AFBR-3905xxRZ

High Voltage Galvanic Insulation Link for DC to 5MBaud

Data Sheet

Description

Avago Technologies' AFBR-3905xxZ is a high voltage galvanic insulation link for DC to 5MBaud. The AFBR-3905xxZ consists of an optical transmitter and receiver operating at 650nm wavelength. Pin to pin distance of approximately 25 to 101 mm provides transient voltage suppression in the range of 15kV to 50kV.

Applications

- Drives/Inverters
- Galvanic insulation on one single PCB
- Medium Voltage Power Distributions
- Regulated Distribution Transformers
- Smart Grid on-board Insulations

Ordering Information

Part Number	Length	mm	Voltage Suppression
AFBR-390525RZ	1 inch	25	15kV
AFBR-390550RZ	2 inch	50.4	27kV
AFBR-390575RZ	3 inch	75.8	40kV
AFBR-390500RZ	4 inch	101.2	50kV

Features

- Data transmission at signal rates of DC to 5MBaud
- DC coupled receiver with CMOS/TTL output for easy designs: no data encoding or digitizing circuitry required
- High noise immunity through receiver IC with integrated photodiode
- RoHS compliant
- Transient voltage suppression in the range of 15kV to 50kV according IEC 60644
- Laser class 1 according to IEC-60825
- Tested according to IEC-60747-5-5
- Housing Material UL-V0 with CTI ≥ 600
- Optional 3.3V or 5V power supply

AFBR-3905xxRZ DC to 5MBaud Data Link

Absolute Maximum Ratings

Parameter		Symbol	Min.	Max.	Units
Signaling Rate		f_s	DC	5	MBd
Storage and Operating Temperature		$T_{S,O}$	-40	+85	°C
Receiver Supply Voltage		V_{DD}	-0.5	+5.5	V
Receiver Output Current		I_{OAV}		10	mA
Transmitter Peak Forward Input Current		$I_{F,PK}$		30	mA
Transmitter Reverse Input Voltage		V_R		3	V
Lead Soldering Cycle [1, 2]	Temp	T_{SOL}		+260	°C
	Time			10	sec

Notes:
1. 1.6mm below seating plane; wave soldering only
2. MSL class 3

Attention

Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Units
Ambient Temperature	T_A	-40	85	°C
Rx Power Supply Voltage [1]	V_{CC}	3.135 4.75	3.465 5.25	V V
Transmitter Average Forward Current	$I_{F,AV}$	5	10	mA
Signaling Rate	f_s	DC	5	MBd

Notes:
1. <100mVp-p Noise

All the data in this specification refers to the operating conditions above and over lifetime unless otherwise stated.

Insulation Characteristics

Parameter	Symbol	Min.	Max.	Units
Apparent charge at Sample Test stage and Type Test stage after subgroup 1 (method a) [1]	q_{pd}		5	pC
Apparent charge at Routine Test stage and Type Test stage, Preconditioning (method b) [2]	q_{pd}		5	pC
Maximum Transient Voltage, peak [3]	V_{IOTM_1inch} V_{IOTM_2inch} V_{IOTM_3inch} V_{IOTM_4inch}	15 27 40 50		kV
Maximum Transient Voltage, effective [3]	V_{ISO_1inch} V_{ISO_2inch} V_{ISO_3inch} V_{ISO_4inch}	10.5 19 28.1 35.2		kV
Maximum Working Voltage, peak [4]	V_{IORM_1inch} V_{IORM_2inch} V_{IORM_3inch} V_{IORM_4inch}	4.25 8.5 12.75 17.00		kV
Maximum Working Voltage, effective [4]	V_{IOWM_1inch} V_{IOWM_2inch} V_{IOWM_3inch} V_{IOWM_4inch}	3 6 9 12		kV
Insulation Resistance @ $T_{amb,max}$, min.100°C	R_{IO}	10^{11}		Ω
Insulation Resistance @ T_S	R_{IO}	10^{9}		Ω
Creepage Distance	1inch 2inch 3inch 4inch	25 50.4 75.8 101.2		mm
Clearance Distance	1inch 2inch 3inch 4inch	25 50.4 75.8 101.2		mm
Surge Isolation Voltage	V_{IOSM}	12		kV
Comparative Tracking Index	CTI	600		
Pollution degree [5]		2		
Climatic category [6]		40/085/21		
Maximum ambient Safety temperature	T_S	110		°C
Maximum input current	I_{SI}	60		mA
Maximum output current	I_{SO}	30		mA
Maximum input power dissipation	P_{SI}	330		mW
Maximum output power dissipation	P_{SO}	165		mW

