

## Descriptions

1W isolated, DC-DC Converter



RoHS



Report

EN62368-1



Report

BS EN62368-1

## Features

- Continuous short-circuit protection
- No-load input current as low as 8mA
- Operating ambient temperature range: -40°C to +105°C
- High efficiency up to 85%
- I/O isolation test voltage: 1.5k VDC
- Industry standard pin-out

## Applications

- Industrial control
- Power
- Instrumentation

## Selection Guide

| Certification | Part No.   | Input Voltage (VDC) | Output           |                           | Full Load Efficiency (%)<br>Min./Typ. | Capacitive Load*( $\mu$ F)<br>Max. |
|---------------|------------|---------------------|------------------|---------------------------|---------------------------------------|------------------------------------|
|               |            | Nominal<br>(Range)  | Voltage<br>(VDC) | Current (mA)<br>Max./Min. |                                       |                                    |
| --            | DFS1-A0303 | 3.3<br>(2.97-3.63)  | $\pm 3.3$        | $\pm 152/\pm 15$          | 74/78                                 | 1200                               |
| --            | DFS1-A0305 |                     | $\pm 5$          | $\pm 100/\pm 10$          | 78/82                                 | 1200                               |
| --            | DFS1-A0309 |                     | $\pm 9$          | $\pm 56/\pm 6$            | 81/85                                 | 470                                |
| --            | DFS1-A0312 |                     | $\pm 12$         | $\pm 42/\pm 5$            | 78/82                                 | 220                                |
| --            | DFS1-A0315 |                     | $\pm 15$         | $\pm 34/\pm 4$            | 78/82                                 | 220                                |
| --            | DFS1-A0324 |                     | $\pm 24$         | $\pm 21/\pm 2$            | 80/84                                 | 100                                |
| EN/BS EN      | DFS1-A0503 | 5<br>(4.5-5.5)      | $\pm 3.3$        | $\pm 152/\pm 15$          | 70/74                                 | 1200                               |
| EN/BS EN      | DFS1-A0505 |                     | $\pm 5$          | $\pm 100/\pm 10$          | 78/82                                 | 1200                               |
| EN/BS EN      | DFS1-A0509 |                     | $\pm 9$          | $\pm 56/\pm 6$            | 79/83                                 | 470                                |
| EN/BS EN      | DFS1-A0512 |                     | $\pm 12$         | $\pm 42/\pm 5$            | 79/83                                 | 220                                |
| EN/BS EN      | DFS1-A0515 |                     | $\pm 15$         | $\pm 34/\pm 4$            | 79/83                                 | 220                                |
| EN/BS EN      | DFS1-A0524 |                     | $\pm 24$         | $\pm 21/\pm 3$            | 81/85                                 | 100                                |
| EN/BS EN      | DFS1-A1203 | 12<br>(10.8-13.2)   | $\pm 3.3$        | $\pm 152/\pm 15$          | 71/75                                 | 1200                               |
| EN/BS EN      | DFS1-A1205 |                     | $\pm 5$          | $\pm 100/\pm 10$          | 76/80                                 | 1200                               |

|          |            |                   |     |          |       |      |
|----------|------------|-------------------|-----|----------|-------|------|
| EN/BS EN | DFS1-A1209 |                   | ±9  | ±56/±5   | 76/80 | 470  |
| EN/BS EN | DFS1-A1212 |                   | ±12 | ±42/±5   | 77/81 | 220  |
| EN/BS EN | DFS1-A1215 |                   | ±15 | ±34/±4   | 77/81 | 220  |
| EN/BS EN | DFS1-A1224 |                   | ±24 | ±21/±3   | 76/80 | 100  |
| --       | DFS1-A1505 | 15<br>(13.5-16.5) | ±5  | ±100/±10 | 76/80 | 1200 |
| --       | DFS1-A1509 |                   | ±9  | ±56/±5   | 76/80 | 470  |
| --       | DFS1-A1512 |                   | ±12 | ±42/±5   | 76/80 | 220  |
| EN/BS EN | DFS1-A1515 |                   | ±15 | ±34/±4   | 77/81 | 220  |
| --       | DFS1-A1524 |                   | ±24 | ±21/±2   | 77/81 | 100  |
| EN/BS EN | DFS1-A2405 | 24<br>(21.6-26.4) | ±5  | ±100/±10 | 74/80 | 1200 |
| EN/BS EN | DFS1-A2409 |                   | ±9  | ±56/±5   | 74/80 | 470  |
| EN/BS EN | DFS1-A2412 |                   | ±12 | ±42/±5   | 75/81 | 220  |
| EN/BS EN | DFS1-A2415 |                   | ±15 | ±34/±4   | 73/79 | 220  |
| EN/BS EN | DFS1-A2424 |                   | ±24 | ±21/±3   | 74/80 | 100  |

Note: \* The specified maximum capacitive load for positive and negative output is identical.

