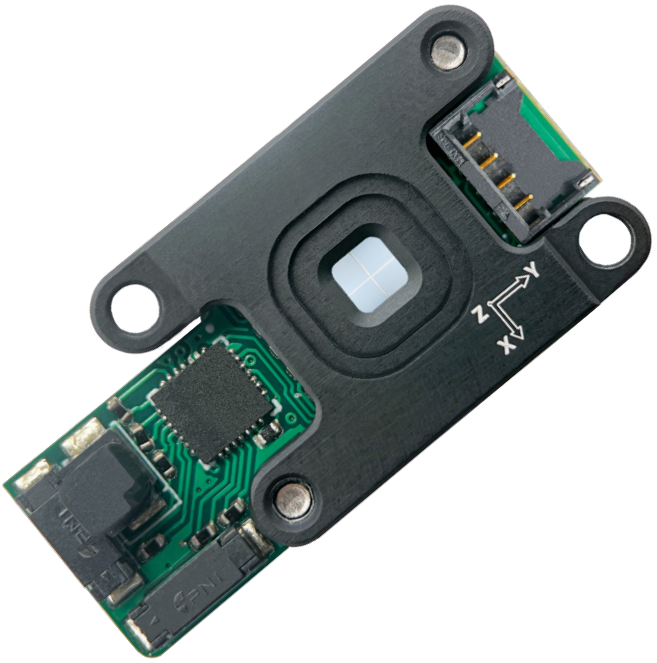
Datasheet for Nano Fine Sun Sensor: TensorFSS-15M



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Product Version	1.3
Firmware Version	2.0.3
Software Version	ftk v1.0.2
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1. INTRODUCTION

1.1 Application and Features

Application	• Attitude Determination • Guidance and Navigation
Features	High Accuracy 2-axis Digital Sun Sensor
	• 0.2 degree accuracy verified under AM0 solar simulator • Calibrate with automated rotary table • UART and I^2C interface
	Low Power Consumption Design
	• Down to 5.5mA at highest sampling rate
	Small Form Factor
	• 22mm * 15mm * 5.2mm • Mass: < 3 gram
	I^2C Bus Stuck Protection
	• Disconnect from bus when SDA/SCL stays low • Failsafe electrical interface for harsh environment
	IPC Class 3 Production and Assembly
	Environmental Test Following NASA GEVS
	Flight Proven (since 2022)

1.2 Description

The TensorFSS-15M is a state-of-the-art 2-axis digital fine sun sensor, purposefully built for small satellite systems. The core QPD architecture circuit, protected with robust failsafe mechanisms, establishes TensorFSS-15M as suitable for satellites exposed to extreme temperatures. The failsafe electrical communication interface ensures the parallel bus to I²C remains operating even if a bus stuck occurs, along with other common failsafe features like a watchdog, brownout reset, etc.

With the ultra-precision processing aperture and low drift circuit design, each TensorFSS-15M is calibrated with the automated rotary table and AM0 solar simulators to ensure that the sensor can produce ultra-precision measurements with an accuracy of up to 0.2 degrees. In addition, the TensorFSS-15M is embedded with the error correction table. Each of the TensorFSS-15M products is distinguished with

an individual in-house calibration to enhance the accuracy compared to other corresponding products on the market. Moreover, its low-power consumption design allows for consuming less than 5.5mA at its highest operating frequency of 16Hz.

Following the NASA GEVS standard, the TensorFSS-15M is the perfect solution for various demanding small satellite applications with the unique precise mechanism, affordable production, numerous functionality, and compliance with the NASA GEVS environmental testing standard.

