

MAX. Power 10.0W Isolated DC-DC Converter

D10 Series Encapsulated PCB Type DC-DC Converter



Features

- Encapsulated Compact Size
- High Efficiency
- Isolated Input – Output
- 300kHz fixed frequency and Current mode Control
- Low output Ripple & Noise
- Built-in over current protection circuit
- Wide 2 : 1 input range
- Safety : Meets UL/CE Standard (Approvals pending)
- RoHS compatible design

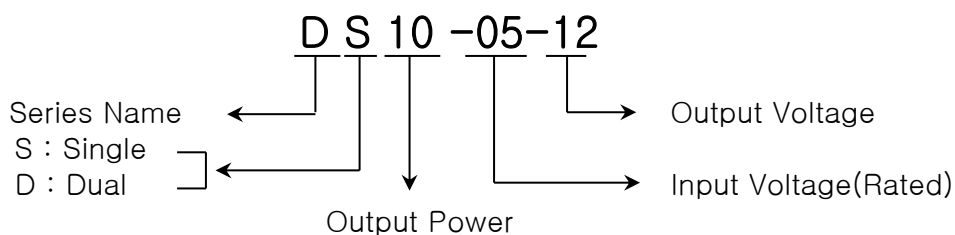
Applications

- Data and telecommunication
- FA control
- Datacommunication electronic equipments

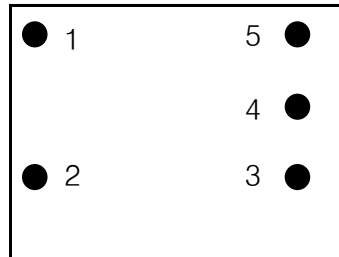
Environment

- Operating Temperature : -20°C ~ 71°C
- Operating Humidity : 20% ~ 90% RH (Non condensing)
- Storage Temperature : -40°C ~ 105°C
- Cooling : Free-Air Convection
- MTBF : 6.0 x 10⁵ hrs

