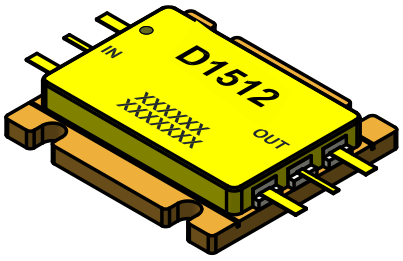
1. Description

- The D1512 is a high power (100W) GaN-HEMT that is internally matched for ultra broadband application to provide optimum power and gain in a 50ohm system.
- The device operates from 1.3 to 6.4GHz with a 28V supply rail. It is offered in a small hermetically sealed metal/ceramic flange package.



D1512-PDS-F01

Figure 1. D1512 Package Outline

2. Applications

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

3. Features[1]

- Operating Frequency: 1.3–6.4GHz
- Output Power (P_{SAT}): 50.0dBm (100W)
- Linear Gain: 10.5dB
- Typical DE @ P_{SAT}: 40.0%
- Operating Voltage: 28V
- Impedance Matched Z_{IN}/Z_{OUT} = 50ohm
- Hermetically Sealed Package
- Package Type: 670F-A

[1] Measured in Raytron DEMO_A

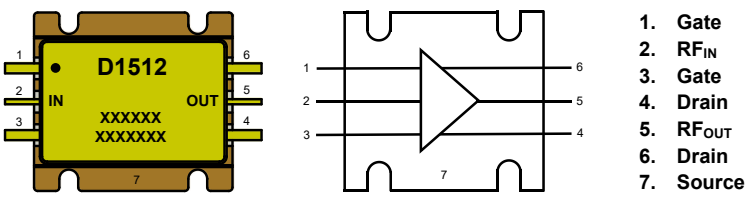
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	1.3GHz	2.0GHz	3.0GHz	4.0GHz	5.0GHz	6.0GHz	6.4GHz	Units
Linear Gain	10.7	11.2	11.2	11.2	11.0	10.3	11.0	dB
Power Gain	7.7	8.2	8.2	8.2	8.0	7.4	8.0	dB
Drain Efficiency	41.1	50.4	41.9	48.9	43.1	44.6	46.9	%
Output Power	50.0	51.2	50.8	51.7	50.8	50.2	50.2	dBm
Output Power	101	131	119	148	119	105	105	W

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 500mA, V_{GS} = -2.84V
- Test condition: CW

5. Block Diagram



1. Gate
2. RF_{IN}
3. Gate
4. Drain
5. RF_{OUT}
6. Drain
7. Source

D1512-PDS-F02

Figure 2. D1512 Block Diagram

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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}	29.8	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}	-	500	-	mA
Gate-Source Voltage, V_{GS}	-	-2.84	-	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)	0.74	°C/W
Thermal Resistance (Junction-to-Case)[2]	R_{thjc} (FEA)	0.95	°C/W

1. Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 100.0W
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} = 29.8mA)	$V_{DS(BR)}$	84	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	32.88	-	A
Gate Threshold Voltage[3] (V_{DS} = 28V, I_{DS} = 29.8mA)	$V_{GS(TH)}$	-3.30	-2.80	-2.30	V
Gate Quiescent Voltage[3] (V_{DS} = 28V, I_{DS} = 500mA)	$V_{GS(Q)}$	-	-2.84	-	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})
2.0GHz	11.2dB	8.2dB	50.4%	51.2dBm (132W)
4.0GHz	11.2dB	8.2dB	48.9%	51.7dBm (148W)
6.0GHz	10.3dB	7.4dB	44.6%	50.2dBm (105W)

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 500mA, V_{GS} = -2.84V
- Test condition: CW

9. Typical Performance

■ Wide-band Application Performance (DEMO_A, 1.3-6.4GHz, CW, 28V)

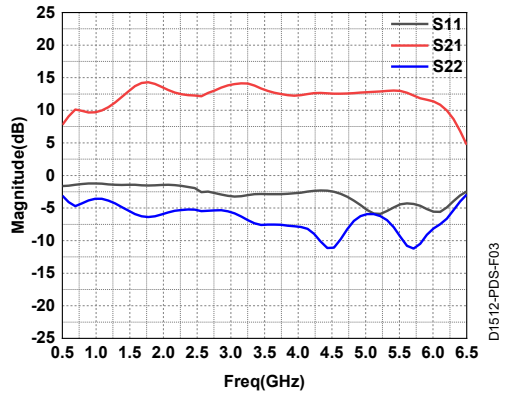


Figure 3. S_{11}, S_{21} and S_{22} vs. Freq.

