HPT5K0-L Series

5000W FAN COOLED

AC-DC POWER SUPPLIES

The HPT5K0-L series offers ultimate flexibility with both output voltage and output current programming and user defined signals, warnings & alarms. Programming is via voltage, I²C PMBus, RS485 and CANopen in a very high efficiency, high power density 5 kW chassis mount package. Options are available for RS232 or UART. The HPT-L can be used in both constant voltage and constant current operation.

Measuring just 13.25" x 10.00" x 2.50" the HPT5K0-L also features active current sharing, remote on/off, remote sense and a power OK signal. The standby output is available whenever the mains supply is present.

Features

- 3 phase 180 to 528 VAC input - 3 wire & earth
- High efficiency - up to 94%
- Programmable output voltage (0-105%)
- Programmable output current (0-110%)
- Parallel operation
- Analog & digital interfaces
- Multiple digital protocols - PMBus, CANopen, MODBUS & SCPI
- Fully featured signals & controls
- 5V/2A standby output
- Graphical User Interface (GUI)
- 3 Year Warranty

Applications

Industrial Electronics

Healthcare

Technology

Semiconductor Manufacturing

Dimensions

HPT5K0-L:

13.25 x 10.00 x 2.50 in (336.5 x 254.0 x 63.5 mm)

Models & Ratings

| Model Number[2,3] | Max Output Power | Output Voltage V1 | | | Output Current | | Efficiency[1] |
		Minimum	Nominal	Maximum	Minimum	Maximum	
HPT5K0TS060-L	5000W	0VDC	60VDC	63VDC	0.0A	83.3A	93%
HPT5K0TS100-L	5000W	0VDC	100VDC	105VDC	0.0A	50.0A	93%
HPT5K0TS200-L	5000W	0VDC	200VDC	210VDC	0.0A	25.0A	93%

Notes:

1. Measured with 480 VAC input and full load.
2. Standard models include PMBus, CANopen and RS485 interfaces. RS485 default is full duplex. RS485 half duplex can be configured via I²C or factory configured on request. To replace RS485 with RS232 or UART, contact sales.
3. For medical applications with 4000 VAC isolation test add suffix -M. Installation Class 3 surge only.
4. USB interface available to enable RS485 and RS232 communication with GUI, part number XP PS MANAGER INT.

HPT5K0-L Series

Input

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Input Voltage	180		264	VAC	3kW output power max, 3 wire & earth
	342		528		5kW output power max, 3 wire & earth
			580		For 5 s
Input Frequency	47		63	Hz	
Power Factor		0.96			Complies with EN61000-3-2 for Class A
Input Current			10/11	A	Per phase, 342VAC (5 kW)/180 VAC (3kW)
Inrush Current			60	A	Per phase, 528VAC (5 kW)
Earth Leakage Current			1.0	mA	528 VAC/60Hz
			3.3		528 VAC/60Hz, single fault
Input Protection	F16A / 500 V fuse fitted in each phase				
Loss of Phase	Shut down after 0.5s, auto-recovery				

Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Output Voltage	0		210	VDC	See Models and Ratings table
Output Set Tolerance		±0.5		%	Nominal voltage irrespective of set voltage.
+5 V Standby Tolerance		±4		%	5V/2A Standby
Output Voltage Program	0		105	%	Of nominal, slew rate <40 ms 10-105% & 105-10%. Max frequency of voltage program is 0.5 Hz 0-5% load, 0.67 Hz 5-10% load, 1Hz 10-20% load, 3 Hz 20-100% load
Output Voltage Adjust	±10			%	Of set output via potentiometer 105% of nominal max.
Output Current Program	0		110	%	Of nominal
Minimum Load	0			A	No minimum load required
Start Up Delay		2.0	2.3	s	Under all load and line conditions
Start Up Rise Time			40	ms	
Hold Up Time	20	22		ms	380 VAC at 5000 W and 25°C
	40	44			180 VAC at 3000 W and 25°C
Line Regulation			±0.5	%	Of nominal voltage
			±0.5		5V Standby
Load Regulation			1	%	0-100% or 100-0% load
			2		5V Standby
Transient Response			3	%	Deviation with a 50-75-50% load change. Output returns to within 1% in less than 500µs
Ripple & Noise			1/2.5	%	Of nominal voltage/5V Standby. Measured with 20 MHz bandwidth limited oscilloscope 0-50°C.
Overshoot			5	%	Turn on & turn off
Overvoltage Protection	110		120	%	Of nominal voltage, latching. Cycle AC to reset. No protection for 5V Standby
Overtemperature Protection	Auto resetting thermal protection				
Overload Protection			±3	% of max load	Set current limit point. Constant current characteristics. Max current limit is 108% ±3% of maximum rated current. For low line (180-264VAC), constant power characteristic set at 3.4W until current limit point is reached. 5V Standby: <5A max
Temperature Coefficient		0.03 of max load		%/°C	
Short Circuit Protection	Constant current characteristics. 5V Standby: Foldback characteristic < 5A max.				
Remote Sense	Compensates for 1% max of nominal voltage per lead, 2% of total nominal voltage drop. Not fitted on HPT5K0-LTS200				

