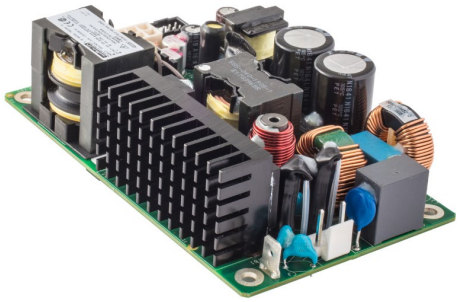
Murata Power Solutions

PQC250 Series

250W 3" x 5" Convection Cooled AC-DC Power Supply



DESCRIPTION

The PQC250 series switching power supplies utilize advanced component and circuit technologies to deliver high efficiency and low power dissipation, in both operational and standby operation, in a compact 3.0" x 5.0" x 1.40" package. Designed for industrial, medical, computing, communications, telecom, consumer, and other OEM applications, and deployable in 1U customer enclosures. All models offer universal AC input capability with active power factor correction (PFC) and compliance to worldwide safety and EMC standards.

FEATURES

- Industry leading MTBF
- Certified to IEC 60601 Ed.3 medical (2 x MOPP Pri-Sec; 1 x MOPP Pri-Chassis Ground), AC input models.
- IEC 60950-1 compliant
- IEC 60335-1 Certificate
- Designed to comply with IEC60601-1-2 4th Edition EMC Standard Requirements[1]
- 250W Convection, 100Vac to 264Vac +50C operation
- Very low no load standby power; designed to meet ENERGY STAR® Program Requirements for Single Voltage External AC-DC Power Supplies
- True zero load operation of the Main (V1) output; no minimum load requirements
- Constant Current overload protection option[3]
- 3" x 5" industry standard footprint
- Optional DC input capability
- High efficiency 94% typical
- Remote sense, main output
- Universal AC input with active PFC
- Less than 1U high
- RoHS compliant
- Active inrush protection
- Compatibility with MVAC250 Series products[2]
- Droop current share, output Terminal block option
- Two-year warranty

[1] When deployed in the End User equipment
[2] Fan output of MVAC250 series not available on this product series
[3] Select voltage variants

Available now at http://www.murata-ps.com/en/3d/acdc.html

ORDERING GUIDE (BASIC MODEL NUMBER)

Model Number[3]	Main output (V1)			Aux Output (V2)		Max. Load Capacitance Main output[4]
	Voltage Vdc	Current @ 50°C 250W	Current @ 70°C [1] 200W	Vdc	Current 50°C & 70°C	
PQC250-12yyy	12	20.8A	16.7A	5	0.5A	6000µF
PQC250-18yyy	18	13.8A	11.1A			1,600uF
PQC250-24yyy	24	10.4A	8.3A			1200µF
PQC250-28yyy	28	8.93A	7.14			1200µF
PQC250-30yyy	30	8.33A	6.6A			1000µF
PQC250-36yyy	36	6.9A	5.6A			1000µF
PQC250-48yyy (PoE Compliant)	48	5.2A	4.2A			750µF
PQC250-54yyy (PoE Compliant)	54	4.6A	3.7A			500µF
PQC-COVER	Optional cover kit assembly see PQC-COVER datasheet for details					

[1] Output De-Rating at 70°C is for horizontal orientation with component side up only. Please refer to ACAN-77 for details
[2] 29V model available, consult with factory for more information
[3] See Part Number Structure for "yyy" options refer to: Part_Number_Options_Guide
[4] Max capacitance limit does not apply to constant current "C" option

INPUT CHARACTERISTICS

Parameter	Conditions	Min	Nom	Max	Units
Input Voltage AC Operating Range	Single Phase	90	100/240	264	Vac
Input Frequency		47	50/60	63	Hz
Turn-on input voltage	Input rising	75		90	Vac
Turn-off input voltage	Input falling	65		80	Vac
DC input[1, 2]		127		300	
		260		400	
Maximum input current	Vin = 115V_{AC}; Full Load		2.5		Arms
	[2] Vin = 127-300Vdc			2.7	Adc
	[2] Vin = 260-400Vdc			1.5	Adc
Inrush Current	230V_{AC},Cold start, 25°C;		30		Apk
Power Factor	At 115VAC, full load	0.95			W/VA
Hold-up Time	90V_{AC}; Full Load	16			msec
Efficiency @ 230V_{AC} for PQC250-48 model.	20% Full Load		88.5		%
	50% Full Load		94		
	100% Full Load		95		
No Load Input Power Consumption	(PS_ON = OFF; Aux (V2) = 0A			<0.5	W

[1] 260-400Vdc range applies to PQC250-xxH variants only; consult with the sales channel for details and availability.
[2] Medical certification applies only to AC input models.

