

# 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).



**ON Semiconductor®**

<http://onsemi.com>

---

## AM Radio Amplifier with Filter Using the CPH3910

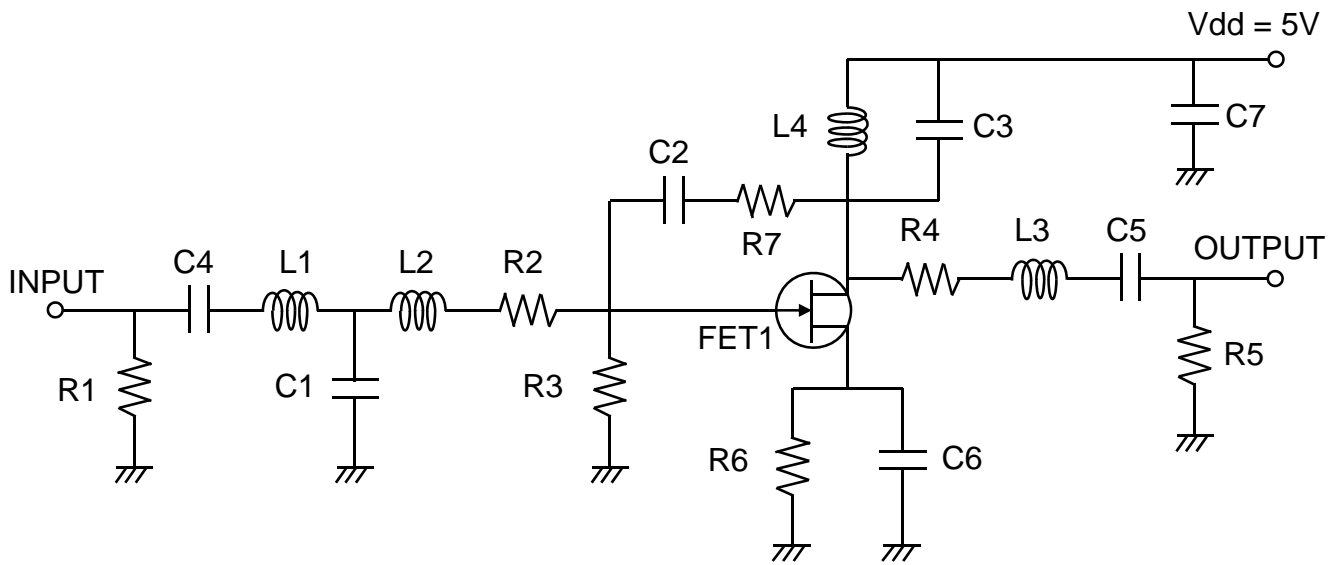
### ■ Summary of Data

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

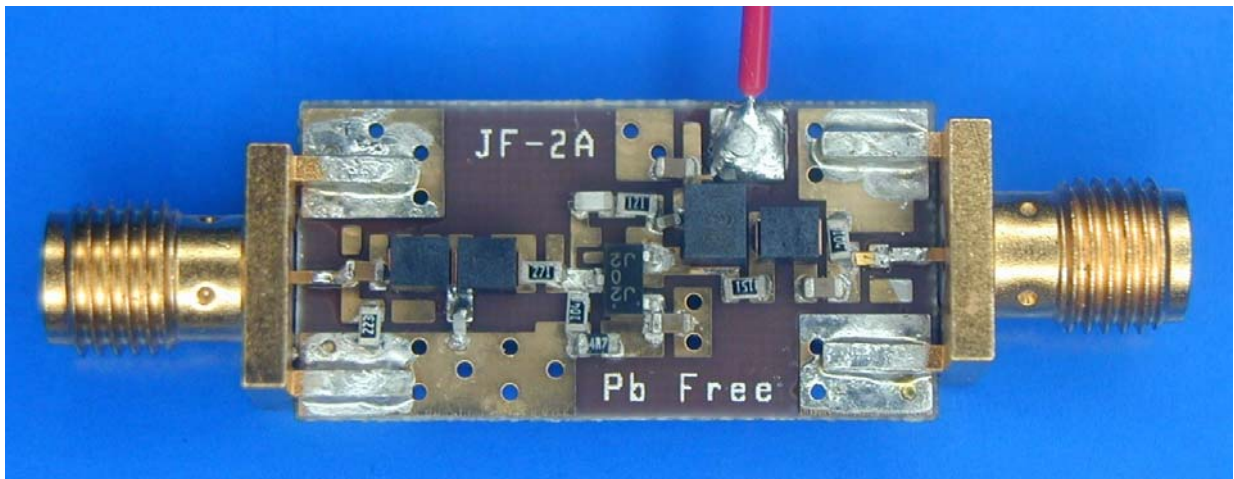
| Parameter          | Symbol | Condition    | Result | Unit |
|--------------------|--------|--------------|--------|------|
| DC Voltage         | Vdd    |              | 5.0    | V    |
| DC Current         | Idd    |              | 26.5   | mA   |
| Power Gain         | Gp1    | f = 520 kHz  | 9.45   | 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  |      |

