RF Power GaN Transistor

This 50 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 2496 to 2690 MHz.

This part is characterized and performance is guaranteed for applications operating in the 2496 to 2690 MHz band. There is no guarantee of performance when this part is used in applications designed outside of these frequencies.

2600 MHz

- Typical Doherty Single-Carrier W-CDMA Characterization Performance: V_{DD} = 48 Vdc, I_{DQA} = 150 mA, V_{GSB} = –5.4 Vdc, P_{out} = 50 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)
2575 MHz	14.3	61.9	7.2	–29.1
2605 MHz	14.3	61.7	7.1	–29.5
2635 MHz	14.3	60.9	6.8	–30.4

1. All data measured in fixture with device soldered to heatsink.

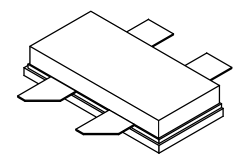
Features

- High terminal impedances for optimal broadband performance
- Advanced high performance in-package Doherty
- Able to withstand extremely high output VSWR and broadband operating conditions

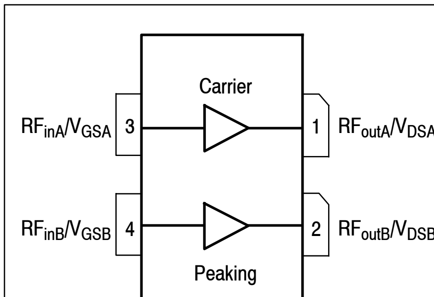
RoHS

A2G26H281-04SR3

2496–2690 MHz, 50 W AVG., 48 V AIRFAST RF POWER GaN TRANSISTOR



NI-780S-4L



(Top View)

Figure 1. Pin Connections

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Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	125	Vdc
Gate-Source Voltage	V_{GS}	–8, 0	Vdc
Operating Voltage	V_{DD}	0 to +55	Vdc
Maximum Forward Gate Current @ T_C = 25°C	I_{GMAX}	31	mA
Storage Temperature Range	T_{stg}	– 65 to +150	°C
Case Operating Temperature Range	T_C	– 55 to +150	°C
Operating Junction Temperature Range	T_J	– 55 to +225	°C
Absolute Maximum Junction Temperature (1)	T_{MAX}	275	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance by Infrared Measurement, Active Die Surface-to-Case Case Temperature 74°C, P_D = 38.3 W	$R_{\theta JC}$ (IR)	1.0 (2)	°C/W
Thermal Resistance by Finite Element Analysis, Junction-to-Case Case Temperature 72°C, P_D = 38.3 W	$R_{\theta JC}$ (FEA)	1.77 (3)	°C/W

Table 3. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JESD22-A114)	1B
Charge Device Model (per JESD22-C101)	C3

Table 4. Electrical Characteristics (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics (4)					
Drain-Source Breakdown Voltage (V_{GS} = –8 Vdc, I_D = 12.0 mAdc) Carrier (V_{GS} = –8 Vdc, I_D = 18.9 mAdc) Peaking	$V_{(BR)DSS}$	 150 150	—	—	Vdc
On Characteristics - Side A, Carrier					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 12.0 mAdc)	$V_{GS(th)}$	–3.8	–3.1	–2.3	Vdc
Gate Quiescent Voltage (V_{DD} = 48 Vdc, I_{DA} = 150 mAdc, Measured in Functional Test)	$V_{GSA(Q)}$	–3.6	–2.8	–2.3	Vdc
Gate-Source Leakage Current (V_{DS} = 0 Vdc, V_{GS} = –5 Vdc)	I_{GSS}	–3.7	—	—	mAdc
On Characteristics - Side B, Peaking					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 18.9 mAdc)	$V_{GS(th)}$	–3.8	–3.1	–2.3	Vdc
Gate-Source Leakage Current (V_{DS} = 0 Vdc, V_{GS} = –5 Vdc)	I_{GSS}	–5.9	—	—	mAdc

1. Functional operation above 225°C has not been characterized and is not implied. Operation at T_{MAX} (275°C) reduces median time to failure by an order of magnitude; operation beyond T_{MAX} could cause permanent damage.
2. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.nxp.com/RF and search for AN1955.
3. $R_{\theta JC}$ (FEA) must be used for purposes related to reliability and limitations on maximum junction temperature. MTTF may be estimated by the expression MTTF (hours) = $10^{[A + B/(T + 273)]}$, where *T* is the junction temperature in degrees Celsius, *A* = –10.3 and *B* = 8260.
4. Each side of device measured separately.

