

THAT1570/THAT5171
Digitally-Controlled Microphone Preamplifier
Demo Board

User's Guide
Document 600134 Rev 03



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Packing List

- (1) THAT1570/5171 DEMO Board PCB Assembly
- (1) USB Cable

If you are missing any of the above items please contact us at support@thatcorp.com.

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.

Features

- “Combo” XLR/TRS balanced input with switchable 48V phantom power
- Balanced audio output on XLR and TRS connectors
- Supports pro audio signal levels: +21dBu input / output
- Gain (measured input to output) adjustable in 1dB steps: 0dB, and 8-63dB
- USB 1.1 and USB 2.0 compatible control port
- Graphical user interface software for controlling 5171 parameters
- Prototyping area

Description

The THAT Digitally-Controlled Mic Preamp Demo Board allows developers to evaluate the performance of the THAT1570 / THAT5171 chipset. The demo board provides a balanced audio input on a Neutrik “combo” connector with 48V phantom power, and a balanced audio output on XLR and ¼” TRS connectors. The supplied graphical user interface (GUI) controls all functions in the 5171 chip via USB. A prototyping area is available for adding or modifying circuitry.

Specifications

Parameter	Symbol	Typical	Units
Power Supply Voltage	V+ - V-	±15	V
Maximum Input Level (V+ /V- = ±15V)	V _{in-BAL}	+21	dBu
Maximum Differential Output Level (V+ /V- = ±15V)	V _{OUT}	+21	dBu
Gain (input to output)	A _{dB}	0 8 to 63 in 1dB steps	dB
Gain error (all settings)	A _{err}	±0.15	dB
Total Harmonic Distortion (V _{OUT} = +16dBu (5V _{RMS}); R _L = 10kΩ; C _L = 10 pF; f = 1kHz; BW = 22 kHz)	THD	0.0003 (0dB gain) 0.0003 (20dB gain) 0.0008 (40dB gain) 0.006 (60dB gain)	%
Equivalent Input Noise (main output)	EIN	1.65 (60dB gain) 1.9 (40dB gain) 5.0 (20dB gain) 22.9 (0dB gain)	nV/√Hz
Equivalent Input Noise (1570 output)	EIN	1.65 (60dB gain) 1.9 (40dB gain) 4.8 (20dB gain) 20 (0dB gain)	nV/√Hz
Supply Current	I _{CC} ; -I _{EE} , I _{DD}	23 (V+ supply) 23 (V- supply) 0.5 (+5V supply)	mA

THAT1570 / THAT5171 Overview

The THAT1570 and THAT5171 ICs enable digitally-controlled microphone preamplifier applications with exceptionally high performance. Operating on maximum +/-17V supplies, the chipset accepts pro audio input levels (+22dBu max) without an input pad. Gain is adjustable to 5.6dB, and 13.6dB to 68.6dB in 1dB increments (a 5.6dB attenuator at the output offsets the overall gain range to 0dB, and 8-63dB). The 5171's built-in zero-crossing detector and other patent-pending techniques for reducing zipper noise enable very smooth and silent gain changes. A differential servo reduces output offsets to less than 1.5mV. Four general purpose outputs on the 5171 can be connected to a variety of peripheral functions, e.g. an input pad, phantom power switch, signal routing switches, LEDs, etc. The 5171's addressable SPI interface supports read-back. By separating the analog mic pre amp front end (THAT1570) from the digital functions and switched resistor ladder (THAT5171), each IC is optimized for high performance.

The THAT1570 is fabricated using THAT's complementary dielectric isolation process and precision laser-trimmed Si-Chrome thin film resistors, yielding extremely high performance. The THAT5171 is fabricated using a high-voltage CMOS process, with proprietary techniques for reducing FET switching glitches. Packaged in 4x4mm QFN16 and 7x7mm QFN32 packages respectively, the THAT1570 and THAT5171 require very little PCB area.

