

MAX. Power 60W Isolated On-Board Type AC-DC Converter

HS60 Series Isolated On-Board Type AC-DC Converter



Features

- Power Saving Mode Operation
- Small, High Efficiency
- Isolated Input - Output
- Quasi-resonant operation and Current mode Control
- Low output Ripple & Noise
- Built-in over current protection circuit
- Built-in over Voltage protection circuit
- Short Circuit Protection
- Universal Input Voltage(Free Voltage)
- Built in EMI Filter
- Safety standard : CB,CE (approvals pending)
- RoHS compatible design

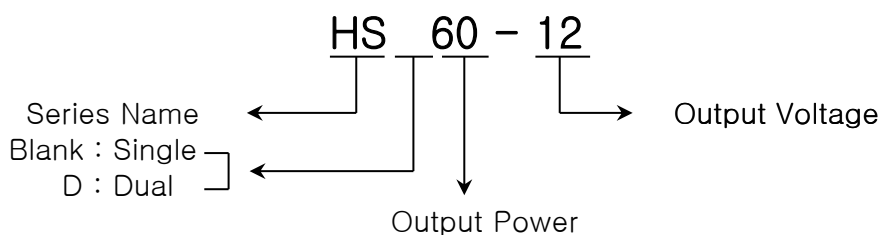
Applications

- Data and telecommunication
- FA control
- Datacommunication electronic equipments

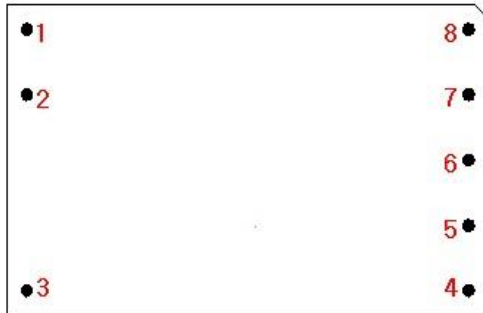
Environment

- Operating Temperature : -10℃ ~ 70℃
- Operating Humidity : 20% ~ 90% RH (Non condensing)
- Storage Temperature : -20℃ ~ 75℃
- Cooling : Free-Air Convection
- MTBF : 3.0 x 10⁵ hrs

