1. Description

- The F7508 is a high-power, high-efficiency power amplifier. The device is manufactured with an advanced GaAs HBT process. It is designed for general purpose radio application in standard sub-bands from 1500MHz to 3000MHz. It can be easily matched externally to obtain optimum power and efficiency for certain applications.
- The F7508 is packaged in a thermally enhanced, ultrasmall, micro lead frame package.

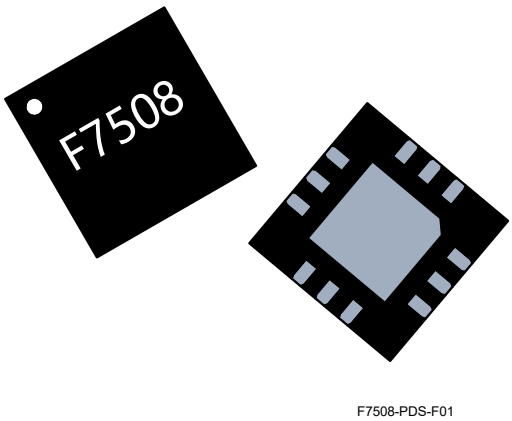


Figure 1. F7508 Package Outline

2. Applications

- small cell
- Mobile Infrastructure
- General Purpose Wireless
- Customer Premises Equipment (CPE)
- Driver amplifier for micro-base and macro-base stations

3. Features[1]

- Operating Frequency: 1500-3000MHz
- Output Power (P1dB): 31.6dBm
- Gain, Small Signal: 27.4dB
- ACPR: -50dbc@22dBm (LTE 20MHz)
- Operating Voltage/Current: 5V/160mA
- Package: QFN 3mm x 3mm x 0.75mm

[1] Measured in Raytron DEMO @ 2600MHz

4. Brief Typical Performance

Table 1. Brief Typical Performance (VCC1=VCC2=VBIAS=5V, T_C=25℃, 50Ω system)

Parameter	Typical Value				Units
Frequency	1600	2100	2600	2900	MHz
Small Signal Gain	24.1	26.1	27.4	26.3	dB
Output P1dB	33.0	30.5	31.6	30.7	dBm
Output P_{SAT}	34.2	33.9	33.0	33.3	dBm
PAE@P_{SAT}	60.2	51.3	52.5	43.2	%

5. Block Diagram

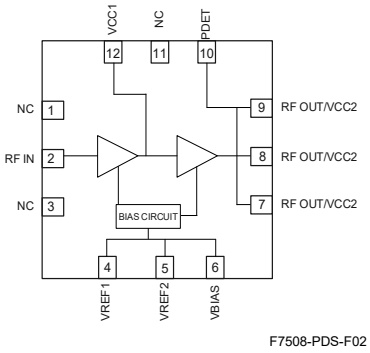


Figure 2. F7508 Block Diagram TOP View

Table of Contents

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3	Features	1
4	Brief Typical Performance	1
5	Block Diagram	1
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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	Symbol	Min.	Typ.	Max.	Units
Operating Temperature Range	-	-40	25	105	°C
Supply Voltage Range	VCC1/VCC2	3.3	5.0	5.25	V
Bias Control Voltage	VBIAS	-	5	-	V
Reference Voltage	Vref1/Vref2	-	5	-	V
Power Control Voltage: High power mode	Vref1/Vref2	-	5	-	V
Power Control Voltage: Standby mode		-	0	0.1	V
Current in Standby Mode	-	-	-	10	uA
Operating Frequency	-	1500	-	3000	MHz

8. Performance

8.1 Performance(1500-1600MHz)

8.1.1 Electronic Characteristics(1500-1600MHz)

Table 4. Electrical Characteristics (VCC1=VCC2=VBIAS=5V, I_{CQ}=190mA, T_C=25℃, 50Ω system)

Parameter	Typical Value		Units
Frequency	1500	1600	MHz
Gain	24.1	24.1	dB
Input Return Loss	-9.0	-10.1	dB
Output Return Loss	-5.2	-4.8	dB
Output P1dB	32.0	33.0	dBm
Output P_{SAT}	33.8	34.2	dBm
ICC@P_{SAT}	908	867	mA
PAE@P_{SAT}	53.3	60.2	%

8.1.2 Performance Plot(1500-1600MHz)

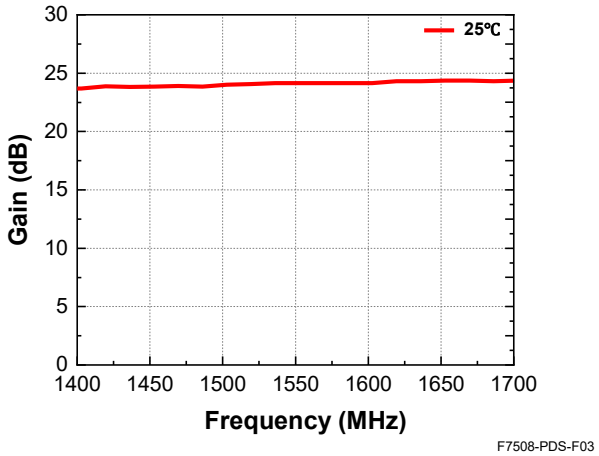


Figure 3. Gain vs. Freq. (1500-1600MHz)

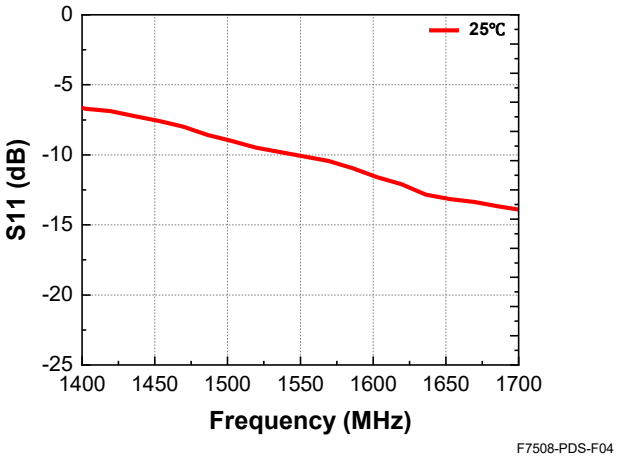


Figure 4. S11 vs. Freq. (1500-1600MHz)

