TYRANNY LIBERATOR

Seamless backup power. With or without solar.

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Complete Plans, Instructions, Parts List & 3D Drawings

Contents

General Information

- **Nano Portable Power Supply**

Is not only made for emergency backup power at home, but is also very useful for camping, or wherever you need power when you are on the go. With high power/energy, you can keep your electrical devices, appliances, lights and more going for longer.

- **Key Features**

Awesome Design, Built in AC Output, DC12V Output, **USB** Output. Built in Lithium ion batteries, Capacity is up to 72000mAh, Which is Powerful but lightweight to carry. Compact with MPPT charging with solar panel. Best mate and gear for power failure, outdoors businesses, night market, when you're off grid.

- **Specifications**

1. Built in High Power Density Lithium ion Batteries;
2. Up to 18Ah/14.8 ~300 Wh Battery power (SONY VTC6 3000mAh cell);
3. Support AC Modified SineWave output;
4. Up to 120W AC continuous output, 200W for peak output;

- **Applications**

1. Back up power source during power failure;
2. Back up power source for Smart devices;
3. For camping, go Outdoor Photography, go fishing, hiking, etc.;
4. For tool charging;
5. For laptops, small LED TVs, mini fridges;
6. Support Car kits, including lift jack, air inflators, vaccum, car wash, electric wrench, etc.;
7. Mobile stalls, night markets.

- **Safety Guaranteed**

Battery Management System (BMS) undertakes voltage control, temperature control and more advanced safety operations, full-protection with short-circuit, low-voltage, over-charge, over-voltage, over-load, over-temperature protection, ensuring complete protection for you and your devices.

Quiet, portable power for base camps, cabins and unexpected outages. The high power emergency power supply allows you to live life off the grid, camp in luxury, or power through an outage without the noise and fumes of traditional back-up generators.

How it Works:

How it works:

Charge from:

- DC source 16-30VDC
- Laptop charger
- Solar panel
- Wind / water generator

NOTE! If voltage is bellow 16v it will not charge if it is beyond 30v MPPT will fry.

Storage:

- 4s5p : 4 cell in serie for 14.8v , 5 in parallel for 15000mah (3000mah x5)
- Can be made from laptop battery (need to test and match cells)
- BMS Protection

Output:

- Main output is 12v (~ 12 to 16v)
- Inverter output is 110v (or 220v depend of country)
- USB output (on inveter 5v)

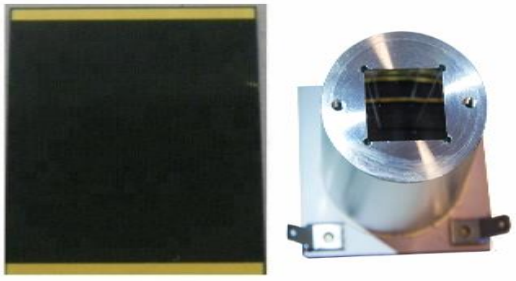
Tools List

Screwdriver	
Bent Nose Plier	
Plier	
Soldering Station/Soldering Gun	
Digital Multimeter	

