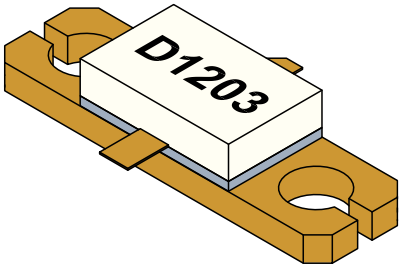
1. Description

- The D1203 is a 50W (P_{SAT}) wideband unmatched gallium nitride (GaN) high electron mobility transistor (HEMT) with first generation RF GaN technology from Raytron.
- The D1203 operates from DC to 6GHz with a 28V supply rail. The device is offered in an industry standard air cavity package.



D1203-PDS-F01

Figure 1. D1203 Package Outline

2. Applications

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

3. Features[1]

- Operating Frequency: DC-6GHz
- Saturated Power (P_{SAT}): 48.4dBm (69W)
- Linear Gain: 16.6dB
- Typical DE @ P_{SAT}: 77.8%
- Operating Voltage: 28V
- CW and Pulse Capable
- Package Type: 360F-A

[1] Measured in Raytron DEMO @2.6GHz

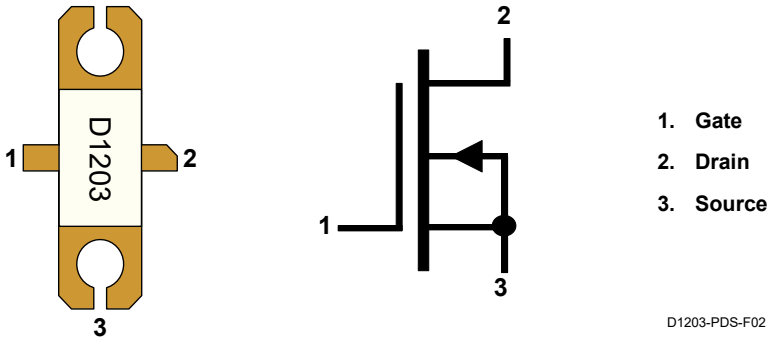
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	2.6GHz	Units
Linear Gain	16.6	dB
Drain Efficiency	77.8	%
Saturated Power	48.4	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



1. Gate
2. Drain
3. Source

D1203-PDS-F02

Figure 2. D1203 Block Diagram

Table of Contents

No.	Contents	Page
1	Description	1
2	Applications	1
3	Features	1
4	Brief Typical Performance	1
5	Block Diagram	1
6	Absolute Maximum Ratings	3
7	Recommended Operating Condition	3
8	Electrical Characteristics	3
9	Typical Performance	4
10	Wide-band Application Performance	5
11	Package Outline	7
12	Application Circuit	8
13	DEMO Summary	9
14	Recommended Solder Temperature Profile	10
15	Handling Precautions	10
16	Contact Information	11
17	Disclaimer	11

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 Condition

Table 3. Recommended Operating Condition

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)	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} = 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]

Parameter	2.6GHz	Units
Linear Gain	16.6	dB
Drain Efficiency	77.8	%
Output Power	48.4	dBm

- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%
- 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}	-	14.0	-	pF
Output Capacitance	C_{DS}	-	6.7	-	pF
Feedback Capacitance	C_{GD}	-	0.8	-	pF