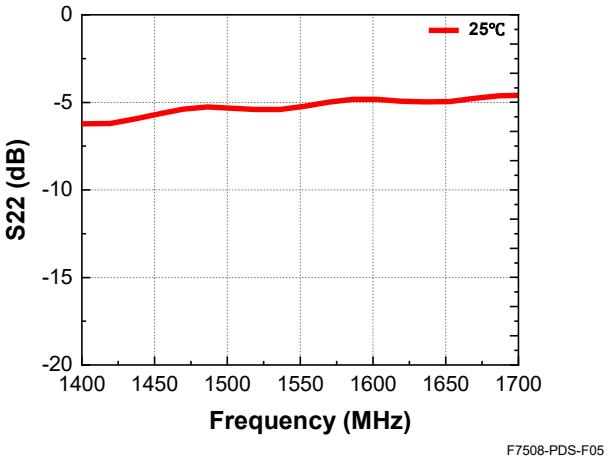


Figure 5. S22 vs. Freq. (1500-1600MHz)

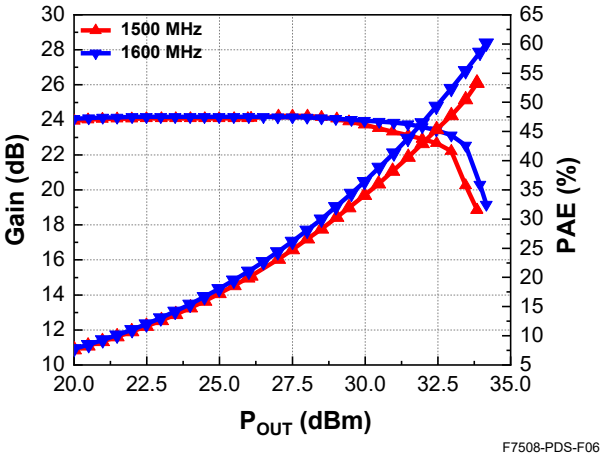


Figure 6. Gain & PAE vs. P_{out}. (1500-1600MHz)

8.1.3 Application Circuit (1500-1600MHz)

■ Schematic

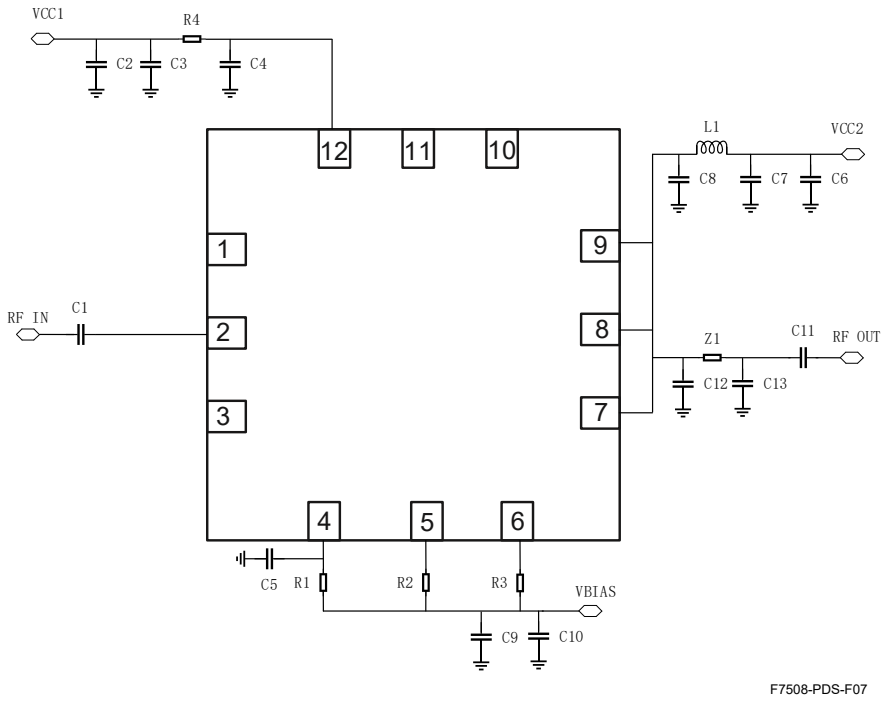


Figure 7. F7508 Circuit Schematic

■ Layout

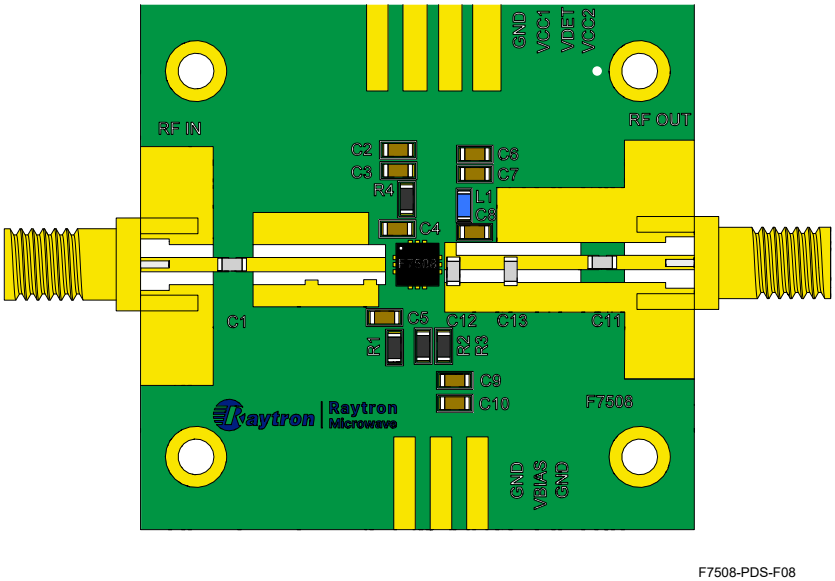


Figure 8. F7508 Evaluation Board

Table 5. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
Q1	N/A	F7508 Amplifier, QFN 3x3-12pin.	Raytron	F7508
C1, C11	20pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E200GB12
C2, C6, C10	2.2uF	C0G 250V 0603 Capacitor	Various	GRM188Z71E225KE43D
C4, C5, C8	1000pF	C0G 250V 0603 Capacitor	Various	GRM1885C1H102JA01D
C3, C7, C9	100pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E101GB12
C12	2.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E2R5BB12D
C13	5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E5R0CB12D
L1	6nH	1High Q 0603 Inductor	Murata	LQW18AN6N0C80D
R1	6.8kΩ	0603 Resistor	Various	N/A
R2	6.8kΩ	0603 Resistor	Various	N/A
R3	0Ω	0603 Resistor	Various	N/A

