

#### FEATURES

- Demonstrates a complete 2 channel digitally-controlled microphone preamplifier system based on THAT5263 IC
- Controls gain of two microphone preamplifiers
- Balanced main audio input/output on XLR connectors
- Balanced TRS line input with -20dB pad
- Switchable phantom power (with external +48V)
- Supports pro audio signal levels: +26 dBu (input and output,  $\pm 15V$  supplies)
- Gain adjustable in 3 dB steps from 0 dB to 51 dB
- Easy to use PC Graphical User Interface software
- Generous prototyping area

#### DESCRIPTION

The THAT 5263-DEMO Digitally-Controlled Mic Preamp Demo Board allows developers to evaluate the THAT5263 digital gain controller IC with THAT differential output microphone preamplifiers. A fully-featured microphone preamplifier is demonstrated

with phantom power switching and fault protection, mic/line inputs, RFI filtering, and output conditioning. The board is controlled by a user-friendly PC graphical user interface over USB.

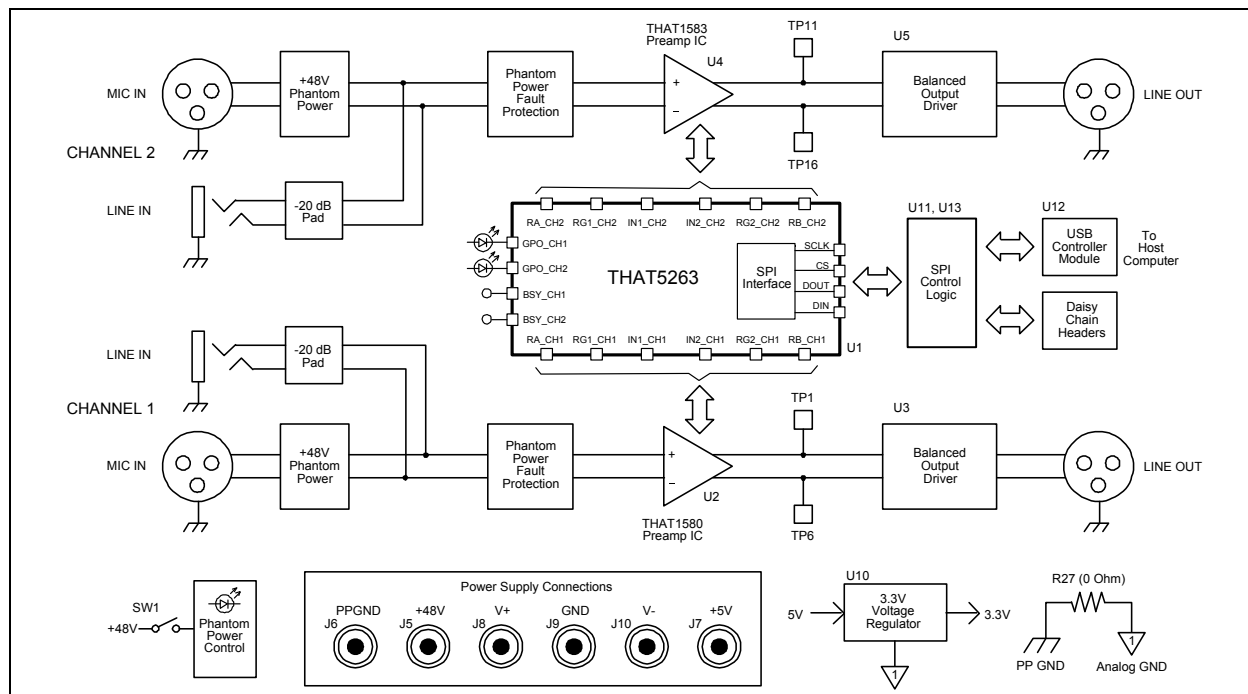


Figure 1. THAT5263 Simplified Application Circuit

## **Overview**

The THAT5263 is a digital gain controller for low-noise, analog, differential, current-feedback audio preamplifiers. When used in conjunction with an appropriate analog gain block (e.g. THAT 1580 or 1583), the 5263 can digitally control gain from 0dB to 51dB in 3dB steps, while preserving low noise and distortion. It operates from  $\pm 5\text{V}$  to  $\pm 17\text{V}$  supplies, supporting input signal levels as high as +27 dBu (at 0dB gain,  $\pm 17\text{ V}$ ) without an input pad.

The THAT5263-DEMO Board demonstrates the 5263 mated with the 1580 and 1583 mic preamplifier ICs in a typical circuit. An easy to use USB Graphical User Interface provides total control over all 5263 features. Developers can take advantage of the generous prototyping area to customize the circuit for their own application.

## **Connections**

### **Power**

The USB interface runs on USB bus power, but the rest of the demo board requires an external power supply. +/-15 V (maximum +/-17V) supplies the analog circuitry. +48V phantom power is input (not generated on the board) and switched on and off via the on-board Phantom Power switch. Note that the ground return for +48V phantom power is via the PPGND and connects to the Analog ground via a zero ohm resistor. connector. The +5V input is regulated on board to 3.3V and supplies the digital logic.

### **Audio Input**

The Neutrik combo connector accepts an XLR or 1/4" TRS cable. The 1/4" TRS signal path includes a 20dB pad in order to support line levels.

### **Audio Output**

The Output XLR connector provides access to the balance audio output signal. Please note that the differential attenuator/ output buffers (U3/U5) add a small amount of noise and distortion to the signal and it is therefore recommended that test points TP10 - TP11 be used to measure performance of the mic preamp circuit in isolation.

### **USB**

A PC must be plugged into the demo board via USB in order to control parameters in the 5263. Take care not to hot plug the demo board while the GUI software is running as this will sometimes crash the Windows drivers.

### **General Purpose Outputs (GPOA, GPOB) and Busy Signal Outputs (BSYA, BSYB)**

Each channel of the 5263 provides a GPO in addition to a digital busy signal (BSY). These pins are connected to header P12 via small series resistors. The GPOs are also connected to LEDs D10 and D11. The LEDs can be enabled/disabled by the on-board DIP switches SW2-1 and SW2-2. When enabled, these LEDs can be controlled with the GPO check box on the GUI.