Rosin Core Solder	
Electric Screwdriver	
Tweezer	
Plastic Soldering Gun	

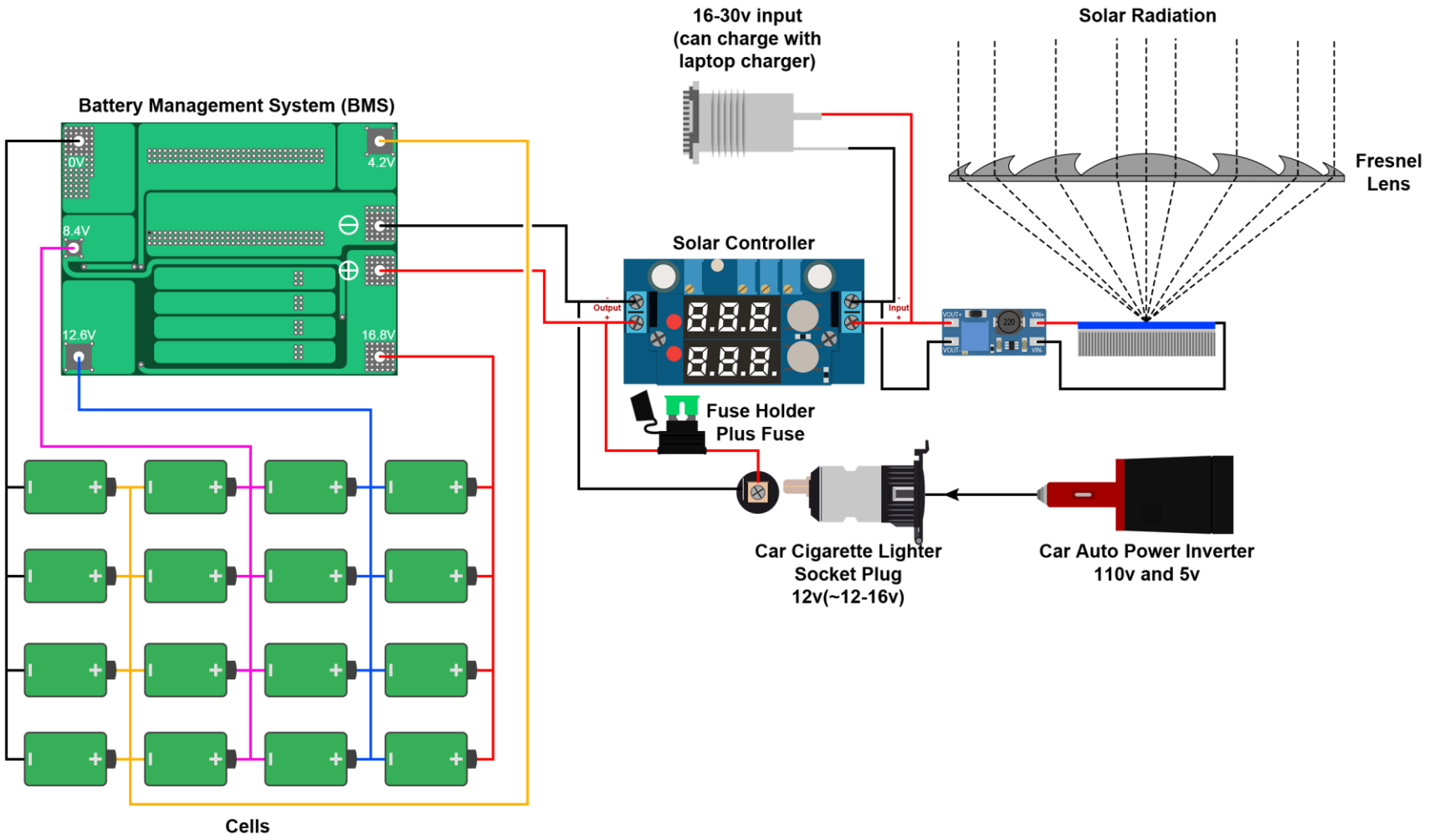
List of Materials

Nr. Crt	Description	Qty/Unit	Vendor	Images
1	5.5 mm x 2.1mm Metal DC Power Jack Socket Female Panel Mount Connector	1	eBay LINK	
2	MPPT Solar Panel Controller 5A DC-DC Step-down CC/CV Charging Module LED Display (chose Double LED Display)	1	eBay LINK	
3	12V 120W Power Motorcycle Boat Car Cigarette Lighter Socket Plug	1	eBay LINK	
4	New 150W Car Auto Power Inverter Charger Adapter 12V DC To 110V AC USB Q9 Ai	1	eBay LINK	
5	3/4S BMS PCB 40A Li-ion Lithium Battery Charging Protector Board 18650 Module (chose the 4s Balanced Version)	1	eBay LINK	

