

Model P600FM-184XR FM Pallet Amplifier

This amplifier module is ideal for final output stages in FM Broadcast Applications.

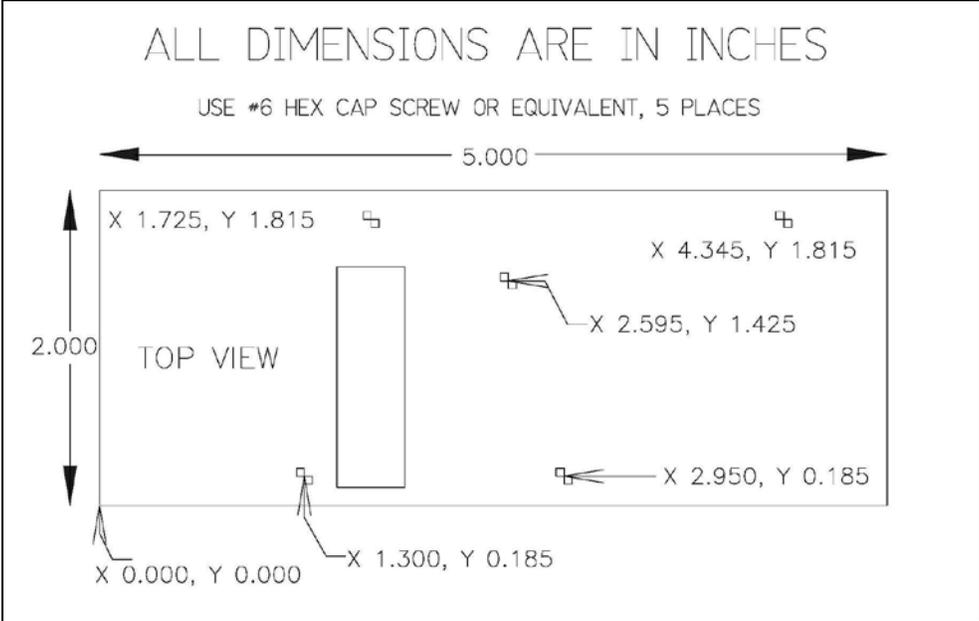
- **87.5 – 108.1MHz (FM BAND)**
- **50 Volts**
- **Input/output 50 ohms**
- **Pout: 1000W minimum**
- **78% efficiency @600W**
- **23dB Gain**
- **NXP BLF184XR Mosfet**



Dimension (L x W x H inch) [5.00" x 2.00" x 1.35"]

Electrical Specifications				
Characteristics	min	typ	max	unit
Operating Frequency range	87.5		108.1	MHz
peak saturated power (@ 50V)	650	650	700	W
P1dB @ 48V		600		W
Power Input		3	3.75	W
Input VSWR		1.3	1.4	VSWR
Power Gain	22	23	24	dB
Amplifier efficiency at 600W	77	78		%
Absolute maximum current rating	-	-	18	A dc
Insertion Phase variation (unit to unit)	-	+/-3.5	-	degrees
Power gain (unit to unit)	-	+/-1.0	-	dB
F2 Second Harmonic	-30	-35	-	dB
F3 Third Harmonic	-18	-20	-	dB
Bias Current per transistor: Factory set @48V.		150		MA dc
Drain voltage supply		48	52	V
Base plate operating temperature	0	n/a	75	Celsius
Load Mismatch (All phase angles, Id=16A, 10 seconds)			65:1	VSWR
Shipping Weight		1.2		LBS

Amplifier Mechanical Drawing: Figure 1



This drawing may be downloaded in DXF format, click here: [Download](#)

