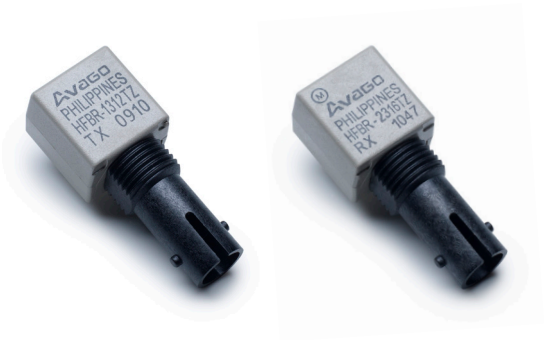
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HFBR-1312TZ Transmitter
HFBR-2316TZ Receiver

1300 nm Fiber Optic Transmitter and Receiver

Data Sheet



Description

The HFBR-1312TZ Transmitter and HFBR-2316TZ Receiver are designed to provide the most cost-effective 1300 nm fiber optic links for a wide variety of data communication applications from low-speed distance extenders up to SONET OC-3 signal rates. Pinouts identical to Avago HFBR-0400Z Series allow designers to easily upgrade their 820 nm links for farther distance. The transmitter and receiver are compatible with two popular optical fiber sizes: 50/125 μm and 62.5/125 μm diameter. This allows flexibility in choosing a fiber size. The 1300 nm wavelength is in the lower dispersion and attenuation region of fiber, and provides longer distance capabilities than 820 nm LED technology. Typical distance capabilities are 2 km at 125 MBd and 5 km at 32 MBd.

Features

- RoHS-compliant
- Low cost fiber optic link
- Signal rates over 155 megabaud
- 1300 nm wavelength
- Link distances up to 5 km
- Dual-in-line package panel-mountable ST* port
- Auto-insertable and wave-solderable
- Specified with 62.5/125 μm and 50/125 μm fiber
- Compatible with 820 nm Miniature Link Series
- Receiver also specified for SM cable spec (9/125 μm)

Applications

- Desktop links for high speed LANs
- Distance extension links
- Telecom switch systems
- TAXIchip® compatible

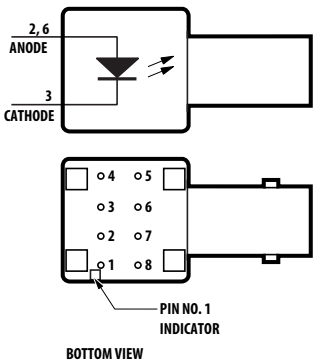
*ST is a registered trademark of AT&T Lightguide Cable Connectors

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Transmitter

The HFBR-1312TZ fiber optic transmitter contains a 1300 nm InGaAsP light emitting diode capable of efficiently launching optical power into 50/125 µm and 62.5/125 µm diameter fiber. Due to the pin compatibility to the 820 nm Miniature Link Series, converting the driver circuit from a HFBR-14xxZ 820 nm transmitter to the HFBR-1312TZ requires the modification of only a few passive components.

HFBR-1312TZ Transmitter



PIN	FUNCTION
1	N.C.
2	ANODE
3	CATHODE
4	N.C.
5	N.C.
6	ANODE
7*	N.C.
8	N.C.

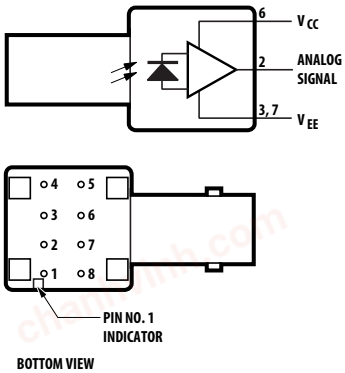
* PIN 7 IS ELECTRICALLY ISOLATED FROM PINS 1, 4, 5, AND 8, BUT IS CONNECTED TO THE HEADER.

