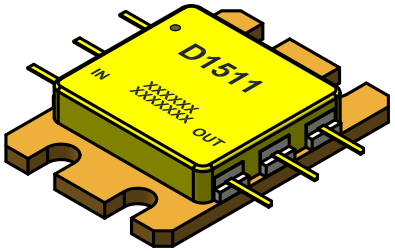
1. Description

- The D1511 is a medium power (30W) GaN-HEMT that is internally matched for ultra broadband application to provide optimum power and gain in a 50ohm system.
- The device operates from 0.8 to 6.0GHz with a 28V or a 32V supply rail. It is offered in a small hermetically sealed metal/ceramic flange package.



D1511-PDS-F01

Figure 1. D1511 Package Outline

2. Applications

- Ultra Broadband Amplifiers
- Test Instrumentation
- EMC Amplifiers
- Electronic Countermeasures

3. Features[1]

- Operating Frequency: 0.8–6.0GHz
- Output Power (P_{SAT}): 45.1dBm (32W)
- Linear Gain: 12.0dB
- Typical DE @ P_{SAT}: 45.1%
- Operating Voltage: 28V
- Impedance Matched Z_{IN}/Z_{OUT} = 50ohm
- Hermetically Sealed Package
- Package Type: 630F-B

[1] Measured in Raytron DEMO_A

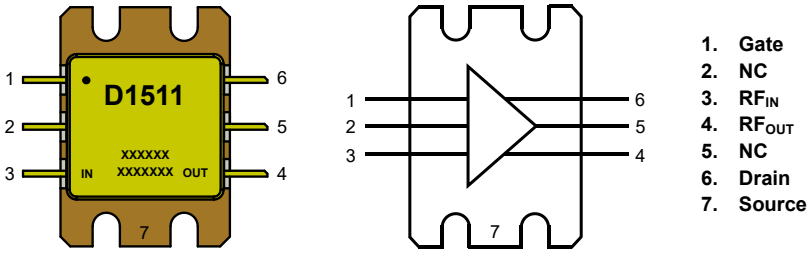
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	0.8GHz	1.7GHz	2.6GHz	3.5GHz	4.4GHz	5.3GHz	6.0GHz	Units
Linear Gain	12.0	12.4	12.3	12.7	12.0	12.1	12.0	dB
Power Gain	9.0	9.4	9.3	9.7	9.0	9.1	9.0	dB
Drain Efficiency	56.7	65.2	52.1	60.1	50.0	45.1	48.2	%
Output Power	45.2	46.3	46.5	46.5	45.6	45.6	45.1	dBm
Output Power	33	43	45	45	36	36	32	W

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 300mA, V_{GS} = -2.95V
- Test condition: CW

5. Block Diagram



D1511-PDS-F02

Figure 2. D1511 Block Diagram

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9	Typical Performance	4
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14	Handling Precautions	12
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6. Absolute Maximum Ratings

Table 2. Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DSS}	84	V
Gate-Source Voltage	V_{GS}	-10 ~ +1	V
Operating Voltage	V_{DS}	10 ~ +32	V
Maximum Forward Gate Current	I_{GMax}	9.12	mA
Storage Temperature Range	T_{STG}	-65 ~ +150	°C
Operating Junction Temperature	T_J	250	°C

7. Recommended Operating Conditions

Table 3. Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Drain-Source Voltage Range, V_{DS}	-	28	32	V
Drain Bias Current, I_{DS}	-	300	-	mA
Gate-Source Voltage, V_{GS}	-	-2.95	-	V
Channel Temperature, T_{CH}	-	-	225	°C

Table 4. Thermal Resistance

Parameter	Symbol	Value	Unit
Thermal Resistance (Active Die Surface-to-Case)[1]	R_{thsc} (IR)	2.00	°C/W
Thermal Resistance (Junction-to-Case)[2]	R_{thjc} (FEA)	2.56	°C/W

1. Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 45.0W
2. Thermal Resistance at average power by Finite Element Analysis, Junction-to-Case, $T_{base\text{-}plate}$ = 85℃, $T_{junction}$ = 200℃

