Agilent HFCT-594x Single Mode Laser Small Form Factor Transceivers for ATM, SONET OC-48/SDH STM-16

Application Note 1232

Introduction

This document details the recommended circuit connections for Agilent single mode LC Small Form Factor (SFF) OC-48 SONET/SDH transceivers.

Overview of HFCT-594x family

Small Form Factors from the HFCT-594x family are high performance, cost effective modules for serial optical data communications applications specified for a signal rate of 2488 Mb/s. They are designed to provide SONET/SDH compliant links for 2488 Mb/s at both short and intermediate reach links.

All modules are designed for single mode fiber and operate at a nominal wavelength of 1300 nm. They incorporate high performance, reliable, long wavelength optical devices and proven circuit technology to give long life and consistent service.

The HFCT-5942 family is supplied in the industry standard 2 x 10 DIP style package.

The HFCT-5941 family is supplied in the 2 x 5 DIP style package. It has the same functionality as the HFCT-5942 but does not offer the following monitoring functions:

– Laser bias monitor (B_{MON})
– Rear facet monitor (P_{MON})
– Photo detector bias monitor (VpdRX)

The HFCT-5943xxx and HFCT-5944xxx have the same functionality as the HFCT-594x family, with the added multirate operation from 125 Mb/s to 2.7 Gb/s.

The HFCT-594x has the LC fiber connector interface and is footprint compatible with the SFF Multi Source Agreement (MSA).

The transmitter section of the HFCT-594xL/G/AL/AG incorporates a 1300 nm Fabry Perot (FP) laser. The transmitter in the HFCT-594xATL/ATG/TL/TG uses a Distributed Feedback (DFB) Laser packaged in conjunction with an optical isolator for excellent back reflection performance. The transmitter has full IEC 825 and CDRH Class 1 eye safety.

For each device, the receiver section uses an MOVPE grown planar SEDET PIN photodetector for low dark current and excellent responsivity.

A positive ECL logic interface simplifies interface to external circuitry.

Table 1 provides a summary of the HFCT-594x family.

Electrical Characteristics

Supply Voltage

The transceiver requires a positive power supply in the range of 3.1 V to 3.5 V. Care should be taken to avoid supply transients. These products are not recommended for ‘hot-plug’ applications.

Transmitter Section

Data Inputs

The Data and /Data inputs are ac coupled and 50 Ohm terminated internally. The transmitter inputs will accept standard PECL signals with levels ranging from 150 mV to 1.2 V single ended.

It is important to ensure data input lines have 50 Ohm characteristic impedance for optimum performance. Refer to ‘Board Layout’ Section for additional recommendations.

Single-ended operation is not recommended since data sheet specifications can only be guaranteed when both differential inputs are used. For input termination recommendations refer to the ‘Termination schemes’ section.

The laser is designed to operate with a 50% duty cycle or balanced signal, for normal operation. Failure to provide this may cause the optical parameters to move out of specification. Extinction Ratio and Duty Cycle Distortion may be affected. In the absence of data the module will emit a mean optical power within the specified limit.

Table 1. Overview and Summary of the HFCT-594x Family

				Pinout		Reach		Temperature			
Part Number			Multi-rate	2x5	2x10	SR	IR	-40 to +85 °C	-20 to +85 °C	0 to +70 °C	Metalization/ Nose Clip
HFCT	5941	L		✓		✓				✓	✓
HFCT	5941	G		✓		✓				✓	
HFCT	5941	AL		✓		✓		✓			✓
HFCT	5941	AG		✓		✓		✓			
HFCT	5941	TL		✓			✓			✓	✓
HFCT	5941	TG		✓			✓			✓	
HFCT	5941	ATL		✓			✓		✓		✓
HFCT	5941	ATG		✓			✓		✓		
HFCT	5942	L			✓	✓				✓	✓
HFCT	5942	G			✓	✓				✓	
HFCT	5942	AL			✓	✓		✓			✓
HFCT	5942	AG			✓	✓		✓			
HFCT	5942	TL			✓		✓			✓	✓
HFCT	5942	TG			✓		✓			✓	
HFCT	5942	ATL			✓		✓		✓		✓
HFCT	5942	ATG			✓		✓		✓		
HFCT	5943	L	✓	✓		✓				✓	✓
HFCT	5943	G	✓	✓		✓				✓	
HFCT	5943	AL	✓	✓		✓		✓			✓
HFCT	5943	AG	✓	✓		✓		✓			
HFCT	5943	TL	✓	✓			✓			✓	✓
HFCT	5943	TG	✓	✓			✓			✓	
HFCT	5943	ATL	✓	✓			✓		✓		✓
HFCT	5943	ATG	✓	✓			✓		✓		
HFCT	5944	L	✓		✓	✓				✓	✓
HFCT	5944	G	✓		✓	✓				✓	
HFCT	5944	AL	✓		✓	✓		✓			✓
HFCT	5944	AG	✓		✓	✓		✓			
HFCT	5944	TL	✓		✓		✓			✓	✓
HFCT	5944	TG	✓		✓		✓			✓	
HFCT	5944	ATL	✓		✓		✓		✓		✓
HFCT	5944	ATG	✓		✓		✓		✓		

Optical Output

Figure 1(a) shows a typical HFCT-5942L transmitter output waveform using the SONET OC-48 optical filter.

Figure 1(b) shows a typical HFCT-5942TL transmitter output waveform using the SONET OC-48 optical filter.

Laser Bias Monitor

The laser bias monitor points (pins 17 and 18) allow the user to directly measure dc bias current. Figure 2 shows the internal configuration for laser bias monitor. If this monitoring function is not used, pins 17 and 18 can be left floating. The I/V relationship for laser bias current is:

$$I_{BIAS} = [(V18 - V17)/10]$$

where I_{BIAS} is the laser bias current in amp (A).

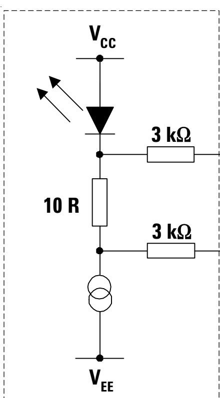

Figure 2. Bias monitor circuit (internal)

It is worth noting that the above relationship yields approximately threshold current. This monitoring facility allows the user to identify EOL conditions in a given application. Figure 3 shows a circuit which can be used for indicating high bias current conditions. Pins 17 and 18 are connected to the inverting and non-inverting inputs of IC1A respectively. IC1A is configured as a unity gain buffer and its output (VIC1A) fed to IC1B.

