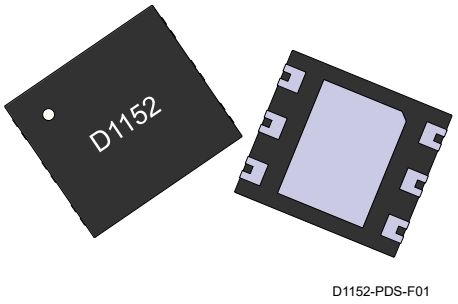
1. Description

- The D1152 is a 20W (P_{SAT}) wideband pre-matched gallium nitride (GaN) high electron mobility transistor (HEMT) with first generation RF GaN technology from Raytron.
- The D1152 operates from DC to 8GHz with a 28V supply rail. It is assembled in a lead-free 4.5 x 4mm 6-lead DFN plastic package.



D1152-PDS-F01

Figure 1. D1152 Package Outline

2. Applications

- Test and Measurement
- Defense Communications
- Land Mobile Radio
- Wireless Infrastructure

3. Features[1]

- Operating Frequency: DC-8GHz
- Output Power (P_{SAT}): 43.4dBm (22W)
- Linear Gain: 16.9dB
- Typical DE @P_{SAT}: 78.1%
- Operating Voltage: 28V
- CW and Pulse Capable
- Package: DFN 4.50 x 4.00 x 0.75mm

[1.] Measured in Raytron DEMO @ 2.6GHz

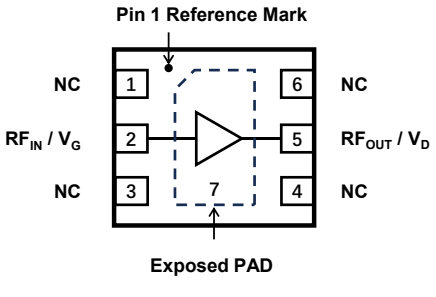
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	2.6GHz	Units
Linear Gain	16.9	dB
Drain Efficiency	78.1	%
Output Power	43.4	dBm
Output Power	22	W

- Typical Class AB performance in Raytron DEMO, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.1V
- Test condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

5. Block Diagram



D1152-PDS-F02

Figure 2. D1152 Block Diagram

Table of Contents

No.	Contents	Page
1	Description	1
2	Applications	1
3	Features	1
4	Brief Typical Performance	1
5	Block Diagram	1
6	Absolute Maximum Ratings	3
7	Recommended Operating Conditions	3
8	Electrical Characteristics	3
9	Typical Performance	4
10	Wide-band Application Performance	5
11	Package Outline	6
12	Application Circuit	7
13	DEMO Summary	8
14	Recommended Solder Temperature Profile	9
15	Handling Precautions	9
16	Contact Information	9
17	Disclaimer	10

6. Absolute Maximum Ratings

Table 2. Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DSS}	150	V
Gate-Source Voltage	V_{GS}	-10 ~ +1	V
Operating Voltage	V_{DS}	10 ~ +55	V
Maximum Forward Gate Current	I_{GMax}	3.5	mA
Storage Temperature Range	T_{STG}	-65 ~ +150	°C
Operating Junction Temperature	T_J	225	°C

7. Recommended Operating Conditions

Table 3. Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Drain-Source Voltage Range, V_{DS}	-	28	48	V
Drain Bias Current, I_{DS}	-	100	-	mA
Gate-Source Voltage, V_{GS}	-	-2.1	-	V
Channel Temperature, T_{CH}	-	-	225	°C

8. Electrical Characteristics (T_C = 25˚C)

Table 4. DC Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Drain-Source Breakdown Voltage[1] (V_{GS} = -10V, I_{DS} = 3.5mA)	$V_{DS(BR)}$	150	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	3.12	-	A
Gate Threshold Voltage[3] (V_{DS} = 28V, I_{DS} = 3.5mA)	$V_{GS(th)}$	-3.00	-2.50	-2.00	V
Gate Quiescent Voltage (V_{DS} = 28V, I_{DS} = 100mA)	$V_{GS(Q)}$	-	-2.10	-	V