Table 6. TL Distance

TL	Value	Description
TL1	12.7mm	Distance between F7508 Pin 2 to C1 (right edge)
TL2	0.6mm	Distance between F7508 Pin 8 to C12 (left edge)
TL3	5.5mm	Distance between F7508 Pin 8 to C13 (left edge)
TL4	12.7mm	Distance between F7508 Pin 8 to C11 (left edge)

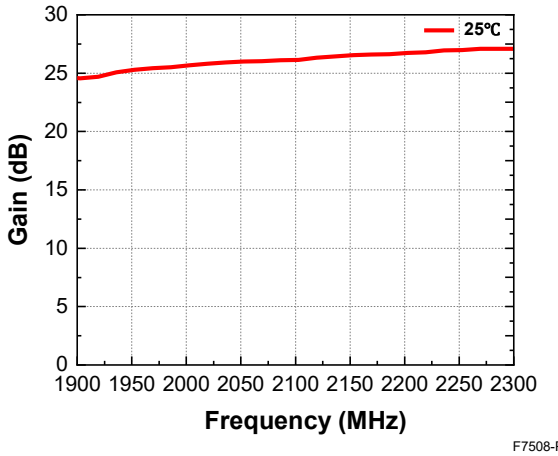
8.2 Performance(2000-2200MHz)

8.2.1 Electronic Characteristics(2000-2200MHz)

Table 7. Electrical Characteristics (VCC1=VCC2=VBIAS=5V, I_{CQ}=200mA, T_C=25℃, 50Ω system)

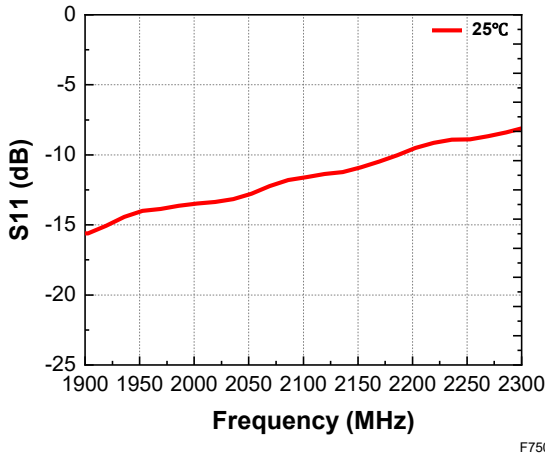
Parameter	Typical Value			Units
Frequency	2000	2100	2200	MHz
Gain	25.6	26.1	26.7	dB
Input Return Loss	-13.5	-11.6	-10.0	dB
Output Return Loss	-5.2	-5.6	-6.5	dB
Output P1dB	32.5	30.5	29.5	dBm
Output P_{SAT}	33.7	33.9	33.6	dBm
ICC@P_{SAT}	900	950	960	mA
PAE@P_{SAT}	51.6	51.3	47.9	%

8.2.2 Performance Plot(2000-2200MHz)



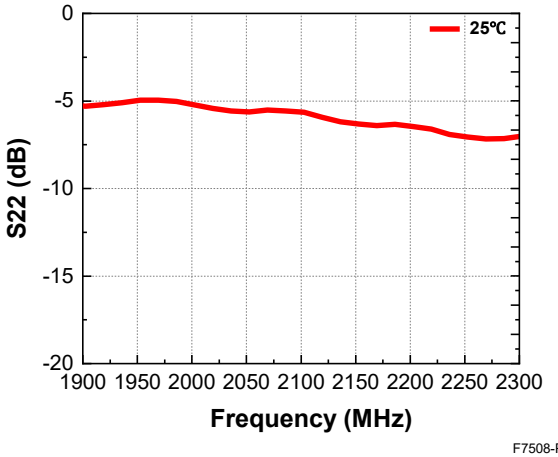
F7508-PDS-F09

Figure 9. Gain vs. Freq. (2000-2200MHz)



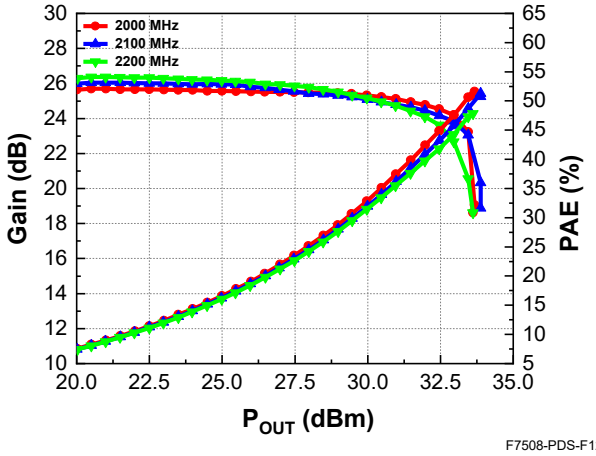
F7508-PDS-F10

Figure 10. S11 vs. Freq. (2000-2200MHz)



F7508-PDS-F11

Figure 11. S22 vs. Freq. (2000-2200MHz)



F7508-PDS-F12

Figure 12. Gain & PAE vs. P_{OUT}. (2000-2200MHz)

