

## Features

- Industry-standard pinout
- Output: 15 V at 5.5 A, 82.5W max.
- No minimum load required
- Low height - 0.374" (9.5mm) max.
- Basic Insulation
- Withstands 100 V input transients
- Fixed-frequency operation
- Industry standard 1/16<sup>th</sup> brick footprint
- Fully protection (OTP, OCP, OVP, UVLO – auto-restart)
- Remote ON/OFF - positive or negative enable logic options
- Remote sense
- Output voltage trim range: +10%/-20% (industry-standard trim equations)
- Weight: 0.45 oz [12.8 g]
- On-board input differential LC-filter
- Meets UL94, V-0 flammability rating
- UL/CSA60950-1 recognized, TUV certified per IEC/EN60950-1 (pending)
- Designed to meet Class B conducted emissions per FCC and EN55022 when used with external filter



## Description

The CPT5C48 “Cool Power Technologies” DC-DC converter is an open frame sixteenth-brick DC-DC converter that conforms to industry standard specifications (DOSA). The converter operates over an input voltage range of 36 to 75 VDC, and provides a tightly regulated output voltage with an output current rating of 5.5 A. The output is fully isolated from the input and the converter meets Basic Insulation requirements. The standard feature set includes remote On/Off (positive or negative enable), input undervoltage lockout, output overvoltage protection, overcurrent and short circuit protections, output voltage trim, remote sense and overtemperature shutdown with hysteresis. The high efficiency of the CPT5C48 allows operation over a wide ambient temperature range with minimal derating (full rated power @ 55°C & 200LFM (1m/s) airflow.)



ELECTRICAL SPECIFICATIONS

36–75Vin, 15V/5.5Aout

Conditions:  $T_A = 25\text{ }^\circ\text{C}$ , Airflow = 300 LFM,  $V_{in} = 48\text{ VDC}$ ,  $C_{in} = 33\text{ }\mu\text{F}$ , unless otherwise specified.

Input Characteristics					
Parameter	Conditions	Min	Typ	Max	Unit
Operating Input Voltage Range		36	48	75	VDC
Input Under-Voltage Lock-out Turn-on Threshold Turn-off Threshold		34 31	35 32.5	36 34	VDC
Input Voltage Transient	100ms			100	VDC
Maximum Input Current	$V_{IN} = 36\text{VDC}; I_{out} = 5.5\text{A}$			2.6	A
Input Standby Current	Converter Disabled		2	5	mA
Input No-Load Current	Converter Enabled		65	90	mA
Input Reflected Ripple Current	5Hz to 50MHz			20	$\text{mA}_{\text{PK-PK}}$
Input Voltage Ripple Rejection	120Hz		50		dB
Inrush Current	All	-	-	1	$\text{A}^2/\text{s}$
Output Characteristics					
Parameter	Conditions	Min	Typ	Max	Unit
Output Voltage Set point	Sense pins connected to output pins	14.78	15	15.22	VDC
Output Current		0		5.5	A
Output Current Limit Inception		6	7.5	9	A
Peak Short-Circuit Current	10m $\Omega$ Short			20	A
RMS Short-Circuit Current	10m $\Omega$ Short		1.75	2.5	$\text{A}_{\text{RMS}}$
External Load Capacitance				1000	$\mu\text{F}$
Output Ripple and Noise	20 MHz bandwidth		75	100	$\text{mV}_{\text{PK-PK}}$
Output Regulation Line: Load: Overall Output Regulation:	Over line, load & temp.	14.55	$\pm 5$ $\pm 5$	$\pm 15$ $\pm 15$ 15.45	mV mV V

**ELECTRICAL SPECIFICATIONS (continued)**

**36–75Vin, 15V/5.5Aout**

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<b>Efficiency</b>					
<b>Parameter</b>	<b>Conditions</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Unit</b>
100% Load			93		%
50% Load			92		%
10% Load			75		%
<b>Dynamic Response</b>					
<b>Parameter</b>	<b>Conditions</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Unit</b>
Load Change 50%-75% or 25% to 50% of Iout Max, di/dt = 0.1 A/ $\mu\text{s}$			150	200	mV
Settling Time to 1% of Vout	Co = 1 $\mu\text{F}$ ceramic + 10 $\mu\text{F}$ tantalum		50		$\mu\text{s}$
Load Change 50%-75% or 25% to 50% of Iout Max, di/dt = 1.0 A/ $\mu\text{s}$	Co = 1 $\mu\text{F}$ ceramic + 100 $\mu\text{F}$ tantalum		150	250	mV
Settling Time to 1% of Vout			50		$\mu\text{s}$
<b>Isolation Specifications</b>					
Isolation Capacitance			1000		pF
Isolation Resistance		10			M $\Omega$
Isolation Voltage – Input to Output				2250	V <sub>DC</sub>



