NOMINAL Controls

Made in Canada

High Power DC-DC Solid State Relay-FET (HPDM011200D)

Image: HPD12600D

Introduction

High Power DC-DC SSR with MOSFET output (**HPDM-Series**) reliably replaces traditional electromechanical relays. With FET, there is very little power loss across the relay, and much less heat generated that would otherwise require more complicated cooling. This property allows **HPDM-** to be more suitable for power, space or weight-limiting applications such as EVs. **HPDM-** relays are directly compatible with programmable controllers, digital circuits and computers. They are a welcoming solution to latest industrial automation needs.

Features:

- MOSFET output with low power loss
- protected against input induced failures
- supports high speed switching up to 100kHz
- made in Canada

Sample Applications:

- high current battery/capacitor/UPS applications
- general robotics
- DC motor controls
- wind turbine
- resistive heating
- dynamic load tests
- DC coil control

Performance Specifications	
Control Input Range:	3 to 32 VDC
Minimum Control Input Current:	1mA
Turn-off Voltage (full off):	<2.9 VDC
Power Supply (stand-alone):	12VDC/100mA
Maximum Load Current:	1200A@25°C
Rated Output Voltage:	100 VDC
On Resistance:	0.55 mΩ typical
Leakage Current:	2 mA
Turn-on Speed:	<2.5 µs
Turn-off Speed:	<2 µs
PWM/Switching Frequency:	Up to 100khz
Isolation Voltage:	3kV (AC 1min 50hz)
Warranty:	1 year

Temperature and Physical Specifications	
Operating Temperature:	-40 to 150°C
Storage Temperature:	-40 to 125°C
Maximum Power Dissipation @150°C	1350 W
Junction to Case Thermal Impedance:	0.1°C/W
Overall Dimensions (LxWxH):	90x60x31.5 mm
Weight:	320g

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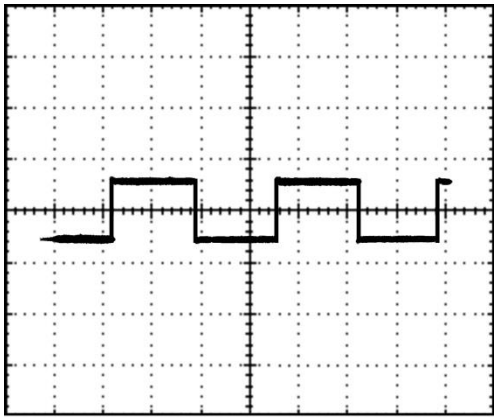
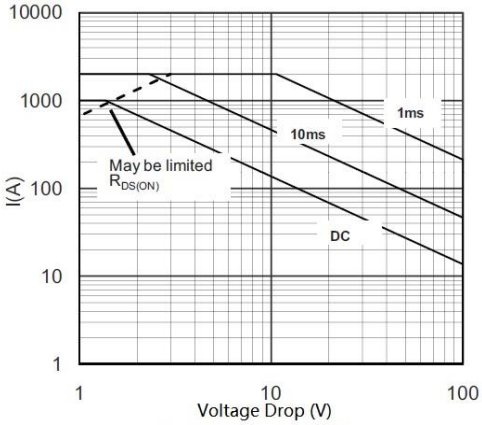
Rev 1.1808

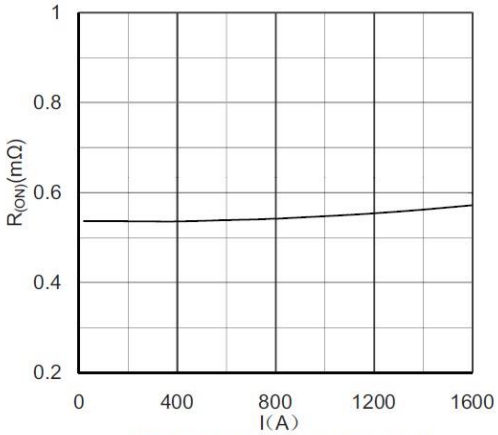
Technical Charts & Drawings:



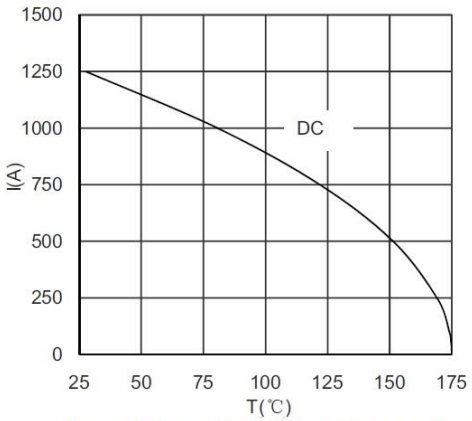
Output Profile (PWM 1kHz)



