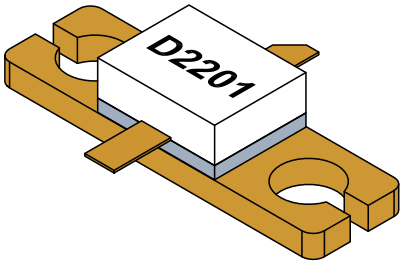
1. Description

- The D2201 is a 10W (P_{SAT}) wideband unmatched gallium nitride (GaN) high electron mobility transistor (HEMT) with first generation RF GaN technology from Raytron.
- The D2201 operates from DC to 10GHz with a 28V or a 48V supply rail. The device is offered in an industry standard air cavity package.



D2201-PDS1-F01

Figure 1. D2201 Package Outline

2. Applications

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

3. Features[1]

- Operating Frequency: DC-10GHz
- Output Power (P_{SAT}): 40.9dBm (12W)
- Linear Gain: 19.6dB
- Typical DE @P_{SAT}: 67.0%
- Operating Voltage: 48V
- CW and Pulse Capable
- Package Type: 200F-A

[1] Measured in Raytron DEMO @2.6GHz

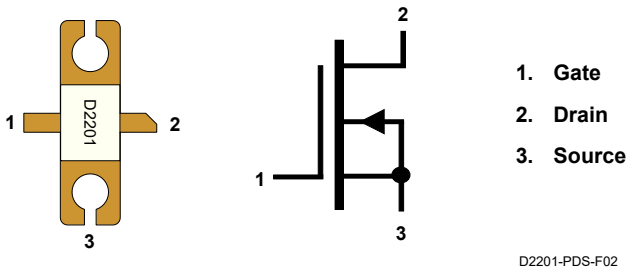
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	2.6GHz	Units
Linear Gain	19.6	dB
Drain Efficiency	67.0	%
Output Power	40.9	dBm

- Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS} = 70mA, V_{GS} = -2.3 V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

5. Block Diagram



1. Gate
2. Drain
3. Source

D2201-PDS-F02

Figure 2. D2201 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 (48V)	4
10	Typical Performance (28V)	5
11	Wide-band Application Performance	5
12	Package Outline	6
13	Application Circuit	7
14	DEMO Summary	8
15	Recommended Solder Temperature Profile	8
16	Handling Precautions	9
17	Contact Information	9
18	Disclaimer	9

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}	0 ~ +55	V
Maximum Forward Gate Current	I_{GMax}	1.4	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}	-	48	55	V
Drain Bias Current, I_{DS}	-	70	-	mA
Gate-Source Voltage, V_{GS}	-	-2.3	-	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)	–	°C/W
Thermal Resistance (Junction-to-Case)[2]	R_{thjc} (FEA)	16.4	°C/W

[1] Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 5.6W

[2] Thermal Resistance at average power by Finite Element Analysis, Junction-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 5.6W

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} = 1.4mA)	$V_{DS(BR)}$	150	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	1.3	-	A
Gate Threshold Voltage[3] (V_{DS} = 48V, I_{DS} = 1.4mA)	$V_{GS(TH)}$	-3.30	-2.80	-2.30	V
Gate Quiescent Voltage[3] (V_{DS} = 48V, I_{DS} = 70mA)	$V_{GS(Q)}$	-	-2.30	-	V

[1] Measured on wafer prior to packaging

[2] Measured with packaged device

[3] Measured in Raytron DEMO

Table 6. RF Characteristics[1]

Test Method	Parameter	Symbol	Min.	Typ.	Max.	Units
DEMO[2] @2.6GHz	Linear Gain	G_{LIN}	-	19.6	-	dB
	Drain Efficiency	η_D	-	67.0	-	%
	Output Power	P_{SAT}	-	40.9	-	dBm

1. Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%
2. Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS} = 70mA, V_{GS} = -2.3 V

Table 7. Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Input Capacitance	C_{GS}	-	2.02	-	pF
Output Capacitance	C_{DS}	-	1.44	-	pF
Feedback Capacitance	C_{GD}	-	0.184	-	pF

