1. Description

- The D1103 is a 20W (P_{SAT}), 50Ω-input matched discrete gallium nitride (GaN) high electron mobility transistor (HEMT) which operates from 0.025 to 2.7GHz with 28V 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.

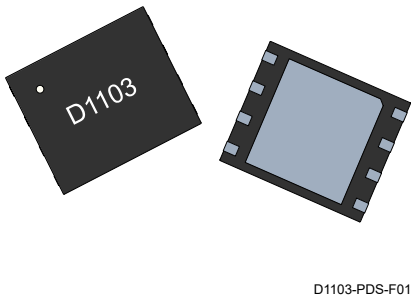


Figure 1. D1103 Package Outline

2. Applications

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

3. Features[1]

- Operating Frequency: 0.025–2.7GHz
- Output Power (P_{SAT}): 43.8dBm (24W)
- Linear Gain: 11.1dB
- Typical DE @P_{SAT}: 60.4%
- 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 @1.0GHz

4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	0.025-2.7GHz	Units
Linear Gain	11.1	dB
Drain Efficiency	60.4	%
Output Power	43.8	dBm
Output Power	24	W

- Typical Class AB performance in Raytron DEMO_A, test condition: V_{DS} = 28V, I_{DS} = 110mA, V_{GS} = -2.5V
- Test Condition: CW

5. Block Diagram

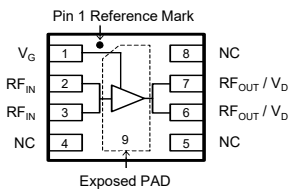


Figure 2. D1103 Block Diagram

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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}	5.8	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}	-	-2.5	-	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} = 5.8 mA)	$V_{DS(BR)}$	150	-	-	V
Saturated Drain Current[2] (V_{DS} = 10V, V_{GS} = 1.0V)	I_{Max}	-	5.35	-	A
Gate Threshold Voltage[3] (V_{DS} = 28V, I_{DS} = 5.8 mA)	$V_{GS(TH)}$	-3.30	-2.80	-2.30	V
Gate Quiescent Voltage (V_{DS} = 28V, I_{DS} = 110mA)	$V_{GS(Q)}$	-	-2.50	-	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] @2.1GHz	Linear Gain	G_{LIN}	-	11.1	-	dB
	Drain Efficiency	η_D	-	65.9	-	%
	Output Power	P_{SAT}	-	44.1	-	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} = 110mA, V_{GS} = -2.5V

