



ACL406AS - Direct AC Line LED Driver

UP TO 6W OUTPUT

ACL406AS-AC 450 to 650 lumen-AN-V1.4 – February 2022

Application Notes



MATURITY
In Production

1. FEATURES

ACL406AS up to 6W output,

- Direct AC Line LED Driver requiring few external components,
- Wide AC Input Range: 50 to 280V AC,
- High Power Factor: > 0.98 with optimized LED configuration,
- Low harmonic content: THD < 15% (typ.),
- Low quiescent current: 120µA,
- High Efficiency: 85% typical,
- Ultra-Flexible LED Forward Voltage Configuration,
- Up to 4 LED stages capability,
- Flicker index: 10%,
- Over Temperature Power derating

2. APPLICATIONS

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

3. DESCRIPTION

The ACL406AS is an AC direct LED driver requiring few external components: a diode bridge to rectify the AC voltage and a resistor to tune the LED current.

Multiple ACL406AS AC line drivers can be used in parallel to drive high power LED systems for industrial applications.

4. PIN CONNECTIONS

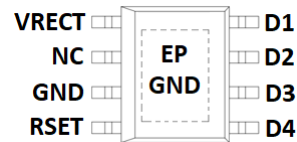


Figure 1: SO8 with Exposed Pad (TOP VIEW)

5. TYPICAL APPLICATION: HIGH RELIABILITY AC 230V_{AC} ENTRY-LEVEL LAMP (RECOMMENDED)

Schematic:

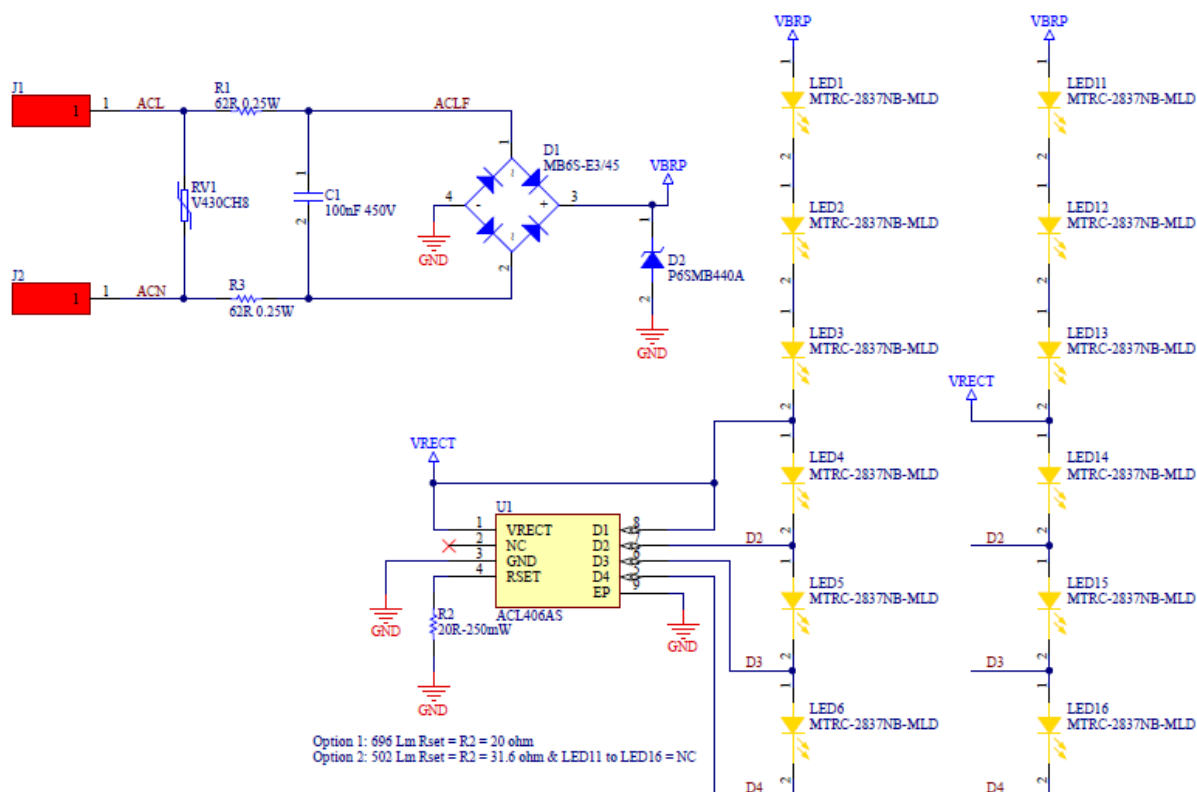


Figure 2: Recommended Low-cost application schematic for 230V_{AC}

Options:

- RSET = 31.6 Ω, the light is at 524 lumens with 6 LED (LED at 120 lm/W). In this design, only 7 components + 6 LEDs on the PCB.
- RSET = 20 Ω, the light is at 727 lumens with 12 LED (LED at 120 lm/W). In this design, only 7 components + 12 LEDs on the PCB.

