

MAX. Power 10W Isolated On-Board Type AC-DC Converter

HS10 Series Isolated On-Board Type AC-DC Converter



Features

- Power Saving Mode Operation
- High Efficiency
- Isolated Input - Output
- 100kHz fixed frequency and Current mode Control
- Low output Ripple & Noise
- Built-in over current protection circuit
- Short Circuit Protection

- Universal Input Voltage(Free Voltage)
- Safety standard : NRTL, CE approved
- RoHS compatible design

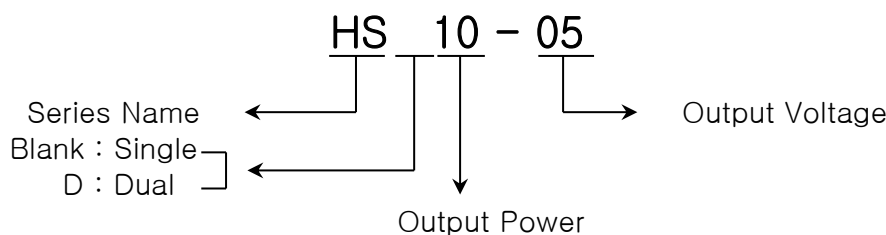
Applications

- Data and telecommunication
- FA control
- Datacommunication electronic equipments

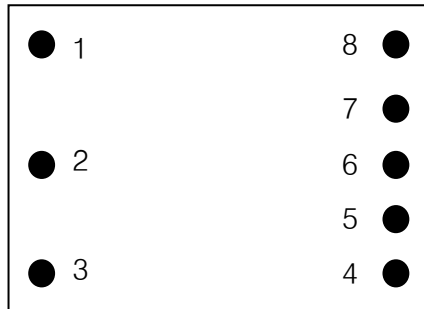
Environment

- Operating Temperature : -10°C ~ 70°C
- Operating Humidity : 20% ~ 90% RH (Non condensing)
- Storage Temperature : -20°C ~ 75°C
- Cooling : Free-Air Convection
- MTBF : 2.0 x 10⁵ hrs

