

BTJM Photovoltaic Cell

Triple-Junction with Monolithic Diode Solar Cell for Space Applications



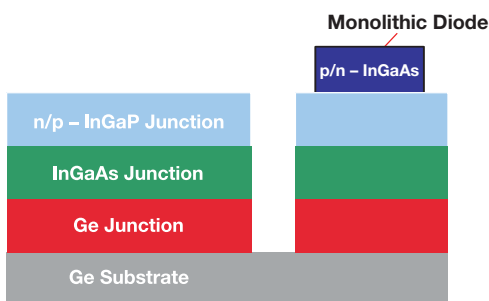
SPACE PHOTOVOLTAICS



Typical Performance Data

Electrical Parameters @ AM0 (135.3 mW/cm ²)	28°C
BOL Efficiency at Maximum Power Point	28.0%
Voc	2.69V
Jsc	17.0 mA/cm ²
Vmp	2.33V
Jmp	16.3 mA/cm ²

BTJM Cell Structure



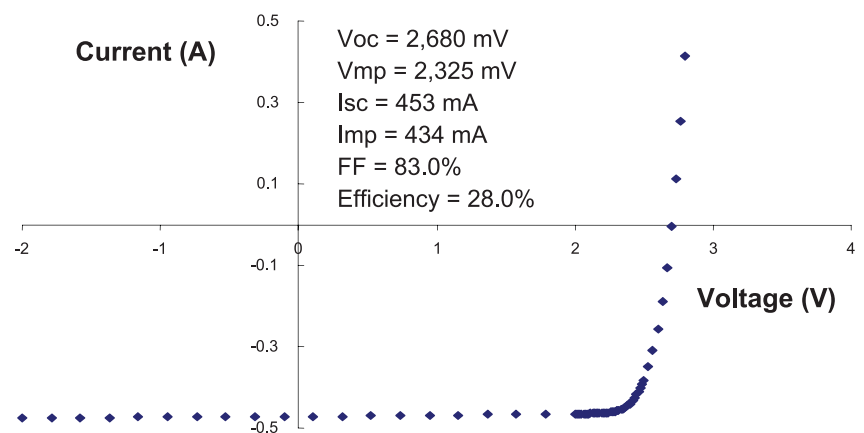
28% Minimum Average Efficiency

Features & Characteristics

- Highest efficiency flight cell with monolithic diode in the market
- Triple-Junction with Monolithic Diode (BTJM InGaP/InGaAs/Ge Solar Cells with n-on-p Polarity on 140- μ m Uniform Thickness Substrate
- Fully space-qualified InGaAs monolithic diode protection in production at Emcore since 2002
- Excellent radiation resistance with P/Po = 0.89 @ 1-MeV, 5E14 e/cm² fluence
- Lowest solar cell mass of 84 mg/cm²
- Designed to accept corner-mounted silicon bypass diode for individual cell reverse bias protection
- Good mechanical strength for reduced attrition during assembly and laydown
- Weldable or Solderable contacts
- Standard and custom sizes available

Typical BTJM Illuminated I-V Plot

Solar Cell Area = 26.6 cm²



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Typical Performance Data

Monolithic Diode Electrical Performance	
$V_{RB} < 2.0 \text{ V} @ I_{RB}$	500 mA, 28°
$I_{RB} < 50 \mu\text{A} @ V_{RB}$	2.5V (Dark), 28°C
$I_{RB} < 200 \mu\text{A} @ V_{RB}$	2.5V (Illuminated), 28°C
$I_{RB} < 10 \mu\text{A} @ V_{RB}$	2.5V (Dark), -150°C
$I_{RB} < 1 \mu\text{A} @ V_{RB}$	2.5V (Dark), +120°C

Key Space Qualification Results

Test Performed	Industry Quality Standard	Typical Test Results
Metal Contact Thickness	4-10 μm	6 μm
Dark Current degradation after reverse bias	$\Delta I_{spec} < 2\%$	<0.4%
Electrical performance after 2,000 thermal cycles -180°C to +95°C	<2%	<0.8%
High-Temperature Anneal at 200°C for >5,000 hrs.	<2%	No measurable difference
Contact pull strength	>300 grams	>1000 grams
Electrical performance degradation after 40 day humidity exposure at 60°C and 95% relative humidity	<1.5%	<0.4%

■ For complete qualification results, please request EMCORE's ATJ Qual Report EWRP036

About EMCORE Corporation



Emcore Photovoltaics Albuquerque, NM

- Incorporated in 1984
- Appx. 900 Employees
- Nasdaq: EMKR

Radiation Performance at 1 MeV Electron Irradiation, EOL/BOL Ratios

Fluence (e/cm^2)	Voc	Isc	Vmp	Imp	Pmp	Efficiency
5E 13	0.97	1.00	0.97	1.00	0.97	0.97
1E 14	0.96	1.00	0.96	1.00	0.96	0.96
5E 14	0.92	0.98	0.92	0.96	0.89	0.89
1E 15	0.90	0.96	0.90	0.94	0.85	0.85
3E 15	0.86	0.90	0.85	0.87	0.74	0.74

Temperature Coefficients

Fluence (e/cm^2)	$\Delta V_{oc}/\Delta T$ (mV/°C)	$J_{sc}/\Delta T$ ⁽¹⁾ ($\mu\text{A}/^\circ\text{C}$)	$V_m/\Delta T$ (mV/°C)	$J_{mp}/\Delta T$ ⁽²⁾ ($\mu\text{A}/^\circ\text{Ccm}$)	Eff/ ΔT (abs. % /°C)
BOL	-6.0	+12	-6.0	+10	-0.064
1E 15	-6.5	+14	-6.4	+12	-0.061

- ⁽¹⁾ J_{sc} is the symbol for normalized Isc
- ⁽²⁾ J_{mp} is the symbol for normalized Imp

Regulatory



EMCORE CORPORATION
ISO 9001 CERTIFIED



EMCORE PHOTOVOLTAICS
AS9100 CERTIFIED