RF and Microwave Power Technology

BATTLE BORN AMPLIFIERS™

RFM2-30-500XR

2-30MHz 500W Class AB Linear High Performance Amplifier

- **Class AB 500W XR-rated linear amplifier**
- **2-30MHz bandwidth**
- **27dB typical gain**
- **63% typical efficiency**
- **+/- 1.0dB typical gain flatness**
- **Temperature-compensated bias**
- **Optional bias disable (+5VDC)**

The RFM2-30-500XR is an XR-rated high power amplifier for linear HF communication systems. It exhibits excellent full power and back-off linearity, and boasts an impressive 63% typical efficiency. It allows the high power system integrator to reduce internal amplifier count by up to half, substantially reducing system size and complexity, and increasing overall efficiency.

Specifications

V_{sup} = +50VDC, I_{DQ} = 2.10A, P_{out} = 500W, T_{base} = 50°C, Z_{load} = 50Ω

Parameter	Min	Typ	Max	Units
Freq. Range	2		30	MHz
P_{1dB}	485	See Figure 4		W
Input Power		30	33	dBm
Gain	24	27		dB
Gain Flatness		+/-1.0	+/-1.5	dB
Drain Current		15.9	16.9	A
Efficiency	59	63		%
IRL		-20	-14	dB
f_2		-42	-30	dBc
f_3		-13	-10	dBc
IMD_3 500W PEP, Δf=10kHz		-32	-28	dBc
Dimensions	3.70 X 6.20 X 2.20 (93.98 X 157.48 X 55.88)			inch (mm)

Maximum Ratings

Operation beyond these ratings will void warranty.

Parameter	Value
V_{supply}	46-50VDC
Bias Current	2.5A
Drain Current	19A
Load Mismatch*	5:1
Maximum Housing Base Temperature See "Special Notes on Cooling", Page 4.	65°C
Storage Temp.	-40°C to 85°C

*All phase angles, 500W forward power, current limited to 19A for 5 seconds max.

Connectors: SMA input, N output

Option Ordering Info

Bias Disable (+5V)	RFM2-30-500XR-DIS

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MADE IN AMERICA

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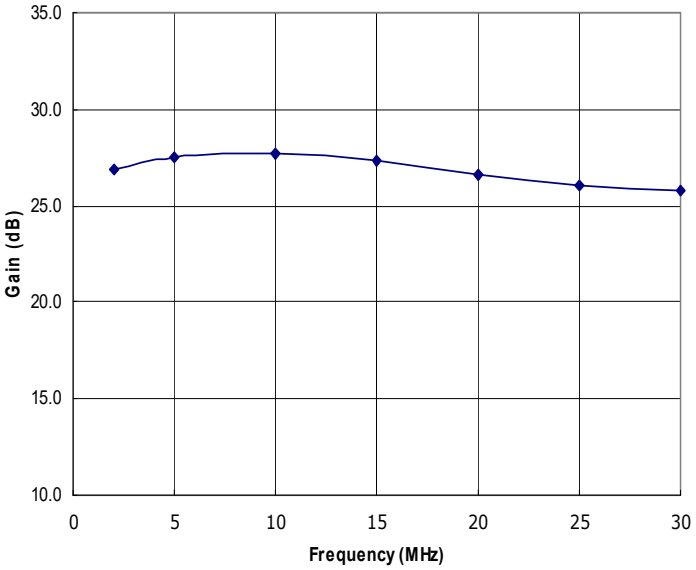

Figure 1: RFM2-30-500XR Typical Gain @ P_{out} = 500W.

