



## RB-TK2051

# CLASS-T DIGITAL AUDIO AMPLIFIER 6 CHANNEL TK2051 REFERENCE BOARD

Technical Information - Board Rev. 2.2

Revision 1.0 – June 2002

### GENERAL DESCRIPTION

The RB-TK2051 Revision 2.2 is a 6 channel, 50W per channel, audio amplifier designed to provide a simple and straightforward reference design for the TK2051 amplifier in a small footprint (3.75" X 4.75" including connectors). For additional documentation on the TK2051, see the TK2051 Data Sheet.

### APPLICATIONS

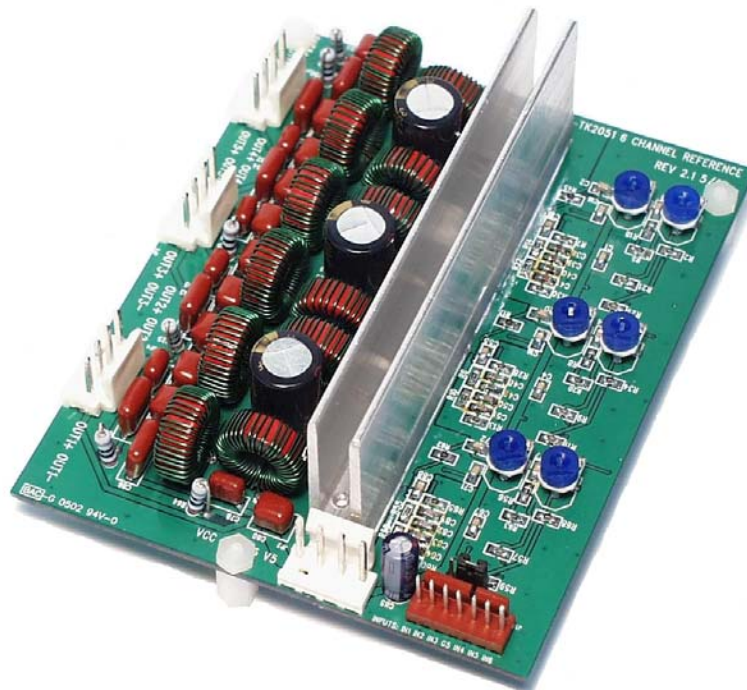
- 6Ω and 8 Ω multi-channel
- 4 Ω mono (parallel operation)
- Home Theater Receivers
- Multi-channel Distribution
- Powered DVD Systems
- Mini/Micro Systems

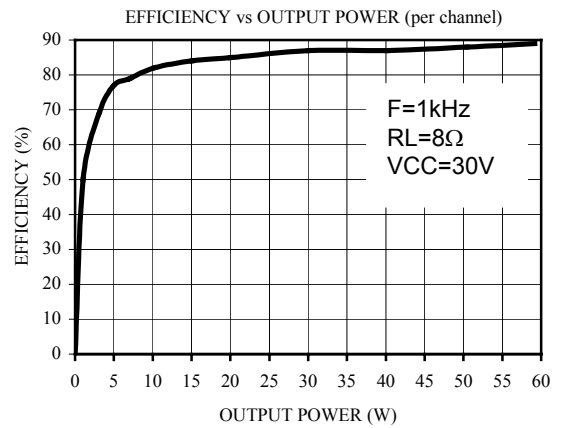
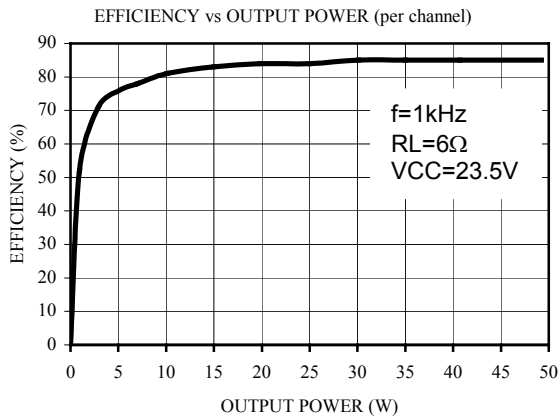
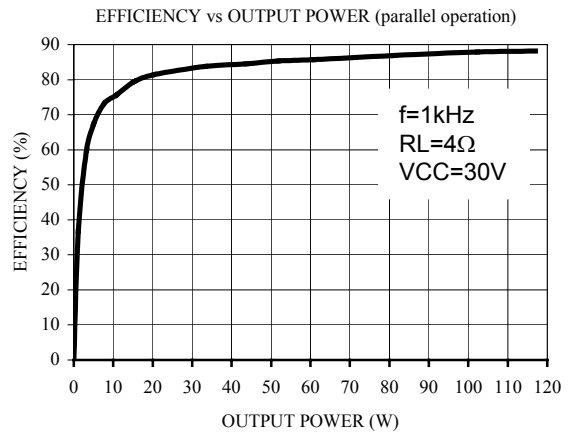
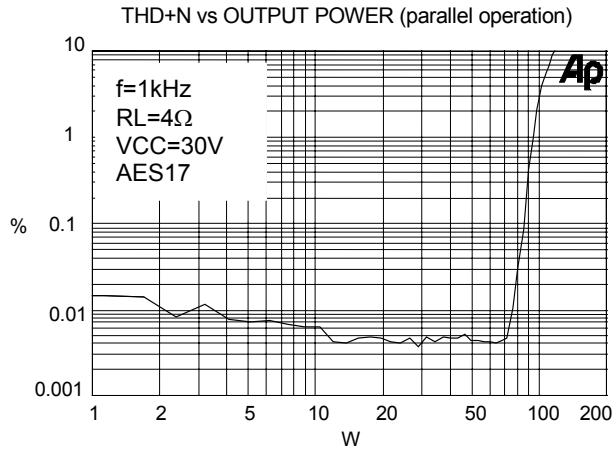
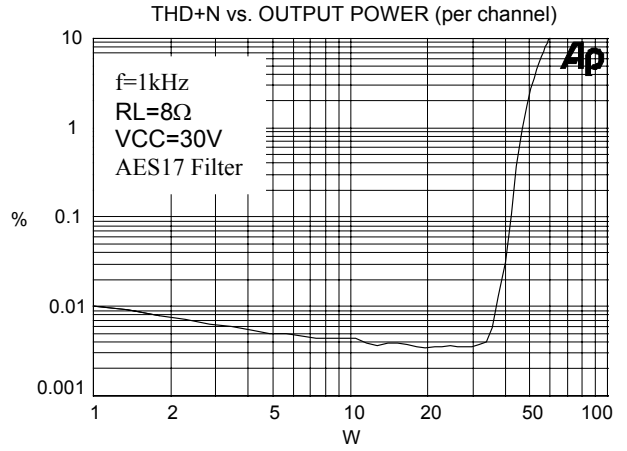
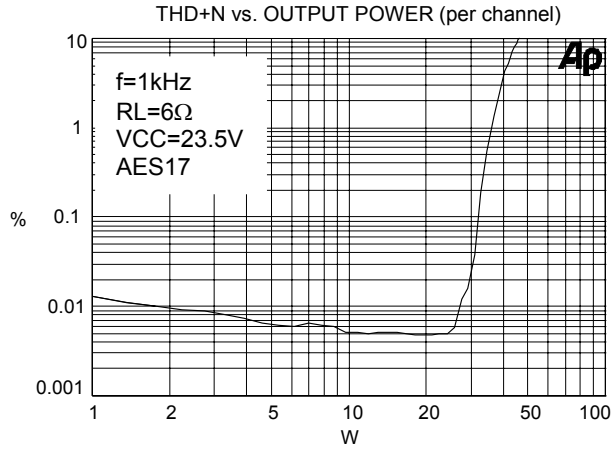
### BENEFITS

