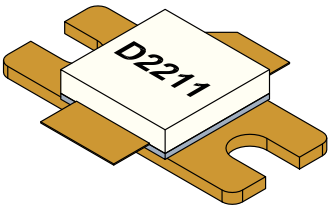
1. Description

- The D2211 is a 450W (P_{SAT}) wideband pre-matched gallium nitride (GaN) high electron mobility transistor (HEMT).
- The D2211 operates from DC to 3GHz with a 48V supply rail. The device is offered in an industry standard air cavity package.



D2211-PDS-F01

Figure 1. D2211 Package Outline

2. Applications

- Military and Civilian Radar
- Target Tracking Radar
- Air Traffic Control (ATC) Radar
- Avionics, IFF Transponders

3. Features

- Operating Frequency: DC–3GHz
- Output Power[1] (P_{SAT}): 56.9dBm (490W)
- Linear Gain[1]: 19.4dB
- Typical DE @P_{SAT}[1]: 72.7%
- Operating Voltage: 48V
- Package Type: 400F-A

[1] Measured in Raytron DEMO @2.1GHz

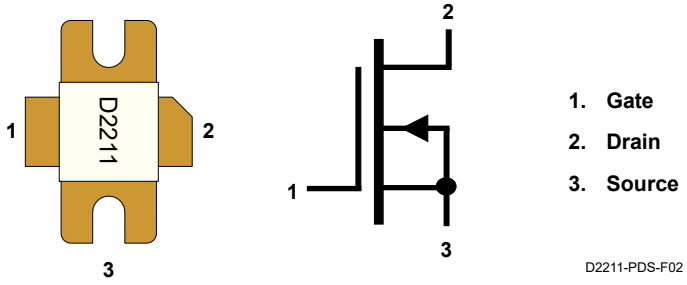
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	1.2GHz	2.1GHz	Units
Linear Gain	20.4	19.4	dB
Drain Efficiency	76.0	72.7	%
Output Power	57.3	56.9	dBm
Output Power	537	490	W

- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 5%
- Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS} = 400mA, V_{GS} = -3.1V

5. Block Diagram



D2211-PDS-F02

Figure 2. D2211 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}	56.26	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}	-	50	55	V
Drain Bias Current, I_{DS}	-	400	-	mA
Gate-Source Voltage, V_{GS}	-	-3.1	-	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)	0.9	°C/W

[1] Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 70.0W

[2] Thermal Resistance at average power by Finite Element Analysis, Junction-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 70.0W

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} = 56.3mA)	$V_{DS(BR)}$	150	-	-	V
Saturated Drain Current[1] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	58.49	-	A
Gate Threshold Voltage[2] (V_{DS} = 48V, I_{DS} = 56.26mA)	$V_{GS(TH)}$	-3.95	-3.32	-2.60	V
Gate Quiescent Voltage[2] (V_{DS} = 48V, I_{DS} = 400mA)	$V_{GS(Q)}$	-	-3.10	-	V

[1] Scaled from PCM data

[2] Measured in Raytron DEMO

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

Parameter	0.96GHz	1.0GHz	1.05GHz	1.1GHz	1.15GHz	1.2GHz	1.25GHz	Units
Linear Gain	19.6	19.5	19.8	19.8	19.9	20.1	19.9	dB
Drain Efficiency	67.4	68.4	68.1	69.0	71.5	73.7	77.4	%
Output Power	55.9	55.8	55.7	55.8	56.1	56.0	55.8	dBm
Output Power	389	380	372	380	407	398	380	W

1. Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 5%
2. Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS} = 400mA, V_{GS} = -3.1V

Table 7. Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Input Capacitance	C_{GS}	-	85.95	-	pF
Output Capacitance	C_{DS}	-	21.34	-	pF
Feedback Capacitance	C_{GD}	-	2.89	-	pF

