



# FireFiber® HMP Series, 2.5Gbps RAD-HARD Optical Transceivers



## General Description

The FireFiber® HMP series transceiver modules provide up to four channels for optical communication at data rates from 100 Mbps up to and exceeding 2.488 Gbps, per channel. They utilize common hermetic packaging and an innovative hermetic fiber feed-through technique. Wavelengths offered include 1310 nm and 1550 nm with various fiber optic interconnect options.

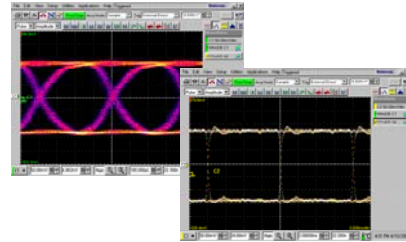
The HMP Series transceivers are designed and fabricated to meet the rigors of military and space qualification via design, assembly, and qualification techniques dictated by MIL-PRF-38534E, EEE-INST-002, and MIL-STD-883F. These optical devices provide enhanced power, size, and mass reduction in addition to EMI, EMP, and Radiation environment immunity over conventional non-optical transceiver modules and copper-based interconnects.

## Features

- Fully customizable channel count (1 – 4)
- various packaging options (single or multi-channel transmitters and receivers, or single and multi-channel transceivers)
- tunable optical output power
- tunable optical receive sensitivity
- Custom and/or standard COTS optical fiber construction and connector options
- Differential inputs and outputs
- Single +3.3V power supply per port
- Low power consumption
- Effectively immune to common ionizing radiation environments – High Energy Proton, Heavy Ion, and X-ray Burst to doses exceeding 1MRad Si.

## Applications

The HMP Series optical transceivers provide low profile, low power, cost effective solutions for high data rate communication in harsh terrestrial, defense, and space environments. The devices are hermetically packaged and historically developed for space and defense applications.



## General Absolute Maximum Ratings\*

Parameter	Symbol	Min	Typ	Max	Units
Storage Temperature	$T_s$	-40	---	125	°C
Lead Soldering Temperature	$T_{SOLD}$	195	---	215	°C
Lead Soldering Time	$t_{SOLD}$	30	60	90	Seconds
Supply Voltage	$V_{CC}$	---	3.3	5.0	V
Differential Output Voltage	$V_D$	---	Varies by product	---	mV

\* “Absolute Maximum Ratings” are given as a threshold to device safety. Stresses beyond these values and stresses within ranges stated for prolonged periods of time may result in damage to the device. The HMP product series is also customizable thus general specifications are subject to slight changes for customized products.

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### General Recommended Operating Conditions\*

Parameter	Symbol	Min	Typ	Max	Units
Operating Temp. Limit	$T_A$	-20	---	85	°C
Supply Voltage	$V_{CC}$	3.15	3.3	3.45	V
Data Output Load	$R_L$	---	50	---	Ohms
Differential Output Voltage	$V_D$	---	Varies by product	---	mV <sub>p-p</sub>

\* subject to change depending on application and/or level of customization

### General DC Electrical Characteristics\*

Parameter	Symbol	Min	Typ	Max	Units
Supply Voltage	$V_{CC}$	3.15	3.3	3.45	V
Supply Current per transmit channel**	$I_{V_{CCTX}}$	90	---	200	mA
Supply Current per receive channel**	$I_{V_{CCRX}}$	60	---	90	mA
Input Bias Voltage	$V_{in}$	---	0.84	0.95	V
Differential Output Impedance	$Z_{out}$	90	105	120	ohm
LOP Output High Voltage	$V_{oh}$	$V_{ccd}-0.1$	---	$V_{ccd}$	V
LOP Output Low Voltage	$V_{ol}$	---	---	0.4	V
Differential Output Voltage Swing	$V_{od}$	---	80	---	mV <sub>p-p</sub>
Output Common-Mode Voltage	$V_{cm}$	---	$V_{ccd}-0.12$	---	V
Power Consumption per transmit channel**	$P_{tx}$	300	---	660	mW
Power Consumption per receive channel**	$P_{rx}$	200	---	300	mW

\* subject to change depending on application and/or level of customization

\*\* varies with speed grade, Re requirement, and I/O termination selected by customer/application

