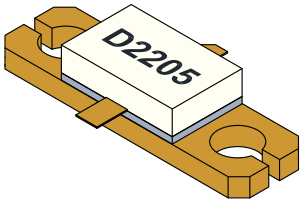
1. Description

- The D2205 is a 100W (P_{SAT}) wideband unmatched gallium nitride (GaN) high electron mobility transistor (HEMT) with first generation RF GaN technology from Raytron.
- The D2205 operates from DC to 6GHz with a 48V supply rail. The device is offered in an industry standard air cavity package.



D2205-PDS-F01

Figure 1. D2205 Package Outline

2. Applications

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

3. Features

- Operating Frequency: DC–6GHz
- Output Power[1] (P_{SAT}): 50.4dBm (110W)
- Linear Gain[1]: 23.0dB
- Typical DE @P_{SAT}[1]: 80.5%
- Operating Voltage: 48V
- CW and Pulse Capable
- Package Type: 360F-A

[1] Measured in Raytron DEMO @1.2GHz

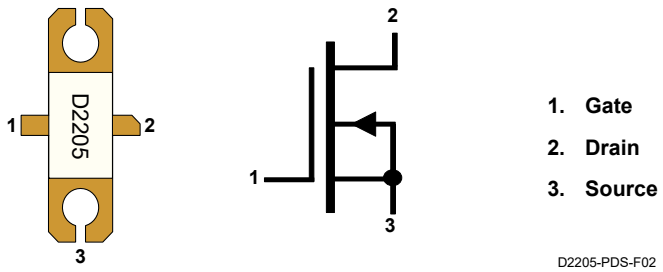
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	1.2GHz	Units
Linear Gain	23.0	dB
Drain Efficiency	80.5	%
Output Power	50.4	dBm

- Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 48, I_{DS} = 200mA, V_{GS} = -3.1V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

5. Block Diagram



D2205-PDS-F02

Figure 2. D2205 Block Diagram

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6. Absolute Maximum Ratings

Table 2. Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DSS}	150	V
Gate-Source Voltage	V_{GS}	-10 ~ 1	V
Operating Voltage	V_{DS}	10 ~ 55	V
Maximum Forward Gate Current	I_{GMax}	11.8	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}	-	48	55	V
Drain Bias Current, I_{DS}	-	200	-	mA
Gate-Source Voltage, V_{GS}	-	-3.1	-	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)	2.7	°C/W
Thermal Resistance (Junction-to-Case)[2]	R_{thjc} (FEA)	3.5	°C/W

1. Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 42.0W

2. Thermal Resistance at average power by Finite Element Analysis, Junction-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 42.0W

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} = 11.8mA)	$V_{DSS(BR)}$	150	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	10.65	-	A
Gate Threshold Voltage[3] (V_{DS} = 48V, I_{DS} = 11.8mA)	$V_{GS(TH)}$	-3.95	-3.30	-2.60	V
Gate Quiescent Voltage[3] (V_{DS} = 48V, I_{DS} = 200mA)	$V_{GS(Q)}$	-	-3.10	-	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

Test Method	Parameter	Symbol	Min.	Typ.	Max.	Units
DEMO[1,2] @1.2GHz	Linear Gain	G_{LIN}	-	23.0	-	dB
	Drain Efficiency	η_D	-	80.5	-	%
	Output Power	P_{SAT}	-	50.4	-	dBm

[1.] Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS} = 200mA, V_{GS} = -3.1V

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

Table 7. Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Input Capacitance	C_{GS}	-	16.47	-	pF
Output Capacitance	C_{DS}	-	5.31	-	pF
Feedback Capacitance	C_{GD}	-	1.14	-	pF

