mmTron
Unleashing the mmWave Frontier

TMC2112-D
25-29.5 GHz Power Amplifier

Product Features

- RF frequency: 25 to 29 GHz
- Linear Gain: 17 dB
- Psat: 25-45W
- Die Size: X=5.0 mm, Y=5.0 mm
- GaN HEMT Process
- 4 mil SiC substrate
- DC Power: 18-28 VDC, 1.1-2.8 A

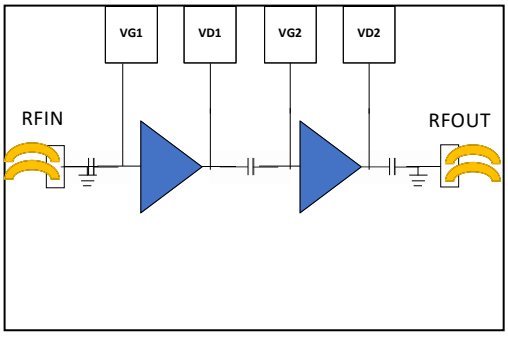
Applications

- 5G Wireless
- SATCOM
- Military Radar, EW

Product Description

The TMC2112-D GaN HEMT Power amplifier is a high linearity two-stage Single-ended power MMIC, designed for use in 5G wireless, SATCOM and Military Radar and EW applications. The TMC2112-D is a 50Ω matched design which eliminates the need for RF port matching. To ensure rugged and reliable operation and moisture protection, the TMC2112-D is designed and layed out to lower the maximum junction temperature. Both bond pad and backside metallization are Au-based that is compatible with ribbon and wedge bonding and high conductivity epoxy and eutectic die attach methods. TMC2112-D can be biased from 18V to 28V to adjust output power levels in the 25W to 45W range while maintaining excellent PAE and NPR. TMC2112-D can handle input power levels > 27 dBm.

Functional Block Diagram



Ordering Information

Part No.	Description
TMC2112-D	Bare Die
TMC2112-T2	Bare Die on CMC Shim
TMC2112-EVM	Evaluation Module [1]

1- Contact mmTron for further information

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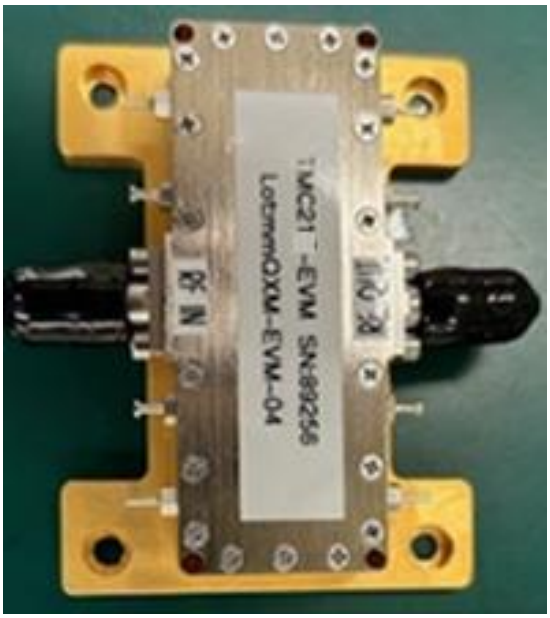
Typical Operating Conditions

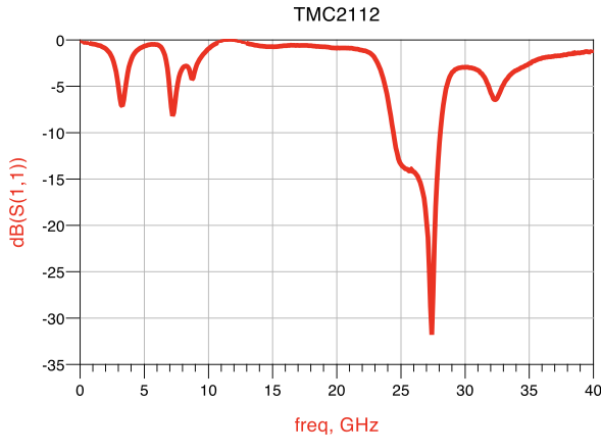
	Min	Typ	Max	Units
Frequency	25		29.5	GHz
Gain	16	17	18	dB
Return Loss	5	10		dB
Psat	44	45	46.5	dBm
PAE	25	28		%
Bias Voltage	18	28	28	V
Bias Current	800	1100	2800	mA