### General Optical Transmit Characteristics\*

Parameter	Symbol	Min	Typ	Max	Units
Optical Output Wavelength	$\lambda_{OUT}$	1270	1310	1380	nm
Extinction Ratio	ER	5	15	35	%
Optical Rise Time*	$t_R$	0.6	1.5	3.0	nS
Optical Fall Time*	$t_F$	0.6	2.0	3.0	nS
Duty Cycle Distortion*	$t_{DCD}$	---	<0.1	0.6	nS
Data Dependent Jitter*	$t_{DDJ}$	---	<0.1	0.7	nS
Optical Output Power	$P_O$	-7.0	1.0	7.0	dBm

\* subject to change depending on application, speed grade, and/or level of customization

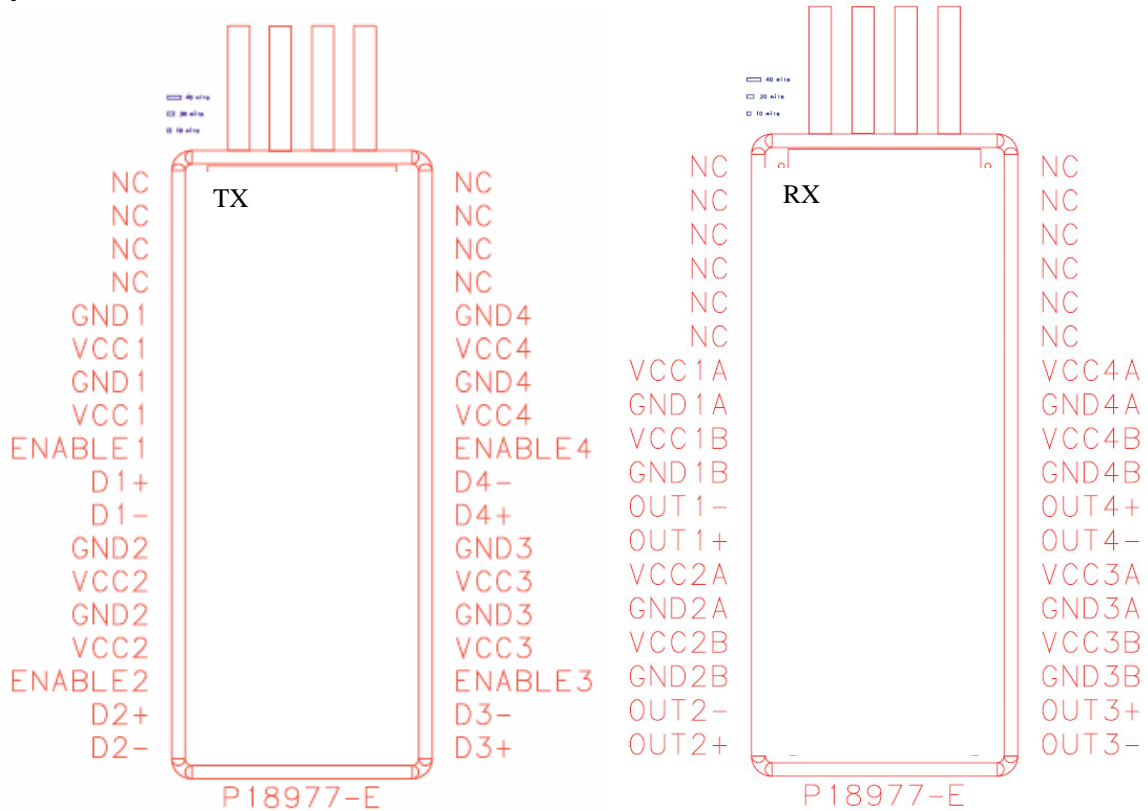
### General Optical Receive Characteristics\*

Parameter	Symbol	Min	Typ	Max	Units
Optical Wavelength	$\lambda_{IN}$	1280	1310	1380	nm
Optical Sensitivity*	$P_I$	-25	-20	-15	dBm
Input Duty Cycle Distortion*	$t_{DCD}$	---	---	1	nS
Input Data Dependent Jitter*	$t_{DDJ}$	---	---	0.76	nS
Signal Detect Assert Time*		---	<10	100	µS
Signal Detect Deassert Time*		---	<10	350	µS

\* subject to change depending on speed grade, application, and/or level of customization

