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

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, I²C, 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
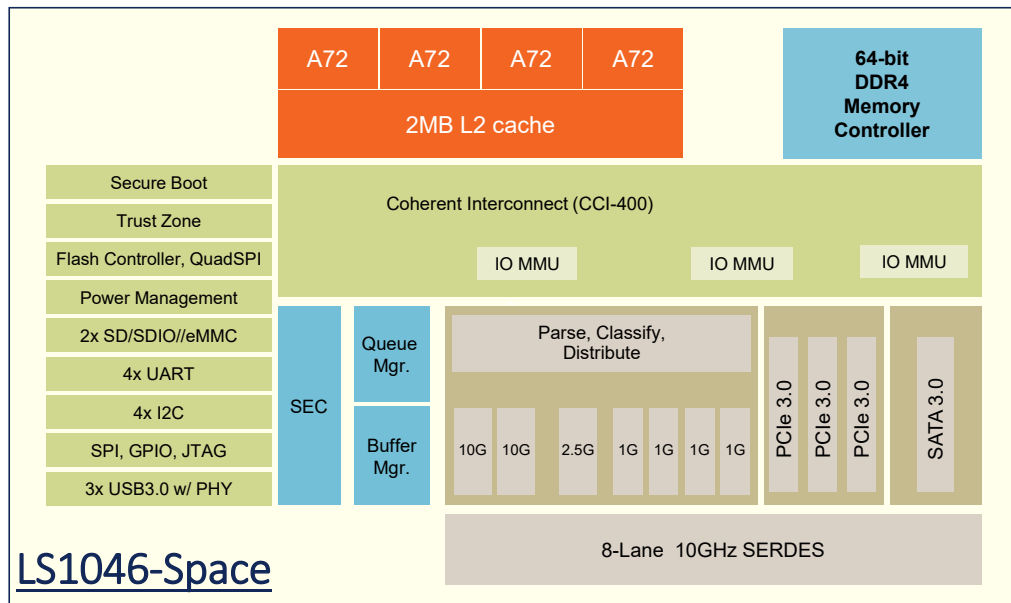
4 Space-Grade Parts Key Features

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)
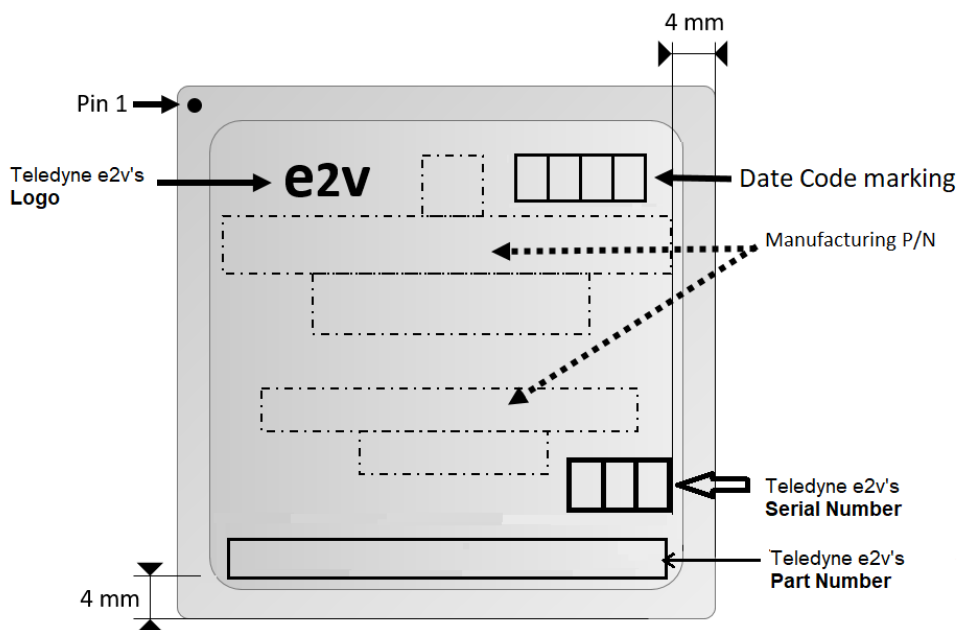- Full lot traceability and serializing

