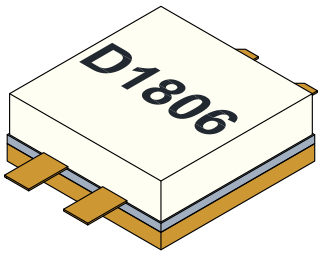
1. Description

- The D1806 is a 100W (P_{SAT}) gallium nitride (GaN) high electron mobility transistor (HEMT) with first generation RF GaN technology from Raytron.
- The D1806 operates from 0.03 to 2.8GHz with a 28V supply rail. It is matched to 50ohm on the input and featured an outstanding input return loss. In typical application like 0.5 to 2.6GHz wideband application, it can deliver 50W CW power.



D1806-PDS-F01

Figure 1. D1806 Package Outline

2. Applications

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

3. Features[1]

- Operating Frequency: 0.03–2.8GHz
- Output Power (P_{SAT}): 50.7dBm (117W)
- Linear Gain: 12.7dB
- Typical DE @P_{SAT}: 77.2%
- Operating Voltage: 28V
- CW and Pulse Capable
- Impedance Matched Z_{IN}=50ohm
- Package Type: 400P-B

[1] Measured in Raytron DEMO @1.2GHz

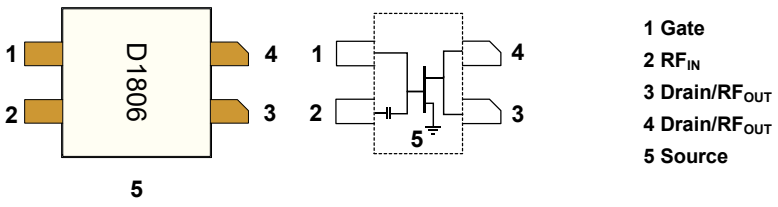
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	0.5GHz	1.2GHz	1.9GHz	2.6GHz	Units
Linear Gain	10.6	11.4	11.6	13.3	dB
Drain Efficiency	77.5	56.4	60.0	53.3	%
Output Power	46.8	48.3	47.8	47.3	dBm
Output Power	48	68	60	53	W

- Typical Class AB performance in Raytron DEMO_A (0.5-2.6GHz) with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 350mA, V_{GS} = -2.88V
- Test Condition: CW

5. Block Diagram



D1806-PDS-F02

Figure 2. D1806 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 ~ +40	V
Maximum Forward Gate Current	I_{GMax}	14.9	mA
Storage Temperature Range	T_{STG}	-65 ~ +150	°C
Operating Junction Temperature	T_J	250	°C
Input power (CW)	RF_{IN}	42	dBm

7. Recommended Operating Conditions

Table 3. Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Drain-Source Voltage Range, V_{DS}	-	28	40	V
Drain Bias Current, I_{DS}	-	350	-	mA
Gate-Source Voltage, V_{GS}	-	-2.88	-	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)	1.48	°C/W
Thermal Resistance (Junction-to-Case)[2]	R_{thjc} (FEA)	1.89	°C/W

1. Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 50.0W
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} = 14.9mA)	$V_{DS(BR)}$	120	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	16.44	-	A
Gate Threshold Voltage[3] (V_{DS} = 28V, I_{DS} = 14.9mA)	$V_{GS(TH)}$	-3.30	-2.80	-2.30	V
Gate Quiescent Voltage[3] (V_{DS} = 28V, I_{DS} = 350mA)	$V_{GS(Q)}$	-	-2.88	-	V

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

Table 6. RF Characteristics @ DEMO_A [1,2]

Freq. (GHz)	Linear Gain (dB)	Drain Efficiency (%)	Output Power (dBm)	Output Power (W)
0.5	10.6	77.5	46.8	48
1.0	11.6	65.5	46.6	46
1.5	11.7	67.4	49.2	84
2.0	11.6	60.4	47.8	60
2.5	13.3	68.6	48.4	69

1. Typical Class AB performance in Raytron DEMO_A (0.5-2.6GHz) with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 350mA, V_{GS} = -2.88V
2. Test Condition: CW

9. Wide-band Application Performance

■ Wide-band Application Performance (DEMO_A: 0.5-2.6GHz)