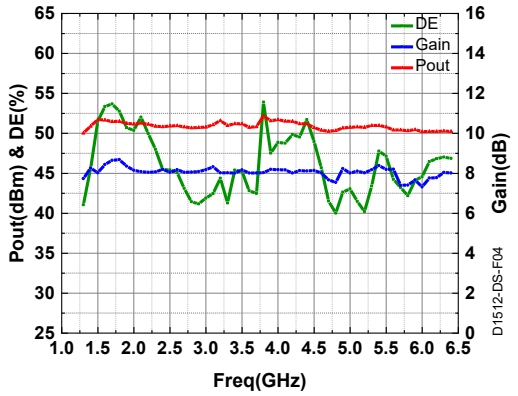


Figure 4. P_{OUT}, DE and Gain vs. Freq.

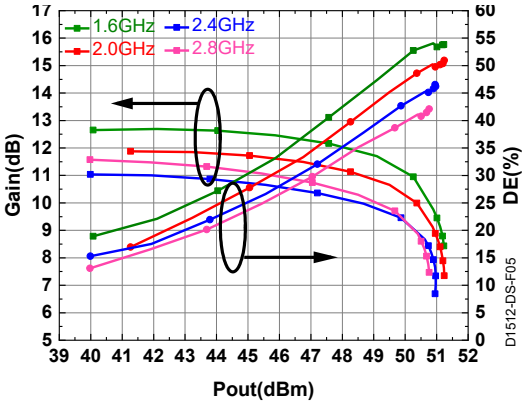


Figure 5. Gain and DE vs. P_{OUT}

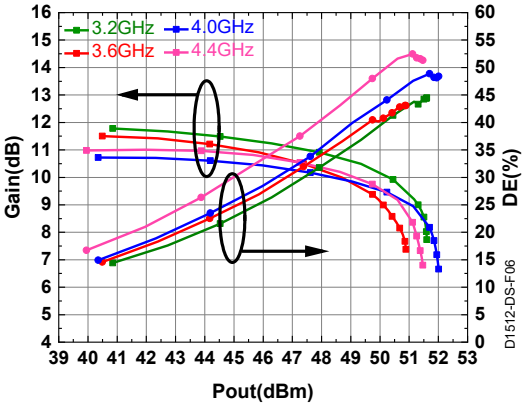


Figure 6. Gain and DE vs. P_{OUT}

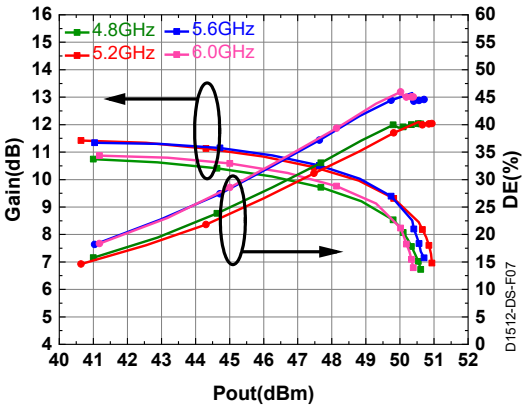


Figure 7. Gain and DE vs. P_{OUT}

Table 7. RF Characteristics @ DEMO_A, 1.3-6.4GHz, CW, 28V

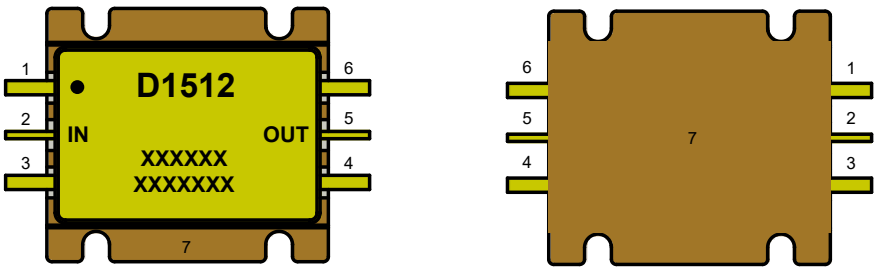
Freq.	Linear Gain (G_{LIN})	Power Gain (G_P)	Drain Efficiency (η_D)	Output Power (P_{SAT})
1.3GHz	10.7dB	7.7dB	41.1%	50.0dBm (100W)
1.4GHz	11.3dB	8.3dB	45.7%	50.9dBm (123W)
1.5GHz	11.0dB	8.0dB	51.5%	51.7dBm (148W)
1.6GHz	11.4dB	8.4dB	53.4%	51.7dBm (148W)
1.7GHz	11.7dB	8.7dB	53.7%	51.5dBm (141W)
1.8GHz	11.7dB	8.7dB	52.8%	51.5dBm (141W)
1.9GHz	11.4dB	8.4dB	50.7%	51.3dBm (135W)
2.0GHz	11.2dB	8.2dB	50.4%	51.2dBm (132W)
2.1GHz	11.1dB	8.1dB	52.0%	51.3dBm (135W)
2.2GHz	11.1dB	8.1dB	50.0%	51.1dBm (129W)
2.3GHz	11.1dB	8.1dB	48.0%	50.9dBm (123W)
2.4GHz	11.2dB	8.2dB	45.5%	50.8dBm (120W)
2.5GHz	11.1dB	8.1dB	45.4%	50.9dBm (123W)
2.6GHz	11.2dB	8.2dB	45.1%	51.0dBm (126W)
2.7GHz	11.1dB	8.1dB	43.1%	50.8dBm (120W)
