



## EB-TK2050-6

### Class-T Digital Audio Amplifier Evaluation Board 6 Channel TK2050 Reference Board

Technical Information

Revision 1.4 – February 2002

#### General Description

The EB-TK2050-6 (a six channel TK2050 Evaluation Board) is a 50 Watt per channel (continuous average, 0.1% THD+N) audio amplifier that utilizes three TK2050 Amplifier Chipsets. The TK2050 is a two channel, 50 Watt per channel audio amplifier IC that uses Tripath's proprietary Digital Power Processing technology. For additional information on the TK2050 Amplifier Chipset, please refer to the TK2050 Data Sheet.



## Operating Instructions

### Power Supply Connection

This board requires a single power supply rail (and ground) to operate. The minimum working voltage on this rail is 7V, and the maximum is 36V. For maximum power operation, the power supply should have at least a 10 Amp rating. The TK2050 chipset also requires a 5 Volt supply for the power processor logic, but this 5V supply is generated on-board by the linear voltage regulator at U10. Note: this regulator is limited to 35V input. For operation of the EB-TK2050-6 at its absolute maximum rating of 36V, the on-board 5V supply must be disabled (at J53) and the an external +5V supply (1A) must be used. Rail voltage is connected at J28 (+) and J30 (GND).

### Input Connection

The audio inputs (J21, J22, J23, J24, J25, J26) use industry standard RCA Connectors. The Mute switch (SW1) should be enabled when inserting and removing RCA cables.

### Output Connection

The outputs of the board are provided through connectors J1-J12. The output connectors are standard banana 0.188" receptacles. The 6 Channel EB-TK2050-6 outputs are in phase with each other. It should be noted that the TK2050 is an inverting amplifier.

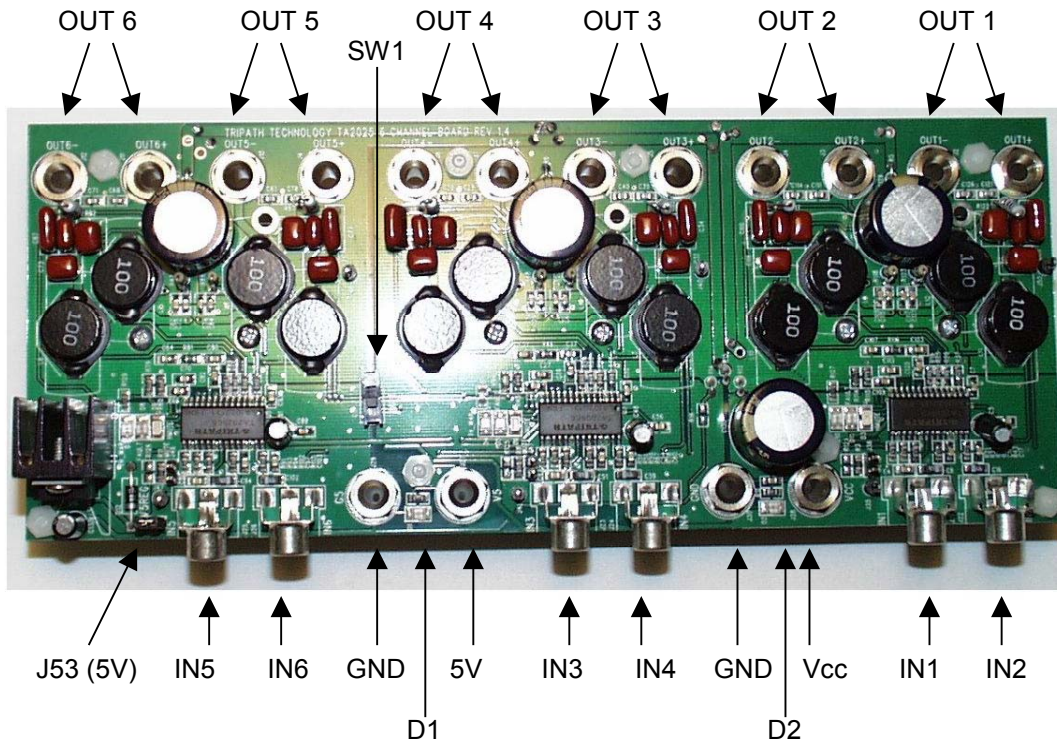
### Switches and Jumpers

Switch SW1 is a toggle switch that mutes all 6 channels. Jumper J36, J42, and J48 are labeled MUTE but are used only when SW1 is not loaded. Do not use these jumper positions, or damage to the board may occur. Jumper J53 enables (on) and disables (off) the on-board 5V regulator.

