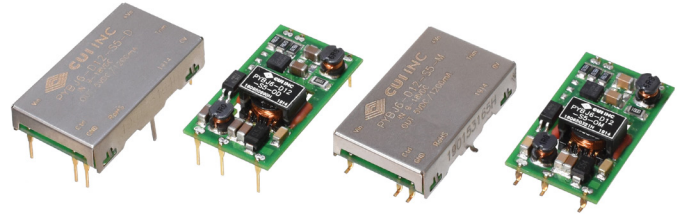


**SERIES: PYBJ6 | DESCRIPTION: DC-DC CONVERTER**
**FEATURES**

- up to 6 W isolated output
- 2:1 input voltage range
- single regulated output
- output short circuit, over current, over voltage protection
- efficiency up to 86%
- DIP and SMT mounting styles
- available with or without case
- 1500 Vdc isolation
- certified to UL 62368-1
- designed to meet EN/BS EN 62368-1

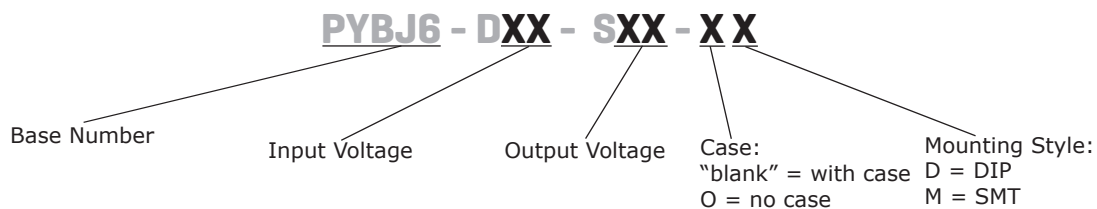

**MODEL**

|               | input voltage |             | output voltage | output current |          | output power max | ripple & noise <sup>1</sup> max | efficiency <sup>2</sup> typ |
|---------------|---------------|-------------|----------------|----------------|----------|------------------|---------------------------------|-----------------------------|
|               | typ (Vdc)     | range (Vdc) |                | min (mA)       | max (mA) |                  |                                 |                             |
| PYBJ6-D12-S5  | 12            | 9~18        | 5              | 0              | 1200     | 6                | 100                             | 81                          |
| PYBJ6-D12-S12 | 12            | 9~18        | 12             | 0              | 500      | 6                | 100                             | 84                          |
| PYBJ6-D12-S15 | 12            | 9~18        | 15             | 0              | 400      | 6                | 100                             | 85                          |
| PYBJ6-D24-S3  | 24            | 18~36       | 3.3            | 0              | 1500     | 4.95             | 100                             | 79                          |
| PYBJ6-D24-S5  | 24            | 18~36       | 5              | 0              | 1200     | 6                | 100                             | 83                          |
| PYBJ6-D24-S12 | 24            | 18~36       | 12             | 0              | 500      | 6                | 100                             | 85                          |
| PYBJ6-D24-S15 | 24            | 18~36       | 15             | 0              | 400      | 6                | 100                             | 86                          |

Notes: 1. From 5~100% load, nominal input, 20 MHz bandwidth oscilloscope, with 10  $\mu$ F tantalum and 1  $\mu$ F ceramic capacitors on the output. From 0~5% load, ripple and noise is <5%  $V_o$ .

2. Measured at nominal input voltage, full load.

3. All specifications are measured at  $T_a=25^\circ\text{C}$ , 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           | 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                     | 12 Vdc input models for 1 second max                     | -0.7                  |     | 25  | Vdc   |
|                                   | 24 Vdc input models for 1 second max                     | -0.7                  |     | 50  | Vdc   |
| under voltage shutdown            | 12 Vdc input models                                      | 5.5                   | 6.5 |     | Vdc   |
|                                   | 24 Vdc input models                                      | 13                    | 15  |     | Vdc   |
| current                           | 12 Vdc input models                                      | 5 Vdc output models   |     | 633 | mA    |
|                                   |                                                          | 12 Vdc output models  |     | 610 | mA    |
|                                   |                                                          | 15 Vdc output models  |     | 603 | mA    |
|                                   | 24 Vdc input models                                      | 3.3 Vdc output models |     | 268 | mA    |
|                                   |                                                          | 5 Vdc output models   |     | 308 | mA    |
|                                   |                                                          | 12 Vdc output models  |     | 302 | mA    |
|                                   |                                                          | 15 Vdc output models  |     | 298 | mA    |
| remote on/off (CTRL) <sup>4</sup> | turn on (CTRL pin open or pulled low to GND (0~0.3 Vdc)) |                       |     |     |       |
|                                   | turn off (CTRL pin pulled high (2.0~12 Vdc))             |                       |     |     |       |
|                                   | input current when switched off                          |                       | 5   | 10  | mA    |
| filter                            | Pi filter                                                |                       |     |     |       |
| no load power consumption         | 0.12                                                     |                       |     |     | W     |