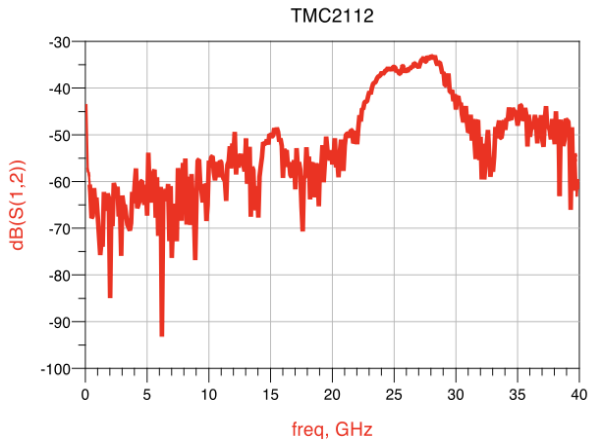
Electrical Performance : Ta = 25 °C, F = 29 GHz, Vdd=18V, Vgg=-4.0V.

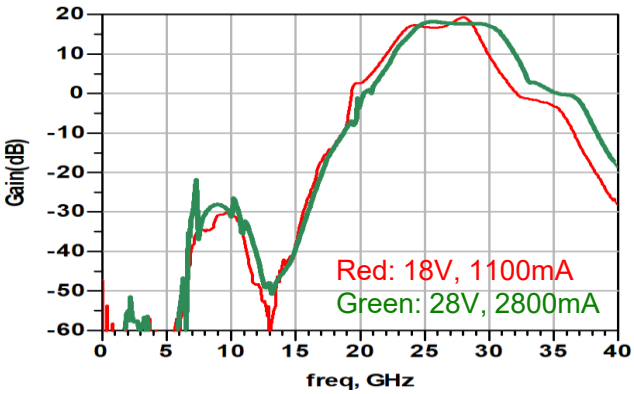
Evaluation Module

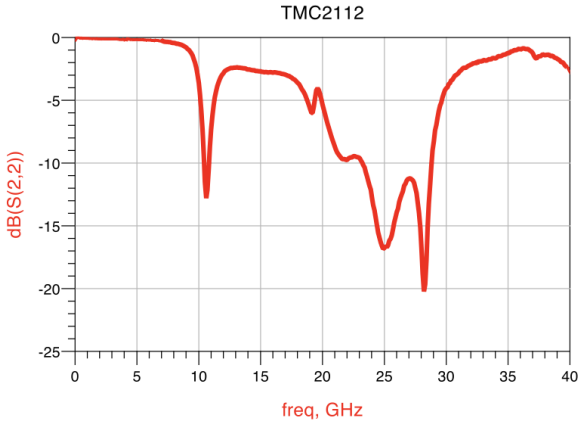


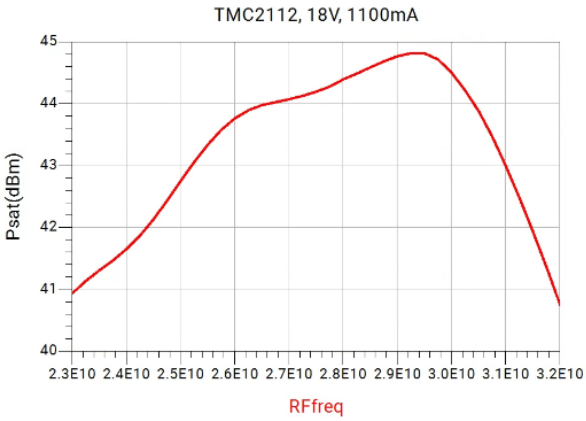
S-Parameters, Psat, TMC2112: Ta = 25°C, 18V/1100 mA

