Document Number: A3T23H300W23S
Rev. 0, 07/2018

RoHS

# RF Power LDMOS Transistor

## N–Channel Enhancement–Mode Lateral MOSFET

This 63 W asymmetrical Doherty RF power LDMOS transistor is designed for cellular base station applications requiring very wide instantaneous bandwidth capability covering the frequency range of 2300 to 2400 MHz.

**2300 MHz**

- Typical Doherty Single–Carrier W–CDMA Performance: $V_{DD}$ = 30 Vdc, $I_{DQA}$ = 500 mA, $V_{GSB}$ = 0.7 Vdc, $P_{out}$ = 63 W Avg., Input Signal PAR = 9.9 dB @ 0.01% Probability on CCDF.

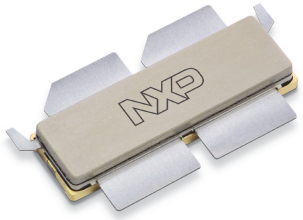
| Frequency | $G_{ps}$ (dB) | $\eta_D$ (%) | Output PAR (dB) | ACPR (dBc) |
|---|---|---|---|---|
| 2300 MHz | 15.6 | 49.3 | 8.4 | –30.1 |
| 2350 MHz | 16.1 | 48.7 | 8.5 | –31.9 |
| 2400 MHz | 16.1 | 48.0 | 8.2 | –32.7 |

**Features**

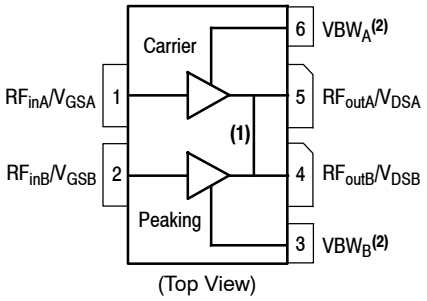
- Advanced high performance in–package Doherty
- Designed for wide instantaneous bandwidth applications
- Greater negative gate–source voltage range for improved Class C operation
- Able to withstand extremely high output VSWR and broadband operating conditions
- Designed for digital predistortion error correction systems

**A3T23H300W23SR6**

**2300–2400 MHz, 63 W AVG., 30 V AIRFAST RF POWER LDMOS TRANSISTOR**




**ACP–1230S–4L2S**




(Top View)

**Figure 1. Pin Connections**

1. Pin connections 4 and 5 are DC coupled and RF independent.
2. Device can operate with $V_{DD}$ current supplied through pin 3 and pin 6.

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**Table 1. Maximum Ratings**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DSS}$ | –0.5, +65 | Vdc |
| Gate-Source Voltage | $V_{GS}$ | –6.0, +10 | Vdc |
| Operating Voltage | $V_{DD}$ | 32, +0 | Vdc |
| Storage Temperature Range | $T_{stg}$ | –65 to +150 | °C |
| Case Operating Temperature Range | $T_C$ | –40 to +150 | °C |
| Operating Junction Temperature Range (1,2) | $T_J$ | –40 to +225 | °C |
| CW Operation @ $T_C$ = 25°C when DC current is fed through pin 3 and pin 6<br>Derate above 25°C | CW | 180<br>1.2 | W<br>W/°C |

**Table 2. Thermal Characteristics**

| Characteristic | Symbol | Value (2,3) | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case<br>Case Temperature 73°C, 63 W Avg., W-CDMA, 30 Vdc, $I_{DQA}$ = 500 mA, $V_{GSB}$ = 0.7 Vdc, 2350 MHz | $R_{\theta JC}$ | 0.17 | °C/W |