ELECTRICAL SPECIFICATIONS (continued)

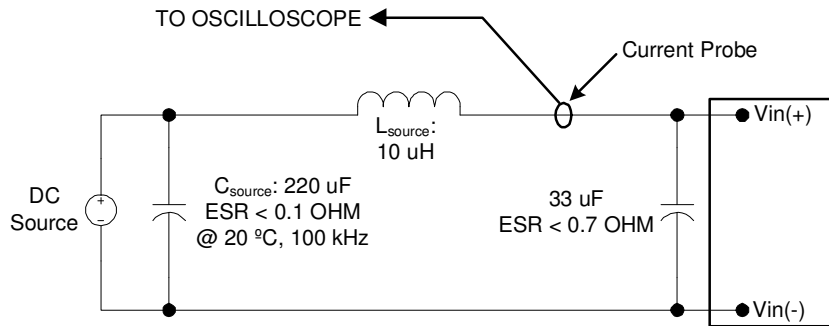
36–75Vin, 15V/5.5Aout

Conditions: Ta = 25 °C, Airflow = 300 LFM, Vin = 48 VDC, Cin=33 µF, unless otherwise specified.

Absolute Maximum Ratings					
Parameter	Conditions	Min	Typ	Max	Unit
Input Voltage	Continuous Operation	0		75	VDC
Operating Ambient Temperature		-40		85	°C
Storage Temperature		-55		125	°C
Feature Characteristics					
Parameter	Conditions	Min	Typ	Max	Unit
Switching Frequency			430		kHz
Output Voltage Trim Range		-20		+10	%
Remote Sense Compensation				+10	%
Output Over-voltage Protection	Non-latching	118	124	130	%
Over-temperature Protection	Avg. PCB temp, non-latching		125		°C
Peak Backdrive Output Current during startup into prebiased output	Sinking current from external voltage source equal to V <sub>OUT</sub> – 0.6V and connected to the output via 1Ω resistor. C <sub>OUT</sub> =220µF, Aluminum		400	600	mA
Backdrive Output Current in OFF state	Converter disabled		0	5	mA
Enable to Output Turn-ON Time	V <sub>OUT</sub> = 0.9*V <sub>OUT,NOM</sub>		20		ms
Output Enable ON/OFF					
Negative Enable					
Converter ON		-0.5		0.8	VDC
Converter OFF		2.4		20	VDC
Positive Enable					
Converter ON		2.4		20	VDC
Converter OFF		-0.5		0.8	VDC
Output Voltage Overshoot @ Startup			0	2	%Vo
Auto-Restart Period	(all protection features)		90		ms



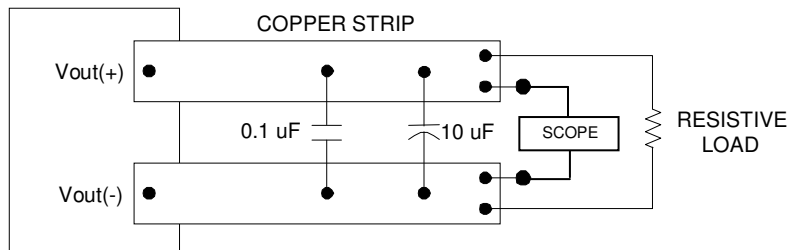
INPUT REFLECTED RIPPLE TEST SETUP:



Note: Measure input reflected-ripple current with a simulated source inductance ( $L_{test}$ ) of 10 uH. Capacitor  $C_s$  offsets possible source impedance.

Figure 1. Input Reflected-ripple Current Test Setup.

OUTPUT RIPPLE TEST SETUP:



Note: Use a 0.1µF X7R ceramic capacitor and a 10µF @ 25V tantalum capacitor. Scope measurement should be made using a BNC socket. Position the load 3 in. [76mm] from module.

Figure 2. Peak-to-Peak Output Noise Measurement Test Setup.