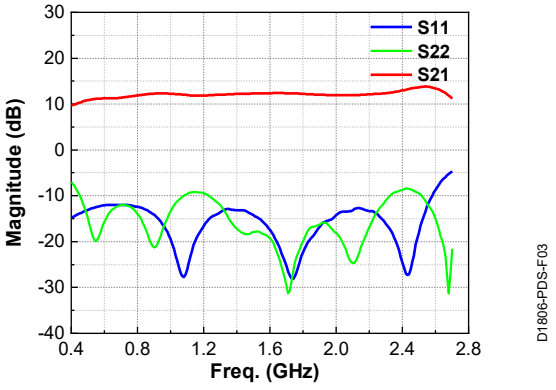


Figure 3. S11, S21, S22 vs. Freq.

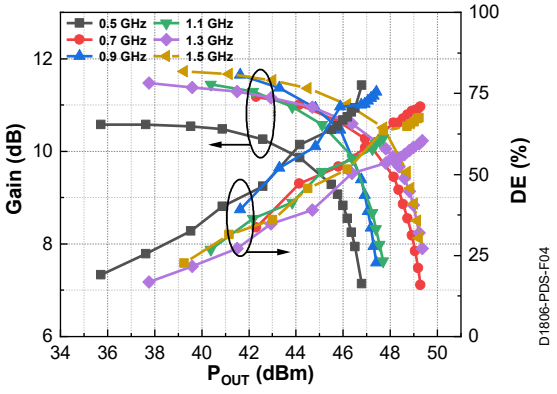


Figure 4. Wide-band Application Gain and DE vs. Output Power

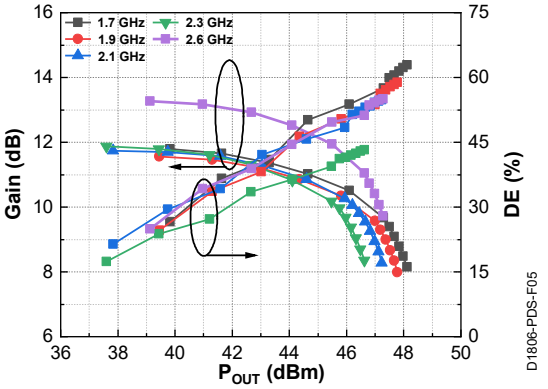


Figure 5. Wide-band Application Gain and DE vs. Output Power

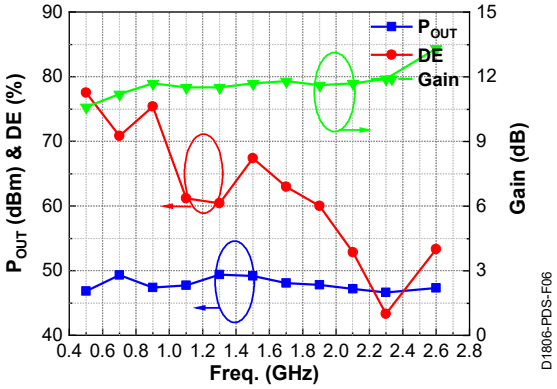


Figure 6. Wide-band Application P_{OUT}, Gain, and DE vs. Freq.

- Typical Class AB performance in Raytron Wide-band Application DEMO_A (0.5-2.6GHz) with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 350mA, V_{GS} = -2.88V
- Test Condition: CW
- The output power is more than 46.6dBm (46W) at 0.5-2.6GHz.

Table 7. RF Characteristics @ DEMO_A

Freq. (GHz)	Linear Gain (dB)	Drain Efficiency (%)	Output Power (dBm)	Output Power (W)
0.5	10.6	77.5	46.8	48
0.6	11.2	75.5	47.0	50
0.7	11.2	70.8	49.3	85
0.8	11.4	73.7	49.2	83
0.9	11.7	75.4	47.4	55
1.0	11.6	65.5	46.6	46
1.1	11.5	61.2	47.7	59
1.2	11.4	56.2	48.3	68
1.3	11.5	60.4	49.4	86
1.4	11.7	69.0	49.6	90
1.5	11.7	67.4	49.2	84
1.6	11.9	64.3	48.9	77
1.7	11.8	63.0	48.1	65
1.8	11.7	60.3	47.8	60
1.9	11.6	60.0	47.8	60
2.0	11.6	60.4	47.8	60
2.1	11.7	52.8	47.2	53
2.2	11.7	47.5	46.8	48
2.3	11.9	43.3	46.6	46
2.4	12.4	65.5	46.2	65
2.5	13.3	68.6	48.4	69
2.6	13.3	53.3	47.3	53

