High Current Amplifier

High Current Amplifier - Introduction

High current amplifier is often a very useful piece of instrument to have in the lab. It is very handy for increasing the current driving capability of a function generator or arbitrary waveform generator. Many laboratory applications require high current amp to drive heavy load. Application for high-current amp include driving heavy resistive load, driving magnetic coil, electrochemical reactor, piezoelectric element, and many other applications.

Conventional function generator or signal generator has an output impedance of 50-ohm and they are optimized for driving 50-ohm loads. If the load impedance is lower than 50-ohm or requires higher current, a current amplifier is needed. The TS200 high-current amplifier is a great companion instrument for function generator.

High Current Amplifier Applications

- Relay
- Solenoid
- Magnetic coil
- Helmholtz coil
- High-power heat generation
- Electrochemical reactor
- Piezo element
- Circuit characterization
- Motor/actuator driver
- Scientific and Industrial testing
- Automotive transient test

Model	Voltage Range (V)	Typical Current*	Peak Current
TS200-0x	-10 to +10	3A	5.0A
TS200-1x	-20 to +20	2.0A	3.8A
TS200-2x	-20 to +45	1.0A	2.0A
TS200-3x	-10 to +72	1.0A	2.0A
TS200-4x	0 to +15	3.0A	3.5A
TS200-5x	-40 to +40	1.0A	2A

* Typical steady-state current vary with output voltage. See the TS200 datasheet for output current vs. output voltage curves.

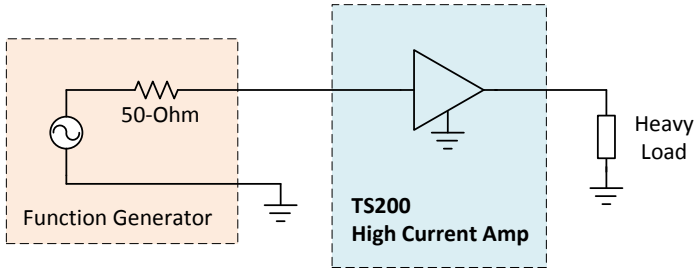


Figure 1. Simplified diagram is showing how to amplify signal from a function generator to delivery high current to a heavy load.

Function Generator Is Not Strong Enough – The Problem

Function generators are commonly found in laboratories. They are being used for all kinds of tests and experiments. Conventional function generator or signal generator has an output impedance of 50-ohm and they are optimize for driving 50-ohm loads. Their outputs are limited to 5V into 50-ohm or 100mA maximum. For high-current applications, a high current amplifier is required to amplify the driving capability.

Figure 2 and 3 shows how a function generator *cannot* drive heavy loads. The output impedance of the generator is 50-ohm. The high source resistance attenuates output voltage and limits the output current. For example, the 50-ohm source impedance and 5-ohm load in Figure 2 forms a voltage divider that attenuates the voltage by a factor of 11.

When the load is capacitive (Figure 3 top), the signal generator's source impedance and load capacitance formed a low-pass RC filter. This RC filter distorts waveforms and limits the maximum operating frequency. It is not practical for a function generator or an arbitrary waveform generator to drive a heavy capacitive load. Similarly, in the case of inductive load such as a relay or a magnetic coil, the waveform is also distorted as shown Figure 3 (bottom).

