

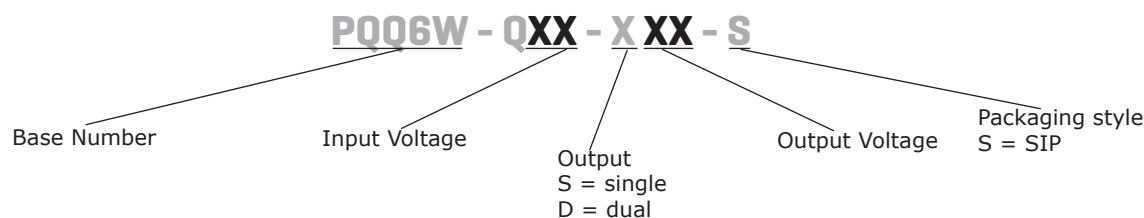
**SERIES: PQQ6W-S | DESCRIPTION: DC-DC CONVERTER**
**FEATURES**

- 6W isolated output
- ultra wide 4:1 input range
- single and dual regulated outputs
- high efficiency up to 87%
- short circuit and over-current protection
- 1,600 Vdc isolation
- operating temperature -40°C ~ 105°C
- control pin
- designed to meet EN/BS EN 62368


**MODEL**

| MODEL           | input voltage |             | output voltage | output current |          | output power | ripple & noise <sup>1</sup> | efficiency <sup>2</sup> |
|-----------------|---------------|-------------|----------------|----------------|----------|--------------|-----------------------------|-------------------------|
|                 | typ (Vdc)     | range (Vdc) | (Vdc)          | min (mA)       | max (mA) | max (W)      | max (mVp-p)                 | typ (%)                 |
| PQQ6W-Q24-S3-S  | 24            | 9~36        | 3.3            | 0              | 1,350    | 4            | 100                         | 78                      |
| PQQ6W-Q24-S5-S  | 24            | 9~36        | 5.0            | 0              | 1,200    | 6            | 100                         | 82                      |
| PQQ6W-Q24-S9-S  | 24            | 9~36        | 9.0            | 0              | 667      | 6            | 100                         | 84                      |
| PQQ6W-Q24-S12-S | 24            | 9~36        | 12.0           | 0              | 500      | 6            | 100                         | 86                      |
| PQQ6W-Q24-S15-S | 24            | 9~36        | 15.0           | 0              | 400      | 6            | 100                         | 87                      |
| PQQ6W-Q24-S24-S | 24            | 9~36        | 24.0           | 0              | 250      | 6            | 100                         | 85                      |
| PQQ6W-Q24-D5-S  | 24            | 9~36        | ±5             | 0              | ±600     | 6            | 150                         | 80                      |
| PQQ6W-Q24-D9-S  | 24            | 9~36        | ±9             | 0              | ±333     | 6            | 150                         | 83                      |
| PQQ6W-Q24-D12-S | 24            | 9~36        | ±12            | 0              | ±250     | 6            | 150                         | 83                      |
| PQQ6W-Q24-D15-S | 24            | 9~36        | ±15            | 0              | ±200     | 6            | 150                         | 83                      |
| PQQ6W-Q24-D24-S | 24            | 9~36        | ±24            | 0              | ±125     | 6            | 150                         | 82                      |

Notes: 1. Ripple and noise are measured at 20 MHz BW by "parallel cable" method. See Figure 3.  
 2. At nominal input voltage.  
 3. Exceeding the maximum input voltage may cause permanent damage.

**PART NUMBER KEY**


## INPUT

| parameter               | conditions/description                                                                                     | min  | typ    | max    | units |
|-------------------------|------------------------------------------------------------------------------------------------------------|------|--------|--------|-------|
| operating input voltage |                                                                                                            | 9    | 24     | 40     | Vdc   |
| start-up voltage        |                                                                                                            |      |        | 9      | Vdc   |
| surge voltage           | for maximum of 1 second                                                                                    | -0.7 |        | 50     | Vdc   |
| current                 | full load / no load                                                                                        |      |        |        |       |
|                         | 3.3 Vdc output                                                                                             |      | 283/5  | 245/12 | mA    |
|                         | 5 Vdc output                                                                                               |      | 305/5  | 313/12 | mA    |
|                         | 9, 12, 15, 24 Vdc output                                                                                   |      | 305/10 | 313/16 | mA    |
|                         | ±5 Vdc output                                                                                              |      | 313/12 | 320/16 | mA    |
|                         | ±9, ±12, ±15 Vdc output                                                                                    |      | 301/12 | 309/16 | mA    |
|                         | ±24 Vdc output                                                                                             |      | 305/12 | 313/16 | mA    |
| filter                  | capacitance filter                                                                                         |      |        |        |       |
| CTRL                    | module on: CTRL pin open or pulled high (3.5-12 Vdc)<br>module off: CTRL pin pulled low to GND (0-1.2 Vdc) |      |        |        |       |

