BMR 492

504 W digital eighth brick DC/DC

The BMR492, eighth brick, 36~75V input, single fully regulated 12V output, isolated DC/DC converter. The impressive performance of this converter includes an efficiency reaching 96% at 48V V_{in} and 60% load. BMR492 delivers a continuous power level of 504 W. This converter is designed for through-hole mounting using wave soldering or reflow soldering in production, and incorporates a novel design of baseplate, which optimizes thermal performance while minimizing height. It can be trimmed to a very wide range of output voltage. The BMR492 is fully protected from abnormal input/output voltage, current, and temperature conditions. Input to output 2250V isolation.

Key features

- High efficiency with 96%
- 12V fully regulated output
- 36~75V input
- 504W output power
- Eighth Brick
- Monotonic and Pre-bias start-up
- Output over voltage protection
- Over temperature protection
- Output short-circuit protection
- 2250V isolation
- Remote control
- PMBus configuration

Soldering methods

- Reflow soldering Pin-in-paste
- Wave soldering
- Manual soldering

Key electrical information

Parameter	Values
Input range	36-75 V
Output voltage	12 V
Output current	42 A
Output power	504 W

Mechanical

58.4 x 22.7 x 12.7 mm / 2.30 x 0.89x 0.50 in

Application areas

- Optical Transport
- Telecom
- Servers

Product options

The table below describes the different product options.

Example:	BMR492	0	3	11	/011	H	Definitions
Product family	BMR492						
Pin length options		0					0 = 5.33 mm / 0.210 in 2 = 3.69 mm / 0.145 in 3 = 4.57 mm / 0.180 in 4 = 2.79 mm / 0.110 in
Baseplate / HS option			3				3 = baseplate
Other hardware options				11			11 = 36-75 Vin, 12 Vout, 504W, 2250V isolation, with 7-pin digital interface
Configuration code					/011		/011=CDA Configuration for 36-75 Vin, 12V, 504W, isolated /021=CDA Configuration for 12.4 V with 0.4V droop load sharing function, OVP latching mode, isolated
Packaging options						H	H = hard tray, dry pack (PIP reflow soldering) blank = foam tray (no dry pack, wave soldering)

For more information, please refer to Part 3 Mechanical information.

If you do not find the variant you are looking for, please contact us at Flex Power Modules .

Order number examples

Part number	V_{in}	Outputs	Configuration
BMR492 0311/011H	36-75 V	12V / 42A/ 504 W	5.33 mm pins / 7-pin digital header / base plate / dry pack, hard tray
BMR492 0311/021	36-75 V	12V / 42A/ 504 W	5.33 mm pins / 7-pin digital header / base plate / 12.4V with 0.4V droop load sharing function / foam tray

Part 1: Electrical specifications

Absolute maximum ratings

Stress in excess of our defined *absolute maximum ratings* may cause permanent damage to the converter. Absolute maximum ratings, also referred to as *non-destructive limits,* are normally tested with one parameter at a time exceeding the limits in the electrical specification.

Characteristics	min	typ	max	Unit
Operating temperature (T_{P1})	-40		+125	°C
Storage temperature	-55		+125	°C
Input voltage (V_{in})	-0.5		+75	V
Input voltage transient (100 ms)			+80	V
Isolation voltage (input to output)			2250	V
Isolation voltage (baseplate to output)			750	V
Remote control pin voltage	-0.3		5	V

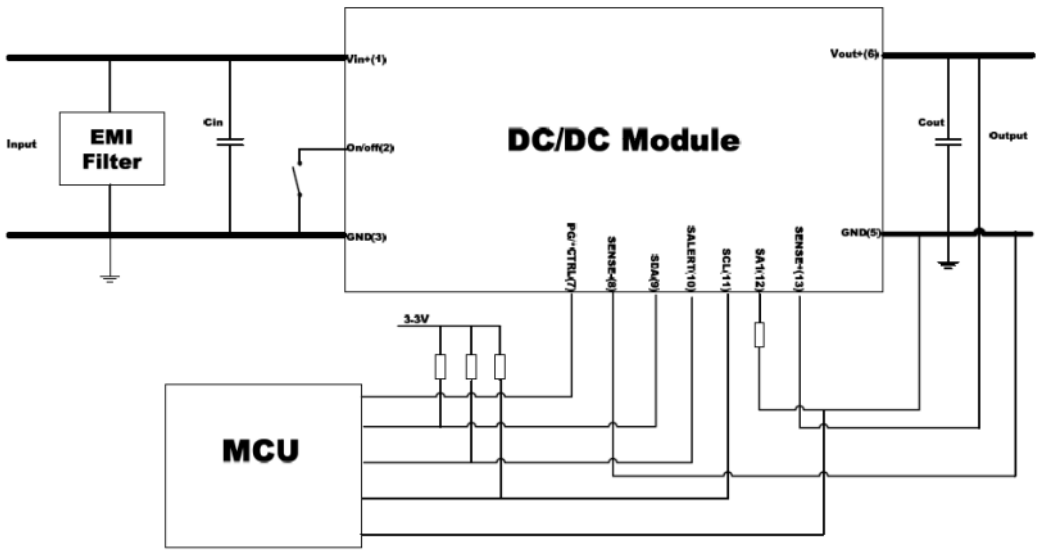
Reliability

Failure rate (λ) and mean time between failures (MTBF= 1/ λ) are calculated based on *Telcordia SR-332 Issue 4: Method 1, Case 3, (80% of I_{out_TDP}, Ta=40°C, Airflow=200 LFM).*

	Mean	90% confidence level	Unit
Steady-state failure rate (λ)	151		nfailures/h
Standard deviation (σ)	22.5		nfailures/h
MTBF	6.64	5.58	MHr

Typical application diagram

Capacitor values are defined in the Electrical Specification tables. The EMI filter is defined in the EMC Part 2.



Electrical specifications for BMR492 X311/011

12V, 42A ≦504W

Min and Max values are valid for: T_{P1} = -30 to +90°C, V_{in}= 36 to 75V, unless otherwise specified under conditions. Typical values given at: T_{P1} = +25°C, V_{in}= 48V, max P_{out_TDP}, unless otherwise specified under conditions, see Note 1.

Additional external C_{in} = 470 µF, C_{out}= 2mF

Characteristic	conditions	minimum	typical	maximum	unit
Key features					
Efficiency (η)	60% of P_{out_TDP} V_{in} = 48 V		96.1		%
	100% of P_{out_TDP} V_{in} = 48 V		95.7		%
P_{out_TDP} thermal design power (TDP)	See Note 1			504	W
Power dissipation	100% of P_{out_TDP}		23.2	29.5	W
Switching frequency (f_s)	0-100 % of P_{out_TDP}		170		kHz
Recommend capacitive load		470	2000	10000	µF
Input characteristics					
Input voltage range (V_{in})		36		75	V
Input idling power	P_{out} = 0 W		4.9		W
Input standby power	(turned off with RC)		0.66		W
Input OVP			85		V
Internal input capacitance			30		µF
Recommended external input capacitance		220			µF

Note 1: Continuous power (thermal design power (TDP) is ≤ 504 W depending on thermal conditions.

Electrical specifications for BMR492 X311/011

12V, 42A ≦504W

Min and Max values are valid for: T_{P1} = -30 to +90°C, V_{in}= 36V to 75V, unless otherwise specified under conditions. Typical values given at: T_{P1} = +25°C, V_{in}= 48V, max P_{out_TDP}, unless otherwise specified under conditions, see Note 1.