- Test Condition: V_{DS} = 48V, V_{GS} = -8V, f = 1MHz

9. Typical Performance

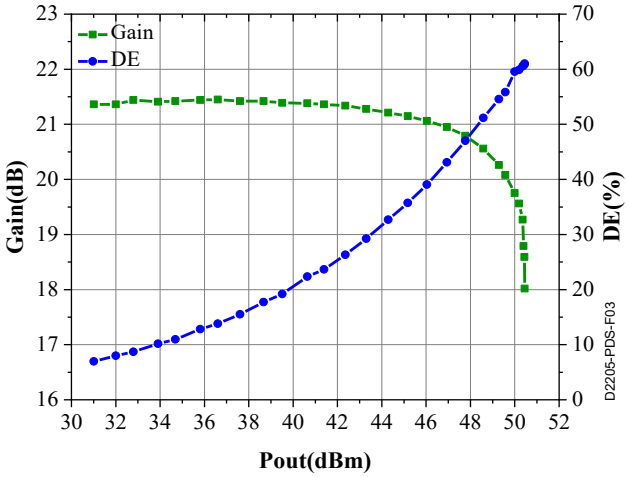


Figure 3. 1.2GHz Gain and DE @ MXP vs. Output Power

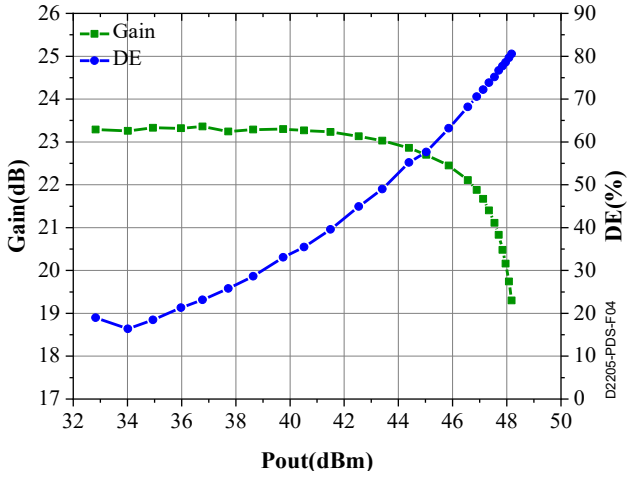


Figure 4. 1.2GHz Gain and DE @ MXE vs. Output Power

- Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS} = 200mA, V_{GS} = -3.1V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

10. Wide-band Application Performance

■ Wide-band Application Performance (DEMO_A: 0.95-1.25GHz)

