RF Power GaN Transistor

This 80 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} = 370 mA, V_{GSB} = –4.6 Vdc, P_{out} = 80 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)
2496 MHz	14.4	48.4	7.8	–32.6
2590 MHz	15.0	49.3	8.2	–35.2
2690 MHz	14.8	51.2	7.8	–34.0

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

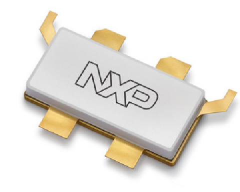
Features

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

RoHS

A3G26H502W17S

2496–2690 MHz, 80 W Avg., 48 V AIRFAST RF POWER GaN TRANSISTOR



NI-780S-4S2S

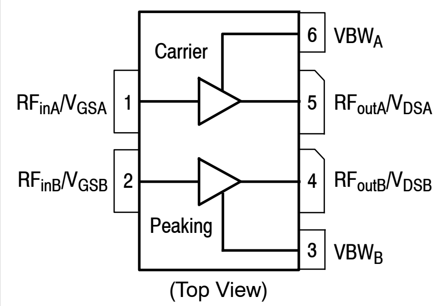


Figure 1. Pin Connections

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}	55	Vdc
Maximum Forward Gate Current, $I_{G\ (A+B)}$, @ T_C = 25°C	I_{GMAX}	66	mA
Storage Temperature Range	T_{stg}	–65 to +150	°C
Case Operating Temperature Range	T_C	–55 to +150	°C
Maximum Channel Temperature	T_{CH}	225	°C

Table 2. Recommended Operating Conditions

Rating	Symbol	Value	Unit
Operating Voltage	V_{DD}	48	Vdc

Table 3. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance by Infrared Measurement, Active Die Surface-to-Case Case Temperature 74°C, P_D = 110 W	$R_{\theta JC}$ (IR)	0.71 (1)	°C/W
Thermal Resistance by Finite Element Analysis, Channel-to-Case Case Temperature 90°C, P_D = 83 W	$R_{\theta CHC}$ (FEA)	1.23 (2)	°C/W

Table 4. ESD Protection Characteristics

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

Table 5. Electrical Characteristics (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics (3)					
Drain-Source Breakdown Voltage (V_{GS} = –8 Vdc, I_D = 24 mAdc) Carrier (V_{GS} = –8 Vdc, I_D = 42 mAdc) Peaking	$V_{(BR)DSS}$	 150 150	—	—	Vdc
On Characteristics — Side A, Carrier					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 20 mAdc)	$V_{GS(th)}$	–3.5	–2.6	–2.3	Vdc
Gate Quiescent Voltage (V_{DD} = 48 Vdc, I_{DA} = 370 mAdc, Measured in Functional Test)	$V_{GSA(Q)}$	–3.1	–2.6	–2.1	Vdc
Gate-Source Leakage Current (V_{DS} = 150 Vdc, V_{GS} = –8 Vdc)	I_{GSS}	–9.9	—	—	mAdc
On Characteristics — Side B, Peaking					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 20 mAdc)	$V_{GS(th)}$	–3.8	–3.2	–2.3	Vdc
Gate-Source Leakage Current (V_{DS} = 150 Vdc, V_{GS} = –8 Vdc)	I_{GSS}	–9.9	—	—	mAdc

1. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://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* = –11.1 and *B* = 8366.
3. Each side of device measured separately.

(continued)

Table 5. Electrical Characteristics (T_A = 25°C unless otherwise noted) **(continued)**

Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests — 2496 MHz [1] (In NXP Doherty Production Test Fixture, 50 ohm system) V_{DD} = 48 Vdc, I_{DQA} = 370 mA, V_{GSB} = –4.6 Vdc, P_{out} = 80 W Avg., f = 2496 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}	11.3	13.1	14.7	dB
Drain Efficiency	η_D	38.0	45.6	—	%
P_{sat}, Pulsed CW	P_{sat}	55.6	56.6	—	dBm
Adjacent Channel Power Ratio	ACPR	—	–35.6	–26.0	dBc
Functional Tests — 2690 MHz [1] (In NXP Doherty Production Test Fixture, 50 ohm system) V_{DD} = 48 Vdc, I_{DQA} = 370 mA, V_{GSB} = –4.6 Vdc, P_{out} = 80 W Avg., f = 2690 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}	11.4	13.2	14.8	dB
Drain Efficiency	η_D	37.0	45.0	—	%
P_{sat}, Pulsed CW	P_{sat}	56.0	56.7	—	dBm
Adjacent Channel Power Ratio	ACPR	—	–30.8	–24.0	dBc
Wideband Ruggedness (In NXP Doherty Production Test Fixture, 50 ohm system) I_{DQA} = 370 mA, V_{GSB} = –4.6 Vdc, f = 2590 MHz, Additive White Gaussian Noise (AWGN) with 10 dB PAR					
ISBW of 400 MHz at 55 Vdc, 140 W Avg. Modulated Output Power (3 dB Input Overdrive from 80 W Avg. Modulated Output Power)	No Device Degradation				

1. Part internally matched both on input and output.

(continued)

NOTE: 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}.

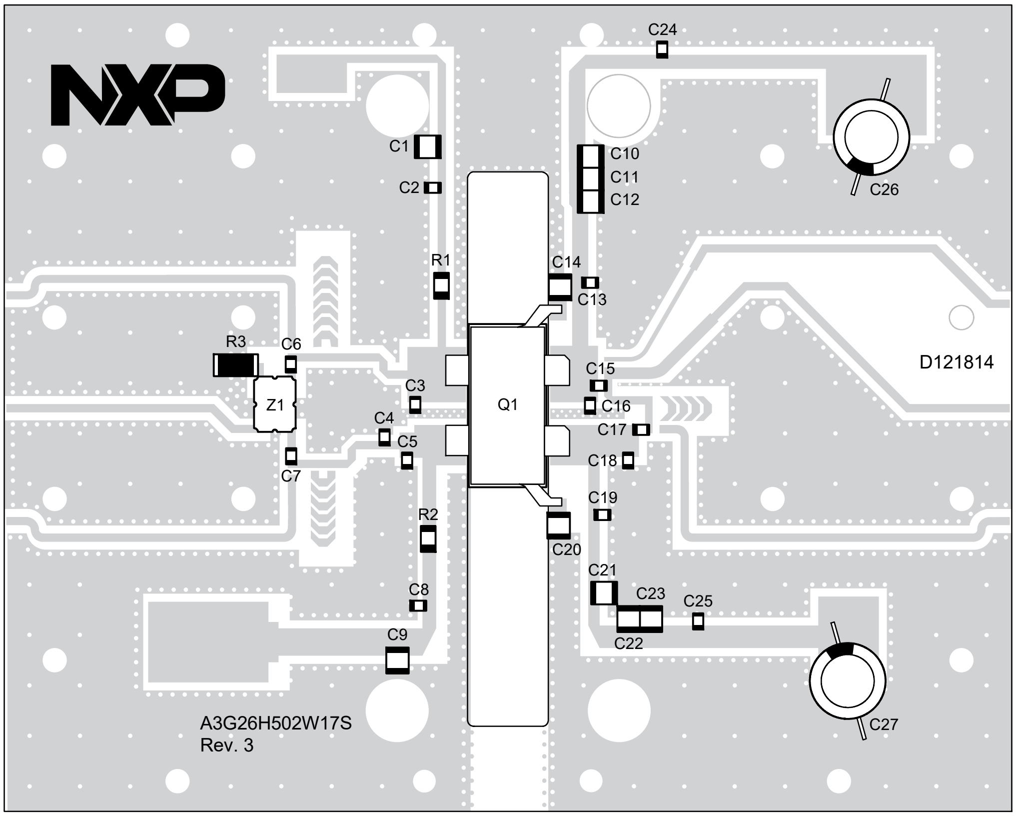
Table 5. Electrical Characteristics (T_A = 25°C unless otherwise noted) **(continued)**

