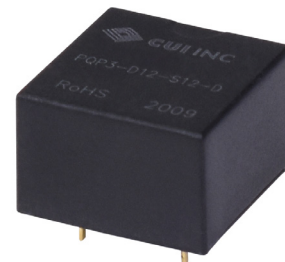


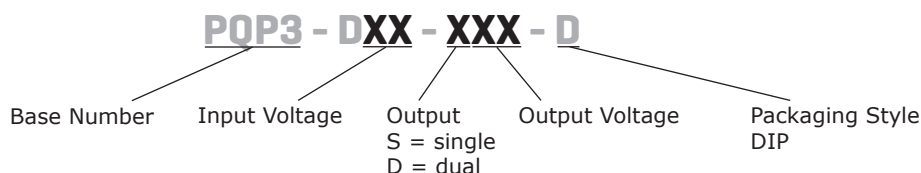
**SERIES: PQP3-D | DESCRIPTION: DC-DC CONVERTER**
**FEATURES**

- wide 2:1 input range
- single and Dual output options
- 1500 Vdc isolation
- industry standard pin-out
- ultra compact DIP package
- short circuit protection (continuous)
- wide operating temp: -40°C to +85°C
- supports negative output (dual output model)
- designed to meet EN/BS EN 62368


**MODEL**

| MODEL          | input voltage |             | output voltage | output current |          | output power | ripple and noise <sup>1</sup> | efficiency |
|----------------|---------------|-------------|----------------|----------------|----------|--------------|-------------------------------|------------|
|                | typ (Vdc)     | range (Vdc) |                | min (mA)       | max (mA) | max (W)      | max (mVp-p)                   | typ (%)    |
| PQP3-D12-S3-D  | 12            | 9~18        | 3.3            | 38             | 758      | 2.5          | 100                           | 75         |
| PQP3-D12-S5-D  | 12            | 9~18        | 5              | 30             | 600      | 3            | 100                           | 79         |
| PQP3-D12-S12-D | 12            | 9~18        | 12             | 13             | 250      | 3            | 100                           | 82         |
| PQP3-D12-S15-D | 12            | 9~18        | 15             | 10             | 200      | 3            | 100                           | 83         |
| PQP3-D12-S24-D | 12            | 9~18        | 24             | 6              | 125      | 3            | 100                           | 81         |
| PQP3-D24-S3-D  | 24            | 18~36       | 3.3            | 38             | 758      | 2.5          | 100                           | 74         |
| PQP3-D24-S5-D  | 24            | 18~36       | 5              | 30             | 600      | 3            | 100                           | 81         |
| PQP3-D24-S12-D | 24            | 18~36       | 12             | 13             | 250      | 3            | 100                           | 83         |
| PQP3-D24-S15-D | 24            | 18~36       | 15             | 10             | 200      | 3            | 100                           | 83         |
| PQP3-D24-S24-D | 24            | 18~36       | 24             | 6              | 125      | 3            | 100                           | 83         |
| PQP3-D12-D5-D  | 12            | 9~18        | ±5             | ±15            | ±300     | 3            | 100                           | 78         |
| PQP3-D12-D9-D  | 12            | 9~18        | ±9             | ±9             | ±167     | 3            | 100                           | 78         |
| PQP3-D12-D12-D | 12            | 9~18        | ±12            | ±7             | ±125     | 3            | 100                           | 79         |
| PQP3-D12-D15-D | 12            | 9~18        | ±15            | ±5             | ±100     | 3            | 100                           | 79         |
| PQP3-D24-D5-D  | 24            | 18~36       | ±5             | ±15            | ±300     | 3            | 100                           | 78         |
| PQP3-D24-D9-D  | 24            | 18~36       | ±9             | ±9             | ±167     | 3            | 100                           | 80         |
| PQP3-D24-D12-D | 24            | 18~36       | ±12            | ±7             | ±125     | 3            | 100                           | 82         |
| PQP3-D24-D15-D | 24            | 18~36       | ±15            | ±5             | ±100     | 3            | 100                           | 81         |

Notes: 1. Ripple & noise testing condition at nominal input voltage and 5%-100% load, the "tip and barrel" method is used for ripple and noise test, please refer to DC-DC Converter Application Notes for specific information.