6	A4 Full Page Large Sheet 3xMagnifier Magnifying Glass Reading Aid Lens Fresnel	1	eBay **LINK**	
7	LLAMEVOL Schottky Diode 25 PCS 15SQ045 15A 45V Schottky Diodes Bridge for Solar Panel Wind Rectifier 15 AMP	1	eBay **LINK**	
8	CPV Solar Cells Or CPV Solar Cell Module	1	eBay **LINK** **LINK**	
9	Various Sizes Electronic ABS Plastic DIY Junction Box Enclosure Project Case (chose 380x260x120)	1	eBay **LINK**	
10	8Gauge Inline ATC Fuse Holder+30AMP Fuse	1	eBay **LINK**	

11	MT3608 DC-DC Step Up Boost Converter Power Supply Module 2V-24V to 5V-28V 2A	1	eBay **LINK**	

Diagram


16-30v input
(can charge with
laptop charger)
Solar Radiation
Fresnel
Lens
Battery Management System (BMS)
0V
4.2V
8.4V
12.6V
16.8V
Solar Controller
Output
Input
Fuse Holder
Plus Fuse
Car Cigarette Lighter
Socket Plug
12v(~12-16v)
Car Auto Power Inverter
110v and 5v
Cells

Concentrating Photovoltaic (CPV)

- CPV Technology

  - **CPV Technology Features**

Concentrating photovoltaic makes use of the photovoltaic effect but adding lenses and mirror to concentrate the sunlight.

CPV technology started about 10-15 years ago when the cost of Silicon was high and there was a need to reduce the area of cell material.

It works with DNI instead of GHI.