8. Electrical Characteristics (T_C = 25˚C)

Table 5. DC Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Drain-Source Breakdown Voltage[1] (V_{GS} = -10V, I_{DS} = 9.12mA)	$V_{DS(BR)}$	84	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	10.49	-	A
Gate Threshold Voltage[3] (V_{DS} = 28V, I_{DS} = 9.12mA)	$V_{GS(TH)}$	-3.30	-2.80	-2.30	V
Gate Quiescent Voltage[3] (V_{DS} = 28V, I_{DS} = 300mA)	$V_{GS(Q)}$	-	-2.95	-	V

1. Measured on wafer prior to packaging
2. Scaled from PCM data
3. Measured in Raytron DEMO_A

Table 6. RF Characteristics

Freq.	Linear Gain (G_{LIN})	Power Gain (G_P)	Drain Efficiency (η_D)	Output Power (P_{SAT})
0.8GHz	12.0dB	9.0dB	56.7%	45.2dBm (33W)
3.4GHz	12.6dB	9.6dB	63.0%	46.8dBm (48W)
6.0GHz	12.0dB	9.0dB	48.2%	45.1dBm (32W)

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 300mA, V_{GS} = -2.95V
- Test condition: CW

9. Typical Performance

■ Wide-band Application Performance (DEMO_A, 0.8-6.0GHz, CW, 28V)

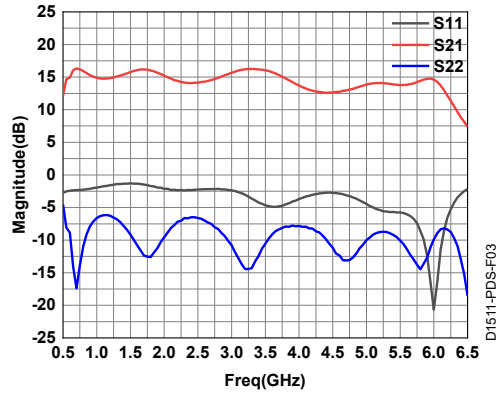


Figure 3. S_{11}, S_{21} and S_{22} vs. Freq.

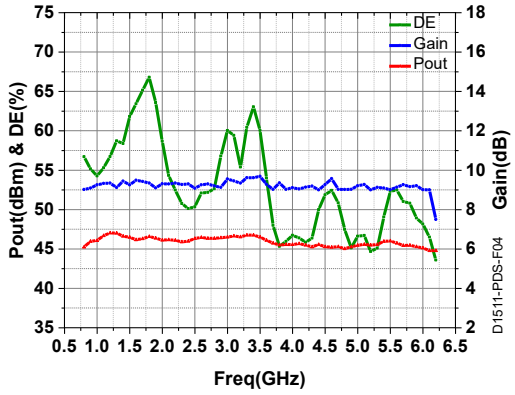


Figure 4. P_{OUT}, DE and Gain vs. Freq.

