

# MV3S Series

3W, Wide 2:1 Input Range, 1.5KV Isolation, SIP8 Package DC/DC Converters

## Features

- ▶ Rated power: 3W Max
- ▶ Input voltage range: 2:1
- ▶ Regulated single or dual output
- ▶ High efficiency up to 83%
- ▶ Isolation voltage 1.5KVDC
- ▶ Operating temperature range: -40 ~ +85°C ambient
- ▶ No external components required for operating
- ▶ RoHS compliant
- ▶ Compact SIP8 package
- ▶ Remote ON/OFF
- ▶ Continuous short circuit protection
- ▶ Designed to meet UL/EN/IEC 62368-1
- ▶ 5 year warranty



## Overview

The MV3S series are 1.5KV isolated 3Watt DC/DC converters with a compact SIP8 package. Designed with high efficiency, they operate in a wide temperature range from -40°C to +85°C. Other features include wide 2:1 input voltage range, remote On/Off control, under voltage, over current and short circuit protections. These converters are ideally suitable for battery operated equipment, measurement equipment, telecom, wireless network, industrial control system.

## Model Numbers

| Model Number | Input Voltage [VDC] |       |       | V <sub>OUT</sub><br>[VDC] | Output Current [mA] |      | Efficiency<br>[%] Typ. | Capacitive Load<br>[uF] Max. |
|--------------|---------------------|-------|-------|---------------------------|---------------------|------|------------------------|------------------------------|
|              | Nominal             | Range | *Max. |                           | Max.                | Min. |                        |                              |
| MV3S-0503    | 5                   | 4.5~9 | 11    | 3.3                       | 758                 | 38   | 68                     | 1800                         |
| MV3S-0505    | 5                   | 4.5~9 | 11    | 5                         | 500                 | 25   | 73                     | 2200                         |
| MV3S-0509    | 5                   | 4.5~9 | 11    | 9                         | 278                 | 14   | 74                     | 1000                         |
| MV3S-0512    | 5                   | 4.5~9 | 11    | 12                        | 208                 | 10   | 77                     | 680                          |
| MV3S-0515    | 5                   | 4.5~9 | 11    | 15                        | 167                 | 8    | 74                     | 470                          |
| MV3S-0524    | 5                   | 4.5~9 | 11    | 24                        | 104                 | 5    | 76                     | 330                          |
| MV3S-0505D   | 5                   | 4.5~9 | 11    | ±5                        | ±250                | ±13  | 74                     | 1000                         |
| MV3S-0509D   | 5                   | 4.5~9 | 11    | ±9                        | ±167                | ±10  | 76                     | 680                          |
| MV3S-0512D   | 5                   | 4.5~9 | 11    | ±12                       | ±104                | ±5   | 77                     | 470                          |
| MV3S-0515D   | 5                   | 4.5~9 | 11    | ±15                       | ±83                 | ±4   | 77                     | 330                          |
| MV3S-0524D   | 5                   | 4.5~9 | 11    | ±24                       | ±52                 | ±3   | 76                     | 220                          |
| MV3S-1203    | 12                  | 9~18  | 20    | 3.3                       | 758                 | 38   | 75                     | 2700                         |
| MV3S-1205    | 12                  | 9~18  | 20    | 5                         | 600                 | 30   | 76                     | 2200                         |
| MV3S-1209    | 12                  | 9~18  | 20    | 9                         | 333                 | 17   | 79                     | 1000                         |
| MV3S-1212    | 12                  | 9~18  | 20    | 12                        | 250                 | 13   | 82                     | 680                          |
| MV3S-1215    | 12                  | 9~18  | 20    | 15                        | 200                 | 10   | 83                     | 470                          |
| MV3S-1224    | 12                  | 9~18  | 20    | 24                        | 125                 | 6    | 81                     | 330                          |

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## Model Numbers [continued]