**Table 3. ESD Protection Characteristics**

| Test Methodology | Class |
|---|---|
| Human Body Model (per JS-001-2017) | 2 |
| 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)** | | | | | |
| Zero Gate Voltage Drain Leakage Current ($V_{DS}$ = 65 Vdc, $V_{GS}$ = 0 Vdc) | $I_{DSS}$ | — | — | 10 | μAdc |
| Zero Gate Voltage Drain Leakage Current ($V_{DS}$ = 32 Vdc, $V_{GS}$ = 0 Vdc) | $I_{DSS}$ | — | — | 5 | μAdc |
| Gate-Source Leakage Current ($V_{GS}$ = 5 Vdc, $V_{DS}$ = 0 Vdc) | $I_{GSS}$ | — | — | 1 | μAdc |
| **On Characteristics - Side A, Carrier** | | | | | |
| Gate Threshold Voltage ($V_{DS}$ = 10 Vdc, $I_D$ = 140 μAdc) | $V_{GS(th)}$ | 1.3 | 1.8 | 2.3 | Vdc |
| Gate Quiescent Voltage ($V_{DD}$ = 30 Vdc, $I_{DA}$ = 500 mAdc, Measured in Functional Test) | $V_{GSA(Q)}$ | 2.2 | 2.6 | 3.0 | Vdc |
| Drain-Source On-Voltage ($V_{GS}$ = 10 Vdc, $I_D$ = 1.4 Adc) | $V_{DS(on)}$ | 0.1 | 0.15 | 0.3 | Vdc |
| **On Characteristics - Side B, Peaking** | | | | | |
| Gate Threshold Voltage ($V_{DS}$ = 10 Vdc, $I_D$ = 320 μAdc) | $V_{GS(th)}$ | 0.8 | 1.2 | 1.6 | Vdc |
| Drain-Source On-Voltage ($V_{GS}$ = 10 Vdc, $I_D$ = 3.2 Adc) | $V_{DS(on)}$ | 0.1 | 0.15 | 0.3 | Vdc |

1. Continuous use at maximum temperature will affect MTTF.
2. MTTF calculator available at http://www.nxp.com/RF/calculators.
3. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.nxp.com/RF and search for AN1955.
4. Side A and Side B are tied together for these measurements.

(continued)

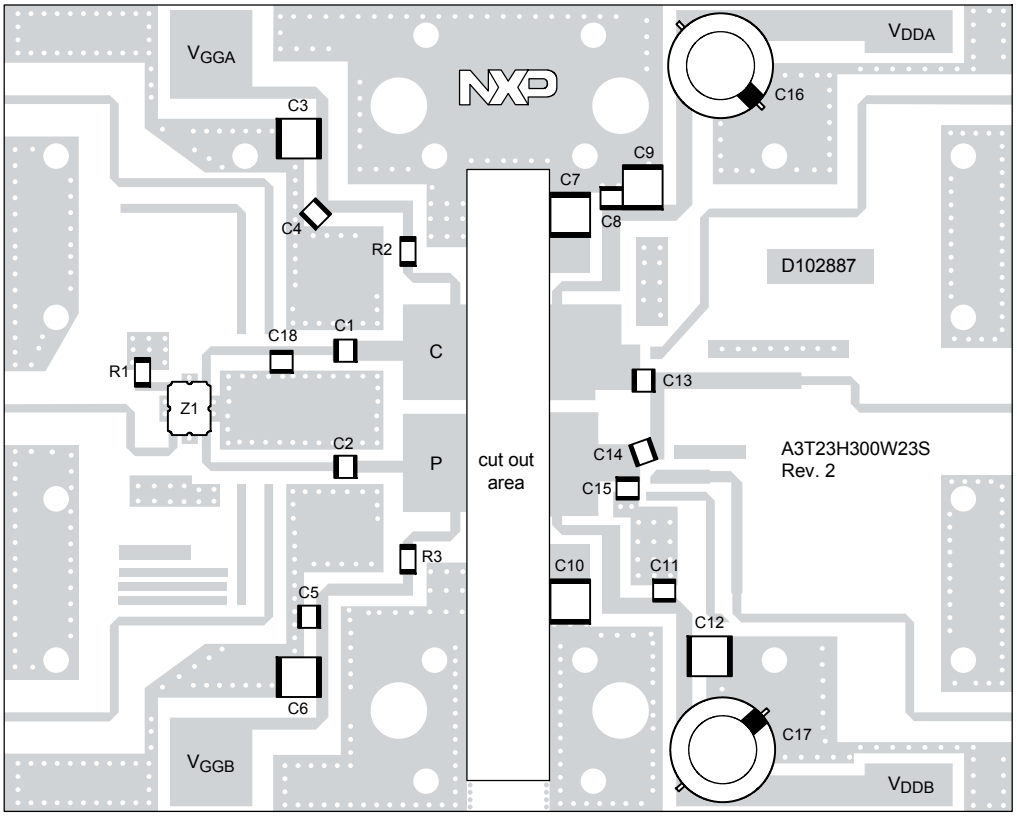
**Table 4. Electrical Characteristics** ($T_A$ = 25°C unless otherwise noted) **(continued)**

