

# Solid State Relays DC Switching

## Types RGC1D Solid State Contactor RGS1D Solid State Relay



- IGBT power semiconductor
- 17.5mm product width, with or without integrated heatsink
- Rated Operational voltage: 1000 VDC
- Rated Operational current: Up to 25 ADC
- Control voltage: 4.5-32 VDC
- UL508, CSA22.2 No. 14-10
- Input polarity protection
- Removable IP20 cover
- Integrated free-wheeling diode for output protection
- Max. transient peak voltage: 1200V
- RoHS compliant

### Product Description

This product series is mainly intended to switch a string of photovoltaic panels with a maximum string voltage of 1000VDC and up to 25ADC in only 17.5mm width. It may be used in other DC application as well.

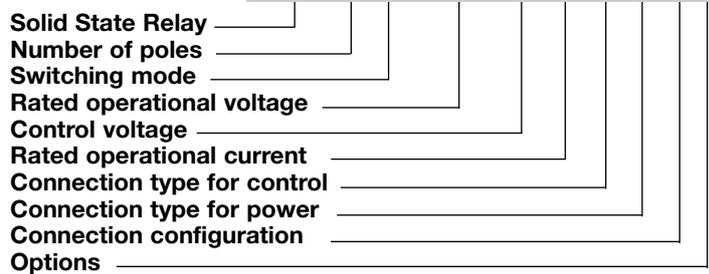
the IGBT at the output is protected against back voltage with an integrated free-wheeling diode.

RGS1D is the panel mount version while the RGC1D has an integrated heatsink.

The control port is protected against reverse polarity while

Specifications are stated at 25°C unless otherwise noted.

### Ordering Key RGC 1 D 1000 D 15 K K E



### Ordering Key

| 1Phase DC switching | Rated Voltage | Control Voltage | Rated Current | Connection Control | Connection Power | Connection Configuration |
|---------------------|---------------|-----------------|---------------|--------------------|------------------|--------------------------|
| RGC1D: Contactor    | 1000:         | D: 4.5 - 32 VDC | 15: 15 ADC    | K: Screw           | K: Screw         | E: Contactor             |
| RGS1D:SSR           | 1000 VDC      |                 | 25: 25 ADC    |                    |                  |                          |

### Selection Guide (Integrated heatsink)

| Rated Output voltage | Max. transient peak voltage | Control Voltage | Rated Operational Current @40°C |
|----------------------|-----------------------------|-----------------|---------------------------------|
| 1000 VDC             | 1200Vp                      | 4.5 - 32 VDC    | 15 ADC                          |
|                      |                             |                 | RGC1D1000D15KKE                 |

### Selection Guide (Panel-mount Solid State Relay)

| Rated Output voltage | Max. transient peak voltage | Control Voltage | Rated Operational Current |                                |
|----------------------|-----------------------------|-----------------|---------------------------|--------------------------------|
| 1000 VDC             | 1200Vp                      | 4.5 - 32 VDC    | 15 ADC                    | 25 ADC                         |
|                      |                             |                 | RGS1D1000D15KKE           | RGS1D1000D25KKE                |
|                      |                             |                 |                           | RGS1D1000D25KKEHT <sup>1</sup> |

1: Option with attached thermal pad.

### Output Voltage Specifications

|  |               |
|--|---------------|
| Operational Voltage Range IEC <sup>2</sup> | 24 - 1000 VDC |
| UL508 <sup>2</sup>                         | 24 - 600 VDC  |
| Maximum transient peak voltage             | 1200 VDC      |
| Maximum Onstate Voltage Drop               | 1.6 VDC       |

