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Rev. 0, 07/2019

RF Power LDMOS Transistor

N–Channel Enhancement–Mode Lateral MOSFET

This 56 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 1805 to 1880 MHz.

1800 MHz

- Typical Doherty Single–Carrier W–CDMA Performance: V_{DD} = 30 Vdc, I_{DQA} = 350 mA, V_{GSB} = 0.3 Vdc, P_{out} = 56 W Avg., Input Signal PAR = 9.9 dB @ 0.01% Probability on CCDF.

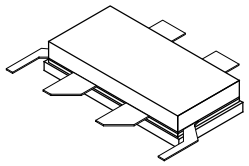
Frequency	G_{ps} (dB)	η_D (%)	Output PAR (dB)	ACPR (dBc)
1805 MHz	15.3	50.9	7.5	–34.5
1840 MHz	15.4	50.9	7.5	–35.3
1880 MHz	15.2	50.9	7.4	–35.9

Features

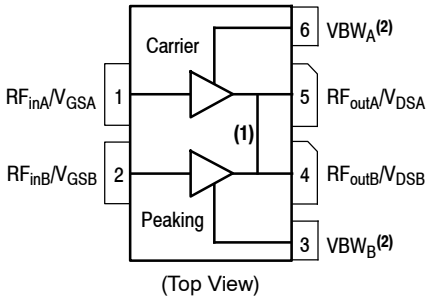
- Advanced high performance in–package Doherty
- Designed for wide instantaneous bandwidth applications
- Greater negative gate–source voltage range for improved Class C operation
- Able to withstand extremely high output VSWR and broadband operating conditions
- Designed for digital predistortion error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

A3T18H408W24S

1805–1880 MHz, 56 W AVG., 30 V AIRFAST RF POWER LDMOS TRANSISTOR



NI–780S–4L2L



(Top View)

Figure 1. Pin Connections

1. Pin connections 4 and 5 are DC coupled and RF independent.
2. Device cannot operate with V_{DD} current supplied through pin 3 and pin 6.

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

Table 2. Thermal Characteristics

Characteristic	Symbol	Value (2,3)	Unit
Thermal Resistance, Junction to Case Case Temperature 25°C, 56 W Avg., W-CDMA, 30 Vdc, I_{DQA} = 350 mA, V_{GSB} = 0.3 Vdc, 1840 MHz	$R_{\theta JC}$	0.45	°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 = 100 μAdc)	$V_{GS(th)}$	1.3	1.9	2.3	Vdc
Gate Quiescent Voltage (V_{DD} = 30 Vdc, I_{DA} = 350 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 Adc)	$V_{DS(on)}$	0.05	0.2	0.3	Vdc
On Characteristics — Side B, Peaking					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 180 μAdc)	$V_{GS(th)}$	0.7	1.3	1.7	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 1.8 Adc)	$V_{DS(on)}$	0.05	0.2	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)

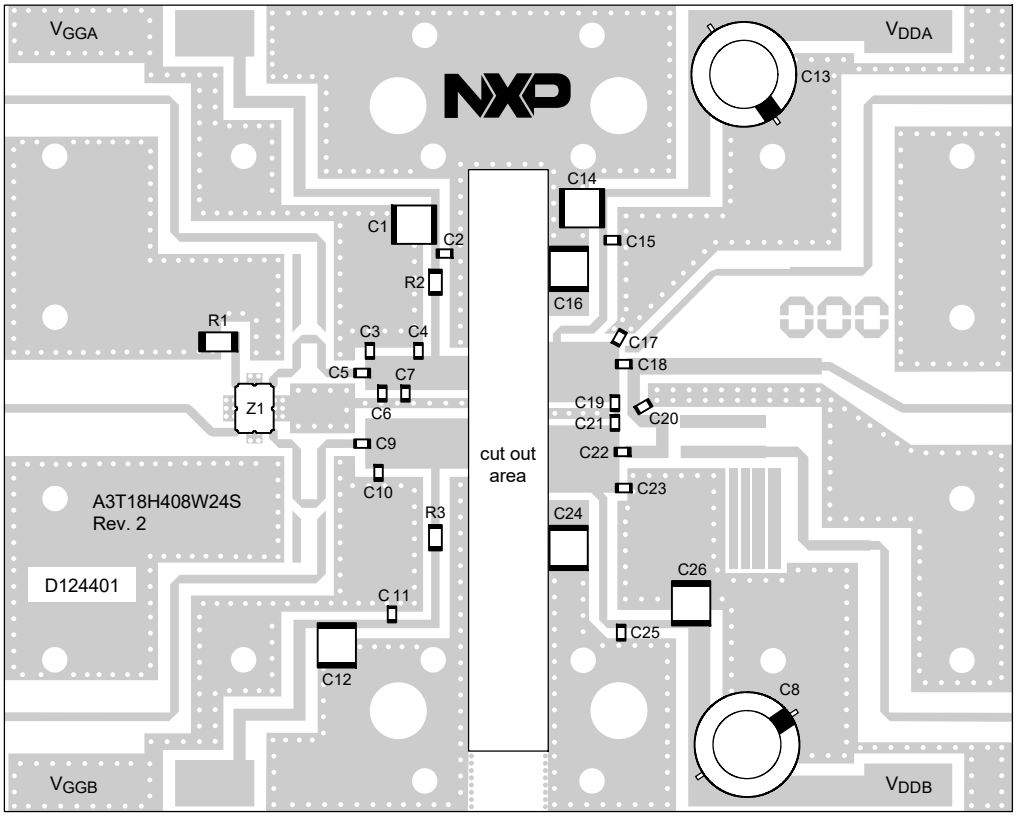
Table 4. Electrical Characteristics (T_A = 25°C unless otherwise noted) **(continued)**

Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests (1,2) (In NXP Doherty Production Test Fixture, 50 ohm system) V_{DD} = 30 Vdc, I_{DQA} = 350 mA, V_{GSB} = 0.3 Vdc, P_{out} = 56 W Avg., f = 1880 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}	14.3	15.2	17.3	dB
Drain Efficiency	η_D	46.5	50.9	—	%
P_{out} @ 3 dB Compression Point, CW	P3dB	52.8	54.9	—	dBm
Adjacent Channel Power Ratio	ACPR	—	–35.9	–29.0	dBc
Wideband Ruggedness (In NXP Doherty Production Test Fixture, 50 ohm system) I_{DQA} = 350 mA, V_{GSB} = 0.3 Vdc, f = 1840 MHz, Additive White Gaussian Noise (AWGN) with 10 dB PAR					
ISBW of 350 MHz at 32 Vdc, 186 W Avg. Modulated Output Power (8 dB Input Overdrive from 56 W Avg. Modulated Output Power)	No Device Degradation				
Typical Performance (In NXP Doherty Production Test Fixture, 50 ohm system) V_{DD} = 30 Vdc, I_{DQA} = 350 mA, V_{GSB} = 0.3 Vdc, 1805–1880 MHz Bandwidth					
P_{out} @ 3 dB Compression Point (3)	P3dB	—	350	—	W
AM/PM (Maximum value measured at the P3dB compression point across the 1805–1880 MHz bandwidth)	Φ	—	–15	—	°
VBW Resonance Point (IMD Third Order Intermodulation Inflection Point)	VBW_{res}	—	90	—	MHz
Gain Flatness in 75 MHz Bandwidth @ P_{out} = 56 W Avg.	G_F	—	0.2	—	dB
Gain Variation over Temperature (–40°C to +85°C)	ΔG	—	0.006	—	dB/°C
Output Power Variation over Temperature (–40°C to +85°C)	ΔP1dB	—	0.013	—	dB/°C

Table 5. Ordering Information

Device	Tape and Reel Information	Package
A3T18H408W24SR3	R3 Suffix = 250 Units, 44 mm Tape Width, 13-inch Reel	NI-780S-4L2L

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. 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.



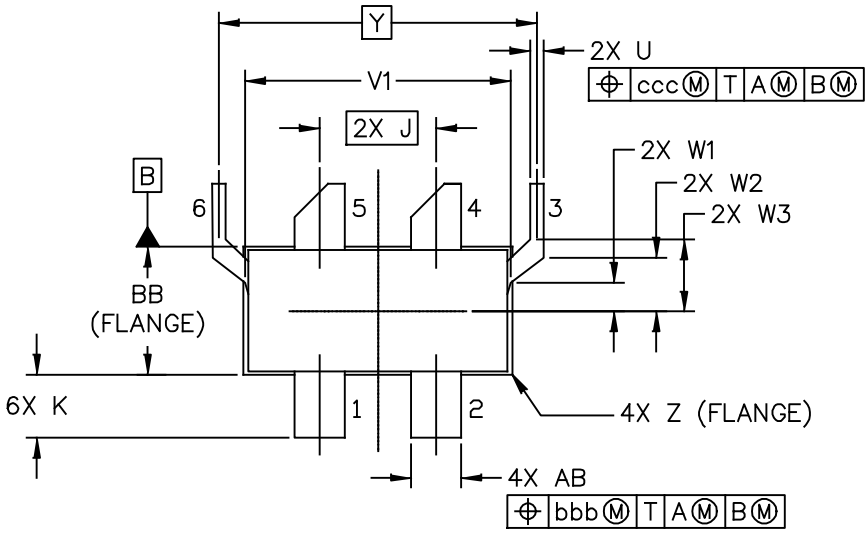
Note: V_{DDA} and V_{DDB} must be tied together and powered by a single DC power supply. aaa-034666

