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

1 Introduction

LS1046-Space is a Space Radiation-Tolerant Microprocessor.

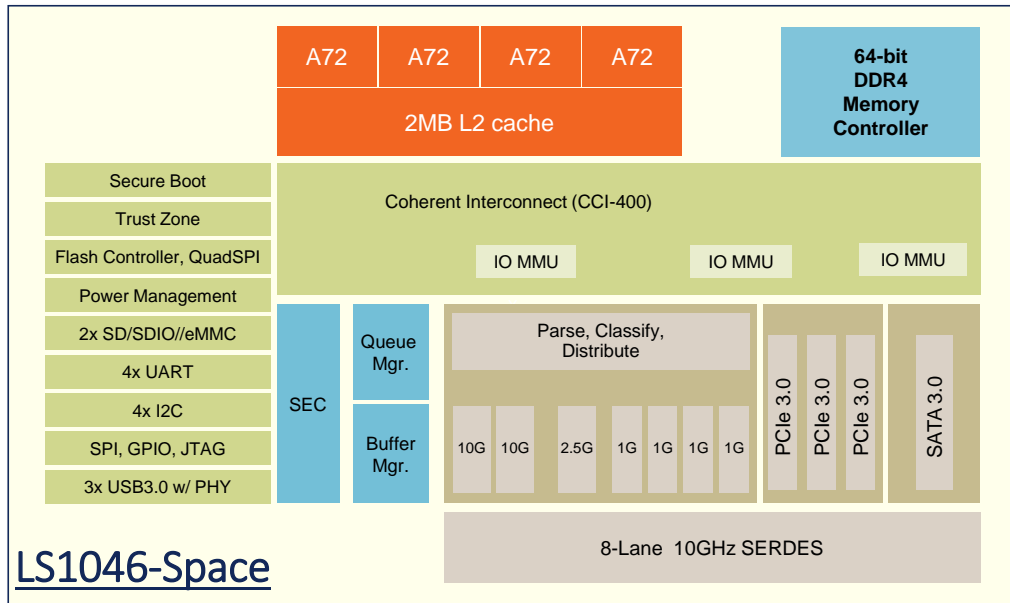
It embeds a Quad-Core ARM® Cortex®-A72 Microprocessor running up to 1.8GHz and bringing 30k DMIPS computing capabilities, with ECC-protected L1 and L2 cache memories for reliable behavior. It features a rich set of peripherals, including integrated packet processing acceleration, high speed serial links 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-60-13)

Up to X1 specific screening flow

Full lot traceability

Full serializing traceability (for NASA and ECSS Flight Model only)

4.2 Radiation Tolerance:

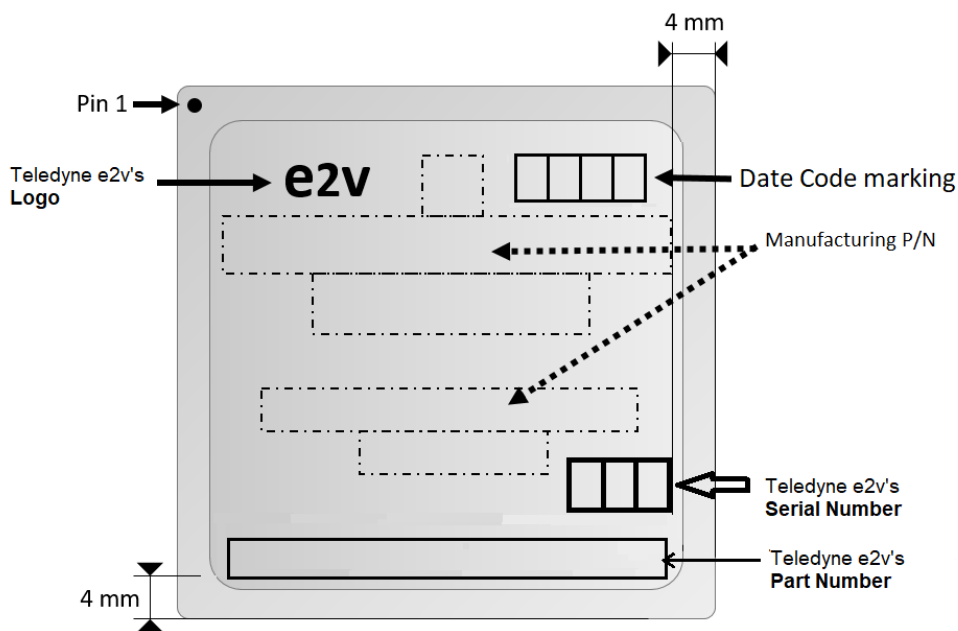
Type	Quality Level			Units
	NASA	ECSS	-X1	
	-N1,-N2,-N3	-E1,-E2,-E3		
SEL immune up to LET :	> 62.5		> 43	MeV.cm ² /mg
SEU - LET Threshold	> 1.8			MeV.cm ² /mg
SEFI - LET Threshold	> 1.8			MeV.cm ² /mg
Radiation tolerance – TID	100		35	krad(Si)
Protons (data available up to)	190			MeV

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

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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

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Physical properties

- Solder Balls Composition - 63% Sn, 37% Pb
- Mass of the device is 4.06g ±0.02
- 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 DS 60S 221109](#).

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	A = Automotive -40°C – 105°C 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 ⁽²⁾ -N2 = Nasa Level 2 ⁽²⁾ -N3 = Nasa Level 3 ⁽²⁾ EM = Engineering Models EQM = Engineering Qualification Models -E1 = ECSS Class 1 ⁽²⁾ -E2 = ECSS Class 2 ⁽²⁾ -E3 = ECSS Class 3 ⁽²⁾ -X1 = Specific screening flow ⁽²⁾

- (1) To know more about grades please refer to NE60S220869 in our web page
- (2) To know more about these following specifications and their screening flows, please contact us:

NASA N1 N2 N3 and ECSS E1 E2 Space Grade Specification	SP 31S 220234
ECSS E3 Space Grade Specification	SP 31S 223962
X1 Specific Screening Flow Space Grade Specification	SP 31S 223961

6 Orderable parts

- LS1046AMN3n1EM*
- LS1046AME3n1EM*
- LS1046AMN3n1EQM*
- LS1046AME3n1EQM*
- LS1046AMN3n1-xx*
- LS1046AME3n1-xx*
- LS1046AAN3n1-zz*
- LS1046AAE3n1-zz*

*Note: replace “n” by CPU speed P, Q, T

*Note: replace “xx” by Grades N1, N2, N3, E1, E2

*Note: replace “zz” by Grades E3, X1

7 LS1046 Product Features

Please refer to Teledyne e2v datasheet reference: [Datasheet DS 60S 221109](#)

8 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
C.1	June 2024	Radiation information provided in a different format Add references to space grade specification and orderable parts
C2	July 2024	Remove confidential marking

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