# Eudyna GaN-HEMT 180W

# EGN21A180IV

*Preliminary*

***High Voltage - High Power GaN-HEMT***

## FEATURES

- High Voltage Operation : $V_{DS}$=50V
- High Gain: 15dB(typ.) at $P_{out}$=45dBm(Avg.)
- High Efficiency: 32%(typ.) at $P_{out}$=45dBm(Avg.)
- Broad Frequency Range : 2100 to 2200MHz
- Proven Reliability


## DESCRIPTION

The EGN21A180IV is a 180 Watt GaN-HEMT that offers high efficiency, high gain, ease of matching, greater consistency and broad bandwidth for high power L-band amplifiers with 50V operation. This device is targeted for high voltage, low current operation in digitally modulated base station applications - ideally suited for W-CDMA base station amplifiers and other HPA designs while offering ease of use.

## ABSOLUTE MAXIMUM RATINGS

| Item | Symbol | Condition | Rating | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | | 120 | V |
| Gate-Source Voltage | $V_{GS}$ | $T_c$=25°C | -5 | V |
| Total Power Dissipation | $P_t$ | | 321 | W |
| Storage Temperature | $T_{stg}$ | | -65 to +175 | °C |
| Channel Temperature | $T_{ch}$ | | 250 | °C |

## RECOMMENDED OPERATING CONDITION(Case Temperature Tc= 25°C)

| Item | Symbol | Condition | Limit | Unit |
|---|---|---|---|---|
| DC Input Voltage | $V_{DS}$ | | 50 | V |
| Forward Gate Current | $I_{GF}$ | $R_G$=2 Ω | <38.8 | mA |
| Reverse Gate Current | $I_{GR}$ | $R_G$=2 Ω | >-14.4 | mA |
| Channel Temperature | $T_{ch}$ | | 200 | °C |

## ELECTRICAL CHARACTERISTICS (Case Temperature Tc=25°C)

| Item | Symbol | Condition | Limit | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Pinch-Off Voltage | $V_p$ | $V_{DS}$=50V $I_{DS}$=72mA | -1.0 | -2.0 | -3.5 | V |
| Gate-Drain Breakdown Voltage | $V_{GDO}$ | $I_{GS}$=- 36 mA | - | -350 | - | V |
| 3rd Order Inter modulation Distortion | $IM_3$ | $V_{DS}$=50V | - | -32 | - | dBc |
| Power Gain | $G_p$ | $I_{DS(DC)}$=1.0A | 14.0 | 15.0 | - | dB |
| Drain Efficiency | $\eta_d$ | $P_{out}$=45dBm(Avg.) Note 1 | - | 32 | - | % |
| Thermal Resistance | $R_{th}$ | Channel to Case | - | 0.55 | 0.7 | °C/W |

Note 1 : IM3 and Gain test condition as follows:
IM3 & Gain : fo=2.135GHz, f1=2.145GHz W-CDMA(3GPP3.4 12-00) BS-1 64ch 67% clipping modulation(Peak/Avg. = 8.5dB@0.01% Probability(CCDF)) measured over 3.84MHz at fo-10MHz and fl+10MHz.