Model Name Structure



Pin assignments & Function



<Top View>

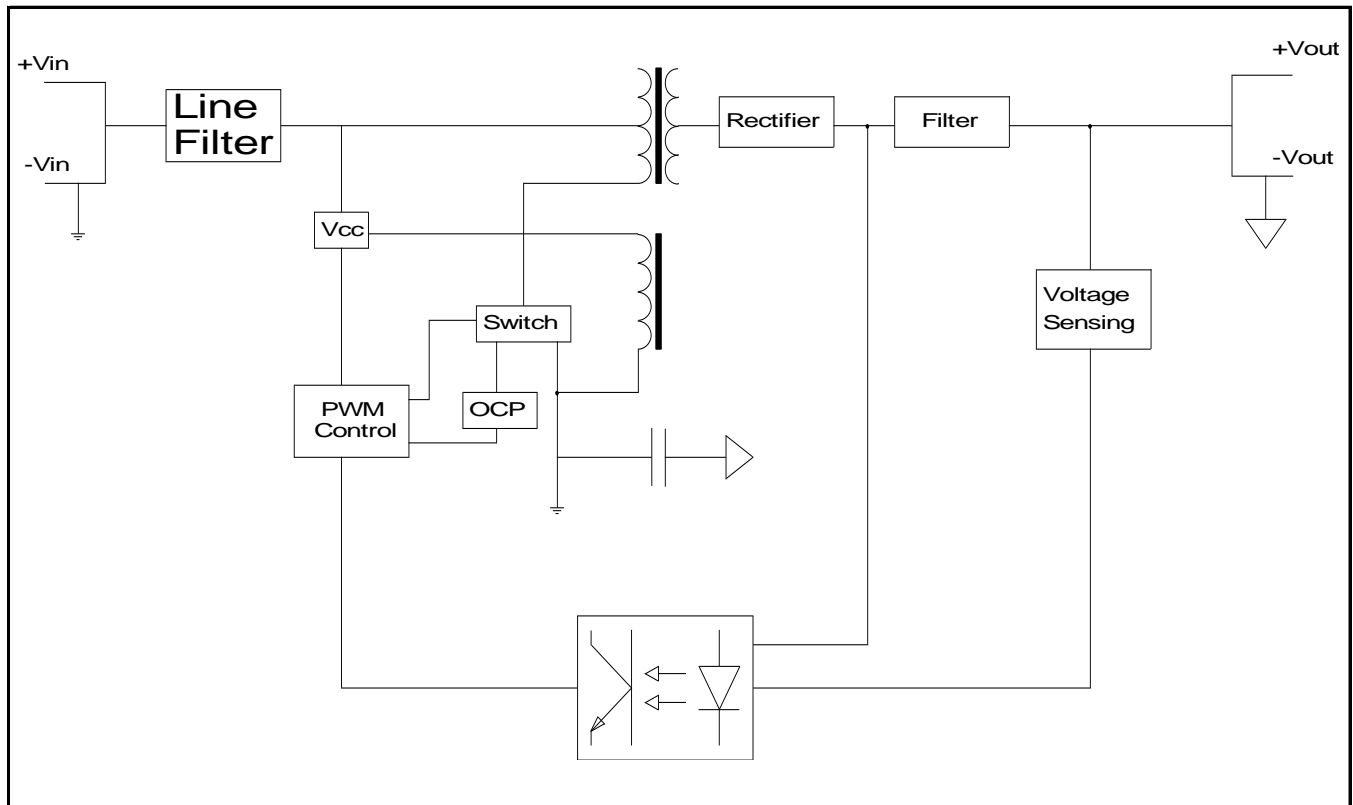
- Single Output Name & Function

| PIN No. | NAME | FUNCTION |
|---------|--------|----------------------------|
| 1 | +Vin | Positive terminal for Vin |
| 2 | -Vin | Negative terminal for Vin |
| 3 | -Vout | Negative terminal for Vout |
| 4 | No Pin | |
| 5 | +Vout | Positive terminal for Vout |

- Dual Output Name & Function

| PIN No. | NAME | FUNCTION |
|---------|-------|----------------------------|
| 1 | +Vin | Positive terminal for Vin |
| 2 | -Vin | Negative terminal for Vin |
| 3 | -Vout | Negative terminal for Vout |
| 4 | Com | The common ground of Vout |
| 5 | +Vout | Positive terminal for Vout |

Internal Circuit Architecture



Maximum Ratings

| Characteristics | | Symbol | Min. | Typ. | Max. | Unit |
|-------------------------------|------------------|--------|------|------|------|------|
| Input Voltage Continuis | DS10 - 05 - XX | Vin | 4.5 | - | 7.2 | VDC |
| | DS10 - 12 - XX | | 8.0 | - | 16.5 | |
| | DS10 - 24 - XX | | 18.0 | - | 32.0 | |
| | DS10 - 48 - XX | | 32.0 | - | 63.0 | |
| Input Voltage Continuis | DD10 - 05 - XXXX | | 4.5 | - | 7.2 | VDC |
| | DD10 - 12 - XXXX | | 8.0 | - | 16.5 | |
| | DD10 - 24 - XXXX | | 18.0 | - | 32.0 | |
| | DD10 - 48 - XXXX | | 32.0 | - | 63.0 | |
| Operating Ambient Temperature | | Ta | -20 | - | 71 | °C |
| Storage Temperature | | Tstg | -40 | - | 105 | °C |
| Withstand Voltage | | | - | - | 500 | Vac |

Electrical Characteristics

- Input Section

Ta : 25°C, Vin : Typical Input Voltage

| Characteristics | | Symbol | Min. | Typ. | Max. | Unit |
|---|-----------------|--------|------|-------|------|------|
| Operating Voltage Range | D()10 - 05 - XX | Vin | 4.5 | 5.0 | 7.2 | VDC |
| | D()10 - 12 - XX | | 8.0 | 12.0 | 16.5 | |
| | D()10 - 24 - XX | | 18.0 | 24.0 | 32.0 | |
| | D()10 - 48 - XX | | 32.0 | 48.0 | 63.0 | |
| Maximum Input Current (Vin : rated, Io : 100%) | D()10 - 05 - XX | Iin | | 2.667 | | A |
| | D()10 - 12 - XX | | | 1.300 | | |
| | D()10 - 24 - XX | | | 0.635 | | |
| | D()10 - 48 - XX | | | 0.321 | | |
| Maximum No Load Input Current (Vin : rated) | D()10 - 05 - XX | | | | | mA |
| | D()10 - 12 - XX | | | | | |
| | D()10 - 24 - XX | | | | | |
| | D()10 - 48 - XX | | | | | |