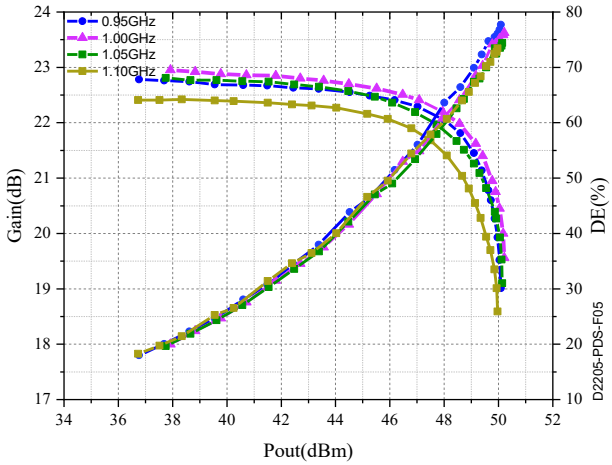


Figure 5. Wide-band Application Gain and DE vs. Output Power

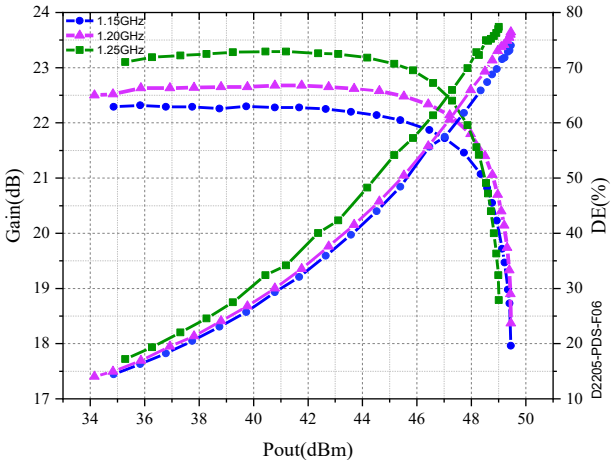


Figure 6. Wide-band Application Gain and DE vs. Output Power

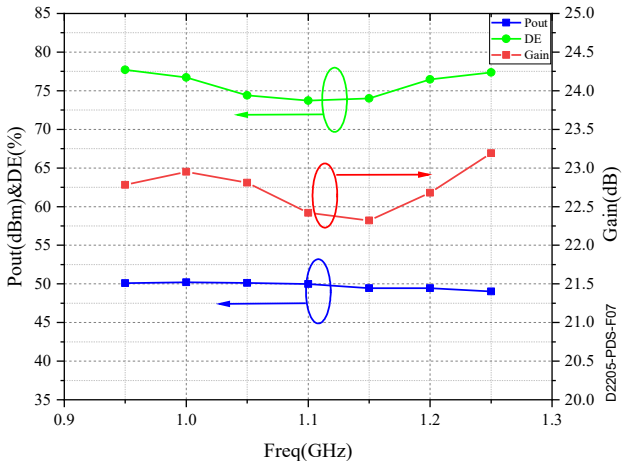


Figure 7. Wide-band Application Gain and DE vs. Freq.

- Typical Class AB performance in Raytron DEMO_A Wide-band Application with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS} = 200mA, V_{GS} = -3.1V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%
- The output power is 49.2dBm (83W) at 0.95-1.25GHz. It can be used as the driver PA in the avionics application, within L band.

11. Package Outline

■ Pin Layout

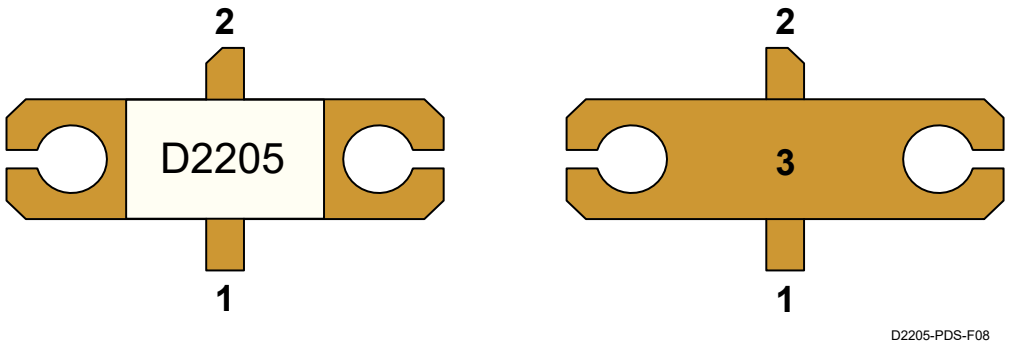


Figure 8. D2205 Pin Layout

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: 360F-A)

