Document Number: A3T21H456W23S
Rev. 1, 08/2018

RF Power LDMOS Transistor

N–Channel Enhancement–Mode Lateral MOSFET

This 87 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 2110 to 2200 MHz.

2100 MHz

- Typical Doherty Single–Carrier W–CDMA Performance: V_{DD} = 30 Vdc, I_{DQA} = 800 mA, V_{GSB} = 0.35 Vdc, P_{out} = 87 W Avg., Input Signal PAR = 9.9 dB @ 0.01% Probability on CCDF.

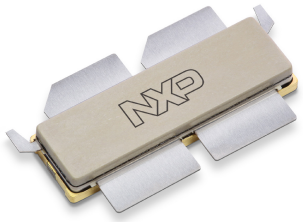
Frequency	G_{ps} (dB)	η_D (%)	Output PAR (dB)	ACPR (dBc)
2110 MHz	14.8	49.5	8.0	–30.3
2140 MHz	15.3	48.9	8.0	–31.1
2170 MHz	15.5	48.6	7.8	–31.3
2200 MHz	15.5	47.9	7.7	–32.0

Features

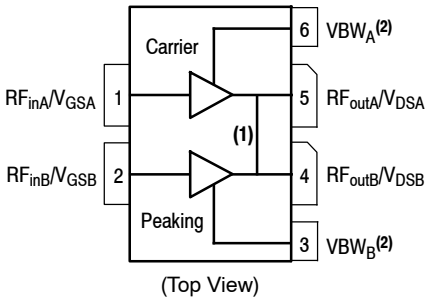
- Advanced high performance in–package Doherty
- Designed for wide instantaneous bandwidth applications
- Greater negative gate–source voltage range for improved Class C operation
- Able to withstand extremely high output VSWR and broadband operating conditions
- Designed for digital predistortion error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

A3T21H456W23SR6

2110–2200 MHz, 87 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 Derate above 25°C	CW	131 0.8	W W/°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (2,3)	Unit
Thermal Resistance, Junction to Case Case Temperature 79°C, 87 W Avg., W–CDMA, 30 Vdc, I_{DQA} = 800 mA, V_{GSB} = 0.35 Vdc, 2155 MHz	$R_{\theta JC}$	0.14	°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 = 160 μAdc)	$V_{GS(th)}$	1.4	1.8	2.2	Vdc
Gate Quiescent Voltage (V_{DD} = 30 Vdc, I_{DA} = 800 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 = 1.6 Adc)	$V_{DS(on)}$	0.0	0.15	0.3	Vdc
On Characteristics – Side B, Peaking					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 360 μAdc)	$V_{GS(th)}$	0.8	1.2	1.6	Vdc
Drain–Source On–Voltage (V_{GS} = 10 Vdc, I_D = 3.6 Adc)	$V_{DS(on)}$	0.0	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)

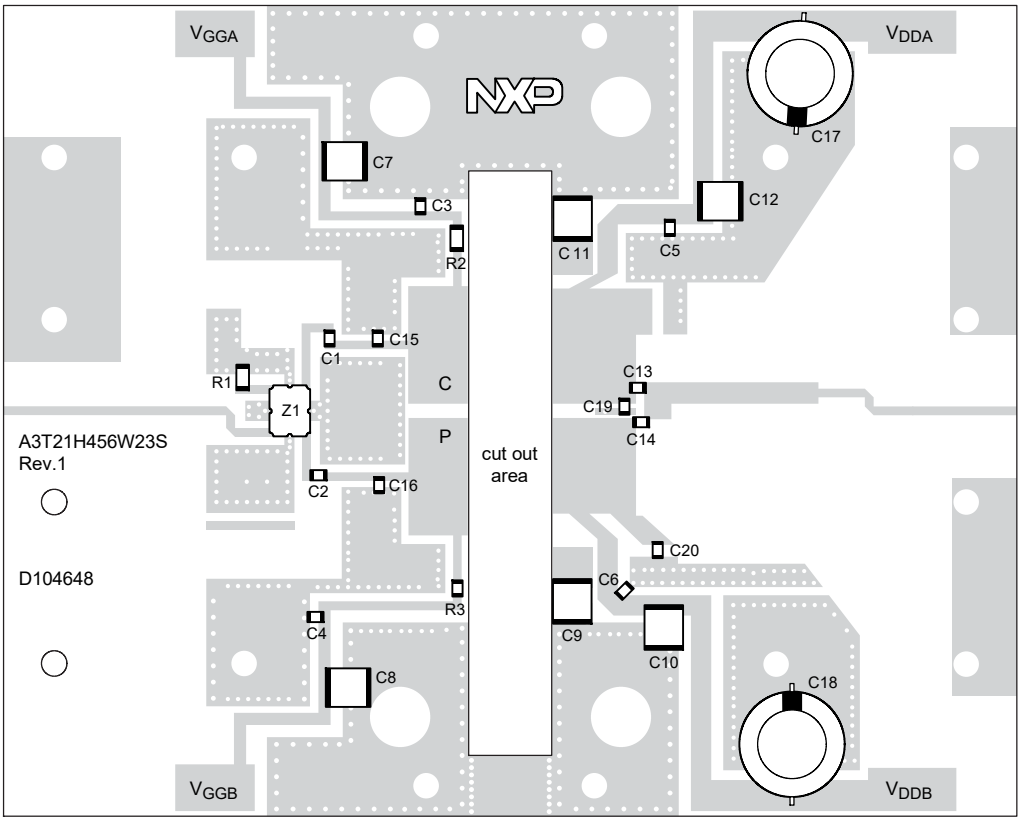
Table 4. Electrical Characteristics (T_A = 25°C unless otherwise noted) **(continued)**

