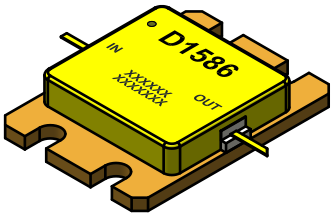
1. Description

- The D1586 is a high power (300W) GaN-HEMT that is internally matched for X-band radar to provide optimum power and gain in a 50ohm system.
- The D1586 operates from 8.6 to 10GHz with a 48V supply rail. It is offered in a small hermetically sealed metal/ceramic flange package.



D1586-PDS-F01

Figure 1. D1586 Package Outline

2. Applications

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

3. Features[1]

- Operating Frequency: 8.6–10GHz
- Output Power (P_{SAT}): 54.8dBm (302W)
- Linear Gain: 11.0dB
- Typical DE @P_{SAT}: 36.0%
- Operating Voltage: 48V
- Impedance Matched Z_{IN}/Z_{OUT} = 50ohm
- Hermetically Sealed Package
- Package Type: 630F-A

[1] Measured in Raytron DEMO_A

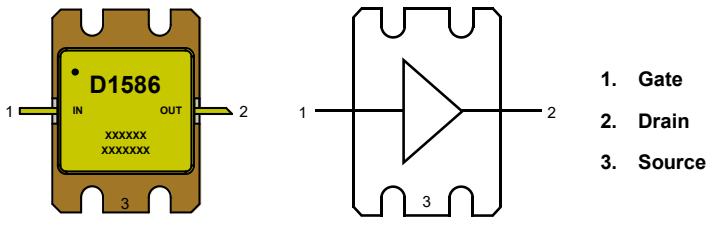
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	8.6GHz	9.0GHz	9.3GHz	9.6GHz	10GHz	Units
Linear Gain	11.8	11.1	11.5	12.3	11.1	dB
Power Gain	8.8	8.1	8.5	9.3	8.1	dB
Drain Efficiency	36.0	40.9	47.2	44.6	43.6	%
Power-added Efficiency	31.5	34.8	40.9	39.6	37.1	%
Output Power	54.8	54.8	56.1	56.0	55.0	dBm
Output Power	313	315	422	419	332	W

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS} = 1000mA, V_{GS} = -2.68V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

5. Block Diagram



1. Gate
2. Drain
3. Source

D1586-PDS-F02

Figure 2. D1586 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 ~ +48	V
Maximum Forward Gate Current	I_{GMax}	59.6	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	-	V
Drain Bias Current, I_{DS}	-	1000	-	mA
Gate-Source Voltage, V_{GS}	-	-2.68	-	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)	0.37	°C/W
Thermal Resistance (Junction-to-Case)[2]	R_{thjc} (FEA)	0.47	°C/W

1. Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 200.0W
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} = 59.6mA)	$V_{DS(BR)}$	120	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	65.76	-	A
Gate Threshold Voltage[3] (V_{DS} = 48V, I_{DS} = 59.6mA)	$V_{GS(TH)}$	-3.3	-2.8	-2.3	V
Gate Quiescent Voltage[3] (V_{DS} = 48V, I_{DS} = 1000mA)	$V_{GS(Q)}$	-	-2.68	-	V

1. Measured on wafer prior to packaging
2. Scaled from PCM data
3. Measured in Raytron DEMO

Table 6. RF Characteristics

Freq. (GHz)	Linear Gain (dB)	Power Gain (dB)	Drain Efficiency (%)	Power-added Efficiency (%)	Output Power (dBm)	Output Power (W)
8.6	11.8	8.8	36.0	31.5	54.8	313
9.0	11.1	8.1	40.9	34.8	54.8	315
9.5	11.6	8.6	48.4	42.0	56.1	431
10.0	11.1	8.1	43.6	37.1	55.0	332

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS} = 1000mA, V_{GS} = -2.68V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

9. Typical Performance (8.6-10GHz)

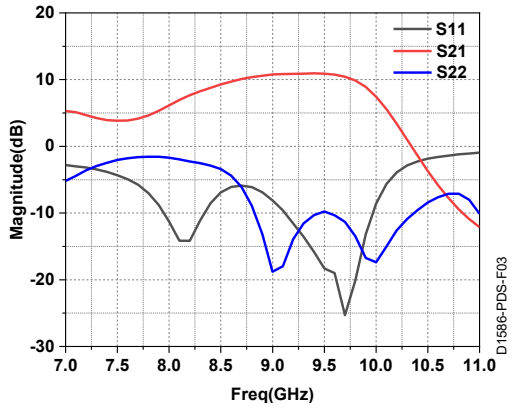


Figure 3. S_{11}, S_{21} and S_{22} vs. Freq.

