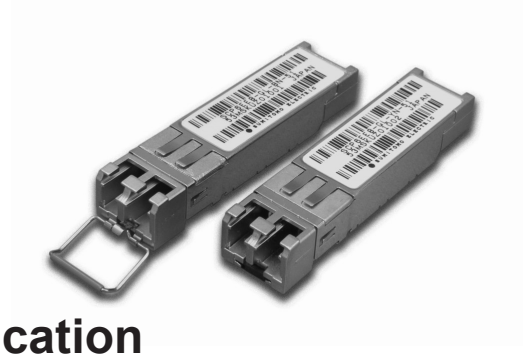
Specification : TS-S03D159C
March, 2005



Technical Specification
for
Small Form Factor Pluggable (SFP)

SCP69P4-GL-#N-xx (No Diagnostic Monitoring)
SCP6EP4-GL-#N-xx (Diagnostic Monitoring with External Calibration)

☐ 155.52Mbps	☐ 622.08Mbps	☑ other Up to 1.25Gbps Multi Rate
☐ Short Haul Intermediate Reach	☐ Long Haul Long Reach	☑ other Link Budget 32dB
☐ Single 5.0 V	☑ Single 3.3 V	☐ other
☐ 1.3 µm	☐ 1.55 µm	☑ other CWDM (APD)
☑ W/ Diagnostic Monitor	☑ W/O Diagnostic Monitor	

Applicable Part Numbers :

SCP69P4-GL-AN-xx, SCP69P4-GL-BN-xx, SCP69P4-GL-CN-xx, SCP69P4-GL-XN-xx, SCP69P4-GL-YN-xx, SCP69P4-GL-ZN-xx
SCP6EP4-GL-AN-xx, SCP6EP4-GL-BN-xx, SCP6EP4-GL-CN-xx, SCP6EP4-GL-XN-xx, SCP6EP4-GL-YN-xx, SCP6EP4-GL-ZN-xx

xx:Wavelength

27: 1270nm, 29: 1290nm, 31: 1310nm, 33, 1330nm, 35, 1350nm, 37, 1370nm, 39, 1390nm, 41, 1410nm, 43, 1430nm

45: 1450nm, 47: 1470nm, 49: 1490nm, 51, 1510nm, 53, 1530nm, 55, 1550nm, 57, 1570nm, 59, 1590nm, 61, 1610nm

SUMITOMO ELECTRIC

#Safety Precaution Symbols This specification uses various picture symbols to prevent possible injury to operator or other persons or damage to properties for appropriate use of the product. The symbols and definitions are as shown below. Be sure to be familiar with these symbols before reading this specification.

⚠ Warning	Wrong operation without following this instruction may lead to human death or serious injury.
⚠ Caution	Wrong operation without following this instruction may lead to human injury or property damage.

Example of picture symbols ❗ indicates prohibition of actions. Action details are explained thereafter.

⃠ indicates compulsory actions or instructions. Action details are explained thereafter.

1. General

Features and applications of SCP69P4-GL and SCP6EP4-GL are listed below.

Features

* Eighteen wavelengths CWDM Transceivers
* Uncooled CWDM rated DFB laser transmitter
* Compliant with SFP MSA.
* SFF-8472 rev9 compliant diagnostic monitoring implemented.(SCP6EP4-GL-#N-xx)
* Multiple Bit Rate Operation Up to 1.25Gbps
* Power Supply voltage Single 3.3V
* Compact package size 56.5 x 13.7 x 8.6mm
* Electrical Interface AC coupled for DATA, LVTTL for Tx Disable and open collector output for LOS and Tx Fault. Circuit ground is internally isolated from frame ground.
* Fiber Coupled Power +1 to +5dBm
* Input Power Range -31 to -8dBm
* Link budget 32dB
* Dispersion Penalty Max. 2dB (to 2400ps/nm)

Applications

* Switch to Switch interface
* Switch backbone applications
* High speed interface for file server

2. Block Diagram

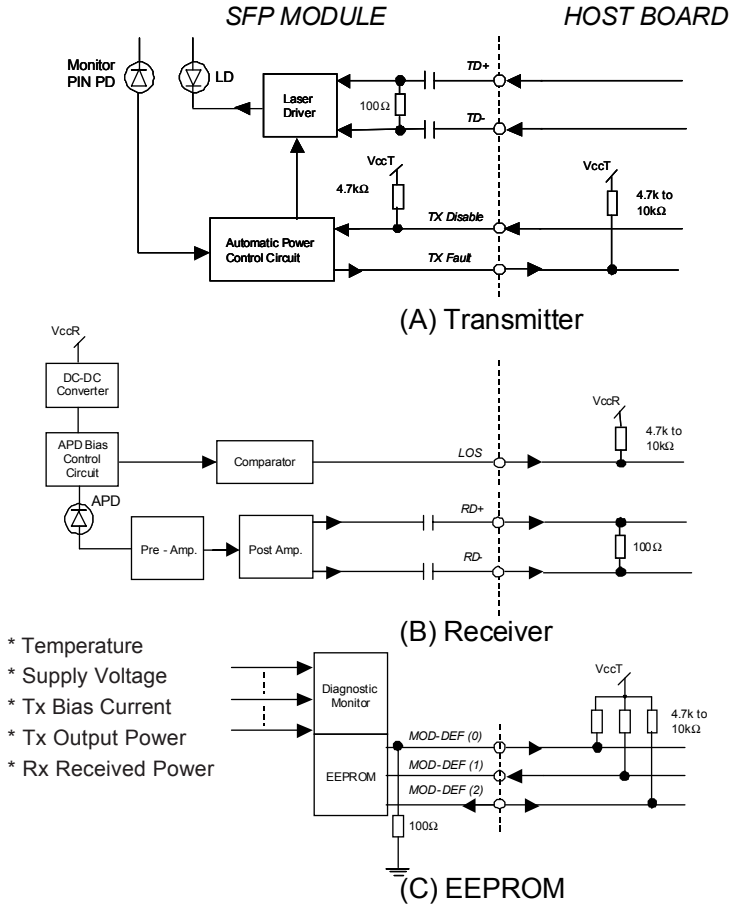


Figure 1. Block Diagram (Diagnostic Monitor is incorporated for SCP6EP4-GL-#N-xx only.)

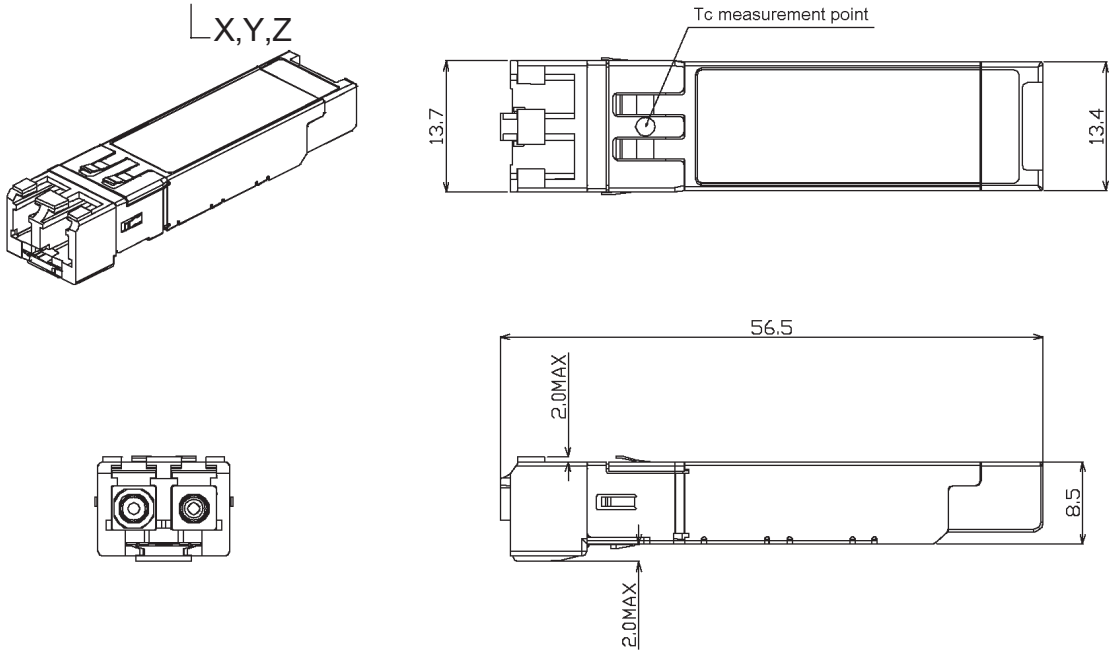
⚠Caution
⃠ Do not disassemble this product. Otherwise, failure, electrical shock, overheating or fire may occur.

