mmTron
Unleashing the mmWave Frontier

TMC2111-D
24.5-29 GHz Power Amplifier

Product Features

- RF frequency: 24.5 to 29 GHz
- Linear Gain: 17 dB
- Psat: 52 W
- Die Size: X=5.0 mm, Y=5.0 mm
- GaN HEMT Process
- 4 mil SiC substrate
- DC Power: 28 VDC, 1.3 A

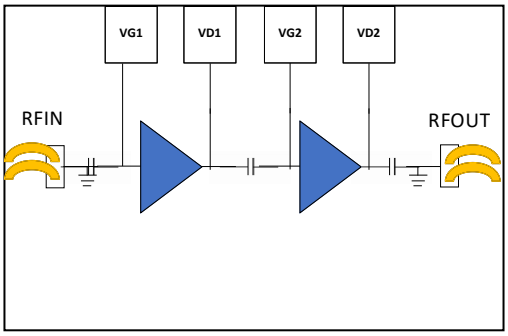
Applications

- SSPA
- Extended Range FWA
- SATCOM
- Military Radar, EW

Product Description

The TMC163D GaAs PHEMT Distributed amplifier is a broadband Ultra High Linearity device, designed for use in Radios, Test instrumentation, Military, EW and Space applications. The TMC163D is a 50 W matched design providing 34dBm of OIP3 and eliminates the need for RF port matching. The typical bias for TMC163D is 8V and 180mA but it can be biased to as low as 5V and 140mA with excellent performance. 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.

Functional Block Diagram



Ordering Information

Part No.	Description
TMC2111-D	Bare Die
TMC2111-EVM	Evaluation Module [1]

1- Contact mmTron for further information

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For additional information and Application support, please visit https://www.mmTron.com/contact

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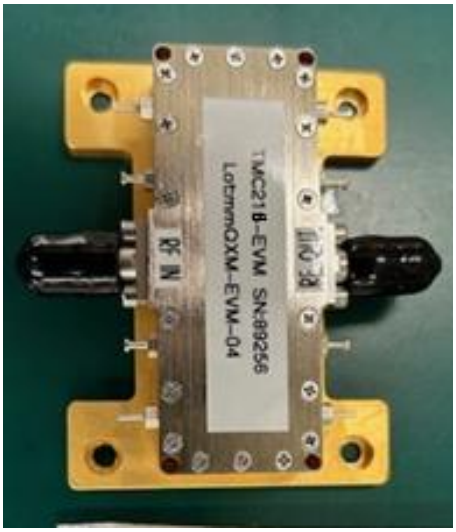
Typical Operating Conditions

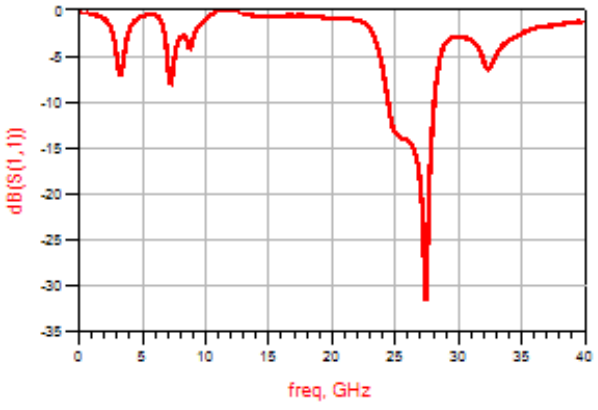
	Min	Typ	Max	Units
Frequency	24.5		29	GHz
Gain	16	17	18	dB
Return Loss	5	10		dB
Psat	45	46	47	dBm
PAE	25	28	32	%
Bias Voltage	18	28	28	V
Bias Current	900	1300	3000	mA