## Specifications

| characteristic        | Item                                   | Operating Conditions           |                    | Min. | Typ.                                | Max.   | Unit |
|-----------------------|----------------------------------------|--------------------------------|--------------------|------|-------------------------------------|--------|------|
| Input Specifications  | Input Current<br>(full load / no-load) | 3.3VDC input                   | 3.3VDC output      | --   | 384/10                              | 405/-- | mA   |
|                       |                                        |                                | Other output       | --   | 370/18                              | 389/-- |      |
|                       |                                        | 5VDC input                     | 3.3VDC/5VDC output | --   | 270/8                               | 286/-- |      |
|                       |                                        |                                | 9VDC/12VDC output  | --   | 241/12                              | 254/-- |      |
|                       |                                        |                                | 15VDC/24VDC output | --   | 241/18                              | 254/-- |      |
|                       |                                        | 12VDC input                    |                    | --   | 105/8                               | 110/-- |      |
|                       |                                        | 15VDC input                    |                    | --   | 84/8                                | 88/--  |      |
|                       |                                        | 24VDC input                    |                    | --   | 56/8                                | 61/--  |      |
|                       | Reflected Ripple Current               |                                |                    | --   | 15                                  | --     |      |
|                       | Surge Voltage<br>(1sec. max.)          | 3.3VDC input                   |                    | -0.7 | --                                  | 5      | VDC  |
|                       |                                        | 5VDC input                     |                    | -0.7 | --                                  | 9      |      |
|                       |                                        | 12VDC input                    |                    | -0.7 | --                                  | 18     |      |
|                       |                                        | 15VDC input                    |                    | -0.7 | --                                  | 21     |      |
|                       |                                        | 24VDC input                    |                    | -0.7 | --                                  | 30     |      |
|                       | Input Filter                           |                                |                    |      | Capacitance filter                  |        |      |
|                       | Hot Plug                               |                                |                    |      | Unavailable                         |        |      |
| Output Specifications | Voltage Accuracy                       |                                |                    |      | See output regulation curve(Fig. 1) |        |      |
|                       | Linear Regulation                      | Input voltage change: ±1%      | 3.3VDC output      | --   | --                                  | ±1.5   | --   |
|                       |                                        |                                | Others             | --   | --                                  | ±1.2   |      |
|                       | Load Regulation                        | 3.3VDC input<br>10% -100% load | 3.3VDC output      | --   | 12                                  | 18     | %    |
|                       |                                        |                                | Other output       | --   | 8                                   | 15     |      |
|                       |                                        | 5VDC input<br>10% -100% load   | 3.3VDC output      | --   | 15                                  | 20     |      |
|                       |                                        |                                | 5VDC output        | --   | 10                                  | 15     |      |
|                       |                                        |                                | 9VDC output        | --   | 8                                   | 10     |      |
|                       |                                        |                                | 12VDC output       | --   | 7                                   | 10     |      |
|                       | 15VDC output                           |                                | --                 | 6    | 10                                  |        |      |