Block Diagram

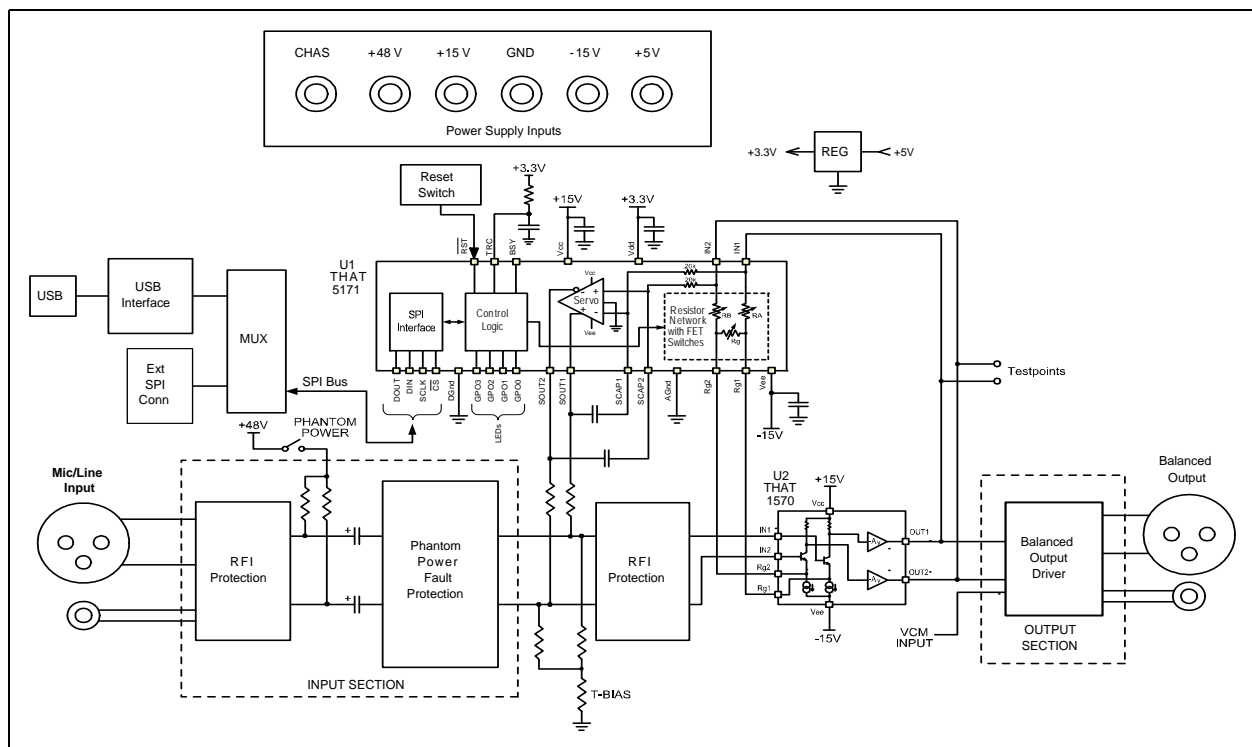


Figure 1 -- Block Diagram of the THAT 1570/5171 Demo Board

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 CHAS (chassis ground) 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. Maximum input signal level is +21dBu with +/-15V supplies, or +22dBu with +/-17V supplies. The 1/4" TRS signal path includes a 20dB pad in order to support very high line levels.

Audio Output

Separate XLR and 1/4" TRS connectors are wired in parallel. Maximum output signal level is +21dBu with +/-15V supplies, or +22dBu with +/-17V supplies. The differential attenuator/output buffer (U3) adds a small amount of noise and distortion to the signal and it is therefore recommended that test points TP1-TP3 be used to measure performance of the 1570/5171 ICs.

USB

A PC must be plugged into the demo board via USB in order to control parameters in the 5171 (e.g. gain). Take care not to hot plug the demo board while the GUI software is running as this will often crash the Windows drivers.

General Purpose Outputs (GPO)

The GPO3:0 pins are connected to header J12. J12 is conveniently located near the prototyping area, so the user can easily connect optional circuitry to them. Note that the GPO pins are also connected to LEDs, D1-D4, and pull up and pull down resistors which set the 5171 device address during reset. Consideration must be given to how any application circuitry that is added interacts with these other functions.

Hardware Set-up

1. Connect a power supply to the V+, V-, +5V, +48V, CHAS and GND connectors. Do not turn on power yet.
2. Plug in the audio input and output
3. Attach a USB cable to the demo board, but do not plug it into the PC yet
4. Turn on the power supply
5. Turn on phantom power to microphone (if appropriate)
6. Plug USB cable into PC. Windows should go through its procedure for discovering the new USB peripheral and loading its driver.

7. Once the Windows driver has been loaded, launch the THAT Corporation MicPreController GUI application. See software section (below) for further instructions on operating the GUI.
8. When finished, close the MicPreController GUI first, then power down the demo board. Unplugging the USB cable before the demo board is powered down will likely crash the Windows drivers.

Software Set-up

Installation

1. Download the software. The software is available from the THAT Corporation website on the page: www.thatcorp.com/Demonstration_Boards.shtml.

