



## EB-TA2041

# CLASS-T DIGITAL AUDIO AMPLIFIER 4 CHANNEL TA2041 EVALUATION BOARD

Technical Information – Board Revision 2.1

Revision 1.1 – January 2003

### GENERAL DESCRIPTION

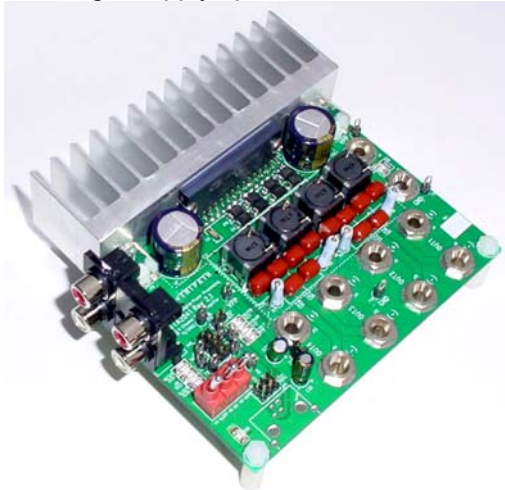
The EB-TA2041 Revision 2.0 is a 4-channel evaluation board based on the TA2041 digital audio power amplifier chipset from Tripath Technology. This board is designed to provide a simple and straightforward environment for the evaluation of the TA2041 amplifier driver. For additional documentation on the TA2041, see the TA2041 Data Sheet.

### APPLICATIONS

- Automotive Head Units
- DVD Receivers
- Multimedia Speaker Systems

### BENEFITS

- 4-channel (280W) solution – with integrated FETs - in a single 32-pin SSIP package
- High fidelity, high efficiency Class-T
- Low external component count
- Single-supply operation