2. -15% on lower voltage limit

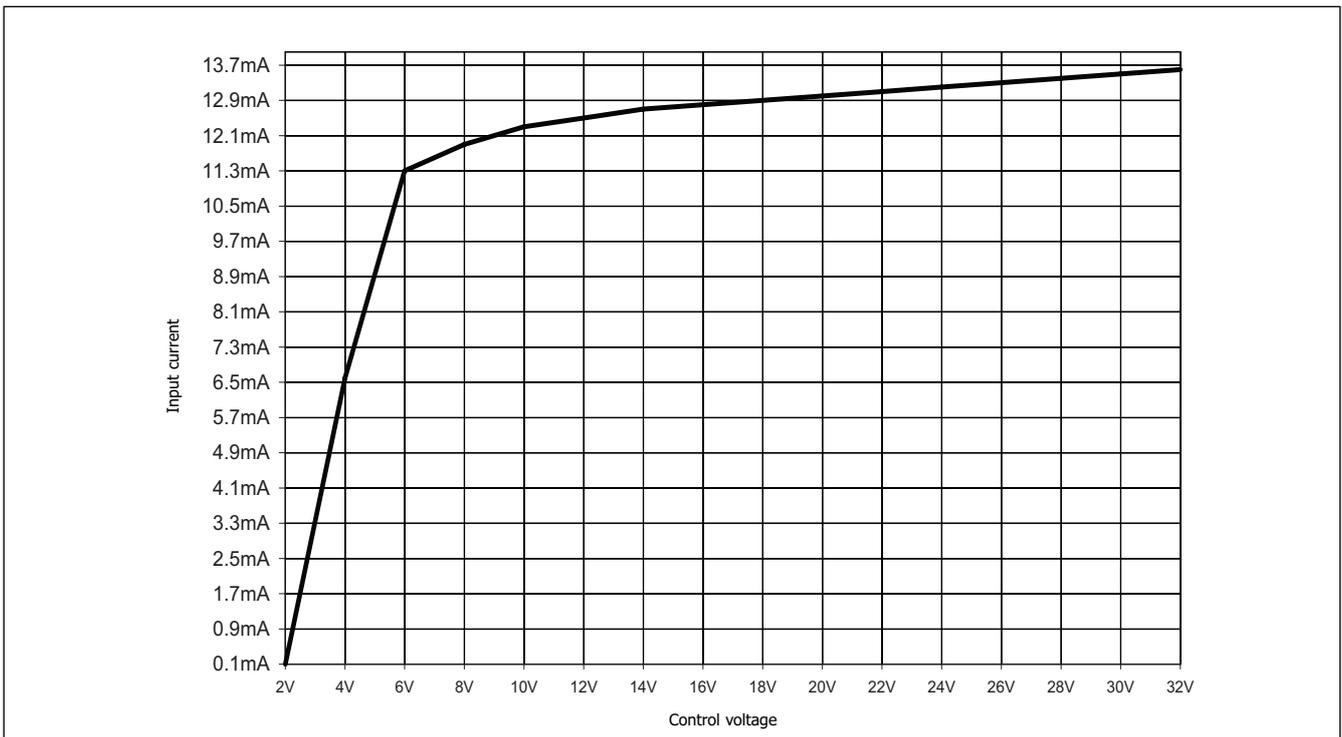
### General Specifications

|                       |   |
|-----------------------|---|
| Protection            | IP20  |
| Control input status  | continuously ON Green LED, when control input is applied        |
| Pollution degree      | 2 (non-conductive pollution with possibilities of condensation) |
| Over-voltage category | III (fixed installations)                                       |
| Isolation             |   |
| Input to Output       | 4kVrms  |
| Input&Output to Case  | 4kVrms  |

## Input Specifications (@ 60°C)

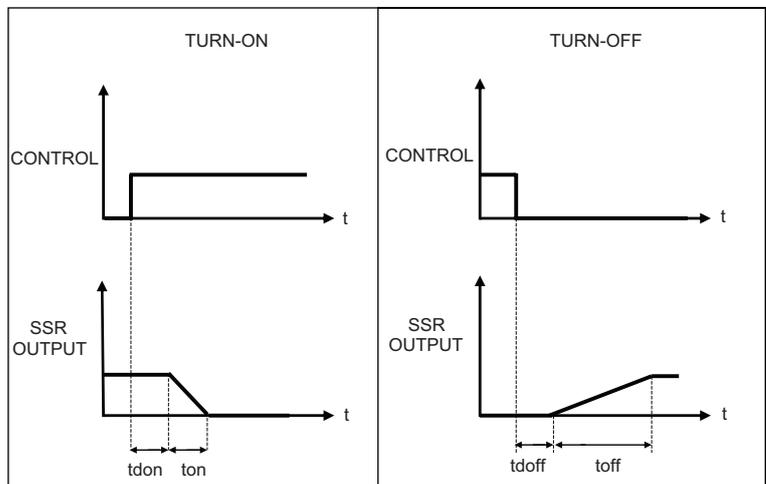
|                              |              |                                |                               |
|------------------------------|--------------|--------------------------------|-------------------------------|
| Control voltage range        | 4.5 - 32 VDC | Maximum response time pick-up  | Refer to Time characteristics |
| Pick-up voltage <sup>3</sup> | 4 VDC        | Maximum response time drop-out | Refer to Time characteristics |
| Drop-out voltage             | 1 VDC        | Input current                  | See diagram below             |
| Maximum Reverse voltage      | 32 VDC       |                                |                               |

Note: Ideally control should be switched with a contactless switch (eg: open collector)  
 3. Pickup voltage should be minimum 6VDC for EMC conformance.

