PBR50 Series – Isolated DC/DC Converters
24V Input (18 – 36Vdc), Maximum Power: 50W

Data Sheet
Dec. 17, 2008

PBR50-24 50W isolated DC/DC converters

Features

- High Efficiency
- Wide operating temperature range
  (-40°C to +85°C)
- Wide 2:1 input range
- Dimensions 2 x 1.6 x 0.45 (inch)
- Six side shield
- Input – Output Isolated
- Built–in over temperature protection circuit
- Output over voltage protection
- Over current protection
- Input under voltage lock out
- Remote on/off control
- Trimmable output voltage
- Long Life Design
  (employed only ceramic capacitor)
- Safety agency approval
  UL (UL 60950-1,CSA C22.2 NO.60950-1): **pending**
  CE (EN 60950): **pending**
- RoHS directive

Applications

- Telecommunication
- Datacom
- Instrumentation/ Equipments
- Distributed Power Systems

Description

PBR50 Series is a high efficiency isolated DC/DC converter provide up to 50 watt output power. This module achieved a high efficiency by employing an active clamp and synchronous rectification topology. It has a wide operating temperature from -40˚C to +85˚C and does not use a tantalum and aluminum electrolytic capacitor for a long life design. This module has a precise thermal protection circuit and it gives a high reliability.

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Absolute Maximum Ratings

Parameter	Min	Typ	Max	Unit	Notes
Input Voltage Continuous	18	-	36	Vdc	
Operating Ambient Temperature	-40	-	85	˚C	
Storage Temperature	-40	-	100	˚C	
I/O Isolation Voltage	-	-	500	VAC	

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device

Electrical Specifications

Input Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Operating voltage Range		18		36	Vdc
Maximum Input current (At nominal input voltage and Maximum Output Power)	I_{in}		1.78@2.5V 2.31@3.3V 2.28@5V 2.20@12V 2.23@15V		A
No load input current PBR50-24-2R5 PBR50-24-3R3 PBR50-24-5 PBR50-24-12 PBR50-24-15			 56 91 53 85 115		 mA mA mA mA mA mA
Input reflected ripple current (At rated input voltage and Maximum Output Power)			10		mA
Input Ripple Rejection voltage (pk to pk)	Vjac				Vdc
Inrush current(peak)	Vp-p		71		A

Disabled input current (Remote on/off control)			4		mA

Output Characteristics

T_A = +25˚C, Vin = 18 ~ 36V unless otherwise specified

Parameter	Symbol	Min	Typ	Max	Unit
Output Voltage tolerance	V_o	-	-	±2	%
Output Current PBR50-24-2R5 PBR50-24-3R3 PBR50-24-5 PBR50-24-12 PBR50-24-15	Io			 15 15 10 4.1 3.3	 A A A A A
Output Regulation; - Line Regulation (From minimum input voltage to maximum input voltage, constant load) - Load Regulation (From 10% load to maximum load)		- -	- -	 ±0.3 ±0.5	 % %
Output Current Limit (Automatic recovery)		 >105			%
Output Ripple and noise (Vin = 24V, and Io =Max output current Bandwidth 20MHz, 1uF Ceramic cap)	 mVp-p	-	-	70@5V 120@12V 150@15V	mV
Efficiency PBR50-24-2R5 PBR50-24-3R3 PBR50-24-5 PBR50-24-12 PBR50-24-15 (100% of max Io, V_{in} = 48V)			 86 88 91 93 92		 % % % % %

Dynamic Load Response (68uFx3 Polymer Capacitor 25% to 50 %, 50% to 25%, Slew rate = 0.05A/μs)			±	3% of Output Voltage	mV
Recovery Time (with in 1% Nominal Vo)					us
Start – Up Time		-	-	10	ms
Turn – on overshoot		-	-	5	%
Maximum output capacitance				2200	μF

Isolation Specifications

Parameter	Symbol	Min	Typ	Max	Unit
I/O Isolation Voltage (AC500V, 1 Min) - Input-Output: - Input-Case: - Output-case:			 - - -	 500 500 500	 Vac Vac Vac
Isolation Resistance - Output-Case (at DC500V at 25˚C And 70%RH for 1 min)	RISO	>100	-	-	MΩ
Isolation Capacitance	CISO		1000		pF

General Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Switching Frequency			250		kHz
Remote ON/OFF control On = open Off = short to - Vin					Vdc

Output voltage trim range			±10		%
MTBF		5.4x10^5			hrs
Dimensions (W.H.L)		40.6 x 11.4 x 50.8 (1.6 x 0.45 x 2.0))			mm (inches)
Weight		-	60	-	Grams

Environmental

Parameter	Symbol	Min	Typ	Max	Unit
Operating Temperature		-40		85	˚C
Operating Humidity (RH non-condensing)		5		95	%
Storage Temperature		-40		105	˚C
Shock					
Vibration					

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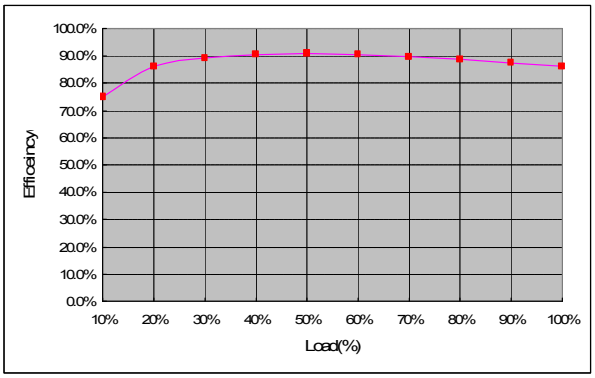
Characteristic Curves

