BMR684

700W digital quarter brick

The BMR684 is a high-density digital solution DC/DC converter for telecom application. The impressive performance of this converter includes an efficiency reaching 96.0% at 48 V_{in} at full load and the baseplate operating temperature up to 100°C.
The BMR684 is a single output regulated DC/DC converter with standard quarter brick format. It delivers up to 14A output current with 50V output voltage.

This converter is designed for through-hole mounting using wave solder process.

Key features

- High efficiency with 96.0%
- 1500Vdc input to output isolation
- Monotonic start-up
- Input under voltage protection
- Output over voltage protection
- Output short-circuit protection
- Over temperature protection
- Remote control
- Remote sense function

Soldering methods

- Wave soldering
- Manual soldering

Key electrical information

Parameter	Values
Input range	36-75V
Output voltage	50V
Output current	14A
Output power	700W

Mechanical

58.4 x 36.8 x 12.7 mm / 2.30 x 1.45 x 0.5 in

Application areas

- Telecom
- Datacom

Product options

The table below describes the different product options.

Example:	BMR684	1	1	00	/001	B	Definitions
Product family	BMR684						
Pin length options		1					1 = 5.33 mm / 0.21 in 2 = 3.69 mm / 0.15 in
Baseplate / HS option			1				1 = standard baseplate
Other hardware options				00			00 = 7-pin digital header 01 = without digital header
Configuration code					/001		/001 =50 V_{out} standard config. for 36-75 Vin N logic /002 =50 V_{out} standard config. for 36-75 Vin P logic
Packaging options						B	B = Foam Tray

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
BMR684 1100/001B	36-75V	50V / 14A/ 700 W	5.33 mm pins / baseplate / 7-pin digital header / negitive logic /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
Ambient operating temperature (T_A)	-40		85	°C
Operating temperature (T_{P1})	-40		125	°C
Baseplate operating temperature (T_{P2})	-40		100	°C
Storage temperature	-55		125	°C
Input voltage (V_{in})	-0.5		80	V
Input voltage transient (100 ms)			100	V
Input capacitance	470			μF
Output capacitance	1000		3400	μF
Isolation voltage (input to output)			1500	V
Isolation voltage (input to baseplate)			750	V
Isolation voltage (baseplate to output)			750	V
Adjust pin voltage	-0.5		5	V
Remote control pin voltage (positive logic)	-0.5		6	V
Remote control pin voltage (negative logic)	-0.5		6	V

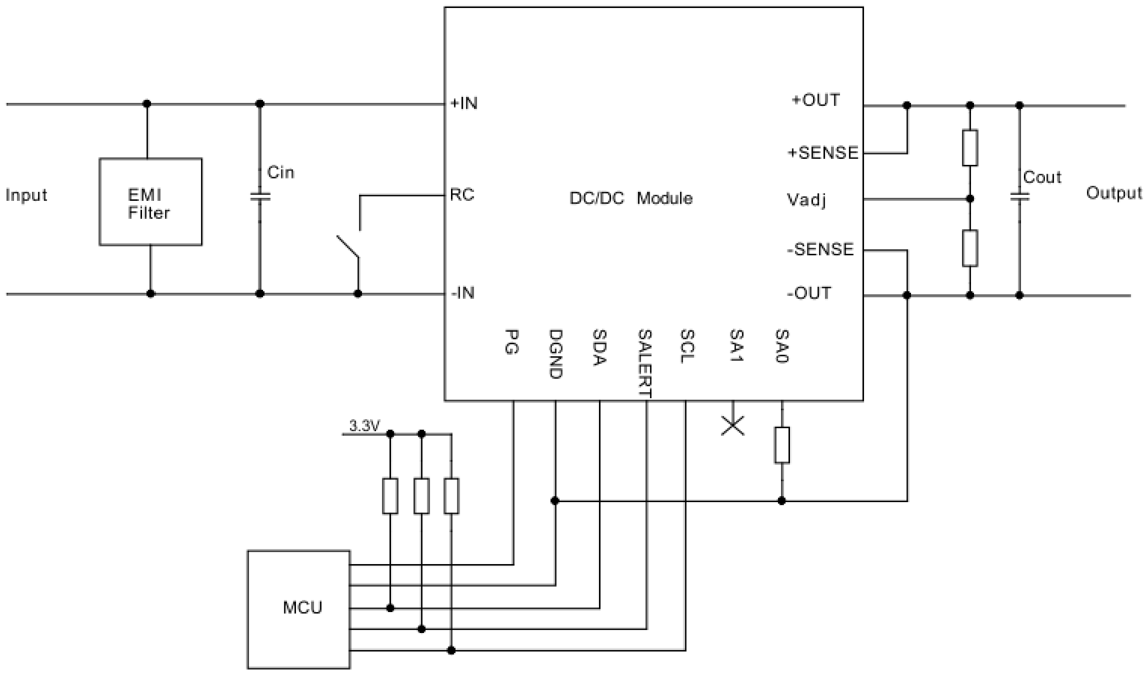
Reliability

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}*,* T_{P1}*=40°C, Airflow=200 LFM)*.