Potential for solar cell efficiencies greater than 40%

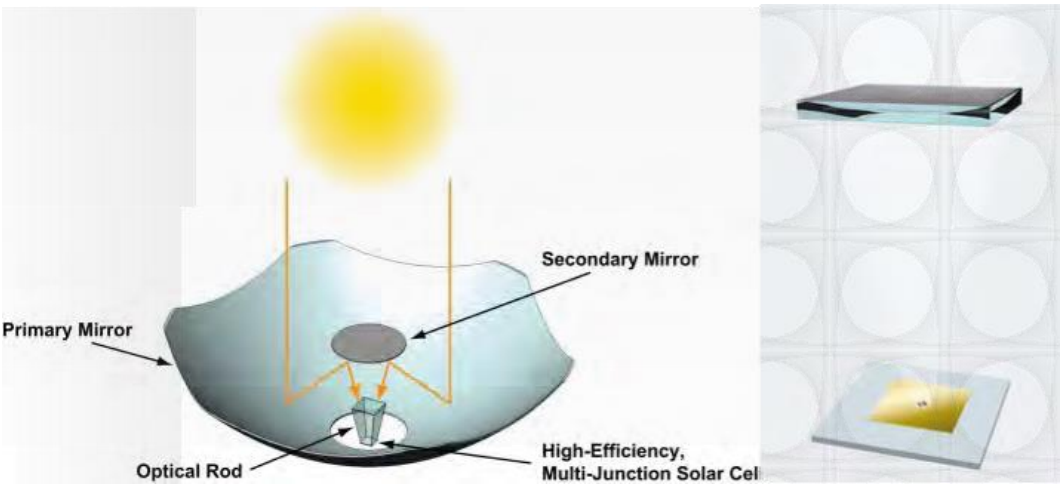
Concentration ratio can reach over 400X

Small cell area of around 1cm2

Accurate Solar System Tracker (~0.01º) and ventilation are required

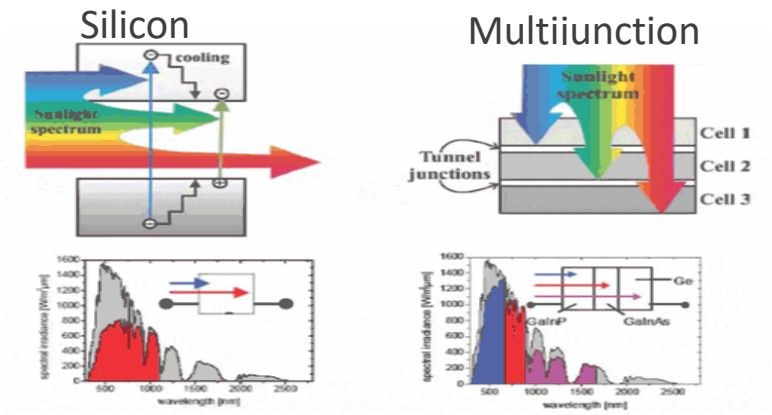
<u>Optical designs:</u>

Reflective Mirror Refractive lens



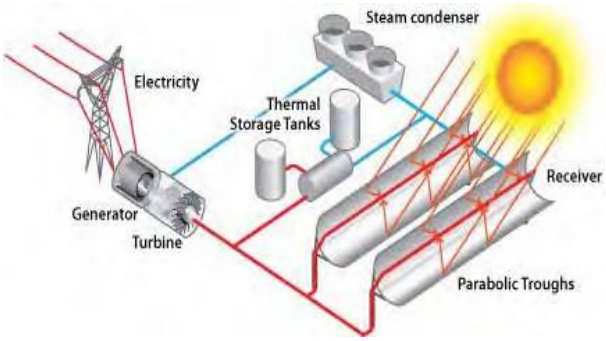
- **Description of Cell Classes of CPV as a function of Concentrated Ratio**

Class of CPV	Concentration Ratio	Type of Cell
High-Concentration MultiJunction cells (HCPV)	>400X	Multijunction - Multiple Photoelectric Effect + Optical concentration
Medium-Concentration (MCPV)	~3X-100X	Silicon or other cells – Optical concentration
Enhanced concentration modules (LCPV)	<3X	Silicon modules -Optical concentration



The high concentration (>400X) and efficiencies (>35%) reached in Multijunction System allows to Reduce the cell size to 1cm^2 or even

➢ Technical Comparison



- **Solar to Thermal** -> Thermal to Electricity conversion
- Use the Direct Normal Radiation (DNI)
- Size: Power plant range from 1MWe to 200MWe

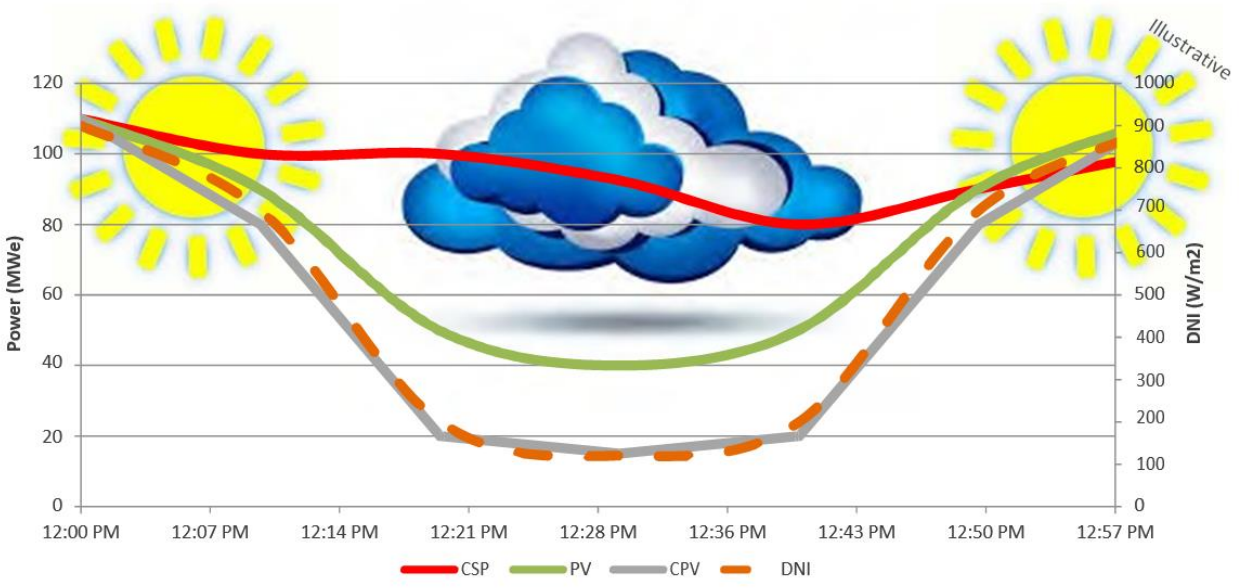
- Direct Solar to Electricity conversion (Photoelectric Effect)
- Tracked systems use Global Normal Radiation (GNI)
- Fixed System use Global Horizontal Irradiance (GHI) increased by a factor to account the inclined surface

