AFBR-0150Z Evaluation Kit

for a MOST150 Fiber Optic Transceiver using the AFBR-1150L Transmitter and AFBR-2150L Receiver

Application Note 5553

Evaluation Board Overview

With the AFBR-0150Z evaluation board, the Avago MOST150 AFBR-1150L transmitter and AFBR-2150L receiver can be easily evaluated. The transmitter and receiver are assembled in a MOST® shielded connector receptacle and soldered to the AFBR-0150Z evaluation board.

As shown in Figure 1, the evaluation board includes four SMA connectors for driving the differential input and output signals, two 2 mm jacks for power supply input, and a number of pin headers used for signal probing as well as for extending the control capabilities.

This application note describes the evaluation printed circuit board (PCB), the test equipment, and the method for evaluating optical and electrical characteristics of the AFBR-1150L transmitter and AFBR-2150L receiver.

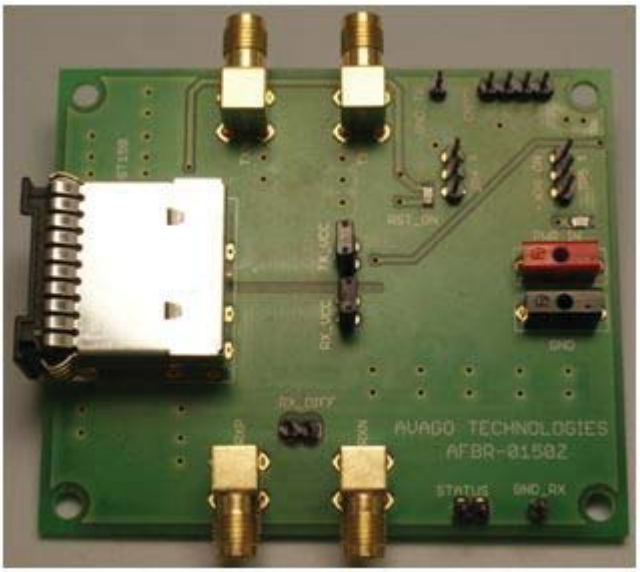

Figure 1. AFBR-0150Z evaluation board

Application Note Outline

1. Evaluation kit
2. Evaluation board description
3. Electro-optical test configurations
4. Evaluation board bill of materials (BOM).

1. Evaluation Kit

The AFBR-0150Z evaluation kit includes:

a. The AFBR-0150Z evaluation board with the MOST150 shielded optical transceiver module, four SMA connectors, nine pin headers (jumpers should be mounted in TX_VCC and RX_VCC pin headers), two 2 mm jack connectors and electronic components mounted on the bottom side of the PCB.

b. Application Note 5553 document

The evaluation kit does not include:

a. 3.3 V power supply and power supply cables

b. Digital multimeter

c. Digital pattern generator

d. Data analyzer/oscilloscope

e. Optical to electrical converter (O/E)

f. MOST150 loopback connector with 200 cm automotive POF[1] cable.

g. MOST150 connector with a single 50 cm POF to TX path

Note 1. For the POF cables used in this application note the 1-1418862-0 TYCO connector is used and standard POF with NA = 0.5

2. Evaluation Board Description

The evaluation board schematic is shown in Figure 2. The transmitter electrical input signals are AC coupled and terminated with a 100 Ω resistor close to the fiber optic transmitter (FOT) pins. The receiver output electrical signals are also AC coupled at the SMA connectors' side, but there is also an option for the signals be measured with a differential probe from the JP3 pin header.

Both transmitter and receiver electrical input and output signals are LVDS compatible. These signals are routed by controlled impedance tracks with a differential impedance of 100 Ω, as specified by the LVDS standard.

Solder jumpers SJ1 and SJ2 are by default soldered so that the user can probe the receiver output with a standard SMA interface oscilloscope or data analyzer. A differential probe can also be connected at JP3 and it is recommended that solder joints SJ1 and SJ2 be opened for improved measurement results.