8.2.3 Application Circuit (2000-2200MHz)

■ Schematic

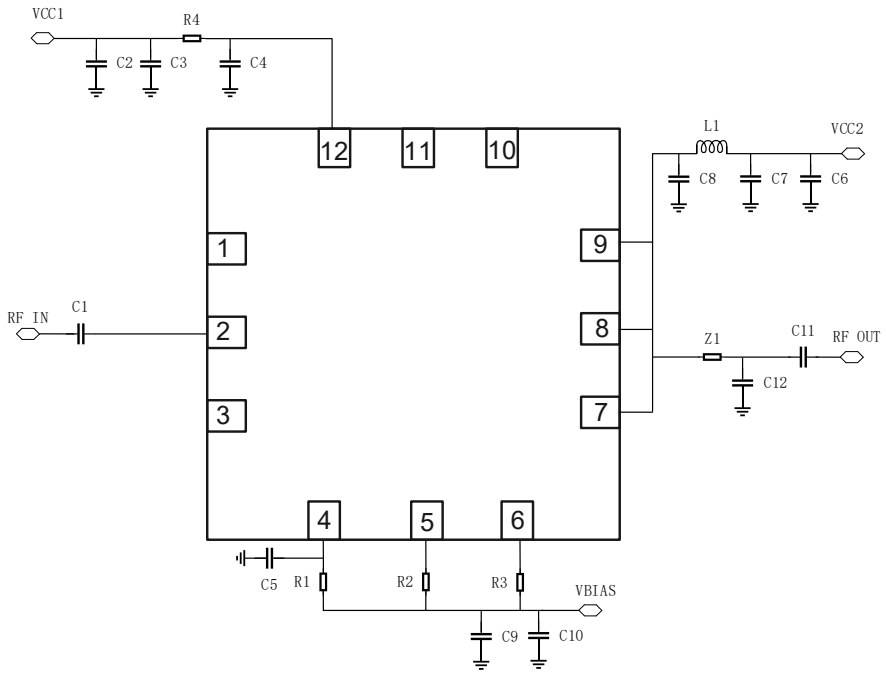


Figure 13. F7508 Circuit Schematic

■ Layout

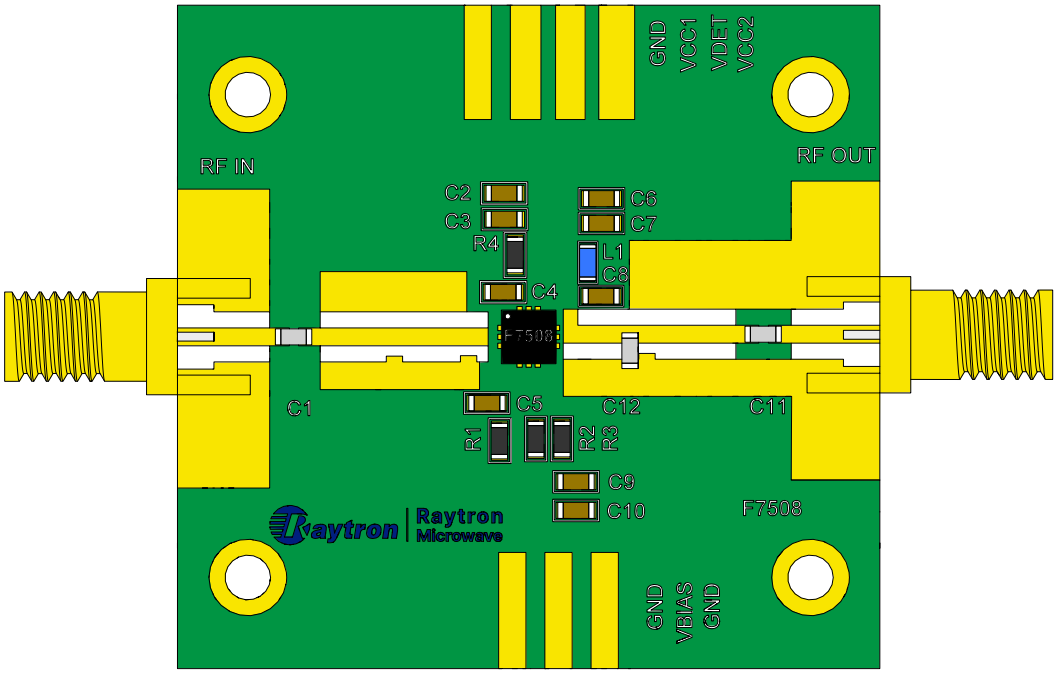


Figure 14. F7508 Evaluation Board

Table 8. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
Q1	N/A	F7508 Amplifier, QFN 3x3-12pin.	Raytron	F7508
C1, C11	20pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E200GB12
C2, C6, C10	2.2uF	C0G 250V 0603 Capacitor	Various	GRM188Z71E225KE43D
C4, C5, C8	1000pF	C0G 250V 0603 Capacitor	Various	GRM1885C1H102JA01D
C3, C7, C9	100pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E101GB12
C12	3.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E2R5BB12D
L1	6nH	1High Q 0603 Inductor	Murata	LQW18AN6N0C80D
R1	6.8kΩ	0603 Resistor	Various	N/A
R2	6.8kΩ	0603 Resistor	Various	N/A
R3	0Ω	0603 Resistor	Various	N/A

Table 9. TL Distance

TL	Value	Description
TL1	12.7mm	Distance between F7508 Pin 2 to C1 (right edge)
TL2	3.5mm	Distance between F7508 Pin 8 to C12 (left edge)
TL4	12.7mm	Distance between F7508 Pin 8 to C11 (left edge)

8.3 Performance(2500-2700MHz)

8.3.1 Electronic Characteristics(2500-2700MHz)

Table 7. Electrical Characteristics (VCC1=VCC2=VBIAS=5V, I_{CQ}=160mA, T_C=25℃, 50Ω system)

Parameter	Typical Value			Units
Frequency	2500	2600	2700	MHz
Gain	27.4	27.4	27.3	dB
Input Return Loss	-15.5	-14.6	-14.0	dB
Output Return Loss	-8.7	-11.1	-15.5	dB
Output P1dB	31.2	31.6	31.0	dBm
Output P_{SAT}	32.8	33.0	32.9	dBm
ACPR (LTE 20MHz without DPD) @ -50dbc	22.8	23.2	21.4	dBm
ICC@P_{SAT}	776	750	740	mA
PAE@P_{SAT}	49.2	52.5	52.6	%

8.3.2 Performance Plot(2500-2700MHz)

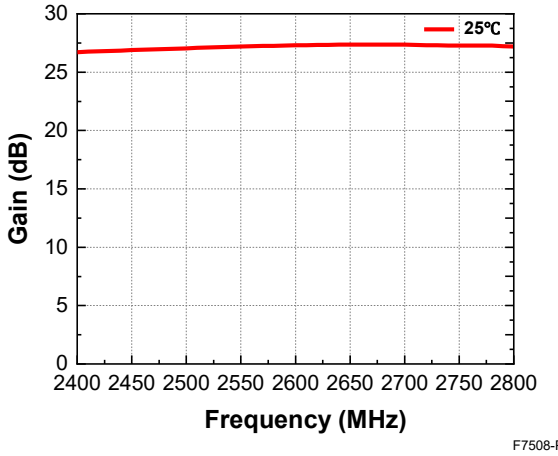


Figure 15. Gain vs. Freq. (2500-2700MHz)