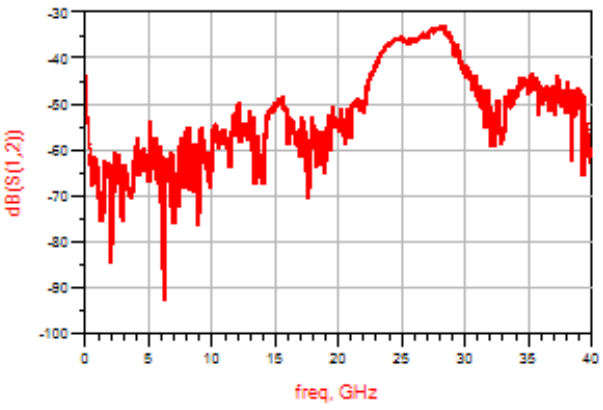
Electrical Performance : Ta = 25 °C, F = 27.5 GHz, Vdd=28V, Vgg=-4.0V.

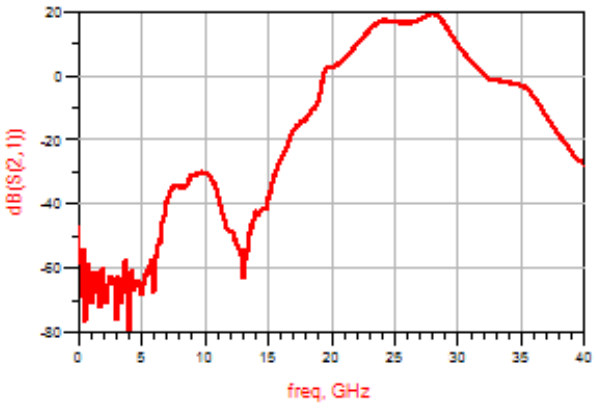
Evaluation Module

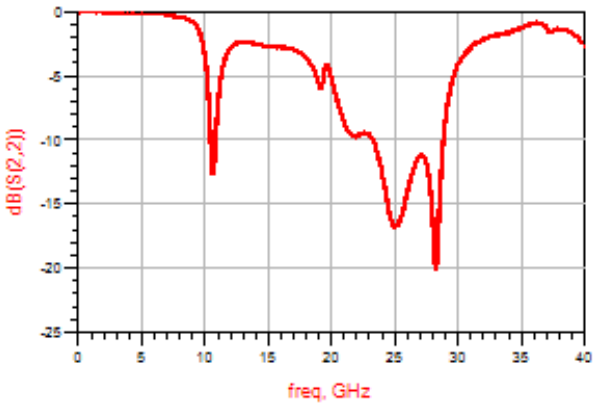


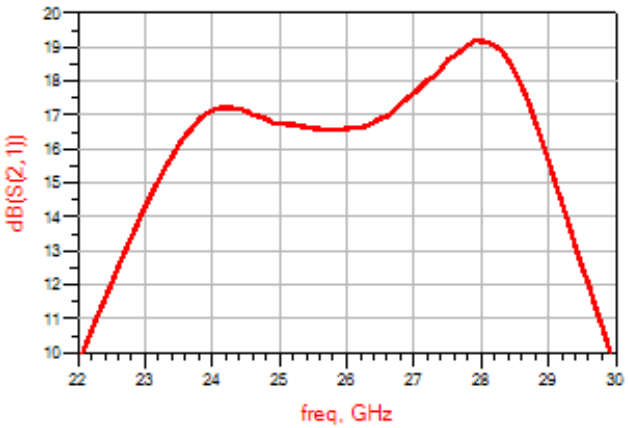
S-Parameters, TMC2111: Ta = 25°C, 28V/1300 mA



