



ISOLED KNOWLEDGE

**APPARENT
POWER**

ISOLED[®]

CUSTOMISED LIGHT SOLUTIONS



APPARENT POWER AND TRANSFORMER DESIGN FOR LED BULBS AT 12 V AC VOLTAGE

It is crucial to deal with the apparent power of the LED bulbs in order to preserve the service life of the LED bulbs and transformers.

Undesired reactive power

Unlike regular light bulbs, LED bulbs are usually not ideal resistive consumers, but instead exhibit a capacitive or inductive load behaviour, depending on the design. This results in a phase shift, in addition to the nominal power (= active power) creating an undesired reactive power, which is expressed in VAR (previously blind watt bW), when in operation with AC.

Apparent power comes from reactive and active (= nominal) power

The apparent power is calculated from this reactive power and the nominal power. The apparent power is specified in VA and therefore easily be compared with the power specifications on AC voltage transformers, which are also listed in VA.

Note: Private or small consumers do not have to pay the additional reactive power of a bulb to the energy utility company. The incurred costs for the expansion of the distribution network required here (since more reactive power always occurs in the public mains) are shared across all consumers or only passed on to the largest consumers of reactive power (industrial companies or also solar energy suppliers).

Definition of power factor:

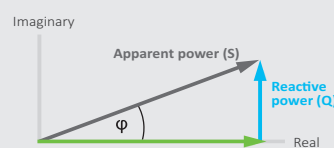
The ratio of nominal power to apparent power is the power factor ($\cos \phi$). The power factor specifies how much of the apparent power is converted into the desired active power. In the case of DC voltage, this is usually the factor of 1. The closer the power factor of electronic consumers with AC voltage comes to 1, the better and more expensive the electronics were designed. The power factor common on the market of, for example, transformers is between λ 0.6 and λ 0.95.

The transformer design is based on apparent power

The reactive power oscillates from the voltage supplier or back and forth between the transformer and electronics of the bulbs. In addition to the nominal power, it therefore loads the transformer, any possible additionally installed dimming actuators as well as the electronics of the bulbs. It is therefore insufficient to add up the nominal power of the individual bulbs for the transformer design – the apparent power must also be added!

Definition of apparent power:

Apparent power is an operand and is made up of the actual active power (P) and the additional reactive power (Q_{tot}). Furthermore, it is defined via the effective values of electric current (I) and voltage (U).



$$S = U \cdot I = \sqrt{P^2 + Q_{\text{tot}}^2}$$

- » S ... apparent power
- » U ... voltage
- » I ... current
- » P ... active power
- » Q_{tot} ... reactive power





The resulting summay NOT exceed the capacity of the transformer. This leads to faults, failures, overheating and defects in the bulbs and of course in the transformer itself.

The result is then the total required power in VA. Ideally, at least 10% reserve is also added to this so that the transformer never reaches its limit.

Transformer design – Table

On the following pages you will find our AR111, MR11 and MR16 LED bulbs with information about the rated power, nominal / active power and apparent power. Tailored to the apparent power, we recommend the corresponding number of LED bulbs in the individual item boxes that can be connected to both of our AC voltage transformers. In this way, there is no interferences, faults or failures that can be caused by an incorrect transformer calculation / design.

Please note: with dimmable LED bulbs, the reactive power increases independently and disproportionately to the dimming levels sometimes by a multiple! We therefore suggest that you adhere to the information we cite here!

In order to avoid problems with the apparent power, it is also possible to use a (dimmable) DC transformer instead of an AC transformer. All of our 12 V LED bulbs in the product range can easily be operated on DC!



