1. Description

- The D1520 is a 10W (P_{SAT}) wideband matched GaN-HEMT device. The D1520 is matched to 50ohm on the input and 50ohm on the output.
- The D1520 operates from 2.7 to 3.5GHz with a 28V supply rail. It is offered in a small hermetically sealed metal/ceramic flange package.

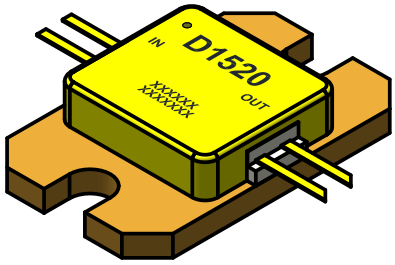


Figure 1. D1520 Package Outline

2. Applications

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

3. Features[1]

- Operating Frequency: 2.7–3.5GHz
- Output Power (P_{SAT}): 41.2dBm (13.2W)
- Linear Gain: 15.0dB
- Typical DE @ P_{SAT}: 57.5%
- 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	2.7GHz	2.9GHz	3.1GHz	3.3GHz	3.5GHz	Units
Linear Gain	15.0	15.3	15.8	15.7	15.4	dB
Drain Efficiency	57.5	61.0	66.8	68.6	72.4	%
Output Power	41.2	41.9	42.3	42.3	42.0	dBm
Output Power	13.2	15.5	17.0	17.0	15.8	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

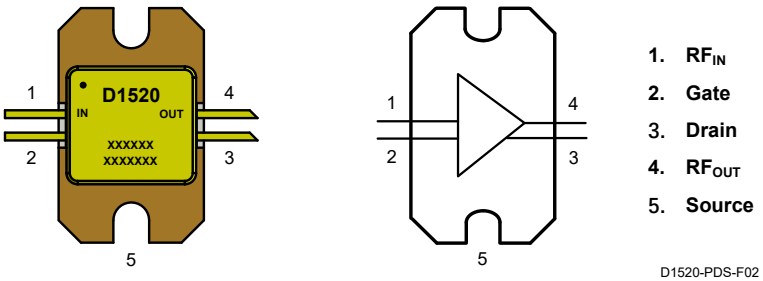


Figure 2. D1520 Block Diagram

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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_{DS}	-	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})
2.7GHz	15.0dB	57.5%	41.2dBm (13.2W)
3.0GHz	15.5dB	63.0%	42.1dBm (16.2W)
3.5GHz	15.4dB	72.4%	42.0dBm (15.8W)

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

9. Typical Performance

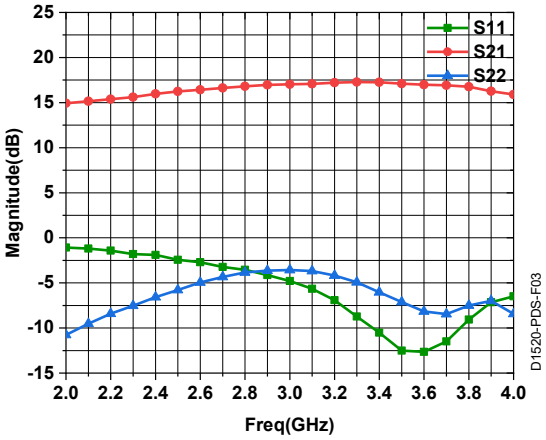


Figure 3. 2.7GHz-3.5GHz S_{11}, S_{21} and S_{22} vs. Freq.

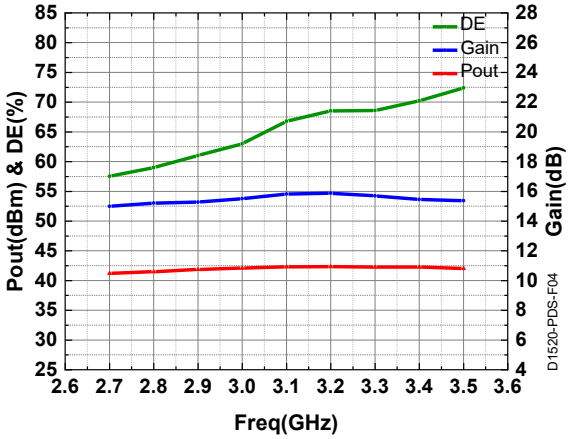


Figure 4. 2.7GHz-3.5GHz Gain and Pout vs. Freq.

