# Service Bulletin

| | | | |
|---|---|---|---|
| Title: | **RMX 2450 IRFZ44N Field Effect Transistors** | | |
| Bulletin #: | RMX0006 | Issue Date: | January 10, 2001 |
| Models Affected: | RMX 2450 | Bulletin Revision: | A |
| Production Range: | 01/2000–12/2000 | | |

## Description:

Individual IRFZ44N field effect transistors (Q170, Q174, Q270, and Q274) in the step circuits of some RMX 2450 amplifiers have failed. These FETs are part of the amplifier's class H circuitry, which improves the amplifier's efficiency by switching between the high and the low supply rail voltages to provide the lowest supply voltage necessary to fully produce the audio signal. As a result of the FET failure, the output transistors have to dissipate power from one or both high-voltage rails, even at idle or low signal levels.

This bulletin describes the procedure for identifying failed FETs and replacing them with new ones having higher voltage and current ratings of 60 volts and 52 amperes.

## Units Affected:

RMX 2450 amplifiers manufactured from January 2000 through December 2000 (serial number range 0100xxxxx through 1200xxxxx).

## Symptoms:

The FETs short-circuit when they fail, so the result of any one of them failing is that one side of the channel's output circuitry runs on only the high rail voltage, reducing the electrical efficiency significantly at low power.

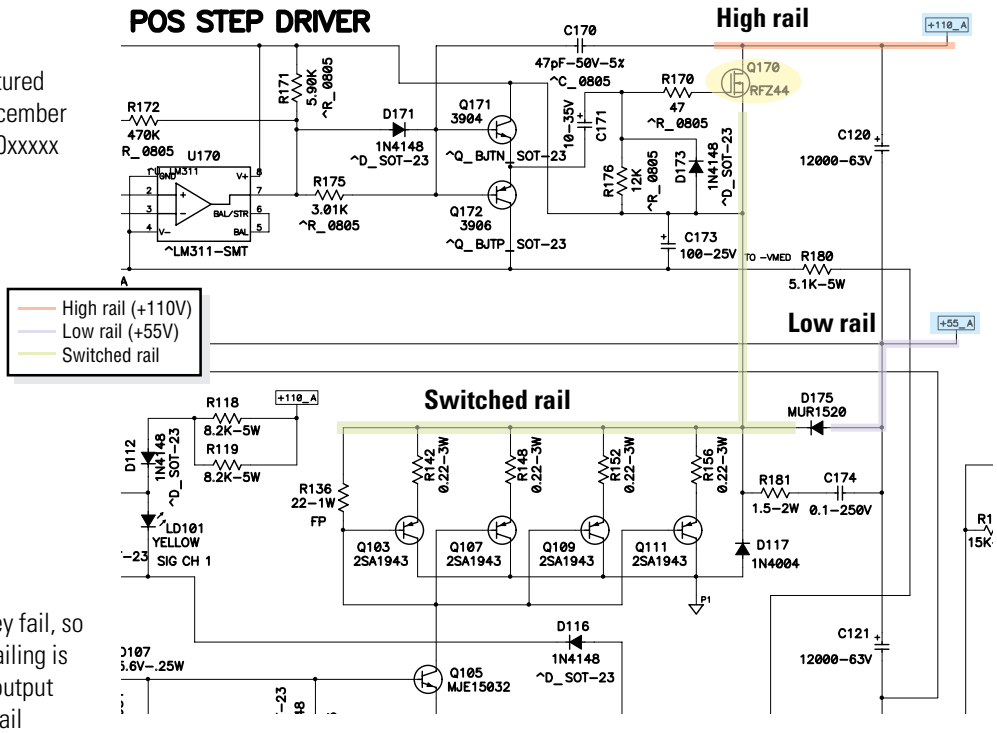


*Figure 1. The step switching circuit, including the FET. Shown here is the positive side of Channel 1. Channel 2's is identical, and the negative switching circuits are similar.*

If that happens, the uneven rail voltages may cause an audible pop in the loudspeaker when the amplifier is turned off. Also, the thermal stress of the resulting higher operating temperature may shorten the life of other electronic components.

The instructions on the next page describe how to verify the condition of the FETs.