- Typical Class AB performance in Raytron Wide-band Application DEMO_A (0.5-2.6GHz) with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 350mA, V_{GS} = -2.88V
- Test Condition: CW
- The output power is more than 46.6dBm (46W) at 0.5-2.6GHz.

10. Package Outline

■ Pin Layout

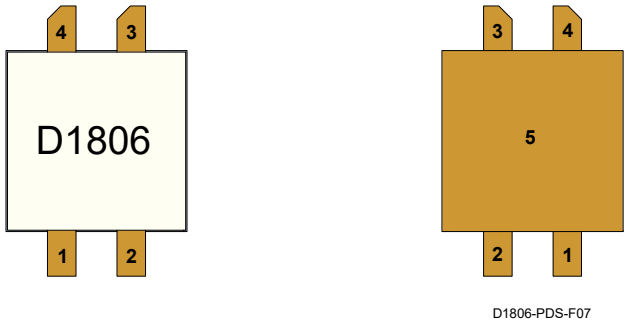


Figure 7. D1806 Pin Layout

Table 8. Pin Description

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

■ Mechanical Drawing (Package Type: 400P-B)

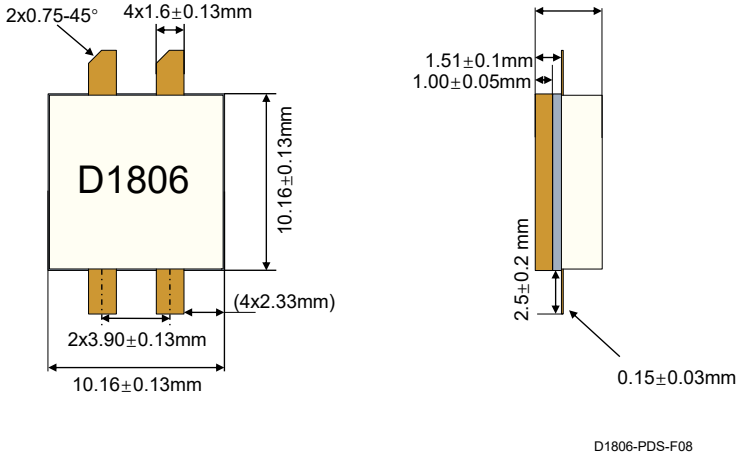


Figure 8. D1806 Mechanical Drawing

11. Application Circuit

■ Schematic

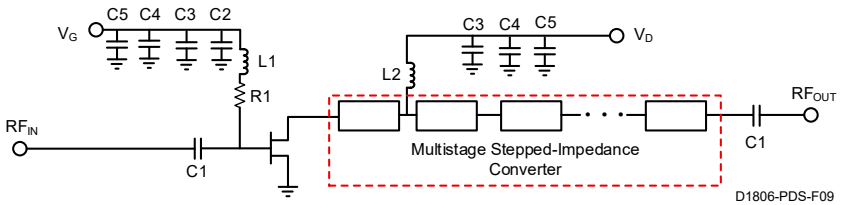


Figure 9. D1806 DEMO_A Application Circuit Schematic (0.5-2.6GHz)

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 (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

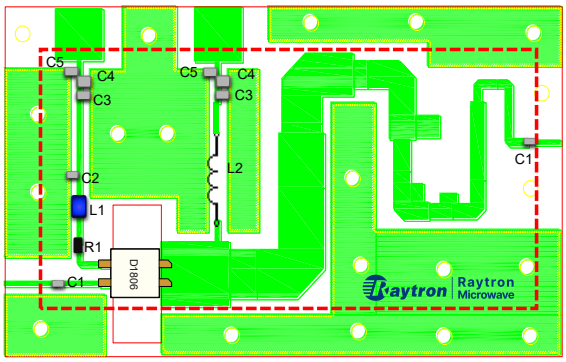


Figure 10. D1806 Application Circuit Layout (0.5-2.6GHz)
(DEMO_A Effective Size: 10.0cm x 5.0cm)