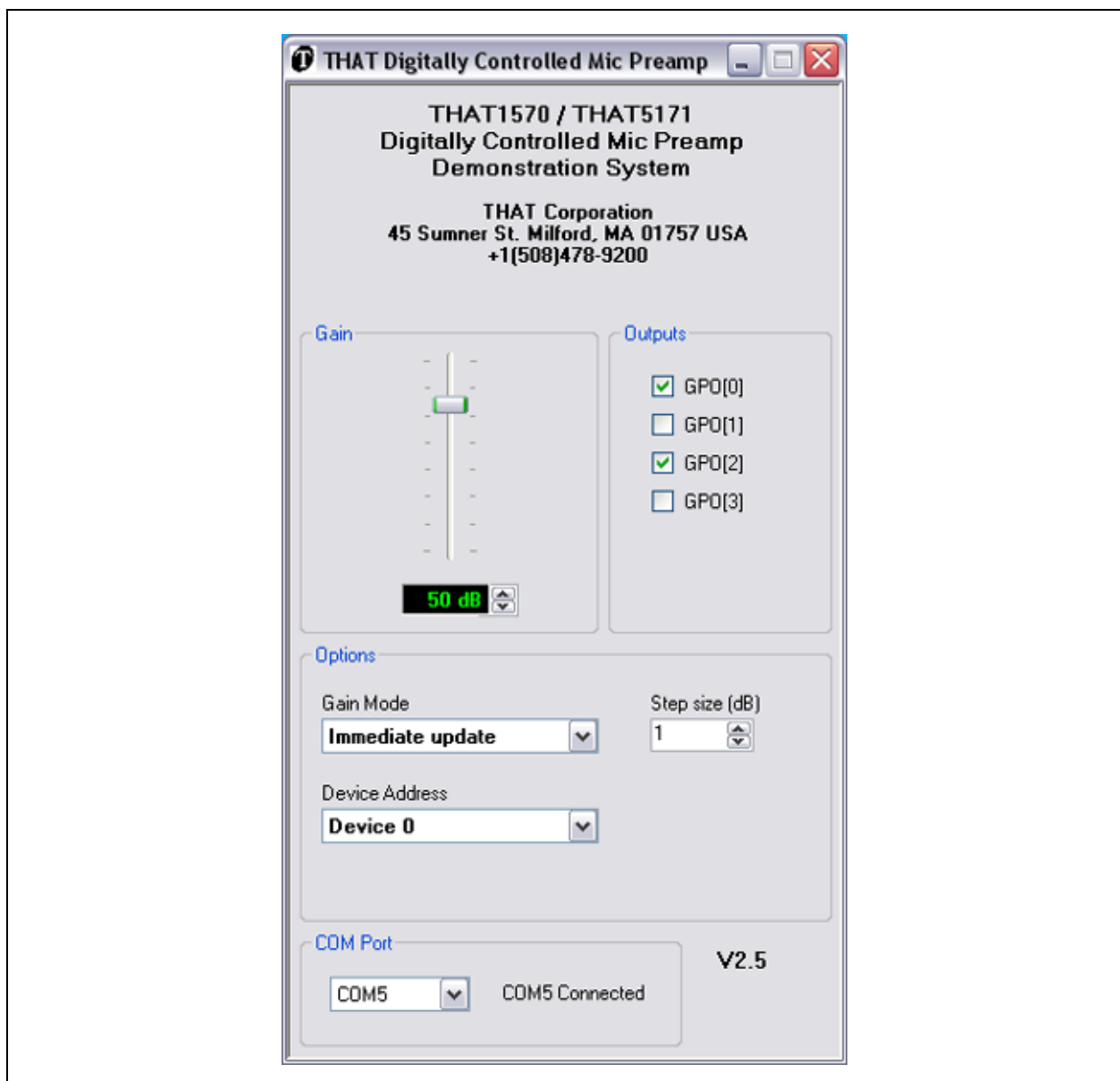


Figure 2. Control GUI

2. Run the software installer program (double-click "1570_5171_Demo_Setup.msi"). The installer automatically detects your operating system and configures the appropriate drivers without any further input from you. You will see a "DOS box" and Windows dialogue box temporarily appear and then disappear during the process. Once the software installation process is complete, you will find an icon labeled "THAT 1570 5171 Demo" on your desktop and a new THAT Corporation group in your start menu.

Operation

1. Apply power to the demo board, then plug the demo board into the PC via USB.
2. Launch the MicPreController GUI application.
3. The USB interface on the demo board will appear in Windows as a new COM port. Click the COM drop down menu in the MicPreController application and select the COM port associated with the USB module.
4. The GUI should now be connected to the demo board and ready to control its parameters. The GUI initially turns on LED1 as an indication that it is successfully communicating with the demo board. If LED1 is not lit, confirm proper cable connections and that you selected the correct COM port in the previous step.
5. Select "Immediate Update" or "Update on Zero Crossings" via the Gain Mode drop down box, depending on your preference.
6. Move the gain slider to adjust gain of the 5171. Gains are continuously adjusted as you move the slider. Note that gain settings of 1-7dB are invalid. 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. The Step Size box in the Options area allows you to set how many decibels the slider changes when you press the UP/DOWN and arrow keys.

Jumper Options

T-Bias Jumper, J4

The input circuit provides a jumper (J4) which enables/disables the "T-Bias" function. With a shunt installed on J4, T-Bias is disabled and the circuit provides a 2 k Ω differential input impedance to the XLR input. With the shunt removed from J4, T-Bias is enabled and provides a high common mode impedance (ideal for both mic and line inputs) but maintains a modest differential impedance.

