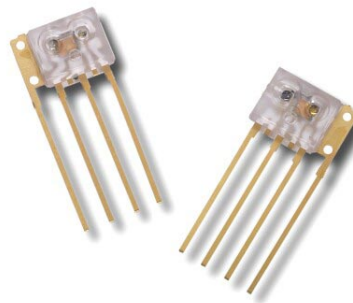


# AFBR-1010/AFBR-2010

## Fiber Optic Transmitter and Receiver for 50 MBaud MOST®



### Data Sheet



Transmitter (EOC)      Receiver (OEC)

#### Description

AFBR-1010 Transmitter and AFBR-2010 Receiver are packaged in 4-pin transfer molded, low-cost packages ready for assembly into plastic fiber optic connector receptacles compliant with MOST® technology. The transmitter utilizes a 650 nm LED source with integrated optics for efficient coupling into 1 mm Polymer Optical Fiber (POF), and the receiver contains a large area PIN diode to receive this light. Input/output data has TTL switching levels, compatible with MOST® Network Interface Controller ICs. These optical components are specified for operation over a wide -40°C to +95°C extended temperature range, and meet the rigorous reliability requirements of automotive applications. In the absence of data activity, the receiver switches to very low power mode. While in this mode, the PIN diode can sense new data activity and switch the receiver back to full operation.

#### Features

- Optical transmitter (EOC) and receiver (OEC) for use in MOST® equipment for up to 50 Mbaud
- Compliant to MOST® Specification of Physical Layer Rev 1.1
- Operating temperature range of -40°C to +95°C
- Reliability performance per automotive application requirements
- Lead is flash gold

#### Applications

- Optical Transmitter and Receiver for MOST® 50 Mbaud systems (A full description of MOST® 50 Mbaud information and entertainment LAN system and standards are available at [www.mostcooperation.com](http://www.mostcooperation.com))

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#### Regulatory Compliance

Feature	Test Method	Performance
Electrostatic Discharge (ESD) to the Electrical Pins Human Body Model	JEDEC/EIA JESD22-A114-B Human Body Model	Min ± 2000 V
Electrostatic Discharge (ESD) to the Electrical Pins Machine Model	JEDEC/EIA JESD22-A115-A Machine Model	Min ± 400 V
Electrostatic Discharge (ESD) to the Electrical Pins Charged Device Model	JEDEC/EIA JESD22-C-101-B Charged Device Model	Min ± 500 V
Eye Safety	IEC 60825-1,2, Class 1	TUV File #: 30382990.001

### Pin Description Transmitter

Front View Optics Up. 1 = Leftmost Pin to 4 = Rightmost Pin

Pin	Name	Function/Description	Notes
1	Data In	Transmitter Data Input	1
2	V <sub>EET</sub>	Transmitter Ground	
3	V <sub>CCT</sub>	Transmitter Power 5 V $\pm$ 5%	
4	CONT	Connection to LED Current Control Resistor	2

#### Notes:

1. Logic 1 input will turn the light on and the logic 0 will turn the light off.
2. This is a digital input for the transmitter output power selector.  $R_{CN} < 17.32 \text{ k}\Omega$  will set the transmitter to normal output power.  $R_{CR} > 25.65 \text{ k}\Omega$  will set the transmitter to reduced output power.  $R_{CN}/R_{CR}$  is connected between CONT input and V<sub>CCT</sub>.

### Pin Description Receiver

Front View Optics Up. 1 = Leftmost Pin to 4 = Rightmost Pin

Pin	Name	Function/Description	Notes
1	V <sub>CCR</sub>	Receiver Power 5 V $\pm$ 5%	
2	V <sub>EER</sub>	Receiver Ground	
3	Mode Out	Receiver Mode Output	1
4	Data Out	Receiver Data Output	2

#### Notes:

1. This output is logic 1 high if the receiver is asleep for no light input, and logic 0 low if the receiver is awake for valid light input levels.
2. TTL compatible data output.

### Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Storage Temperature	T <sub>s</sub>	-40		100	°C	1
Ambient Temperature, No Air Flow	T <sub>c</sub>	-40		95	°C	1, 2
Relative Humidity	RH	0		95	%	1
Supply Voltage	V <sub>CCT</sub> /V <sub>CCR</sub>	-0.5		7	V	1
Data Input Voltage	V <sub>IN</sub>	-0.5		V <sub>CC</sub> + 0.5	V	1
CONT Input Voltage	V <sub>CONT</sub>	-0.5		V <sub>CC</sub> + 0.5	V	1, 3
Data Output Current	I <sub>O</sub>			10	mA	1, 4
Mode Output Current	I <sub>M</sub>			10	mA	1
Data Rate		8	45.2	50	MBaud	

#### Notes:

1. Absolute Maximum Ratings are those values beyond which damage to the device may occur if these limits are exceeded for other than a short period of time. See Reliability Data Sheets for specific reliability performance.
2. Measured 1 cm outside of MOST® optical connector housing (header) on a MOST® application PCB. The optical components (EOC and OEC) are inside the header connector assembly composed of the plastic housing and EMI shield, that is, airflow is restricted to natural convection.
3. The CONT input is a digital function. An open circuit will select lower (normal light output -3 dB), and a short circuit to V<sub>CCT</sub> will select normal light output power. This makes the LED meet eye safety under this fault condition.
4. A safety resistor of 50  $\Omega$  (minimum) is to be connected between Data Out and the receiving circuitry. The receiving circuitry must be powered up within 50 ms after Mode Out goes low to prevent permanent damage to the OEC.

## Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Ambient Temperature, No Air Flow	$T_A$	-40	25	95	°C	1, 2
Supply Voltage	$V_{CCT}/V_{CCR}$	4.75	5	5.25	V	1
CONT Input Resistor for Normal Output Power	$R_{CN}$	0	13.5	17.32	k $\Omega$	1, 3
CONT Input Resistor for Reduced Output Power	$R_{CR}$	25.65	27	Open Circuit	k $\Omega$	1, 3

### Notes:

1. Recommended operating conditions are those values outside of which functional performance is not intended, device reliability is not implied, and damage to the device may occur over an extended period of time. See Reliability Data Sheet for specific reliability performance.
2. Measured 1 cm outside of MOST® optical connector housing (header) on a MOST® application PCB. The optical components (EOC and OEC) are inside the header connector assembly composed of the plastic housing and EMI shield, that is, airflow is restricted to natural convection.
3. Resistor values between 17.32 k $\Omega$  - 25.65 k $\Omega$  are not allowed.

## Process Compatibility

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Solder Environment	$T_{SOLD}$			260	°C	1, 3, 4
	$t_{SOLD}$			10	sec	2, 3, 4

### Notes:

1. Maximum temperature refers to peak temperature.
2. Maximum time refers to time spent at peak temperature.
3. Solder surface to be at least 1 mm below lead frame stops.
4. Product is moisture sensitive level 2A. See Application Note "Avago AFBR-1010 Fiber Optic Transmitter and AFBR-2010 Receiver for 50 Mbaud MOST®-Handling."

## Transmitter Electrical Characteristics

( $T_A = -40^{\circ}\text{C}$  to  $+95^{\circ}\text{C}$ ,  $V_{CCT} = 5\text{ V} \pm 5\%$ )

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Supply Current (Optical Power ON)	$I_{CCT}$			40	mA	1
Supply Current (Optical Power OFF)	$I_{CCT}$			40	mA	2
Optical Power ON Delay	$t_{ON2}$			7	$\mu\text{s}$	5
Optical Power OFF Delay	$t_{OFF2}$			50	$\mu\text{s}$	4
Input Voltage – Low	$V_{IL}$	-0.3		0.8	V	3
Input Voltage – High	$V_{IH}$	2.0		$V_{CC} + 0.3$	V	3
Data Input Capacitance	$C_{IN}$			7	pF	
Data Input Resistance	$R_{IN}$	2			k $\Omega$	

### Notes:

1. For 50% duty cycle Biphasic mark data and  $R_{CN} = 13.5\text{ k}\Omega$  (normal light output control selection).
2. Data In = 0 V.
3. Standard TTL compatible inputs.
4. After a static 0 is received on Data In for  $t_{OFF2}\text{ }\mu\text{s}$ , the transmitter optical output power drops to a level below -50 dBm.
5. After modulated data is received on Data In for  $t_{ON2}\text{ }\mu\text{s}$ , the transmitter exits the "OFF" state to enter normal operating "ON" state.

