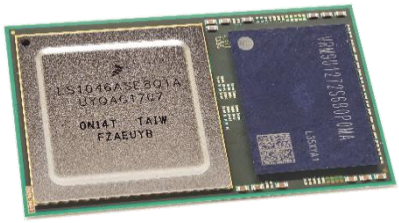
Teledyne e2v Qormino® Family



Radiation Tolerant Space Compute Intensive Module

QLS1046-Space
Quad ARM® Cortex®-A72 Microprocessor & 4GB DDR4 Memory

1 Introduction

QLS1046-Space is a Space Radiation Tolerant Compute Intensive processing module.

It embeds:

- A Quad ARM® Cortex®-A72 Microprocessor (LS1046) running at up to 1.8GHz and bringing 30K DMIPS computing capabilities, integrated packet processing acceleration, high speed peripherals including 10 Gb Ethernet, PCIe® Gen3, SATA 3.0 and USB.
- A 4GB DDR4 memory connected to the Space Microprocessor

QLS1046-Space Flight Models are Radiation Tolerant & Space qualified.

2 Typical end applications

QLS1046-Space is a common computer platform that can serve many applications requiring compute intensive capabilities in Space. See examples below.

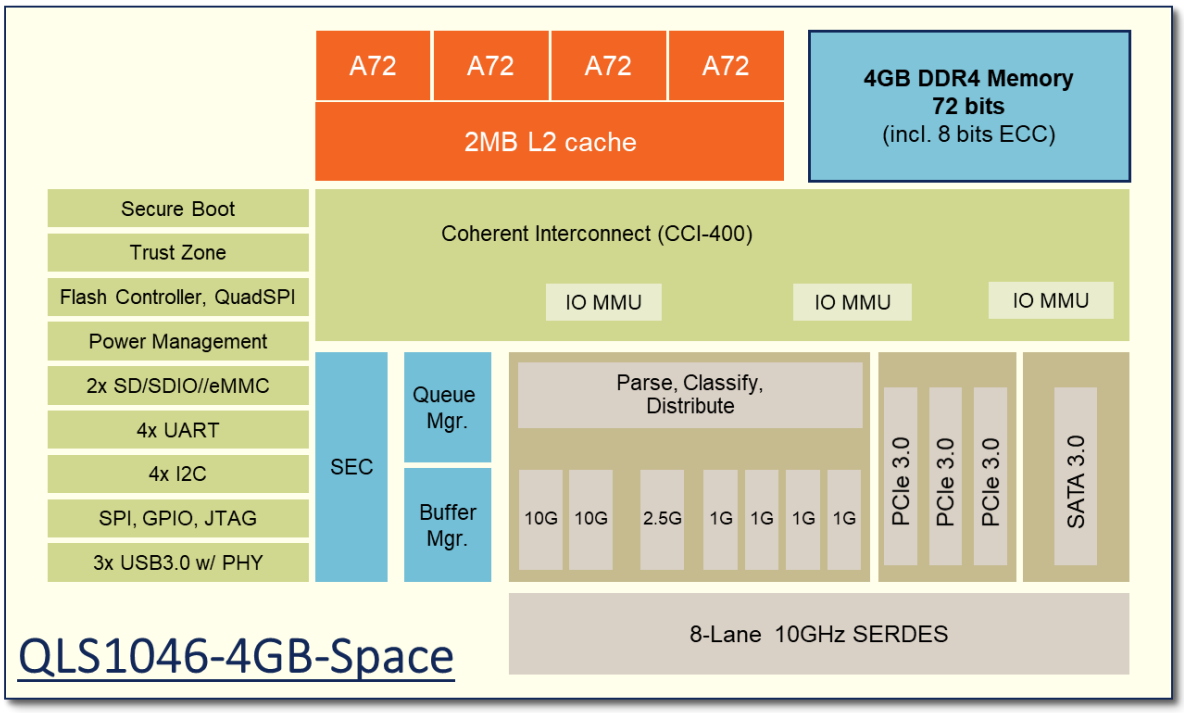
QLS1046-Space is also very useful for platforms in Space and embedding Artificial Intelligence, as it can run deep learning AI algorithms for image processing in Space for example. It brings then the technical benefits of pre-processing information at the edge and reduce the downlink bandwidth when sending to the ground.

