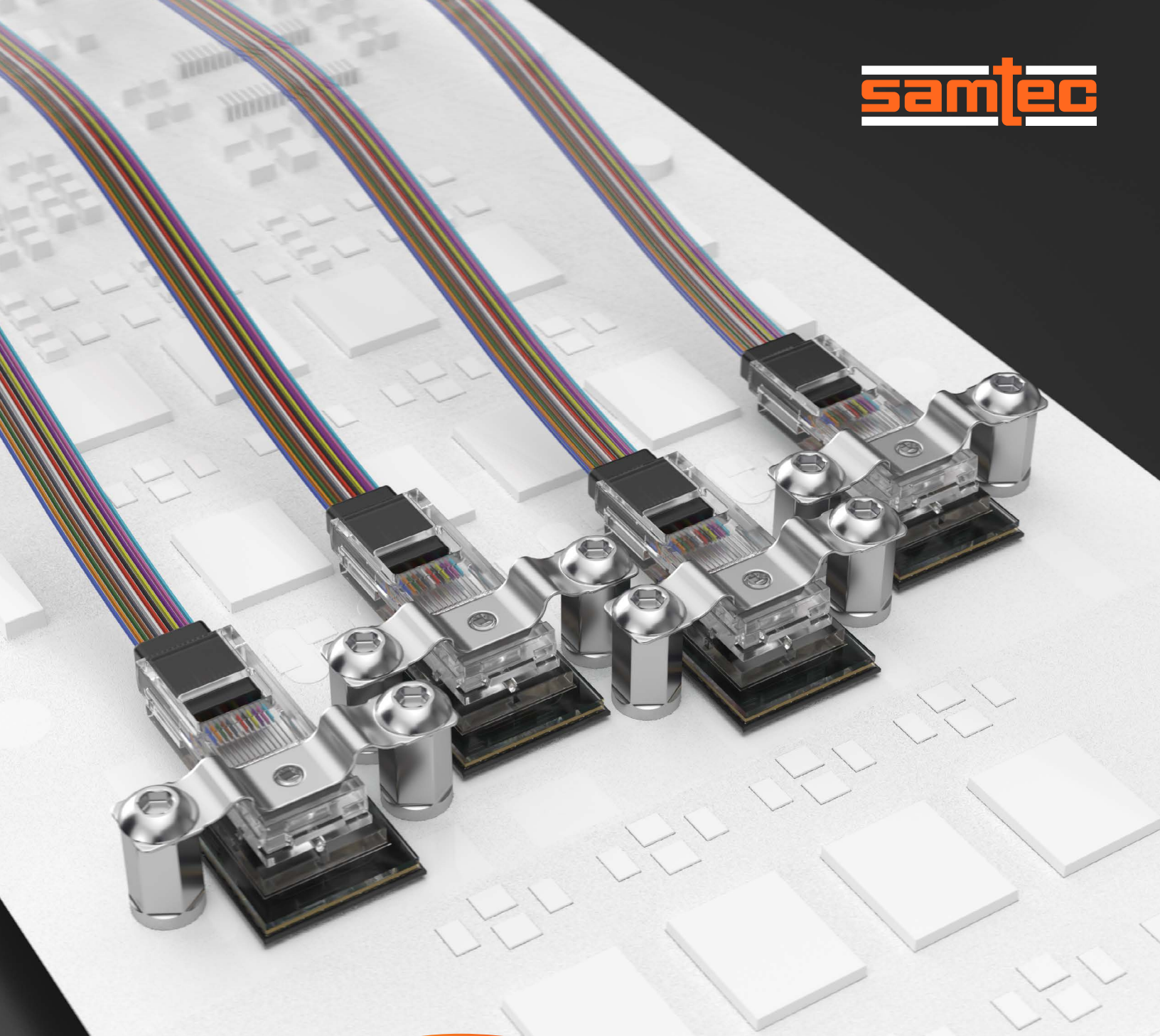


FIREHAWK™

APPLICATION DESIGN GUIDE

FIREHAWK™

RUGGEDIZED OPTICAL TRANSCEIVERS

Samtec's FireHawk™ ruggedized optical transceivers combine extreme density with extreme performance to meet the harshest environments of land, sea, air and space. The innovative design delivers much needed fiber optic bandwidth to a new generation of radar, vision systems, communications networks, surveillance and reconnaissance sensors. FireHawk™ is the smallest optical transceiver on the market for reliable operation in extreme applications.

