

OC-12/STM-4 Single Mode Transceiver with Clock Recovery & Differential Facet Monitors



Features

- ☑ Full Compliance with OC-12/STM-4 SONET/SDH Specifications
- ☑ Long Reach 1310 nm & 1550 nm and Intermediate Reach
- ☑ Eye Safe (Class I Laser Safety)
- ☑ Multi-sourced 2x9 package style
- ☑ Duplex SC or ST or FC connector
- ☑ - 40°C to +85°C Operating Temperature
- ☑ Single +5 V supply & PECL interface
- ☑ Wave Solder Process Compatible

Description

The DTC-12-S fiber optic transceivers with clock recovery offer a simple, convenient way to interface ATM/SONET/SDH OC-12/STM-4 PCBs to single mode fiber optic cables. For Short and Intermediate Reach applications, a 1300 nm Fabry Perot Laser is used while for Long Reach applications, a 1300 nm or 1550 nm DFB Laser is used. All modules satisfy Class I Laser Safety requirements in accordance with the US FDA/CDRH and international IEC-825 standards.

The transmit and receive functions are contained in a two-row, 18-pin (2x9) package with a Duplex SC or ST or FC connector interface. The transmitter incorporates all the necessary control and driver circuit for converting

PECL data to light. A Transmitter Disable input as well as differential Laser Facet and Bias Monitor outputs are provided. The receiver uses an InGaAs/InP PIN photodiode to convert the light signal into an electrical current which is amplified and resampled using internal clock recovery (PLL) to generate PECL-compatible data and clock. The transimpedance amplifier IC has an internal AGC for wide dynamic range.

The transceiver operates from a single +5V power supply over an operating temperature range of - 40°C to +85°C. The transceiver package is made of either *conductive* plastic (Duplex-SC version) or metal (FC and ST version) for good EMI shielding.

Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature	T_{st}	- 40	+ 85	°C
Operating Temperature	T_{op}	- 40	+ 85	°C
Supply Voltage	V_{CC}	- 0.5	+ 6.0	V
Input Voltage	V_{in}	- 0.5	V_{CC}	V
Output Current	I_O	-	50	mA
Lead Soldering Temperature & Time	-	-	260°C, 10 sec	

DTC-12-S

Transmitter Performance Characteristics (over Operating Case Temperature Range)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Data Rate		B	622.08 - 50 ppm	622.08	622.08 + 50 ppm	Mb/s
Average Optical Output Power (coupled into single mode fiber, 50% duty cycle)	HP	P_o	- 3.0	0	+2.0	dBm
	L0		- 5.0	- 3.0	0	
	L1		- 8.0	- 5.0	- 2.0	
	L2		- 12.0	- 8.0	- 5.0	
	L3		- 15.0	- 11.0	- 8.0	
Extinction Ratio	SR & IR	P_{hi}/P_{lo}	8.2	-	-	dB
	LR1 & LR2		10	-	-	
Center Wavelength ¹	SR (Short Reach)	λ_c	1261	1310	1360	nm
	IR (Intermediate Reach)		1274	1310	1356	
	LR1 (Long Reach 1310 nm)		1293	1310	1334	
	LR2 (Long Reach 1550 nm)		1280	1310	1335	
			1480	1550	1580	
Spectral Width (RMS) ¹	SR (Short Reach)	$\Delta\lambda_{RMS}$	-	-	4.0	nm
	IR (Intermediate Reach)		-	-	2.5	
			-	-	4.0	
Spectral Width (-20 dB)	LR1 & LR2	$\Delta\lambda_{20}$	-	-	1.0	
Optical Rise and Fall Time (10% to 90%)		t_r, t_f	-	0.5	1.0	ns
Optical Output Eye	compliant with Bellcore TR-NWT-000253 and ITU-T Recommendation G.957					
¹ For Intermediate Reach version, the Center Wavelength is either $1274 \text{ nm} \leq \lambda_c \leq 1356 \text{ nm}$ for $\Delta\lambda_{RMS} \leq 2.5 \text{ nm}$ or $1293 \text{ nm} \leq \lambda_c \leq 1334 \text{ nm}$ for $\Delta\lambda_{RMS} \leq 4.0 \text{ nm}$.						

