

SPECIFICATIONS FOR  
INTEGRAL LED MODULE 5

## (1) SUMMARY

LED ( $T_j = 25\text{ °C}$ ,  $I = 350\text{ mA}$ )

Article number	Description and LED type	Colour typ. °K or nm	Voltage Vf typ. V	Power W	Luminous flux typ. lm	Efficacy lm / W	Lifetime h @ $\Phi_v$ -30 %	Forward current max. mA	Module $T_a$ °C	Spacing mm
09010301	Module 5 cool white side-emitter NS6W083A	6300 K <sup>1)</sup>	3,80	1.3	95	75	50 000	350	-30 °C ... +60 °C <sup>6)</sup>	214
09010401	Module 5 cool white lambertian NS6W083A	6300 K <sup>1)</sup>	3,80	1.3	95	75	50 000	350	-30 °C ... +60 °C <sup>6)</sup>	214
09010302	Module 5 cool white side-emitter NS6W083B	6300 K <sup>1)</sup>	3,40	1.2	114	95	50 000	350	-30 °C ... +60 °C <sup>7)</sup>	214
09010402	Module 5 cool white lambertian NS6W083B	6300 K <sup>1)</sup>	3,40	1.2	114	95	50 000	350	-30 °C ... +60 °C <sup>7)</sup>	214
09010304	Module 5 warm white side-emitter NS6L083B	2650 K <sup>2)</sup>	3,40	1.2	90	75	50 000	350	-30 °C ... +60 °C <sup>7)</sup>	214
09010404	Module 5 warm white lambertian NS6L083B	2650 K <sup>2)</sup>	3,40	1.2	90	75	50 000	350	-30 °C ... +60 °C <sup>7)</sup>	214
09010303	Module 5 blue side-emitter NS6B083	464 <sup>3)</sup>	3,80	1.3	16	12	50 000	350	-30 °C ... +60 °C <sup>8)</sup>	214
09010403	Module 5 blue lambertian NS6B083	464 <sup>3)</sup>	3,80	1.3	16	12	50 000	350	-30 °C ... +60 °C <sup>8)</sup>	214
09010304	Module 5 green side-emitter NS6G083	535 <sup>4)</sup>	3,80	1.3	58	45	50 000	350	-30 °C ... +60 °C <sup>8)</sup>	214
09010404	Module 5 green lambertian NS6G083	535 <sup>4)</sup>	3,80	1.3	58	45	50 000	350	-30 °C ... +60 °C <sup>8)</sup>	214
09010505	Module 5 red side-emitter SPNovaLED	625 <sup>5)</sup>	2,40	0.8	28	35	40 000	350	-30 °C ... +55 °C <sup>9)</sup>	214
09010605	Module 5 red lambertian SPNovaLED	625 <sup>5)</sup>	2,40	0.8	28	35	40 000	350	-30 °C ... +55 °C <sup>9)</sup>	214

1) 6300 K  $\pm$  700 K2) 2650 K  $\pm$  150 K3) 464 nm  $\pm$  5 nm4) 535 nm  $\pm$  5 nm5) 625 nm  $\pm$  5 nm6) Total thermal resistance 33 °C/W from LED junction to air.  
LED natural air flow cooling area 50 cm<sup>2</sup>.7) Total thermal resistance 30 °C/W from LED junction to air.  
LED natural air flow cooling area 50 cm<sup>2</sup>.8) Total thermal resistance 33 °C/W from LED junction to air.  
LED natural air flow cooling area 50 cm<sup>2</sup>.9) Total thermal resistance 40 °C/W from LED junction to air.  
LED natural air flow cooling area 50 cm<sup>2</sup>.

Bi-metallic switch in sign supply needs to be applied in critical conditions.

(2) MAXIMUM RATINGS FOR COOL WHITE MODULE 5 AT NICHIA NS6W083A

Item	Symbol	Maximum ratings	Unit
Forward current	$I_f$	350	mA
Pulse forward current	$I_{fp}$	600	mA
Allowable reverse current	$I_r$	85	mA
Power Dissipation	$P_d$	1.54	W
Operating temperature	$T_{opr}$	- 30 ~ + 60	°C
Storage temperature and RH	$T_{stg}$	- 30 ~ + 45 / RH ≤ 70 %	°C
Dice temperature	$T_j$	120	°C

$I_r$  conditions: Module is not designed for reverse current.  
 $T_{opr}$  conditions: Thermal resistance 33°C / W or less.  
 $T_j$  conditions: Maximum recommended long term junction temperature 115°C.  
 $I_{fp}$  conditions: Pulse width ≤ 10 msec. and duty cycle ≤ 1/10.

(3) MAXIMUM RATINGS FOR COOL WHITE MODULE 5 AT NICHIA NS6W083B AND WARM WHITE AT NICHIA NS6L083B

Item	Symbol	Maximum ratings	Unit
Forward current	$I_f$	350	mA
Pulse forward current	$I_{fp}$	600	mA
Allowable reverse current	$I_r$	85	mA
Power Dissipation	$P_d$	1.40	W
Operating temperature	$T_{opr}$	- 30 ~ + 60	°C
Storage temperature and RH	$T_{stg}$	- 30 ~ + 45 / RH ≤ 70 %	°C
Dice temperature	$T_j$	120	°C

$I_r$  conditions: Module is not designed for reverse current.  
 $T_{opr}$  conditions: Thermal resistance 30°C / W or less.  
 $T_j$  conditions: Maximum recommended long term junction temperature 115°C.  
 $I_{fp}$  conditions: Pulse width ≤ 10 msec. and duty cycle ≤ 1/10.

