SQL-RV-1.8 Reduced Voltage SQUIGGLE RV linear drive system

FEATURES

- Tiny, 2.8 x 2.8 x 6 mm, high performance motor
  - 45% Higher speed
  - 40% Lower power
  - Nearly twice the force of previous SQL-1.8 motor
  - Sub-micron position resolution
- Industry's smallest piezo driver solution
  - 5x smaller than comparable solution
  - 1.8 x 1.8 mm driver IC
- Industry first direct IC input from 2.3 VDC
  - Smart IC with proprietary controls
  - *No boost required*

APPLICATIONS

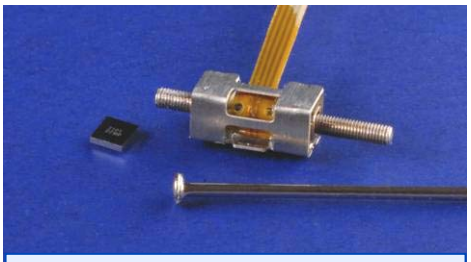
- Battery-operated hand-held devices
- Mobile phone cameras
- Digital still and video cameras
- Miniature medical actuators
- Robotics, UAVs and defense/security
- Motion stabilization systems
- Miniature optical modules
- Miniature electronic locks
- Precision industrial and research instrumentation

The world's smallest linear motion system…

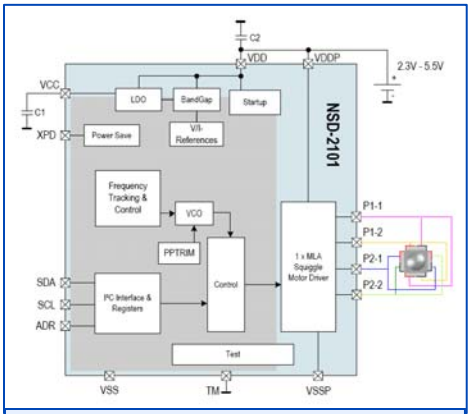
The SQUIGGLE® RV Reduced Voltage micro motor and NSD-2101 drive ASIC combine to create the world's smallest linear piezo motion control system, with performance comparable to much larger systems. State-of-the-art multi-layered piezo technology is combined with advanced, smart integrated circuit design and patent-pending control algorithms to create a breakthrough linear motion control system with unparalleled performance.

The new "RV" version of this patented ultrasonic piezo motor and driver introduces a number of **Industry Firsts** including:

- Direct battery input as low as 2.3 VDC to the drive chip with *no external voltage boost circuitry required.*
- Complete driver solution much smaller than motor and 5x smaller than comparable systems.
- 40% lower power consumption than comparable electromagnetic solutions.



SQL-RV SQUIGGLE motor with NSD-2101 piezo motor driver shown next to a common pin.



NSD-2101 Smart IC provides the most advanced piezo control circuitry in the miniature 1.8mm x 1.8mm package.

New smart motor driver ASIC

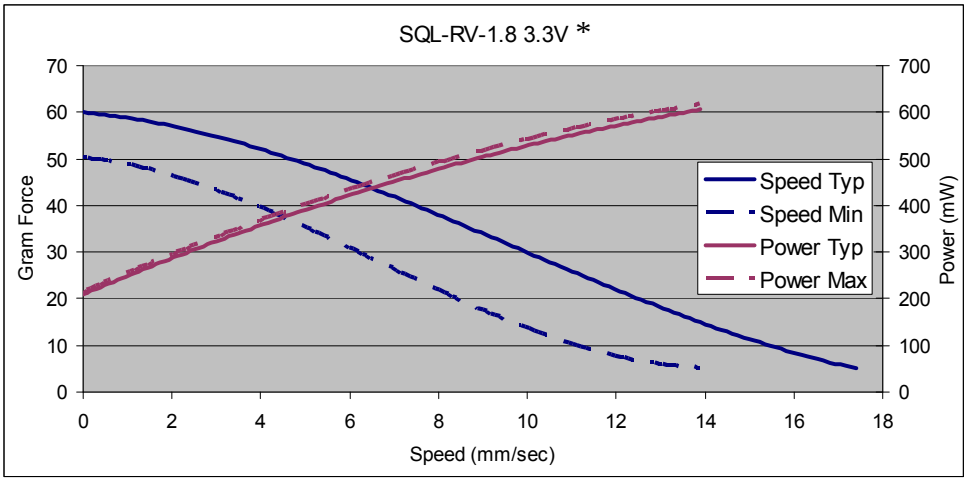
(see separate NSD-2101 datasheet)