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

9. Typical Performance

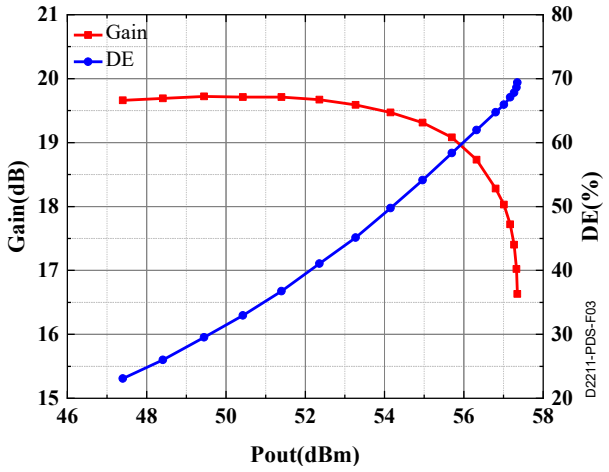


Figure 3. 1.2GHz Gain and DE @MXP vs. Output Power

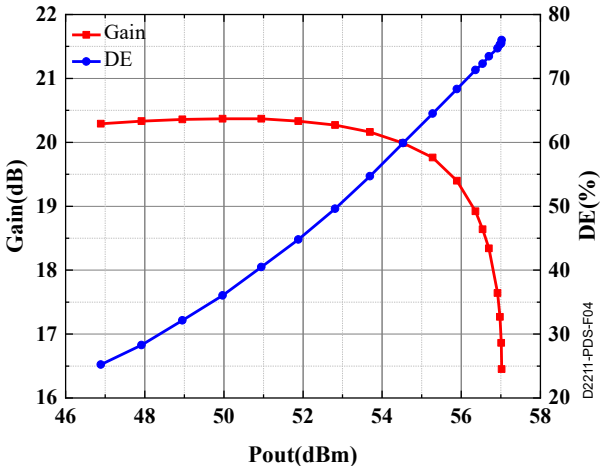


Figure 4. 1.2GHz Gain and DE @MXE vs. Output Power

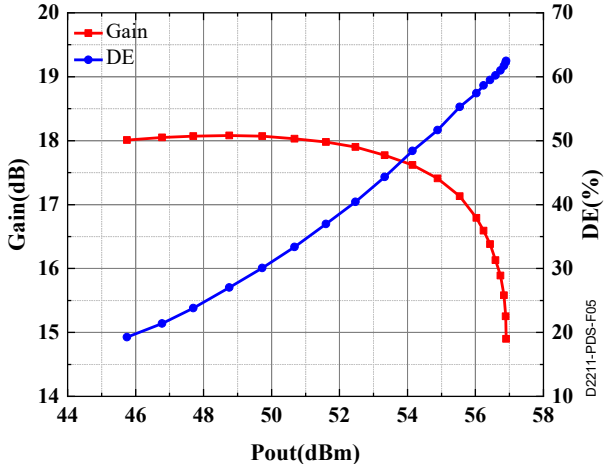


Figure 5. 2.1GHz Gain and DE @MXP vs. Output Power

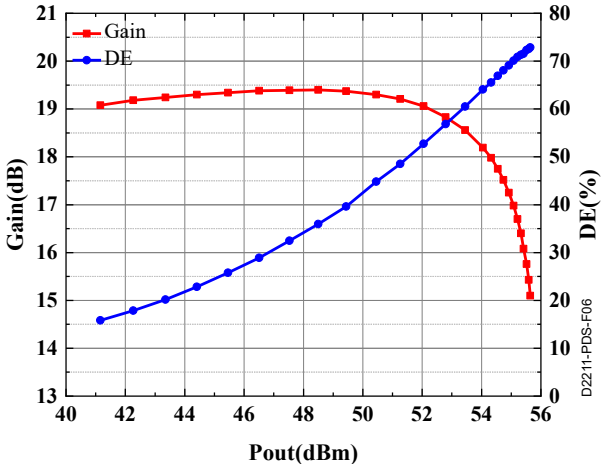


Figure 6. 2.1GHz Gain and DE @MXE vs. Output Power

- Typical performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS}= 400mA, V_{GS} = -3.1V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 5%

10. Wide-band Application Performance

■ Wide-band Application Performance (DEMO_A: 0.96-1.25GHz)