### Indicators

There are two LEDs that indicate power supply conditions. D1 indicates 5V condition and D2 indicates Vcc condition. A green light indicates operational voltage on each supply. If there is an undervoltage condition, the FAULT LEDs will glow red.

Each channel pair has two LEDs that indicate the mute status and the temperature of the power die. The HMUTE LED is red when muted, and is unlit in normal operation. The TH\_WAR LED is lit when its corresponding power die (mounted on the underside of the board) reaches a temperature of 130 degrees C. The TH\_WAR LED is unlit in normal operation.

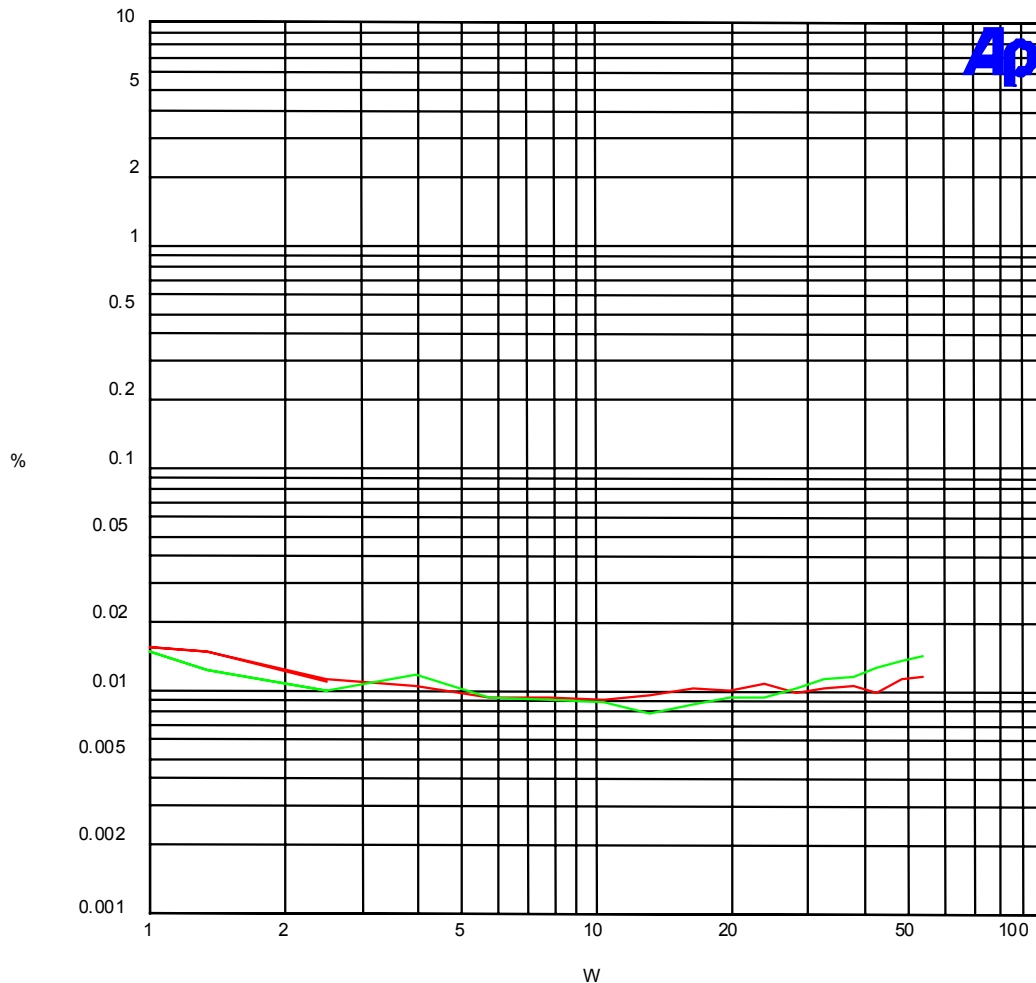


## Usage Notes

We recommend bringing up the amplifier as follows:

1. Connect loads to the individual channels. Note that unloaded channels are allowed, as the Tripath application circuit is tolerant of very high impedances. Also note the polarity markings on the outputs.
2. Mute the amplifiers by sliding SW1 to the right (toward the outputs).
3. Connect the input sources to RCA connectors J21-J26. Note that channel pairs “cross over” to the corresponding outputs – that is, Input 1 is to the left of Input 2, but Output 1 is to the right of Output 2. This is noted on the board silkscreen.
4. If you are using an external 5V supply, connect it to J27 (+5) and J29 (GND), and remove J53. If you are using the on-board 5V supply, simply leave J53 in place.
5. Connect the main power supply to J28 (Vcc) and J30 (GND).
6. Bring up the power supply (supplies). If an external 5V supply is used, bring it up before the main supply. Both power supply indicator LEDs should be illuminated and green. If either of the supply LEDs are unlit or the FAULT LEDs are lit, recheck your supplies and connections.
7. Unmute the amplifiers by sliding SW1 to the left (toward the inputs). The HMUTE LEDs should turn off.
8. The amplifiers are now ready for use.

## 2 Channel TK2050 Characteristic Curves (THD+N vs Power @ 4 Ohms)



TK2050 THD+N VS PWR 4 ohms.at2c

## Heat Sink Considerations

The heatsinks supplied on the EB-TK2050-6 allow for operation of the individual amplifiers at roughly 15W continuous output per channel, assuming 25 degrees C ambient conditions and zero airflow. Once at a stable operating temperature, the amplifiers can be run at maximum output long enough for test purposes. This heatsink rating will thus permit the standard 1/3 power testing for amplifier certification.

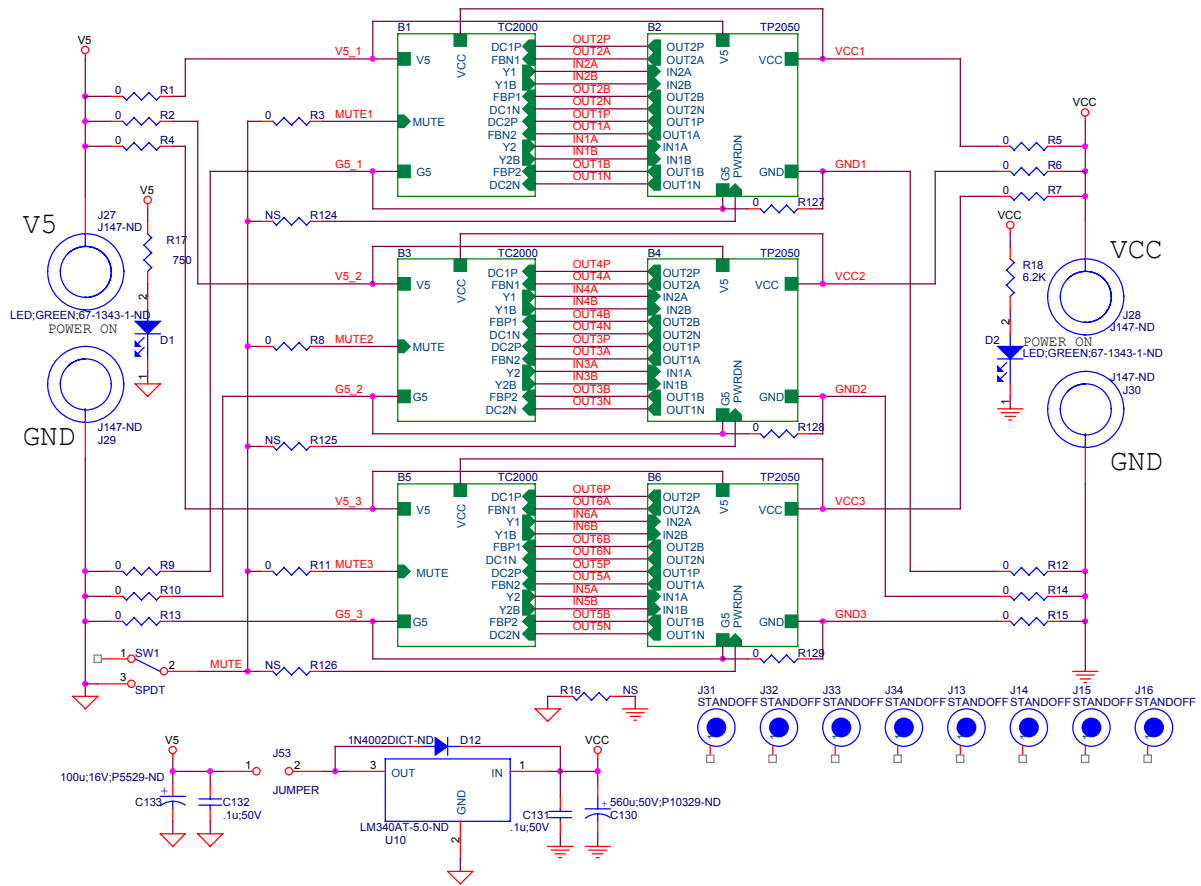
**Note that the supplied heatsinks are not sufficient to drive the amplifiers at their full rated output on a continuous basis at 25 degrees C and with zero airflow.** Appropriate heatsink size and configuration is implementation specific, taking into account anticipated power levels, ambient air temperatures, and free airflow velocities/volumes. Each amplifier pair is equipped with a thermal warning LED (denoted TH\_WAR on the silkscreen) that will light when the power die temperature reaches 130 degrees C. When die temperature reaches 150 degrees C, the amplifier will shut down to prevent any damage to the die.