(4) MAXIMUM RATINGS FOR BLUE MODULE 5 AT NICHIA NS6B083 AND GREEN AT NICHIA NS6G083

Item	Symbol	Maximum ratings	Unit
Forward current	$I_f$	350	mA
Pulse forward current	$I_{fp}$	600	mA
Allowable reverse current	$I_r$	85	mA
Power Dissipation	$P_d$	1.54	W
Operating temperature	$T_{opr}$	- 30 ~ + 55	°C
Storage temperature and RH	$T_{stg}$	- 30 ~ + 45 / RH ≤ 70 %	°C
Dice temperature	$T_j$	120	°C

$I_r$  conditions: Module is not designed for reverse current.  
 $T_{opr}$  conditions: Thermal resistance 33°C / W or less.  
 $T_j$  conditions: Maximum recommended long term junction temperature 115°C.  
 $I_{fp}$  conditions: Pulse width ≤ 10 msec. and duty cycle ≤ 1/10.

(5) MAXIMUM RATINGS FOR RED MODULE 5 AT DOMINANT SEMICONDUCTORS RED SP NOVALED

Item	Symbol	Maximum ratings	Unit
Forward current	$I_f$	400	mA
Pulse forward current	$I_{fp}$	500	mA
Allowable reverse current	$I_r$	-	mA
Power Dissipation	$P_d$	1.20	W
Operating temperature	$T_{opr}$	- 40 ~ + 55	°C
Storage temperature and RH	$T_{stg}$	- 30 ~ + 45 / RH ≤ 70 %	°C
Dice temperature	$T_j$	125	°C

$I_r$  conditions: Module is not designed for reverse current.  
 $T_{opr}$  conditions: Thermal resistance 40°C / W or less.  
 $T_j$  conditions: Maximum recommended long term junction temperature 85°C.  
 $I_{fp}$  conditions: Pulse width ≤ 10 µsec. and duty cycle ≤ 1/10.

(6) RANKING FOR COOL WHITE MODULE 5 AT NICHIA NS6W083A

Item		Symbol	Condition	Min	Max	Unit
Forward voltage	Rank M	$V_f$	$I_f = 350$ [mA]	3.8	4.2	V
	Rank L			3.4	3.8	
Luminous Flux	Rank P17	$\Phi_v$	$I_f = 350$ [mA]	103	122	lm
	Rank P16			86	103	

Color rank b41				
<b>x</b>	0.306	0.304	0.330	0.330
<b>y</b>	0.323	0.330	0.360	0.350

Color rank b42				
<b>x</b>	0.307	0.306	0.330	0.330
<b>y</b>	0.315	0.323	0.350	0.339

- Luminous flux values are presented for LED itself within module.
- Two color bins solution minimizes variations.
- Shipment can consist of a combination of the above ranks.
- Up to 10 k modules of one bin can be supplied at once.
- Typical CCT is 6300 K  $\pm$  500 K.
- Forward Voltage Measurement allowance is  $\pm$  5%.
- Luminous flux Measurement allowance is  $\pm$  15%.
- Color coordinates Measurement allowance is  $\pm$  0.01 for LED.

(7) RANKING FOR COOL WHITE MODULE 5 AT NICHIA NS6W083B

Item		Symbol	Condition	Min	Max	Unit
Forward voltage	Rank L	$V_f$	$I_f = 350$ [mA]	3.4	3.8	V
	Rank K			2.8	3.4	
Luminous Flux	Rank B10	$\Phi_v$	$I_f = 350$ [mA]	120	132	lm
	Rank B09			108	120	

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Rank b41				
<b>x</b>	0.306	0.304	0.330	0.330
<b>y</b>	0.323	0.330	0.360	0.350

- Luminous flux values are presented for LED itself within module.
- Two color bins solution minimizes variations.
- Shipment can consist of a combination of the above ranks.
- Up to 10 k modules of one bin can be supplied at once.

Rank b42				
<b>x</b>	0.307	0.306	0.330	0.330
<b>y</b>	0.315	0.323	0.350	0.339

- Typical CCT is 6300 K ± 500 K.
- Forward Voltage Measurement allowance is ± 5%.
- Luminous flux Measurement allowance is ± 15%.
- Color coordinates Measurement allowance is ± 0.01 for LED.

(8) RANKING FOR WARM WHITE MODULE 5 AT NICHIA NS6L083B

Item		Symbol	Condition	Min	Max	Unit
Forward voltage	Rank L	$V_f$	$I_f = 350$ [mA]	3.4	3.8	V
	Rank K			2.8	3.4	
Luminous Flux	Rank B08	$\Phi_v$	$I_f = 350$ [mA]	96	108	lm
	Rank B07			84	96	

Rank f41				
<b>x</b>	0.4600	0.4680	0.4970	0.4870
<b>y</b>	0.4236	0.4385	0.4466	0.4302

- Luminous flux values are presented for LED itself within module.
- Two color bins solution minimizes variations.
- Shipment can consist of a combination of the above ranks.
- Up to 10 k modules of one bin can be supplied at once.

Rank f42				
<b>x</b>	0.4519	0.4600	0.4870	0.4770
<b>y</b>	0.4086	0.4236	0.4770	0.4137

- Typical CCT is 2650 K ± 150 K.
- Forward Voltage Measurement allowance is ± 5%.
- Luminous flux Measurement allowance is ± 15%.
- Color coordinates Measurement allowance is ± 0.01 for LED.

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(9) RANKING FOR BLUE MODULE 5 AT NICHIA NS6B083

Item		Symbol	Condition	Min	Max	Unit
Forward voltage	Rank M	$V_f$	$I_f = 350$ [mA]	3.8	4.2	V
	Rank L			3.4	3.8	
Luminous Flux	Rank P7	$\Phi_v$	$I_f = 350$ [mA]	18	22	lm
	Rank P6			14	18	

Rank W				
<b>x</b>	0.11	0.11	0.15	0.15
<b>y</b>	0.04	0.10	0.10	0.04

- Luminous flux values are presented for LED itself within module.
- One color bin solution eliminates all color variations.
- Shipment can consist of a combination of the above ranks.
- Up to 10 k modules of one bin can be supplied at once.
- Typical Wavelength is 464 nm  $\pm$  5 nm.
- Forward Voltage Measurement allowance is  $\pm$  5%.
- Luminous flux Measurement allowance is  $\pm$  15%.
- Wavelength measurement allowance is  $\pm$  2 nm.