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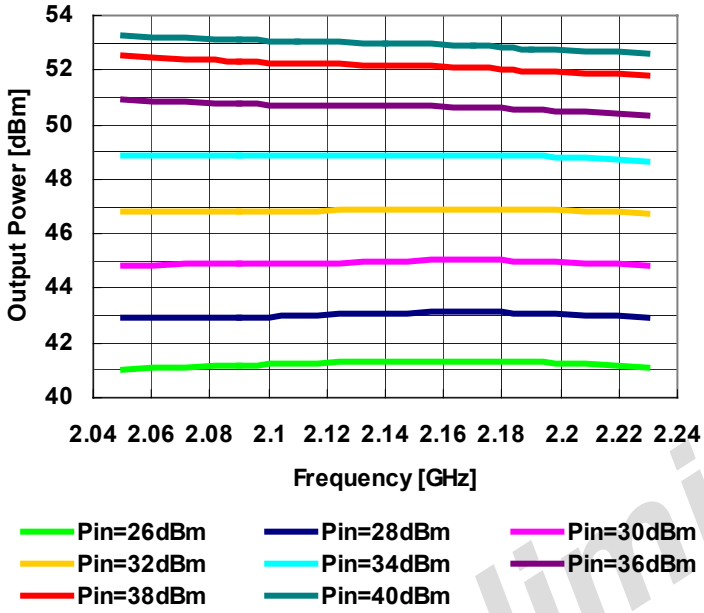
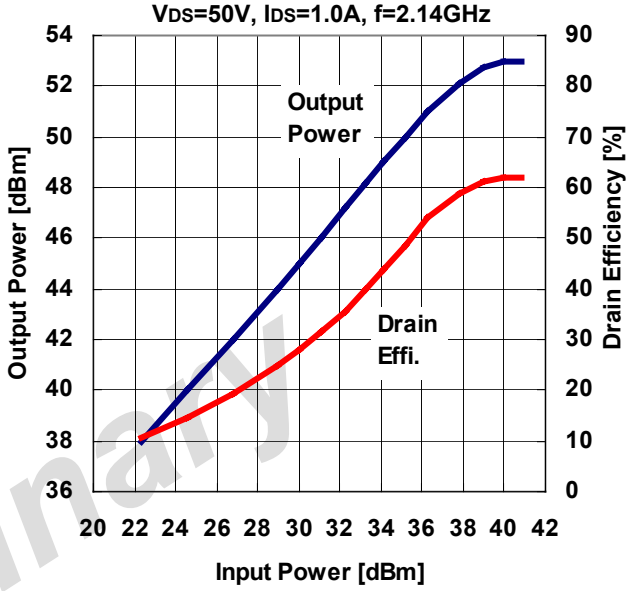
***High Voltage - High Power GaN-HEMT***

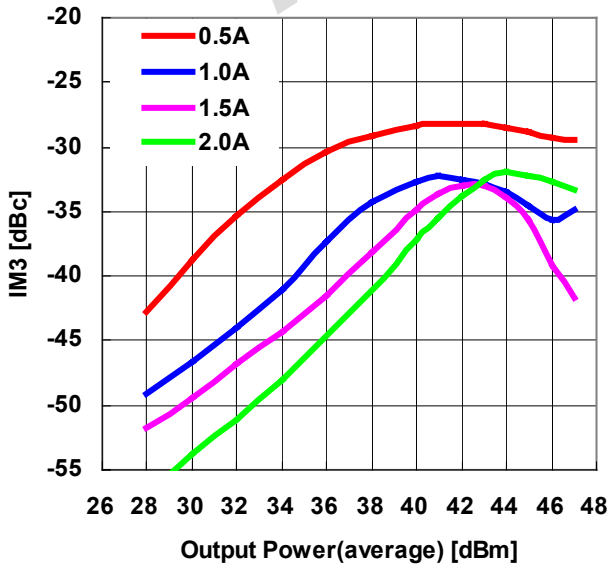
**Output Power vs. Frequency**
**$V_{DS}$=50V, $I_{DS}$=1.0A**



