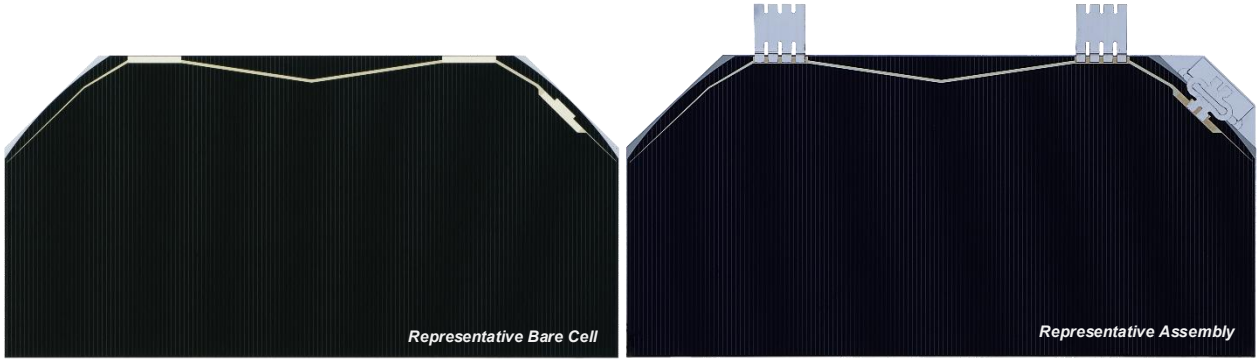
AZUR SPACE
A 5N PLUS COMPANY

32% Quadruple-Junction (QJ) III-V Bare Solar Cells & Assemblies

QJ 4G32-Advanced (4x8)
Standard Thickness Devices

Enabling highest power and voltage for space applications



AZUR SPACE Product Identifiers	Bare Cell	Assembly (SCA / CIC)
AZUR SPACE Material (Part) Number	82859	82358
AZUR SPACE Drawing Number	ZP-0006924	ZP-0006920

AZUR SPACE's 4G32-Advanced bare solar cells and solar cell assemblies ("SCA"), or CICs (cell-interconnect-coverglass) are the ideal solution for space power applications to reach highest power levels on small areas and at low weight. The 4G32-Advanced technology design offers best-in-class beginning-of-life (BOL) and end-of-life (EOL) performances and exceptionally high voltage, enabling a multitude of options and missions.

The 4G32C-Advanced bare cell device is a space-qualified AlInGaP/AlInGaAs/InGaAs/Ge quadruple-junction solar cell originating from a 100 mm germanium (Ge) substrate and provides 32% BOL class efficiency. This device includes AZUR SPACE's proprietary radiation-hardened design for best EOL performance. Our standard cell features well-proven metallization as well as an improved busbar and grid-design with two contact pads plus one for a discrete bypass diode connection and a standard bare cell size of 30.60 cm² (4 cm x 8 cm, or "4x8"). This configuration offers a bare cell total thickness of 195 µm. This 4G32C solar cell is compatible with an external bypass diode, which is also available from AZUR SPACE together with bare cell orders.

The 4G32A assembly includes a bare 4G32C-Advanced solar cell, a corner-mounted silicon bypass diode, welded out-of-plane silver-coated Kovar interconnectors ("ICs"), and a 100 µm AR coated coverglass bonded with space-grade heritage adhesive. The assembly has a standard size of 31.42 cm² (glass size) and has a total device thickness of 330 µm. A digital CAD / CAM STEP file as well as digital device photographs of bare cell or assembly are available upon request.

Other non-standard sizes, thicknesses and configurations are also available upon request. Thickness and mass values and variations of the above standard devices are shown below.

The 4G32-Advanced technology, cells and assemblies are ECSS-E-ST-20-08C (Rev. 1) qualified. These devices are all produced in our mature MRL-10 Heilbronn facility. Our technology and products have demonstrated in-orbit TRL-9 level heritage. AZUR SPACE is certified to ISO 9001:2015 (QMS), EN 9100:2018 (QMS, European equivalent to AS 9100D), as well as ISO 14001:2015 (Environmental) and ISO 45001:2018 (Health & Safety).