- Output Section

Ta : 25°C, Vin : Minimum, Typical, Maximum Input Voltage

| Characteristics | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|--------|------|------|------------|------------------------|
| Output Voltage Accuracy | Single | Vo | - | - | ±2 | % |
| | Dual | | - | - | ±3 | |
| Regulation | Line Regulation (From min. Vin to max. Vin, constant load) | | - | - | ±0.5 | % |
| | Load Regulation (From no load to maximum load) | | - | - | ±1 ±2.5 | %(@Single) %(@Dual) |
| Output Ripple and Noise (Vin : Rated, Io : Max., BW : 20MHz) | | mVp-p | - | - | 1% of Vout | mV (peak to peak) |

| Characteristics | | Symbol | Min. | Typ. | Max. | Unit |
|--|--------------------------|--------------------|------|------|---------------------------|-------------------------|
| Output Current | DS10 - XX - 3R3 (05) | I _o | - | - | 2.3 (1.8) | A |
| | DS10 - XX - 05 (05) | | - | - | 2.0 (1.6) | |
| | DS10 - XX - 09 (05) | | - | - | 1.2 (0.8) | |
| | DS10 - XX - 12 (05) | | - | - | 0.9 (0.7) | |
| | DS10 - XX - 15 (05) | | - | - | 0.7 (0.6) | |
| | DS10 - XX - 24 (05) | | - | - | 0.45 (0.33) | |
| | DD10 - XX - 0505 (05) | I _o | - | - | 1.0 (0.8) | |
| | DD10 - XX - 1212 (05) | | - | - | 0.45 (0.35) | |
| | DD10 - XX - 1515 (05) | | - | - | 0.35 (0.3) | |
| | | | | | | |
| Output Current Limit (OCP : Over Current Protection, recovers automatically) | | | 105 | - | - | % |
| Dynamic Load Response (V _{in} : rated, I _o : from 50% to 100%, from 100% to 50%, BW : 20MHz, Freq. : 100Hz, Duty : 0.5, Tr/Tf : 100us use the external capacitor(1uF) between +V _o and -V _o) | | | - | - | 3% of V _{out} | mV (peak to peak) |
| Start - Up Time | | T _{start} | | | | ms |
| Turn - on Overshoot | | | - | - | 5 | % |
| Efficiency (V _{in} : Rated, I _o : Max.) | DS10 - 05 - 3R3 | | - | 77 | - | % |
| | DS10 - 05 - 05 | | - | 79 | - | |
| | DS10 - 05 - 09 | | - | 79 | - | |
| | DS10 - 05 - 12 | | - | 81 | - | |
| | DS10 - 05 - 15 | | - | 81 | - | |
| | DS10 - 05 - 24 | | - | 80 | - | |
| | DD10 - 05 - 0505 | | - | 79 | - | |
| | DD10 - 05 - 1212 | | - | 81 | - | |
| | DD10 - 05 - 1515 | | - | 81 | - | |

| Characteristics | | Symbol | Min. | Typ. | Max. | Unit |
|---|------------------|--------|------|------|------|------|
| Efficiency (Vin : Rated, Io : Max.) | DS10 - 12 - 3R3 | | - | 80 | - | % |
| | DS10 - 12 - 05 | | - | 82 | - | |
| | DS10 - 12 - 09 | | - | 83 | - | |
| | DS10 - 12 - 12 | | - | 83 | - | |
| | DS10 - 12 - 15 | | - | 83 | - | |
| | DS10 - 12 - 24 | | - | 83 | - | |
| | DD10 - 12 - 0505 | | - | 82 | - | |
| | DD10 - 12 - 1212 | | - | 83 | - | |
| | DD10 - 12 - 1515 | | - | 83 | - | |
| | DS10 - 24 - 3R3 | | - | 80 | - | |
| | DS10 - 24 - 05 | | - | 82 | - | |
| | DS10 - 24 - 09 | | - | 85 | - | |
| | DS10 - 24 - 12 | | - | 85 | - | |
| | DS10 - 24 - 15 | | - | 85 | - | |
| | DS10 - 24 - 24 | | - | 85 | - | |
| | DD10 - 24 - 0505 | | - | 84 | - | |
| | DD10 - 24 - 1212 | | - | 85 | - | |
| | DD10 - 24 - 1515 | | - | 85 | - | |
| | DS10 - 48 - 3R3 | | - | 80 | - | |
| | DS10 - 48 - 05 | | - | 82 | - | |
| | DS10 - 48 - 09 | | - | 84 | - | |
| | DS10 - 48 - 12 | | - | 84 | - | |
| | DS10 - 48 - 15 | | - | 84 | - | |
| | DS10 - 48 - 24 | | - | 84 | - | |
| | DD10 - 48 - 0505 | | - | 82 | - | |
| | DD10 - 48 - 1212 | | - | 84 | - | |
| | DD10 - 48 - 1515 | | - | 84 | - | |