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min	Nom	Max	Units
Line, Load Regulation	Main (V1) Output[1]			±1	%
	Aux (V2) Output			±5	
Minimum Load Capability	Stable Operation	0			A
Output Ripple	Zero to Full Load[2]			1	%

[1] Zero load output voltage may exceed the regulation window however will not cause OVP to engage or PWROK to change to low state. A 500mA min. load current is required to keep output voltage within ±1%.
[2] Ripple and noise are measured with 0.1uF ceramic capacitor and 10uF tantalum capacitor. A short coaxial cable with 50 ohm termination is used.

AUXILIARY OUTPUT CHARACTERISTICS (ALL MODELS)

Auxiliary Output	Aux Output Voltage	Load Current	Load Capacitance	Line, Load, Cross Regulation	Ripple Voltage & Noise
Aux (V2)	5V	0 to 0.5A	0 to 220µF	± 5%	120mVPP

For full details go to www.murata-ps.com/rohs

Certificate and Test Report

12V Model

Applies to AC Input models

MAIN OUTPUT CHARACTERISTICS (ALL MODELS EXCEPT WHERE NOTED)

Parameter	Conditions	Typ.	Max.	Units
Transient Response [1]	50% load step, 1A/µsec slew rate and min 0.1A load		± 5	%
Settling Time to 1% of Nominal			500	µsec
Turn On Delay	After application of input power		3	sec
Output Voltage Rise	Monotonic		50	msec
Remote Sense	Compensates for up to 120mV of total lead drop (output and return connections) with remote sense connected. Protected against short circuit and reverse connection.		120	mV

[1] Min. 1 second time between consecutive transients.

ENVIRONMENTAL CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Storage Temperature Range		-40		85	°C
Operating Temperature Range	See power derating curves	-10		70	°C
	Start up with -20C @ 100V_{AC} minimum input *contact Murata for lower operating temperature range	-20		-	
Operating Humidity	Non-condensing	10		95	%
Operating Altitude		-200		5000[1]	m
MTBF	Telcordia SR-332 Issue 3; M1C3 @ 40°C Telcordia SR-332 Issue 3; M1C3 @ 25°C		2,145K 4,500K		Hours
Shock	30G, non-operating	Complies			
Operational Vibration	Sine Sweep; 5-150Hz, 2G Random Vibration, 5-500Hz, 1.11G	Complies			
Safety – Medical Standards 2 x MOPP (Primary-Secondary)	IEC 60601 1:2005, IEC 60601 1:2005/AMD1:2012 ANSI/AAMI ES60601-1: A1:2012, C1:2009 /(R)2012 and A2:2010/(R)2012, CSA CAN/CSA-C22.2 NO. 60601-1:14 EN 60601-1:2006/A1:2013				
Safety – ITE & Consumer Standards	IEC 60950-1:2005, IEC 60950-1:2005/AMD1:2009, IEC 60950-1:2005/AMD2:2013 CAN/CSA-C22.2 No. 60950-1-07, Amendment 2:2014 (MOD) ANSI/UL 60950-1-2014 EN 60950-1:2006+A11+A1+A12+A2 IEC 60335-1:2010, IEC 60335-1:2010 /AMD1:2013 IEC 62368-1:2014 CAN/CSA-C22.2 No. 62368-1:14 UL 62368-1 2nd Ed GB17625.1-2012, GB4943.1-2011, GB/T9254-2008 (Class A) CNS13438 95; CNS14336-1 99; CNS 15663 5 102 (For model PQC250-12 only)				
Fuses	Dual Fuses; Line and Neutral; 6.3A Time Lag; 250V				
Outside Dimensions	3.0" x 5.0" x 1.44" (76.2mm x 127mm x 35.2mm) nominal				
Weight (typ.)	0.352/0.78				kg/lbs.

[1] 3000 M max. altitude for Medical applications

PROTECTION CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Over Voltage Protection	V1 (main output) latching	115		140	%
	V2 (aux output) latching	5.5		7.5	V
Over Current Protection[1]	V1, hiccup mode	120		150	%Amax
	V1, latch mode	160		Short circuit	
	V2, auto-recovery	110		150	
Over Temperature Protection (Primary and Secondary Heatsink Temperature)	Auto-recovery	125		130	°C
Remote Sense Short Circuit Protection			Complies		
Remote Sense Reverse Connection Protection			Complies		

[1] Overcurrent conditions below 150% result in hiccup. Above 160% will cause the supply to latch off. Also, refer to Constant Current overload section on page 5

[2] In the event of a fault overvoltage or overcurrent fault that causes a "latch" state; it shall be necessary to recycle the incoming AC source. Allow the AC source to be removed for a period of not less than 10s before reapplying,

ISOLATION CHARACTERISTICS

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation	Primary to Chassis	1500			V_{AC}
	Primary to Secondary (2xMOPP)	4000			
	Secondary to Chassis[1]	1500			
	Output to Output				
	Secondary to chassis[2]	100			V_{DC}
Earth Leakage Current (under single fault condition)	264V_{AC}, 60Hz, 25°C		300		µA
Earth Leakage Current (under normal conditions)	264V_{AC}, 60Hz, 25°C		150		µA

[1] For PQC250-48-yyy and PQC250-54-yyy variants only.

