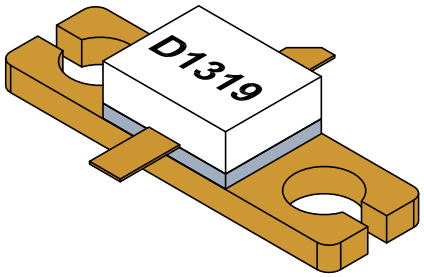
1. Description

- The D1319 is a 30W (P_{SAT}) wideband unmatched gallium nitride (GaN) high electron mobility transistor (HEMT) with first generation RF GaN technology from Raytron.
- The D1319 operates from DC to 8GHz with a 28V supply rail. The device is offered in an industry standard air cavity package.



D1319-PDS-F01

Figure 1. D1319 Package Outline

2. Applications

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

3. Features[1]

- Operating Frequency: DC-8GHz
- Output Power (P_{SAT}): 45.2dBm (33W)
- Linear Gain: 12.5dB
- Typical DE @ P_{SAT}: 53.8%
- Operating Voltage: 28V
- CW and Pulse Capable
- Package Type: 200F-A

[1] Measured in Raytron DEMO @5.0GHz

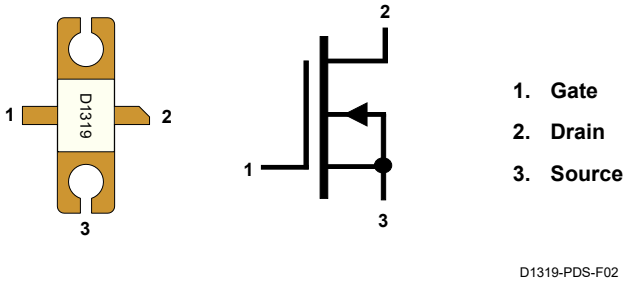
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	5.0GHz	Units
Linear Gain	12.5	dB
Drain Efficiency	53.8	%
Output Power	45.2	dBm

- Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 150mA, V_{GS} = -2.63V
- Test Condition: CW

5. Block Diagram



D1319-PDS-F02

Figure 2. D1319 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}	6.72	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}	-	100	-	mA
Gate-Source Voltage, V_{GS}	-	-2.63	-	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)	3.30	°C/W
Thermal Resistance (Junction-to-Case)[2]	R_{thjc} (FEA)	4.38	°C/W

1. Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 23.0W

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} = 6.72mA)	$V_{DS(BR)}$	84	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	7.73	-	A
Gate Threshold Voltage[3] (V_{DS} = 28V, I_{DS} = 6.72mA)	$V_{GS(TH)}$	-3.30	-2.80	-2.30	V
Gate Quiescent Voltage[3] (V_{DS} = 28V, I_{DS} = 150mA)	$V_{GS(Q)}$	-	-2.63	-	V

1. Measured on wafer prior to packaging
2. Measured with packaged device
3. Measured in Raytron DEMO

Table 6. RF Characteristics[1]

Test Method	Parameter	Symbol	Min.	Typ.	Max.	Units
DEMO[2] @5.0GHz	Linear Gain	G_{LIN}	-	12.5	-	dB
	Drain Efficiency	η_D	-	53.8	-	%
	Output Power	P_{SAT}	-	45.2	-	dBm

1. Test Condition: CW
2. Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 150mA, V_{GS} = -2.63V

Table 7. Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Input Capacitance	C_{GS}	-	7.07	-	pF
Output Capacitance	C_{DS}	-	2.83	-	pF
Feedback Capacitance	C_{GD}	-	0.53	-	pF

- Test Condition: V_{DS} = 28V, V_{GS} = -8V, f = 1MHz

9. Wide-band Application Performance

■ Wide-band Application Performance (DEMO_A: 4.9-5.2GHz)

