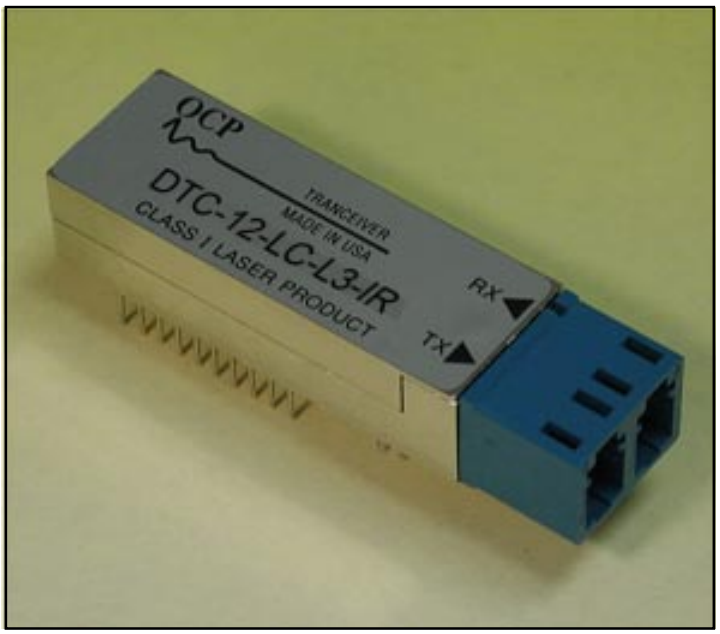
OCP©

DTC-xx-LC / DTC-xx-LS

3.3 volt LC connector OC-3 & OC-12 Single Mode Transceiver with Clock Recovery



Features

- ☑ *Full Compliance with OC-3/STM-1 to OC-12/STM-4 SONET/SDH Specifications*
- ☑ *Long Reach 1310 nm (40Km distance) and 1550 nm (80Km) as well as Intermediate Reach (15Km)*
- ☑ *Eye Safe (Class I Laser Safety)*
- ☑ *Multi-sourced 2x10 package style*
- ☑ *Duplex LC connector*
- ☑ *- 40°C to + 85°C Operating Temperature ("A" option)*
- ☑ *Single +3.3 V supply & LV-PECL interface*
- ☑ *LV-TTL Signal Detect*

Description

The DTC-xx-LC and DTC-xx-LS are 3.3 volt supply fiber optic transceivers with clock recovery designed to interface ATM/SONET/SDH OC-3/STM-1 and OC-12/STM-4 PCBs to single mode fiber optic cables. 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, 20-pin (2x10) package with a Duplex LC connector interface. The receptacle fits into an RJ-45 form factor outline. The 20-pin configuration is in conformance to a Small Form Factor (SFF) multisource transceiver agrement.

The transmitter includes the laser driving circuitry as well as an Average Power Control (APC) loop to stabilize the transmitter average optical output power. A Transmitter Disable Input, differential Laser Back Facet Monitor and differential Laser Bias Monitor outputs are provided. The receiver features a high performance InGaAs PIN photodiode and a transimpedance amplifier IC with internal AGC for wide dynamic range. A PLL clock recovery IC is used to generate LV-PECL data and clock. A Signal Detect status output (LV-TTL) is included.

The transceiver operates from a single +3.3V power supply over an operating temperature range of 0°C to +70°C ("B" option) or - 40°C to +85°C ("A" option). The transceiver package is made of either *conductive* plastic or metal for excellent EMI shielding.

Absolute Maximum Ratings

Parameter		Symbol	Minimum	Maximum	Units
Storage Temperature		T_{st}	- 40	+ 85	°C
Operating Case Temperature	"A" Option	T_{op}	- 40	+ 85	°C
	"B" Option		0	+ 70	
Supply Voltage		V_{CC}	0	+ 5.0	V
Input Voltage		V_{in}	0	V_{CC}	V
Output Current		I_O	-	50	mA
Lead Soldering Temperature & Time		-	-	260°C, 10 sec	

