RF Power GaN Transistor

This 45 W RF power GaN transistor is designed for cellular base station applications covering the frequency range of 1800 to 2200 MHz.

This part is characterized and performance is guaranteed for applications operating in the 1800 to 2200 MHz band. There is no guarantee of performance when this part is used in applications designed outside of these frequencies.

2000 MHz

- Typical Single-Carrier W-CDMA Performance: V_{DD} = 48 Vdc, I_{DQ} = 250 mA, P_{out} = 45 W Avg., Input Signal PAR = 9.9 dB @ 0.01% Probability on CCDF.

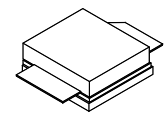
Frequency	G_{ps} (dB)	η_D (%)	Output PAR (dB)	ACPR (dBc)	IRL (dB)
1805 MHz	17.6	34.8	6.9	–35.1	–10
1990 MHz	17.9	37.2	7.0	–34.4	–8
2170 MHz	18.2	37.0	6.9	–34.1	–10

Features

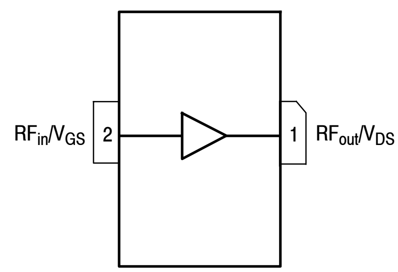
- High terminal impedances for optimal broadband performance
- Designed for digital predistortion error correction systems
- Optimized for Doherty applications

A3G20S250-01SR3

1800–2200 MHz, 45 W AVG., 48 V AIRFAST RF POWER GaN TRANSISTOR



NI-400S-2SA



(Top View)

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}	0 to +55	Vdc
Maximum Forward Gate Current @ T_C = 25°C	I_{GMAX}	24	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 Channel 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 76°C, P_D = 78 W	$R_{\theta JC}$ (IR)	1.0 (2)	°C/W
Thermal Resistance by Finite Element Analysis, Channel-to-Case Case Temperature 80°C, P_D = 78 W	$R_{\theta CHC}$ (FEA)	1.32 (3)	°C/W

Table 3. ESD Protection Characteristics

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

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

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Drain-Source Breakdown Voltage (V_{GS} = –8 Vdc, I_D = 24 mAdc)	$V_{(BR)DSS}$	150	—	—	Vdc
On Characteristics					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 24 mAdc)	$V_{GS(th)}$	–3.8	–3.0	–2.3	Vdc
Gate Quiescent Voltage (V_{DD} = 48 Vdc, I_D = 250 mAdc, Measured in Functional Test)	$V_{GS(Q)}$	–3.6	–2.9	–2.6	Vdc
Gate-Source Leakage Current (V_{DS} = 0 Vdc, V_{GS} = –5 Vdc)	I_{GSS}	–7.5	—	—	mAdc

1. Reliability tests were conducted at 225°C.
2. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.nxp.com/RF and search for AN1955.
3. $R_{\theta CHC}$ (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* = –10.3 and *B* = 8260.

(continued)

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

Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests [1] (In NXP Test Fixture, 50 ohm system) V_{DD} = 48 Vdc, I_{DQ} = 250 mA, P_{out} = 45 W Avg., f = 2170 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}	16.5	18.2	19.5	dB
Drain Efficiency	η_D	33.2	37.0	—	%
Output Peak-to-Average Ratio @ 0.01% Probability on CCDF	PAR	6.3	6.9	—	dB
Adjacent Channel Power Ratio	ACPR	—	–34.1	–32.0	dBc
Input Return Loss	IRL	—	–10	–5	dB
Load Mismatch (In NXP Test Fixture, 50 ohm system) I_{DQ} = 250 mA, f = 1990 MHz, 12 μsec(on), 10% Duty Cycle					
VSWR 10:1 at 55 Vdc, 281 W Pulsed CW Output Power (3 dB Input Overdrive from 229 W Pulsed CW Rated Power)	No Device Degradation				
Typical Performance (In NXP Test Fixture, 50 ohm system) V_{DD} = 48 Vdc, I_{DQ} = 250 mA, 1805–2170 MHz Bandwidth					
P_{out} @ 3 dB Compression Point [2]	P3dB	—	240	—	W
AM/PM (Maximum value measured at the P3dB compression point across the 1805–2170 MHz bandwidth)	Φ	—	–12	—	°
VBW Resonance Point (IMD Third Order Intermodulation Inflection Point)	VBW_{res}	—	170	—	MHz
Gain Flatness in 365 MHz Bandwidth @ P_{out} = 45 W Avg.	G_F	—	0.5	—	dB
Gain Variation over Temperature (–40°C to +85°C)	ΔG	—	0.013	—	dB/°C
Output Power Variation over Temperature (–40°C to +85°C)	ΔP1dB	—	0.004	—	dB/°C