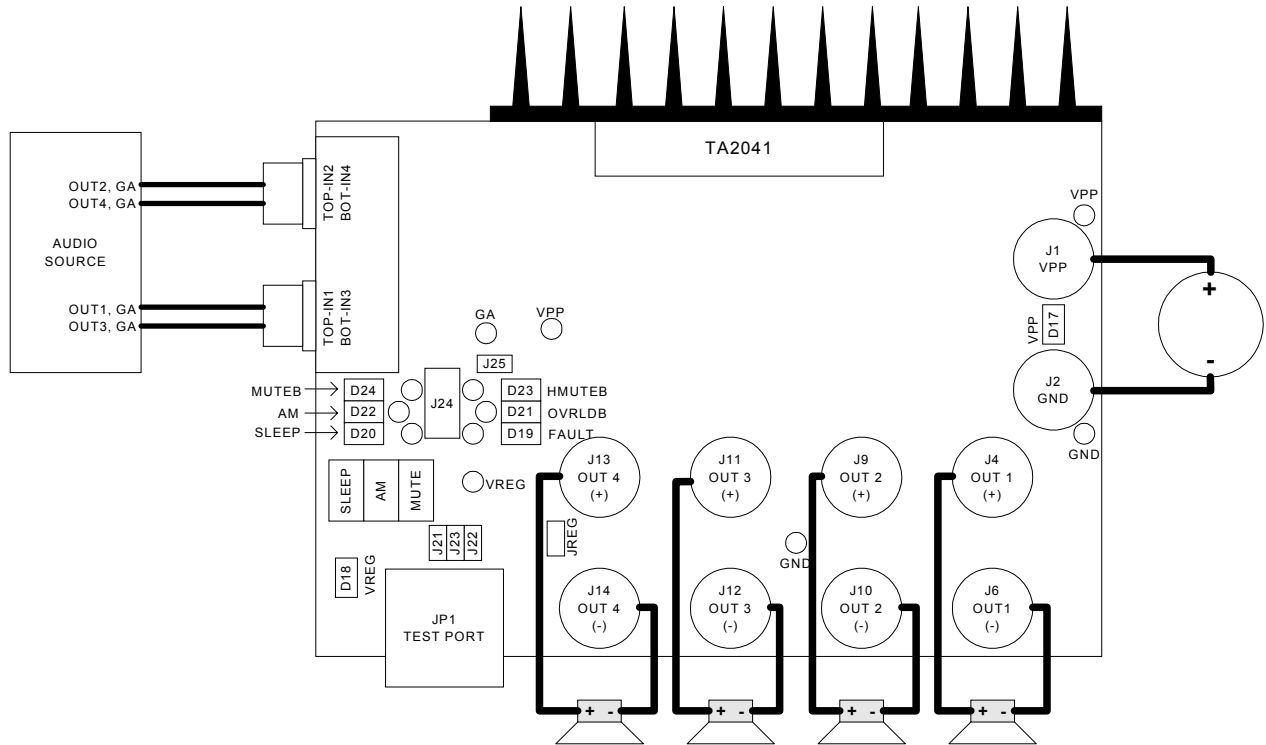


### FEATURES

- Class-T architecture
- Four H-Bridge outputs
- “Audiophile” Sound Quality
- High Power @20.0V
  - 70W<sub>sat. sq. wave</sub> @ 4Ω
  - 50W @ 4Ω, 10% THD+N
- “Audiophile” Quality Sound
  - 0.04% THD+N @ 30W 4Ω
  - 0.18% IHF-IM @ 5W 4Ω
- High Efficiency
  - 89% @ 25W 8Ω
  - 85% @ 50W 4Ω
- AM “Low EMI” mode
- Pop-Free startup and shutdown
- High Dynamic Range
- Mute and Stand-By function
- Automatic DC Offset Trim
- Clip Detection Output
- Protection Modes:
  - Output Short to VPP and Ground
  - Output Short across Load
  - Fortuitous Open Ground
  - Load Dump Protection
  - Over-/Under-Voltage Protection
  - Over-current Protection
  - Over-temperature Protection
- Low Noise Floor: <135uV A-weighted

## OPERATING INSTRUCTIONS

### BOARD CONNECTION DIAGRAM



### POWER SUPPLIES

The EB-TA2041 operates on a single supply voltage (VPP referenced to GND) ranging from 9.5-21V. The VPP and GND connectors are standard female banana jacks. The VPP LED will glow green when the VPP supply is on. Please refer to the Board Connection Diagram for the connector locations on the EB-TA2041.

The EB-TA2041 has an on board 3.3V regulator (U2) that operates off of the VPP rail. It produces VREG referenced to GA. The VREG jumper connects the on board 3.3V regulator to the rest of the circuit. It must be shorted for normal operation. It can be opened for use with an external 3.3-5V power supply. J25 connects pin 7 of J24 to VREG. This allows an external control fixture connected to J24 to supply VREG to the board instead of the on board regulator. The VREG LED will glow green when VREG is powered up.

The VREG ground (GA) must not be connected externally to the VPP ground (GND). GND and GA are joined at a common point on the EB-TA2041 with a trace.

### OUTPUTS

The output connections for each channel of the EB-TA2041 are made with standard female banana jacks. The output of the TA2041 is differential; therefore each output has a positive output and a negative output.

Do not short the negative outputs to ground. Do not ground one side of the speaker. Please refer to the Board Connection Diagram for the connector locations on the EB-TA2041.

## **INPUTS**

The input connection for each channel of the EB-TA2041 is a female RCA jack. The RCA connectors are labeled IN1 through IN4. These inputs share a common ground referenced to GA. Please refer to the Board Connection Diagram for the connector locations on the EB-TA2041.

## **LOGIC SIGNALS**

The TA2041 has six logic signals. MUTE<sub>B</sub>, AM, and SLEEP are inputs. HMUTE<sub>B</sub>, OVR<sub>LDB</sub>, and FAULT are outputs.

The EB-TA2041 has LED's connected to each of the six logic signals: The MUTE<sub>B</sub> LED will glow red when the MUTE<sub>B</sub> signal is driven active low by the MUTE switch. The AM LED will glow yellow when the AM signal is driven active high by the AM switch. The SLEEP<sub>B</sub> LED will glow red when the SLEEP<sub>B</sub> signal is driven active low by the SLEEP switch.

Each logic signal has a test pin connected to it. These test pins are located next to the corresponding signal's LED.

J24 may be used to connect an external microcontroller to the logic signals. If driving the input signals externally, R4, R6 and R8 should be removed to prevent bus contention with the switches. Please refer to the schematic for details.

Please refer to the TA2041 Data Sheet for a complete description of the logic signals. Please refer to the Board Connection Diagram for the LED and connector locations on the EB-TA2041.

## **AMPLIFIER GAIN**

The gain of the TA2041 is internally set to 26dB.

## **TEST PORT**

JP1 is a test port for internal testing. It is not supported. J21, J22, and J23 are for internal testing and must be left open.