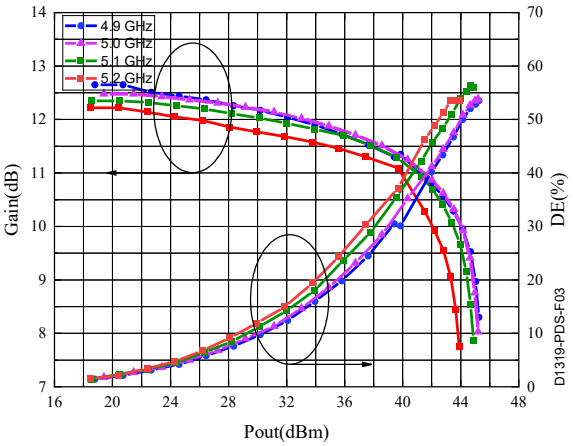


Figure 3. CW Gain and DE vs. Output Power

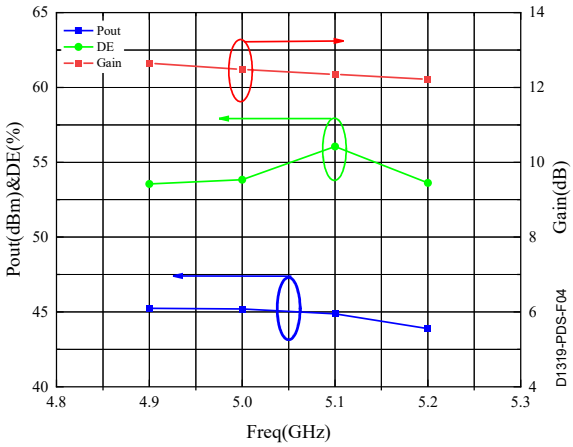


Figure 4. Wide-band Application Gain and DE vs. Freq.

Table 8. RF Characteristics @ DEMO_A

Freq. (GHz)	Linear Gain (dB)	Power Gain (dB)	Drain Efficiency (%)	Output Power (dBm)	Output Power (W)
4.9	12.7	8.7	53.6	45.2	33
5.0	12.5	8.5	53.8	45.2	33
5.1	12.4	8.4	56.1	44.9	31
5.2	12.2	8.2	53.6	43.9	25

- Typical Class AB performance in Raytron Wide-band Application DEMO_A, test condition: V_{DS} = 28V, I_{DS} = 150mA, V_{GS} = -2.63V
- Test Condition: CW
- The output power is 43.9dBm (25W) at 4.9-5.2GHz.

■ Wide-band Application Performance (DEMO_B: 5.6-6GHz)

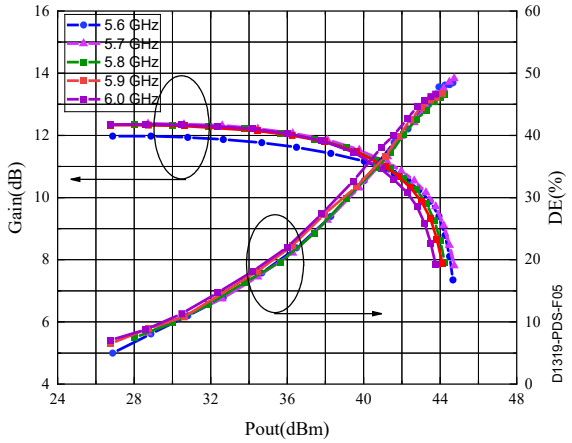


Figure 5. CW Gain and DE vs. Output Power

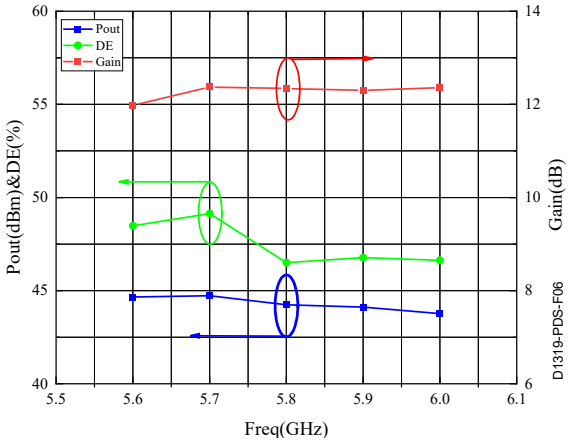


Figure 6. Wide-band Application Gain and DE vs. Freq.

Table 9. RF Characteristics @ DEMO_B

Freq. (GHz)	Linear Gain (dB)	Power Gain (dB)	Drain Efficiency (%)	Output Power(dBm)	Output Power(W)
5.6	12.0	8.0	48.5	44.7	30
5.7	12.4	8.4	49.1	44.7	30
5.8	12.3	8.3	46.5	44.2	26
5.9	12.3	8.3	46.8	44.1	26
6.0	12.4	8.4	46.6	43.8	24

- Typical Class AB performance in Raytron Wide-band Application DEMO_B, test condition: V_{DS} = 28V, I_{DS} = 150mA, V_{GS} = -2.63V
- Test Condition: CW
- The output power is 43.8dBm (24W) at 5.6-6GHz.

