

# RMOD600-W Series / Plug & Play E-Mobility

600W / Wide Input 33.6V-96VDC

## FEATURES

- On-Board DC/DC Converter
- E-Mobility and industry vehicles
- Very wide input voltage range for 48V / 80V
- Plug & Play, ready to use
- Chassis mount and base plate cooled
- Full power at ambient temperature up to 70°C
- Water and dust proof (IP69K), robust and reliable
- High and extremely constant efficiency
- Parallel operation without active current sharing
- High power density
- 2 years warranty



Dimensions (LxWxH): 203.0 x 115.0 x 71.0mm (8.0 x 4.53 x 2.8 inch)  
2000g (4.4 lbs)

## APPLICATIONS



## SAFETY & EMC



## DESCRIPTION

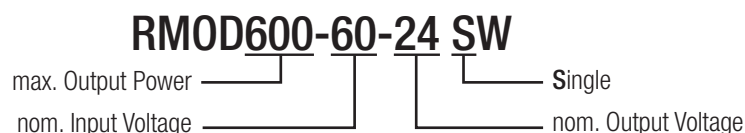
The RMOD families are extremely robust plug & play modules which are used to generate the low voltage network from a vehicle's traction battery. The wide input voltage range up to 96VDC (120V / 5 minutes) covers all common battery voltages in the off-highway vehicle (OHV) segment. Thanks to the waterproof and dust proof housing construction, the devices can be connected mechanically and thermally directly to the chassis, i.e., at any point on the vehicle, and will therefore operate reliably even under the most adverse conditions. This solution is ideal for electric vehicles with nominal 48V...80V battery-powered systems in "Off-Highway E-Mobility Applications" such as Material Handling, Forklift trucks, Golf cars, AGVs, Loaders, Construction vehicles, Airport equipment, People mover, Special vehicles, Transporters, Tractors, etc.

## SELECTION GUIDE

Part Number	Input Voltage Range [VDC]	Output Voltage nom. [VDC]	Output Current max. [A]	Efficiency	Output Power
				typ. <sup>(1)</sup> [%]	max. [W]
RMOD600-60-24SW	33.6-96	24	25	89	600

Note1: Efficiency is tested at nominal input and 50%-100% +25°C ambient

## MODEL NUMBERING



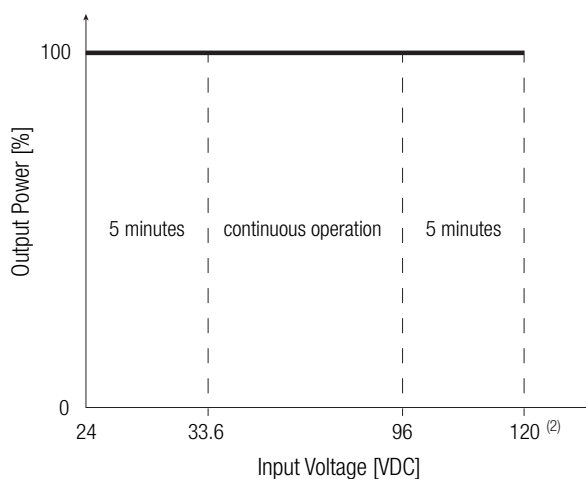
# RMOD600-W Series / Plug & Play E-Mobility

## 600W / Wide Input 33.6V-96VDC

**BASIC CHARACTERISTICS** (measured @  $T_{AMB}= 25^{\circ}C$ , nom.  $V_{IN}$ , full load and after warm-up unless otherwise stated)

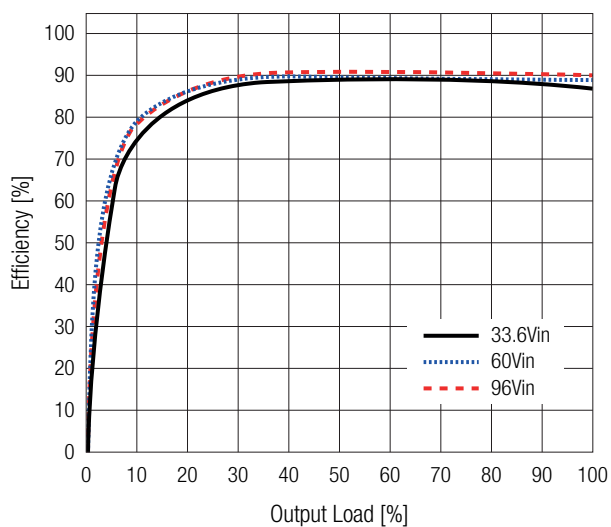
Parameter	Conditions	Min.	Typ.	Max.	
Input Voltage Range <sup>(2)</sup>	refer to „Input Voltage Range“	nom. $V_{IN}= 48, 80VDC$	33.6VDC		96VDC
		Extended range: 5 minutes max.	24VDC		33.6VDC
			96VDC		120VDC <sup>(2)</sup>
Input Current				32A	
Inrush Current				1.5A <sup>2</sup> s	
Quiescent Current	nom. $V_{IN}= 80VDC$			60mA	
Minimum Load		0%			
Start-up time			250ms	500ms	
Rise time			70ms		
Internal Operating Frequency	BOOST stage		100kHz		
	MAIN power stage		200kHz		
	auxiliary		300kHz		
Output Ripple and Noise				500mVp-p	