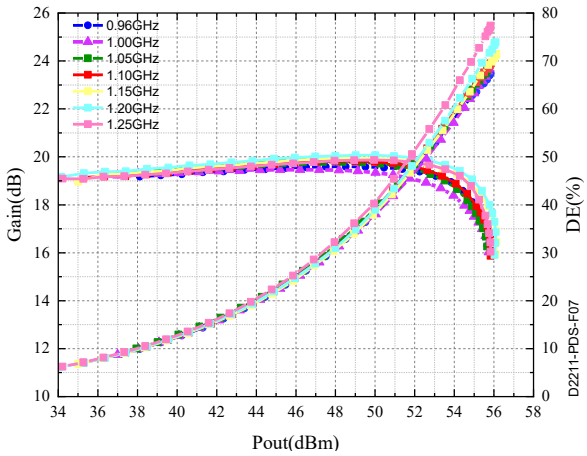


Figure 7. Wide-band Application Gain and DE vs. Output Power

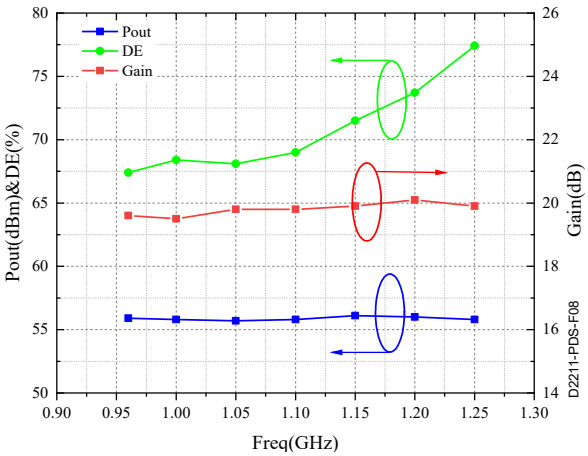


Figure 8. Wide-band Application Gain and DE vs. Freq.

- Typical Class AB performance in Raytron Wide-band Application DEMO_A (0.96-1.25GHz) with the device soldered onto the heatsink, test condition: V_{DS} = 48V, I_{DS} = 400mA, V_{GS} = -3.1V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 5%
- The output power is 55.7dBm (372W) at 0.96-1.25GHz. It can be used in the avionics and L band radar application.

11. Package Outline

■ Pin Layout

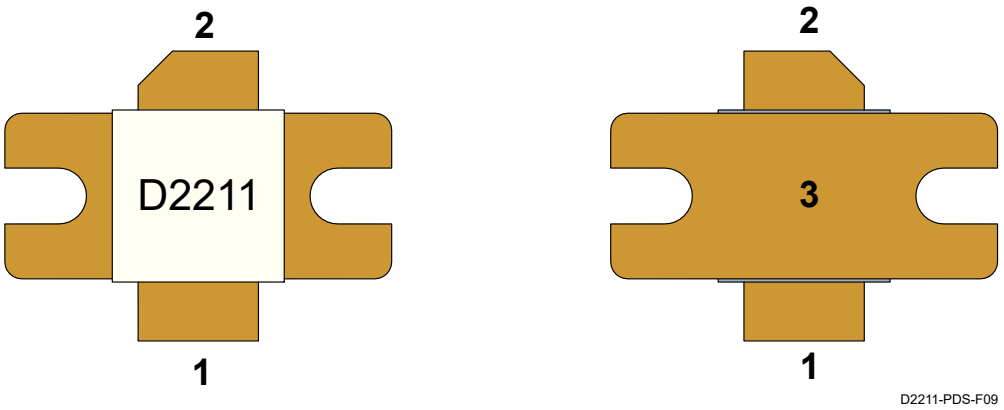


Figure 9. D2211 Pin Layout

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: 400F-A)