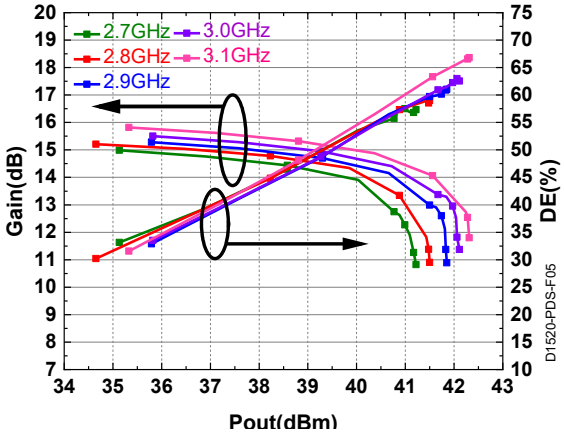


Figure 5. 2.7GHz-3.1GHz Gain and DE vs. P_{OUT}

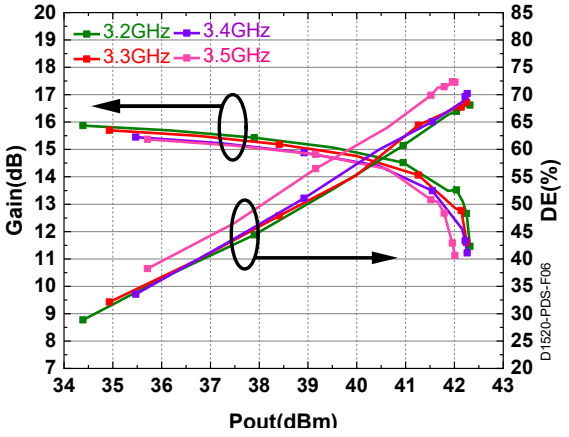


Figure 6. 3.2GHz-3.5GHz Gain and DE vs. P_{OUT}

- 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

Table 7. RF Characteristics @ DEMO_A[1,2,3], 2.7-3.5GHz, CW, 28V

Frequency	Linear Gain (G_{LIN})	Drain Efficiency (η_D)	Output Power (P_{SAT})
2.7GHz	15.0dB	57.5%	41.2dBm (13.2W)
2.8GHz	15.2dB	59.0%	41.5dBm (14.1W)
2.9GHz	15.3dB	61.0%	41.9dBm (15.5W)
3.0GHz	15.5dB	63.0%	42.1dBm (16.2W)
3.1GHz	15.8dB	66.8%	42.3dBm (17.0W)
3.2GHz	15.9dB	68.5%	42.3dBm (17.0W)
3.3GHz	15.7dB	68.6%	42.3dBm (17.0W)
3.4GHz	15.5dB	70.2%	42.3dBm (17.0W)
3.5GHz	15.4dB	72.4%	42.0dBm (15.8W)

1. Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28 I_{DS} = 100mA V_{GS} = -2.84V
2. Test Condition: CW
3. The output power is 41.2dBm (13.2W) at 2.7-3.5GHz when V_{DS}=28V.