PINS 1, 4, 5, AND 8 ARE ISOLATED FROM THE INTERNAL CIRCUITRY, BUT ARE ELECTRICALLY CONNECTED TO EACH OTHER.

Receiver

The HFBR-2316TZ receiver contains an InGaAs PIN photodiode and a low-noise transimpedance preamplifier that operate in the 1300 nm wavelength region. The HFBR-2316TZ receives an optical signal and converts it to an analog voltage. The buffered output is an emitter-follower, with frequency response from DC to typically 125 MHz. Low-cost external components can be used to convert the analog output to logic compatible signal levels for a variety of data formats and data rates. Due to the pin compatibility to the 820 nm Miniature Link receiver HFBR-2416xxZ, converting from a 820nm to a 1300nm receiver circuit is realizable by replacing the HFBR-2416xxZ with the HFBR-2316TZ.

HFBR-2316TZ Receiver

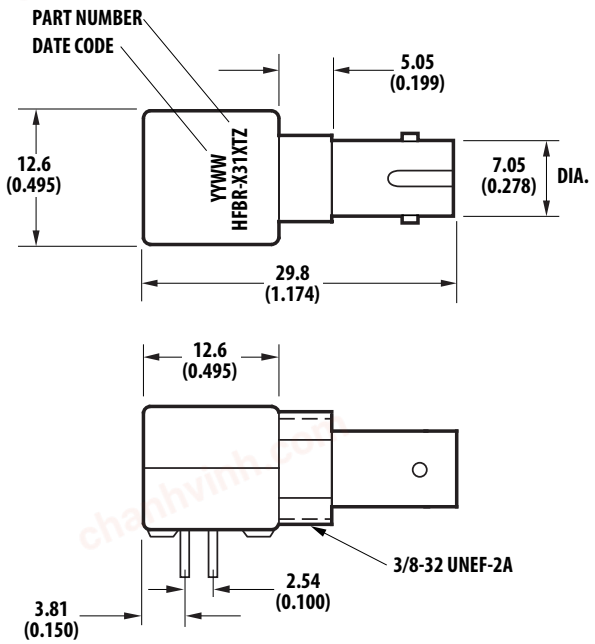


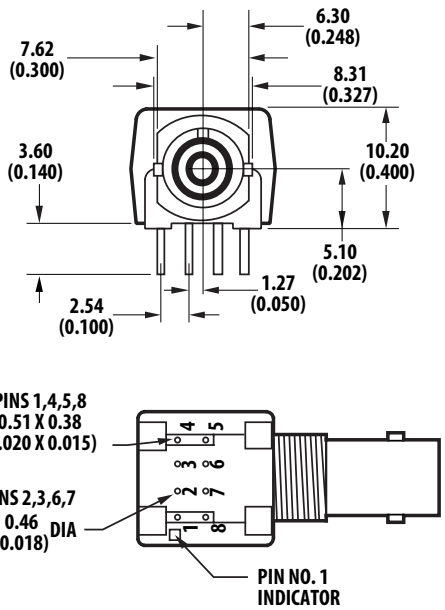
PIN	FUNCTION
1	N.C.
2	SIGNAL
3*	V_{EE}
4	N.C.
5	N.C.
6	V_{CC}
7*	V_{EE}
8	N.C.

* PINS 3 AND 7 ARE ELECTRICALLY CONNECTED TO THE HEADER.

PINS 1, 4, 5, AND 8 ARE ISOLATED FROM THE INTERNAL CIRCUITRY, BUT ARE ELECTRICALLY CONNECTED TO EACH OTHER.

Mechanical Dimensions





Dimensions in mm (inches)

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Package Information

The transmitter and receiver are housed in a dual-in-line package made of high strength, heat resistant, chemically resistant, and UL V-0 flame retardant plastic. The package is auto-insertable and wave solderable for high volume production applications.

Note: The "T" in the product numbers indicates a Threaded ST connector (panel mountable), for both transmitter and receiver.

