Evaluation Board Documentation

TRF7610 RF Power Amplifier 4.8 Volt GSM Application

APPLICATION BRIEF: SWRA016

Wireless Communication Business Unit

Digital Signal Processing Solutions
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TEXAS INSTRUMENTS

TRADEMARKS

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TRF7610 RF Power Amplifier 4.8 Volts GSM Application

Abstract

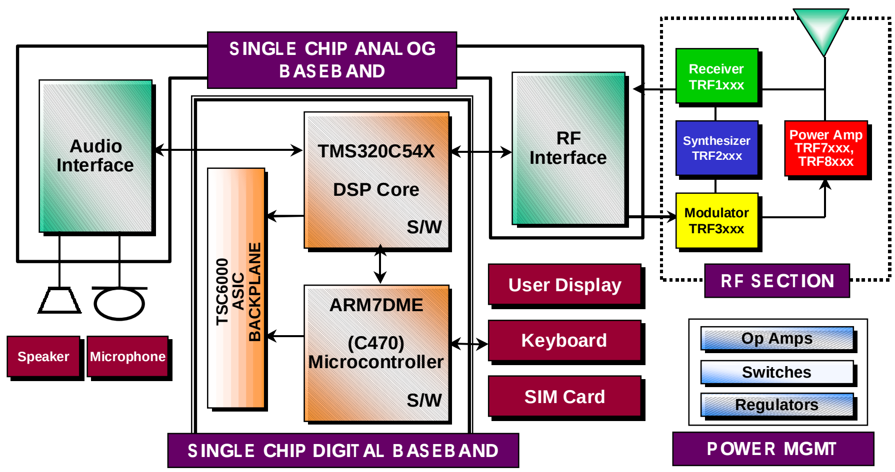
The evaluation board documentation for the TRF7610 RF Power Amplifier is primarily for device assessment. Included in this documentation are the following:

- Evaluation board mechanical outline
- Evaluation board schematic for GSM

  The schematic includes a component list describing the resistors, inductors, and capacitors, along with the suppliers and board material specifications.
- Test bench diagram with organized instructions for configuration

Product Support

The TI Advantage Extends Beyond RF to Every Other Major Wireless System Block



Digital Baseband

TI's single-chip Digital Baseband Platform, combines two high-performance core processors – a digital signal processor tailored for digital wireless applications and a microcontroller designed specifically for low-power embedded systems. The customizable platform helps wireless digital telephone manufacturers lower component counts, save board space, reduce power consumption, introduce new features, save development costs and achieve faster time to market, at the same time giving them flexibility and performance to support any standard worldwide.

Analog Baseband

TI analog baseband components provide a Mixed-signal bridge between the real world of analog signals and digital signal processors, the key enabling technology of the digital wireless industry. Using a seamless architecture for wireless communications technology, TI matches its baseband interfaces, radio frequency ICs and power management ICs to digital signal processing engines to create complete DSP Solutions for digital wireless systems.

Power Management

TI provides power management solutions with integration levels designed to meet the needs of a range of wireless applications. From discrete LDOs and voltage supervisors to complete power supplies for the baseband section, TI power management solutions play an important role in increasing wireless battery life, time-to-market and system functionality.

For more information visit the Wireless Communications web site at www.ti.com/sc/docs/wireless/home.htm.

Related Documentation

The following list specifies product names, part numbers, and literature numbers of corresponding TI documentation.

- Data sheet, *Silicon MOSFET Power Amplifier IC for GSM*, Literature number SLWS059A
- *Thermal Considerations for RF Power Amplifier Devices Application Report*, Literature number SLWA009
- *TRF7610 RF Power Amplifier S-Parameter EVM,* Literature Number SWRA026

World Wide Web

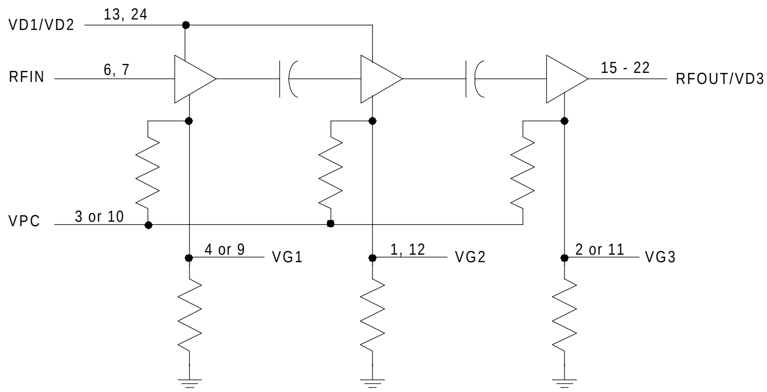
Our World Wide Web site at www.ti.com contains the most up to date product information, revisions, and additions. Users registering with TI&ME can build custom information pages and receive new product updates automatically via email.