Model Name Structure



Pin assignments & Function



<Top View>

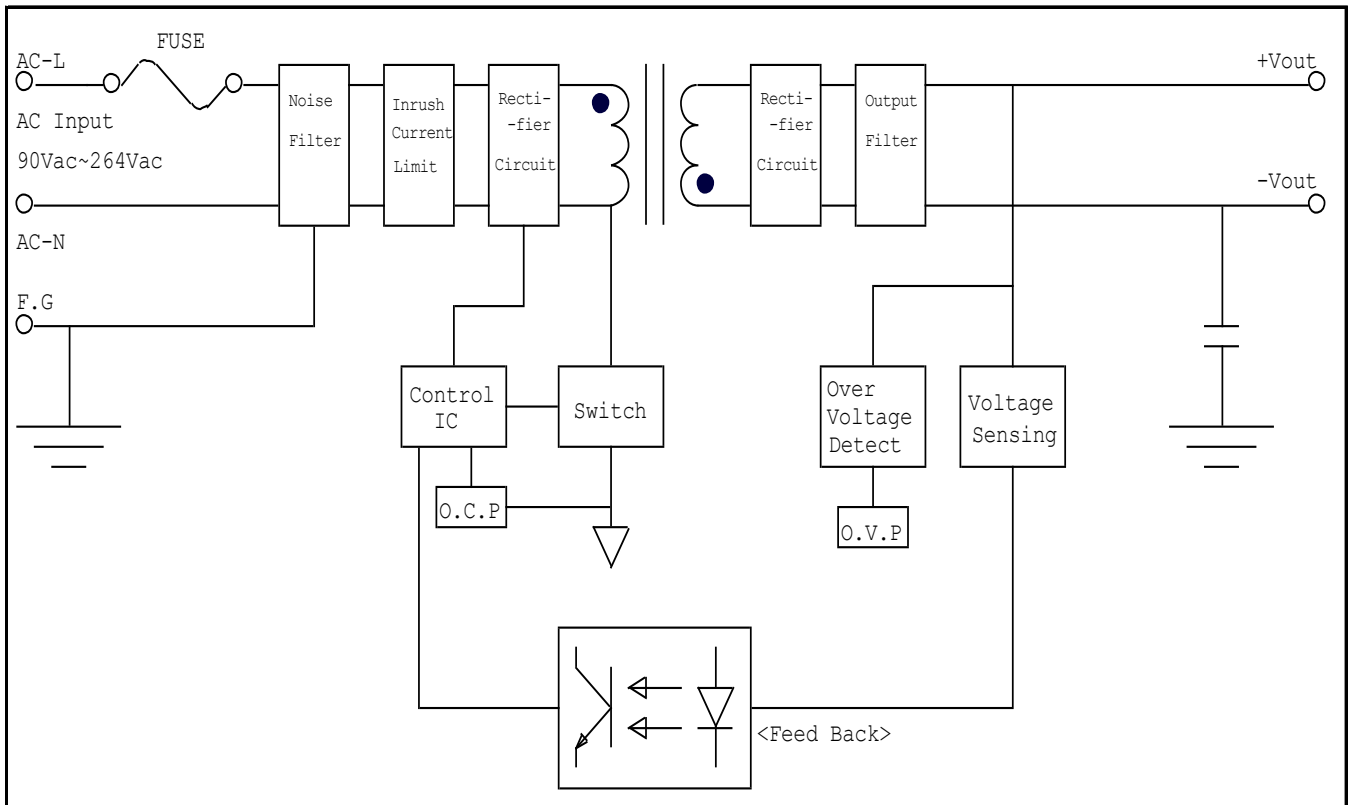
- Single Output Name & Function

| PIN No. | NAME | FUNCTION |
|---------|--------|----------------------------|
| 1 | FRG | Frame Ground |
| 2 | N | AC input N |
| 3 | L | AC input L |
| 4 | No Pin | |
| 5 | +Vout | Positive terminal for Vout |
| 6 | No Pin | |
| 7 | -Vout | Negative terminal for Vout |
| 8 | No Pin | |

- Dual Output Name & Function

| PIN No. | NAME | FUNCTION |
|---------|--------|----------------------------|
| 1 | FRG | Frame Ground |
| 2 | N | AC input N |
| 3 | L | AC input L |
| 4 | No Pin | |
| 5 | +Vout | Positive terminal for Vout |
| 6 | Com | The common ground of Vout |
| 7 | -Vout | Negative terminal for Vout |
| 8 | No Pin | |

Internal Circuit Architecture



Maximum Ratings

| Characteristics | | Symbol | Min. | Typ. | Max. | Unit |
|------------------------------------|--------------|--------|------|------|------|------|
| No-load Power Consumption | HS10 - XX | | | | 0.3 | W |
| Frequency | HS10 - XX | | 44 | - | 440 | Hz |
| Input Voltage Continuous | HS10 - 05 | Vin | 90 | - | 264 | Vac |
| | HS10 - 12 | | 90 | - | 264 | |
| | HS10 - 15 | | 90 | - | 264 | |
| | HS10 - 24 | | 90 | - | 264 | |
| Input Voltage Continuous | HSD10 - 1212 | | 90 | - | 264 | Vac |
| | HSD10 - 1515 | | 90 | - | 264 | |
| Operating Ambient Temperature | | Ta | -10 | - | 70 | °C |
| Storage Temperature | | Tstg | -20 | - | 75 | °C |
| Withstand Voltage (Input - Output) | | | - | - | 3000 | Vac |

