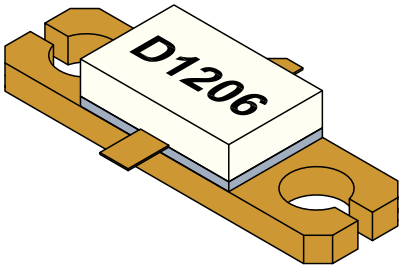
1. Description

- The D1206 is a 100W (P_{SAT}) wideband unmatched gallium nitride (GaN) high electron mobility transistor (HEMT) with first generation RF GaN technology from Raytron.
- The D1206 operates from DC to 6GHz with a 28V supply rail. The device is offered in an industry standard air cavity package.



D1206-PDS-F01

Figure 1. D1206 Package Outline

2. Applications

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

3. Features[1]

- Operating Frequency: DC–6GHz
- Output Power (P_{SAT}): 50.5dBm (112W)
- Linear Gain: 13.4dB
- Typical DE @ P_{SAT}: 72.3%
- Operating Voltage: 28V
- CW and Pulse Capable
- Package Type: 360F-A

[1] Measured in Raytron DEMO @2.6GHz

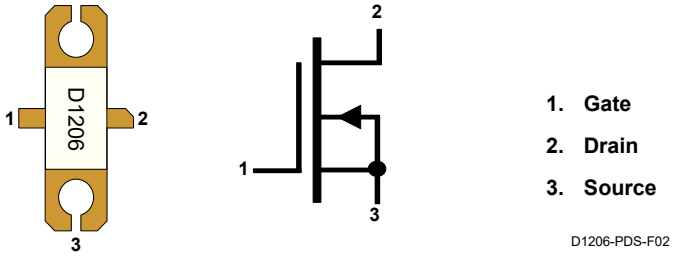
4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	2.6GHz	Units
Linear Gain	13.4	dB
Drain Efficiency	72.3	%
Output Power	50.5	dBm

- Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 200mA, V_{GS} = -2.75V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

5. Block Diagram



D1206-PDS-F02

Figure 2. D1206 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	8
15	Handling Precautions	9
16	Contact Information	9
17	Disclaimer	9

6. Absolute Maximum Ratings

Table 2. Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DSS}	120	V
Gate-Source Voltage	V_{GS}	-10 ~ +1	V
Operating Voltage	V_{DS}	10 ~ +40	V
Maximum Forward Gate Current	I_{GMax}	18.5	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	40	V
Drain Bias Current, I_{DS}	-	200	-	mA
Gate-Source Voltage, V_{GS}	-	-2.8	-	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)	1.31	°C/W
Thermal Resistance (Junction-to-Case)[2]	R_{thjc} (FEA)	1.61	°C/W

[1] Thermal Resistance at average power by infrared measurement, Active Die Surface-to-Case, $T_{base\text{-}plate}$ = 85℃, P_D = 64.0W

[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} = 18.5mA)	$V_{DS(BR)}$	120	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	20.41	-	A
Gate Threshold Voltage[3] (V_{DS} = 28V, I_{DS} = 18.5mA)	$V_{GS(TH)}$	-3.30	-2.80	-2.30	V
Gate Quiescent Voltage[3] (V_{DS} = 28V, I_{DS} = 200mA)	$V_{GS(Q)}$	-	-2.75	-	V

[1] Measured on wafer prior to packaging

[2] Measured with packaged device

[3] Measured in Raytron DEMO

Table 6. RF Characteristics

Parameter	2.6GHz	Units
Linear Gain	13.4	dB
Drain Efficiency	72.3	%
Output Power	50.5	dBm

- Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 200mA, V_{GS} = -2.75V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

Table 7. Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Input Capacitance	C_{GS}	-	16.70	-	pF
Output Capacitance	C_{DS}	-	8.92	-	pF
Feedback Capacitance	C_{GD}	-	1.01	-	pF

