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POWERBOX Industrial Line
PHE75W Series
75W 4:1 Single Output
DC/DC Converter
Manual V10

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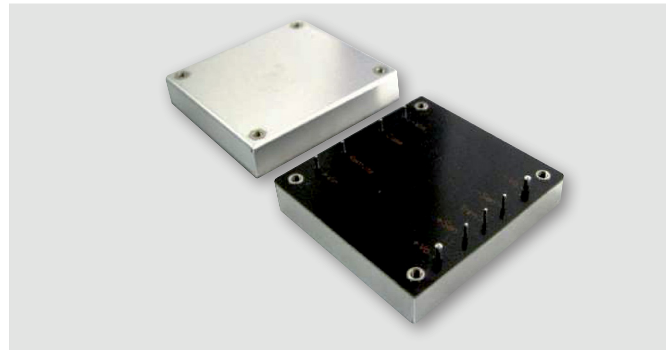


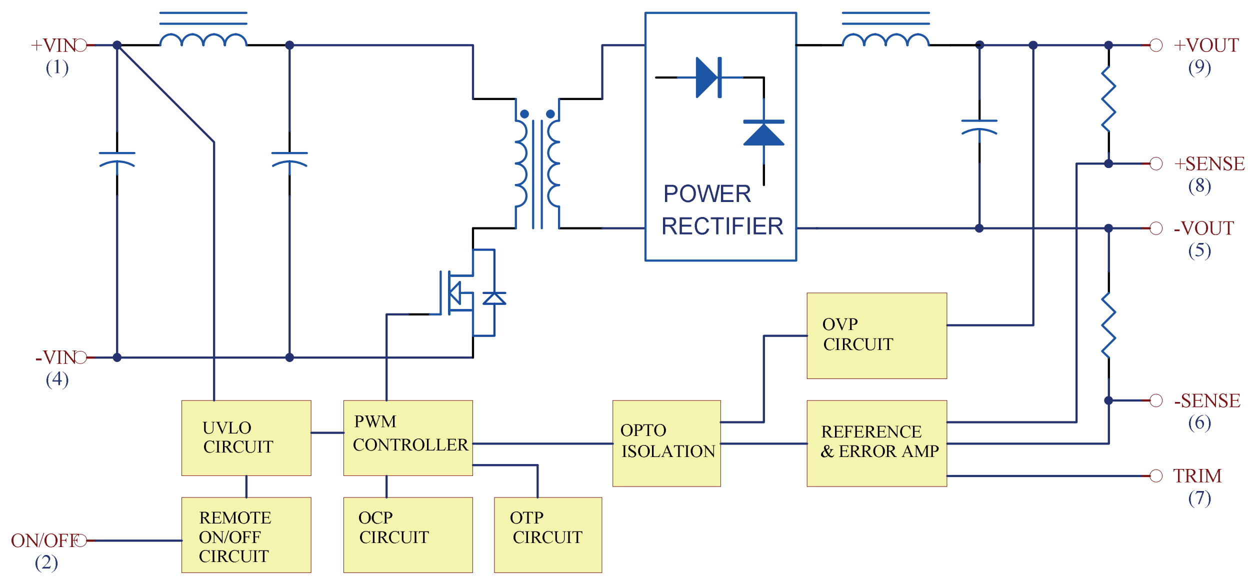
1. Introduction

The PHE75W series offers 75 watts of output power with high power density in an industry standard half- brick package. The PHE75W series has wide (4:1) input voltage ranges of 9-36 and 18-75VDC and provides a precisely regulated output. This series has features such as high efficiency, 1500VDC isolation and a case operating temperature range of –40°C to 105°C.The modules are fully protected against input UVLO (under voltage lock out), output short circuit, output overvoltage and overtemperature conditions. Furthermore, the standard control functions include remote on/off and output voltage trimming. All models are highly suited to telecommunications, distributed power architectures, battery operated equipment, industrial, and mobile equipment applications.

2. DC/DC Converter Features

- 75W isolated output
- Efficiency (at full load) up to 92.5%
- Regulated output
- 250KHz switching frequency
- Input under voltage lockout protection
- Over temperature/voltage/current protection
- Remote ON/OFF
- Continuous short circuit protection
- Industry standard half-brick package
- Fully isolated to 1500VDC
- No tantalum capacitor inside
- CE mark meets 2004/108/EC
- Safety meets UL60950-1 and EN60950-1 and IEC60950-1

3. Electrical Block Diagram



4. Technical Specifications

(All specifications are typical at nominal input, full load at 25°C unless otherwise noted.)

Absolute Maximum Ratings

Parameters	Notes and Conditions	Device	Min	Typical	Max	Units
Input voltage						
Continuous		24SXX	9	24	36	VDC
		48SXX	18	48	75	VDC
Transient	100ms	24SXX			50	VDC
		48SXX			100	VDC
Operating case temperature		All	-40		105	°C
Storage temperature		All	-55		105	°C
Input/output isolation voltage	1 minute	All	1500			VDC

Input Characteristics

Parameters	Notes and Conditions	Device	Min	Typical	Max	Units
Operating input voltage		24SXX	9	24	36	VDC
		48SXX	18	48	75	VDC
Input Under Voltage Lockout						
Turn-on voltage threshold		24SXX	8	8.5	8.8	VDC
		48SXX	16.5	17	17.5	VDC
Turn-off voltage threshold		24SXX	7.7	8	8.3	VDC
		48SXX	15.5	16	16.5	VDC
Lockout hysteresis voltage		24SXX		0.6		VDC
		48SXX		0.6		VDC
Maximum input current	100% Load, Vin=9V for 24SXX	24SXX		9.5		A
	100% Load, Vin =18V for 48SXX	48SXX		4.8		A
No-load input current		24S3V3		150		mA
		24S05		150		mA
		24S12		150		mA
		24S15		150		mA
		24S24		70		mA
		24S48		70		mA
		48S3V3		80		mA
		48S05		80		mA
		48S12		80		mA
		48S15		70		mA
		48S24		70		mA
		48S48		70		mA
Inrush current (I^2t)		All			0.1	A^2s
Input reflected ripple current	P-P thru 12uH inductor, 5Hz to 20MHz	All		30		mA

