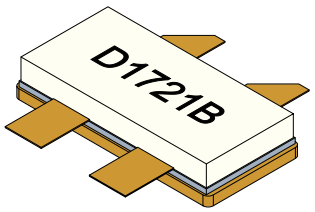
1. Description

- The D1721B is an 200W (P_{SAT}) wideband pre-matched gallium nitride (GaN) high electron mobility transistor (HEMT) with the first-generation RF GaN technology from Raytron.
- The D1721B operates from DC to 4GHz with a 28V supply rail. It can deliver 90W CW power across 30-1000MHz. The device is offered in an industry standard air cavity package.



D1721B-PDS-F01

Figure 1. D1721B Package Outline

2. Applications

- Civilian Radar
- Land Mobile and Radio Communications
- Avionic and Test Instrumentation
- Balanced Amplifiers, Push-pull Amplifiers and Doherty Power Amplifiers

3. Features

- Operating Frequency: DC–4GHz
- Output Power[1] (P_{SAT}): 53.3dBm (214W)
- Linear Gain[1]: 18.0dB
- Typical DE @P_{SAT}[1]: 74.0%
- Operating Voltage: 28V
- CW and Pulse Capable
- Package Type: 780P-A

[1] Typical Class AB performance in Raytron DEMO @2.6GHz

4. Brief Typical Performance

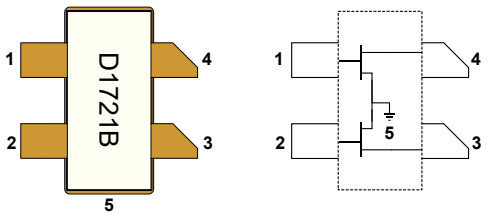
Table 1. Brief Typical Performance

Parameter	0.3GHz	0.6GHz	1GHz	Units
Linear Gain	19.7	21.1	20.2	dB
Drain Efficiency	51.0	65.0	41.0	%
Output Power	50.4	50.0	49.8	dBm

- Test Condition: CW
- Typical Class AB performance in Raytron DEMO_A (30-1000MHz) with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 400mA, V_{GS} = -2.80V
- I_{DS} is the sum of two discrete drain terminals, each contributing 200mA.

5. Block Diagram

- Pin 3 and Pin 4 serve as two separate drain terminals. It's suited for Balun matching on the board for the low frequency application.



1. Gate
2. Gate
3. Drain
4. Drain
5. Source

D1721B-PDS-F02

Figure 2. D1721B 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[1]	I_{GMax}	18.5	mA
Storage Temperature Range	T_{STG}	-65 ~ +150	°C
Operating Junction Temperature	T_J	250	°C

1. The current is the characteristic value for one drain terminal of the device

7. Recommended Operating Conditions

Table 3. Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Drain-Source Voltage Range, V_{DS}	-	28	-	V
Drain Bias Current, I_{DS}	-	400	-	mA
Gate-Source Voltage, V_{GS}	-	-2.80	-	V
Channel Temperature, T_{CH}	-	-	225	°C

- I_{DS} is the sum of two discrete drain terminals, each contributing 200mA

Table 4. Thermal Resistance[1]

Parameter	Symbol	Value	Unit
Thermal Resistance (Active Die Surface-to-Case)[2]	R_{thsc} (IR)	1.31	°C/W
Thermal Resistance (Junction-to-Case)[3]	R_{thjc} (FEA)	1.61	°C/W

1. Thermal Resistance simulated or measured for one drain terminal of the device
2. Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 64.0W
3. 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[1]

Parameter	Symbol	Min.	Typ.	Max.	Units
Drain-Source Breakdown Voltage[2] (V_{GS} = -10V, I_{DS} = 18.5mA)	$V_{DS(BR)}$	84	-	-	V
Saturated Drain Current[3] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	20.4	-	A
Gate Threshold Voltage[4] (V_{DS} = 28V, I_{DS} = 18.5mA)	$V_{GS(th)}$	-3.3	-2.8	-2.3	V
Gate Quiescent Voltage[4] (V_{DS} = 28V, I_{DS} = 200mA)	$V_{GS(Q)}$	-	-2.80	-	V

1. Performance for one drain terminal of the device
2. Measured on wafer prior to packaging
3. Measured with packaged device
4. Measured in Raytron DEMO