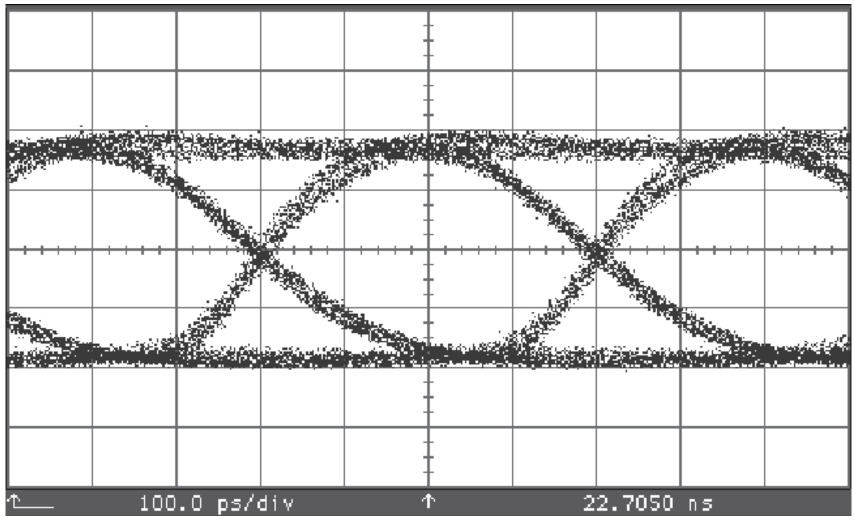

Figure 1(a). Typical HFCT-5942L transmitter output

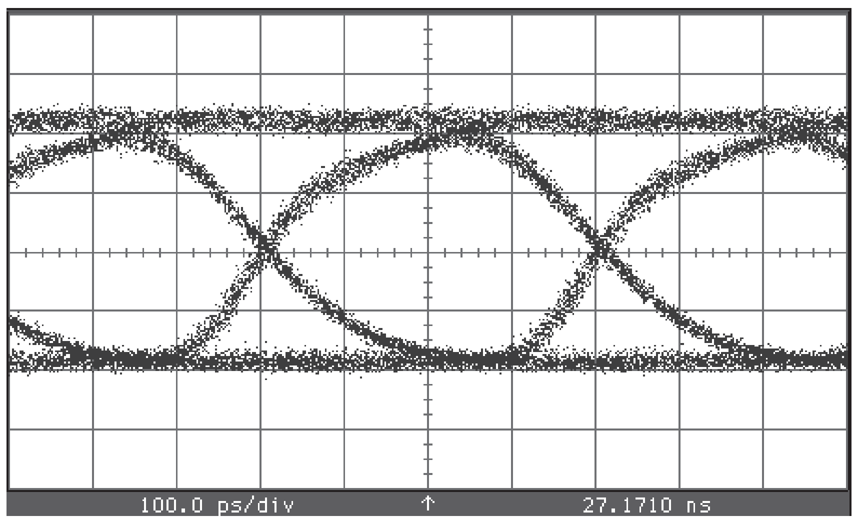

Figure 1(b). Typical HFCT-5942TL transmitter output

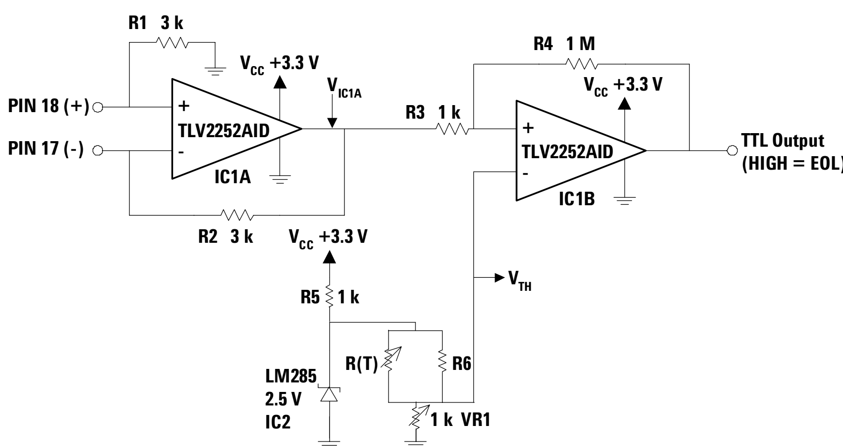

Figure 3. Laser bias indicator interface circuit

IC2 provides a fixed 2.5 V reference to a voltage divider that includes a Negative Thermal Coefficient (NTC) thermistor (R(T)) and a variable resistor (VR1). The thermistor compensates for threshold variations of the laser over temperature and VR1 allows adjustment for setting the threshold voltage (VTH).

IC1B is configured as a TTL comparator where a high output indicates End Of Life. The voltage VTH at IC1B's inverting input determines the level at which the high bias conditions results in a TTL flag.

Figure 4 shows the typical variations of laser bias monitor voltage over temperature for HFCT-5942AL (Fabry Perot laser) and HFCT-5942ATL (DFB laser).

The interface circuit described in Figure 3 allows the user to set coarse end of life indication independently of temperature.

The characteristic of VTH over temperature is matched for both types of laser using the following components:

- HFCT-5942L/AL (Fabry Perot laser)
  - R6 = 6 kΩ
  - R(T) = 20 kΩ (at +25 °C, β = 4000° K)
- HFCT-5942TL/ATL (DFB laser)
  - R6 = 15 kΩ
  - R(T) = 5 kΩ (at +25 °C, β = 3500° K)

For End of Life indication based on a 50% increase in laser threshold, the voltage setting for VTH is:

- 1.5*(VIC1A)

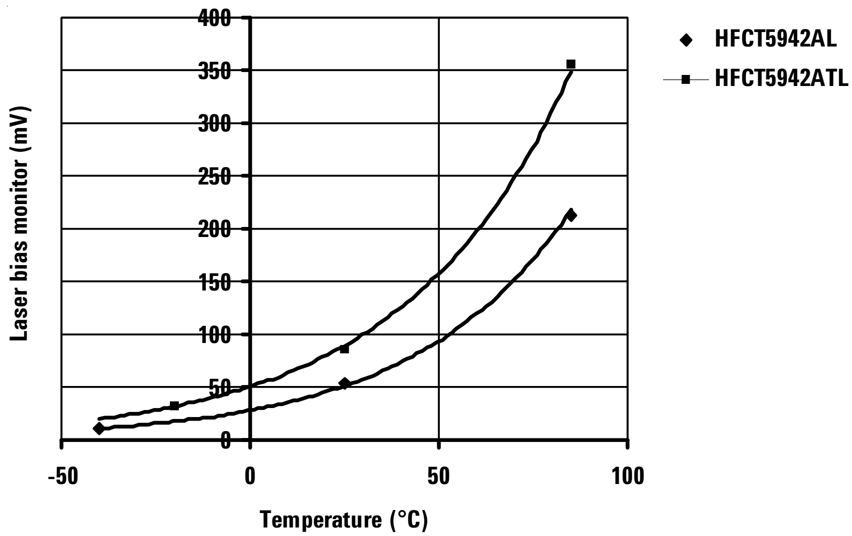

Figure 4. Typical variations of laser bias monitor voltage over temperature

This ratio is approximate and represent a coarse EOL indicator when used in conjunction with the circuit shown.

Rear Facet Monitor

The optical power rear facet monitor circuit provides a photo current which is proportional to the voltage measured between pins 19 and 20, this voltage is measured across an internal 200 Ohm resistor. Figure 5 shows the internal configuration for rear facet monitor. If this monitoring function is not used, pins 19 and 20 can be left floating.

Figure 6 shows a circuit which can be used to interface and/or monitor the photo current.