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

9. Typical Performance

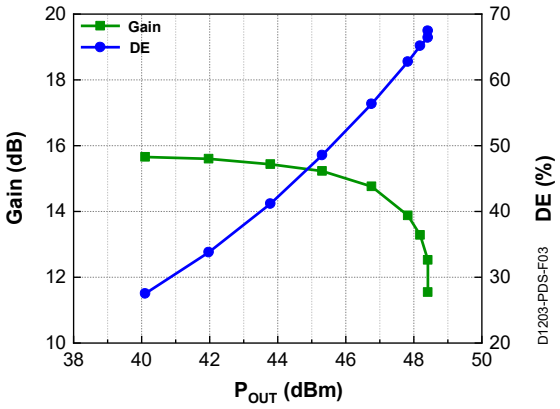


Figure 3. 2.6GHz Gain and DE @ MXP vs. Output Power

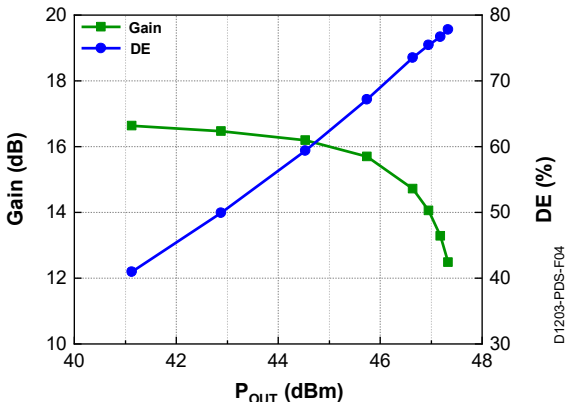


Figure 4. 2.6GHz Gain and DE @ MXE vs. Output Power

- 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%

10. Wide-band Application Performance

■ Wide-band Application Performance (DEMO_A: 1.3-1.95GHz)

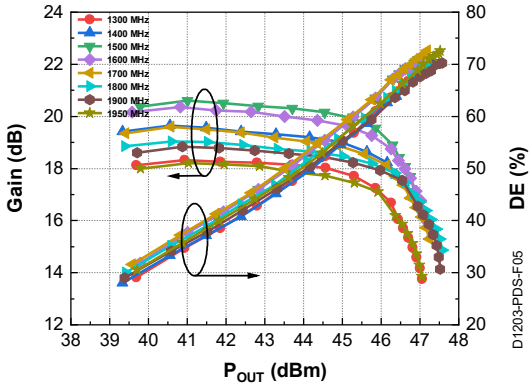


Figure 5. Wide-band Application Gain and DE vs. Output Power

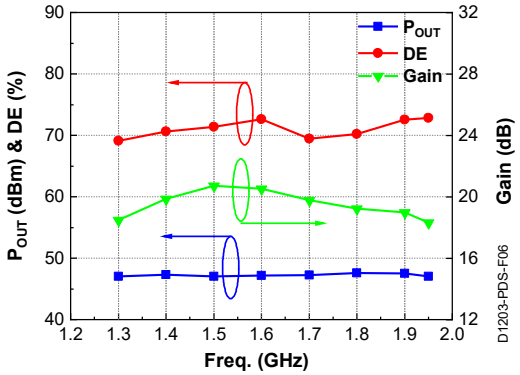


Figure 6. Wide-band Application Gain and DE vs. Freq.

Table 8. Wide-band RF Characteristics of DEMO_A

Freq. (GHz)	Linear Gain (dB)	Drain Efficiency (%)	Output Power (dBm)	Output Power (W)
1.3	18.5	69.1	47.1	51
1.4	19.9	70.6	47.3	54
1.5	20.7	71.4	47.0	50
1.6	20.5	72.7	47.2	53
1.7	19.8	69.4	47.2	53
1.8	19.2	70.2	47.6	58
1.9	19.0	72.6	47.5	56
1.95	18.3	72.9	47.1	51

- Typical Class AB performance in Raytron Wide-band Application DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.65V
- Test Condition: CW
- The output power is 47.0dBm(50W) at 1.3-1.95GHz.

■ Typical IMD3 Performance (DEMO_A: 1.3-1.95GHz)

