EB-TA2020

CLASS-T DIGITAL AUDIO AMPLIFIER EVALUATION BOARD USING DIGITAL POWER PROCESSING™ TECHNOLOGY

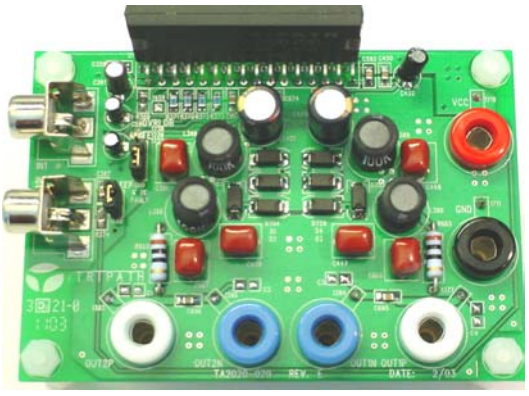
Technical Information **Revision E – 07.03**

GENERAL DESCRIPTION

The EB-TA2020 evaluation platform is based on the TA2020-020 digital audio power amplifier from Tripath Technology. This board is designed to provide a simple and straightforward environment for the evaluation of the Tripath TA2020-020. The TA2020-020 provides amplification for two channels of audio and drives 4Ω and 8Ω passive loads (loudspeakers). Input, output and power connections are via standard connectors.

FEATURES

- Class-T architecture
- Proprietary Digital Power Processing™ Technology
- Requires single 13.5V power source
- Output Power (per channel @ V_S = 13.5V)
- 20W - 4Ω @ 10% THD+N
- 12W - 4Ω @ 0.1% THD+N
- Easy engineering evaluation platform for Tripath Technology's TA2020-020 product
- "Audiophile performance" typically:
  0.03% THD+N, 4W @ 4Ω
  0.08% IHF-IM @ 4Ω
- Efficiency - >85% @ full power (R_L = 8Ω)
- Frequency Response:
  20Hz - 20kHz = ± `0.5dB
- Mute input
- Turn-on & turn-off pop suppression
- Short-circuit protection
- Intelligent over-temperature protection
- Connects to any passive 4/8Ω speakers
- Takes standard audio line output from any sound system
- Bridged outputs
- 2-layer low cost board
- 30-pin Power SOP package

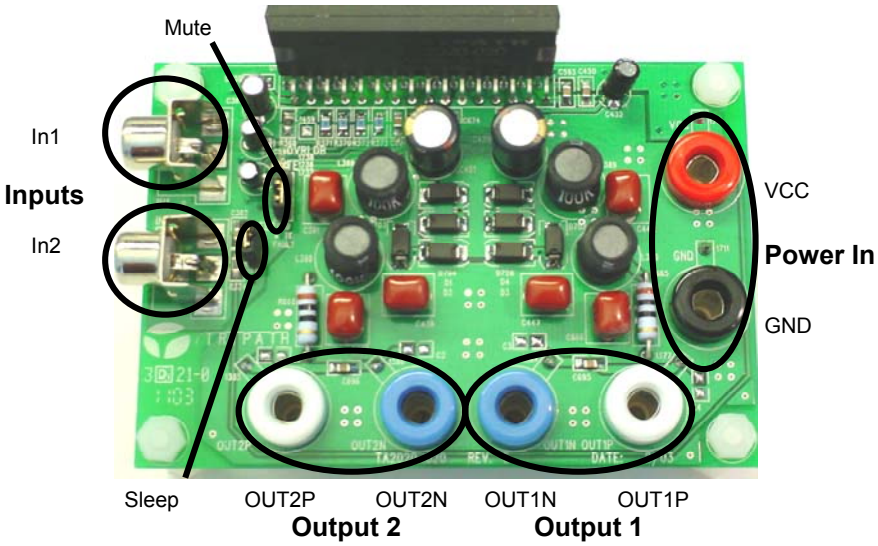


Introduction

The EB-TA2020 was designed the designer with a simple means of evaluating the performance and functionality of the TA2020, 2 x 20W amplifier IC from Tripath Technology. The EB-TA2020 is simple to operate and requires only a few things to get up and running:

- Stereo signal source
- 13.5V power supply (not to exceed 14.6V)
- Two loads (4 ohm minimum)

For more information on the TA2020, please refer to the TA2020 datasheet (www.tripath.com)



EB-TA2020 Board

Connection and Operation

Figure 1 shows the connections required for proper operation of the EB-TA2020.

