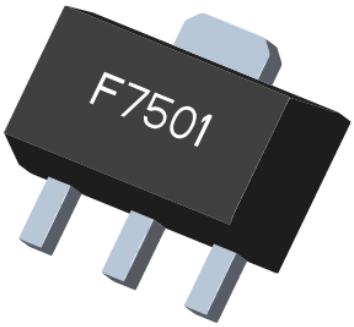
1. Description

- The F7501 is a high linearity driver amplifier in a low-cost, surface mount package. The F7501 delivers high performance across a broad range of frequencies with 44.5dBm OIP3 and 29.1dBm P1dB while only consuming 270mA quiescent current.
- The F7501 has an overvoltage protection function. When the power supply voltage exceeds a certain value, the protection function is turned on.



F7501-PDS-F01

Figure 1. F7501 Package Outline

2. Applications

- PA Driver Amplifier
- Repeaters
- Mobile Infrastructure
- CDMA/WCDMA/LTE
- General Purpose Wireless

3. Features[1]

- Operating Frequency: 400-4000MHz
- Output Power (P1dB): 29.1dBm
- Gain, Small Signal: 15.8dB
- Operating Voltage/Current: 5V/270mA
- Package: SOT-89

1. Measured in Raytron DEMO @2140MHz

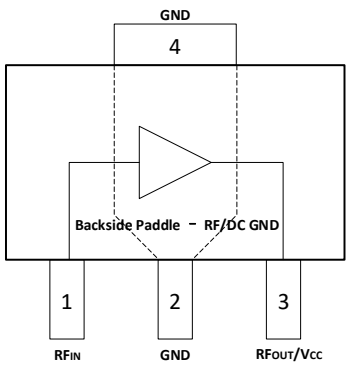
4. Brief Typical Performance

Table 1. Brief Typical Performance (V_{CC}=5V, I_{CQ}=270mA, T_C=25℃, 50Ω system)

Parameter	Typical Value					Units
Frequency	940	1850	2140	2600	3500	MHz
Gain, Small Signal	19.8	17.0	15.8	14.7	12.4	dB
Output P1dB	29.1	29.7	29.1	29.5	29.3	dBm
Output IP3[1]	40.7	41.5	44.5	40.8	40.6	dBm

1. Input signal: 2-tone, P_{OUT}=8dBm/tone, Δf=1MHz

5. Block Diagram



F7501-PDS-F02

Figure 2. F7501 Block Diagram TOP View

Table of Contents

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7	Recommended Operating Conditions	3
8	Performance	3
9	Package Outline	13
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6. Absolute Maximum Ratings

Table 2. Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Operating Voltage	V_{CC}	5.5	V
Input Power	P_{IN}	30	dBm
Storage Temperature Range	T_{STG}	- 55 ~ +125	°C
Operating Junction Temperature	T_J	150	°C

7. Recommended Operating Conditions

Table 3. Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Operating Temperature Range	-40	25	85	°C
Operating Voltage	4.75	5.0	5.25	V
Operating Frequency	400	-	4000	MHz

8. Performance

8.1 Performance(920-960MHz)

8.1.1 Electrical Characteristics (920-960MHz, T_C=25°C)

Table 4. Electrical Characteristics(V_{CC}=5V, I_{CQ}=270mA, T_C=25℃, 50Ω system)

Parameter	Conditions	Typical Value			Units
Frequency	-	920	940	960	MHz
Gain	-	20	19.8	19.7	dB
Input Return Loss	-	9.1	9.3	9.1	dB
Output Return Loss	-	8.8	9.1	9.6	dB
Output P1dB	-	29	29.1	29.2	dBm
Output IP3	P_{OUT}=13dBm/tone, Δf=1MHz	40.8	40.7	40.5	dBm
WCDMA Channel Power[1]	ACLR=-50dBc	18.5	18.5	18.6	dBm