Estimation of CAPEX, OPEX and LEC for the three different technologies

	CSP	CPV	PV
Maturity	30 years of proven technology (depending on the technology)	Under development, or first commercial stages	More than 30 years of proven technology
LCOE estimate 2013 ($c/kWh)	17-29	13-24	10-20
Installed capacity (end 2013)	~3500 MW	~300 MW	~100 GW
Annual Solar-Electricity conversion efficiency	16-19%	19-22% (24-35% peak)	15-17%
Dispatchability	Yes	No	No
Water use	Medium-High (dry or wet cooling)	Very Low	Very Low

Responds comparison of transient situation

As CPV systems do not have inertia nor can take advantage of diffuse irradiation they respond in a quite negative way to transient situations.



➢ Conclusion

- CPV system price is still the double than PV system price but they have the highest efficiency of all solar power systems (>25%).
- Reduced CPV market competition by strong ongoing consolidation.
- CPV is not dispatchable and grid integration on large scale can be more complicated than for PV.
- CPV has a steep cost reduction path ahead, and last year the pipeline of projects
- According to a report HIS (2013), the global market for CPV systems is "on the verge of explosive growth, with worldwide installations set to skyrocket 750% between 2013 and 2020".

Concentrator Triple Junction Solar Cell

Cell type: 3C42 – 10x10mm²

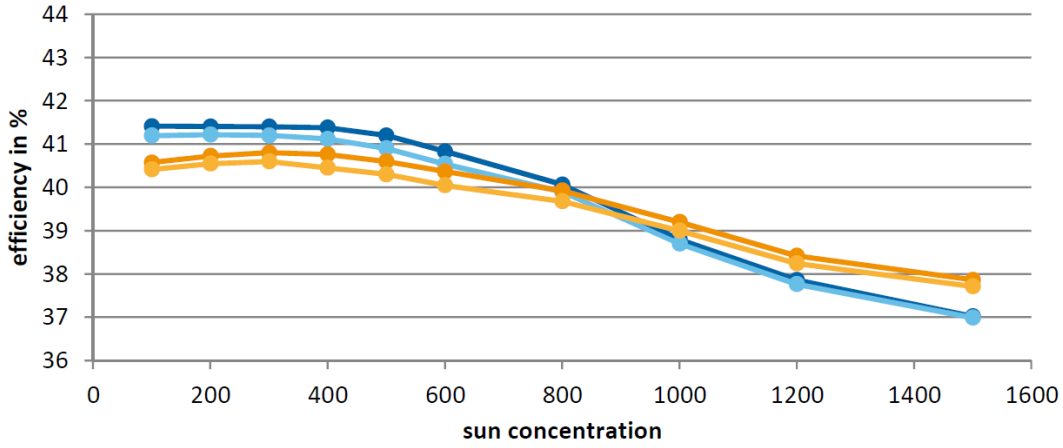
Application: Concentrating Photovoltaic (CPV) Modules

