



# POWER MODULES, ASSEMBLIES AND DRIVERS

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## Contact details

## General information

This is a document intended for general guidance with the product list of the devices produced by CJSC «Electrum AV».

When choosing and ordering an device is recommended previously to review the User's manual of the device (see links).

The information in the user's manuals is more complete; catalog information can be presented in general form (e.g., not all the dimension drawings are represented) or the information can be incomplete and insufficient to order.

When ordering the drivers you should specify the names shown in this Catalogue.

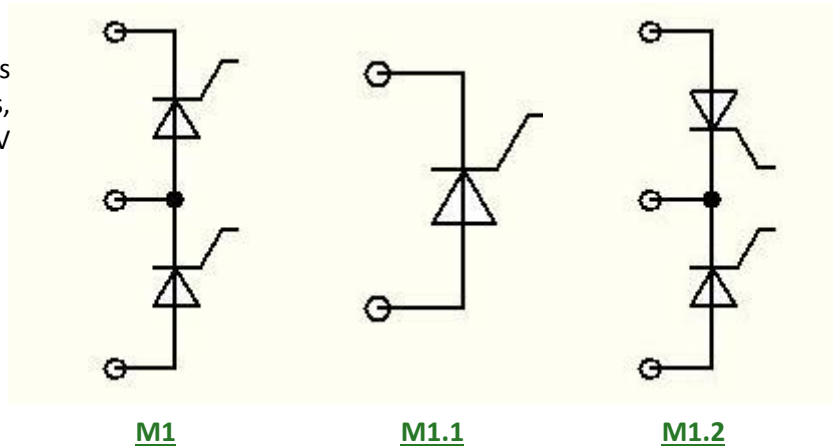
Contact details see in the end of the Catalogue.

## Modules based on thyristors and rectifier diodes

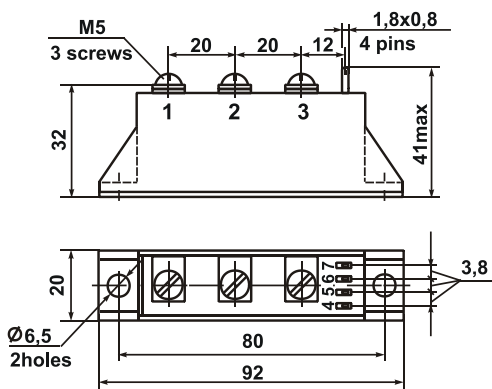


### Thyristor assemblies of series M1

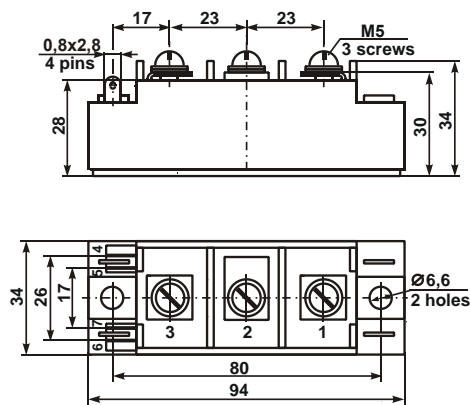
Thyristor modules are thyristor assemblies intended to operate as a part of converters, rectifiers with maximum peak voltage 1200 V or 1600 V and average current up to 250 A.



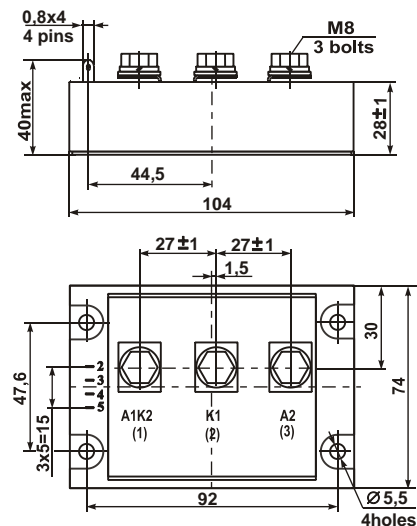
Type	Maximum average current, A									
	25	40	63	80	100	125	160	200	250	
<b>M1</b>	Fig. 1,2	Fig. 1,2	Fig. 1,2	Fig.2	Fig. 2	Fig. 2	Fig. 2	Fig. 3	Fig.3	
<b>M1.1</b>	Fig. 1	Fig. 1	Fig. 1	Fig.1,2	Fig. 1,2	Fig. 2	Fig. 2	Fig. 3	Fig.3	
<b>M1.2</b>	Fig. 1,2	Fig. 1,2	Fig. 1,2	Fig.1,2	Fig. 1,2	Fig. 2	Fig. 2	Fig. 3	Fig. 3	



**Figure 1**



**Figure 2**

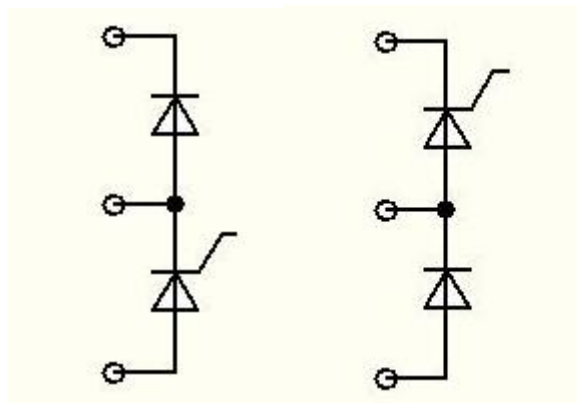


**Figure 3**

### Thyristor-diode assemblies M2, M3

Modules **M2** – thyristor-diode modules, with common cathode of thyristor and anode of diode. The modules are produced with an amount of maximum average current 25,40,63,80,100,125,160,200,250 A, with peak voltage 1200 V or 1600 V.

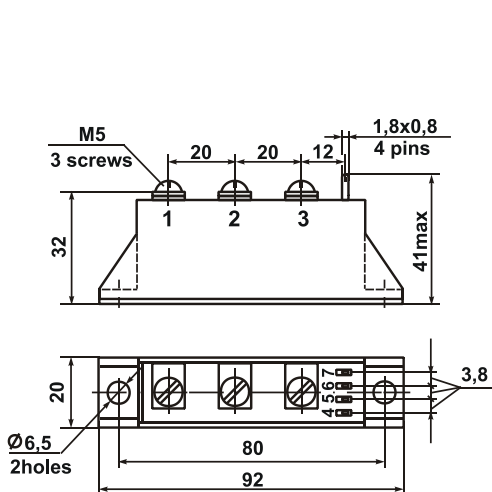
Modules **M3** – thyristor-diode modules, with common anode of thyristor and cathode of diode. The modules are produced with an amount of maximum average current 25,40,63,100,160,250 A, with peak voltage 1200 V or 1600 V.



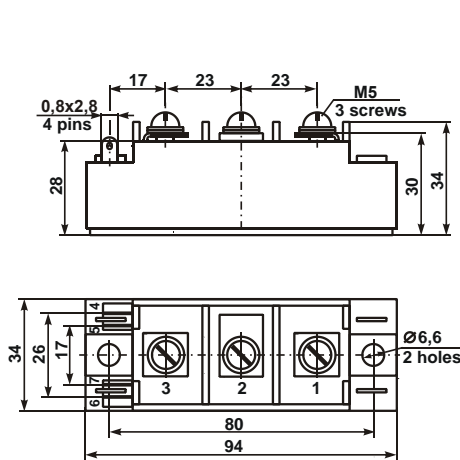
**M2**

**M3**

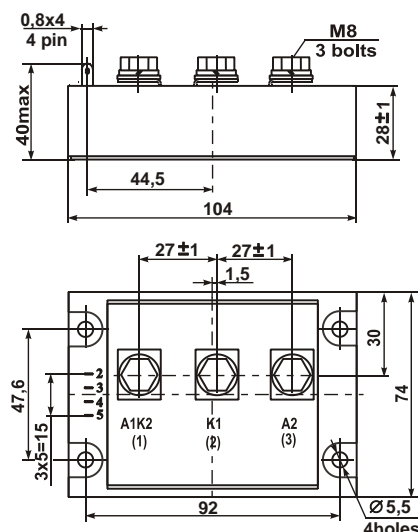
Type	Maximum average current, A								
	25	40	63	80	100	125	160	200	250
<b>M2</b>	Fig. 1,2	Fig. 1,2	Fig. 1,2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 3	Fig. 3
<b>M3</b>	Fig. 1	Fig. 1	Fig. 1	Fig. 1,2	Fig. 1,2	Fig. 2	Fig. 2	Fig. 3	Fig. 3



**Figure 1**



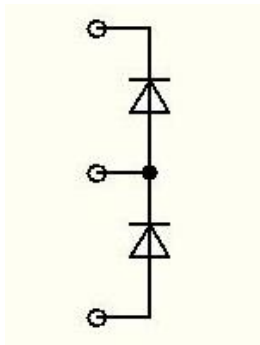
**Figure 2**



**Figure 3**

### Diode assemblies of series M4

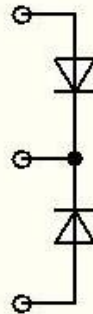
Modules of series **M4** – diode assemblies based on rectifier diodes. The modules are produced with an amount of maximum average current 25,40,63,80,100,125,160,200,250 A, with peak voltage 1200V or 1600V.



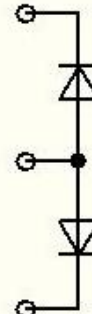
**M4**



**M4.1**

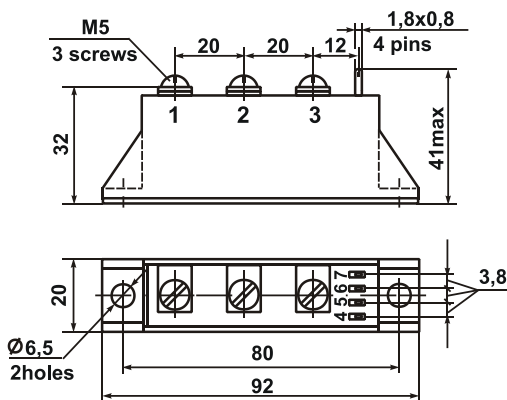


**M4.2**

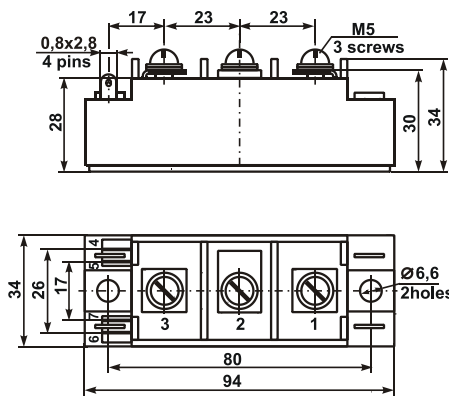


**M4.3**

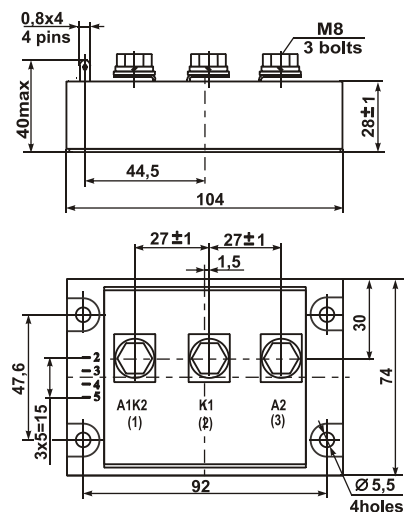
Type	Maximum average current, A								
	25	40	63	80	100	125	160	200	250
<b>M4</b>	Fig. 1,2	Fig. 1,2	Fig. 1,2	Fig. 1,2	Fig. 2	Fig. 2	Fig. 2	Fig. 3	Fig. 3
<b>M4.1</b>	Fig. 1,2	Fig. 1,2	Fig. 1,2	Fig. 1,2	Fig. 2	Fig. 2	Fig. 2	Fig. 3	Fig. 3
<b>M4.2</b>	Fig. 1,2	Fig. 1,2	Fig. 1,2	Fig. 1,2	Fig. 2	Fig. 2	Fig. 2	Fig. 3	Fig. 3
<b>M4.3</b>	Fig. 1,2	Fig. 1,2	Fig. 1,2	Fig. 1,2	Fig. 2	Fig. 2	Fig. 2	Fig. 3	Fig. 3



**Figure 1**



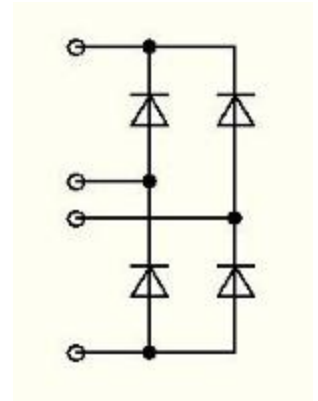
**Figure 2**



**Figure 3**

## Diode bridges M5

Modules **M5** – a single-phase diode rectifier bridge. The modules are produced with an amount of maximum average current 63,100,160,200,250 A with peak voltage 1200 V or 1600 V.



