1. Description

- The D1101 is a 5W/2W/1W (P_{SAT}), 50Ω-input matched discrete gallium nitride (GaN) high electron mobility transistor (HEMT) which operates from 0.03GHz to 3GHz with 28V/18V/12V supply rail.
- The integrated input matching network enables wideband gain and power performance, while the output can be matched on board to optimize power and efficiency. It is assembled in a lead-free 6 x 5mm 8-lead DFN plastic package.

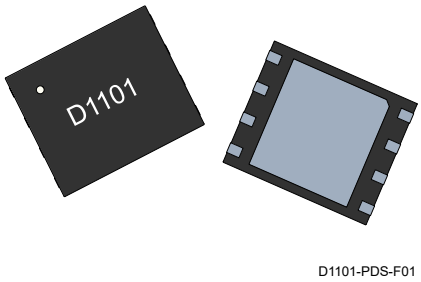


Figure 1. D1101 Package Outline

2. Applications

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

3. Features[1]

- Operating Frequency: 0.01–3GHz
- Output Power (P_{SAT}): 38.5dBm (7W)
- Linear Gain: 12.2dB
- Typical DE @ P_{SAT}: 56.7%
- Operating Voltage: 28V
- CW and Pulse Capable
- Fully Matched at Input, Unmatched at Output
- Package: DFN 6.00 x 5.00 x 0.85mm

[1.] Measured in Raytron DEMO_A @1.0GHz

4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	0.03-3GHz	Units
Linear Gain	12.2	dB
Drain Efficiency	56.7	%
Output Power	38.5	dBm
Output Power	7	W

- Typical Class AB performance in Raytron DEMO_A, test condition: V_{DS} = 28V, I_{DS} = 30mA, V_{GS} = -2.4V
- Test Condition: CW

5. Block Diagram

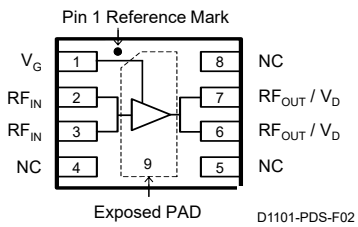


Figure 2. D1101 Block Diagram

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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}	1.28	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	55	V
Drain Bias Current, I_{DS}	-	100	-	mA
Gate-Source Voltage, V_{GS}	-	-2.3	-	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} = 1.28mA)	$V_{DS(BR)}$	150	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	1.18	-	A
Gate Threshold Voltage[3] (V_{DS} = 28V, I_{DS} = 1.28mA)	$V_{GS(TH)}$	-3.30	-2.80	-2.30	V
Gate Quiescent Voltage (V_{DS} = 28V, I_{DS} = 30mA)	$V_{GS(Q)}$	-	-2.30	-	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}	-	17.5	-	dB
	Drain Efficiency	η_D	-	68.8	-	%
	Output Power	P_{SAT}	-	39.4	-	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} = 30mA, V_{GS} = -2.4V

9. Typical Performance

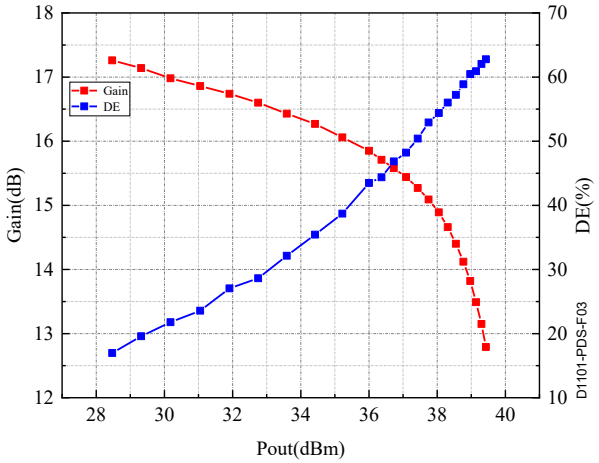


Figure 3. 2.6GHz Gain and DE @ MXP vs. Output Power

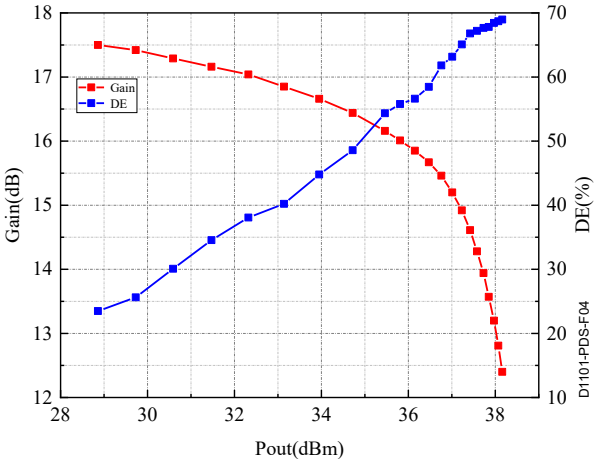


Figure 4. 2.6GHz Gain and DE @ MXE vs. Output Power

- Typical Class AB performance in Raytron DEMO, test condition: V_{DS} = 28V, I_{DS} = 30mA, V_{GS} = -2.4V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