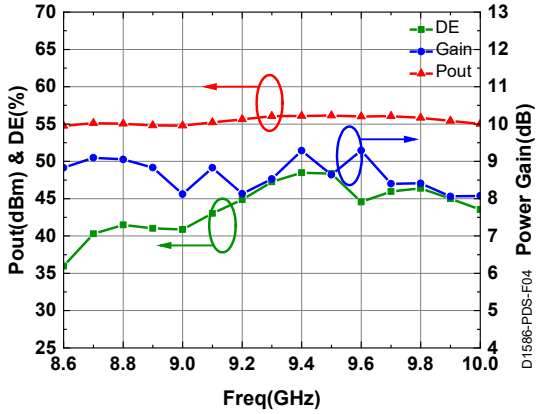


Figure 4. P_{OUT}, DE and Gain vs. Freq.

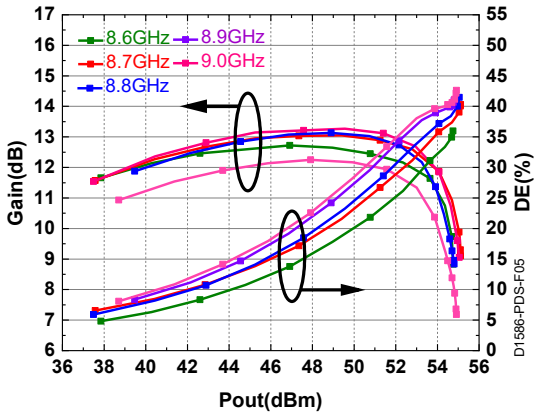


Figure 5. Gain and DE vs. P_{OUT}

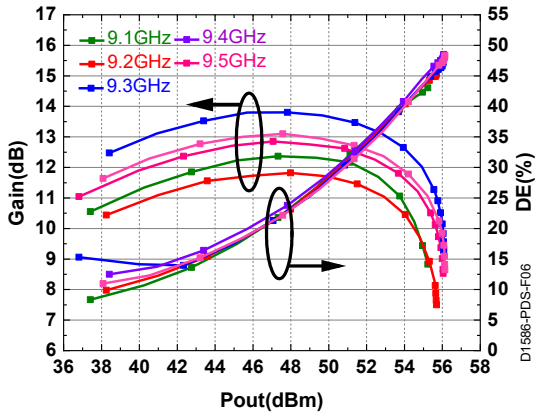


Figure 6. Gain and DE vs. P_{OUT}

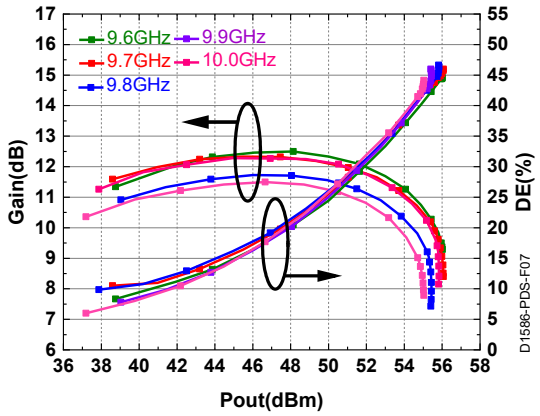


Figure 7. Gain and DE vs. P_{OUT}

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS} = 1000mA, V_{GS} = -2.68V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%
- The V_{DS} is modulated as pulse voltage, the input RF pulse signal must be offered synchronize with the V_{DS}.

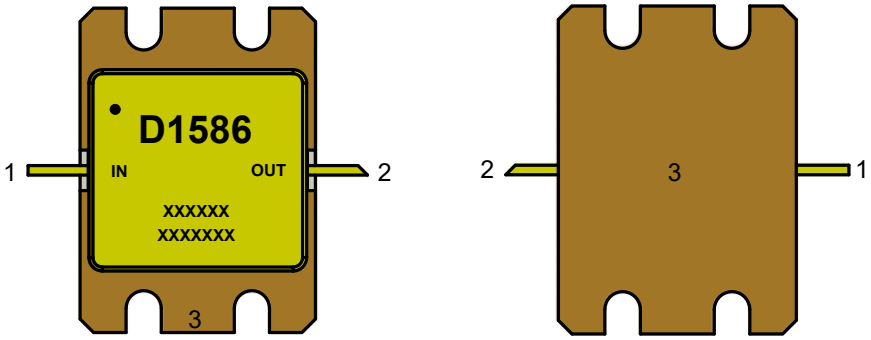
Table 7. RF Characteristics @ DEMO_A, 8.6-10GHz, Pulse, 48V