Type	Maximum average current, A				
	63	100	160	200	250
<b>M5</b>	Fig. 3	Fig. 1	Fig. 1	Fig. 2	Fig. 2

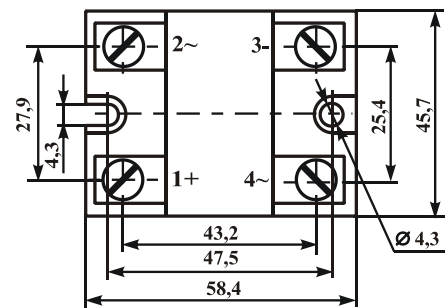
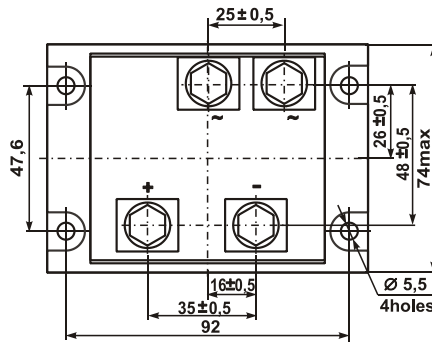
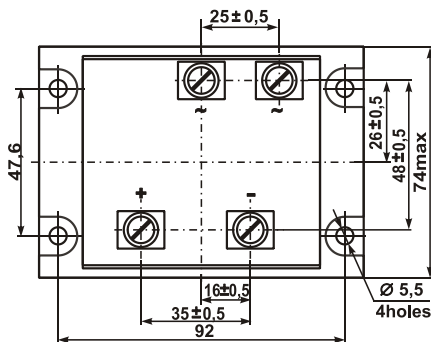
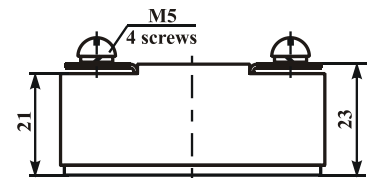
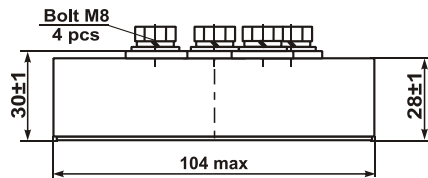
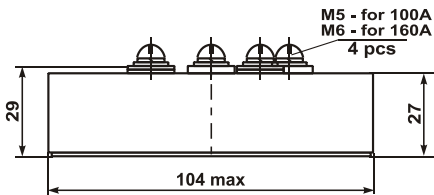


Figure 1

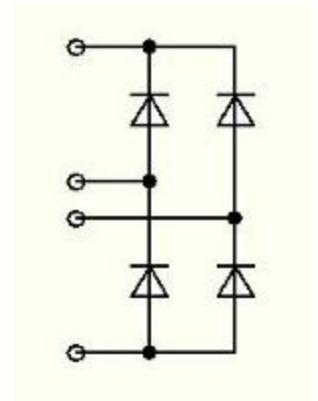
Figure 2

Figure 3



### Compact diode bridges M5

Compact modules **M5** – this is single-phase diode rectifier bridges of versions M5M, M5-PP2.1, M5-PP3 for PCB mounting. The modules are produced with an amount of maximum output average current 6,3, 25, 63, 100 A with peak voltage 1200 V.



Type	Maximum average current, A			
	6.3	25	63	100
M5M			Fig. 3	Fig. 3
M5-PP2.1	Fig. 1			
M5-PP3		Fig. 2		

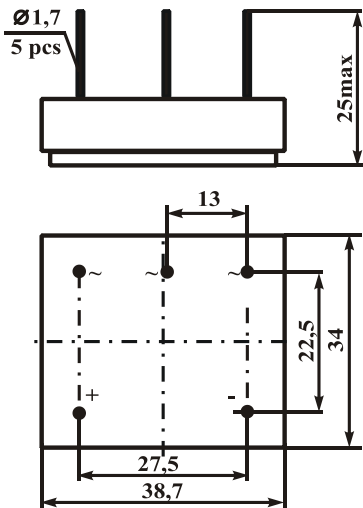


Figure 1

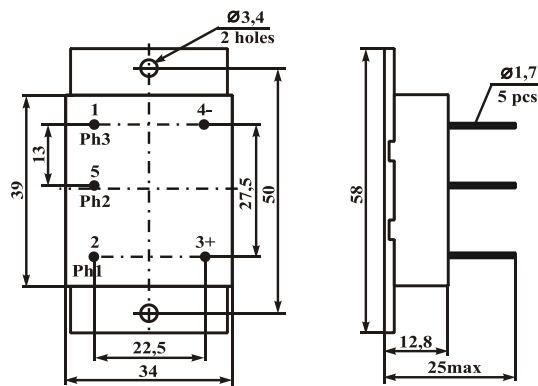


Figure 2

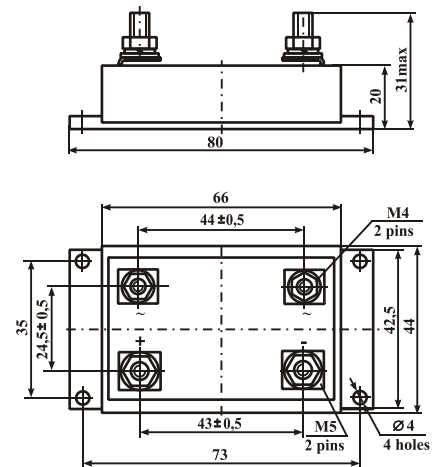
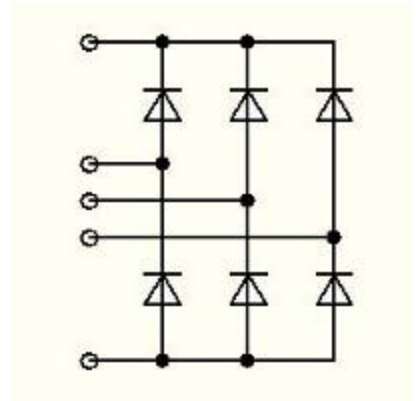


Figure 3

### Diode bridges M6

Modules **M6** – a three-phase diode rectifier bridge. The modules are produced with an amount of maximum output average current 63,100,160,200,250 A with peak voltage 1200 V or 1600 V.



Type	Maximum average current, A				
	63	100	160	200	250
<b>M6</b>	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 2

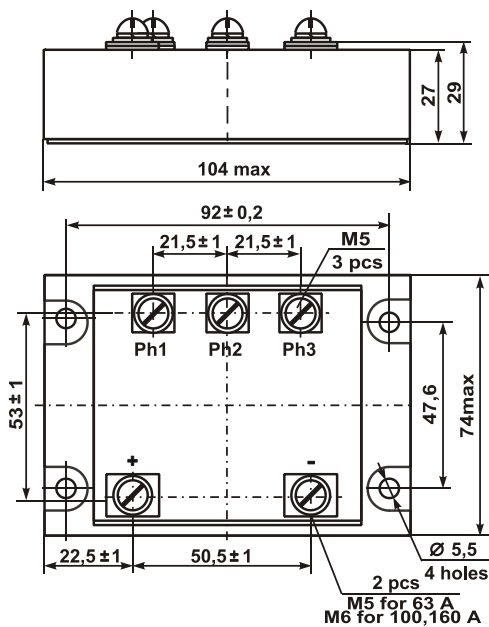


Figure 1

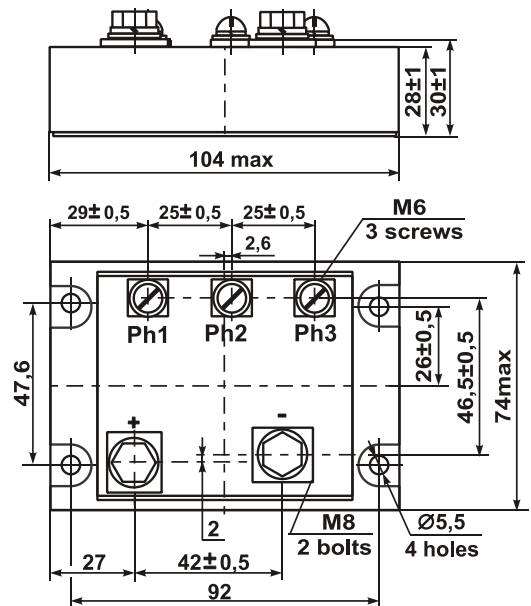
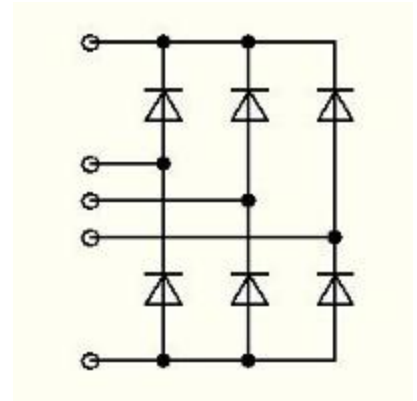


Figure 2

### Compact diodes bridges M6

Compact modules **M6** – this is three-phase diode rectifier bridges of versions M6M, M6-PP2.1, M6-PP3 for PCB mounting. The modules are produced with an amount of maximum output average current 6.3, 25, 63, 100 A with peak voltage 1200 V.



Type	Maximum average current, A			
	6.3	25	63	100
M6M			Fig. 3	Fig. 3
M6-PP2.1	Fig. 1			
M6-PP3		Fig. 2		

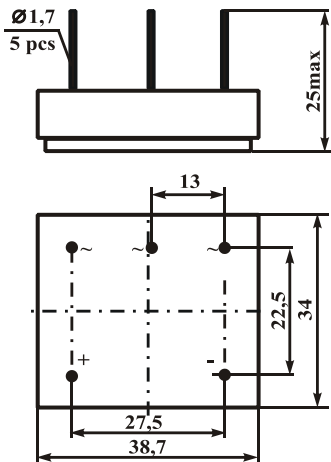


Figure 1

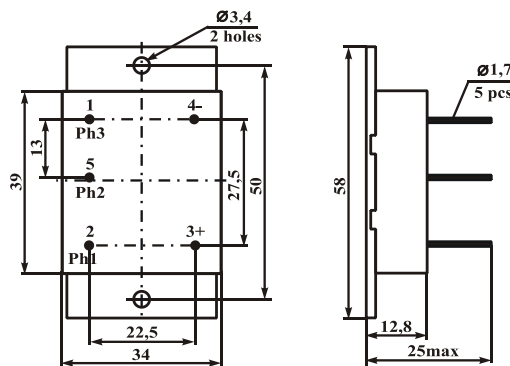


Figure 2

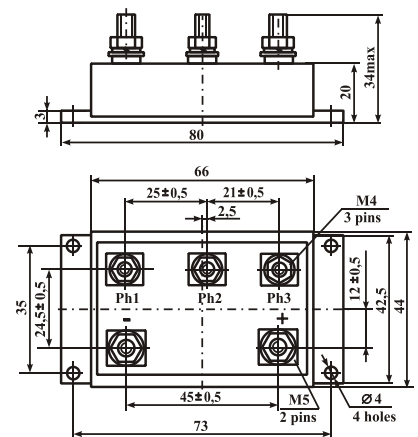
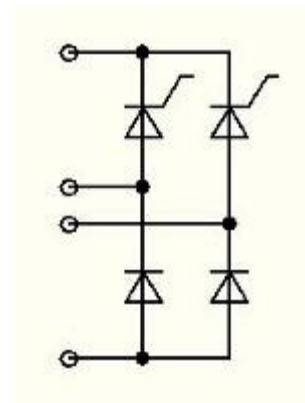


Figure 3

### Thyristor-diode bridges M20

Modules **M20** – a diode-thyristor single-phase rectifier bridge (thyristors in cathode group). The modules are produced with an amount of maximum output average current 63,100,160,200,250 A, with peak voltage 1200 V or 1600 V.



Type	Maximum average current, A				
	63	100	160	200	250
<b>M20</b>	Fig. 3	Fig. 1	Fig. 1	Fig. 2	Fig. 2

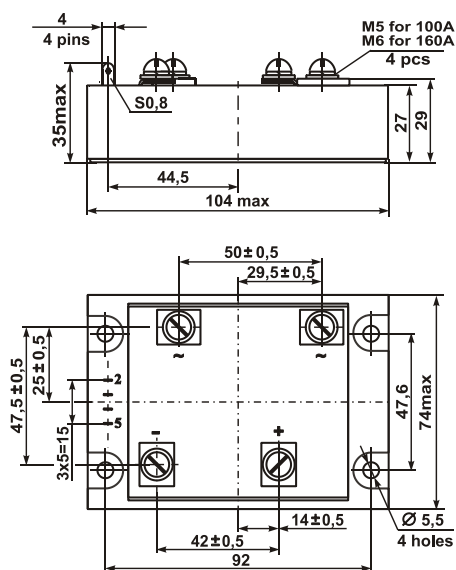


Figure 1

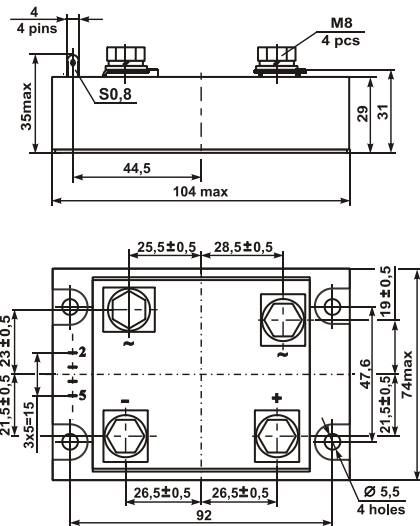


Figure 2

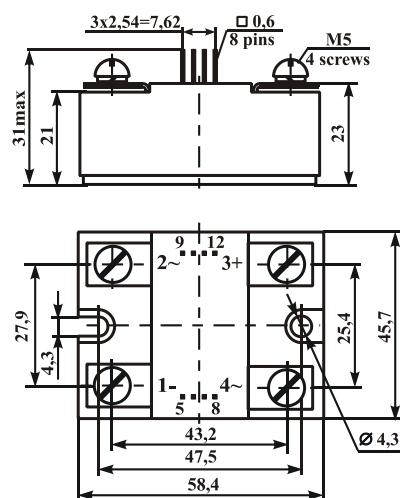
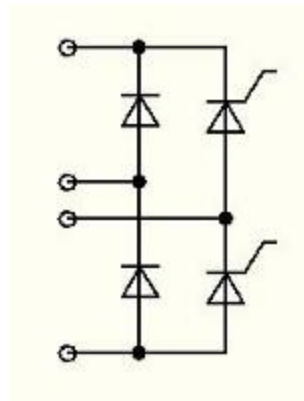


Figure 3

### Thyristor-diode bridges M21

Modules **M21** – a diode-thyristor single-phase rectifier bridge (thyristors in single arm). The modules are produced with an amount of maximum output average current 63,100,160 A, with peak voltage 1200 V or 1600 V.