Email

For technical issues or clarification on switching products, please send a detailed email to sc-infomaster@ti.com. Questions receive prompt attention and are usually answered within one business day.

Functional Block Diagram

Figure 1. Functional Block Diagram

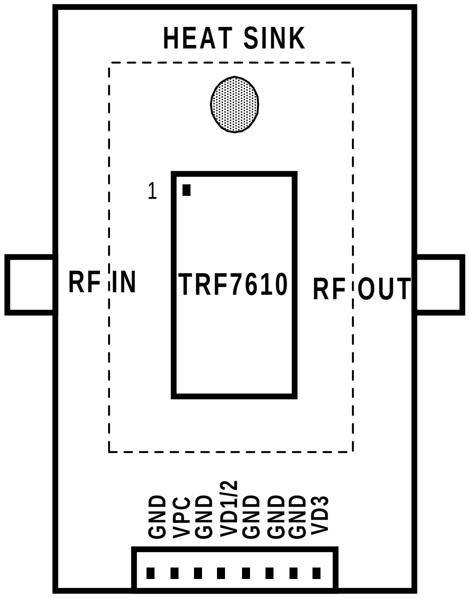


Terminal Functions

CONNECTOR		I/O	DESCRIPTION
Name	**Number**		
GND	14,23		**Analog ground for all internal circuits.** All signals are referenced to the ground terminals.
NC	5,8		**No internal connection.** It is recommended that all NC terminals be connected to ground.
RFIN	6,7	I	**RF input.** RFIN accepts signals between 800 and 1000 MHz.
RFOUT/ VD3	15-22	I/O	**RF output and third stage drain bias.** RF requires an external matching network.
VG1	4,9	I	**First stage gate bias set by the resistor.** Either terminal may be used or both may be connected externally.
VG2	1,12	I	**Second stage gate bias set by resistor.** These terminals must be connected externally.
VG3	2,11	I	**Third stage gate bias set by resistor.** Either terminal may be used or both may be connected externally.
VPC	3,10	I	**Voltage Power Control.** VPC is a signal between 0V and 3V that adjusts the output power from –43dBm to +35dBm. Either terminal may be used or both may be connected externally.
VD1/VD2	13,24	I	**First and second stage drain bias.** These terminals must be connected externally.

