

**SERIES:** PQDE6W-U | **DESCRIPTION:** DC-DC CONVERTER

**FEATURES**

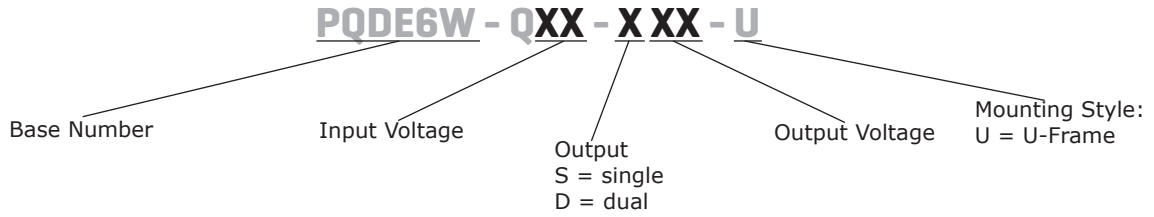
- high efficiency up to 88%
- single and dual output models available
- same side input/output connections
- 1,500 Vdc isolation
- industrial operating temp -40~85 °C
- wide 4:1 input range
- input under-voltage, output short-circuit, over-current, & over-voltage protections
- EN/BS EN 62368-1 certified



| MODEL                         | input voltage |                | output voltage<br>(Vdc) | output current |             | output power<br>max<br>(W) | ripple & noise <sup>1</sup><br>max<br>(mVp-p) | efficiency <sup>2</sup><br>typ<br>(%) |
|-------------------------------|---------------|----------------|-------------------------|----------------|-------------|----------------------------|---|---------------------------------------|
|                               | typ<br>(Vdc)  | range<br>(Vdc) |                         | min<br>(mA)    | max<br>(mA) |                            |   |                                       |
| PQDE6W-Q24-D5-U <sup>3</sup>  | 24            | 9~36           | ±5                      | 0              | ±600        | 6                          | 85  | 83                                    |
| PQDE6W-Q24-D12-U <sup>3</sup> | 24            | 9~36           | ±12                     | 0              | ±250        | 6                          | 85  | 87                                    |
| PQDE6W-Q24-D15-U <sup>3</sup> | 24            | 9~36           | ±15                     | 0              | ±200        | 6                          | 85  | 85                                    |
| PQDE6W-Q24-D24-U <sup>3</sup> | 24            | 9~36           | ±24                     | 0              | ±125        | 6                          | 85  | 87                                    |
| PQDE6W-Q24-S3-U <sup>3</sup>  | 24            | 9~36           | 3.3                     | 0              | 1500        | 4.95                       | 85  | 77                                    |
| PQDE6W-Q24-S5-U <sup>3</sup>  | 24            | 9~36           | 5                       | 0              | 1200        | 6                          | 85  | 83                                    |
| PQDE6W-Q24-S9-U <sup>3</sup>  | 24            | 9~36           | 9                       | 0              | 667         | 6                          | 85  | 84                                    |
| PQDE6W-Q24-S12-U <sup>3</sup> | 24            | 9~36           | 12                      | 0              | 500         | 6                          | 85  | 85                                    |
| PQDE6W-Q24-S15-U <sup>3</sup> | 24            | 9~36           | 15                      | 0              | 400         | 6                          | 85  | 86                                    |
| PQDE6W-Q24-S24-U <sup>3</sup> | 24            | 9~36           | 24                      | 0              | 250         | 6                          | 85  | 86                                    |
| PQDE6W-Q48-D5-U               | 48            | 18~75          | ±5                      | 0              | ±600        | 6                          | 85  | 83                                    |
| PQDE6W-Q48-D12-U              | 48            | 18~75          | ±12                     | 0              | ±250        | 6                          | 85  | 87                                    |
| PQDE6W-Q48-D15-U              | 48            | 18~75          | ±15                     | 0              | ±200        | 6                          | 85  | 88                                    |
| PQDE6W-Q48-S3-U               | 48            | 18~75          | 3.3                     | 0              | 1500        | 4.95                       | 85  | 79                                    |
| PQDE6W-Q48-S5-U               | 48            | 18~75          | 5                       | 0              | 1200        | 6                          | 85  | 83                                    |
| PQDE6W-Q48-S12-U              | 48            | 18~75          | 12                      | 0              | 500         | 6                          | 85  | 87                                    |
| PQDE6W-Q48-S15-U              | 48            | 18~75          | 15                      | 0              | 400         | 6                          | 85  | 88                                    |
| PQDE6W-Q48-S24-U              | 48            | 18~75          | 24                      | 0              | 250         | 6                          | 85  | 88                                    |