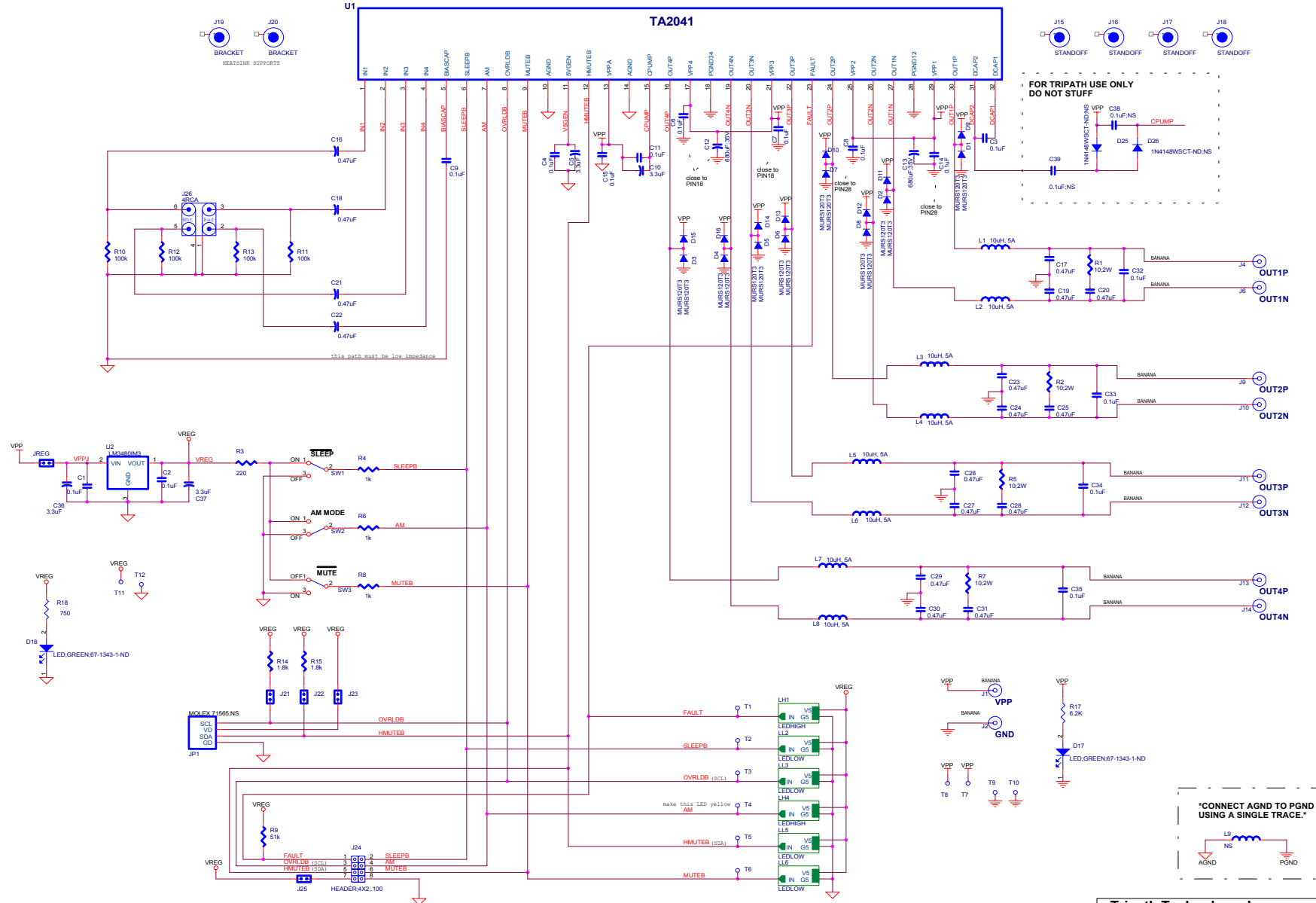
## **Performing Measurements on the EB-TA2041:**

The TA2041 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 TA2041 amplifier switching pattern will degrade the measurement by including out of band (audio) energy.

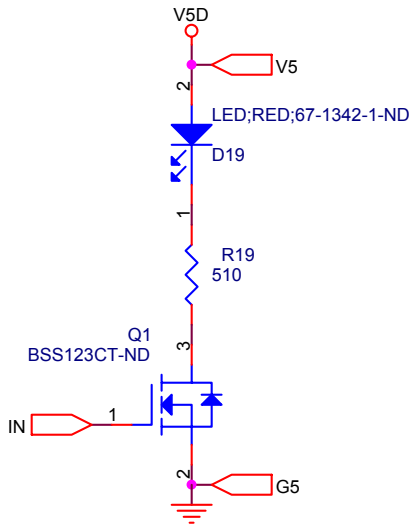
One feature of the TA2041 is that it does not require large multi-pole filters to achieve excellent performance in listening tests, usually a more critical factor than performance measurements. Though using a multi-pole filter may remove high-frequency noise and improve THD+N type measurements (when they are made with wide-bandwidth measuring equipment), these same filters degrade frequency response. The EB-TA2041 has a simple two-pole output filter with excellent performance in listening tests. (See Application Note 4 for additional information on bench testing)

