1490nm/1310nm Single Fiber OLT Transceiver
Preliminary Datasheet

SPS-43-48H-HP-xDE (x=C, R, T)

Features
- Burst receive GPON OLT transceiver
- Small Form Factor Pluggable, Simple SC Connector
- "Fast Signal Detect" feature reduces ranging overhead
- Simplifed OLT "reset" timing
- 1490 nm DFB Tx with isolator
- 1310 nm APD Rx
- 2488 Mbps downstream Tx/1244 Mbps upstream Rx
- Single 3.3 V supply
- ITU-T G.984.2 compliant
- 20 km reach; 28 dB link budget
- RoHS-5/6 compliant (lead exemption)

General Operating

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating Voltage	V_{cc}	3.135	3.3	3.465	V
Total Supply Current	I_{CC}	-	-	500	mA
Case Operating Temerature (-CDE)	T_{opr}	-5	-	70	°C
Case Operating Temerature (-RDE)	T_{opr}	-20	-	85	°C
Case Operating Temerature (-TDE)	T_{opr}	-40	-	85	°C
Storage Temperature	T_{stg}	-40	-	85	°C

General Optical Parameters

Parameter	Symbol	Min.	Typ.	Max.	Unit
Back Reflection at 1490 nm		-	-	-20	dB
Back Reflection at 1310 nm		-	-	-20	dB
1490 nm to 1310 nm crosstalk		-	-	-45	dB

Transmitter Specifications (Optical)

Parameter	Symbol	Min	Typical	Max	Unit
Optical Power	P_{op}	1.5	-	5	dBm
Average launch power of off Tx	P_{off}	-	-	-40	dBm
Wavelength	λ	1480	1490	1500	nm
Spectral Width (-20 dB)	$\Delta\lambda_{20}$	-	-	1	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Extinction Ratio	ER	10	-	-	dB
Transmit eye mask			G.984.2		
Bit Rate		-	2488	-	Mbps
Optical Rise time[a]		-	-	160	ps
Optical Fall time[a]		-	-	160	ps
Tolerence to TX back reflection[b]		-15	-		dB

a) 20% to 80% values
b) 1 dB degradation of receiver sensitivity

20550 Nordhoff St. • Chatsworth, CA 91311 • tel: 818.773.9044 • fax: 818.576.9486
9F, No 81, Shui Lee Rd. • Hsinchu, Taiwan, R.O.C. • tel: 886.3.5169222 • fax: 886.3.5169213

Transmitter Specifications (Electrical)

Parameter	Symbol	Min	Typical	Max	Unit
Input Differential Impedence	R_{in}	80	100	120	Ω
Single Ended data input swing (ac coupled inside module)	$V_{in, p-p}$	300	-	1200	mV
Tx Disable (LVTTL)	V_d	2	-	V_{cc}	V
Tx Enable (LVTTL)	V_{en}	0	-	0.8	V
Tx_Fail_High	$V_{\_Fail}$	2.4	-	V_{cc}	V
Tx_Fail_Normal	$V_{\_Normal}$	0	-	0.4	V

Receiver Specifications (Optical)

Parameter	Symbol	Min	Typical	Max	Unit
Wavelength	λ	1260	1310	1360	nm
Data Rate (burst-mode)		-	1244	-	Mbps
Receiver Sensitivity[c]	R_{ENS}	-	-	-28	dBm
Receiver Overload[c]	R_{OL}	-8	-	-	dBm
Receiver Burst-mode Dynamic Range[d]		15	20	-	dB
BRST_Det Assert (Signal Detected)	$P_{\_DET}$	-	-	-28	dBm
Receiver CID Tolerance	CID	72	-	-	bits
Damage Threshold for Receiver	$P_{in, damage}$	3	-	-	dBm
Maximum Reflectance of Receiver	RX_r	-	-	-20	dB

c) At 10^{-10} BER with PRBS 2^{23}-1 data
d) The input power difference between two subsequent high and low burst data.

Receiver Specifications (Electrical)

Parameter	Symbol	Min	Typical	Max	Unit
PECL Single ended data output swing(LVPECL)	$V_{out,p-p}$	250	-	800	mV
Data output rise time[e]	t_r	-	250	-	ps
Data output fall time[e]	t_f	-	250	-	ps
BRST_Det_High[f]	$V_{\_DETH}$	2.4	-	V_{cc}	V
BRST_Det_Low[f]	$V_{\_DETL}$	0	-	0.4	V
BRST_Det Response Time	$T_{\_BRST\_Det}$	-	-	6.4	nS

e) 20% to 80% values
f) BRST_Det assert low when module receive "reset" signal, assert high when incoming burst is detected and latch to high state until next "Reset" signal.