3. Package Dimensions

All dimensions are in mm.

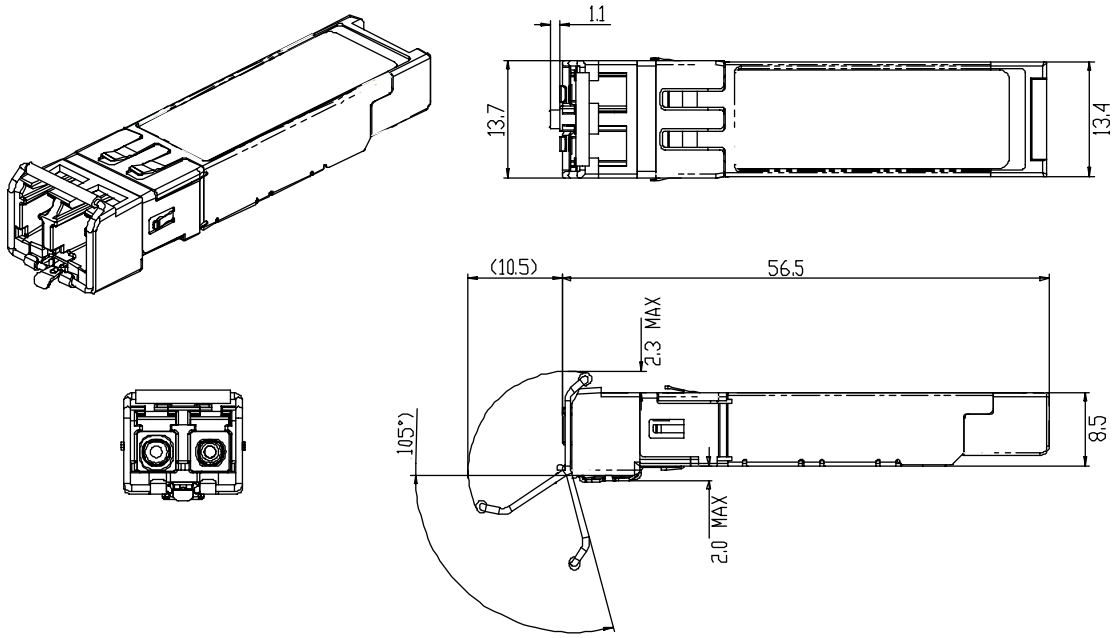
3.1 SCP6#P4-GL- □N-xx (MSA Standard Actuator Type)

└X,Y,Z



3.2 SCP6#P4-GL- □N-xx (Bail Actuator Type)

└A,B,C



* Recommended Cage and Connector

-Top EMI Cage 1367035-1(Tyco/Electronics:1308292--AMP-04/00)
-Bottom EMI Cage 1367034-1(Tyco/Electronics:1308292--AMP-04/00)
-Host Connector 1367073-1(Tyco/Electronics:1308292--AMP-04/00)
Please refer to their latest specifications.

Figure 2. Outline Dimensions

4. Pin Assignment

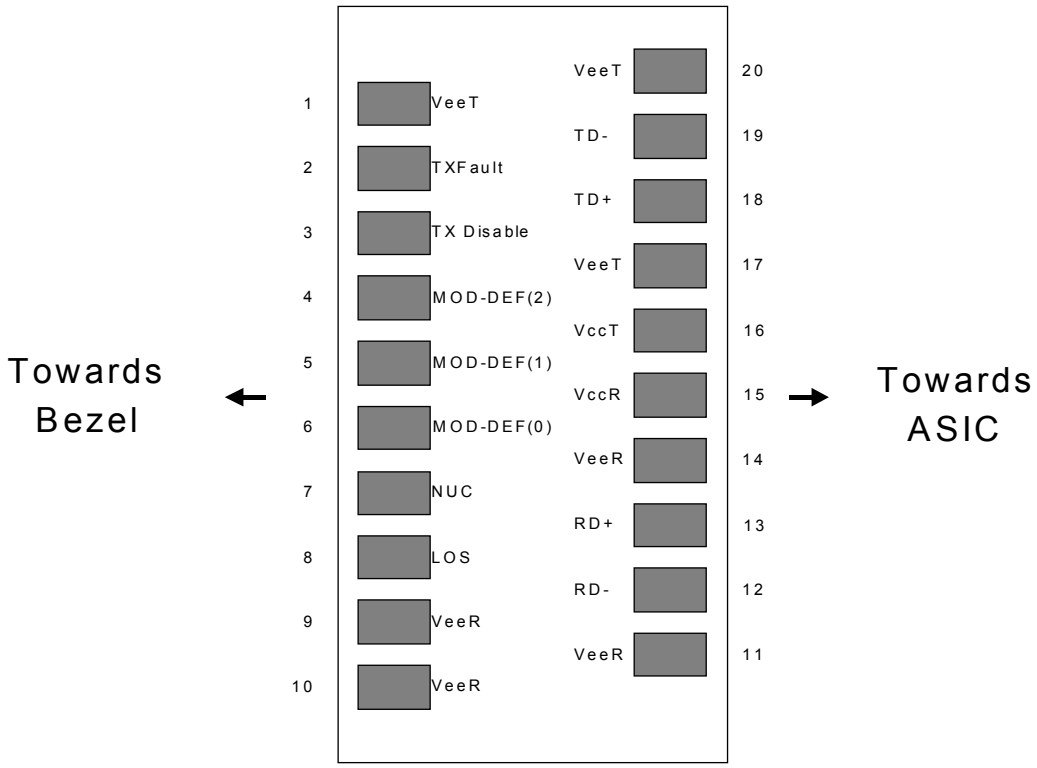


Figure 3. Diagram of Host Board Connector Block Pin Numbers and Names

Pin Num.	Name	Function	Plug Seq.	Notes
1	VeeT	Transmitter Ground	1	
2	TX Fault	Transmitter Fault Indication	3	Note 1
3	TX Disable	Transmitter Disable	3	Note 2 Module disables on high or open
4	MOD-DEF2	Module Definition 2	3	Note 3, 2 wire serial ID and Interface
5	MOD-DEF1	Module Definition 1	3	Note 3, 2 wire serial ID and Interface
6	MOD-DEF0	Module Definition 0	3	Note 3 Grounded internally via 100Ω
7	NUC	NUC	3	No User Connection, reserved for future function.
8	LOS	Loss of Signal	3	Note 4
9	VeeR	Receiver Ground	1	
10	VeeR	Receiver Ground	1	
11	VeeR	Receiver Ground	1	
12	RD-	Inv. Receiver Data Out	3	Note 5
13	RD+	Receiver Data Out	3	Note 5
14	VeeR	Receiver Ground	1	
15	VccR	Receiver Power	2	3.3V± 5%
16	VccT	Transmitter Power	2	3.3V± 5%
17	VeeT	Transmitter Ground	1	
18	TD+	Transmitter Data In	3	Note 6
19	TD-	Inv. Transmitter Data In	3	Note 6
20	VeeT	Transmitter Ground	1	

Plug Seq.: Pin engagement sequence during hot plugging.

Note

1) Tx Fault is an open collector output that shall be pulled up with a 4.7k - 10kΩ resistor on the host board. Pull up voltage between 2.0V and VccT+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation.
   Tx Fault is asserted when bias current of laser exceeds the factory-calibrated threshold level.

2) Tx Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7kΩ resistor.

3) Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7k - 10kΩ resistor on the host board. The pull-up voltage shall be VccT.

   Mod-Def 0 indicates that the module is present
   Mod-Def 1 is the clock line of two wire serial interface for serial ID
   Mod-Def 2 is the data line of two wire serial interface for serial ID

4) LOS (Loss of Signal) is an open collector output that shall be pulled up with a 4.7k - 10kΩ resistor. Pull up voltage between 2.0V and VccR+0.3V. Low indicates normal operation.

5) RD-/+: These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board.

6) TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.

