Faculté de **physique et ingénierie**
Université de Strasbourg

Examen LPro. Efficacité Énergétique
Technologie des éclairages

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A lire avant de commencer l'examen :

— Mettez votre Nom sur la copie
— Calculatrice interdite
— Durée de l'examen : 1h

1 Analyse d'un module LED Tridonic QLE CRI90 ADV5

1. (a) Quelles sont les deux températures de couleur disponibles pour les modules Tridonic QLE CRI90 ADV5 ?
   (b) Quelle température de couleur tire sur le jaune et laquelle se rapproche de la lumière du jour ?
   (c) Quelle température de couleur est actuellement privilégiée dans un environnement de travail ?

   ...

2. Que signifie High Colour rendering index CRI>90

   ...

3. Tridonic précise dans la documentation *LED system solution with outstanding system efficacy up to 156 lm/W, consisting of squared LED modules and dimmable LED Driver LCA 50W 150–400mA lp PRE* et dans la ligne juste en-dessous *Efficacy of the module up to 169 lm/W.*
   (a) Pourquoi Tridonic précise deux valeurs de rendements pour son module LED ?

   ...

4. La documentation technique *Luminous flux range from 1,000 – 2,430 lm*, mais quel est le flux nominal pour lequel ce module Led est vendu ?

   ...

5. La documentation technique indique *Small colour tolerance MacAdam 3*, expliquez ce que cela représente et indiquez si pour vous, la valeur MacAdam 3 représente une bonne qualité ou non.

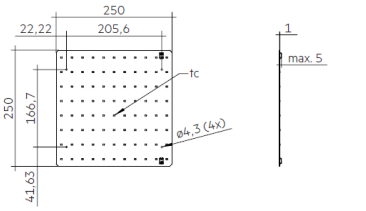
   ...

6. Traduisez
   — Small luminous flux tolerances. Perfectly uniform light, even if several LED modules are used together in a line
   — Self cooling (no additional heat sink required)
   — Push terminals for quick and simple wiring of LED module to LED module

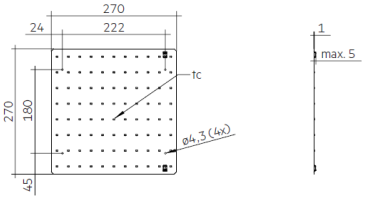
   ...

7. Le constructeur donne les caractéristiques suivantes :

Technical data	
Beam characteristic	120°
Ambient temperature range	-40 ... +65 °C
tp rated	45 °C
tc	90 °C
Irated for 250x250 / 270x270mm	200 mA
Imax for 250x250 / 270x270mm	1,200 mA
Max. permissible LF current ripple for 250x250 / 270x270mm	1,320 mA
Max. permissible peak current for 250x250 / 270x270mm	2,400 mA / max. 10 ms
Max. working voltage for insulation[4]	405 V
Insulation test voltage	1.81 kV
CTI of the printed circuit board	≥ 600
ESD classification	severity level 4
Risk group (IEC 62471:2008)[5]	RG1
Classification acc. to IEC 62031	Built-in
Type of protection	IP00
Life-time	up to 72,000 h



QLE 250x250mm 1250lm ADV5



QLE 270x270mm 1250lm ADV5

FIGURE 1 – Tableau 1

Expliquez la signification des courants, $I_{rated} = 200mA$, $I_{max} = 1200mA$, Max. permissible peak current for 250x250/270x270mm 2400mA/ max 10ms.

...

8. D'après les caractéristiques données ci-dessus, le module Led est-il à faisceau large ou étroit ? Justifiez par une valeur.

...

9. Le constructeur nous donne les caractéristiques électriques suivantes pour le module LED :

Specific technical data

Type[4]	Photo-metric code	Typ. luminous flux at tp = 25 °C[4]	Typ. luminous flux at tp = 45 °C[4]	Typ. forward current	Min. forward voltage at tp = 45 °C	Max. forward voltage at tp = 25 °C	Typ. power consumption at tp = 45 °C[4]	Efficacy of the module at tp = 25 °C	Efficacy of the module at tp = 45 °C	Efficacy of the system at tp = 45 °C	Colour rendering index CRI
QLE 250x250 / 270x270 mm – Operating mode NM at 200 mA											
QLE 250x250mm 1250lm 930 ADV5	930/359	970 lm	930 lm	200 mA	27.0 V	31.0 V	5.7 W	168 lm/W	162 lm/W	149 lm/W	> 90
QLE 250x250mm 1250lm 940 ADV5	940/359	1,010 lm	960 lm	200 mA	27.0 V	31.0 V	5.7 W	175 lm/W	169 lm/W	156 lm/W	> 90
QLE 270x270mm 1250lm 930 ADV5	930/359	970 lm	930 lm	200 mA	27.0 V	31.0 V	5.7 W	168 lm/W	162 lm/W	149 lm/W	> 90
QLE 270x270mm 1250lm 940 ADV5	940/359	1,010 lm	960 lm	200 mA	27.0 V	31.0 V	5.7 W	175 lm/W	169 lm/W	156 lm/W	> 90
QLE 250x250 / 270x270 mm – Operating mode NM at 250 mA											
QLE 250x250mm 1250lm 930 ADV5	930/359	1,210 lm	1,160 lm	250 mA	27.2 V	31.2 V	7.2 W	167 lm/W	162 lm/W	149 lm/W	> 90
QLE 250x250mm 1250lm 940 ADV5	940/359	1,260 lm	1,210 lm	250 mA	27.2 V	31.2 V	7.2 W	172 lm/W	167 lm/W	154 lm/W	> 90
QLE 270x270mm 1250lm 930 ADV5	930/359	1,210 lm	1,160 lm	250 mA	27.2 V	31.2 V	7.2 W	167 lm/W	162 lm/W	149 lm/W	> 90
QLE 270x270mm 1250lm 940 ADV5	940/359	1,260 lm	1,210 lm	250 mA	27.2 V	31.2 V	7.2 W	172 lm/W	167 lm/W	154 lm/W	> 90

FIGURE 2 – Tableau 2

Pour quelle valeur de courant et pour quelle température de couleur, obtient t'on le meilleur rendement pour un module de 250x250mm ?

...

10. Le constructeur communique sur les caractéristiques du module autour de deux températures : $t_p = 45°C$ et $t_p = 25°C$. Laquelle de ces deux températures correspond à la température nominale de fonctionnement du module ? (cf Tableau 1)

...

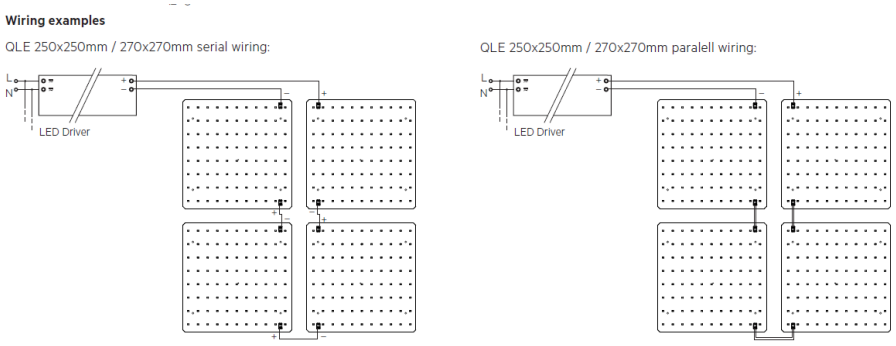
11. À votre avis, pourquoi Tridonic a choisi de communiquer autour la valeur de rendement de 169 lm/W pour le module LED alors que des valeurs de rendements plus importantes sont données dans la documentation technique ?

...

12. Pour un module **QLE 250x250mm 1250lm 940 ADV5 en Operating mode NM at 200 mA**, donnez la plage de tension de seuil minimale (pour $t_p = 45°C$) du module et la puissance électrique absorbée par le module :

...

13. Le constructeur nous propose deux possibilités de câblage pour le module (série/parallèle) :



Dans le cas de modules QLE 250x250mm 1250lm 940 ADV5 en Operating mode NM at 200 mA

(a) Pour le cas d'un câblage série de 4 modules comme représenté dans le schéma ci-dessus à gauche, indiquer la tension de sortie minimale que doit pouvoir fournir le driver LED.

(b) Toujours pour le cas d'un câblage série de 4 modules, indiquer le courant qui traverse chacun des modules et le courant que doit fournir le driver.

(c) Pour le cas d'un câblage parallèle de 4 modules comme représenté dans le schéma ci-dessus à droite, indiquer la tension de sortie minimale que doit pouvoir fournir le driver LED.

(d) Toujours pour le cas d'un câblage parallèle de 4 modules, indiquer le courant qui traverse chacun des modules et le courant que doit fournir le driver.

...

14. Tridonic nous donne les caractéristiques suivantes pour les durées de vie des modules :

4.1 Life-time, lumen maintenance and failure rate

The light output of an LED Module decreases over the life-time, this is characterized with the L value.
L70 means that the LED module will give 70 % of its initial luminous flux.
This value is always related to the number of operation hours and therefore defines the life-time of an LED module.

As the L value is a statistical value and the lumen maintenance may vary over the delivered LED modules.
The B value defines the amount of modules which are below the specific L value, e.g. L70B10 means 10 % of the LED modules are below 70 % of the initial luminous flux, respectively 90 % will be above 70 % of the initial value.
In addition the percentage of failed modules (fatal failure) is characterized by the C value.

The F value is the combination of the B and C value. That means for F degra-dation and complete failures are considered, e.g. L70F10 means 10 % of the LED modules may fail or be below 70 % of the initial luminous flux.