### **Connecting Multiple Demo Boards in Daisy Chain Mode**

Headers P9 and P10 provide easy access to the SPI signals for linking multiple pairs of 5263 channels. Please refer to the 5263 Data Sheet for complete details. Note that the on-board DIP switches SW2-3 and SW2-4 control the Daisy Chain function. These switches must be set to the OFF position (toward the left side of the board) in order to insure proper operation in the normal two channel mode.

## Software Set-up and Operation

Download the latest 5362 Demo Board GUI software from the THAT Corporation web site

In the .zip file you will find the GUI executable along with other associated demo board documentation. Simply un-zip the file and place the MicPre\_v1\_3.exe in some convenient location on your PC.

Once the hardware has been set up as described above, double click the MicPre.exe icon and the GUI should appear:

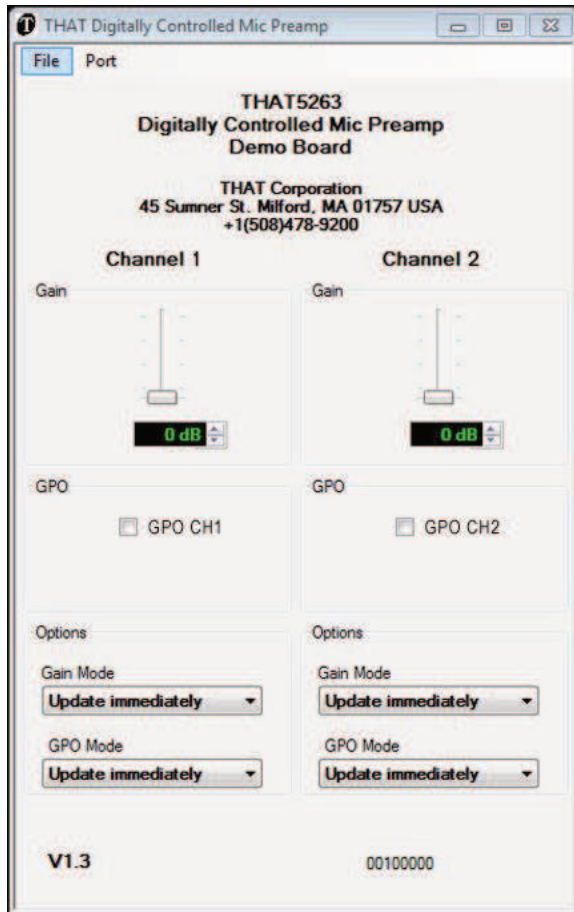


Figure 2. 5263-DEMO GUI

Next connect the GUI to the demo board by clicking on the Port pull down menu at the top and selecting Reconnect.

The small green LED on the USB module should blink, indicating that communications have been established. Try the GPO check boxes on the GUI and the red LEDs on the demo board should light up,

indicating that the GUI is successfully talking to the 5263.

If the GUI fails to recognize the demo board (most likely caused by a missing USB connection) you will see the following error message:

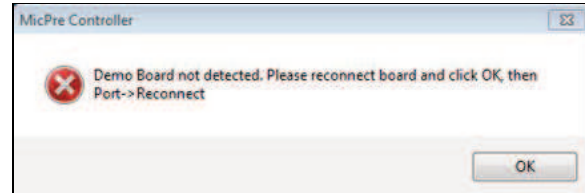


Figure 3. 5263-DEMO software error message.

If this message appears, you can click OK and the GUI will open, but there will be no connection to the demo board. Once the source of the problem has been resolved (i.e. Turn on the power or connect the missing USB cable), use the Port=>Reconnect pull down to establish communications.

The Port=>Reconnect pull down can be used any-time to reestablish the USB link between the GUI and demo board.

Select "Update immediately" or "Update on zero crossings" from the Gain Mode and GPO Mode drop down menus.

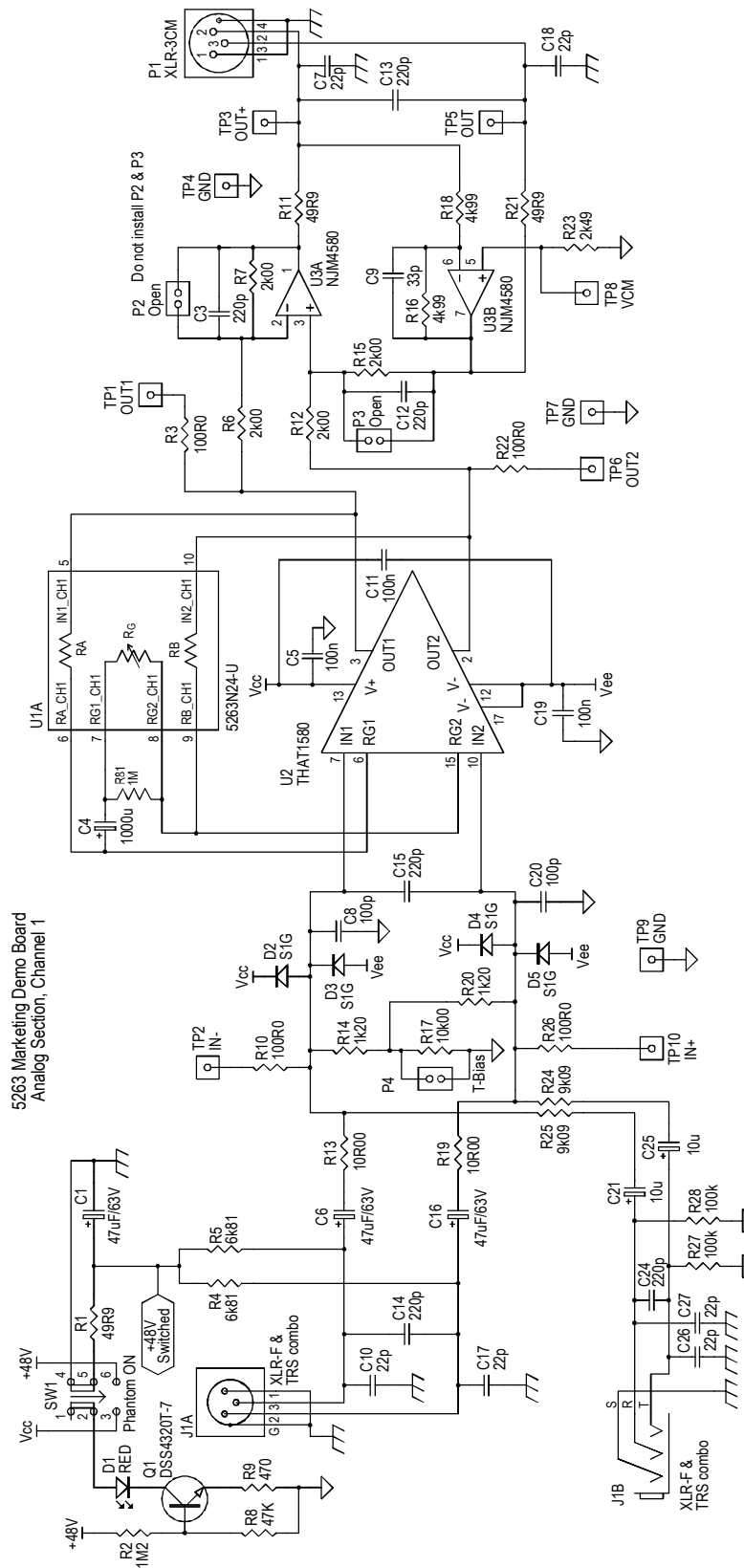
Move the gain slider to adjust gain of the 5263. Gains are continuously adjusted as you move the slider. You may also adjust the gain slider by first giving it scope (clicking it with the mouse) and then pressing the UP and DOWN arrow keys on your computer keyboard, or by clicking the up or down arrow buttons next to the numeric gain text box below the gain slider.

