Document Number: A2G35S200-01S
Rev. 0, 5/2016

RF Power GaN Transistor

This 40 W RF power GaN transistor is designed for cellular base station applications requiring very wide instantaneous bandwidth covering the frequency range of 3400 to 3600 MHz.

This part is characterized and performance is guaranteed for applications operating in the 3400 to 3600 MHz band. There is no guarantee of performance when this part is used in applications designed outside of these frequencies.

3500 MHz

- Typical Single-Carrier W-CDMA Performance: V_{DD} = 48 Vdc, I_{DQ} = 291 mA, P_{out} = 40 W Avg., Input Signal PAR = 9.9 dB @ 0.01% Probability on CCDF.

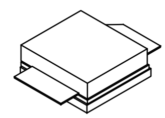
Frequency	G_{ps} (dB)	η_D (%)	Output PAR (dB)	ACPR (dBc)	IRL (dB)
3400 MHz	14.7	32.4	7.2	–34.9	–10
3500 MHz	16.1	35.3	7.0	–34.7	–19
3600 MHz	16.1	36.7	6.6	–32.8	–9

Features

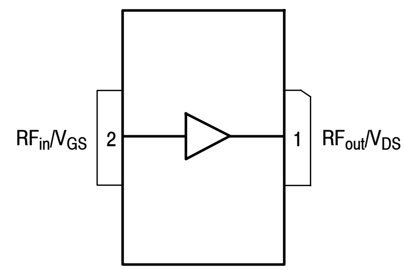
- High Terminal Impedances for Optimal Broadband Performance
- Designed for Digital Predistortion Error Correction Systems
- Optimized for Doherty Applications

A2G35S200-01SR3

**3400–3600 MHz, 40 W AVG., 48 V
AIRFAST RF POWER GaN
TRANSISTOR**



NI-400S-2S



(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}	25	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 75°C, P_D = 81 W	$R_{\theta JC}$ (IR)	1.3 (2)	°C/W
Thermal Resistance by Finite Element Analysis, Junction-to-Case Case Temperature 85°C, P_D = 80 W	$R_{\theta JC}$ (FEA)	1.75 (3)	°C/W

Table 3. ESD Protection Characteristics

Test Methodology	Class
Human Body Model (per JESD22-A114)	1B
Machine Model (per EIA/JESD22-A115)	A
Charge Device Model (per JESD22-C101)	IV

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 = 24.3 mAdc)	$V_{(BR)DSS}$	150	—	—	Vdc
On Characteristics					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 24.3 mAdc)	$V_{GS(th)}$	–3.8	–2.8	–2.3	Vdc
Gate Quiescent Voltage (V_{DD} = 48 Vdc, I_D = 291 mAdc, Measured in Functional Test)	$V_{GS(Q)}$	–3.6	–3.1	–2.3	Vdc
Gate-Source Leakage Current (V_{DS} = 0 Vdc, V_{GS} = –5 Vdc)	I_{GSS}	–7.5	—	—	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.

(continued)

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

Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests (1) (In Freescale Test Fixture, 50 ohm system) V_{DD} = 48 Vdc, I_{DQ} = 291 mA, P_{out} = 40 W Avg., f = 3500 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}	14.3	16.1	17.4	dB
Drain Efficiency	η_D	29.4	35.3	—	%
Output Peak-to-Average Ratio @ 0.01% Probability on CCDF	PAR	6.4	7.0	—	dB
Adjacent Channel Power Ratio	ACPR	—	–34.7	–29.9	dBc
Input Return Loss	IRL	—	–19	–9	dB
Load Mismatch (In Freescale Test Fixture, 50 ohm system) I_{DQ} = 291 mA, f = 3500 MHz, 12 μsec(on), 10% Duty Cycle					
VSWR 10:1 at 55 Vdc, 205 W Pulsed CW Output Power (3 dB Input Overdrive from 180 W Pulsed CW Rated Power)	No Device Degradation				
Typical Performance (In Freescale Test Fixture, 50 ohm system) V_{DD} = 48 Vdc, I_{DQ} = 291 mA, 3400–3600 MHz Bandwidth					
P_{out} @ 1 dB Compression Point, CW	P1dB	—	180	—	W
P_{out} @ 3 dB Compression Point (2)	P3dB	—	225	—	W
AM/PM (Maximum value measured at the P3dB compression point across the 3400–3600 MHz bandwidth)	Φ	—	–12	—	°
VBW Resonance Point (IMD Third Order Intermodulation Inflection Point)	VBW_{res}	—	100	—	MHz
Gain Flatness in 200 MHz Bandwidth @ P_{out} = 40 W Avg.	G_F	—	1.2	—	dB
Gain Variation over Temperature (–30°C to +85°C)	ΔG	—	0.03	—	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
A2G35S200-01SR3	R3 Suffix = 250 Units, 32 mm Tape Width, 13-inch Reel	NI-400S-2S