- Test Condition: V_{DS} = 48V, V_{GS} = -8V, f = 1MHz

9. Typical Performance（48V）

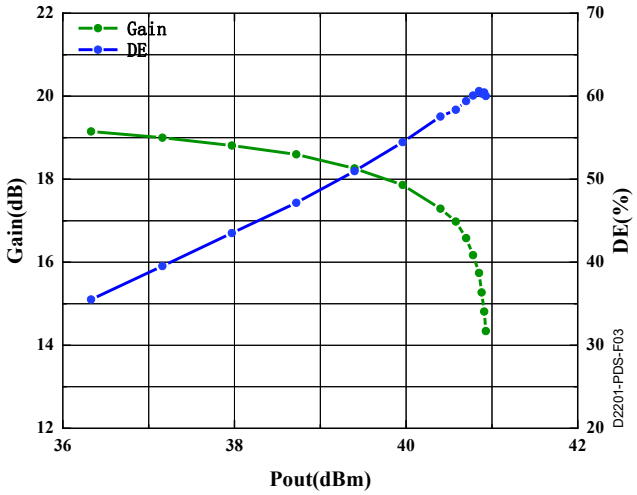


Figure 3. 2.6GHz Gain and DE @MXP vs. Output Power

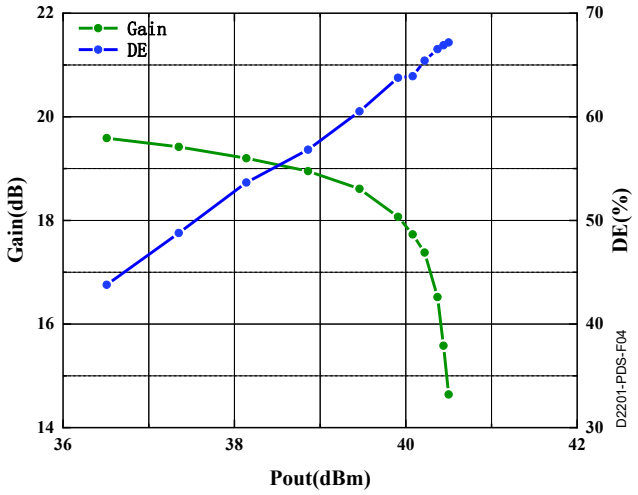


Figure 4. 2.6GHz Gain and DE @MXE vs. Output Power

- Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS} = 70mA, V_{GS} = -2.3 V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

10. Typical Performance（28V）

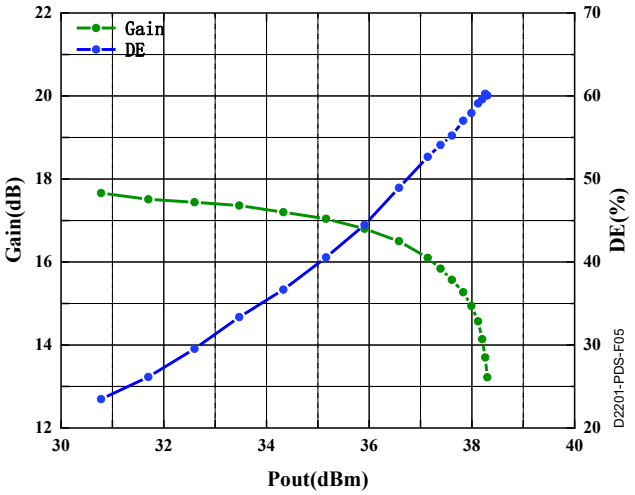


Figure 5. 2.6GHz Gain and DE @MXP vs. Output Power

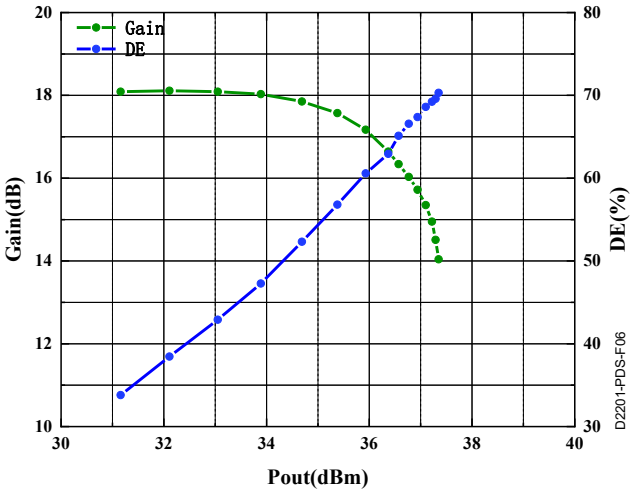


Figure 6. 2.6GHz Gain and DE @MXE vs. Output Power

- Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 70mA, V_{GS} = -2.3 V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

