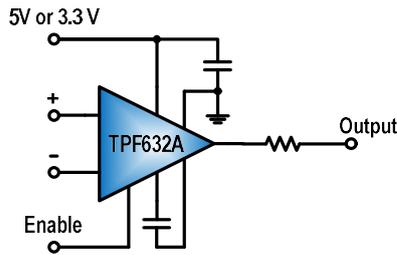


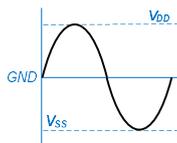
## TPF6XXA application note

The TPF6XX are 3PEAK pop-free audio stereo line driver which have below features:

1 Line outputs have  $\pm 8\text{kV}$  IEC HBM ESD and  $\pm 2\text{kV}$  IEC CDM ESD, This feature makes TPF6XX very suitable for STB, DVR's audio line out application.



Internal charge pump to provide a negative voltage rail



In Set-top box application, customer often meet ESD and surge issues which were caused by interface hot plug, unstable power supply or other factors, so it needs very robust ESD and surge immunity capability on the output of the audio output port.

Currently, for the mute function circuit design which integrated in most of the audio line driver chip, just connecting the output of the OPA with one or several transistors shorted to ground: When the chip is working on normal status, this transistors is useless, When meet high rating ESD or surge voltage on the output of the chip, the high inrush current always find the weakest way to release the energy, so it may make the chip permanent damaged. This conventional audio driver chip design architecture has serious limitations on Electrostatic protection and surge protection, usually customer has to add extra TVS device on the output port, but it will add the BOM cost.

3PEAK TPF6XX use improved high performance ESD and surge immunity architecture design: this series product move the mute circuit from the output to other place, so it could make sure the chip's output different device have the same working loading, meanwhile, this output device also have improved ESD immunity design. When the ESD or surge occurs, the high-voltage current could be apportioned evenly by the chip's internal device, so it could protect the internal device far from damaged.

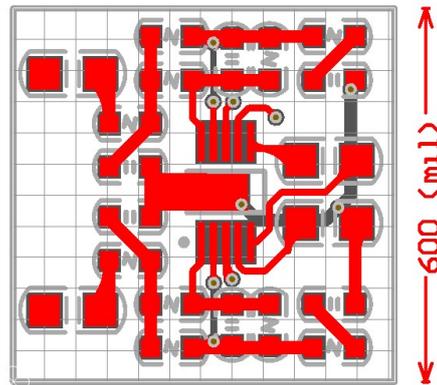
2 Built-in click and pop reduction circuit, the new architecture audio line drivers TPF6XX requires no output dc blocking capacitors, further lower the BOM cost.

## Gain Adjustable Audio Line Driver TPF6XX

- 3 Short-Circuit Protection, The TP6XX has an external under-voltage detector that mutes the output when the power supply is removed, ensuring a pop-free shutdown. This makes TP6XX very suitable for portable audio player application.
- 4 3.3V or 5V single power supply, improved the low frequency response and THD performance.

## Typical Application

In order to facilitate customer applications, to meet the higher demand, we gives the typical application circuit and layout recommendations, if used MSOP-10 Packaged products, according to the layout of a typical circuit and we could minimize the total audio output part to  $1.5 \times 1.5 \text{ cm}^2$  in area, if Use a smaller 0402 resistors and capacitors, the area can be re-Reduced by at least 30%.

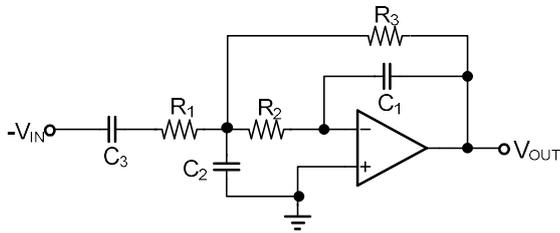


## Filter Design

In some high-quality audio requirement conditions, usually adding filters in the audio driver section, for the convenience of customers, we are given a set of common configuration data, so that help customers to get the appropriate parameters.

TP6XX have different audio drivers structure with TI, we give a more reasonable and more suitable solutions for reference design with our chip, for which we have done quite a lot of experiments to prove feasible, and performance excellence. Of course, also consider customer actually requirement, we also provide a PIN to PIN solution.

## Gain Adjustable Audio Line Driver TPF6XX

 (a) Conventional 2<sup>nd</sup> low pass filter


$$\text{GAIN} = R_3/R_1$$

We also give the recommended gain and external RC configuration, as below table description:

	R1	R2	R3	C1	C2	C3
	kΩ	kΩ	kΩ	pF	pF	uF
G=2	5	25	10	33	470	10
G=5	5	10	25	33	470	10
G=10	4	17	40	33	470	10

This structure is designed according to the audio driver circuit; it can achieve better filtering effect and better THD which could fully meet the international standard.

Meanwhile, in the circuit design, the TP6XX is sufficient to drive feedback resistor, so the feedback resistor should be selected as small as possible, so that we could lower the noise caused by the resistance, this advantage could also contribute to improve the THD.

Of course, in our recommended design solution, we already reserved the modified position, make it's better to allow customers to select the appropriate filtering solution. But there is no impact if the customer application does not use the filter.

### Why need to change Filter

Same as described above, in order to provide better reliability assurance, we move the output mute switch to the input side. Thus, when the ESD and surge into the output interface, the chip will be better protected.

### POP Noise

When the Vcc or VIN is setting up/power down, because of capacitance's voltage (C3) is charging up/down, the Vout may have a pulse output. In order to minimize the output,  $T >= 2 * \pi * C3 * (R1 + R3)$  should be waited before turn on TPF632A.