(10) RANKING FOR GREEN MODULE 5 AT NICHIA NS6G083

Item		Symbol	Condition	Min	Max	Unit
Forward voltage	Rank M	$V_f$	$I_f = 350$ [mA]	3.8	4.2	V
	Rank L			3.4	3.8	
Luminous Flux	Rank P14	$\Phi_v$	$I_f = 350$ [mA]	61	73	lm
	Rank P13			52	61	

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	Rank G			
<b>x</b>	0.14	0.14	0.22	0.22
<b>y</b>	0.64	0.74	0.74	0.64

- Luminous flux values are presented for LED itself within module.
- One color bin solution eliminates all color variations.
- Shipment can consist of a combination of the above ranks.
- Up to 10 k modules of one bin can be supplied at once.
- Typical Wavelength is 464 nm ± 5 nm.
- Forward Voltage Measurement allowance is ± 5%.
- Luminous flux Measurement allowance is ± 15%.
- Wavelength measurement allowance is ± 2 nm.

(11) RANKING FOR RED MODULE 5 AT DOMINANT SEMICONDUCTORS RED SP NOVALED

Item		Symbol	Condition	Min	Max	Unit
Forward voltage	Rank 03	$V_f$	$I_f = 350$ [mA]	2.4	2.7	V
	Rank 02			2.1	2.4	
Luminous Flux	Rank AB	$\Phi_v$	$I_f = 350$ [mA]	25	30	lm

Rank	NPR	
Wavelength [nm]	min	max
Value	620	630

- Luminous flux values are presented for LED itself within module.
- One color bin solution eliminates all color variations.
- Shipment can consist of a combination of the above ranks.
- Only forward voltage is variable parameter in shipments.
- Typical Wavelength is 625 nm ± 5 nm.
- Forward Voltage Measurement allowance is ± 5%.
- Luminous flux Measurement allowance is ± 15%.
- Wavelength measurement allowance is ± 2 nm.

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(12) INITIAL OPTICAL / ELECTRICAL CHARACTERISTICS

Please refer to figure's page.

(13) OUTLINE DIMENSIONS AND MATERIALS

Please refer to figure's page.

Material as follows;

LED	; according component manufacturer.
Solder	; SAC 405 with additional Ag content.
Cover	; fire protected and UV blocking polycarbonate.
Wire	; PVC insulated and tin coated solid core copper (90 °C).
Encapsulating adhesive	; acryl adhesive with fluorescing additive.
PCB	; Al <sub>2</sub> O <sub>3</sub> ceramic with Ag plating's.
Thermally conductive tape	; acrylic foam adhesive with thermally conductive filler.

(14) PACKAGING

- The LED-modules are packed in cardboard boxes after reeling. Please refer to figure's page.
- The label on the minimum packing unit shows article number, color, LED, module lot number, LED lot number, LED ranking and quantity.
- In order to protect the LED-modules from mechanical shock, modules are packed in cardboard boxes for transportation.
- The LED-modules may be damaged if the boxes are dropped or receive a strong impact against them.
- The boxes are not water resistant and therefore must be kept away from water and moisture.
- When the LED-modules are transported, we recommend that you use the same packing method as Imagon.

(15) LOT NUMBER

The lot number is composed of the following characters;

□□□□	First four numbers are Imagon lot number according module type.
⊗⊗⊗⊗	Second four numbers lot number of LED-manufacturer; each value (0001 etc) present one lot. (In one lot color variations are smallest.)
⊕⊕⊕	1 ... 3 characters ranking at LED color or color coordinates according LED type.
⊗⊗⊗	2 ... 3 characters ranking at LED luminous flux.
OO	1 ... 2 characters ranking at LED forward voltage.

□□□□ ⊗⊗⊗⊗ ⊕⊕⊕ ⊗⊗⊗ OO Underlined characters are always presented in module lot number.