Notes:

1. $V_{pd(m)} = 1.6 \times V_{IORM}$ (=6.8kV for 1inch, =13.6kV for 2inch, =20.4kV for 3inch, =27.2kV for 4inch), $V_{ini,a} = V_{IOTM}$, $t_{ini,a} = 60s$; $t_m = 10s$
2. $V_{pd(m)} = 1.875 \times V_{IORM}$ (=8kV for 1inch, =16kV for 2inch, =24kV for 3inch, =32kV for 4inch), $V_{ini,b} = V_{IOTM}$, $t_{ini,b} = 1s$; $t_m = 1s$
3. Altitude up to 2000m above sea level
4. Pollution degree 2; please note that inhomogeneous field conditions may lead to partial discharge through air for these voltages
5. According IEC-60064-1
6. According IEC-60068-1

Electrical Input Characteristics

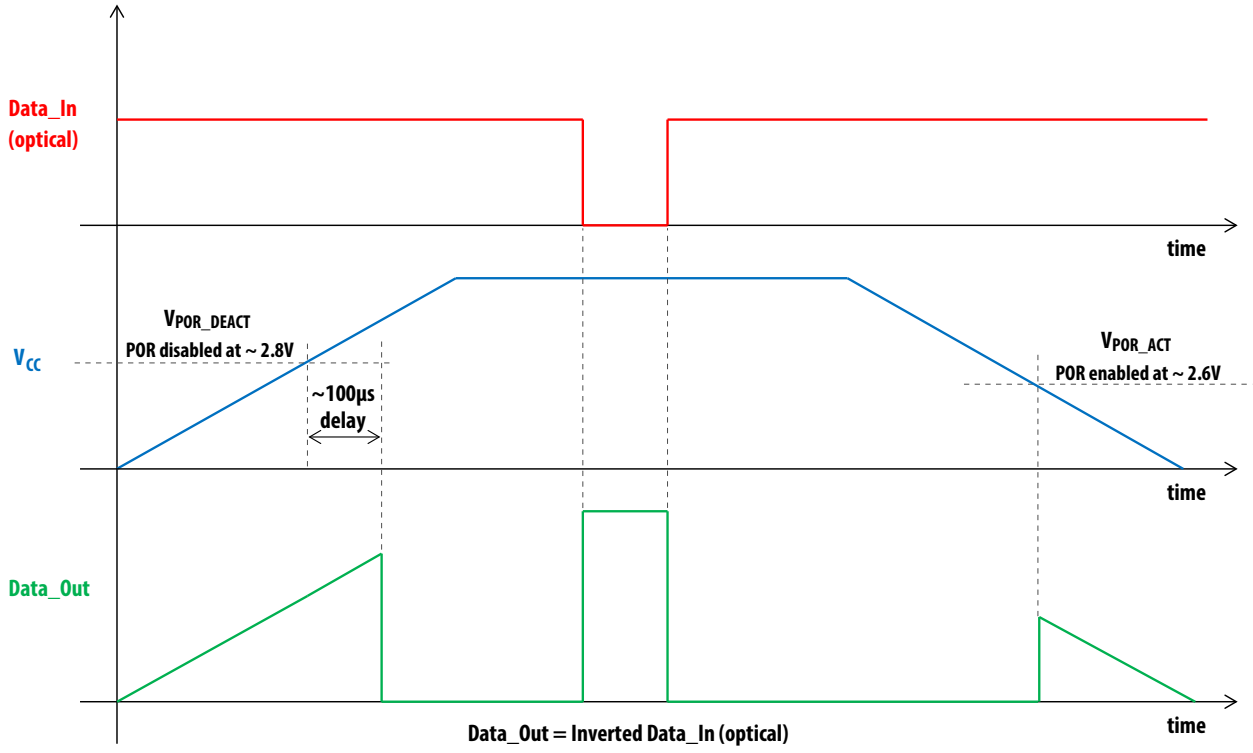
Parameter	Symbol	Min.	Typ.	Max.	Units
Forward Voltage [1]	V_F	1.6		2.2	V
Forward Voltage Temperature Coefficient	$\Delta V_F / \Delta T$		-1.8		mV/°C
Reverse Input Breakdown Voltage [2]	V_{BR}	3.0	13		V
Diode Capacitance [3]	C_0		30		pF

