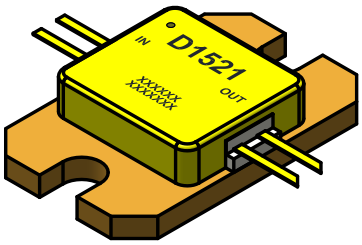
1. Description

- The D1521 is a 10W (P_{SAT}) wideband matched GaN-HEMT device. The D1521 is matched to 50ohm on the input and 50ohm on the output.
- The D1521 operates from 2 to 4GHz with a 28V supply rail. It is offered in a small hermetically sealed metal/ceramic flange package.



D1521-PDS-F01

Figure 1. D1521 Package Outline

2. Applications

- Military and Civilian Radar
- Land Mobile and Military Radio Communications
- Avionics and Test Instrumentation

3. Features[1]

- Operating Frequency: 2–4GHz
- Output Power (P_{SAT}): 40.0dBm (10.0W)
- Linear Gain: 13.1dB
- Typical DE @ P_{SAT}: 51.7%
- Operating Voltage: 28V
- CW and Pulse Capable
- Impedance Matched Z_{IN}/Z_{OUT} = 50ohm
- Hermetically Sealed Package
- Package Type: 450F-A

[1] Measured in Raytron DEMO_A

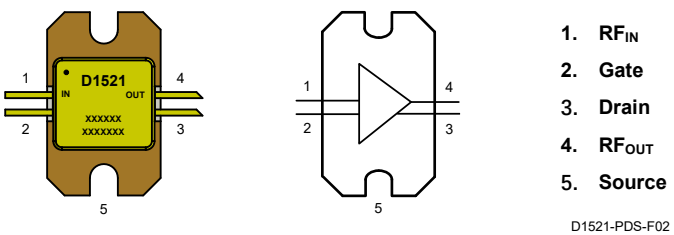
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	2.0GHz	2.5GHz	3.0GHz	3.5GHz	4.0GHz	Units
Linear Gain	13.1	15.7	15.5	14.0	15.3	dB
Drain Efficiency	52.9	55.0	55.6	55.4	57.9	%
Output Power	40.3	40.8	41.0	41.3	40.0	dBm
Output Power	10.7	12.0	12.6	13.5	10.0	W

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.84V
- Test Condition: CW

5. Block Diagram



D1521-PDS-F02

Figure 2. D1521 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}	2.4	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_{DSS}	-	28	-	V
Drain Bias Current, I_{DS}	-	100	-	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)	6.70	°C/W
Thermal Resistance (Junction-to-Case)[2]	R_{thjc} (FEA)	9.45	°C/W

[1] Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 11.0W

[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} = 2.4mA)	$V_{DS(BR)}$	84	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	2.76	-	A
Gate Threshold Voltage[3] (V_{DS} = 28V, I_{DS} = 2.4mA)	$V_{GS(TH)}$	-3.30	-2.80	-2.30	V
Gate Quiescent Voltage[3] (V_{DS} = 28V, I_{DS} = 100mA)	$V_{GS(Q)}$	-	-2.84	-	V

[1] Measured on wafer prior to packaging

[2] Measured with packaged device

[3] Measured in Raytron DEMO

Table 6. RF Characteristics[1,2]

Freq.	Linear Gain (G_{LIN})	Drain Efficiency (η_D)	Output Power (P_{SAT})
2.0GHz	13.1dB	52.9%	40.3dBm (10.7W)
2.5GHz	15.7dB	55.0%	40.8dBm (12.0W)
3.0GHz	15.5dB	55.6%	41.0dBm (12.6W)
3.5GHz	14.0dB	55.4%	41.3dBm (13.5W)
4.0GHz	15.3dB	57.9%	40.0dBm (10.0W)

1. Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.84V
2. Test Condition: CW

9. Typical Performance

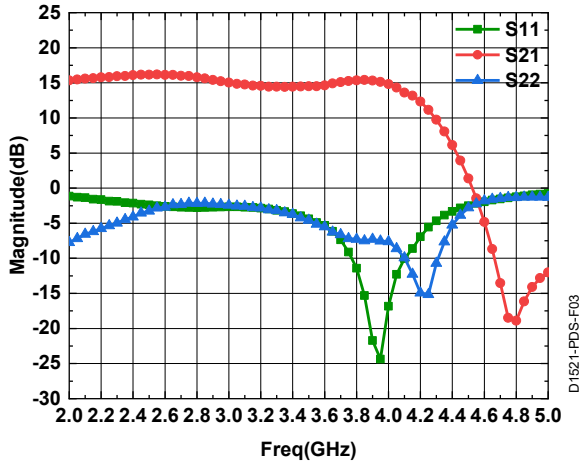


Figure 3. 2.0GHz-4.0GHz S_{11} and S_{21} vs. Freq.

