EXC250011-00

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RGB SLED 14pin BTF module with single-mode fiber

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1. SCOPE

1.1. PURPOSE

The purpose of this document is to specify the electro-optical performance and dimensions of a combined Red-Green-Blue (RGB) superluminescent light emitting diodes (SLED) module.

1.2. RESPONSIBILITY

EXALOS is responsible for establishing, implementing and maintaining this procedure. The Quality representative shall ensure that a timely Engineering Change Notice (ECN) is issued in accordance with EXALOS procedure for any changes.

2. REFERENCE DOCUMENT

1.1.EXS-WI-0001 Visual Inspection Criteria SLED Chip-on-Submount Procedure

1.2.MIL STD 883 C method.

1.3.Bellcore GR-468-CORE.

3. ELECTRO-OPTICAL PERFORMANCE (T_{set} = 25°C)

Table 1. Electrical-optical characteristics of the RGB module under cw operation

Parameter	Symbol	Cond.	Min	Typ	Max	Unit
Operating current: Red Green Blue	 I_{op}^{R} I_{op}^{G} I_{op}^{B}			 60 500 140	 65 600 160	mA
Forward voltage: Red Green Blue	 V_{op}^{R} V_{op}^{G} V_{op}^{B}	$I_{op,max}$[1]		 2.2 7.0 5.0	 2.5 7.7 6.0	V
Output power ex-fiber: Red Green Blue	 P_{f}^{R} P_{f}^{G} P_{f}^{B}	$I_{op,max}$	 3.0 3.0 3.0	 5.0 5.0 5.0		mW
Center wavelength: Red Green Blue	 λ_{c}^{R} λ_{c}^{G} λ_{c}^{B}	$I_{op,max}$	 632 505 450	 636 510 455	 640 515 460	nm
Bandwidth FWHM: Red Green Blue	 BW^{R} BW^{G} BW^{B}	$I_{op,max}$	 5 6 4	 6 8 5		nm
Full divergence angle ex-fiber[2]: Red Green Blue	 θ^{R} θ^{G} θ^{B}	$I_{op,max}$		 12.6 14.9 16.0		degrees
Mode field diameter in fiber[2]: Red Green Blue	 MFD^{R} MFD^{G} MFD^{B}	$I_{op,max}$		 4.6 4.0 3.6		µm
Monitor PD current[3]	I_{MPD}	$I_{op,max}$	0.1			mA
Monitor PD bias voltage			0		-12	V

[1] The measurement condition "$I_{op,max}$" corresponds to the maximum operating currents that are specified individually for each SLED emitter.
[2] Angles are full angles measured at 1% intensity distribution.
[3] Measured with 0 V bias voltage on monitor photodiode (MPD) and termination resistance of 10-50 Ohm.

4. TEC PERFORMANCE & POWER DISSIPATION

Fig. 1 shows TEC current consumption as a function of the heat sink temperature at different levels of total power dissipation from RGB SLEDs for a set temperature of 25°C. In order to keep the power dissipation of the internal TEC to reasonable values, good heat sinking with a heat sink (base) temperature of less than 55 °C is recommended at 4.5 W total power dissipation from RGB SLED devices.