Isolation Characteristics

| Characteristics | | Symbol | Min. | Typ. | Max. | Unit |
|--|----------------|--------|------|------|------|------|
| Withstand Voltage (AC500V, 1minute) | Input – Output | | – | – | 500 | Vac |
| | Input – Case | | – | – | 500 | Vac |
| | Output – Case | | – | – | 500 | Vac |
| Isolation Resistance (DC500V at 25°C and 70%RH) | Output – Case | Riso | 100 | – | – | MΩ |

General Characteristics

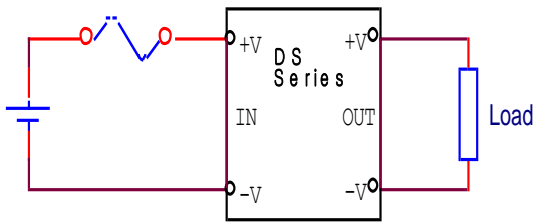
| Characteristics | Symbol | Min. | Typ. | Max. | Unit |
|---|--------|------|-----------------------|------|-------|
| Remote on / off control (CNT Pin, Negative Logic Module on : Logic Low or Short to –Vin Module off : Logic High or open) | CNT | | | | |
| External Trim Adj. Range (TRM Pin, Vout variation by external parts) | TRM | | | | |
| Switching Frequency | | | 300 | | kHz |
| MTBF (MIL-HDBK-217F) | | | 6.0 x 10 ⁵ | | hrs |
| Dimension (W x H x L) | | | 47.0 x 9.0 x 42.0 | | mm |
| Weight | | – | – | 30 | grams |

Environment

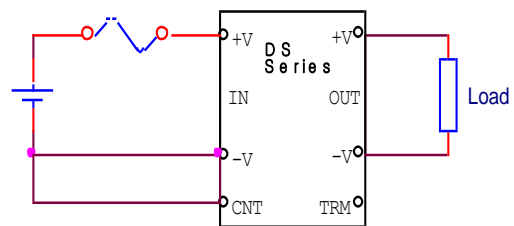
| Characteristics | Symbol | Min. | Typ. | Max. | Unit |
|--|--------|------|------|------|------|
| Operating Temperature Range | Ta | –20 | – | 71 | °C |
| Operating Humidity (non Condensing) | | 20 | – | 90 | %RH |
| Storage Temperature | Tstg | –40 | – | 105 | °C |

Application Sheet

Basic Connection



D Series(D1R5, D3, D6, D10)



D Series(D15, D25, D30)

Input Section

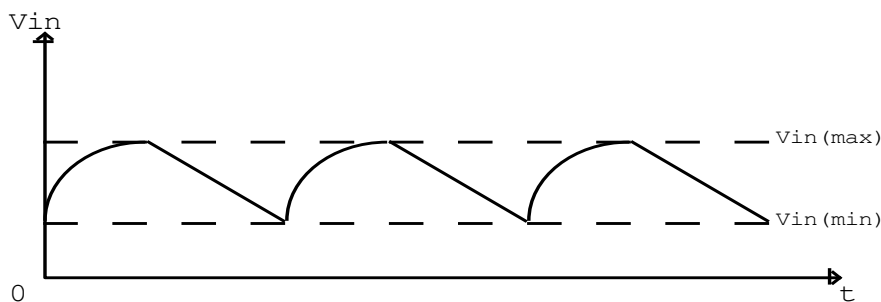
- Input fuse

Generally, encapsulated power supplies do not have internal fuse. To ensure safe operation, an external fuse(Regular or Slow Blow Type) is recommended.