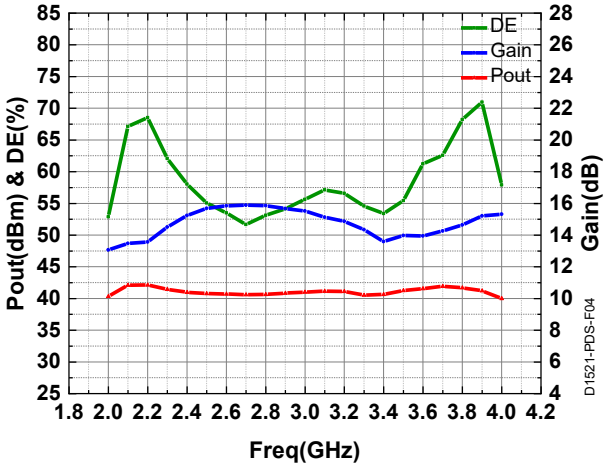


Figure 4. 2.0GHz-4.0GHz Gain and Pout vs. Freq.

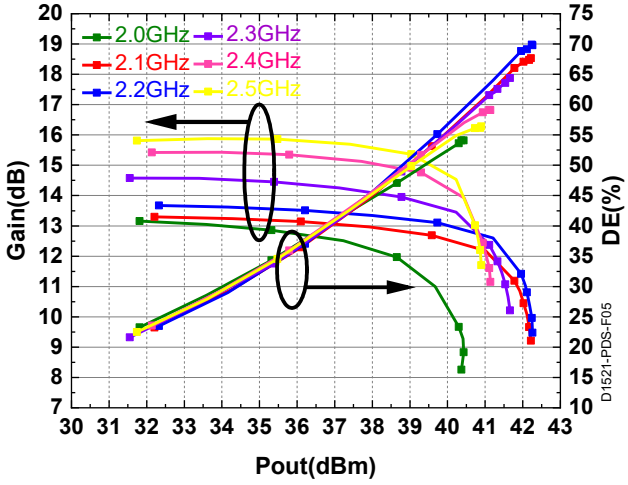


Figure 5. 2.0GHz-2.5GHz Gain and DE vs. P_{OUT}

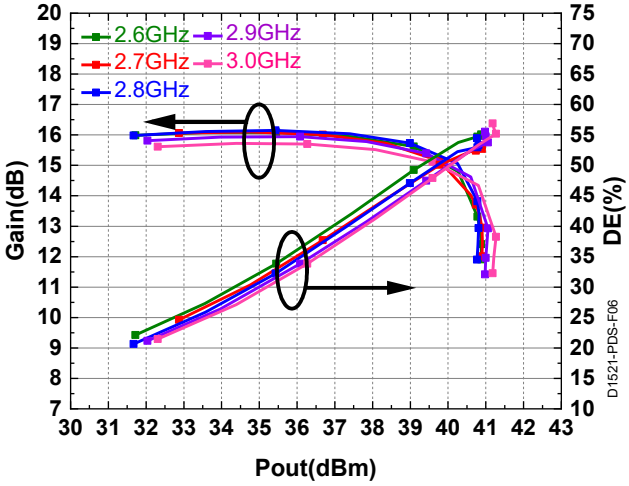


Figure 6. 2.6GHz-3.0GHz Gain and DE vs. P_{OUT}

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.84V
- Test Condition: CW

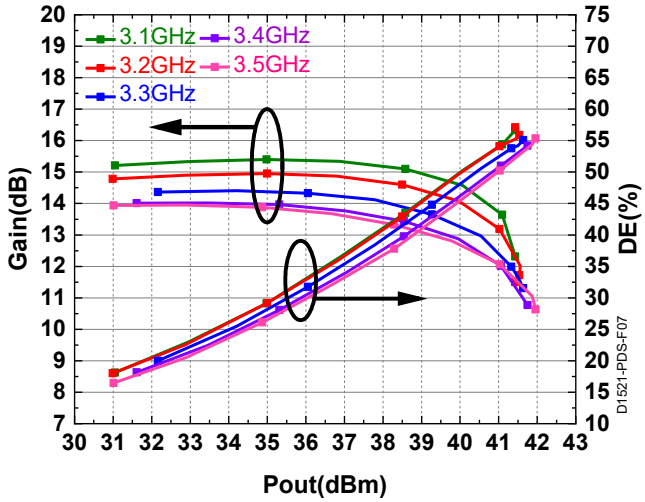


Figure 7. 3.1GHz-3.5GHz Gain and DE vs. P_{OUT}

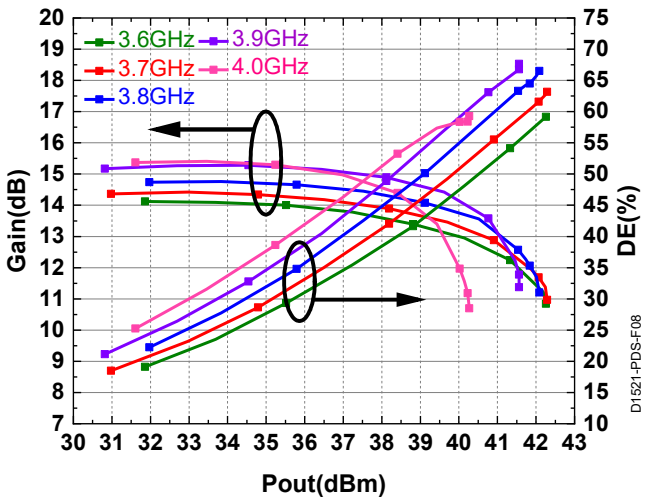


Figure 8. 3.6GHz-4.0GHz Gain and DE vs. P_{OUT}

Table 7. RF Characteristics @ DEMO_A[1,2,3], 2.0-4.0GHz, CW, 28V

Freq.	Linear Gain (G_{LIN})	Drain Efficiency (η_D)	Output Power (P_{SAT})
2.0GHz	13.1dB	52.9%	40.3dBm (10.7W)
2.1GHz	13.5dB	67.1%	42.1dBm (16.2W)
2.2GHz	13.6dB	68.5%	42.1dBm (16.2W)