4.2 Lumen maintenance for QLE

QLE 250x250mm / 270x270mm:

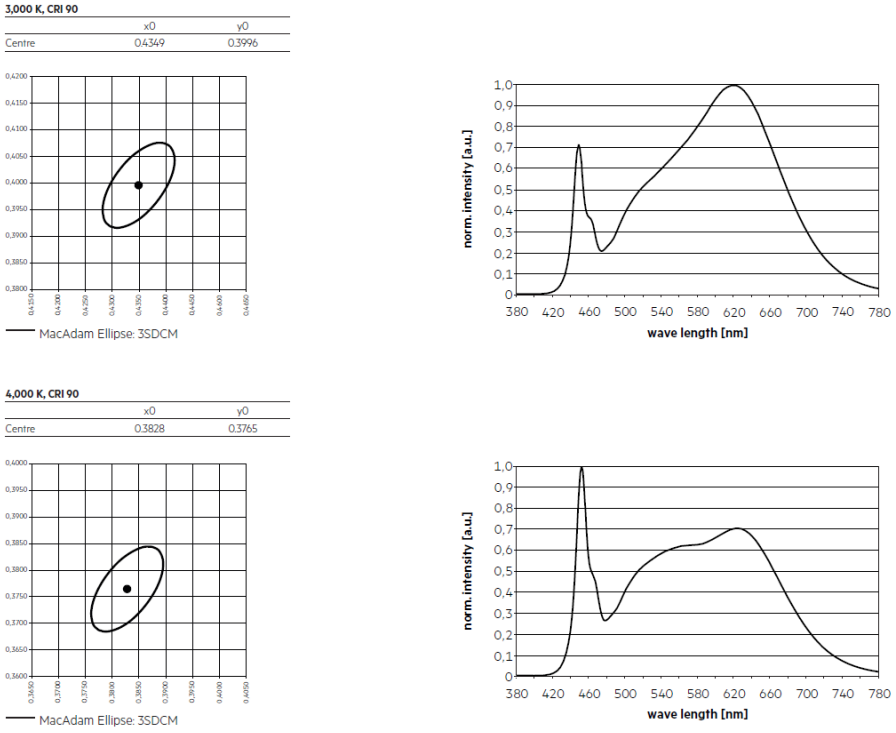
Forward current	tp temperature	L90 / F10	L90 / F50	L80 / F10	L80 / F50	L70 / F10	L70 / F50
200 mA	40 °C	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	50 °C	64,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	60 °C	57,000 h	69,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
250 mA	40 °C	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	50 °C	64,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	60 °C	57,000 h	69,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
300 mA	40 °C	71,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	50 °C	64,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	60 °C	57,000 h	68,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
350 mA	40 °C	71,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	50 °C	63,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	60 °C	56,000 h	68,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
400 mA	40 °C	71,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	50 °C	63,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	60 °C	56,000 h	68,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
450 mA	40 °C	70,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	50 °C	63,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	60 °C	56,000 h	67,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
500 mA	40 °C	70,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	50 °C	62,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	60 °C	56,000 h	67,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h

(a) Que signifie L90/F10 ?

(b) Dans quelle configuration d'alimentation et de température faut il se placer pour maximiser la durée de vie des modules ?

...

15. Les spectres des modules LED pour des TC de 3000K et 4000K sont représentés ci-dessous :



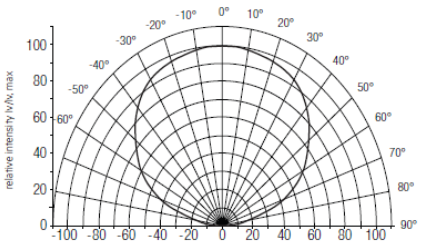
Dans un contexte d'installation de luminaires pour une micro-crèche, sur quel aspect conseillerez vous le client et quelle TC préconiseriez d'installer ?

...

16. Les caractéristiques du module LED nous donne des graphiques : "Relative luminous flux vs. tp temperature" et "Relative luminous flux vs. Operating current"

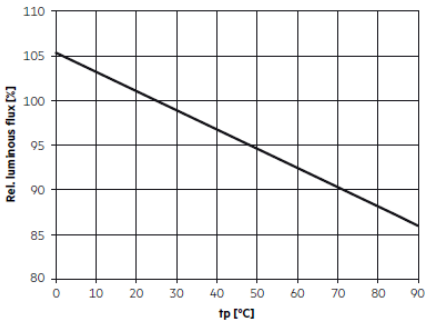
6.2 Light distribution

The optical design of the QLE product line ensures optimum homogeneity for the light distribution.



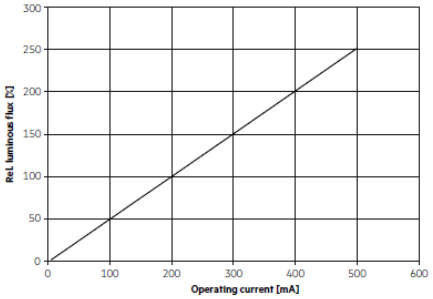
The colour temperature is measured integral over the complete module. The single LED light points can have deviations in the colour coordinates within MacAdam tbd.
To ensure an ideal mixture of colours and a homogeneous light distribution a suitable optic (e. g. PMMA diffuser) and a sufficient spacing between module and optic (typ. 6 cm) should be used.

6.3 Relative luminous flux vs. tp temperature



6.4 Relative luminous flux vs. operating current

QLE 250x250mm / 270x270mm:



7. Miscellaneous

7.1 Additional information

Additional technical information at www.tridonic.com → Technical Data

Guarantee conditions at www.tridonic.com → Services

Life-time declarations are informative and represent no warranty claim.

Que pouvez vous conclure de ces deux graphiques ? Que ce passe-t-il si on augmente le courant (niveau thermique) ? Conclure

...

17. A la suite de cette analyse, pensez-vous avoir affaire à un module LED de haute qualité, qualité standard, basse qualité ? Justifiez.

...

2 Analyse d'un driver LED LCA 10W 150–400mA C PRE

1. Quelle est la puissance max que peut fournir ce driver ?

   ...

2. Que signifie
   (a) *Up to 82 % efficiency* ?
   (b) *Power input on stand-by < 0.2 W* ?
   (c) *Nominal life-time up to 100,000 h* ?

   ...

3. Nous souhaitons utiliser ce driver pour piloter le module LED vu dans la section 1. Est-il compatible ?
   (a) Justifer par rapport aux courants possibles pour le driver
   (b) Justifer par rapport à la plage tension de sortie possible pour le driver

   ...

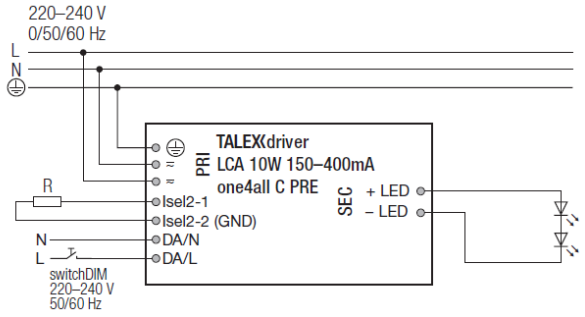
4. Par quel dispositif règle t-on le courant constant de sortie du driver et quelle valeur doit on choisir pour obtenir un courant constant de 200mA ?

   ...

5. S'agit-il d'un driver DALI ?

   ...

6. Que permet le switchDIM sur le schéma ci-dessous ?



...

7. Dans quel cas précis atteind t-on le rendement maximum avec ce driver ?

...

8. En terme de rendement, de facteur de puissance, de THD, vaut il mieux travailler à pleine charge avec ce driver (100 %) ou en gradation à demi-charge (50%) ?

...

9. D'après les caractéristiques ce de driver, le considèreriez vous comme de haute qualité ? de qualité standard ? ou de basse qualité ? Justifiez.

...

3 Normes et caractéristiques photométriques

1. Quelle norme régit l'éclairage public ?

   ...

2. L'application de la norme pour l'éclairage public, est elle obligatoire ?

   ...

3. Quelle norme est relative aux installations électriques extérieures (mobilier urbain, abris bus ...) ?

   ...

4. Quelle norme régit l'éclairage des lieux de travail ?

   ...

5. Quel est l'unité de l'éclairement ? Avec quel appareil mesure t'on l'éclairement ?

   ...

6. Qu'est ce que l'UGR ? Préciser la valeur max pour une salle de TD ?

   ...

7. Je possède un spot que je souhaite installer dans la salle de bain. Quels paramètres dois-je prendre en compte ?

   ...

8. Que signifients les paramètres IP, IK et la classe (I, II, III) pour les luminaires ?

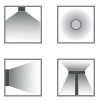
...

9. Que représente le facteur de maintenance. Comment le choisit on ?

...

10. Quel protocole utilise-t-on dans le cadre de l'éclairage scénique ? Développez les caractéristiques principales de ce protocole.

...