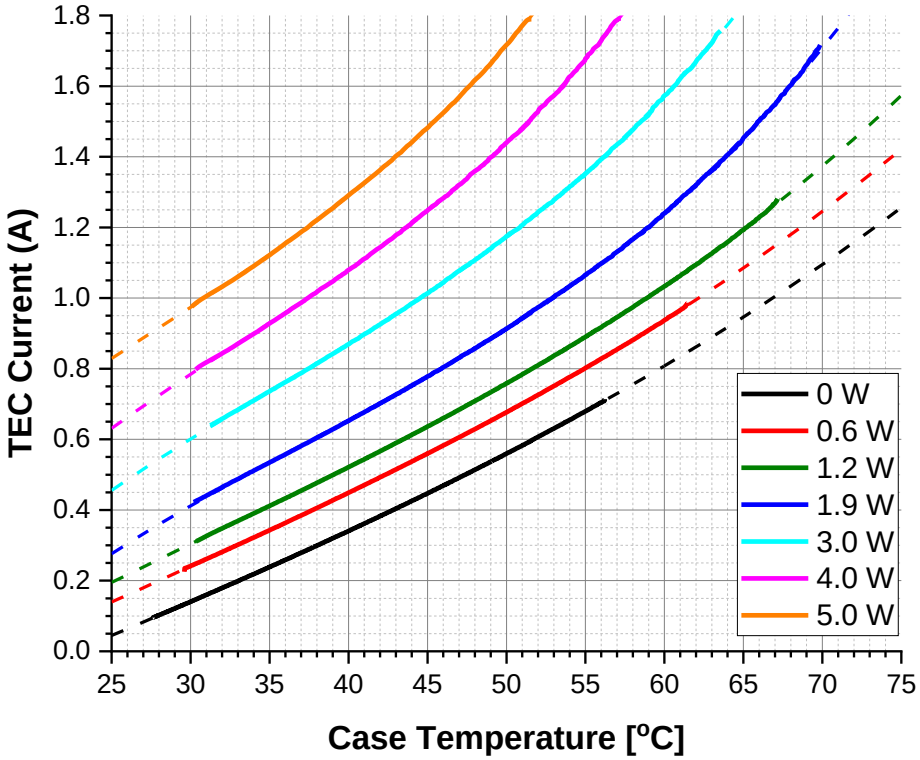


Figure 1: Drive current of the internal TEC as a function of the heat sink (base temperature) at various power dissipation from the RGB SLEDs, for an SLED operating temperature of 25°C.

A power dissipation of the RGB SLED devices of up to 4.7 W total is expected with the currently available SLED devices in the GREEN spectral range. As shown in Table 1, 80% of the power consumption is expected to be consumed by the GREEN SLED prototype devices. However, further progress expected in the electro-optical efficiency of these SLED devices will reduce those values over time.

SLED	Drive Current	Forward Voltage	Power Consumption
RED	60 mA	2.4 V	0.14 W
GREEN	500 mA	7.5 V	3.75 W
BLUE	150 mA	5.5 V	0.82 W
Total			**4.71 W**

Table 2: Example of a power dissipation calculation for an RGB SLED module

The RGB SLED module is realized with a high-performance Peltier cooler (TEC) inside, capable of efficiently removing heat loads at low TEC currents and low TEC voltages. Figure 2 shows a typical V-I curve of the RGB module TEC when the heat sink temperature is maintained at 25 °C. EXALOS recommends to keep the TEC current below 1.8A in order to avoid self-heating of the TEC and thermal instabilities. The corresponding controller needs to have a compliance voltage of minimum 3V at those currents.