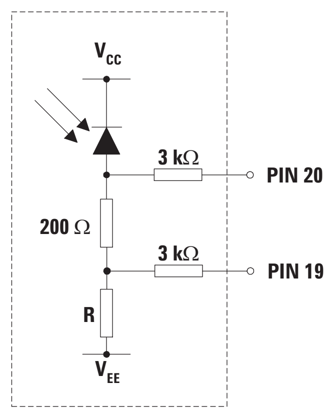

Figure 5. Rear facet monitor (internal)

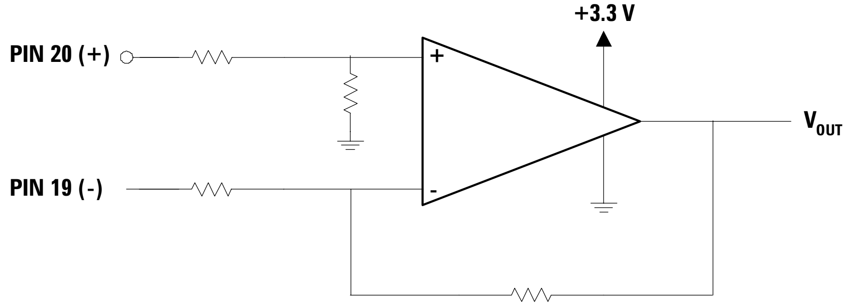

Figure 6. Rear facet monitor interface circuit. Resistor network should be used to reflect the gain required by the interconnecting IC and the output range of the product being used.

To minimize the effect on the optical output power of the transmitter, the impedance of the circuit should be at least 1 MΩ.

For measurement requiring higher gain, care should be taken to select an amplifier with low offset (eg. TLV2252AID).

Transmitter Disable

In normal operation (transmitter enabled) TxDis should be left open circuit (no external connection required). The module will emit a mean optical power within the specified range. Connecting TxDis to V_{CCT} via a 500 Ohm resistor will disable the transmitter. When the laser is disabled, the optical power falls below -45 dBm. This input pin is LVTTL compatible and requires a minimum of 50 µA for it to operate.

Typical response times for the transmitter disable function are:

- TxDis ON (Optical signal turned OFF) = 160 ns
- TxDis OFF (Optical signal turned ON) = 6 µs

If this function is not used, pin 13 can be left floating.

Transmitter Jitter Generation

The jitter generation requirements for SONET/SDH transport systems are:

- 100 m UI pk - pk (SONET)
- 10 m UI rms (SONET/SDH)

Figure 7 shows the experimental configuration used to test jitter generation. An Agilent 70841B pattern generator is used to generate PECL data at 2.48832 Gb/s to modulate the transmitter. Jitter generation is measured using a SONET STS48C, 2^{23}-1 PRBS scrambled pattern. The optical output of the transmitter is attenuated and fed into the OmniBER 37718A at an input sensitivity of -14.0 dBm.

Receiver Section

Data Outputs

Data and /Data outputs are ac coupled and biased internally. Typical output swings are in the order of 700 mV. Figure 8 shows typical receiver waveforms.

It is recommended that the receiver outputs are connected to 50 Ohm transmission lines.

Signal Detect (SD)

The signal detect circuit works by sensing the peak level of the received signal and comparing this level to a reference. SD is provided via a single-ended, dc coupled output and offers +3.3 V TTL capability. Interfacing this node to other stages requires a high impedance input typically in the order of 10 K Ohms. Low input impedance stages are unsuitable. This node may be left unconnected if not used. Hysteresis for the signal detect function is typically 1.5 dB.

The Signal Detect circuit provides a deasserted output signal when the optical link is broken or when the transmitter is OFF. The Signal Detect threshold is set to transition from a high to low state between the minimum receiver input optical power and -45 dBm avg. input optical power indicating a definite optical fault (e.g. unplugged connector for the receiver or transmitter, broken fiber, or failed far-end transmitter or data source).

