TRIPATH

RB-TK2019

2 X 20W CLASS-T DIGITAL AUDIO AMPLIFIER REFERENCE BOARD

Technical Information- Board Rev. 2.1 **Revision 2.0 – December 2003**

GENERAL DESCRIPTION

The RB-TK2019 Revision 2.1 is a stereo single ended 20W continuous average power per channel audio amplifier designed to provide a simple and straightforward environment for the evaluation of the TK2019 as a single ended amplifier. For additional documentation on the TK2019, see the TK2019 Data Sheet.

APPLICATIONS

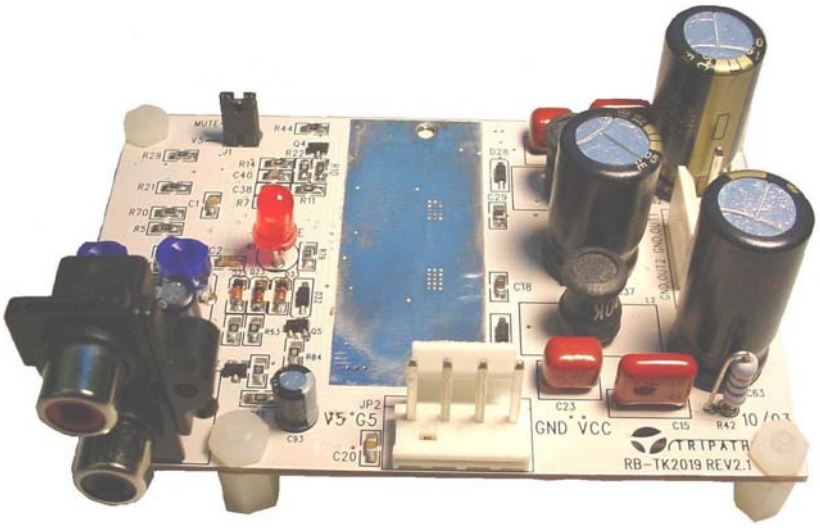
- 4Ω and 8 Ω stereo
- Home Theater Receivers
- Powered DVD Systems
- Mini/Micro Systems

BENEFITS

- Single Supply Operation
- Very High Efficiency
- Wide Dynamic Range
- Compact Layout

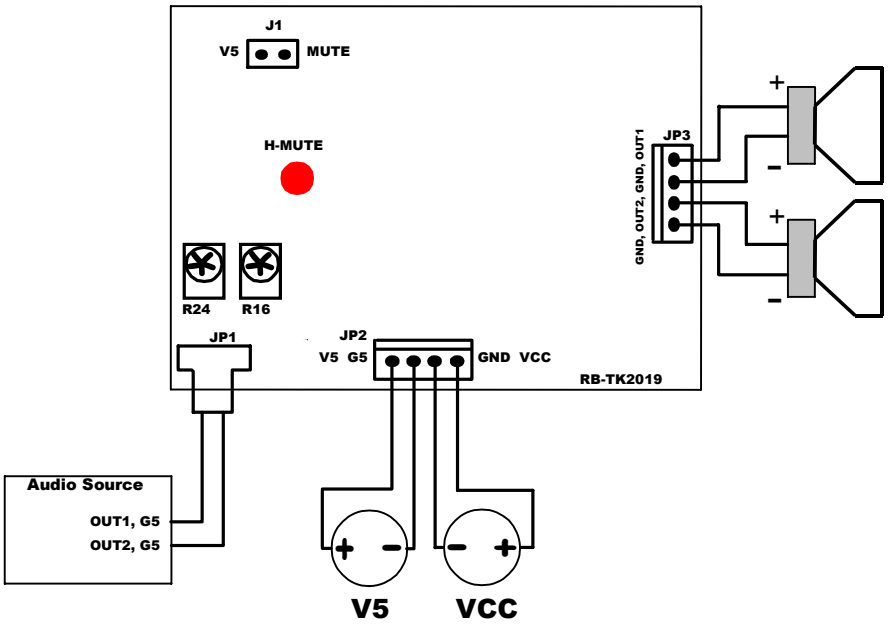
FEATURES

- High Continuous Power: 20W @ 4Ω, 10% THD+N
  11W @ 8Ω, 10% THD+N
- Low Noise Floor: 82uV A-weighted
- Low Distortion: .03% THD+N, 11W, 4Ω
  .03% THD+N, 6W, 8Ω
- High Efficiency: 89% @ 20W, 4Ω
  92% @ 11W, 8Ω
- Dynamic Range >100dB