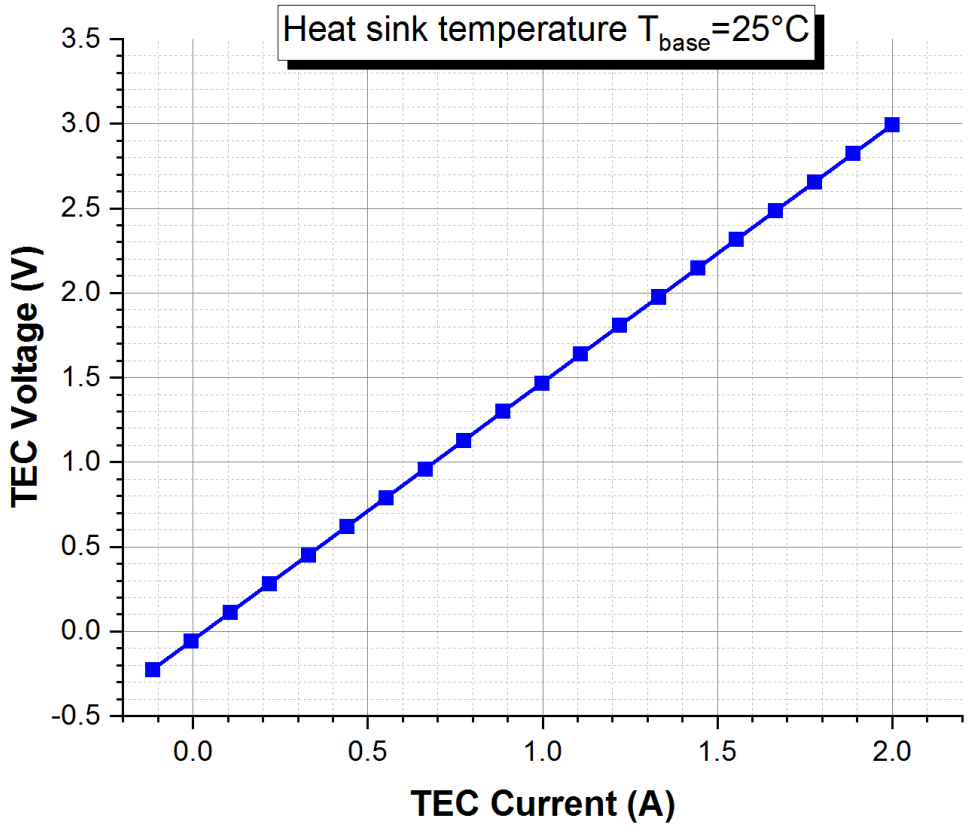


Figure 3: V-I curve of the TEC of the RGB SLED module for heat sink temperature of 25°C.

5. ABSOLUTE MAXIMUM RATINGS

Stresses beyond the absolute maximum ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Table 3: Absolute maximum ratings

Parameter	Symbol	Cond.	Min	Max	Unit
Forward current: Red Green Blue	I_F			 70 650 200	mA
Reverse voltage	V_R			-2	V
Storage temperature	T_{stg}		-40	85	°C
Operating temperature	T_{op}	$I_{F,max}$	0	40	°C
Storage humidity	<30°C >30°C		5	95 85	% r.h. % r.h.
Thermoelectric cooler voltage	V_{tec}			4	V
Thermoelectric cooler current	I_{tec}			2	A
Thermistor Resistance	R_{th}	25°C	10		KΩ
Thermistor constant	B		3892		K
Lead soldering temperature				260	°C
Lead soldering duration				10	s
ESD		human b.m		500	V