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} = 800 mA, V_{GSB} = 0.35 Vdc, P_{out} = 87 W Avg., f = 2110 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}	13.8	14.8	16.8	dB
Drain Efficiency	η_D	46.0	49.5	—	%
P_{out} @ 3 dB Compression Point, CW	P3dB	55.9	56.8	—	dBm
Adjacent Channel Power Ratio	ACPR	—	–30.3	–27.5	dBc
Load Mismatch (3) (In NXP Doherty Test Fixture, 50 ohm system) I_{DQA} = 800 mA, V_{GSB} = 0.35 Vdc, f = 2140 MHz, 12 μsec(on), 10% Duty Cycle					
VSWR 10:1 at 32 Vdc, 550 W Pulsed CW Output Power (3 dB Input Overdrive from 389 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} = 800 mA, V_{GSB} = 0.35 Vdc, 2110–2200 MHz Bandwidth					
P_{out} @ 3 dB Compression Point (4)	P3dB	—	562	—	W
AM/PM (Maximum value measured at the P3dB compression point across the 2110–2200 MHz bandwidth)	Φ	—	–20	—	°
VBW Resonance Point (IMD Third Order Intermodulation Inflection Point)	VBW_{res}	—	210	—	MHz
Gain Flatness in 90 MHz Bandwidth @ P_{out} = 87 W Avg.	G_F	—	0.2	—	dB
Gain Variation over Temperature (–30°C to +85°C)	ΔG	—	0.005	—	dB/°C
Output Power Variation over Temperature (–30°C to +85°C)	ΔP1dB	—	0.004	—	dB/°C

Table 5. Ordering Information

Device	Tape and Reel Information	Package
A3T21H456W23SR6	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.