Notes: 4. The voltage of the CTRL pin is referenced to input GND pin.

## OUTPUT

| parameter                            | conditions/description                      | min | typ  | max   | units |
|--------------------------------------|---------------------------------------------|-----|------|-------|-------|
| maximum capacitive load <sup>5</sup> | 3.3 Vdc output models                       |     |      | 1,800 | μF    |
|                                      | 5 Vdc output models                         |     |      | 1,000 | μF    |
|                                      | 12 Vdc output models                        |     |      | 680   | μF    |
|                                      | 15 Vdc output models                        |     |      | 470   | μF    |
| voltage accuracy                     | from 0% to full load                        |     | ±1   | ±3    | %     |
| line regulation                      | from low line to high line, full load       |     | ±0.2 | ±0.5  | %     |
| load regulation <sup>6</sup>         | from 5% to full load                        |     | ±0.5 | ±1    | %     |
| adjustability                        | see application notes                       |     | ±5   |       | %     |
| switching frequency <sup>7</sup>     | PWM mode                                    |     | 330  |       | kHz   |
| transient recovery time              | 25% load step change, nominal input voltage |     | 300  | 500   | μs    |
| transient response deviation         | 25% load step change, nominal input voltage |     |      |       |       |
|                                      | 3.3, 5 Vdc output models                    |     | ±5   | ±8    | %     |
|                                      | all other output models                     |     | ±3   | ±5    | %     |
| temperature coefficient              | at full load                                |     |      | ±0.03 | %/°C  |

Note: 5. Tested at input voltage range and full load.

6. At 0~100% load, the max load regulation is ±5%.

7. Value is based on full load. At loads <50%, the switching frequency decreases with decreasing load for efficiency improvement.

## PROTECTIONS

| parameter                | conditions/description            | min | typ | max | units |
|--------------------------|-----------------------------------|-----|-----|-----|-------|
| over voltage protection  | output shut down                  | 110 |     | 160 | %     |
| over current protection  | hiccup, auto recovery             | 110 | 140 | 200 | %     |
| short circuit protection | hiccup, continuous, auto recovery |     |     |     |       |

## SAFETY AND COMPLIANCE

| parameter             | conditions/description                                                                            | min       | typ   | max | units |
|-----------------------|---------------------------------------------------------------------------------------------------|-----------|-------|-----|-------|
| isolation voltage     | input to output for 1 minute at 5 mA                                                              | 500       |       |     | Vac   |
|                       | input to case <sup>8</sup> for 1 minute at 5 mA                                                   | 500       |       |     | Vac   |
|                       | output to case <sup>8</sup> for 1 minute at 5 mA                                                  | 500       |       |     | Vac   |
|                       | input to output for 1 minute at 1 mA                                                              | 1,500     |       |     | Vdc   |
|                       | input to case <sup>8</sup> for 1 minute at 1 mA                                                   | 1,500     |       |     | Vdc   |
|                       | output to case <sup>8</sup> for 1 minute at 1 mA                                                  | 1,500     |       |     | Vdc   |
| isolation resistance  | input to output at 500 Vdc                                                                        | 100       |       |     | MΩ    |
|                       | input to case <sup>8</sup> at 500 Vdc                                                             | 100       |       |     | MΩ    |
|                       | output to case <sup>8</sup> at 500 Vdc                                                            | 100       |       |     | MΩ    |
| isolation capacitance | input to output, 100 kHz / 0.1 V                                                                  |           | 1,000 |     | pF    |
| safety approvals      | certified to 62368-1: UL<br>designed to meet 62368-1: EN, BS EN                                   |           |       |     |       |
| conducted emissions   | CISPR32/EN55032, class A (no external circuit); class B (external circuit required, see Figure 3) |           |       |     |       |
| radiated emissions    | CISPR32/EN55032, class B (external circuit required, see Figure 4)                                |           |       |     |       |
| ESD                   | IEC/EN61000-4-2, contact ±6 kV, class B                                                           |           |       |     |       |
| radiated immunity     | IEC/EN61000-4-3, 10 V/m, class A                                                                  |           |       |     |       |
| EFT/burst             | IEC/EN61000-4-4, ±2 kV, class B (external circuit required, see Figure 2)                         |           |       |     |       |
| surge                 | IEC/EN61000-4-5, line-line ±2 kV, class B (external circuit required, see Figure 2)               |           |       |     |       |
| conducted immunity    | IEC/EN61000-4-6, 3 Vr.m.s, class A                                                                |           |       |     |       |
| MTBF                  | as per MIL-HDBK-217F, 25°C                                                                        | 1,000,000 |       |     | hours |
| RoHS                  | yes                                                                                               |           |       |     |       |