	Mean	90% confidence level	Unit
Steady-state failure rate (λ)	162	191	nfailures/h
Standard deviation (σ)	22.8		nfailures/h
MTBF	6.17	5.23	MHr

Typical application diagram

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



Electrical specifications for BMR684 1100/001

50 V, 14 A / 700 W

Min and Max values are valid for: T_{P1} = -40 to +85 °C, V_{in}= 36 to 75 V, unless otherwise specified under conditions. Typical values given at: T_{P1} = +25 °C, V_{in}= 48 V, max I_o, unless otherwise specified under conditions. Additional external C_{in} = 470 µF, C_{out}= 1 mF.

Characteristic	conditions	minimum	typical	maximum	unit
Key features					
Efficiency (η)	50% of max I_o, V_{in}= 48 V	93.5	95.5		%
	100% of max I_o, V_{in}= 48 V	94.0	96.0		%
	50% of max I_o, V_{in}= 53 V	93.0	95.0		%
	100% of max I_o, V_{in}= 53 V	93.8	95.8		%
Output power		0		700	W
Power dissipation	100% of max I_o		30	50	W
Switching frequency (f_s)	0-100 % of max I_o	170	180	190	kHz
Recommend capacitive load		1000	1360	3400	µF
Input characteristics					
Input voltage range (V_{in})		36	48	75	V
Input idling power	I_o = 0 A		9		W
Input standby power	(turned off with RC)		0.8		W
Recommended external input capacitance		470			µF

Electrical specifications for BMR684 1100/001

50 V, 14 A / 700 W

Characteristic	conditions	minimum	typical	maximum	unit
Output characteristics					
Output voltage initial setting and accuracy	T_{P1} = +25 °C, V_{in}= 48 V, I_o= 0 A	49	50	51	V
Output voltage tolerance band	0-100% of max I_o	48.5		51.5	V
Output adjust range	0-100% of max I_o	25		55	V
Idling voltage	I_o= 0 A	48.5		51.5	V
Line regulation	0 – 100% of max I_o		30	200	mV
Load regulation	0 - 100% of max I_o		30	200	mV
Output current (I_o)		0		14	A
Load transient voltage deviation	Load step 25-75-25% of max I_o, di/dt = 1 A/µs. See Note 1		±250	±750	mV
Load transient recovery time			200	500	µs
Output ripple & noise	max I_o, 10 µF + *0.1* µF, *20MHz bandwidth*		200	400	mV_{p-p}

Note 1: C_{out} is 2 x 680 µF aluminum electrolytic capacitor

Electrical specifications for BMR684 1100/001

50 V, 14 A / 700 W

Characteristic	conditions	minimum	typical	maximum	unit
On/off control					
Turn-on input voltage	Increasing input voltage	30.5	32.5	34.5	V
Turn-off input voltage	Decreasing input voltage	29.5	31	32.5	V
Turn-on delay time (from RC toggle to V_{out} start to ramp up)			80		ms
Turn-on rise time (from 0% to 100% of V_{out})			90		ms
RC start-up time (from RC toggle to 100% of V_{out})		140	170	200	ms
Start-up time (from V_{in} connection to 100% of V_{out})		150	180	210	ms
RC sink current		1.5			mA
RC logic high voltage		3.3		6	V
RC logic low voltage		0		0.8	V
Protection features					
Output over current protection (OCP)	T_{P1} < max T_{P1}	16	18	20	A
Output over current protection (OCP) response		Disable and retry continously			
Short circuit current	T_{P1} = 25°C, See Note 2		5	7	A
Output under current protection (UCP)			-8		A
Output under current protection (UCP) response		Disable and retry continously			
Output over voltage protection (OVP)			58. 5		V
Output over voltage protection (OVP) response		Disable and retry continously			
Over temperature protection (OTP)	Note 3		110		°C
Over temperature protection (OTP) recovery	Note 3		90		°C
Over temperature protection (OTP) response		Disable until fault is cleared			

Note 2: Hiccup mode, RMS value

Note 3: Temperature measured at P2

Electrical specifications for BMR684 1100/001

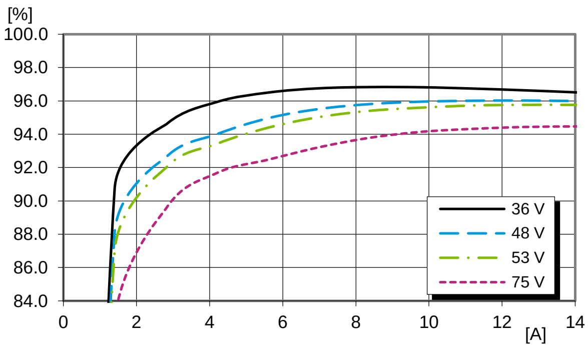
50 V, 14 A / 700 W

Command	Conditions	minimum	typical	maximum	Unit
Monitoring accuracy					
Input voltage READ_VIN			±125		mV
Output voltage READ_VOUT			±40		mV
Output current READ_IOUT			±0.25		A
Temperature READ_TEMPERATURE_1	Temperature sensor, -40 - 120 °C		±5		°C

This product is supported by the Flex Power Designer tool.