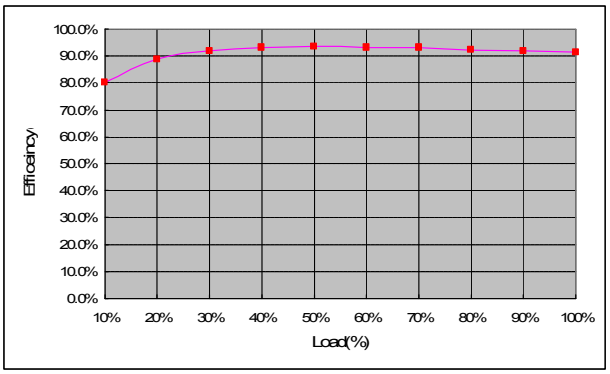
Efficiency Curves

PBR50-24-2R5



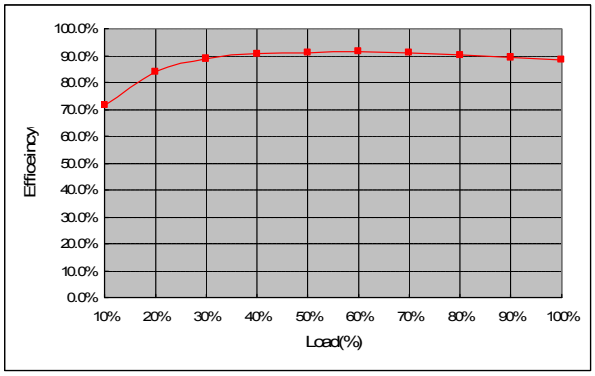
Vin=24V, Vo=2.5V@15A , At 25°C

PBR50-24-5



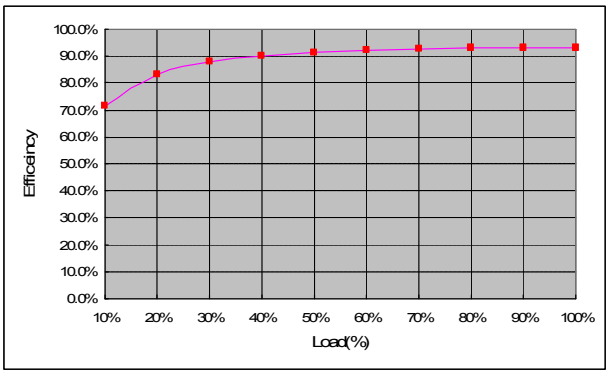
Vin=24V, Vo=5V@10A , At 25°C

PBR50-24-3R3



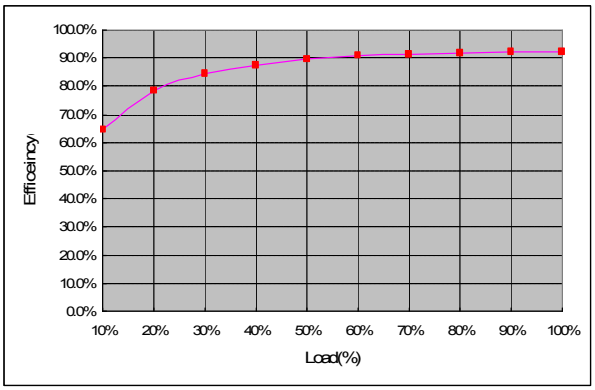
Vin=24V, Vo=2.5V@15A , At 25°C

PBR50-24-12



Vin=24V, Vo=12@4.1A , At 25°C

PBR50-24-15



Vin=24V, Vo=15V@3.3A , At 25°C

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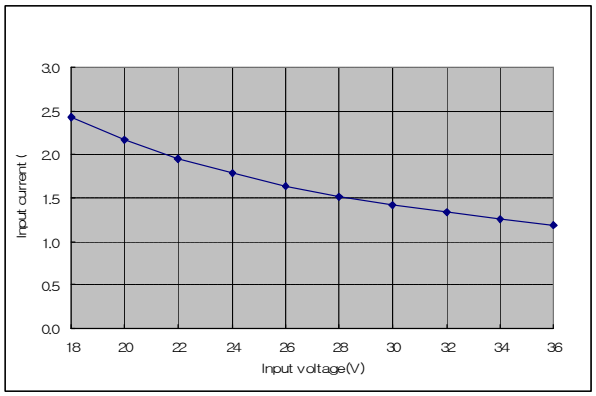
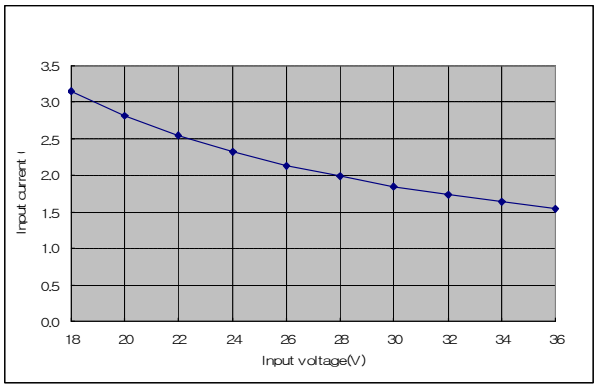
Input Voltage vs Input Current