Digital RSSI Timing Specification

Parameter	Symbol	Min	Typical	Max	Unit
RSSI Trigger Delay[g]	$T_{Trigger}$	25	-	-	nS
RSSI Sampling Time[g]	$RSSI_{Sample}$	300	-	-	nS
Internal I2C Delay[g]	T_{I2C}	-	-	500	µS
Reciever Power DDM (RSSI) Error[h]	RX_{DDM}	-	-	+/- 3	dB

g) RSSI_ACQ Input signal rising edge will trigger RSSI sampling, and falling edge will trigger internal digital RSSI information written to I2C. It is recommended that host shall not trigger RSSI_ACQ input again until RSSI data is valid in I2C from previous RSSI trigger.
h) RSSI DDM working range is between -8 to -30 dBm. RSSI DDM accuracy is better than +/- 3dB for input power levels between -10 to -30 dBm, the accuracy reduces to +/- 5dBm for power levels larger than -10dBm.

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Pinout Definitions

Pin	Function	Notes
1	Veet	Tx Ground
2	Tx_Fail (Tx_Fault)	Tx Fail Alarm. LVTTL Output Active High
3	TX_DIS	Tx Disable. LVTTL input. Laser output is disabled when this pin is asserted high or left unconnected. Laser output is enabled when this pin is asserted low.
4	MOD_DEF (2)	2-Wire Serial Data I/O Pin.
5	MOD_DEF (1)	2-Wire Serial Clock Input.
6	MOD_DEF (0)	Internally Grounded
7	Reset	CMOS input. Assert "Reset" high at the end of previous burst, 2 bytes in duration
8	BRST_Det	LVTTL output. BRST_Det assert low when module receives "reset" signal, assert high when incoming burst is present.
9	RSSI_ACQ	RSSI acquire/hold LVTTL Input. Digital RSSI output through I2C
10	Veer	Rx Ground
11	Veer	Rx Ground
12	RXD-	Negative Data Output, LVPECL; DC coupled
13	RXD+	Positive Data Output, LVPECL; DC coupled
14	Veer	Rx Ground
15	Vcc_RX	Rx Vcc
16	Vcc_TX	Tx Vcc
17	Veet	Tx Ground
18	TXD+	Positive Data Input, LVPECL or CML (AC coupled; internally 100 ohms differential termination)
19	TXD-	Negative Data Input, LVPECLor CML (AC coupled; internally 100 ohms differential termination)
20	Veet	Tx Ground

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Timing Diagram

Detailed burst-mode receiver timing diagram is available upon request.

Digital RSSI Acquire/Hold Timing Specification

Detailed digital RSSI Acquisition/Hold timing diagram is available upon request.

DEC Addr.	HEX Addr.	Field Size (bytes)	Name	Default Value	Description
I2C A0h Address					
0	00	1	Identifier	03h	SFP tranceiver
1	01	1	Extended Identifier	04h	Function defined by serial ID
2	02	1	Connector	01h	SC receptacle
3	03	8	Transceiver	00 00 00 00 00 00 00 00h	Ext Calibration, Average Power Measurement
11	0B	1	Encoding	03h	NRZ encoding
12	0C	1	Nominal Bit Rate in 100 MBps	19h	2488.32 Mbps
13	0D	1	Reserved	00h	Reserved
14	0E	1	Length (9µ, km) in km	14h	20km
15	0F	1	Length (9µ, m) in 100 m	C8h	20km
16	10	1	Length (50µ) in 10 m	00h	Not Supported
17	11	1	Length (62.5µ) in 10 m	00h	Not Supported
18	12	1	Length (Copper) in m	00h	Not Supported
19	13	1	Reserved	00h	Reserved
20	14	16	Vendor Name (ASCII)	"LUMINENTOIC "	Vendor Name (ASCII)
36	24	1	Reserved	00h	Reserved
37	25	3	Vender IEEE Company ID	00 06 B5h	LuminentOIC IEEE ID
40	28	16	Vendor Part Number (ASCII)	"SPS4348HHPxDE "	Vendor Part Number (ASCII); x=C, R, T
56	38	4	Vendor Rev (ASCII)	31 20 20 20h	Revision
60	3C	2	Laser Wavelength in nm	05 D2h	1490nm Tx Wavelength
62	3E	1	Reserved	00h	Reserved
63	3F	1	Check Code for Base ID Fields	xxh	Checksum from byte 0-62
64	40	2	Options	00 1Ch	TX_DIS, TX_Fault, SD
66	42	1	Upper Bit Rate Margin in %	00h	BR, Max not specified
67	43	1	Lower Bit Rate Margin in %	00h	BR, Min not specified
68	44	16	Vendor Serial Number (ASCII)	"xxxxxxxxxxxxxxxx"	16 byte Serial number field (ASCII)
84	54	8	Date Code	xx xx xx xx xx xx 20 20h	Year(2 bytes) month(2 bytes) day(2 bytes)
92	5C	1	Diagnostic Monitoring Type	58h	Ext Calibration, Average Power Measurement
93	5D	1	Enhanced Options	E0h	Optical Alarm/warning implemented Soft TX_DIS, TX_FAULT implemented
94	5E	1	SFF-8472 Compliance	02h	Compliance to SFF-8472 Rev 9.4
95	5F	1	Check Code for Extended ID Fields	xxh	Checksum from byte 64-69
96	60	30	Vendor Specific	"SPS-43-48H-HP-xDE "	LOIC part number (ASCII); x=C, R, T
126	7E	2	Vendor Specific	00 00h	Reserved
128	80	128	Reserved	00….00h	Reserved; return to 0