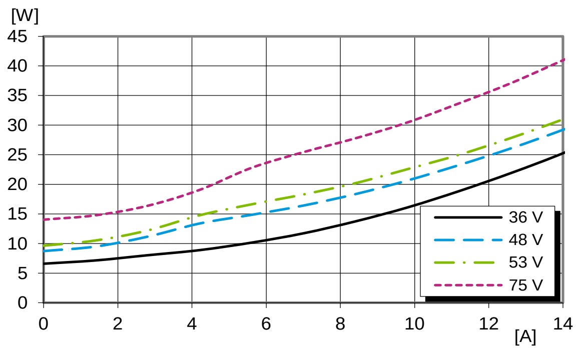
Electrical graphs for BMR684 1100/001
50 V, 14 A / 700 W

Efficiency



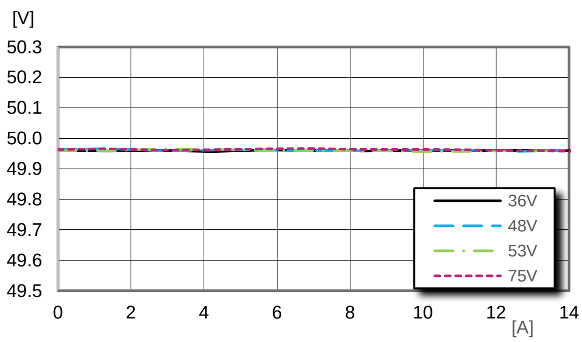
Efficiency vs. output power and input voltage at T_{P1} = +25°

Power Dissipation



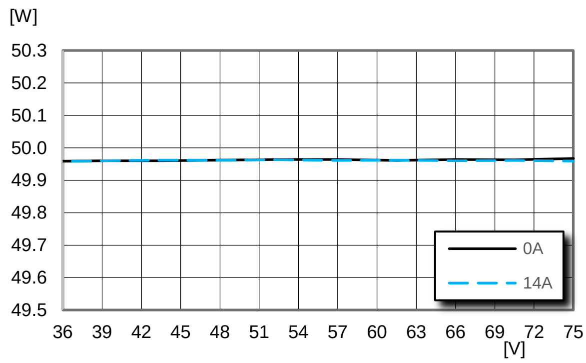
Dissipated power vs. load power at T_{P1} = +25°C

Load Regulation



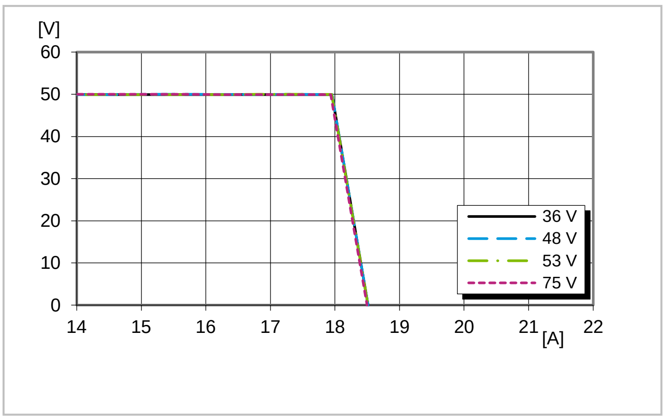
Output voltage vs. load current at T_{P1} = +25°C

Line Regulation



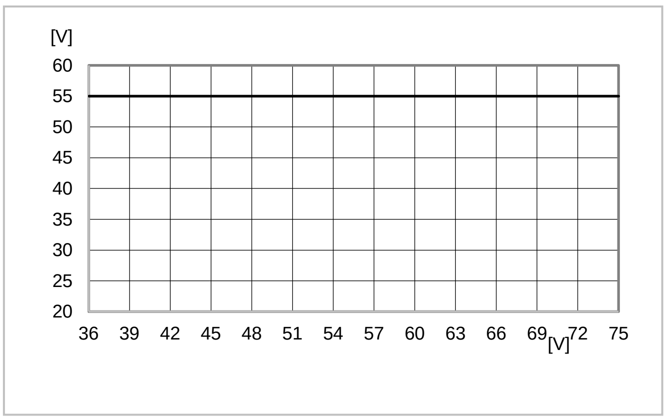
Output voltage vs. input voltage at T_{P1} = +25°C

