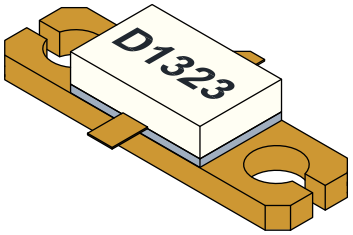
1. Description

- The D1323 is a 50W (P_{SAT}) wideband pre-matched gallium nitride (GaN) high electron mobility transistor (HEMT) with first generation RF GaN technology from Raytron.
- The D1323 operates from 5 to 7GHz with a 28V supply rail. The device is offered in an industry standard air cavity package.



D1323-PDS-F01

Figure 1. D1323 Package Outline

2. Applications

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

3. Features[1]

- Operating Frequency: 5-7GHz
- Output Power (P_{SAT}): 47.5dBm (56W)
- Linear Gain: 11.2dB
- Typical DE @ P_{SAT}: 49.2%
- Operating Voltage: 28V
- CW and Pulse Capable
- Package Type: 360F-A

1. Measured in Raytron DEMO @6.2GHz

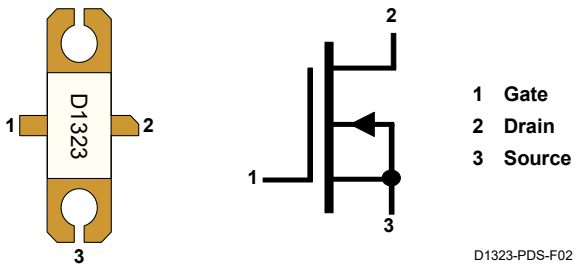
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	5.9GHz	6.1GHz	6.4GHz	Units
Linear Gain	12.3	12.6	13.0	dB
Drain Efficiency	39.8	44.8	46.8	%
Output Power	46.0	46.4	46.5	dBm
Output Power	39.4	43.9	44.3	W

- Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 200mA, V_{GS} = -2.92V
- Test Condition: CW

5. Block Diagram



D1323-PDS-F02

Figure 2. D1323 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}	9.12	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}	-	200	-	mA
Gate-Source Voltage, V_{GS}	-	-2.92	-	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)	2.00	°C/W
Thermal Resistance (Junction-to-Case)[2]	R_{thjc}(FEA)	2.56	°C/W

1. Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 45.0W

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} = 9.12mA)	$V_{DS(BR)}$	84	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	10.49	-	A
Gate Threshold Voltage[3] (V_{DS} = 28V, I_{DS} = 9.12mA)	$V_{GS(TH)}$	-3.30	-2.80	-2.30	V
Gate Quiescent Voltage[3] (V_{DS} = 28V, I_{DS} = 200mA)	$V_{GS(Q)}$	-	-2.92	-	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)
5.9	12.3	39.8	46.0	40
6.0	12.8	43.8	46.3	43
6.1	12.6	44.8	46.4	44
6.2	12.2	43.0	46.3	43
6.3	12.2	43.3	46.3	43
6.4	13.0	46.8	46.5	44

1. Typical Class AB performance in Raytron DEMO_A (5.9-6.4GHz) with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 200mA, V_{GS} = -2.92V
2. Test Condition: CW

Table 7. Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Input Capacitance	C_{GS}	-	22.6	-	pF
Output Capacitance	C_{DS}	-	8.8	-	pF
Feedback Capacitance	C_{GD}	-	0.8	-	pF

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

9. Wide-band Application Performance

■ Wide-band Application Performance (DEMO_A: 5.9-6.4GHz)

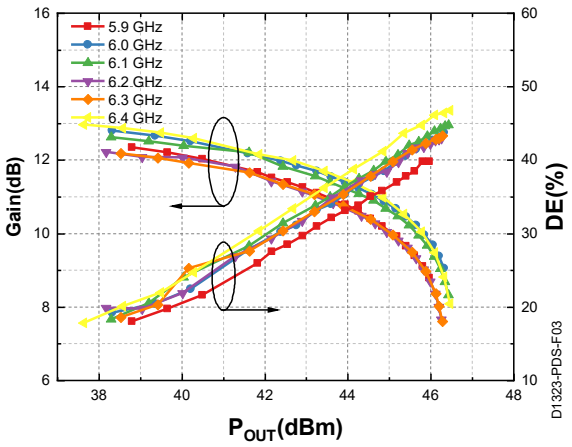


Figure 3. Wide-band Application Gain and DE @ vs. Output Power

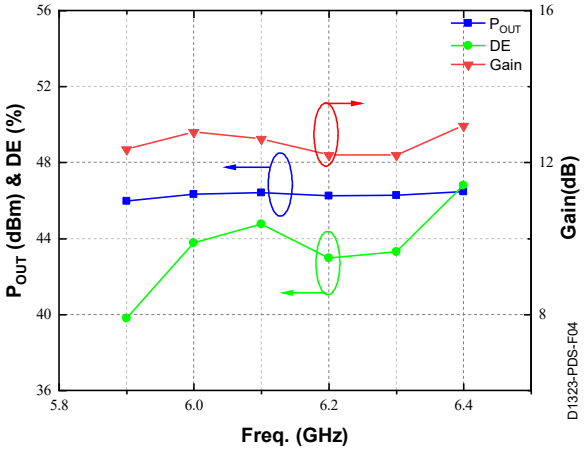


Figure 4. Wide-band Application P_{OUT}, Gain, and DE vs. Freq.