EB-TA2041 SCHEMATIC

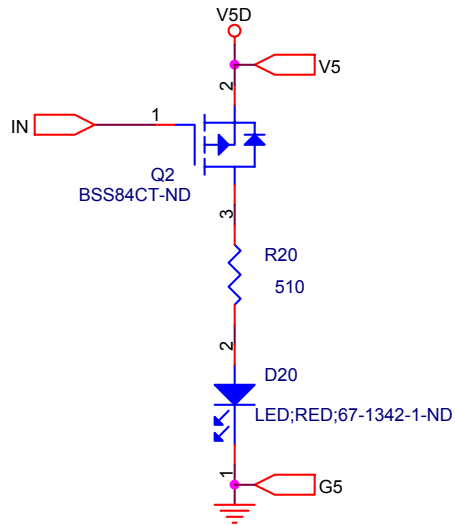


NOTE: AMP GAIN IS INTERNALLY FIXED AT 26dB

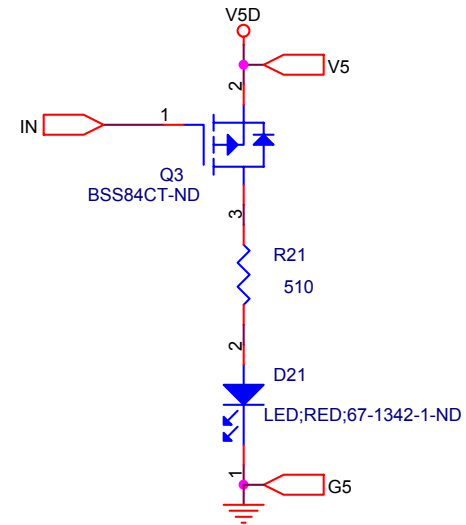
Tripath Technology, Inc.		
File	TA2041 eval board rev 2.1	
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Date	Wednesday, January 22, 2003	Sheet 1 of 7



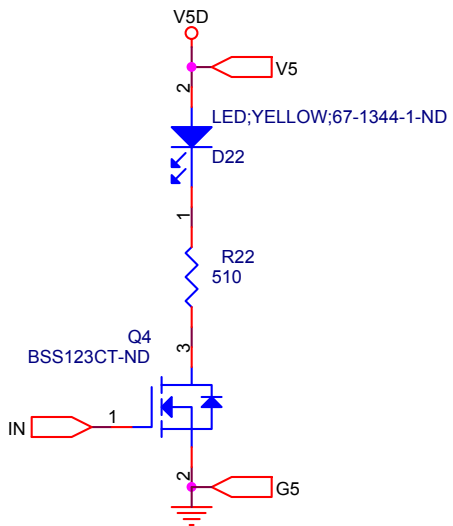
**LH1 block**



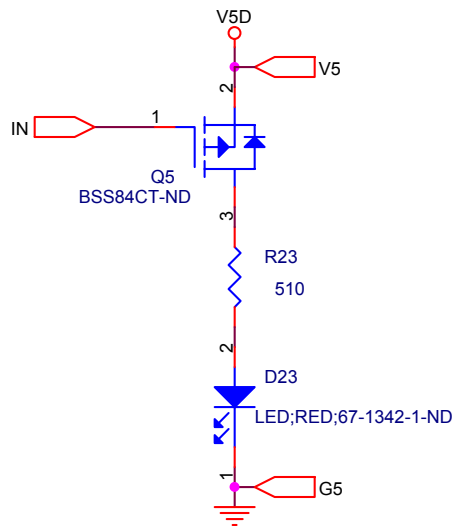
**LL2 block**



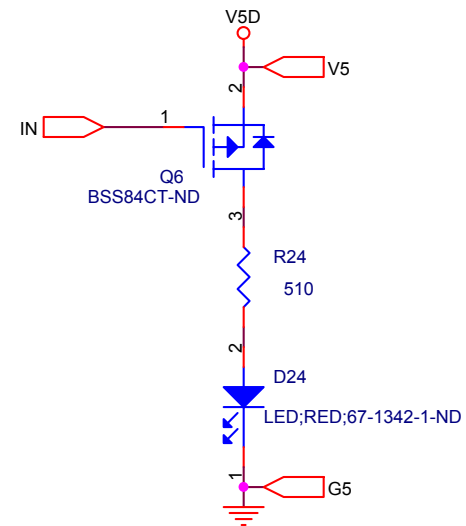
**LL3 block**



**LH4 block**



**LL5 block**



**LL6 block**

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All capacitors are 10% tolerance unless otherwise noted.