Output Characteristics

Parameters	Notes and Conditions	Device	Min	Typical	Max	Units
Output voltage set point	Vin=Nominal Vin, Io = Io_max, Tc=25°C	Vo=3.3 VDC	3.2505	3.3	3.3495	VDC
		Vo=5.0 VDC	4.925	5	5.075	VDC
		Vo=12 VDC	11.82	12	12.18	VDC
		Vo=15 VDC	14.775	15	15.225	VDC
		Vo=24 VDC	23.64	24	24.36	VDC
		Vo=48 VDC	47.28	48	48.72	VDC
Output voltage regulation						
Load regulation	Io=Io_min to Io_max	All			±0.2	%
Line regulation	Vin=low line to high line	All			±0.2	%
Temperature coefficient	TC=-40°C to 100°C	All			±0.03	%/°C
Output voltage ripple and noise						
Peak-to-Peak	5Hz to 20MHz bandwidth, full load, 10uF solid tantalum and 1.0uF ceramic capacitors	Vo= 3.3V & 5.0V			100	mV
		Vo=12V & 15V			120	mV
	5Hz to 20MHz bandwidth, full load, 10uF aluminum and 1.0uF ceramic capacitors	Vo=24V			240	mV
		Vo=48V			480	mV
RMS	5Hz to 20MHz bandwidth, full load, 10uF solid tantalum and 1.0uF ceramic capacitors	Vo= 3.3V & 5.0V			40	mV
		Vo=12V & 15V			60	mV
	5Hz to 20MHz bandwidth, full load, 10uF Aluminum and 1.0uF ceramic capacitors	Vo=24V & 28V			100	mV
		Vo=48V			200	mV
Operating output current range		Vo=3.3 V	0		20	A
		Vo=5.0 V	0		15	A
		Vo=12 V	0		6.25	A
		Vo=15 V	0		5	A
		Vo=24 V	0		3.12	A
		Vo=48 V	0		1.56	A
Output DC current limit inception	Output voltage=90% nominal output voltage	All	110		140	%
Maximum output capacitance	Full load (resistive)	Vo=3.3 V	0		20000	uF
		Vo=5.0 V	0		15000	uF
		Vo=12 V	0		6250	uF
		Vo=15 V	0		5000	uF
		Vo=24 V	0		3120	uF
		Vo=48 V	0		1560	uF

Dynamic Characteristics

Parameters	Notes and Conditions	Device	Min	Typical	Max	Units
Output voltage current transient (1A/us)						
Step change in output current	75% to 100% of Io max	All			±5	%
Setting time (within 1% Vout nominal)	di/dt=0.1A/us	All			500	us
Output voltage rise time	10%Vo_set to 90%Vo_set	Vo=12V & 15V		15		ms
		Other		10		ms
Turn-on delay and rise time						
Turn-on delay time, from On/Off control	Von/off to 10%Vo_set	All		10		ms
Turn-on delay time, from input	Vin_min to 10%Vo_set	All		10		ms

Efficiency

Parameters	Notes and Conditions	Device	Min	Typical	Max	Units
100% load	Vin = 12VDC	24S3V3		87.5		%
		24S05		90.5		%
		24S12		91		%
		24S15		91		%
		24S24		90		%
		24S48		90		%
	Vin = 24VDC	24S3V3		88.5		%
		24S05		91		%
		24S12		91.5		%
		24S15		91.5		%
		24S24		90		%
		24S48		89		%
	Vin = 24VDC	48S3V3		88.5		%
		48S05		92		%
		48S12		92		%
		48S15		92.5		%
		48S24		91		%
		48S48		91.5		%
	Vin = 48VDC	48S3V3		89		%
		48S05		92		%
		48S12		92		%
		48S15		92.5		%
		48S24		90.5		%
		48S48		90		%

Isolation Characteristics

Parameters	Notes and Conditions	Device	Min	Typical	Max	Units
Isolation voltage	1 minute; input/output, input/case, output/case				1500	VDC
Isolation resistance			10			MΩ
Isolation capacitance	Input to output			1000		pF

Feature Characteristics

Parameters	Notes and Conditions	Device	Min	Typical	Max	Units
Switching frequency				250		KHz
ON/OFF control, positive remote On/Off logic						
Logic low (module off)	Von/off at Ion/off=1.0mA				1.2	V
Logic high (module on)	Von/off at Ion/off=0.0uA		3.5 or open circuit		75	V
ON/OFF control, negative remote On/Off logic						
Logic high (module off)	Von/off at Ion/off=0.0uA		3.5 or Open Circuit		75	V
Logic high (module on)	Von/off at Ion/off=1.0mA				1.2	V
ON/OFF current (for both remote on/off logic)	Ion/off at Von/off=0.0V			0.3	1	mA
Leakage current (for both remot on/off logic)	Logic High, Von/off=15V				30	uA
Off converter input current	Shutdown input idle current			4	10	mA
Output voltage trim range	Pout=max rated power		-10		+10	%
Output over voltage protection			115	125	140	%
Over-temperature shutdown				110		°C

General Specifications

Parameters	Notes and Conditions	Device	Min	Typical	Max	Units
MTBF	Io=100% of Io_max:	Vo=3.3 & 5.0V		820		Khours
	Ta=25°C per MIL-HDBK-217F	Vo=12 & 48V		820		Khours
		Vo=15 & 24V		950		Khours
Weight		All		95		grams

5. Main Features and Functions

5.1 Operating Temperature Range

The PHE75W series converters can be operated within a wide case temperature range of -40°C to 105°C. Consideration must be given to the derating curves when ascertaining maximum power that can be drawn from the converter. The maximum power drawn from open half brick models is influenced by usual factors, such as:

- Input voltage range
- Output load current
- Forced air or natural convection

5.2 Output Voltage Adjustment

Section 6.8 describes in detail how to trim the output voltage with respect to its set point. The output voltage on all models is adjustable within the range of +10% to −10%.

5.3 Over Current Protection

All models have internal overcurrent and continuous short circuit protection. The unit operates normally once the fault condition is removed. At the point of current limit inception, the converter will go into hiccup mode protection.

5.4 Output Over Voltage Protection

The output overvoltage protection consists of circuitry that internally limits the output voltage. If more accurate output over voltage protection is required then an external circuit can be used via the remote on/off pin.