## OUTPUT

| parameter                            | conditions/description                       | min   | typ | max   | units |
|--------------------------------------|----------------------------------------------|-------|-----|-------|-------|
| maximum capacitive load <sup>4</sup> | 3.3 Vdc output                               |       |     | 1,800 | μF    |
|                                      | 5 Vdc output                                 |       |     | 1,000 | μF    |
|                                      | ±5, 9 & 12 Vdc output                        |       |     | 470   | μF    |
|                                      | ±9, 15 Vdc output                            |       |     | 220   | μF    |
|                                      | ±12 Vdc output                               |       |     | 120   | μF    |
|                                      | ±15, 24 Vdc output                           |       |     | 100   | μF    |
|                                      | ±24 Vdc output                               |       |     | 68    | μF    |
| voltage accuracy                     | 5%~100% load                                 | Vout1 |     | ±2    | %     |
|                                      |                                              | Vout2 |     | ±3    | %     |
| line regulation                      | at full load, from low to high input voltage | Vout1 |     | ±1    | %     |
|                                      |                                              | Vout2 |     | ±1.5  | %     |
| load regulation                      | 5%~100% load                                 | Vout1 |     | ±1.5  | %     |
|                                      |                                              | Vout2 |     | ±2    | %     |
| switching frequency                  | PWM mode                                     |       | 500 |       | kHz   |
| transient recovery time              | 25% load step change, nominal input voltage  |       |     |       |       |
|                                      | single output models                         |       | 300 | 500   | μS    |
|                                      | dual output models                           |       | 450 | 500   | μS    |
| transient response deviation         | 25% load step change, nominal input voltage  |       |     |       |       |
|                                      | ±9, ±12, ±15 & ±24 Vdc output                |       | ±3  | ±5    | %     |
|                                      | all other outputs                            |       | ±5  | ±8    | %     |
| temperature coefficient              | at full load                                 |       |     | ±0.03 | %/°C  |

Notes: 4. The specified maximum capacitive load for positive and negative output is identical.

## PROTECTIONS

| parameter                | conditions/description    | min | typ | max | units |
|--------------------------|---------------------------|-----|-----|-----|-------|
| over current protection  |                           | 110 |     | 230 | %     |
| short circuit protection | continuous, auto recovery |     |     |     |       |

## SAFETY AND COMPLIANCE

| parameter             | conditions/description                                                        | min   | typ   | max | units   |
|-----------------------|-------------------------------------------------------------------------------|-------|-------|-----|---------|
| isolation voltage     | input to output, for 1 minute with 1 mA max                                   |       |       |     | Vdc     |
|                       | single output models                                                          | 1,600 |       |     | Vdc     |
|                       | dual output models                                                            | 1,500 |       |     |         |
| isolation resistance  | input to output at 500 Vdc                                                    | 1,000 |       |     | MΩ      |
| isolation capacitance | input to output, 100 kHz / 0.1 V                                              |       | 1,000 |     | pF      |
| safety approvals      | designed to meet 62368-1: EN/BS EN                                            |       |       |     |         |
| EMI/EMC               | CISPR32/EN 55032 Class B (see recommended circuit)                            |       |       |     |         |
| ESD                   | IEC/EN 61000-4-2 Contact ±4kV, perf. Criteria B                               |       |       |     |         |
| radiated immunity     | IEC/EN61000-4-3 10V/m, perf. Criteria A                                       |       |       |     |         |
| EFT/burst             | IEC/EN61000-4-4 ±2KV (see recommended circuit), perf. Criteria B              |       |       |     |         |
| surge                 | IEC/EN61000-4-5 line to line ±2KV (see recommended circuit), perf. Criteria B |       |       |     |         |
| conducted immunity    | IEC/EN61000-4-6 3 Vr.m.s, perf. Criteria A                                    |       |       |     |         |
| MTBF                  | as per MIL-HDBK-217F, 25°C                                                    | 1,000 |       |     | K hours |
| RoHS                  | yes                                                                           |       |       |     |         |