PBR50-24-2R5



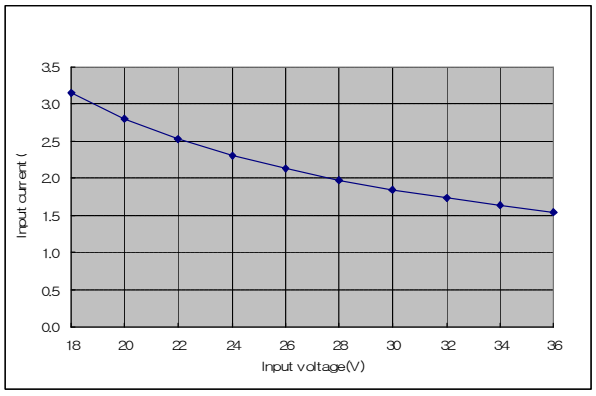
Vo=2.5V@15A, At 25°C

PBR50-24-3R3



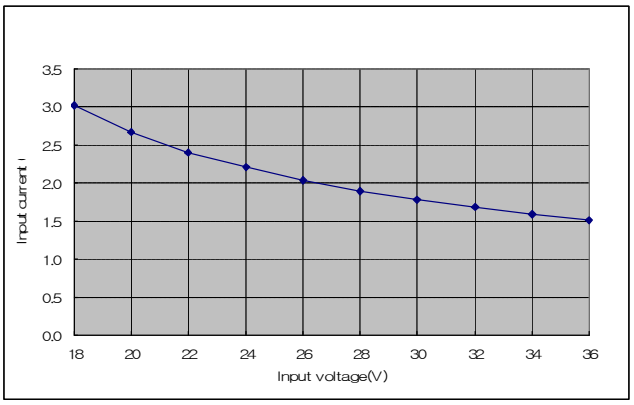
Vo=3.3V@15A , At 25°C

PBR50-24-5



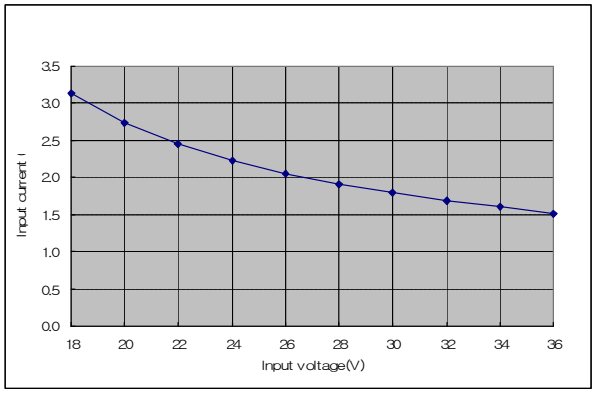
Vo=5V@10A , At 25°C

PBR50-24-12



Vo=12V@4.1A , At 25°C

PBR50-24-15



Vo=15V@3.3A , At 25°C

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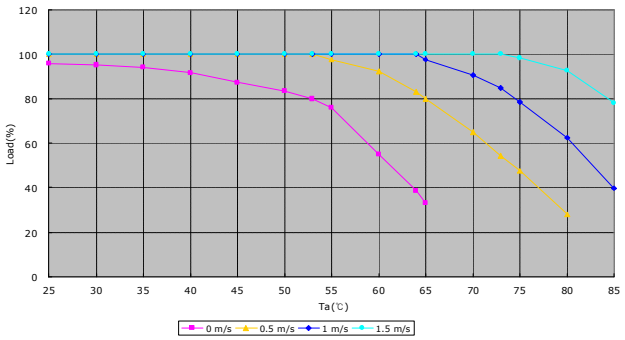
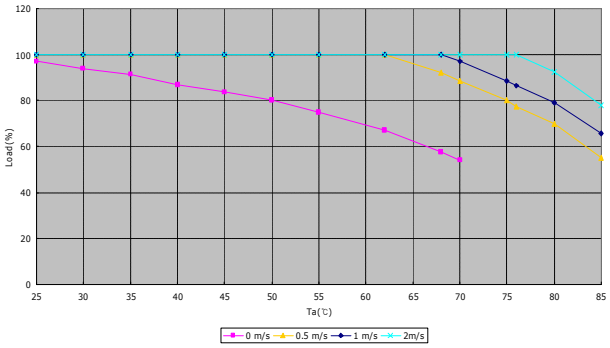
Output derating curve

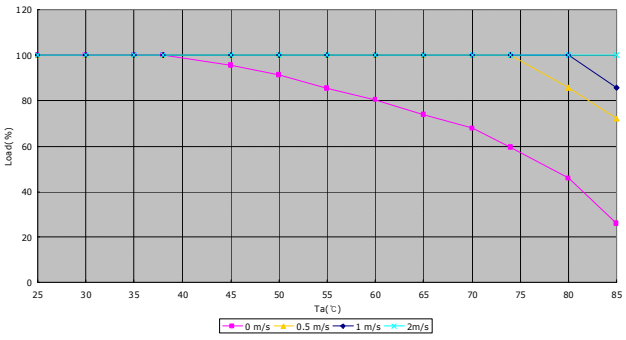
PBR50-24-2R5



PBR50-24-3R3



PBR50-24-5



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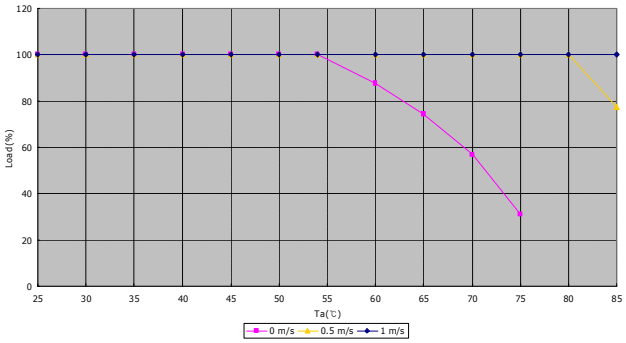
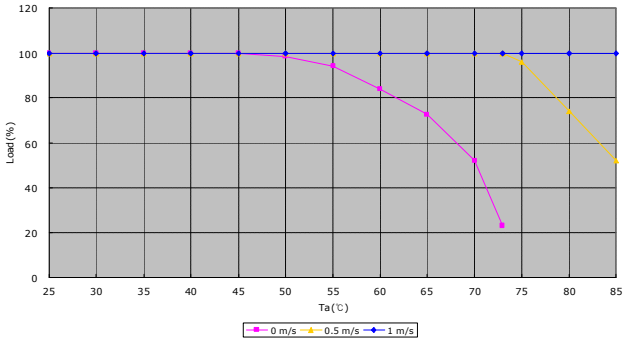


PBR50-24-15



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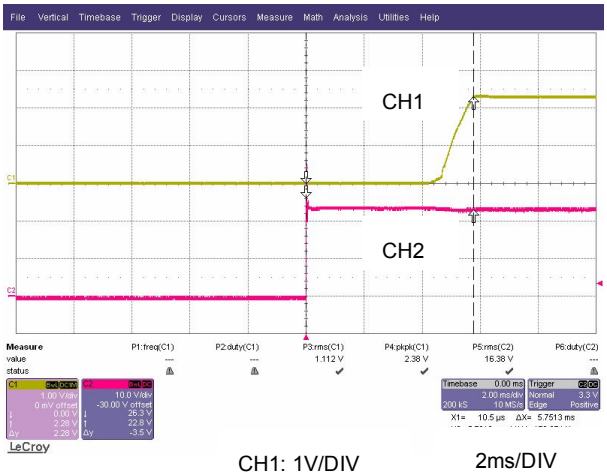
Start-up from Vin