Model Name Structure



Pin assignments & Function



<Top View>

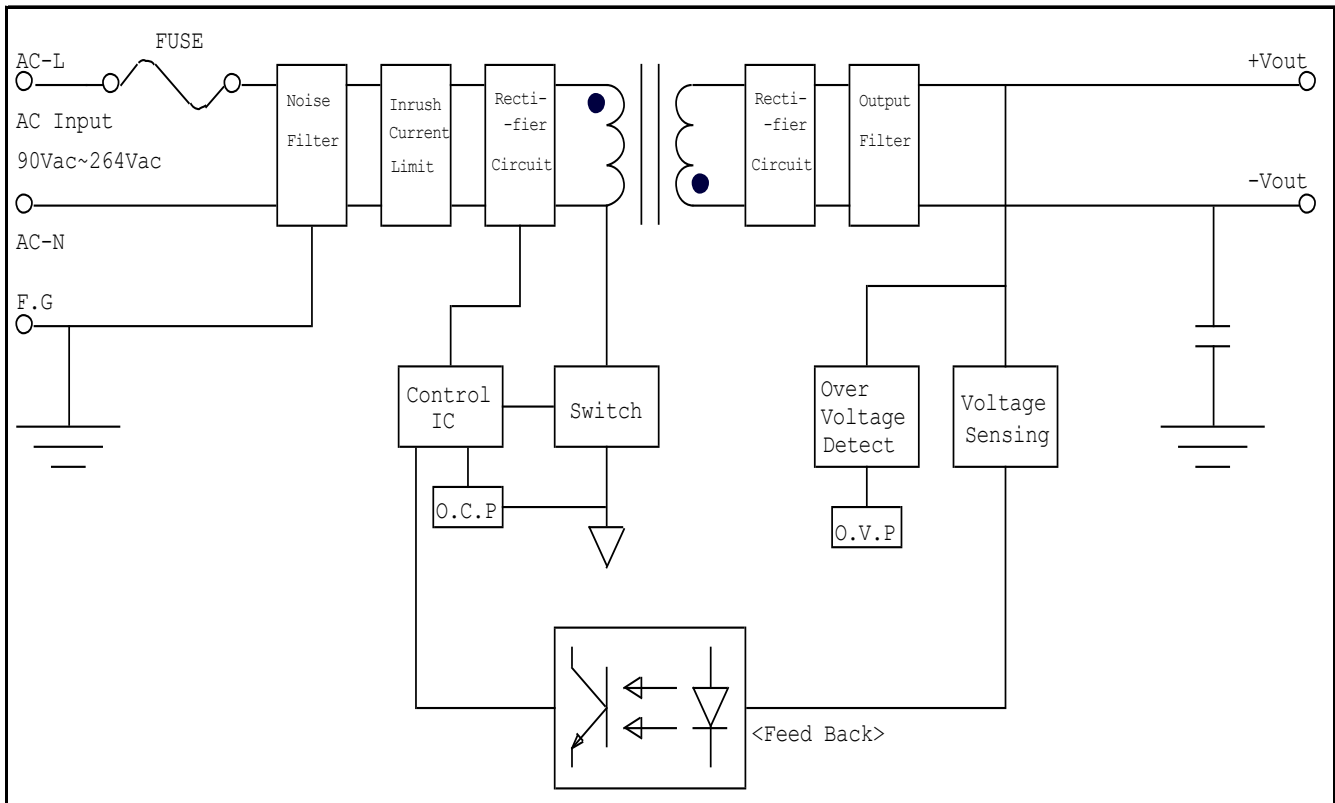
- Single Output Name & Function

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

- Dual Output Name & Function

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

Internal Circuit Architecture



Maximum Ratings

Characteristics		Symbol	Min.	Typ.	Max.	Unit
No-load Power Consumption	HS60 - 05,12,15,24 HS60 - 48				0.3 0.5	W
Frequency	HS60 - XX		44	-	440	Hz
Input Voltage Continuous	HS60 - 05	Vin	90	-	264	Vac
	HS60 - 12		90	-	264	
	HS60 - 15		90	-	264	
	HS60 - 24		90	-	264	
	HS60 - 48		90	-	264	
Input Voltage Continuous	HSD60 - 1212		90	-	264	Vac
	HSD60 - 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	HS60 - 05,12,15,24 HS60 - 48				0.3 0.5	W
Operating Voltage Range	HS60 - XX	Vin	90	110, 220	264	Vac
Frequency	HS60 - XX		44	50, 60	440	Hz
Maximum Input Current (Vin : rated, Io : 100%)	HS60 - XX	Iin		1.08		A
Maximum No Load Input Current (Vin : rated)	HS60 - XX			30		mA
Inrush Current (In : 220Vac)	HS60 - XX				60	A
Leakage Current (In : 220Vac)	HS60 - 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		mVp-p	-	-	1% of Vout	mV (peak to peak)
(Vin : Rated, Io : Max., BW : 20MHz)						

Characteristics		Symbol	Min.	Typ.	Max.	Unit
Output Current	HS60 - 05	Io	-	-	10	A
	HS60 - 12		-	-	5	
	HS60 - 15		-	-	4	
	HS60 - 24		-	-	2.5	
	HS60 - 48		-	-	1.25	
	HSD60 - 1212	Io	-	-	2.5	
HSD60 - 1515	-		-	2		
Output Current Limit (OCP : Over Current Protection, recovers automatically)			105	-	-	%
Dynamic Load Response (Vin : rated, Io : from 50% to 100%, from 100% to 50%, BW : 20MHz, Freq. : 100Hz, Duty : 0.5, Tr/Tf : 100us)			-	-	3% of Vout	mV (peak to peak)
Start - Up Time		Tstart				ms
Turn - on Overshoot			-	-	5	%
Efficiency (Vin : Rated, Io : Max.)	HS60 - 05		-	84	-	%
	HS60 - 12		-	89	-	
	HS60 - 15		-	90	-	
	HS60 - 24		-	90	-	
	HS60 - 48		-	89	-	
	HSD60 - 1212		-	89	-	
HSD60 - 1515	-	89	-			

