

# Solid State Relays Industrial, 1-Phase ZS (IO) w. LED Types RAM1A, RAM1B



- Zero switching (RAM1A) or instant-on switching (RAM1B) AC Solid State Relay
- Direct copper bonding (DCB) technology
- LED indication
- Clip-on IP 20 protection cover
- Self-lifting terminals
- Housing free of moulding mass
- 2 input ranges: 3-32 \* and 20-280 VAC/22-48VDC
- Operational ratings: Up to 125AACrms and 600VACrms
- Blocking voltage: Up to 1600V<sub>p</sub>
- Opto-isolation: > 4000VACrms
- Integrated overvoltage protection by self switching (suffix "Z" option)

## Product Description

The industrial, 1-phase relay with antiparallel thyristor output is the most widely used industrial SSR due to its multiple application possibilities. The relay can be used for resistive, inductive and capacitive loads. The zero switching relay switches ON when the sinusoidal curve crosses zero and switches OFF when the current cross-

es zero. The instant-on relay with DC control input can be used for phase angle control. The built-in snubber secures transient protection. The LED indicates the status of the control input. The clip-on cover secures touch protection (IP 20). Protected output terminals can handle cables up to 16 mm<sup>2</sup>.

## Ordering Key

**RAM 1 A 60 D 125 Z**

Solid State Relay  
Number of poles  
Switching mode  
Rated operational voltage  
Control voltage  
Rated operational current  
Options

## Type Selection

| Switching mode                                                 | Rated operational voltage                       | Control voltage                                                         | Rated operational current                                                         | Options                                    |
|----------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------|
| A: Zero Switching<br>B: Instant-on switching (DC Control only) | 23: 230VACrms<br>60: 600VACrms<br>69: 690VACrms | A: 20-280 VAC/22-48VDC<br>D: 3 - 32VDC*                                 | 25 : 25AACrms<br>50 : 50AACrms<br>75 : 75AACrms<br>100:100AACrms<br>125:125AACrms | Z: Overvoltage protection (self-switching) |
|                                                                |                                                 | * 4 to 32VDC for RAM1A60..., RAM1A69...<br>* 4 to 32VDC for RAM1B types |                                                                                   |                                            |

## Selection Guide

| Rated operational voltage | Blocking voltage   | Control voltage     | Rated operational current |            |            |             |             |
|---------------------------|--------------------|---------------------|---------------------------|------------|------------|-------------|-------------|
|                           |                    |                     | 25A                       | 50A        | 75A        | 100A        | 125A        |
| 230VACrms                 | 650V <sub>p</sub>  | 3 - 32VDC           | RAM1A23D25                | RAM1A23D50 | RAM1A23D75 | RAM1A23D100 | RAM1A23D125 |
|                           |                    | 20-280VAC/22-48VDC  | RAM1A23A25                | RAM1A23A50 | RAM1A23A75 | RAM1A23A100 | RAM1A23A125 |
| 600VACrms                 | 1200V <sub>p</sub> | 4 - 32VDC           | RAM1A60D25                | RAM1A60D50 | RAM1A60D75 | RAM1A60D100 | RAM1A60D125 |
|                           |                    | 20-280VAC/22-48VDC  | RAM1A60A25                | RAM1A60A50 | RAM1A60A75 | RAM1A60A100 | RAM1A60A125 |
| 690VACrms                 | 1600V <sub>p</sub> | 4-32VDC             | -                         | -          | RAM1A69D75 | RAM1A69D100 | RAM1A69D125 |
|                           |                    | 20-280VAC/ 22-48VDC | -                         | -          | RAM1A69A75 | RAM1A69A100 | RAM1A69A125 |

### Options

1 Overvoltage protection by self-switching: add suffix Z to include. Example: RAM1A60D25Z. Not applicable for 690V version.

