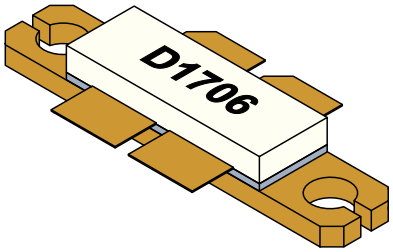
## 1. Description

- The D1706 is an 200W ($P_{SAT}$) wideband pre-matched gallium nitride (GaN) high electron mobility transistor (HEMT) with first generation RF GaN technology from Raytron.
- The D1706 operates from DC to 6.5GHz with a 28V supply rail. It can deliver 200W pulse power across the 4.5 to 6 GHz. The device is offered in an industry standard air cavity package.




D1706-PDS-F01

**Figure 1. D1706 Package Outline**

## 2. Applications

- Point-to-point Communication
- Broadband Wireless Access
- 5.8GHz ISM Applications

## 3. Features[1]

- Operating Frequency: DC–6.5GHz
- Output Power[1] ($P_{SAT}$): 53.5dBm (224W)
- Linear Gain[1]: 14.2dB
- Typical DE @$P_{SAT}$[1]: 59.6%
- Operating Voltage: 28V
- CW and Pulse Capable
- Package Type: 650F-B

[1] Measured in Raytron DEMO @6GHz

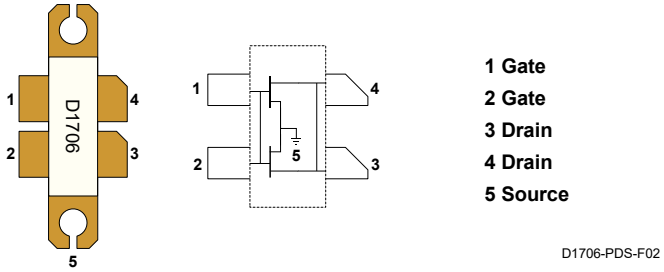
## 4. Brief Typical Performance

**Table 1. Brief Typical Performance**

| Parameter | 4.6GHz Pulse | 5.2GHz Pulse | 5.7GHz Pulse | Units |
|---|---|---|---|---|
| Linear Gain | 13.0 | 12.9 | 14.2 | dB |
| Drain Efficiency | 55.6 | 57.8 | 54.4 | % |
| Output Power | 53.8 | 53.1 | 53.1 | dBm |
| Output Power | 240 | 204 | 204 | W |

- Typical Class AB performance in DEMO_A with the device soldered onto the heatsink, test condition: $V_{DS}$ = 28V, $I_{DS}$ = 500mA, $V_{GS}$ = - 2.80V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 5%

## 5. Block Diagram




D1706-PDS-F02

**Figure 2. D1706 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 | $I_{GMax}$ | 37 | mA |
| Storage Temperature Range | $T_{STG}$ | -65 ~ +200 | °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, $I_{DS}$ | - | 500 | - | mA |
| Gate-Source Voltage, $V_{GS}$ | - | -2.80 | - | 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) | 0.66 | °C/W |
| Thermal Resistance (Junction-to-Case)[2] | $R_{thjc}$ (FEA) | 0.81 | °C/W |

1. Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, $P_D$ = 128.0W
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, $I_{DS}$ = 37mA) | $V_{DS(BR)}$ | 84 | - | - | V |
| Saturated Drain Current[2] ($V_{DS}$ = 10V, $V_{GS}$ = 1.0V) | $I_{Max}$ | - | 40.82 | - | A |
| Gate Threshold Voltage[3] ($V_{DS}$ = 28V, $I_{DS}$ = 37mA) | $V_{GS(TH)}$ | -3.30 | -2.80 | -2.30 | V |
| Gate Quiescent Voltage[3] ($V_{DS}$ = 28V, $I_{DS}$ = 500mA) | $V_{GS(Q)}$ | - | -2.80 | - | V |

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

### Table 6. Dynamic Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Input Capacitance | $C_{GS}$ | - | 54.7 | - | pF |
| Output Capacitance | $C_{DS}$ | - | 34.0 | - | pF |
| Feedback Capacitance | $C_{GD}$ | - | 2.0 | - | pF |

