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# SC Duplex Single Mode Transceiver

## Technical Data

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### HFCT-5208

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#### Features

- **SC Duplex Single Mode Transceiver**
- **Intermediate SONET OC12 SDH STM (14.1) Compliant**
- **Single +5 V Power Supply**
- **Multisourced 1 x 9 Pin Configuration**
- **Aqueous Washable Plastic Package**
- **Interchangeable with LED Multisourced 1 x 9 Transceivers**
- **Unconditionally Eyesafe Laser IEC 825/CDRH Class 1 Compliant**

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#### Applications

- **SONET/SDH Equipment Interconnect**
- **ATM**

#### Description

The HFCT-5208 transceiver is a high performance, cost effective module for serial optical data communications applications specified for a signal rate of 622 MBd. It is designed to provide a SONET/SDH compliant link for 622 Mb/s intermediate reach links.

This module is designed for single mode fiber and operates at a nominal wavelength of 1300 nm. It incorporates Hewlett-Packard's high performance, reliable, long wavelength optical devices and proven circuit technology to give long life and consistent service.

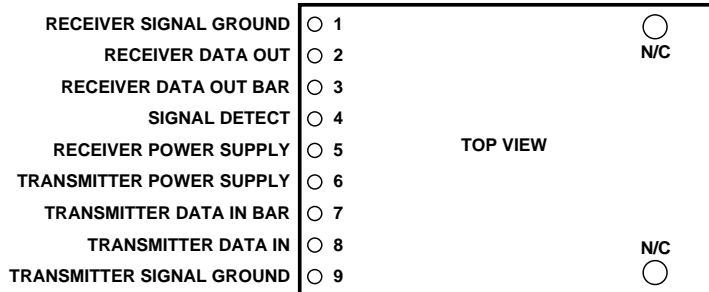
The transmitter section uses an advanced Fabry Perot laser with full IEC 825 and CDRH Class 1 eye safety.



The receiver section uses a MOVPE grown planar PIN photo-detector for low dark current and excellent responsivity.

A pseudo-ECL logic interface simplifies interface to external circuitry.

## Connection Diagram



## Pin Descriptions:

### Pin 1. Receiver Signal Ground V<sub>CC</sub>:

Directly connect this pin to the receiver ground plane.

### Pin 2. Receiver Data Out RD+:

Terminate this high-speed, differential, PECL output with standard PECL techniques.

### Pin 3. Receiver Data Out Bar RD-:

Terminate this high-speed, differential, PECL output with standard PECL techniques.

### Pin 4. Signal Detect SD:

Normal optical input levels to the receiver result in a logic "1" output.

Low optical input levels to the receiver result in a fault condition indicated by a logic "0" output. This Signal Detect output can be used to drive a PECL input on an upstream circuit, such as Signal Detect input or Loss of Signal-bar.

### Pin 5. Receiver Power Supply V<sub>CC</sub>:

Provide +5 V dc via the recommended transmitter power supply filter circuit. Locate the power supply filter circuit as close as possible to the V<sub>CC</sub> pin.

### Pin 6. Transmitter Power Supply V<sub>CC</sub>:

Provide +5 V dc via the recommended transmitter power supply filter circuit. Locate the power supply filter circuit as close as possible to the V<sub>CC</sub> pin.

### Pin 7. Transmitter Data In Bar TD-:

Terminate this high-speed, PECL output with standard PECL techniques.

### Pin 8. Transmitter Data In TD+:

Terminate this high-speed, PECL output with standard PECL techniques.

### Pin 9. Transmitter Signal Ground V<sub>CC</sub>:

Directly connect this pin to the transmitter ground plane.

## Mounting Studs

The mounting studs are provided for mechanical attachment to the circuit board. They are embedded in the nonconductive plastic housing and are not tied to the transceiver internal circuit and should be soldered into plated-through holes on the printed circuit board.

## Functional Description Receiver Section

### Design

The receiver section contains an InGaAs/InP photo detector and a preamplifier within the receptacle, coupled to a postamp/decision circuit on a separate circuit board.

The postamplifier is ac coupled to the preamplifier as illustrated in Figure 1. The coupling capacitor is large enough to pass the SONET/SDH test pattern at 622 MBd without significant distortion or performance penalty. If a lower signal rate, or a code which has significantly more low frequency content is used, sensitivity, jitter and pulse distortion could be degraded.

Figure 1 also shows a filter network which limits the bandwidth of the preamp output signal. The filter is designed to bandlimit the preamp output noise and thus improve the receiver sensitivity.

These components will also reduce the sensitivity of the receiver as the signal bit rate is increased above 622 MBd.