5.5 Remote On/Off

The PHE75W series allows the user to switch the module on and off electronically with the remote on/off feature. All models are available in "positive logic" and "negative logic" (optional) versions. The converter turns on if the remote On/Off pin is high (>3.5Vdc or open circuit). Setting the pin low (<1.2Vdc) will turn the converter off. The signal level of the remote on/off input is defined with respect to ground. If not using the remote on/off pin, leave the pin open (converter will be on). Models with part number suffix "N" are the "negative logic" remote On/Off version. The unit turns off if the remote On/Off pin is high (>3.5Vdc or open circuit). The converter turns on if the On/Off pin input is low (<1.2Vdc). Note that the converter is off by default.

5.6 UVLO&OVLO (Under/Over Voltage Lock Out)

Input under voltage lockout is standard on the PHE75W unit. The unit will shut down when the input voltage drops below a threshold, and the unit will operate when the input voltage goes above the upper threshold.

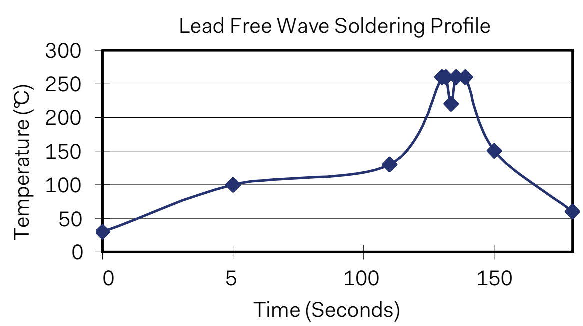
5.7 Over Temperature Protection

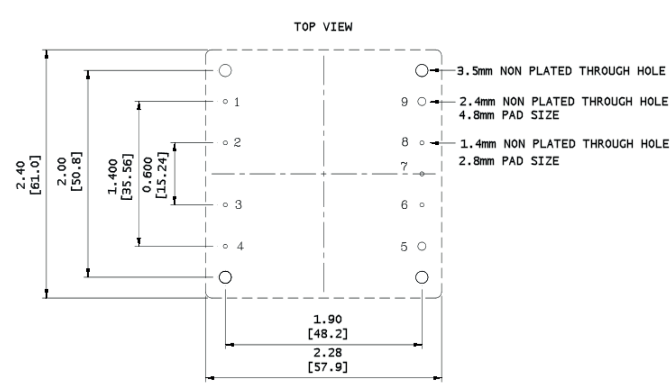
These modules have an overtemperature protection circuit to safeguard against thermal damage. Shutdown occurs with the maximum case reference temperature is exceeded. The module will restart when the case temperature falls below overtemperature shutdown threshold.

6. Applications

6.1 Recommended Layout, PCB Footprint and Soldering Information

The system designer or end user must ensure that metal and other components in the vicinity of the converter meet the spacing requirements for which the system is approved. Low resistance and inductance PCB layout traces are the norm and should be used where possible. Due consideration must also be given to proper low impedance tracks between power module, input and output grounds. The recommended soldering profile and PCB layout are shown below.





6.2 Convection Requirements for Cooling

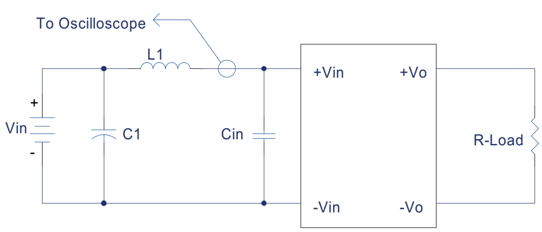
To predict the approximate cooling needed for the half brick module, refer to the power derating curves in section 6.4. These derating curves are approximations of the ambient temperatures and airflows required to keep the power module temperature below its maximum rating. Once the module is assembled in the actual system, the module's temperature should be monitored to ensure it does not exceed 100°C as measured at the center of the top of the case (thus verifying proper cooling).

6.3 Thermal Considerations

The power module operates in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. The test data is presented in section 6.4. The power output of the module should not be allowed to exceed rated power (Vo_set x Io_max).

6.4 Input Capacitance at the Power Module

The converters must be connected to low AC source impedance. To avoid problems with loop stability source inductance should be low. Also, the input capacitors (Cin) should be placed close to the converter input pins to de- couple distribution inductance. However, the external input capacitors are chosen for suitable ripple handling capability. Low ESR capacitors are good choice. Circuit as shown as below represents typical measurement methods for reflected ripple current. C1 and L1 simulate a typical DC source impedance. The input reflected-ripple current is measured by current probe to oscilloscope with a simulated source Inductance (L1).



L1: 12uH
C1: 220uF ESR<0.1ohm @100KHz
Cin: 220uF ESR<0.1ohm @100KHz
Input Reflected-Ripple Test Setup

6.5 Power De-rating

The operating case temperature range of PHE75W series is -40°C to +100°C. When operating the PHE75W series, proper de-rating or cooling is needed. The maximum case temperature under any operating condition should not be exceeded 105°C.

The following curve is the de-rating curve of PHE75W series without heat sink.

Example

What is the minimum airflow necessary for a PHE75W-48S12 operating at nominal line voltage, an output current of 6.25A, and a maximum ambient temperature of 50°C?

Solution: Given: V_{in}=24Vdc Vo=12Vdc Io=6.52A

Determine power dissipation (Pd): Pd =Pi-Po=Po(1-η)/η

Pd =12V×6.52A×(1-0.92)/0.92=6.52Watts

Determine airflow: Given: Pd =6.52W and Ta=50°C

Check above power de-rating curve: minimum airflow= 100 ft./min.

Verifying: The maximum temperature rise:

ΔT = Pd × Rca=6.52W×6.21=40.48°C

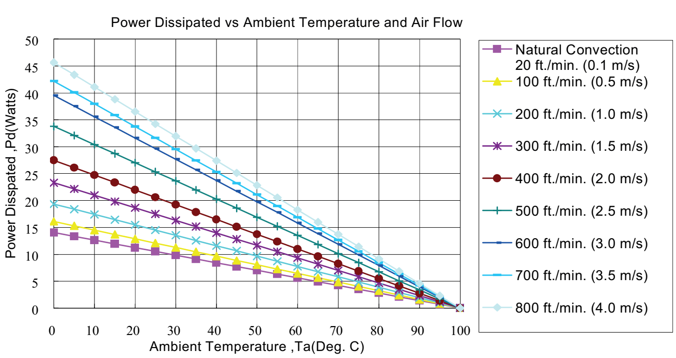
The maximum case temperature: Tc=Ta+ΔT=90.48°C <105°C

Where:

The R_{ca} is thermal resistance from case to ambient environment.