Table 5. Ordering Information

Device	Tape and Reel Information	Package
A3G20S250-01SR3	R3 Suffix = 250 Units, 32 mm Tape Width, 13-inch Reel	NI-400S-2SA

1. Part internally input matched.
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: 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}

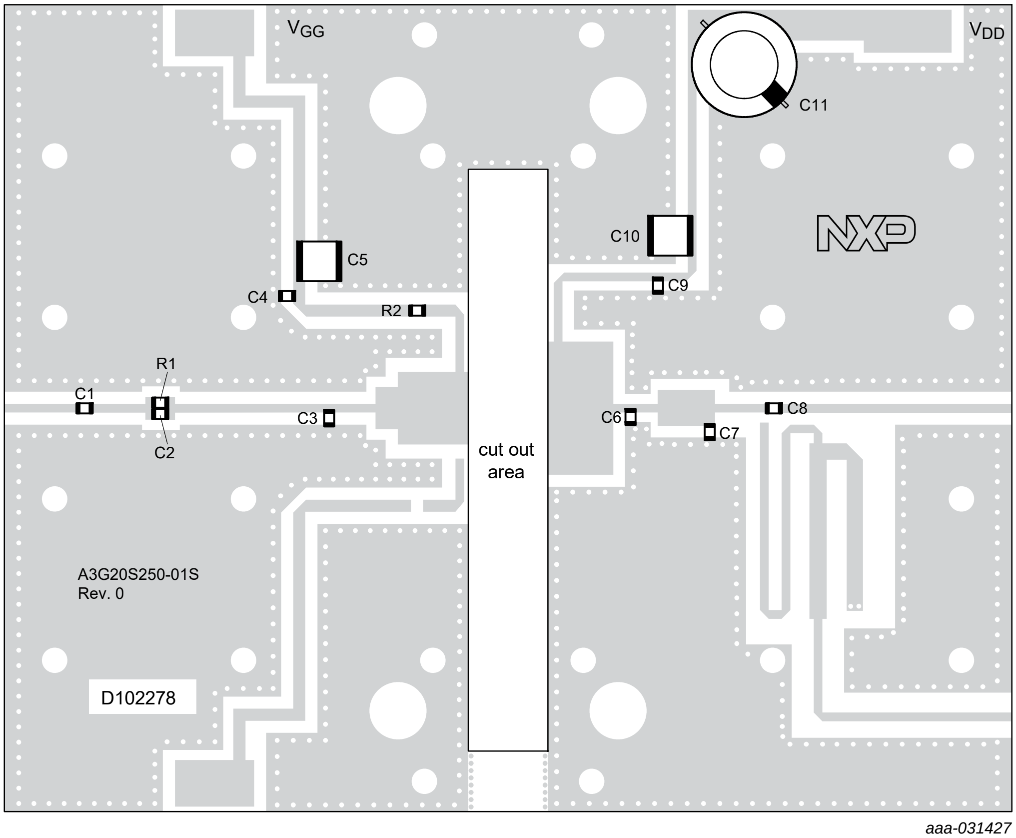
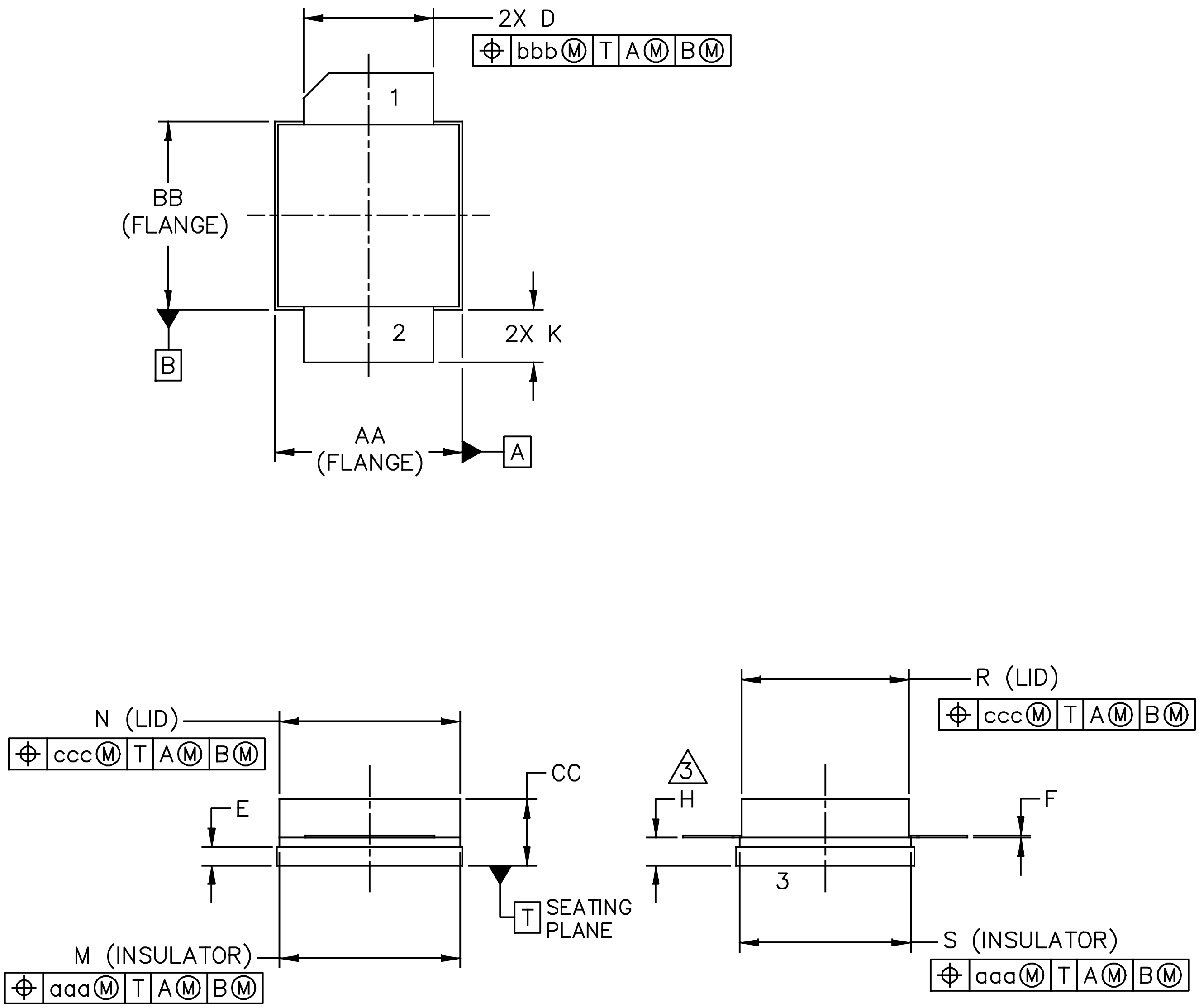