|                           |                                      |                                                                                     |                                                         |      |       |     |         |
|---------------------------|--------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------|------|-------|-----|---------|
|                           |                                      | 12/15/24VDC input<br>10% -100% load                                                 | 24VDC output                                            | --   | 5     | 10  |         |
|                           |                                      |                                                                                     | 3.3VDC output                                           | --   | 8     | 20  |         |
|                           |                                      |                                                                                     | 5VDC output                                             | --   | 5     | 15  |         |
|                           |                                      |                                                                                     | 9VDC output                                             | --   | 3     | 10  |         |
|                           |                                      |                                                                                     | 12VDC output                                            | --   | 3     | 10  |         |
|                           |                                      |                                                                                     | 15VDC output                                            | --   | 3     | 10  |         |
|                           |                                      |                                                                                     | 24VDC output                                            | --   | 2     | 10  |         |
|                           | Ripple & Noise*                      | 20MHz bandwidth                                                                     | Other output                                            | --   | 30    | 75  | mVp-p   |
|                           |                                      |                                                                                     | 24VDC output                                            | --   | 50    | 100 |         |
|                           | Temperature Coefficient              | Full load                                                                           |                                                         | --   | ±0.02 | --  | %/°C    |
|                           | Short-circuit Protection             | Continuous, self-recovery                                                           |                                                         |      |       |     |         |
| General Specifications    | Isolation                            | Input-output electric strength test for 1 minute with a leakage current of 1mA max. |                                                         | 1500 | --    | --  | VDC     |
|                           | Insulation Resistance                | Input-output resistance at 500VDC                                                   |                                                         | 1000 | --    | --  | MΩ      |
|                           | Isolation Capacitance                | Input-output capacitance at 100kHz/0.1V                                             |                                                         | --   | 20    | --  | pF      |
|                           | Operating Temperature                | 5VDC input                                                                          | Derating when operating temperature≥85°C, (see Fig. 2)  | -40  | --    | 105 | °C      |
|                           |                                      | 3.3/12/15/24 VDC input                                                              | Derating when operating temperature≥100°C, (see Fig. 2) |      |       |     |         |
|                           | Storage Temperature                  |                                                                                     |                                                         | -55  | --    | 125 |         |
|                           | Case Temperature Rise                | Ta=25°C                                                                             |                                                         | --   | 25    | --  |         |
|                           | Pin Soldering Resistance Temperature | Soldering spot is 1.5mm away from case for 10 seconds                               |                                                         | --   | --    | 300 |         |
|                           | Storage Humidity                     | Non-condensing                                                                      |                                                         | 5    | --    | 95  | %RH     |
|                           | Vibration                            | 10-150Hz, 5G, 0.75mm. along X, Y and Z                                              |                                                         |      |       |     |         |
|                           | Switching Frequency                  | Full load, nominal input voltage                                                    | 3.3VDC input                                            | --   | 220   | --  | kHz     |
|                           |                                      |                                                                                     | 5VDC input                                              | --   | 270   | --  |         |
|                           |                                      |                                                                                     | 12/15/24VDC input                                       | --   | 260   | --  |         |
|                           | MTBF                                 | MIL-HDBK-217F @ 25°C                                                                |                                                         | 3500 | --    | --  | k hours |
| Mechanical Specifications | Case Material                        | Black plastic; flame-retardant and heat-resistant (UL94V-0)                         |                                                         |      |       |     |         |
|                           | Dimensions                           | 19.65 x 6.00 x 10.16mm                                                              |                                                         |      |       |     |         |
|                           | Weight                               | 2.1g(Typ.)                                                                          |                                                         |      |       |     |         |
|                           | Cooling Method                       | Free air convection                                                                 |                                                         |      |       |     |         |

Note:\*The "parallel cable" method is used for Ripple and Noise test.

## Electromagnetic Compatibility

|           |     |                 |                                         |
|-----------|-----|-----------------|-----------------------------------------|
| Emissions | CE  | CISPR32/EN55032 | CLASS B                                 |
|           | RE  | CISPR32/EN55032 | CLASS B                                 |
| Immunity  | ESD | IEC/EN61000-4-2 | Air ±8kV, Contact ±6kV perf. Criteria B |

Note: Refer to Fig. 4 for recommended circuit test.