Module QLE CRI90 ADV5

Modules QLE advanced

Product description

- Ideal for linear and panel lights
- Luminous flux range from 1,000 – 2,430 lm
- LED system solution with outstanding system efficacy up to 156 lm/W, consisting of squared LED modules and dimmable LED Driver LCA 50W 150–400mA lp PRE
- Efficacy of the module up to 169 lm/W
- High colour rendering index CRI > 90
- Small colour tolerance MacAdam 3①
- Small luminous flux tolerances
- Colour temperatures 3,000 and 4,000 K
- Perfectly uniform light, even if several LED modules are used together in a line
- Self cooling (no additional heat sink required)
- Push terminals for quick and simple wiring of LED module to LED module
- Simple installation (e.g. screws)
- Long life-time: 72,000 hours
- 5-year guarantee

→

Standards, page 5

Colour temperatures and tolerances, page 9

QLE 250x250mm 1250lm ADV5

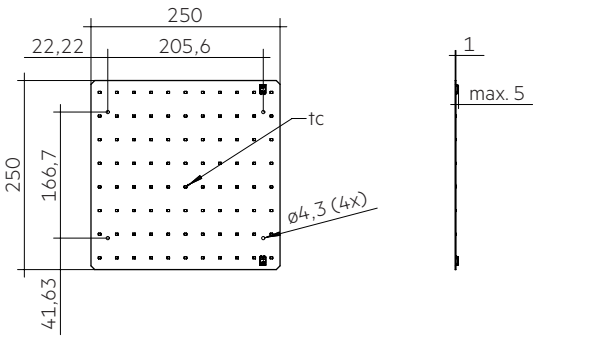
QLE 270x270mm 1250lm ADV5

Module QLE CRI90 ADV5

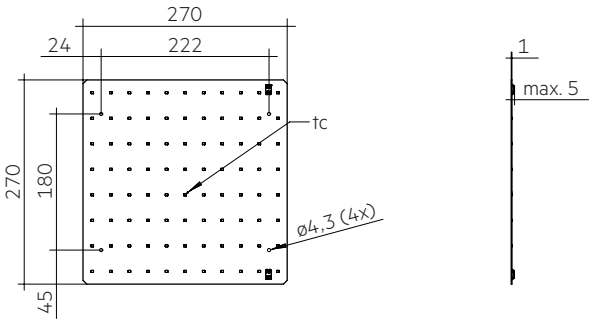
Modules QLE advanced

Technical data

Beam characteristic	120°
Ambient temperature range	-40 … +65 °C
tp rated	45 °C
tc	90 °C
Irated for 250x250 / 270x270mm	200 mA
Imax for 250x250 / 270x270mm	1,200 mA
Max. permissible LF current ripple for 250x250 / 270x270mm	1,320 mA
Max. permissible peak current for 250x250 / 270x270mm	2,400 mA / max. 10 ms
Max. working voltage for insulation[2]	405 V
Insulation test voltage	1.81 kV
CTI of the printed circuit board	≥ 600
ESD classification	severity level 4
Risk group (IEC 62471:2008)[5]	RG1
Classification acc. to IEC 62031	Built-in
Type of protection	IP00
Life-time	up to 72,000 h



QLE 250x250mm 1250lm ADV5



QLE 270x270mm 1250lm ADV5

Bestelldaten

Typ	Artikel-nummer	Farb-temperatur	Verpackung Karton	Gewicht pro Stk.
QLE 250x250mm 1250lm 930 ADV5	**28002983**	3.000 K	40 Stk.	0,140 kg
QLE 250x250mm 1250lm 940 ADV5	**28002984**	4.000 K	40 Stk.	0,140 kg
QLE 270x270mm 1250lm 930 ADV5	**28002989**	3.000 K	40 Stk.	0,165 kg
QLE 270x270mm 1250lm 940 ADV5	**28002990**	4.000 K	40 Stk.	0,165 kg

Specific technical data

Type[4]	Photo-metric code	Typ. luminous flux at tp = 25 °C[3]	Typ. luminous flux at tp = 45 °C[3]	Typ. forward current	Min. forward voltage at tp = 45 °C	Max. forward voltage at tp = 25 °C	Typ. power consumption at tp = 45 °C[3]	Efficacy of the module at tp = 25 °C	Efficacy of the module at tp = 45 °C	Efficacy of the system at tp = 45 °C	Colour rendering index CRI
QLE 250x250 / 270x270 mm – Operating mode NM at 200 mA											
QLE 250x250mm 1250lm 930 ADV5	930/359	970 lm	930 lm	200 mA	27.0 V	31.0 V	5.7 W	168 lm/W	162 lm/W	149 lm/W	> 90
QLE 250x250mm 1250lm 940 ADV5	940/359	1,010 lm	960 lm	200 mA	27.0 V	31.0 V	5.7 W	175 lm/W	169 lm/W	156 lm/W	> 90
QLE 270x270mm 1250lm 930 ADV5	930/359	970 lm	930 lm	200 mA	27.0 V	31.0 V	5.7 W	168 lm/W	162 lm/W	149 lm/W	> 90
QLE 270x270mm 1250lm 940 ADV5	940/359	1,010 lm	960 lm	200 mA	27.0 V	31.0 V	5.7 W	175 lm/W	169 lm/W	156 lm/W	> 90
QLE 250x250 / 270x270 mm – Operating mode NM at 250 mA											
QLE 250x250mm 1250lm 930 ADV5	930/359	1,210 lm	1,160 lm	250 mA	27.2 V	31.2 V	7.2 W	167 lm/W	162 lm/W	149 lm/W	> 90
QLE 250x250mm 1250lm 940 ADV5	940/359	1,260 lm	1,210 lm	250 mA	27.2 V	31.2 V	7.2 W	172 lm/W	167 lm/W	154 lm/W	> 90
QLE 270x270mm 1250lm 930 ADV5	930/359	1,210 lm	1,160 lm	250 mA	27.2 V	31.2 V	7.2 W	167 lm/W	162 lm/W	149 lm/W	> 90
QLE 270x270mm 1250lm 940 ADV5	940/359	1,260 lm	1,210 lm	250 mA	27.2 V	31.2 V	7.2 W	172 lm/W	167 lm/W	154 lm/W	> 90
QLE 250x250 / 270x270 mm – Operating mode HO at 300 mA											
QLE 250x250mm 1250lm 930 ADV5	930/359	1,450 lm	1,390 lm	300 mA	27.4 V	31.4 V	8.7 W	165 lm/W	161 lm/W	148 lm/W	> 90
QLE 250x250mm 1250lm 940 ADV5	940/359	1,520 lm	1,450 lm	300 mA	27.4 V	31.4 V	8.7 W	171 lm/W	166 lm/W	152 lm/W	> 90
QLE 270x270mm 1250lm 930 ADV5	930/359	1,450 lm	1,390 lm	300 mA	27.4 V	31.4 V	8.7 W	165 lm/W	161 lm/W	148 lm/W	> 90
QLE 270x270mm 1250lm 940 ADV5	940/359	1,520 lm	1,450 lm	300 mA	27.4 V	31.4 V	8.7 W	171 lm/W	166 lm/W	153 lm/W	> 90
QLE 250x250 / 270x270 mm – Operating mode HO at 350 mA											
QLE 250x250mm 1250lm 930 ADV5	930/359	1,700 lm	1,630 lm	350 mA	27.6 V	31.6 V	10.2 W	165 lm/W	160 lm/W	147 lm/W	> 90
QLE 250x250mm 1250lm 940 ADV5	940/359	1,770 lm	1,690 lm	350 mA	27.6 V	31.6 V	10.2 W	170 lm/W	165 lm/W	152 lm/W	> 90
QLE 270x270mm 1250lm 930 ADV5	930/359	1,700 lm	1,630 lm	350 mA	27.6 V	31.6 V	10.2 W	165 lm/W	160 lm/W	147 lm/W	> 90
QLE 270x270mm 1250lm 940 ADV5	940/359	1,770 lm	1,690 lm	350 mA	27.6 V	31.6 V	10.2 W	170 lm/W	165 lm/W	152 lm/W	> 90
QLE 250x250 / 270x270 mm – Operating mode HO at 400 mA											
QLE 250x250mm 1250lm 930 ADV5	930/359	1,940 lm	1,860 lm	400 mA	27.7 V	31.8 V	11.7 W	164 lm/W	159 lm/W	146 lm/W	> 90
QLE 250x250mm 1250lm 940 ADV5	940/359	2,030 lm	1,940 lm	400 mA	27.7 V	31.8 V	11.7 W	170 lm/W	164 lm/W	151 lm/W	> 90
QLE 270x270mm 1250lm 930 ADV5	930/359	1,940 lm	1,860 lm	400 mA	27.7 V	31.8 V	11.7 W	164 lm/W	159 lm/W	146 lm/W	> 90
QLE 270x270mm 1250lm 940 ADV5	940/359	2,030 lm	1,940 lm	400 mA	27.7 V	31.8 V	11.7 W	170 lm/W	164 lm/W	151 lm/W	> 90
QLE 250x250 / 270x270 mm – Operating mode HO at 450 mA											
QLE 250x250mm 1250lm 930 ADV5	930/359	2,190 lm	2,100 lm	450 mA	27.9 V	32.0 V	13.2 W	163 lm/W	159 lm/W	146 lm/W	> 90
QLE 250x250mm 1250lm 940 ADV5	940/359	2,280 lm	2,180 lm	450 mA	27.9 V	32.0 V	13.2 W	168 lm/W	163 lm/W	150 lm/W	> 90
QLE 270x270mm 1250lm 930 ADV5	930/359	2,190 lm	2,100 lm	450 mA	27.9 V	32.0 V	13.2 W	163 lm/W	159 lm/W	146 lm/W	> 90
QLE 270x270mm 1250lm 940 ADV5	940/359	2,280 lm	2,180 lm	450 mA	27.9 V	32.0 V	13.2 W	168 lm/W	163 lm/W	150 lm/W	> 90
QLE 250x250 / 270x270 mm – Operating mode HO at 500 mA											
QLE 250x250mm 1250lm 930 ADV5	930/359	2,430 lm	2,330 lm	500 mA	28.1 V	32.2 V	14.8 W	162 lm/W	158 lm/W	145 lm/W	> 90
QLE 250x250mm 1250lm 940 ADV5	940/359	2,540 lm	2,430 lm	500 mA	28.1 V	32.2 V	14.8 W	168 lm/W	163 lm/W	150 lm/W	> 90
QLE 270x270mm 1250lm 930 ADV5	930/359	2,430 lm	2,330 lm	500 mA	28.1 V	32.2 V	14.8 W	162 lm/W	158 lm/W	145 lm/W	> 90
QLE 270x270mm 1250lm 940 ADV5	940/359	2,540 lm	2,430 lm	500 mA	28.1 V	32.2 V	14.8 W	168 lm/W	163 lm/W	150 lm/W	> 90

[1] Integral measurement over the complete module.

[2] If mounted with M4 screws.

[3] Tolerance range for optical data: ±7.5 % and electrical data: ±10 %.

[4] NM ... nominal mode, HO ... high output.

[5] Meassured at Imax.