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(16) RELIABILITY TESTING

Nr	Test type	Test content	Test standard	Test conditions	On / off	Duration
1	Very low ambient temperature	Extra low temperature reliability	IEC 60068-2-1, Ad	Ambient temperature $\leq -40^{\circ}\text{C}$	On	16 hours
2	Low ambient temperature	Low temperature reliability	IEC 60068-2-1, Ad	Ambient temperature $\leq +5^{\circ}\text{C}$	On	96 hours & on going
3	Normal ambient temperature	Normal conditions reliability	IEC 60068-2-2, Bd	Ambient temperature $+30^{\circ}\text{C}$	On	96 hours & on going
4	High ambient temperature	High temperature reliability	IEC 60068-2-2, Bd	Ambient temperature $+45^{\circ}\text{C}$	On	96 hours & on going
5	Very high ambient temperature	Very high temperature reliability	IEC 60068-2-2, Bd	Ambient temperature $+60^{\circ}\text{C}$	On	96 hours & on going
6	Very high humidity and ambient temperature	Material compatibility, heat and moisture resistance	IEC 60068-2-76, Cab	Ambient temperature $+85^{\circ}\text{C}$ ; RH = 85%;	On, cyclic 30 min. on-off	1000 hours
7	Power cycling	Cyclic operation durability, moisture resistance	Imagon internal test method	$-40^{\circ}\text{C} \dots +85^{\circ}\text{C}$ ; RH 90%, $\approx 2^{\circ}\text{C} / \text{min.}$ transfer with 30 min. stabilising	On, cyclic 30 min. on-off	1000 hours
8	Thermal shock	Durability of bondings, LED's and solderings	IEC 60068-2-14	$-40^{\circ}\text{C} \dots +125^{\circ}\text{C}$ , 250 cycles, < 3 min. total transfer with 30 min. stabilising	Off	250 hours
9	Salt spray	Sea atmosphere and corrosion resistance	ISO 9227 NSS	$+35^{\circ}\text{C}$ , 5% salt water, neutral salt spray test	On (accelerates corrosion)	168 hours
10	Chemical compatibility	Chemical resistance	Imagon internal test method	Samples brushed at chemical and kept in $+50^{\circ}\text{C}$	On (accelerates corrosion)	168 hours
11	Cold storage	Storing specification lowest temperature limit	IEC 60068-2-1, Ab	$-40^{\circ}\text{C}$ , gradual change of temperature $1^{\circ}\text{C}$ to $10^{\circ}\text{C}$ per min.	Off	72 hours
12	Dry heat storage	Storing specification highest temperature limit	Modified test from IEC 60068-2-2, Bb	$+85^{\circ}\text{C}$ , gradual changes of temperature not performed	Off	96 hours
13	High humidity storage	Storing specification humidity limits	IEC 60068-2-30, Db	$-40^{\circ}\text{C} \dots +30^{\circ}\text{C}$ , 95% RH, Damp heat cyclic variant 1	Off	24 h / 2 cycles
14	Random vibration (delivery and installation)	Packaged and installed products vibration resistance	IEC 60068-2-64, Fh	ASD $1 \text{ m}^2/\text{s}^2$ , 5-20 Hz, 20-200 Hz -3 dB/oct, 3 x 30 min	On, off	1,5 hrs
15	Mechanical shocks and bumps (delivery)	Packaged and installed products shock resistance	IEC 60068-2-29, Eb	Bump, Half sine, 6 ms, $180 \text{ m}/\text{s}^2$ , 6 directions 100 pcs in each direction	On, off	1,5 hrs
16	Free fall (delivery)	Packaged and installed products falling test	IEC 60068-2-32, Ed	$1,2 \text{ m} < 20 \text{ kg}$ , 1 fall / face, if weight is $< 5\text{kg}$ , Jig for samples	Off	4 hrs
17	Outdoor use within IP23 case	Integral module test	Imagon internal test method	Modules operates in outdoors within IP23 case	On, off, on-off	On going
18	IP - class tests	IP- classification	IEC 60529 - IP 66	Accordinging standard	Accordinging standard	Acc. std.
19	Product safety	Product reliability, CE, FI	IEC 62031 - Ed. 1	Accordinging standard	Accordinging standard	Acc. std.

(Routine testing started for module 5 during 4/2009)

<b>Damage judgement rules</b> (I.L. = initial level)
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No visible changes, $V_{fmax}$ 1.1 x I.L., $Flux_{min}$ 0.7 x I.L., $\Delta CCT_{max}$ 100 K, 0.5 x wires I.L. pulling force
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The tests are performed after the evaluation board is cooled down to the room temperature. Nichia white NS6W083A and Dominant Semiconductors red SP Novald are tested, generally at least 32 pcs sample per test.

#### (17) RECOMMENDED CIRCUIT

In designing a circuit, the current through each LED must not exceed its maximum rating. It is recommended to use circuit which regulates the current flowing through each LED. Constant current drivers are primary supplies for these modules.

These products should be operated in forward bias. If reverse voltage is applied to product during installation or in application continuously, such operation can cause migration resulting LED damage. Modules which are subjected for reverse bias in installation should to be changed due possibility for reduced lifetime.

#### (18) CLEANING, SOLVENTS AND CHEMICAL COMPATIBILITY

It is recommended that isopropyl alcohol to be used as a solvent for cleaning the LED-modules. When using other solvents, it should be confirmed beforehand whether the solvents will dissolve the packaging materials or not. Freon solvents should not be used to clean the LEDs because of worldwide regulations. Do not clean the LED modules by the ultrasonic.

In some application conditions module thermally adhesive tape may be subjected for aggressive chemicals. This may cause the radical change of thermal PAD properties. Especially large care is needed when structural adhesive glues with volatile ksylene content are applied in same assembly with modules. If the assembly is closed, vaporized ksylene gases could cause tape adhesion failure.

Imagon can supply from request a list of harmful substances for all materials applied in module. If very exotic substances are applied in the same areas where modules are used, chemical compatibility can be ensured separately as well.

(19) STATIC ELECTRICITY

All module 5 components are protected against static electricity according human body model (HBM). Static electricity or surge voltage damages the LEDs, but LED within module is typically not subjected to electro-static discharge directly. However, care is needed and it is not recommended to avoid for example plastic sheets handling just before module assembly work.

When inspecting the final products in which LEDs were assembled, it is recommended regularly to check whether the assembled LEDs are damaged by static electricity or not. It is easy to find static- damaged LEDs by a light-on test or a VF test at lower current (below 6 mA is recommended). Damaged LEDs will show some unusual characteristics such as the forward voltage becomes lower, or the LEDs do not light at the low current. Criteria: ( $V_f > 2.0V$  at  $I_f = 3mA$ ).

(20) HEAT GENERATION AND MODULE TC-POINT

Thermal design of the end product is of paramount importance. Please consider the heat generation of the LED when making the system design. The coefficient of temperature increase per input electric power is affected by the thermal resistance of the module fixed to the cooling element, for example to signage structure made preferably from aluminum. It is necessary to avoid intense heat generation and operate within maximum ratings of LED given in this specification. Also it is necessary to ensure that materials applied in the sign conducts heat well enough outside from the sign. For example foam PVC sheet applied in structure may cause too high temperatures within the sign because thermal conduction away from sign is stopped.

Please determine the ambient temperature local to the LED and refer result of ambient temperature to module later presented Tc-point temperatures. Please consider also to removing heat from the area near the LED (heat sink) to improve the operational characteristics of the LED.