[2] For all other variants

CURRENT SHARING OPTION – PQC250-XX-DXX

Model Number	Description
PQC250-XX-Dxx Refer to ACAN-78 for additional details	Main Output current share is achieved using "the droop method". Nominal output voltage is achieved at 50% load and output voltage increases/decreases approximately ±3% of nominal voltage. This regulation window does not include the additional tolerance due to line, temperature, long term stability etc. Startup of parallel power supplies is not internally synchronized. If more than 250W combined power is needed, start-up synchronization must be provided by system using a common PS_ON signal. To account for ±10% full load current sharing accuracy and the reduction in full load output voltage due to droop, available output power must be derated by 15% when units are operated in parallel. Current sharing can be achieved with or without remote sense connected to the common load. ORing protection is available on the PQC250-xxDRT models (see Application notes, ACAN-78 for additional details); Aux (V2) output can be tied together for redundancy but total combined output power must not exceed 2.5W, external ORing devices are recommended to preserve redundancy.

EMISSIONS AND IMMUNITY[1]

Characteristic	Standard	Compliance
Input Current Harmonics	IEC/EN 61000-3-2	Class A
Voltage Fluctuation and Flicker	IEC/EN 61000-3-3	Complies
Conducted Emissions	EN 55032	Class B
	FCC Part 15	Class B
Radiated Emissions	CISPR 22 -3 meter	Class B
	FCC 15.109 - 3 meter	Class B
ESD Immunity	IEC/EN 61000-4-2	Level 4, Criterion 2
Radiated Field Immunity	IEC/EN 61000-4-3	Level 3, Criterion A
Electrical Fast Transient Immunity	IEC/EN 61000-4-4	Level 4, Criterion A
Surge Immunity	IEC/EN 61000-4-5	Level 3, Criterion A (Com. Mode: 2kV 12 OHM, Diff. Mode: 1kV, 2 OHM)
Radiated Field Conducted Immunity	IEC/EN 61000-4-6	Level 3, 10V/m, Criterion A
Magnetic Field Immunity	IEC/EN 61000-4-8	Level 3, Criterion A
Voltage dips, interruptions[2]	IEC/EN 61000-4-11	Level 3, Criterion B

[1]Designed to comply with IEC60601-1-2 4th Edition EMC Standard Requirements
[2] For AC source interruptions that extend beyond 20ms then the output it shall be necessary to recycle the incoming AC source. Allow the AC source to be removed for a period of not less than 10s before reapplying,

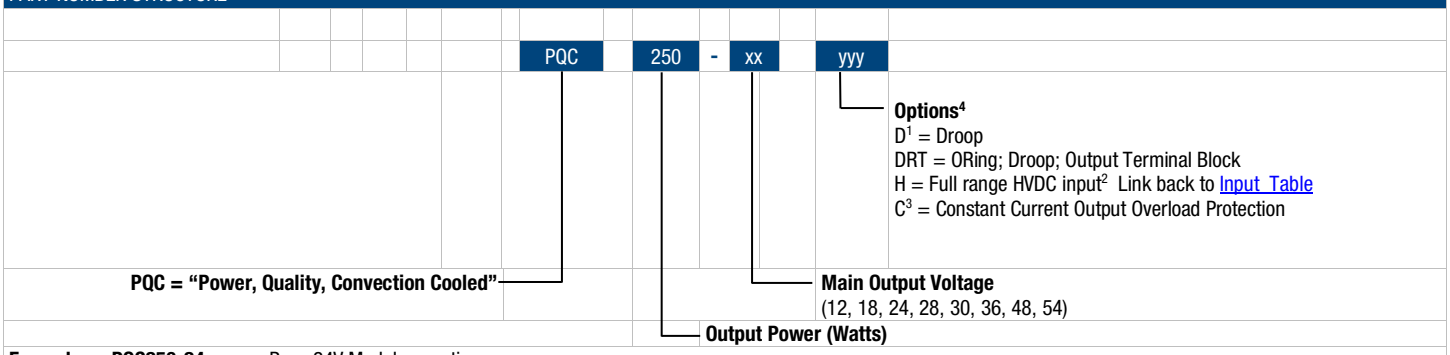
EMI CONSIDERATIONS

For optimum EMI performance, the power supply should be mounted to a metal plate grounded to all 4 mounting holes of the power supply. To comply with safety standards, this plate must be properly grounded to protective earth (see mechanical dimension notes). Pre-compliance testing has shown the stand-alone power supply to comply with EN55022 class B radiated emissions with a metal enclosure with grounded base plate. See PQC-COVER for details - testing was based on adding a toroid, Fair-Rite#5961004901 with five turns of both of the output leads. Radiated emission results vary with system enclosure and cable routing paths.

