

1. Functional Description of the AMG-LL7AXX

The AMG-LL7AXX is a family of non isolated High Voltage LED driver modules. The family consists out of a master and slave modules. A complete system can consist out of 1 master and up to 2 LL7A7-9 (1500mA) or 4 LL7A4-6 (700mA) or 8 LL7A1-3 (350mA) slave modules. The modules can be stacked up to form a line, a stack, a curve or other shapes. For all shapes other than the line an interconnection cable is necessary. A 0-10V dimmer, analog voltage or potentiometer can be connected to the master module for dimming. The modules will go into low power shut down mode at dimming voltages below 1.2V.

Each Module has two shunt resistors, which allow for further adjustment of the LED current. The nominal current will be supported by two shunt resistors. This is the factory setting. By removing one of the shunts, the maximum LED current will be reduced.

2. Features

- AC mains supply
- Low current ripple <10%
- Short circuit/over current protection
- Wide output voltage range
- Output power up to 15/30/63W
- Power factor >0,85
- Dimmable (0-10V)
- Fast wire to board connections (stackable modules)
- Small form factor (147x30mm)
- Very slim module (<16mm)
- Wide temperature range (-20 => 85C)

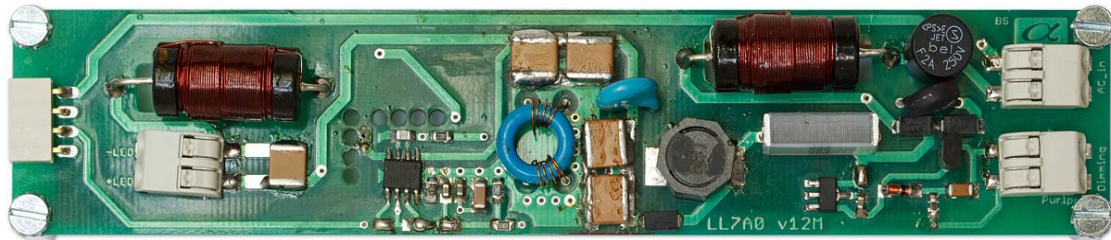
3. Application

The AMG-LL7AXX are suitable for many LED lighting applications such as:

- LED backlighting
- Illumination
- LED light fixtures
- Decorative lights
- Security lights
- Industrial lighting
- Aircraft + watercraft lights
- Dimmable (0-10V)

3.1. Master Module

Figure 1: Picture of Master Module



3.2. Application Notes

The module can be operated directly off the mains. As such, all applicable safety rules and guidelines have to be observed. Specifically, but not limited, during test and evaluation.



Warning, High Voltage!

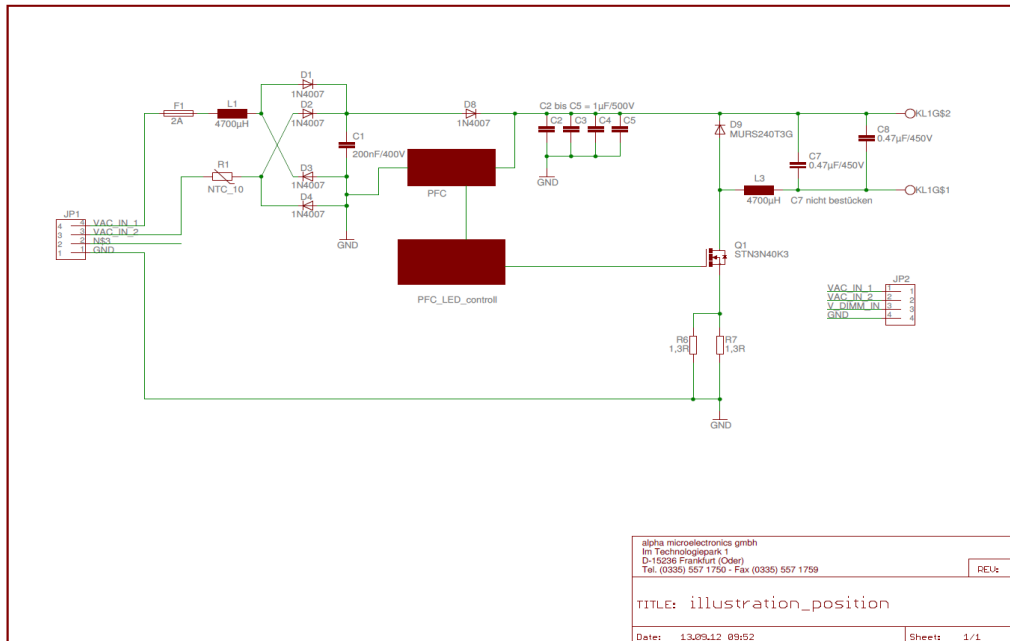
Caution, exposed voltage on the circuit board. Working with line voltage is dangerous! Electrical shock above 42V can be life threatening! Use only under the supervision of qualified personnel! Caution, use only in a laboratory environment! Ensure all applicable safety regulations are observed.