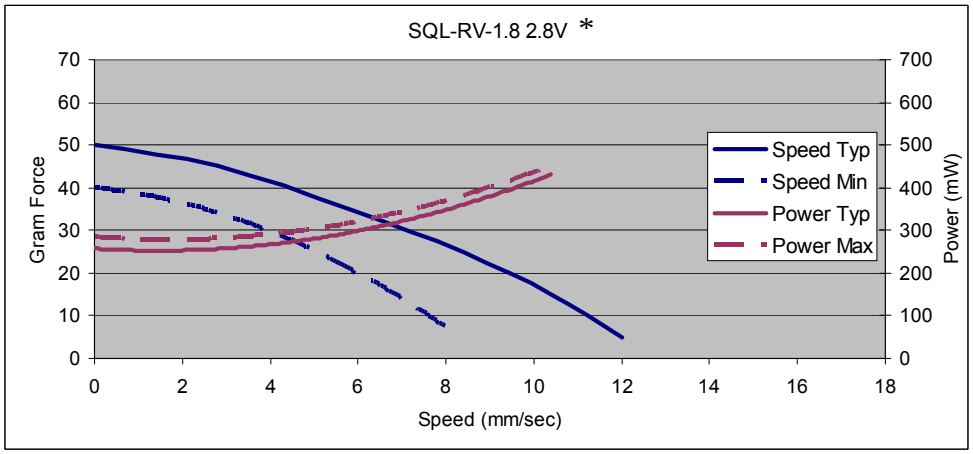
The NSD-2101 piezo motor driver is only 1.8 x 1.8 mm in wafer-level form. It converts 2.3 to 5.5 VDC battery input directly to high frequency AC power to control the SQL-RV SQUIGGLE motor. Custom designed to drive the SQUIGGLE RV multilayer motor technology, the NSD-2101 provides advanced, proprietary features such as frequency tracking and hybrid speed control to optimize motor performance while minimizing power consumption over a broad range of operating and environmental conditions. NSD-2101 accepts commands from your system processor over a digital I^2C serial interface.

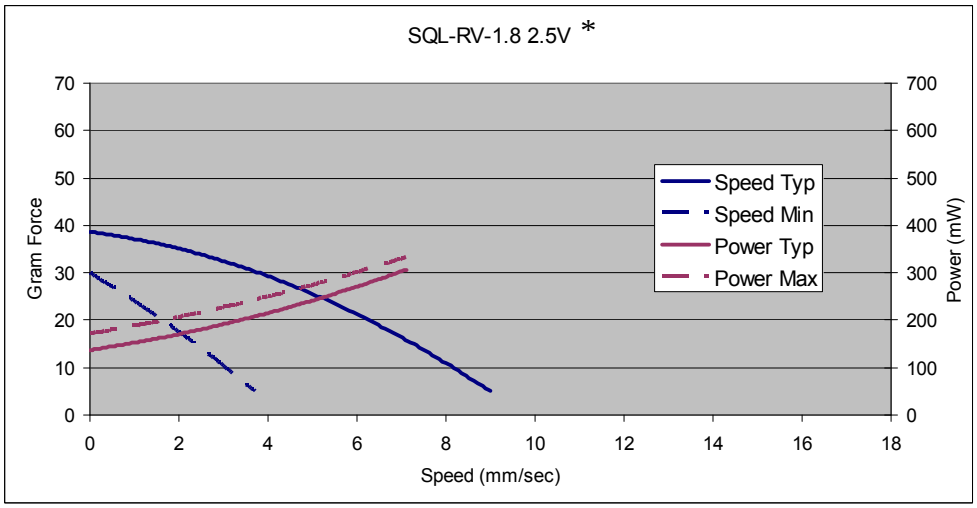
SQL-RV-1.8-6-12 SQUIGGLE motor specifications

Unmatched Size and Performance

SQL-RV-1.8 and NSD-2101 driver provide a broad range of performance over a range of voltages as shown. The graphs below represent the force and speed performance of the motors at various input voltages to the NSD-2101 IC. Also shown is the power required at various voltages to achieve a range of linear motor speeds. The power curves are generated with a 15 gram of axial load applied to the motor.







