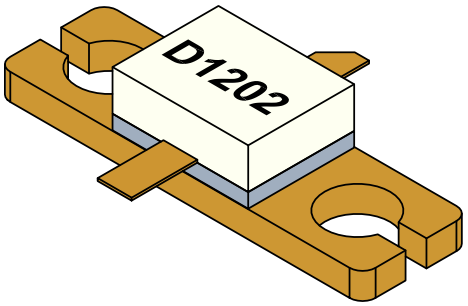
1. Description

- The D1202 is a 30W (P_{SAT}) wideband unmatched gallium nitride (GaN) high electron mobility transistor (HEMT) with first generation RF GaN technology from Raytron.
- The D1202 operates from DC to 10GHz with a 28V supply rail. The device is offered in an industry standard air cavity package.



D1202-PDS-F01

Figure 1. D1202 Package Outline

2. Applications

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

3. Features[1]

- Operating Frequency: DC-10GHz
- Output Power (P_{SAT}): 46.6dBm (45W)
- Linear Gain: 15.7dB
- Typical DE @ P_{SAT}: 80.6%
- Operating Voltage: 28V
- CW and Pulse Capable
- Package Type: 200F-A

[1] Measured in Raytron DEMO @2.6GHz

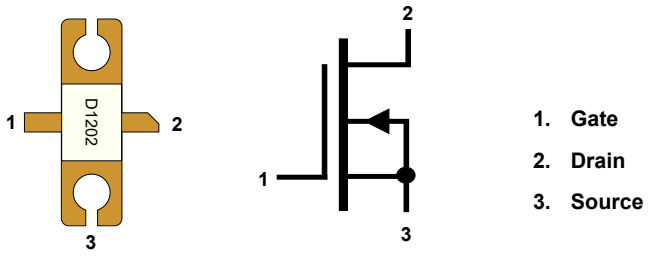
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	2.6GHz	Units
Linear Gain	15.7	dB
Drain Efficiency	80.6	%
Output Power	46.6	dBm

- Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.65V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

5. Block Diagram



D1202-PDS-F02

Figure 2. D1202 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}	-	-2.65	-	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} = 100mA)	$V_{GS(Q)}$	-	-2.65	-	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
Load-pull[2] @2.6GHz	Linear Gain	G_{LIN}	-	16.2	-	dB
	Drain Efficiency	η_D	-	84.6	-	%
	Output Power	P_{SAT}	-	46.9	-	dBm
DEMO[3] @2.6GHz	Linear Gain	G_{LIN}	-	15.7	-	dB
	Drain Efficiency	η_D	-	80.6	-	%
	Output Power	P_{SAT}	-	46.6	-	dBm

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

[2]. Typical Class AB performance is measured in Load-pull system, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.65V

[3]. Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.65V

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. Load-pull Performance

Table 8. Load-pull Performance

Parameter	Symbol	Min.	Typ.	Max.	Units
Linear Gain	G_{LIN}	-	16.2	-	dB
Drain Efficiency	η_D	-	84.6	-	%
Output Power	P_{SAT}	-	46.9	-	dBm

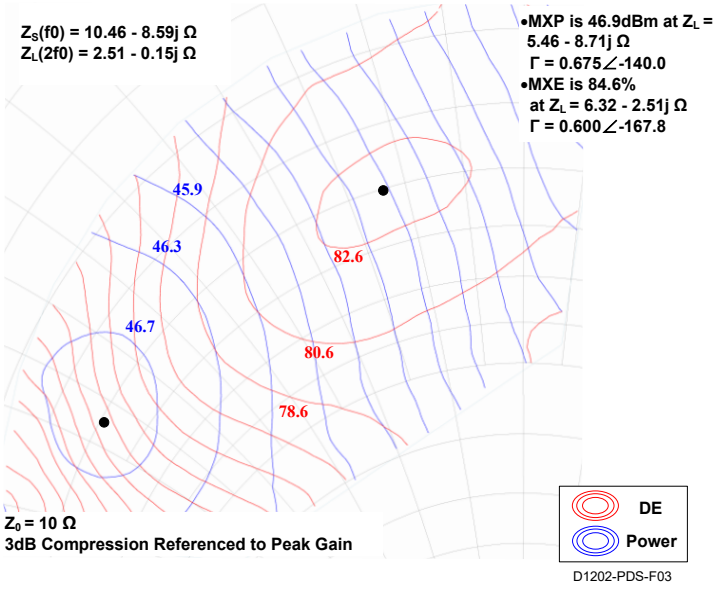


Figure 3. Load-pull Smith Chart @ 2.6GHz

- Typical Class AB performance is measured in Load-pull system, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.65V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

