



ACL410C - Direct AC Line LED Driver Dimmable

UP TO 10W OUTPUT with improved dimming compatibility

ACL410C-AN-V1.3 – JUNE 2019



Application Notes



MATURITY
In Production

1. FEATURES

ACL410C UP TO 10W OUTPUT

- 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.

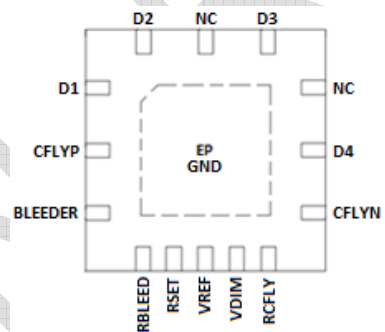
3. DESCRIPTION

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



QFN 5x5mm with exposed pad (TOP VIEW)

PRELIMINARY

5. TYPICAL APPLICATION: 230V_{AC} LOW-COST DIMMER COMPATIBLE BULBS, 8W LED DEMO BOARD

Schematics:

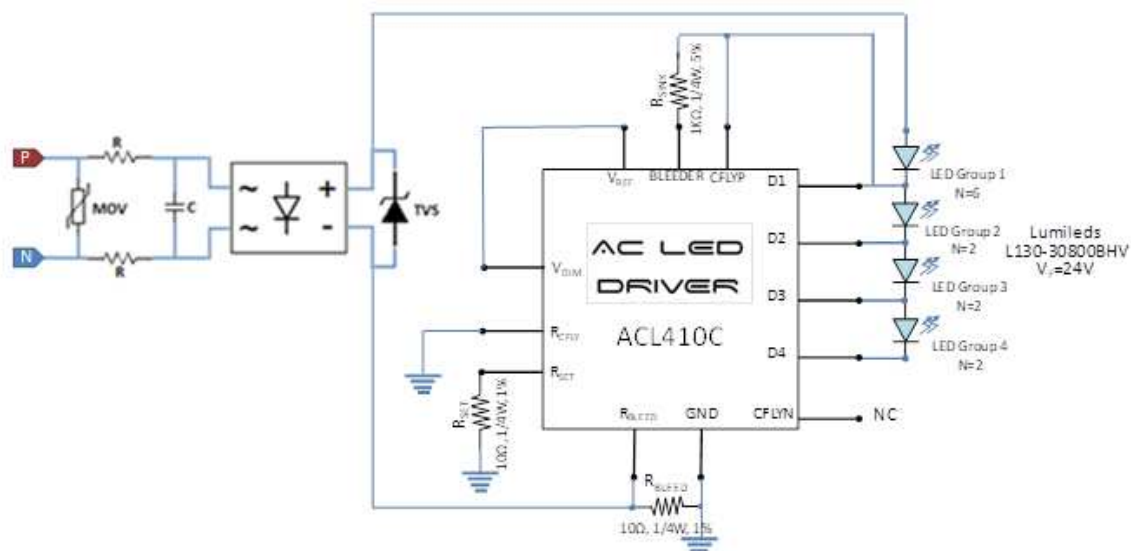


Figure 1: Low-cost application schematic for 230V_{AC} Direct AC Bulb

LED Group description: A LED group is defined by a number N of LEDs in series.

Dimming phase	P _{sector}	P _{LED}	P _{LUM}	Efficiency	Percentage flicker	Flicker index
160°	9.7 W	8.4 W	1000 Lm	0.86	100 %	35 %
100°	5.6 W	5.1 W	614 Lm	0.86	100 %	60 %
60°	1.9 W	1.5 W	180 Lm	0.8	100 %	82 %

Table 1: Bulb characteristics with dimmer position

Calculation of I_{LED} (@25°C):

- $I_{D1} = 0.74 / (8.6 + R_{SET})$ in A,
- $I_{D2} = 0.79 / (8.6 + R_{SET})$ in A,
- $I_{D3} = 0.89 / (8.6 + R_{SET})$ in A,
- $I_{D4} = 1.05 / (8.6 + R_{SET})$ in A.

