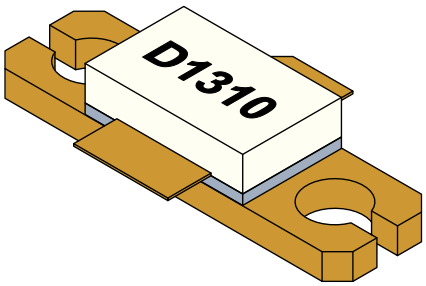
1. Description

- The D1310 is a 50W (P_{SAT}) wideband pre-matched gallium nitride (GaN) high electron mobility transistor (HEMT) with first generation RF GaN technology from Raytron.
- The D1310 operates from DC to 6.5GHz with a 28V supply rail. It can deliver 35W CW power across the 5 to 6 GHz. The device is offered in an industry standard air cavity package.



D1310-PDS-F01

Figure 1. D1310 Package Outline

2. Applications

- Point-to-point Communication
- Broadband Wireless Access
- 5.8GHz ISM Applications

3. Features[1]

- Operating Frequency: DC–6.5GHz
- Output Power[1] (P_{SAT}): 47.5 dBm (56W)
- Linear Gain[1]: 16.7dB
- Typical DE @P_{SAT}[1]: 61.5%
- Operating Voltage: 28V
- CW and Pulse Capable
- Package Type: 360F-C

[1] Measured in Raytron DEMO @6GHz

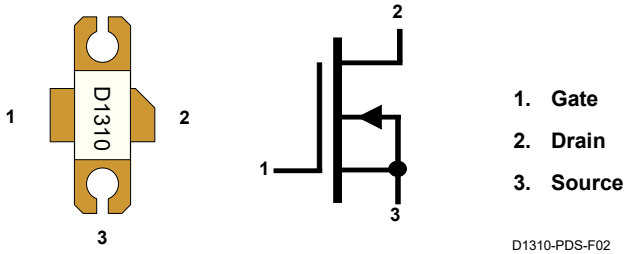
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	5.0GHz		5.5GHz		6.0GHz		Units
	Pulse	CW	Pulse	CW	Pulse	CW	
Linear Gain	16.2	15.8	17.5	17.1	16.9	16.7	dB
Drain Efficiency	69.6	66.2	65.6	61.0	63.9	61.5	%
Output Power	46.4	46.2	46.3	45.9	45.8	45.7	dBm
Output Power	44	42	42	39	38	37	W

- Typical Class AB performance in DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 90mA, V_{GS} = - 3.07V
- Pulse Test Condition: CW and Pulse

5. Block Diagram



D1310-PDS-F02

Figure 2. D1310 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}	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
Drain-Source Voltage Range, V_{DS}	-	28	32	V
Drain Bias Current, I_{DS}	-	90	-	mA
Gate-Source Voltage, V_{GS}	-	-3.07	-	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℃, P_D = 45.0W
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} = 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} = 90mA)	$V_{GS(Q)}$	-	-3.07	-	V

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

Table 6. Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Input Capacitance	C_{GS}	-	30.8	-	pF
Output Capacitance	C_{DS}	-	12.7	-	pF
Feedback Capacitance	C_{GD}	-	0.8	-	pF

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

9. Wide-band Application Performance

■ Wide-band Application Performance (DEMO_A, 5.0-6.0GHz, Pulse)

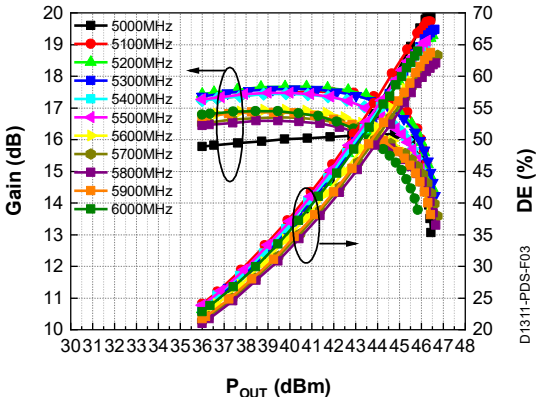


Figure 3. Pulse Gain and DE vs. Output Power

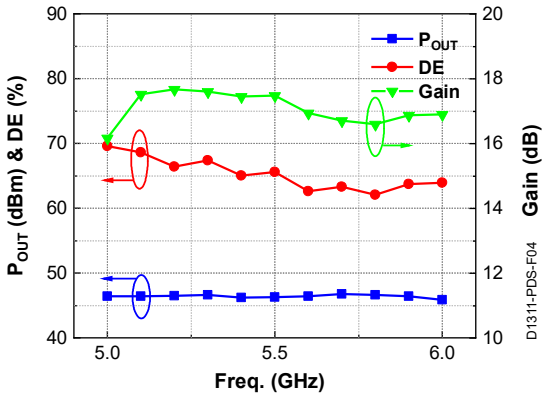


Figure 4. Pulse Gain and DE vs. Freq.