OPERATING INSTRUCTIONS

BOARD CONNECTION DIAGRAM



POWER SUPPLIES

Two external power supplies are required to operate the RB-TK2019 Revision 2.0: 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 PCB with a 0Ω resistor (R1).

The Minimum and Maximum VCC supply voltages are 15V and 25V, respectively.

The V5 supply voltage is 5V. Please see the TK2019 Data Sheet for Minimum and Maximum values.

The VCC and V5 power supply connection (JP2) is a standard 4 pin, .156” Molex header. Please refer to the Board Connection Diagram for the connector locations.

OUTPUT

The output connection for each channel of the RB-TK2019 Revision 2.0 is a standard 4 pin, .156” Molex header. The output of the RB-TK2019 Revision 2.0 is single ended; therefore each output has a positive output (OUT1 and OUT2) and a ground (GND).
Please refer to the Board Connection Diagram for the connector locations.

INPUT

The input connection for each channel of the RB-TK2019 Revision 2.0 is made using a dual RCA connector (JP1). The RCA connectors are labeled IN1 and IN2 on the bottom of the PCB. Channel 1’s RCA is color coded black and Channel 2’s RCA is color-coded red. These inputs share a common ground referenced to G5. Please refer to the Board Connection Diagram for the connector locations.

JUMPER SETTINGS

J1 is a 2-pin header for the MUTE control. With the jumper shorting the header pins the part is un-muted. When the jumper is removed the mute pin is pulled high (5V) and the amplifier is muted. Please refer to the Board Connection Diagram for location of J1.

INDICATOR LED'S

The RB-TK2019 Revision 2.0 has one red LED labeled H-MUTE. The HMUTE LED will glow red and both outputs are muted when a fault occurs or the MUTE header (J1) is opened. Please refer to the TK2019 Data Sheet for a complete description of HMUTE. Please refer to the Board Connection Diagram for the LED location.

OUTPUT OFFSET NULL

There are two potentiometers, R16 (Channel 1) and R24 (Channel 2) that are used to manually trim the output offset to half of the supply rail voltage (VCC). Because this board uses an output DC blocking capacitor the offset measurement must be made at or before C62 and C63 and not at the output header. Please refer to the Board Connection Diagram for the potentiometer locations. The offset should be trimmed to VCC/2 or +12V for a 24V supply. Although the idle current is not affected by the offset, the output power will be reduced if the output offset is not properly trimmed. The Evaluation board is shipped with the offset nulled within +/-10mV for a 24V supply.

GAIN SETTING

The gain of the RB-TK2019 Rev 2.0 is set to 10V/V. The gain of the TK2019 is the product of the TC2001 (control stage) gain and the TPS1035 (power stage) gain. The control stage gain is set to unity. Before changing the gain of the RB-TK2019 Rev 2.0, please refer to the Amplifier Gain section of the TK2019 Data Sheet.