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

## 9. Wide-band Application Performance

### ■ Wide-band Application Performance (DEMO_A: 4.5-6GHz)

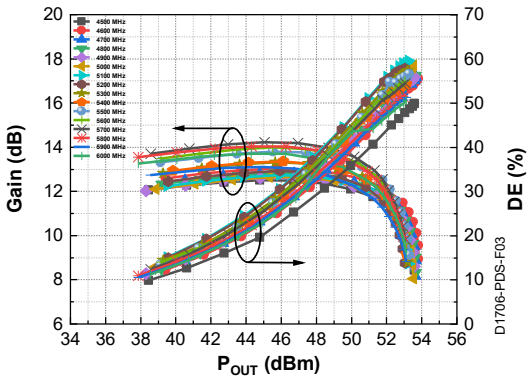



Figure 3. Wide-band Application Gain and DE vs. Output Power

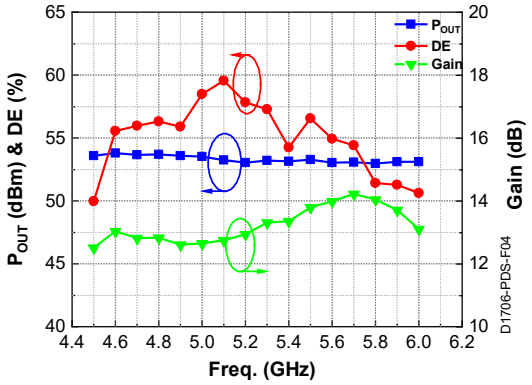



Figure 4. Wide-band Application $P_{OUT}$, Gain and DE vs. Freq.

### Table 7. RF Characteristics

| Freq. (GHz) | Linear Gain (dB) | Drain Efficiency (%) | Output Power (dBm) | Output Power (W) |
|---|---|---|---|---|
| 4.5 | 12.5 | 50.0 | 53.6 | 229 |
| 4.6 | 13.0 | 55.6 | 53.8 | 240 |
| 4.7 | 12.8 | 56.0 | 53.7 | 234 |
| 4.8 | 12.8 | 56.3 | 53.7 | 234 |
| 4.9 | 12.6 | 55.9 | 53.6 | 229 |
| 5.0 | 12.7 | 58.5 | 53.5 | 224 |
| 5.1 | 12.7 | 59.6 | 53.2 | 209 |
| 5.2 | 12.9 | 57.8 | 53.1 | 204 |
| 5.3 | 13.3 | 57.3 | 53.2 | 209 |
| 5.4 | 13.4 | 54.2 | 53.1 | 204 |
| 5.5 | 13.8 | 56.6 | 53.3 | 214 |
| 5.6 | 14.0 | 54.9 | 53.0 | 200 |
| 5.7 | 14.2 | 54.4 | 53.1 | 204 |
| 5.8 | 14 | 51.4 | 53.0 | 200 |
| 5.9 | 13.7 | 51.3 | 53.1 | 204 |
| 6.0 | 13.1 | 50.6 | 53.1 | 204 |

• Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: $V_{DS}$ = 28V, $I_{DS}$ = 500mA, $V_{GS}$ = -2.80V

• Test Condition: Input pulse, Pulse width = 100μs, Duty cycle = 5%

• The output power is 53.0dBm (200W) at 4.5-6GHz.