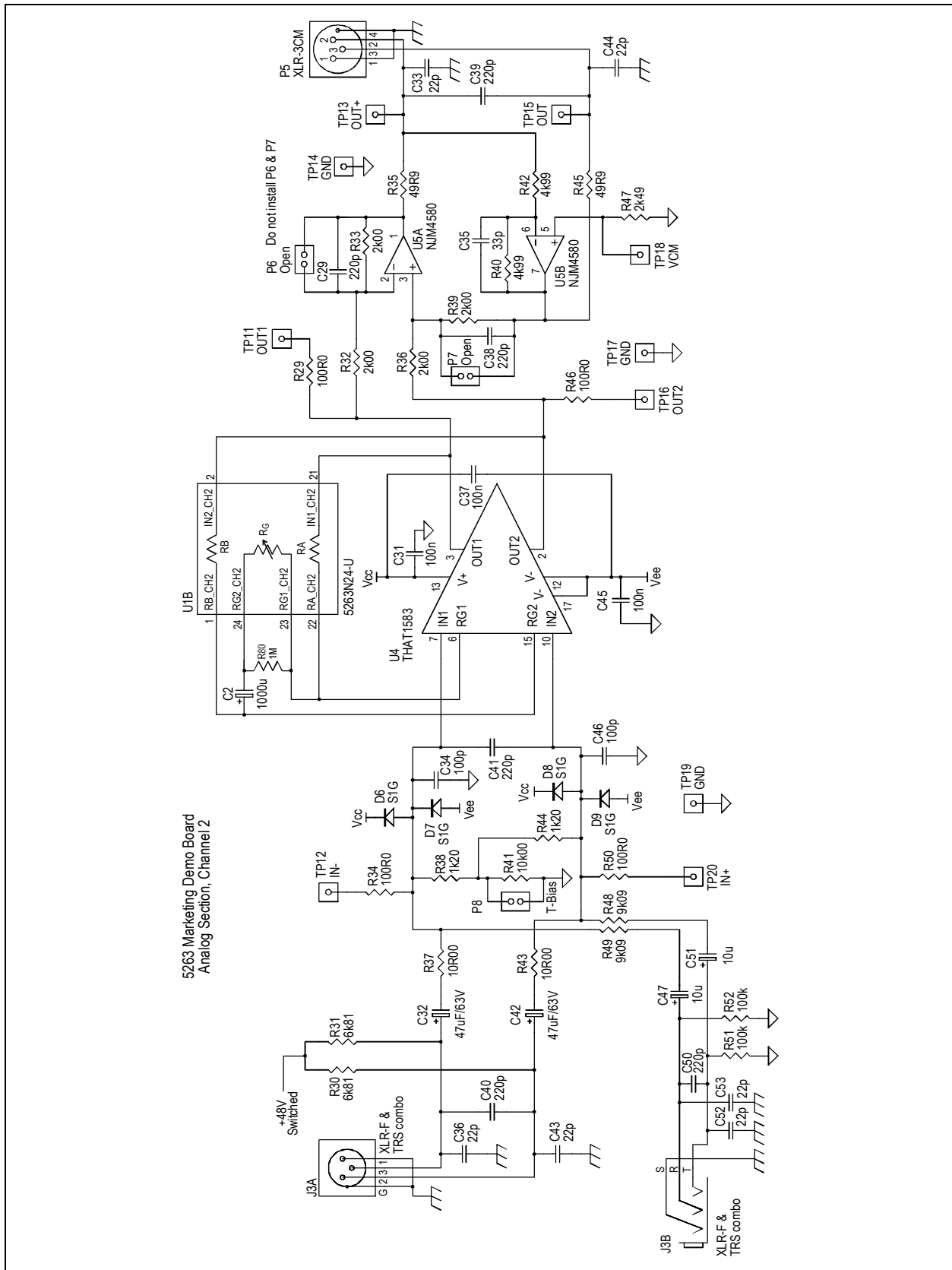
### Jumper Options

T-Bias Jumpers, P4, P8

The input circuit provides jumpers (P4, P8) which enable/disable the "T-Bias" function. With the shunts installed, T-Bias is disabled and the circuit provides a 2kΩ differential input impedance to the XLR input. With the shunts removed, T-Bias is enabled and provides a high common mode impedance (ideal for both mic and line inputs) but maintains a modest differential impedance.

