BMR321

8:1 fixed ratio digital IBC (750W)

BMR321 is an unregulated and non-isolated Intermediate Bus Converter developed for AI and Cloud Computing applications.

BMR321 can deliver a continuous power of 750W and has a peak capability of 1500W. The module has excellent thermal performance and delivers an efficiency of 98.4% at half load.

The module has a PMBus compatible digital interface, and is supported by Flex Power Designer tool for further simulation and design into an overall system design.

BMR321 is following the Open Compute Project (OCP) module standard, Open Accelerator Module (OAM), and can be can be used with two units in parallel to supply an overall output power of up to 1500W.

Key features

- 8:1 fixed ratio IBC
- Unregulated
- Non-isolated
- Peak efficiency 98.4%
- Excellent thermal performance
- Small form factor
- Parallelable
- SYNC capability
- Digital interface with PMBus
- Following OAM standards

Soldering methods

- Pb Free SMD reflow

Target key electrical information

Parameter	Values
Input range	40 - 60V
Output voltage	5 - 7.5V
Output current continuous	111A at $54V_{in}$
Output power continuous	750W
Peak power	1500W

Mechanical

41.47 x 17.67 x 6.9 mm / 1.63 x 0.7 x 0.26 in (+/- 0.4mm//0.016 in)

Application areas

- Designed for Artificial Intelligence (AI) and Cloud computing applications.
- OAM standard compatible.

Product options

The table below describes the different product options.

Example:	BMR321	1	0	00	/001	C	Definitions
Product family	BMR321						
Pin length options		1					1 = SMD
Baseplate / HS option			0				0 = Open deck baseplate
Other hardware options				00			00 = Standard variant
Configuration code					/001 /002 /006		/001 = EN Active High, Base add 0x4n /002 = EN Active Low, Base add 0x4n /006 = EN Active Low, Base add 0x6n
Packaging options						C	C = Tape on Reel

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

Order number examples

Part number	V_{in}	Output	Configuration
BMR3211000/001	40-60 V	5-7.5 V / 111 A / 750 W	Open deck baseplate / EN Active High, Base add 0x4n / Antistatic tape and reel package
BMR3211000/002	40-60 V	5-7.5 V / 111 A / 750 W	Open deck baseplate / EN Active Low, Base add 0x4n / Antistatic tape and reel package
BMR3211000/006	40-60 V	5-7.5 V / 111 A / 750 W	Open deck baseplate / EN Active Low, Base add 0x6n / Antistatic tape and reel package

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		110	°C
Storage temperature	-55		125	°C
Input voltage (V_{in})	-0.3		64	V
Isolation voltage (input to output)	0		0	V
3.3V V_{CC}	-0.3		3.6	V
Enable control pin voltage	-0.3		3.6	V
PMBus pins	-0.3		3.6	V

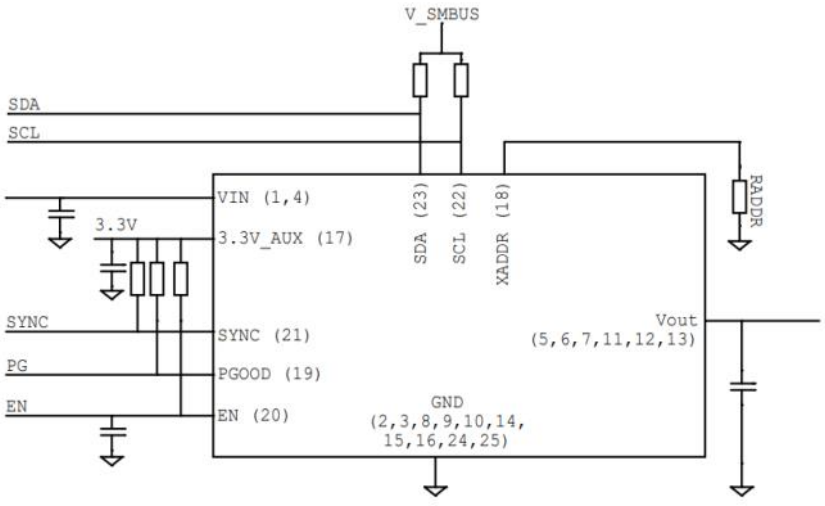
Reliability

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)	168	197	nfailures/h
Standard deviation (σ)	22.9		nfailures/h
MTBF	5.95	5.07	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 BMR321

6.75 V, 111A ≤ 750 W

Min and Max values are valid for: T_{P1} = -40 to + 110°C, V_{in}= 40 to 60 V, unless otherwise specified under conditions. Typical values given at: T_{P1} = +25°C, V_{in}= 54 V, max P_{out_TDP}, unless otherwise specified under conditions, see Note 1.
Additional external C_{in} = 220 µF, C_{out}= 1 mF