➢ Typical Average Electrical Data

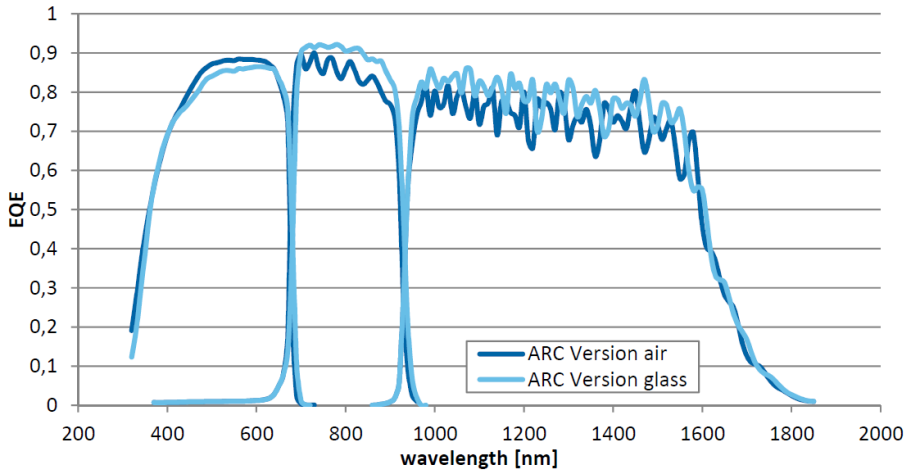
Sun Concentration	I_{SC} [A]	V_{OC} [V]	I_{MPP} [A]	V_{MPP} [V]	P_{MPP} [W_{MPP}]	FF [%]	η [%]
Version MC/AIR							
Grid optimized for medium concentration + Antireflective Coating adapted to air							
X250	3,79	3,07	3,71	2,80	10,40	89,4%	41,4
X500	7,58	3,12	7,42	2,79	20,71	87,6%	41,2
X1000	15,07	3,16	14,77	2,64	39,00	81,9%	38,8
Version MC/Glass							
Grid optimized for medium concentration + Antireflective Coating adapted to glass							
X250	3,76	3,08	3,70	2,80	10,35	89,4%	41,2
X500	7,53	3,12	7,37	2,79	20,55	87,5%	40,9
X1000	15,08	3,15	14,68	2,65	38,90	81,9%	38,7

Sun Concentration	I_{SC} [A]	V_{OC} [V]	I_{MPP} [A]	V_{MPP} [V]	P_{MPP} [W_{MPP}]	FF [%]	η [%]
Version HC/AIR							
Grid optimized for high concentration + Antireflective Coating adapted to air							
X250	3,70	3,07	3,62	2,83	10,25	90,2%	40,8
X500	7,41	3,12	7,26	2,81	20,40	88,2%	40,6
X1000	14,90	3,14	14,52	2,72	39,50	84,4%	39,3
Version HC/Glass							
Grid optimized for high concentration + Antireflective Coating adapted to glass							
X250	3,69	3,07	3,62	2,82	10,20	90,0%	40,6
X500	7,39	3,11	7,23	2,80	20,25	88,1%	40,3
X1000	14,70	3,14	14,41	2,72	39,20	84,9%	39,0