Current Limit



Output voltage vs. load current at I_O > max I_O, T_{P1} = +25°C

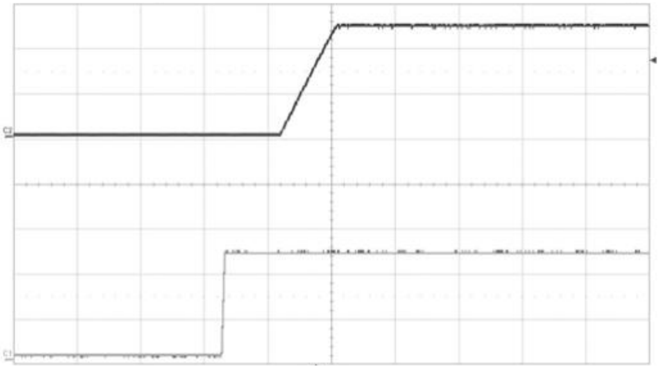
Maximum Adjustable Output Voltage



Maximum Adjustable output voltage vs. input voltage at T_{P1} = +25°C

Electrical graphs for BMR684 1100/001
50 V, 14 A / 700 W

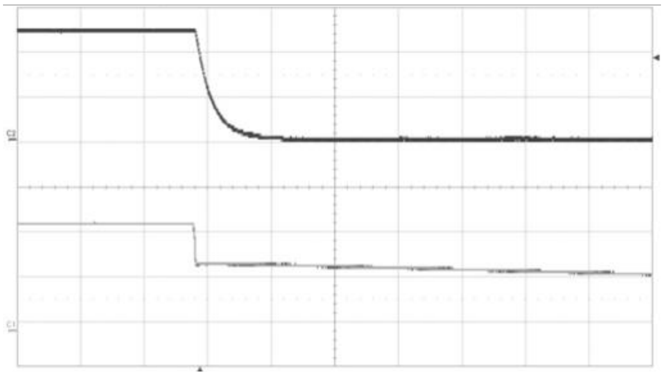
Start-up



Start-up enabled by connecting V_{in} at: T_{P1} = +25 °C, V_{in} = 48 V, I_O = 14 A resistive load.

Top trace: output voltage 20 V/div. Bottom trace: input voltage 20 V/div. Time scale: 100 ms/div.

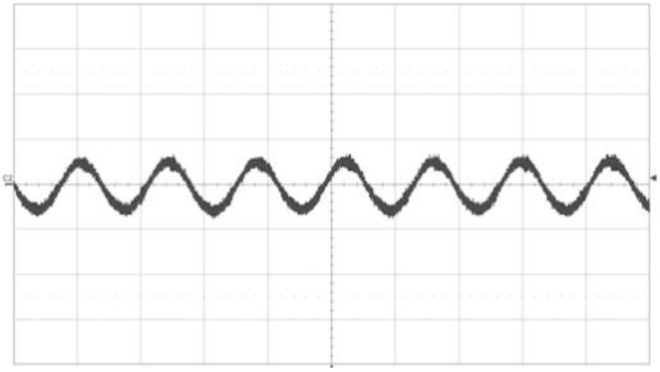
Shut-down



Shut-down enabled by disconnecting V_{in} at: T_{P1} = +25 °C, V_{in} = 48 V, I_O = 14 A resistive load.

Top trace: output voltage 20 V/div. Bottom trace: input voltage 20 V/div. Time scale: 20 ms/div.

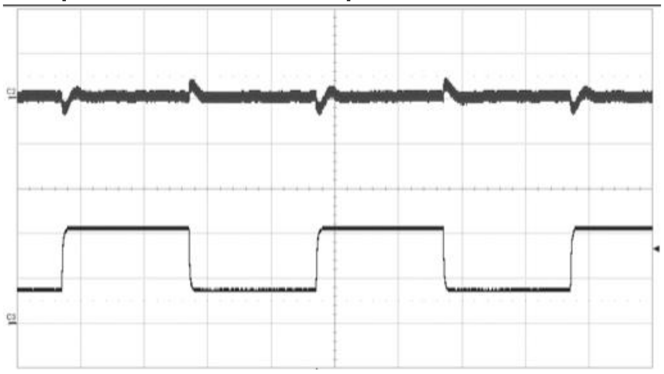
Output Ripple & Noise



Output voltage ripple at V_{in} = 48 V, I_o = 14A resistive load, T_{P1} = +25 °C, 20 MHz bandwidth

Voltage scale: 100 mV/div. Time scale: 2 µs/div

Output Load Transient Response



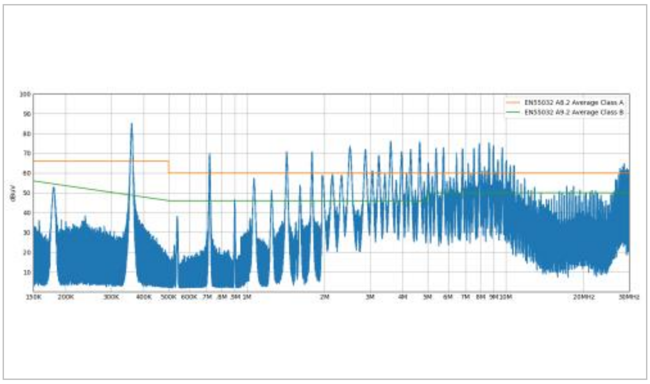
Output voltage response to output current change (3.5-10.5-3.5 A) at V_{in} = 48 V, C_O = 2 x 680 µF, T_{P1} = +25 °C, di/dt = 1 A/µs.