Input Connection

Audio input to the board is provided via two RCA female connectors.

Connector Name	Channel
IN1	Channel 1 Input
IN2	Channel 2 Input

Power Connection

The EB-TA2020 requires a +13.5V power supply (14.3V max) to operate. For supplies greater than +13.5V diodes D1, D2, D3 and D4 are required in order to prevent overshoot issues.

Power to the board is connected via the red and black banana connectors. The positive 13.5V from the power supply is connected to the red banana connector labeled VCC. The ground connection of power attaches to the black banana connector labeled GND.

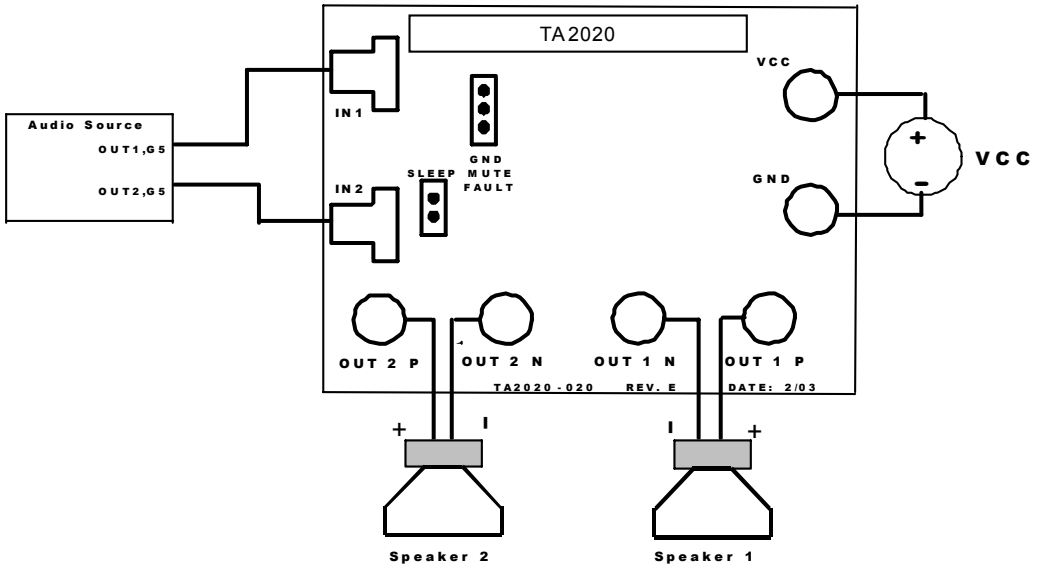


Figure 1

Connector Label	Description	Color
VCC	Positive of the 13.5V Power supply	Red
GND_P	Negative (GND) of 13.5V Power Supply	Black

***Warning*: Do not exceed Maximum Operating Supply Voltage (Vs) of 14.6V**

Output Connection

There are four banana connectors on the evaluation board for speaker output. The TA2020-020 has differential outputs, and so it requires two wires per channel to connect to each speaker.

Connector Label	Description	Color
OUT1P	Positive output of Channel 1	White
OUT1N	Negative output of Channel 1	Blue
OUT2P	Positive output of Channel 2	White
OUT2N	Negative output of channel 2	Blue

Jumper Setting

There are two jumpers on the board that control the MUTE and SLEEP functions. These jumpers should be in place at all times for normal operation. The MUTE jumper connects the fault output pin to the mute input pin. If the jumper is removed, the part will enter MUTE mode. With the jumper in place, if the part enters an over-current or over-temperature fault condition, the output will be muted.

