NXP Semiconductors
Technical Data

Document Number: A3G20S350-01S
Rev. 0, 08/2020

RF Power GaN Transistor

A3G20S350-01S

2110–2170 MHz, 59 W Avg., 48 V
AIRFAST RF POWER GaN
TRANSISTOR

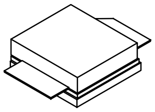
This 59 W RF power GaN transistor is designed for cellular base station applications covering the frequency range of 2110 to 2170 MHz.

This part is characterized and performance is guaranteed for applications operating in the 2110 to 2170 MHz band. There is no guarantee of performance when this part is used in applications designed outside of these frequencies.

2100 MHz

- Typical Single-Carrier W-CDMA Performance: V_{DD} = 48 Vdc, I_{DQ} = 500 mA, P_{out} = 59 W Avg., Input Signal PAR = 9.9 dB @ 0.01% Probability on CCDF.

Frequency	G_{ps} (dB)	η_D (%)	Output PAR (dB)	ACPR (dBc)
2110 MHz	18.0	37.0	7.0	–33.3
2140 MHz	18.0	36.9	7.0	–33.3
2170 MHz	18.1	37.0	6.9	–32.3



NI-400S-2SA

Features

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

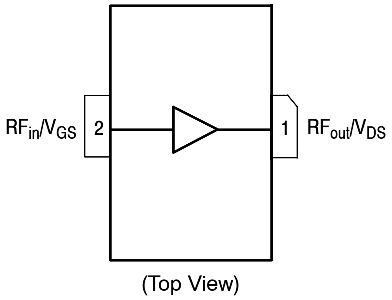


Figure 1. Pin Connections

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 Active Die Surface Temperature Range	T_J	–55 to +225	°C
Maximum Channel Temperature (1)	T_{CH}	275	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance by Infrared Measurement, Active Die Surface-to-Case Case Temperature 83°C, P_D = 89.8 W	$R_{\theta JC}$ (IR)	0.64 (2)	°C/W
Thermal Resistance by Finite Element Analysis, Channel-to-Case Case Temperature 83°C, P_D = 89.8 W	$R_{\theta CHC}$ (FEA)	1.01 (3)	°C/W

Table 3. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JS-001-2017)	1B
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					
Off-State Drain Leakage (V_{DS} = 150 Vdc, V_{GS} = –8 Vdc)	$I_{D(BR)}$	—	—	35.0	mAdc
On Characteristics					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 10 mAdc)	$V_{GS(th)}$	–3.8	–3.0	–2.3	Vdc
Gate Quiescent Voltage (V_{DD} = 48 Vdc, I_D = 500 mAdc, Measured in Functional Test)	$V_{GS(Q)}$	–3.7	–2.9	–2.3	Vdc
Gate-Source Leakage Current (V_{DS} = 150 Vdc, V_{GS} = –8 Vdc)	I_{GSS}	–9.9	—	—	mAdc

1. Reliability tests were conducted at 225°C. Operations with T_{CH} at 275°C will reduce median time to failure.
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* = 8263.

(continued)

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

Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests [1] (In NXP Production Test Fixture, 50 ohm system) V_{DD} = 48 Vdc, I_{DQ} = 500 mA, P_{out} = 59 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}	17.0	18.1	19.5	dB
Drain Efficiency	η_D	34.8	37.0	—	%
P_{out} @ 3 dB Compression Point, CW	P3dB	54.2	54.7	—	dBm
Adjacent Channel Power Ratio	ACPR	—	–32.3	–30.3	dBc
Wideband Ruggedness (In NXP Production Test Fixture, 50 ohm system) I_{DQ} = 500 mA, f = 2140 MHz, Additive White Gaussian Noise (AWGN) with 10 dB PAR					
ISBW of 400 MHz at 55 Vdc, 191 W Avg. Modulated Output Power (3 dB Input Overdrive from 11 W Avg. Modulated Output Power)	No Device Degradation				
Typical Performance (In NXP Production Test Fixture, 50 ohm system) V_{DD} = 48 Vdc, I_{DQ} = 500 mA, 2110–2170 MHz Bandwidth					
P_{out} @ 3 dB Compression Point [2]	P3dB	—	410	—	W
AM/PM (Maximum value measured at the P3dB compression point across the 2110–2170 MHz bandwidth)	Φ	—	–15	—	°
VBW Resonance Point (IMD Third Order Intermodulation Inflection Point)	VBW_{res}	—	70	—	MHz
Gain Flatness in 60 MHz Bandwidth @ P_{out} = 59 W Avg.	G_F	—	0.2	—	dB
Gain Variation over Temperature (–40°C to +85°C)	ΔG	—	0.018	—	dB/°C
Output Power Variation over Temperature (–40°C to +85°C)	ΔP1dB	—	0.001	—	dB/°C

