

## Enhanced Fresnel Assembly - EFA

Type: 3C44A – with 10x10mm<sup>2</sup> CPV TJ Solar Cell  
 Application: Concentrating Photovoltaic (CPV) Modules



### Typical Average Electrical Data

Sun Concentration	I <sub>sc</sub> [A]	V <sub>oc</sub> [V]	I <sub>MPP</sub> [A]	V <sub>MPP</sub> [V]	P <sub>MPP</sub> [W <sub>MPP</sub> ]	FF [%]	D [%]
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#### ● Version MC/Air

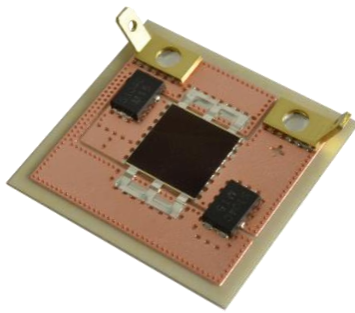
Grid optimized for medium concentration + Antireflective Coating adapted to air

X 250	3,85	3,06	3,77	2,80	10,59	89,9%	42,1
X 500	7,66	3,11	7,54	2,81	21,20	88,9%	42,0
X 1000	15,35	3,15	15,07	2,69	40,56	83,8%	40,3

#### ● Version MC/Glass

Grid optimized for medium concentration + Antireflective Coating adapted to glass

X 250	3,82	3,07	3,76	2,80	10,55	89,9%	41,9
X 500	7,61	3,11	7,50	2,81	21,04	88,8%	41,8
X 1000	15,36	3,15	14,98	2,70	40,46	83,8%	40,2



Sun Concentration	I <sub>sc</sub> [A]	V <sub>oc</sub> [V]	I <sub>MPP</sub> [A]	V <sub>MPP</sub> [V]	P <sub>MPP</sub> [W <sub>MPP</sub> ]	FF [%]	D [%]
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#### ● Version HC/Air

Grid optimized for high concentration + Antireflective Coating adapted to air

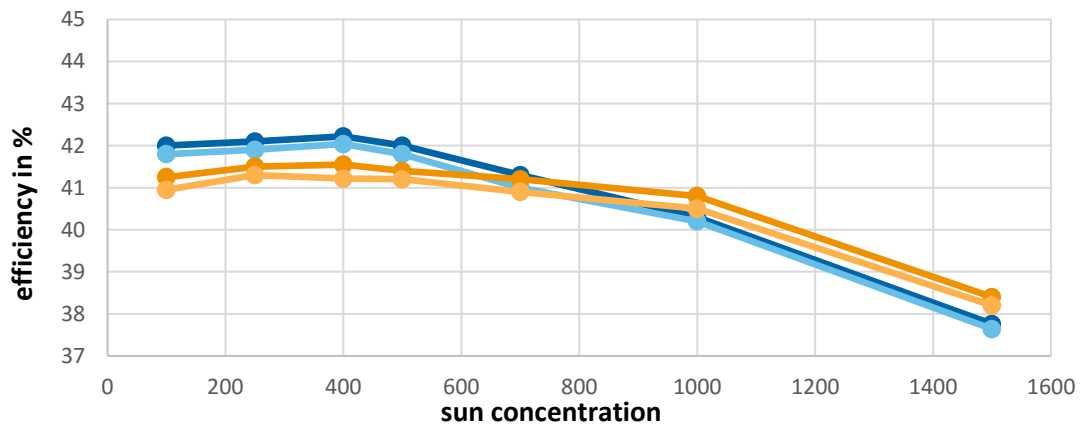
X 250	3,76	3,06	3,68	2,83	10,44	90,7%	41,5
X 500	7,49	3,11	7,38	2,83	20,88	89,6%	41,4
X 1000	15,17	3,14	14,82	2,77	41,08	86,4%	40,8

