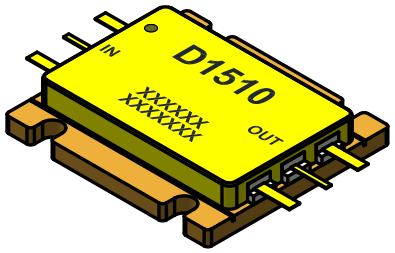
## 1. Description

- The D1510 is a high power (70W) GaN-HEMT that is internally matched for ultra broadband application to provide optimum power and gain in a 50ohm system.
- The device operates from 1 to 6GHz with a 28V or a 32V supply rail. It is offered in a small hermetically sealed metal/ceramic flange package.




D1510-PDS-F01

**Figure 1. D1510 Package Outline**

## 2. Applications

- Ultra Broadband Amplifiers
- Test Instrumentation
- EMC Amplifiers
- Electronic Countermeasures

## 3. Features[1]

- Operating Frequency: 1–6GHz
- Output Power ($P_{SAT}$): 48.2dBm (66W)
- Linear Gain: 10.4dB
- Typical DE @ $P_{SAT}$: 42.3%
- Operating Voltage: 28V
- Impedance Matched $Z_{IN}/Z_{OUT}$ = 50ohm
- Hermetically Sealed Package
- Package Type: 670F-A

[1] Measured in Raytron DEMO_A

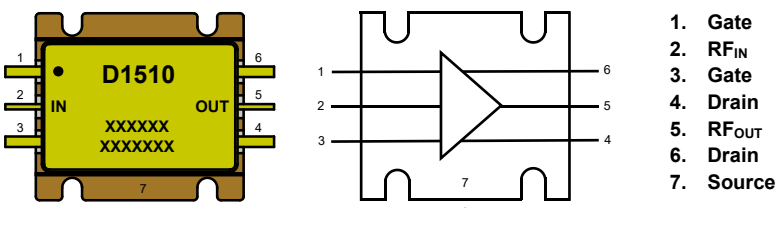
## 4. Brief Typical Performance

**Table 1. Brief Typical Performance**

| Parameter | 1.0GHz | 1.8GHz | 2.6GHz | 3.4GHz | 4.2GHz | 5.0GHz | 6.0GHz | Units |
|---|---|---|---|---|---|---|---|---|
| Linear Gain | 10.4 | 11.9 | 11.4 | 11.3 | 11.2 | 10.8 | 10.6 | dB |
| Power Gain | 7.4 | 8.9 | 8.4 | 8.3 | 8.2 | 7.8 | 7.6 | dB |
| Drain Efficiency | 43.2 | 59.2 | 49.3 | 51.1 | 60.2 | 42.9 | 50.1 | % |
| Output Power | 48.2 | 49.3 | 49.1 | 49.9 | 49.5 | 49.0 | 48.5 | dBm |
| Output Power | 66 | 85 | 81 | 98 | 89 | 79 | 71 | W |

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: $V_{DS}$ = 28V, $I_{DS}$ = 500mA, $V_{GS}$ = -2.94V
- Test condition: CW

## 5. Block Diagram




1. Gate
2. $RF_{IN}$
3. Gate
4. Drain
5. $RF_{OUT}$
6. Drain
7. Source

D1510-PDS-F02

**Figure 2. D1510 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 | $I_{GMax}$ | 18.24 | 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, $V_{DS}$ | - | 28 | 32 | V |
| Drain Bias Current, $I_{DS}$ | - | 500 | - | mA |
| Gate-Source Voltage, $V_{GS}$ | - | -2.94 | - | 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) | 1.00 | °C/W |
| Thermal Resistance (Junction-to-Case)[2] | $R_{thjc}$ (FEA) | 1.28 | °C/W |

1. Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, $P_D$ = 90.0W
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, $I_{DS}$ = 18.24mA) | $V_{DS(BR)}$ | 84 | - | - | V |
| Saturated Drain Current[2] ($V_{DS}$ = 10V, $V_{GS}$ = 1.0V) | $I_{Max}$ | - | 20.98 | - | A |
| Gate Threshold Voltage[3] ($V_{DS}$ = 28V, $I_{DS}$ = 18.24mA) | $V_{GS(TH)}$ | -3.30 | -2.80 | -2.30 | V |
| Gate Quiescent Voltage[3] ($V_{DS}$ = 28V, $I_{DS}$ = 500mA) | $V_{GS(Q)}$ | - | -2.94 | - | V |

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

### Table 6. RF Characteristics

| Freq. | Linear Gain ($G_{LIN}$) | Power Gain ($G_P$) | Drain Efficiency ($\eta_D$) | Output Power ($P_{SAT}$) |
|---|---|---|---|---|
| 1.0GHz | 10.4dB | 7.4dB | 43.2% | 48.2dBm (66W) |
| 3.4GHz | 11.3dB | 8.3dB | 51.1% | 49.9dBm (98W) |
| 6.0GHz | 10.6dB | 7.6dB | 50.1% | 48.5dBm (71W) |

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: $V_{DS}$ = 28V, $I_{DS}$ = 500mA, $V_{GS}$ = -2.94V
- Test condition: CW

## 9. Typical Performance

### ■ Wide-band Application Performance (DEMO_A, 1-6GHz, Pulse, 28V)

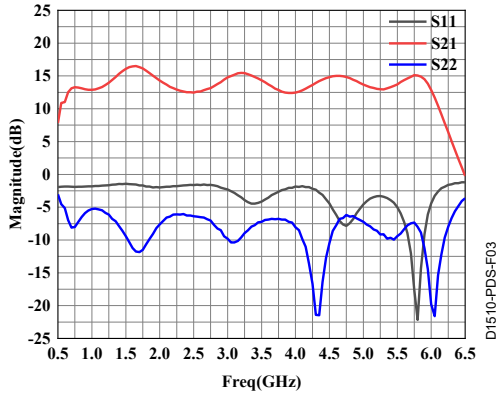



Figure 3. $S_{11}$, $S_{21}$ and $S_{22}$ vs. Freq.

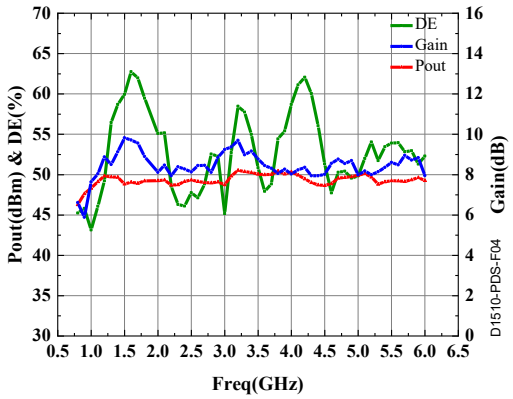



Figure 4. $P_{OUT}$, DE and Gain vs. Freq.

