ACL410C - Direct AC Line LED Driver Dimmable

UP TO 10W OUTPUT with improved dimming compatibility

ACL410C-DS-V1.1 – JUNE 2021

Datasheet

MATURITY
In Production

1. FEATURES

ACL410C UP TO 10W OUTPUT Dimmable

- Direct AC Line LED Driver with improved dimming compatibility
- Wide AC Input Range: 50 to 280V AC
- High Power Factor: 0.97 with optimized LED configuration
- Low quiescent current: 610µA
- High Efficiency: 85% typical
- Ultra-Flexible LED Forward Voltage Configuration,
- Up to 4 LED stages capability,
- Over Temperature Power derating
- Embedded and flexible bleeder for external dimmer compatibility (leading and trailing edge dimmers)
- Independent and flexible additional current source for improved low-flicker performances

2. APPLICATIONS

- General Solid State Lighting,
- Medium Power LED Lamp,
- Connected Medium Power Led Lamp,
- Industrial High power LED Lamp,
- Dimmable light.

3. DESCRIPTION

The ACL410C is an AC direct LED driver with improved dimming compatibility requiring few external components.
The dimmer compatibility is ensured by an embedded and configurable bleeder. The bleeder current can be set thanks to external components. The NEMA SSL-6 dimming profile can be easily reached, even in low-flicker configurations.
The ACL410C also embeds an independent and configurable additional current source allowing improved performances in low-flicker configurations.

4. PIN CONNECTIONS

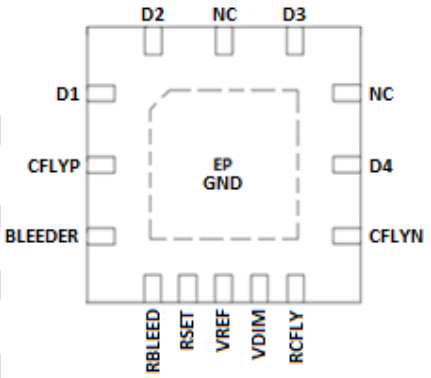

Figure 1: QFN 5x5mm with Exposed Pad (TOP VIEW)

5. TYPICAL APPLICATIONS

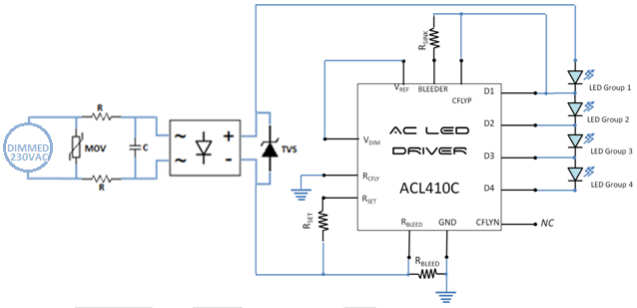

Figure 2: Low-cost application schematic for 230VAC direct AC bulb

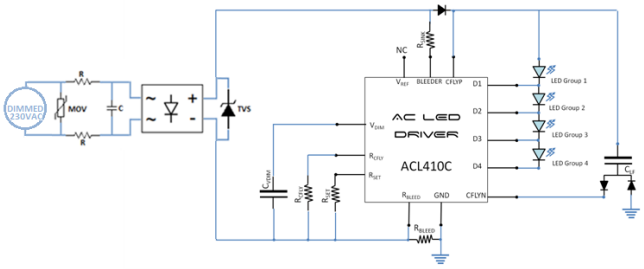

Figure 3: Low-cost application schematic for 230VAC low-flicker bulb

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6. REVISION HISTORY

Version	Date	Changes
1.0	27/06/2019	Preliminary 1st public release
1.1	23/06/2021	