10. Wide-band Application Performance (CW)

■ Wide-band Application Performance (DEMO_A, 0.03-3GHz, 5W, 28V)

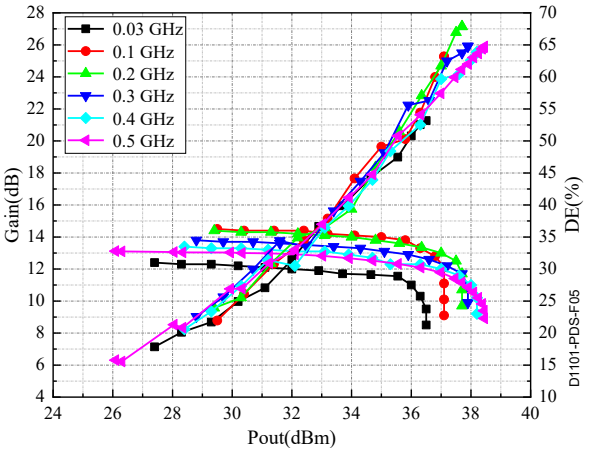


Figure 5. Wide-band Application Gain and DE vs. Output Power

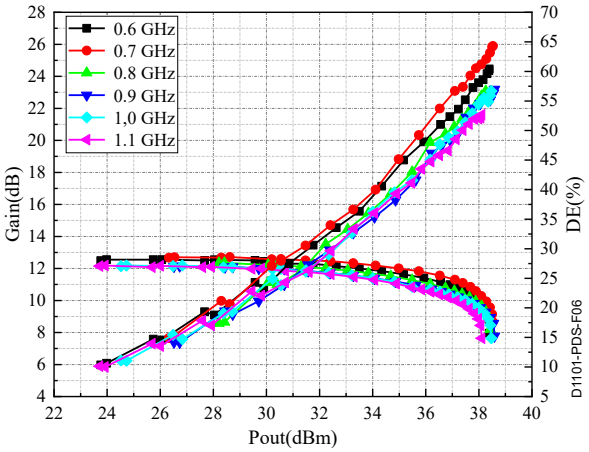


Figure 6. Wide-band Application Gain and DE vs. Output Power

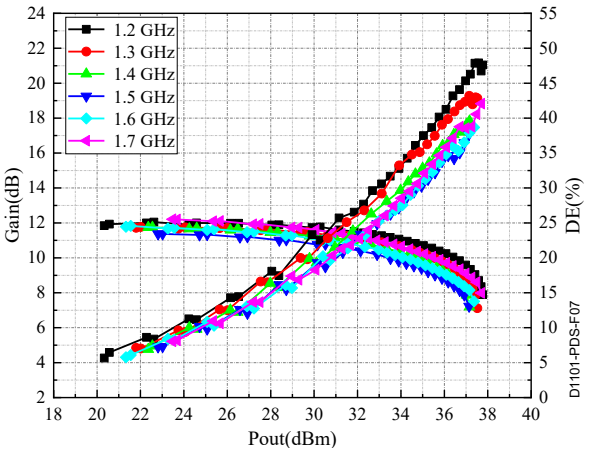


Figure 7. Wide-band Application Gain and DE vs. Output Power

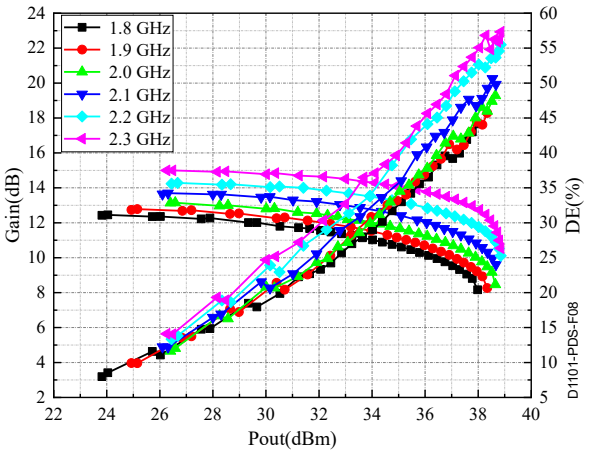


Figure 8. Wide-band Application Gain and DE vs. Output Power

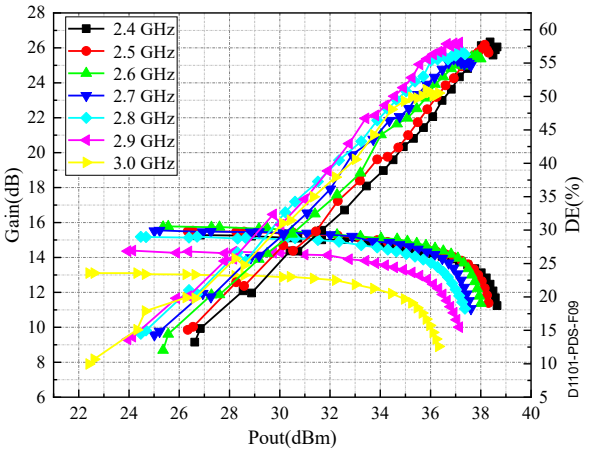


Figure 9. Wide-band Application Gain and DE vs. Output Power

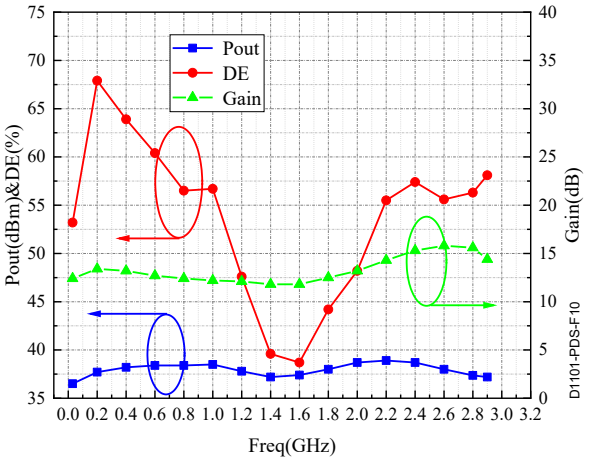


Figure 10. Wide-band Application P_{OUT}, Gain and DE vs. Freq.

- Typical Class AB performance in Raytron Wide-band Application DEMO_A, test condition: V_{DS} = 28V, I_{DS} = 30mA, V_{GS} = -2.4V
- Test Condition: CW
- The output power can get 5W at 0.03-3GHz when V_{DS} = 28V.

Table 6. RF Characteristics @ DEMO_A, 0.03-3GHz, 5W, 28V

Freq. (GHz)	Linear Gain (dB)	Power Gain (dB)	Drain Efficiency (%)	Output Power (dBm)	Output Power (W)