## General Specifications

|                             | RAM1.23..           | RAM1.60..           | RAM1.69..           |
|-----------------------------|---------------------|---------------------|---------------------|
| Operational voltage range   |                     |                     |                     |
| RAM1A...                    | 24 to 265VACrms     | 42 to 660VACrms     | 42 to 760VACrms     |
| RAM1B...                    | 42 to 265VACrms     | 42 to 660VACrms     | 42 to 760VACrms     |
| Blocking voltage            | $\geq 650V_p$       | $\geq 1200V_p$      | $\geq 1600V_p$      |
| Zero voltage turn-on        | $\leq 10V$          | $\leq 10V$          | $\leq 10V$          |
| Operational frequency range | 45 to 65Hz          | 45 to 65Hz          | 45 to 65Hz          |
| Power factor                | $> 0.5 @ 230VACrms$ | $> 0.5 @ 600VACrms$ | $> 0.5 @ 690VACrms$ |
| Approvals                   | UL, cUL, CSA, VDE*  | UL, cUL, CSA, VDE*  | -                   |
| CE-marking                  | Yes                 | Yes**               | Yes**               |

\* VDE0805

\*\* Heatsink must be connected to ground

## Input Specifications

|                                      | RAM1...D..       | RAM1...A..          |
|--------------------------------------|------------------|---------------------|
| Control voltage range                |                  |                     |
| RAM1A23...                           | 3-32VDC          | 20-280VAC, 22-48VDC |
| RAM1A60..., RAM1A69...               | 4-32VDC          | 20-280VAC, 22-48VDC |
| RAM1B...                             | 4-32VDC          | -                   |
| Pick-up voltage @ $T_a = 25^\circ C$ |                  |                     |
| RAM1A23...                           | 2.5VDC           | 18VAC/DC            |
| RAM1A60..., RAM1A69...               | 3.5VDC           | 18VAC/DC            |
| RAM1B...                             | 3.5VDC           | -                   |
| Reverse voltage                      | 32VDC            | -                   |
| Drop out voltage                     | 1.2VDC           | 6VAC/DC             |
| Input current @ max input voltage    |                  |                     |
| RAM1A                                | $\leq 12mA$      | $\leq 20mA$         |
| RAM1B                                | $\leq 15mA$      | -                   |
| Response time pick-up                |                  |                     |
| RAM1A                                | $\leq 1/2$ cycle | $\leq 12ms$         |
| RAM1B                                | $\leq 0.1ms$     | -                   |
| Response time drop-out               | $\leq 1/2$ cycle | $\leq 40ms$         |