ACCES-SORIES

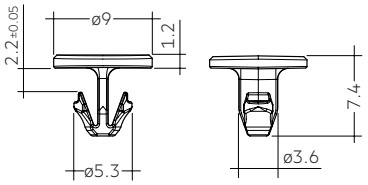
CLIP 4.3mm

Product description

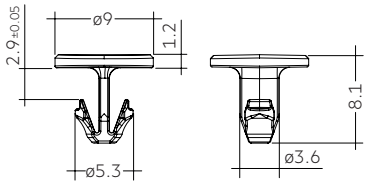
- Clip for fixation of LED modules with 4.3 mm holes
- Fast snap on mounting (sheet thickness 0.5 – 1.0 mm for PUSH-FIX and 1 – 2 mm for PUSH-FIX Long)
- For drilling hole 4 mm
- Clip made of Polycarbonat

ACL CLIP 4.3mm PUSH-FIX

ACL CLIP 4.3mm PUSH-FIX Long



ACL CLIP 4.3mm PUSH-FIX



ACL CLIP 4.3mm PUSH-FIX Long

Ordering data

Type	Article number	Colour	Packaging bag[1]	Weight per pc.
ACL CLIP 4.3mm PUSH-FIX	**28001036**	White	500 pc(s).	0.001 kg
ACL CLIP 4.3mm PUSH-FIX Long	**28002314**	Transparent	500 pc(s).	0.001 kg

[1] Minimum sales quantity 500 pcs.

1. Standards

IEC 62031
IEC 62471
IEC 62778
UL 8750 (for CLASS2 circuits and dry locations)*

* Pending.

1.1 Photometric code

Key for photometric code, e. g. 830 / 359

1st digit		2nd + 3rd digit	4th digit	5th digit	6th digit	
Code	CRI	Colour temperature in Kelvin x 100	MacAdam initial	MacAdam after 25% of the life-time (max.6000h)	Luminous flux after 25% of the life-time (max.6000h)	
					Code	Luminous flux
7	70 – 79				7	≥ 70 %
8	80 – 89				8	≥ 80 %
9	≥90				9	≥ 90 %

1.2 Energy classification

Type	Energy classification
QLE ADV5	A++

2. Thermal details

2.1 tc point, ambient temperature and life-time

The temperature at tp reference point is crucial for the light output and life-time of a LED product.

For QLE a tp temperature of 45 °C has to be complied in order to achieve an optimum between thermal requirements, light output and life-time.

Compliance with the maximum permissible reference temperature at the tc point must be checked under operating conditions in a thermally stable state. The maximum value must be determined under worst-case conditions for the relevant application.

The tc and tp temperature of LED modules from Tridonic are measured at the same reference point.

2.2 Storage and humidity

Storage temperature	-40 … +85 °C

Operation only in non condensing environment.
Humidity during processing of the module should be between 30 to 70 %.

2.3 Thermal design and heat sink

The rated life of LED products depends to a large extent on the temperature. If the permissible temperature limits are exceeded, the life of the QLE will be greatly reduced or the QLE may be destroyed.

3. Installation / wiring

3.1 Electrical supply/choice of LED Driver

QLE modules from Tridonic are not protected against overvoltages, overcurrents, overloads or short-circuit currents. Safe and reliable operation can only be guaranteed in conjunction with a LED Driver which complies with the relevant standards. The use of LED Driver from Tridonic in combination with QLE modules guarantees the necessary protection for safe and reliable operation.

If a LED Driver other than Tridonic is used, it must provide the following protection:
- Short-circuit protection
- Overload protection
- Overtemperature protection

QLE modules must be supplied by a constant current LED Driver. Operation with a constant voltage LED Driver will lead to an irreversible damage of the module.

Wrong polarity can damage the QLE.

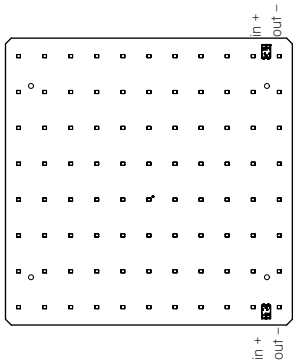
With parallel wiring tolerance-related differences in output are possible (thermal stress of the module) and can cause differences in brightness. If a wire breaks or a complete module fails then the current passing through the other module increases. This may reduce its life considerably.

QLE modules can be operated either from SELV LED Drivers or from LED Drivers with LV output voltage.

QLE modules are basic isolated up to 405 V (if mounted with M4 screws with head diameter of 7 mm) against ground and can be mounted directly on earthed metal parts of the luminaire. If the max. output voltage of the led control gear (also against earth) is above 405 V, an additional isolation between LED module and heat sink is required (for example by isolated thermal pads) or by a suitable luminaire construction.
At voltages > 60 V an additional protection against direct touch (test finger) to the light emitting side of the module has to be guaranteed. This is typically achieved by means of a non removable light distributor over the module.

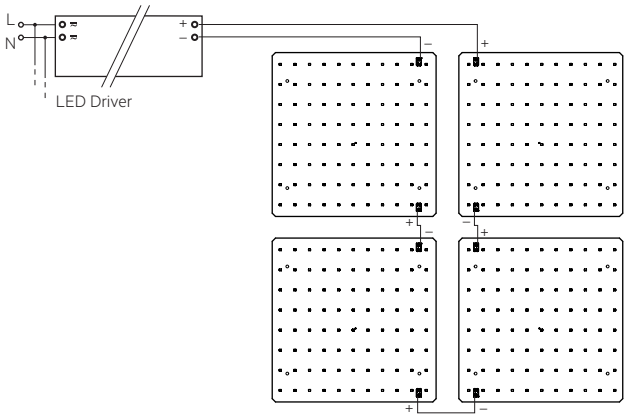
3.2 Wiring

QLE 250x250mm / 270x270mm:

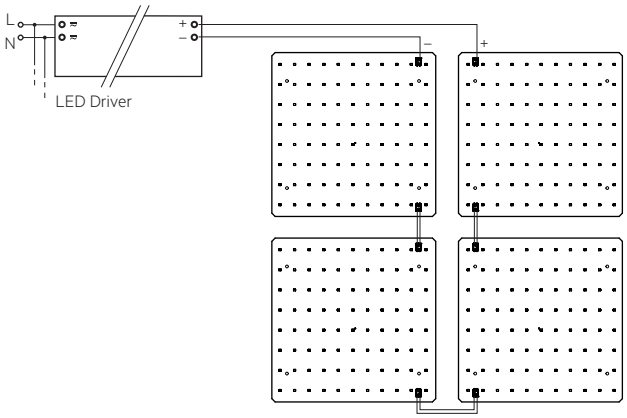


Wiring examples

QLE 250x250mm / 270x270mm serial wiring:



QLE 250x250mm / 270x270mm paralell wiring:

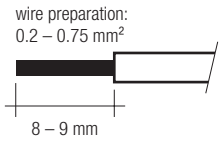


Type	Max. number with parallel wiring*
QLE 250x250 / 270x270mm 1250lm ADV5	6

* with direkt chaining (without additional terminals).

3.3 Wiring type and cross section

The wiring can be in stranded wires or solid with a cross section of 0.2 to 0.75 mm².
For the push-wire connection you have to strip the insulation (8–9 mm).



To remove the wires use a suitabel tool (e.g. Microcon release pin) or through twist and pull .

3.4 Mounting instruction

None of the components of the QLE (substrate, LED, electronic components etc.) may be exposed to tensile or compressive stresses.

Max. torque for fixing: 0.5 Nm.

The LED modules are mounted with M4 screws or ACL CLIP 4.3mm per module.

Chemical substance may harm the LED module. Chemical reactions could lead to colour shift, reduced luminous flux or a total failure of the module caused by corrosion of electrical connections.

Materials which are used in LED applications (e.g. sealings, adhesives) must not produce dissolver gas. They must not be condensation curing based, acetate curing based or contain sulfur, chlorine or phthalate.
Avoid corrosive atmosphere during usage and storage.

3.5 EOS/ESD safety guidelines

The device / module contains components that are sensitive to electrostatic discharge and may only be installed in the factory and on site if appropriate EOS/ESD protection measures have been taken. No special measures need be taken for devices/modules with enclosed casings (contact with the pc board not possible), just normal installation practice. Please note the requirements set out in the document EOS / ESD guidelines (Guideline_EOS_ESD.pdf) at: http://www.tridonic.com/esd-protection

4. Life-time

4.1 Life-time, lumen maintenance and failure rate

The light output of an LED Module decreases over the life-time, this is characterized with the L value.
L70 means that the LED module will give 70 % of its initial luminous flux.
This value is always related to the number of operation hours and therefore defines the life-time of an LED module.

As the L value is a statistical value and the lumen maintenance may vary over the delivered LED modules.
The B value defines the amount of modules which are below the specific L value, e.g. L70B10 means 10 % of the LED modules are below 70 % of the initial luminous flux, respectively 90 % will be above 70 % of the initial value.
In addition the percentage of failed modules (fatal failure) is characterized by the C value.

The F value is the combination of the B and C value. That means for F degra-dation and complete failures are considered, e.g. L70F10 means 10 % of the LED modules may fail or be below 70 % of the initial luminous flux.

4.2 Lumen maintenance for QLE

QLE 250x250mm / 270x270mm:

Forward current	tp temperature	L90 / F10	L90 / F50	L80 / F10	L80 / F50	L70 / F10	L70 / F50
200 mA	40 °C	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	50 °C	64,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	60 °C	57,000 h	69,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
250 mA	40 °C	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	50 °C	64,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	60 °C	57,000 h	69,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
300 mA	40 °C	71,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	50 °C	64,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	60 °C	57,000 h	68,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
350 mA	40 °C	71,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	50 °C	63,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	60 °C	56,000 h	68,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
400 mA	40 °C	71,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	50 °C	63,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	60 °C	56,000 h	68,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
450 mA	40 °C	70,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	50 °C	63,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	60 °C	56,000 h	67,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
500 mA	40 °C	70,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	50 °C	62,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h
	60 °C	56,000 h	67,000 h	> 72,000 h	> 72,000 h	> 72,000 h	> 72,000 h

Lumen maintenance values are based on LM80 data. Table may be updated when more recent results are available.

