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Data Sheet

AFBR-15x9xZ

DC to 10-Mbaud Versatile Link Fiber-Optic Analog Transmitter for 1-mm POF and 200-µm PCS

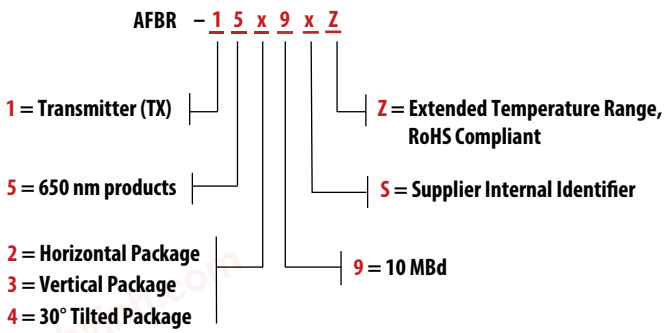


Overview

The Broadcom® AFBR-15x9xZ analog transmitter uses a 650-nm LED source in a housing that is designed to efficiently couple into 1-mm polymer optical fiber (POF) and 200-µm diameter plastic-clad silica (PCS). Links up to 50m are supported with 1-mm POF and up to 200m with 200-µm PCS. It is designed to interoperate with the Broadcom HFBR-25xxZ, AFBR-25xxZ, and AFBR-26xxZ receivers.

The transmitter is a 4-pin device that is packed in a Versatile Link housing. Versatile Link components can be interlocked (N-plexed together) to minimize space and to provide dual connections with duplex connectors. Various simplex and duplex connectors, as well as POF cables, are available for Versatile Link components.

Part Numbering and Options



Option	Part Number
Horizontal Package	AFBR-1529Z
Vertical Package	AFBR-1539Z
30° Tilted Package	AFBR-1549SZ

Features

- RoHS compliant
- Data transmission at signal rates from DC up to 10 Mbaud
- Up to 50 meters distance with 1-mm POF and 200 meters with 200-µm PCS
- Operating temperature range of –40°C to +85°C
- Compatible with the Broadcom Versatile Link family of connectors, for easy termination of fiber

Applications

- Industrial control and factory automation
- Serial field buses
- Intra-system links: board-to-board, rack-to-rack
- Extension of RS-232 and RS-485
- High voltage isolation
- Elimination of ground loops
- Reduction of voltage transient susceptibility

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Application Literature

Versatile Link Family: Application Note 1035 (AV02-0730EN).

Package and Handling Information

Versatile Link packages are made of a flame-retardant material and use the same pad layout as a standard 8-pin, dual-inline package. Versatile Link packages are stackable and are enclosed to provide a dust-resistant seal. Snap action simplex, simplex latching, duplex, and duplex latching connectors are offered with simplex or duplex cables.

Package Housing Color

Versatile Link components and simplex connectors are color-coded to eliminate confusion when making connections. Transmitters are gray.

Handling

Versatile Link components are auto-insertable. When wave soldering is performed with Versatile Link components, the optical port plug should be left in to prevent contamination of the port. Do not use reflow solder processes (for example, infrared reflow or vapor-phase reflow). Use non-halogenated water-soluble fluxes (for example, 0% chloride), not rosin-based fluxes, with Versatile Link components.

Versatile Link components are moisture-sensitive devices and are shipped in a moisture-sealed bag. If the components are exposed to air for an extended period of time, they may require a baking step before the soldering process. Refer to the special labeling on the shipping tube for details.