2.3GHz	14.5dB	62.1%	41.4dBm (13.8W)
2.4GHz	15.2dB	58.0%	41.0dBm (12.6W)
2.5GHz	15.7dB	55.0%	40.8dBm (12.0W)
2.6GHz	15.8dB	53.5%	40.7dBm (11.7W)
2.7GHz	15.9dB	51.7%	40.6dBm (11.5W)
2.8GHz	15.9dB	53.1%	40.6dBm (11.5W)
2.9GHz	15.7dB	54.1%	40.9dBm (12.7W)
3.0GHz	15.5dB	55.6%	41.0dBm (12.6W)
3.1GHz	15.1dB	57.1%	41.1dBm (12.9W)
3.2GHz	14.9dB	56.6%	41.1dBm (12.9W)
3.3GHz	14.3dB	54.6%	40.5dBm (11.2W)
3.4GHz	13.6dB	53.4%	40.7dBm (11.2W)
3.5GHz	14.0dB	55.4%	41.3dBm (13.5W)
3.6GHz	13.9dB	61.2%	41.5dBm (14.1W)
3.7GHz	14.3dB	62.6%	41.9dBm (15.5W)
3.8GHz	14.6dB	68.2%	41.7dBm (14.8W)
3.9GHz	15.2dB	71.0%	41.2dBm (13.2W)
4.0GHz	15.3dB	57.9%	40.0dBm (10.0W)

1. Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.84V
2. Test Condition: CW
3. The output power is 40dBm (10W) at 2-4GHz when V_{DS}=28V.