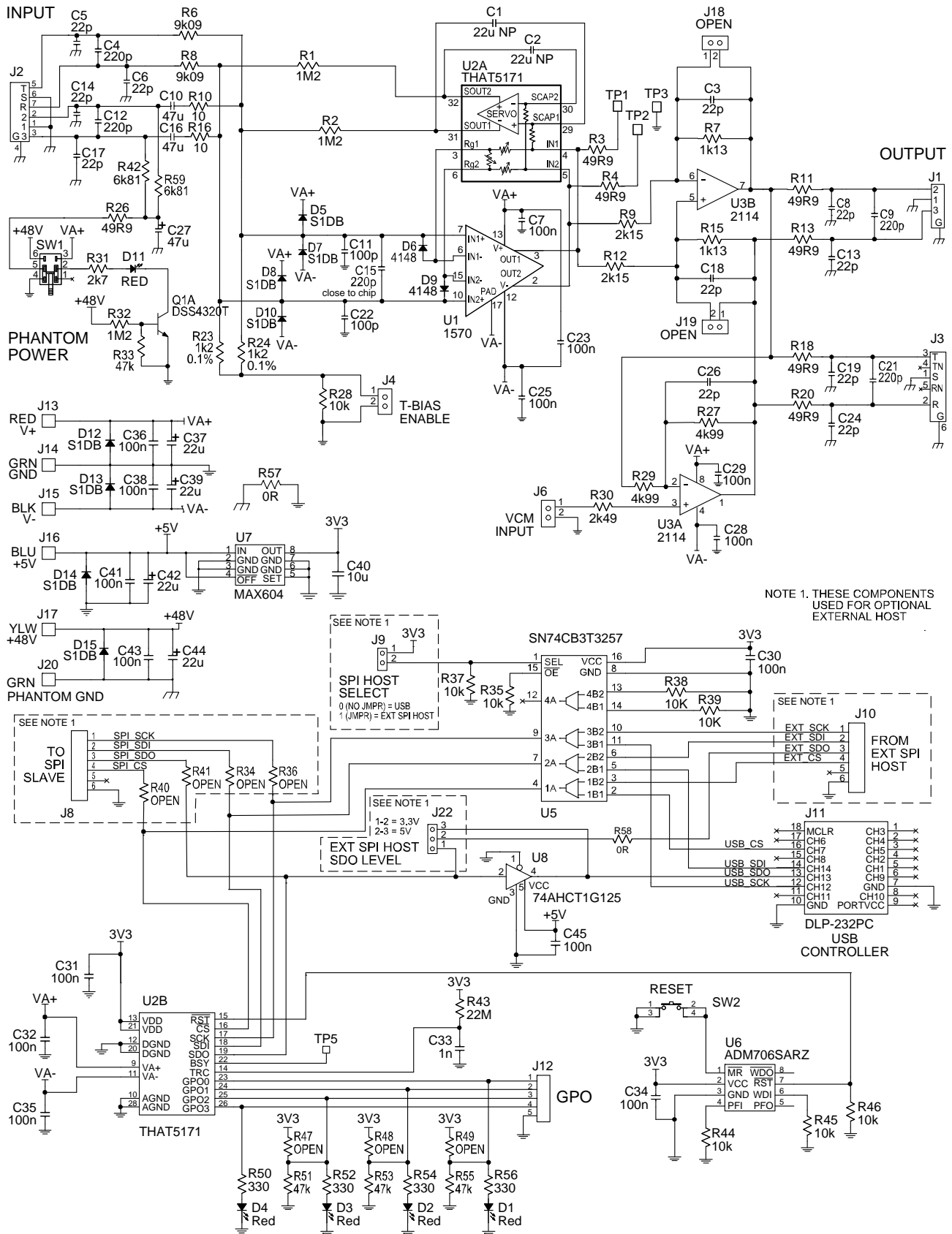
VCM Jumper/Input, J6

The output attenuator (U3) is normally biased at 0 VDC via R30 connected to ground through a shunt on jumper J6. If the J6 shunt is removed, a bias voltage may be input via J6, e.g. the common mode voltage output pin (VCOM) of an A/D Converter.

External SPI Host Jumpers & Connectors

The demo board has two connectors, J8 and J10, for connecting up to 8 boards to an external SPI master device, such as a microcontroller. J8 is not installed at the factory and it is up to the user to add it if required. Note also that current limiting resistors R34, R36, R40, and R41 must be installed with the appropriate value for the application. Please contact THAT Corporation technical support for assistance.