With the SLEEP jumper removed, the TA2020-020 goes into sleep mode when no input signal is present. With the jumper in place, the SLEEP mode is disabled.

Gain Setting

The EB-TA2020 amplifier gain can be adjusted by changing the external resistors R370-R373. R370 and R371 are used to set the gain for channel 1. R372 and R373 are used to set the gain for channel 2. The equation for the gain setting is:

$$A_V = 12 \cdot \left(\frac{R_f}{R_i} \right)$$

Where,

For channel 1: $A_{V\_Ch1} = 12 \cdot \left(\frac{R371}{R370} \right)$ For channel 2: $A_{V\_Ch2} = 12 \cdot \left(\frac{R372}{R373} \right)$

For a more detailed description, please refer to the TA2020 data sheet.

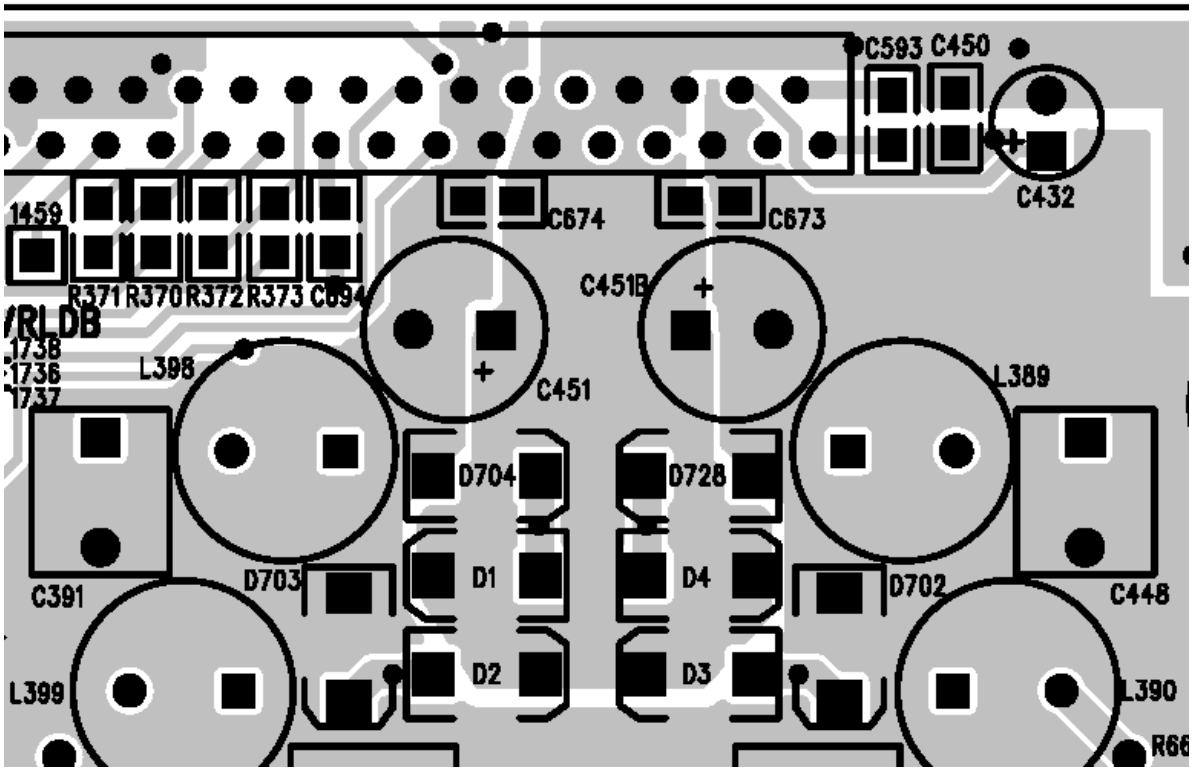
Circuit Board Layout

The TA2020-020 is a power (high current) amplifier that operates at relatively high switching frequencies. The outputs of the amplifier switch between the supply voltage and ground at high speeds while driving high currents. This high-frequency digital signal is passed through an LC low-pass filter to recover the amplified audio signal. Since the amplifier must drive the inductive LC output filter and speaker loads, the amplifier outputs can be pulled above the supply voltage and below ground by the energy in the output inductance. To avoid subjecting the TA2020-020 to potentially damaging voltage stress, it is critical to have a good printed circuit board layout. It is recommended that Tripath's layout and application circuit be used for all applications and only be deviated from after careful analysis of the effects of any changes.