[1] 3GPP WCDMA, TM1+64 DPCH, +5MHz offset, PAR=10.2dB at 0.01% Probability

8.1.2 Performance Plots(920-960MHz)

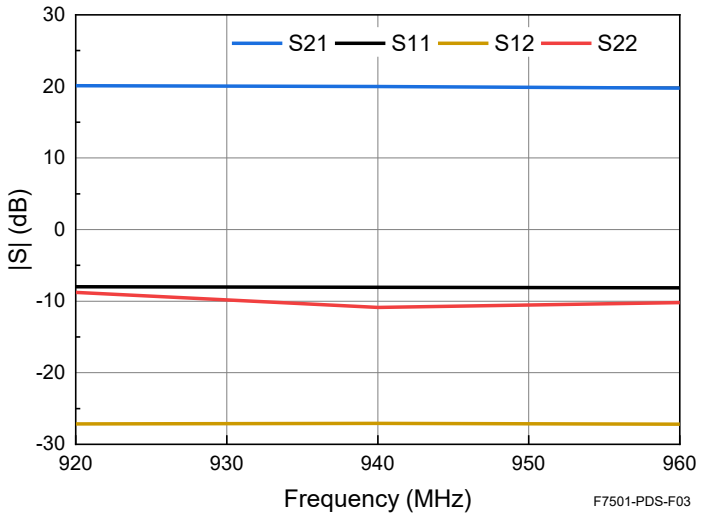


Figure 3. Small Signal S-Parameters vs. Freq.(920-960MHz)

8.1.3 Evaluation Board(920-960MHz)

■ Schematic

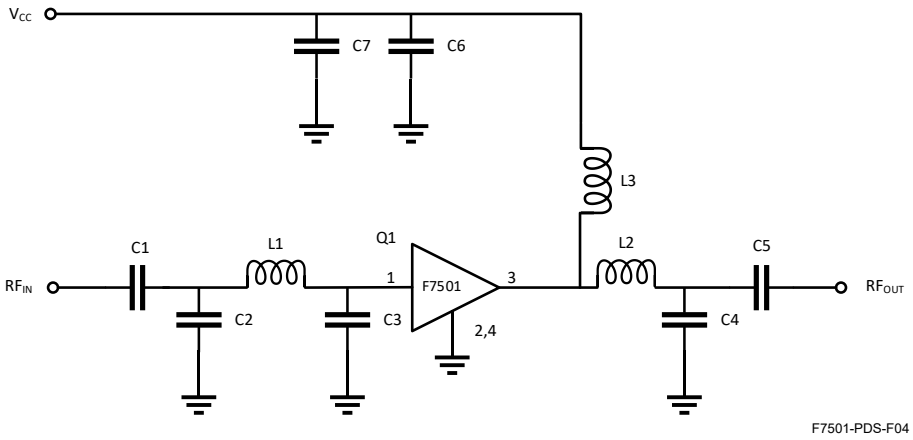


Figure 4. F7501 Application Circuit Schematic

■ Layout

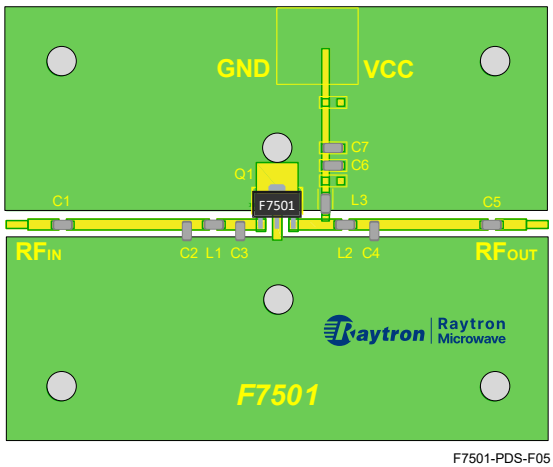


Figure 5. F7501 Application Circuit Layout

Table 5. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
Q1	N/A	F7501 Amplifier, SOT-89 pkg.	Raytron	F7501
C1 C5	220.0pF	0603 Capacitor	Murata	GCM1885C2A221JA16D
C2	5.6pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E5R6BB12
C3	18.0pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E180GB12
C4	5.6pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E5R6BB12
C6	100.0pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E101GB12
C7	2.2uF	0603 Capacitor	Various	N/A
L1	4.3nH	High Q 0603 Inductor	Murata	LQW18AN4N3C80D
L2	2.2nH	High Q 0603 Inductor	Murata	LQW18AN2N2C80D
L3	30.0nH	High Q 0603 Inductor	Murata	LQW18AN30NG80D

