Dossier Technique

SMART MUSEUM
Château Musée de Dieppe

Sommaire

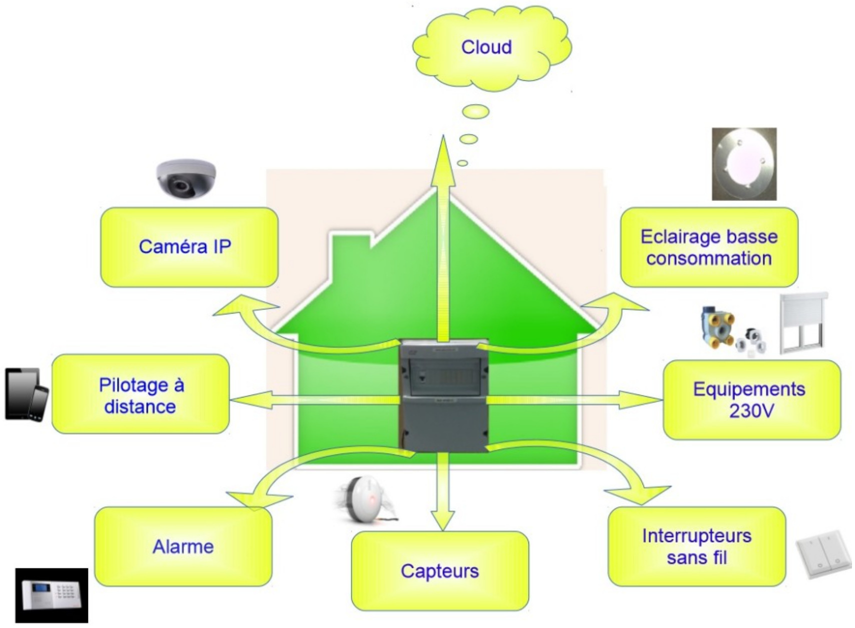
1. Présentation générale

a. Introduction

Ecogelec est une société spécialisée à l'origine dans le photovoltaïque mais qui, avec la décroissance du secteur de l'énergie solaire, se repositionne sur la technologie de l'Ethernet pour la gestion et le transport des données et de l'énergie sur le même câble.

Aujourd'hui la société commercialise une « box énergétique » pouvant piloter avec une seule interface tous les flux d'une habitation. La société développe un concept de d'habitat intelligent : de la gestion de l'énergie, du chauffage, de l'éclairage, de la sécurité et des applications domotiques câblées mais pilotées sans fil depuis son smartphone ou sa tablette.

b. Présentation



c. Principe de fonctionnement

La box Ecogelec propose une solution d'éclairage pour particulier ou entreprise, basée sur un coffret auquel on vient raccorder des spots et des boutons via des câbles Ethernet. L'intensité lumineuse est contrôlée par des boutons poussoir et peut être mémorisée grâce à ces mêmes boutons. Cette solution de base peut évoluer vers une solution domotique plus complète en intégrant des capteurs (température, humidité,…), en interfaçant une alarme ou encore en la connectant à des volets roulants ou à une installation de chauffage.

d. Exemples d’utilisation

Pilotage d’ouverture et fermeture de volets roulants via un Smartphone ou un interrupteur sans fil.

Réglage de l’intensité lumineuse des spots basse consommation via un bouton poussoir sans fil.

Réglage de la nuance de blanc via l’espace internet.

Pilotage d’une VMC en fonction des informations des capteurs et du ressenti des personnes

Système de sécurité visuel permettant l’envoi de mail/SMS en cas de nécessité.

2. Définition du besoin

a. Mise en situation

Le projet sera développé au Château Musée de Dieppe. Dominant la ville et la mer depuis la falaise, le château de Dieppe offre une vue exceptionnelle sur Dieppe et son front de mer. Ce château est construit à partir d'un donjon bâti du XIVe au XVIIIe siècle.

Son emploi militaire s'achève en 1898, et il devient en 1923 un musée où sont conservées les collections municipales.

b. Analyse du besoin

Les musées sont les garants de notre patrimoine. La mise en valeur des objets est essentielle et la conservation des œuvres est indispensable.

Les problèmes liés à l'éclairage sont de différents ordres dont le niveau d'éclairement, la neutralité de l'éclairage, la présence d'ultraviolets et le dégagement de chaleur.

i. Problèmes liés à l'éclairage

Le niveau d'éclairement

Le niveau d'éclairement, c'est la quantité de lumière qui atteint un objet. Le niveau d'éclairement doit être homogène sur l'ensemble de l'œuvre éclairée.

La présence de rayons UV

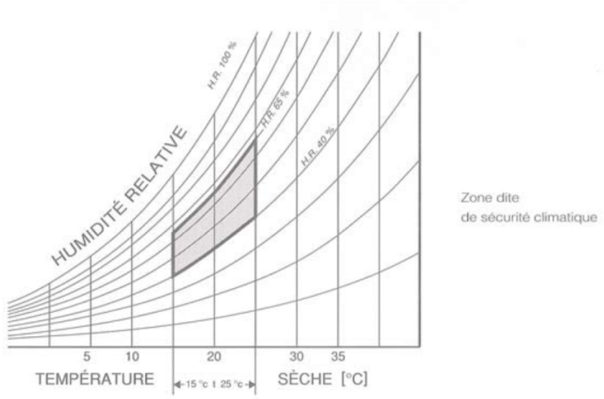
Le deuxième problème lié à l'éclairage est la présence de rayons ultraviolets ou UV. La lumière solaire, l'éclairage fluorescent et la plupart des lumières halogènes émettent des UV. Ces rayons très énergétiques endommagent les objets. Les UV étant inutiles pour l'éclairage des objets, on recommande de les éliminer. Même sous un niveau d'éclairement faible, la quantité d'UV peut être excessive. Des filtres UV arrêtent les ultraviolets, sans diminuer pour autant le niveau d'éclairement.

La chaleur émise

Un troisième problème lié à l'éclairage est celui de la chaleur. La lumière incandescente et la lumière solaire produisent beaucoup de chaleur. Or, une chaleur trop élevée dessèche les matériaux organiques et accélère leur vieillissement.

ii. Problèmes liés à l'hygrométrie et à la température

En règle générale, les valeurs de température et d'hygrométrie relative (HR) pour lesquelles les risques de dégradation des œuvres sont minimes se situent dans la « Zone dite de sécurité climatique », et cela à condition que les variations soient très lentes et de faible amplitude.
A partir de ce constat, il devient nécessaire de quantifier et d'analyser les agents perturbateurs susceptibles de modifier l'environnement climatique du bâtiment. Il s'agit des charges internes et externes du bâtiment.



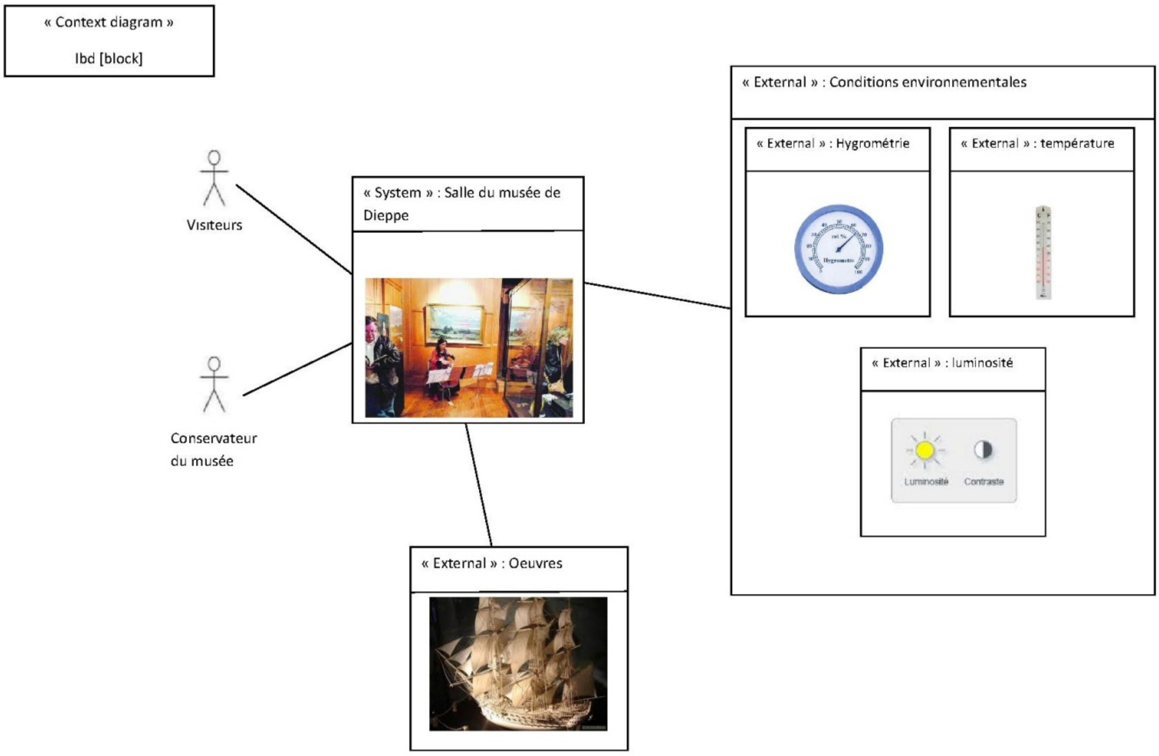
Le château Musée est un bâtiment ancien à forte l'inertie hygrométrique situé dans une zone climatique tempérée. On peut considérer que les apports calorifiques des visiteurs ne suffisent pas à modifier l'équilibre climatique des salles. Il convient cependant de surveiller les paramètres de température et d'hygrométrie notamment dans les réserves.