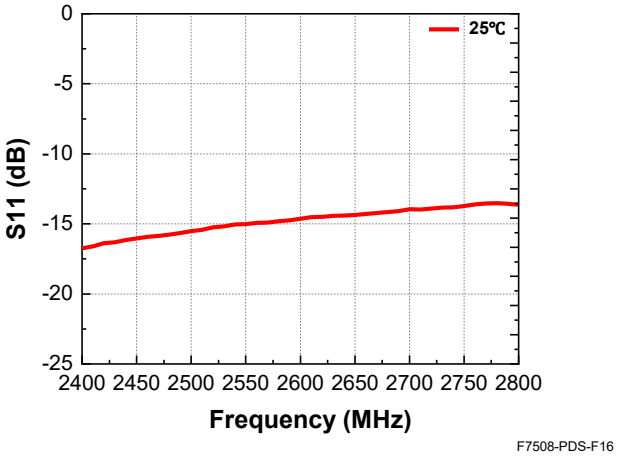


Figure 16. S11 vs. Freq. (2500-2700MHz)

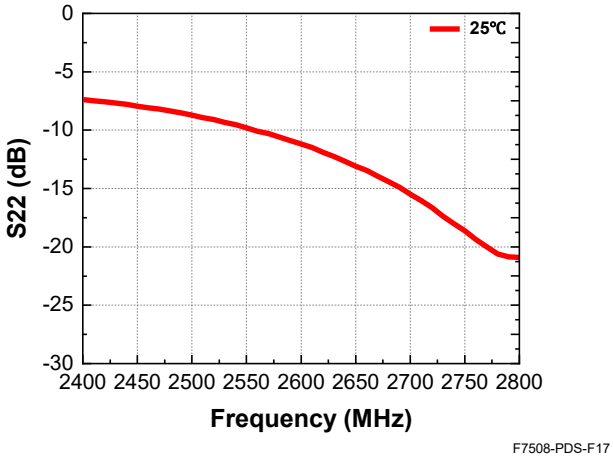


Figure 17. S22 vs. Freq. (2500-2700MHz)

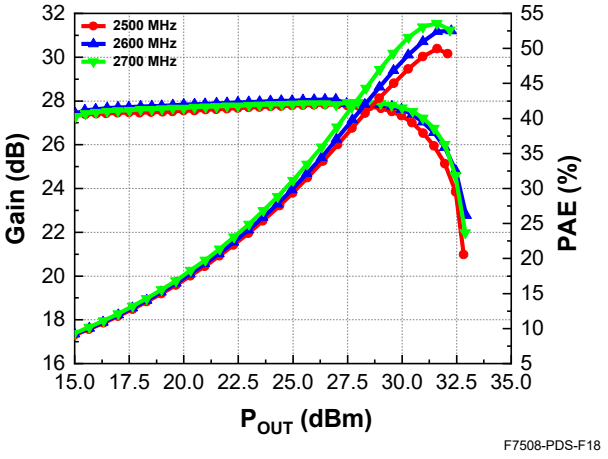


Figure 18. Gain & PAE vs. P_{OUT}. (2500-2700MHz)

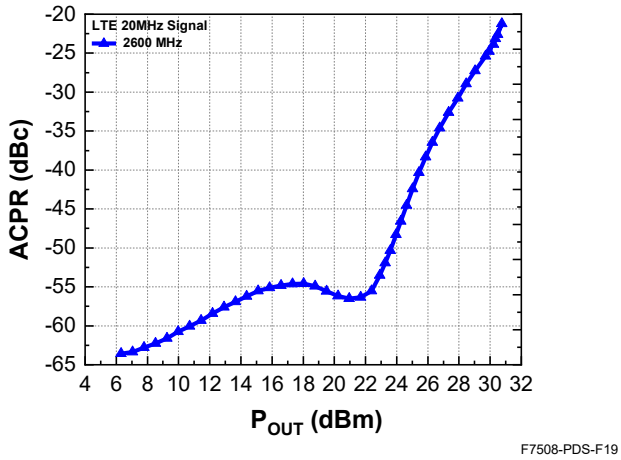


Figure 19. Gain & PAE vs. P_{OUT}. (2700-3000MHz)