9. Typical Performance

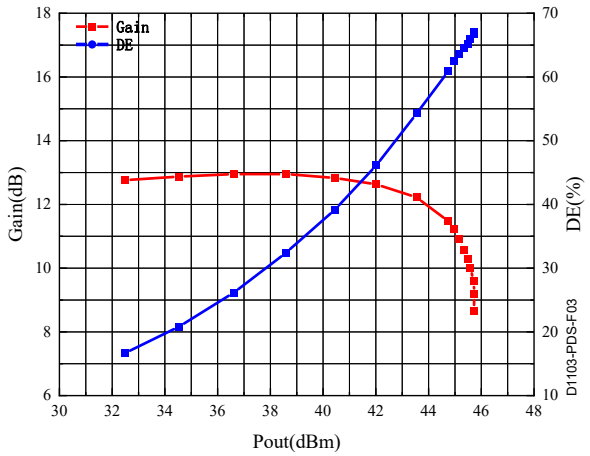


Figure 3. 2.1GHz Gain and DE @ MXP vs. Output Power

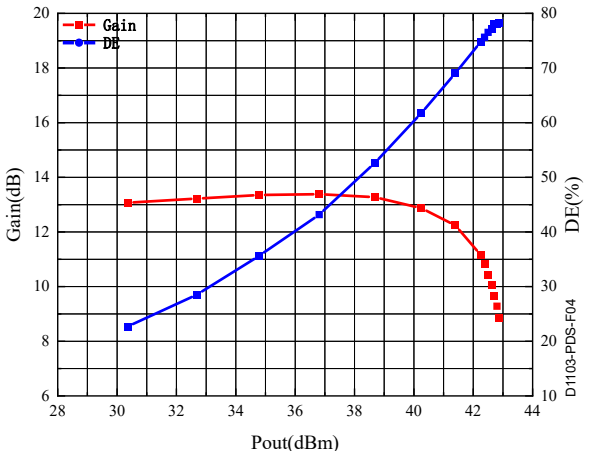


Figure 4. 2.1GHz Gain and DE @ MXE vs. Output Power

- Typical Class AB performance in Raytron DEMO, test condition: V_{DS} = 28V, I_{DS} = 110mA, V_{GS} = -2.5V
- Test Condition: Pulse, Pulse width = 100μs, Duty cycle = 10%

10. Wide-band Application Performance (CW)

■ Wide-band Application Performance (DEMO_A: 0.025-2.7GHz)

