

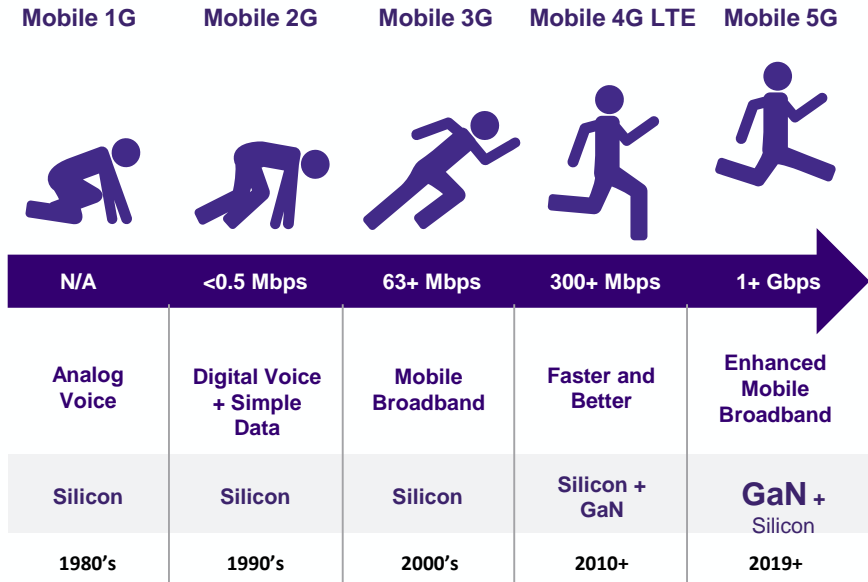


RF Power Amplifier Portfolio for 5G Cellular Base Station Applications



GaN RF – Enabling Faster 4G and the Transition to 5G

Mobile Generation Data Rates



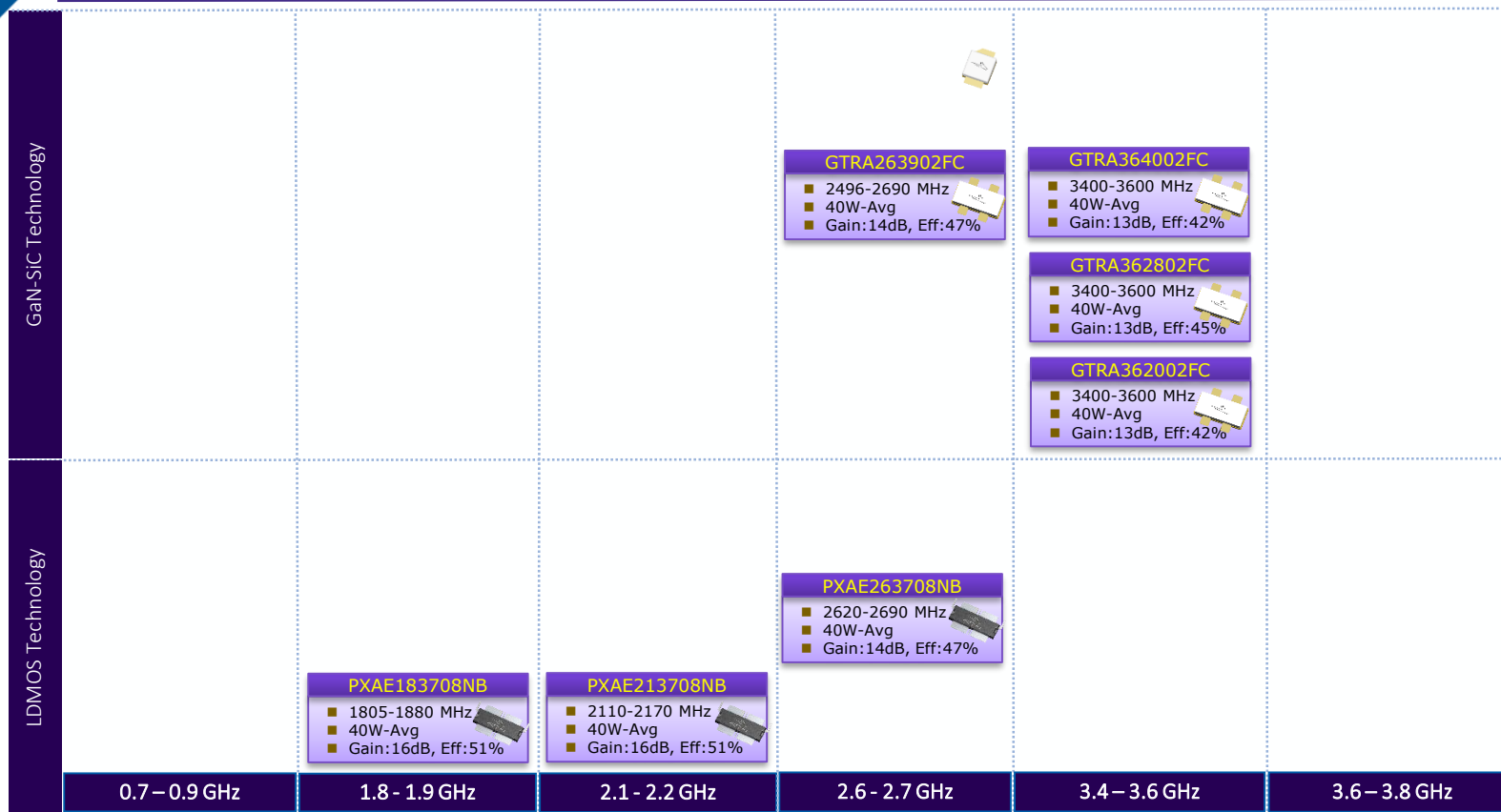
Expected Worldwide 5G Rollout Plan

Location	Freq Band	5G Rollout
China	2.6GHz, 3.5GHz, 4.9GHz	2019
U.S.A	600MHz, 2.5GHz, 28GHz, 39GHz	2019
S.Korea	3.5GHz, 28GHz	2018
Japan	4.0GHz, 28GHz	2019
Middle East	3.5GHz, 3.7GHz	2020
European	3.7GHz, C-Band, 73GHz	2020

Wolfspeed overall advantages

- Deep domain expertise in SiC, GaN-on-SiC, LDMOS and cellular applications
- Fully vertically integrated – from substrate, wafer fab to packaged RF transistors
- Wide portfolio offering
 - Both GaN-on-SiC and LDMOS technology-based product solutions
 - Both high performance open cavity ceramic package and cost effective overmold plastic package
- Global team to provide local support to our customers in Europe, Asia and North America
- Simulation tools and reference designs to enable our customers to achieve fast time-to-market
- Secure long-term material supply
- State of the art automated production facility
- Continuous yield improvement and reducing lead-times and cost

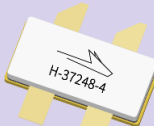
RF Power Transistor Portfolio to Enable 5G Networks



LDMOS RF Power Transistors

Device ID	PXAE183708NB	PXAE213708NB	PXAE263708NB
Freq (MHz)	1805-1880	2110-2170	2620-2690
Vds (V)	28	28	28
Pout-Peak (W)	420	400	420
Pout-Avg (W)	55	55	55
PAR (dB)	8.8	8.8	8.5
Eff (%)	51.5	51	49.5
Gain (dB)	16	16	15
Device & Circuit Sample	✓	✓	✓
Package			