Recommended Chemicals for Cleaning and Degreasing

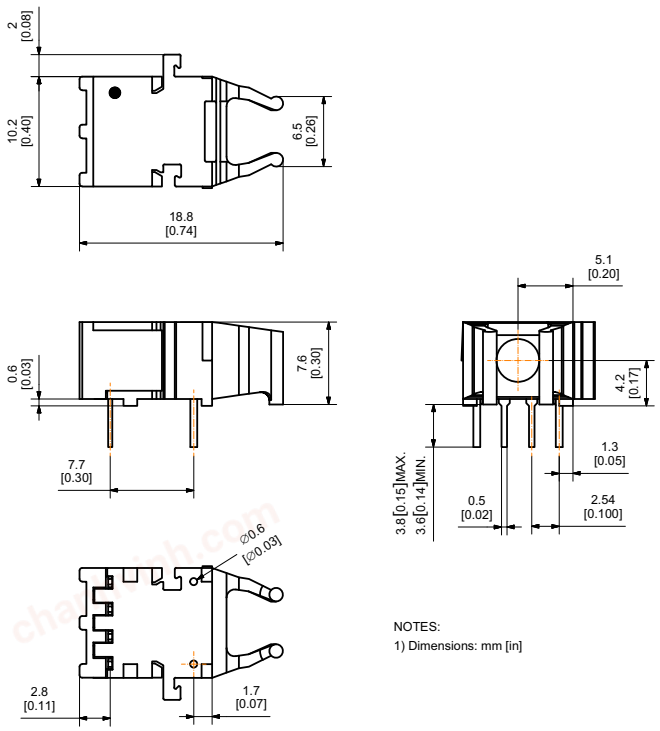
- Alcohols: methyl, isopropyl, isobutyl
- Aliphatics: hexane, heptanes
- Other: soap solution, naphtha

Do not use partially halogenated hydrocarbons, such as 1,1,1 trichloroethane, or ketones, such as MEK, acetone, chloroform, ethyl acetate, methylene dichloride, phenol, methylene chloride, or N-methylpyrolldone. Do not use cleaners that use halogenated hydrocarbons because of their potential environmental harm.

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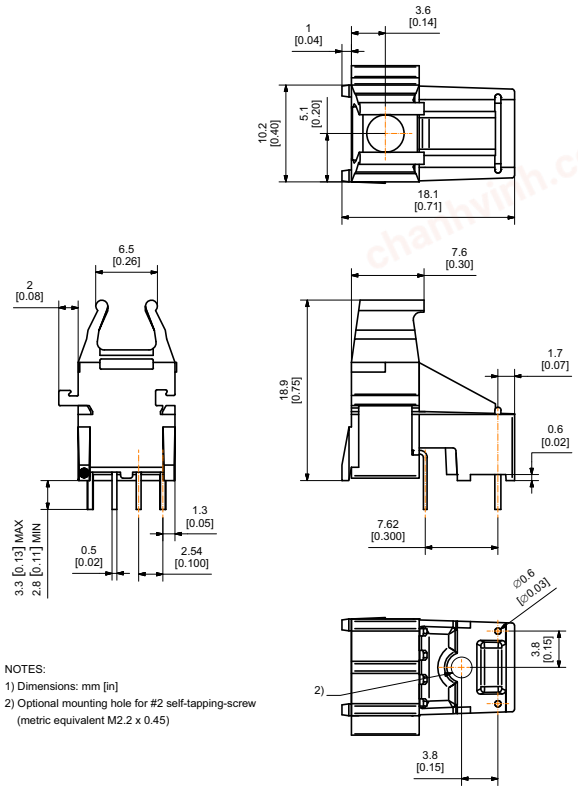
Mechanical Dimensions

Horizontal Module



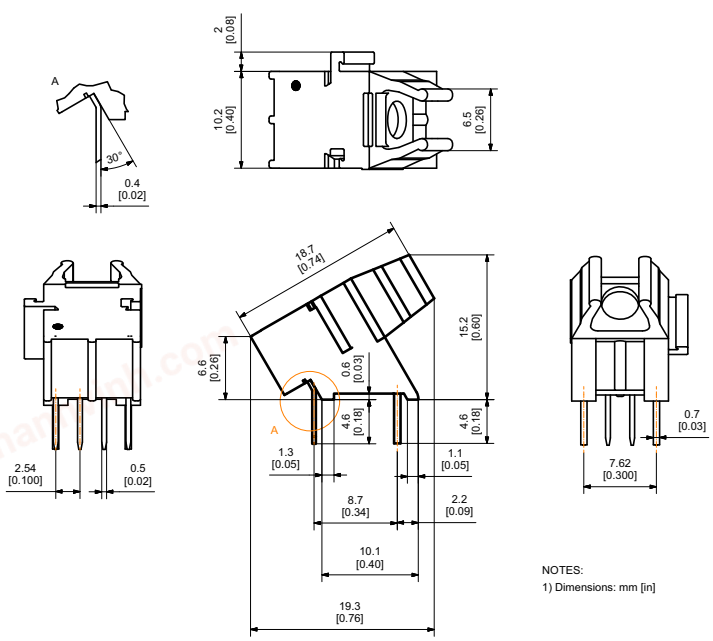
NOTES:
1) Dimensions: mm [in]