4.3 Switching capability

100,000 cycles

Tridonic test according to IEC 62717 Cl 10.3.3
30 s on / 30 s off at Imax

5. Electrical values

5.1 Declaration of electrical parameters

Irated ... Nominal operating current the module is designed for.

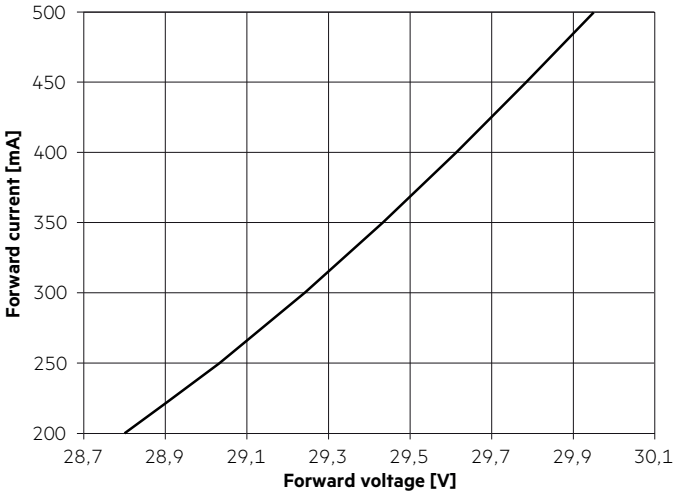
Imax ... Max. permissible continuous operating current incl. the tolerances of the LED Driver.

Max. permissible LF current ripple ... Max. output current of the LED driver incl. Tolerances and LF current ripple must not exceed this value.

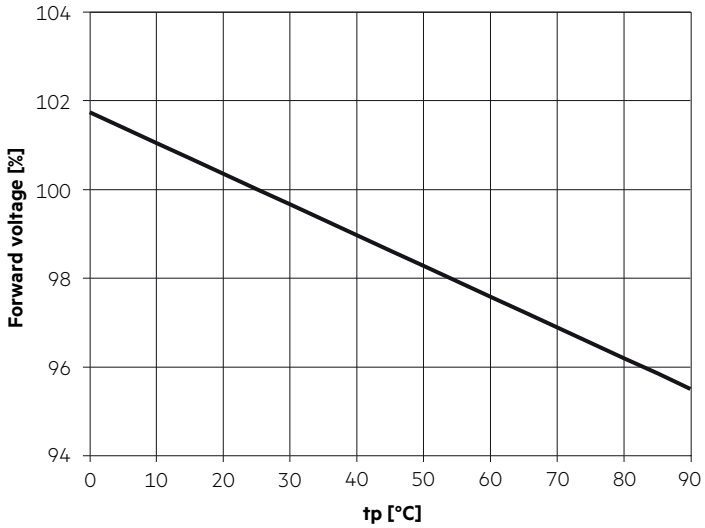
Max. permissible peak current ... The max. output peak current of the LED driver must not exceed this value.

5.2 Typ. forward voltage vs. forward current at tp = 25 °C

QLE 250x250mm / 270x270mm:



5.2 Forward voltage vs. tp temperature



The diagrams are based on statistic values.
The real values can be different.

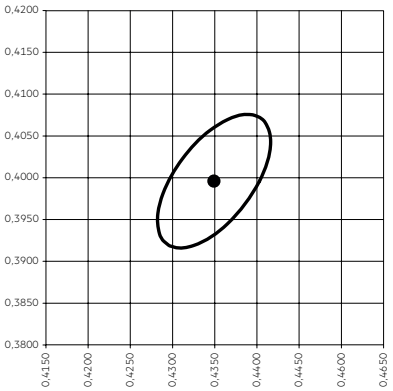
6. Photometric characteristics

6.1 Coordinates and tolerances according to CIE 1931

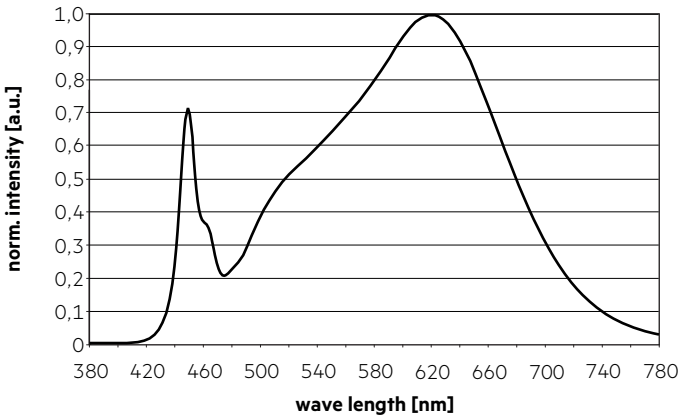
The specified colour coordinates are measured integral by a current impulse of 200 / 400 mA and a duration of 100 ms.
The ambient temperature of the measurement is ta = 25 °C.
The measurement tolerance of the colour coordinates are ± 0.01.

3,000 K, CRI 90

	x0	y0
Centre	0.4349	0.3996

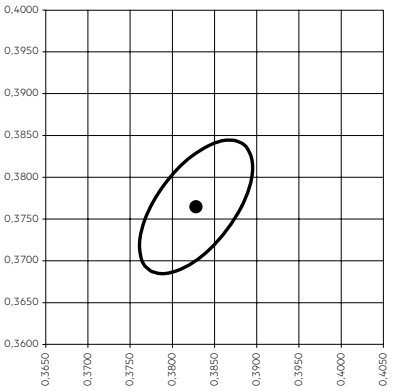


MacAdam Ellipse: 3SDCM

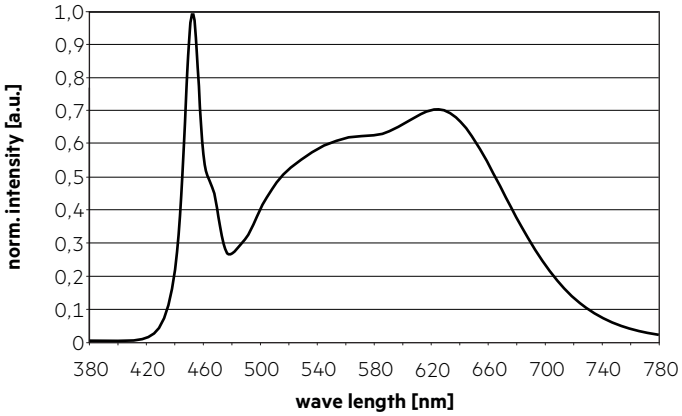


4,000 K, CRI 90

	x0	y0
Centre	0.3828	0.3765

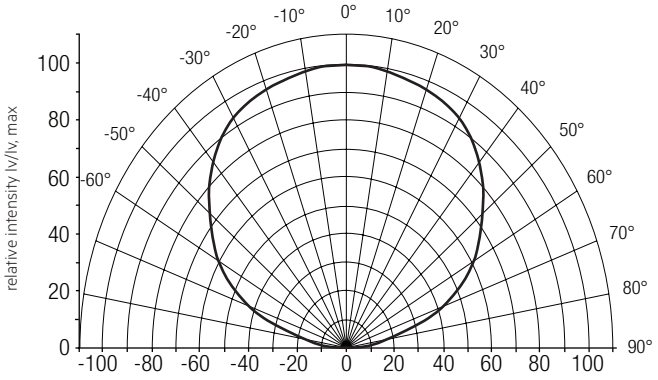


MacAdam Ellipse: 3SDCM



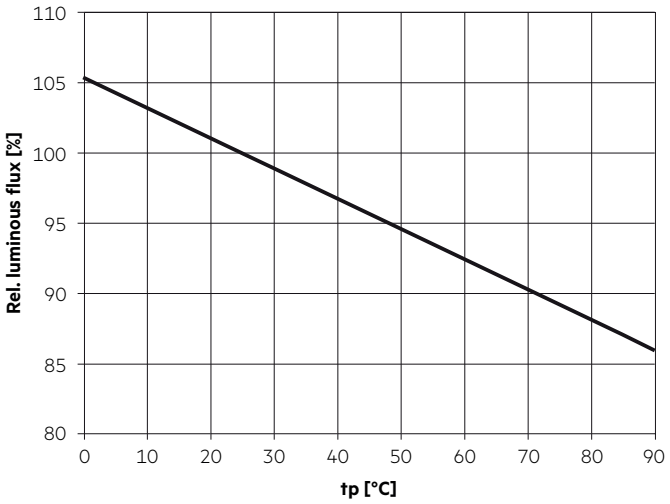
6.2 Light distribution

The optical design of the QLE product line ensures optimum homogeneity for the light distribution.



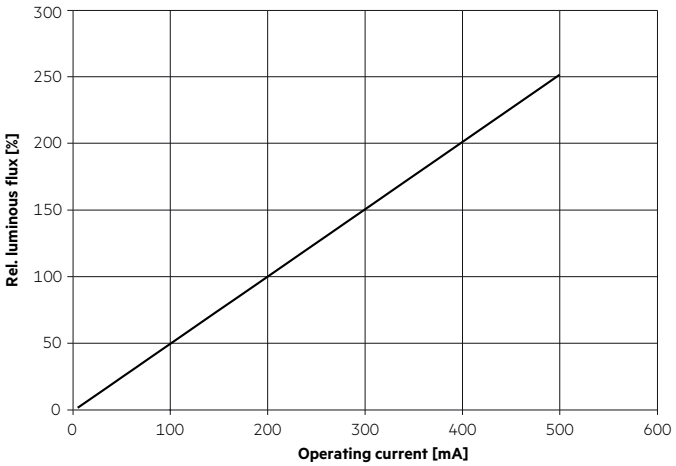
The colour temperature is measured integral over the complete module. The single LED light points can have deviations in the colour coordinates within MacAdam tbd.
To ensure an ideal mixture of colours and a homogeneous light distribution a suitable optic (e. g. PMMA diffuser) and a sufficient spacing between module and optic (typ. 6 cm) should be used.