COMPACT/ EXTREME DENSITY

Smallest footprint in the industry – 10 x 7.7 x 2.5 mm

Lowest profile in the industry – 2.5 mm

Lowest mass in the industry – Less than 0.4 grams

EXTREME PERFORMANCE

Up to 40 and 100 Gbps transfer rates

High-speed digital and active optics

High fidelity electrical and optical coupling

RUGGEDNESS

Rugged BGA board attach withstands high shock and vibration

-40 °C to +85 °C extreme temperatures

Radiation tolerant design

SAMTEC & ULTRA COMMUNICATIONS

TOGETHER, SAMTEC AND ULTRA COMMUNICATIONS COMBINE INDUSTRY-LEADING CUSTOMER SERVICE WITH NEXT GEN TECHNOLOGIES TO SERVE THE MOST ADVANCED MILITARY, AEROSPACE AND SPACE APPLICATIONS.

CONTENTS

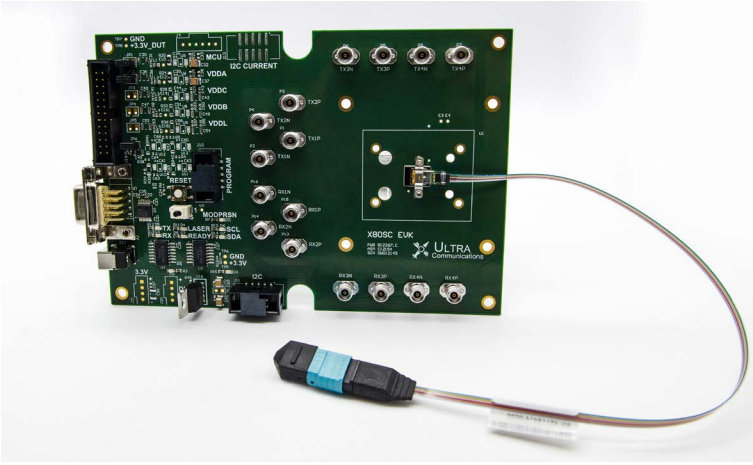
MADE IN THE U.S.A.

FIREHAWK™ OPTICAL MODULES ARE DESIGNED AND MANUFACTURED IN THE UNITED STATES. SAMTEC CAN PROVIDE MODIFIED COTS AND ITAR PRODUCTS TO MEET THE MOST STRINGENT MANUFACTURING PROCESSES REQUIRED BY MIL/AERO AND SATELLITE CUSTOMERS. CONTACT FIREHAWK@SAMTEC.COM FOR MORE INFORMATION.

EVALUATION BOARD

Easy-to-use platform for testing and real time evaluation of Samtec's FireHawk™ optical transceivers to simplify design and reduce time to market. Contact KitsandBoards@samtec.com, or visit samtec.com/firehawk-kits for more information.

- Four receive and four transmit channels (10/25 Gbps)
- Controlled through I2C or RS-232 serial connection
- Control software with GUI provided (GUI interface controls the board, and provides direct access and control of the transceiver and diagnostics through the RS-232 serial connection)
- MPO fiber connection (12-inch fiber ribbon, MTP®)
- Single 3.3 V supply (provided)



RUGGEDIZED
CHIP SCALE PACKAGING

SAMTEC'S FIREHAWK™ CHIP SCALE PACKAGING (CSP)
OPTIMIZES SWAP (SIZE, WEIGHT & POWER) FOR IMPROVED BOARD DENSITY.

ULTRA COMPACT

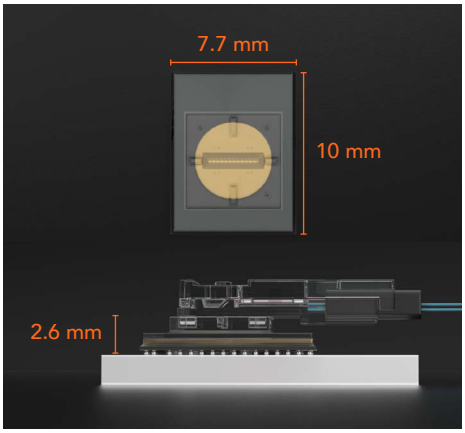
- Less than 0.4 grams total mass for optical swap
- 10 mm x 7.7 mm footprint
- Ultra low 2.5 mm height
- Fully shielded package

