

Custom FPC connectors for Miniaturizing SQUIGGLE Motor Connections

Dan Viggiano III, Director Custom Products Division
Rev. 1 | Feb. 8, 2010

SQUIGGLE motors, the world's smallest linear motors, are now routinely integrated into motion systems by OEM customers all over the world. The challenge is always to minimize the total package size while accommodating such system components as the drive electronics, microprocessors, and perhaps the worst offenders of all, connectors.

This app note provides advice for minimizing the size of SQUIGGLE motor connectors.

SQUIGGLE Motor FPC Connectors

With the SQL-RV SQUIGGLE motor and drive ASIC, New Scale provides the smallest motor and drive electronics package in the world (*figure 1*). We continue to support our customers' need for miniaturized integration packages with innovative solutions for position sensing, mechanical system design and electrical connections.

SQUIGGLE motors, specifically the SQL series motors, are wired with Flexible Printed Circuits (FPCs) that are easy to integrate into small mechanisms. They are available in custom lengths and shapes to accommodate most routing requirements.

As a standard, the SQUIGGLE motor FPC has five conductor terminations: two for Phase 1, two for Phase 2, and one for Ground. (Please refer to the motor datasheets and specifications for a circuit diagram of your specific motor.) The SQUIGGLE motor runs on only these three signals (P1, P2, GND), which is in fact the output from the NSD Series drive ASIC.

There are four piezoelectric elements on the SQL series SQUIGGLE motors, and each element has its own electric lead. The standard FPC requires that the Phase 1 signal be applied to two leads, which is most easily accomplished by jumpering the connector leads on the board. A standard five-lead, board-mountable FPC connector can then be used to make the connection to the motor. While quite small, this may not be small enough for some applications.

Custom FPC Connector Options

Alternatively, New Scale can supply a custom FPC combining the leads in the FPC itself, rather than on the board, thereby requiring only a three-lead connection to the PCB. These connectors are typically offered in a board-mountable configuration and are slightly smaller than the five-lead version.

For some mechanisms these five-lead or three-lead FPC connectors still aren't small enough. New Scale has worked with customers on other ways to connect to the FPC in order to reduce the footprint and volume required for FPC connection. These options include:

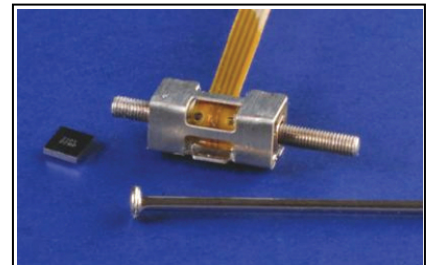


Figure 1: SQUIGGLE motor and NSD Series piezo motor driver ASIC – the world's smallest linear motor system.

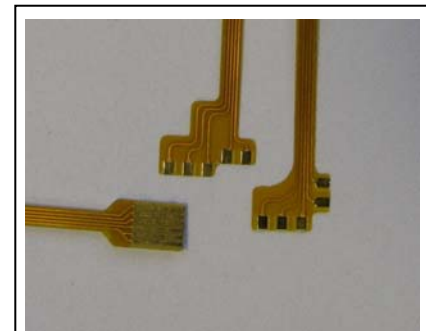


Figure 2: Custom FPC connectors with solder pads for direct connection to a PCB.

- Using alternate form factor connectors. Alternative connectors can be slightly wider, but not as deep, and have a lower profile relative to the PCB. This option may be worth considering if you need to optimize the size in only one or two dimensions. Some form factors will be more expensive than others.
- Directly soldering the FPC to the circuit board. *Figure 2* shows some examples of custom FPCs that were designed to be soldered directly to the PCB. This can be done with pre-tinning of the FPC, with wire bonding, or with a solder bridge technique. This requires less upfront tooling and design work, but potentially a more expensive assembly operation if you do not already have this capability set up.
- Integrating the FPC with the PCB – a Rigid Flexible Printed Circuit. This option offers the greatest optimization in size and cost by reducing the number of parts and simplifying the assembly. The upfront tooling and design work is a little more expensive, but in volume it offers significant cost advantages.

New Scale is able to provide custom-designed FPCs for any of these options. The rigid FPC option is especially attractive, as New Scale can integrate the NSD Series ASIC and any other components along with the motor, and provide a complete electrical and mechanical motion system ready for integration into your product.