**PART NUMBER KEY**


## INPUT

| parameter        | conditions/description  | min  | typ    | max    | units |
|------------------|-------------------------|------|--------|--------|-------|
| input voltage    | 12 Vdc input models     | 9    | 12     | 18     | Vdc   |
|                  | 24 Vdc input models     | 18   | 24     | 36     | Vdc   |
| start-up voltage | 12 Vdc input models     |      |        | 9      | Vdc   |
|                  | 24 Vdc input models     |      |        | 18     | Vdc   |
| surge voltage    | for maximum of 1 second |      |        |        |       |
|                  | 12 Vdc input models     | -0.7 |        | 25     | Vdc   |
|                  | 24 Vdc input models     | -0.7 |        | 50     | Vdc   |
| filter           | capacitance filter      |      |        |        |       |
| current          | full load/no load       |      |        |        |       |
|                  | 12 Vdc input models     |      | 314/30 | 338/50 | mA    |
|                  | 24 Vdc input models     |      | 154/20 | 165/40 | mA    |

## OUTPUT

| parameter               | conditions/description   | min | typ  | max   | units |
|-------------------------|--------------------------|-----|------|-------|-------|
| line regulation         | min to max Vin           |     |      |       |       |
|                         | positive outputs         |     | ±0.2 | ±0.5  | %     |
|                         | negative outputs         |     | ±0.5 | ±1    | %     |
| load regulation         | 5% ~ 100% load           |     |      |       |       |
|                         | positive outputs         |     | ±0.5 | ±1    | %     |
|                         | negative outputs         |     |      | ±3    | %     |
| set-point accuracy      | 5% ~ 100% load           |     |      |       |       |
|                         | positive outputs         |     | ±1   | ±3    | %     |
|                         | negative outputs         |     | ±3   | ±5    | %     |
| switching frequency     | full load, nominal input |     | 300  |       | kHz   |
| transient response      | 25% load step change     |     | ±2.5 | ±5    | %     |
| temperature coefficient | full load                |     |      | ±0.03 | %/°C  |

## PROTECTIONS

| parameter                | conditions/description    | min | typ | max | units |
|--------------------------|---------------------------|-----|-----|-----|-------|
| short circuit protection | continuous, self-recovery |     |     |     |       |

## SAFETY AND COMPLIANCE

| parameter             | conditions/description                                                         | min  | typ | max | units  |
|-----------------------|--------------------------------------------------------------------------------|------|-----|-----|--------|
| isolation voltage     | input-output electric strength test for 1 minute                               | 1500 |     |     | Vdc    |
| isolation resistance  | input-output insulation at 500 Vdc                                             | 1000 |     |     | MΩ     |
| isolation capacitance | input-output capacitance at 100 KHz / 0.1 V                                    |      | 100 |     | pF     |
| safety approvals      | designed to meet 62368: EN/BS EN                                               |      |     |     |        |
| EMC                   | CISPR32/EN55032 Class B (see recommended circuit)                              |      |     |     |        |
| ESD                   | IEC/EN61000-4-2, Contact ±6K, perf. Criteria B                                 |      |     |     |        |
| radiated immunity     | IEC/EN61000-4-3, 10 v/m, perf. Criteria A                                      |      |     |     |        |
| EFT/burst             | IEC/EN61000-4-4, ±2KV, perf. Criteria B (see recommended circuit)              |      |     |     |        |
| surge                 | IEC/EN61000-4-5, line to line ±2KV, perf. Criteria B (see recommended circuit) |      |     |     |        |
| conducted immunity    | IEC/EN61000-4-6 3 Vrms, perf. Criteria A                                       |      |     |     |        |
| RoHS                  | yes                                                                            |      |     |     |        |
| MTBF                  | MIL-HDBK-217F @ 25°C                                                           | 1000 |     |     | kHours |