Transmitter Performance Characteristics (over Operating Case Temperature Range)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Data Rate		B	50	155.52	200	Mb/s
Average Optical Output Power (coupled into single mode fiber), 50% duty cycle	L0	P_o	- 5.0	- 3.0	0	dBm
	L3		- 15.0	- 11.0	- 8.0	
Extinction Ratio		P_{hi} / P_{lo}	10	-	-	dB
Center Wavelength	IR (Intermediate Reach)	λ_c	1261	1310	1360	nm
	LR1 (Long Reach 1310 nm)		1280	1310	1335	
	LR2 (Long Reach 1550 nm)		1480	1550	1580	
Spectral Width (RMS)	LR1 (0°C to 70°C) & IR	$\Delta\lambda_{RMS}$	-	-	4	nm
Spectral Width (-20 dB)	LR1 (-40°C to 85°C) & LR2	$\Delta\lambda_{20}$	-	-	1	
Side Mode Suppression Ratio	LR1 (-40°C to 85°C) & LR2	$SMSR$	30	-	-	dB
Optical Output Eye	compliant with Bellcore TR-NWT-000253 and ITU-T Recommendation G.957					

Receiver Performance Characteristics (over Operating Case Temperature Range)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Data Rate		B	155.52 - 200 ppm	155.52	155.52 + 200 ppm	Mb/s
Receiver Sensitivity (10^{-10} BER) [1]		P_{min}	- 34.0	- 36.0	-	dBm
Maximum Input Optical Power (10^{-10} BER) [1]		P_{max}	- 7.0	0	-	dBm
Signal Detect Thresholds	Increasing Light Input	P_{sd+}	-	-	- 34.0	dBm
	Decreasing Light Input	P_{sd-}	- 45.0	-	-	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 (1550 nm for LR2 option) with 2^{23}-1 PRBS.

Ordering Information

DTC - 03 - *xx* -*T*- *Ln* - *DR* - *P*

EMI shield option
LC: Package witout shield
LS: Package with shield

Temperature Range
A: - 40°C to 85°C
B: 0°C to 70°C

Light Output Option
L0: - 3 dBm (typ.)
L3: - 11 dBm (typ.)

Distance Option
specifies the range for Center Wavelength & Spectral Width to be compliant with SONET/SDH standard
IR : Intermediate Reach / S-1.1 (15Km) [5]
LR1 : Long Reach 1310 nm / L-1.1 (40Km) [5]
LR2 : Long Reach 1550 nm / L-1.2 (80Km) [5]

Package Option
"Blank" : Plastic Package
M : Metal Package

NOTES

1. For full compliance with OC-3/STM-1 Intermediate Reach / S-1.1 standard, the DTC-03-xx-*T*-L3-IR-(M) modules are recommended.
2. For full compliance with OC-3/STM-1 Long Reach / L-1.1 standard, the DTC-03-xx-A-L0-LR1-(M) and DTC-03-xx-L0-LR1-(M) modules are recommended. The DTC-03-xx-A-L0-LR1-(M) uses a DFB laser to satisfy the - 40°C to +85°C requirement for Center Wavelength.
3. For full compliance with OC-3/STM-1 Long Reach / L-1.2 standard, the DTC-03-xx-A-L0-LR2-(M) and DTC-03-xx-L0-LR2-(M) modules are recommended. Both modules use DFB lasers. However, the DTC-03-*xx*-A-L0-LR2-(M) is specified only over - 25°C to +70°C.
4. The LR1 (- 40°C to +85°C) & LR2 options are available only with DFB lasers and L0 optical output power level.
5. These are target distances to be used for classification and not for specification, per ITU-T Recommendation G.957.

Transmitter Performance Characteristics (over Operating Case Temperature Range)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Data Rate		B	50	622.08	700	Mb/s
Average Optical Output Power (coupled into single mode fiber, 50% duty cycle)	HP	P_o	- 3.0	0	+2.0	dBm
	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	
			1293	1310	1334	
	LR1 (Long Reach 1310 nm)		1280	1310	1335	
	LR2 (Long Reach 1550 nm)		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 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 nm $\leq \lambda_c \leq$ 1356 nm for $\Delta\lambda_{RMS} \leq$ 2.5 nm
or 1293 nm $\leq \lambda_c \leq$ 1334 nm for $\Delta\lambda_{RMS} \leq$ 4.0 nm.