- More power per cubic inch for 50W/Channel design
- Simplifies thermal management
- Signal Quality comparable to high quality, linear amplifiers
- Simple building block for multi-channel design

### FEATURES

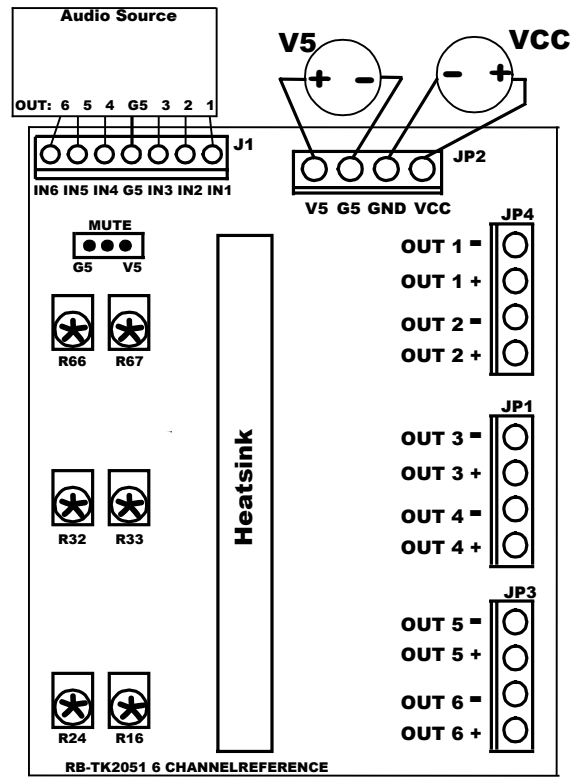
- High Continuous Power:
  - 46W @ 6Ω
  - 50W @ 8Ω
  - \* 1/8 power for 1 hour followed by full power for 5 minutes.
- Low Noise Floor: <135uV A-weighted
- Low Distortion:
  - .005% THD+N, 20W, 6Ω
  - .005% THD+N, 30W, 8Ω
- High Efficiency:
  - 85% @ 46W, 6Ω
  - 89% @ 59W, 8Ω
- Over-Current Protection
- Over and Under Voltage Protection
- Over Temperature Protection





## OPERATING INSTRUCTIONS

### BOARD CONNECTION DIAGRAM



#### POWER SUPPLIES

Two external power supplies are required to operate the RB-TK2051: VCC (referenced to GND), and V5 (referenced to G5). The V5 ground (G5) must be kept separate from the VCC ground (GND). GND and G5 are joined at a common point on the EB-TK2051 with a 0 $\Omega$  resistor (R1).