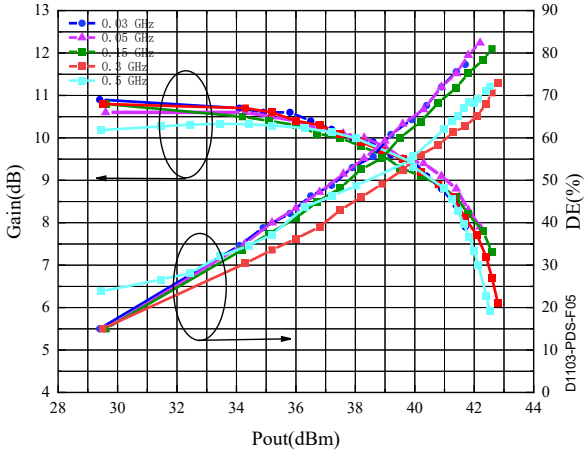


Figure 5. CW Gain and DE vs. Output Power

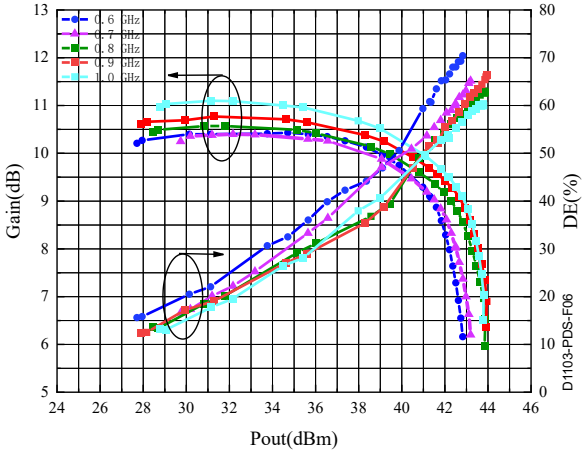


Figure 6. CW Gain and DE vs. Output Power

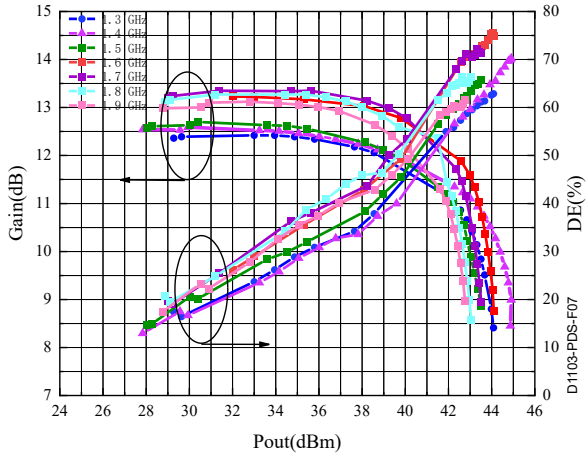


Figure 7. CW Gain and DE vs. Output Power

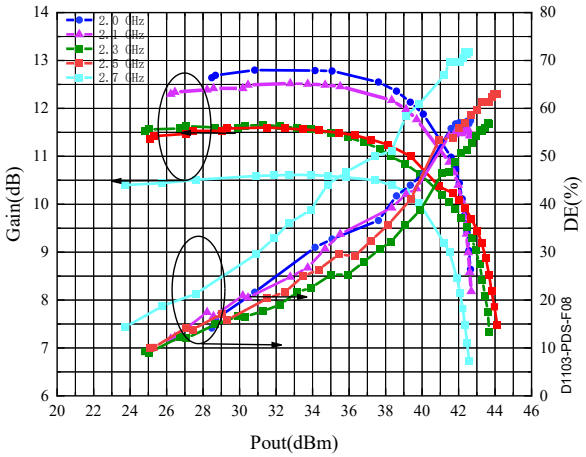


Figure 8. CW Gain and DE vs. Output Power

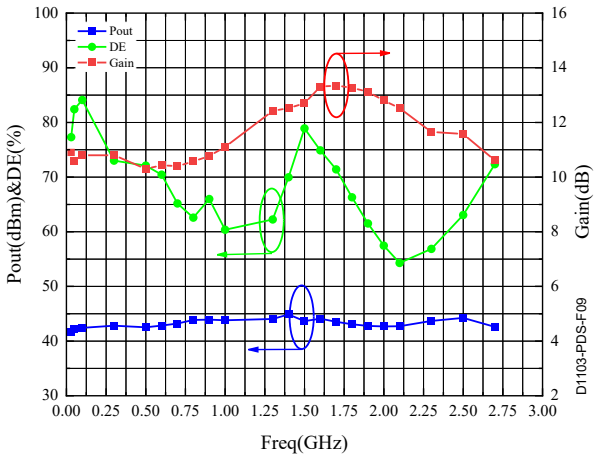


Figure 9. CW Gain and DE vs. Freq.

- Typical Class AB performance in Raytron Wide-band Application DEMO_A, test condition: V_{DS} = 28V, I_{DS} = 110mA, V_{GS} = -2.5V
- Test Condition: CW
- The output power reaches 41.7dBm (15W) at 0.025-2.7GHz with V_{DS}=28V.

Table 6. RF Characteristics @ DEMO_A [1,2,3]

Freq. (GHz)	Linear Gain (dB)	Power Gain (dB)	Drain Efficiency (%)	Output Power (dBm)	Output Power (W)
0.025	10.7	7.7	75.0	41.4	14
0.03	10.9	7.9	77.3	41.7	15
0.05	10.6	7.6	82.4	42.2	17
0.1	10.8	7.8	84.1	42.4	17
0.15	10.7	7.7	81.0	42.6	18
0.2	10.7	7.7	75.5	42.6	18
0.3	10.8	7.8	73.0	42.8	19
0.4	10.8	7.8	69.6	42.9	19
0.5	10.3	7.3	72.1	42.5	18
0.6	10.4	7.4	70.4	42.8	19
0.7	10.4	7.4	65.2	43.2	21
0.8	10.6	7.6	62.6	43.9	25
0.9	10.8	7.8	66.0	43.9	25
1.0	11.1	8.1	60.4	43.8	24
1.1	11.7	8.7	62.5	44.0	25
1.2	11.9	8.9	61.0	44.4	28
1.3	12.4	9.4	62.2	44.0	25
1.4	12.5	9.5	70.0	44.9	31
1.5	12.7	9.7	78.9	43.6	23
1.6	13.3	10.3	74.9	44.1	26
1.7	13.4	10.4	71.4	43.5	22
1.8	13.3	10.3	66.3	43.1	20
1.9	13.1	10.1	61.5	42.8	19
2.0	12.8	9.8	57.5	42.7	19
2.1	12.5	9.5	54.3	42.7	19
2.2	11.8	8.8	60.9	43.6	23
2.3	11.7	8.7	56.9	43.7	23
2.4	11.8	8.8	58.1	44.0	25
2.5	11.6	8.6	63.1	44.2	26
2.6	11.4	8.4	66.1	44.0	25
2.7	10.6	7.6	72.4	42.6	18

[1]. Typical Class AB performance in Raytron DEMO_A (0.025-2.7GHz), test condition: V_{DS} = 28V, I_{DS} = 110mA, V_{GS} = -2.5V

[2]. Test Condition: CW

[3]. The output power reaches 41.4dBm(14W) at 0.025-2.7GHz.