## Appendix A. Schematic (1 of 3)



**Appendix A. Schematic (2 of 3)**

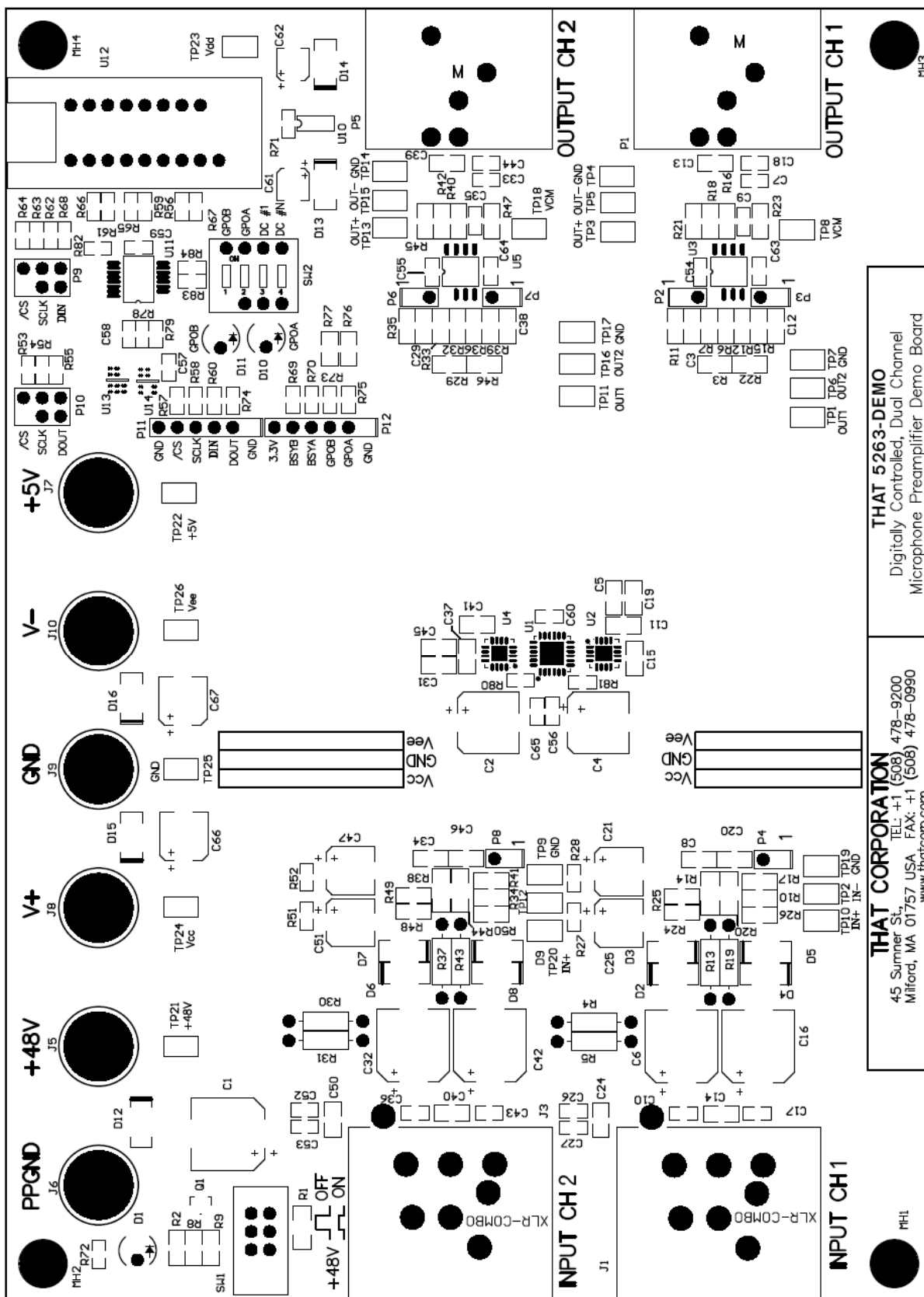


## **Appendix B. Bill of Materials**

| Item | Qty | P/N    | Title     | Detail                                   | Reference(m)                                                               | Mfr                    | Mfr P/N                   |
|------|-----|--------|-----------|------------------------------------------|----------------------------------------------------------------------------|------------------------|---------------------------|
| 1    | 2   | 030000 | RESISTOR  | 0R 100MW 5% THICK FILM<br>200 PPM 0603   | R71, R72                                                                   | Panasonic              | ERJ-3GEY0R00V             |
| 2    | 9   | 031002 | RESISTOR  | 10K0 100MW 1% THICK<br>FILM 100 PPM 0603 | R62, R63, R64, R65, R66,<br>R67, R68, R78, R79                             | Vishay Dale            | CRCW06031002FRT1          |
| 3    | 14  | 034999 | RESISTOR  | 49R9 100MW 1% THICK<br>FILM 100 PPM 0603 | R53, R54, R55, R56, R57,<br>R58, R59, R60, R61, R69,<br>R70, R73, R74, R75 | Xicon                  | 302-49.9-RC               |
| 4    | 4   | 070551 | RESISTOR  | 10R00 1/4W 0%1 MF 50<br>PPM AXIAL        | R13, R19, R37, R43                                                         | VPR                    | A010.00M3EB               |
| 5    | 4   | 070567 | RESISTOR  | 6K81 1/4W 0%1 MF 25<br>PPM AXIAL         | R4, R5, R30, R31                                                           | IRC                    | RC55LF-D-6K81-B-B         |
| 6    | 1   | 070568 | RESISTOR  | 49R90 1/4W 0%1 MF 25<br>PPM1206          | R1                                                                         | Vishay Dale            | TNPW120649R9BEEN          |
| 7    | 4   | 070570 | RESISTOR  | 49R90 1/10W 0%1 THIN<br>FILM 25 PPM 0805 | R11, R21, R35, R45                                                         | Stackpole Electronics  | RNCS0805BKE49R9           |
| 8    | 4   | 080003 | RESISTOR  | 100K 63MW 1% THIN FILM<br>100 PPM 0603   | R27, R28, R51, R52                                                         | Venkel, Ltd.           | TFCR0603-16W-C-<br>1003FT |
| 9    | 8   | 084001 | RESISTOR  | 100R0 100MW 1% THIN<br>FILM 25 PPM 0805  | R3, R10, R22, R26, R29,<br>R34, R46, R50                                   | VPR                    | A100.00E3EF               |
| 10   | 2   | 084003 | RESISTOR  | 10K00 100MW 0%5 THIN<br>FILM 25 PPM 0805 | R17, R41                                                                   | Susumu Co              | RR1220P-103-D             |
| 11   | 1   | 084007 | RESISTOR  | 1M2 0.125W 1% TF 100<br>PPM 0805         | R2                                                                         | Vishay Dale            | CRCW08051M21FKEA          |
| 12   | 8   | 084008 | RESISTOR  | 2K00 100MW 0%1 THIN<br>FILM 25 PPM 0805  | R6, R7, R12, R15, R32,<br>R33, R36, R39                                    | Susumu                 | RR1220P-202-B-T5          |
| 13   | 4   | 084009 | RESISTOR  | 9K09 125MW 0%1 THIN<br>FILM 25 PPM 0805  | R24, R25, R48, R49                                                         | Susumu Co              | RG2012P-9091-B-T5         |
| 14   | 4   | 084011 | RESISTOR  | 4K99 100MW 0%5 THIN<br>FILM 25 PPM 0805  | R16, R18, R40, R42                                                         | Susumu                 | RR1220P-4991-D-M          |
