} \) matching from 2.1 to 6.0GHz
- \( P_{1dB} \) more than 15dBm
- The first tunable PA at 2-6GHz