Table 6. TL Distance

TL	Value	Description
TL1	1.02mm	Distance between F7501 Pin 1 to C3 (right edge)
TL2	2.87mm	Distance between F7501 Pin 1 to L1 (right edge)
TL3	6.23mm	Distance between F7501 Pin 1 to C2 (right edge)
TL4	3.30mm	Distance between F7501 Pin 3 to L2 (left edge)
TL5	6.78mm	Distance between F7501 Pin 3 to C4 (left edge)

8.2 Performance(1805-1880MHz)

8.2.1 Electrical Characteristics (1805-1880MHz, T_C=25°C)

Table 7. Electrical Characteristics(V_{CC}=5V, I_{CQ}=270mA, T_C=25℃, 50Ω system)

Parameter	Conditions	Typical Value			Units
Frequency	-	1805	1850	1880	MHz
Gain	-	17.2	17.0	16.8	dB
Input Return Loss	-	18.2	27	21	dB
Output Return Loss	-	9.5	9.3	10.2	dB
Output P1dB	-	29.4	29.3	29.7	dBm
Output IP3	P_{OUT}=13dBm/tone, Δf=1MHz	41.1	41.5	40.5	dBm
WCDMA Channel Power[1]	ACLR=-50dBc	18.3	18.2	18.5	dBm

[1] 3GPP WCDMA, TM1+64 DPCH, +5MHz offset, PAR=10.2dB at 0.01% Probability

8.2.2 Performance Plots (1805-1880MHz)

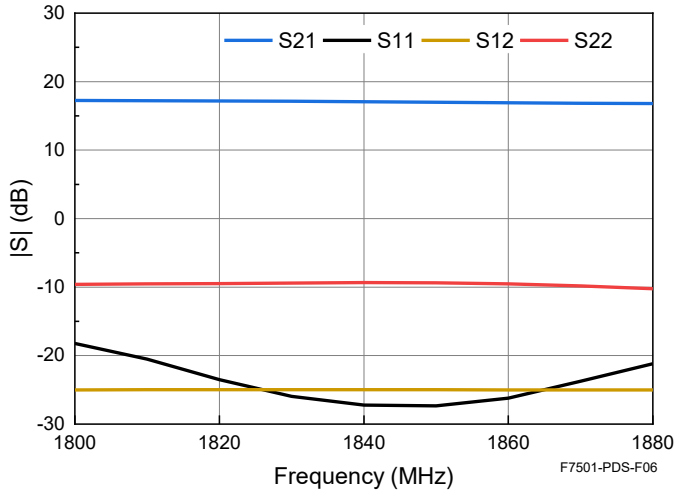


Figure 6. Small Signal S-Parameters vs. Freq.(1805-1880MHz)