GaN-SiC RF Power Transistors

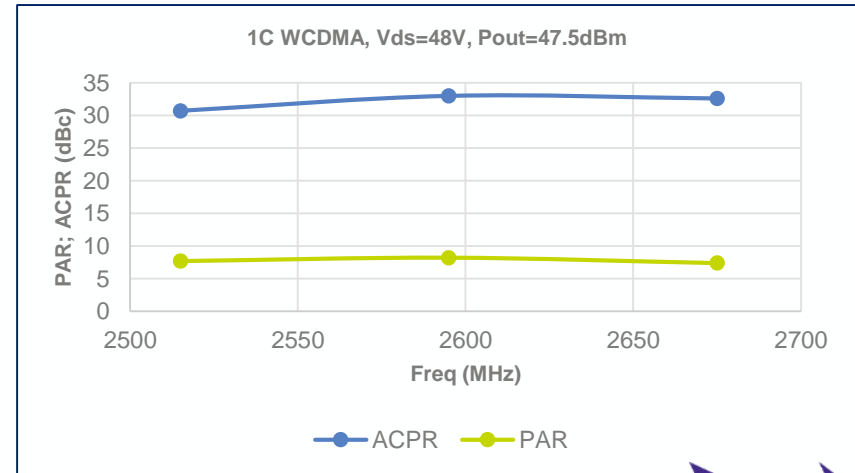
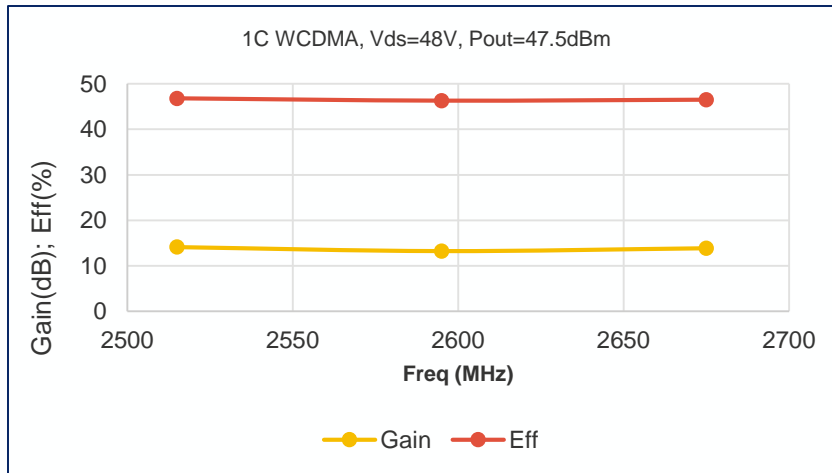
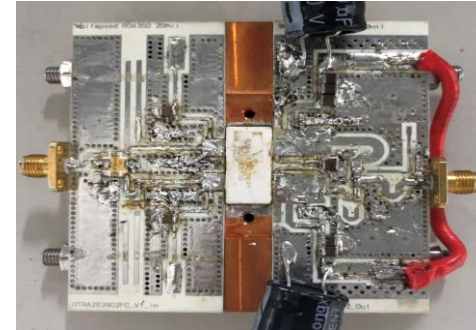
Device ID	GTRA362002FC	GTRA362802FC	GTRA364002FC	GTRA263902FC
Freq (MHz)	3400 - 3600	3400 – 3600	3400 – 3600	2496 - 2690
Vds (V)	48	48	48	48
Pout-Peak(W)	190	240	450	370
Pout-Avg (W)	30	45	50	56
PAR (dB)	7.5	6.5	9	7.5
Eff (%)	49	48	42	47
Gain (dB)	13.5	13	13.5	14
Device & Circuit Sample	✓	✓	✓	✓
Package				