Additional external C_{in} = 470 µF, C_{out}= 2mF

Characteristic	conditions	minimum	typical	maximum	unit
Output characteristics					
Output voltage initial setting and accuracy	T_{P1}= +25°C,V_{in}= 48V, 0A	11.94	12.0	12.06	V
Output voltage tolerance band	0 – 100% of max P_{out_TDP} V_{in} = 36-75 V	11.76		12.24	V
Output adjust range	0-100% of max P_{out_TDP}	8		13.2	V
Idling voltage	P_{out} = 0 W, 48 V	11.9		12.12	V
Line regulation	V_{in} = 36 - 75 V 0 – 100% of max P_{out_TDP}		3	10	mV
Load regulation	0 - 100% of max P_{out_TDP} -Stand alone(011H)		50	60	mV
Output current (I_{out})	V_{in} = 36 - 75 V	0		42	A
Load transient voltage deviation	Load step 25%-75%-25% of max P_{out_TDP} di/dt = 5 A/µs. See Note 2		±350		mV
Load transient recovery time			200		µs
Output ripple & noise	max P_{out_TDP} See Note 3		50		mV_{p-p}

Note 1: continuous power (thermal design power (TDP) is ≤ 504 W depending on thermal conditions.
Note 2: C_{out} is 2x1mF
Note 3: See Technical Reference doc: Design considerations

Electrical specifications for BMR492 X311/011

12V, 42A ≦504W

Characteristic	conditions	minimum	typical	maximum	unit
On/off control					
Turn-off input voltage	Decreasing input voltage	31	32.5	34	V
Turn-on input voltage	Increasing input voltage	33	34.5	36	V
Ramp-up time (from 0−100% of V_{out})			10		ms
Start-up time (from V_{in} connection to 90% of V_{out})			40		ms
RC start-up time			25		ms
Logic high: trigger level			0.8		V
Logic low: trigger level			0.7		V
Logic low: response time		0.1	0.2	0.3	ms
Sink current		0.4			mA
Protection features					
Current limit threshold (OCP)	T_{P1} < max T_{P1}		56	60	A
Output current limit (OCP) response time and type	Retry continuously		1		ms
Output overvoltage protection (OVP)	See note 1		15.6		V
Output overvoltage protection (OVP) response time and type	Disabled until fault cleared		70		µs
Over temperature protection (OTP)	See note 2		130		°C
Over temperature protection (OTP) type	Disabled until fault cleared				ms

Note 1: OVP is auto-recover mode by default.

Note 2: Please attach thermocouple on NTC resistor to test OTP function, the hot spot (P1) temperature is just for reference.

Electrical specifications for BMR492 X311/011

12V, 42A ≦504W

In the table below all PMBus are written in capital letters.

T_{P1} = -30 to +90°C, V_{in} = 36V to 75V, unless otherwise specified under conditions.
Typical values given at: T_{P1} = +25 °C, V_{in} = 48V, max P_{out_TDP}, unless otherwise specified under conditions

Command	Conditions	minimum	typical	maximum	Unit
Monitoring accuracy					
Input voltage READ_VIN			±0.5		V
Output voltage READ_VOUT			±40		mV
Output current READ_IOUT	T_{P1} = 25 °C, V_O = 12 V		±1.0		A
	T_{P1} = -20-120 °C, V_O = 12V		±1.5		A
Duty cycle READ_DUTY_CYCLE	No tolerance, Read value is the actual value applied by PWM controller				
Temperature READ_TEMPERATURE_1	Temperature sensor, -20-120 °C		±5		°C

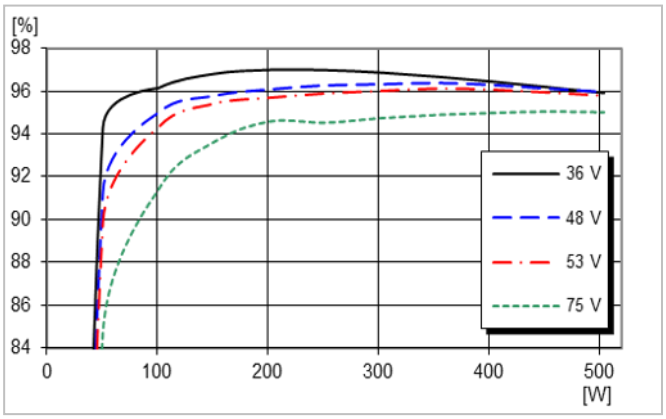
For more detailed information please refer to Technical Reference Document: PMBus commands.

This product is supported by the Flex Power Designer tool.

Electrical specifications for BMR492 X311/011

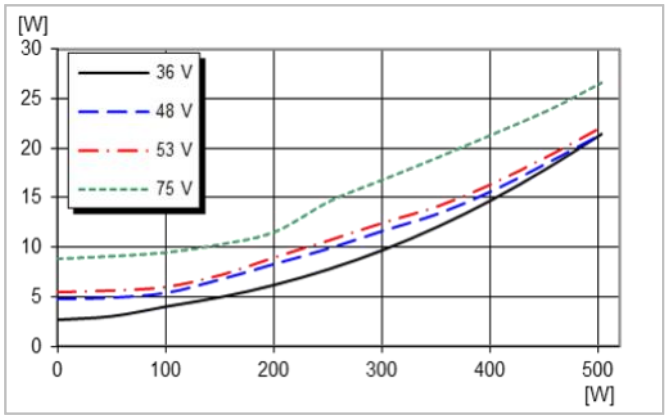
12V, 42A ≦504W

Efficiency



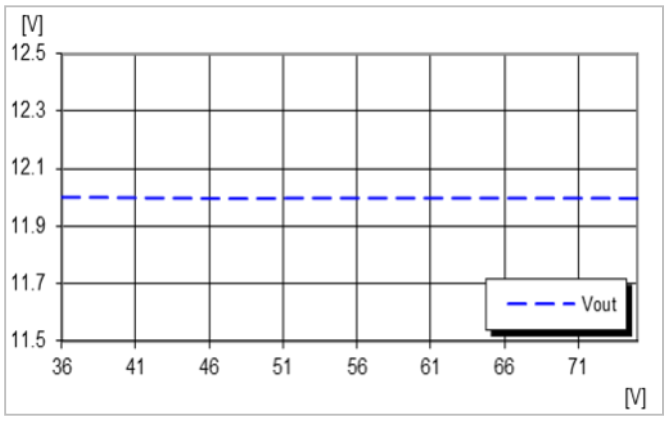
Efficiency vs. output power and input voltage at T_{P1} = +25°

Power dissipation



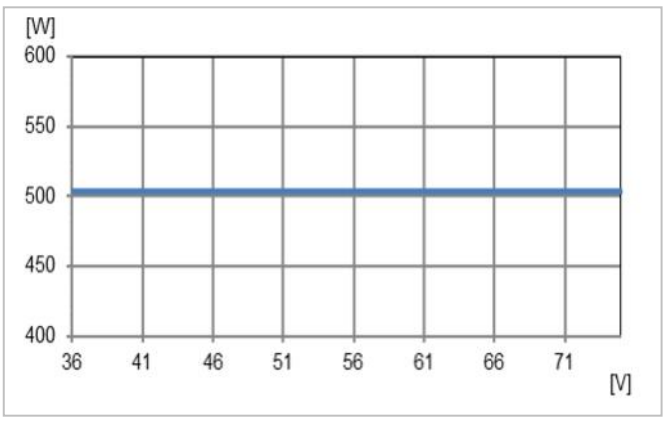
Dissipated power vs. load power at T_{P1} = +25°C