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

9. Typical Performance

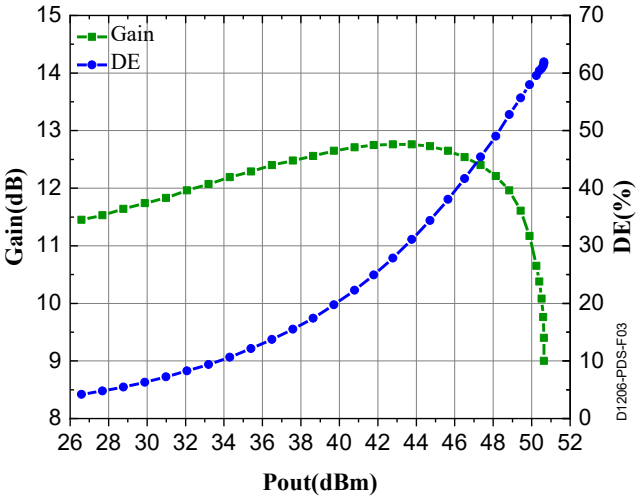


Figure 3. 2.6GHz Gain and DE @MXP vs. Output Power

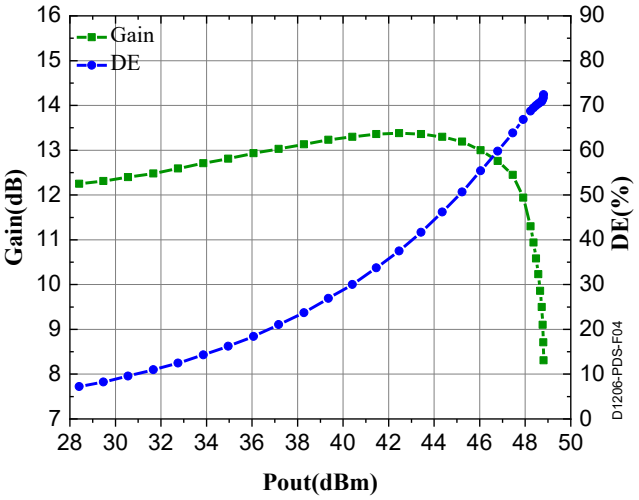


Figure 4. 2.6GHz Gain and DE @MXE vs. Output Power

- Typical Class AB performance in Raytron DEMO with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 200mA, V_{GS} = -2.75V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

10. Wide-band Application Performance

■ Wide-band Application Performance (DEMO_A: 1.3-1.8GHz)

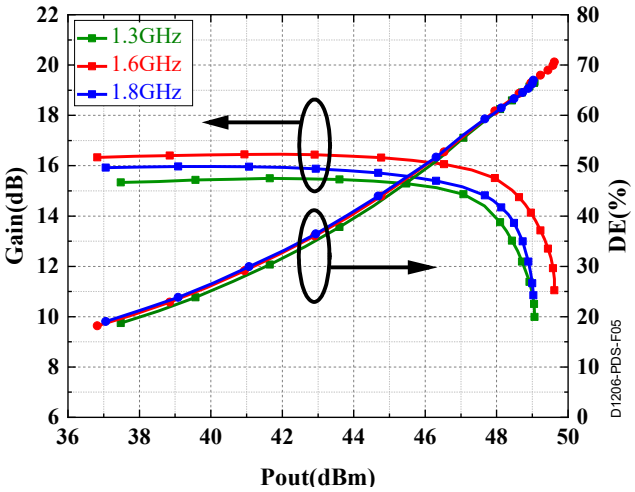


Figure 5. Wide-band Application Gain and DE vs. Output Power

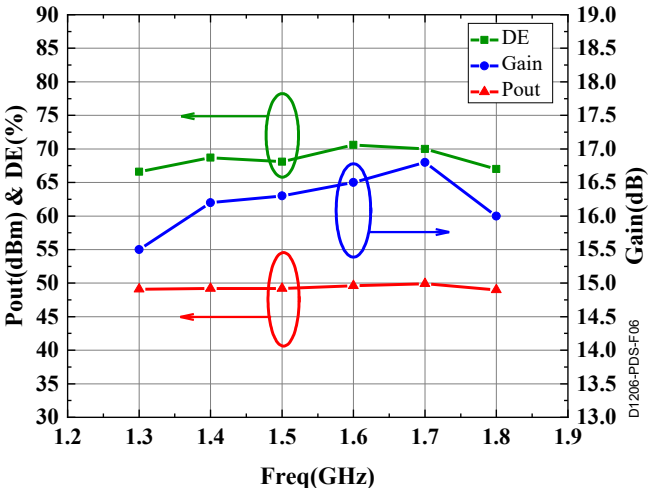


Figure 6. Wide-band Application Gain and DE vs. Freq.

