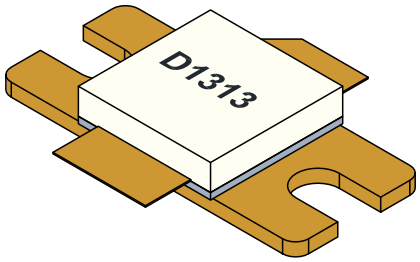
1. Description

- The D1313 is a 130W (P_{SAT}) wideband pre-matched gallium nitride (GaN) high electron mobility transistor (HEMT).
- The D1313 operates from DC to 3GHz with a 28V supply rail. The device is offered in an industry standard air cavity package.



D1313-PDS-F01

Figure 1. D1313 Package Outline

2. Applications

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

3. Features[1]

- Operating Frequency: DC–3GHz
- Output Power (P_{SAT}): 51.8dBm (151W)
- Linear Gain: 20.0dB
- Typical DE @P_{SAT}: 74.7%
- Operating Voltage: 28V
- CW and Pulse Capable
- Package Type: 400F-A

[1] Measured in Raytron DEMO @2.6GHz

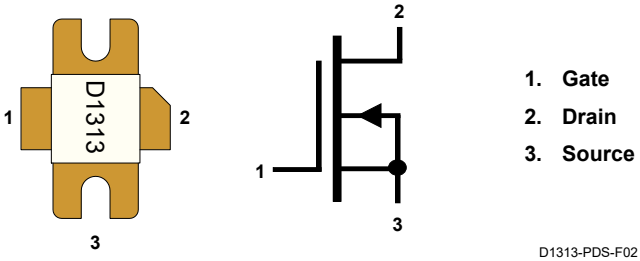
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	1.3GHz	1.6GHz	1.95GHz	Units
Linear Gain	16.5	16.3	17.0	dB
Drain Efficiency	70.0	74.9	80.2	%
Output Power	51.2	51.3	51.0	dBm
Output Power	132	135	126	W

- Typical Class AB performance in Raytron DEMO_A (1.3-1.95GHz) with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 300mA, V_{GS} = -2.63V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

5. Block Diagram



D1313-PDS-F02

Figure 2. D1313 Block Diagram

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6. Absolute Maximum Ratings

Table 2. Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DSS}	120	V
Gate-Source Voltage	V_{GS}	-10 ~ +1	V
Operating Voltage	V_{DS}	10 ~ +40	V
Maximum Forward Gate Current	I_{GMax}	24.80	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	40	V
Drain Bias Current, I_{DS}	-	300	-	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)	1.04	°C/W
Thermal Resistance (Junction-to-Case)[2]	R_{thjc} (FEA)	1.35	°C/W

[1]. Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 76.0W

[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} = 24.8mA)	$V_{DS(BR)}$	120	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	27.40	-	A
Gate Threshold Voltage[3] (V_{DS} = 28V, I_{DS} = 24.8mA)	$V_{GS(TH)}$	-3.30	-2.80	-2.30	V
Gate Quiescent Voltage[3] (V_{DS} = 28V, I_{DS} = 300mA)	$V_{GS(Q)}$	-	-2.63	-	V

[1]. Measured on wafer prior to packaging

[2]. Measured with packaged device

[3]. Typical Class AB performance in Raytron DEMO

Table 6. RF Characteristics @ DEMO_A [1,2]

Parameter	1.3GHz	1.4GHz	1.5GHz	1.6GHz	1.7GHz	1.8GHz	1.95GHz	Units
Linear Gain	16.5	16.6	16.4	16.3	16.4	16.8	17.0	dB
Drain Efficiency	70.0	70.9	72.9	74.9	75.1	74.7	80.2	%
Output Power	51.2	51.0	51.0	51.2	51.1	51.2	51.0	dBm
Output Power	132	126	126	132	129	132	126	W

[1]. Typical Class AB performance in Raytron DEMO_A (1.3-1.95GHz) with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 300mA, V_{GS} = -2.63V