#### ● Version HC/Glass

Grid optimized for high concentration + Antireflective Coating adapted to glass

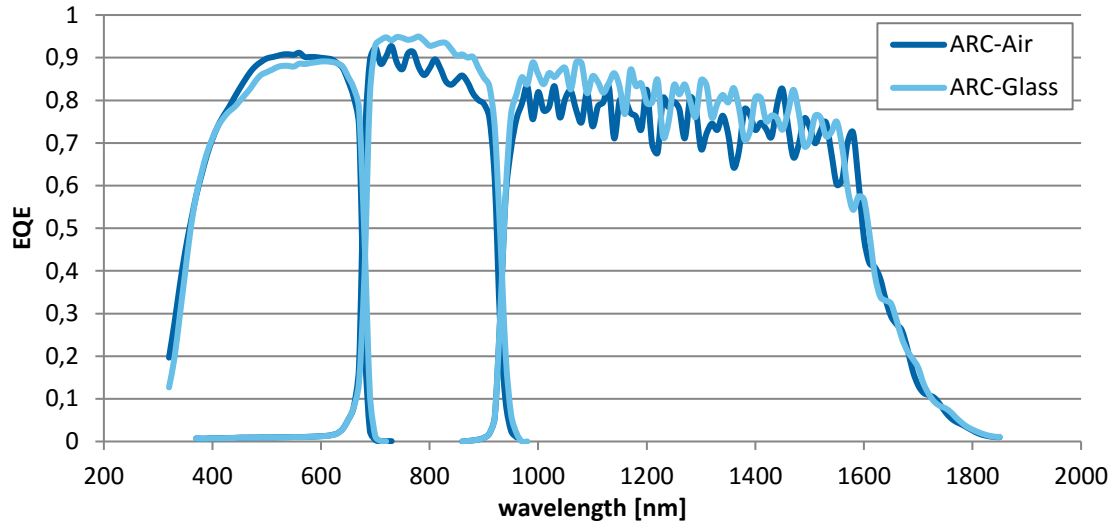
X 250	3,75	3,06	3,68	2,82	10,39	90,5%	41,3
X 500	3,75	3,06	3,68	2,82	10,39	90,5%	41,3
X 1000	14,97	3,14	14,71	2,77	40,77	86,9%	40,5

### Efficiency versus Sun Concentration



Measurement conditions: 1.5 AM<sub>d</sub> – 1000 W/m<sup>2</sup> (ASTM G 173-03), T = 25 °C, designated measurement area = 100,51 mm<sup>2</sup>

## Spectral Response



## Typical Temperature Coefficients

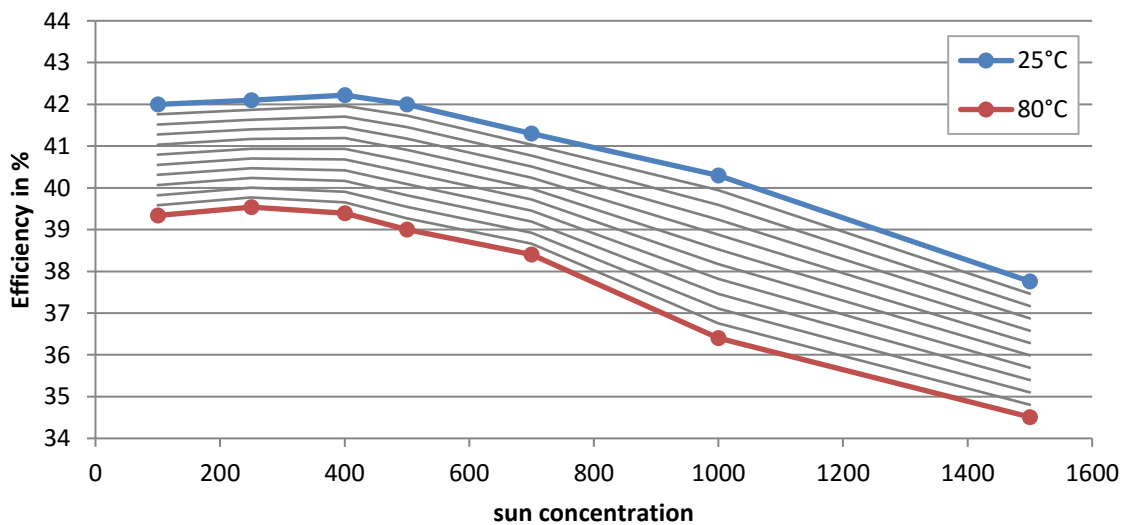
Temperature range (25 – 80 °C)

Parameter	$(\Delta I_{sc} / I_{sc(25^\circ C)}) / \Delta T$	$(\Delta V_{oc} / V_{oc(25^\circ C)}) / \Delta T$	$(\Delta P_{mpp} / P_{mpp(25^\circ C)}) / \Delta T$	$(\Delta \eta / \eta_{(25^\circ C)}) / \Delta T$
Value	0,080%/K	-0,135%/K	-0,106%/K	-0,106% <sub>(rel)</sub> /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	-22,5 mW/K	-0,045% <sub>(abs)</sub> /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		Influence of Cell Dimension	
Antireflective Coating	Efficiency change on glass covered cells	Active Area	Typical efficiency (Version MC/Air at 500 suns)
Version Air	-3,2 % <sub>(rel)</sub>	3 x 3 mm	44,0 %
Version Glass	-0,4 % <sub>(rel)</sub>	5,5 x 5,5 mm	42,9 %
		10 x 10 mm	42,1 %