Input Voltage Range <sup>(2)</sup>

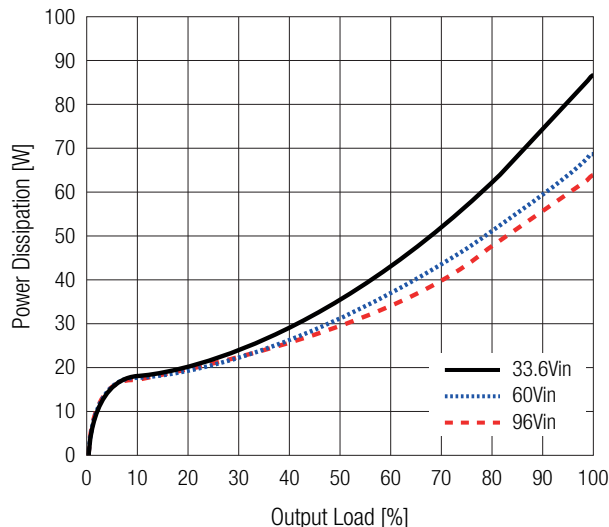


Note2: Recognized by safety agency for safe operation at input voltage up to 108VDC

Efficiency vs. Load



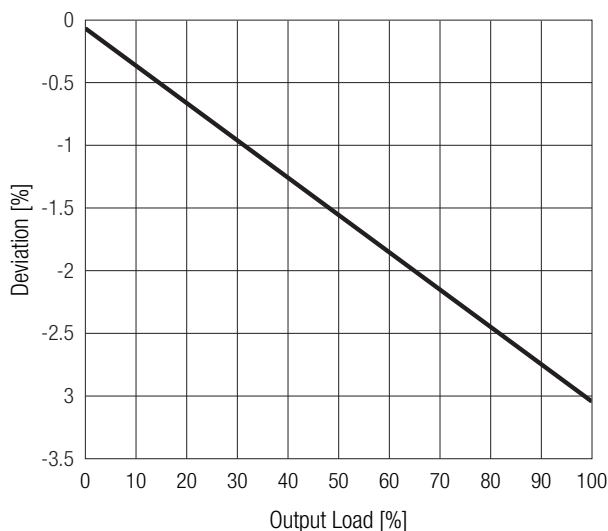
Power Dissipation vs. Load



**REGULATIONS (measured @  $T_{AMB} = 25^{\circ}C$ , nom.  $V_{IN}$ , full load and after warm-up unless otherwise stated)**

Parameter	Conditions		Value
Output Accuracy			$\pm 4.0\%$ max.
Line Regulation	low line to high line, full load	$V_{IN} = 33.6-96VDC$	$\pm 1.0\%$ max.
		$V_{IN} = 24-33.6VDC$ and $96-120VDC$	$\pm 3.0\%$ max.
Load Regulation	10-90% load		2.5% typ.
Transient Response	10-90% load, $V_{IN} = 33.6-120VDC$		1.92VDC
	recovery time		100ms typ.

Deviation vs. Load  
(nom.  $V_{IN}$ )



**PROTECTIONS (measured @  $T_{AMB} = 25^{\circ}C$ , nom.  $V_{IN}$ , full load and after warm-up unless otherwise stated)**

Parameter	Type		Value
Short Circuit Protection (SCP)	auto recovery		current limitation
Over Current Protection (OCP)	auto recovery		29A typ.; current limitation
Over Temperature Protection (OTP)			yes
Isolation Voltage <sup>(3)</sup>	1 minute	I/P to O/P; I/P to case	2.5kVDC
		O/P to case	1.7kVDC
Isolation Resistance			10M $\Omega$ min.
Insulation Grade			basic