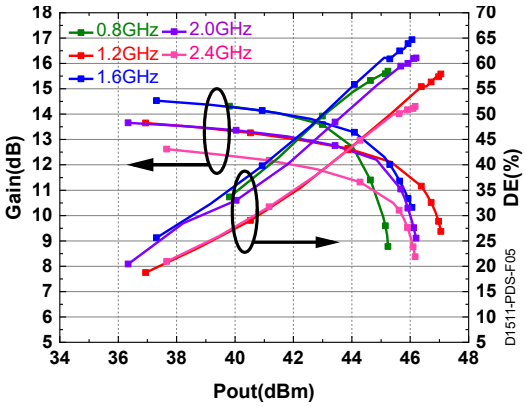


Figure 5. Gain and DE vs. P_{OUT}

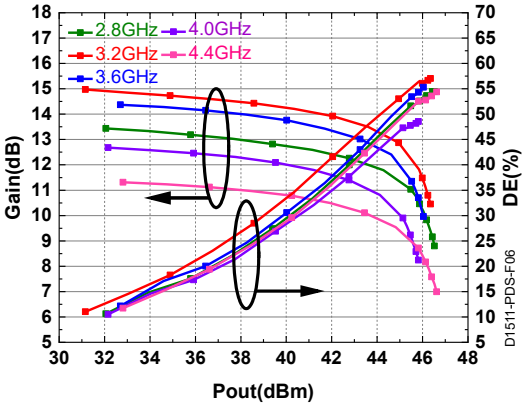


Figure 6. Gain and DE vs. P_{OUT}

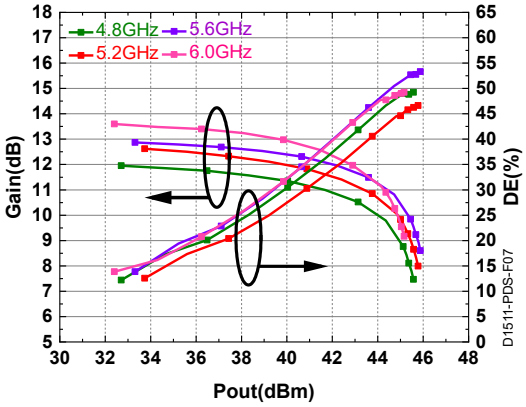


Figure 7. Gain and DE vs. P_{OUT}

Table 7. RF Characteristics @ DEMO_A, 0.8-6.0GHz, CW, 28V

Freq.	Linear Gain (G_{LIN})	Power Gain (G_P)	Drain Efficiency (η_D)	Output Power (P_{SAT})
0.7GHz	13.7dB	10.7dB	56.9%	43.6dBm (23W)
0.8GHz	12.0dB	9.0dB	56.7%	45.2dBm (33W)
0.9GHz	12.1dB	9.1dB	55.2%	46.0dBm (40W)
1.0GHz	12.3dB	9.3dB	54.3%	46.1dBm (41W)
1.1GHz	12.3dB	9.3dB	55.3%	46.7dBm (47W)
1.2GHz	12.3dB	9.3dB	56.7%	47.0dBm (50W)
1.3GHz	12.1dB	9.1dB	58.7%	47.0dBm (50W)
1.4GHz	12.4dB	9.4dB	58.4%	46.6dBm (46W)
1.5GHz	12.3dB	9.3dB	61.8%	46.5dBm (45W)
1.6GHz	12.5dB	9.5dB	63.4%	46.2dBm (42W)
1.7GHz	12.4dB	9.4dB	65.2%	46.3dBm (43W)
1.8GHz	12.3dB	9.3dB	66.8%	46.6dBm (46W)
1.9GHz	12.1dB	9.1dB	63.6%	46.4dBm (44W)
2.0GHz	12.3dB	9.3dB	58.7%	46.1dBm (41W)
2.1GHz	12.3dB	9.3dB	54.3%	46.2dBm (42W)
2.2GHz	12.3dB	9.3dB	52.5%	46.1dBm (41W)
2.3GHz	12.3dB	9.3dB	50.8%	45.9dBm (39W)
2.4GHz	12.3dB	9.3dB	50.1%	46.0dBm (40W)
2.5GHz	12.1dB	9.1dB	50.4%	46.3dBm (43W)
2.6GHz	12.3dB	9.3dB	52.1%	46.5dBm (45W)
2.7GHz	12.3dB	9.3dB	52.2%	46.4dBm (44W)
2.8GHz	12.2dB	9.2dB	52.6%	46.4dBm (44W)
2.9GHz	12.1dB	9.1dB	56.8%	46.4dBm (44W)
3.0GHz	12.6dB	9.6dB	60.0%	46.5dBm (45W)
3.1GHz	12.5dB	9.5dB	59.4%	46.7dBm (47W)
3.2GHz	12.3dB	9.3dB	55.4%	46.5dBm (45W)
3.3GHz	12.6dB	9.6dB	60.4%	46.8dBm (48W)
3.4GHz	12.6dB	9.6dB	63.0%	46.8dBm (48W)
3.5GHz	12.7dB	9.7dB	60.1%	46.5dBm (45W)
3.6GHz	12.3dB	9.3dB	54.0%	46.1dBm (41W)
3.7GHz	12.0dB	9.0dB	48.0%	45.7dBm (37W)
3.8GHz	12.4dB	9.4dB	45.3%	45.5dBm (35W)
3.9GHz	12.0dB	9.0dB	46.0%	45.6dBm (36W)
4.0GHz	12.1dB	9.1dB	46.7%	45.6dBm (36W)
4.1GHz	12.1dB	9.1dB	46.4%	45.7dBm (37W)
4.2GHz	12.1dB	9.1dB	45.9%	45.5dBm (35W)
4.3GHz	12.2dB	9.2dB	46.4%	45.3dBm (34W)
4.4GHz	12.0dB	9.0dB	50.0%	45.6dBm (36W)
4.5GHz	12.3dB	9.3dB	51.9%	45.3dBm (34W)
4.6GHz	12.6dB	9.6dB	52.4%	45.2dBm (33W)
4.7GHz	12.0dB	9.0dB	50.9%	45.3dBm (34W)
4.8GHz	12.0dB	9.0dB	47.5%	45.1dBm (32W)