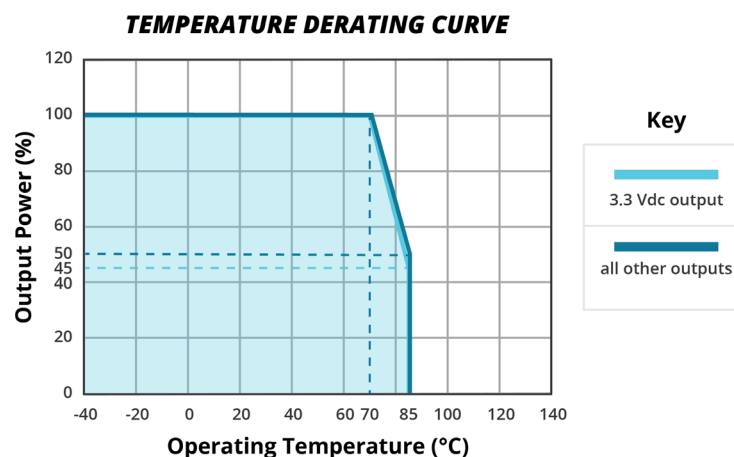
## ENVIRONMENTAL

| parameter             | conditions/description | min | typ | max | units |
|-----------------------|------------------------|-----|-----|-----|-------|
| operating temperature |                        | -40 |     | 85  | °C    |
| storage temperature   |                        | -55 |     | 125 | °C    |
| humidity              | non-condensing         | 5   |     | 95  | %     |

## SOLDERABILITY

| parameter        | conditions/description          | min | typ | max | units |
|------------------|---------------------------------|-----|-----|-----|-------|
| hand soldering   | 1.5 mm from case for 10 seconds |     |     | 300 | °C    |
| reflow soldering | 60 s max over 217°C             |     |     | 245 | °C    |

## DERATING CURVE



## MECHANICAL

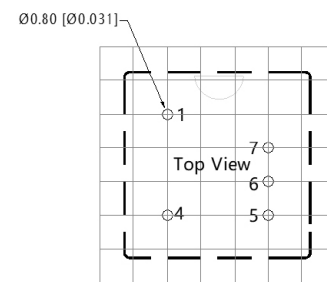
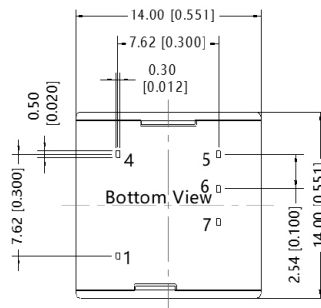
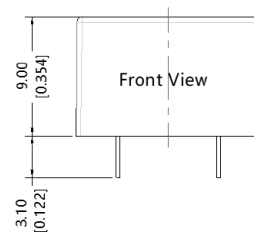
| parameter     | conditions/description                            | min | typ | max | units |
|---------------|---------------------------------------------------|-----|-----|-----|-------|
| dimensions    | 14 x 14 x 9                                       |     |     |     | mm    |
| case material | Black plastic; flame-retardant and heat-resistant |     |     |     |       |
| weight        |                                                   |     | 2.2 |     | g     |

## MECHANICAL DRAWING

units: mm [inches]

tolerance:  $\pm 0.50$  [ $\pm 0.020$ ]

| PIN CONNECTIONS |        |      |
|-----------------|--------|------|
| PIN             | Single | Dual |
| 1               | GND    | GND  |
| 4               | Vin    | Vin  |
| 5               | +Vo    | +Vo  |
| 6               | NC     | 0V   |
| 7               | 0V     | -Vo  |

