SFP-1GBT-05

SFP Copper Transceiver 10/100/1000Base-T to SGMII

The Bel SFP-1GBT-05 transceiver is an internally configured 10/100/1000Base-T SFP module for SGMII host interfaces. The host interface transmits and receives serial data differentially at 1.25Gbps. The copper interface is advertised as full duplex and will auto-negotiate to 10/100/1000 Base-T.

Key Features & Benefits

- Designed with Broadcom's BCM54616S chipset
- Complies with IEEE 802.3, 802.3u, and 802.3ab specifications
- Conforms to Multi-Source Agreement (MSA) specifications for SFP transceivers
- Supports IEEE 802.3u and IEEE 802.3ab auto–negotiation features to allow networking equipment to automatically determine and adjust the required settings
- Operates in extended temperature range of -40° to +85° C
- Automatically compensates for baseline wander by removing DC offset from the input signal
- Assembled with low EMI emissions IC and fully metallic housings
- Automatic dependent interface (DI) crossover, eliminating the need for crossover cables or cross-wire (MDIX) ports
- Bail latch provides ease of extraction
- Compact RJ45 connector assembly
- Data is scrambled to reduce radiated emission
- Power consumption is 610mW typical
- Fully RoHS compliant
- The BCM54616S physical layer IC (PHY) can be accessed via I^2C interface:
  PHY address = "ACh"
  EEPROM address = "A0h"

Applications

- 10/100/1000 Mbps data rate in excess of 100 meters of Category 5/5e cable
- Industrial temperature environments -40° to +85° C
- Networking equipment
- Switch-to-switch interface
- Routers

Regulatory and Standards Compliance

- Compliant with IEEE 802.3:2000
- FCC Part 15, Class A
- EN 55024 Immunity standard and ESD

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Please read our datasheet & drawing disclaimer here.

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SFP-1GBT-05 Module Specifications

Parameter	Symbol	Min	Type	Max	Units	Notes
Supply Voltage	V_{DD3}	3.13	3.3	3.46	V	VDC
Supply Current	Is		185	132	mA	1000 Base-T
Supply Current	Is		98		mA	10/100 Base-T

SFP Host Serial Interface (TX/RX)	Symbol	Min	Type	Max	Units	Notes
Line Frequency	F_{LINE}		125		MHz	
TX Output Impedance	Z_{TX_OUT}		100		Ω	Differential
RX Output Impedance	Z_{RX_IN}		100		Ω	Differential
Clock Frequency			25		MHz	
Rise/Fall Time	T_R/T_F		4		Ns	20% - 80%
RMS Phase Jitter	F_J			1.5	ps-rms	F_J = 12 кHz to 20 MHz offset frequency

Environmental Specifications	Symbol	Min	Type	Max	Units	Notes
Operating Temp	T_{OP}	-40		+85	°C	Case temperature
Storage Temp	T_{STG}	-40		+85	°C	Ambient temperature

SFP Host Connector Electrical Interface Descriptions

Pin	Name	Descriptions
1	VeeT	Transmitter ground (common with receiver ground)
2	TX Fault	Transmitter fault is internally tied to transmit ground and is not supported
3	TX Disable	Disable PHY when logic '1'. Internal Pull Down
4	MOD-DEF2	Signal SDA (data) of the two-wire serial interface
5	MOD-DEF1	Signal SCL (clock) of the two-wire serial interface
6	MOD-DEF0	This pin is internally tied to transmit ground
7	Rate Select	Not implemented. This Pin is floating internally
8	LOS	Logic '1' when no signal or linked at 10Base-T
9	VeeR	Receiver ground (common with transmitter ground)
10	VeeR	Receiver ground (common with transmitter ground)
11	VeeR	Receiver ground (common with transmitter ground)
12	RD-	Differential Transmitter Output. User to terminate 100Ω differential at host. AC Coupled within SFP.
13	RD+	Differential Transmitter Output. User to terminate 100Ω differential at host. AC Coupled within SFP.
14	VeeR	Receiver ground (common with transmitter ground)
15	VccR	3.3V power
16	VccT	3.3V power
17	VeeT	Transmitter ground (common with receiver ground)
18	TD+	Differential Receiver Input. 100Ω differential termination & AC Coupling within SFP.
19	TD-	Differential Receiver Input. 100Ω differential termination & AC Coupling within SFP.
20	VeeT	Transmitter ground (common with receiver ground)

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SGMII Installation Guide

Part Number	Link Indicator on Rx_LOS Pin	Auto-Negotiation enabled by default	Interface
SFP-1GBT-05	Yes	Yes	SGMII 10/100/1000Base-T

- Rx_LOS is always ENABLE.
  High —> Not linked
  Low —> Linked to link-partner.

- Customer's **MAC** should be setup for **SGMII interface with Auto-Negotiation** and the preferred mode of operation. In most cases there is no need to access the PHY registers of the Broadcom PHY within the SFP-1GBT-05 Transceiver.

- The transceiver will automatically detect the advertised speed and mode of operation via the host of the link-partner.

- Default is 1000Base-T (Full-Duplex or Half Duplex)

- The transceiver will automatically detect the advertised 100Base-Tx speed and mode of operations (Full-Duplex or Half Duplex) from MAC and link to its link-partner.

- The transceiver will automatically detect advertised 10Base-T speed and mode of operation (Full- Duplex or Half Duplex) from the MAC and link to its link-partner.

Depending on the condition of the MAC Configuration, the SFP can also be forced to operate at the preferred speed and mode of operation by accessing the **Broadcom PHY** registers via "**0xAC**" address:

- 1000Base-T Full-Duplex and/or Half-Duplex – by default.