Handling and Design Information

When soldering, it is advisable to leave the protective cap on the unit to keep the optics clean. Good system performance requires clean port optics and cable ferrules to avoid obstructing the optical path. Clean compressed air is often sufficient to remove particles of dirt; methanol on a cotton swab also works well.

Recommended Chemicals for Cleaning/Degreasing

Alcohols (methyl, isopropyl, isobutyl)
Aliphatics (hexane, heptane)
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.

Panel Mounting Hardware

The HFBR-4411Z kit consists of 100 nuts and 100 washers with dimensions as shown in Figure 1. These kits are available from Avago or any authorized distributor. Any standard size nut and washer will work, provided the total thickness of the wall, nut, and washer does not exceed 0.2 inch (5.1 mm).

When preparing the chassis wall for panel mounting, use the mounting template in Figure 2. When tightening the nut, torque should not exceed 0.8 N-m (8.0 in-lb).

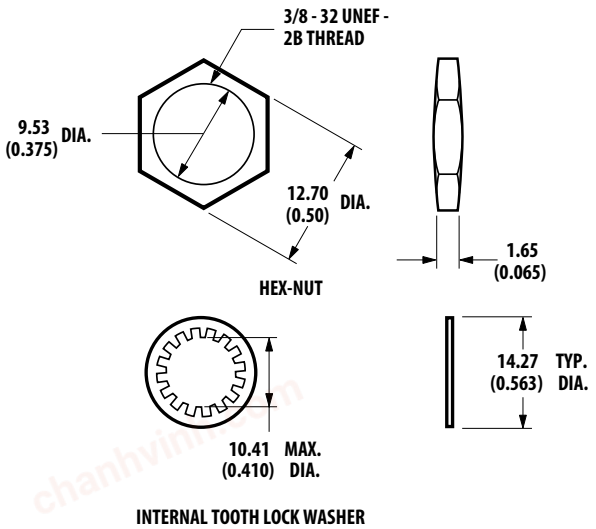


Figure 1. HFBR-4411Z mechanical dimensions

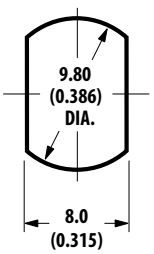


Figure 2. Recommended cut-out for panel mounting

Dimensions in mm (inches)

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HFBR-1312TZ Transmitter Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Reference
Storage Temperature	T_S	-55	85	°C	
Operating Temperature	T_A	-40	85	°C	
Lead Soldering Cycle Temperature			260	°C	Note 1
Lead Soldering Cycle Time			10	sec	
Forward Input Current DC	I_{FDC}		100	mA	
Reverse Input Voltage	V_R		1	V	

Notes:
1. 2.0 mm from where leads enter case.

CAUTION: *The small junction sizes inherent to the design of this bipolar component increase the component's susceptibility to damage from electrostatic discharge (ESD). It is advised that normal static precautions be taken in handling and assembly of this component to prevent damage and/or degradation which may be induced by ESD.*

HFBR-1312TZ Transmitter Electrical/Optical Characteristics

0 to 70°C unless otherwise specified

Parameter	Symbol	Min.	Typ.[2]	Max.	Unit	Condition	Ref.
Forward Voltage	V_F	1.1	1.4	1.7	V	I_F = 75 mA	Fig. 3
			1.5			I_F = 100 mA	
Forward Voltage Temperature Coefficient	$\Delta V_F/\Delta T$		-1.5		mV/°C	I_F = 75 - 100 mA	
Reverse Input Voltage	V_R	1	4		V	I_R = 100 µA	
Center Emission Wavelength	λ_C	1270	1300	1370	nm		
Full Width Half Maximum	FWHM		130	185	nm		
Diode Capacitance	C_T		16		pF	V_F = 0 V, f = 1 MHz	
Optical Power Temperature Coefficient	$\Delta P_T/\Delta T$		-0.03		dB/°C	I_F = 75 - 100 mA DC	
Thermal Resistance	θ_{JA}		260		°C/W		Note 3

Notes:
2. Typical data are at T_A = 25°C.
3. Thermal resistance is measured with the transmitter coupled to a connector assembly and mounted on a printed circuit board; $\theta_{JC} < \theta_{JA}$.