| | 5Vdc | 12Vdc | 24Vdc | 48Vdc |
|------|------|-------|-------|-------|
| D1R5 | 2A | 1A | 0.5A | 0.5A |
| D3 | 3A | 2A | 1A | 1A |
| D6 | 4A | 3A | 2A | 1A |
| D10 | 6A | 3A | 2A | 1A |
| D15 | 7A | 5A | 3A | 1.5A |
| D25 | 12A | 7A | 4A | 2A |
| D30 | | | 5A | 2.5A |

- Unstable Input

Input voltage is comprised of both the DC voltage(average rectified voltage)and the peak to peak ripple voltage. Peak to peak ripple voltage should be minimized so that the input voltage is within the standard input voltage range as follows.



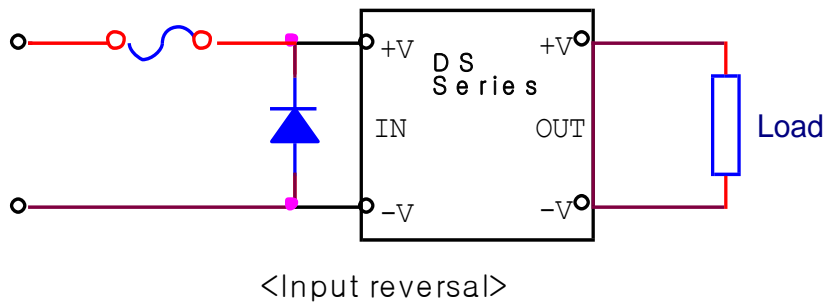
< Unstable Input >

- Battery Input

When using a battery as the input power supply, make sure that the maximum and minimum input voltage do not away out of the standard input voltage range.

- Input Reverse-polarity voltage protection

Accidently reversing the input connections could damage the module. Thus. If the connections may be accidentally reversed. Use a protective diode and an input fuse as shown below.



- Remote On/Off Control(CNT) (D15, D25, D30 Series)

Without switching the input on/off, the output can be enabled and disabled using this function. This function is useful for sequence control when building multiple output power supplies. This control circuit is on the input side using the CNT pin. Ground of CNT pin is the input -V terminal. When not using this function, short CNT to input -V terminal.

| CNT level for -Vin | | OUTPUT |
|--------------------|---------------|--------|
| Low level | Short to -Vin | ON |
| High level | Open | OFF |

< Negative Logic on/off Control >

Output Section

- Output Ripple and Noise Measurement Method

The measurement for output ripple and noise are based on normal probe with 20MHz bandwidth scope. Upon measurement of the ripple voltage, make sure that the scope probe leads are not too long. If a precise measurement can be made, the noise occurs from circumference must be reduced.

- Line Regulation

The line regulation means to the change in output voltage when the input voltage is varied within the input voltage range, at constant load and constant ambient temperature. The measurement point for the input and output voltage are $\pm V_{in}$ pins, $\pm V_{out}$ pins respectively.

- Load Regulation

The load regulation means to the change in output voltage when the load is changed from minimum load to maximum load, at constant input voltage and constant ambient temperature. The measurement point for the input and output voltage are $\pm V_{in}$ pins, $\pm V_{out}$ pins respectively.

- Output Voltage adjustment (TRM) (D15, D25, D30 Series)

The output voltage can be varied within $\pm 10\%$ of the standard output voltage when use the external parts-resistors and variable resistor.

