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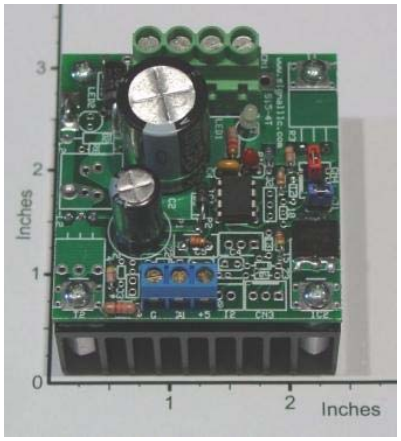
# Si5PiUdMC1-30V-32A, Single, Open-Loop, Pulse Input, Unidirectional 30V-32A Motor Controller with Integrated Heat Sink and with 5kHz or 20kHz Output PWM, T-Chip




The **Si5PiUdMC1-30V-32A** is a 30V, 32A, microprocessor based, Single, Open-Loop, Pulse-input, Unidirectional Motor-Controller board that uses pulse-width modulation (**PWM**) to efficiently control the speed of a brush type DC motor (or load current ) in the 0 to 960W power range, with 8.0W steps. An onboard microprocessor generates a 5kHz or 20kHz output **PWM** carrier signal, controls the load-power (or motor speed) and controls the load-current rate (or motor acceleration and deceleration). The output **PWM** carrier frequency is user selectable by the jumper **CN4**, 20kHz when **CN4** is open and 5kHz when short. The high frequency PWM rate provides a smooth speed control and insures a quiet motor environment. As the name hybrid (**Pi**) implies, the desired motor speed (or PWM pulse-duration) is set by a variable pulse-duration 0-12V, **PWM** input-voltage ($\mathbf{V_{I1,G}}$) with carrier frequency greater than 120Hz. This input contains an RC integrator with Time-Constant of 0.5 sec and a 5.1V clipping circuit that provides protection. The user can choose between slow or fast motor acceleration/deceleration modes by short-circuiting or open-circuiting the pins labeled **J1**. The slow mode, with rise-time/fall-time of 1.5s, is selected by short-circuit (**J1** jumper installed); while the fast buildup mode, with rise-time/fall-time of 0.75s, is selected by leaving these pins open (no Jumper installed). All control lines (analog and digital) are sampled approximately at 20Hz rate in the fast mode, and at 15Hz rate in the slow mode. An onboard LED (red) is used to monitor the load-voltage. A small (2.3"x2.4"x0.95") finned integrated heat sink is included with mounting hardware (as shown on the photograph) to operate at 32A or 960W power levels. Higher power-levels (30V, 40A or 1200W) can be achieved with more efficient heat-sinks. Please click on this link and read the **Board Mounting Instructions and Heat Sink Selection Guide**. This board requires a single 9V to 30V DC power source (unregulated) at a 0A to 32A current range to operate normally. Typical applications are: DC Motor-Speed Controller, Light-Dimmer with variable delay, Power Amplifier, SPST Solid State Relay, etc. This board can be configured and programmed to perform efficiently in many customized applications.

## Specification and Application for Si5PiUdMC1-30V-32A

- **Typical Operating Temperature at 32A:** $45^0$C with the Metal Heat-Ring Bolted to a small (2.3"x2.4"x0.925") finned Aluminum Heat-Sink, while it is exposed to ambient air at $25^0$C (as shown on photograph).
- **Source-Voltage Requirement ($\mathbf{V_P}$ from pin +P to pin -P):** Any DC voltage from 9V to 30V, unregulated DC.
- **Average Load-Voltage:** Linearly variable from 0 to $\mathbf{V_P}$ in 0.83% steps, using $\mathbf{V_{I1,G}}$ as control input.
- **Max. Continuous Average Load-Current:** 32A at 100% duty-cycle, with heat-sink (as shown).
- **Max. Load-Current for 5sec:** 40A at 100% duty-cycle, with heat-sink (as shown).
- **Load Isolation:** The Load or Motor must be isolated from the source voltage ($\mathbf{V_P}$).
- **Power-Conversion Efficiency:** Approximately 97.5% at full-load (30V and 32A).
- **Output PWM Switching Frequency:** 5kHz when **CN4** short and 20kHz when **CN4** open.
- **Output PWM Duty-Cycle:** varies linearly from 0% to 100% in 0.833% steps, using a 0 to 12V, <120Hz PWM $\mathbf{V_{I1,G}}$ as control voltage (voltage at pin **I1** relative to pin **G** on connector **CN5**). Where a 0% Input PWM on $\mathbf{V_{I1,G}}$ yields 0% Output and a 100% input PWM yields 1000%, output PWM.
- **Load-Current Step-Response Time:** The user can choose between slow or fast motor acceleration/deceleration modes by short-circuiting or open-circuiting the pins labeled **J1**. The

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slow mode, with rise-time/fall-time of 1.5s, is selected by short-circuit (**J1** jumper installed); while the fast buildup mode, with rise-time/fall-time of 0.75s, is selected by leaving these pins open.

- **Jumper Selection:** The **J1** and **CN4** control jumpers are examined only when the power is turned on, consequently the power must be turned off for 10 sec when these jumpers are reconfigured.
- **Motor-Indicator and Board Protection:** An onboard LED (red) is used to monitor the motor (or load) voltage, and the analog control inputs are zener diode protected.

**About the Voltage Requirement:** The Si5 will work with any DC motor or load in the 9 V to 30 V voltage range. In addition, the power filters are included on this board, consequently, only unregulated (full-wave rectified) DC input power is required in most applications.

## A Typical Application of the Si5PiUdMC1-30V-32A

In this application, the motor speed (or PWM pulse-duration) is linearly adjusted with a 0 to 12V, 120Hz, variable pulse-duration PWM input signal applied to I1 pin ($V_{I1,G}$). This input signal is efficiently controlling the motor power from 0 to 960W in 8.0W steps. The DC Motor can be purchased from Bodine, **www.bodine-electric.com**.
Or from other vendors: **http://www.e-motorsonline.com/emotors/dcmproduct_list.php**.

An inexpensive, unregulated DC power supply design is shown in this application drawing. This power supply consists of a transformer, a 40A bridge rectifier and an optional C=2200uF, 35V capacitor (**www.digikey.com** part number **493-1323-ND**). The secondary voltage and current rating of the transformer determines the DC voltage and current output of this power supply. Low-voltage and low-current transformers can be purchased from www.mpja.com with the following part numbers: for 33V, 10A DC output use transformer **7846-TR**; for 16V, 4A DC output use transformer **7840-TR**. A wide variety of linear and switching power supplies can also be used with this board. Consult the most recent catalog on www.mpja.com to purchase these power supplies. **Warning: The connecting wires to the Motor and the Power Supply must be heavy gauge copper wire (#10 AWG or heavier) to handle the rated current level. In addition, these heavy gauge wires act as a heat sink, protecting the board from overheating.**