Receiver Performance Characteristics (over Operating Case Temperature Range)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Data Rate		B	622.08 - 200 ppm	622.08	622.08 + 200 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}	- 8.0	- 6.0	-	dBm
Signal Detect Thresholds	Increasing Light Input	P_{sd+}	-	-	- 28.0	dBm
	Decreasing Light Input	P_{sd-}	- 45.0	-	-	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.

Ordering Information

DTC - 12 - *xx* -*T*- *Ln* - *DR* - *P*

EMI shield option
LC: Package witout shield
LS: Package with shield

Temperature Range
A: - 40°C to 85°C
B: 0°C to 70°C

Light Output Option
HP: 0 dBm (typ.)
L3: - 11 dBm (typ.)

Distance Option
specifies the range for Center Wavelength & Spectral Width to be compliant with SONET/SDH standard
SR : Short Reach / I-1.1 (2 Km) [4]
IR : Intermediate Reach / S-1.1 (15 Km) [4]
LR1 : Long Reach 1310 nm / L-1.1(40 Km) [4]
LR2 : Long Reach 1550 nm / L-1.2 (80 Km) [4]

Package Option
"Blank" : Plastic Package
M : Metal Package

NOTES

1. For full compliance with OC-12/STM-4 Intermediate Reach / S-4.1 standard, the DTC-12-xx-*T*-L3-IR-(M) modules are recommended.
2. For full compliance with OC-12/STM-4 Long Reach / L-4.1 & L-4.2 standard, the DTC-12-xx-*T*-HP-LR1-(M) & LR2-(M) are recommended. They all use DFB lasers. However, the DTC-12-xx-A-HP-LR2-(M) operating temperature is limited to only -25°C to +70°C.
3. The LR1 & LR2 options are available only with DFB lasers and HP optical output power level.
4. These are target distances to be used for classification and not for specification, per ITU-T Recommendation G.957.

Transmitter Electrical Interface (over Operating Case Temperature Range)

Parameter	Symbol	Minimum	Typical	Maximum	Units
DATA Input HIGH Voltage	V_{IH}	V_{CC} - 1.165	-	V_{CC} - 0.700	V
DATA Input LOW Voltage	V_{IL}	V_{CC} - 1.950	-	V_{CC} - 1.475	V
DATA Input Current - HIGH	I_H	-	-	150	μA
DATA Input Current - LOW	I_L	0.5	-	-	μA
Transmitter Disable Voltage	V_{DIS}	2.0	-	V_{CC}	V
Transmitter Enable Voltage	V_{EN}	0	-	0.8	V
Differential Bias Monitor Voltage (T_a = 25°C)	V_{BM+} - V_{BM-}	0.02	-	0.12	V
Differential Back Facet Monitor Voltage	V_{FM+} - V_{FM-}	-	100	-	mV

Receiver Electrical Interface (over Operating Case Temperature Range)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Output HIGH Voltage (DATA & CLOCK) [1]	V_{OH}	V_{CC} - 1.16	-	V_{CC} - 0.67	V
Output LOW Voltage (DATA & CLOCK) [1]	V_{OL}	V_{CC} - 2.0	-	V_{CC} - 1.50	V
Output Differential Voltage (DATA & CLOCK) [2]	V_{DIFF}	0.4	-	1.4	V
Output Current (DATA & CLOCK)	I_O	-	-	25	mA
Output HIGH Voltage (SIGNAL DETECT) [3]	V_{OH}	2.4	-	V_{CC}	V
Output LOW Voltage (SIGNAL DETECT) [3]	V_{OL}	0	-	0.8	V

[1] With 50 ohm termination to V_{CC} - 2 V.
[2] If AC coupling is used.
[3] With minimum of 10Kohm load.

