

### SPS-6340WG / SPS-6340BWG / SPS-6340AWG

**(RoHS Compliant)**

### 16GFC / 40 km / 1550 nm Digital Diagnostic SFP+ LC SINGLE-MODE TRANSCEIVER

#### FEATURES

- Up to 14.025 Gbps Bi-directional Data Links
- Compliant with SFP+ MSA
- Compliance with Fibre Channel 1600-SM-LC-L
- Compliant with 8G and 4G Fibre Channel
- SFF-8472 Digital Diagnostic Function
- Temperature-stabilized 1550 nm EML Transmitter
- Distance up to 40 km at SM Fiber
- RX Rate Selection for 16G FC and 8G/4G FC
- Flexibility in RX data rate selection through either hardware or software control
- AC/AC Coupling according to MSA
- Single +3.3 V Power Supply
- Low Power consumption
- RoHS Compliant
- 0 to 70°C Operating: SPS-6340WG
- -5 to 85°C Operating: SPS-6340BWG
- -40 to 85°C Operating: SPS-6340AWG
- Class 1 Laser International Safety Standard IEC-60825 Compliant

#### DESCRIPTION

The SPS-6340WG series single mode transceiver is a small form factor pluggable module for bi-directional serial optical data communications such as 16x/8x/4x Fibre Channel. It is with the SFP+ 20-pin connector to allow hot plug capability. Digital diagnostic functions are available via an I<sup>2</sup>C. This module is designed for single mode fiber and operates at a nominal wavelength of 1550 nm. The transmitter section uses a temperature-stabilized 1550 nm electrical-modulated laser (EML) and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a rate selection clock data recovery (CDR) IC.

#### LASER SAFETY

This single mode transceiver is a Class 1 laser product. It complies with IEC-60825 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated within the specified temperature and voltage limits. The optical ports of the module shall be terminated with an optical connector or with a dust plug.

#### APPLICATIONS

- Multi-rate 16x / 8x / 4x Fibre Channel
- 10G Ethernet / Fibre Channel / Sonet

#### ORDER INFORMATION

P/No.	Bit Rate (Gb/s)	FC	Distance (km)	Wavelength (nm)	Package	Temp. (°C)	RoHS Compliant
SPS-6340WG	14.025	16G / 8G / 4G	40	1550 EML	SFP+ with DMI	0 to 70	Yes
SPS-6340BWG	14.025	16G / 8G / 4G	40	1550 EML	SFP+ with DMI	-5 to 85	Yes
SPS-6340AWG	14.025	16G / 8G / 4G	40	1550 EML	SFP+ with DMI	-40 to 85	Yes

Absolute Maximum Ratings						
Parameter	Symbol	Min	Max	Units	Notes	
Storage Temperature	Tstg	-40	85	°C		
Relative Humidity	RH	5	85	%	Non-condensing	
Operating Case Temperature	Topr	0	70	°C	SPS-6340WG	
		-5	85		SPS-6340BWG	
		-40	85		SPS-6340AWG	
Power Supply Voltage	Vcc	-0.5	3.6	V		
Receiver Input Optical Power	Mip		3	dBm	Average power	

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Recommended Operating Conditions					
Parameter	Symbol	Min	Typ	Max	Units / Notes
Power Supply Voltage	V <sub>CC</sub>	3.135	3.3	3.465	V
Operating Case Temperature	T <sub>opr</sub>	0		70	°C / SPS-6340WG
		-5		85	°C / SPS-6340BWG
		-40		85	°C / SPS-6340AWG
Relative Humidity	RH	5	85	%	Non-condensing
Power Supply Current	I <sub>CC(TX+RX)</sub>		350	450	mA / SPS-6340WG
			350	650	mA / SPS-6340B(A)WG
Data Rate		4.25	14.025		Gb/s

Transmitter Optical Specifications (0°C < T <sub>opr</sub> < 70°C, 3.13V < V <sub>CC</sub> < 3.47V)						
Parameter	Symbol	Min	Typ	Max	Units	Notes
Average Launch Power	P <sub>O, AVE</sub>	-1		+3.0	dBm	1
Output Center Wavelength	λ <sub>c</sub>	1530		1565	nm	
Output Spectrum Width	σ <sub>λ</sub>			1	nm	-20 dB width
Side Mode Suppression Ratio	SMSR	30			dB	
Extinction Ratio	ER	6.0				
Relative Intensity Noise	RIN			-128	dB/Hz	
Transmitter and Dispersion Penalty	TDP			3	dB	
Average Launch Power of OFF Transmitter				-30	dBm	