10. Package Outline

■ Pin Layout

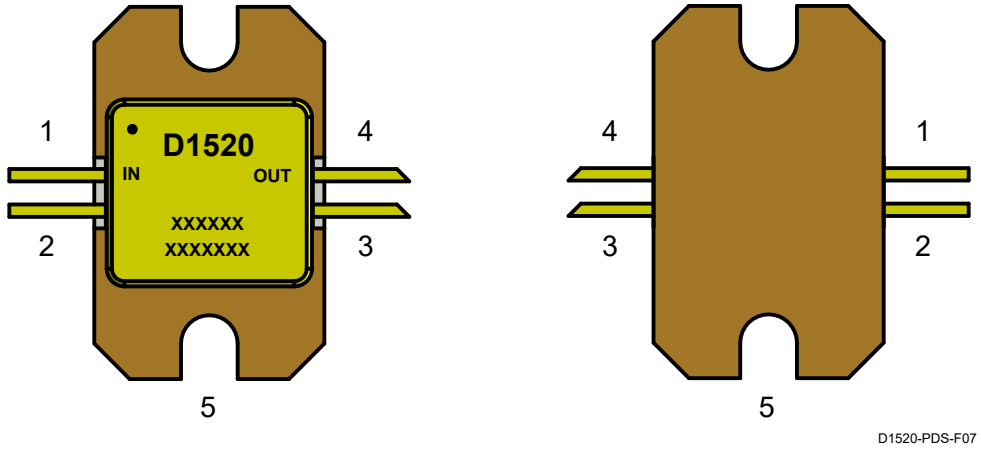


Figure 7. D1520 Pin Layout

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)

