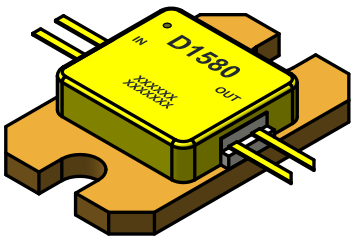
1. Description

- The D1580 is a 10W (P_{SAT}) wideband matched GaN-HEMT device. The D1580 is matched to 50ohm on the input and 50ohm on the output.
- The D1580 operates from 8.5 to 9.7GHz with a 28V or a 40V supply rail. It is offered in a small hermetically sealed metal/ceramic flange package.



D1580-PDS-F01

Figure 1. D1580 Package Outline

2. Applications

- Marine Radar
- Military and Civilian Radars
- Military Radio Communications
- Avionics and Test Instrumentation

3. Features[1]

- Operating Frequency: 8.5–9.7GHz
- Output Power (P_{SAT}): 40.3dBm (10.7W)
- Linear Gain: 12.5dB
- Typical DE @ P_{SAT}: 56.6%
- Operating Voltage: 28V
- CW and Pulse Capable
- Impedance Matched Z_{IN}/Z_{OUT} = 50ohm
- Hermetically Sealed Package
- Package Type: 450F-A

[1] Measured in Raytron DEMO_A

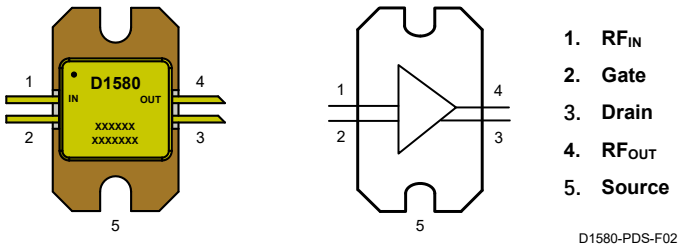
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	8.5GHz	8.8GHz	9.1GHz	9.4GHz	9.7GHz	Units
Linear Gain	12.8	12.5	13.4	14.2	14.5	dB
Drain Efficiency	56.6	60.6	62.9	65.3	61.1	%
Output Power	42.4	42.3	42.4	41.1	40.3	dBm
Output Power	17.4	17.0	17.4	12.9	10.7	W

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 250mA, V_{GS} = -2.48V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

5. Block Diagram



D1580-PDS-F02

Figure 2. D1580 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}	3.4	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_{DSS}	-	28	-	V
Drain Bias Current, I_{DS}	-	250	-	mA
Gate-Source Voltage, V_{GS}	-	-2.48	-	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)	5.92	°C/W
Thermal Resistance (Junction-to-Case)[2]	R_{thjc} (FEA)	7.40	°C/W

1. Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 14.0W
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} = 3.4mA)	$V_{DS(BR)}$	150	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	3.14	-	A
Gate Threshold Voltage[3] (V_{DS} = 28V, I_{DS} = 3.4mA)	$V_{GS(TH)}$	-3.30	-2.80	-2.30	V
Gate Quiescent Voltage[3] (V_{DS} = 28V, I_{DS} = 250mA)	$V_{GS(Q)}$	-	-2.48	-	V

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

Table 6. RF Characteristics

Freq.	Linear Gain (G_{LIN})	Power Gain (G_P)	Drain Efficiency (η_D)	Power-added Efficiency (PAE)	Output Power (P_{SAT})
8.5GHz	12.8dB	10.5dB	56.6%	51.5%	42.4dBm (17.4W)
9.0GHz	13.0dB	11.2dB	62.8%	58.1%	42.2dBm (16.6W)
9.5GHz	14.7dB	12.0dB	64.2%	60.1%	40.6dBm (11.5W)
9.7GHz	14.5dB	10.3dB	58.0%	52.5%	40.3dBm (10.7W)

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 250mA, V_{GS} = -2.48V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

9. Typical Performance

■ Wide-band Application Performance (DEMO_A, 8.5-9.7GHz, 10W, 28V)

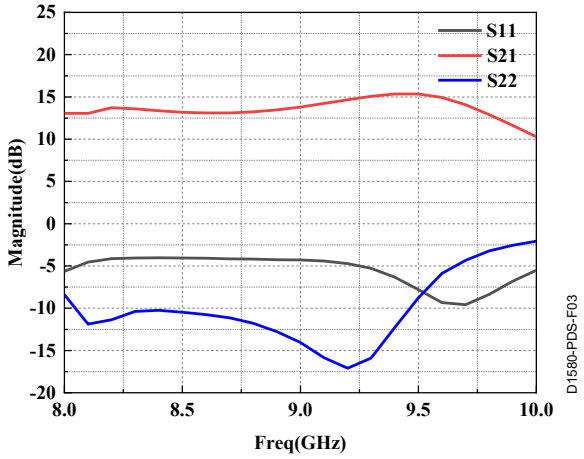


Figure 3. 8.5GHz-9.7GHz S_{11} and S_{21} vs. Freq.

