Document Number: A3G26H200W17S
Rev. 0, 03/2020

RoHS

# RF Power GaN Transistor

This 34 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 Performance: $V_{DD}$ = 48 Vdc, $I_{DQA}$ = 120 mA, $V_{GSB}$ = –5.3 Vdc, $P_{out}$ = 34 W Avg., Input Signal PAR = 9.9 dB @ 0.01% Probability on CCDF.

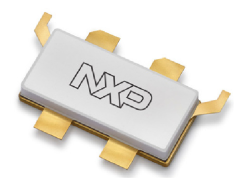
| Frequency | $G_{ps}$ (dB) | $\eta_D$ (%) | Output PAR (dB) | ACPR (dBc) |
|---|---|---|---|---|
| 2496 MHz | 14.7 | 54.2 | 8.1 | –29.3 |
| 2590 MHz | 14.8 | 55.5 | 7.9 | –30.9 |
| 2690 MHz | 14.2 | 54.0 | 7.8 | –34.1 |

## 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

**A3G26H200W17S**

**2496–2690 MHz, 34 W Avg., 48 V
AIRFAST RF POWER GaN
TRANSISTOR**



**NI-780S-4S2S**

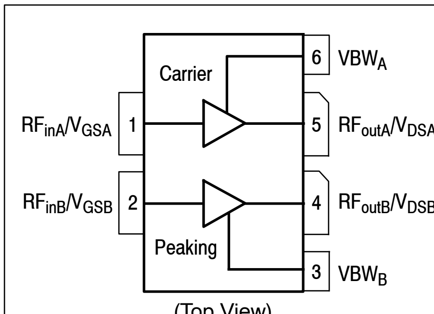



**Figure 1. Pin Connections**

### 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 | $V_{DD}$ | 0 to +55 | Vdc |
| Maximum Forward Gate Current, $I_{G\ (A+B)}$, @ $T_C$ = 25°C | $I_{GMAX}$ | 29 | 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<br>Case Temperature 77°C, $P_D$ = 31.8 W | $R_{\theta JC}$ (IR) | 1.2 (2) | °C/W |
| Thermal Resistance by Finite Element Analysis, Channel-to-Case<br>Case Temperature 90°C, $P_D$ = 31.8 W | $R_{\theta CHC}$ (FEA) | 1.75 (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 (4)** | | | | | |
| Drain-Source Breakdown Voltage<br>($V_{GS}$ = –8 Vdc, $I_D$ = 16.2 mAdc) Carrier<br>($V_{GS}$ = –8 Vdc, $I_D$ = 29.7 mAdc) Peaking | $V_{(BR)DSS}$ | <br>150<br>150 | — | — | Vdc |
| **On Characteristics — Side A, Carrier** | | | | | |
| Gate Threshold Voltage<br>($V_{DS}$ = 10 Vdc, $I_D$ = 10 mAdc) | $V_{GS(th)}$ | –3.5 | –3 | –2.5 | Vdc |
| Gate Quiescent Voltage<br>($V_{DD}$ = 48 Vdc, $I_{DA}$ = 120 mAdc, Measured in Functional Test) | $V_{GSA(Q)}$ | –3.2 | –2.7 | –2.2 | Vdc |
| Gate-Source Leakage Current<br>($V_{DS}$ = 150 Vdc, $V_{GS}$ = –8 Vdc) | $I_{GSS}$ | –5.0 | — | — | mAdc |
| **On Characteristics — Side B, Peaking** | | | | | |
| Gate Threshold Voltage<br>($V_{DS}$ = 10 Vdc, $I_D$ = 18.9 mAdc) | $V_{GS(th)}$ | –4.0 | –3 | –2.5 | Vdc |
| Gate-Source Leakage Current<br>($V_{DS}$ = 150 Vdc, $V_{GS}$ = –8 Vdc) | $I_{GSS}$ | –4.75 | — | — | 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* = –11.1 and *B* = 8366.
4. Each side of device measured separately.

(continued)

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **Functional Tests** (1) (In NXP Doherty Production Test Fixture, 50 ohm system) $V_{DD}$ = 48 Vdc, $I_{DQA}$ = 120 mA, $V_{GSB}$ = –5.3 Vdc, $P_{out}$ = 34 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 | $G_{ps}$ | 13.0 | 14.2 | 16.0 | dB |
| Drain Efficiency | $\eta_D$ | 46.0 | 54.0 | — | % |
| $P_{out}$ @ 3 dB Compression Point, CW | P3dB | 51.9 | 52.5 | — | dBm |
| Adjacent Channel Power Ratio | ACPR | — | –34.1 | –27.0 | dBc |
| **Wideband Ruggedness** (In NXP Doherty Production Test Fixture, 50 ohm system) $I_{DQA}$ = 120 mA, $V_{GSB}$ = –5.3 Vdc, f = 2590 MHz, Additive White Gaussian Noise (AWGN) with 10 dB PAR | | | | | |
| ISBW of 400 MHz at 55 Vdc, 120 W Avg. Modulated Output Power (7 dB Input Overdrive from 34 W Avg. Modulated Output Power) | No Device Degradation | | | | |
| **Typical Performance** (In NXP Doherty Production Test Fixture, 50 ohm system) $V_{DD}$ = 48 Vdc, $I_{DQA}$ = 120 mA, $V_{GSB}$ = –5.3 Vdc, 2496–2690 MHz Bandwidth | | | | | |
| $P_{out}$ @ 3 dB Compression Point (2) | P3dB | — | 178 | — | W |
| AM/PM (Maximum value measured at the P3dB compression point across the 2496–2690 MHz bandwidth) | $\Phi$ | — | –26 | — | ° |
| VBW Resonance Point (IMD Third Order Intermodulation Inflection Point) | $VBW_{res}$ | — | 240 | — | MHz |
| Gain Flatness in 194 MHz Bandwidth @ $P_{out}$ = 34 W Avg. | $G_F$ | — | 0.7 | — | dB |
| Gain Variation over Temperature (–40°C to +85°C) | $\Delta G$ | — | 0.015 | — | dB/°C |
| Output Power Variation over Temperature (–40°C to +85°C) | $\Delta P1dB$ | — | 0.001 | — | dB/°C |