Optimized Doherty Performance using signal conditions, WCDMA, 1Channel, 10dB PAR

GTRA263902FC: 2515 – 2675 MHz, 48V GaN-SiC

Features

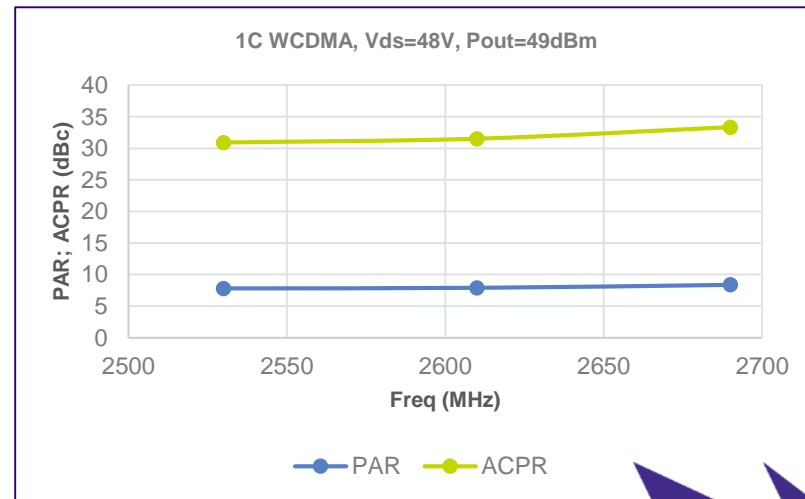
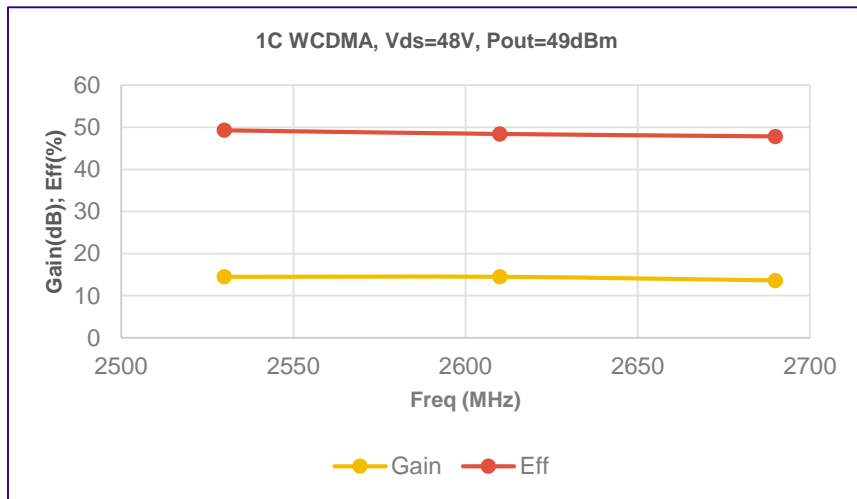
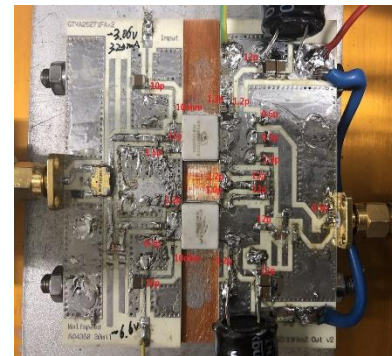
- Thermally Enhanced Ceramic Package
- 2515 - 2675 MHz Broadband Operation
- 40W Average Power
- 47% Broadband Efficiency
- 14dB Minimum Broadband Gain
- 10:1 VSWR Rated @ 40W W-CDMA
- Device and Circuit Samples Available
- Production Released