Evaluation board power supply is provided by the CON1 (+ power) and CON2 (ground) jack connectors. Power should be +3.3 V (± 5%) with a 300 mA minimum current capability. A green LED, near the positive power supply jack (PWR_IN), illuminates when power is present. The power supply is filtered with a ferrite bead and 10 µF capacitors separately for the transmitter and the receiver. Jumpers RX_VCC, TX_VCC are placed before the filter in order to provide the option to perform a current consumption measurement for the transmitter and receiver as well as to operate them independently. Decoupling capacitors of 100 nF and 1 nF are also placed close to the transmitter and receiver power supply pins..

For the transmitter RST/ and -3DB control signals, there is the option to set them to either "0" or "1" logic levels or to drive them at the CNTRL pin header in order for the user to control them externally. In the default setup (no jumpers at JP4, JP5), RST/ and -3DB signals are both inactive so the transmitter operates in normal mode. Table 1 shows the correspondence between the different jumper positions and the RST/ and -3DB signals. A red LED, near the RST_ON pin header, illuminates when the RST/ signal is active.

Pin header JP2 can be used to monitor the receiver STATUS signal. Two extra 1-pin headers (JP6, JP7) are also used to provide a reference for the measurement instruments.

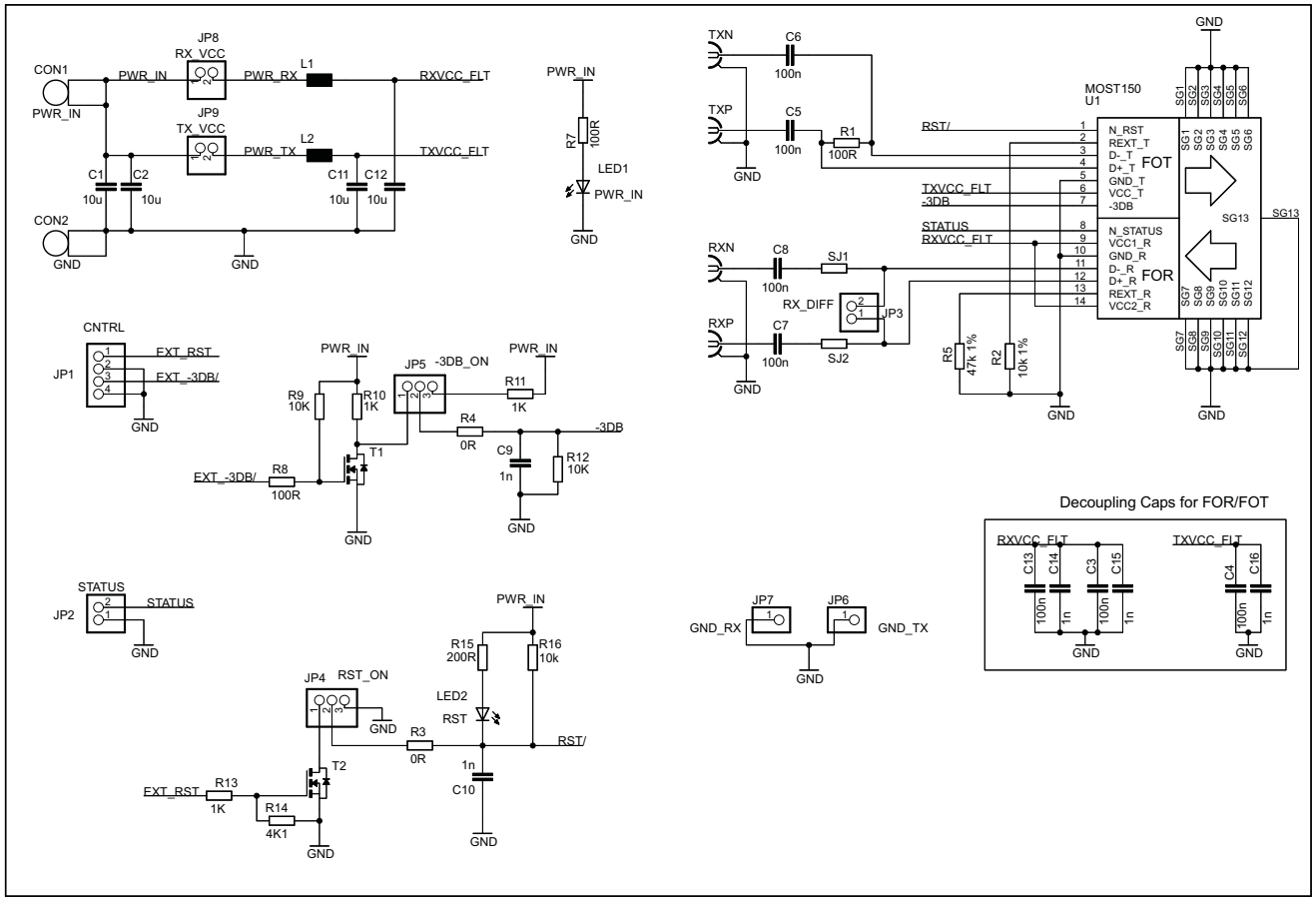

Figure 2. Schematic of the AFBR-0150Z evaluation board

Table 1. Jumper positions for the -3DB_ON RST_ON pin headers

RST/	1-2	2-3	No jumper
Active ("0")		√	
Inactive ("1")	√		√
CNTRL[1]	√		

-3DB	1-2	2-3	No jumper
Active ("1")		√	
Inactive ("0")	√		√
CNTRL[1]	√		

Notes:
1. When the RST/ and -3DB signals are controlled externally from the CNTRL connector, the polarity of the control signals is inverted (see Table 2).