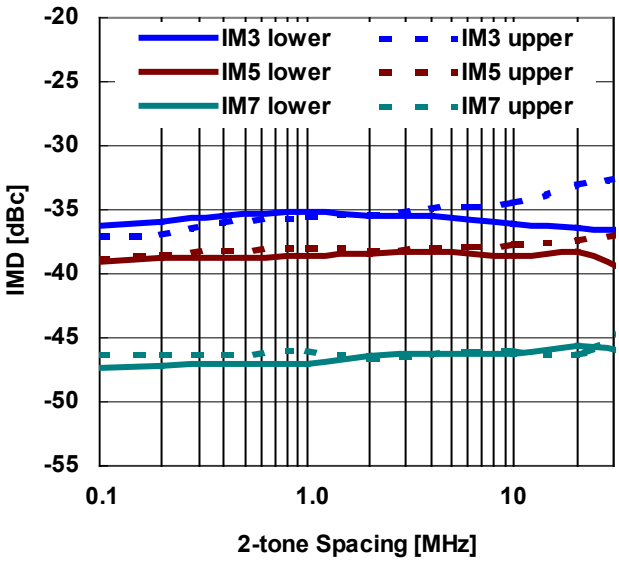

**Output Power and Drain Efficiency vs. Input Power**
**$V_{DS}$=50V, $I_{DS}$=1.0A, f=2.14GHz**



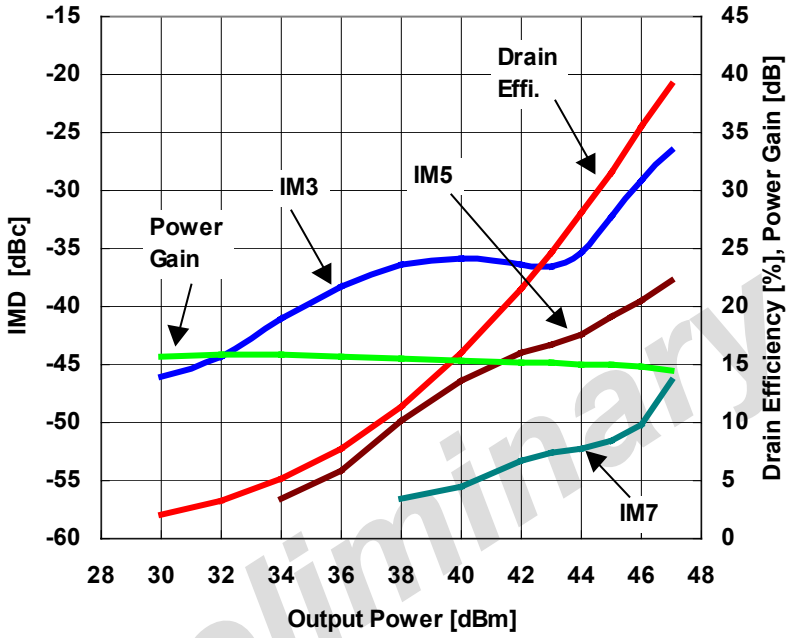

**2-tone IMD vs. Output Power**
**$V_{DS}$=50V, $f_1$=2.135GHz, $f_2$=2.145GHz, 10MHz Spacing**




**2-tone IMD vs. Tone Spacing, $V_{DS}$=50V, $I_{DS}$=1.0A**
**$P_{out}$=45dBm(average) Center Frequency=2.14GHz**

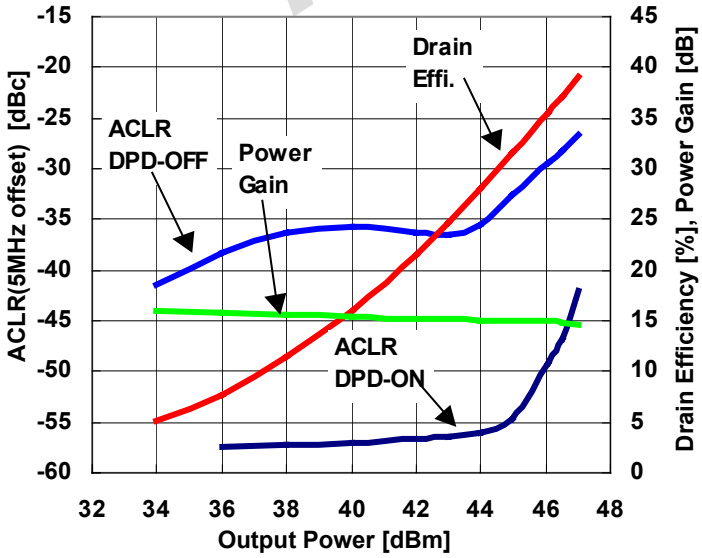


**2-Carrier IMD, Drain Efficiency and Power Gain vs. Output Power**
**$V_{DS}$=50V, $I_{DS}$=1.0A, $f_1$=2.135GHz, $f_2$=2.145GHz(10MHz Spacing)**
**Peak/Avg. = 8.5dB@0.01% Probability(CCDF)**