Line regulation



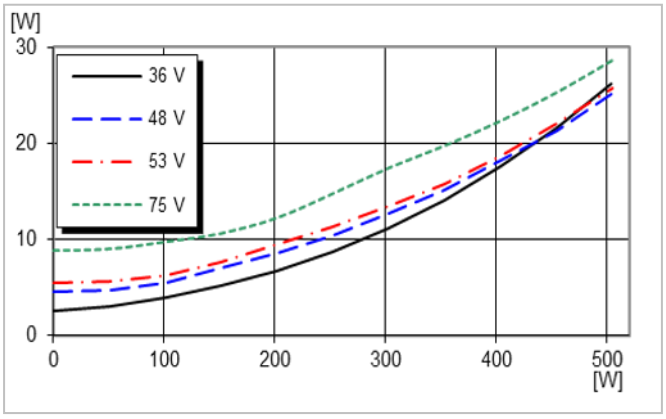
Output voltage vs. input voltage at T_{P1} = +90°C

Available power



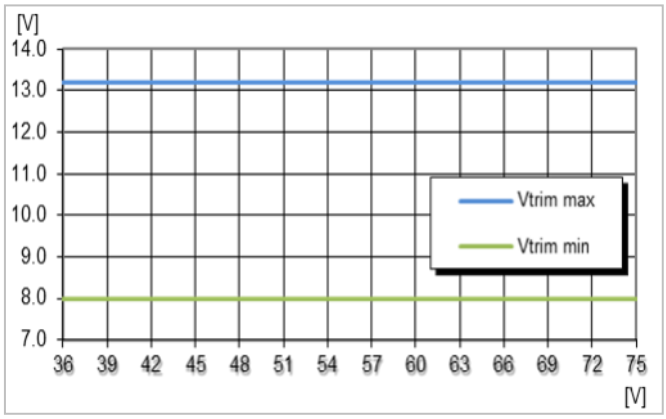
Available output power vs. input voltage , T_{P1} = +90°C

Power loss at max temperature



Dissipated power vs. output power and input voltage at T_{P1} = +90°C

Output voltage adjust range



Max and min V_{out} trim vs V_{in}

Electrical specifications for BMR492 X311/021

12V, 42A ≦504W

Min and Max values are valid for: T_{P1} = -30 to +90°C, V_{in}= 36V to 75V, unless otherwise specified under conditions. Typical values given at: T_{P1} = +25°C, V_{in}= 48V, max P_{out_TDP}, unless otherwise specified under conditions, see Note 1.

Additional external C_{in} = 470 µF, C_{out}= 2mF

Characteristic	conditions	minimum	typical	maximum	unit
Output characteristics					
Output voltage initial setting and accuracy	T_{P1}= +25°C,V_{in}= 48V, 0A	12.34	12.4	12.46	V
Output voltage tolerance band	0 – 100% of max P_{out_TDP} V_{in} = 36-75 V	11.76		12.64	V
Output adjust range	0-100% of max P_{out_TDP}	8		13.2	V
Idling voltage	P_{out} = 0 W, 48 V	12.3		12.52	V
Line regulation	V_{in} = 36 - 75 V 0 – 100% of max P_{out_TDP}		3	10	mV
Load regulation	0 - 100% of max P_{out_TDP}		400	450	mV
Output current (I_{out})	V_{in} = 36 - 75 V	0		42	A
Load transient voltage deviation	Load step 25%-75%-25% of max P_{out_TDP} di/dt = 5 A/µs. See Note 2		±650		mV
Load transient recovery time			200		µs
Output ripple & noise	max P_{out_TDP} See Note 3		50		mV_{p-p}

Note 1: continuous power (thermal design power (TDP) is ≤ 504 W depending on thermal conditions.
Note 2: C_{out} is 2x1mF
Note 3: See Technical Reference doc: Design considerations

Electrical specifications for BMR492 X311/021

12V, 42A ≦504W

Characteristic	conditions	minimum	typical	maximum	unit
On/off control					
Turn-off input voltage	Decreasing input voltage	31	32.5	34	V
Turn-on input voltage	Increasing input voltage	33	34.5	36	V
Ramp-up time (from 0−100% of V_{out})			20		ms
Start-up time (from V_{in} connection to 90% of V_{out})			50		ms
RC start-up time			35		ms
Logic high: trigger level			0.8		V
Logic low: trigger level			0.7		V
Logic low: response time		0.1	0.2	0.3	ms
Sink current		0.4			mA
Protection features					
Current limit threshold (OCP)	T_{P1} < max T_{P1}		56	60	A
Output current limit (OCP) response time and type	Retry continuously		1		ms
Output overvoltage protection (OVP)	See note 1		15.6		V
Output overvoltage protection (OVP) response time and type	Disabled until fault cleared		70		µs
Over temperature protection (OTP)	See note 2		130		°C
Over temperature protection (OTP) type	Disabled until fault cleared				ms

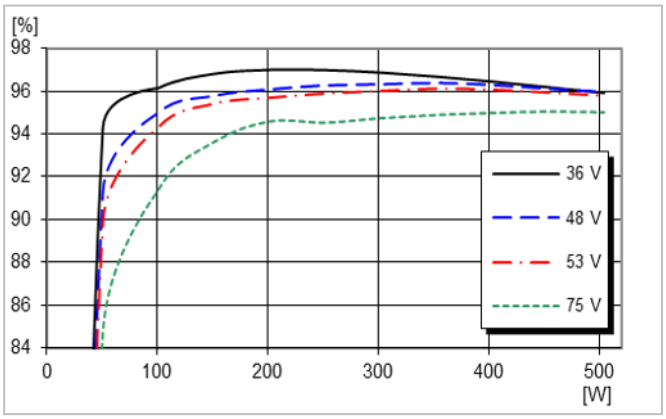
Note 1: OVP is latch mode by default.

Note 2: Please attach thermocouple on NTC resistor to test OTP function, the hot spot (P1) temperature is just for reference.

Electrical specifications for BMR492 X311/021

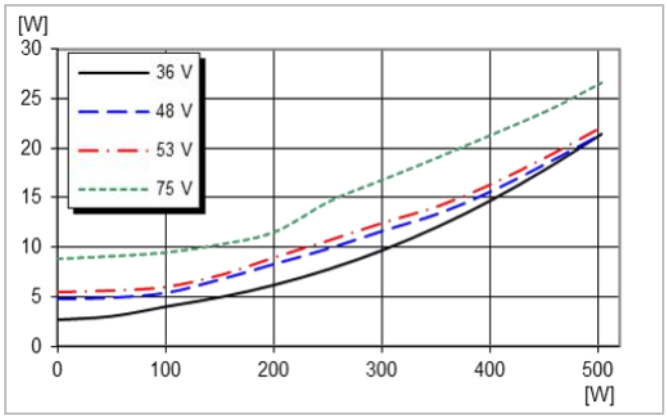
12V, 42A ≦504W

Efficiency



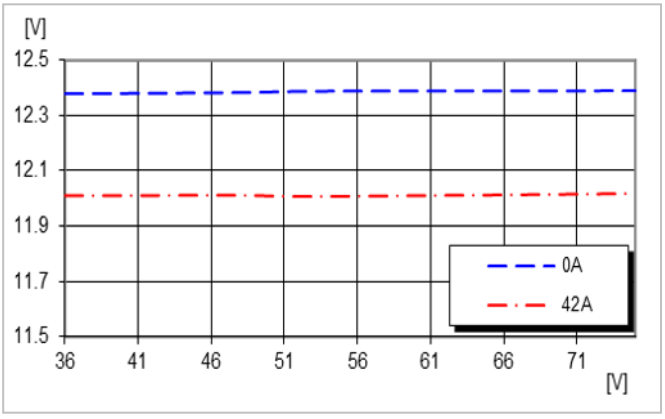
Efficiency vs. output power and input voltage at T_{P1} = +25°