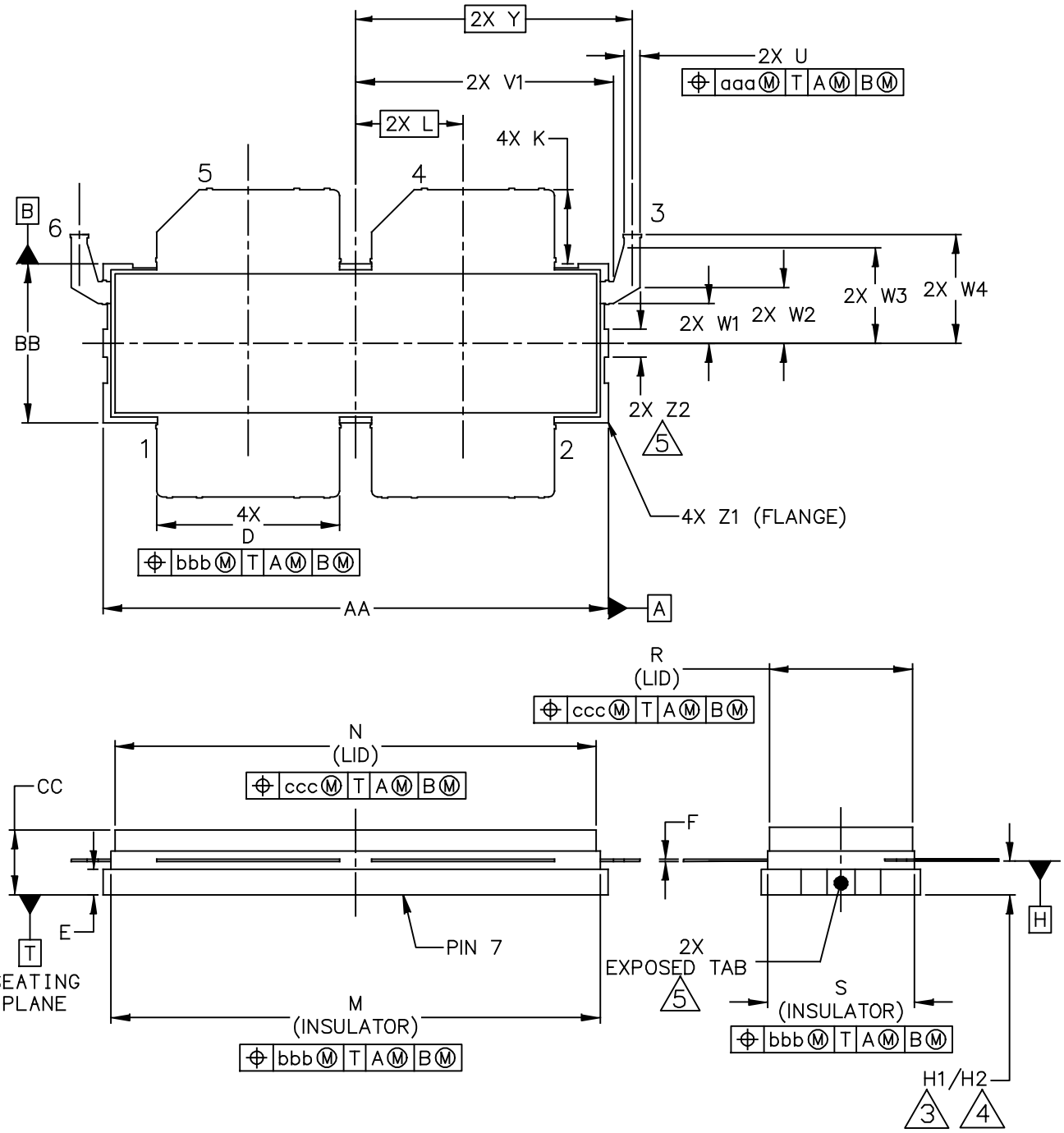
Note: V_{DDA} and V_{DDB} must be tied together and powered by a single DC power supply. aaa-030170

Figure 2. A3T21H456W23SR6 Test Circuit Component Layout

Table 6. A3T21H456W23SR6 Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C2, C3, C4, C5, C6, C14	15 pF Chip Capacitor	ATC600F150FW250XT	ATC
C7, C8, C9, C10, C11, C12	10 μF Chip Capacitor	C5750X7S2A106M230KB	TDK
C13	5.1 pF Chip Capacitor	ATC600F5R1BW250XT	ATC
C15	0.6 pF Chip Capacitor	ATC600F0R6BW250XT	ATC
C16	1.0 pF Chip Capacitor	ATC600F1R0BW250XT	ATC
C17, C18	220 μF, 50 V Electrolytic Capacitor	227CKS050M	Illinois Capacitor
C19	2.2 pF Chip Capacitor	ATC600F2R2BW250XT	ATC
C20	0.3 pF Chip Capacitor	ATC600F0R4BW250XT	ATC
R1	50 Ω, 8 W Termination Chip Resistor	S1206N	RN2 Technologies
R2, R3	6.8 Ω, 1/4 W Chip Resistor	CRCW12066R80FKEA	Vishay
Z1	2000–2300 MHz Band, 90°, 2 dB Asymmetric Coupler	CMX21Q02	RN2 Technologies
PCB	Rogers RO4350B, 0.020″, ε_r = 3.66	D104848	MTL

PACKAGE DIMENSIONS



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	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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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	May 2018	• Initial release of data sheet
1	Aug. 2018	• Functional Tests table: changed P3dB min value from 55.5 dBm to 55.9 dBm to reflect current production data, p. 3

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