Top trace: output voltage (500mV/div). Bottom trace: output current (5A/div), time scale: 500 µs/div

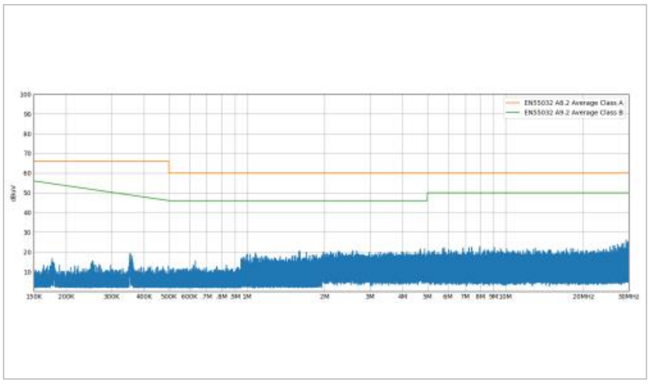
Part 2: EMC

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 180 kHz for BMR684. The EMI characteristics below is measured at V_{in} = 48 V and max I_{out}.



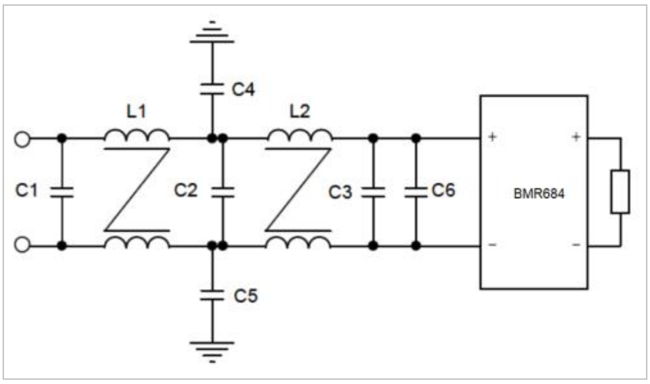
EMI without filter. EN55032 test method and limits are the same as EN55022.



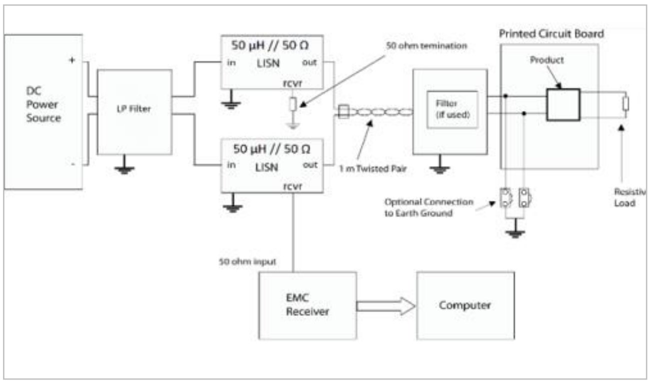
EMI with filter, EN55022 test methods and limits are the same as EN55032

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, C2 = 4 x 4.7 µF MLCC; C3 = 3 x 4.7 µF MLCC; C4, C5 = 2 x 10nF 2kV MLCC; C6 = 470 µF; L1, L2 = 0.63mH (Pulse P0469NL)