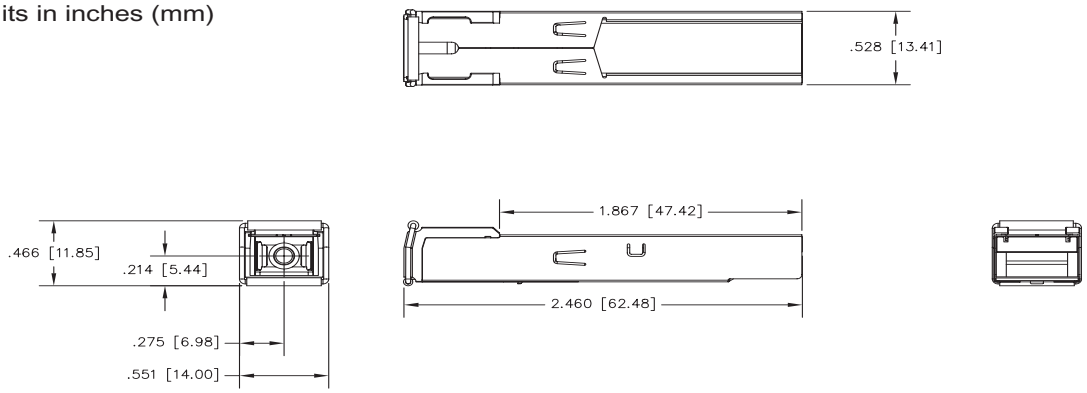
For detailed specifications of EEPROM contents and externally calibrated digital diagnostic monitor (DDM) functions, please refer to SFF-8472 standard Rev 9.5.

