SPM-VFDHP

40kW Three Phase Inverter Stack

With Optional SiC FET / IGBT Switches

DESIGNED FOR RESEARCH & EDUCATION

SPM-VFDHP is high power 3 phase inverter stack that comes with optional SiC or IGBT switches suitable for wide variety of applications. It is specially designed with flexibility and reliability in mind for applications such as motor drive inverters, 3 phase active rectifiers and PV-inverters.

OVERVIEW

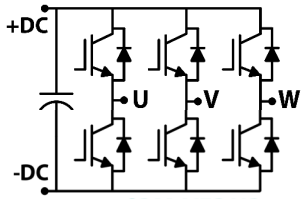
SPM-VFDHP is a high-power three phase inverter stack designed with flexibility and reliability in mind. It can be ordered with either SiC or IGBT switches based on application switching frequency requirements. Furthermore, a safe and easy method for connection and disconnection of the power terminals is provided with the help of lever-actuated spring cage terminal blocks. The inverter stack is equipped with a directly pluggable gate driver module which has test points and LEDs providing instant visual feedback during run-time and fault conditions. In addition, isolation optocouplers have been used for better EMI immunity and handling of high dv/dt spikes, making it suitable for applications having excessive noise such as motor drives and meeting the challenges of high-speed switching with SiC FETs. The inverter built-in protection features include short circuit protection, over temperature protection & serviceable Varistor based over voltage protection, additionally, overload protection can be achieved using a standard 63A circuit breaker. The system reliability and MTBF is also greatly enhanced by using 900V DC-Link film capacitors which can handle high currents, high temperatures and even higher than rated voltages without failure or degradation. Thus, providing dependable operation during service lifetime.

SPECIFICATIONS

		IGBT	SiC FET
Parameter	Note	Specifications	
Input Voltage	Maximum	750 VDC	750 VDC
Input Voltage	Recommended	600 VDC	600 VDC
Output Current	RMS, Max. Per Phase	50 A	50 A
Output Power	600 VDC, 415 VAC Out	36 kVA	36 kVA
Output Power	700 VDC, 480 VAC Out	41.5 kVA	41.5 kVA
Overload Capacity	30s Max. @ 25°C	150%	150%
Over-Voltage Protection	Varistor: V25S625P	825 VDC	825 VDC
Short Circuit Protection	Gate Driver Based	✓	✓
Short Circuit Current	Typical	315 A	210 A
Over Temperature Protection	Trips @ 85°C	✓	✓
Over Load Protection		✗	✗
Switching Frequency	With Derating	30 kHz	50 kHz
Switching Frequency	Without Derating	5 kHz	20 kHz
Dead-time	Minimum	2.2 µs	0.3 µs
Logic Supply		15 VDC, 1A	
Login Input Voltage	See Ordering Guide	3.3/5/15V	
Login Input Current	See Ordering Guide	10mA (LI) / 2mA (HI)	
Input Propagation Delay	Maximum	60ns (LI) / 120ns (HI)	
Feedback Supply Voltage		2.7~5.5V	
Feedback Supply Current	Maximum	5 mA	
Cooling		Forced Air	
DC-Link Capacitance		200uF | 900V	
Capacitor Type		Metallized Polypropylene Film	
Dimensions		260 x 292.5 x 161.5 (mm)	
Weight		~12 kg	

* All Specifications at 25 C Ambient.

BASIC SCHEMATIC



SPM-VFDHP

KEY FEATURES

- ✓ Built-in SCP, OTP & OVP Protections
- ✓ High MTBF 900V DC-Link Film Capacitors
- ✓ Screw-less Power Connectors
- ✓ Isolated Control Inputs & Outputs

APPLICATIONS

- ✓ Three Phase AC Motor Drive
- ✓ Three Phase Grid-Tie Inverter
- ✓ Single Phase Solar Inverter with MPPT
- ✓ Active PFC Rectifier

OPTIONS

- ✓ SiC FET / IGBT Switches
- ✓ High Impedance / Low Impedance Inputs
- ✓ Controller Input Voltage

ORDERING GUIDE

SPM - **VFDHP** - **SiC** - **50** - **LI**

SPM: Series

VFDHP: 3Phase Inverter

SiC: SiC FET
IGBT: IGBT

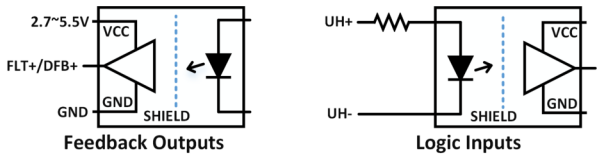
50: 5V Inputs
33: 3.3V Inputs
15: 15V Inputs