(continued)

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Table 4. Electrical Characteristics (T_A = 25°C unless otherwise noted) **(continued)**

Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests (1,2) (In NXP Doherty Production Test Fixture, 50 ohm system) V_{DD} = 48 Vdc, I_{DQA} = 150 mA, V_{GSB} = –5.4 Vdc, P_{out} = 50 W Avg., f = 2635 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. **[See note on correct biasing sequence.]**					
Power Gain	G_{ps}	12.9	14.2	16.9	dB
Drain Efficiency	η_D	55.7	58.7	—	%
Output Peak-to-Average Ratio @ 0.01% Probability on CCDF	PAR	6.5	7.1	—	dB
Adjacent Channel Power Ratio	ACPR	—	–31.4	–27.0	dBc
Load Mismatch (2) (In NXP Doherty Characterization Test Fixture, 50 ohm system) I_{DQA} = 150 mA, V_{GSB} = –5.4 Vdc, f = 2605 MHz, 12 μsec(on), 10% Duty Cycle					
VSWR 10:1 at 55 Vdc, 275 W Pulsed CW Output Power (3 dB Input Overdrive from 180 W Pulsed CW Rated Power)	No Device Degradation				
Typical Performance (2) (In NXP Doherty Characterization Test Fixture, 50 ohm system) V_{DD} = 48 Vdc, I_{DQA} = 150 mA, V_{GSB} = –5.4 Vdc, 2575–2635 MHz Bandwidth					
P_{out} @ 3 dB Compression Point (3)	P3dB	—	251	—	W
VBW Resonance Point (IMD Third Order Intermodulation Inflection Point)	VBW_{res}	—	110	—	MHz
Gain Flatness in 60 MHz Bandwidth @ P_{out} = 50 W Avg.	G_F	—	0.35	—	dB
Gain Variation over Temperature (–30°C to +85°C)	ΔG	—	0.01	—	dB/°C
Output Power Variation over Temperature (–30°C to +85°C)	ΔP1dB	—	0.01	—	dB/°C

Table 5. Ordering Information

Device	Tape and Reel Information	Package
A2G26H281-04SR3	R3 Suffix = 250 Units, 32 mm Tape Width, 13-inch Reel	NI-780S-4L

1. Part internally input matched.
2. Measurements made with device in an asymmetrical Doherty configuration.
3. P3dB = P_{avg} + 7.0 dB where P_{avg} is the average output power measured using an unclipped W-CDMA single-carrier input signal where output PAR is compressed to 7.0 dB @ 0.01% probability on CCDF.

NOTE: Correct Biasing Sequence for GaN Depletion Mode Transistors

Turning the device ON

1. Set V_{GS} to –5 V
2. Turn on V_{DS} to nominal supply voltage (48 V)
3. Increase V_{GS} until I_{DS} current is attained
4. Apply RF input power to desired level

Turning the device OFF

1. Turn RF power off
2. Reduce V_{GS} down to –5 V
3. Reduce V_{DS} down to 0 V (Adequate time must be allowed for V_{DS} to reduce to 0 V to prevent severe damage to device.)
4. Turn off V_{GS}

