Single Event Effect (Heavy Ion)
- Single Event Latch-Up (SEL): No single event latch-up, 77.8 MeV-cm²/mg
- Single Event Upset (SEU): No reset events < 46 MeV-cm²/mg, No permanent damage > 85.4 MeV-cm²/mg

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/cm²

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
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 ºC to +85 ºC 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.
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 ºC

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

<table>
<thead>
<tr>
<th>HUMIDITY</th>
<th>85 ºC (85 ºC RH) for 1,000 hours; &gt; 95 ºC RH for 600 hours (at 60 – 80 ºC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SALT FOG</td>
<td>24 Hours</td>
</tr>
<tr>
<td>RADIATION</td>
<td>Single Event: &gt; 75 MeV; Heavy Ion: 3.77E11 n/cm²; Ionizing Dose (ELDRS): &gt; 63 krad</td>
</tr>
<tr>
<td>VIBRATION</td>
<td>20G$_{max}$</td>
</tr>
<tr>
<td>SHOCK</td>
<td>50G</td>
</tr>
<tr>
<td>ESD</td>
<td>Class 1A 250 V HBM; Class 1C 1,000 V HBM</td>
</tr>
<tr>
<td>TEMPERATURE CYCLES</td>
<td>-40 ºC to +85 ºC (standard); -40 ºC to +95 ºC (also available)</td>
</tr>
</tbody>
</table>
- 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.
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 ºC to +85 ºC temperature range (+95 ºC 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

Module Control
Serial communication: I2C, UART

Built-In Test (BiT)
ASIC & MCU temperature
VCSEL & Supply Voltages
Average Rx optical power monitoring
Loss of signal flag

<table>
<thead>
<tr>
<th>CSPO</th>
<th>WIDTH</th>
<th>DATA RATE</th>
<th>ENVIRONMENT TYPE</th>
<th>0</th>
<th>FIRMWARE</th>
<th>1</th>
<th>BALL TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>-B04</td>
<td>-4 channel, bidirectional</td>
<td>-10G</td>
<td>-3 = Military</td>
<td>-1 = Standard</td>
<td>-2 = Tin Lead</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FireHawk™

Optical Signal IN
4 x OM3 @ 850 nm

Optical Signal OUT
4 x OM3 @ 850 nm

Electrical Signal IN
(4x Differential CML)

Electrical Signal OUT
(4x Differential CML)

Quad Laser Driver
Quad Laser Array

Quad Receiver Driver
Quad PIN Receiver

MCU

Module Controls
TEST & DIAGNOSTICS

MCU
MODULE CONTROLS
TEST & DIAGNOSTICS
- 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 BALL TYPE

<table>
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<tr>
<th>CSSO</th>
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<th>ENVIRONMENT TYPE</th>
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<tr>
<td>CSSO</td>
<td>B04</td>
<td>10G</td>
<td>-4</td>
<td>2</td>
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</table>

FIREHAWK™ CSSO IS DESIGNED TO WITHSTAND VIBRATIONS & RADIATION IN SPACE APPLICATIONS WITHOUT THE NEED FOR A MICROCONTROLLER.
### Reference Charts (CSSO for Space - Data Available for Up to 10G)

<table>
<thead>
<tr>
<th>Description</th>
<th>Conditions</th>
<th>Exposure Level</th>
<th>Units</th>
</tr>
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<tbody>
<tr>
<td><strong>ESD</strong></td>
<td>JS-001-20170. 250 V. Class 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LATCH-UP</strong></td>
<td>JESD78E. Class A</td>
<td></td>
<td></td>
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</tbody>
</table>

#### Description

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<td>Single Event Upset (SEU)</td>
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<td>krad</td>
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