2xGTVA262701FA: 2515 – 2675 MHz, 48V GaN-SiC

Features

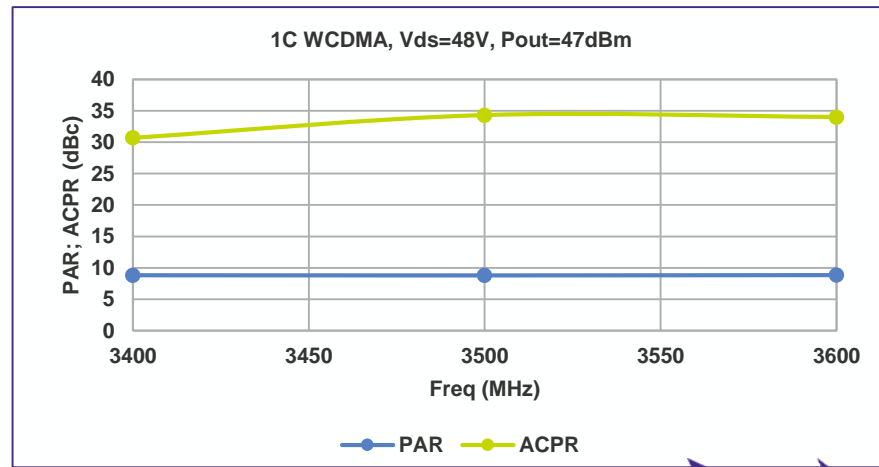
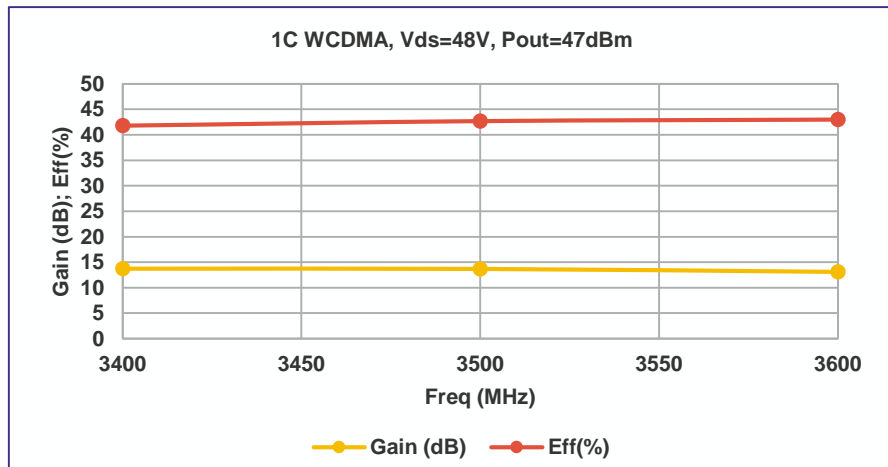
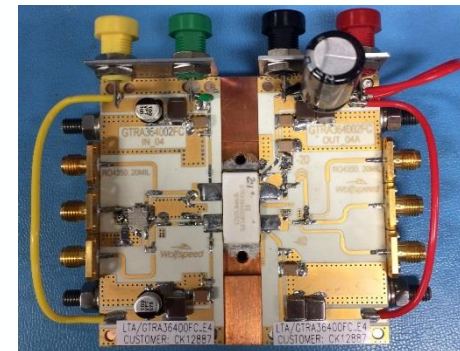
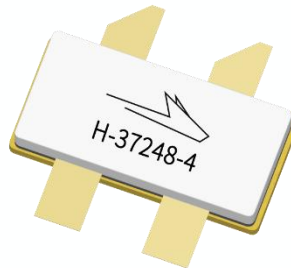
- Thermally Enhanced Ceramic Package
- 2515 - 2675 MHz Broadband Operation
- 80W Average Power
- 48% Broadband Efficiency
- 13.6dB Minimum Broadband Gain
- 10:1 VSWR Rated @ 80W W-CDMA
- Device and Circuit Samples Available
- Production Released



GTRA364002FC: 3400 – 3600 MHz, 48V GaN-SiC

Features

- Thermally Enhanced Ceramic Package
- 3400 - 3600 MHz Broadband Operation
- 50W Average Power
- 42% Broadband Efficiency
- 13.5dB Minimum Broadband Gain
- 10:1 VSWR Rated @ 50W W-CDMA
- Device and Circuit Samples Available
- Production Released





Additional Product Details

RF Power Product Line

28V LDMOS

- › 4 W to 360 W
- › 450 MHz to 2700 MHz
- › Symmetric & Asymmetric Doherty
- › Optimized for DPD
- › Highest reliability and consistency



50V GaN-SiC

- › High power density
- › High efficiency
- › Optimized designs for cellular systems
- › High power devices for RADAR and commercial Avionics



50V LDMOS

- › 10 W to 1,000 W
- › 500 MHz to 1400 MHz
- › High Power Density
- › Optimized designs for cellular systems
- › High power devices for RADAR applications



28V LDMOS 2-Stage RFICs

- › 20 W, 40 W, 45 W, 2x20 W
- › 700 MHz to 2200 MHz
- › 30 dB Gain
- › >45% Efficiency
- › Plastic overmold packages