* Above power curves at 15 gram force load

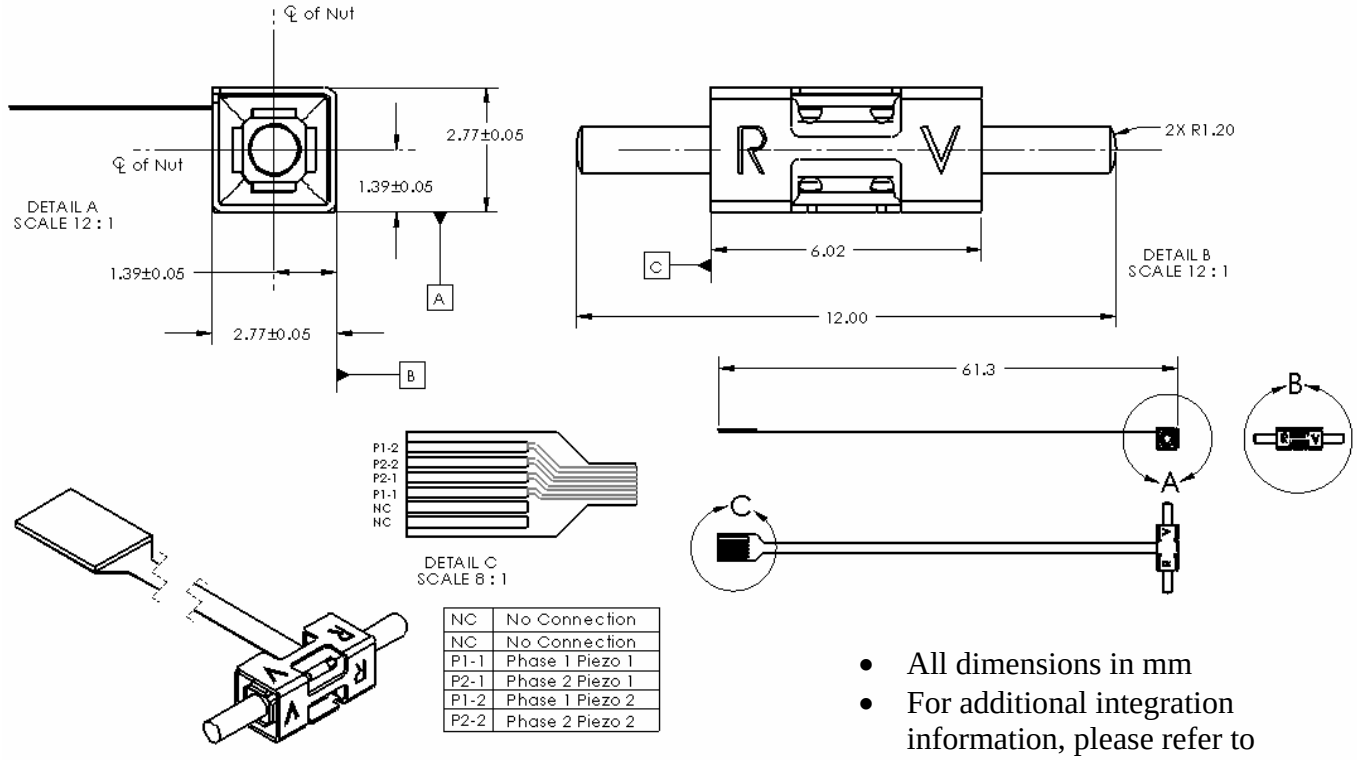
SQL-RV-1.8-6-12 SQUIGGLE motor specifications

System Performance Specifications

The table at the right shows typical motor and controls performance specifications. The SQUIGGLE RV drive system provides high force, speed, efficiency and resolution, with robust, long term performance.

