

# Thyristor Modules

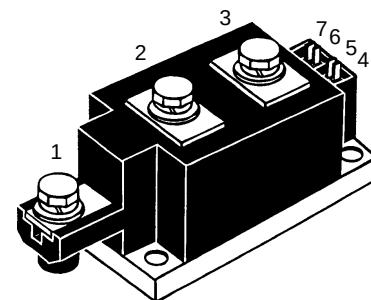
## Thyristor/Diode Modules

$$I_{TRMS} = 2 \times 450 \text{ A}$$

$$I_{TAVM} = 2 \times 250 \text{ A}$$

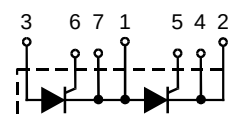
$$V_{RRM} = 1200\text{-}1800 \text{ V}$$

| $V_{RSM}$<br>$V_{DSM}$<br>V | $V_{RRM}$<br>$V_{DRM}$<br>V | Type          |               |
|-----------------------------|-----------------------------|---------------|---------------|
| 1300                        | 1200                        | MCC 255-12io1 | MCD 255-12io1 |
| 1500                        | 1400                        | MCC 255-14io1 | MCD 255-14io1 |
| 1700                        | 1600                        | MCC 255-16io1 | MCD 255-16io1 |
| 1900                        | 1800                        | MCC 255-18io1 | MCD 255-18io1 |

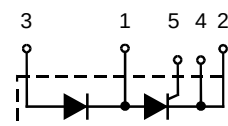


| Symbol                                       | Test Conditions                                                                                                                                        |                                   | Maximum Ratings |                  |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------|------------------|
| $I_{TRMS}, I_{FRMS}$<br>$I_{TAVM}, I_{FAVM}$ | $T_{VJ} = T_{VJM}$<br>$T_C = 85^\circ\text{C}; 180^\circ \text{ sine}$                                                                                 |                                   | 450<br>250      | A<br>A           |
| $I_{TSM}, I_{FSM}$                           | $T_{VJ} = 45^\circ\text{C};$<br>$V_R = 0$                                                                                                              | $t = 10 \text{ ms (50 Hz)}$       | 9000            | A                |
|                                              |                                                                                                                                                        | $t = 8.3 \text{ ms (60 Hz)}$      | 9600            | A                |
|                                              | $T_{VJ} = T_{VJM}$<br>$V_R = 0$                                                                                                                        | $t = 10 \text{ ms (50 Hz)}$       | 7800            | A                |
|                                              |                                                                                                                                                        | $t = 8.3 \text{ ms (60 Hz)}$      | 8600            | A                |
| $\int i^2 dt$                                | $T_{VJ} = 45^\circ\text{C}$<br>$V_R = 0$                                                                                                               | $t = 10 \text{ ms (50 Hz)}$       | 405 000         | A <sup>2</sup> s |
|                                              |                                                                                                                                                        | $t = 8.3 \text{ ms (60 Hz)}$      | 382 000         | A <sup>2</sup> s |
|                                              | $T_{VJ} = T_{VJM}$<br>$V_R = 0$                                                                                                                        | $t = 10 \text{ ms (50 Hz)}$       | 304 000         | A <sup>2</sup> s |
|                                              |                                                                                                                                                        | $t = 8.3 \text{ ms (60 Hz)}$      | 307 000         | A <sup>2</sup> s |
| $(di/dt)_{cr}$                               | $T_{VJ} = T_{VJM}$<br>$f = 50 \text{ Hz}, t_p = 200 \mu\text{s}$<br>$V_D = 2/3 V_{DRM}$<br>$I_G = 1 \text{ A},$<br>$di_G/dt = 1 \text{ A}/\mu\text{s}$ | repetitive, $I_T = 860 \text{ A}$ | 100             | A/ $\mu\text{s}$ |
|                                              |                                                                                                                                                        | non repetitive, $I_T = I_{TAVM}$  | 500             | A/ $\mu\text{s}$ |
| $(dv/dt)_{cr}$                               | $T_{VJ} = T_{VJM}; V_{DR} = 2/3 V_{DRM}$<br>$R_{GK} = \infty; \text{method 1 (linear voltage rise)}$                                                   |                                   | 1000            | V/ $\mu\text{s}$ |
| $P_{GM}$                                     | $T_{VJ} = T_{VJM}$<br>$I_T = I_{TAVM}$                                                                                                                 | $t_p = 30 \mu\text{s}$            | 120             | W                |
|                                              |                                                                                                                                                        | $t_p = 500 \mu\text{s}$           | 60              | W                |
| $P_{GAV}$                                    |                                                                                                                                                        |                                   | 20              | W                |
| $V_{RGM}$                                    |                                                                                                                                                        |                                   | 10              | V                |
| $T_{VJ}$                                     |                                                                                                                                                        |                                   | -40...+130      | °C               |
| $T_{VJM}$                                    |                                                                                                                                                        |                                   | 130             | °C               |
| $T_{stg}$                                    |                                                                                                                                                        |                                   | -40...+125      | °C               |
| $V_{ISOL}$                                   | 50/60 Hz, RMS<br>$I_{ISOL} \leq 1 \text{ mA}$                                                                                                          | $t = 1 \text{ min}$               | 3000            | V~               |
|                                              |                                                                                                                                                        | $t = 1 \text{ s}$                 | 3600            | V~               |
| $M_d$                                        | Mounting torque (M6)<br>Terminal connection torque (M8)                                                                                                |                                   | 4.5-7/40-62     | Nm/lb.in.        |
|                                              |                                                                                                                                                        |                                   | 11-13/97-115    | Nm/lb.in.        |
| Weight                                       | Typical including screws                                                                                                                               |                                   | 750             | g                |

