

## Signal Consulting, LLC

16 Wilelinor Drive, Edgewater, MD 21037-1003 USA

Phone: 410-224-8429, Fax: 410-510-1821, E-mail: info@signallc.com

### **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**

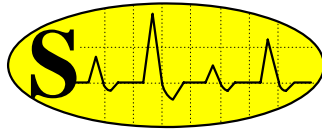
The **Si24DiBdMC1-50V-20A-AP1** is a 50V 20A, microprocessor based, high-power, Digital, Bidirectional, Motor Controller with user selectable Soft-Start and Soft-Stop features. This controller uses a single (9V to 50V at 0 to 20A) DC power supply to control the speed of a DC motor in forward or reverse direction. 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 1.25Sec, 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 ( $V_{F,N}$  and  $V_{R,N}$  on **CN4**) or switches. All inputs are optically isolated or zener-diode protected. A bicolor LED is used to monitor the motor (or load) voltage (Red = Forward, Green = Reverse). A serial LCD port (with 5V, RS232 Interface Standard and with back-light) is provided for optional display of motor RPM data with a 2 line by 16 character format. A small (4.0"x3.3"x0.062") **AP1** Aluminum Plate heat-sink is used 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) at max. continuous load current of 20A. Typical applications are: Bi-directional DC Motor-Speed Controller, Peltier Effect TE Coolers, Heat Pumps, DPDT Solid State Relay, etc. This board can be configured and programmed to perform efficiently in many customized applications.



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

$(V_{F,N})$ Voltage at Pin F relative to pin N	$(V_{R,N})$ Voltage at Pin R relative to pin N	Operation Mode of Motor or Load
$V_{F,N} = 5V$ or pin Open	$V_{R,N} = 5V$ or pin Open	Stop Rotatio (Motor Open)
$V_{F,N} = 0V$ @ 2mA Sink	$V_{R,N} = 5V$ or pin Open	Forward Rotation with $V_{PWM}$ Control
$V_{F,N} = 5V$ or pin Open	$V_{R,N} = 0V$ @ 2mA Sink	Reverse Rotation with $V_{PWM}$ Control
$V_{F,N} = 0V$ @ 2mA Sink	$V_{R,N} = 0V$ @ 2mA Sink	Stop Rotation (Motor Open)

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 **CN4** connector; as shown in the Truth-Table given above. Similarly, the Up and Down RPM inputs on **CN6** 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



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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.

## Specification and Application of [Si24DiBdMC1-50V-20A-AP1](#)

- **Typical Operating Temperature at 20A:** 45°C with the Metal Heat-Ring Bolted to the AP1 Heat-Sink, while it is exposed to air at 25°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.
- **Average Load Voltage (from pin +L to pin -L):** 0V at 0% Duty-Cycle and  $V_P$  at 100% Duty-Cycle.
- **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).
- **LCD Port:** 5V RS232 Serial Interface Standard, 9600 Baud, 1 Start, 8 Data, No Parity, 1 Stop.
- **About the Voltage Requirement:** The Si24 will work with any DC Source in the 9 V to 50 V range. In addition, the power filters are included on this board.

## 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 [Si14LCD2L16CH-4PC](#) (2-Line by 16-Char display with 12" cable, 4-pin connector, and with back-light). **Warning: The connecting wires to the Load 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.**