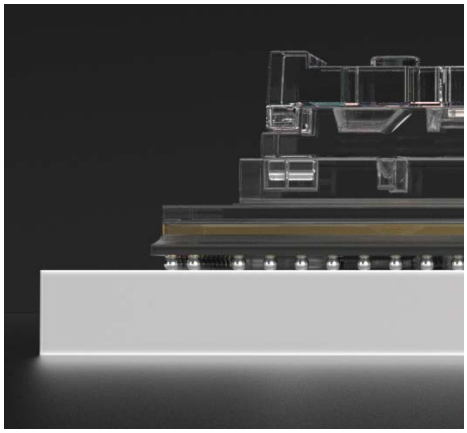
DIRECT BOARD MOUNT

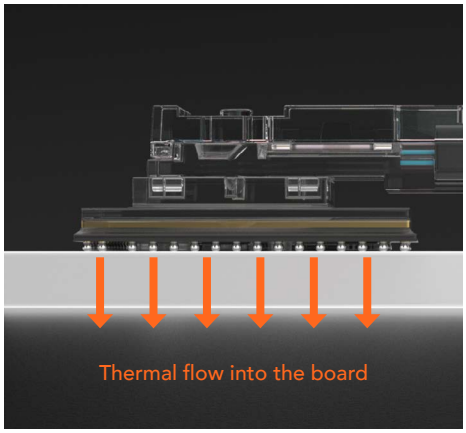
- Direct mount to the PCB board for a robust shock and vibration insensitive connection
- Superior thermal control with direct conductive thermal cooling
- Reflow solderable with standard pick and place pad
- 300 µm solder balls standard (available without)

THERMAL CONTROL

- Direct mount to the PCB board provides the shortest possible thermal path
- Increased VCSEL life and reliability
- Minimum case-junction temperature difference
- Supports extended operational temperature range to 95 °C







HARSH ENVIRONMENTS

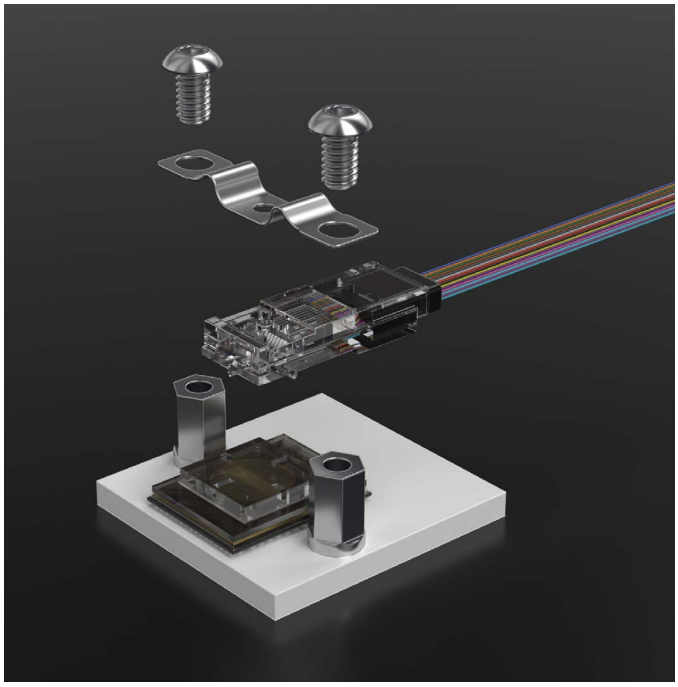
- Meets Mil/Aero requirements like MIL-PRF-38534
- Designed to withstand shock, vibration, electrostatic discharge, temperature cycles, humidity, salt fog and radiation

HUMIDITY	85 °C (85 °C RH) for 1,000 hours; > 95 °C RH for 600 hours (at 60 – 80 °C)
SALT FOG	24 Hours
RADIATION	Single Event: > 75 MeV; Heavy Ion: 3.77E11 n/cm^2; Ionizing Dose (ELDRS): > 63 krad
VIBRATION	20G$_{rms}$
SHOCK	50G
ESD (ELECTROSTATIC DISCHARGE)	Class 1A 250 V HBM; Class 1C 1,000 V HBM
TEMPERATURE CYCLES	-40 °C to +85 °C (standard); -40 °C to +95 °C (also available)

FIREHAWK™ RVCON®
OPTICAL CABLES

RVCON® OPTICAL CABLES ARE REMOVEABLE CONNECTOR/FIBER TERMINATIONS PROVIDING FLEXIBILITY FOR SAMTEC'S FIREHAWK™ CHIP SCALE PACKAGE.