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

7. PIN CONFIGURATION

Pin descriptions and Functions

Symbol	Pin #	Type	Function
D1	1	IO	LED Cathod group 1
CFLYP	2	PWR	Power supply
BLEEDER	3	IO	Bleeder input
R_{BLEED}	4	IO	Resistor to set the max bleeder current
R_{SET}	5	GND	Resistor to set the max LED current
V_{REF}	6	IO	Regulator output 3.3V
V_{DIM}	7	IO	Analog input for dimming profile improvement
R_{CFLY}	8	IO	Resistor to set the max low-flicker capacitance current (low-flicker configurations)
CFLYN	9	IO	Low-flicker capacitor current source
D4	10	IO	Cathode LED group 4
NC	11		Not Connected
D3	12	IO	Cathode LED group 3
NC	13		Not Connected
D2	14	IO	Cathode LED group 2
GND/EP	15	GND	Exposed Pad connected to the GND

Table 1: Pin description and functions

ACL410C PINOUT (QFN 5x5x0.85mm with Exposed Pad)

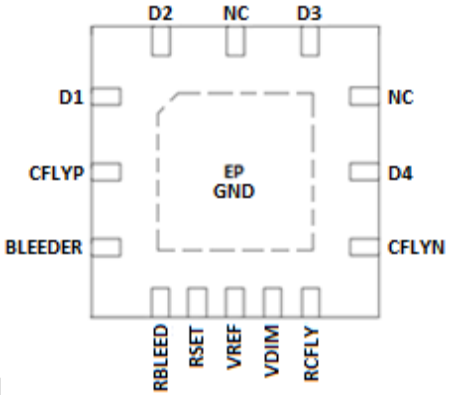


Figure 4: Pin mapping

8. ABSOLUTE MAXIMUM RATINGS

Parameter	Min	Typ	Max	Units
Input power supply CFLYP	TBD		TBD	V
Input power supply BLEEDER	TBD		TBD	V
Output R_{BLEED}	TBD		TBD	V
Output R_{SET}	TBD		TBD	V
Output VREF	TBD		TBD	V
Input VDIM	TBD		TBD	V
Output R_{CFLY}	TBD		TBD	V
Output capacitor current source CFLYN	TBD		TBD	V
Output LED Voltage D1	TBD		TBD	V
Output LED Voltage D2	TBD		TBD	V
Output LED Voltage D3	TBD		TBD	V
Output LED Voltage D4	TBD		TBD	V
$T°_{junction}$	TBD		TBD	°C

Table 2: Absolute maximum ratings

Notes:

1. The **ACL410C** product type has been submitted to and conforms with HTOL, PCON/MSL1/TMCL, PCON/MSL1/UHAST and HTSL qualification tests. Stress tests have been completed without rejects and were performed according to the requirements of the test reference.
2. HTOL test reference is **JESD22-A108**. PCON/MSL1/TMCL test reference is according to the **JESD22-A113, JESD22-A104** standard. PCON/MSL1/UHAST test reference is according to the **JESD22-A113, JESD22-A118** standard. HTSL test reference is according to the **JESD22-A103** standard.
3. The ACL410C product withstands class I with immunity level A of latch-up **JESD78E** standard.

9. ELECTRICAL CHARACTERISTICS

Operating Conditions

Parameter	Min	Typ	Max	Units
Input power supply CFLYP			TBD	V (peak)
Input power supply BLEEDER			TBD	V (peak)
dV/dt (V_{RECT})			TBD	$V.\mu s^{-1}$
V_{D1}	TBD		TBD	V
Voltage difference D_{n-1}-D_n (2≤n≤4)	TBD	75	TBD	V
V_{D4}	TBD	75	TBD	V
R_{SET}	TBD		TBD	Ω
R_{BLEED}	TBD		TBD	Ω
R_{CFLY}	TBD		TBD	Ω
V_{DIM}	TBD		V_{REF}	V
Load Current V_{REF} *			TBD	µA
$T°_{junction}$	TBD		TBD	°C