In addition, and naturally brought by the product form factor and integration, QLS1046-Space is particularly interesting for project teams willing to reduce their development time, platform size and bill of material.

Typical End applications:

- Communication Satellites / Constellations – Requiring AI / Security
- Human Mission Exploration & Science Missions
- Early Warning, Observation Satellites - Security / Automated situation detection & awareness / AI
- Defense In Space
- High bandwidth Space Observation
- Meteorological Satellites

3 Block Diagram



4 Space Key Features

4.1 Space Qualification

QLS1046-Space Flight Models screening & Lot Acceptance

QLS1046-Space screening & Lot Acceptance are derived from MIL-PRF-38534 and are described in the Space-grade specifications document (reference SP31S222009). The QLS1046 Flight Models are assembled with processors and memories that follow NASA EEE-INST-002 from level 1 to level 3 and ECSS-Q-ST-60-13C for class 3, for screening and qualification.

4.2 Radiation Tolerance (for NASA and ECSS Flight Models)

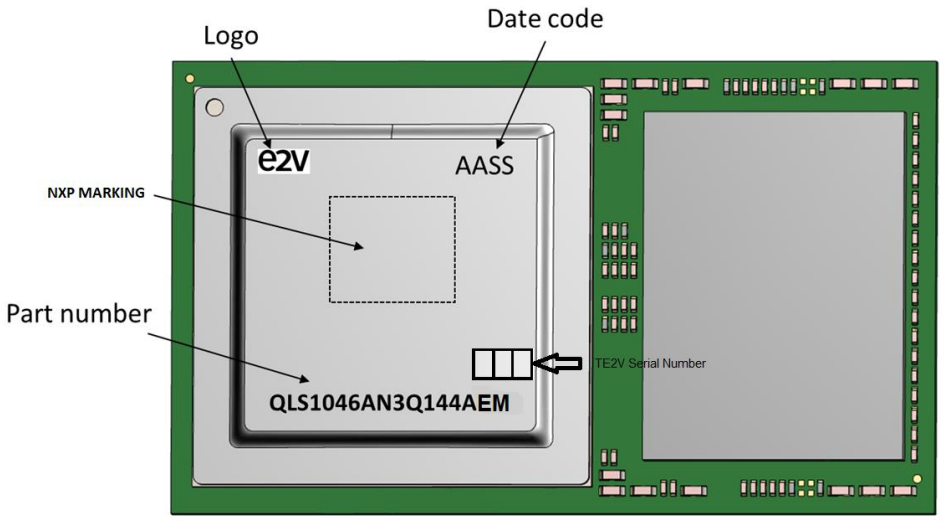
The radiation performance of the module has been extensively characterized, and is summarized below:

- Module general characteristics:
  - TID capability: 100 krad(Si)
  - SEL LET Threshold > 60 MeV.cm²/mg
- Processor specific figures:
  - SEU LET Threshold 1.8 MeV.cm²/mg | Upset cross-section @ 62.5 MeV.cm²/mg = 3.25 E-9 cm²/bit
  - SEFI LET Threshold 1.8 MeV.cm²/mg | SEFI cross-section @ 62.5 MeV.cm²/mg = 7.23 E-5 cm²/device
  - Protons: Data is available up to 190MeV
- DDR4 memory specific figures:
  - SEU evaluated from LET 2.6 MeV.cm²/mg & Upset cross-section @ 60.88 MeV.cm²/mg = 8.73E-12 cm²/bit
  - SEFI evaluated from LET 2.6 MeV.cm²/mg & SEFI cross-section @ 60.88 MeV.cm²/mg = 4.17E-4 cm²/device
  - Protons: Data is available up to 190MeV

Detailed radiation reports are available upon request. A radiation mitigations application note is also available to help customers cope with radiation effects.

