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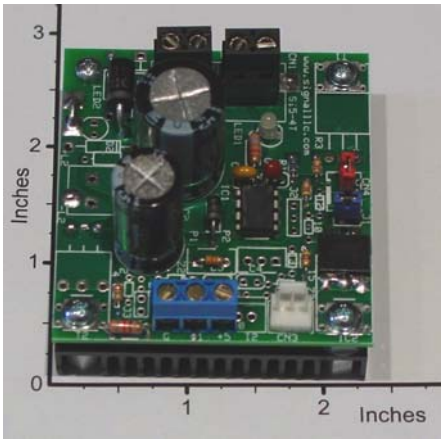
Si5HyUdMCAF1-50V-20A, Single, 50V 20A, Closed-Loop, Hybrid, Unidirectional, Motor Controller with an Integrated Heat Sink, Analog Feedback Port and with 5kHz or 20kHz PWM, T-Chip



The **Si5HyUdMCAF1-50V-20A** is a 50V 20A, microprocessor based, Single, Hybrid, Closed-Loop, Unidirectional, Motor-Controller board with an Integrated Heat Sink and with an Analog Feedback Port. This board uses pulse-width modulation (**PWM**) to efficiently control the speed of a brush type DC motor (or load current) in open or closed loop control mode in the 0 to 1000W power range, and in 8.3W steps. An onboard microprocessor generates a 5kHz or 20kHz **PWM** carrier signal, regulates the motor speed, controls motor the acceleration/deceleration, and monitors the sensor inputs. The **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 motor-speed control, and insures a quiet motor environment. As the name hybrid (**Hy**) implies, the desired motor speed (or PWM pulse-duration) is set by a variable analog input-voltage $\mathbf{V_{I1,G}}$ (0 to +5V, applied to pin **I1** relative to pin **G**, on port **CN4**) providing a smooth motor-speed control from 0 to 100% in 0.833% steps while the other control signals are digital. The user can choose between open-loop or closed-loop modes by short-circuiting or open-circuiting the pins labeled **J1M**. An open-circuit (no jumper) selects the open-loop mode, while short-circuit (jumper installed) selects the closed-loop mode. In closed-loop mode, the external analog voltage $\mathbf{V_{F,G}}$ (0 to 5V, applied to pin **F** relative to pin **G** on port **CN3**) provides the feedback, keeping the motor-shaft rotating at a constant speed. These two analog input pins (**I1, F**) are zener-diode protected. An onboard LED (red) is used to monitor the load-voltage. A small (2.3"x2.4"x0.45") finned integrated heat sink is included with mounting hardware (as shown on the photograph) to operate at 20A or 1000W power levels. Higher power-levels (50V, 30A or 1500W) 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 50V DC power source (unregulated and unfiltered) at a 0A to 20A 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 Si5HyUdMCAF1-50V-20A

- **Typical Operating Temperature at 20A:** 45^0C with the Metal Heat-Ring Bolted to a small (2.3"x2.4"x0.45") finned Aluminum Heat-Sink, while exposed to air at 25^0C (as shown on the photograph).
- **Source-Voltage Requirement ($\mathbf{V_P}$, from pin +P to pin -P):** Any DC voltage from 9V to 50V, 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:** 20A 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 (50V and 20A).
- **PWM Switching Frequency:** 5kHz when **CN4** short and 20kHz when **CN4** open.

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- **PWM Duty-Cycle:** varies linearly from 0% to 100% in 0.833% steps, using $\mathbf{V_{I1,G}}$ as control voltage (voltage at pin **I1** relative to pin **G** on connector **CN4**): where $\mathbf{V_{I1,G}}$ = 0V yields 0%, and $\mathbf{V_{I1,G}}$ = +5V, yields 100%. Note that the Duty-Cycle is defined as the ratio of the load-voltage on-time (t) to the switching period (T) times 100% (i.e. Duty-Cycle = (t /T)100%). These variables are defined and shown below.
- **Closed-Loop Control Mode** is selected by inserting a jumper into **J1M** port and using the an external analog feedback-voltage $\mathbf{V_{F,G}}$ (0 to 5V on pin **F** relative to pin **G** at port **CN3**) to achieve motor speed regulation. The default is open-loop mode (open **J1M**).
- The $\mathbf{V_{I1,G}}$ and $\mathbf{V_{F,G}}$ inputs have a linear control range of 0 to+5V, above this range, these inputs are clipped to +5V and zener-diode protected.
- **Load-Current Step-Response Time:** Software adjustable from 0.02Sec to 0.5Sec with default value of 0.1Sec.
- **Motor-Indicator:** An onboard LED (red) is used to monitor the motor (or load) voltage.

A Typical Application of the Si5HyUdMCAF1-50V-20A

In this closed-loop application (shown below), the shaft-speed of a 24V DC Motor is controlled and regulated by the external analog feedback-voltage $\mathbf{V_{F,G}}$ (voltage at **F** relative to **G**, on port **CN3**). While the desired motor speed (or PWM pulse-duration) is linearly adjusted with the **Si5Pot1-5k** accessory (an external 1-turn 5kΩ pot); from 0 to 1000W range in 8.3W steps. These two analog voltages ($\mathbf{V_{I1,G}}$ and $\mathbf{V_{F,G}}$ with range of 0 to +5V) are efficiently controlling the motor power and maintain a constant motor speed. 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** .

Warning: The connecting wires to the Motor and the Power Supply must be heavy gauge copper wire (#12 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.