[2]. Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

Table 7. Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Input Capacitance	C_{GS}	-	88.95	-	pF
Output Capacitance	C_{DS}	-	11.18	-	pF
Feedback Capacitance	C_{GD}	-	1.40	-	pF

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

9. Wide-band Application Performance

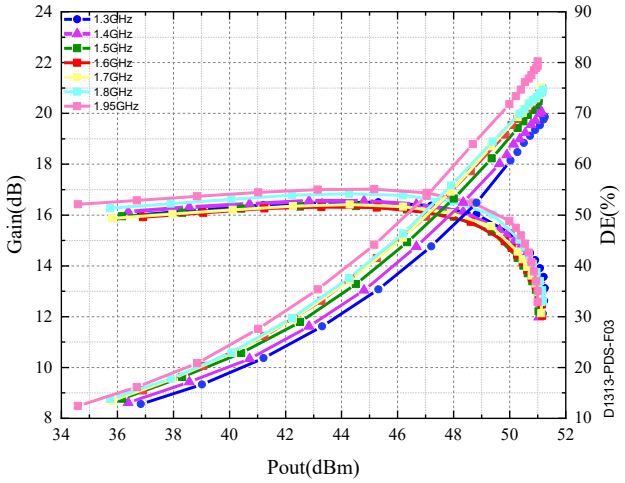


Figure 3. Gain and DE vs. Output Power

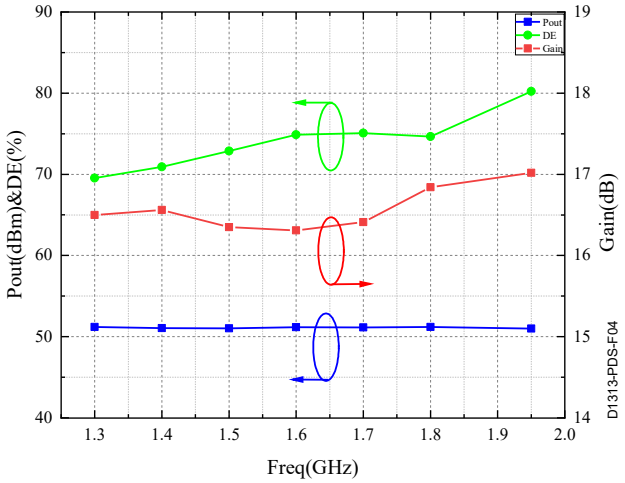


Figure 4. Gain and DE vs. Freq.

- Typical Class AB performance in Raytron Wide-band Application DEMO_A (1.3-1.95GHz) with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 300mA, V_{GS} = -2.63V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%
- The output power is 51.0dBm (126W) at 1.3-1.95GHz. It can be used in the avionics and L band radar application.

10. Package Outline

■ Pin Layout

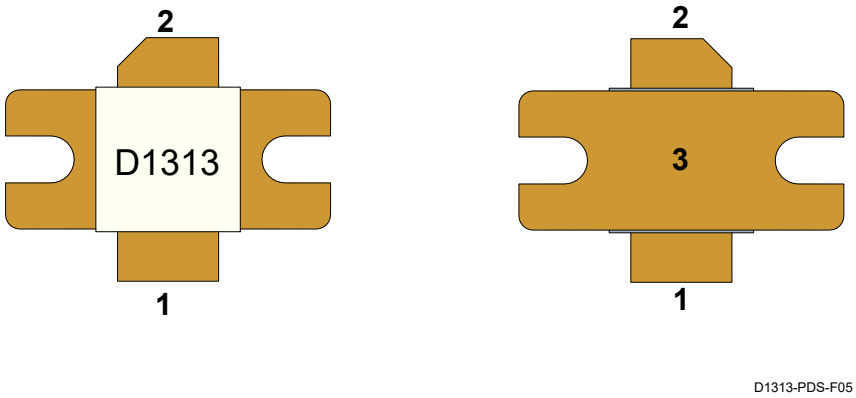


Figure 5. D1313 Pin Layout

Table 8. 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: 400F-A)