The Minimum and Maximum VCC supply voltages are +10V and +30V, respectively.

The V5 supply voltage is 5V. Please see the TK2051 Data Sheet for Minimum and Maximum values.

The VCC and V5 power supply connection is a standard 4-pin .156" Molex header (JP4). Please refer to the Board Connection Diagram for the connector locations on the EB-TK2051.

#### OUTPUT

The output connections for each channel of the RB-TK2051 are made with standard 4-pin .156" Molex headers (JP1, JP3, JP4). The output of the TK2051 is differential; therefore each output has a positive output (OUT\_+) and a NEGATIVE OUTPUT (OUT\_-).

Please refer to the Board Connection Diagram for the connector locations on the RB-TK2051.

#### INPUT

The input connections of the RB-TK2051 are made with a standard 7-pin .100" Molex header (J1). There are six inputs and one common Agnd. Please refer to the Board Connection Diagram for the connector locations on the RB-TK2051.

## **JUMPER SETTINGS**

There is a 3-pin header for the MUTE control of the TK2051. With the jumper placed in the G5 position the system is un-muted. When the jumper is placed in the V5 position the mute pin is pulled high (5V) and the amplifiers are muted. Please refer to the Board Connection Diagram for the connector locations on the RB-TK2051.

## **OUTPUT OFFSET NULL**

There are six potentiometers that are used to manually trim the output offset to 0Vdc. Please refer to the Board Connection Diagram for the potentiometer locations on the RB-TK2051. The Evaluation board is shipped with the offsets nulled within +/-10mV.

## **GAIN SETTING**

The gain of the RB-TK2051 Rev 2.2 is set to 15V/V. The gain of the TK2051 is the product of the TC2000 (control stage) gain and the TP2051 (power stage) gain. The control stage gain is set to unity. Before changing the gain of the RB-TK2051, please refer to the Amplifier Gain section of the TK2051 Data Sheet.

## **Performing Measurements on the EB-TK2051 Rev 1.3:**

The TK2051 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, are 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 filter has a very sharp roll-off just beyond the audio band or the bandwidth of the measurement instrument is limited, some of the inaudible noise components introduced by the TK2051 amplifier switching pattern will degrade the measurement by including out of band (audio) energy.

One feature of the TK2051 is that it does not require large multi-pole filters to achieve excellent performance in listening tests, usually 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 RB-TK2051 has a simple two-pole output filter with excellent performance in listening tests.

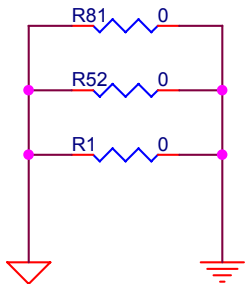
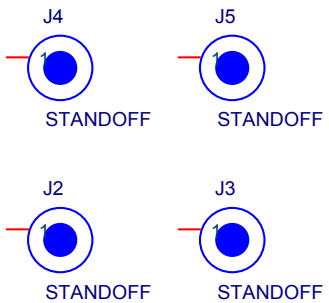
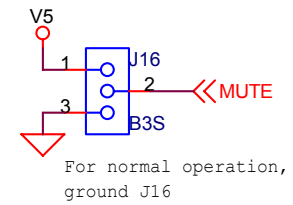
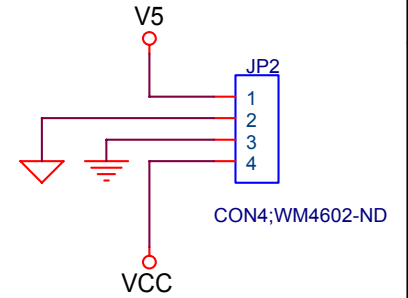
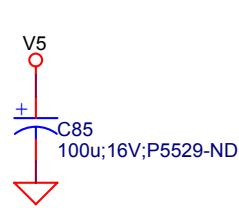
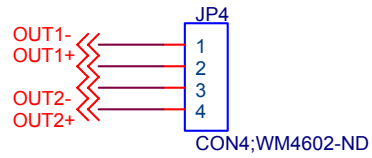
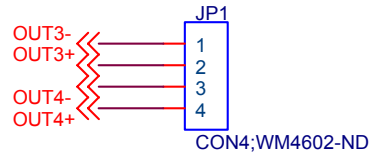
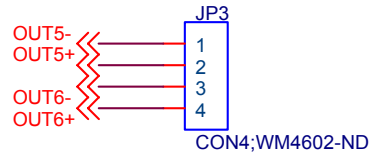
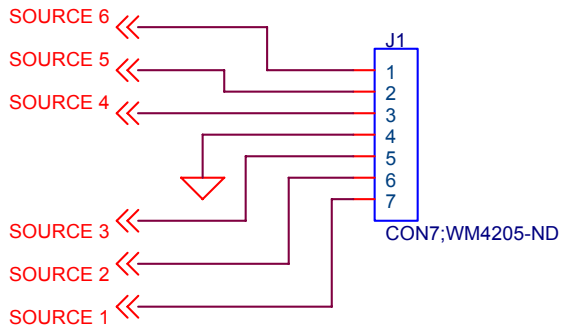
(See Application Note 4 for additional information on bench testing)