The evaluation board is a two side PCB with 1.57 mm thickness and 35 µm copper thickness. A ±5% variation on the PCB and copper thickness is acceptable.

Table 2. Evaluation board connectors and pin out describes the input and output signals of the evaluation board.

Connector/Pin		I/O	Description	Signal Level
PWR_IN		PWR	Board power supply	+3.3 V (±5%)
GND		PWR	Power supply reference	Vref
RXP		OUT	Receiver differential output	LVDS
RXN				
RX_DIFF	1: RXP	OUT	Receiver differential output for differential probe measurement	LVDS
	2: RXN			
TXP		IN	Transmitter differential input	LVDS
TXN				
STATUS[1]	1: GND	PWR	Ground reference	"1": No RX signal "0": RX Signal presence
	2: STATUS	OUT	Receiver STATUS signal	
CNTRL[2]	1: EXT_RST	IN	External Transmitter RST control signal	"1": TX Reset "0", open: TX Normal Operation
	2: GND	PWR	Ground reference	
	3: EXT_-3DB/	IN	External Transmitter -3DB control signal	"1", open: TX in Normal Operation "0": TX in -3DB mode
	4: GND	PWR	Ground reference	
GND_RX		PWR	Ground reference	Vref
GND_TX		PWR	Ground reference	Vref

Notes:
1. For the STATUS signal voltage levels refer to the AFBR-1150L/AFBR-2150L data sheet.
2. EXT_RST and EXT_-3DB/ voltage levels are 3.3 V TTL.

3. Electro-Optical Test Configuration

Two basic test configuration setups are used for evaluating the MOST150 transceiver. These are shown in Figure 3 and Figure 4. The optical and electrical characteristics of the transceiver module can be characterized by an eye diagram, rise and fall time, jitter and current consumption.

Low loss and equal length 50 Ω RF cables with SMA connectors should be used to drive and probe TXP, TXN and RXP, RXN signals respectively. The current consumption measurements included in the following paragraphs refer to the total power consumption of the evaluation board. However, separate power consumption measurements can be performed using the JP8 and JP9 pin headers.