### Noise Immunity

The receiver includes internal circuit components to filter power supply noise. Under some conditions of EMI and power supply noise, external power supply filtering may be necessary. If receiver sensitivity is found to be degraded by power supply noise, the filter network illustrated in Figure 2 may be used to improve performance. The values of the filter components are general recommendations and may be changed to suit a particular system environment. Shielded inductors are recommended.

### Terminating the Outputs

The PECL Data outputs of the receiver may be terminated with the standard Thevenin-equivalent 50 ohm to  $V_{CC} - 2\text{ V}$  termination.

Other standard PECL terminating techniques may be used.

The two outputs of the receiver should be terminated with identical load circuits to avoid unnecessarily large ac current in  $V_{CC}$ . If the outputs are loaded identically, the ac current is largely nulled. The SD output of the receiver is PECL logic and must be loaded if it is to be used. The signal detect circuit is much slower than the data path, so the ac noise generated by an asymmetrical load is negligible. Power consumption may be reduced by using a higher than normal load impedance for the SD output. Transmission line effects are not generally a problem as the switching rate is slow.

### The Signal Detect Circuit

The signal detect circuit works by sensing the peak level of the received signal and comparing this level to a reference.

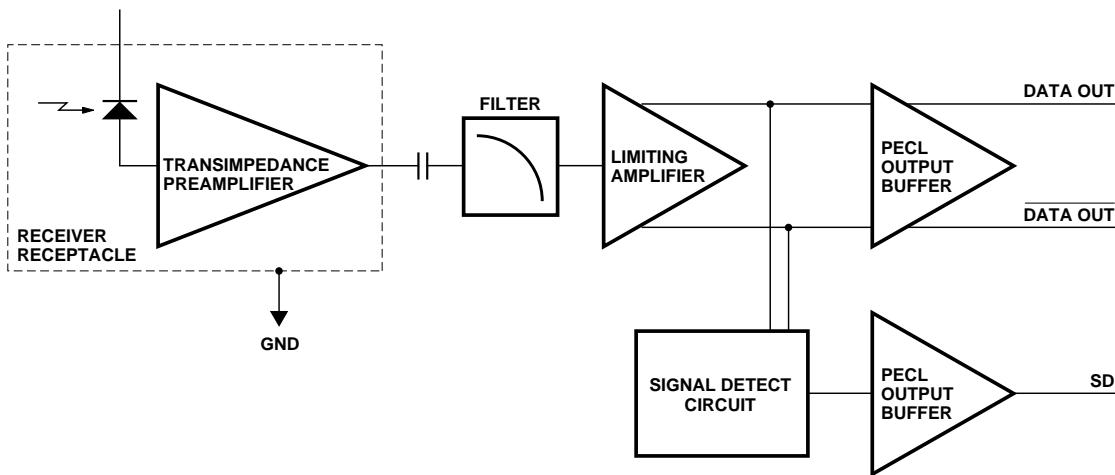


Figure 1. Receiver Block Diagram.

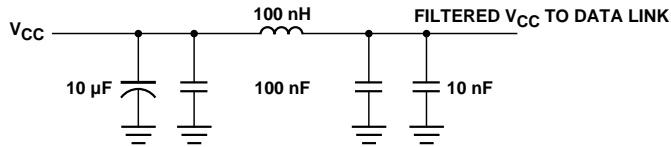


Figure 2.  $\pi$  Filter Network for Noise Filtering.

## Functional Description Transmitter Section

### Design

The transmitter section uses a buried heterostructure Fabry-Perot laser as its optical source. The package of this laser is designed to allow repeatable coupling into single mode fiber. In addition, this package has been designed to be compliant with IEC 825 eye safety requirements under all fault conditions.

The optical output is controlled by a custom IC which detects the laser output via the monitor photodiode. This IC provides both dc and ac current drive to the laser to ensure correct modulation, eye diagram and extinction ratio over temperature, supply voltage and life.

### PCB Mounting

The HFCT-5208 has two solderable mounting studs. These studs are not electrically connected. The transceiver is

designed for common production processes. It may be wave soldered and aqueous washed providing the process plug is in place.

Each process plug can only be used once during processing, although with subsequent use, it can be used as a dust cover.