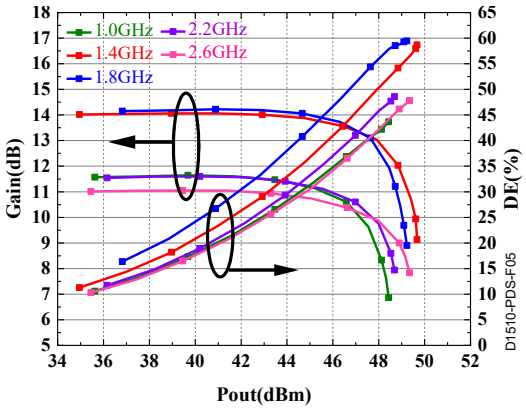



Figure 5. Gain and DE vs. $P_{OUT}$

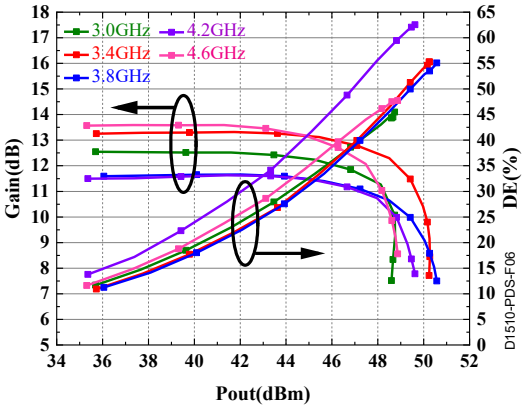



Figure 6. Gain and DE vs. $P_{OUT}$

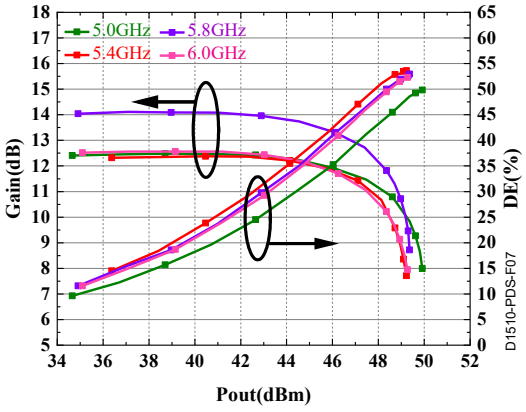



Figure 7. Gain and DE vs. $P_{OUT}$

## Table 7. RF Characteristics @ DEMO_A, 1-6GHz, Pulse, 28V

| Freq. | Linear Gain ($G_{LIN}$) | Power Gain ($G_P$) | Drain Efficiency ($\eta_D$) | Output Power ($P_{SAT}$) |
|---|---|---|---|---|
| 1.0GHz | 10.6dB | 7.6dB | 43.1% | 48.3dBm (68W) |
| 1.1GHz | 11.0dB | 8.0dB | 46.1% | 49.1dBm (81W) |
| 1.2GHz | 11.9dB | 8.9dB | 49.2% | 49.8dBm (95W) |
| 1.3GHz | 11.5dB | 8.5dB | 56.5% | 49.7dBm (93W) |
| 1.4GHz | 12.1dB | 9.1dB | 58.7% | 49.7dBm (93W) |
| 1.5GHz | 12.8dB | 9.8dB | 59.9% | 48.8dBm (76W) |
| 1.6GHz | 12.7dB | 9.7dB | 62.8% | 49.1dBm (81W) |
| 1.7GHz | 12.6dB | 9.6dB | 62.0% | 48.9dBm (78W) |
| 1.8GHz | 11.9dB | 8.9dB | 59.5% | 49.2dBm (83W) |
| 1.9GHz | 11.5dB | 8.5dB | 56.2% | 49.3dBm (85W) |
| 2.0GHz | 11.1dB | 8.1dB | 55.1% | 49.3dBm (85W) |
| 2.1GHz | 11.5dB | 8.5dB | 55.2% | 49.3dBm (85W) |
| 2.2GHz | 10.9dB | 7.9dB | 48.6% | 48.7dBm (74W) |
| 2.3GHz | 11.4dB | 8.4dB | 46.3% | 48.8dBm (76W) |
| 2.4GHz | 11.3dB | 8.3dB | 46.1% | 49.2dBm (83W) |
| 2.5GHz | 11.1dB | 8.1dB | 47.8% | 49.3dBm (85W) |
| 2.6GHz | 11.5dB | 8.5dB | 47.1% | 49.2dBm (83W) |
| 2.7GHz | 11.5dB | 8.5dB | 48.8% | 49.0dBm (79W) |
| 2.8GHz | 11.1dB | 8.1dB | 52.6% | 49.0dBm (79W) |
| 2.9GHz | 11.9dB | 8.9dB | 52.3% | 49.1dBm (81W) |
| 3.0GHz | 12.2dB | 9.2dB | 45.2% | 48.8dBm (76W) |
| 3.1GHz | 12.4dB | 9.4dB | 52.7% | 49.8dBm (95W) |
| 3.2GHz | 12.7dB | 9.7dB | 58.5% | 50.5dBm (112W) |
| 3.3GHz | 12.0dB | 9.0dB | 57.8% | 50.4dBm (110W) |
| 3.4GHz | 12.2dB | 9.2dB | 55.0% | 50.3dBm (107W) |
| 3.5GHz | 11.8dB | 8.8dB | 50.8% | 50.1dBm (102W) |
| 3.6GHz | 11.5dB | 8.5dB | 47.9% | 50.0dBm (100W) |
| 3.7GHz | 11.3dB | 8.3dB | 48.8% | 50.0dBm (100W) |
| 3.8GHz | 11.1dB | 8.1dB | 54.4% | 50.5dBm (112W) |
| 3.9GHz | 11.3dB | 8.3dB | 55.4% | 50.1dBm (102W) |
| 4.0GHz | 11.0dB | 8.0dB | 58.7% | 50.3dBm (107W) |
| 4.1GHz | 11.2dB | 8.2dB | 61.1% | 50.0dBm (100W) |
| 4.2GHz | 11.4dB | 8.4dB | 62.1% | 49.5dBm (89W) |
| 4.3GHz | 10.9dB | 7.9dB | 60.1% | 49.0dBm (79W) |
| 4.4GHz | 10.9dB | 7.9dB | 56.1% | 48.7dBm (74W) |
| 4.5GHz | 11.0dB | 8.0dB | 51.3% | 48.7dBm (74W) |
| 4.6GHz | 11.6dB | 8.6dB | 47.7% | 48.9dBm (78W) |
| 4.7GHz | 11.8dB | 8.8dB | 50.3% | 49.6dBm (91W) |
| 4.8GHz | 11.6dB | 8.6dB | 50.4% | 49.6dBm (91W) |
| 4.9GHz | 11.7dB | 8.7dB | 49.6% | 49.8dBm (95W) |
| 5.0GHz | 11.0dB | 8.0dB | 49.8% | 49.9dBm (98W) |
| 5.1GHz | 11.2dB | 8.2dB | 52.0% | 50.1dBm (102W) |

