ESCC evolution: Enhanced Grade Component for improving the availability of strategic EEE component in Europe.

Denis Lacombe, ESA, ESCC Deputy executive manager of ESCC
Keplerlaan 1, Postbox 299, 2200 AG Noordwijk, The Netherlands
denis.lacombe@esa.int T +31 634600039
www.esa.int

CMSE 2026, 28-30/04/2026, ESA-TECEDC-HO-2026-001151

Content

- Presentation of ESCC
- New recognition scheme: Enhanced Grade component
- Enhanced Grade examples

What is ESCC about?

ESCC European Space Components Coordination

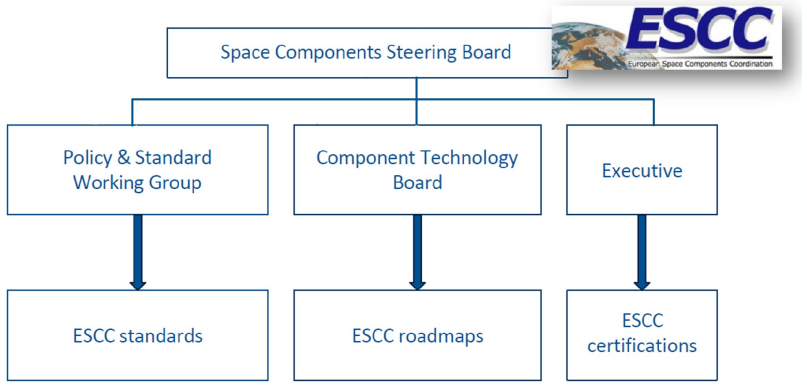
ESCC Stakeholders

- EEE **Manufacturers**
- **Users** through ASD Eurospace
- **Space agencies** - ESA and National Space Agencies
- **Observers** ie European Commission, EDA, JAXA, ISRO

ESCC Goals

- **Harmonizing development efforts and resources** by ESA, European public space organizations, the component manufacturers and user industries.
- **Standardizing procurement procedures, qualification testing,** derating, radiation hardness assurance, test methods, ...
- **Improving the availability of strategic EEE space components** with the required performance and at an affordable cost

ESCC Boards



Specification System

- Basic
- Generic
- Detail
- Policy, Implementation, Support

ESCC Qualification and Certification Schemes

QPL: Qualified Part List

- **Component Qualification** for standard parts (ESCC 20100)

ESCC QUALIFIED PARTS LIST (QPL)

QML: Qualified Manufacturer List

- **Manufacturer Qualification** - Technology Flow Qualification (ESCC 25400)
- Components belonging to the QML are listed in QPL

Page 1 of 47

ESCC QUALIFIED MANUFACTURERS LIST (QML)

PCAL: Process Capability Approval List

- Process Capability Approval (ESCC25600)
- List of Certified Manufacturer process capabilities

ESCC PROCESS CAPABILITY APPROVAL LIST (PCAL)

EPPL: European Preferred Part List

Part 1 - ESCC QPL and QML parts, some JAXA and MIL QPL/QML parts

Part 2 - European parts with the demonstrated potential for qualification
- Other qualification systems
- GaAs and GaN MMICs processes

* *Components listed in EPPL are recognized as preferable in ECSS-Q-ST-60*

Qualification

Certification

All the publications are available at escies.org, including the previous issues

ESCC QPL Qualification Flow

Evaluation stage

Evaluate the manufacturer, the part and its limits

Manufacturer Evaluation - audit of the manufacturer's design, production, test facilities and QMS (Basic Specification 202xxxx)

Component Evaluation - Components/technologies are extensively characterized and tested to destruction to understand reliability margins. (Evaluation Test Programme No. 226xxxx). Constructional analysis.

AUDIT REPORT

EVALUATION TESTING REPORT

(DRAFT) PID

(DRAFT) DETAIL SPEC

Qualification stage

validate the manufacturing flow and operations

Screened (Chart F3) and Lot tested (Chart F4) according to the relevant ESCC Generic Spec. (e.g. ESCC 9000 for ICs; ESCC 4001 for film resistors; etc.)