Power dissipation



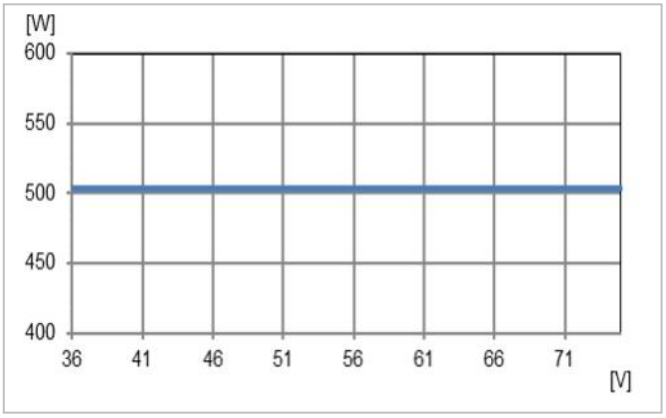
Dissipated power vs. load power at T_{P1} = +25°C

Line regulation



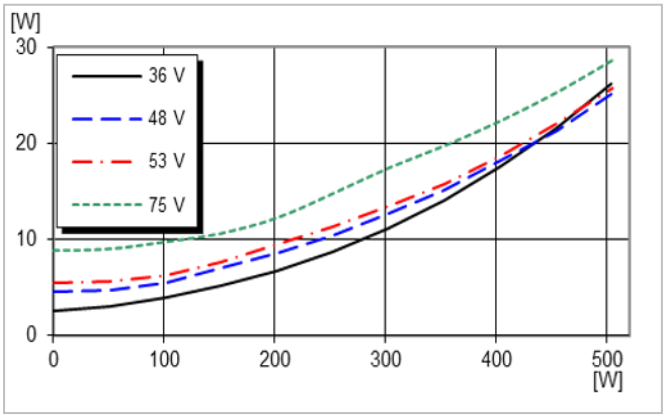
Output voltage vs. input voltage at T_{P1} = +90°C

Available power



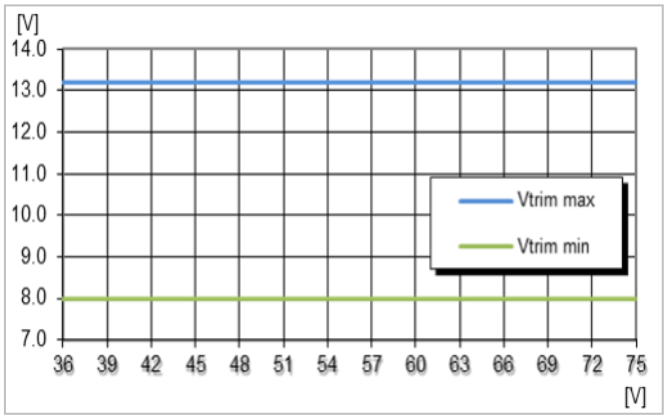
Available output power vs. input voltage , T_{P1} = +90°C

Power loss at max temperature



Dissipated power vs. output power and input voltage at T_{P1} = +90°C

Output voltage adjust range

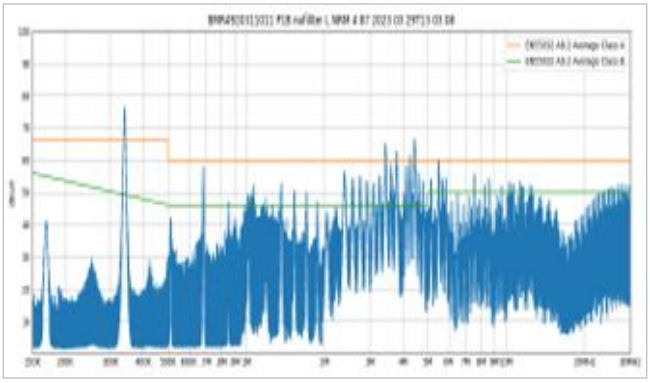


Max and min V_{out} trim vs V_{in}

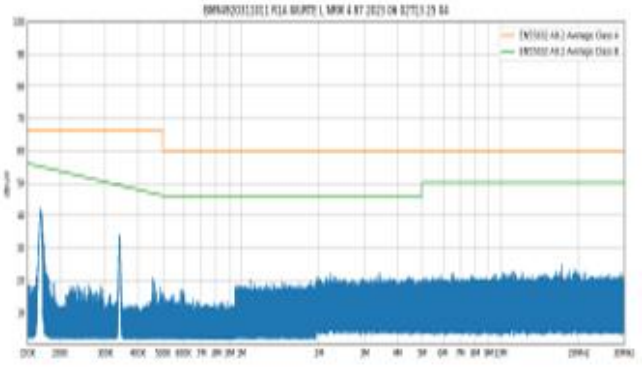
Part 2: EMC

EMC specifications

Conducted EMI measured according to EN55022 / EN55032, CISPR 22 / CISPR 32 and FCC part 15J (see test set-up below). The fundamental switching frequency is 170kHz for BMR492. The EMI characteristics below is measured at V_{in} = 48 V and max I_{out}.



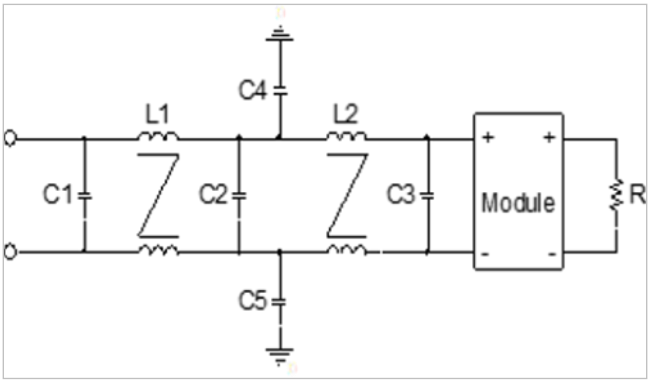
EMI without filter. EN55032 test method and limits are the same as EN55022. 220 µF 100V input capacitor and 2000 µF 16 V OS-CON output capacitor used



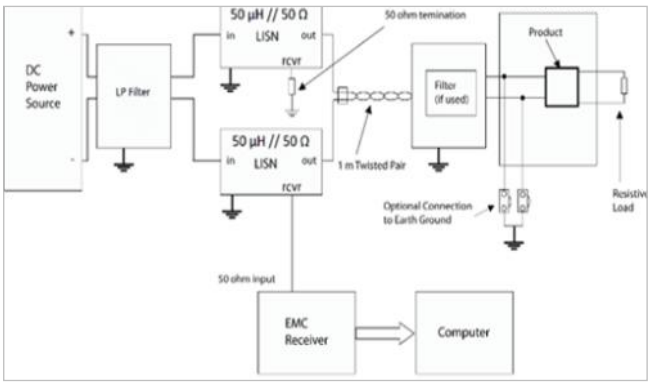
EMI with filter, EN55022 test methods and limits are the same as EN55032

Optional external filter for Class B

Suggested external input filter in order to meet Class B in EN 55022 / EN 55032, CISPR 22 / CISPR 32 and FCC part 15J.