SQL-RV-1.8 and Controls Minimum Specifications	
Travel Range	6 mm (call for custom)
Housing Dimensions	2.8 x 2.8 x 6 mm
Stator Dimensions	1.8 x 1.8 x 6 mm
Stall Force (4.5V input)	50 gram force // 0.5 N (55 gram force // 0.55N typical)
Speed (at 15 gram load)	> 7 mm/s (10 mm/sec typical)
Resolution	0.5 µm
Input Power (stopped)	OFF POWER HOLD (0 mW)
Input Power to motor driver (moving) *	< 340 mW (direct drive)
Input Power to controller components (moving)*	< 1 mW (MC-33DB-RV) ~330 mW (MC-33MB controller)
Lifetime **	>1 Million cycles
Operating Temperature	-30 to +80° C
Storage Temperature	-40 to +85° C
Shock Resistance ***	2500 Gs
Operating Frequency	~ 171 KHz
Motor Controller	MC-3300-RV (Controller for 2 Motors) └MC-33DB-RV (one per) └NSD-2101 Driver IC (qty 2)
Weight	0.16 grams

* Power depends on input voltage, speed & load. Shown at 15g load. Measured at 2.8V, 7mm/sec
** Continuous operation at full speed, room temperature, 15 gram force load.
*** Motor Only - zero mass load.



NC	No Connection
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P1-1	Phase 1 Piezo 1
P2-1	Phase 2 Piezo 1
P1-2	Phase 1 Piezo 2
P2-2	Phase 2 Piezo 2

- All dimensions in mm
- For additional integration information, please refer to SQL-RV-1.8 motor manuual

SQL-RV-1.8 motor controller

The MC-3300-RV is a full-function controller. The mother board includes a processor, 12-bit A/D converter for analog position feedback, digital differential quadrature feedback, I^2C feedback for TRACKER, and a USB interface for easy connection to a PC and communication through New Scale Pathway software.

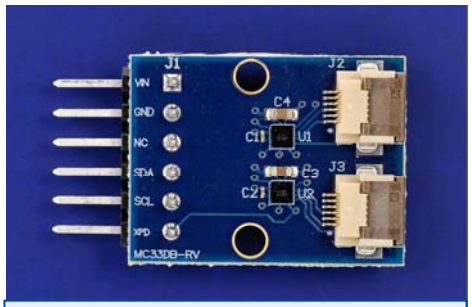
The MC-33DB-RV daughter board contains two NDS-2101 driver ICs, capacitors and motor connectors. The daughter board and ICs are available separately for integration into OEM systems.

MC-3300-RV motor controller specifications	
Input Power	2.3 to 5.5 V DC 1.6 W max system power*
Output Signals	Two sets of 4 high frequency half-bridge control signals providing control for qty. 2 SQL-1.8-RV motors (+P1-1, -P1-2, +P2-1, -P2-2)
Control Input	USB interface for PC control using New Scale Pathway Software (included); LabView or other application Analog input position servo I^2C serial interface (custom option only)
Position Sensor Input	Digital (differential quadrature, single axis only) Analog (12 bit A/D converter) Limit switch input I^2C (TRACKER only)
Closed Loop Commands	13 commands including Speed, Move to Target, Step, Zero, Enable Reference Mark
Open Loop Commands	17 commands including Speed, Run, Stop, Timed Step(s)
Dimensions (*l* x *w* x *h*)	1.2 x 2.3 x 0.63 inches (29 x 58 x 16 mm)

* Each motor requires only a few hundred mW drive power. Refer to performance curves on page 2.

MC-3300-RV Motor Controller drives one or two SQL-RV Series SQUIGGLE motors. It allows OEMs to easily evaluate open-loop and closed-loop performance of the motors and the NSD-2101 driver.

MC-33DB-RV daughter board	
Input Power	2.3 to 5.5 V DC
Output Signals	Two sets of 4 high frequency half-bridge control signals providing control for qty. 2 SQL-1.8-RV motors (+P1-1, -P1-2, +P2-1, -P2-2)
Control Input	I^2C serial interface
Dimensions (*l* x *w* x *h*)	23 x 18 x 13 mm (0.9 x 0.7 x 0.5 inches)



The MC-33DB-RV daughter board contains two NDS-2101 IC's and is easily removable from the MC-3300-RV controller when direct input is via I^2C is desired.