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	Riso	70	-	-	MΩ

General Characteristics

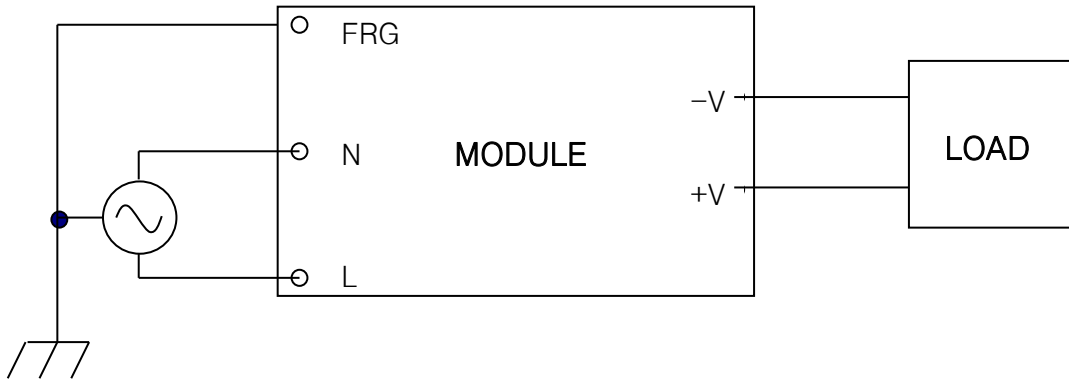
Characteristics	Symbol	Min.	Typ.	Max.	Unit
Remote on / off control (CNT Pin, Negative Logic Module on : Logic Low or Short to -Vin Module off : Logic High or open)	CNT				
External Trim Adj. Range (TRM Pin, Vout variation by external parts)	TRM				
Switching Frequency					kHz
MTBF (MIL-HDBK-217F)		3.0 x 10 ⁵			hrs
Dimension (W x H x L)		95.0 x 52.5 x 26.5			mm
Weight		-	-	220	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

	HS30	HS60
Fuse	2.0A	2.5A

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 HS60 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 HS60 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.

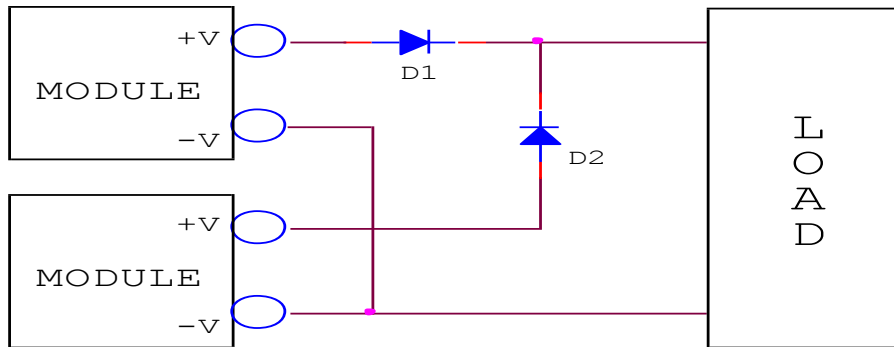
Over Voltage Protection

The HS60 series is built into an OVP(Over Voltage Protection) circuit. When the OVP triggers, the output voltage is clamped 60%~80% of output voltage. The input must be taken out (for at least five seconds), and than reinputted manually. Otherwise, the module will maintain the clamped voltage.