c. Problématique

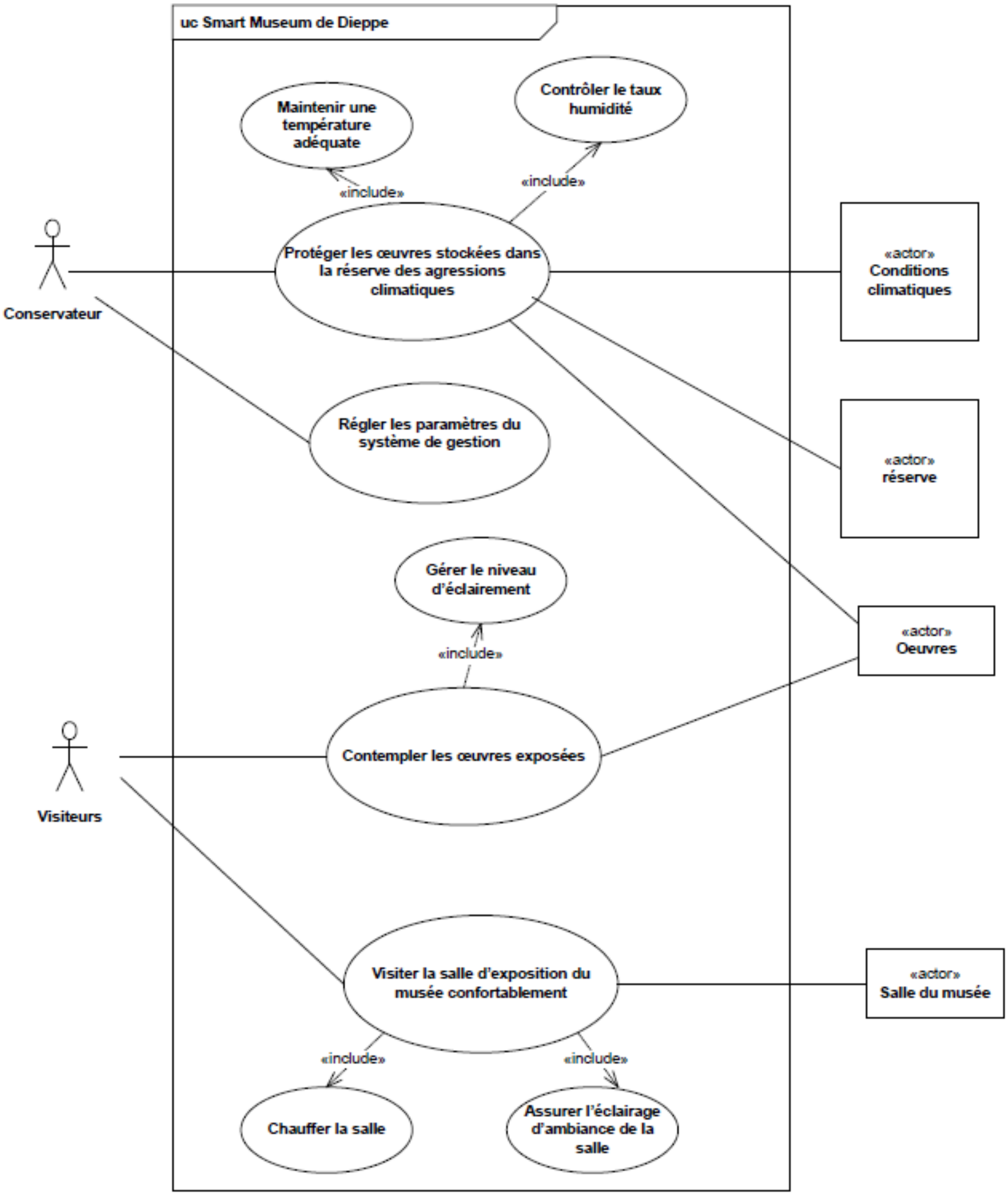
Comment améliorer la mise en valeur des œuvres tout en les préservant et en réduisant les coûts liés à l'éclairage ?

3. Analyse SysML

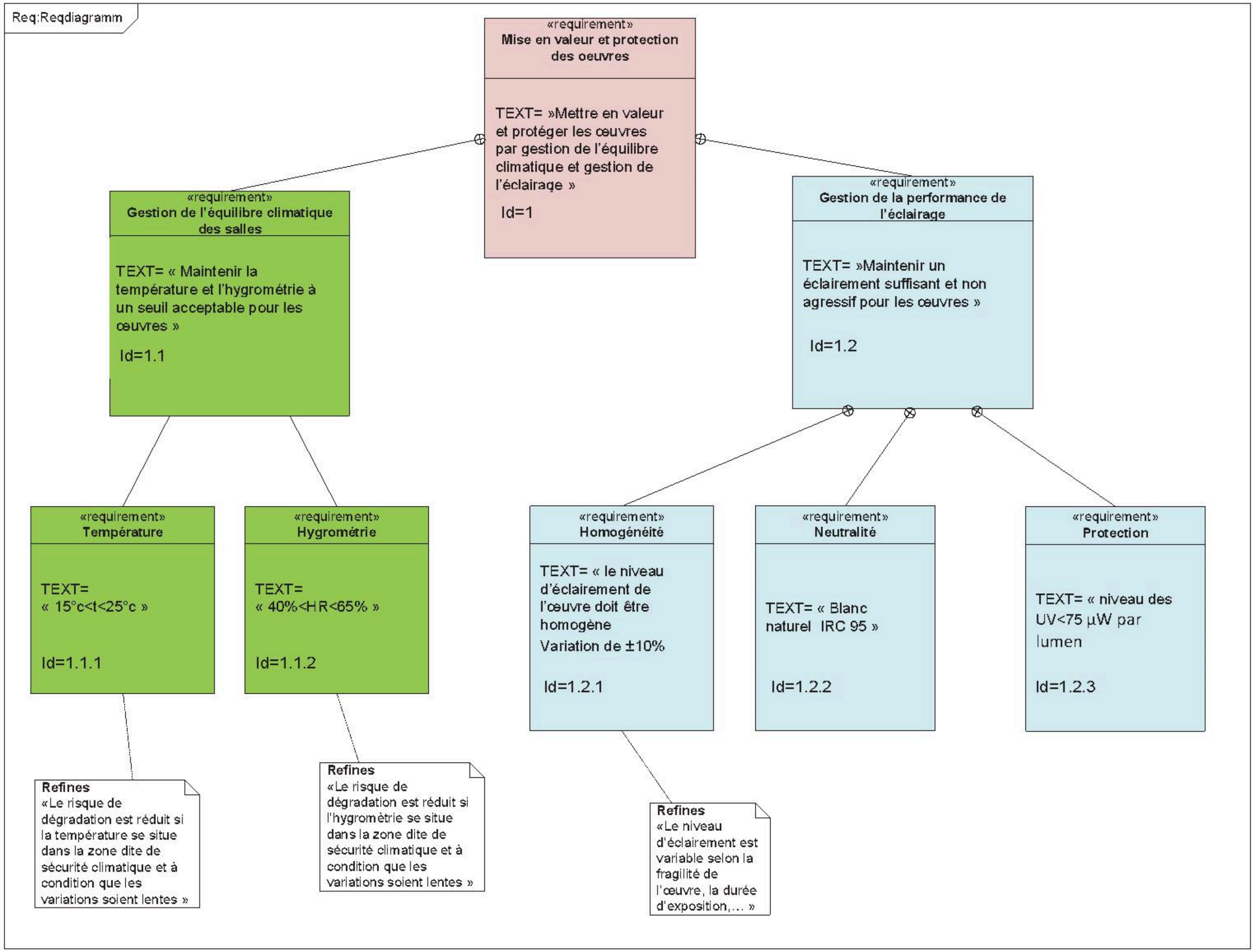
a. Diagramme de contexte



b. Diagramme des cas d'utilisation



c. Diagramme des exigences



4. Maquette didactique : Smart Muséum

a. Présentation générale

La maquette didactique est constituée de 3 salles :

- Salle d'exposition des œuvres, avec :
  - ✓ Un point lumineux (éclairage par spots à leds 2 zones) avec modulation d'énergie indépendante. La modulation peut être commandée par impulsion sur le bouton poussoir ou à distance à partir de la page Web
  - ✓ Mesure d'éclairement

- Réserve, avec :
  - ✓ Un point lumineux (éclairage fixe par lampe à leds)
  - ✓ Détection de présence
  - ✓ Gestion du chauffage (résistance de chauffage et modulation d'énergie)
  - ✓ Mesure de la température
  - ✓ Contrôle du taux d'humidité

- Couloir, avec :
  - ✓ Un point lumineux (éclairage par spots à leds, avec modulation d'énergie)
  - ✓ Détection de présence

b. Les différents scénarios envisagés

Mode normal :

- Pour la réserve, le fonctionnement est toujours le même : il s'agit de maintenir une température constante et de contrôler l'hygrométrie. La lumière sera allumée lorsqu'une personne entrera dans la réserve.