External Resistors :

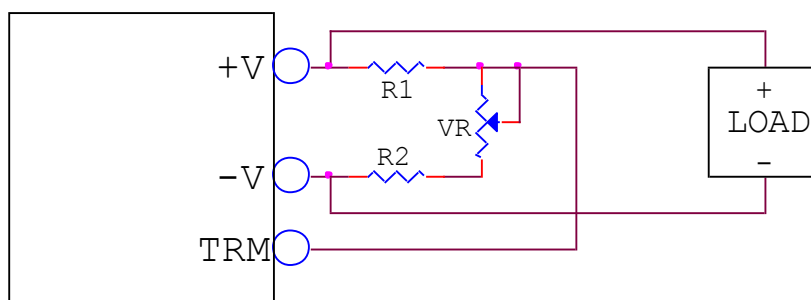
Resistance tolerance $\pm 5\%$

Variable Resistor(VR) :

Total resistance toloatace $\pm 20\%$

Remaining Resistance : Value less than 1%

| Vo | R1 | R2 | VR |
|---------------|---------------|--------------|--------------|
| 3.3V | 150 Ω | 680 Ω | 1 k Ω |
| 5V | 1 k Ω | 680 Ω | 1 k Ω |
| 9V | 3k Ω | 680 Ω | 1 k Ω |
| 12V | 3.9k Ω | 680 Ω | 1 k Ω |
| 15V | 5.6k Ω | 750 Ω | 1 k Ω |
| $\pm 5(10V)$ | 3.3k Ω | 680 Ω | 1 k Ω |
| $\pm 12(24V)$ | 12k Ω | 1 k Ω | 1 k Ω |
| $\pm 15(30V)$ | 15k Ω | 1 k Ω | 1 k Ω |



< Trim Method >

- Over Current Protection

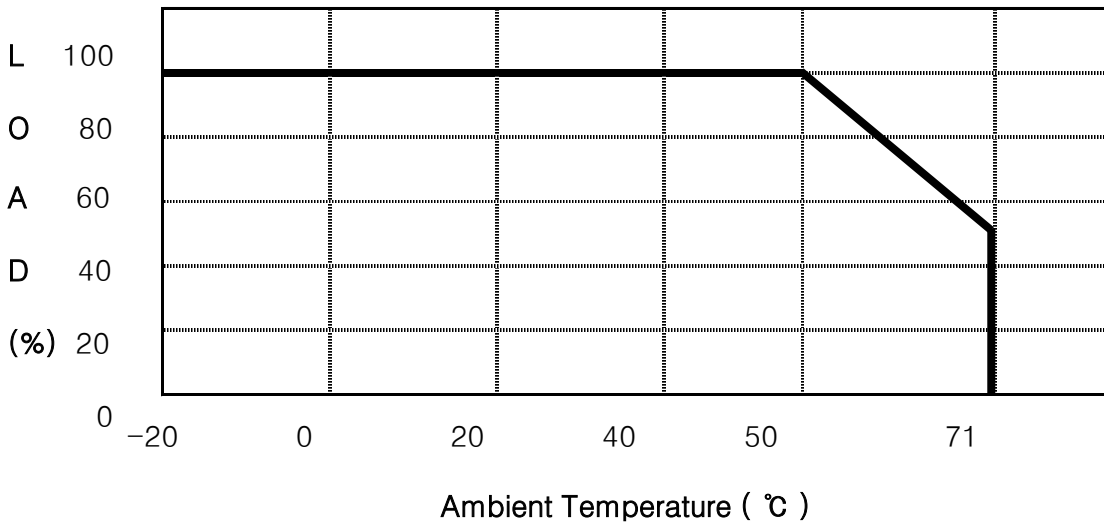
The SDS series is built into an OCP(Over Current Protection) circuit. When the OCP triggers, the output voltage will be fall. If overload condition is removed, the output will automatically recover.

Environment

- Temperature

Operation Temperature

The range of ambient temperature in °C over which a module can be operated safely at either rated or derated output power. Refer to derating curve as shown below.



※ Operating Temperature Range : From -20°C to 71°C

< Derating Curve >

Storage Temperature

The range of ambient temperature in °C over which a module may be stored long term without damage. The storage temperature range is from -40°C to 105°C.

- Humidity

Operation Humidity

The range of ambient humidity in % over which a module can be operated safely at either rated or derated output power. Refer to derating curve as shown below. The operating humidity range is from 20% to 90%RH.

Storage Humidity

The range of ambient humidity in % over which a module may be stored long term without damage. The storage humidity range is from 10% to 95%RH.

Outline Dimensions : All dimensions are in inches and (mm)