Type	Maximum average current, A		
	63	100	160
<b>M21</b>	Fig. 2	Fig. 1	Fig. 1

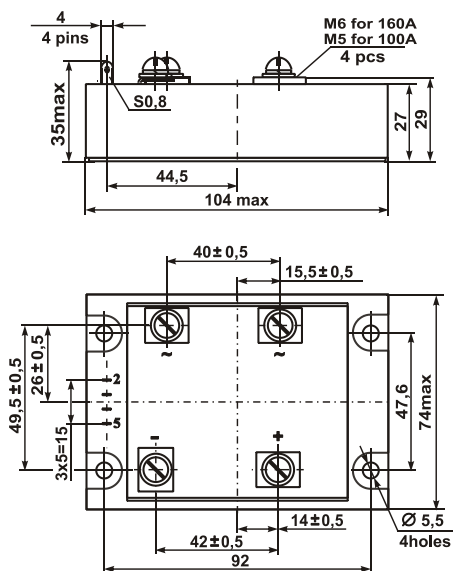


Figure 1

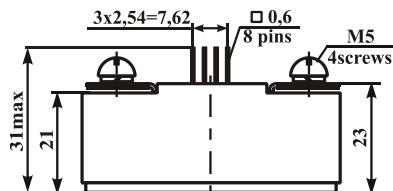
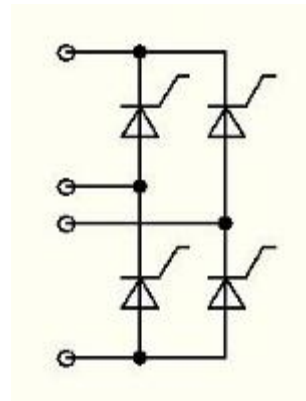


Figure 2

## Thyristor bridges M22

Modules **M22** – a thyristor single-phase rectifier bridge. The modules are produced with an amount of maximum output average current 63,100,160 A, with peak voltage 1200 V or 1600 V.



Type	Maximum average current, A		
	63	100	160
<b>M22</b>	Fig. 1	Fig. 2	Fig. 3

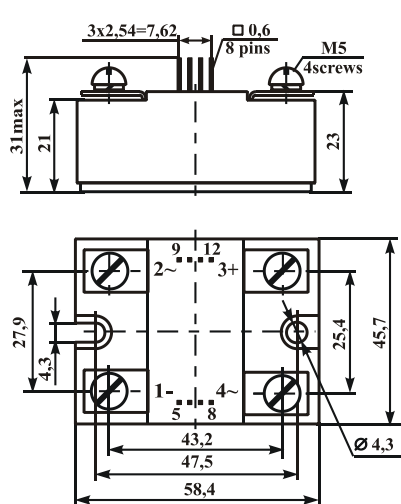


Figure 1

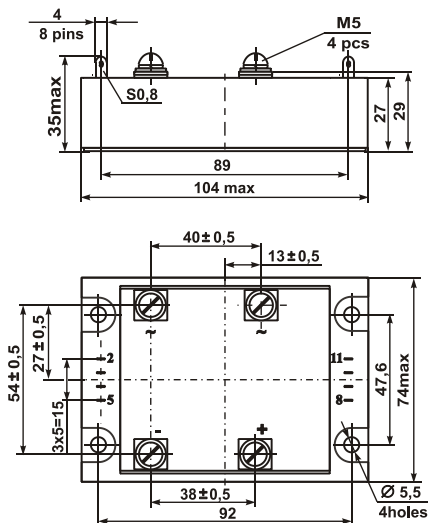


Figure 2

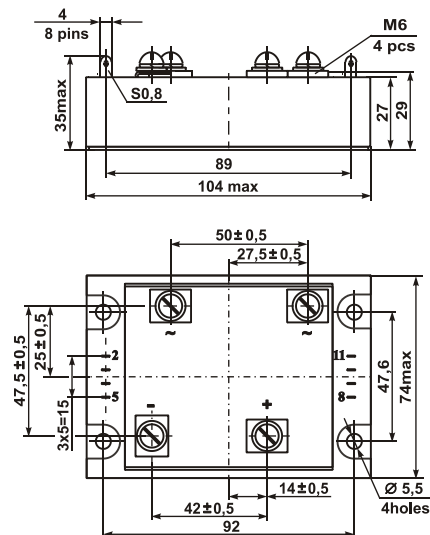
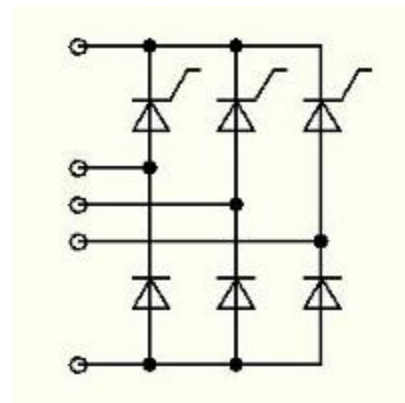


Figure 3

## Thyristor-diode bridges M23

Modules **M23** – a diode-thyristor three-phase rectifier bridge (thyristors in cathode group). The modules are produced with an amount of maximum output average current 63,100,160,200,250 A, with peak voltage 1200 V or 1600 V.

Modules **M23M** are produced with maximum output current 63 A and peak voltage 1200 V.



Type	Maximum average current, A				
	63	100	160	200	250
<b>M23</b>	Fig. 1	Fig. 2	Fig. 2	Fig. 2	Fig. 2
<b>M23M</b>	Fig. 3				

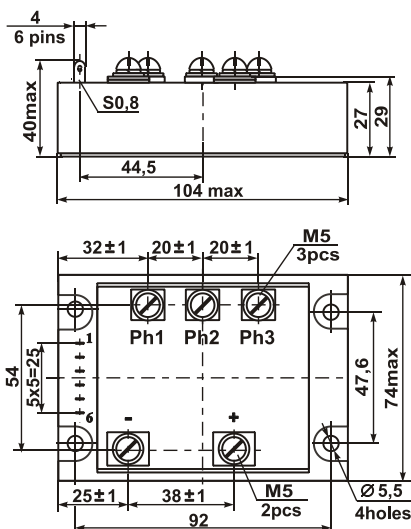


Figure 1

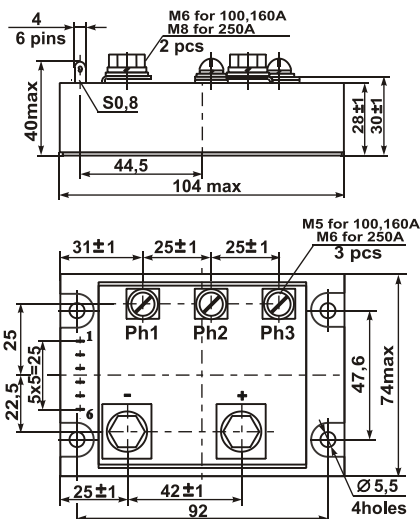


Figure 2

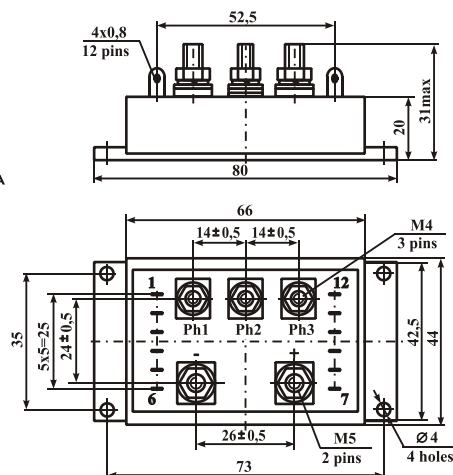
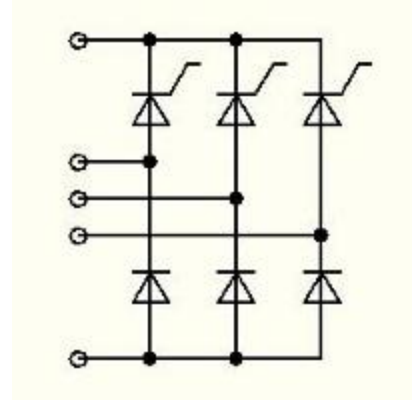


Figure 3

## Thyristor bridges M24

Modules **M24** – a thyristor three-phase rectifier bridge. The modules are produced with an amount of maximum output average current 63,100,160,200,250 A, with peak voltage 1200 V or 1600 V.

Modules **M24M** are produced with maximum output current 63 A and peak voltage 1200 V.



Type	Maximum average current, A				
	63	100	160	200	250
<b>M23</b>	Fig. 1	Fig. 2	Fig. 2	Fig. 2	Fig. 2
<b>M23M</b>	Fig. 3				

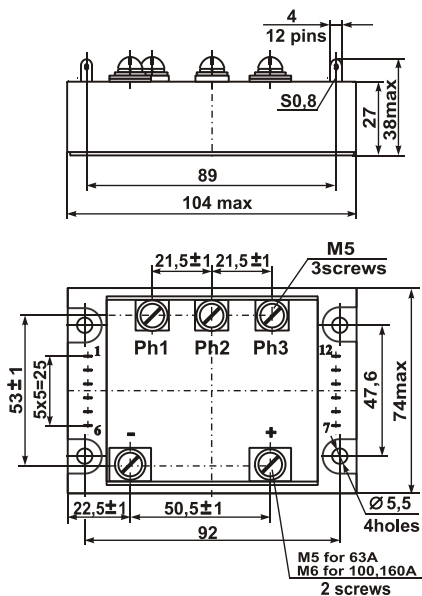


Figure 1

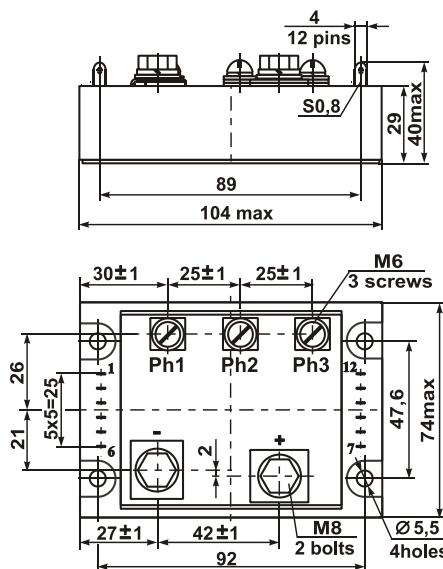


Figure 2

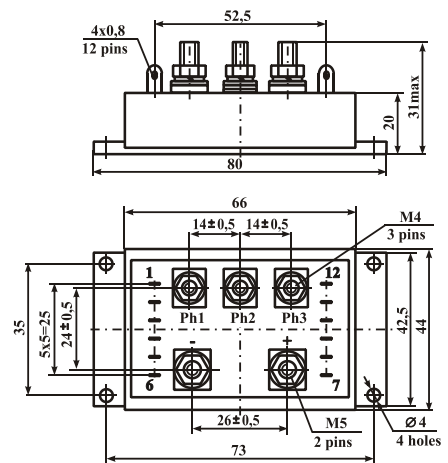
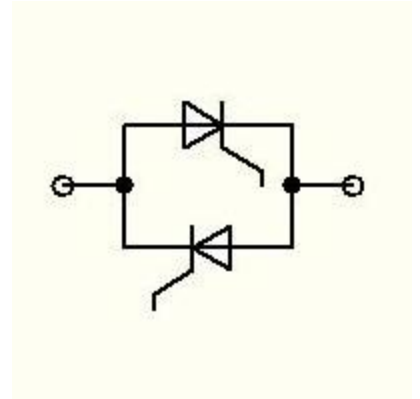


Figure 3



### Inverse-parallel thyristors M8

Modules **M8** – two inverse-parallel connected thyristors. The modules are produced with an amount of maximum rated current 25,40,63,80,100,125,160,200,250 A, with peak voltage 1200 V or 1600 V.