MCC



MCD



### Features

- International standard package
- Direct copper bonded  $\text{Al}_2\text{O}_3$ -ceramic with copper base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered E 72873
- Keyed gate/cathode twin pins

### Applications

- Motor control, softstarter
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Solid state switches

### Advantages

- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.  
IXYS reserves the right to change limits, test conditions and dimensions

| Symbol             | Test Conditions                                                                                                                                                                 | Characteristic Values        |                  |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------|
| $I_{RRM}, I_{DRM}$ | $T_{VJ} = T_{VJM}; V_R = V_{RRM}; V_D = V_{DRM}$                                                                                                                                | 40                           | mA               |
| $V_T, V_F$         | $I_T, I_F = 600 \text{ A}; T_{VJ} = 25^\circ\text{C}$                                                                                                                           | 1.36                         | V                |
| $V_{T0}$           | For power-loss calculations only ( $T_{VJ} = 130^\circ\text{C}$ )                                                                                                               | 0.8                          | V                |
| $r_T$              |                                                                                                                                                                                 | 0.68                         | mΩ               |
| $V_{GT}$           | $V_D = 6 \text{ V}; T_{VJ} = 25^\circ\text{C}$                                                                                                                                  | 2                            | V                |
|                    | $T_{VJ} = -40^\circ\text{C}$                                                                                                                                                    | 3                            | V                |
| $I_{GT}$           | $V_D = 6 \text{ V}; T_{VJ} = 25^\circ\text{C}$                                                                                                                                  | 150                          | mA               |
|                    | $T_{VJ} = -40^\circ\text{C}$                                                                                                                                                    | 220                          | mA               |
| $V_{GD}$           | $T_{VJ} = T_{VJM}; V_D = 2/3 V_{DRM}$                                                                                                                                           | 0.25                         | V                |
| $I_{GD}$           | $T_{VJ} = T_{VJM}; V_D = 2/3 V_{DRM}$                                                                                                                                           | 10                           | mA               |
| $I_L$              | $T_{VJ} = 25^\circ\text{C}; t_p = 30 \mu\text{s}; V_D = 6 \text{ V}$<br>$I_G = 0.45 \text{ A}; di_G/dt = 0.45 \text{ A}/\mu\text{s}$                                            | 200                          | mA               |
| $I_H$              | $T_{VJ} = 25^\circ\text{C}; V_D = 6 \text{ V}; R_{GK} = \infty$                                                                                                                 | 150                          | mA               |
| $t_{gd}$           | $T_{VJ} = 25^\circ\text{C}; V_D = 1/2 V_{DRM}$<br>$I_G = 1 \text{ A}; di_G/dt = 1 \text{ A}/\mu\text{s}$                                                                        | 2                            | μs               |
| $t_q$              | $T_{VJ} = T_{VJM}; I_T = 300 \text{ A}, t_p = 200 \mu\text{s}; -di/dt = 10 \text{ A}/\mu\text{s}$<br>$V_R = 100 \text{ V}; dv/dt = 50 \text{ V}/\mu\text{s}; V_D = 2/3 V_{DRM}$ | typ. 200                     | μs               |
| $Q_S$              | $T_{VJ} = 125^\circ\text{C}; I_T, I_F = 300 \text{ A}; -di/dt = 50 \text{ A}/\mu\text{s}$                                                                                       | 760                          | μC               |
| $I_{RM}$           |                                                                                                                                                                                 | 275                          | A                |
| $R_{thJC}$         | per thyristor (diode); DC current per module                                                                                                                                    | other values<br>see Fig. 8/9 | 0.140 K/W        |
| $R_{thJK}$         | per thyristor (diode); DC current per module                                                                                                                                    |                              | 0.07 K/W         |
|                    |                                                                                                                                                                                 |                              | 0.18 K/W         |
|                    |                                                                                                                                                                                 |                              | 0.09 K/W         |
| $d_S$              | Creeping distance on surface                                                                                                                                                    | 12.7                         | mm               |
| $d_A$              | Creepage distance in air                                                                                                                                                        | 9.6                          | mm               |
| $a$                | Maximum allowable acceleration                                                                                                                                                  | 50                           | m/s <sup>2</sup> |