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

Parameter	0.03GHz	0.15GHz	0.3GHz	0.5GHz	0.7GHz	0.9GHz	1.0GHz	Units
Linear Gain	19.1	23.3	19.7	25.8	21.1	20.0	20.2	dB
Drain Efficiency	57.0	71.4	51.0	55.3	65.0	45.8	41.0	%
Output Power	50.1	52.0	50.4	50.4	50.0	49.8	49.8	dBm
Output Power	102	158	110	110	100	95	95	W

1. Test Condition: CW
2. Typical Class AB performance in Raytron DEMO_A (30-1000MHz) with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 400mA, V_{GS} = -2.80V

- I_{DS} is the sum of two discrete drain terminals, each contributing 200mA

Table 7. Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Input Capacitance	C_{GS}	-	75.9	-	pF
Output Capacitance	C_{DS}	-	9.25	-	pF
Feedback Capacitance	C_{GD}	-	1.01	-	pF

- Table 7 demonstrates the capacitance of one drain terminal of the device
- Test Condition: V_{DS} = 28V, V_{GS} = -8V, f = 1MHz

9. Wide-band Application Performance

■ Wide-band Application Performance (DEMO_A: 30-1000MHz)

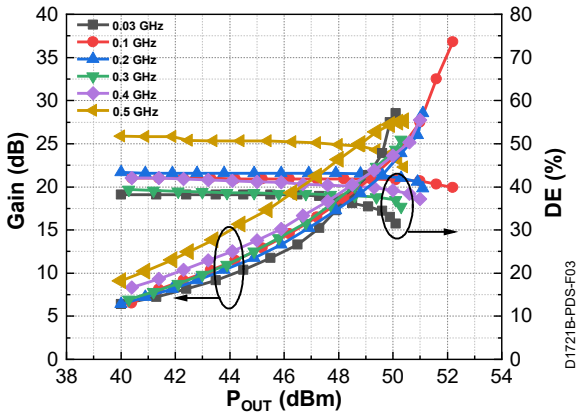


Figure 3. Wide-band Application Gain and DE vs. Output Power

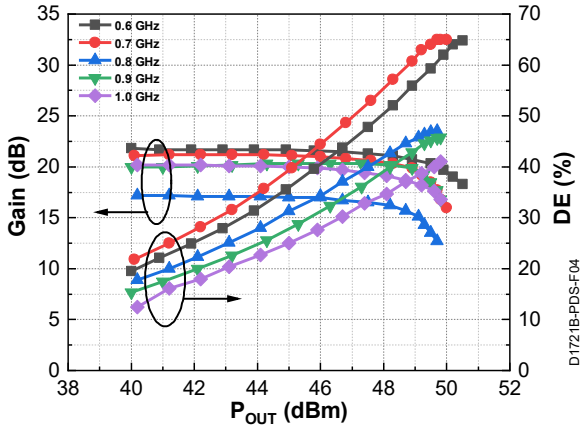


Figure 4. Wide-band Application Gain and DE vs. Output Power

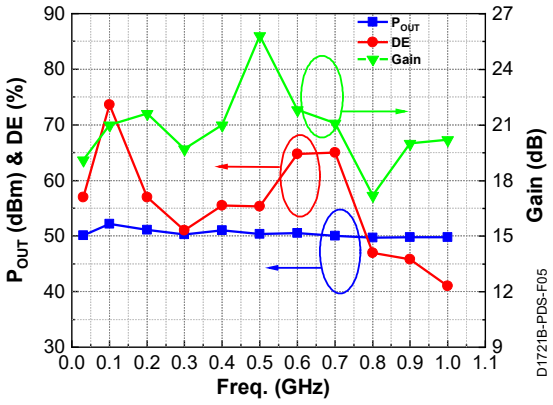
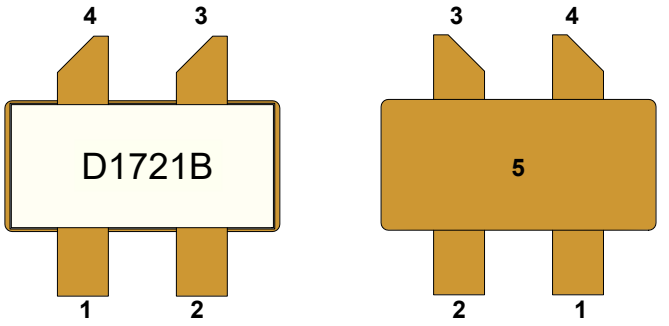


Figure 5. Gain, P_{OUT}, and DE vs. Freq.