Characteristic	conditions	minimum	typical	maximum	unit
Key features					
Efficiency (η)	50% of P_{out_TDP}		98.4		%
	100% of P_{out_TDP}		97.8		%
	50% of P_{out_TDP} V_{in} = 40V		98.2		%
	100% of P_{out_TDP} V_{in} = 40V		96.7		%
P_{out_TDP} thermal design power (TDP)	See Note 1			750	W
Peak P_{out_EDP} excursion design power	See Note 2			1500	W
Recommend capacitive load		500	1000	6000	µF
Switching frequency (f_s)	0-100 % of P_{out_TDP}		650		kHz
Power Loss	50% of P_{out_TDP}		6.6		W
	100% of P_{out_TDP}		17.2		W
	50% of P_{out_55A} V_{in} = 40V Note3		5.6		W
	100% of P_{out_110A} V_{in} = 40V Note3		16.5		W
Input characteristics					
Input voltage range (V_{in})		40	54	60	V
Input OVP		63	64	65	V
Input idling power	Vin=54V, Iout=0A, EN on		3.1		W
Input standby power	Vin=54V, Iout=0A, EN off		0		mW
Internal input capacitance	Nominal capacitance		40		µF
Recommended external input capacitance		220		680	µF

Note 1: Max. output current is rated 111A at 54V Vin. Max power is ≤ 750W and continuous power (thermal design power (TDP) is ≤ 750 W depending on thermal conditions.
Note 2: Peak power (2xTDP) duration complies to the OCP OAM V2.0 standard.
Note 3: Pout is outpout current, instead of TDP.

Electrical specifications for BMR321

6.75 V, 111A ≤ 750 W

Characteristic	conditions	minimum	typical	maximum	unit
Output characteristics					
Output voltage initial setting and accuracy	P_{out} = 0 W	5	6.7	7.5	V
Output current (I_{out})	V_{in} = 40 - 60 V	0		111	A
Max start-up load	Max load			3	A
Load transient voltage deviation	See Note 1		70		mV
Output ripple & noise	20 MHz BW, max P_{out_TDP}		11		mV_{p-p}
Internal output capacitance	V_{out} = 0V			440	µF
On/off control					
Turn-off input voltage	Decreasing input voltage		33.7		V
Turn-on input voltage	Increasing input voltage		38.3		V
Ramp-up time	From 10–90% of V_{out}		2.3		ms
Enable start-up time			1.5		ms
Logic high: trigger level	Voltage Rising	1.72			V
Logic low: trigger level	Voltage Falling			1.52	V
Sink current			0.01		mA
Protection features					
Output current limit (OCP) response and type	Slow (Fast) Latch (0x80)		130 (250)		A
Output overvoltage protection (OVP)	Latch (0x80)		8		V
Output undervoltage protection (UVP)	Latch (0x80)		2		V
Over temperature warning (OTW)			100		°C
Over temperature protection (OTP)	Latch (0x80)		120		°C
3.3 V Vcc Auxiliary power					
Voltage		3.0	3.3	3.6	V
Current	Note 2		600	700	mA

Note 1: Load step 25-75-25% of max P_{out_TDP} di/dt = 10 A/µs.

Note 2: In standby, the current draw is approximately 20 mA.

Electrical specifications for BMR321 1000/001

6.75 V, 111A ≤ 750 W

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

T_{P1} = -40 to +110 °C, V_{in} = 40 to 60 V, unless otherwise specified under conditions.
Typical values given at: T_{P1} = +25 °C, V_{in} = 54 V, max P_{out_TDP}, unless otherwise specified under conditions

Command	Conditions	minimum	typical	maximum	Unit
Monitoring accuracy					
Input voltage READ_VIN			±0.3	±2	V
Output voltage READ_VOUT			±50	±250	mV
Output current READ_IOUT	See Note 1		±3	±10	A
Temperature READ_TEMPERATURE_1	See Note 2		±1	±5	°C

Note 1: Valid from 20A and above.

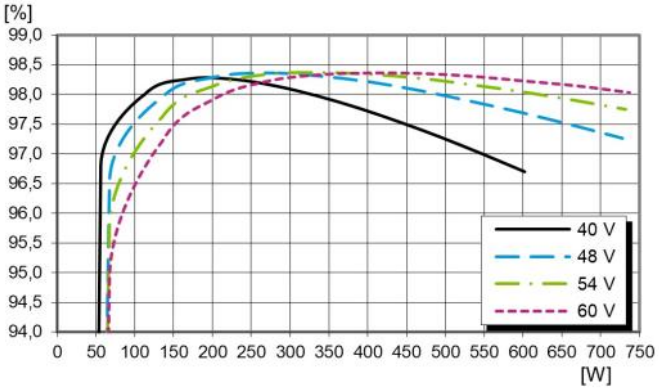
Note 2: Depends on cooling type and thermal resistance.

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

Electrical graphs for BMR321 1000/00X

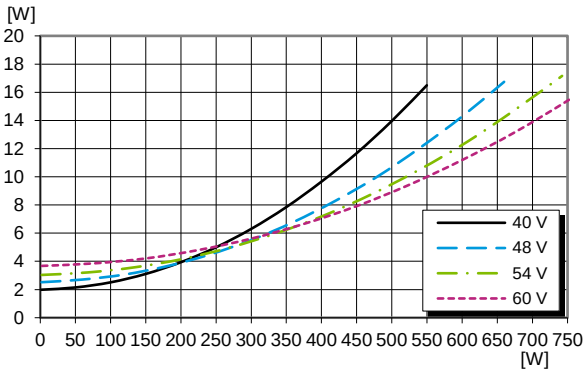
6.75 V, 111A ≤ 750 W

Efficiency vs Output Power



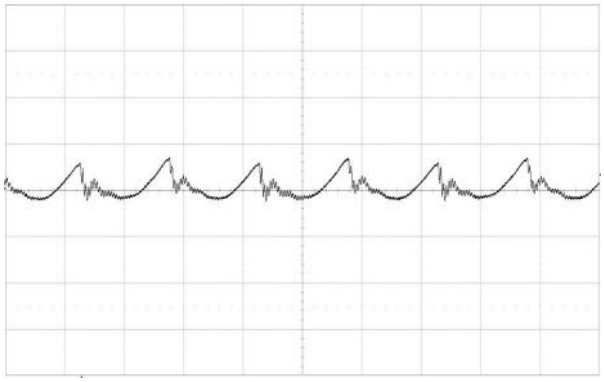
Efficiency vs. output power and input voltage at T_{P1} = +25 °

