Application Note

Proper Procedures for Powering Up and Powering Down an RF Amplifier

AN006

Sequencing your amplifier on and off improperly can lead to damage of your device. These failures can occur in the lab, during production test or, worse yet, in the field. While lower power devices such as LNAs and gain blocks are typically less sensitive to this sequencing, it is still a good idea to follow the guidelines below.

Power-up Sequence:

1) Ensure that the device under test (DUT) is properly terminated with the correct source/load impedances and ground connections. In the case of an evaluation board or production test environment, this typically means that the board input and output ports are connected to a vector network analyzer (VNA) or other measurement equipment prior to power-up.

2) Apply main power supply V_{DD}/V_{CC}. As noted in item 1, all required ground connections should be made prior to the application of any voltage to the device.

3) Apply enable voltages at a time ≥ the time when V_{DD}/V_{CC} is applied. The key point here is that V_{ENABLE} should not occur prior to the application of the drain/collector voltages of the amplifier.

4) Apply RF input power. Note: Turning the device on (steps 2 and 3) with RF already applied is known as "hot switching" and is a frequent cause of amplifier damage. During device power-up, the device impedances and gain undergo a transition through a range of values prior to settling. During this time, a device which is stable under steady-state conditions may become unstable. Applying RF power can sometimes lead to destructive oscillations.

Power-down Sequence:

1) Remove RF input power.

2) Bring V_{ENABLE} voltages to ground potential.

3) Bring V_{DD}/V_{CC} to ground potential at a time ≥ to the time when the V_{ENABLE} voltages are brought to ground.

Device damage due to improper on/off sequencing is a common cause of electrical over-stress (EOS). Refer to additional App Notes which provide an overview of other causes of EOS, such as RF input power transients, power supply transients and electrostatic discharge.

As always, we are committed to providing the reliable, high-performance RF solutions you need, and we are pleased to provide the applications support you need to successfully implement any of our components.

Contact us at applications@guerrilla-rf.com for further guidance.

Disclaimers

Information in this application note is specific to the Guerrilla RF, Inc. ("Guerrilla RF") product identified.

This application note, including the information contained in it, is provided by Guerrilla RF as a service to its sales team, sales representatives and distributors and may be used for informational purposes only. Guerrilla RF assumes no responsibility for errors or omissions within this note or the information contained herein. Information provided is believed to be accurate and reliable, however, no responsibility is assumed by Guerrilla RF for its use, nor for any infringement of patents, or other rights of third parties, resulting from its use. Guerrilla RF assumes no liability for any datasheet, datasheet information, materials, products, product information, or other information provided hereunder, including the sale, distribution, reproduction or use of Guerrilla RF products, information or materials.

No license, whether express, implied, by estoppel, by implication or otherwise is granted by this datasheet for any intellectual property of Guerrilla RF, or any third party, including without limitation, patents, patent rights, copyrights, trademarks and trade secrets. All rights are reserved by Guerrilla RF.

All information herein, products, product information, datasheets, and datasheet information are subject to change and availability without notice. Guerrilla RF reserves the right to change component circuitry, recommended application circuitry and specifications at any time without prior notice. Guerrilla RF may further change its datasheet, product information, documentation, products, services, specifications or product descriptions at any time, without notice. Guerrilla RF makes no commitment to update any materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes.

GUERRILLA RF INFORMATION, PRODUCTS, PRODUCT INFORMATION, APPLICATION NOTES, DATASHEETS AND DATASHEET INFORMATION ARE PROVIDED "AS IS" AND WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. GUERRILLA RF DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. GUERRILLA RF SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Customers are solely responsible for their use of Guerrilla RF products in the Customer's products and applications or in ways which deviate from Guerrilla RF's published specifications, either intentionally or as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks. Guerrilla RF assumes no liability or responsibility for applications assistance, customer product design, or damage to any equipment resulting from the use of Guerrilla RF products outside of stated published specifications or parameters.

Revision History

Revision	Date | Reason for Revision
Initial Release	September 1, 2020