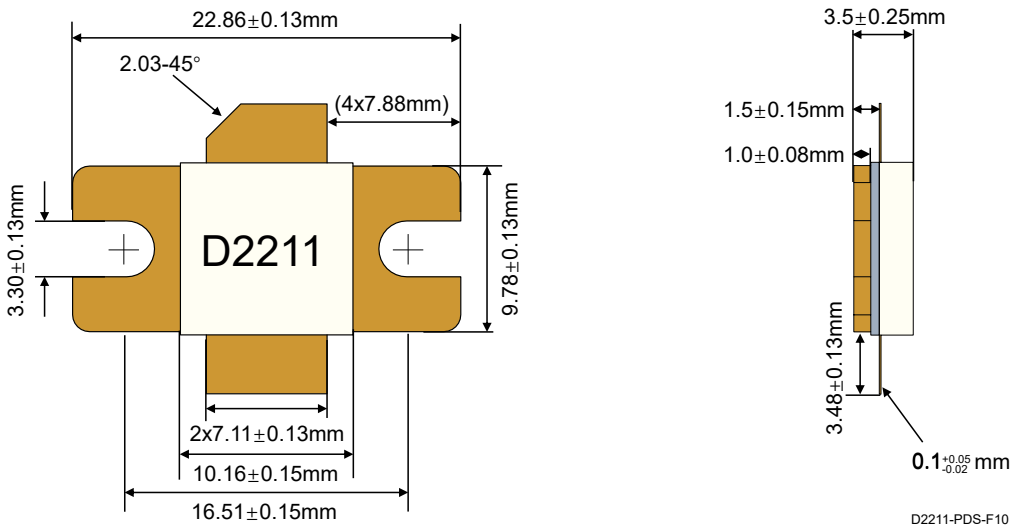


Figure 10. D2211 Mechanical Drawing

12. Application Circuit

■ Schematic

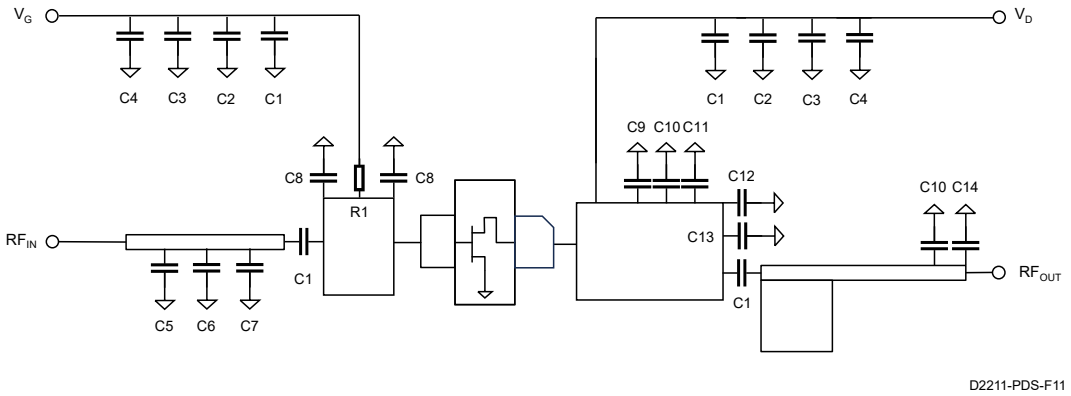
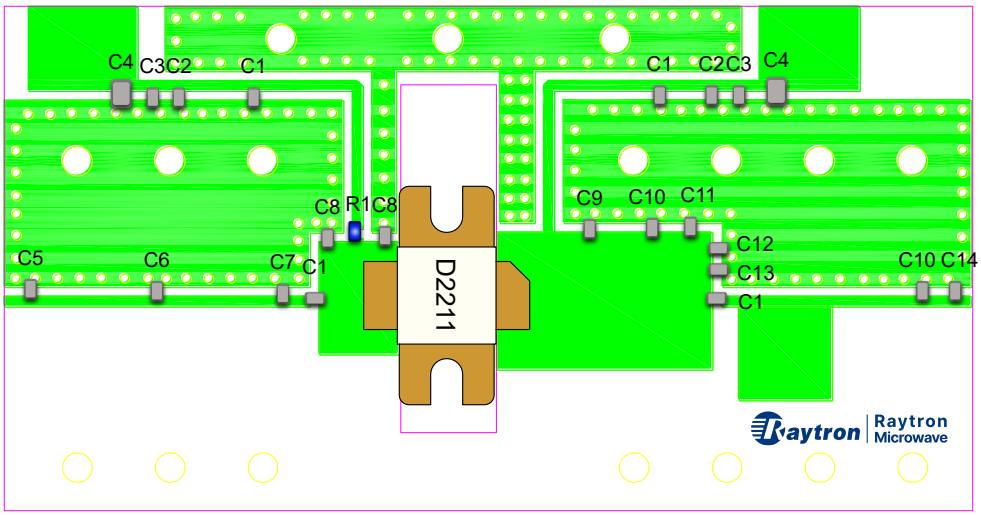


Figure 11. D2211 DEMO_A Application Circuit Schematic

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 (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



D2211-PDS-F12

Figure 12. D2211 Application Circuit Layout
(DEMO_A Size: 10.5 x 5.5cm)