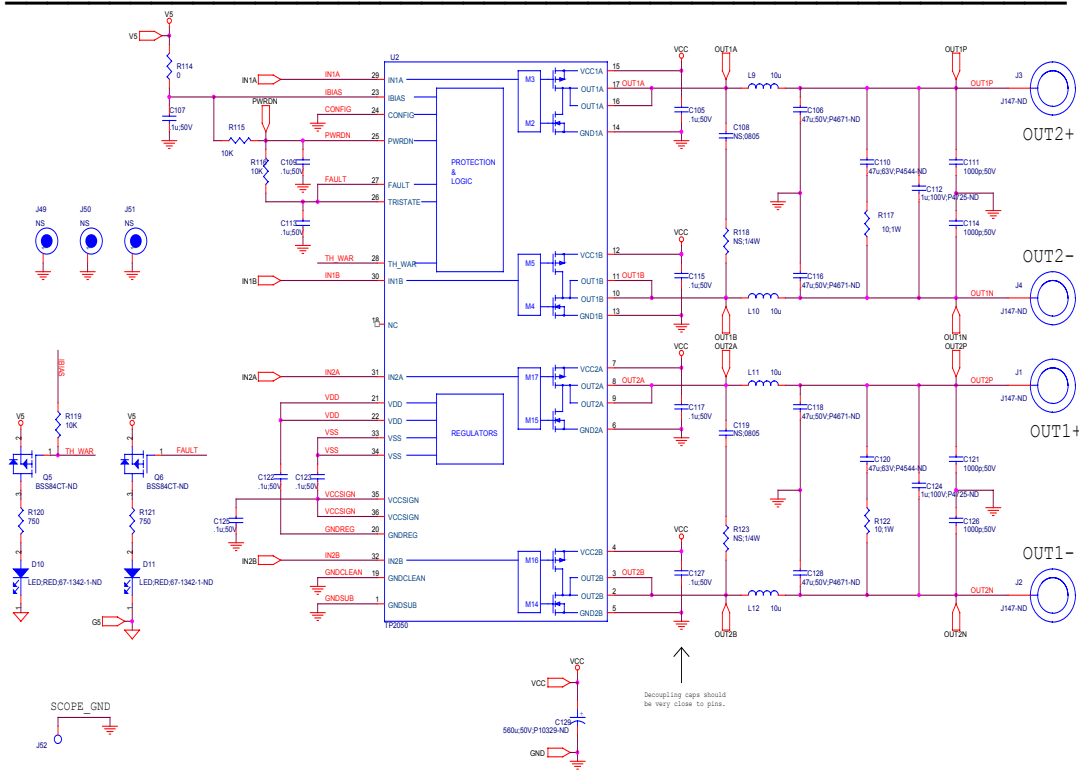
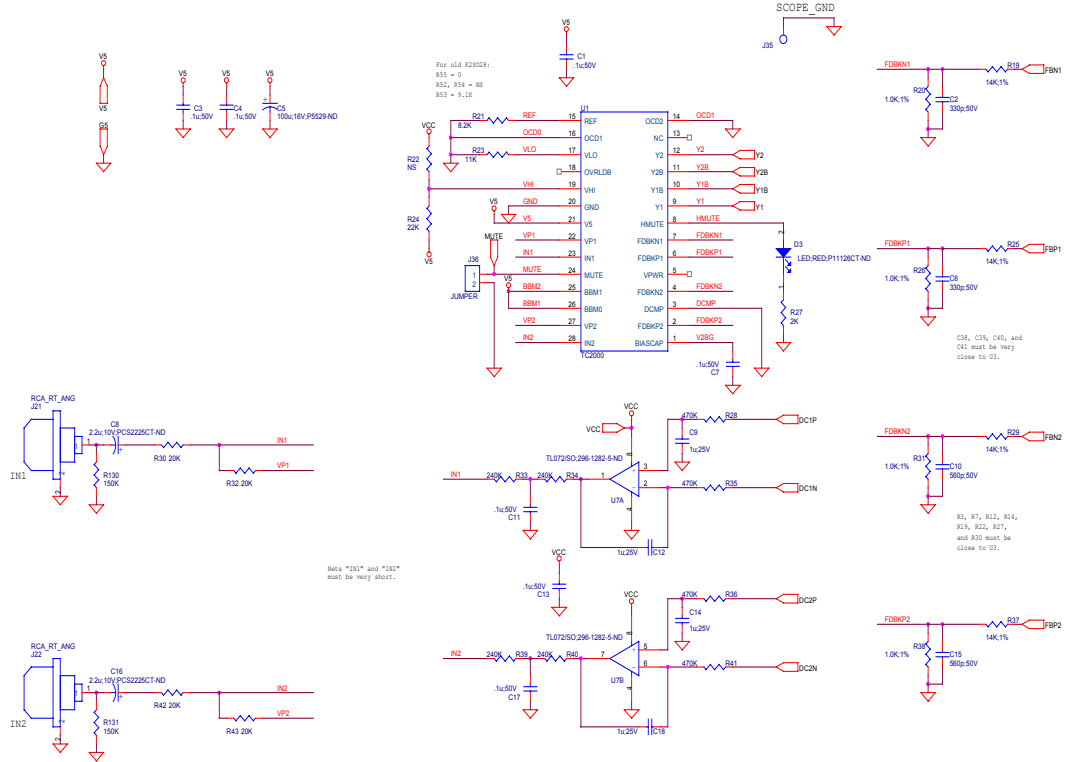
## Performing Measurements on the EB-TK2050-6