## ENVIRONMENTAL

| parameter             | conditions/description                 | min | typ | max | units |
|-----------------------|----------------------------------------|-----|-----|-----|-------|
| operating temperature | see derating curve                     |     |     |     |       |
|                       | single output models                   | -40 |     | 105 | °C    |
|                       | dual output models                     | -40 |     | 85  | °C    |
| storage temperature   |                                        | -55 |     | 125 | °C    |
| storage humidity      | non-condensing                         | 5   |     | 95  | %     |
| vibration             | 10-150Hz, 5G, 0.75mm. along X, Y and Z |     |     |     |       |

## MECHANICAL

| parameter     | conditions/description                            | min | typ | max | units |
|---------------|---------------------------------------------------|-----|-----|-----|-------|
| dimensions    | 22.00 × 9.50 × 12.00 [0.866 × 0.374 × 0.472 inch] |     |     |     | mm    |
| case material | black plastic                                     |     |     |     |       |
| weight        |                                                   |     | 4.9 |     | g     |

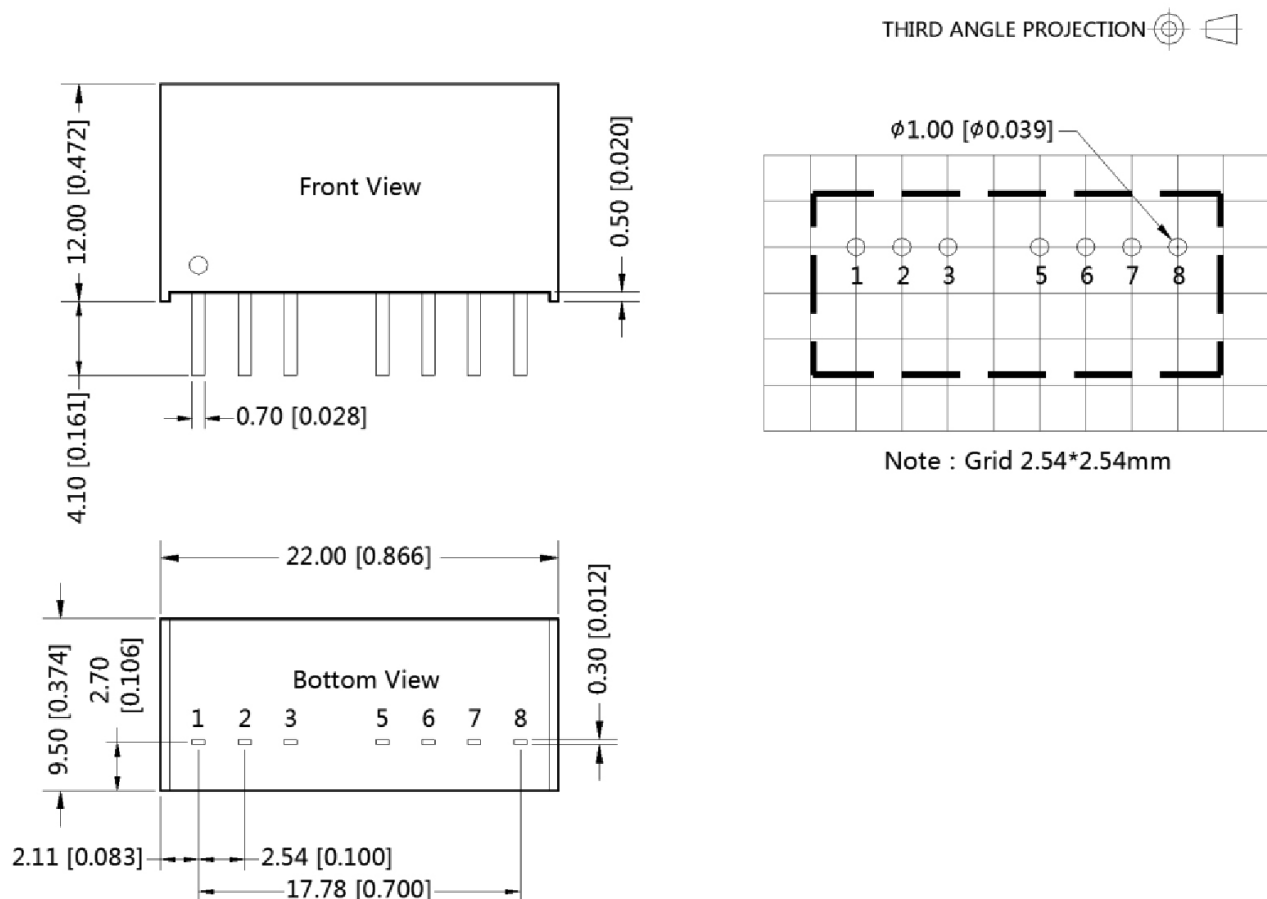
## MECHANICAL DRAWING

units: mm [inch]

pin section tolerance:  $\pm 0.10[\pm 0.004]$ general tolerance:  $\pm 0.50[\pm 0.020]$ 

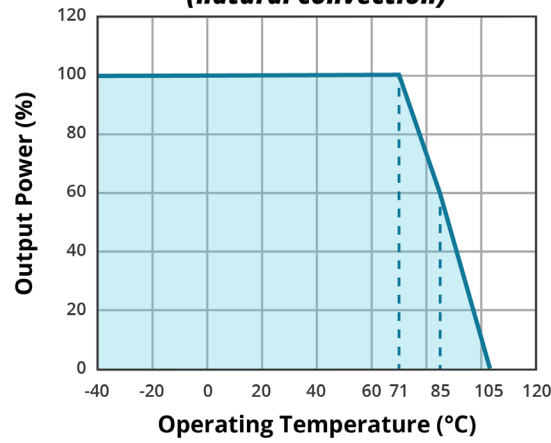
| PIN Out |                           |                         |
|---------|---------------------------|-------------------------|
| PIN     | Function<br>Single output | Function<br>Dual output |
| 1       | GND                       | GND                     |
| 2       | Vin                       | Vin                     |
| 3       | Ctrl                      | Ctrl                    |
| 5       | NC                        | NC                      |
| 6       | +Vout                     | +Vout                   |
| 7       | 0V                        | 0V                      |
| 8       | NC                        | -Vout                   |

NC: Pin to be isolated from circuitry.

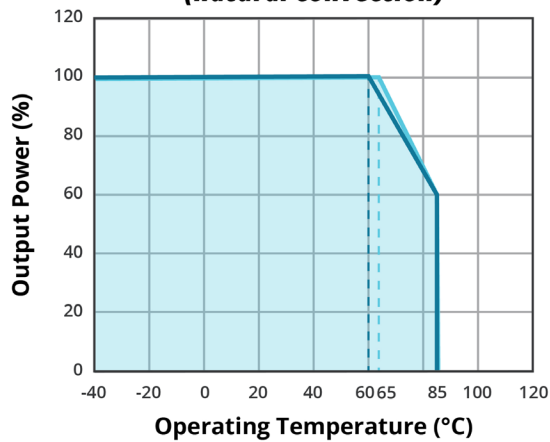


## DERATING CURVE

**TEMPERATURE DERATING CURVE**  
**single output models**  
**(natural convection)**



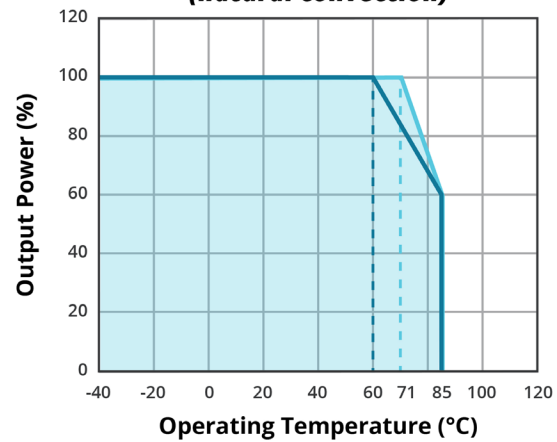
**TEMPERATURE DERATING CURVE**  
**±5 Vdc output**  
**(natural convection)**