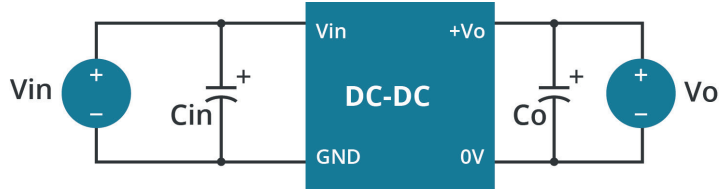


Note: Grid 2.54\*2.54mm

## RECOMMENDED CIRCUITS

Figure 1

### Single output



### Dual output

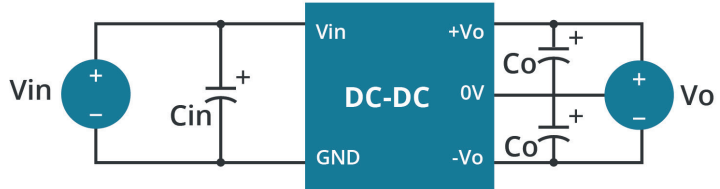


Table 1

| Parameter Description / Single Output |            |            |
|---------------------------------------|------------|------------|
| Vin (Vdc)                             | 12         | 24         |
| Cin                                   | 47uF/25V   | 47uF/50V   |
| Vo (Vdc)                              | 3.3, 5     | 12, 15, 24 |
| Co                                    | 100uF/6.3V | 27uF/35V   |

| Parameter Description / Dual Output |          |          |
|-------------------------------------|----------|----------|
| Vin (Vdc)                           | 12       | 24       |
| Cin                                 | 47uF/50V | 47uF/50V |
| Vo (Vdc)                            | 5, 9     | 12, 15   |
| Co                                  | 47uF/16V | 10uF/35V |

## EMC COMPLIANCE CIRCUITS

Figure 2

### Single output

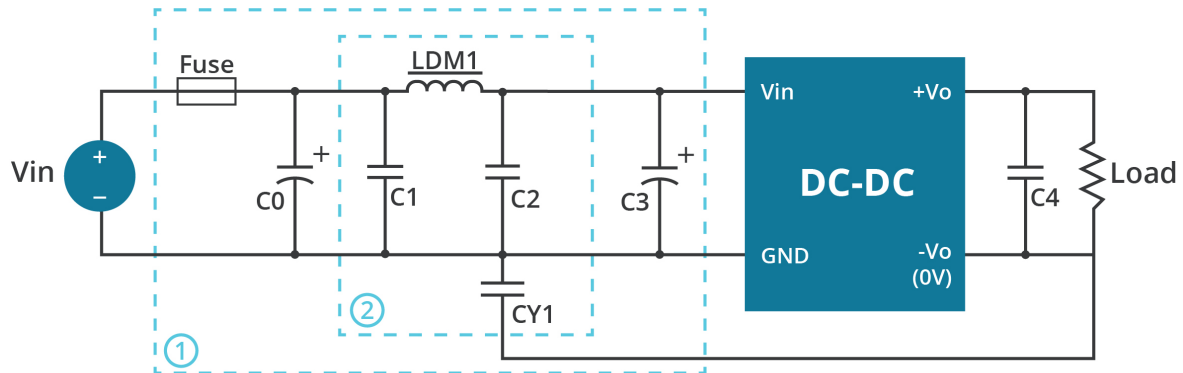


Table 2

| Parameter Description |                                                     |   |           |    |    |             |   |           |    |    |
|-----------------------|-----------------------------------------------------|---|-----------|----|----|-------------|---|-----------|----|----|
| Part No.              | Vin: 12 Vdc                                         |   |           |    |    | Vin: 24 Vdc |   |           |    |    |
| Vo (Vdc)              | 3.3                                                 | 5 | 12        | 15 | 24 | 3.3         | 5 | 12        | 15 | 24 |
| FUSE                  | slow blow, choose according to actual input current |   |           |    |    |             |   |           |    |    |
| C0                    | 1000μF/25V                                          |   |           |    |    | 680μF/50V   |   |           |    |    |
| C1                    | 10μF/50V                                            |   | 4.7μF/50V |    |    | 10μF/50V    |   | 4.7μF/50V |    |    |
| LDM1                  | 15μH                                                |   |           |    |    |             |   |           |    |    |
| C2                    | 4.7μF/50V                                           |   |           |    |    |             |   |           |    |    |
| C3                    | 330μF/50V                                           |   |           |    |    |             |   |           |    |    |
| CY1                   | 1nF/2KV                                             |   |           |    |    |             |   |           |    |    |
| C4                    | Refer to the Cout Fig.1                             |   |           |    |    |             |   |           |    |    |