## Typical Performance Curves

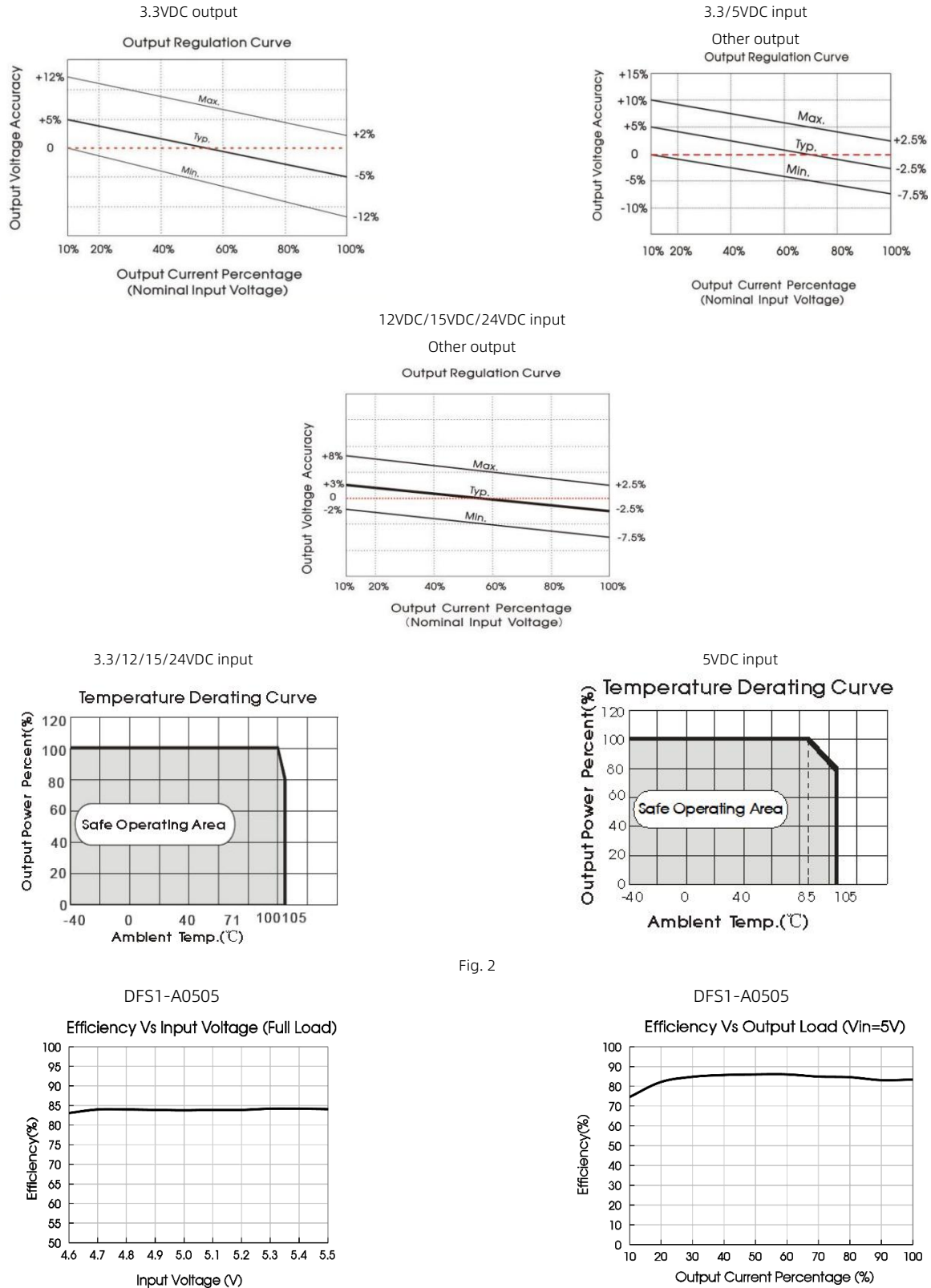


Fig. 2

## Design Reference

### 1. Typical application

Input and/or output ripple can be further reduced, by connecting a filter capacitor from the input and/or output terminals to ground as shown in Fig. 3.

Choosing suitable filter capacitor values is very important for a smooth operation of the modules, particularly to avoid start-up problems caused by capacitor values that are too high. For recommended input and output capacitor values refer to Table 1.

Table 1: Recommended input and output capacitor values

| Vin   |        | Cin       | Dual Vout  | Cout       |
|-------|--------|-----------|------------|------------|
| 3.3V  | 3.3VDC | 10uF/16V  | ±3.3/±5VDC | 10uF/16V   |
|       | --     | --        | ±9/±12VDC  | 2.2uF/25V  |
|       | --     | --        | ±15/±24VDC | 1uF/50V    |
| other | 5VDC   | 4.7μF/16V | ±3.3/5VDC  | 4.7μF/16V  |
|       | 12VDC  | 2.2μF/25V | ±9VDC      | 1μF/16V    |
|       | 15VDC  | 2.2μF/25V | ±12VDC     | 1μF/25V    |
|       | 24VDC  | 1μF/50V   | ±15VDC     | 0.47μF/25V |
|       | --     | --        | ±24VDC     | 0.47μF/50V |