The figure below is the Tripath TA2020-020 evaluation board. The most critical components on the board are the power supply decoupling capacitors. Capacitors, C674 and C451, must be placed right next to pins 22 (VDD2) and 19 (PGND2) as shown. Similarly, capacitors, C673 and C451B, must be placed right next to pins 25 (VDD1) and 28 (PGND1) as shown. These power supply decoupling capacitors not only help reject power supply noise, but more importantly, absorb voltage spikes on the VDD pins caused by overshoots of the outputs of the amplifiers.

Similarly, schottky diodes, D1, D2, D3 and D4, minimize overshoots with respect to VDD and schottky diodes, D702, D703, D704 and D728, minimize undershoots with respect to power ground. For maximum effectiveness, these diodes must be located close to the output pins and returned to their respective VDD or PGND pins. Diodes D1, D2, D3 and D4 are only required for applications where VDD>13.5V. Voltage overshoots can also be caused by output inductor flyback during high current switching events such as shorted outputs or driving low impedances at high levels. If these capacitors and diodes are not close enough to the pins, electrical overstress to the part can occur, possibly resulting in permanent damage to the TA2020-020.

The output inductors, L389, L390, L398 and L399 should be placed close to the TA2020-020 without compromising the locations of the closely placed supply decoupling capacitors and diodes. The purpose of placing the output inductors close the TA2020-020 output pins is to reduce the trace length of the switching outputs. Following this guideline will aid in reducing radiated emissions.



Performing Measurements on the EB-TA2020

The TA2020 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 TA2020 amplifier switching pattern will degrade the measurement.

One feature of the TA2020 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-TA2020 Evaluation Board has a simple two-pole output filter with excellent performance in listening tests.

