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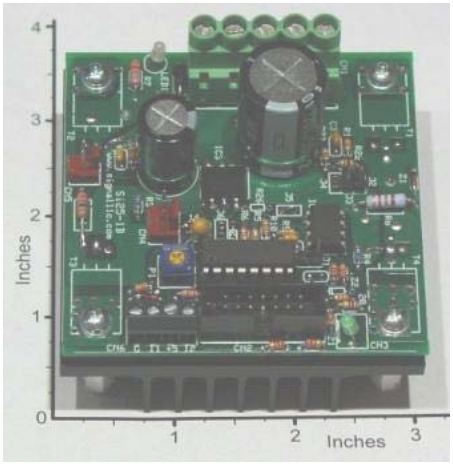
Si25NeBdMC1-50V-20A, Networkable, Bidirectional, Open-Loop, 50V 20A, Motor Controller with RS232 Serial Port, Integrated Heat Sink and with 20kHz or 5kHz PWM, B-Chip



The **Si25NeBdMC1-50V-20A** is a 50V 20A, networkable, microprocessor based, high-power, Bidirectional, Motor Controller that 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), monitors the user inputs and controls the RS232 Network Port. The **PWM** carrier frequency is user selectable by the jumper **J2**, 5kHz when **J2** is open and 20kHz when short. The jumper **J2** is examined only at power turn-on. 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 **J3**. The slow mode, with rise-time/fall-time of 0.5s, is selected by open-circuit (**J3** jumper NOT installed); while the fast buildup mode, with rise-time/fall-time of 0.05s, is selected by shorting these pins (**Jumper installed as shown on the application diagram**). All control lines are sampled approximately at 80Hz rate in the fast mode (**J3** jumper short), and at 8Hz rate in the slow mode (**J3** jumper open). As the name (**Ne, Networkable**) implies, the required motor speed (PWM pulse-duration and direction) is variable from 0 to + or -100% in 0.83% steps by using ASCII command strings on the RS232 Network Port; or it can changed by using external **UP/DOWN keys** connected to **NC4**. The RS232 data format and the Local Area Network (LAN) commands are described on the next page. A "**Kill-Switch**" (connected to **J1**) is used for emergency motor-stop (switch open=Motor Runs, Switch closed=Motor Stop with zero current, as shown on the application drawing below). All control inputs are optically isolated or zener-diode protected. A bicolor LED is used to monitor the motor (or load) voltage (Red = Forward, Green = Reverse). An optional 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 (3.0"x3.0"x0.8"), integrated Aluminum 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**. A flashing green **LED** indicates that the microprocessor is operating properly. 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, Proportional Valve-Coil Controller, DPDT Solid State Relay, etc. This board can be configured and programmed to perform efficiently in many customized applications.

Specification and Application of Si25NeBdMC1-50V-20A

- **Typical Operating Temperature at 20A:** 45^{0}C with the Metal Heat-Ring Bolted to a small (3.0"x3.0"x0.8") Finned Aluminum heat-sink, while the heat-sink is exposed to ambient 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.
- **Average Load Voltage (from pin +L to pin -L):** 0V at 0% Duty-Cycle and **V_p** at 100% Duty-Cycle.