Freq.	Linear Gain (G_{LIN})	Power Gain (G_P)	Drain Efficiency (η_D)	Output Power (P_{SAT})
4.9GHz	12.0dB	9.0dB	45.1%	45.3dBm (34W)
5.0GHz	12.2dB	9.2dB	46.6%	45.5dBm (35W)
5.1GHz	12.3dB	9.3dB	46.7%	45.6dBm (36W)
5.2GHz	12.0dB	9.0dB	44.7%	45.5dBm (35W)
5.3GHz	12.1dB	9.1dB	45.1%	45.6dBm (36W)
5.4GHz	12.1dB	9.1dB	49.1%	46.0dBm (40W)
5.5GHz	12.0dB	9.0dB	52.3%	46.0dBm (40W)
5.6GHz	12.1dB	9.1dB	52.5%	45.8dBm (38W)
5.7GHz	12.3dB	9.3dB	51.0%	45.5dBm (35W)
5.8GHz	12.2dB	9.2dB	50.8%	45.5dBm (35W)
5.9GHz	12.2dB	9.2dB	48.9%	45.3dBm (34W)
6.0GHz	12.0dB	9.0dB	48.2%	45.1dBm (32W)
6.1GHz	13.7dB	9.0dB	46.5%	44.8dBm (30W)
6.2GHz	12.6dB	7.5dB	43.6%	44.8dBm (30W)

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 300mA, V_{GS} = -2.95V
- Test condition: CW
- The output power is 45.1dBm (32W) at 0.8-6GHz when V_{DS} = 28V.

■ Wide-band Application Performance (DEMO_A, 0.8-6.0GHz, CW, 32V)

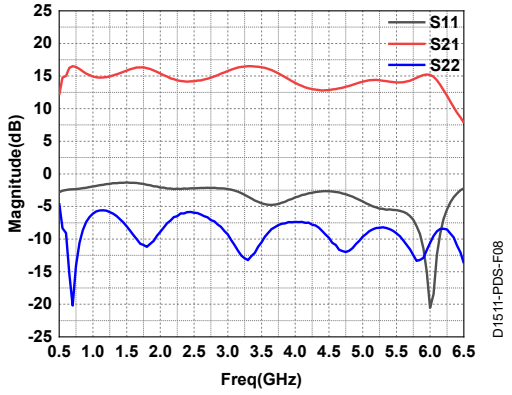


Figure 8. S_{11}, S_{21} and S_{22} vs. Freq.

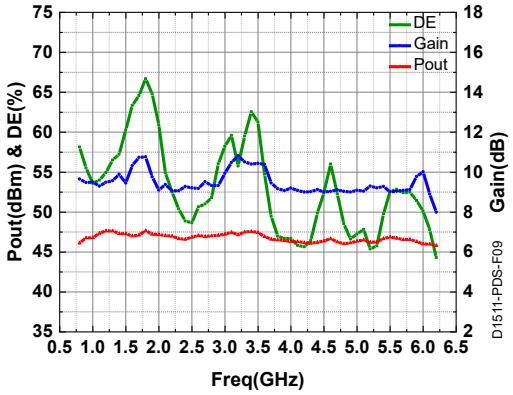


Figure 9. P_{OUT}, DE and Gain vs. Freq.