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.

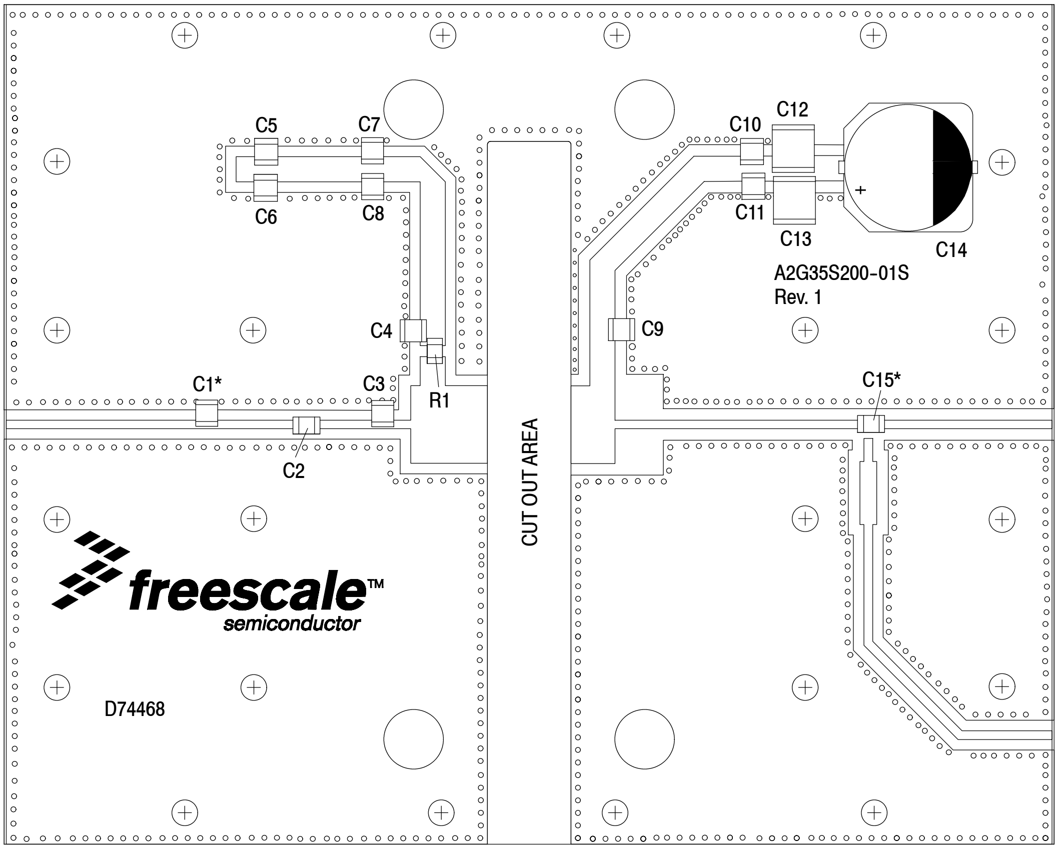
NOTE: Correct Biasing Sequence for GaN Depletion Mode Transistors

Turning the device ON

1. Set V_{GS} to the pinch-off (V_P) voltage, typically –5 V
2. Turn on V_{DS} to nominal supply voltage (50 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 V_P, typically –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}



*C1 and C15 are mounted vertically.