Type	Maximum rated current, A								
	25	40	63	80	100	125	160	200	250
<b>M8</b>	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 2	Fig. 2

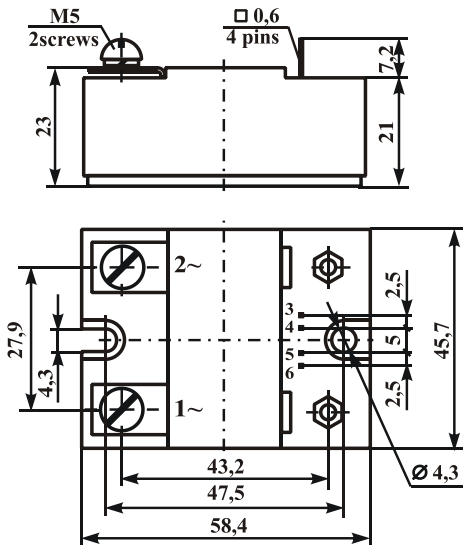


Figure 1

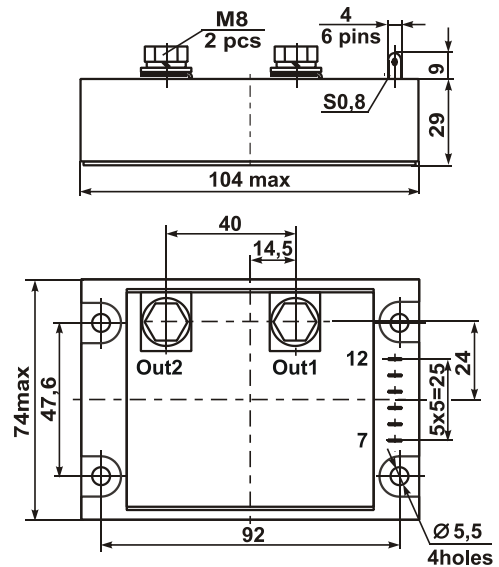
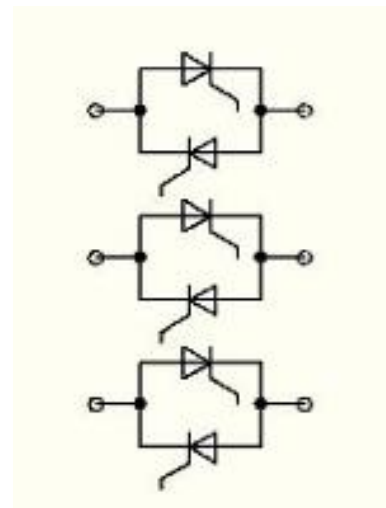


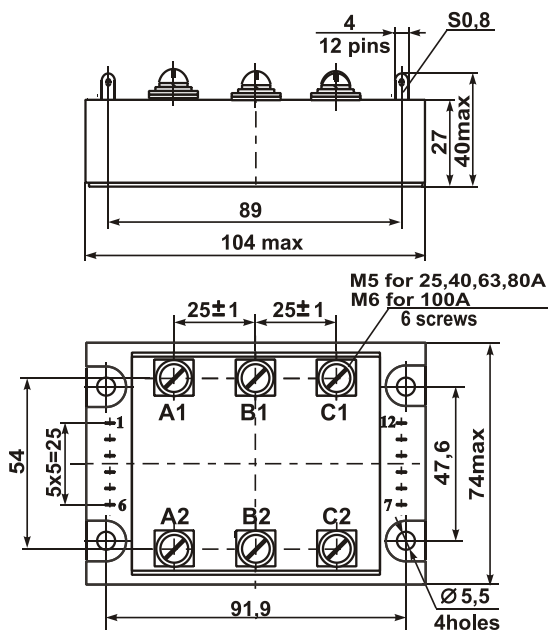
Figure 2

**Three pairs of inverse-parallel thyristors M26**

Modules **M26** – three pairs of inverse-parallel connected thyristors. The modules are produced with an amount of maximum rated current 25,40,63,80,100,125 A, with peak voltage 1200 V or 1600 V.



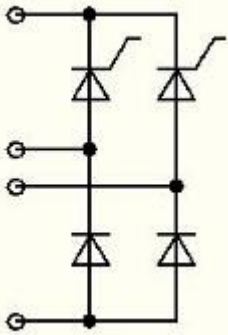
Type	Maximum rated current, A					
	25	40	63	80	100	125
<b>M26</b>	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1



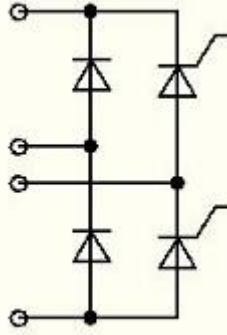
**Figure 1**

### Thyristor-diode modules RM

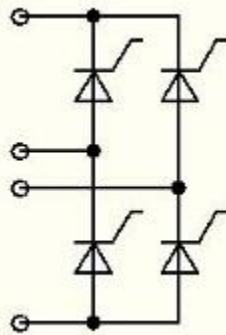
Diode, thyristor and diode-thyristor modules kind of **RM** are assemblies of inverse-parallel thyristors, three-phase and single-phase bridges based on thyristors and rectifier diodes intended to operate as a part of converters with maximum peak voltage 1200 V and maximum average output current 15, 25, 45 A.



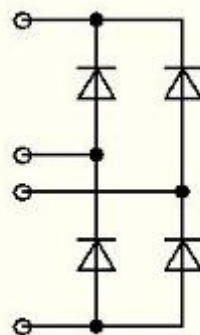
Type 1



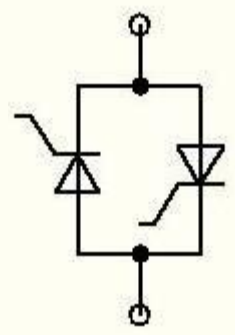
Type 2



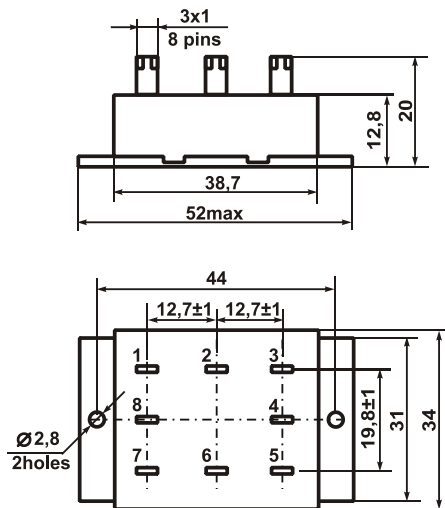
Type 3



Type 5



Type 4

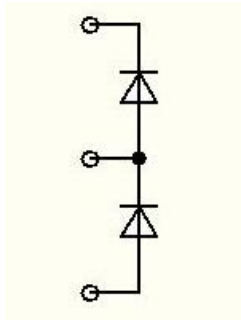


## Modules based on fast-recovery diodes

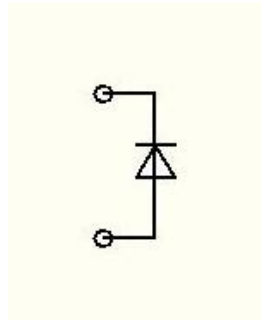


### Diode assemblies of series M4FRD

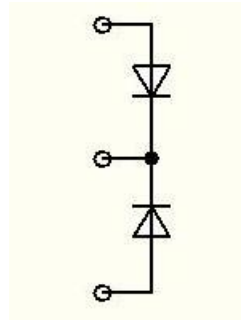
Modules of series **M4FRD** – diode assemblies based on fast-recovery diodes (FRD). The modules are produced with an amount of maximum average current 50,100,150,200,250,300,400 A, with peak voltage 1200 V .



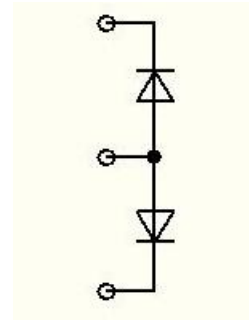
**M4**



**M4.1**

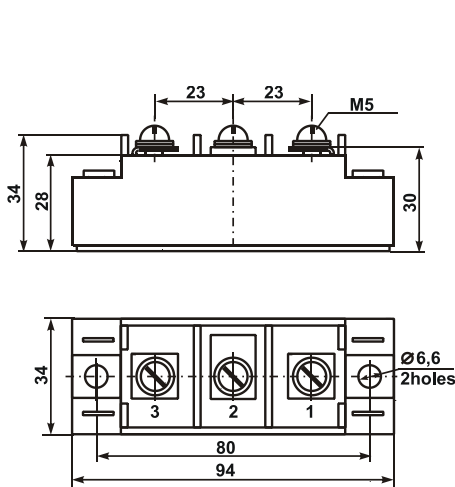


**M4.2**

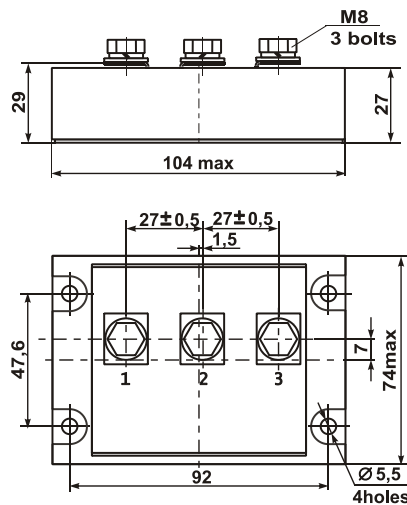


**M4.3**

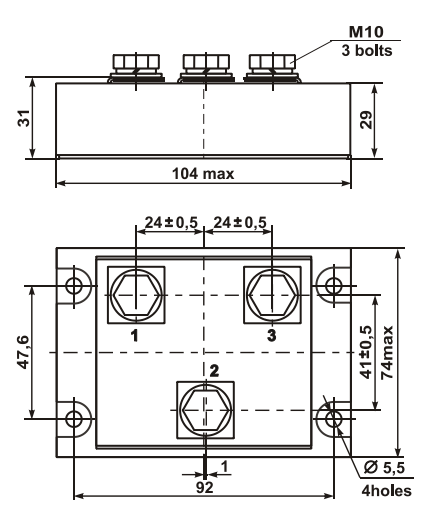
Type	Maximum average current, A						
	50	100	150	200	250	300	400
<b>M4FRD</b>	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 3	
<b>M4.1FRD</b>	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 3	Fig. 3
<b>M4.2FRD</b>	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 3	
<b>M4.3FRD</b>	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 3	



**Figure 1**



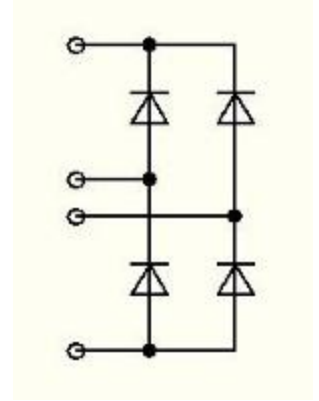
**Figure 2**



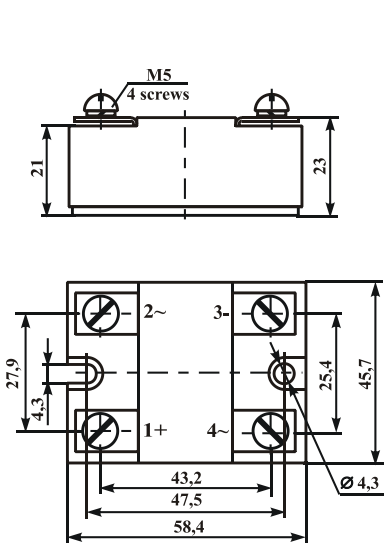
**Figure 3**

### Diode bridges M5FRD

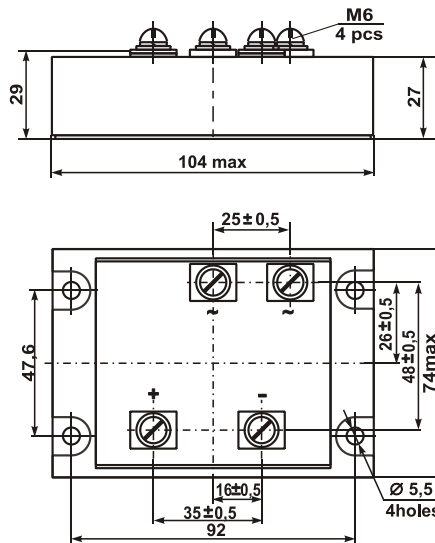
Modules **M5FRD** – a single-phase rectifier bridge based on fast-recovery diodes. The modules are produced with an amount of maximum average current 50,100,150,200 A, with peak voltage 1200 V.



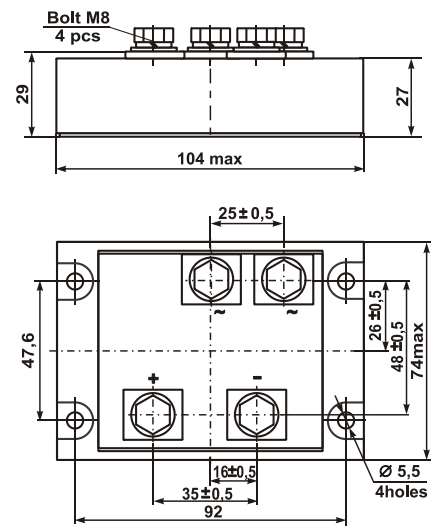
Type	Maximum average current, A			
	50	100	150	200
<b>M5FRD</b>	Fig. 1	Fig. 2	Fig. 2	Fig. 3



**Figure 1**



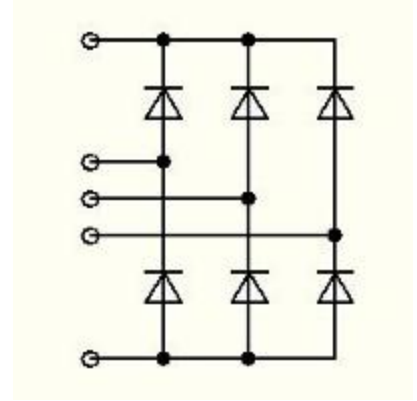
**Figure 2**



**Figure 3**

### Diode bridges M6FRD

Modules **M6FRD** – a three-phase rectifier bridge based on fast-recovery diodes. The modules are produced with an amount of maximum average current 50,100,150,200 A, with peak voltage 1200 V.



Type	Maximum average current, A			
	50	100	150	200
<b>M6FRD</b>	Fig. 1	Fig. 1	Fig. 1	Fig. 2

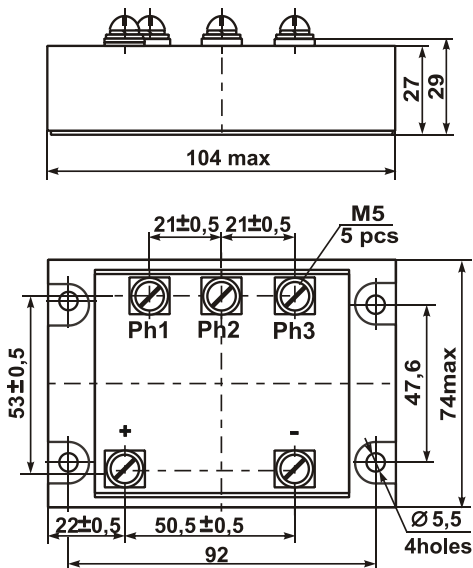


Figure 1

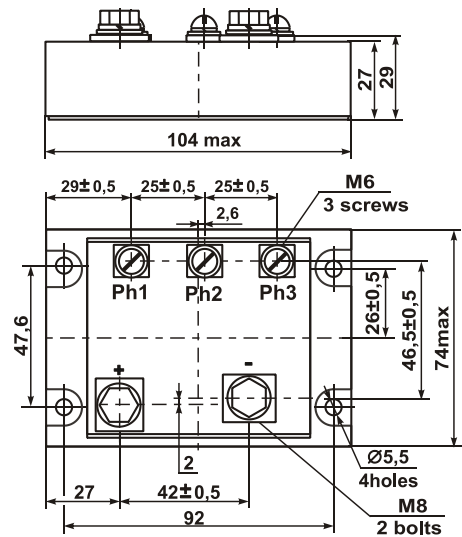
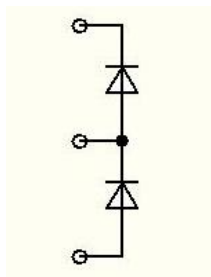


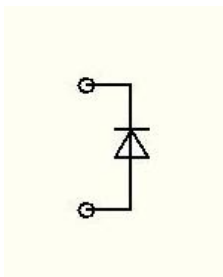
Figure 2

### High-voltage diode assemblies FRD

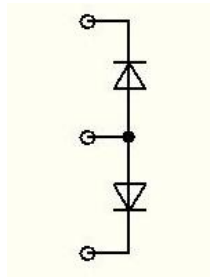
High-voltage modules of fast-recovery diodes (FRD) of series M4 and M5 are assemblies of AKB intended to operate as a part of converters, rectifiers with maximum peak voltage 3300 V or 6500 V and average current up to 200 A.