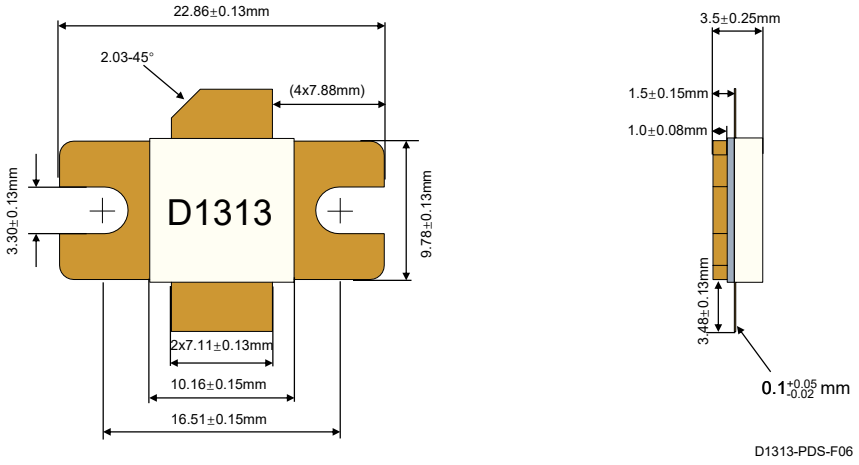


Figure 6. D1313 Mechanical Drawing

11. Application Circuit

■ Schematic

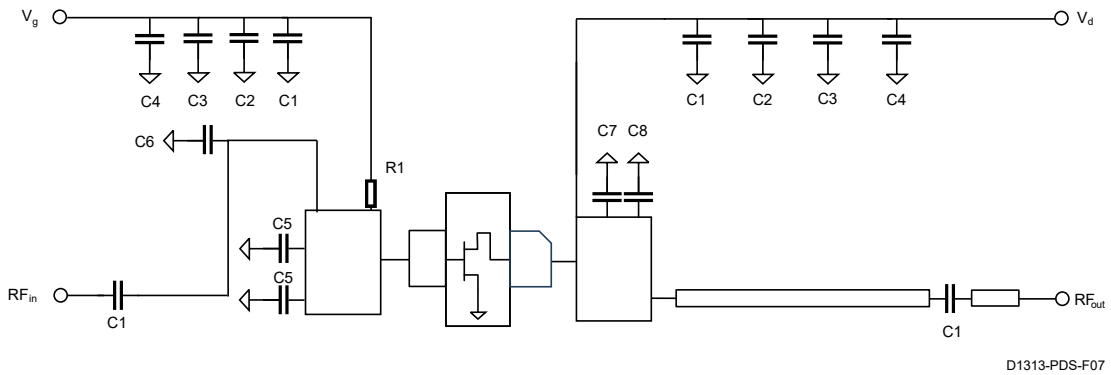


Figure 7. D1313 DEMO_A Application Circuit Schematic (1.3-1.95GHz)

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

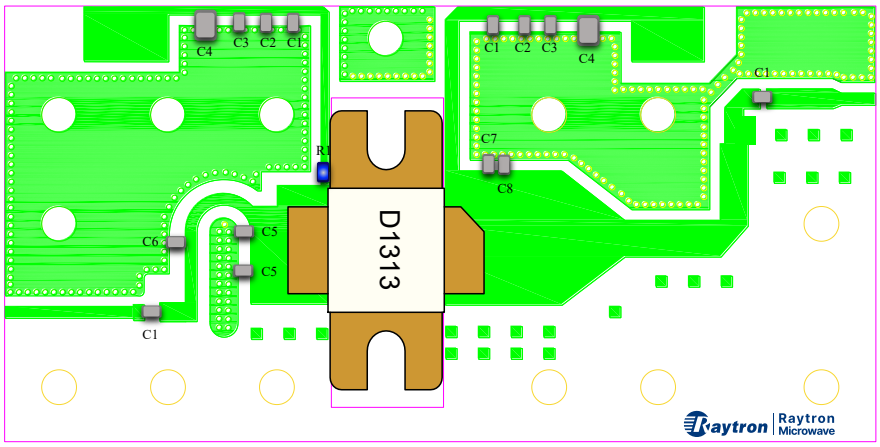


Figure 8. D1313 Application Circuit Layout (1.3-1.95GHz)
(DEMO_A Size: 8.0cm x 4. 0cm)

