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AM Radio Amplifier with Filter Using the CPH3910

Application Note

Overview

This application note explains about ON Semiconductor's CPH3910 which is used as a Low Noise Amplifier (LNA) for AM Radio.

The CPH3910 is a silicon junction field effect transistor best suited for high-frequency applications which is assembled in the 3-pin surface mount package.

For information about the performance, please refer to the datasheet of this product.

The evaluation board is adjusted to provide +9.5dB gain in AM band (520 to 1720 kHz) and reduce gain to -80dB in FM band (76 to 108 MHz).

A standard material FR4 is used for the printed circuit board (PCB).



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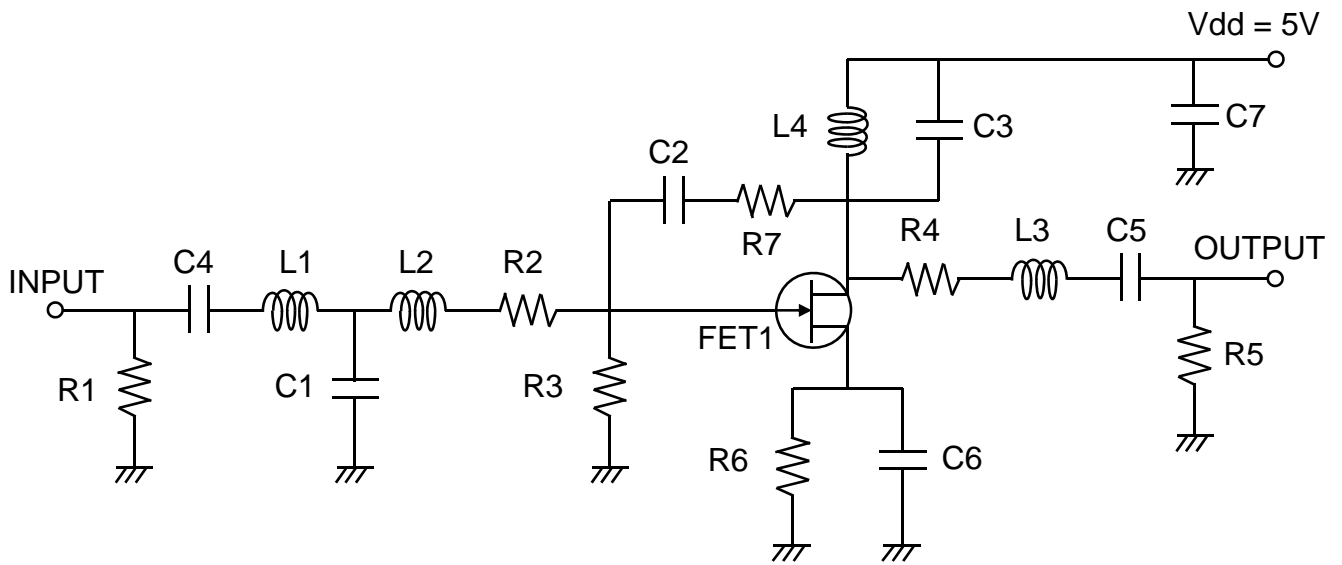
■ Summary of Data

