# LMV225/LMV226/LMV228 microSMD Evaluation Board

National Semiconductor
Application Note 1804
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## General Description

This board can be used to evaluate National Semiconductor's LMV225/LMV226/LMV228 RF detectors. These logarithmic power detectors are intended for use in CDMA and WCDMA applications. They have a 30 dB dynamic range and an RF frequency range from 450 MHz to 2 GHz. The LMV226/LMV228 are designed to be used in combination with a directional coupler, while the LMV225 detector is especially suited for power measurements via a high-resistive tap as well as directional coupler. The LMV226 has an additional output voltage buffer and therefore a low output impedance. The LMV225/LMV226/LMV228 have an integrated filter for low-ripple average power detection of CDMA signals. Additional filtering can be applied using a single external capacitor.

## Basic Operation

The LMV225/LMV226/LMV228 provide an accurate temperature and supply compensated DC output voltage that relates linearly to the applied RF input power in dBm. The single supply, ranging from 2.7V to 5.5V, can be applied through connectors $P_4$ and $P_5$. The signal applied to connector $P_2$ puts the detector in an active or a shutdown mode. The detector is active for Enable = HI, otherwise it is in a low power consumption shutdown mode. The RF signal is applied through connector $P_1$, while the output voltage is measured through connector $P_3$.

## Schematic

The schematic of the evaluation board is depicted in *Figure 1*.

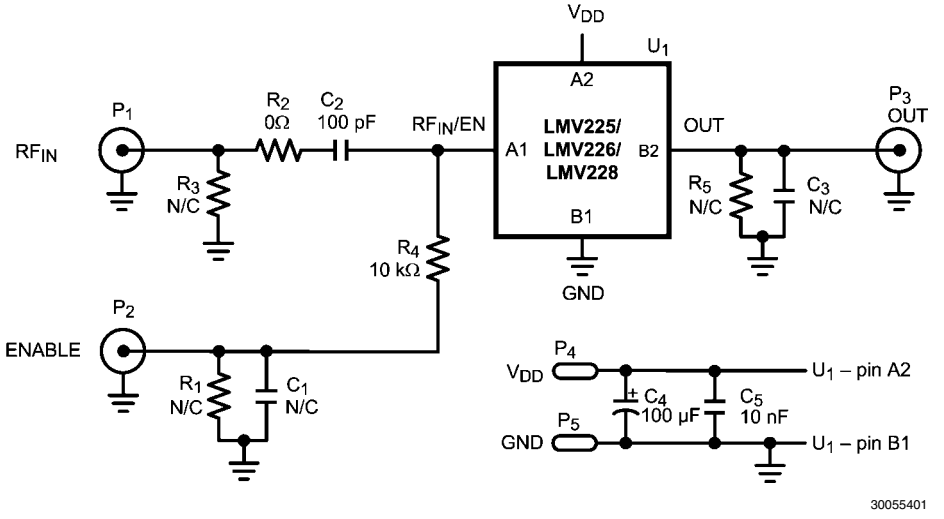


**FIGURE 1. Schematic of the Evaluation Board**

### Input

The LMV225 has an RF power detection range from –30 dBm to 0 dBm and is designed for direct use in combination with resistive taps. The LMV226/LMV228 have a detection range from –15 dBm to 15 dBm and are intended for use in combination with a directional coupler. All three detectors have an input impedance of 50Ω. Details about the configuration can be found in the datasheet.

### Output

The output voltage range is typically 0.2V to 2V and can be scaled down to meet ADC input range requirements (LMV225 and LMV228 only). Since the LMV225/LMV228 have a current controlled output, the voltage range can be adjusted by changing the output resistance. To change this a resistor needs to be placed in $R_5$. The output impedance of the detector (typical 19.8 kΩ) together with the resistor $R_5$ translates the current into a voltage. The value of resistor $R_5$ determines the exact scaling. A value of 19.8 kΩ for example divides the output voltage range by half. Besides scaling the output voltage, the output ripple can be reduced by lowpass filtering. This can be realized with capacitor $C_3$. Further details can be found in the applications information section in the datasheet.