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}) : $V_{rm} > 1.5 \times V_o$

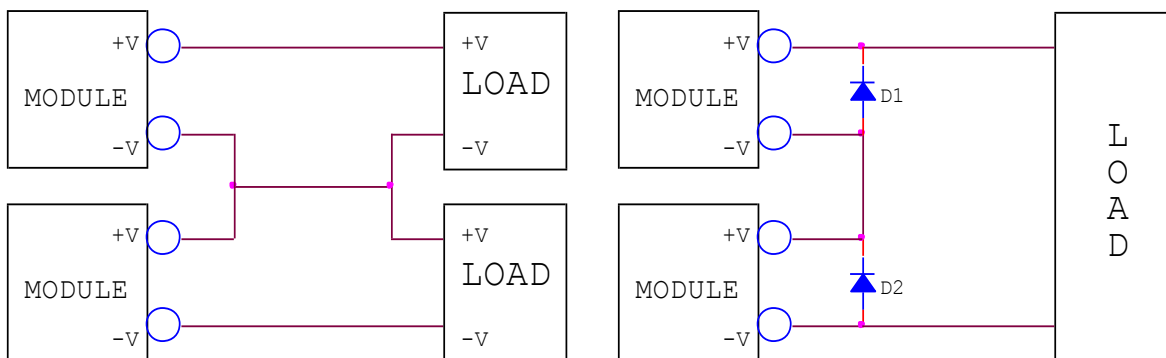
Forward current(I_f) : $I_f > 3 \times I_o$

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.

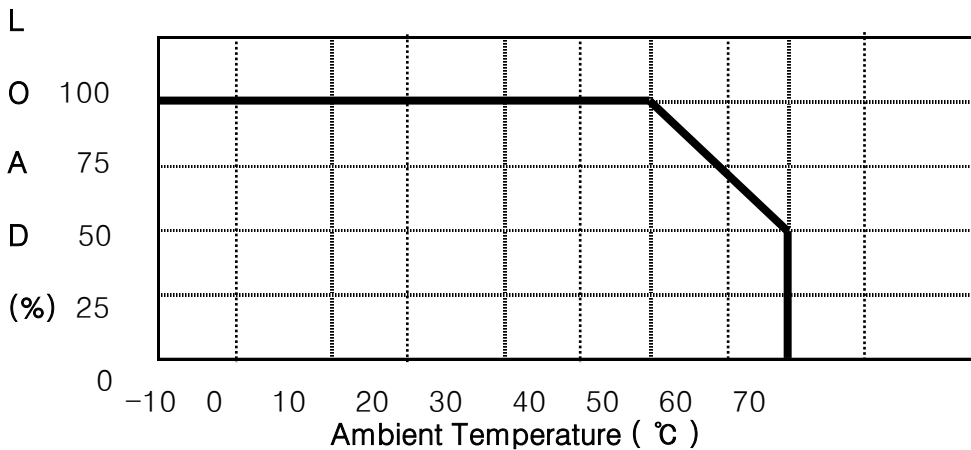
Power loss = $V_f(\text{forward voltage}) \times I_o(\text{output current})$

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

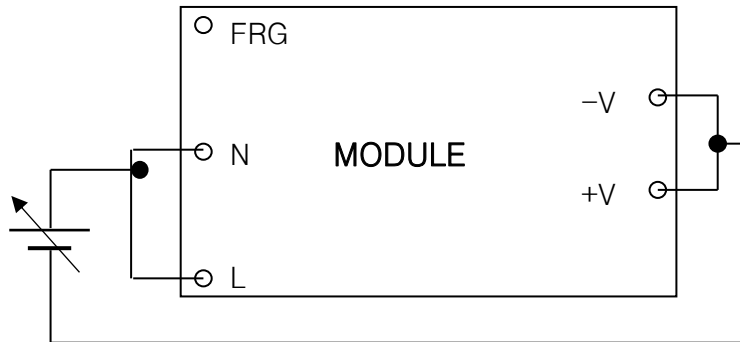
The range of ambient humidity in % over which a module may be stored long term without damage. The storage humidity range is from 20% to 90%RH.