Notes:
1. $I_{F,dc}$ = 10mA
2. $I_{F,dc}$ = -10µA
3. V_F = 0V; f = 1MHz

Electrical Output Signal Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
High Level Output Voltage	V_{OH}	2.5	V_{CC}	V_{CC}+0.3	V
Low Level Output Voltage	V_{OL}		0.22	0.4	V
Output Risetime (10-90%) [1, 2]	t_r			10	ns
Output Falltime (90-10%) [1, 2]	t_f			10	ns
Power Supply Noise Immunity [3]	PSNI	0.1	0.4		Vpp
Vcc level to deactivate POR [4]	V_{POR_DEACT}		2.8		V
Vcc level to activate POR [4]	V_{POR_ACT}		2.6		V
POR deactivate delay time [4]	$t_{POR\text{-}DEACT\_DEL}$		100		µs

Notes:
1. CL = 20pF, RL = 50kOhm
2. In the recommended drive circuit
3. Peak-to-peak sine wave
4. Power-on reset (POR) is active below V_{POR_DEACT}. Once V_{POR_DEACT} is reached the POR remains active for $t_{POR\text{-}DEACT\_DEL}$. During power down POR starts at V_{POR_ACT}.

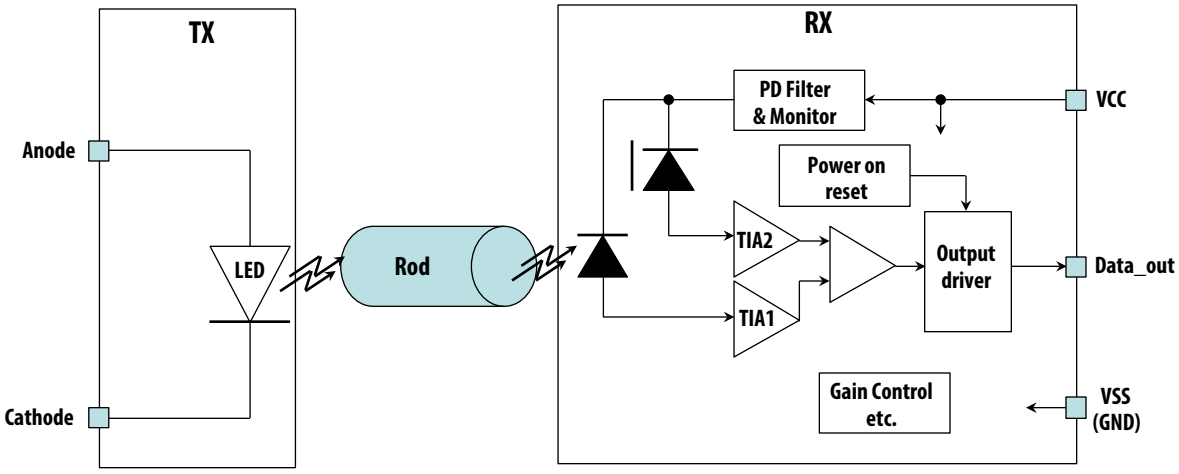


Specified Link Performance, T_A = -40°C to +85°C, DC to 5MBaud, unless otherwise noted.