Qualification test report

Final version of PID and Detail specification

Satisfactory close-out of QA-related actions

QPL

ESCC European Space Components Coordination

Maintenance of Qualification

Every 2 years, a subset of the Qualification test
Regular audits

Active ESCC certificates and specifications

- **131** active certificates
- **328** part type families
- **48** certified manufacturers
- **650** active ESCC specifications
- **10** different European countries
- **5** Space Agencies with ESCC Executive agreements

cnes CENTRE NATIONAL D'ÉTUDES SPATIALES

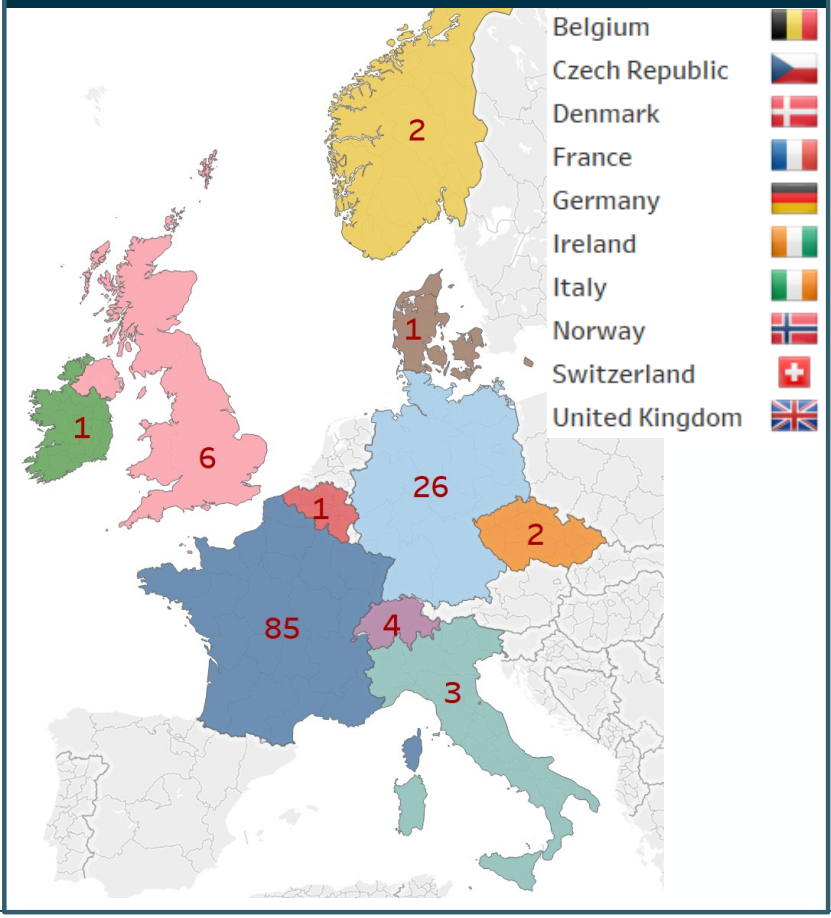
DLR

ENTERPRISE IRELAND

UK SPACE AGENCY

esa * ESA qualifying authority

Number of certificates per countries



The first ESA certificate has been delivered in 1977


european space agency
agence spatiale européenne
europäische weltraumorganisation

Certificate of Qualification

This is to certify that SGS-ATES Agrate Brianza (Italy)

has been qualified by ESA for the supply of C-MOS 4000A Series Integrated Circuits

for use in ESA space programmes, according to ESA/SCC OPL Page 1 Issue 1 Rev. - September 77

as recommended by the Space Components Coordination Group.

This certificate is valid until 31st August 1978

Head of Product Assurance Division | Director Estec | Date 16/6/77

ESA does not incur any liability arising out of the delivery or the use of this certificate.

More information about ESCC

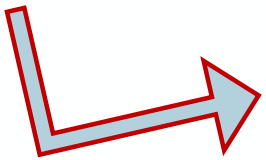
ESCIES European Space Components Information Exchange System

ESCIES www.escies.org

Key Objectives for the New Scheme

- **Cost & Lead Time:** Reduce costs and lead times to increase the availability of space parts.
- **Flexibility:** Maintain manufacturer flexibility by allowing them to propose their own procurement and validation testing specifications.
- **Quality:** Ensure a high level of quality through continued visibility and control by the Executive.

- **Trust:** Maintain a trusting relationship between the Executive and the manufacturer, similar to qualified products.
- **Efficiency:** Reduce testing cost for certified manufacturers during MOQs by leveraging similarity with EG products.
- **Market Growth:** Support the market share of European manufacturers by recognizing EG products.
- **Added Value:** Increase the added value of the EPPL.
- **System Protection:** Avoid disrupting the existing, efficient qualification system already in place with committed manufacturers.