Ta = 25°C, Input Power = -40 dBm, Zo = 50 Ω

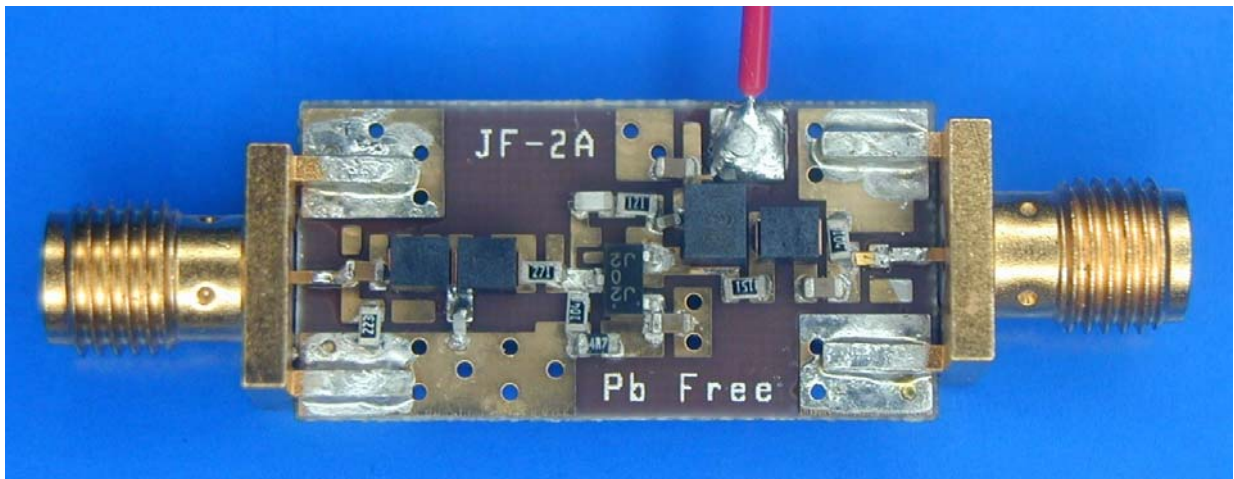
| Parameter | Symbol | Condition | Result | Unit |
|--------------------|--------|--------------|--------|------|
| DC Voltage | Vdd | | 5.0 | V |
| DC Current | Idd | | 26.5 | mA |
| Power Gain | Gp1 | f = 520 kHz | 9.45 | dB |
| | | f = 1120 kHz | 9.85 | |
| | | f = 1720 kHz | 9.81 | |
| | Gp2 | f = 76 MHz | -89.9 | |
| | | f = 90 MHz | -87.6 | |
| | | f = 108 MHz | -82.3 | |
| Input Return Loss | RLin | f = 520 kHz | -0.03 | dB |
| | | f = 1120 kHz | -0.19 | |
| | | f = 1720 kHz | -0.48 | |
| Output Return Loss | RLout | f = 520 kHz | -0.81 | dB |
| | | f = 1120 kHz | -1.08 | |
| | | f = 1720 kHz | -1.67 | |
| Isolation | ISL | f = 520 kHz | -48.2 | dB |
| | | f = 1120 kHz | -41.5 | |
| | | f = 1720 kHz | -37.9 | |

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■Circuit Design



■Evaluation Board



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■Bill of Materials

| Item | Symbol | Value | Manufacture | Size |
|-----------|-------------|---------|------------------|------------|
| J-FET | FET1 | CPH3910 | ON Semiconductor | SC-59 |
| Capacitor | C1 | 10 pF | Murata GRM155 | 1005 |
| | C2 | 12 pF | Murata GQM188 | 1608 |
| | C3 | 120 pF | Murata GRM155 | 1005 |
| | C4,C5,C6,C7 | 0.1 uF | ROHM MCH182CN | 1608 |
| Resistor | R1 | 22 kΩ | Various | 1608 |
| | R2 | 270 Ω | Various | 1608 |
| | R3 | 100 kΩ | Various | 1608 |
| | R4 | 150 Ω | Various | 1608 |
| | R5 | 100 kΩ | Various | 1608 |
| | R6 | 4.7 Ω | Various | 1608 |
| | R7 | 120 kΩ | Various | 1608 |
| Inductor | L1,L2,L3 | 3.3 uH | TDK NLV25T | 2520 |
| | L4 | 330 uH | TDK NLCV32T | 3225 |
| Material | | FR-4 | | 25 x 13 mm |