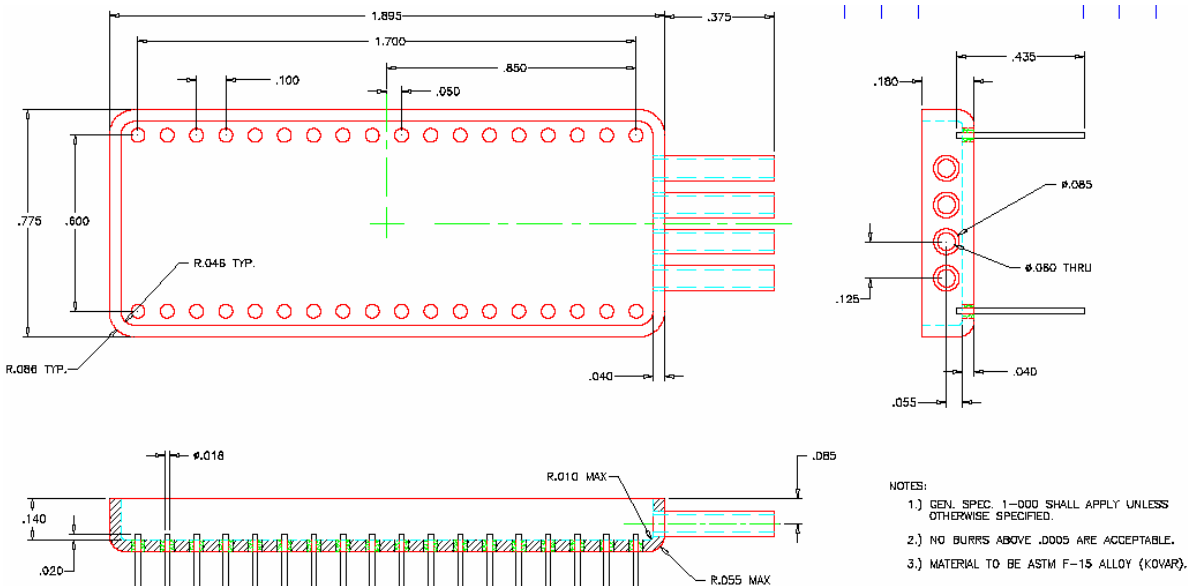
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## Sample Quad Channel TX / RX Pin-Out \*



\* subject to change depending on application and/or level of customization

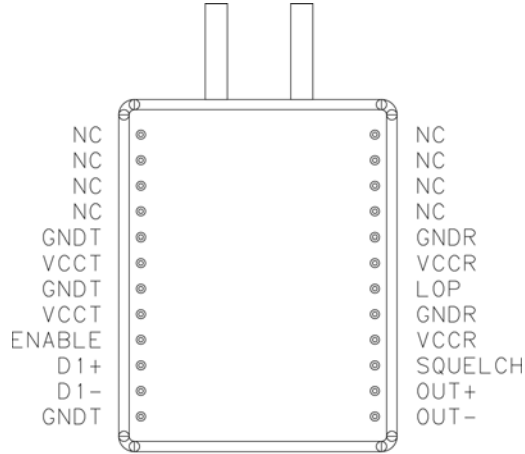
## Sample Quad Channel TX / RX Packaging\*