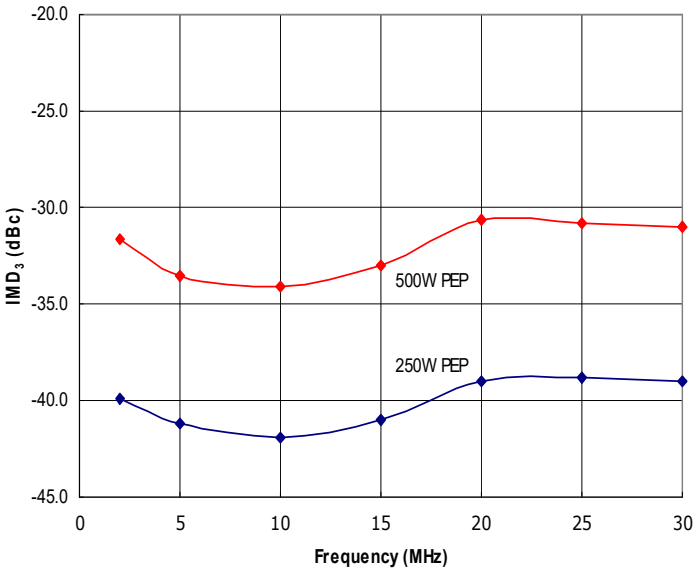

Figure 2: RFM2-30-500XR Typical IMD_3 @ Δf=10kHz, 500W PEP and 250W PEP.

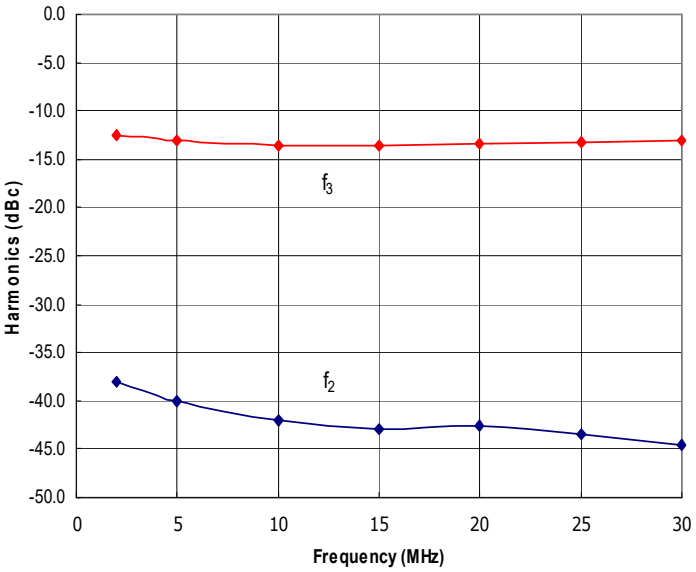

Figure 3: RFM2-30-500XR Typical f_2 and f_3 @ P_{out} = 500W.

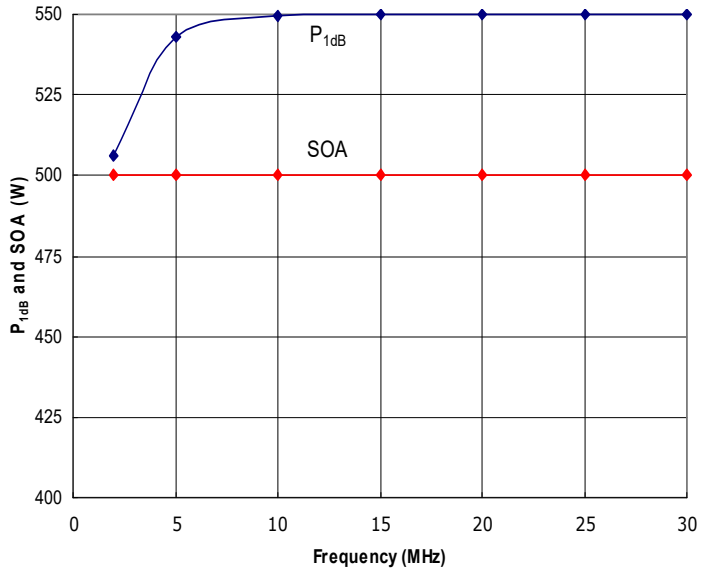

Figure 4: RFM2-30-500XR Typical P_{1dB} and Safe Operating Area (SOA). Do not exceed the SOA shown above without first contacting RFMPT to discuss your application.