Table 7. RF Characteristics

Freq. (GHz)	Linear Gain (dB)	Drain Efficiency (%)	Output Power (dBm)	Output Power (W)
5.0	16.2	69.6	46.4	44
5.1	17.5	68.6	46.4	44
5.2	17.7	66.4	46.5	45
5.3	17.6	67.4	46.6	46
5.4	17.5	65.0	46.2	42
5.5	17.5	65.6	46.3	42
5.6	16.9	62.6	46.4	44
5.7	16.7	63.3	46.7	47
5.8	16.6	62.1	46.7	46
5.9	16.9	63.7	46.4	44
6.0	16.9	63.9	45.8	38

• Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 90mA, V_{GS} = -3.07V

• Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

• The output power is 45.8dBm (38W) at 5.0-6.0GHz.

■ Wide-band Application Performance (DEMO_A, 5.0-6.0GHz, CW)

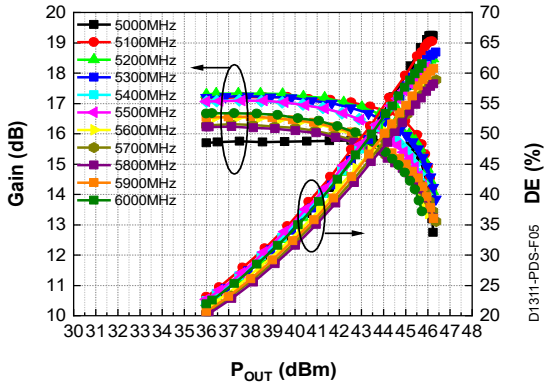


Figure 5. CW Gain and DE vs. Output Power

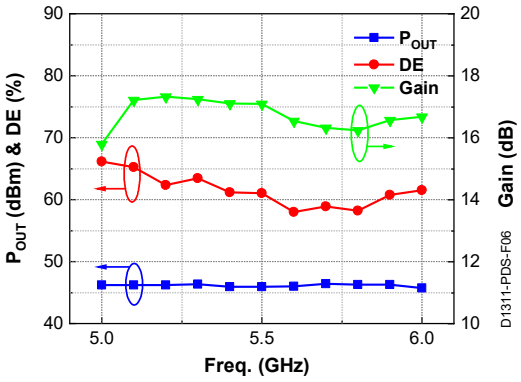


Figure 6. CW Gain and DE vs. Freq

Table 8. RF Characteristics

Freq. (GHz)	Linear Gain (dB)	Drain Efficiency (%)	Output Power (dBm)	Output Power (W)
5.0	15.8	66.2	46.2	42
5.1	17.2	65.3	46.2	42
5.2	17.3	62.3	46.2	42
5.3	17.2	63.5	46.2	43
5.4	17.1	61.2	46.4	39
5.5	17.1	61.0	45.9	39
5.6	16.5	58.0	45.9	40
5.7	16.3	58.9	46.0	43
5.8	16.2	58.2	46.4	42
5.9	16.6	60.8	46.3	42
6.0	16.7	61.5	48.6	37

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 90mA, V_{GS} = -3.07V
- Test Condition: CW
- The output power is 45.7dBm (37W) at 5.0-6.0GHz.