Electrical Power Supply Characteristics (over Operating Case Temperature Range)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Supply Voltage		V_{CC}	3.13	3.3	3.47	V
Supply Current	TX	$I_{CC,TX}$	-	80	115	mA
	RX	$I_{CC,RX}$	-	195	225	mA

Pin Assignment

PIN	FUNCTION	PIN	FUNCTION
1	VPD	11	V_{CC}TX
2	RX GND	12	TX GND
3	RX GND	13	TX DISABLE
4	CLK - (RX CLOCK OUT-)	14	TD+ (TX DATA IN +)
5	CLK + (RX CLOCK OUT +)	15	TD- (TX DATA IN -)
6	RX GND	16	TX GND
7	V_{CC}RX	17	BM- (BIAS MONITOR -)
8	SD (RX SIGNAL DETECT)	18	BM+ (BIAS MONITOR+)
9	RD- (RX DATA OUT -)	19	FM- (FACET MONITOR-)
10	RD+ (RX DATA OUT +)	20	FM+ (FACET MONITOR+)

Laser Safety: All transmitters are Class I Laser products per FDA/ CDRH and IEC-825 standards. They must be operated under specified operating conditions.

Optical Communication Products, Inc.
DATE OF MANUFACTURE:

MANUFACTURED IN THE USA
This product complies with
21 CFR 1040.10 and 1040.11
Meets Class I Laser Safety Requirements

Application Notes

Transmitter: When the DATA+ input is at logic HIGH and DATA- input is at logic LOW, the Laser Diode (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 input voltage is higher than 2 V, the laser is turned off independent of the input data.

The transmitter incorporates an Average Power Control (APC) loop to stabilize the transmitter average optical output power against temperature variation. The APC loop always acts to keep the transmitter average optical output power at a constant value (assuming that the transmitter is enabled). Therefore, when the input data is all continuous “zeroes” or all continuous “ones”, the transmitter optical output power is a constant level equal to the nominal average optical output power (not at the “OFF” level or at the “ON” level).

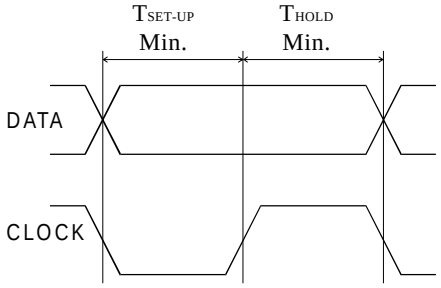
Receiver: Both differential outputs (DATA+ and DATA-, CLOCK+ and CLOCK-) are LV-PECL levels requiring termination (either 50 ohms to V_{CC} - 2 volts or 160 ohms to *GND* is recommended). For optimum performance, both outputs should be terminated in the same manner, even if only one is used.

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 TTL compatible and no termination is required.

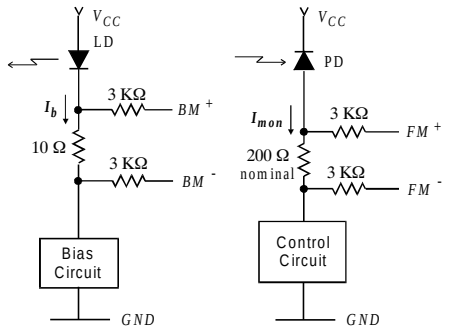
When there is loss of synchronization, the clock is locked to an internal reference frequency and provides an output CLOCK frequency of 622.08 ± 0.2 MHz for OC-12 and 155.52 ± 0.1MHz for OC-3. In addition, both DATA+ and DATA- is held at static logic LOW .

Interface circuit: The power suply line should be well filtered. All 0.1 μF power suply bypass capacitors should be as close to the transceiver module as possible. The two front ground posts (mounting studs) should be grounded to Circuit Ground or Chassis Ground.