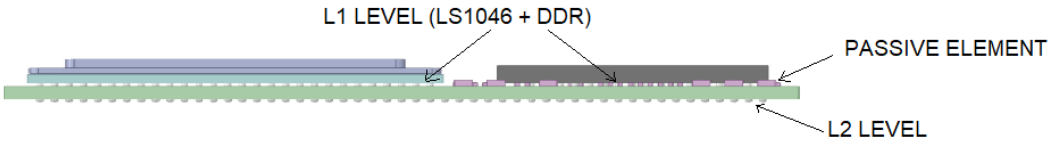
4.3 Package & physical properties

Marking drawing for the QLS1046-Space is given below:



QLS1046AN3Q144AEM	ENGINEERING MODEL WITH ROHS DDR4 & LS10
QLS1046MN1T144AEQM	ENGINEERING QUALIFICATION MODEL
QLS1046MN1T144AFN1	FLIGHT MODEL WITH DDR4 & LS1046A NASA LEVEL 1

The description of the different levels referred to in the ordering information is given hereafter:



Physical properties

- Solder balls composition:
  - RoHs: 96.5% Sn, 3% Ag, and 0.5% Cu
  - SnPb: 63% Sn, 37% Pb
- Mass of the device (refer to ordering information in Section 5):
  - QLS1046xx**1**xxxxA : 9.5g
  - QLS1046xx**3**xxxxA: 9.4g
- CTE of the substrate: ~8ppm/°C
- Outgassing: Compliant with ASTM 595 and ESCC-Q-ST-70-02

General package characteristics are given in the datasheet of the standard version (Datasheet DS60S217489)

5 QLS1046-Space Part numbering Information

Generation [1]	Performance Level	Number of virual cores	Unique ID	Temperature range	Encryption	Configuration (Level 1 / Level 2 / Passives)	CPU Speed	DDR Data Rate	DDR size	Memory type	Product Revision	Quality Level at Module level	Quality Level at LS1046 & DDR4 component levels[4]
QLS = Layerscape	1	04 = four cores 02 = two cores	6	A = Automotive -40°C – 105°C F = -40°C – 125°C M = Military -55°C – 125°C	E = SEC present N = SEC not present	1[2] : SnPb / SnPb / RoHS 3 : RoHS / SnPb / RoHS	P = 1400 MHz Q = 1600 MHz T = 1800 MHz	Q = 1600 MHz 1 = 2100 MHz	4 = 4GB	4 = DDR4	A = Rev 1.0	EM = Engineering Model EQM = Engineering Qualification Model F[3] = Flow derived from MIL-PRF-38534 (Used for Flight Models)	blank blank N1 = NASA Level 1 N2 = NASA Level 2 N3 = NASA Level 3 E3 = ECSS Class 3 X1 = Specific screening flow

1. For availability of the different versions, contact your local Te2v sales office.
2. '1' means full leaded, except for the passives which are RoHs finish but assembled with SnPb solder paste.
3. Custom space flow derived from MIL-PRF-38534 HYBRID MICROCIRCUITS- Screening and Quality Conformance Inspection Requirements for QLS1046A.
4. To know more about processor and memory grades please refer to NE60S220869 in our web page

Orderable Parts

EM:

QLS1046AN1Q144AEM

QLS1046AN3Q144AEM

EQM, FM or X1:

QLS1046MN1T144AEQM

QLS1046MN1T144AF**XX***

*Note: "XX" should be replaced by Grades: N1, N2, N3, E3, X1

6 QLS1046-Space Product Features

Please refer to Teledyne e2v datasheet reference: Datasheet DS60S217489

7 Revision history

This table summarizes revisions to this document.

Issue	Date	Comments
DS 60S 222025	05/22	Initial revision
DS 60S 222025 (A.1)	10/23	Add information about Radiation, outgassing and X1/E3 parts

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