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **Functional Tests** (1,2,3) (In NXP Doherty Test Fixture, 50 ohm system) $V_{DD}$ = 30 Vdc, $I_{DQA}$ = 500 mA, $V_{GSB}$ = 0.7 Vdc, $P_{out}$ = 63 W Avg., f = 2300 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. | | | | | |
| Power Gain | $G_{ps}$ | 14.4 | 15.6 | 16.8 | dB |
| Drain Efficiency | $\eta_D$ | 46.7 | 49.3 | — | % |
| $P_{out}$ @ 3 dB Compression Point, CW | P3dB | 55.3 | 56.2 | — | dBm |
| Adjacent Channel Power Ratio | ACPR | — | –29.0 | –26.0 | dBc |
| **Load Mismatch** (3) (In NXP Doherty Test Fixture, 50 ohm system) $I_{DQA}$ = 500 mA, $V_{GSB}$ = 0.7 Vdc, f = 2350 MHz, 12 μsec(on), 10% Duty Cycle | | | | | |
| VSWR 10:1 at 32 Vdc, 360 W Pulsed CW Output Power (3 dB Input Overdrive from 210 W Pulsed CW Rated Power) | No Device Degradation | | | | |
| **Typical Performance** (3) (In NXP Doherty Test Fixture, 50 ohm system) $V_{DD}$ = 30 Vdc, $I_{DQA}$ = 500 mA, $V_{GSB}$ = 0.7 Vdc, 2300–2400 MHz Bandwidth | | | | | |
| $P_{out}$ @ 3 dB Compression Point (4) | P3dB | — | 410 | — | W |
| AM/PM (Maximum value measured at the P3dB compression point across the 2300–2400 MHz bandwidth) | Φ | — | –18 | — | ° |
| VBW Resonance Point (IMD Third Order Intermodulation Inflection Point) | $VBW_{res}$ | — | 230 | — | MHz |
| Gain Flatness in 100 MHz Bandwidth @ $P_{out}$ = 63 W Avg. | $G_F$ | — | 0.4 | — | dB |
| Gain Variation over Temperature (–40°C to +85°C) | ΔG | — | 0.007 | — | dB/°C |
| Output Power Variation over Temperature (–40°C to +85°C) | ΔP1dB | — | 0.003 | — | dB/°C |

**Table 5. Ordering Information**

| Device | Tape and Reel Information | Package |
|---|---|---|
| A3T23H300W23SR6 | R6 Suffix = 150 Units, 56 mm Tape Width, 13-inch Reel | ACP-1230S-4L2S |

1. $V_{DDA}$ and $V_{DDB}$ must be tied together and powered by a single DC power supply.
2. Part internally matched both on input and output.
3. Measurements made with device in an asymmetrical Doherty configuration.
4. 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.