Enhanced Grade

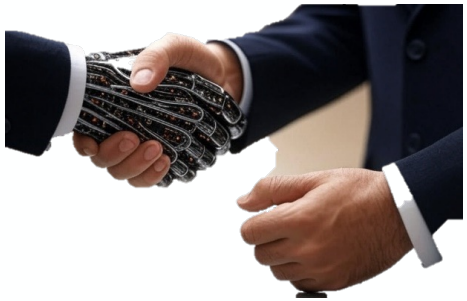
ESCC Enhanced Grade Component

a new quality level integrated into the ESCC system

ESCC Enhanced Grade

EG Characteristics

- Components supplied by manufacturers included in ESCC QML or PCAL
- The selection is under the responsibility of ESCC Executive from CNES, DLR, ESA and UK Space Agency
- It relies on available reliability and test data and manufacturers' procurement specifications
- The Enhanced scheme Grade is defined in a dedicated ESCC Basic Specification ESCC 25700
- Based on manufacturer know-how
- it is not a ESCC qualified component



What are the minimum requirement for ESCC Enhanced Grade Component?

EG Minimum Requirements

- **The manufacturer shall be listed in QML or PCAL**
- The EG Definition shall detail the Manufacturer's particular approach and philosophy for the selection of the component which are intended for recognition
- The component shall be manufactured according to an ESCC approved Enhanced Grade Component Document (EG-CD) and procured according to the manufacturers' procurement specification
- ESCC executive will review and guarantee the maintenance test plan
- ESCC executive will review and guarantee the available reliability data
  - Reliability test data
  - Outgassing according to ECSS-Q-ST-70-02C
  - Radiation test
  - Component with matte pure tin finish, >97% tin shall pass the JESD-201A class 2 requirements or meet the GEIA-STD-0005-2/Level 2B requirements

Why only QML or PCAL listed manufacturers?

Because of trust and Technology Revew Board

The role and responsibilities of the EG-TRB include:

- The EG-TRB is responsible for the internal approval and ongoing oversight of the Manufacturer's specific EG Definition and its associated Enhanced Grade Component Document (EG-CD) (see Para. 5.1).
- Non-Conformance and Process Change Authority. It is responsible for defining and approving corrective actions, assessing the impact, and, when appropriate, informing the ESCC Executive.
- Managing all aspects of EG Validation Testing and all the activities associated with the Maintenance of EG Certification.
- All EG-TRB minutes shall be provided to the ESCC Executive on at least an annual basis.
- The EG-TRB is responsible for proposing specific EG component(s) from within the EG Definition for EPPL 2 certification.

ESCC Qualification and Certification Schemes – To be

QPL: Qualified Part List

- **Component Qualification** for standard parts (ESCC 20100)

QML: Qualified Manufacturer List

- **Manufacturer Qualification** - Technology Flow Qualification (ESCC 25400)

-Components belonging to the QML are listed in QPL

-ESCC Enhanced Grade components, family description

PCAL: Process Capability Approval List

- Process Capability Approval (ESCC25600)
- List of **Certified** Manufacturer process capabilities

- ESCC Enhanced Grade components, family description

EPPL: European Preferred Part List

Part 1 - ESCC QPL and QML parts, ~~JAXA and MIL QPL/QML parts~~

Part 2 - **ESCC Enhanced Grade components, first list expected in Q3 2026**

Part 2~~-3~~
- European parts with the demonstrated potential for qualification
- Other qualification systems
- GaAs and GaN MMICs processes

Qualification

Certification

All the publications are available at escies.org, including the previous issues

First manufacturer candidates for EG implementation

cnes
CENTRE NATIONAL D'ÉTUDES SPATIALES

- Microchip (QML)
- STM (QML)
- Vishay Sfernice (QML)
- 3DPLUS (PCAL)
- Axon' cable (QPL)

DLR

- Infineon (QPL)
- Isabellenhütte Heusler (QPL)
- TESAT (PCAL)
- Rosenberger (QPL)

UK SPACE AGENCY

- Gore UK (QPL)

esa

- Flux (QML)
- IRCA RICA (QML)

Examples of EG part types candidates (1)

Radiation Tolerant Parts, AEC-Q101 qualified

Part Number	Type	Package
BUP06CN015E-01	60V N-channel MOSFET	TO-247
BUP06CN035L-01	60V N-channel MOSFET	SMD
BUP15CN027E-01	150V N-channel MOSFET	TO-247
BUP15CN060L-01	150V N-channel MOSFET	SMD

Testing and Traceability

- Test Flow: 100% electrical test at room temperature. No additional screening.
- SEE & TID (30 krads) performance are covered by tests performed during product qualification.
- Infineon's Change Management Process applies.
- Traceability to manufacturing lot by 4 digit date code.
- Possibility to SLDC with traceability to wafer lot production.

