

P R B X

POWERBOX Defense Line 300
DBC Series
Up to 300W Single and Dual Output
AC/DC Rugged Power Supply
Manual

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1. Introduction

The DBC series, very compact and low profile 300W AC-DC power supply in chassis format, incorporates input filtering, input and output protections, very robust mechanical mounting and connection, conformal coating and MIL-STD options required in most of the severe environment for industrial and defense applications. The PSU provides high reliability, high efficiency, input-to-output isolation, soft start and active very low inrush current, overtemperature protection, input over/undervoltage lockout. The PSU is configurable with 1 to 2 outputs in many output voltages from 3.3V to 48Vdc and other outputs are possible as semi-standard version. Outputs are continuously short-circuit proof. The 100°C baseplate allows operation in high temperature environment.

2. Features

85-264VAC, 47-440Hz or 100-350 VDC Input voltage ranges

1 to 2 isolated outputs up to 300W

Active very low inrush current limiting circuit

200 x 80 x 40mm very low profile

Industrial or ruggedized for harsh environment

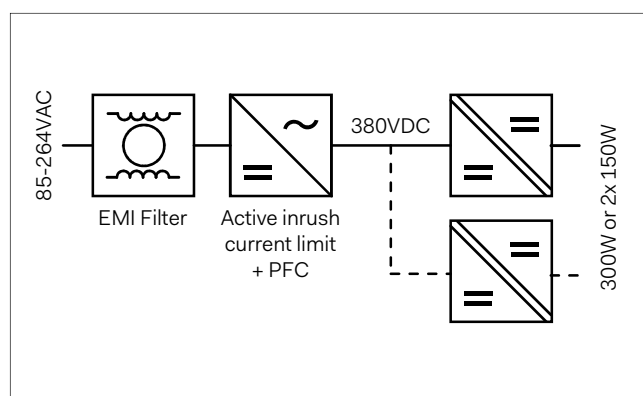
Many output configurations available

Conduction cooled 100°C baseplate

Safety IEC/EN 60950-1, RoHS lead-free-solder compliant



3. Block diagram



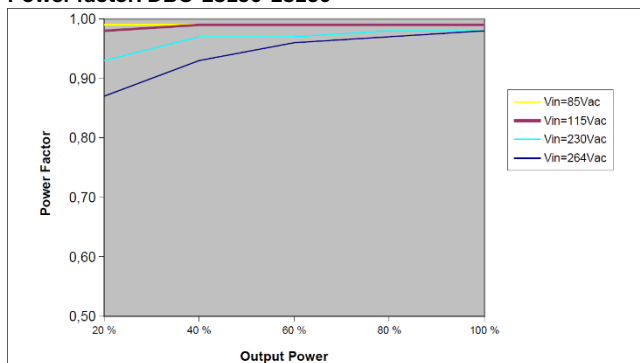
4. Options

Ruggedizing (-M)	MIL-STD 461E CE102, MIL-STD 1399-300A, MIL-STD810E shock & vibrations compliance.
-40°C operation (-T)	Thermal grade of DC/DC converters and other components are changed to comply with low ambient temperature.
Conformal coating (-V)	Components and PCB are covered with an acrylic coating to address high level of ambient humidity.
Heatsink (-H, -H1)	-H: 15 mm heatsink with longitudinal fins. -H1: 15 mm heatsink with transversal fins.
IP enclosure (-IP)	Build in IP65 sealed enclosure.

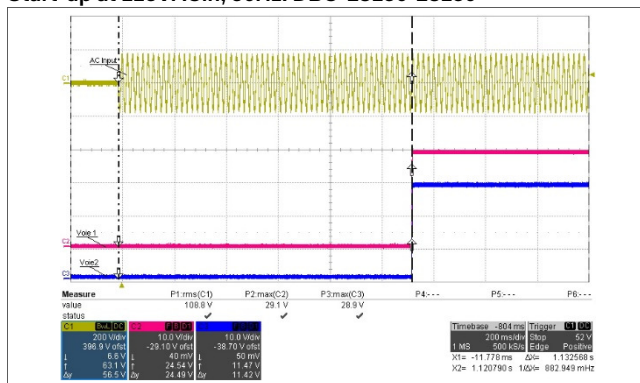
5. Input

Operating voltage range	85 ~ 264VAC or 100 ~ 350VDC
Frequency	47 ~ 440Hz
Power factor	230VAC, 50Hz, Phom. 0.96typ, 0.98max
Input current	Vin min 5Amax
No-load input power	Vin typ 8Wtyp
Peak inrush current	Vin max 5Amax
Start-up time	2smax
Fuse	Schurter 3403.0173 5A Not user accessible
Transient protection	VDR and common mode filter