Figure 2. A2G35S200-01SR3 Test Circuit Component Layout

Table 6. A2G35S200-01SR3 Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1	0.7 pF Chip Capacitor	ATC100B0R7BT500XT	ATC
C2, C7, C8, C15	10 pF Chip Capacitors	ATC800B100JT500XT	ATC
C3	1 pF Chip Capacitor	ATC100B1R0BT500XT	ATC
C4, C9	8.2 pF Chip Capacitors	ATC800B8R2CT500XT	ATC
C5, C6	10 μF Chip Capacitors	GRM32ER61H106KA12L	Murata
C10, C11	12 pF Chip Capacitors	ATC800B120JT500XT	ATC
C12, C13	10 μF Chip Capacitors	C5750X7S2A106M230KB	TDK
C14	220 μF, 100 V Electrolytic Capacitor	EEV-FK2A221M	Panasonic-ECG
R1	5.6 Ω, 1/4 W Chip Resistor	CRCW12065R60FKEA	Vishay
PCB	Rogers RO4350B, 0.023″, ε_r = 3.66	D74468	MTL

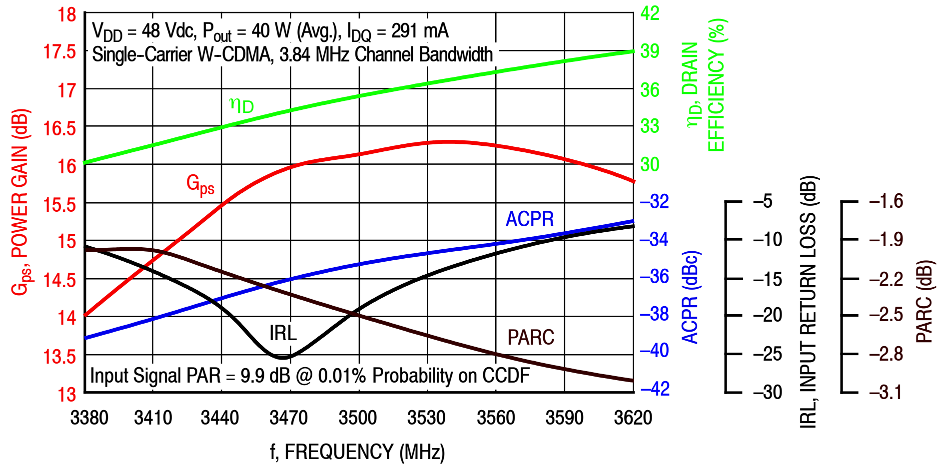


Figure 3. Single-Carrier Output Peak-to-Average Ratio Compression (PARC) Broadband Performance @ P_{out} = 40 Watts Avg.