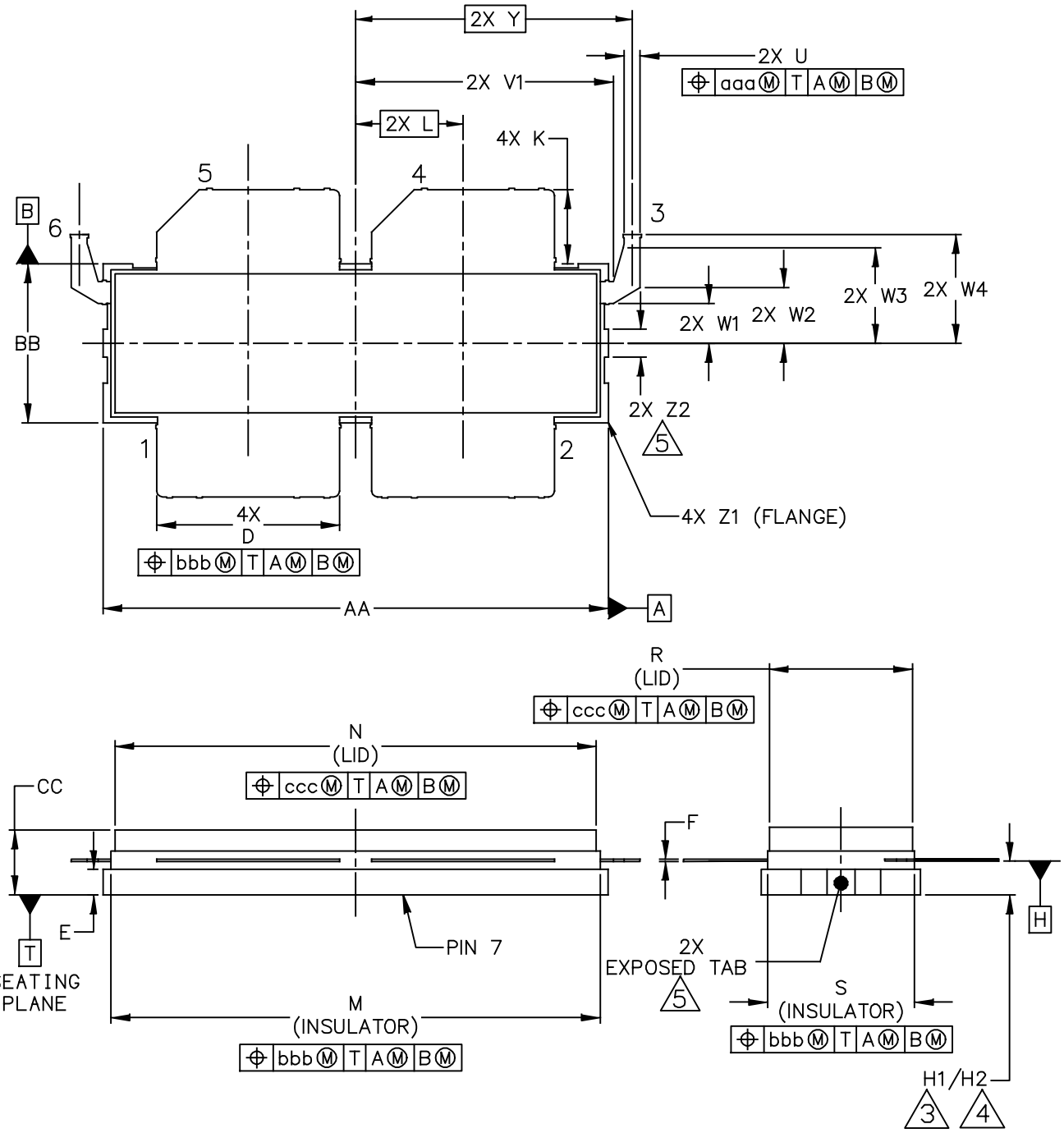

Note: $V_{DDA}$ and $V_{DDB}$ must be tied together and powered by a single DC power supply. aaa-030921