Filter components:
C1 = 5 x 1 µF
C2 = 5 x 1 µF
C3 = 220 µF+15 µF
C4 = 2 x 10 nF
C5 = 2 x 10 nF
L1 = 1 mH (e.g Wurth 7448031501)
L2 = 1 mH (e.g Wurth 7448031501)



Test set-up

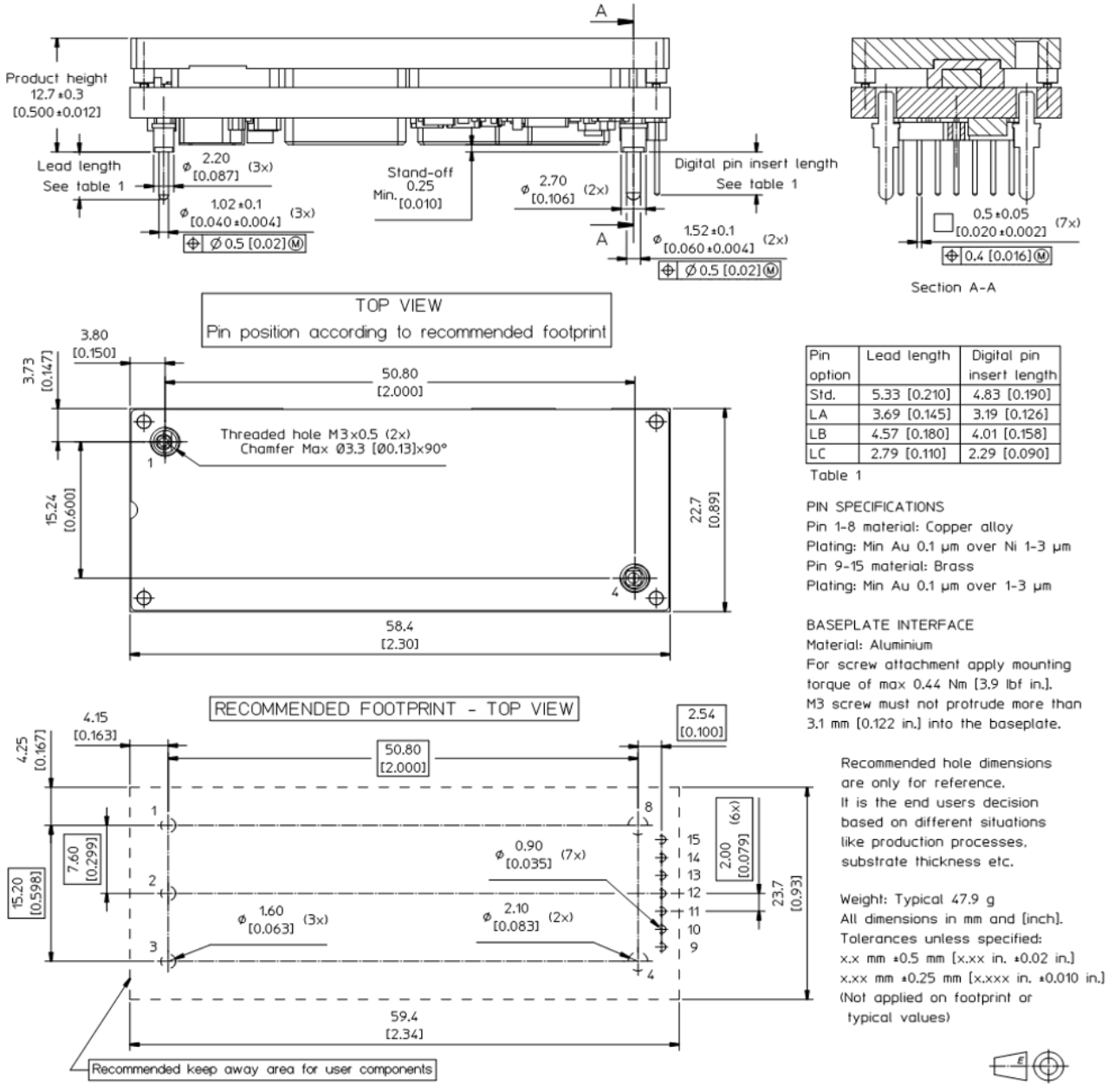
Layout recommendations

The radiated EMI performance of the product will depend on the PWB layout and ground layer design. It is also important to consider the stand-off of the product. If a ground layer is used, it should be connected to the output of the product and the equipment ground or chassis.
A ground layer will increase the stray capacitance in the PWB and improve the high frequency EMC performance.

Part 3: Mechanical information

BMR492 X311/XXX: Hole mount, Press fit Baseplate version

The mechanical information is based on a module which is hole mounted and has a baseplate.



Pin option	Lead length	Digital pin insert length
Std.	5.33 [0.210]	4.83 [0.190]
LA	3.69 [0.145]	3.19 [0.126]
LB	4.57 [0.180]	4.01 [0.158]
LC	2.79 [0.110]	2.29 [0.090]

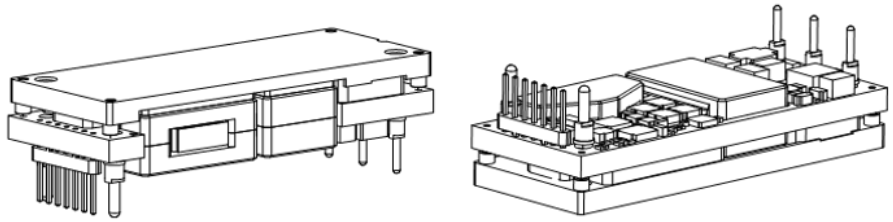
Table 1

PIN SPECIFICATIONS
Pin 1-8 material: Copper alloy
Plating: Min Au 0.1 µm over Ni 1-3 µm
Pin 9-15 material: Brass
Plating: Min Au 0.1 µm over 1-3 µm

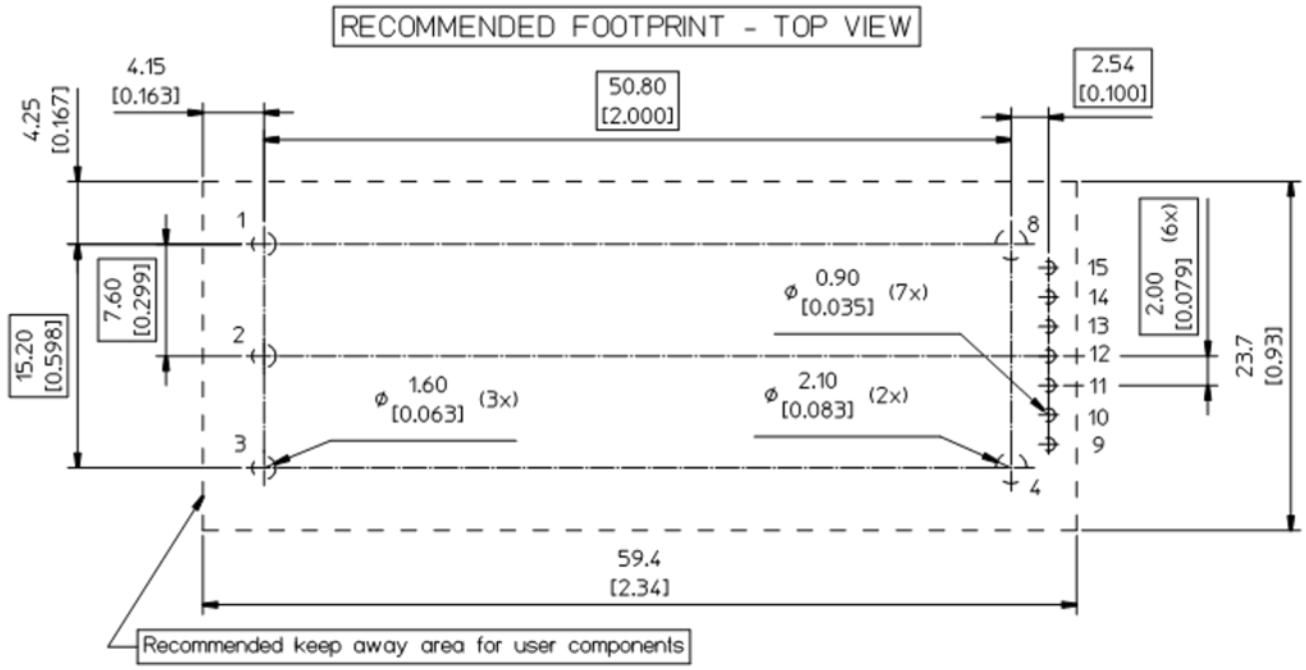
BASEPLATE INTERFACE
Material: Aluminium
For screw attachment apply mounting torque of max 0.44 Nm [3.9 lbf in.].
M3 screw must not protrude more than 3.1 mm [0.122 in.] into the baseplate.