Test set-up

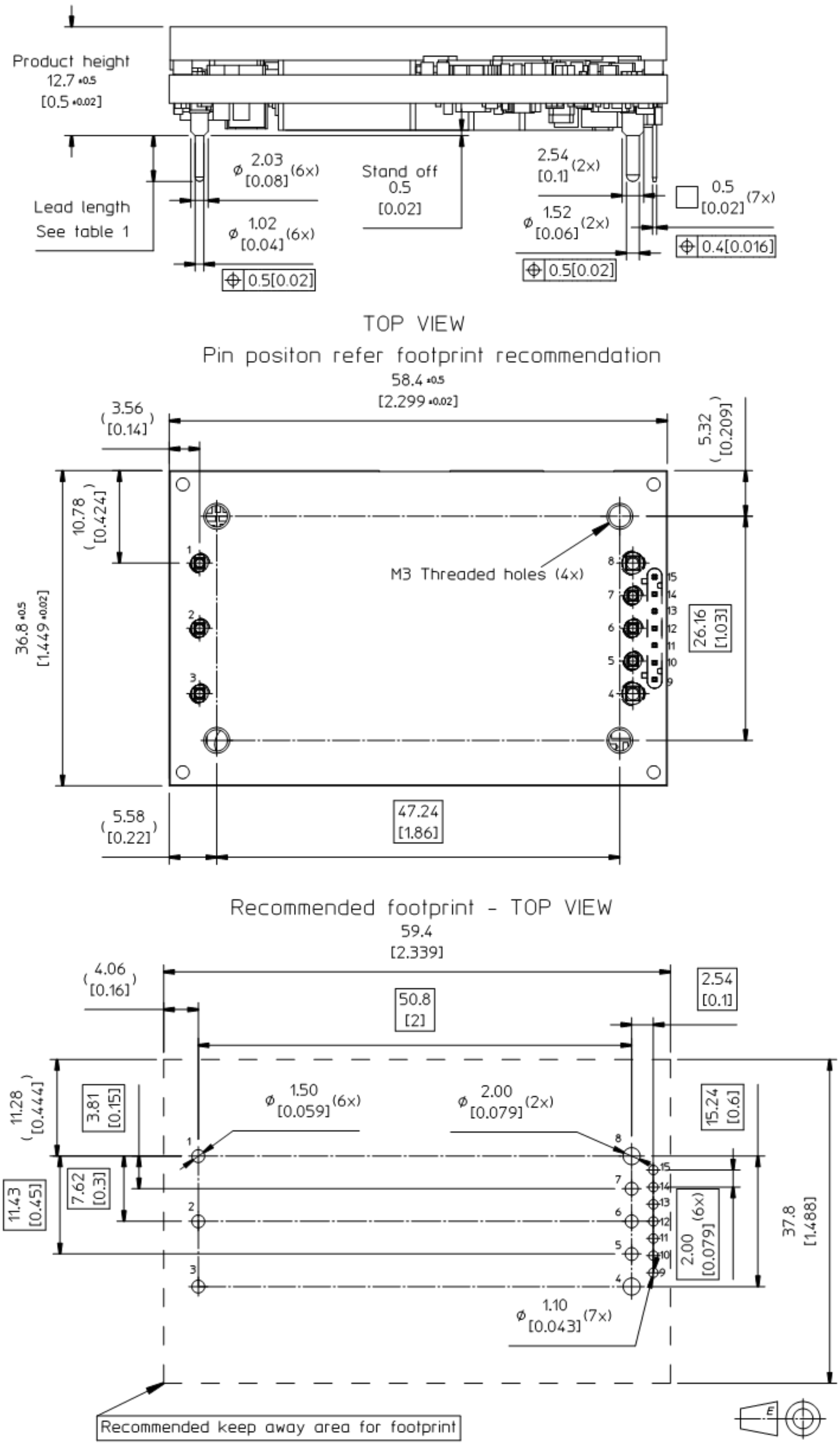
Layout recommendations

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

BMR684 : baseplate version

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



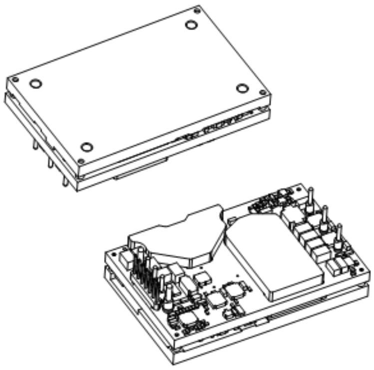


Table 1

Option	Lead length
1	5.33 [0.210]
2	3.69 [0.145]

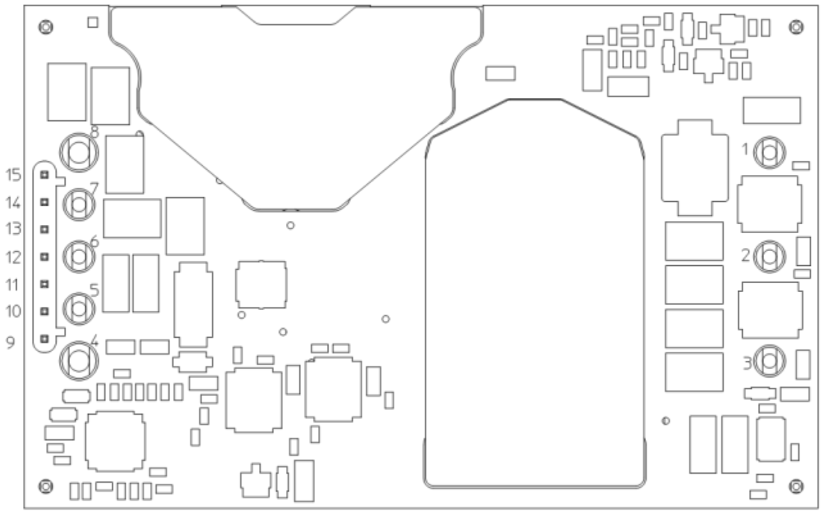
PIN SPECIFICATIONS
Pin 1-15 Material: Copper alloy
Plating: Min 0.1 µm Au over 1-3 µm Ni.

CASE
Material: Aluminium
For screw attached apply mounting torque of max 0.44 Nm [3.9lbf].
M3 screws must not protrude more than 3.4 mm [0.134] 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 82 g
All dimensions in mm [inch].
Tolerances unless specified
x.x ±0.5 mm [0.02],
x.xx ±0.25 mm [0.01]
(not applied on footprint or typical values)

Connections for BMR684 1100/001



Pin layout, bottom view

Pin	Designation	Type (Power, Input, Output)	Description
1	+In	Power	Positive input
2	RC	I	Remote control
3	-In	Power	Negative input
4	-Out	Power	Negative output
5	-Sense	I	Remote sense negative
6	Vadj	I	Output voltage adjust
7	+Sense	I	Remote sense positive
8	+Out	Power	Positive output
9	PG	O	Power good
10	DGND	Power	PMBus ground
11	SDA	I/O	PMBus data
12	SALERT	O	PMBus alert
13	SCL	I/O	PMBus clock
14	SA1	I	PMBus address 1
15	SA0	I	PMBus address 0