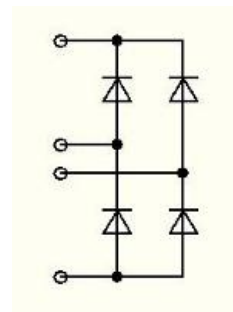
**M4**



**M4.1**

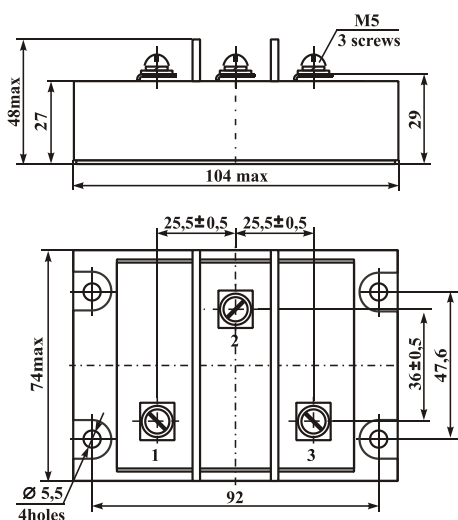


**M4.3**

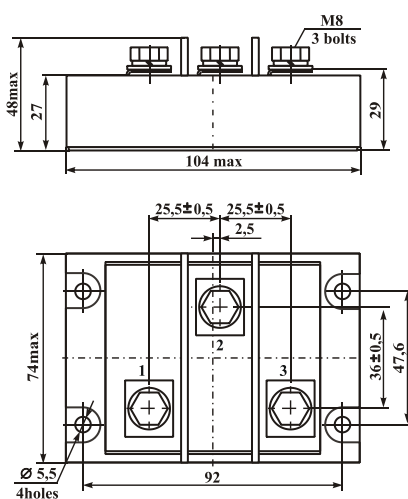


**M5**

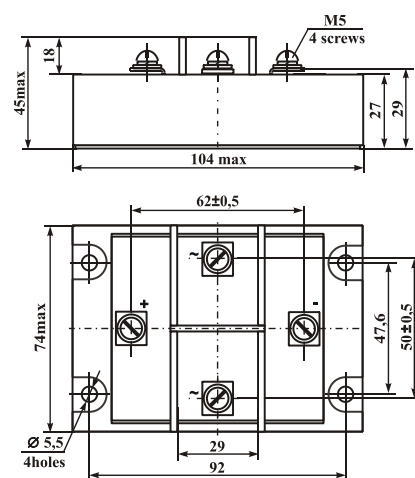
Type	Class	Maximum average module current, A			
		25	50	100	200
M4	33			Fig. 1	Fig. 2
	65		Fig. 1	Fig. 1	
M4.1	33			Fig. 1	Fig. 2
	65		Fig. 1	Fig. 1	
M4.3	33			Fig. 1	Fig. 2
	65		Fig. 1	Fig. 1	
M5	65	Fig. 3			



**Figure 1**



**Figure 2**



**Figure 3**

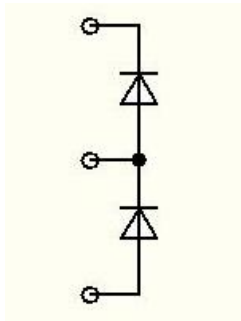


## Modules based on Schottky diodes

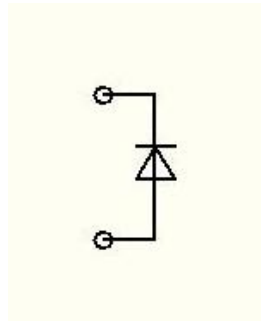


## Diode assemblies of series M4Sch

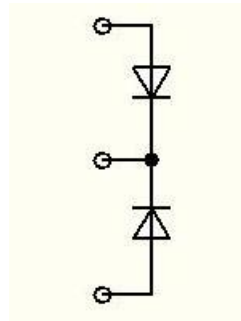
Modules of series **M4Sch** – diode assemblies based on Schottky diodes. The modules are produced with an amount of maximum average current 40,80,120,160,200,240,320,400 A, with peak voltage 60,125,150,200 V.



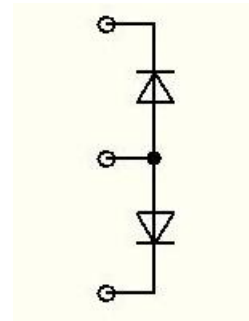
**M4**



**M4.1**

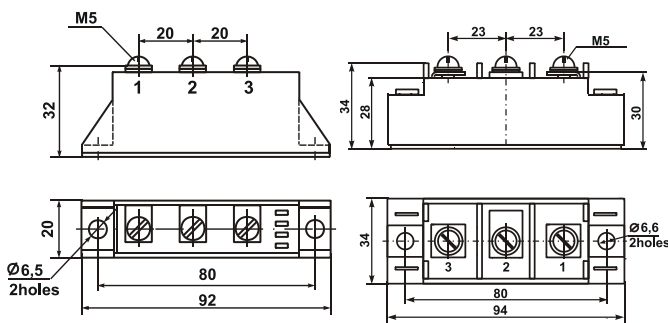


**M4.2**

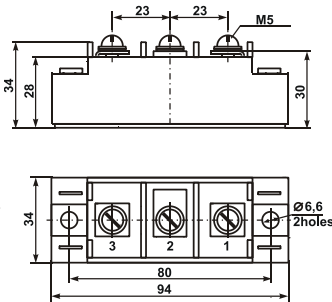


**M4.3**

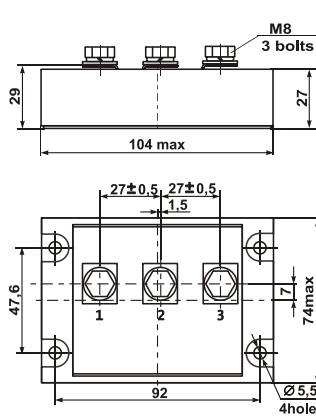
Type	Maximum average module current, A							
	40	80	120	160	200	240	320	400
<b>M4</b>	Fig. 1,2	Fig. 1,2	Fig. 2	Fig. 2	Fig. 3	Fig. 3	Fig. 4	
<b>M4.1</b>	Fig. 1,2	Fig. 1,2	Fig. 2	Fig. 2	Fig. 3	Fig. 4	Fig. 4	Fig. 4
<b>M4.2</b>	Fig. 1,2	Fig. 1,2	Fig. 2	Fig. 2	Fig. 3	Fig. 3	Fig. 4	
<b>M4.3</b>	Fig. 1,2	Fig. 1,2	Fig. 2	Fig. 2	Fig. 3	Fig. 3	Fig. 4	



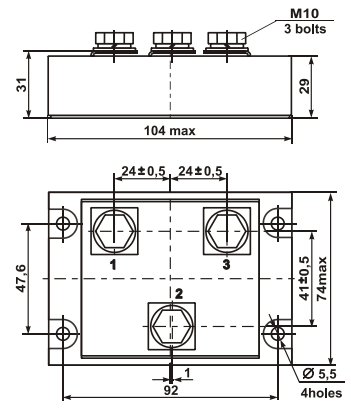
**Figure 1**



**Figure 2**



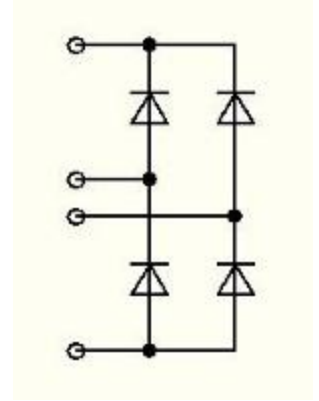
**Figure 3**



**Figure 4**

### Diode bridges M5Sch

Modules **M5Sch** – single-phase rectifier bridge based on Schottky diodes. The modules are produced with an amount of maximum average current 40,80,120,160,200 A and with an amount of peak voltage 60,125,150,200 V.



Type	Maximum average current, A				
	40	80	120	160	200
M5Sch	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 3

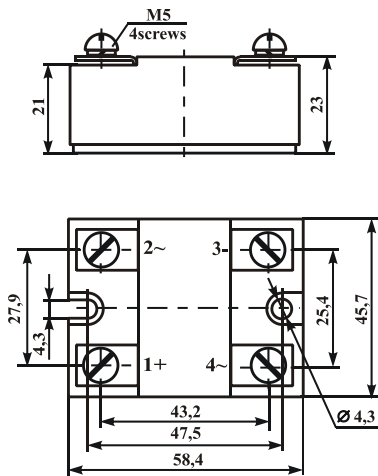


Figure 1

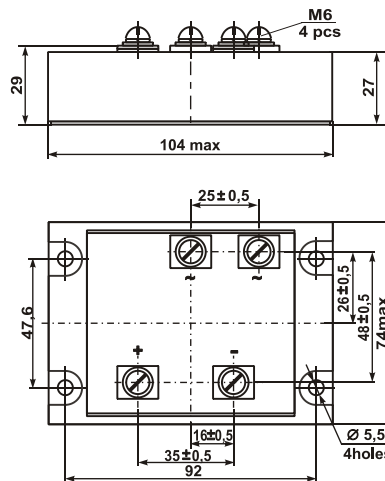


Figure 2

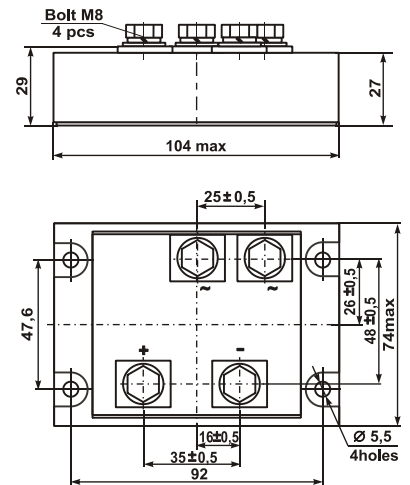
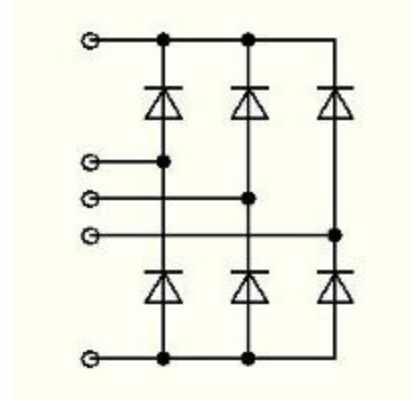


Figure 3

### Diode bridges M6Sch

Modules **M6Sch** – a three-phase rectifier bridge based on Schottky diodes. The modules are produced with an amount of maximum average current 40,80,120,160,200,240 A and with an amount of peak voltage 60,125,150,200 V.



Type	Maximum average current, A					
	40	80	120	160	200	240
M6Sch	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 2

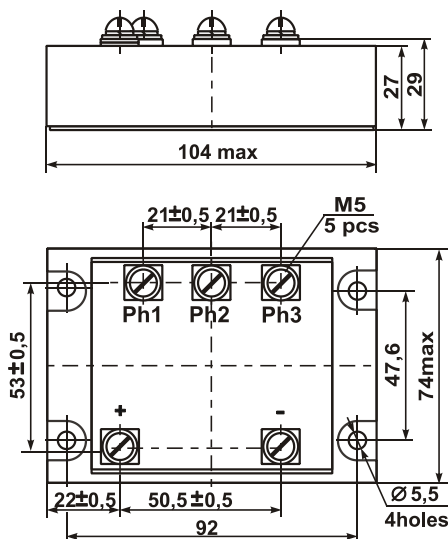


Figure 1

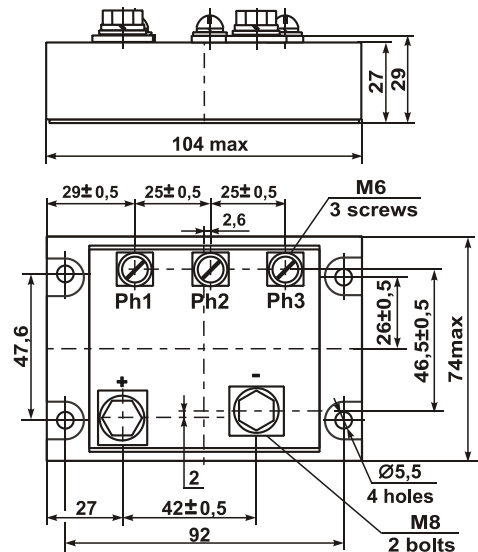


Figure 2

## Modules based on MOSFET-transistors



## Single switch M9

Modules **M9** – a single MOSFET-transistor with a inbuilt reverse diode. The modules produced in the following versions:

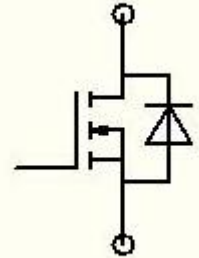
Peak voltage 40 V with an amount of direct current 100,200,300,400,500 A.