Appendix A. Schematic Diagram

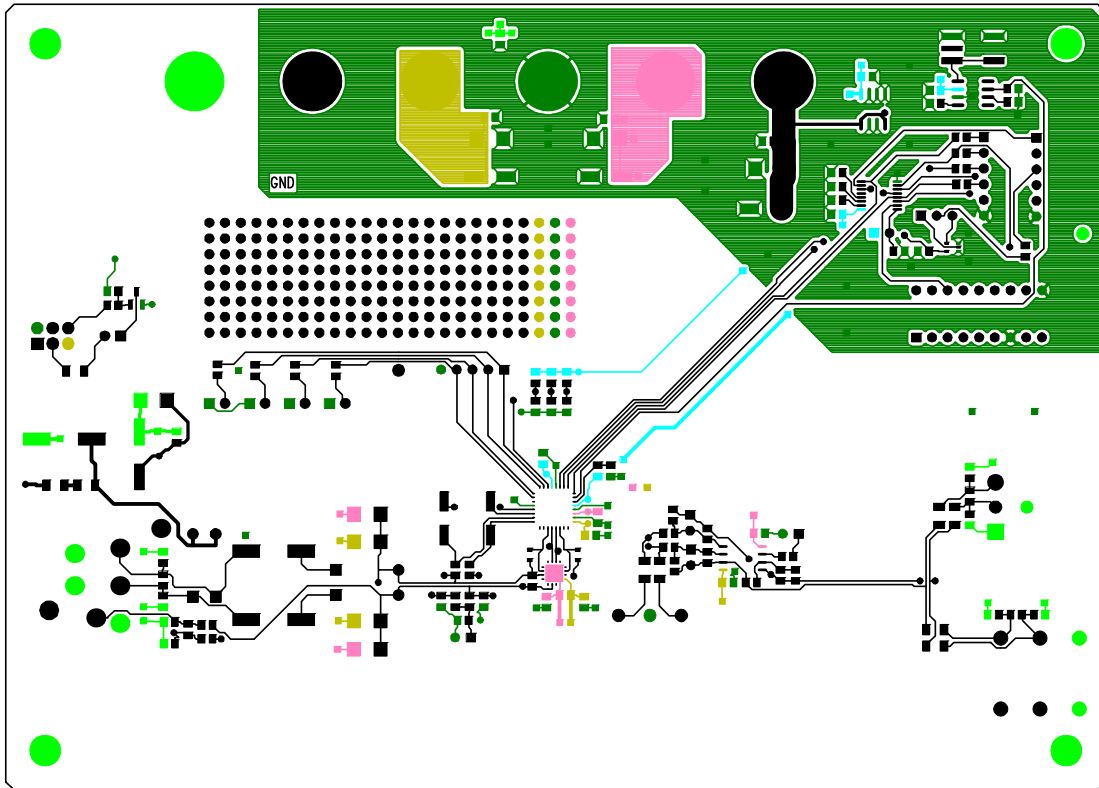


Appendix B. Bill of Materials

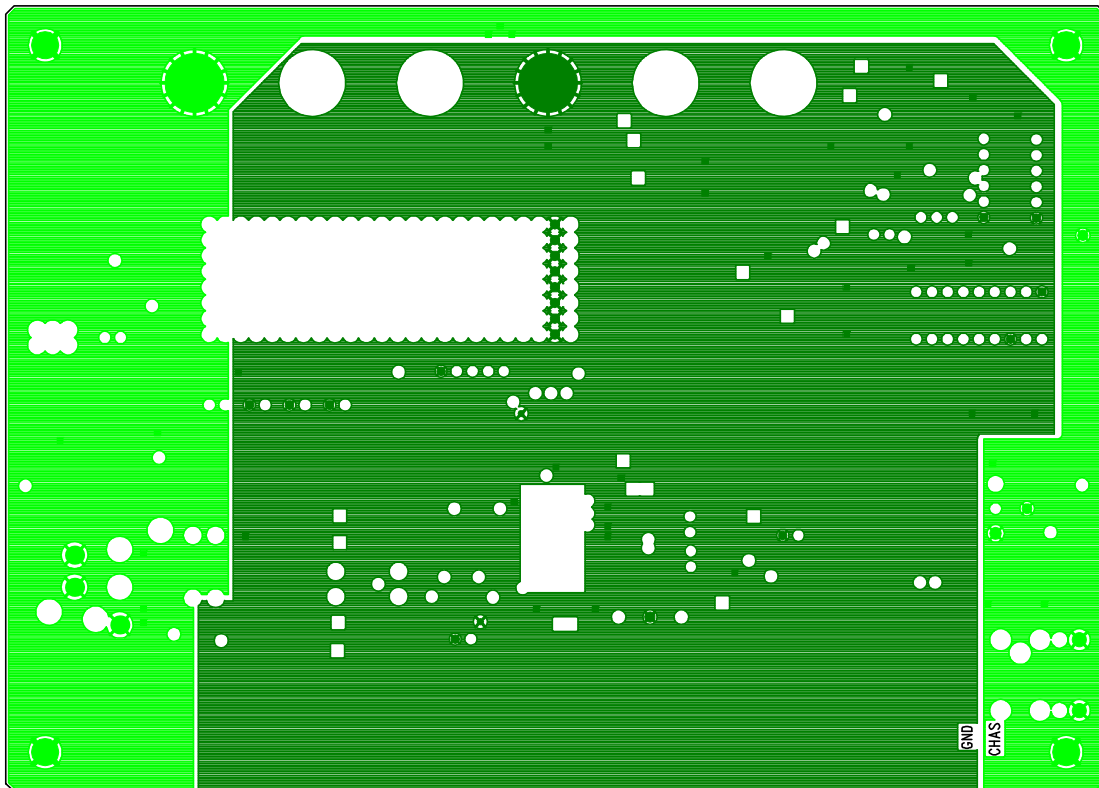
Item	Qty	Ref	Value	Description	MFR	MFR PN
1	2	C1, C2	22uF/NP	Cap. EL, nonpol, 20%, 16V	Nichicon	UWP1C220MCL1GB
2	11	C3, C5, C6, C8, C13, C14, C17, C18, C19, C24, C26	22pF	Cap., 50V, 5%, NPO	Panasonic	ECJ-2VC1H220J
3	5	C4, C9, C12, C15, C21	220pF	Cap., 50V, 5%, NPO	Panasonic	ECJ-2VC1H221J
4	15	C7, C23, C25, C28, C29, C30, C31, C32, C34, C35, C36, C38, C41, C43, C45	100nF	Cap., 50V,10%, X7R	Panasonic	ECJ-2YB1H104K
5	3	C10, C16, C27	47UF	Cap, EL, 20%, 63V, 1ohm	Panasonic	EEV-TG1J470P
6	2	C11, C22	100PF	Cap., 50V, 5%, NPO	Panasonic	ECJ-2YB1H104K
7	1	C33	1nF	Cap., 50V,10%, X7R	Panasonic	ECJ-2VB1H102K
8	3	C37, C39, C42	22uF	Cap. EL, 20%, 25V	Panasonic	EEV-FC1E220P
9	1	C40	10uF	Cap., 10V,10%, X5R	Panasonic	ECJ-2FB1A106K
10	1	C44	22uF	Cap, EL, 20%, 63V, 1ohm	Panasonic	EEV-TG1J220P
11	5	D1, D2, D3, D4, D11	RED	LED, red, T1	Rohm	SLA-560LT3F
12	8	D5, D7, D8, D10, D12, D13, D14, D15	S1DB	Diode, RECTIFIER GPP SMD 200V 1A	Diodes, Inc	S1DB-13
13	2	D6, D9	4148	Diode, DIODE SWITCHING 75V 150MA	Comchip	CDSU4148
14	1	J1	NC3MAH	Conn., XLR, Male, PCB	Neutrik	NC3MAH
15	1	J2	NCJ6FI-H	Conn., Combo, PCB	Neutrik	NCJ6FI-H
16	1	J3	NRJ6HF-1	Conn., Phone Jack, TRS	Neutrik	NRJ6HF-1
17	3	J4, J6, J9	CON2	Conn., HEADER 36POS .100 VERT GOLD	Molex	22-28-4363
18	3	J5, J7, J21	SHUNT-2POS	Conn, shunt, 2-pos, 100mil	TYCO	382811-6
19	1	J8	CON6	Conn., HEADER 36POS .100 VERT GOLD	Molex	OPEN
20	1	J10	CON6	Conn., HEADER 36POS .100 VERT GOLD	Molex	22-28-4363
21	1	J11	DLP-232PC	PCB, USB Module	DLP	DLP-232PC
22	1	J12	CON5	Conn., HEADER 36POS .100 VERT GOLD	Molex	22-28-4363
23	1	J13	5WBP, RED	Conn., 5-way binding post, Red	Pomona	3760-2
24	2	J14, J20	5WBP, GRN	Conn., 5-way binding post, Green	Pomona	3760-5
25	1	J15	5WBP, BLK	Conn., 5-way binding post, Black	Pomona	3760-0
26	1	J16	5WBP, BLU	Conn., 5-way binding post, Blue	Pomona	3760-6
28	1	J17	5WBP, YLW	Conn., 5-way binding post, Yellow	Pomona	3760-4
29	1	J22	CON3	Conn., HEADER 36POS .100 VERT GOLD	Molex	22-28-4363
30	1	Q1	DSS4320T	NPN, 20V, 2A	Diodes, Inc	DSS4320T-7