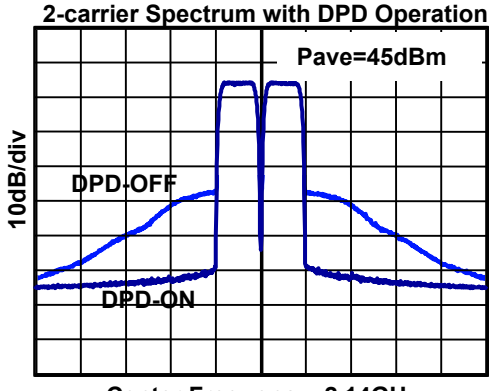





**2-Carrier ACLR, Drain Efficiency and Power Gain vs. Output Power with DPD Operation (note**
**$V_{DS}$=50V, $I_{DS}$=1.0A**
**$f_1$=2.1375GHz, $f_2$=2.1425GHz(5MHz Spacing)**
**Peak/Avg. = 6.5dB@0.01% Probability(CCDF);**
**Single Carrier Signal**
**Note) Digital Predistortion evaluation test system:**
**PMC-Sierra PALADIN-15 DPD chip-set**




**2-carrier Spectrum with DPD Operation**

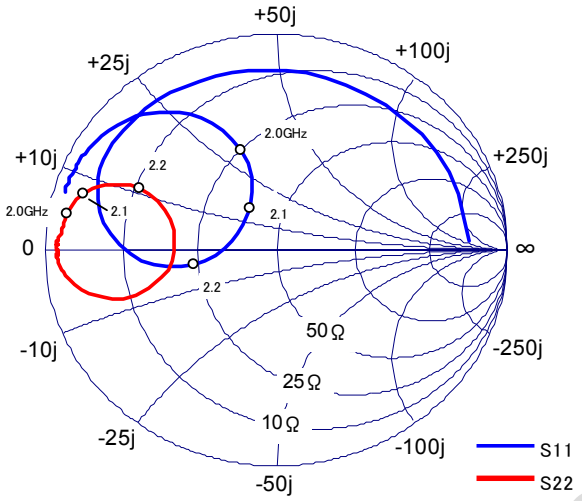


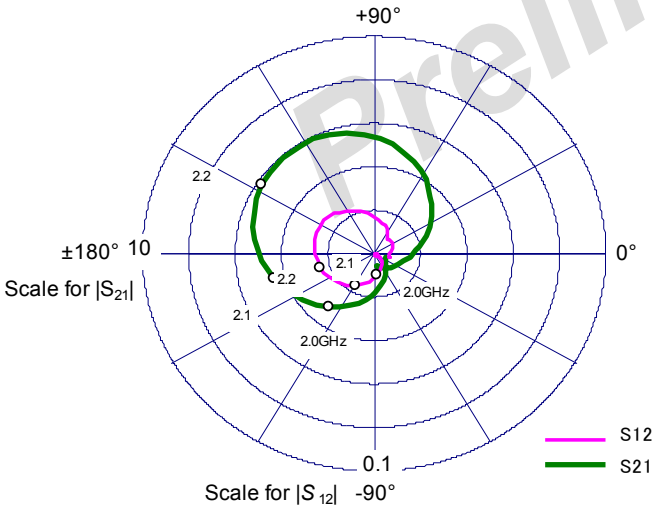

**Center Frequency=2.14GHz**
**5MHz/div**

# EGN21A180IV

## *High Voltage - High Power GaN-HEMT*

**S-Parameters @$V_{DS}$=50V, $I_{DS}$=1.0A, f=1 to 3 GHz,**
**$Z_l = Z_s$ = 50 ohm**




| Freq | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| [GHz] | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 1.00 | 0.950 | 163.5 | 0.506 | -14.4 | 0.001 | -37.4 | 0.940 | -178.3 |
| 1.10 | 0.950 | 161.1 | 0.495 | -19.4 | 0.001 | -8.8 | 0.943 | -179.3 |
| 1.20 | 0.951 | 158.1 | 0.507 | -24.5 | 0.001 | -19.5 | 0.944 | 179.9 |
| 1.30 | 0.950 | 155.2 | 0.539 | -30.1 | 0.001 | -53.7 | 0.945 | 178.7 |
| 1.40 | 0.941 | 151.7 | 0.598 | -36.8 | 0.001 | -40.4 | 0.947 | 178.0 |
| 1.50 | 0.930 | 147.6 | 0.696 | -43.7 | 0.001 | -17.3 | 0.943 | 177.1 |
| 1.60 | 0.908 | 142.4 | 0.849 | -52.7 | 0.001 | -32.0 | 0.941 | 176.2 |
| 1.70 | 0.876 | 136.3 | 1.102 | -64.1 | 0.002 | -34.4 | 0.931 | 175.2 |
| 1.80 | 0.814 | 128.2 | 1.508 | -79.2 | 0.004 | -38.3 | 0.933 | 173.8 |