4.2 Radiation Tolerance

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

- SEL LET Threshold > 62.5 MeV.cm²/mg
- 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
- TID 100 krad

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

4.3 Package and physical properties

Marking drawing for the LS1046-Space is given below:

4 mm

Pin 1 →

Teledyne e2v's **Logo** → **e2v**

Date Code marking

Manufacturing P/N

Teledyne e2v's **Serial Number**

Teledyne e2v's **Part Number**

4 mm

e2v   Y Y W W

| L | S | 1 | 0 | 4 | 6 | A | M | N | 3 | T | 1 | A | - | N | 1 | NASA LEVEL 1

| L | S | 1 | 0 | 4 | 6 | A | M | N | 3 | T | 1 | A | - | N | 2 | NASA LEVEL 2

| L | S | 1 | 0 | 4 | 6 | A | M | N | 3 | T | 1 | A | - | N | 3 | NASA LEVEL 3

| L | S | 1 | 0 | 4 | 6 | A | M | N | 3 | T | 1 | A | - | E | 1 | ECSS CLASS 1

| L | S | 1 | 0 | 4 | 6 | A | M | N | 3 | T | 1 | A | - | E | 2 | ECSS CLASS 2

| L | S | 1 | 0 | 4 | 6 | A | M | N | 3 | T | 1 | A | - | 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).

An Important Notice at the end of this datasheet addresses availability, warranty, changes, use in critical applications, intellectual property matters and other important disclaimers.

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 [1]
LS = Layer scape	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

[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

An Important Notice at the end of this datasheet addresses availability, warranty, changes, use in critical applications, intellectual property matters and other important disclaimers.

IMPORTANT NOTICE

Teledyne e2v provides technical and reliability data, including datasheets, design resources, application and other recommendations ("Resources") "as is" at the date of its disclosure. All Teledyne e2v Resources are subject to change without notice to improve reliability, function or design, or otherwise.

These Resources are intended for skilled developers designing with Teledyne e2v products. You are solely responsible for a. selecting the appropriate Teledyne e2v products for your application, b. designing, validating and testing your application, and c. ensuring your application meets applicable standards, and any other safety, security, or other requirements.

Teledyne e2v makes no warranty, representation or guarantee regarding the suitability of these Resources for any particular purpose, or the continuing production of any of its products. Teledyne e2v grants you permission to use these Resources only for the development of an application that uses the Teledyne e2v products described in the Resource. Other reproduction and display of these Resources are not permitted. No license, express or implied, to Teledyne e2v intellectual property right or to any third party intellectual property right is granted by this document or by the conduct of Teledyne e2v.

To the maximum extent permitted by law, Teledyne e2v disclaims (i) any and all liability for any errors, inaccuracies or incompleteness contained in these Resources, or arising out of the application of or use of these Resources, and (ii) any and all express or implied warranties, including those of merchantability, fitness for a particular purpose or non-infringement of intellectual property rights. You shall fully indemnify Teledyne e2v against, any claims, damages, costs, losses, and liabilities arising out of your application of or use of these Resources.

Teledyne e2v's acceptance of any products purchase orders is expressly conditioned upon your assent to Teledyne e2v's General Terms and Conditions of Sale which are stated in any Teledyne e2v's offer and can be found at www.teledyne-e2v.com/about-us/terms-and-conditions/.
The provision of these Resources by Teledyne e2v does not expand or otherwise alter Teledyne e2v's applicable warranties or warranty disclaimers for Teledyne e2v products.

Mailing Address: Teledyne e2v Semiconductors SAS, Avenue de Rochepleine, 38120 Saint Egrève, France.
Telephone: +33 4 76 58 30 00
e-mail: hotline-std@teledyne.com
Copyright © 2021, Teledyne e2v Semiconductors SAS

An Important Notice at the end of this datasheet addresses availability, warranty, changes, use in critical applications, intellectual property matters and other important disclaimers.