



## RB-TA0105A-1 RB-TA0105A-2

### CLASS-T DIGITAL AUDIO AMPLIFIER REFERENCE BOARD USING DIGITAL POWER PROCESSING (DPP™) TECHNOLOGY

Technical Information

Rev. 1.1 November 2004

#### GENERAL DESCRIPTION

The RB-TA0105A reference board is based on the TA0105A digital audio power amplifier driver from Tripath Technology. This board is designed to provide a simple and straightforward environment for the evaluation of the Tripath stereo TA0105A amplifier.

**Note:** There are two versions of the RB-TA0105A, depending on nominal supply voltage.

RB-TA0105A-1 – “LV” Version - Nominal supply voltage +/-60V to +/-93V

RB-TA0105A-2 – “HV” Version - Nominal supply voltage +/-125V to +/-185V

#### FEATURES

- RB-TA0105A-1: 2 x 500W continuous output power @ 0.1% THD+N, 4Ω, ±90V
- RB-TA0105A-1: 1000W continuous output power @ 0.1% THD+N, bridged 4Ω, ±75V
- RB-TA0105A-2: 2 x 325W continuous output power @ 0.1% THD+N, 25Ω, ±148V
- RB-TA0105A-2: 2 x 400W continuous output power @ 0.1% THD+N, 12.5Ω, ±125V
- Outputs short circuit protected

#### BENEFITS

- Quick and easy evaluation of the TA0105A in multiple applications
- Uses only N-channel power MOSFETs
- Ready to use in many applications:
  - 2 channel stereo systems
  - 70V and 100V systems
  - Powered Subwoofers



Note: RB-TA0105A-2 shown

# OPERATING INSTRUCTIONS

## Power Supply Description

There are four external power supplies required to operate this board: VPP, VNN, V12 and V5 (see Figures 1 and 2). VPP and VNN power the load and so must each be able to provide half of the desired output power, plus about 20% for overhead and margin. The TA0105A amplifier also requires a supply, VN12, that is 12V more positive than VNN and tracks VNN. This VN12 power supply should be a regulated, positive 12V supply. Output and power supply connections are supplied using cable harnesses (not shown in picture).

Though not required from a device reliability standpoint, the following powering-up sequence is usually adhered to during bench evaluations: 1<sup>st</sup>) V5 and V10 2<sup>nd</sup>) VNN and 3<sup>rd</sup>) VPP. Please refer to the Turn-on/off Pop section for additional discussion on power supply sequencing

The positive and negative supply voltages do not have to match or track each other, but distortion or clipping levels will be determined by the lowest (absolute) supply voltage. Figure 1 shows the proper supply configuration for the RB-TA0105A.

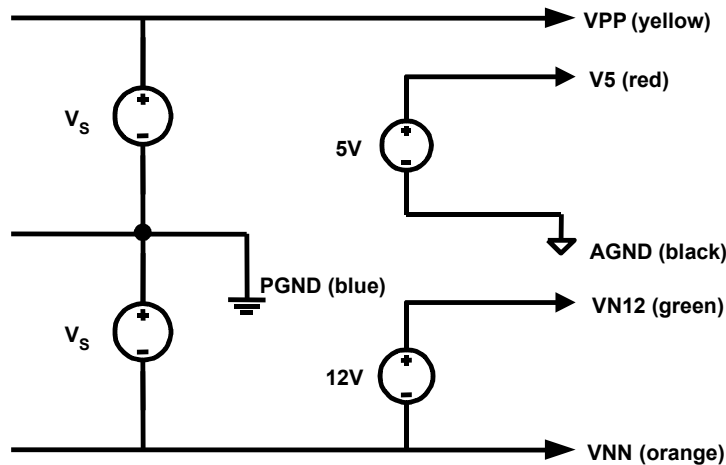


Figure 1

**Note:** To avoid signal degradation, AGND (Analog Ground) and PGND (Power Ground) should be kept separate at the power supply. They are connected internally on the TA0105A module.

Connector	Power Supply
J5 (Yellow)	VPP
J5 (Blue)	PGND
J5 (Orange)	VNN
J5 (Green)	VN12
J2 (Red)	V5
J2 (Black)	AGND

Table 1

## Input Connections

Audio input to the board is located at IN1 (J100) and CH2 IN2 (J200) (see Figures 2 and 3). The input can be a test signal or music source. The connectors are standard RCA types.

## Output Connections

There are two output connectors on the reference board for the speaker outputs. Channel 1 output and associated Power Ground 1 is located at J101. Channel 2 output and associated Power Ground 2 is located at J201. A two-wire harness for each output is provided. See Table 2 for the output connector wire colors. The TA0105A can be operated as a two-channel single-ended amplifier, bridged mono output amplifier (see Figure 9) or with a passive crossover for a 2.1 channel application (refer to Application Note 13). Outputs can be any passive speaker(s) or test measurement equipment with resistive load (see Application Note 4 for more information on bench testing).