| Model Number | Input Voltage [VDC] |       |       | V <sub>OUT</sub><br>[VDC] | Output Current [mA] |      | Efficiency<br>[%] Typ. | Capacitive Load<br>[uF] *Max. |
|--------------|---------------------|-------|-------|---------------------------|---------------------|------|------------------------|-------------------------------|
|              | Nominal             | Range | *Max. |                           | Max.                | Min. |                        |                               |
| MV3S-1205D   | 12                  | 9~18  | 20    | ±5                        | ±300                | ±15  | 78                     | 1000                          |
| MV3S-1209D   | 12                  | 9~18  | 20    | ±9                        | ±167                | ±8   | 78                     | 680                           |
| MV3S-1212D   | 12                  | 9~18  | 20    | ±12                       | ±125                | ±6   | 79                     | 470                           |
| MV3S-1215D   | 12                  | 9~18  | 20    | ±15                       | ±100                | ±5   | 80                     | 330                           |
| MV3S-2403    | 24                  | 18~36 | 40    | 3.3                       | 758                 | 38   | 74                     | 2700                          |
| MV3S-2405    | 24                  | 18~36 | 40    | 5                         | 600                 | 30   | 81                     | 2200                          |
| MV3S-2409    | 24                  | 18~36 | 40    | 9                         | 333                 | 17   | 83                     | 2200                          |
| MV3S-2412    | 24                  | 18~36 | 40    | 12                        | 250                 | 13   | 83                     | 1000                          |
| MV3S-2415    | 24                  | 18~36 | 40    | 15                        | 200                 | 10   | 83                     | 680                           |
| MV3S-2424    | 24                  | 18~36 | 40    | 24                        | 125                 | 6    | 83                     | 470                           |
| MV3S-2405D   | 24                  | 18~36 | 40    | ±5                        | ±300                | ±15  | 79                     | 1000                          |
| MV3S-2409D   | 24                  | 18~36 | 40    | ±9                        | ±167                | ±8   | 81                     | 680                           |
| MV3S-2412D   | 24                  | 18~36 | 40    | ±12                       | ±125                | ±6   | 83                     | 470                           |
| MV3S-2415D   | 24                  | 18~36 | 40    | ±15                       | ±100                | ±5   | 83                     | 330                           |
| MV3S-4803    | 48                  | 36~75 | 80    | 3.3                       | 758                 | 38   | 75                     | 2700                          |
| MV3S-4805    | 48                  | 36~75 | 80    | 5                         | 600                 | 30   | 76                     | 2200                          |
| MV3S-4812    | 48                  | 36~75 | 80    | 12                        | 250                 | 13   | 80                     | 680                           |
| MV3S-4815    | 48                  | 36~75 | 80    | 15                        | 200                 | 10   | 84                     | 470                           |
| MV3S-4824    | 48                  | 36~75 | 80    | 24                        | 125                 | 6    | 82                     | 330                           |
| MV3S-4805D   | 48                  | 36~75 | 80    | ±5                        | ±300                | ±15  | 79                     | 1000                          |
| MV3S-4812D   | 48                  | 36~75 | 80    | ±12                       | ±125                | ±6   | 82                     | 470                           |
| MV3S-4815D   | 48                  | 36~75 | 80    | ±15                       | ±100                | ±5   | 82                     | 330                           |

\* Only typical models are listed. Other models may be available upon request.

\* Input voltage exceed the Max. value may cause permanent damage.

\* For dual output models, max capacitive load stipulated in the above list is for each output.

\* Standard models in this series are 1.5KV isolation. See MVK3S series for 3KV isolation models.

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## Electrical Specifications

Unless otherwise indicated, specifications are measured at  $T_A=25^{\circ}\text{C}$ , nominal input voltage, full load after warm up.