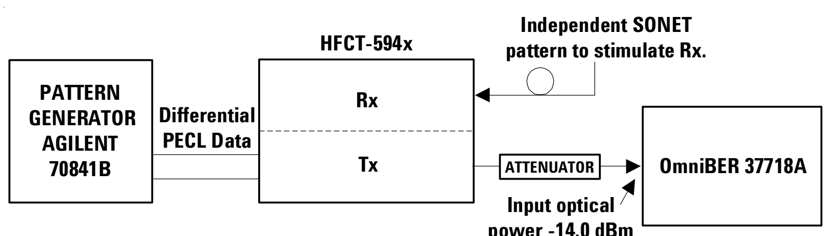

Figure 7. Jitter generation test configuration

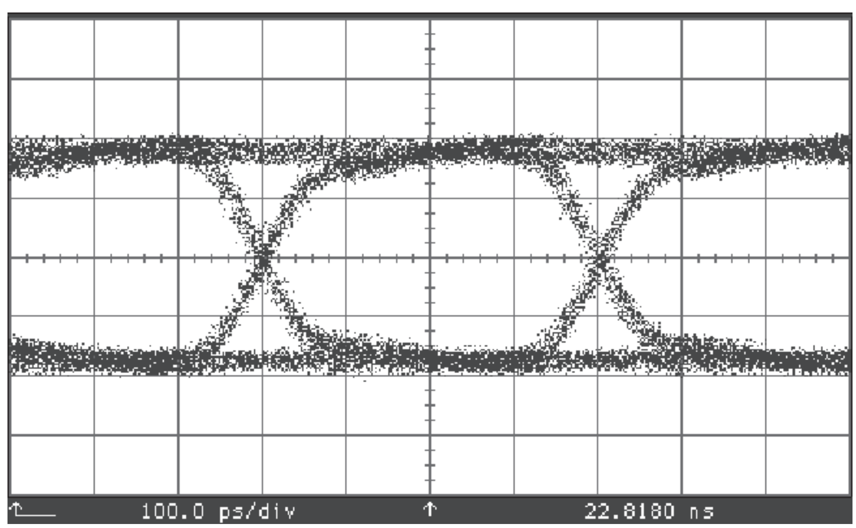

Figure 8. Shows typical receiver waveforms

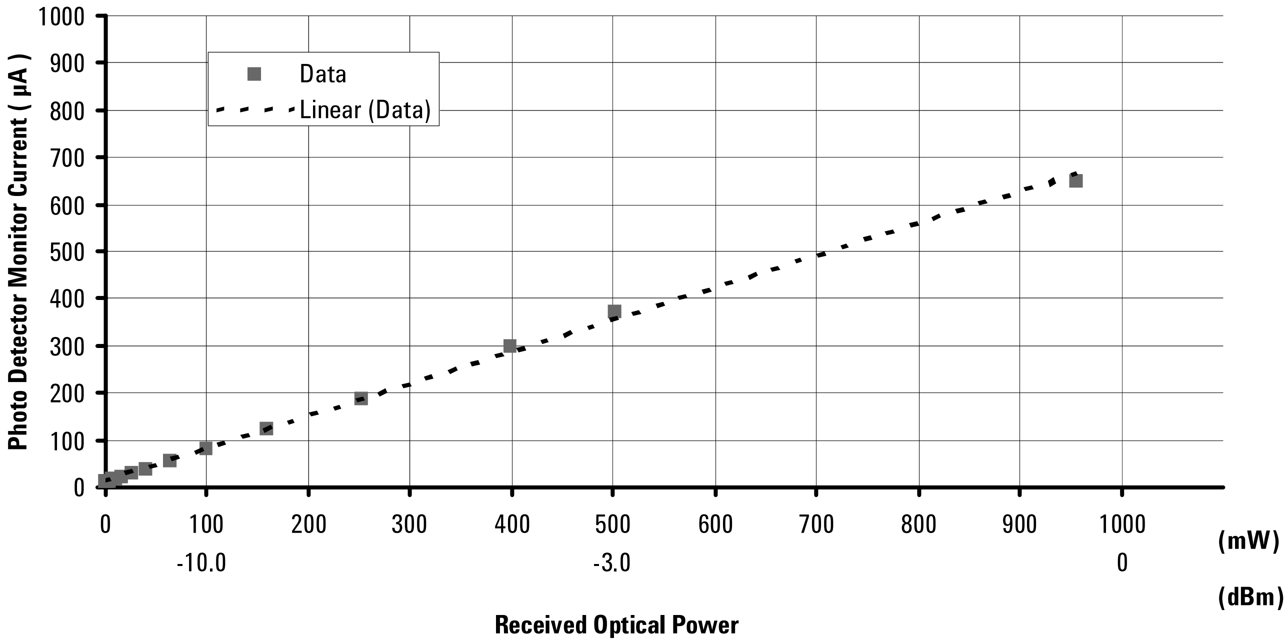

Figure 9. Typical responsivity of the photo detector bias monitor

The Signal Detect does not detect receiver data error or error-rate. Data errors can be determined by signal processing offered by upstream PHY ICs.

Typical value for Signal Detect Deassert Time is 1 µs. For multi rate applications, Signal Detect may deassert for long “all zeros” pattern. This is due to the fast response time of the peak detector.

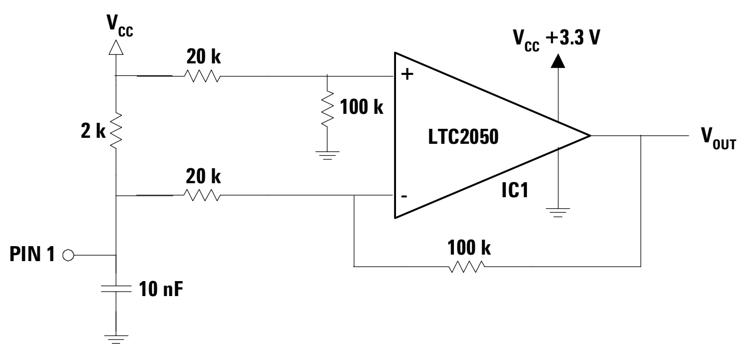

Figure 10. Photo detector bias current interface circuit

PIN Photo Detector Bias Current Monitor

The designer also has the option of monitoring the PIN photo detector bias current. Pin 1 can be connected to V_{CC} through a bias resistor. This resistor should not exceed 2 kΩ. Agilent also recommends that a decoupling capacitor is used on this pin. Alternatively, if the photo detector bias monitor is not used, pin 1 can be left floating.

The PIN photo detector bias current monitor is provided by the preamplifier and is a mirrored output of the photo current generated by the PIN diode.

The typical responsivity of the photo detector bias monitor is shown in Figure 9. The bias current was measured using a pico ammeter.

Linear range for the HFCT-5942L/AL is -19 dBm to -3 dBm.

Linear range for the HFCT-5942TL/ATL is -19 dBm to 0 dBm.

When no optical power is received, the remaining photo detector monitor current is typically 10 µA.

Figure 10 shows a circuit which can be used to monitor photo detector bias. IC1 is configured as a differential amplifier and the output voltage is proportional to the photo detector current. The output can be interfaced to other ICs such as comparators or A/D for further processing.

Receiver BER Performance

Figure 11 shows a typical waterfall chart for HFCT-594x where optical input sensitivity has been plotted as a function of Bit Error Ratio (BER). Measurements were made in optical loopback configuration using a 2^{23}-1 PRBS pattern at 2.48832 Gb/s.

Receiver Jitter Performance

Jitter performance of the receiver has been evaluated in conjunction with commercially available Multiplexer, Demultiplexer and Clock and Data Recovery (CDR) ICs.

Jitter transfer and jitter tolerance were measured successfully and results are presented in different Application Notes. The Recommended References section at the end of this document gives a list of available reference designs using HFCT-594x.

Operating Wavelength

The HFCT-594x receiver is specified for operation over a range of wavelengths from 1260 nm to 1570 nm. Figure 12 shows the typical dc responsivity curve of an InGaAs PIN Photodiode.