1.3 Block Diagram

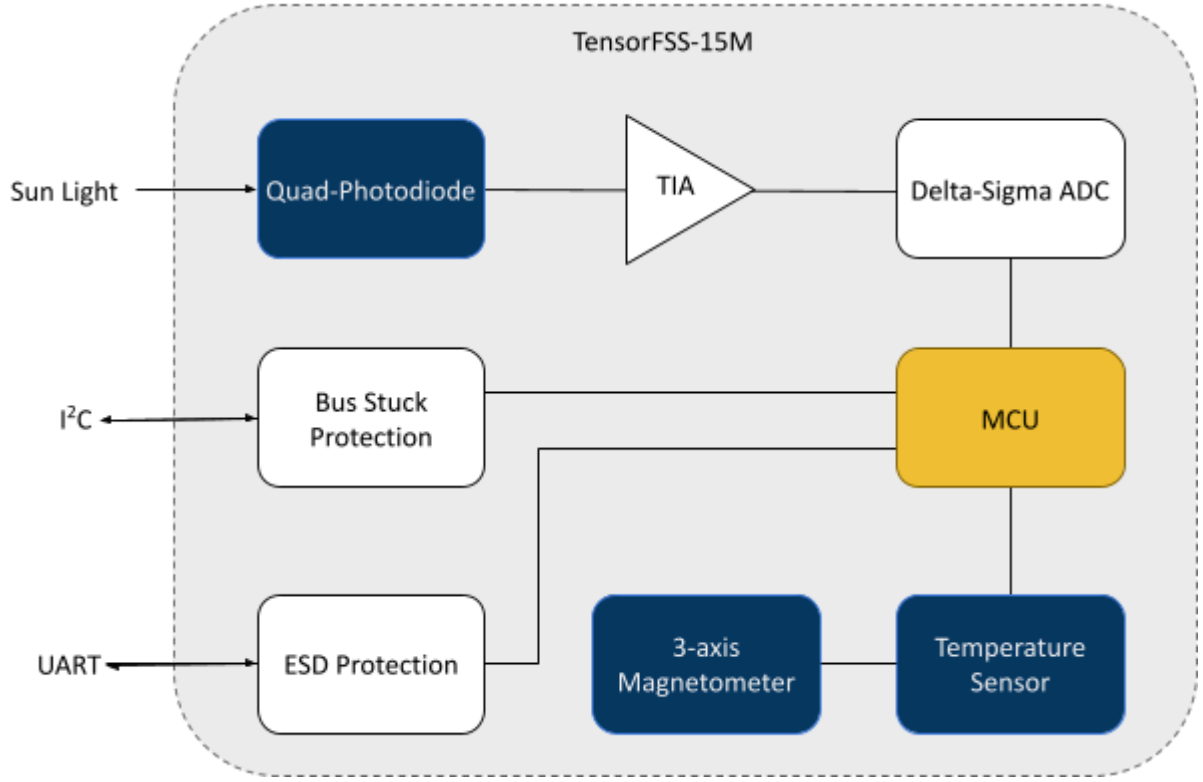

Figure 1-1. TensorFSS-15M Block Diagram

2. SPECIFICATIONS

Table 2-1. Standard Specification

	TensorFSS-15M
Operating Mode	One-Shot Mode, Continuous Mode
Update Rate	4, 8, 16 Hz
Magnetometer	3-axis
I²C Connector	1

UART Connector	1

Table 2-2. Technical Specification

Parameter	Description	Min	Typ	Max	Unit
Sun Angle Accuracy	Incident Sun angle measurement error, 1σ	-	0.2[1]	-	°
Mass	Total Mass (tolerance: ±5%)	-	3.3	-	gram
Length	Dimensions	-	30	-	mm
Width		-	15	-	mm
Height		-	9	-	mm
FOV	Field of View	-	120	-	°
Voltage	3.3V Bus, Operating	3.1	3.3	3.5	V
	3.3V Bus, Absolute Maximum	-0.3	-	3.6	
Current	Operate in Continuous Mode, 16 Hz	-	5.6	-	mA
	Idle	-	3.3	-	
Temperature	Operating	-20	-	85	℃
	Absolute	-40	-	100	
Radiation Hardness (Si)		-	24	-	krad
Magnetic Field Measurement Range(Full Scale, FS)		-800	-	+800	uT
Magnetic Field Measurement Linearity			0.5	-	%FS
Magnetic Field Measurement Noise		-	15	-	nT

[1] Verified under AM0 sun simulator, without albedo. Accuracy test report shipped with each unit.

3. ENVIRONMENTAL TEST

Table 3-1. Summary of the environmental test on TensorFSS-15 models

	QM	EM	FM
CPT	●	●	●
Random Vibration Test	●	-	●
Thermal Cycling Test	-	-	●
Thermal Vacuum Cycling Test[2]	●	-	-
TID Radiation Test[3]	●	-	-

REVISION HISTORY

Date	Editor	Version	Contents
2023.07.15	S. Lee	1.0.0	Initial release.
2023.10.06	S. Lee	1.0.1	Update CH6, accuracy specification
2024.02.19	S. Lee, Z. Liu A. Huang	1.0.2	Description correction: 1. Bus stuck recovery 2. ESD protection of UART bus
2024.03.05	C. Hu	1.0.3	Environmental Test update
2024.06.20	S. Lee	1.0.4a	FSS-15D is no longer available due to the algorithm update.
2024.06.28	A. Huang	1.0.4b	rebrand the product name FSS-15 to the marketing name TensorFSS-15
2024.09.19	S. Lee, A. Huang	1.0.4c	Version 1.3 of the TensorFSS-15 has been retired, and all related content has been removed. Version 1.3 of the TensorFSS-15M remains available for supply.

[2] CPT is executed in every hot/cold plateau.
[3] For TID and SEE tests, LPT is executed while the DUT is exposed to radiation.