CHARACTERISTIC CURVES:

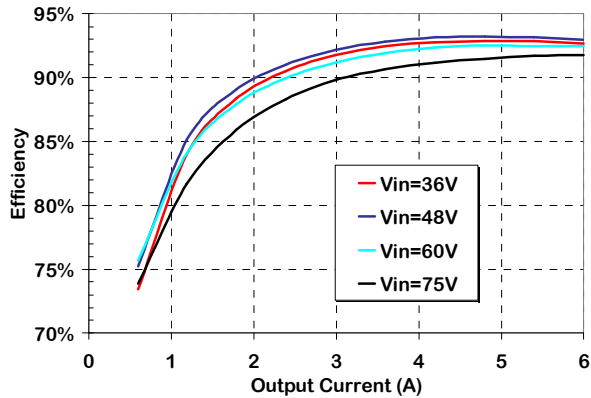


Figure 3. Efficiency vs Output Current, 300lfm airflow, 25°C ambient.

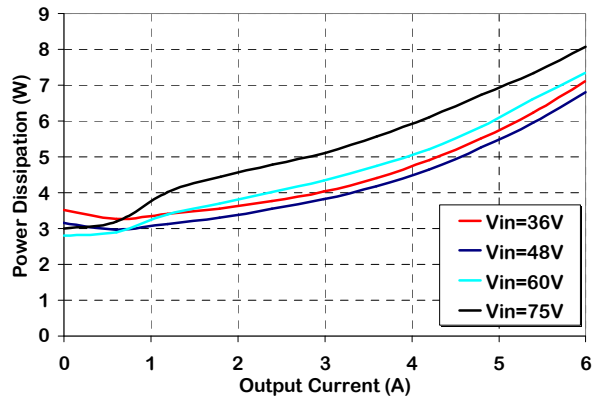


Figure 4. Power Dissipation vs. Load Current, 300lfm airflow, 25°C ambient.

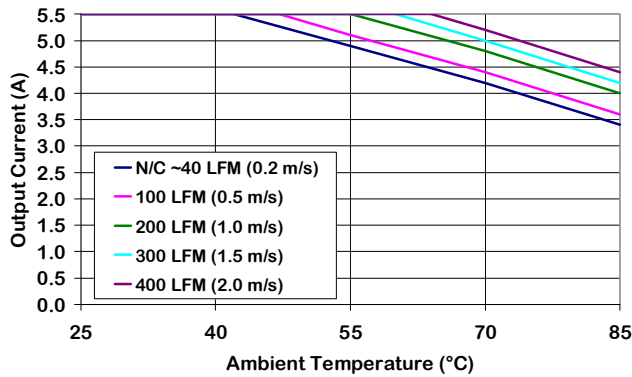


Figure 5. Output Current Derating vs Ambient Temperature & Airflow (converter mounted vertically with air flowing from pin 3 to pin 1, Vin = 48 V.)

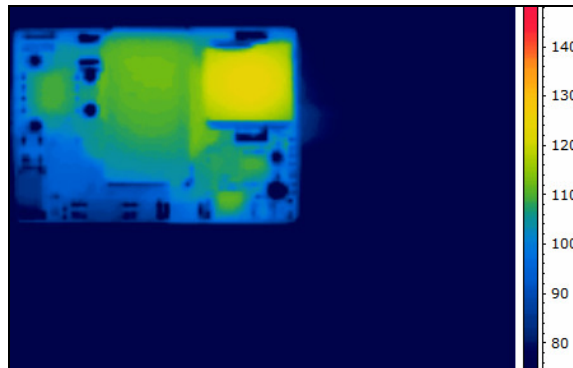


Figure 6. Thermal Image of CPT5C48 (5.5A output, 55C Ambient, 200lfm airflow, Vin = 48V, airflow from pin 3 to pin 1, T<sub>max</sub> = 124°C)

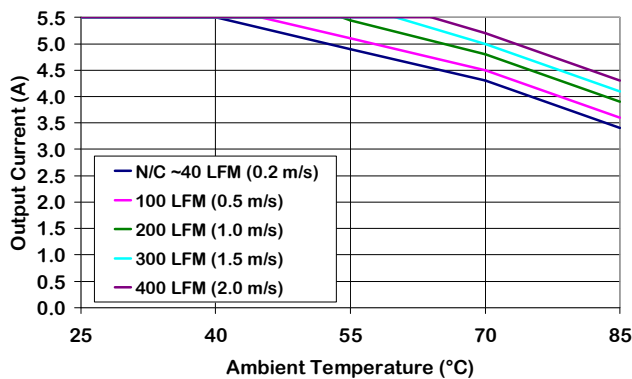


Figure 7. Output Current Derating vs Ambient Temperature & Airflow (converter mounted vertically with air flowing from pin 1 to pin 3, Vin = 48 V.)