8.3.3 Application Circuit (2500-2700MHz)

■ Schematic

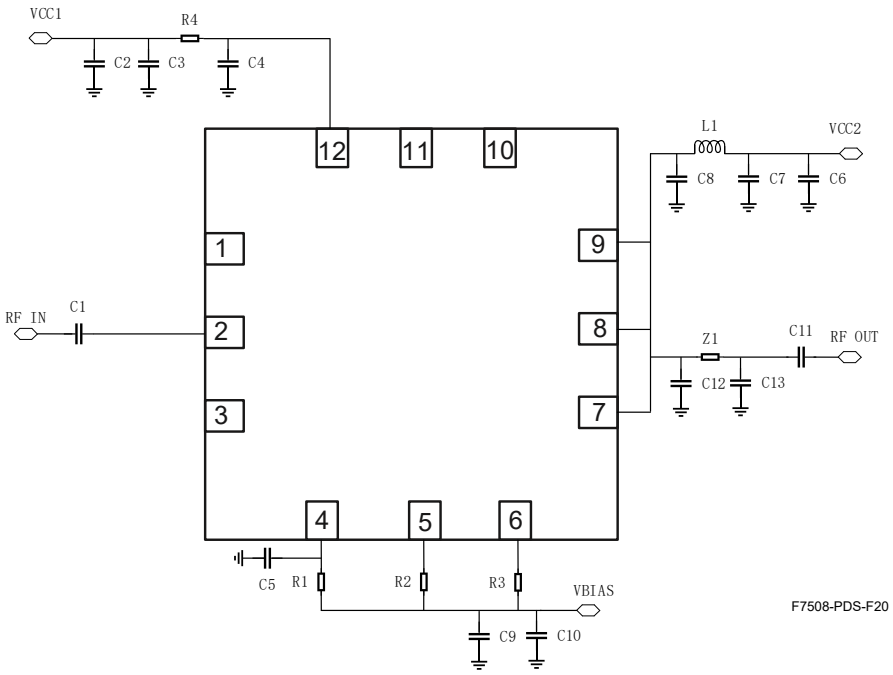


Figure 20. F7508 Circuit Schematic

■ Layout

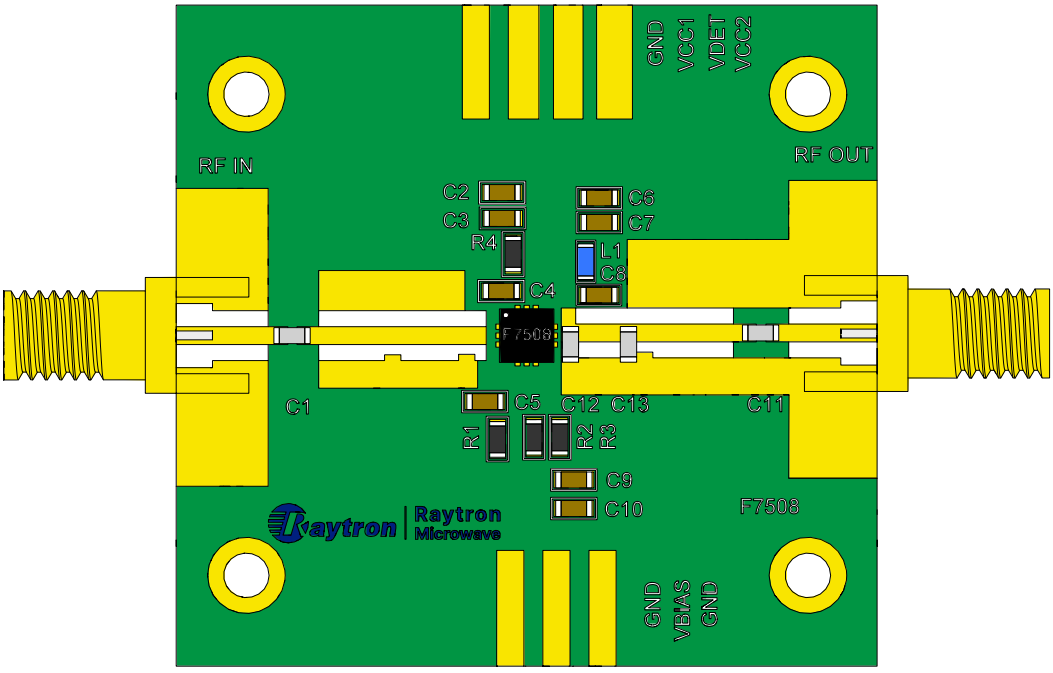


Figure 21. F7508 Evaluation Board

Table 8. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
Q1	N/A	F7508 Amplifier, QFN 3x3-12pin.	Raytron	F7508
C1, C11	20pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E200GB12
C2, C6, C10	2.2uF	C0G 250V 0603 Capacitor	Various	GRM188Z71E225KE43D
C4, C5, C8	1000pF	C0G 250V 0603 Capacitor	Various	GRM1885C1H102JA01D
C3, C7, C9	100pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E101GB12
C12	0.9pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E2R5BB12D
C13	1.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E5R0CB12D
L1	6nH	1High Q 0603 Inductor	Murata	LQW18AN6N0C80D
R1	5.6kΩ	0603 Resistor	Various	N/A
R2	9.1kΩ	0603 Resistor	Various	N/A
R3	0Ω	0603 Resistor	Various	N/A

Table 9. TL Distance

TL	Value	Description
TL1	12.7mm	Distance between F7508 Pin 2 to C1 (right edge)
TL2	0.6mm	Distance between F7508 Pin 8 to C12 (left edge)
TL3	3.7mm	Distance between F7508 Pin 8 to C13 (left edge)
TL4	12.7mm	Distance between F7508 Pin 8 to C11 (left edge)

8.4 Performance(2700-3000MHz)

8.4.1 Electronic Characteristics(2700-3000MHz)

Table 7. Electrical Characteristics (VCC1=VCC2=VBIAS=5V, I_{CQ}=150mA, T_C=25℃, 50Ω system)

Parameter			Typical Value		Units
Frequency	2700	2800	2900	3000	MHz
Gain	26.7	26.6	26.3	25.5	dB
Input Return Loss	-13.5	-12.8	-11.4	-11.4	dB
Output Return Loss	-10.3	-14.8	-16.5	-11.2	dB
Output P1dB	30.4	30.7	31.2	31.5	dBm
Output P_{SAT}	33.5	33.5	33.3	33.0	dBm
ICC@P_{SAT}	974	998	987	930	mA
PAE@P_{SAT}	45.4	45.0	43.2	43.0	%

8.3.2 Performance Plot(2700-3000MHz)

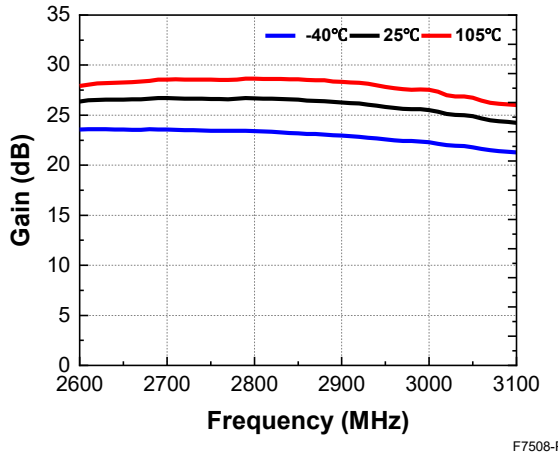


Figure 22. Gain vs. Freq. (2700-3000MHz)

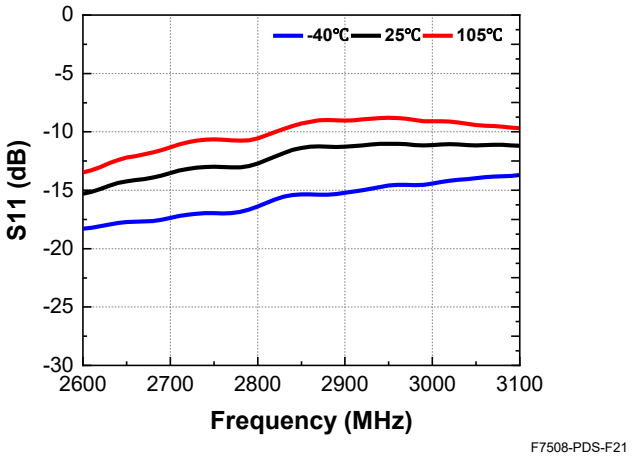


Figure 21. S11 vs. Freq. (2700-3000MHz)