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4. Block Diagramm

Figure 2: Block Diagram



5. Block Descriptions (optional)

6. Pinning

PIN#	Symbol	Description
1	VAC1	Mains Supply 1
2	VAC2	Mains Supply 2
3	LED+	LED Anode connection
4	LED-	LED Cathode connections
5	Vdimm	0-10V dimm input
-6-8	Bus Female	Module interconnect bus
-9-11	Bus Male	Module interconnect bus
12	GND	GND for dimm input

1)

7. Pin description

Pin 1 and 2 => connect the mains supply

Pin 3 and 4 => connect the LED string

Pin 5 => input for dimming voltage or dimmer connection

Pin 6-8 => module interconnect bus (female)

Pin 9-11 => module interconnect bus (male)

Pin 12 => GND for dimming

8. Absolute Maximum Ratings

The Absolute Maximum Ratings may not be exceeded under any circumstances.

#	Symbol	Parameter	Min	Max	Unit
1	V _{dd}	DC supply voltage	20	450	V
2	I _{DD}	Supply Current		1	A
3	V _{dimm}	Input voltage for dimming		50	V
4	I _{ripple}	Ripple	-10	10	%
5	E	Efficiency	tbd	tbd	%
6	V _{out}	Output voltage	10	40	V
7	f _{PWM}	Switching frequency	80	120	kHz
8	f _{mains}	Frequency of AC supply	45	65	Hz
9	PFC	Power Factor Correction	0,7		
10	D	Dimming Range	5	100	%

Note:

9. Electrical Characteristics

9.1. General

#	Symbol	Parameter	Min	Max	Unit
1	V_{dimm}	Dimming Voltage Range	0	10	VDC
2	V_{thres}	Threshold for low power shut down	1,1	1,3	V

9.2. 120V Modules

P/N	Description
AMG-LL7A1M-IPM06E	120VAC/350mA Master
AMG-LL7A1S-IPM06E	120VAC/350mA Slave
AMG-LL7A4M-IPM06E	120VAC/700mA Master
AMG-LL7A4S-IPM06E	120VAC/700mA Slave
AMG-LL7A7M-IPM06E	120VAC/1500mA Master
AMG-LL7A7S-IPM06E	120VAC/1500mA Slave

#	Symbol	Parameter	Min	Max	Unit
1	V_{in}	Nominal Supply Voltage	90	135	VAC
2	PFC	Power Factor	0,8	0,89	
3	P_{standby}	Standby Power Consumption Master	0	280	mW
4		Standby Power Consumption Slave		70	mW

Note:

9.3. 230V Modules

P/N	Description
AMG-LL7A2M-IPM06E	230VAC/350mA Master
AMG-LL7A2S-IPM06E	230VAC/350mA Slave
AMG-LL7A5M-IPM06E	230VAC/700mA Master
AMG-LL7A5S-IPM06E	230VAC/700mA Slave
AMG-LL7A8M-IPM06E	230VAC/1500mA Master
AMG-LL7A8S-IPM06E	230VAC/1500mA Slave