AM Radio Amplifier with Filter Using the CPH3910

■ Measurement Results

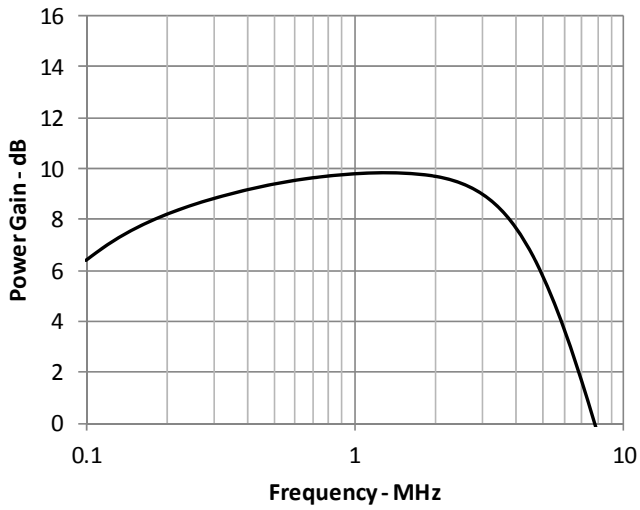


Figure 1 Power Gain vs. Frequency

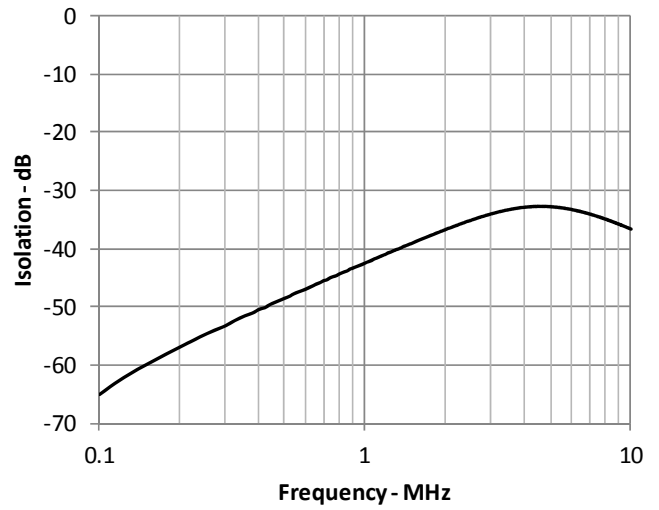


Figure 2 Isolation vs. Frequency

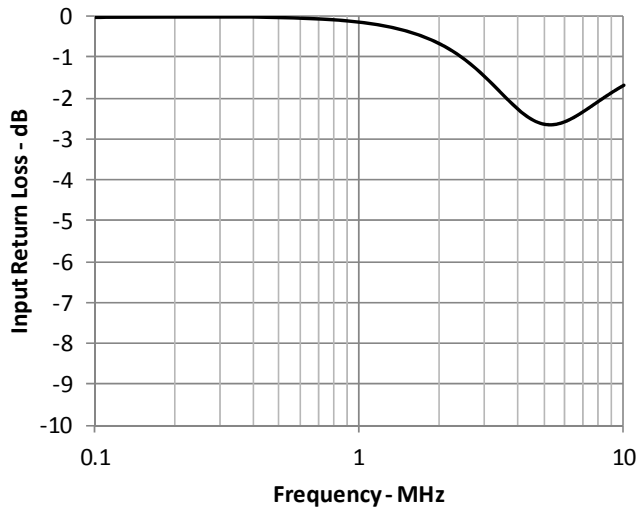


Figure 3 Input Return Loss vs. Frequency

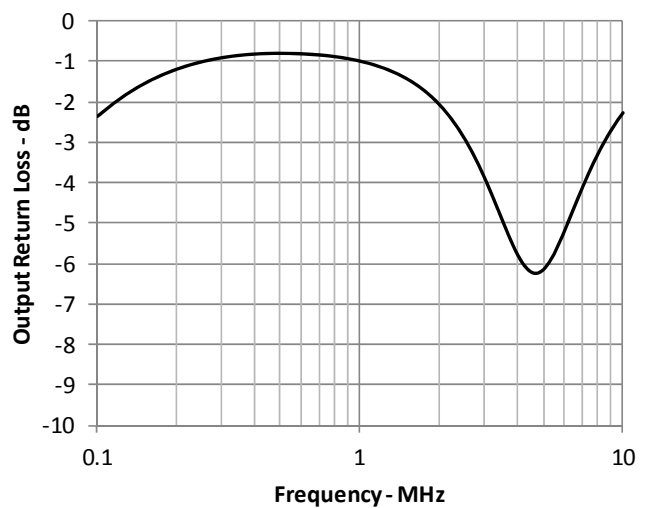


Figure 4 Output Return Loss vs. Frequency