Isolation

Isolation Resistance

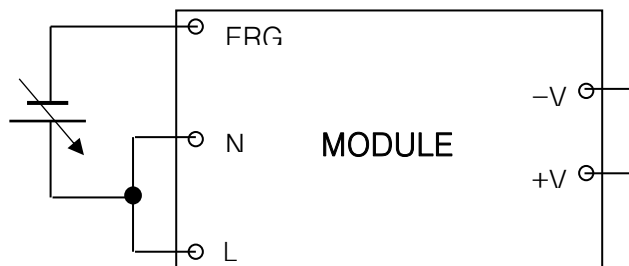
The electrical separation between input and output of a module by means of the power transformer. The isolation resistance is a function of materials and spacings employed throughout the module. Please don't test with a voltage above standard voltage for the Isolation Resistance Test.

< INPUT - OUTPUT >



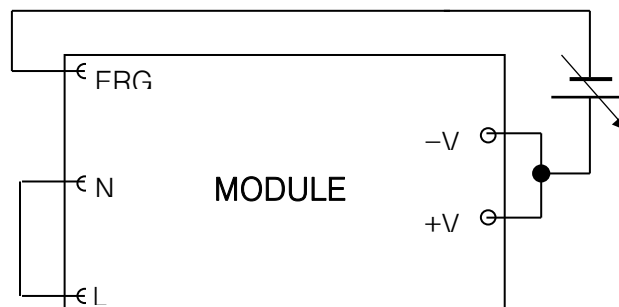
500VDC, 100MΩ

< INPUT - FRG >



500VDC, 100MΩ

< OUTPUT - FRG >

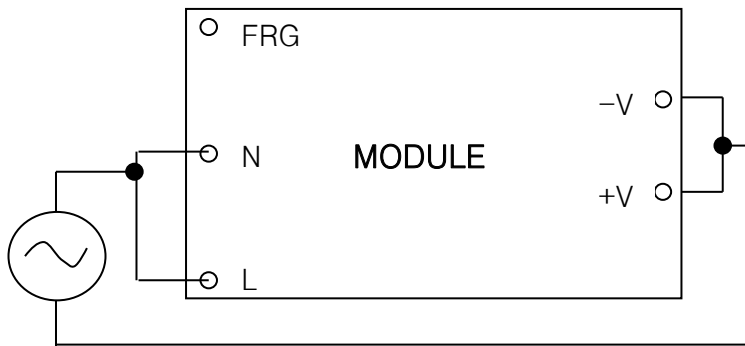


500VDC, 70MΩ

Withstand Voltage

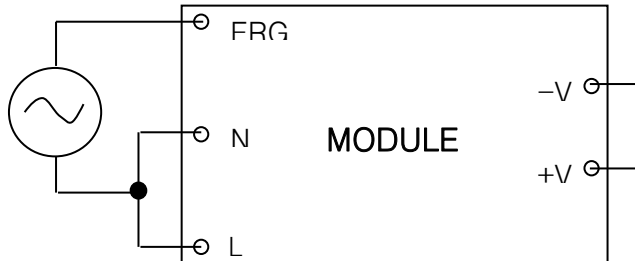
For the withstand voltage test, the applied voltage must be increased gradually from zero to the testing value, and then decreased gradually at shut down. Especially stay away from use of a timer. Where a pulse of several times the applied voltage can be generated.

< INPUT - OUTPUT >



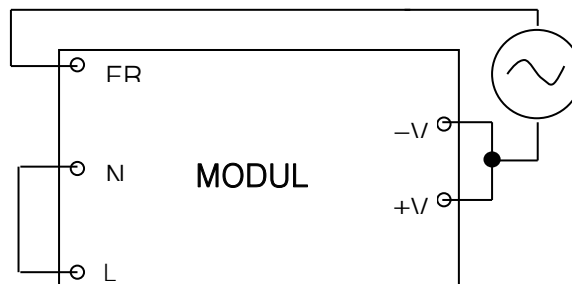
3kVAC (10mA) 1minute

< INPUT - FRG >



2kVAC (10mA) 1minute

< OUTPUT - FRG >



0.5kVAC (10mA) 1minute

Outline Dimensions