The T_a is ambient temperature and the Tc is case temperature.

Example (with heatsink M-C091):



AIR FLOW RATE	TYPICAL Rca
Natural Convection 20ft./min. (0.1m/s)	7.12°C/W
100 ft./min. (0.5m/s)	6.21°C/W
200 ft./min. (1.0m/s)	5.17°C/W
300 ft./min. (1.5m/s)	4.29°C/W
400 ft./min. (2.0m/s)	3.64°C/W
500 ft./min. (2.5m/s)	2.96°C/W
600 ft./min. (3.0m/s)	2.53°C/W
700 ft./min. (3.5m/s)	2.37°C/W
800 ft./min. (4.0m/s)	2.19°C/W

What is the minimum airflow necessary for a PHE75W-48S12 operating at nominal line voltage, an output current of 8.4A, and a maximum ambient temperature of 60°C?

Solution: Given: Vin=24Vdc, Vo=12Vdc, Io=6.25A

Determine Power dissipation (Pd): Pd=Pi-Po=Po(1-η)/ η

Pd=12x6.25x(1-0.92)/0.92=6.52Watts

Determine airflow: Given: P_d=6.52W and Ta=60°C

Check above Power de-rating curve: Natural convection

Verifying:

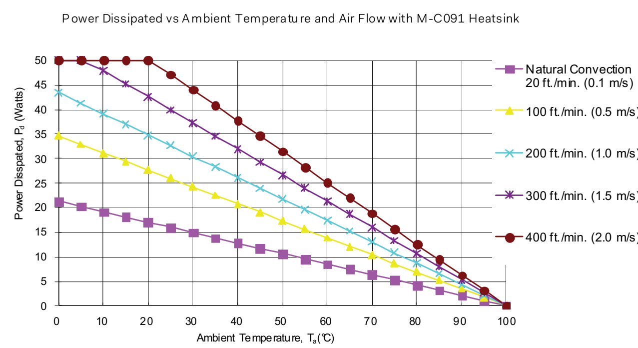
The maximum temperature rise ΔT = Pd × Rca=6.52×4.7=30.64°C

The maximum case temperature Tc=Ta+ΔT=90.64°C <105°C

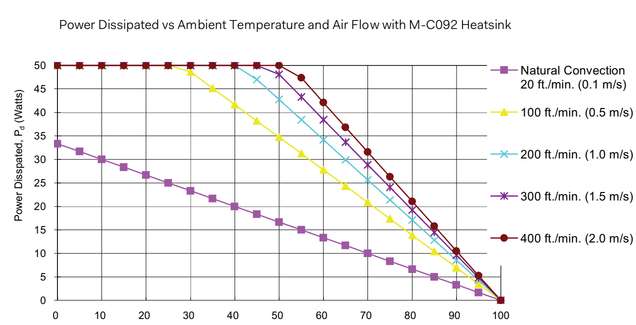
Where:

The R_{ca} is thermal resistance from case to ambient environment.

The T_a is ambient temperature and the T_c is case temperature.

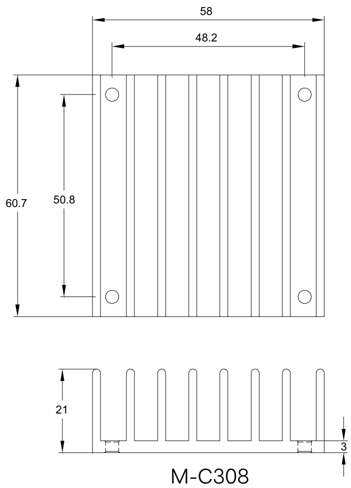


AIR FLOW RATE	TYPICAL Rca
Natural convection 20ft./min. (0.1m/s)	4.70°C/W
100 ft./min. (0.5m/s)	2.89°C/W
200 ft./min. (1.0m/s)	2.30°C/W
300 ft./min. (1.5m/s)	1.88°C/W
400 ft./min. (2.0m/s)	1.59°C/W

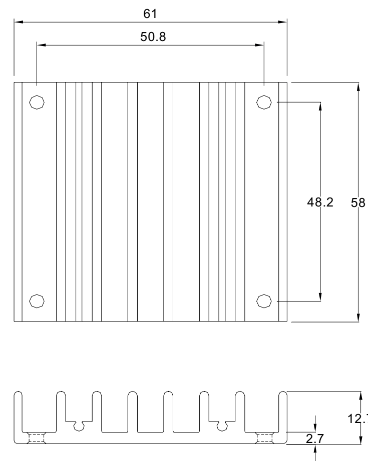


AIR FLOW RATE	TYPICAL Rca
Natural convection 20ft./min. (0.1m/s)	3.00°C/W
100 ft./min. (0.5m/s)	1.44°C/W
200 ft./min. (1.0m/s)	1.17°C/W
300 ft./min. (1.5m/s)	1.04°C/W
400 ft./min. (2.0m/s)	0.95°C/W