ISA-PLAN Precision Resistors, AEC-Q200 qualified

Part Type	Size	R (mΩ)	Tol. (%)	TCR (ppm/K)	P (W)
FMK	1206	2-6	1/5/10	< 50	3.5
FMP	2010	2-6	1/5	< 50	3.5

- Jumper Parts:
  - FMH-K-R0000 (size 0603)
  - FMI-R000 (size 0805)

Examples of EG part types candidate

Zoppas Industries
Heating Element Technologies

esa

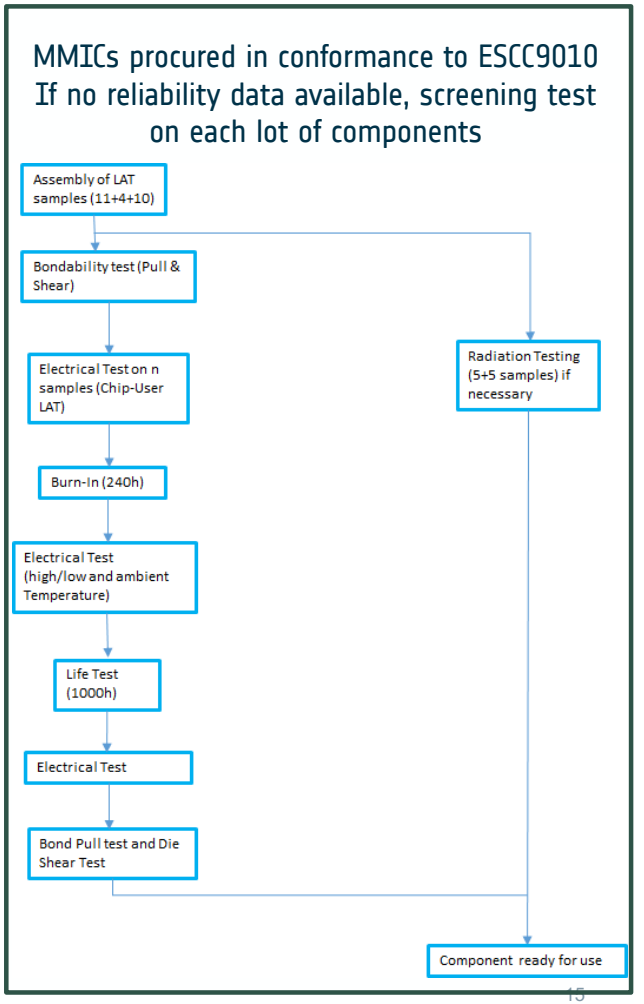
Test Category	Test Description	ESCC	PFM	QM
In-process External Visual Inspection (according to ESCC 2054009)	External Visual Inspection after etching	OK Complete lot	OK Complete lot	OK Complete lot
	External Visual Inspection after 2° Lamination	OK Complete lot	OK Complete lot	OK Complete lot
	External Visual Inspection after Cable Sealing (only cable sealing area)	OK Complete lot	OK Complete lot	OK Complete lot
In-process Electrical Tests	Room Temperature Electrical Measurements (ESCC 4009 - 8.1.3)	OK Complete lot	OK Complete lot	OK Complete lot
Production Control (CHART F2 - ESCC 4009)	Robustness of termination (ESCC 4009 - 5.2.1)	OK	OK	OK Lot start and end
	Dimension check (ESCC 4009 - 5.2.2)	OK (3 pieces per lot)	OK (3 pieces per lot)	OK (5 pieces per lot)
	Weight (ESCC 4009 - 5.2.3)	OK	OK	OK

