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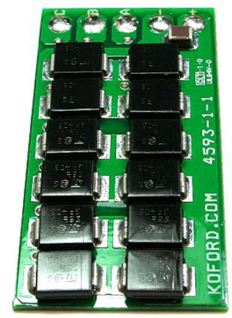


# Generators

• Standard sensorless motors when driven by a power source with the output leads connected to a three phase bridge rectrifier diode board act as a generator.

•Power up to 500 watts and input rpm up to 200,000 are available, speeds up to 400,000 rpm have been achieved using a sleeved rotor in the frameless configuration.

Applications include generators for UAV's, isolated electric power from compressed air or using a standard AC motor to drive the generator using a dielectric drive shaft, and starter/generators for gas turbines.

•Sensorless motors if connected directly to a three phase load produce a three phase AC voltage equal to the input frequency times the number of pole pairs.  For example for an input speed of 24,000 rpm a two pole motor will generate a 400 hz output.  The voltage will depend on the rpm/v and the load.  Contact the factory for more details.

•Four different  rectrifier diode boards available for different power levels.

•Low loss Schottky diodes used on boards for highest possible efficiency.

•Higher voltages available on special order

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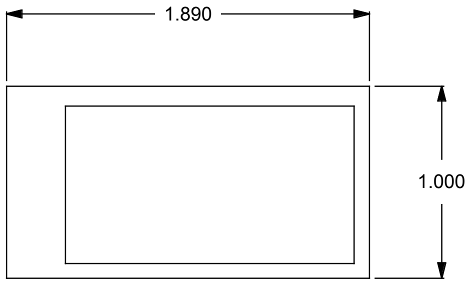
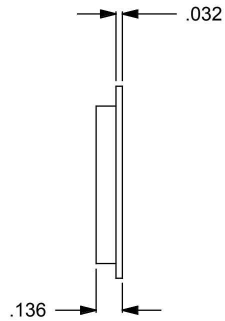
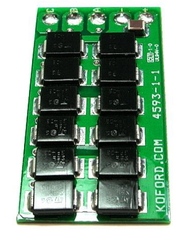
# D1 rectifier diode board 24v 8 amps

## For epoxy attachment




Absolute maximum voltage 40V. Absolute maximum output current 8 amps. Voltage drop at 6 amps .8V. Connection to circuit by soldering to pads. Motor leads solder to A, B, C, output leads solder to + and -, weight .4 oz.

Total System Performance
22S1200A motor with D1 diode board
Driven at 8,326 rpm

| Voltage (V) | Current (A) | Power (watts) |
|---|---|---|
| 6.95 | 0.00 | 0.00 |
| 5.84 | 0.12 | 0.70 |
| 5.81 | 0.13 | 0.76 |
| 5.78 | 0.14 | 0.81 |
| 5.72 | 0.15 | 0.86 |
| 5.70 | 0.17 | 0.97 |
| 5.57 | 0.19 | 1.06 |
| 5.53 | 0.22 | 1.22 |
| 5.42 | 0.26 | 1.41 |
| 5.39 | 0.32 | 1.73 |
| 5.00 | 0.40 | 2.00 |

Total System Performance
22S1200A motor with D1 diode board
Driven at 18,445 rpm

| Voltage (V) | Current (A) | Power (watts) |
|---|---|---|
| 15.72 | 0.00 | 0.00 |
| 13.73 | 0.29 | 3.98 |
| 13.66 | 0.31 | 4.23 |
| 13.54 | 0.34 | 4.6 |
| 13.48 | 0.38 | 5.12 |
| 13.32 | 0.42 | 5.59 |
| 13.21 | 0.48 | 6.34 |
| 13.06 | 0.55 | 7.18 |
| 12.84 | 0.65 | 8.35 |
| 12.51 | 0.79 | 9.88 |
| 12.00 | 1.02 | 12.24 |

Total System Performance

22S1200A motor with D1 diode board

Driven at 36,477 rpm

| Voltage (V) | Current (A) | Power (watts) |
| --- | --- | --- |
| 31.20 | 0.00 | 0.00 |
| 27.67 | 0.58 | 16.05 |
| 27.50 | 0.64 | 17.60 |
| 27.34 | 0.70 | 19.14 |
| 27.09 | 0.77 | 20.86 |
| 26.82 | 0.86 | 23.06 |
| 26.49 | 0.97 | 25.70 |
| 26.12 | 1.12 | 29.25 |
| 25.60 | 1.31 | 33.54 |
| 25.01 | 1.60 | 40.02 |
| 24.00 | 2.05 | 49.20 |