- Pour le couloir et la salle d'exposition, la gestion sera faite en fonction des horaires d'ouverture du musée :
- Durant l'ouverture, la luminosité de la salle d'exposition sera maintenue constante, celle du couloir sera constante.
- Durant la fermeture, les luminaires seront éteints.

Mode sécurité :

On peut envisager qu'en cas d'intrusion durant les heures de fermetures du musée les lumières du couloir et de la salle d'exposition « clignotent » pour dérouter l'intrus.

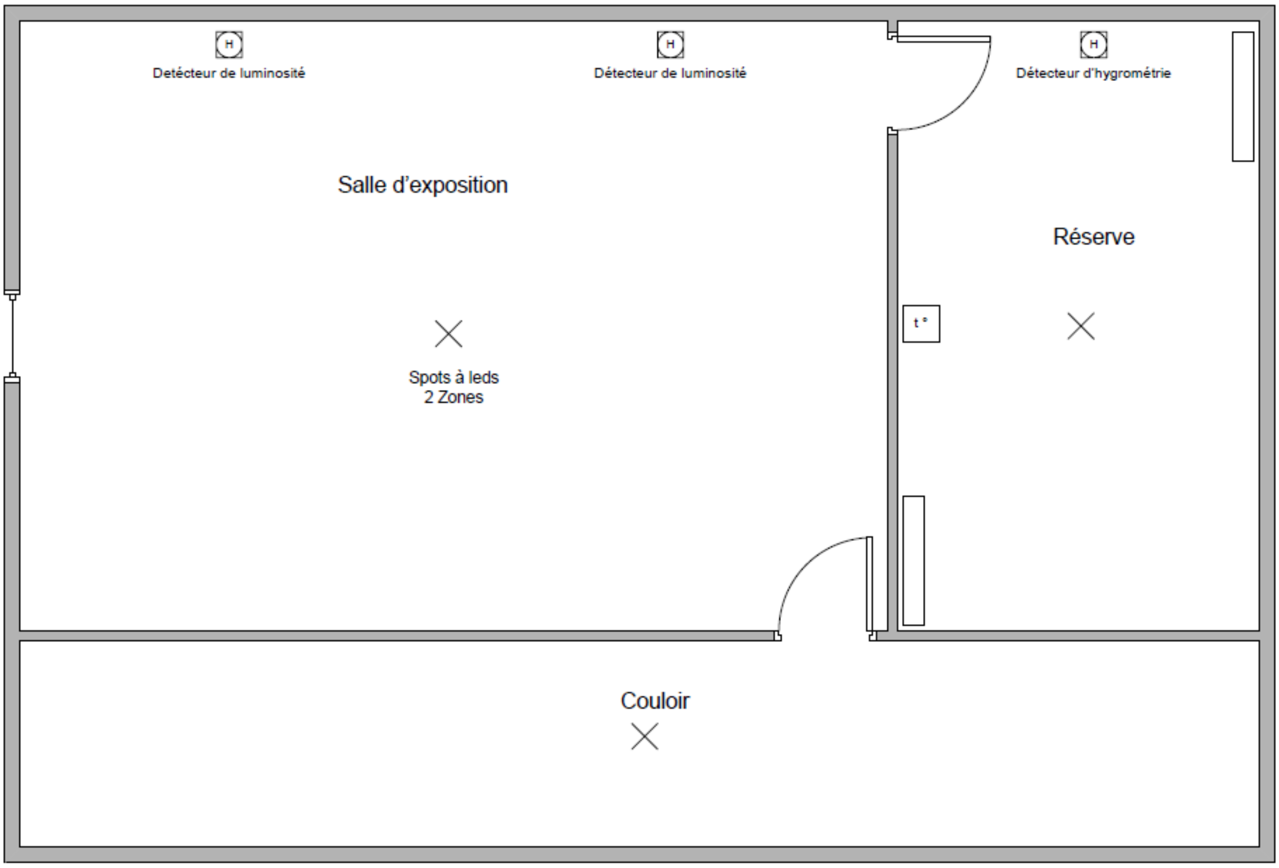
Mode accueil dynamique :

Durant les heures d'ouverture, l'éclairage du couloir peut être établi à un niveau intermédiaire lorsqu'il n'y a pas de passage et augmenté lorsqu'un visiteur arrive.

Mode forçage :

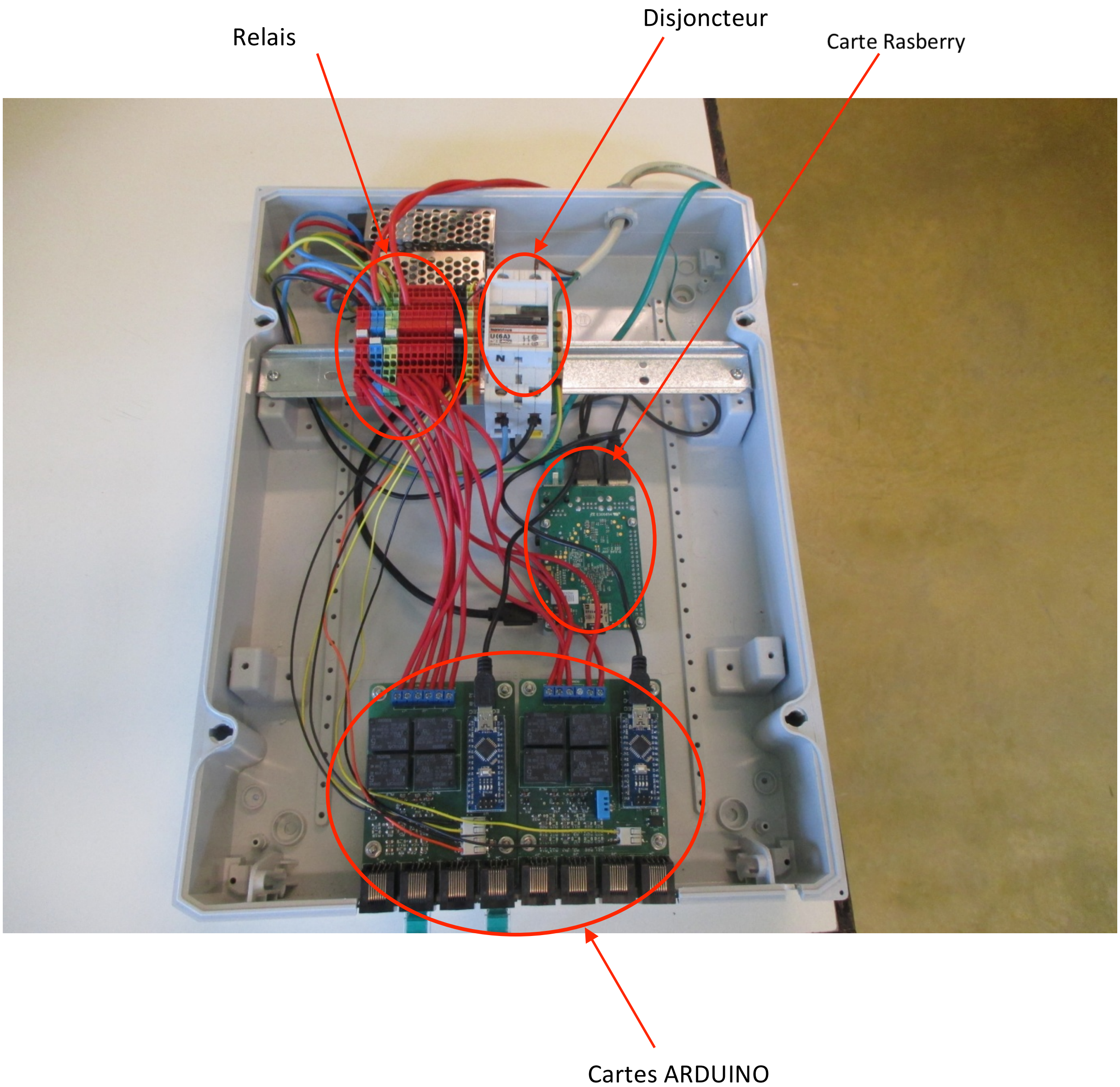
En cas d'évènement particuliers (journées du patrimoine…), le conservateur doit pouvoir forcer le fonctionnement au-delà des heures d'ouvertures habituelles.