First EG candidates with 2 quality levels

Test Category	Test Description	ESCC	PFM	QM
Screening Tests (CHART F3 - ESCC 4009)	Room Temperature Electrical Measurements (ESCC 4009 - 8.1.3)	OK Complete lot	OK Statistical Control according to UNI ISO 2859-1 type G, AQL 040	N/A
	Rapid Change of Temperature (ESCC 4009 - 8.2)	OK Complete lot	OK Statistical Control according to UNI ISO 2859-1 type G, AQL 040	N/A
	Overload (ESCC 4009 - 8.3)	OK (5 pieces per lot)	OK (5 pieces per lot)	N/A
	Burn-in (ESCC 4009 - 8.4)	OK Complete lot	OK Statistical Control according to UNI ISO 2859-1 type G, AQL 040	N/A
	High and Low Temperature Electrical Measurement (ESCC 4009 - 8.1.2)	OK (3 pieces per lot)	OK (3 pieces per lot)	N/A
	Final Room Temperature Electrical Measurements (ESCC 4009 - 8.1.3)	OK Complete lot	OK Statistical Control according to UNI ISO 2859-1 type G, AQL 040	OK 5 pieces per lot
	Check for Lot Failure (ESCC 4009 - 6.4)	OK Complete lot	OK Statistical Control according to UNI ISO 2859-1 type G, AQL 040	N/A
	External Visual Inspection (according to ESCC 2054009)	OK Complete lot	OK Statistical Control according to UNI ISO 2859-1 type G, AQL 040	N/A

Examples of EG part types candidates

1. Procured Parts has to fullfill at least **automotive graded standard with reliability data**. In case no reliability data from the part manufacturer are available a Chip User Lat according to ECSS-Q-ST-60-05C will take place.
2. All samples will use the **same manufactures processes** for dispensing, pick&place and wire bonding as described in the **PID**.
3. For all manufactures processes **SPC data are available**.
4. Following **screening tests** will be at least applied on all lots:
   - 100% automatical optical inspection (AOI)
   - AOI verification by AQL based Inline Visual Inspection
   - 100% Burn-In
   - 100% electrical test before and after Burn-In
   - 100% hermetical sealing test (in case of hermetical sealed components)
5. In case of a **non-hermetical module a Temperature Humidity Bias Life Test** (THB) is foreseen on the first lot.
6. In case of failures or findings during production TRB will decide according to TESAT NC-Process.
7. Evaluation of the SPC data and all screening data by the TRB before lot relase.



Enhanced Component Overview

Hermetic Components for Enhanced Grade

Enhanced Component	TESAT Material No.	Discription	Status
X-Band MPA	TM00177928	Frequency Range: 6.875-7.055 GHz Max. Output Power: 3.2W Max. PAE: 60%	Covered within Process Capability Approcal No. 341
X-Band HPA1	TM00189371	Frequency Range: 6.875-7.055 GHz Max. Output Power: Max. PAE: 45%	Covered within Process Capability Approcal No. 341
X-Band HPA2	TM00190417	Frequency Range: 6.875-7.055 GHz Max. Output Power: 50W Max. PAE: 51%	Covered within Process Capability Approcal No. 341

Non-hermetic Components for Enhanced Grade

Enhanced Component	TESAT Material No.	Discription	Status
X-Band MPA	tbd	Frequency Range: 6.875-7.055 GHz Max. Output Power: 3.2W Max. PAE: 60%	Humidity Test outstanding
X-Band HPA1	tbd	Frequency Range: 6.875-7.055 GHz Max. Output Power: Max. PAE: 45%	Humidity Test outstanding
X-Band HPA2	tbd	Frequency Range: 6.875-7.055 GHz Max. Output Power: 50W Max. PAE: 51%	Humidity Test outstanding

Conclusion

ESCC Enhanced Grade component are under the responsibility of the **Technology Review Board** of the manufacturer

ESCC Enhanced Grade component family is described in **Enhanced Grade Component Document (EG-CD)** and procured according to a **manufacturer specification**

ESCC executive will review and guarantee the available reliability data, the maintenance test plan, the EG-CD and the management of ESCC Enhanced Grade component family by the TRB

ESCC Enhanced Grade component will be **listed in EPPL 2**

Thank you for your attention!