## Contact Information

### **TRIPATH TECHNOLOGY, INC**

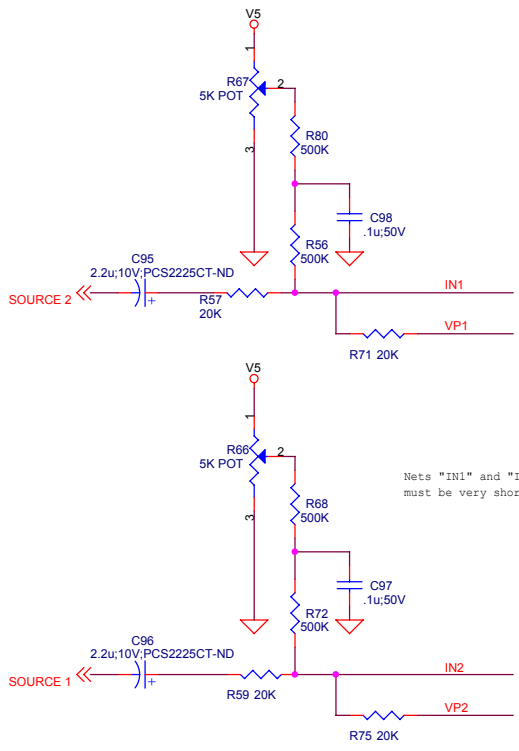
2560 Orchard Parkway, San Jose, CA 95131  
408.750.3000 - P  
408.750.3001 - F

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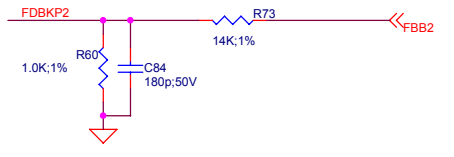
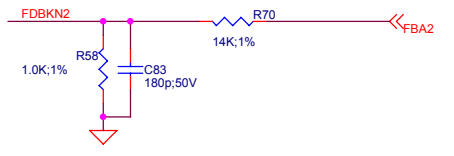
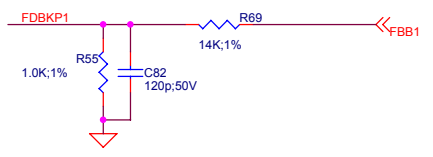
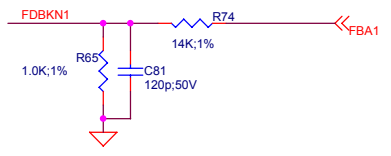
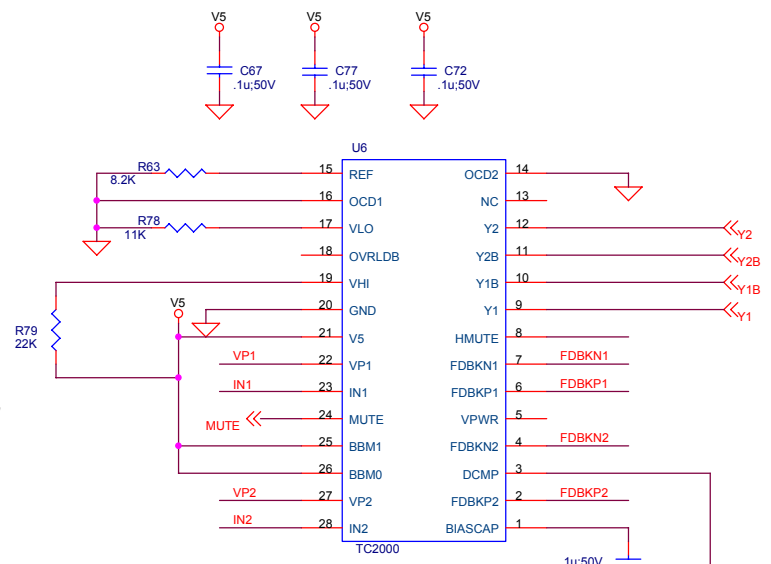


G5 to GND short at a single point, therefore, use only one of these three resistors (0 ohm).

