

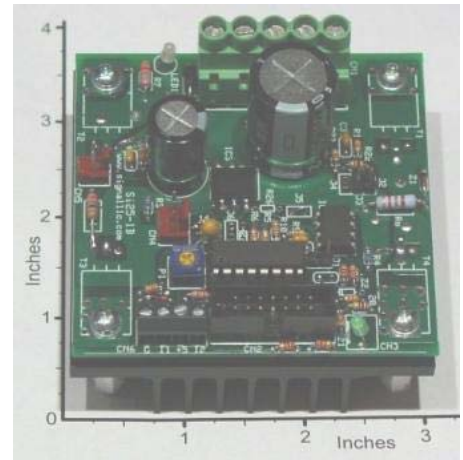
## Signal Consulting, LLC

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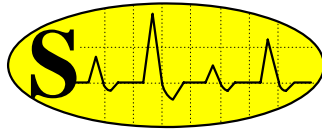
### **Si25NeBdMC1-50V-20A**, Networkable, Bidirectional, Open-Loop, 50V 20A, Motor Controller with RS232 Serial Port, Integrated Heat Sink and with 20kHz or 5kHz PWM, B-Chip

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 be 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<sup>0</sup>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<sup>0</sup>C (as shown on photograph).
- **Source-Voltage Requirements:** **V<sub>C</sub>** (from pin **+C** to pin **-P**): 9V to 30V DC, and for **V<sub>P</sub>** (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<sub>p</sub>** at 100% Duty-Cycle.



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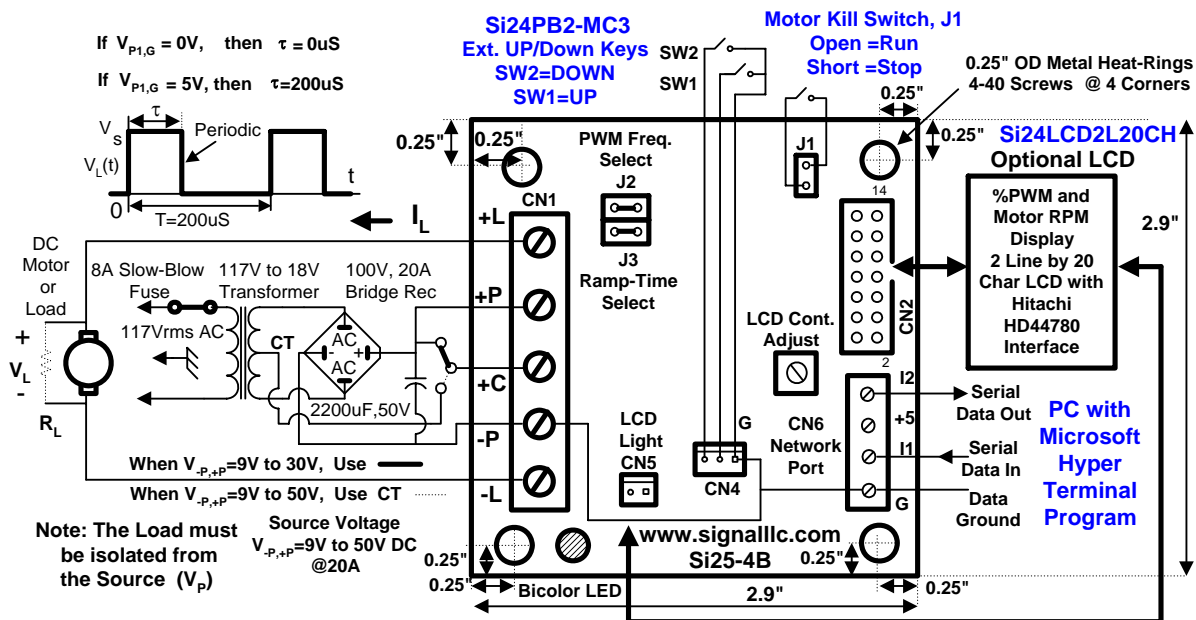
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- **Max. Continuous Load Current:** 20A at 100% Duty-Cycle.
- **Max. Load Current for 5Sec:** 40A at 100% Duty-Cycle.
- **Two User Selectable Motor Acceleration/Deceleration Modes:** Using Jumpers, on Port J3.
- **Load Isolation:** The Load or Motor 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.

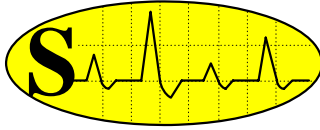
## A Typical Application of the Si25NeBdMC1-50V-20A

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, **non-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



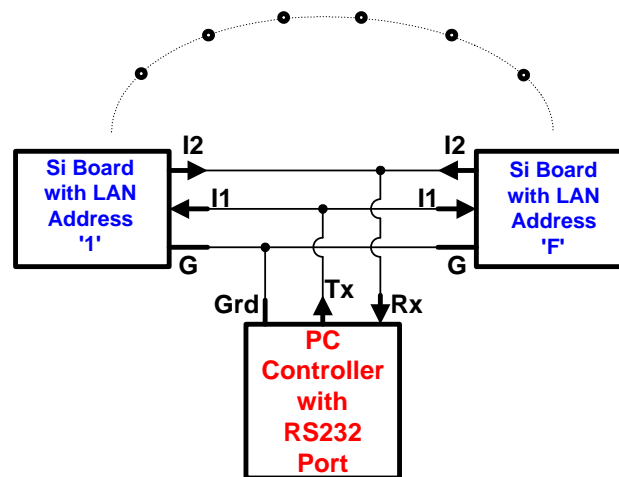
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to +12V). In addition, this output pin is normally an open circuit and it will only output a serial TTL binary bit-stream when properly referenced by its Node-Address. The serial data input-voltage (on pin **I1, CN6**) has the standard range of -12V 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 1<sup>st</sup> Char. in a string is either ASCII **#** or a Node Address (**1, ..,9,A..Z, a,..,z**). If the 1<sup>st</sup> Char. is an **#**, it denotes a query to all boards on the LAN to output their Node Address and Program Name.
5. If the 1<sup>st</sup> 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 2<sup>nd</sup> Char. in the string is the Command Character that operates on the addressed board.
7. The 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> 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 on-board microprocessor provides the bus arbitration, required to avoid data collisions on the 3-wire LAN bus.** 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 your network, click on this blue link and read this Application Note:** [SigNote on Configuring a LAN-2.](#)