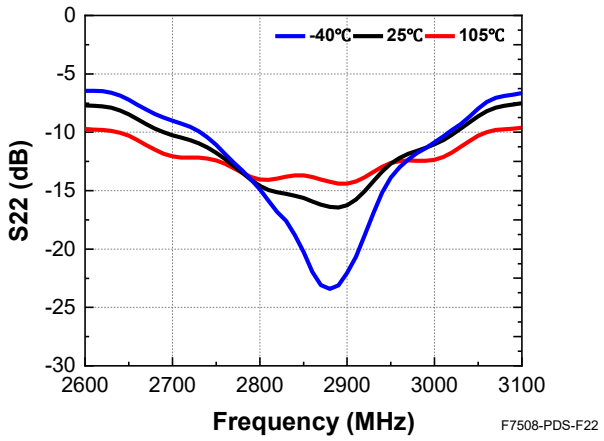


Figure 22. S22 vs. Freq. (2700-3000MHz)

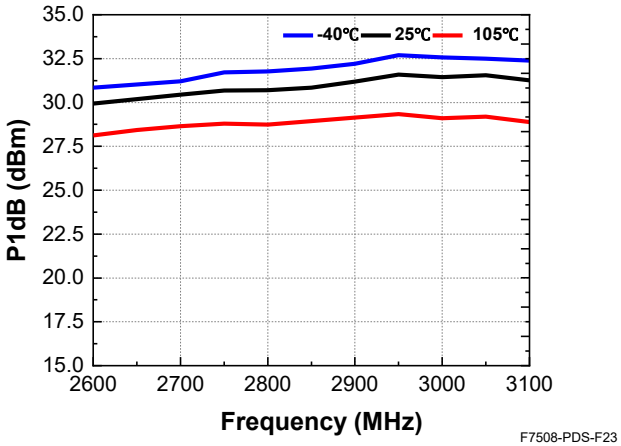


Figure 23. P1dB vs. P_{OUT}. (2700-3000MHz)

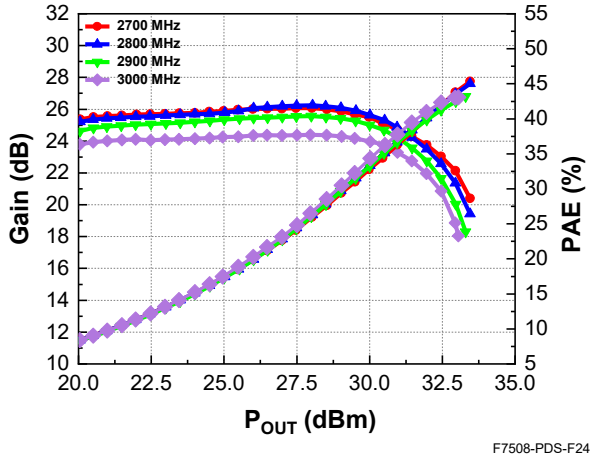


Figure 24. Gain & PAE vs. P_{OUT}. (2700-3000MHz)