6.3 Relative luminous flux vs. tp temperature



6.4 Relative luminous flux vs. operating current

QLE 250x250mm / 270x270mm:



7. Miscellaneous

7.1 Additional information

Additional technical information at www.tridonic.com → Technical Data

Guarantee conditions at www.tridonic.com → Services

Life-time declarations are informative and represent no warranty claim.

Driver LCA 10W 150–400mA one4all C PRE

premium series

Product description

- Dimmable built-in constant current LED Driver
- Dimming range 1 – 100 %
- For luminaires of protection class I and protection class II
- Adjustable output current between 150 and 400 mA via ready2mains™ Programmer, I-SELECT 2 plugs or DALI
- Max. output power 10 W
- Up to 82 % efficiency
- Power input on stand-by < 0.2 W
- Nominal life-time up to 100,000 h
- 5-year guarantee

Housing properties

- Casing: polycarbonate, white
- Type of protection IP20

Interfaces

- one4all (DALI-2 DT 6, DSI, switchDIM, corridorFUNCTION)
- ready2mains™ (configuration and dimming via mains)
- Terminal blocks: 45° push terminals

Functions

- Adjustable output current (DALI, ready2mains™, I-SELECT 2)
- Constant light output function (CLO)
- Power-up fading at AC
- Configurable via ready2mains™
- Service monitor to log certain events
- Protective features (overtemperature, short-circuit, overload, no-load, input voltage range, reduced surge amplification)
- Suitable for emergency escape lighting systems acc. to EN 50172

Benefits

- Application-oriented operating window for maximum compatibility
- Best energy savings due to low standby losses and high efficiency
- Flexible configuration via DALI, ready2mains™ and I-SELECT 2
- Reliability proven by life-time up to 100,000 h and 5-year guarantee

Typical applications

- For spot light and downlight in retail and hospitality applications

Standards, page 4

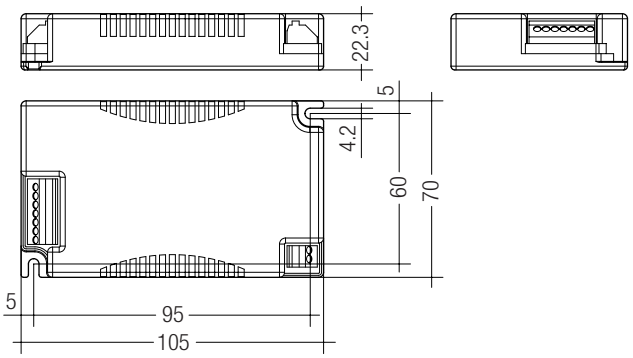
IP20 SELV RoHS

Driver LCA 10W 150–400mA one4all C PRE

premium series

Technical data

Rated supply voltage	220 – 240 V
Input voltage, AC	198 – 264 V
Input voltage, DC	176 – 280 V
Mains frequency	0 / 50 / 60 Hz
Overvoltage protection	320 V AC, 48 h
Typ. current (at 230 V, 50 Hz, full load)[1] [2]	35 – 60 mA
Typ. current (220 V, 0 Hz, full load, 15 % dimming level)[2]	10 – 20 mA
Leakage current (at 230 V, 50 Hz, full load)[1] [2]	< 700 µA
Max. input power	13 W
Typ. efficiency (at 230 V / 50 Hz / full load)[2]	82 %
λ (at 230 V, 50 Hz, full load)[1]	0.96
Typ. power input on stand-by[3]	< 0.2 W
Typ. input current in no-load operation	10.5 mA
Typ. input power in no-load operation	0.5 W
In-rush current (peak / duration)	15 A / 243 µs
THD (at 230 V, 50 Hz, full load)[1]	< 7 %
Starting time (at 230 V, 50 Hz, full load)[1]	< 0.7 s
Starting time (DC mode)	< 0.4 s
Switchover time (AC/DC)[7]	< 0.4 s
Turn off time (at 230 V, 50 Hz, full load)	< 20 ms
Output current tolerance[1] [6]	± 3 %
Max. output current peak (non-repetitive)	≤ output current + 40 %
Output LF current ripple (< 120 Hz)	± 5 %
Max. output voltage (no-load voltage)	60 V
Dimming range	1 – 100 %
Mains surge capability (between L – N)	1 kV
Mains surge capability (between L/N – PE)	2 kV
Surge voltage at output side (against PE)	< 500 V
Type of protection	IP20
Life-time	up to 100,000 h
Dimensions L x W x H	105 x 70 x 22 mm



Ordering data

Type	Article number	Packaging carton	Packaging pallet	Weight per pc.
LCA 10W 150-400mA one4all C PRE	**28000663**	10 pc(s).	1,120 pc(s).	0.128 kg

Specific technical data

Type	Output current[4] [6]	Min. forward voltage	Max. forward voltage	Max. output power	Typ. power consumption (at 230 V, 50 Hz, full load)	Typ. current consumption (at 230 V, 50 Hz, full load)	Max. casing temperature tc	Ambient temperature ta max.	I-SELECT 2 resistor value[5]
LCA 10W 150-400mA one4all C PRE	150 mA	15 V	40 V	6 W	8.4 W	40 mA	85 °C	-25 … +65 °C	open
	200 mA	15 V	40 V	8 W	10.4 W	48 mA	85 °C	-25 … +65 °C	25.00 kΩ
	250 mA	15 V	40 V	10 W	12.6 W	57 mA	85 °C	-25 … +65 °C	20.00 kΩ
	300 mA	15 V	33 V	10 W	12.2 W	55 mA	85 °C	-25 … +65 °C	16.67 kΩ
	350 mA	15 V	29 V	10 W	12.4 W	56 mA	80 °C	-25 … +65 °C	14.29 kΩ
	400 mA	15 V	25 V	10 W	12.1 W	55 mA	80 °C	-25 … +65 °C	short circuit (0 Ω)

[1] Valid at 100 % dimming level.

[2] Depending on the selected output current.

[3] Depending on the DALI traffic at the interface.

[4] The table only lists a number of possible operating points but does not cover each single point. The output current can be set within the total value range in 1-mA-steps.

[5] Not compatible with I-SELECT (generation 1). Calculated resistor value.

[6] Output current is mean value.

[7] Valid for immediate change of power supply type otherwise the starting time is valid.

ACCES-SORIES

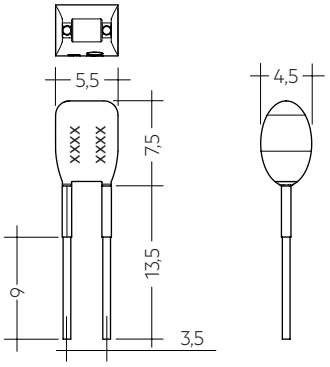
I-SELECT 2 PLUG PRE / EXC

Product description

- Ready-for-use resistor to set output current value
- Compatible with LED Driver featuring I-SELECT 2 interface; not compatible with I-SELECT (generation 1)
- Resistor is base isolated
- Resistor power 0.25 W
- Current tolerance ± 2 % to nominal current value
- Compatible with LED Driver series PRE and EXC

Example of calculation

- R [kΩ] = 5 V / I_out [mA] x 1000
- E96 resistor value used
- Resistor value tolerance ≤ 1 %; resistor power ≥ 0.1 W; base isolation necessary
- When using a resistor value beyond the specified range, the output current will automatically be set to the minimum value (resistor value too big), respectively to the maximum value (resistor value too small)



Ordering data

Type	Article number	Colour	Marking	Current	Resistor value	Packaging bag	Weight per pc.
I-SELECT 2 PLUG 150MA BL	**28001102**	Blue	0150 mA	150 mA	33.20 kΩ	10 pc(s).	0.001 kg
I-SELECT 2 PLUG 175MA BL	**28001103**	Blue	0175 mA	175 mA	28.70 kΩ	10 pc(s).	0.001 kg
I-SELECT 2 PLUG 200MA BL	**28001104**	Blue	0200 mA	200 mA	24.90 kΩ	10 pc(s).	0.001 kg
I-SELECT 2 PLUG 225MA BL	**28001105**	Blue	0225 mA	225 mA	22.10 kΩ	10 pc(s).	0.001 kg
I-SELECT 2 PLUG 250MA BL	**28001106**	Blue	0250 mA	250 mA	20.00 kΩ	10 pc(s).	0.001 kg
I-SELECT 2 PLUG 275MA BL	**28001107**	Blue	0275 mA	275 mA	18.20 kΩ	10 pc(s).	0.001 kg
I-SELECT 2 PLUG 300MA BL	**28001108**	Blue	0300 mA	300 mA	16.50 kΩ	10 pc(s).	0.001 kg
I-SELECT 2 PLUG 325MA BL	**28001109**	Blue	0325 mA	325 mA	15.40 kΩ	10 pc(s).	0.001 kg
I-SELECT 2 PLUG 350MA BL	**28001110**	Blue	0350 mA	350 mA	14.30 kΩ	10 pc(s).	0.001 kg
I-SELECT 2 PLUG 375MA BL	**28001111**	Blue	0375 mA	375 mA	13.30 kΩ	10 pc(s).	0.001 kg
I-SELECT 2 PLUG 400MA BL	**28001112**	Blue	0400 mA	400 mA	12.40 kΩ	10 pc(s).	0.001 kg
I-SELECT 2 PLUG MAX BL	**28001099**	Blue	MAX	MAX	0.00 kΩ	10 pc(s).	0.001 kg

1. Standards

EN 55015
EN 61000-3-2
EN 61000-3-3
EN 61347-1
EN 61347-2-13
EN 62384
EN 61547
EN 62386-101 (DALI-2)
EN 62386-102 (DALI-2)
EN 62386-207 (DALI-2)
According to EN 50172 for use in central battery systems
According to EN 60598-2-22 suitable for emergency lighting installations

Housing fulfils requirements for reinforced insulation according EN 60598-1.

1.1 Glow wire test

according to EN 61347-1 with increased temperature of 850 °C passed.