0.03	12.4	8.4	53.2	36.5	4.5
0.1	13.5	9.5	63.2	37.1	5.1
0.2	13.4	9.4	67.8	37.7	5.9
0.3	13.9	9.9	67.8	37.9	6.2
0.4	13.2	9.2	63.8	38.2	6.6
0.5	13.2	9.2	64.8	38.5	7.0
0.6	12.7	8.7	64.3	38.5	7.1
0.7	12.6	8.6	60.4	38.4	6.9
0.8	12.4	8.4	56.7	38.4	7.0
0.9	12.2	8.2	57.0	38.6	7.2
1.0	12.2	8.2	56.7	38.5	7.0
1.1	12.2	8.2	52.7	38.1	6.5
1.2	12.1	8.1	47.9	37.8	6.0
1.3	11.8	7.8	43.2	37.5	5.7
1.4	11.8	7.8	39.6	37.2	5.2
1.5	11.4	7.4	37.7	37.1	5.2
1.6	11.8	7.8	38.7	37.4	5.5
1.7	12.2	8.2	42.1	37.7	5.9
1.8	12.5	8.3	44.2	38.0	6.3
1.9	12.8	8.8	45.7	38.3	6.8
2.0	13.2	9.2	48.2	38.7	7.3
2.1	13.7	9.7	50.6	38.7	7.4
2.2	14.3	10.3	55.5	38.9	7.7
2.3	15.0	11.0	57.3	38.9	7.7
2.4	15.3	11.3	58.2	38.7	7.3
2.5	15.5	11.5	57.7	38.3	6.8
2.6	15.8	11.8	56.1	38.0	6.3
2.7	15.6	11.6	55.6	37.6	5.8
2.8	15.2	11.2	56.9	37.4	5.5
2.9	14.4	10.4	58.1	37.2	5.2
3.0	13.0	9.0	51.0	36.3	4.3

- Typical Class AB performance in Raytron Wide-band Application DEMO_A, test condition: V_{DS} = 28V, I_{DS} = 30mA, V_{GS} = -2.4V
- Test Condition: CW
- The output power reaches 5W at 0.03-3GHz when V_{DS} = 28V.

■ Wide-band Application Performance (DEMO_A, 0.03-3GHz, 2W, 18V)