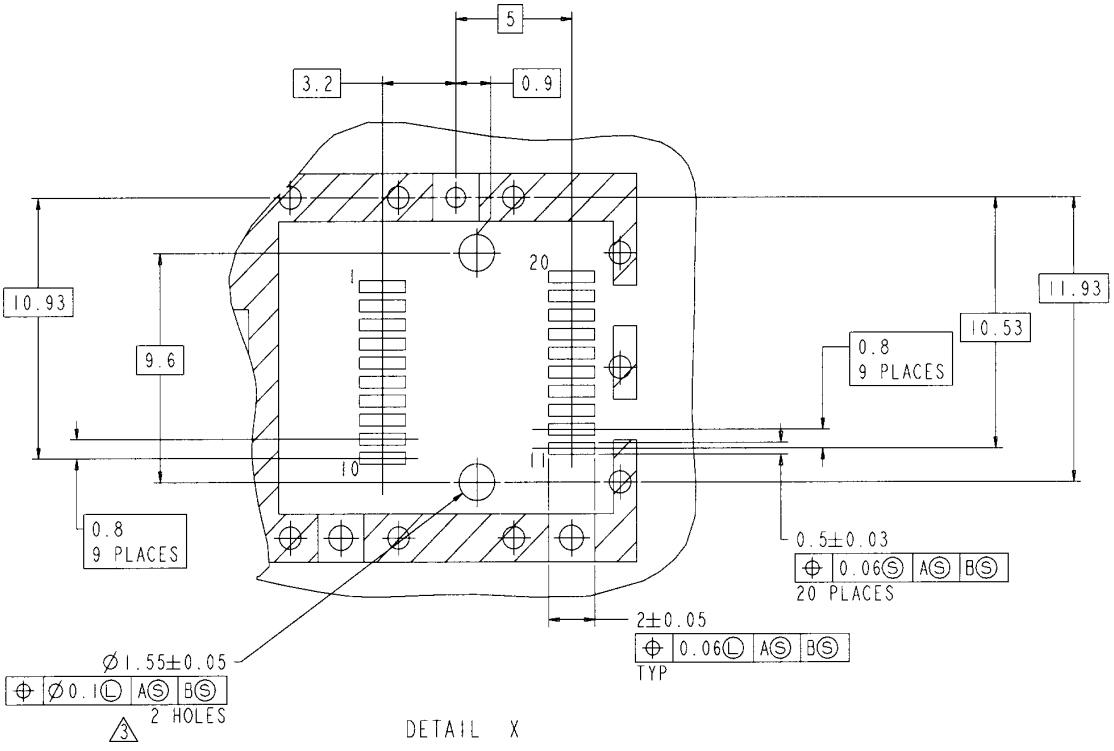


Figure 4. SFP Host Board Mechanical Layout

Notes:
1. Datum and basic dimensions established by customer
2. Pads and vias are chassis ground, 11 places
3. Thru holes, plating optional

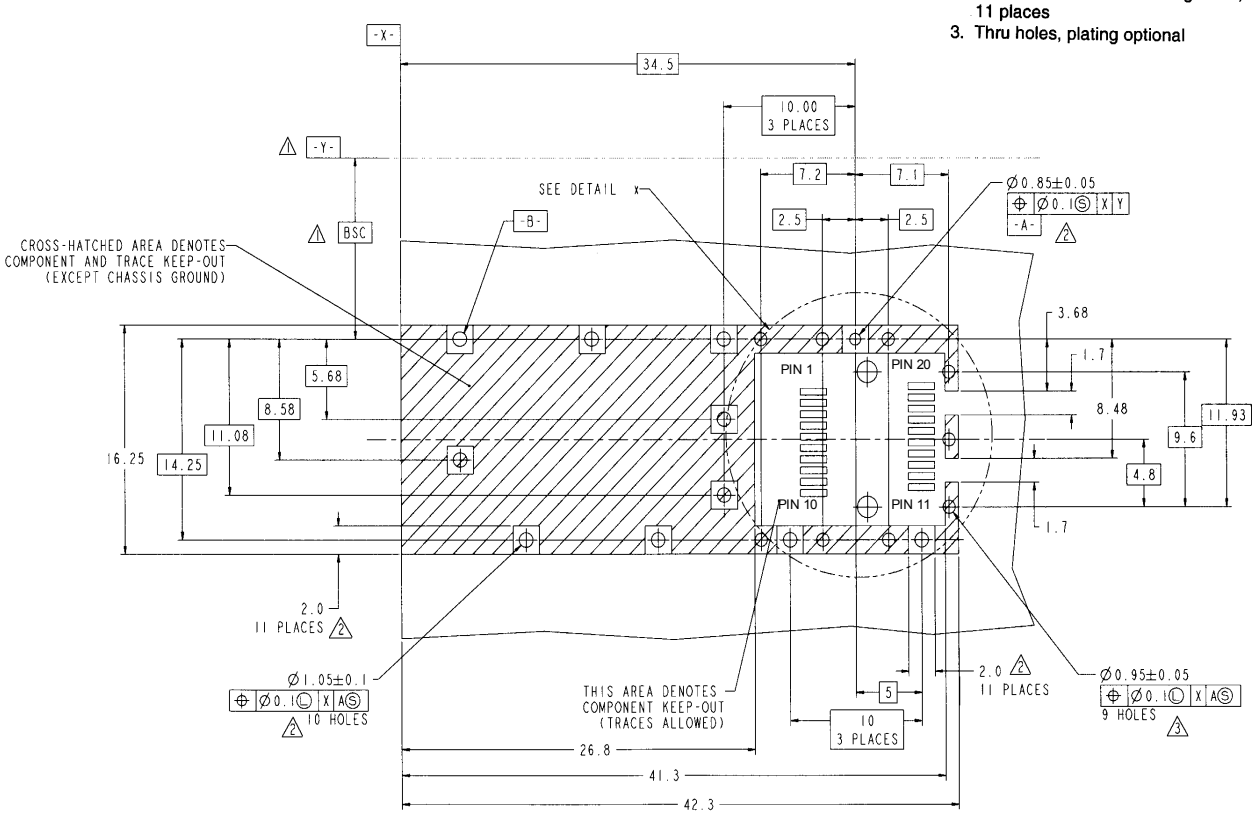
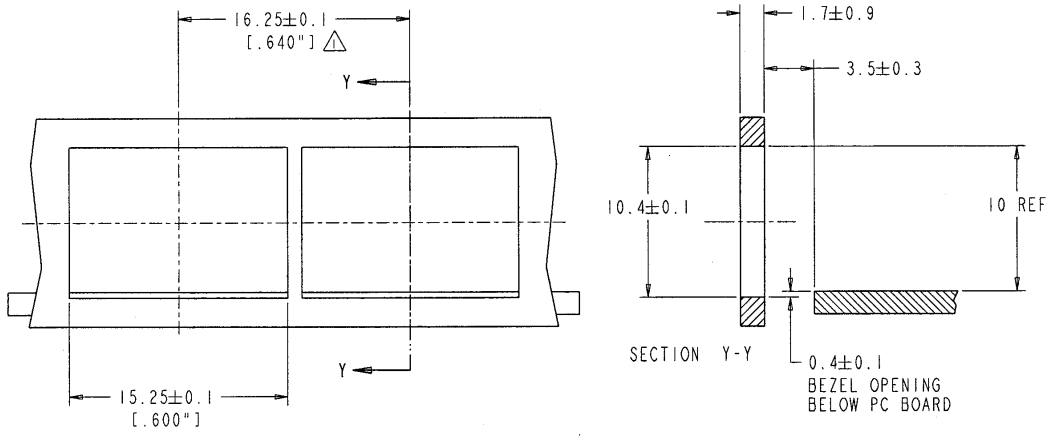


Figure 5. SFP Host Board Mechanical Layout (Cont.)



NOTES:
1. MINIMUM PITCH ILLUSTRATED, ENGLISH DIMENSIONS ARE FOR REFERENCE ONLY
2. NOT RECOMMENDED FOR PCI EXPANSION CARD APPLICATIONS

Figure 6. Recommended Bezel Design

5. Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Storage Ambient Temperature	Ts	-40	-	85	°C	1
Operating Case Temperature	Tc	-5	-	70	°C	
Optical Input Level	Pin			-5	dBm	
Supply Voltage	VccT,R	-0.3	-	4.0	V	
Input Voltage	Vi	0	-	VccT,R+0.3	V	2
Differential Input Voltage Swing (TD+,TD-)	Vin			2.5	Vp-p	

Notes
1. No condensation allowed. 2: For MODE-DEF (1:2)

⚠ Warning

Use the product with the rated voltage described in the specification. If the voltage exceeds the maximum rating, overheating or fire may occur.

⚠ Caution

Do not store the product in the area where temperature exceeds the maximum rating, where there is too much moisture or dampness, where there is acid gas or corrosive gas, or other extreme conditions. Otherwise, failure, overheating or fire may occur.