LI: 10mA I/O
HI: 2mA I/O

APPLICATION INFORMATION

Input Voltage and Impedance Selection

The inverter configuration options include the input voltage and impedance, both of which have to be selected depending on the controller to be used with the inverter. While lower impedance (10mA sink current) is preferred for higher noise immunity, standard DSP controllers do not support this current and require higher impedance inputs (2mA). Also, to control the input current that is driving the input optocouplers, a series resistance is selected based on the supplied input voltage. Therefore, using the controller voltage as a criterion, this resistor is configured during assembly process accordingly. Below are the schematics for logic I/Os:



Fault Feedback and Reset

There are two fault feedbacks governing the operation of the inverter, providing feedback for short circuit and over temperature protections. Both faults disable the inverter to avoid permanent damage. The controller in use can monitor both faults to take necessary control action, however, for both feedbacks to be operational, feedback power supply needs to be given to power up the isolation optocouplers. To reset the fault using the controller, please refer to used gate driver datasheet which may vary depending on the configuration of the inverter being used.

Power Switches Selection Guide

Switching frequency sets the main criterion for the selection of the power switches in the inverter. Standard IGBT switches are enough for applications such as motor drives, however, when higher switching frequency is required, SiC switches are better suited. Besides, if power requirement is lower and efficiency is not a consideration, then IGBT switches can also be used for up to 30 KHz switching frequency. Please refer to derating curves of output power vs operating switching frequency to select a switch for your application.

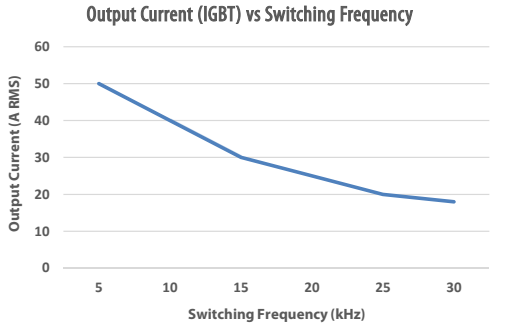
Overload Protection

The inverter does not have a built-in over load protection, however, that can be easily achieved using a standard 63A circuit breaker at the output (such as 9926253560, 3D60UM etc.). Since the inverter is capable of overloading for a short period of time, circuit breaker trigger time is comfortably enough to protect the inverter against any damage. Additionally, over temperature protection can always kick in to protect the inverter against light continuous over load.

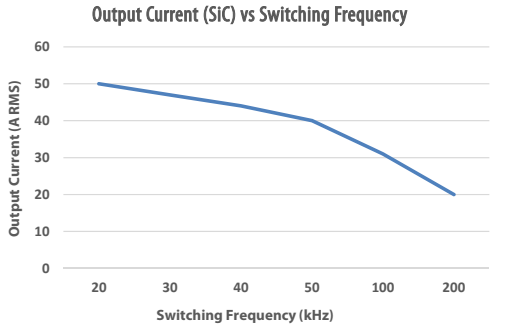
Safety and Reliability Considerations

To insure safe and reliable operation of the inverter, certain measures need to be taken. For instance, DC-Link capacitors are directly connected to the input terminal block, hence, if power is supplied from an uncontrolled source, large inrush current may flow. To avoid this, input voltage ramp-up is the best option. Furthermore, application specific considerations must be taken. For example, in motor drive applications, energy can flow from the motor to the inverter during de-acceleration which causes DC-Link voltage to go up and potentially trigger the varistor protecting the DC-Link capacitors. To prevent this, the motor needs to be slowly de-accelerated or power supply with sink function needs to be used. Lastly, to ensure safety and avoid EMC issues, the inverter must be connected to the building earth which will ensure any charges that build up on the inverter due to leakage currents are safely dealt with.

DERATING CURVES



@ 25C° Ambient Temperature, 600V DC-Link, Sinusoidal Output Current



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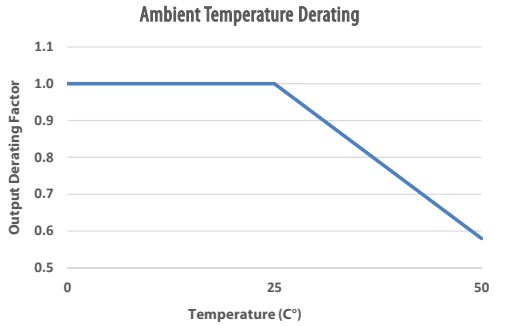
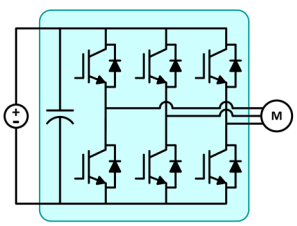
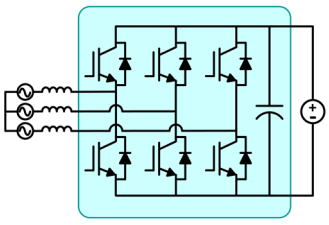