- 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} = 200mA, V_{GS} = -2.92V
- Test Condition: CW
- The output power is 46.0dBm (40W) at 5.9-6.4GHz.

10. Package Outline

■ Pin Layout

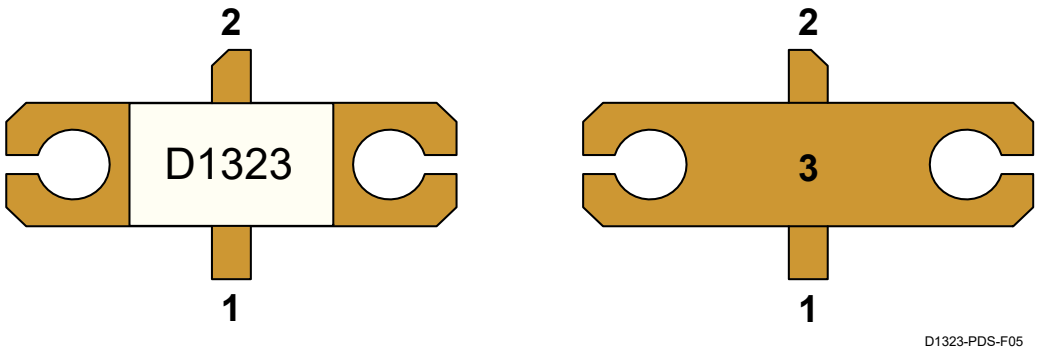


Figure 5. D1323 Pin Layout

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:360F-A)