Connector Name	Output	Ground
J101	Red	Blue
J201	White	Blue

Table 2

## Turn-on/off Pop

To avoid turn-on pops, bring the mute from a high to a low state after all power supplies have settled. To avoid turn-off pops, bring the mute from a low to a high state before turning off the supplies. The only issue with bringing up the V5 last, or turning it off first, is clicks/pops. If the mute line is properly toggled (slow turn-on, quick turn-off), then any power up sequence is acceptable. In practice, the V5 will usually collapse before VPP and VNN. The same discussion holds true for the VN10 supply. It can collapse before VPP or VNN though this may cause a larger turn-off pop than if the mute had been activated before either the VN10 or V5 supply have collapsed. No damage will occur to the TA0105A chipset if either the V5 or VN10 collapse before VPP or VNN, assuming the mute is asserted before the supplies start to discharge.

## RB-TA0105A Board

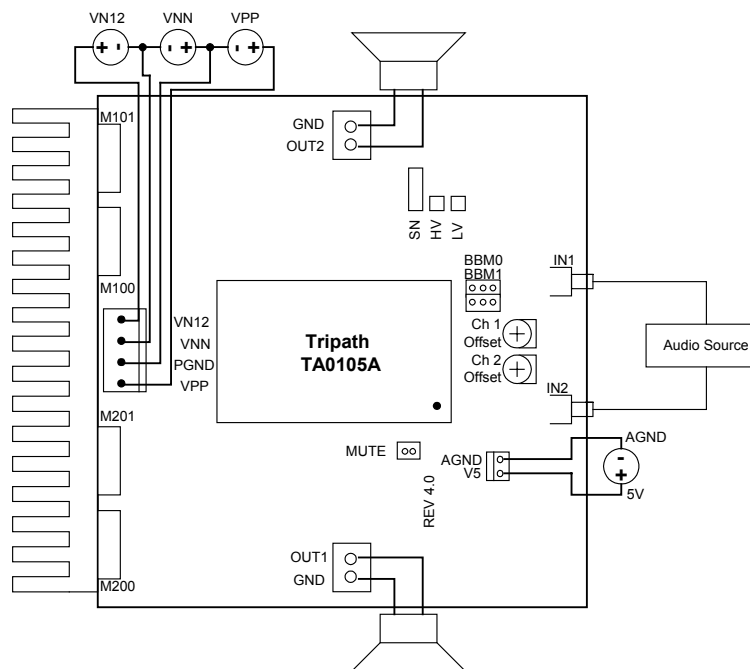


Figure 3

## ARCHITECTURE

A block diagram of one channel of the reference board is shown in Figure 4. The major functional blocks of the amplifier are described below.

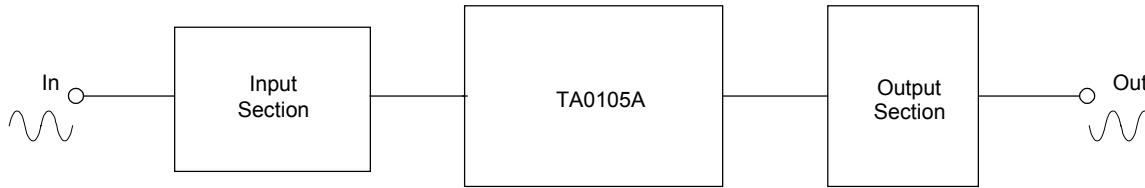


Figure 4

Note: The TA0105A is an inverting amplifier.

### TA0105A Amplifier Gain

The TA0105A amplifier gain is the product of the input stage gain and the modulator gain. Additional information is available in the TA0105A datasheet available at [www.tripath.com](http://www.tripath.com).

$$A_{VTA0105A} = A_{VINPUTSTAGE} * A_{VMODULATOR}$$

$$A_{VTA0105A} \approx -\frac{20k\Omega}{4.99k\Omega + R_I} \left( \frac{(1.0k\Omega + R_{FB}) * 2.02}{1020} + 1 \right)$$

For the RB-TA0105A-1 board;

$$R_I (R100, R200) = 49.9k\Omega$$

$$R_{FBC} (R106, R206) = 18.7k\Omega$$

$$A_{VTA0105A} \approx -\frac{20k\Omega}{54.89k\Omega} \left( \frac{19.7k\Omega * 2.02}{1020} + 1 \right) = -14.58 \frac{V}{V}$$