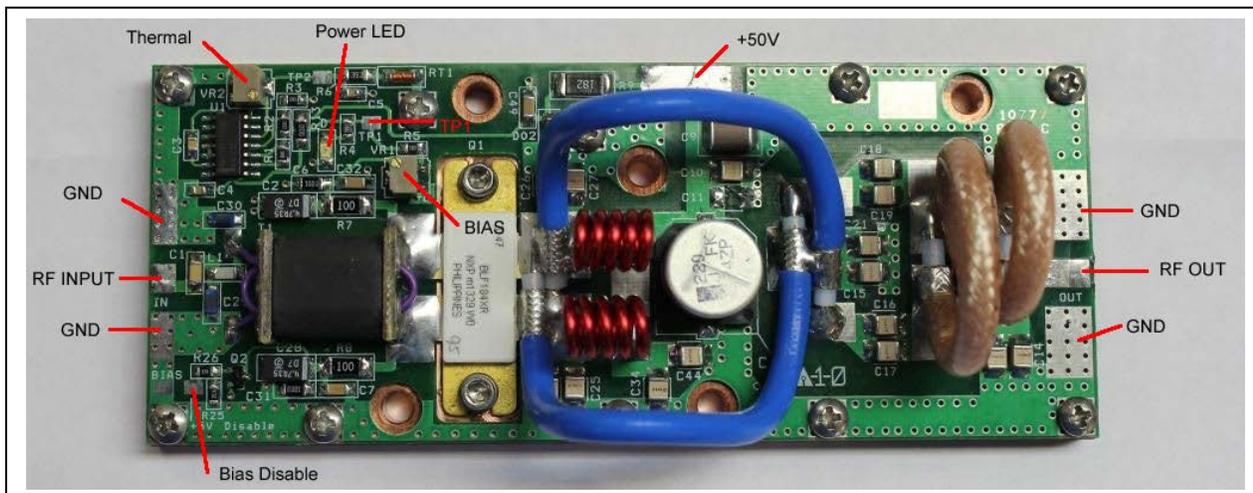
Heatsink Mounting/Hardware

Tips for Mechanical Mounting:

- 1 All mounting holes are 0.156 inch thru and they are designed for a #6 Screw. Stainless Steel mounting hardware is recommended, grade 18-8 or better. A lock washer of same material should also be used.
- 2 Ensure mounting surface is flat to better than 0.0025"
- 3 Use a thin layer of thermal compound on the backside of the PA - no more than 0.001" - 0.002" thickness!
- 4 Torque all screws to 10-12 in-lbs

Use of cooling air on top of pallet to keep output transformers cool is required. Output transformers are rated for continuous operation at 200C; however, temperatures under 75C are easily maintained at 600W with airflow over the output cables. Keep all external circuitry away from input and output transformers to avoid interference - give at least 0.5 inch clearance above tallest cables to avoid creating feedback loops.

Warning: Failure to use a proper heat sink and/or improper installation will cause the transistors to burn out. This type of failure is not covered by warranty. This product can be ordered with a custom heat sink. Please contact factory for more information.



Electrical Notes:

There is 1 VCC pad for the main power supply (marked +50V in the drawing above). The Meanwell RSP1000 or SE1000 are the suggested power supplies for this amplifier. **Do not attempt to connect ground to the pallet or modify the PCB for ground attachment.** Ground can be attached to the heat sink that the pallet is mounted on.

The pot VR1 marked “Bias” controls the bias current for BLF184XR. The factory setting is 150ma and adjustment is not required.

The adjustment pot VR2 marked “Thermal” sets up the thermal compensation slope. Adjustment of this pot is not required; however, if it is accidentally tampered with simply re-adjust it until “7.2 volts” is present at TP1 as this is the factory setting. “Bias disable” removes bias voltage from the transistor. A voltage above 2.0V is required to activate the “bias disable” condition.

There is a power led marked D1 on the PCB. When this indicator is illuminated it means that the bias circuits have power. It does not provide any additional function.

If transistor replacement is necessary always verify that the bias circuits are functioning before installing new parts. Transistor pocket must be cleaned with alcohol, all debris removed and new thermal compound applied prior to installing new transistor. Bias voltage should be adjusted to 0.5V before new part is installed. We assume no responsibility for self repairs. Please consider sending pallet back to factory for service.

When bias adjustment is required always use a small lab supply that is current limited. This will prevent accidental over bias and loss of a transistor.

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Warning: Solid state amplifiers can be easily destroyed! Operating the amplifier outside of its specifications will cause the mosfets to fail. These failures are not covered by warranty.

- Do not over drive the amplifier.
- Do not run the amplifier into an open circuit. Do not run the amplifier when the SWR is unknown. System integrator must foresee adding VSWR protection if there is a risk that the amplifier will be subjected to high VSWR conditions. Do not adjust the bias settings or attempt transistor replacement without a current limited lab supply.
- Do not allow the amplifier to overheat. Do not let the base plate temp exceed 75C. **This product requires prior experience working with high power RF amplifiers. This is not for beginners.**
- This amplifier has been designed for analog FM broadcast. Performance in digital FM has not been evaluated.
- Expensive test equipment like RF watt meters, dummy loads, Ammeters and thermal meters are required to verify proper installation. Operating this amplifier without this equipment is like driving blind. You won't be able to see what's really going on and the end result could be transistors that burn out.