- Forcing the SFP-1GBT-05 to operate at **100Base-TX** Full Duplex and/or Half-Duplex:
  1. Force Full-Duplex mode:
     Write PHY register 00h to 0x2100h. (Force copper operate at 100Base-Tx Full-Duplex mode)
  2. Force Half-Duplex mode:
     Write PHY register 00h to 0x2000h. (Force copper operate at 100Base-Tx Half-Duplex mode)
  3. Auto-Negotiation mode:
     Write PHY register 09h to 0x000. (Disable 1000Bast-T ability)
     Write PHY register 00h to 0x1340. (Restart Auto-Negotiation)

- Forcing the SFP-1GBT-05 to operate at 10Base-T Full-Duplex and/or Half Duplex
  1. Force Full-Duplex mode:
     Write PHY register 00h to 0x0100h. (Force copper operate at 10Base-T Full-Duplex mode)
  2. Force Half-Duplex mode:
     Write PHY register 00h to 0x0000h. (Force copper operate at 10Base-T Half-Duplex mode)
  3. Auto-Negotiation mode:
     Write PHY register 09h to 0x0000. (Disable 1000Base-T ability)
     Write PHY register 04h to 0x0061. (Disable 10Base-T and 100Base-Tx ability)
     Write PHY register 00h to 0x1340. (Restart Auto-Negotiation)

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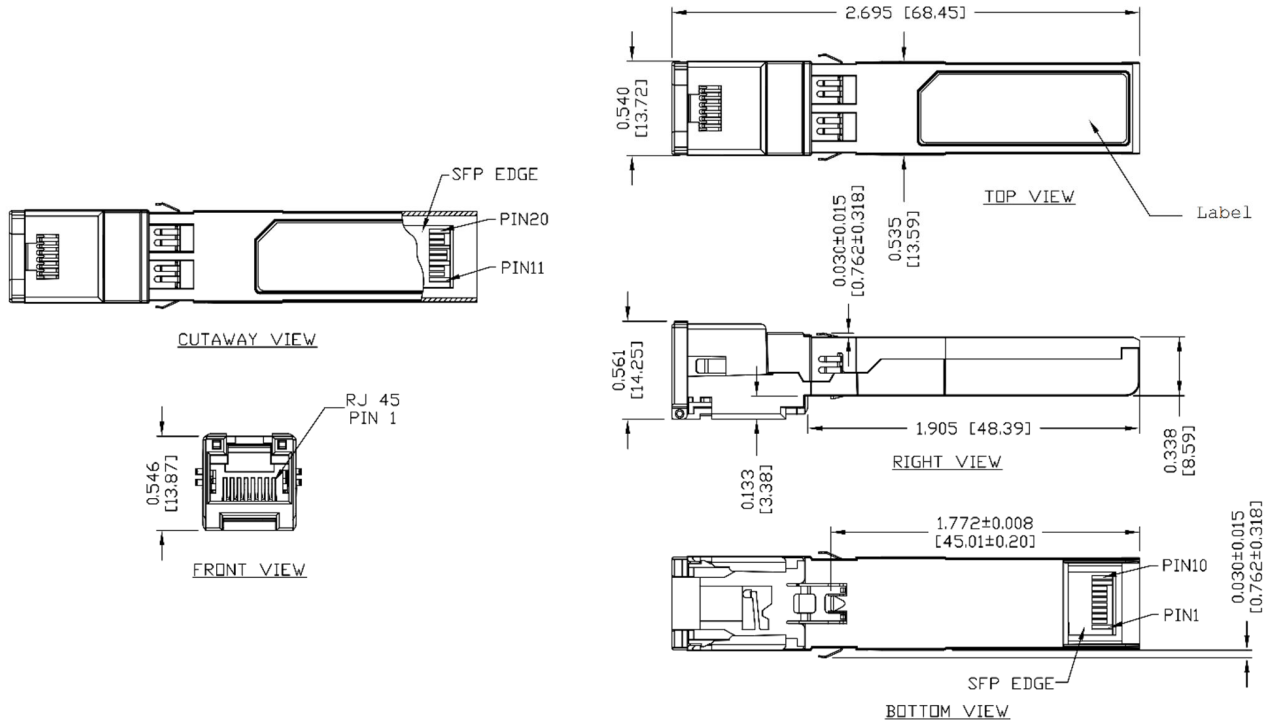
SGMII-copper to GBIC:

- If the GBIC Interface is required, Bel would recommend the SFP-1GBT-06 Transceiver for installation.
- However, the device can also be configured to operate in GBIC (1000Base-X to 1000Base-T) interface by accessing the Broadcom PHY registers via "**0xAC**":

1. Write register 18h, shadow 07h bit [7] = 0 (Disable RGMII Mode)
2. Write register 1Ch, shadow 1Fh bit [0] = 1 (Enable Fiber register bank)
3. Write register 00h, bit [11] = 1 (Power-down SerDes interface)
4. Write register 1Ch, shadow 1Fh bit [2:1] = 11 (Configure the BCM54616S in GBIC mode)
5. Write register 00h, bit [11] = 0 (Power-up SerDes interface)
6. Write register 1Ch, shadow 1Fh bit [0] = 0 (Enable Copper register bank)
7. Write register 00h, bit [11] = 0 (Power-up Copper interface)

MAC Auto-Negotiation vs. MAC without Auto-Negotiation:

In case MAC does not have Auto-Negotiation capability, the Auto-Negotiation of the SFP-1GBT-05 can also be disabled by clearing the Broadcom PHY register 00h, bit12 to "0", before connecting the Bel transceiver to the link partner.

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