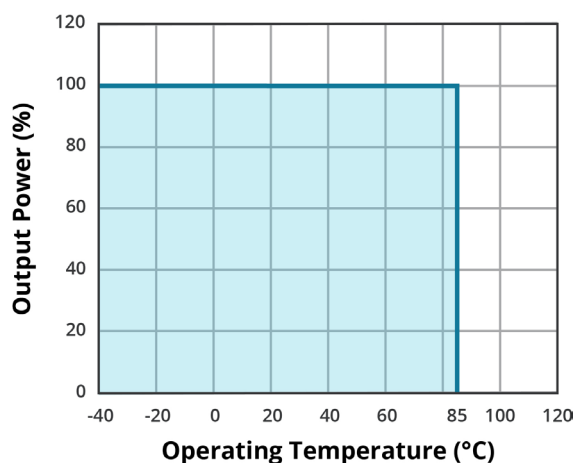
Note: 8. Only applies to versions with case.

## ENVIRONMENTAL

| parameter             | conditions/description                 | min | typ | max | units |
|-----------------------|----------------------------------------|-----|-----|-----|-------|
| operating temperature | see derating curves                    | -40 |     | 85  | °C    |
| storage temperature   |                                        | -55 |     | 125 | °C    |
| storage humidity      | non-condensing                         | 5   |     | 95  | %     |
| vibration             | 10~150 Hz, for 90 minutes on each axis |     | 5   |     | G     |