■ Wide-band Application Performance (DEMO_B: 1.3-1.95GHz)

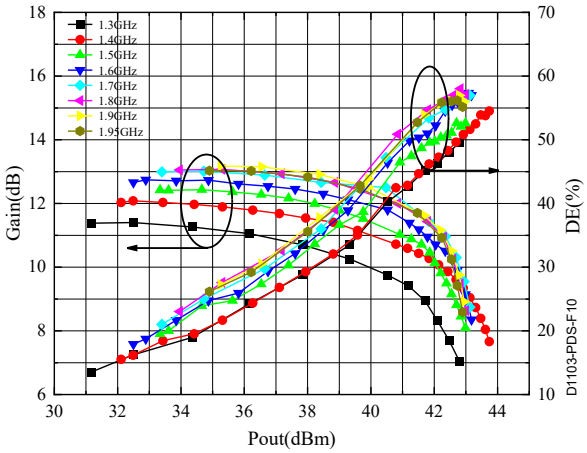


Figure 10. CW Gain and DE vs. Output Power

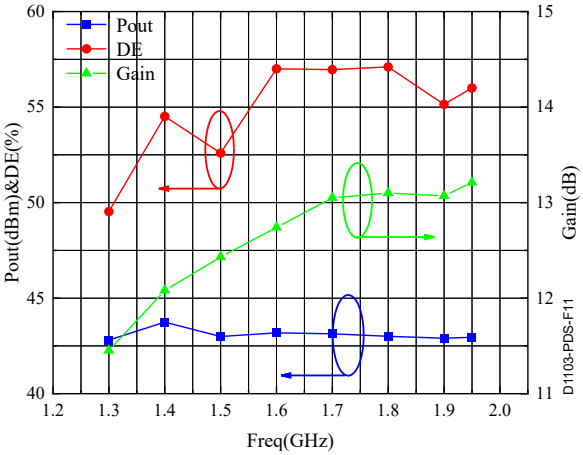


Figure 11. CW Gain and DE vs. Freq.

- Typical Class AB performance in Raytron Wide-band Application DEMO_B, test condition: V_{DS} = 28V, I_{DS} = 110mA, V_{GS} = -2.5V
- Test Condition: CW
- The output power reaches 43.2dBm (21W) at 1.3-1.95GHz.

Table 7. RF Characteristics @ DEMO_B [1,2]

Parameter	1.3GHz	1.4GHz	1.5GHz	1.6GHz	1.7GHz	1.8GHz	1.9GHz	1.95GHz	Units
Linear Gain	11.5	12.2	12.7	12.9	13.2	13.3	13.3	13.3	dB
Power Gain	7.5	8.1	8.3	8.8	9.2	9.0	9.2	9.0	dB
Drain Efficiency	54.4	58.9	59.0	60.4	61.6	62.0	60.2	59.8	%
Output Power	43.3	44.2	43.7	43.6	43.5	43.4	43.2	43.3	dBm
Output Power	22	26	23	23	22	22	21	21	W

[1]. Typical Class AB performance in Raytron DEMO_B (1.3-1.95GHz), test condition: V_{DS} = 28V, I_{DS} = 110mA, V_{GS} = -2.5V

[2]. Test Condition: CW

11. Package Outline

■ Pin Layout

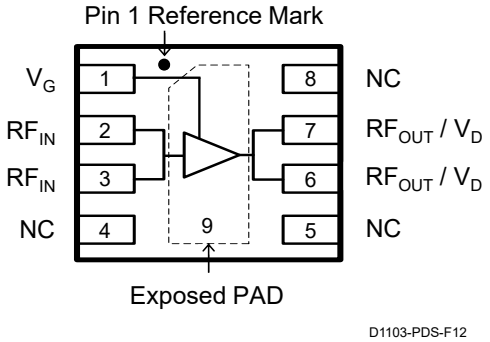


Figure 12. D1103 Pin Layout

Table 8. 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)