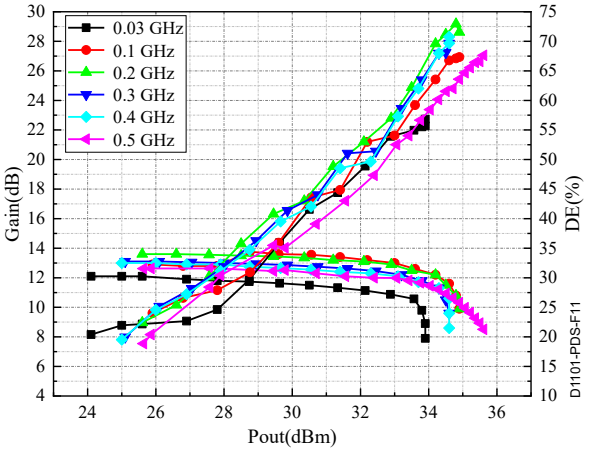


Figure 11. Wide-band Application Gain and DE vs. Output Power

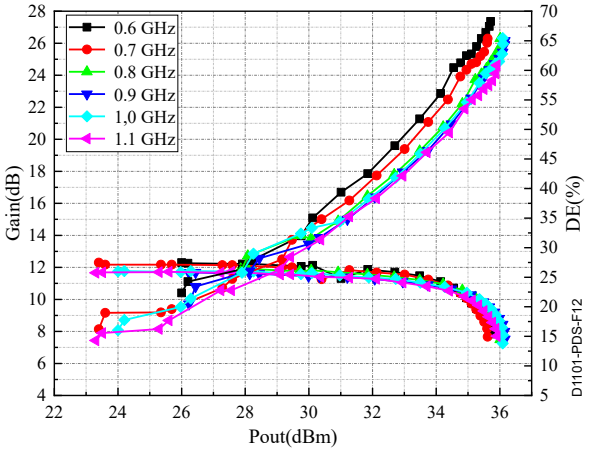


Figure 12. Wide-band Application Gain and DE vs. Output Power

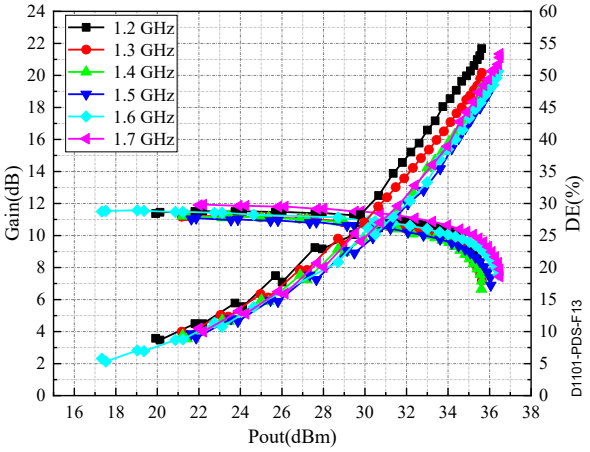


Figure 13. Wide-band Application Gain and DE vs. Output Power

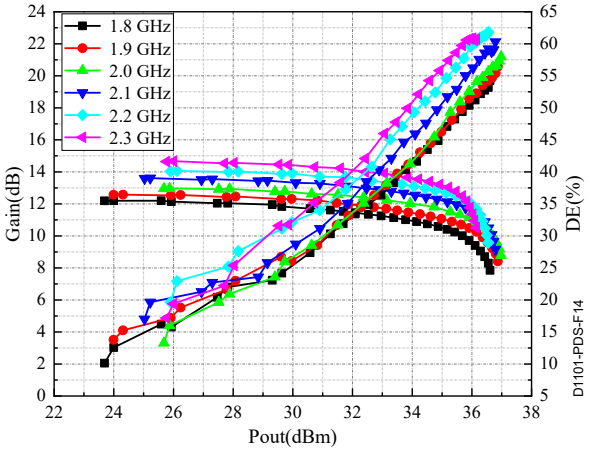


Figure 14. Wide-band Application Gain and DE vs. Output Power

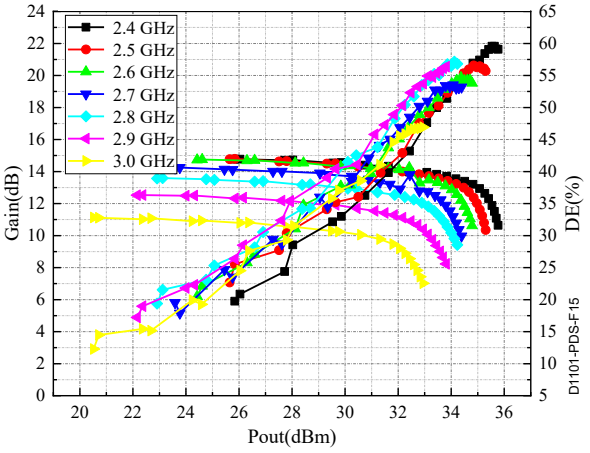


Figure 15. Wide-band Application Gain and DE vs. Output Power

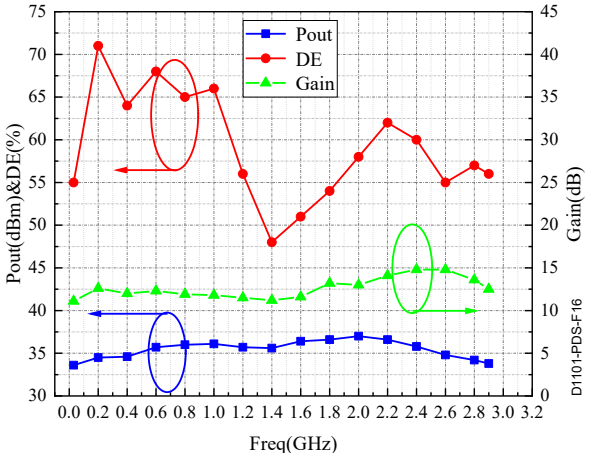


Figure 16. Wide-band Application P_{OUT}, Gain and DE vs. Freq.

- Typical Class AB performance in Raytron Wide-band Application DEMO_A, test condition: V_{DS} = 18V, I_{DS} = 30mA, V_{GS} = -2.4V
- Test Condition: CW
- The output power reaches 2W at 0.03-3GHz when V_{DS} = 18V.