For the RB-TA0105A-2 board;

$$R_I (R100, R200) = 34.8k\Omega$$

$$R_{FBC} (R106, R206) = 39.2k\Omega$$

$$A_{VTA0105A} \approx -\frac{20k\Omega}{39.79k\Omega} \left( \frac{40.2k\Omega * 2.02}{1020} + 1 \right) = -40.52 \frac{V}{V}$$

### Input Stage

Figure 5 shows one channel of the Input Stage. The TA0105A amplifier is designed to accept unbalanced inputs. For the RB-TA0105A-1, the gain is -14.58V/V, or approximately 23.28 dB. For the RB-TA0105A-2, the gain is approximately -40.52V/V, or approximately 32.15 dB. Please note that the input stage of the TA0105A is biased at approximately 2.5VDC. Therefore, for an input signal centered around ground (0VDC), the polarity of the coupling capacitor,  $C_{IN}$ , shown in Figure 5 is correct. In addition, the TA0105A amplifier is an inverting amplifier.

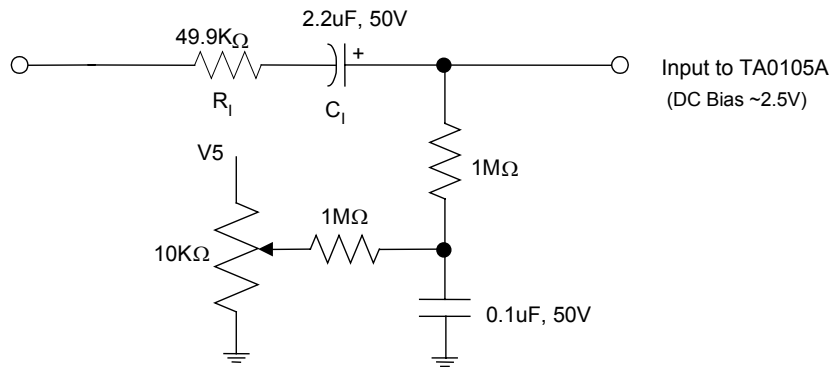


Figure 5

The value of the input capacitor,  $C_I$ , in Figure 5 (labeled C100 and C200 on the schematic), and the input resistor,  $R_{IN}$  (labeled R100 and R200), set the  $-3\text{dB}$  point of the input high-pass filter. The frequency of the input high pass pole,  $F_P$ ,  $-3\text{dB}$  point can be calculated as follows:

$$F_P = 1/(2\pi \times C_I \times R_I)$$

where:  $C_I$  = input capacitor value in Farads  
 $R_I$  = input resistor value in Ohms

Output offset voltages can be nulled by adjusting the  $10\text{K}\Omega$  potentiometer shown in Figure 5. Once set, and the TA0105A reaches equilibrium, the offset does not typically drift. Offsets can typically be set to  $\pm 25\text{ mV}$ . R103 is used to adjust the offset of CH1, and R203 is used to adjust the offset of CH2. If a different TA0105A is placed in the RB-TA0105A reference board, the offset of each channel will need to be re-trimmed.

### RB-TA0105A Control Circuitry

The MUTE pin is brought out to an external 2-pin header, J1 (Figure 6). When a jumper is installed from Pin 1 to 2 of J4, the MUTE line is pulled to ground and the outputs are enabled. Note that if the MUTE jumper is removed, the MUTE pin floats high, and the amplifier is muted.

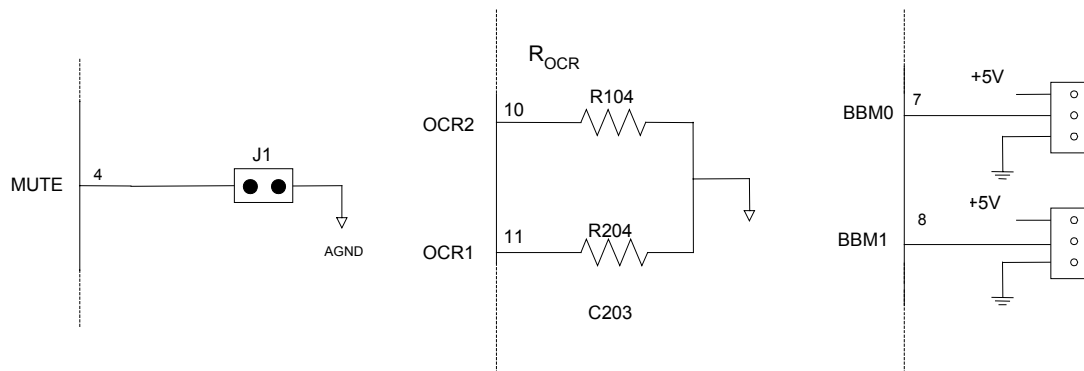


Figure 6

The resistors,  $R_{OCR}$  in Figure 6 (labeled R104 and R204 in the schematic), set the overcurrent threshold for the output devices. Note that these are NOT the sense resistors (the overcurrent sense resistors,  $R_S$ , are in the output stage). By adjusting the  $R_{OCR}$  resistor values, the threshold at which the amplifier “trips” can be changed. The range that the overcurrent trip point can be adjusted (by changing  $R_{OCR}$ ) is determined by the value of the sense resistors.