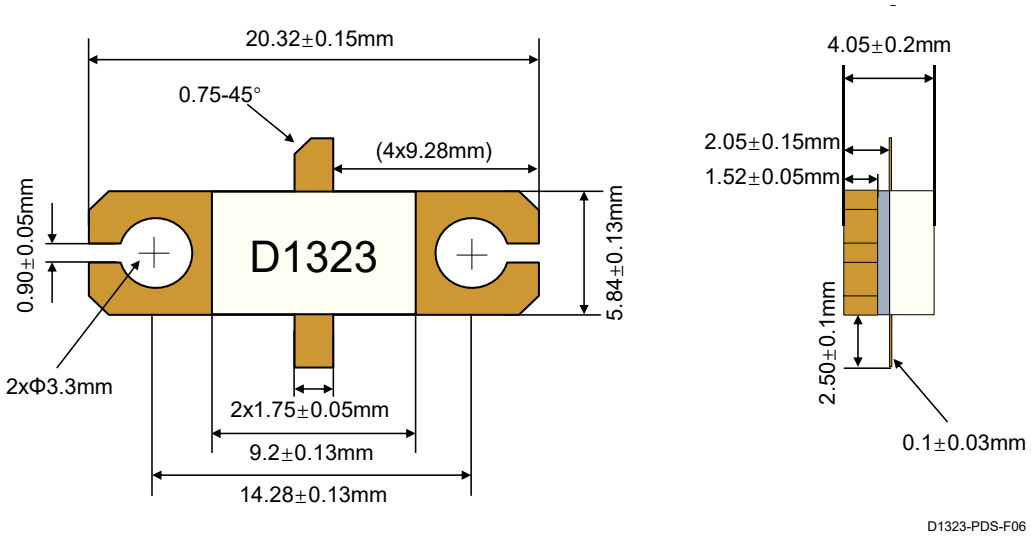


Figure 6. D1323 Mechanical Drawing

11. Application Circuit

■ Schematic

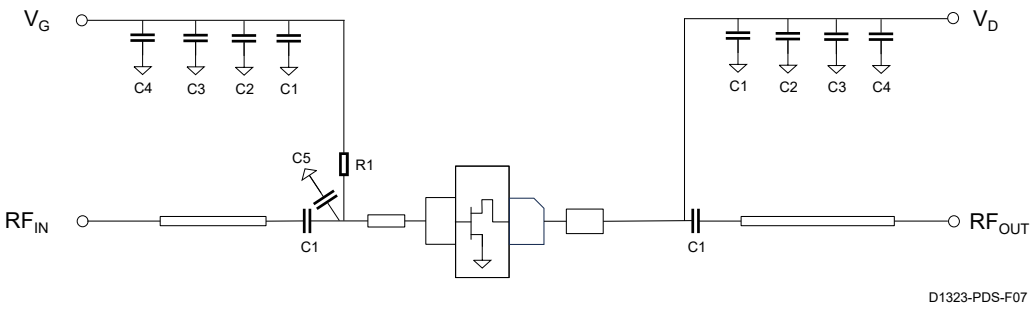


Figure 7. D1323 DEMO_A Application Circuit Schematic

■ 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

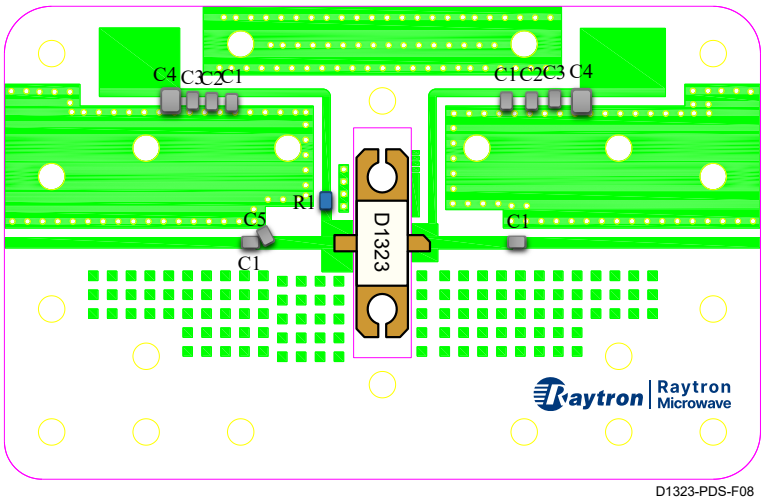


Figure 8. D1323 Application Circuit Layout
(DEMO_A Size: 8.0cm x 5.0cm)

Table 9. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	1.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E1R5BB12
C2	100.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E101JB12
C3	1000pF	X7R 250V 0603 Capacitor	Murata	GRM188R72E102KW07D
C4	1.0uF	X7R 100V 1210 Capacitor	Murata	GRM32ER72A105KA01
C5	0.2pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2ER20WB12
R1	10Ω	1/8W 0805 Resistor	Yageo	RC0805FR-0710RL

12. DEMO Summary

Table 11. DEMO Summary

NO.	D1323 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency	Pulse or CW
1	DEMO_A, 40W	28	5.9-6.4	12.2	46.0	40	40%	CW

13. Recommended Solder Temperature Profile

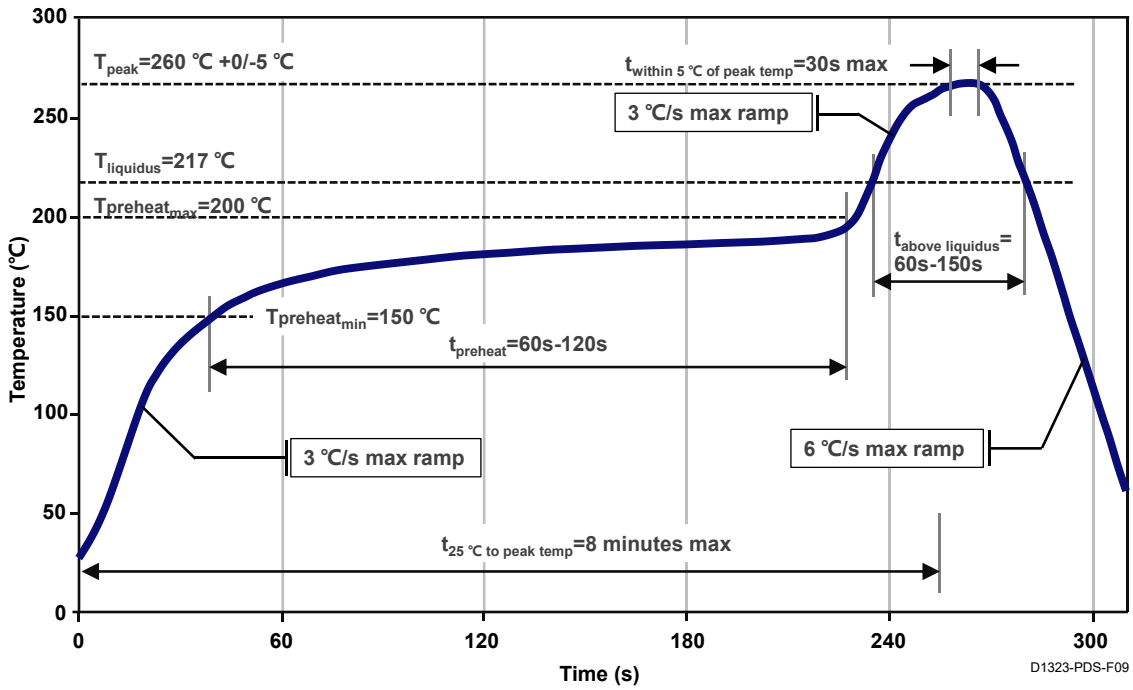


Figure 9. Recommended Solder Temperature Profile

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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