 

## Layout

The layout of the evaluation board is depicted in *Figure 2*.

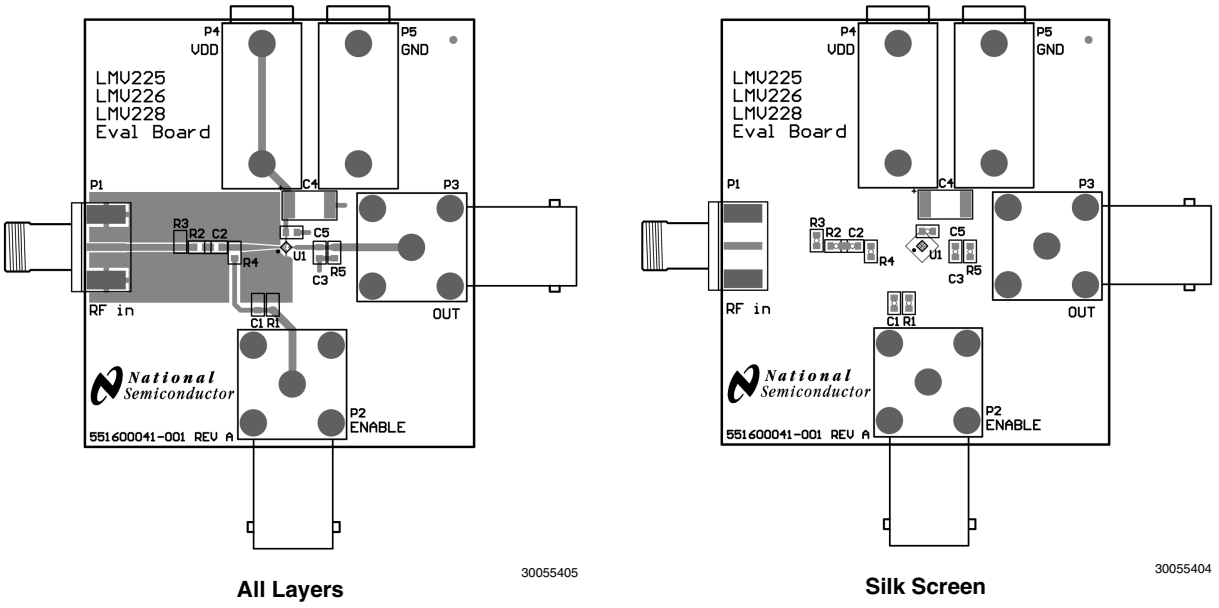


**FIGURE 2. Layout of the Evaluation Board**

## Bill of Materials

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

| Designator | Description | Comment |
|---|---|---|
| C2 | 0603 Capacitor | 100 pF |
| C4 | Case_C Capacitor | 100 µF |
| C5 | 0603 Capacitor | 10 nF |
| C1, C3 | 0603 Capacitor | Not Connected |
| P1 | Connector | SMA |
| P2 | Connector | BNC |
| P3 | Connector | BNC |
| P4 | Connector | Banana |
| P5 | Connector | Banana |
| R2 | 0603 Resistor | 0Ω |
| R4 | 0603 Resistor | 10 kΩ |
| R1, R3, R5 | 0603 Resistor | Not Connected |
| U1 | microSMD | LMV225TL or LMV226TL or LMV228TL |

## Measurement Procedure

The performance of the LMV225/LMV226/LMV228 can be measured with the setup given in *Figure 3*.