TRANSFORMER DESIGN - TABLE: QUICK SEARCH FOR ARTICLE NUMBERS

ITEM NO.	PRODUCT DESCRIPTION	PAGE	ITEM NO.	PRODUCT DESCRIPTION	PAGE
110016	MR16 LED spotlight 3x1 W Style 2 warm white	5	111768	MR16 LED 5 W diffuse warm white	4
110056	MR16 LED spotlight SMD20 3.6 W warm white	6	111807	MR11 LED spotlight 3 W COB 38° warm white dimmable	4
110060	MR16 LED spotlight SMD20 3.6 W cold white	6	111810	AR111 G53 Spot 11 W 30° warm white	3
110068	MR11 LED spotlight SMD6 1 W warm white	4	111811	AR111 G53 Spot 11 W 30° neutral white	3
110069	MR16 LED spotlight 3x1 W Style 2 cold white	5	111933	MR16 LED spotlight 5.5 W COB 70° warm white dimmable	5
110092	MR16 LED spotlight 5 W warm white dimmable	5	111939	MR16 LED spotlight 5.5 W COB 70° ultra-warm white dimmable	5
110110	MR16 LED spotlight 5 W cold white dimmable	5	111973	MR11 LED 4 W diffuse warm white dimmable	4
111347	MR11 LED spotlight SMD27 2 W warm white	4	111974	MR11 LED 4 W diffuse neutral white dimmable	4
111543	MR16 LED spotlight 5.5 W COB 38° neutral white dimmable	5	112036	MR16 LED spotlight 6 W GLASCOB 70° warm white dimmable	6
111544	MR16 LED spotlight 5.5 W COB 38° warm white dimmable	5	112042	MR16 LED spotlight 5 W COB focusable 30°-80° warm white dimmable	6
111716	MR11 LED 2.5 W 30° warm white	3	112258	MR16 LED spotlight 5.5 W GLASCOB 70° warm white	6
111717	MR11 LED 2.5 W 30° cold white	3	112284	AR111 G53 COB Spot 15 W 75° warm white	3
111718	MR11 LED 2 W diffuse warm white	3	112285	AR111 G53 COB Spot 15 W 75° neutral white	3
111719	MR11 LED 2 W diffuse cold white	3	112339	MR16 LED spotlight 6 W glass diffuse warm white	6
111767	MR16 LED spotlight 5.5 W COB 38° ultra-warm white dimmable	5	112340	MR16 LED spotlight 6 W glass neutral white	6



NUMBER OF LED BULBS PER AC VOLTAGE TRANSFORMER 12 VOLTS – OUR RECOMMENDATI ON!

Rated power (= light output) in watts » is the technically possible output of the LED chips

Apparent power in VA » the apparent power takes the reactive power into consideration and serves as a calculation basis for the transformer design

Nominal power (= active power) in watts » is the actual power consumption in watts

Transformer design in VA » is the maximum resulting apparent power of all connected LED bulbs on the square pulse AC voltage (undimmed)