HPT5K0-L Series

General

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Efficiency	92	93		%	Measured from 342 to 528 VAC, 5V Standby at full load.
Isolation: Input to Output	4000			VAC	2 x MOPP. Barrier only(1)
Input to Ground	1500			VAC	1 x MOPP
Output to Ground	500			VDC	
Switching Frequency	55	60	65	kHz	Fixed frequency PFC
	40		250	kHz	Variable frequency main converter
Power Density			15.38	W/in³	
Signals and Controls	V Program, I Program, AC OK, DC OK, Fan Fail/Temperature Warning, Sync, PMBus, Inhibit, Current Share.				
MTBF		600		kHrs	Telecordia 332
Weight		12.5 (5.7)		lb (kg)	

1. For test at 4000 VAC, GDTs must be removed. -M versions available with installation Class 3 surge only. See models and ratings table..

Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating Temperature	-20		70	°C	Derate linearly from 50°C to 50% rated power at 70 °C
Storage Temperature	-40		+85	°C	
Cooling					Force-cooled with intelligent fan speed control
Humidity	5		95	%RH	Non-condensing
Operating Altitude			3000	m	Medical
			5000		ITE
Transport Altitude			10000	m	
Shock	±3 x 30 g shocks in each plane, total 18 shocks. 30 g = 11 ms (±0.5 ms) half sine. Conforms to EN60068-2-27 & EN60068-2-47				
Vibration	Single axis 10-500 Hz at 2 g sweep and endurance at resonance in all 3 planes. Conforms to EN60068-2-6				
Accoustic Noise	< 70 db(A) Lw				

Signals & Controls

	Function
V Program[1][2]	0V to 5V signal will program Vout from 0-105%. VProg accurancy ±3% of nominal output voltage. When left open, supply will go into its default operating mode.
I Program[1][2]	0V to 5V signal will program the current limit from 0-110%. When this signal is left open, supply will go into its default operating mode. IProg accurancy ±3% of maximum rating.
AC OK	LOW = Input Voltage is within operating range, HIGH = Input Voltage is outside of operating range or there is a loss of phase. Uncommitted opto-transistor, 2 ms warning time
DC OK	When the supply is used as a variable output supply, this signal is disabled. When the supply is programmed as a fixed output supply, LOW = Vout > 95% of Vnominal. This level is programmable by the user through the PMBus. Uncommitted opto-transistor
Fan Fail/Temp Warning	High = Fan FAIL and/or overtemperature, Low = Fan OK and temperature OK (3.3V Logic), unit switches off 10 s after Fan Fail/Temp Warning alarm, auto recovery. XP GUI available for download, contact sales.
Sync.	Connect parallel units to synchronise output turn on.
PMBus, CANopen and RS485 Optional: RS485 can be replaced with RS232 or UART	The interface specification is detailed in a separate document "HPT5K0-L Communication, Control and Status Specification". XP GUI available for download, contact sales. Vout monitor accuracy is ±1% of nominal voltage, Vout setting accuracy is ±1% of nominal voltage, Iout monitor accuracy is ±3% of full load, Iout setting accuracy is ±3% of full load.
Current Share	Connecting pin 23 on one unit to pin 23 on a like voltage unit will force the current to be shared. Up to 5 units can be paralleled. Current share accuracy ±3% of full system load.
Inhibit	Uncommitted opto diode. See Signals & Controls.