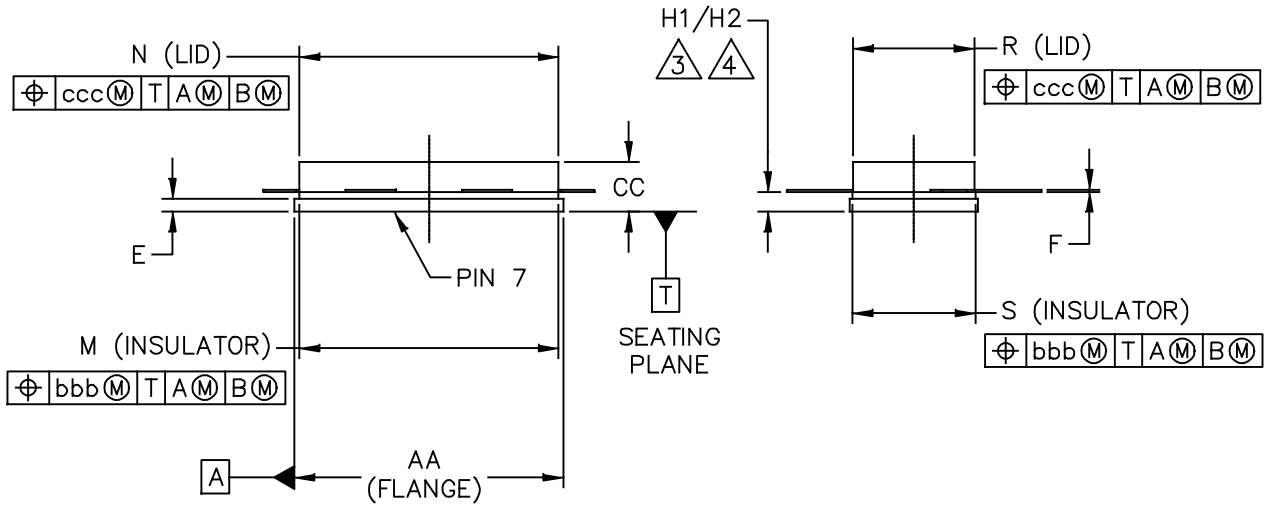
Figure 2. A3T18H408W24S Production Test Circuit Component Layout

Table 6. A3T18H408W24S Production Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1, C12, C14, C16, C24, C26	10 μF Chip Capacitor	C5750X7S2A106M230KB	TDK
C2, C5, C9, C11, C15, C22, C25	20 pF Chip Capacitor	600F200JT250XT	ATC
C3	0.8 pF Chip Capacitor	600F0R8BT250XT	ATC
C4, C21	1.2 pF Chip Capacitor	600F1R2BT250XT	ATC
C6, C7, C10	0.2 pF Chip Capacitor	600F0R2BT250XT	ATC
C8, C13	220 μF, 100 V Electrolytic Capacitor	MCGPR100V227M16X26	Multicomp
C17, C20	0.4 pF Chip Capacitor	600F0R4BT250XT	ATC
C18	8.2 pF Chip Capacitor	600F8R2BT250XT	ATC
C19	2.4 pF Chip Capacitor	600F2R4BT250XT	ATC
C23	0.5 pF Chip Capacitor	600F0R5BT250XT	ATC
R1	50 Ω, 10 W Termination Chip Resistor	C10A50Z4	Anaren
R2, R3	3.3 Ω, 1/4 W Chip Resistor	CRCW12063R30JNEA	Vishay
Z1	1700–2000 MHz Band, 90°, 2 dB Asymmetric Coupler	CMX19Q02	RN2
PCB	Rogers RO4350B, 0.020″, ε_r = 3.66	D124401	MTL

PACKAGE DIMENSIONS





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	STANDARD: NON-JEDEC	
	SOT1799-3	18 FEB 2016

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. H1 APPLIES TO PINS 1, 2, 4 & 5. H2 APPLIES TO PINS 3 & 6.
4. TOLERANCE OF DIMENSION H2 IS TENTATIVE.

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	.080	.090	2.03	2.29
H1	.057	.067	1.45	1.70	W2	.155	.165	3.94	4.19
H2	.054	.070	1.37	1.78	W3	.210	.220	5.33	5.59
J	.350 BSC		8.89 BSC		Y	.956 BSC		24.28 BSC	
K	.170	.210	4.32	5.33	Z	R.000	R.040	R0.00	R1.02
M	.774	.786	19.66	19.96	AB	.145	.155	3.68	3.94
N	.772	.788	19.61	20.02	aaa	.005		0.13	
					bbb	.010		0.25	
					ccc	.015		0.38	

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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

- 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 2019	• Initial release of data sheet

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