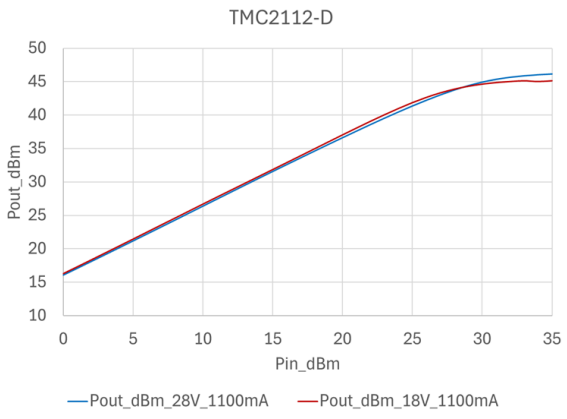




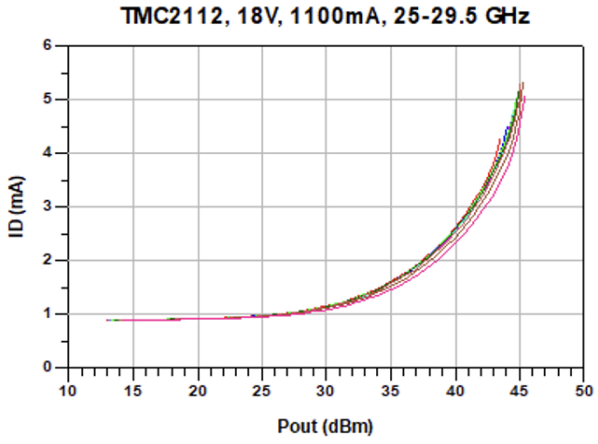


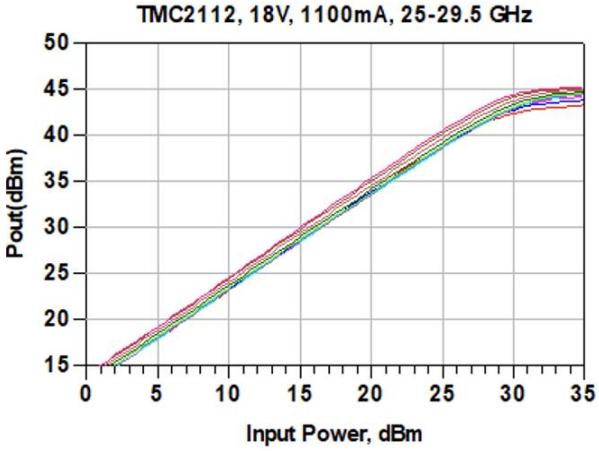


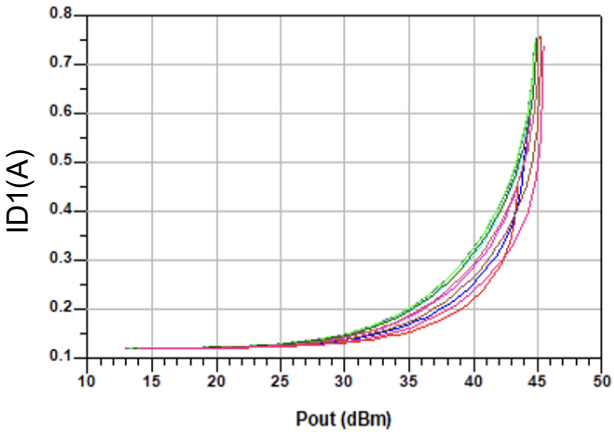


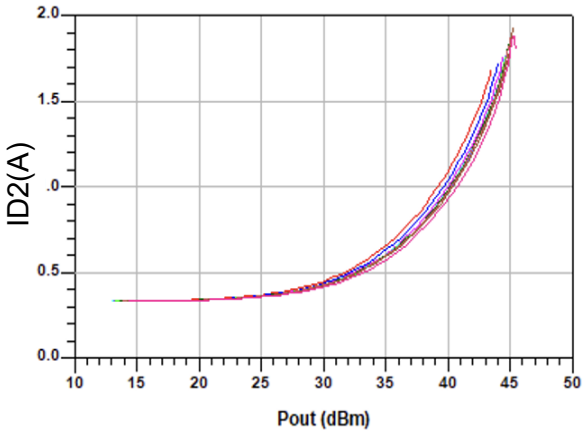


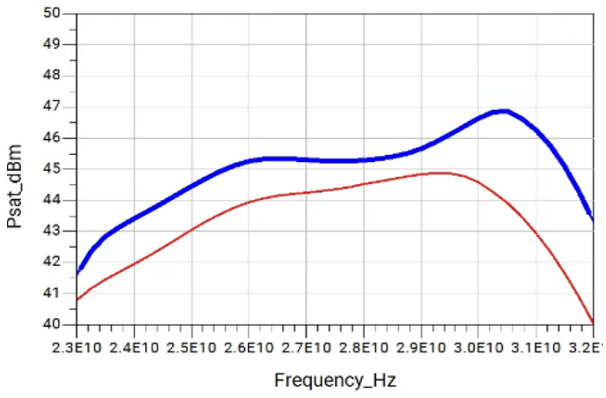
TMC2112 Electrical Performance: Ta = 25°C, 18V, 1100 mA, 25-29.5 GHz

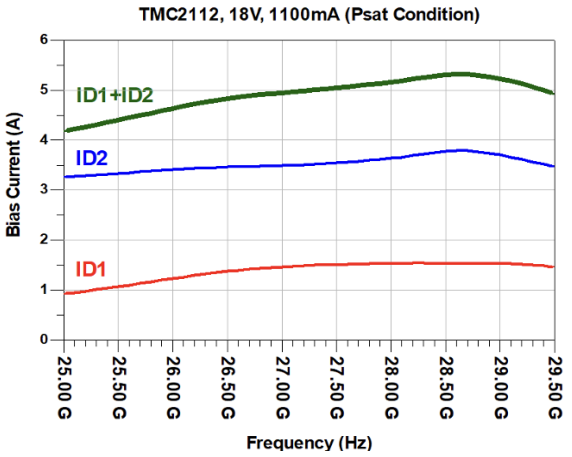












Recommended Biasing

The TMC2112-D is operated with one positive supply VDD (VD1=VD2) and one negative supply VGG (VG1 = VG2). The positive supply must be connected to the VD1 and VD2 pads on the die. The negative supply must be connected to the VG1 and VG2 pads on the die. VGG is biased to -6V first, then VDD is gradually biased to +18V and finally, VGG is adjusted to around -4.2V for ID_total = 1100mA DC current.