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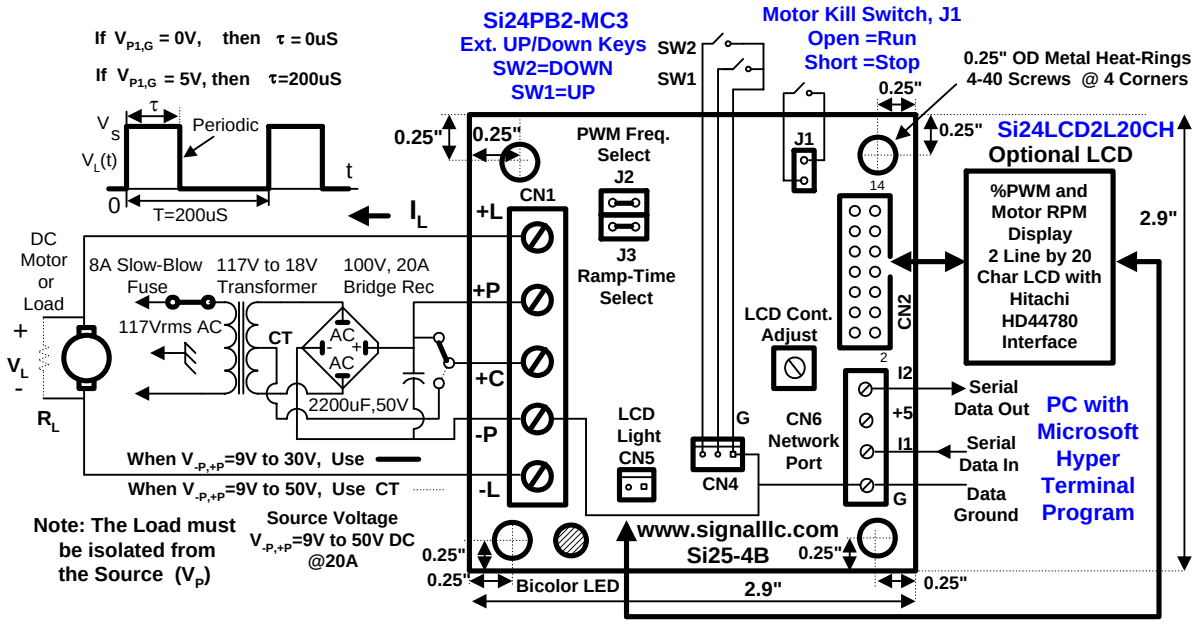
- **Max. Continuous Load Current:** 20A at 100% Duty-Cycle.
- **Max. Load Current for 5Sec:** 40A at 100% Duty-Cycle.
- **Two User Selectable Motor Acceleration/Deceleration Modes:** Using Jumpers, on Port **J3**.
- **Load Isolation:** The Load or Motor must be isolated from the source voltage (V_P).
- **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 Si25 will work with any DC Load in the 9V to 50V 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 Si25NeBdMC1-50V-20A

In this open-loop application, the PWM or motor speed (in forward or reverse direction) is adjusted by command strings derived from a Personal Computer (PC) using the Microsoft "Hyper Terminal" program (or any-other ASCII controller) operating at 9600 Baud, 1 start-bit, 8 data-bits, 1 stop-bit, No parity-bit. The optional LCD module can be ordered from Signal as 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 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.**



Command Format and Local Area Network (LAN) for the Si25NeBdMC1-50V-20A

Each board has a unique, 8-bit, ASCII, **none-volatile,** Node-Address ranging from 1….9, A..Z, a,…z (or a total of 61 Units can be networked).The address can be changed by a **LAN** command (the factory default address is 1). The board uses a modified version of the RS232 serial-data communication standard, where the output-voltage (on pin **I2, CN6**) ranges from 0 to +5V (rather than the usual -12V

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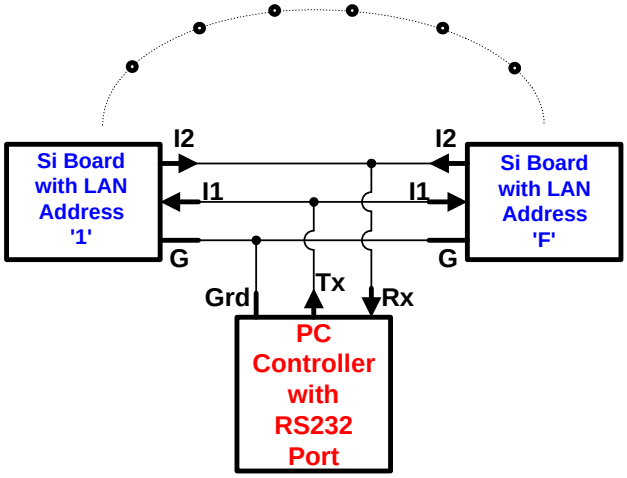
to +12V). In addition, this output pin is normally an open circuit and it will only output a serial TTL binary bit-stream when properly referenced by its Node-Address. The serial data input-voltage (on pin **I1, CN6**) has the standard range of -12V to +12V. The serial data-format is: 9600 Baud Rate, 1 Start-Bit, 8 Data-Bits, 1 Stop-Bit, and no Parity-Bit.