### Circuit description:

The output circuits of the RMX 2450 use two sets of positive and negative supply voltages: one set (the low rails) is approximately +55 and -55 volts, and the other (the high rails) is approximately +110 and -110 volts. These voltages are unregulated and will vary with the AC line voltage.

At idle and most signal levels the low rails are sufficient for reproducing audio cleanly, so the current flows from the +55 volt supply through a diode to the switched rail (as shown in Figure 1, which depicts the positive side of Channel 1's output circuitry). The same thing happens on the negative side, too, as well as on Channel 2.

But transients and peaks often require more voltage, so comparator circuits detect when the audio signal requires one of the switched rails to be switched up to the high voltage. The comparator circuit turns on the FET (for example, Q170 in Figure 1), which switches the switched rail up to the high rail supply of +110 volts. This reverse-biases the diode (D175 in Figure 1) and prevents current from flowing from the high rail to the low rail. When the signal drops back down below the point where the high rail voltage is needed, the comparator turns off the FET, and the switched rail drops down to the lower voltage again.

Thus, a short-circuited FET is always "on," and it will pull its switched rail up to the high rail voltage permanently.

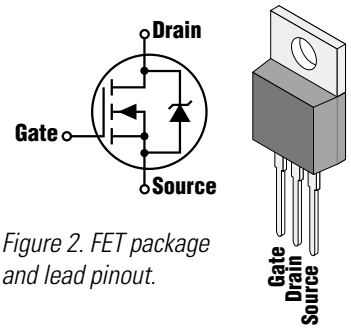


*Figure 2. FET package and lead pinout.*

# Tools and materials required:

- Digital multimeter
- #1 and #2 Philips screwdrivers
- 2.5 mm Allen (hex) wrench
- Soldering iron and rosin-core solder (60/40 or 63/37 eutectic type)
- Desoldering equipment or solder braid
- Needle-nose pliers
- Replacement FETs (Motorola MTP52N06V or QSC-authorized substitute; QSC part # 490F-Z440-5); four per amplifier (Figure 2)

# Procedure: Identifying defective FETs

1. Disconnect the amplifier from the AC power. Disconnect all inputs and outputs.
2. Remove the top cover.
3. Reconnect the amplifier to the AC line and turn it on.
4. Use the heat sink as ground reference. On both channels, check the positive and negative stepped rail voltages on both channels by measuring the DC voltage at the emitter resistors (Figure 2).

   If the FETs are working properly, the stepped rail voltages should be +55 volts and -55 volts (±5 volts). If an FET is shorted, its switched rail will be at +110 volts or -110 volts (±10 volts).

   On Channel 1, Q170 switches the positive rail and Q174 switches the negative. Similarly, on Channel 2, Q270 switches the positive rail and Q274 switches the negative.

If you find that any FETs have failed, you must replace all four of them. If all four are okay, turn the amplifier off, reinstall the top cover, and return the amplifier to use.

# Procedure: Replacing defective FETs

## Preparation

1. Turn the amplifier off and disconnect it from the AC line. Wait about 10 minutes for the internal voltages to bleed down.
2. Lift the amplifier up onto its side and remove the four screws that attach the heat sinks and the chassis. Set the amp back down.
3. A rectangle of black plastic covers the FETs on each channel. To move it out of the way, loosen the 2.5 mm hex screw on the clamp on transistors Q110 and Q112 (on Channel 1) and on Q210 and Q212 (on Channel 2). Use needle-nose pliers to pull the end of the plastic out from under the loosened clamp. Tuck the free end of the plastic between the nearby 12,000 µF reservoir capacitors to hold it away from the FETs.
4. Remove the screw on each FET.
5. On the amp's rear panel, loosen the four screws on the fan grill until you can lift up and remove the fan's metal shroud.
6. On the front panel, pull the gain control knobs straight off.
7. Remove the screws (five on Channel 1 and six on Channel 2) that fasten the channel module circuit boards to the chassis standoffs.