DEC Addr.	HEX Addr.	Field Size (bytes)	Name	Default Value	Description
I2C A2h Address					
0	00	2	Temp High Alarm	xx xxh	Temperature high alarm threshold
2	02	2	Temp Low Alarm	xx xxh	Temperature low alarm threshold
4	04	2	Temp High Warning	xx xxh	Temperature high warning threshold
6	06	2	Temp Low Warning	xx xxh	Temperature low warning threshold
8	08	2	Voltage High Alarm	94 70h	3.8V
10	0A	2	Voltage Low Alarm	6D 60h	2.8V
12	0C	2	Voltage High Warning	8C A0h	3.6V
14	0E	2	Voltage Low Warning	75 30h	3.0V
16	10	2	Bias High Alarm	83 81h	110mA
18	12	2	Bias Low Alarm	02 64h	2mA
20	14	2	Bias High Warning	77 8Ch	100mA
22	16	2	Bias Low Warning	03 96h	3mA
24	18	2	TX Power High Alarm	xx xxh	+5.5 dBm
26	1A	2	TX Power Low Alarm	xx xxh	+0.5dBm
28	1C	2	TX Power High Warning	xx xxh	+5.0dBm
30	1E	2	TX Power Low Warning	xx xxh	+1.0dBm
32	20	2	RX Power High Alarm	FF FFh	No alarm
34	22	2	RX Power Low Alarm	00 00h	No alarm
36	24	2	RX Power High Warning	FF FFh	No alarm
38	26	2	RX Power Low Warning	00 00h	No alarm
40	28	16	Reserved	00….000h	Reserved
56	38	4	RX_PWR(4) Calibration	xx xx xx xxh	4th order RSSI calibration coefficient
60	3C	4	RX_PWR(3) Calibration	xx xx xx xxh	3rd order RSSI calibration coefficient
64	40	4	RX_PWR(2) Calibration	xx xx xx xxh	2nd order RSSI calibration coefficient
68	44	4	RX_PWR(1) Calibration	xx xx xx xxh	1st order RSSI calibration coefficient
72	48	4	RX_PWR(0) Calibration	xx xx xx xxh	0th order RSSI calibration coefficient
76	4C	2	TX_I(Slope) Calibration	01 A3h	Slope for Bias calibration
78	4E	2	TX_I(Offset) Calibration	00 00h	Offset for Bias calibration
80	50	2	TX_PWR(Slope) Calibration	xx xxh	Slope for TX Power calibration
82	52	2	TX_PWR(Offset) Calibration	00 00h	Offset for TX Power calibration
84	54	2	T(Slope) Calibration	01 00h	Slope for Temperature calibration
86	56	2	T(Offset) Calibration	xx xxh	Offset for Temperature calibration, in units of 256ths C
88	58	2	V(Slope) Calibration	01 00h	Slope for VCC calibration
90	5A	2	V(Offset) Calibration	00 00h	Offset for VCC calibration
92	5C	3	Reserved	00h	reserved
95	5F	1	Checksum	xxh	Checksum
96	60	2	Transceiver Temperature	xx xxh	Temperature in C/256
98	62	2	Supply Voltage	xx xxh	Vcc
100	64	2	TX Bias Current	xx xxh	BIASMON
102	66	2	TX Optical Output Power	xx xxh	Back facet monitor
104	68	2	RX Optical Input Power	xx xxh	RSSI
106	6A	2	Reserved	0000h	Reserved
108	6C	2	Reserved	0000h	Reserved
110	6E.7	1bit	TX_DIS State	x	Digital state of the TX Disable Input Pin.
	6E.6	1bit	Soft TX Disable	x	Read/write bit that allows software disable of laser.
	6E.5	1bit	Reserved.	0	Reserved.
	6E.4	1bit	Rate Select State	0	NOT SUPPORTED.
	6E.3	1bit	Rate Select	0	NOT SUPPORTED.
	6E.2	1bit	TX_FAULT	x	Digital state of the TX Fault Output Pin.
	6E.1	1bit	LOS	0	NOT SUPPORTED
	6E.0	1bit	Data_ready_bar	x	Indicates transceiver has achieved power up and data is ready.

DEC Addr.	HEX Addr.	Field Size (bytes)	Name	Default Value	Description
I2C A2h Address					
111	6F.7	1bit	Reserved	0	Reserved
	6F.6	1bit	Reserved	0	Reserved
	6F.5	1bit	Reserved	0	Reserved
	6F.4	1bit	Reserved	0	Reserved
	6F.3	1bit	Reserved	0	Reserved
	6F.2	1bit	INTERRUPT_NOT	x	Interrupt state (active low)
	6F.1	1bit	MODE_EN	0	TX FAULT pin enable
	6F.0	1bit	APD_SHUTDOWN	x	APD shut-down latch. Write 0 to clear condition
112	70.7	1bit	Temperature too high alarm	x	Temperature too high alarm
	70.6	1bit	Temperature too low alarm	x	Temperature too low alarm
	70.5	1bit	VCC too high alarm	x	VCC too high alarm
	70.4	1bit	VCC too low alarm	x	VCC too low alarm
	70.3	1bit	BIASMON too high alarm	x	BIASMON too high alarm
	70.2	1bit	BIASMON too low alarm	x	BIASMON too low alarm
	70.1	1bit	BFMON too high alarm	x	BFMON too high alarm
	70.0	1bit	BFMON too low alarm	x	BFMON too low alarm
113	71.7	1bit	RSSI too high alarm	x	RSSI too high alarm
	71.6	1bit	RSSI too low alarm	x	RSSI too low alarm
	71.5	1bit	Reserved interrupt status bit	x	Reserved interrupt status bit
	71.4	1bit	Reserved interrupt status bit	x	Reserved interrupt status bit
	71.3	1bit	Reserved interrupt status bit	x	Reserved interrupt status bit
	71.2	1bit	Reserved interrupt status bit	x	Reserved interrupt status bit
	71.1	1bit	Reserved interrupt status bit	x	TX Fail went HIGH
	71.0	1bit	Reserved interrupt status bit	x	APD Shutdown event detected
114	72	1	Reserved	00h	Interrupt Mask for ISRC0
115	73	1	Reserved	00h	Interrupt Mask for ISRC1
116	74.7	1bit	Temperature too high warning	x	Temperature too high warning
	74.6	1bit	Temperature too low warning	x	Temperature too low warning
	74.5	1bit	VCC too high warning	x	VCC too high warning
	74.4	1bit	VCC too low warning	x	VCC too low warning
	74.3	1bit	BIASMON too high warning	x	BIASMON too high warning
	74.2	1bit	BIASMON too low warning	x	BIASMON too low warning
	74.1	1bit	BFMON too high warning	x	BFMON too high warning
	74.0	1bit	BFMON too low warning	x	BFMON too low warning
117	75.7	1bit	RX Power High Warning	x	RSSI too high warning
	75.6	1bit	RX Power Low Warning	x	RSSI too low warning
	75.5	1bit	Reserved	0	Reserved
	75.4	1bit	Reserved	0	Reserved
	75.3	1bit	Reserved	0	Reserved
	75.2	1bit	Reserved	0	Reserved
	75.1	1bit	Reserved	0	Reserved
	75.0	1bit	Reserved	0	Reserved
118	76	1	Reserved	00h	Interrupt Mask for ISRC2
119	77	1	Reserved	00h	Interrupt Mask for ISRC3
120	78	8	Vendor Specific	00 00 00 00 00 00 00 00h	Vendor Specific