| Freq. | Linear Gain ($G_{LIN}$) | Power Gain ($G_P$) | Drain Efficiency ($\eta_D$) | Output Power ($P_{SAT}$) |
|---|---|---|---|---|
| 5.2GHz | 11.0dB | 8.0dB | 54.0% | 49.7dBm (93W) |
| 5.3GHz | 11.1dB | 8.1dB | 51.7% | 48.8dBm (76W) |
| 5.4GHz | 11.4dB | 8.4dB | 53.5% | 49.1dBm (81W) |
| 5.5GHz | 11.6dB | 8.6dB | 53.9% | 49.3dBm (85W) |
| 5.6GHz | 11.5dB | 8.5dB | 53.9% | 49.2dBm (83W) |
| 5.7GHz | 12.0dB | 9.0dB | 52.8% | 49.2dBm (83W) |
| 5.8GHz | 11.7dB | 8.7dB | 53.0% | 49.4dBm (87W) |
| 5.9GHz | 11.8dB | 8.8dB | 51.3% | 49.6dBm (91W) |
| 6.0GHz | 11.0dB | 8.0dB | 52.3% | 49.3dBm (85W) |

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: $V_{DS}$ = 28V, $I_{DS}$ = 500mA, $V_{GS}$ = -2.94V
- Test condition: Pulse, Pulse width = 100μs, Duty cycle = 10%
- The output power is 48.3dBm (68W) at 1-6GHz when $V_{DS}$ = 28V.

## ■ Wide-band Application Performance (DEMO_A, 1-6GHz, CW, 28V)

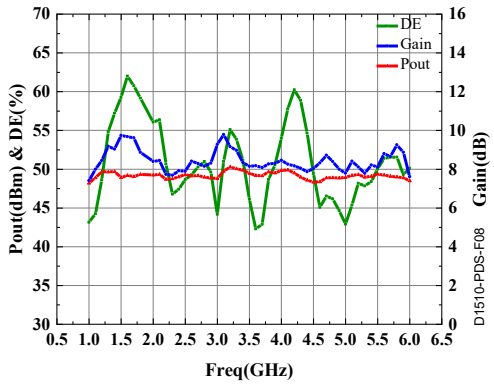



Figure 8. $P_{OUT}$, DE and Gain vs. Freq.

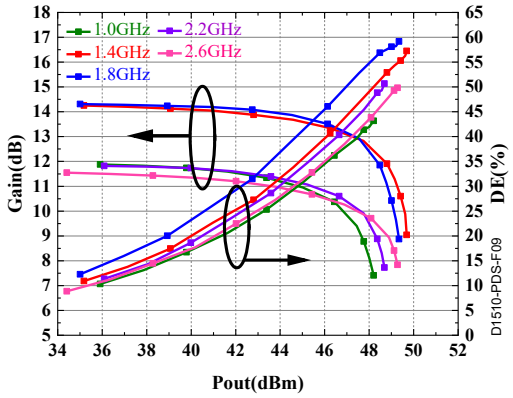



Figure 9. Gain and DE vs. $P_{OUT}$

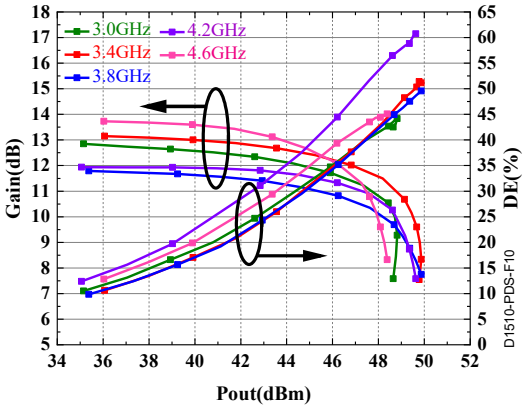



Figure 10. Gain and DE vs. $P_{OUT}$

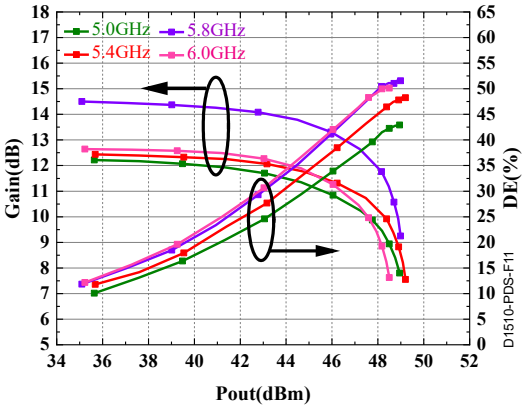



Figure 11. Gain and DE vs. $P_{OUT}$

## Table 8. RF Characteristics @ DEMO_A, 1-6GHz, CW, 28V

| Freq. | Linear Gain ($G_{LIN}$) | Power Gain ($G_P$) | Drain Efficiency ($\eta_D$) | Output Power ($P_{SAT}$) |
|---|---|---|---|---|
| 1.0GHz | 10.4dB | 7.4dB | 43.2% | 48.2dBm (66W) |
| 1.1GHz | 11.0dB | 8.0dB | 44.2% | 48.9dBm (78W) |
| 1.2GHz | 11.5dB | 8.5dB | 48.6% | 49.7dBm (93W) |
| 1.3GHz | 12.2dB | 9.2dB | 54.8% | 49.7dBm (93W) |