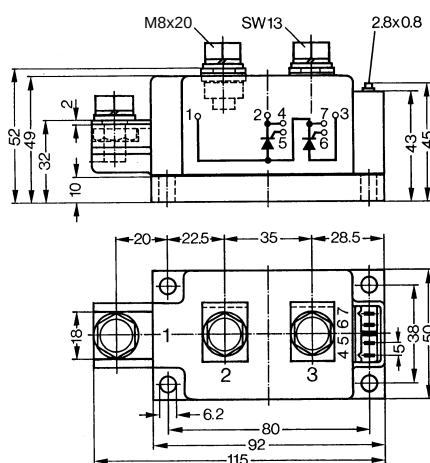
### Optional accessories for modules

Keyed Gate/Cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red

Type **ZY 180 L** (L = Left for pin pair 4/5) } UL 758, style 1385,  
Type **ZY 180 R** (R = Right for pin pair 6/7) } CSA class 5851, guide 460-1-1

**Dimensions in mm (1 mm = 0.0394")**

## MCC 255



## MCD 255

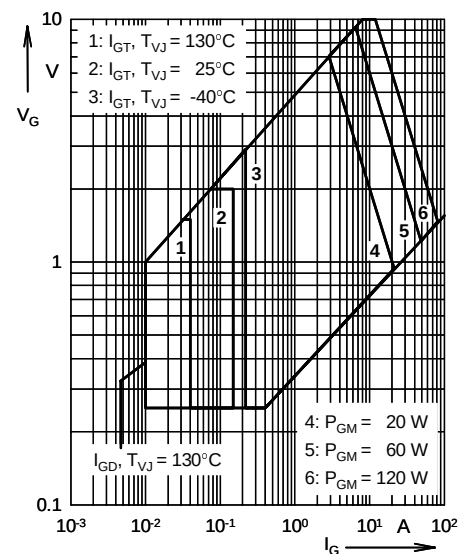
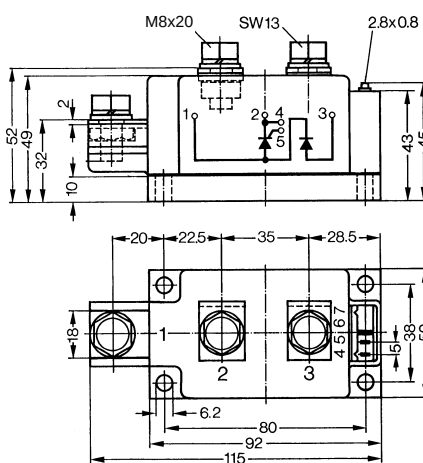