**Key**

—  $V_{in} \leq 18\text{ V}$   
—  $18\text{ V} < V_{in} \leq 36\text{ V}$

**TEMPERATURE DERATING CURVE**  
**±9, ±12, ±15 & ±24 Vdc output**  
**(natural convection)**

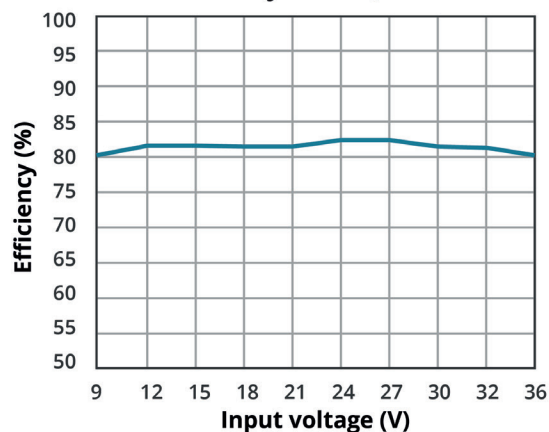


**Key**

—  $V_{in} \leq 18\text{ V}$   
—  $18\text{ V} < V_{in} \leq 36\text{ V}$

## EFFICIENCY CURVES

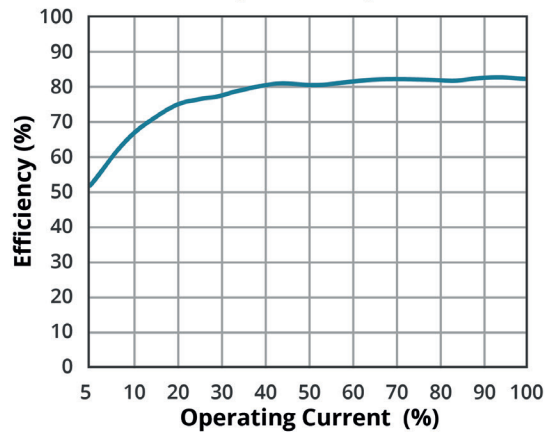
**EFFICIENCY VS INPUT VOLTAGE**  
(full load)



Key

PQQ6W-Q24-S5-S

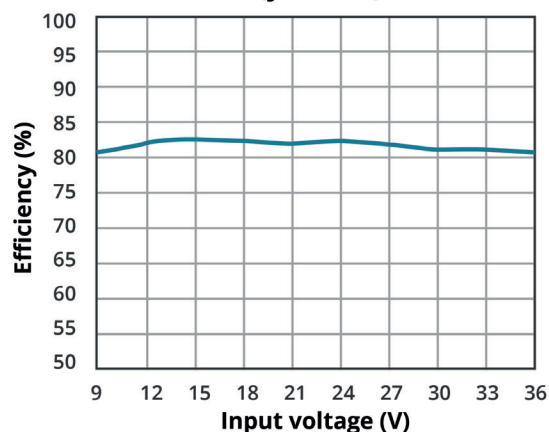
**EFFICIENCY VS OUTPUT LOAD**  
(Vin = 24 V)



Key

PQQ6W-Q24-S5-S

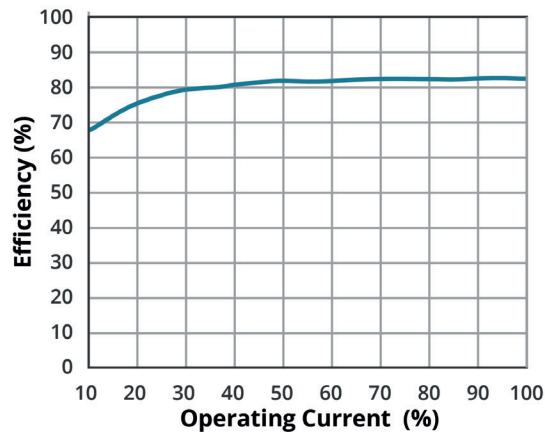
**EFFICIENCY VS INPUT VOLTAGE**  
(full load)