These features allow the creation of a Local Area Network (**LAN**) with up to 61 nodes (boards). A typical 3-wire **LAN** with "Star Topology" is shown below. Note that the control lines (**G, I1, I2**) with the same name are connected together (or the boards are connected in parallel) and driven by an **ASCII** controller (or **PC**), equipped with an RS232 serial port, operating at 9600 Baud rate.



Command Rules:

1. All Commands are **ASCII** character strings (Chars.). An ASCII string is denoted here with **Bold Red Letters (Characters).**

2. Each string is terminated by a Carriage Return Character, **(CR)**. The only exception is the **#** command.

3. Upper-Case Letters are used for Output Commands; and Lower-Case Letters are used for Input Commands.

4. The 1st Char. in a string is either ASCII **#** or a Node Address (**1**, **.**,**9,A..Z, a,..,z**). If the 1st Char. is an **#**, it denotes a query to all boards on the LAN to output their Node Address and Program Name.

5. If the 1st Char. is an ASCII (**1..,9, A,..Z, a,…,z**), it directs the rest of the command string to the board that has this address.

6. The 2nd Char. in the string is the Command Character that operates on the addressed board.

7. The 3rd, 4th, 5th and 6th Chars. represents the value of the input data. Where **+** numbers denote forward rotational values; and **-** numbers denote reverse rotational values.

8. The last Char. in the sequence is always the string terminator, **(CR)**.

Command Examples:

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Ex#1. Com. String: **#** Action: All boards on the LAN will output their Address and Program Name.

Ex#2. Com. String: **1u5(CR)** Action: Change Board 1 Address in EPROM from 1 to 5.

Ex#3. Com. String: **1D(CR)** Action: Board 1 outputs its Set and Measured % PWM (0,..100.0%).

Ex#4. Com. String: **2d25(CR)** Action: Change Board 2 PWM to 25.0% in Forward Direction.

Ex#5. Com. String: **2d+25.0(CR**) Action: Change Board 2 PWM to 25.0% in Forward Direction.

Ex#6. Com. String: **2d-25(CR)** Action: Change Board 2 PWM to 25.0% in Reverse Direction.

Ex#7. Com. String: **2d-25.0(CR)** Action: Change Board 2 PWM to 25.0% in Reverse Direction.

Ex#8. Com. String: **1M(CR)** Action: Board 1 outputs its Set and Measured Motor Value (0,..120).

Ex#9. Com. String: **2m+60(CR**) Action: Change Board 2 Motor Value to 60 = +50% PWM, in Forward Direction.

Ex#10. Com. String: **2m-60(CR)** Action: Change Board 2 Motor Value to -50 = -25.0% PWM in Reverse Direction.

Note1: The **m** command inputs decimal integer Motor Values, ranging from -120,….,0,….+120. The positive values are used for forward speed control, while the negative Motor Values are used for reverse speed control. The PWM duty-cycle varies linearly with the input values; 0 value is equal to 0% PWM, while 120 value is equal to 100% PWM.

Note2: The **d** command uses a variable input format (integer or fractional) % PWM Motor Values, ranging from -100.0,…., 0.0,….+100.0. The positive % PWM Motor values are used for forward speed control, while the negative % PWM Motor Values used for reverse speed control.

Note3: The **d** command is subject to +, - 0.833% “round-off” errors, while the **m** command **is NOT**!!!

LCD Display Format:

LCD **Line#1** is used to display **Set Values**. While LCD **Line#2** is used to display **Measured Values**.

The Display Format depends on the **last LAN Command used**:

The **d** command provides variable decimal display format (+ - 00.0%,…100.0%).

While the **m** command provides decimal integer display format (0,…+, - 120).

Network Configuration:

The **Si..Ne..** boards can be arranged in many Local Area Network (LAN) topologies: Star, Daisy-Chain, etc. You may create your own network or you may order one or more of the Network Cable Assemblies listed in the Application Note. **Before you build a network, we recommend that you click on this blue link and read this Application Note: SigNote on Configuring a LAN-2 .**