| Parameters                                                                                   | Conditions                             | Min.                           | Typ. | Max. | Unit               | Note           |
|----------------------------------------------------------------------------------------------|----------------------------------------|--------------------------------|------|------|--------------------|----------------|
| Input current<br>Full load                                                                   | V <sub>IN, Nom</sub> = 5V              | -                              | 805  | -    | mA                 |                |
|                                                                                              | V <sub>IN, Nom</sub> = 12V             |                                | 314  |      |                    |                |
|                                                                                              | V <sub>IN, Nom</sub> = 24V             |                                | 154  |      |                    |                |
|                                                                                              | V <sub>IN, Nom</sub> = 48V             |                                | 78   |      |                    |                |
| Input current<br>No load                                                                     | V <sub>IN, Nom</sub> = 5V              | -                              | 40   | 85   | mA                 |                |
|                                                                                              | V <sub>IN, Nom</sub> = 12V             |                                | 30   | 40   |                    |                |
|                                                                                              | V <sub>IN, Nom</sub> = 24V             |                                | 20   | 40   |                    |                |
|                                                                                              | V <sub>IN, Nom</sub> = 48V             |                                | 5    | 15   |                    |                |
| Input reflected ripple current                                                               | V <sub>IN, Nom</sub> = 5V, 12V         | -                              | 20   | -    | mA                 |                |
|                                                                                              | V <sub>IN, Nom</sub> = 24V, 48V        |                                | 55   |      |                    |                |
| Input voltage surge<br>1 second max                                                          | V <sub>IN, Nom</sub> = 5V              | -0.7                           | -    | 12   | Vdc                |                |
|                                                                                              | V <sub>IN, Nom</sub> = 12V             | -0.7                           |      | 25   |                    |                |
|                                                                                              | V <sub>IN, Nom</sub> = 24V             | -0.7                           |      | 50   |                    |                |
|                                                                                              | V <sub>IN, Nom</sub> = 48V             | -0.7                           |      | 100  |                    |                |
| Startup input voltage                                                                        | V <sub>IN, Nom</sub> = 5V              | -                              | -    | 4.5  | Vdc                |                |
|                                                                                              | V <sub>IN, Nom</sub> = 12V             |                                |      | 9    |                    |                |
|                                                                                              | V <sub>IN, Nom</sub> = 24V             |                                |      | 18   |                    |                |
|                                                                                              | V <sub>IN, Nom</sub> = 48V             |                                |      | 36   |                    |                |
| Output voltage accuracy                                                                      | V <sub>OUT</sub> =3.3V, 5V             | -                              | ±2   | ±5   | %                  |                |
|                                                                                              | All others                             |                                | ±1   | ±3   |                    |                |
| Line regulation<br>Full load, V <sub>IN</sub> = V <sub>IN, Min</sub> to V <sub>IN, Max</sub> |                                        | -                              | ±0.2 | ±0.5 | %                  |                |
| Load regulation<br>I <sub>OUT</sub> =5% to 100% of I <sub>OUT, rated</sub>                   |                                        | -                              | ±0.5 | ±1.0 | %                  |                |
| Temperature coefficient                                                                      | Full load                              | -                              | 0.02 | 0.03 | %/°C               |                |
| Dynamic load response<br>I <sub>OUT</sub> =25%~50%~75% of I <sub>OUT, rated</sub>            | Peak deviation                         | -                              | ±2.5 | ±5   | % V <sub>OUT</sub> |                |
|                                                                                              | Recovery time                          |                                | 0.5  | 3    | mS                 |                |
| Output ripple and noise                                                                      | 20MHz bandwidth                        | -                              | 80   | 150  | mVp-p              |                |
| Remote On/Off control                                                                        | Logic high                             | 3.5                            | -    | 12   | VDC                | Positive Logic |
|                                                                                              | “Ctrl” pin open or logic high [ON]     | 0                              | -    | 0.7  | VDC                |                |
|                                                                                              | “Ctrl” pin grounded or logic low [OFF] | -                              | 5    | 10   | mA                 |                |
| Output short circuit protection                                                              |                                        | Continuous, automatic recovery |      |      |                    |                |

\* Operating with less than 5% of rated load will not cause damage to the converters, but the performances data may not fall into the specifications, and stable operating is not assured.

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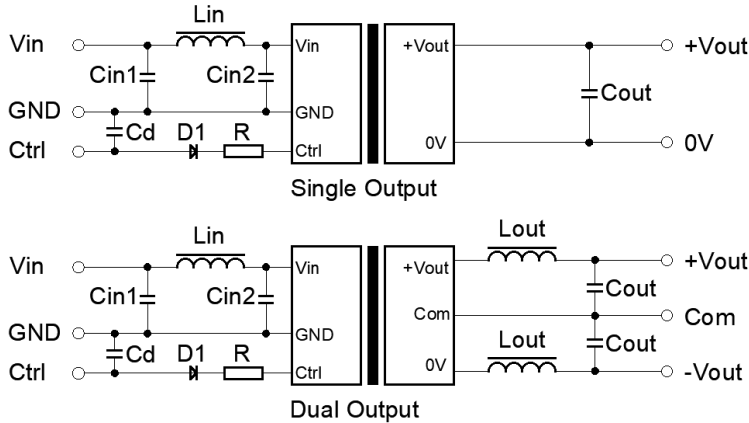
## General Specifications