Key

PQQ6W-Q24-D5-S

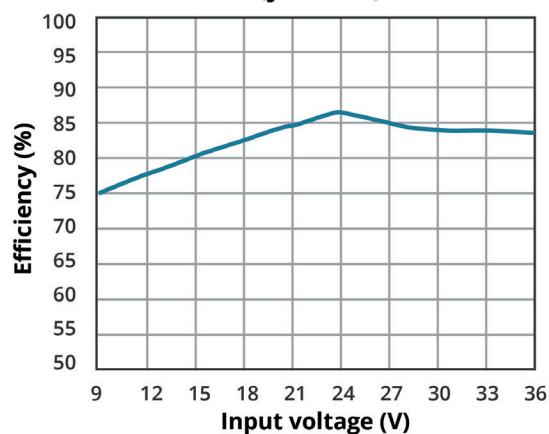
**EFFICIENCY VS OUTPUT LOAD**  
(Vin = 24 V)



Key

PQQ6W-Q24-D5-S

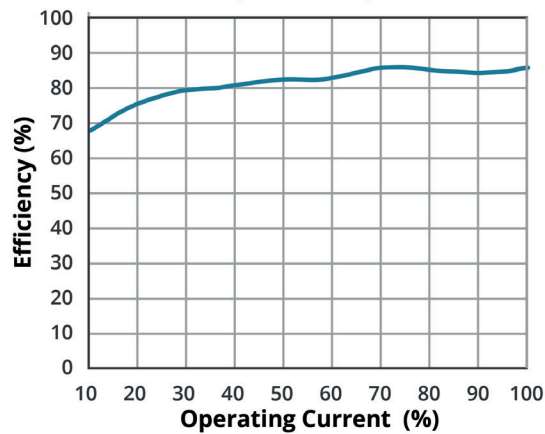
**EFFICIENCY VS INPUT VOLTAGE**  
(full load)



Key

PQQ6W-Q24-D24-S

**EFFICIENCY VS OUTPUT LOAD**  
(Vin = 24 V)



Key

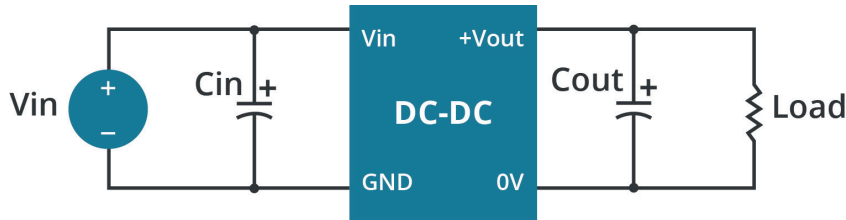
PQQ6W-Q24-D24-S

## APPLICATION CIRCUIT

All the DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 1. Input and/or output ripple can be further reduced by appropriately increasing the input & output capacitor values  $C_{in}$  and  $C_{out}$  and/or by selecting capacitors with a low ESR (equivalent series resistance). Also make sure that the capacitance is not exceeding the max. capacitive load value of the product.

Figure 1

### Single output



### Dual output

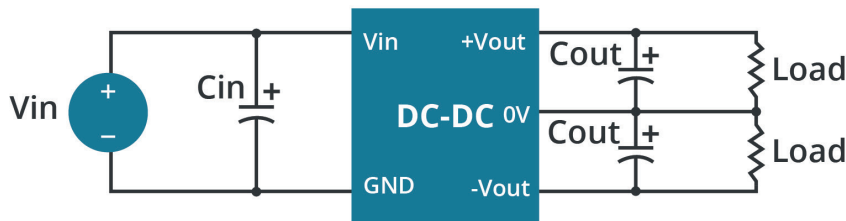


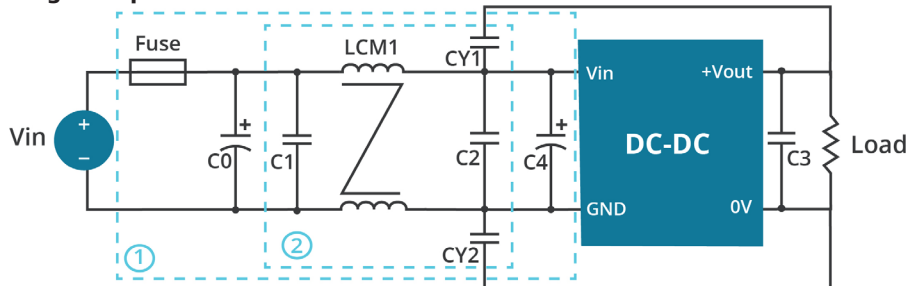
Table 1

| $C_{in}$ ( $\mu\text{F/V}$ ) | $C_{out}$ ( $\mu\text{F/V}$ ) |
|------------------------------|-------------------------------|
| 100 $\mu\text{F}$ / 50V      | 22 $\mu\text{F}$ / 50V        |