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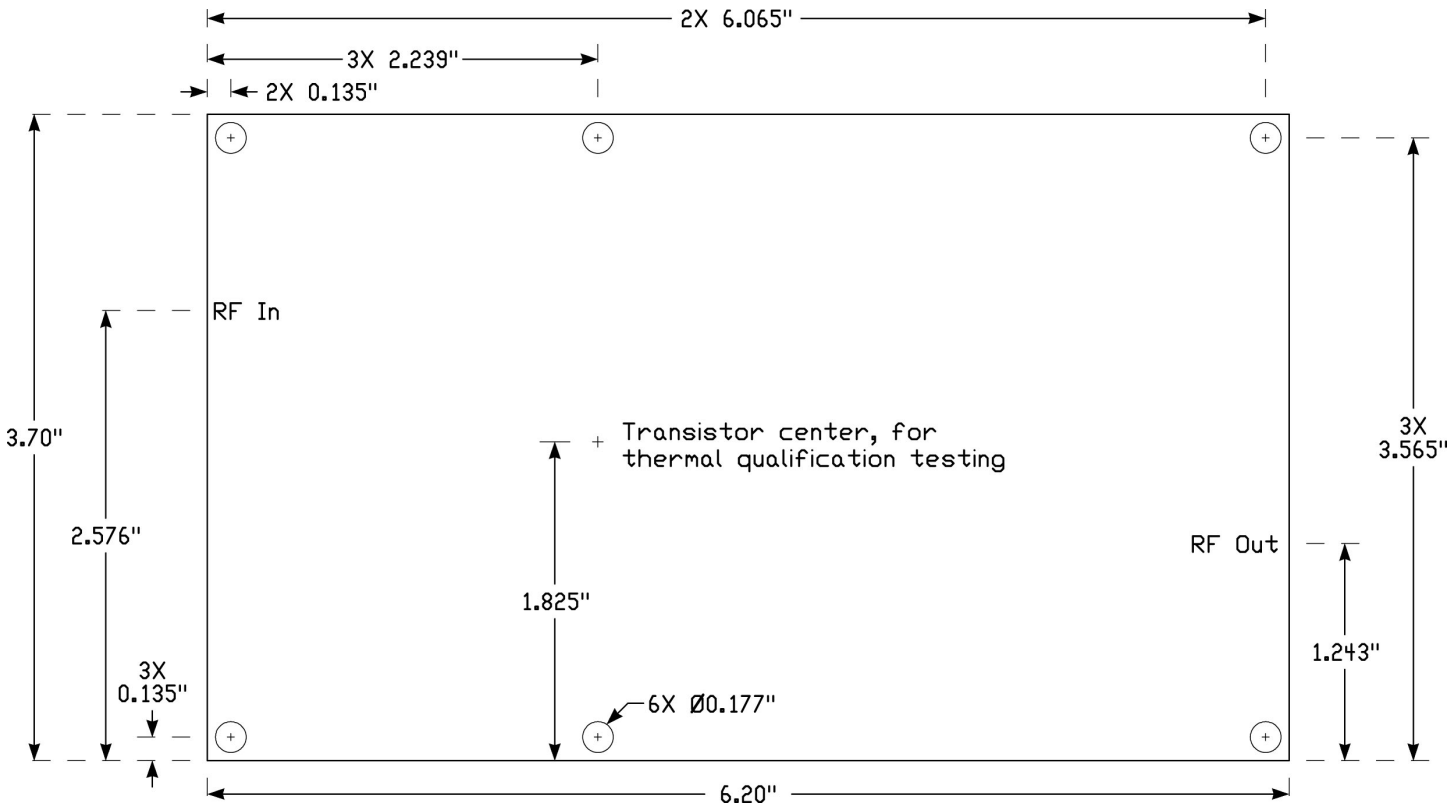
Amplifier Mounting Hole and RF Locations



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Special Notes on Cooling

This amplifier is capable of dissipating over 400W into even limited VSWR. This is significant heat for a single transistor to safely dissipate. In normal operation into 50Ω, it will dissipate up to 335W at 20MHz, when running 500W CW. Dissipation will *increase* as the output power is reduced, until the output power is well below normal operating conditions. All operational scenarios therefore require careful attention to cooling, in order to keep the transistor die at a temperature low enough to ensure long term reliable operation.

This amplifier is supplied in a nickel-plated copper baseplate/vented ringframe construction for best thermal conductivity and output transformer cooling. The maximum rated housing base temperature is 65°C. This is to be measured, for cooling system qualification, on the bottom of the housing *directly below the center of the transistor* (see drawing on Page 3). A high performance heatsink will be required in order to maintain the housing base temperature at or below the specified limit. Required airflow can be preliminarily determined through thermal modeling, but must be confirmed by testing under intended worst case operating conditions.