6. Electrical Interface

(Unless otherwise specified, VccT,R = 3.135 to 3.465 V and all operating temperature shall apply.)

6-1. Operating Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	VccT,R	3.135	3.30	3.465	V	
Power Dissipation	Pw			1200	mW	1

Note
1. 1250Mbps, PRBS2^7-1, NRZ, 50% duty cycle data.

6-2. Transmitter side

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
Differential Input Voltage Swing (TD+,TD-)		Vin	0.5		2.4	Vp-p	1
Input Differential Impedance		Zin	80	100	120	Ω	
Tx Fault	Fault	VfaultH	2.0		VccT+0.3	V	2, 3
	Normal	VfaultL	0		0.8	V	2, 3, 4
Tx Disable	Disable	Vdi	2.0		VccT+0.3	V	5
	Enable	Vei	0		0.8	V	
Tdis Input Current	High	Ids	-1		50	μA	

Notes
1. Refer to Figure 7.
2. Tx Fault is pulled up to VccT with a 4.7k-10kΩ resistor on the host board.
   When high, output indicates a laser fault of some kind. Low indicates normal operation.
3. Refer to Ordering Information (P.15) about Tx Fault and Tx Shutdown behavior.
4. Sink Current : 1mA
5. Tx Disable input is internally terminated to VccT via 4.7 kΩ resistor. If pin3 is left open, Tx is disable.

6-3. Receiver side

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
Differential Output Voltage Swing (RD+,RD-)		Vout	0.5		1.2	Vp-p	1
LOS	High	Vloh	2.0		VccR+0.3	V	2
Output Voltage	Low	Vlol	0		0.8	V	2, 3
Data Rise / Fall Time		tr / tf			240	psec	4

Notes
1. Vcc=+3.3V+/-5%, Output load resistance Rdif=100Ω. Refer to Figure1-(B).
   Refer to Figure7. about definition of differential swing.
2. LOS is pulled up to VccR with a 4.7k - 10kΩ resistor on the host board. Low indicates normal operation.
3. Sink Current : 1mA 4. 20 to 80%, 1250Mbps, PRBS 2^7-1, NRZ, 50% duty cycle data.

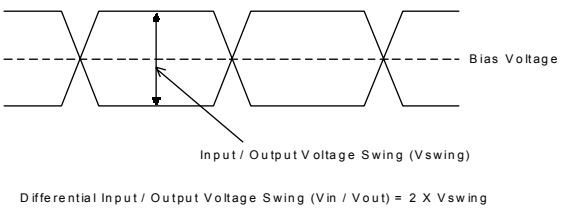


Figure 7. Definition of Differential Input / Output Voltage Swing

6-4. Module Definition

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
MOD_DEF(1:2) Input Voltage	High	Vih	0.7VccT		VccT+0.3	V	1
	Low	Vil	0		0.3VccT	V	
MOD_DEF(2) Output Voltage	High	Voh	2.0		VccT	V	1
	Low	Vol1	0		0.4	V	1, 2

Notes

1. They shall be pulled up to VccT with a 4.7k - 10kΩ resistor on the host board.
2. Sink Current : 3mA

7. Optical Interface

7-1. Transmitter Side

Parameter	Symbol	Min.	Typ	Max.	Units	Notes
Bit Rate Range		0.1	-	1.25	Gbps	
Average Output Power (Enable)	Po	1	-	5	dBm	1
Average Output Power (Disable)	Pdis	-	-	-45	dBm	
Extinction Ratio	Er	9.0	-	-	dB	
Center Wavelength	λc (27)	1264.5	1270	1277.5	nm	
	λc (29)	1284.5	1290	1297.5	nm	
	λc (31)	1304.5	1310	1317.5	nm	
	λc (33)	1324.5	1330	1337.5	nm	
	λc (35)	1344.5	1350	1357.5	nm	
	λc (37)	1364.5	1370	1377.5	nm	
	λc (39)	1384.5	1390	1397.5	nm	
	λc (41)	1404.5	1410	1417.5	nm	
	λc (43)	1424.5	1430	1437.5	nm	
	λc (45)	1444.5	1450	1457.5	nm	
	λc (47)	1464.5	1470	1477.5	nm	
	λc (49)	1484.5	1490	1497.5	nm	
	λc (51)	1504.5	1510	1517.5	nm	
	λc (53)	1524.5	1530	1537.5	nm	
	λc (55)	1544.5	1550	1557.5	nm	
	λc (57)	1564.5	1570	1577.5	nm	
	λc (59)	1584.5	1590	1597.5	nm	
	λc (61)	1604.5	1610	1617.5	nm	
Spectral width	Δλ	-	-	1	nm	
Side Mode Suppression Ratio		30	-	-	dB	
Eye Mask for Optical Output	Compliant with Eye Mask Defined in IEEE 802.3 standard					
Transmitter Jitter (peak to peak)	TjpkT	-	-	227.0	ps	1, 2
Optical Rise / Fall Time	tr / tf	-	-	260	ps	3
Dispersion Penalty	Dp	-	-	2.0	dB	4

Notes

1. Measured at 1250Mbps, PRBS 2^7-1, 50% duty cycle, NRZ.
2. TP2 refers to the compliance point specified in IEEE802.3, section 38.2.1.
3. These are unfiltered 20-80% values.
4. Maximum dispersion values correspond to the approximate worst-case dispersion (to 2400ps/nm) at 1610nm.

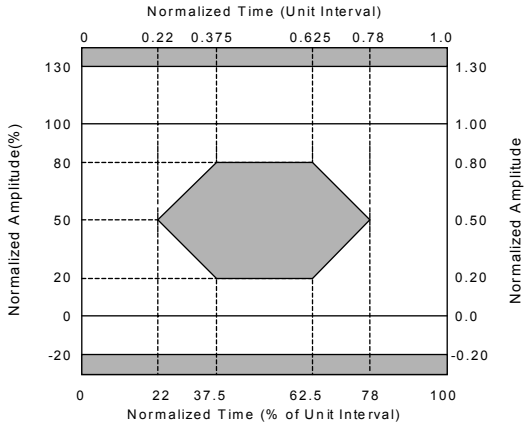


Figure 8. Eye Diagram Mask for Optical Output (IEEE 802.3)

⚠Warning
Do not look at the laser beam projection area (e.g. end of optical connector) with naked eyes or through optical equipment while the power is supplied to this product. Otherwise, your eyes may be injured.

7-2. Receiver side

Parameter	Symbol	Min.	Typ	Max	Units	Notes
Bit Rate Range	-	0.1	-	1.25	Gbps	
Center Wavelength	-	1260	-	1620	nm	
Minimum Sensitivity (EOL)	Pmin	-	-	-31.0	dBm	1,2
Overload	Pmax	-8.0	-	-	dBm	1,2
LOS Activation Level	P_{La}	-45.0	-	-31.3	dBm	2
LOS Deactivation Level	P_{Ld}	-44.7	-	-31.0	dBm	
LOS Hysteresis	Phys	0.3	-	6.0	dB	

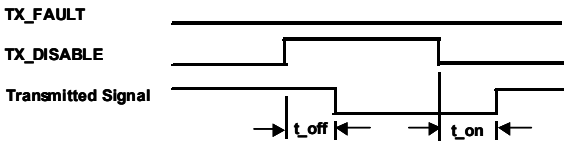
Notes

1. BER = 10^-12
2. Worst case extinction ratio. Measured at 1.25Gbps, PRBS 2^7-1 test pattern, NRZ, EOL

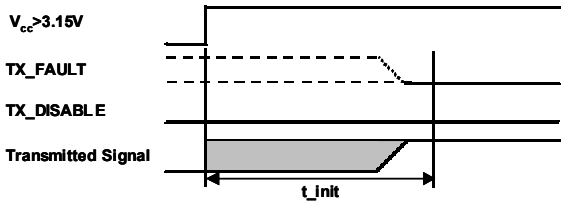
7-3. Transceiver Timing Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Tx Disable Assert Time	t_off			10	us	1
Tx Disable Negate Time	t_on			1	ms	2
Time to Initialize	t_init			300	ms	3
Tx Fault Assert Time	t_fault			100	us	4
Tx Disable to Reset	t_reset	10			us	5
LOS Assert Time	t_loss_on			100	us	6
LOS Deassert Time	t_loss_off			100	us	7
Serial ID Clock Rate	f_serial_clock			100	kHz	

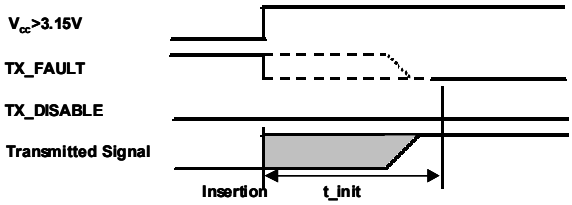
Notes
1. Time from rising edge of TX Disable to when the optical output falls below 10% of nominal.
2. Time from falling edge of TX Disable to when the modulated optical output rises above 90% of nominal.
3. From power on. 4. Time from fault to TX fault on. 5. Time Tx Disable must be held high to reset TX_fault.
6. Time from LOS state to RX LOS assert. 7. Time from non-LOS state to RX LOS deassert.