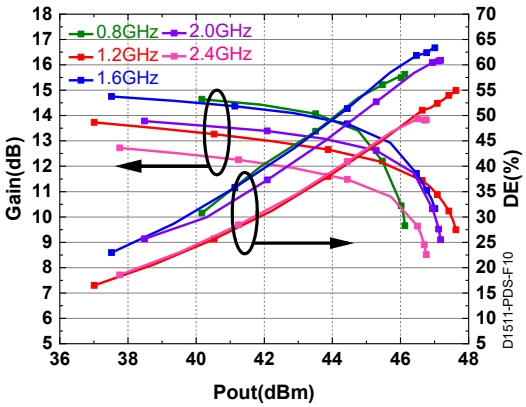


Figure 10. Gain and DE vs. P_{OUT}

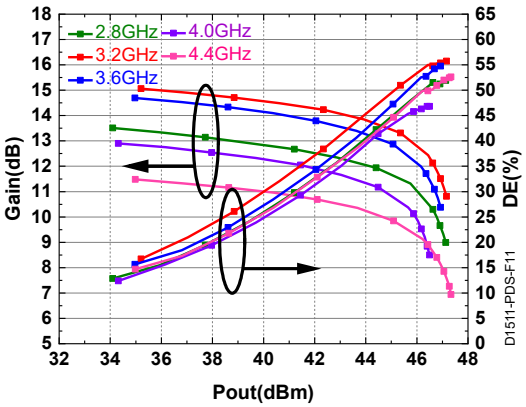


Figure 11. Gain and DE vs. P_{OUT}

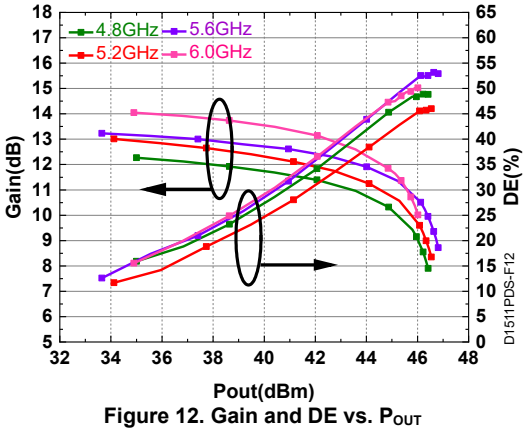


Figure 12. Gain and DE vs. P_{OUT}

Table 8. RF Characteristics @ DEMO_A, 0.8-6.0GHz, CW, 32V

Freq.	Linear Gain (G_{LIN})	Power Gain (G_P)	Drain Efficiency (η_D)	Output Power (P_{SAT})
0.7GHz	14.1dB	11.1dB	57.2%	44.6dBm (29W)
0.8GHz	12.7dB	9.7dB	58.1%	46.1dBm (41W)
0.9GHz	12.5dB	9.5dB	55.5%	46.8dBm (48W)
1.0GHz	12.5dB	9.5dB	53.6%	46.8dBm (48W)
1.1GHz	12.3dB	9.3dB	54.0%	47.4dBm (55W)
1.2GHz	12.5dB	9.5dB	55.0%	47.6dBm (58W)
1.3GHz	12.6dB	9.6dB	56.5%	47.6dBm (58W)
1.4GHz	12.9dB	9.9dB	57.2%	47.3dBm (54W)
1.5GHz	12.5dB	9.5dB	60.3%	47.3dBm (54W)
1.6GHz	13.3dB	10.3dB	63.4%	47.0dBm (50W)
1.7GHz	13.7dB	10.7dB	64.6%	47.1dBm (51W)
1.8GHz	13.8dB	10.8dB	66.7%	47.7dBm (59W)
1.9GHz	12.8dB	9.8dB	64.8%	47.2dBm (52W)
2.0GHz	12.1dB	9.1dB	60.9%	47.2dBm (52W)
2.1GHz	12.4dB	9.4dB	54.9%	47.1dBm (51W)
2.2GHz	12.1dB	9.1dB	52.5%	47.0dBm (50W)
2.3GHz	12.1dB	9.1dB	50.4%	46.7dBm (47W)
2.4GHz	12.3dB	9.3dB	48.9%	46.6dBm (46W)
2.5GHz	12.2dB	9.2dB	48.7%	46.8dBm (48W)
2.6GHz	12.2dB	9.2dB	50.7%	47.1dBm (51W)
2.7GHz	12.5dB	9.5dB	51.0%	46.9dBm (49W)
2.8GHz	12.3dB	9.3dB	51.8%	47.0dBm (50W)
2.9GHz	12.3dB	9.3dB	56.0%	47.1dBm (51W)
3.0GHz	12.9dB	9.9dB	58.2%	47.2dBm (52W)
3.1GHz	13.5dB	10.5dB	59.6%	47.5dBm (56W)
3.2GHz	13.8dB	10.8dB	55.8%	47.2dBm (52W)
3.3GHz	13.5dB	10.5dB	59.5%	47.5dBm (56W)
3.4GHz	13.4dB	10.4dB	62.6%	47.6dBm (58W)
3.5GHz	13.4dB	10.4dB	61.3%	47.4dBm (55W)