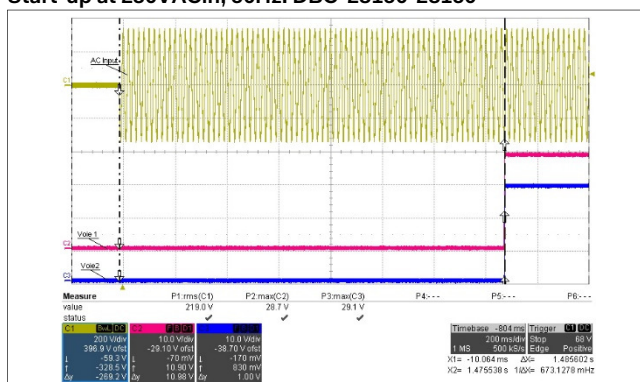
Power factor: DBC-28150-28150



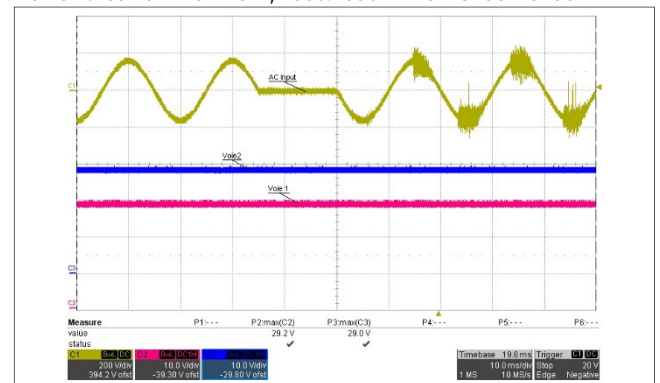
Start-up at 115VACin, 50Hz: DBC-28150-28150



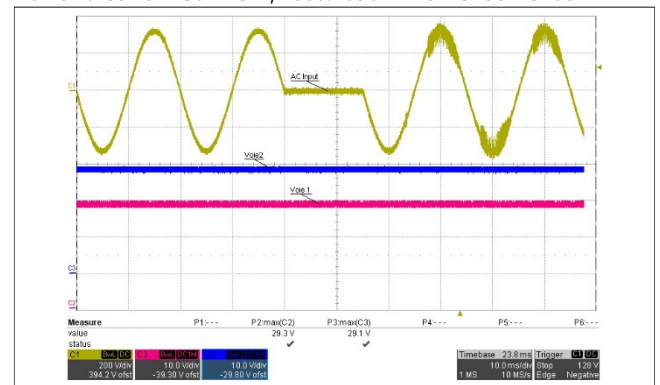
Start-up at 230VACin, 50Hz: DBC-28150-28150



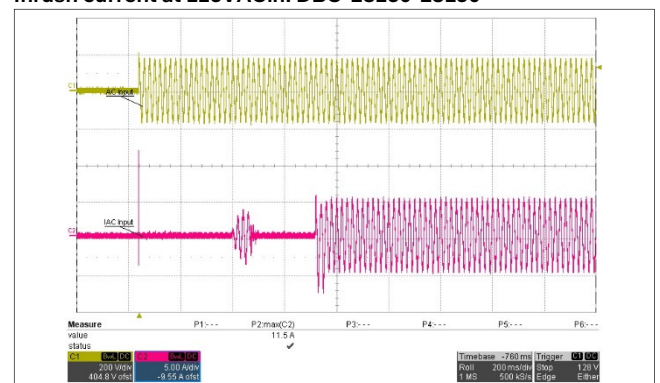
Power break at 115VACin, 100% load: DBC-28150-28150



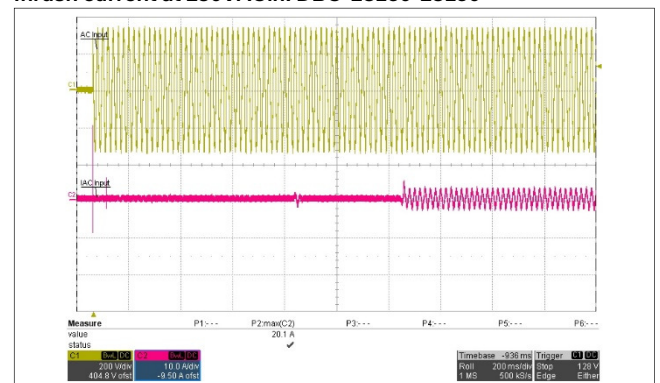
Power break at 230VACin, 100% load: DBC-28150-28150



