# GaN Hybrid Power Amplifier TG1000-10

## Product Features

- GaN on SiC HEMT
- In/Out 50Ω Impedance Matching
- Surface Mount Hybrid Type
- Small Size & Weight
- High Efficiency
- Low Cost
- Custom design available

## Applications

- Radio System
- TRS(Trunked Radio System)
- RF Sub-Systems
- Base Station


Package Type : NP-18

## Description

The power amplifier module is designed for TETRA (Terrestrial Trunked Radio, formerly known as Trans European Trunked Radio) applications. TETRA networks are already operational in all the traditional PMR market segments, such as Public Safety, Transportation, Utilities, Government, PAMR, Commercial & Industry and Oil & Gas. GaN HEMT technology is used and attached on a copper sub carrier. It is connected by using bias and in/out matching circuit method with gold wire bonding.

## Electrical Specifications @ $V_{ds}$=28V, $V_{gs}$ @Idq, Ta=25℃

| PARAMETER | UNIT | MIN | TYP | MAX | CONDITION |
|---|---|---|---|---|---|
| **Frequency Range** | MHz | 100 | - | 1000 | ZS = ZL = 50 ohm |
| **Power Gain @P1dB** | dB | 12 | 15 | - | Vds = +28V<br>Vgs @Idq<br>Idq = 5mA |
| **Pout @ P1dB** | dBm | 36 | 38 | - | |
| **Efficiency @ P1dB** | % | 40 | 55 | - | |
| **Ids @ P1dB** | mA | - | 475 | 700 | |
| **Pout @ P3dB** | dBm | 38.5 | 40 | - | |
| **Input Return Loss** | dB | - | -10 | -5 | Vds= +28V, Idq=150mA |
| **Supply Voltage** | V | Vgs@Idq=1mA | Vgs@Idq | Vgs@Idq=5mA | Vgs |
| | | - | 28 | - | Vds |

**Caution**

The drain voltage must be supplied to the device after the gate voltage is supplied

Turn on : Turn on the Gate Voltage supply and last turn On the Drain voltage supplies

Turn off : Turn off the Drain Voltage and last turn off the Gate voltage

**Note**

TG Series have internal DC blocking capacitors at the RF input and output ports

## Mechanical Specifications

| PARAMETER | UNIT | TYP | REMARK |
|---|---|---|---|
| **Mass** | g | 1 | - |
| **Dimension** | mm | 15 x 10 x 5.4 | Outermost |

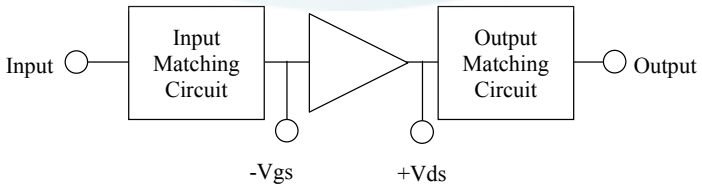
## Absolute Maximum Ratings

| PARAMETER | UNIT | RATING | SYMBOL |
|---|---|---|---|
| **Gate-Source Voltage** | V | -10 ~ 0 | Vgs |
| **Drain-Source Voltage** | V | 50 | Vds |
| **Gate Current** | mA | 3.6 | Ig |
| **Operating Junction Temperature** | °C | 225 | $T_J$ |
| **Operating Case Temperature** | °C | -40 ~ 85 | $T_C$ |
| **Storage Temperature** | °C | -40 ~ 100 | $T_{STG}$ |
| **Load Mismatch** | | 5:1 (all load phase) | |

## Operating Voltages

| PARAMETER | UNIT | MIN | TYP | MAX | SYMBOL |
|---|---|---|---|---|---|
| **Drain Voltage** | V | - | +28 | - | Vds |
| **Gate Voltage (on-state)** | V | - | Vgs@Idq | -2 | Vgs |
| **Gate Voltage (off-state)** | V | - | -8 | - | Vgs |