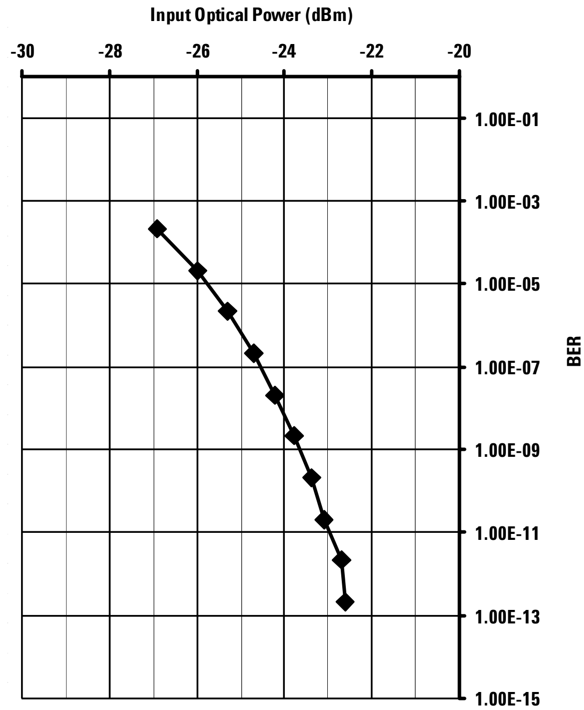

Figure 11. Typical waterfall chart

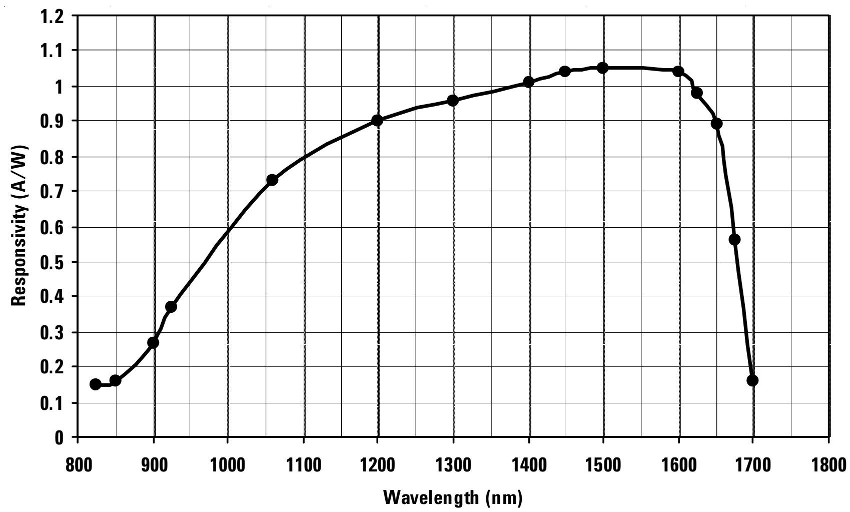

Figure 12. Typical dc responsivity graph of an InGaAs PIN photodiode

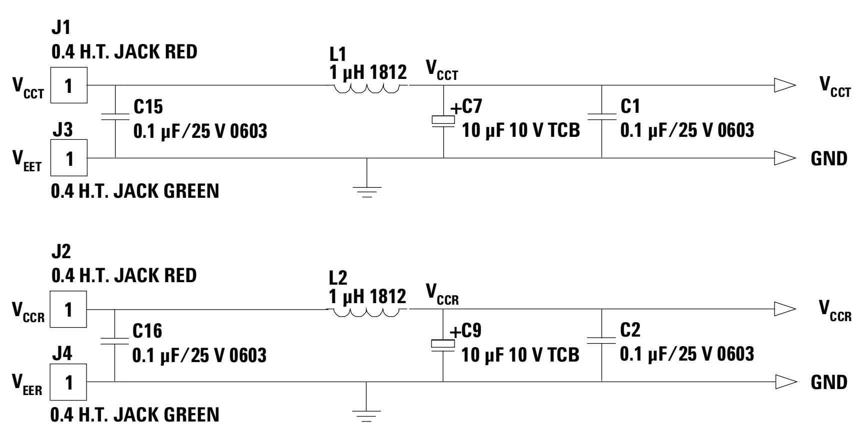

Figure13. Recommended filter

Power Supply filtering

Good power supply filtering is required for optimum performance. The LC filtering technique illustrated in the circuit diagram of Figure 13 is recommended for the user. When using this filter arrangement, supply noise >100 mV pk-pk, over a frequency range of 10 Hz to 1 MHz, can be tolerated before a receiver sensitivity penalty of 1.0 dB occurs.

Power Dissipation and Thermal Analysis

The maximum power dissipation of a transceiver is 0.9 W. It is important to note that this figure includes termination and bias current as the module is internally ac coupled.

Figures 14(a) and 14(b) show case temperature variations and difference as a function of ambient temperature under airflow (2 m/s)/no airflow conditions. Measurements were made using a single transceiver on the standard evaluation board. The temperature of the convection oven was varied for the HFCT594xAL from -40 °C to +85 °C and from -20 °C to +85 °C for the HFCT-594xATL.

For the HFCT-5942AL (see Figure 14(a), the results are:

- Under 2 m/s of airflow, case temperature is the same as ambient temperature.
- Under no airflow, case temperature is on average +10 °C higher than ambient temperature.

For the HFCT-5942ATL (see Figure 14(b), the results are:

- Under 2 m/s of airflow, case temperature is on average +7 °C higher than ambient temperature.

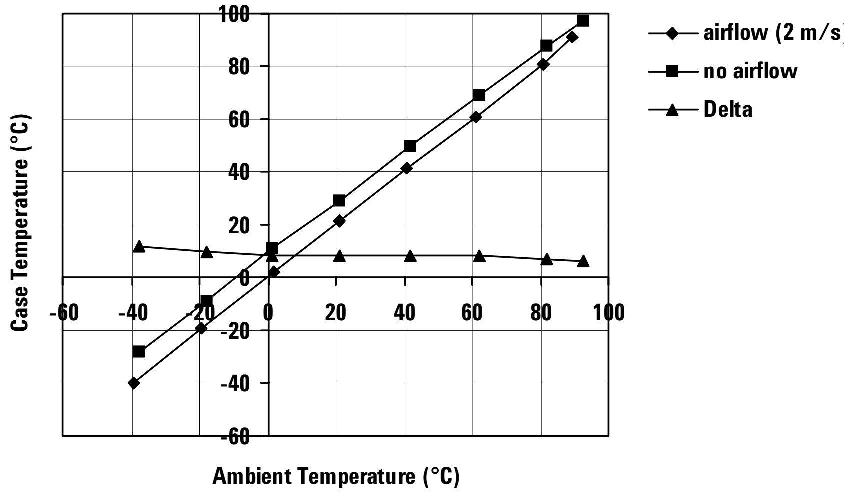

Figure 14(a). Case temperature variations as a function of ambient temperature under airflow (2 m/s)/and no airflow conditions

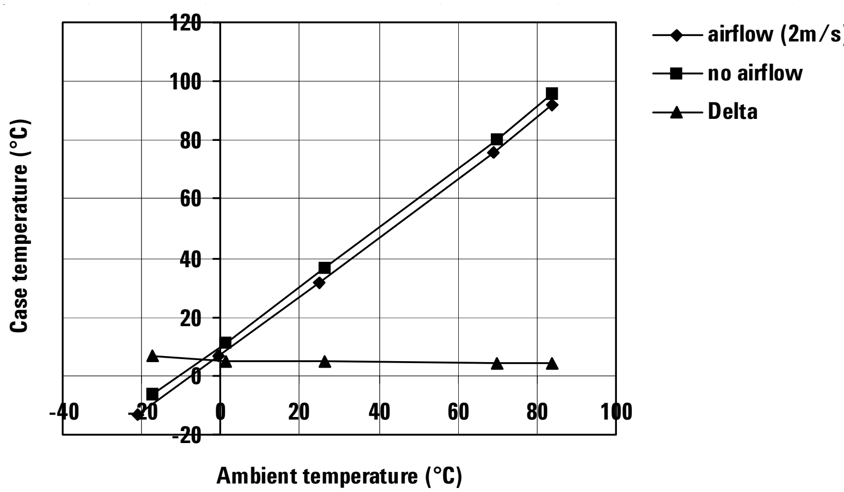

Figure 14(b). Case temperature variations as a function of ambient temperature under airflow (2 m/s)/and no airflow conditions

- Under no airflow, case temperature is on average +11°C higher than ambient temperature.

Evaluation board

Description

The SFF evaluation board (Part number HFCT-5005), shown in Figure 15, is available for easy use and demonstration of transceiver performance. It has a four layer FR-4 printed circuit board with ground planes on both sides. It is designed to be footprint compatible for all 2 x 10 SFF variants. A weighted base enclosure is provided for stability on the bench. Edge-mounted SMA connectors are provided for data inputs and data outputs. Standard 2 mm sockets are included for easy connection to dc power supplies and monitors. A sliding switch is provided for selecting the transmitter disable function. Gold contact pin sockets are used to allow interchangeability between transceiver modules while assuring good connection integrity. The four grounding tabs and two mounting studs are all tied to the ground plane in the test fixture. However, under normal operation, it is recommended only the four grounding tabs to be connected to signal ground for optimum EMI compliance. The two mounting studs are either left floating or connected to chassis ground. Generous grounding is provided around the transceiver footprint using plated through holes.

Circuit Schematic

Figure 16 shows the circuit schematic for the test fixture. Separate power supplies are provided to the transmitter and receiver sections and recommended filtering arrangements are used. The Signal Detect (SD) function is provided for the user. This is single ended +3.3 V TTL output.