AR111 G53 COB SPOT
15 W | 75°

- Warm white:
Item no. 112284
- Neutral white:
Item no. 112285

15,0 W Rated power LED Chip

15,0 W Nominal / active power **18,2 VA** Apparent power

**ONLY DD OPERATION POSSIBLE –
OPERATION WITH TOROIDAL TRANSFORMER
EXCEPT FOR 12 V AC**



AR111 G53 SPOT
11 W | 30°

- Warm white:
Item no. 111810
- Neutral white:
Item no. 111811

11,0 W Rated power LED Chip

11,0 W Nominal / active power **16,5 VA** Apparent power

**ONLY DD OPERATION POSSIBLE –
OPERATION WITH TOROIDAL TRANSFORMER
EXCEPT FOR 12 V AC**



MR11 LED
2,5 W | 30°

- Warm white:
Item no. 111716
- Cold white:
Item no. 111717

2,0 W Rated power LED Chip

2,0 W Nominal / active power **2,5 VA** Apparent power



TRANSFORMER

Item no. 111213

17 Pieces

Art.-Nr. 112669

25 Stück



MR11 LED
2 W | DIFFUSE

- Warm white:
Item no. 111718
- Cold white:
Item no. 111719

1,6 W Rated power LED Chip

1,6 W Nominal / active power **2,0 VA** Apparent power



TRANSFORMER

Item no. 111213

25 Pieces

Item no. 112669

35 Pieces





MR11 LED 4 W | DIFFUSE | DIM- MABLE

- Warm white:
Item no. 111973
- Neutral white:
Item no. 111974

4,0 W Rated power LED Chip

3,6 W Nominal / active power

4,3 VA Apparent power



TRANSFORMER

Item no. 111213

10 pieces

If dimmed then 6
pieces

Item no. 112669

15 pieces

If dimmed then 9
pieces



MR11 LED SPOTLIGHT COB 3 W | 38° | DIMMABLE

- Warm white:
Art.-Nr. 111807

3,0 W Rated power LED Chip

2,6 W Nominal / active power

3,2 VA Apparent power



TRANSFORMER

Item no. 111213

15 pieces

If dimmed then 9
pieces

Item no. 112669

20 pieces

If dimmed then 12
pieces



MR11 LED SPOTLIGHT SMD27 | 2 W

- Warm white:
Item no. 111347

2,0 W Rated power LED Chip

1,5 W Nominal / active power

2,0 VA Apparent power



TRANSFORMER

Item no. 111213

20 Pieces

Item no. 112669

30 Pieces



MR11 LED SPOTLIGHT SMD6 | 1 W

- Warm white:
Item no. 110068

1,0 W Rated power LED Chip

0,7 W Nominal / active power

2,1 VA Apparent power



TRANSFORMER

Item no. 111213

20 Pieces

Item no. 112669

25 Pieces



MR16 LED SPOTLIGHT 5W | DIFFUSE

- Warm white:
Item no. 111768

5,0 W Rated power LED Chip

5,0 W Nominal / active power

5,0 VA Apparent power



TRANSFORMER

Item no. 111213

10 Pieces



Item no. 112669

15 Pieces





MR16 LED SPOTLIGHT 3X1 W | STYLE 2

-  Warm white:
Item no. 110016
-  Cold white:
Item no. 110069

3,0 W Rated power LED Chip

3,0 W Nominal / active power

3,0 VA Apparent power





TRANSFORMER

Item no. 111213
19 pieces

Item no. 112669
25 Pieces



MR16 LED SPOTLIGHT 5 W | DIMMABLE

-  Warm white:
Item no. 110092
-  Cold white:
Item no. 110110

5,0 W Rated power LED Chip

4,3 W Nominal / active power

5,3 VA Apparent power



TRANSFORMER

Item no. 111213
8 pieces
If dimmed then
5 pieces

Item no. 112669
12 pieces
If dimmed then
7 pieces



MR16 LED SPOTLIGHT 5,5 W COB | 38° | DIM- MABLE

-  Ultra warm white:
Item no. 111767
-  Warm white:
Item no. 111544
-  Neutralweiß:
Item no. 111543

5,5 W Rated power LED Chip

5,0 W Nominal / active power

6,2 VA Apparent power





TRANSFORMER

Item no. 111213
7 pieces
If dimmed then
4 pieces

Item no. 112669
10 pieces
If dimmed then
6 pieces



MR16 LED SPOTLIGHT 5,5 W COB | 70° | DIM- MABLE

-  Ultra warm white:
Item no. 111939
-  Warm white:
Item no. 111933

5,5 W Rated power LED Chip

5,0 W Nominal / active power

6,3 VA Apparent power



TRANSFORMER

Item no. 111213
7 pieces
If dimmed then
4 pieces

Item no. 112669
10 pieces
If dimmed then
6 pieces





MR16 LED SPOTLIGHT 5,5 W | GLAS-COB | 70°

Warm white:
Item no. 112258

6,0 W Rated power LED Chip

5,3 W Nominal / active power

6,3 VA Apparent power



TRANSFORMER

Item no. 111213

7 pieces

Item no. 112669

10 Pieces



MR16 LED SPOTLIGHT 5 W COB | FOCUSABLE 30°-80° | DIMMABLE

Warm white:
Item no. 112042

5,0 W Rated power LED Chip

4,9 W Nominal / active power

6,3 VA Apparent power



TRANSFORMER

Item no. 111213

7 pieces
If dimmed then
4 pieces

Item no. 112669

10 pieces

If dimmed then
6 pieces



MR16 LED SPOTLIGHT 6 W | GLASS | DIFFUSE

Warm white:
Item no. 112339

Neutral white:
Item no. 112340

6,0 W Rated power LED Chip

6,1 W Nominal / active power

7,2 VA Apparent power



TRANSFORMER

Item no. 111213

7 pieces

Item no. 112669

10 Pieces



MR16 LED SPOTLIGHT 6 W | GLAS-COB | 70° DIMMABLE

Warm white:
Item no. 112036

6,0 W Rated power LED Chip

5,3 W Nominal / active power

6,7 VA Apparent power



TRANSFORMER

Item no. 111213

7 pieces

If dimmed then
4 pieces

Item no. 112669

10 pieces

If dimmed then
6 pieces



MR16 LED SPOTLIGHT SMD20 | 3,6 W

Warm white:
Item no. 110056

Cold white:
Item no. 110060

3,6 W Rated power LED Chip

3,4 W Nominal / active power

3,6 VA Apparent power



TRANSFORMER

Item no. 111213

15 Pieces

Item no. 112669

20 Pieces