| Freq. | Linear Gain ($G_{LIN}$) | Power Gain ($G_P$) | Drain Efficiency ($\eta_D$) | Output Power ($P_{SAT}$) |
|---|---|---|---|---|
| 1.4GHz | 12.0dB | 9.0dB | 57.2% | 49.7dBm (93W) |
| 1.5GHz | 12.7dB | 9.7dB | 59.3% | 48.9dBm (78W) |
| 1.6GHz | 12.7dB | 9.7dB | 62.0% | 49.2dBm (83W) |
| 1.7GHz | 12.6dB | 9.6dB | 60.8% | 49.1dBm (81W) |
| 1.8GHz | 11.9dB | 8.9dB | 59.2% | 49.3dBm (85W) |
| 1.9GHz | 11.4dB | 8.4dB | 55.2% | 49.3dBm (85W) |
| 2.0GHz | 11.4dB | 8.4dB | 56.1% | 49.3dBm (85W) |
| 2.1GHz | 11.5dB | 8.5dB | 56.4% | 49.3dBm (85W) |
| 2.2GHz | 10.7dB | 7.7dB | 50.7% | 48.7dBm (74W) |
| 2.3GHz | 10.7dB | 7.7dB | 46.8% | 48.8dBm (76W) |
| 2.4GHz | 10.9dB | 7.9dB | 47.4% | 49.0dBm (79W) |
| 2.5GHz | 10.9dB | 7.9dB | 48.7% | 49.3dBm (85W) |
| 2.6GHz | 11.4dB | 8.4dB | 49.3% | 49.1dBm (81W) |
| 2.7GHz | 11.3dB | 8.3dB | 50.3% | 49.2dBm (83W) |
| 2.8GHz | 11.2dB | 8.2dB | 51.0% | 49.0dBm (79W) |
| 2.9GHz | 11.3dB | 8.3dB | 49.6% | 48.9dBm (78W) |
| 3.0GHz | 12.3dB | 9.3dB | 44.2% | 48.8dBm (76W) |
| 3.1GHz | 12.8dB | 9.8dB | 51.0% | 49.7dBm (93W) |
| 3.2GHz | 12.2dB | 9.2dB | 55.1% | 50.3dBm (107W) |
| 3.3GHz | 12.0dB | 9.0dB | 53.9% | 50.1dBm (102W) |
| 3.4GHz | 11.3dB | 8.3dB | 51.1% | 49.9dBm (98W) |
| 3.5GHz | 11.2dB | 8.2dB | 46.1% | 49.5dBm (89W) |
| 3.6GHz | 11.2dB | 8.2dB | 42.3% | 49.2dBm (83W) |
| 3.7GHz | 11.1dB | 8.1dB | 42.9% | 49.2dBm (83W) |
| 3.8GHz | 11.3dB | 8.3dB | 48.7% | 49.6dBm (91W) |
| 3.9GHz | 11.3dB | 8.3dB | 50.6% | 49.5dBm (89W) |
| 4.0GHz | 11.5dB | 8.5dB | 54.0% | 49.8dBm (95W) |
| 4.1GHz | 11.3dB | 8.3dB | 57.8% | 49.9dBm (98W) |
| 4.2GHz | 11.2dB | 8.2dB | 60.2% | 49.5dBm (89W) |
| 4.3GHz | 11.1dB | 8.1dB | 58.9% | 49.0dBm (79W) |
| 4.4GHz | 10.9dB | 7.9dB | 54.7% | 48.6dBm (72W) |
| 4.5GHz | 11.0dB | 8.0dB | 49.5% | 48.3dBm (68W) |
| 4.6GHz | 11.3dB | 8.3dB | 45.1% | 48.4dBm (69W) |
| 4.7GHz | 11.7dB | 8.7dB | 46.5% | 48.9dBm (78W) |
| 4.8GHz | 11.4dB | 8.4dB | 46.2% | 48.9dBm (78W) |
| 4.9GHz | 11.0dB | 8.0dB | 44.7% | 48.9dBm (78W) |
| 5.0GHz | 10.8dB | 7.8dB | 42.9% | 49.0dBm (79W) |
| 5.1GHz | 11.4dB | 8.4dB | 45.4% | 49.2dBm (83W) |
| 5.2GHz | 11.1dB | 8.1dB | 48.2% | 49.3dBm (85W) |
| 5.3GHz | 10.8dB | 7.8dB | 47.8% | 49.0dBm (79W) |
| 5.4GHz | 11.2dB | 8.2dB | 48.4% | 49.1dBm (81W) |
| 5.5GHz | 11.1dB | 8.1dB | 50.0% | 49.4dBm (87W) |
| 5.6GHz | 11.8dB | 8.8dB | 51.4% | 49.2dBm (83W) |

| Freq. | Linear Gain ($G_{LIN}$) | Power Gain ($G_P$) | Drain Efficiency ($\eta_D$) | Output Power ($P_{SAT}$) |
|---|---|---|---|---|
| 5.7GHz | 11.7dB | 8.7dB | 51.5% | 49.1dBm (81W) |
| 5.8GHz | 12.3dB | 9.3dB | 51.6% | 49.0dBm (79W) |
| 5.9GHz | 11.9dB | 8.9dB | 49.3% | 48.9dBm (78W) |
| 6.0GHz | 10.6dB | 7.6dB | 50.1% | 48.5dBm (71W) |

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: $V_{DS}$ = 28V, $I_{DS}$ = 500mA, $V_{GS}$ = -2.94V
- Test condition: CW
- The output power is 48.2dBm (66W) at 1-6GHz when $V_{DS}$ = 28V.

## ■ Wide-band Application Performance (DEMO_A, 1-6GHz, Pulse, 32V)

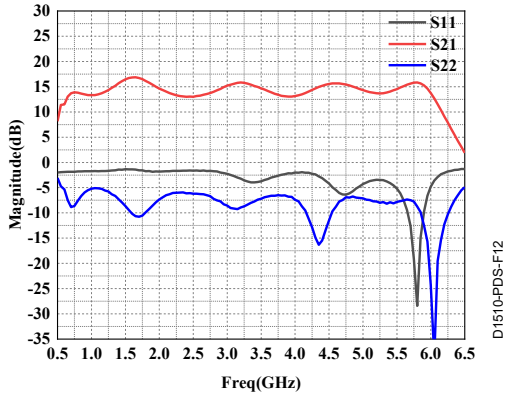



Figure 12. $S_{11}$, $S_{21}$ and $S_{22}$ vs. Freq.

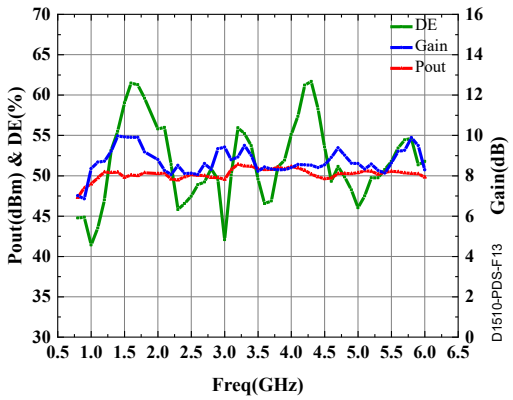



Figure 13. $P_{OUT}$, DE and Gain vs. Freq.