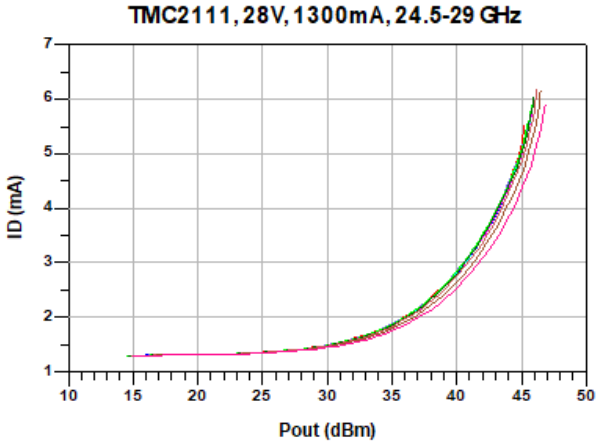


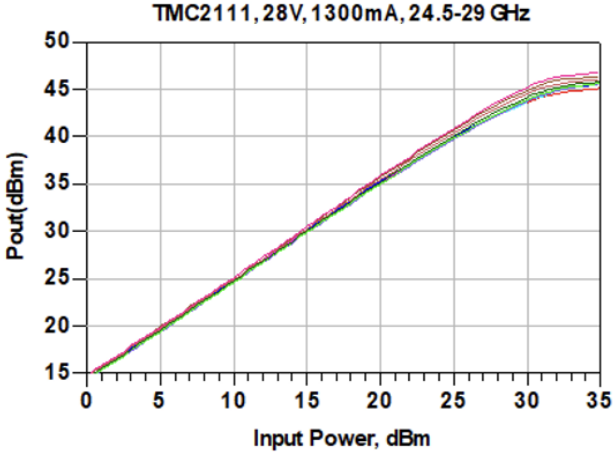


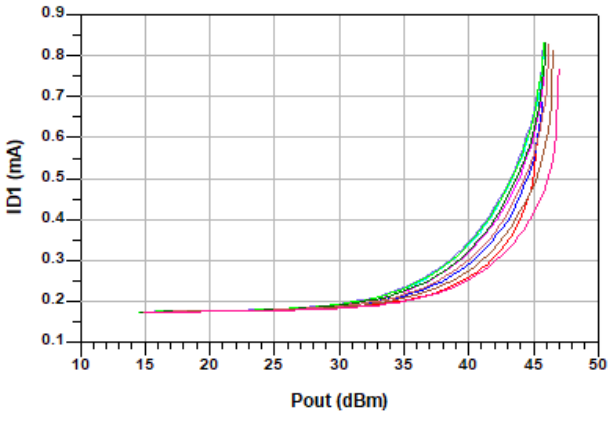


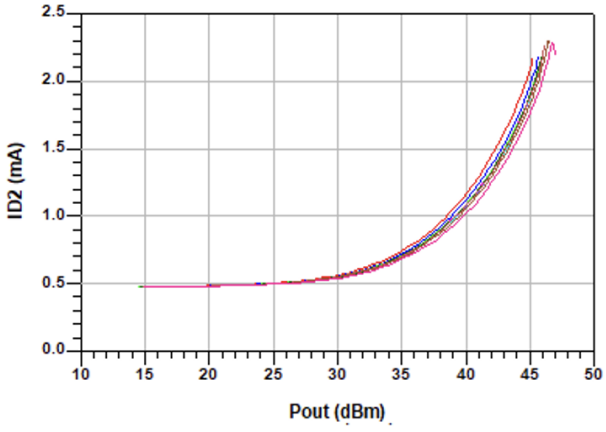


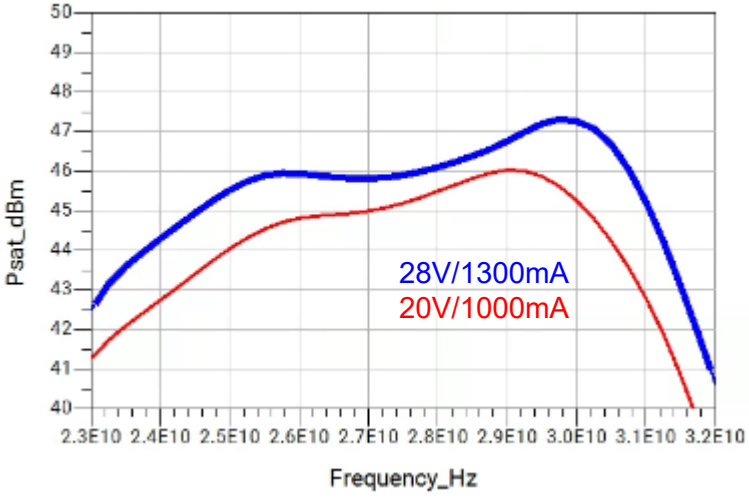
TMC2111 Electrical Performance: Ta = 25°C, 28V, 1300 mA, 24.5-29 GHz