## EMC COMPLIANCE CIRCUITS (CONTINUED)

Figure 3

Dual output

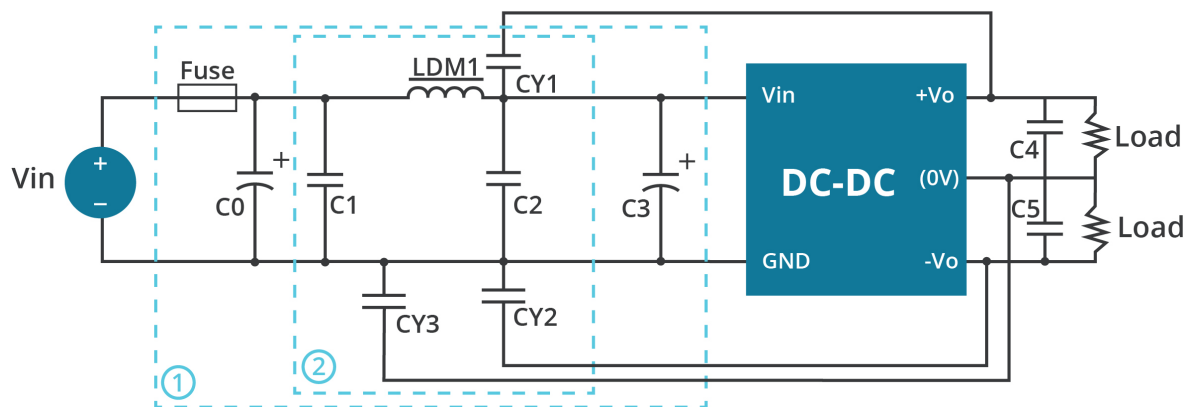


Table 3

| Parameter Description |                                                     |    |             |     |             |    |     |     |
|-----------------------|-----------------------------------------------------|----|-------------|-----|-------------|----|-----|-----|
| Part No.              | Vin: 12 Vdc                                         |    |             |     | Vin: 24 Vdc |    |     |     |
| Vo (Vdc)              | ±5                                                  | ±9 | ±12         | ±15 | ±5          | ±9 | ±12 | ±15 |
| FUSE                  | slow blow, choose according to actual input current |    |             |     |             |    |     |     |
| C0                    | 1000μF/25V                                          |    |             |     | 680μF/50V   |    |     |     |
| C1                    | 4.7μF/50V                                           |    |             |     |             |    |     |     |
| LDM1                  | 10μH                                                |    |             |     |             |    |     |     |
| C2                    | 10μF/50V                                            |    |             |     |             |    |     |     |
| C3                    | 330μF/50V                                           |    |             |     |             |    |     |     |
| CY1                   | 1nF/2000V                                           |    | 470pF/2000V |     | 1nF/2000V   |    |     |     |
| CY2                   | 1nF/2000V                                           |    | 470pF/2000V |     | 1nF/2000V   |    |     |     |
| CY3                   | 1nF/2000V                                           |    | 470pF/2000V |     | /           |    |     |     |
| C4, C5                | Refer to the Cout Fig.1                             |    |             |     |             |    |     |     |

## REVISION HISTORY

| rev. | description                                     | date       |
|------|-------------------------------------------------|------------|
| 1.0  | initial release                                 | 03/28/2020 |
| 1.01 | units updated in the mechanical drawing section | 10/19/2020 |
| 1.02 | derating curve and circuit figures updated      | 07/14/2021 |
| 1.03 | dual diagrams added                             | 04/06/2022 |
| 1.04 | CE certification removed                        | 11/22/2022 |

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



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