APPLICATION EXAMPLES

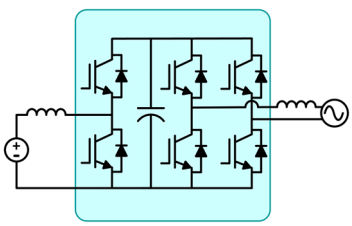
Three Phase AC Motor Drive



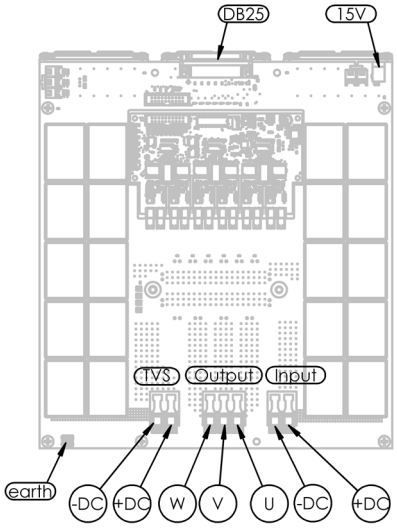
Active PFC Rectifier

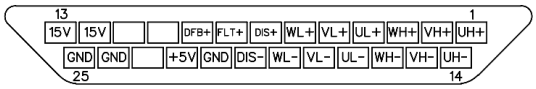


Single Phase Solar Inverter with MPPT



PIN MAPPING





DB25

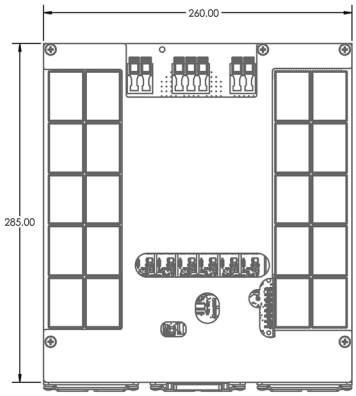
DB25 Pin Mapping

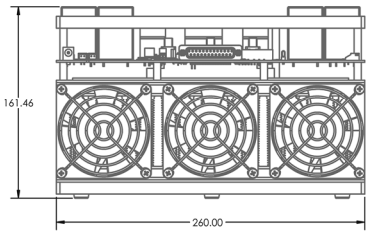
Name	Connector (Pin No.)	Description
Fault Feedback	FLT+(8)	Fault feedback (active low), 2.7~5.5V need to be supplied through +5V pin
OTP Feedback	DFB+(9)	OTP feedback (active low), 2.7~5.5V need to be supplied through +5V pin
Feedback Supply	GND(21), +5V(22)	2.7~5.5V need to be supplied to enable feedback
Disable	DIS+(7), DIS-(20)	Input disable signal, active high will drive all switches to LOW
UH, VH, WH	UH+(1), UH-(14), VH+(2), VH-(15), WH+(3), WH-(16)	High side switches input signals
UL, VL, WL	UL+(4), UL-(17), VL+(5), VL-(18), WL+(6), WL-(19)	Low side switches input signals
Logic Supply	15V(12,13), GND(24,25)	Optional 15V logic supply to power up fan and gate drive circuit, normally disconnected by jumper resistors

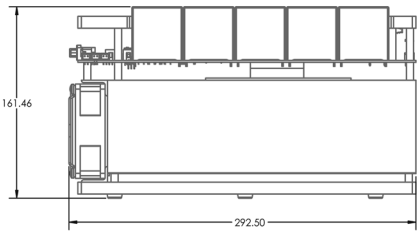
Connectors Mapping

Name	Connector (Pin No.)	Description
Input	+DC, -DC	DC-Link input terminal block
Output	U, V, W	3 Phase output terminal block
Earth	Earth	Earth safety connection, also connected to heatsink
TVS	+DC, -DC	TVS Varistor terminal block to protect against DC-Link over voltage
DB25	DB25	Logic input/output signals connector (female DB25)
15V	15V DC Adapter Jack	15V logic supply to power up fan and gate drive circuit. Adapter included: SWI15-15-E-P5

MECHANICAL







SAFETY NOTICE!

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