Freq.	Linear Gain (G_{LIN})	Power Gain (G_P)	Drain Efficiency (η_D)	Output Power (P_{SAT})
3.6GHz	13.4dB	10.4dB	54.8%	46.9dBm (49W)
3.7GHz	12.5dB	9.5dB	49.5%	46.6dBm (46W)
3.8GHz	12.2dB	9.2dB	47.0%	46.5dBm (45W)
3.9GHz	12.1dB	9.1dB	46.7%	46.4dBm (44W)
4.0GHz	12.2dB	9.2dB	46.7%	46.3dBm (43W)
4.1GHz	12.1dB	9.1dB	45.8%	46.3dBm (43W)
4.2GHz	12.0dB	9.0dB	45.7%	46.2dBm (42W)
4.3GHz	12.0dB	9.0dB	46.4%	46.1dBm (41W)
4.4GHz	12.1dB	9.1dB	49.9%	46.2dBm (42W)
4.5GHz	12.0dB	9.0dB	52.4%	46.4dBm (44W)
4.6GHz	12.0dB	9.0dB	56.0%	46.7dBm (47W)
4.7GHz	12.1dB	9.1dB	52.3%	46.3dBm (43W)
4.8GHz	12.0dB	9.0dB	48.5%	46.0dBm (40W)
4.9GHz	12.0dB	9.0dB	46.6%	46.1dBm (41W)
5.0GHz	12.1dB	9.1dB	47.3%	46.4dBm (44W)
5.1GHz	12.1dB	9.1dB	47.8%	46.5dBm (45W)
5.2GHz	12.3dB	9.3dB	45.4%	46.2dBm (42W)
5.3GHz	12.2dB	9.2dB	45.8%	46.3dBm (43W)
5.4GHz	12.3dB	9.3dB	49.8%	46.7dBm (47W)
5.5GHz	12.0dB	9.0dB	52.6%	46.9dBm (49W)
5.6GHz	12.1dB	9.1dB	52.9%	46.7dBm (47W)
5.7GHz	12.1dB	9.1dB	52.4%	46.6dBm (46W)
5.8GHz	12.1dB	9.1dB	52.5%	46.6dBm (46W)
5.9GHz	12.8dB	9.8dB	51.4%	46.3dBm (43W)
6.0GHz	13.0dB	10.0dB	50.1%	46.0dBm (40W)
6.1GHz	14.4dB	8.9dB	47.8%	46.0dBm (40W)
6.2GHz	13.2dB	8.0dB	44.3%	45.8dBm (38W)

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 32V, I_{DS} = 300mA, V_{GS} = -2.95V
- Test condition: Input CW
- The output power is 46.0dBm (40W) at 0.8-6GHz when V_{DS} = 32V.