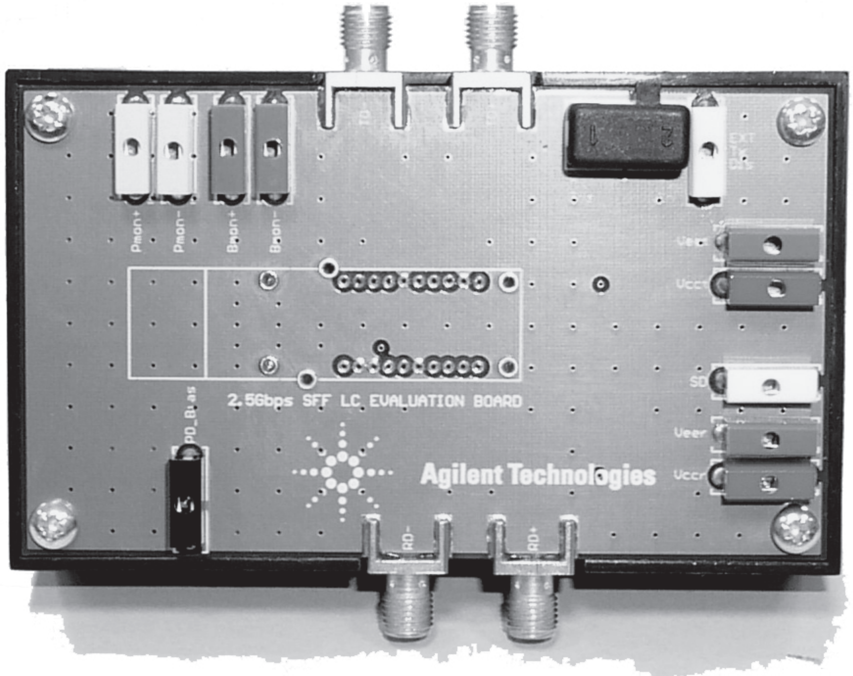

Figure 15. SFF LC Evaluation board

The photo detector bias (V_{pdR}) allows the monitoring of photo detector bias current through pin 1. The pin should either be connected to V_{CCRX} directly or to V_{CCRX} through a resistor (R_2) for monitoring photo detector bias current which would be equivalent to $(V_{CC}-V_{PIN1})/R_2$.

The laser diode bias current ($B_{MON+/-}$) is accessible by measuring the voltage across pins 17 and 18. Dividing the voltage by 10 Ohm will yield the value of the laser bias current:

$$I_{BIAS} = (V_{18}-V_{17})/10$$

where I_{BIAS} is the laser bias current in amp (A).

It is worth noting that the above relationship yields total laser forward current (threshold and bias) when no data is applied and approximately threshold current when modulation is applied.

The back facet diode current monitor ($P_{MON+/-}$) is accessible by measuring the voltage across pins 19 and 20. Dividing the voltage by 2 kOhm will yield a value proportional to the photo current.

Figure 17 shows the power supply circuit fitted on the test fixture. Recommendations for optimum power supply noise reduction are currently under investigation. Results will be published when available.