1. Output power is power coupled into a 9/125 μm single-mode fiber.

Receiver Optical Specifications (0°C < T <sub>opr</sub> < 70°C, 3.13V < V <sub>CC</sub> < 3.47V)						
Parameter	Symbol	Min	Typ	Max	Units	Notes
Sensitivity in Average Power	SenI			-14	dBm	2
Receiver Overload	P <sub>MAX</sub>	0	---		dBm	
LOS -- Deasserted	LOS <sub>D</sub>	---	---	-14	dBm	Transition: low to high
LOS -- Asserted	LOS <sub>A</sub>	-24	---	---	dBm	Transition: high to low
Wavelength of Operation	λ <sub>c</sub>	1530		1565	nm	

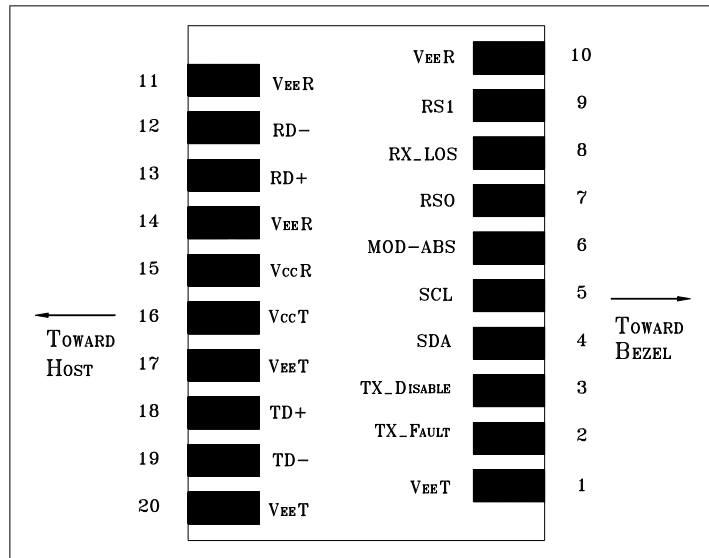
2. BER < 10<sup>-12</sup> and PRBS 2<sup>31</sup>-1 at 14.025 Gb/s..

Electrical Characteristics						
Parameter	Symbol	Min	Typ	Max	Units	Notes
<b>High-Speed Signal (CML) Interface Specification</b>						
Input Data Rate		4.25	14.025		Gb/s	
TX Clock Tolerance				±100	ppm	3
Differential Input Impedance	R <sub>in</sub>		100		Ω	
Differential Data Input Amplitude		150		1200	mV <sub>pp</sub>	Internally AC coupled
Output Data Rate		4.25	14.025		Gb/s	
RX Clock Tolerance				±100	ppm	3
Differential Output Impedance	R <sub>out</sub>		100		Ω	
Differential Data Output Amplitude		350	600	700	mV <sub>pp</sub>	Internally AC coupled
<b>Low-Speed Signal (LVTTTL) Interface Specification</b>						
Input High Voltage		2.0		V <sub>CC</sub> +0.3	V	
Input Low Voltage		GND		0.8	V	
Output High Voltage		2.4		V <sub>CC</sub>	V	
Output Low Voltage		GND		0.5	V	

3. Clock tolerance for 14.025 Gb/s, 8.5Gb/s and 4.25 Gb/s.

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### CONNECTION DIAGRAM



PIN	Signal Name	Description	PIN	Signal Name	Description
1	V <sub>EE</sub> T	Transmitter Signal Ground	11	V <sub>EE</sub> R	Receiver Signal Ground
2	TX_Fault	Transmitter Fault Indication. Logic “1” Output = Laser Fault. Logic “0” Output = Normal Operation	12	RD-	Inverse Receiver Data Out
3	TX_Disable	Logic “1” Input (or no connection) = Laser off, Logic “0” = Laser on.	13	RD+	Receiver Data Out
4	SDA	Modulation Definition 2 – Two wires serial ID Interface	14	V <sub>EE</sub> R	Receiver Signal Ground
5	SCL	Modulation Definition 1 – Two wires serial ID Interface	15	V <sub>CC</sub> R	Receiver Power – 3.3V±5%
6	MOD-ABS	Modulation Definition 0 – Ground in Module	16	V <sub>CC</sub> T	Transmitter Power – 3.3V±5%
7	RS0	RX Rate Select: Open or Low: 8.5 or 4.25 Gb/s FC. High: enable CDR for 16GFC.	17	V <sub>EE</sub> T	Transmitter Signal Ground
8	RX_LOS	Loss of Signal Out (OC).	18	TD+	Transmitter Data In
9	RS1	TX Rate Select (LVTTTL). This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance.	19	TD-	Inverse Transmitter Data In
10	V <sub>EE</sub> R	Receiver Signal Ground	20	V <sub>EE</sub> T	Transmitter Signal Ground