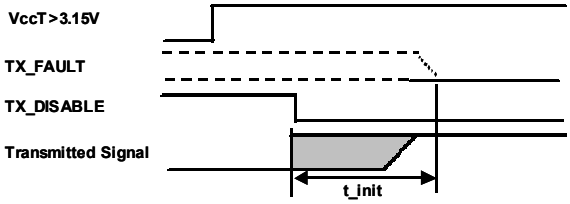
TX_DISABLE timing during normal operation.



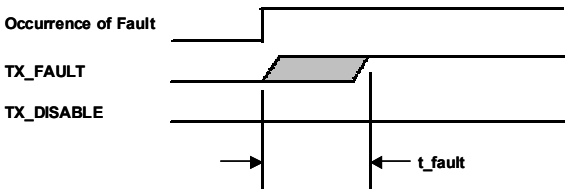
Power on initialization of SFP transceiver, TX_DISABLE negated



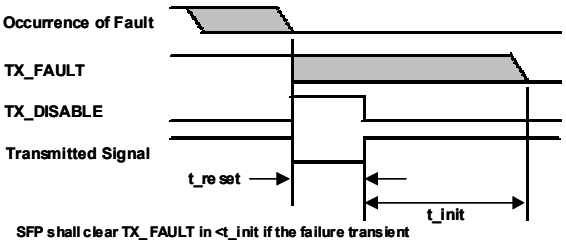
Example of initialization during hot plugging, TX_DISABLE negated



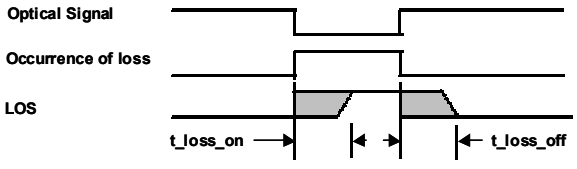
Power on initialization of SFP,TX_DISABLE asserted



Detection of transmitter safety fault condition



Successful recovery from transient safety fault condition (Except for Type "B" and "Y". Refer to next page.)



Timing of LOS detection

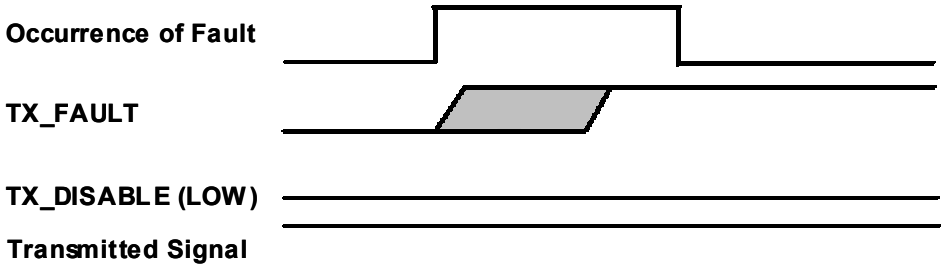
Figure 9. Transceiver Timing Charts

7-4. Tx_Fault / Tx Shutdown Options

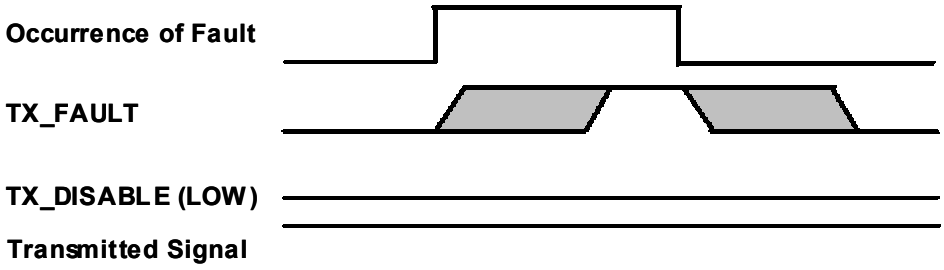
SCP69P4-GL- □N-xx
SCP6EP4-GL- □N-xx
└Actuator and Tx_Fault Type

Type	Actuator	Tx Fault	Tx Shutdown on Tx Fault
A	Bail	Latched	No
B	Bail	Not Latched	No
C	Bail	Latched	Yes
X	MSA	Latched	Yes
Y	MSA	Not Latched	No
Z	MSA	Latched	No

Type:"A" or "Z"



Type:"B" or "Y"



Type:"C" or "X"

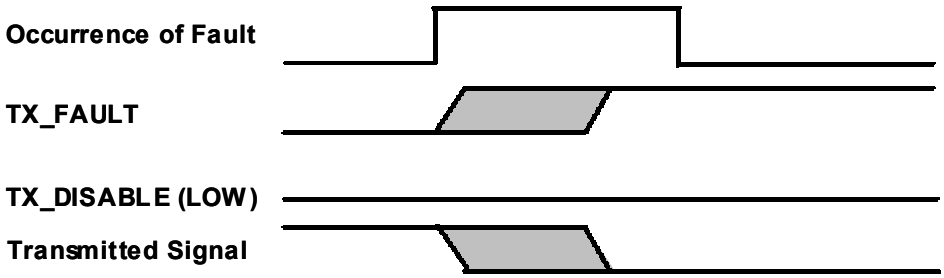


Figure 10. Part Number Identification For Tx_Fault / Tx Shutdown Behavior

8. Digital Diagnostic Memory Map

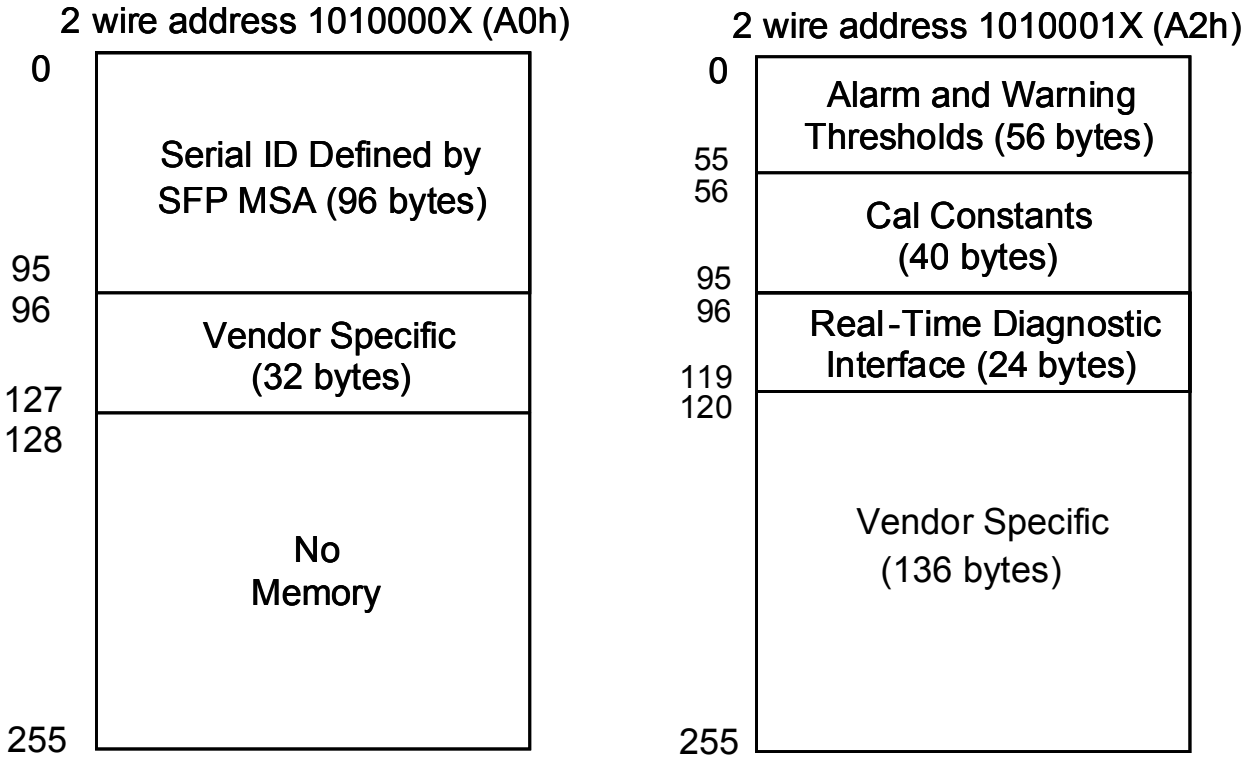


Figure 11. Digital Diagnostic Memory Map (A2h is applicable for SCP6EP4-GL-#N-xx)

9. EEPROM Serial ID Memory Contents

The data can be read using the 2-wire serial CMOS EEPROM protocol of the Atmel AT24C01A or equivalent.