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

Table 5. RF Characteristics[1]

Test Method	Parameter	Symbol	Min.	Typ.	Max.	Units
DEMO[2] @2.6GHz	Linear Gain	G_{LIN}	-	16.9	-	dB
	Drain Efficiency	η_D	-	78.1	-	%
	Output Power	P_{SAT}	-	43.4	-	dBm

1. Test condition: Pulse, Pulse width = 100μs, Duty cycle = 10%
2. Typical Class AB performance in Raytron DEMO, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.1V

Table 6. Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Input Capacitance	C_{GS}	-	6.95	-	pF
Output Capacitance	C_{DS}	-	1.79	-	pF
Feedback Capacitance	C_{GD}	-	0.46	-	pF

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

9. Typical Performance

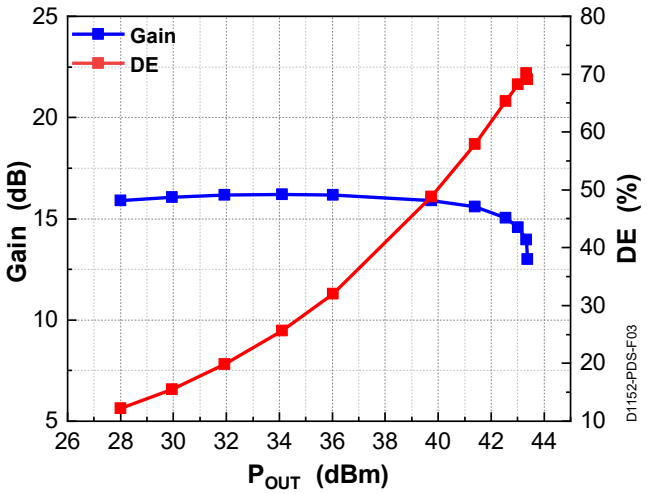


Figure 3. 2.6GHz Gain and DE @ MXP vs. Output Power

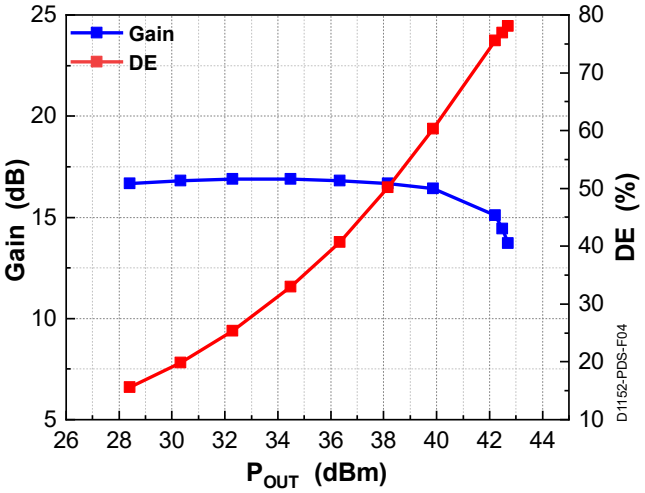


Figure 4. 2.6GHz Gain and DE @ MXE vs. Output Power

- Typical Class AB performance in Raytron DEMO, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.1V
- Test condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

10. Wide-band Application Performance (CW)

Table 7. RF Characteristics (CW)

Parameter	5.7GHz	5.8GHz	5.9GHz	Units
Linear Gain	13.5	14.4	14.4	dB
Power Gain	10.5	11.4	11.4	dB
Drain Efficiency	49.9	53.8	55.5	%
Output Power	42.4	42.1	41.5	dBm
Output Power	17	16	14	W

- Typical Class AB performance in Raytron DEMO_G, test condition: V_{DS} = 28V, I_{DS} = 100mA
- Test condition: CW