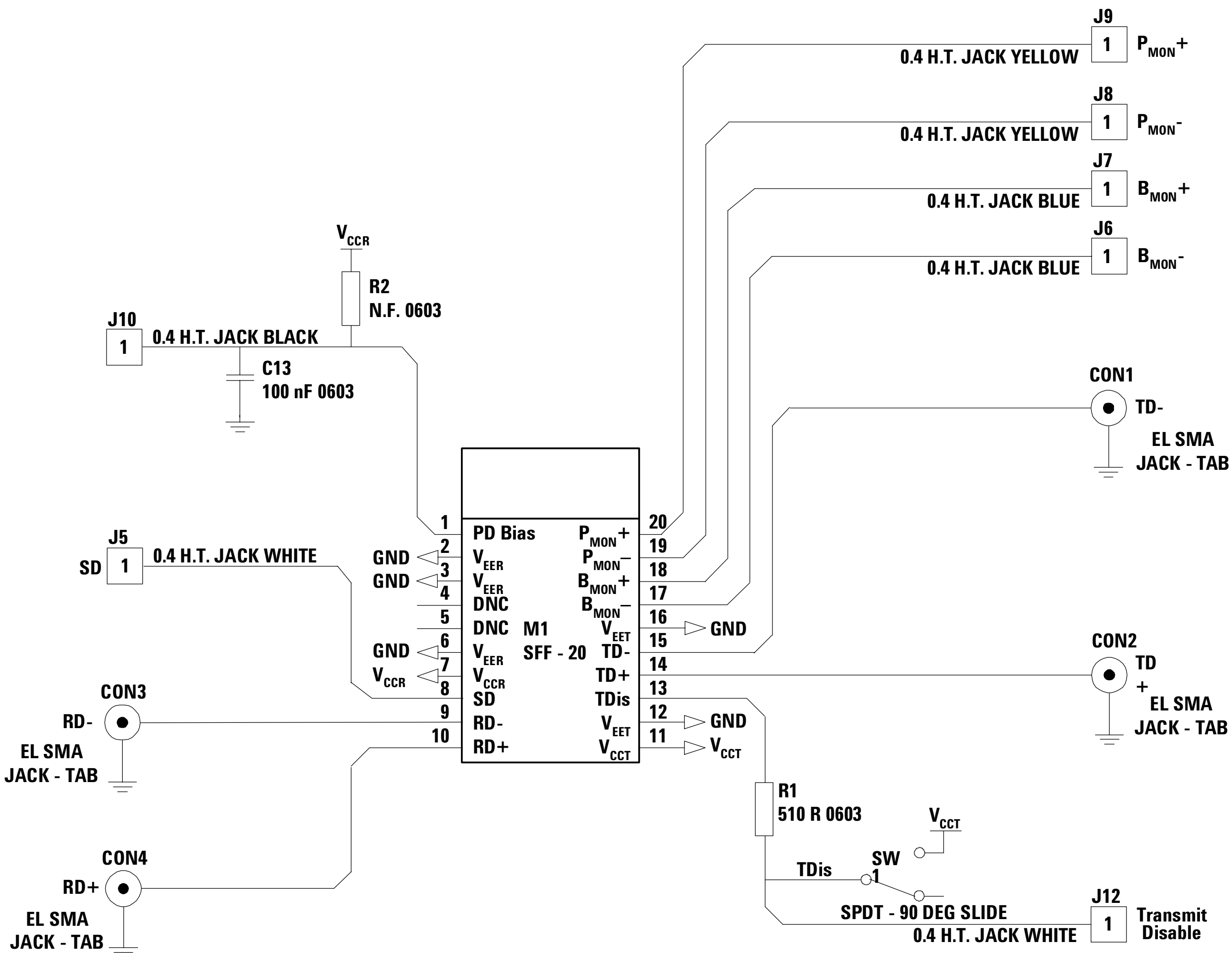

Figure 16. SFF Test Fixture Circuit Diagram for 2.5 Gb/s Transceivers

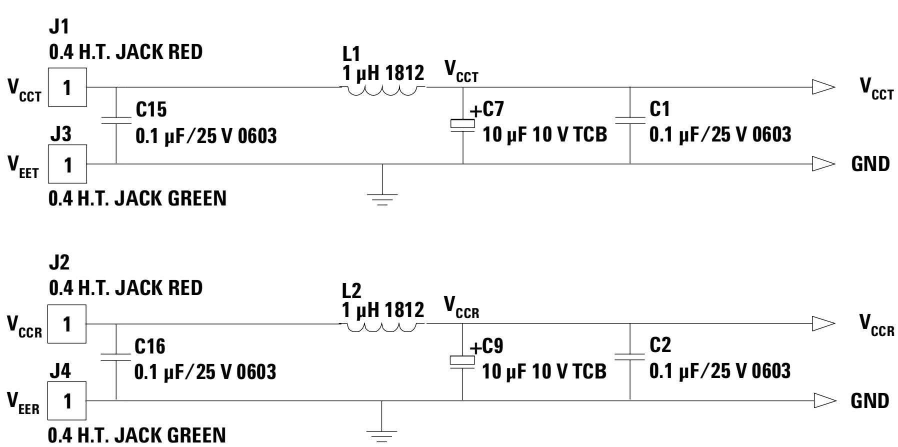

Figure 17. Filter Network for Power Supply Noise Reduction

Operation

The test fixture requires +3.3 V supplies to both V_{CCT} and V_{CCR}. The Transmitter Enable/ Disable switch needs to be in position 2 for normal operation while position 1 disables optical data transmission. The test fixture is rated for repeated temperature evaluation from -40 °C to +85 °C.

PCB Layout

Like all RF applications, the PCB design and layout for this high-speed transceiver requires careful consideration and attention towards interconnect impedance for DATA and CLOCK nodes. Any form of power supply filtering or decoupling should be done as close as possible to the power supply pins to minimize radiated or conductive pickup. It is recommended that high-speed data and clock tracks be buried striplines to minimize exposure of these lines for EMI suppression. Also, such an approach will ensure signal integrity and avoid waveform degradation from RF interference. Plated through holes or via used should be as small as possible to avoid impedance discontinuities along interconnecting tracks. Where ac coupling capacitors are required, small 0603 size components are recommended for minimizing variations in track impedance.

EMI Radiation/Susceptibility

One of a circuit board designer's foremost concerns is the control of electromagnetic emissions from electronic equipment. Success in controlling generated Electromagnetic Interference (EMI) enables the designer to pass a governmental agency's EMI regulatory standard and more importantly, it reduces the possibility of interference to neighboring equipment. Agilent has designed the HFCT-594x to provide excellent EMI performance. The EMI performance of a chassis is dependent on physical design and features which help improve EMI suppression.

Agilent encourages using standard RF suppression practices and avoiding poorly EMI-sealed enclosures. The evaluation board used for EMI testing contains one HFCT-594x transceiver. Layout was per the recommendations in application note AN1232 and pin sockets were used in the mounting holes allowing easy installation and removal of the transceiver. An OC-48 SONET structured pattern with a 223 -1 PRBS payload was optically fed to the receiver side. The electrical output of the receiver was looped back directly to the transmitter through 50 stripline. For simulated chassis measurements, the evaluation board was screwed into a RF tight metal box with the recommended panel openings for the LC transceiver. A battery inside the box was used to supply +3.3 V dc bias to the board. The RF box was manipulated +360 ° over all three axes to determine maximum available emissions. EMI response was measured under simulated chassis conditions and Figures 18 and 19 show the worst EMI response when measured from 100 MHz to 12 GHz. For both intermediate and short reach, the highest peak was recorded at 4.98 GHz.

- HFCT-5942L/AL: 17 short reach modules were measured and the maximum emission was 41.4 dB µV/m at 4.96 GHz (see Figure 18).
- HFCT-5942TL/ATL: 7 intermediate reach modules were measured and the maximum emission was 37.1 dB µV/m at 4.96 GHz (see Figure 19).

Compatibility Trials

The HFCT-5942xxx transceivers have been evaluated using Vitesse Semiconductors, AMCC and Broadcom Mux/Demux chipsets and compatibility has been confirmed. The aim of this exercise was to design functional boards with a view of sharing relevant layout and circuit information with the optics system designer. Full description of the design, layout, measurements and results are beyond the scope of this document but a separate document is available. Please contact your Agilent representative for further information.

Multi Rate Ability

The HFCT-5943xxx and HFCT-5944xxx have been designed to operate at different data rates from 125 Mb/s to 2.7 Gb/s. It is important to note that for multirate applications, transceivers will meet the SONET/SDH specification for OC-48/STM-16 across all data rates.

Please refer to the data sheets and characterization reports for an overview of their performance.

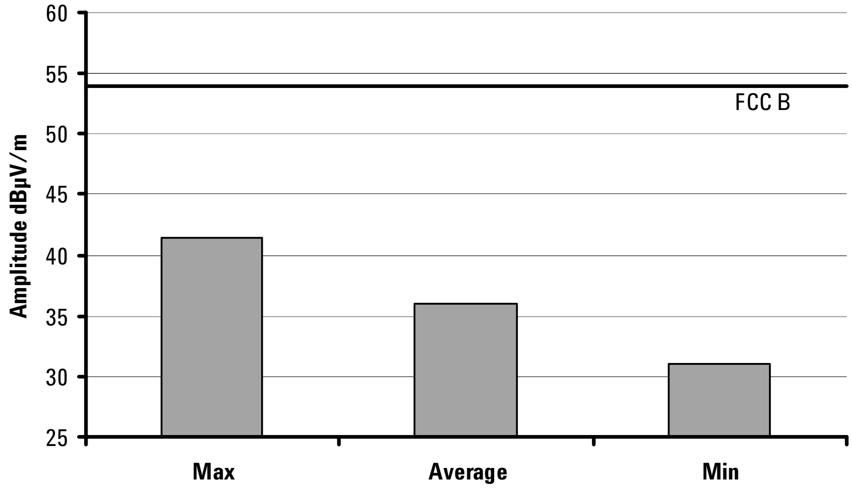

Figure 18. Radiated emissions for HFCT-5942L/AL

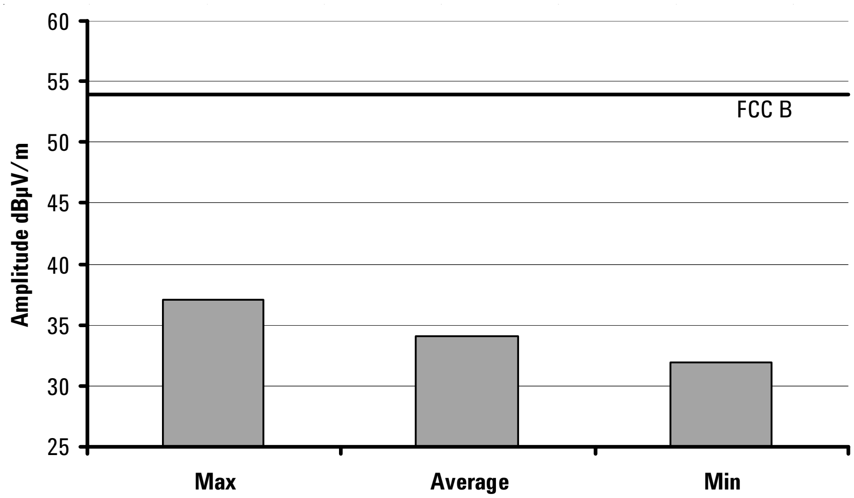

Figure 19. Radiated emissions for HFCT-5942TL/ATL

Recommendations for 2 x 5 interface

The HFCT-5942xxx are supplied in the industry standard 2 x 10 DIP style package and are footprint compatible with the SFF MSA. The 2 x 10 transceivers have the same functionality as the 2 x 5 and Figure 20 shows the common pins between the two packages. The 10 extra pins of the 2 x 10 package provides 3 additional monitoring functions:

- rear facet monitor (P_{MON})
- bias monitor (B_{MON})
- photo detector bias monitor (V_{pdRx})

Some applications may not require the use of the additional monitoring functions and the HFCT-5942 may be used in a 2 x 5 configuration. It is recommended to connect the unused pins as follows:

- **Pin 1: photo detector bias.** It is recommended to connect pin 1 to V_{CC} as shown in Figure 6 on the Data sheet. Alternatively, pin 1 can also be left floating.
- **Pins 2, 3 and 16: V_{EE}.** Connect to ground.
- **Pins 4 and 5:** Do Not Connect.
- **Pins 17, 18, 19 and 20: bias and power monitor.** Do Not Connect. These pins can be left floating.

IBIS Model

An IBIS model, HFCT-5942.ibs, based on measurements is available for the HFCT-5942xxx. The measurements were from a typical HFCT-5942 optical transceiver. The database structure of IBIS allows for a measurement-based model to provide the most accurate representation of a typical transceiver; however, this model does not cover the minimum and maximum corners of the transceiver operation.

The model has been shown to operate in Mentor Graphics ICX software. Downloads are available at **http://www.agilent.com/view/ibis.**

Recommended Solder and Wash Process

The HFCT-594x is compatible with industry standard wave or hand solder processes.

Process Plug

The HFCT-594x transceiver is supplied with a process plug for protection of the optical ports with the LC connector receptacle. This process plug prevents contamination during wave solder and aqueous rinse as well as during handling, shipping or storage. It is made of high-temperature, moulded, sealing material that will withstand +85 °C and a rinse pressure of 110 lb/in^2 .

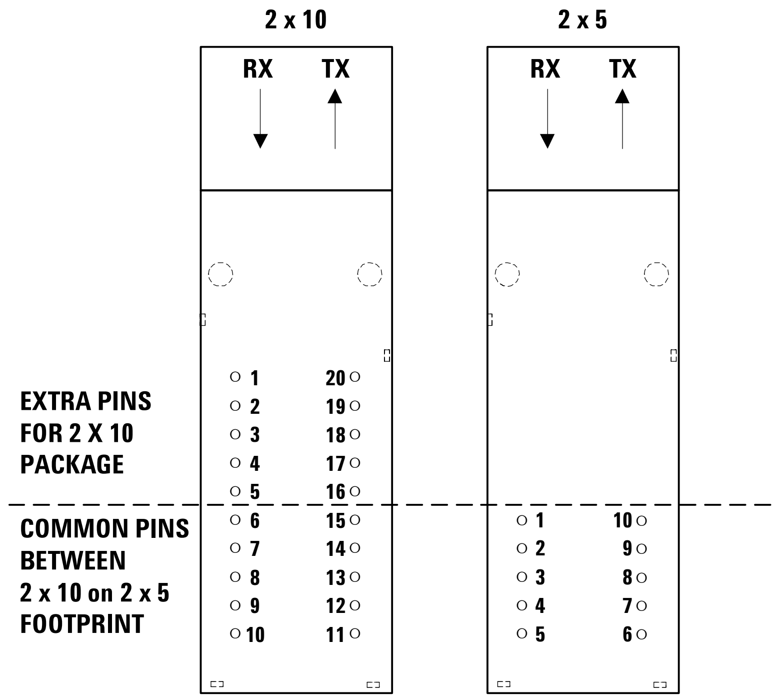

Figure 20. 2 x 10 and 2 x 5 pin out diagrams (top view)

Recommended Solder Fluxes and Cleaning/Degreasing Chemicals

Solder fluxes used with the HFCT-594x fiber-optic transceiver should be water-soluble, organic solder fluxes. Some recommended solder fluxes are Lonco 3355-11 from London Chemical West, Inc. of Burbank, CA, and 100 Flux from Alpha-metals of Jersey City, NJ. Recommended cleaning and degreasing chemicals for the HFCT-5942xxx are alcohol's (methyl, isopropyl, isobutyl), aliphatics (hexane, heptane) and other chemicals, such as soap solution or naphtha. Do not use partially halogenated hydro-carbons for cleaning/degreasing. Examples of chemicals to avoid are 1.1.1. trichloroethane, ketones (such as MEK), acetone, chloroform, ethyl acetate, methylene dichloride, phenol, methylene chloride or N-methylpyrolldone.

Regulatory Compliance

The HFCT-594x is intended to enable commercial system designers to develop equipment that complies with the various regulations governing certification of Information Technology Equipment.

The HFCT-594x utilize a carefully designed optical subassembly with a current limiting circuit to guarantee eye-safety. It is intrinsically eye safe and does not require shut down circuitry. Additional information is available from your Agilent sales representative.

Electrostatic Discharge (ESD)

Normal ESD handling precautions for ESD sensitive devices should be followed while using the HFCT-594x. These precautions include using grounded wrist straps, work benches and floor mats in ESD controlled areas. Additionally, static discharges to the exterior of the equipment chassis containing the transceiver parts must also be considered.

Qualification

The HFCT-594x transceivers have been successfully qualified in accordance with the requirements of Bellcore document TA-NWT-000983, under the supervision of Agilent Quality and Reliability Engineering.

Recommended References

– HFCT-594x data sheet, characterization reports and reliability data

– Application Note 1173: Interfacing to PECL optical transceivers

– OC-48 Agilent Small Form Factor Transceiver HFCT-5942 with AMCC S3055 Chip Reference Design

– OC-48 Agilent Small Form Factor Transceiver HFCT-5942 with Vitesse VSC8122 and VSC8141 Multirate Chip Set Reference Design Application Note 1247

– Introduction to IBIS modeling of fiber optic transceivers, Mark Chang, Optical Network Interface Design Symposium 2000

– Jitter measurements of Agilent OC-48 optical transceivers using the OmniBER 37718, Nicolas Schmitt and Dave Grant, Optical Network Interface Design Symposium 2000.

www.agilent.com/
semiconductors

For product information and a complete list of distributors, please go to our web site.

For technical assistance call:
Americas/Canada: +1 (800) 235-0312 or
(408) 654-8675
Europe: +49 (0) 6441 92460
China: 10800 650 0017
Hong Kong: (+65) 271 2451
India, Australia, New Zealand: (+65) 271 2394
Japan: (+81 3) 3335-8152(Domestic/International), or
0120-61-1280(Domestic Only)
Korea: (+65) 271 2194
Malaysia, Singapore: (+65) 271 2054
Taiwan: (+65) 271 2654

Obsoletes: 5988-8127EN
December 18, 2002
5988-8538EN

Agilent Technologies