Table 7. RF Characteristics @ DEMO_A, 0.03-3GHz, 2W, 18V

Freq. (GHz)	Linear Gain (dB)	Power Gain (dB)	Drain Efficiency (%)	Output Power (dBm)	Output Power (W)
0.03	11.1	7.1	55.0	33.6	2.3
0.1	12.9	8.9	63.5	34.2	2.6
0.2	12.6	8.6	71.2	34.5	2.8
0.3	12.1	8.1	68.0	34.3	2.7
0.4	12.0	8.0	64.1	34.6	2.9
0.5	12.6	8.6	67.6	35.6	3.6
0.6	12.3	8.3	68.3	35.7	3.7
0.7	12.2	8.2	65.4	35.6	3.7
0.8	11.9	7.9	65.4	36.0	4.0
0.9	11.7	7.7	65.0	36.2	4.1
1.0	11.8	7.8	65.5	36.1	4.1
1.1	11.7	7.7	60.9	35.9	3.9
1.2	11.5	7.5	55.5	35.7	3.7
1.3	11.2	7.2	50.4	35.6	3.7
1.4	11.2	7.2	48.1	35.6	3.6
1.5	11.1	7.1	48.8	36.1	4.0
1.6	11.6	7.6	50.7	36.4	4.4
1.7	11.9	7.9	53.4	36.5	4.5
1.8	13.2	9.2	54.3	36.6	4.6
1.9	12.7	8.7	56.4	36.9	4.9
2.0	13.0	9.0	58.0	37.0	5.0
2.1	13.6	9.6	60.3	36.8	4.8
2.2	14.1	10.1	61.8	36.6	4.5
2.3	14.7	10.7	60.9	36.2	4.1
2.4	14.8	10.8	59.6	35.8	3.8
2.5	14.8	10.8	56.6	35.3	3.4
2.6	14.8	10.8	54.7	34.8	3.0
2.7	14.3	10.3	53.5	34.4	2.8
2.8	13.6	9.6	57.2	34.2	2.7
2.9	12.5	8.5	56.4	33.8	2.4
3.0	11.1	7.1	46.9	32.9	2.0

- Typical Class AB performance in Raytron Wide-band Application DEMO_A, test condition: V_{DS} = 18V, I_{DS} = 30mA, V_{GS} = -2.4V
- Test Condition: CW
- The output power reaches 2W at 0.03-3GHz when V_{DS} = 18V.

■ Wide-band Application Performance (DEMO_A, 0.03-3GHz, 1W, 12V)

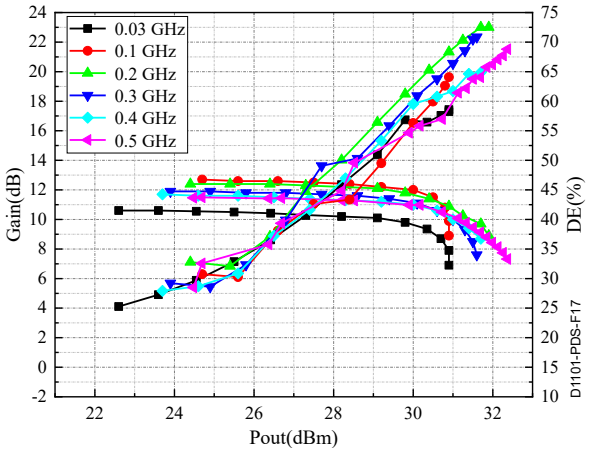


Figure 17. Wide-band Application Gain and DE vs. Output Power

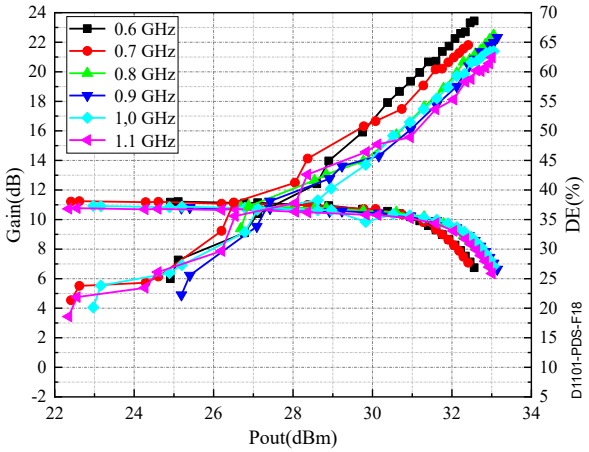


Figure 18. Wide-band Application Gain and DE vs. Output Power

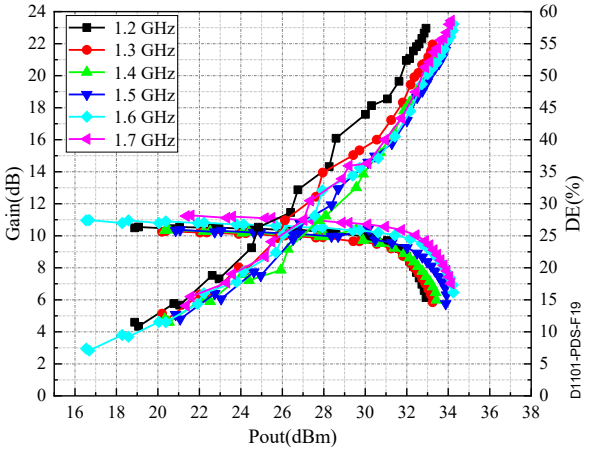


Figure 19. Wide-band Application Gain and DE vs. Freq.