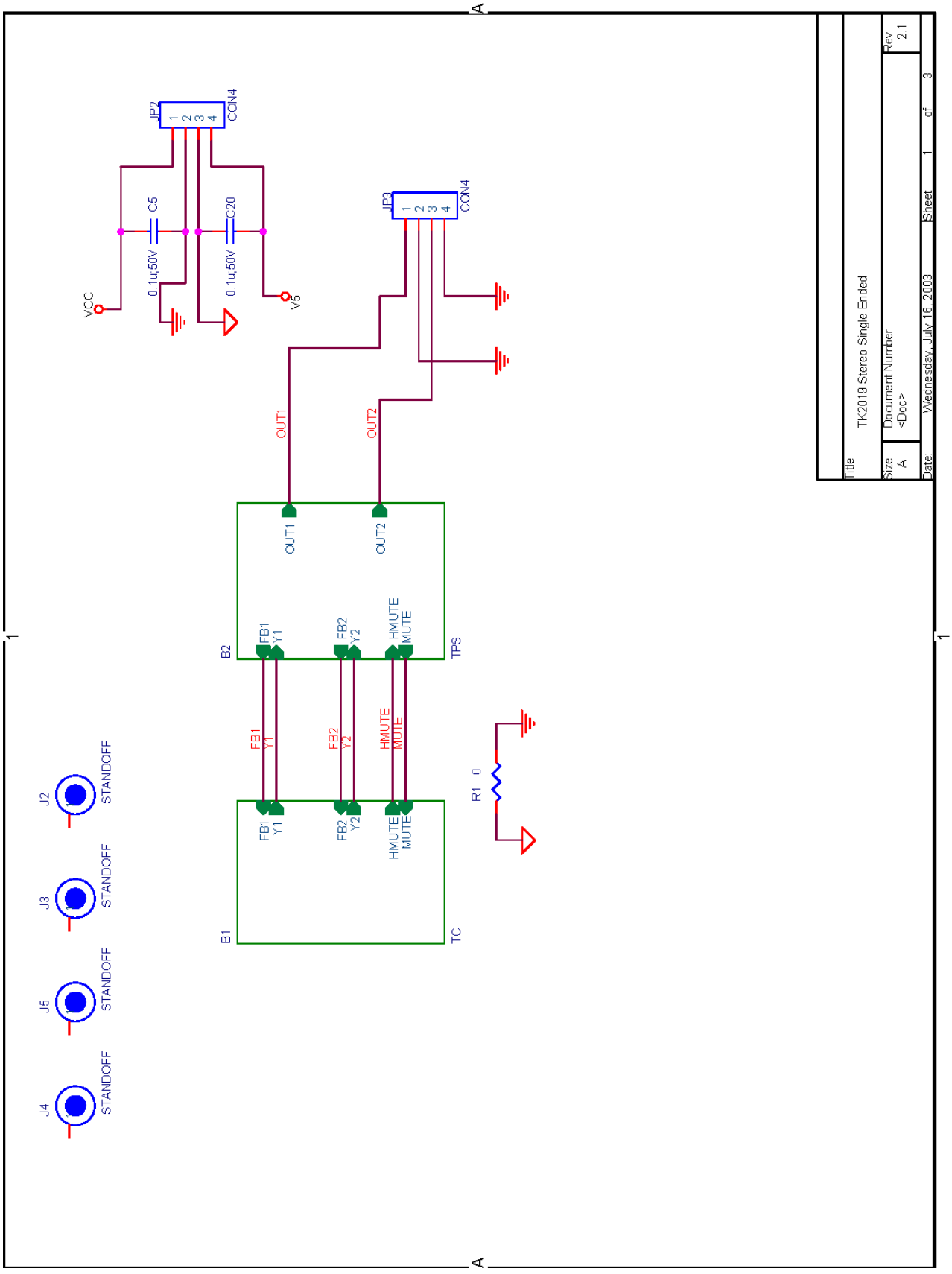
PERFORMING MEASUREMENTS ON THE RB-TK2019 REV 2.1:

The RB-TK2019 Rev 2.1 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.