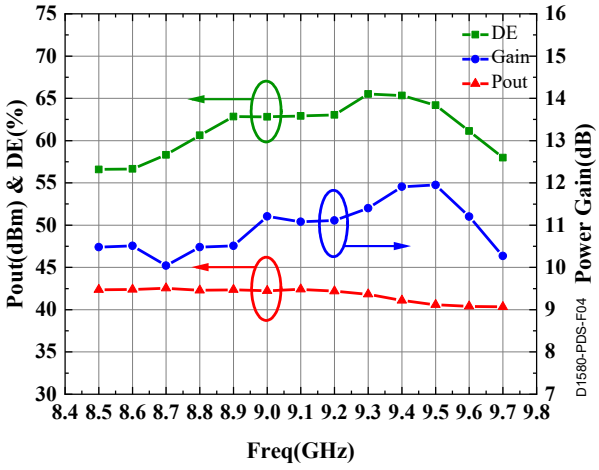


Figure 4. 8.5GHz-9.7GHz Gain and P_{OUT} vs. Freq.

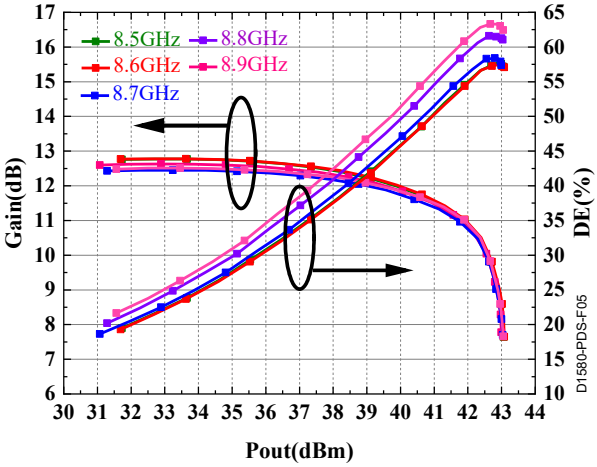


Figure 5. 8.5GHz-8.9GHz Gain and DE vs. P_{OUT}

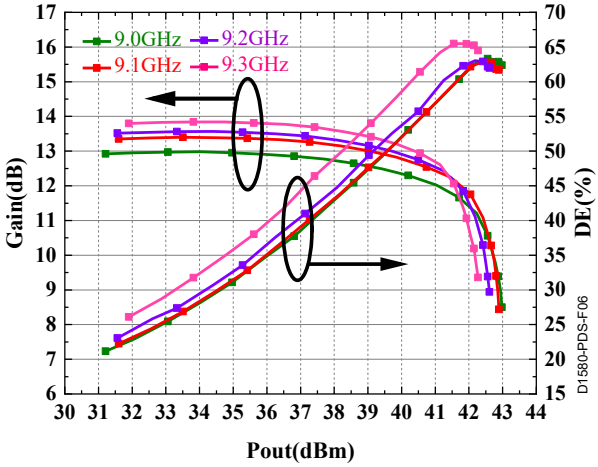


Figure 6. 9.0GHz-9.3GHz Gain and DE vs. P_{OUT}

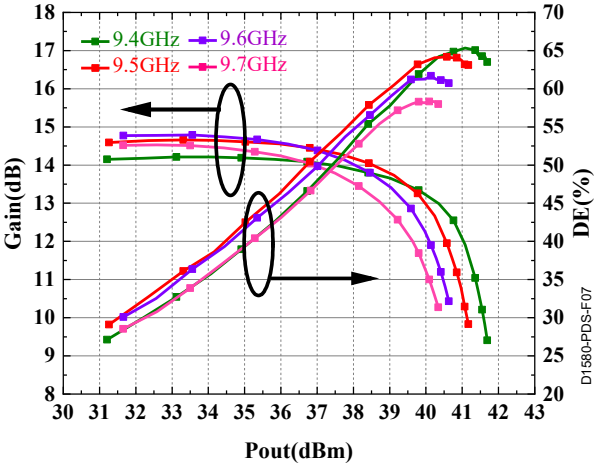


Figure 7. 9.4GHz-9.7GHz Gain and DE vs. P_{OUT}

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 250mA, V_{GS} = -2.48V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