**Table 5. Ordering Information**

| Device | Tape and Reel Information | Package |
|---|---|---|
| A3G26H200W17SR3 | R3 Suffix = 250 Units, 44 mm Tape Width, 13-inch Reel | NI-780S-4S2S |

1. Part internally matched both on input and output.
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 $V_{GS}$

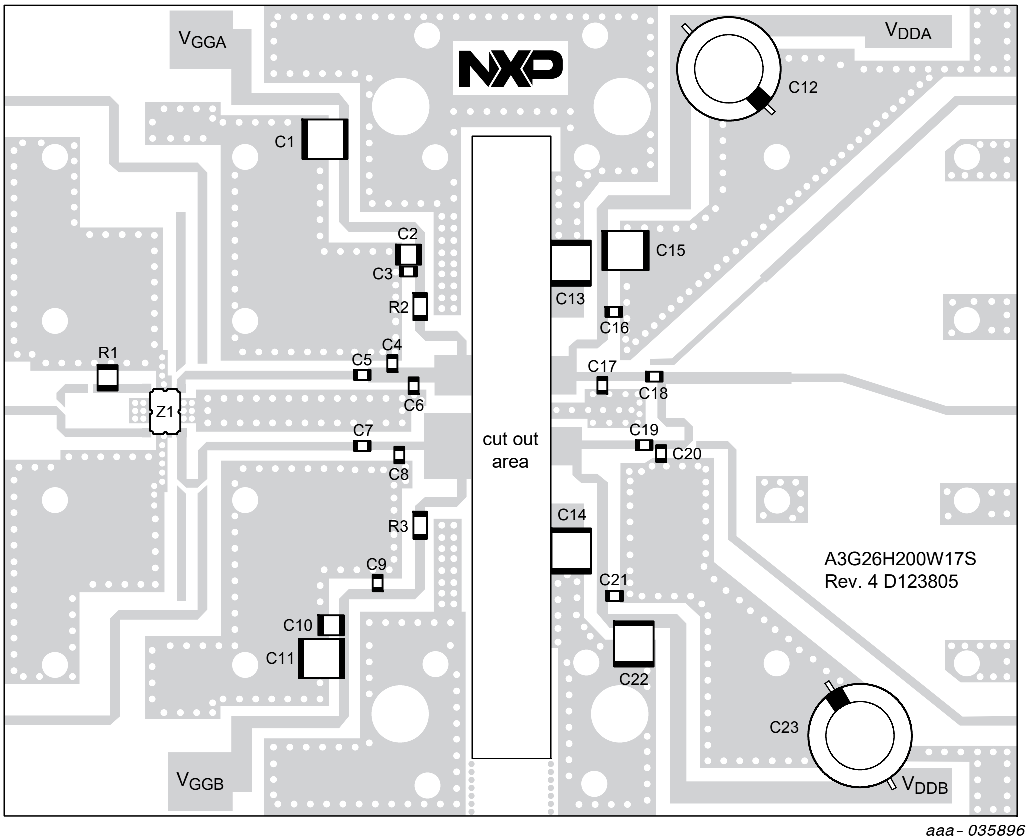
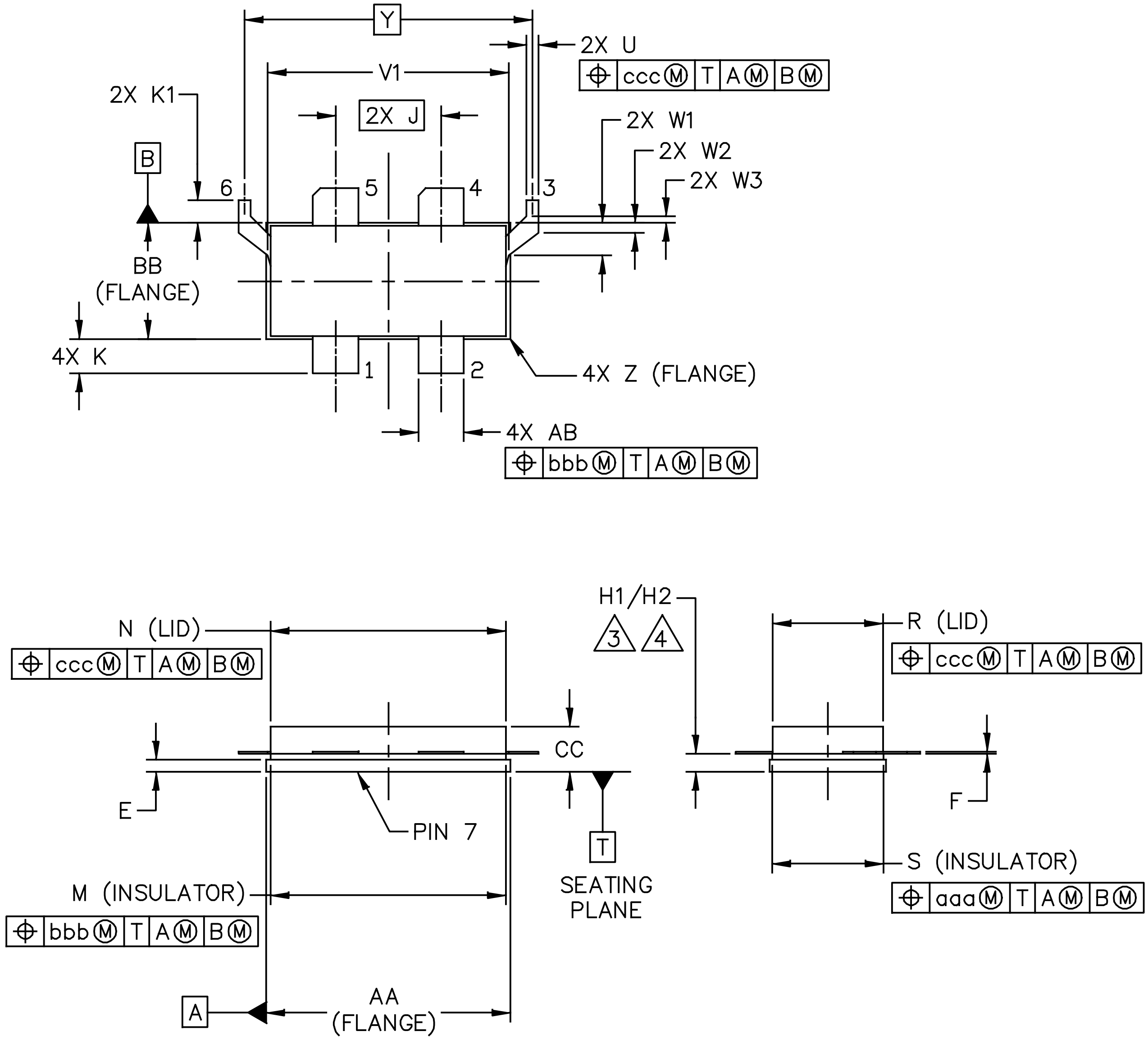