### MODULE DEFINITION

Module Definition	PIN 4	PIN 5	PIN 6	Interpretation by Host
4	SDA	SCL	MOD-ABS	Serial module definition protocol

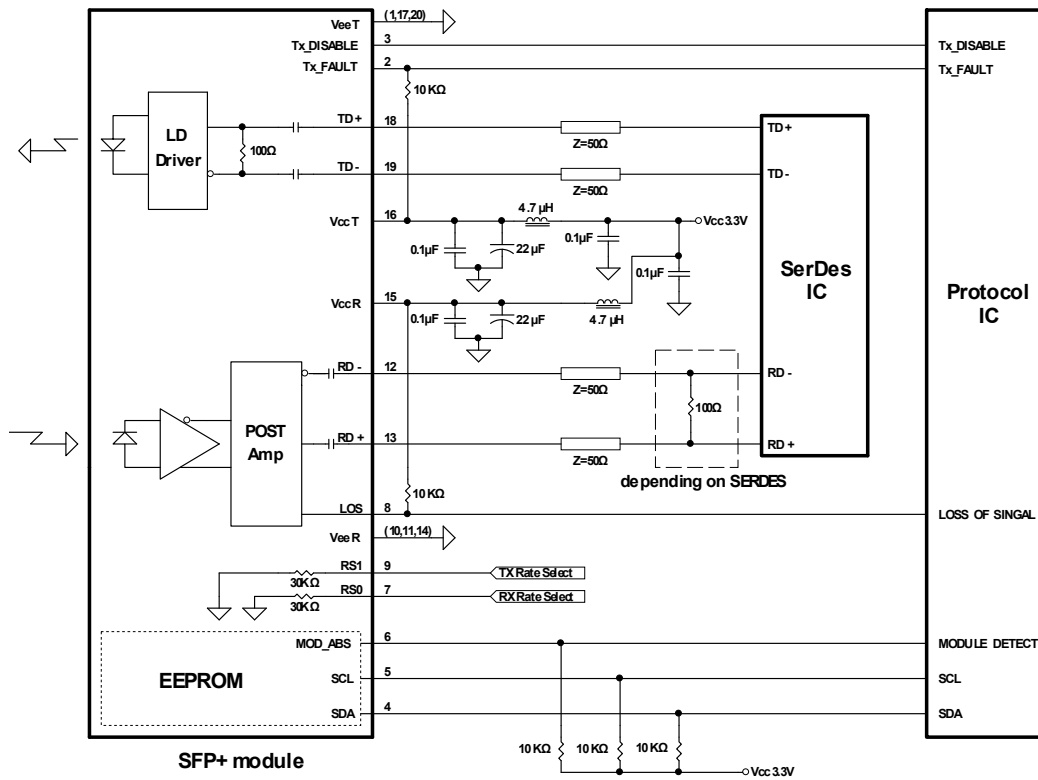
Module Definition 4 specifies a serial definition protocol. For this definition, upon power up, SDA and SCL appear as no connection (NC) and MOD-ABS is TTL LOW. When the host system detects this condition, it activates the serial protocol. The protocol uses the 2-wire serial CMOS E<sup>2</sup>PROM protocol of the ATMEL AT24C01A/02/04 family of components.