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Calculating Die Temperature:

How do you know if the amplifier is running too hot? There are symptoms to watch for. If there is a significant drop in power of more than 5% over a short period of time the amplifier is likely overheating.

There is a scientific method that must be used to verify that the amplifier is installed and running within thermal limits. We do not recommend the “dropping power with time test” described above.

Use the thermal resistance (R_{th}) of the device to calculate the junction temperature. The R_{th} from the junction to the device flange for the BLF184XR is $0.18\text{ }^{\circ}\text{C}/\text{W}$. If the device is soldered down to the pallet baseplate, this same value can be used to determine T_j . If the device is greased down to the pallet baseplate, the $R_{th(j-h)}$ value becomes $0.33\text{K}/\text{W}$, as the thermal resistivity for the grease layer from the flange to the baseplate is approximately $0.15\text{ }^{\circ}\text{C}/\text{W}$.

Note: We always use thermal grease under transistors because soldering them directly would render the pallets unserviceable.

Example: Assuming that the device is running at 600W with the RF output power at 48V while consuming 16.0 amps on a pallet baseplate (e.g. $70\text{ }^{\circ}\text{C}$). T_j can be determined based on this condition for the given baseplate temperature:

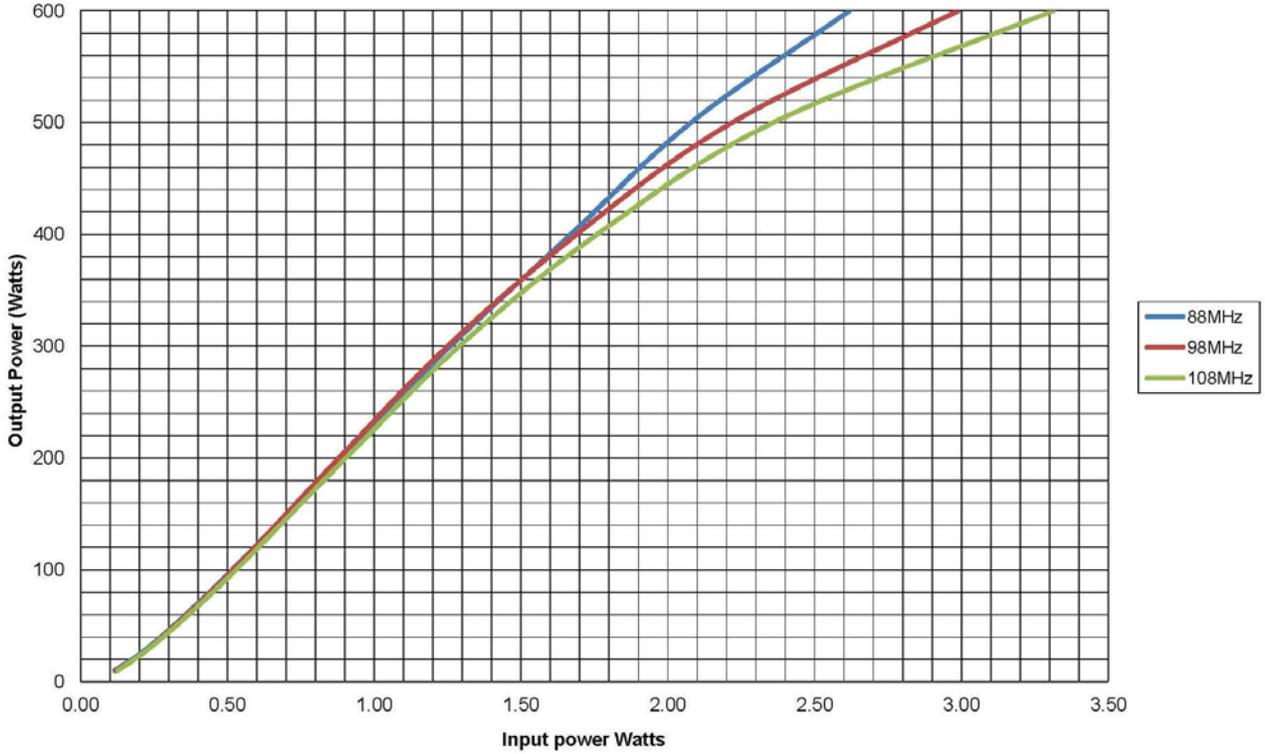
- Dissipated power (P_d) = $(48\text{V} \times 16.0) - (600\text{W}) = 168\text{W}$
- Temperature rise (T_r) = $P_d * R_{th} = 168\text{W} * (0.33\text{ }^{\circ}\text{C}/\text{W}) = 55.4\text{ }^{\circ}\text{C}$
- Junction temperature (T_j) = $T_h + T_r = 70^{\circ}\text{C} + 55.4\text{ }^{\circ}\text{C} = 125.4\text{ }^{\circ}\text{C}$

The best way to make this calculation is to measure the temperature of the transistor flange directly. In this case temperature rise is calculated using $0.18^{\circ}\text{C}/\text{W}$.