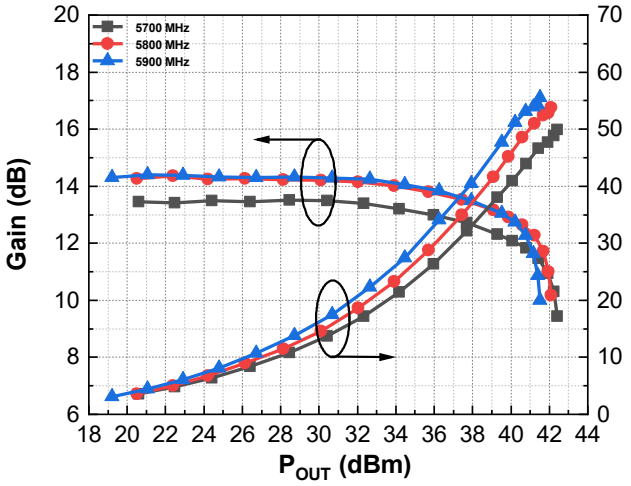


Figure 5. Gain and DE vs. Output Power (5.7GHz-5.9GHz)

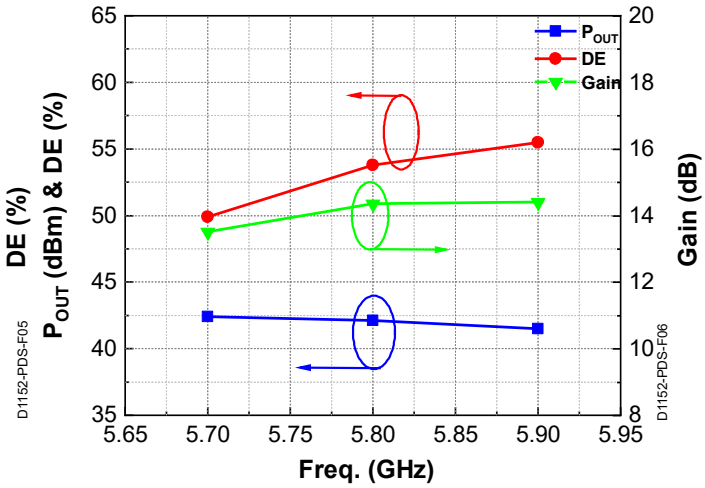


Figure 6. Gain and DE vs. Freq. (5.7GHz-5.9GHz)

- Typical Class AB performance in Raytron Wide-band Application DEMO_G, test condition: V_{DS} = 28V, I_{DS} = 100mA, V_{GS} = -2.1V
- Test Condition: CW
- The output power reaches 41.5dBm(15W) at 5.7-5.9GHz.

11. Package Outline

■ Pin Layout

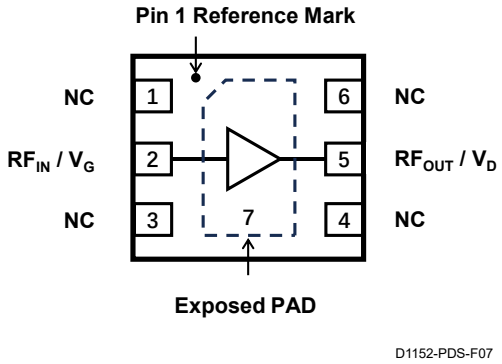


Figure 7. D1152 Pin Layout

Table 8. Pin Description

Pin	Symbol	Description
1/3/4/6	NC[1]	Not Connected
2	RF_{IN} / V_G	RF Input / Gate voltage
5	RF_{OUT} / V_D	RF Output / Drain voltage
7	Exposed PAD[2]	Ground / Source

[1] All no connection pins may be left floating or connected to the ground.

[2] The exposed pad centered on the package bottom must be connected to RF and DC ground. This path must also provide a low thermal resistance heat path.