10. Package Outline

■ Pin Layout

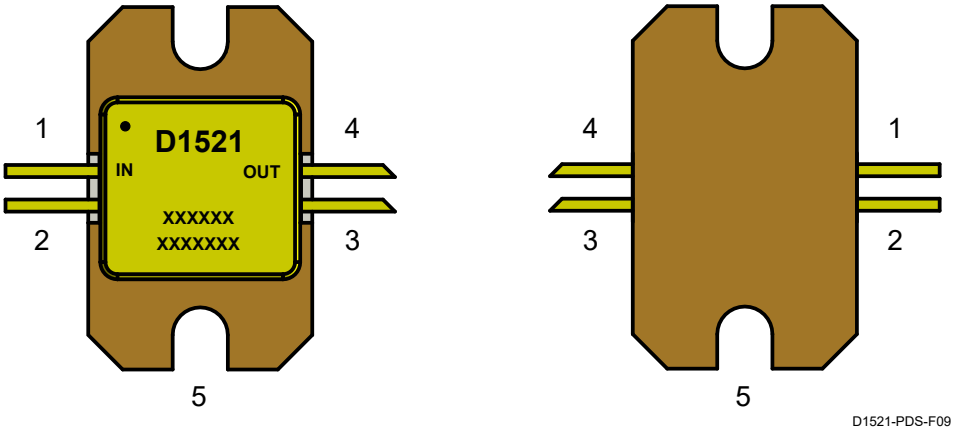


Figure 9. D1521 Pin Layout

Table 8. Pin Description

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

■ Mechanical Drawing (Package Type: 450F-A)