# AM Radio Amplifier with Filter Using the CPH3910

## ■Circuit Design



## ■Evaluation Board



## AM Radio Amplifier with Filter Using the CPH3910

### ■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 k $\Omega$  | Various          | 1608       |
|           | R2          | 270 $\Omega$   | Various          | 1608       |
|           | R3          | 100 k $\Omega$ | Various          | 1608       |
|           | R4          | 150 $\Omega$   | Various          | 1608       |
|           | R5          | 100 k $\Omega$ | Various          | 1608       |
|           | R6          | 4.7 $\Omega$   | Various          | 1608       |
|           | R7          | 120 k $\Omega$ | 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

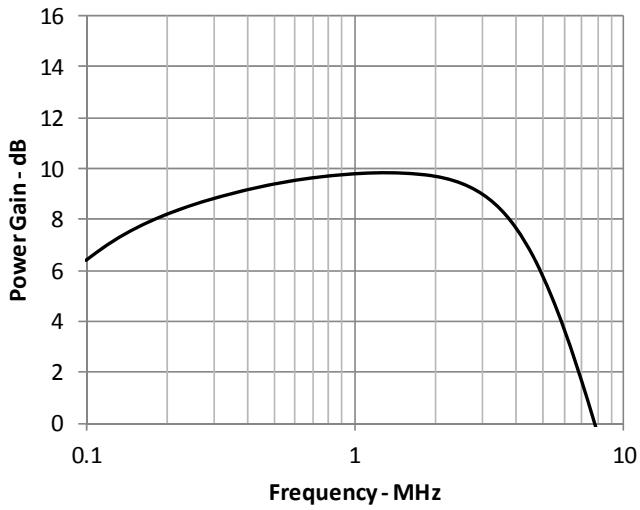


Figure 1 Power Gain vs. Frequency