| 1.90 | 0.694 | 118.0 | 2.156 | -99.7 | 0.006 | -57.1 | 0.925 | 172.4 |
| 2.00 | 0.489 | 108.2 | 3.135 | -128.0 | 0.010 | -81.7 | 0.916 | 169.3 |
| 2.10 | 0.224 | 121.0 | 4.441 | -164.8 | 0.017 | -118.2 | 0.872 | 162.4 |
| 2.11 | 0.204 | 127.2 | 4.579 | -169.0 | 0.017 | -122.3 | 0.859 | 161.8 |
| 2.12 | 0.188 | 135.9 | 4.728 | -173.3 | 0.018 | -126.6 | 0.848 | 160.6 |
| 2.13 | 0.180 | 146.1 | 4.881 | -177.6 | 0.019 | -131.0 | 0.829 | 160.0 |
| 2.14 | 0.183 | 156.7 | 5.015 | 177.7 | 0.019 | -135.6 | 0.814 | 158.9 |
| 2.15 | 0.196 | 167.0 | 5.168 | 173.0 | 0.020 | -140.1 | 0.796 | 158.0 |
| 2.16 | 0.215 | 175.5 | 5.305 | 168.0 | 0.022 | -144.4 | 0.777 | 157.1 |
| 2.17 | 0.243 | -178.1 | 5.442 | 163.0 | 0.022 | -150.2 | 0.750 | 156.1 |
| 2.18 | 0.277 | -173.5 | 5.569 | 157.8 | 0.023 | -154.4 | 0.721 | 155.3 |
| 2.19 | 0.318 | -170.9 | 5.692 | 152.3 | 0.024 | -159.1 | 0.690 | 154.9 |
| 2.20 | 0.360 | -169.4 | 5.820 | 146.6 | 0.024 | -164.8 | 0.656 | 154.5 |
| 2.30 | 0.760 | 170.4 | 5.331 | 87.3 | 0.026 | 138.3 | 0.453 | -173.8 |
| 2.40 | 0.861 | 145.0 | 3.406 | 42.4 | 0.019 | 98.7 | 0.699 | -161.4 |
| 2.50 | 0.862 | 126.3 | 2.183 | 14.7 | 0.014 | 75.5 | 0.837 | -166.0 |
| 2.60 | 0.845 | 108.0 | 1.551 | -6.1 | 0.011 | 57.6 | 0.889 | -169.7 |
| 2.70 | 0.831 | 86.9 | 1.180 | -25.0 | 0.010 | 44.1 | 0.920 | -172.7 |
| 2.80 | 0.821 | 62.1 | 0.945 | -43.3 | 0.008 | 21.4 | 0.935 | -175.5 |
| 2.90 | 0.825 | 33.0 | 0.761 | -62.7 | 0.007 | 7.5 | 0.943 | -177.2 |
| 3.00 | 0.836 | 3.1 | 0.597 | -80.7 | 0.007 | -12.2 | 0.949 | -179.1 |