Note3: For repeated Hi-Pot testing, reduce the time and/or the test voltage

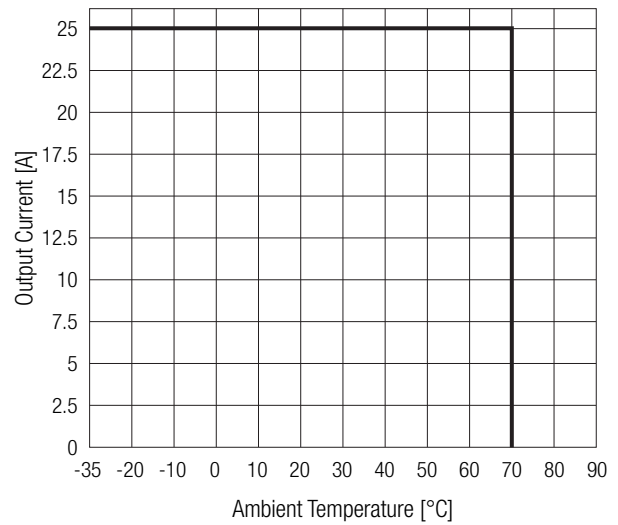
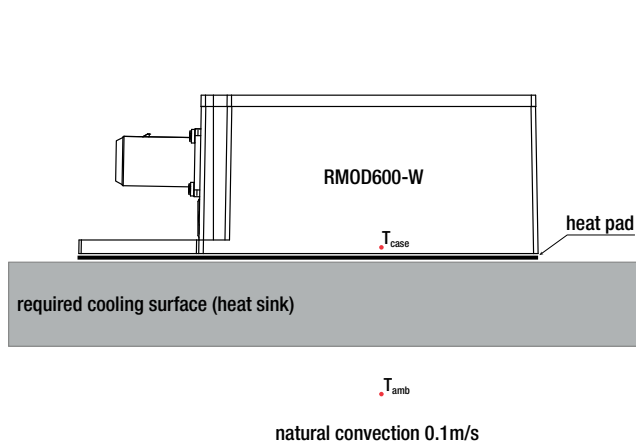
**ENVIRONMENTAL (measured @  $T_{AMB} = 25^{\circ}C$ , nom.  $V_{IN}$ , full load and after warm-up unless otherwise stated)**

Parameter	Conditions	Value
Operating Ambient Temperature Range <sup>(4)</sup>	refer to „Thermal Consideration“	$-35^{\circ}C$ to $+70^{\circ}C$
Operating Altitude		3000m
Pollution Degree		PD3
IP Rating	according to ISO 20653	IP69K
MTBF	according to SR-332; $T_{AMB} = +50^{\circ}C$	$500 \times 10^3$ hours

Note4: For operation at  $+70^{\circ}C$  ambient, take care about sufficient cooling (never exceed max. allowed base plate temperature =  $70^{\circ}C$ )

**ENVIRONMENTAL** (measured @  $T_{AMB} = 25^{\circ}\text{C}$ , nom.  $V_{IN}$ , full load and after warm-up unless otherwise stated)

### Thermal Consideration



The module can be used in enclosed applications with full load, as long as the cooling is sufficient to keep the baseplate temperature at  $T_{CASE}$  below  $70^{\circ}\text{C}$ . The surrounding temperature should not exceed  $70^{\circ}\text{C}$ .

### ENVIRONMENTAL

Parameter	Condition	Standard
Temperature Change	1 cycle: $-25^{\circ}\text{C}$ (30 mins) and $70^{\circ}\text{C}$ (20 mins); Transition $5^{\circ}\text{C}/\text{min}$ . 100 cycles. Operational	EN60068-2-14
Constant Temperature- warm	duration: 21 days, ambient: $70^{\circ}\text{C}$	EN60068-2-2
Temperature Shock	Duration: 20 cycles Operation mode: Non-operating Test temperature: Chamber 1: $75^{\circ}\text{C}$ ; Chamber 2: $-30^{\circ}\text{C}$ Test duration: 1 hour per chamber Transfer duration: $<10\text{ s}$	EN60068-2-14
Humidity/Heat Cycle	Max air temperature: $55^{\circ}\text{C}$ Number of cycles: 2 Cycles duration: 24 hours	EN60068-2-30
Vibrations, Sinusoidal	Shock load: 5G Frequency range: 10-500Hz Length of time subject to load: 3 axes, 2 hours (10 cycles) per axis Shock form: sinusoidal Operation mode: operational	EN60068-2-6
Continuous Shock	Shock load: 10G Duration: 16 ms Number of impacts: 1000 shocks/axis	EN60068-2-29
Shock	Shock load: 30G Duration: 11 ms 3 shocks per direction, 6 directions	EN60068-2-27
Salt Spray	at $35^{\circ}\text{C}$ for 96 hours	EN60068-2-11