(1) In analog mode, the default Vout and Iout settings are 0% when open circuit.

(2) To activate analog mode, PMBus_EN (pin 24) must be pulled down to SGND or 5VSBY return. Default when open is digital progamming.

EMC: Emissions

Phenomenon	Standard	Test Level	Notes & Conditions
Conducted	EN55011/EN55032	Class B	
Radiated	EN55011/EN55032	Class A	
Harmonic Currents	EN61000-3-2	Class A	
Voltage Flicker	EN61000-3-3		

EMC: Immunity

Phenomenon	Standard	Test Level	Criteria	Notes & Conditions
ESD Immunity	EN61000-4-2	4	A	±8 kV contact / ±15 kV air discharge
Radiated Immunity	EN61000-4-3	3	A	
EFT/Burst	EN61000-4-4	3	A	
Surge	EN61000-4-5	Installation class 4	A	
Conducted	EN61000-4-6	3	A	
Magnetic Field	EN61000-4-8	4	A	
Dips and Interruptions	EN61000-4-11 (200/380 VAC)	Dip 100% (0 VAC), 8.4ms	A	
		Dip 100% (0 VAC), 16.7ms	A	
		Dip 60% (80/152 VAC), 200ms	A	
		Dip 30% (140/266 VAC), 500ms	A	
		Dip 20% (160/304 VAC), 5000ms	B	
		Int 100% (0 VAC), 5000ms	B	
	EN61000-4-11 (240/480 VAC)	Dip 100% (0 VAC), 10ms	A	
		Dip 100% (0 VAC), 20ms	A	
		Dip 60% (96/192 VAC), 200ms	A	
		Dip 30% (168/336 VAC), 500ms	A	
		Dip 20% (192/384 VAC), 5000ms	B	
		Int 100% (0 VAC), 5000ms	B	
	EN60601-1-2 (200/380 VAC)	Dip 100% (0 VAC), 10ms	A	
		Dip 100% (0 VAC), 20ms	A	
		Dip 60% (80/152 VAC), 100ms	A	
		Dip 30% (140/266 VAC), 500ms	A	
		Int 100% (0 VAC), 5000ms	B	
	EN60601-1-2 (240/480 VAC)	Dip 100% (0 VAC), 10ms	A	
		Dip 100% (0 VAC), 20ms	A	
		Dip 60% (96/192 VAC), 100ms	A	
		Dip 30% (168/336 VAC), 500ms	A	
		Int 100% (0 VAC), 5000ms	B	
	SEMI F47 (200/380 VAC)	Dip 22% (156/296 VAC), 1000ms	A	
		Dip 33% (134/254 VAC), 500ms	A	
		Dip 55% (90/171 VAC), 200ms	A	

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AC-DC POWER SUPPLIES

Safety Approvals

Safety Agency	Safety Standard	Notes & Conditions
CB Report	IEC62368-1 Ed 2	Information Technology
	IEC60601-1 Ed 3 Including Risk Management	Medical
UL	UL62368-1, CSA 22.2 No.62368-1, UL60950-1	Information Technology
	ANSI/AAMI ES60601-1:2005 & CSA C22.2, No.60601-1:08	Medical
TUV	EN62368-1	Information Technology
	EN60601-1/2006	Medical
CE	Meets all applicable directives	
UKCA	Meets all applicable legislation	
Equipment Protection Class	Class I	See safety agency conditions of acceptibility for details

	Means of Protection	Notes & Conditions
Primary to Secondary	2 x MOPP (Means of Patient Protection)	
Primary to Earth	1 x MOPP (Means of Patient Protection)	IEC60601-1 Ed 3
Secondary to Earth	N/A	

Applications Notes

Input Derating
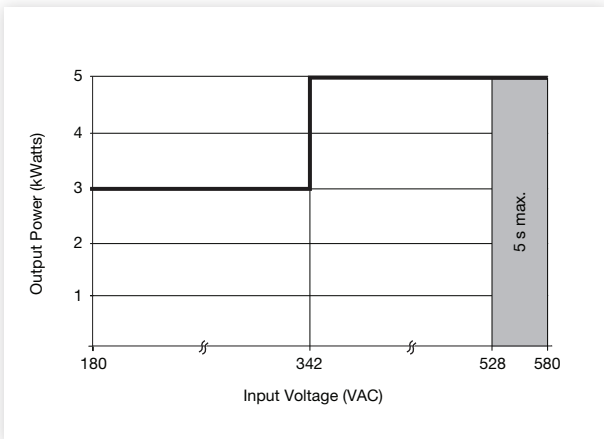
Output Voltage Programming