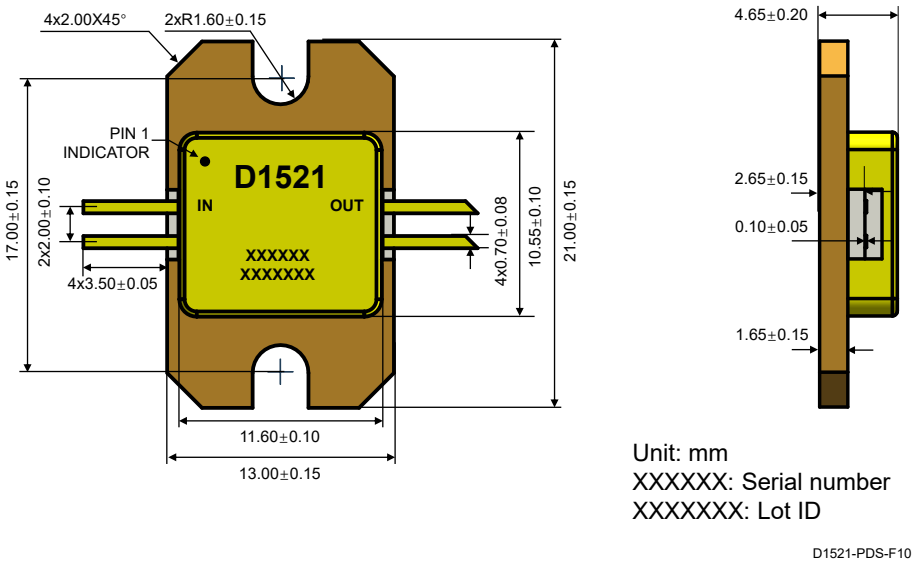


Figure 10. D1521 Mechanical Drawing

11. Application Circuit

■ Schematic

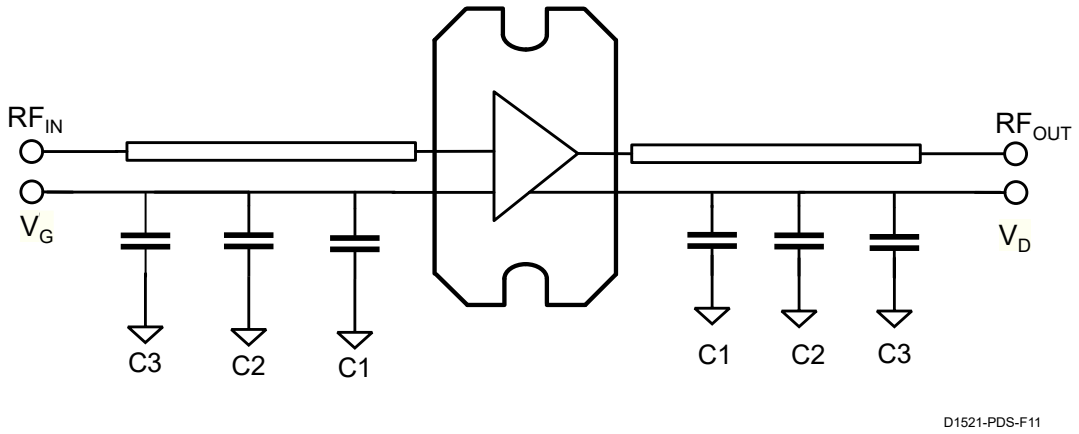


Figure 11. D1521 DEMO_A Application Circuit Schematic

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

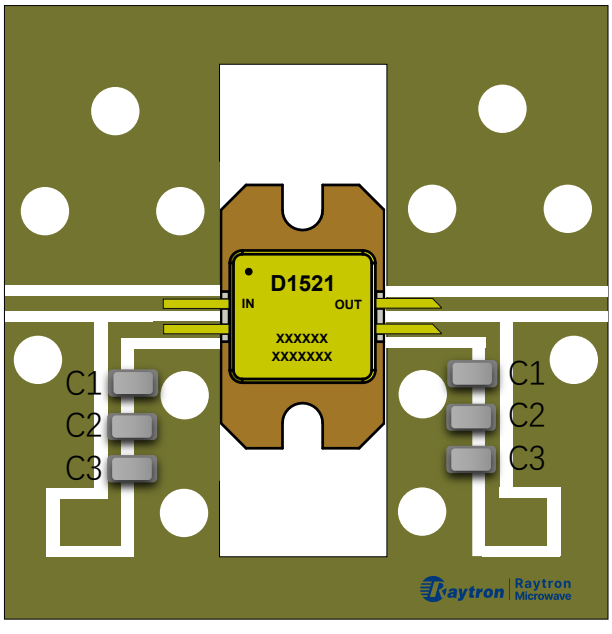


Figure 12. D1521 Application Circuit Layout
(DEMO_A Size: 4.8cm x 4.8cm)

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	GQM2195C2E101JB12
C2	10.0nF	X7R 100V 0603 Capacitor	Murata	GCM188R72A103KA37D
C3	1.0uF	X7R 100V 1210 Capacitor	Murata	GRM3195C2A104JA01

12. DEMO Summary

Table 11. DEMO Summary

NO.	D1521 DEMO Name	V_{DS} (V)	Freq. (GHz)	Linear Gain (dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency (%)	Pulse or CW
1	DEMO_A, 10W	28	2-4	13.1	40	10	51.7	CW

13. Recommended Solder Temperature Profile

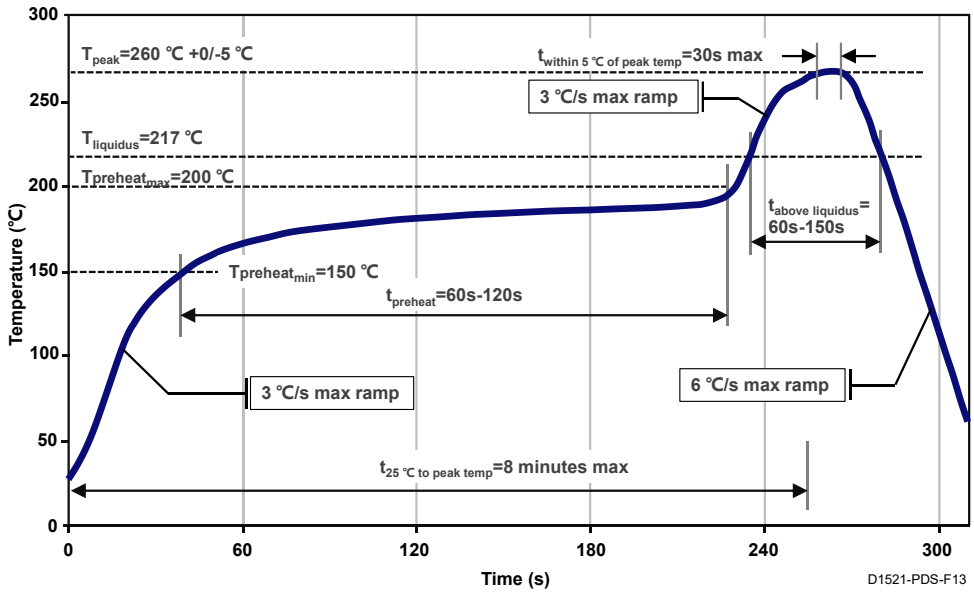


Figure 13. Recommended Solder Temperature Profile

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

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