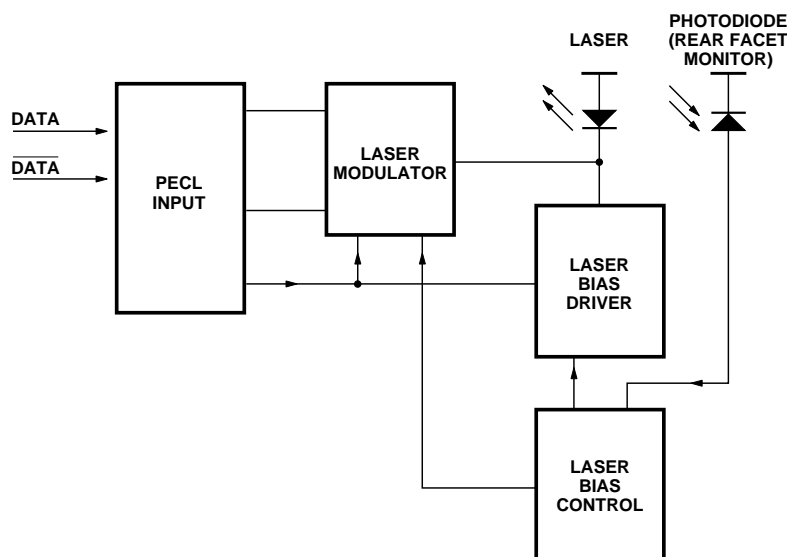


Figure 3. Simplified Transmitter Schematic.

## Performance Specifications

### Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature	$T_S$	-40	+85	°C
Operating Temperature HFCT-5208A/C	-	-40	+85	°C
Operating Temperature HFCT-5208B/D	-	0	+70	°C
Lead Soldering Temperature/Time	-	-	+240/10	°C/s
Output Current (Other Outputs)	$I_{out}$	0	30	mA
Input Voltage	-	GND	$V_{CC}$	V
Power Supply Voltage	-	0	6	V

### Operating Environment

Parameter	Symbol	Minimum	Maximum	Units
Power Supply Voltage	$V_{CC}$	+4.75	+5.25	V
Ambient Operating Temperature HFCT-5208A/C	$T_{op}$	-40	+85	°C
Ambient Operating Temperature HFCT-5208B/D	$T_{op}$	0	+70	°C

### Transmitter Section

(Ambient Operating Temperature  $T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$ ,  $V_{CC} = 4.75\text{ V}$  to  $5.25\text{ V}$ )

Parameter	Symbol	Minimum	Maximum	Units	Notes
Output Center Wavelength	$\lambda_{ce}$	1274	1356	nm	-
Output Spectral Width (RMS)	$\Delta\lambda$	-	2.5	nm	-
Average Optical Output Power	$P_o$	-15	-8	dBm	1
Extinction Ratio	$E_r$	8.2	-	dB	-
Power Supply Current	$I_{CC}$	-	140	mA	2
Output Eye	Compliant with Bellcore TR-NWT-000253 and ITU recommendation G.957				

### Receiver Section

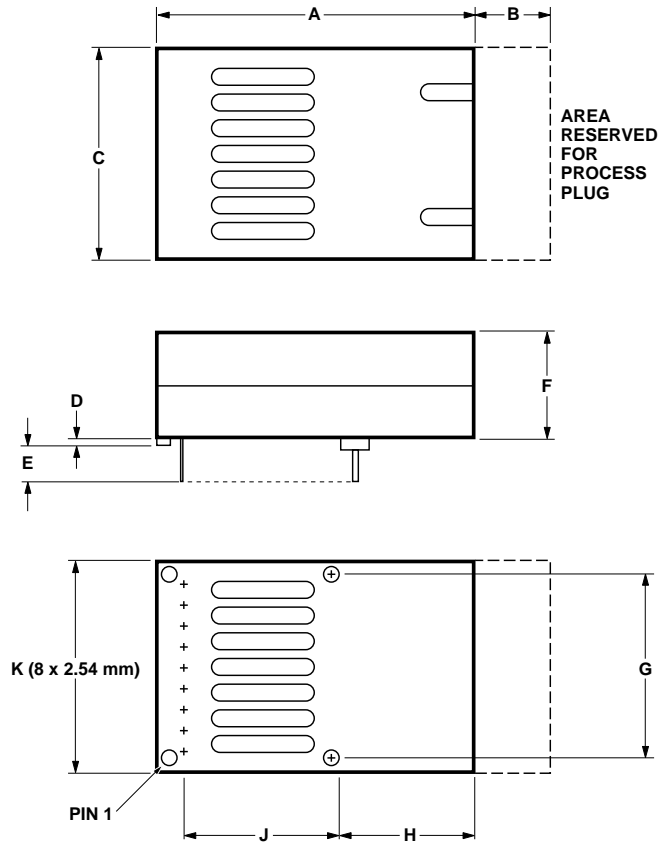
(Ambient Operating Temperature  $T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$ ,  $V_{CC} = 4.75\text{ V}$  to  $5.25\text{ V}$ )

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
Receiver Sensitivity	-	-28	-	-	dBm	3
Maximum Input Power	-	-7	-	-	dBm	-
Alarm ON	-	-42	-	-31	dBm	-
Hysteresis	-	0.5	-	4.0	dB	-
Power Supply Current	$I_{CC}$	-	105	150	mA	4
Data Outputs PECL Alarm Output PECL						

#### Notes:

- Output power is power coupled into a single mode fiber.
- The power supply current varies with temperature. Maximum current is specified at  $V_{CC} = \text{Maximum}$  at maximum temperature (not including terminations and end of life).
- Minimum sensitivity and saturation levels for a  $2^{A23-1}$  PRBS with 72 ones and 72 zeros inserted. (ITU-T recommendation G.958).
- The current excludes the output load current.