Outline Drawing

Units in inches (mm)



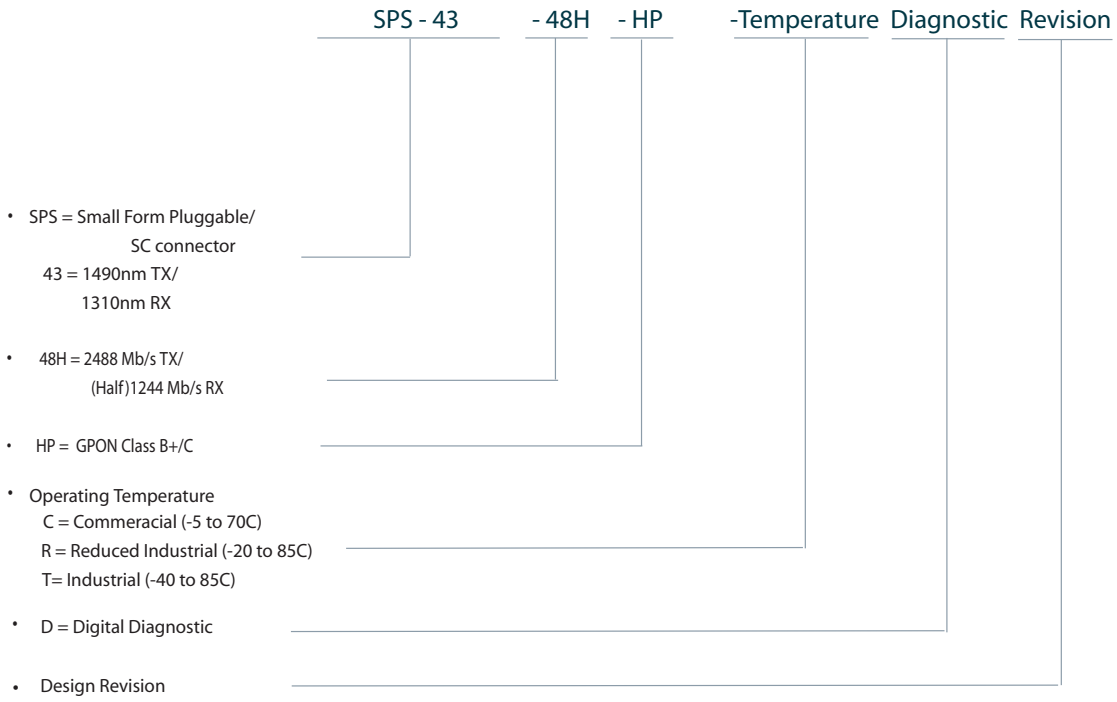
1. CUSTOMER MAKES EXTERNAL CONNECTIONS TO COMPONENT FIBER, WIRING, AND CONNECTORS.

NOTES: UNLESS OTHERWISE SPECIFIED

Ordering informatio

Available Options:
SPS-43-48H-HP-CDE
SPS-43-48H-HP-RDE
SPS-43-48H-HP-TDE

Part numbering Definition:



Handling Precautions: This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.
Laser Safety: Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.