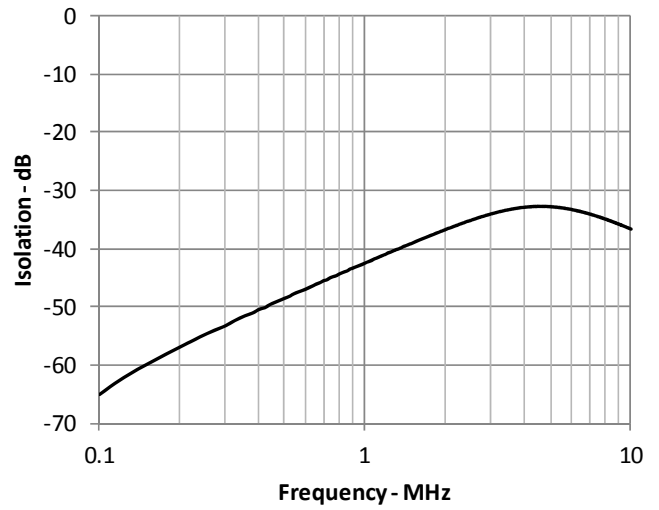


Figure 2 Isolation vs. Frequency

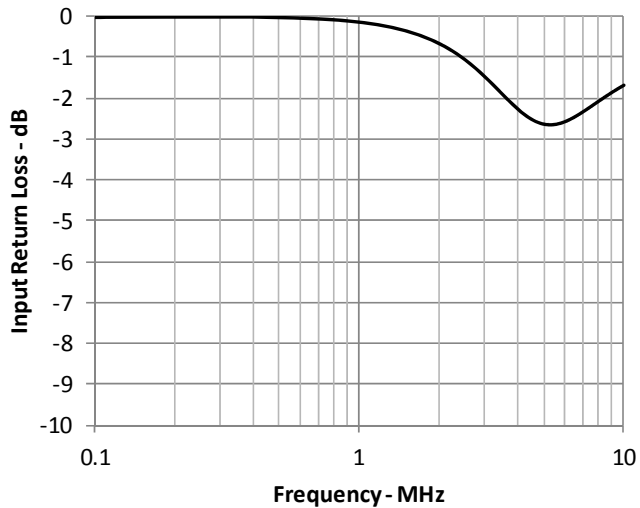


Figure 3 Input Return Loss vs. Frequency

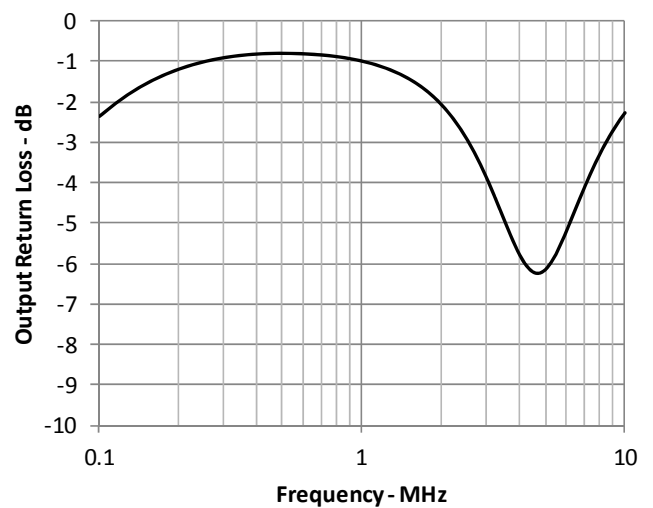


Figure 4 Output Return Loss vs. Frequency

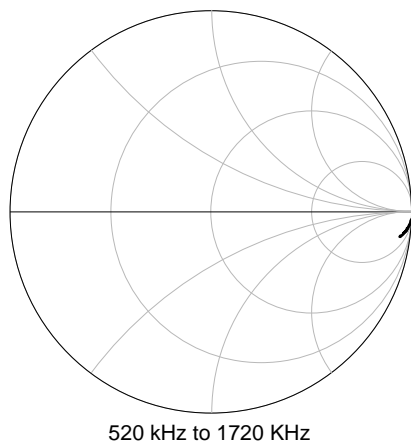


Figure 5 Smith Chart S11

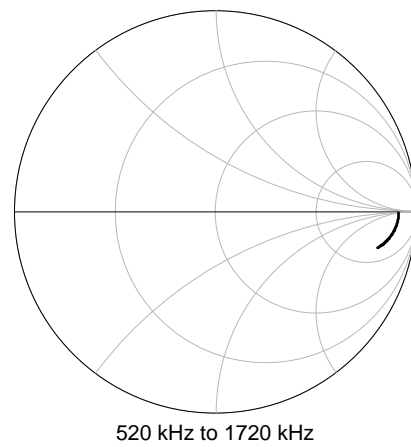


Figure 6 Smith Chart S22

# AM Radio Amplifier with Filter Using the CPH3910

## ■ Measurement Results

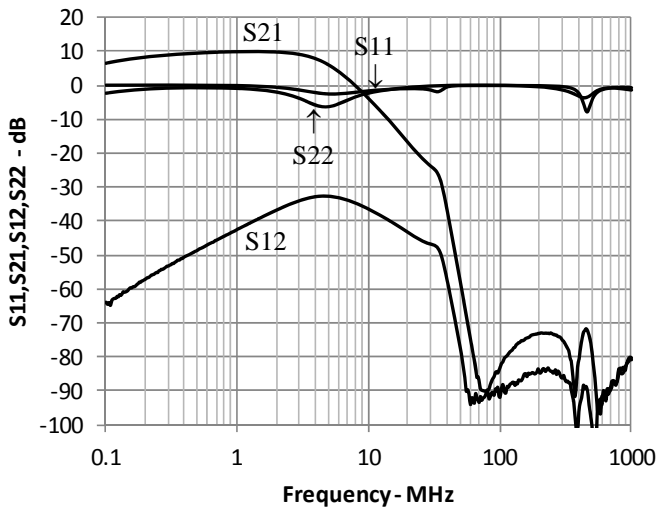


Figure 7 Wide Span

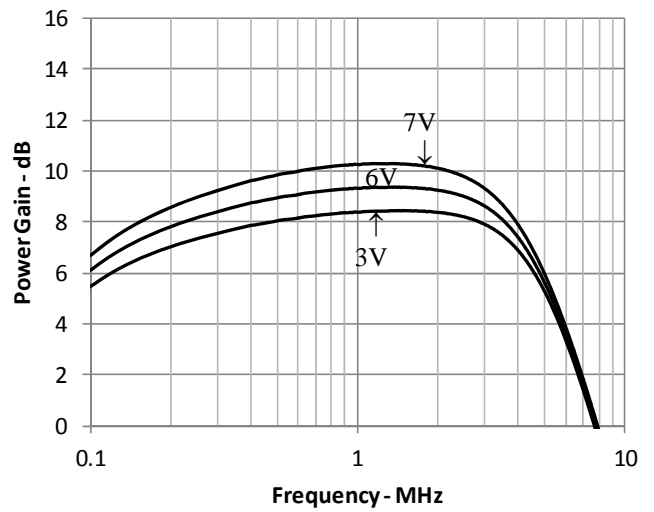


Figure 8 Voltage Dependency

## AM Radio Amplifier with Filter Using the CPH3910

ON Semiconductor and the ON logo are registered trademarks of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries. SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.