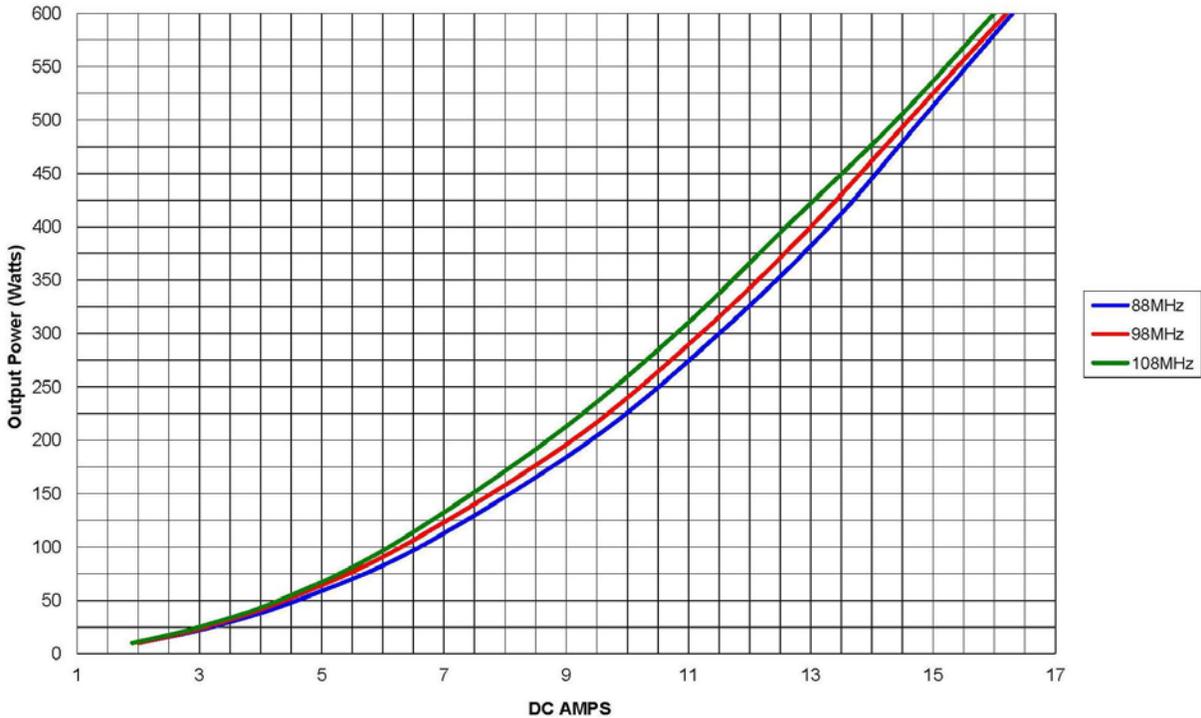
The maximum junction temperature for most LDMOS devices is 200°C . We suggest staying under 175°C . In the example above a base plate temperature of 70°C was used. When the pallet is mounted to an efficient heatsink like one of our bonded fin models base plate temperatures in the 50°C range are easily maintained at full output power.

Note: The NXP BLF184XR has nearly identical surface area as a BLF278. The R_{th} junction to flange on a BLF278 is $0.35^{\circ}\text{C}/\text{W}$. The BLF184XR is $0.18\text{ }^{\circ}\text{C}/\text{W}$. The lower the R_{th} the better the thermal performance of the transistor.