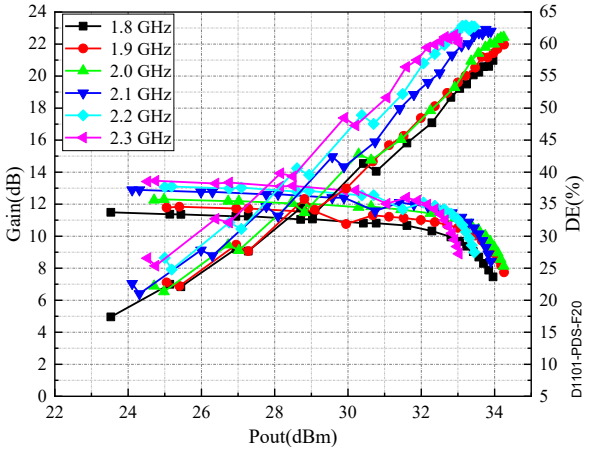


Figure 20. Wide-band Application Gain and DE vs. Freq.

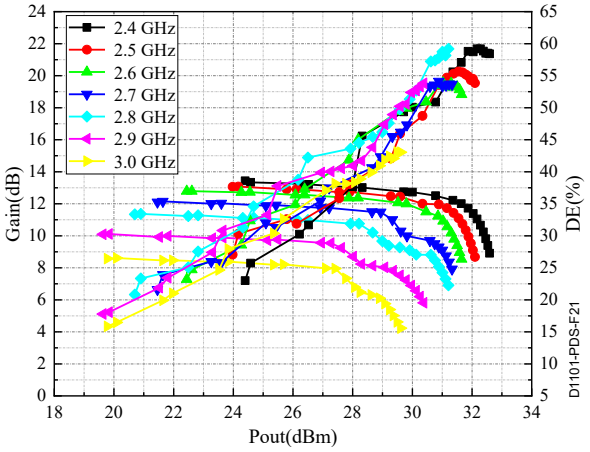


Figure 21. Wide-band Application Gain and DE vs. Freq.

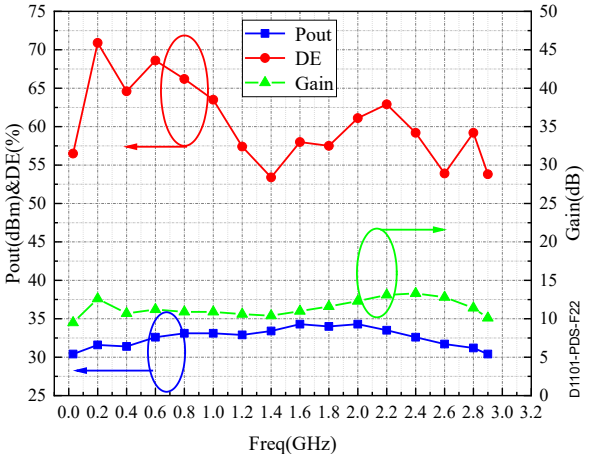


Figure 22. Wide-band Application Gain and DE vs. Freq.

- Typical Class AB performance in Raytron Wide-band Application DEMO_A, test condition: V_{DS} = 12V, I_{DS} = 30mA, V_{GS} = -2.4V
- Test Condition: CW
- The output power reaches 1W at 0.03-3GHz when V_{DS} = 12V.

Table 8. RF Characteristics @ DEMO_A, 0.03-3GHz, 1W, 12V

Freq. (GHz)	Linear Gain (dB)	Power Gain (dB)	Drain Efficiency (%)	Output Power (dBm)	Output Power (W)
0.03	9.5	5.5	56.5	30.4	1.1
0.1	12.9	8.9	60.0	30.5	1.1
0.2	12.6	8.6	70.9	31.6	1.4
0.3	12.1	8.1	66.4	31.0	1.3
0.4	10.7	6.7	64.6	31.4	1.4
0.5	11.5	7.5	68.8	32.4	1.7
0.6	11.2	7.2	68.6	32.6	1.8
0.7	11.2	7.2	54.5	32.4	1.7
0.8	10.9	6.9	66.2	33.1	2.0
0.9	10.8	6.8	65.8	33.1	2.1
1.0	10.9	6.9	63.5	33.1	2.0
1.1	10.8	6.8	62.4	33.0	2.0
1.2	10.6	6.6	57.4	32.9	2.0
1.3	10.3	6.3	54.9	33.3	2.1
1.4	10.4	6.4	53.4	33.4	2.2
1.5	10.4	6.4	55.6	33.9	2.4
1.6	11.0	7.0	58.0	34.3	2.7
1.7	11.3	7.3	58.6	34.1	2.6
1.8	11.6	7.6	57.5	34.0	2.5
1.9	12.0	8.0	60.0	34.3	2.7
2.0	12.3	8.3	61.1	34.3	2.7
2.1	12.9	8.9	62.3	33.9	2.5
2.2	13.1	9.1	62.9	33.5	2.2
2.3	13.5	9.5	61.5	33.0	2.0
2.4	13.3	9.3	59.2	32.6	1.8
2.5	13.1	9.1	55.6	32.1	1.6
2.6	12.8	8.8	53.9	31.7	1.5
2.7	12.2	8.2	54.1	31.3	1.4
2.8	11.4	7.4	59.2	31.2	1.3
2.9	10.1	6.1	53.8	30.4	1.1
3.0	8.7	4.7	43.1	29.6	0.9