Transmitter Configuration

Figure 3 shows the transmitter measurement configuration. The light optical power (LOP) of the transmitter is measured with an optical power meter (OPM) and then driven by an optical–to–electrical converter (O/E) to an oscilloscope. For the current measurements the RST/ signal was disabled whereas the -3DB signal has been set to both "0" and "1" logic levels to measure the variation in the LOP for both the normal and -3DB mode.

Receiver Configuration

Figure 4 shows the receiver measurement configuration setup. The loopback POF cable provides an optical input signal to the receiver module. The electrical output of the receiver is monitored through the SMA type connectors RXN and RXP. A voltmeter is connected to the JP2 pin header to monitor the STATUS signal output of the receiver.

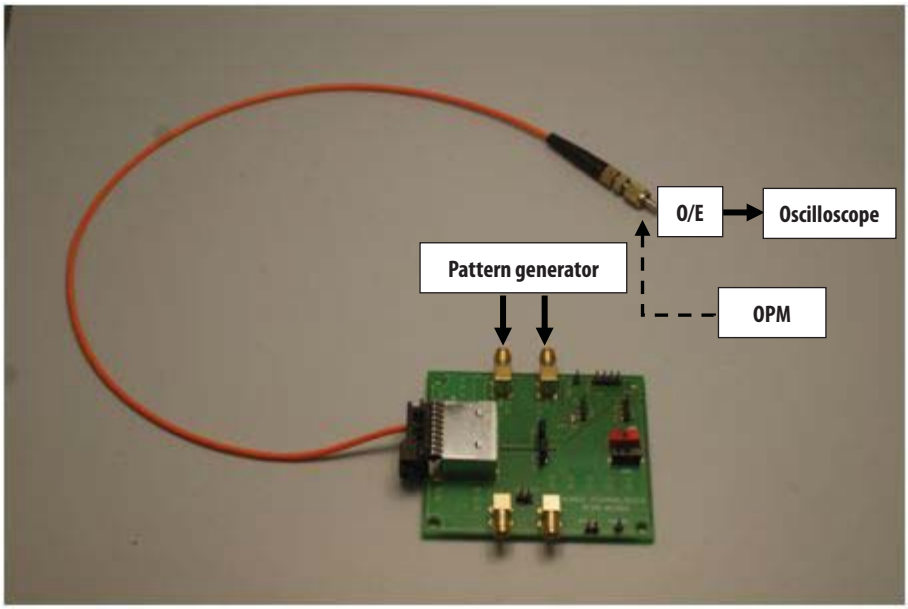

Figure 3. Transmitter measurement configuration setup

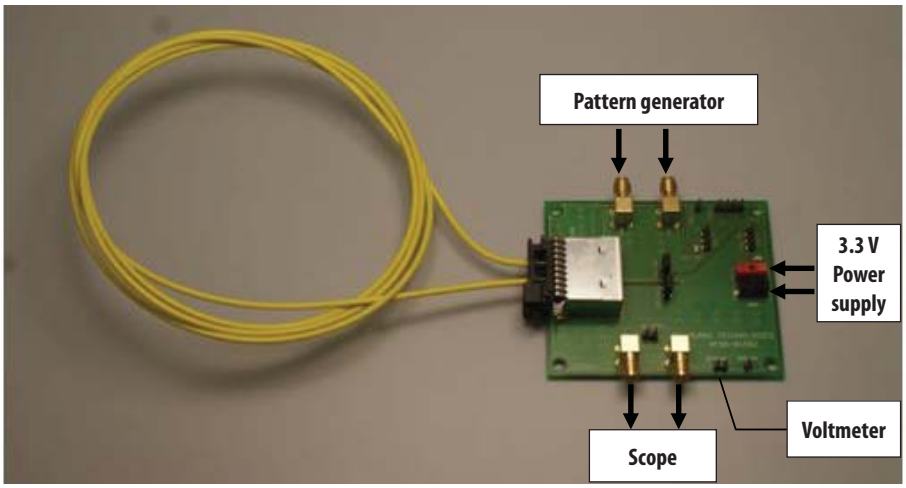

Figure 4. Receiver measurement configuration setup

Results

For the receiver and transmitter measurements two different patterns were used. A PRBS7 pattern at 150 MBd and a standard MOST150 stress pattern at 294.912 MBd. Table 3 and Table 4 present typical average LOP and typical board current consumption for both patterns in normal and -3DB TX operating modes. Figure 5 and Figure 6 show the monitored electrical output signal.

For the receiver measurement setup, the current consumption is 62 mA and 65 mA for the PRBS7 and MOST150 stress pattern respectively. Figure 7 and Figure 8 show the electrical output signal at the receiver side. The STATUS signal voltages are 33 mV with no optical input and 3.2 V with an optical input.

Table 3. Typical average LOP and typical board current consumption with TX in normal mode

TX-Normal	Typical Average LOP (dBmW)	Typical Board Current (mA)
PRBS7 (150 MBd)	-5.7	51.0
MOST Stress	- 5.6	52.6

Table 4. Typical average LOP and typical board current consumption with TX in -3DB mode.

TX-3DB	Typical Average LOP (dBmW)	Typical Board Current (mA)
PRBS7 (150 MBd)	-8.1	41.8
MOST Stress	-8.0	43.2