## EMC RECOMMENDED CIRCUIT

Figure 2

### Single output



### Dual output

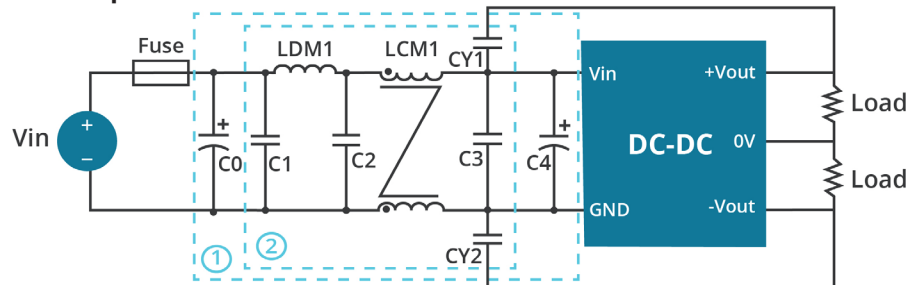
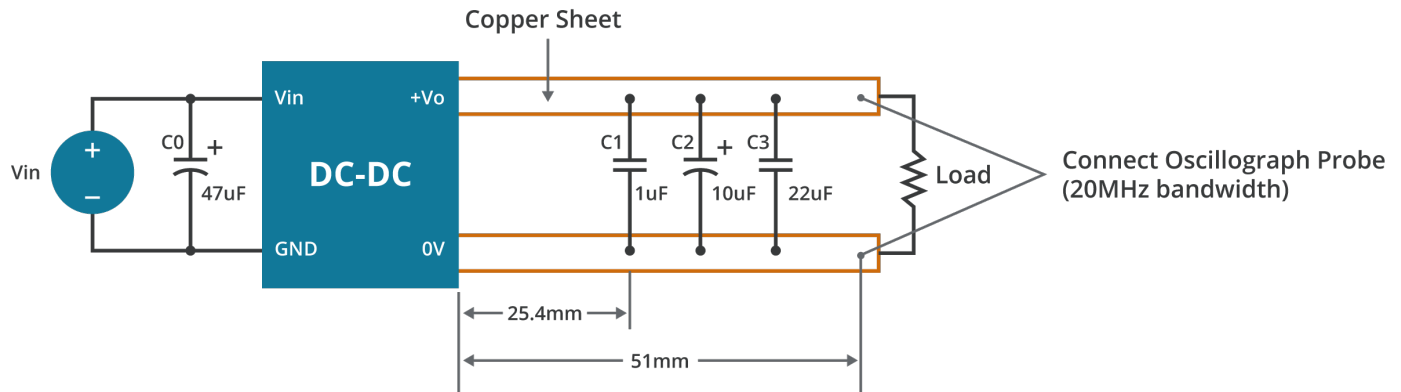


Table 2

| Model    | Single output                            | Dual output             |
|----------|------------------------------------------|-------------------------|
| FUSE     | Choose according to actual input current |                         |
| C0, C4   | 330 $\mu\text{F}$ /50V                   | 330 $\mu\text{F}$ /100V |
| C1, C2   | 10 $\mu\text{F}$ /50V                    | 10 $\mu\text{F}$ /50V   |
| C3       | 22 $\mu\text{F}$ /50V                    | 10 $\mu\text{F}$ /50V   |
| LCM1     | 1.4-1.7mH<br>(TN150-RH12.7*12.7*7.9)     |                         |
| LDM1     | ---                                      | 10 $\mu\text{H}$        |
| CY1, CY2 | 1nF/400V                                 | 1nF/2kV                 |

## RIPPLE AND NOISE

Figure 3



## REVISION HISTORY

| rev. | description                                     | date       |
|------|-------------------------------------------------|------------|
| 1.0  | initial release                                 | 09/22/2020 |
| 1.01 | datasheet update                                | 01/21/2021 |
| 1.02 | product image updated, dual output models added | 11/07/2022 |
| 1.03 | CE safety mark removed                          | 11/22/2022 |
| 1.04 | efficiency curves updated                       | 12/13/2022 |
| 1.05 | features updated                                | 02/07/2023 |

The revision history provided is for informational purposes only and is believed to be accurate.



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