Receiver Performance Characteristics (over Operating Case Temperature Range)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Data Rate		B	622.08 - 50 ppm	622.08	622.08 + 50 ppm	Mb/s
Receiver Sensitivity (10^{-10} BER) ¹		P_{min}	- 28.0	- 30.0	-	dBm
Maximum Input Optical Power (10^{-10} BER) ¹		P_{max}	- 7.0	0	-	dBm
Signal Detect Thresholds	Increasing Light Input	P_{sd+}	-	-	- 28.0	dBm
	Decreasing Light Input	P_{sd-}	- 40.0	-	-	dBm
Signal Detect Hysteresis			-	0.5	-	dB
Wavelength of Operation		λ	1100	-	1600	nm
Output Clock Jitter		CLK_J	-	-	0.01	UIrms
Jitter Tolerance & Transfer Function		compliant with ITU Recommendation G.958				
¹ Specified in Average Optical Input Power and measured at 1300 nm wavelength with 2^{23} -1 PRBS.						

Transmitter Electrical Interface (over Operating Case Temperature Range)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Input HIGH Voltage		V_{IH}	$V_{CC} - 1.165$	-	$V_{CC} - 0.700$	V
Input LOW Voltage		V_{IL}	$V_{CC} - 1.890$	-	$V_{CC} - 1.475$	V
Data Input Current - HIGH		I_H	-	-	350	μA
Data Input Current - LOW		I_L	-	-	250	μA
Transmitter Disable Voltage		V_{DIS}	$V_{CC} - 2.0$	-	V_{CC}	V
Transmitter Enable Voltage		V_{EN}	0	-	0.8	V
Differential Bias Monitor Voltage	at 25°C	$V_{BM+} - V_{BM-}$	-	80	120	mV
	at 85°C		-	280	500	
Differential Facet Monitor Voltage		$V_{FM+} - V_{FM-}$	20	100	200	mV

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Receiver Electrical Interface (over Operating Case Temperature Range)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Output HIGH Voltage	V_{OH}	$V_{CC} - 1.200$	-	$V_{CC} - 0.700$	V
Output LOW Voltage	V_{OL}	$V_{CC} - 2.000$	-	$V_{CC} - 1.620$	V
Output Current	I_O	-	-	25	mA

Electrical Power Supply Characteristics (over Operating Case Temperature Range)

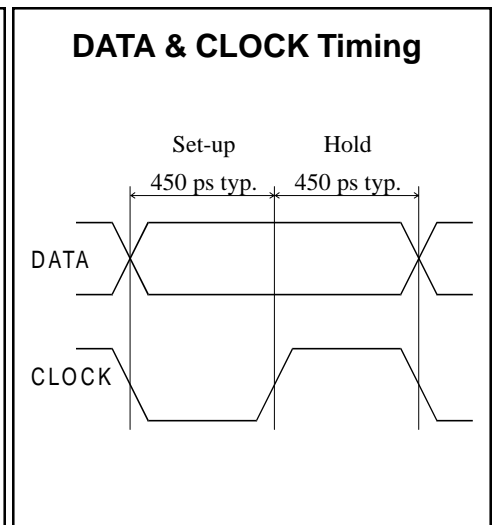
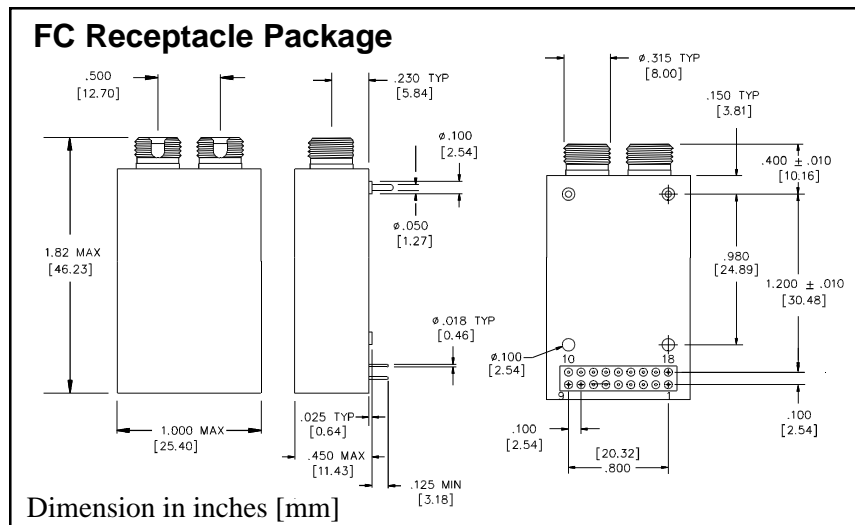
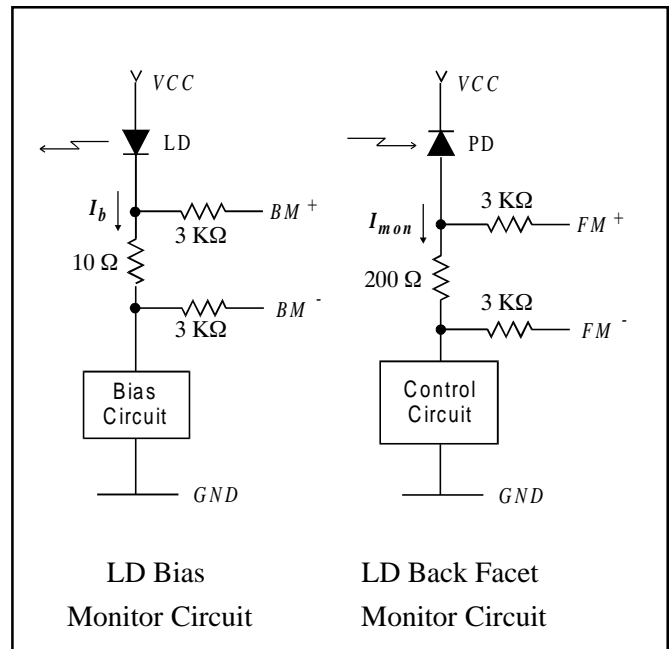
Parameter	Symbol	Minimum	Typical	Maximum	Units	
Supply Voltage	V_{CC}	4.75	5.0	5.25	V	
Supply Current	TX	SR & IR	-	100	130	mA
		LR1 & LR2	-	120	150	
	RX	I_{CC}	-	160	220	mA
Power Dissipation	SR & IR	-	1300	1800	mW	
	LR1 & LR2	-	1400	1950		