Fig. 1 Gate trigger characteristics

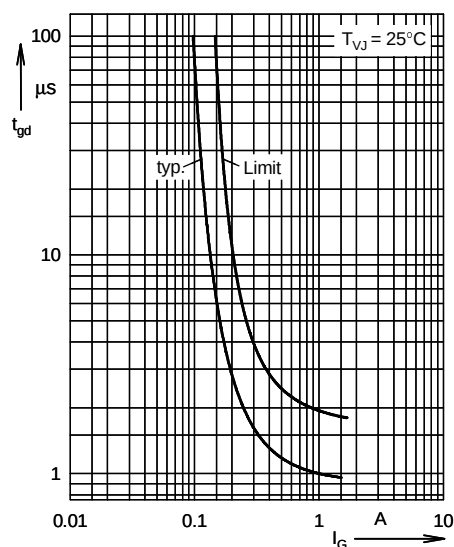


Fig. 2 Gate trigger delay time

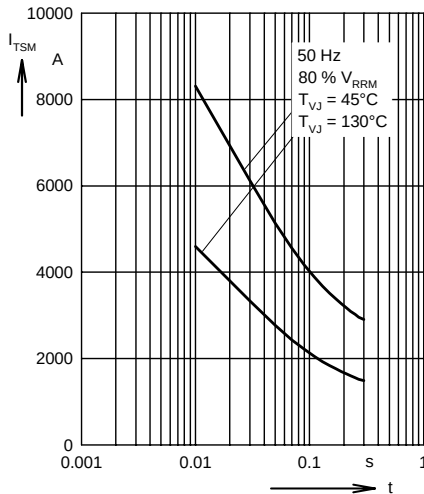


Fig. 3 Surge overload current  
 $I_{TSM}$ ,  $I_{FSM}$ : Crest value,  $t$ : duration

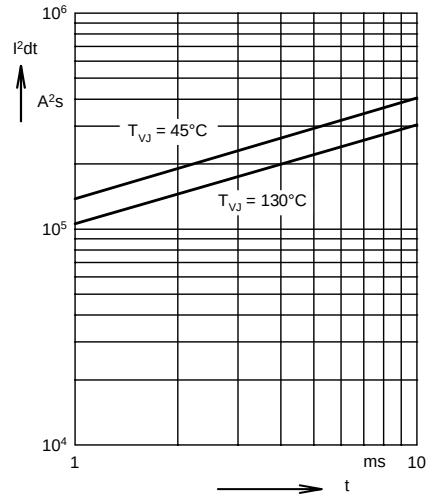


Fig. 4  $\int i^2 dt$  versus time (1-10 ms)