In this application, the currents are summarized below:

R _{SET} (Ω)	ID1 (mA)	ID2 (mA)	ID3 (mA)	ID4 (mA)
10	39.8	42.5	47.8	56.4

Table 2: current in LED

It's compulsory to make the full tests and qualifications of this design before to place it in the market.

6. TYPICAL APPLICATION: 230V_{AC} LOW-FLICKER DIMMER COMPATIBLE BULBS, 10W LED LOW FLICKER EASII-IC PATENT

Schematics:

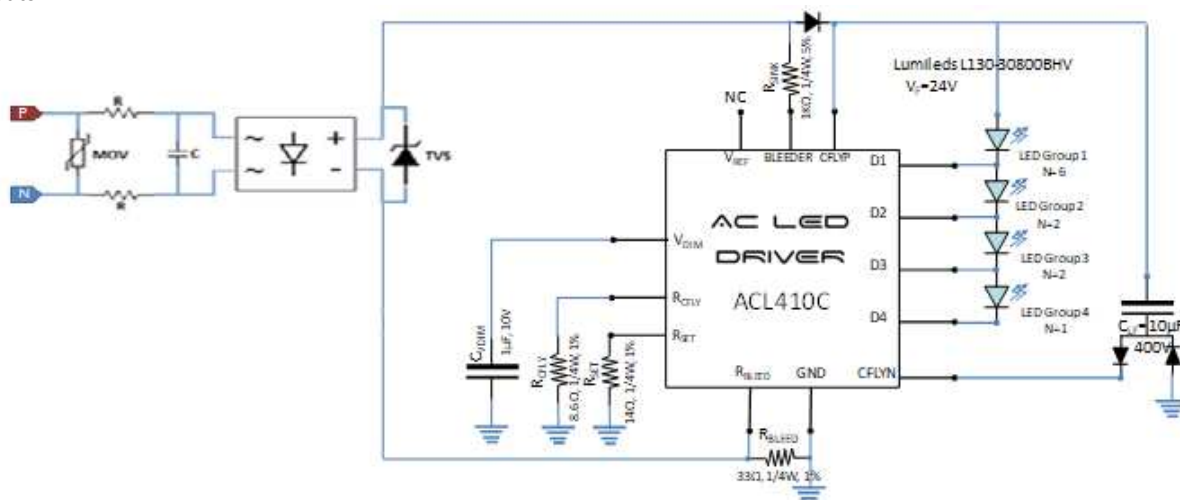


Figure 2: Low-cost application schematic for 230VAC low-flicker bulb

Dimming phase	P _{sector}	P _{LED}	P _{LUM}	Efficiency	Percentage flicker	Flicker index
160°	12.5 W	10 W	1200 Lm	0.8	15 %	7 %
100°	7.6 W	5.7 W	680 Lm	0.75	43 %	10 %
60°	1.2 W	0.7 W	80 Lm	0.58	80 %	17 %

Table 3: Bulb characteristics with dimmer position

Calculation of I_{LED} and the load current I_{CFLY} (@25°C):

- $I_{D1} = 0.74 / (8.6 + R_{SET})$ in A,
- $I_{D2} = 0.79 / (8.6 + R_{SET})$ in A,
- $I_{D3} = 0.89 / (8.6 + R_{SET})$ in A,
- $I_{D4} = 1.05 / (8.6 + R_{SET})$ in A,
- $I_{CFLY} = 1.204 / (8.6 + R_{CFLY})$ in A.

In this application, the currents are summarized below:

R _{SET} (Ω)	R _{CFLY} (Ω)	I _{D1} (mA)	I _{D2} (mA)	I _{D3} (mA)	I _{D4} (mA)	I _{CFLY} (mA)
14	8.6	32.7	34.9	39.3	46.5	70

Table 4: current in LED

It's compulsory to make the full tests and qualifications of this design before to place it in the market.