Figure 2. A3G20S250-01SR3 Test Circuit Component Layout

Table 6. A3G20S250-01SR3 Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C2, C4, C8, C9	10 pF Chip Capacitor	ATC600F100JT250XT	ATC
C3	1.8 pF Chip Capacitor	ATC600F1R8BT250XT	ATC
C5, C10	10 μF Chip Capacitor	C5750X7S2A106M230KB	TDK
C6	0.6 pF Chip Capacitor	ATC600F0R6BT250XT	ATC
C7	0.3 pF Chip Capacitor	ATC600F0R3BT250XT	ATC
C11	220 μF, 100 V Electrolytic Capacitor	MCGPR100V227M16X26	Multicomp
R1	6.2 Ω, 1/4 W Chip Resistor	CRCW12066R20FKEA	Vishay
R2	3.3 Ω, 1/4 W Chip Resistor	CRCW12063R30FKEA	Vishay
PCB	Rogers RO4350B, 0.020″, ε_r = 3.66	D102278	MTL

PACKAGE DIMENSIONS



	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
TITLE: NI–400S–2SA	DOCUMENT NO: 98ASA01061D REV: 0	
	STANDARD: NON-JEDEC	
	SOT1828-3 05 MAR 2018	

NOTES:

1. CONTROLLING DIMENSION: INCH

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

3. (△) DIMENSION H IS MEASURED .030 INCH (0.762 MM) AWAY FROM THE FLANGE TO CLEAR THE EPOXY FLOW OUT REGION PARALLEL TO DATUM B.

4. INPUT & OUTPUT LEADS (PIN 1 & 2) MAY HAVE SMALL FEATURES SUCH AS SQUARE HOLES OR NOTCHES FOR MANUFACTURING CONVENIENCE.

	INCH		MILLIMETER			INCH		MILLIMETER	
BB	MIN	MAX	MIN	MAX	DIM	MIN	MAX	MIN	MAX
AA	.395	.405	10.03	10.29	aaa	.005		0.13	
DIM	.382	.388	9.70	9.86	bbb	.010		0.25	
CC	.125	.163	3.18	4.14	ccc	.015		0.38	
D	.275	.285	6.98	7.24					
E	.031	.041	0.79	1.04					
F	.004	.006	0.10	0.15					
H	.057	.067	1.45	1.70					
K	.0995	.1295	2.53	3.29					
M	.395	.405	10.03	10.29					
N	.385	.395	9.78	10.03					
R	.355	.365	9.02	9.27					
S	.365	.375	9.27	9.53					

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	STANDARD: NON–JEDEC
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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. 2018	• Initial release of data sheet