c. Plan



Detécteur de luminosité
Détecteur de luminosité
Détecteur d'hygrométrie
Salle d'exposition
Réserve
t °
Spots à leds
2 Zones
Couloir

d. Coffret ECOGELEC

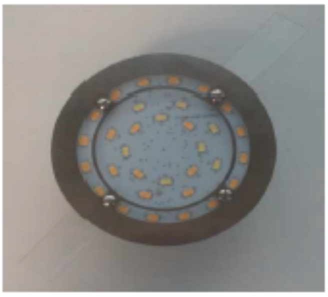


e. Spots à leds

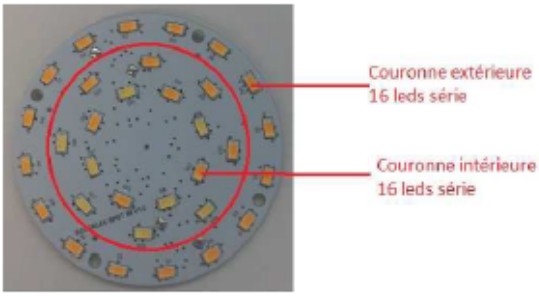
Spot à leds S88-V1.0 Ecogelec

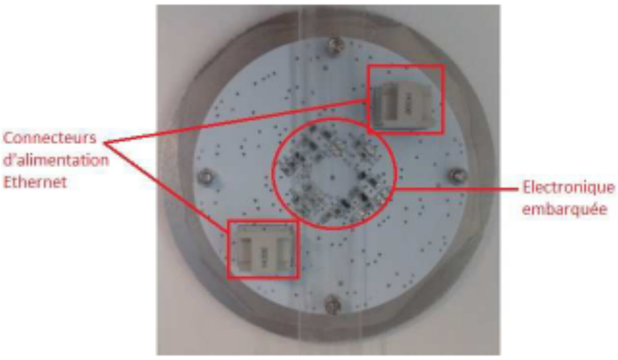
Les caractéristiques du spot sont les suivantes :

- Economie d'énergie
- Grande durée de vie
- Alimentation par courant et tensions faibles
- Pilotable à distance, création de scénarii (dimming de led)
- Protection contre courant inverse
- Possibilité de chaîner les spots
- Connectique simple par Ethernet



Descriptif général





Alimentation électrique

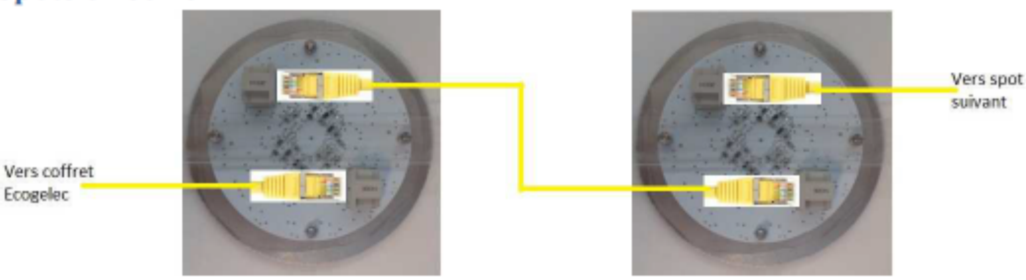
L'alimentation électrique du spot se fait via les deux connecteurs Ethernet. Le connecteur Ethernet amène deux 0-48V ainsi que deux signaux PWM (Pulse Width Modulation). En ce qui concerne les signaux PWM, le câblage est directement fait au niveau du coffret Ecogelec. Les signaux PWM permettent de régler la puissance de l'intensité lumineuse. Les deux connecteurs Ethernet permettent de réaliser des chaînes de plusieurs spots en série (voir schéma ci-dessous).

Important : Pas d'objet métallique en contact avec l'électronique !

Les signaux PWM

Sur ce spot, il y a la possibilité de commander les deux couronnes de 16 leds avec une commande différente ou bien avec une seule commande commune aux 32 leds selon la version du spot S88 (voir chapitre « Les versions du spot »). En utilisant une seule commande, il reste une commande libre pour un autre groupe de spots. Le fait d'alimenter avec deux commandes différentes permet d'obtenir une large gamme de température de blanc allant de 2700°K à 5400°K.

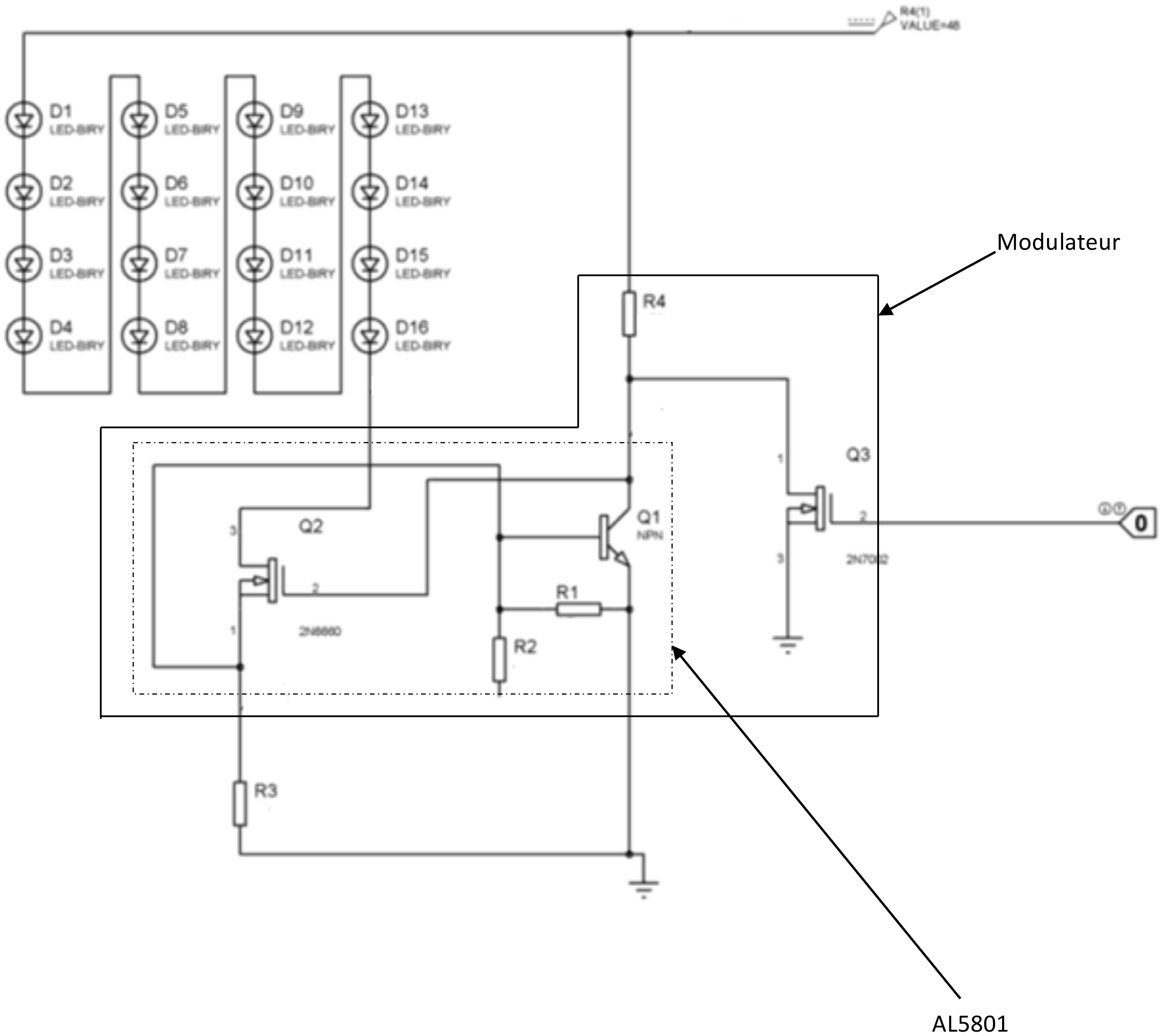
Spots en série



Données technique (à modifier)

Tension d'alimentation	48V DC
Courant consommé	70mA
Luminosité	800Lm
Température de fonctionnement (à Ta=25°C)	40°C
Durée de vie	55000h
Certification	IP21
Poids	25g
Angle d'éclairage	120°

f. Schéma de principe de la modulation d'énergie des spots à leds



LED : 2,45v 70mA

R1 : 4.7KΩ

R2 : 47KΩ

R3 : 5,6Ω

R4 :470KΩ

g. Datasheet AL5801

100V, ADJUSTABLE CURRENT SINK LINEAR LED DRIVER

Description

The AL5801 combines a 100V N-channel MOSFET with a pre-biased NPN transistor to make a simple, small footprint LED driver.

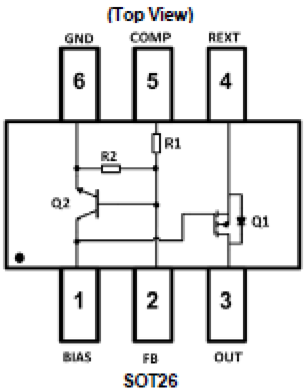
The LED current is set by an external resistor connected from R_{EXT} pin (4) to GND pin (6). The internal pre-biased transistor develops approximately 0.56V across the external resistor.

The AL5801 open-drain output can operate from 1.1V to 100V enabling it to operate 5V to 100V power supplies without additional components.

PWM dimming of the LED current can be achieved by driving the BIAS pin (1) with an external, open-collector NPN transistor or open-drain N-channel MOSFET.

The AL5801 is available in a SOT26 package and is ideal for driving LED currents up to 350mA.