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HFBR-1312TZ Transmitter Output Optical Power and Dynamic Characteristics

Parameter	Symbol	Min.	Typ.[1]	Max.	Unit	Condition T_A	Condition $I_{F, peak}$	Ref.
Peak Power 62.5/125 µm NA = 0.275	P_{T62}	-16.0	-14.0	-12.5	dBm	25°C	75 mA	Notes 2, 3, 4 Fig. 4
		-17.5		-11.5		0-70°C	75 mA	
		-15.5	-13.5	-12.0		25°C	100 mA	
		-17.0		-11.0		0-70°C	100 mA	
Peak Power 50/125 µm NA = 0.20	P_{T50}	-19.5	-17.0	-14.5	dBm	25°C	75 mA	Notes 2, 3, 4 Fig. 4
		-21.0		-13.5		0-70°C	75 mA	
		-19.0	-16.5	-14.0		25°C	100 mA	
		-20.5		-13.0		0-70°C	100 mA	
Optical Overshoot	OS		5	10	%	0-70°C	75 mA	Note 5 Fig. 5
Rise Time	t_r		1.8	4.0	ns	0-70°C	75 mA	Note 6 Fig. 5
Fall Time	t_f		2.2	4.0	ns	0-70°C	75 mA	Note 6 Fig. 5

Notes:
1. Typical data are at T_A = 25°C.
2. Optical power is measured with a large area detector at the end of 1 meter of mode stripped cable, with an ST* precision ceramic ferrule (MIL-STD-83522/13), which approximates a standard test connector. Average power measurements are made at 12.5 MHz with a 50% duty cycle drive current of 0 to $I_{F,peak}$; $I_{F,average} = I_{F,peak}/2$. Peak optical power is 3 dB higher than average optical power.
3. When changing from µW to dBm, the optical power is referenced to 1 mW (1000 µW).
   Optical power P(dBm) = 10*log[P(µW)/1000µW].
4. Fiber NA is measured at the end of 2 meters of mode stripped fiber using the far-field pattern. NA is defined as the sine of the half angle, determined at 5% of the peak intensity point. When using other manufacturer's fiber cable, results will vary due to differing NA values and test methods.
5. Overshoot is measured as a percentage of the peak amplitude of the optical waveform to the 100% amplitude level. The 100% amplitude level is determined at the end of a 40 ns pulse, 50% duty cycle. This will ensure that ringing and other noise sources have been eliminated.
6. Optical rise and fall times are measured from 10% to 90% with 62.5/125 µm fiber. LED response time with recommended test circuit (Figure 3) at 25 MHz, 50% duty cycle.

