Technical Article

High-current Amplifier Applications Made Smaller

Aditya Ambardar

Often, when defining a new device to meet rigorous automotive standards, our teams see other systems that require the same capabilities, and we'll design the device to cross all these applications. This is what happened when our team was developing the new ALM2402, a dual high-current operational amplifier (op amp) designed for automotive applications.

While defining the ALM2402, we realized that many automotive and industrial systems require an op amp that can drive high-current capacitive or inductive loads.

In the past, designers have often been required to solve this need with discrete components. To design a simple high-current amplifier with discrete components, you need an amplifier, bipolar junction transistors (BJTs) and diodes. An example of this is shown in Figure 1, which is typically used in a motor drive application. This implementation drives the excitation coil of a resolver, which is used to measure degrees of motor shaft rotation. You can find amplifier designs like driving inductive loads in many automotive and industrial applications. This typical solution creates challenges for the designer around board space and biasing of the output transistor.

Adding to the space challenge of the discrete implementation is the need to provide additional circuitry for overcurrent protection. Without overcurrent protection, the system is "dumb." It will keep burning power without any protection.

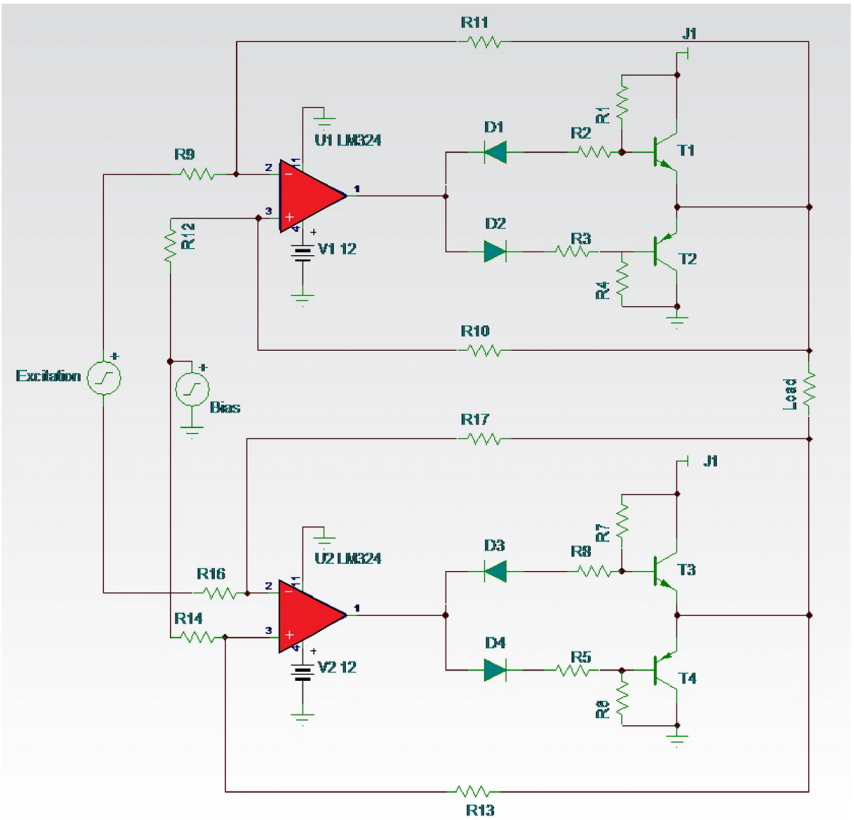

Figure 1. Discrete Implementation of Driving an Excitation Coil

In contrast, let's look at the ALM2402 implementation for driving an excitation coil, shown in Figure 2. Simple, right? No biasing of the external transistor is required, and the ALM2402 can drive up to 400mA through each channel. The circuit is small, housed in a 3-mm x 3-mm DRR package, which allows designers to minimize their overall solution size.

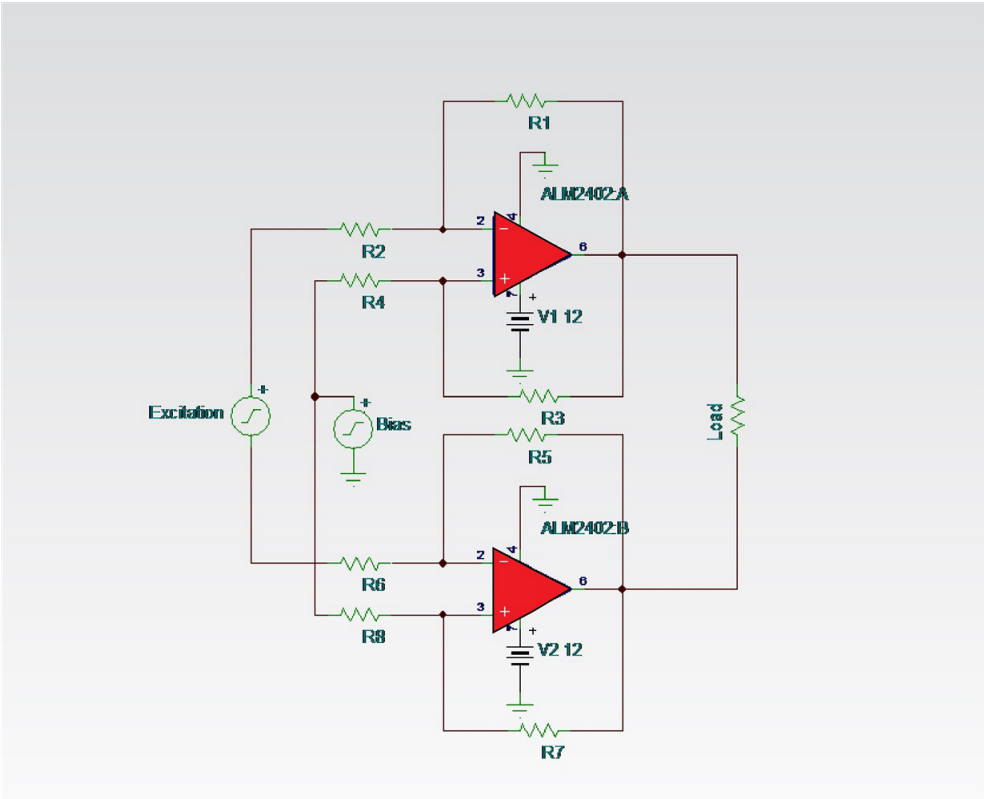

Figure 2. Excitation Coil Drive Using the ALM2402-Q1

Protection is a critical requirement in high-current driving applications, and the ALM2402 integrates several system protection features, including the following:

- Integrated overcurrent protection
- Output short to battery if a series diode is connected from the battery to the supply pin of the device. Over-temperature protection shuts down the device if there is an error in layout or a higher-than-specified ambient temperature in the system.

In addition, the device's flag pin is a handy feature that serves several purposes. The flag pin goes low when an over-temperature event occurs, allowing users to design a feedback mechanism to shut down the system. These can also externally pull down the flag pin to shut down the op amp, which puts it in sleep mode to consume very low current. This feature is useful for battery applications where power consumption is of utmost importance.

Being a high-current operational amplifier, the ALM2402 could be useful for many applications, in addition to motor drives and LED-driving applications. In future posts, I will discuss additional applications that can be implemented using ALM2402.

Additional Resources

- Datasheet: "ALM2402-Q1 dual op-amp with high current output"
- "Designing with dual-power op-amp, ALM2402Q1" application report
- See TI's entire precision amplifier portfolio

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265