Parameter	Symbol	Min.	Typ	Max.	Unit	Condition
Signaling Rate	f_S	DC		5	MBd	NRZ
Pulse Width Distortion [1]	PWD	-30		30	ns	5MBaud
Propagation Delay [2]	t_D			80	ns	5MBaud
Skew [3]	t_S			20	ns	5MBaud
Supply Current Rx [4]	I_{CC}		6	10	mA	

Notes:
1. ±15% of the nominal pulse width, provided no pulse width distortion at the electrical input
2. determined from 50% of the rising edge of data_in to 50% of the consecutive rising egde of data_out
3. Variations of t_D between multiple devices measured for same input conditions and same external signal delay
4. C_L = 20pF, RL = 50kOhm

Block Diagram - AFBR-3905xxRZ



The Rx Data_out signal is inverted which means that light_on will lead to Data_out low.

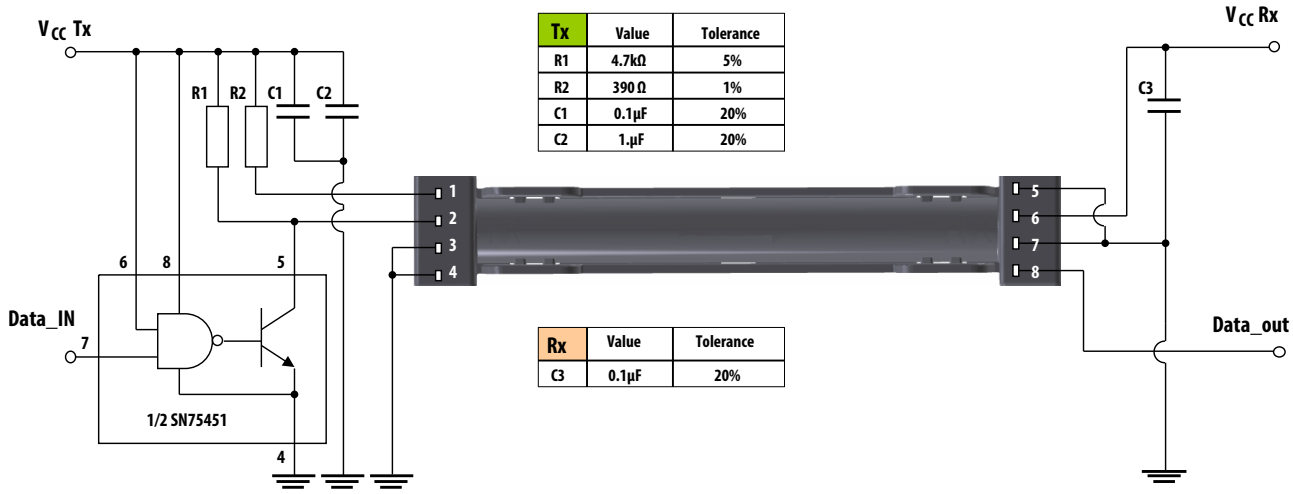
POR remains active during V_{CC} power up, typically until 100µs after 2.8V is reached. POR follows V_{CC} while active.

Recommended chemicals for Cleaning/Degreasing

Alcohols: methyl, isopropyl, isobutyl.
Aliphatics: hexane, heptanes
Other: soap solution, naphtha

Do not use partially halogenated hydrocarbons such as 1.1.1 trichloroethane, ketones such as MEK, acetone, chloroform, ethyl acetate, methylene dichloride, phenol, methylene chloride, or N-methylpyrolldone. Also, Avago does not recommend the use of cleaners that use halogenated hydrocarbons because of their potential environmental harm.