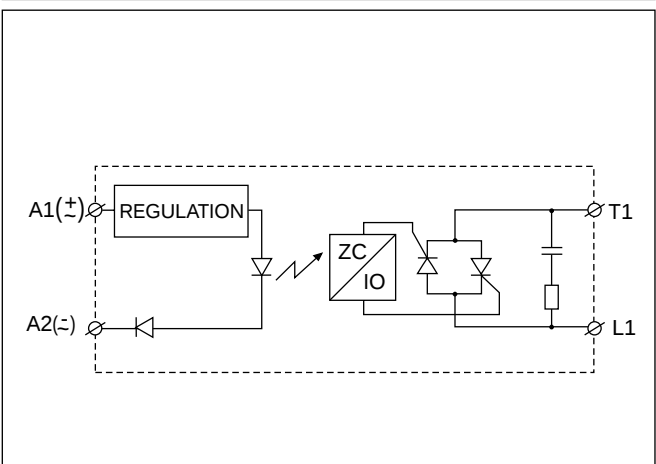
## Output Specifications

|                                                         | RAM1...25      | RAM...50       | RAM1...75      | RAM1...100     | RAM...125      |
|---------------------------------------------------------|----------------|----------------|----------------|----------------|----------------|
| Rated operational current                               |                |                |                |                |                |
| AC51 @ $T_a = 25^\circ C$                               | 25Arms         | 50Arms         | 75Arms         | 100Arms        | 125Arms        |
| AC53a @ $T_a = 25^\circ C$                              | 5Arms          | 15Arms         | 17Arms         | 20Arms         | 30Arms         |
| Min. operational current                                | 150mA          | 250mA          | 400mA          | 400mA          | 500mA          |
| Rep. overload current $t=1$ s                           | $< 55AACrms$   | $< 125AACrms$  | $< 130 AACrms$ | $< 150 AACrms$ | $< 200AACrms$  |
| Non-rep. surge current $t=10$ ms                        | $325A_p$       | $600A_p$       | $800A_p$       | $1150A_p$      | $1900A_p$      |
| Off-state leakage current @ rated voltage and frequency | $< 3mArms$     | $< 3mArms$     | $< 3mArms$     | $< 3mArms$     | $< 3mArms$     |
| $I^2t$ for fusing $t=10$ ms                             | $< 520A^2s$    | $< 1800A^2s$   | $< 3200A^2s$   | $< 6600A^2s$   | $< 18000A^2s$  |
| On-state voltage drop                                   | $\leq 1.6Vrms$ | $\leq 1.6Vrms$ | $\leq 1.6Vrms$ | $\leq 1.6Vrms$ | $\leq 1.6Vrms$ |
| Critical $dV/dt$ off-state min.                         | $1000V/\mu s$  | $1000V/\mu s$  | $1000V/\mu s$  | $1000V/\mu s$  | $1000V/\mu s$  |

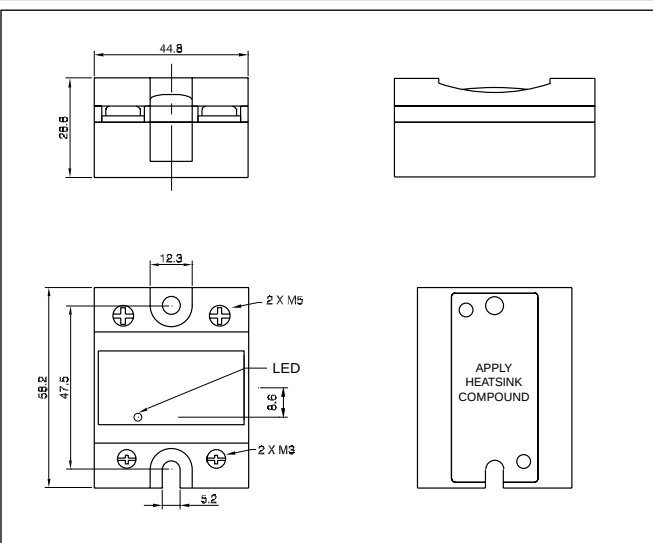
# Housing Specifications

|                                          |                                    |                                                        |                 |
|------------------------------------------|------------------------------------|--------------------------------------------------------|-----------------|
| Weight<br>25A, 50A<br>75A, 100A, 125A    | Approx. 60g<br>Approx. 100g        | Relay<br>Mounting screws<br>Mounting torque            | M5<br>1.5-2.0Nm |
| Housing material                         | Noryl, black                       | Control terminal<br>Mounting screws<br>Mounting torque | M3 x 9<br>0.5Nm |
| Baseplate<br>25A, 50A<br>75A, 100A, 125A | Aluminium<br>Copper, nickel-plated | Power terminal<br>Mounting screws<br>Mounting torque   | M5 x 9<br>2.4Nm |

# Functional Diagram



# Dimensions



All dimensions in mm.