### SAFETY & CERTIFICATIONS

Certificate Type (Safety)	Standard
Audio/Video, information and communication technology equipment - Part1: Safety requirements 2nd Edition	UL62368-1:2014 2nd Edition CAN/CSA-C22.2 No. 62368-1-14 2nd Edition
Audio/Video, information and communication technology equipment - Part1: Safety requirements 2nd Edition	IEC62368-1:2014 2nd Edition EN62368-1:2014+A11:2017
RoHS2	RoHS 2011/65/EU + AM2015/863

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## 600W / Wide Input 33.6V-96VDC

### SAFETY & CERTIFICATIONS

EMC Compliance	Condition	Standard
Industrial trucks - Electromagnetic compatibility		EN12895
Vehicles, boats and internal combustion engines - Radio disturbance characteristics - Limits and methods of measurement for the protection of on-board receivers		CISPR25 / EN55025
ESD Electrostatic Discharge Immunity Test		EN61000-4-2
Radiated, radio-frequency, electromagnetic field immunity test		EN61000-4-3
Fast Transient and Burst Immunity		EN61000-4-4
Surge Immunity		EN61000-4-5
Immunity to conducted disturbances, induced by radio-frequency fields		EN61000-4-6
Power Magnetic Field Immunity		EN61000-4-8

### DIMENSION & PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	case	aluminum
Dimension (LxWxH)		203.0 x 115.0 x 71.0mm 8.0 x 4.53 x 2.8 inch
Weight		2000g typ. 4.4 lbs

#### Dimension Drawing (mm)

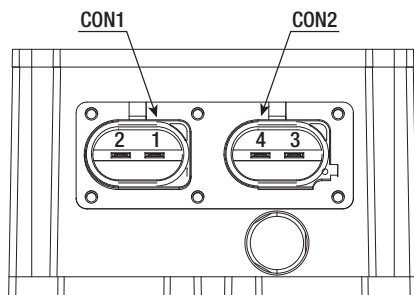
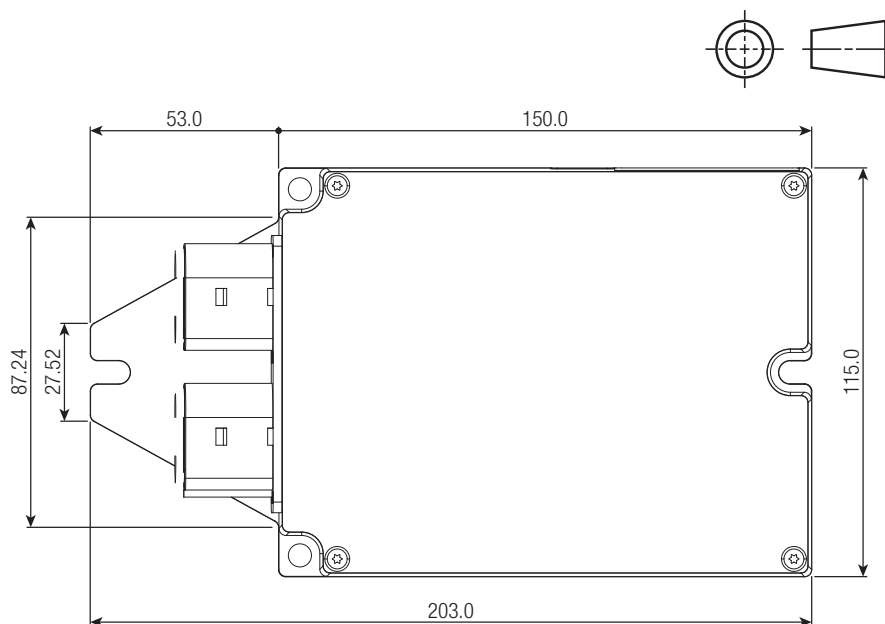
**Connector Information**

Connector	#	Function
DC Input CON1	1	+V <sub>IN</sub>
	2	-V <sub>IN</sub>
DC Output CON2	3	-V <sub>OUT</sub>
	4	+V <sub>OUT</sub>

