HPSP Manual

High Power Smart Programmable
Vehicle Power Supply
DC-to-DC Converter

Manufactured by

Tri-M Technologies

Engineered Solutions for Embedded Applications

Technical Manual

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PREFACE

This manual is for integrators of applications of embedded systems. It contains information on hardware requirements and interconnection to other embedded electronics.

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CHAPTER - 1 INTRODUCTION

1.1 GENERAL DESCRIPTION

The HPSP is the product family name of the power supply platform HPSP-x-y-z. The “x” suffix defines the OUT1 voltage, “y” suffix the OUT2 voltage and “z” the OUT3 voltage. In addition to the three main outputs the HPSP also provides a 5VSBY 1A output.

The HPSP is a high power, high performance DC-to-DC converter that supplies three outputs programmable that are programmable up to 24V output and supports an ultra wide input range of 6-50V. The HPSP has two power inputs protected with heavy-duty transient surge stoppers that clamps the input voltage to safe levels. The HPSP is ideal for battery and unregulated input applications. The HPSP uses a flash based microcontroller to supply advanced power management that monitors and controls the operation of the HPSP through a RS232 serial port.

The HPSP is a state-of-the-art Mosfet based design that provides outstanding line and load regulation and high efficiency. The low noise design makes the HPSP ideal for use aboard aircraft or military applications or wherever EMI or RFI must be minimized.

The HPSP advanced power management functions provide timed on/off control of the HPSP, notification of changes to main power and secondary power status.

The HPSP is PC/104 footprint in size of 3.55 x 3.775 inches with the same mounting holes pattern. However, the HPSP does not include the PC/104 bus connectors. All generated voltages are provided to a removable header. A removable plug allows the HPSP to be easily installed. The RS232 serial port is provided on a 2x5 row pin header.

1.2 FEATURES

· DC to DC converter for embedded applications.
· “Load Dump” transient suppression on both main and secondary power supply inputs.
· Operates from 6VDC to 50VDC input.
· PC/104 size and mounting holes.
· Three main programmable outputs OUT1, OUT2 & OUT3. A 1.5A 5VSB outputs is also provided.
· Temperature range -40 to 85degC (measured on heat spreader).
· Complete with built-in digital temperature sensor.
· RS232 serial port for setup, monitoring and control.
· Opto-coupled inputs for ignition, and system "shut-down" push-button.

1.3 SPECIFICATIONS

Power Supply General Specifications Output voltages can be programmed between the minimum and maximum for OUT1, OUT2 & OUT3 5VSB output is fixed to a nominal 5V			
Output	**Maximum Output Current**	**Minimum Output Voltage**	**Maximum Output Voltage**
OUT1	6 A	10.85V	25.5V
OUT2	5A	3.25V	5.55V
OUT3	2.5A	1.20V	14.20V
5VSB output	1.5A	4.95V	5.15V

1.4 ORDERING PART NUMBERS

The HPSP is the product family name of this programmable power supply. Each output can be specified to be factory set to a specific voltage when ordered. The part number ordering format for specifying output voltages is: HPSP-x-y-z-PBF where:

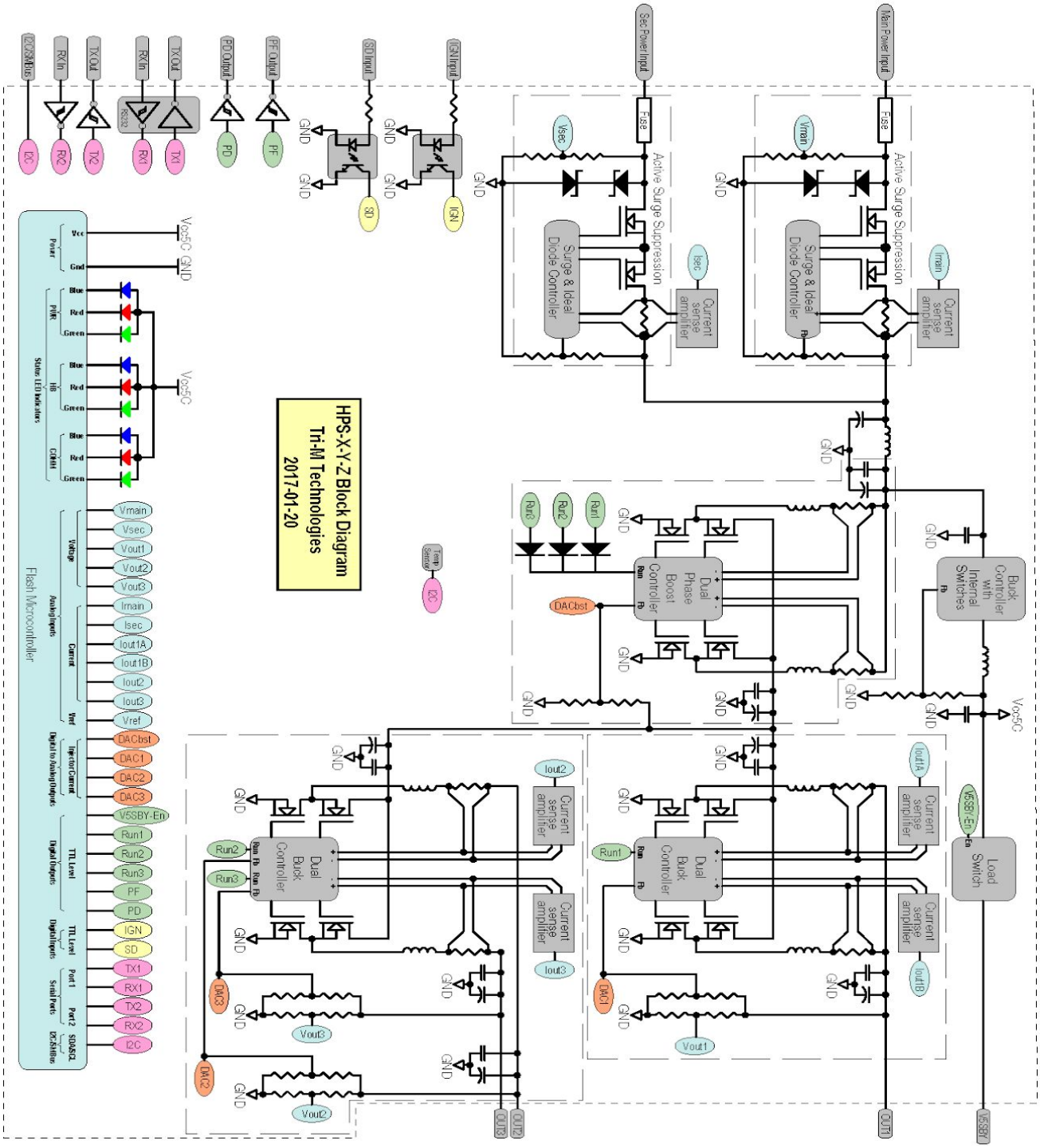
- The “x” suffix defines the OUT1 voltage,
- the “y” suffix the OUT2 voltage
- and “z” the OUT3 voltage.
- The PBF denotes that the parts and assembly process is RoHs compliant. For a load assembled product specify “LD” instead of “PBF”.
- Example: HPSP-24-5-12-PBF. OUT1 = 24V, OUT2 = 5V, OUT3 = 12V. RoHs compliant.

Other ordering options:

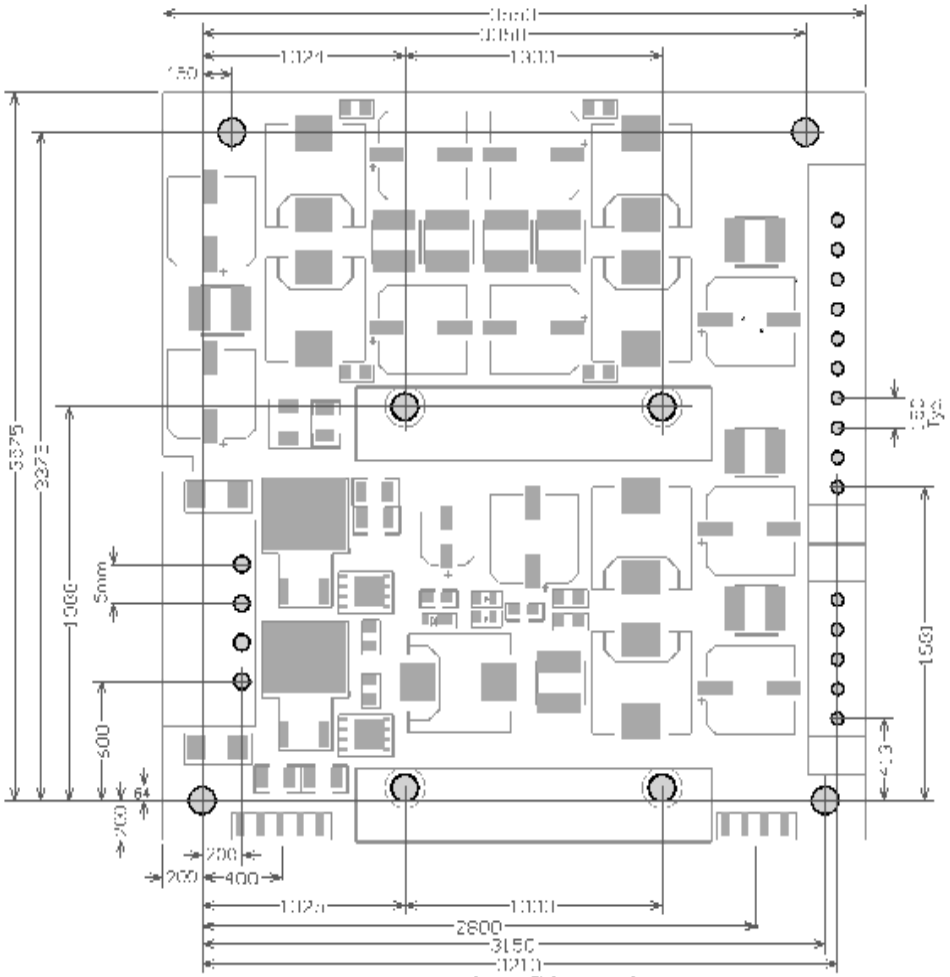
Conformal coating can be specified as follow: HPSP-x-y-z[-Cq]-PBF where [-Cq] is the optional conformal coating selection.

- “-CS” for silicone conformal coating.
- “CU” for urethane conformal coating.
- “CH” for HumiSeal conformal coating.
- Example: HPSP-24-5-12-CS-PBF. Silicone conformal coating is applied.

1.5 BLOCK DIAGRAM



1.6 MECHANICAL DIMENSIONS



Mechanical Dimensions

Note: All dimensions in mils unless otherwise stated
(1000mils = 1 inch)

1.7 DESCRIPTION OF OPERATION

The HPSP consists of:

1. Two power inputs (Main and Secondary) with heavy-duty surge stoppers.
2. Each of the surge stoppers on the power inputs include ideal diode Mosfets. The ideal diode Mosfets outputs are connected together and the power input with the greater voltage will be used to power the switching regulators and electronics of the HPSP. The ideal coupled input power voltage rail name is VmainC.
3. A high efficiency switching regulator is used to create a 5V maintenance power rail Vcc5C. The Vcc5C is used to power the on-board microcontroller, digital temperature sensor, RS232 serial port driver, RGB LEDs and I/O buffers and isolators.
4. The 5VSBY power output is supplied from the Vcc5C power rail. An electronic switch monitors the current and will automatically turn off the 5VSBY output of the current exceeds 1.5A. The on-board microcontroller can be configured to turn on the 5VSBY output automatically when power is available or a Host CPU can command the HPSP to turn On/Off the 5VSBY output via the RS232 serial port.
5. A dual phase boost regulator raises the input power VmainC to a minimum voltage level that is equal to or greater than 24V. The boosted voltage name is Vbst. The microcontroller can adjust the Vbst voltage level. The HPSP Vbst voltage is factory set to 25V. The Vbst voltage will track VmainC if VmainC exceeds the Vbst setpoint. The dual phase boost regulator automatically turns on whenever the switching regulators for OUT1, OUT2 and OUT3 are running.
6. A dual phase buck regulator creates the OUT1 power rail by reducing the Vbst level to the programmed level. The microcontroller can adjust the OUT1 voltage.
7. A buck regulator creates the OUT2 power rail by reducing the Vbst level to the programmed level. The microcontroller can adjust the OUT2 voltage.
8. A buck regulator creates the OUT3 power rail by reducing the Vbst level to the programmed level. The microcontroller can adjust the OUT3 voltage.