PBR50-24-2R5

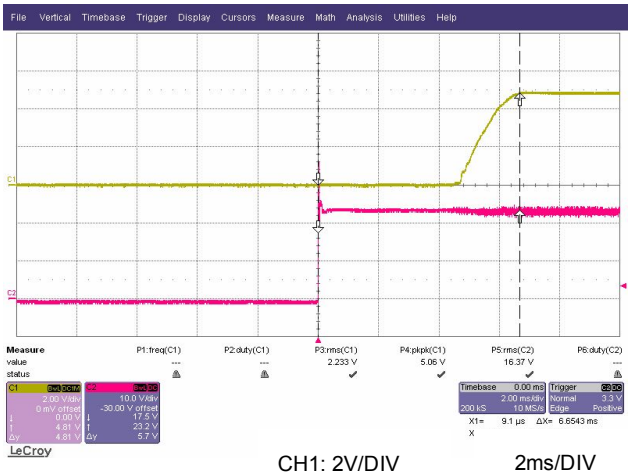


CH1: 1V/DIV

CH2: 10V/DIV

2ms/DIV

PBR50-24-5

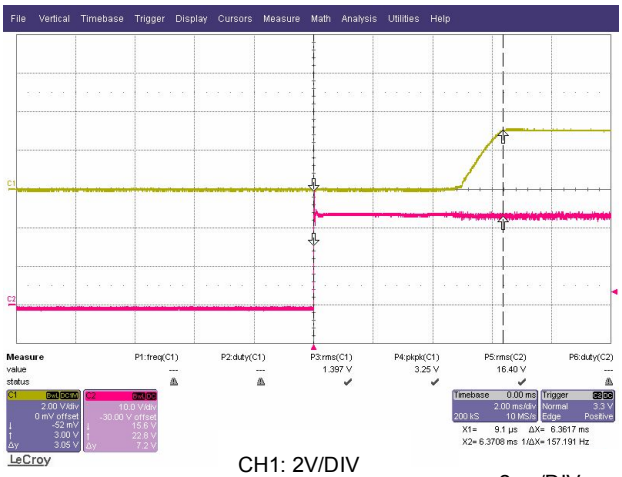


CH1: 2V/DIV

CH2: 10V/DIV

2ms/DIV

PBR50-24-3R3

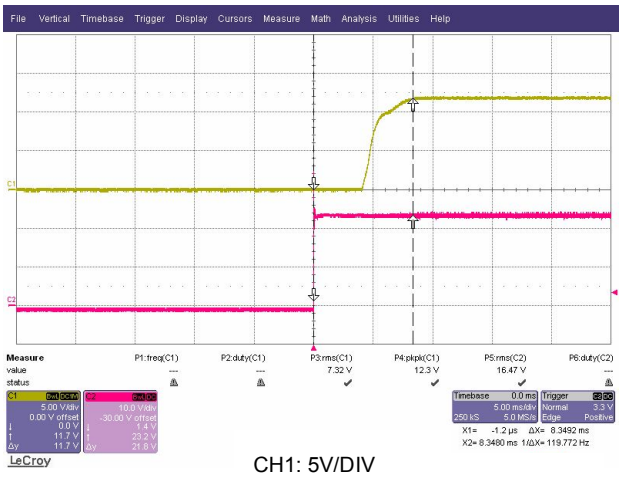


CH1: 2V/DIV

CH2: 10V/DIV

2ms/DIV

PBR50-24-12



CH1: 5V/DIV

CH2: 10V/DIV

5mS/DIV

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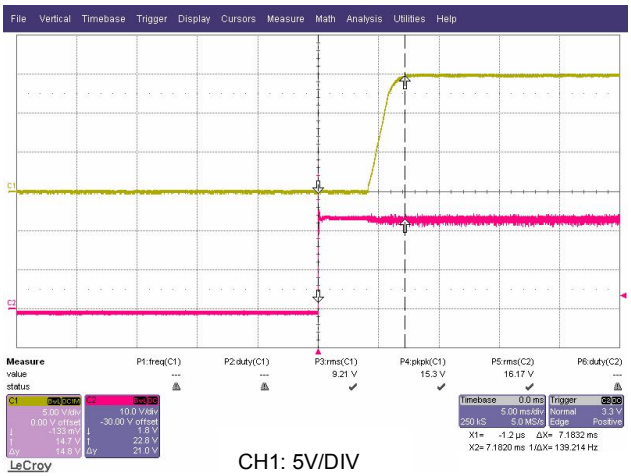
PBR50-24-15