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

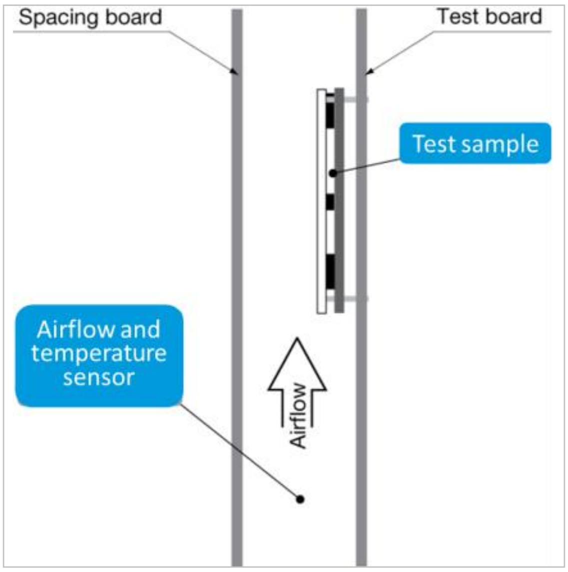
For products mounted on a PWB without a heatsink attached, cooling is achieved mainly by conduction, from the pins to the host board, and convection, which is dependent on the airflow across the product. Increased airflow enhances the cooling of the product. The wind speed and temperature are measured 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.

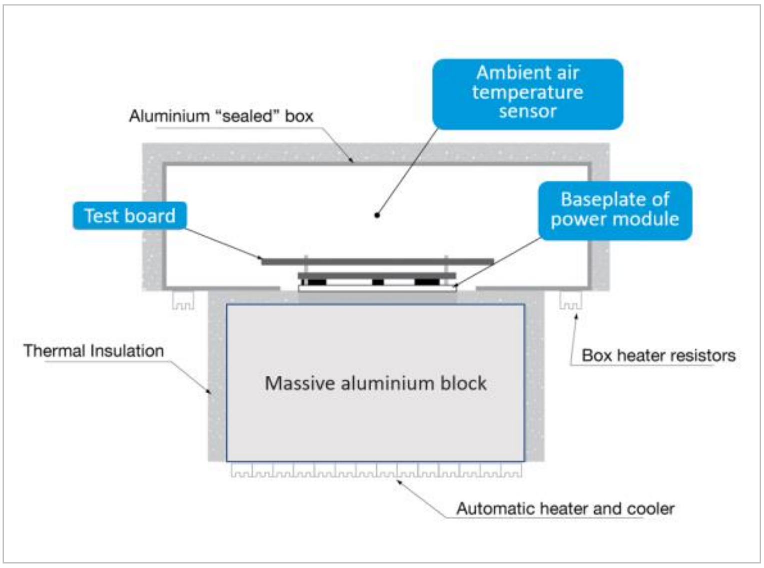
Distance between the tested device and the top space board and the side airflow guides are 6.35 mm ± 1 mm.

The product is tested on a 254 x 254 mm, 35 µm (1 oz), 16-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: wind-tunnel test set-up

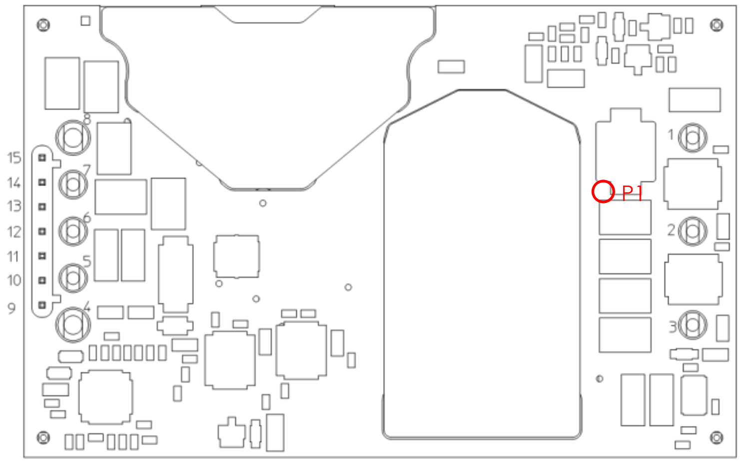


Picture: cold wall test set-up

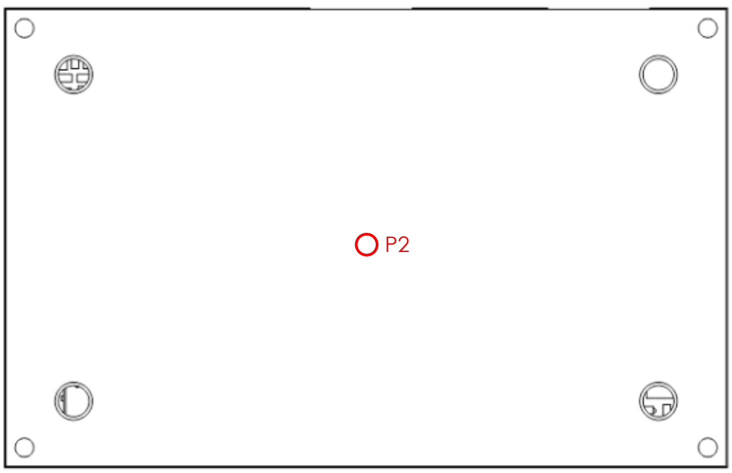
Definition of product operating temperature