Vertical Module



NOTES:
1) Dimensions: mm [in]
2) Optional mounting hole for #2 self-tapping-screw (metric equivalent M2.2 x 0.45)

30° Tilted Module

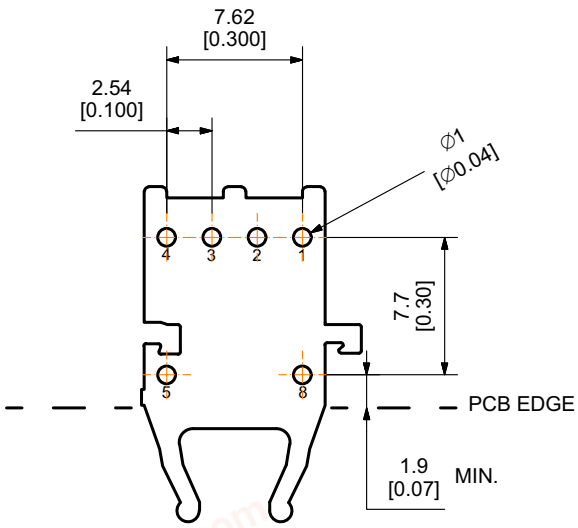


NOTES:
1) Dimensions: mm [in]

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Versatile Link Printed Board Layout Dimensions

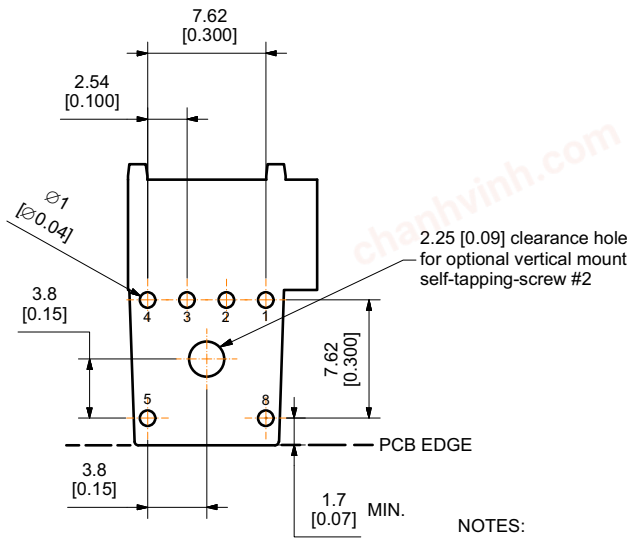
Horizontal Module



NOTES:
1) Dimensions: mm [in]

Footprint - TOP VIEW

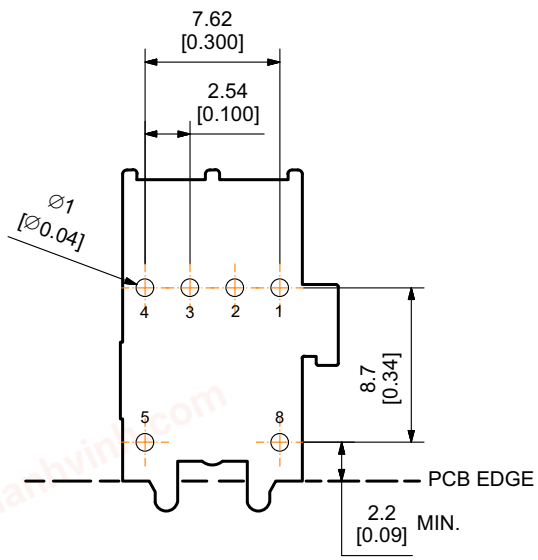
Vertical Module



NOTES:
1) Dimensions: mm [in]

Footprint - TOP VIEW

30° Tilted Module



NOTES:
1) Dimensions: mm [in]