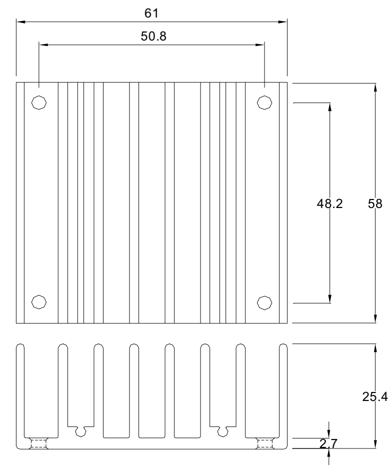
6.6 Half Brick Heat Sinks



M-C308



M-C091



M-C092

M-C308 (G6620400201)
Longitudinal Heat Sink

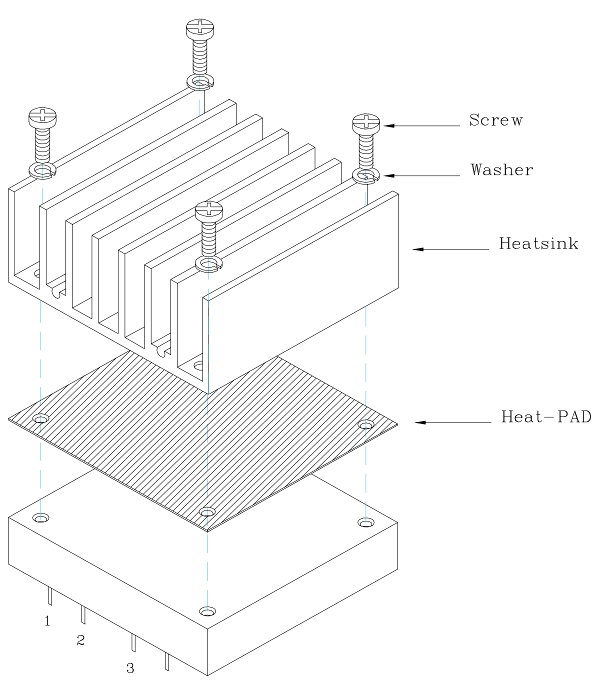
Rca:
3.90℃/W (typ.), natural convection
1.74℃/W (typ.), at 100LFM
1.33℃/W (typ.), at 200LFM
1.12℃/W (typ.), at 300LFM
0.97℃/W (typ.), at 400LFM

M-C091 (G6610120402)
Transverse Heat Sink

Rca:
4.70℃/W (typ.), natural convection
2.89℃/W (typ.), at 100LFM
2.30℃/W (typ.), at 200LFM
1.88℃/W (typ.), at 300LFM
1.59℃/W (typ.), at 400LFM

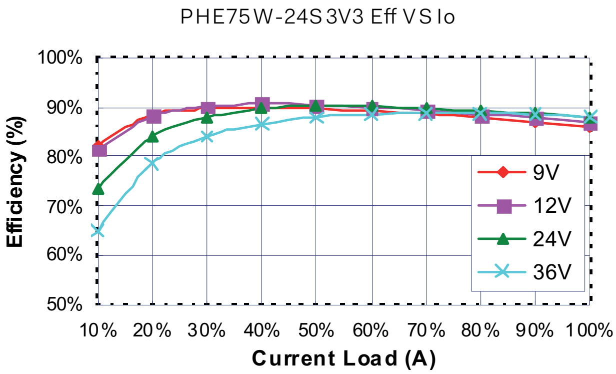
M-C092 (G6610130402)
Transverse Heat Sink

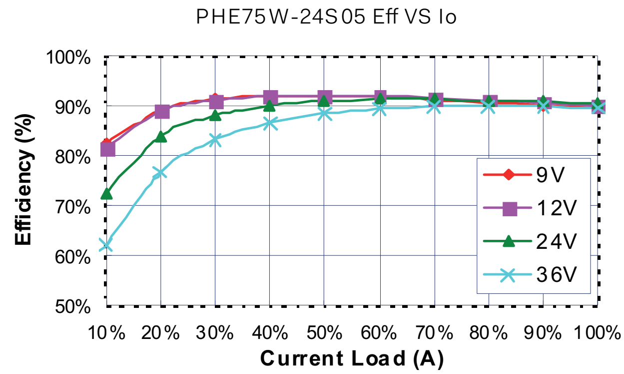
Rca:
3.00℃/W (typ.), natural convection
1.44℃/W (typ.), at 100LFM
1.17℃/W (typ.), at 200LFM
1.04℃/W (typ.), at 300LFM
0.95℃/W (typ.), at 400LFM

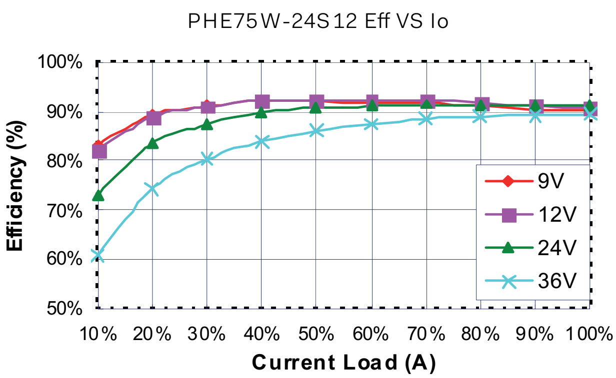


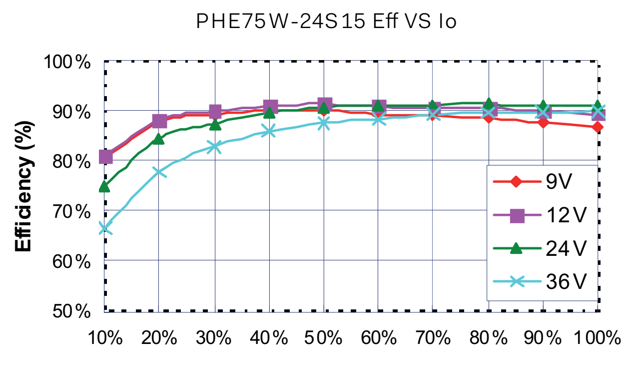
THERMAL PAD: SZ 56.9*60*0.25 mm (G6135041091)
SCREW: SMP+SW M3*8L
(G75A1300322)