- Notes:
1. From 5~100% load, nominal input, 20 MHz bandwidth oscilloscope. From 0~5% load, ripple and noise is <5% Vo.
  2. Measured at nominal input voltage and rated output load.
  3. Model is not CE certified.
  4. All specifications are measured at Ta=25°C, humidity < 75%, nominal input voltage, and rated output load unless otherwise specified.

## PART NUMBER KEY



## INPUT

| parameter                         | conditions/description   | min  | typ   | max    | units |
|-----------------------------------|--------------------------|------|-------|--------|-------|
| operating input voltage           | 24 Vdc input models      | 9    | 24    | 40     | Vdc   |
|                                   | 48 Vdc input models      | 18   | 48    | 80     | Vdc   |
| start-up voltage                  | 24 Vdc input models      |      |       | 9      | Vdc   |
|                                   | 48 Vdc input models      |      |       | 18     | Vdc   |
| surge voltage                     | for maximum of 1 second  |      |       |        |       |
|                                   | 24 Vdc input models      | -0.7 |       | 50     | Vdc   |
|                                   | 48 Vdc input models      | -0.7 |       | 100    | Vdc   |
| under voltage shutdown            | 24 Vdc input models      | 5.5  | 6.5   |        | Vdc   |
|                                   | 48 Vdc input models      | 12   | 15.5  |        | Vdc   |
| input current                     | 24 Vdc input models      |      | 268/5 | 275/12 | mA    |
|                                   | at nominal voltage       |      | 301/5 | 312/12 | mA    |
|                                   | 48 Vdc input models      |      | 130/4 | 134/8  | mA    |
|                                   | at nominal input voltage |      | 150/4 | 155/8  | mA    |
| reflected ripple current          | at nominal input voltage |      | 20    |        | mA    |
| filter                            | Pi filter                |      |       |        |       |
| input reverse polarity protection | no                       |      |       |        |       |
| no load power consumption         |                          |      | 0.12  |        | W     |

## OUTPUT

| parameter                            | conditions/description  | min | typ  | max   | units |
|--------------------------------------|---|-----|------|-------|-------|
| maximum capacitive load <sup>1</sup> | 3.3 Vdc output models   |     |      | 1,800 | μF    |
|                                      | 5 Vdc output models   |     |      | 1,000 | μF    |
|                                      | 9 Vdc output models   |     |      | 680   | μF    |
|                                      | 12, ±5 Vdc output models  |     |      | 470   | μF    |
|                                      | 15 Vdc output models  |     |      | 220   | μF    |
|                                      | all other models  |     |      | 100   | μF    |
| total regulation <sup>2</sup>        | 0% to full load   |     | ±1   | ±3    | %     |
| line regulation                      | from low line to high line, full load   |     |      |       |       |
|                                      | positive outputs  |     | ±0.2 | ±0.5  | %     |
|                                      | negative outputs  |     | ±0.5 | ±1    | %     |
| load regulation <sup>3</sup>         | from 5% to full load  |     |      |       |       |
|                                      | positive outputs  |     | ±0.5 | ±1    | %     |
|                                      | negative outputs  |     | ±0.5 | ±1.5  | %     |
| cross regulation                     | dual output models:<br>main output 50% load<br>secondary output from 10~100% load |     |      | ±5    | %     |
| switching frequency <sup>4</sup>     | PWM mode  |     | 300  |       | kHz   |

**OUTPUT (CONTINUED)**

| parameter                    | conditions/description                      | min | typ | max   | units |
|------------------------------|---|-----|-----|-------|-------|
| transient response deviation | 25% load step change, nominal input voltage |     | ±5  | ±8    | %     |
|                              | 3.3, 5, ±5 Vdc output models                |     | ±3  | ±5    | %     |
| transient recovery time      | 25% load step change, nominal input voltage |     | 300 | 500   | µs    |
| temperature coefficient      | at full load                                |     |     | ±0.03 | %/°C  |

Note:

1. The specified maximum capacitive load value for positive and negative output is identical.
2. Output voltage accuracy of ±5 & ±9 Vdc output converter for 0~5% load is ±5% max.
3. At 0~100% load, the max load regulation is ±5%.
4. Value is based on full load. At loads <50%, the switching frequency decreases with decreasing load.