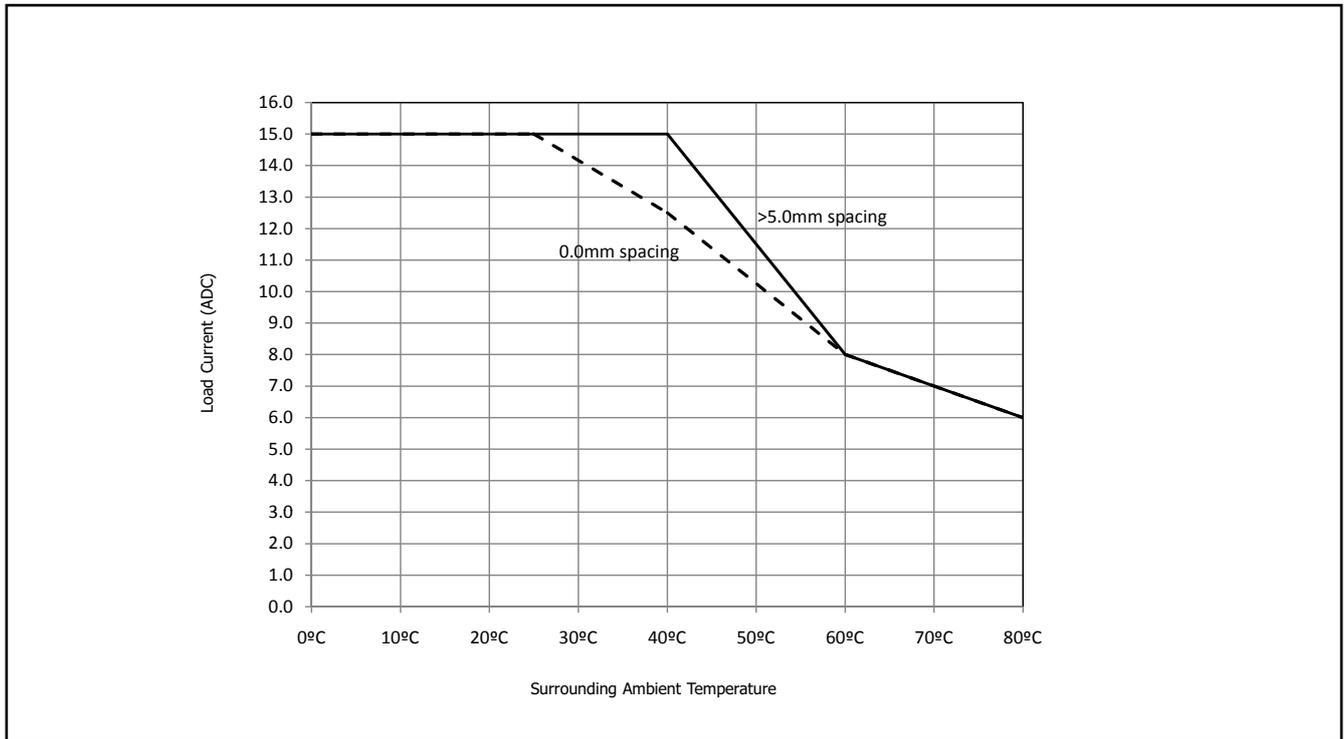


## Time Characteristics

| CHARACTERISTICS        |       |
|------------------------|-------|
| Turn on time (ton)     | 50µs  |
| Turn on delay (tdon)   | 50µs  |
| Turn off time (toff)   | 200µs |
| Turn off delay (tdoff) | 50µs  |
| Switching Frequency    | 20Hz  |



## Current Derating for RGC1D



## Output Specifications (@ 40°C unless otherwise specified)

|   | RGC1D..15                  | RGS1D..15 | RGS1D..25 |
|---|----------------------------|-----------|-----------|
| Current Rating                            | DC-1 @ 60°C<br>DC-1 @ 40°C | 15 ADC    | 25 ADC    |
| Maximum offstate leakage at rated voltage | 1.5mA                      | 1.5mA     | 1.5mA     |
| Min. operational current                  | 20 mADC                    | 20 mADC   | 20 mADC   |
| Maximum Transient Surge Current (t=10 μs) | 200 ADC                    | 200 ADC   | 200 ADC   |

## Agency Approvals and Conformances

RGC1D

UL508 Listed (E172877)  
cUL Listed (E172877)



RGS1D

UL508 Recognised (E172877)  
CSA (204075)



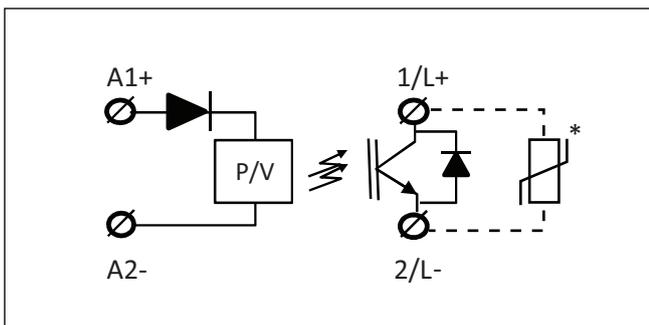
## Electromagnetic Compatibility

|   |                        |   |                        |
|---|------------------------|---|------------------------|
| <b>EMC Immunity</b>                                 | IEC/EN 61000-6-2       | <b>Radiated Radio Frequency Immunity</b>  | IEC/EN 61000-4-3       |
| <b>Electrostatic Discharge (ESD) Immunity</b>       | IEC/EN 61000-4-2       | 10V/m, 80 - 1000 MHz  | Performance Criteria 1 |
| Air discharge, 8kV                                  | Performance Criteria 1 | 10V/m, 1.0 - 2.7GHz   | Performance Criteria 1 |
| Air discharge, 16kV                                 | Performance Criteria 2 | <b>Conducted Radio Frequency Immunity</b>   | IEC/EN 61000-4-6       |
| Contact, 4kV  | Performance Criteria 1 | 10V/m, 0.15 - 80 MHz  | Performance criteria 1 |
| Contact, 8kV  | Performance Criteria 2 | <b>Voltage Dips, Short Interruptions and Voltage Variations Immunity tests</b>                | IEC/EN 61000-4-11      |
| <b>Electrical Fast Transient (Burst) Immunity</b>   | IEC/EN 61000-4-4       | 0% @ 5000ms   | Performance Criteria 2 |
| Output: 4kV, 5kHz/100 kHz                           | Performance Criteria 2 | 40% @ 200ms   | Performance Criteria 2 |
| Input: 1kV, 5kHz/ 100kHz                            | Performance Criteria 1 | 60% @ 10, 30, 100, 300, 1000ms  | Performance Criteria 2 |
| <b>Electrical Surge Immunity</b>                    | IEC/EN 61000-4-5       | <b>Voltage Dips, Short Interruptions and Voltage Variations on Input Lines Immunity tests</b> | IEC/EN 61000-4-29      |
| Output, line to line, 1kV                           | Performance Criteria 1 | 0% @ 1, 3, 10, 30, 100, 300, 1000ms   | Performance Criteria 2 |
| Output, line to earth, 2kV                          | Performance Criteria 1 | 30% @ 10, 30, 100, 300, 1000ms  | Performance Criteria 2 |
| Input, line to line, 1kV                            | Performance Criteria 1 | 70% @ 10, 30, 100, 300, 1000ms  | Performance Criteria 2 |
| Input, line to earth, 2kV                           | Performance Criteria 1 | -20% @ 10, 30, 100, 300, 1000ms, 3s, 10s  | Performance Criteria 2 |
|   |                        | +20% @ 10, 30, 100, 300, 1000ms, 3s, 10s  | Performance Criteria 2 |
| <b>EMC Emission</b>                                 | IEC/EN 61000-6-3       | <b>Radio Interference Voltage Emission (Conducted)</b>  | IEC/EN 55011           |
| <b>Radio Interference field emission (Radiated)</b> | IEC/EN 55011           | <b>0.15 - 30MHz</b>   | Class B                |
| <b>30 - 1000MHz</b>                                 | Class B                |   |                        |