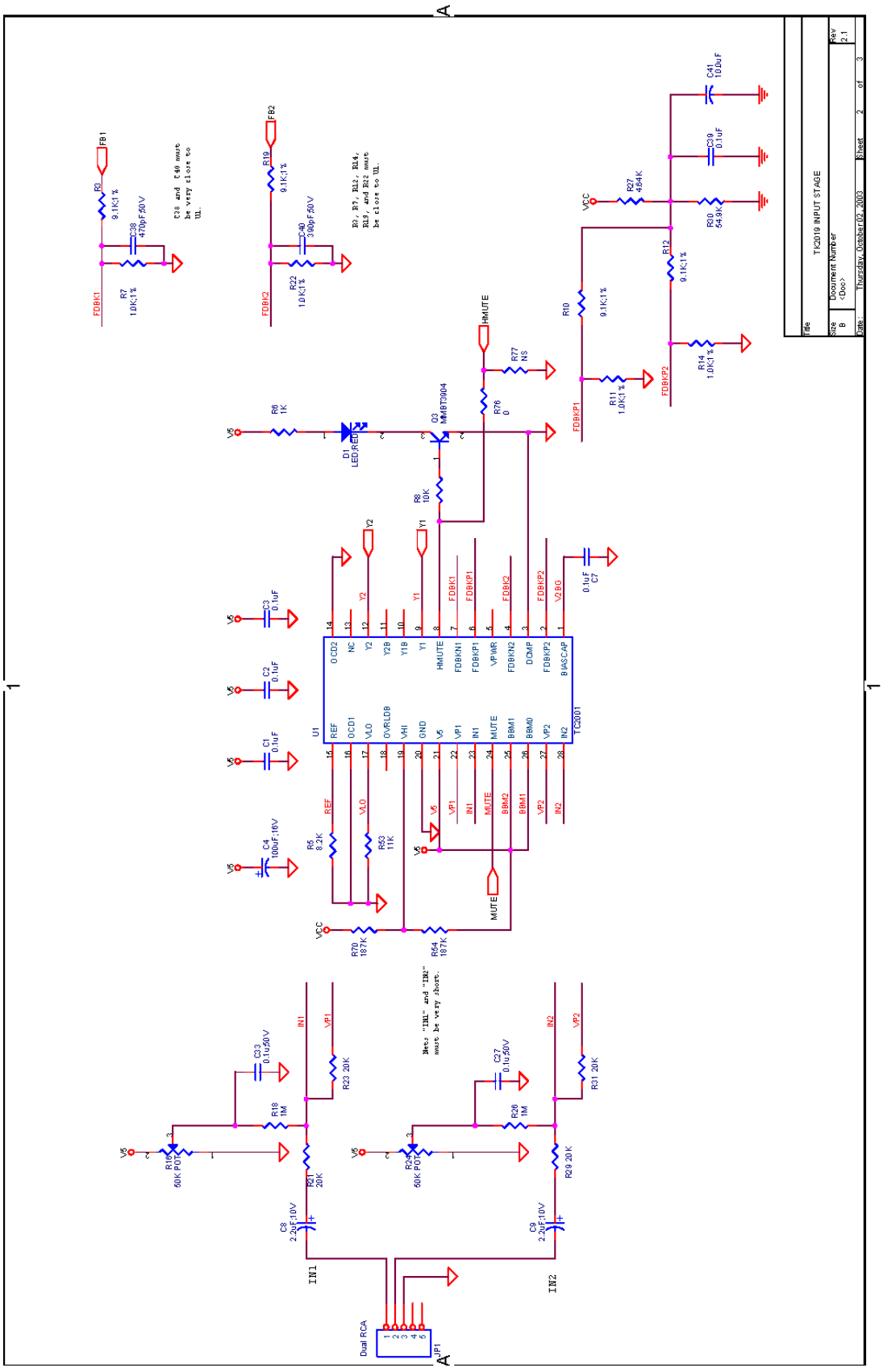
The measurements of certain performance parameters, particularly noise related specifications such as THD+N, are significantly affected by the design of the low-pass filter used on the output as well as the bandwidth setting of the measurement instrument used. Unless the filter has a very sharp roll-off just beyond the audio band or the bandwidth of the measurement instrument is limited, some of the inaudible noise components introduced by the TK2019 amplifier switching pattern will degrade the measurement by including out of band (audio) energy.

One feature of the TK2019 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-TK2019 Rev 2.1 has a simple two-pole output filter with excellent performance in listening tests.
(See Application Note 4 for additional information on bench testing)

EVALUATION BOARD SCHEMATIC



EVALUATION BOARD SCHEMATIC (cont.)