2 wire address 1010000X (A0h)

Address	Name of field	Hex	ASCII	Description
BASE ID FIELDS				
0	Identifier	03		SFP Transceiver
1	Ext. Identifier	04		
2	Connector	07		LC Connector
3	Transceiver	00		
4		00		
5		00		
6		02		1000BASE
7		00		
8		00		
9		00		
10		00		
11	Encoding	01		8B10B
12	BR, Nominal	0D		1250Mbps
13	Reserved	00		
14	Length(9um) - km	78 (Note1)		120Km
15	Length (9um)	FF		
16	Length (50um)	37		550m
17	Length (62.5um)	37		550m
18	Length (Copper)	00		
19	Reserved	00		
20	Vendor name	53	S	
21		75	u	
22		6D	m	
23		69	i	
24		74	t	
25		6F	o	
26		6D	m	
27		6F	o	
28		45	E	
29		6C	l	
30		65	e	
31		63	c	
32		74	t	
33		72	r	
34		69	i	
35		63	c	
36	Reserved	00		
37	Vendor OUI	00		
38		00		
39		5F		
40	Vendor PN	53	S	
41		43	C	
42		50	P	
43		36	6	
44		39	9	Non-diagnostics
		45	E	Diagnostics(Ext.Cal)
45		50	P	
46		34	4	
47		2D	-	
48		47	G	
49		4C	L	
50		2D	-	
51		41 to 43	A to C	Actuator and Tx_Fault Type
52		4E	N	
53		2D	-	
54		32,33,34,35,36	2,3,4,5,6	Wavelength
55		31,33,35,37,39	1,3,5,7,9	
56	Vendor rev	41 to 5A	A to Z	Variable
57		20		
58		20		
59		20		
60	Wavelength	Note2		
61				
62	Reserved	00		
63	CC_BASE	Note3		

Address	Name of field	Hex	ASCII	Description
EXTENDED ID FIELDS				
64	Options	00		
65		1A		
66	BR, max	00		
67	BR, min	00		
68	Vendor SN	Note4		Year
69				Month
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84	Date code	Note5		
85				
86				
87				
88				
89				
90				
91				
92	Diagnostic Monitoring Type	58(Note6)		Diagnostics(Ext.Cal)
		80		Non-diagnostics
93	Enhanced Options	B0(Note6)		Diagnostics
		00		Non-diagnostics
94	SFF-8472 Compliance	01		Diagnostics
		00		Non-diagnostics
95	CC_EXT	Note7		
VENDOR SPECIFIC ID FIELDS				
96	Read-only	20		
97		20		
98		20		
99		20		
100		20		
101		20		
102		20		
103		20		
104		20		
105		20		
106		20		
107		20		
108		20		
109		20		
110		20		
111		20		
112		20		
113		20		
114		20		
115		20		
116		20		
117		20		
118		20		
119		20		
120		20		
121		20		
122		20		
123		20		
124		20		
125		20		
126		20		
127		20		

Note1. Fiber Loss 0.35dB/km. Fiber loss budget plus all other system penalties must not exceed total system budget specification.
Note2. The laser wavelength is equal to t he 16 bi t integer value in nm.
1270nm: 4F6h, 1290nm: 50Ah, 1310nm: 51Eh, 1330nm: 532h, 1350nm: 546h, 1370nm: 55Ah, 1390nm: 56Eh, 1410nm: 582h, 1430nm: 596h, 1450nm: 5AAh
1470nm: 5BEh, 1490nm: 5D2h, 1510nm: 5E6h, 1530nm: 5FAh, 1550nm: 60Eh, 1570nm: 622h, 1590nm: 636h,1610nm: 64Ah
Note3. Address 63 is check sum of bytes 0 - 62. Note4. Address 68 - 83 is Vendor serial Number.
Note5. Address 84 - 91 is Date Code. Note6. Refer to Section 10.(Enhanced Monitoring Functions)
Note7. Address 95 is check sum of bytes 64 - 94.

10. Enhanced Monitoring Functions (SCP6EP4-GL-#N-xx)

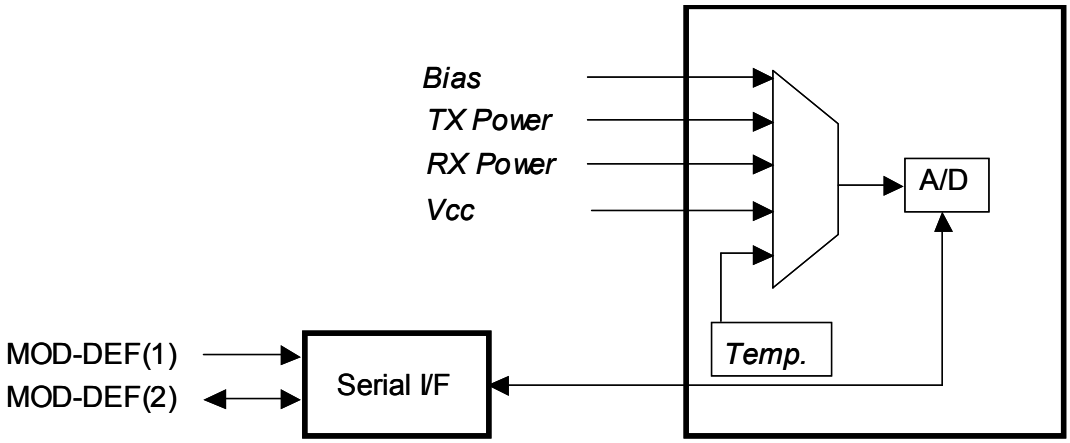


Figure 12. Block Diagram

Diagnostic Monitoring Type, 2 wire address A0h

Data Address	Bits	Description	Status(SEI)
92	7	Reserved for legacy diagnostic implementations. Must be '0' for compilance with SFF-8472.	0
92	6	Digital diagnostic monitoring implemented (described in SFF-8472). Must be '1' for compliance with SFF-8472.	1
92	5	Internally Calibrated	0
92	4	Externally Calibrated	1
92	3	Received power measurement type 0 = OMA, 1 = Average Power	1
92	2	Address change required. (Refer to SFF-8472)	0
92	1-0	Reserved	0

Enhanced Options, 2 wire address A0h

Data Address	Bits	Description	Status(SEI)
93	7	Optional Alarm/warning flags implemented for all monitored quantities	1
93	6	Optional Soft TX_DISABLE control and monitoring implemented	0
93	5	Optional Soft TX_FAULT monitoring implemented	1
93	4	Optional Soft RX_LOS monitoring implemented	1
93	3	Optional Soft RATE_SELECT control and monitoring implemented	0
93	2-0	Reserved	0

11. Calibration Calculation (SCP6EP4-GL-#N-xx)

Calibration constants for External Calibration Option, 2 wire address A2h

Address	#Bytes	Name	Description
56-59	4	RP_4	Single precision floating-point calibration data for received power. Byte 56 is MSB. Byte 59 is LSB.
60-63	4	RP_3	Single precision floating-point calibration data for received power. Byte 60 is MSB. Byte 63 is LSB.
64-67	4	RP_2	Single precision floating-point calibration data for received power. Byte 64 is MSB. Byte 67 is LSB.
68-71	4	RP_1	Single precision floating-point calibration data for received power. Byte 68 is MSB. Byte 71 is LSB.
72-75	4	RP_0	Single precision floating-point calibration data for received power. Byte 72 is MSB. Byte 75 is LSB.
76-77	2	I_{SLOPE}	Unsigned fixed-point calibration data for laser bias current. Byte 76 is MSB. Byte 77 is LSB.
78-79	2	I_{OFFSET}	16-bit signed 2's complement calibration data for laser bias current. Byte 78 is MSB. Byte 79 is LSB.
80-81	2	TP_{SLOPE}	Unsigned fixed-point calibration data for laser output power. Byte 80 is MSB. Byte 81 is LSB.
82-83	2	TP_{OFFSET}	16-bit signed 2's complement calibration data for laser output power. Byte 82 is MSB. Byte 83 is LSB.
84-85	2	T_{SLOPE}	Unsigned fixed-point calibration data for transceiver temperature. Byte 84 is MSB. Byte 85 is LSB.
86-87	2	T_{OFFSET}	16-bit signed 2's complement calibration data for transceiver temperature. Byte 86 is MSB. Byte 87 is LSB.
88-89	2	V_{SLOPE}	Unsigned fixed-point calibration data for supply voltage. Byte 88 is MSB. Byte 89 is LSB.
90-91	2	V_{OFFSET}	16-bit signed 2's complement calibration data for supply voltage. Byte 90 is MSB. Byte 91 is LSB.
92-94	3	Reserved	Reserved
95	1	Checksum	Byte 95 contains the low order 8 bits of the sum at data address bytes 0-94.