2.8GHz	11.1dB	8.1dB	41.4%	50.7dBm (117W)
2.9GHz	11.1dB	8.1dB	41.2%	50.7dBm (117W)
3.0GHz	11.2dB	8.2dB	41.9%	50.8dBm (120W)
3.1GHz	11.3dB	8.3dB	42.5%	51.1dBm (129W)
3.2GHz	11.0dB	8.0dB	44.4%	51.6dBm (145W)
3.3GHz	11.0dB	8.0dB	41.3%	51.0dBm (126W)
3.4GHz	11.0dB	8.0dB	45.4%	51.2dBm (132W)
3.5GHz	11.2dB	8.2dB	45.2%	51.2dBm (132W)
3.6GHz	11.0dB	8.0dB	42.8%	50.8dBm (120W)
3.7GHz	11.0dB	8.0dB	42.5%	50.8dBm (120W)
3.8GHz	11.0dB	8.0dB	53.9%	52.2dBm (166W)
3.9GHz	11.2dB	8.2dB	47.5%	51.6dBm (145W)
4.0GHz	11.2dB	8.2dB	48.9%	51.7dBm (148W)
4.1GHz	11.2dB	8.2dB	48.8%	51.5dBm (141W)
4.2GHz	11.0dB	8.0dB	49.9%	51.5dBm (141W)
4.3GHz	11.1dB	8.1dB	49.5%	51.2dBm (132W)
4.4GHz	11.1dB	8.1dB	51.7%	51.2dBm (132W)
4.5GHz	11.1dB	8.1dB	49.0%	50.7dBm (117W)
4.6GHz	11.0dB	8.0dB	45.7%	50.4dBm (110W)
4.7GHz	10.7dB	7.7dB	41.5%	50.3dBm (107W)
4.8GHz	10.5dB	7.5dB	40.0%	50.4dBm (110W)
4.9GHz	11.2dB	8.2dB	42.6%	50.7dBm (117W)
5.0GHz	11.0dB	8.0dB	43.1%	50.8dBm (120W)
5.1GHz	11.1dB	8.1dB	41.5%	50.8dBm (120W)
5.2GHz	11.0dB	8.0dB	40.2%	50.8dBm (120W)
5.3GHz	11.2dB	8.2dB	43.4%	51.0dBm (126W)
5.4GHz	11.4dB	8.4dB	47.8%	51.0dBm (126W)