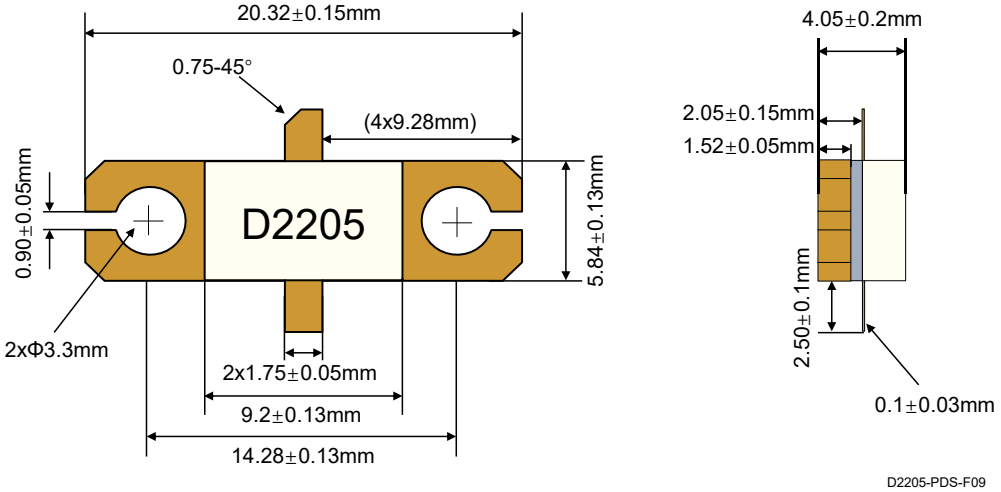


Figure 9. D2205 Mechanical Drawing

12. Wide-band Application Circuit

■ Schematic

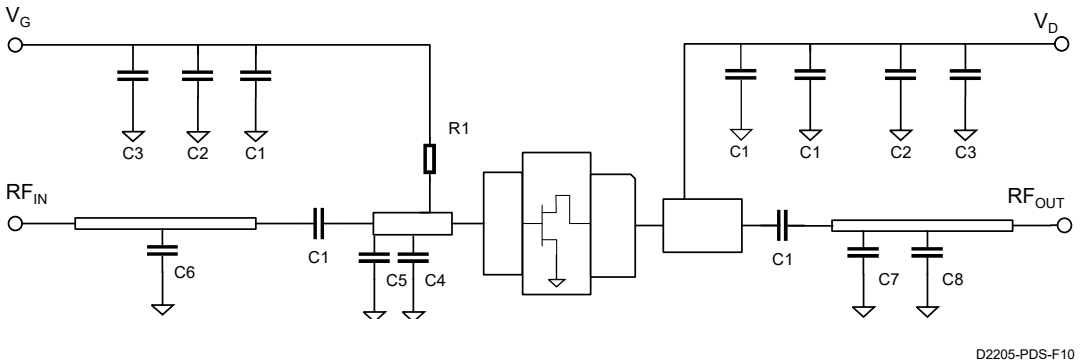


Figure 10. D2205 DEMO_A Wide-band Application Circuit Schematic

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 (48V)	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

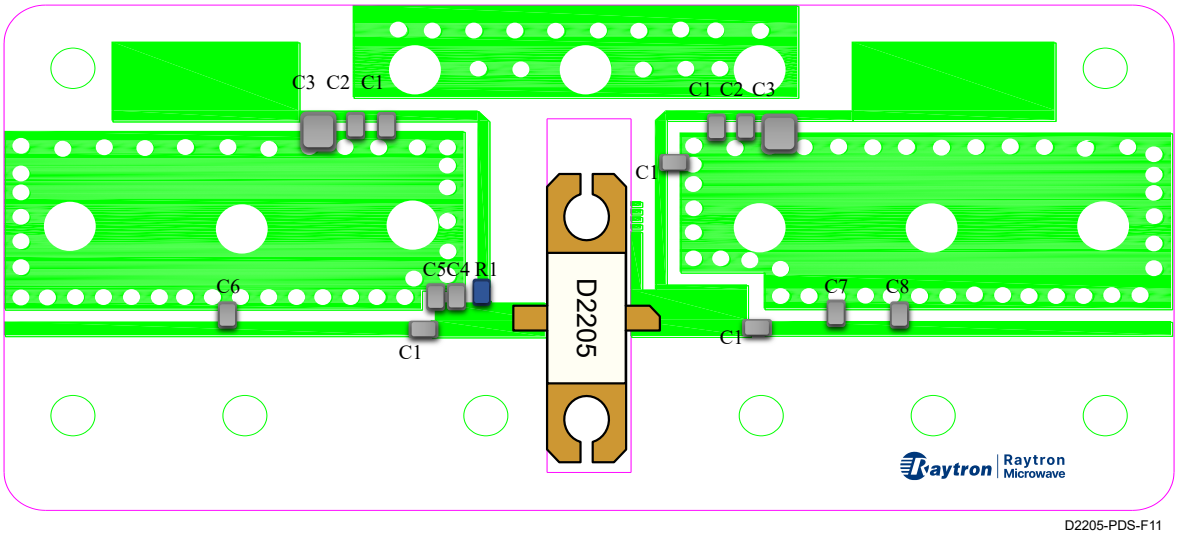


Figure 11. D2205 Wide-band Applica tion Circuit Layout
(DEMO_A Size: 8.5cm x 4.0cm)