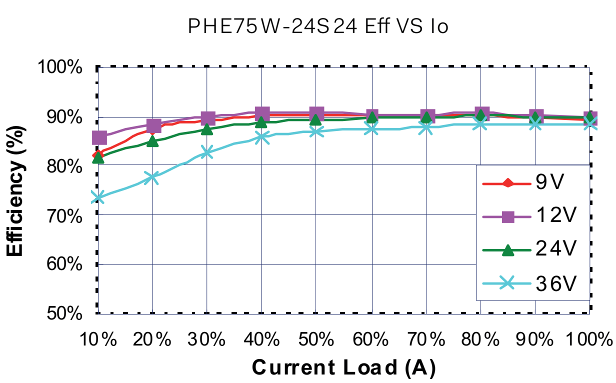
6.7 Efficiency VS. Load

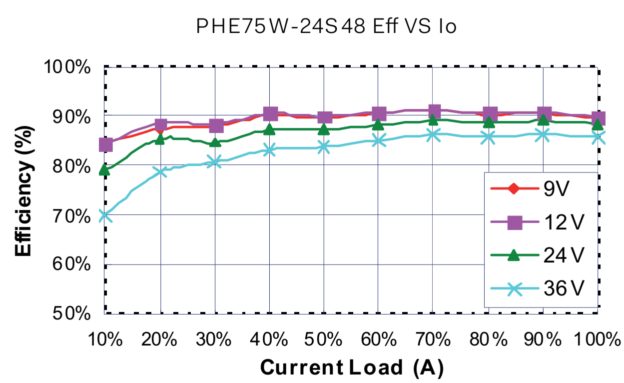


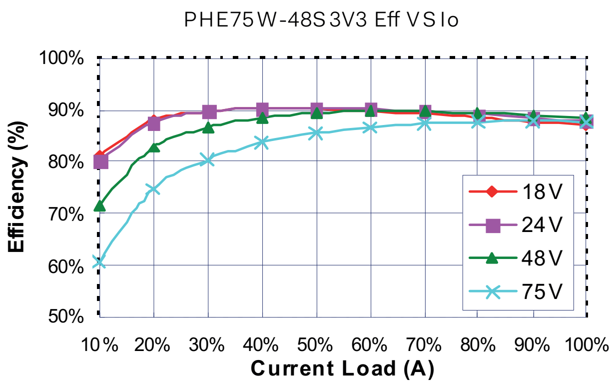


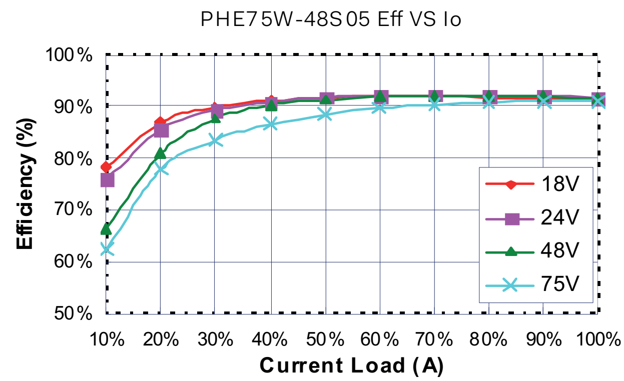


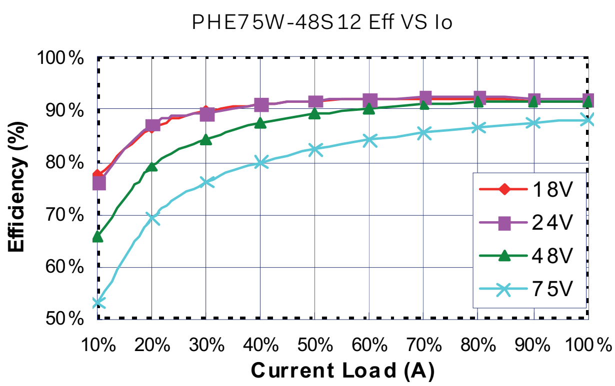


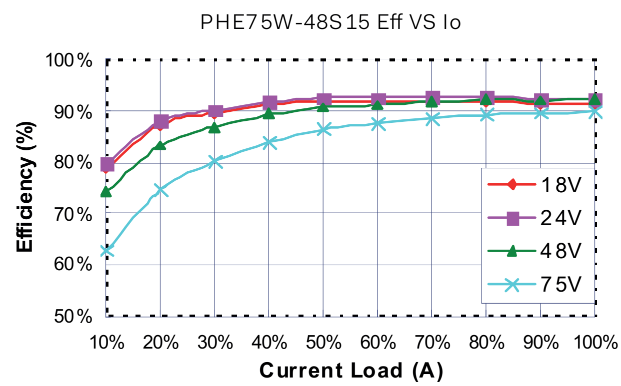


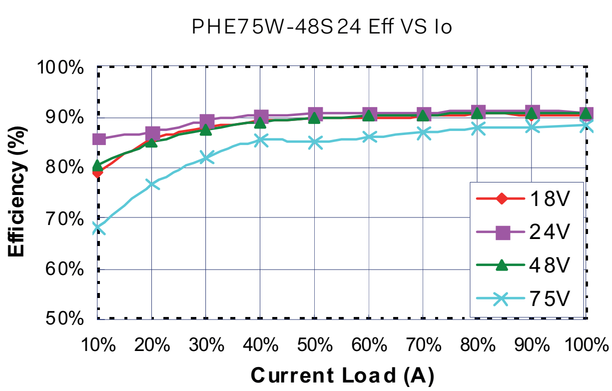


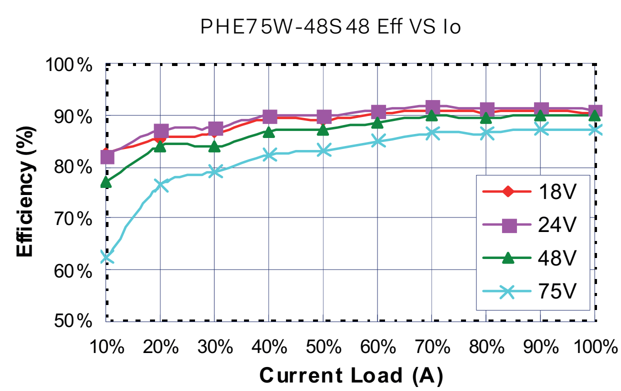












Note:
The Y-axis (Efficiency) shows values from 55% to 90% EXCEPT on models 24S15, 48S12, 48S15 and 48S24. Because these models may operate at efficiencies of 90% or higher, the Y-axis (Efficiency) shows values from 60% to 100%

6.8 Test Set-Up

The basic test set-up to measure parameters such as efficiency and load regulation is shown below. When testing the modules under any transient conditions please ensure that the transient response of the source is sufficient to power the equipment under test. We can calculate:

- Efficiency
- Load regulation and line regulation.