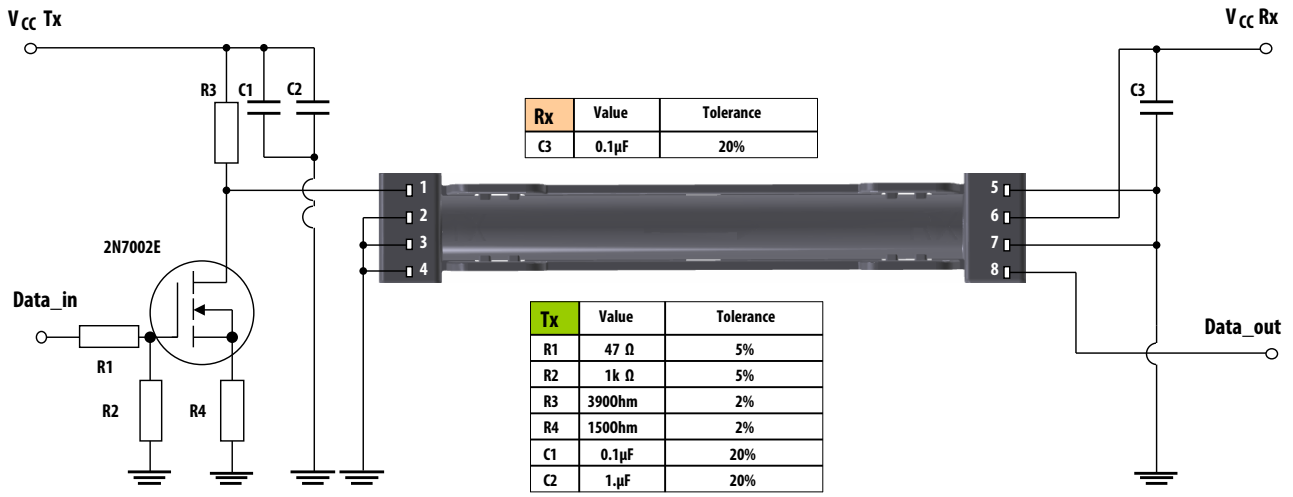
Recommended Drive Circuit (a) – Top View



Tx	Value	Tolerance
R1	4.7kΩ	5%
R2	390 Ω	1%
C1	0.1µF	20%
C2	1.µF	20%

Rx	Value	Tolerance
C3	0.1µF	20%

Recommended Drive Circuit (b) – Top View



Rx	Value	Tolerance
C3	0.1µF	20%

Tx	Value	Tolerance
R1	47 Ω	5%
R2	1k Ω	5%
R3	3900hm	2%
R4	1500hm	2%
C1	0.1µF	20%
C2	1.µF	20%

Pin Description

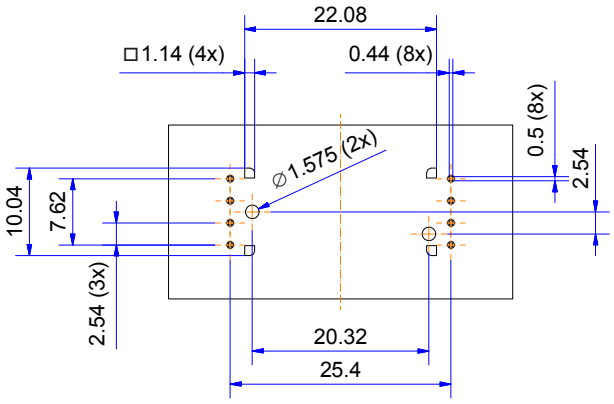
Pin number	Transmitter	Pin number	Receiver
1	Anode	5	No function [1]
2	Cathode	6	VCC
3	No function [1]	7	GND
4	No function [1]	8	Data_out

