A5G18H610W19N

Airfast RF Power GaN Transistor

Rev. 2 — 31 January 2025 Product data sheet

1 General description

This 85 W asymmetrical Doherty RF power GaN transistor is designed for cellular base station applications requiring very wide instantaneous bandwidth capability covering the frequency range of 1805 to 1880 MHz.

This part is characterized and performance is guaranteed for applications operating in the 1805 to 1880 MHz band. There is no guarantee of performance when this part is used in applications designed outside of these frequencies.

2 Features and benefits

- High terminal impedances for optimal broadband performance
- Advanced high performance in-package Doherty
- Improved linearized error vector magnitude with next generation signal
- Able to withstand extremely high output VSWR and broadband operating conditions
- Plastic package

3 Typical performance

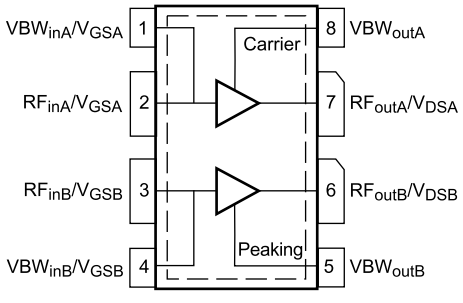
Table 1. 1800 MHz — Typical Doherty single-carrier W-CDMA reference circuit performance

V_{DD} = 48 Vdc, I_{DQA} = 300 mA, V_{GSB} = -5.4 Vdc, P_{out} = 85 W Avg., Input Signal PAR = 9.9 dB @ 0.01 % Probability on CCDF.[1]

Frequency	G_{ps} (dB)	η_D (%)	Output PAR (dB)	ACPR (dBc)
1805 MHz	17.3	55.8	8.4	-32.3
1840 MHz	17.5	55.6	8.6	-34.7
1880 MHz	17.4	54.1	8.5	-33.7

[1] All data measured with device soldered to NXP reference circuit.

4 Pinning information



(Top view)

Note: Exposed backside of the package is the source terminal for the transistor.

Figure 1. Pin configuration

5 Ordering information

Table 2. Ordering information

Device	Tape and Reel Information	Package
A5G18H610W19NR3	R3 Suffix = 250 Units, 44 mm Tape Width, 13-inch Reel	OM-780-4S4S

6 Product marking

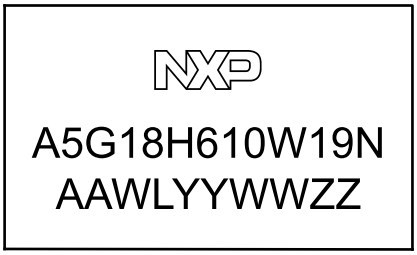


Figure 2. Product marking

Table 3. Product marking trace code

Identifier	Description
AA	Assembly location
WL	Wafer lot indicator
YYWW	Date code
ZZ	Assembly lot

7 Limiting values

Table 4. Limiting values

Symbol	Parameter	Conditions	Value	Unit
V_{DSS}	Drain-Source Voltage		125	Vdc
V_{GS}	Gate-Source Voltage		-16, 0	Vdc
V_{DD}	Operating Voltage		55	Vdc
I_{GMAX}	Maximum Forward Gate Current	$I_{G\ (A+B)}$, @ T_C = 25 °C	95	mA
T_{stg}	Storage Temperature Range		-65 to +150	°C
T_C	Case Operating Temperature Range		-55 to +150	°C
T_{CH}	Maximum Channel Temperature		225	°C

8 Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Value	Unit
V_{DD}	Operating Voltage		48	Vdc

9 Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Value	Unit
$R_{\theta SC}$ (IR)	Thermal Resistance by Infrared Measurement, Active Die Surface-to-Case	Case Temperature 122 °C, P_D = 112 W	0.49[1]	°C/W
$R_{\theta CHC}$ (FEA)	Thermal Resistance by Finite Element Analysis, Channel-to-Case	Case Temperature 122 °C, P_D = 112 W	0.8[2]	°C/W

[1] Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers*. Go to https://www.nxp.com/RF and search for AN1955.