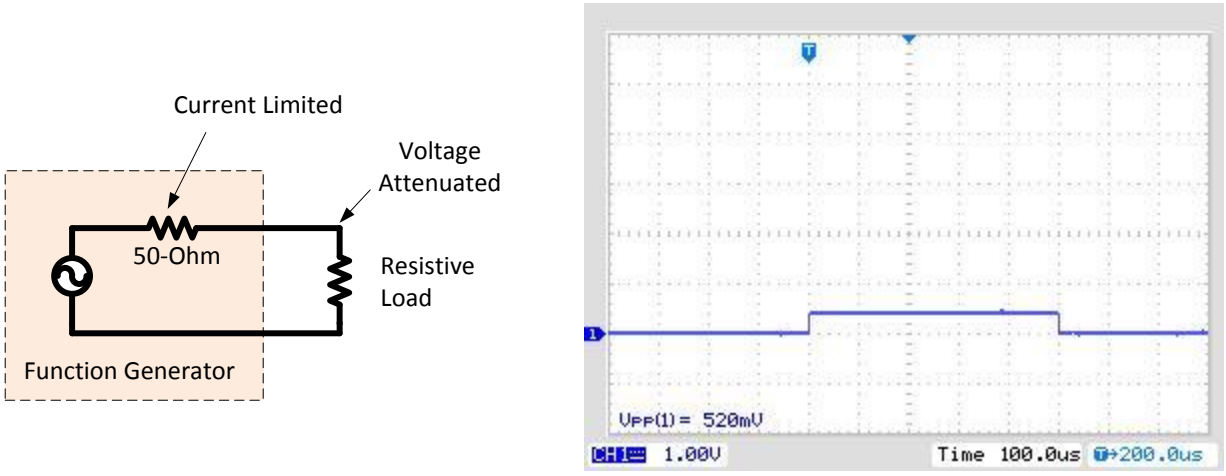
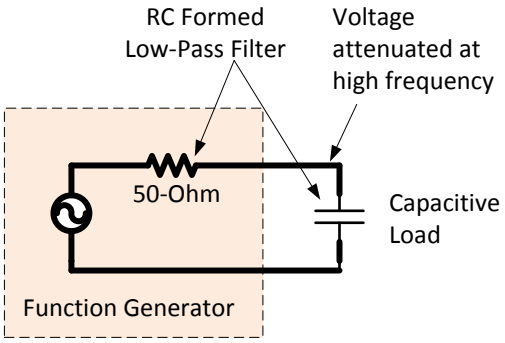
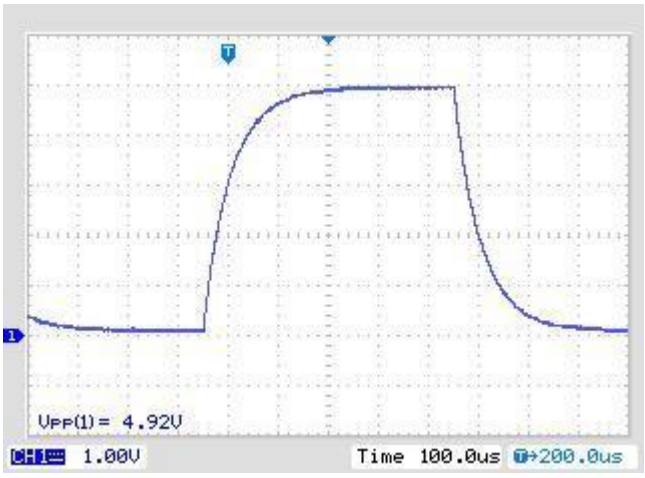
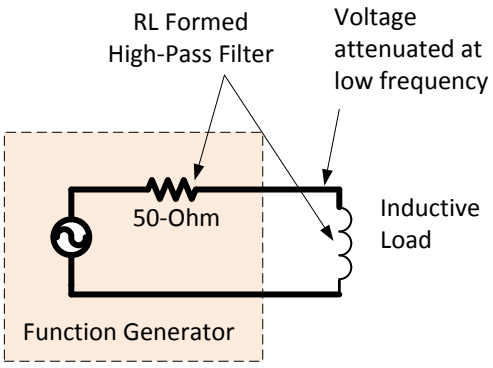


Figure 2. A function generator outputs 0-to-5V square-wave with 50-ohm source impedance driving a low-resistance load (left). The output voltage is attenuated (right).







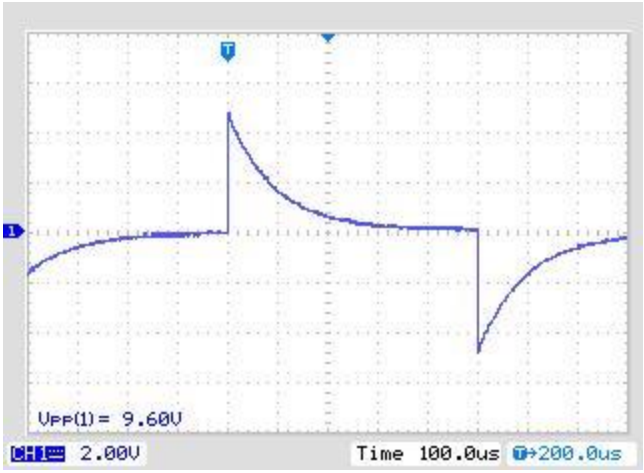


Figure 3. A function generator outputs a 0-to-5V square-wave with 50-ohm source impedance. Top: The function generator is driving a capacitive load. The output waveform is distorted. Bottom: The function generator is driving an inductive load. The output waveform is distorted.