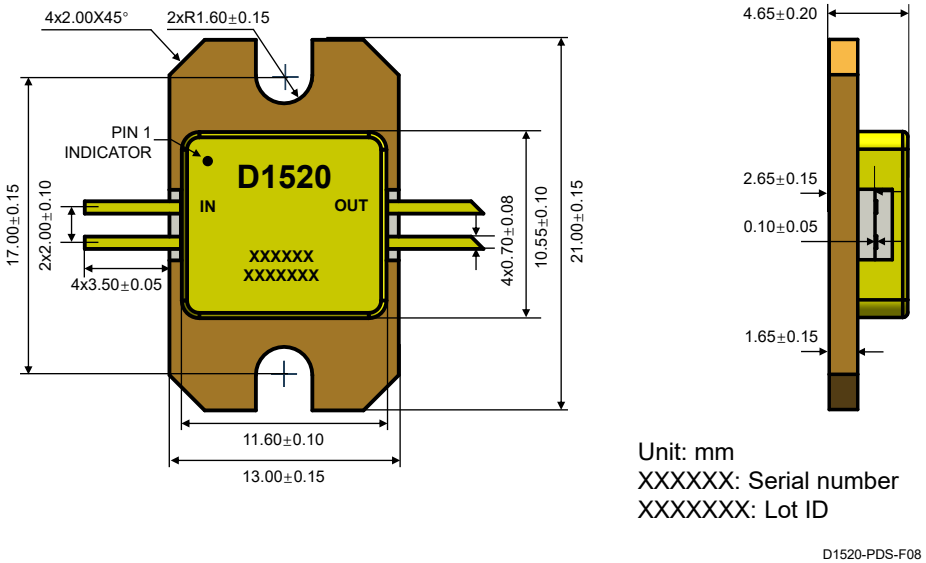


Figure 8. D1520 Mechanical Drawing

11. Application Circuit

■ Schematic

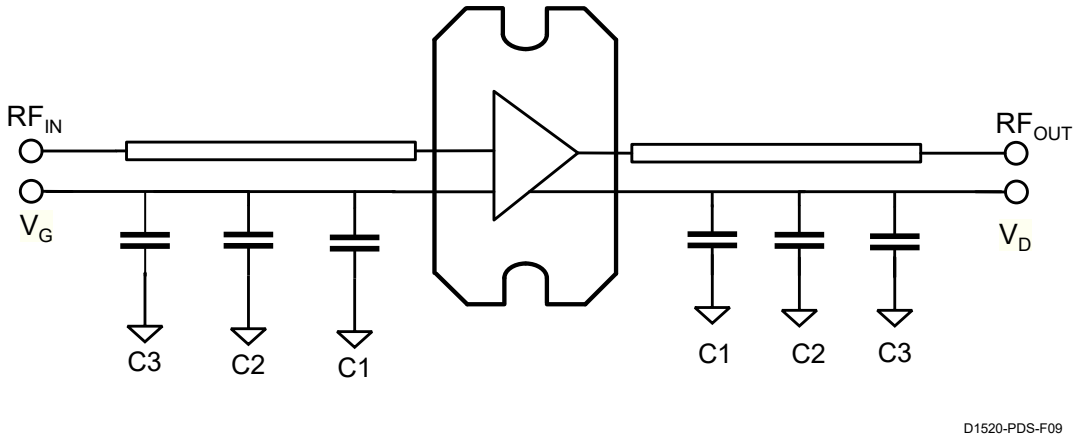


Figure 9. D1520 DEMO_A Application Circuit Schematic

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

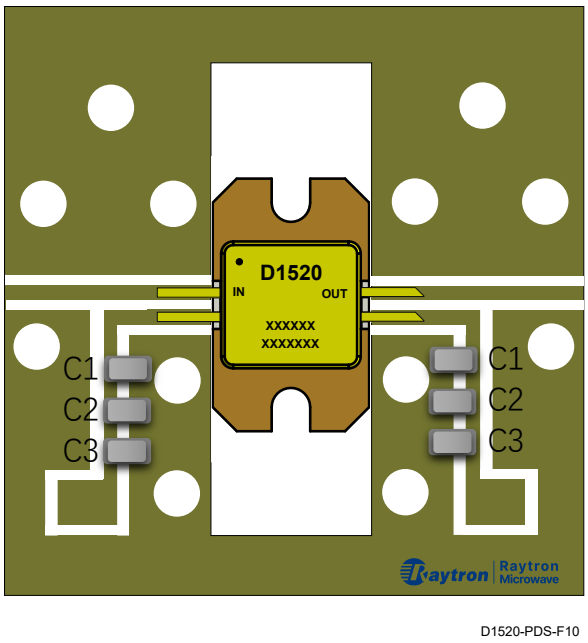


Figure 10. D1520 Application Circuit Layout
（DEMO_A Size: 4.8cm x 4.8cm）

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.	D1520 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	2.7-3.5	15.0	41.2	13	57.5	CW

13. Recommended Solder Temperature Profile

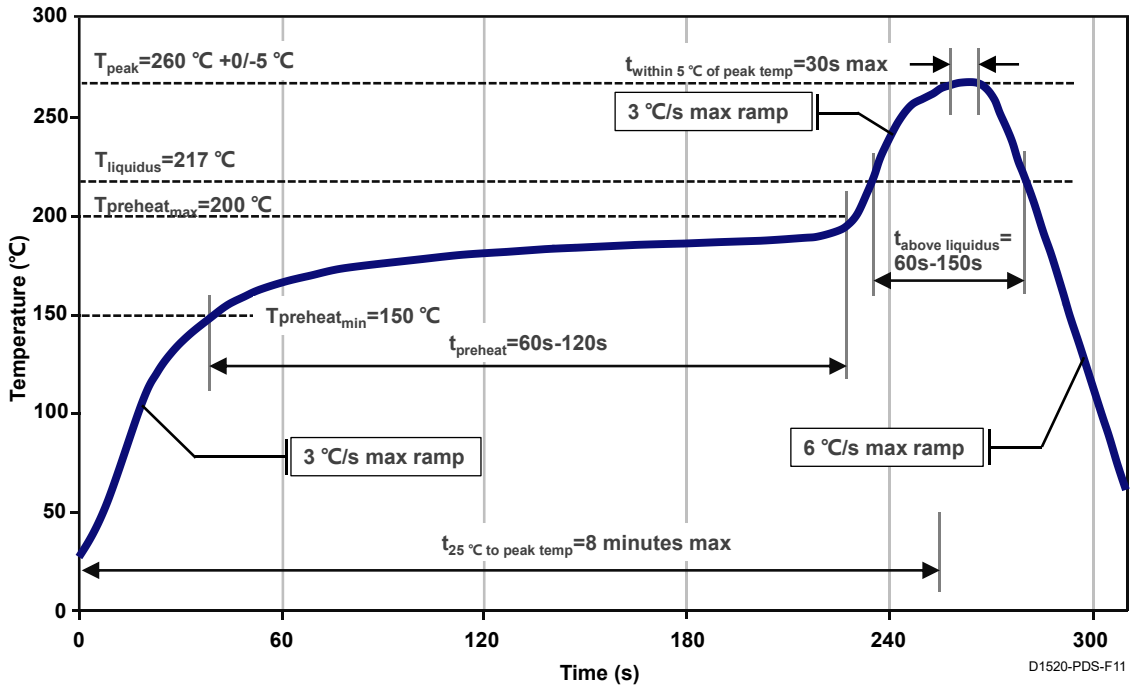


Figure 11. Recommended Solder Temperature Profile

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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