Table 7. RF Characteristics @ DEMO_A, 8.5-9.7GHz, 10W, 28V

Freq.	Linear Gain (G_{LIN})	Power Gain (G_P)	Drain Efficiency (η_D)	Power-added Efficiency (PAE)	Output Power (P_{SAT})
8.5GHz	12.8dB	10.5dB	56.6%	51.5%	42.4dBm (17.4W)
8.6GHz	12.8dB	10.5dB	56.7%	51.6%	42.4dBm (17.4W)
8.7GHz	12.6dB	10.0dB	58.3%	52.5%	42.6dBm (18.2W)
8.8GHz	12.5dB	10.5dB	60.6%	55.2%	42.3dBm (17.0W)
8.9GHz	12.5dB	10.5dB	62.8%	57.2%	42.4dBm (17.4W)
9.0GHz	13.0dB	11.2dB	62.8%	58.1%	42.2dBm (16.6W)
9.1GHz	13.4dB	11.1dB	62.9%	58.0%	42.4dBm (17.4W)
9.2GHz	13.6dB	11.1dB	63.0%	58.2%	42.2dBm (16.6W)
9.3GHz	13.8dB	11.4dB	65.5%	60.8%	41.8dBm (15.1W)
9.4GHz	14.2dB	11.9dB	65.3%	61.1%	41.1dBm (12.9W)
9.5GHz	14.7dB	12.0dB	64.2%	60.1%	40.6dBm (11.5W)
9.6GHz	14.8dB	11.2dB	61.1%	56.5%	40.4dBm (11.0W)
9.7GHz	14.5dB	10.3dB	58.0%	52.5%	40.3dBm (10.7W)

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 250mA, V_{GS} = -2.48V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%
- The output power is 40.3dBm (10.7W) at 8.5-9.7GHz when V_{DS}=28V.

■ Wide-band Application Performance (DEMO_A, 8.5-9.7GHz, 20W, 40V)

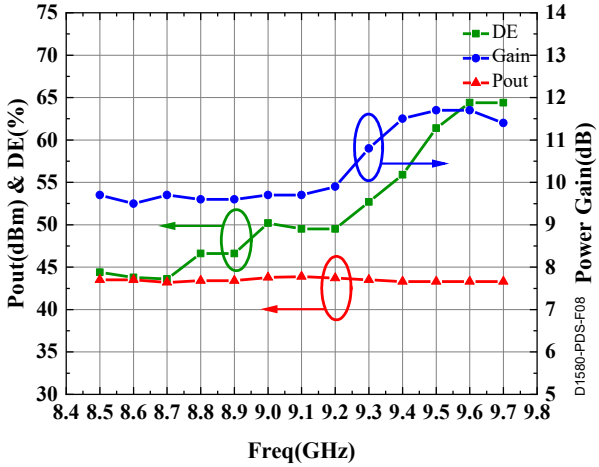


Figure 8. 8.5GHz-9.7GHz Gain and P_{OUT} vs. Freq.