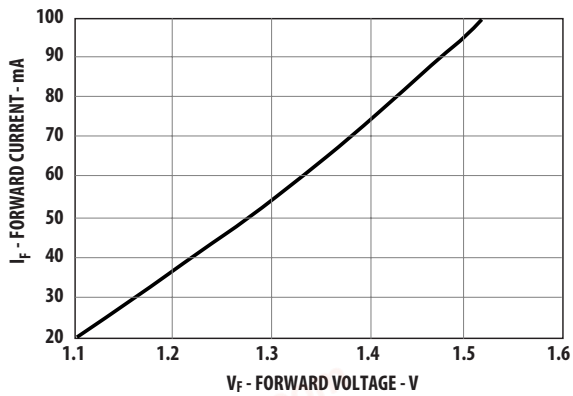


Figure 3. Typical forward voltage and current characteristics

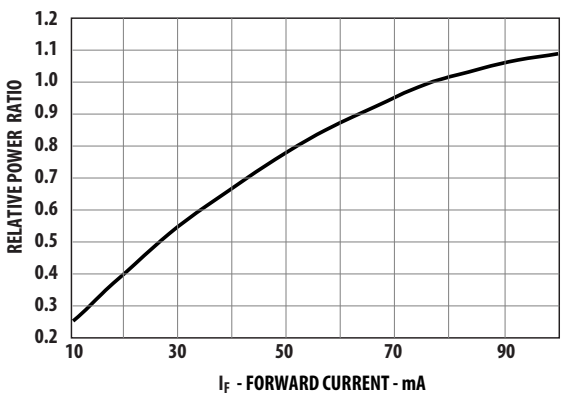


Figure 4. Normalized transmitter output power vs. forward current

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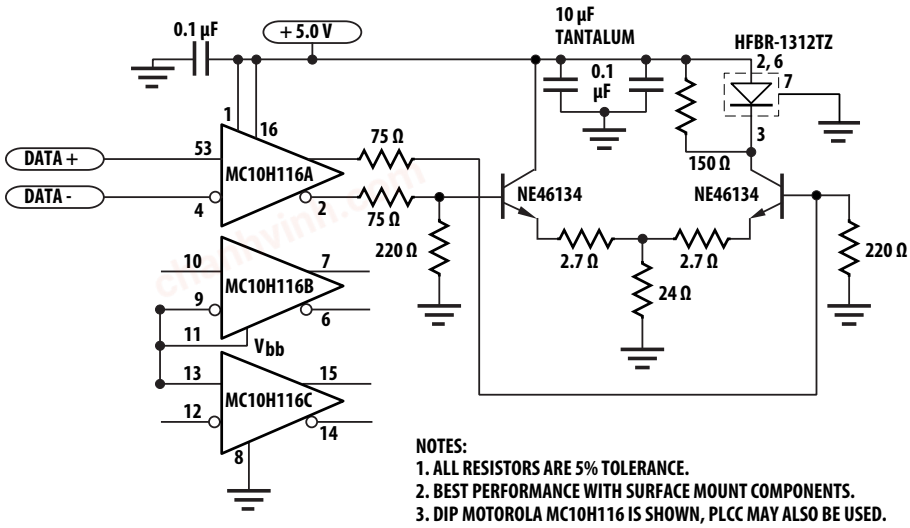


Figure 5. Recommended transmitter drive and test circuit

HFBR-2316TZ Receiver Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Reference
Storage Temperature	T_S	-55	85	°C	
Operating Temperature	T_A	-40	+85	°C	
Lead Soldering Temperature			260	°C	Note 1
Cycle Time			10	s	
Signal Pin Voltage	V_O	-0.5	V_{CC}	V	
Supply Voltage	V_{CC} - V_{EE}	-0.5	6.0	V	Note 2
Output Current	I_O		25	mA	

Notes:
1. 2.0 mm from where leads enter case.
2. The signal output is referred to V_{CC}, and does not reject noise from the V_{CC} power supply. Consequently, the V_{CC} power supply must be filtered. The recommended power supply is +5 V on V_{CC} for typical usage with +5 V ECL logic. A -5 V power supply on V_{EE} is used for test purposes to minimize power supply noise.

CAUTION: *The small junction sizes inherent to the design of this bipolar component increase the component's susceptibility to damage from electrostatic discharge (ESD). It is advised that normal static precautions be taken in handling and assembly of this component to prevent damage and/or degradation which may be induced by ESD.*

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HFBR-2316TZ Receiver Electrical/Optical and Dynamic Characteristics

0 to 70°C; 4.75 V < V_{CC} - V_{EE} < 5.25 V; power supply must be filtered (see note 10).

