

Enhanced Grade Fuses

Bridging the Gap Between Industrial and Space-Grade Circuit Protection for New-Space Applications

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Schurter Product Portfolio



Fuses



Fuse Holders



Power Entry Modules without Filter



Connectors



Switches



CBE



Filters and Chokes



Supercapacitors



HMI



TrenoLux Railway Lighting

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SCHURTER Aerospace – Who we are today

"Zero Defects": Absolute reliability under the most extreme conditions in avionics and space

- Trusted partner for circuit protection in satellites for decades
- ESA ESCC 4008 qualified SMD fuses
- Highly reliable fuses in thin-film technology with ceramic housing, hermetically sealed and extremely robust
- Attractive Portfolio: the most compact and high-performance fuses on market!















The New-Space dilemma: two options and a gap between them

Industrial fuse

– High volume, commercially attractive
– Short lead-time
– **Limited reliability assurance**
– No quantified failure rate, no marking, no space-specific evidence



The gap

Clearly specified qualification and screening measures tailored to New-Space mission requirements, without implying equivalence to full space-grade qualification

ESCC qualified fuse (MGA-S)

– **Highest level of assurance**
– 100 % screening, periodic testing, controlled changes
– Cost and lead-time sized for institutional programmes
– Disproportionate for many New-Space mission profiles

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One fuse technology, three qualification grades

Same hermetically sealed thin-film element, same 1206 package. The difference is the assurance generated around the part.

	MGA Commercial Grade	MGA-X Enhanced grade	MGA-S ESCC Qualified (Space Grade)
Reliability / Assurance	**Commercial level** (standard test programme)	**Enhanced reliability assurance** (additional screening and control)	**Full ESCC qualification** (highest assurance level)
Qualification Level	**Commercial**	**Intermediate** (beyond commercial, below ESCC)	**ESCC qualified** (ESCC specification)
Lead Time	**12 weeks** (current commercial lead time)	**Target: ≤ 12 weeks** (keep competitive with commercial)	**Longer lead time** (ESCC qualification cycle)
Cost	**Lowest** (commercial)	**Moderate** (additional measures)	**Highest** (ESCC qualification and control)



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Commercial grade MGA: what it provides, and what it does not

Provides

– Hermetically sealed solid-state thin-film fuse, SMD 1206
– Rated currents 0.2 A – 5 A, 125 Vdc
– More than two decades of high-volume production
– ISO 9001 quality system, UL 248-14 approval
– 100 % cold resistance measurement on every lot
– 100 % hermetic seal verification on every lot
– Dimensional check by sampling

Does not provide

– No burn-in screening
– No lot-based accelerated life test
– **No quantified failure rate**
– No marking on the component
– No space-specific environmental evidence

Adequate for industrial use – but limited evidence for a spacecraft integrator who must document component selection for a mission

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Space grade MGA-S: what ESCC qualification provides, and what it costs

< 1 FIT

basic failure rate
ongoing screening data since 2008

168 h

100 % burn-in at +80 °C
on every lot (Chart F3)

24 months

periodic testing of all
Chart F4 subgroups

√2

rating safety factor
relative to commercial MGA

The price of this assurance

– 100 % screening of every lot, periodic qualification maintenance, controlled changes under ESCC rules, supply chain sized for institutional rather than commercial volumes
– **These are precisely the factors that translate into lead-time and unit cost – disproportionate for many New-Space mission profiles**

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Why AEC-Q200 as the foundation

Widely recognised, highest after space-grade

– Third-party-defined stress test qualification

– Methods based on MIL-STD-202 and JEDEC

– Understood by component engineers worldwide

– Referenced in one line of a parts list

Proven at SCHURTER

– AEC-Q200 qualified fuse families: UMT-H, UMT 250, chip fuses

– Automotive customers require it as a matter of course

– Extending an existing flow to a further product is a controlled, moderate effort

New for fuses

– Fuses added only with Revision E, March 2023

– Dedicated fuse table (Table 15)

– Delivers recognised environmental robustness at a cost compatible with commercial volumes

AEC-Q200 was written for the automotive environment, not for space. Each measure added for the MGA-X had to be justified by a risk or a documentation need, not by its presence in the ESCC flow.

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Gap analysis: AEC-Q200 (Table 15) versus ESCC 4008 / 4008/001

Test / requirement	AEC-Q200 Rev E, Table 15	ESCC 4008 / 4008/001 (MGA-S)	MGA-X
Operating life	1000 h at max. operating temp.	2000 h at +125 °C, 95 % IR, periodic	Covered by AEC-Q200 + 1-week HTOL on every lot
Temperature cycling	1000 cycles, min./max. operating temp.	−55/+150 °C, 200 cycles (4008/001 App. A)	Covered by AEC-Q200
High temp. storage · humidity	1000 h · 1000 h at 85 °C / 85 % RH biased	Not included · 56 days 40 °C / 93 % RH	Covered by AEC-Q200
Shock, vibration, terminal strength, soldering	MIL-STD-202, AEC-Q200-005/006, J-STD-002	IEC 60068 / MIL-STD-202 methods	Covered by AEC-Q200
Thermal vacuum	Not included	48 h at +125 °C, 400 % IR on half of samples, periodic	Added to qualification (once)
Breaking capacity	Electrical characterisation, once	Para. 8.6, qualification and periodic	Lot acceptance test on every lot
Time-current characteristic	Electrical characterisation, once	Para. 8.5, screening and periodic	Final check on every lot
Burn-in / FIT from burn-in	Not included	168 h at +80 °C, 100 %; FIT data	Not included – reliability figures from lot HTOL
Periodic tests	Requalification on change only	All Chart F4 subgroups every 24 months	Not included
Marking · documentation	Not required · PPAP on request	ESCC 21700 · CoC, test data	Marking · CoC, lot test report