Table 5. Ordering Information

Device	Tape and Reel Information	Package
A3G20S350-01SR3	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 the pinch-off voltage, typically –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 the pinch-off voltage, typically –5 V.
3. Adjust drain voltage V_{DS} to 0 V. Allow adequate time for drain voltage to reduce to 0 V from external drain capacitors.
4. Turn off V_{GS}.

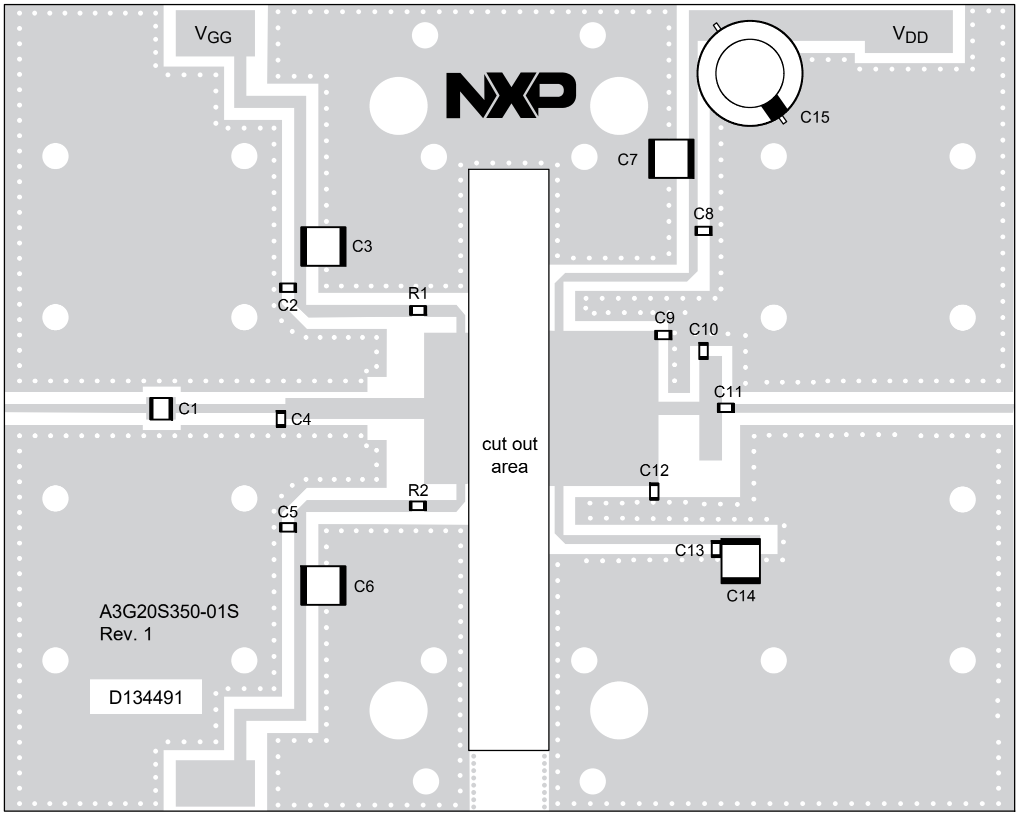
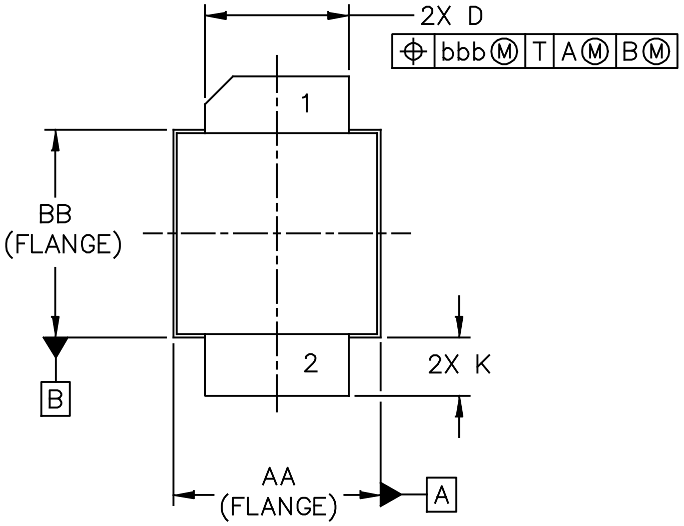