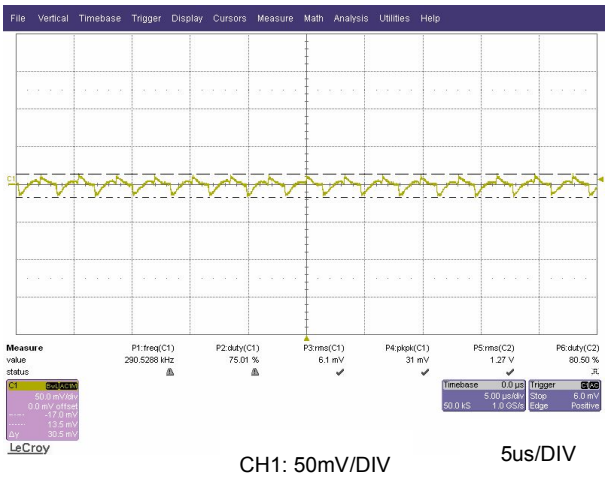
CH1: 5V/DIV

CH2: 10V/DIV

5ms/DIV

Output Ripple/Noise

PBR50-24-2R5

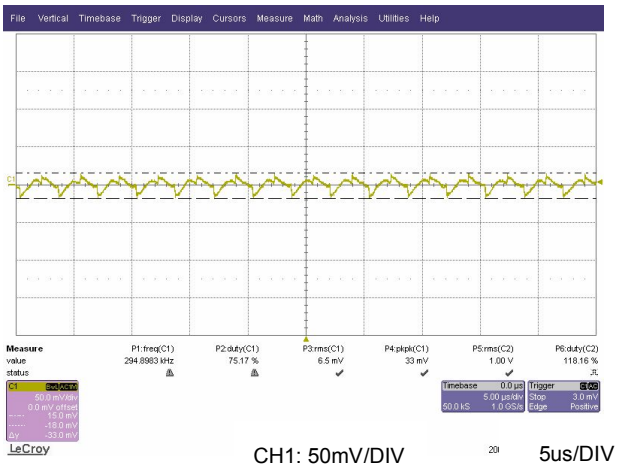


CH1: 50mV/DIV

5us/DIV

Vin=24V, Vo=2.5V@15A ,At 25°C

PBR50-24-3R3



CH1: 50mV/DIV

5us/DIV

Vin=24V, Vo=3.3V@15A, At 25°C

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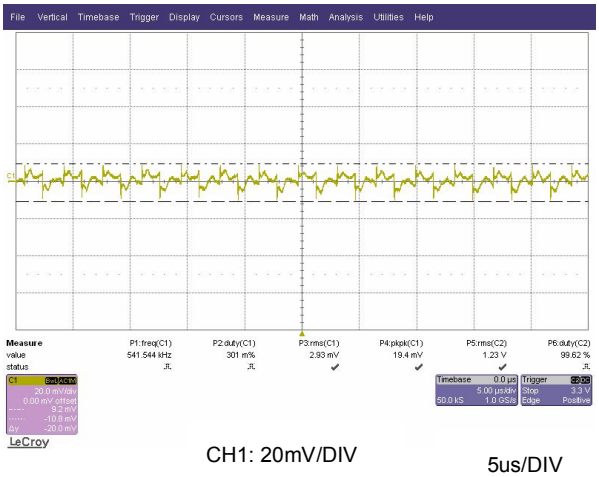
PBR50-24-5

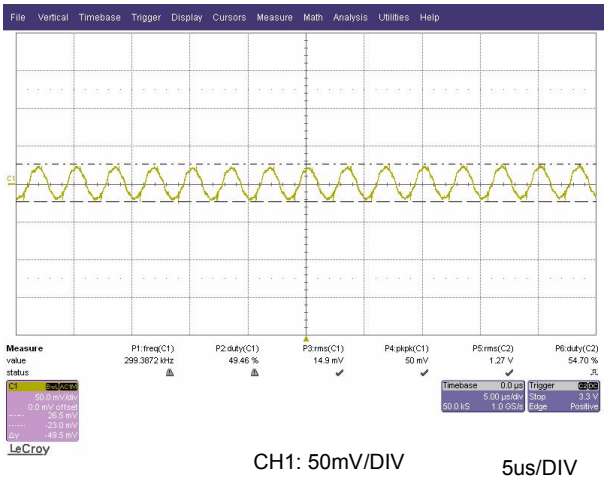


CH1: 20mV/DIV

5us/DIV

Vin=24V, Vo=5V@10A, At 25°C

PBR50-24-15

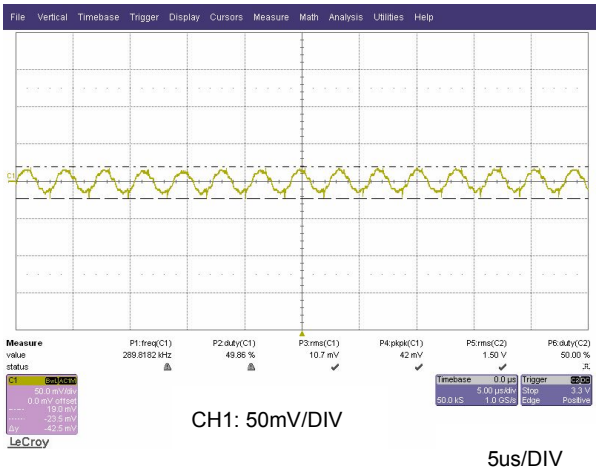


CH1: 50mV/DIV

5us/DIV

Vin=24V, Vo=15V@3.3A, At 25°C

PBR50-24-12



CH1: 50mV/DIV

5us/DIV

Vin=24V, Vo=12V@4.1A, At 25°C

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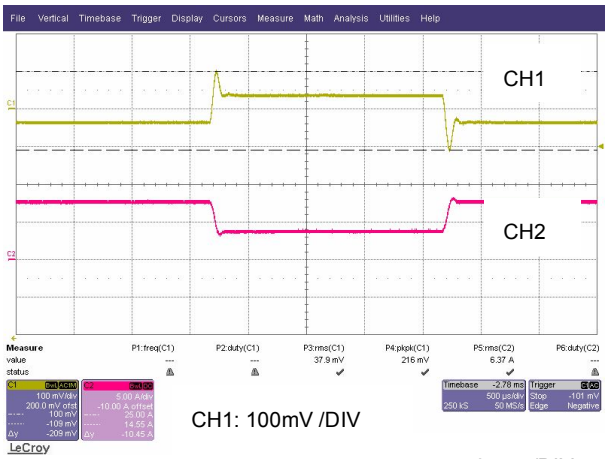
Output Load Transient Response

(Dynamic load change from 25% to 50% to 25% of full load)