R _{SET}	P sector	PLED	PLUM	PF	Efficiency	Percentage flicker (%)	Flicker index (%)
31.6 Ω	4.98 W	4.37 W	524 lm	0.98	87.8 %	100 %	33.9 %
20 Ω	6.87 W	6.05 W	727 lm	0.98	88.1 %	100 %	33.9 %

Table 1: Characteristics of the bulb

Calculations of I_{LED} @25°C for each stage are:

- $I_{D1} = 0.88 / (10 + R_{SET})$ in A,
- $I_{D2} = 0.93 / (10 + R_{SET})$ in A,
- $I_{D3} = 1.02 / (10 + R_{SET})$ in A,
- $I_{D4} = 1.20 / (10 + R_{SET})$ in A.

The LED current is summarized below:

RSET	Conditions	I _{D1}	I _{D2}	I _{D3}	I _{D4}
31.6 Ω	@25°C	21.2 mA	22.4 mA	24.5 mA	28.8 mA
20 Ω	@25°C	29.3 mA	31.0 mA	34.0 mA	40.0 mA

Table 2: LED currents

BOM:

Item	QTY	Designator	Description
1	1	C1	Capacitor 1210 450V 0.1uF X7T 20%
2	1	D1	Bridge Rectifier 500mA 600V SMD TO-269AA
3	1	D2	DIODE TVS 376V 602V DO214AA
4	6 or 12	LED1 to LED6, and / or LED11 to LED16	LED 48V, 20mA, 4000K, BIN=5, 120lm, code 40M, case 2835
5	2	R1, R3	Resistor, Thin Film, 62R, 5%, 0.25W, 1206
6	1	R2	RES SMD 20 OHM 5% 1/4W 0603 (case with 12 LED) RES SMD 31.6 OHM 1% 1/4W 0603 (case with 6 LED)
7	1	RV1	VARIATOR 430V 250A 2SMD
8	1	U1	Direct AC line LED driver Full range

Table 3: BOM for reference only

6. TYPICAL APPLICATION: LOW-COST AC 230V_{AC} LIGHT WITHOUT ELECTRIC PROTECTION

Schematic:

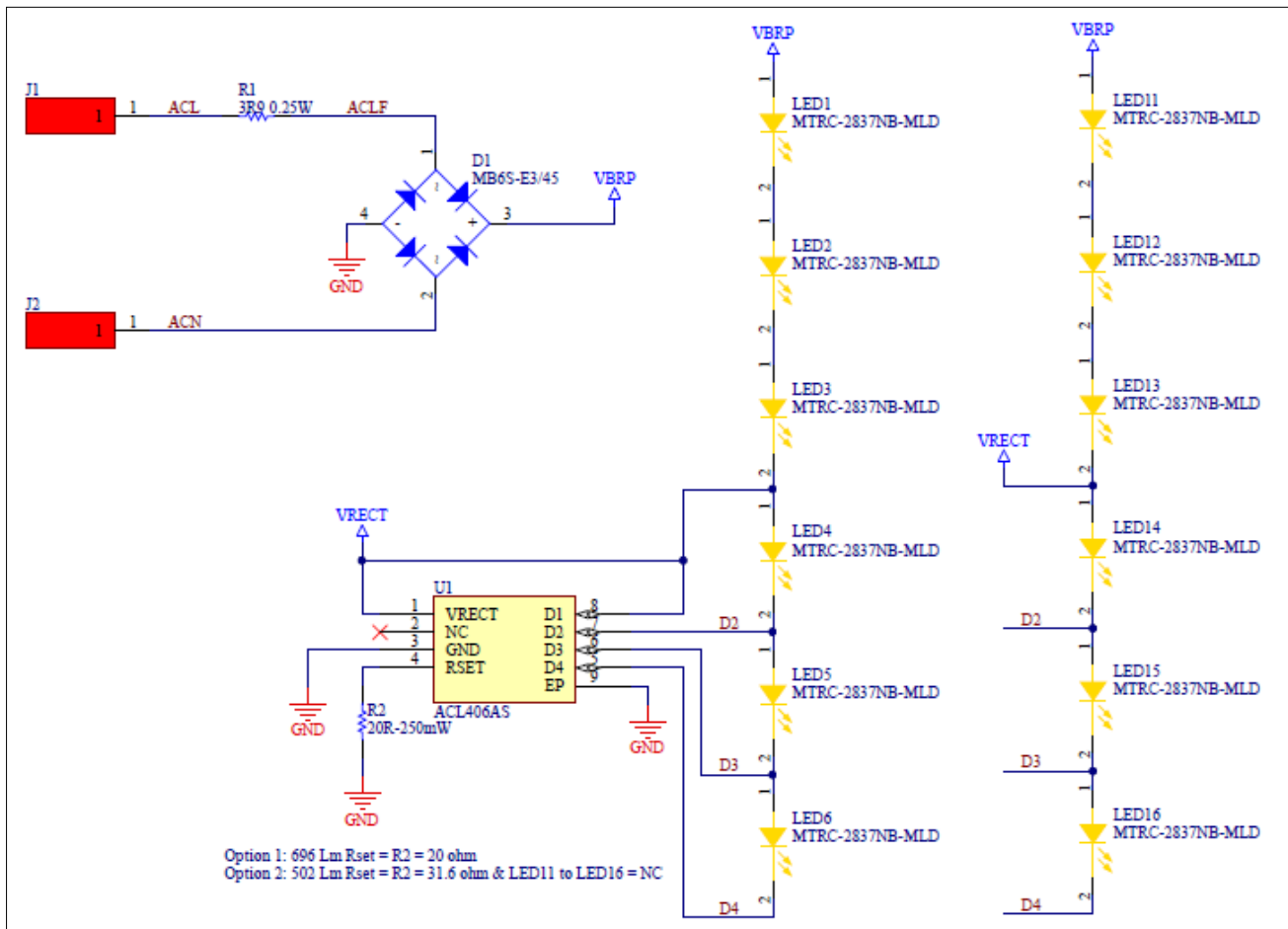


Figure 3: **Not Recommended** - Low-cost application schematic for 230V_{AC}

In this design, the light is like the recommended schematic but without electric protections! Only the fuse resistor is placed before the bridge rectifier. In this case, it's only 4 components on the PCB to have 500 lumen lights (or 10 components with LED).

Options:

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- RSET = 20 Ω, the light is at 727 lumens with 12 LED (LED at 120 lm/W). In this design, only 4 components + 12 LEDs on the PCB.

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BOM:

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2	6 or 12	LED1 to LED6, and / or LED11 to LED16	LED 48V, 20mA, 4000K, BIN=5, 120lm, code 40M, case 2835
3	1	R1	Resistor, Thin Film, 3R9, 5%, 0.25W, 1206
4	1	R2	RES SMD 20 OHM 5% 1/4W 0603 RES SMD 31.6 OHM 1% 1/4W 0603
5	1	U1	Direct AC line LED driver Full range

Table 4: BOM for reference only

Example of PCBA:

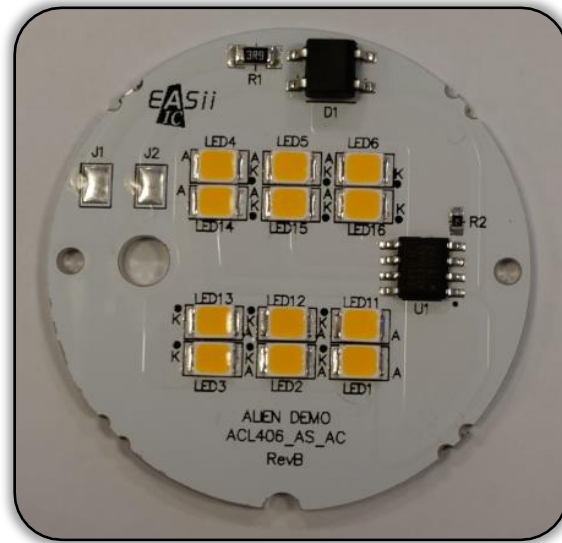


Figure 4: PCBA with ACL406AS at 230V_{AC}.
IMS PCB, diameter 40 mm, thickness 1.6 mm.

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