| 15   | 1   | 084012 | RESISTOR  | 47K0 125MW 1% THIN<br>FILM 100 PPM 0805  | R8                                                                         | Yageo                  | RC0805FR-0747KL           |
| 16   | 1   | 084013 | RESISTOR  | 470R 125MW 1% TF 100<br>PPM 0805         | R9                                                                         | Yageo                  | RC0805FR-07470RL          |
| 17   | 2   | 084014 | RESISTOR  | 2K49 125MW 1% THIN<br>FILM 100 PPM 0805  | R23, R47                                                                   | Stackpole Electronics  | RNCP0805FTD2K49           |
| 18   | 2   | 084015 | RESISTOR  | 330R 125MW 1% TF 100<br>PPM 0805         | R76, R77                                                                   | Yageo                  | RC0805FR-07330RL          |
| 19   | 4   | 084061 | RESISTOR  | 1K20 0.25W 0%1 THIN<br>FILM 25 PPM 1206  | R14, R20, R38, R44                                                         | Vishay Dale            | TNPW12061K20BEEN          |
| 20   | 10  | 131054 | CAPACITOR | 100N 10% 50V X7R CM<br>0603              | C54, C55, C56, C57, C58,<br>C59, C60, C63, C64, C65                        | Murata Electronics     | GRM188R71H104K            |
| 21   | 6   | 131062 | CAPACITOR | 100N 10% 50V X7R CM<br>0805              | C5, C11, C19, C31, C37,<br>C45                                             | Murata Electronics     | GRM21BR71H104KA0<br>1L    |
| 22   | 4   | 131063 | CAPACITOR | 100P 10% 50V X7R CM<br>0805              | C8, C20, C34, C46                                                          | Murata Electronics     | GRM2165C1H101JA01<br>D    |
| 23   | 12  | 131065 | CAPACITOR | 220P 5% 50V NP0 CM LOW<br>ESR 0805       | C3, C12, C13, C14, C15,<br>C24, C29, C38, C39, C40,<br>C41, C50            | AVX                    | 08055A221JAT2A            |
| 24   | 12  | 131066 | CAPACITOR | 22P 10% 50V NP0 CM LOW<br>ESR 0805       | C7, C10, C17, C18, C26,<br>C27, C33, C36, C43, C44,<br>C52, C53            | Panasonic              | ECJ-2VC1H220J             |
| 25   | 2   | 131067 | CAPACITOR | 33P 5% 50V NP0 CM LOW<br>ECR 0805        | C9, C35                                                                    | Panasonic              | ECJ-2VC1H330J             |
| 26   | 4   | 137010 | CAPACITOR | 10U 20% 50V ALUMINUM<br>SMT              | C21, C25, C47, C51                                                         | Nichicon               | UWX1H100MCL1GB            |
| 27   | 2   | 137011 | CAPACITOR | 10U 20% 25V ALUMINUM<br>SMT              | C61, C62                                                                   | United Chemi-Con, Inc. | EMVA250ADA100MD5<br>5G    |
| 28   | 2   | 137012 | CAPACITOR | 22U 20% 25V ALUMINUM<br>LOW IMP SMT      | C66, C67                                                                   | Panasonic              | EEV-FC1E220P              |
| 29   | 5   | 137013 | CAPACITOR | 47U 20% 63V AL LOW ESR<br>SMT            | C1, C6, C16, C32, C42                                                      | Panasonic              | EEE-TG1J470P              |
| 30   | 2   | 137025 | CAPACITOR | 1000U20% 6.3V<br>ALUMINUM SMT            | C2, C4                                                                     | Nichicon               | UWT0J102MNL1GS            |