# Heatsink Dimensions (load current versus ambient temperature)

## RAM..25

| Load current [A] | Thermal resistance [K/W] |       |       |       |       |      |      | Power dissipation [W] |
|------------------|--------------------------|-------|-------|-------|-------|------|------|-----------------------|
|                  | 20                       | 30    | 40    | 50    | 60    | 70   | 80   | T <sub>A</sub>        |
| 25.0             | 3.23                     | 2.80  | 2.37  | 1.94  | 1.51  | 1.09 | 0.66 | 23                    |
| 22.5             | 3.70                     | 3.21  | 2.73  | 2.24  | 1.75  | 1.26 | 0.78 | 21                    |
| 20.0             | 4.30                     | 3.74  | 3.17  | 2.61  | 2.05  | 1.49 | 0.92 | 18                    |
| 17.5             | 5.07                     | 4.41  | 3.76  | 3.10  | 2.44  | 1.78 | 1.12 | 15                    |
| 15.0             | 6.12                     | 5.33  | 4.54  | 3.75  | 2.96  | 2.17 | 1.38 | 13                    |
| 12.5             | 7.58                     | 6.61  | 5.64  | 4.66  | 3.69  | 2.72 | 1.75 | 10                    |
| 10.0             | 9.80                     | 8.55  | 7.30  | 6.05  | 4.80  | 3.55 | 2.30 | 8                     |
| 7.5              | 13.5                     | 11.80 | 10.09 | 8.37  | 6.66  | 4.94 | 3.23 | 6                     |
| 5.0              | -                        | 18.3  | 15.7  | 13.04 | 10.39 | 7.74 | 5.09 | 4                     |
| 2.5              | -                        | -     | -     | -     | -     | 16.2 | 10.7 | 2                     |

Ambient temp. [°C]

## RAM..50

| Load current [A] | Thermal resistance [K/W] |      |      |      |      |      |      | Power dissipation [W] |
|------------------|--------------------------|------|------|------|------|------|------|-----------------------|
|                  | 20                       | 30   | 40   | 50   | 60   | 70   | 80   | T <sub>A</sub>        |
| 50.0             | 1.25                     | 1.07 | 0.88 | 0.70 | 0.52 | 0.34 | 0.16 | 55                    |
| 45.0             | 1.46                     | 1.25 | 1.04 | 0.84 | 0.63 | 0.42 | 0.21 | 48                    |
| 40.0             | 1.73                     | 1.49 | 1.25 | 1.01 | 0.77 | 0.52 | 0.28 | 41                    |
| 35.0             | 2.08                     | 1.80 | 1.51 | 1.23 | 0.94 | 0.66 | 0.37 | 35                    |
| 30.0             | 2.56                     | 2.22 | 1.87 | 1.53 | 1.18 | 0.84 | 0.49 | 29                    |
| 25.0             | 3.24                     | 2.81 | 2.38 | 1.95 | 1.52 | 1.09 | 0.66 | 23                    |
| 20.0             | 4.26                     | 3.71 | 3.15 | 2.59 | 2.03 | 1.47 | 0.92 | 18                    |
| 15.0             | 5.99                     | 5.22 | 4.45 | 3.67 | 2.90 | 2.12 | 1.35 | 13                    |
| 10.0             | 9.49                     | 8.27 | 7.06 | 5.85 | 4.64 | 3.43 | 2.22 | 8                     |
| 5.0              | -                        | 17.5 | 15.0 | 12.4 | 9.91 | 7.39 | 4.86 | 4                     |

Ambient temp. [°C]

## Heatsink Dimensions (cont.)

### RAM..75

| Load current [A] | Thermal resistance [K/W] |       |       |       |      |      |      | Power dissipation [W] |
|------------------|--------------------------|-------|-------|-------|------|------|------|-----------------------|
|                  | 20                       | 30    | 40    | 50    | 60   | 70   | 80   | T <sub>A</sub>        |
| 75.0             | 0.94                     | 0.82  | 0.70  | 0.58  | 0.47 | 0.35 | 0.23 | 85                    |
| 67.5             | 1.10                     | 0.96  | 0.82  | 0.69  | 0.55 | 0.41 | 0.27 | 73                    |
| 60.0             | 1.30                     | 1.14  | 0.98  | 0.81  | 0.65 | 0.49 | 0.33 | 61                    |
| 52.5             | 1.57                     | 1.38  | 1.18  | 0.98  | 0.79 | 0.59 | 0.39 | 51                    |
| 45.0             | 1.95                     | 1.70  | 1.46  | 1.22  | 0.97 | 0.73 | 0.49 | 41                    |
| 37.5             | 2.48                     | 2.17  | 1.86  | 1.55  | 1.24 | 0.93 | 0.62 | 32                    |
| 30.0             | 3.32                     | 2.90  | 2.49  | 2.07  | 1.66 | 1.24 | 0.83 | 24                    |
| 22.5             | 4.75                     | 4.15  | 3.56  | 2.97  | 2.37 | 1.78 | 1.19 | 17                    |
| 15.0             | 7.68                     | 6.72  | 5.76  | 4.80  | 3.84 | 2.88 | 1.92 | 10                    |
| 7.5              | -                        | 14.59 | 12.50 | 10.42 | 8.34 | 6.25 | 4.17 | 5                     |