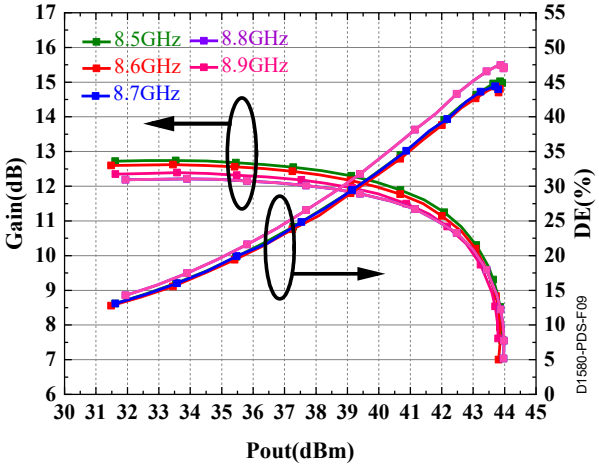


Figure 9. 8.5GHz-8.9GHz Gain and DE vs. P_{OUT}

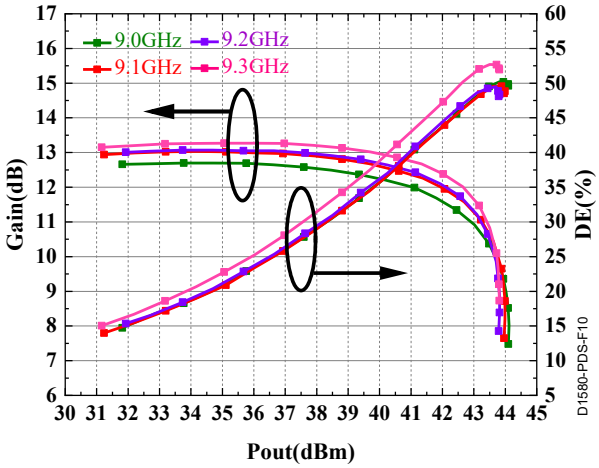


Figure 10. 9.0GHz-9.3GHz Gain and DE vs. P_{OUT}

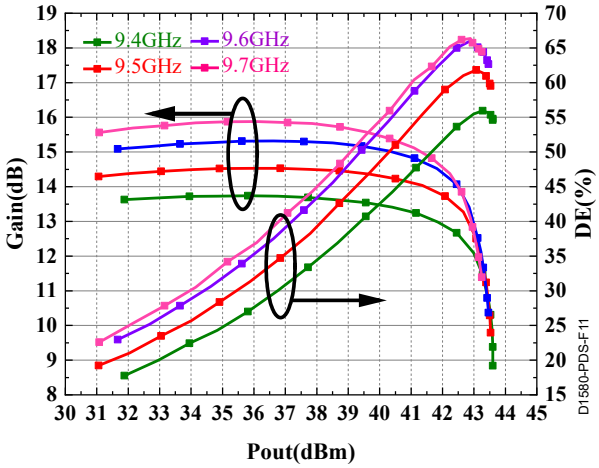


Figure 11. 9.4GHz-9.7GHz Gain and DE vs. P_{OUT}

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 40V, I_{DS} = 250mA, V_{GS} = -2.48V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

Table 8. RF Characteristics @ DEMO_A, 8.5-9.7GHz, 20W, 40V

Freq.	Linear Gain (G_{LIN})	Power Gain (G_P)	Drain Efficiency (η_D)	Power-added Efficiency (PAE)	Output Power (P_{SAT})
8.5GHz	12.7dB	9.7dB	44.4%	39.6%	43.5dBm (22.4W)
8.6GHz	12.6dB	9.5dB	43.8%	38.9%	43.5dBm (22.4W)
8.7GHz	12.4dB	9.7dB	43.6%	39.0%	43.2dBm (20.9W)
8.8GHz	12.2dB	9.6dB	46.6%	41.4%	43.4dBm (21.9W)
8.9GHz	12.2dB	9.6dB	46.6%	41.4%	43.4dBm (21.9W)
9.0GHz	12.7dB	9.7dB	50.2%	44.9%	43.8dBm (24.0W)
9.1GHz	13.0dB	9.7dB	49.5%	44.2%	43.9dBm (24.5W)
9.2GHz	13.1dB	9.9dB	49.5%	44.4%	43.7dBm (23.4W)
9.3GHz	13.3dB	10.8dB	52.7%	48.3%	43.5dBm (22.4W)
9.4GHz	13.7dB	11.5dB	55.9%	51.9%	43.3dBm (21.4W)
9.5GHz	14.5dB	11.7dB	61.4%	57.2%	43.3dBm (21.4W)

Freq.	Linear Gain (G_{LIN})	Power Gain (G_P)	Drain Efficiency (η_D)	Power-added Efficiency (PAE)	Output Power (P_{SAT})
9.6GHz	15.3dB	11.7dB	64.4%	60.0%	43.3dBm (21.4W)
9.7GHz	15.9dB	11.4dB	64.4%	59.8%	43.3dBm (21.4W)

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 40V, I_{DS} = 250mA, V_{GS} = -2.48V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%
- The output power is 43.3dBm (21.4W) at 8.5-9.7GHz when V_{DS}=40V.