Transceiver temperature: Temperature, T, is given by

$T = T_{SLOPE} * T_{AD} + T_{OFFSET}$

Where T_{AD} is 16-bit signed 2's complement A/D value at bytes 96-97, T_{SLOPE} is unsigned fixed-point value at bytes 84-85 and T_{OFFSET} is signed 2's complement value with LSB equal to 1/256 deg-C at bytes 86-87. The result, T, is 16-bit signed 2's complement value with LSB equal to 1/256 deg-C.The monitored output is the junction temperature of the diode inside the transceiver, hence, there is some discrepancy between the output and transceiver case temperature of the point illustrated in section 3 mechanical dimension.

Supply voltage: Voltage, V, is given by

$V = V_{SLOPE} * V_{AD} + V_{OFFSET}$

Where V_{AD} is 16-bit unsigned A/D value at bytes 98-99, V_{SLOPE} is unsigned fixed-point value at bytes 88-89 and V_{OFFSET} is signed 2's complement value with LSB equal to 100 μV at bytes 90-91. The result, V, is 16-bit unsigned value with LSB equal to 100 μV.

Laser bias current: Current, I, is given by
$I = I_{SLOPE} * I_{AD} + I_{OFFSET}$

Where I_{AD} is 16-bit unsigned A/D value at bytes 100-101, I_{SLOPE} is unsigned fixed-point value at bytes 76-77 and I_{OFFSET} is signed 2's complement value with LSB equal to 2 µA at bytes 78-79. The result, I, is 16-bit unsigned value with LSB equal to 2 µA.

Laser output power: Power, TP, is given by
$TP = TP_{SLOPE} * TP_{AD} + TP_{OFFSET}$
Where TP_{AD} is 16-bit unsigned A/D value at bytes 102-103, TP_{SLOPE} is unsigned fixed-point value at bytes 80-81 and TP_{OFFSET} is signed 2's complement value with LSB equal to 0.1 µW at bytes 82-83. The result, TP, is 16-bit unsigned value with LSB equal to 0.1 µW.

Received power: Power, RP, is given by
$RP = RP_4 * RP_{AD}^4 + RP_3 * RP_{AD}^3 + RP_2 * RP_{AD}^2 + RP_1 * RP_{AD} + RP_0$

Where RP_{AD} is 16-bit unsigned A/D value at bytes 104-105 and RP_4, RP_3, RP_2, RP_1 and RP_0 are single precision floating-point values at bytes 56-75. The result, RP, is 16-bit unsigned value with LSB equal to 0.1 µW.

A/D Accuracy, 2 wire address A2h

Data Address	***Parameter***	***Accuracy***	***Units Display***	***Note***
96-97	Temperature	+/-3 deg-C.	Signed 2's complement interger deg.	Junction Temperature of Monitoring IC.
98-99	Vcc	+/-3%	x 10µVolt	-
100-101	TX Bias	+/-10%	x 2mA	Specified by nominal value
102-103	TX Power	+/-3dB	x 0.1µW	1 to 5dBm
104-105	RX Power	TBD	x 0.1µW	At specifed Transmitter wavelength (Section 7-1)

12. A/D Values and Status (SCP6EP4-GL-#N-xx)

Converted analog values, 2wire address A2h

Byte	Bit	Name	Description
96	All	Temperature MSB	Signed 2's complement integer temperature(-40 to +125C) Based on internal temperature measurement
97	All	Temperature LSB	Fractional part of temperature(count/256)
98	All	Vcc MSB	Internally measured supply voltage in transeciver. Actual voltage is full 16 bit value *100uVolt.(Yields range of 0-6.55V)
99	All	Vcc LSB	
100	All	TX Bias MSB	Measured Laser Bias Current in mA. Bias current is full 16 bit value *2μA.(Full range of 0-131mA)
101	All	TX Bias LSB	
102	All	TX Power MSB	Measured TX output power in mW. TX power is full 16 bit value*0.1μW.(Full range of -40 to+8.2dBm)
103	All	TX Power LSB	
104	All	RX Power MSB	Measured RX input power in mW. RX power is full 16 bit value*0.1μW.(Full range of -40 to+8.2dBm)
105	All	RX Power LSB	
106-109	All	Reserved	

Optional Status Bits, 2wire address A2h

Byte	Bit	Name	Description
110	0	Data_Ready_Bar	Indicates transceiver has achieved power up and data is ready. Bit remains high until data is ready to be read at which time the device sets the bit low.

13. Alarm and Warning Flags (SCP6EP4-GL-#N-xx)

Alarm and Warning Flags, 2wire address A2h

Byte	Bit	Name	Description
112	7	Temp High Alarm	Set when internal temperature exceeds high alarm level.
112	6	Temp Low Alarm	Set when internal temperature is below low alarm level.
112	5	Vcc High Alarm	Set when internal supply voltage exceeds high alarm level.
112	4	Vcc Low Alarm	Set when internal supply voltage is below low alarm level.
112	3	TX Bias High Alarm	Set when TX Bias current exceeds high alarm level.
112	2	TX Bias Low Alarm	Set when TX Bias current is below low alarm level.
112	1	TX Power High Alarm	Set when TX output power exceeds high alarm level.
112	0	TX Power Low Alarm	Set when TX output power is below low alarm level.
113	7	RX Power High Alarm	Set when Received Power exceeds high alarm level.
113	6	RX Power Low Alarm	Set when Received Power is below low alarm level.
113	5-0	Reserved	
114	All	Reserved	
115	All	Reserved	
116	7	Temp High Warning	Set when internal temperature exceeds high warning level.
116	6	Temp Low Warning	Set when internal temperature is below low warning level.
116	5	Vcc High Warning	Set when internal supply voltage exceeds high warning level.
116	4	Vcc Low Warning	Set when internal supply voltage is below low warning level.
116	3	TX Bias High Warning	Set when TX Bias current exceeds high warning level.
116	2	TX Bias Low Warning	Set when TX Bias current is below low warning level.
116	1	TX Power High Warning	Set when TX output power exceeds high warning level.
116	0	TX Power Low Warning	Set when TX output power is below low warning level.
117	7	RX Power High Warning	Set when Received Power exceeds high warning level.
117	6	RX Power Low Warning	Set when Received Power is below low warning level.
117	5-0	Reserved	
118	All	Reserved	
119	All	Reserved	

