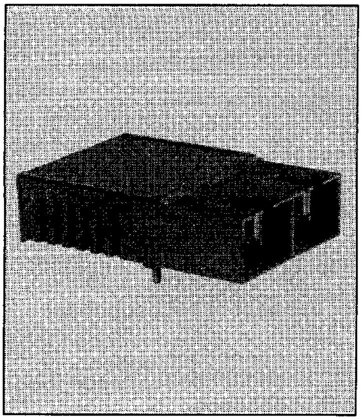
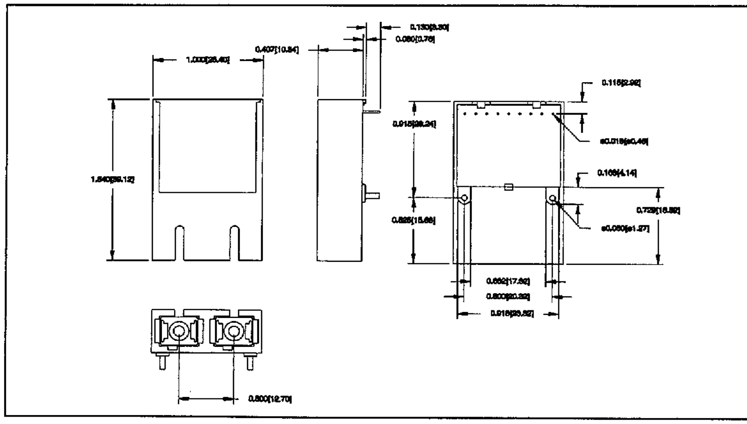
Product Bulletin OPF5104
May 1996

PRELIMINARY

Short Wavelength 125 MBd Transceiver Type OPF5104





Features

- Low Cost Alternative to Long Wavelength Devices
- Enables low cost implementation of FDDI and ATM designs at the 100 Mbps/125 MBd rate
- Multisourced 1x9 Package Style with Duplex SC connector
- Wave Solderable and Aqueous Wash Compatible
- Single +5 V power supply

Description

The OPF5104 is a low cost 850 nm alternative to expensive 1300 nm FDDI and ATM components. FDDI and ATM compliant signaling allows the system designer to design short haul FDDI and ATM performance at significant cost savings versus 1300 nm devices. The OPF5104 transceiver is supplied in the industry standard 1x9 SIP package with a duplex SC connector.

Absolute Maximum Ratings

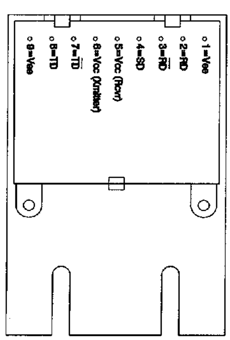
Storage Temperature	-40° C to +100° C
Lead Soldering Temperature	260° C
Lead Soldering Time	10 sec
Supply Voltage	-0.5 to 7.0 V
Data Input Voltage	-0.5 to V_{CC}
Differential Input Voltage	1.4 V(1)
Output Current	50 mA

Recomended Operating Conditions

Ambient Operating Temperature	0° C to +70° C
Supply Voltage	4.75 to 5.25 V
Data Input Voltage- Low (V_{il} -V_{CC})	-1.810 to -1.475 V
Data and Signal Detect Output Load	50 Ω(2)

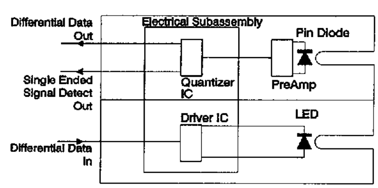
Notes:
(1) This is the maximum voltage that can be applied across the Differential Transmitter Data Inputs to prevent damage to the input ESD protection circuit.
(2) The Outputs are terminated with 50 Ω's connected to V_{CC} - 2 V.