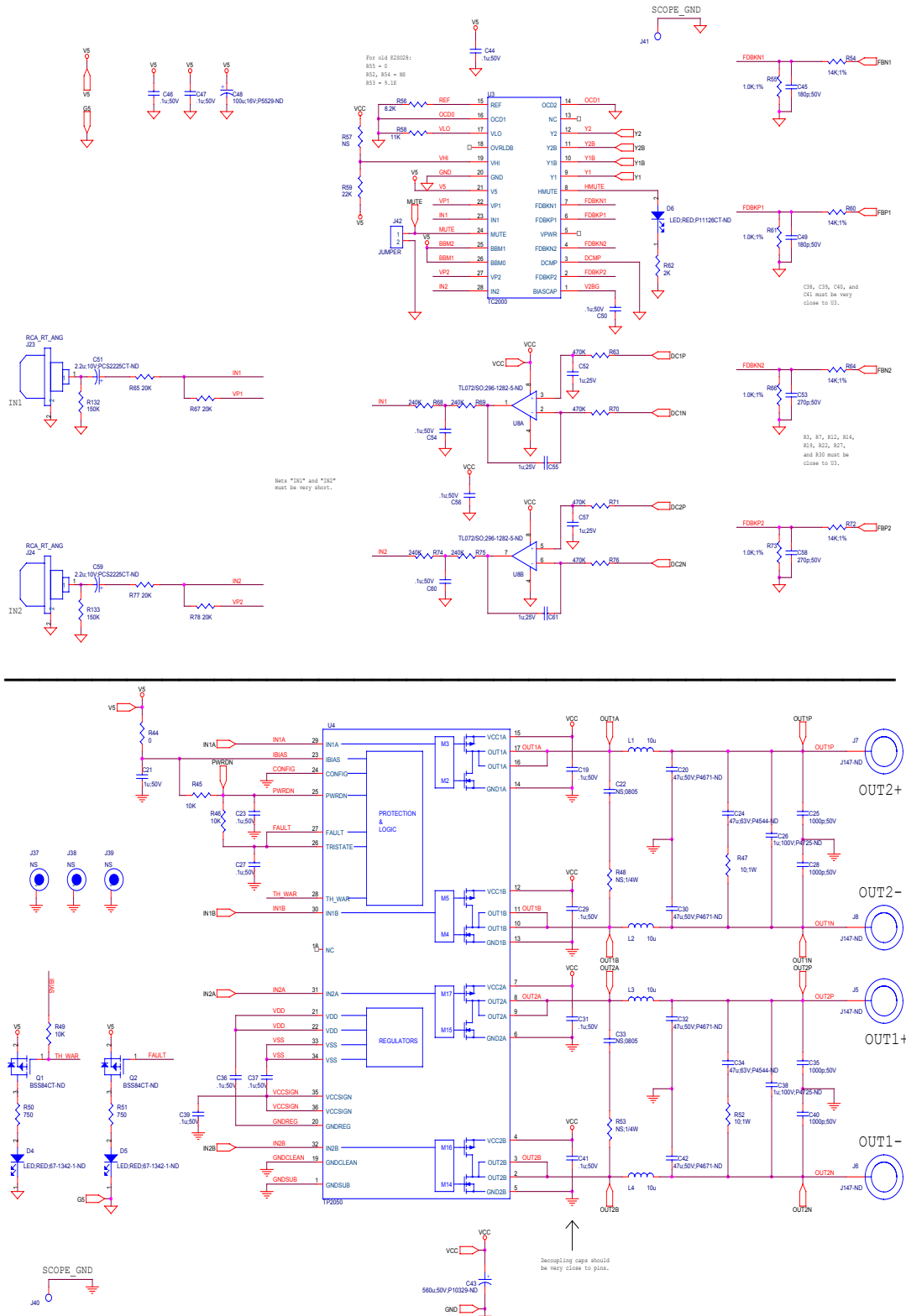
The TK2050 operates by generating a high frequency switching signal based on the audio input. This signal is sent through a low-pass filter that recovers an amplified version of the audio input. The frequency of the switching pattern is spread spectrum in nature and typically varies between 100kHz and 1MHz, which is well above the 20Hz – 20kHz audio band. The pattern itself does not alter or distort the audio input signal, but it does introduce some inaudible components.