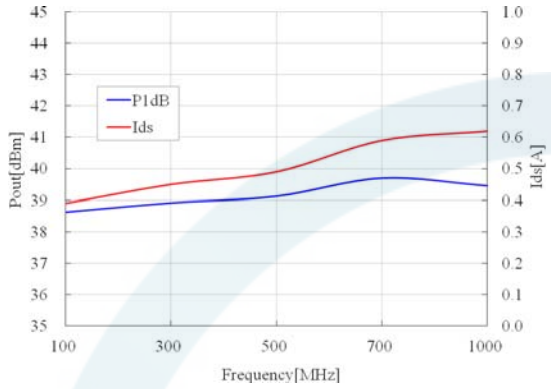
## Block Diagram



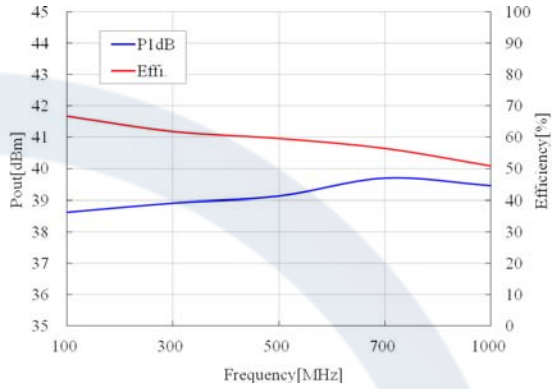
## Performance Charts

*** Bias condition** @ Idq=5mA, Vgs@Idq, Vds =+28V, Ta=25℃

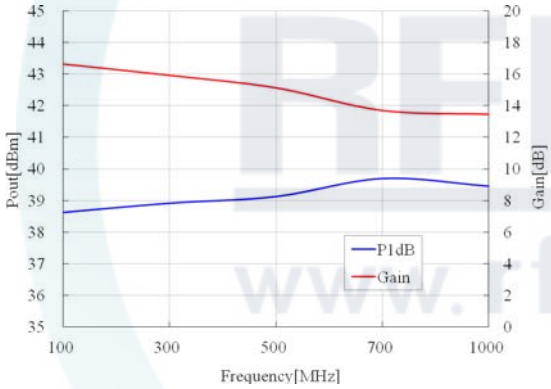
**Ids vs. Frequency (@P1dB)**



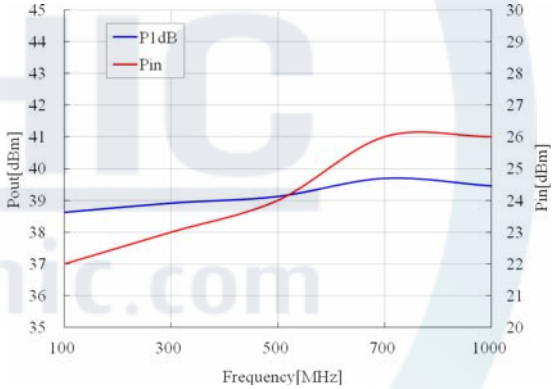

**Efficiency vs. Frequency (@P1dB)**



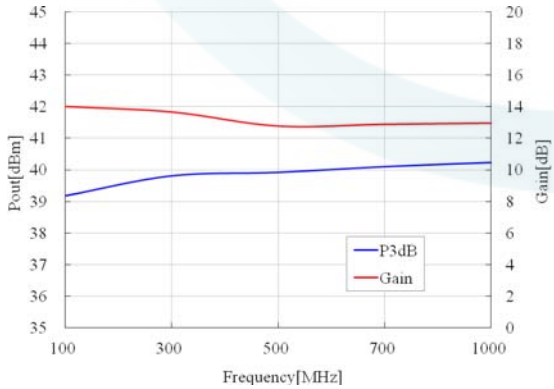

**Power Gain vs. Frequency (@P1dB)**



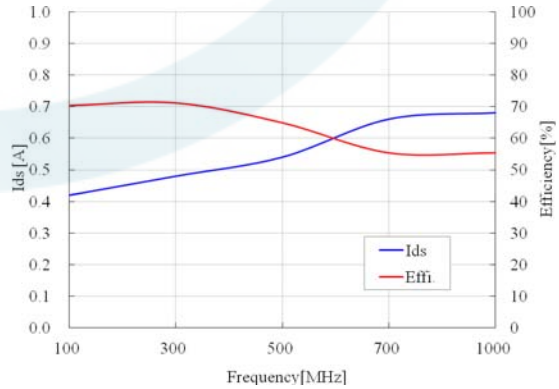

**Pin vs. Frequency (@P1dB)**




**P3dB & Gain vs. Frequency**

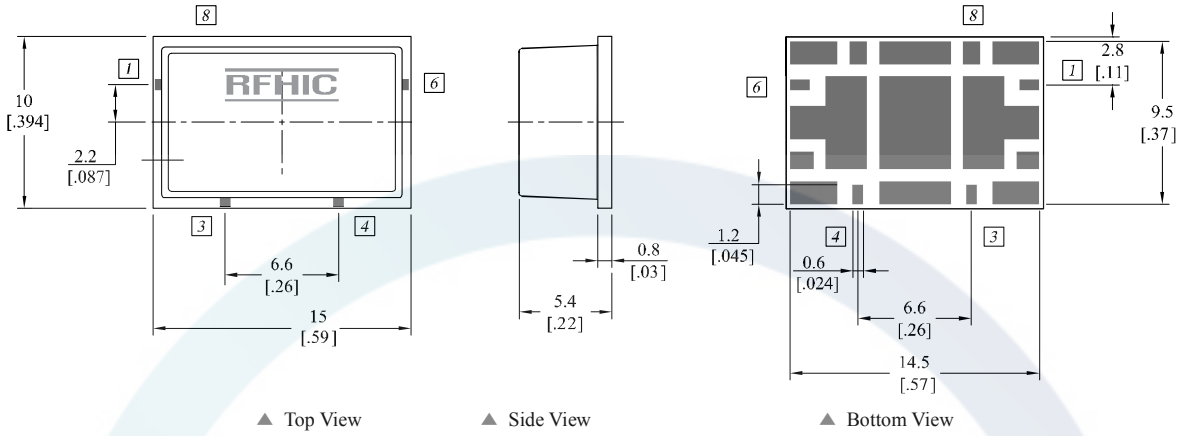



**Ids & Efficiency vs. Frequency (@ P3dB)**



## Package Dimensions (Type: NP-18)

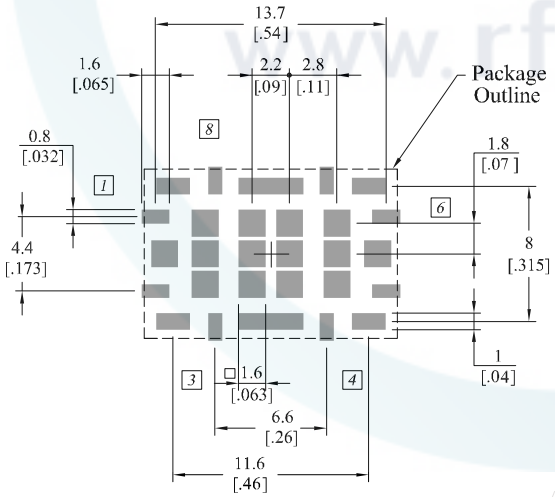
* Unit: mm[inch] | Tolerance: ±0.15[.006]



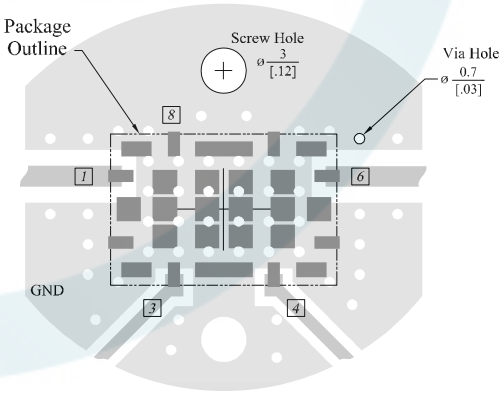

▲ Top View ▲ Side View ▲ Bottom View

| Pin Description | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pin No** | **Function** | **Pin No** | **Function** | **Pin No** | **Function** | **Pin No** | **Function** |
| 1 | RF Input | 3 | Gate Bias (-Vgs) | 5 | GND | 7 | GND |
| 2 | GND | 4 | Drain Bias (+Vds) | 6 | RF Output | 8 | GND |

## Recommended Pattern




## Recommended Mounting Configuration




*** Mounting Configuration Notes**

1. For the proper performance of the device, Ground / Thermal via holes must be designed to remove heat.
2. To properly use heatsink, ensure the ground/thermal via hole region to contact the heatsink. We recommend the mounting screws be added near the heatsink to mount the board
3. In designing the necessary RF trace, width will depend upon the PCB material and construction.
4. Use 1 oz. Copper minimum thickness for the heatsink.
5. Do not put solder mask on the backside of the PCB in the region where the board contacts the heatsink
6. We recommend adding as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.