Application Notes

Transmitter: When the DATA+ input is at logic HIGH and DATA- input is at logic LOW, the LD is ON; and vice versa. In single-ended applications, the unused input pin should be biased to $V_{CC} - 1.29$ V. The transmitter is normally enabled (i.e. when the TX DISABLE control input is not connected). When the TX DISABLE control input voltage is higher than $V_{CC} - 2$ V, the laser is turned off independent of the input data. A Transmitter End-of-Life Alarm (T_{ALM}) is also provided, which will switch to TTL level HIGH when the laser is reaching its End-of-Life.

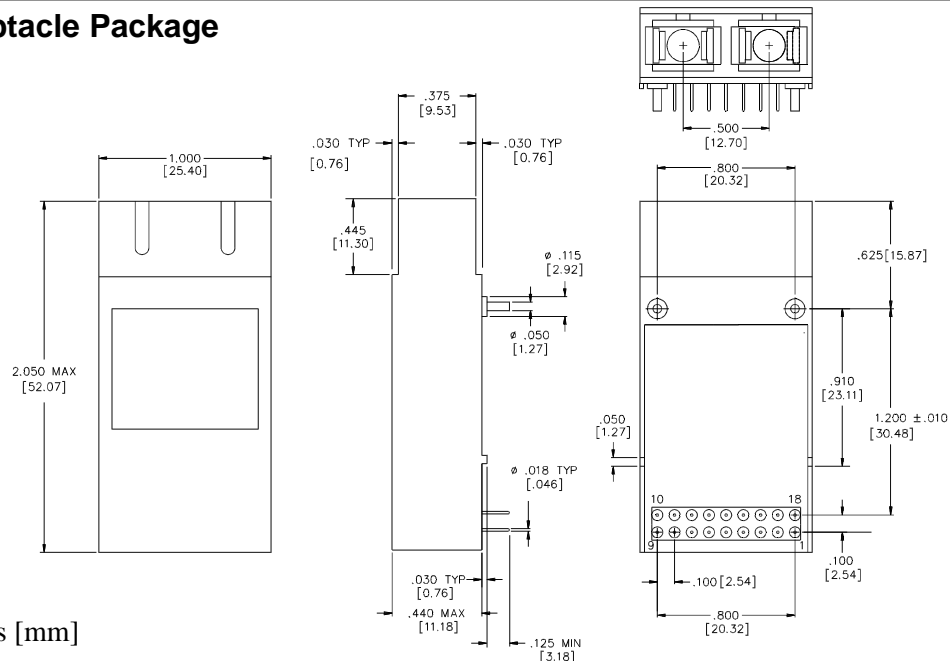
Receiver: Both differential outputs (DATA+ and DATA-, CLOCK+ and CLOCK-) are PECL levels requiring termination (50 ohms to $V_{CC} - 2$ volts or 510 ohms to GND is recommended). For optimum performance, both outputs should be terminated in the same manner, even if only one is used.