High Current Amplifier – The Solution

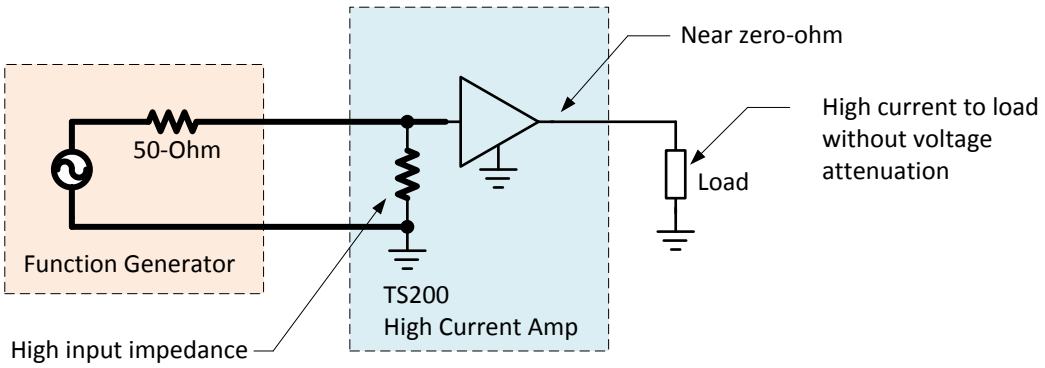


Figure 4. TS200 high-current amplifier drives high current load without voltage attenuation.

Figure 4 shows how the TS200 high current amp can drive the above mentioned heavy loads with negligible attenuation, because its source impedance is near zero. The TS200 current amplifier has very low output impedance in the order of tens of mili-ohms allowing it to drive heavy loads without attenuation. The output amplitude remains constant up to its rated frequency. Figure 5 shows the TS200 output waveform maintained 5V square-wave when driving a 5-ohm resistor (left) or 1uF capacitor (right). Figure 6 shows the TS200-0A high current amp driving a 1-ohm resistive load with 10A peak-to-peak or 5A 0-to-peak.

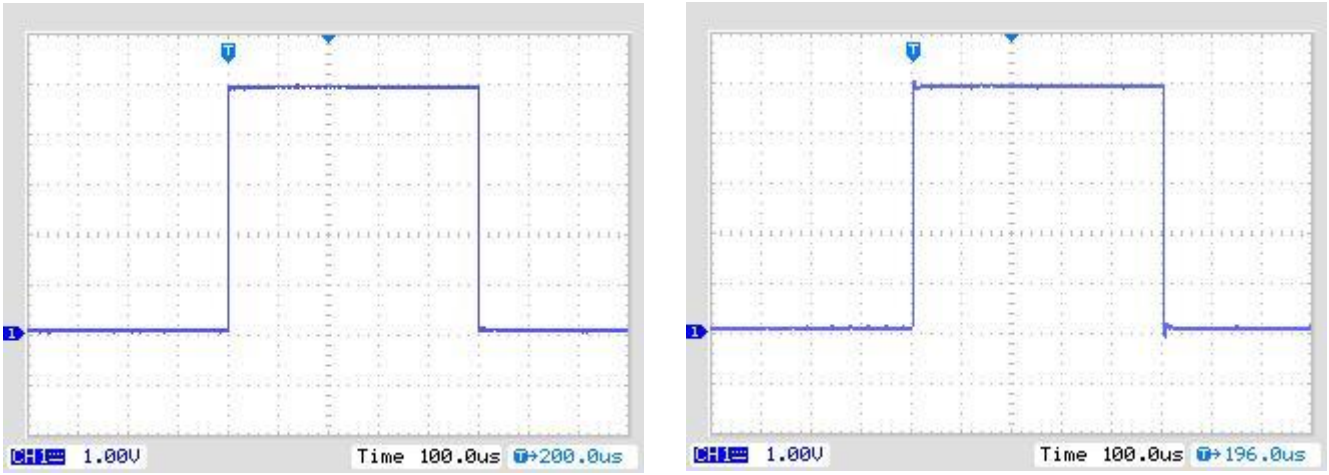


Figure 5. TS200 high-current amplifier is driving a 5-ohm (left) or a 1uF capacitor (right). The output waveforms maintained 5V square without any distortion or attenuation.