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	PCB	T_{P1}= 125 °C
P2	Base Plate	T_{P2}= 100 °C



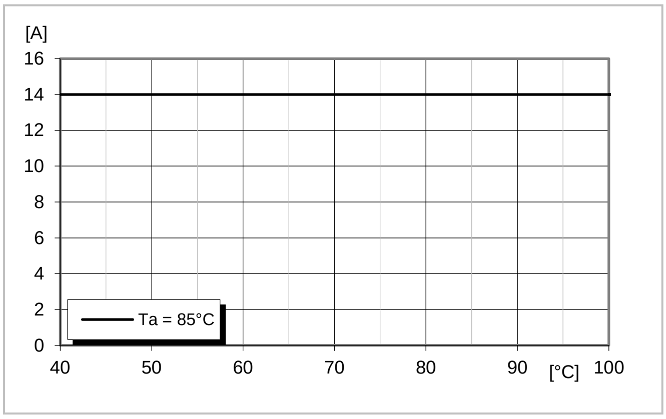
Temperature position P1, bottom view



Temperature position P2, top view

Thermal graphs for **BMR684 1100/001**

Output current derating - Cold wall sealed box

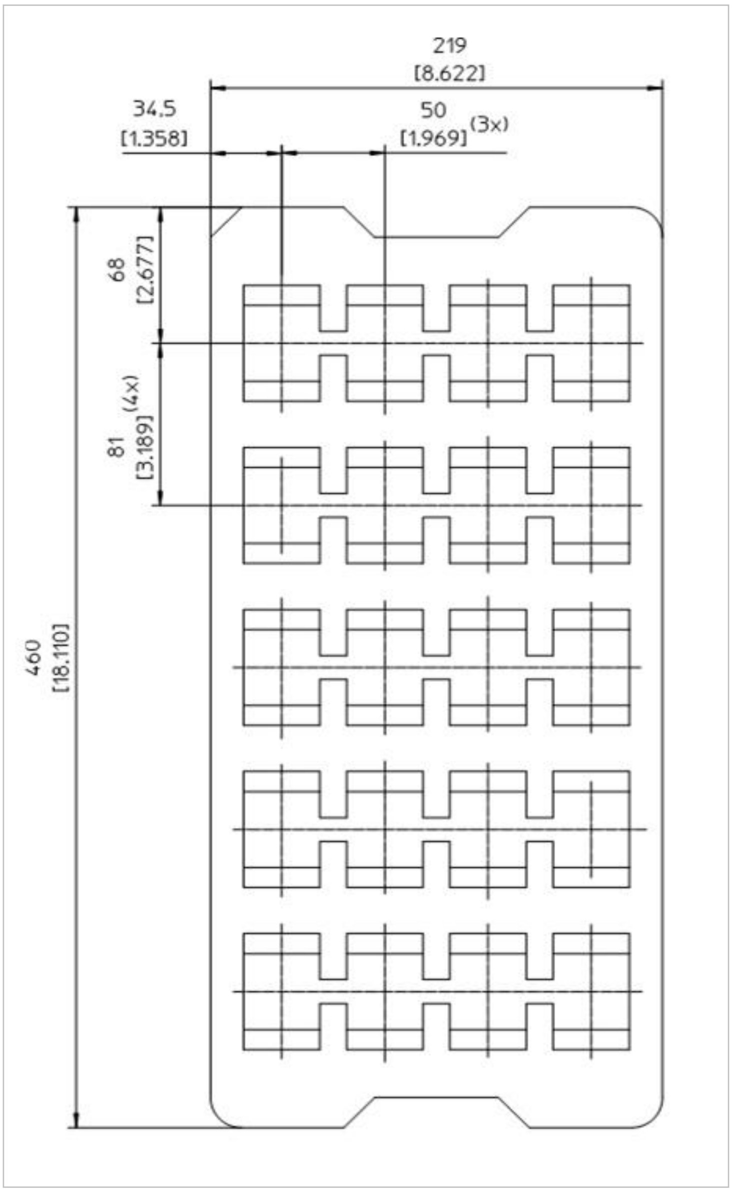


Available output current vs. base plate temperature, V_I = 48 V.

Part 5: Packaging

Packaging information

Blank option: baseplate version (wave or hand soldering, NOT dry packed)	
Material	Antistatic Polyethylene (PE) foam
Surface resistance	10^5 < ohm/square < 10^{11}
Bakeability	Tray cannot be baked
Tray capacity	20 converters / tray
Box capacity	60 products (3 full trays/box)
Weight	48 g empty tray, 1690 g full tray



Example PE foam tray

Part 6: Revision history

Revision table

Revision number	revision information	date	responsible
Rev. A	First edition	2023-04-19	JIDMWANG