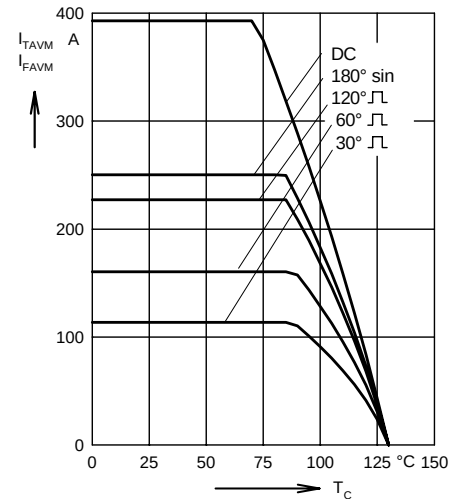


Fig. 4a Maximum forward current at case temperature

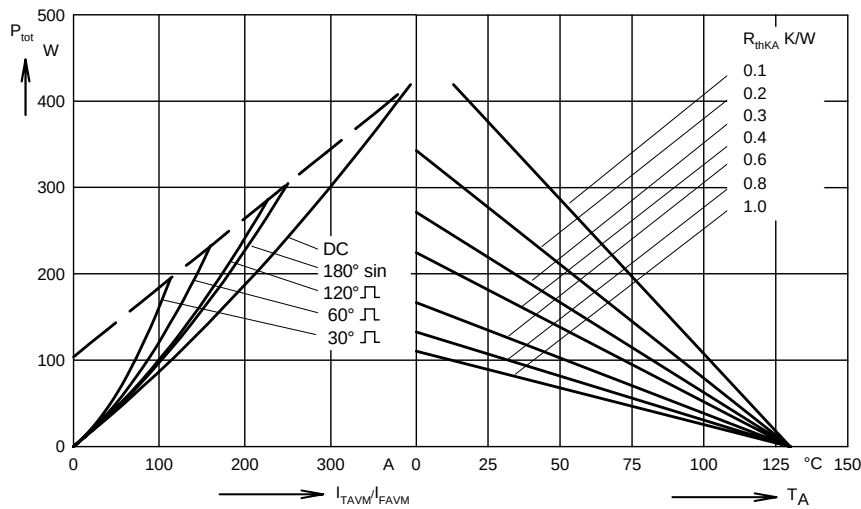


Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

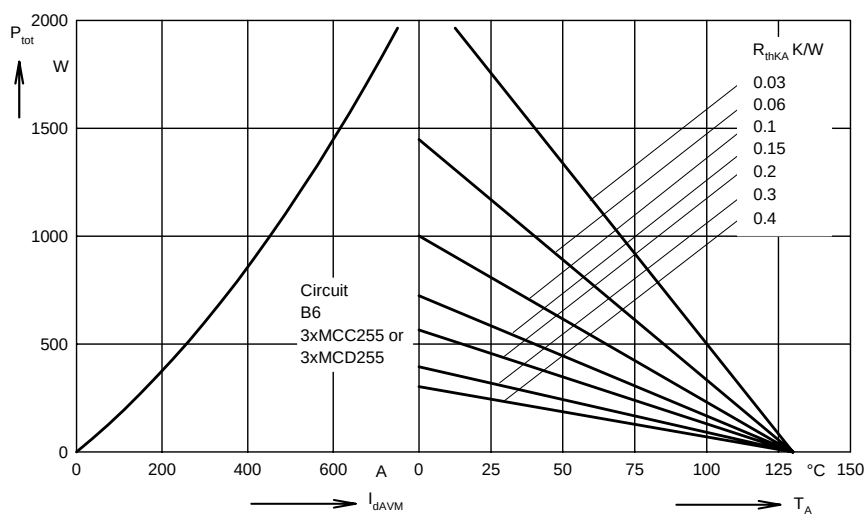


Fig. 6 Three phase rectifier bridge:  
Power dissipation versus direct output current and ambient temperature

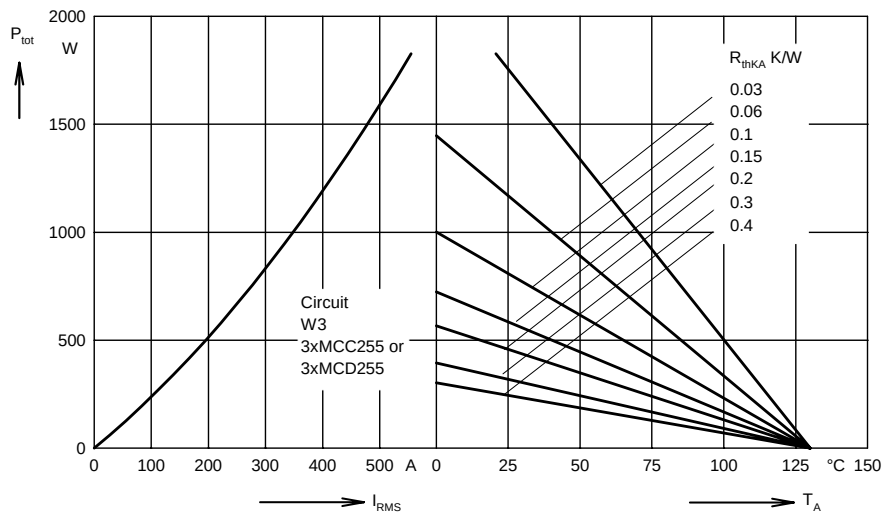


Fig. 7 Three phase AC-controller:  
Power dissipation versus RMS  
output current and ambient  
temperature