10. Package Outline

■ Pin Layout

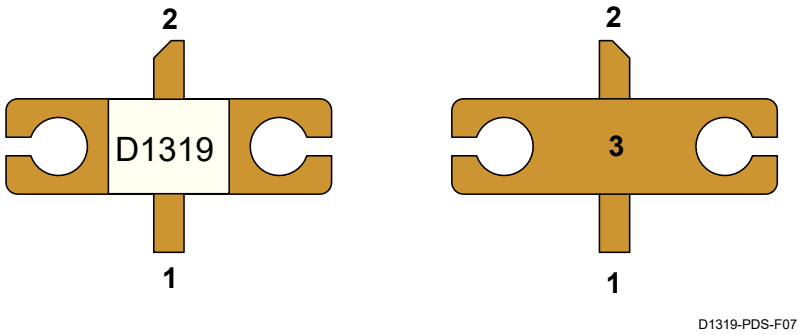


Figure 7. D1319 Pin Layout

Table 10. Pin Description

Pin	Symbol	Description
1	V_G / RF IN	Gate voltage / RF Input
2	V_D / RF OUT	Drain voltage / RF Output
3	Flange	Source to be Connected to Ground

■ Mechanical Drawing (Package Type: 200F-A)

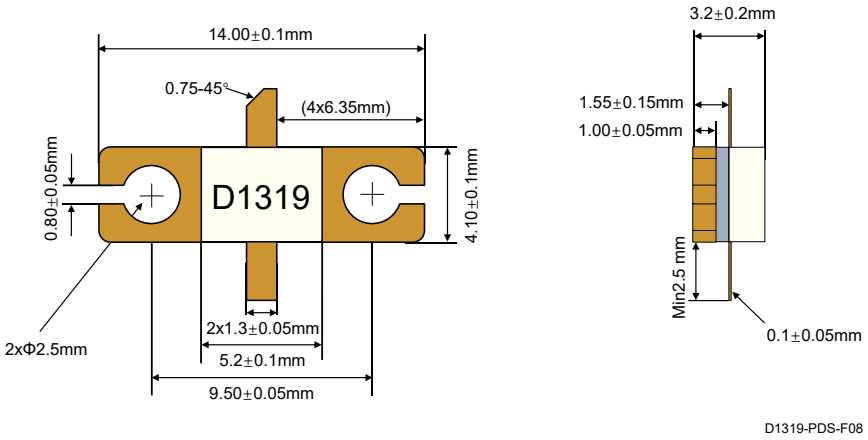


Figure 8. D1319 Mechanical Drawing

11. Application Circuit

■ Schematic

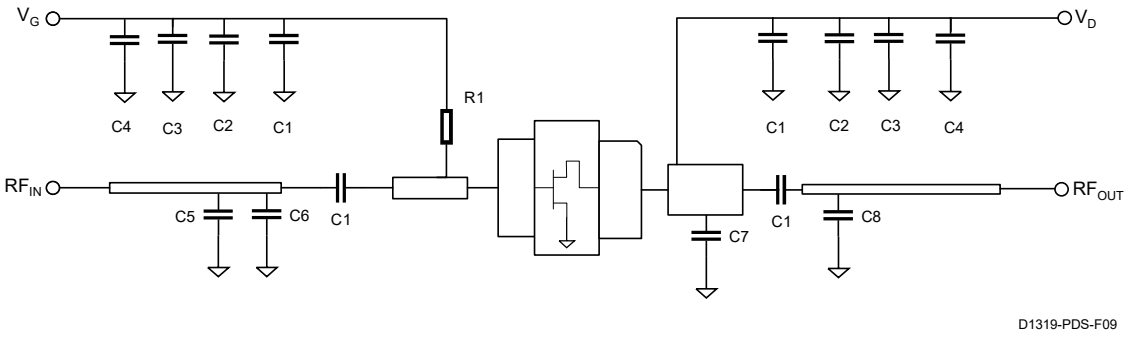


Figure 9. D1319 DEMO_A Application Circuit Schematic

Table 11. 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

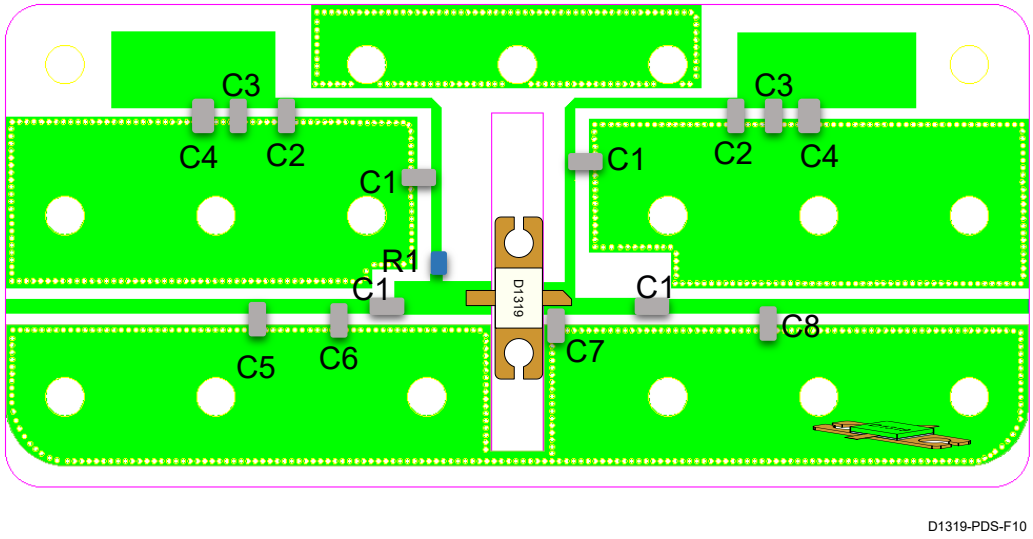


Figure 10. D1319 DEMO Application Circuit Layout
(DEMO_A Effective Size: 4.5 x 2.4cm)

Table 12. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	1.9pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E1R9BB12
C2	100.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E101JB12D
C3	1000.0pF	X7R 100V 0603 Capacitor	Murata	GCM1885C2A102JA16D