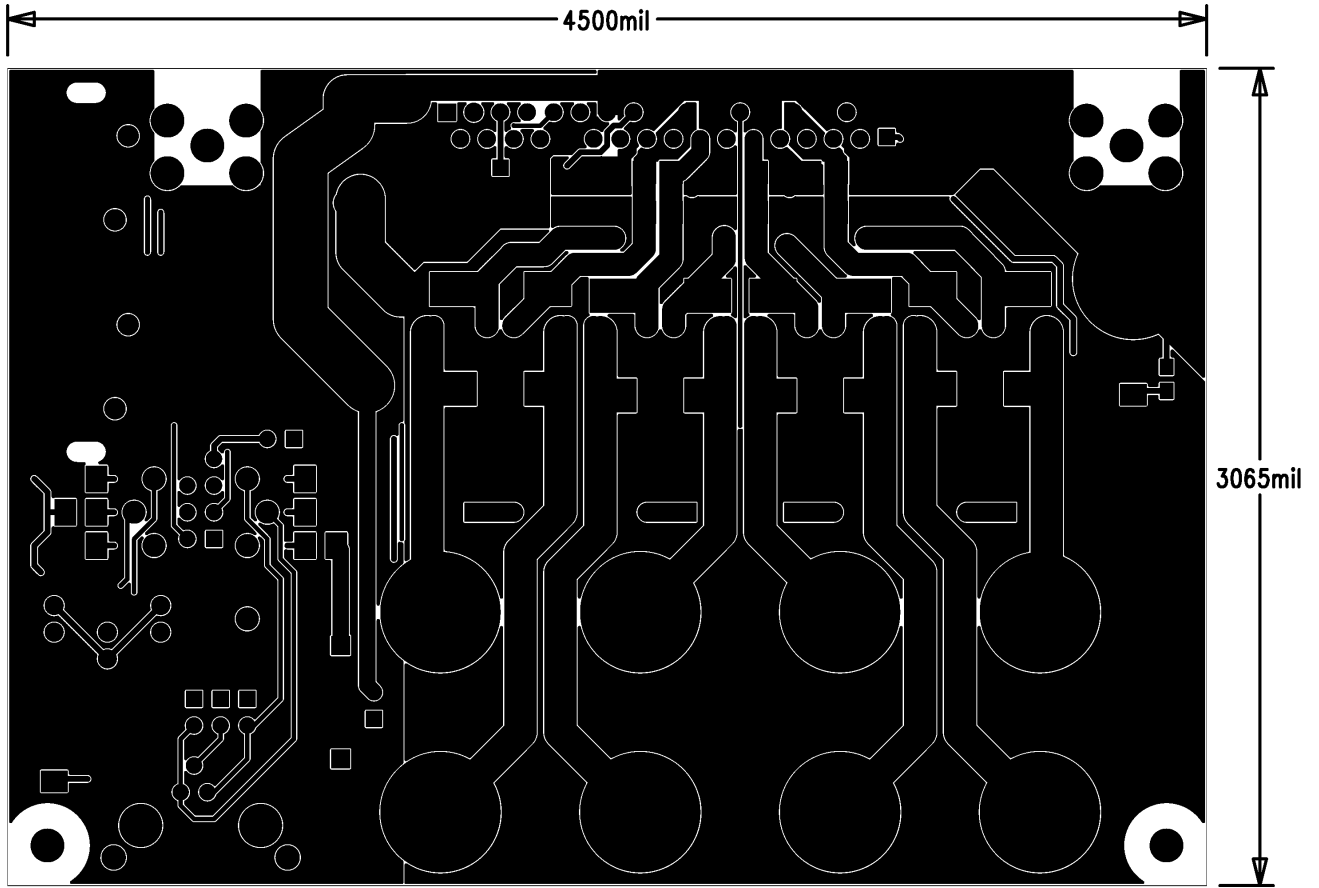
All resistors are 5% tolerance 1/10W unless otherwise noted.

Bill Of Materials January 22,2003 17:53:14

Item	Qty	Reference	Part	PCB Footprint	Manufacturer	Manufacturer Part #	Source	Source Part #
1	15	C1,C2,C3,C4,C6,C7,C8,C9, C11,C14,C15,C32,C33,C34, C35	0.1uF	1206	Panasonic	ECJ-3VB1H104K	Digikey	PCC104BCT-ND
2	1	C5	3.3uF	CAP3216	Panasonic	ECS-T1AY335R	Digikey	PCS2335CT-ND
3	1	C10	3.3uF	CAP3528	Panasonic	ECS-T1EX335R	Digikey	PCS5335CT-ND
4	2	C12,C13	680uF;35V	CAPE\300\630	Panasonic	EEU-FC1V681S	Digikey	P10303-ND
5	4	C16,C18,C21,C22	0.47uF	CAP3216	Panasonic	ECJ-3YB1E474K	Digikey	PCC1891CT-ND
6	12	C17,C19,C20,C23,C24,C25, C26,C27,C28,C29,C30,C31	0.47uF	CAP200F	Panasonic	ECQ-V1H474JL	Digikey	P4671-ND
7	2	C36,C37	3.3uF	CAPE\80\200	Panasonic	EEU-FC1H3R3	Digikey	P10314-ND
8	2	C38,C39	0.1uF;NS	1206	Panasonic	ECJ-3VB1H104K	Digikey	PCC104BCT-ND
9	16	D1,D2,D3,D4,D5,D6,D7,D8, D9,D10,D11,D12,D13,D14, D15,D16	MURS120T3	DIODE_MBRS130T3	Diodes Inc	MURS120-13	Digikey	MURS120DICT-ND
10	2	D17,D18	LED;GREEN;67-1343-1-ND	LEDSMT	Lumex Opto/Components Inc.	CCL-CRS10G	Digikey	67-1343-1-ND
11	5	D19,D20,D21,D23,D24	LED;RED;67-1342-1-ND	LEDSMT	Lumex Opto/Components Inc.	CCL-CRS10R	Digikey	67-1342-1-ND
12	1	D22	LED;YELLOW;67-1344-1-ND	LEDSMT	Lumex Opto/Components Inc.	CCL-CRS10Y	Digikey	67-1344-1-ND
13	2	D26,D25	1N4148WSCT-ND;NS	SOD-123	Diodes Inc.	1N4148WS-7	Digikey	1N4148WSCT-ND
14	1	JP1	molex_shield_recep;PN51565;NS	molex71565	Molex	71565	Force Electronics	MOL15-83-0064
15	5	J21,J22,J23,J25,JREG	HEADER;2PIN_SIP	sip-2p				
16	1	J1	VPP	BANANA_PLT_A	Johnson Components	108-0740-001	Digikey	J147-ND
17	1	J2	GND	BANANA_PLT_A	Johnson Components	108-0740-001	Digikey	J147-ND
18	1	J4	OUT1P	BANANA_PLT_A	Johnson Components	108-0740-001	Digikey	J147-ND
19	1	J6	OUT1N	BANANA_PLT_A	Johnson Components	108-0740-001	Digikey	J147-ND
20	1	J9	OUT2P	BANANA_PLT_A	Johnson Components	108-0740-001	Digikey	J147-ND
21	1	J10	OUT2N	BANANA_PLT_A	Johnson Components	108-0740-001	Digikey	J147-ND