Freq. (GHz)	Linear Gain (dB)	Power Gain (dB)	Drain Efficiency (%)	Power-added Efficiency (%)	Output Power (dBm)	Output Power (W)
8.6	11.8	8.8	36.0	31.5	54.8	313
8.7	12.1	9.1	40.3	35.6	55.1	340
8.8	12.1	9.1	41.5	36.5	55.1	335
8.9	11.8	8.8	41.0	35.9	54.8	317
9.0	11.1	8.1	40.9	34.8	54.8	315
9.1	11.8	8.8	43.0	37.6	55.2	349
9.2	11.1	8.1	44.9	38.3	55.6	382
9.3	11.5	8.5	47.2	40.9	56.1	422
9.4	12.3	9.3	48.5	43.0	56.1	425
9.5	11.6	8.6	48.4	42.0	56.1	431
9.6	12.3	9.3	44.6	39.6	56.0	419
9.7	11.4	8.4	46.0	39.6	56.1	424
9.8	11.4	8.4	46.4	40.0	55.8	402
9.9	11.1	8.1	45.0	38.3	55.4	366
10.0	11.1	8.1	43.6	37.1	55.0	332

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS} = 1000mA, V_{GS} = -2.68V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%
- The output power is 54.8dBm (313W) at 8.6-10.0GHz when V_{DS}=48V.

10. Package Outline

■ Pin Layout



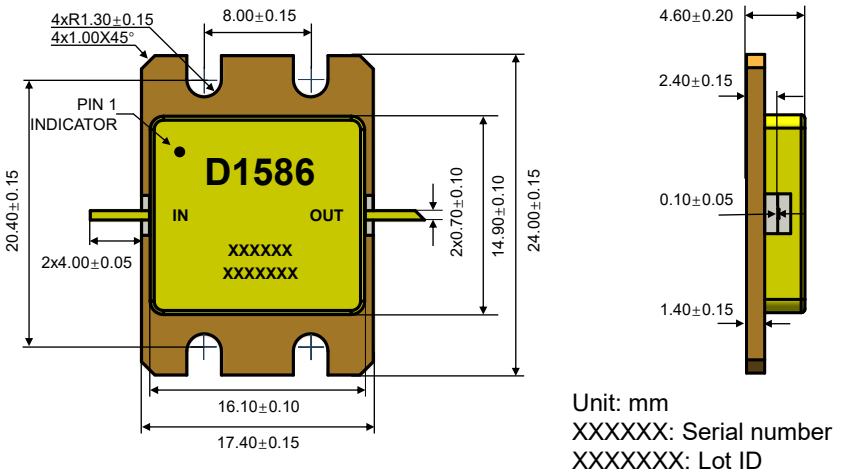
D1586-PDS-F08

Figure 8. D1586 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: 630F-A)