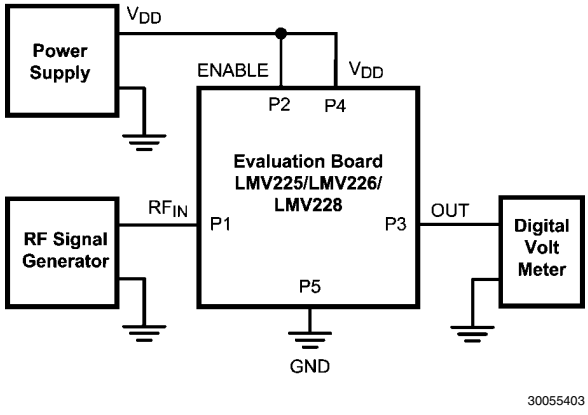


**FIGURE 3. Measurement Setup**

In this measurement example a supply voltage of 2.7V is applied by the power supply. To put the LMV225/LMV226/LMV228 in active mode, the Enable ($P_2$) is connected to 2.7V as well. The resulting DC output voltage is measured with a multimeter connected to $P_3$. A 900 MHz RF signal is applied by the RF generator to connector $P_1$, where the RF power is swept from −50 dBm to +20 dBm.

## Measurement Results

*Figure 4*, *Figure 5* and *Figure 6* depict the measurement results for the LMV225/LMV226/LMV228 respectively. For each plot the RF power is swept at 900 MHz for different temperatures. Also the error in dBs with respect to an ideal straight line is plotted (Log conformance).

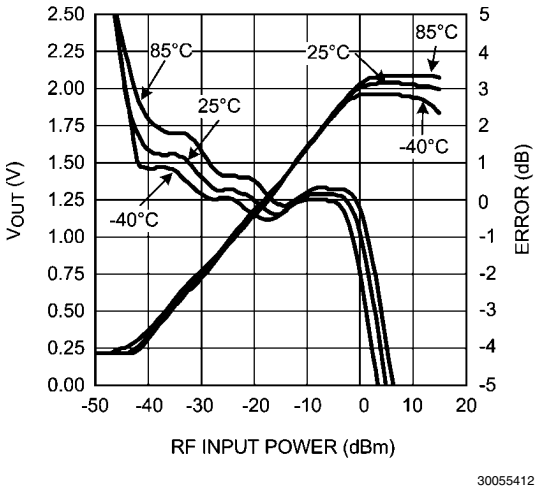


**FIGURE 4. LMV225 Output Voltage and Log Conformance vs. RF Input Power at 900 MHz**

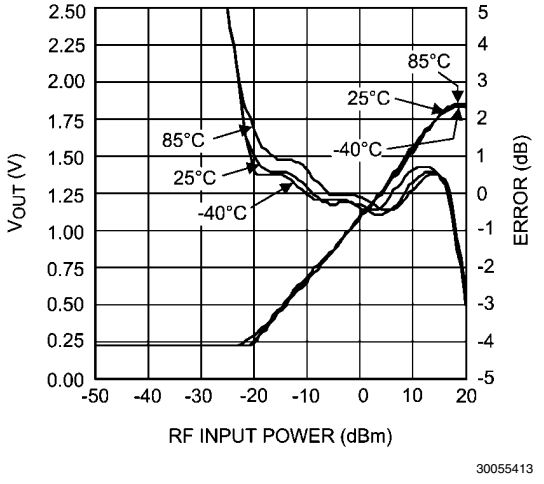


**FIGURE 5. LMV226 Output Voltage and Log Conformance vs. RF Input Power at 900 MHz**

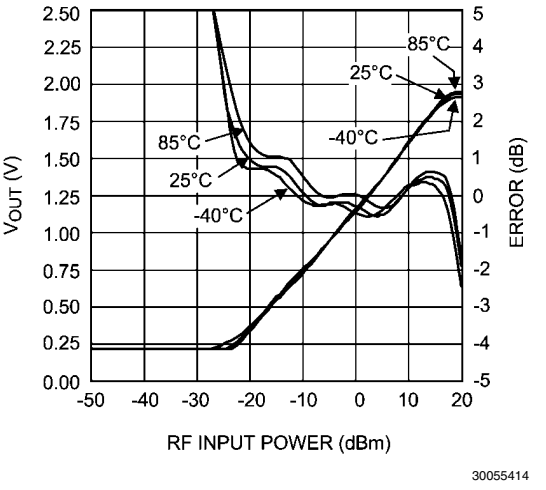


**FIGURE 6. LMV228 Output Voltage and Log Conformance vs. RF Input Power at 900 MHz**

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