- RVCON® connector transfers the vertical output from the transceiver into optical fibers
- Removeable and replaceable for repair or reconfiguration
- Attaches to the CSP after surface mount processing of the PCB board
- Designed for harsh environments and wide temperature ranges

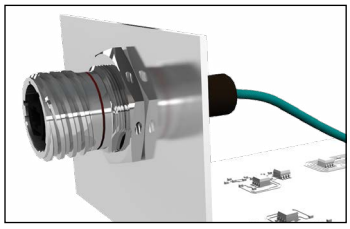


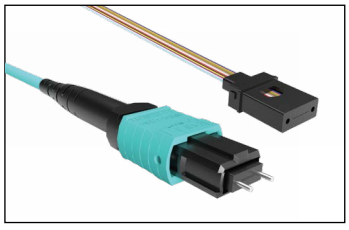
DESIGN FLEXIBILITY

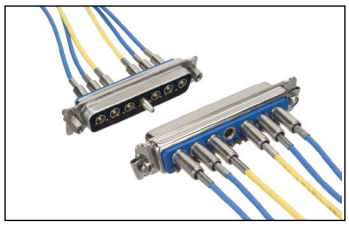
- Standard OM3, rad-hard or customer specified fiber options available
- Ribbon, tubed and breakout fiber options
- MUX/DMUX input and output configurations
- CSP to multiple ends
- Single input to multiple CSPs (1:1, 1:2, 1:3)
- MPO-based standard connection includes MPO (MTP®) and MT ferrule

END OPTION FLEXIBILITY

A variety of end 2 options are available including standard and mil/aero connectors, pins and shells. Contact FireHawk@samtec.com for application specific solutions.





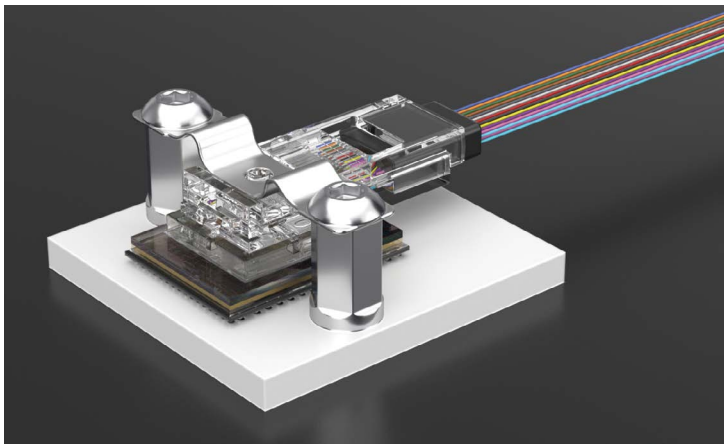


RVCN	END 1 OPTION	END 2 OPTION	FIBER TYPE	CABLE CONFIGURATION	CABLE LENGTH
	–1 = 1 RVCON®	**–3** = MT Ferrule	**–MM** = Multi Mode	**–2** = Jacketed Ribbon	**–XXXX** = Total length in millimeters (mm)