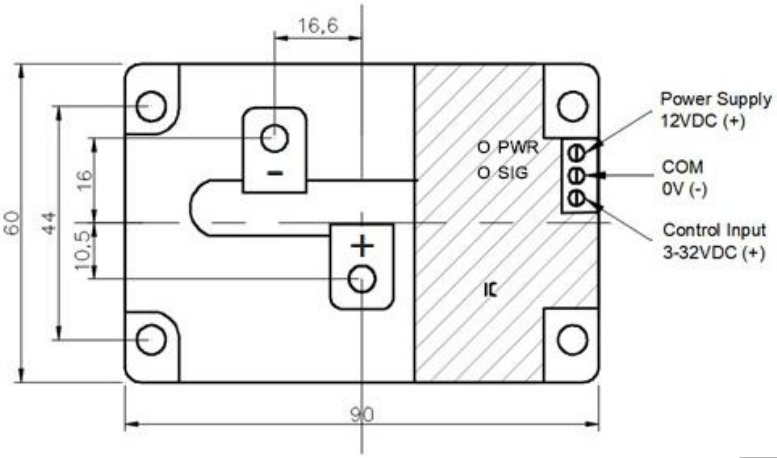
Safe Operating Area



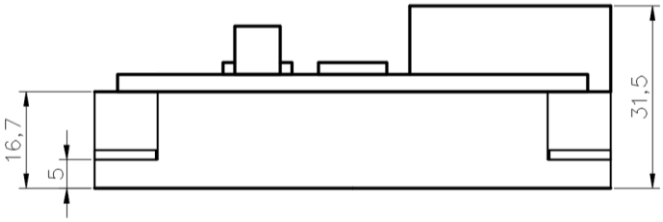
On-Resistance vs Current



Current Capacity vs Base Temperature



Dimensions mm



Part# Guide:

Rated Voltage	
(HPD- Series)	
12:	Up to 1200 VDC
17:	Up to 1700 VDC
(HPDM- Series)	
01:	Up to 100 VDC
01A:	Up to 150 VDC (800A only)

Control Input	
D:	3-32 VDC
Other:	Contact us

Model	
HPD:	Standard IGBT Output
HPDM:	FET Output

Rated Current	
(HPD- Series)	
400:	400 A
600:	600 A
800:	800 A
900:	900 A
1200:	1200 A
1600:	1600 A
(HPDM- MOSFET Series)	
600:	600 A
800:	800 A
1200:	1200 A
1500:	1500 A
2000:	2000 A

Important Information:

(Current/Voltage Selection, Power Supply Requirement)

Relay Output Selection:

Standard (HPD-) relays are with IGBT output recommended for high voltage, high current applications switching less than 10kHz. MOSFET (HPDM-) output relays are available for low voltage, high current applications where power loss, cooling weight and space may be of issue. Note MOSFET high power DC SSRs do not currently support high voltage switching applications over 150VDC.

Type	Available Rated Voltage	Available Rated Current	Voltage Drop	Switching Frequency
HPD- Series (Standard IGBT)	1200VDC, 1700VDC	400A, 600A, 800A, 900A, 1200A	1.7V to 2V	Up to 20kHz
HPDM- Series (MOSFET)	100VDC, 150VDC(800A only)	600A, 800A, 1200A, 1500A, 2000A	<0.35V typical	Up to 100kHz

Rated Current Selection:

Our High Power DC solid state relays are designed for maximum reliability. Moderate degrees of tolerances and safety protocols have been incorporated into their design. However, due to improper selection or misuse, irreversible damages to the relay's internal components may still occur. While selecting a SSR, parameters such as inductive reactance, capacitance, inrush current, power grid variables, and other tolerances must be taken into account. A lower SSR current rating may be permitted if the load's start-up current follows a lower and gradual increasing inrush current such as motor soft-start. As a rule of thumb, choose SSR rated at least 50% of the expected peak inrush current.

Typically for applications without the ability to limit inrush current:
If load is resistive, choose relay rated 1.5 to 1.8 times the maximum continuous current.
If load is inductive, choose relay rated 4 to 5 times the maximum continuous current.
If load is capacitive, choose relay rated 10 times the maximum continuous current. The charge current should be half the withstanding surge current of the solid state relay.

For HPDM- relays with MOSFET output only. It is possible to double the continuous current rating by connecting two relay modules in parallel. However each relay still needs to individually handle the rush current. Please consult us before proceeding.

Rated Voltage Selection:

Ensure relay's rated voltage is higher than operating voltage. For inductive applications or harsh operating environment with the risk of voltage spike/transient overvoltage, ensure enough voltage margins are provided; typically 3x for brushless motors, 2x for brushed motors, 5x for electromagnets.

Power Supply:

A constant 12VDC power supply is needed to power the control circuit prior to any switching. This power source must not be, nor converted from the control voltage. Otherwise it will cause unpredictable switching behaviour and result in the failure of the module.

Important Information:

(Over-current/over-voltage, Static Electricity, Grounding, Switching Frequency)

Overcurrent, Overvoltage:

Most solid state relay failures are the result of overcurrent or overvoltage. For overcurrent protection, add a quick fuse or air circuit breaker in the control loop.