10. Typical Performance

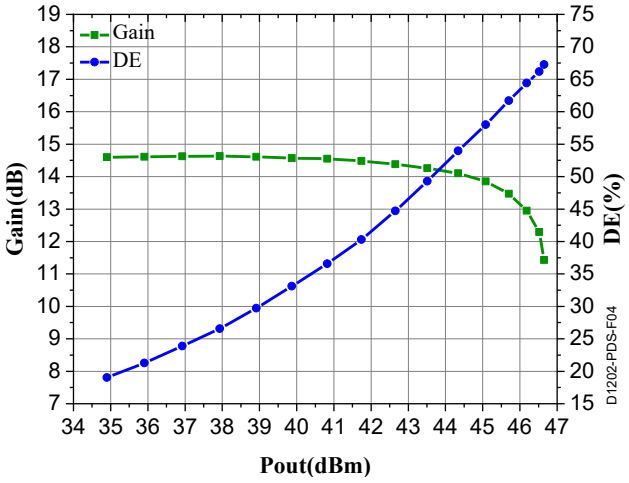


Figure 4. 2.6GHz Gain and DE @ MXP vs. Output Power

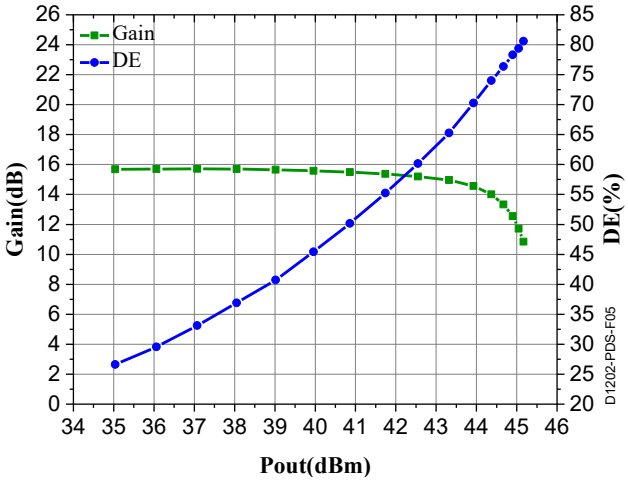


Figure 5. 2.6GHz Gain and DE @ MXE vs. Output Power

- Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.65V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

11. Package Outline

■ Pin Layout

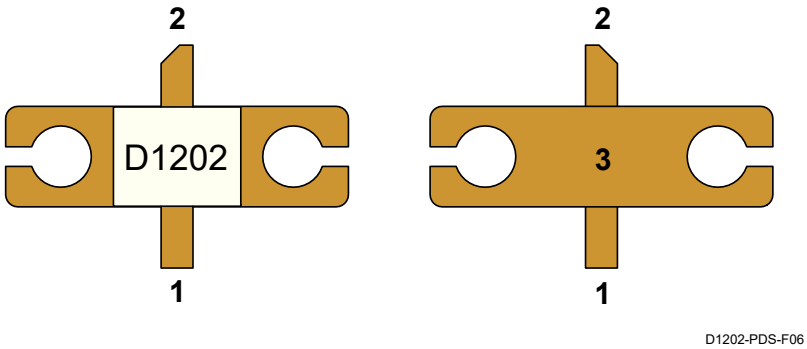


Figure 6. D1202 Pin Layout

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: 200F-A)