7. TYPICAL APPLICATION: EXAMPLE OF LIGHT WITH ACL410C LOW FLICKER 1000 LM

Schematics:

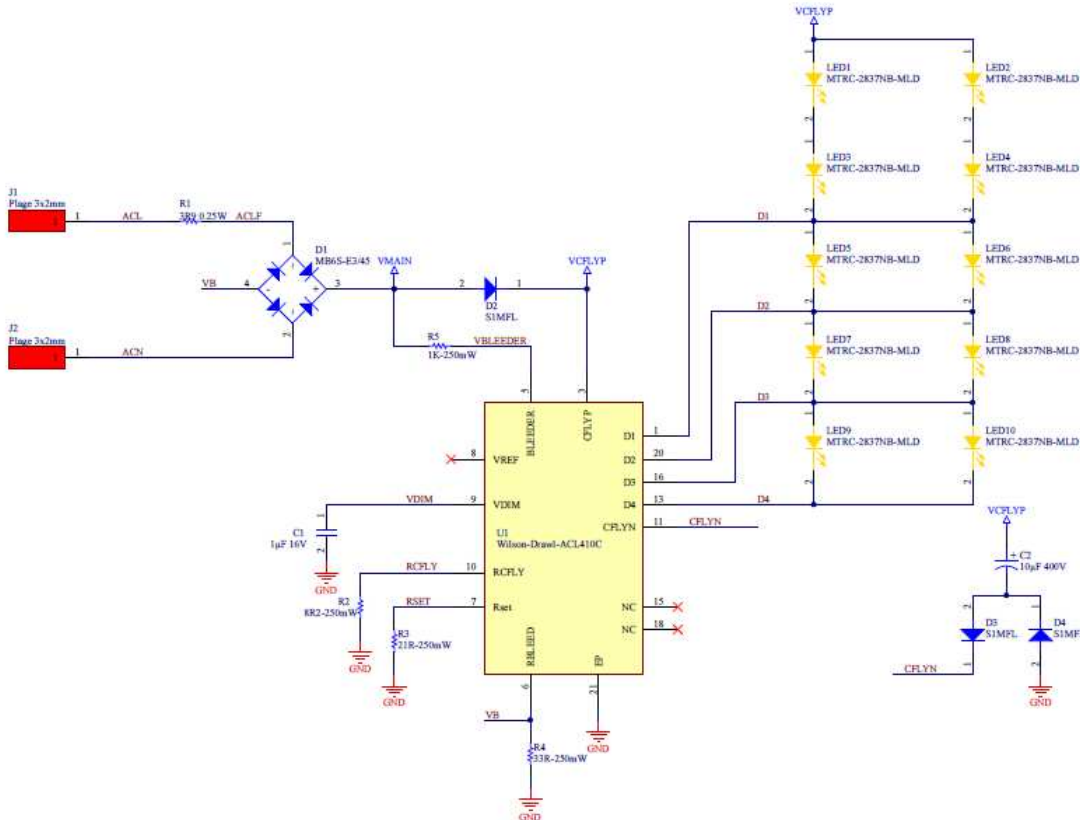


Figure 3: Dimmable Light without protections.

BOM:

Item	QTY	Designator	Description
1	1	C1	Capacitor, Ceramic, 1µF, 16V, 10%, X7R, 0603
2	1	C2	CAP ALUM 10UF 20% 400V RADIAL d10 x 14 mm
3	1	D1	Bridge Rectifier 500mA 600V SMD TO-269AA
4	3	D2, D3, D4	1 Amp Rectifier 1000 Volts
5	10	LED1 to LED10	LED 48V, 20mA, 4000K, BIN=5, 120Lm, code 40M, case 2835
6	1	R1	Resistor, Thin Film, 3R9, 5%, 0.25W, 1206
7	1	R2	Resistor, Thin Film, 8R2, 5%, 1/4W, 0603
8	1	R3	Resistor SMD 21 OHM 1% 1/4W 0603
9	1	R4	Resistor, Thin Film, 33R, 1%, 1/4W, 0603
10	1	R5	Resistor, Thin Film, 1K, 1%, 1/4W, 0603
11	1	U1	Direct AC Line LED Driver

Table 5: BOM ACL410C

It's compulsory to make the full tests and qualifications of this design before to place it in the market. It's recommended to add the protections for the light, a fuse, a varistor, two resistors with high voltage capacitor and a TVS.



Figure 4: PCBA with ACL410C

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