## DERATING CURVES

**TEMPERATURE DERATING CURVE**

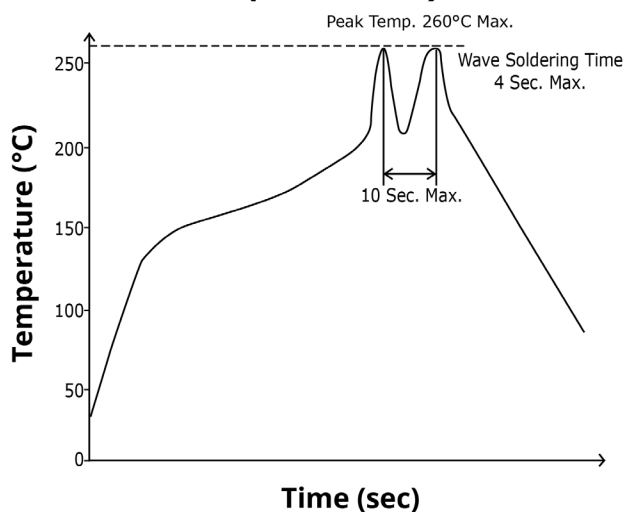


## SOLDERABILITY

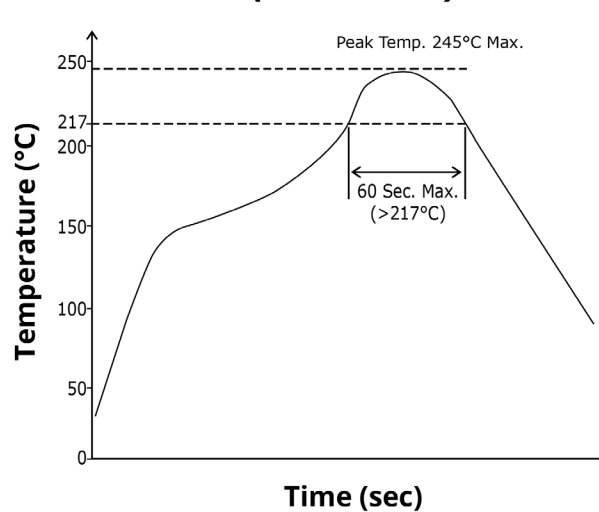
| parameter                      | conditions/description                                                                                                            | min | typ | max | units |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-------|
| hand soldering                 | 1.5 mm from case for 10 seconds                                                                                                   |     |     | 300 | °C    |
| wave soldering <sup>9</sup>    | see wave soldering profile                                                                                                        |     |     | 260 | °C    |
| reflow soldering <sup>10</sup> | see reflow soldering profile<br>Maximum duration >217°C is 60 seconds.<br>For actual application, refer to IPC/JEDEC J-STD-020D.1 |     |     | 245 | °C    |

Note: 9. For DIP models only.  
10. For SMT models only.

**WAVE SOLDERING PROFILE  
(DIP models)**



**REFLOW SOLDERING PROFILE  
(SMT models)**



## MECHANICAL

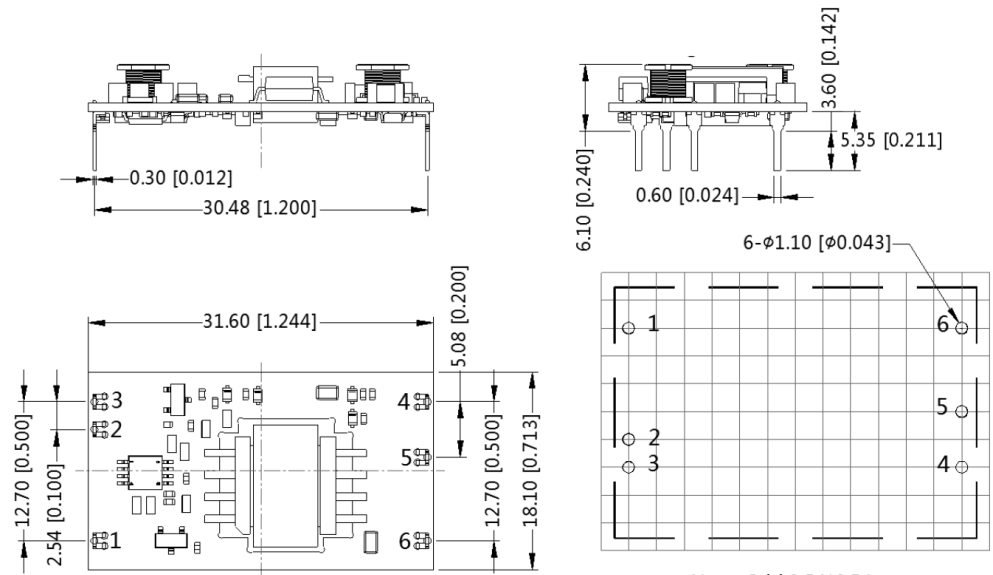
| parameter     | conditions/description                                              | min | typ | max | units |
|---------------|---------------------------------------------------------------------|-----|-----|-----|-------|
| dimensions    | DIP without case: 31.60 x 18.10 x 6.10 [1.244 x 0.713 x 0.240 inch] |     |     |     | mm    |
|               | DIP with case: 32.60 x 19.10 x 6.80 [1.283 x 0.752 x 0.268 inch]    |     |     |     | mm    |
|               | SMT without case: 31.60 x 18.10 x 6.30 [1.244 x 0.713 x 0.248 inch] |     |     |     | mm    |
|               | SMT with case: 32.60 x 19.10 x 7.00 [1.283 x 0.752 x 0.276 inch]    |     |     |     | mm    |
| case material | aluminum alloy                                                      |     |     |     |       |
| weight        | models without case                                                 |     | 4.7 |     | g     |
|               | models with case                                                    |     | 5.7 |     | g     |