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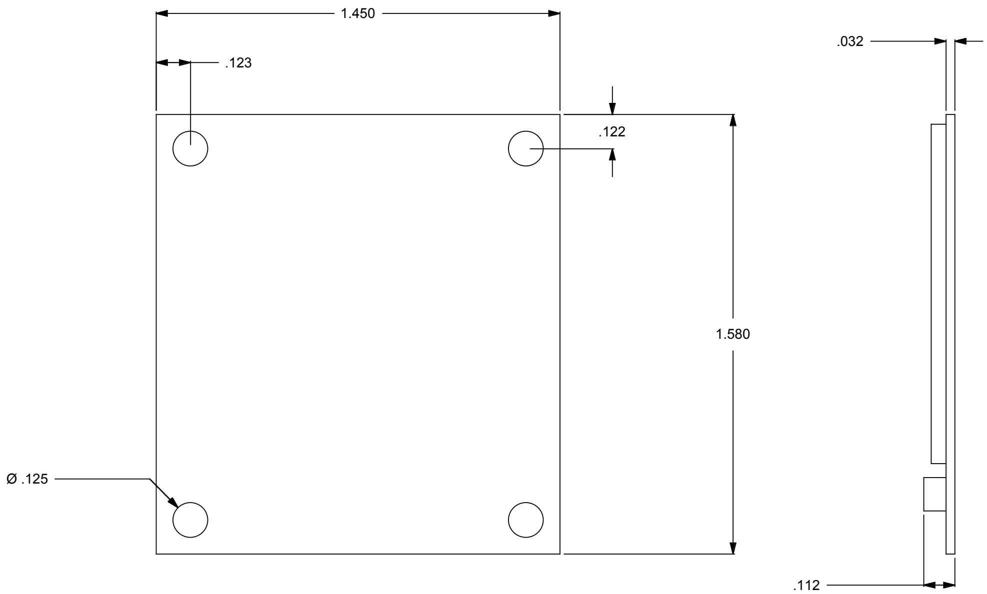
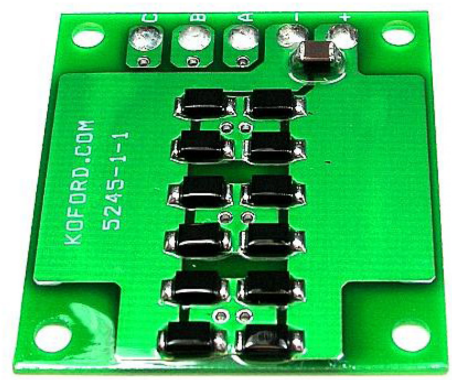
# D2 rectifier diode board 24v 15 amps

## For screw attachment




Absolute maximum voltage 40V. Absolute maximum output current 15 amps. Voltage drop at 10 amps .76V. Connection to circuit by soldering to pads. Motor leads solder to A, B, C, output leads solder to + and -.

Total System Performance

22S2667A motor with D2 diode board

Driven at 19,200 rpm

| Voltage (V) | Current (A) | Power (watts) |
|---|---|---|
| 8.20 | 0.00 | 0.00 |
| 6.32 | 0.62 | 3.92 |
| 5.56 | 1.00 | 5.56 |
| 5.00 | 1.55 | 7.75 |

Total System Performance

22S2667A motor with D2 diode board

Driven at 36,000 rpm

| Voltage (V) | Current (A) | Power (watts) |
|---|---|---|
| 15.29 | 0.00 | 0.00 |
| 13.05 | 0.50 | 6.53 |
| 12.51 | 1.00 | 12.51 |
| 12.00 | 1.50 | 18.00 |

Total System Performance

22S2667A motor with D2 diode board

Driven at 66,663 rpm

| Voltage (V) | Current (A) | Power (watts) |
|---|---|---|
| 28.30 | 0.00 | 0.00 |
| 27.70 | 0.03 | 0.83 |
| 25.50 | 0.25 | 6.38 |
| 24.88 | 0.50 | 12.44 |
| 24.42 | 1.00 | 24.42 |
| 24.00 | 1.50 | 36.00 |

