



Engineering Change Notice (ECN) 002

Thermally Compensated Surface Mount SMT-334 Regulator Dyna-70 Ultimate Upgrade Regulator Update

Part/System: Dyna-70 Ultimate Upgrade Circuit Card Assembly (Auto. & Man. Bias configuration)
Effectivity: 27 September 2023
Priority: Optional; an upgrade to the Dyna-70 is not required, however it is recommended for best amplifier performance.

Introduction

This ECN addresses the operational environment of the LM-334 as utilized in the Dyna-70 Ultimate Upgrade Kit. As a part of our continuous product & process improvement efforts, Miller Audio LLC (MALLC), in conjunction with Auto Amp in Slovakia, has developed a surface mounted, thermally compensated LM-334 regulator as a replacement for the TO-92 packaged LM-334 as provided in all original Kits of the Dyna-70 Ultimate Upgrade.

This does not impact Miller Audio LLC built Dyna-70 Ultimate Upgrade ST-70 amplifiers. We build all new amplifiers with the newest and latest components in use at time of order / sale.

This new part is an upgrade over all previous LM-334 installations used on the Dyna-70 Ultimate Upgrade, and addresses the operational impacts identified in ECN001 (Ref. ECN001 for details). There is no defect or fault in the LM-334, the Dyna-70 Printed Circuit Board (PCB), the completed Dyna-70 Circuit Card Assembly, or in its design.

ECN002 introduces a new part that supersedes the original LM-334 regulator as utilized in ECN001 and all previous editions of the Dyna-70 Ultimate Upgrade. This is an optional upgrade; it is not required to continue use and enjoyment of your Dyna-70 Ultimate Upgrade ST-70 amplifier. However, we recommend that when the proper time presents itself, that all owners consider this upgrade since the new part is thermally compensated and has less impact on sound stage if amplifier has been playing for a long period of time and it reaches thermal equilibrium.

With this release of ECN002, all Dyna-70 Ultimate Upgrade Kits will include this new SMT-334 in the kits at no charge.

Background

Recent testing in early 2023 demonstrated the LM-334 (i.e., all components in the LM134/234/334 family) exhibit thermal sensitivity (common with semiconductors) that can impart negative effects to the audio signal in the audio drive circuits in the 6SN7's for the left channel (V1) and right channel (V5) of the Dyna-70 Ultimate Upgrade Kit.

This has not been an issue with Dyna-70 upgraded ST-70's where the amplifier is operated with the tube cage removed. However, from a safety standpoint with regard to children, pets, or flammable objects, MALLC recommends users keep the tube cage in place during operation of the amplifier. While a Dyna-70 modified ST-70 using the tube cage will play for long periods of time, it has been noted that changes in distortion levels increase over time due to thermal heating of the LM-334, reaching an equilibrium thermal environment that degrades sound quality and stereo image in those units where users keep the tube cage in place.

Engineering Analysis

The Dyna-70 Ultimate Upgrade utilizes two LM-334 voltage regulators for the amplifier drive stage of the left and right channel 6SN7 tubes, V1 and V5. Adjacent to the V1 and V5 6SN7 signal tubes, are V3 and V6, the left and right EL34/6CA7 power output tubes. The LM-334 is in this corner between tubes V1 & V3 on the left side and V5 and V6 on the right side, reference Figure 1.