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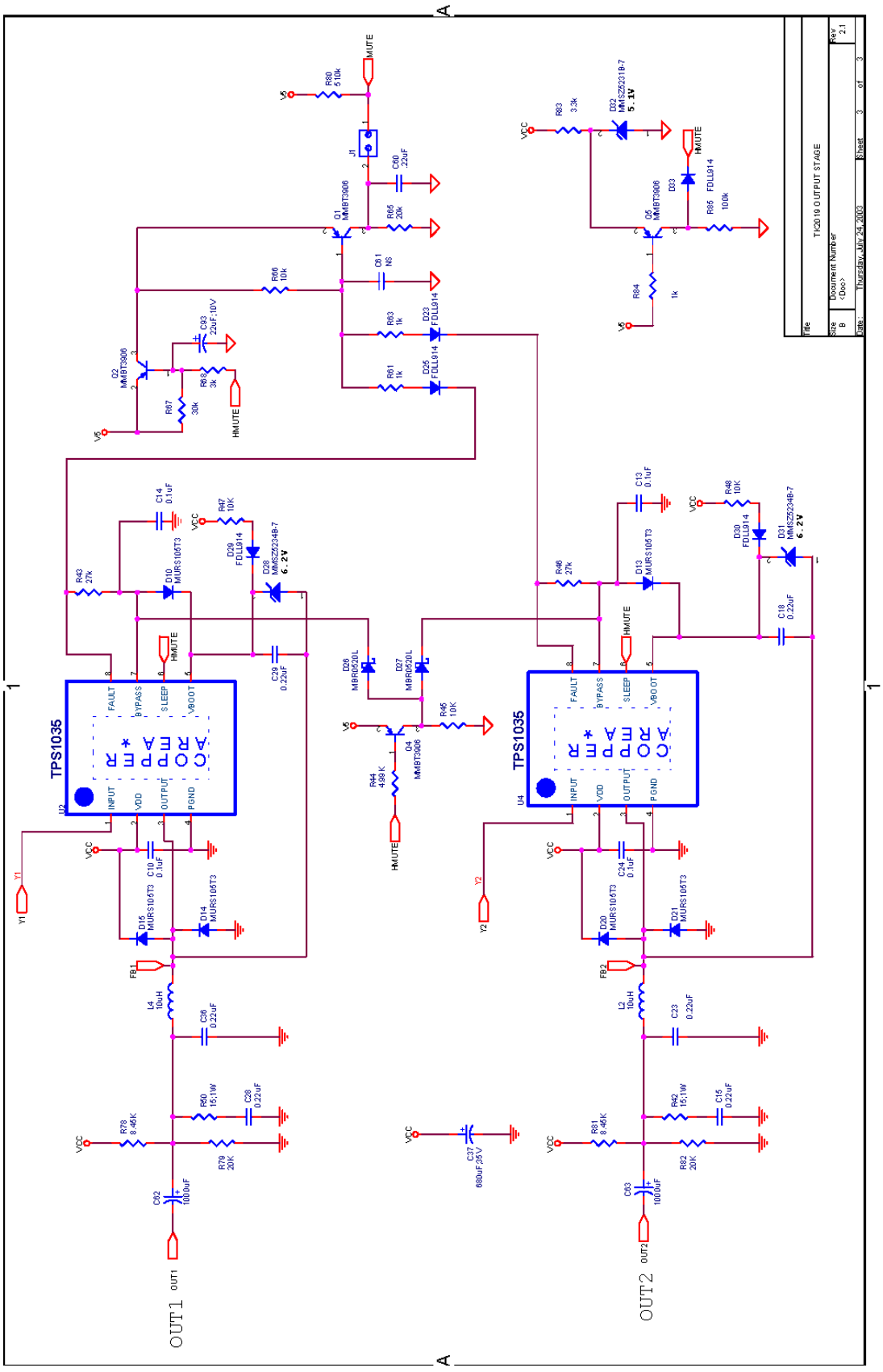