## MECHANICAL DRAWING (DIP WITHOUT CASE)

units: mm [inch]

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

| PIN CONNECTIONS |          |
|-----------------|----------|
| PIN             | Function |
| 1               | Vin      |
| 2               | CTRL     |
| 3               | GND      |
| 4               | 0V       |
| 5               | trim     |
| 6               | +Vo      |



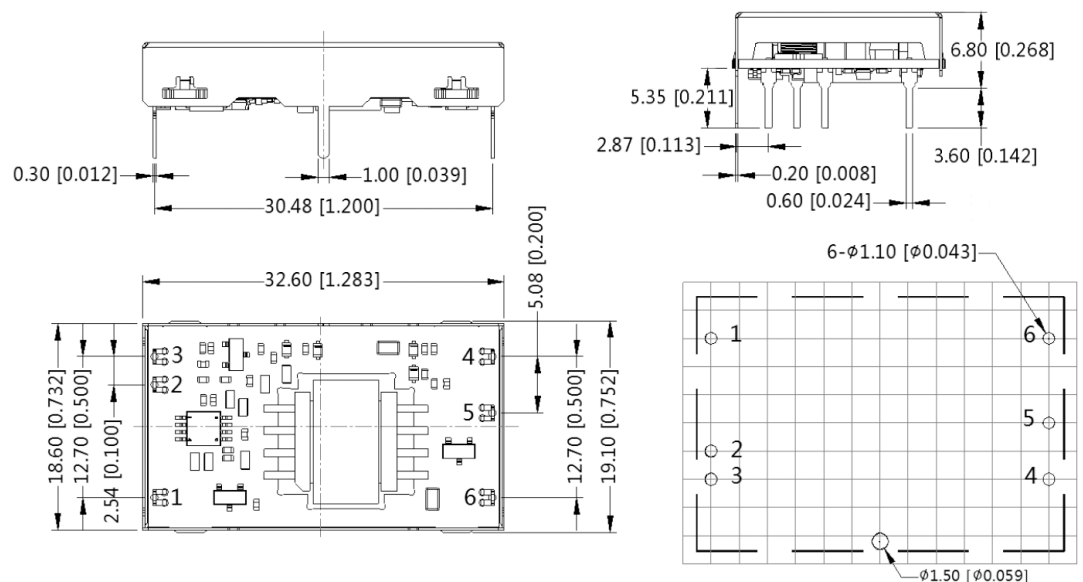
Note: Grid 2.54\*2.54mm  
Recommended PCB Layout  
Top View

## MECHANICAL DRAWING (DIP WITH CASE)

units: mm [inch]

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

| PIN CONNECTIONS |          |
|-----------------|----------|
| PIN             | Function |
| 1               | Vin      |
| 2               | CTRL     |
| 3               | GND      |
| 4               | 0V       |
| 5               | trim     |
| 6               | +Vo      |