Freq.	Linear Gain (G_{LIN})	Power Gain (G_P)	Drain Efficiency (η_D)	Output Power (P_{SAT})
5.5GHz	11.2dB	8.2dB	47.1%	50.8dBm (120W)
5.6GHz	11.2dB	8.2dB	44.3%	50.4dBm (110W)
5.7GHz	10.4dB	7.4dB	43.2%	50.4dBm (110W)
5.8GHz	10.4dB	7.4dB	42.2%	50.3dBm (107W)
5.9GHz	10.7dB	7.7dB	44.1%	50.5dBm (112W)
6.0GHz	10.3dB	7.4dB	44.6%	50.2dBm (105W)
6.1GHz	10.8dB	7.8dB	46.5%	50.2dBm (105W)
6.2GHz	10.8dB	7.8dB	46.8%	50.2dBm (105W)
6.3GHz	11.0dB	8.0dB	47.0%	50.3dBm (107W)
6.4GHz	11.0dB	8.0dB	46.9%	50.2dBm (105W)

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 500mA , V_{GS} = -2.84V
- Test condition: Input CW
- The output power reaches 50.0dBm (100W) at 1.3-6.4GHz when V_{DS} = 28V.

10. Package Outline

■ Pin Layout



D1512-PDS-F08

Figure 8. D1512 Pin Layout

Table 8. Pin Description

Pin	Symbol	Description
1/3	V_G	Gate Voltage
2	RF_{IN}	RF Input
5	RF_{OUT}	RF Output
4/6	V_D	Drain Voltage
7	Flange	Source Connected to Ground

■ Mechanical Drawing (Package Type: 670F-A)

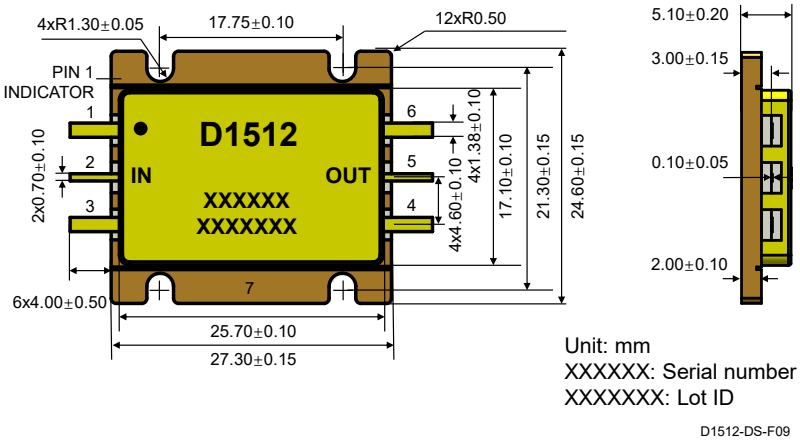


Figure 9. D1512 Mechanical Drawing

11. Application Circuit

■ Schematic

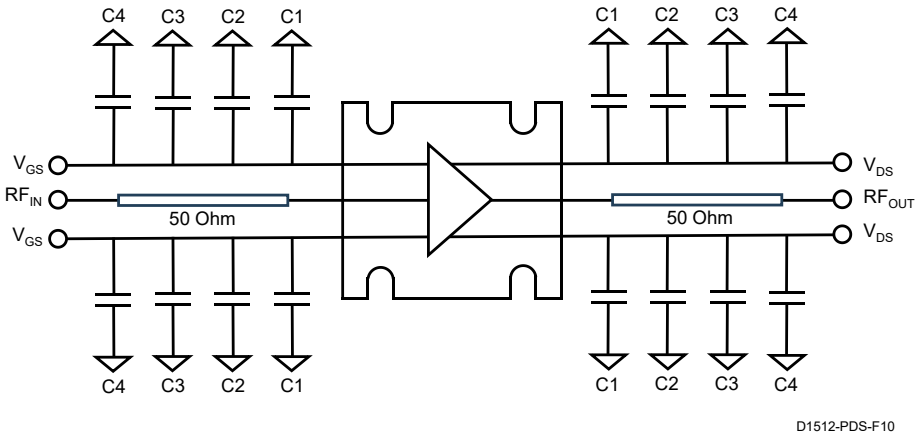


Figure 10. D1512 DEMO_A Application Circuit Schematic

Table 9. 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 (28V)	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