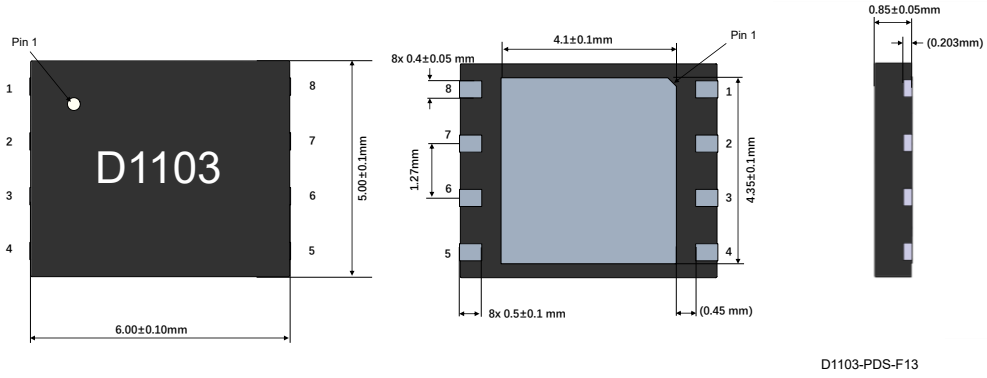


Figure 13. D1103 Mechanical Drawing

12. Application Circuit

■ Schematic

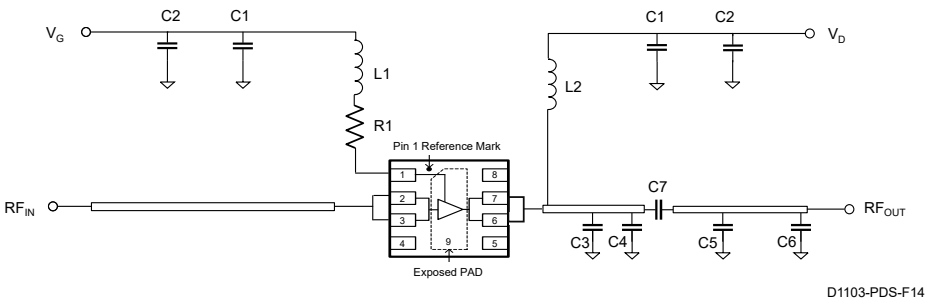


Figure 14. D1103 DEMO_A Application Circuit Schematic

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 (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

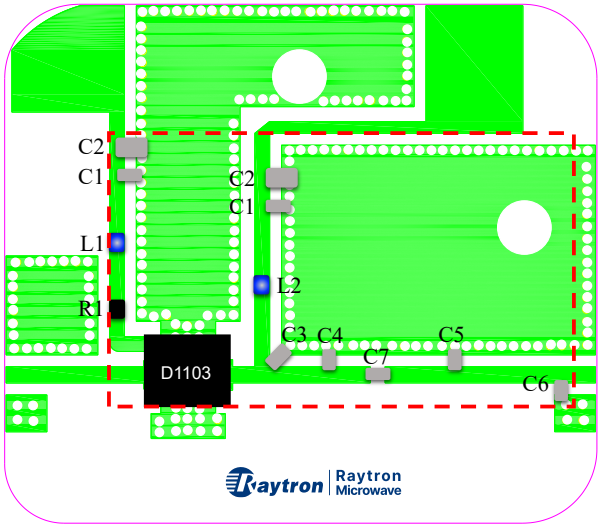


Figure 15. D1103 Application Circuit Layout
（DEMO_A Effective Size: red dotted line, 3.2 x 2cm）