In addition to providing proper airflow through the heatsink fins, air must also be directed through the vertical vent slots in the amplifier housing in order to cool the output transformers and DC feed structure. However, the cooling requirements of the transformers are less critical than that of the housing base and transistor. The goal is to avoid stagnant airspace inside the amplifier housing. Approximately 10-15cfm of normal ambient air *per RFM2-30-500XR* is sufficient for cooling the transformers.

High power 2-30MHz amplifiers frequently feed combiners, filters, a coupler, and ultimately an antenna. The resultant load presented to the RFM2-30-500XR will almost invariably be something other than 50Ω. Device dissipation has the potential to increase beyond that seen with a perfectly matched load, depending on the phase angle of the reflected power. *It is therefore highly recommended* to use a high performance thermal compound such as Wakefield Type 122 between the amplifier and heatsink.

Finally, the transistor and amplifier are designed to withstand high VSWR. However, it is the user's responsibility to take appropriate measures to limit VSWR to the rated specification, as well as limit the current drawn by the amplifier. Unlimited exposure to high VSWR and/or high DC current can cause amplifier damage, and is not covered by the warranty. It is left to the end user to ensure that appropriate system protection measures are employed to avoid damage to the amplifier. Please contact RFMPT for guidance if you are unsure how to properly protect the amplifier or system electrically and/or thermally.

Transistor Bias Drift

The die in the RF transistor used in this amplifier were not designed for high linearity applications, rather they were designed for high efficiency non-linear purposes. Their DC I_{DQ} may drift as much as 20% (always an increase) over time, even with a fixed gate voltage. While insignificant for non-linear applications, this may negatively impact linear use, most importantly with respect to IMDs. To a lesser extent, gain and P_{1dB} may also shift. The bias drift must be taken into account when designing a linear RF amplifier system utilizing this amplifier. For a comparable amplifier module which uses a different RF transistor and has much less bias drift, please see our RFM1.6-30-500XR.

Note on Bias Disable

The Bias Disable function does not completely eliminate RF output power if RF drive is present at the amplifier's input. Because this is a linear amplifier, feedback networks are utilized around the RF transistor, and will allow some limited amount of RF to be passed through the amplifier, even with transistor bias turned off.

General Instructions for Amplifier Use

1) When mounting on a heatsink, apply a layer of high performance thermal grease (Wakefield Type 122 or equivalent) to the underside of the amplifier housing. Thinner is better, but ensure that when mounted to your heatsink, contact across the ***entire*** housing base is made. Gaps and air bubbles will significantly reduce cooling, leading to possible amplifier damage. Use six #6-32 or M4 screws to mount the amplifier to your heatsink.
2) Guarantee sufficient airflow through the heatsink fins to keep the maximum baseplate temperature at or less than that specified in the Maximum Ratings section. Contact RFMPT for details on how to qualify your heatsink's performance, if needed.
3) Connect a proper signal source to the RF IN SMA connector, and desired load to the RF OUT N connector. Torque connectors to industry standards for the respective types.
4) Connect DC V_{supply} to the provided DC feedthrough filter. This amplifier can draw more than 19A into VSWR, so use of 12 gauge wire is recommended. Solder a wire of the same gauge to the GND lug. Ensure that the connections are of proper polarity, and within the voltage range in the Maximum Ratings section.
5) Apply DC power, then sufficient RF drive to achieve desired output level. Ensure that the Safe Operating Area (SOA) power level indicated in Figure 4 is not exceeded, or amplifier damage may occur, and will void the warranty.
6) To disconnect the amplifier, first remove the RF drive, then DC power, then the RF connections.

Contact our factory at sales@rfmpt.com with any questions, or for special options, extended frequency range operation, testing requirements, and/or other operating conditions not specified in this document.

Document Control

Revision	Date	Notes
A	12-8-2015	Initial release.
B	10-5-2017	Updated dimensions, mounting hole locations, performance data, company logo and contact information.
C	3-26-2019	Updated performance specifications and added note on bias disable.
D	5-6-2020	Added notes about transistor bias drift.