Power dissipation



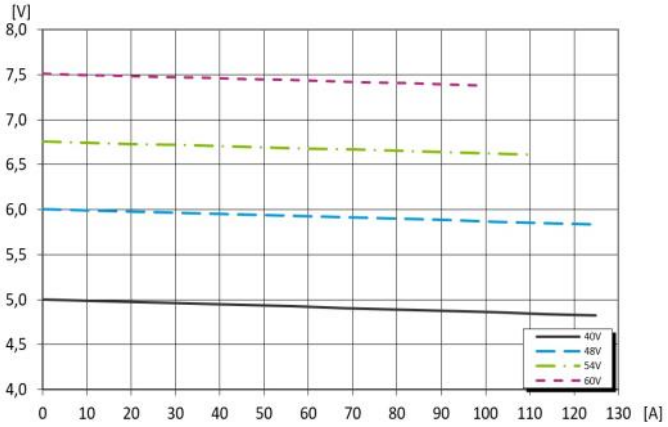
Dissipated power vs. load power at T_{P1} = +25 °C.

Output Ripple and Noise



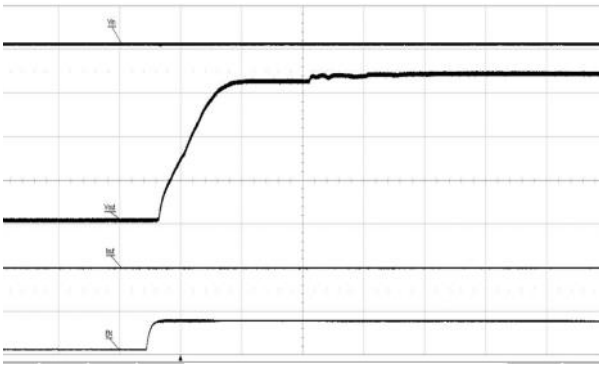
V_{in} = 54 V, I_{out} = 110 A, 20 MHz BW. Scale 10 mV/div, 0.5 us/div.

Output voltage droop



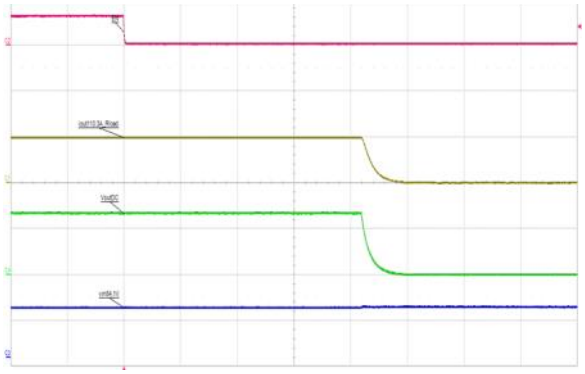
Output voltage vs output current.

Startup



Output enabled by EN pin. V_{in} = 54 V, I_{out} = 0.3 A
Scale from top: 50, 2, 5, 5 V/div, 2 ms/div.

Shutdown

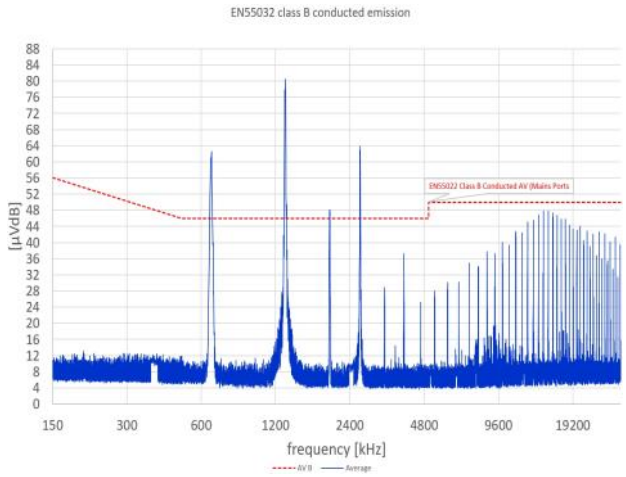


Output disabled by EN pin. V_{in} = 54 V, I_{out} = 100 A
Scale from top: 5, 100, 5, 50 V/div, 500 µs/div.

