

# Shell Solar

## Shell PowerMax™ solar modules for grid-connected markets\*

1<sup>st</sup> edition 2005

### Shell PowerMax™

Shell PowerMax™ is a range of high performance crystalline products designed specifically for grid-connected photovoltaic applications. Shell PowerMax™ is backed by a leading energy company with 30 years experience in solar power and more than 350MW of installed capacity. Shell PowerMax™ includes two ranges of products, each with specific characteristics and benefits making them ideally suited for grid-connected applications ranging from small private households to multi-Megawatt power plants.



### Shell PowerMax™ Plus

160W and 150W photovoltaic modules that contain 72 series connected 125 x 125mm<sup>2</sup> multi-crystalline silicon solar cells.

These modules can generate a peak power of 160/150 watts at 34.0/33.0 volts.

- Multi-crystalline silicon solar cells
- High power density for a wide range of installations
- 20 year limited power warranty (category C)\*\*
- 2 year workmanship warranty



### Shell PowerMax™ Ultra

175W and 165W photovoltaic modules that contain 72 series connected 125 x 125mm<sup>2</sup> mono-crystalline silicon solar cells.

These modules can generate a peak power of 175/165 watts at 35.4/35.0 volts.

- Mono-crystalline silicon solar cells
- Maximum power density – where space is a limitation
- 25 year limited power warranty (category D)\*\*
- 2 year workmanship warranty

\* except North America and Japan

\*\* See Shell Solar Limited Warranty for PV-Modules

\*\*\* -C/-LCA options only

### The Shell PowerMax™ advantage

#### Exceptional Performance

- High efficiency crystalline solar cells which maximise light to electricity conversion
- Industry leading energy yields in a wide variety of climates
- Products rated on fully stabilised initial power so you get the power you pay for
- Ideal for large systems with a TÜV Safety Class 2 rating of 1000Vdc\*\*\*

#### Proven Reliability

- Module design proven over 30 years of field operations with reliability in excess of 99.9%
- A 25 year (Shell PowerMax™ Ultra) and 20 year (Shell PowerMax™ Plus) limited power warranty backed by a company you can trust

#### Safety by Design


- Suitable for high snow & wind loads
- B2 flammability rating; UL Fire Safety Class C
- Designed to meet the future requirements of IEC 61730 (safety) and IEC 61215 Ed.2 (design) standards\*\*\*

#### Shell Easy-Install

- Cables and Multi-Contact® plugs pre-assembled to reduce installation time
- Low profile junction box which does not interfere with mounting structures\*\*\*
- 12 mounting holes available per framed module; up to 4 grounding holes



## Product Applications and Designs

Application	Standard Residential and Commercial		Power Plants	Roof Integrated
Option	-C	-PC	-LCA	-PLC*
Description	framed product	framed product	unframed product with 4 pre-fitted "A" clamps	unframed product
Weight	18.4kg	18.4kg	16.6kg	16.2kg
Mounting Options**	Front-side clamps (not provided) or 12 rear-side frame holes	Front-side clamps (not provided) or 12 rear-side frame holes	"A" clamps only (provided)	None provided
Grounding	2 rear-side frame holes	4 rear-side frame holes	n/a	n/a
Junction Box	low profile Spelsberg IP65	ProCharger™ IP54	low profile Spelsberg IP65	ProCharger™ IP54
Certificates 	IEC61215 TÜV Safety Class 2 B2 flammability rating CE	UL1703 UL Fire Safety Class C	IEC61215 TÜV Safety Class 2 B2 flammability rating CE	UL Recognised Component UL Fire Safety Class C
Limited Power Warranty	25 years (Shell PowerMax™ Ultra); 20 years (Shell PowerMax™ Plus)			Available on request

\* Note this product requires a custom order

\*\* For recommended mounting options see the Shell Solar Installation and Safety Instructions