Notes:
1. It is recommended to connect this pin to signal ground

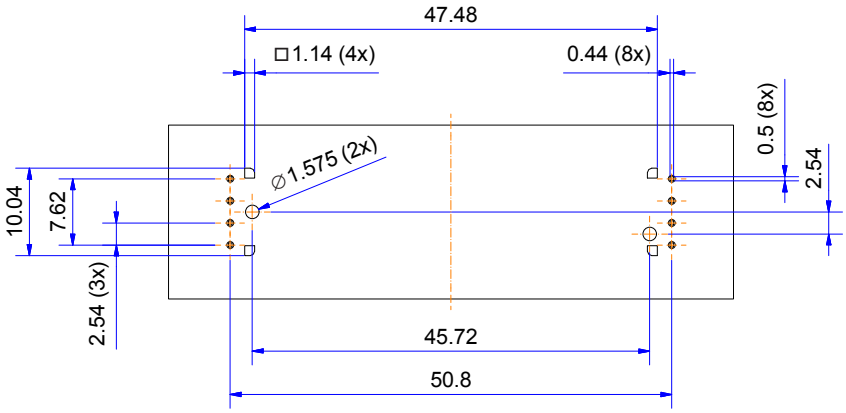
Footprint (Top View)

Dimensions in mm

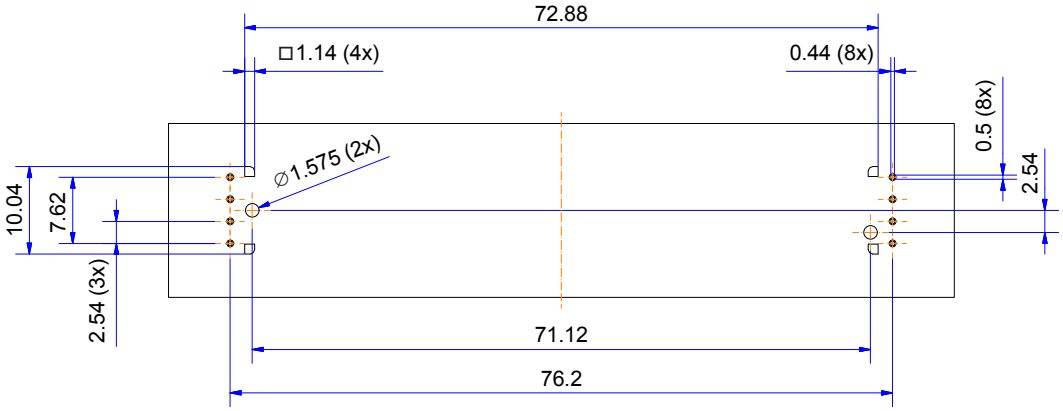
AFBR-390525RZ



AFBR-390550RZ



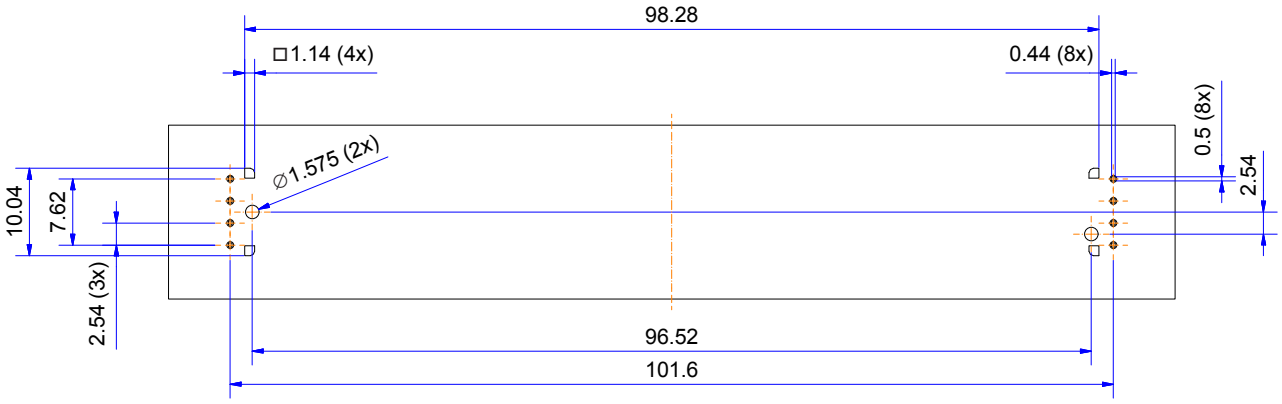
AFBR-390575RZ



Footprint (Top View)