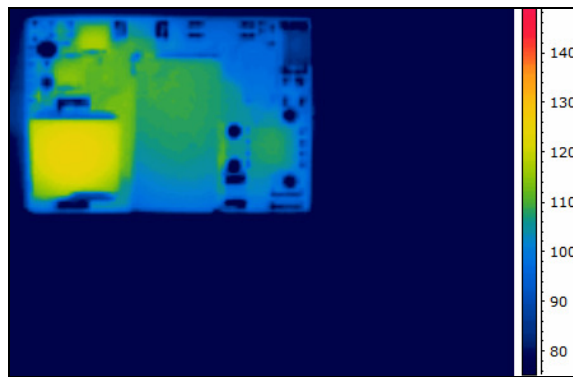


Figure 8. Thermal Image of CPT5C48 (5.5A output, 55C Ambient, 200lfm airflow, Vin = 48V, airflow from pin 1 to pin 3, T<sub>max</sub> = 125°C)

CHARACTERISTIC WAVEFORMS:

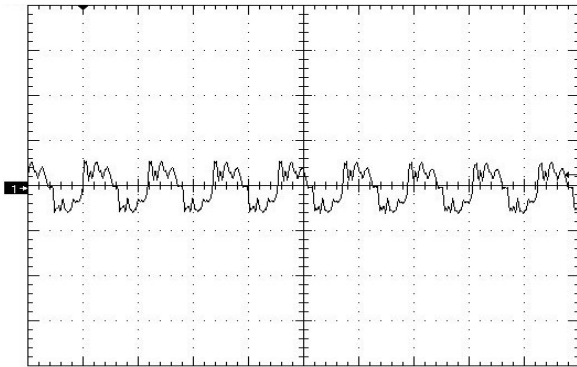


Figure 9. Output Voltage Ripple (50mV/div), time scale – 2uS/div.

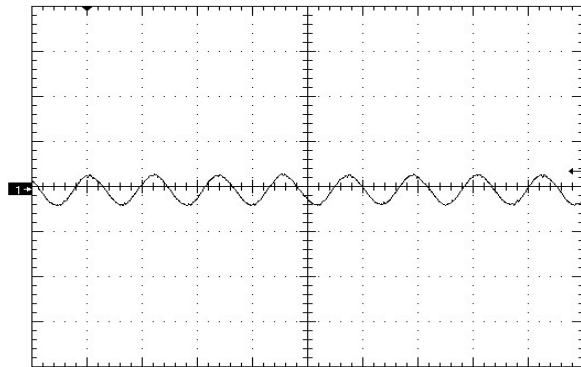


Figure 10. Input Reflected Ripple Current (10mA/div) time scale 10mS/div. Vin=Vin\_nom, full resistive

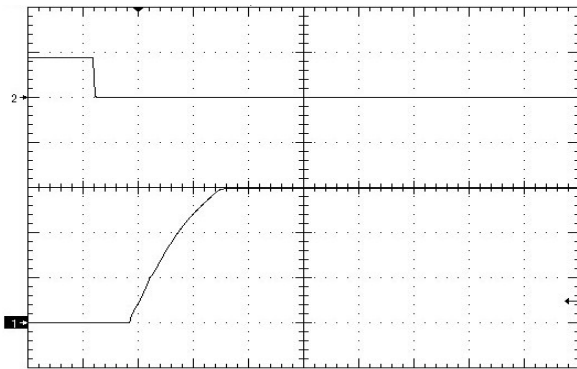


Figure 11. Startup Waveform via Enable Pin (5V/div), time scale 10mS/div. Vin=Vin\_nom, full resistive load (negative enable.)

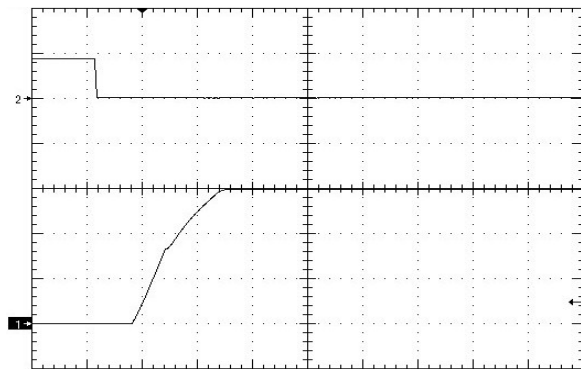


Figure 12. Startup Waveform via Enable Pin (5V/div), time scale 10mS/div. Vin=Vin\_nom, full resistive load + 1000uF (negative enable.)