Table 10. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	25.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E250GB12
C2	100.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E101JB12
C3	10000.0pF	X7R 100V 0603 Capacitor	Murata	GCM188R72A103KA37D
C4	1.0uF	X7R 100V 1210 Capacitor	Murata	GRM32ER72A105KA01
C5	1.4pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E1R4BB12
C6	5.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E5R0CB12
C7	7.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E7R0CB12
C8	9.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E9R0CB12
C9	3.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E3R5BB12
C10	2.3pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E2R3BB12
C11	1.9pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E1R5BB12
C12	0.4pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2ER40WB12
C13	3.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E3R5BB12
C14	2.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E2R5BB12
R1	10Ω	1/8W 0805	Yageo	RC0805FR-0710RL

13. DEMO Summary

Table 11. DEMO Summary

NO.	D2211 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency	Pulse or CW
1	DEMO_A, 400W	48	0.96-1.25	19.5	55.7	372	68%	Pulse
2	DEMO_B, 300W	48	0.99-1.4	18.2	54.6	288	60%	Pulse
3	DEMO_C, 230W	32	1.3-1.95	14.9	53.6	229	53%	Pulse
4	DEMO_D, 310W	48	0.1	35.7	54.9	310	79%	CW
5	DEMO_E, 150W	28	0.5-1	17.7	51.9	155	69%	CW
6	DEMO_F, 150W	28	1-1.4	16.3	52.0	158	62%	Pulse
7	DEMO_J, 450W	48	1.47-1.53	17.7	56.3	427	56%	Pulse
8	DEMO_K, 120W	28	1-1.5	15.4	50.8	120	64%	CW
9	DEMO_L, 150W	28	0.4-1	16.5	51.6	146	59%	Pulse

14. Recommended Solder Temperature Profile

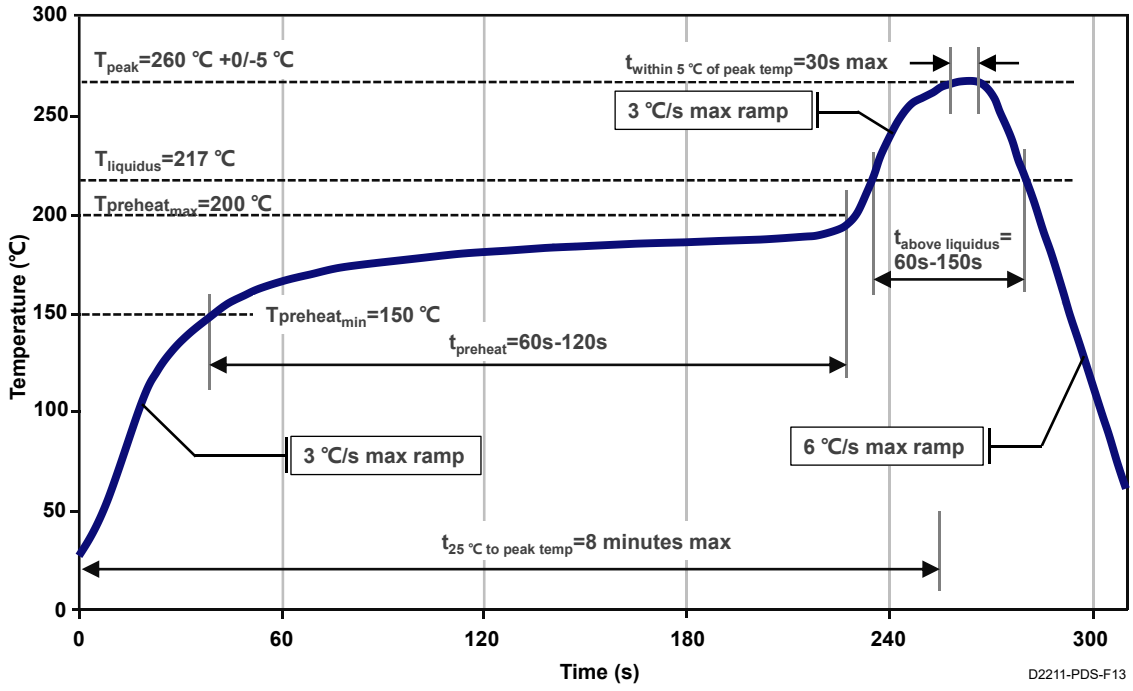


Figure 13. Recommended Solder Temperature Profile

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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