$R_{OCR}$  on the TA0105A-2 reference board is pre-set to  $20\text{K}\Omega$  for a  $12.5\Omega$  (and above) single-ended applications. For lower impedance applications, this board’s overcurrent may trip prematurely. This is indicated by the amplifier going into mute; to clear, toggle the mute or cycle the power. To reduce overcurrent sensitivity, decrease the value of  $R_{OCR}$  until the sensitivity meets the desired level.  $R_{OCR}$  can be reduced, though if set too low of a value, this may result in an overcurrent threshold that is so high the amplifier will try

to drive a short circuit, possibly damaging the output FETs. In addition, the power dissipation when driving lower impedances may become prohibitive resulting in reduced efficiency and possible FET damage.

Finally, the Break-Before-Make (or “BBM”) lines are used to control the “dead time” of the output FETs. The “dead time” is the period of time between the turn-off of one device and the turn-on of the opposite device on the same channel. If the two devices are both on at the same time, current “shoots through” from one supply to the other, bypassing the load altogether. Obviously, this will have a great impact on the overall efficiency of the amplifier. However, if the dead time is too long, linearity suffers. The optimum BBM setting will change with different output FETs, different operating voltages, different layouts and different performance requirements. For this reason, Tripath has provided a means to adjust the BBM0 (via J3) and BBM1 (via J4) settings. The stock setting for BBM is 65nS for the RB-TA0105A-1 board and 105nS for the RB-TA0105-2 board. These settings should be verified over the full temperature and load range of the application to ensure that any thermal rise of the output FETs and TA0105A does not impact the performance of the amplifier.

BBM1	BBM0	DELAY
0	0	145nS
0	1	105nS
1	0	65nS
1	1	25nS

Note: The default delay jumper setting is 65nS for the RB-TA0105A-1 and 105nS for the RB-TA0105A-2.

Figure 7

### Output Section

The output section includes the gate resistors, output diodes, FETs, output filters, the previously mentioned OVERCURRENT sense resistors, clamping diodes, a Zobel Network, and various bypass capacitors.

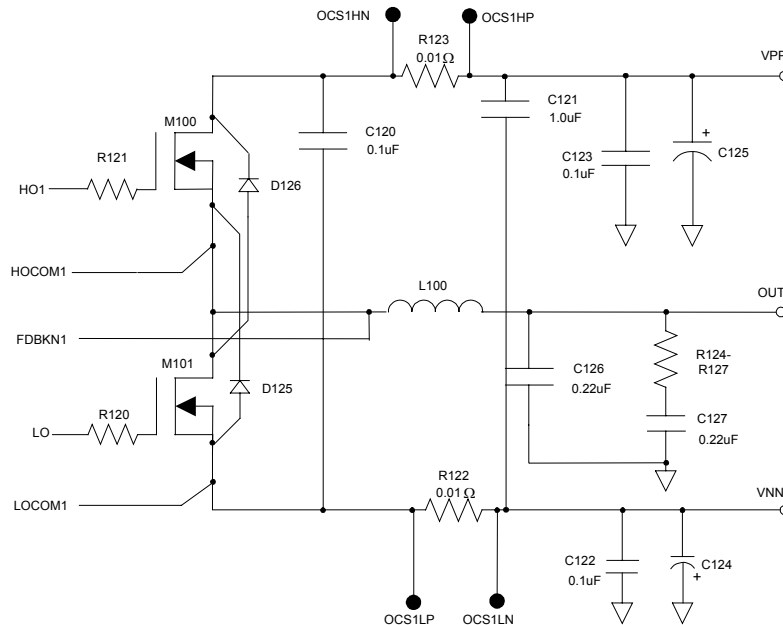


Figure 8

The gate resistors (labeled R120 and R121 in Figure 8 and the attached schematic) are used to control MOSFET switching rise/fall times and thereby minimize voltage overshoots. They also dissipate a portion of the power resulting from moving the gate charge each time the MOSFET is switched. If  $R_G$  is too small, excessive heat can be generated in the driver. Large gate resistors lead to slower gate transitions resulting in longer rise/fall times and thus requiring a larger BBM setting.

