



Wolfspeed RF Bias and RF sequencing for GaN and LDMOS RF Power Devices

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Wolfspeed supplies LDMOS (Laterally-Diffused Metal-Oxide Semiconductor) and GaN (Gallium Nitride) RF Power Amplifier solutions for a variety of applications ranging from aerospace and defense to cellular infrastructure. GaN HEMT (High-Electron-Mobility Transistor) and LDMOS MOSFET (Metal-Oxide Semiconductor Field-Effect Transistor) are voltage controlled field-effect transistors requiring specific bias sequencing to ensure safe operation under the conditions specified within a datasheet.

Field-effect transistors come in two different device architectures, enhancement mode and depletion mode. The mode refers to the gate voltage required to turn a transistor ON/OFF. For enhancement mode devices, the device is pinched off at 0 V and is turned on as the voltage is increased in the positive direction. For depletion mode devices, the device is pinched off at a negative voltage, such as -5 V, and turns on as the voltage becomes less negative. For GaN, the main implication is applying drain voltage with 0 V on the gate will result in catastrophic damage to the device. Unless otherwise specified in the datasheet, Wolfspeed’s RF GaN are depletion mode devices and LDMOS are enhancement mode devices.

The sequencing for both architectures requires the gate to be pinched-off before the drain voltage is applied. Once the drain voltage is applied, the gate voltage can be adjusted until the desired quiescent current is achieved. RF input should not be applied prior to biasing the transistor and it should be turned off before sequencing off the transistor.

Table 1 Bias Sequencing

GaN	
Bias ON	Bias OFF
<ol style="list-style-type: none"> 1. Ensure RF is turned-off 2. Apply pinch-off voltage of -5 V to the gate 3. Apply nominal drain voltage 4. Bias gate to desired quiescent drain current 5. Apply RF 	<ol style="list-style-type: none"> 1. Turn RF off 2. Apply pinch-off voltage to the gate 3. Turn-off drain voltage 4. Turn-off gate voltage

LDMOS	
Bias ON	Bias OFF
<ol style="list-style-type: none"> 1. Ensure RF is turned-off 2. Apply pinch-off voltage of 0 V to the gate 3. Apply nominal drain voltage 4. Bias gate to desired quiescent drain current 5. Apply RF 	<ol style="list-style-type: none"> 1. Turn RF off 2. Apply pinch-off voltage of 0 V to the gate 3. Turn-off drain voltage 4. Turn-off gate voltage