LDMOS Discrete Drivers & 2-Stage Amplifiers

< 1GHz


PTVA120121MT LDMOS

- P1dB ~ 12 W
- 500 - 1200 MHz
- 4x4mm DFN
- Vdd = 50V



PTGA090304MD LDMOS

- P1dB~15W+15W
- 575-960 MHz
- 30dB Gain
- Vdd=50V



PTVA120252MT LDMOS

- P1dB ~ 25 W
- 500 - 1200 MHz
- 4x6mm DFN
- Vdd=50V



> 1GHz


PTFC270051M LDMOS

- P1dB ~ 7 W
- 900 - 2700 MHz
- 4x4mm DFN




PTMC210124MD LDMOS

- P1dB ~ 6+6W
- 1800-2200MHz
- Vdd=28V



PTNC210604MD LDMOS

- Asymmetric Design
- P1dB~20+40W
- 1800-2200MHz
- Vdd=28V




PTFC270101M LDMOS

- P1dB ~ 10 W
- 900 - 2700 MHz
- 4x4mm DFN




PTMC210204MD LDMOS

- P1dB ~ 10+10W
- 1800-2200MHz
- Vdd=28V



PTMC210404MD LDMOS

- P1dB ~ 20+20W
- 1800-2200MHz
- Vdd=28V

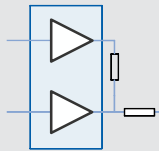


<1 GHz Solutions

LDMOS & GaN

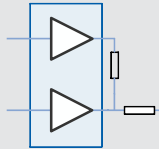

<1GHz Solutions – LDMOS & GaN

720-821 MHz




PTRA082808NF LDMOS

- 790-820 MHz
- Pavg: 47.5 dBm
- 50% DHT Eff
- 54.8dBm P_{3dB}, 16dB Gain

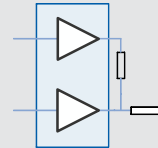


PTRA084308NB LDMOS

- 720-803 MHz
- P1dB~480W
- >53% DHT Eff
- 48.1 dBm, 19 dB Gain




850-960 MHz



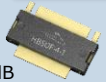
PTRA093302FC LDMOS

- P1dB~190+260W
- 925-960 MHz
- > 51% DHT Eff
- 49 dBm, Gain: 17dB



PTVA082407NF LDMOS

- P1dB~240W
- 746-821MHz
- >39% Eff
- 49 dBm, Gain: 22dB



PTVA092407NF LDMOS

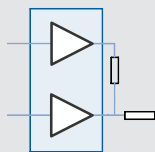
- P1dB~240W
- 869-960 MHz
- >40% Eff
- 49 dBm, Gain: 22dB



40W

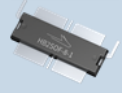
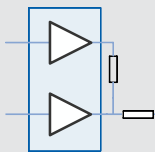
60W & 80W Solutions - <1GHz Output Stages

720-821 MHz



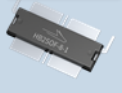
PTRA083818NF LDMOS

- 733-805 MHz
- 49.1 dBm avg.
- 56% DHT eff
- 18 dB Gain

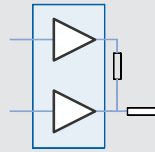



PTRA084808NF LDMOS

- 703-821 MHz
- 49.4 dBm avg
- 55% DHT Eff
- 18 dB Gain


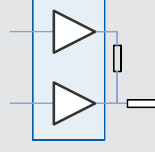


850-960 MHz



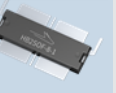
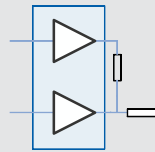
PTRA094252FC LDMOS

- P1dB~190+260W
- 925-960 MHz
- 52% DHT eff
- Gain: 18.5dB

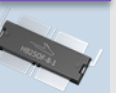
PTRA093818NF LDMOS

- 920-960 MHz
- 49.1 dBm avg
- 52% DHT eff
- 17 dB Gain

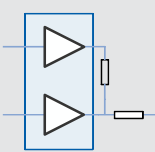
PTRA094808NF LDMOS

- 859-960 MHz
- 49.4 dBm
- 52% DHT eff
- 17 dB Gain



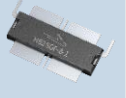
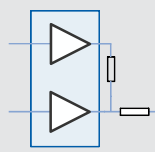
60W