Inrush current at 115VACin: DBC-28150-28150



Inrush current at 230VACin: DBC-28150-28150



6. Output

Output		3V3			5V			12V			15V			24V			28V			48V			Unit
Characteristics	Conditions	min	typ	max	min	typ	max	min	typ	max	min	typ	max	min	typ	max	min	typ	max	min	typ	max	
Output voltage		3,3			5			12			15			24			28			48			V
Trim range	Factory set	3		3,6	4,5		5,5	10,8		13,2	13,5		16,5	21,6		26,4	25,2		30,8	43,2		52,8	V
Overvoltage protection		4,5			6,5			14,9			18,5			29,1			34			58			V
Output noise	20MHz	100			100			150			150			150			150			200			mVpp
Efficiency		75			83			85			84			84			83			84			%
Load regulation	Vin nom.	1			1			0,5			0,5			0,4			0,4			0,4			%

m-board One m-board can be mounted in DBC unit

Output current		0	45	0	40	0	25	0	20	0	12,5	0	10,7	0	6,25	A		
Max. Power		150			200			300			300			300			300	W
Output current limit		54	64	46	52	29	35	23	26	14,5	17	12,5	14,5	7,2	8,2	A		

μ-board Two μ-boards can be mounted in DBC unit

Output current		0	22,7	0	20	0	12,5	0	10	0	6,25	0	5,3	0	3,1	A		
Max. power		75			100			150			150			150			150	W
Output current limit		25	31	23	26	14,5		17	11	14	7,2	8,2	6,2	7	3,6	4,4	A	

General conditions: 25°C ambient, full load. Refer to 'options and configurations' for possible configuration.

Parallel operation & current share

Parallel operation is possible between different units for m-boards only with active current sharing through the PR signal. The outputs put in parallel MUST be exactly the same, all OUT+ connected together and all OUT- connected together when PR are linked (risk of damage otherwise).

Redundant systems operation

When systems require a very high level of reliability and should work normally in the event of a failure, N+1 redundancy is implemented where N is the number of converter to support power requirement. If one converter fails, the remaining ones still delivers the power to the loads. Redundant operation requires external ORing diodes.

Hold-up time

The psu provides internal hold-up time (see curve).

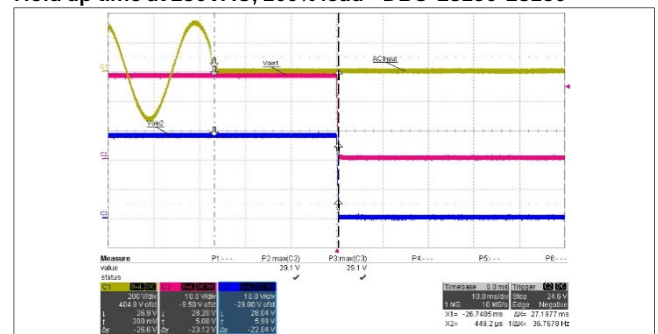
Output current limitation

All outputs are continuously protected against short-circuit by a constant current limitation (no foldback) with automatic recovery. Refer to output table for values.

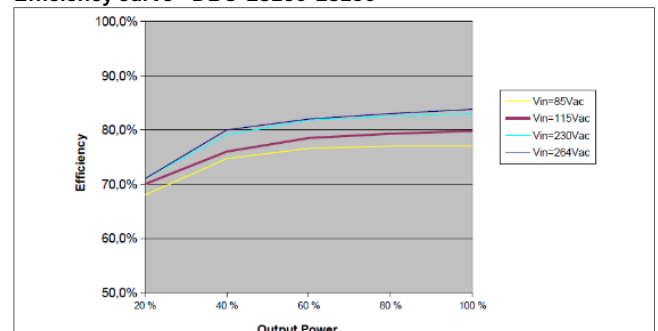
Overvoltage protection

An OVP is incorporated on each output configuration. Outputs is cut if an OVP is detected. This protection is latch style (Recovery after AC reset or inhibit).

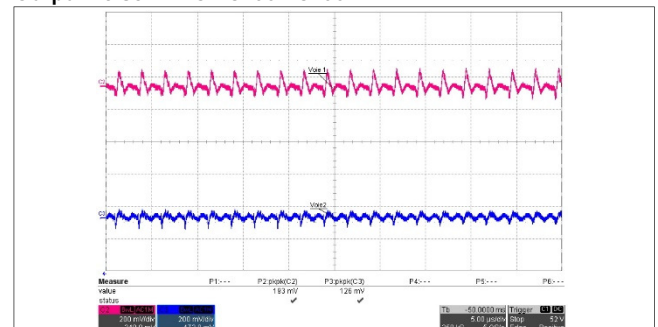
Hold up time at 230VAC, 100% load - DBC-28150-28150



Efficiency curve - DBC-28150-28150



Output noise - DBC-28150-28150



7. Auxiliary functions

Remote On/Off (INHIB)

An isolated INHIB signal disables all output voltage when connected to RTN (TTL signal or closed contact). Outputs inhibited: INHIB level LOW. Additionally, in case of μ -board with two outputs, it is possible to control each output separately with INHIB1 and INHIB2 (for revision IND02 and above).

As semi standard version, an inversion of the inhibition level is possible, please consult factory.