The output MOSFETs (M100 and M101) provide the switching function required of a Class-T design. They are driven directly by the TA0105A through the gate resistors. The devices used on the RB-TA0105A-1 board are ST STW34NB20 MOSFETs. The devices used on the RB-TA0105A-2 board are ST STW20NM50FD MOSFETs. The devices used on the RB-TA0105A-1 board are ST STW34NB20 MOSFETs. The TA0105A data sheet contains information on output FET selection as well as Tripath application note AN16, "Output Mosfet Selection Guide For Tripath Drivers."

The bypass capacitors C120/C121 are critical to the reduction of ringing on the output MOSFETs. These parts are placed as closely as possible to the leads of the MOSFETs, and the leads of the capacitors themselves are as short as practical. Their values will not change with different output MOSFETs.

The output diodes D125/D126 are also critical to the reduction of ringing on the outputs of the FETs. They shunt the inductive energy if the output exceeds VPP or goes below VNN. The proper connection of these diodes are "drain to drain" and "source to source" as shown in the schematic diagrams.

The output filter, L100/C126, is a second order low-pass filters that recovers the analog audio signal. One of the benefits of the Class-T design is the ability to use output filters with relatively high cutoff frequencies. This greatly reduces the speaker interactions that can occur with the use of lower-frequency filters common in Class-D designs. Also, the higher-frequency operation means that the filter can be of a lower order (simpler and less costly).

The OEM may benefit from some experimentation in the filter design, but the values provided in the RB-TA0105A-1 reference design, 11.3uH and 0.22uF (nominal resonant frequency of 101kHz), provide excellent results for most loads between 4Ω and 8Ω. The filter values used on the RB-TA0105A-2, 33uH and 0.22uF (nominal resonant frequency of 59kHz), provide excellent results loads above 12.5Ω. As the supply voltage is increased (most applicable to the RB-TA0105A-2), the inductor value can have a significant effect on amplifier efficiency. Thus, amplifier efficiency characterization should be completed before the inductor value of 33uH is increased.

As important as the values themselves, the material used in the core is important to the performance of the filter. Core materials that saturates too easily will not provide acceptable distortion or efficiency figures. Tripath recommends a low-mu core, like type 2, iron powder cores. Micrometals, ([www.micrometals.com](http://www.micrometals.com)), is a main supplier of iron powder cores. The core part number used on the RB-TA0105A-1 is T106-2 and is wound with 29 turns of 16AWG wire. The core part number used on the RB-TA0105A-2 is T106-2 and is wound with 49 turns of 18AWG wire.

The Zobel circuits R124-R127/C127 are there in case an amplifier is powered up with no load attached as well as terminating the amplifier with typical, "inductive" loudspeakers. The Q of the LC output filter, with no load attached, rises quickly out to 80kHz. Resonant currents in the filter and ringing on the output could reduce the reliability of the amplifier. The Zobel eliminates these problems by reducing the Q of the network significantly above 50kHz. Modifying the LC output filter should not require a recalculation of the Zobel components, though depending on application, the power capability of the Zobel resistor may need to be increased. The components used on the reference board should be quite adequate for almost all applications. The amplifier should never be operated without a zobel filter attached even if an output load is always present.

### Connection Diagram for Bridge Mode Operation

The amplifier is connected to the power supplies and load as shown in Figure 9. Note that an opamp inverter has been added in front of one of the channel inputs (i.e. Channel 2). The main reason for processing the channels out of phase is to avoid potential problems with switching power supplies, but it also simplifies the connections for bridged-mode operation. For bridged operation, simply connect the "-" terminal to the output of the inverted channel (Channel 1 output, J100 pin 1) and the "+" terminal to the output of the non-inverted channel with respect to the input signal (Channel 2 output, J200 pin 1). The opamp inverter shown in Figure 9 is not needed if the audio generator used for testing has 2 separate outputs with a phase switch.

There are tradeoffs to bridging an amplifier. For a given supply voltage, the output capability is theoretically increased by a factor of four. But this increased potential power comes at the expense of lower efficiency. Thus, the power supply voltage used for bridged operation is usually reduced such that the power dissipation in the output mosfets is not increased to a potentially damaging level. This usually results in twice the output power as compared to the single ended case.