C4	4.7uF	X7R 100V 1210 Capacitor	Murata	GRM31CC72A475KE11L
C5	0.6pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2ER60WB12
C6	0.2pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2ER20WB12
C7	0.7pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2ER70WB12
C8	0.2pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2ER20WB12
R1	10Ω	1/8W 0805 Resistor	Yageo	AT0805BRD0710RL

12. DEMO Summary

Table 13. DEMO Summary

NO.	D1319 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency	Pulse or CW
1	DEMO_A, 25W	28	4.9-5.2	12.2	43.9	25	54%	CW
2	DEMO_B, 20W	28	5.6-6.0	12.0	43.8	24	47%	CW
3	DEMO_C, 20W	28	5.9-6.4	10.6	43.6	23	41%	CW

13. Recommended Solder Temperature Profile

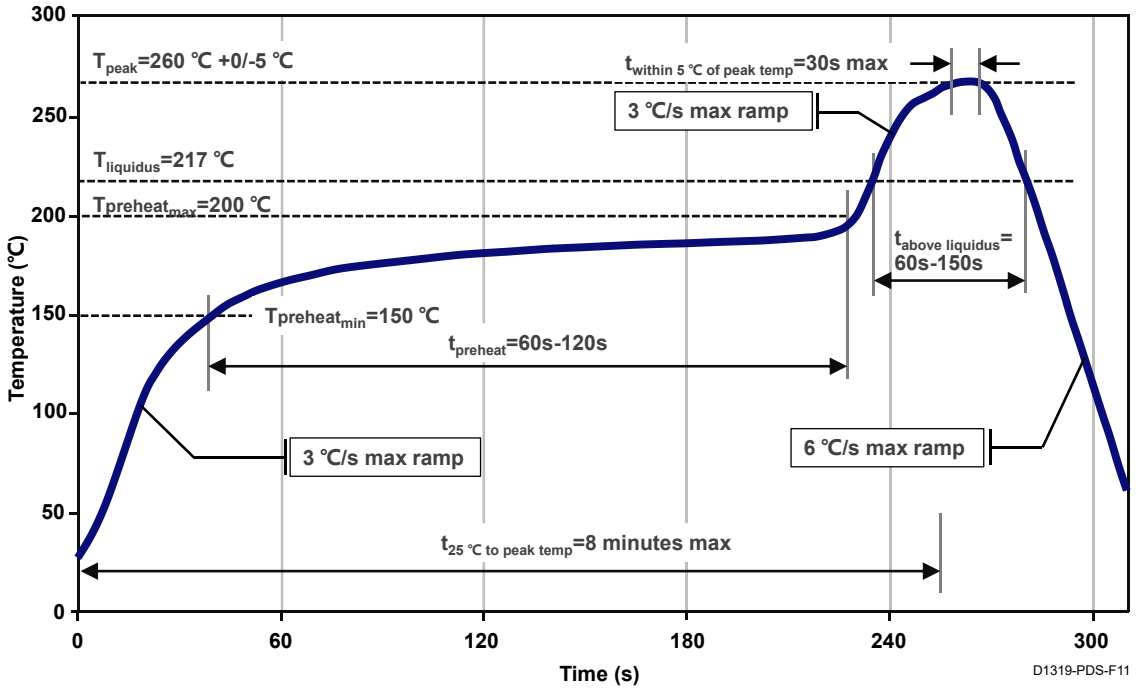


Figure 11. Recommended Solder Temperature Profile

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.



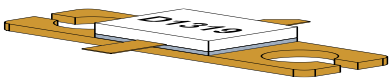
15. Contact Information

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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