10. Package Outline

■ Pin Layout

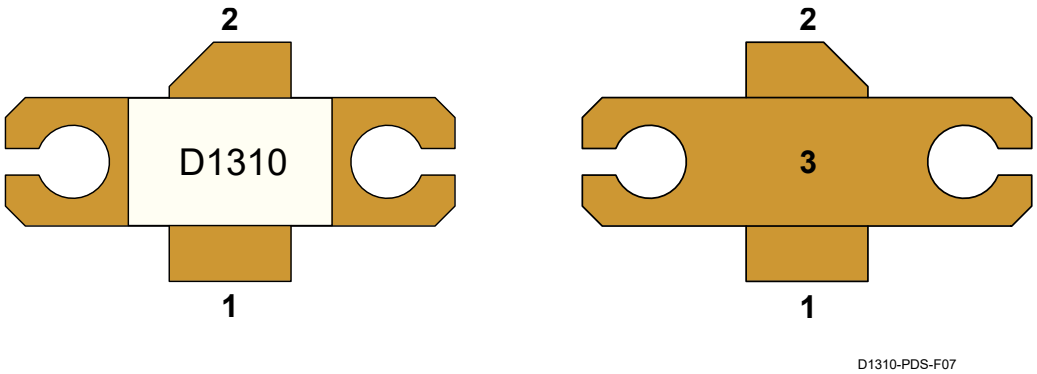


Figure 7. D1310 Pin Layout

Table 9. 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: 360F-C)