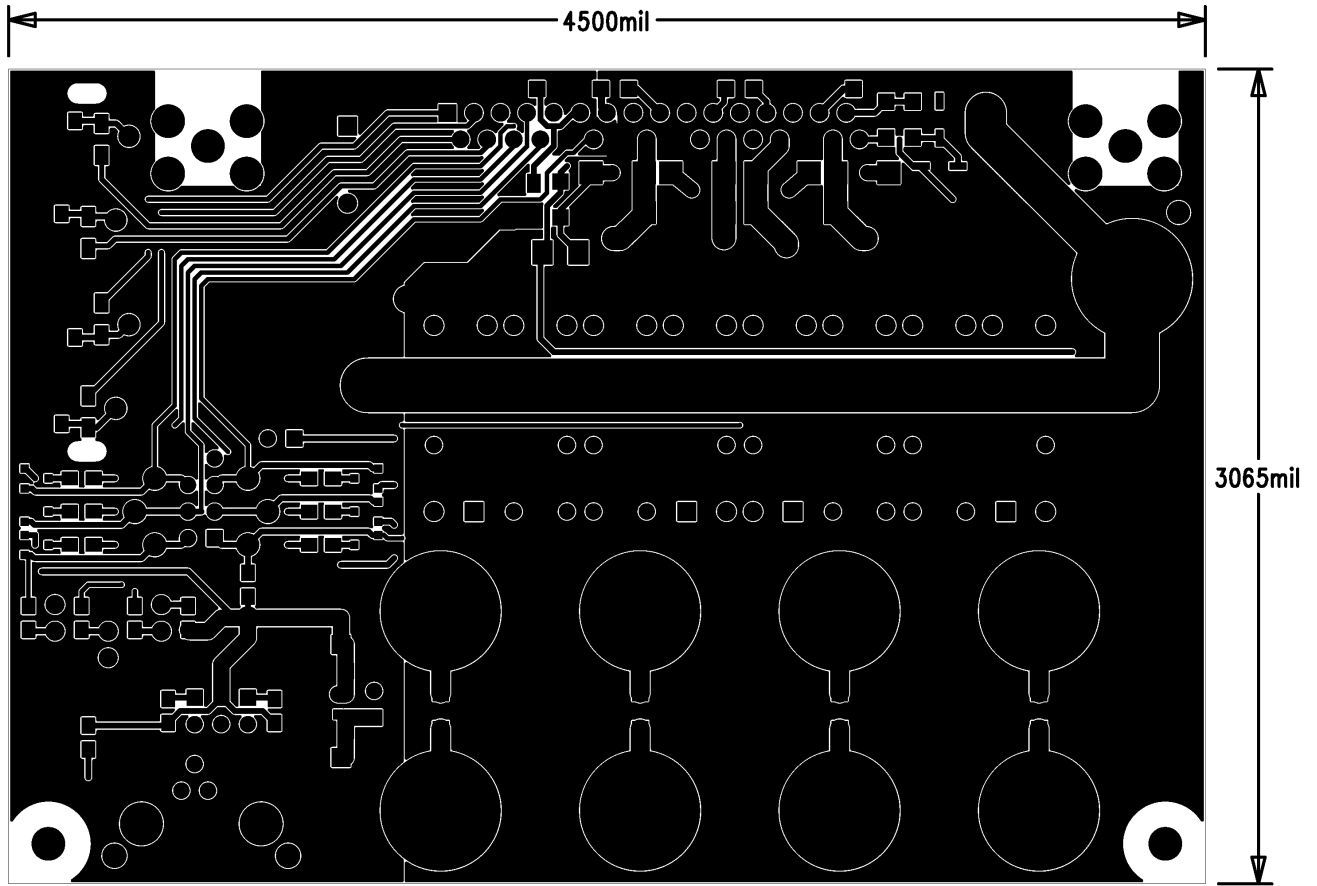
22	1	J11	OUT3P	BANANA_PLT_A	Johnson Components	108-0740-001	Digikey	J147-ND
23	1	J12	OUT3N	BANANA_PLT_A	Johnson Components	108-0740-001	Digikey	J147-ND
24	1	J13	OUT4P	BANANA_PLT_A	Johnson Components	108-0740-001	Digikey	J147-ND
25	1	J14	OUT4N	BANANA_PLT_A	Johnson Components	108-0740-001	Digikey	J147-ND
26	4	J15,J16,J17,J18	STANDOFF	STANDOFF_440				
27	2	J19,J20	BRACKET	8190K			Digikey	8190K-ND
28	1	J24	HEADER;4X2;.:100	JUMPER4X2G				
29	1	J26	4RCA	RCJ-41XXXX			Digikey	CP-1438-ND
30	8	L1,L2,L3,L4,L5,L6,L7,L8	10uH, 5A	TOR675X300	American Cores - Julie Yuan - (714)850-4660	AW600-06-40T-24-V	American Cores - Julie Yuan - (714)850-4660	AW600-06-40T-24-V
31	1	L9	NS	1206				
32	2	Q4,Q1	BSS123CT-ND	SOT23_FC				
33	4	Q2,Q3,Q5,Q6	BSS84CT-ND	SOT23_FC				
34	4	R1,R2,R5,R7	10;2W	RESV150	Panasonic	Yageo	Digikey	P10W-2BK-ND
35	1	R3	220	RES0805				
36	3	R4,R6,R8	1k	RES0805				
37	1	R9	51k	RES0805				
38	4	R10,R11,R12,R13	100k	RES0805				
39	2	R14,R15	1.8k	RES0805				
40	1	R17	6.2K	RES0805				
41	1	R18	750	RES0805				
42	6	R19,R20,R21,R22,R23,R24	510	RES0805				
43	3	SW1,SW2,SW3	SW SPDT	SW_ET01	CK Corp	ET01SD1CBE	Digikey	CKN1071-ND
44	12	T1,T2,T3,T4,T5,T6,T7,T8, T9,T10,T11,T12	TP	SIP-1P_LOOP			Digikey	5011K-ND
45	1	U1	TA2041	TA2041			Tripath	TA2041
46	1	U2	LM3480IM3	SOT23	National Semi	LM3480IM3-3.3	Digikey	LM3480IM3-3.3CT-ND