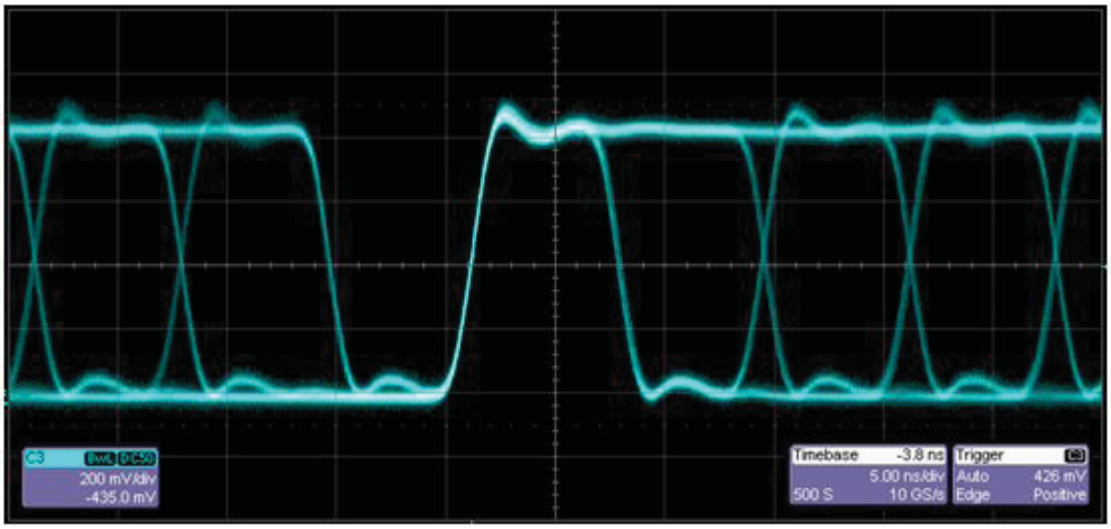

Figure 5. Transmitter eye diagram for a PRBS7-150 MBd pattern

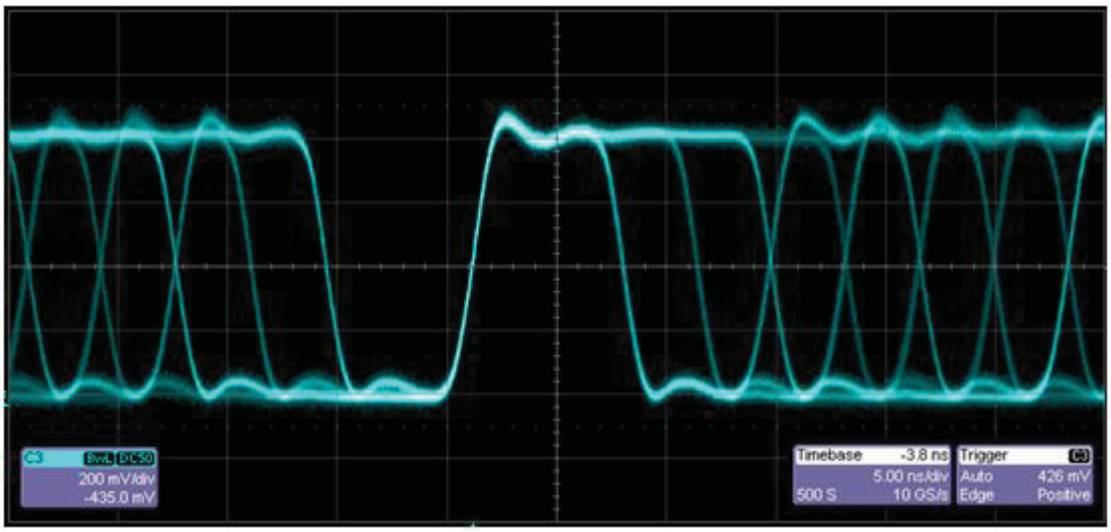

Figure 6. Transmitter eye diagram for a MOST150 stress pattern

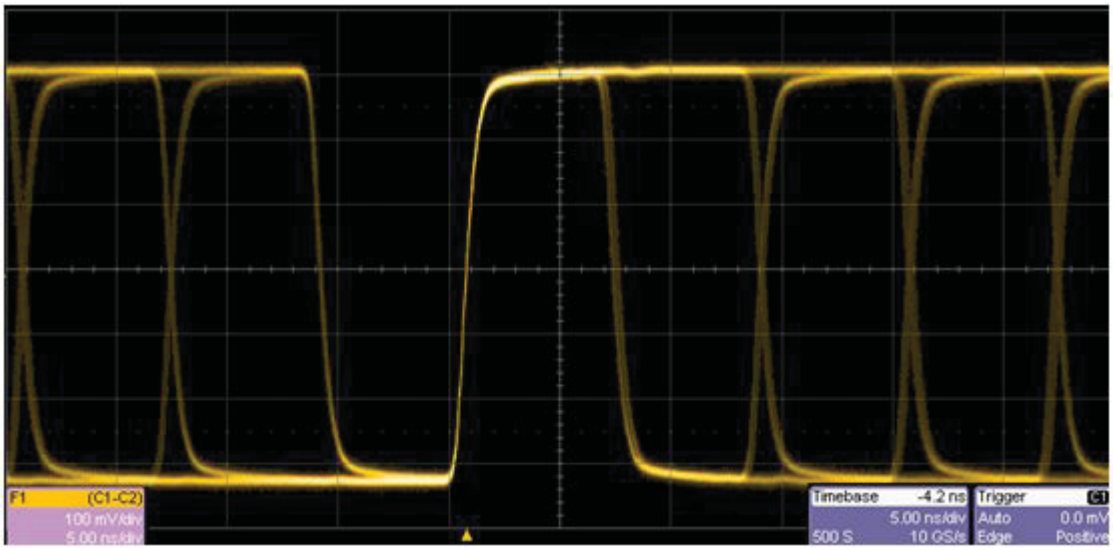

Figure 7. Receiver eye diagram for a PRBS7-150 MBd pattern

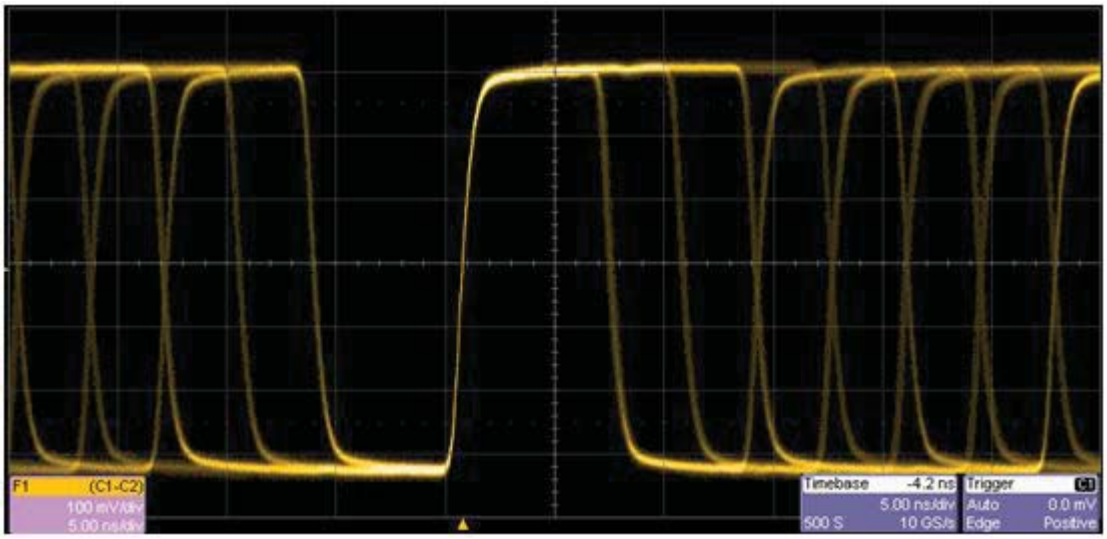

Figure 8. Receiver eye diagram for a MOST150 stress pattern

4. Evaluation Board Bill of Materials

The bill of materials (BOM) for the AFBR-0150Z evaluation board is shown in Table 5. Component references are relative to the schematic shown in Figure 2.