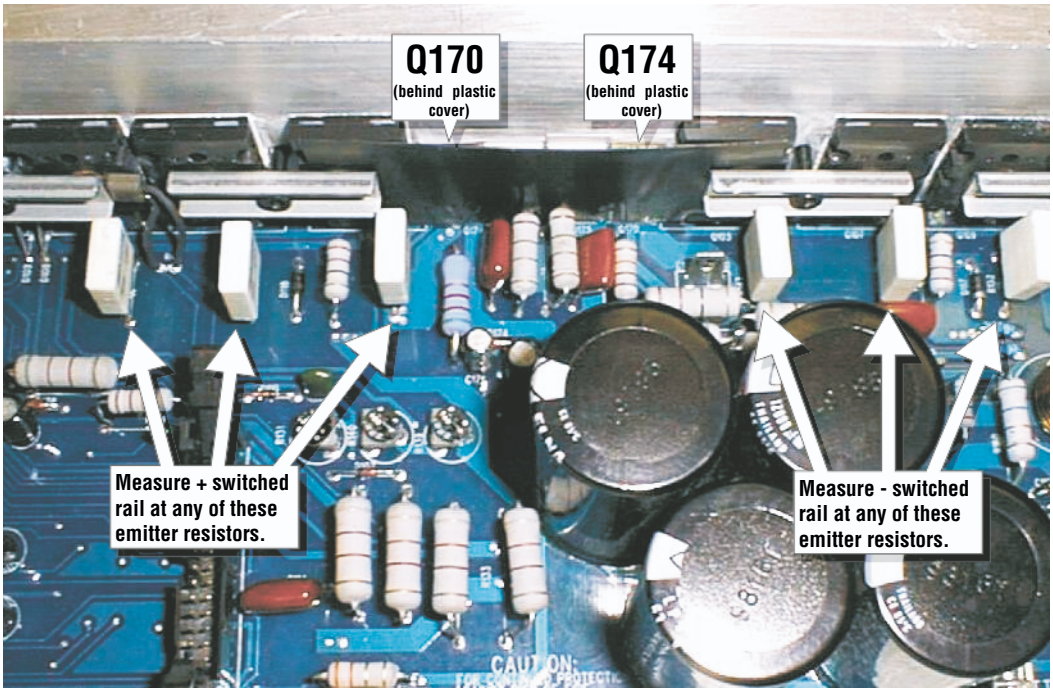


*Figure 3. FET and emitter resistor locations. Channel 1 shown; Channel 2 is similar.*

8. Disconnect the 26-pin header J203 from Channel 1's module and the three-pin J257 from Channel 2's. Disconnect one end of the ribbon cable that joins the channel modules together in front of the heat sinks.
9. To protect the chassis paint and finish, cover the upper edge of the amp's front panel with a towel, pad, or other protective material.
10. Slide the two channel modules back. Lift up the front ends and set the modules vertically in the chassis so they rest on the rear end of the heat sinks. This permits easy access to both sides of the circuit boards.

## Removing and replacing the FETs

11. Carefully unsolder and remove the four FETs. Because the holes are so close to the heat sink, it may be easier to remove the solder using solder braid instead of a vacuum-type desoldering device.
12. Inspect the mica insulator and clean away any debris that could cause the new component to short-circuit to the heat sink.
13. Insert a new FET into the circuit board. Re-use the screw and plastic washer from the old FET and attach the new FETto the heat sink. Tighten the screw only with light finger pressure; overtightening can damage the washer or the mica insulator underneath and short the FET to the heat sink. Repeat for the three other FETs.
14. Solder the FET leads to the circuit boards.

## Re-assembly

15. Place the plastic covers back over the FETs and slip their free ends back under the transistor clamps. Tighten the clamps.
16. Set the modules back down and re-attach them to the chassis. Re-install the gain control knobs and the fan shroud. Re-connect the ribbon cable and headers J203 and J257.
17. On the underside of the amplifier, fasten the heat sinks to the chassis.

## One last test

18. Plug in the amplifier to the AC power and turn it on. Measure the switched rail voltages to verify that the FETs are operating correctly.
19. Re-install the top cover. The amplifier is ready for use.

## Contact information

If you need any further information regarding this service procedure, please contact QSC Technical Services at the addresses or numbers below. You can also order parts; to expedite processing please use the correct part number when ordering.


*Telephone:* 1-800-772-2834 (within USA only)
+1 714-957-7150

*Fax:* +1 714-754-6173

*E-mail:* tech_support@qscaudio.com

Web Site: www.qscaudio.com (product info/support)
www.qscstore.com (on-line accessory and replacement component sales)

*Postal and parcel address:*

QSC Audio Products, Inc.
Technical Services Group
1665 MacArthur Blvd.
Costa Mesa, CA 92626 USA