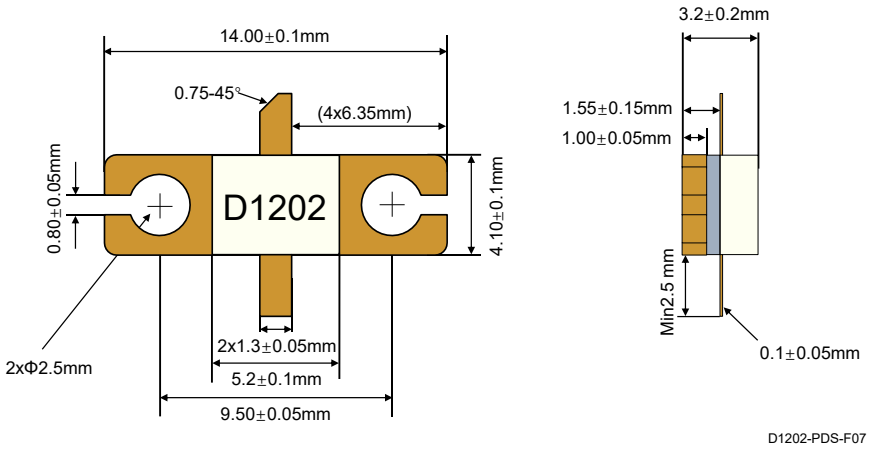


Figure 7. D1202 Mechanical Drawing

12. Application Circuit

■ Schematic

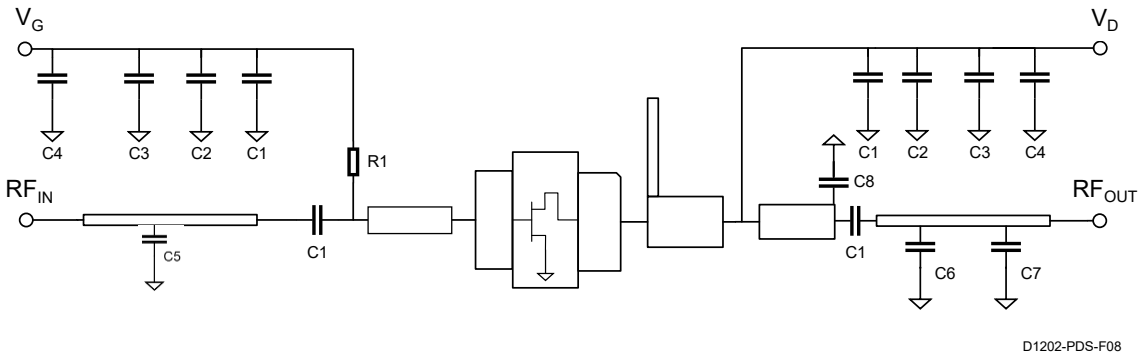
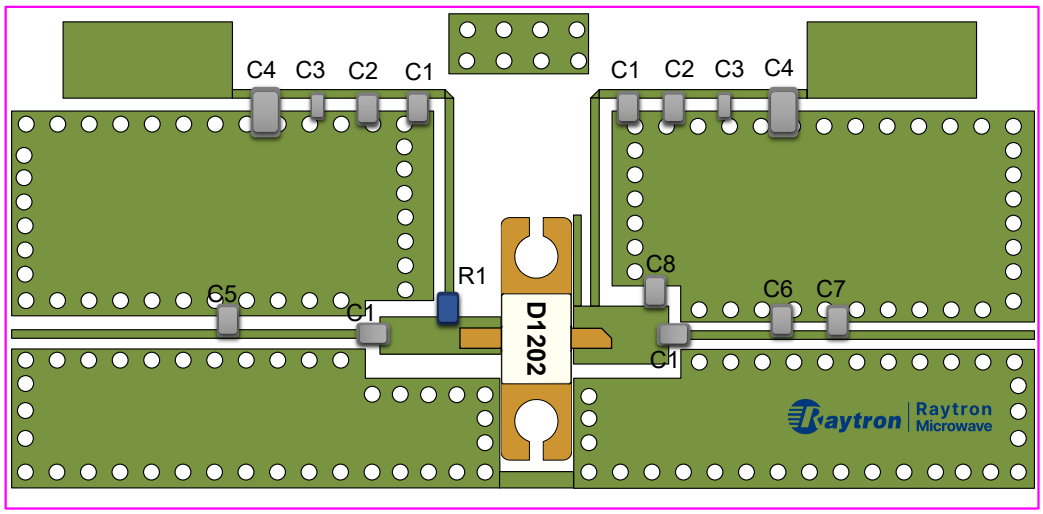


Figure 8. D1202 (DEMO @ MXP) Application Circuit Schematic

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



D1202-PDS-F09

Figure 9. D1202 Application Circuit Layout (DEMO @ MXP)
(DEMO Size: 8.5 x 4.0cm)

Table 11. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	5.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E5R5JB12
C2	100.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E101JB12
C3	10.0nF	X7R 100V 0603 Capacitor	Murata	GCM188R72A103KA37D
C4	1.0uF	X7R 100V 1210 Capacitor	Murata	GRM32ER72A105KA01
C5	0.6pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E0R6BB12
C6	1.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E1R0BB12
C7	0.2pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E0R2WB12
C8	0.4pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E0R4WB12
R1	10Ω	1/8W 0805 Resistor	Yageo	RC0805FR-0710RL