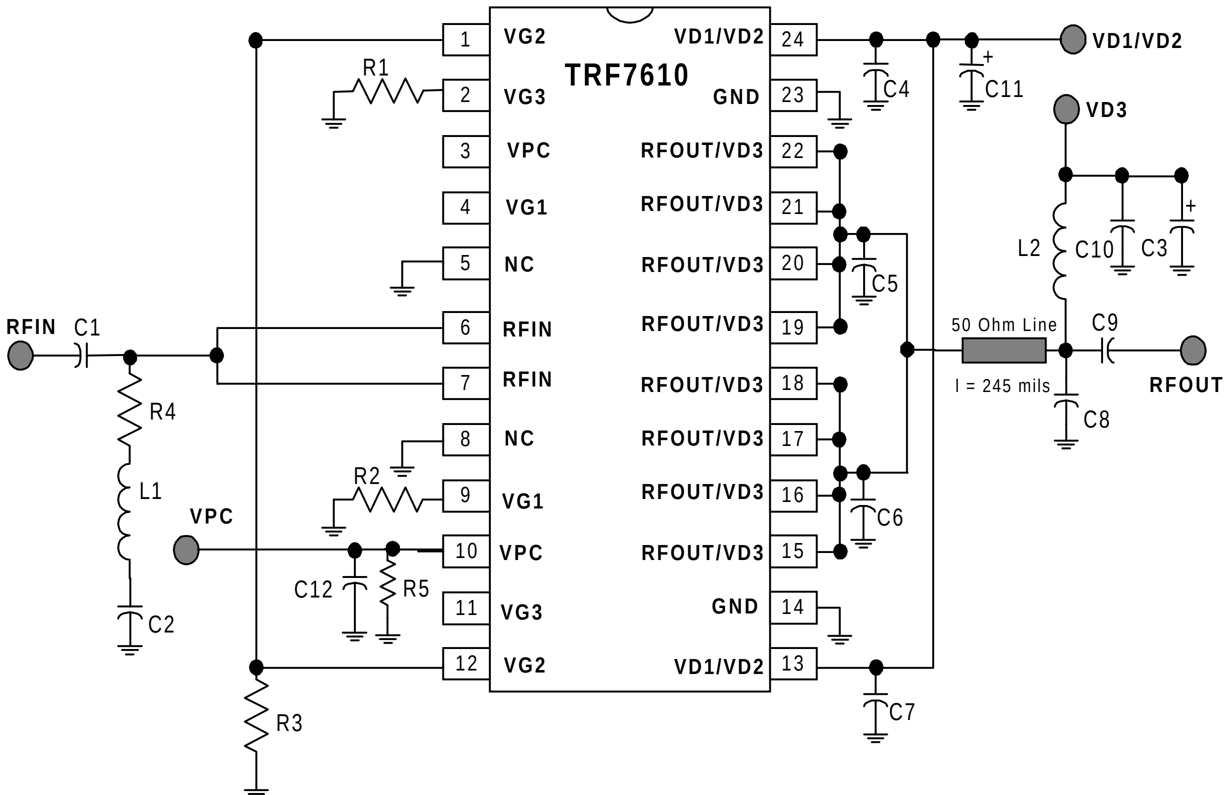
Evaluation Board Mechanical Outline (Top View)

Figure 2. Evaluation Board Mechanical Outline (Top View)



Evaluation Board Schematic

Figure 3. Evaluation Board Schematic for GSM



Component List

Resistor (Ohms)	Inductor (nH)	Capacitor (pF)
R1=2.2K	L1=2.7	C1=100
R2=5.1K	L2=18.5	C2=100
R3=5.1K		C3=330 uF
R4=3.9		C4=.033 uF
R5=51		C5=22
		C6=22
		C7=.033 uF
		C8=11
		C9=100
		C10=100
		C11=100 uF
		C12=100

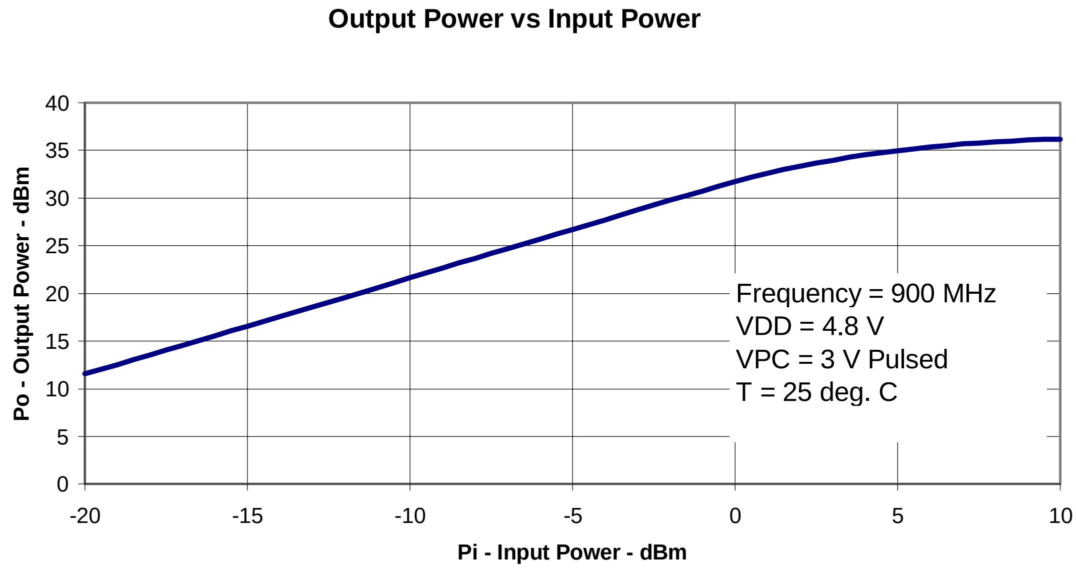
Supplier:

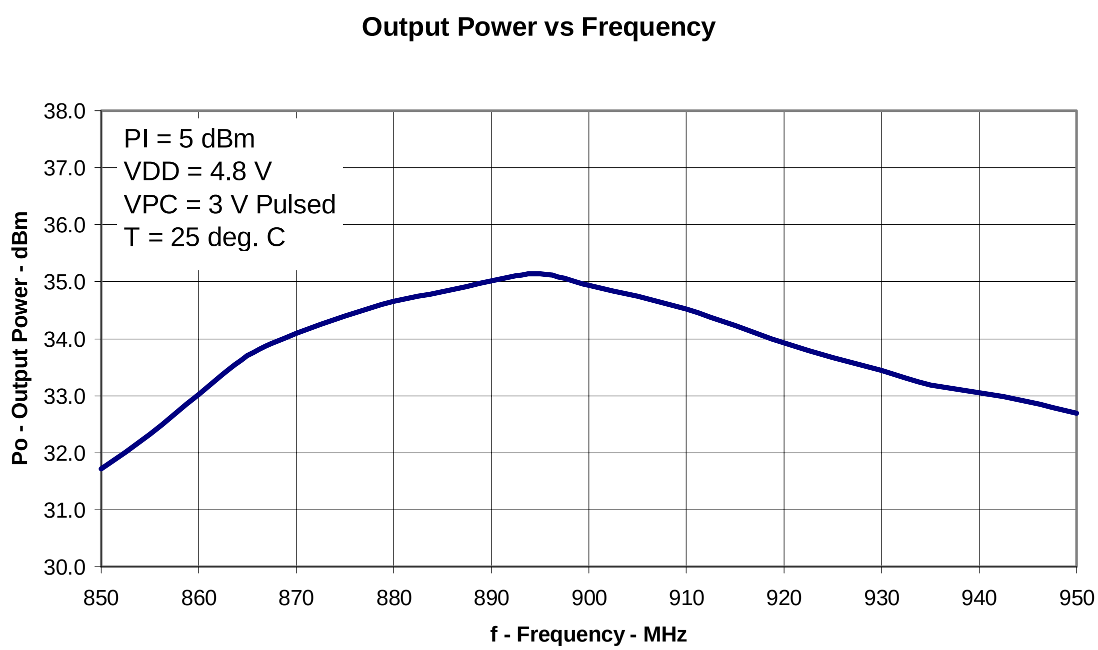
- IMS
  RCI-0402 series (resistors)
- Toko
  LL1005-F8N2 series or (inductors)
- Murata
  GRM36C series (capacitors)
  GRM36Y series (capacitors)
- ATC
  100A series high - Q capacitors (C5, C6, C8)
- Sprague
  5950337X9010R2 330 uF bias decoupling capacitors
  λ/4 transmission line may be used as a substitute.

Board Material Specifications:

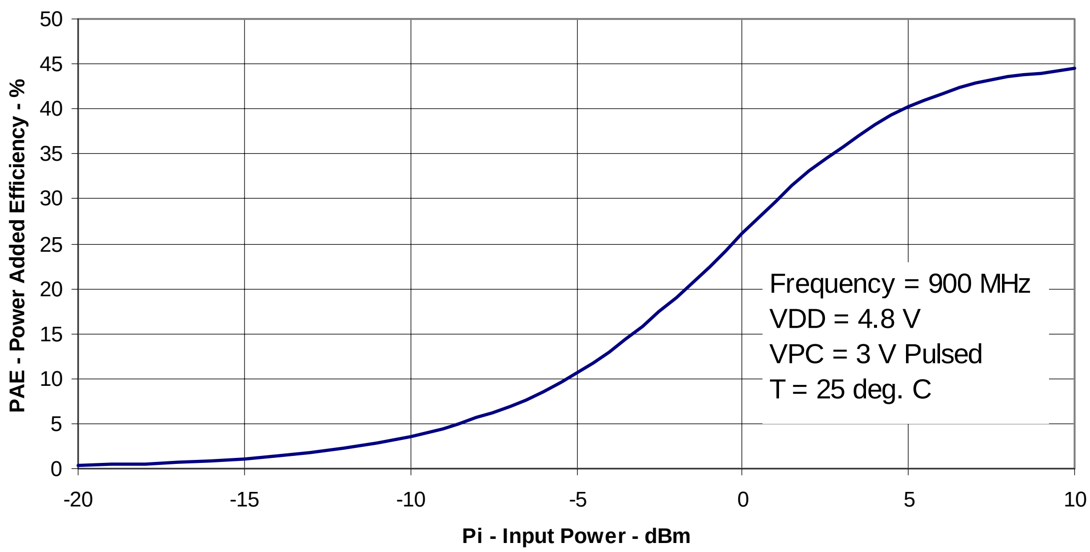
Type FR4**;** ε_r = 4.3; h = 12 mils

Typical RF Performance

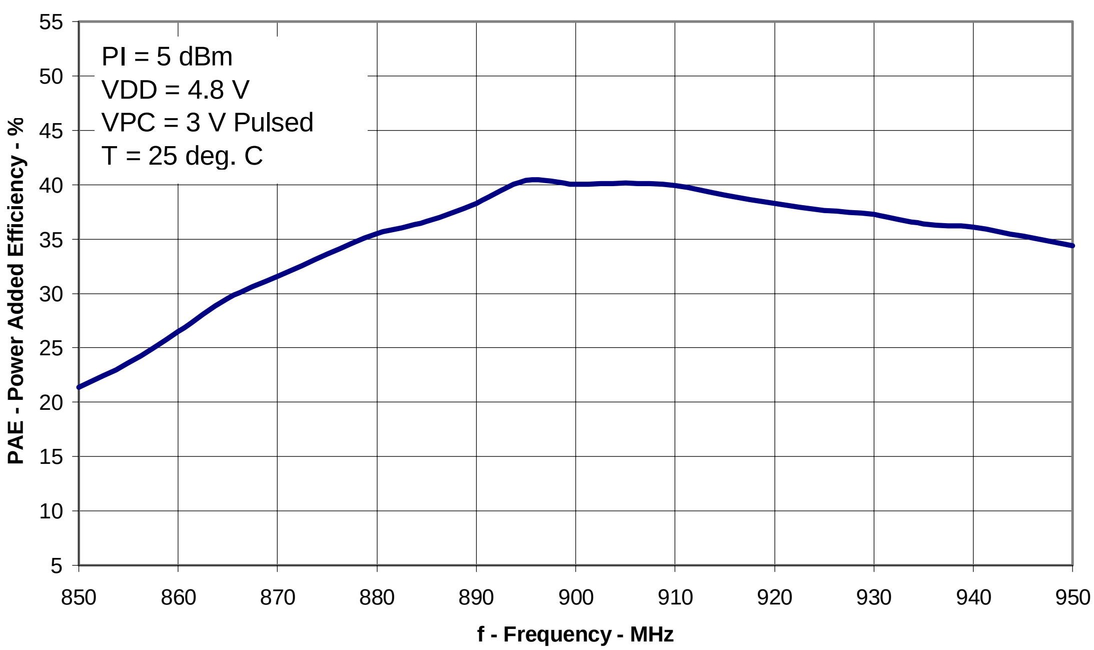




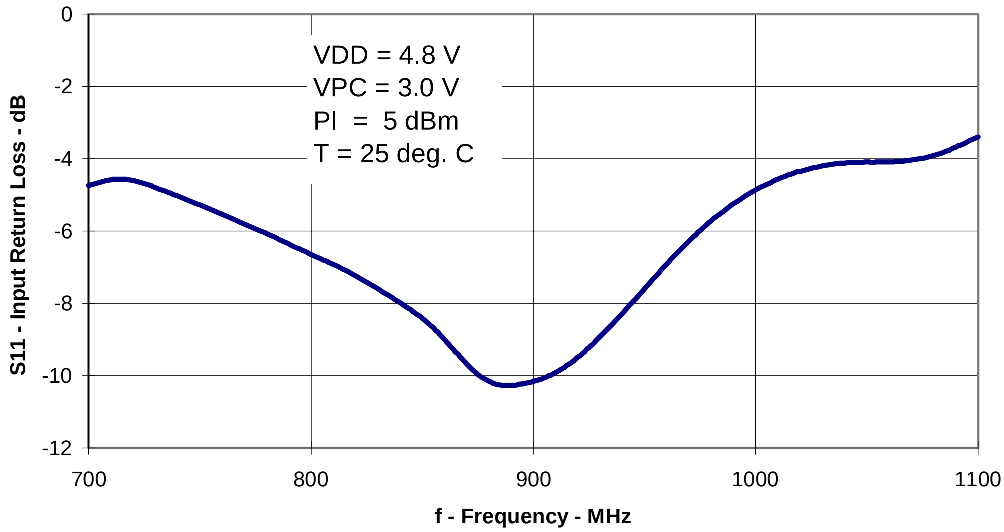
Power Added Efficiency vs Input Power



Power Added Efficiency vs Frequency

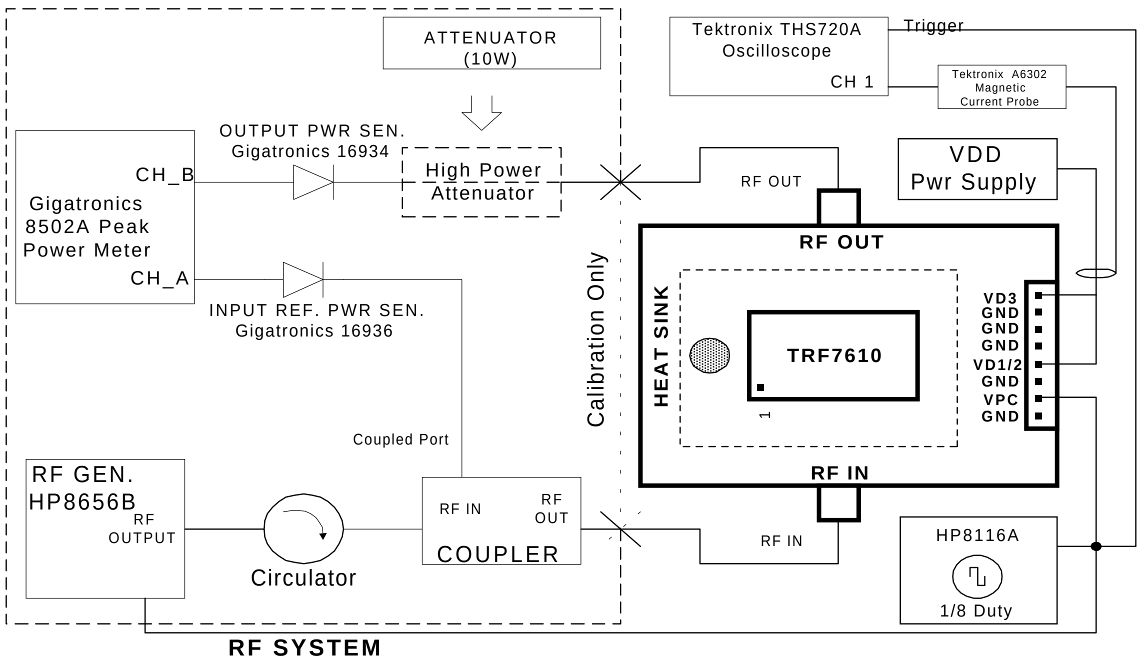


Input Return Loss versus Frequency
Matched Application Board



Test Bench Diagram

Figure 4. Typical Bench Test Setup



Configure the Test Bench as shown below.

1) Calibrate *RF SYSTEM* - less *Device Under Test and high-power attenuator*.

   a) Zero and calibrate *POWER METER, POWER SENSORS*.

   b) Set RF power and frequency on *RF GENERATOR*.

   c) RF Input Calibration:

      Offset *Channel A* of *POWER METER* by the difference between the reading of *Channel B* and *Channel A*. Verify that *Channel A* reading and *Channel B* reading are the same after offsetting.

   d) RF Output Calibration:

      Attach an Attenuator to *OUTPUT POWER SENSOR*. Offset *Channel B* of *POWER METER* by the difference between the reading of *Channel A* and *Channel B*. Verify *Channel A* reading and *Channel B* reading are the same after offsetting.