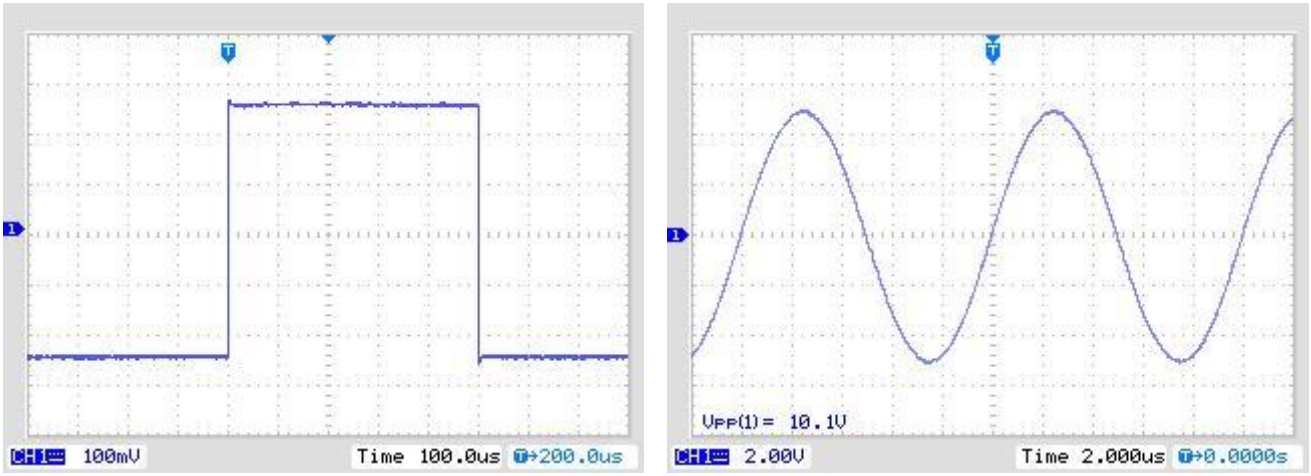


Figure 6. Left: The TS200 high output current amplifier is driving a 4.7mH inductor. The output waveform maintains 5V square without any distortion or attenuation. Right: The TS200 amplifier is driving a 1-ohm resistor achieving 10A peak-to-peak.

TS200 High-Current Amp Features

Figure 7 is the TS200 high current amplifier functional equivalent diagram. It features a selectable AC or DC coupled input. It also feature an adjustable DC offset voltage output which is useful if a fixed DC bias voltage is required. Two versions of the TS200 are available, the A-version has unity gain and the B-version has 20dB gain.

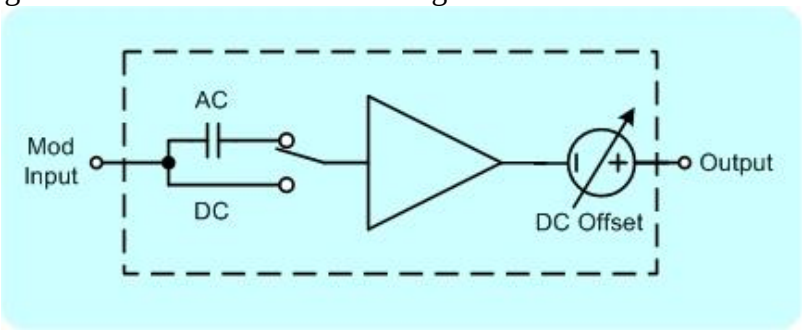


Figure 7. TS200 high-current amplifier functional equivalent circuit.

In summary, the TS200 is an ideal companion for a lab function generator or arbitrary waveform generator. It amplifies waveforms, both voltage and current, for driving heavy load. It has very low output impedance and can drive high current to the load without voltage attenuation. Up to 10A peak-to-peak current is possible with the TS200-0x.

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