11. Wide-band Application Performance

■ Wide-band Application Performance 1 (DEMO_B: 2.5-2.7GHz)

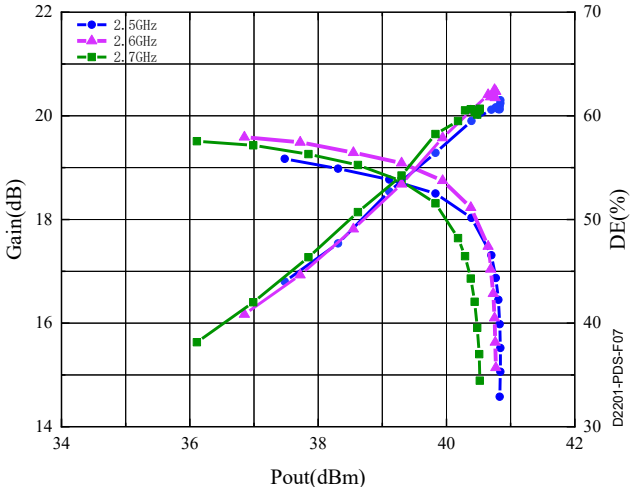


Figure 7. Wide-band Application Gain and DE vs. Output Power

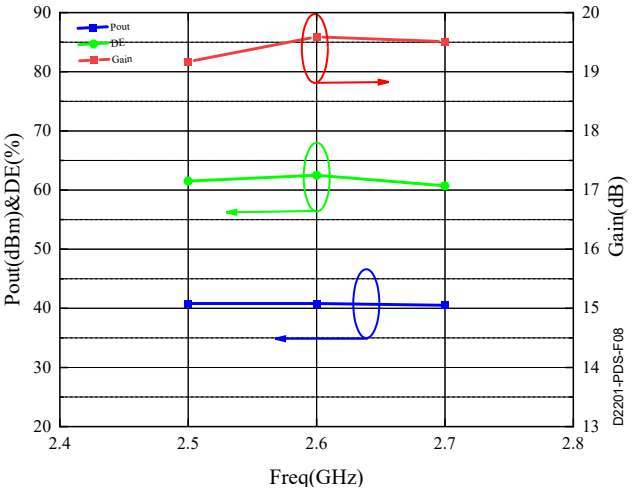


Figure 8. Wide-band Application P_{OUT}, Gain and DE vs. Freq.

- Typical Class AB performance in Raytron Wide-band Application DEMO_B with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS} = 70mA, V_{GS} = -2.3 V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%
- The output power is 40.5dBm(11W) at 2.5-2.7GHz. It can be used as the driver PA in the avionics application within S band.