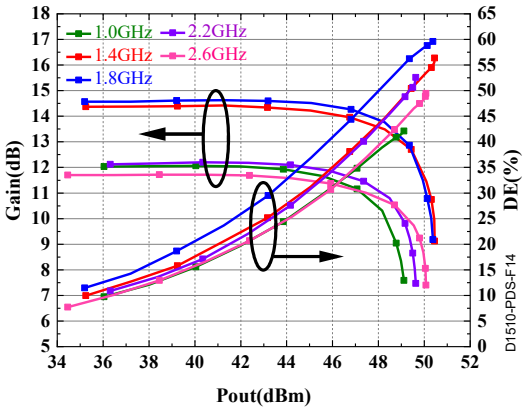



Figure 14. Gain and DE vs. $P_{OUT}$

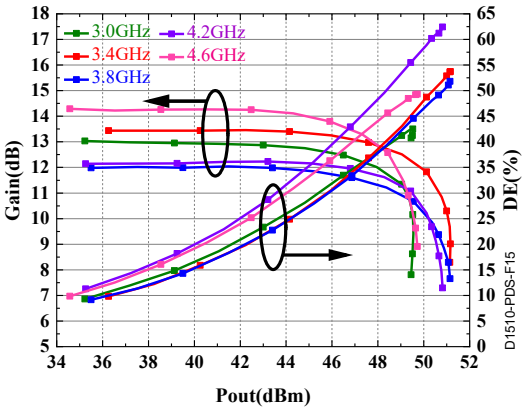



Figure 15. Gain and DE vs. $P_{OUT}$

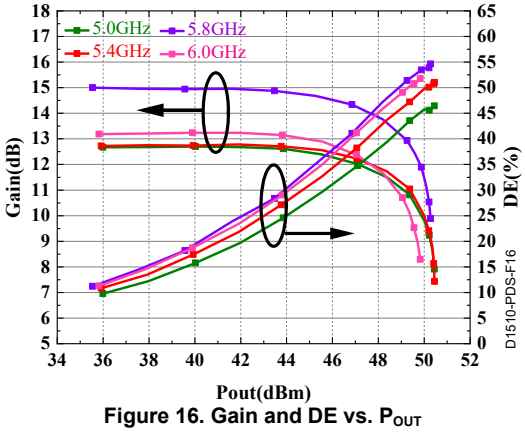



Figure 16. Gain and DE vs. $P_{OUT}$

## Table 9. RF Characteristics @ DEMO_A, 1-6GHz, Pulse, 32V

| Freq. | Linear Gain ($G_{LIN}$) | Power Gain ($G_P$) | Drain Efficiency ($\eta_D$) | Output Power ($P_{SAT}$) |
|---|---|---|---|---|
| 1.0GHz | 11.4dB | 8.4dB | 41.4% | 49.0dBm (79W) |
| 1.1GHz | 11.7dB | 8.7dB | 43.5% | 49.7dBm (93W) |
| 1.2GHz | 11.7dB | 8.7dB | 47.0% | 50.5dBm (112W) |
| 1.3GHz | 12.2dB | 9.2dB | 53.2% | 50.4dBm (110W) |
| 1.4GHz | 13.0dB | 10.0dB | 55.5% | 50.4dBm (110W) |
| 1.5GHz | 12.9dB | 9.9dB | 59.0% | 49.8dBm (95W) |
| 1.6GHz | 12.9dB | 9.9dB | 61.5% | 50.1dBm (102W) |
| 1.7GHz | 12.9dB | 9.9dB | 61.3% | 50.0dBm (100W) |
| 1.8GHz | 12.2dB | 9.2dB | 59.6% | 50.4dBm (110W) |
| 1.9GHz | 11.4dB | 8.4dB | 56.2% | 50.3dBm (107W) |
| 2.0GHz | 11.8dB | 8.8dB | 55.8% | 50.3dBm (107W) |
| 2.1GHz | 11.3dB | 8.3dB | 56.0% | 50.3dBm (107W) |
| 2.2GHz | 11.1dB | 8.1dB | 51.4% | 49.6dBm (91W) |
| 2.3GHz | 11.5dB | 8.5dB | 45.8% | 49.5dBm (89W) |
| 2.4GHz | 11.1dB | 8.1dB | 46.6% | 49.9dBm (98W) |
| 2.5GHz | 11.1dB | 8.1dB | 47.5% | 50.1dBm (102W) |
| 2.6GHz | 11.1dB | 8.1dB | 48.9% | 50.1dBm (102W) |
| 2.7GHz | 11.6dB | 8.6dB | 49.2% | 50.0dBm (100W) |
| 2.8GHz | 11.3dB | 8.3dB | 50.9% | 49.8dBm (95W) |
| 2.9GHz | 12.3dB | 9.3dB | 49.5% | 49.8dBm (95W) |
| 3.0GHz | 12.4dB | 9.4dB | 42.1% | 49.6dBm (91W) |
| 3.1GHz | 11.8dB | 8.8dB | 50.1% | 50.8dBm (120W) |
| 3.2GHz | 11.9dB | 8.9dB | 55.9% | 51.4dBm (138W) |
| 3.3GHz | 12.5dB | 9.5dB | 55.2% | 51.2dBm (132W) |
| 3.4GHz | 12.0dB | 9.0dB | 53.7% | 51.2dBm (132W) |
| 3.5GHz | 11.2dB | 8.2dB | 49.6% | 50.9dBm (123W) |
| 3.6GHz | 11.4dB | 8.4dB | 46.6% | 50.8dBm (120W) |
| 3.7GHz | 11.3dB | 8.3dB | 46.9% | 50.8dBm (120W) |
| 3.8GHz | 11.3dB | 8.3dB | 51.1% | 51.1dBm (129W) |
| 3.9GHz | 11.3dB | 8.3dB | 51.9% | 50.9dBm (123W) |
| 4.0GHz | 11.4dB | 8.4dB | 55.1% | 51.1dBm (129W) |
| 4.1GHz | 11.6dB | 8.6dB | 57.4% | 51.0dBm (126W) |
| 4.2GHz | 11.5dB | 8.5dB | 61.2% | 50.7dBm (117W) |
| 4.3GHz | 11.5dB | 8.5dB | 61.7% | 50.2dBm (105W) |
| 4.4GHz | 11.4dB | 8.4dB | 58.3% | 49.9dBm (98W) |
| 4.5GHz | 11.5dB | 8.5dB | 53.6% | 49.6dBm (91W) |
| 4.6GHz | 11.9dB | 8.9dB | 49.3% | 49.7dBm (93W) |
| 4.7GHz | 12.4dB | 9.4dB | 51.1% | 50.3dBm (107W) |
| 4.8GHz | 12.0dB | 9.0dB | 49.8% | 50.3dBm (107W) |
| 4.9GHz | 11.6dB | 8.6dB | 48.2% | 50.3dBm (107W) |
| 5.0GHz | 11.6dB | 8.6dB | 46.0% | 50.4dBm (110W) |
| 5.1GHz | 11.3dB | 8.3dB | 47.5% | 50.6dBm (115W) |