Total System Performance

22S2667A motor with D2 diode board

Driven at 78,310 rpm

| Voltage (V) | Current (A) | Power (watts) |
|---|---|---|
| 34.21 | 0 | 0 |
| 29.21 | 0.50 | 14.61 |
| 28.60 | 1.00 | 28.60 |
| 28.00 | 1.50 | 42.00 |

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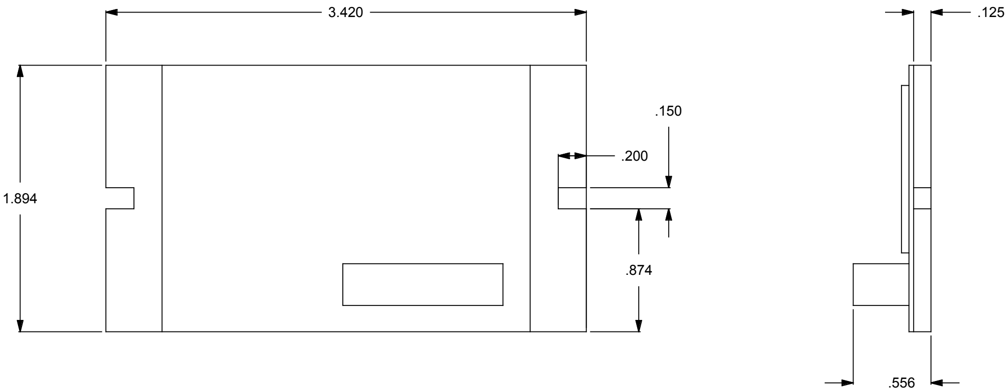
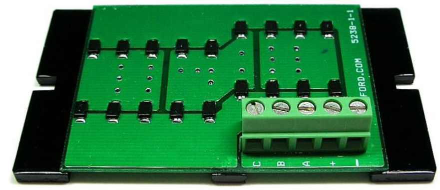
# D3 rectifier diode board 24v 20 amps

## For screw attachment



Absolute maximum voltage 40V. Absolute maximum output current 20 amps. Voltage drop at 15 amps .76V. Connections by terminal blocks. Motor leads connect to A, B, C, output leads connect to + and -

| Total System Performance | | |
|---|---|---|
| 60H805T Motor with D3 diode board | | |
| Driven at 25,360 rpm | | |
| Voltage (V) | Current (A) | Power (W) |
| 31.35 | 0.00 | 0.00 |
| 29.60 | 4.78 | 141.49 |
| 29.03 | 9.57 | 277.82 |
| 28.80 | 14.30 | 411.84 |
| 28.00 | 19.30 | 540.40 |

| Total System Performance | | |
|---|---|---|
| 42S952A Motor with D3 diode board | | |
| Driven at 32,880 rpm | | |
| Voltage (V) | Current (A) | Power (W) |
| 35.2 | 0.0 | 0.00 |
| 32.2 | 5.3 | 170.66 |
| 31.3 | 10.1 | 316.13 |
| 30.3 | 14.8 | 448.44 |
| 28.0 | 19.6 | 548.80 |