## Precautions

This product is a Gallium Nitride Transistor.
The Gallium Nitride Transistor requires a Negative Voltage Bias which operates alongside a Positive Voltage Bias. These Biases are applied in accordance to the Sequence during Turn-On and Turn-Off.
The Pallet Amplifier does not have a built-in Bias Sequence Circuit. Therefore, users need to either apply positive voltages and negative voltages in the required sequence, or add an external Bias Circuit to this Amplifier.
The required sequence for power supply is as follows.

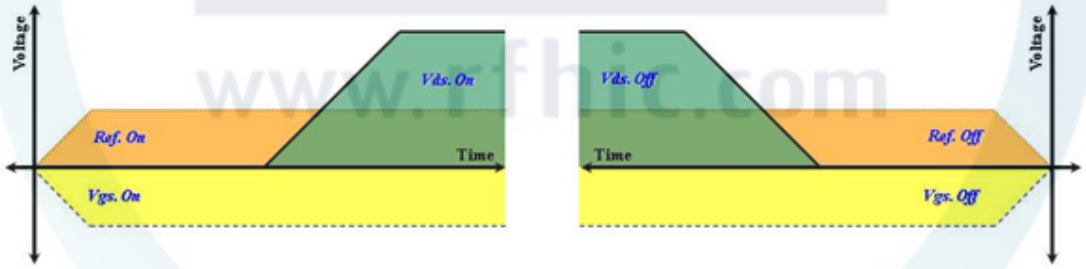
## During Turn-On

1. Connect GND.
2. Apply Vgs.
3. Apply Vds.
4. Apply the RF Power.

## During Turn-Off

1. Turn off RF power.
2. Turn off Vds, and then, turn off the Vgs.
3. Remove all connections.

**Turn On**



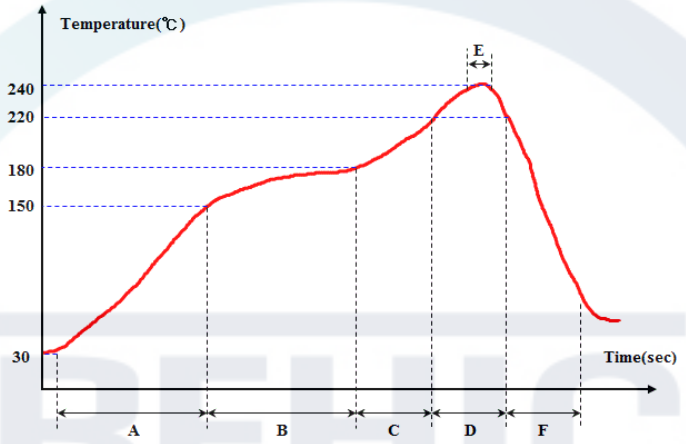

**- Sequence Timing Diagram -**

## Reflow Profile

*** Reflow oven settings**

| Zone | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| Temperature(℃) | 30 ~ 150 ℃ | 150 ~ 180 ℃ | 180 ~ 220 ℃ | 220 ~ 220 ℃ | 235 ~ 240 ℃ | 2 ~ 6 ℃ Sec Drop |
| Belt speed | 55 ~ 115 sec | 55 ~ 75 sec | 30 ~ 50 sec | 30 ~ 50 sec | 5 ~ 10 sec | 60 ~ 90 sec |

*** Measured reflow profile**




## Ordering Information

| Part Number | Package Design |
|---|---|
| TG1000-10 | -R (Reel) |
| | -B (Bulk) |
| | -EVB (Evaluation Board) |

## Revision History

| Part Number | Release Date | Version | Modification | Data Sheet Status |
|---|---|---|---|---|
| TG1000-10 | 2014.06.26 | 1.1 | ▪ A mass of mechanical specification is changed. | - |
| TG1000-10 | 2012.01.18 | 1.0 | ▪ This is formally released.<br>▪ A Format is changed at Parameters of Specification.<br>▪ Performance graphs of P3dB are added to 'Chart' part. | - |
| TG1000-10 | 2012.01.08 | 0.93 | ▪ Parameters of specifications are changed. | Preliminary |