The value of efficiency is defined as:

$$\eta = \frac{Vo \times Io}{Vin \times Iin} \times 100\%$$

Where:
V_o is output voltage,
I_o is output current,
V_{in} is input voltage,
I_{in} is input current.

The value of load regulation is defined as:

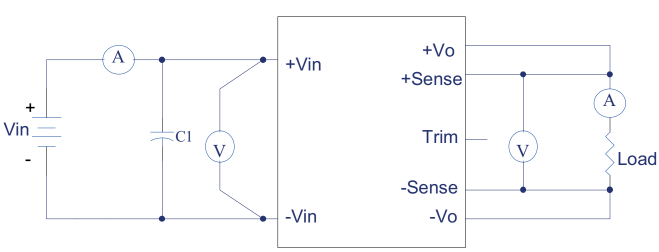
$$Load.reg = \frac{V_{FL} - V_{NL}}{V_{NL}} \times 100\%$$

Where:
V_{FL} is the output voltage at full load
V_{NL} is the output voltage at no load

The value of line regulation is defined as:

$$Line.reg = \frac{V_{HL} - V_{LL}}{V_{LL}} \times 100\%$$

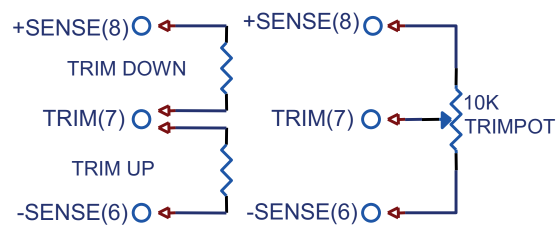
Where: V_{HL} is the output voltage of maximum input voltage at full load.
V_{LL} is the output voltage of minimum input voltage at full load.



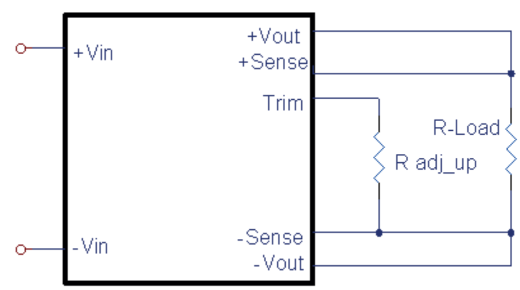
PHE75W Series Test Setup

6.9 Output Voltage Adjustment

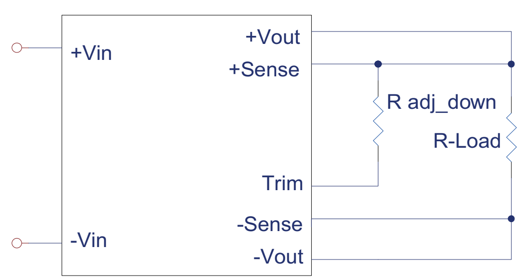
Output may be externally trimmed (±10%) with a fixed resistor or an external trimpot as shown (optional). Model specific formulas for calculating trim resistors are available upon request as a separate document.



In order to trim the voltage up or down, one needs to connect the trim resistor either between the trim pin and -Vo for trim-up or between trim pin and +Vo for trim-down. The output voltage trim range is ±10%. This is shown:



Trim-up Voltage Setup



Trim-down Voltage Setup

Vout (V)	R1 (KΩ)	R2 (KΩ)	R3 (KΩ)	Vr (V)	Vf (V)
3.3V	3.0	12	4.3	1.24	0.46
5V	2.32	3.3	0	2.5	0
12V	9.1	51	5.1	2.5	0.46
15V	12	56	8.25	2.5	0.46
24V	20	100	7.5	2.5	0.46
48V	36	270	5.1	2.5	0.46

Trim Resistor Values

For 5V Rtrim_up decision

$$R_{trim\_up} = \left(\frac{R_1 Vr}{Vo - V_{o\_nom}}\right) - R_2 \quad (K\Omega)$$

For others Rtrim_up decision

$$R_{trim\_up} = \left(\frac{R_1\left(V_r - V_f\left(\frac{R_2}{R_2 + R_3}\right)\right)}{Vo - V_{o\_nom}}\right) - \frac{R_2 R_3}{R_2 + R_3} \quad (K\Omega)$$

Where:
Rtrim_up is the external resistor in KΩ.
Vo_nom is the nominal output voltage.
Vo is the desired output voltage.
R1, R2, R3 and Vr are internal components.
For example, to trim-up the output voltage of 12V module (PHE75W-48S12) by 5% to 12.6V, Rtrim_up is calculated as follows:

Vo – Vo_nom = 12.6 – 12 = 0.6V
R1 = 9.1 KΩ , R2 = 51 KΩ , R3 = 5.1KΩ,
Vr= 2.5 V , Vf=0.46 V

$$R_{trim\_up} = \frac{18.944}{0.6} - 4.636 = 26.94\ (K\Omega)$$

The value or Rtrim_down defined as:

$$R_{trim\_down} = \frac{R_1 \times (V_o - V_r)}{V_{o\_nom} - V_o} - R_2 \quad (K\Omega)$$

Where:
Rtrim_down is the external resistor in KΩ.
Vo_nom is the nominal output voltage.
Vo is the desired output voltage.
R1, R2, R3 and Vr are internal components.

For example: to trim-down the output voltage of 12V module (PHE75W-48S12) by 5% to 11.4V, Rtrim_down is calculated as follows:

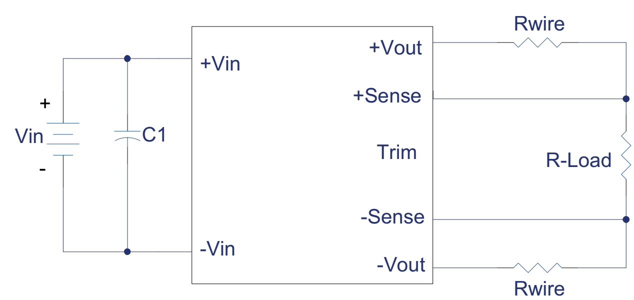
Vo_nom – Vo = 12 – 11.4 = 0.6 V
R1 = 9.1 KΩ, R2 = 51 KΩ, Vr = 2.5 V

$$R_{trim\_down} = \frac{9.1 \times (11.4 - 2.5)}{0.6} - 51 = 83.98 \quad (K\Omega)$$