- Efficiency versus sun concentration



- Efficiency versus sun concentration



- Typical Temperature Coefficients

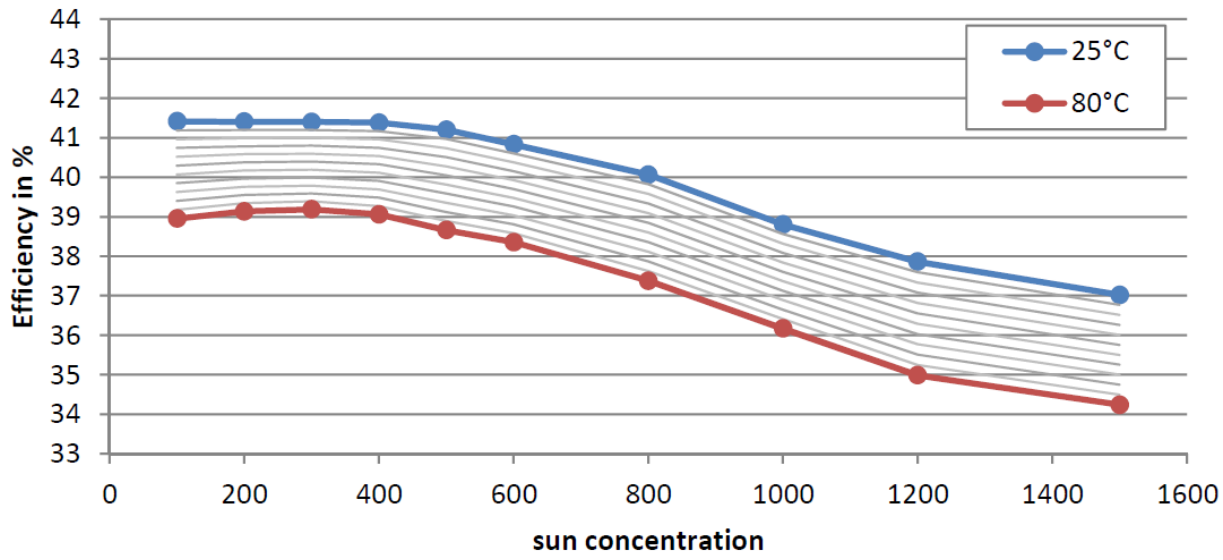
Temperature range (25-80°C)

Parameter	$(\Delta I_{SC}/I_{SC(25°C)})/\Delta T$	$(\Delta V_{OC}/V_{OC(25°C)})/\Delta T$	$(\Delta P_{MPP}/P_{MPP(25°C)})/\Delta T$	$(\Delta \eta/\eta_{(25°C)})/\Delta T$
Value	0,080%/K	-0,135%/K	-0,106%/K	-0,106%$_{(rel)}$K
Parameter	$\Delta I_{SC}/\Delta T$	$\Delta V_{OC}/\Delta T$	$\Delta P_{MPP}/\Delta T$	$\Delta \eta/\Delta T$
Value	6,1 mA/K	-4,2 mV/K	-23,7 mW/K	-0,047%$_{(abs)}$/K

Exemplary values measured with version MC/Air, at 500 suns.