NSD-2101 motor driver IC specifications	
Input Power	2.3 to 5.5 V DC
Output Signals	ONE set 4 high frequency half-bridge control signals providing control for ONE SQL-RV-1.8 motors (+P1-1, -P1-2, +P2-1, -P2-2)
Control Input	I^2C serial interface
Dimensions (*l* x *w* x *h*)	1.8 x 1.8 x 0.6 mm ball grid array chip scale pkg **or** 4 x 4 x 0.9 mm 16-pin QFN (min order quantities apply for QFN package)

See detailed NSD-2101 specification sheet for additional information.

SQL-RV SQUIGGLE motor Developer's Kits

(see Developer's Kit Datasheets for additional information)

Full-featured system development platform

SQL-RV motor Developer's Kits provide a convenient platform for initial evaluation of the RV motion system through prototype integration. The basic Developer's Kit contains one SQL-RV motor, the New Scale Pathway™ PC Software and MC-3300-RV motor controller containing two NSD-2101 IC's. This system can be used to control up to two SQL-RV motors and when combined with New Scale's TRACKER position sensors or other encoders, provides the basis for a precision, multi-axis closed-loop system.

The motor and controller can be easily removed for integration into your prototype.

Open-loop vs. closed-loop operation

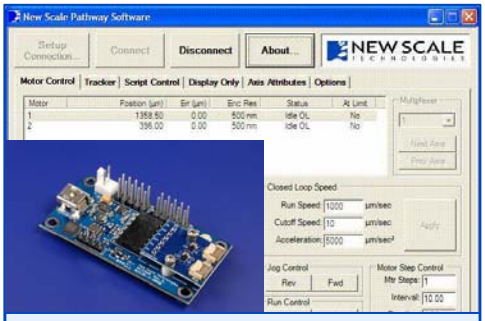
The SQL-1.8-RV SQUIGGLE is an open-loop motor with 0.5 µm resolution. We recommend using a linear sensor such as New Scale's TRACKER NSE-5310 encoder for closed-loop operation when repeatable step size, absolute position or precise velocity control is needed.

Developer's Kits are available in Open and Closed-Loop versions. The Closed-Loop Developer's Kit includes one SQL-RV-1.8 Motor and one TRK-1T02 TRACKER NSE-5310.

See *Creating Closed-Loop Positioning Systems Using SQUIGGLE Motors* for more information
www.newscaletech.com/application_notes.html

Ordering information

Order online at http://shop.newscaletech.com or find your nearest distributor at http://www.newscaletech.com/contactus.html



System development platform: MC-3300-RV controller with NSD-2101 drive IC, plus New Scale Pathway™ software for motor and driver evaluation, system development and prototype test.

SQL-RV-1.8 Developer's Kits Battery operated; ready-to-use kits includes motor in a mechanical stage, an MC-3300-RV controller and New Scale Pathway™ software with an optional TRACKER position sensor.

Part Number	Description
DK-RV-1.8-33 Open-Loop Developer's Kit	One SQL-RV-1.8-6-12 SQUIGGLE motor, mounted in a reference design module demonstrating proper motor loading, mounting and alignment. Integrated with MC-3300-RV motor controller in a protective case. Kit is easily disassembled for integration into your system. Includes USB cable, New Scale Pathway Software and user guides. Battery operated (2 AA batteries included).
DK-RV-1.8-TRK-33 Closed-Loop Developer's Kit	One SQL-RV-1.8-6-12 SQUIGGLE motor - and one TRK-1T02 TRACKER *NSE-5310 miniature position sensor* with 11 mm magnet - mounted in a reference design module demonstrating proper motor loading, mounting and alignment. Integrated with MC-3300-RV motor controller in a protective case. Kit is easily disassembled for integration into your system. Includes USB cable, New Scale Pathway Software and user guides. Battery operated (2 AA batteries included).
SQL-RV-1.8-6-12 motor	SQL-RV-1.8 motor with 6 mm travel range / 12 mm screw length.* (Each MC-3300-RV controller or DK Developer's Kit can drive two motors).
MC-3300-RV Controller	Drives two SQL-RV-1.8 motors. New Scale Pathway Software included.
PCS-3V-K	Optional AC Power option for MC-3300-RV or Developer's Kits. 110/220VAC international power adapter, 3.3 V. Power cable connects AC adapter to MC-3300-RV.
NSD-2101	Piezo motor drive IC in WLCSP. Available in OEM quantities; contact the factory.

**Call us for custom travel range and screw length*