PBR50-24-2R5

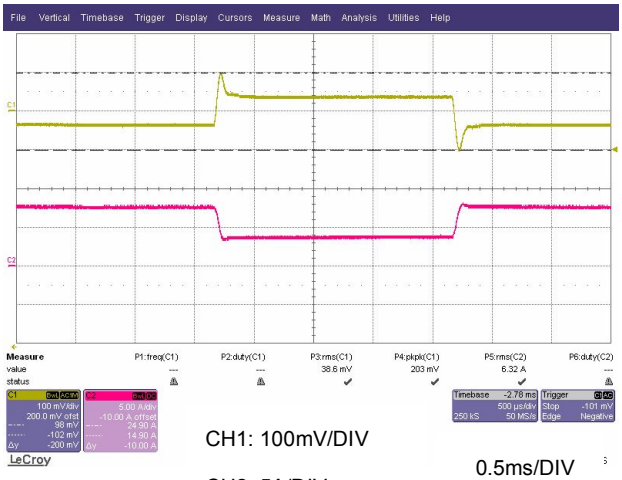


CH1: 100mV /DIV

CH2: 5A/DIV

0.5ms/DIV

PBR50-24-3R3

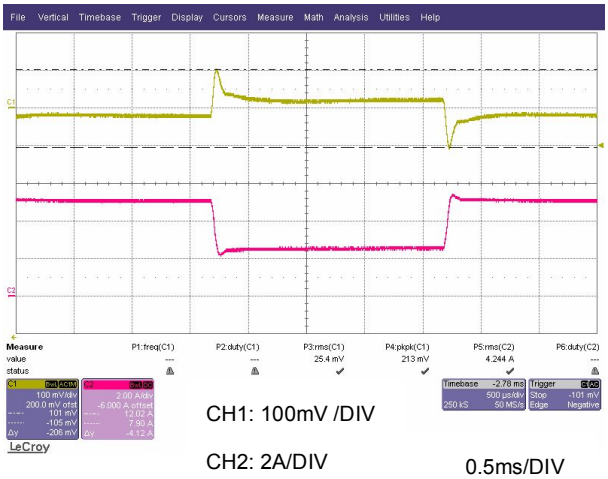


CH1: 100mV/DIV

CH2: 5A/DIV

0.5ms/DIV

PBR50-24-5

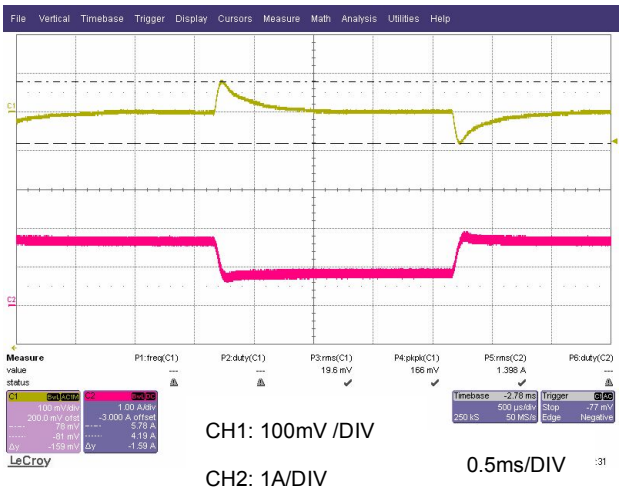


CH1: 100mV /DIV

CH2: 2A/DIV

0.5ms/DIV

PBR50-24-12



CH1: 100mV /DIV

CH2: 1A/DIV

0.5ms/DIV

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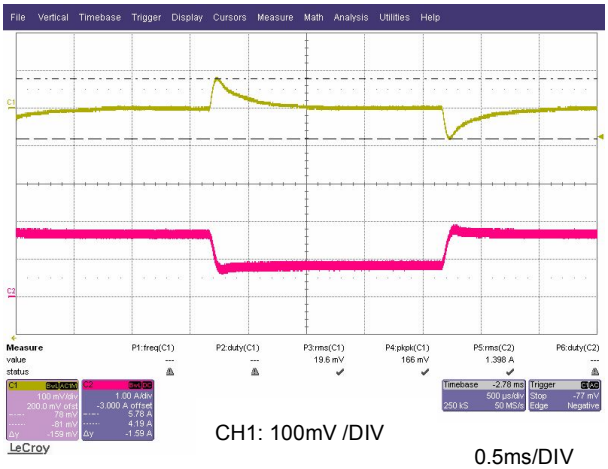
PBR50-24-15



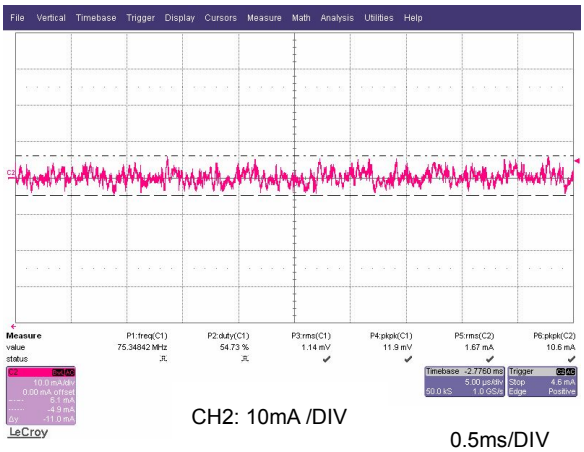
CH1: 100mV /DIV

CH2: 1A/DIV

0.5ms/DIV

Input Reflected Ripple Current

PBR50-24-5

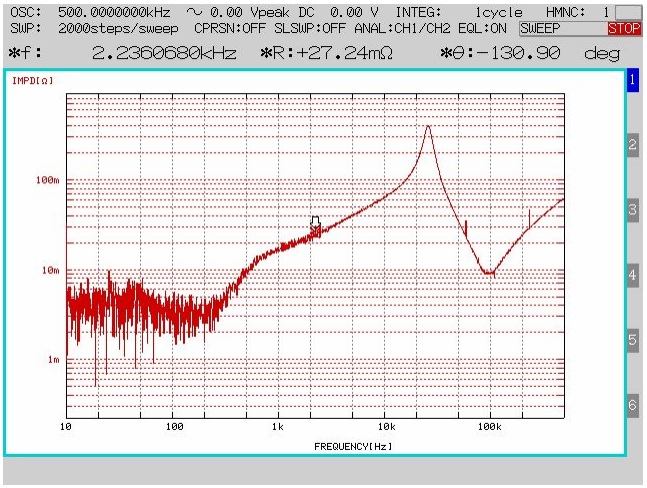


CH2: 10mA /DIV

0.5ms/DIV

Output Impedance

PBR50-24-5



Frequency response analyzer
FRA5097(NF)

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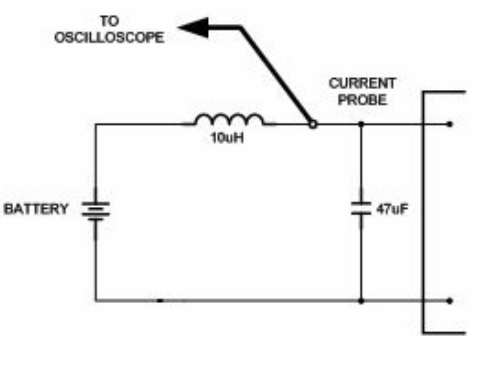
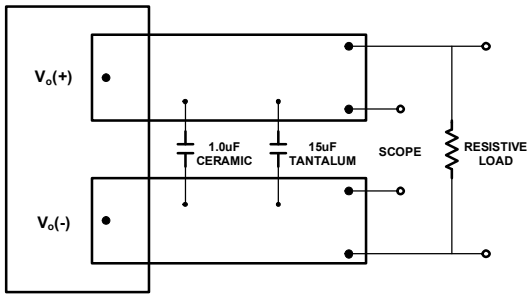
TEST Configurations