10. Package Outline

■ Pin Layout

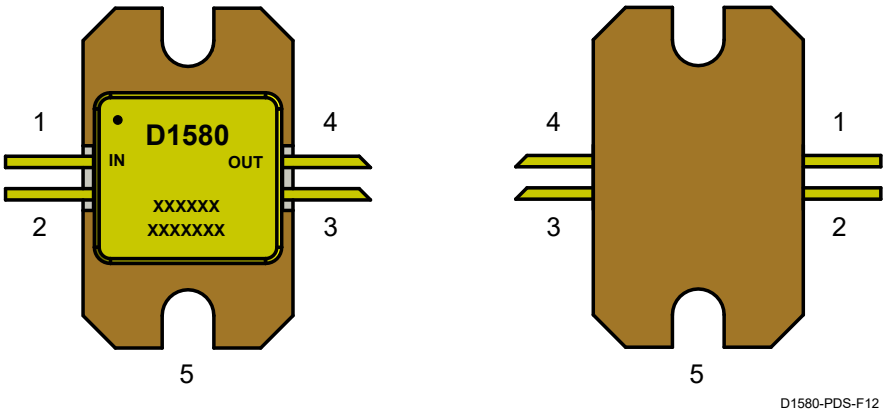


Figure 12. D1580 Pin Layout

Table 9. Pin Description

Pin	Symbol	Description
1	RF_{IN}	RF Input
2	V_G	Gate Voltage
3	V_D	Drain Voltage
4	RF_{OUT}	RF Output
5	Flange	Source to be Connected to Ground

■ Mechanical Drawing (Package Type: 450F-A)

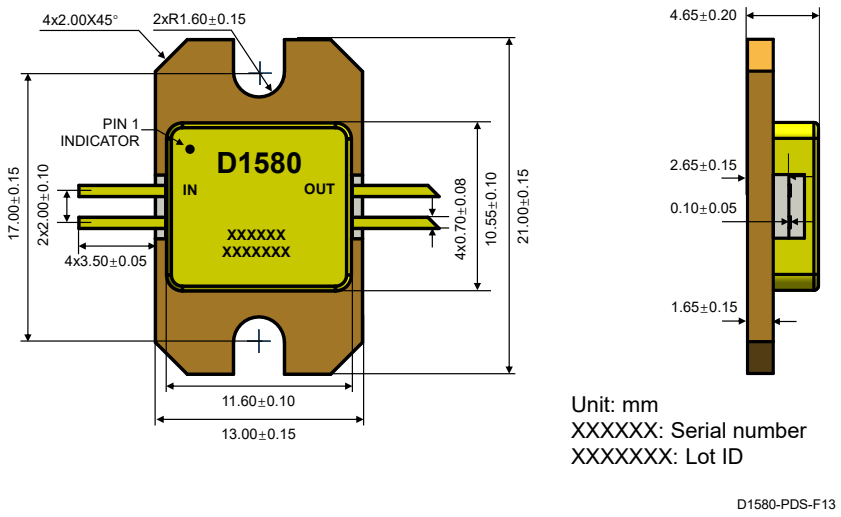


Figure 13. D1580 Mechanical Drawing

11. Application Circuit

■ Schematic

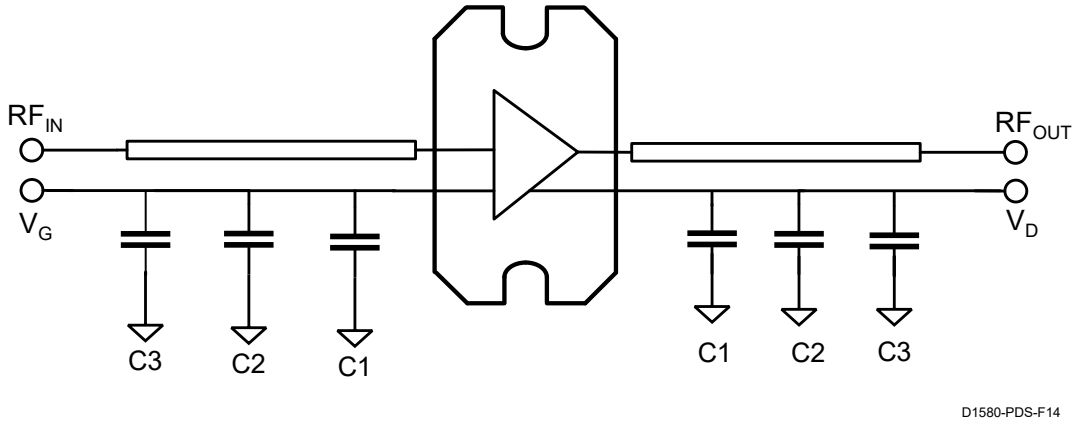
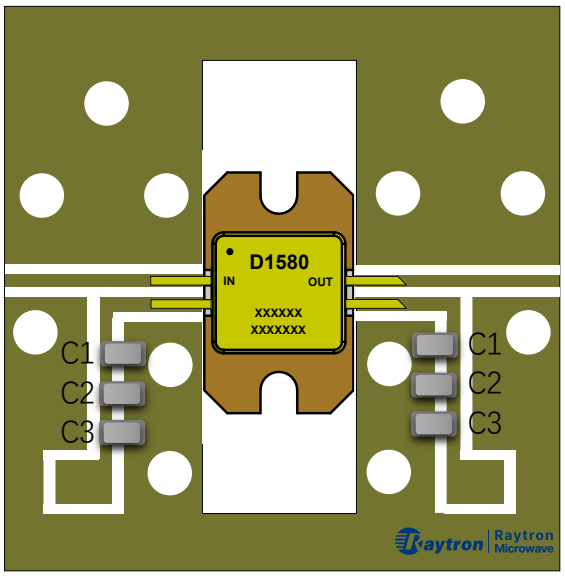