## Transmitter Optical Characteristics

(T<sub>A</sub> = -40°C to +95°C, V<sub>CC</sub>T = 5 V ± 5%)

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Output Optical Power (Average), Normal Power	P <sub>N</sub>	-7.5		-1.5	dBm	1, 3, 5
Delta Between Reduced and Normal Optical Output Power	ΔP <sub>o</sub>		-3.0		dB	2
Output Optical Power (Average), OFF	P <sub>S</sub>			-50	dBm	
Extinction Ratio	ER	10			dB	
Spectrum Central Wavelength	λ <sub>C</sub>	635		675	nm	6
Spectrum RMS	λ <sub>W</sub>			17	nm	7
Rise Time (20%–80%)	t <sub>RT</sub>			6.0	ns	1, 3
Fall Time (20%–80%)	t <sub>FT</sub>			6.0	ns	1, 3
Pulse Width Variation	t <sub>PWVT</sub>	20.0		24.3	ns	1, 3, 4
Pulse Width Distortion – Average	t <sub>APWDT</sub>	-1.39		+1.39	ns	1, 3, 4

### Notes:

1. Resistance between CONT and V<sub>CC</sub>T pin, R<sub>CN</sub> = 13.5 kΩ (normal light output control selection).
2. The difference between R<sub>CN</sub> = 13.5 kΩ and R<sub>CR</sub> = 27 kΩ (reduced versus normal output optical power control selection).
3. Using input signal to the Transmitter as defined in SP1 MOST® Specification of Physical Layer Rev 1.1 at 45.2 MBaud, UI = 22.14 ns.
4. Pulse width is measured at 50% threshold using a rising edge trigger and a MOST® worst case test pattern (WCPWV).
5. Measured with ideal alignment to LED after 1 meter 0.5 NA 1mm POF with polished face using a large area detector.
6. Central wavelength is defined as:

$$\lambda_C = \frac{\sum_{i=1}^N P_i \lambda_i}{\sum_{i=1}^N P_i};$$

Ref: EIA/TIA standard FOTP-127/61.1, 1991.

7. Spectrum RMS is defined as:

$$\lambda_W = \left[ \left( \frac{\sum_{i=1}^N P_i \lambda_i^2}{\sum_{i=1}^N P_i} \right) = \lambda_C^2 \right]^{\frac{1}{2}}$$

Ref: EIA/TIA standard FOTP-127/61.3, 1991.

### Receiver Electrical Characteristics

( $T_A = -40^{\circ}\text{C}$  to  $+95^{\circ}\text{C}$ ,  $V_{CCR} = 5\text{ V} \pm 5\%$ )

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Supply Current – Awake	$I_{CCR}$			35	mA	1
Supply Current – Sleep	$I_{CCR}$			20	$\mu\text{A}$	2
Data Output Voltage – Low	$V_{OL}$	-0.3		0.4	V	3, $I_{OL} = 1.6\text{ mA}$
Data Output Voltage – High	$V_{OH}$	2.5	3.0	$V_{CCR} + 0.3$	V	3, $I_{OH} = -150\text{ }\mu\text{A}$
Mode Output Voltage – Low	$V_{OLM}$	-0.3	0.0	0.5	V	$I_{OL} = 2.4\text{ mA}$
Mode Output Voltage – High	$V_{OHM}$	$V_{CCR} - 1$		$V_{CCR} + 0.3$	V	$I_{OH} = -1\text{ mA}$
Rise Time (10%–90%)	$t_{RR}$			9.9	ns	1, 4, 6
Fall Time (10%–90%)	$t_{FR}$			9.9	ns	1, 4, 6
Pulse Width Variation	$t_{PWVR}$	16.5		31.0	ns	1, 4, 5, 6
Pulse Width Distortion – Average	$t_{APWDR}$	-3.3		7.0	ns	1, 4, 5, 6

#### Notes:

1. Measured using Input signal condition as defined by SP3 MOST® Specification of Physical Layer Rev 1.1 at 45.2 MBaud, UI = 22.14 ns.
2. Optical input is  $< -40\text{ dBm}$ , and Mode Out  $I_M = 0$ .
3. Standard TTL output.
4. Measured with  $R_L = 50\text{ k}\Omega$  and  $C_L = 15\text{ pF}$ .
5. Pulse width is measured at 1.5 V threshold using a rising edge trigger and a MOST® worst case test pattern (WCPWV).
6. Optical power generated by a standard Avago Transmitter, with ideal alignment to the photodiode using a 1 mm POF (NA = 0.5).