Dimensions in mm

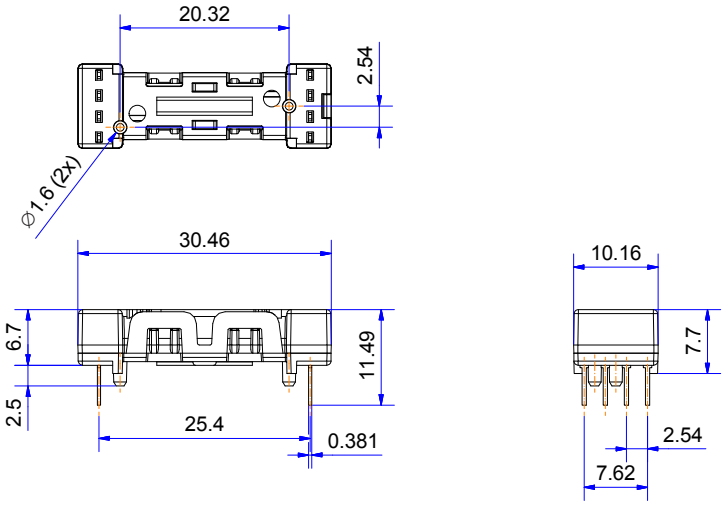
AFBR-390500RZ



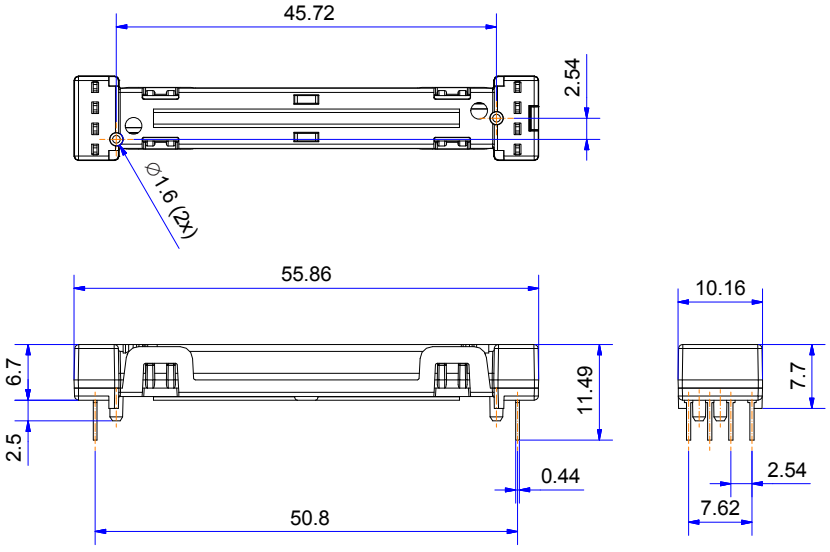
Mechanical Dimensions

Dimensions in mm

AFBR-390525RZ



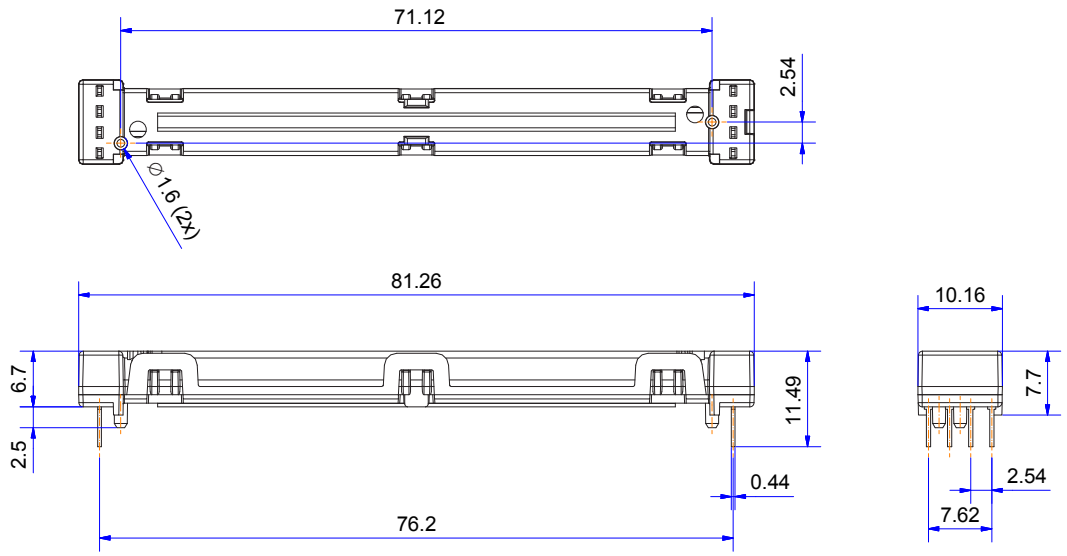
AFBR-390550RZ



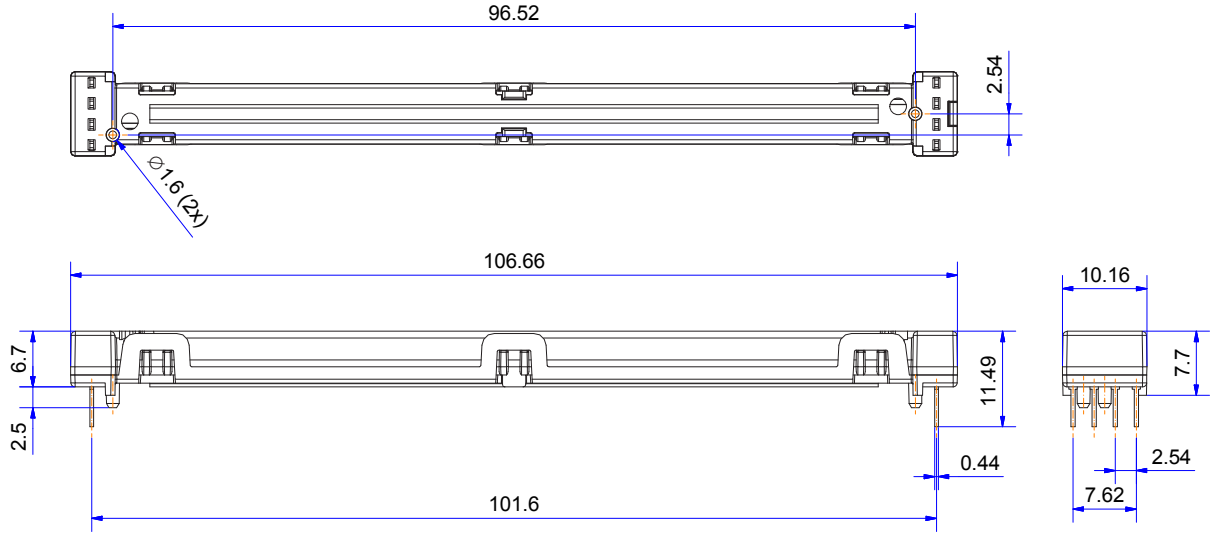
Mechanical Dimensions

Dimensions in mm

AFBR-390575RZ



AFBR-390500RZ



IMPORTANT NOTE:

AFBR-3905xxRZ devices must not be bent under any circumstances.

For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**

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