## Product Options

Shell PowerMax™	Plus 150	Plus 160	Ultra 165	Ultra 175
Standard Residential and Commercial	-C	-C	-C -PC	-C -PC
Power Plants	-LCA	-LCA	-LCA	-LCA
Roof Integrated	-	-	-PLC*	-PLC*

Abbreviations stand for

-C: Framed with Spelsberg junction box and factory assembled cables

-PC: Framed with ProCharger junction box and factory assembled cables

-LCA: Unframed with Spelsberg junction box and factory assembled "A" clamps and cables

-PLC: Unframed with ProCharger Junction Box and and factory assembled cables

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

**See the Shell Solar Installation and Safety Instructions for further information on installation and use of these products.**

**Check with your Shell Solar representative for actual availability of any individual product.**

## Product Types – 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

Shell PowerMax™			Plus 150	Plus 160	Ultra 165	Ultra 175
Rated power	$P_r$	[W]	150	160	165	175
Peak power	$P_{mpp}^*$	[W]	150	160	165	175
Tolerance on peak power		[%]	+/- 5	+/- 5	+/- 5	+/- 5
Minimum peak power	$P_{mpp, min}$	[W]	142.5	152	156.75	166.20
Module efficiency	$\eta$	[%]	11.4	12.1	12.5	13.3
Maximum system voltage	$V_{sys}$	[V]	1,000 (TÜV)	1,000 (TÜV)	1,000 (TÜV)/ 600 (UL)	1,000 (TÜV)/ 600 (UL)
Peak power voltage	$V_{mpp}$	[V]	33.0	34.0	35.0	35.4
Peak power current	$I_{mpp}$	[A]	4.55	4.71	4.72	4.95
Open circuit voltage	$V_{oc}$	[V]	42.6	43.1	44.5	44.6
Short circuit current	$I_{sc}$	[A]	5.10	5.20	5.40	5.43

\* 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

Shell PowerMax™			Plus 150	Plus 160	Ultra 165	Ultra 175
Temperature	T <sub>NOCT</sub>	[°C]	44	44	45.5	45.5
Peak power	$P_{mpp}$	[W]	110	120	120	127
Peak power voltage	$V_{mpp}$	[V]	31	31.5	31.6	32.2
Open circuit voltage	$V_{oc}$	[V]	39.5	40	40.0	40.4
Short circuit current	$I_{sc}$	[A]	3.9	4.0	4.20	4.25