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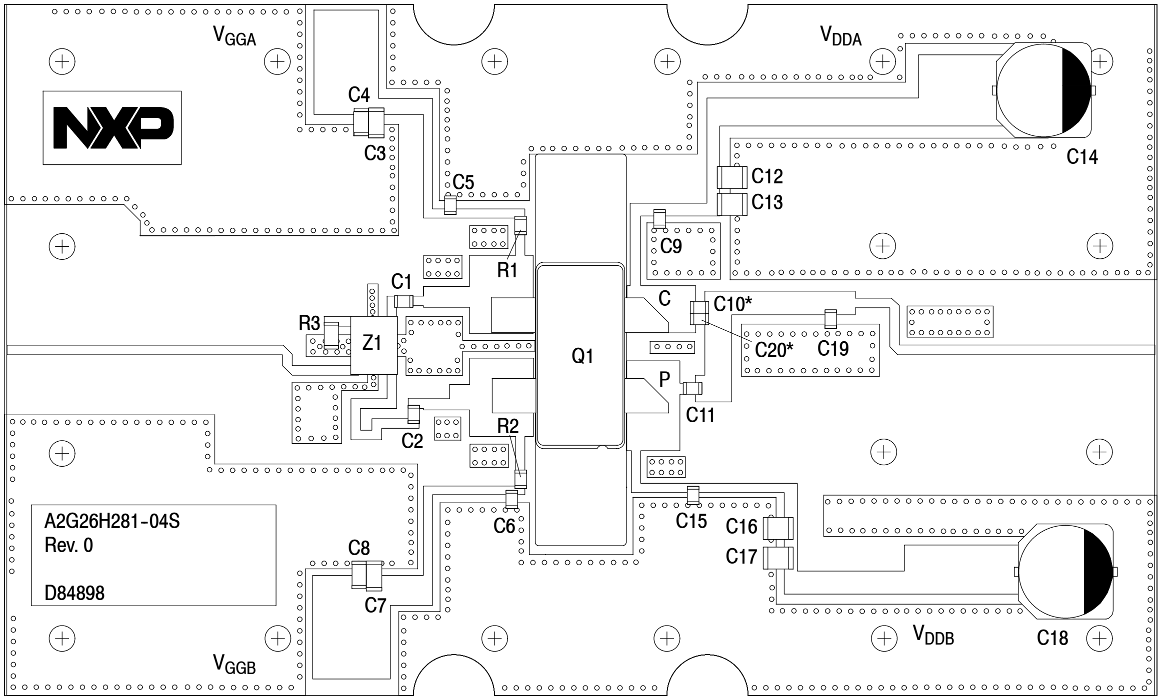

*C10 and C20 are mounted vertically.

Note: All data measured in fixture with device soldered to heatsink. Production fixture does not include device soldered to heatsink.

Figure 2. A2G26H281-04SR3 Characterization Test Circuit Component Layout

Table 6. A2G26H281-04SR3 Characterization Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C2, C5, C6, C9, C15	6.8 pF Chip Capacitors	ATC600F6R8BT250XT	ATC
C3, C7	10 μF Chip Capacitors	GRM31CR61H106KA12L	Murata
C4, C8	1 μF Chip Capacitors	GRM31CR72A105KA01L	Murata
C10	2.0 pF Chip Capacitor	ATC600F2R0BT250XT	ATC
C11	4.7 pF Chip Capacitor	ATC600F4R7BT250XT	ATC
C12, C13, C16, C17	2.2 μF Chip Capacitors	GRM32ER72A225KA35L	Murata
C14, C18	220 μF, 100 V Electrolytic Capacitors	EEV-FK2A221M	Panasonic
C19	0.2 pF Chip Capacitor	ATC600RF0R2BT250XT	ATC
C20	0.1 pF Chip Capacitor	ATC600RF0R1BT250XT	ATC
Q1	RF Power GaN Transistor	A2G26H281-04S	NXP
R1, R2	5.6 Ω, 1/4 W Chip Resistors	CRCW12065K60FKEA	Vishay
R3	50 Ω, 30 W Termination Resistor	RFP-375375N6Z50-2	Anaren
Z1	2300–2700 MHz Band, 90°, 2 dB Hybrid Coupler	X3C25P1-02S	Anaren
PCB	Rogers RO4350B, 0.020″, ε_r = 3.66	D84898	MTL

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TYPICAL CHARACTERISTICS — 2575–2635 MHz