**Figure 2. A3T23H300W23SR6 Test Circuit Component Layout**

**Table 6. A3T23H300W23SR6 Test Circuit Component Designations and Values**

| Part | Description | Part Number | Manufacturer |
|---|---|---|---|
| C1, C2, C4, C5, C8, C11, C14 | 6.2 pF Chip Capacitor | ATC100B6R2BT500XT | ATC |
| C3, C6, C7, C9, C10, C12 | 10 μF Chip Capacitor | C5750X7S2A106M230KB | TDK |
| C13 | 3.3 pF Chip Capacitor | ATC100B3R3CT500XT | ATC |
| C15 | 0.8 pF Chip Capacitor | ATC100B0R8BT500XT | ATC |
| C16, C17 | 470 μF, 63 V Electrolytic Capacitor | MCGPR63V477M13X26 | Multicomp |
| C18 | 0.3 pF Chip Capacitor | ATC100B0R3BT500XT | ATC |
| R1 | 50 Ω, 30 W Termination Resistor | RFP-375375N6Z50-2 | Anaren |
| R2, R3 | 3.6 Ω, 1/4 W Chip Resistor | CRCW12063R60FKEA | Vishay |
| Z1 | 2300–2700 MHz Band, 90°, 2 dB Hybrid Coupler | X3C25P1-02S | Anaren |
| PCB | Rogers RO4350B, 0.020″, $\varepsilon_r$ = 3.66 | D102887 | MTL |

## PACKAGE DIMENSIONS




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|---|---|---|
| TITLE: ACP–1230S–4L2S | DOCUMENT NO: 98ASA00974D | REV: A |
| | STANDARD: NON–JEDEC | |
| | SOT1800–4 | 21 JUN 2017 |

NOTES:

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

2. CONTROLLING DIMENSION: INCH

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

4. TOLERANCE OF DIMENSION H2 IS TENTATIVE.

5. THESE SURFACES OF THE HEAT SLUG ARE NOT PART OF THE SOLDERABLE SURFACES AND MAY REMAIN UNPLATED.

6. DATUM H IS LOCATED AT THE BOTTOM OF THE LEAD FRAME AND IS COINCIDENT WITH THE LEAD WHERE THE LEADS EXIT THE PLASTIC BODY.

7. DIMENSIONS M AND S DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .012 INCH (0.30 MM) PER SIDE. DIMENSIONS M AND S DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE H.

8. DIMENSIONS D, U AND K DO NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .010 INCH (0.25 MM) TOTAL IN EXCESS OF THE D, U AND K DIMENSION AT MAXIMUM MATERIAL CONDITION.

9. DATUM A AND B TO BE DETERMINED AT DATUM T.

| | INCHES | | MILLIMETERS | | | INCHES | | MILLIMETERS | |
|---|---|---|---|---|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX | DIM | MIN | MAX | MIN | MAX |
| AA | 1.265 | 1.275 | 32.13 | 32.39 | S | .365 | .375 | 9.27 | 9.53 |
| BB | .395 | .405 | 10.03 | 10.29 | U | .035 | .045 | 0.89 | 1.14 |
| CC | .160 | .190 | 4.06 | 4.83 | V1 | .640 | .655 | 16.26 | 16.64 |
| D | .455 | .465 | 11.56 | 11.81 | W1 | .105 | .115 | 2.67 | 2.92 |
| E | .062 | .069 | 1.57 | 1.75 | W2 | .135 | .145 | 3.43 | 3.68 |
| F | .004 | .007 | 0.10 | 0.18 | W3 | .245 | .255 | 6.22 | 6.48 |
| H1 | .082 | .090 | 2.08 | 2.29 | W4 | .265 | .281 | 6.73 | 7.14 |
| H2 | .078 | .094 | 1.98 | 2.39 | Y | 0.695 BSC | | 17.65 BSC | |
| K | .175 | .195 | 4.45 | 4.95 | Z1 | R.000 | R.040 | R0.00 | R1.02 |
| L | 0.270 BSC | | 6.86 BSC | | Z2 | .060 | .100 | 1.52 | 2.54 |
| M | 1.219 | 1.241 | 30.96 | 31.52 | aaa | .015 | | 0.38 | |
| N | 1.218 | 1.242 | 30.94 | 31.55 | bbb | .010 | | 0.25 | |
| R | .365 | .375 | 9.27 | 9.53 | ccc | .020 | | 0.51 | |

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TITLE: ACP–1230S–4L2S

DOCUMENT NO: 98ASA00974D REV: A

STANDARD: NON–JEDEC

SOT1800–4 21 JUN 2017

## 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**

- Electromigration MTTF Calculator
- .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 | July 2018 | • Initial release of data sheet |

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