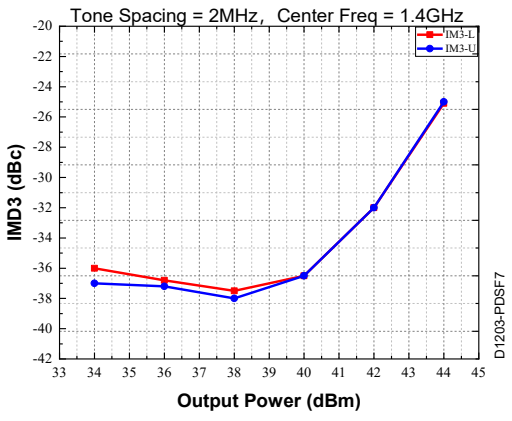


Figure 7. IMD3 vs. Output power

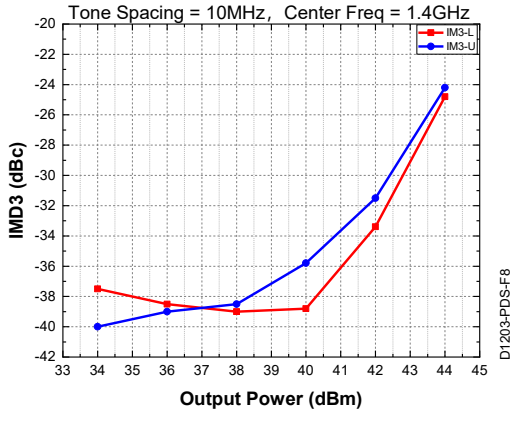


Figure 8. IMD3 vs. Output power

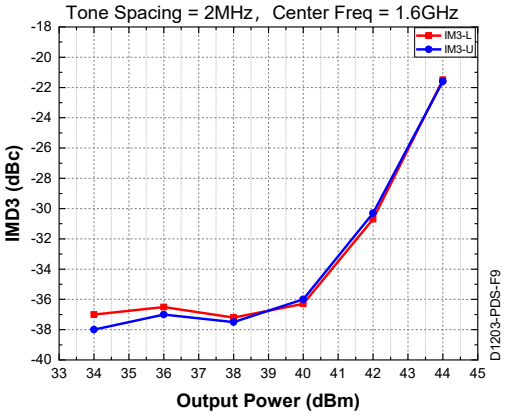


Figure 9. IMD3 vs. Output power

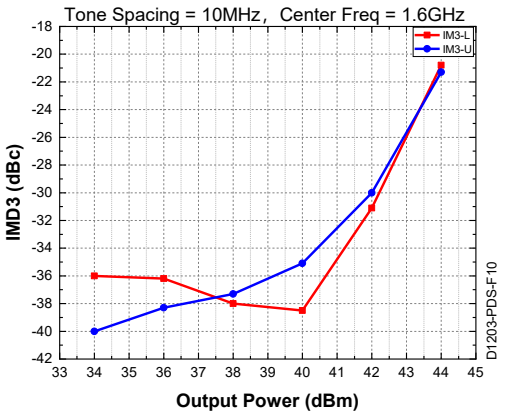


Figure 10. IMD3 vs. Output power

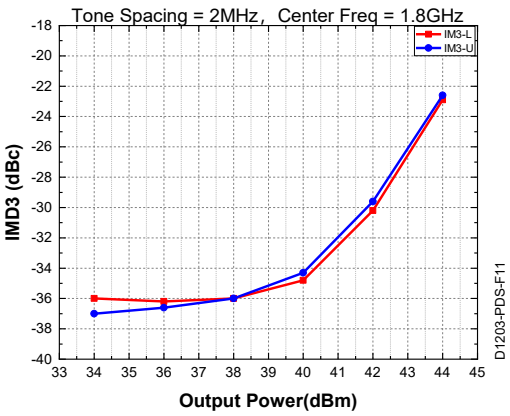


Figure 11. IMD3 vs. Output power

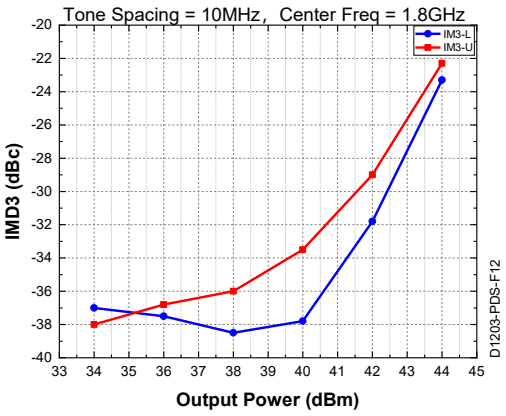


Figure 12. IMD3 vs. Output power

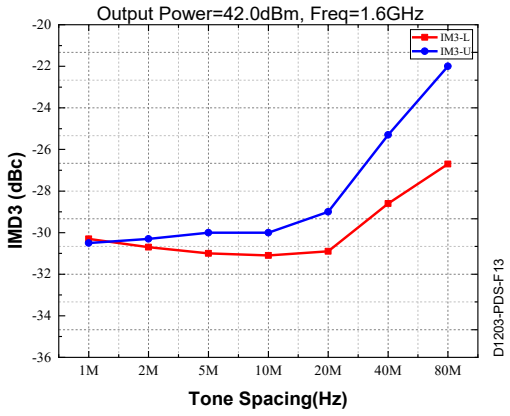


Figure 13. IMD3 vs. Tone Spacing

- Measured in the Raytron Wide-band Application DEMO_A
- Test Condition: V_{DS} = 28V, I_{DQ} = 100mA, V_{GS} = -2.65V