Output Current Programming

XP Power

5
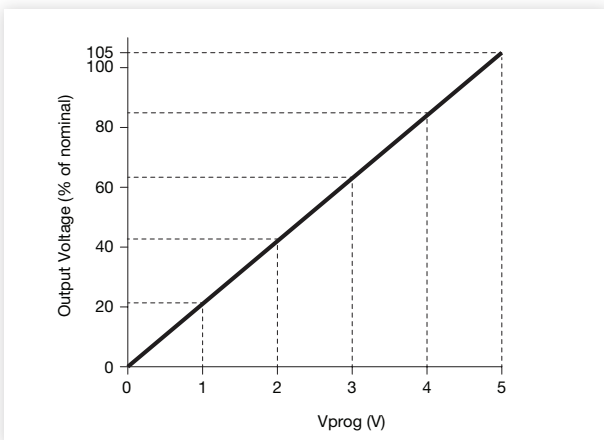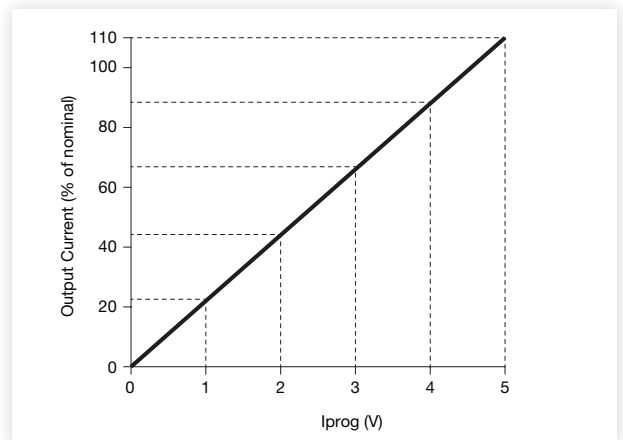
Signals & Controls