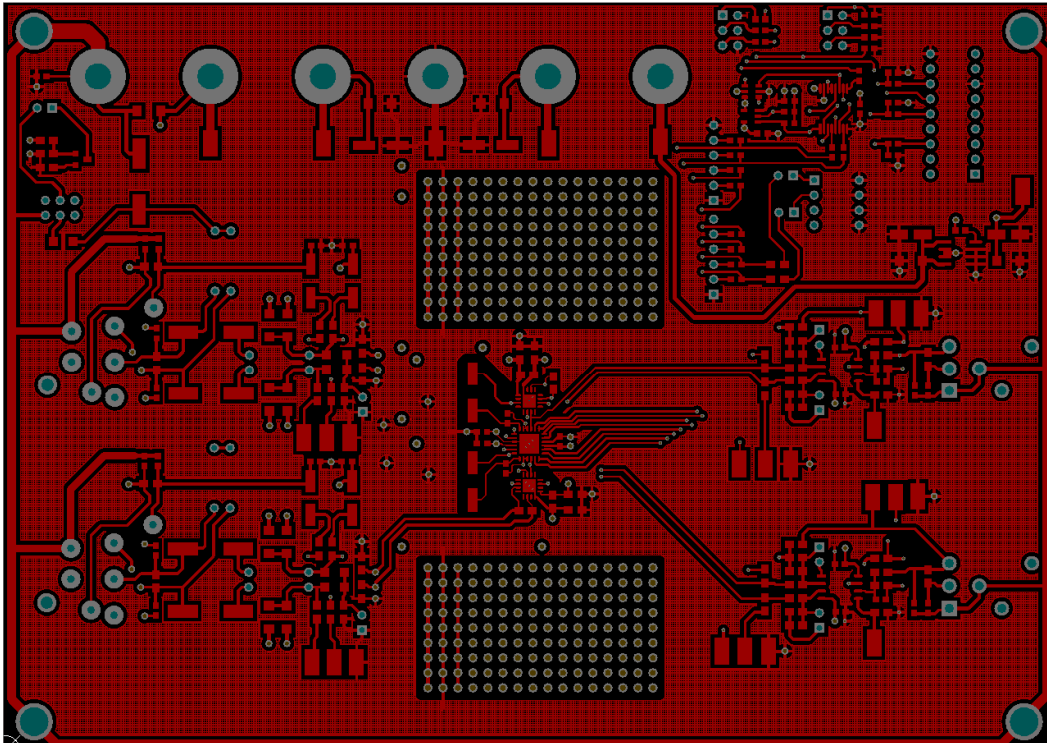
| Item | Qty | P/N       | Title      | Detail                                         | Reference(m)                                                                                                                                      | Mfr                              | Mfr P/N          |
|------|-----|-----------|------------|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------|
| 31   | 13  | 140017    | DIODE      | RECTIFIER 1A 400V DO-214AC S1G                 | D2, D3, D4, D5, D6, D7, D8, D9, D12, D13, D14, D15, D16                                                                                           | Diodes, Inc.                     | S1G-13-F         |
| 32   | 1   | 140035    | TRANSISTOR | BIPOLAR NPN 20V 2A SOT-23DSS4320T-7            | Q1                                                                                                                                                | Diodes, Inc.                     | DSS4320T-7       |
| 33   | 3   | 140146    | LED        | RED HIGH BRIGHTNESS                            | D1, D10, D11                                                                                                                                      | Rohm                             | SLA-560LT3F      |
| 34   | 1   | 146292    | IC         | REGULATOR VOLTAGE LOW DROP 3.3V SO-8 MAX604CSA | U10                                                                                                                                               | Maxim / Dallas                   | MAX604CSA        |
| 35   | 2   | 146380    | IC         | OP AMP DUAL LOW NOISE DMP-8 NJM2114M           | U3, U5                                                                                                                                            | NJR Corporation                  | NJM2114M         |
| 36   | 1   | 146381    | IC         | MULTIPLEXER QUAD 2 INPUT 74LVC157ADB,112       | U11                                                                                                                                               | NXP                              | 74LVC157ADB,112  |
| 37   | 1   | 146462    | IC         | MULTIPLEXER SINGLE 2 INPUT 74LVC1G157GV,125    | U13                                                                                                                                               | NXP Semiconductors               | 74LVC1G157GV,125 |
| 38   | 1   | 146692    | IC         | AND GATE SINGLE SMT SN74LVC1G08DBVR            | U14                                                                                                                                               | Texas Instruments                | SN74LVC1G08DBVR  |
| 39   | 1   | 1580N16-U | IC         | IC DIFFERENTIAL AUDIO PREAMPLIFIER LOW NOISE   | U2                                                                                                                                                | THAT Corporation                 | 1580N16-U        |
| 39A  | 1   | 1583N16-U | IC         | IC DIFFERENTIAL AUDIO PREAMPLIFIER LOW NOISE   | U4                                                                                                                                                | THAT Corporation                 | 1583N16-U        |
| 40   | 1   | 250169    | SWITCH     | DIP SPST 4P DIP8                               | SW2                                                                                                                                               | CTS Corporation                  | 206-4            |
| 41   | 1   | 250177    | SWITCH     | PUSHBUTTON DPDT                                | SW1                                                                                                                                               | E-Switch                         | PBH2UEENAGX      |
| 42   | 1   | 270914    | PCB        | 5263 Marketing Demo Board                      |                                                                                                                                                   |                                  |                  |
| 43   | 1   | 280020    | CONN       | 1P BINDING POST CHASSIS MNT BLUE               | J7                                                                                                                                                | Pomona Electronics               | 3760-6           |
| 44   | 1   | 280100    | CONN       | 1P BINDING POST CHASSIS MNT YELLOW             | J5                                                                                                                                                | Pomona Electronics               | 3760-4           |
| 45   | 2   | 280440    | CONN       | 60P 3 X 2 MALE GOLD                            | P9, P10                                                                                                                                           | 3M                               | 2306-6121TG      |
| 46   | 6   | 280461    | CONN       | 2P MALE STR GOLD 0.1" 2 X 1                    | P2, P3, P4, P6, P7, P8                                                                                                                            | Samtec USA                       | TSW-102-07-G-S   |
| 47   | 2   | 280499    | CONN       | 6P MALE GOLD 0.1" 6 X 1                        | P11, P12                                                                                                                                          | Molex                            | 22-28-4063       |
| 48   | 1   | 280586    | CONN       | 1P BINDING POST CHASSIS MNT RED                | J8                                                                                                                                                | Pomona Electronics               | 3760-2           |
| 49   | 2   | 280587    | CONN       | 1P BINDING POST CHASSIS MNT GREEN              | J6, J9                                                                                                                                            | Pomona Electronics               | 3760-5           |
| 50   | 1   | 280588    | CONN       | 1P BINDING POST CHASSIS MNT BLACK              | J10                                                                                                                                               | Pomona Electronics               | 3760-0           |
| 51   | 26  | 280638    | CONN       | 1P 1 X 1 TEST POINT SMT 0.015 THICK            | TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23, TP24, TP25, TP26 | Keystone Electronics Corporation | 5016             |
| 52   | 2   | 280651    | CONN       | 3P XLR-3C MALE RT ANGLE                        | P1, P5                                                                                                                                            | Neutrik USA Inc.                 | NC3MAH           |
| 53   | 2   | 280652    | CONN       | 3P XLR - COMBO STEREO RT ANGLE                 | J1, J3                                                                                                                                            | Neutrik USA Inc.                 | NCJ6FI-H         |
| 54   | 4   | 311036    | HARDWARE   | STANDOFF 4-40 X 1/4" X 1" HEX SWAGE BRASS      | MH1, MH2, MH3, MH4                                                                                                                                | RAF                              | 3559-B-440-B-0   |
| 55   | 1   | 470644-00 | PCBA       | MODULE USB MICRO-CONTROLLER DLP-232PC          |                                                                                                                                                   | DLP Design, Inc                  | DLP-232PC        |