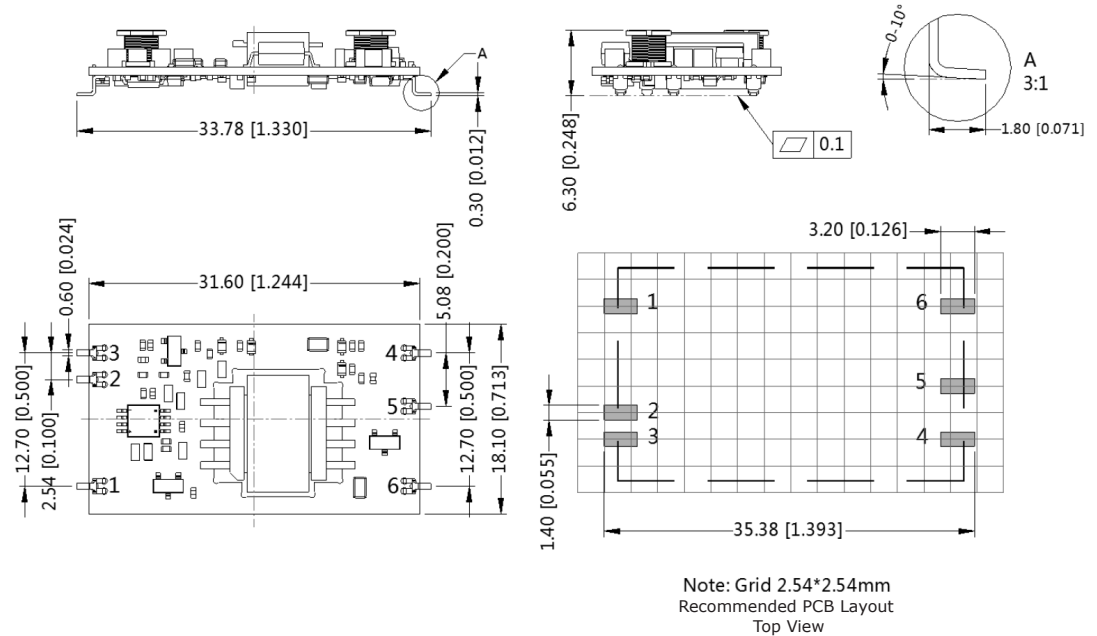


Note: Grid 2.54\*2.54mm  
Recommended PCB Layout  
Top View

## MECHANICAL DRAWING (SMT WITHOUT CASE)

units: mm [inch]  
 tolerance:  $\pm 0.50[\pm 0.020]$   
 pin section tolerance:  $\pm 0.10[\pm 0.004]$

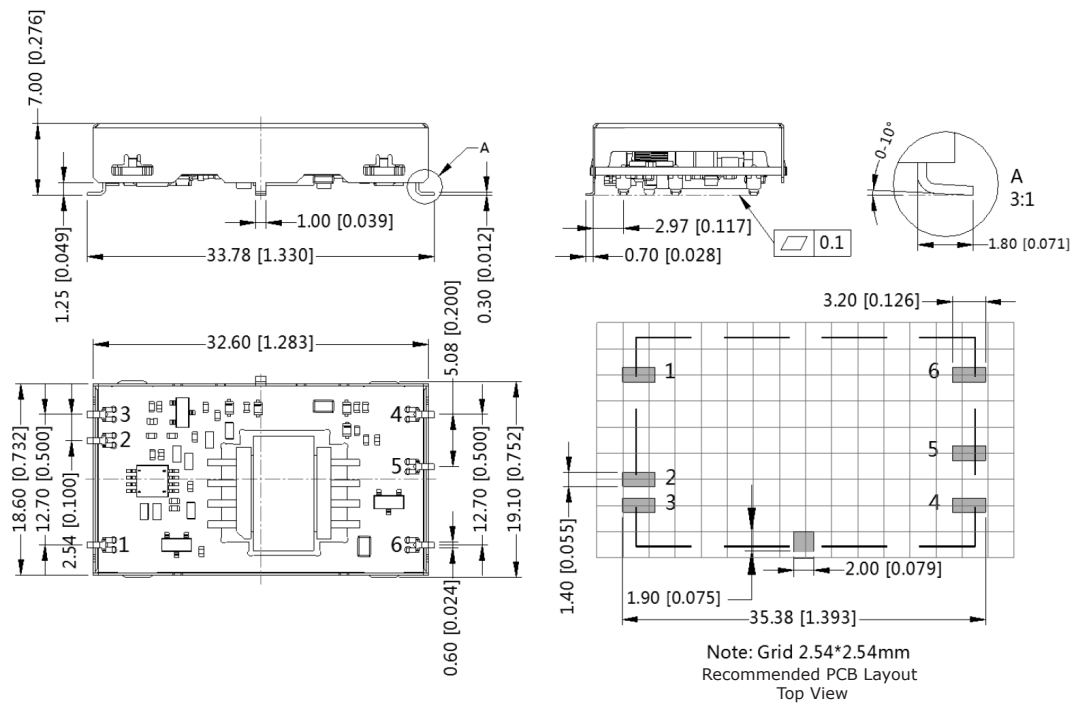
| PIN CONNECTIONS |          |
|-----------------|----------|
| PIN             | Function |
| 1               | Vin      |
| 2               | CTRL     |
| 3               | GND      |
| 4               | 0V       |
| 5               | trim     |
| 6               | +Vo      |