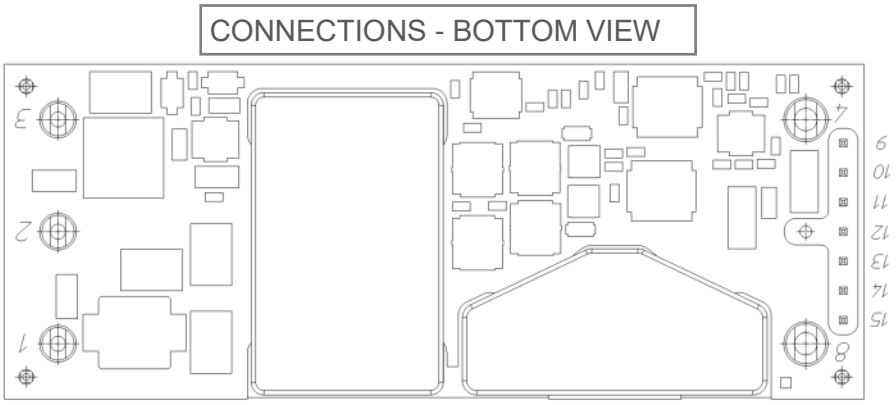
Recommended hole dimensions are only for reference.
It is the end users decision based on different situations like production processes, substrate thickness etc.

Weight: Typical 47.9 g
All dimensions in mm and [inch].
Tolerances unless specified:
x.x mm ±0.5 mm [x.xx in. ±0.02 in.]
x.xx mm ±0.25 mm [x.xxx in. ±0.010 in.]
(Not applied on footprint or typical values)



TOP VIEW - Recommended footprint all variants showing pin positions





Pin	Desig-nation	Function 7 pin
1	+In	Positive Input
2	RC	Remote Control
3	-In	Negative Input
4	-Out	Negative Output
8	+Out	Positive Output

Pin	Desig-nation	Function 7 pin
9	PG/*CTRL	Power Good
10	DGND	PMBus ground
11	SDA	PMBus Data
12	SALERT	PMBus alert signal
13	SCL	PMBus Clock
14	SA1	PMBus Address 1
15	SA0	PMBus Address 0

*Pin 7 secondary remote control, set by hardware

Part 4: Thermal considerations

Thermal considerations

The products are designed to operate in different thermal environments and sufficient cooling must be provided to ensure reliable operation.

General

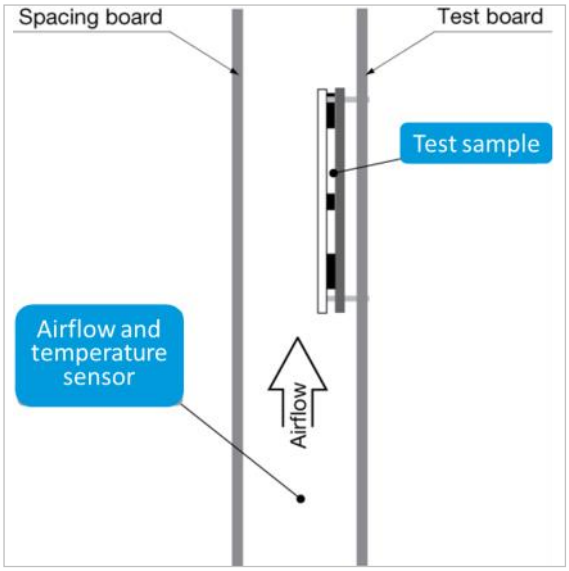
For products mounted on a PWB without a heatsink attached, cooling is achieved mainly by conduction, from the pins to the host board, and convection, which is dependent on the airflow across the product. Increased airflow enhances the cooling of the product. The wind speed and temperature are measured in a point upstream the device. The *output current derating graphs* found later in this section for each model provide the available output current vs. ambient air temperature and air velocity at V_{in} = 48 V.

For products using any form of heatsink structure a top spacing board and side airflow guides are used to ensure airflow hitting the module and not diverted away.

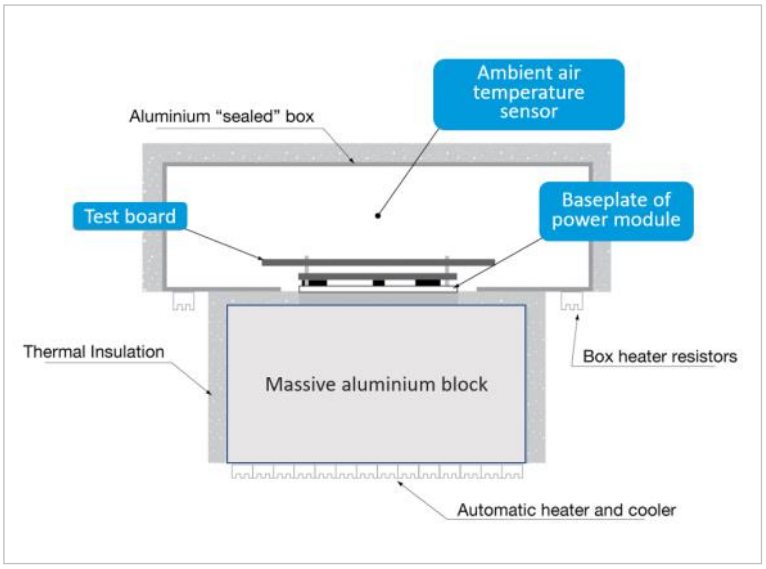
Distance between the tested device and the top space board and the side airflow guides are 6.35 mm ± 1 mm.

The product is tested on a 185 x 185 mm, 105 µm (3 oz), 6-layer test board mounted vertically in a wind tunnel.

For products with baseplate used in a sealed box/cold wall application, cooling is achieved mainly by conduction through the cold wall. The product is tested in a sealed box test set up with ambient temperatures 85°C. See Design Note 028 for further details.