# **Appendix C. PCB Layout (1 of 3)**

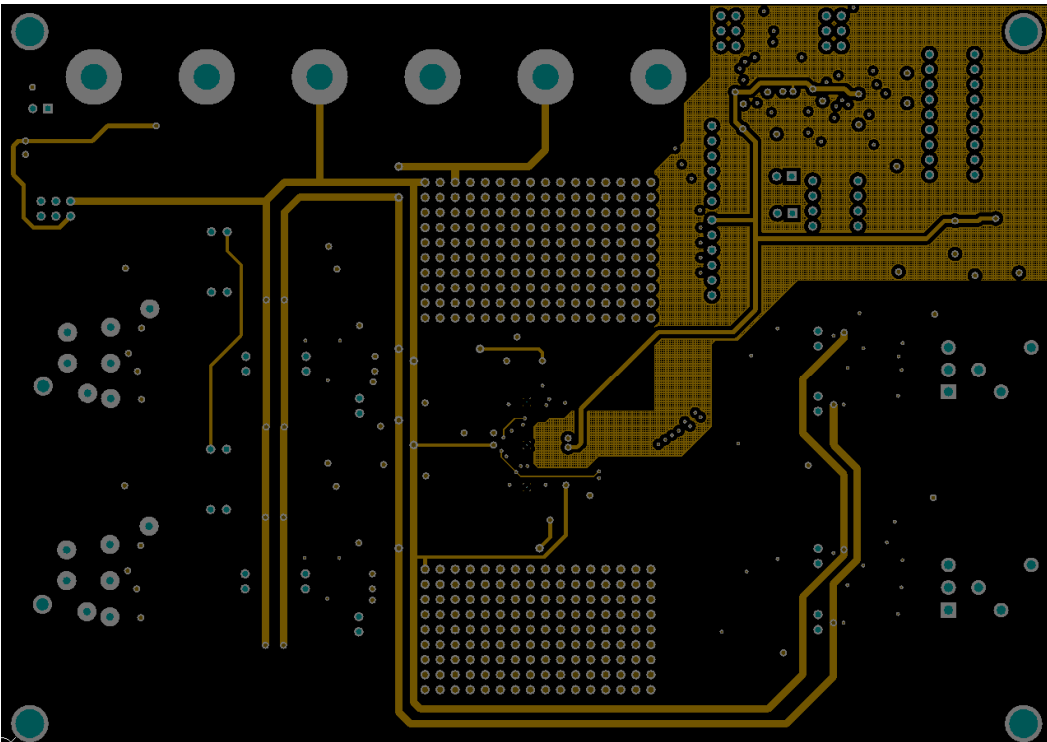


**THAT 5263-DEMO**  
Digitally Controlled, Dual Channel  
Microphone Preamplifier Demo Board

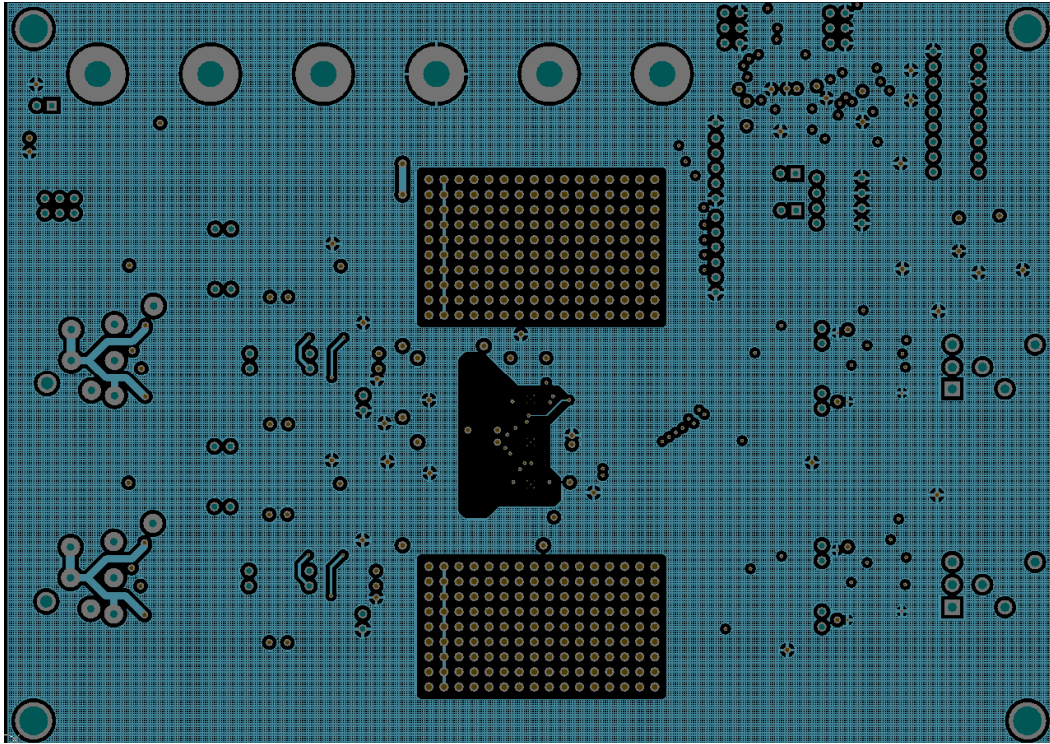
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Milford, MA 01757 USA  
TEL: +1 (508) 478-9200  
FAX: +1 (508) 478-0990  
www.thatcorp.com

**Appendix C. PCB Layout (2 of 3)**

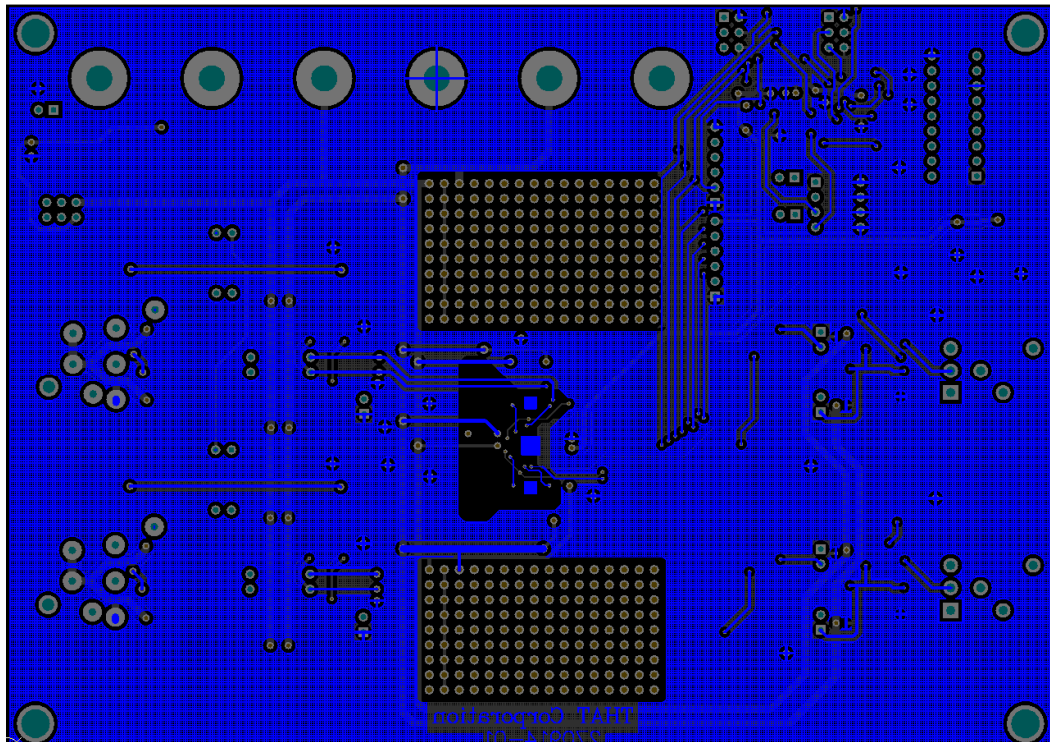
Layer 1 (Top)