Table 5. Bill of Materials

Component	Type	Value	Footprint	Comments
C1, C2, C11, C12	SMD Capacitor	10u	C1206	
C3, C4, C5, C6, C7, C8, C13	SMD Capacitor	100n	C0805	
C9, C10, C14, C15, C16	SMD Capacitor	1n	C0805	
CON1	Jack, 2mm			Red (Farnell P/N: 1773763)
CON2	Jack, 2mm			Black (Farnell P/N: 1773764)
JP1	Pin Head. 1x4			
JP2, JP3, JP8, JP9	Pin Head. 1x2			
JP4, JP5	Pin Head. 1x3			
JP6, JP7	Pin Head. 1x1			
L1, L2	Ferrite Bead	1000 Ohm @ 100 MHz	L1206	Würth: 742 792 131 (RS P/N: 3275544)
LED1	SMD LED		R0805	Green LED (AVAGO P/N: HSMG-C170)
LED2	SMD LED		R0805	Red LED (AVAGO P/N: HSMH-C1709)
R1, R7, R8	SMD Resistor	100R	R0805	
R2	SMD Resistor	10k 1%	R0805	
R3, R4	SMD Resistor	0R	R0805	
R5	SMD Resistor	47k 1%	R0805	
R9, R12, R16	SMD Resistor	10K	R0805	
R10, R11, R13	SMD Resistor	1K	R0805	
R14	SMD Resistor	4K1	R0805	
R15	SMD Resistor	200R	R0805	
RXN, RXP, TXN,TXP	Jack SMA, R/A			
SJ1, SJ2	Solder Jumper		R0603	Default state: short
T1, T2	SMD N-MOS	NTR4003NT1G	SOT-23	Farnell: 1453635
U1	Module	MOST150	See TYCO P/N: 1823725	

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