Ambient temp. [°C]

### RAM..100

| Load current [A] | Thermal resistance [K/W] |      |      |      |      |      |      | Power dissipation [W] |
|------------------|--------------------------|------|------|------|------|------|------|-----------------------|
|                  | 20                       | 30   | 40   | 50   | 60   | 70   | 80   | T <sub>A</sub>        |
| 100.0            | 0.60                     | 0.52 | 0.43 | 0.34 | 0.26 | 0.17 | 0.09 | 117                   |
| 90.0             | 0.74                     | 0.64 | 0.54 | 0.44 | 0.34 | 0.24 | 0.14 | 101                   |
| 80.0             | 0.91                     | 0.79 | 0.68 | 0.56 | 0.45 | 0.33 | 0.22 | 87                    |
| 70.0             | 1.09                     | 0.96 | 0.82 | 0.68 | 0.55 | 0.41 | 0.27 | 73                    |
| 60.0             | 1.33                     | 1.16 | 1.00 | 0.83 | 0.66 | 0.50 | 0.33 | 60                    |
| 50.0             | 1.66                     | 1.45 | 1.24 | 1.04 | 0.83 | 0.62 | 0.41 | 48                    |
| 40.0             | 2.16                     | 1.89 | 1.62 | 1.35 | 1.08 | 0.81 | 0.54 | 37                    |
| 30.0             | 3.01                     | 2.64 | 2.26 | 1.88 | 1.51 | 1.13 | 0.75 | 27                    |
| 20.0             | 4.73                     | 4.14 | 3.55 | 2.96 | 2.37 | 1.78 | 1.18 | 17                    |
| 10.0             | 9.94                     | 8.70 | 7.45 | 6.21 | 4.97 | 3.73 | 2.48 | 8                     |

Ambient temp. [°C]

### RAM..125

| Load current [A] | Thermal resistance [K/W] |      |      |      |      |      |      | Power dissipation [W] |
|------------------|--------------------------|------|------|------|------|------|------|-----------------------|
|                  | 20                       | 30   | 40   | 50   | 60   | 70   | 80   | T <sub>A</sub>        |
| 125.0            | 0.63                     | 0.55 | 0.47 | 0.40 | 0.32 | 0.24 | 0.16 | 126                   |
| 112.5            | 0.73                     | 0.64 | 0.54 | 0.45 | 0.36 | 0.27 | 0.18 | 110                   |
| 100.0            | 0.84                     | 0.74 | 0.63 | 0.53 | 0.42 | 0.32 | 0.21 | 95                    |
| 87.5             | 0.99                     | 0.87 | 0.74 | 0.62 | 0.50 | 0.37 | 0.25 | 81                    |
| 75.0             | 1.20                     | 1.05 | 0.90 | 0.75 | 0.60 | 0.45 | 0.30 | 67                    |
| 62.5             | 1.48                     | 1.30 | 1.11 | 0.93 | 0.74 | 0.56 | 0.37 | 54                    |
| 50.0             | 1.92                     | 1.68 | 1.44 | 1.20 | 0.96 | 0.72 | 0.48 | 42                    |
| 37.5             | 2.65                     | 2.32 | 1.98 | 1.65 | 1.32 | 0.99 | 0.66 | 30                    |
| 25.0             | 4.12                     | 3.60 | 3.09 | 2.57 | 2.06 | 1.54 | 1.03 | 19                    |
| 12.5             | 8.55                     | 7.48 | 6.41 | 5.34 | 4.27 | 3.21 | 2.14 | 9                     |

Ambient temp. [°C]