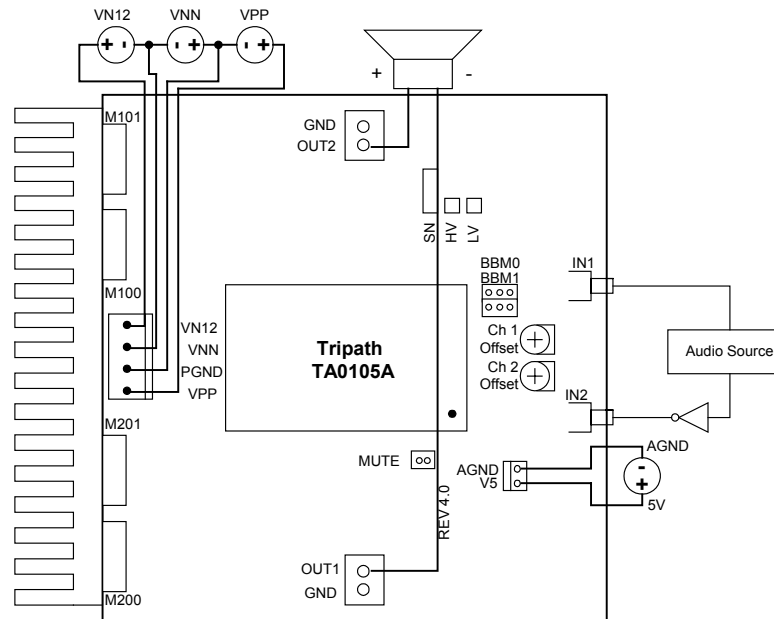


Figure 9

### Circuit Board Layout

The TA0105A is a power (high current) amplifier that operates at relatively high switching frequencies. The output of the amplifier switches between VPP and VNN at high speeds while driving large 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 TA0105A and external mosfets 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 following components are important to place near either their associated TA0105A or output MOSFET pins. The recommendations are ranked in order of layout importance, either for proper device operation or performance considerations.

- The impedance of the output node (the connection between the top side MOSFET source to bottom side MOSFET drain) must be minimized. Reducing the parasitic trace inductance is the most effective way of limiting output node ringing. A flat, bar conductor, in parallel with the PCB output node trace, is quite effective at minimizing the inductance thereby reducing output transients due to the switching architecture.
- The capacitors,  $C_{HBR}$ , provide high frequency bypassing of the amplifier power supplies and will serve to reduce spikes and modulation of the power supply rails. Please note that both mosfet half-bridges must be decoupled separately. In addition, the voltage rating for  $C_{HBR}$  should be at least 400V as this capacitor is exposed to the full supply range, VPP-VNN.
- The output diodes,  $D_O$ , are used to minimize overshoots/undershoots on the output node. Please note that the proper connection of these is "Drain to Drain" and "Source to Source" as shown in the Application/Test Circuit. Improper routing of these diodes will render them useless due to PCB trace inductance.
- The gate resistors,  $R_G$ , should be located as close to the output MOSFET gates leads as possible. In addition, the trace length from the pins LOx/HOx to the gate resistor should be minimized. To reduce the loop area, a parallel trace from LOxCOM/HOxCOM should be routed directly to the respective MOSFET source lead.



- $C_{FB}$  removes very high frequency components from the amplifier feedback signals and lowers the output switching frequency by delaying the feedback signals. The value of  $C_{FB}$ , in conjunction with internal processors delays, keeps the average switching frequency for channel 1 and channel 2 separated by 40kHz. This minimizes in-band audio noise. Locate these capacitors as close to their respective TA0105A pin as possible.

Some components are not sensitive to location but are very sensitive to layout and trace routing.

- The routing of the sense resistors,  $R_S$ , must be Kelvin connected. This implies a direct trace from the respective TA0105A pin to the sense resistor lead without interruption. If additional connections are made to the TA0105A overcurrent sense pins or the traces, the overcurrent sense circuit may prematurely trigger. In no instance, should a sense pin on the TA0105A be connected to other equal potential pins on the TA0105A. For instance, one should not connect LOxCOM to OCSxLP at the TA0105A.
- To maximize the damping factor and reduce distortion and noise, the modulator feedback connections should be routed directly from the pins of the output inductors.  $L_O$ .
- The output filter capacitor,  $C_O$ , and zobel capacitor,  $C_Z$ , should be star connected with the load return. The output ground feedback signal should be taken from this star point.
- To minimize the possibility of any noise pickup, the trace lengths of IN1 and IN2 should be kept as short as possible. This is most easily accomplished by locating the input resistors,  $R_I$  as close to the TA0105A as possible. In addition, the offset trim resistor,  $R_{OFB}$ , which connects to either IN1, or IN2, should be located close to the TA0105A input section.

### TA0105A Grounding

Proper grounding techniques are required to maximize TA0105A functionality and performance. Parametric parameters such as THD+N, Noise Floor and Crosstalk can be adversely affected if proper grounding techniques are not implemented on the PCB layout. The following discussion highlights some recommendations about grounding both with respect to the TA0105A as well as general “audio system” design rules.