Table 10. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	1000pF	C0G 100V 0603 Capacitor	Murata	GCM1885C2A102JA16
C2	82pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E820JB12D
C3	0.1uF	C0G 100V 1206 Capacitor	Murata	GRM3195C2A104JA01D
C4	1uF	X7R 100V 1210 Capacitor	Murata	GRM32ER72A105KA01L
C5	4.7uF	X7S 100V 1206 Capacitor	Murata	GRM31CC72A475KE11L
R1	91Ω	1/8W 0805 Resistor	Yageo	RC0805FR-0791RL
L1	0.9uH	1.4A 1008 Inductor	Coilcraft	1008AF-901X
L2	N/A	2 turns, R=0.6mm	N/A	N/A

12. DEMO Summary

Table 11. DEMO Summary

D1806 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency(%)	Pulse or CW
DEMO_A, 50W	28	0.5-2.6	10.6	46.6	46	43.3	CW
DEMO_B, 50W	28	0.3-2.7	9.9	46.6	46	47.9	Pulse
DEMO_C, 50W	28	0.3-2.3	9.4	47.1	51	54.9	CW

13. Recommended Solder Temperature Profile

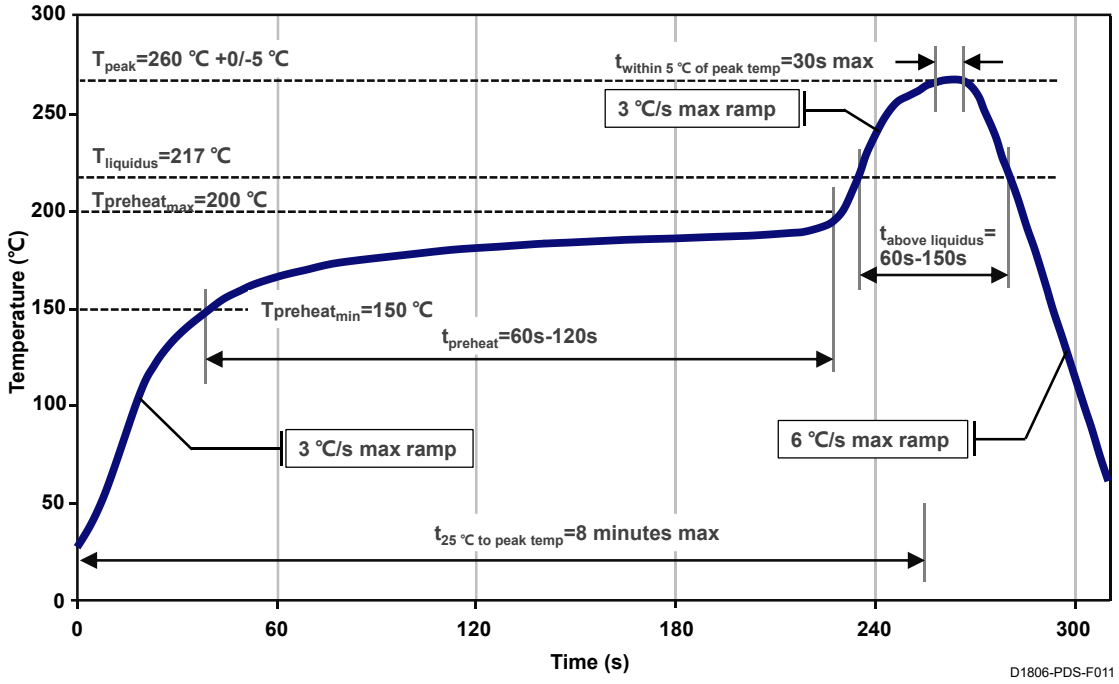


Figure 11. Recommended Solder Temperature Profile

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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