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

Contact Information

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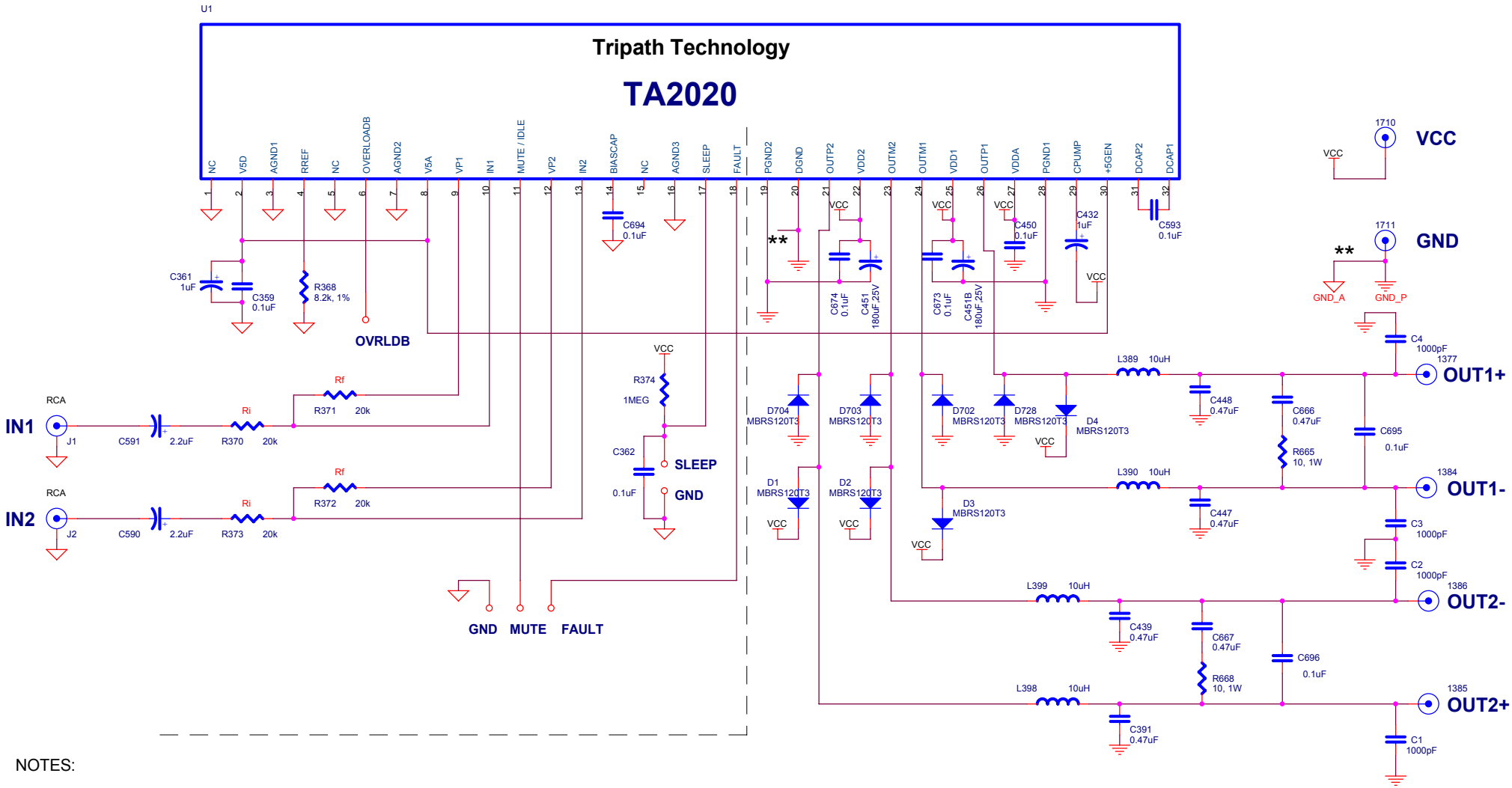
For more Sales Information, please visit us @ www.tripath.com/cont_s.htm
For more Technical Information, please visit us @ www.tripath.com/data.htm



NOTES:

1. Ground plane is split into two. Both halves are joined at one point.
2. The MUTE function can be optionally tied to the FAULT pin to allow for an automatic reset in the event of an over current FAULT.
3. TA2020 inputs have a DC bias of 2.5V. If input preamp circuitry is NOT biased at 0V, C590 and C591 may need to be reversed.

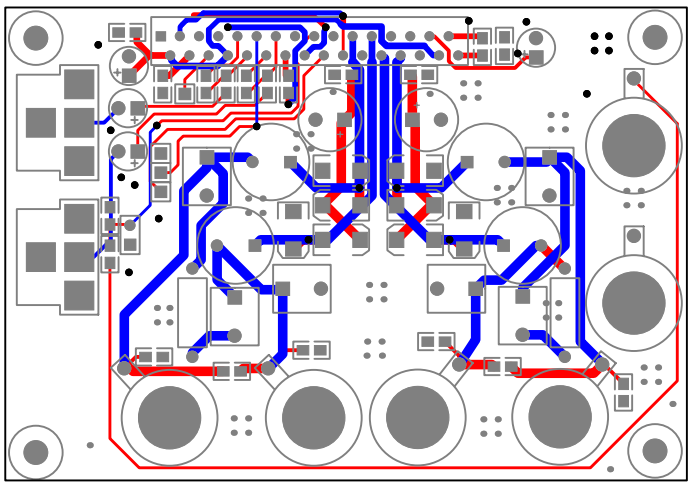
** Connect GND_POWER from PIN 20 to GND_A PIN 3 with a single trace.