■ Mechanical Drawing (Package Type: DFN 4.50 x 4.00 x 0.75mm)

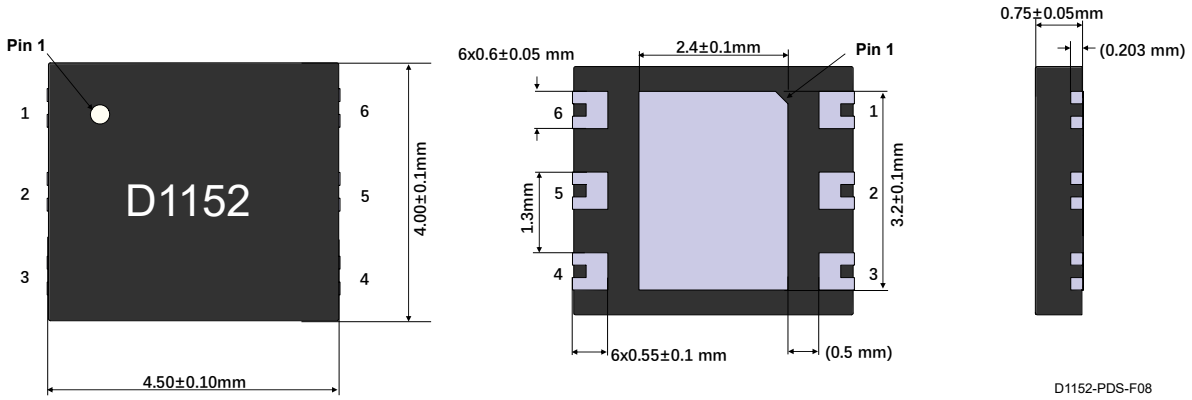


Figure 8. D1152 Mechanical Drawing

12. Application Circuit

■ Schematic

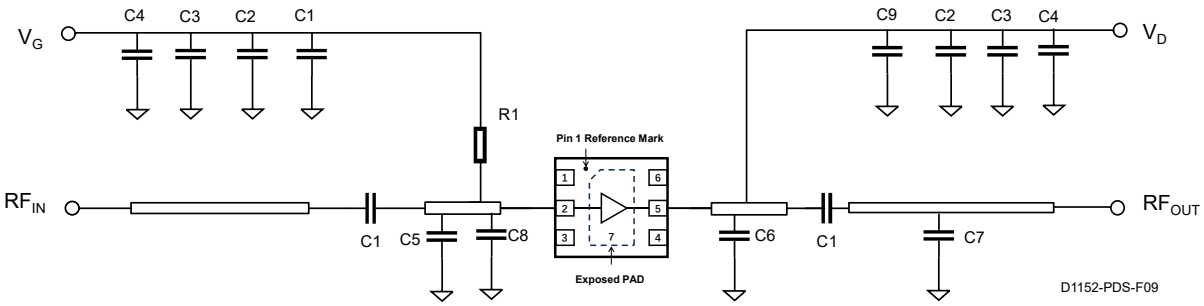


Figure 9. D1152 DEMO_G Application Circuit Schematic

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

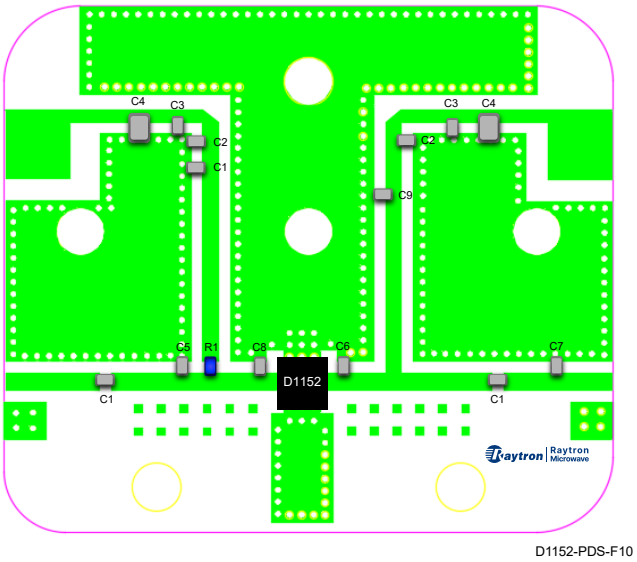


Figure 10. D1152 Application Circuit Layout (5.7GHz-5.9GHz)
（DEMO_G Size: 4.0 x 3.5cm）