Table 10. Bill of Materials

Component	Value	Description	Manufacturer
PCB	20mil	Rogers4350B	Rogers
C1	51.0pF	C0G 250V 0805 Capacitor	Murata
C2	10.0nF	X7R 100V 0603 Capacitor	Murata
C3	1.0uF	X7R 100V 1210 Capacitor	Murata
C4	7.0pF	C0G 250V 0805 Capacitor	Murata
C5	5.0pF	C0G 250V 0805 Capacitor	Murata
C6	1.9pF	C0G 250V 0805 Capacitor	Murata
C7	1.4pF	C0G 250V 0805 Capacitor	Murata
C8	3.0pF	C0G 250V 0805 Capacitor	Murata
R1	10Ω	1/4W 0603 Resistor	Yageo

13. DEMO Summary

Table 11. DEMO Summary

NO.	D2205 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency	Pulse or CW
1	DEMO_A, 80W	48	0.95-1.25	22.0	49.2	83	74%	Pulse

14. Recommended Solder Temperature Profile

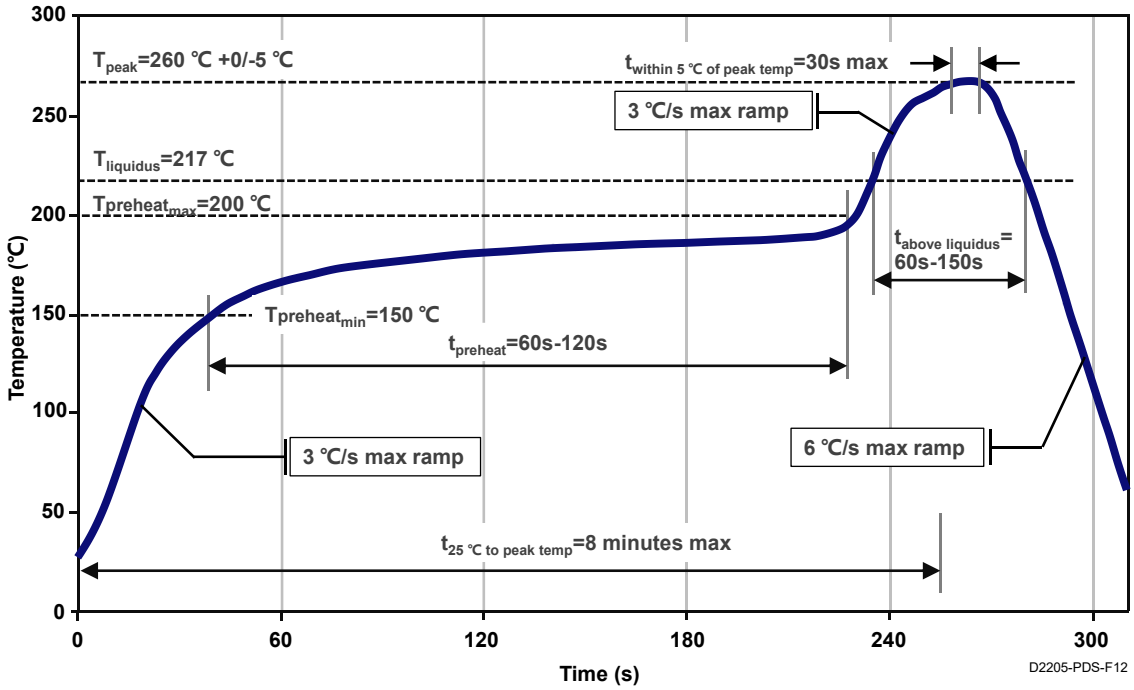


Figure 12. Recommended Solder Temperature Profile

15. 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.



16. 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

17. Disclaimer

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