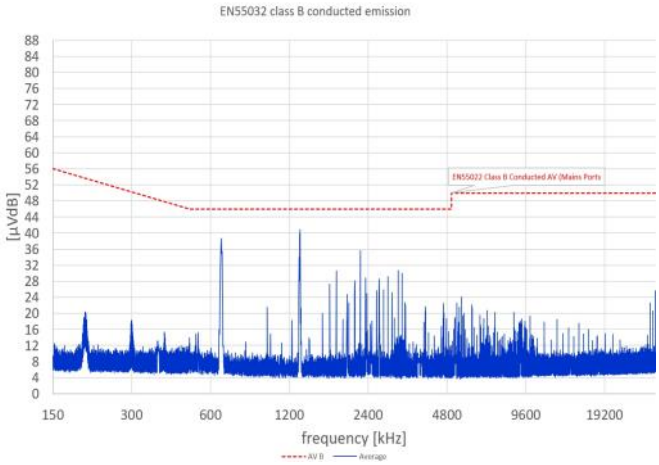
Part 2: EMC

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 650kHz for BMR321. The EMI characteristics below is measured at V_{in} = 54 V and max I_{out}. Note the provided filter ensures the module is below average limit.



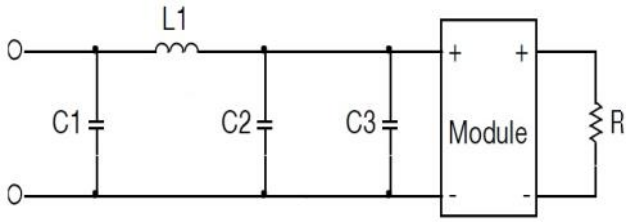
Without EMC filter, V_{in}= 54 V, max P_{out_TDP}



With EMC filter, V_{in}= 54 V, max P_{out_TDP}

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.



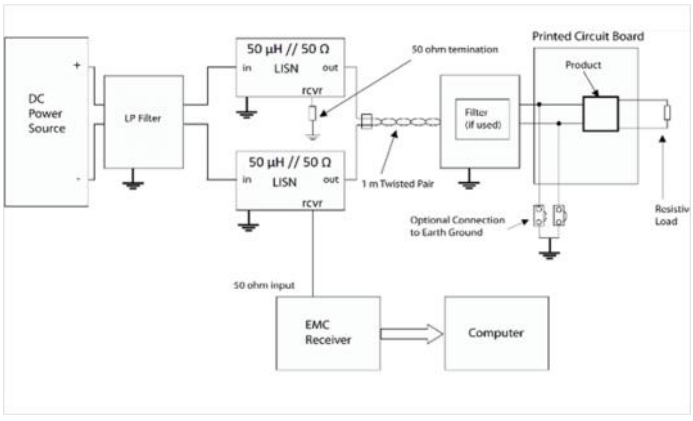
Filter components:

C1 - 10uFx63V (5pcs) GRM32ER71J106KA12L

C2 - 10uFx63V (5pcs) GRM32ER71J106KA12L

C3 - 220uFx80V

L1 - 2.2uH IHLP4040DZER2R2M01

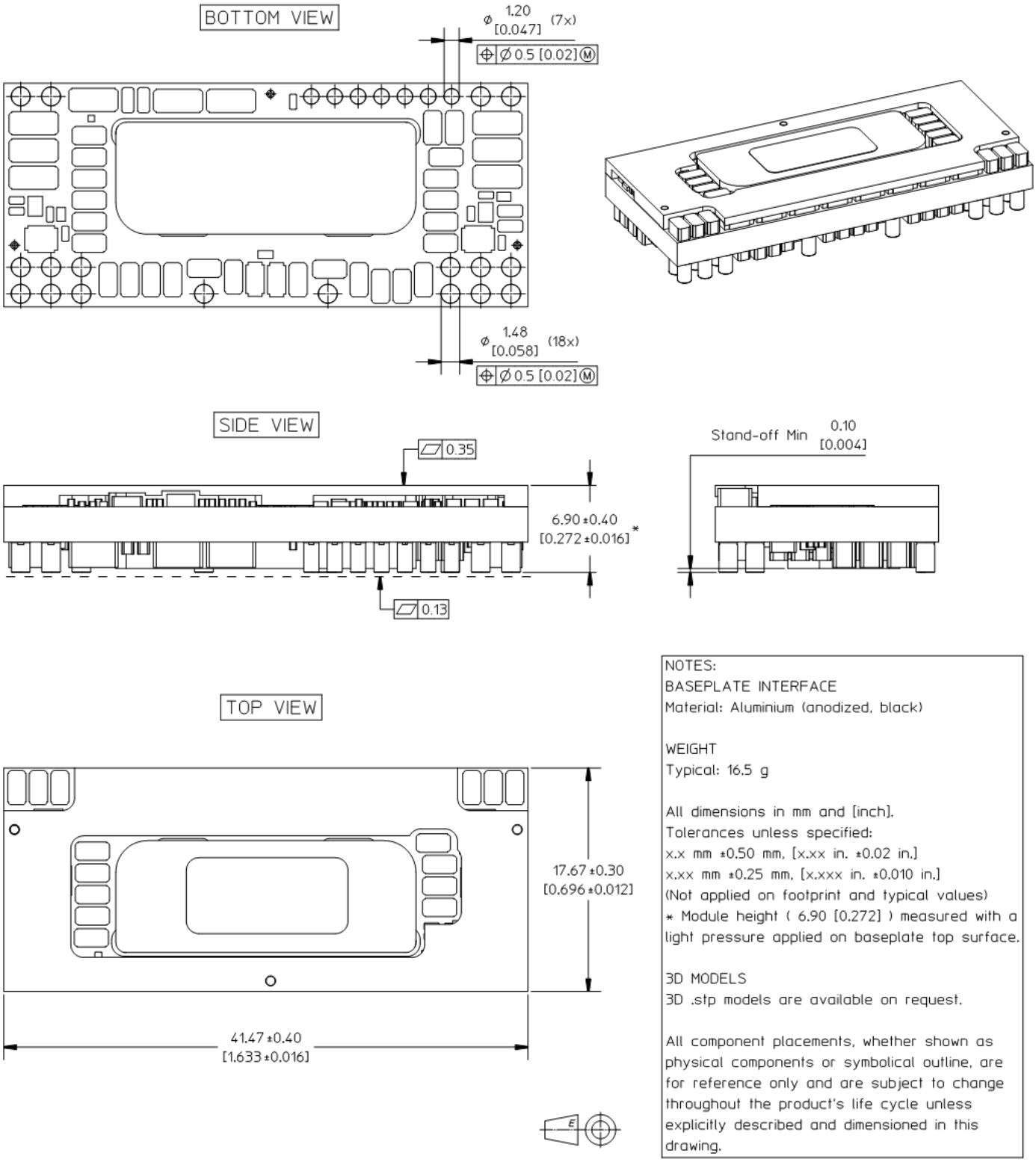


Test set-up

Layout recommendations

The radiated EMI performance of the product will depend on the PCB 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 PCB and improve the high frequency EMC performance.

Part 3: Mechanical information



NOTES:
BASEPLATE INTERFACE
Material: Aluminium (anodized, black)

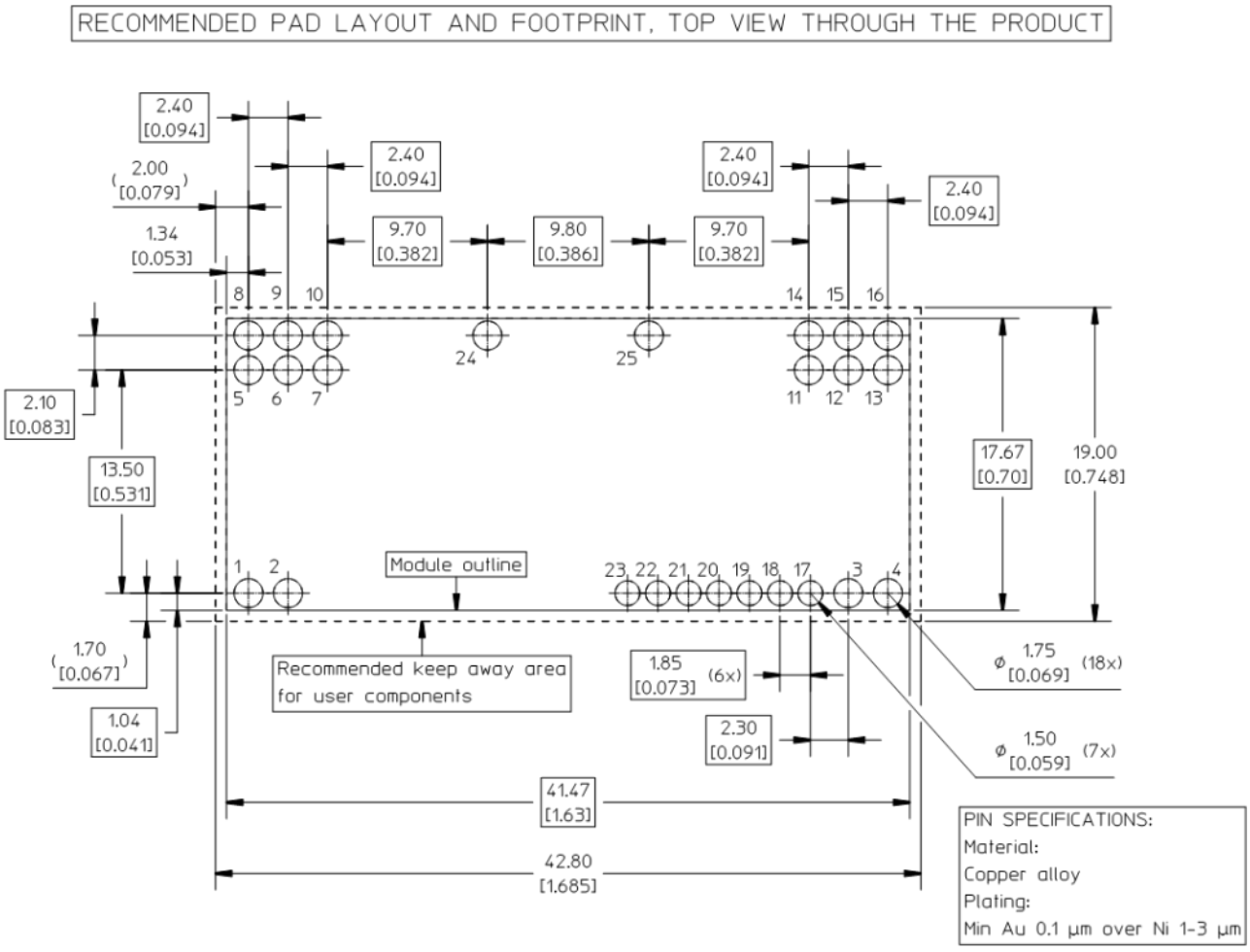
WEIGHT
Typical: 16.5 g

All dimensions in mm and [inch].
Tolerances unless specified:
x.x mm ±0.50 mm, [x.xx in. ±0.02 in.]
x.xx mm ±0.25 mm, [x.xxx in. ±0.010 in.]
(Not applied on footprint and typical values)
* Module height (6.90 [0.272]) measured with a light pressure applied on baseplate top surface.