■ Wide-band Application Performance (DEMO_H: 2.1-2.6GHz)

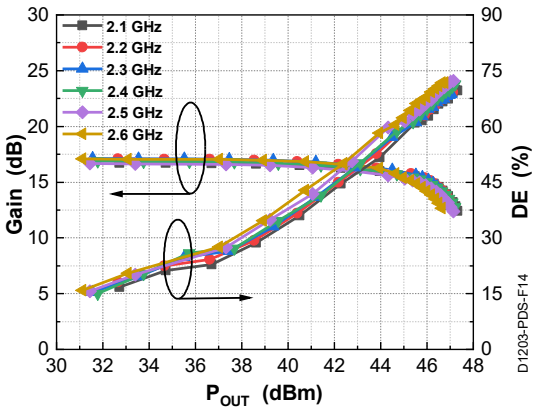


Figure 14. Wide-band Application Gain and DE vs. Output

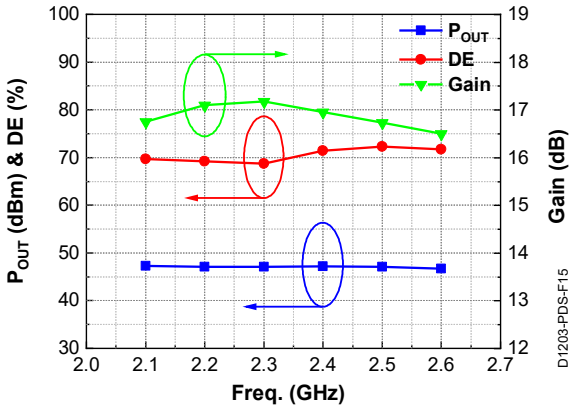


Figure 15. Wide-band Application Gain and DE vs. Freq.

Table 9. Wide-band RF Characteristics of DEMO_H

Freq. (GHz)	Linear Gain (dB)	Drain Efficiency (%)	Output Power (dBm)	Output Power (W)
2.1	16.7	71.8	47.5	56
2.2	17.1	71.1	47.3	54
2.3	17.1	70.2	47.2	52
2.4	16.9	73.4	47.4	55
2.5	16.8	74.4	47.2	52
2.6	16.6	74.1	46.9	49

- Typical Class AB performance in Raytron Wide-band Application DEMO_H with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.65V
- Test Condition: CW
- The output power is 46.9dBm(49W) at 2.1-2.6 GHz.

11. Package Outline

■ Pin Layout

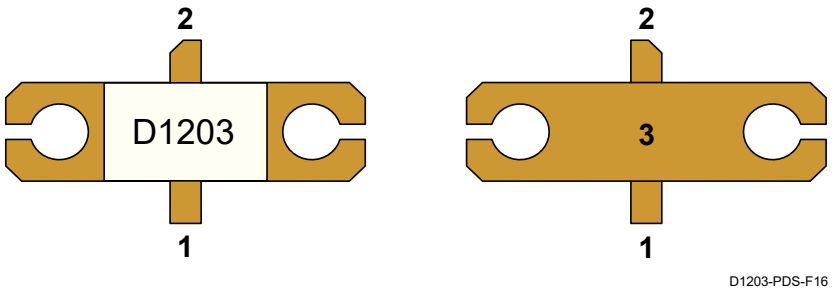


Figure 16. D1203 Pin Layout

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: 360F-A)