Signal Connections

View A
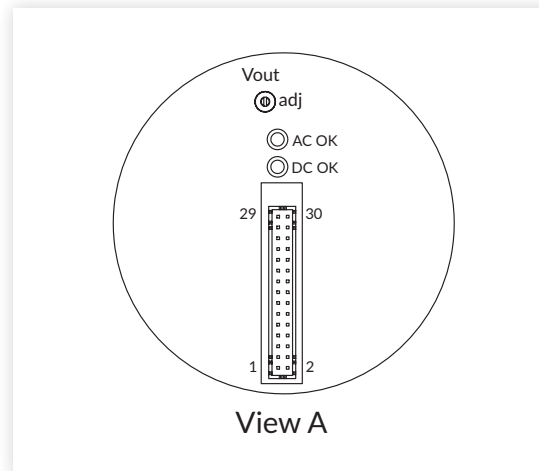
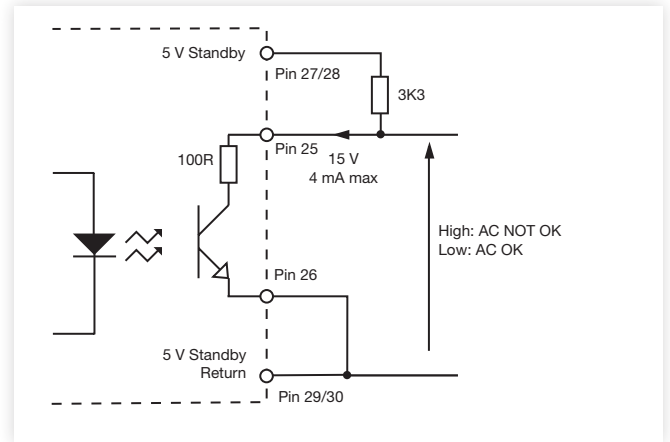|	J1 Signal Connector Connections	
Pin	**Function**	**Description**
1	DCOK	Low means Vout is within range (Opto Isolated; Open Collector)
2	DCOK Return	Return for DCOK (Opto Isolated)
3	Remote Inhibit	High to Inhibit - uncommitted opto diode
4	Remote Inhibit Return	Return for Inhibit - uncommitted opto diode
5	A0	I²C Device Address Bit (10kΩ pull up to 3.3V)
6	A1	I²C Device Address Bit (10kΩ pull up to 3.3V)
7	A2	I²C Device Address Bit (10kΩ pull up to 3.3V)
8	CANH	CAN Bus Communication using CANopen protocol
9	RS485_Y	RS485 Differential Serial Bus Communication
10	CANL	CAN Bus Communication using CANopen protocol
11	RS485_Z	RS485 Differential Serial Bus Communication
12	SGND	Signal Return
13	UART_RX / RS232_RX/RS485_A	RS485 Differential Serial Bus Communication OR RS232 Serial Bus Communication OR UART
14	I²C SDA	I²C (10kΩ pull up to 3.3V)
15	UART_TX / RS232_TX/RS485_B	RS485 Differential Serial Bus Communication OR RS232 Serial Bus Communication OR UART
16	I²C SCL	I²C Bus Clock (10kΩ pull up to 3.3V)
17	FAN_FAIL/TEMP WARNING	Fan Failure/Temp Warning Reporting (High means fan fails and/or overtemperature rating; 10kΩ pull up to 3.3V)
18	SYNC	Connect parallel units to synchronise output turn on
19	VPROG	0 - 5V to set Vout from 0 to 105%[1] (50.8 kΩ discharge resistor to SGND (2))
20	RS+	Postive Remote Sense (HPT5K0TS060 & HPT5K0TS100 only)
21	RS-	Negative Remote Sense (HPT5K0TS060 & HPT5K0TS100 only)
22	IPROG	0 - 5V to set Current Limit from 0 - 110% of rated current[1] (50.8 kΩ discharge resistor to SGND[2])
23	ISHARE	0 - 2.6V for current sharing of units in parallel
24	PMBUS_EN	Selecting Digital (open) or Analog (low) mode for VPROG & IPROG (10kΩ pull up to 3.3V)
25	ACOK	Low means AC is within range operating range (Opto Isolated; Open Collector)
26	ACOK Return	Return for ACOK (Opto isolated)
27	5VSBY	5V/2A Standby
28	5VSBY	5V/2A Standby
29	5VSBY_RTN	5V/2A Standby Return
30	5VSBY_RTN	5V/2A Standby Return

Notes:

1. In analog mode, the default Vout & Iout settings are 0% when Vprog & Iprog are open circuit.
2. To activate analog mode, PMBus_EN must be pulled down to SGND or 5VSBY return. Default if left open is digital programming.
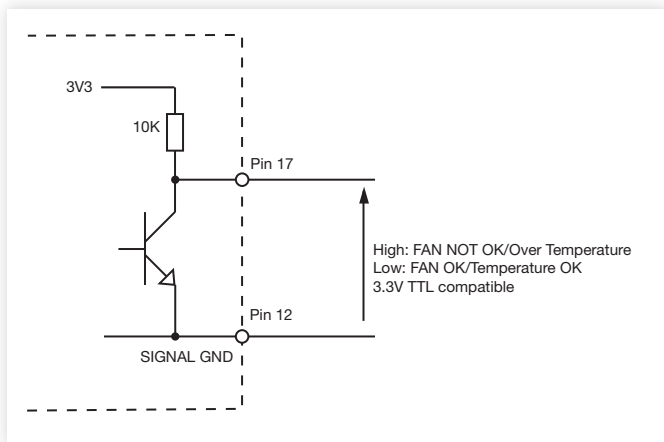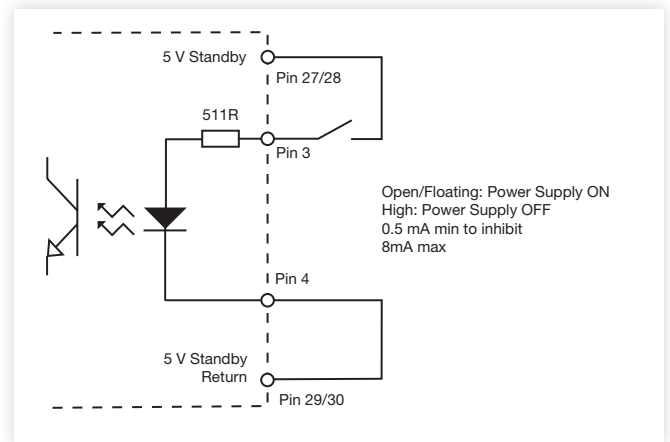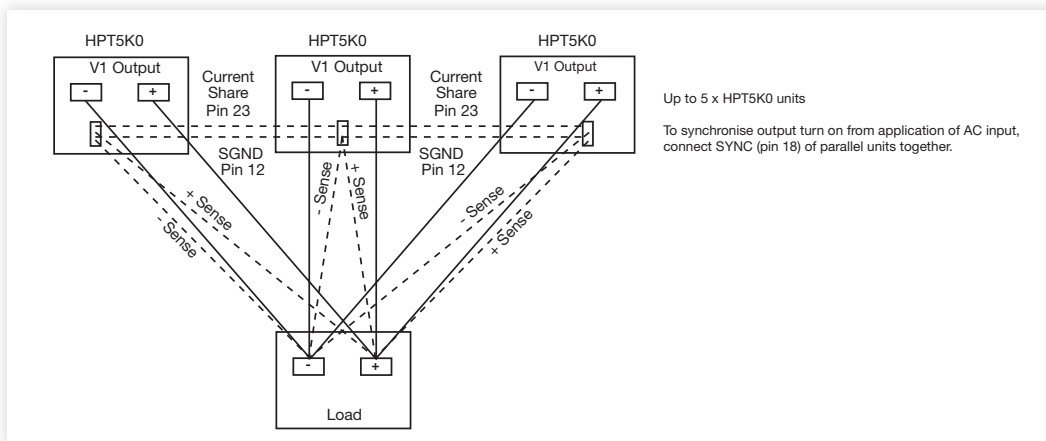
Signals & Controls

DC OK

5 V Standby
Pin 27/28
3K3
100R
Pin 1 15 V
4 mA max
High: DC NOT OK
Low: DC OK
Pin 2
5 V Standby Return
Pin 29/30

AC OK

5 V Standby
Pin 27/28
3K3
100R
Pin 25 15 V
4 mA max
High: AC NOT OK
Low: AC OK
Pin 26
5 V Standby Return
Pin 29/30

Fan Fail/Temperature Warning

3V3
10K
Pin 17
High: FAN NOT OK/Over Temperature
Low: FAN OK/Temperature OK
3.3V TTL compatible
Pin 12
SIGNAL GND

Inhibit

5 V Standby
Pin 27/28
511R
Pin 3
Open/Floating: Power Supply ON
High: Power Supply OFF
0.5 mA min to inhibit
8mA max
Pin 4
5 V Standby Return
Pin 29/30

Current Share

HPT5K0
V1 Output
− +
Current Share Pin 23
SGND Pin 12

HPT5K0
V1 Output
− +
− Sense + Sense

HPT5K0
V1 Output
− +
Current Share Pin 23
SGND Pin 12
− Sense + Sense

Up to 5 x HPT5K0 units

To synchronise output turn on from application of AC input, connect SYNC (pin 18) of parallel units together.

Load
− +

LED Signals

View A

Conditions	LED State		Signals			
	AC OK	DC OK	AC OK	DC OK	FAN _FAIL/ TEMP	Remote Inhibit
AC input OK	ON	ON[3]	LOW	LOW	LOW	LOW
AC not present or too low	OFF	OFF	HIGH	HIGH	LOW	X[2]
AC Present but out of range or PFC failure or no Primary to secondary communication	Blink (0.2s ON, 0.2s OFF)	OFF	HIGH	HIGH	LOW	X[2]
Output Over Voltage	ON	OFF	LOW	HIGH	LOW	LOW
Current Limit (Constant current response)	ON	Blink (0.2s ON, 0.2s OFF)	LOW	LOW or HIGH[3]	LOW	LOW
Fan Failure/Thermal Shutdown	ON	OFF	LOW	HIGH	HIGH[1]	LOW
Remote OFF	ON	Blink (1.0s ON, 1.0s OFF)	LOW	HIGH	LOW	HIGH
PMBus Operation OFF	ON	Blink (1.0s ON, 1.0s OFF)	LOW	HIGH	LOW	LOW

Notes:

1. In case of fan failure, and/or Overtemperature, FAN_FAIL/Temp Warning signal will be set 10s before output shutdown.
2. Don't care / not applicable.