9. The on-board microcontroller monitors and/or controls the following I/O signals:

Analog Inputs	**Analog output**	**Digital Inputs**	**Digital Outputs**	**LED Outputs**			**Serial Data Ports**
				LED	Color	Description	Signal
Main input voltage	Vbst voltage	IGN	PD		Green	Power Good	TX232 CN4
Input current	OUT1 voltage	SD	PF	LED1	Red	Power Fail	RX232 CN4
Secondary input voltage	OUT2 voltage	SD232 CN4	PF232 CN4		Blue	TDB	TX TTL CN7
OUT1 voltage	OUT3 voltage		Run1 (OUT1)		Green	CPU Heart Beat	RX TTL CN7
OUT1 current phase 1			Run2 (OUT2)	LED2	Red	CPU Fail	I2C SDA CN7
Out1 current phase 2			Run3 (OUT3)		Blue	TBD	I2C SCL CN7
OUT2 voltage			V5SBY Enable		Green	RX	
OUT2 current			Main Surge Stopper Enable	LED3	Red	TX	
OUT3 voltage			Sec Surge Stopper Enable		Blue	TBD	
OUT3 current							
Vref (4.096)							

CHAPTER - 2 CONFIGURATION AND INSTALLATION

2.1 Introduction

Chapter 2 describes the configuration and installation of the HPSP power supply. Figure 2 shows the heat spreader with labels and Figure 3 shows the power and I/O connections.

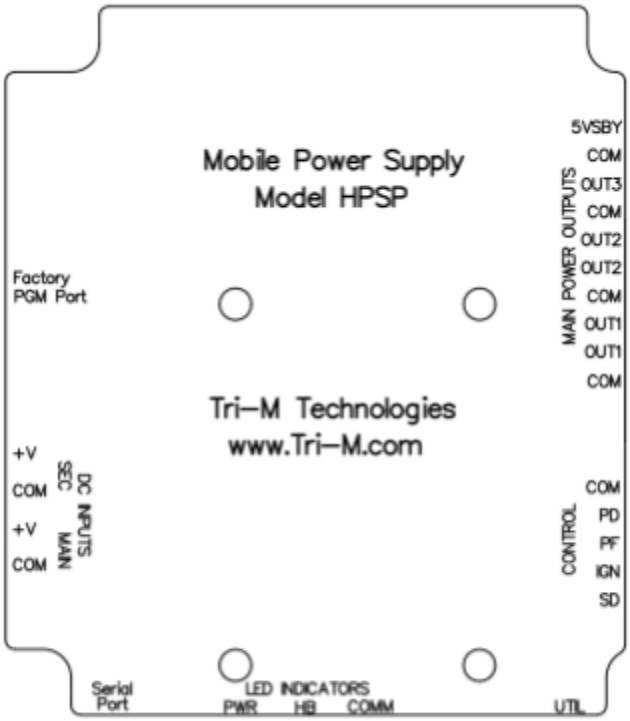


Figure 2: Heat Spread Labels

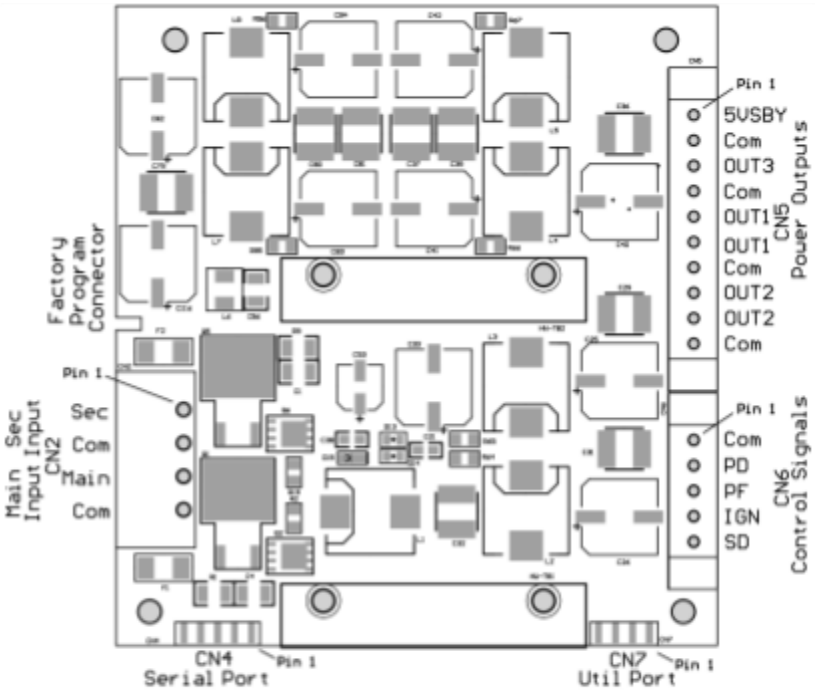


Figure 3: Power & I/O Connectors

2.2 Main Input and Secondary Power Connector

Main and Secondary power is connected to the HPSP by a four position removable plug (CN2) with screw locking flanges. The power supply accepts DC input voltages in the range of 6VDC to 50VDC.