Pinout



Top View

Block Diagram



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Electrical Characteristics (T_A = 0° C to 70° C, V_{CC} = 4.75 V to 5.25 V)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	REFERENCE
Transmitter						
I_{CC}	Supply Current		165	205	mA	
P_{DISS}	Power Dissipation		0.86	1.1	W	
I_{IL}	Data Input Current - Low	-350	0		µA	
I_{IH}	Data Input Current - High		14	350	µA	
Receiver						
I_{CC}	Supply Current		102	165	mA	Note 3
P_{DISS}	Power Dissipation		0.3	0.5	W	Note 4
$V_{OL} - V_{CC}$	Data Output Voltage - Low	-1.840		-1.620	V	Note 5
$V_{OH} - V_{CC}$	Data Output Voltage - High	-1.045		-0.880	V	Note 5
t_r	Data Output Rise Time	0.35		2.2	ns	Note 6
t_f	Data Output Fall Time	0.35		2.2	ns	Note 6
$V_{OL} - V_{CC}$	Signal Detect Output Voltage - Low	-1.840		-1.620	V	Note 5
$V_{OH} - V_{CC}$	Signal Detect Output Voltage - High	-1.045		-0.880	V	Note 5
t_r	Signal Detect Output Rise Time	0.35		2.2	ns	Note 6
t_f	Signal Detect Output Fall Time	0.35		2.2	ns	Note 6
Transmitter Optical						
P_O	Output Optical Power (62.5/125 µm, NA = 0.275 Fiber)	-17.0		-12.0	dBm avg.	Note 7
P_O	Output Optical Power (50/125 µm, NA = 0.20 Fiber)	-20.8		-12.0	dBm avg.	Note 7
	Optical Extinction Ratio			0.01 -40	% dB	Note 8
P_O ("0")	Output Optical Power at Logic "0" State			-45	dBm avg.	Note 9
λ_C	Center Wavelength	800		900	nm	
$\Delta\lambda$	Spectral Width - FWHM			100	nm	
t_r	Optical Rise Time			4.5	ns	Note 10
t_f	Optical Fall Time			4.5	ns	Note 10
SJ	Systematic Jitter Contributed by the Transmitter			1.7	ns p-p	Note 15
RJ	Random Jitter Contributed by the Transmitter			0.69	ns p-p	Note 16
Receiver Optical						
$P_{IN\ Min.}$ (W)	Input Optical Power (Minimum at Window Edge)			-26	dBm avg.	Note 11
$P_{IN\ Min.}$ (C)	Input Optical Power (Minimum at Eye Center)			-27	dBm avg.	Note 12
$P_{IN\ Max.}$	Input Optical Power Maximum	-12			dBm avg.	Note 11
λ	Operating Wavelength	800		900	nm	
SJ	Systematic Jitter Contributed by the Receiver			1.2	ns p-p	Note 15
RJ	Random Jitter Contributed by the Receiver			2.6	ns p-p	Note 16
P_A	Signal Detect - Asserted	P_D +1.5 dB		-28	dBm avg.	Note 13
P_D	Signal Detect - Deasserted	-45			dBm avg.	Note 14
$P_A - P_D$	Signal Detect - Hysteresis	1.5			dB	
AS_Max	Signal Detect Assert Time (off to on)	0	55	100	µs	Note 13
ANS_Max	Signal Detect Deassert Time (on to off)	0	110	350	µs	Note 14

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Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Notes:

(3) This value is measured with the outputs terminated into 50 Ω's connected to V_{CC} - 2 V and an Input Optical Power level of -14 dBm average.

(4) The power dissipation value is the power dissipated in the receiver itself. Power dissipation is calculated as the sum of the products of supply voltage and currents minus the sum of the products of the output voltages and currents.

(5) This value is measured with respect to V_{CC} with the output terminated into 50 Ω's connected to V_{CC} - 2 V.

(6) The output rise and fall times are measured between 20% and 80% levels with the output connected to V_{CC} -2 V through 50 Ω's.

(7) These optical power values are measured with the following conditions:
- At the Beginning of Life (BOL). The actual performance required by the FDDI standards is 1.5 dB lower power at the End of Life (EOL) for the equipment. The definition of the Beginning of Life (BOL) to the End of Life (EOL) optical power degradation is assumed to be 1.5 dB per the industry convention for long wavelength LEDs. The industry convention for short wavelength LED (800 nm) BOL to EOL aging is 3 dB. This value for Output Optical Power will provide a minimum of a 6 dB optical power budget at the EOL, which will provide at least 150 meter link lengths with margin left over for overcoming normal passive losses, such as in line connectors, in the cable plant.
- Over the specified operating voltage and temperature ranges.
- With HALT Line State (12.5 MHz square-wave) input signal.
- At the end of one meter of optical fiber with cladding modes removed.