Electrical Characteristics

- Input Section

Ta : 25°C, Vin : Typical Input Voltage

| Characteristics | | Symbol | Min. | Typ. | Max. | Unit |
|--|-----------|--------|------|----------|------|------|
| No-load Power Consumption | HS10 - XX | | | | 0.3 | W |
| Operating Voltage Range | HS10 - XX | Vin | 90 | 110, 220 | 264 | Vac |
| Frequency | HS10 - XX | | 44 | 50, 60 | 440 | Hz |
| Maximum Input Current (Vin : rated, Io : 100%) | HS10 - XX | Iin | | 0.21 | | A |
| Maximum No Load Input Current (Vin : rated) | HS10 - XX | | | | | mA |
| Inrush Current (In : 220Vac) | HS10 - XX | | | | 60 | A |
| Leakage Current (In : 220Vac) | HS10 - XX | | | | 0.35 | mA |

- 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) | | - | - | ±1 | % |
| | 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 | HS10 - 05 | I _o | - | - | 2 | A |
| | HS10 - 12 | | - | - | 0.9 | |
| | HS10 - 15 | | - | - | 0.7 | |
| | HS10 - 24 | | - | - | 0.45 | |
| | HSD10 - 1212 | I _o | - | - | 0.45 | |
| | HSD10 - 1515 | | - | - | 0.35 | |
| Output Current Limit (OCP : Over Current Protection, recovers automatically) | | | 105 | - | - | % |
| Dynamic Load Response (V _{in} : rated, I _o : from 10% to 100%, from 100% to 10%, BW : 20MHz, Freq. : 100Hz, Duty : 0.5, Tr/Tf : 100us) | | | - | - | 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.) | HS10 - 05 | | - | 78 | - | % |
| | HS10 - 12 | | - | 82 | - | |
| | HS10 - 15 | | - | 82 | - | |
| | HS10 - 24 | | - | 82 | - | |
| | HSD10 - 1212 | | - | 80 | - | |
| | HSD10 - 1515 | | - | 81 | - | |

Isolation Characteristics

| Characteristics | | Symbol | Min. | Typ. | Max. | Unit |
|--|----------------|------------------|------|------|------|------|
| Withstand Voltage | Input - Output | | - | - | 3000 | Vac |
| | Input - FRG | | - | - | 2000 | Vac |
| | Output - FRG | | - | - | 500 | Vac |
| Isolation Resistance (DC500V at 25°C and 70%RH) | Output - FRG | R _{iso} | 70 | - | - | MΩ |

General Characteristics

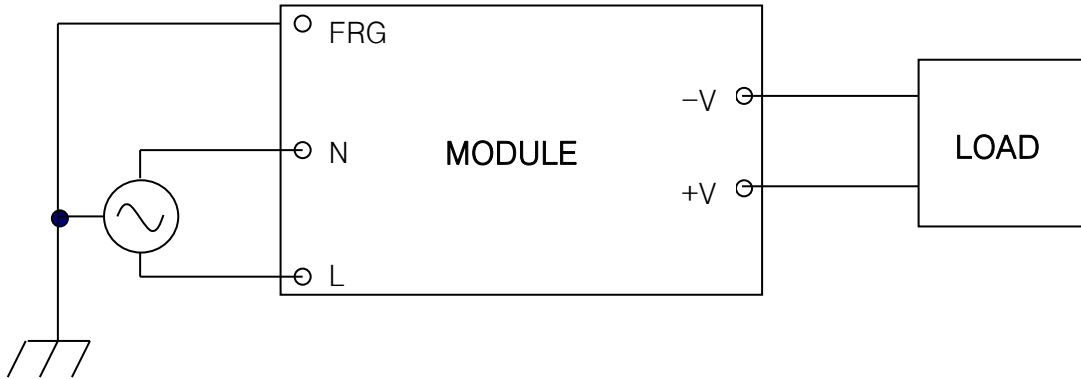
| Characteristics | Symbol | Min. | Typ. | Max. | Unit |
|---|--------|-----------------------|------|------|-------|
| Remote on / off control (CNT Pin, Negative Logic Module on : Logic Low or Short to -Vin Module off : Logic High or open) | CNT | | | | |
| External Trim Adj. Range (TRM Pin, Vout variation by external parts) | TRM | | | | |
| Switching Frequency | | | 100 | | kHz |
| MTBF (MIL-HDBK-217F) | | 2.0 x 10 ⁶ | | | hrs |
| Dimension (W x H x L) | | 58.0 x 45.0 x 19.5 | | | mm |
| Weight | | - | - | 90 | grams |