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Certified Company

SPACE | 4G32-Advanced (4x8)

32% Quadruple-Junction Bare Solar Cells & Assemblies

QJ 4G32-Advanced (4x8) — Standard Thickness Devices

Design and Mechanical Data	4G32C-Adv. Bare Cell	4G32A-Adv. Assembly (SCA / CIC)
AZUR SPACE Material (Part) Number	82859	82358
Base Material	AlInGaP/AlInGaAs/InGaAs/Ge on Ge	AlInGaP/AlInGaAs/InGaAs/Ge on Ge
AR-Coating	TiO_2/Al_2O_3	TiO_2/Al_2O_3
Outer Dimensions (mm)	40.08 (± 0.05) x 80.08 (± 0.05)	40.26 (± 0.1) x 80.26 (± 0.1)
Cell Area (cm2)	30.60	31.34 glassed area (cell area is 30.60)
Average Weight	≤ 109 mg/cm² / 3.3 grams	≤ 139 mg/cm² / 4.2 grams
Thickness (µm)	195 (± 25)	330 (± 50)
Coverglass	n/a	100 µm AR coated
Contacts	2x front side pads (plus diode pad)	2x interconnects
Interconnect Configuration	n/a	Out-of-Plane
Interconnector Material	n/a	Silver (Ag) coated Kovar
Interconnector Dimensions	n/a	6.5 mm x 7.52 mm x 25 µm

Typical Electrical Performance		BOL		5E13		2.5E14		5E14		1E15		1E16	
		Cell	CIC	Cell	CIC	Cell	CIC	Cell	CIC	Cell	CIC	Cell	CIC
See fina V_{oc}	[mV]	3415	3415	3330	3330	3289	3289	3251	3251	3196	3196	2927	2927
I_{sc}	[mA]	450	445	449	444	448	443	446	441	444	439	360	356
V_{mp}	[mV]	3015	3015	2940	2940	2891	2891	2849	2849	2786	2786	2572	2572
I_{mp}	[mA]	433	428	431	426	429	424	428	423	423	418	321	317
η (1367 W/m²)	[%]	31.3	30.9	30.3	29.9	29.7	29.3	29.1	28.8	28.2	27.8	19.7	19.5
η (1353 W/m²)	[%]	31.6	31.2	30.6	30.2	30.0	29.6	29.4	29.1	28.5	28.1	19.9	19.7

QTR 5466-01-01, QTR 0005927-0100, QTR 0006412-01-00. Spectrum AMO WRC, 1367 W/m2; T=25°C; Fluence 1 MeV [e/cm2]. Other fluence values or proton degradation data available on request. Radiation hardness is periodically assessed.

Typical Temperature Coefficients		BOL	2.5E14	5E14	1E15
		Cell or CIC	Cell or CIC	Cell or CIC	Cell or CIC
$\Delta V_{oc}/\Delta T$	[mV/°C]	-8.4	-8.5	-8.8	-8.9
$\Delta I_{sc}/\Delta T$	[mA/°C]	0.07	0.103	0.142	0.142
$\Delta V_{mp}/\Delta T$	[mV/°C]	-8.6	-8.7	-9.0	-9.0
$\Delta I_{mp}/\Delta T$	[mA/°C]	0.031	0.048	0.071	0.071

QTR 5466-01-01, QTR 0005927-0100, QTR 0006412-01-00; Temperature range 28°C – 140°C; fluence 1 e- MeV [e/cm²]

Other Information	Item	Typical Value
Diode (Assemblies)	External Si Protection Diode	$V_{forward}$ (620 mA) ⩽ 0.8 V (T = 25°C ± 3°C) $I_{reverse}$ (4 V) ≤ 0.1 µA
Threshold Absorptivity	Absorptivity Value	≤ 0.91 (100 µm AR coverglass)
Threshold Pull Test	Pull Test Values	> 1.6 N at 45° (with 12.5 µm Ag strips) > 7.0 N at 0° (with standard Kovar interconnectors)

These performance data reflect a defined configuration at a specific mission environment across a large manufacturing population. Changes in configuration or production order volume may modify typical performance values.

Please refer to the AZUR SPACE **General Information Sheet** for additional information including in-orbit heritage, quality certifications, business licenses, product registrations and general company information at **www.azurspace.com**. Contact information is shown below and is also available on our website.

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