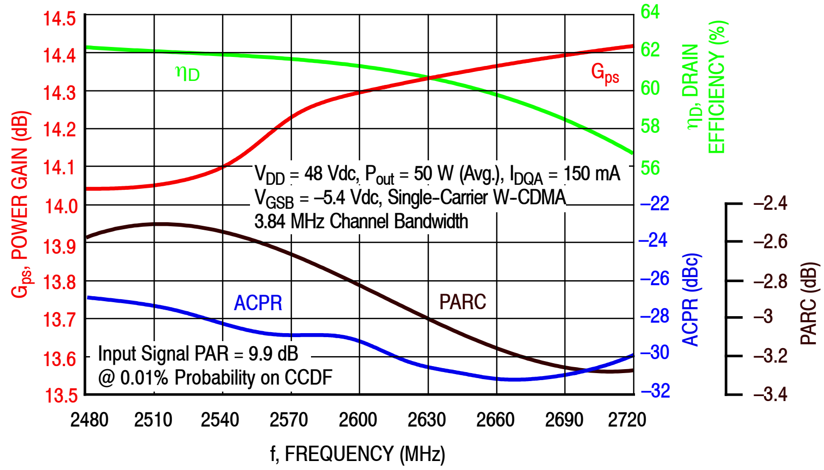

Figure 3. Single-Carrier Output Peak-to-Average Ratio Compression (PARC) Broadband Performance @ P_{out} = 50 Watts Avg.