[2] $R_{\theta CHC}$ (FEA) must be used for purposes related to reliability and limitations on maximum channel temperature. MTTF may be estimated by the expression MTTF (hours) = $10^{[A + B/(T + 273)]}$, where T is the channel temperature in degrees Celsius, A = -11.6 and B = 9129.

10 ESD protection characteristics

Table 7. ESD protection characteristics

Test Methodology	Class
Human Body Model (per JS-001-2017)	1C
Charge Device Model (per JS-002-2014)	C3

11 Moisture sensitivity level

Table 8. Moisture sensitivity level

Test Methodology	Rating	Package Peak Temperature	Unit
Per JESD22-A113, IPC/JEDEC J-STD-020	3	245	°C

12 Electrical characteristics

12.1 DC characteristics — off characteristics

Table 9. DC characteristics — off characteristics

(T_A = 25 °C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off characteristics[1]						
$I_{D(BR)}$	Off-State Drain Leakage	Carrier (V_{DS} = 150 Vdc, V_{GS} = -8 Vdc)	-	-	13.2	mAdc
		Peaking (V_{DS} = 150 Vdc, V_{GS} = -8 Vdc)	-	-	26.4	mAdc

[1] Each side of device measured separately.

12.2 DC characteristics — on characteristics

Table 10. DC characteristics — on characteristics

(T_A = 25 °C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
On characteristics — Side A, Carrier						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = 10 Vdc, I_D = 30 mAdc	-4.6	-2.5	-1.9	Vdc
$V_{GSA(Q)}$	Gate Quiescent Voltage	V_{DD} = 48 Vdc, I_{DA} = 300 mAdc[1]	-3.1	-2.5	-2.1	Vdc
On characteristics — Side B, Peaking						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = 10 Vdc, I_D = 60 mAdc	-4.6	-2.7	-1.9	Vdc

[1] Measured in functional test.

12.3 Functional tests

Table 11. Functional tests

(In NXP Doherty Production Test Fixture, T_A = 25 °C unless otherwise noted, 50 ohm system)[1] V_{DD} = 48 Vdc, I_{DQA} = 300 mA, V_{GSB} = (V_t - 2.25) Vdc, P_{out} = 85 W Avg., f = 1880 MHz, Single-Carrier W-CDMA, IQ Magnitude Clipping, Input Signal PAR = 9.9 dB @ 0.01 % Probability on CCDF. ACPR measured in 3.84 MHz Channel Bandwidth @ ±5 MHz Offset.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G_{ps}	Power Gain		15.0	16.6	19.0	dB
η_D	Drain Efficiency		45.0	50.3	-	%
P_{sat}	Saturated Power	Pulsed CW, 5 % Duty Cycle	57.0	58.0	-	dBm
ACPR	Adjacent Channel Power Ratio		-	-37.3	-31.0	dBc

[1] Internally matched part.

12.4 Wideband ruggedness

Table 12. Wideband ruggedness

(In NXP Doherty Production Test Fixture, T_A = 25 °C unless otherwise noted, 50 ohm system) I_{DQA} = 300 mA, V_{GSB} = -5.0 Vdc, f = 1840 MHz, Additive White Gaussian Noise (AWGN) with 10 dB PAR.

Characteristic	Test results
ISBW of 400 MHz at 55 Vdc, 145 W Avg. Modulated Output Power (3 dB Input Overdrive from 83 W Avg. Modulated Output Power)	No Device Degradation

12.5 Typical performance

Table 13. Typical performance

(In NXP Doherty Reference Circuit, T_A = 25 °C unless otherwise noted, 50 ohm system) V_{DD} = 48 Vdc, I_{DQA} = 300 mA, V_{GSB} = -5.4 Vdc, 1805–1880 MHz Bandwidth.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Pulsed CW, 10 % duty cycle						
P_{sat}	Saturated Power[1]		-	624	-	W
Φ	AM/PM[1] (Maximum value measured at saturated power across the 1805–1880 MHz bandwidth)		-	-11	-	°
Single-carrier W-CDMA, unclipped						
ΔG	Gain Variation @ Avg. Power over Temperature	-40 °C to +85 °C	-	0.018	-	dB/°C
ΔP_{sat}	Output Power Variation @ Saturated Power over Temperature	-40 °C to +85 °C	-	0.003	-	dB/°C
G_F	Gain Flatness[1]	75 MHz Bandwidth @ P_{out} = 85 W Avg.	-	0.14	-	dB
2-tone CW						
VBW_{res}	VBW Resonance[1][2]		-	290	-	MHz

[1] All data measured with device soldered to NXP reference circuit.
[2] IMD third order inflection point.