Unregulated vehicle power is connected as follows:

Input Power Connector CN2	
Terminal Identification on Heat Spreader	**Description**
SEC INPUT	Secondary DC input 6-50V
SEC INPUT COM	Common (0VDC)
MAIN INPUT	Main DC input 6-50V
MAIN INPUT COM	Common (0VDC)

2.3 Output Power Connector CN5

outputs are supplied on two terminals each and parallel wires should be used to remain under the 8 amp limit and to lower

Note: A Common (0VDC) return wire should be used for each power wire used.

Output Power Connector CN5	
Terminal Identification on Heat Spreader	**Description**
5VSBY	5V standby
COM	Common
OUT3	Output 3
COM	Common
OUT2	Output 2
OUT2	Output 2
COM	Common
OUT1	Output 1
OUT1	Output 1
COM	Common

2.4 Control Signal Interface Connector CN6

Control Signal Connector CN6		
Terminal Identification on Heat Spreader	**Description**	**I/O Architecture**
COM	Common	0VDC
PD	Power Disable	Buffered TTL output *1
PF	Power Fail	Buffered TTL output *1
IGN	Maintained Contact Input	Opto-isolated with 5K series resistance *2
SD	Pushbutton Contact Input	Opto-isolated with 5K series resistance

*1 Note: The outputs are active low.

*2 The active state of the IGN signal is programmable. The SCU.exe utility can be used to change the polarity.

2.5 RS232 Serial Port Connector CN4

The HPSP provides an RS232 serial port for remote control, monitoring and data-logging. The serial port connector is a two row by five-pin header connector, CN4.

CN4	Signal	Function	In/Out	CN4	Signal	Function	In/Out
1	PF *3	Serial 1 Data Carrier Detect	Out	2	NC	No connection	N/A
3	TX	RS232 transmit data	Out	4	NC	No connection	N/A
5	RX	RS232 receive data	Input	6	PF232	Power fail indication	Out
7	SD232	Shut-down request	Input	8	NC	No connection	N/A
9	COM	Electrical common	N/A	10	COM	Electrical common	N/A

*3 Note: PF on CN4-6 is a buffered TTL level and is same signal as CN6 PF.

CHAPTER - 3 USING HPSP POWER MANAGEMENT FEATURES

Note: In order to use the advanced power management features, the HPSP must have the HPSP Firmware loaded. Please refer to the HPSP firmware manual for details.

By monitoring and activating the following inputs and outputs, the HPSP power supply is capable of responding to changes in Main and Secondary input supply and to alert the host CPU of such conditions. TRI-M's Windows based Smart Charger Utility (SCU.exe) allows monitoring various HPSP functions, and can change the operational profile.

The active state of IGN can be programmed for either signal applied or absence of signal (6 – 50 VDC). The SD signal responds to a "momentarily" applied 6-50V DC signal.

PL is driven low when the Secondary voltage is below the set point value of Minimum Secondary Input Voltage EEProm variable.

PF (available on the serial port connector) is driven active after the main input power is removed and the "debounce" interval is completed or whenever there is a pending shutdown of the main outputs.

IGN, SD, and PF can be used to signal the host CPU to prepare for shutdown. It is critical that operating systems such as Linux and Windows are shutdown gracefully otherwise corruption of the OS and the file system may result.

After any of the three signals (IGN, SD, PF) becomes active, the corresponding counter will start counting down to zero. When the counter reaches zero, a shutdown command is issued to switch off the HPSP outputs immediately.

3.1 ATX compatibility

The HPSP can be configured to be signal compatible to an ATX power supply (The HPSP does not provide -5V, -12V that standard ATX supplies include but the three outputs can be programmed to provide the standard 3.3V, 5V and 12V). The active state of the IGN has to be configured to start-up the supply when the applied PS-ONOFF signal is low. To configure the IGN pin to act in this manner, set the Ign-HiOffEn bit in the ChFlags register to "0".

Power Supply ATX Wiring **The outputs of the HPSP can be programmed to other voltages. Below is one set of values that could be used for an ATX type of operation**	
ATX connector	**HPSP**
12 V	OUT1
3.3V	OUT2
5V	OUT3
5VSBY	5VSBY
PS_On#	IGN