Footprint - TOP VIEW

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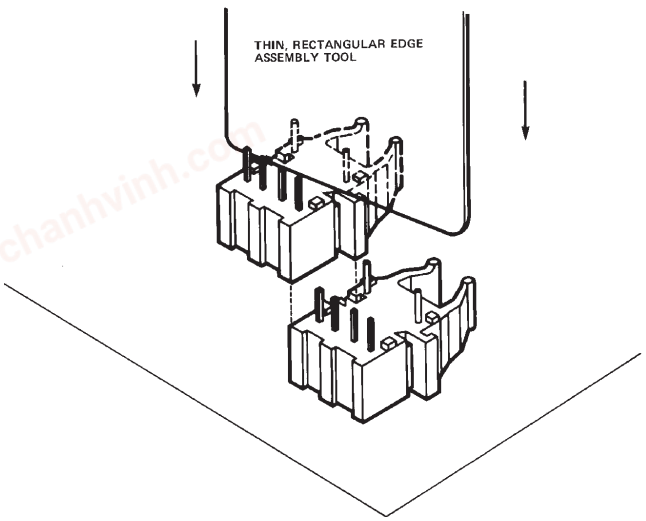
Interlocked (Stacked) Assemblies

Horizontal and tilted packages may be stacked by placing units with pins facing upward. Initially engage the interlocking mechanism by sliding the L bracket body from above into the L slot body of the lower package. Use a straight edge, such as a ruler, to bring all stacked units into uniform alignment. This technique prevents potential harm that could occur to fingers and hands of assemblers from the package pins. Stacked horizontal and tilted packages can be disengaged if necessary. Repeated stacking and unstacking causes no damage to individual units.

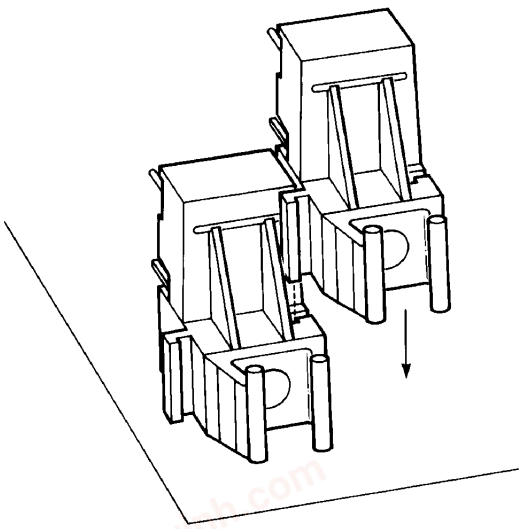
To stack vertical packages, hold one unit in each hand, with the pin facing away and the optical ports on the bottom. Slide the L bracket unit into the L slot unit. The straight edge used for horizontal package alignment is not needed.

It is recommended to interlock (stack) no more than four compatible housings together.

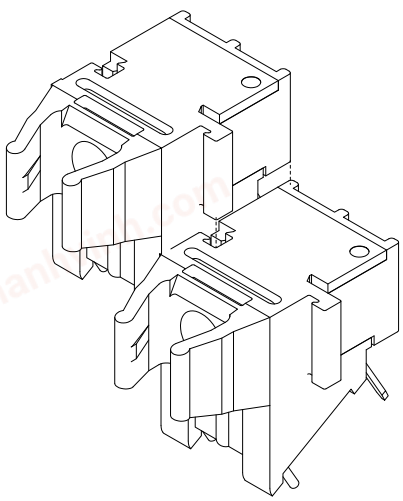
Stacking Horizontal Modules



Stacking Vertical Modules

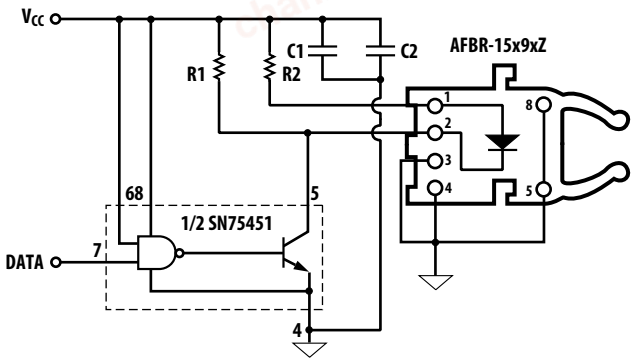


Stacking 30° Tilted Modules



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Figure 1: Recommended Drive Circuit, Top View



	Value	Tolerance
R1	2 kΩ	5%
R2	100Ω	1%
C1	0.1 µF	20%
C2	10 µF	20%

NOTE:

- $I_{F,on}$ = 30 mA nominal at T_A = 25°C.
- This is an inverting circuit; thus the LED is off in case of DATA “H”. Therefore, an inverting receiver (for example, AFBR-2529Z) should be used accordingly.