The measurements of certain performance parameters, particularly noise related specifications such as THD+N, can be significantly affected by the design of the low-pass filter used on the output as well as the bandwidth setting of the measurement instrument used. Unless the output filter has a very sharp roll-off just beyond the audio band or the bandwidth of the measurement instrument is low-pass filtered, some of the inaudible noise components introduced by the TK2050 switching pattern will degrade the measurement.

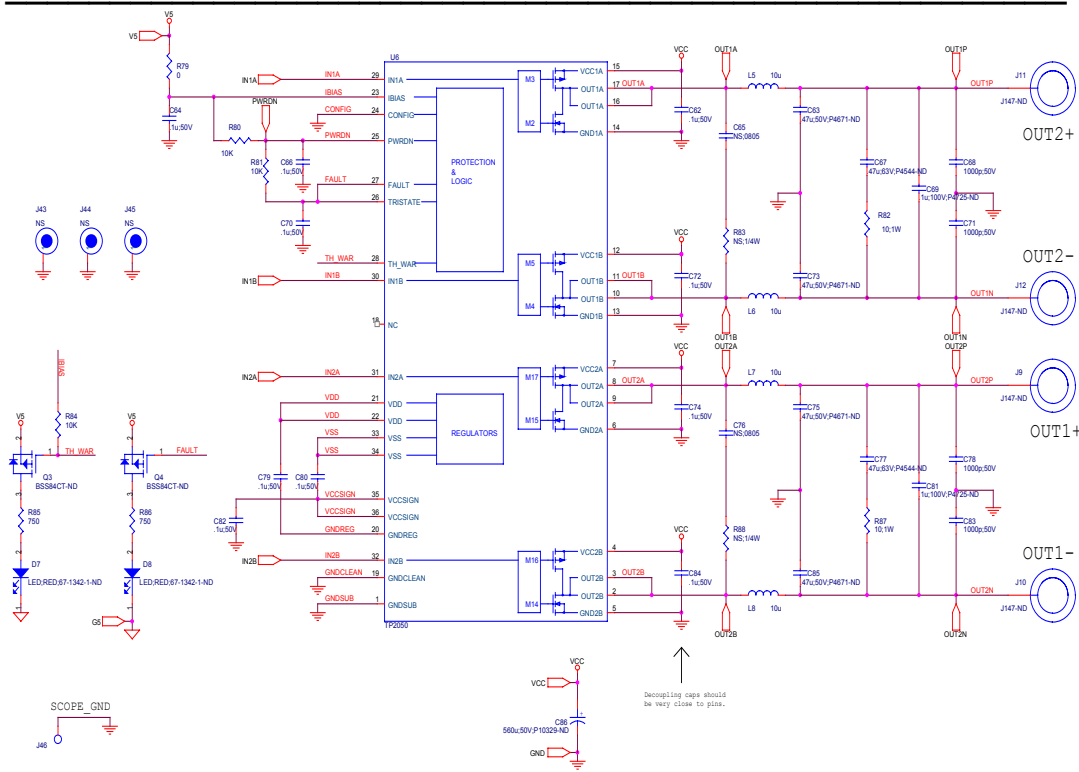
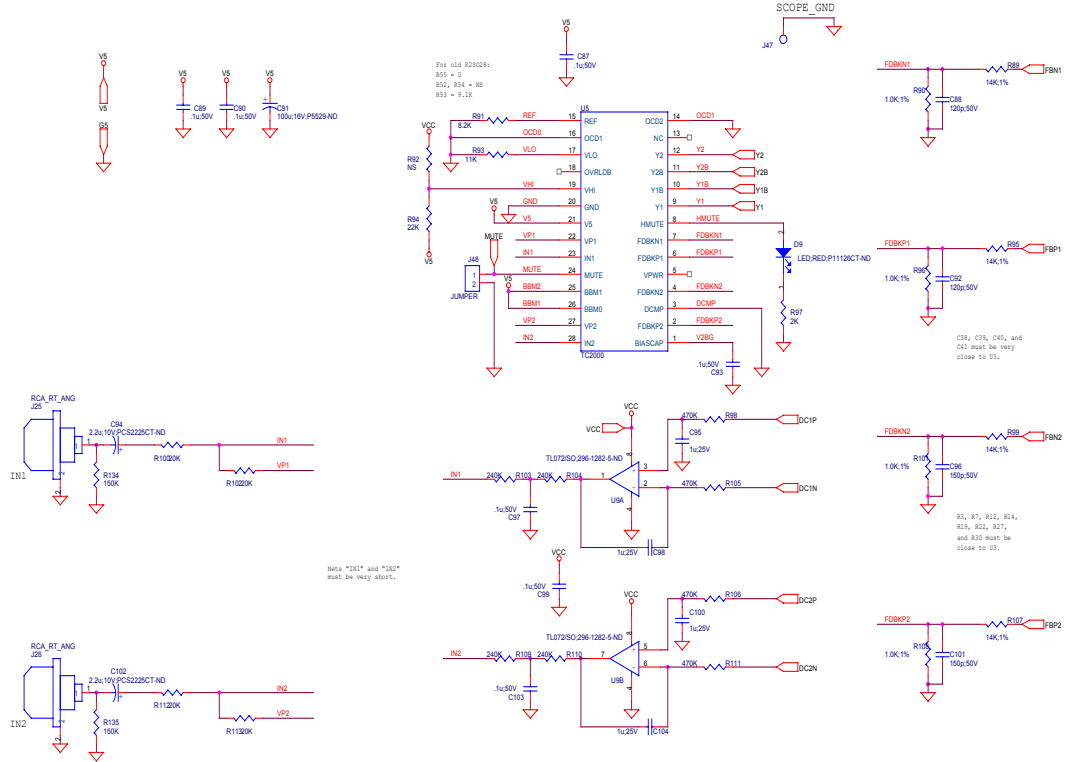
One feature of the TK2050 is that it does not require large multi-pole filters to achieve excellent performance in listening tests, which are often a more critical factor than performance measurements. Though using a multi-pole filter may remove high-frequency noise and improve THD+N type measurements (when they are made with wide-bandwidth measuring equipment), these same filters degrade frequency response. The EB-TK2050-6 Evaluation Board has a simple two-pole output filter with excellent performance in listening tests. See Tripath Application Note 4 for more information on bench testing.