FC= fixing centers

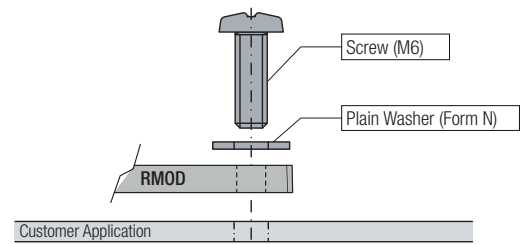
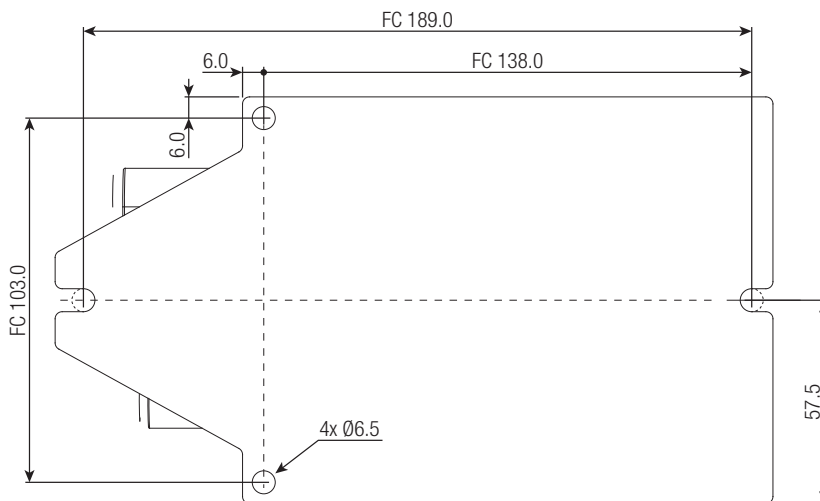
**Compatible Connector**

Connector	Housing
DC Input CON1	FEP 42122900
DC Output CON2	FEP 42123400



Tolerance: ±0.5mm

### DIMENSION & PHYSICAL CHARACTERISTICS



Recommended mounting screw/washer:

4x M6 stainless steel screw  
 Minimum length= 12mm  
 Head diameter= 10.5mm max.

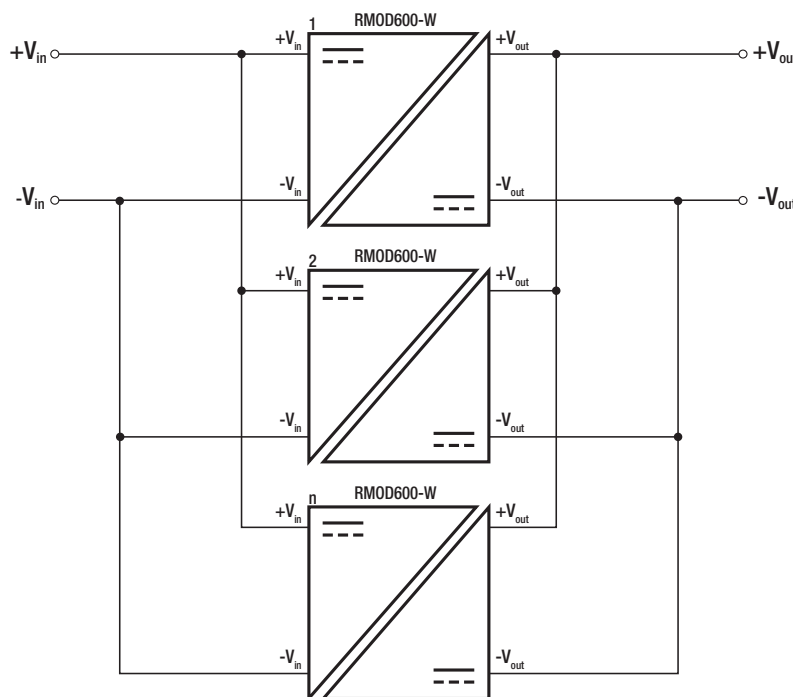
4x plain washer acc. to ISO 10673 form N  
 (hardness class 200HV)  
 Recommended tightening torque: 4.6Nm

Tolerance: ±0.5mm

### INSTALLATION & APPLICATION

#### Parallel Operation

Parallel operation is possible with all combinations of DC/DC converter versions providing they have the same rated output voltage. There is no active current sharing and therefore the units connected in parallel could be contributing different amounts to the total load current.



### PACKAGING INFORMATION

Parameter	Type	Value
Packaging Dimension (LxWxH)	cardboard box	788.0 x 594.0 x 109.0mm
Packaging Quantity		10pcs
Storage Temperature Range		-40°C to +85°C
Storage Humidity		95% max.

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