Output voltage adjustment (ADJ)

A potentiometer at the output side allows output voltage variation from -10% to +10% of V_{nom} . The TRIM signal allows output voltage to be adjusted by an external voltage 1.15 to 1.25 V_{max} voltage referenced to -OUT.

Remote sense (+S -S)

This feature enables compensation of voltage drop across the connector contacts and the load lines. Remote Sense, max 0,5V per line compensation (If local sense, connect locally S+ to OUT+ and S- to OUT- of the corresponding output).

Output type	Total drop	Positive line drop
V1, V2	< 0.5V	< 0.25V

PowerGood & LED (Pgood)

Collector isolated optocoupled signal referenced to RTN, closed when all outputs voltages are OK (30VDCmax).

Led is also available for each output.

AC FAIL

Collector isolated optocoupled signal referenced to RTN (30VDCmax), closed when AC input voltage is present and input power factor correction circuit in normal operation.

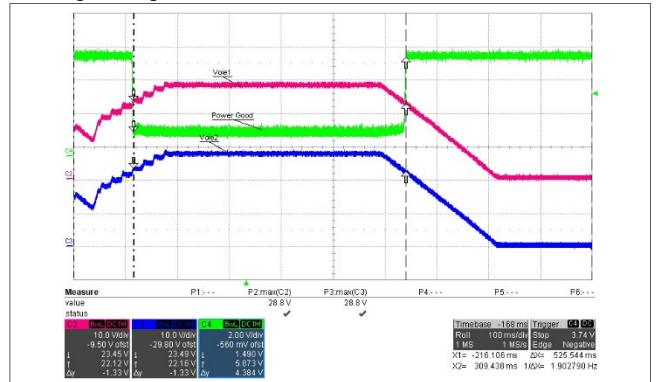
Auxiliary bias voltage (+5VAUX)

Auxiliary supply limited to 200mA, signal referenced to RTN

Paralleling signal (PR1)

Parallel only identical outputs (voltage and power). Outputs in parallel will current share when their corresponding PR are connected together. When outputs are coming from different boards, RTN have to be connected together.

Powergood signal - DBC-28150-28150



8. Electromagnetic compatibility

Electromagnetic immunity

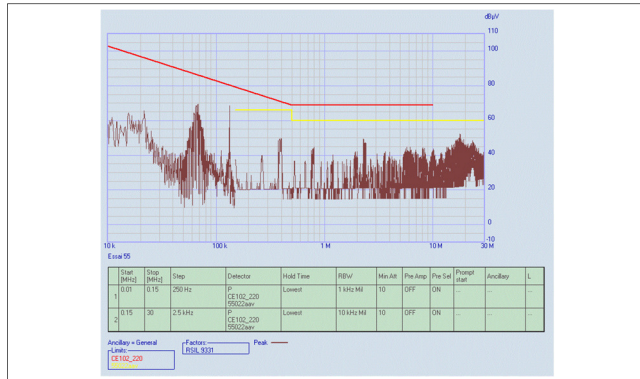
	Standard	Level	Value	Waveform	Source impedance	Test procedure	Mode	Criteria
Harmonics	EN 61000-3-2							
Flicker	EN 61000-3-3							
Electrostatic discharge (to case)	EN 61000-4-2	4	8kV	1 / 50µs	330Ω	10pos., 10neg.	OP	B
Radiated immunity	EN 61000-4-3							
Electrical fast transients/burst	EN 61000-4-4	4	4kV	5 / 50µs	50Ω		OP	B
Surges	EN 61000-4-5	DM	1kV	1.2 / 50µs	12Ω		OP	B
		CM	2kV	1.2 / 50µs	12Ω		OP	A
Conducted immunity	EN 61000-4-6							
Dips and interruptions	EN 61000-4-11							

All compliance build to meet.

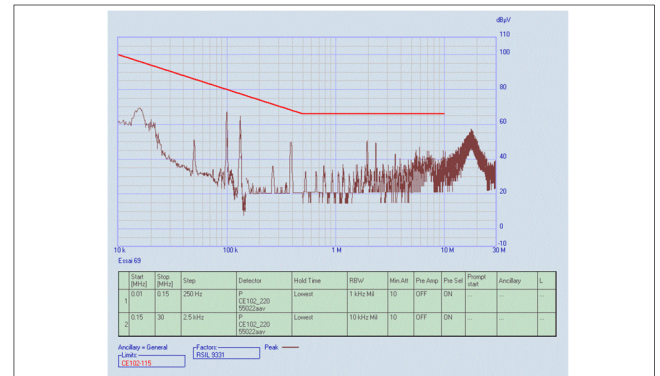
Electromagnetic emissions

According to the voltage configuration, EMI results could change. External filter may be required to meet EN55022A or B and MIL-STD461E CE102. The figure below have been made with revision 2, results may change with previous revision.