3D MODELS
3D .stp models are available on request.

All component placements, whether shown as physical components or symbolical outline, are for reference only and are subject to change throughout the product's life cycle unless explicitly described and dimensioned in this drawing.

Top View - Recommended footprint all variants showing pin positions



Pin	Designation
1, 4	VIN, Power input terminals
2, 3, 8, 9, 10, 14, 15, 16, 24, 25	GND, Power Ground
5, 6, 7, 11, 12, 13	VOUT, Power output terminals
17	3.3V_AUX External 3.3 supply
18	ADDR, PMBus address configure
19	PGOOD, Power Good terminal
20	EN, Enable terminal
21	SYNC, Synchronize pin. When multiphase system is used this PIN needs to be connected between all the phases.
22	SCL, I²C Serial Clock Line
23	SDA, I²C Serial Data Line

Part 4: Thermal considerations

The products are designed to operate using a heatsink mounted on top of the device, or by other suitable cooling method.

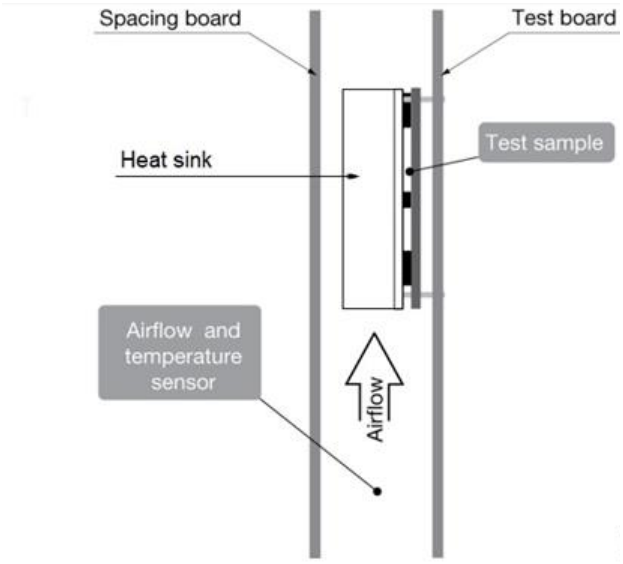
General

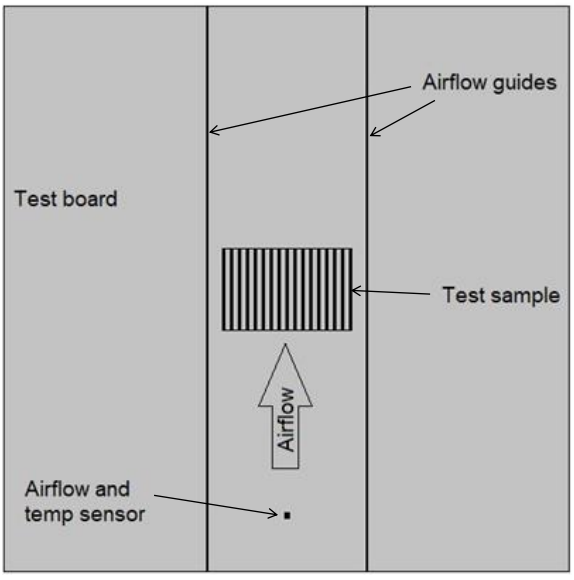
For products mounted on a PWB with a heatsink attached, cooling is achieved both by conduction, from the pins to the host board, and through the heatsink mounted on top of the device. The wind speed and temperature are measured in a point upstream to the device. The output current derating graphs found later in this section provide the available output current vs. ambient air temperature and air velocity at V_{in} = 54 V.

For products using any form of heatsink structure a top spacing board and side airflow guides are used to ensure airflow hits the module and is 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.