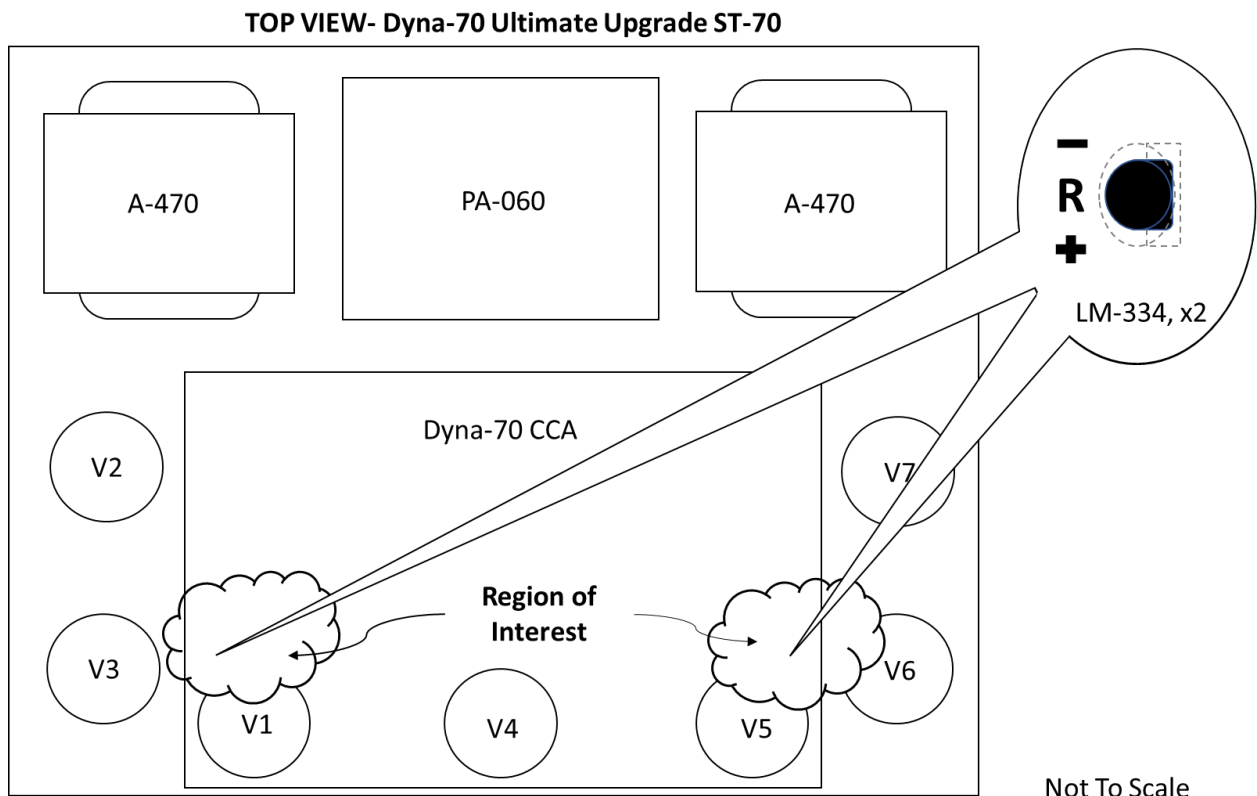


Figure 1- Thermal Region of Interest with LM-334 Regulator

Action & Resolution

MALLC in reviewing preliminary findings and reviewing technical documentation from Texas Instruments on the LM-134/234/334 family of regulators, resolved that the best solution was to introduce a thermally compensated SMT-334, providing a solution that provides a more robust design and less user interaction with the amplifier (however we still suggest use of the Vornado Zippy Fabric Fan, it just keeps the whole amplifier cooler).

1. Since many owners of Dyna-70 Ultimate Upgrade use their ST-70 amplifier without the tube cage, they don't experience or notice any thermal distortion: Continue operation without the tube cage, however its suggested owners consider use of a small, quiet fan for improved air circulation across the Dyna-70 CCA.

2. For owners that operate their Dyna-70 Ultimate Upgrade with a tube cage, use of a small fan also helps to stir air circulation and convection cooling currents, lowering thermal distortion. This benefits both users who use a tube cage and those who do not use a tube cage. MALLC has measured a 30F degree decrease in LM-334 temperatures using forced air cooling from the Zippy Fan vs. no force air cooling. This did not involve use of a heat sink, but the bare, top-mounted LM-334. Use of a fan permits leaving the LM-334 in its topside location, which will also extend service life of all hot components in the amplifier.



Figure 2- Vornado Zippy Fan

NOTE: We use and can recommend the Vornado brand Zippy cloth three-blade personal fan, Figure 2. They are available at Home Depot, Amazon, Target, etc. for approximately \$25. They feature 2-speeds and are very quiet and safe to use since the blades are fabric.