DBC-28150-28150 IND02 EN55022 MILSTD461 CE102 230Vac/50Hz 100% load

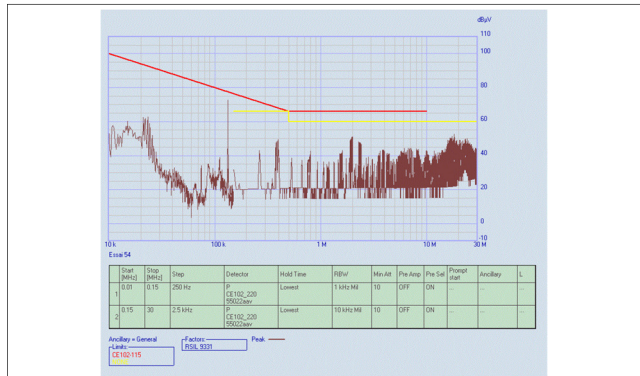


DBC-28150-28150 IND02 MILSTD461 CE102 115Vac/400Hz 100% load



Harmonics at 50kHz and 100kHz are due to the input source and should not be considered.

DBC-28150-28150 IND02 EN55022 MILSTD461 CE102 115Vac/50Hz 100% load



9. Environmental

Immunity to Environmental Conditions

Test method	Standard	Test conditions	Requirement
Humidity	MIL-STD-810F Proc. 507.4	Humidity 93%, 40°C, 56 days	Option -V
Shock	MIL-STD-810F Proc. 516.5	20g / 18ms half sine, 5g / 30ms	Option -M
Vibration	MIL-STD-810F Proc. 514.5	4-80Hz (2,8m/s ²)/Hz, non operating	Option -M
		160-500Hz (0,175m/s ²)/Hz, non operating	

Thermal considerations

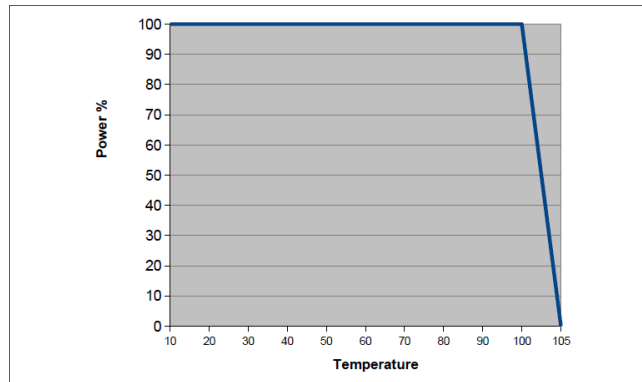
When a converter is mounted in conduction cooled, the temperature measured on the baseplate should not exceed 100°C.
 When heatsink option is used in convection cooling and is operating at its nominal output power at the max. ambient temperature, the temperature measured on the heatsink should not exceed 100°C.

Thermal protection

A temperature protection (OTP) is integrated in each output module, disabling output when baseplate temperature exceeds 105°C (+/-5°C). The converter automatically restarts, when the temperature drops below 70°C. Nevertheless, exceeding the max operating temperature may cause failures of the converter.