Characteristic	Symbol	Min	Typ	Max	Unit
Typical Performance [1] (In NXP Doherty Characterization Test Fixture, 50 ohm system) V_{DD} = 48 Vdc, I_{DQA} = 370 mA, V_{GSB} = −4.6 Vdc, 2496–2690 MHz Bandwidth					
P_{out} @ 3 dB Compression Point [2]	P3dB	—	500	—	W
AM/PM (Maximum value measured at the P3dB compression point across the 2496–2690 MHz bandwidth)	Φ	—	–8	—	°
VBW Resonance Point (IMD Third Order Intermodulation Inflection Point)	VBW_{res}	—	250	—	MHz
Gain Flatness in 194 MHz Bandwidth @ P_{out} = 80 W Avg.	G_F	—	0.5	—	dB
Gain Variation over Temperature (–40°C to +85°C)	ΔG	—	0.033	—	dB/°C
Output Power Variation over Temperature (–40°C to +85°C)	ΔP1dB	—	0.023	—	dB/°C

Table 6. Ordering Information

Device	Tape and Reel Information	Package
A3G26H502W17SR3	R3 Suffix = 250 Units, 44 mm Tape Width, 13-inch Reel	NI-780S-4S2S

1. All data measured in fixture with device soldered to heatsink.
2. 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.



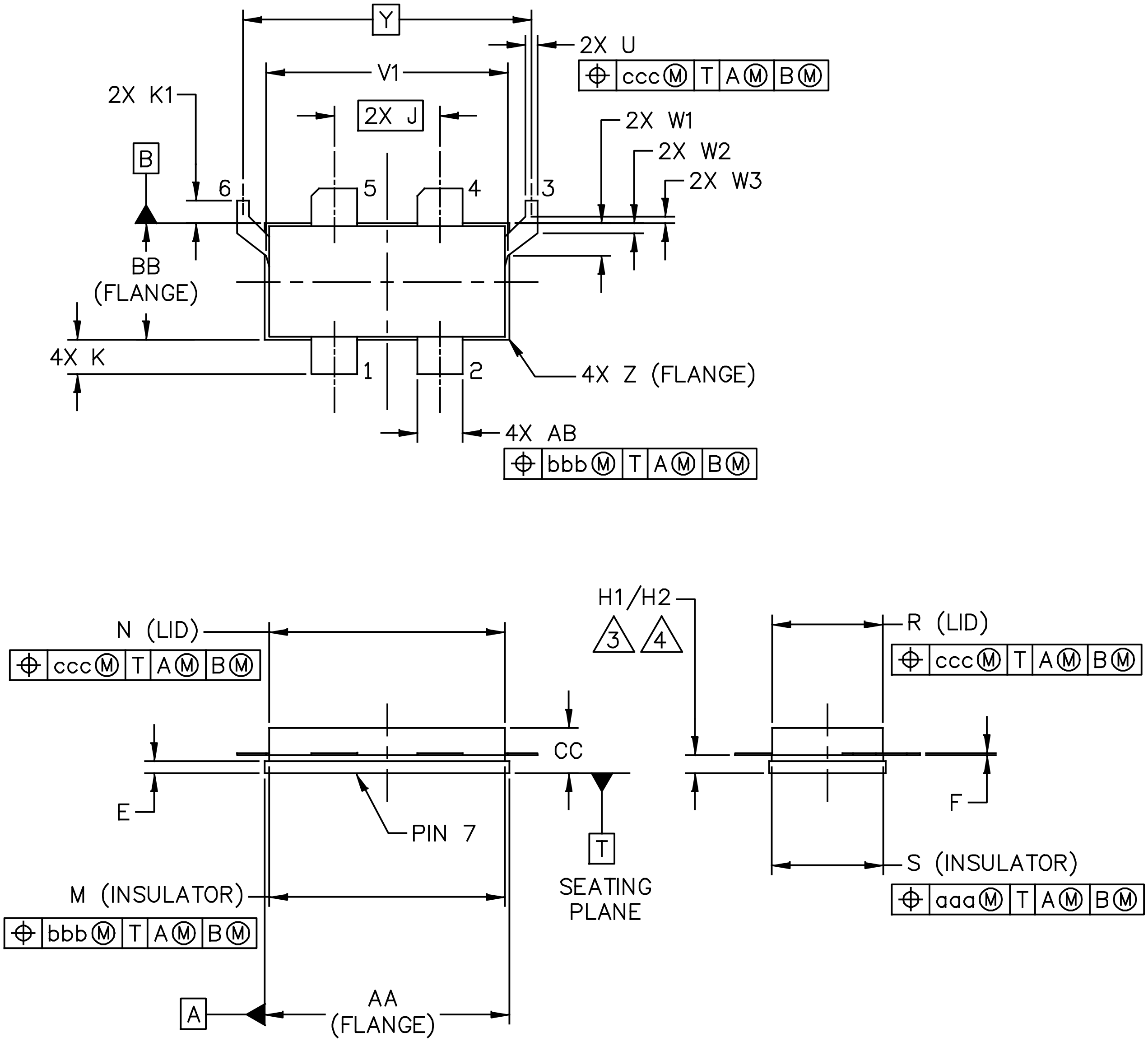
Note: All data measured in fixture with device soldered to heatsink. Production fixture does not include device soldered to heatsink.

