

PRODUCT BRIEF
PB 5127, Rev B

SENSORLESS BLDC MOTOR DIGITAL SPEED CONTROLLER



The Digital Vector Motor Drive is a digital motor controller designed for high reliability and industrial motor control applications. This controller utilizes space vector modulation control design for maximum utilization of the DC bus voltage and provides smooth torque control. The DC bus voltage operating range is 100V to 800V. The flexibility of this design allows use of a single device/part number for multiple motor applications with few hardware changes. There are two internal assemblies in a small footprint module: the Field Oriented Control (FOC) hardware and a 3-Phase Bridge. The FOC hardware is programmable via an isolated RS-232 input port, and the 3 Phase Bridge designs are rated up to 40A, 1000V utilizing IGBT's or 60A, 150V with MOSFETs. The sensorless algorithm allows start up to be tuned for almost any load.

Features

- Sinusoidal Sensorless Speed Control
- Vector Drive FOC with Space Vector PWM
- Available Power stages use IGBT's rated to 1200V or MOSFET's rated to 600V
- 75A peak phase, 800V steady state operation
- Top speed of 74,000+ RPM; 4 pole motor
- Re-configurable firmware
- Programmable PWM 7-20Khz
- Isolated RS232 interface
- Programmable digital Control lines
- Digital Tach and Direction output via RS232
- Smart gate drivers with de-sat protection
- Boot-strap powered high sided gate driver
- Integrated phase current sensors
- DC bus voltage sensor

Protection

- DC Bus Overvoltage
- DC Bus Undervoltage
- DC Bus Critical Detection
- Phase Loss Detection
- Zero Speed Detection

Operating Baseplate Temperature

- -40°C to 85°C

Power Requirements

- Bus Voltage to 800 VDC
- +3.3V +/-5%
- +5.0V +/-5%
- +15V +/-10%

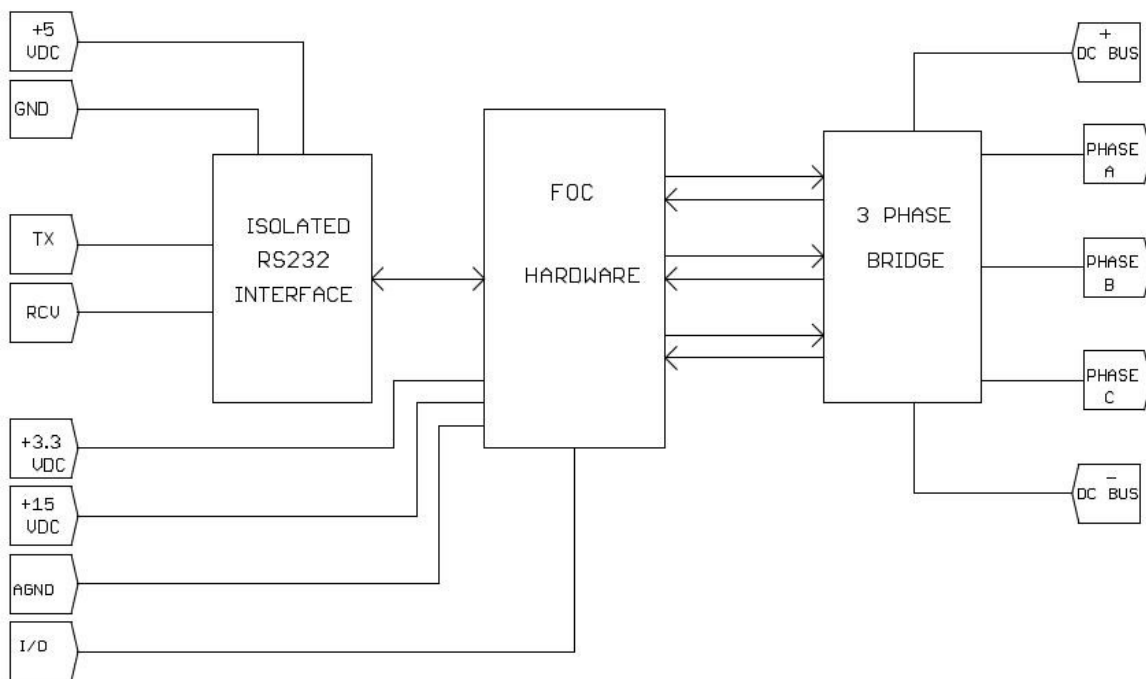
Application Areas:

This product is intended to be used in high reliability military and industrial motor control applications. The design can be used for pump and fan applications in the following markets:

- **Military Ground Vehicles**
- **Industrial Equipment**
- **Heavy Duty Vehicles**
- **Lifts**
- **Compressors**
- **Fans**

BLOCK DIAGRAM

The vector drive is programmed via an Isolated RS232 Interface to configure the motor and control parameters. The FOC Hardware has an inner torque loop (Sinusoidal/Space Vector/FOC -Field Oriented Control) and an outer speed loop. The torque loop uses a digitally tunable P+I controller and integrated phase current sensors. The speed loop uses a digitally tunable P+I controller and speed feedback derived from the FOC. Sensorless startup is performed open loop using a Volts-per-Hertz algorithm. The Volts-per-Hertz startup parameters are digitally configurable. Space vector modulation allows for the motor line to line voltage to reach the full DC Bus Voltage without waveform clipping unlike other sinusoidal control methods.



SOFTWARE

The device is configured using a windows based Configuration Utility. The Utility configures the motor parameters through the RS232 interface. It also is designed to control/run a motor directly while monitoring information such as speed, current and voltage. This software enables the controller to operate a motor with improving engineering development time on motor control applications.

The list below shows the motor input parameters and typical Application parameters:

Motor Input Parameters

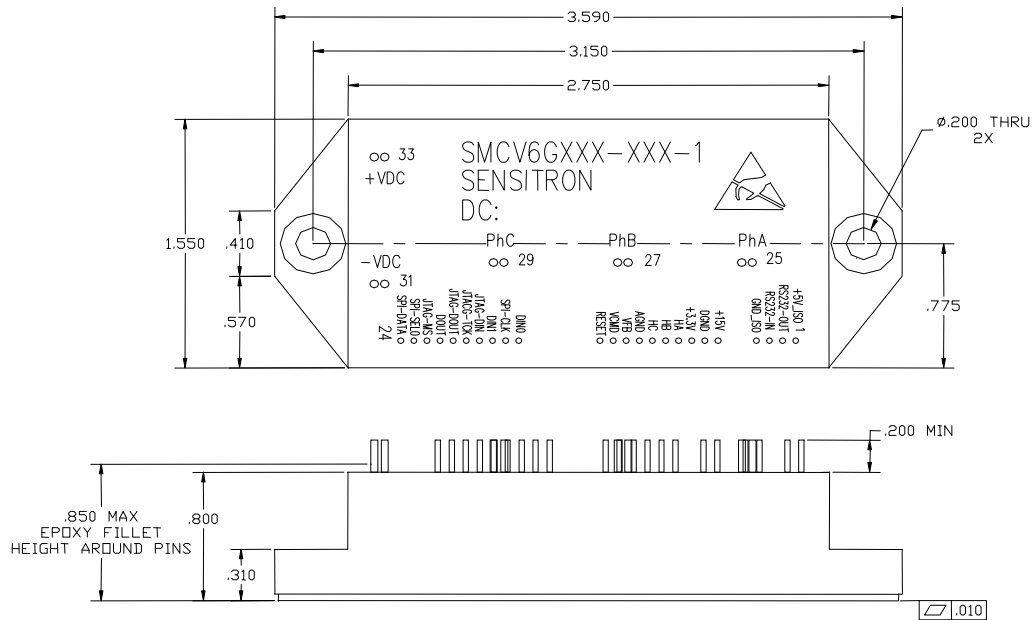
- RPM
- Current
- Poles
- Inertia
- Stator Resistance
- Inductance
- Kt, Ke