12. Package Outline

■ Pin Layout

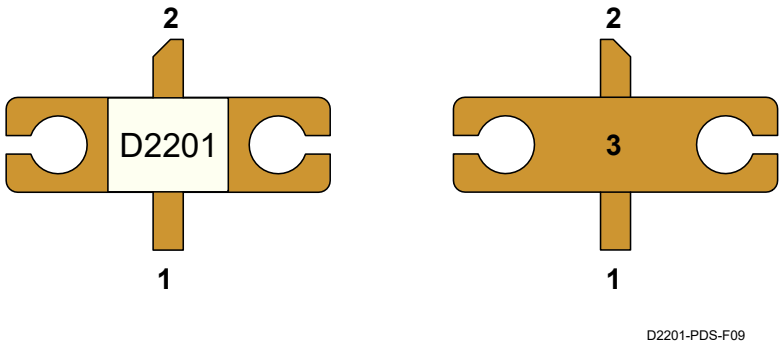


Figure 9. D2201 Pin Layout

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: 200F-A）

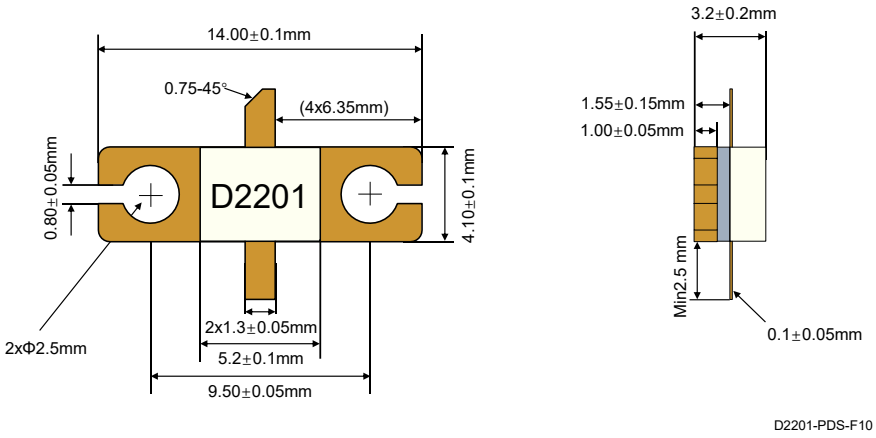


Figure 10. D2201 Mechanical Drawing

13. Application Circuit

■ Schematic

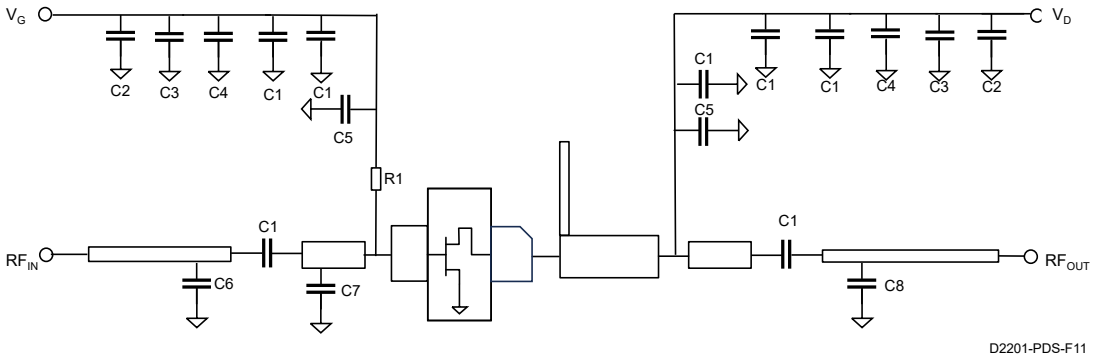


Figure11. D2201 DEMO_B Application Circuit Schematic

Table 8. 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 (48V)	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