## MECHANICAL DRAWING (SMT WITH CASE)

units: mm [inch]  
 tolerance:  $\pm 0.50[\pm 0.020]$   
 pin section tolerance:  $\pm 0.10[\pm 0.004]$

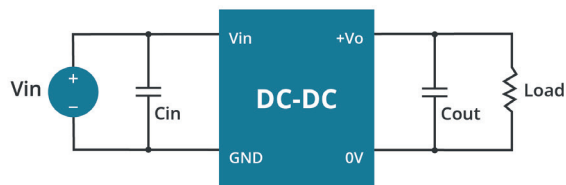
| PIN CONNECTIONS |          |
|-----------------|----------|
| PIN             | Function |
| 1               | Vin      |
| 2               | CTRL     |
| 3               | GND      |
| 4               | 0V       |
| 5               | trim     |
| 6               | +Vo      |



## APPLICATION CIRCUIT

This series has been tested according to the following recommended circuit (Figure 1) 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**

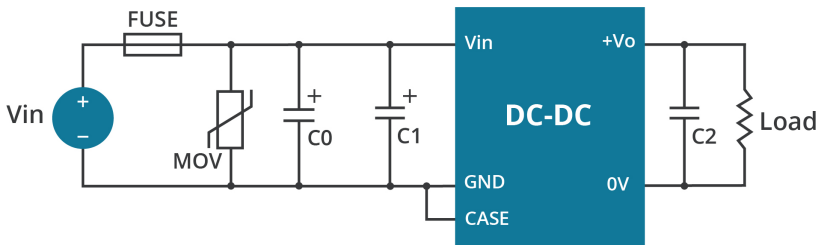


**Table 1**

| Vout (Vdc)  | Cin (μF) | Cout (μF) |
|-------------|----------|-----------|
| 3.3/5/12/15 | 10       | 10        |

## EMC RECOMMENDED CIRCUIT

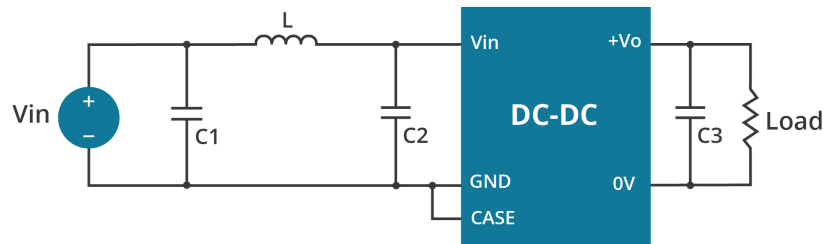
**Figure 2**



**Table 2**

| Recommended External Circuit Components |                                          |
|-----------------------------------------|------------------------------------------|
| Vin (Vdc)                               | 12, 24                                   |
| FUSE                                    | choose according to actual input current |
| MOV                                     | S20K30                                   |
| C0                                      | 680 μF / 100 V                           |
| C1                                      | 330 μF / 25 V                            |
| C2                                      | 10 μF / 25 V                             |

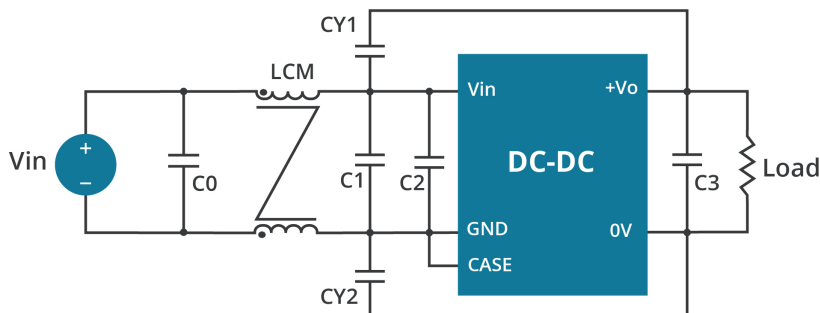
**Figure 3**



**Table 3**

| Recommended External Circuit Components |               |
|-----------------------------------------|---------------|
| Vin (Vdc)                               | 12, 24        |
| C1, C2                                  | 4.7 μF / 50 V |
| L                                       | 4.7 μH        |
| C3                                      | 10 μF / 25 V  |