**Figure 2. A3G26H200W17S Production Test Circuit Component Layout**

**Table 6. A3G26H200W17S Production Test Circuit Component Designations and Values**

| Part | Description | Part Number | Manufacturer |
|---|---|---|---|
| C1, C11, C13, C14, C15, C22 | 10 μF Chip Capacitor | C5750X7S2A106M230KB | TDK |
| C2, C10 | 1 μF Chip Capacitor | C3225JB2A105K200AA | TDK |
| C3, C5, C7, C9, C16, C21 | 8.2 pF Chip Capacitor | 600F8R2BT250XT | ATC |
| C4, C6 | 0.5 pF Chip Capacitor | 600F0R5BT250XT | ATC |
| C8, C17 | 0.3 pF Chip Capacitor | 600F0R3BT250XT | ATC |
| C12, C23 | 470 μF, 100 V Electrolytic Capacitor | MCGPR100V477M16X32 | Multicomp |
| C18 | 2.4 pF Chip Capacitor | 600F2R4BT250XT | ATC |
| C19 | 3.6 pF Chip Capacitor | 600F3R6BT250XT | ATC |
| C20 | 0.2 pF Chip Capacitor | 600F0R2BT250XT | ATC |
| R1 | 50 Ω, 10 W Termination Chip Resistor | C10A50Z4 | Anaren |
| R2, R3 | 3 Ω, 1/4 W Chip Resistor | CRCW12063R00JNEA | Vishay |
| Z1 | 2300–2700 MHz Band, 90°, 2 dB Hybrid Coupler | X3C25P1-02S | Anaren |
| PCB | Rogers RO4350B, 0.020″, $\varepsilon_r$ = 3.66 | D123805 | MTL |

## PACKAGE DIMENSIONS

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| | STANDARD: NON-JEDEC | |
| | SOT1799-6 | 14 AUG 2018 |

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.

| 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 | 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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| | STANDARD: NON−JEDEC | |
| | SOT1799−6 | 14 AUG 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 | Mar. 2020 | • Initial release of data sheet |

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