EVALUATION BOARD BILL-OF-MATERIALS

RB-TK2019
Bill of Materials

Revision: 2.1

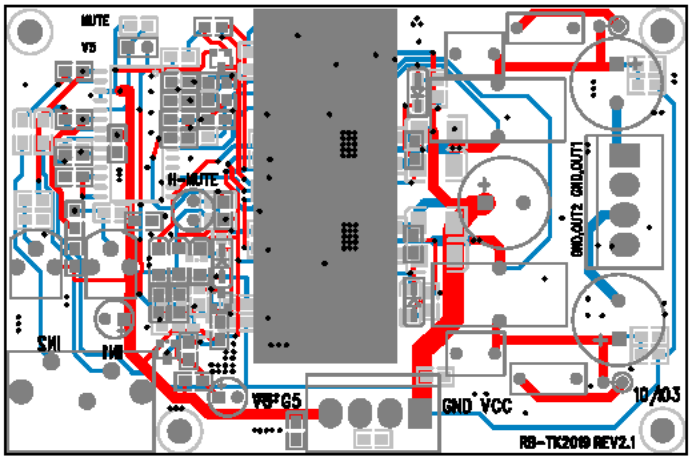
Revised: October 2, 2003

Item	Qty	Reference	Part	Type	Footprint	Rating	Manufacturer	Manufacturer P/N	Digikey P/N
1	11	C1,C2,C3,C5,C7,C10,C13,C14,C20 C24,C27,C33,C39	Capacitor	0.1uF Ceramic X7R	805	50V	PANASONIC	ECJ-2VF1H104Z	DK PCC1864CT-ND
2	1	C4	Capacitor	100uF Electrolytic	Thru-hole	16V			
3	2	C8,C9	Capacitor	2.2uF Ceramic X5R	3216	10V	Panasonic ECG	ECJ-3YB1A225K	PCC1868CT-ND
5	2	C28,C15	Capacitor	0.47uF Metal Film	Thru-hole	63V			
6	2	C18,C29,C60	Capacitor	0.22uF Ceramic X7R	805	50V	Panasonic ECG	ECJ-2VF1H224Z	PCC1866CT-ND
7	2	C36,C23	Capacitor	0.47uF Metal Film	Thru-hole	63V			
8	1	C37	Capacitor	680uF Electrolytic	Thru-hole	35V			
9	1	C38	Capacitor	560pF Ceramic NPO	805	50V	Panasonic ECG	ECJ-2VC1H561J	PCC561CGTR-ND
10	1	C40	Capacitor	390pF Ceramic NPO	805	50V	Panasonic ECG	ECJ-2VC1H391J	PCC391CGCT-ND
11	1	C41	Capacitor	10.0uF Electrolytic	SMB	16V			
12	1	C93	Capacitor	22uF Electrolytic	Thru-hole	10V			
13	1	C61	NS		805				
14	2	C62,C63	Capacitor	1000uF Electrolytic	Thru-hole	35V			
15	1	D1	LED	RED			Fairchild Semiconductor	MBR0520L	MBR0520LCT-ND
16	2	D26,D27	Schottky Diode	MBR0520L	SOD-123				
17	6	D10,D13,D14,D15,D20,D21	Schottky Diode	MURS105T3	1206				
18	5	D23,D25,D29,D30,D33	Diode	FDLL914	805				
19	2	D28,D31	Zener Diode	MMSZ5234B-7	SOD-123	6.2V	Diodes Inc.	MMSZ5234B-7	MMSZ5234BDICT-ND
20	1	D32	Zener Diode	MMSZ5231B-7	SOD-123	5.1V	Diodes Inc.	MMSZ5231B-7	MMSZ5231BDICT-ND
21	1	JP1	Dual RCA connector	Dual RCA					
22	2	JP3,JP2	Header	4 pin connector	header4-156				
23	1	J1	Jumper	2 pin jumper	SIP-2P				
24	4	J2,J3,J4,J5	Standoff				ISI		
25	2	L4,L2	Inductor	10uH	ISI Thru-hole				
26	4	Q1,Q2,Q4,Q5	PNP transistor	MMBT3906	SOT23		Fairchild Semiconductor	MMBT3906	MMBT3906FSTR-ND
27	1	Q3	NPN transistor	MMBT3904	SOT23		Fairchild Semiconductor	MMBT3904	MMBT3904FSTR-ND
28	2	R1,R76	Resistor	0	805		OPEN		
29	4	R3,R10,R12,R19	Resistor	9.1K	805	1%	OPEN		
30	1	R5	Resistor	8.2K			OPEN		
31	1	R6	Resistor	2K			OPEN		
32	4	R7,R11,R14,R22	Resistor	1K	805	1%	OPEN		
33	2	R24,R16	Potentiameter	50K			BOURNS	3306P-1-503	DK 3306P-503-ND
34	2	R18,R26	Resistor	1M	805		OPEN		
35	7	R21,R23,R29,R31,R65,R79,R82	Resistor	20K	805		OPEN		
36	2	R78,R81	Resistor	8.45K	805		OPEN		
37	1	R27	Resistor	4.64K	805		OPEN		
38	1	R67	Resistor	30K	805		OPEN		
39	2	R42,R50	Resistor	10	Thru-hole	1W	Panasonic	ERG-1SJ100A	P10W-1TR-ND
40	2	R43,R46	Resistor	27K	805		OPEN		
41	1	R53	Resistor	11K	805		OPEN		
42	2	R54,R70	Resistor	187K	805		OPEN		
43	3	R61,R63,R84	Resistor	1K	805		OPEN		
44	6	R8,R45,R47,R48,R66,R68	Resistor	10K	805		OPEN		
45	1	R85	Resistor	100K	805		OPEN		
46	1	R80	Resistor	510K	805		OPEN		
47	1	R77	Resistor	No Stuff	805				
48	1	R83	Resistor	3.3k	805		OPEN		