14. Recommended Interface Circuit

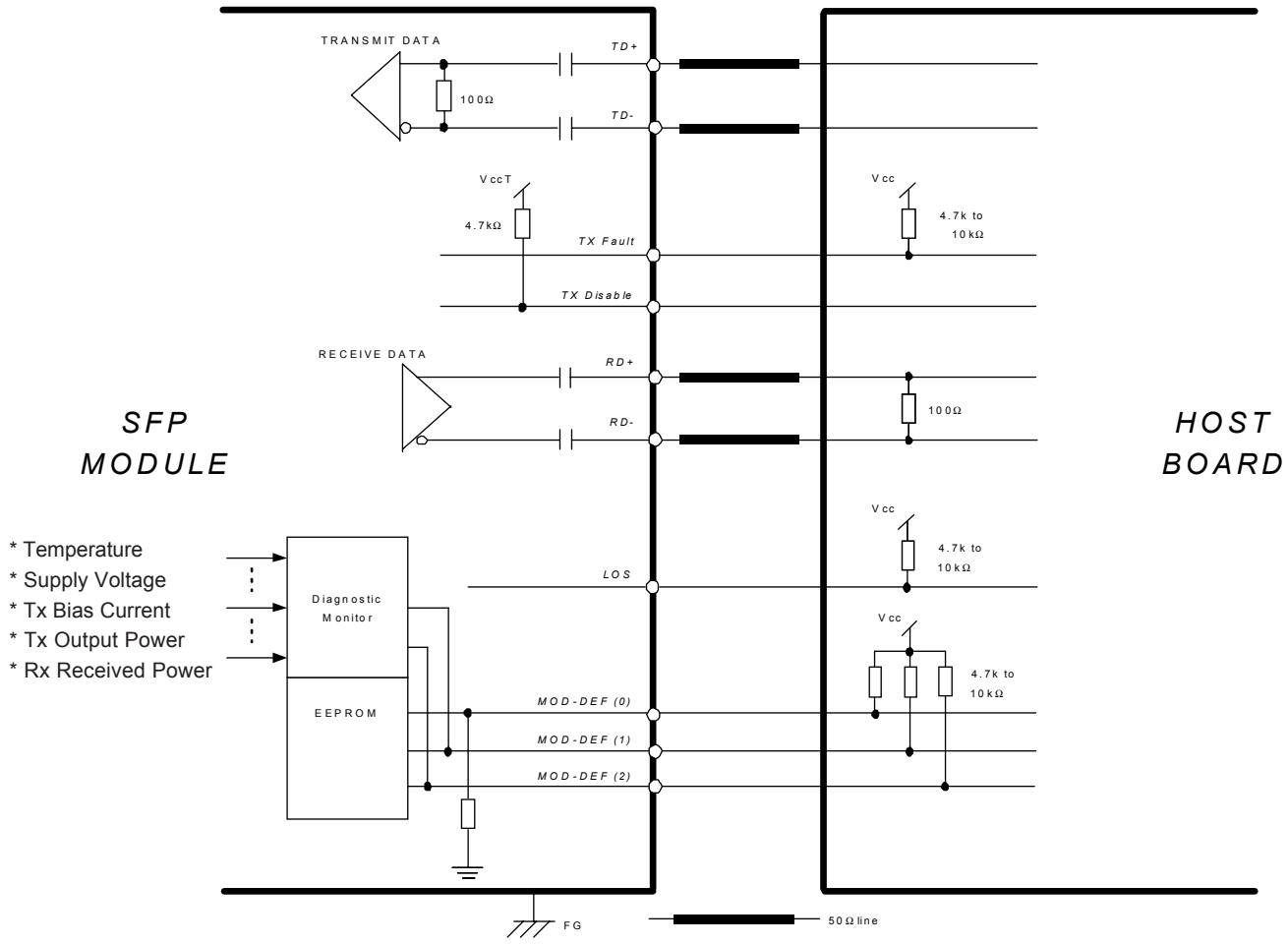
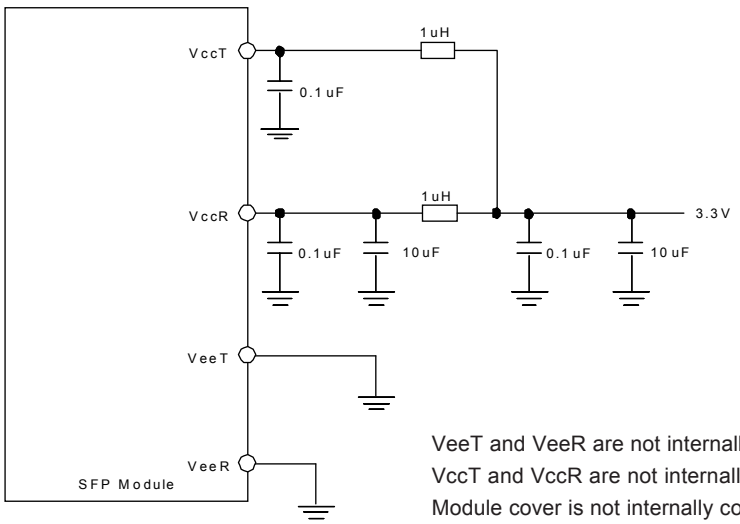


Figure 13. Recommended Interface Circuit (Diagnostic Monitor is incorporated for SCP6EP4-GL-#N-xx only.)

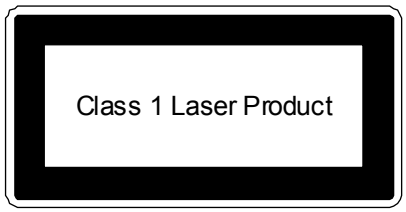


VeeT and VeeR are not internally connected to each other.
VccT and VccR are not internally connected to each other.
Module cover is not internally connected to VeeT and VeeR.

Figure 14. Recommended Supply Filtering Network

15. Laser Safety

This product uses a semiconductor laser system and the product with center wavelength λc(41) to λc(61) is a laser class 1 product acceptable FDA, complies with 21CFR 1040. 10 and 1040.11. Also this product is a laser class 1 product acceptable IEC 60825.



⚠Caution

⃠ If this product is used under conditions not recommended in the specification or this product is used with unauthorized revision, classfication for laser product safety standard is invalid. Classify the product again at your responsibility and take appropriate actions.

16. Other Precaution

Under such a strong vibration environment as in automobile, the performance and reliability are not guaranteed. The governmental approval is required to export this product to other countries. To dispose of these components, the appropriate procedure should be taken to prevent illegal exportation.

This module must be handled, used and disposed of according to your company's safe working practice.

⚠ Warning

⃠ Do not put this product or components of this product into your mouth. This product contains material harmful to health.

⚠ Caution.

⃠ Dispose this product or equipment including this product properly as an industrial waste according to the regulations.

17. Ordering Information

SCP6[a]P4 - GL -[b] N-[c][d]

Wavelength
27: 1270nm 45: 1450nm
29: 1290nm 47: 1470nm
31: 1310nm 49: 1490nm
33: 1330nm 51: 1510nm
35: 1350nm 53: 1530nm
37: 1370nm 55: 1550nm
39: 1390nm 57: 1570nm
41: 1410nm 59: 1590nm
43: 1430nm 61: 1610nm

Actuator and Tx Fault Type

Type	Actuator	Tx Fault	Tx Shutdown on Tx Fault	Part Number on Label
A	Bail	Latched	No	SCP6[a]P4-GL-AN-[c][d]
B	Bail	Not Latched	No	SCP6[a]P4-GL-BN-[c][d]
C	Bail	Latched	Yes	SCP6[a]P4-GL-CN-[c][d]
X	MSA	Latched	Yes	SCP6[a]p4-GL-XN-[c][d]
Y	MSA	Not Latched	No	SCP6[a]P4-GL-YN-[c][d]
Z	MSA	Latched	No	SCP6[a]P4-GL-ZN-[c][d]

Diagnostic Monitor / Calibration type
9: No Diagnostic Monitoring
E: Diagnostic Monitoring with External Calibration

18. Bail Color

wavelength	c d	Bail color
1270nm	27	Light purple
1290nm	29	Sky blue
1310nm	31	Yellow Green
1330nm	33	Yellow Ocher
1350nm	35	Pink
1370nm	37	Beige
1390nm	39	white
1410nm	41	Silver
1430nm	43	Black
1450nm	45	Yellow Orange
1470nm	47	Gray
1490nm	49	Violet
1510nm	51	Blue
1530nm	53	Green
1550nm	55	Yellow
1570nm	57	Orange
1590nm	59	Red
1610nm	61	Brown

19. For More Information

U.S.A.
ExceLight Communications
4021 Stirrup Creek Drive, Suite 200 Durham, NC 27703 USA
Tel. +1-919-361-1600 / Fax. +1-919-361-1619
E-mail: info@excelight.com
http://www.excelight.com

Europe
Sumitomo Electric Europe Ltd.
220 Centennial Park, Elstree, Herts, WD6 3SL UK
Tel. +44-208-953-8681 / Fax. +44-208-207-5950
E-mail: photonics@sumielectric.com
http://www.sumielectric.com

Japan
Sumitomo Electric Industries, Ltd.
1 Taya-cho, Sakae-ku, Yokohama, 244-8588 Japan
Tel. +81-45-853-7154 / Fax. +81-45-851-1932
E-mail: product-info@ppd.sei.co.jp
http://www.sei.co.jp/Electro-optic/index_e.html