

Course : Diploma in Electronics, Computer & Communications Engineering  
Course Code : EGDF01  
Module : Solar Technology  
Module Code : EG3357

Tutorial	04
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Question

Suppose that Shell Solar manufactures a new 54-cell PV panel using the same types of cells as in Shell SQ85-P photovoltaic panel. -- All 54cells are connected in series.

The datasheet for Shell SQ85-P photovoltaic panel is attached.

- (a) Determine the following nameplate data for the new 54-cell panels at  $1000 \text{ W/m}^2$  and  $25^\circ\text{C}$

Open-circuit voltage =

Short-circuit current =

Peak power voltage =

Peak power current =

- (b) At  $400 \text{ W/m}^2$  solar irradiance and  $25^\circ\text{C}$ , estimate the following:

Open-circuit voltage =

Short-circuit current =



# Shell Solar

## Shell Solar

### Shell PowerMax™ solar modules for off-grid markets

1<sup>st</sup> edition 2005

#### General

Shell PowerMax™ is a new range of dependable, high performance solar products – with designs created specifically for off-grid applications.

Shell PowerMax™ Ultra 85-P and 80-P products contain 36 series connected 125mmx125mm mono-crystalline solar cells, which can generate a peak power of 85 and 80 watts at 17.2 and 16.9V respectively.

#### Qualifications and Certificates

The Shell PowerMax™ Ultra 85-P and 80-P products meet the following requirements:

- IEC 61215
- UL-Listing 1703
- FM approved
- TÜV Safety Class 2 (pending)



All these Shell Solar modules are produced in ISO 9001:2000 certified factories.

#### Limited Warranties\*

- Peak Power for 25 years (category D)
- Product workmanship 2 years
- \* See Shell Solar Limited Warranty for PV Modules

#### Shell PowerMax™ Ultra 85-P/80-P



ELECTRICAL EQUIPMENT,  
CHECK WITH YOUR INSTALLER

Due to continuous research and product improvement the specifications in this Product Information Sheet are subject to change without notice. Specifications can vary slightly. For installation and operation instructions, see the applicable manuals. No rights can be derived from this Product Information Sheet and Shell Solar assumes no liability whatsoever connected to or resulting from the use of any information contained herein.

References in this Product Information Sheet to 'Shell Solar' are to companies and other organisational entities within the Royal Dutch/Shell Group of Companies that are engaged in the photovoltaic solar energy business. Shell Solar was set up in 1999 and has its principal office in Amsterdam, the Netherlands.

#### The Shell PowerMax™ advantage

##### Exceptional Performance

- High efficiency crystalline silicon solar cell technology; enhanced by TOPS™ and new silicon nitride anti-reflection coatings.
- One of the industry's leading energy yields in a wide variety of climates.
- Products rated on fully stabilized initial power so you get the power you pay for

##### Proven Reliability

- Module design proven over 30 years of field operations with reliability in excess of 99.9%
- Extended limited power warranties backed by a company you can trust.
- UL 1703, IEC 61215, FM and TÜV Safety Class 2 certifications.

##### Safety by Design

- Suitable for high snow and wind loads
- UL fire safety class C

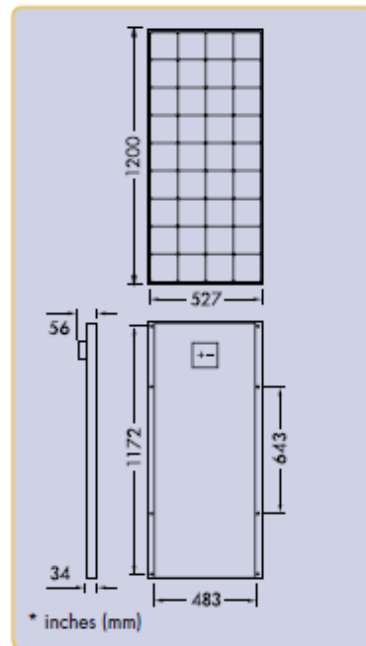
##### Easy to install

- Conduit ready junction box
- 12 mounting holes per product;  
4 grounding holes
- 20A series fuse rating



## Mechanical Specifications

A torsion and corrosion-resistant anodized aluminium frame ensures dependable performance, even under harsh weather conditions. Pre-drilled mounting holes are provided for ease of installation.



Outside dimensions (in/mm)	47.2x20.8/1200x527
Thickness (inc. junction box) (in/mm)	2.2/56
Thickness (exc. junction box) (in/mm)	1.3/34
Weight (lbs/kg)	16.7/7.6
Junction box type	ProCharger™ IP44
Junction box size (in/mm)	5x4.4x1.8/130x110x50

The junction box allows for easy field replacement of diodes.

For installation instructions, please

## Electrical Characteristics

### Data at Standard Test Conditions (STC)

STC: irradiance level 1000W/m<sup>2</sup>, spectrum AM 1.5 and cell temperature 25°C.

	PowerMax™	Ultra 80-P	Ultra 85-P
Rated power [W]	P <sub>r</sub>	80	85
Peak power* [W]	P <sub>mpp</sub> *	80	85
Module efficiency [%]	η	12.7	13.4
Maximum system voltage	V <sub>sys</sub>	600V (UL)/715V (TUV)	600V (UL)/715V (TUV)
Peak power voltage [V]	V <sub>mpp</sub>	16.9	17.2
Peak power current [A]	I <sub>mpp</sub>	4.76	4.95
Open circuit voltage [V]	V <sub>oc</sub>	21.8	22.2
Short circuit current [A]	I <sub>sc</sub>	5.35	5.45
Series fuse rating [A]	I <sub>fuse</sub>	20	20
Minimum peak power [W]	P <sub>mpp min</sub>	76	80.75
*Tolerance on Peak Power [%]	%	+/-5	+/-5

\* The abbreviation 'mpp' stands for Maximum Power Point.

### Typical Data at Nominal Operating Cell Temperature (NOCT) conditions

NOCT: irradiance level 800W/m<sup>2</sup>, spectrum AM 1.5, wind velocity 1m/s, T<sub>amb</sub> 20°C.

Temperature [°C]	T <sub>NOCT</sub>	45.5	45.5
Mpp power [W]	P <sub>mpp</sub>	59	63
Mpp voltage [V]	V <sub>mpp</sub>	15.8	16.4
Open circuit voltage [V]	V <sub>oc</sub>	20.0	20.1
Short circuit current [A]	I <sub>sc</sub>	4.20	4.25

### Temperature coefficients

α P <sub>mpp</sub> [%/°C]	-0.43	-0.43
α V <sub>mpp</sub> [mV/°C]	-72.5	-72.5
α I <sub>sc</sub> [mA/°C]	1.4	1.4
α V <sub>oc</sub> [mV/°C]	-64.5	-64.5

### Typical data at low irradiance

The relative reduction of module efficiency at an irradiance of 200W/m<sup>2</sup> in relation to 1000W/m<sup>2</sup> both at 25°C cell temperature and spectrum AM 1.5 is 8%.

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