## Environmental Specifications

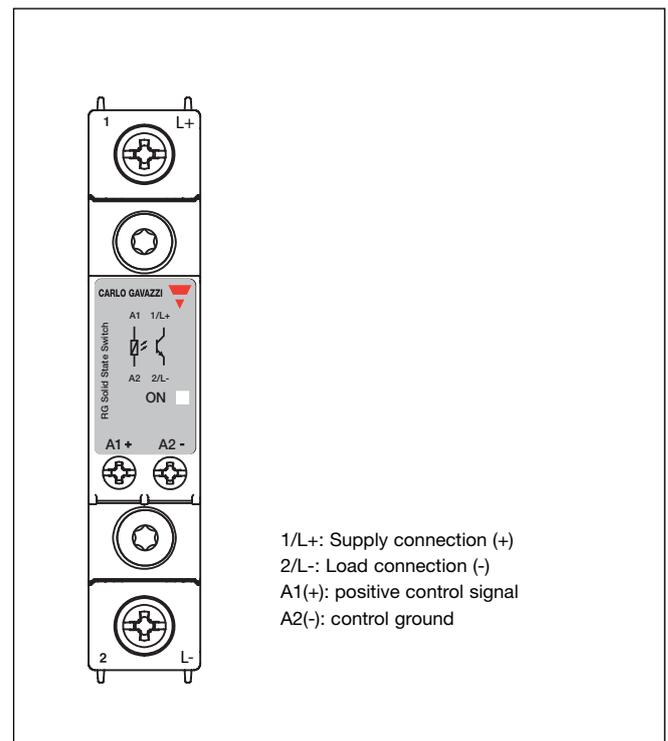
|   |                                  |
|---|----------------------------------|
| Operating Temperature   | -40°C to 80°C (-40°F to +176°F)  |
| Storage Temperature   | -40°C to 100°C (-40°F to +212°F) |
| RoHS (2011/65/EU)   | Compliant                        |
| Impact resistance (EN50155, EN61373)                            | 15/11 g/ms                       |
| Vibration resistance (2-100Hz, IEC 60068-2-6, EN50155, EN61373) | 2g per axis (5g for RGS)         |
| Relative humidity   | 95% non-condensing @ 40°C        |
| UL flammability rating (housing)                                | UL 94 V0                         |