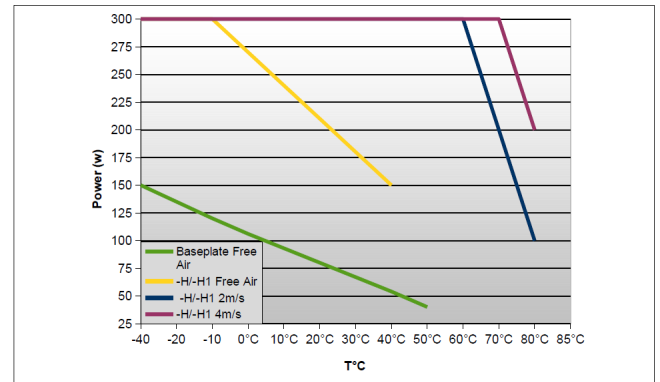
Temperature derating

DBC-28150-28150 conduction cooled



Temperature derating

DBC-28150-28150 convection and forced air



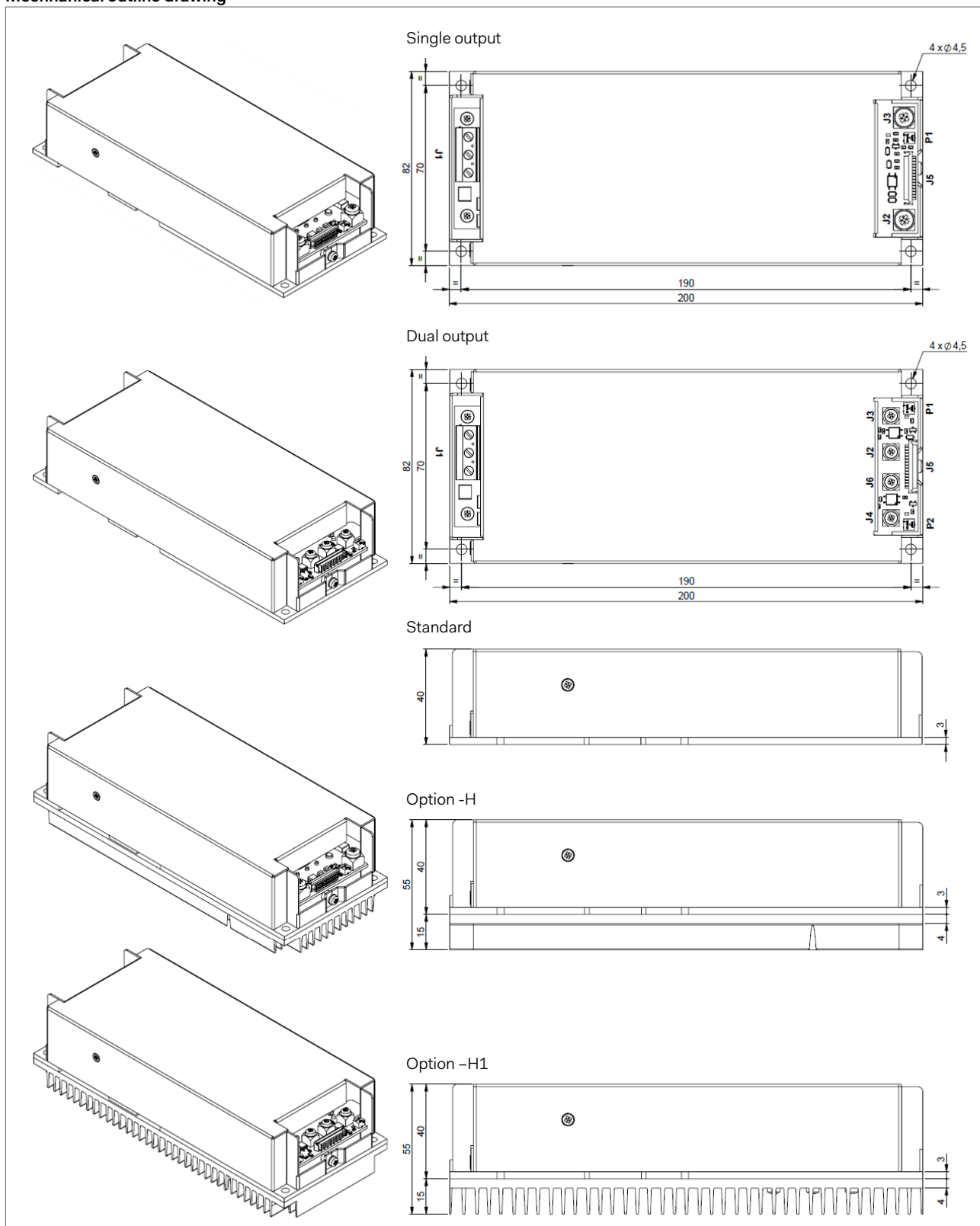
Temperatures

		Standard		T-option		Unit
Conditions		Min	Max	Min	Max	
Ambient	Operating	-20	+71	-40	+71	°C
Heatsink	(see derating)	-20	+100	-40	+100	°C
Storage	Not operating	-40	+125	-40	+125	°C

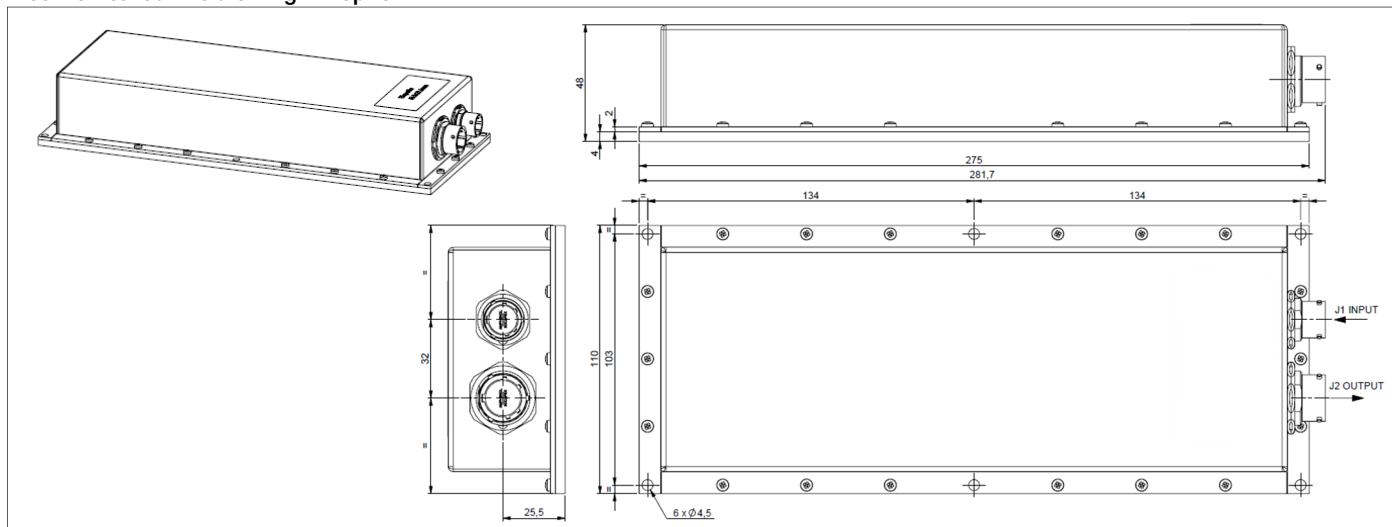
In operation, there is no power derating as long as the baseplate temperature is in the indicated range.