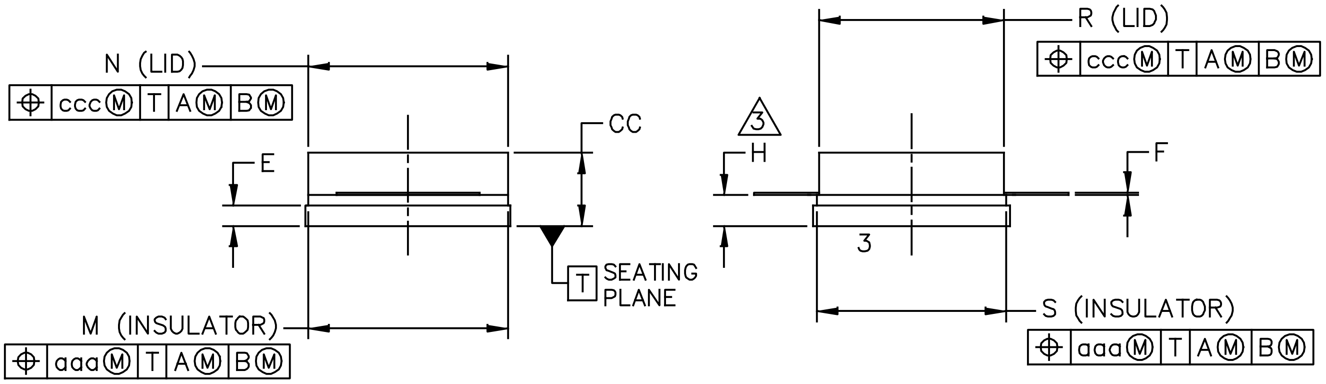
Figure 2. A3G20S350-01S Production Test Circuit Component Layout

Table 6. A3G20S350-01S Production Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1	10 pF Chip Capacitor	100B100JT500XT	ATC
C2, C5, C8, C11, C13	9.1 pF Chip Capacitor	600F9R1BT250XT	ATC
C3, C6, C7, C14	10 μF Chip Capacitor	C5750X7S2A106M230KB	TDK
C4	1.6 pF Chip Capacitor	600F1R6BT250XT	ATC
C9	0.6 pF Chip Capacitor	600F0R6BT250XT	ATC
C10	0.8 pF Chip Capacitor	600F0R8BT250XT	ATC
C12	0.3 pF Chip Capacitor	600F0R3BT250XT	ATC
C15	220 μF, 100 V Electrolytic Capacitor	MCGPR100V227M16X26	Multicomp
R1, R2	15 Ω, 1/4 W Chip Resistor	CRCW120615R0FKEA	Vishay
PCB	Rogers RO4350B, 0.020″, ε_r = 3.66	D134491	MTL

PACKAGE INFORMATION





© NXP SEMICONDUCTORS N. V. ALL RIGHTS RESERVED	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					

© NXP SEMICONDUCTORS N.V. ALL RIGHTS RESERVED	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE

TITLE:	DOCUMENT NO: 98ASA01061D REV: 0
NI−400S−2SA	STANDARD: NON−JEDEC
	SOT1828−3 05 MAR 2018

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	Aug. 2020	• Initial release of data sheet