**PROTECTIONS**

| parameter                | conditions/description    | min | typ | max | units |
|--------------------------|---------------------------|-----|-----|-----|-------|
| over voltage protection  |                           | 110 |     | 160 | %     |
| over current protection  |                           | 110 | 140 | 190 | %     |
| short circuit protection | continuous, self recovery |     |     |     |       |

**SAFETY AND COMPLIANCE**

| parameter                    | conditions/description   | min       | typ   | max | units |
|------------------------------|--|-----------|-------|-----|-------|
| isolation voltage            | input to output for 1 minute at 1 mA max   | 1,500     |       |     | Vdc   |
| 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             | certified to 62368: EN/BS EN   |           |       |     |       |
| conducted emissions          | CISPR32/EN55032 Class A (w/o external components), Class B (see Fig. 3-2 for recommended circuit)<br>EN50121-3-2 150kHz-500kHz 99dBuV (see Fig. 3-2 for recommended circuit)<br>EN55016-2-1 500kHz-30MHz 93dBuV (see Fig. 3-2 for recommended circuit) |           |       |     |       |
| radiated emissions           | CISPR32/EN55032 Class A (w/o external components), Class B (see Fig. 3-1 for recommended circuit)<br>EN50121-3-2 30MHz-230MHz 40dBuV/m at 10m, 230MHz-1GHz 47dBuV/m at 10m (see Fig. 3-1 for recommended circuit)                                      |           |       |     |       |
| ESD                          | IEC/EN61000-4-2 Contact ±4kV, perf. Criteria B<br>EN50121-3-2 Contact ±6kV/Air ±8kV, perf. Criteria A  |           |       |     |       |
| radiated immunity            | IEC/EN61000-4-3 10V/m, perf. Criteria A<br>EN50121-3-2 20V/m, perf. Criteria A   |           |       |     |       |
| EFT/burst                    | IEC/EN61000-4-4 ±2kV (See Fig. 3-1 for recommended circuit), perf. Criteria B<br>EN50121-3-2 ±2kV 5/50ns 5kHz (See Fig. 3-1 for recommended circuit), perf. Criteria A   |           |       |     |       |
| surge                        | IEC/EN61000-4-5 line to line ±2KV (see Fig. 3-1 for recommended circuit), perf. Criteria A<br>EN50121-3-2 line to line ±1KV (see Fig. 3-1 for recommended circuit), perf. Criteria A   |           |       |     |       |
| conducted immunity           | IEC/EN61000-4-6 3 Vr.m.s, perf. Criteria A<br>EN50121-3-2 10 Vr.m.s, perf. Criteria A  |           |       |     |       |
| voltage dips & interruptions | IEC/EN61000-4-29, 0%-70%, perf. Criteria B   |           |       |     |       |
| MTBF                         | as per MIL-HDBK-217F, 25°C   | 1,000,000 |       |     | hours |
| RoHS                         | yes  |           |       |     |       |

**ENVIRONMENTAL**

| parameter             | conditions/description            | min | typ | max | units |
|-----------------------|-----------------------------------|-----|-----|-----|-------|
| operating temperature | see derating curve                | -40 |     | 85  | °C    |
| storage temperature   |                                   | -55 |     | 125 | °C    |
| storage humidity      | non-condensing                    | 5   |     | 95  | %     |
| vibration             | IEC/EN61373 - Category 1, Grade B |     | 10  |     | G     |

**SOLDERABILITY**

| parameter                            | conditions/description          | min | typ | max | units |
|--------------------------------------|---------------------------------|-----|-----|-----|-------|
| pin soldering resistance temperature | 1.5 mm from case for 10 seconds |     |     | 300 | °C    |