3. For new builds or retrofit of the Dyna-70 Ultimate Upgrade Kit in either Automatic or Manual Bias configurations, we recommend the SMT-334 be mounted on the underside (backside) of the Dyna-70 PCB, reference following illustration, Figure 3. This follows the previous TO-92 packaged LM-334 relocation in ECN001, reducing exposure to elevated temperatures near the tubes. As described in ECN001 and this ECN, the mounting of all -334 regulators is now to be made on the underside of the Dyna-70 PCB; DO NOT mount the -334 in the topside location as originally described in the Auto Bias and Manual Bias Assembly Manuals.

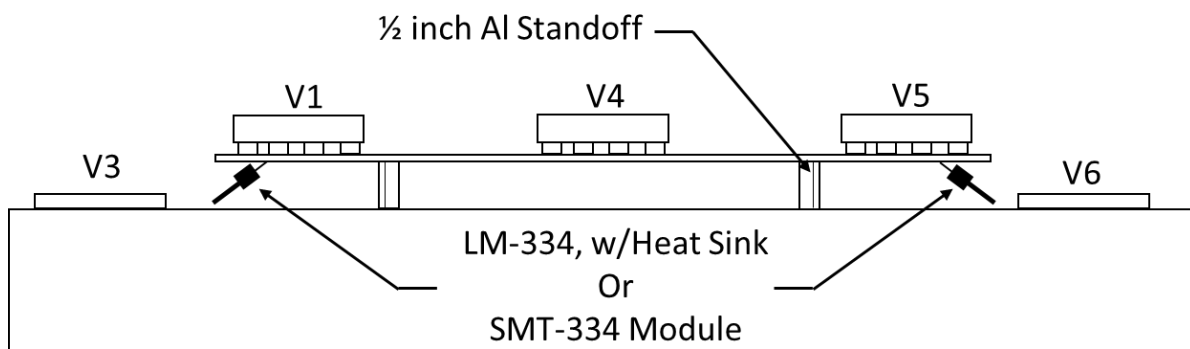


Figure 3- Front View Dyna-70 CCA with underside mounting of SMT-334; mounts in similar fashion to earlier LM-334 TO-92 package.

While this is not a complication for the Manual Bias version of the Dyna-70, the Auto Bias version will require more attention to detail during assembly since there are more wires that can snag and interfere with the SMT-334.

We suggest the SMT-334 be installed after all wiring between the Dyna-70 CCA and the Auto Bias CCA has been completed and before final mounting of the Dyna-70 Circuit Card Assembly (CCA), allowing for insertion of the SMT-334 from the bottom of the PCB and soldering from the top of the PCB, then trimming the remaining lead excess from the top surface of the PCB. **Pay particular attention to the polarity of the SMT-334, the markings are small on the SMT-334 and one can easily confuse the “+” sign and the negative ground arrow symbol!**

Also ensure that the SMT-334 does not contact the solder points for R12. This was not an issue in our prototype development, but if not aligned properly, it could touch one of these R12 solder locations and ground the circuit. **DO NOT let the SMT-334 or any part of the SMT-334 assembly touch any electrical connection points!**

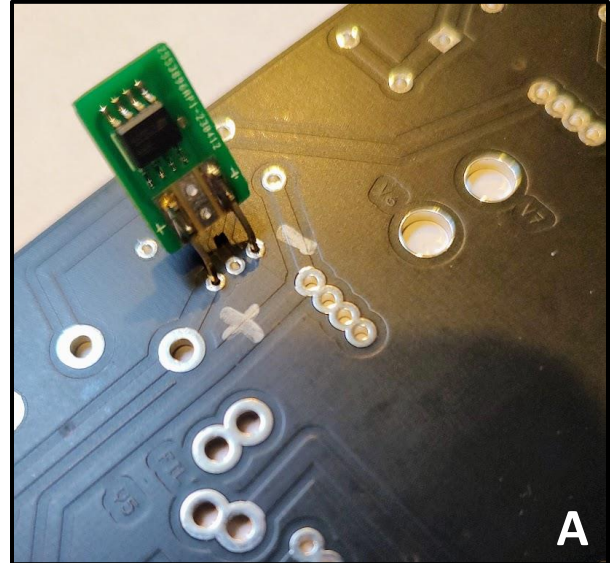


Photo A: Underside view of Dyna-70 PCB; viewed from underside, this is the left side SMT-334 (Right side when installed face-up on amplifier). Note polarity markings on PCB and the SMT-334.

