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AM Radio Amplifier with Filter Using the CPH3910

Application Note

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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).

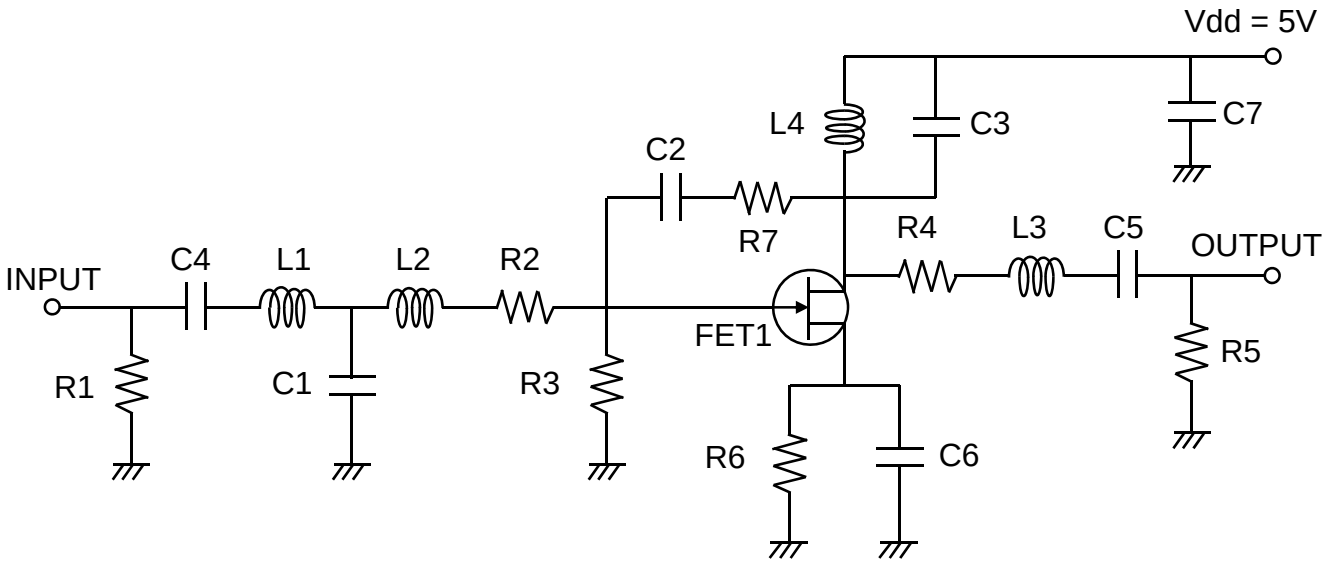
A standard material FR4 is used for the printed circuit board (PCB).

■Summary of Data

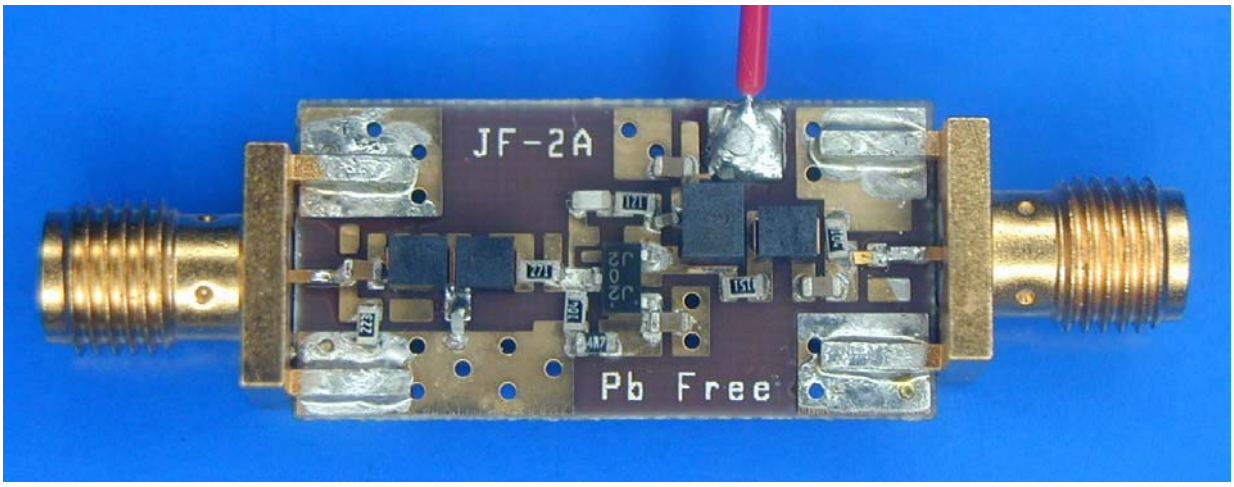
Ta = 25°C, Input Power = -40 dBm, Zo = 50 Ω