### Receiver Optical Characteristics

( $T_A = -40^{\circ}\text{C}$  to  $+95^{\circ}\text{C}$ ,  $V_{CCR} = 5\text{ V} \pm 5\%$ )

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Input Optical Power (Average)	$P_{IN}$	-25		-2	dBm	1
Optical Spectrum Range	$\lambda_c$	630		685	nm	
Input Optical Power for light-off state	$P_{INSQ}$	-40		-25	dBm	2

#### Notes:

1. All Receiver input condition to be as specified in SP3 of MOST® Specification of Physical Layer Rev 1.1 at 45.2 MBaud, UI = 22.14 ns.
2. Light-off state means Mode Output Voltage is high and Data Output Voltage is low.

### Receiver Timing Characteristics

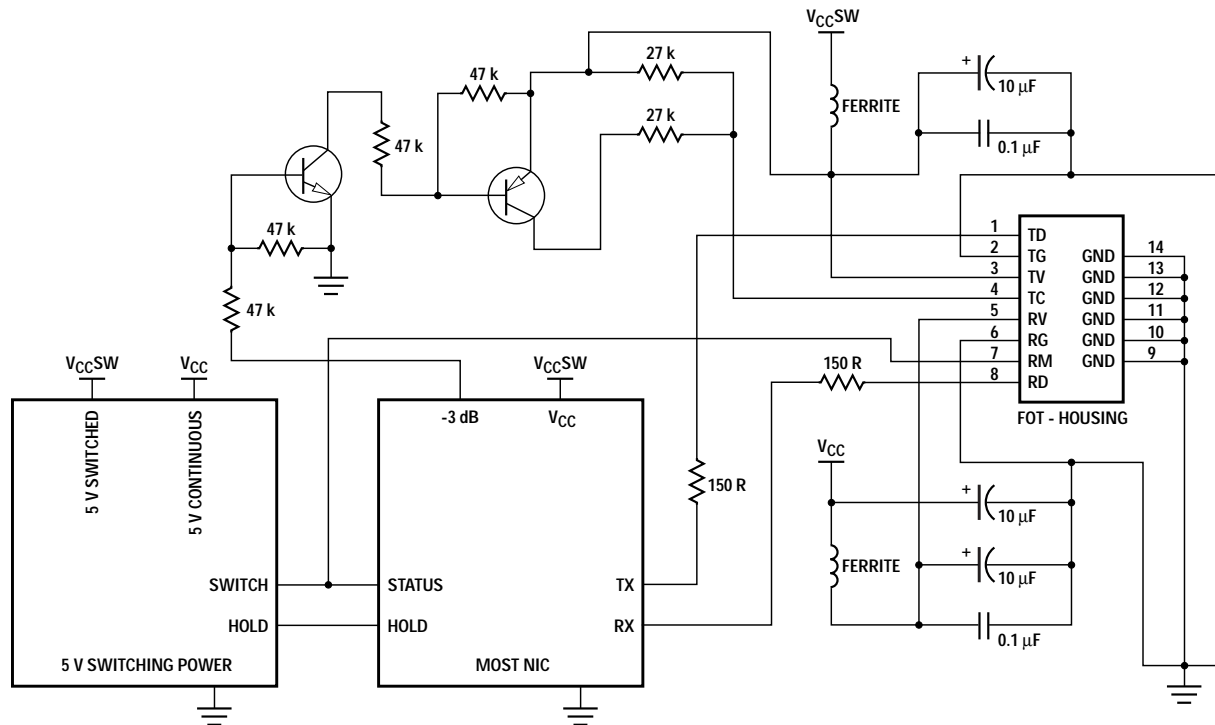
( $T_A = -40^{\circ}\text{C}$  to  $+95^{\circ}\text{C}$ ,  $V_{CCR} = 5\text{ V} \pm 5\%$ )

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Mode Deassert Time (On to Off)	$t_D$			2	ms	
Squelch Time (Signal OFF Delay)	$t_{OFF4}$			2	ms	
Wakeup Time (Signal ON Delay)	$t_{ON4}$			3	ms	1

