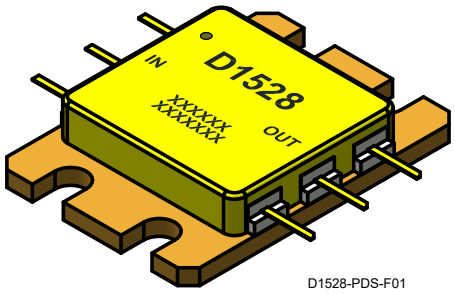
1. Description

- The D1528 is a 50W (P_{SAT}) wideband matched gallium nitride (GaN) high electron mobility transistor (HEMT) with first generation RF GaN technology from Raytron.
- The D1528 is matched to 50ohm on the input and 50ohm on the output. The device operates from 3.6 to 4.0GHz with a 28V supply rail. It is offered in a small hermetically sealed metal/ceramic flange package.



D1528-PDS-F01

Figure 1. D1528 Package Outline

2. Applications

- Radar
- Radio Communications
- Test Instrumentation
- Airborne Communication System

3. Features[1]

- Operating Frequency: 3.6–4.0GHz
- Output Power (P_{SAT}): 47.0dBm (50W)
- Linear Gain: 16.1dB
- Typical DE @ P_{SAT}: 61.3%
- Operating Voltage: 28V
- CW and Pulse Capable
- Impedance Matched Z_{IN}/Z_{OUT} = 50ohm
- Hermetically Sealed Package
- Package Type: 630F-B

[1] Measured in Raytron DEMO_A

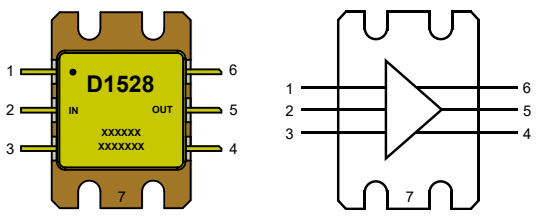
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	3.6GHz	3.7GHz	3.8GHz	3.9GHz	4.0GHz	Units
Linear Gain	16.1	16.1	16.2	16.7	16.7	dB
Drain Efficiency	64.2	67.8	67.7	65.9	61.3	%
Output Power	47.3	47.2	47.1	47.0	47.0	dBm
Output Power	54	52	51	50	50	W

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 200mA, V_{GS} = -3.05V
- Test Condition: CW

5. Block Diagram



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

Figure 2. D1528 Block Diagram D1528-PDS-F02

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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
Operating Voltage, V_{DS}	-	28	-	V
Drain Bias Current, I_{DS}	-	200	-	mA
Gate-Source Voltage, V_{GS}	-	-3.05	-	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°C, P_D = 45.0W

[2]. Thermal Resistance at average power by Finite Element Analysis, Junction-to-Case, $T_{base\text{-}plate}$ = 85°C, $T_{junction}$ = 200°C

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} = 200mA)	$V_{GS(Q)}$	-	-3.05	-	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)	Out Power (P_{SAT})
3.6GHz	16.1dB	64.2%	47.3dBm (54W)
3.8GHz	16.2dB	67.7%	47.1dBm (51W)
4.0GHz	16.7dB	61.3%	47.0dBm (50W)

1. Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 200mA, V_{GS} = -3.05V
2. Test Condition: CW

9. Typical Performance

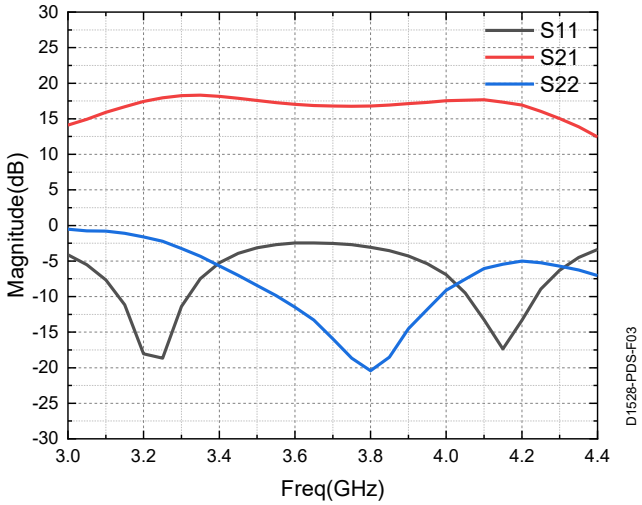


Figure 3. 3.6-4.0GHz S_{11}, S_{21} and S_{22} vs. Freq.