STATUS AND CONTROL SIGNALS

Parameter	Models	Conditions
PS_ON Connector J3 Pin 4	All Models (Except as noted)	This pin must be pulled low (sink current >2mA) to +5V_AUX_RTN (connector J3 Pin 8) to (enable) turn on the main output. The +5V_AUX output is independent of the PS_ON signal, and comes up automatically when the input AC or input DC voltage is applied within their specified operating ranges.
	"C" Option Models	This pin can be left unterminated (or alternatively pulled high to +5V_AUX; Connector J3 Pin 1) to (enable) turn on the main output. The +5V_AUX output is independent of the PS_ON signal, and comes up automatically when the input AC or input DC voltage is applied (within their respective specified operating ranges). If it is desired to turn off the Main Output (during normal operation) then this pin can be pulled "low" (sink current >2mA) to +5V_AUX_RTN.
PWR_OK Connector J3 Pin 2	All Models	Open collector logic goes high 40-100ms after the main output is within regulation; it goes low at least 2msecs before loss of regulation. Internal 10K pull up to +5V_AUX is provided. Applications using the PWR_OK signal should maintain a minimum load of 5W on the main output.

PART NUMBER STRUCTURE

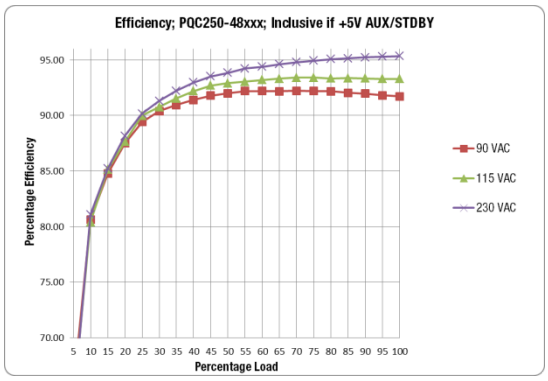


Examples: PQC250-24 = Base 24V Model; no options
PQC250-24D = Base model, 24V Model with Droop Current Share option
PQC250-24DRT = Base model, 24V Model with Droop Current Share, ORing isolation and Terminal Block options
PQC250-24CRT = Base inclusive of Constant Current Output Overload Protection characteristic plus ORing plus Terminal Block (no droop)

[1] Not available for 18V model
[2] CCC Certification not included for "H" models and 30V models;
[3] Only available for 24V and 28V Voltage Variants
[4] "yyy" can be any combination of the options as shown or left blank; "C" and "D" options not possible in combination.