Parameter	Symbol	Min.	Typ.[1]	Max.	Unit	Condition	Ref.
Responsitivity	R_P 62.5 µm	6.5	13	19	mV/µW	λ_p = 1300 nm, 50 MHz Multimode Fiber 62.5/125 µm	Note 2 Fig. 6, 10
	R_P 9 µm	8.5	17			Singlemode Fiber 9/125 µm	
RMS Output Noise Voltage	V_{NO}		0.4	0.59	mV_{RMS}	100 MHz Bandwidth, P_R = 0 µW	Note 3 Fig. 7
				1.0	mV_{RMS}	Unfiltered Bandwidth P_R = 0 µW	
Equivalent Optical	$P_{N, RMS}$		-45	-41.5	dBm	@ 100 MHz, P_R = 0 µW	Note 3
Noise Input Power (RMS)			0.032	0.071	µW		
Peak Input Optical Power	P_R			-11.0	dBm	50 MHz, 1 ns PWD	Note 4 Fig. 8
				80	µW		
Output Resistance	R_O		30		Ohm	f = 50 MHz	
DC Output Voltage	$V_{O,DC}$	0.8	1.8	2.6	V	V_{CC} = 5 V, V_{EE} = 0 V P_R = 0 µW	
Supply Current	I_{CC}		9	15	mA	R_{LOAD} = ∞	
Electrical Bandwidth	BW_E	75	125		MHz	-3 dB electrical	Note 5
Bandwidth * Rise Time Product			0.41		Hz *s		Note 9
Electrical Rise, Fall Times, 10-90%	t_r,t_f		3.3	5.3	ns	P_R = -15 dBm peak, @ 50 MHz	Note 6 Fig. 9
Pulse-Width Distortion	PWD		0.4	1.0	ns	P_R = -11 dBm, peak	Note 4,7 Fig. 8
Overshoot			2		%	P_R = -15 dBm, peak	Note 8

Notes:
1. Typical specifications are for operation at T_A = 25°C and V_{CC} = +5 V_{DC}.
2. The test circuit layout should be in accordance with good high frequency circuit design techniques.
3. Measured with a 9-pole "brick wall" low-pass filter [Mini-Circuits™, BLP-100*] with -3 dB bandwidth of 100 MHz.
4. -11.0 dBm is the maximum peak input optical power for which pulse-width distortion is less than 1 ns.
5. Electrical bandwidth is the frequency where the responsivity is -3 dB (electrical) below the responsivity measured at 50 MHz.
6. The specifled rise and fall times are referenced to a fast square wave optical source. Rise and fall times measured using an LED optical source with a 2.0 ns rise and fall time (such as the HFBR-1312TZ) will be approximately 0.6 ns longer than the specifled rise and fall times. E.g.: measured $t_{r,f} \sim [(\text{specifled } t_{r,f})^2 + (\text{test source optical } t_{r,f})^2]^{1/2}$.
7. 10 ns pulse width, 50% duty cycle, at the 50% amplitude point of the waveform.
8. Percent overshoot is defined as: $((V_{PK} - V_{100\%})/V_{100\%}) \times 100\%$. The overshoot is typically 2% with an input optical rise time ≤1.5 ns.
9. The bandwidth*risetime product is typically 0.41 because the HFBR-2316TZ has a second-order bandwidth limiting characteristic.
10. The signal output is referred to V_{CC}, and does not reject noise from the V_{CC} power supply. Consequently, the V_{CC} power supply must be filtered. The recommended power supply is +5 V on V_{CC} for typical usage with +5 V ECL logic. A -5 V power supply on V_{EE} is used for test purposes to minimize power supply noise.

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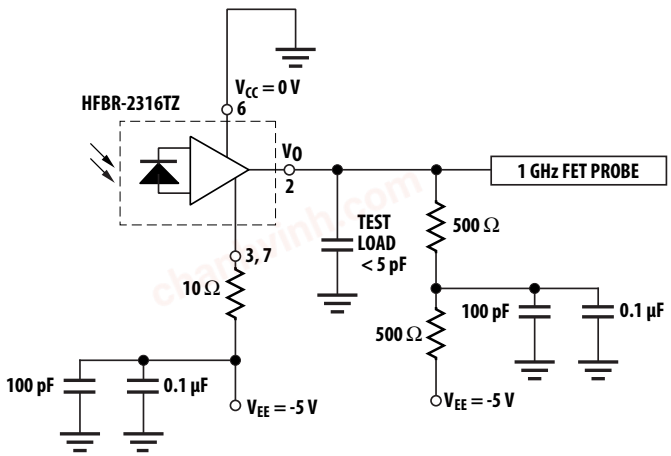