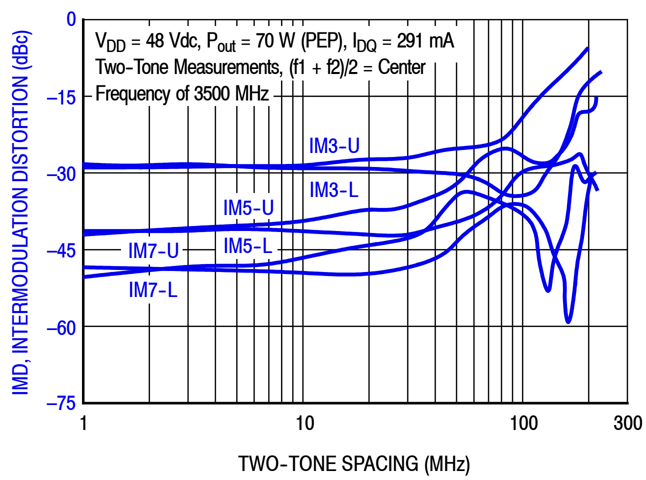


Figure 4. Intermodulation Distortion Products versus Two-Tone Spacing

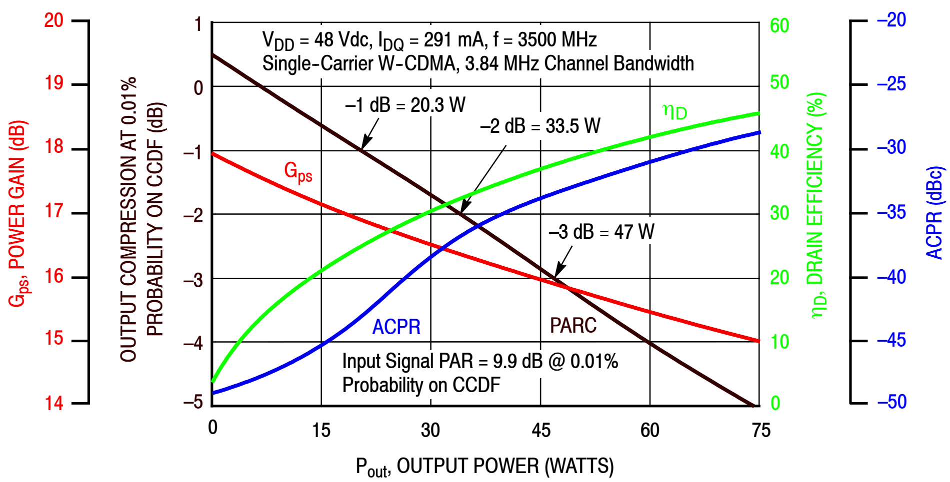


Figure 5. Output Peak-to-Average Ratio Compression (PARC) versus Output Power

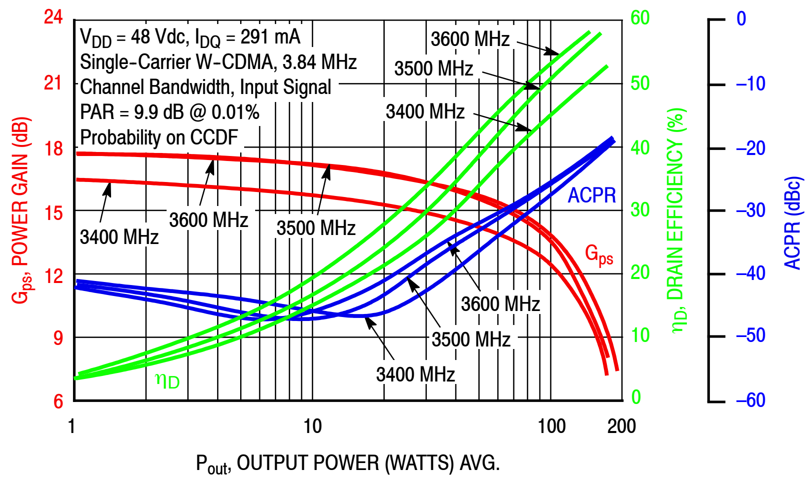


Figure 6. Single-Carrier W-CDMA Power Gain, Drain Efficiency and ACPR versus Output Power

