

TUMA16 Pulser Plus: A Complete Solution for Sequencing and Biasing GaN Radar Power Amplifiers

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## **ADI GaN Power Amplifiers**





### **Depletion Mode RF Amplifier Biasing**





# The Critical Turn-On Sequence



Power On

- 1. Set  $V_{GG1} = -5V$  (pinchoff)
- 2. Set  $V_{DD} = +50V$
- 3. Turn on channel by increasing  $V_{GG1}$  until  $I_{DQ}$  = 1000 mA
- 4. Apply RF Input Signal
- 5. If target  $V_{GG1}$  is known,  $V_{GG1}$  can be set directly to that value (no dwell time at -5V)



# Pulser Plus – Motivation for Development

- Develop a Complete Reference Design for Our Customer Use including negative voltage generation
- Support Drain Pulsing and Gate Pulsing
- Measurement of Pulsed Drain Current
- Pulgs into ADI GaN PA Eval Boards
- Support < 1 us switching times</li>
- Supports 20-50V Drain Voltages
- Supports Drain Currents up to 5A
- Monitor Drain Current
- Gate Voltage/Current: 0 to -5V (+/-10mA)





#### Pulser Plus – Block Diagram





#### Pulser Plus - Typical Lab Setup - Drain Pulsing



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### Pulser Plus - Typical Lab Setup - Gate Pulsing





# Drain Pulsing vs. Gate Pulsing







Drain Pulsing



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# LTC7000A and LT1999 IMON Outputs





Drain Pulsing

Gate Pulsing

- LT1999
  - LTC7000A Drain/Gate Pulse Enable
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## **Drain Pulsed Mode for Phased Array Application**





### **Gate Pulsed Mode for Phased Array Application**



### Other Solutions for GaN PA Biasing









### Conclusions

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- Electrical Performance and Response Times of Gate and Drain Pulsing are similar
- For Multi-Channel Applications, Gate Pulsing is more space-efficient
- For Single-Channel Applications, Drain Pulsing requires less hardware
- Pulser Plus reference design supports Gate and Drain Pulsing and is a "use-whatyou-want design"
- LDO Bypass in Gate Branch is viable for Drain Pulsed Mode
- Pulser Plus Product Page (<u>ADPULSERPLUSEBZ Evaluation Board | Analog Devices</u>)
- User Guide Wiki (<u>Pulser Plus Reference Design for GaN PA Biasing and Sec</u> (<u>ADPULSERPLUSEBZ</u>)[<u>Analog Devices Wiki</u>])
- Boards in stock (\$750)





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