## Connection Diagram

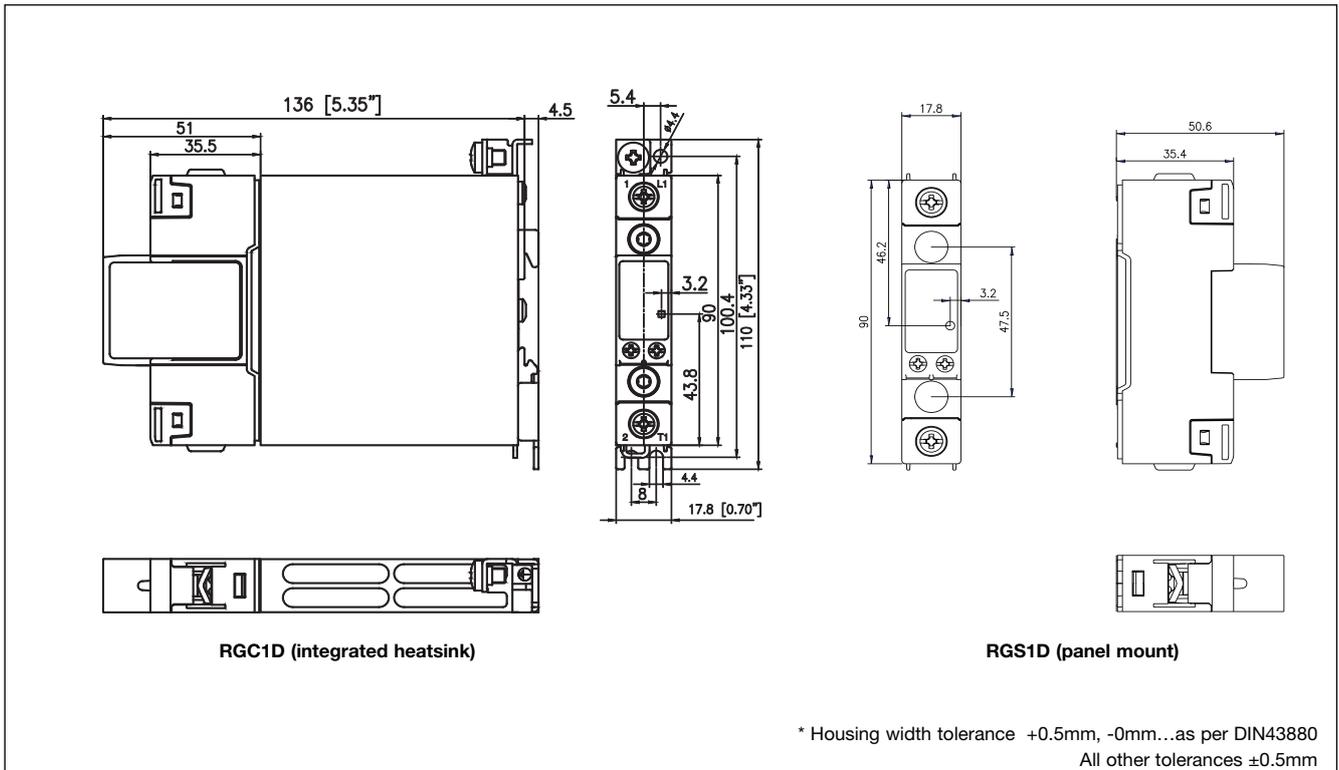


\* varistor not included

## Terminal Layout



## Dimensions



\* Housing width tolerance +0.5mm, -0mm...as per DIN43880  
All other tolerances ±0.5mm

All dimensions in mm

## Connection Specifications

### POWER CONNECTIONS: 1/L+, 2 /L-

Use 75°C copper (Cu) conductors

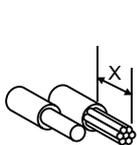
#### Torque specifications



IEC: 1.5 - 2.0Nm (13.3 - 17.7 lb-in)  
UL: 2.0Nm (17.7 lb-in)  
M4, Pozidriv 2  
Stripping Length (X) = 12mm

#### Rigid (Solid & Stranded)

UL/ CSA rated data



2 x 2.5..6 mm<sup>2</sup> 1 x 2.5..6 mm<sup>2</sup>  
2 x 14..10 AWG 1 x 14..10 AWG

#### Flexible with end sleeve

2 x 1.0..2.5mm<sup>2</sup>  
2 x 2.5..4mm<sup>2</sup>  
2 x 14..12AWG 1 x 1.0..4mm<sup>2</sup>  
2 x 18..14AWG 1 x 18..12AWG



#### Flexible without end sleeve

2 x 1.0..2.5mm<sup>2</sup>  
2 x 2.5..6 mm<sup>2</sup>  
2 x 2.5..6 mm<sup>2</sup> 1 x 1.0..6 mm<sup>2</sup>  
2 x 18..14AWG 1 x 18..10 AWG



#### Aperture for termination lug

12.3mm

### CONTROL CONNECTIONS: A1(+), A2(-)

Use 60/75°C copper (Cu) conductors

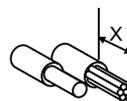
#### Torque specifications



IEC: 0.5 - 0.6Nm (4.4 - 5.3 lb-in)  
UL: 0.5Nm (4.4 lb-in)  
M3, Pozidriv 1  
Stripping Length (X) = 8mm

#### Rigid (Solid & Stranded)

UL/ CSA rated data



2 x 0.5..2.5mm<sup>2</sup> 1 x 0.5..2.5mm<sup>2</sup>  
2 x 18..12 AWG 1 x 18..12 AWG

#### Flexible with end sleeve

2 x 0.5..2.5mm<sup>2</sup> 1 x 0.5..2.5mm<sup>2</sup>  
2 x 18..12AWG 1 x 18..12AWG



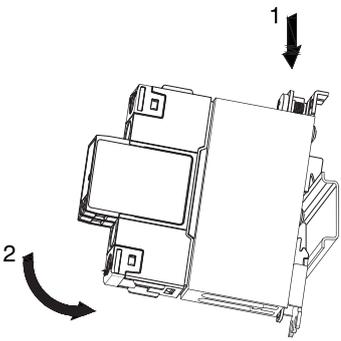
#### Protective Earth Connection (RGC)



M5, 1.5Nm (13.3 in-lb)  
(not provided with SSR)

Note: M5 PE screw not provided with SSR. PE connection required when product is intended to be used in Class 1 applications according to EN/IEC 61140.