Figure 6. HFBR-2316TZ receiver test circuit

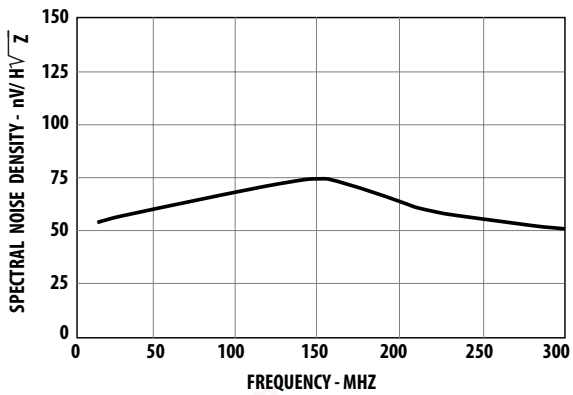


Figure 7. Typical output spectral noise density vs. frequency

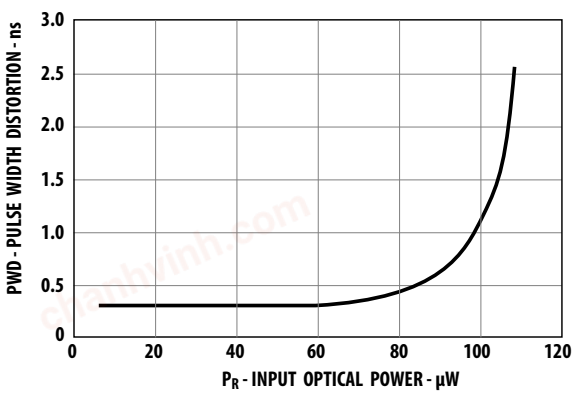


Figure 8. Typical pulse width distortion vs. peak input power.

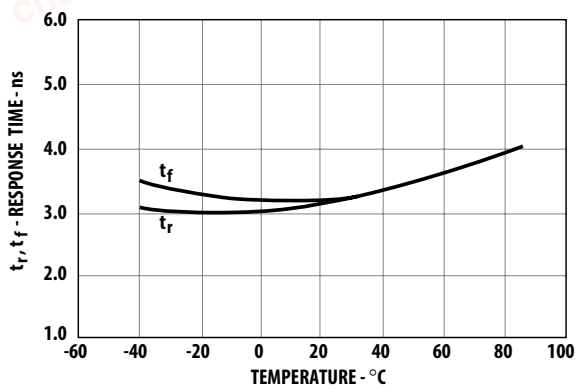


Figure 9. Typical rise and fall times vs. temperature

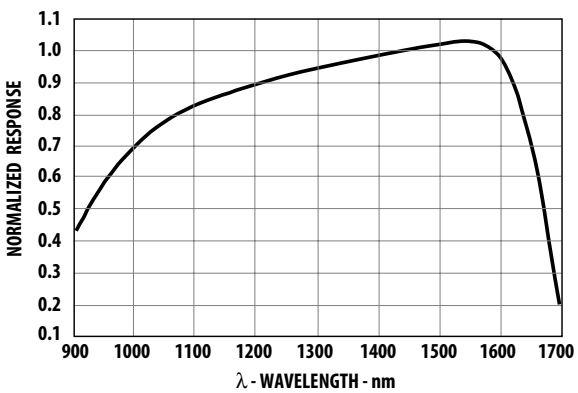


Figure 10. Normalized receiver spectral response

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AV02-1500EN - October 10, 2013