D1586-PDS-F09

Figure 9. D1586 Mechanical Drawing

11. Application Circuit

■ Schematic

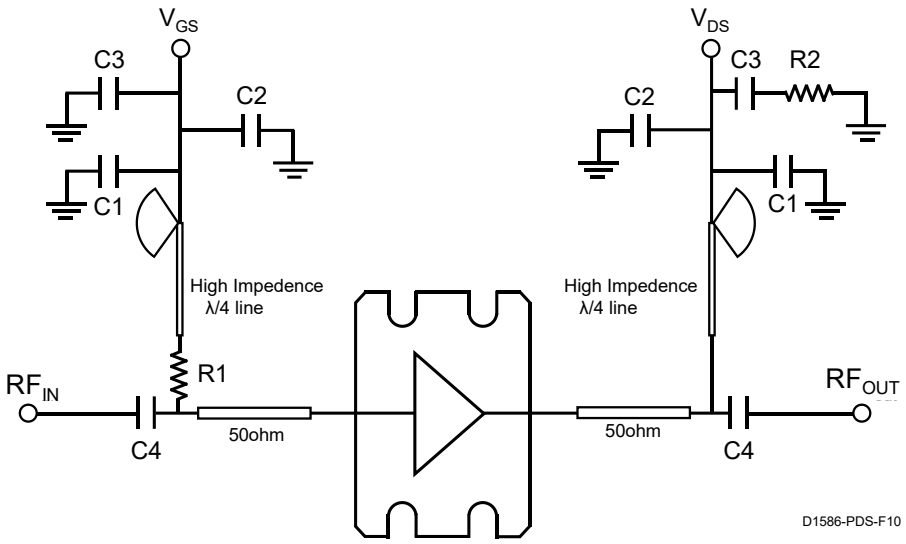


Figure 10. D1586 DEMO_A Application Circuit Schematic

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

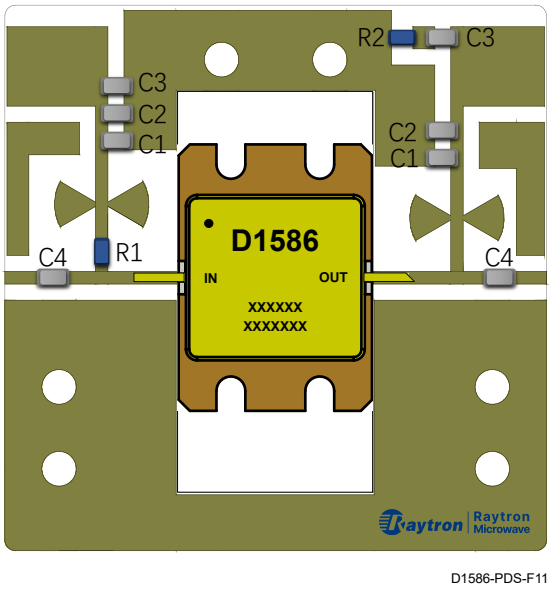


Figure 11. D1586 Application Circuit Layout（8.6GHz-10GHz）
（DEMO_A Size: 4.8cm x 4.8cm）

Table 10. 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
C4	1.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E1R0BB12D
R1	100Ω	1/8W 0805 Resistor	Yageo	RC0805FR-07100RL
R2	10Ω	1/8W 0805 Resistor	Yageo	RC0805FR-0710RL

12. DEMO Summary

Table 11. DEMO Summary

NO.	D1586 DEMO Name	V_{DS} (V)	Freq. (GHz)	Linear Gain (dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency (%)	Pulse or CW
1	DEMO_A, 300W	48	8.6-10	11.0	54.8	302	36	Pulse

13. Recommended Solder Temperature Profile

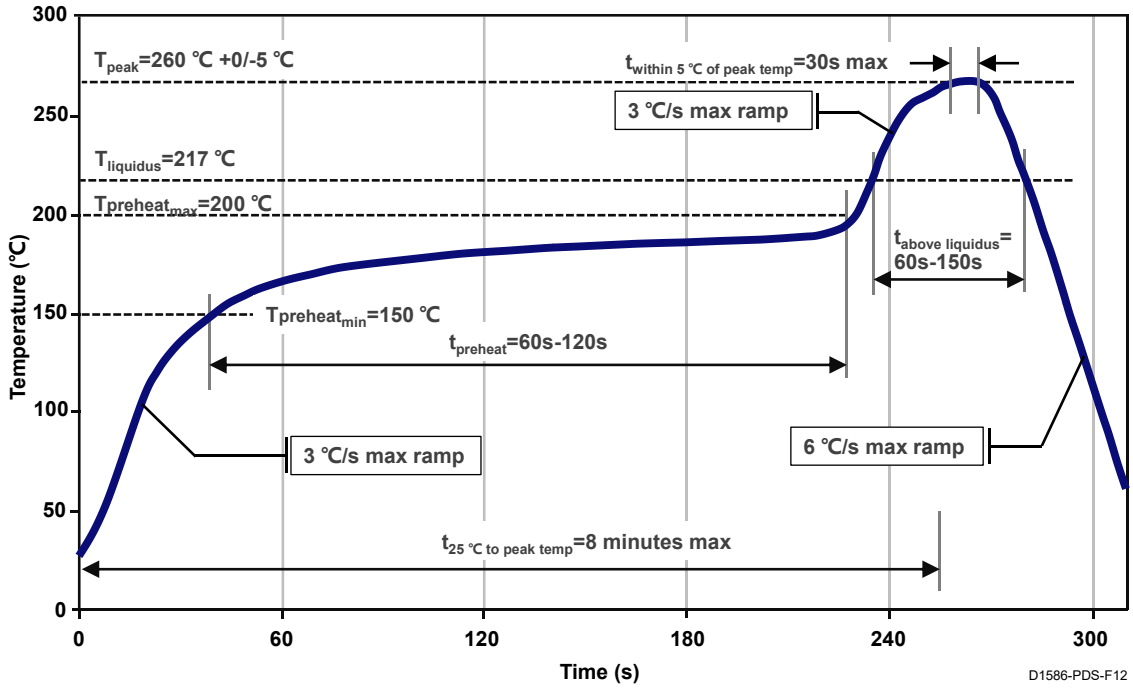


Figure 12. Recommended Solder Temperature Profile

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

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