MOSFET output relays are susceptible to overvoltage damages commonly result from counter-electromotive force at turn-off of an inductive load (eg. solenoid or electromagnetic valve). To absorb sufficient overvoltage or inductive fly back energy of these applications, you need to add a zener diode across the two output terminals if not already provided.

Static Electricity:

High Power DC-DC Solid State Relays (HPD or HPDM Series) are very electrostatic-sensitive. To mitigate the risk of damage by electrostatic discharge:

- Handle the relay module with care at all times. Use antistatic gloves, or hold it by its edge/frame. Do not touch solder joints, pins or exposed printed circuitry.
- Discharge your static electricity and limit your physical movement to minimize static build up before handling the unit.
- Do not leave the device where others may mishandle and possibly damage the device.
- Before removing the unit from its package, touch the antistatic package to an unpainted safe metal surface for at least 2 seconds.
- Remove the unit from the antistatic package and install it directly to your system without placing it down.
- Keep the resalable antistatic package so if you may use it later to store the module or physically transfer it.
- Handle the relay module with increased care during cold weather. Indoor humidity decreases will cause increased static electricity.

Grounding:

HPD-Relay must be properly grounded. Grounding connections should be checked carefully.

Switching Frequency:

A sufficient dead time or recovery time is required between on/off cycles to ensure the relay module does not accidentally cross conduct. Do not exceed the recommended switching frequency of 10kHz for HPD-series relays, and 100kHz for HPDM- series.

Important Information:

(Heatsink/Fan Selection)

HPDM011200D Heatsink/Fan Requirement:

Cooling must be carefully planned with HPD- Series solid state relays with IGBT output. This is due to their voltage drop ~0.4VDC, which generates some heat at high continuous currents. The following can be used to estimate the required thermal resistance of heatsink (°C/W) without fan:

(150°C - $T_{Ambient°C}$) / Power Loss - $R_{jc\ junction\ to\ case\ thermal\ resistance}$ - $R_{ch\ case\ to\ heatsink\ thermal\ resistance}$
$T_{Ambient\ °C}$ = default value 50°C
Power Loss = on resistance in ohms x (continuous current)^2
R_{jc} = default value 0.1°C/W
R_{ch} = default value 0.05°C/W (with heat-conducting pad or gels applied)

In order to maximize relay heat dissipation through heatsink, ensure that heat pad or heat gel is applied between the relay base and heatsink. Tighten all relay screws to ensure a very close contact between the base of relay and the surface of heatsink.

The following table provides a reference for heatsink needs according to the continuous current:

Continuous Current through HPDM011200D	**Recommended Heatsink Part# and Thermal Resistance (without a fan)**	**Recommended Heatsink Part# and Thermal Resistance (fanned with 25cfm)**
Up to 50 Amps	*No heatsink needed*	*No Heatsink needed*
50 - 100 Amps	*No heatsink needed*	*No Heatsink needed*
100 - 170 Amps	*No heatsink needed*	*No Heatsink needed*
170 - 225 Amps	*Metal Surface Only*	*No Heatsink needed*
225 - 260 Amps	*IH60 (2°C/W)*	*No Heatsink needed*
260 - 300 Amps	*IH100 (1.4°C/W)*	*Metal Surface Only*
300 - 400 Amps	*T100 (0.92°C/W)*	*IH60 (2°C/W)*
400 - 500 Amps	*T150 (0.6°C/W)*	*IH100 (1.4°C/W)*
500 - 600 Amps	*LH120 (0.16°C/W)*	*T100 (0.92°C/W)*
600 – 700 Amps	*LH150 (0.13°C/W)*	*T150 (0.6°C/W)*
700 – 800 Amps	*LH200 (0.09°C/W)*	*LH120 (0.16°C/W)*
800 -900 Amps	*LH250 (0.07°C/W)*	*LH170 (0.11°C/W)*
900 – 1000 Amps	*LH300 (0.6°C/W)*	*LH250 (0.07°C/W)*

*Calculations are based on the default values. The fan assumed is a standard 12 VDC fan rated 25cfm, 120x120mm or 4.7x4.7”. The cooling requirement should be adjusted accordingly if you have different values than assumed.

Important Information:

(Storage, Handling and Operations)

Storage/Handling:

- The long term storage condition of the relay should be at an ambient temperature of 0 to 40°C with relative humidity of 45 – 85%.
- Store in an antistatic containers to prevent electrostatic discharge from damaging the module.
- Do not store or use relay in wet, moisture or corrosive environment.
- Do not drop the relay or subject it to hard impact.
- Do not subject the relay to excess vibrations.
- Do not expose the relay to direct sunlight
- Do not store or use the relay in environments exposed to salt, dusts or metallic dusts.
- Do not store or use the relay in environments exposed to oil, chemical, water or liquid splashes.

Please ensure proper working knowledge, safety precautions, and handle all electrical components with care to avoid risks of electrical shock!

Do not touch SSR terminals when power supply is ON or immediately after power supply is switched off.

Conduct wiring only when the power supply is OFF.

SSR and heatsink may likely be hot and cause burns. Do not touch them until power is off and surfaces are cooled.