FIREHAWK™ CSPO
FOR MIL/AERO APPLICATIONS

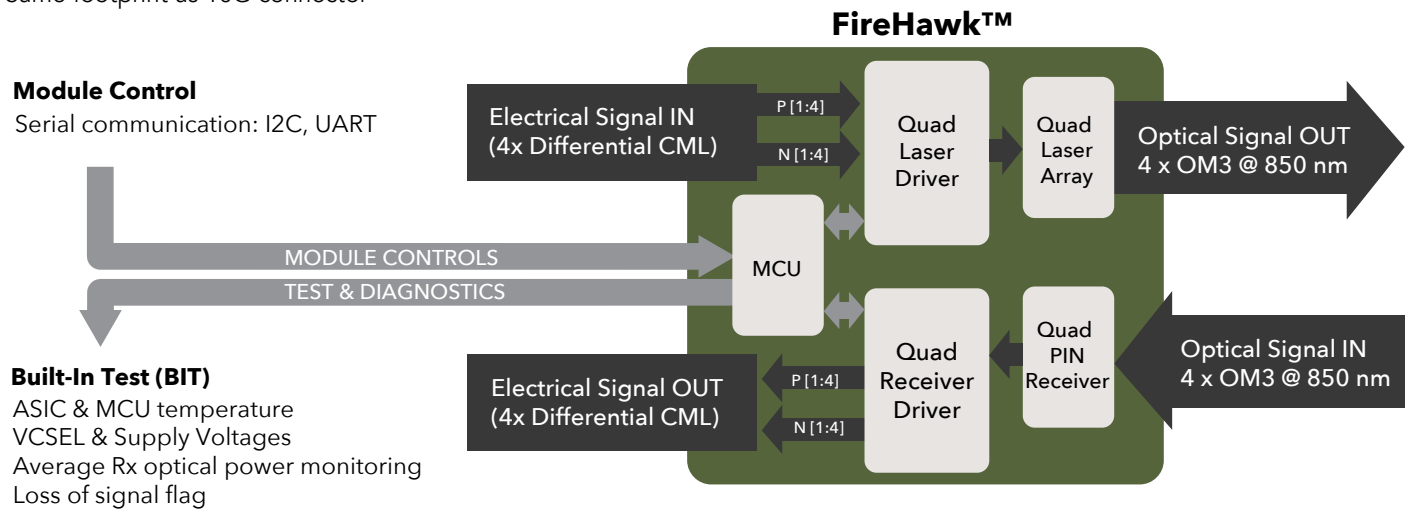
FIREHAWK™ CSPO IS A SMALL EMBEDDED OPTICAL TRANSCEIVER WITH AN INTEGRATED MICROCONTROLLER DESIGNED FOR THE CHALLENGING ENVIRONMENTS OF MIL/AERO APPLICATIONS.

- 10G x 4 data rate (10 Mbps to 10 Gbps per channel)
- SMT reflow solderable package with removeable RVCON™ connector/fiber termination
- Integrated microcontroller automates key functions:
  - Calibration
  - Temperature compensation
  - Register configuration
  - Converts analog BIT into calibrated digital
- 850 nm VCSEL transmitter
- 3.3 V supply voltage; 1.2 W (total power 4 Tx and 4 Rx active)
- -40 °C to +85 °C temperature range (+95 °C available)
- Automatic Gain Control (AGC) for high Rx dynamic range with reduced noise
- Individual channel power-down and squelch



ROADMAP: 25G X 4 FIREHAWK™

- Up to 25 Gbps per channel
- 3.3 V supply voltage; 1.5 W (total power 4 Tx and 4 Rx active)
- Same footprint as 10G connector

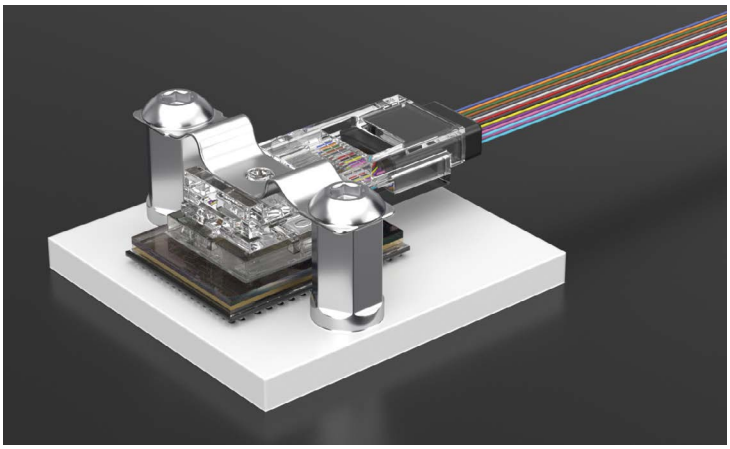


CSPO	WIDTH	DATA RATE	ENVIRONMENT TYPE	0	FIRMWARE	1	BALL TYPE
	–B04 =4 channel, bidirectional	**–10G** = 10 Gbps	**–3** = Military		**–1** = Standard		**–2** = Tin Lead