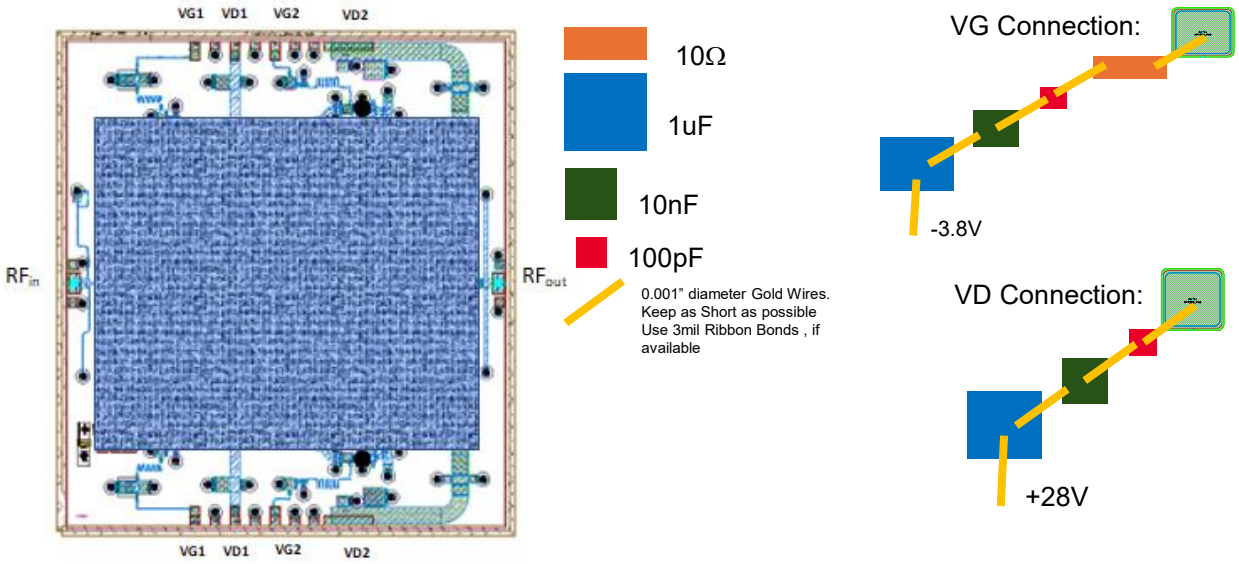
Reverse the sequence during power down, i.e. bring VGG to -6V, lower VDD to 0V, and then VGG to 0V.

Note that VG1 and VG2 can be separated and controlled independently in order to further improve linearity.

Assembly Techniques

The TMC2112-D is fabricated using a GaN-based semiconductor material structure and may be packaged in an air-cavity QFN or used as a die. The die is designed to allow either epoxy or eutectic attach.

TMC2112 Assembly Drawing and Power Connection Details



TMC2112-EVM Evaluation Module



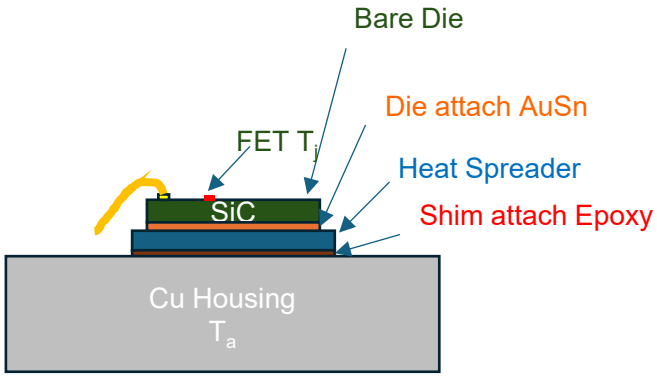
TMC2112 Packaged Device Power Derating

Instructions:

If the MMIC backside temperature is increased, the P_{diss} should be reduced to maintain the desired junction temperature.

Note: In real applications, the T_{case} is the backside of the housing, so the total thermal resistance is the sum of the MMIC thermal resistance plus the AuSn Eutectic, the CuMoCu shim and the Silver Epoxy.

$$\Theta_{th_Total} = \frac{T_j - Ta}{P_{diss}}$$



$$\Theta_{th_Total} = \Theta_{th_TMC} + \Theta_{AuSn} + \Theta_{shim} + \Theta_{Epoxy}$$

Parameter	Condition	Value	Unit
Thermal Resistance	Pout=44dBm (25W), Frequency=27 GHz VDD=18 V, IDQ=1.1A IDRF=5.1A	0.8 +/- 0.05	°C/W
Junction Temperature	$T_{backside}$=85°C, P_{diss}=67 W	142	°C