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	

■Circuit Design



■Evaluation Board



■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

■Measurement Results

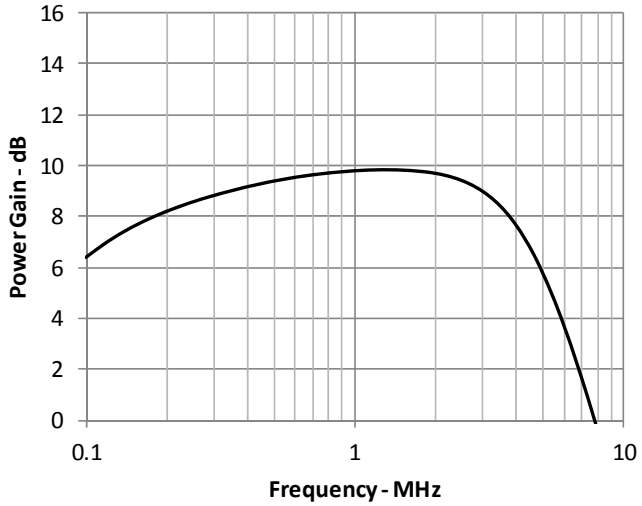


Figure 1 Power Gain vs. Frequency

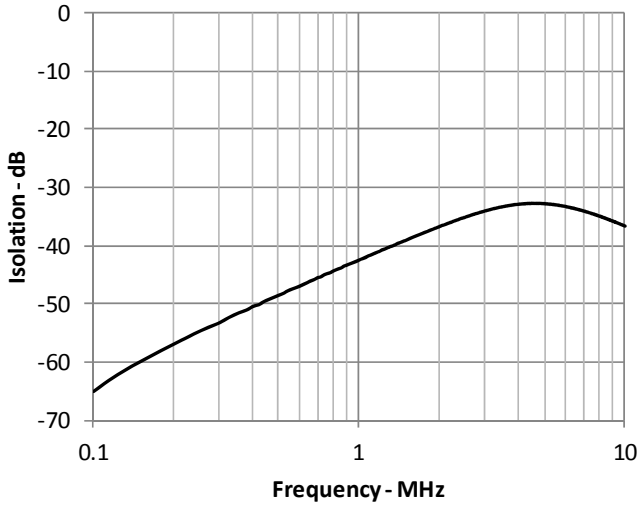


Figure 2 Isolation vs. Frequency

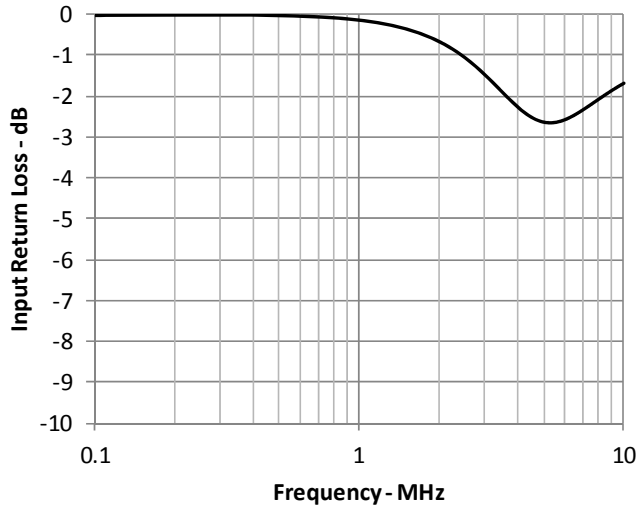


Figure 3 Input Return Loss vs. Frequency