| Freq. | Linear Gain ($G_{LIN}$) | Power Gain ($G_P$) | Drain Efficiency ($\eta_D$) | Output Power ($P_{SAT}$) |
|---|---|---|---|---|
| 5.2GHz | 11.6dB | 8.6dB | 49.7% | 50.6dBm (115W) |
| 5.3GHz | 11.3dB | 8.3dB | 49.7% | 50.2dBm (105W) |
| 5.4GHz | 11.1dB | 8.1dB | 50.8% | 50.4dBm (110W) |
| 5.5GHz | 11.6dB | 8.6dB | 51.8% | 50.6dBm (115W) |
| 5.6GHz | 12.2dB | 9.2dB | 53.4% | 50.5dBm (112W) |
| 5.7GHz | 12.3dB | 9.3dB | 54.5% | 50.3dBm (107W) |
| 5.8GHz | 12.9dB | 9.9dB | 54.6% | 50.3dBm (107W) |
| 5.9GHz | 12.5dB | 9.5dB | 51.3% | 50.2dBm (105W) |
| 6.0GHz | 11.3dB | 8.3dB | 51.8% | 49.8dBm (95W) |

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: $V_{DS}$ = 32V, $I_{DS}$ = 500mA, $V_{GS}$ = -2.94V
- Test condition: Pulse, Pulse width = 100μs, Duty cycle = 10%
- The output power is 49.0dBm (79W) at 1-6GHz when $V_{DS}$ = 32V.

## ■ Wide-band Application Performance (DEMO_A, 1-6GHz, CW, 32V)

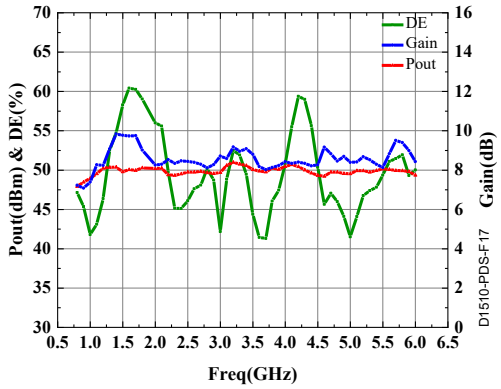



Figure 17. $P_{OUT}$, DE and Gain vs. Freq.