**RX Rate Select Control**

RX rate can be independently controlled by either RS0 input pin (Hardware) or via register write to soft RS0 select bit (Software). RS0 input pin (pin 7) is used to select RX rate. Status of RS0 input pin logic level is reflected to register byte 110 bit 4 on address A2h. RX rate can also be controlled by register write to soft RS0 select bit (byte 110 bit 3 on address A2h). Power on default of soft RS0 select bit is logic low. Hardware and software control inputs are OR'd to allow flexible control. See following RX operation logic table:

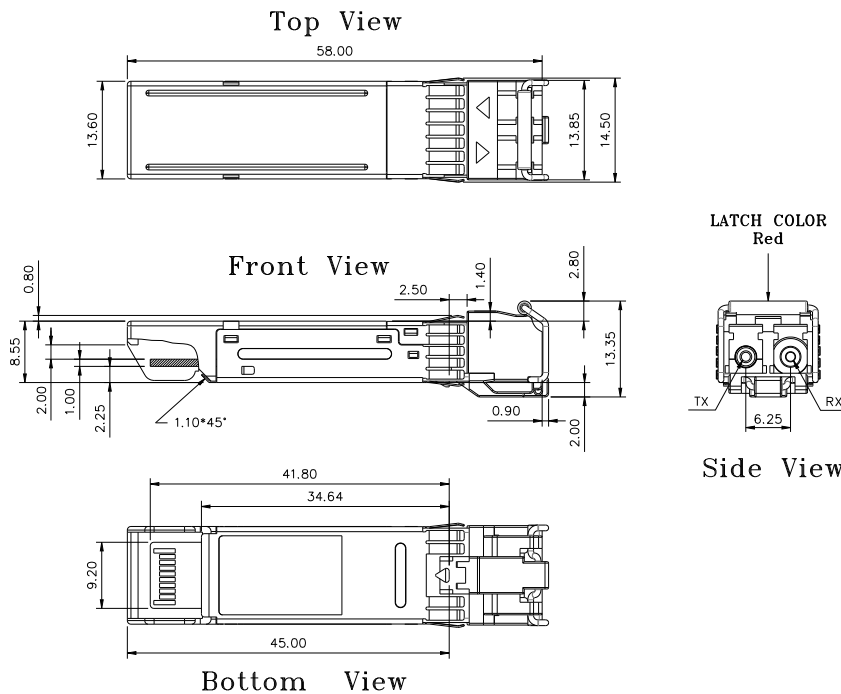
RS0 Control Input		RX Speed	RX CDR
RS0 Input Pin (Hardware: Pin 7)	Soft RS0 Select Bit (Software: Byte 110 Bit 3, A2h)		
0	0	4G/8G FC	Bypassed
0	1	16G FC	Enabled
1	0		
1	1		

### RECOMMENDED CIRCUIT SCHEMATIC



### PACKAGE DIAGRAM

Units in mm



**Note:** Specifications subject to change without notice.

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**EEPROM Series ID Memory Contents (Address A0h)**  
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Addr.	Hex	ASCII	Note	Addr.	Hex	ASCII	Note	Addr.	Hex	ASCII	Note	Addr.	Hex	ASCII	Note
0	03		SFP+	32	20			64	06		Cooled Tx,	96	00		Vendor specific EEPROM
1	04			33	20			65	3A		Power Level 2, Txdis, Txfault, LOS enable, RX Rate Select	97	00		
2	07		LC	34	20			66	00		Up bit rate	98	00		
3	80		10G Base-ER	35	20			67	00		Low bit rate	99	00		
4	00			36	00		NA	68			Serial number: each piece with different serial number	100	00		
5	00			37	00		Vendor IEEE OUI	69				101	00		
6	00			38	0E			70				102	00		
7	10		Long Distance (L)	39	FA			71				103	00		
8	10		Longwave Laser (LL)	40	53	S	Part Number	72				104	00		
9	01		Single Mode (SM)	41	50	P		73			105	00			
10	F0		1600/1200/ 800/400 Mbytes/sec	42	53	S		74			106	00			
11	06		64B/66B	43	2D	-		75			107	00			
12	8C		14.025Gbps	44	36	6		76			108	00			
13	08		Rx Rate_select only, High=16G, Low=10G/8G/4G	45	33	3		77			109	00			
14	28		40km	46	34	4		78			110	00			
15	FF		>25.4km	47	30	0		79			111	00			
16	00			48	57	W		80			112	00			
17	00			49	47	G		81			113	00			
18	00			50	20			82			114	00			
19	00			51	20			83			115	00			
20	4F	O	Vendor name	52	20			84			Date Code	116	00		
21	50	P		53	20			85				117	00		
22	54	T		54	20			86				118	00		
23	4F	O		55	20			87				119	00		
24	57	W		56	30	0	Revision, depended on version	88				120	00		
25	41	A		57	30	0		89				121	00		
26	59	Y		58	30	0		90				122	00		
27	20			59	31	1		91				123	00		
28	20		60	06		1550 nm	92	68		Monitoring	124	00			
29	20		61	0E			93	FA		Soft Control and Monitoring	125	00			
30	20		62	00		Reserved	94	05		SFF-8472V11.0	126	00			
31	20		63			Checksum 0-62	95			Checksum 64-94	127	00			