Table 10. 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	82.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E820JB12
C3	1000pF	C0G 250V 0603 Capacitor	Murata	GCM1885C2A102JA16D
C4	4.7uF	X7S 100V 1206 Capacitor	Murata	GRM31CC72A475KE11L
C5	0.7pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2ER70WB12
C6	0.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2ER50WB12
C7	0.3pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2ER30WB12
C8	0.6pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2ER60WB12
C9	2.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E2R0BB12
R1	10.0Ω	1/4W 0603 Resistor	Yageo	AT0603BRA0710RL

13. DEMO Summary

Table 11. DEMO Summary

No.	D1152 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain (dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency (%)	Pulse or CW
1	DEMO_A, 18W	28	2.4-2.5	19.9	42.7	18	69.1%	CW
2	DEMO_B, 13W	28	2.5-5.2	12.0	41.1	13	46.0%	CW
3	DEMO_C, 10W	28	2.5-6.4	10.5	40.1	10	41.0%	CW
4	DEMO_D, 18W	28	4.3-4.5	15.3	42.6	18	65.0%	CW
5	DEMO_E, 10W	28	4.6-6.4	11.3	40.2	10	43.0%	CW
6	DEMO_F, 16W	28	5.1-5.95	12.7	42.0	16	43.0%	CW
7	DEMO_G, 15W	28	5.7-5.9	13.6	41.8	15	59.0%	CW
8	DEMO_H, 11W	28	6-7.2	10.8	40.4	11	40.1%	CW
9	DEMO_I, 12W	28	6-7.5	10.2	40.8	12	39.0%	CW

14. Recommended Solder Temperature Profile

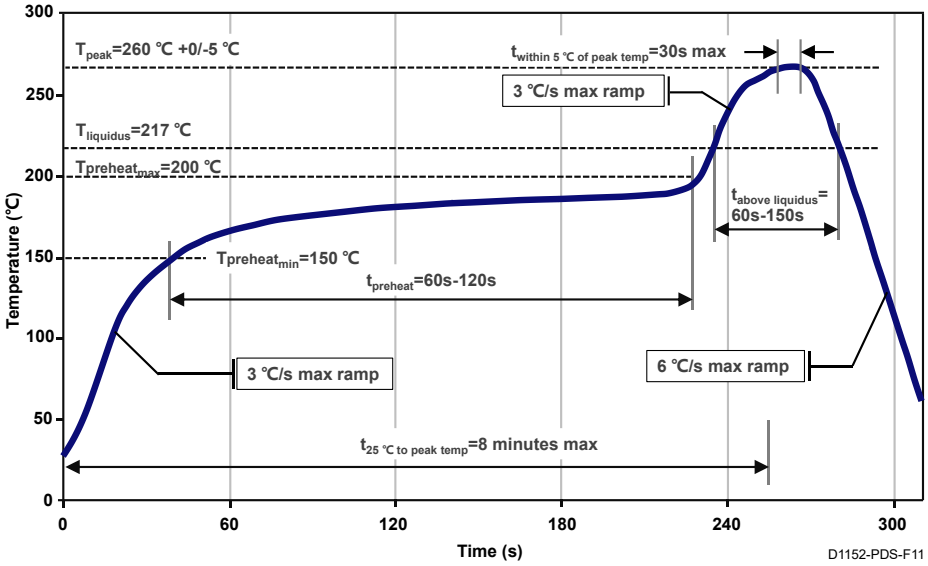


Figure 11. Recommended Solder Temperature Profile

15. 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.



16. 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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