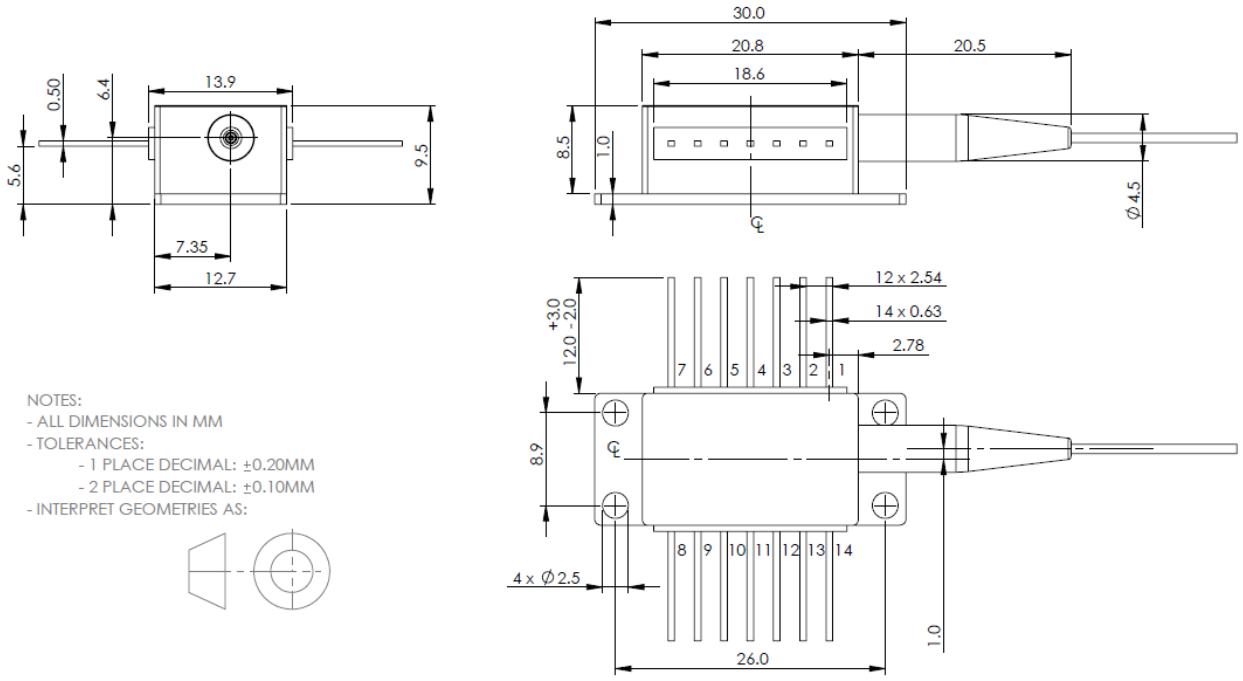
6. SCREENING

The produced Module is required to meet all operating conditions specified in Table 4, Electro-Optical Performance Specifications after being subjected to the following screening tests:

Table 4: Foreseen screening tests for fully-released production module

Test Item	Test Conditions	Reference
Seal	Fine: Condition A1 Gross: Condition C	MIL-STD-883, Method 1014 Temperature max. 85°C
Temperature Cycling	-40°C to +85°C, ramp rate >= 5°C/min, 10 cycles	MIL-STD-883, Method 1010

7. PACKAGE DIMENSIONS



14 pin RGB Butterfly Package			
Pin	**Function**	**Pin**	**Function**
1	**TEC (+)**	**8**	**Red SLED Anode (+)**
2	**Case**	**9**	**Red SLED Cathode (-)**
3	**Monitor Photodiode Anode**	**10**	**Blue SLED Anode (+)**
4	**Monitor Photodiode Cathode**	**11**	**Blue SLED Cathode (-)**
5	**Thermistor (+)**	**12**	**Green SLED Anode (+)**
6	**Thermistor (-)**	**13**	**Green SLED Cathode (-)**
7	**NC**	**14**	**TEC (-)**

8. FIBER AND CONNECTOR

Part	Description
Optical fiber	SM 3.3/125 µm Nufern S405-XP
Furcation tubing	Loose tube 900 µm
Fiber pigtail length (min.)	1 m
Optical connector	FC/APC **Narrow Key** (2.0mm)

9. IMPORTANT NOTES

1. Avoid electrostatic discharges, which may destroy the SLEDs.
2. Never use the SLED module without heat sinking.
3. Adequate eye protection against laser radiation should be used while handling and operating the module.
4. EXALOS declines any responsibility if the device is used in applications where human life may be endangered.
5. Back-reflections may influence the output power and spectral characteristics of the SLEDs. An optical return loss of less than -30 dB is recommended.

10. ORDERING INFORMATION

Please use the following **part number** to order product from EXALOS:

E	X	C	2	5	0	0	1	1	–	0	0

10.1. TECHNICAL DESCRIPTION

E	X	C	-	0	6	3	5	-	0	5	1	0	-	0	4	5	0	-	0	5	-	0	2	0	T	1	3	0
				RED Wavelength					GREEN Wavelength					BLUE Wavelength					Output power per color			Package			Fiber	Connector	MPD	Option	

11. REVISION HISTORY

Revision History				
Rev.	**Description**	**ECN**	**Date**	**Released**
0.1	Preliminary version	-	09.07.2019	NPR
0.3	Table 1 revised		10.03.2020	NPR
0.4	Table 1 revised, total power dissipation of the RGB module recalculated, chip order changed		23.12.2020	NPR
0.5	Updated driver currents and forward voltages for GREEN and BLUE SLEDs, updated total power consumption as well as absolute max currents. Total power consumption of the module is reduced to 4.6 W GREEN SLED bandwidth is updated.		03.03.2021	NPR
0.6	New COS order: GBR, adjusted the driver current of GREEN and BLUE and overall module power consumption		16.07.2021	NPR
0.7	Values for MFD and Divergence angle updated. Red max current updated.		29.09.2022	NPR
0.8	Values for voltages adjusted based on recent builds, total power consumption is updated, mechanical drawing changed according to the new 14 pin housing.		12.12.2023	NPR