31	3	R1, R2, R32	1M2	Res., thick film, 1/8W, 1%	YAGEO	RC0805FR-071M2L
32	8	R3, R4, R11, R13, R18, R20, R25, R26	49R9	Res., thin film, 1/4W, 0.1%	Vishay	TNPW120649R9BEEN
33	2	R6, R8	9K09	Res., thin film, 1/8W, 0.1%, 25ppm/c	Susumu	RG2012P-9091-B-T5
34	2	R7, R15	1K13	Res., thin film, 1/10W, 0.5%	Susumu	RR1220P-1131-D-M
35	2	R9, R12	2K15	Res., thin film, 1/10W, 0.5%	Susumu	RR1220P-2151-D-M
36	2	R10, R16	10	Res., metal film, 1/4W, 1%	Vishay	CMF5010R000FHEB
37	1	R23	1K2	Res., thin film, 1/4W, 0.1%, 25ppm/c	Susumu	RGH2012-2E-P-122-B
38	1	R24	1K2	Res., thin film, 1/4W, 0.1%, 5ppm/c	Susumu	RGH2012-2E-P-122-B
39	2	R27, R29	4K99	Res., thin film, 1/10W, 0.5%	Susumu	RR1220P-4991-D-M
40	1	R28	10K	Res., thin film, 1/10W, 25ppm, 0.5%	Susumu	RR1220P-103-D
41	1	R30	2K49	Res., thin film, 1/10W, 0.5%	Susumu	RR1220P-2491-D-M
42	1	R31	2K7	Res., thick film, 1/4W, 5%	YAGEO	RC1206JR-072K7L
43	4	R33, R51, R53, R55	47K	Res., thick film, 1/8W, 1%	YAGEO	RC0805FR-0747KL
44	7	R35, R37, R38, R39, R44, R45, R46	10K	Res., thin film, 1/10W, 25ppm, 0.5%	YAGEO	RR1220P-103-D
45	2	R42, R59	6K81	Res., metal film, 1/4W, 0.1%	IRC	RC55LF-D-6K81-B-B
46	1	R43	22M	Res., thick film, 1/8W, 10%	Panasonic	ERJ-6GEYK226V
47	4	R50, R52, R54, R56	330	Res., thick film, 1/8W, 1%	YAGEO	RC0805FR-07330RL
48	2	R57, R58	0R	Res., thick film, 1/8W, 5%	YAGEO	RC0805JR-070RL
49	1	SW1	PBH2UEENAGX	SW., push, DPDT	E Switch	PBH2UEENAGX
50	1	SW2	SW MOM. PUSH	SW., push, mom, DPST	Panasonic	EVQ-PHV03T
51	3	TP1, TP2, TP3	TP	Conn., Test point	Keystone	1250
52	1	U1	THAT1570	IC, Mic Pre	THAT Corp	THAT1570
53	1	U2	THAT5171	IC, Mic Pre Controller	THAT Corp	THAT5171
54	1	U3	NJM2114	IC, op amp, dual	NJR	NJM2114M
55	1	U5	SN74CB3T3257	IC, Quad MUX	TI	SN74CB3T3257PWR
56	1	U6	ADM706SARZ	IC, Reset monitor	Analog Devices	ADM706SARZ
57	1	U7	MAX604	IC, Adj LDO Reg.	Maxim	MAX604CSA
58	1	U8	74AHCT1G125	IC, buffer, single	TI	SN74AHCT1G125DCK