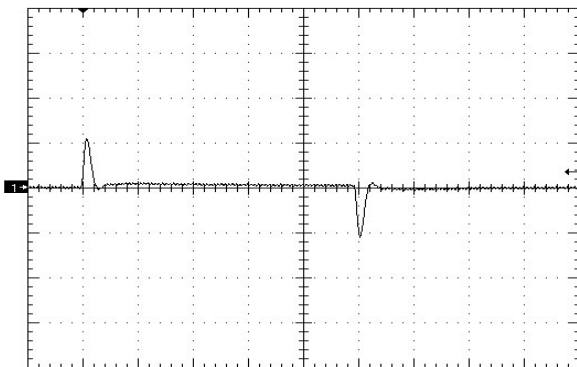


Figure 13. Load Transient Response (100mV/div), di/dt=0.1A/uS, 50% - 25% - 50% of full load, time scale: 200uS/div.

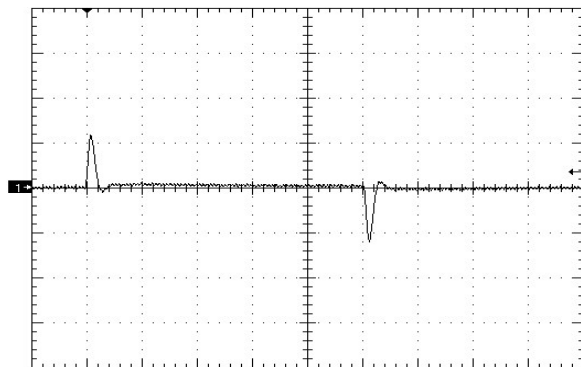


Figure 14. Load Transient Response (100mV/div), di/dt=0.1A/uS, 75% - 50% - 75% of full load, time scale: 200uS/div.

OUTPUT VOLTAGE TRIM

Output voltage adjustment is accomplished by connecting an external resistor between the Trim Pin and either the +Vout (or +Sense) or -Vout (or -Sense) Pins.

TRIM UP EQUATION:

$$R_{trim\_up} = \left[ \frac{5.1 \times V_{o\_nom} \times (100 + \Delta\%)}{1.225 \times \Delta\%} - \frac{510}{\Delta\%} - 10.2 \right] \times k\Omega$$

Where  $R_{trim\_up}$  is the resistance value in k-ohms and  $\Delta\%$  is the percent change in the output voltage.

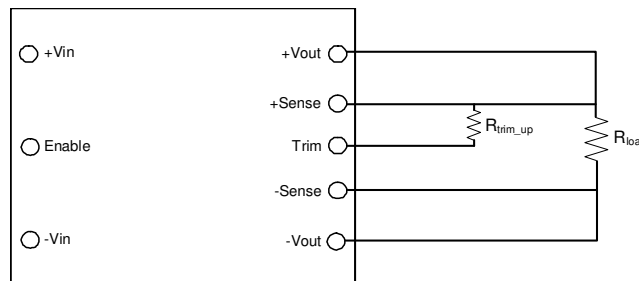


Figure 15. Trim UP circuit configuration

TRIM-DOWN EQUATION:

$$R_{trim\_down} = \left( \frac{510}{\Delta\%} - 10.2 \right) \times k\Omega$$

Where  $R_{trim\_down}$  is the resistance value in k ohms and  $\Delta\%$  is the percent change in the output voltage.