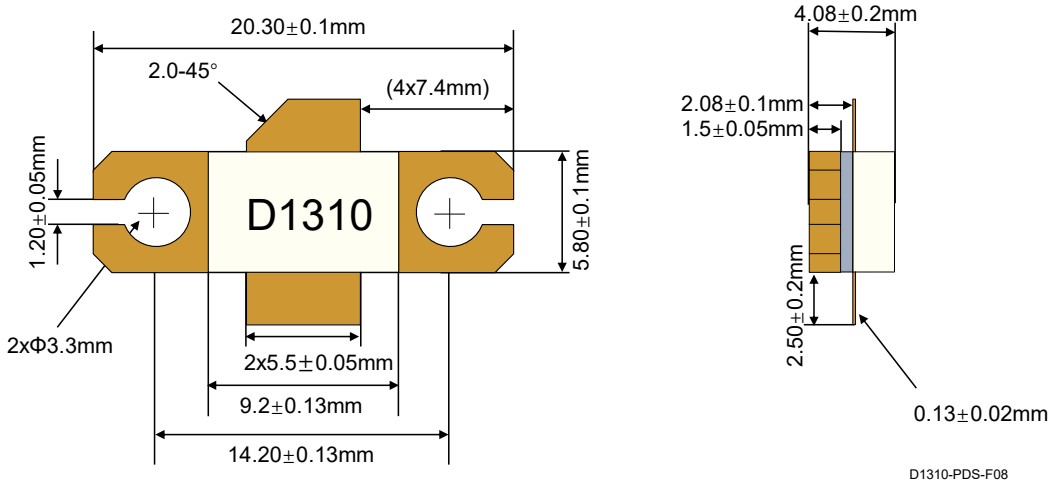


Figure 8. D1310 Mechanical Drawing

11. Application Circuit

■ Schematic

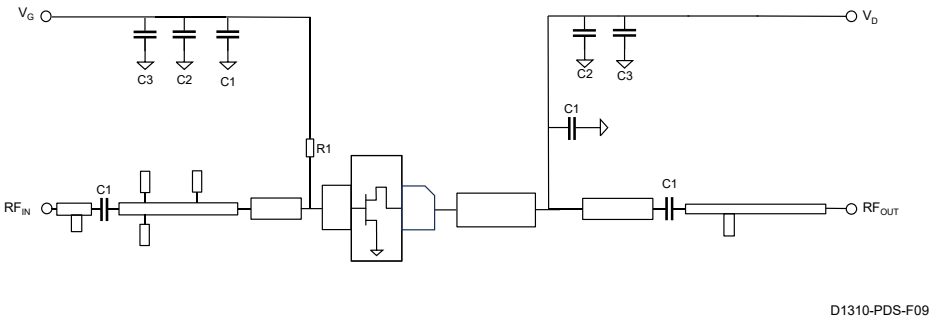


Figure 9. D1310 DEMO_A Application Circuit Schematic

Table 10. 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

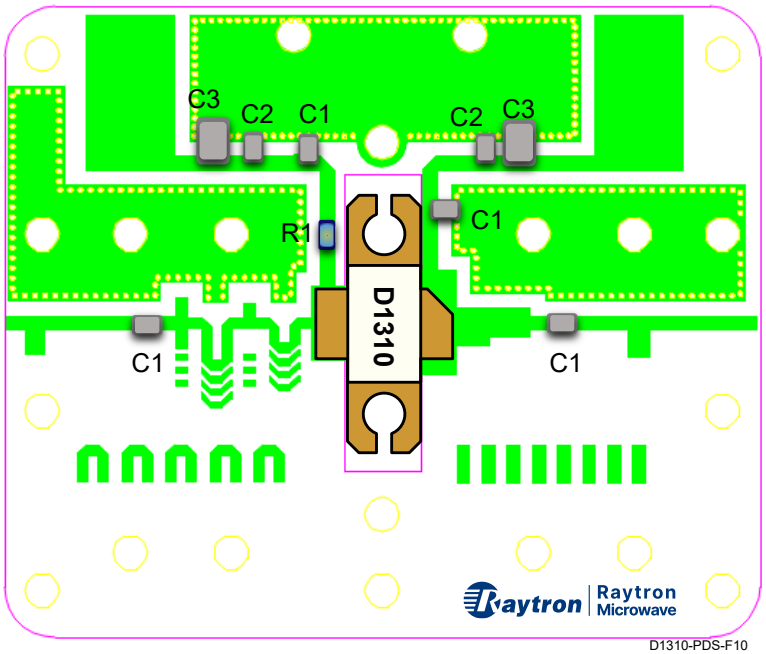


Figure 10. D1310 Application Circuit Layout (5.0GHz-6.0GHz)

（DEMO_A Size: 6.0cm x 5.0cm）

Table 11. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	2.3pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E2R3BB12
C2	1nF	C0G 250V 0805 Capacitor	Murata	GRM21A5C2E102JWA1D
C4	10.0uF	X7R 100V 1210 Capacitor	Murata	GRM32EC72A106KE05L
R1	15Ω	1/8W 0805 Resistor	Yageo	RC0805FR-0715RL

12. DEMO Summary

Table 12. DEMO Summary

NO.	D1310 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency	Pulse or CW
1	DEMO_A, 35W	28	5.0-6.0	15.8	45.7	37	58.0%	CW

13. Recommended Solder Temperature Profile

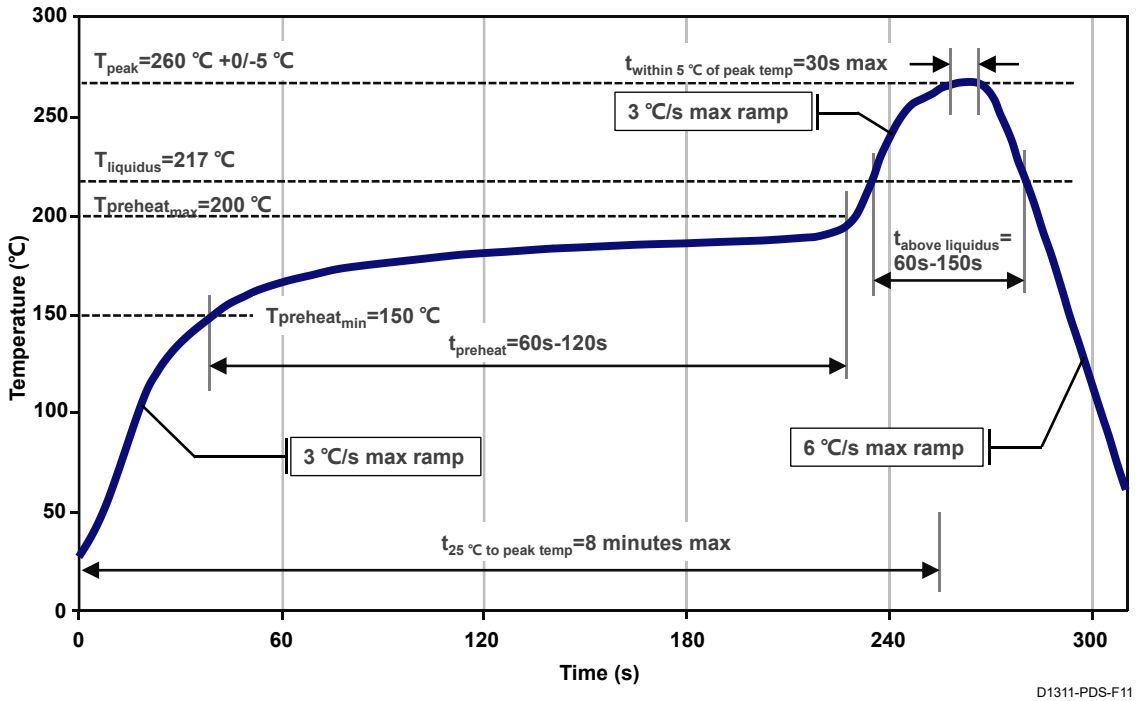


Figure 11. Recommended Solder Temperature Profile

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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