Peak voltage 60 V with an amount of direct current 150,220,300,360,450 A.

Peak voltage 100 V with an amount of direct current 120,160,200,250,300,400 A.

Peak voltage 200 V with an amount of direct current 120,160,200,240,320,400 A.

Peak voltage 250 V with an amount of direct current 120,150,200,240,300 A.



Module type	Current, A	Voltage class				
		0,4	0,6	1	2	2,5
M9	100	Fig. 2				
	120			Fig. 3	Fig. 1	Fig. 3
	150		Fig. 3			Fig. 3
	160			Fig. 3	Fig. 1	
	200	Fig. 3		Fig. 1	Fig. 1	Fig. 1
	220		Fig. 3			
	240				Fig. 1	Fig. 1
	250			Fig. 1		
	300	Fig. 3	Fig. 1	Fig. 1		Fig. 1
	320				Fig. 1	
	360		Fig. 1			
	400	Fig. 1		Fig. 1	Fig. 1	
450		Fig. 1				
500	Fig. 1					

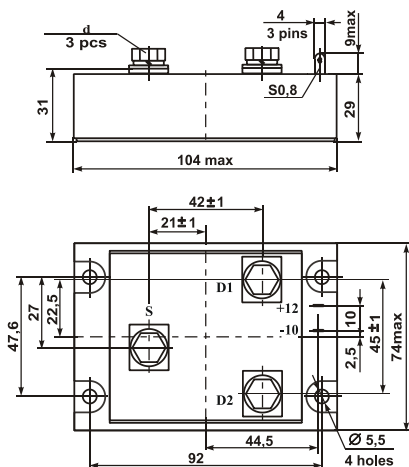


Figure 1

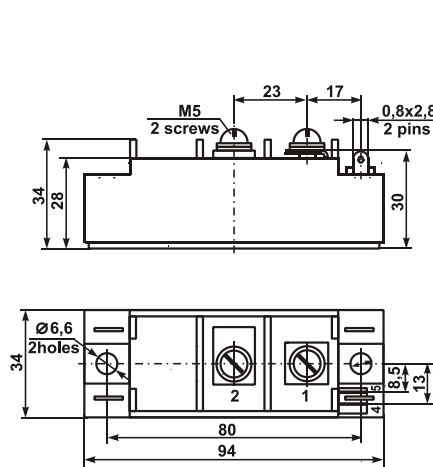


Figure 2

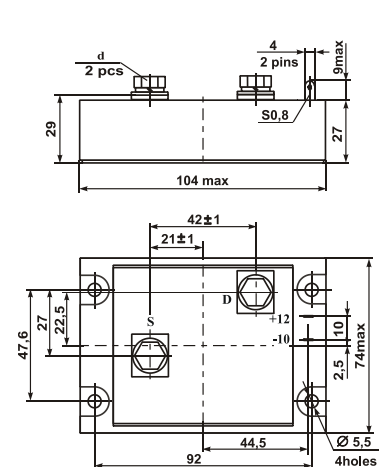
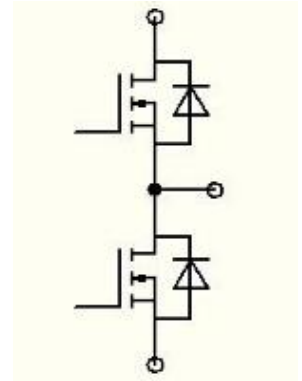


Figure 3

## Half-bridge M12

Modules **M12** – two series connected MOSFET-transistors (half-bridge) with inbuilt reverse diodes. The module is produced in the following versions:

- Peak voltage 40 V with an amount of direct current 100,200,300,400,500 A.
- Peak voltage 60 V with an amount of direct current 75,150,220,300 A.
- Peak voltage 100 V with an amount of direct current 120,160,200,250 A.
- Peak voltage 200 V with an amount of direct current 120,160,200 A.
- Peak voltage 250 V with direct current 120 A.



Module type	Current, A	Voltage class				
		0,4	0,6	1	2	2,5
M12	75		Fig. 1			
	100	Fig. 1				
	120			Fig. 2	Fig. 2	Fig. 2
	150		Fig. 2			
	160			Fig. 2	Fig. 2	
	200	Fig. 2		Fig. 2	Fig. 2	
	220		Fig. 2			
	250			Fig. 2		
	300	Fig. 2	Fig. 2			
	400	Fig. 2				
500	Fig. 2					

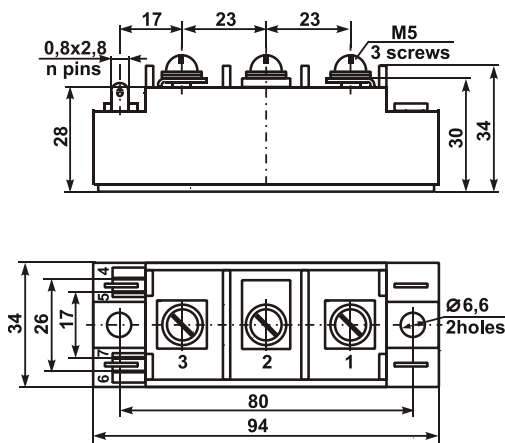


Figure 1

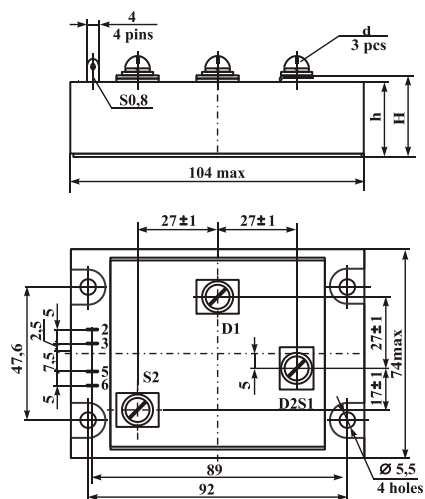
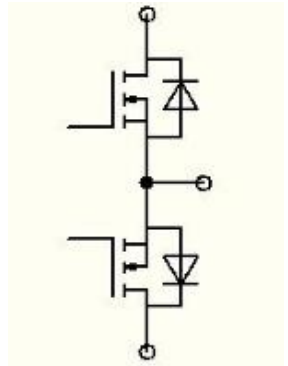


Figure 2

### Back-to-back transistors M12.1

Modules **M12.1** – two back-to-back MOSFET-transistors (common emitter) with inbuilt reverse diodes. The module is produced in the following versions:

- Peak voltage 40 V with an amount of direct current 100,200,300,400,500 A.
- Peak voltage 60 V with an amount of direct current 75,150,220,300 A.
- Peak voltage 100 V with an amount of direct current 120,160,200,250 A.
- Peak voltage 40 V with an amount of direct current 120,160,200 A.
- Peak voltage 250 V with direct current 120 A.



Module type	Current, A	Voltage class				
		0,4	0,6	1	2	2,5
M12.1	75		Fig. 1			
	100	Fig. 1				
	120			Fig. 2	Fig. 2	Fig. 2
	150		Fig. 2			
	160			Fig. 2	Fig. 2	
	200	Fig. 2		Fig. 2	Fig. 2	
	220		Fig. 2			
	250			Fig. 2		
	300	Fig. 2	Fig. 2			
	400	Fig. 2				
500	Fig. 2					

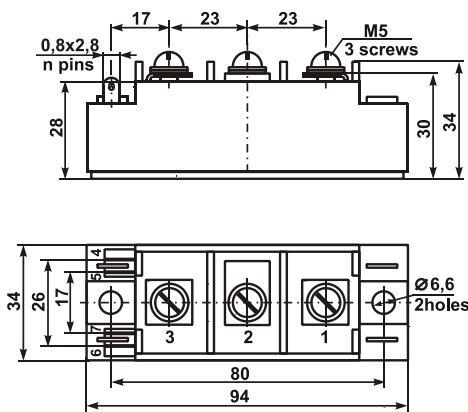


Figure 1

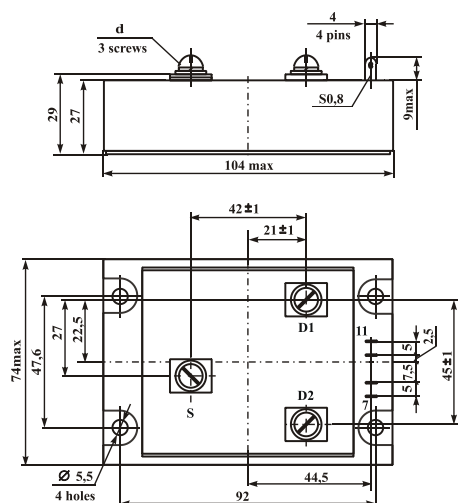
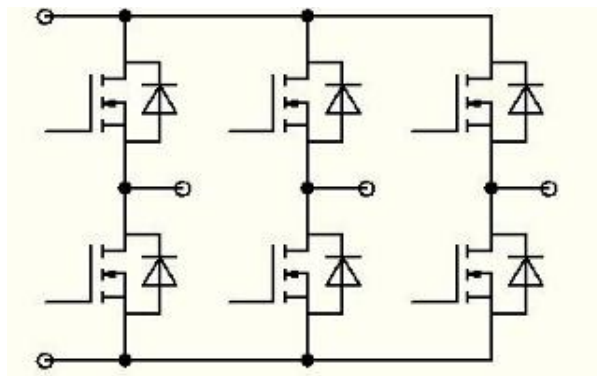


Figure 2



## Three-phase inverter M13A

Modules of series **M13A** – a three-phase inverter based on MOSFET-transistors. The modules are produced with maximum peak voltage 100 V or 200 V with an amount of maximum average switch current 2,10,30,50,90 A.



Type	Class	Maximum average current, A				
		2	10	30	50	90
M13A	1		Fig. 1	Fig. 1	Fig. 1	Fig. 1
	2		Fig. 1	Fig. 1	Fig. 1	Fig. 1
M13MA	1		Fig. 2			
	2		Fig. 2			
M13A-PP4	1	Fig. 3				
	2	Fig. 3				

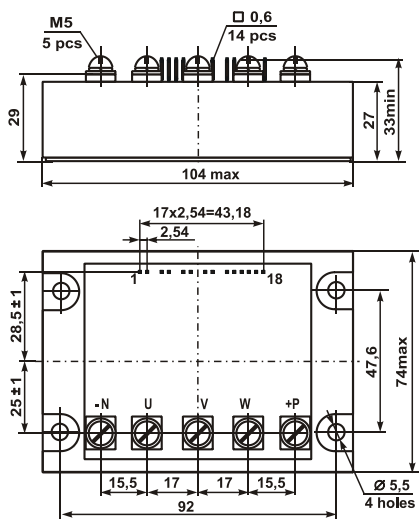


Figure 1

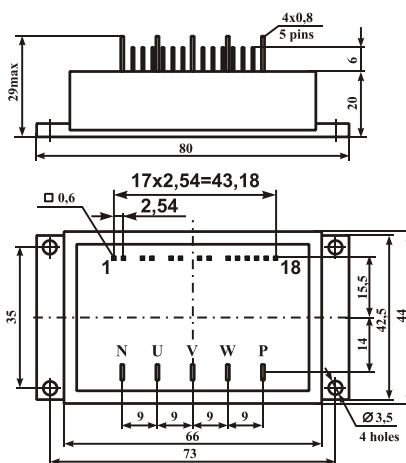


Figure 2

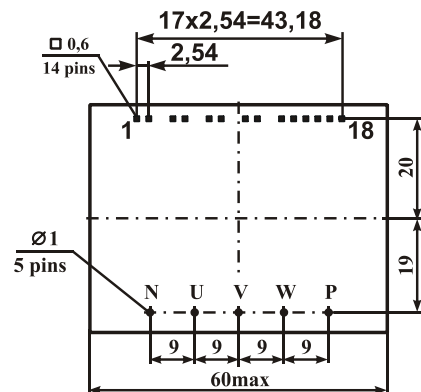
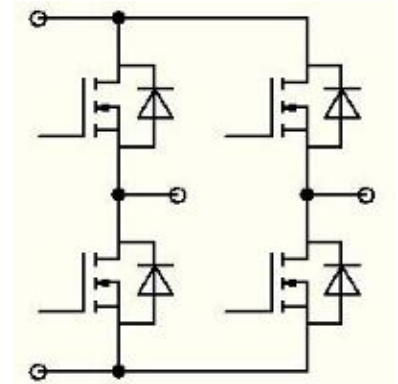


Figure 3

## H-bridge M13B

Modules of series **M13B** – a H-bridge based on MOSFET-transistors. The modules are produced with maximum peak voltage 100 V or 200 V with an amount of maximum average switch current 2,10,30,50,90 A.