2. Thermal details and life-time

4.1 Expected life-time

Expected life-time

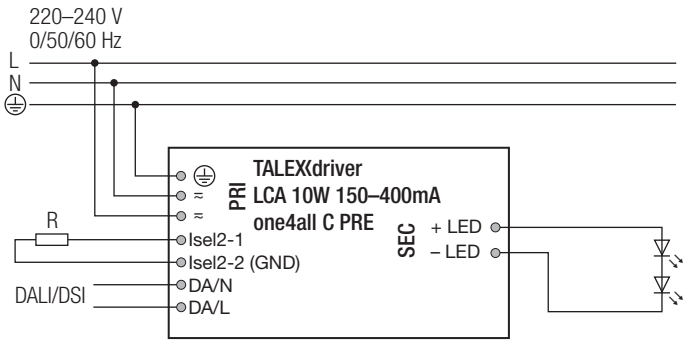
Type	Output current	ta	40 °C	50 °C	55 °C	60 °C	65 °C
LCA 10W 150-400mA one4all C PRE	150 – 300 mA	tc	65 °C	70 °C	75 °C	80 °C	85 °C
		Life-time	> 100,000 h	> 100,000 h	> 100,000 h	> 100,000 h	80,000 h
	> 300 – 400 mA	tc	60 °C	65 °C	70 °C	75 °C	80 °C
		Life-time	> 100,000 h	> 100,000 h	> 100,000 h	> 100,000 h	90,000 h

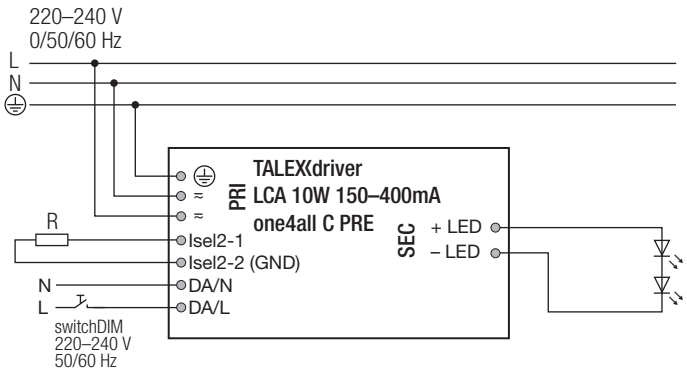
The LED Driver is designed for a life-time stated above under reference conditions and with a failure probability of less than 10 %.

The relation of tc to ta temperature depends also on the luminaire design.
If the measured tc temperature is approx. 5 K below tc max., ta temperature should be checked and eventually critical components (e.g. ELCAP) measured. Detailed information on request.

3. Installation / wiring

3.1 Circuit diagram



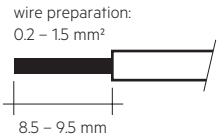


For wiring in dimming operation with ready2mains refer to the ready2mains Gateway data sheet.

3.2 Wiring type and cross section

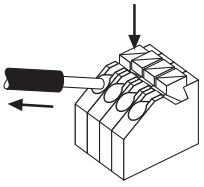
The wiring can be in stranded wires with ferrules or solid with a cross section of 0.2–1.5 mm².
Strip 8.5–9.5 mm of insulation from the cables to ensure perfect operation of the push-wire terminals.
Use one wire for each terminal connector only.
Use each strain relief channel for one cable only.

LED module/LED Driver/supply



3.3 Loose wiring

Press down the “push button” and remove the cable from front.



3.4 Wiring guidelines

- The cables should be run separately from the mains connections and mains cables to ensure good EMC conditions.
- The LED wiring should be kept as short as possible to ensure good EMC. The max. secondary cable length is 2 m (4 m circuit), this applies for LED output as well as for I-SELECT 2.
- Secondary switching is not permitted.
- The LED Driver has no inverse-polarity protection on the secondary side. Wrong polarity can damage LED modules with no inverse-polarity protection.
- Wrong wiring of the LED Driver can lead to malfunction or irreparable damage.
- To avoid the damage of the Driver, the wiring must be protected against short circuits to earth (sharp edged metal parts, metal cable clips, louver, etc.).

3.5 Hot plug-in

Hot plug-in is not supported due to residual output voltage of > 0 V.
If a LED load is connected the device has to be restarted before the output will be activated again.
This can be done via mains reset or via interface (DALI, DSI, switchDIM, ready2mains).

3.6 Earth connection

The earth connection is conducted as protection earth (PE). The LED Driver can be earthed via earth terminal. If the LED Driver will be earthed, protection earth (PE) has to be used. There is no earth connection required for the functionality of the LED Driver. Earth connection is recommended to improve following behaviour:

- Electromagnetic interferences (EMI)
- LED glowing at standby
- Transmission of mains transients to the LED output

In general it is recommended to earth the LED Driver if the LED module is mounted on earthed luminaire parts respectively heat sinks and thereby representing a high capacity against earth.

3.7 I-SELECT 2 resistors connected via cable

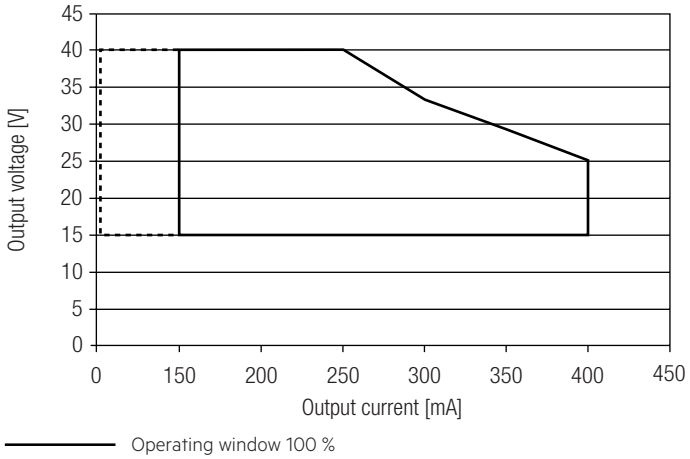
For details see:
http://www.tridonic.com/com/en/download/technical/LCA_PRE_LC_EXC_ProductManual_en.pdf.

3.8 Installation note

Max. torque at the clamping screw: 0.5 Nm / M4

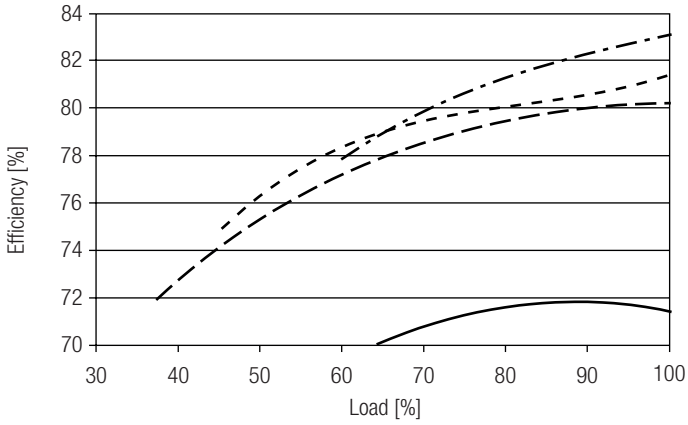
4. Electrical values

4.1 Operating window

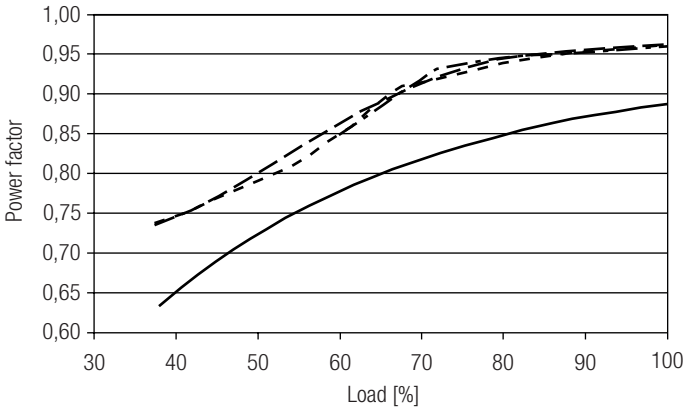


Make sure that the LED Driver is operated within the given window under all operating conditions. Special attention needs to be paid at dimming and DC emergency operation as the forward voltage of the connected LED modules varies with the dimming level, due to the implemented amplitude dimming technology. Coming below the specified minimum output voltage of the LED Driver may cause the device to shut-down.
See chapter "6.11 Light level in DC operation" for more information.

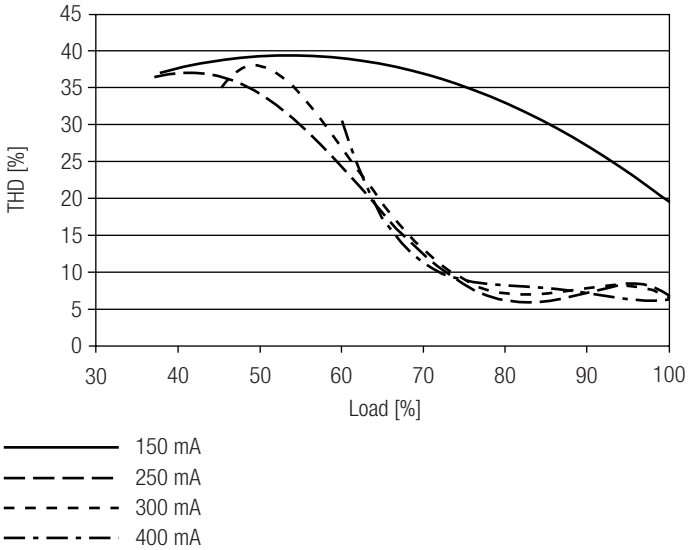
4.2 Efficiency vs load



4.3 Power factor vs load



4.4 THD vs load (without harmonic < 5 mA or 0.6 % of the input current)



100 % load corresponds to the max. output power (full load) according to the table on page 2.