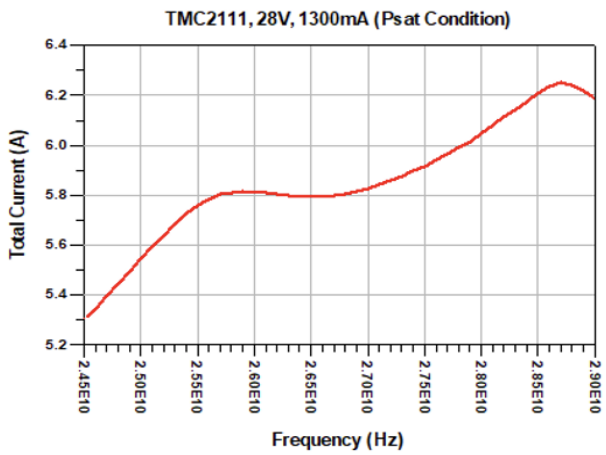


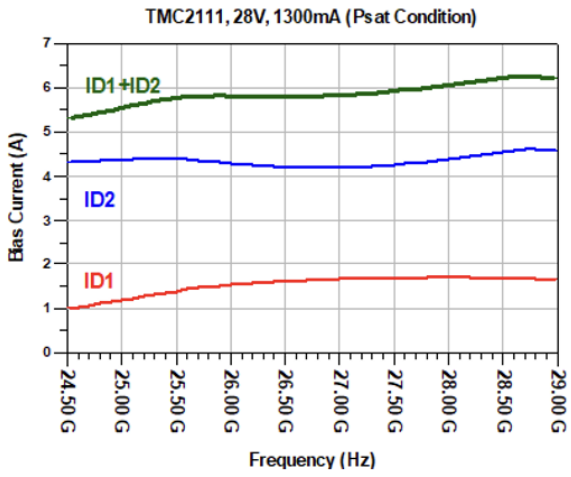


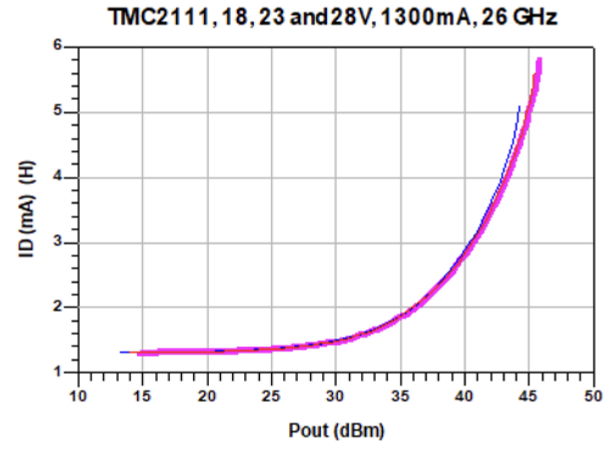


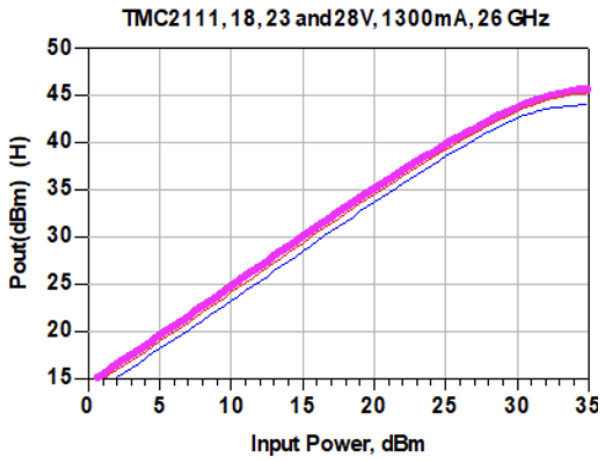


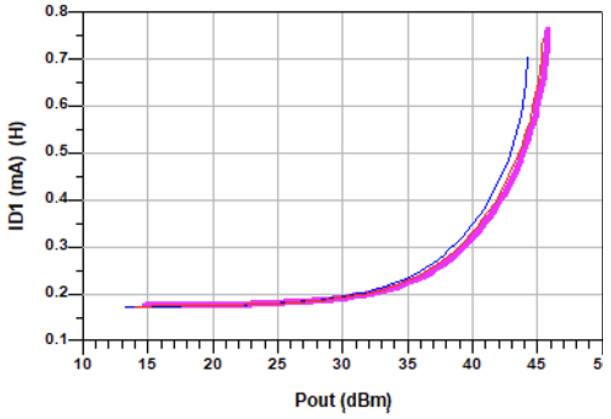
TMC2111 Electrical Performance: Ta = 25°C, 28V, 1300 mA, 24.5-29 GHz