#### Single



Fig. 3

### 2. EMC compliance circuit

#### Dual

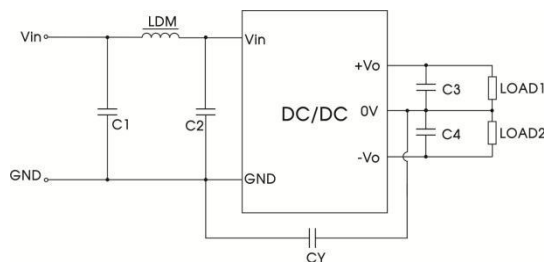
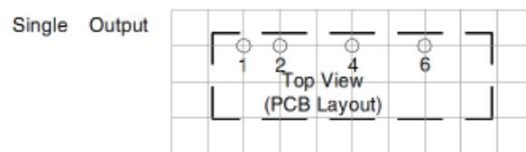
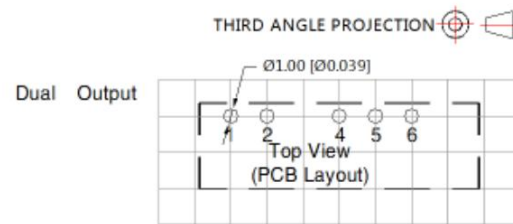
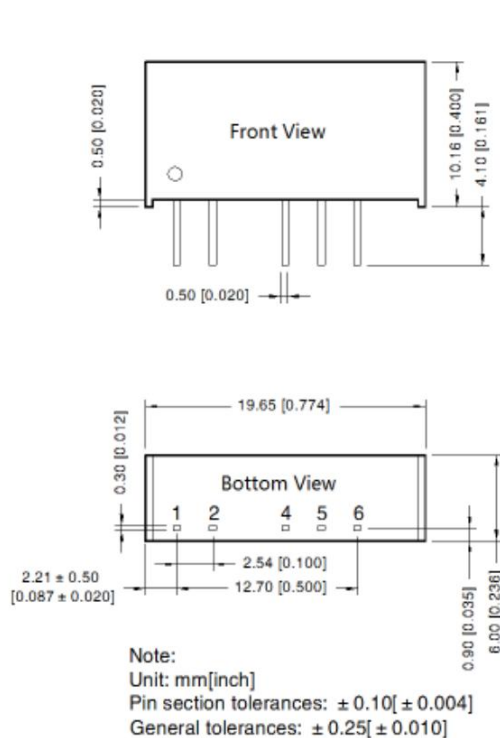


Fig. 4

Table 2: EMC recommended circuit value table

| Input Voltage  |       | 3.3VDC                       |               | 5VDC       |             | Other input |
|----------------|-------|------------------------------|---------------|------------|-------------|-------------|
| Output Voltage |       | 3.3/5VDC                     | 9/12/15/24VDC | 3.3/5/9VDC | 12/15/24VDC | --          |
| Emissions      | C1/C2 | 4.7μF/16V                    | 4.7μF/16V     | 4.7μF/25V  | 4.7μF/25V   | 4.7μF/50V   |
|                | CY    | --                           | 270pF/4kVDC   | 100pF/2kV  | 1000pF/2kV  | 270pF/2kV   |
|                | C3/C4 | Refer to the Cout in table 1 |               |            |             |             |
|                | LDM   | 6.8μH                        |               |            |             |             |

## Dimensions and Recommended Layout



Note: Grid 2.54\*2.54mm

| Pin-Out |        |      |
|---------|--------|------|
| Pin     | Single | Dual |
| 1       | Vin    | Vin  |
| 2       | GND    | GND  |
| 4       | 0V     | -Vo  |
| 5       | No Pin | 0V   |
| 6       | +Vo    | +Vo  |

### Notes:

1. If the product is not operated within the required load range, the product performance cannot be guaranteed to comply with all parameters in the datasheet;
2. The maximum capacitive load offered were tested at input voltage range and full load;
3. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25°C, humidity<75%RH with nominal input voltage and rated output load;
4. All index testing methods in this datasheet are based on our company corporate standards;
5. Products are related to laws and regulations: see "Features" and "EMC";
6. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.