aaa-039549

Figure 2. A3G26H502W17S Characterization Test Circuit Component Layout

Table 7. A3G26H502W17S Characterization Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C9, C10, C11, C12, C14, C20, C21, C22, C23	10 uF Chip Capacitor	GRM32EC72A106KE05L	Murata
C2, C8, C13, C19	12 pF Chip Capacitor	GQM2195C2E120FB12D	Murata
C3	0.3 pF Chip Capacitor	GQM2195C2ER30BB12D	Murata
C4, C5	0.5 pF Chip Capacitor	GQM2195C2ER50BB12D	Murata
C6, C7, C24, C25	10 pF Chip Capacitor	GQM2195C2E100FB12D	Murata
C15, C17	3.9 pF Chip Capacitor	GQM2195C2E3R9BB12D	Murata
C16, C18	0.6 pF Chip Capacitor	GQM2195C2ER60BB12D	Murata
C26, C27	470 μF, 100 V Electrolytic Capacitor	MCGPR100V477M16X32	Multicomp
Q1	RF Power GaN Transistor	A3G26H502W17S	NXP
R1, R2	3.3 Ω, 1/4 W Chip Resistor	CRCW12063R30JNEA	Vishay
R3	50 Ω, 4 W Chip Resistor	CW12010T0050GBK	ATC
Z1	2300–2700 MHz Band, 5 dB Directional Coupler	X3C25P1-05S	Anaren
PCB	Rogers RO3035, 0.020″, ε_r = 3.66	D121814	MTL



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	STANDARD: NON-JEDEC	
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NOTES:

1. CONTROLLING DIMENSION: INCH.

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

3. DIMENSIONS H1 AND H2 ARE MEASURED .030 INCH (0.762 MM) AWAY FROM FLANGE PARALLEL TO DATUM B TO CLEAR EPOXY FLOW OUT. H1 APPLIES TO PINS 1, 2, 4 & 5. H2 APPLIES TO PINS 3 & 6.

	INCH		MILLIMETER			INCH		MILLIMETER	
DIM	MIN	MAX	MIN	MAX	DIM	MIN	MAX	MIN	MAX
AA	.805	.815	20.45	20.70	R	.365	.375	9.27	9.53
BB	.380	.390	9.65	9.91	S	.365	.375	9.27	9.53
CC	.125	.170	3.18	4.32	U	.035	.045	0.89	1.14
E	.035	.045	0.89	1.14	V1	.795	.805	20.19	20.45
F	.004	.007	0.10	0.18	W1	.0975	.1175	2.48	2.98
H1	.057	.067	1.45	1.70	W2	.0225	.0425	0.57	1.08
H2	.054	.070	1.37	1.78	W3	.0125	.0325	0.32	0.83
J	.350 BSC		8.89 BSC		Y	.956 BSC		24.28 BSC	
K	.0995	.1295	2.53	3.29	Z	R.000	R.040	R0.00	R1.02
K1	.070	.090	1.78	2.29	AB	.145	.155	3.68	3.94
M	.774	.786	19.66	19.96	aaa	.005		0.13	
N	.772	.788	19.61	20.02	bbb	.010		0.25	
					ccc	.015		0.38	

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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

Software

- .s2p File

Development Tools

- Printed Circuit Boards

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
0	Nov. 2020	• Initial release of data sheet
1	Jan. 2021	• Table 1, Maximum Ratings: updated operating voltage for complete data sheet standardization, p. 2 • Table 2, Recommended Operating Conditions: added to data sheet, p. 2