EVALUATION BOARD BILL-OF-MATERIALS (cont.)

49						OPEN	
50	1	R44	Resistor	4.99k	805	OPEN	
51	1	R30	Resistor	54.9K	805	Tripath Technology	
52	1	U1	IC	TC2001	SO28	Tripath Technology	
	2	U4,U2	IC	TPS1035	SO8_HEATSLUG		

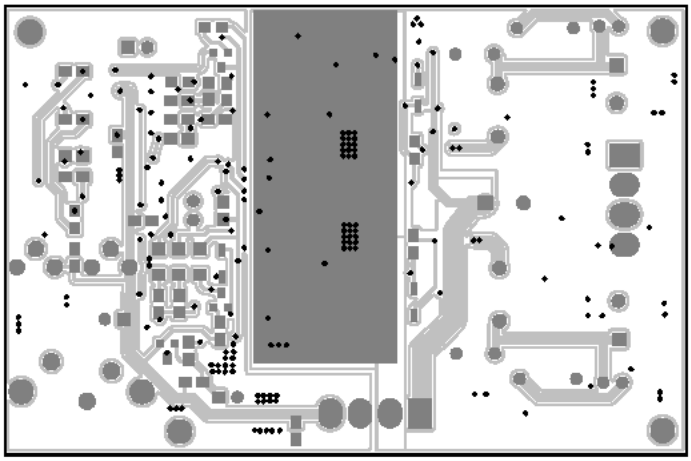
EVALUATION BOARD LAYOUT



FABRICATION NOTES
DOUBLE SIDED BOARD
MATERIAL: .062 FR-4
2 OZ COPPER, ALL LAYERS

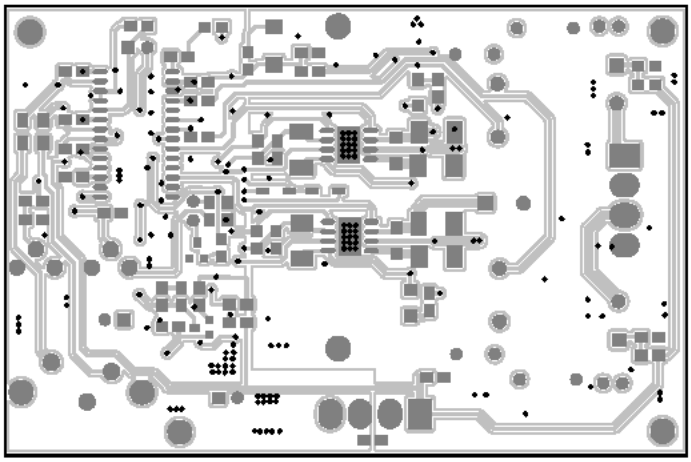
VIEWED FROM TOP SIDE
COMPOSITE DRAWING
Top Trace RED
Bottom Trace BLUE
Top Component DARK GRAY
Bottom Component LIGHT GRAY

EVALUATION BOARD LAYOUT (cont.)



FABRICATION NOTES