#	Symbol	Parameter	Min	Max	Unit
1	V_{in}	Nominal Supply Voltage	215	245	VAC
2	PFC	Power Factor	0,7	0,95	
3	$P_{standby}$	Standby Power Consumption Master	0	570	mW
4		Standby Power Consumption Slave		150	mW

9.4. 277V Modules

P/N	Description
AMG-LL7A3M-IPM06E	277VAC/350mA Master
AMG-LL7A3S-IPM06E	277VAC/350mA Slave
AMG-LL7A6M-IPM06E	277VAC/700mA Master
AMG-LL7A6S-IPM06E	277VAC/700mA Slave
AMG-LL7A9M-IPM06E	277VAC/1500mA Master
AMG-LL7A9S-IPM06E	277VAC/1500mA Slave

#	Symbol	Parameter	Min	Max	Unit
1	V_{in}	Nominal Supply Voltage	250	305	VAC
2	PFC	Power Factor	0,7	0,95	
3	$P_{standby}$	Standby Power Consumption Master	0	tbd	mW
4		Standby Power Consumption Slave		tbd	mW

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9.5. 350mA Modules

P/N	Description
AMG-LL7A1M-IPM06E	120VAC/350mA Master
AMG-LL7A1S-IPM06E	120VAC/350mA Slave
AMG-LL7A2M-IPM06E	230VAC/350mA Master
AMG-LL7A2S-IPM06E	230VAC/350mA Slave
AMG-LL7A3M-IPM06E	277VAC/350mA Master
AMG-LL7A3S-IPM06E	277VAC/350mA Slave

#	Symbol	Parameter	Min	Max	Unit
1	I _{LED}	Nominal LED current	340	360	mA
2		LED current with shunt R1	195	205	mA
3		LED current with shunt R2	145	155	mA

9.6. 700mA Modules

P/N	Description
AMG-LL7A4M-IPM06E	120VAC/700mA Master
AMG-LL7A4S-IPM06E	120VAC/700mA Slave
AMG-LL7A5M-IPM06E	230VAC/700mA Master
AMG-LL7A5S-IPM06E	230VAC/700mA Slave
AMG-LL7A6M-IPM06E	277VAC/700mA Master
AMG-LL7A6S-IPM06E	277VAC/700mA Slave

#	Symbol	Parameter	Min	Max	Unit
1	I _{LED}	Nominal LED current	680	720	mA
2		LED current with shunt R1	495	505	mA
3		LED current with shunt R2	195	205	mA

9.7. 1500mA Modules

P/N	Description
AMG-LL7A7M-IPM06E	120VAC/1500mA Master
AMG-LL7A7S-IPM06E	120VAC/1500mA Slave
AMG-LL7A8M-IPM06E	230VAC/1500mA Master
AMG-LL7A8S-IPM06E	230VAC/1500mA Slave
AMG-LL7A9M-IPM06E	277VAC/1500mA Master
AMG-LL7A9S-IPM06E	277VAC/1500mA Slave

#	Symbol	Parameter	Min	Max	Unit
1	I _{LED}	Nominal LED current	1470	1530	mA
2		LED current with shunt R1	975	1025	mA
3		LED current with shunt R2	495	505	mA

10. Application

The LL7Ax modules are intended for use in lighting fixtures. Up to 6 Slaves can be connected to one Master.

10.1. Example Application Circuit



Figure 3: Example Application Circuit Diagram

10.2. Reliability

MTTF	Formula:	λ	Formula:	Aft * 1000
3831417,5h ca. 437,4 years	$\lambda = \frac{1 \cdot 10^9}{MTTF_{gesamt}}$	261 FIT	$Aft = \frac{1,833}{2 \cdot \lambda \cdot t} \cdot 10^9$	73156h 8,3 years @ 25°C Ta

$$t = 48000h$$

10.3. Application Notes

- a) Considerations on heat dissipation...
tbd
- b) Considerations on LED-string forward voltage and efficiency...
tbd
- c) Considerations on LED-string forward voltage and current ripple...
tbd
- d) Modification of max. string current
the maximum string current is set by two shunt resistors on the slave modules. The two shunts are in parallel and combined provide the highest current setting for the board. Removing either one will lower the maximum string voltage of that particular slave module.