| Parameters                                                                                                       | Conditions                                 | Min.                                                                                                                                                                                                                                                                  | Typ. | Max. | Unit  | Note |
|------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-------|------|
| <b>Isolation voltage</b><br>Tested for 1 minute                                                                  | Input to Output                            | 1500                                                                                                                                                                                                                                                                  | -    | -    | VDC   |      |
| <b>Isolation resistance</b><br>Tested at 500VDC                                                                  | Input to Output                            | 1000                                                                                                                                                                                                                                                                  | -    | -    | M ohm |      |
| <b>Isolation capacitance</b><br>100KHz, 0.1V                                                                     | Input to Output                            | -                                                                                                                                                                                                                                                                     | 120  | -    | pF    |      |
| <b>Switching frequency</b>                                                                                       | Full load                                  | -                                                                                                                                                                                                                                                                     | 250  | -    | KHz   |      |
| <b>Operating temperature</b>                                                                                     | No derating                                | -40                                                                                                                                                                                                                                                                   | -    | +85  | °C    |      |
| <b>Storage temperature</b>                                                                                       |                                            | -55                                                                                                                                                                                                                                                                   | -    | +125 | °C    |      |
| <b>Storage humidity</b>                                                                                          | None condensing                            | 5                                                                                                                                                                                                                                                                     | -    | 95   | %RH   |      |
| <b>Pin soldering resistance</b><br>1.5mm away from case for 10 sec                                               |                                            | -                                                                                                                                                                                                                                                                     | -    | 300  | °C    |      |
| <b>Case material</b>                                                                                             |                                            | Black plastic UL94-V0                                                                                                                                                                                                                                                 |      |      |       |      |
| <b>Cooling method</b>                                                                                            |                                            | Free air convection                                                                                                                                                                                                                                                   |      |      |       |      |
| <b>Vibration</b>                                                                                                 |                                            | 10-150Hz, 5G, 0.75mm along X, Y and Z                                                                                                                                                                                                                                 |      |      |       |      |
| <b>MTBF</b>                                                                                                      | MIL-HDBK-217F                              | >1,000,000 Hours, T <sub>A</sub> =25°C                                                                                                                                                                                                                                |      |      |       |      |
| <b>Design based on standards</b>                                                                                 |                                            | IEC/EN/UL 62368-1                                                                                                                                                                                                                                                     |      |      |       |      |
| <b>Safety certifications</b>                                                                                     |                                            | IEC/EN 62368-1                                                                                                                                                                                                                                                        |      |      |       |      |
| <b>EMC</b><br>[Fig x] means connected with external circuit as shown in the Recommended External Circuit section | CE & RE<br>ESD<br>RS<br>EFT<br>Surge<br>CS | CISPR32, EN55032 Class B with [Fig 2]<br>IEC/EN61000-4-2, Contact ±4kV, Criteria B<br>IEC/EN61000-4-3, 10V/m, Criteria A<br>IEC/EN61000-4-4, ±2kV, Criteria B [Fig 1]<br>IEC/EN61000-4-5, Line to Line ±2kV, Criteria B [Fig 1]<br>IEC/EN61000-4-6, 3Vrms, Criteria A |      |      |       |      |
| <b>Size &amp; Weight</b>                                                                                         |                                            | 22x9.5x12mm, 4.5g                                                                                                                                                                                                                                                     |      |      |       |      |

### Recommended Application Circuit

#### Typical External Circuit

\*Models in this series are 100% tested in production using this circuit.



#### Recommended Component Spec

| Item | V <sub>IN</sub> =5V, 12V | V <sub>IN</sub> =24V, 48V |
|------|--------------------------|---------------------------|
| Cin1 | 100uF                    | 10uF                      |
| Cin2 | 47uF                     | 1uF                       |
| Cout | 100uF                    | 100uF                     |
| Cd   | 47nF, 100V               | 47nF, 100V                |
| Lin  | 4.7uH~12uH               | 4.7uH~12uH                |
| Lout | 2.2uH~10uH               | 2.2uH~10uH                |

Figure 1. Typical Application Circuit

#### EMC Enhancement for EN55032 Class B

\*External circuits within block "Part 1" is to improve EMS, "Part 2" to improve EMI test performance, "Part 3" to use the remote on/off control function.