The TA0105A is divided into two sections: the input section, which spans pins 1-12 and pins 35-38 and the output (high voltage) section, which spans pins 13 through pin 34. On the TA0105A evaluation board, the ground is also divided into distinct sections, one for the input and one for the output. To minimize ground loops and keep the audio noise floor as low as possible, the input and output ground should not be externally connected. They are already connected internally via a ferrite bead between pin 1 and pin 28. Additionally, any external input circuitry such as preamps, or active filters, should be referenced to pin 1.

For the power section, Tripath has traditionally used a “star” grounding scheme. Thus, the load ground returns and the power supply decoupling traces are routed separately back to the power supply. In addition, any type of shield or chassis connection would be connected directly to the ground star located at the power supply. These precautions will both minimize audible noise and enhance the crosstalk performance of the TA0105A.

The TA0105A incorporates a differential feedback system to minimize the effects of ground bounce and cancel out common mode ground noise. As such, the feedback from the output ground for each channel needs to be properly sensed. This can be accomplished by connecting the output ground “sensing” trace directly to the star formed by the output ground return, output capacitor,  $C_O$ , and the zobel capacitor,  $C_Z$ . Refer to the Application / Test Circuit for a schematic description.

### Performing Measurements on the RB-TA0105A

The TA0105A 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 TA0105A amplifier switching pattern will degrade the measurement.

One feature of the TA0105A 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-TA0105A Reference Board has a simple two-pole output filter with excellent performance in listening tests.

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

## **Documentation**

Soft copies of the schematics and layout can be provided upon request (available in Protel 2.8 format). Gerber files, with embedded apertures, are also available.

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## Bill of Material for C:\DOCUME~1\KLAVOIE\DESKTOP\FROMZE~1\TA0105A\RB0105\_1.Sch

Used	Part Type	Designator	Footprint	Part Field 1	Part Field 2	Part Field 3
====	=====	=====	=====	=====	=====	=====
4	0.01OHM/2W	R122 R123 R222 R223	PWRR052W	OHMITE	12FR010	DK 12FR010-ND
6	0.1UF/250V	C120 C122 C123 C220 C222 C223	C0U1MF10	PANASONIC	ECQ-E2104KF	DK EF2104-ND
3	0.1UF/50V	C1 C101 C201	C0U1MF05	PANASONIC	ECQ-V1H104JL	DK P4525-ND
4	0.22uF/100V	C126 C127 C226 C227	C0U1MF10	PANASONIC	ECH-S1224JZ	DK PS1224J-ND
2	1.0UF/250V	C121 C221	C100UEL06	PANASONIC	ECQ-E2105KF	DK EF2105-ND
1	1.21M	R1	0805	1/8W, 1%	*	*
2	1.33M	R2 R4	0805	1/8W, 1%	*	*
2	1000pF/50V	C3 C4	0805	10% NPO	*	*
2	10K OHM	R104 R204	RES50	1/8W, 1%	*	*
2	10K POT	R103 R203	POTSTURN	PANASONIC	3306P-1-103	DK 3306P-103-NI
1	10UF/50V	C2	C10UEL05	PANASONIC	ECA-1HHG100	DK P5567-ND
2	11.3uH	L100 L200	IND130	MICROMETALS	T106-2 CORE	29 turns, 16awg
1	150W DRVR	I1	150W DRVR	TRIPATH TECHNOLOGY, INC.	*	*
4	18.7KOHM/0.6W	R105 R106 R205 R206	RES1W	BC Components	B0207C18K70F5T	DK BC18.7KZCT-M
4	1M	R101 R102 R201 R202	RES50	1/8W, 5%	*	*
2	2.2UF/50V	C100 C200	C10UEL05	PANASONIC	ECA-1HHG2R2	DK P5564-ND
1	3.57M	R3	0805	1/8W, 1%	*	*
4	330UF/100V	C124 C125 C224 C225	C100UEL06	PANASONIC	EEU-FC2A331S	DK P10783-ND
4	33OHM/5W	R124 R126 R224 R226	R33R3W	XICON	PRM5-33	MSR 280-PRM5-33
2	49.9K	R100 R200	RES50	1/8W, 1%	*	*
4	5.6OHM/1W	R120 R121 R220 R221	2512	PANASONIC	ERJ-1TYJ5R6U	DK PT5.6XCT-ND
2	5pF	C106 C206	0805	5% NPO, 50V	*	*
1	CON2	J2	CON2	WALDOM	22-23-2021	DK WM4200-ND
1	CON4	J5	PWR4	WALDOM	26-60-4040	DK WM4622-ND
2	CPR2PIN	CPR100 CPR200		FLAT COPPER BAR OR 16 AWG SOLID CORE WIRE WITH INSULAT		
1	JUMPER	J1	GJMPR001	*	*	*
2	JUMPER3	J3 J4	GJMP3001	*	*	*
4	MUR420	D125 D126 D225 D226	267 03	ON SEMICONDUCTOR	MUR420	NWK - 08F2106
12	NS	D120 D121 D123 D124 D220 D221 D223 D224 R125 R127 R225 R227		NOT USED		
2	PWR2	J101 J201	PWR2	WALDOM	26-60-4020	DK WM4620-ND
2	RCAJACK	J100 J200	CON2	DGS PRO AUDIO	*	MSR 161-0390
4	STW34NB20	M100 M101 M200 M201	TO3P	ST MICROELECTRONICS	STW34NB20	*