4.5 Maximum loading of automatic circuit breakers

Automatic circuit breaker type	C10	C13	C16	C20	B10	B13	B16	B20	Inrush current	
Installation Ø	1.5 mm²	1.5 mm²	2.5 mm²	4 mm²	1.5 mm²	1.5 mm²	2.5 mm²	4 mm²	I_{max}	time
LCA 10W 150-400mA one4all C PRE	40	56	64	80	24	31	38	48	15 A	243 µs

Calculation uses typical values from ABB series S200 as a reference.
Actual values may differ due to used circuit breaker types and installation environment.

4.6 Harmonic distortion in the mains supply (at 230 V / 50 Hz and full load) in %

	THD	3.	5.	7.	9.	11.
LCA 10W 150-400mA one4all C PRE	< 7	< 6	< 4	< 2	< 4	< 4

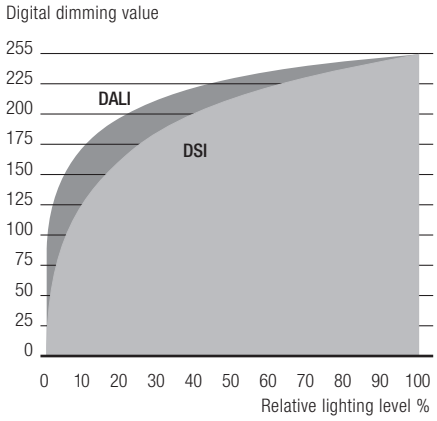
Acc. to 61000-3-2. Harmonics < 5 mA or < 0.6 % (whatever is greater) of the input current are not considered for calculation of THD.

4.7 Dimming

Dimming range 1 % to 100 %
Digital control with:
- DSI signal: 8 bit Manchester Code
  Speed 1 % to 100 % in 1.4 s
- DALI signal: 16 bit Manchester Code
  Speed 1 % to 100 % in 0.2 s
  Programmable parameter:
  Minimum dimming level
  Maximum dimming level
  Default minimum = 1 %
  Programmable range 1 % ≤ MIN ≤ 100 %
  Default maximum = 100 %
  Programmable range 100 % ≥ MAX ≥ 1 %

Dimming curve is adapted to the eye sensitiveness.
Dimming is realized by amplitude dimming.

4.8 Dimming characteristics



Dimming characteristics as seen by the human eye

5. Interfaces / communication

5.1 Control input (DA/N, DA/L)

Digital DALI signal or switchDIM can be wired on the same terminals (DA/N and DA/L).

The control input is non-polar for digital control signals (DALI, DSI).
The control signal is not SELV. Control cable has to be installed in accordance to the requirements of low voltage installations.
Different functions depending on each module.

5.2 Control input ready2mains (L, N)

The digital ready2mains protocol is modulated onto the mains signal which is wired to the mains terminal (L and N).

5.3 switchDIM

Integrated switchDIM function allows a direct connection of a pushbutton for dimming and switching.
Brief push (< 0.6 s) switches LED Driver ON and OFF. The dimm level is saved at power-down and restored at power-up.
When the pushbutton is held, LED modules are dimmed. After repush the LED modules are dimmed in the opposite direction.
In installations with LED Drivers with different dimming levels or opposite dimming directions (e.g. after a system extension), all LED Drivers can be synchronized to 50 % dimming level by a 10 s push.
Use of pushbutton with indicator lamp is not permitted.

6. Functions

6.1 Function: adjustable current

The output current of the LED Driver can be adjusted in a certain range.
For adjustment there are three options available.

Option 1: DALI
Adjustment is done by masterCONFIGURATOR (see masterCONFIGURATOR documentation).

Option 2: I-SELECT 2
By inserting a suitable resistor into the I-SELECT 2 interface, the current value can be adjusted. The relationship between output current and resistor value can be found in the chapter “Accessories I-SELECT 2 Plugs”.

Please note that the resistor values for I-SELECT 2 are not compatible with I-SELECT (generation 1). Installation of an incorrect resistor may cause irreparable damage to the LED module(s).

Resistors for the main output current values can be ordered from Tridonic (see accessories).

Option 3: ready2mains
Adjustment is done by the ready2mains programmer and the corresponding configuration software (see ready2mains documentation).

The priority for current adjustment methods is DALI (highest priority), I-SELECT 2, ready2mains (lowest priority).

6.2 ready2mains – configuration

The ready2mains interface can be used to configure the main parameters of LED Drivers via the mains wiring, such as LED output current, CLO and DC level. These parameters can be adjusted either via ready2mains-capable configuration software or directly via the ready2mains programmer (output current only).

6.3 ready2mains – dimming

ready2mains allows for mains-based group dimming, controlled via the ready2mains protocol and appropriate dimming interfaces.

For details on the operation of ready2mains and its components see the relevant technical information.

6.4 Short-circuit behaviour

In case of a short-circuit at the LED output the LED output is switched off.
After restart of the LED Driver the output will be activated again.
The restart can either be done via mains reset or via interface (DALI, DSI, switchDIM, ready2mains).

6.5 No-load operation

The LED Driver will not be damaged in no-load operation. The output will be deactivated and is therefore free of voltage. If a LED load is connected the device has to be restarted before the output will be activated again.

6.6 Overload protection

If the output voltage range is exceeded the LED Driver turns off the LED output. After restart of the LED Driver the output will be activated again.
The restart can either be done via mains reset or via interface (DALI, DSI, switchDIM, ready2mains).

6.7 Overtemperature protection

The LED Driver is protected against temporary thermal overheating.
If the temperature limit is exceeded the output current of the LED module(s) is reduced. The temperature protection is activated above tc max.
The activation temperature differs depending on the LED load.
On DC operation this function is deactivated to fulfill emergency requirements.

6.8 corridorFUNCTION

The corridorFUNCTION can be programmed in two different ways.
To program the corridorFUNCTION by means of software a DALI-USB interface is needed in combination with a DALI PS. The software can be the masterCONFIGURATOR.
To activate the corridorFUNCTION without using software a voltage of 230 V has to be applied for five minutes at the switchDIM connection.
The unit will then switch automatically to the corridorFUNCTION.

Note:
If the corridorFUNCTION is wrongly activated in a switchDIM system (for example a switch is used instead of pushbutton), there is the option of installing a pushbutton and deactivating the corridorFUNCTION mode by five short pushes of the button within three seconds.

switchDIM and corridorFUNCTION are very simple tools for controlling gears with conventional pushbuttons or motion sensors.
To ensure correct operation a sinusoidal mains voltage with a frequency of 50 Hz or 60 Hz is required at the control input.
Special attention must be paid to achieving clear zero crossings. Serious mains faults may impair the operation of switchDIM and corridorFUNCTION.

6.9 Constant light output (CLO)

The luminous flux of a LED decreases constantly over the life-time. The CLO function ensures that the emitted luminous flux remains stable. For that purpose the LED current will increase continuously over the LED life-time.
In masterCONFIGURATOR it is possible to select a start value (in percent) and an expected life-time. The LED Driver adjusts the current afterwards automatically.

6.10 Power-up/-down fading

The power-up/-down function offers the opportunity to modify the on-/off behavior. The time for fading on or off can be adjusted in a range of 0.2 to 16 seconds. According to this value, the device dims either from 0 % up to the power-on level or from the current set dim level down to 0 %.
This feature applies while operating via switchDIM, ready2mains and when switching the mains voltage on or off. By factory default no fading time is set (= 0 seconds).

6.11 Light level in DC operation

The LED Driver is designed to operate on DC voltage and pulsed DC voltage. For a reliable operation, make sure that also in DC emergency operation the LED Driver is run within the specified conditions as stated in chapter “4.1 operating window”.

Light output level in DC operation: programmable 1 – 100 % (EOF_i = 0.13).
Programming by DALI or ready2mains.
In DC operation dimming mode can be activated.

The voltage-dependent input current of Driver incl. LED module is depending on the used load.

The voltage-dependent no-load current of Driver (without or defect LED module) is for:
AC: < 10.5 mA
DC: < 3.3 mA

6.12 Software / programming

With appropriate software and an interface different functions can be activated and various parameters can be configured in the LED Driver.
To do so, a DALI-USB or ready2mains programmer and the software (masterCONFIGURATOR) are required.

6.13 masterCONFIGURATOR

From version 2.8:
For programming functions (CLO, I-SELECT 2, power-up fading, corridorFUNCTION) and device settings (fade time, ePowerOnLevel, DC level, etc.). For further information see masterCONFIGURATOR manual.

6.14 deviceCONFIGURATOR

PC (windows) based software application to transfer parameters into our drivers.
Workflow optimised for the use in OEM production line.
For further information see deviceCONFIGURATOR manual.

7. Miscellaneous

7.1 Isolation and electric strength testing of luminaires

Electronic devices can be damaged by high voltage. This has to be considered during the routine testing of the luminaires in production.

According to IEC 60598-1 Annex Q (informative only!) or ENEC 303-Annex A, each luminaire should be submitted to an isolation test with 500 V DC for 1 second. This test voltage should be connected between the interconnected phase and neutral terminals and the earth terminal.
The isolation resistance must be at least 2 MΩ.

As an alternative, IEC 60598-1 Annex Q describes a test of the electrical strength with 1500 V AC (or 1.414 x 1500 V DC). To avoid damage to the electronic devices this test must not be conducted.

7.2 Conditions of use and storage

Humidity:	5 % up to max. 85 %, not condensed (max. 56 days/year at 85 %)
Storage temperature:	-40 °C up to max. +80 °C

The devices have to be acclimatised to the specified temperature range (ta) before they can be operated.

7.3 Maximum number of switching cycles

All LED Driver are tested with 50,000 switching cycles.
The actually achieved number of switching cycles is significantly higher.

7.4 Additional information

Additional technical information at www.tridonic.com → Technical Data

Guarantee conditions at www.tridonic.com → Services

Life-time declarations are informative and represent no warranty claim.
No warranty if device was opened.