10. Package Outline

■ Pin Layout

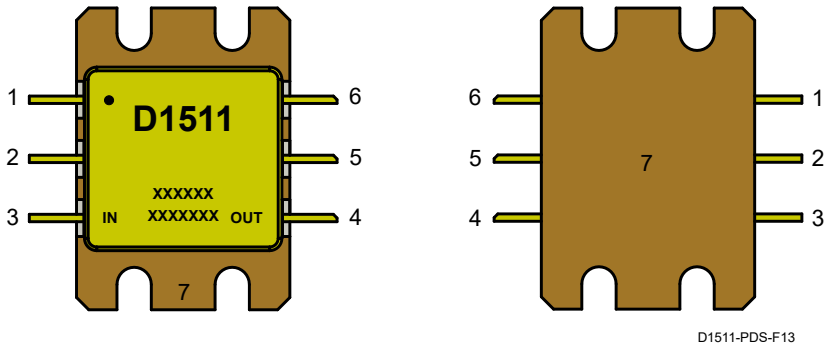


Figure 13. D1511 Pin Layout

Table 9. Pin Description

Pin	Symbol	Description
1	V_G	Gate Voltage
2/5	NC	Not Connected
3	RF_{IN}	RF Input
4	RF_{OUT}	RF Output
6	V_D	Drain Voltage
7	Flange	Source Connected to Ground

■ Mechanical Drawing (Package Type: 630F-B)

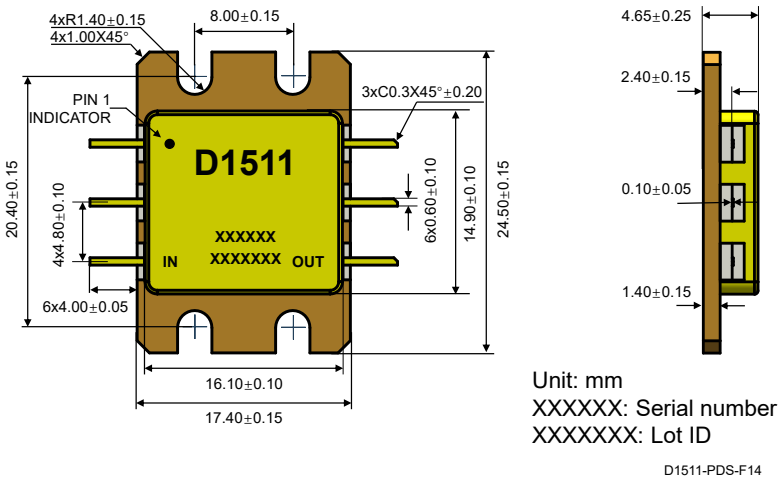


Figure 14. D1511 Mechanical Drawing

11. Application Circuit

■ Schematic

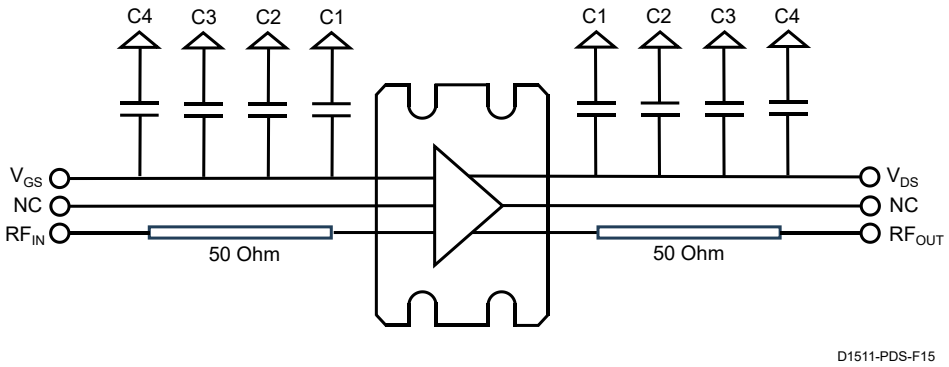


Figure 15. D1511 DEMO_A Application Circuit Schematic

Table 10. Bias Procedure

Bias-up Procedure	Bias-down Procedure
1) Set V_{GS} to the pinch-off voltage, typically -6V	1) Turn off RF signal
2) Turn on V_{DS} to nominal supply voltage	2) Turn off V_{DS}
3) Slowly adjust V_{GS} until I_{DS} current is attained	3) Wait two seconds to allow drain capacitor to discharge
4) Apply RF input power to desired level	4) Turn off V_{GS}