13. DEMO Summary

Table 12. DEMO Summary

NO.	D1202 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency	Pulse or CW
1	DEMO_A, 30W	28	1.3-1.95	18.5	44.3	27	75%	Pulse
2	DEMO_B, 30W	28	0.3-3	13.9	44.9	30	60%	Pulse
3	DEMO_C, 35W	28	1.63-1.8	19.3	45.5	35	70%	CW
4	DEMO_D, 30W	28	4.25-4.35	11.7	45.1	30	66%	CW
5	DEMO_E, 30W	28	1.61-1.63	19.6	45.2	33	71%	CW
6	DEMO_F, 20W	28	1.3-1.5	23.0	43.9	25	65%	CW
7	DEMO_G, 30W	28	1.56-1.63	20.2	45.7	37	69%	CW

Continued table 12. DEMO Summary

NO.	D1202 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency	Pulse or CW
8	DEMO_H, 30W	28	1.35-1.45	23.2	45.0	32	77%	CW
9	DEMO_I, 10W	28	0.07-1	18.6	40.0	10	50%	CW
10	DEMO_J, 30W	28	1.98-2.01	20.3	45.3	34	76%	Pulse
11	DEMO_K, 30W	28	2.4-2.5	17.6	45.2	32	77%	CW
12	DEMO_L, 25W	28	1.3-1.95	18.3	44.0	25	67%	CW
13	DEMO_M, 35W	28	2.4-2.6	17.3	45.3	34	74%	CW

14. Recommended Solder Temperature Profile

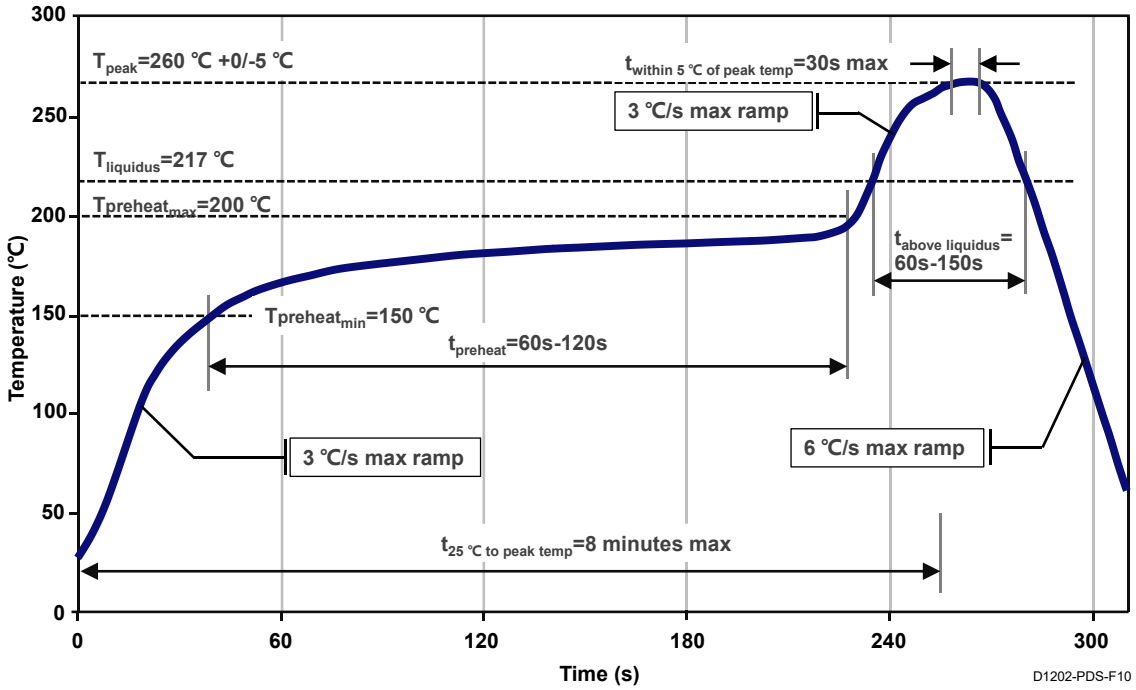


Figure 10. Recommended Solder Temperature Profile

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

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