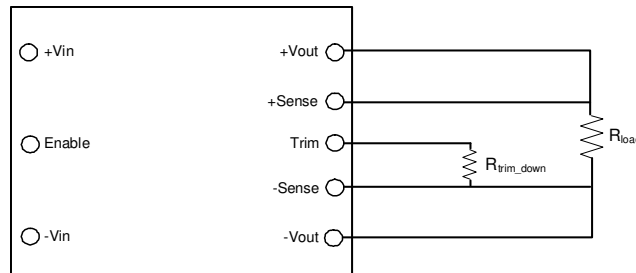


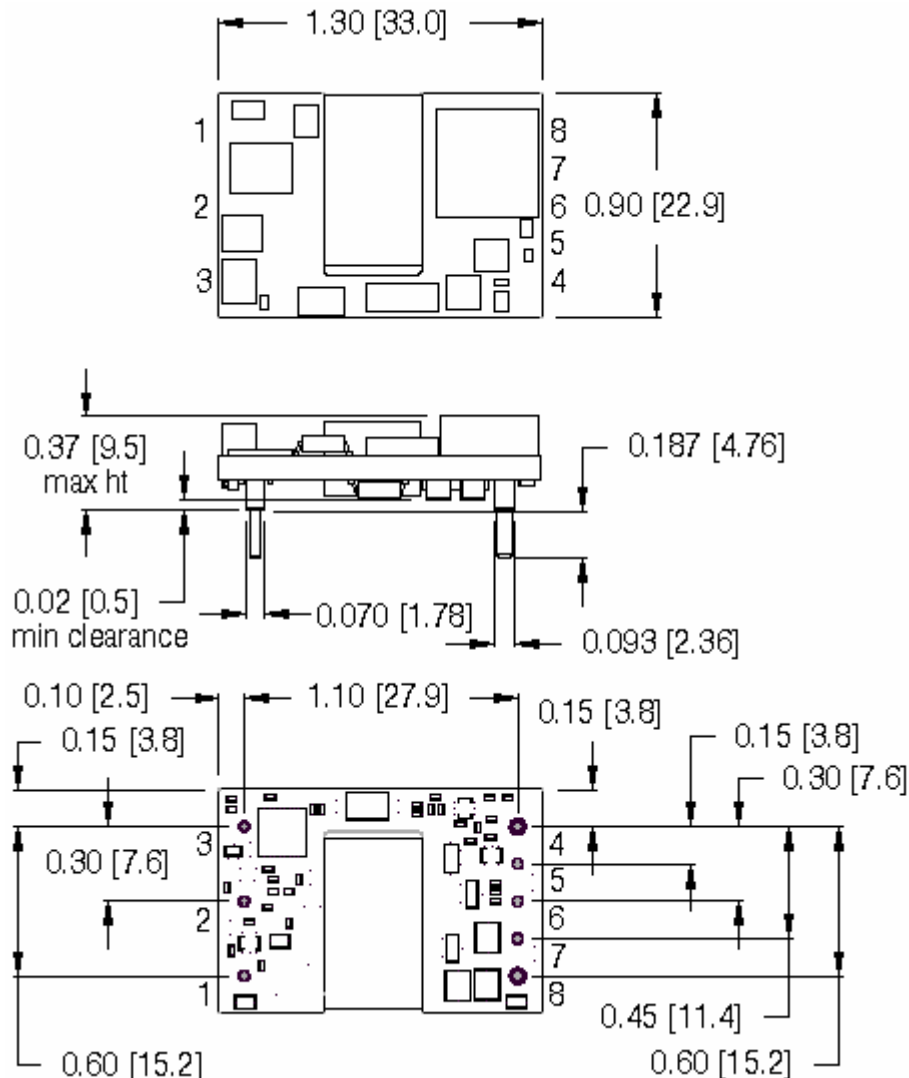
Figure 16. Trim DOWN circuit configuration



## MODULE PIN ASSIGNMENT

PIN #	DESIGNATION	NOTES
1	V <sub>IN</sub> (+)	1) All dimensions in inches [mm] Tolerances: .xx ± 0.02 [.x ± .5] .xxx ± 0.010 [.xx ± .25] 2) Input, on/off control and sense/trim pins are Ø 0.040" [1.02] with Ø 0.070" [1.77] standoff shoulders. 3) Output pins are Ø 1.57 mm (0.062") with Ø 0.093" [2.36] shoulders (note, shoulder sits .008" above mounting surface) 4) All pins are gold plated with nickel under plating. 5) Weight: 12.8 g (0.45 oz.) 6) Workmanship: Meet or exceeds IPC-A-610 Class II
2	On/Off	
3	V <sub>IN</sub> (-)	
4	V <sub>OUT</sub> (-)	
5	Sense (-)	
6	Trim	
7	Sense (+)	
8	V <sub>OUT</sub> (+)	

## MECHANICAL OUTLINE



**Ordering Information:**

Product Identifier	Output Current	Output Voltage	Input Voltage	Enable logic option	Additional features
CPT	5	C	48	N or P	- XX
“Cool Power Technologies”	5.5A	15V	36 – 75V	N = Negative P = Positive	TBD

Rev 1.0, 16-Oct-10