8.2.3 Evaluation Board(1805-1880MHz)

■ Schematic

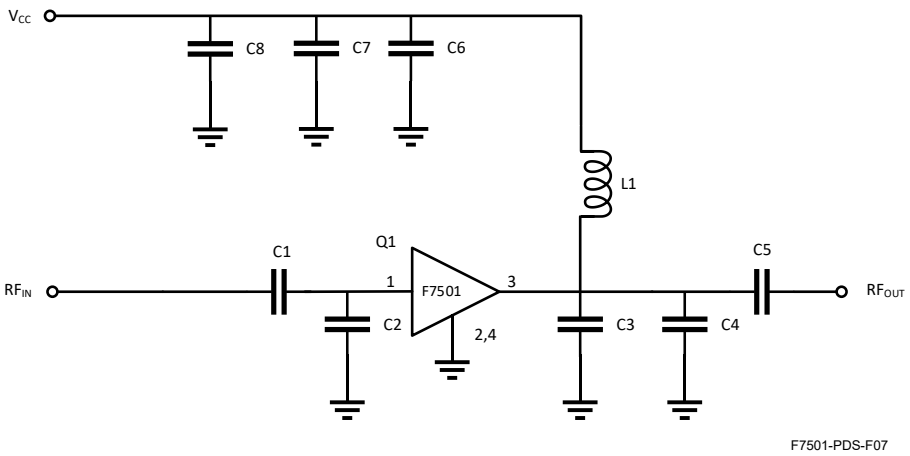


Figure 7. F7501 Application Circuit Schematic

■ Layout

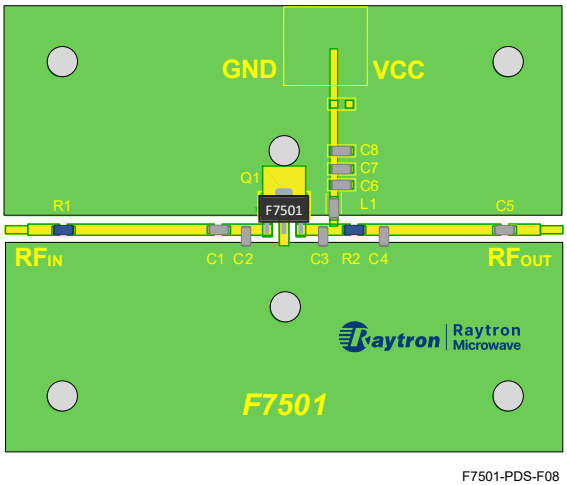


Figure 8. F7501 Application Circuit Layout

Table 8. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
Q1	N/A	F7501 Amplifier, SOT-89 pkg.	Raytron	F7501
R1 R2	0Ω	0603 Resistor	Various	N/A
C1	1.5pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E1R5BB12
C2	2.2pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E2R2BB12
C3	2.7pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E2R7BB12
C4	0.6pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2ER60BB12
C5	91.0pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E910GB12
C6	22.0pF	C0G 250V 0603 Capacitor	Various	GQM1875C2E220GB12
C7	0.1uF	0603 Capacitor	Various	N/A
C8	2.2.0uF	0603 Capacitor	Various	N/A
L1	30.0nH	High Q 0603 Inductor	Murata	LQW18AN30NG80D

Table 9. TL Distance

TL	Value	Description
TL1	1.02mm	Distance between F7501 Pin 1 to C2 (right edge)
TL2	2.87mm	Distance between F7501 Pin 1 to C1 (right edge)
TL3	1.02mm	Distance between F7501 Pin 3 to C3 (left edge)
TL4	6.78mm	Distance between F7501 Pin 3 to C4 (left edge)
TL5	16.82mm	Distance between F7501 Pin 3 to C5 (left edge)

8.3 Performance(2110-2170MHz)

8.3.1 Electrical Characteristics (2110-2170MHz, T_C=25°C)

Table 10. Electrical Characteristics(V_{CC}=5V, I_{CQ}=270mA, T_C=25℃, 50Ω system)

Parameter	Conditions	Typical Value			Units
Frequency	-	2110	2140	2170	MHz
Gain	-	15.8	15.8	15.8	dB
Input Return Loss	-	10.7	11.9	12.1	dB
Output Return Loss	-	12.2	11.8	11.9	dB
Output P1dB	-	29.0	29.1	29.1	dBm
Output IP3	P_{OUT}=8dBm/tone, Δf=1MHz	44.3	44.5	44.2	dBm
WCDMA Channel Power[1]	ACLR=-50dBc	19.1	19.2	19.2	dBm

[1] 3GPP WCDMA, TM1+64 DPCH, +5MHz offset, PAR=10.2dB at 0.01% Probability

8.3.2 Performance Plots(2110-2170MHz)

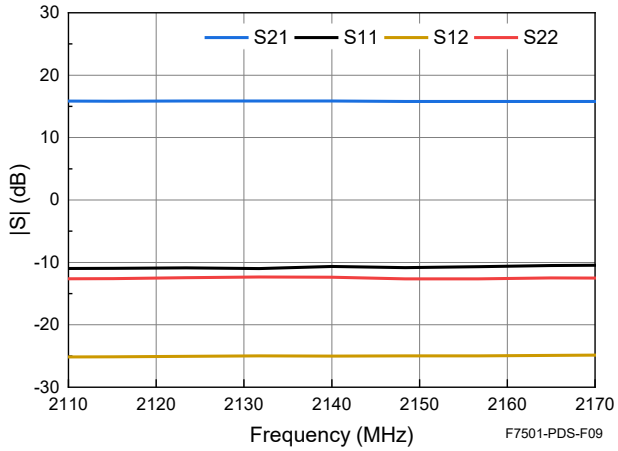


Figure 9. Gain vs. Freq.(2110-2170MHz)