Type	Class	Maximum average current, A				
		2	10	30	50	90
M13B	1		Fig. 1	Fig. 1	Fig. 1	Fig. 1
	2		Fig. 1	Fig. 1	Fig. 1	Fig. 1
M13MB	1		Fig. 2			
	2		Fig. 2			
M13B-PP4	1	Fig. 3				
	2	Fig. 3				

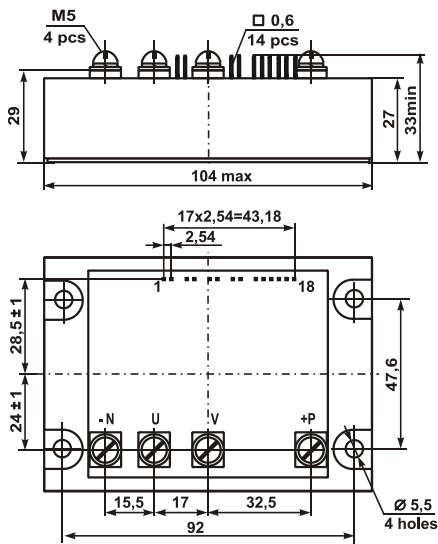


Figure 1

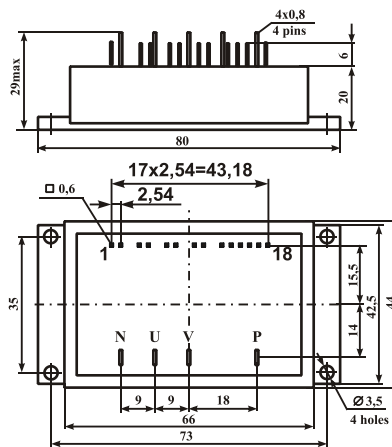


Figure 2

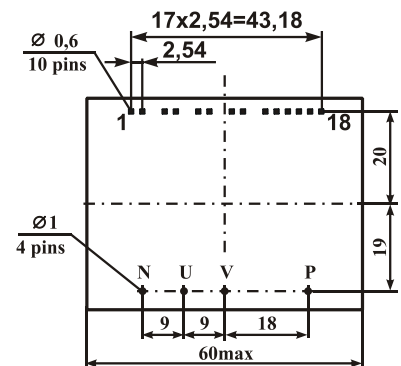
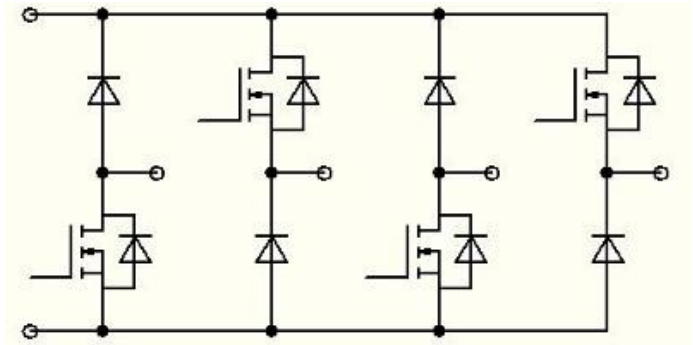


Figure 3

### Two skew bridges M13C

Modules **M13C** – two skew bridges based on MOSFET-transistors. The modules are produced with maximum peak voltage 100 V or 200 V with an amount of maximum average switch current 10,30,50,90 A.



Type	Class	Maximum average current, A			
		10	30	50	90
M13C	1	Fig. 1	Fig. 2	Fig. 2	Fig. 2
	2	Fig. 1	Fig. 2	Fig. 2	Fig. 2

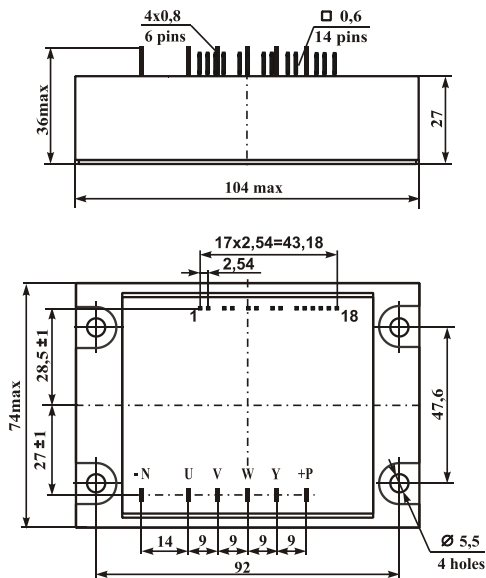


Figure 1

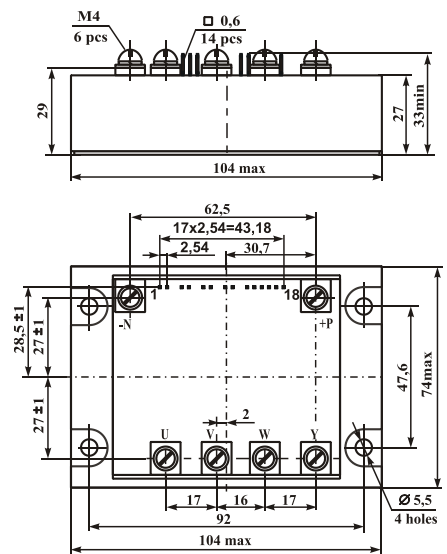
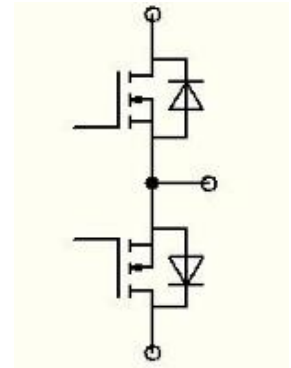


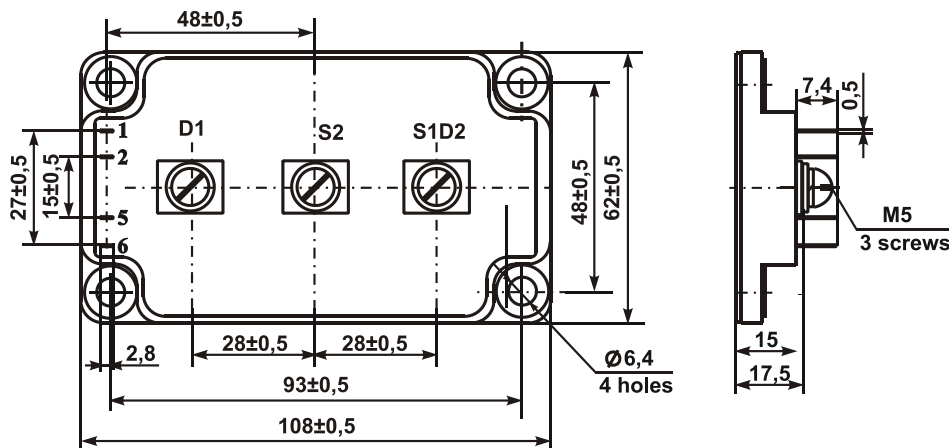
Figure 2

### Half-bridge based on silicon carbide transistors M12Sic

Modules **M12Sic** – SiC MOSFET modules based on silicon carbide MOSFET-transistors and FRD, are an assembly of two series connected MOSFET-transistors shunted with reverse FRDs, intended to commute power loads as a part of converters with maximum peak voltage up to 1200 V and direct current up to 100 A.



Dynamic characteristics					
Input capacitance, pF	C <sub>iss</sub>		9370	10500	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1 MHz
Output capacitance, pF	C <sub>oss</sub>		3300	4000	
Cross capacitance, pF	C <sub>rss</sub>		168	200	
Switch-on delay duration, ns	t <sub>d(on)</sub>		80	100	V <sub>DS</sub> = 600 V, V <sub>GS</sub> = -5/15 V, I <sub>D</sub> = 100 A, L <sub>D</sub> = 250 m, R <sub>G</sub> = 4.7 Ω
Rise time, ns	t <sub>r</sub>		88	100	
Switch-off delay duration, ns	t <sub>d(off)</sub>		96	120	
Fall time, ns	t <sub>f</sub>		56	70	
Switch-on loss energy, mJ	E <sub>ON</sub>		7.35		V <sub>DS</sub> = 600 V, V <sub>GS</sub> = -5/15 V, I <sub>D</sub> = 100 A
Switch-off loss energy, mJ	E <sub>OFF</sub>		6.7		
Common gate charge, nC	Q <sub>G</sub>		450	800	

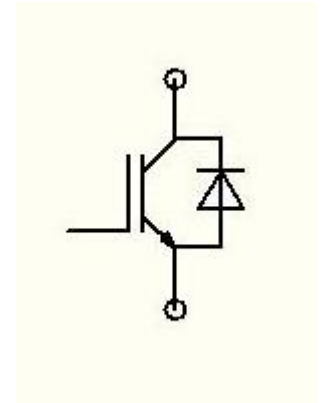


## Modules based on IGBT-transistors



## Single switch M9

Modules **M9** – a single transistor shunted with a reverse FRD. The module is produced with an amount maximum direct current 50,100,200,300,400 A with peak voltage 1200 V.



Module type	Current, A				
	50	100	200	300	400
<b>M9</b>	Fig. 3	Fig. 3	Fig. 2	Fig. 2	Fig. 2
<b>M9-01</b>	Fig. 3	Fig. 1	Fig. 2	Fig. 2	

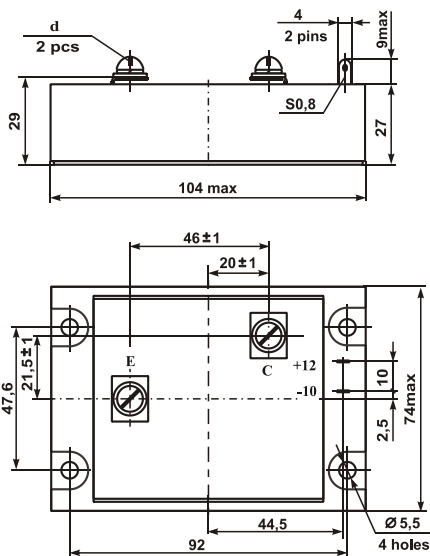


Figure 1

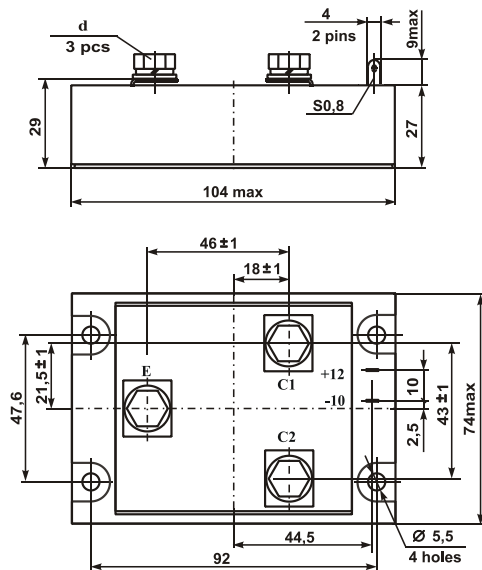


Figure 2

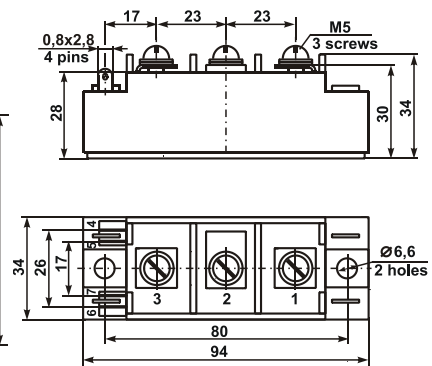
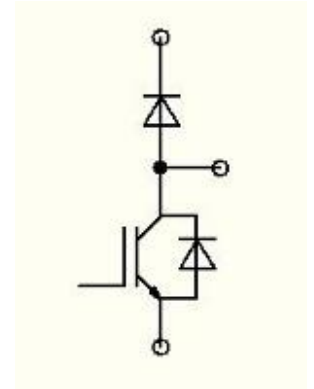


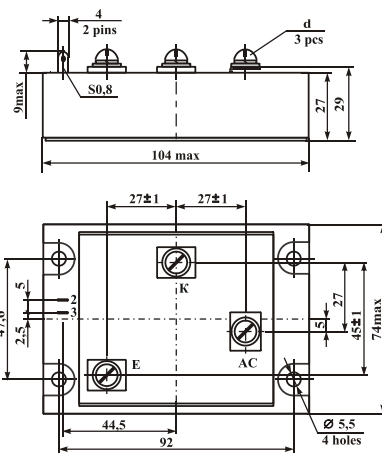
Figure 3

## Lower switch M10

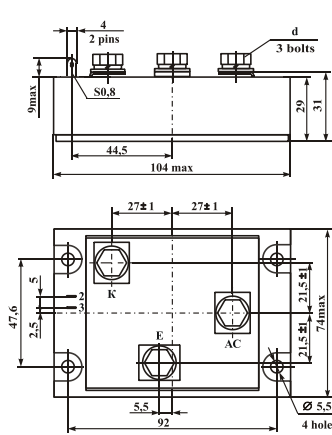
Modules **M10** – series connected IGBT-transistor shunted with a reverse FRD and series connected FRD (common collector-anode). The module is produced with an amount of maximum direct current 50,100,150,200 A with peak voltage 1200 V.



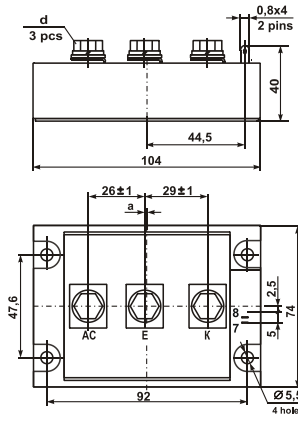
Module type	Current, A			
	50	100	150	200
<b>M10</b>	Fig. 4	Fig. 4	Fig. 3	Fig. 3
<b>M10-01</b>	Fig. 1	Fig. 1	Fig. 2	Fig. 2



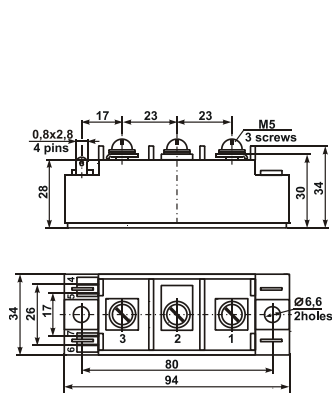
**Figure 1**



**Figure 2**



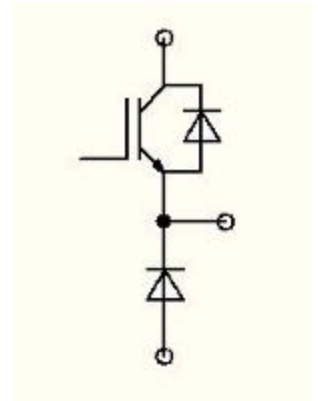
**Figure 3**



**Figure 4**

### Upper switch M11

Modules **M11** – series connected IGBT-transistor shunted with a reverse fast-recovery diode and a series connected fast-recovery diode (common emitter-cathode). The module is produced with an amount of maximum direct current 50,100,150,200 A with peak voltage 1200 V.