Picture: general test set-up



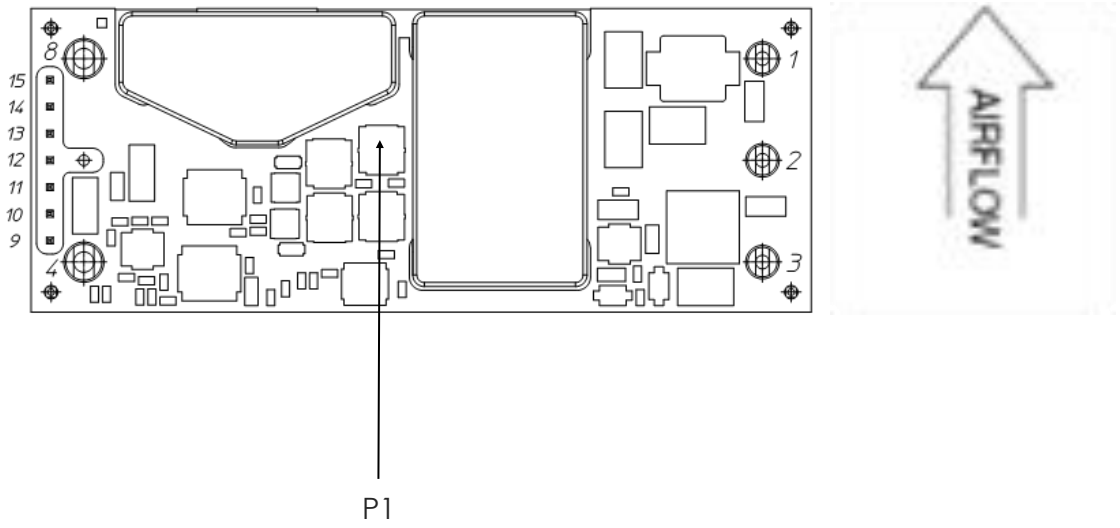
Picture: cold wall test set-up

Definition of product operating temperature

Proper thermal conditions can be verified by measuring the temperature at position P1 as shown below. The temperature at this position (T_{P1}) should not exceed the maximum temperatures in the table below. The number of measurement points may vary with different thermal design and topology. Temperatures above maximum T_{P1}, measured at the reference point P1 are not allowed and may cause permanent damage.

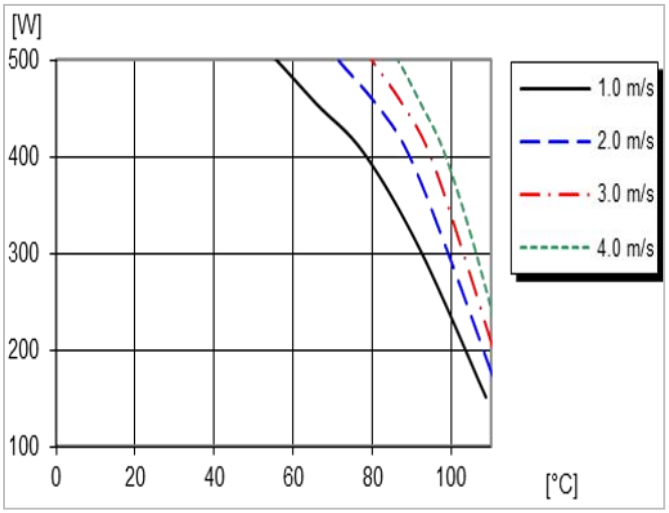
Position	Description	Max. Temp.
P1	MOSFET CASE	T_{P1}= 125°C

Bottom view



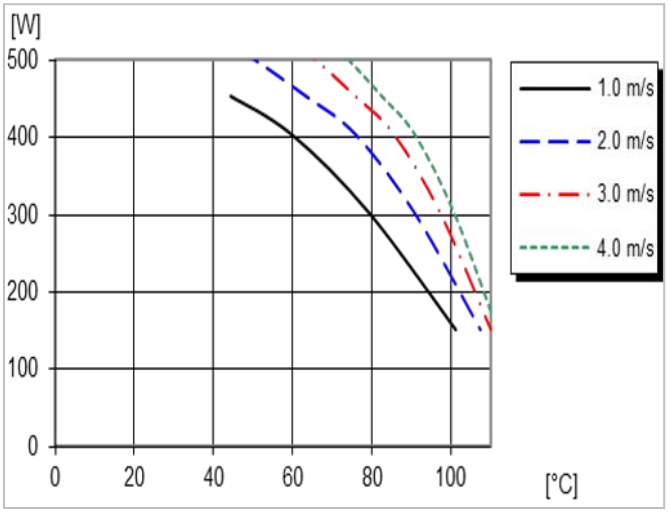
Thermal graphs

Output power derating - 1.0 inch heatsink



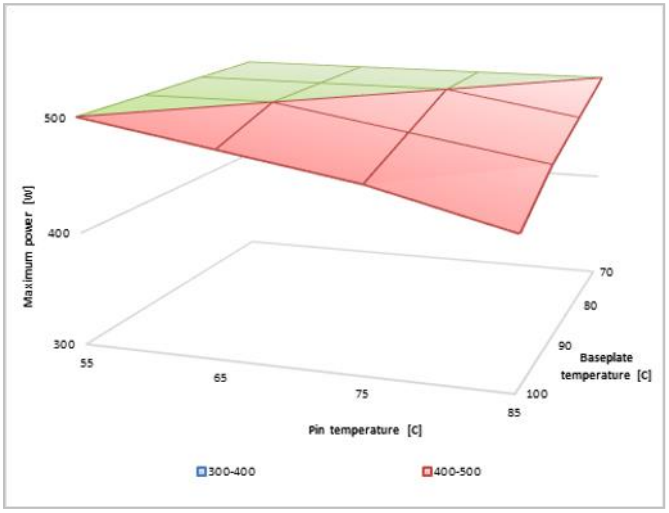
Available output power vs. ambient air temperature and airflow. Vin:48V . Airflow Direction -IN to +IN.

Output power derating - baseplate



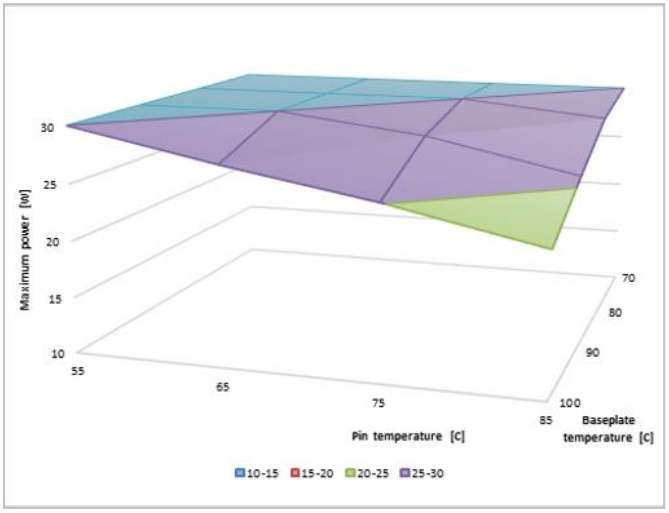
Available output power vs. ambient air temperature and airflow. Vin:48V . Airflow Direction -IN to +IN.

Maximum Output Power



Maximum allowed thermal power (restriction by POMAX might occur). Above 860W only peak t ≤ 1s .

Maximum Allowed Power Loss



Available output power vs. pin and baseplate temperature See Thermal Consideration section. Above 860W only peak t ≤ 1s .

For more information, please refer to our thermal models on the website.