## Drawing Dimensions



DIM.	MIN.	MAX.
A	–	39.16
B	–	12.70
C	–	25.40
D	0.65	0.85
E	2.92	3.68
F	–	10.35
G	–	20.32
H	–	15.93
J	–	20.32
K	AS SHOWN IN DIAGRAM	

ALL DIMENSIONS IN MILLIMETERS

ELECTRIC PINS ARE NOMINALLY 0.46 mm/0.018 in. DIAMETER.  
MOUNTING POSTS ARE NOMINALLY 1.27 mm/0.050 in. DIAMETER.

## Regulatory Compliance

The HFCT-5208 is intended to enable commercial system designers to develop equipment that complies with the various regulations governing certification of Information Technology Equipment. See the Regulatory Compliance Table 1 for details. Additional information is available from your Hewlett-Packard sales representative.

### Electrostatic Discharge (ESD)

There are two design cases in which immunity to ESD damage is important.

The first case is during handling of the transceiver prior to mounting it on the circuit board. It is important to use normal ESD handling precautions for ESD sensitive devices. These precautions include using grounded wrist straps, work benches, and floor mats in ESD controlled areas.

The second case to consider is static discharges to the exterior of the equipment chassis containing the transceiver parts. To the extent that the duplex SC connector is exposed to the outside of the equipment chassis, it may be subject to whatever ESD system level test criteria that the equipment is intended to meet.

### Electromagnetic Interference (EMI)

Most equipment designs utilizing these high-speed transceivers from Hewlett-Packard will be required to meet the requirements of FCC in the United States, CENELEC EN55022 (CISPR 22) in Europe and VCCI in Japan.

The HFCT-5208 has been characterized without a chassis enclosure to demonstrate the robustness of the part's integral shielding. Performance of a system

containing these transceivers within a well-designed chassis is expected to be better than the results of those tests with no chassis enclosure.

### Immunity

Equipment utilizing these HFCT-5208 transceivers will be subject to radio-frequency electromagnetic fields in some environments. These transceivers, with their integral shields, have been characterized without the benefit of a normal equipment chassis enclosure and the results are reported below. Performance of a system containing these transceivers within a well-designed chassis is expected to be better than the results of these tests without a chassis enclosure.

**Table 1. Regulatory Compliance – Typical Performance**

Feature	Test Method	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883C Method 3015.4	Class 1 (>1000 V)
Electrostatic Discharge (ESD) to the Duplex SC Receptacle.	Variation of IEC 801-2	Products of this design typically withstand at least 25 kV without damage when the Duplex SC Connector Receptacle is contacted by a Human Body Model probe.
Electromagnetic Interference (EMI)	FCC Class B CENELEC EN55022 Class B (CISPR 22B) VCCI Class 2	Typically provide 5 dB margin to FCC Class B when tested at a certified test range with the transceiver mounted to a circuit card without a chassis enclosure at frequencies up to 1 GHz. Margins above 1 GHz are dependent on customer board and chassis designs.
Immunity	Variation of IEC 801-3	Typically shows 2 dB margin against sensitivity when swept with a 3 V/m field from 27 MHz to 16 GHz.
Eye Safety	IEC 825	License Pending.
	CDRH Class 1	License Pending.

## Ordering Information

**HFCT-5208 X**

Temperature Range:

A = -40°C to +85°C, Black Case

B = 0 to +70°C, Black Case

C = -40°C to +85°C, Blue Case

D = 0 to +70°C, Blue Case

Model Name:

HFCT-5208

Recommended Part Numbers:

HFCT-5208C

HFCT-5208D

**Class I Laser Product:** This product conforms to the applicable requirements of 21 CFR 1040 at the date of manufacture.

Date of Manufacture: \_\_\_\_\_  
Hewlett-Packard Ltd., Whitehouse Rd., Ipswich, England

## Handling Precautions

1. The HFCT-5208 can be damaged by current surges or overvoltage. Power supply transient precautions should be taken.
2. Normal handling precautions for electrostatic sensitive devices should be taken.

*[www.hp.com/go/fiber](http://www.hp.com/go/fiber)*

For technical assistance or the location of your nearest Hewlett-Packard sales office, distributor or representative call:

**Americas/Canada:** 1-800-235-0312 or 408-654-8675

**Far East/Australasia:** Call your local HP sales office.

**Japan:** (81 3) 3335-8152

**Europe:** Call your local HP sales office.

Data subject to change.

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