#### Note:

1. Receiver is designed to only respond to modulated light input.

## Reference Design Schematic

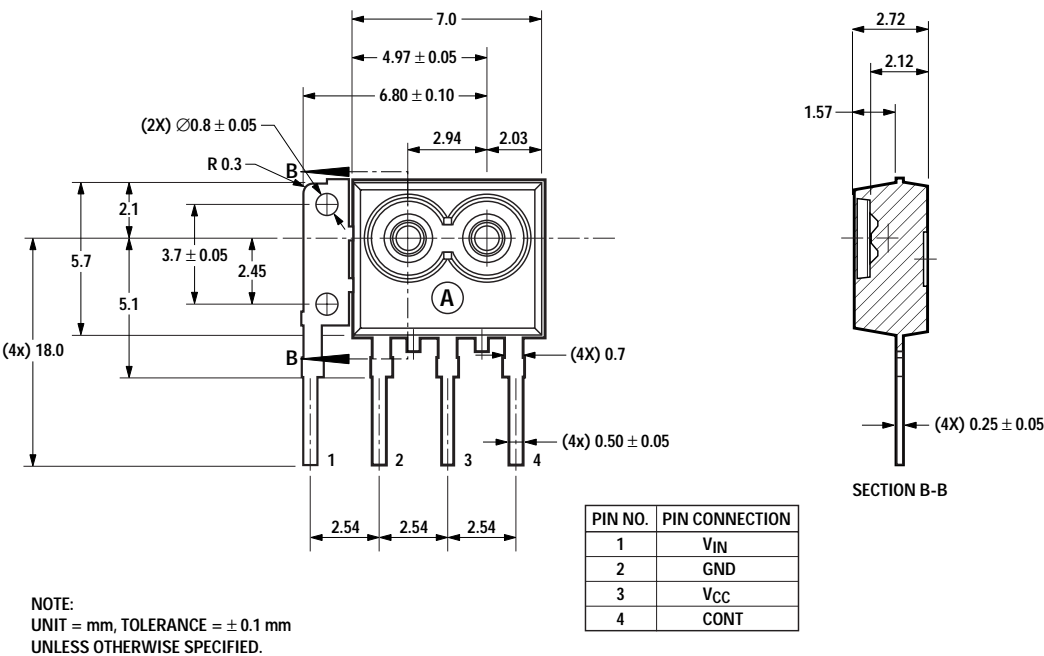


## Part Number Options

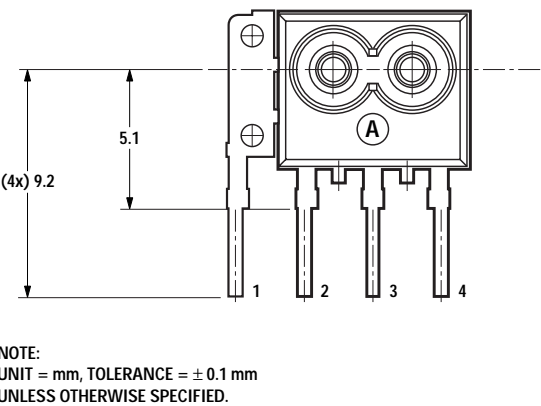
Part Number	Part Description
AFBR-1010	Transmitter
AFBR-2010	Receiver
AFBR-1010S	Transmitter – Short Lead
AFBR-2010S	Receiver – Short Lead
AFBR-1010T	Transmitter – 90° Bent Lead
AFBR-2010T	Receiver – 90° Bent Lead

Package Dimensions

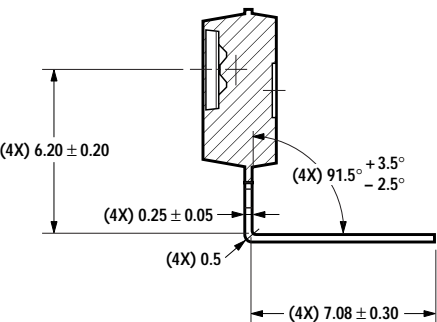
Transmitter (AFBR-1010)