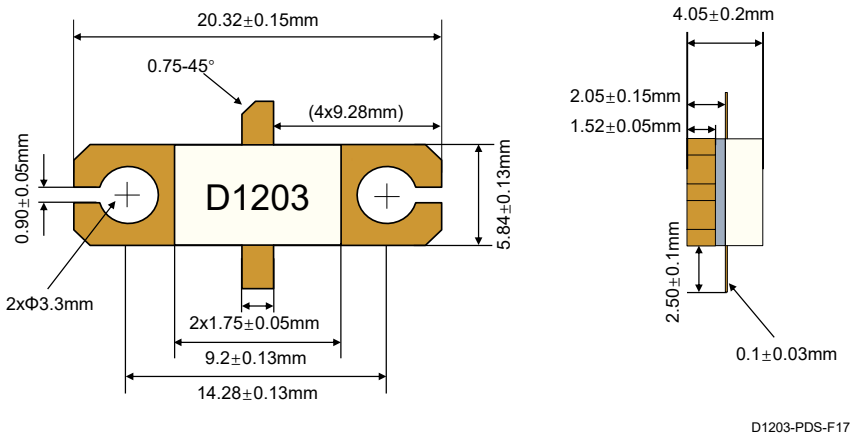


Figure 17. D1203 Mechanical Drawing

12. Application Circuit

■ Schematic

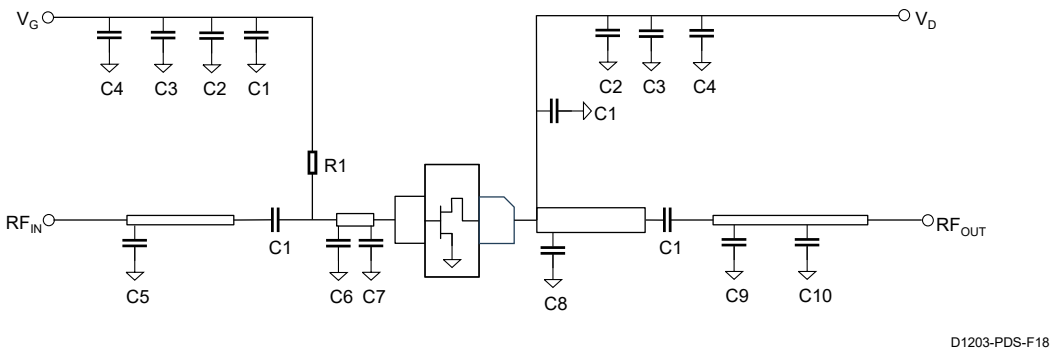
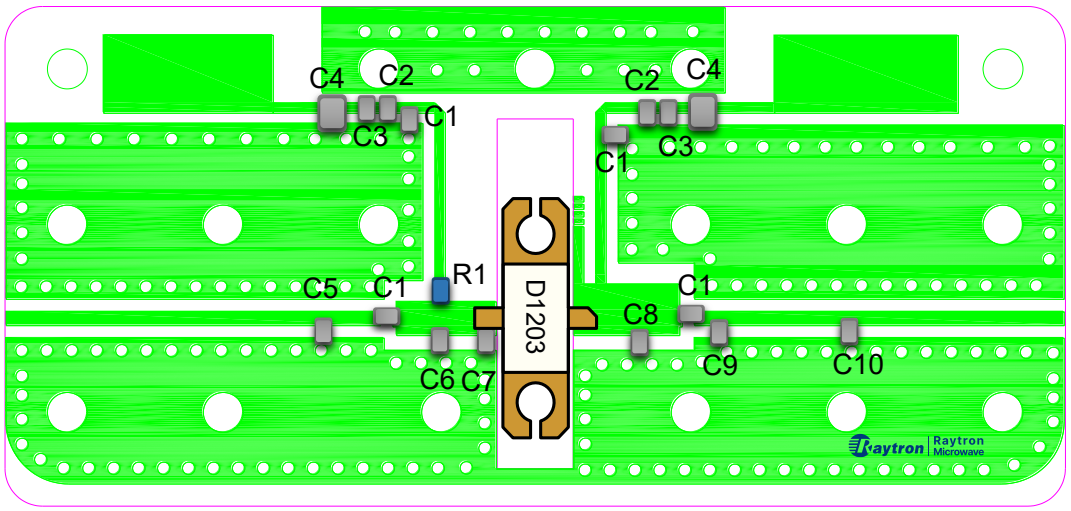


