Twisted X Driver – TXD

A Twisted Pear Audio Production

Russ White

Revision 1.0.0

Overview:

TXD is a flexible fully differential driver which can be configured for the following uses:

1) A balanced line driver/preamp.
1) A Single ended signal to balanced signal converter.
2) A fully differential power amplifier driver when used with external power modules.

TXD is designed to utilize the Texas Instruments THS41xx family of fully differential op amps.

The TXD kit comes with components required for several configurations. Many other configurations are possible by simply changing a few values. Please consult the THS4131 data sheet for more information especially in regard to gain setting and the use of the input instrumentation op amp.

TXD is also the backbone of the Twisted X Overture amplifier. There will be other "Twisted X" amplifiers based on the TXD in the future.

Power Supply Considerations:

The TXD requires a +/- 8 to +/-15V power supply. We supply the LCPS(driver or preamp) or the TXPS (with TXO). LCPS should be setup for +/-10V to power TXD. See the LCPS documentation. There is also a regulated power supply for the TXD in the Twisted X Power Supply (TXPS) which will also supply around +/-10V to the TXD when used for a TXO. It is perfectly fine if the regulated rails are not exactly 10V. For example +9.1V and -9.8V is perfectly normal with the TXPS and should not cause alarm.

Input impedance:

The TXD is usually built with the input instrumentation amplifier in place. The instrumentation amp gives the TXD a higher input impedance. The THS4131 utilizes current feedback, and each side of the op amp behaves like an inverting op amp, so the input impedance of the THS4131 itself will be relatively low. The addition of a high quality (we use LM4562) op amp as a instrumentation amp allows us to get the input impedance up much higher which makes the TXD an easy load. R3A and R3B set the input impedance of the circuit. The instrumentation amplifier also gives you an additional gain block prior to the THS4131. The overall gain of the circuit is calculated by the following formula:

$$G = (RF / RG) * (1 + (2R2 / R1))$$

If you choose you may omit the instrumentation op amp and use the TXD with an input impedance which will be the value of RG and just one gain block. In that case you would simply Omit IC1, R1, R2(A&B), and R3(A&B) along with C1 and C2. You will also add a jumper which is marked with a line on the PCB (around R3 and R2) to bypass the input section. In this case gain is set with the following formula:

$$G = (RF / RG)$$

TXD as a line driver/preamp or SE to BAL converter (or both):

In the line driver configuration the TXD can be built either unity gain (or even less then unity) or with gain as mentioned already. **The compensation caps (C7 and C8) should always be omitted when using TXD as a line driver or SE to Balanced converter.**

When using the TXD as a line driver you must also close the feedback loop by utilizing J1/J2. RO1 and RO2 are output resistors which help stabilize the THS4131 in case you are driving a capacitive load. 21–47-ohms is usually perfectly adequate. If the load has only slight capacitance you can simply jumper RO1/R02 instead of using resistors. This will lower the output impedance of the TXD down to around .3-ohms.

To utilize TXD as a SE to Balanced converter you simply connect -IN and GND together, and connect your single ended signal to +IN. When the gain of the TXD is 1 (unity) the signal at the inverting and non-inverting (-OUT/+OUT) outputs will be half (-6db) the amplitude of the input signal, summed they equal the input signal. Sometimes you may find it necessary to increase the gain of the TXD to 6db (2X) to get the level you expect out of the TXD when utilized as a SE – BAL converter.

Resistor values supplied with TXD kit for this application:

Driver Gain	***R1***	***R2***	***RG***	***RF***
1(0db or -6db SE-IN)	Omit	1K 1%	1.1K .1%	1.1K .1%
4(12db or 6db SE-IN)	1K .1%	2.2K .1%	1.1K .1%	1.1K .1%

TXD as the driver for TXO:

TXD was conceived in large part to be the driver for a power amplifier where the power modules are in a global feedback loop controlled by the TXD. This works very well and brings all the benefits of the fully symmetrical nature of the TXD to the power amplifier as a whole. These benefits include extremely low THD from the power amp along with excellent CMRR.

Utilizing a single Twisted Power Module (TPM) per output of the TXD results in a TXO-2. This results in a symmetrically bridged amplifier consisting of the two power modules in the single TXD feedback loop. **To keep the entire amplifier stable the two compensation capacitors (C7 and C8) must be used, and the feedback resistors (RF1 and RF2) need to be at least 20K. You also must not use J1 and J2. Feedback for the global loop is provided by running a wire (as short as possible) from the output (marked FBK on the TPM) to the terminal marked FBK on the TXD.**

Multiple power modules can be paralleled together as a single power block. A TXO-4 is simply a TXO with 2 paralleled TPMs instead of just one at the outputs of the TXD. This produces an amp with great current drive capability. The TXO-4 can easily drive a 4ohm load very hard.

Resistor values supplied with TXD kit for this application:

TXO Gain	***R1***	***R2***	***RG***	***RF***
10(20db or 14db SE-IN)	Omit	1K 1%	2.2K .1%	22K .1%
20(26db or 20db SE-IN)	Omit	1K 1%	1.1K .1%	22K .1%

Summary:

I hope you have enough information to allow you to use TXD to suit your goals. Please utilize the support forum at http://www.twistedpearaudio.com/forum if you would like additional support. Thanks!

TXD Schematic