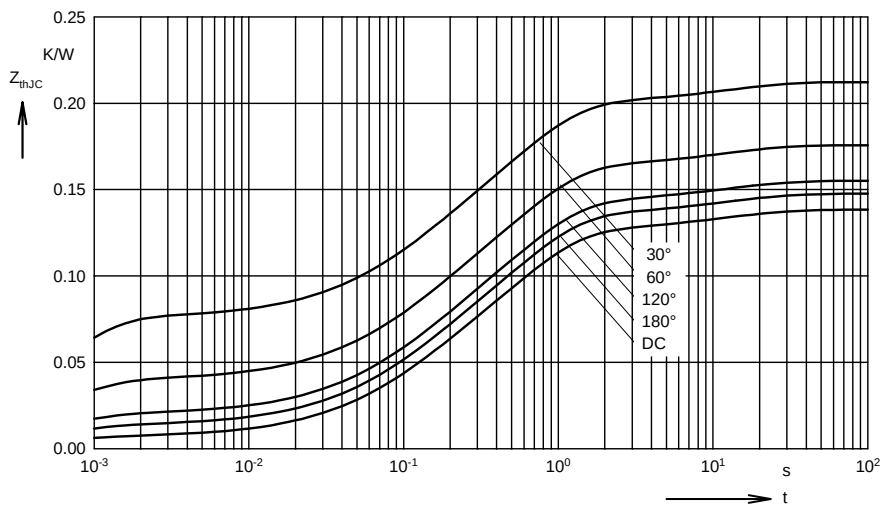


Fig. 8 Transient thermal impedance  
junction to case (per thyristor or  
diode)

$R_{thJC}$  for various conduction angles d:

| d    | $R_{thJC}$ (K/W) |
|------|------------------|
| DC   | 0.139            |
| 180° | 0.148            |
| 120° | 0.156            |
| 60°  | 0.176            |
| 30°  | 0.214            |

Constants for  $Z_{thJC}$  calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|-----------------|-----------|
| 1 | 0.0066          | 0.00054   |
| 2 | 0.0358          | 0.098     |
| 3 | 0.0831          | 0.54      |
| 4 | 0.0129          | 12        |

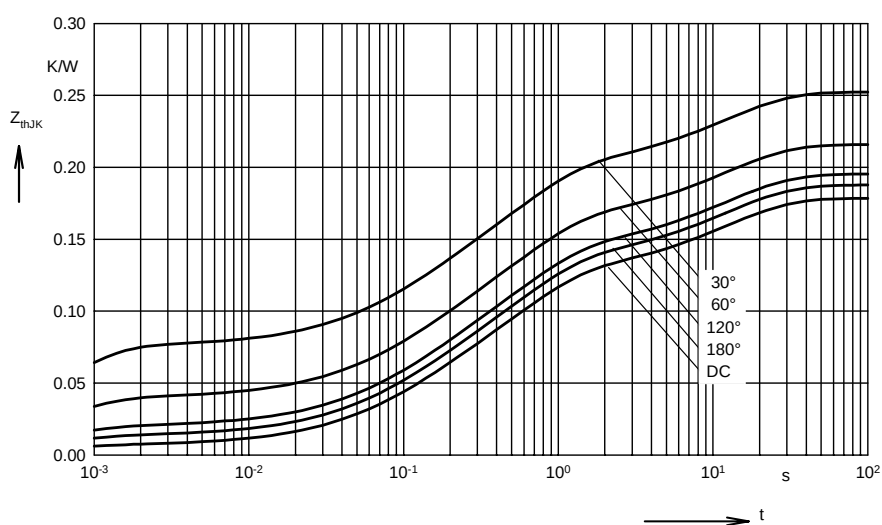


Fig. 9 Transient thermal impedance  
junction to heatsink (per thyristor  
or diode)

$R_{thJK}$  for various conduction angles d:

| d    | $R_{thJK}$ (K/W) |
|------|------------------|
| DC   | 0.179            |
| 180° | 0.188            |
| 120° | 0.196            |
| 60°  | 0.216            |
| 30°  | 0.254            |

Constants for  $Z_{thJK}$  calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|-----------------|-----------|
| 1 | 0.0066          | 0.00054   |
| 2 | 0.0358          | 0.098     |
| 3 | 0.0831          | 0.54      |
| 4 | 0.0129          | 12        |
| 5 | 0.04            | 12        |