PV module - TSM-650DE21

Manufacturer	Trina Solar	**Commercial data**	
Model	TSM-650DE21	Availability :	Prod. Since 2021
		Data source :	UL 2021
Pnom STC power (manufacturer)	650 Wp	Technology	Si-mono
Module size (W x L)	1.303 x 2.384 m²	Rough module area (Amodule)	3.11 m²
Number of cells	2 x 66	Sensitive area (cells) (Acells)	2.91 m²

Specifications for the model (manufacturer or measurement data)

Reference temperature (TRef)	25 ° C	Reference irradiance (GRef)	1000 W/m²
Open circuit voltage (Voc)	45.3 V	Short-circuit current (Isc)	18.44 A
Max. power point voltage (Vmpp)	37.4 V	Max. power point current (Impp)	17.39 A
=> maximum power (Pmpp)	650.4 W	Isc temperature coefficient (muIsc)	8.5 mA/° C

One-diode model parameters

Shunt resistance (Rshunt)	400 Ω	Diode saturation current (IoRef)	0.116 nA
Serie resistance (Rserie)	0.16 Ω	Voc temp. coefficient (MuVoc)	-130 mV/° C
Specified Pmax temper. coeff. (muPMaxR)	-0.35 %/° C	Diode quality factor (Gamma)	1.04
		Diode factor temper. coeff. (muGamma)	0.000 1/° C

Reverse Bias Parameters, for use in behaviour of PV arrays under partial shadings or mismatch

Reverse characteristics (dark) (BRev)	3.20 mA/V²	(quadratic factor (per cell))	
Number of by-pass diodes per module	3	Direct voltage of by-pass diodes	-0.7 V

Model results for standard conditions (STC: T=25 ° C, G=1000 W/m² , AM=1.5)

Max. power point voltage (Vmpp)	37.2 V	Max. power point current (Impp)	17.54 A
Maximum power (Pmpp)	651.1 Wp	Power temper. coefficient (muPmpp)	-0.35 %/° C
Efficiency(/ Module area) (Eff_mod)	21.0 %	Fill factor (FF)	0.779
Efficiency(/ Cells area) (Eff_cells)	22.4 %