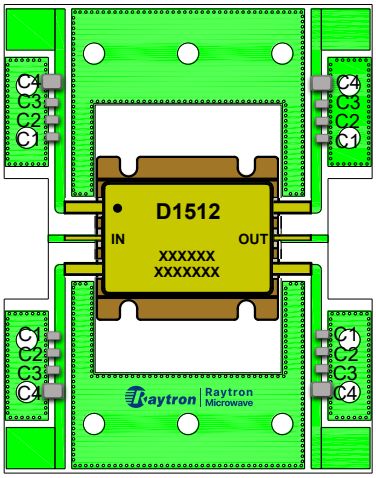


Figure 11. D1512 Application Circuit Layout (1.3-6.4GHz)
(DEMO_A Size: 7.0cm x 5.5cm)

Table 10. 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 11. DEMO Summary

NO.	D1512 DEMO Name	V_{DS} (V)	Freq. (GHz)	Linear Gain (dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency (%)	Pulse or CW
1	DEMO_A, 100W	28	1.3-6.4	10.5	50.0	100	40.0	CW

13. Recommended Solder Temperature Profile

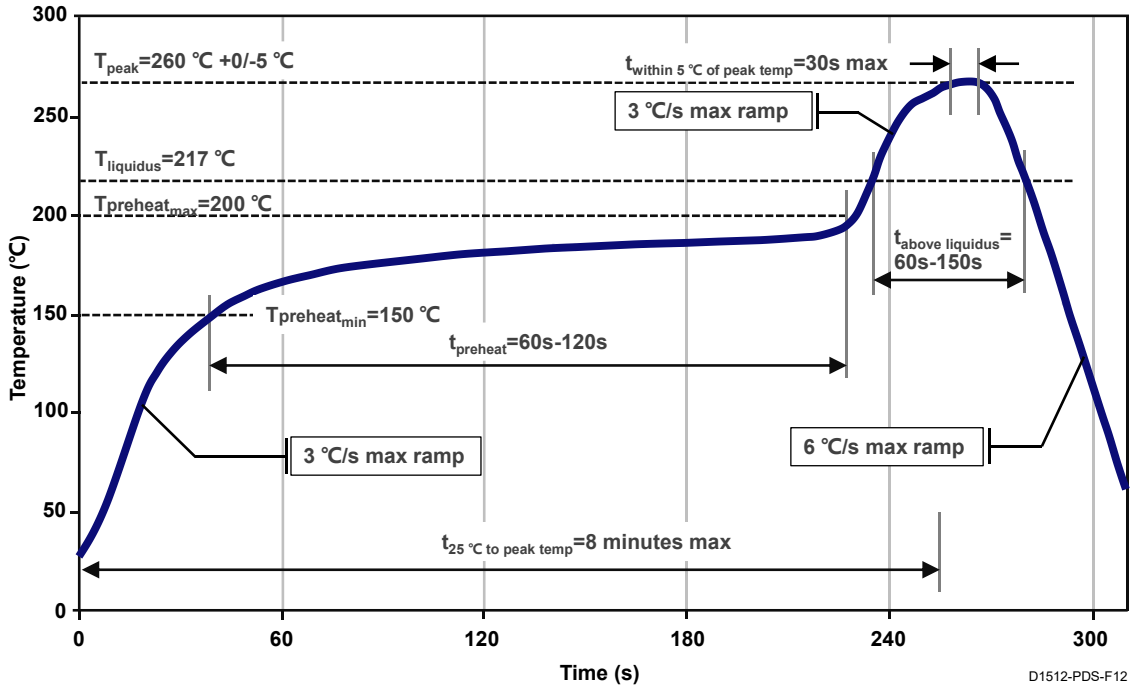


Figure 12. Recommended Solder Temperature Profile

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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