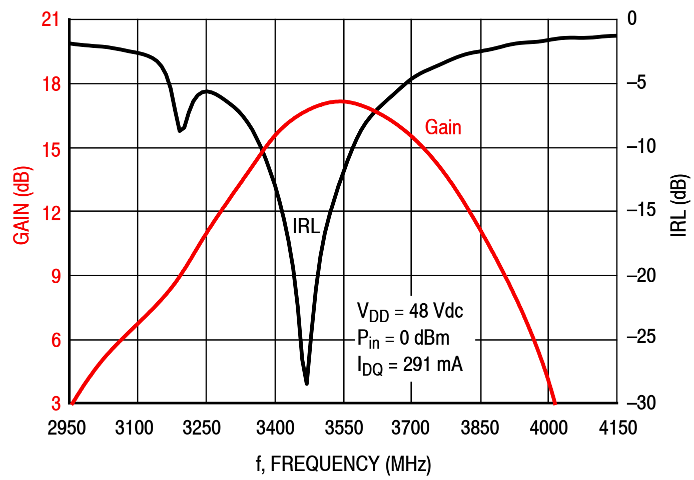
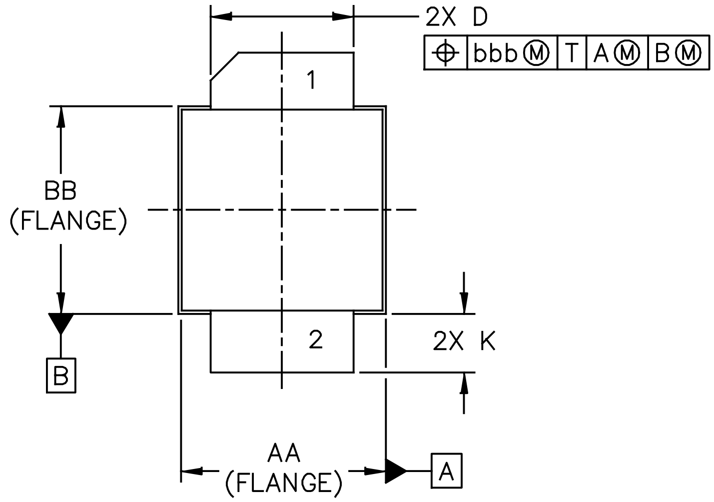
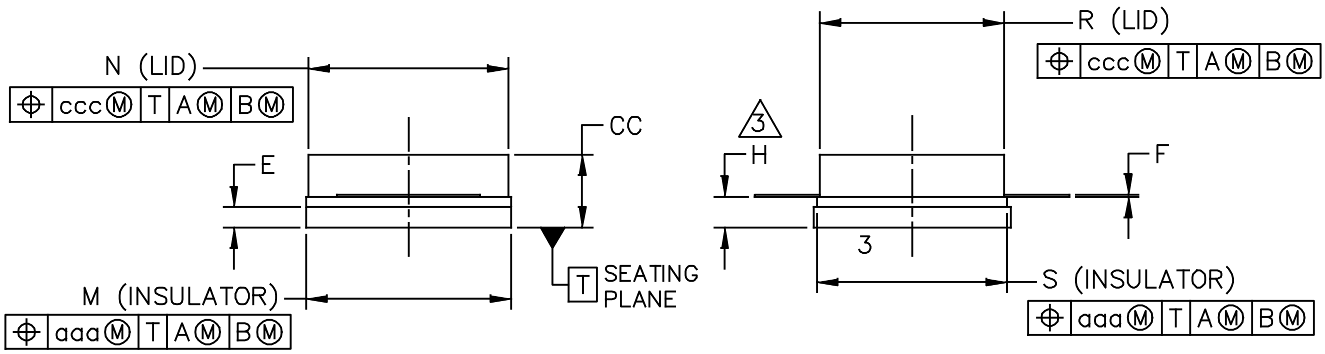


Figure 7. Broadband Frequency Response

PACKAGE DIMENSIONS





© NXP SEMICONDUCTORS N.V. ALL RIGHTS RESERVED	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
TITLE: NI–400S–2S	DOCUMENT NO: 98ASA10732D	REV: C
	STANDARD: NON–JEDEC	
	SOT1828–1	13 JAN 2016

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.

DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX	DIM	INCH MIN	INCH MAX	MILLIMETER MIN	MILLIMETER MAX
AA	.395	.405	10.03	10.29	aaa	.005		0.13	
BB	.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	.035	.045	0.89	1.14					
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					

	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
TITLE: NI−400S−2S	DOCUMENT NO: 98ASA10732D	REV: C
	STANDARD: NON−JEDEC	
	SOT1828−1	13 JAN 2016

PRODUCT DOCUMENTATION, SOFTWARE AND TOOLS

Refer to the following resources to aid your design process.

Application Notes

- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

Software

- RF High Power Model
- .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	May 2016	• Initial Release of Data Sheet

How to Reach Us:

Home Page:
freescale.com

Web Support:
freescale.com/support

Document Number: A2G35S200-01S
Rev. 0, 5/2016