PERFORMANCE TYPICAL DATA EXAMPLES

Efficiency 48V Model



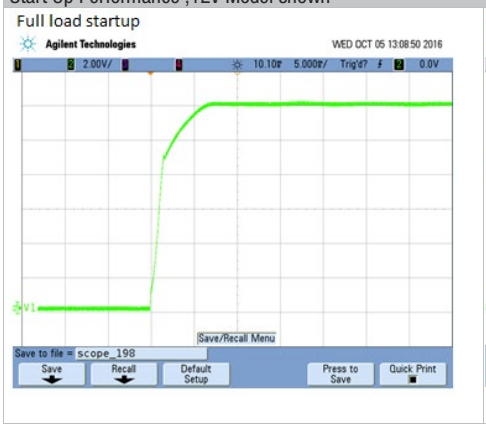
Ripple, 12V Model

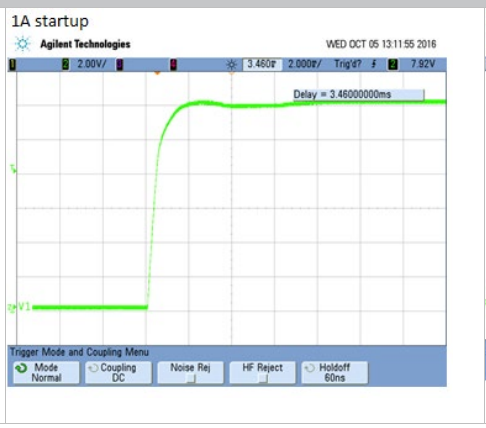
Transient Performance, 12V Model

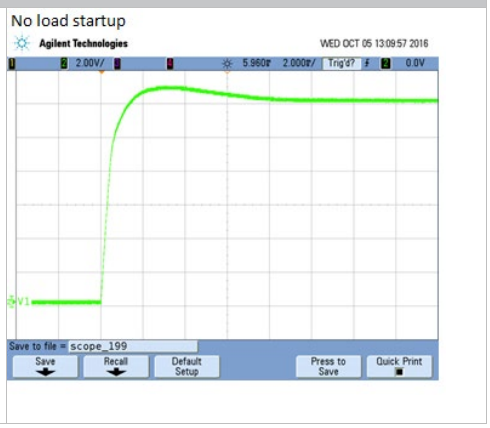
Transient Performance, 12V Model

PERFORMANCE DATA

Start Up Performance ,12V Model shown



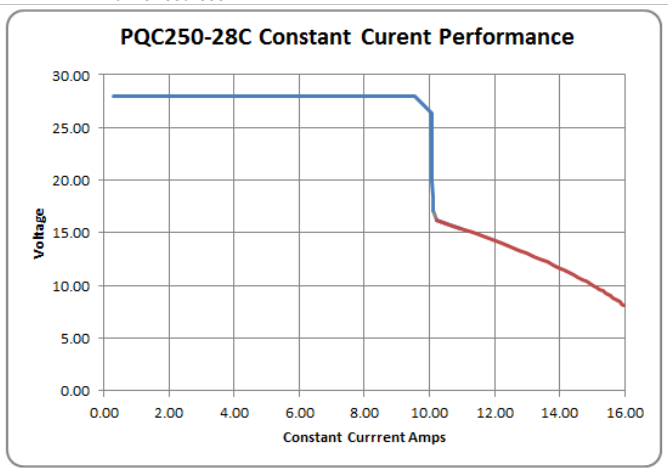


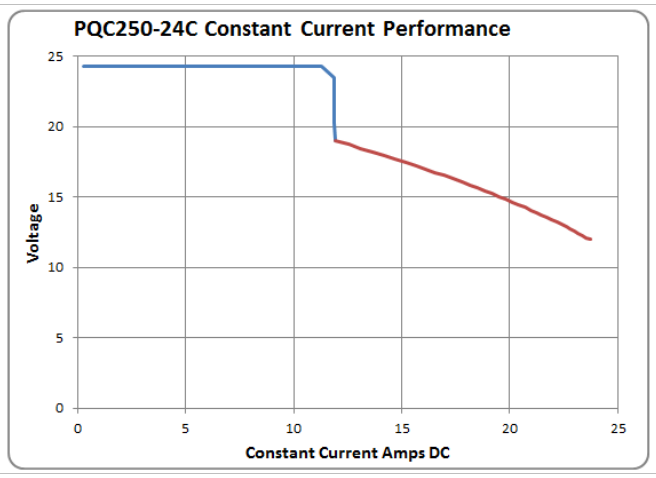


CONSTANT CURRENT OVERLOAD PERFORMANCE DATA; PQC250-xxC VARIANTS

The "C" option variant provides an overload (abnormal) Constant Current (CC) characteristic as shown in the following curves. This option will enable the PQC250 to successfully operate (at initial startup or during normal operation) in applications experiencing (large current) transient loads such as:

- Large capacitive loads
- Incandescent (i.e. halogen) lamps
- Inductive loads (motors and solenoids)
- LED driver sources





1. Curves generated for the PQC250-xxC variants by subjecting output to an incremental load (constant resistance) equivalent to 1Adc increments between 0A and 50A dc.
2. The resultant curve shows current limited to a constant "brick wall" shown by the blue portion of the curves.
3. If the load current is further incremented the current is still limited but will "tail" and result in the red portion of the curves. End Users should be aware of the potential magnitude of the "current tail" and rate their track/trace and/or interconnection cables accordingly.
4. If the overload (abnormal) current is maintained above maximum load for an extended period then internal over temperature protection may (will) shut down the output to prevent potential thermal overstress of components and maintain safe and reliable operation.