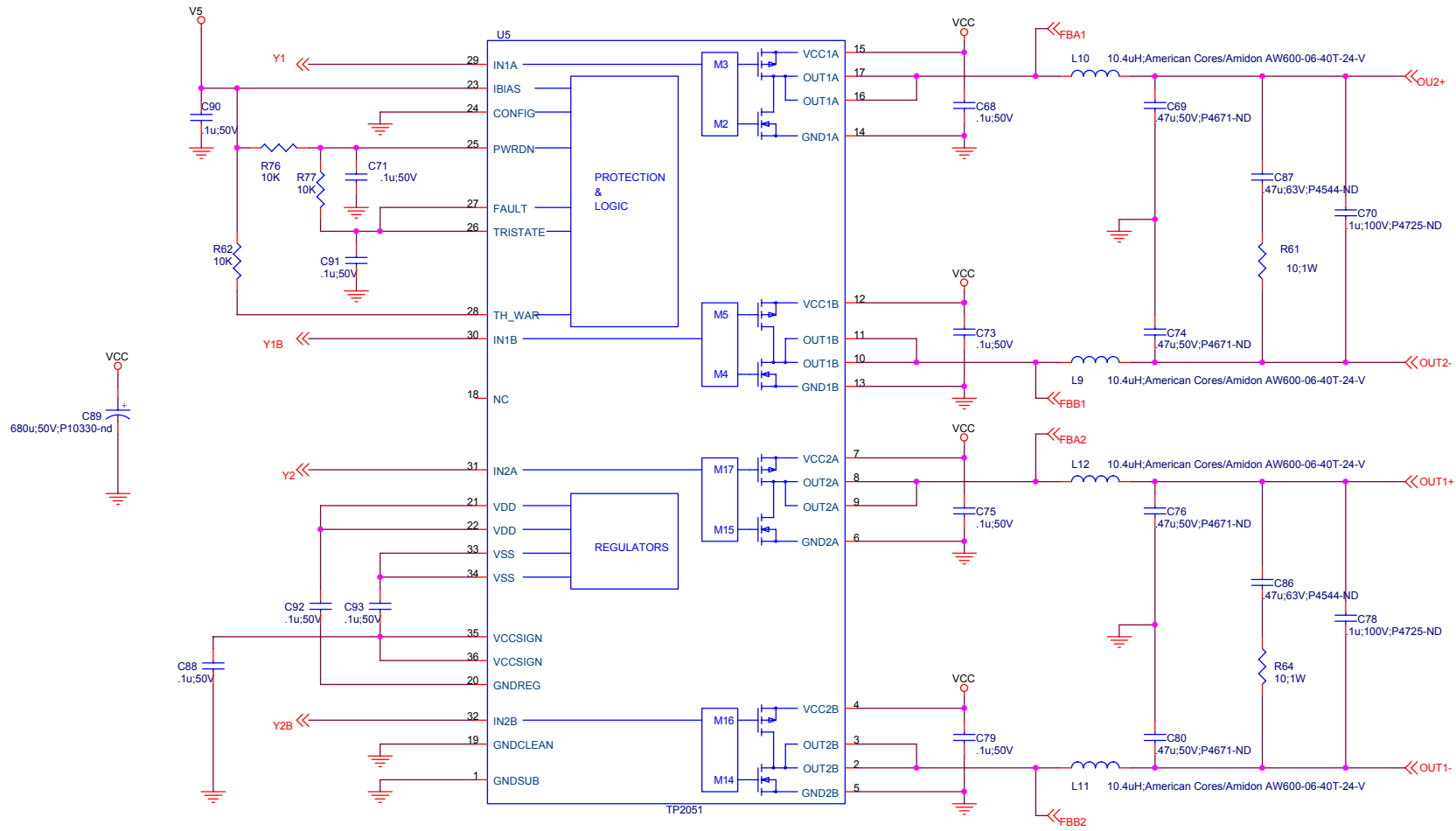
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Nets "IN1" and "IN2" must be very short.

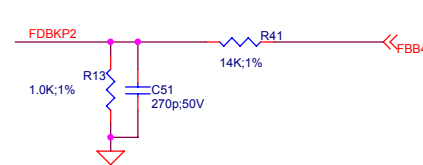
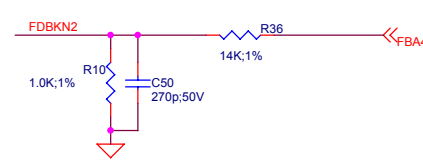
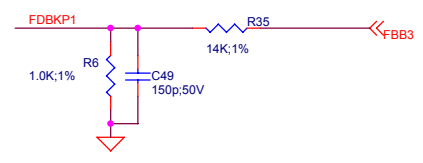
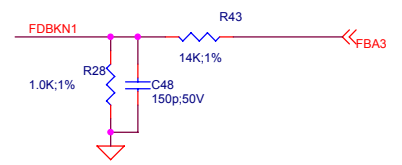
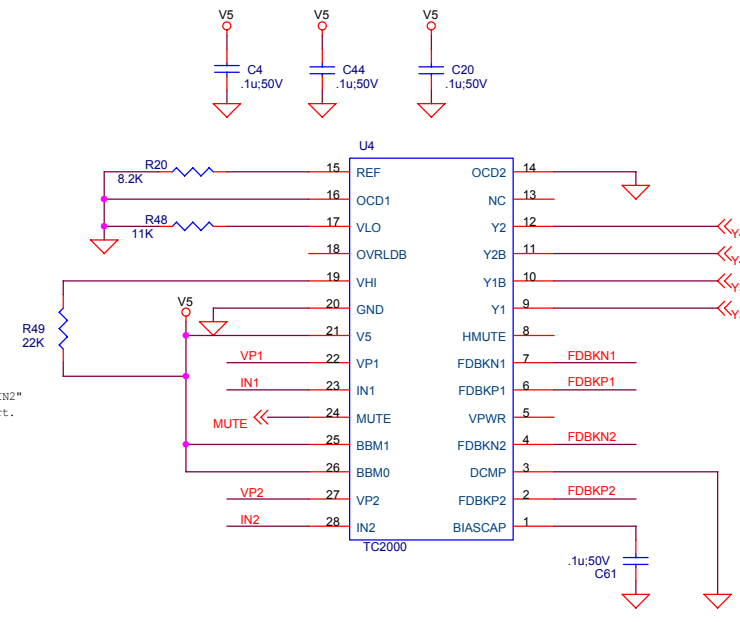
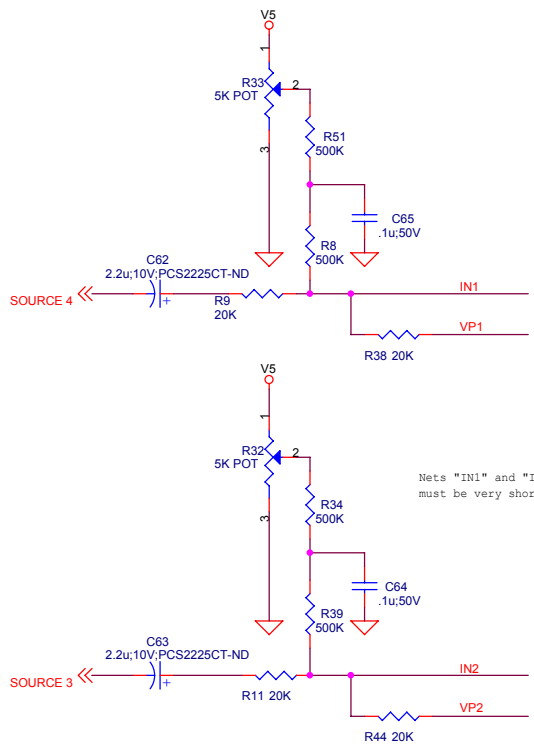