Correct biasing sequence for GaN depletion mode transistors in a Doherty configuration

Bias ON the device

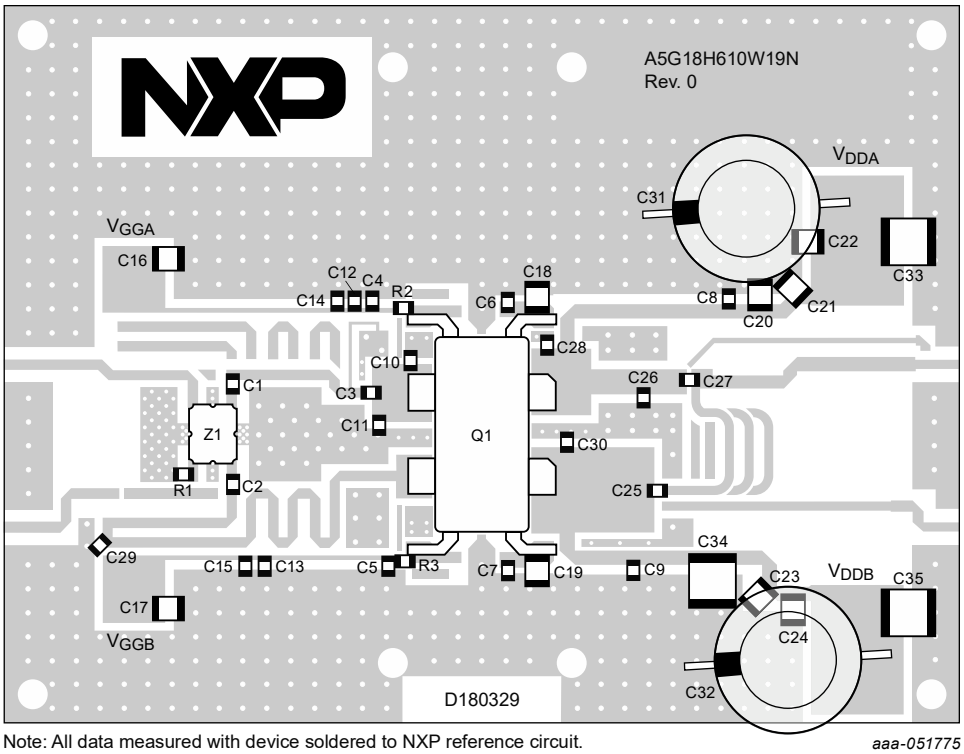
1. Set gate voltage V_{GSA} and V_{GSB} to -5 V.
2. Set drain voltage V_{DSA} and V_{DSB} to nominal supply voltage (+48 V).
3. Increase V_{GSA} (carrier side) until I_{DQA} current is attained.
4. Increase V_{GSB} (peaking side) to target bias voltage.
5. Apply RF input power to desired level.

Bias OFF the device

1. Disable RF input power.
2. Adjust gate voltage V_{GSA} and V_{GSB} to -5 V.
3. Adjust drain voltage V_{DSA} and V_{DSB} to 0 V. Allow adequate time for drain voltage to reduce to 0 V from external drain capacitors.
4. Disable V_{GSA} and V_{GSB}.