Pin Assignments



Features

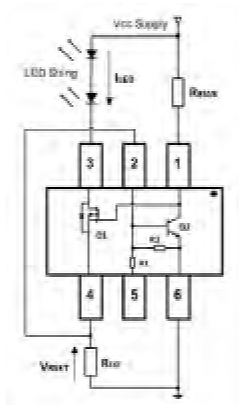
- Feedback Pin Reference Voltage V_{RSET} = 0.56V at +25°C
- -40°C to +125°C Temperature Range
- 1.1V to 100V Open-Drain Output
- Negative temperature V_{RSET} co-efficient automatically reduces the LED current at high temperatures
- Low thermal impedance SOT26 package with copper lead frame
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

Applications

- Linear LED Drivers
- LED Signs
- Offline LED Luminaries

Notes: 1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
2. See http://www.diodes.com for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Typical Applications Circuit



Pin Descriptions

Pin Number	Pin Name	Function
1	BIAS	Biases the open-Drain output MOSFET
2	FB	Feedback pin
3	OUT	Open-Drain LED driver output
4	R_{EXT}	Current sense pin. LED current sensing resistor should be connected from here to GND
5	COMP	Compensation pin. Connect COMP pin to REXT pin and insert a 1nF ceramic capacitor from COMP pin to FB pin for improved transient stability
6	GND	Ground reference point for setting the LED current

Functional Block Diagram

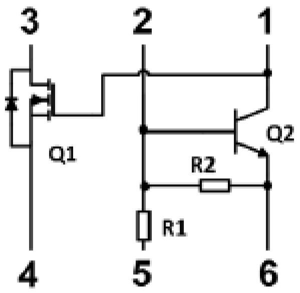


Figure 1 Block Diagram

Absolute Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

Symbol	Characteristics	Values	Unit
V_{OUT}	Output voltage relative to GND	100	V
V_{BIAS}	BIAS voltage relative to GND (Note 4)	20	V
V_{FB}	FB voltage relative to GND	6	V
V_{COMP}	COMP voltage relative to GND	6	V
V_{REXT}	REXT voltage relative to GND	6	V
I_{OUT}	Output current	350	mA
T_J	Operating junction temperature	-40 to +150	°C
T_{ST}	Storage temperature	-55 to +150	°C

Note: 4. With pins 5 and 6 connected together.

These are stress ratings only. Operation outside the absolute maximum ratings may cause device failure.
Operation at the absolute maximum rating for extended periods may reduce device reliability.

Package Thermal Data

Characteristic	Symbol	Value	Unit
Power Dissipation (Note 5) @ T_A = +25°C	P_D	0.75	W
Power Dissipation (Note 6) @ T_A = +25°C		0.70	
Power Dissipation (Note 7) @ T_A = +25°C		0.85	
Power Dissipation (Note 8) @ T_A = +25°C		1.05	
Thermal Resistance, Junction to Ambient Air (Note 5) @ T_A = +25°C	$R_{\theta JA}$	165	°C/W
Thermal Resistance, Junction to Ambient Air (Note 6) @ T_A = +25°C		180	
Thermal Resistance, Junction to Ambient Air (Note 7) @ T_A = +25°C		145	
Thermal Resistance, Junction to Ambient Air (Note 8) @ T_A = +25°C		120	

Notes:
5. Device mounted on 15mm x 15mm 2oz copper board.
6. Device mounted on 25mm x 25mm 1oz copper board.
7. Device mounted on 25mm x 25mm 2oz copper board.
8. Device mounted on 50mm x 50mm 2oz copper board.

Recommended Operating Conditions (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Min	Max	Unit
V_{BIAS}	Supply voltage range	3.5	20	V
V_{OUT}	OUT voltage range	1.1	100	
I_{LED}	LED pin current (Note 9)	25	350	mA
T_A	Operating ambient temperature range	-40	125	°C

Note: 9. Subject to ambient temperature, power dissipation and PCB.

NMOSFET Electrical Characteristics: (Q1) (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	100	—	—	V	V_{GS} = 0V, I_D = 250µA
Zero Gate Voltage Drain Current	I_{DSS}	—	—	1	µA	V_{DS} = 60V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS} = ±20V, V_{DS} = 0V
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(th)}$	2.0	—	4.1	V	V_{DS} = V_{GS}, I_D = 250µA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	— —	0.85 0.99	Ω	V_{GS} = 10V, I_D = 1.5A V_{GS} = 6V, I_D = 1A
Forward Transconductance	g_{fs}	—	0.9	—	S	V_{DS} = 15V, I_D = 1A
Diode Forward Voltage	V_{SD}	—	0.89	1.1	V	V_{GS} = 0V, I_S = 1.5A
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{iss}	—	129	—	pF	V_{DS} = 50V, V_{GS} = 0V f = 1.0MHz
Output Capacitance	C_{oss}	—	14	—	pF	
Reverse Transfer Capacitance	C_{rss}	—	8	—	pF	

Pre-Bias Transistor Electrical Characteristics: (Q2) (@T_A = +25°C, unless otherwise specified.)

Characteristic (Note 10)	Symbol	Min	Typ	Max	Unit	Test Condition
Input Voltage	$V_{I(off)}$	0.4	-	-	V	V_{CC} = 5V, I_O = 100µA
	$V_{I(on)}$	-	-	1.5	V	V_{CC} = 0.3V, I_O = 5mA
Output Voltage	$V_{O(on)}$	-	0.05	0.3	V	I_O/I_I = 5mA/0.25mA
Output Current	$I_{O(off)}$	-	-	0.5	µA	V_{CC} = 50V, V_I = 0V
DC Current Gain	G_1	80	-	-	-	V_O = 5V, I_O = 10mA
Input Resistance	R_1	3.2	4.7	6.2	kΩ	-
Resistance Ratio	R_2/R_1	8	10	12	-	-

Notes: 10. Short duration pulse test used to minimize self-heating effect.