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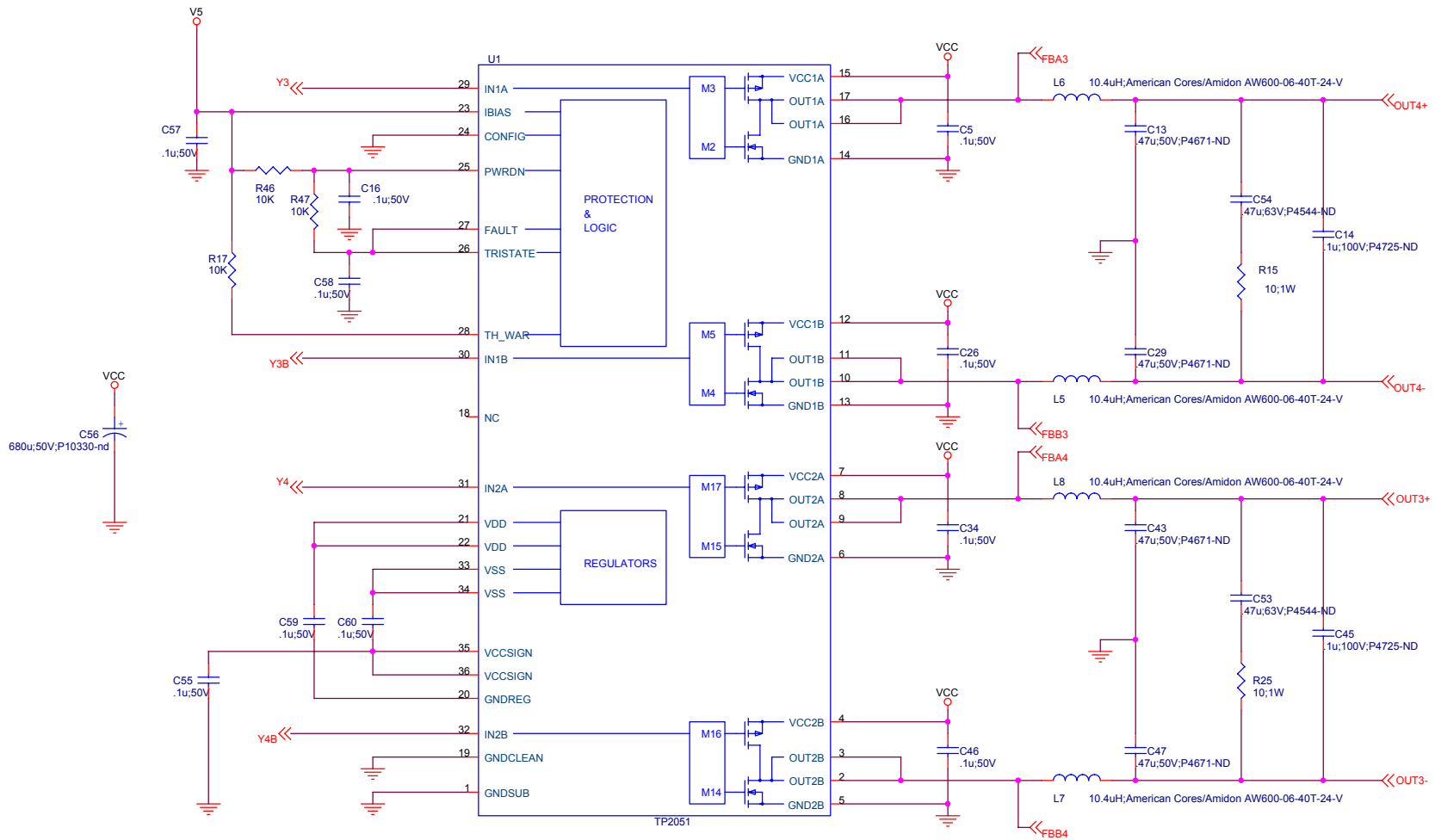