Table 10. Bill of Materials

Component	Value	Description	Manufacturer	Part Number
PCB	20mil	N/A	Rogers	RO4350B
C1	1000pF	C0G 250V 0603 Capacitor	Murata	GCM1885C2A102JA16D
C2	4.7uF	X7R 100V 1206 Capacitor	Murata	GRM31CC72A475KE11L
C3	1.0pF	C0G 250V 0603 Capacitor	Murata	GQM2195C2E1R0BB12
C4	2.2pF	C0G 250V 0603 Capacitor	Murata	GQM2195C2E2R2BB12
C5	1.5pF	C0G 250V 0603 Capacitor	Murata	GQM2195C2E1R5BB12
C6	1.2pF	C0G 250V 0603 Capacitor	Murata	GQM2195C2E1R2BB12
C7	1000pF	C0G 250V 0603 Capacitor	Murata	GCM1885C2A102JA16D
L1	1.2uH	310mA 1008 Inductor	Murata	LQW2UAS1R2J00L
L2	0.9uH	1.3A 1008 Inductor	Coilcraft	1008AF-901X
R1	3000Ω	1/4W 0603	Yageo	AT0603BRE073K01L

13. DEMO Summary

Table 11. DEMO Summary

No.	D1103 DEMO Name	V_{DS} (V)	Freq (GHz)	Linear Gain (dB)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency (%)	Pulse or CW
1	DEMO_A, 15W	28	0.025-2.7	10.3	41.4	14	54.3	CW
2	DEMO_B, 20W	28	1.3-1.95	11.5	42.8	19	49.5	CW
3	DEMO_C, 15W	28	0.3-0.7	11.2	42.1	16	60%	CW

14. Recommended Solder Temperature Profile

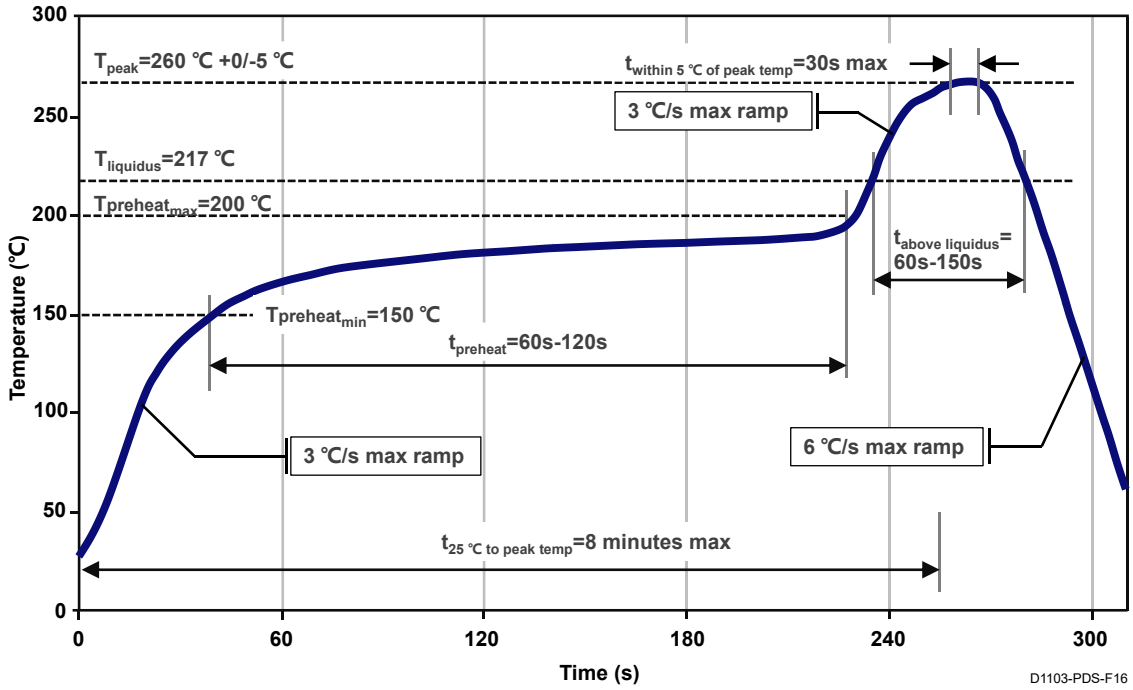


Figure 16. Recommended Solder Temperature Profile

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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