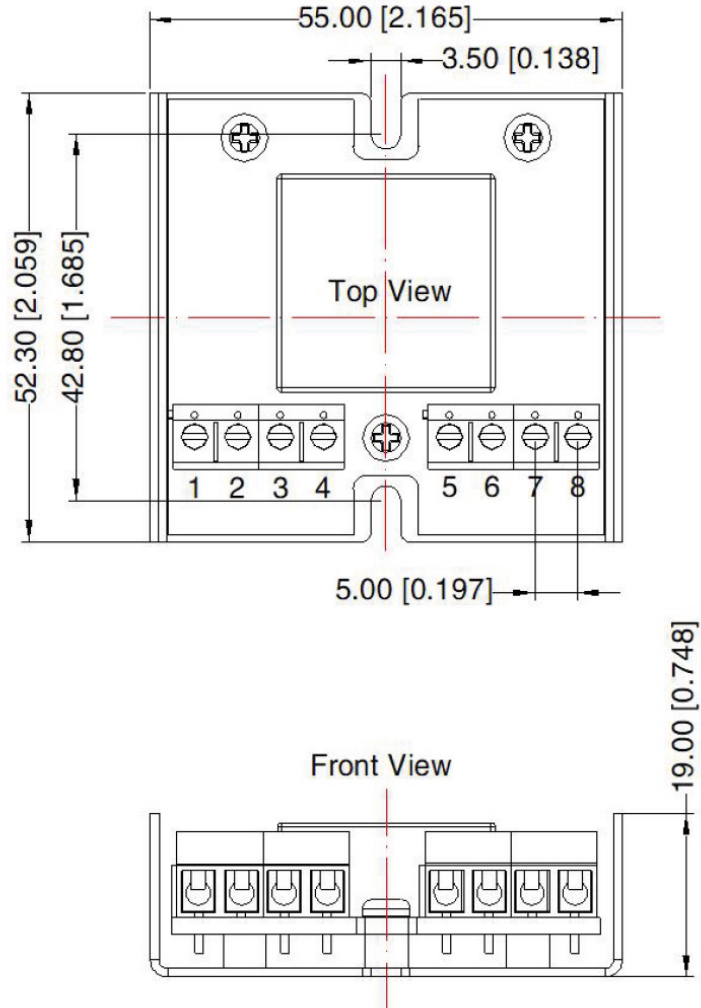
## MECHANICAL

| parameter     | conditions/description                             | min | typ  | max | units |
|---------------|--|-----|------|-----|-------|
| dimensions    | 55.00 x 52.30 x 19.00 [2.165 x 2.059 x 0.748 inch] |     |      |     | mm    |
| case material | aluminum alloy                                     |     |      |     |       |
| weight        |  |     | 43.5 |     | g     |

## MECHANICAL DRAWING

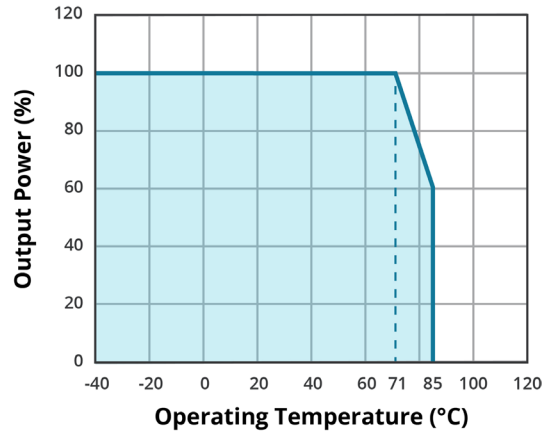
units: mm [inch]  
 wire range: 24-12 AWG  
 tightening torque: Max 0.4 N·m  
 tolerance: ±1.00[±0.039]

| PIN CONNECTIONS |          |      |
|-----------------|----------|------|
| PIN             | Function |      |
|                 | Single   | Dual |
| 1               | GND      | GND  |
| 2               | Vin      | Vin  |
| 3               | NC       | NC   |
| 4               | Case     | Case |
| 5               | NC       | NC   |
| 6               | +Vo      | +Vo  |
| 7               | NC       | 0V   |
| 8               | 0V       | -Vo  |