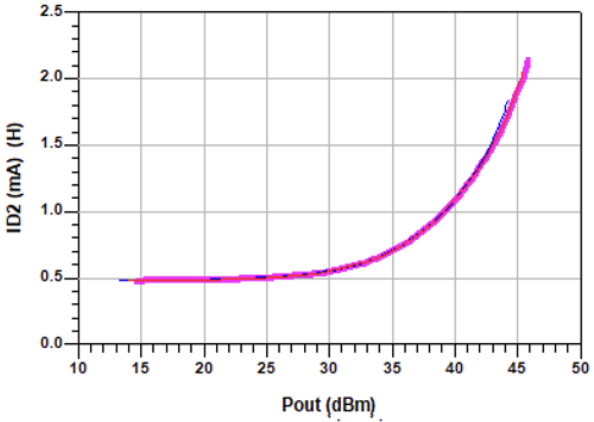




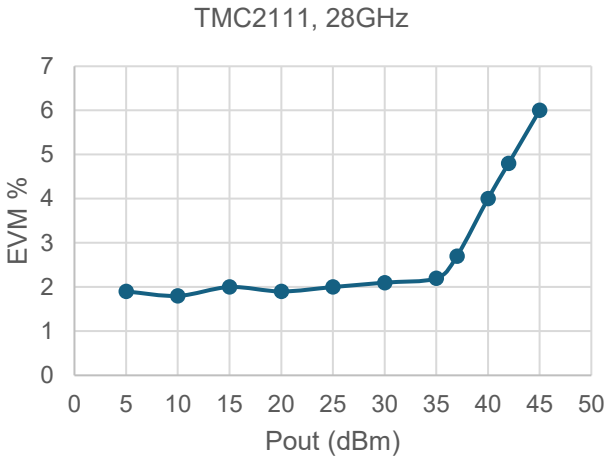


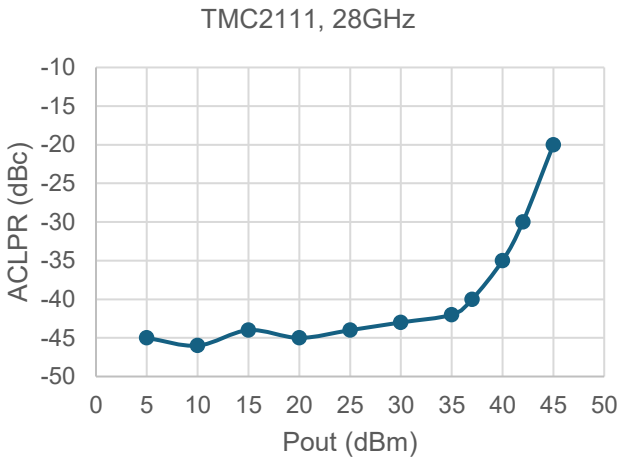


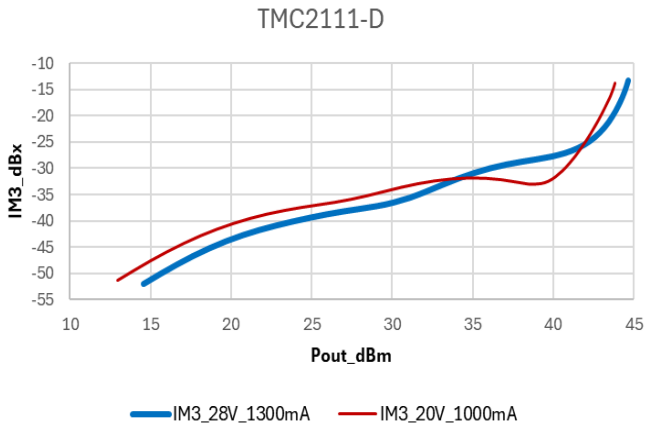


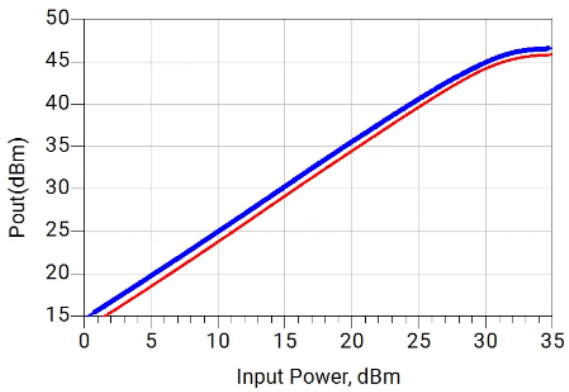


TMC2111 Linearity, IM3, EVM and ACLPR vs. Pout : Ta = 25°C, 28V, 1300 mA