- Typical Class AB performance in Raytron Wide-band Application DEMO_A with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 400mA, V_{GS} = -2.80V; I_{DS} is the sum of two discrete branches, each contributing 200mA.
- Test Condition: CW
- The output power is 49.5dBm (89W) at 30-1000MHz. It can be used in the radio station application.

10. Package Outline

■ Pin Layout



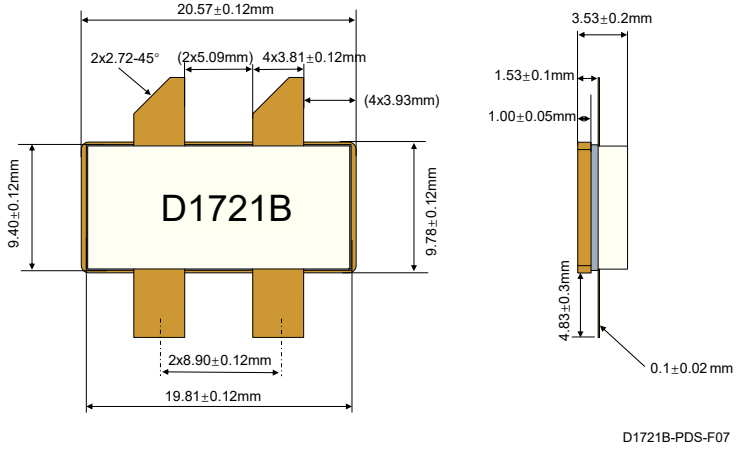
D1721B-PDS-F06

Figure 6. D1721B 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: 780P-A)



D1721B-PDS-F07

Figure 7. D1721B Mechanical Drawing

11. Application Circuit

■ Schematic

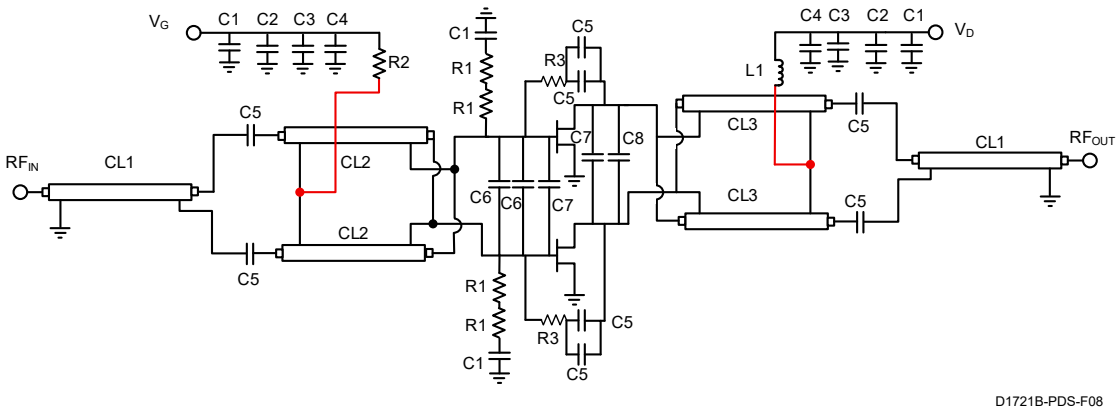


Figure 8. D1721B DEMO_A Application Circuit Schematic

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

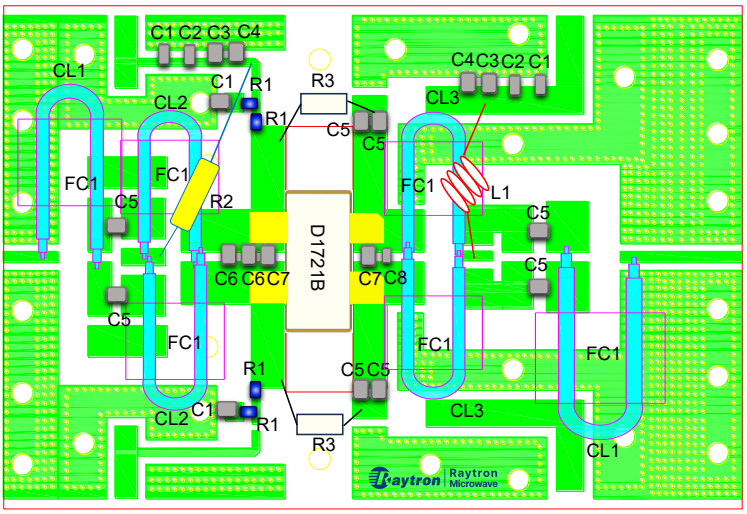


Figure 9. D1721B DEMO_A Application Circuit Layout
(DEMO_A Size: 11.0cm x 7.5cm)