The equation 1. indicates correlation between  $T_j$  and Tc-point of the module.

$$T_j = T_c + R_{j-Tc} \times W \tag{1.}$$

$T_j$	Dice (junction) temperature	°C
$T_c$	Module Tc-point temperature	°C
$R_{j-Tc}$	Thermal resistance from dice (junction) to Tc-measuring point	°C/W
$W$	Input Power of LED ( $I_f \times V_f$ )	W

Thermal resistances of modules LED-packages,  $R_{j-Tc}$  (junction to Tc-point):

Cold white	NS6W083A	16	°C/W
Cold white	NS6W083B	10	°C/W
Warm white	NS6L083B	10	°C/W
Blue	NS6B083	16	°C/W
Green	NS6G083	16	°C/W
Red	SP NovaLED	20	°C/W

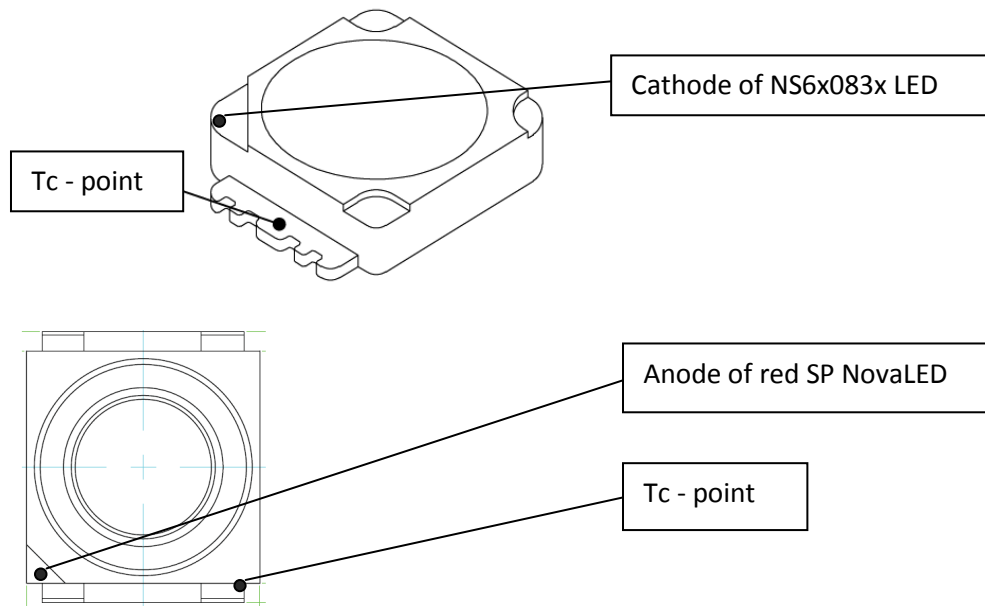
In fact, it can be seen from figures above, that due the lower internal thermal resistance components NS6W083B and NS6L083B can be driven in higher temperatures. These LEDs operational temperatures are still determined according 16 °C/W thermal resistance, because variations in the module operational temperature limits are this way minimized.

It is recommended to apply large cooling plate for each module. When modules are applied in thick letters and at over 10 cm intervals (cooling plate area 100 cm<sup>2</sup>), cooling area is generally always large enough. Care is necessary when modules are applied more densely, for example in thin letters.

Temperature limits mentioned in this document are determined for 1 mm thick aluminum cooling plates which areas are 50 cm<sup>2</sup> or more and in these cases the allowed thickness of the powder coating is ≤ 200 μm. Most recommended structural aluminum sheet is factory pre-coated.

The following table can be used as initial reference for cooling element size and temperature limits. Values for red module are 5 °C lower than values presented in table. The presented thermal resistances are determined from LED Tc-point to ambient.

Single module colour	Module $T_{a \max}$ °C	Module $T_{c \max}$ °C	$R_{T_c - \text{ambient}}$ °C / W	Heat sink surface $\text{cm}^2$
Green / Blue / White / Warm white	+ 40 °C	+ 80 °C	30 °C / W	18 $\text{cm}^2$
Green / Blue / White / Warm white	+ 50 °C	+ 80 °C	24 °C / W	34 $\text{cm}^2$
Green / Blue / White / Warm white	+ 60 °C	+ 80 °C	17 °C / W	50 $\text{cm}^2$



The image shows the Tc point determination in modules which are made at Nichia NS6x083x components. Also lower image shows the Tc-point location in the Dominant Semiconductors red SP NovaLED components.

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The measuring of Tc-point (Tc) temperatures is the practical method to ensure system operational temperature limits. Maximum allowable ambient temperature for system can be obtained at measuring Tc-point temperature. Measured Tc-point temperature result is reduced from Tc-point maximum temperature of 80 °C. When result is added to ambient temperature during measurement, the system operational temperature maximum is known. It is necessary to measure assembly worst case LED in this analysis.

If module needs to be driven at full power with small cooling element, it is necessary to eliminate possibility of LED operating with too high junction temperatures. This can be simple done with bi-metallic switch in sign supply. For example Limitor GmbH in Germany supplies outdoor rated 230 VAC / 16 A bi-metallic switches, which suits well to this purpose.

Signs operate in too high ambient temperatures when they are from reason or another on in direct sunlight. Under these conditions sign internal LED-lighting is not visible due the strong sunlight. Therefore safety switching of sign supply is generally acceptable; changes in light output are not easily noticeable.

#### (21) THERMALLY CONDUCTIVE TAPE

Modules have to be installed on a heat sink at thermally conductive adhesive tape on the back of the ceramic board. Modules must be installed with this adhesive tape and finger lift eases installation. To ensure permanent adhesion the fixing/cooling surface must be cleaned before installing the power LED modules to remove all dirt, dust and grease. Tape needs to be compressed 2 ... 5 seconds. Apply tape over +15 °C ambient.

Thermally conductive tape has adhered and remained in contact very well with PET and epoxy based powder coatings. Still the adhesion further ensuring with powder coat applied is necessary. Consult Imagon in this case.

#### (22) CONNECTORS

Recommended connectors to module string connection are 3M UR2 and UY2 connectors, also Tyco and Wago have some suitable connector series. Other connectors suited to application conditions and wire cross-section (0.28 mm<sup>2</sup>) can be applied as well. When using gel-filled connectors, avoid grease contamination for the surface where thermally adhesive tape is applied.