8.3.3 Evaluation Board(2110-2170MHz)

■ **Schematic**

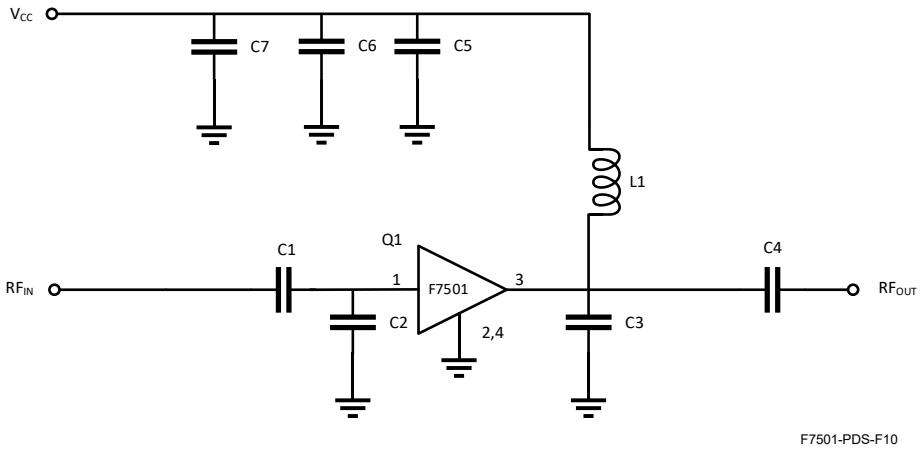


Figure 10. F7501 Application Circuit Schematic

■ **Layout**

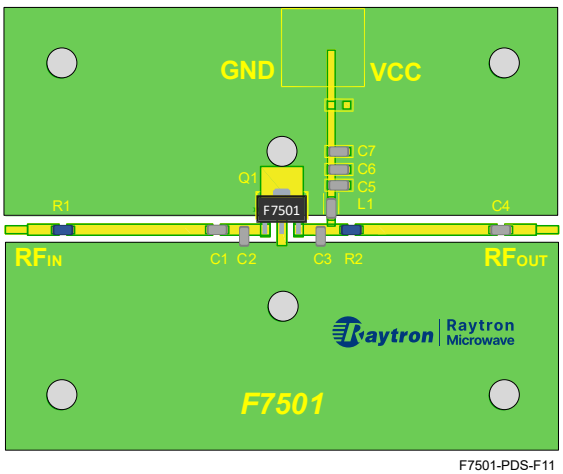


Figure 11. F7501 Application Circuit Layout

Table 11. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
Q1	N/A	F7501 Amplifier, SOT-89 pkg.	Raytron	F7501
R1	0Ω	0603 Resistor	Various	N/A
R2	0Ω	0603 Resistor	Various	N/A
C1	1.2pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E1R2BB12
C2	1.5pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E1R5BB12
C3	2.2pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E2R2BB12
C4 C5	24pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E240GB12
C6	0.1uF	0603 Capacitor	Various	N/A
C7	2.2uF	0603 Capacitor	Various	N/A
L1	30.0nH	High Q 0603 Inductor	Murata	LQW18AN30NG80D

Table 12. TL Distance

TL	Value	Description
TL1	1.02mm	Distance between F7501 Pin 1 to C2 (right edge)
TL2	2.87mm	Distance between F7501 Pin 1 to C1 (right edge)
TL3	1.02mm	Distance between F7501 Pin 3 to C3 (left edge)
TL4	16.82mm	Distance between F7501 Pin 3 to C4 (left edge)

8.4 Performance(2500-2700MHz)

8.4.1 Electrical Characteristics (2500-2700MHz, T_C=25°C)

Table 13. Electrical Characteristics(V_{CC}=5V, I_{CQ}=270mA, T_C=25℃, 50Ω system)

Parameter	Conditions	Typical Value			Units
Frequency	-	2500	2600	2700	MHz
Gain	-	14.4	14.7	14.2	dB
Input Return Loss	-	9.5	18	13.6	dB
Output Return Loss	-	13	11.7	14.4	dB
Output P1dB	-	29.0	29.5	29.4	dBm
Output IP3	P_{OUT}=13dBm/tone, Δf=1MHz	41.5	40.8	41.0	dBm
WCDMA Channel Power[1]	ACLR=-50dBc	17.9	18.2	18.4	dBm