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**EEPROM Series ID Memory Contents (Address A2h)**  
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Addr.	Hex	Note	Addr.	Hex	Note	Addr.	Hex	Note	Addr.	Hex	Note
0	4B	Temp. High Alarm (75°C)	32	31	Rx Power High Alarm (1dBm)	64	00	For External Cal.	96		Real Time Temp. MSB
1	00		33	2D		65	00	For External Cal.	97		Real Time Temp. LSB
2	FB	Temp. Low Alarm (-5°C)	34	00	Rx Power Low Alarm (-16dBm)	66	00	For External Cal.	98		Real Time Vcc MSB
3	00		35	FB			67	00	For External Cal.	99	
4	49	Temp. High Warming(73°C)	36	27	Rx Power High Warming (0dBm)	68	3F	For External Cal.	100		Real Time Tx Bias MSB
5	00		37	10			69	80	For External Cal.	101	
6	00	Temp. Low Warming (0°C)	38	01	Rx Power Low Warming(-14dBm)	70	00	For External Cal.	102		Real Time Tx Pwr MSB
7	00		39	8E			71	00	For External Cal.	103	
8	8C	Voltage High Alarm (3.6V)	40	00	Reserved	72	00	For External Cal.	104		Real Time Rx Pwr MSB
9	A0		41	00	Reserved	73	00	For External Cal.	105		Real Time Rx Pwr LSB
10	75	Voltage Low Alarm(3.0V)	42	00	Reserved	74	00	For External Cal.	106		Reserved
11	30		43	00	Reserved	75	00	For External Cal.	107		Reserved
12	88	Voltage High Warming(3.5V)	44	00	Reserved	76	01	For External Cal.	108		Reserved
13	B8		45	00	Reserved	77	00	For External Cal.	109		Reserved
14	79	Voltage Low Warming (3.1V)	46	00	Reserved	78	00	For External Cal.	110		Tx Dis, Tx Fault, Rx Los, RS0, Soft RS0 Rate_Select Ctrl
15	18		47	00	Reserved	79	00	For External Cal.	111		Reserved
16	FD	Tx Bias High Alarm(130mA)	48	00	Reserved	80	01	For External Cal.	112		Alarm Flag
17	E8		49	00	Reserved	81	00	For External Cal.	113		Alarm Flag/Reserved
18	13	Tx Bias Low Alarm(10mA)	50	00	Reserved	82	00	For External Cal.	114		Reserved
19	88		51	00	Reserved	83	00	For External Cal.	115		Reserved
20	EA	Tx Bias High Warming(120mA)	52	00	Reserved	84	01	For External Cal.	116		Warming Flag
21	60		53	00	Reserved	85	00	For External Cal.	117		Warming Flag/Reserved
22	1D	Tx Bias Low Warming(15mA)	54	00	Reserved	86	00	For External Cal.	118		Reserved
23	4C		55	00	Reserved	87	00	For External Cal.	119		Reserved
24	62	Tx Power High Alarm (4dBm))	56	00	For External Cal.	88	01	For External Cal.	120		Vendor Specific
25	1F		57	00	For External Cal.	89	00	For External Cal.	121		
26	18	Tx Power Low Alarm(-2dBm)	58	00	For External Cal.	90	00	For External Cal.	122		
27	A6		59	00	For External Cal.	91	00	For External Cal.	123		
28	4D	Tx Power High Warming(3dBm)	60	00	For External Cal.	92	00	For External Cal.	124		
29	F1		61	00	For External Cal.	93	00	For External Cal.	125		
30	1F	Tx Power Low Warming (-1dBm)	62	00	For External Cal.	94	00	For External Cal.	126		
31	07		63	00	For External Cal.	95		Check Sum	127		

Note: Address 128 – 247: customer RW eeprom. Address 248 – 255: Vendor Specific.

**Note:** Specifications subject to change without notice.

**REVISION HISTORY**

Version	Subject	Release Date
1.0	Initial datasheet	2011/1/1
2.0	Revise package diagram	2013/7/1
3.0	Add -5 to 85°C and -40 to 85°C version	2016/1/5