(23) EYE SAFETY

The International Electrical Commission (IEC) published in 2006 IEC 62471:2006 “Photobiological safety of lamps and lamp systems” which includes LEDs within its scope. Following IEC 62471:2006, most module 5`s can be classified either exempt group or risk group 1. Optical characteristics of a LED such a output power, spectrum and light distribution are factors that affect the risk group determination of the LED. Especially a high power LED, that emits light containing blue wavelengths, may be in risk group 2.

Great care should be taken when viewing directly the LED driven at high current or the LED with optical instruments, which may greatly increase the hazard risk for your eyes. It is recommended to use suitable protection glasses at least. Best solution is to determine required protections with local work safety authorities.

(24) INTEGRAL MODULE

The International Electrical Commission (IEC) published in 2008 IEC 62031:2008 “LED Modules” which includes LED-modules within its scope. The LED-modules described in this brochure are intended to be used for ordinary electronic equipment (such as signage luminaries generally are) as integral part according IEC 62031:2008. Heat conductive tape adheres in long term so tightly, that components are very difficult to separate later without breaking them. Warning labels from bright light should to be applied in final product.

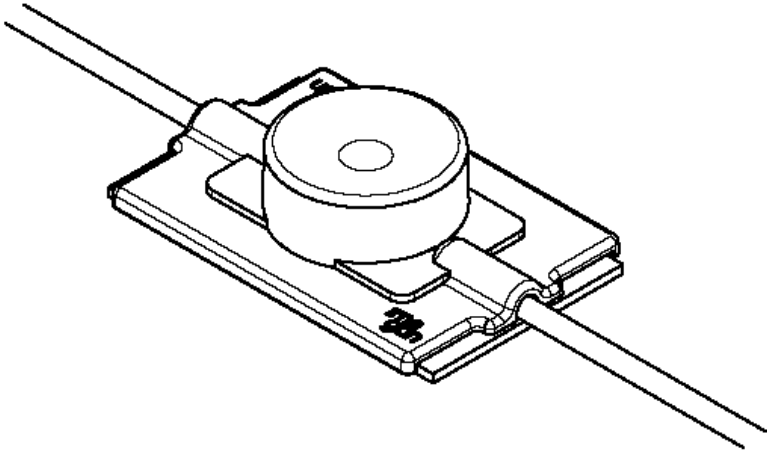
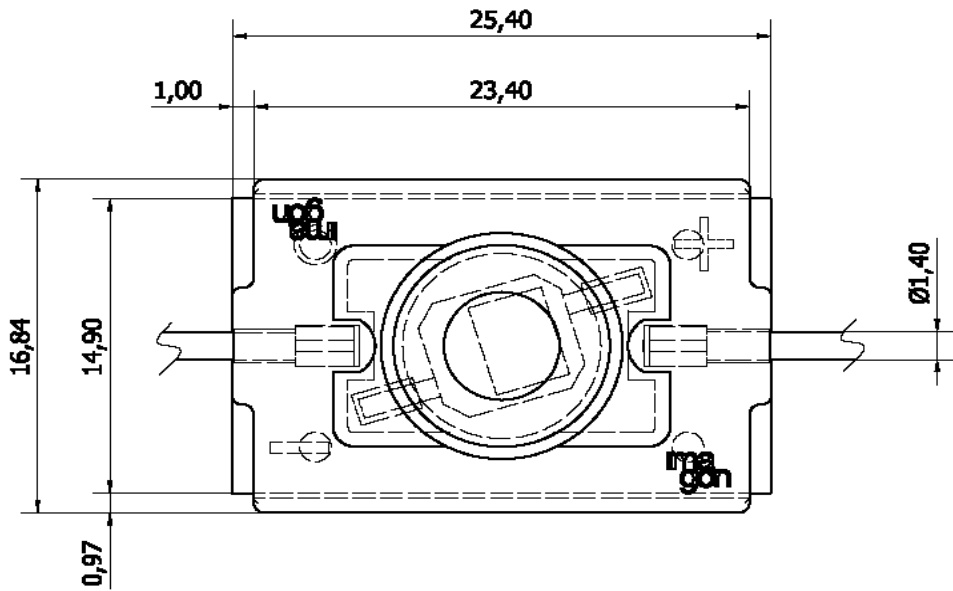
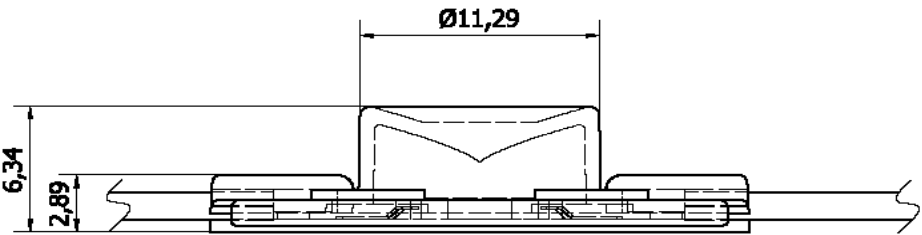
(25) OTHERS

LED-modules comply with LVD, REACH and RoHS Directive (CE, FI). The LED light output is strong enough to injure human eyes. Precautions must be taken prevent looking directly at the LEDs with unaided eyes for more than a few seconds. Flashing lights have been known to cause discomfort in people; you can prevent this by taking precautions during use. Also, people should be cautious when using equipment with LEDs incorporated into it.

If defective modules are found, the user shall inform Imagon directly before disassembling or analysis. The appearance and specifications of the product may be modified for improvement without notice.