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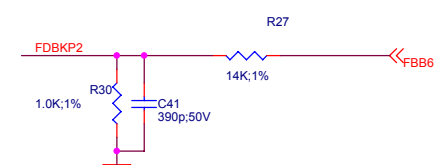
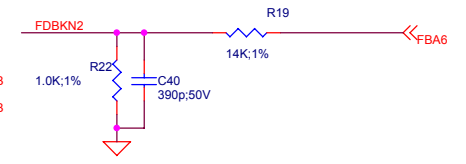
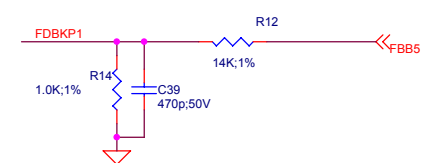
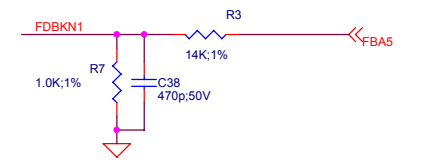
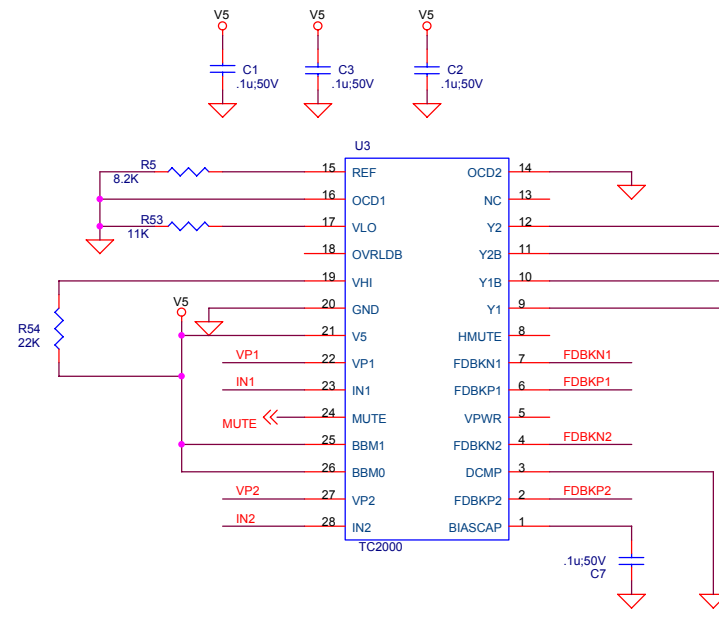
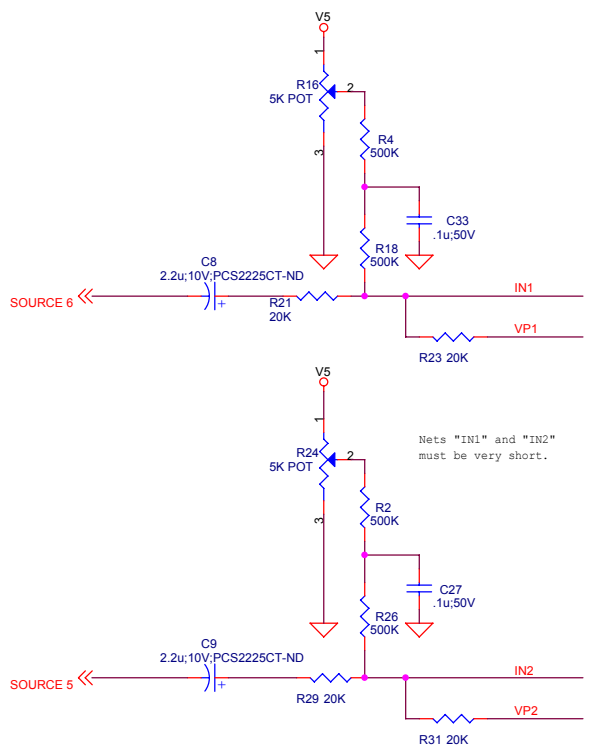