Tripath Technology Inc.		
Title: TA2020_DEMO_BOARD		
Size: B	Document Number: <Doc>	Rev: E
Date: Wednesday, March 12, 2003	Sheet 1 of 1	

TA2020B Bill Of Materials

Revision E 7/03

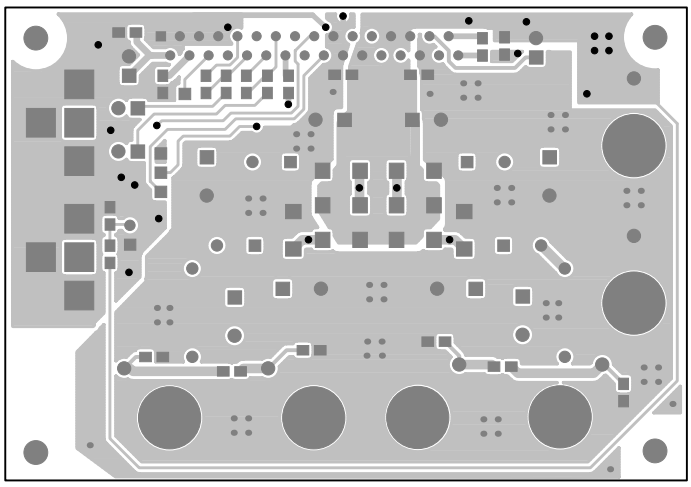
Item	Qty.	Designator	Description	Value	Rating	MFG	MFG part #	Vendor	Vendor Part #
1	9	C673, C674, C694, C593, C362, C359, C450, C695, C696	SMT 0805 Ceramic, CAPACITOR +/-20%,	0.1uF	50V	OPEN			
2	6	C391, C439, C447, C448, 666, 667	PTH Stacked Metal Film	0.47uF	50v	Panasonic	ECQ-V1H474JL	Digi-Key	P4671-ND
3	2	C361, C432	E-CAPACITOR +/-20%, 100 mil inch	1.0uF	16V	Panasonic	ECE-A1HKA010	Digi-Key	P824-ND
4	2	C451, C451B	E-CAPACITOR +/-20%, 200 mil inch	180uF	25V	Panasonic	EEU-FC1E181	Digi-Key	P11217-ND
5	2	C591, C590	E-CAPACITOR +/-10%, 100 mil inch	2.2uF	6.3V	Panasonic	ECE-A1EKK2R2	Digi-Key	P971-ND
6	4	C1, C2, C3, C4	SMT 0805 Ceramic, CAPACITOR +/-20%,	1000pF	50V	OPEN			
7	8	D702, D703, D704, D728, D1, D2, D3, D4	Schottky Diode (20V, 1A), SMB	DIODE		Onsemi	MBRS120T3	Newark	08F2006
8	2	J1, J2	RIGHT ANGLE, Phono jack Snap Fit, 90 deg.	RCA JACK		RCA			
9	4	L389, L390, L398, L399	INDUCTOR +/-10%, 200 mil inch	10uH		ISI	RL622-100K	Inter-star	LHL10TB100K
10	1	R368	RESISTOR +/-1%, 0805	8.25k ohm		OPEN			
11	4	R370, R371, R372, R373	RESISTOR +/-1%, 0805	20k ohm		OPEN			
12	1	R374	RESISTOR +/-5%, 0805	1MEG ohm		OPEN			
13	2	R668, R665	RESISTOR +/-5%, 1W thru-hole	10 ohm		Panasonic	ERG-1SJ100	Digi-Key	P10W-1BK
14	2	OUT1+ (1377), OUT2+ (1385)	WHITE	BANANA		Johnson Comps	108-0901-001	Digi-Key	J150-ND
15	1	OUT1- (1384), OUT2- (1386)	BLUE	BANANA		Johnson Comps	108-0910-001	Digi-Key	J155-ND
16	1	VCC (1710)	RED	BANANA		Johnson Comps	108-0902-001	Digi-Key	J151-ND
17	1	GND_P (1711)	BLACK	BANANA		Johnson Comps	108-0903-001	Digi-Key	J152-ND
18	1	U1	ZIP Package	AMPLIFIER		TRIPATH	TA2020-020		
19	1	GND/MUTE/FAULT (1738, 1736, 1737)	MALE HEADERS, 1X3 (100 mil in spacing)	Male pins		OPEN			
20	1	SLEEP (1688)	MALE HEADERS, 1X2 (100 mil in spacing)	Male pins		OPEN			
21	1	OVRLDB (1459)	MALE HEADERS, 1X1 (100 mil in spacing)	Male pins		OPEN			
22	4	standoffs	6mm Hex, 3 x 25 male/female, AL			Orlander			
23	4	Hex Nut, standoff	Hex Nut 4-40						
24	1	Blank. PCB Fab.	TA2020B, Rev E			Bay Area Ckts			
25	2	SLEEP (1688), GND/MUTE/FAULT(1736, 1737)	Shunts			OPEN			
26	1		Shipping Box, 4" x 3" x 2"			Adv. Paper Systems	M438		
27	1		Shielded, Anti-static bag						



