

FUSION-640-2560

Single-Chip Dual-Spectrum Module

Technical Specification

Uncooled LWIR thermal imaging · 5 MP monochrome visible imaging · RS422 control · compact payload integration

THERMAL RESOLUTION	VISIBLE RESOLUTION	POWER INPUT	TOTAL WEIGHT
640 × 512	2560 × 1920	DC 5.0–5.5 V	≤70 g

The FUSION-640-2560 is a compact dual-spectrum imaging module integrating long-wave infrared thermal imaging and visible-light imaging functions for embedded electro-optical systems. It provides digital video output, image preprocessing/enhancement, self-test reporting, version query and serial-port online software upgrade functions, making it suitable for compact payloads and multi-sensor platforms.

Dual-spectrum output	Independent visible-light and infrared digital video outputs for system-level image fusion or parallel processing.
Compact and lightweight	Thermal module envelope ≤35 × 35 × 32.2 mm; visible module envelope ≤41 × 23 × 5.5 mm; total weight ≤70 g.
Enhanced imaging functions	Visible-light image enhancement, haze penetration, strong-light suppression, digital zoom and manual image tuning.
Thermal image processing	Automatic/manual NUC, shutter correction disable, polarity switching, gain/brightness control, digital zoom and OSD blanking.

1 Product Overview

The FUSION-640-2560 dual-spectrum module is designed for applications requiring compact infrared and visible-light imaging in a single payload architecture. It supports real-time digital video output, serial communication control, image enhancement and built-in test functions. The module is intended for integration into EO payloads, compact gimbals, vehicle-borne systems, unmanned platforms and other embedded imaging devices.

2 Sensor Specifications

Category	Parameter	Specification
Thermal Sensor	Resolution	640 × 512
	Pixel pitch	12 μm
	Spectral response	8–14 μm
	Defective pixels	Total detector defective pixels: ≤5‰. No defective pixels are allowed in the central area (128 × 104). Outside the central area, clustered defective pixels shall be ≤3 groups.
	MRTD	≤0.45 K (@ 2 cy/mrad, focal length 40 mm, F# 1.1)
	NETD	≤60 mK (@ 25°C, 75% FOV, temporal domain)
Visible-Light Sensor	Resolution	2560 × 1920
	Pixel size	2.5 μm
	Spectral response	0.4–1.1 μm
	Illumination range	200 Lux–170,000 Lux
	Color mode	Monochrome

3 Functional Capabilities

Category	Parameter	Specification
General Functions	Video output	Supports output of visible-light and infrared digital video signals.
	Image preprocessing	Supports preprocessing and enhancement of visible-light and infrared digital images.
	Built-in test	Supports power-on self-test and forced self-test, and reports self-test results.
	Version management	Supports software version reporting and query.
	Online upgrade	Supports online software upgrade through the serial port.
Visible-Light Imaging	Automatic controls	Automatic brightness, automatic gain and automatic exposure.
	Manual adjustment	Manual brightness and contrast adjustment.
	Strong-light suppression	Supports strong-light suppression.
	Enhancement and dehazing	Supports image enhancement and haze penetration / dehazing.
	Digital zoom	1× / 2× / 4× electronic zoom.
Thermal Imaging	NUC	Automatic and manual non-uniformity correction.
	Shutter control	Supports disabling shutter correction.
	Image enhancement	Supports infrared image enhancement.
	Digital zoom	Supports electronic zoom.
	Image control	Polarity switching, gain adjustment, brightness adjustment and

Category	Parameter	Specification
		automatic gain/brightness control.
	OSD	Supports character overlay and blanking.

4 Performance and Image Quality

Category	Parameter	Specification
Performance	Self-test time	≤4 s
	Start-up time	≤8 s
	Image quality	The overall image shall be clear, consistent and uniform, without vignetting, overexposure, stripes, snow noise, aperture artifacts or other visual interference.
Anti-Interference Imaging	Natural background	The module shall provide reliable imaging under front-lighting, back-lighting and other natural background conditions.
	Sun-angle condition	When the angle between the optical axis and the sun is ≥15°, the module shall maintain reliable imaging without excessive overexposure or underexposure.
	Nearby fire source	When a burning object is located 30 m laterally from the target, the module shall maintain reliable imaging.