For operation above 450 watts use a cooling fan directed at side of motor

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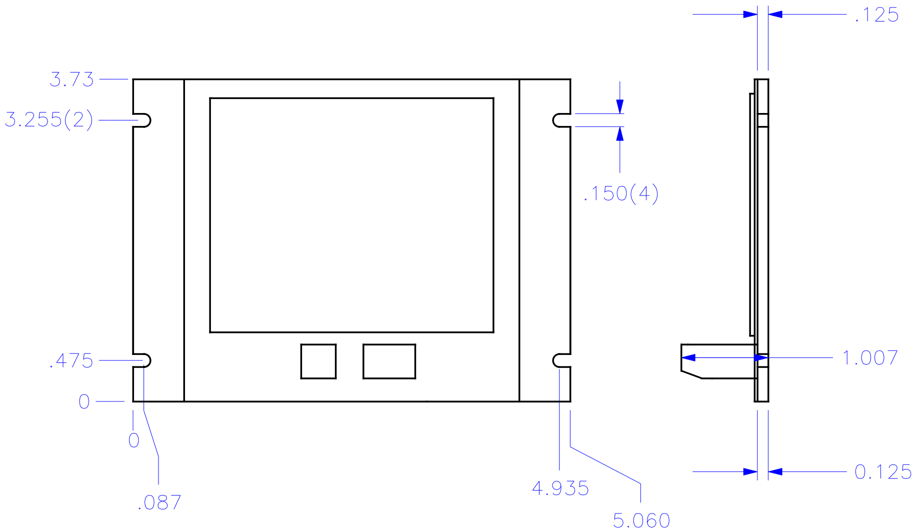
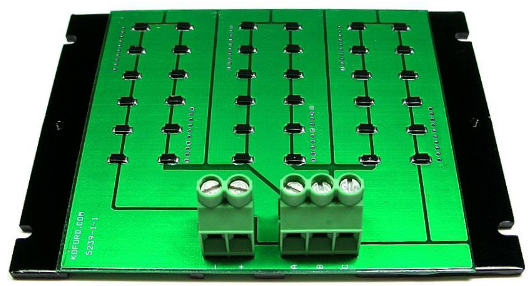
# D4 rectifier diode board 24v 30 amps

## For screw attachment



Absolute maximum voltage 40V. Voltage drop at 30 amps .76V. Connections using terminal blocks. Motor leads connect to A, B, C, output leads connect to + and -

## Unit conversions

°F -32 ÷1.8=°C example: 212°F=100°C, °C x1.8+32=°F example: 100°C=212°F, in x 25.40=mm, mm x.03937= in., oz x 28.3495=g, oz-in x 7.06=mNm, mNm x .142=oz-in, Nm x .142=oz-in, Ncm x 1.42=oz-in, rpm x .1047=rad $s^{-1}$, V/R/S x .1047=volts/rpm, 746 watts=1hp, lb-$in^2$ x .04144=oz-in-$sec^2$

## Generator cooling

The continuous output torque which can be achieved from a motor is limited by the allowable maximum temperature. This in turn is determined by the cooling provided by the user, and the ambient temperature. The data sheet lists continuous current with a 20°C (68°F) ambient. Two values are listed, the first with the motor case cooled to 20°C and the second with no cooling in still air. Most applications will fall somewhere between these two extremes. If the ambient temperature is above 20°C then the continuous current is reduced. Generators are available with temperature sensors and this can be useful during prototyping to evaluate cooling. The actual limitation is the rotor (magnet) temperature, but since the windings surround the rotor, the temperature can be assumed to be the same in most cases. For applications in air the allowable output torque can be increased by mounting the motor to a thick aluminum plate with surface area several times larger then the surface area of the motor. Further improvements can be obtained with the use of a fan directed at the body of the motor. Even higher performance can be obtained by the use of a refrigerant cooled sleeve around the outside diameter of the motor coupled with heatsink grease. If the motor housing can be cooled below 20°C then improved performance above data sheet values can be obtained. If only natural convection is used and the motor is mounted to plastic or a low thermal conductivity material such as steel then consideration should be given to ensuring free flow of air over the motor. Placing the motor in a small enclosed space with poor thermal connection to the outside ambient can result in considerable reduction in the amount of output power possible without overheating. When performing temperature rise calculations remember that the resistance of the copper windings increases with temperature. You must use the resistance at the operating temperature not at 20C.

## Frameless generators

Frameless generators are useful for certain specialized applications where housed generators cannot be used. These include air bearing or magnetic bearing generators.

## Generator hook up

The output wires should be trimmed as short as possible to reduce EMI and power losses. Where electrical noise is a consideration the wires may be twisted or braided with each other or enclosed in a shielded jacket.

## System efficiency

The system efficiency is different then the generator efficiency. The system efficiency takes into account generator losses, lead wire losses, and three phase bridge losses Additional losses can occur if the generator is not isolated from a DC to DC converter and the current is not continuous. Most DC to DC converter designs will have input filtering such a input caps and or inductors that will avoid this additional losses. If heat rise is an issue and there is signuficiant current ripple at the pwm frequency of the DC to DC converter then additional filtering may be advised.