Application Information

- Maximum RPM
- Nominal dc bus voltage
- Current Limits – Start, Regen
- Running Speed – Max, Min, Coast, Stop
- Protection Levels – Speed, Phase Loss, DC Bus
- Speed & Current Regulator Bandwith

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OUTLINE DRAWING:



Configuration Utility:

Configuration Utility - Sensitron SMCVxxx, Version 3.0.11.0

File SMCV SMCV6G040-120-1 Windows

SYNCHRONIZED with SMCV

| DC Bus Parameters | | Load Parameters | |
|-------------------------|------------|-------------------|--|
| Nominal DC Bus Voltage | 159.9185 V | Load Inertia | 0.009100 kg-m ² (including motor rotor) |
| DC Bus Over Voltage | 401.3640 V | Acceleration Rate | 4999.8633 RPM / sec |
| DC Bus Under Voltage | 50.1705 V | Deceleration Rate | 999.2576 RPM / sec |
| DC Bus Critical Voltage | 451.5345 V | | |

| Sensorless startup Parameters | | Motor Parameters | | Speed Control Parameters | |
|-------------------------------|---------------------|---------------------|-----------------------------------|----------------------------|---------------------|
| Parking Current | 60.1623 % of Rated | Motor Rated Amps | 2.2565 Arms | Set P+I Gains | P+I |
| Parking Time | 1.9922 seconds | Motor Rated Speed | 1866.00 RPM | Speed Minimum | 200.6209 RPM |
| Startup Current | 100.0000 % of Rated | Motor Poles | 6.0000 - | Speed Maximum | 2998.8797 RPM |
| Startup Accel | 52.1413 RPM / sec | Motor Resistance | 13.6811 Ohms (line-line) | Field Weakening I Limit | 0.9975 Apk |
| Start OK Delay | 49.1500 msec | Motor Lq Inductance | 41.8561 mH (line-line max) | | |
| | | Motor Ld Inductance | 41.8561 mH (line-line min) | Current Control Parameters | |
| | | Motor Ke | 60.6000 Vrms /kRPM (line to line) | Set P+I Gains | P+I |
| | | Motor KT | 1.0700 Nm/Arms | Accel Current Limit | 100.0000 % of Rated |
| | | | | Decel Current Limit | 0.0000 % of Rated |

| Operating Frequencies | |
|-----------------------|-------------|
| fssystem | 50.0000 MHz |
| fPWM | 10.0000 kHz |

Baseplate Temperature Limit 75.0183 °C

Auto-Set All to Max Bandwidths

Read Complete

PART NUMBER INFORMATION:

| Part Number | Recommended Operating DC Bus Supply Voltage | Absolute Peak DC Bus Voltage | Recommended RMS Output Motor Current | Peak Over Current Shutdown Protection | Design Peak Output Current |
|--------------------|--|-------------------------------------|---|--|-----------------------------------|
| SMCV6G040-120-1 | 600 | 1200 | 20 | 39 | 42 |
| SMCV6G050-060-1 | 300 | 600 | 25 | 39 | 80 |
| SMCV6M060-025-1 | 120 | 250 | 25 | 39 | 80 |
| SMCV6M080-010-1 | 50 | 100 | 25 | 39 | 80 |
| | High Current Applications | | | | |
| SMCV6G050-060-1A | 300 | 600 | 50 | 74 | 80 |
| SMCV6M060-025-1A | 120 | 250 | 50 | 74 | 80 |
| SMCV6M080-010-1A | 50 | 100 | 50 | 74 | 80 |

NOTE: Evaluation boards, Software GUI and additional technical information are available. Please contact the factory.

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