Appendix C. PCB Layout

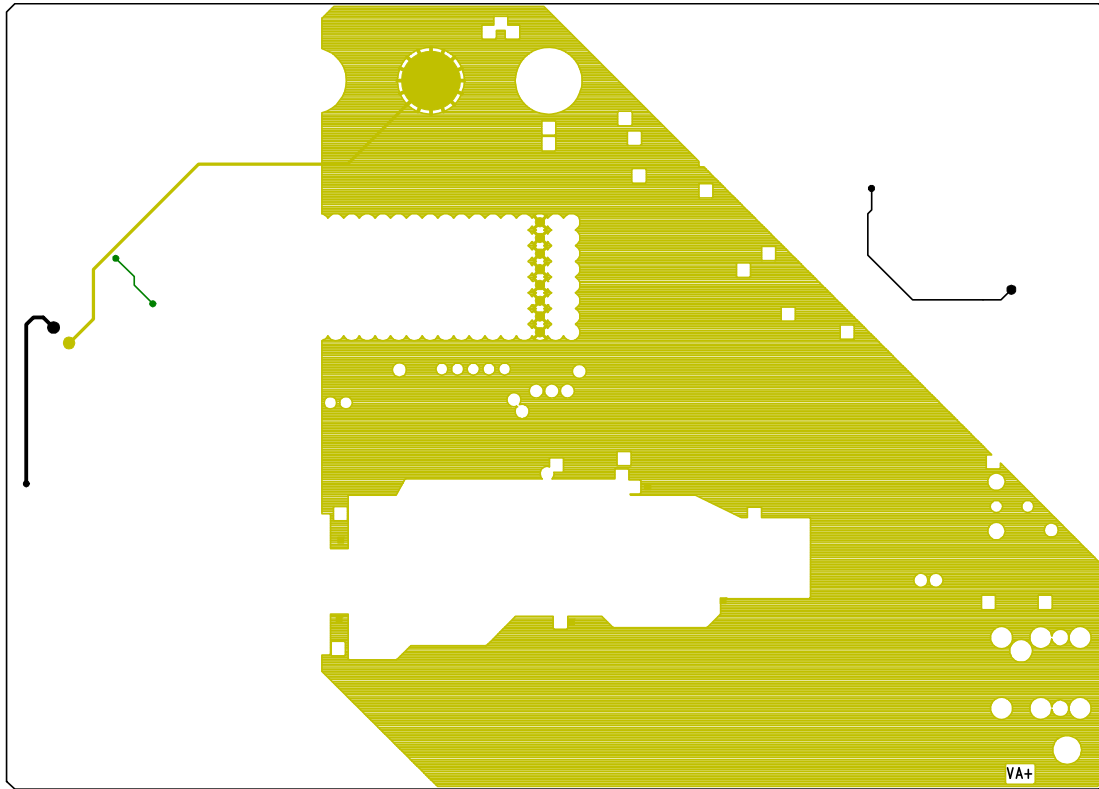


PCB Layout - Layer 1 (Top)