Slave module	Shunts 1+2 present	Shunt 1 present	Shunt 2 present
LL7A1-3	350mA	200mA	150mA
LL7A4-6	700mA	500mA	200mA
LL7A7-9	1500mA	1000mA	500mA

One shunt on the slave boards can be removed with a soldering iron to further reduce the maximum string current if desired.

- e) Dimming...
A 0-10V dimmer can be attached to the master module. Both linear and logarithmic dimming curves will work. Logarithmic dimming curves usually are more appealing to the eye. Care needs to be taken, that the dimmer is connected with it's positive and negative connectors correctly to the master module. It is also possible to connect a 3k potentiometer or a galvanically isolated 0-10v source instead of a dimmer. All slave modules which are connected to that particular master module will all simultaneously be dimmed from that one connected dimmer. If the dimming input is left open, the slave modules will work with their highest current setting. No open ended wires should be connected to the dimmer input of the master module. Wiring from the master module to the dimmer should not run parallel to mains lines. This can cause flicker, particularly at the lower dimming end.
High voltage (>15V) provided to the dimmer connector will potentially destroy the master and all connected slave modules.

11. Module Dimensions

11.1. Master

Length = 147mm (may change)

Width = 30mm

Height < 16mm

11.2. Slave

Lengths = 131mm (may change)

Widths = 30mm

Height < 16mm

12. Ordering Information

P/N	Type	Avg. Current/mA	Voltage/V
AMG-LL7A1M-IPM06E	Master	350	120
AMG-LL7A2M-IPM06E	Master	350	230
AMG-LL7A3M-IPM06E	Master	350	277
AMG-LL7A1S-IPM06E	Slave	350	120
AMG-LL7A2S-IPM06E	Slave	350	230
AMG-LL7A3S-IPM06E	Slave	350	277
AMG-LL7A4M-IPM06E	Master	700	120
AMG-LL7A5M-IPM06E	Master	700	230
AMG-LL7A6M-IPM06E	Master	700	277
AMG-LL7A4S-IPM06E	Slave	700	120
AMG-LL7A5S-IPM06E	Slave	700	230
AMG-LL7A6S-IPM06E	Slave	700	277
AMG-LL7A7M-IPM06E	Master	1500	120
AMG-LL7A8M-IPM06E	Master	1500	230
AMG-LL7A9M-IPM06E	Master	1500	277
AMG-LL7A7S-IPM06E	Slave	1500	120
AMG-LL7A8S-IPM06E	Slave	1500	230
AMG-LL7A9S-IPM06E	Slave	1500	277

13. Notes and Cautions

13.1. ESD Protection

The Requirements for Handling Electrostatic Discharge Sensitive Devices are described in the JEDEC standard JESD625-A. Please note the following recommendations:

- When handling the device, operators must be grounded by wearing a for the purpose designed grounded wrist strap with at least 1M Ω resistance and direct skin contact.
- Operators must at all times wear ESD protective shoes or the area should be surrounded by for ESD protection intended floor mats.
- Opening of the protective ESD package that the device is delivered in must only occur at a properly equipped ESD workbench. The tape with which the package is held together must be cut with a sharp cutting tool, never pulled or ripped off.
- Any unnecessary contact with the device or any unprotected conductive points should be avoided.
- Work only with qualified and grounded tools, measuring equipment, casing and

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workbenches.

- ❑ Outside properly protected ESD-areas the device or any electronic assembly that it may be part of should always be transported in EGB/ESD shielded packaging.

13.2. Storage conditions

The AMG-LL7AXX corresponds to moisture sensitivity classification **ML2**, according to JEDEC standard J-STD-020, and should be handled and stored according to J-STD-033.

14. Disclaimer

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