The average power value can be converted to a peak power value by adding 3 dB.

(8) The Extinction Ratio is a measure of the modulation depth of the optical signal. The data "0" output optical power is compared to the data "1" peak output optical power and expressed as a percentage. With the transmitter driven by a HALT Line State (12.5 MHz square-wave) signal, the average optical power is measured. The data "1" peak power is then calculated by adding 3 dB to the measured average optical power. The data "0" output optical power is found by measuring the optical power when the transmitter is driven by a logic "0" input. The extinction ratio is the ratio of the optical power at the "0" level compared to the optical power at the "1" level expressed as a percentage or in decibels.

(9) The transmitter provides compliance with the need for Transmit_Disable commands from the FDDI SMT layer by providing an Output Optical Power level of <-45 dBm average in response to logic "0" input. This specification applies to either 62.5/125 µm or 50/125 µm fiber cables.

(10) The optical rise and fall times are measured from 10% to 90% when the transmitter is driven by the FDDI HALT Line State (12.5 MHz square-wave) input signal.

(11) This specification is intended to indicate the performance of the receiver section of the transceiver when Input Optical Power signal characteristics are present per the following definitions. The Input Optical Power dynamic range from the minimum level (with a window time-width) to the maximum level is the range over which the receiver is guaranteed to provide output data with a Bit Error Ratio (BER) better than or equal to 1×10^{-12}.
- At the Beginning of Life (BOL).
- Over the specified operating temperature and voltage ranges.
- Input symbol pattern is the FDDI test pattern defined in FDDI PMD Annex A. 5 with 4B/5B NRZI encoded data that contains a duty cycle base-line wander effect of 50 kHz. This sequence causes a near worst case condition for inter-symbol interference.
- Receiver data window time-width is 2.13 ns or greater and centered at mid-symbol. This worst case window time-width is the minimum allowed eye-opening presented to the FDDI PHY PM._Data indication input (PHY input) per the example in FDDI PMD Annex E. This minimum window time-width of 2.13 ns is based upon the worst case FDDI PMD Active Input Interface Optical conditions for peak-to-peak DCD (1.0 ns), DDJ (1.2 ns) and RJ (0.76 ns) presented to the receiver.

To test a receiver with the worst case FDDI PMD Active Input jitter condition requires exacting control over DCD, DDJ and RJ jitter components that is difficult to implement with production test equipment. The receiver can be equivalently tested to the worst case FDDI PMD input jitter conditions and meet the minimum output data window time-width of 2.13 ns. This is accomplished by using a nearly ideal input optical signal (no DCD, insignificant DDJ and RJ) and measuring for a wider window time-width of 4.2 ns. This is possible due to the cumulative effect of jitter components through their superposition (DCD and DDJ are directly additive and RJ components are rms additive). This window time-width of 4.2 ns guarantees the FDDI PMD Annex E minimum window time-width of 2.13 ns under worst case input jitter conditions to the Optek receiver.
- Transmitter operating with an IDLE Line State pattern, 125 MBd (62.5 MHz square-wave), input signal to simulate any cross-talk present between the transmitter and receiver sections of the transceiver.

(12) All conditions of Note 12 apply except that the measurement is made at the center of the symbol with no window time-width.

(13) This value is measured during the transition from low to high levels of input optical power.

(14) This value is measured during the transition form high to low levels of Input Optical Power. The maximum value will occur when the Input Optical Power is either -45 dBm average or when the input optical power yields a BER of 10^{-2} or better, whichever power is higher.

(15) Systematic Jitter (SJ) contributed by the 800 nm transmitter is a combination of Duty Cycle Distortion (DCD) and Data Dependent Jitter (DDJ).

(16) Random Jitter contributed by the 800 nm transmitter is specified with an IDLE Line State, 125 MBd (62.5 MHz square-wave), input signal.

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