5 Electrical and Interface Characteristics

Category	Parameter	Specification
Electrical	Power supply	DC +5.0 to +5.5 V
	Power consumption	≤7 W under all operating conditions
Communication	Control interface	Standard asynchronous RS422 communication interface, 115200 bps baud rate
Video Interface	Visible-light video	2560 × 1920 pixels/frame, 25 fps, 8-bit transmission
	Infrared video	640 × 512 pixels/frame, 25 fps, simultaneous 8-bit + 14-bit transmission
	Output channels	One visible-light channel and one infrared channel
Grounding	Grounding requirement	The housing is used as shield ground. The internal circuitry is not connected to chassis ground.

6 Physical Characteristics and Optional Lenses

Category	Parameter	Specification
Mechanical Envelope	Thermal module	35 (±0.3) mm × 35 (±0.3) mm × 32.2 (±0.2) mm
	Visible-light module	41 (±0.1) mm × 23 (±0.2) mm × 5.5 (±0.1) mm
	Total weight	≤70 g
Optional Lenses	Thermal imaging lenses	25 mm / 40 mm / 65 mm
	Visible-light lenses	25 mm / 40 mm

7 Environmental Conditions

Category	Parameter	Specification
Temperature	Operating temperature	-40°C to +65°C

Category	Parameter	Specification
	Storage temperature	-50°C to +75°C
Mechanical Environment	Vibration	Random vibration, all axes, 10 min/axis
	Shock	20 g (or half-sine 10 g), three axes, duration 11 ms
EMC	Electromagnetic compatibility	When integrated with the system, the product shall not interfere with satellite signals.

8 Mechanical Interface and Dimensions

The following drawing summarizes the mechanical interface and main dimensions for the thermal module and visible-light module. Final mounting design should be verified against the formal mechanical interface drawing and project-specific integration requirements.

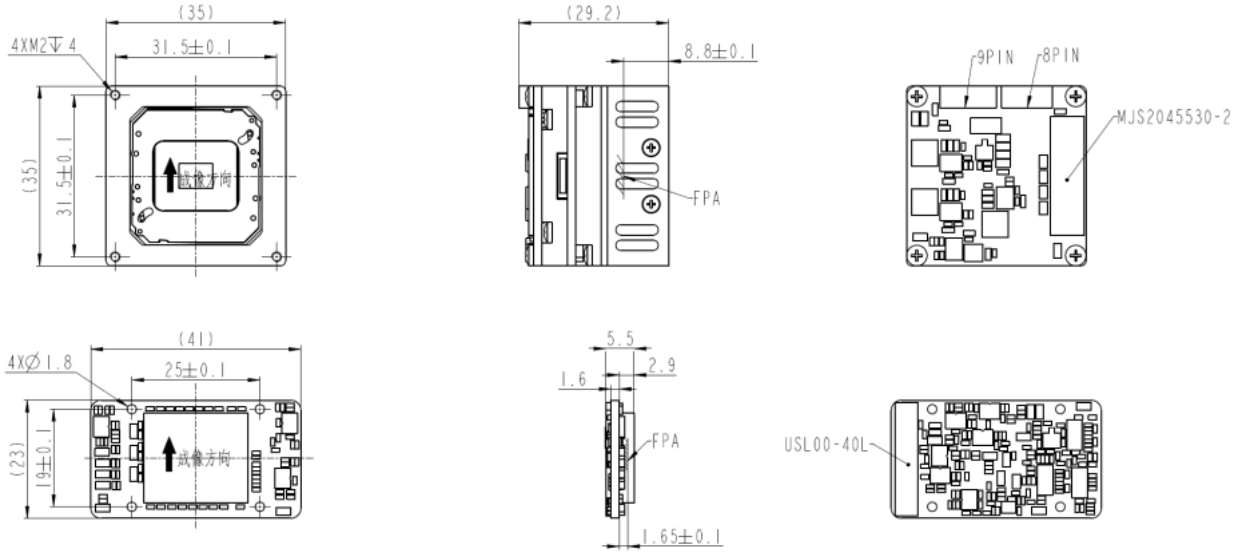


Figure 1. FUSION-640-2560 mechanical interface and envelope dimensions

Category	Parameter	Specification
Mechanical Interface	Thermal module	35 (±0.3) mm × 35 (±0.3) mm × 29.2 (±0.2) mm
	Visible-light module	41 (±0.1) mm × 23 (±0.2) mm × 5.5 (±0.1) mm

9 Delivery and Integration Notes

- The specifications listed in this document describe the standard FUSION-640-2560 module. Final delivery configuration may be adjusted according to lens selection, interface definition and platform integration requirements.
- For system integration, joint verification is recommended for mechanical mounting, power stability, RS422 communication, video timing, thermal management, grounding/shielding and optical-axis alignment.
- All performance values should be interpreted under the test conditions and configuration stated in the corresponding engineering documentation.