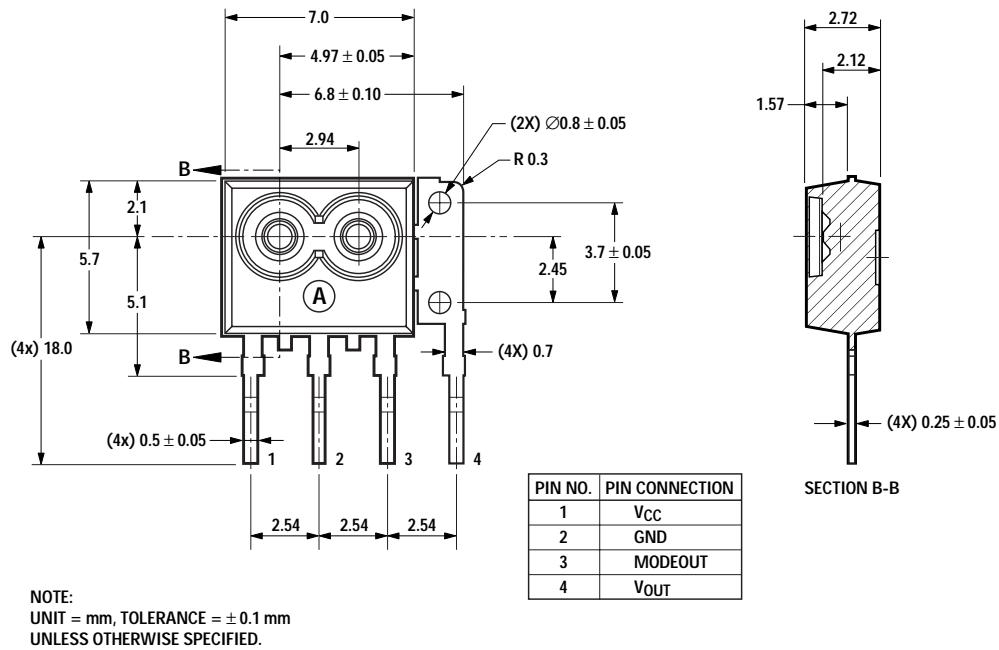
Short Lead Option (AFBR-1010S)



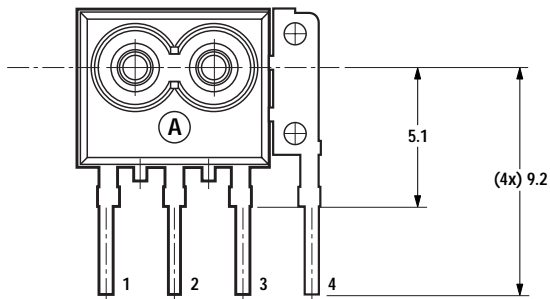
Bend Option (AFBR-1010T)



## Receiver (AFBR-2010)

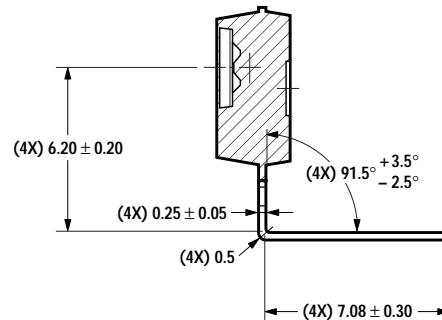


## Short Lead Option (AFBR-2010S)



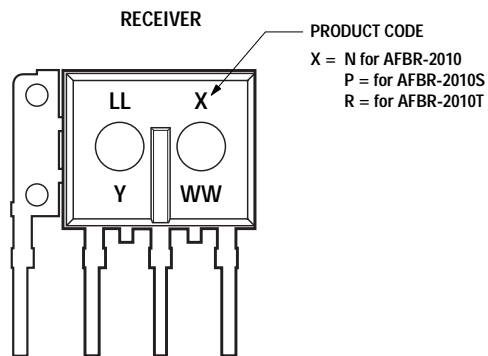
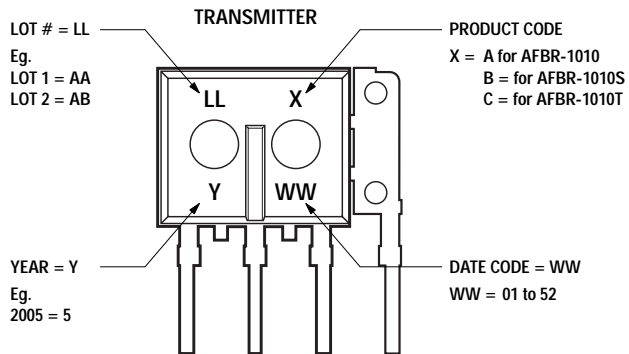
NOTE:  
UNIT = mm, TOLERANCE = ± 0.1 mm  
UNLESS OTHERWISE SPECIFIED.

## Bend Option (AFBR-2010T)





## Device Marking



For product information and a complete list of distributors, please go to our website: [www.avagotech.com](http://www.avagotech.com)

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