# 10. Package Outline

## ■ Pin Layout

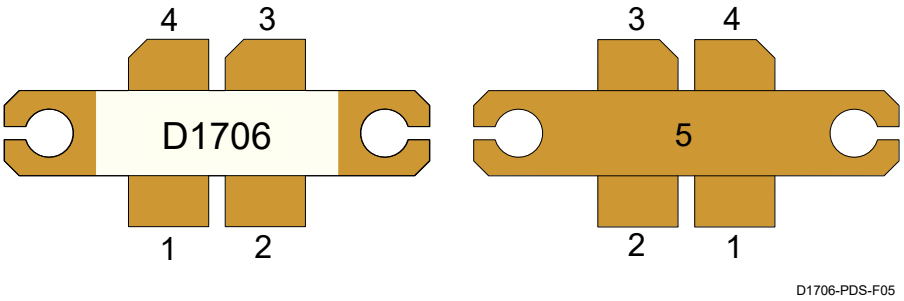



**Figure 5. D1706 Pin Layout**

### Table 8. Pin Description

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

## ■ Mechanical Drawing (Package Type: 650F-B)

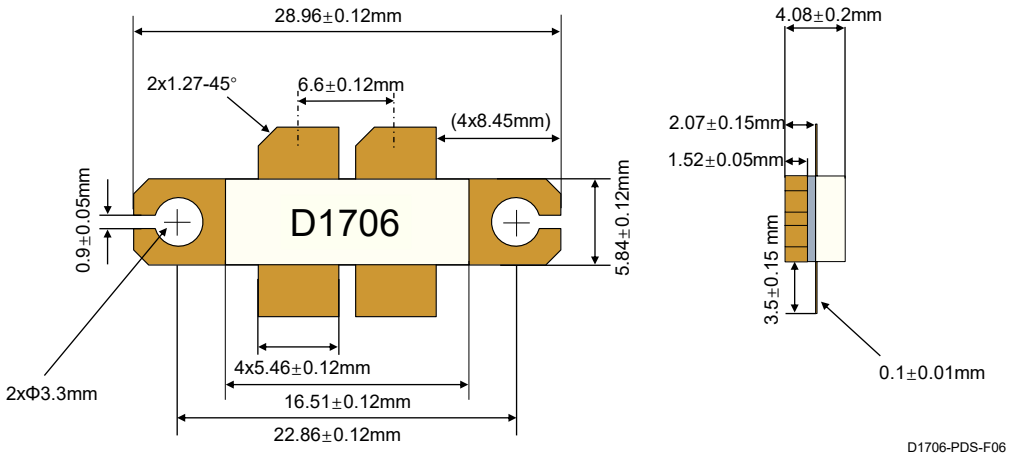



**Figure 6. D1706 Mechanical Drawing**

# 11. Application Circuit

## ■ Schematic

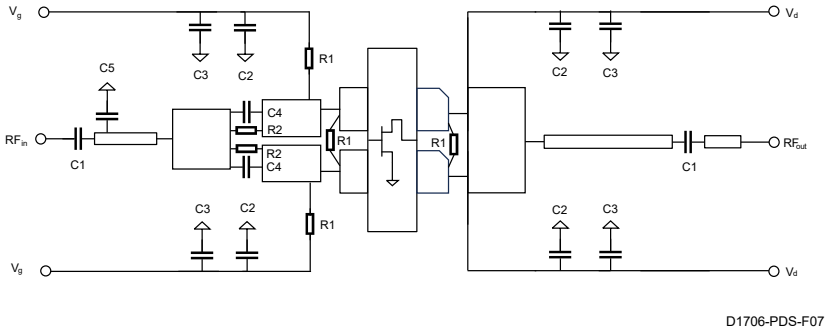



**Figure 7. D1706 DEMO_A Application Circuit Schematic**

### 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 (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

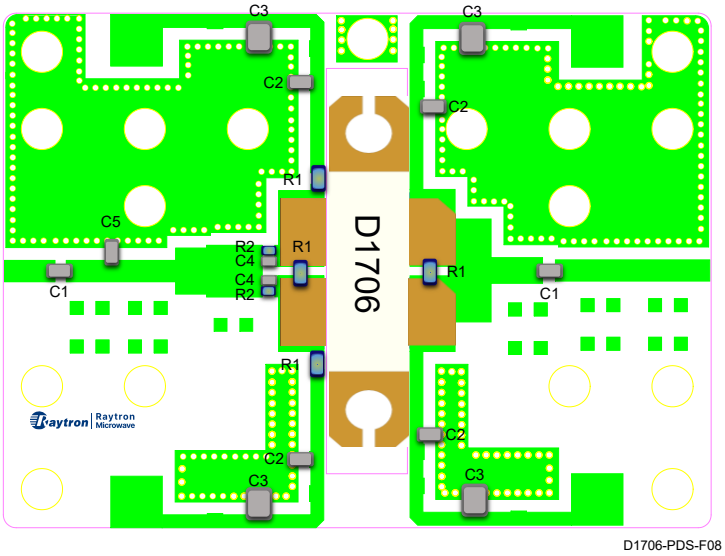



**Figure 8. D1706 Application Circuit Layout**
**（DEMO_A Size: 5.5cm x 4.0cm）**

**Table 10. Bill of Materials**

| Component | Value | Description | Manufacturer | Part Number |
|---|---|---|---|---|
| PCB | 30mil | N/A | Rogers | RO4350B |
| C1 | 1.5pF | C0G 250V 0805 Capacitor | Murata | GQM2195C2E1R5BB12D |