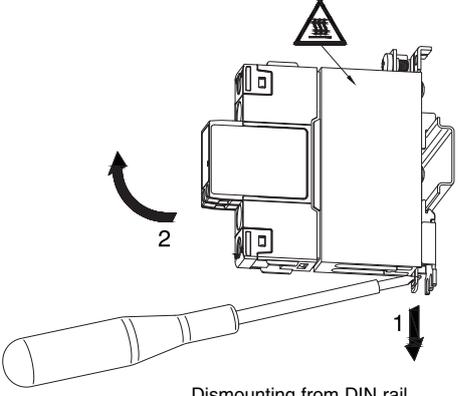
# Installation Instructions for RGC1D



1 ↓

2 ↻

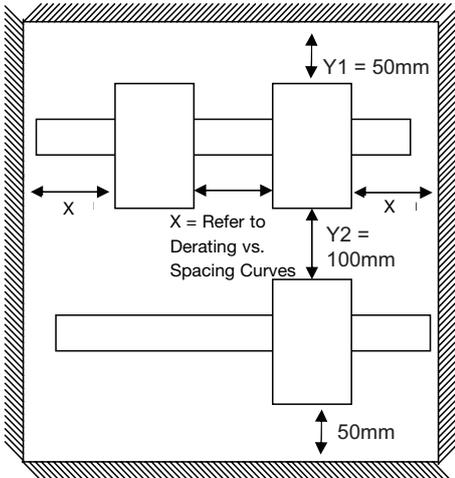
Mounting on DIN rail



2 ↻

1 ↓

Dismounting from DIN rail



Y1 = 50mm

X

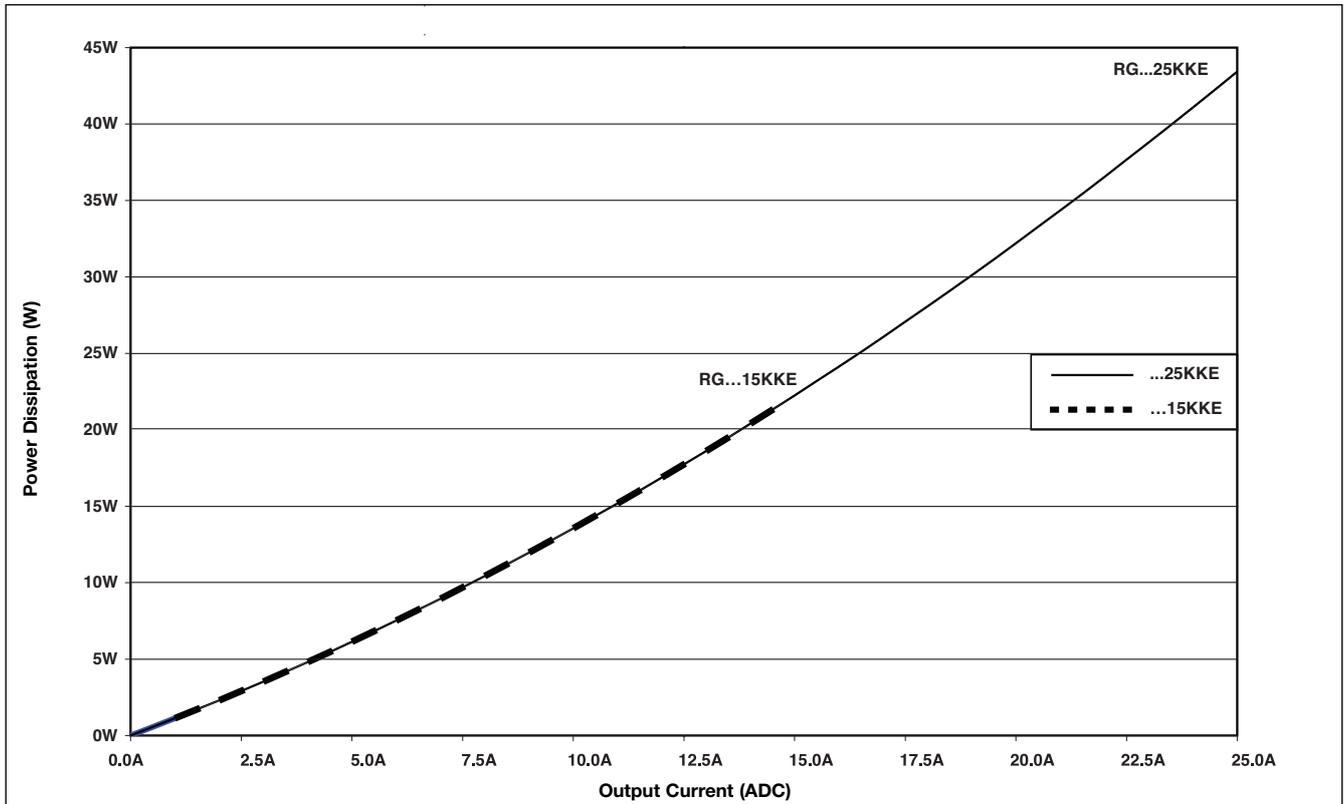
X = Refer to Derating vs. Spacing Curves

Y2 = 100mm

50mm

Detailed description: The diagram shows the RGC1D device being pushed onto a DIN rail. Step 1 is a downward arrow indicating the direction of movement. Step 2 is a curved arrow indicating the rotation of the device. The photograph shows the device with its terminal block. The dismounting diagram shows a screwdriver being used to lift the device off the rail. The terminal spacing diagram shows two rows of terminals. The vertical distance between the top and bottom rows is Y1 = 50mm. The vertical distance between the top and bottom rows of the second row is Y2 = 100mm. The horizontal distance between the terminals of the two rows is X.

## Output Power Dissipation



## Mounting Instructions for RGS1D

Thermal stress will reduce the lifetime of the SSR. Therefore it is necessary to select the appropriate heatsinks, taking into account the surrounding temperature, load current and the duty cycle.