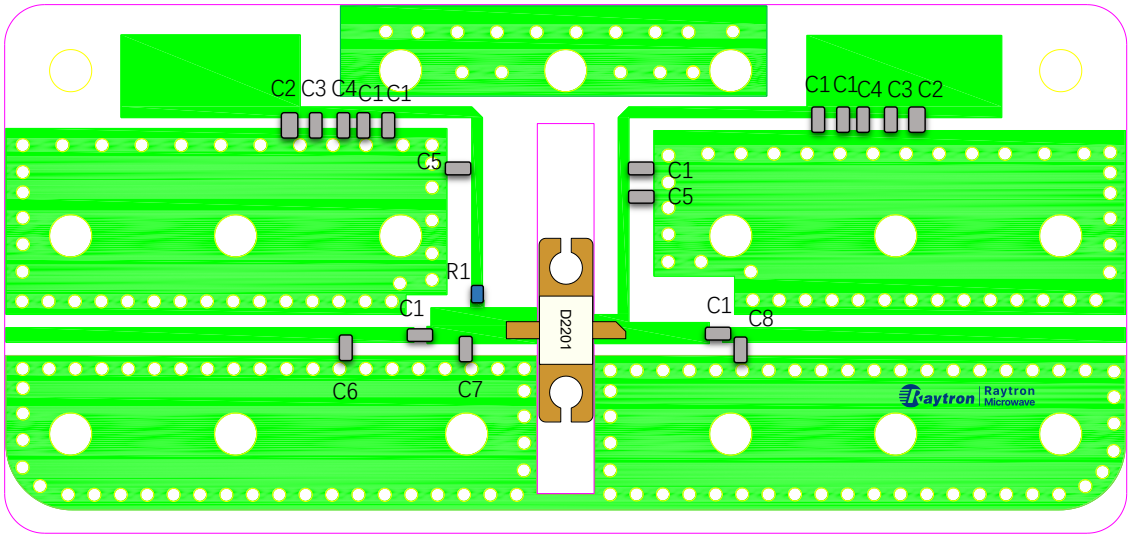


Figure 12. D2201 Application Circuit Layout
（DEMO_B Size：8.50cm x 4.00cm）

Table 9. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	6.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E5R5BB12
C2	1.0uF	X7R 100V 1210 Capacitor	Murata	GCM188R72A103KA37D
C3	10000.0pF	C0G 250V 0603 Capacitor	Murata	GQM2195C2E101JB12
C4	100.0pF	C0G 250V 0805 Capacitor	Murata	GRM32ER72A105KA01
C5	0.1uF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E1R9BB12
C6	0.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2ER60WB12
C7	1.9pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2ER50WB12
C8	0.6pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E1R7BB12
R1	10.0Ω	1/8W 0805 Resistor	Yageo	RC0805FR-0710RL

14. DEMO Summary

Table 10. DEMO Summary

NO.	D2201 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency	Pulse or CW
1	DEMO_A, 10W	48	2.5-2.7	19.2	40.5	11	61%	Pulse
2	DEMO_B, 5W	24	1.1-1.7	17.9	37.4	5	58%	CW
3	DEMO_C, 10W	48	2.7-3	20.2	40.2	11	65%	Pulse

15. Recommended Solder Temperature Profile

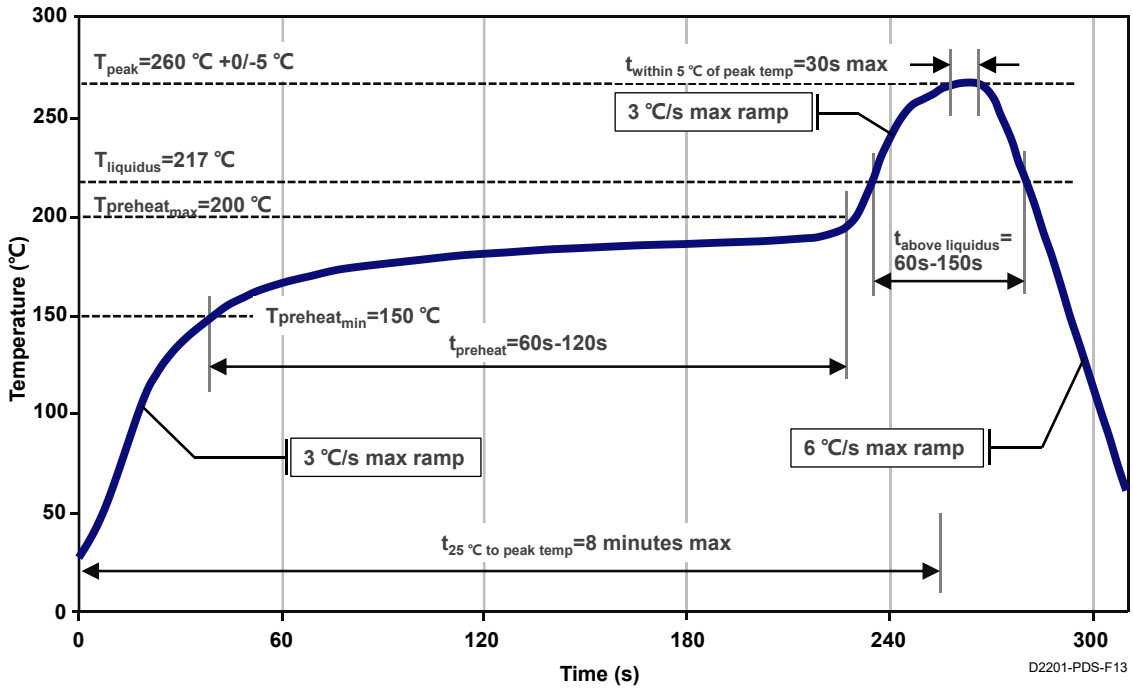


Figure 13. Recommended Solder Temperature Profile

16. 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.



17. 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

18. Disclaimer

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