| C2 | 2.0pF | C0G 250V 0805 Capacitor | Murata | GQM2195C2E2R0BB12D |
| C3 | 1.0uF | X7S 100V 2006 Capacitor | Murata | GRM32ER72A105KA01L |
| C4 | 2.4pF | C0G 250V 0603 Capacitor | Murata | GQM1875C2E2R4CB12D |
| C5 | 0.3pF | C0G 250V 0805 Capacitor | Murata | GQM2195C2ER30WB12D |
| R1 | 10Ω | 1/8W 0805 Resistor | Yageo | RC0805FR-0710RL |
| R2 | 5.1Ω | 1/10W 0603 Resistor | Yageo | RC0603FR-075R1L |

## 12. DEMO Summary

**Table 11. DEMO Summary**

| NO. | D1706 DEMO Name | $V_{DS}$ (V) | Freq (GHz) | Linear Gain(dB) | $P_{SAT}$ (dBm) | $P_{SAT}$ (W) | Drain Efficiency | Pulse or CW |
|---|---|---|---|---|---|---|---|---|
| 1 | DEMO_A, 200W | 28 | 4.5-6.0 | 12.5 | 53.0 | 200 | 50.0% | Pulse |

## 13. Recommended Solder Temperature Profile

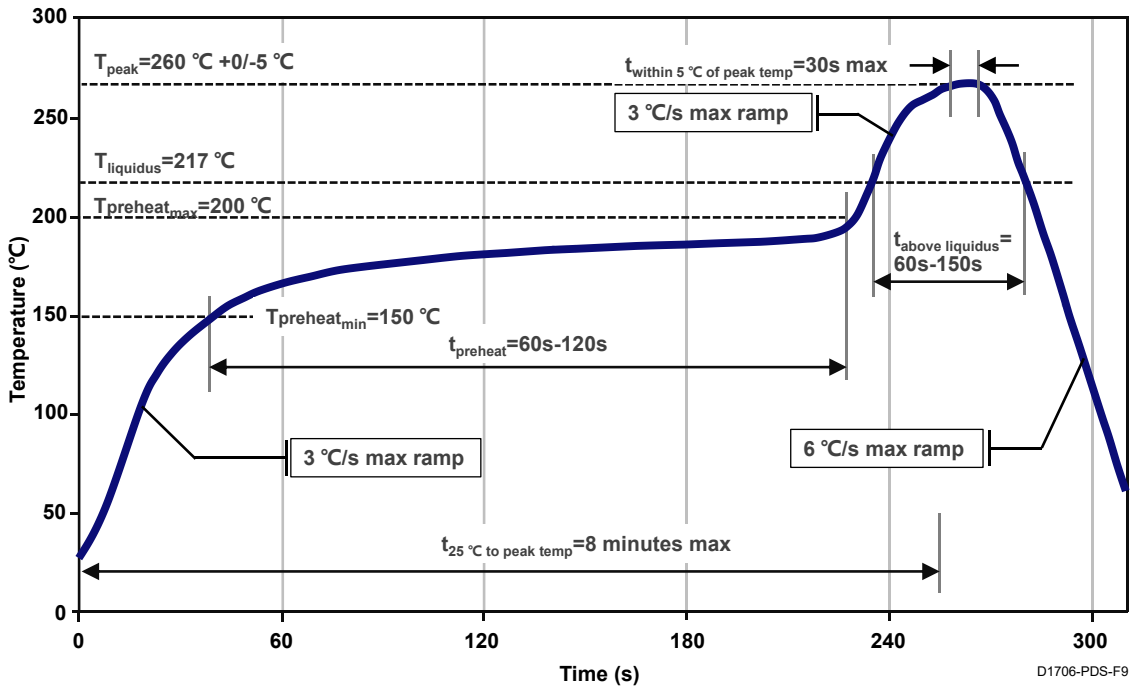



**Figure 9. Recommended Solder Temperature Profile**

## 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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