Recommended Biasing

The TMC2111-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 +28V and finally, VGG is adjusted to around -4.2V for ID_total = 1300mA DC current.

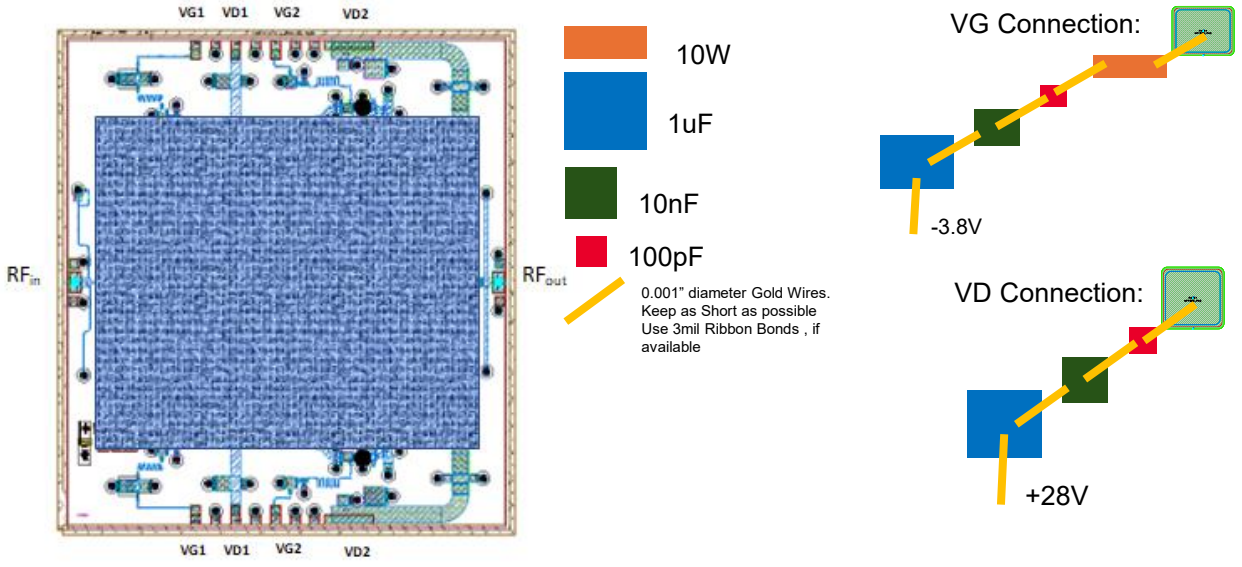
Reverse the sequence during power down, i.e. bring VGG to -6V, lower VDD to 0V, and then VGG to 0V.