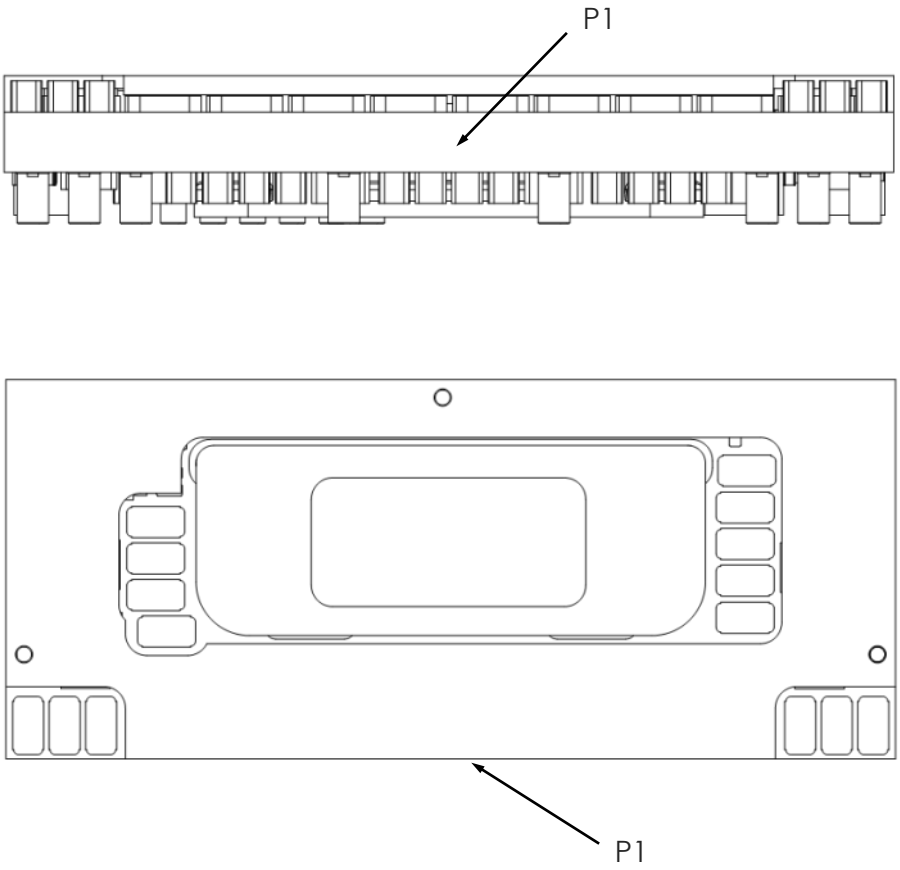


Definition of product operating temperature

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.

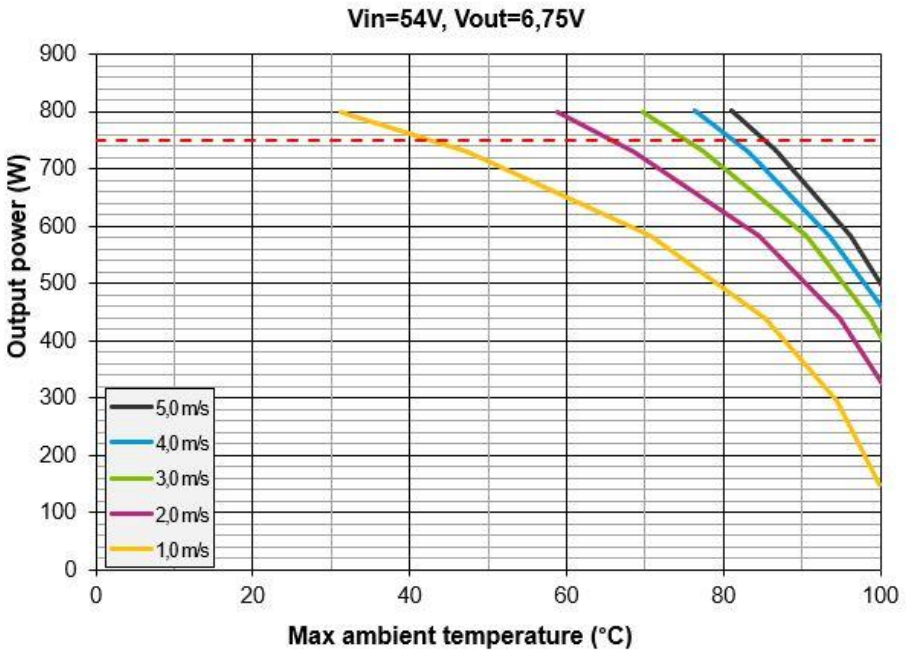
Position	Description	Max. Temp.
P1	PWB edge	T_{P1}= 110 °C*

*This is the measurement spot that shall correspond with hot spot reaching up to OTP level, which is 120*C.