Input Reflected Ripple Current Test

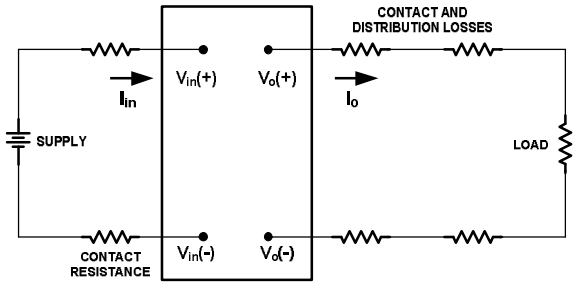


Output ripple and noise Test



* Conductor from Vout-pins to capacitors = 50mm (1.97in)

Output Voltage and Efficiency Test



*All measurements are taken at the module terminals when Socketing, place Kelvin connections at module terminals to Avoid measurement errors due to socket contact resistance

Efficiency

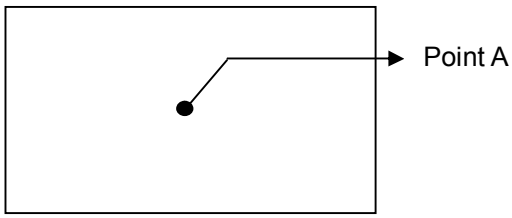
$$\eta = \left(\frac{[V_O(+) - V_O(-)] \times I_O}{[V_{in}(+) - V_{in}(-)] \times I_{in}} \right) \times 100\%$$

Thermal Considerations

PBR50 series has wide operating temperature range from -40˚C to +85˚C.

However, it should be required an enough air flow for more reliable operation. Output derating curve provide designers with a quantity of a current under the desired ambient temperature and velocity of a airflow

If the device is installed in a system, the device's temperature of point A should be checked if does not exceed specified temperature as below. Please make sure that the ambient temperature does not exceed 100˚C. PBR50 series has a precise thermal shunt down circuit. If the temperature of point A exceed a 100˚C over temperature protection circuit will operate and output shunt down. As the temperature goes down the output will recover automatically.



Feature Description

Input Fuse

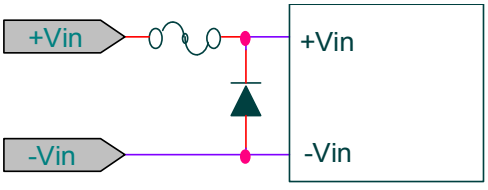
PBR50 series has not built in internal fuse. Therefore in order to ensure protection and safety fuses should be used at input line of converter

We recommend to use a slow blow type fuse with a typical value of about twice the maximum input current, calculated at low line with the converter minimum efficiency.

Input Reverse-polarity voltage protection

Input reverse voltage protection has not built in this product.

So, you can set up a circuit externally as described below if necessary



Input Output Filter

PBR50 series have an internal input filter. To minimize the ripple and noise of the input voltage, additional external capacitor is required

To reduce an output ripple and noise, external capacitor is required at the output of the device.

Remote ON/OFF Control (CNT)

By using CNT pin you can control the output without turning the input power on or off.

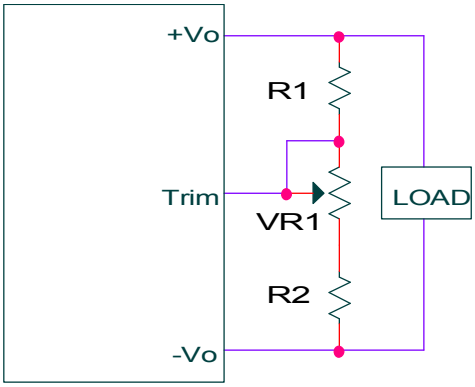
If you need not this function open this pin.

CNT Level for –Vin	OUTPUT
Open	ON
Short	OFF

Output voltage variation (Trim)

Output Voltage adjusted by using trim pin within ±10% of output voltage.

Use of trim function can cause the output power to increase, so you should not use beyond the this module's specified output power rating



Output voltage	VR	R1	R2
3.3V	500Ω	1kΩ	560Ω
5V	1kΩ	1kΩ	680Ω
12V	1kΩ	3.9kΩ	680Ω
15V	1kΩ	5.6k	750Ω

Over current Protection(OCP)

PBR50 series built in over current protection circuit which operates when the output current is over 105% of rating and automatically recovers when over current condition is removed

Over Voltage Protection(OVP)

PBR50 series built in over voltage protection circuit which operates when the output voltage within 115~140% of rating. When OVP is triggered, the input must be taken out for second and than re-inputted manually.

Soldering Information

The product is intended for through hole mounting in a PCB, When wave soldering is used, the temperature on the pins is specified to maximum 260°C for maximum 10 seconds

when hand soldering, care should be taken to avoid direct contact between the hot soldering iron tip and the pins for more than a few seconds in order to prevent overheating.

PBR50 Series – Isolated DC/DC Converters
24V Input (18 – 36Vdc), Maximum Power: 50W

Data Sheet
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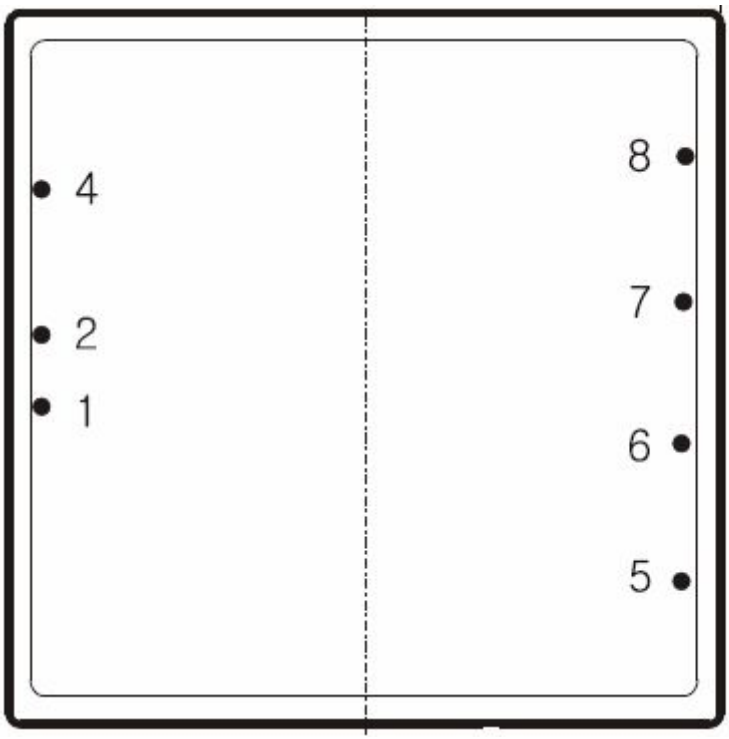
Pin assignments