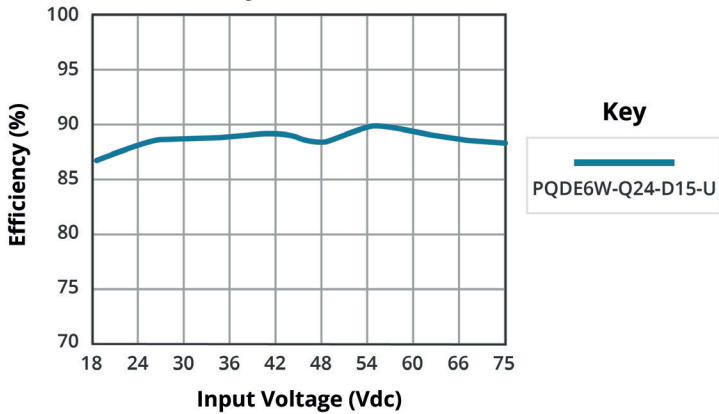
## DERATING CURVE

**TEMPERATURE DERATING CURVE**

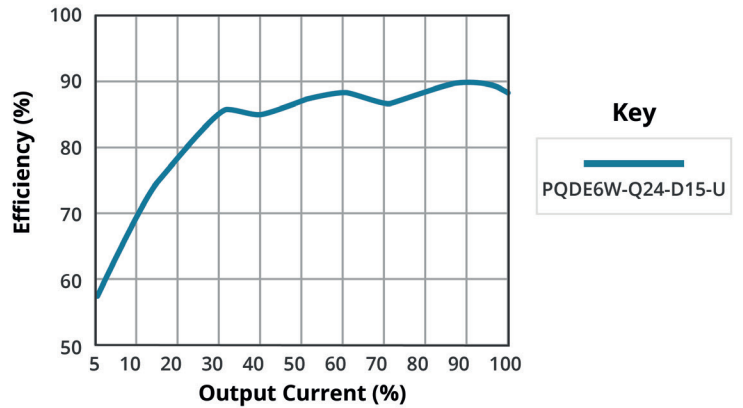


## EFFICIENCY CURVES

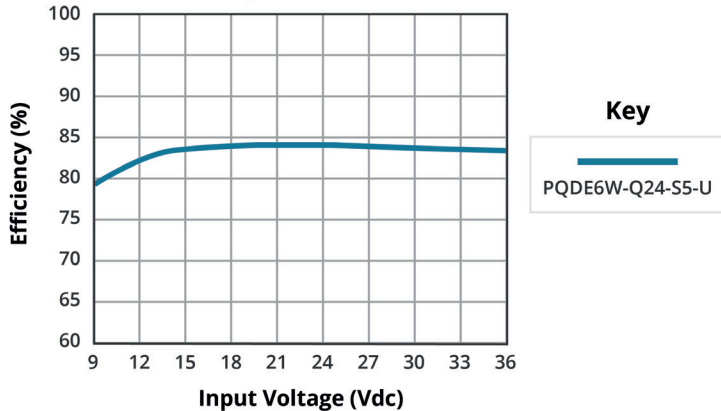
**EFFICIENCY VS INPUT VOLTAGE (full load)**



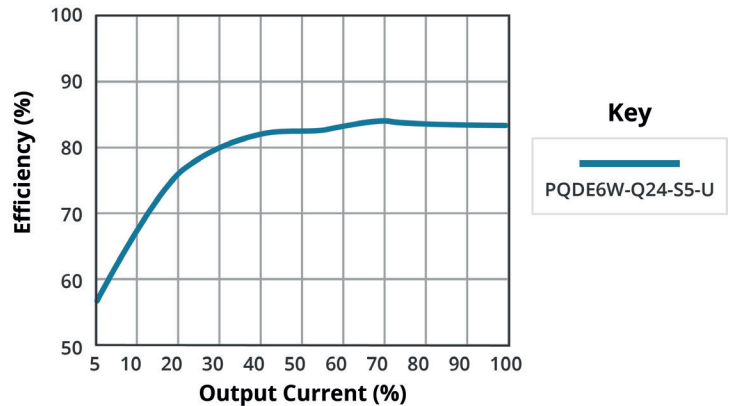
**EFFICIENCY VS OUTPUT LOAD (Vin = 24 Vdc)**