6.10 Output Remote Sensing

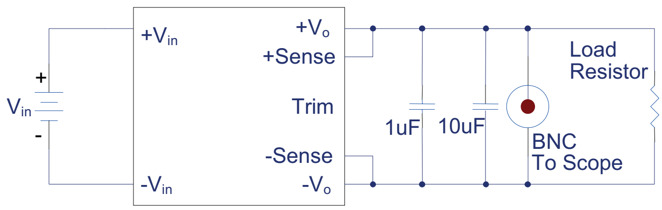
The PHE75W series converters have the capability to remotely sense both lines of its output. This feature moves the effective output voltage regulation point from the output of the unit to the point of connection of the remote sense pins. This feature automatically adjusts the real output voltage of the PHE75W series in order to compensate for voltage drops in distribution and maintain a regulated voltage at the point of load. The remote-sense voltage range is:
[(+Vout) - (-Vout)] – [(+Sense) – (-Sense)] ≤ 10% of Vo_nominal

If the remote sense feature is not to be used, the sense pins should be connected locally. The +Sense pin should be connected to the +Vout pin at the module and the - Sense pin s hould be connected to the -Vout pin at the module. This is shown in the schematic below.



Note: Although the output voltage can be varied (increased or decreased) by both remote sense and trim, the maximum variation for the output voltage is the larger of the two values not the sum of the values. The output power delivered by the module is defined as the voltage at the output terminals multiplied by the output current. Using remote sense and trim can cause the output voltage to increase and consequently increase the power output of the module if output current remains unchanged. Always ensure that the output power of the module remains at or below the maximum rated power. Also be aware that if Vo.set is below nominal value, Pout.max will also decrease accordingly because Io.max is an absolute limit. Thus, Pout.max = Vo.set x Io.max is also an absolute limit.

6.11 Output Ripple and Noise



Vo=24 & 48V Output ripple and noise is measured with 1.0uF ceramic and 10uF/100V KMF Aluminum capacitors across the output.
Other Vo Output ripple and noise is measured with 1.0uF ceramic and 10uF solid tantalum capacitors across the output.

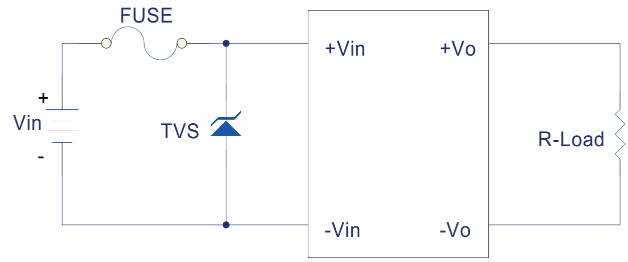
6.12 Output Capacitance

The PHE75W series converters provide unconditional stability with or without external capacitors. For good transient response, low ESR output capacitors should be located close to the point of load. PCB design emphasizes low resistance and inductance tracks in consideration of high current applications. Output capacitors with their associated ESR values have an impact on loop stability and bandwidth. Powerbox converters are designed to work with load capacitance up to 1000uF per amp.

7. Safety & EMC

7.1 Input Fusing and Safety Consideration

The PHE75W series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a 20A time delay fuse for 24Vin models, and 10A for 48Vin models. It is recommended that the circuit have a transient voltage suppressor diode (TVS) across the input terminal to protect the unit against surge or spike voltage and input reverse voltage (as shown).



7.2 EMC Considerations

EMI Test standard: EN55022 Class A and Class B Conducted Emission
Test Condition: Input Voltage: Nominal, Output Load: Full Load.

8. Part Number

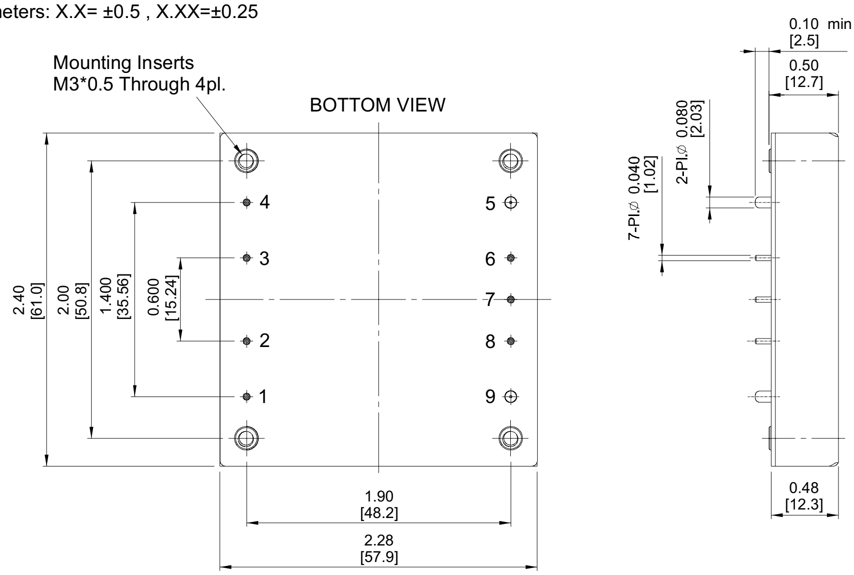
Format: PHE75W – II X OO L

Parameter Symbol	Series PHE75W	Nominal Input Voltage II	Number of Outputs X	Output Voltage OO	Remote ON/OFF Logic L
Value	PHE75W	24: 24 Volts 48: 48 Volts	S: Single	3V3: 3.3 Volts 05: 05 Volts 12: 12 Volts 15: 15 Volts 24: 24 Volts 48: 48 Volts	None: Positive N: Negative

9. Mechanical Specifications

9.1 Mechanical Outline Diagrams

All Dimensions In Inches(mm)
Tolerances Inches: X.XX= ±0.02 , X.XXX= ±0.010
Millimeters: X.X= ±0.5 , X.XX=±0.25



Pin	Function
1	+Vin
2	ON/OFF
3	CASE
4	-Vin
5	-Vout
6	-Sense
7	Trim
8	+Sense
9	+Vout