Environment

| Characteristics | Symbol | Min. | Typ. | Max. | Unit |
|--|--------|------|------|------|------|
| Operating Temperature Range | Ta | -10 | - | 70 | °C |
| Operating Humidity (non Condensing) | | 20 | - | 90 | %RH |
| Storage Temperature | Tstg | -20 | - | 75 | °C |

Application Sheet

Basic Connection



AC INPUT : 90Vac ~ 264Vac (Free Voltage)

- ※ For safety and improved noise, ensure secure connection of the FRG Pin to the ground terminal of the equipment.
- ※ To avoid excessive voltage drop and improved noise, short and thick wire should be used to connect the load.

Input Section

Input Fuse

Generally, ac-dc converter(HS Series) has internal fuse. Refer to Fuse Rating table. Avoid using fast-blow fuse.

< Fuse Rating table > Type : SS5, Time-Lag

| | HS10 | HS15 |
|------|------|------|
| Fuse | 1.6A | 1.6A |

UL/CSA or IEC approved type should be used to meet safety requirements.

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.

Regulation

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 output voltage are $\pm V_{out}$ 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 output voltage are $\pm V_{out}$ pins respectively.

Protection

Over Current Protection

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

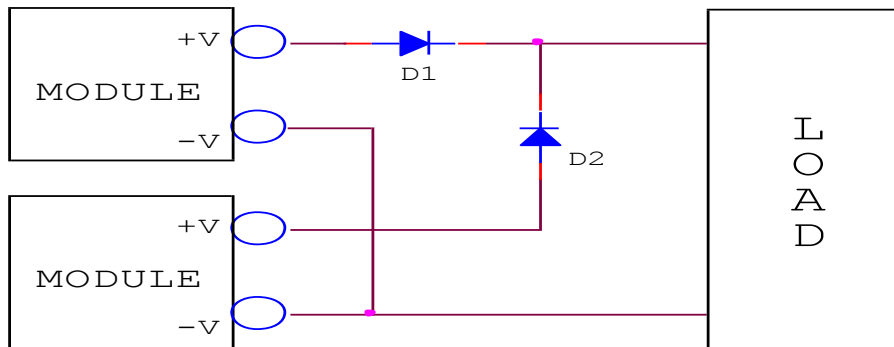
Short Circuit Protection

The HS series is built into an short circuit protection circuit. It is similar to OCP circuit. When output is short condition, the output voltage will fall. If short condition is removed, the output will automatically recover. However, if the short condition continues damage to the module could occur.

Operation Method

Parallel Operation

The module can be operated parallel connection. Refer to diagram as shown below.



Please, you must consider both reverse voltage and forward current of diode, when you choose a diode.

Maximum reverse voltage(V_{rm}) : $V_{rm} > 1.5 \times V_o$

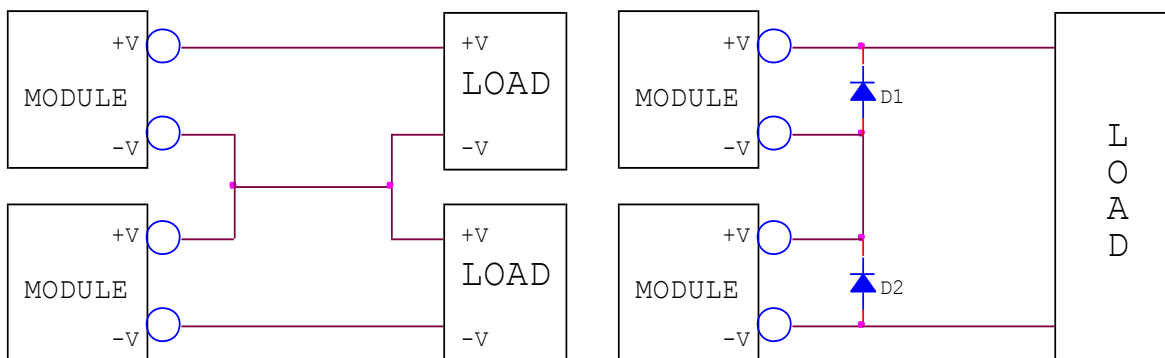
Forward current(I_f) : $I_f > 3 \times I_o$

Also, design a heatsink according to power loss at diode. If you want to reduce power loss, use a schottky barrier diode.