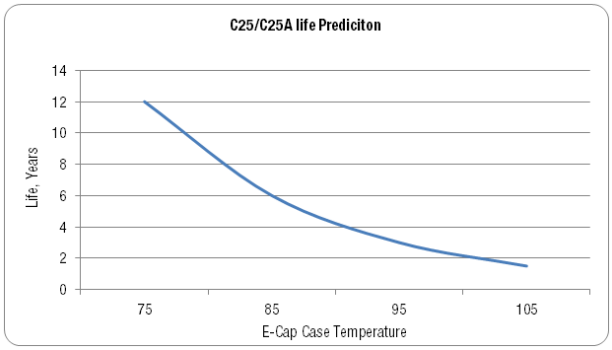
THERMAL CONSIDERATIONS

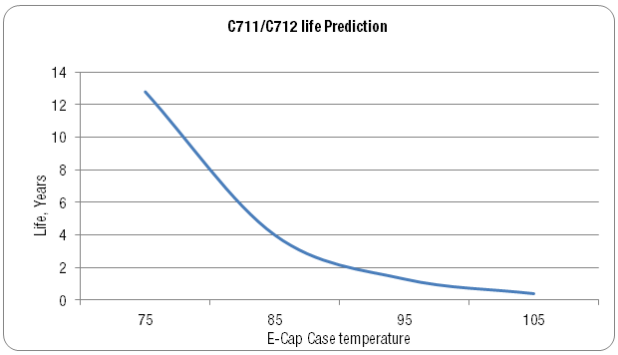
System thermal management is critical to the performance and reliability of the PQC250 series power supplies. Performance derating curves are provided which can be used as a guideline for what can be achieved in a system configuration with controlled airflow at various input voltage conditions.

The product is designed to provide 250W using natural convection cooling when mounted horizontally with un-obstructed convection current airflow flow at room temperature. At elevated temperature the power supply data is taken while it is surrounded by a large vented enclosure to minimize forced cross flows inherent in the elevated temperature test.

The product is capable of operation when mounted in other orientations; operational/derating curves shall be provided to show the effect of such mounting. See ACAN-77 for additonal details

Capacitor case temperature and Mounting Orientation:
The power supply can operate in any orientation; however, the power supply contains overtemperature protection that will shut off the output as the temperature of the power supply heatsinks approach the limt specified in the protection table. Additonally, life expectantcy of the power supply is inversely proportional to the case temperature of electrolytic capacitors C25, C25A, C711 & C712. The designer of the system in which this power supply is deployed should consider this relationship to ensure optium product life. The following charts illustrate this relationship:

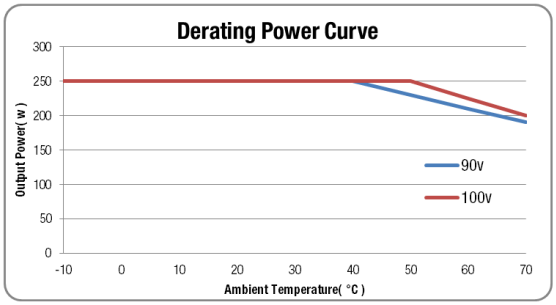




The PQC250 Series will also benefit from the provision of forced cooling airflow (generated by an external host system fan). This will enable operation at potentially higher local surrounding ambient temperatures.
Please refer to ACAN-78 for additonal details

Derating Curve vs. Temperature (based on horizontal mounting, PTH components facing up, natural convection)

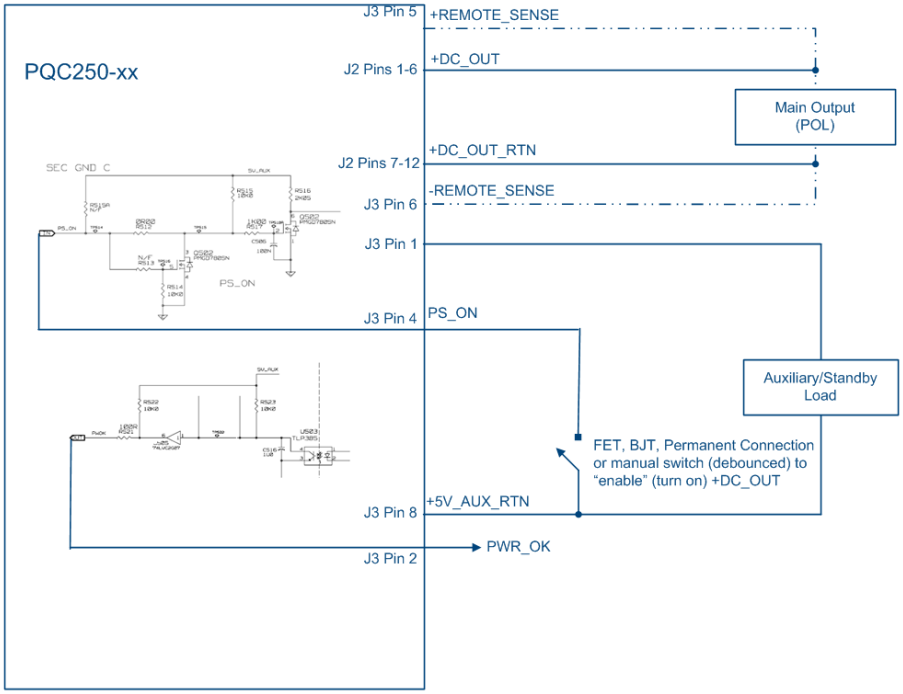
Derating curves are provided to indicate operation at varying input voltages with respect to temperature. See ACAN-77 for more details
Link Back to Thermal Considerations; Ordering Guide