Green: covered by AEC-Q200 · **Orange**: added for MGA-X · Grey: deliberately not included

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What the MGA-X adds beyond AEC-Q200

Ongoing reliability test

30 parts from every lot · 168 h HTOL at +125 °C, rated current · continuous process monitor, accumulates device hours for reliability figures

Lot acceptance tests

Breaking capacity on 10 parts per lot · time-current characteristic on 30 parts per lot · on top of 100 % cold resistance and hermetic seal

Thermal vacuum

Method of ESCC 4008 para. 8.15 · once in qualification, not periodic · the one space-specific environmental test AEC-Q200 lacks

Marking on the component

Identification of a mounted part during inspection and failure analysis · the commercial MGA is unmarked

Au-Ni terminal finish

Tin-Whisker-free · solderable with leaded and lead-free processes.

Documentation

Certificate of conformance and test report covering the lot acceptance tests with every delivery

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What the MGA-X deliberately does not do

No 100 % burn-in

and therefore, no burn-in-based FIT figure. Reliability figures come from the lot HTOL as device hours accumulate.

No periodic testing

as in ESCC 4008 Chart F4. Requalification follows the AEC-Q200 rules on change of design, material or process.

No √2 rating margin

The commercial rated-current definition is kept (safety factor 1). This gives a wider design range. Thermal margin is provided by derating at system level, as for any commercial part.

Why

Each item adds cost and lead-time out of proportion to the risk it mitigates for the target mission class, given that the fuse element and the hermetic package are unchanged from the qualified MGA-S design. The MGA-X is defined by the specific measures applied, not by a claim of equivalence to a qualification level.

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MGA · MGA-X · MGA-S at a glance

Attribute	MGA (COTS)	MGA-X (Enhanced Grade)	MGA-S (Space Grade)
Qualification	None	**AEC-Q200 Rev E**	ESCC 4008 / 4008/001
Third-party approval	UL 248-1/14	UL 248-1/14	None
Rated current safety factor	1	1	√2
Marking on component	No	**Yes**	Yes
Terminal finish	Sn	**Au-Ni**	Sn-Pb
Thermal vacuum test	No	**Yes, qualification**	Yes, periodic
Lot acceptance: time-current characteristic	Yes	Yes	Yes
Lot acceptance: breaking capacity	No	**Yes**	Qualification and periodic
FIT values from burn-in	No	No	Yes
Reliability figures from ongoing lot test	No	**Yes (1-week HTOL per lot)**	No
Certificate of conformance · test report	No	**Yes · lot acceptance tests**	Yes · Yes
Periodic tests	No	No	Yes

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Implementation Plan

Prototype lots

First MGA-X lots with Au-Ni finish and marking; validation of the lot-level tests

AEC-Q200 qualification

Table 15 on three production lots; thermal vacuum added; 1000 h operating life on the critical path

Q2 2027

AEC-Q200 qualification completed; datasheet and documentation package released

Customer engagement

Evaluation lots for selected New-Space customers; feedback on documentation and reliability figures

Industrialisation

MGA-X flow integrated into standard MGA production and logistics

Activity	Reference / method	Samples	Acceptance criterion
AEC-Q200 stress test qualification	AEC-Q200 Rev E, Table 15	per AEC-Q200, 3 lots	Per AEC-Q200, zero failures
Ongoing reliability test (HTOL, 1 week)	Internal spec.; +125 °C, rated current	30 per lot	No failure; cold resistance drift ≤ 10 %
Breaking capacity lot acceptance test	UL 248-14 / ESCC 4008 para. 8.6	10 per lot	Safe interruption at rated interrupt current and voltage
Time-current characteristic final check	Internal spec.	30 per lot	Within datasheet limits
Thermal vacuum	ESCC 4008 para. 8.15 as method	6	Time-current characteristic within datasheet limits
Au-Ni finish · marking	Solderability (J-STD-002) · marking permanence per AEC-Q200	per AEC-Q200 · tbd	Per AEC-Q200 · legible after stress tests

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Summary

The gap is reliability assurance, not technology

MGA, MGA-X and MGA-S share one hermetically sealed thin-film element and package; the grades differ in qualification, lot-level checks, reliability monitoring, marking and documentation.

An acknowledged standard for new-space grade

AEC-Q200 Rev E, Table 15, is recognised, third-party-defined and already operated at SCHURTER.

Targeted additions, openly stated omissions

Additions	Omissions
Lot HTOL, breaking capacity per lot, thermal vacuum, marking, Au-Ni finish, CoC and test report.	100 % burn-in, periodic tests, √2 margin.

Market Launch Q2/27

AEC-Q200 qualification on three lots expected complete in Q2 2027; customer evaluation lots to follow.

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Lost in the Mission SPCD 2026!

- My dear colleague Swissnaut is lost in Space!!
- Anyone helping her to return will be rewarded with a
- **Schurter Swiss Army Knife**
- **Thanks for your help!**



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