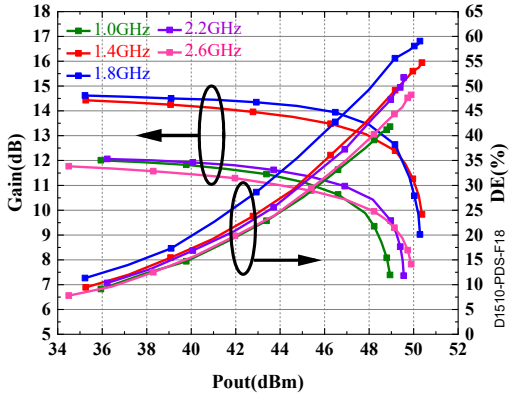



Figure 18. Gain and DE vs. $P_{OUT}$

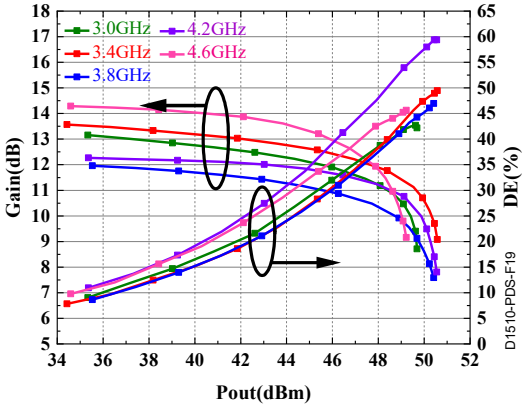



Figure 19. Gain and DE vs. $P_{OUT}$

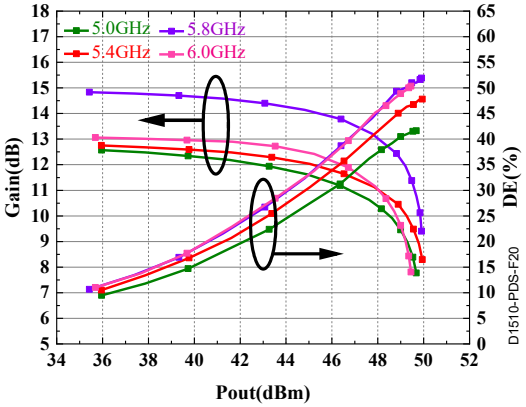



Figure 20. Gain and DE vs. $P_{OUT}$

## Table 10. RF Characteristics @ DEMO_A, 1-6GHz, CW, 32V

| Freq. | Linear Gain ($G_{LIN}$) | Power Gain ($G_P$) | Drain Efficiency ($\eta_D$) | Output Power ($P_{SAT}$) |
|---|---|---|---|---|
| 1.0GHz | 10.4dB | 7.4dB | 41.8% | 48.9dBm (78W) |
| 1.1GHz | 11.3dB | 8.3dB | 43.1% | 49.5dBm (89W) |
| 1.2GHz | 11.2dB | 8.2dB | 46.4% | 50.2dBm (105W) |
| 1.3GHz | 12.1dB | 9.1dB | 52.6% | 50.4dBm (110W) |
| 1.4GHz | 12.8dB | 9.8dB | 54.7% | 50.4dBm (110W) |
| 1.5GHz | 12.8dB | 9.8dB | 58.3% | 49.8dBm (95W) |
| 1.6GHz | 12.7dB | 9.7dB | 60.4% | 50.1dBm (102W) |
| 1.7GHz | 12.8dB | 9.8dB | 60.3% | 50.0dBm (100W) |
| 1.8GHz | 12.0dB | 9.0dB | 59.0% | 50.3dBm (107W) |
| 1.9GHz | 11.2dB | 8.2dB | 54.2% | 50.3dBm (107W) |
| 2.0GHz | 11.3dB | 8.3dB | 56.0% | 50.2dBm (105W) |
| 2.1GHz | 11.3dB | 8.3dB | 55.6% | 50.2dBm (105W) |
| 2.2GHz | 11.5dB | 8.5dB | 49.7% | 49.4dBm (87W) |
| 2.3GHz | 11.3dB | 8.3dB | 45.2% | 49.3dBm (85W) |
| 2.4GHz | 11.5dB | 8.5dB | 45.1% | 49.5dBm (89W) |
| 2.5GHz | 11.4dB | 8.4dB | 46.1% | 49.8dBm (95W) |
| 2.6GHz | 11.4dB | 8.4dB | 47.6% | 49.7dBm (93W) |
| 2.7GHz | 11.3dB | 8.3dB | 48.1% | 49.8dBm (95W) |
| 2.8GHz | 11.1dB | 8.1dB | 50.2% | 49.7dBm (93W) |
| 2.9GHz | 11.3dB | 8.3dB | 48.7% | 49.6dBm (91W) |
| 3.0GHz | 11.7dB | 8.7dB | 42.2% | 49.7dBm (93W) |
| 3.1GHz | 11.6dB | 8.6dB | 48.8% | 50.6dBm (115W) |
| 3.2GHz | 12.2dB | 9.2dB | 52.5% | 51.0dBm (126W) |
| 3.3GHz | 12.0dB | 9.0dB | 51.9% | 50.8dBm (120W) |
| 3.4GHz | 12.1dB | 9.1dB | 49.5% | 50.6dBm (115W) |
| 3.5GHz | 11.8dB | 8.8dB | 44.4% | 50.1dBm (102W) |
| 3.6GHz | 11.2dB | 8.2dB | 41.4% | 49.9dBm (98W) |
| 3.7GHz | 11.0dB | 8.0dB | 41.3% | 49.8dBm (95W) |
| 3.8GHz | 11.1dB | 8.1dB | 46.1% | 50.2dBm (105W) |
| 3.9GHz | 11.2dB | 8.2dB | 47.5% | 50.1dBm (102W) |
| 4.0GHz | 11.4dB | 8.4dB | 50.8% | 50.5dBm (112W) |
| 4.1GHz | 11.3dB | 8.3dB | 55.5% | 50.7dBm (117W) |
| 4.2GHz | 11.4dB | 8.4dB | 59.4% | 50.4dBm (110W) |
| 4.3GHz | 11.3dB | 8.3dB | 59.0% | 50.0dBm (100W) |
| 4.4GHz | 11.2dB | 8.2dB | 55.6% | 49.6dBm (91W) |
| 4.5GHz | 11.3dB | 8.3dB | 50.4% | 49.3dBm (85W) |
| 4.6GHz | 12.2dB | 9.2dB | 45.6% | 49.2dBm (83W) |
| 4.7GHz | 11.8dB | 8.8dB | 47.0% | 49.7dBm (93W) |
| 4.8GHz | 11.5dB | 8.5dB | 46.0% | 49.7dBm (93W) |
| 4.9GHz | 11.7dB | 8.7dB | 44.1% | 49.6dBm (91W) |
| 5.0GHz | 11.4dB | 8.4dB | 41.5% | 49.5dBm (89W) |
| 5.1GHz | 11.4dB | 8.4dB | 44.1% | 49.9dBm (98W) |

| Freq. | Linear Gain ($G_{LIN}$) | Power Gain ($G_P$) | Drain Efficiency ($\eta_D$) | Output Power ($P_{SAT}$) |
|---|---|---|---|---|
| 5.2GHz | 11.7dB | 8.7dB | 46.8% | 49.9dBm (98W) |
| 5.3GHz | 11.5dB | 8.5dB | 47.4% | 49.7dBm (93W) |
| 5.4GHz | 11.3dB | 8.3dB | 47.8% | 49.9dBm (98W) |
| 5.5GHz | 11.1dB | 8.1dB | 49.4% | 50.2dBm (105W) |
| 5.6GHz | 11.8dB | 8.8dB | 51.1% | 50.1dBm (102W) |
| 5.7GHz | 12.5dB | 9.5dB | 51.5% | 49.9dBm (98W) |
| 5.8GHz | 12.4dB | 9.4dB | 51.9% | 49.9dBm (98W) |
| 5.9GHz | 12.0dB | 9.0dB | 49.3% | 49.8dBm (95W) |
| 6.0GHz | 11.4dB | 8.4dB | 50.0% | 49.4dBm (87W) |

- Typical Class AB performance in Raytron DEMO_A with the device soldered onto the heatsink, test condition: $V_{DS}$ = 32V, $I_{DS}$ = 500mA, $V_{GS}$ = -2.94V
- Test condition: CW
- The output power is 48.9dBm (78W) at 1-6GHz when $V_{DS}$ = 32V.

## 10. Package Outline

### ■ Pin Layout

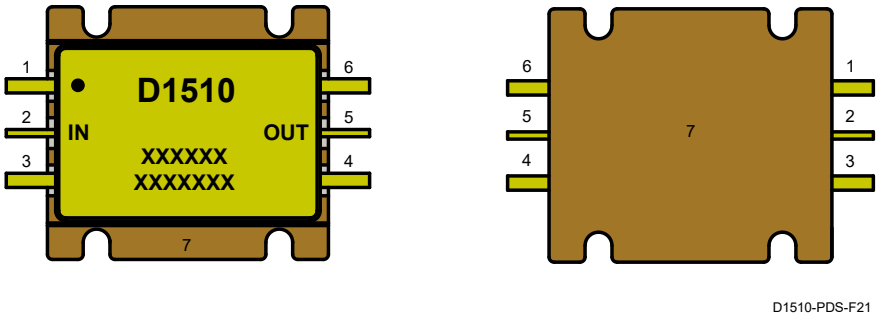



**Figure 21. D1510 Pin Layout**

### Table 11. Pin Description

| Pin | Symbol | Description |
|---|---|---|
| 1/3 | $V_G$ | Gate Voltage |
| 2 | $RF_{IN}$ | RF Input |
| 5 | $RF_{OUT}$ | RF Output |
| 4/6 | $V_D$ | Drain Voltage |
| 7 | Flange | Source Connected to Ground |