DOUBLE SIDED BOARD
MATERIAL: .062 FR-4
2 OZ COPPER, ALL LAYERS

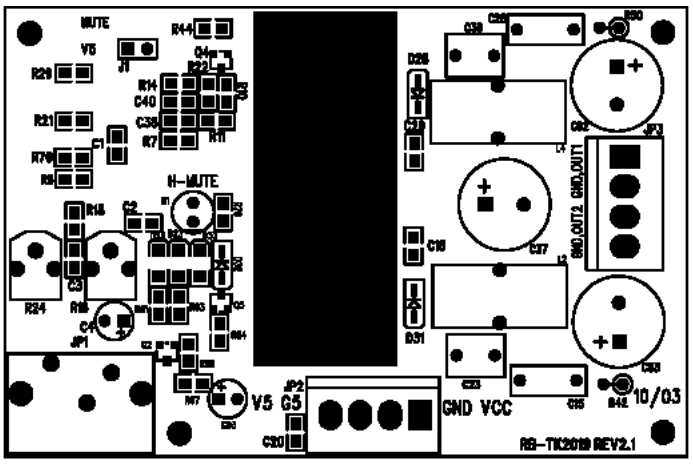
VIEWED FROM TOP SIDE
TOP SIDE ETCH



FABRICATION NOTES
DOUBLE SIDED BOARD
MATERIAL: .062 FR-4
2 OZ COPPER, ALL LAYERS

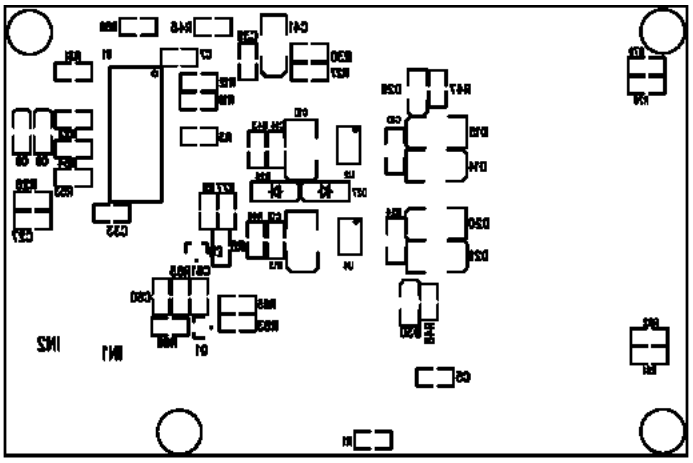
VIEWED FROM TOP SIDE
BOTTOM SIDE ETCH

EVALUATION BOARD LAYOUT (cont.)



FABRICATION NOTES
DOUBLE SIDED BOARD
MATERIAL: .062 FR-4
2 OZ COPPER, ALL LAYERS

VIEWED FROM TOP SIDE
SILKSCREEN TOP



FABRICATION NOTES
DOUBLE SIDED BOARD
MATERIAL: .062 FR-4
2 OZ COPPER, ALL LAYERS

VIEWED FROM TOP SIDE
SILKSCREEN BOTTOM