Layer 2 (Power)

**Appendix C. PCB Layout (3 of 3)**

Layer 2 (Ground)



Layer 4 (Bottom)

**Appendix D. 5263 + 1583 Specifications<sup>1,2,3</sup>**

| Parameter                                                                     | Symbol                 | Typical                                                                                                                                         | Units |
|-------------------------------------------------------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Power Supply Voltage                                                          | V+ - V-                | ±15                                                                                                                                             | V     |
| Power Supply Current<br>(per channel)                                         | I(V+), I(V-)<br>I(Vdd) | 42<br>12 (All LEDs lit)                                                                                                                         | mA    |
| Maximum Input Level<br>(V+ /V- = ±15V)(1% THD)                                | V <sub>IN-BAL</sub>    | +26.4                                                                                                                                           | dBu   |
| Maximum Differential Output Level<br>(V+ /V- = ±15V)(1% THD)                  | V <sub>OUT</sub>       | +28 (at 1583 output test points)<br>+27 (at XLR outputs; limited by output driver)                                                              | dBu   |
| Gain (input to output)                                                        | A <sub>dB</sub>        | 0 to 51 in 3dB steps                                                                                                                            | dB    |
| Gain error (all settings)                                                     | A <sub>err</sub>       | ±0.3 (typical)                                                                                                                                  | dB    |
| Total Harmonic Distortion + N<br>(f = 1kHz; BW = 22 kHz)                      | THD+N                  | 0.0007 (0dB gain, V <sub>OUT</sub> = +10dBu)<br>0.0006 (+21dB gain, V <sub>OUT</sub> = +21dBu)<br>0.003 (+51dB gain, V <sub>OUT</sub> = +20dBu) | %     |
| Equivalent Input Noise, Main Output<br>(R <sub>SOURCE</sub> =150 Ω, BW=22kHz) | EIN                    | -126.2 (+51dB gain)<br>-116 (+21dB gain)<br>-95.5 (0dB gain)                                                                                    | dBu   |
| Channel Separation<br>(any combination of gain settings)                      |                        | 117 (1 kHz)<br>92 (20 kHz)                                                                                                                      | dB    |

1. All specifications are subject to change without notice.

2. Unless otherwise specified, T<sub>A</sub>=25°C, V<sub>CC</sub>=+15V, V<sub>EE</sub>=-15V, V<sub>DD</sub>=+3.3V

3. All audio specifications include the effects of the differential output buffer stage.

**Appendix E. 5263 + 1580 Specifications<sup>1,2,3</sup>**

| Parameter                                                                                      | Symbol                 | Typical                                                                                                                                         | Units |
|------------------------------------------------------------------------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Power Supply Voltage                                                                           | V+ - V-                | ±15                                                                                                                                             | V     |
| Power Supply Current<br>(per channel)                                                          | I(V+), I(V-)<br>I(Vdd) | 42<br>12 (All LEDs lit)                                                                                                                         | mA    |
| Maximum Input Level<br>(V+ /V- = ±15V)(1% THD)                                                 | V <sub>IN-BAL</sub>    | +26                                                                                                                                             | dBu   |
| Maximum Differential Output Level<br>(V+ /V- = ±15V)(1% THD)<br>(limited by the output driver) | V <sub>OUT</sub>       | +28 (at 1580 output test points)<br>+27 (at XLR outputs)                                                                                        | dBu   |
| Gain (input to output)                                                                         | A <sub>dB</sub>        | 0 to 51 in 3dB steps                                                                                                                            | dB    |
| Gain error (all settings)                                                                      | A <sub>err</sub>       | ±0.3 (typical)                                                                                                                                  | dB    |
| Total Harmonic Distortion + N<br>(f = 1kHz; BW = 22 kHz)                                       | THD+N                  | 0.0004 (0dB gain, V <sub>OUT</sub> = +10dBu)<br>0.0004 (+21dB gain, V <sub>OUT</sub> = +21dBu)<br>0.002 (+51dB gain, V <sub>OUT</sub> = +20dBu) | %     |
| Equivalent Input Noise, Main Output<br>(R <sub>SOURCE</sub> = 150 Ω, BW = 22kHz)               | EIN                    | -128 (+51dB gain)<br>-119.5 (+21dB gain)<br>-102.3 (0dB gain)(at 1580 output test points)<br>-101.8 (at XLR output; limited by output driver)   | dBu   |
| Channel Separation<br>(any combination of gain settings)                                       |                        | 117 (1 kHz)<br>92 (20 kHz)                                                                                                                      | dB    |

1. All specifications are subject to change without notice.

2. Unless otherwise specified, T<sub>A</sub> = 25°C, V<sub>CC</sub> = +15V, V<sub>EE</sub> = -15V, V<sub>DD</sub> = +3.3V

3. All audio specifications include the effects of the differential output buffer stage.

**FCC Warning**

This device is only intended for laboratory test environments. It may radiate radio frequency energy and has not been tested for compliance with subpart J of part 15

of the FCC regulations. Operation of this device in other environments may cause interference with radio communications.

**Revision History**

| Revision | ECO  | Date     | Changes                                            | Page   |
|----------|------|----------|----------------------------------------------------|--------|
| 00       | —    | 10/28/15 | Initial Release                                    | —      |
| 01       | 2986 | 10/27/16 | Minor corrections to the specs in Appendix D and E | 13, 14 |
|          |      |          |                                                    |        |

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

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[158X/5263-DEMO](#)