Power loss = $V_f(\text{forward voltage}) \times I_o(\text{output current})$

Series Operation

Series operation is available by connecting the outputs of two or more module as shown below.



< A. General Series Operation >

< B. Complemental Series Operation >

Please, you must consider both reverse voltage and forward current of diode, when you choose a diode.

Maximum reverse voltage(V_{rm}) : $V_{rm} > 1.5 \times V_o$

Forward current(I_f) : $I_f > 3 \times I_o$

Also, design a heatsink according to power loss at diode. If you want to reduce power loss, use a schottky barrier diode.

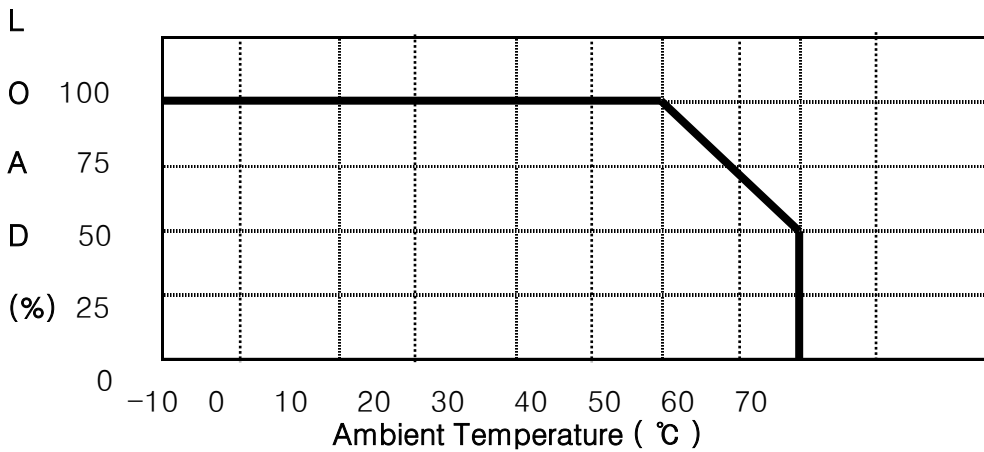
Power loss = $V_f(\text{forward voltage}) \times I_o(\text{output current})$

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 -10°C to 70°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 -20°C to 75°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

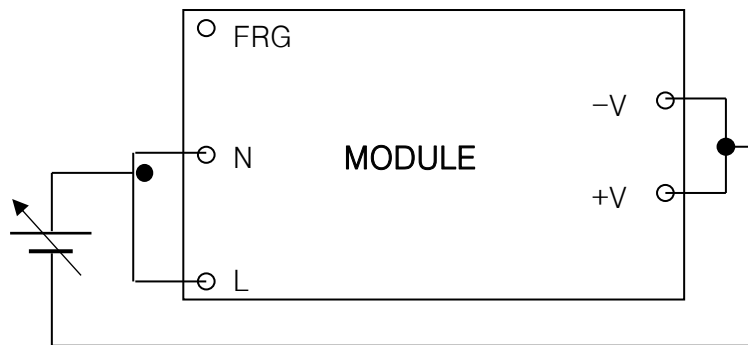
The range of ambient humidity in % over which a module may be stored long term without damage. The storage humidity range is from 20% to 90%RH.