[1] 3GPP WCDMA, TM1+64 DPCH, +5MHz offset, PAR=10.2dB at 0.01% Probability

8.4.2 Performance Plots(2500-2700MHz)

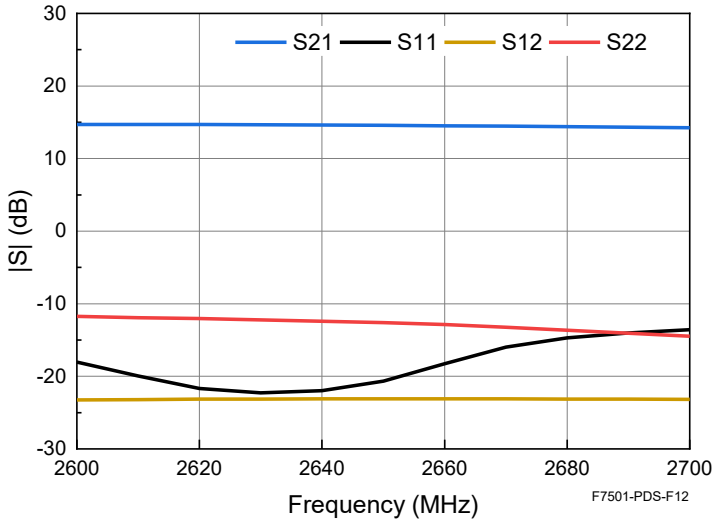


Figure 12. Small Signal S-Parameters vs. Freq.(2500-2700MHz)

8.4.3 Evaluation Board(2500-2700MHz)

■ **Schematic**

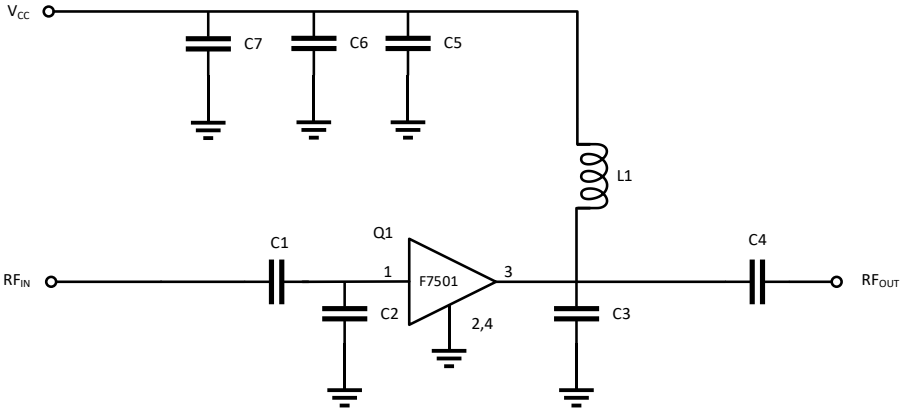
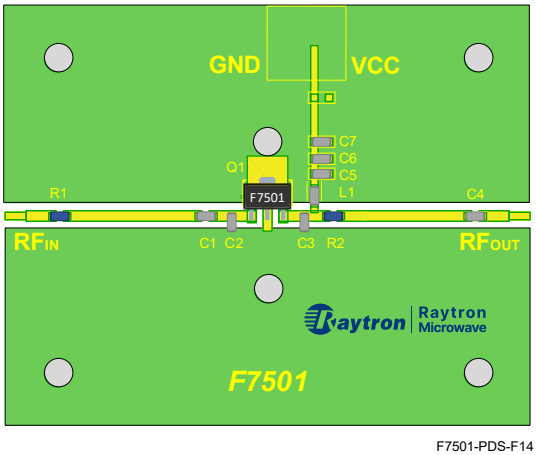


Figure 13. F7501 Application Circuit Schematic F7501-PDS-F13

■ **Layout**



F7501-PDS-F14

Figure 14. F7501 Application Circuit Layout

Table 14. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
Q1	N/A	F7501 Amplifier, SOT-89 pkg.	Raytron	F7501
R1	0Ω	0603 Resistor	Various	N/A
C1	0.6pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2ER60BB12
C2	0.7pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2ER70BB12
C3	2.4pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E2R0BB12
R2	0Ω	0603 Resistor	Various	N/A
C4	12.0pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E120GB12
C5	22.0pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E220GB12
C6	0.1uF	0603 Capacitor	Various	N/A
C7	2.2uF	0603 Capacitor	Various	N/A
L1	18.0nH	High Q 0603 Inductor	Murata	LQW18AN18NG80D