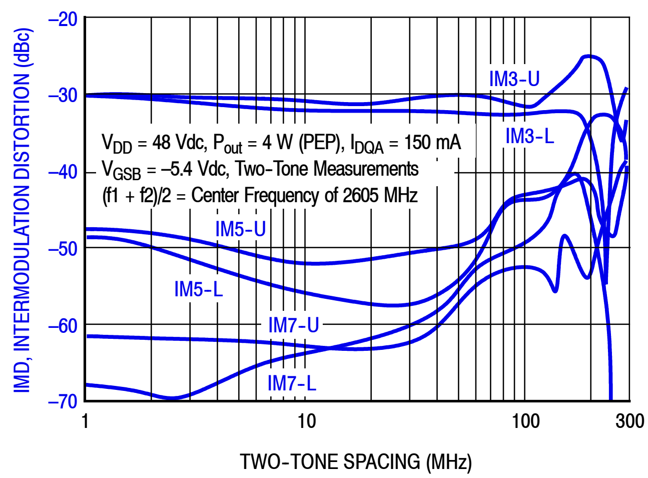

Figure 4. Intermodulation Distortion Products versus Two-Tone Spacing

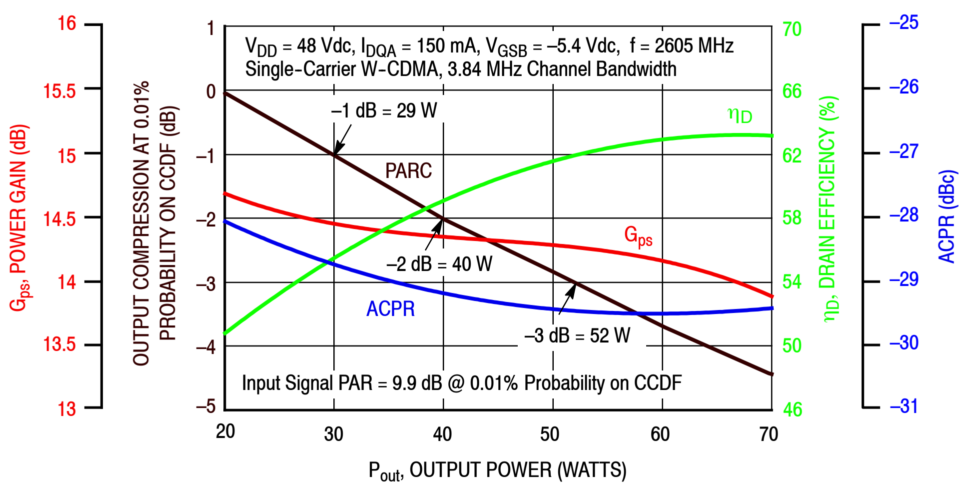

Figure 5. Output Peak-to-Average Ratio Compression (PARC) versus Output Power

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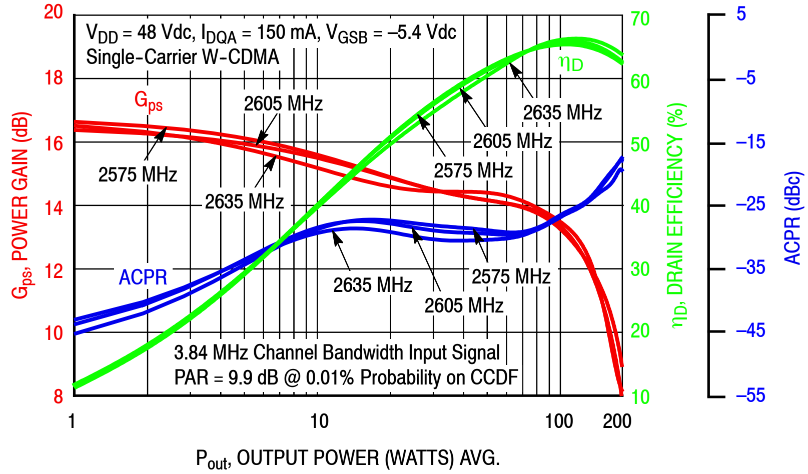

Figure 6. Single-Carrier W-CDMA Power Gain, Drain Efficiency and ACPR versus Output Power