PIN NO	NAME	FUNCTION	
1	+Vin	Positive terminal for 24V	
2	-Vin	Negative terminal for 24V	
4	CNT	CNT Level for –Vin	OUTPUT
		Open	ON
		Short	OFF
5	No pin	-	
6	+Vout	Positive terminal for Vout	
7	-Vout	Negative terminal for Vout	
8	Trim	Output voltage variation	

PBR50 Series – Isolated DC/DC Converters
24V Input (18 – 36Vdc), Maximum Power: 50W

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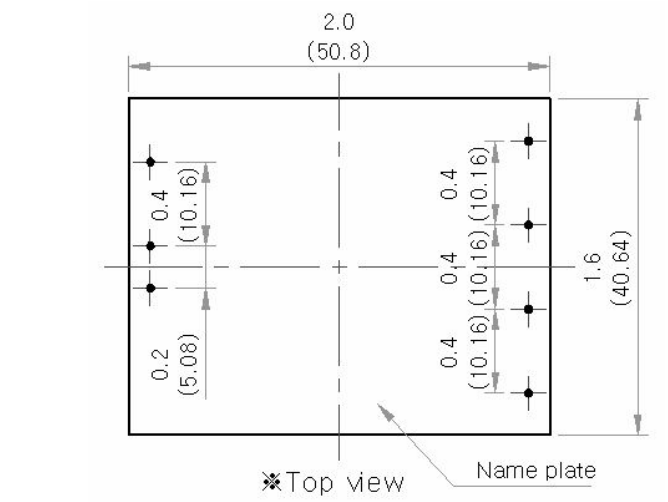
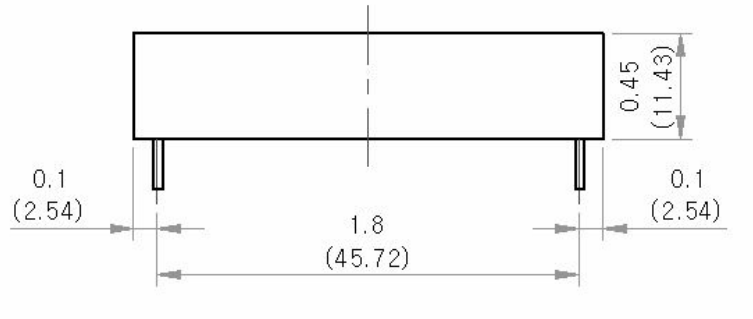
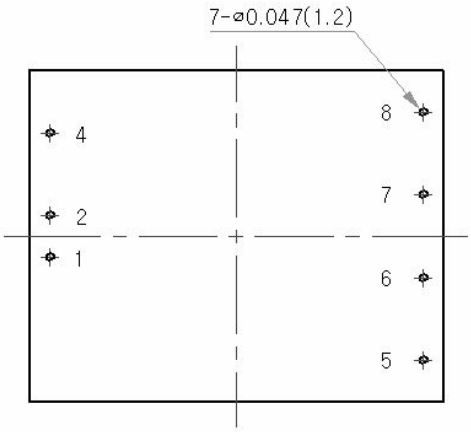
Mechanical Specification





SIDE VIEW



All dimensions are inches and (mm)

PBR50 Series – Isolated DC/DC Converters
24V Input (18 – 36Vdc), Maximum Power: 50W

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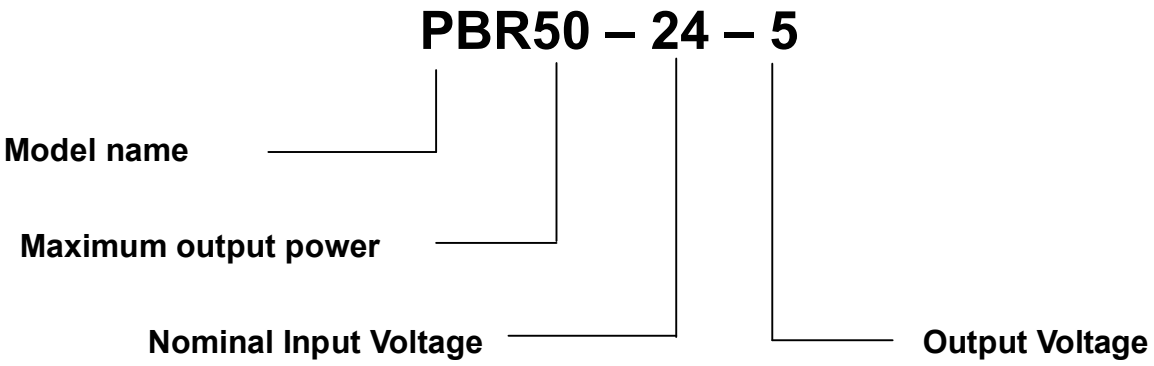
Ordering Information

Input	Output1	Maximum Power	Ripple & Noise Typ.	Efficiency Typ.	Model Number
18 - 36V	2.5V@15A	37.5W	70mVp-p	86%	PBR50-24-2R5
	3.3V@15A	49.5W	70mVp-p	88%	PBR50-24-3R3
	5V@10A	50W	70mVp-p	91%	PBR50-24-5
	12V@4.1A	49.2W	120mVp-p	93%	PBR50-24-12
	15V@3.3A,	49.5W	150mVp-p	92%	PBR50-24-15
36 – 75V	2.5V@15A	37.5W	70mVp-p	87%	PBR50-48-2R5
	3.3V@15A	49.5W	70mVp-p	88%	PBR50-48-3R3
	5V@10A	50W	70mVp-p	90%	PBR50-48-5
	12V@4.1A	49.2W	120mVp-p	92%	PBR50-48-12
	15V@3.3A,	49.5W	150mVp-p	91%	PBR50-48-15

Part number structure



PBR50 Series – Isolated DC/DC Converters
24V Input (18 – 36Vdc), Maximum Power: 50W

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