Table 15. TL Distance

TL	Value	Description
TL1	1.02mm	Distance between F7501 Pin 1 to C2 (right edge)
TL2	2.87mm	Distance between F7501 Pin 1 to C1 (right edge)
TL3	1.02mm	Distance between F7501 Pin 3 to C3 (left edge)
TL4	16.82mm	Distance between F7501 Pin 3 to C4 (left edge)

8.5 Performance(3400-3600MHz)

8.5.1 Electrical Characteristics (3400-3600MHz, T_C=25°C)

Table 16. Electrical Characteristics(V_{CC}=5V, I_{CQ}=270mA, T_C=25℃, 50Ω system)

Parameter	Conditions	Typical Value			Units
Frequency	-	3400	3500	3600	MHz
Gain	-	12.4	12.4	11.4	dB
Input Return Loss	-	15.5	17	7.8	dB
Output Return Loss	-	7.3	6.7	7.2	dB
Output P1dB	-	29.3	29.3	29	dBm
Output IP3	P_{OUT}=10dBm/tone, Δf=1MHz	41.2	40.6	40	dBm
WCDMA Channel Power[1]	ACLR=-50dBc	19.1	19.2	18.5	dBm

[1] 3GPP WCDMA, TM1+64 DPCH, +5MHz offset, PAR=10.2dB at 0.01% Probability

8.52 Performance Plots(3400-3600MHz)

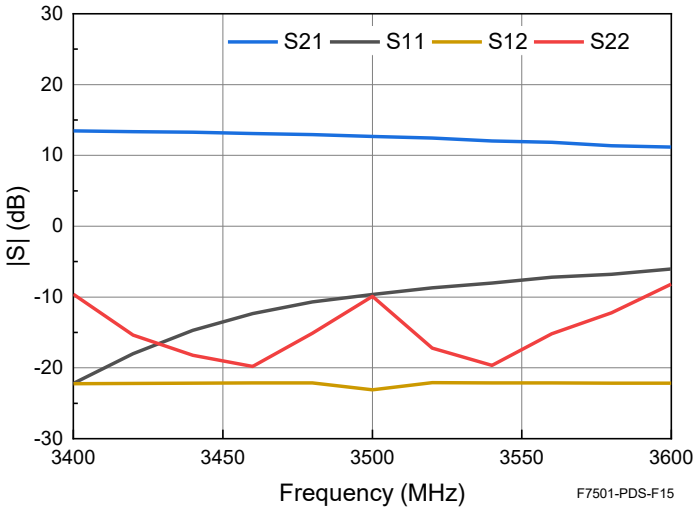


Figure 15. Small Signal S-Parameters vs. Freq.(3400-3600MHz)