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

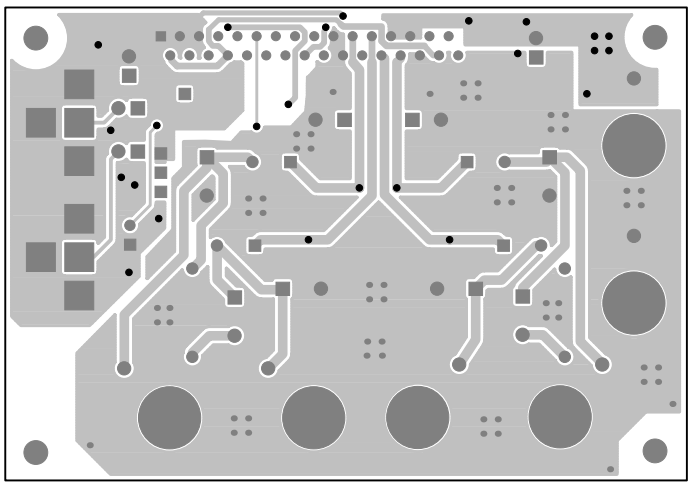
VIEWED FORM TOP SIDE
COMPOSITE DRAWING

Top Trace RED
Bottom Trace BLUE
Top Component DARK GRAY
Bottom Component LIGHT GRAY



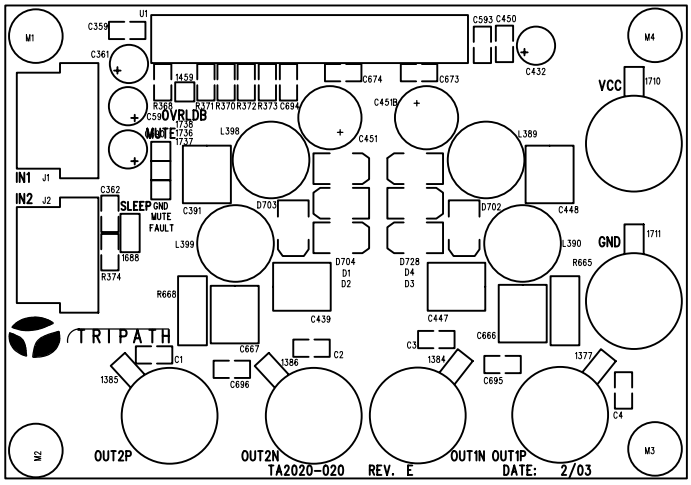
FABRICATION NOTES
DOUBLE SIDED BOARD
MATERIAL: .062 FR-4
2 OZ COPPER, ALL LAYERS

VIEWED FORM TOP SIDE
TOP SIDE ETCH



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

VIEWED FORM TOP SIDE
BOTTOM SIDE ETCH



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

VIEWED FORM TOP SIDE
SILKSCREEN TOP