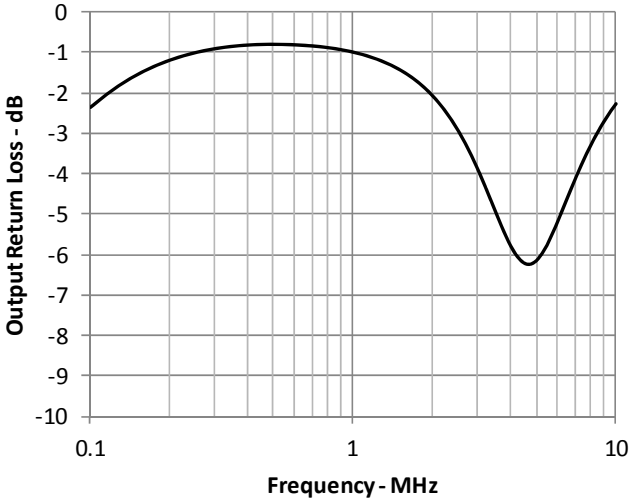
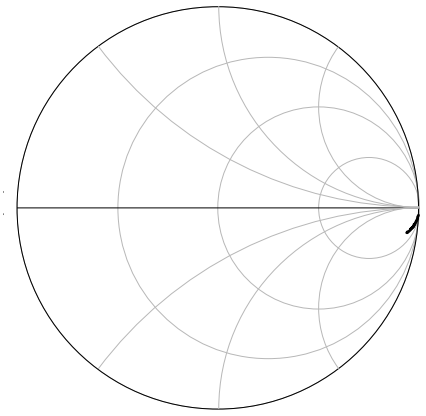
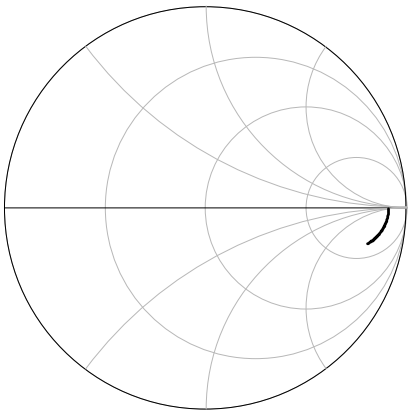


Figure 4 Output Return Loss vs. Frequency



520 kHz to 1720 KHz

Figure 5 Smith Chart S11



520 kHz to 1720 kHz

Figure 6 Smith Chart S22

■Measurement Results

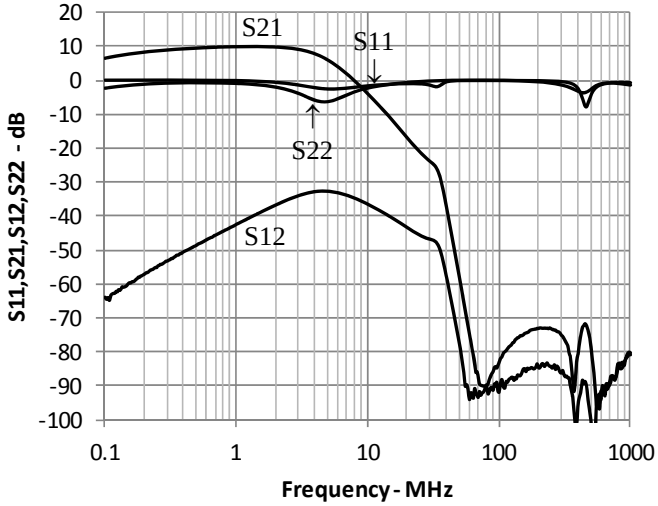


Figure 7 Wide Span

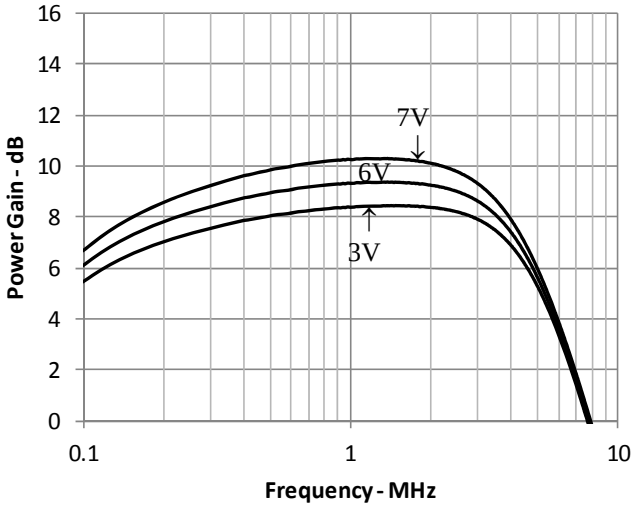


Figure 8 Voltage Dependency