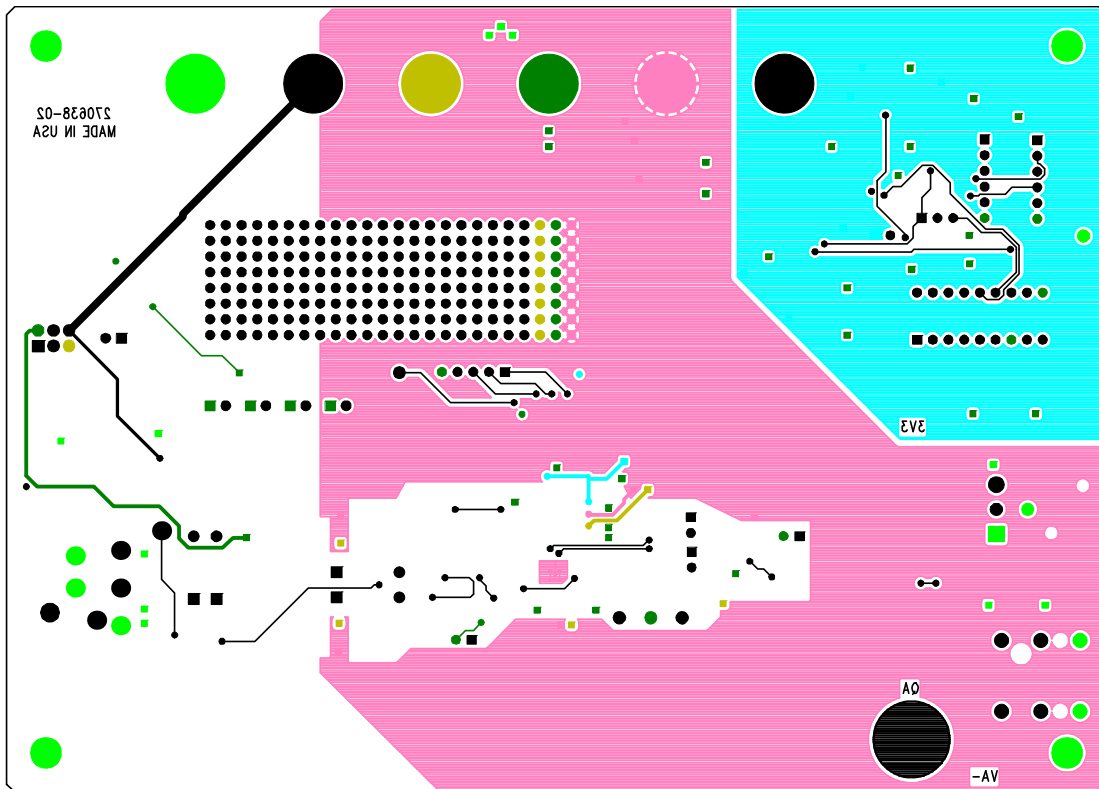


PCB Layout - Layer 2

Appendix C. PCB Layout (Continued)

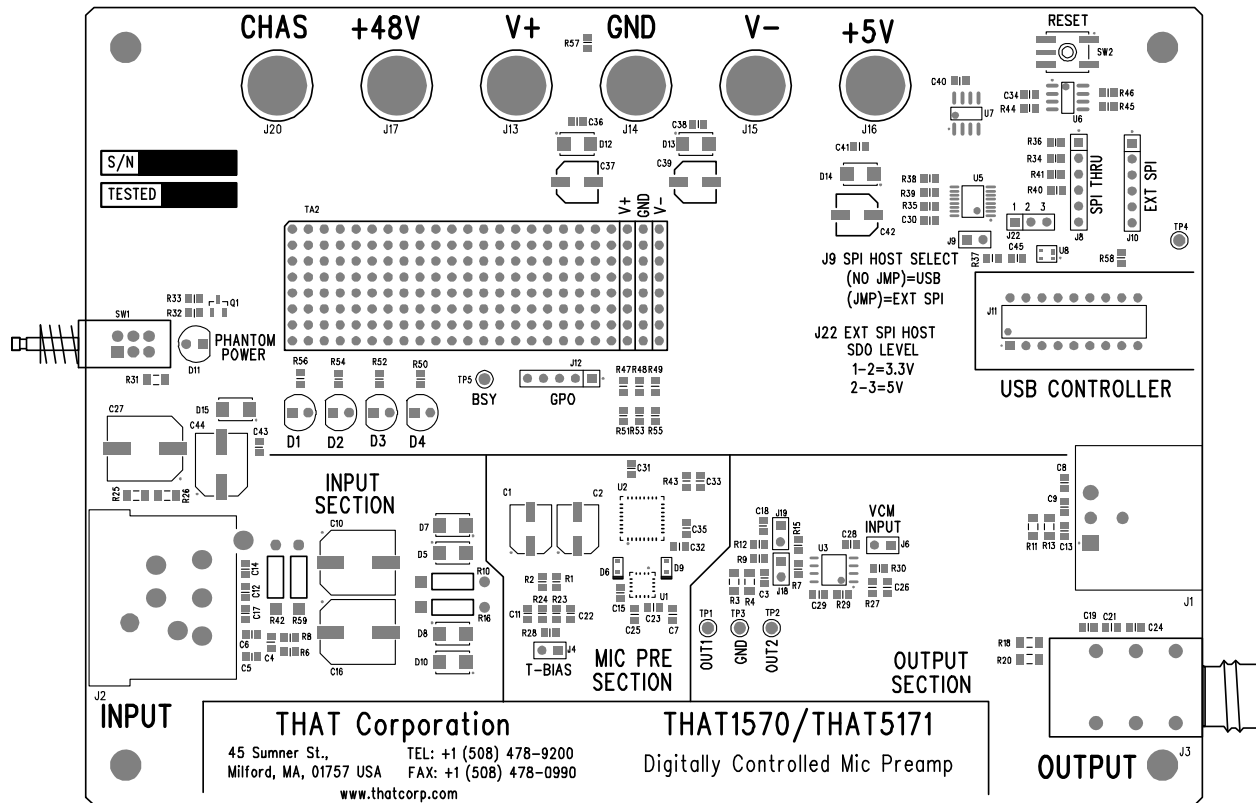


PCB Layout - Layer 3



PCB Layout - Layer 4 (Bottom)

Appendix C. PCB Layout (Continued)



PCB Layout - Silk Screen

Notes

Revision History

Revision	ECO	Date	Changes	Page
00	—	November 2009	Released	—
01	2360	December 2009	Change to software install procedure	6 - 7
02	2589	August 2011	Corrected 5171 pin names on schematic diagram	9
03	2922	May 2015	Replaced references to a software CD with software download instructions	2, 6