Part 5: Packaging

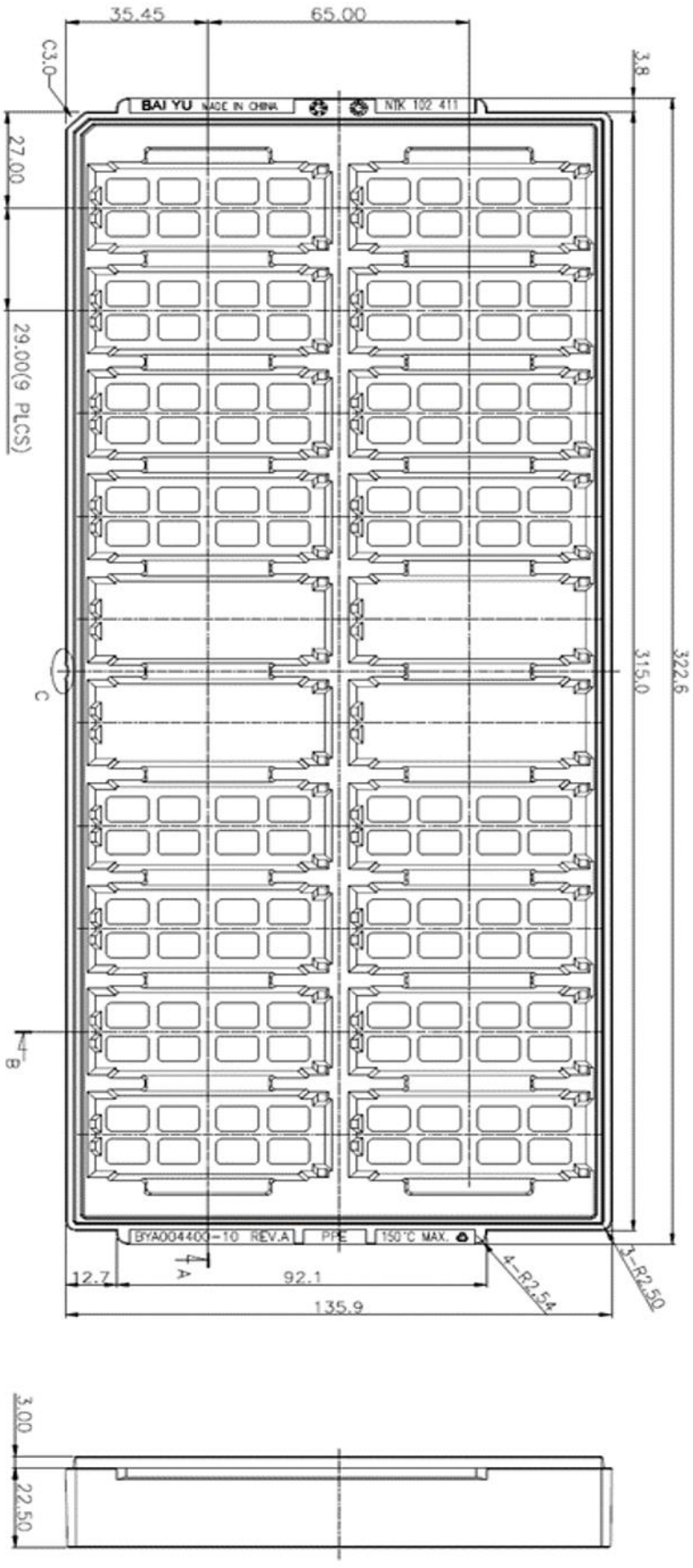
Packaging information

H option: Select for PIP reflow solder and pick & place - dry packed	
Material	Antistatic Polyphenylene Ester (PPE)
Surface resistance	≥ 1 x 10^4 to < 1 x 10^{11} ohms
Bakabilty	Tray can be baked at max. 125 °C for 24 h. Please remove the fitments before baking.
Tray capacity	20 converters/tray
Box capacity	80 products (4 full trays/ box)
Tray weight	212 g empty tray, 1170 g full tray

JEDEC standard tray.
All dimensions in mm

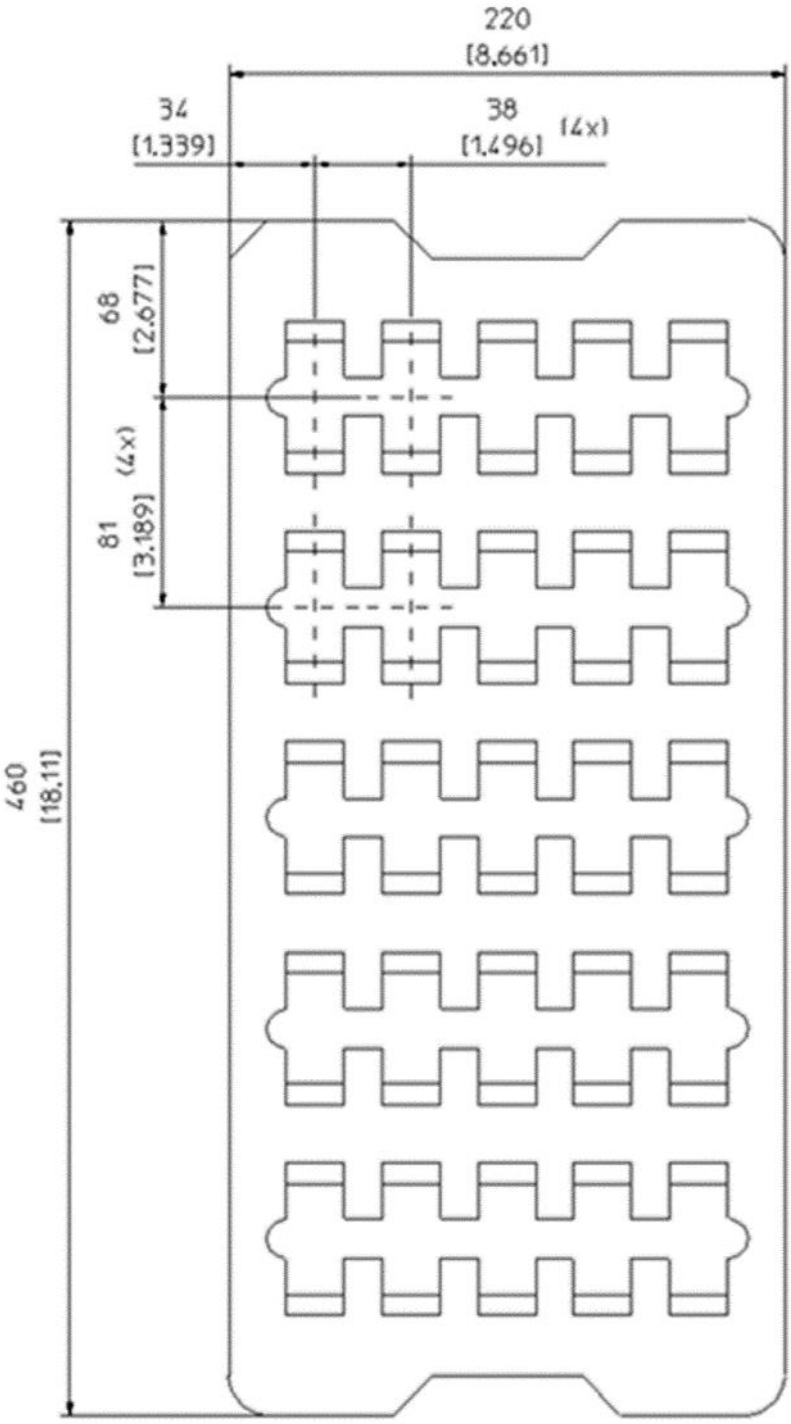
Tolerances: X.x ±0.26 [0.01], X.xx ±0.13 [0.005]

Note: Pick up positions refer to center of pocket.
See mechanical drawing for exact location on product.



Packaging information

Blank option: Select for wave or hand soldering, NOT dry packed	
Material	Antistatic Polyethylene (PE) foam
Surface resistance	≥ 1 x 10^4 to < 1 x 10^{11} ohms
Bakabilty	Tray cannot be baked
Tray capacity	25 converters / tray
Box capacity	100 products (4 full trays/ box) 25 products (1 full tray/ box)
Weight	45 g empty tray, 1225 g full tray



Example PE foam tray

Part 6: Revision history

Revision table

Revision number	revision change	date	revisor
Rev. A	New	2023/6/13	jidrober
Rev. B	Add dls	2023/7/4	jidrober

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