A fine layer of thermally conductive silicone paste must be applied to the back of the SSR. RGS should be mounted on the heatsink with two M5 x 30mm screws. Gradually

tighten each screw (alternating between the two) until both are tightened with a torque of 0.75Nm. Then tighten both screws to their final mounting torque of 1.5Nm.

In case of a thermal pad attached to the back of the SSR, no thermal paste is required. The RGS is gradually tightened (alternating between the 2 screws) to a maximum torque of 1.5Nm.





# Heatsink Selection for RGS1D

## RGS1D..15

| Load current [A] | Thermal resistance [°C/W] |       |       |       |       |      |       | T <sub>A</sub> |
|------------------|---------------------------|-------|-------|-------|-------|------|-------|----------------|
|                  | 20                        | 30    | 40    | 50    | 60    | 70   | 80    |                |
| 15               | 3.60                      | 3.15  | 2.70  | 2.25  | 1.80  | 1.35 | 0.90  |                |
| 13.5             | 4.10                      | 3.59  | 3.08  | 2.56  | 2.05  | 1.54 | 1.03  |                |
| 12               | 4.74                      | 4.15  | 3.56  | 2.96  | 2.37  | 1.78 | 1.19  |                |
| 10.5             | 5.57                      | 4.87  | 4.18  | 3.48  | 2.79  | 2.09 | 1.39  |                |
| 9                | 6.69                      | 5.85  | 5.01  | 4.18  | 3.34  | 2.51 | 1.67  |                |
| 7.5              | 8.26                      | 7.23  | 6.20  | 5.16  | 4.13  | 3.10 | 2.07  |                |
| 6                | 10.64                     | 9.31  | 7.98  | 6.65  | 5.32  | 3.99 | 2.66  |                |
| 4.5              | 14.63                     | 12.81 | 10.98 | 9.15  | 7.32  | 5.49 | 3.66  |                |
| 3                | ----                      | ----  | ----  | 14.17 | 11.33 | 8.50 | 5.67  |                |
| 1.5              | ----                      | ----  | ----  | ----  | ----  | ---- | 11.71 |                |

## RGS1D..25

| Load current [A] | Thermal resistance [°C/W] |       |      |      |       |       |      | T <sub>A</sub> |
|------------------|---------------------------|-------|------|------|-------|-------|------|----------------|
|                  | 20                        | 30    | 40   | 50   | 60    | 70    | 80   |                |
| 25               | 1.82                      | 1.59  | 1.36 | 1.13 | 0.90  | 0.67  | 0.44 |                |
| 22.5             | 2.12                      | 1.86  | 1.59 | 1.33 | 1.06  | 0.80  | 0.53 |                |
| 20               | 2.48                      | 2.17  | 1.86 | 1.55 | 1.24  | 0.93  | 0.62 |                |
| 17.5             | 2.96                      | 2.59  | 2.22 | 1.85 | 1.48  | 1.11  | 0.74 |                |
| 15               | 3.60                      | 3.15  | 2.70 | 2.25 | 1.80  | 1.35  | 0.90 |                |
| 12.5             | 4.51                      | 3.95  | 3.38 | 2.82 | 2.26  | 1.69  | 1.13 |                |
| 10               | 5.90                      | 5.17  | 4.43 | 3.69 | 2.95  | 2.21  | 1.48 |                |
| 7.5              | 8.26                      | 7.23  | 6.20 | 5.16 | 4.13  | 3.10  | 2.07 |                |
| 5                | 13.03                     | 11.41 | 9.78 | 8.15 | 6.52  | 4.89  | 3.26 |                |
| 2.5              | ----                      | ----  | ---- | ---- | 13.75 | 10.31 | 6.87 |                |

|   |             |
|---|-------------|
| Maximum junction temperature  | 125°C       |
| Heatsink temperature  | 100°C       |
| Junction to case thermal resistance, R <sub>thjc</sub>              | <0.36 °C/W  |
| Case to heatsink thermal resistance, R <sub>thcs</sub> <sup>4</sup> | < 0.32 °C/W |

|   |             |
|---|-------------|
| Maximum junction temperature  | 125°C       |
| Heatsink temperature  | 100°C       |
| Junction to case thermal resistance, R <sub>thjc</sub>              | <0.36 °C/W  |
| Case to heatsink thermal resistance, R <sub>thcs</sub> <sup>4</sup> | < 0.32 °C/W |