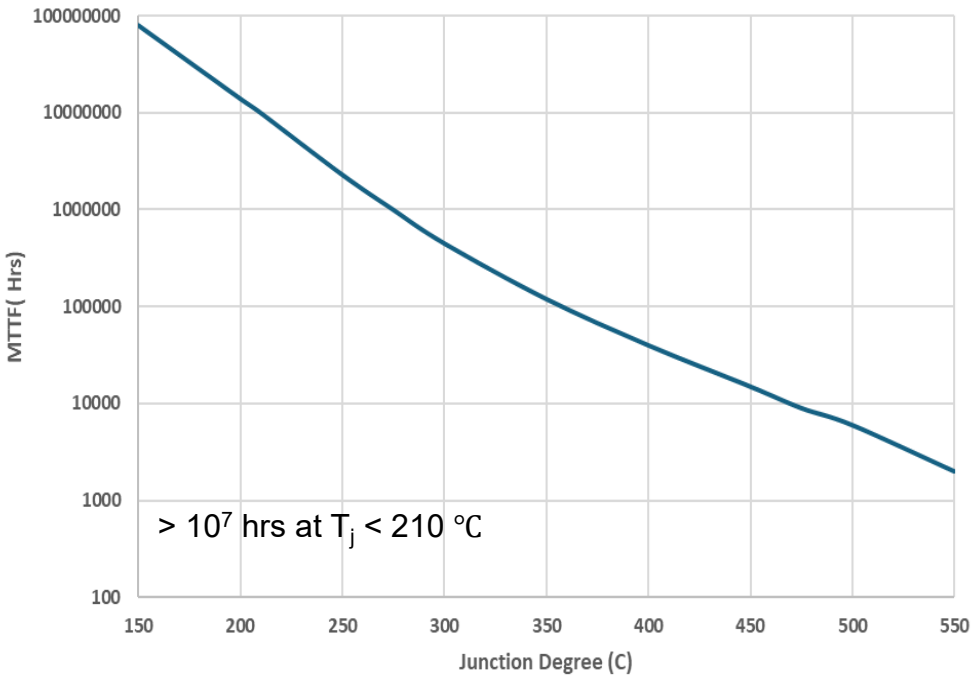
Parameter	Condition	Value	Unit
Thermal Resistance	Pout=46.5dBm (45W), Frequency=27 GHz VDD=28 V, IDQ=1.1A IDRF=5.5A	0.8 +/- 0.05	°C/W
Junction Temperature	$T_{backside}$=85°C, P_{diss}=110 W	178	°C

Absolute Maximum Ratings

Parameter	Value / Range
Drain Bias Voltage (VDD)	+32 V
Gate Bias Voltage (VG1)	-8 to 0 V
Gate Bias Current (IG1)	+10 mA
RF Input Power (RFIN) (VDD=+28V)	+27 dBm
Channel Temperature	210 °C
Storage Temperature	-65 to +150 °C
Operating Temperature for MTTF>1E6 hrs.	-55 to +125 °C

NOTE: Operation of TMC2112 outside the parameter ranges given above can cause irreversible damage.

TMC2112 MTTF





Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. mmTron Inc. recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications. III-V MMICs are ESD-sensitive. Preventative ESD measures must be employed in all aspects of storage, handling, and assembly. MMIC ESD precautions, handling considerations, and die-attach and bonding methods are critical factors in successful III-V MMIC performance and reliability.



RoHS Compliant

This part is RoHS compliant, meeting the requirements of the EU Restriction of Hazardous Substances Directive 2002/95/EC, commonly known as RoHS. Six substances are regulated: lead, mercury, cadmium, chromium VI (hexavalent chromium), polybrominated biphenyls (PBB), and polybrominated biphenyl ethers (PBDE). RoHS compliance requires that any residual concentration of these substances is below the Directive's maximum concentration values (MCV): cadmium 100ppm by weight and all others 1000ppm by weight.

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