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

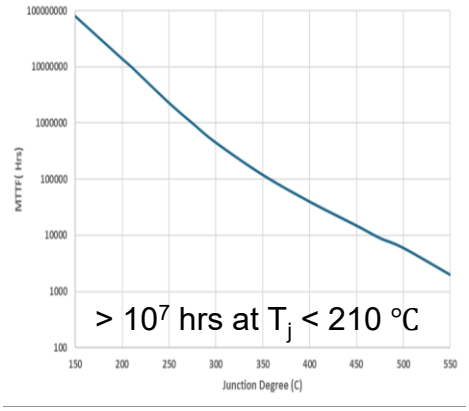
Assembly Techniques

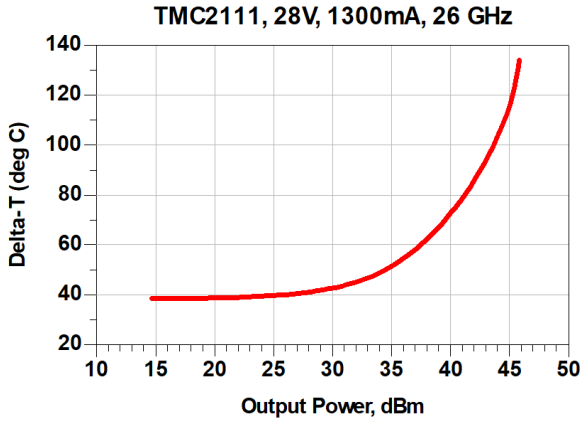
The TMC2111-D is fabricated using a GaN-based semiconductor material structure and may be packaged in an air-cavity QFN or used as a die. The die is designed to allow either epoxy or eutectic attach.

TMC2111 Assembly Drawing and Power Connection Details



TMC2111 MTTF, Thermal Resistance and Junction Temperature





Parameter	Condition	Value	Unit
Thermal Resistance	Pout=45.8dBm (38W), Frequency=27 GHz VDD=28 V, IDQ=1.3A □ IDRF=5.92A	0.95 +/- 0.6	℃/W
Junction Temperature	$T_{backside}$=85℃, P_{diss}=128 W	199	℃

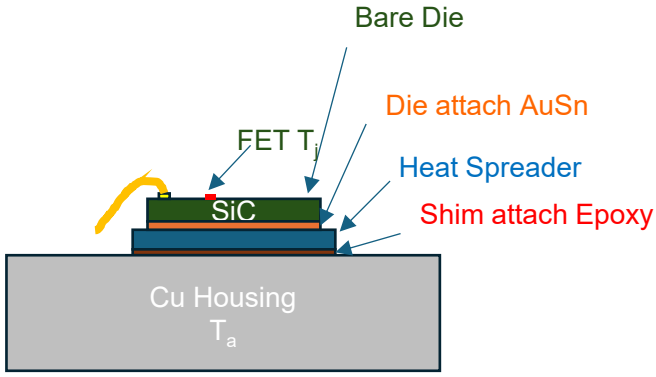
TMC2111 Packaged Device Power Derating

Instructions:

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

Example: Max Tj=200 C, T_{case}=75 C, 26GHz, using worst-case thermal impedance of 0.95 C/W, then P_{diss}=(200-75)/0.95=131 W or ID=4.7A → using the ID versus Pout plot, the maximum output power is 45dBm. Alternatively, using the Dela-Temp plot , the maximum output power for DT=200-75=125 C is 45dBm.

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



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

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.



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)	+35 dBm
Channel Temperature	180 °C
Storage Temperature	-65 to +150 °C
Operating Temperature for MTTF>1E6 hrs.	-55 to +125 °C

NOTE: Operation of TMC2111 outside the parameter ranges given above can cause irreversible damage.



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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