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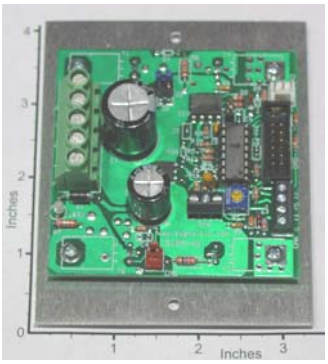
Si24DiBdMC1-50V-20A-AP1, Open-Loop, 50V 20A, Digital Bidirectional Motor Controller with Active Low Soft-Start and Soft-Stop Control, AP1 Aluminum Plate Heat Sink, LCD Port and with 5kHz or 20kHz PWM, Y-Chip



The **Si24DiBdMC1-50V-20A-AP1** is a 50V 20A, microprocessor based, high-power, Digital, Bidirectional, Motor Controller that uses a single DC power supply to control the speed of a DC motor in forward or reverse direction at a voltage-range of 9V to 50V and with a current-range of 0 to 20A. An onboard microprocessor generates a 5kHz or 20kHz **PWM** carrier signal, controls the load-power (or motor speed), controls the load-current rate (or motor acceleration and deceleration), updates the Liquid Crystal Display (LCD) and monitors the user inputs. The **PWM** carrier frequency is user selectable by the jumper **J2**, 20kHz when **J2** is open and 5kHz when short. This high frequency PWM rate insures a quiet motor environment. 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 0.5s, is selected by short-circuit (**J1** jumper installed); while the fast buildup mode, with rise-time/fall-time of 0.05s, is selected by leaving these pins open (no Jumper installed). As the name digital (**Di**) implies, the required motor speed (or PWM pulse-duration) is adjusted in 0.83% steps with **Up/Down RPM** push-buttons (connected to port **CN6**) while the motor direction is selected using two active low digital (0 to 5V) control signals ($\mathbf{V_{F,G}}$ and $\mathbf{V_{R,G}}$) or switches. A bicolor LED is used to monitor the motor (or load) voltage (Red = Forward, Green = Reverse). An LCD port (with HITACHI HD44780 Interface Standard and with back-light) is provided for optional display of motor RPM data in a 2 line by 20 character format. A small (3.3”x4.0”x0.065”) AP1 Aluminum plate, is required to operate at 20A current levels. Higher current-levels (25A 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 operates in a wide voltage-range (9V to 50V) with max. continuous current of 20A. Typical applications are: Bi-directional DC Motor-Speed Controller, Peltier Effect TE Coolers, Heat Pumps, DPDT Solid State Relay, etc.

Motor Control-Action Truth Table, (Pins on Connector CN4)

($\mathbf{V_{F,G}}$) Voltage at Pin **F** relative to pin **G**	($\mathbf{V_{R,G}}$) Voltage at Pin **R** relative to pin **G**	**Operation Mode of Motor or Load**
$\mathbf{V_{F,G}}$ = 5V or pin Open	$\mathbf{V_{R,G}}$ = 5V or pin Open	Stand-by without Braking (Motor Open)
$\mathbf{V_{F,G}}$= 0V @ 1.2mA	$\mathbf{V_{R,G}}$ = 5V or pin Open	Forward Rotation with $\mathbf{V_{PWM}}$ Control
$\mathbf{V_{F,G}}$ = 5V or pin Open	$\mathbf{V_{R,G}}$= 0V @ 1.2mA	Reverse Rotation with $\mathbf{V_{PWM}}$ Control
$\mathbf{V_{F,G}}$= 0V @ 1.2mA	$\mathbf{V_{R,G}}$= 0V @ 1.2mA	Stand-by with Braking (Motor Shorted)

The motor action or load-current direction is controlled by the voltage (0 to +5V) applied to Pin **F** (Forward) and/or pin **R** (Reverse) relative to Pin **G** (Ground) on the **CN6** connector**;** as shown in the Truth-Table given above. Similarly, the Up and Down RPM inputs on **CN4** connector use active low control, requiring a momentary low to increment or decrement the Set-RPM values. The time duration for a one-step momentary low is 7ms + or – 2ms when **J1** is open (fast mode), and 70ms + or -20ms when **J1** is short circuited (slow mode). The Set-RPM register is cleared at power turn on, always starts with zero % PWM value and can be incremented to 100% with 0.83% steps. All control lines are sampled approximately at 80Hz rate in the fast mode, and at 8Hz rate in the slow mode.

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Specification and Application of Si24DiBdMC1-50V-20A-AP1

- **Typical Operating Temperature at 20A:** 45^{0}C with the Metal Heat-Ring Bolted to **AP1** Aluminum plate (3.3"x4.0"x0.065") acting as a Heat-Sink, while the plate is exposed to air at 25^{0}C (as shown on photograph).
- **Source-Voltage Requirements: V_C (from pin +C to pin -P):** 9V to 30V DC, and for **V_P (from pin +P to pin -P)** 9V to 50V, both unregulated DC voltages. For low-voltage applications (9V to 30V) a single DC power supply can be used by connecting **pin +P** and **pin +C** together.
- **Max. Continuous Load Current:** 20A at 100% Duty-Cycle.
- **Max. Load Current for 5Sec:** 40A at 100% Duty-Cycle.
- **Two User Selectable Motor Acceleration/Deceleration Modes:** Using Jumpers, on Port **J1**.
- **Load Isolation:** The Load or Motor must be isolated from the source voltage (**V_P**).
- **Power-Conversion Efficiency:** Approximately 98.5% at full-load (50V and 20A).
- **Load-Current Indicator:** An onboard bicolor LED is used to monitor the motor (or load) voltage (Red = Forward, Green = Reverse). **About the Voltage Requirement:** The Si24 will work with any DC Load in the 9 V to 50 V 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 Si24DiBdMC1-50V-20A-AP1

In this open-loop application, the PWM or motor speed (in forward or reverse direction) is adjusted in 0.83% steps using two external Up/Down RPM push-buttons (Signal Part number **Si24PB2-MC3** connected to port **CN6**) and the motor direction is controlled by 4 external switches connected to port **CN4** (as shown below). The normally-open switches select the motor direction, while the optional normally-closed limit-switches are included to prevent over-rotation in window-lifting applications. The LCD module can be ordered from Signal with the part number of **Si24LCD2L20CH** (2x20 display with 8" ribbon cable and 14-pin connector, and with back-light). **Warning: The connecting wires to the Load and the Power Supply must be heavy gage copper wire (#12 AWG or heavier) to handle the rated current level. In addition, these heavy gage wires act as a heat sink, protecting the board from overheating.**