80W



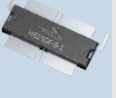
PTRA087008NB LDMOS

- 729-960 MHz
- 50.3 dBm avg
- 51% DHT eff
- 19 dB Gain

PTRA097008NB LDMOS

- 920-960 MHz
- 49.5 dBm avg
- 51% DHT eff
- 18 dB Gain



1800-2200 MHz Solutions

LDMOS & GaN

1800–2200 MHz – LDMOS & GaN

40W

1805-1880 MHz



PXAE183708NB LDMOS

- 1805-1880 MHz
- 47.3 dBm avg
- 51% DHT eff
- P3dB: 56.2dBm



2110-2200 MHz



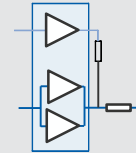
PXAE213708NB LDMOS

- 2110-2180 MHz
- 47.3 dBm avg
- 50% DHT eff
- P3dB: 55.9dBm




60W

2110-2200 MHz



GTVA212701FA GaN

- P3dB ~270W
- 2110-2200 MHz
- >38% Eff
- 47.5dBm, 19dB Gain

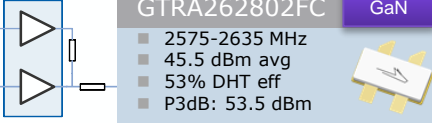


2300-2700 MHz Solutions

LDMOS & GaN

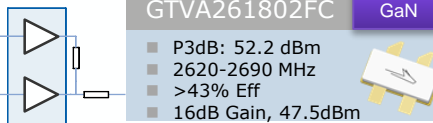
2500-2700 MHz Solutions – LDMOS & GaN

20W
30W



GTRA262802FC GaN

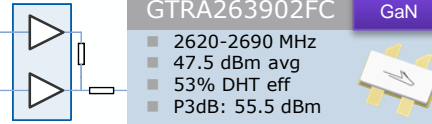
- 2575-2635 MHz
- 45.5 dBm avg
- 53% DHT eff
- P3dB: 53.5 dBm



GTVA261802FC GaN

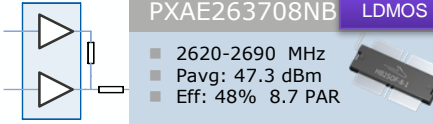
- P3dB: 52.2 dBm
- 2620-2690 MHz
- >43% Eff
- 16dB Gain, 47.5dBm

40W



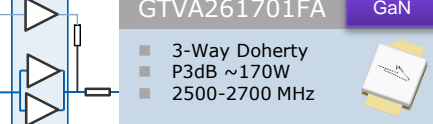
GTRA263902FC GaN

- 2620-2690 MHz
- 47.5 dBm avg
- 53% DHT eff
- P3dB: 55.5 dBm



PXAE263708NB LDMOS

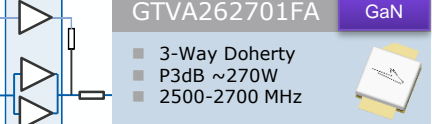
- 2620-2690 MHz
- Pavg: 47.3 dBm
- Eff: 48% 8.7 PAR



GTVA261701FA GaN

- 3-Way Doherty
- P3dB ~170W
- 2500-2700 MHz

80W



GTVA262701FA GaN

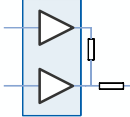
- 3-Way Doherty
- P3dB ~270W
- 2500-2700 MHz

> 3GHz Macro Solutions

GaN

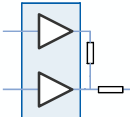

3400-3800 MHz - GaN

20W
30W




GTRA362002FC GaN

- 85+115W
- 3400-3600 MHz
- 49% DHT Eff
- 13.5dB Gain

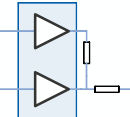


GTRA362802FC GaN

- 115+170W
- 3400-3600 MHz
- 48% DHT Eff
- 13dB Gain

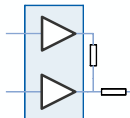



40W



GTRA364002FC GaN

- 170+230W
- 3400-3600 MHz
- 42% DHT Eff
- 13.5dB Gain



GTRA374902FC GaN

- 170+280W
- 3600-3700 MHz
- 42% DHT Eff
- 12.3dB Gain