**Figure 4**



**Table 4**

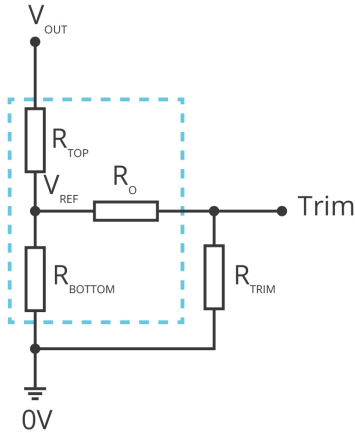
| Recommended External Circuit Components |                     |
|-----------------------------------------|---------------------|
| Vin (Vdc)                               | 12, 24              |
| C0                                      | 4.7 μF / 50 V       |
| C1                                      | 4.7 μF / 50 V       |
| C2                                      | 4.7 μF / 50 V       |
| C3                                      | 10 μF / 25 V        |
| LCM                                     | 3.3 mH              |
| CY1, CY2                                | 1000 pF / ≥2000 Vdc |

## APPLICATION NOTES

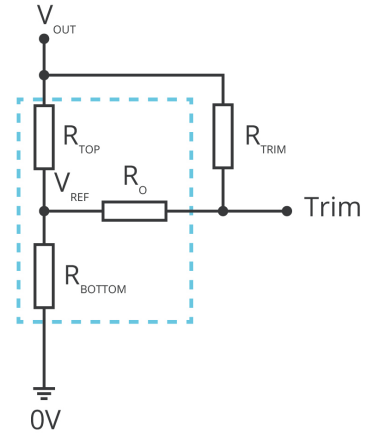
Output voltage trimming  
Leave open if not used.

Figure 5

Trim up



Trim down



$$R_{\text{TRIM}} = \frac{a \cdot R_{\text{BOTTOM}}}{R_{\text{BOTTOM}} - a} - R_O \quad a = \frac{V_{\text{REF}}}{V_{\text{OUT}} - V_{\text{REF}}} \cdot R_{\text{TOP}}$$

Formula for Trim up

$$R_{\text{TRIM}} = \frac{a \cdot R_{\text{TOP}}}{R_{\text{TOP}} - a} - R_O \quad a = \frac{V_{\text{OUT}} - V_{\text{REF}}}{V_{\text{REF}}} \cdot R_{\text{BOTTOM}}$$

Formula for Trim down

Table 5

| $V_{\text{OUT}}$ | $R_{\text{TOP}}$ | $R_{\text{BOTTOM}}$ | $R_O$ | $V_{\text{REF}}$ |
|------------------|------------------|---------------------|-------|------------------|
| (Vdc)            | (kΩ)             | (kΩ)                | (kΩ)  | (V)              |
| PYBJ6-D12-S5     | 2.94             | 2.87                | 10    | 2.5              |
| PYBJ6-D12-S12    | 11               | 2.87                | 15    | 2.5              |
| PYBJ6-D12-S15    | 14.5             | 2.87                | 15    | 2.5              |
| PYBJ6-D24-S3     | 4.8              | 2.87                | 12    | 1.24             |
| PYBJ6-D24-S5     | 2.94             | 2.87                | 15    | 2.5              |
| PYBJ6-D24-S12    | 11.0             | 2.87                | 33    | 2.5              |
| PYBJ6-D24-S15    | 14.5             | 2.87                | 15    | 2.5              |

Note: Value for  $R_{\text{TOP}}$ ,  $R_{\text{BOTTOM}}$ ,  $R_O$ , and  $V_{\text{REF}}$  refer to Table 3 (fixed internal values).

$R_{\text{TRIM}}$ : Trim resistance

$a$ : User-defined parameter, no actual meanings

$V_{\text{OUT}}$ : Nominal output voltage

## REVISION HISTORY

| rev. | description                                                     | date       |
|------|-----------------------------------------------------------------|------------|
| 1.0  | initial release                                                 | 06/24/2019 |
| 1.01 | packaging removed, safeties updated in features and safety line | 01/14/2021 |
| 1.02 | derating curve and circuit figures updated                      | 07/20/2021 |
| 1.03 | CE certification removed                                        | 12/05/2022 |
| 1.04 | remote on/off updated                                           | 08/16/2023 |

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



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