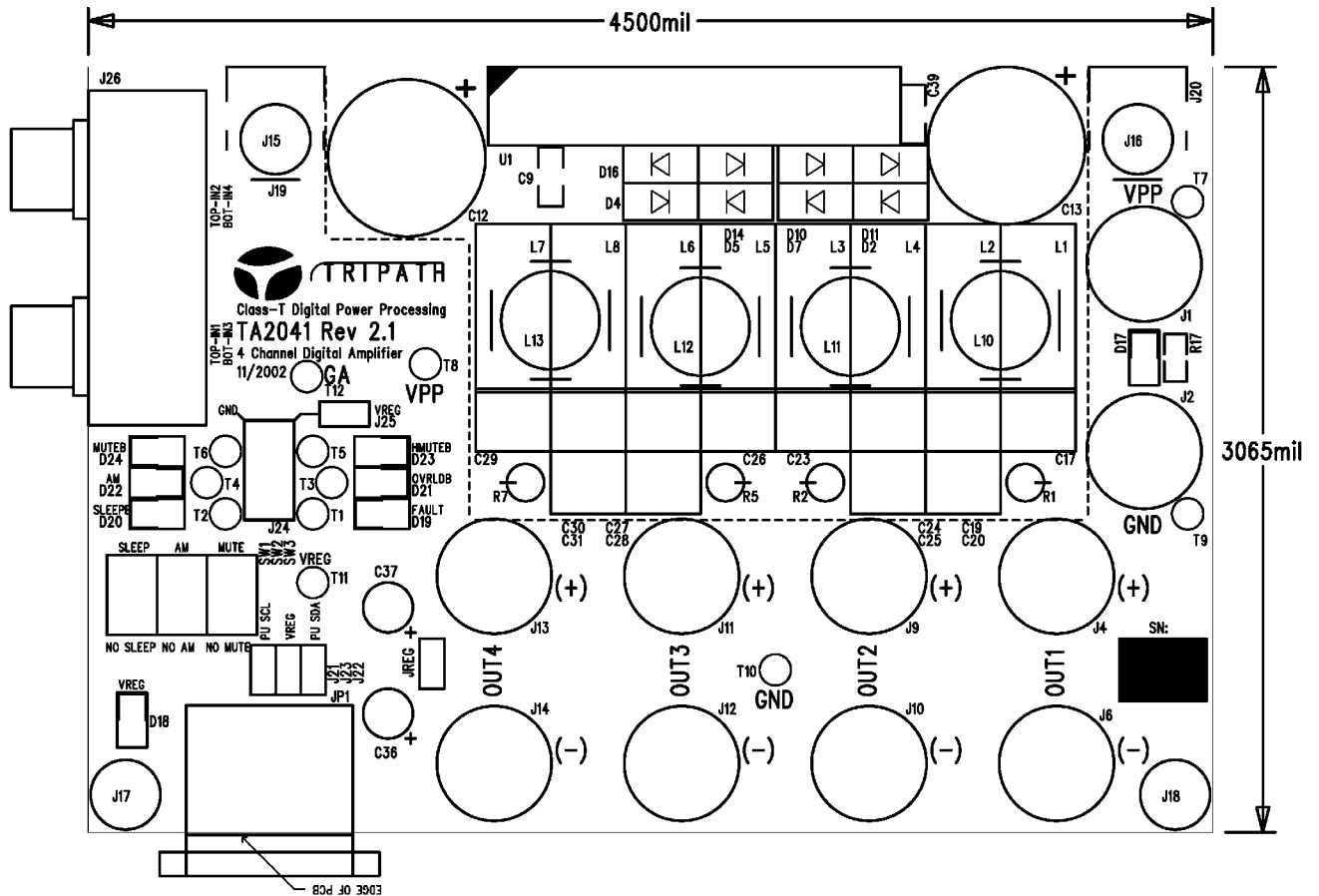
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VIEWED FROM TOP SIDE