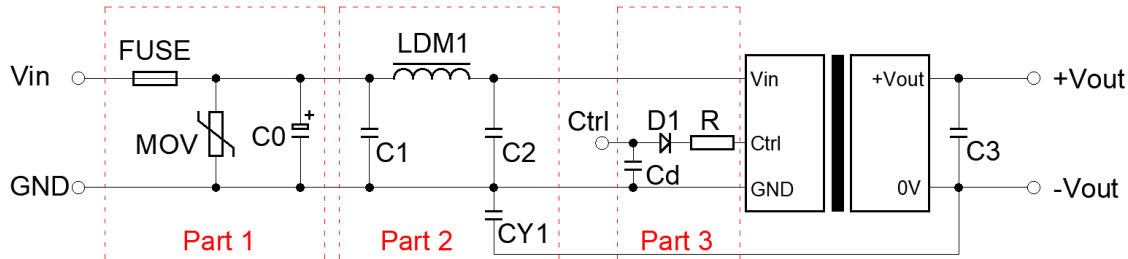


Figure 2. Circuit for EMC Enhancement

#### Recommended component spec

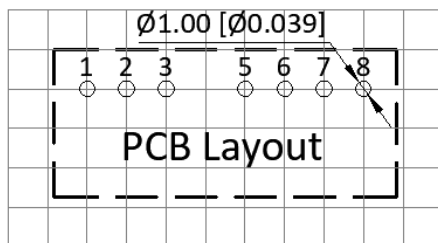
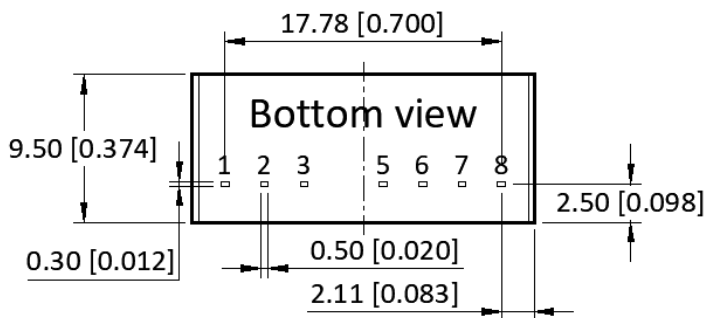
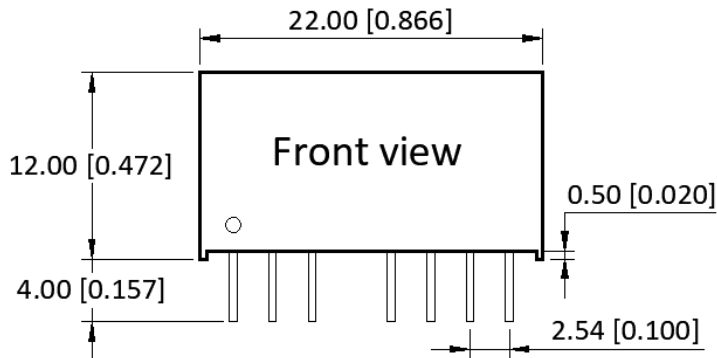
| Items                | C0          | C1, C2      | Cd         | CY1      | D1      | LDM1 | MOV     |
|----------------------|-------------|-------------|------------|----------|---------|------|---------|
| V <sub>IN</sub> =5V  | 1K uF, 25V  | 4.7uF, 50V  | 47nF, 100V | 1nF, 2KV | 60V, 1A | 12uH | -       |
| V <sub>IN</sub> =12V | 1K uF, 25V  | 4.7uF, 50V  | 47nF, 100V | 1nF, 2KV | 60V, 1A | 12uH | 14D390K |
| V <sub>IN</sub> =24V | 330uF, 50V  | 4.7uF, 50V  | 47nF, 100V | 1nF, 2KV | 60V, 1A | 12uH | 14D560K |
| V <sub>IN</sub> =48V | 330uF, 100V | 4.7uF, 100V | 47nF, 100V | 1nF, 2KV | 60V, 1A | 12uH | 14D101K |

\*C3 refer to C<sub>OUT</sub> in above Figure 1, FUSE to be selected according to application needs.

\*Resistor R may be calculated using following formula: 
$$R = \frac{V_C - V_D - 1.0}{I_C} - 300$$

\*V<sub>C</sub> is the Ctrl to GND voltage, V<sub>D</sub> is voltage drop on D1, I<sub>C</sub> is current flow into Ctrl.

## Mechanical Specifications



### Pin Definition

| Pin # | Single Out             | Dual Out          |
|-------|------------------------|-------------------|
| 1     | GND                    | GND               |
| 2     | V <sub>IN</sub>        | V <sub>IN</sub>   |
| 3     | Ctrl                   | Ctrl              |
| 5     | No connection          | No connection     |
| 6     | +V <sub>OUT</sub>      | +V <sub>OUT</sub> |
| 7     | -V <sub>OUT</sub> [0V] | COM               |
| 8     | NC                     | -V <sub>OUT</sub> |

\* Unless otherwise specified unit: mm [inch]

\* General tolerance: ±0.25 [±0.010]

\* Pin thickness: ±0.10 [±0.004]

\* Footprint grid 2.54 x 2.54 mm