Application Report
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AN-1805 LMV243 Single-Channel, Quad-Band GSM Power Controller Evaluation Board

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ABSTRACT

This board can be used to evaluate National Semiconductor's LMV243 Single-Channel, Quad-Band GSM Power Controller. The device is intended for use within an RF transmit power control loop in GSM mobile phones and supports GaAs HBT and bipolar RF single supply power amplifiers (PA's). The key value is its immunity to changes in the PA gain control function. It contains a 50 dB logarithmic amplifier detector and interfaces directly with the directional coupler. The operating frequency range of the device is from 450 MHz to 2 GHz.

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1 General Description

This board can be used to evaluate National Semiconductor's LMV243 Single-Channel, Quad-Band GSM Power Controller. The device is intended for use within an RF transmit power control loop in GSM mobile phones and supports GaAs HBT and bipolar RF single supply power amplifiers (PA's). The key value is its immunity to changes in the PA gain control function. It contains a 50 dB logarithmic amplifier detector and interfaces directly with the directional coupler. The operating frequency range of the device is from 450 MHz to 2 GHz.

2 Basic Operation

The LMV243 RF power controller provides an accurate temperature compensated DC output voltage (with a negative slope) that relates linearly to the applied RF input power in dBm. To evaluate the LMV243 in a simple straight forward way, the control loop is formed by the LMV243 and resistor R_5 instead of LMV243, PA, and a directional coupler. In an actual closed loop TX control system, including a PA, resistor R_5 should be removed. In an open loop measurement configuration the output voltage ramps down with increasing input power from a maximum voltage defined by V_{RAMP}. This maximum output voltage equals $V_{OUT} = V_{RAMP} * R_5 / R_{RAMP}$, where $1/R_{RAMP}$ is the transconductance defined in the datasheet.

The single supply voltage ranges from 2.7V to 3.3V and can be applied through connectors P_5 and P_6. The input interface consists of the RF input (P_1), a ramp voltage applied through P_3 and a digital input TX_EN (P_2) to perform the function "Shutdown/Transmit Enable." The device will be active in the case TX_EN = HI, otherwise, the device is in a low power consumption shutdown mode. During shutdown the output will be in high impedance mode (tristate). A single external RC combination is used to provide stable operations that accommodates individual PA characteristics. This is done with resistor R_4 and capacitor C_3.

3 Schematic

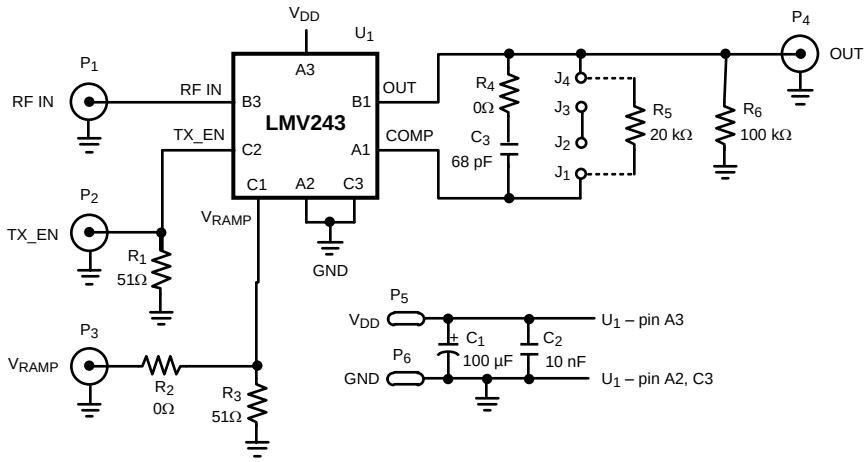


Figure 1. Schematic of the Evaluation Board

4 Layout

The Layout of the evaluation board is given in Figure 3.