The Signal Detect circuit monitors the level of the incoming optical signal and generates a logic LOW signal when insufficient photocurrent is produced. The SIGNAL DETECT output is PECL level requiring termination (510 ohms to GND is recommended).



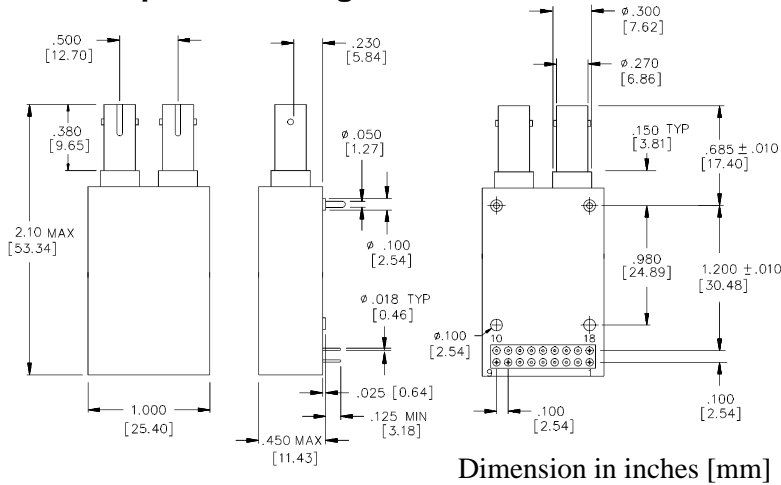
DTC-12-S

Duplex SC Receptacle Package



Dimension in inches [mm]

ST Receptacle Package



Dimension in inches [mm]

PIN	FUNCTION	PIN	FUNCTION
1	N/C	10	TX GND
2	N/C	11	TD+ (TX DATA IN +)
3	CLOCK -	12	TD- (TX DATA IN -)
4	CLOCK +	13	V _{CC} TX
5	BM- (BIAS MONITOR -)	14	V _{CC} RX
6	BM+ (BIAS MONITOR +)	15	SD (RX SIGNAL DETECT)
7	TX DISABLE	16	RD- (RX DATA OUT -)
8	FM+ (FACET MONITOR +)	17	RD+ (RX DATA OUT +)
9	FM- (FACET MONITOR -)	18	RX GND

Ordering Information

DTC - 12 - S - XX - T - Ln - DR

<p>Receptacle</p> <p>Blank : SC Receptacle</p> <p>ST : ST Receptacle</p> <p>FC : FC Receptacle</p>	<p>Temperature Range</p> <p>A: - 40°C to 85°C</p> <p>B: 0°C to 70°C</p>	<p>Light Output Option</p> <p>HP: 0 dBm (typ.)</p> <p>L0: - 3 dBm (typ.)</p> <p>L1: - 5 dBm (typ.)</p> <p>L2: - 8 dBm (typ.)</p> <p>L3: - 11 dBm (typ.)</p>	<p>Distance Option</p> <p>Blank: Short Reach / I-4</p> <p>IR : Intermediate Reach / S-4.1</p> <p>LR1 : Long Reach 1310 nm / L-4.1</p> <p>LR2 : Long Reach 1550 nm / L-4.2</p>
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NOTES

- The DTC-12-S-xx-T-L3-IR modules are fully compliant with OC-12/STM-4 Intermediate Reach / S-4.1 standard.
- The DTC-12-S-xx-T-HP-LR1 & LR2 are fully compliant with OC-12/STM-4 Long Reach / L-4.1 & L-4.2 standard. They all use DFB lasers. However, the DTC-12-S-xx-A-HP-LR2 operating temperature is limited to only -25°C to +70°C.
- The LR1 & LR2 options are available only with DFB lasers and HP & L0 optical output power levels.

Optical Communication Products, Inc.

9736 Eton Avenue, Chatsworth, CA 91311, Tel.: 818-701-0164, FAX: 818-701-1468

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