DATA & CLOCK Timing

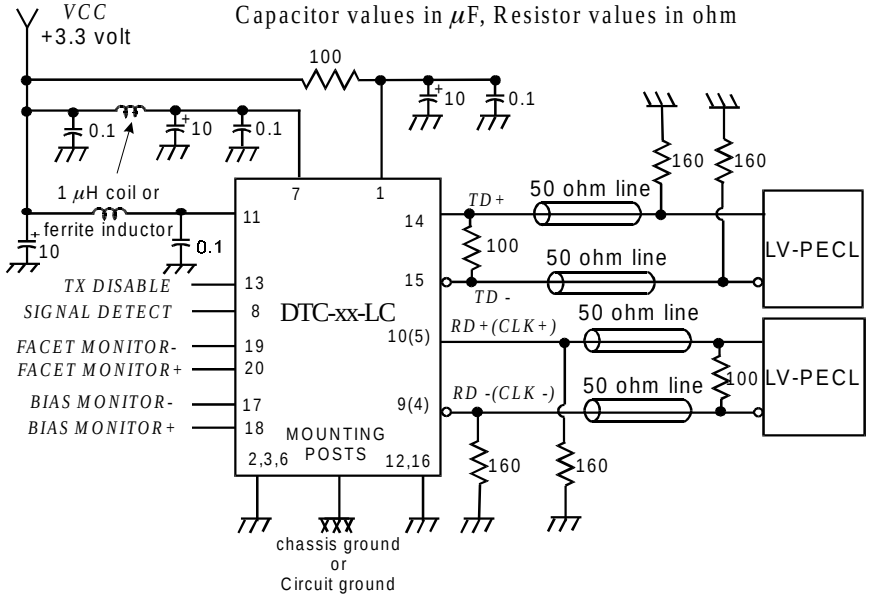


	155.52Mb/s	622.08Mb/s
T_{SET-UP}	2.5ns	450ps
T_{HOLD}	2.5ns	450ps



LD Bias Monitor Circuit

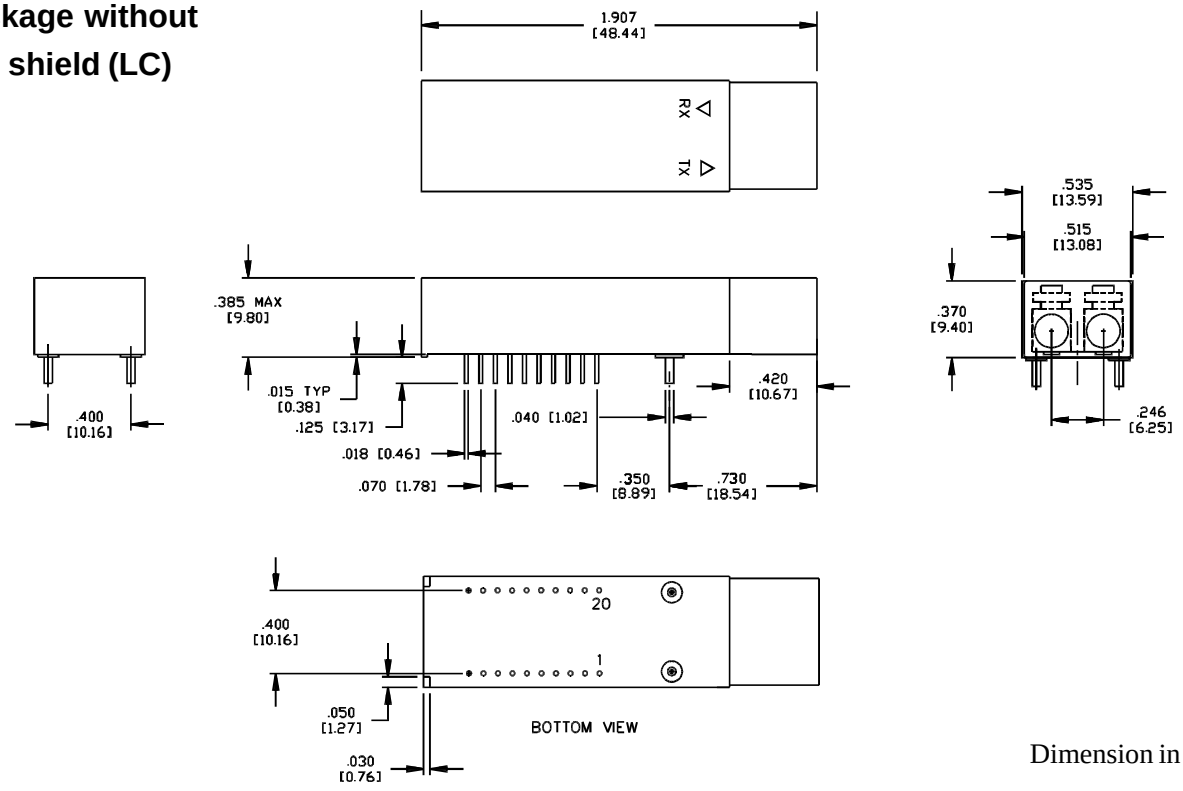
LD Back Facet Monitor Circuit



Note: Pins 4 and 5 could be teminated in the same manner as pins 9 and 10.