Isolation

Isolation Resistance

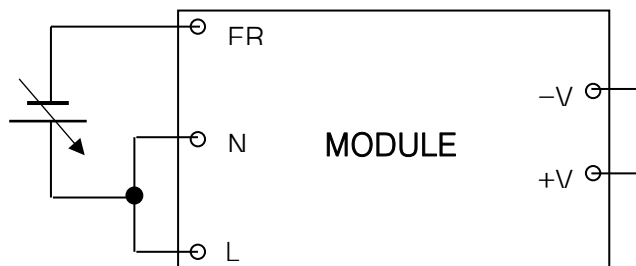
The electrical separation between input and output of a module by means of the power transformer. The isolation resistance is a function of materials and spacings employed throughout the module. Please don't test with a voltage above standard voltage for the Isolation Resistance Test.

< INPUT - OUTPUT >



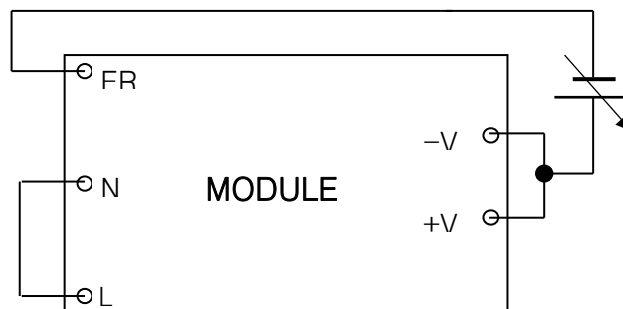
500VDC, 100MΩ

< INPUT - FRG >



500VDC, 100MΩ

< OUTPUT - FRG >

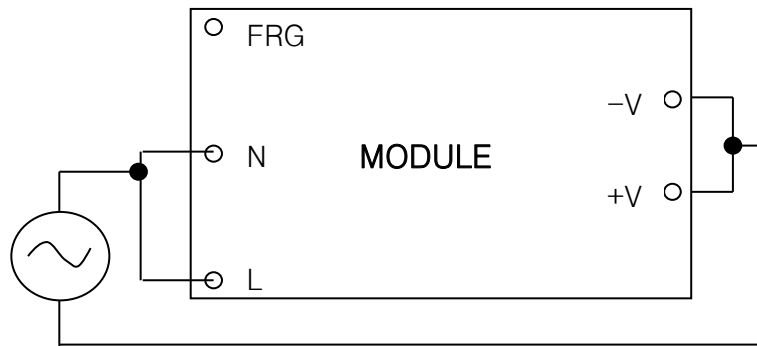


500VDC, 70MΩ

Withstand Voltage

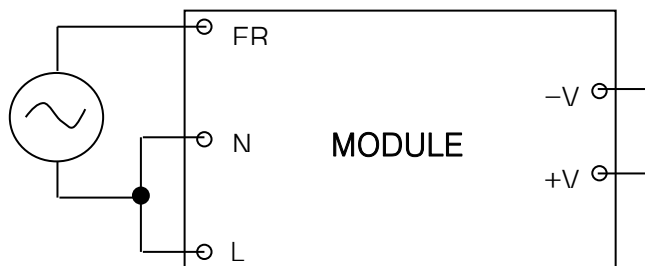
For the withstand voltage test, the applied voltage must be increased gradually from zero to the testing value, and then decreased gradually at shut down. Especially stay away from use of a timer. Where a pulse of several times the applied voltage can be generated.