\* subject to change depending on application and/or level of customization

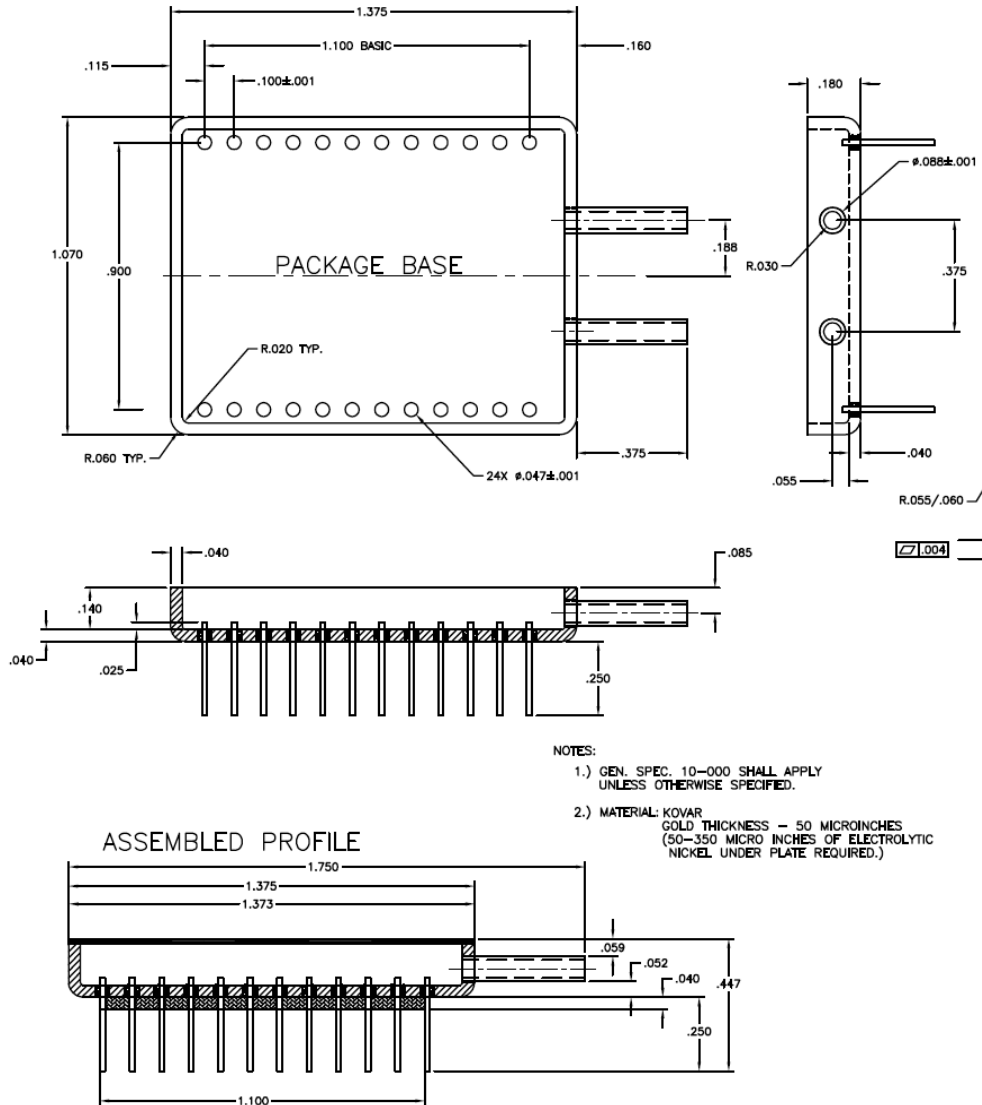
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## Sample Single Channel TRX Pin-Out \*



\* subject to change depending on application and/or level of customization

## Sample Single Channel TRX Packaging\*

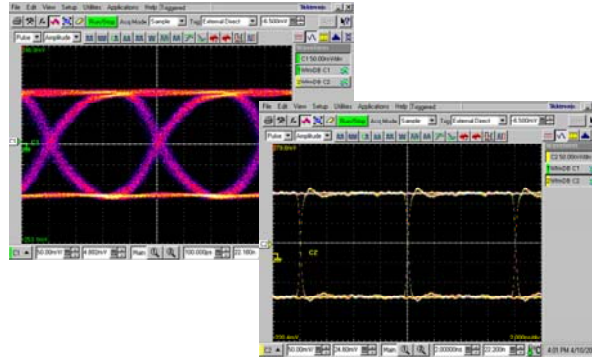


\* subject to change depending on application and/or level of customization

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### Sample Data Rate Eye-Patterns\*

BERT reveals that the SPI FireFiber® HMP Series optical Transceiver is virtually free from errors, without error correction implementation, from 100 Mbps up to 3.2Gbps per channel with a bit error rate less than  $1 \times 10^{-13}$ .\*\*



\*Eye-patterns were obtained using a PN7 PRBS BER signal generator and high-speed oscilloscope.

\*\*BERT for the HMP Series devices is performed utilizing an Agilent BERT system.

### Environmental Screening and Qualifications\*

All HMP Series products are designed and fabricated with military and space qualification in mind. Qualifications testing is based on a standards set of test plans generated from MIL-PRF-38534E and/or EEE-INST-002. Common testing includes but is not limited to:

- Heavy Ion, Ionizing Radiation Environmental Testing
- High Energy Proton, Ionizing Radiation Environmental Testing
- X-ray Burst, Ionizing Radiation Environmental Testing
- Thermal Cycling
- Thermal Shock
- Vibration Fatigue / Random Vibration
- Mechanical Shock (as needed)
- Moisture Resistance (Humidity Cycling)
- Constant Acceleration (as needed)
- Fine/Gross Leak
- Salt Atmosphere (as needed)

\* *subject to change depending on application and/or level of customization*

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