Thermal Characteristics

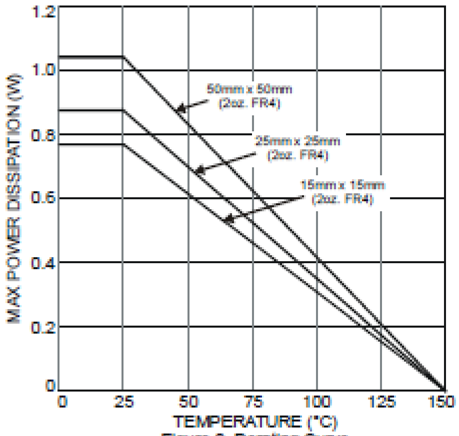


Figure 2 Derating Curve

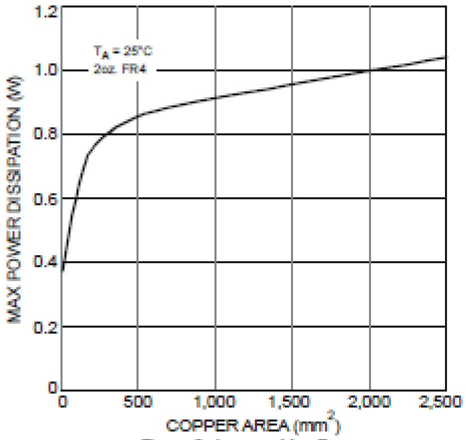


Figure 3 Area vs. Max Power

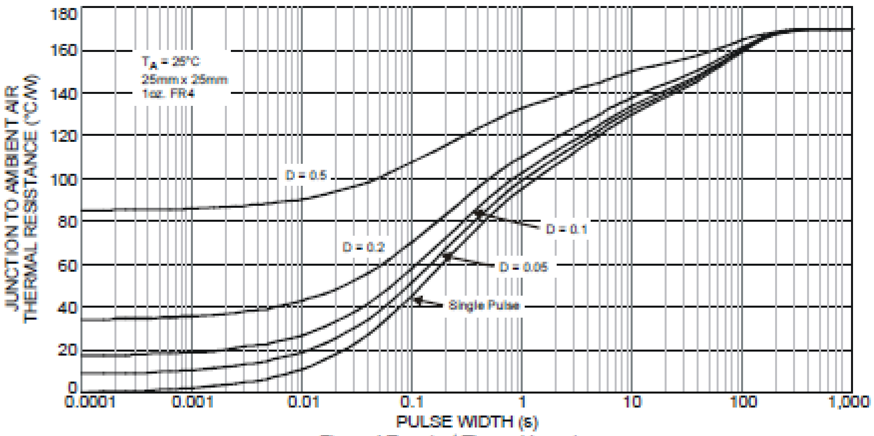


Figure 4 Transient Thermal Impedance

Typical Performance Characteristics

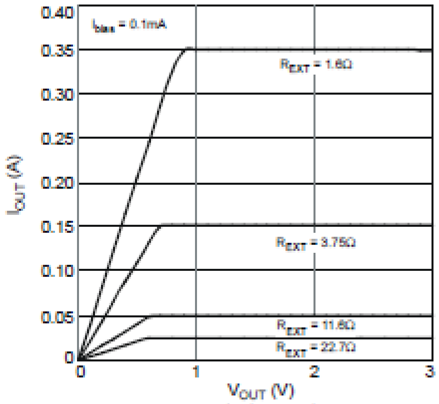


Figure 5 Output Current vs. V_{OUT}

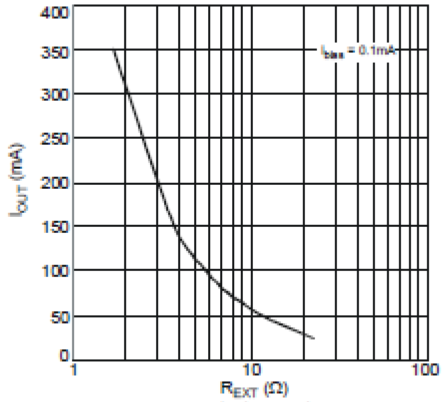


Figure 6 Output Current vs. R_{EXT}

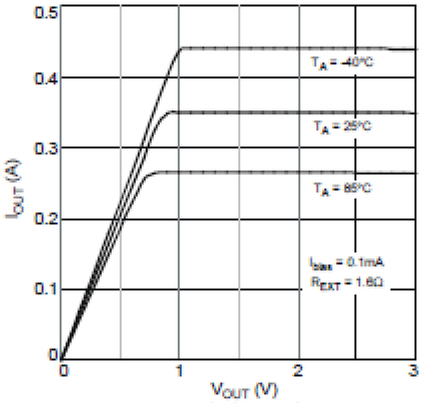


Figure 7 Output Current vs. V_{OUT}

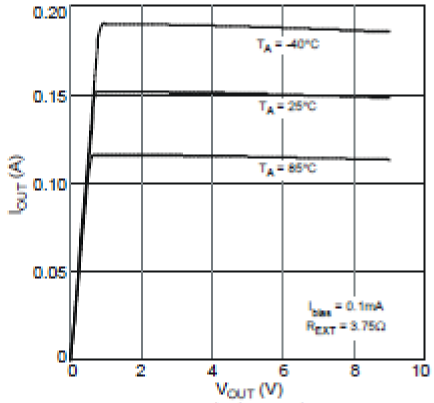


Figure 8 Output Current vs. V_{OUT}

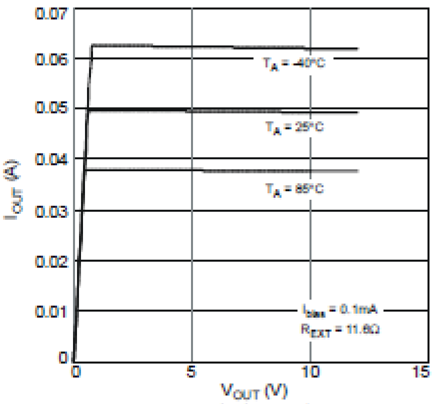


Figure 9 Output Current vs. V_{OUT}

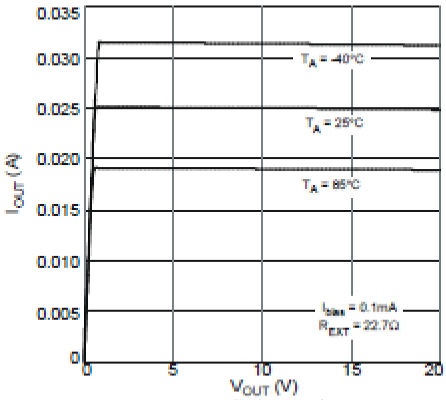


Figure 10 Output Current vs. V_{OUT}

Typical Performance Characteristics (cont.)

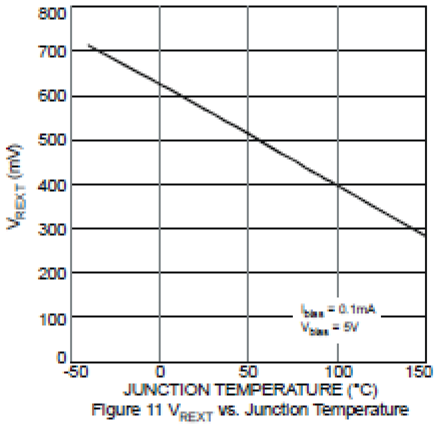


Figure 11 V_{REXT} vs. Junction Temperature

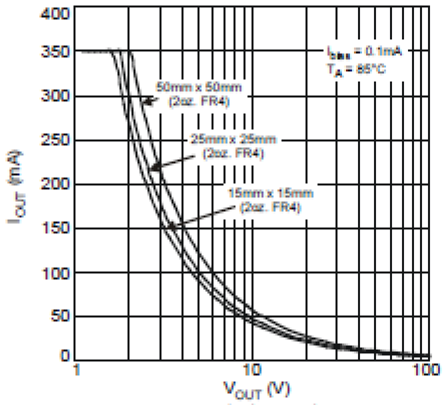


Figure 12 Output Current vs. V_{OUT}

Application Information

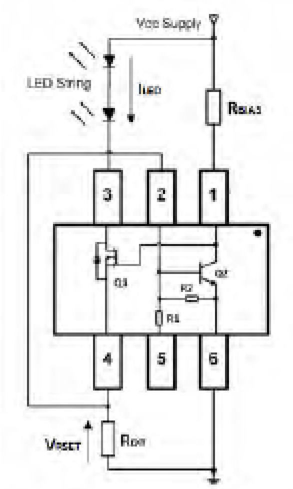


Figure 13 Typical Application Circuit for Linear Mode Current Sink LED Driver

The AL5801 is designed for driving high brightness LEDs with typical LED current up to 350mA. It provides a more cost effective way for driving low current LEDs when compared against more complex switching regulator solutions. Furthermore, it reduces the PCB board area of the solution because there is no need for external components like inductors, capacitors and/or switching diodes.

Figure 13 shows a typical application circuit diagram for driving an LED or a string of LEDs. The NPN transistor Q2 measures the LED current by sensing the voltage across an external resistor R_{EXT}. Q2 uses its V_{BE} as reference to set the voltage across R_{EXT} and controls the gate voltage of MOSFET Q1. Q1 operates in linear mode to regulate the LED current. The LED current is:

$$I_{LED} = V_{RSET} / R_{EXT}$$

where V_{RSET} is the V_{BE} of Q2. V_{BE} is 0.56V typical at a +25°C device temperature. See Figure 11 for the variation of V_{BE} with Q2's junction temperature at I_{BIAS} = 0.1mA. V_{BE} has a negative temperature coefficient which reduces the LED current as the device warms up, protecting the LED(s).

R_{BIAS} should be chosen to drive 0.1mA current into the BIAS pin

$$R_{BIAS} = (V_{CC} - 3.75V) / 0.1mA$$

From the above equation, for any required LED current the necessary external resistor R_{EXT} can be calculated from

$$R_{EXT} = V_{RSET} / I_{LED}$$

The expected linear mode power dissipation must be factored into the design consideration. The power dissipation across the device can be calculated by taking the maximum supply voltage less the minimum voltage across the LED string.

$$V_{DS(Q1)} = V_{CC(max)} - V_{LED(min)} - V_{RSET}$$

$$P_D = V_{DS(Q1)} * I_{LED}$$

As the output LED current of AL5801 increases so will its power dissipation. The power dissipation will cause the device temperature to rise above ambient, T_A, by an amount determined by the package thermal resistance, $R_{θJA}$.

Therefore, the power dissipation supported by the device is dependent upon the PCB board material, the copper area and the ambient temperature. The maximum dissipation the device can handle is given by:

$$P_D = (T_{J(MAX)} - T_A) / R_{θJA}$$

$T_{J(MAX)}$ = +150°C is the maximum device junction temperature. Refer to the thermal characteristic graphs in Figure 2 to 4 for selecting the appropriate PCB copper area. Figure 12 shows the current capabilities of the AL5801 at +25°C with different PCB copper area heat sinks.

Constant LED Current Temperture Compensation

Variation in the junction temperature of Q2 will cause variations in the value of controlled LED current I_{LED}. The base-emitter V_{BE} voltage of Q2 decreases with increasing temperature at a rate of approximately 2mV/°C. Figure 14 shows a simple temperature compensation network, which comprises of an NTC thermistor and resistor R_{base}, for stabilizing the LED current.

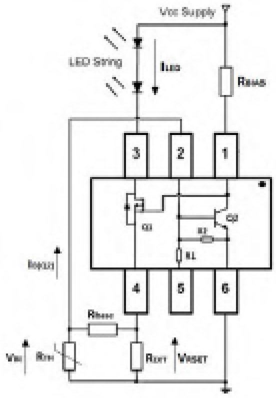


Figure 14 Constant LED Current Temperature Compensation for AL5801

The voltage drop V_{RSET} in the sense resistor R_{EXT} should be set to be 40 to 100mV higher than the $V_{BE(Q2)}$ at 25°C. Figure 11 shows the typical $V_{BE(Q2)}$ is 0.56V at room temperature with 0.1mA I_{BIAS}, so V_{RSET} is selected to be 0.62V.

With the V_{RSET} chosen, the sense resistor value for 350mA I_{LED} is determined by

$R_{EXT} = V_{RSET} / I_{LED} = 0.62V / 350mA = 1.77\Omega$

So a standard resistor value of 1.78Ω with 1% tolerance is used.

The R_{TH} resistance of the NTC thermistor at room temperature is recommended as 10kΩ. The value of base resistor R_{base} is set to be 470Ω. Q2's base current is obtained as

$I_{B(Q2)} = (V_{RSET} - V_{BE(Q2)}) / R_{base} - V_{BE(Q2)} / R_{TH} = (0.62V - 0.56) / 470\Omega - 0.56V / 10k\Omega = 72\mu A$

When $V_{BE(Q2)}$ is changed to V_{BE}^{T} as the temperature increases to T°C, the thermistor resistance at T°C required to compensate this variation is given by

$R_{TH}^{T} = V_{BE}^{T} / ((V_{RSET} - V_{BE}^{T}) / R_{base} - I_{B(Q2)})$

At -2mV/°C, $V_{BE(Q2)}$ reduces to 0.44V from 0.56V as the temperature increases from +25°C to +85°C. From the above equation, the thermistor's resistance at +85°C to keep the same output current is given by

$R_{TH}^{85} = 0.44V / ((0.62V – 0.44V) / 470\Omega - 72\mu A) = 1.4k\Omega$

The NTC thermistor is chosen for compensation whose resistance is 10kΩ at +25°C and 1.38kΩ at +85°C with a β value of 3530.