- Typical Class AB performance in Raytron Wide-band Application DEMO_A, test condition: V_{DS} = 12V, I_{DS} = 30mA, V_{GS} = -2.4V
- Test Condition: CW
- The output power reaches 1W at 0.03-3GHz when V_{DS} = 12V.

11. Package Outline

■ Pin Layout

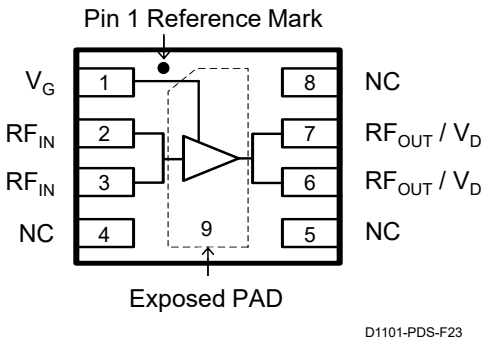


Figure 23. D1101 Pin Layout

Table 9. Pin Description

Pin	Symbol	Description
1	V_G	Gate voltage
2/3	RF_{IN}	RF Input
4/5/8	NC[1]	Not Connected
6/7	RF_{OUT} / V_D	RF output / Drain voltage
9	Exposed PAD[2]	Ground / Source

[1] All no connection pins may be left floating or connected to 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 6.00 x 5.00 x 0.85mm)