Efficiency comparison at 500 suns

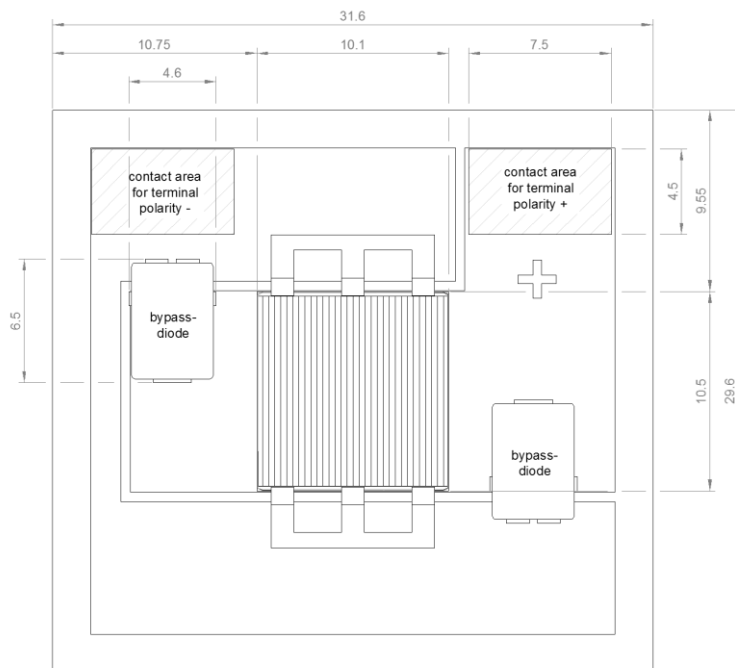


## Design and Mechanical Data

Base Material	DCB Board (0,32 mm Al <sub>2</sub> O <sub>3</sub> -Ceramic with two-sided 0,25 mm copper)
Board Size	29,6 mm x 31,6 mm ± 0,2 mm
Connectivity Options	Suitable for flat connectors or direct soldering
Solar Cell Type	Triple Junction CPV Solar Cell 3C44
Cell Base Material	GaNP/GaInAs/Ge on Ge substrate
Active Cell Area	10,0 mm x 10,0 mm = 100 mm <sup>2</sup>
AR Coating	TiO <sub>x</sub> /AlO <sub>x</sub>
By-pass Diode	2x 10A Diode

## Layout details

Drawing dimension are mm



Sample drawing without terminals; More details in drawing HNR 0003382, available on request.



## Storage and Application Requirements

- Humidity protection is strongly recommended
- Storage in dry air or nitrogen atmosphere is requested
- The cell junction shall not exceed a maximum operation temperature of 110 °C
- The assembly shall not exceed a maximum process temperature of 175 °C
- For concentration > 500x a secondary optical element is needed (available on request)
- Secondary glass glue on the front side has to be flexible (prefer silicone glue or similar)

## Additional Information



- Current values at specific operating voltage can be offered on customer request
- Explanation of ARC versions:
  - o AIR:
 

The antireflective coating on top of the solar cell is optimized for the interface to air. In this kind of application the light enters the solar cell directly from air. The indoor test measurement (flash test) will be done at air atmosphere.
  - o GLASS:
 

The antireflective coating on top of the solar cell is optimized for the interface to glass or similar ( $n \approx 1.43$ ). At this kind of application the light enters the solar cell through a glass component or similar (e.g. secondary element, homogenizer element, cover glass). However, the indoor test measurement (flash test) will be done at air atmosphere without glass interface. Therefore the flash test results will underestimate the potential cell performance. The performance of a system with glass interfaces is expected to be higher using cells with ARC Glass than with ARC Air.
- Acceptance test rules for delivery lots:
  - o Minimum average efficiency = typical average value minus 4% (rel.)
  - o Minimum individual EFA efficiency = typical average value minus 7% (rel.)

## Order Information

- Customized package for cost optimized optical train is offered on request

Product Version			(no Terminal)
	45° Terminal	90° Terminal	Pre soldered only
● MC/Air	81269	81270	81271
● MC/Glass	81272	81273	81274
● HC/Air	81275	81276	81277
● HC/Glass	81281	81279	81280