10.Mechanical

Mechanical outline drawing



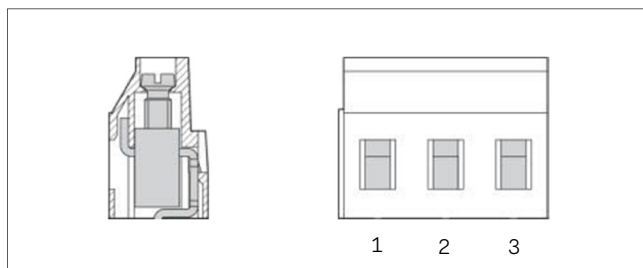
Mechanical outline drawing - IP option



11. Pin allocation

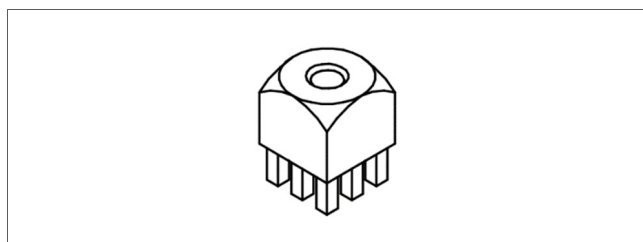
Input: Phoenix Contact GMKDS 3/3-7.62

J1-1	Earth
J1-2	Neutral AC/N
J1-3	Line AC/L



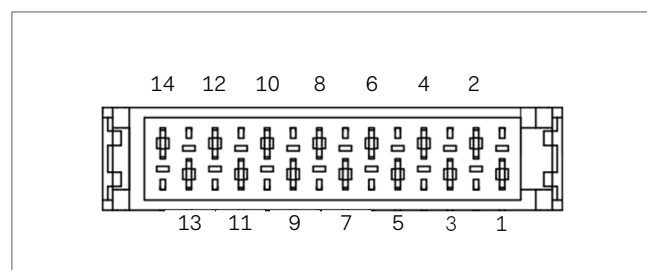
Output: Würth Press-Fit

	μ-board	m-board
	M3: 7461093	M4: 7461095
J2	OUT1+	OUT1+
J3	OUT1-	OUT1-
J4	OUT2+	NP
J6	OUT2-	NP



Signals: Würth 690368191472 Female Male 2*7 pins

	μ-board	m-board
J5-1	ACFAIL	ACFAIL
J5-2	PGOOD	PGOOD
J5-3	RTN	RTN
J5-4	INHIB	NC
J5-5	+5VAUX	+5VAUX
J5-6	S1+	NC
J5-7	S1-	NC
J5-8	ADJ1	NC
J5-9	INHIB1	PR1
J5-10	NC	NC
J5-11	INHIB2	INHIB1
J5-12	S2+	S1+
J5-13	S2-	S1-
J5-14	ADJ2	ADJ1

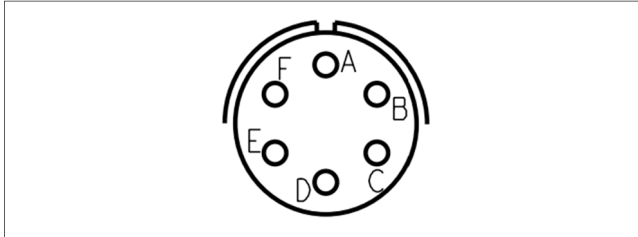


Note: PINOUT apply for revision IND02 and above. For earlier revision, for μ-board, INHIB1 and INHIB2 do not exist