### ■ Mechanical Drawing (Package Type: 670F-A)

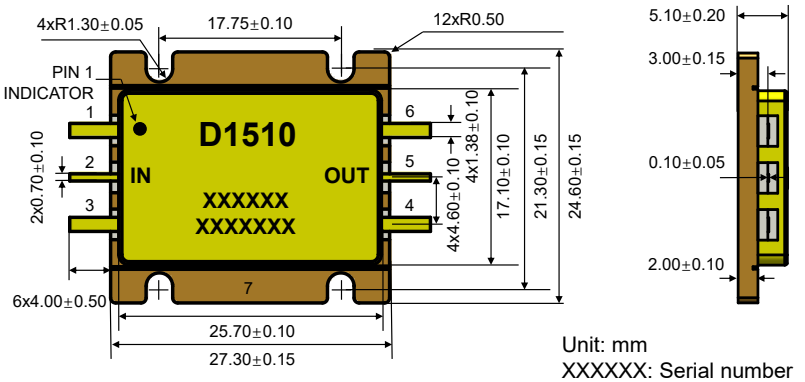



**Figure 22. D1510 DEMO_A Mechanical Drawing**

## 11. Application Circuit

### ■ Schematic

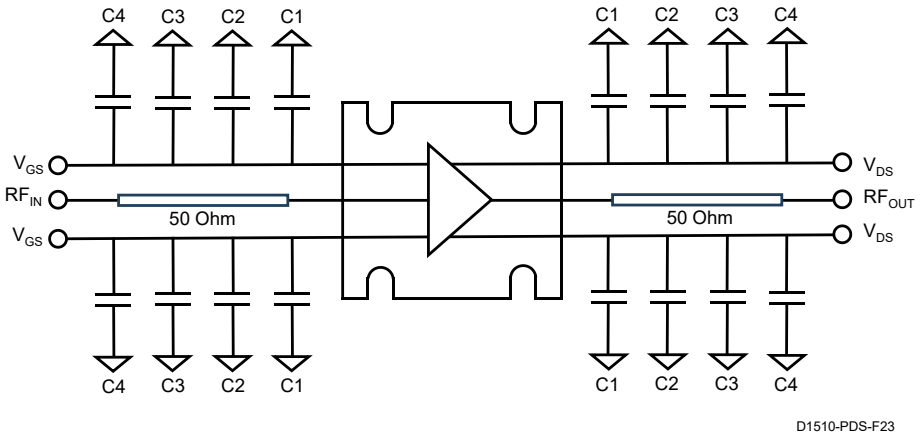
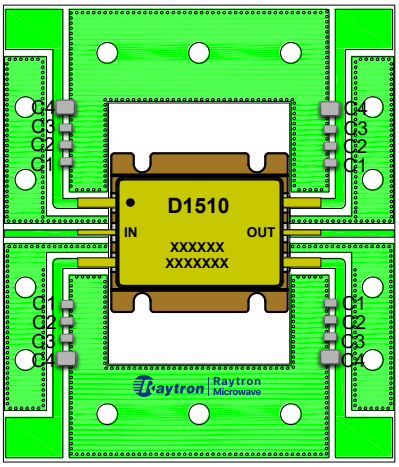



**Figure 23. D1510 DEMO_A Application Circuit Schematic**

### Table 12. 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 32V) | 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




D1510-PDS-F24

**Figure 24. D1510 Application Circuit Layout (1-6GHz)**
**(DEMO_A Size: 7.0cm x 6.0cm)**

**Table 13. 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 | 1000.0pF | X7R 100V 0603 Capacitor | Murata | GCM188R72A102KA37D |
| C3 | 10.0nF | X7R 100V 0603 Capacitor | Murata | GCM188R72A103KA37D |
| C4 | 1.0uF | X7R 100V 1210 Capacitor | Murata | GRM32ER72A105KA01L |

## 12. DEMO Summary

**Table 14. DEMO Summary**

| NO. | D1510 DEMO Name | $V_{DS}$ (V) | Freq. (GHz) | Linear Gain (dB) | $P_{SAT}$ (dBm) | $P_{SAT}$ (W) | Drain Efficiency (%) | Pulse or CW |
|---|---|---|---|---|---|---|---|---|
| 1 | DEMO_A, 70W | 28 | 1-6 | 10.6 | 48.3 | 68 | 43.1 | Pulse |
| 2 | DEMO_A, 70W | 28 | 1-6 | 10.4 | 48.2 | 66 | 42.3 | CW |
| 3 | DEMO_A, 80W | 32 | 1-6 | 11.1 | 49.0 | 79 | 41.4 | Pulse |
| 4 | DEMO_A, 80W | 32 | 1-6 | 10.4 | 48.9 | 78 | 41.3 | CW |

## 13. Recommended Solder Temperature Profile

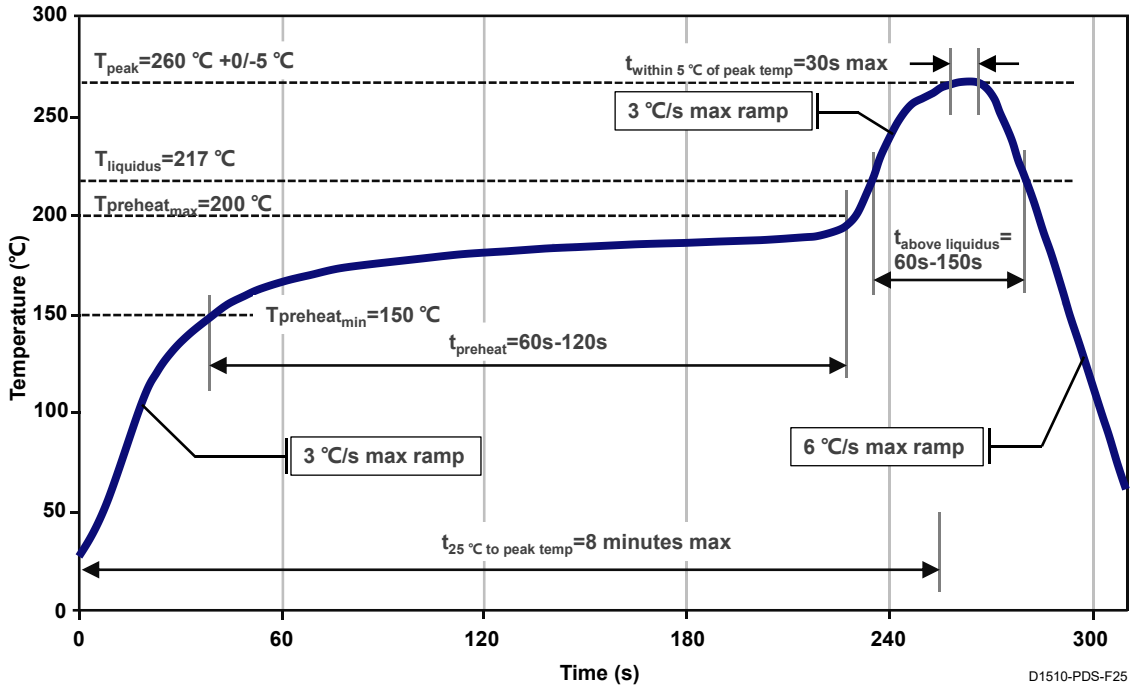



**Figure 25. Recommended Solder Temperature Profile**

## 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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