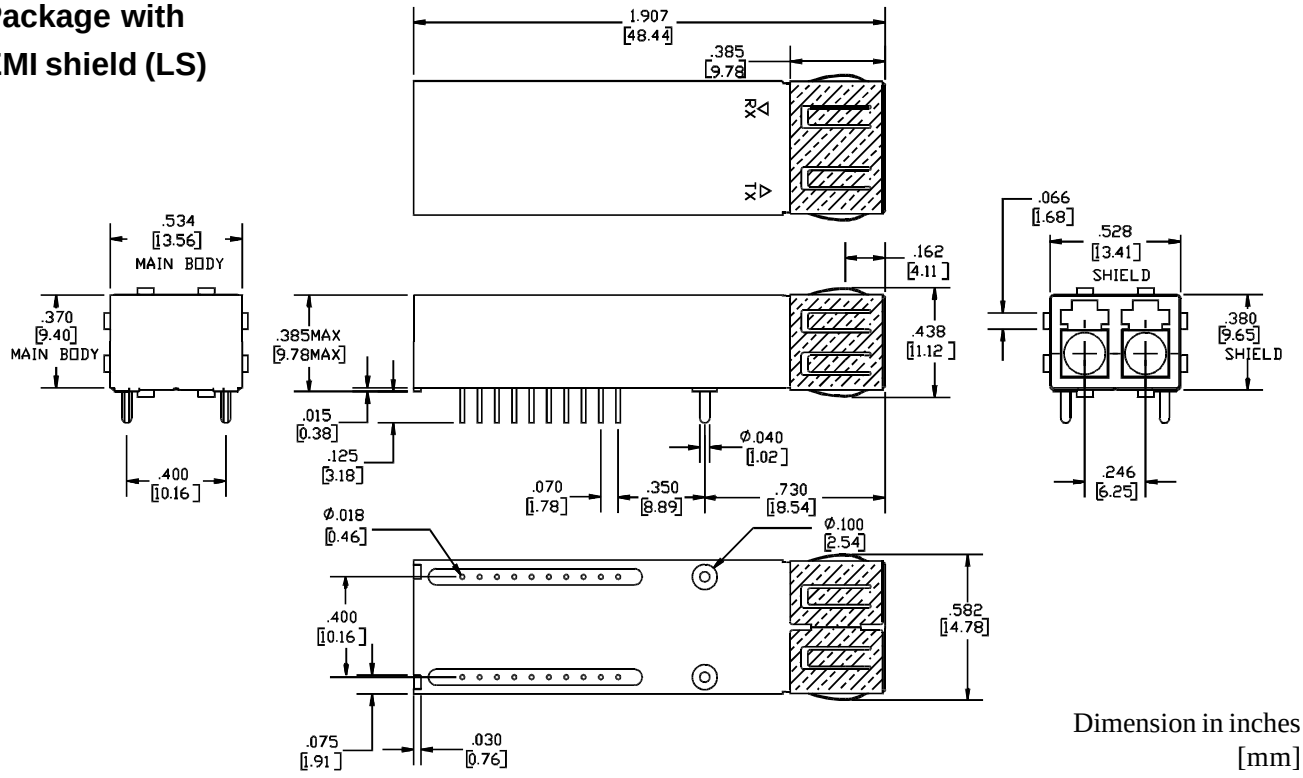
DTC-xx-LC / DTC-xx-LS

Package without EMI shield (LC)



Dimension in inches
[mm]

Package with EMI shield (LS)



Dimension in inches
[mm]

Optical Communication Products, Inc.

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