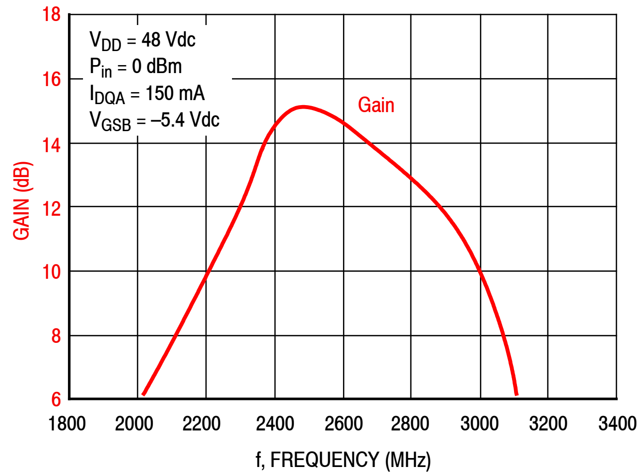

Figure 7. Broadband Frequency Response

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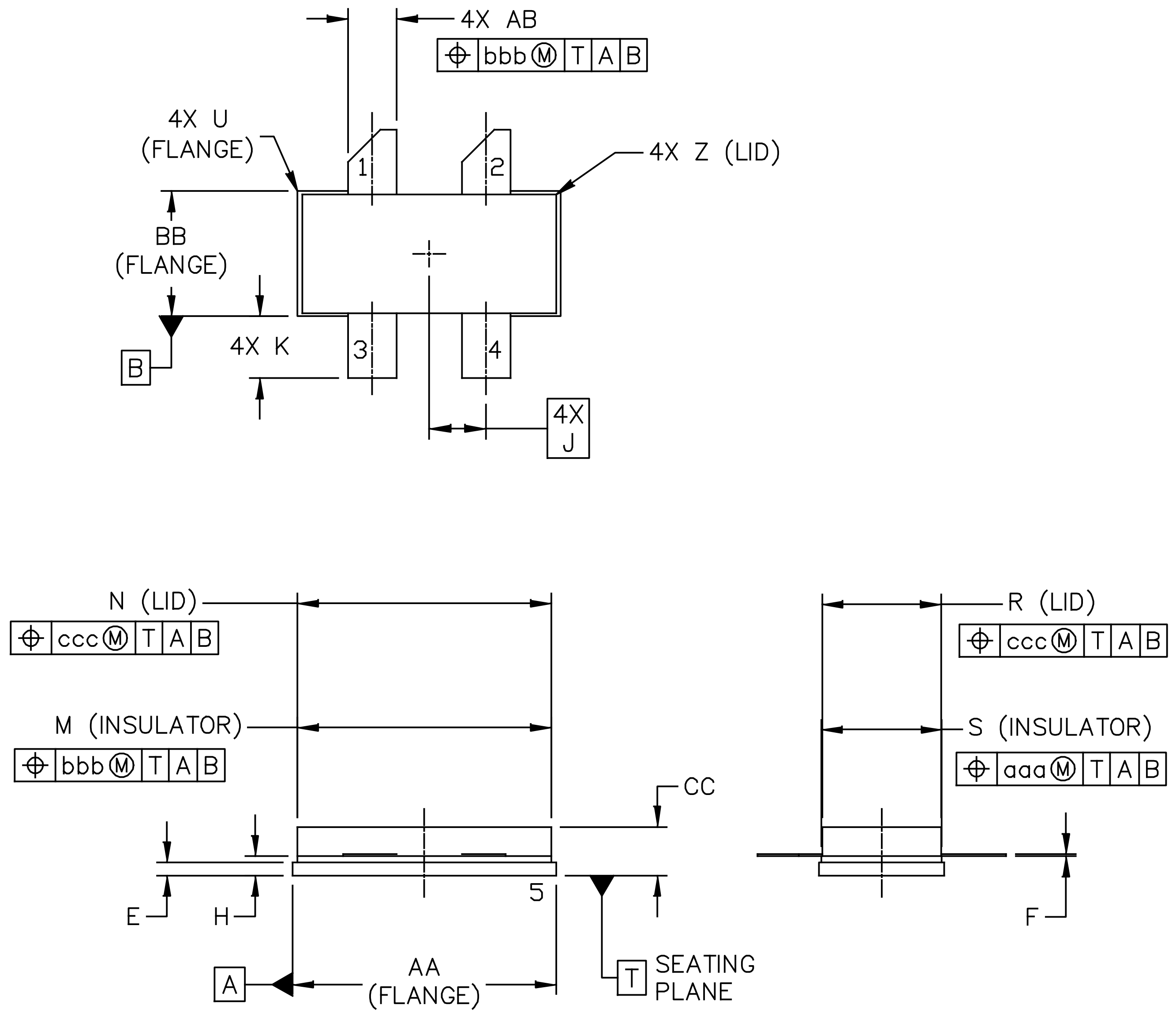
PACKAGE DIMENSIONS



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NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.

2. CONTROLLING DIMENSION: INCH.

3. DELETED

4. DIMENSION H IS MEASURED .030 (0.762) AWAY FROM FLANGE TO CLEAR EPOXY FLOW OUT PARALLEL TO DATUM B.

DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX	DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX
AA	.805	.815	20.45	20.70	U		.040		1.02
BB	.382	.388	9.70	9.86	Z		.030		0.76
CC	.125	.170	3.18	4.32	AB	.145	.155	3.68 –	3.94
E	.035	.045	0.89	1.14					
F	.003	.006	0.08	0.15	aaa	.005		0.127	
H	.057	.067	1.45	1.70	bbb	.010		0.254	
J	.175 BSC		4.44 BSC		ccc	.015		0.381	
K	.170	.210	4.32	5.33					
M	.774	.786	19.61	20.02					
N	.772	.788	19.61	20.02					
R	.365	.375	9.27	9.53					
S	.365	.375	9.27	9.52					

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PRODUCT DOCUMENTATION, SOFTWARE AND TOOLS

Refer to the following resources to aid your design process.

Application Notes

- AN1908: Solder Reflow Attach Method for High Power RF Devices in Air Cavity Packages
- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

Software

- .s2p File

Development Tools

- Printed Circuit Boards

To Download Resources Specific to a Given Part Number:

1. Go to http://www.nxp.com/RF
2. Search by part number
3. Click part number link
4. Choose the desired resource from the drop down menu

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
0	Sept. 2016	• Initial release of data sheet
1	Feb. 2017	• Functional test table: Min, Typ and Max values updated to reflect the true capability of the device, p. 3 • Bias Sequencing Note, Turning the device ON, step 2: 50 V changed to 48 V to reflect the functionality of the part, p. 3

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