Table 10. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	30mil	N/A	Rogers	RO4350B
C1	0.1uF	C0G 100V 1206 Capacitor	Murata	GRM3195C2A104JA01D
C2	4.7uF	X7S 100V 1206 Capacitor	Murata	GRM31CC72A475KE11L
C3	1000pF	1111 1nF 1500V Capacitor	Chuangtian	SQ-1111C0G102J501NT
C4	470pF	1111 470pF 1500V Capacitor	Chuangtian	SQ-1111C0G471J152NT
C5	150pF	1111 150pF 1500V Capacitor	Chuangtian	SQ-1111C0G151J102NT
C6	8.2pF	1111 8.2pF 1500V Capacitor	Chuangtian	SQ-1111C0G8R2C152NT
C7	10pF	1111 10pF 1500V Capacitor	Chuangtian	SQ-1111C0G100J152NT
C8	2.3pF	C0G 250V 2.3pF Capacitor	Murata	GQM2195C2E2R3BB12
L1	60nH	4 turns, R=2mm, r=0.5mm	N/A	N/A
R1	24Ω	1/8W 0805 Resistor	Yageo	RC0805FR-0724RL
R2	330Ω	2W ±1% 11.5 x 4.5mm	Huaxing	MF2WS-330Ω±1%T
R3	300Ω	30W 5 x 2.5mm	Qingda	RFG300-30-W8
CL1	40mm	50Ohm Coaxial	Various	SFF-50-1.5
CL2	40mm	17Ohm Coaxial	Various	SFF-17-1.5
CL3	55mm	17Ohm Coaxial	Various	SFF-17-1.5
FC1	190Ω	Ferrite Core	FAIR-RITE	2861000202

12. DEMO Summary

Table 11. DEMO Summary

NO.	D1721B DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency	Pulse or CW
1	DEMO_A, 90W	28	0.03-1.0	17.1	49.5	89	41%	CW
2	DEMO_B, 110W	28	0.03-0.7	22.0	50.5	112	60%	CW

13. Recommended Solder Temperature Profile

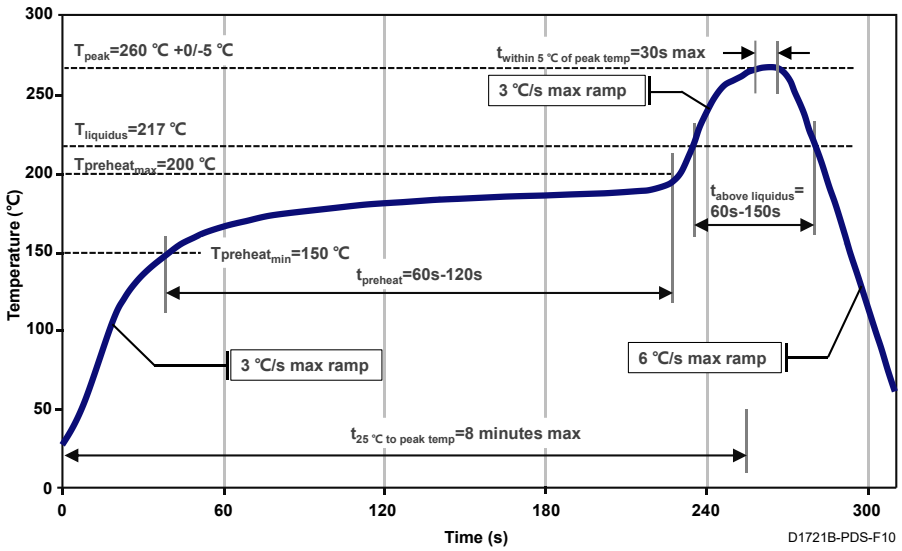


Figure 10. Recommended Solder Temperature Profile

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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