WIRING DIAGRAM FOR OUTPUT

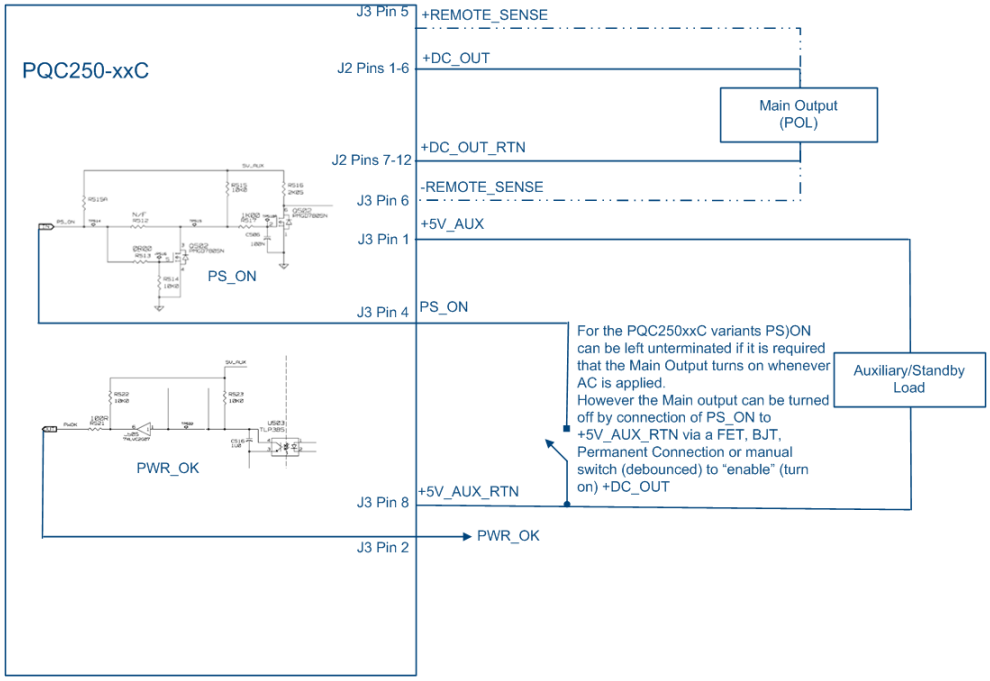
PQC250-xx

Dotted lines show optional remote sense connections, that can be extended to the Point of Load (POL) which can be some physical distance from the power module output connector (J2). The intent is to compensate for any voltage drop in the cables to the to maintain voltage regulation at the POL .



PQC250-xxC

Dotted lines show optional remote sense connections, that can be extended to the Point of Load (POL) which can be some physical distance from the power module output connector (J2). The intent is to compensate for any voltage drop in the cables to the to maintain voltage regulation at the POL .