12. Pin allocation –IP option

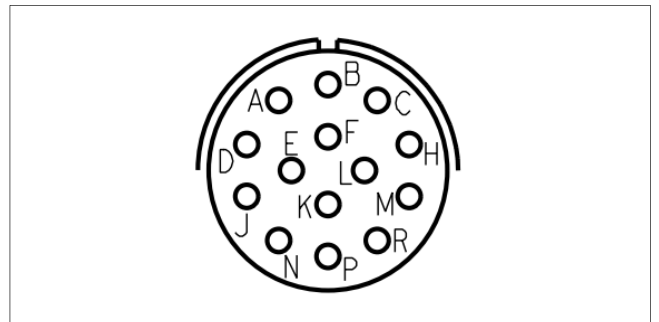
Input: Amphenol Male 451-07A106P50

J1-A	NC
J1-B	Line AC/L
J1-C	NC
J1-D	Earth
J1-E	NC
J1-F	Neutral AC/N



Output: Amphenol Female 451-07A1214S50

	μ-board (22Amax/OP)	m-board (45Amax/OP)
J2-B	OUT1+	OUT+
J2-C	OUT1+	OUT+
J2-F	OUT1+	OUT+
J2-H	OUT2+	OUT+
J2-L	OUT2+	OUT+
J2-M	OUT2+	OUT+
J2-R	OUT1-	OUT-
J2-P	OUT1-	OUT-
J2-K	OUT1-	OUT-
J2-E	OUT2-	OUT-
J2-J	OUT2-	OUT-
J2-N	OUT2-	OUT-
J2-A	INHIB	INHIB
J2-D	RTN	RTN



13. Safety and isolation

These converters are components, intended exclusively for integration into other equipment by an industrial assembly process or by a professionally competent person. Installation must strictly follow the safety regulations in respect of the enclosure, mounting, creepage and clearance distances, markings of the end-use application. Connection to the system shall be made via the Würth male connector.

The AC/L is internally fused. This fuse is designed to protect the converter against overcurrent caused by a failure, but may not be able to satisfy all requirements. External fuses in the wiring circuit to one or both input pins may be necessary to ensure compliance with local requirements.

Do not open the PSU, or the warranty will be invalidated. Make sure that there is sufficient thermal baseplate dissipation (max. temperature: 100°C). This should be verified by measuring the case of temperature at the specified measuring point, when the converter is operated in the end-use application.

Standards and approvals

The converters are built to meet the safety standards IEC 60950-1, EN 60950-1.

'Built to meet' mentioned in the different paragraphs of the datasheet means that Powerbox has designed the product to meet the standard but not certified it in a laboratory.

'Qualified' means that the test has been made in a certified laboratory.

Cleaning agents and process

The converters are not hermetically sealed. In order to avoid possible damage, any penetration of liquids shall be avoided.

Electric strength

Characteristic	IN-PE	IN-OUT	OUT-PE	OUT-OUT	Unit
Design strength	1500	3000	500		Vrms
Prod. test (>10s)	2120	2120	500		VDC
Insulation resistance			>100	>100	MΩ

Electric strength test is performed in the factory in accordance with IEC/EN 60950.

Reliability

MIL-HDBK-217F, NTC 2	Model	Baseplate temp.	GB	GF
MTBF (Hours)	DBC, Single output, 300W	40°C	287612	163937
		70°C	138054	80330
		100°C	85211	49807

MTBF calculation for a specific part number ordered separately.

14. Part number configuration

DBC	-	28	150	-	28	150	-	MTV	-	IP
Series Name	Output 1 Voltage	Output 1 Power	Output 2 Voltage	Output 2 Power	Options	Format				
DBC	2: 2VDC	50: 50W	□: Single output	□: Single output	□: No option	□: IP00				
	3V3: 3,3VDC	75: 75W	2: 2VDC	50: 50W	H: Heatsink longitudinal fins	IP: IP65				
	5: 5VDC	100: 100W	3V3: 3,3VDC	75: 75W	H1: Heatsink transversal fins					
	8: 8VDC	150: 150W	5: 5VDC	100: 100W	M: Ruggedizing					
	12: 12VDC	200: 200W	8: 8VDC	150: 150W	T: -40°C					
	15: 15VDC	300: 300W	12: 12VDC		V: Conformal coating					
	24: 24VDC		15: 15VDC							
	28: 28VDC		24: 24VDC							
	36: 36VDC		28: 28VDC							
	48: 48VDC		36: 36VDC							
			48: 48VDC							

Configuration

DBC Series units are factory configurable consisting of a common input stage with protective circuitry, filtering, rectifier and active PFC followed either by single output m-board with up to 300W output power or a dual output μ-board with up to 150W power per output. The DBC Series units are not field configurable.

Example configurations

DBC-48150-48150-MTV

(One μ-board with two isolated outputs of 48V 150W with MIL-STD, -40°C and conformal coating options)

DBC-3V375-5100

(One m-board with two different outputs of 3.3V 75W and 5V 100W)

DBC-36300

(One m-board with single output 36V 300W)

Available output configurations

U [V]	μ-board, P [W]	m-board, P [W]
2	50	100
3V3	50, 75	100, 150
5	50, 100	150, 200
8	100	200
12	75, 150	200, 300
15	75, 150	200, 300
24	75, 150	200, 300
28	75, 150	200, 300
36	75, 150	200, 300
48	75, 150	200, 300