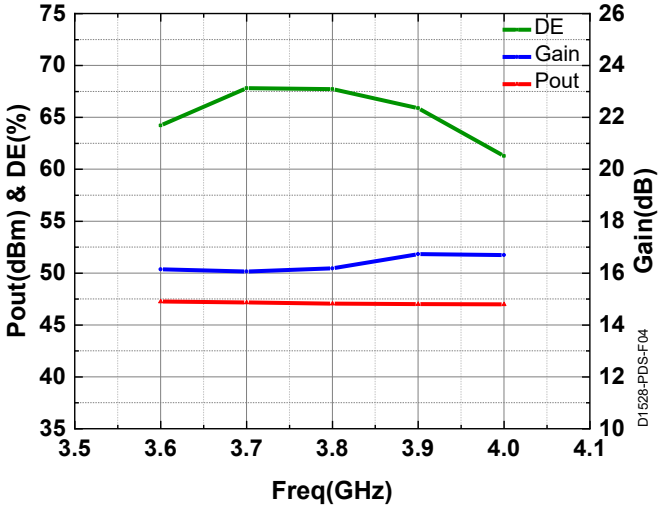


Figure 4. 3.6-4.0GHz Gain and Pout vs. Freq.

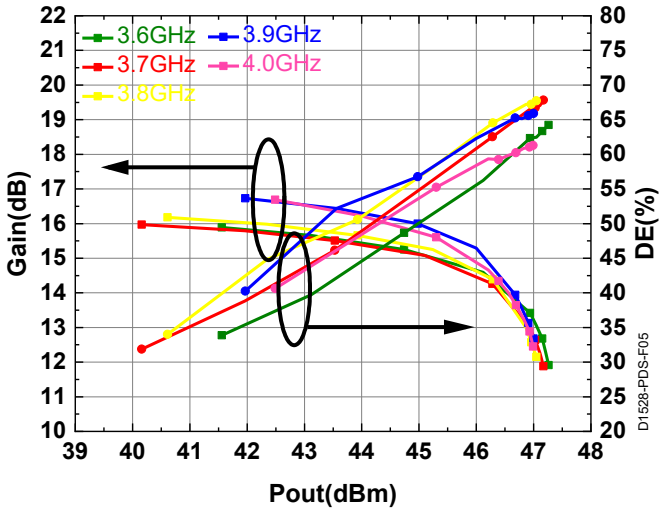


Figure 5. 3.6-4.0GHz Gain and DE vs. P_{OUT}

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 200mA, V_{GS} = -3.05V
- Test Condition: CW

Table 7. RF Characteristics @ DEMO_A[1,2,3], 3.6-4.0GHz, CW, 28V

Freq.	Linear Gain (G_{LIN})	Drain Efficiency (η_D)	Out Power (P_{SAT})
3.6GHz	16.1dB	64.2%	47.3dBm (54W)
3.7GHz	16.1dB	67.8%	47.2dBm (52W)
3.8GHz	16.2dB	67.7%	47.1dBm (51W)
3.9GHz	16.7dB	65.9%	47.0dBm (50W)
4.0GHz	16.7dB	61.3%	47.0dBm (50W)

1. Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 200mA, V_{GS} = -3.05V
2. Test Condition: CW
3. The output power reaches 47.0dBm (50W) at 3.6-4.0GHz when V_{DS}=28V.