### Temperature coefficients

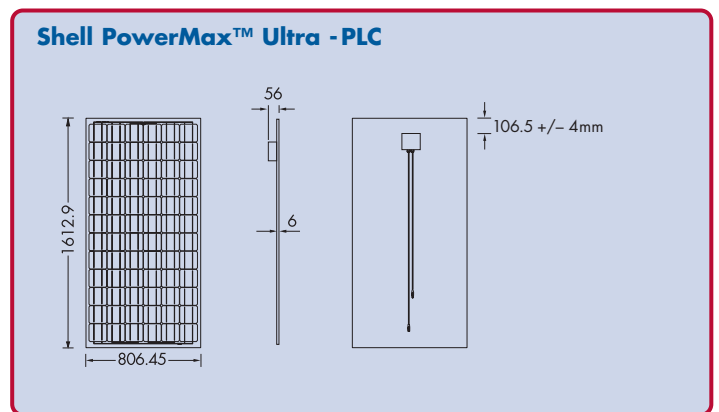
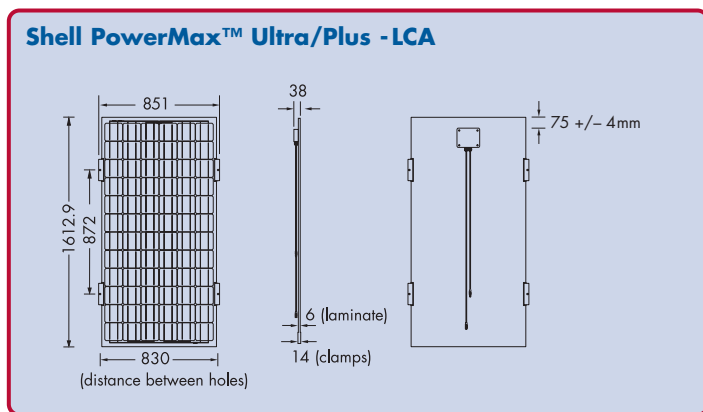
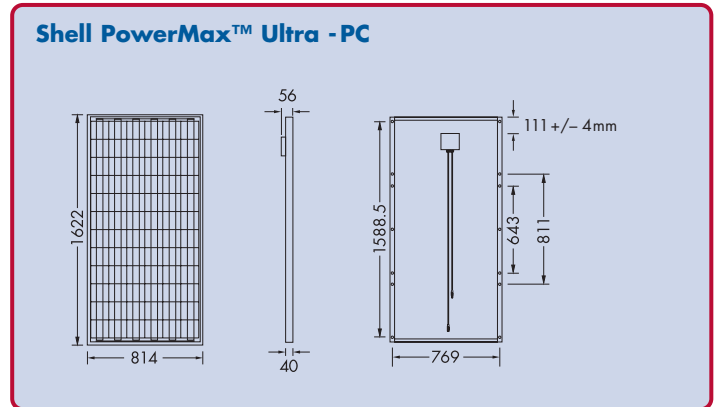
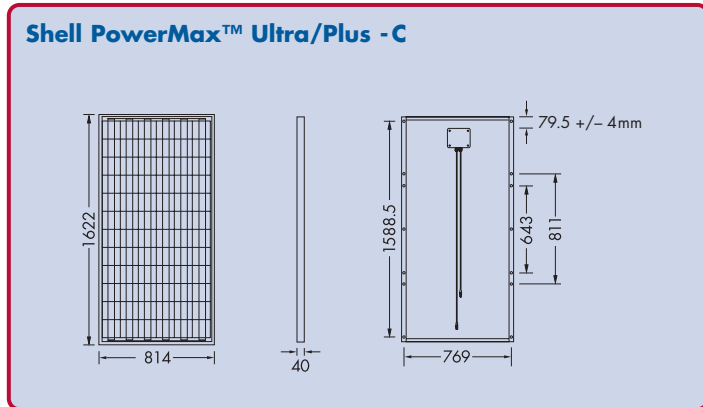
Shell PowerMax™			Plus 150	Plus 160	Ultra 165	Ultra 175
	$\alpha P_{mpp}$	[%/°C]	-0.50	-0.50	-0.43	-0.43
	$\alpha V_{mpp}$	[mV/°C]	-152	-152	-145	-145
	$\alpha I_{sc}$	[mA/°C]	1.45	1.45	1.40	1.40
	$\alpha V_{oc}$	[mV/°C]	-148	-148	-129	-129

### 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%.

## Product Types – Mechanical Characteristics

A torsion and corrosion-resistant anodised aluminium frame ensures dependable performance, even under harsh weather conditions. Pre-drilled mounting holes (12) are provided for ease of installation (-C/-PC).



## Junction Box

Junction Box	Outside dimensions (length x width x height)	Cables (male; female; cross-section)
Low profile Spelsberg IP65	156x100x27 mm	1.3 m; 1.0 m; 4 mm <sup>2</sup>
ProCharger™ IP54	126x111x46 mm	1.3 m; 1.0 m; 4 mm <sup>2</sup>

For ease of installation the junction box includes pre-mounted male and female MultiContact® plugs and flying cables. The junction boxes allow for easy field replacement of diodes and cable assemblies.



### ELECTRICAL EQUIPMENT, CHECK WITH YOUR INSTALLER

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

References in this Product Information 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.

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V3/PowerMax/Grid-Connected/Int/04/05  
Ref-Nr.: 400711