8.5.3 Evaluation Board(3400-3600MHz)

■ Schematic

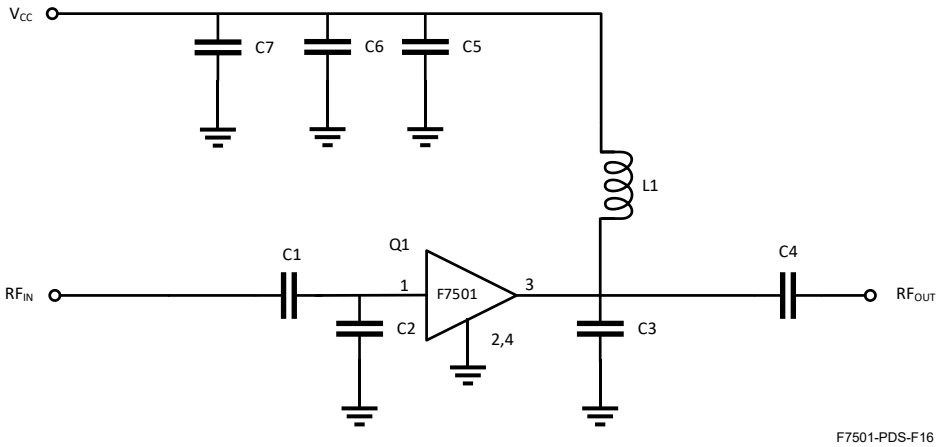


Figure 16. F7501 Application Circuit Schematic

■ Layout

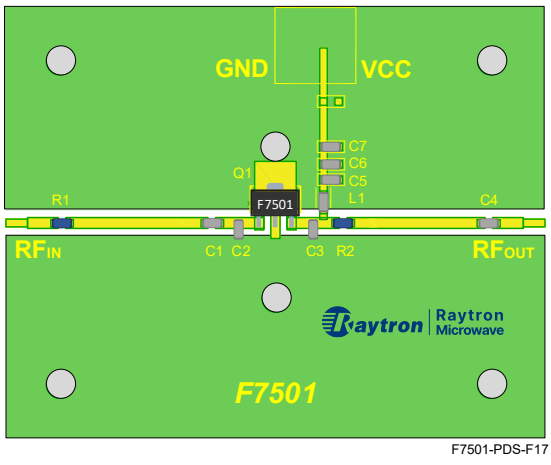


Figure 17. F7501 Application Circuit Layout

Table 17. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
Q1	N/A	F7501 Amplifier, SOT-89 pkg.	Raytron	F7501
R1 R2	0Ω	0603 Resistor	Murata	GQM1875C2E300GB12
C1	0.3pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2ER30BB12
C2	0.1pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2ER10BB12
C3	1.0pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E1R0BB12
C4 C5	24.0pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E240GB12
C6	0.1uF	0603 Capacitor	Various	N/A
C7	2.2uF	0603 Capacitor	Various	N/A
L1	30.0nH	High Q 0603 Inductor	Murata	LQW18AN30NG80D

Table 18. TL Distance

TL	Value	Description
TL1	1.02mm	Distance between F7501 Pin 1 to C2 (right edge)
TL2	2.87mm	Distance between F7501 Pin 1 to C1 (right edge)
TL3	1.02mm	Distance between F7501 Pin 3 to C3 (left edge)
TL4	16.82mm	Distance between F7501 Pin 3 to C4 (left edge)

9. Package Outline

■ Pin Layout

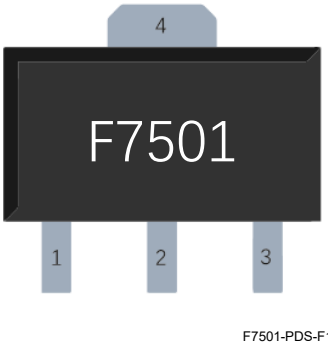


Figure 18. F7501 Pin Layout

Table 19. Pin Description

Pin	Symbol	Description
1	RF_{IN}	RF Input. External DC Block capacitor required.
3	RF_{OUT}/V_{CC}	RF Output and DC supply input. External DC Block capacitor required.
2/4	GND	RF/DC ground

■ Mechanical Drawing

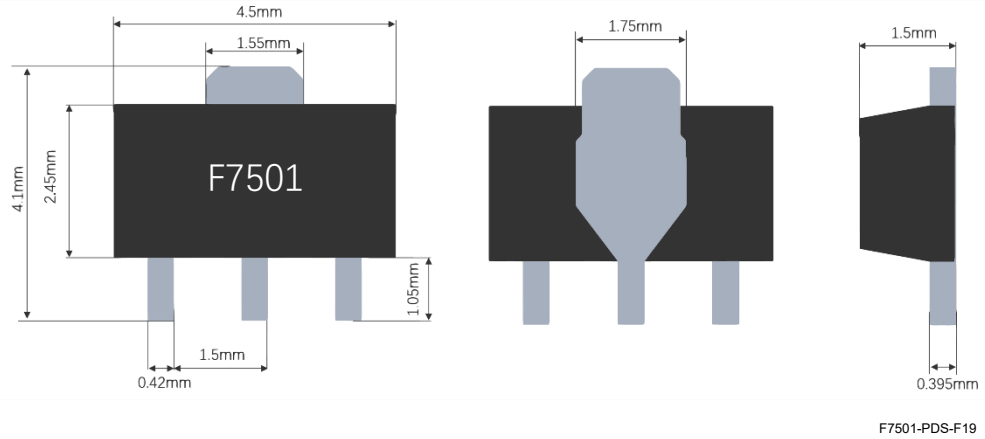


Figure 19. F7501 Mechanical Drawing

10. Handling Precautions

■ ESD Caution

Table 20. ESD/MSL Rating

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 2	ESDA / JEDEC JS-001-2014
ESD – Charged Device Model (CDM)	Class C3	ESDA / JEDEC JS-002-2014
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore proper ESD precautions should be taken to avoid performance degradation or loss of functionality.



11. Contact Information

For the latest specifications, additional product information, technical support and sales support, please contact:

- **Email:** RF.support@raytrontek.com
- **Web:** www.raytrontek.com

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