FIREHAWK™ CSSO FOR SPACE APPLICATIONS

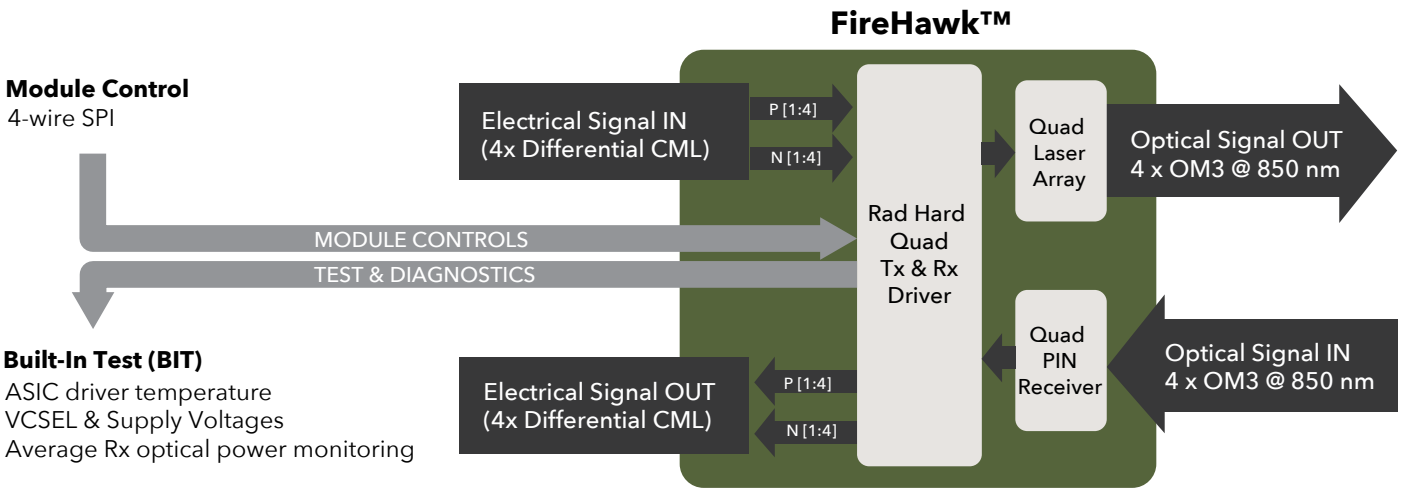
FIREHAWK™ CSSO IS DESIGNED TO WITHSTAND VIBRATIONS & RADIATION IN SPACE APPLICATIONS WITHOUT THE NEED FOR A MICROCONTROLLER.

- 0.4 grams total weight for optimal SWaP
- No internal microcontroller needed
- Radiation tolerant circuitry
- Optical cabling reduces weight and size for longer connections in satellites
- Module management, controls and diagnostics through a Serial Peripheral Interface (SPI)
- 850 nm VCSEL transmitter
- Automatic Gain Control (AGC) for high Rx dynamic range with reduced noise
- Individual channel power-down and squelch



RAD-HARD DESIGN FOR SATELLITES

Internal driver ASIC for the VCSELs and PIN receivers designed using radiation hardened by design guidelines. The result is a robust performing ASIC for use in radiation environments. Please see page 8 for reference charts.



CSSO	WIDTH	DATA RATE	ENVIRONMENT TYPE	0	0	1	BALL TYPE
	–B04 =4 channel, bidirectional	**–10G** = 10 Gbps	**–4** = Space				**–2** = Tin Lead

REFERENCE CHARTS (CSSO FOR SPACE - DATA AVAILABLE FOR UP TO 10G)

DESCRIPTION	CONDITIONS	COMMENTS
ESD	JS-001-20170. 250 V. Class 1	ESD circuits designed for Class 2A
LATCH-UP	JESD78E. Class A	ESD circuits designed for Class 2A

DESCRIPTION		CONDITIONS	EXPOSURE LEVEL	UNITS
SINGLE EVENT EFFECT (HEAVY ION)	Single Event Latch-Up (SEL)	No single event Latch-up	77.8	MeV-cm^2/mg
	Single Event Upset (SEU)	No reset events	< 46	MeV-cm^2/mg
		No permanent damage	> 85.4	
DISPLACEMENT DAMAGE (NEUTRON)	1 MeV equiv. neutron fluence	Pre and post irradiation test for Δ in Tx eye and Rx sensitivity	3.70E+11	n/cm^2
TOTAL IONIZING DOSE (ELDRS)	Ionizing dose of biased and unbiased parts	Pre and post irradiation test for Δ in Tx eye and Rx sensitivity	63.75	krad

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