## Heatsink Selection

| Carlo Gavazzi Heatsink<br>(see Accessories) | Thermal resistance... | for power dissipation |
|---------------------------------------------|-----------------------|-----------------------|
| No heatsink required                        | ---                   | N/A                   |
| RHS 300                                     | 5.00 K/W              | > 0 W                 |
| RHS 100                                     | 3.00 K/W              | > 25 W                |
| RHS 45C                                     | 2.70 K/W              | > 55 W                |
| RHS 45B                                     | 2.00 K/W              | > 60 W                |
| RHS 90A                                     | 1.35 K/W              | > 60 W                |
| RHS 45C plus fan                            | 1.25 K/W              | > 0 W                 |
| RHS 45B plus fan                            | 1.20 K/W              | > 0 W                 |
| RHS 112A                                    | 1.10 K/W              | > 100 W               |
| RHS 301                                     | 0.80 K/W              | > 80 W                |
| RHS 90A plus fan                            | 0.45 K/W              | > 0 W                 |
| RHS 112A plus fan                           | 0.40 K/W              | > 0 W                 |
| RHS 301 plus fa                             | 0.25 K/W              | > 0 W                 |
| Consult your distribution                   | > 0.25 K/W            | N/A                   |
| Infinite heatsink - No solution             | ---                   | N/A                   |

## Thermal Specifications

|                       |                                 |
|-----------------------|---------------------------------|
| Operating temperature | -40° to +80°C (-40° to +176°F)  |
| Storage temperature   | -40° to +100°C (-40° to +212°F) |
| Junction temperature  | ≤ 125°C (257°F)                 |

## Isolation

|                         |              |
|-------------------------|--------------|
| Rated isolation voltage |              |
| Input to output         | ≥ 4000VACrms |
| Output to case          | ≥ 4000VACrms |

# Faston terminals



- Faston tabs
- Tab dimensions according to DIN 46342 part 1
- Pure tin-plated brass

## Ordering Key

**Screw mounted Faston terminals** **RAM1A60D25** **F 4\***

**RAM Solid State Relay Faston terminals**

**Tab orientation**

Input Tab width: 4.8mm  
Output Tab width: 6.3mm

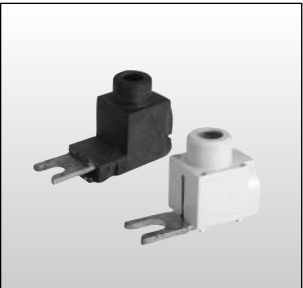
**Faston terminals in packs of 20** **RM48\*\*** **F4\***

**RS, RM Solid State Relay**

**Tab orientation**

- \* 0: Flat (0°)
- 4: Angled (45°)
- \*\* 48: 4.8mm faston for input
- 63: 6.3mm faston for output

# Fork Terminals



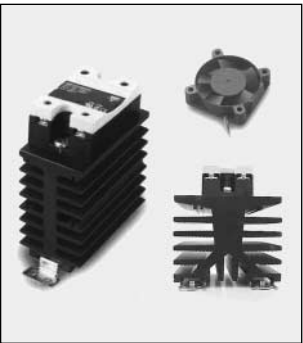
- Terminal adaptors for 35mm<sup>2</sup> cable
- Type RM635FK
- Pack size: 20 pieces

**Ordering Key** **RM635FK** **P**

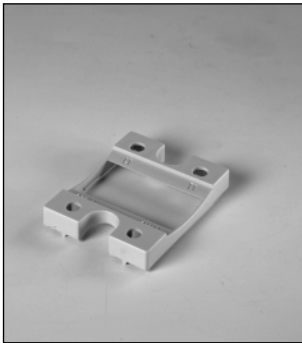
**RM terminal adaptor**

**Touch protected (optional)**

# Other Accessories



- Heatsinks and fans
- Type RHS....
- 0.25 to 5.00 k/W
- Single and dual relay types



- Touch safety cover
- Type RMIP20
- IP20 protection degree
- Pack size: 20 pieces

All accessories can be ordered pre-assembled with Solid State Relays.  
Other accessories include DIN rail adaptors, fuses, varistors and spacers.  
For further information refer to Accessories datasheets.