Figure 18. D1203 DEMO_A Application Circuit Schematic

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



D1203-PDS-F19

Figure 19. D1203 Application Circuit Layout
(DEMO_A Size: 8.5 x 4.0cm)

Table 12. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	25pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E250GB12
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	2.7pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E2R7BB12
C6	4.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E4R5BB12
C7	6pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E6R0CB12
C8	3.7pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E3R7BB12
C9	0.4pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2ER40WB12
C10	1.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E1R5BB12
R1	10Ω	1/8W 0805 Resistor	Yageo	RC0805FR-0710RL

13. DEMO Summary

Table 13. DEMO Summary

NO.	D1203 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency	Pulse or CW
1	DEMO_A, 50W	28	1.3-1.95	18.3	47.0	50	69%	CW
2	DEMO_B, 50W	28	2.4-2.5	16.1	47.1	51	72%	CW
3	DEMO_C, 50W	28	0.8-0.88	24.9	47.1	51	77%	CW
4	DEMO_D, 45W	28	1.1-1.7	19.5	46.7	47	66%	Pulse
5	DEMO_E, 50W	28	3.23-3.27	13.6	46.9	49	65%	CW

NO.	D1203 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency	Pulse or CW
6	DEMO_F, 30W	28	0.8-3	14.9	44.9	31	54%	CW
7	DEMO_G, 35W	28	2.95-3.25	13.7	45.6	36	72%	CW
8	DEMO_H, 45W	28	2.1-2.6	16.5	46.8	48	69%	CW
9	DEMO_I, 45W	28	1.92-2.05	18.0	46.7	47	76%	CW
10	DEMO_J, 40W	28	0.7-1	21.7	46.3	43	56%	CW
11	DEMO_K, 30W	28	0.85-1.4	17.8	45.1	32	51%	CW
12	DEMO_L, 40W	28	2.7-3.35	14.1	46.1	40	58%	CW

14. Recommended Solder Temperature Profile

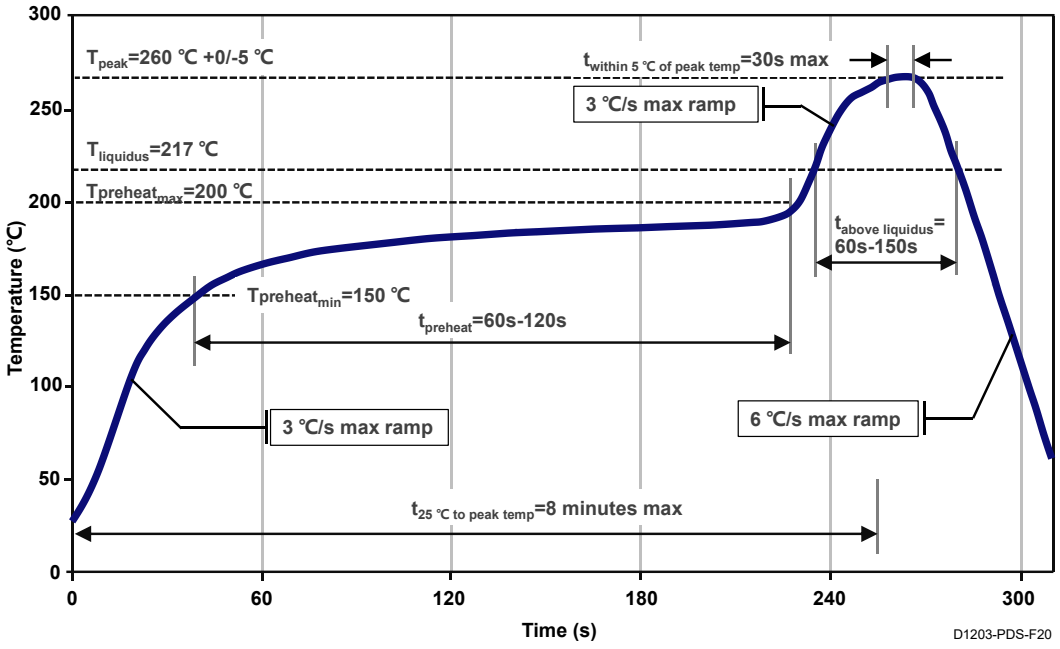


Figure 20. Recommended Solder Temperature Profile

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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