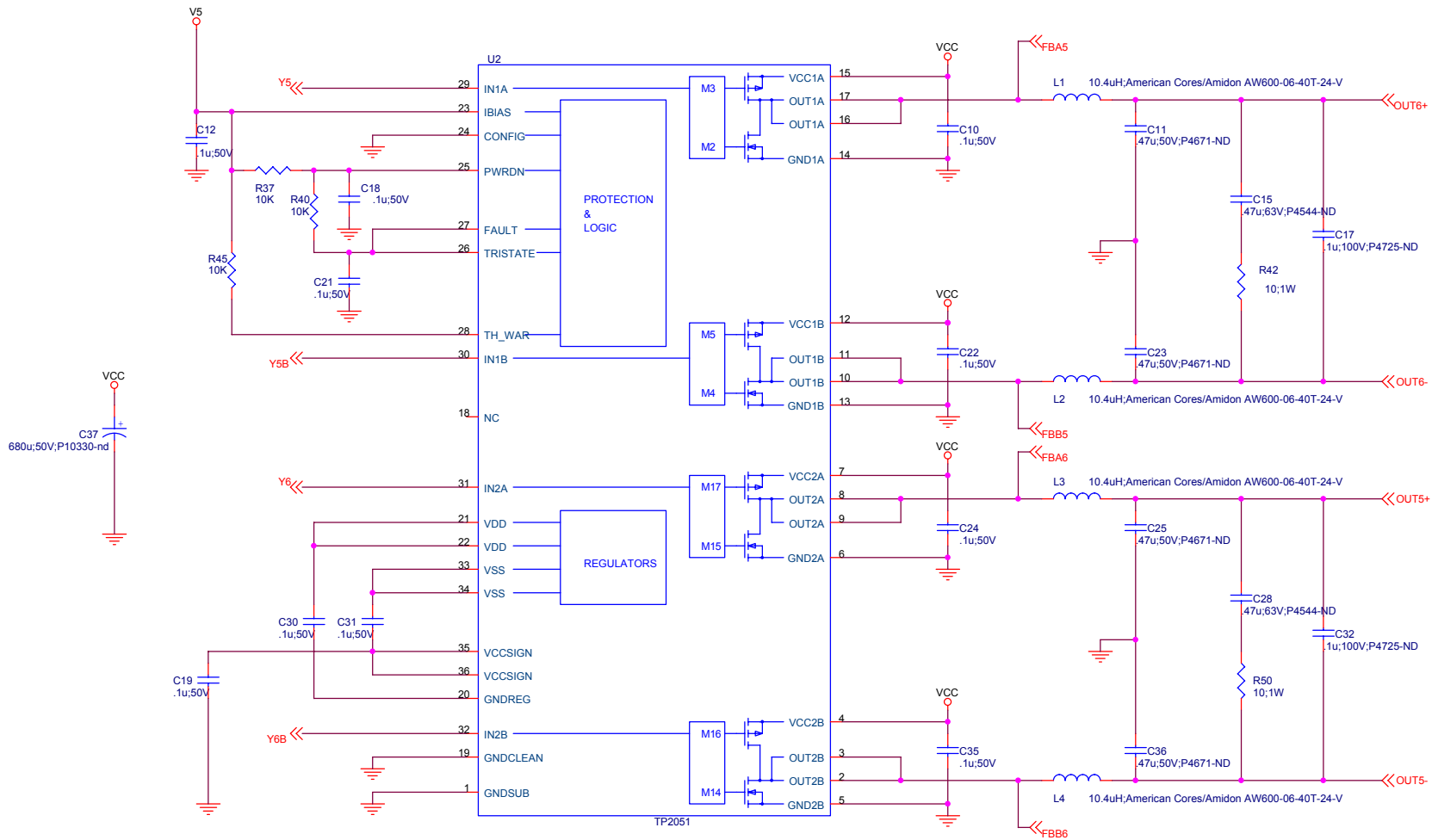
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2	6	C8,C9,C62,C63,C95,C96	2.2u;10V;PCS2225CT-ND
3	12	C11,C13,C23,C25,C29,C36, C43,C47,C69,C74,C76,C80	.47u;50V;P4671-ND
4	6	C14,C17,C32,C45,C70,C78	.1u;100V;P4725-ND
5	6	C15,C28,C53,C54,C86,C87	.47u;63V;P4544-ND
6	3	C37,C56,C89	680u;50V;P10330-ND
7	2	C38,C39	470p;50V
8	2	C40,C41	390p;50V
9	2	C48,C49	150p;50V
10	2	C50,C51	270p;50V
11	2	C81,C82	120p;50V
12	2	C83,C84	180p;50V
13	1	C85	100u;16V;P5529-ND
14	4	JP1,JP2,JP3,JP4	CON4;WM4602-ND
15	1	J1	CON7;WM4205-ND
16	4	J2,J3,J4,J5	4-40 1/4" STANDOFF
17	1	J16	3pin .100" header
18	12	L1,L2,L3,L4,L5,L6,L7,L8, L9,L10,L11,L12	10.4uH;American Cores/Amidon AW600-06-40T-24-V
19	3	R1,R52,R81	0
20	12	R2,R4,R8,R18,R26,R34,R39, R51,R56,R68,R72,R80	500K
21	12	R3,R12,R19,R27,R35,R36, R41,R43,R69,R70,R73,R74	14K;1%
22	3	R5,R20,R63	8.2K
23	12	R6,R7,R10,R13,R14,R22,	1.0K;1%

24	12	R28,R30,R55,R58,R60,R65 R9,R11,R21,R23,R29,R31, R38,R44,R57,R59,R71,R75	20K
25	6	R15,R25,R42,R50,R61,R64	10;1W
26	6	R16,R24,R32,R33,R66,R67	5K POT
27	9	R17,R37,R40,R45,R46,R47, R62,R76,R77	10K
28	3	R48,R53,R78	11K
29	3	R49,R54,R79	22K
30	3	U1,U2,U5	TP2051
31	3	U3,U4,U6	TC2000