- Typical Performance over Temperature

Exemplary for version MC/Air



- Version Comparison

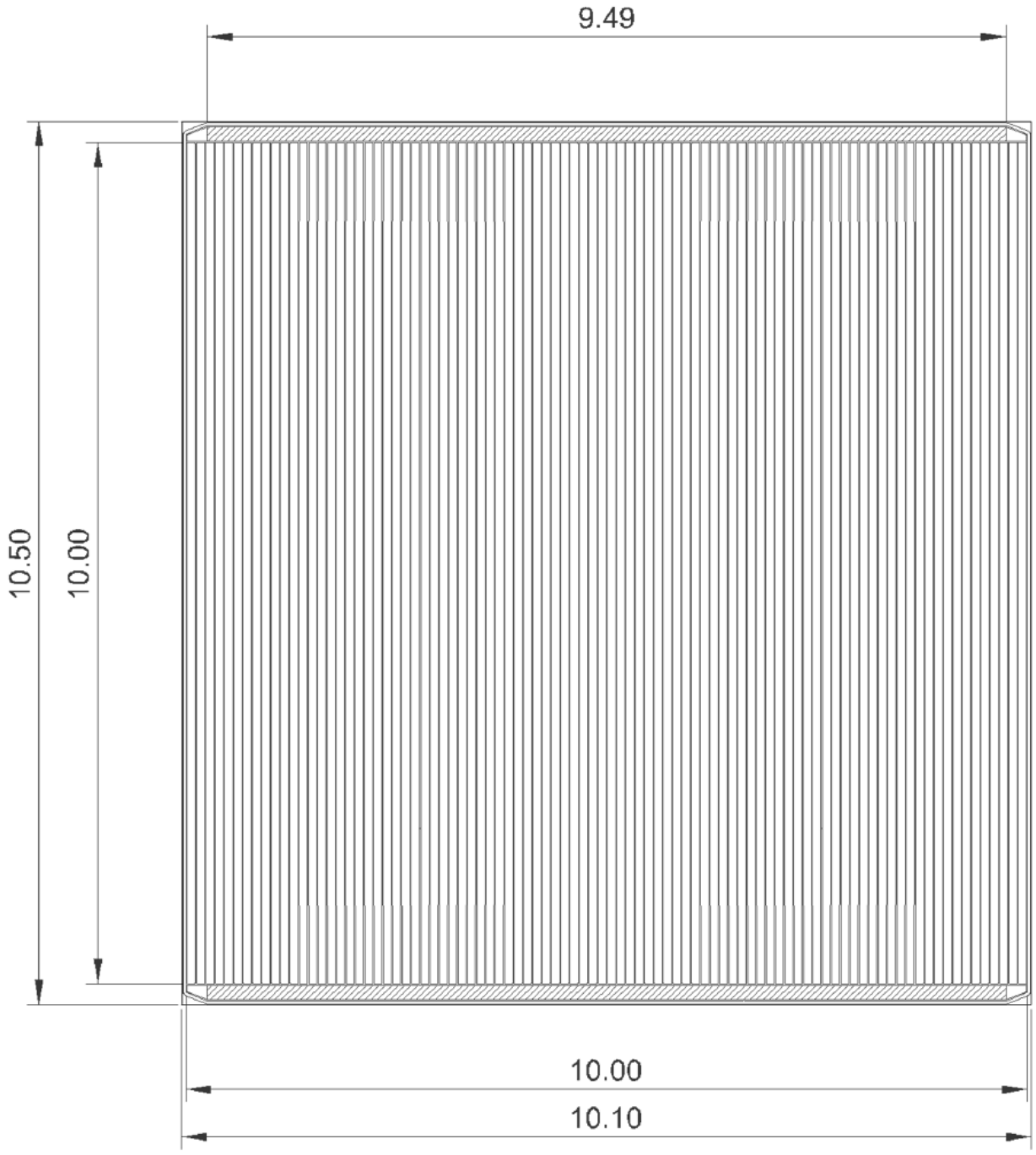
Opto Electrical Behaviour	
Antireflective Coating	Efficiency change on Glass covered cells
Version Air	-3,2%(rel)
Version Glass	-0,4%(rel)

Influence of Cell Dimension	
Active Area	Typical efficiency (version MC/Air at 500 suns)
3 x 3 mm	42.7%
5,5 x 5,5 mm	41,9%
10 x 10 mm	41,2%

- Design and Mechanical Data

Base Material	GaInP/GaInAs/Ge on Ge substrate
Ar Coating	TiO_x/AlO_x
Chip Size	10,1 mm x 10,5 mm = 106,05 mm^2
Active Cell Area	10,0 mm x 10,0 mm = 100 mm^2
Cell Thickness	190 µm ± 20 µm
Polarity	N on P
Thickness of Front Contact	≥ 5 µm (finish is an Ag/Au alloy)
Thickness of Back Contact	≥ 4 µm (finish is an Ag/Au alloy)
Assembly	suitable for welding, soldering and bonding

- Layout Details



- Storage and Operation Conditions Requirements

  - Humidity protection is strongly recommended
  - Storage in dry air or nitrogen atmosphere is requested
  - As front side interconnector material we recommend gold or silver
  - We recommend to use Sn96.5/Ag3.5-solder or another solder with saturated silver for rear side assembly
  - A void free rear side assembly (heat sink) is requested to avoid hot spots
  - The cell junction shall not exceed a maximum operation temperature of 110°C
  - Secondary glass glue on the front side has to be flexible (prefer silicone glue or similar)