Table 10. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	25.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E250GB12D
C2	100.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E101JB12D
C3	10000.0pF	X7R 100V 0603 Capacitor	Murata	GCM188R72A102KA37D
C4	1.0uF	X7R 100V 1210 Capacitor	Murata	GRM32ER72A105KA01L
C5	1.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E1R5BB12D
C6	2.3pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E2R3BB12D
C7	2.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E2R0BB12D
C8	0.8pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2ER80WB12D
R1	10Ω	1/8W 0805 Resistor	Yageo	RC0805FR-0710RL

12. DEMO Summary

Table 11. DEMO Summary

NO.	D1313 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency	Pulse or CW
1	DEMO_A, 125W	28	1.3-1.95	16.3	51.0	125	70.0%	Pulse
2	DEMO_B, 130W	28	2.0-2.65	13.6	50.7	117	64.8%	CW
3	DEMO_C, 135W	32	1.2-1.55	18.6	51.3	135	64.9%	Pulse
4	DEMO_D, 105W	28	1.1-1.7	16.3	50.2	105	57.3%	CW

13. Recommended Solder Temperature Profile

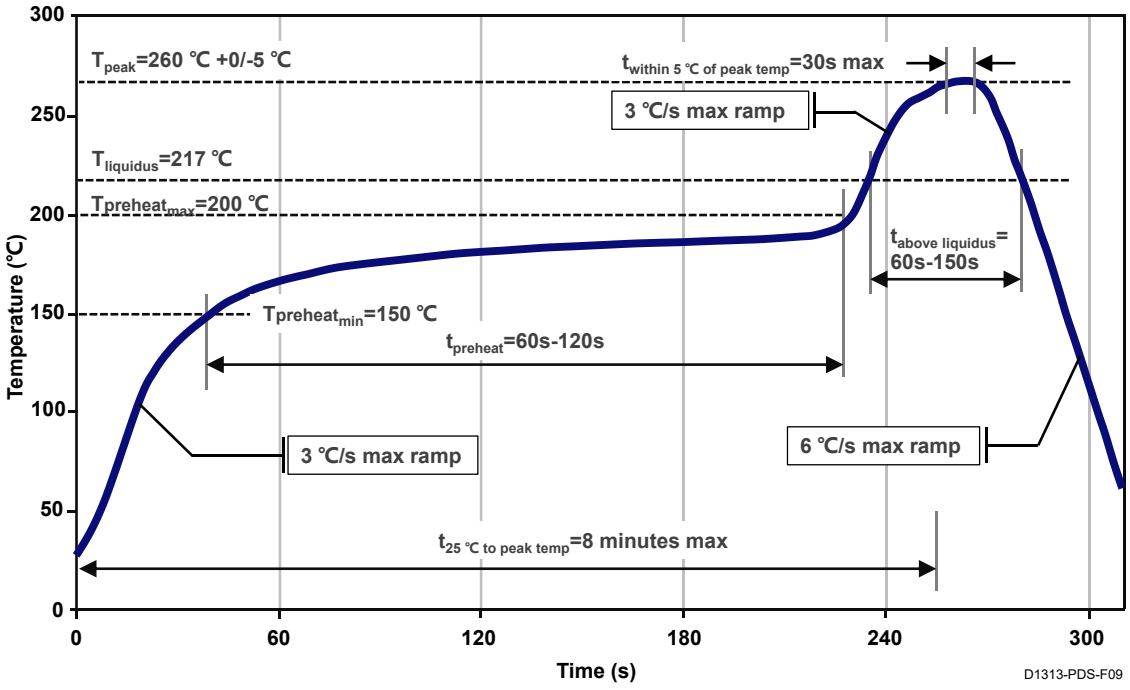


Figure 9. Recommended Solder Temperature Profile

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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