Pin Description Transmitter

Fiber port faces front, pins downward,
1 = Rightmost pin to 4 = Leftmost pin.

Pin	Name	Function/Description	Notes
1	Anode	LED anode	—
2	Cathode	LED cathode	—
3	Pin	No function, physical pin available, recommended to signal GND	—
4	Pin	No function, physical pin available, recommended to signal GND	—
5	Housing Pin	Physical pin available, recommended to chassis GND	a
8	Housing Pin	Physical pin available, recommended to chassis GND	a

a. Pins 5 and 8 are for mounting and retaining purposes. Make sure that they are electrically connected to chassis GND.

Regulatory Compliance

Feature	Test Method	Performance
Electrostatic Discharge (ESD) to the Electrical Pins: Human Body Model	MIL-STD-883 Method 3015	Min ± 2000V
Eye Safety	IEC 60825-1, 2, Class 1	Class 1

Specified Link Performance

T_A = –40°C to +85°C, 10 Mbaud.

Parameter	Min.	Max.	Unit	Condition	Note
Link Distance with Standard Loss POF Cable	0.1	50	m	–40°C to +85°C	a
Link Distance with 200-µm PCS Cable	0.1	200	m	–40°C to +85°C	b

a. The POF is HFBR-R/EXXYYYZ plastic (1-mm) optical fiber. Worst-case attenuation used (0.27 dB/m for a standard loss POF cable from –40°C to +85°C at 650 nm). Link performance is valid in combination with AFBR-26x4Z and AFBR-25x9Z.

b. PCS, worst-case attenuation (12 dB/km from –40°C to +85°C at 650 nm).

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Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Notes
Storage and Operating Temperature	$T_{S,O}$	–40	85	°C	—
Transmitter Peaking Forward Input Current	$I_{F,PK}$	—	45	mA	a
Transmitter Short-Term Peaking Forward Input Current	$I_{F,\ PKshort}$	—	80	mA	b
Transmitter Average Forward Input Current	$I_{F,AVG}$	—	30	mA	—
Transmitter Reverse Input Voltage	V_R	—	3	V	—

a. For $I_{F,PK}$ > 30 mA, the duty factor must maintain ≤30 mA $I_{F,AVG}$ and pulse width ≤1 µs.

b. Maximum short-term peaking forward current must not be applied longer than 5 ns to improve the rise time or enhance the signaling rate. Applying a short-term peaking forward current must not result in exceeding 30 mA average forward current.

Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Unit	Notes
Ambient Temperature, No Air Flow	T_A	–40	85	°C	a, b
Transmitter Average Forward Input Current	$I_{F,AVG}$	3	30	mA	—
Signaling Rate	f_s	DC	10	Mbaud	c

a. 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. Refer to the reliability data sheet for specific reliability performance.

b. Measured at the housing.

c. Without peaking of the electrical input signal.

Process Compatibility

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Solder Environment	T_{SOLD}	—	—	260	°C	a, b, c
	t_{SOLD}	—	—	10	seconds	b, c, d

a. Maximum temperature refers to peak temperature.

b. 1.6 mm below the seating plane.

c. Product is Moisture Sensitive Level 3.

d. Maximum time refers to the time spent at peak temperature. To guard against solder process fluctuations, the recommended nominal soldering time is 5 seconds.

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AFBR-15x9xZ Analog Transmitter

The AFBR-15x9xZ analog transmitter utilizes a 650-nm LED source in a housing that is designed to efficiently couple into 1-mm polymer optical fiber (POF) or 200-µm plastic-clad silica (PCS). Links up to 50 meters are supported with 1-mm POF. Links up to 200 meters are supported with 200-µm PCS.