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



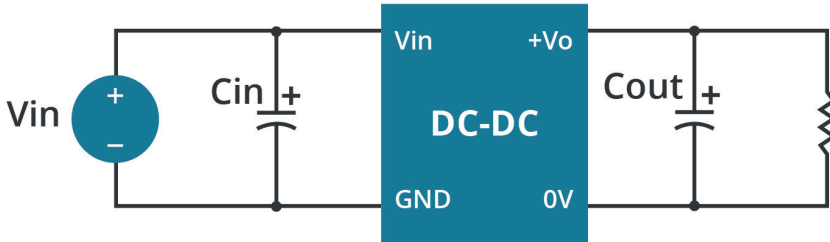
**EFFICIENCY VS OUTPUT LOAD (Vin = 24 Vdc)**



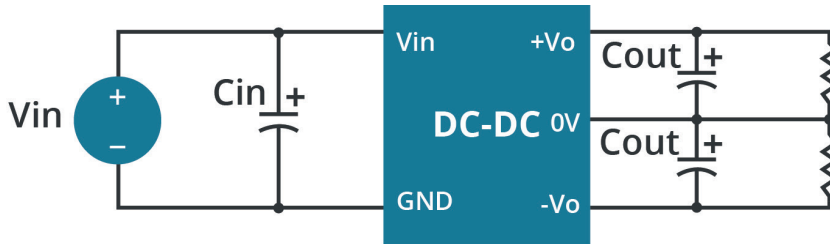
## APPLICATION CIRCUIT

This series has been tested according to the following recommended circuits (Figures 1 & 2) before leaving the factory. If you want to further reduce the input and output ripple, you can increase the input and output capacitors or select capacitors of low equivalent impedance provided that the capacitance is less than the maximum capacitive load of the model.

**Figure 1**  
Single Output Models



**Figure 2**  
Dual Output Models

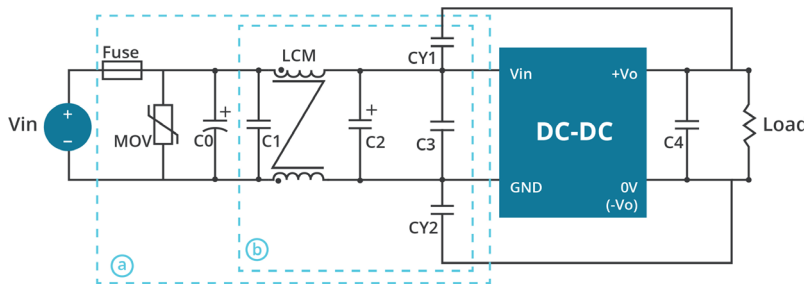


**Table 1**

| Vin (Vdc) | Cin (μF/V)            | Cout (μF/V) |
|-----------|-----------------------|-------------|
| 24        | 100 μF/50 V           | 10 μF/50 V  |
| 48        | 10 μF ~ 47 μF / 100 V | 10 μF/50 V  |

## EMC RECOMMENDED CIRCUIT

**Figure 3**



**Table 2**

| Recommended External Circuit Components |  |                |
|---|--|----------------|
| Vin (Vdc)                               | 24                                       | 48             |
| FUSE                                    | choose according to actual input current |                |
| MOV                                     | S20K30                                   | S14K60         |
| C0                                      | 680 μF / 50 V                            | 680 μF / 100 V |
| C1                                      | 1 μF / 50 V                              | 1 μF / 100 V   |
| C2                                      | 330 μF / 50 V                            | 330 μF / 50 V  |
| C3                                      | 4.7 μF / 50 V                            | 4.7 μF / 100 V |
| C4                                      | refer to the Cout in Fig. 1 & 2          |                |
| LCM                                     | 4.7 mH                                   |                |
| CY1, CY2                                | 1 nF / 2 kV                              |                |

Notes: For EMC tests part ① in Figure 3 was used for immunity and part ② for emissions test. Selecting based on needs.

## REVISION HISTORY

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| rev. | description     | date       |
|------|-----------------|------------|
| 1.0  | initial release | 11/07/2022 |

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



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a bel group

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