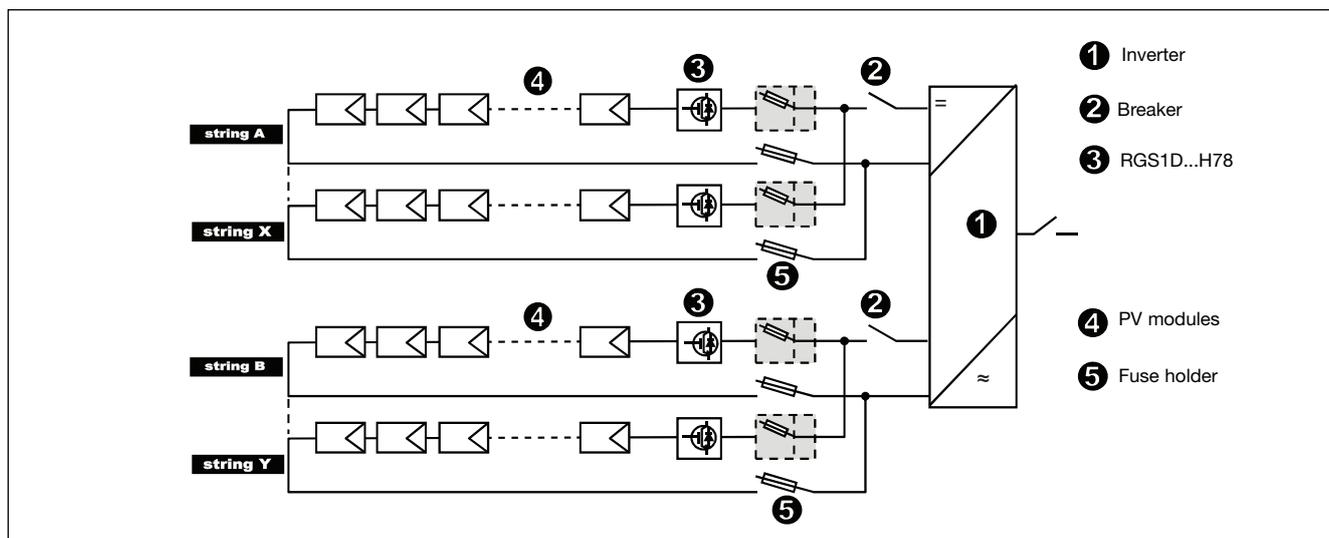
## RGS1D..25..HT (with attached thermal pad)

| Load current [A] | Thermal resistance [°C/W] |       |      |      |       |       |      | T <sub>A</sub> |
|------------------|---------------------------|-------|------|------|-------|-------|------|----------------|
|                  | 20                        | 30    | 40   | 50   | 60    | 70    | 80   |                |
| 25.0             | 1.16                      | 0.93  | 0.70 | 0.47 | 0.24  | --    | --   |                |
| 22.5             | 1.53                      | 1.26  | 1.00 | 0.73 | 0.47  | 0.20  | --   |                |
| 20.0             | 2.00                      | 1.69  | 1.38 | 1.07 | 0.76  | 0.45  | 0.14 |                |
| 17.5             | 2.62                      | 2.25  | 1.88 | 1.51 | 1.14  | 0.77  | 0.40 |                |
| 15.0             | 3.46                      | 3.01  | 2.56 | 2.11 | 1.66  | 1.21  | 0.76 |                |
| 12.5             | 4.51                      | 3.95  | 3.38 | 2.82 | 2.26  | 1.69  | 1.13 |                |
| 10.0             | 5.90                      | 5.17  | 4.43 | 3.69 | 2.95  | 2.21  | 1.48 |                |
| 7.5              | 8.26                      | 7.23  | 6.20 | 5.16 | 4.13  | 3.10  | 2.07 |                |
| 5.0              | 13.03                     | 11.41 | 9.78 | 8.15 | 6.52  | 4.89  | 3.26 |                |
| 2.5              | ---                       | ---   | ---  | ---  | 13.75 | 10.31 | 6.87 |                |

|  |             |
|--|-------------|
| Maximum junction temperature                           | 125°C       |
| Heatsink temperature                                   | 100°C       |
| Junction to case thermal resistance, R <sub>thjc</sub> | <0.36 °C/W  |
| Case to heatsink thermal resistance, R <sub>thcs</sub> | < 0.90 °C/W |

4. Thermal resistance case to heasink values are applicable upon application of a fine layer of silicon based thermal paste HTS02S from electrolube between SSR and heatsink.

## Connection in Application



## Short Circuit Protection

### Protection Co-ordination, Type 1:

Type 1 protection implies that after a short circuit, the device under test will no longer be in a functioning state.

In case, however the short circuit has to be interrupted. The fuse between enclosure and supply shall not open. The door or cover of the enclosure shall not be blown open. There shall be no damage to conductors or terminals and the conductors shall not separate from terminals. There shall be no breakage or cracking of insulating bases to the extent that the integrity of the mounting of live parts is impaired. Discharge of parts or any risk of fire shall not occur.

The product variants listed in the table hereunder are suitable for use on a circuit capable of delivering not more than 5,000ADC, 600Volts maximum when protected by fuses. Tests at 5,000A were performed with RK5 fuses, time delay; please refer to the table below for maximum allowed ampere rating of the fuse. Use fuses only.

### Co-ordination type 1 (UL508)

| Part no. | Max. fuse size [A] | Class | Current [kA] | Voltage [VDC] |
|----------|--------------------|-------|--------------|---------------|
| RGC..15  | 25                 | RK5   | 5            | Max. 600      |
| RGS..15  | 25                 | RK5   | 5            | Max. 600      |
| RGS..25  | 25                 | RK5   | 5            | Max. 600      |

### Co-ordination type 1 (IEC/EN 60947-4-1)

| Part no. | Max. fuse size [A] | SIBA part no. | Current [kA] | Voltage [VDC] |
|----------|--------------------|---------------|--------------|---------------|
| RGC..15  | 16                 | 9008010.16    | 5            | Max. 600      |
| RGS..15  | 16                 | 9008010.16    | 5            | Max. 600      |
| RGS..25  | 25                 | 9008010.25    | 5            | Max. 600      |