Electrical and Optical Characteristics

T_A = –40°C to +85°C unless otherwise stated.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Notes
Peak Output Power, 1-mm POF, 30 mA	P_T	–6	–1	2	dBm	$I_{F,DC}$ = 30 mA	a, b
Peak Output Power, 200-µm PCS, 30 mA	P_T	–18	–12	–9	dBm	$I_{F,DC}$ = 30 mA	a, b
Peak Output Power, 1-mm POF, 10 mA	P_T	–11	–6	–3	dBm	$I_{F,DC}$ = 10 mA	a, b
Peak Output Power, 1-mm POF, 5 mA	P_T	–14	–9	–6	dBm	$I_{F,DC}$ = 5 mA	a, b
Peak Output Power, 1-mm POF, 3 mA	P_T	–16	–11	–8	dBm	$I_{F,DC}$ = 3 mA	a, b
Optical Power Temperature Coefficient	$\Delta P_T/\Delta T$	—	–0.01	—	dB/K	–40°C to +25°C	—
Optical Power Temperature Coefficient	$\Delta P_T/\Delta T$	—	–0.02	—	dB/K	+25°C to +85°C	—
Peak Emission Wavelength	λ_P	630	650	685	nm	—	—
Peak Emission Wavelength Temperature Coefficient	$\Delta\lambda/\Delta T$	—	0.16	—	nm/K	—	—
Spectral Width	FWHM	—	20	—	nm	—	—
Forward Voltage	V_F	1.4	—	2.3	V	$I_{F,DC}$ = 3 mA to 30 mA	—
Forward Voltage Temperature Coefficient	$\Delta V_F/\Delta T$	—	–1.6	—	mV/K	$I_{F,DC}$ = 30 mA	—
Reverse Input Breakdown Voltage	—	9	20	—	V	—	—
Diode Capacitance	—	—	30	70	pF	—	—
Optical Rise Time	t_r	—	—	30	ns	20% to 80%	c
Optical Fall Time	t_f	—	—	30	ns	80% to 20%	c

a. The optical power is measured with the polished connector end face at the end of 0.5 meters of 1-mm diameter POF with a numerical aperture (NA) of 0.5, or of 200-µm diameter PCS with NA = 0.37.

b. The minimum average output power specification value includes a degradation margin of 1 dB.

c. Using the recommended drive circuit in Figure 1 for $I_{F,DC}$ = 30 mA.

Figure 2: Typical Forward Voltage vs. Drive Current

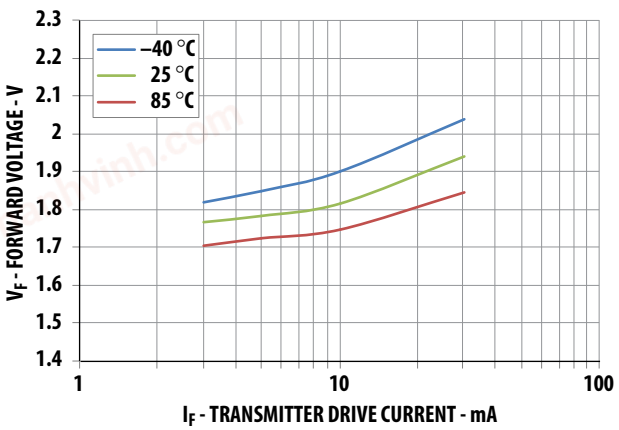
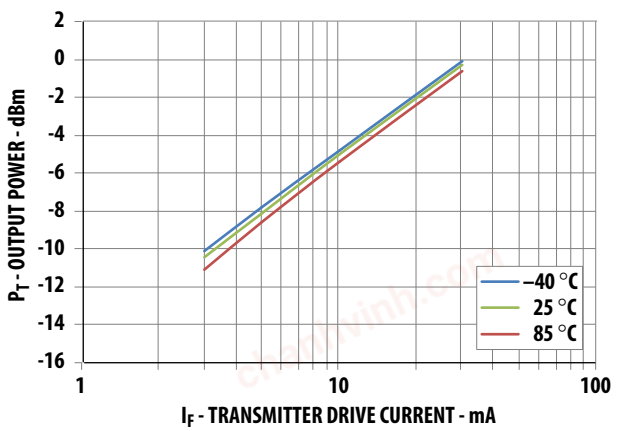


Figure 3: Typical Optical Output Power, 1-mm POF vs. Drive Current



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