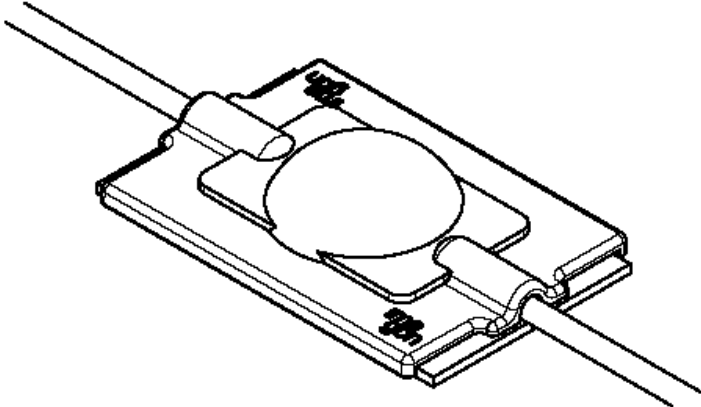
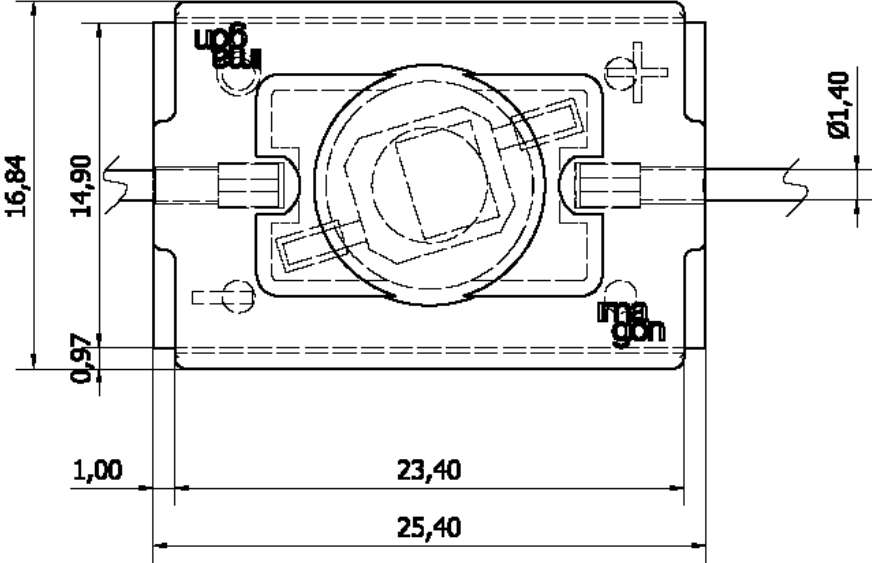
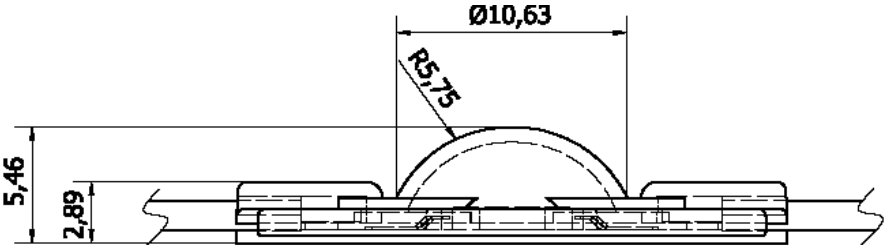
This module 5 specification revision is 1.0 and it is released 1.6.2009.

Unit: [mm]



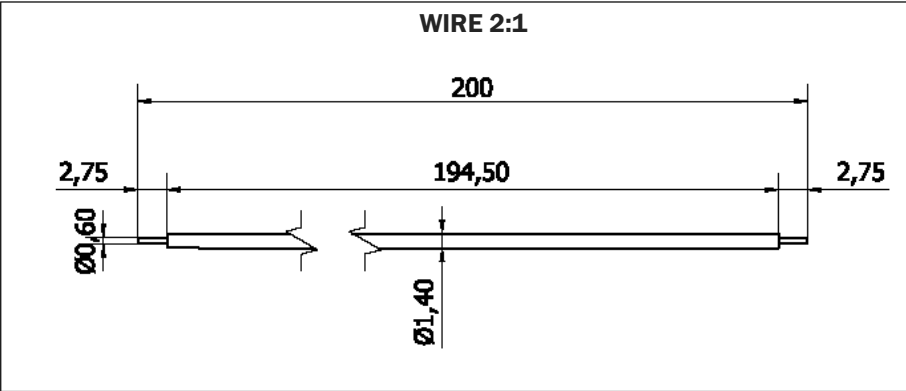
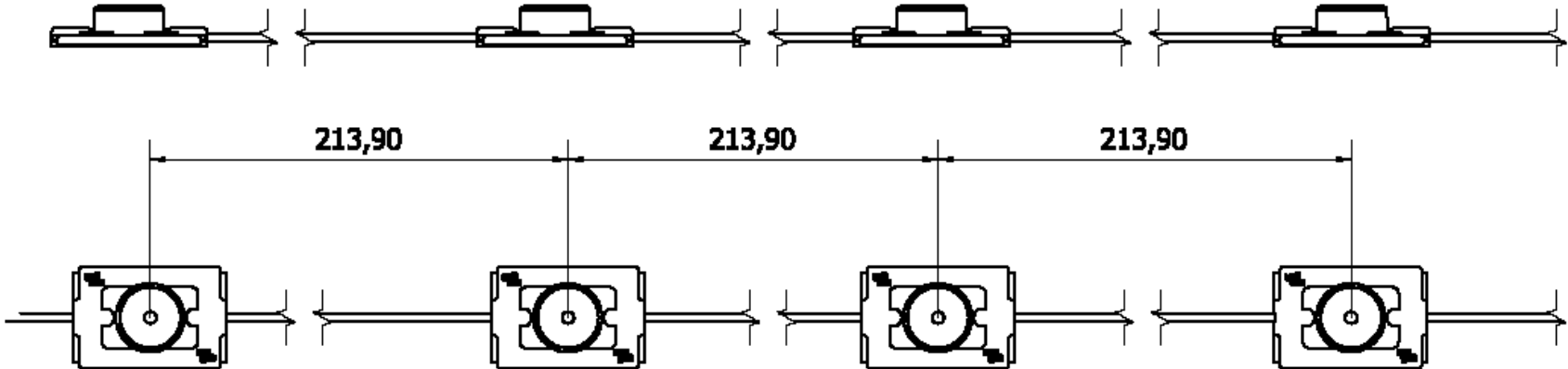
IMAGON Ltd	Model	MODULE 5	
	Title	SIDE-EMITTER	