Table 8. Wide-band RF Characteristics of DEMO_A

Parameter	1.30GHz	1.40GHz	1.50GHz	1.60GHz	1.70GHz	1.80GHz	Units
Linear Gain	15.5	16.2	16.3	16.5	16.8	16.0	dB
Drain Efficiency	66.6	68.7	68.1	70.6	70.0	67.0	%
Output Power	49.1	49.2	49.2	49.6	49.9	49.0	dBm

- 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} = 250mA, V_{GS} = -2.72V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%
- The output power is 49.0dBm (79W) at 1.30-1.80GHz when V_{DS} = 28V. It can be used in the avionics and L band radar application.

■ Wide-band Application Performance (DEMO_I: 1.1-1.7GHz)

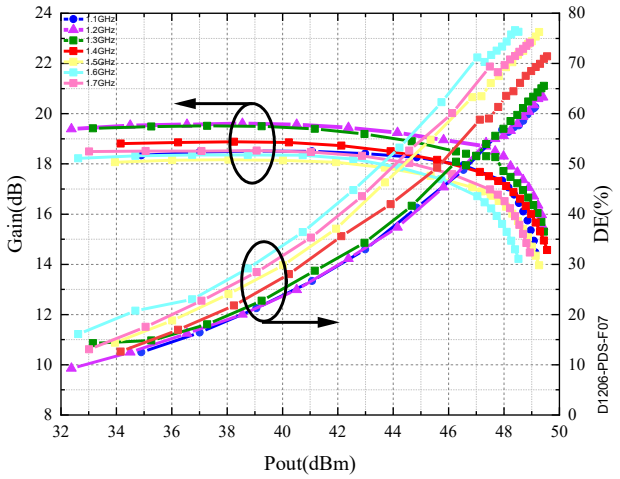


Figure 7. Wide-band Application Gain and DE vs. Output Power

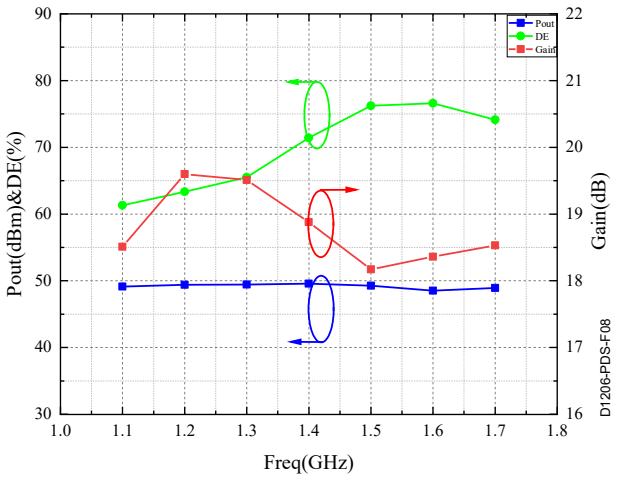


Figure 8. Wide-band Application Gain and DE vs. Freq.

Table 9. Wide-band RF Characteristics of DEMO_I

Parameter	1.1GHz	1.2GHz	1.3GHz	1.4GHz	1.5GHz	1.6GHz	1.7GHz	Units
Linear Gain	18.5	19.6	19.5	18.8	18.2	18.4	18.5	dB
Drain Efficiency	61.3	63.3	65.5	71.4	76.2	76.5	74.1	%
Output Power	49.1	49.4	49.4	49.6	49.3	48.5	48.9	dBm

- Typical Class AB performance in Raytron Wide-band Application DEMO_I with the device soldered onto the heatsink, test condition: V_{DS} = 28V, I_{DS} = 200mA, V_{GS} = -2.8V
- Test Condition: Input CW
- The output power is 48.5dBm (71W) at 1.1-1.7GHz when V_{DS} = 28V. It can be used in the avionics and L band radar application.