TOP SIDE ETCH

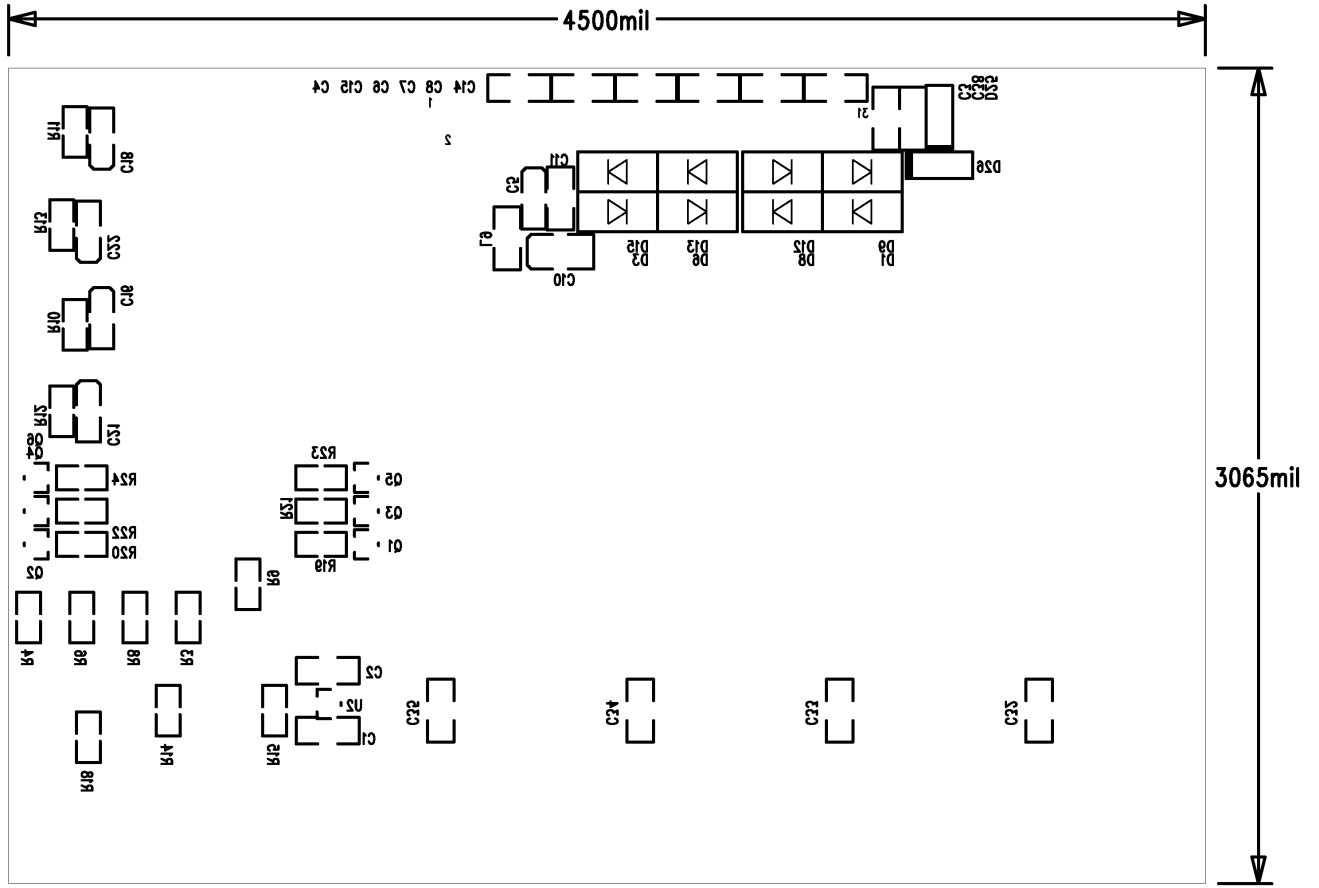


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BOTTOM SIDE ETCH



USE 2 OZ COPPER  
 VIEWED FROM TOP SIDE  
 SILKSCREEN TOP



USE 2 OZ COPPER  
 VIEWED FROM TOP SIDE  
 SILKSCREEN BOTTOM

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