13 Component layout and parts list

13.1 Component layout



Note: All data measured with device soldered to NXP reference circuit.

aaa-051775

Figure 3. A5G18H610W19N reference circuit component layout

13.2 Component designations and values

Table 14. A5G18H610W19N reference circuit component designations and values

Part	Description	Part Number	Manufacturer
C1, C2, C3, C4, C5, C6, C7, C8, C9	10 pF Chip Capacitor	600F100JT250XT	ATC
C10	3.3 pF Chip Capacitor	600F3R3BT250XT	ATC
C11	3.0 pF Chip Capacitor	600F3R0BT250XT	ATC
C12, C13	10 nF Chip Capacitor	C0805C103K5RAC	Kemet
C14, C15	1.0 µF Chip Capacitor	08055C105KAT2A	AVX
C16, C17, C18, C19, C20, C21, C22, C23, C24	4.7 µF Chip Capacitor	GRM55ER72A475KA01L	Murata
C25	4.7 pF Chip Capacitor	600F4R7BT250XT	ATC
C26	0.4 pF Chip Capacitor	600F0R4BT250XT	ATC
C27	2.7 pF Chip Capacitor	600F2R7BT250XT	ATC
C28	0.7 pF Chip Capacitor	600F0R7BT250XT	ATC
C29, C30	1.2 pF Chip Capacitor	600F1R2BT250XT	ATC
C31, C32	470 µF, 100 V Electrolytic Capacitor	MCGPR100V477M16X32	Multicomp
C33, C34, C35	10 µF Chip Capacitor	C5750X7S2A106K	TDK
Q1	RF Power GaN Transistor	A5G18H610W19N	NXP
R1	50 Ω, 16 W Termination Chip Resistor	C16A50Z4	Anaren
R2, R3	2.2 Ω, 1/8 W Chip Resistor	CRCW08052R20JNEA	Vishay
Z1	1700–2000 MHz, 90°, 4 dB RF Directional Coupler	X3C19P1-04S	Anaren/TTM
PCB	Rogers RO4350B, 0.020″, ε_r = 3.66	D180329	MTL