Figure 15 shows the I_{LED} variation with temperature with and without temperature compensation.

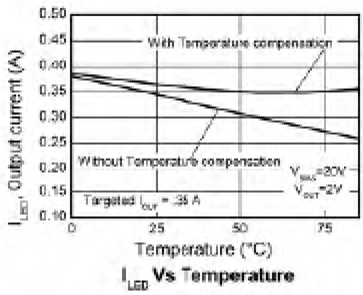
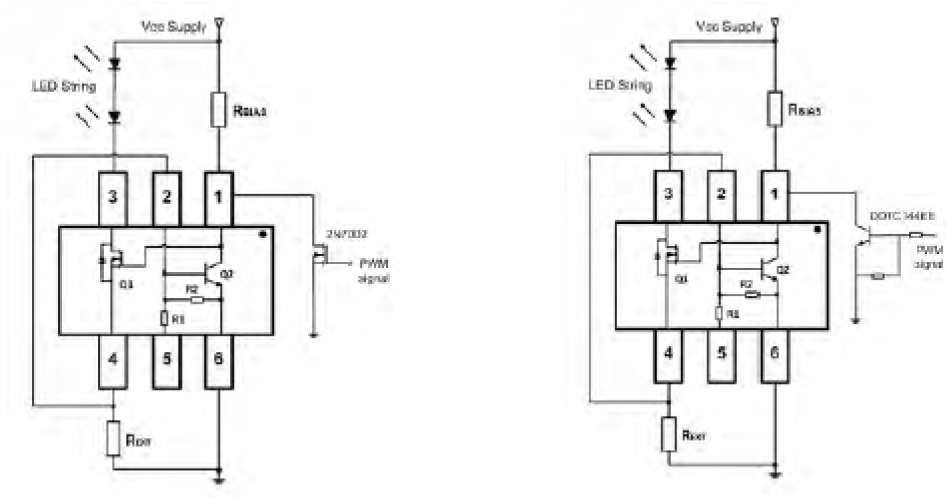


Figure 15 LED Current Variation with and without Temperature Compensation

PWM Dimming



(a) (b)

Figure 16 Application Circuits for LED Driver with PWM Dimming Functionality (a) MOSFET driving and (b) Transistor driving

PWM dimming can be achieved by driving the BIAS pin (1). An external open-collector NPN transistor or open-drain N-channel MOSFET can be used to drive the BIAS pin as shown in Figure 16. Dimming is achieved by turning the LEDs ON and OFF for a portion of a single cycle. The PWM signal can be provided by a micro-controller or by analog circuitry.

Figure 17 shows the LED current against the PWM signal duty ratio when the AL5801 is used to drive three series connected LEDs from a 12V supply. The PWM dimming frequency is set to 200Hz. The PWM signal is supplied to the open-Drain small signal MOSFET's gate as shown in Figure 16a. The BIAS pin signal is an inversion of the PWM drive to the MOSFET's gate. Therefore, a PWM signal duty cycle of 0% provides the maximum LED current. Sufficiently large PCB copper area is used for heat sinking of the AL5801 in order to minimize the device self-heating at +25°C ambient.

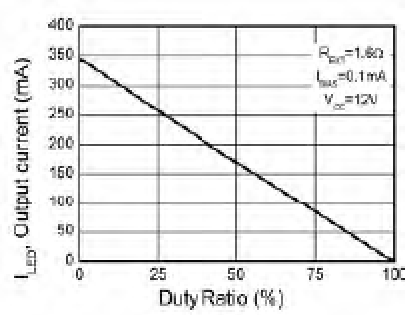


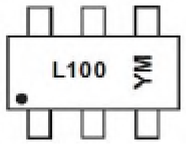
Figure 17 LED Current against PWM Dimming Signal Duty Ratio at 200Hz PWM Frequency

Ordering Information

Part Number	Qualification	Package Code	Packaging (Note 11)	7" Tape and Reel	
				Quantity	Part Number Suffix
AL5801W6-7	Commercial	W6	SOT26	3,000/Tape & Reel	-7
AL5801W6Q-7	Automotive	W6	SOT26	3,000/Tape & Reel	-7

Notes: 11. For packaging details, go to our website at http://www.diodes.com

Marking Information



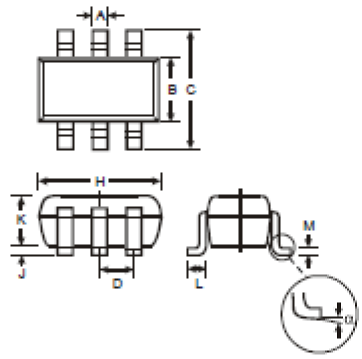
L100 = Product Type Marking Code
YM = Date Code Marking
Y = Year (ex: Y = 2012)
M = Month (ex: 9 = September)

Date Code Key

Year	2012	2013	2014	2015	2016	2017	2018
Code	Z	A	B	C	D	E	F

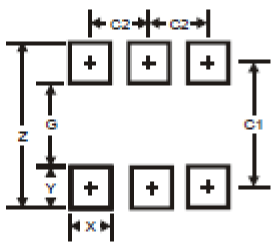
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Code	1	2	3	4	5	6	7	8	9	O	N	D

Package Outline Dimensions (All dimensions in mm.)



SOT26			
Dim	Min	Max	Typ
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	—	—	0.95
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
α	0°	8°	—
All Dimensions in mm			

Suggested Pad Layout



Dimensions	Value (in mm)
Z	3.20
G	1.60
X	0.55
Y	0.80
C1	2.40
C2	0.95

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2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

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5. Gestion du chauffage de la réserve

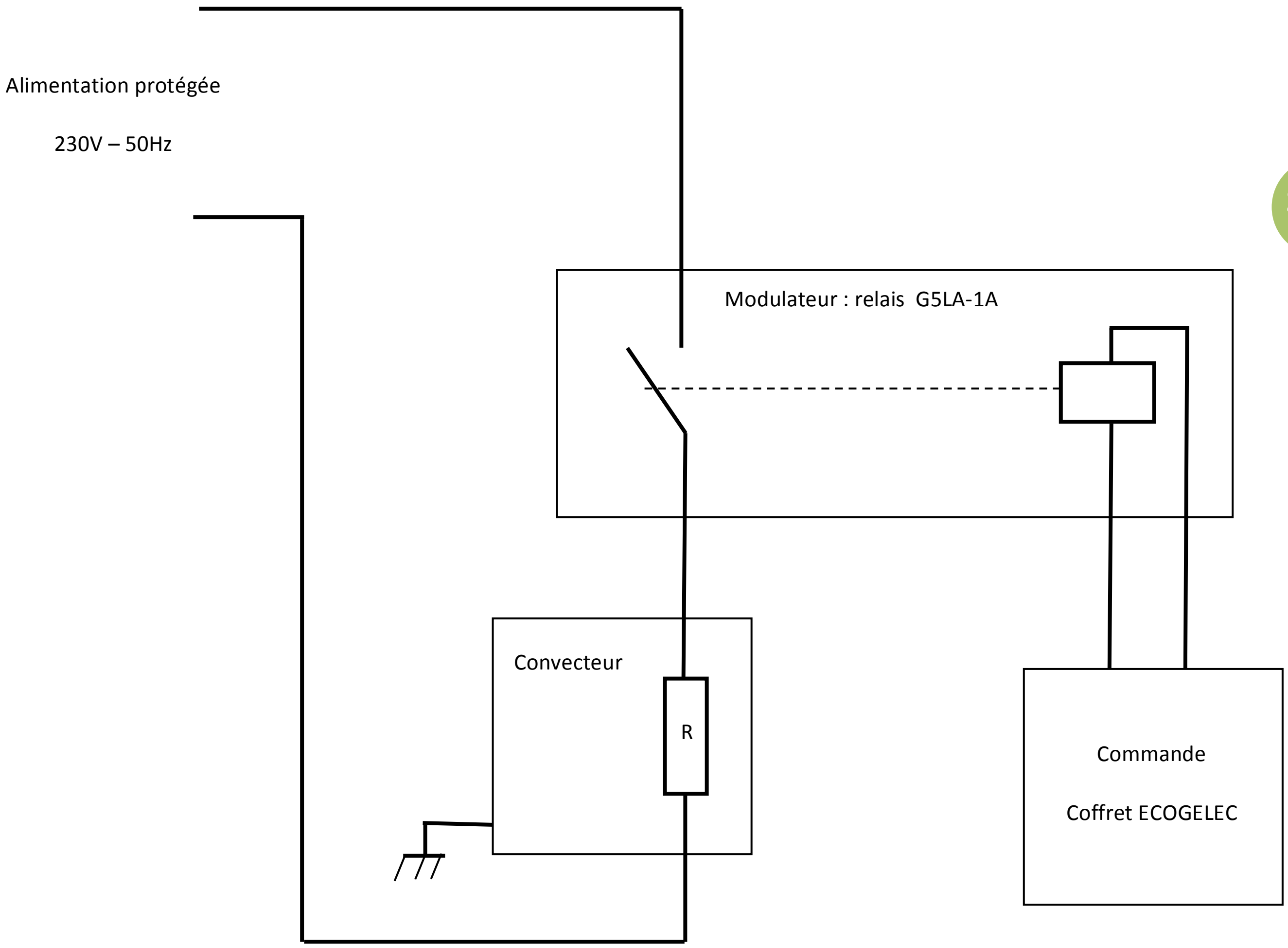
a. Gamme de convecteurs F117T

- Montée en chaleur rapide
- Résistance blindée avec diffuseur en aluminium.
- Dispositif de blocage des commandes.
- Coloris : blanc (RAL 9016).