8.4.3 Application Circuit (2700-3000MHz)

■ Schematic

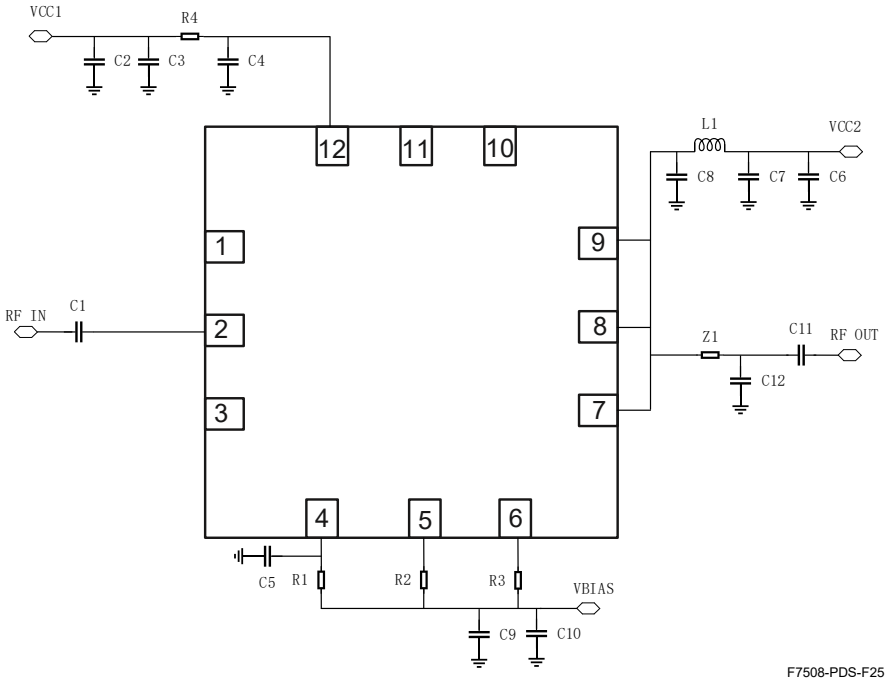


Figure 25. F7508 Circuit Schematic

■ Layout

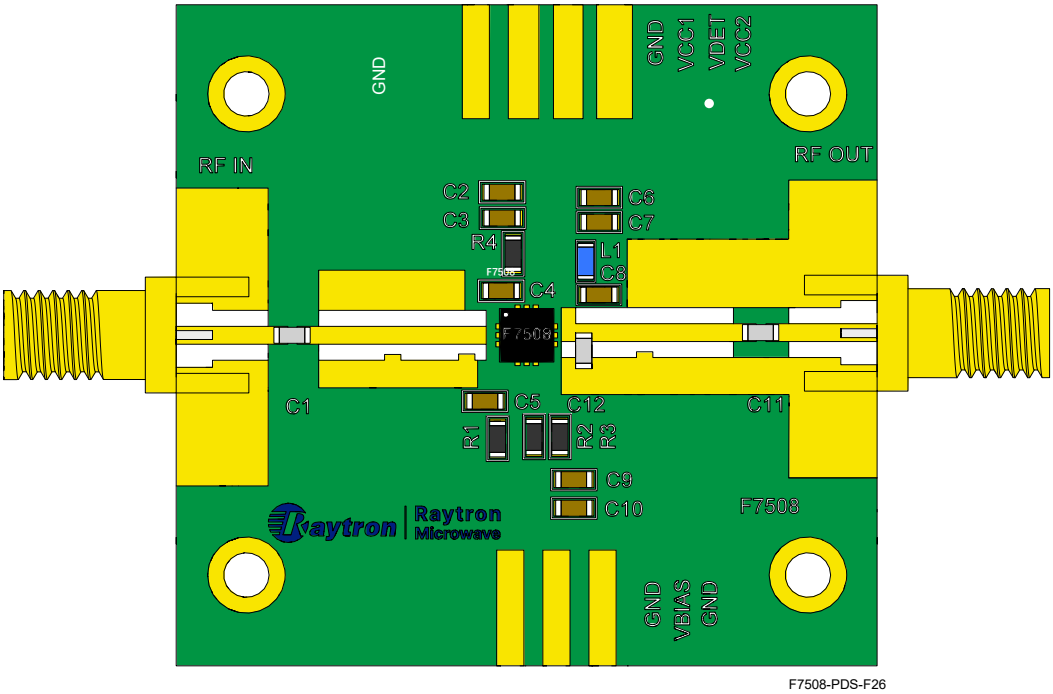


Figure 26. F7508 Evaluation Board

Table 8. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
Q1	N/A	F7508 Amplifier, QFN 3x3-12pin.	Raytron	F7508
C1, C11	20pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E200GB12
C2, C6,C10	2.2uF	C0G 250V 0603 Capacitor	Various	GRM188Z71E225KE43D
C4,C5,C8	1000pF	C0G 250V 0603 Capacitor	Various	GRM1885C1H102JA01D
C3,C7,C9	100pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E101GB12
C12	2.3pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E2R5BB12D
L1	6nH	1High Q 0603 Inductor	Murata	LQW18AN6N0C80D
R1	9.1kΩ	0603 Resistor	Various	N/A
R2	9.1kΩ	0603 Resistor	Various	N/A
R3	0Ω	0603 Resistor	Various	N/A

Table 9. TL Distance

TL	Value	Description
TL1	12.7mm	Distance between F7508 Pin 2 to C1 (right edge)
TL2	1.3mm	Distance between F7508 Pin 8 to C12 (left edge)
TL4	12.7mm	Distance between F7508 Pin 8 to C11 (left edge)

9. Package Outline

■ Pin Layout

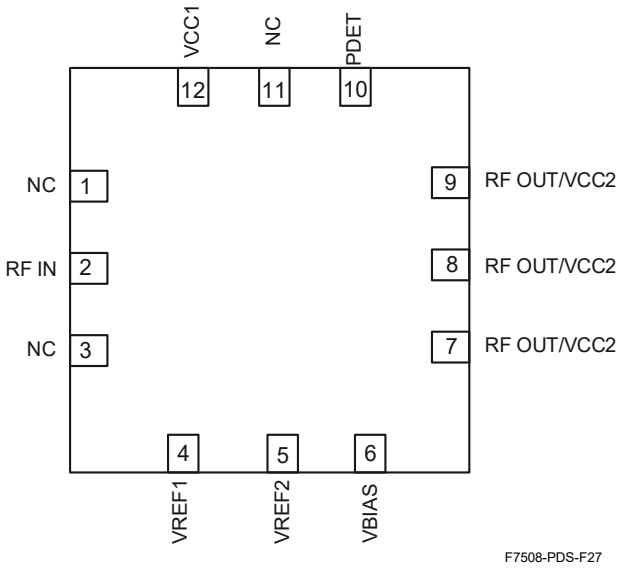


Figure 27. F7508 Pin Layout

Table 10. Pin Description

Pin	Symbol	Description
1/3/11	NC	No electrical connection
2	RF IN	RF Input. Requires external match for optimal performance. External DC Block capacitor required.
4/5	Vref1/Vref2	Reference Voltage into internal active bias current mirror. Also, can be used as on/off control.
6	VBIAS	Control voltage input to bias control circuit.
7/8/9	RF OUT/VCC2	RF Output and DC supply input to the second stage. Requires external match for optimal performance. External DC Block capacitor required.
10	PDET	
12	VCC1	DC supply input to the first stage

■ Mechanical Drawing

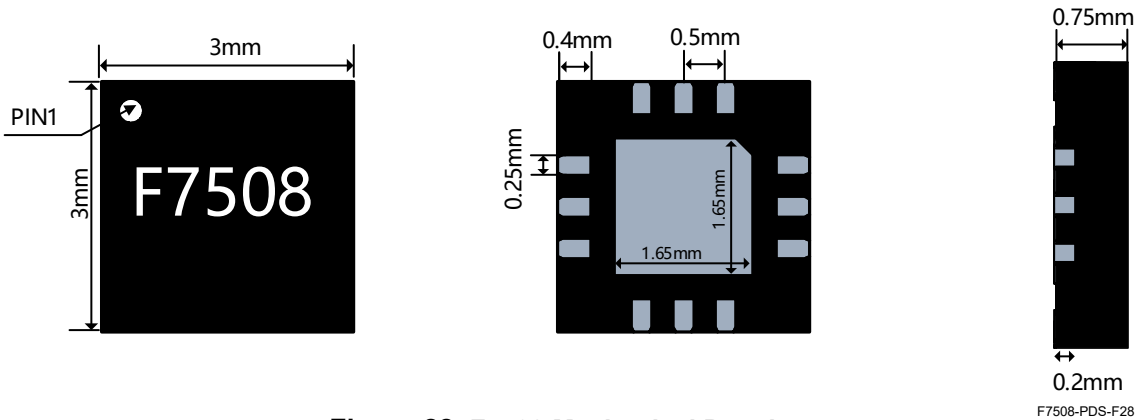


Figure 28. F7508 Mechanical Drawing

10. DEMO Summary

Table 11. DEMO Summary

No.	F7508 DEMO Name	V_{CC} (V)	Freq (MHz)	Linear Gain(dB)	P_{SAT} (dBm)	PAE (%)	Pulse or CW
1	DEMO_A, 2W	5	1500-1600	24.1	33.8-34.2	53.3-60.2	CW
2	DEMO_B, 2W	5	2000-2200	25.6-26.7	33.6-33.9	47.9-51.6	CW
3	DEMO_C, 2W	5	2500-2700	27.3-27.4	32.8-33.0	49.2-52.6	CW
4	DEMO_D, 2W	5	2700-3000	23.8-25.4	33.0-33.5	43.0-45.4	CW

11. Handling Cautions

- **ESD Caution**

Table 12. ESD/MSL Rating

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1B	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.



12. 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

13. Disclaimer

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