14 Package information

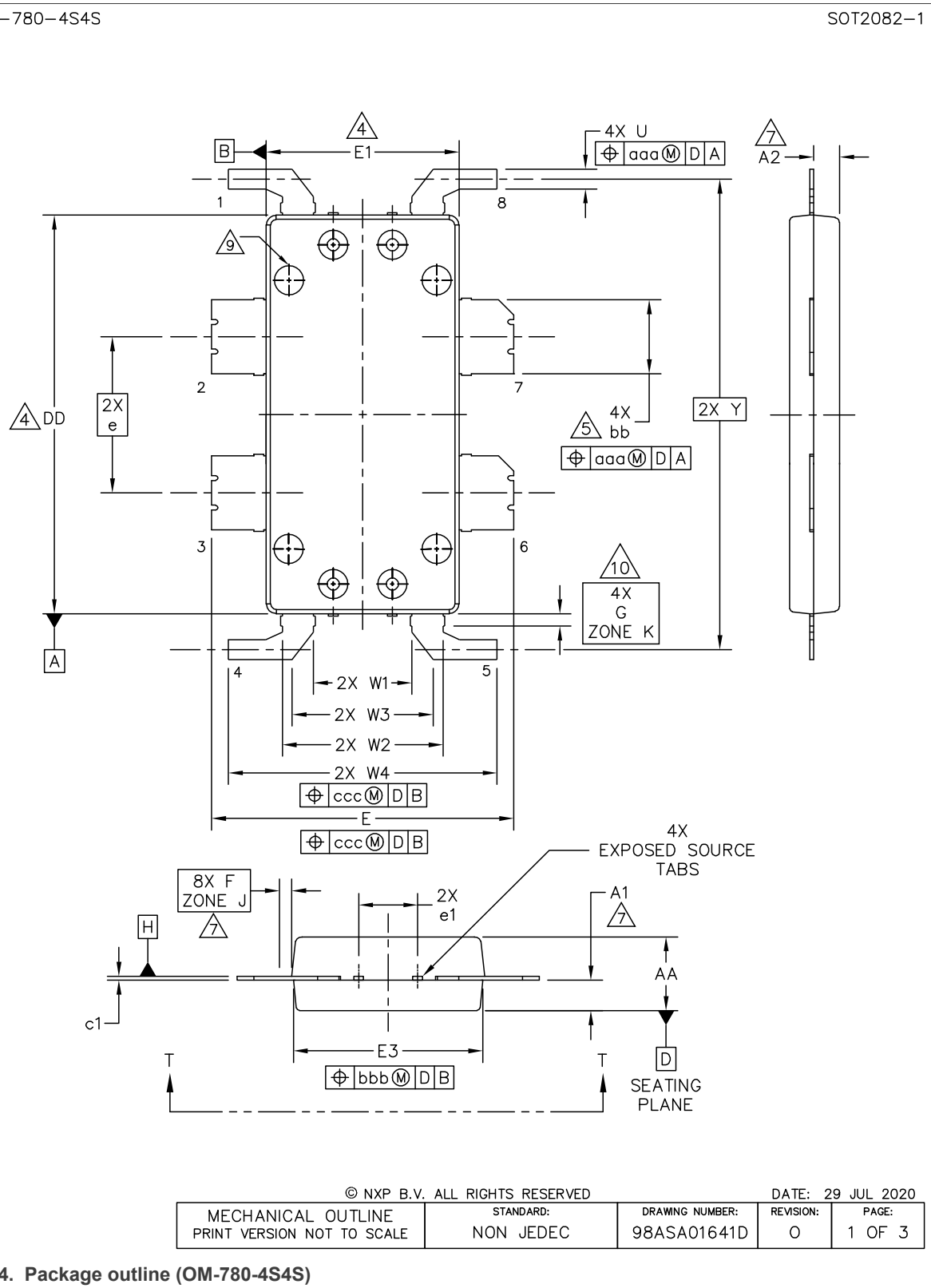
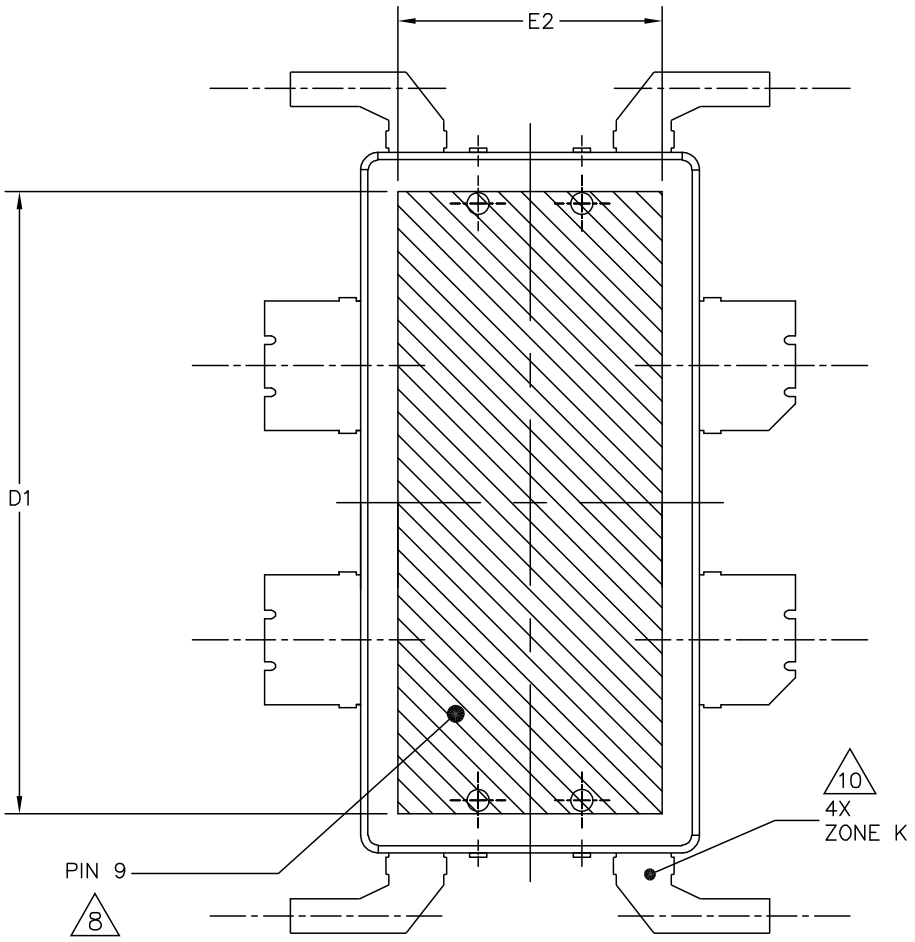