11. Package Outline

■ Pin Layout

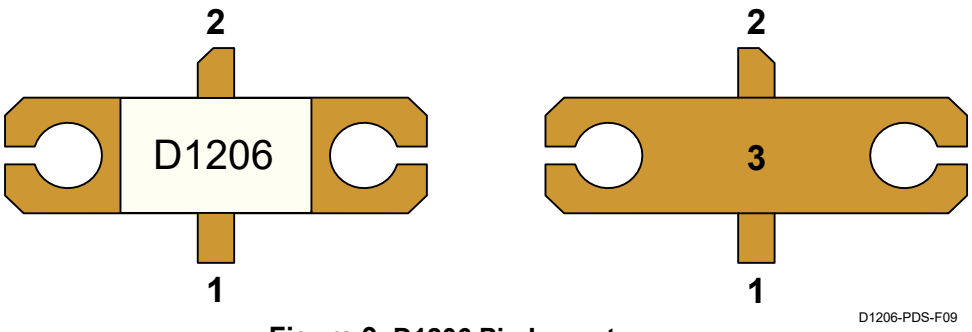


Figure 9. D1206 Pin Layout

Table 10. 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）

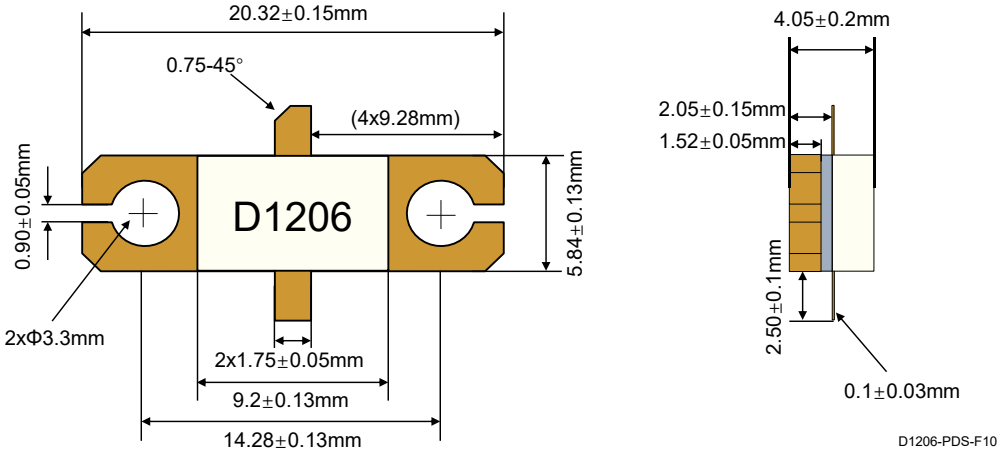


Figure 10. D1206 Mechanical Drawing

12. Application Circuit

■ Schematic

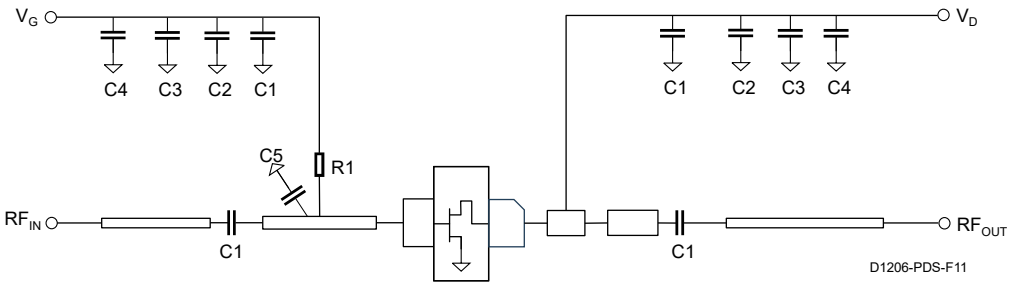


Figure 11. D1206 DEMO_I Application Circuit Schematic

Table 11. 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

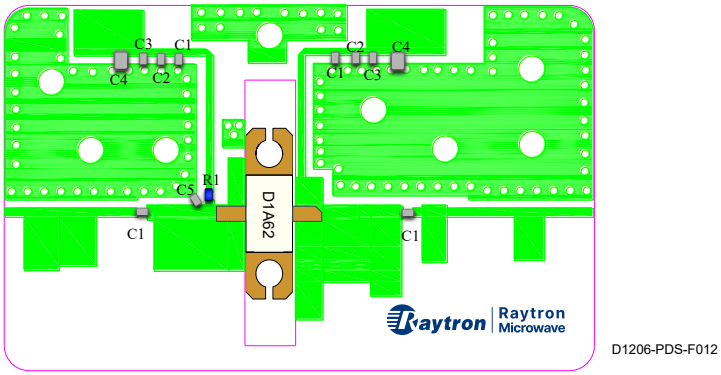


Figure 12. D1206 Application Circuit Layout
(DEMO_I Size: 7.1cm x 4.4cm)

Table 12. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	30.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E300GB12
C2	100.0pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E101JB12
C2	1000pF	C0G 250V 0603 Capacitor	Murata	GCM1885C2A102JA16D
C3	1.0uF	X7S 100V 1210 Capacitor	Murata	GRM32ER72A105KA01
C5	5.5pF	C0G 250V 0805 Capacitor	Murata	GQM2195C2E5R5BB12
R1	10ohms	1/10W 0603 Resistor	Yageo	RC0603FR-0710RL