Table 3: Operating conditions

Electrical Parameters

Parameter	Conditions	Min	Typ	Max	Units
$I_{QUIESCENT}$		TBD	610	TBD	µA
I_{CC}			$I_{QUIESCENT}$ + I_{BLEED} + I_{CAP}		
I_{LED}		TBD	$I_{D1}=0.74/(9.4+R_{SET})$	TBD	A
			$I_{D2}=0.79/(9.4+R_{SET})$		
			$I_{D3}=0.89/(9.4+R_{SET})$		
			$I_{D4}=1.05/(9.4+R_{SET})$		
I_{CAP}		TBD	$I_{CAP}=1.204/(9.4+R_{CAP})$	TBD	A
I_{BLEED}		TBD	$0.102/R_{BLEED}$	TBD	A
Input V_{DIM} current		TBD		TBD	µA
V_{REF} voltage		TBD		TBD	V
Output power derating* Curie point ($P_T = P_{25°C}/2$)			175		°C
Output power derating* from -40°C to 100°C			0.1		%/°C
Package Thermal Resistance Θ_{JA}** (junction to air thermal resistance)			26		°C/W

Table 4: Electrical parameters

* Power derating acts as a soft over temperature protection. LED currents decrease with excessive IC temperature.

** Warning: Junction-to-air thermal resistance highly depends on application and PCB layout. Thermal management of lighting system has to be carefully taken into account.

Over temperature and LED failure Protection.

- In case of excessive temperature in the IC, thermal regulation is managed by regulating the delivered power and the associated temperature. The implemented output power acts as soft temperature protection. The LED current is decreased to regulate the junction temperature until a safe state is found.
- In case of LED failure, the output power derating acts also as a protection. If the group of LED n is broken (open circuit), the LED current will flow in the previous pin Dn-1 of the IC. This will increase dissipated power and temperature too. The output power derating will activate to decrease temperature until a safe state is reached again.

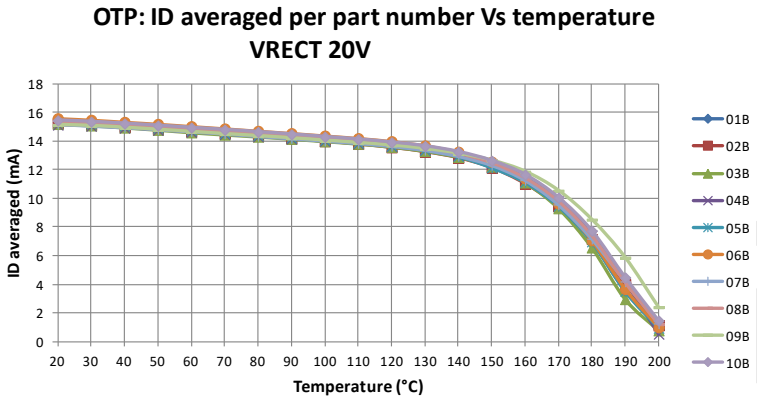


Figure 5: Output LED current derating vs temperature

R_{SET} open/short Protection.

When R_{SET} Pin is opened, the LED output current becomes zero.
When R_{SET} Pin is shorted to GND, a current limitation is enabled. It is set to a hundred of milliamperes and prevents damage to the IC.

VDD short Protection

When VDD Pin is shorted to GND, a current limitation starts up, set to around 25 mA preventing damage to the IC.