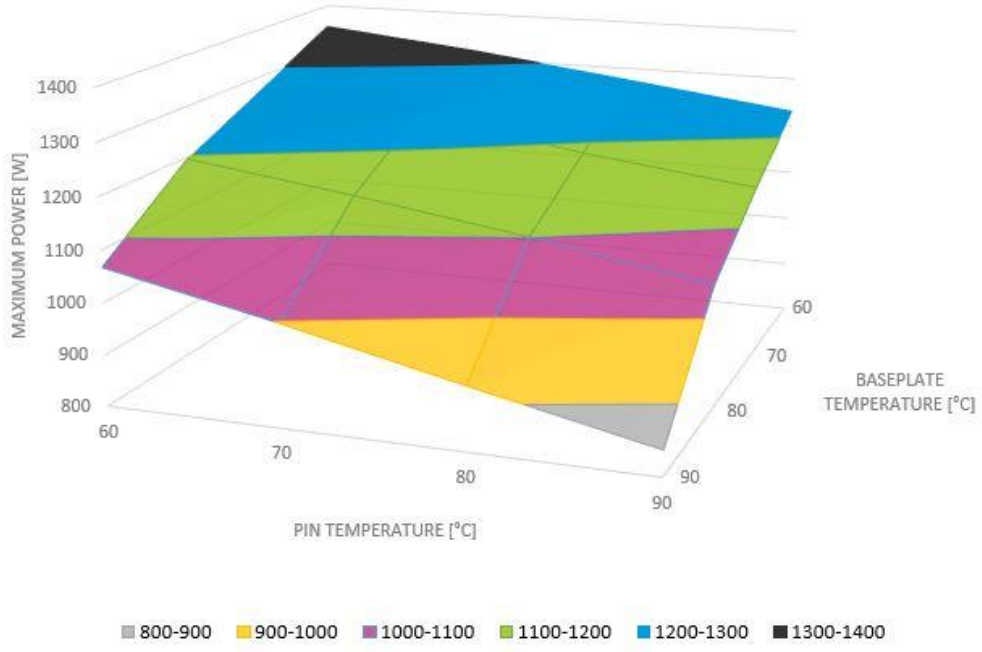


Thermal graphs

Output power derating



3D liquid cooling

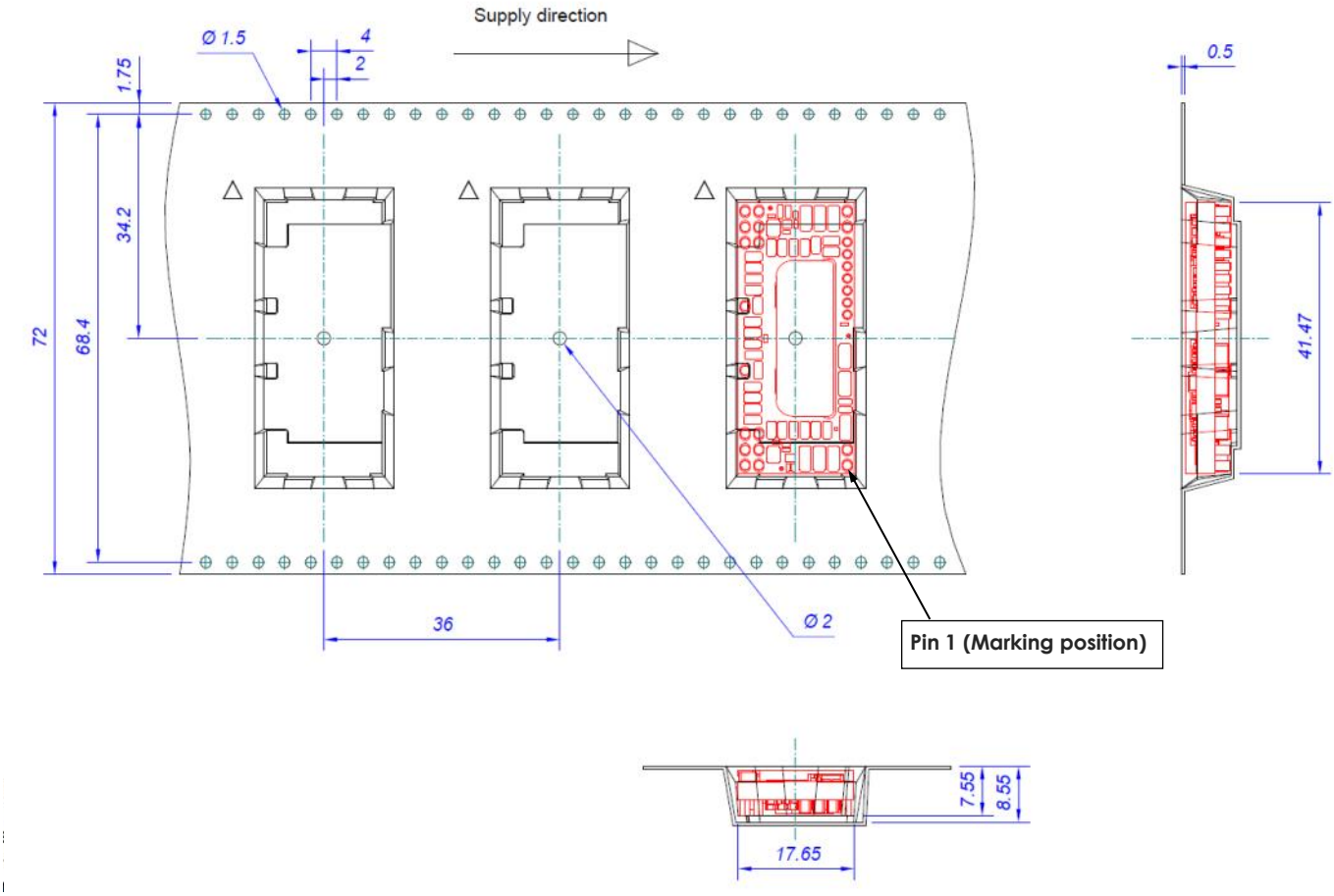


Part 5: Packaging

Packaging information

The products are delivered in an antistatic carrier tape (EIA 481 standard).

Carrier Tape Specification	
Material	PS, Antistatic
Surface resistance	< 10^7 Ω/square
Bakabilty	The tape is not bakeable
Tape width, W	72 mm [2.835 inch]
Pocket pitch, P_1	36 mm [1.417 inch]
Pocket depth, K_0	8.55 mm [0.337 inch]
Reel diameter	330 mm [13.0 inch]
Reel capacity	150 products/reel
Reel weight	3450 g/full reel



Part 6: Revision history

Revision table

Revision number	revision change	date	revisor
Rev. A	Release of product	2025-06-03	Team K4

Flex Power Modules, a buiness line of Flex, is a leading manufacturer and solution provider of scalable DC/DC converter primarily serving the data processing, communications, industrial and transportation markets. Offering a wide range of both isolated and non-isolated solutions, its digitally-enabled DC/DC converters include PMBus compatibility supported by the powerful Flex Power Designer.