3) Device D.C. Power-up

   a) Set *VDD Power Supply* to 4.8Vdc at the device.

b) Set *VPC Power Supply* to

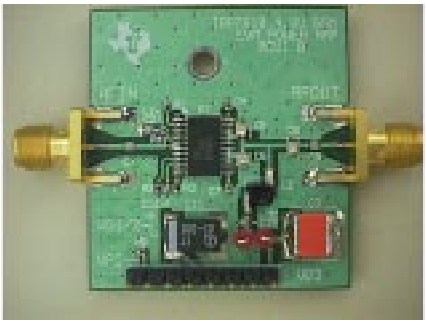
- 3.0 Vdc for the Power Test
- 0 to 3.0 Volts for VPC Control Test

NOTE:
Ensure that VDD is always 4.8V during RF test.
Adjustment of *VDD Power Supply* may be required.

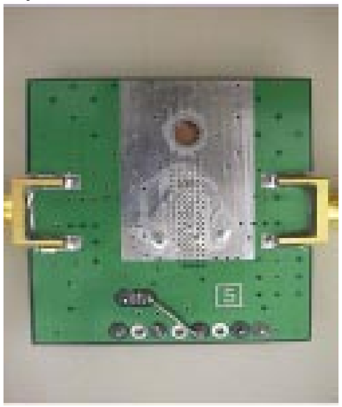
Device Testing Notes

The applications board is designed to provide testing flexibility. There are two points that need to be addressed. First, the 51 ohm VPC termination resistor, R5, is not essential to device operation. It is provided to be used with fifty-ohm pulse generators such as the Hewlett Packard 8116A. If your system incorporates a high impedance pulse generator, the termination resistor should be removed to prevent unnecessary loading of the signal source.

Second, the applications board provides current measurement flexibility. Since power added efficiency is a critical measurement in characterizing an amplifier, the applications board provides enough flexibility to accurately measure the device current rather than the supply current. The figure to the right illustrates the top-side view of the applications board. When measuring the device efficiency it is recommended that the device be connected in the following manner.

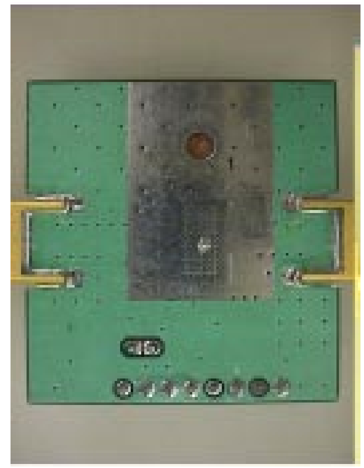


- Connect the external power supply to the VD3 connector.
- Connect the pulse generator to the VPC terminal.
- Connect a wire loop to the two red loop terminals located between the large dc bias capacitors.
- Connect a wire jumper from the loop terminal closest to the black 100 uF capacitor to the VD1/2 terminal. This can be done using an EZ-Clip wire jumper or by soldering a jumper on the back side of the board as illustrated in the photograph to the right.



This connection method ensures that the majority of the device current flows through the wire jumper between the two red terminals and allows for a magnetic current probe current measurement using a current probe of known voltage output and an oscilloscope. TI has found this to be the best method of measuring the pulsed current supplied by the capacitors. If the user does not wish to use a current probe measurement, a precision resistor may be connected between the red terminal connectors and a differential voltage measurement will yield an accurate mathematical current result.

If power added efficiency is not an issue, the power supply connections may be independent of each other. However, a wire jumper must be connected between the two red terminals to provide third-stage drain bias to the device. If a wire jumper is not desired, the two D-shaped solder pads on the back of the board may be connected together with a solder bridge. The photograph to the right shows the two D-shaped solder pads on the back side of the red terminal connectors.



Evaluation Board Disclaimer

Please note that the enclosed evaluation boards are experimental Printed Circuit Boards and are therefore only intended for device evaluation.

We would like to draw your attention to the fact that these boards have been processed through one or more of Texas Instruments' external subcontractors which have not been production qualified.

Device parameters measured, using these boards, are not representative of any final data sheet or of a final production version. Texas Instruments does not represent or guarantee that a final version will be made available after device evaluation.

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