10. PACKAGE DESCRIPTION

QFN014 5x5x0.85mm with exposed pad

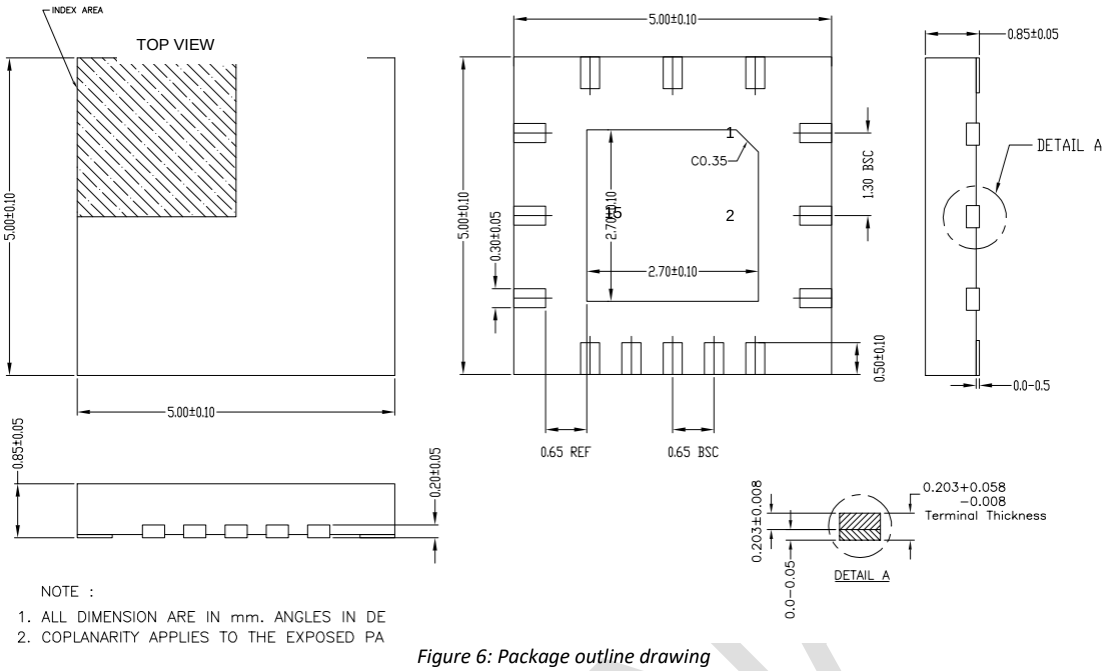
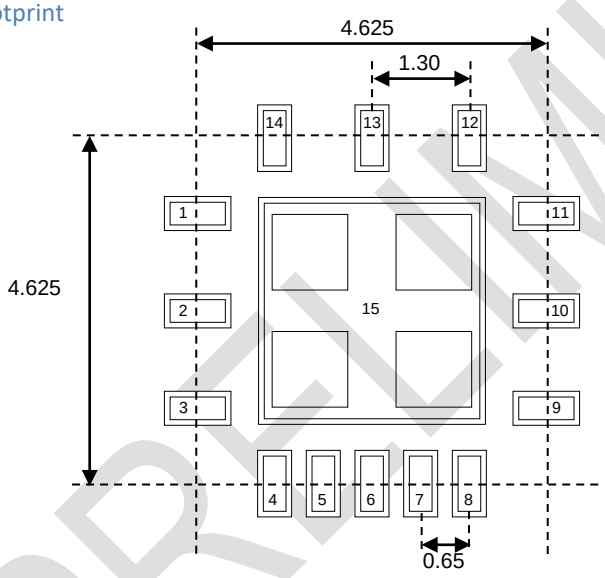


Figure 6: Package outline drawing

PCB Footprint



Pad Top Elec: 0.725 x 0.3 mm
Pad Top Paste: 0.725 x 0.3 mm
Pad Top Solder Resist: 0.875 x 0.45 mm

Thermal Pad Top Elec: 2.85 x 2.85 mm
Thermal Pad Top Paste: 1 x 1 mm (x4)
Thermal Pad Top Solder Resist: 3.0 x 3.0 mm

Figure 7: PCB footprint (TOP view)

11. ORDERING INFORMATION

Device*	Package	Shipping**
ACL410C	QFN14 5x5mm	Tape & Reel

Table 5: Ordering reference

* Only Engineering samples are available.
** Please, ask EASii IC for details of the quantity per reel with part orientation.

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