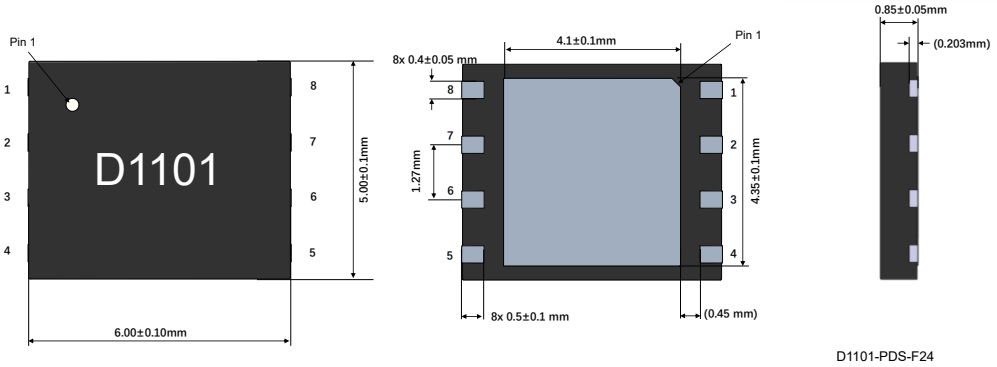


Figure 24. D1101 Mechanical Drawing

12. Application Circuit

■ Schematic

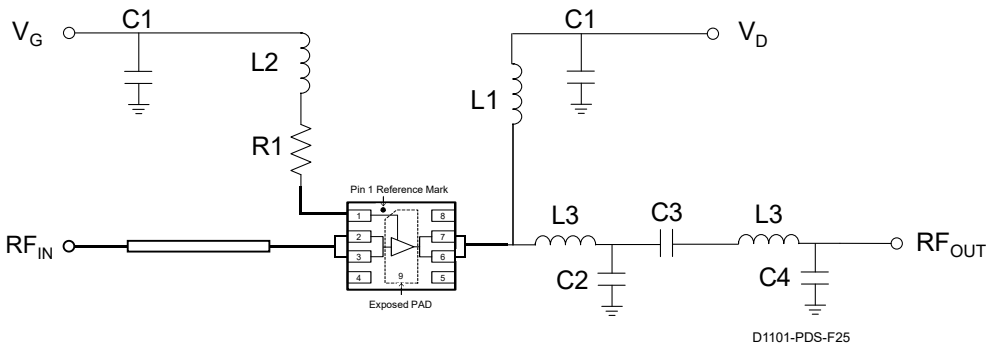


Figure 25. D1101 DEMO_A Application Circuit Schematic

Table 10. 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

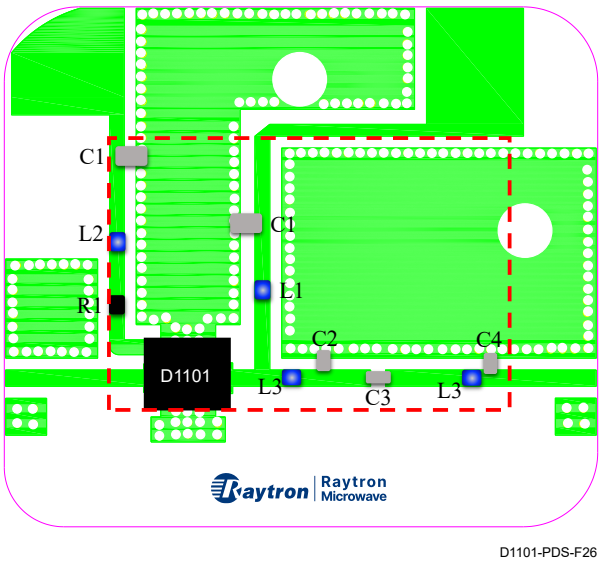


Figure 26. D1101 Application Circuit Layout (0.03-3GHz)
（DEMO_A Effective Size: red dotted line, 2.5 x 1.0cm）

Table 11. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	4.7uF	X7S 100V 1206 Capacitor	Murata	GRM31CC72A475KE11L
C2	1.5pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2E1R5BB12D
C3	1000pF	C0G 50V 0603 Capacitor	Murata	GRM1885C1H102JA01D
C4	0.4pF	C0G 250V 0603 Capacitor	Murata	GQM1875C2ER40BB12
L1	0.9uH	1.3A 1008 Inductor	Coilcraft	1008AF-901X
L2	1.2uH	310mA 1008 Inductor	Murata	LQW2UAS1R2J00L
L3	2.2nH	3.2A 0603 Inductor	Murata	LQW18AN2N2C80D
R1	1100Ω	1/10W 0603 Resistor	Yageo	AT0603BRD071K1L

13. DEMO Summary

Table 12. DEMO Summary

No.	D1101 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency (%)	Pulse or CW
1	DEMO_A, 5W	12	0.03-3	9.5	30.4	1	53%	CW
2	DEMO_A, 5W	18	0.03-3	11.1	33.6	2	48%	CW
3	DEMO_A, 5W	28	0.03-3	11.8	36.5	4.5	38%	CW
4	DEMO_B, 5W	28	0.2-3	13.9	37	5	48%	CW
5	DEMO_C, 4W	28	0.01-3.1	11.8	36.3	4	37%	CW

14. Recommended Solder Temperature Profile

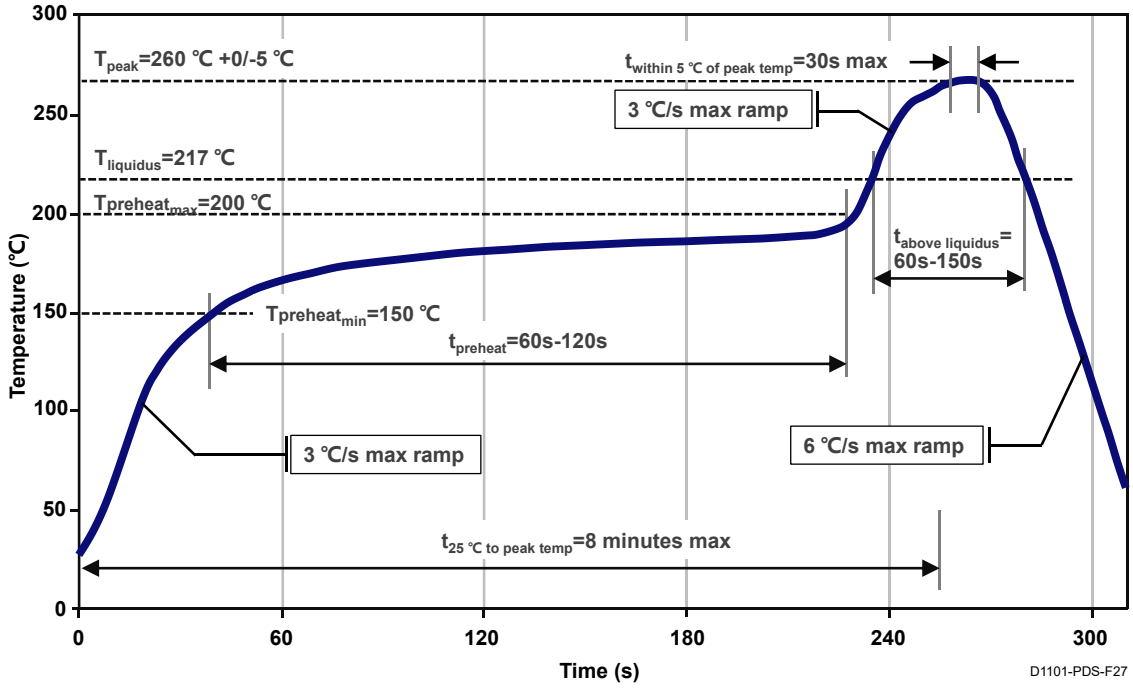


Figure 27. Recommended Solder Temperature Profile

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

17. Disclaimer

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