3. DC_OK LED is ON if Output Voltage >= VOUT_UV_FAULT_LIMIT, if Output Voltage < VOUT_UV_FAULT_LIMIT, the DC_OK LED will be OFF

Mechanical Details
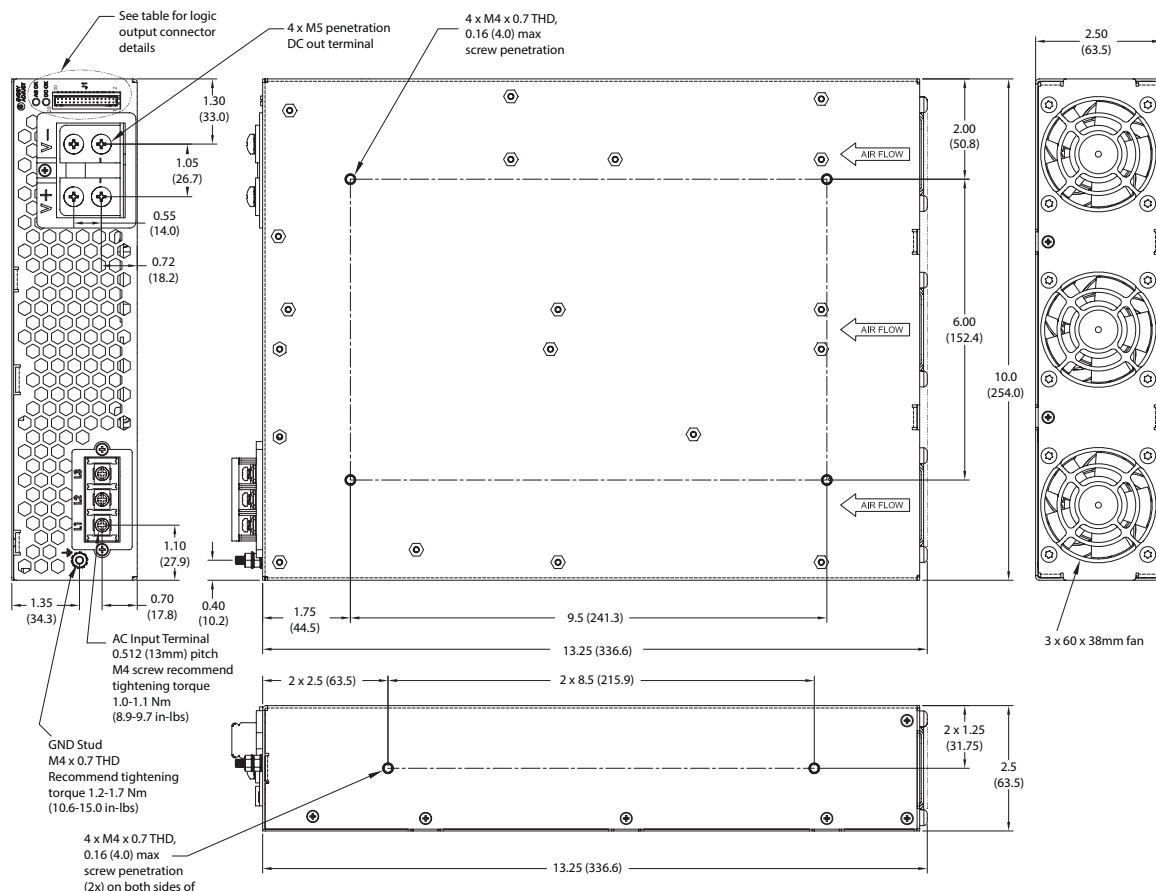
Notes:

1. All dimensions are in inches (mm).
2. Weight 12.5 lb (5.7 kg)

3. Signal Connector: P/N JST S30B-PHDSS (LF) (SN) or equivalent
   Mates with P/N JST PHDR-30VS or equivalent
   Contact: SPHD-002T-P0.5

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