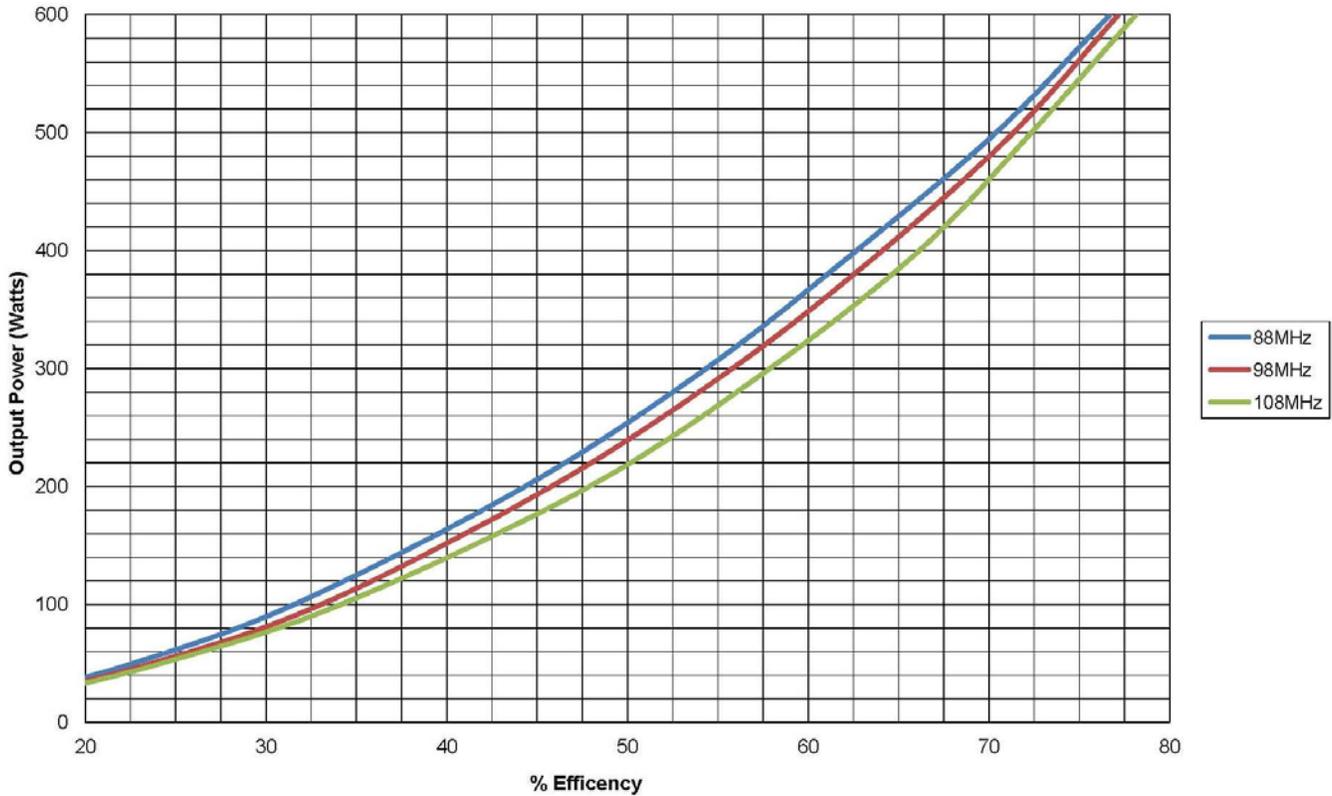
Input power & Output Power @ 48VDC; 150ma bias BLF184XR



DC Amps Vs Output Power @ 48VDC; BLF184XR 150ma bias



Output Power & Efficiency @ 48VDC; 150ma bias BLF184XR



Low Pass Filter

A low pass filter is required to reduce harmonics. Harmonics from FM transmitters are regulated by most government regulatory authorities. Any of our low pass filters rated for at least 600 watts can be used with this pallet. It is critical to install a 13.0 inch piece of RG400 between the pallet output and the filter input to prevent a filter reaction. When a filter reaction occurs the pallet sees a high mismatch which can cause the transistor to overheat and slowly burnout. The cause of filter reactions is not fully understood; however, reflected harmonic energy at a certain phase and frequency is strongly suspected. Filter reactions do not occur when 2 or more amplifiers are power combined since the combiners provide isolation from the low pass filter.

The BLF184XR can operate into open and short circuits without damage; however, operation into a mismatched load for even a few minutes can cause the transistor to fail from thermal stress. The BLF184XR is not clown proof. Thermal overload and RF overdrive will still destroy the transistor. It should be noted that load mismatches that cause the transistor to draw high current are the ones that are most likely to cause a thermal failure.

Revision History:

Replaced low impedance coax cables in output match to improve second harmonic performance at low frequencies: 12.1.15