TK2050 6 CHANNEL EVAL BOARD Revised: Friday, February 01, 2002  
Revision: 1.5

Bill Of Materials February 7,2002 16:00:07 Page1

Item	Quantity	Reference	Description / Digikey number
1	53	C1,C3,C4,C7,C11,C13,C17, C19,C21,C23,C27,C29,C31, C36,C37,C39,C41,C44,C46, C47,C50,C54,C56,C60,C62, C64,C66,C70,C72,C74,C79, C80,C82,C84,C87,C89,C90, C93,C97,C99,C103,C105, C107,C109,C113,C115,C117, C122,C123,C125,C127,C131, C132	.1u;50V
2	2	C6,C2	330p;50V
3	4	C5,C48,C91,C133	100u;16V;P5529-ND
4	6	C8,C16,C51,C59,C94,C102	2.2u;10V;PCS2225CT-ND
5	12	C9,C12,C14,C18,C52,C55, C57,C61,C95,C98,C100, C104	1u;25V
6	2	C15,C10	560p;50V
7	12	C20,C30,C32,C42,C63,C73, C75,C85,C106,C116,C118, C128	.47u;50V;P4671-ND
8	6	C22,C33,C65,C76,C108, C119	NS;0805
9	6	C24,C34,C67,C77,C110, C120	.47u;63V;P4544-ND
10	12	C25,C28,C35,C40,C68,C71, C78,C83,C111,C114,C121, C126	1000p;50V
11	6	C26,C38,C69,C81,C112, C124	.1u;100V;P4725-ND
12	4	C43,C86,C129,C130	560u;50V;P10329-ND
13	2	C49,C45	180p;50V
14	2	C58,C53	270p;50V
15	2	C92,C88	120p;50V
16	2	C101,C96	150p;50V
17	2	D2,D1	LED;GREEN;67-1343-1-ND
18	3	D3,D6,D9	LED;RED;P11126CT-ND
19	6	D4,D5,D7,D8,D10,D11	LED;RED;67-1342-1-ND
20	1	D12	1N4002DICT-ND
21	16	J1,J2,J3,J4,J5,J6,J7,J8,	J147-ND

		J9,J10,J11,J12,J27,J28, J29,J30	
22	8	J13,J14,J15,J16,J31,J32, J33,J34	STANDOFF
23	6	J21,J22,J23,J24,J25,J26	RCA_RT_ANG
24	6	J35,J40,J41,J46,J47,J52	5011K-ND
25	4	J36,J42,J48,J53	JUMPER
26	16	R16,R22,J37,J38,J39,J43, J44,J45,J49,J50,J51,R57, R92,R124,R125,R126	NS
27	12	L1,L2,L3,L4,L5,L6,L7,L8, L9,L10,L11,L12	10u
28	6	Q1,Q2,Q3,Q4,Q5,Q6	BSS84CT-ND
29	21	R1,R2,R3,R4,R5,R6,R7,R8, R9,R10,R11,R12,R13,R14, R15,R44,R79,R114,R127, R128,R129	0
30	7	R17,R50,R51,R85,R86,R120, R121	750
31	1	R18	6.2K
32	12	R19,R25,R29,R37,R54,R60, R64,R72,R89,R95,R99,R107	14K;1%
33	12	R20,R26,R31,R38,R55,R61, R66,R73,R90,R96,R101, R108	1.0K;1%
34	3	R21,R56,R91	8.2K
35	3	R23,R58,R93	11K
36	3	R24,R59,R94	22K
37	3	R27,R62,R97	2K
38	12	R28,R35,R36,R41,R63,R70, R71,R76,R98,R105,R106, R111	470K
39	12	R30,R32,R42,R43,R65,R67, R77,R78,R100,R102,R112, R113	20K
40	12	R33,R34,R39,R40,R68,R69, R74,R75,R103,R104,R109, R110	240K
41	9	R45,R46,R49,R80,R81,R84, R115,R116,R119	10K
42	6	R47,R52,R82,R87,R117, R122	10;1W
43	6	R48,R53,R83,R88,R118, R123	NS;1/4W
44	6	R130,R131,R132,R133,R134, R135	150K
45	1	SW1	SPDT
46	3	U1,U3,U5	TC2000
47	3	U2,U4,U6	TP2050

48	3	U7,U8,U9	TL072/SO;296-1282-5-ND
49	1	U10	LM340AT-5.0-ND

Unless otherwise noted, all resistors are 1/10 watt 5% tolerance and all capacitors are 10% tolerance.

## Contact Information

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