Figure 4. Package outline (OM-780-4S4S)

OM−780−4S4S SOT2082−1



BOTTOM VIEW
VIEW T−T

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Figure 5. Package outline (OM-780-4S4S) — bottom view

OM−780−4S4S SOT2082−1

NOTES:
1. CONTROLLING DIMENSION: INCH

2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M−1994.

3. DATUM PLANE H IS LOCATED AT TOP OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE TOP OF THE PARTING LINE.

4. DIMENSIONS DD AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .006 INCH (0.15 MM) PER SIDE. DIMENSIONS DD AND E1 DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE H.

5. DIMENSION bb DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .005 INCH (0.13 MM) TOTAL IN EXCESS OF THE bb DIMENSION AT MAXIMUM MATERIAL CONDITION.

6. DATUMS A AND B TO BE DETERMINED AT DATUM PLANE H.

7. DIMENSIONS A1 AND A2 APPLIES WITHIN ZONE J ONLY. A1 APPLIES TO PINS 2, 3, 6 AND 7. A2 APPLIES TO PINS 1, 4, 5 AND 8.

8. HATCHING REPRESENTS THE EXPOSED AREA OF THE HEAT SLUG. THE DIMENSIONS D1 AND E2 REPRESENT THE VALUES BETWEEN THE TWO OPPOSITE POINTS ALONG THE EDGES OF EXPOSED AREA OF HEAT SLUG.

9. DIMPLED HOLE REPRESENTS INPUT SIDE.

10. ZONE K REPRESENTS NON−SOLDERABLE REGION WHERE MOLD FLASH AND RESIN BLEED ARE PERMITTED ON BOTH SIDES OF THE LEADS.

DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX	DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX
AA	.148	.152	3.76	3.86	W2	.321	.331	8.15	8.41
A1	.059	.065	1.50	1.65	W3	.281	.291	7.14	7.39
A2	.056	.068	1.42	1.73	W4	.538	.554	13.67	14.07
DD	.808	.812	20.52	20.62	U	.037	.043	0.94	1.09
D1	.720	----	18.29	----	Y	.956 BSC		24.28 BSC	
E	.610	.618	15.49	15.70	bb	.147	.153	3.73	3.89
E1	.390	.394	9.91	10.01	c1	.007	.011	0.18	0.28
E2	.306	----	7.77	----	e	.317 BSC		8.05 BSC	
E3	.383	.387	9.73	9.83	e1	.116	.124	2.95	3.15
F	.025 BSC		0.64 BSC		aaa	.004		0.10	
G	.030 BSC		0.76 BSC		bbb	.006		0.15	
W1	.195	.205	4.95	5.21	ccc	.010		0.25	

DATE: 29 JUL 2020

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Figure 6. Package outline (OM-780-4S4S) — notes, dimensions

15 Product documentation, software and tools

Refer to the following resources to aid your design process.

Application notes

- AN1907: Solder Reflow Attach Method for High Power RF Devices in Plastic Packages
- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

Software

- .s2p File

Development tools

- Printed Circuit Boards

16 Revision history

The following table summarizes revisions to this document.

Table 15. Revision history

Document ID	Release date	Description
A5G18H610W19N Rev. 2	31 January 2025	• Fig. 2, Product marking: updated, p. 2 • Table 3, Product marking trace code: updated, p. 2
A5G18H610W19N Rev. 1	21 December 2023	• Table 8, Moisture Sensitivity Level: package peak temperature updated to reflect actual test data, p. 3
A5G18H610W19N Rev. 0	9 October 2023	• Initial release of data sheet

Legal information

Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL https://www.nxp.com.

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