Unit: [mm]



IMAGON Ltd	Model	MODULE 5	
	Title	LAMBERTIAN	

Unit: [mm]



WIRE COLORS:

- NS6W083A, NS6W083B & NS6L083B      WHITE
- NS6B083    BLUE
- NS6G083    GREEN
- SP NOVALED    RED

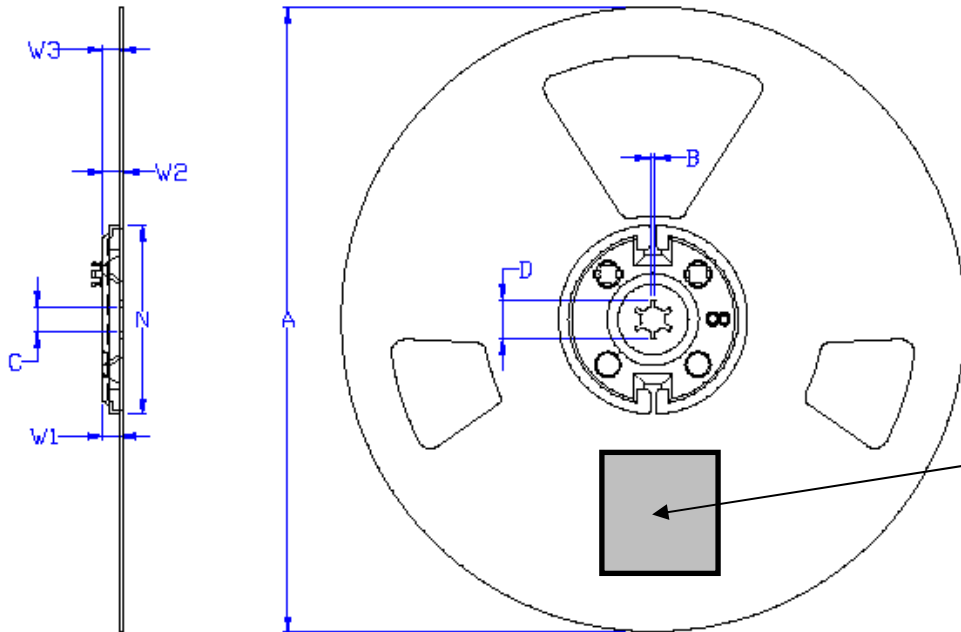
Visual control to module colors at seeing wire color only.

IMAGON Ltd	Model	MODULE 5	
	Title	WIRING	

Imagon M5 – 001 [20/21]

Width	A	B (min)	C	D (min)	N	W1	W2 (max)	W3 (min)	W3 (max)
8	330 ±2	1.5	13 <sup>+0.5</sup> / <sub>-0.1</sub>	20.2	100 ±1	8.2 <sup>+1.0</sup> / <sub>-0.0</sub>	11.2	7.95	9.7

Unit: [mm]



Paper liner between module layers prevent modules stacking.  
All colors and types 100 modules / reel.

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**SIDE-EMITTER LED MODULE 5**

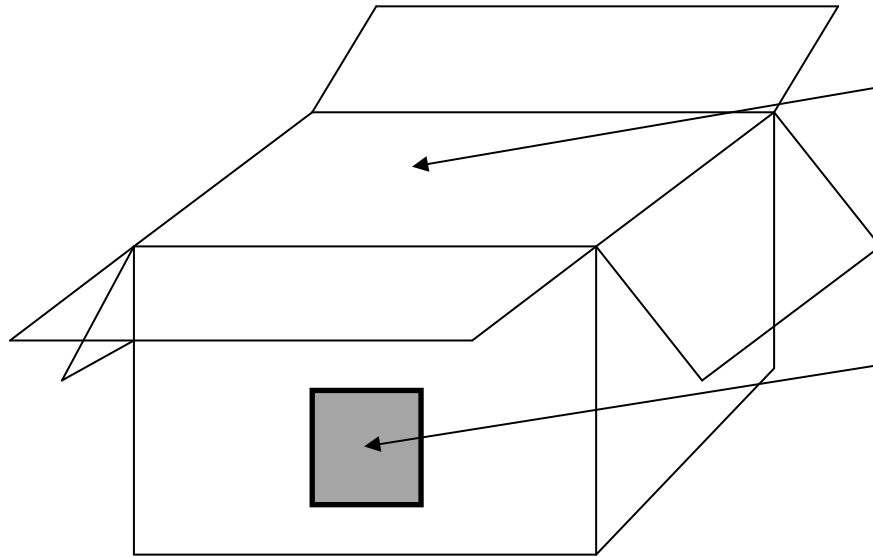
ARTICLE NUMBER 09010302  
 COLOR COOL WHITE 6300 K  
 LED NS6W083B  
 LOT 0001 0001 B41P16M  
 QTY 100 PCS

ROHS
REACH
CE

**imagon oy**  
[www.imagon.com](http://www.imagon.com)

Tekojenkatu 13  
 87400 KAJAANI  
 VAT no: FI08482582  
 Finland

IMAGON Ltd	Model	MODULE 5
	Title	REEL



Up to 7 reels are packaged on each others.

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**SIDE-EMITTER LED MODULE 5**

ARTICLE NUMBER 09010302

COLOR COOL WHITE 6300 K

LED NS6W083B

LOT 0001 0001 B41P16M

QTY 700 PCS

ROHS
REACH
CE

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www.imagon.com

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 VAT no: FI06482582  
 Finland

Box size	Dimensions [mm]	Reel / box	Quantity / pcs
Cardboard S	340 x 340 x 100	≤ 5 reel	500 (max.)
Cardboard M	340 x 340 x 140	≤ 7 reel	700 (max.)

Other packaging quantities need to be considered separately.  
 Minimum packaging quantity is still one reel, thus 100 pcs.  
 Other packaging quantities are determined at 1 reel intervals.

IMAGON Ltd	Model	MODULE 5	
	Title	PACKAGING	