< INPUT - OUTPUT >



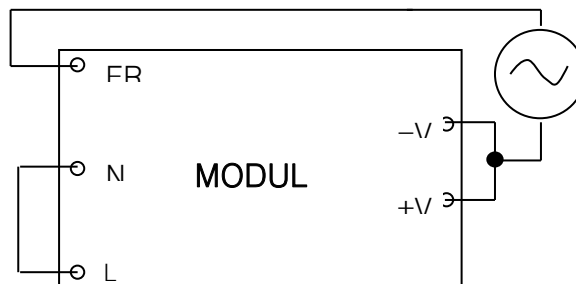
3kVAC (10mA) 1minute

< INPUT - FRG >



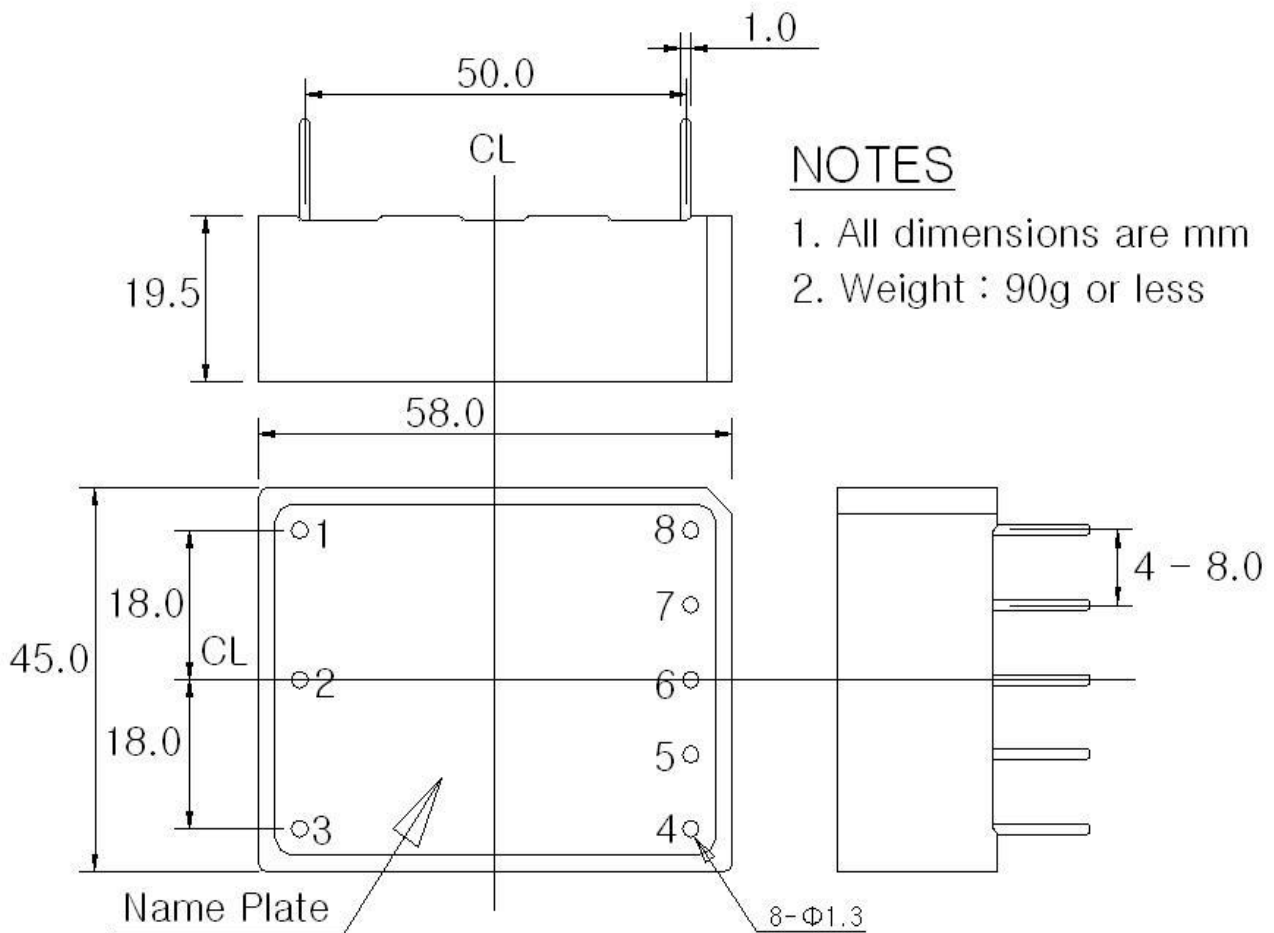
2kVAC (10mA) 1minute

< OUTPUT - FRG >



0.5kVAC (10mA) 1minute

Outline Dimensions



NOTES

1. All dimensions are mm
2. Weight : 90g or less