ESCIES
European Space Components Information Exchange System

- QPL, QML, PCAL
- ESCC specifications

Contacts

- ESCC Executive Manager
- Ali Zadeh
- Ali.Zadeh@esa.int

- Head of EEE component section
- Karin Lundmark
- Karin.lundmark@esa.int

ESA ESCC executive Team

- Denis Lacombe
- Giuseppe Badolato
- Stephan Hernandez

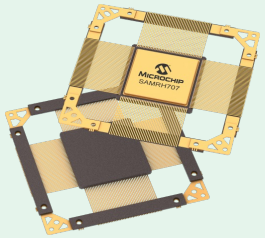
- Denis.lacombe@esa.int
- Giuseppe.badolato@esa.int
- Stephan.hernandez@esa.int

Examples of EG part types candidates (2)

- Microchip France Quality grades definition

MICROCHIP

HERMETIC



ESCC & QML-V

-**SV**: Class V/ESCC9000 compliant

-**SP**
Class P/ESCC9030 compliant

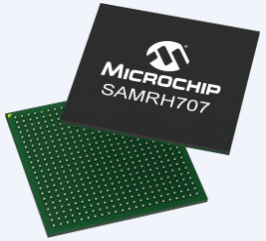
QML-Q
-**MQ**: Class Q compliant

-**HC**
Test 3-temp./inspection

-**E**
Test room temp.

-**HP**
Test 3-temp./inspection

EG candidate



PEMS
Plastic Encapsulated Microcircuits

Examples of EG part types candidates (2)

- HP/COTS Quality comparison

QUALITY REQUIREMENTS		HP – (EG)	COTS
Requirements	Reference Document	Internal procedure	AEC-Q100 JESD47
Traceability and Acceptance			
Single controlled manufacturing baseline	-	X	not required
Wafer Lot traceability and acceptance process	-	X	X
Single wafer lot per datecode/tracecode	-	X	not required
Management			
Extended product Longevity (15+ years)	-	X	not required
Extended PCN program	-	X	not required
Obsolescence Management Program	-	X	X
Extended process monitors	-	X	not required
Minimum Order Quantity	-	X	not required
Access to capability and reliability data	-	X	not required
Lot acceptance and screening			
Wafer Lot traceability and acceptance process	-	X	X
Assembly lot acceptance (bond pull/ball shear tests)	MIL-STD-883 TM2011/JESD22-B116	X	not required
Solderability test	MIL-STD-883 TM2003	X	not required
Electrical test at Tmin/Tamb/Tmax	product specification	X	not required
Thermal cycling / Burn-in	MIL-STD-883 TM1010B/TM1015D	option	not required
Extended Qualification			
Wafer Level Reliability tests – lifetime estimation over operating temp. Range	Internal procedure	X	not available
Specific Assembly Capability tests	Internal procedure	X	not required
Construction analysis	Internal procedure	X	not required
Outgassing	ASTM E595	X	not required
Extended lifetest 4000h/125°C/Vcc max	MIL-STD-883 TM1005	X	not required
Extended biased HAST 192h/130°C/85%	JESD22-A110	X	not required
Lifetest biased HAST 192h/130°C/85%	JESD22-A110	X	not required

Examples of EG part types candidates (2)

- List of HP products available with qualification report

Product	Description	Technology	Package	Availability	Hermetic version in ESCC QML/QPL
AT17LV010	1 Mbit EEPROM	350nm, CSO - 35K5	PLCC20	YES	--
SAMRH71	ARM® Cortex®-M7 µC	150nm, UMC8C - 77K9	TFBGA625	YES	YES
SAMRH707	ARM® Cortex®-M7 µC	150nm, UMC8C - 77K9	TFBGA484	YES	YES
ATmegaS64M1	AVR 8bit µC	350nm, CSO - 35K4	TQFP64	YES	--
ATmegaS128	AVR 8bit µC	350nm, CSO - 35K4	TQFP64	YES	--
SAMV71Q21RT	ARM® Cortex®-M7 µC	65nm, UMC Singapore - 65K1	LQFP144	YES	YES
SAM3X8ERT	ARM® Cortex®-M3 µC	150nm, UMC8C - 58K85	LQFP144	YES	--
VSC8541RT	Ethernet PHY 1 Gbps	65nm, TSMC14 - CLN65	VQFN68	YES	YES
VSC8574RT	Ethernet PHY 1 Gbps	65nm, TSMC14 - CLN65	PBGA256	YES	2025Q4
SAMD21RT	Arm® Cortex®-M0+ µC	110nm,UMC8D - 66K11	TQFP64	25Q1	2026Q1
ATA6571RT	CAN FD transceiver	150nm, UMC8C - 77K3	SOIC14	25Q4	2026

First EG candidates