10. Package Outline

■ Pin Layout

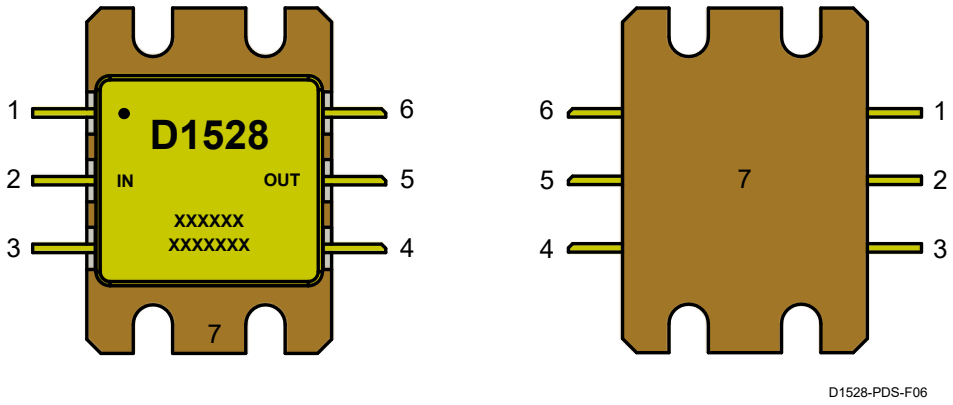


Figure 6. D1528 Pin Layout

Table 8. Pin Description

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

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

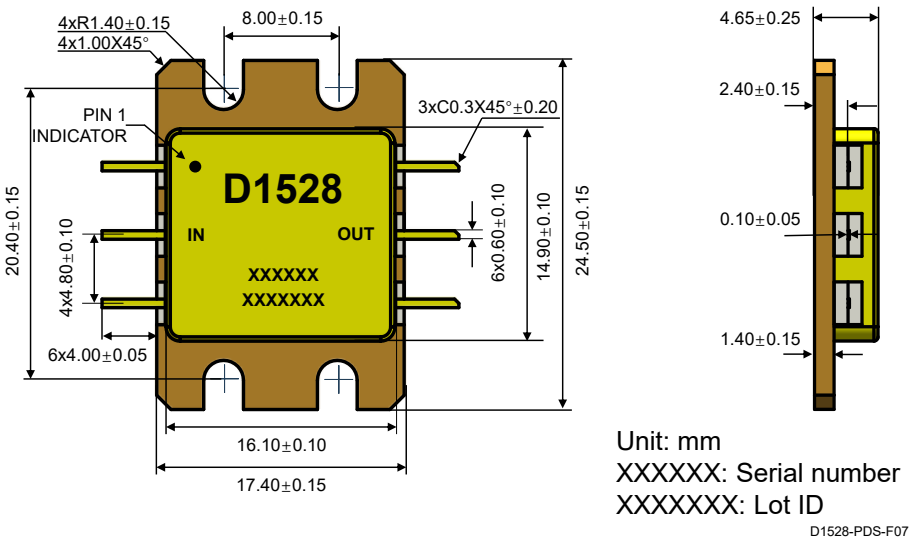


Figure 7. D1528 Mechanical Drawing

11. Application Circuit

■ Schematic

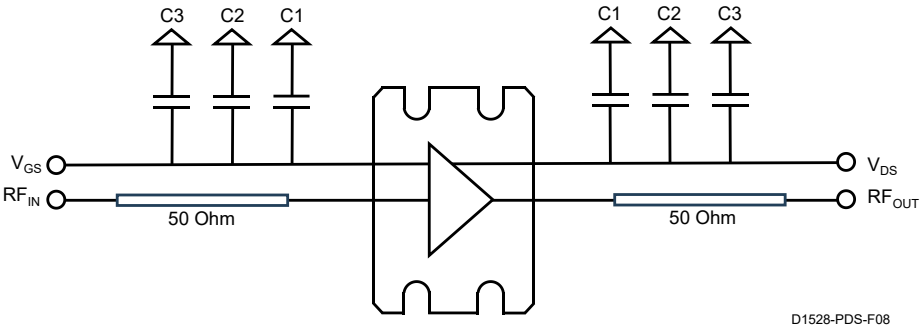
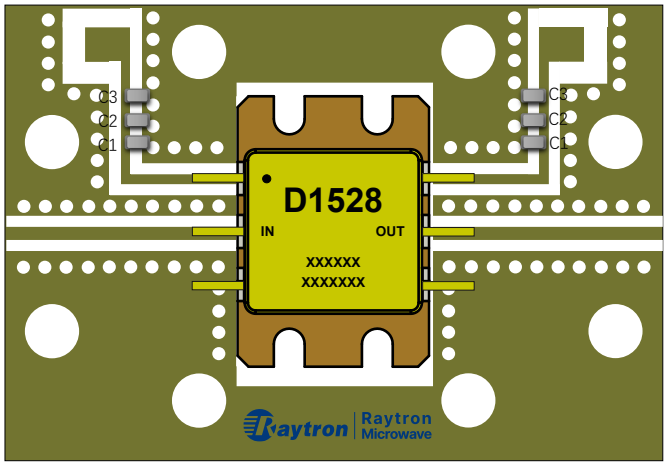


Figure 8. D1528 DEMO_A Application Circuit Schematic

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



D1528-PDS-F09

Figure 9. D1528 Application Circuit Layout
（DEMO_A Size: 5.8cm x 4.0cm）

Table 10. Bill of Materials

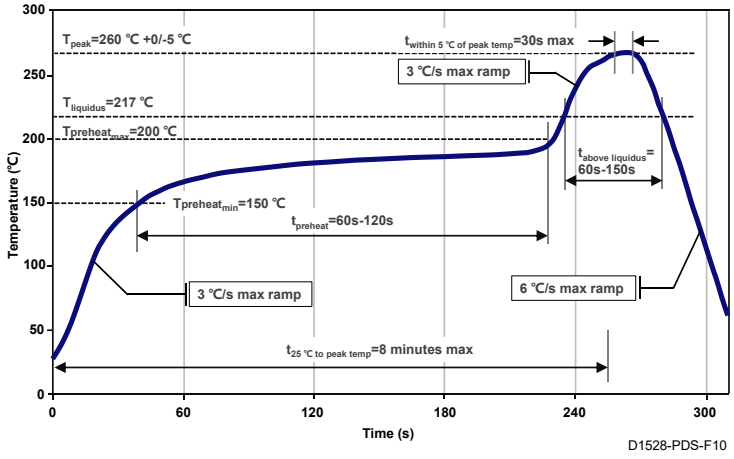
Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	100.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E101JB12
C2	10.0nF	X7R 100V 0603 Capacitor	Murata	GCM188R72A103KA37D
C3	1.0uF	X7R 100V 1210 Capacitor	Murata	GRM3195C2A104JA01

12. DEMO Summary

Table 11. DEMO Summary

NO.	D1528 DEMO Name	V_{DS} (V)	Freq. (GHz)	Linear Gain (dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency (%)	Pulse or CW
1	DEMO_A, 50W	28	3.6-4.0	16.1	47.0	50	61.3	CW

13. Recommended Solder Temperature Profile



D1528-PDS-F10

Figure 10. 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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