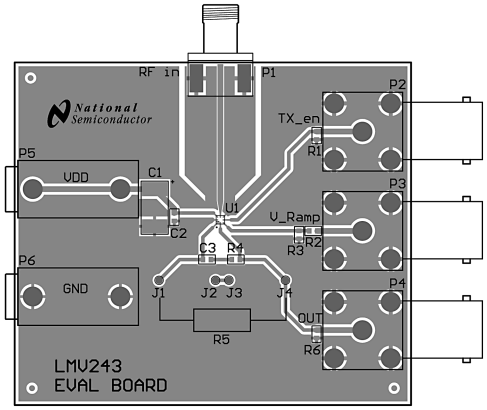
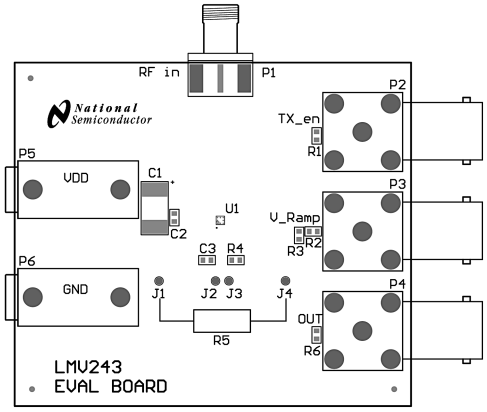


Figure 2. All Layers



Silk Screen

Figure 3. Layout of the Evaluation Board

5 Bill of Materials

The Bill of Material (BOM) of the evaluation board is given in the table below.

Table 1. Bill of Materials of the Evaluation Board

Designator	Description	Comment
C1	Case_D Capacitor	100 µF
C2	0603 Capacitor	10 nF
C3	0603 Capacitor	68 pF
P1	Connector	SMA
P2, P3, P4	Connector	BNC
P5, P6	Connector	Banana
R1, R3	0603 Resistor	51Ω
R2, R4	0603 Resistor	0Ω
R5	Axial Resistor	20 kΩ
R6	0603 Resistor	100 kΩ
U1	microSMD	LMV243BL

6 Measurement Procedure

The performance of the LMV243 can be measured with the setup shown in Figure 4.

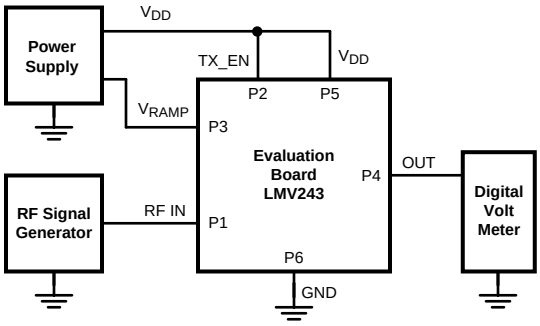


Figure 4. Measurement Setup

In this measurement example a supply voltage of 2.8V is applied by the power supply. The LMV243 is set in active mode by connecting TX_EN (P_2) to V_{DD}, which is 2.8V. V_{RAMP} is set to 1.4V. An RF signal is applied by the RF generator to connector P_1. The RF power is swept from -70 dBm to +16 dBm. The resulting output voltage is measured with a multimeter connected to P_4.

7 Measurement Results

Figure 5 shows the output voltage and the log conformance error versus the applied RF power. The RF power is swept for three different frequencies.

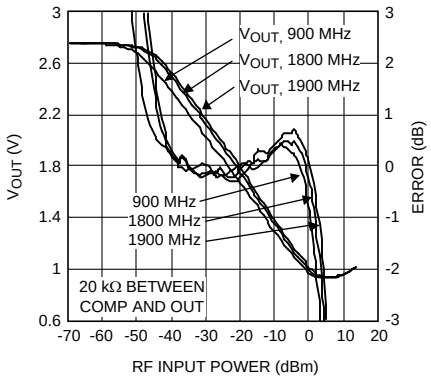


Figure 5. Frequency Response

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