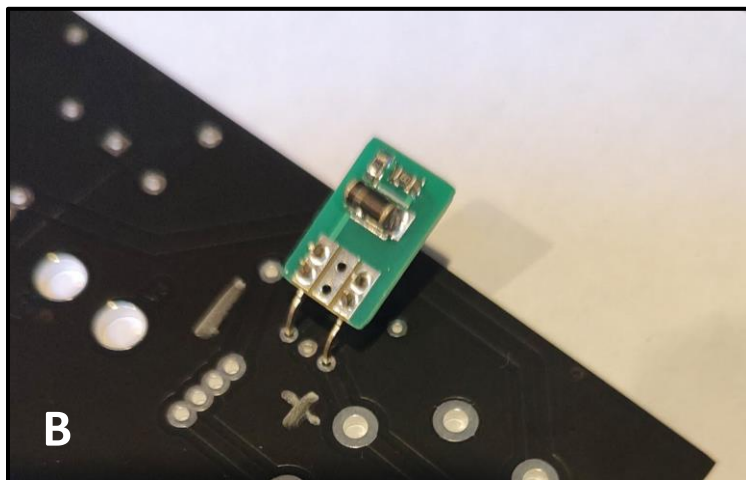
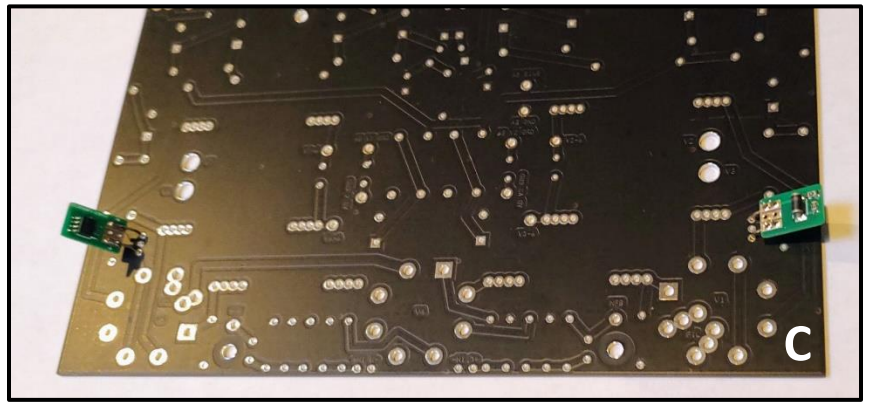


Photo B: Underside view of Dyna-70 PCB; viewed from underside, this is the right side SMT-334 (Left side when installed face-up on amplifier). Note polarity marking on PCB- on this side of the SMT one can not see the Positive and Negative markings on SMT-334.

Photo C: Underside view of Dyna-70 PCB; this is the full view of the Dyna-70 PCB. Note correct installation of the SMT-334 has the SMT334 (small black square chip) facing to the RIGHT when viewed from underside of PCB.

The tubular resistor on both SMT334's will face to the LEFT when viewed from underside of Dyna-70 PCB



4. For fully assembled and operating Dyna-70 Ultimate Upgrade ST-70's, owners are encouraged to remove the top mounted LM-334 and install the SMT-334 on the underside of the Dyna-70 PCB. We suggest you obtain 2 new SMT-334's do not try to de-solder and then re-solder the same LM-334's on the underside. Often the components experience a long heating cycle during removal that exceeds the rated thermal time-at-temperature for the device, ruining the -334.

Users are cautioned to permit their amplifier time to cool to room temperature while ensuring that all electrolytic power capacitors have discharged. We suggest a minimum of 20-30 minutes or more to cool the amplifier and discharge the capacitors. Finally, we recommend use of an Aluminum heat sink clamp to prevent overheating of the SMT-334 during soldering into the PCB, see figure 4.



Figure 4- Heat Sink Clamp

#5. MALLC will update the Dyna-70 Ultimate Upgrade Kit Assembly Manuals to reflect this change.

#6. MALLC will post this ECN in its' website documentation pages for reference.

Miller Audio LLC reserves the right to make design changes, parts replacement, substitutions and specification revisions at any time without notice. If you have questions about these changes/updates, please contact us.

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