Puissance et dimensions des convecteurs F117

Puissance	Largeur	Hauteur	Epaisseur	Poids
500 W	369	451	78	3.9
750 W	369	451	78	3.9
1000 W	443	451	78	4.4
1250 W	517	451	78	5.1
1500 W	591	451	78	5.8
1750 W	665	451	78	6.7
2000 W	739	451	78	7

b. Schéma de principe de la commande du chauffage



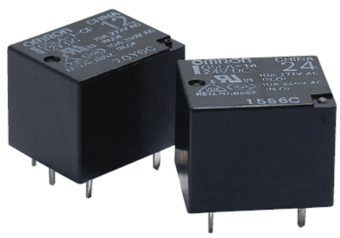
c. Datasheet du Relais OMRON G5LA-1A

OMRON

PCB Relay
G5LA

A Cubic, Single-pole 10A Power Relay

- Economical cube relay with universal terminal footprint
- Conforms to VDE0435, CQC
- UL recognized/ CSA certified.
- High switching power: 10A @ 250VAC
- Withstands impulse of up to 4,500V
- Coil power consumption: 360mW
- UL Class F coil insulation type also available
- Tracking resistance: CTI>250
- RoHS Compliant



Ordering Information

Type	Contact form	Enclosure ratings	Model
Standard	SPST-NO (Class A)	Flux protection	**G5LA-1A**
		Sealed	**G5LA-1A4**
	SPST-NO (Class F)	Flux protection	**G5LA-1A-CF**
		Sealed	**G5LA-1A4-CF**
	SPDT (Class A)	Flux protection	**G5LA-1**
		Sealed	**G5LA-14**
	SPDT (Class F)	Flux protection	**G5LA-1-CF**
		Sealed	**G5LA-14-CF**
High-capacity	SPDT (Class A)	Flux protection	**G5LA-1-E**
		Sealed	**G5LA-14-E**
	SPDT (Class F)	Flux protection	**G5LA-1-E-CF**
		Sealed	**G5LA-14-E-CF**

Note: When ordering, add the rated coil voltage to the model number.
Example: G5LA-1 DC12
Rated coil voltage

■ Model Number Legend

G5LA- □ □ □ - □ - □ DC □
1 2 3 4 5 6

1. **Number of Poles**
   1: 1 pole
2. **Contact Form**
   None: SPDT
   A: SPST-NO
3. **Enclosure Ratings**
   None: flux protection
   4: fully sealed
4. **Type**
   None: Standard
   E: High Capacity (SPDT only)
5. **Insulation Class**
   None: Class A
   CF: Class F
6. **Rated Coil Voltage**
   5, 9, 12, 24, or 48

Specifications

■ Coil Ratings

Rated Voltage (VDC)	Rated current (mA)	Coil resistance (Ω)	Must operate voltage	Must release voltage	Rated power consumption (W)	Max voltage
5	72	69.4	75% max.	10% min.	Approx. 0.36	130% of rated voltage at 85°C 170% of rated voltage at 23°C
9	40	225				
12	30	400				
24	15	1600				
48	10	4800			Approx. 0.48	

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with tolerances of ±10%.
2. Please avoid ultrasonic cleaning this relay.

■ Contact Ratings

Rated load (resistive)	**SPST-NO**	10 A @ 250 VAC (NO)	10 A @ 24 VDC (NO)	
	SPDT	5 A @ 125 VAC (NO/NC)	5 A @ 24 VDC (NO/NC)	
	High-capacity	5 A @ 250 VAC (NO/NC)	5 A @ 24 VDC (NO/NC)	
Rated carry current		10 A (SPST-NO)	10 A (High-capacity)	5 A (SPDT)
Max. switching voltage		250 VAC	24 VDC	
Max. switching current		10 A	SPST-NO	
		5 A	SPDT, High-capacity	
Max. switching capacity		2500 VA, 240 W (NO)	625 VA, 120 W (NC)	1250 VA, 120 W (NO/NC High-capacity)
Min. permissible load		100 mA at DC5V (P level: $\lambda_{60} = 0.1 \times 10^{-6}$ / ops)		
Contact Material		$AgSnO_2$		

Note: SPDT type can switch up to 10 A @ 250 VAC/24 VDC Resistive Load on NO contact if there is no load on the NC contact.

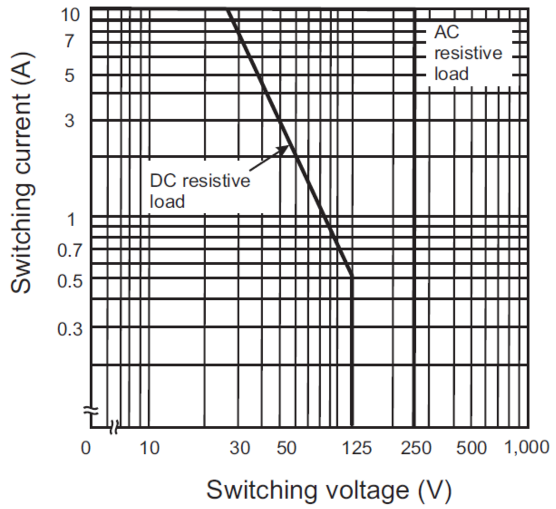
■ Characteristics

Contact resistance	100 mΩ max.
Operate time	10 ms max.
Release time	5 ms max.
Max. operating frequency	Mechanical: 18,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric strength	2,000 VAC, 50/60 Hz for 1 minute between coil and contacts 750 VAC, 50/60 Hz for 1 minute between contacts of same polarity
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 100 m/s^2 (approx. 10G)
Life expectancy	Mechanical: 10,000,000 operations min. (at 18,000 operations/hr under no load) Electrical: 100,000 operations average. (at 1,800 operations/hr under rated load)
Ambient temperature	Operating:- 40°C to 85°C (with no icing or condensation) Storage: -40°C to 85°C (with no icing or condensation)
Ambient humidity	Operating: 35% to 85% Storage: 35% to 85%
Weight	Approx. 7.5g

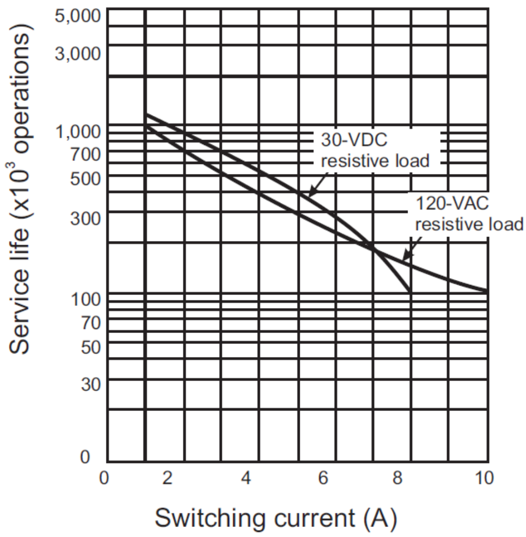
Note: 1. Data shown are of initial value.
2. All G5LA Class A rated relays are factory guaranteed to maximum Operating Temperature of 85°C.
UL rated maximum temperature is pending approval for Class B rating.

Engineering Data

Maximum switching capacity (NO)

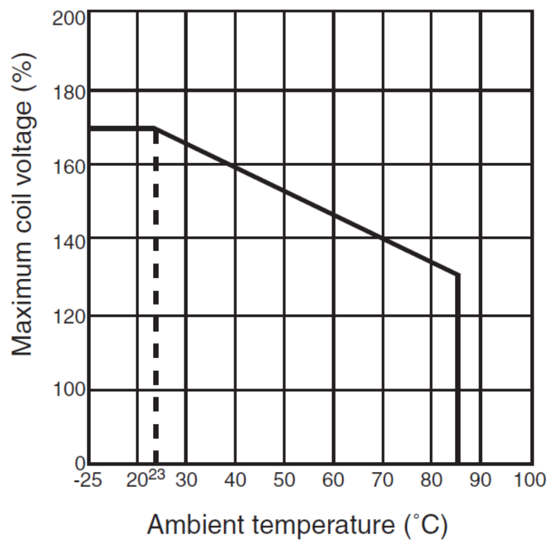


Electrical service life NO (Average value)



Note: The 120 VAC resistive load service life curve also applies for 250 VAC resistive load.

Ambient Temperature vs. Maximum Coil Voltage



Note: The maximum coil voltage refers to the maximum value in a varying range of operating power voltage not a continuous voltage.

6. Crédits Photographiques

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