■ Layout

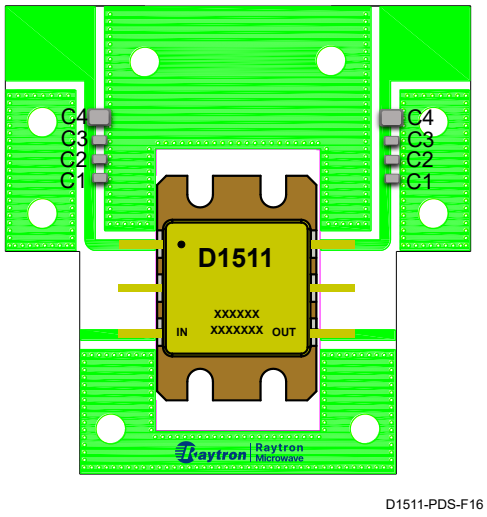


Figure 16. D1511 Application Circuit Layout (0.8-6.0GHz)
(DEMO_A Size: 5.0cm x 5.0cm)

Table 11. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	100.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E101JB12D
C2	1000.0pF	X7R 100V 0603 Capacitor	Murata	GCM188R72A102KA37D
C3	10.0nF	X7R 100V 0603 Capacitor	Murata	GCM188R72A103KA37D
C4	1.0uF	X7R 100V 1210 Capacitor	Murata	GRM32ER72A105KA01L

12. DEMO Summary

Table 12. DEMO Summary

NO.	D1511 DEMO Name	V_{DS} (V)	Freq. (GHz)	Linear Gain (dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency (%)	Pulse or CW
1	DEMO_A, 30W	28	0.8-6.0	12.0	45.1	32	44.7	CW
2	DEMO_A, 40W	32	0.8-6.0	12.0	46.0	40	45.4	CW

13. Recommended Solder Temperature Profile

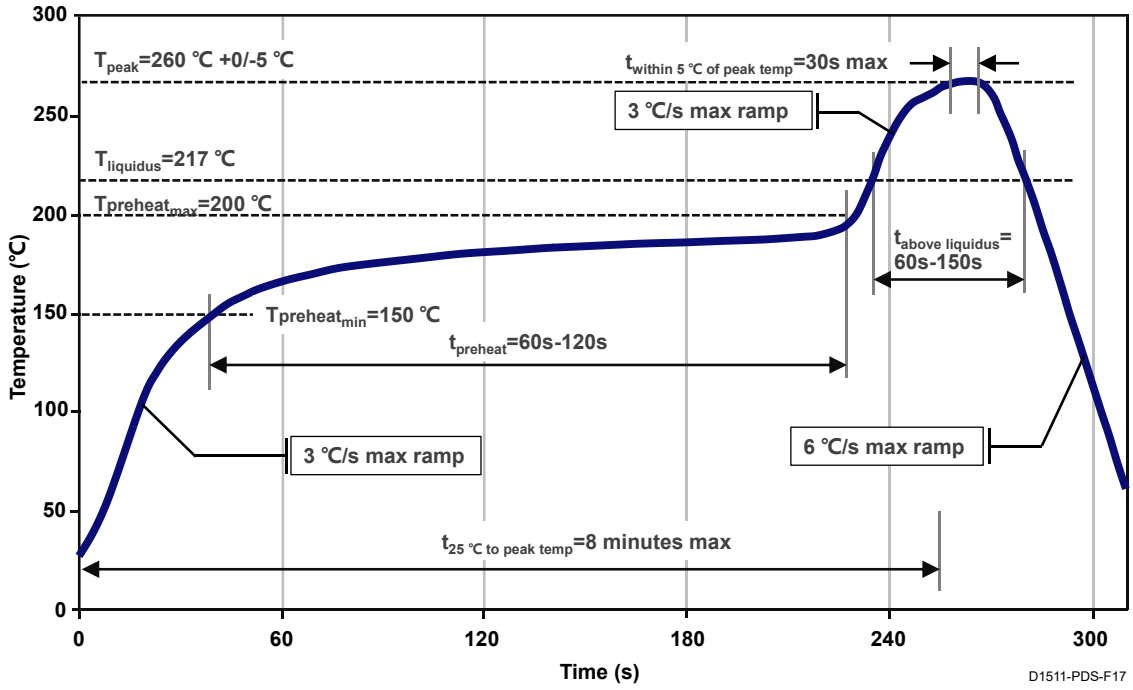


Figure 17. Recommended Solder Temperature Profile

14. Handling Precautions

- **ESD Caution**

  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.



15. 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

16. Disclaimer

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