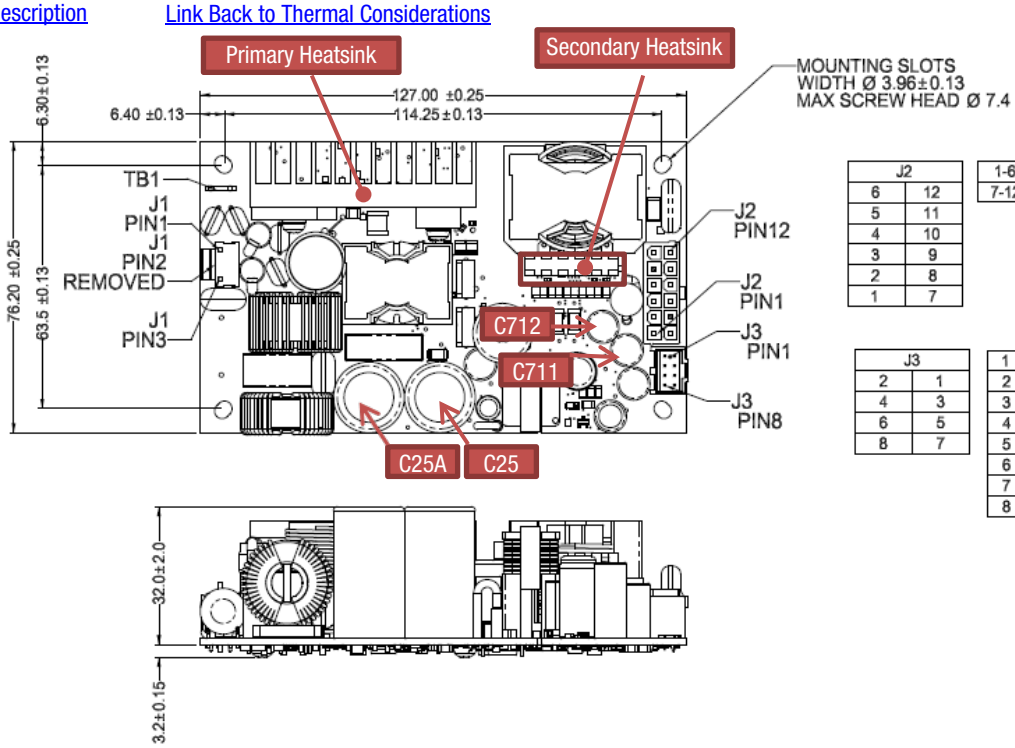


Note: For parallel (current share) operation it is required to connect the sharing power supplies in parallel (+DC out connected together and DC out Return connected together on sharing power supplies. Since each output has an identical "droop" share characteristic then each output will intrinsically share the total load current. See ACAN-78 for more details.

MECHANICAL DIMENSIONS (Nominal)

PQC250-xx and PQC250-xxD MODELS

Link Back to Description Link Back to Thermal Considerations



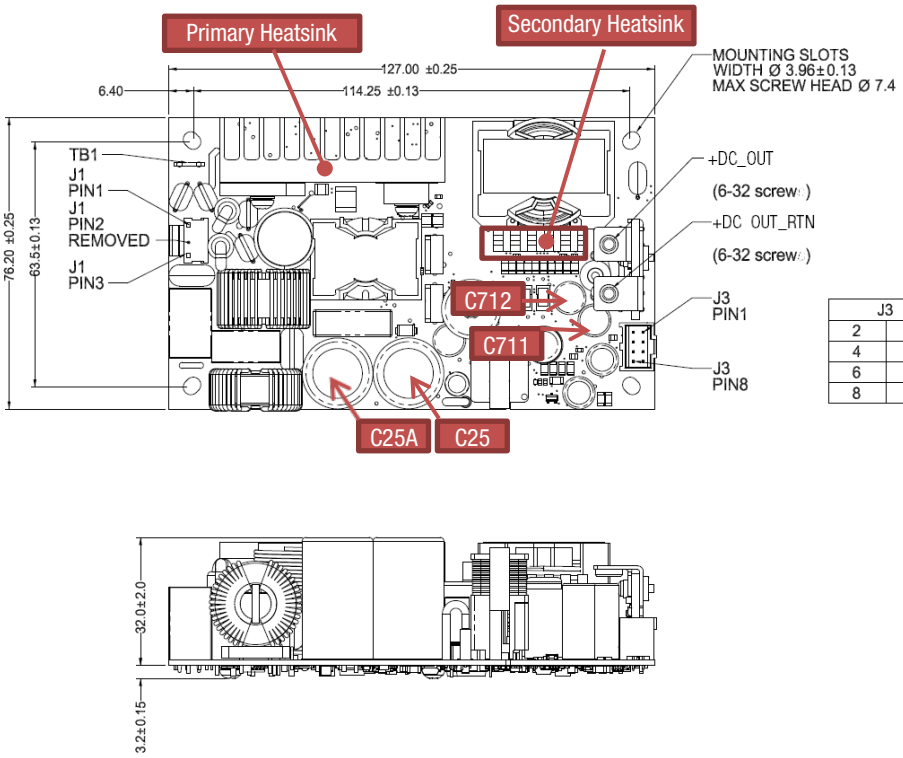
J2	
6	12
5	11
4	10
3	9
2	8
1	7

1-6	+DC_OUT
7-12	+DC_OUT_RTN

J3	
2	1
4	3
6	5
8	7

1	+5V AUX
2	PWR OK
3	DO NOT USE
4	PS ON
5	+REMOTE_SENSE
6	-REMOTE_SENSE
7	DO NOT USE
8	+5V AUX_RTN

PQC250-xxyRT MODELS



J3	
2	1
4	3
6	5
8	7

1	+5V AUX
2	PWR OK
3	DO NOT USE
4	PS ON
5	+REMOTE_SENSE
6	-REMOTE_SENSE
7	DO NOT USE
8	+5V AUX_RTN