Figure 14. D1580 DEMO_A Application Circuit Schematic

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 or 40V)	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



D1580-PDS-F15

Figure 15. D1580 Application Circuit Layout（8.5GHz-9.7GHz）
（DEMO_A Size: 4.8cm x 4.8cm）

Table 11. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	100.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E101JB12D
C2	10.0nF	X7R 100V 0603 Capacitor	Murata	GCM188R72A103KA37D
C3	1.0uF	X7R 100V 1210 Capacitor	Murata	GRM32ER72A105KA01L

12. DEMO Summary

Table 12. DEMO Summary

NO.	D1580 DEMO Name	V_{DS} (V)	Freq. (GHz)	Linear Gain (dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency (%)	Pulse or CW
1	DEMO_A, 10W	28	8.5-9.7	12.5	40.3	10.7	56.6	Pulse
2	DEMO_A, 20W	40	8.5-9.7	12.2	43.2	21.0	39.0	Pulse

13. Recommended Solder Temperature Profile

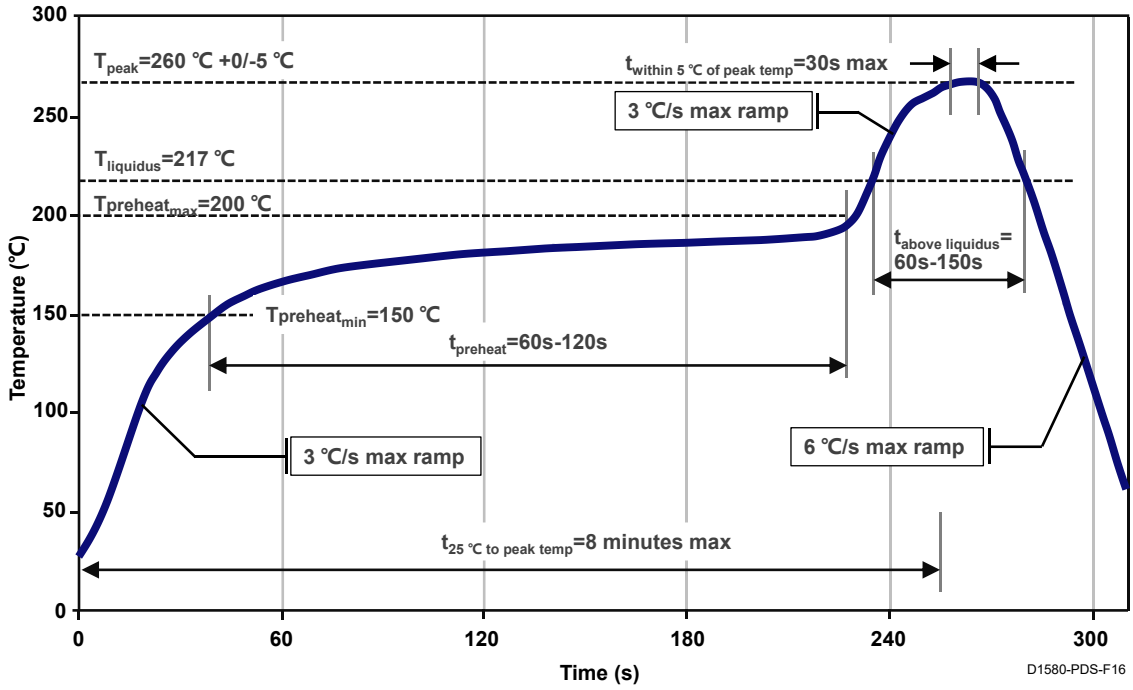


Figure 16. Recommended Solder Temperature Profile

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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