## Bill of Material for C:\DOCUME~1\KLAVOIE\DESKTOP\FROMZE~1\TA0105A\RB0105\_2.Sch

Used	Part Type	Designator	Footprint	Part Field 1	Part Field 2	Part Field 3
====	=====	=====	=====	=====	=====	=====
4	0.01OHM/2W	R122 R123 R222 R223	PWRR052W	OHMITE	12FR010	DK 12FR010-ND
6	0.1UF/400V	C120 C122 C123 C220 C222 C223	C0U1MF10	PANASONIC	ECQ-E4104KF	DK EF4104-ND
3	0.1UF/50V	C1 C101 C201	C0U1MF05	PANASONIC	ECQ-V1H104JL	DK P4525-ND
4	0.22uF/250V	C126 C127 C226 C227	C0U1MF10	PANASONIC	ECW-F2224JB	DK PF2224-ND
2	1.0UF/400V	C121 C221	C100UEL06	PANASONIC	ECQ-E4105KF	DK EF4105-ND
2	1000pF/50V	C3 C4	0805	10% NPO	*	*
2	10K POT	R103 R203	POTSTURN	PANASONIC	3306P-1-103	DK 3306P-103-ND
1	10UF/50V	C2	C10UEL05	PANASONIC	ECA-1HHG100	DK P5567-ND
1	150W DRVR	I1	150W DRVR	TRIPATH TECHNOLOGY, INC.	*	*
2	2.2UF/50V	C100 C200	C10UEL05	PANASONIC	ECA-1HHG2R2	DK P5564-ND
2	20K OHM	R104 R204	RES50	1/8W, 1%	*	*
4	220UF/200V	C124 C125 C224 C225	C100UEL06	PANASONIC	EEU-EB2D221	DK P5921-ND
1	22pF/50V	C106	0805	5% NPO,50V	*	*
4	33OHM/1W	R120 R121 R220 R221	2512	PANASONIC	ERJ-1WYJ330U	DK P33XCT-ND
2	33uH	L100 L200	IND130	MICROMETALS	T106-2 CORE	49 turns, 18awg wire
2	34.8K	R100 R200	RES50	1/8W, 1%	*	*
4	39KOHM/1W	R105 R106 R205 R206	RES1W	PANASONIC	ERG-1SJ393	DK P39KW-1BK-ND
6	47OHM/5W	R124 R125 R126 R224 R225 R226	R33R3W	XICON	PRM5-47	MSR 280-PRM5-47
1	47pF/50V	C206	0805	5% NPO,50V	*	*
4	510K	R101 R102 R201 R202	RES50	1/8W, 5%	*	*
1	CON2	J2	CON2	WALDOM	22-23-2021	DK WM4200-ND
1	CON4	J5	PWR4	WALDOM	26-60-4040	DK WM4622-ND
2	CPR2PIN	CPR100 CPR200		FLAT COPPER BAR OR 16 AWG	SOLID CORE	WIRE WITH INSULATION
1	JUMPER	J1	GJMPR001	*	*	*
2	JUMPER3	J3 J4	GJMP3001	*	*	*
4	MUR460	D125 D126 D225 D226	267 03	ON SEMICONDUCTOR	MUR460	NWK - 08F2110
10	NS	D123 D124 D223 D224 R1 R127 R2 R227 R3 R4		NOT USED		
2	PWR2	J101 J201	PWR2	WALDOM	26-60-4020	DK WM4620-ND
2	RCAJACK	J100 J200	CON2	DGS PRO AUDIO	*	MSR 161-0390
4	SS16	D120 D121 D220 D221	SMB	GENERAL SEMICONDUCTOR	SS16	DK SS16GICT-ND
4	STW20NM50FD	M100 M101 M200 M201	TO3P	ST MICROELECTRONICS	STW20NM50FD	*