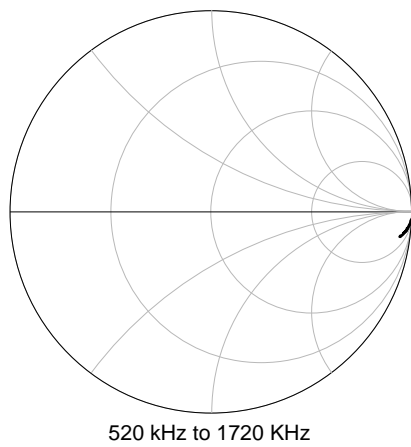


Figure 5 Smith Chart S11

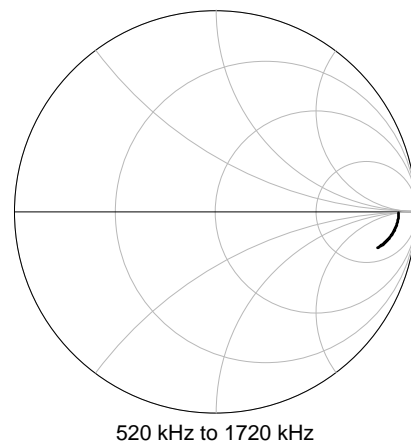


Figure 6 Smith Chart S22

AM Radio Amplifier with Filter Using the CPH3910

■ Measurement Results

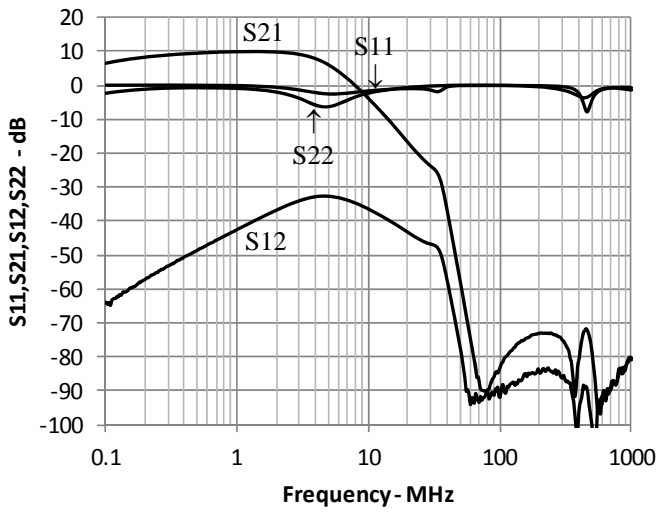


Figure 7 Wide Span

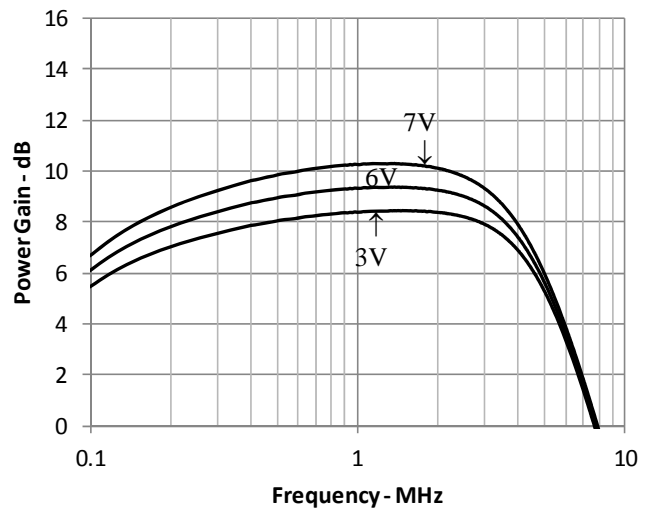


Figure 8 Voltage Dependency

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