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## **Radiation-Tolerant Quad-Core ARM® Cortex®-A72 1.8GHz Microprocessor**

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### **1 Introduction**

LS1046-Space is a Space Radiation-Tolerant Microprocessor.

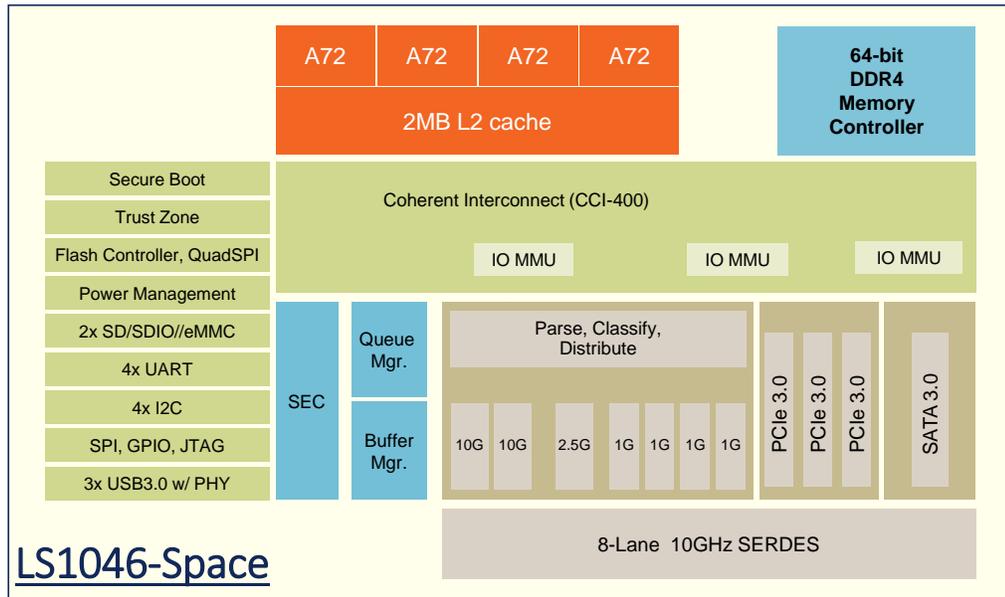
It embeds a Quad-Core ARM® Cortex®-A72 Microprocessor running up to 1.8GHz and bringing 30k DMIPS computing capabilities, with ECC-protected L1 and L2 cache memories for reliable behavior. It features a rich set of peripherals, including integrated packet processing acceleration, high speed serial links supporting 10 Gb Ethernet, PCIe® Gen3, SATA 3.0 and USB, as well as a number of general purpose interfaces such as SPI, I<sup>2</sup>C, and UART.

It is a Space-qualified, radiation-tolerant version of Teledyne e2v LS1046 standard Hi-Rel component. This document provides the specific features and characteristics of the LS1046-Space. From the functional and computing performance point of view, LS1046-Space is equivalent to the standard version. For the general characteristics, the datasheet and reference manual of the commercial version are applicable.

### **2 Typical end applications**

- Communication Satellites / Constellations – Requiring AI / Security
- Observation Satellites - AI / Security / Automated situation detection & awareness
- High bandwidth Space Observation
- Defense In Space
- Meteorological Satellites
- Data Storage / Servers in the Sky
- Human Mission Exploration & Science Missions

### 3 Block Diagram



### 4 Space-Grade Parts Key Features

#### 4.1 Space Qualification

- Up to NASA Level 1 (based on NASA EEE-INST-002 - Section M4 – PEMs)
- Up to Class 1 (ECSS-Q-ST-60-13C)
- Full lot traceability and serializing

#### 4.2 Radiation Tolerance (for NASA and ECSS Flight Models):

Key figures of the radiation performance of the device are highlighted below:

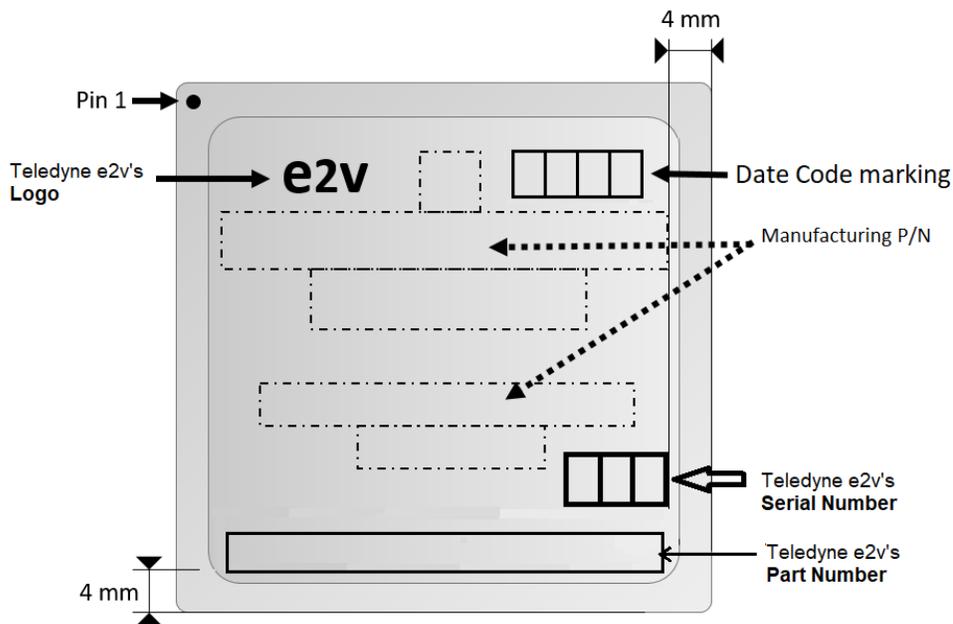
- SEL LET Threshold > 62.5 MeV.cm<sup>2</sup>/mg
- SEU LET Threshold 1.8 MeV.cm<sup>2</sup>/mg    Upset cross-section @ 62.5 MeV.cm<sup>2</sup>/mg = 3.25 E-9 cm<sup>2</sup>/bit
- SEFI LET Threshold 1.8 MeV.cm<sup>2</sup>/mg    SEFI cross-section @ 62.5 MeV.cm<sup>2</sup>/mg = 7.23 E-5 cm<sup>2</sup>/device
- TID 100 krad(Si)<sup>1</sup>
- Protons: Data is available up to 190MeV

Complete radiation reports available for SEE (heavy-ions and protons) and TID testing.

<sup>1</sup> Guaranteed value, unless otherwise specified in the radiation test data report.

### 4.3 Package and physical properties

Marking drawing for the LS1046-Space is given below:



e2v		YYMM
LS1046AMN3T1A - N 1	NASA LEVEL 1	
LS1046AMN3T1A - N 2	NASA LEVEL 2	
LS1046AMN3T1A - N 3	NASA LEVEL 3	
LS1046AMN3T1A - E 1	ECSS CLASS 1	
LS1046AMN3T1A - E 2	ECSS CLASS 2	
LS1046AMN3T1A - E 3	ECSS CLASS 3	

**Physical properties**

- Solder Balls Composition - 63% Sn, 37% Pb
- Mass of the device is 4.06g
- CTE of the package: please contact your Teledyne e2v technical support
- Low outgassing: Compliant with ASTM 595 and ESCC-Q-ST-70-02

General package characteristics are given in the datasheet of the standard version ([Datasheet DS1202](#)).

## 5 LS1046-Space ordering information

LS	n	nn	n	x	t	e	n	c	t	r	Quality Level
Generation	Performance Level	Number of Virtual cores	Unique ID	Core Type	Temperature Range	Encryption	Package Type	CPU Speed	DDR Data Rate	Die Revision	Grade <sup>(1)</sup>
LS = Layer scope	1	04 = four cores  02 = two cores	6	A = Arm	M = Military -55°C – 125°C	E = Encryption  N = Non-Encryption	3 = FCPBGA C4 Pb-free/C5 Leaded	P = 1400 MHz  Q = 1600 MHz  T = 1800 MHz	1 = 2100 MHz	A = Rev 1.0	-N1 = Nasa Level 1 -N2 = Nasa Level 2 -N3 = Nasa Level 3 EM = Engineering Models EQM = Engineering Qualification Models -E1 = ECSS Class 1 -E2 = ECSS Class 2 -E3 = ECSS Class 3 -X1 = Specific screening flow

(1) To know more about grades please refer to NE60S220869 in our web page

## 6 LS1046 Product Features

Please refer to Teledyne e2v datasheet reference: [Datasheet DS1202](#)

## 7 Revision history

This table summarizes revisions to this document.

Issue	Date	Comments
A	March 2021	Initial revision
A.1	October 2021	Add outgassing information
B	January 2022	EQM Engineering Qualification Model/ ref model NE60S220869
C	September 2023	Add TID complementary information and X1 Grade

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