13. DEMO Summary

Table 13. DEMO Summary

NO.	D1206 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain(dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency	Pulse or CW
1	DEMO_A, 80W	28	1.3-1.8	15.5	49.0	79	66%	Pulse
2	DEMO_B, 100W	28	0.95-1.22	20.7	50.0	100	72%	Pulse
3	DEMO_C, 100W	28	2.37-2.43	15.0	50.0	100	68%	Pulse
4	DEMO_D, 60W	28	1.5-2.5	14.8	47.7	59	54%	CW
5	DEMO_E, 100W	28	1.1-1.3	20.9	50.0	100	73%	CW
6	DEMO_F, 100W	28	0.7-0.8	21.9	50.3	108	62%	CW
7	DEMO_G, 100W	28	2.4-2.5	14.4	50.1	102	63%	CW
8	DEMO_H, 70W	28	0.75-1.53	17.4	48.5	71	58%	CW
9	DEMO_I, 70W	28	1.1-1.7	18.2	48.5	71	61%	CW
10	DEMO_J, 50W	28	2.2-2.9	12.1	47.0	50	47%	CW
11	DEMO_K, 70W	28	1.1-1.9	16.9	48.6	72	62%	CW

14. Recommended Solder Temperature Profile

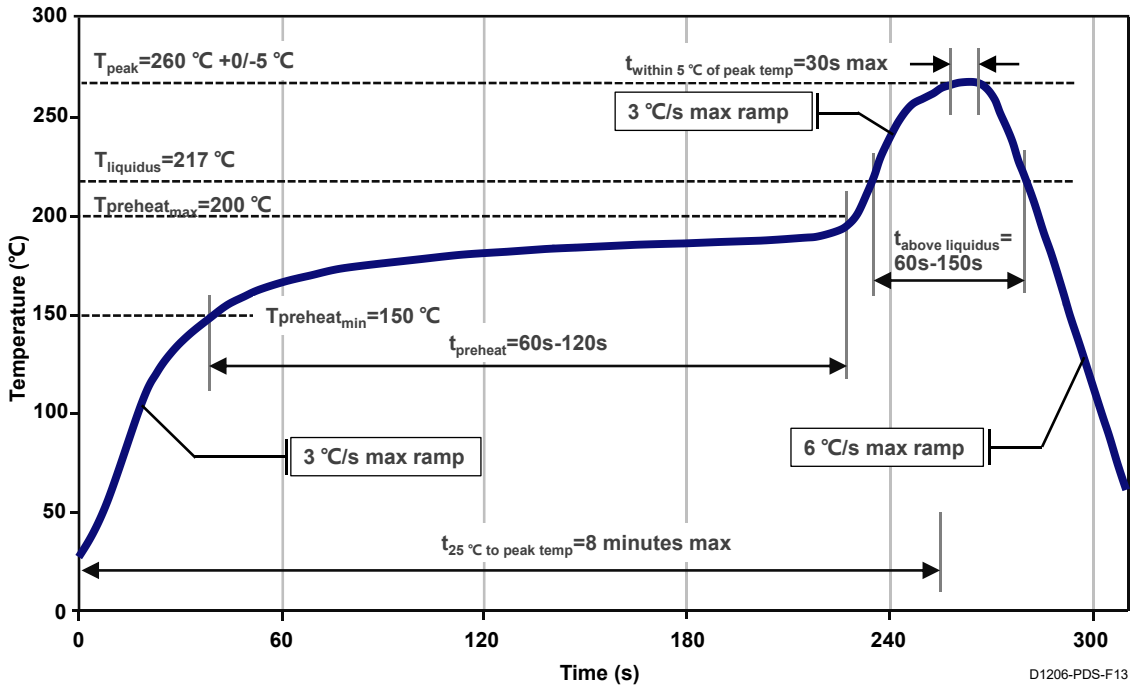


Figure 13. Recommended Solder Temperature Profile

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

The information provided here is believed to be reliable at the time of publication. Raytron reserves the right to make changes to its products, specifications and product descriptions at any time without notice. Raytron assumes no responsibility for the use of this information and all such information should entirely be at the user's own risk. Raytron makes no warranty about the suitability of its products for specific purpose or application and disclaims all liability, including without limitation consequential and incidental damages. Raytron does not authorize or warrant any Raytron products for use in the life support devices or systems.

Raytron Microwave

Copyright @ Raytron Technology Co., Ltd.