Module type	Current, A			
	50	100	150	200
<b>M11</b>	Fig. 4	Fig. 4	Fig. 3	Fig. 3
<b>M11-01</b>	Fig. 1	Fig. 1	Fig. 2	Fig. 2

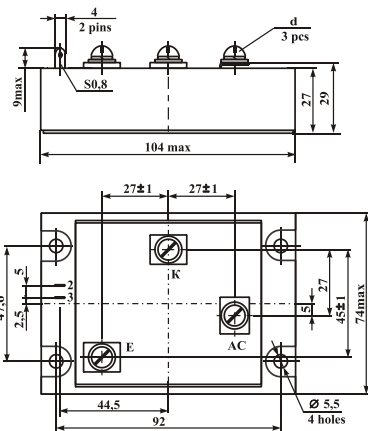


Figure 1

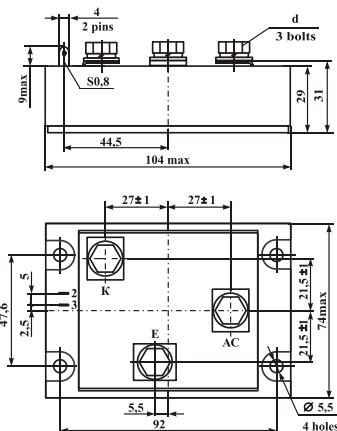


Figure 2

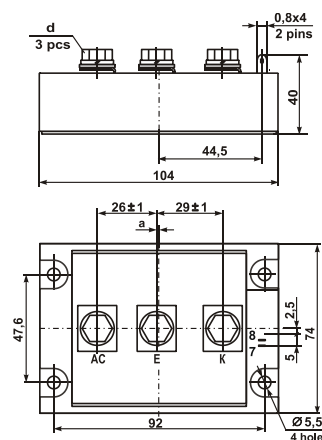


Figure 3

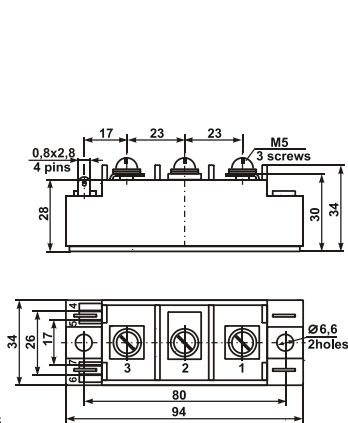
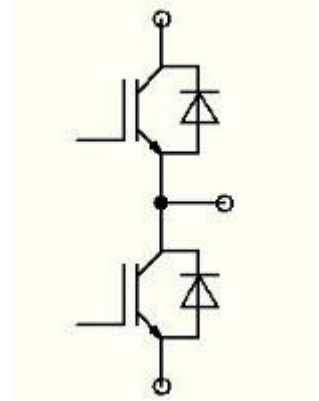


Figure 4

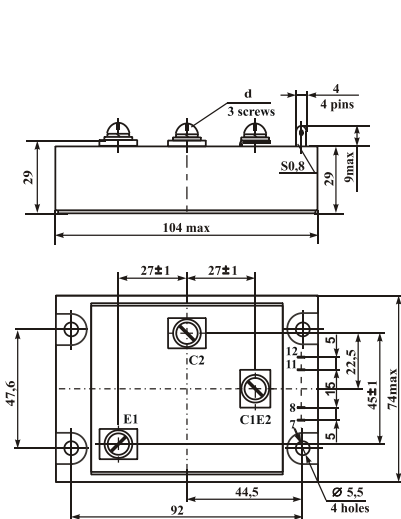


### Half-bridge M12

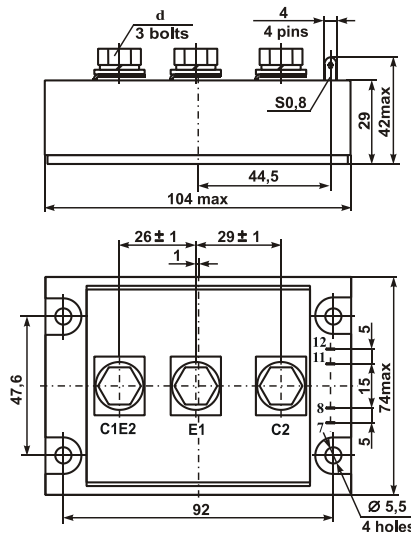
Modules **M12** – two series connected IGBT-transistors (half-bridge) shunted with reverse fast-recovery diodes. The module is produced with an amount of maximum direct current 50,100,150,200 A with peak voltage 1200 V.



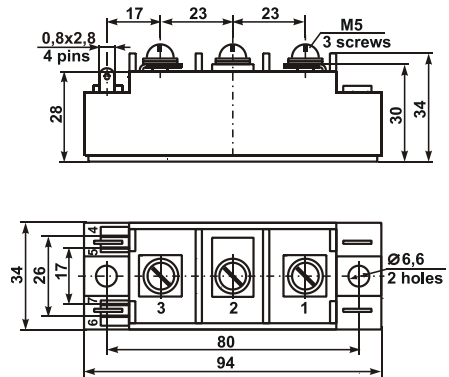
Module type	Current, A			
	50	100	150	200
<b>M12</b>	Fig.3	Fig. 3	Fig. 1	Fig. 2
<b>M12-02</b>	Fig. 3	Fig. 3	Fig. 1	Fig. 2



**Figure 1**



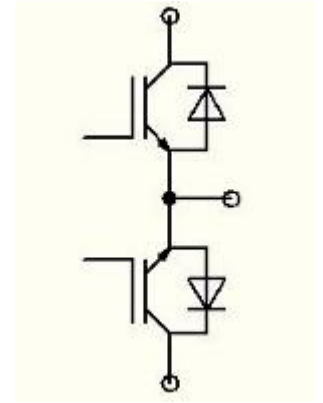
**Figure 2**



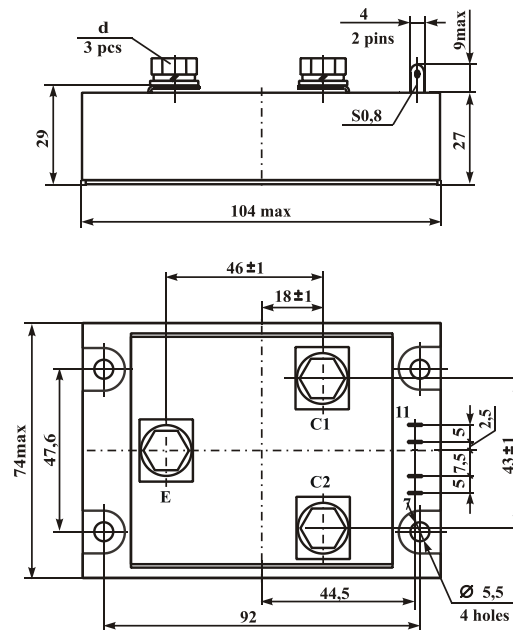
**Figure 3**

### Back-to-back transistors M12.1

Modules **M12.1** – two back-to-back IGBT-transistors (common emitter) shunted with reverse fast-recovery diodes. The module is produced with an amount of maximum direct current 50,100,150,200 A with peak voltage 1200 V.



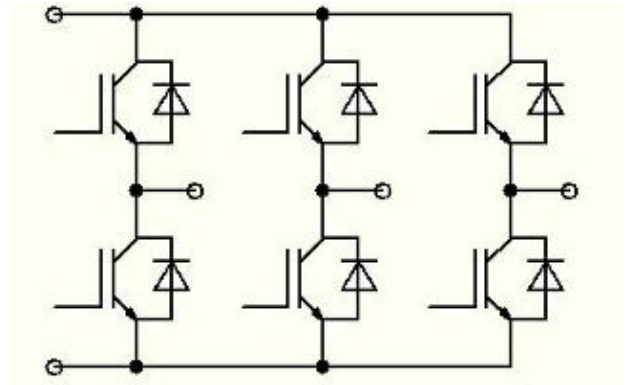
Module type	Current, A			
	50	100	150	200
M12.1	Fig. 1	Fig. 1	Fig. 1	Fig. 1



**Figure 1**

### Three-phase inverter M13A

Modules of series **M13A** – three-phase inverter based on IGBT-transistors. The modules are produced with maximum peak voltage 600 V or 1200 V with an amount of maximum average switch current 1,10,30,50 A.



Type	Class	Maximum average current, A			
		1	10	30	50
M13A	6		Fig. 1	Fig. 1	Fig. 1
	12		Fig. 1	Fig. 1	Fig. 1
M13MA	6		Fig. 2		
M13A-PP4	6	Fig. 3			

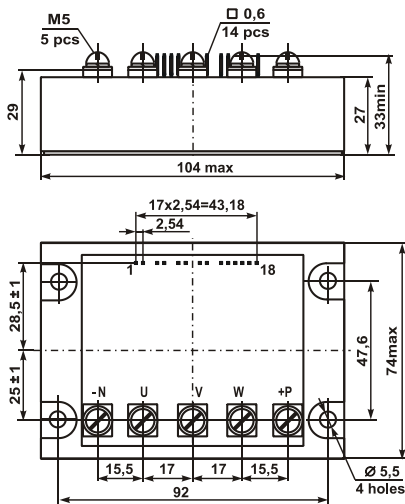


Figure 1

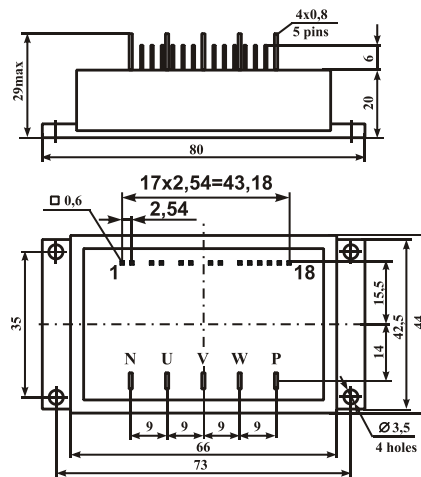


Figure 2

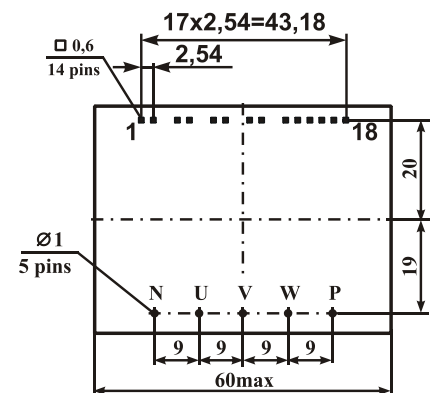
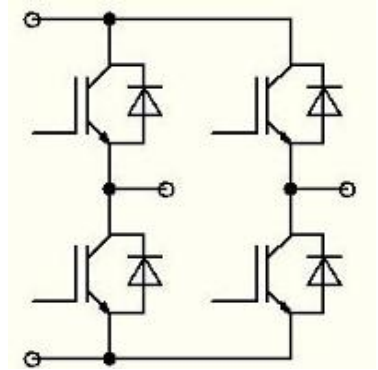


Figure 3

### H-bridge M13B

Modules of series **M13B** – an H-bridge based on IGBT-transistors. The modules are produced with maximum peak voltage 600 V or 1200 V with an amount of maximum average switch current 1,10,30,50 A.



Type	Class	Maximum average current, A			
		1	10	30	50
M13B	6		Fig. 1	Fig. 1	Fig. 1
	12		Fig. 1	Fig. 1	Fig. 1
M13MB	6		Fig. 2		
M13B-PP4	6	Fig. 3			

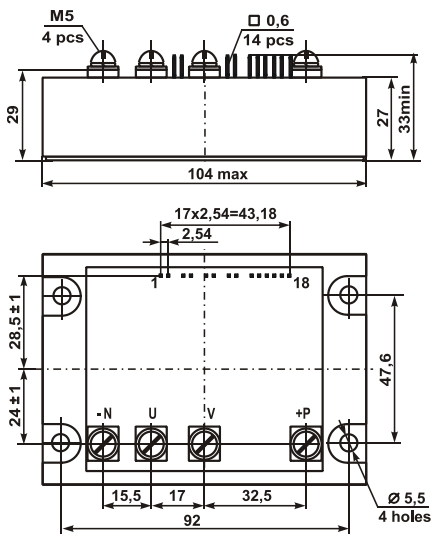


Figure 1

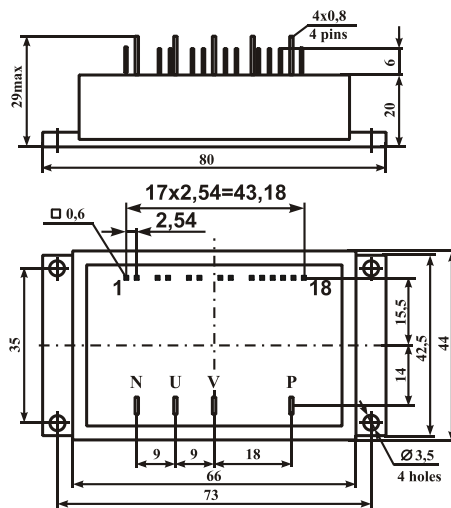


Figure 2

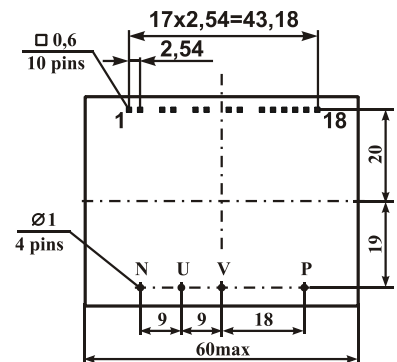
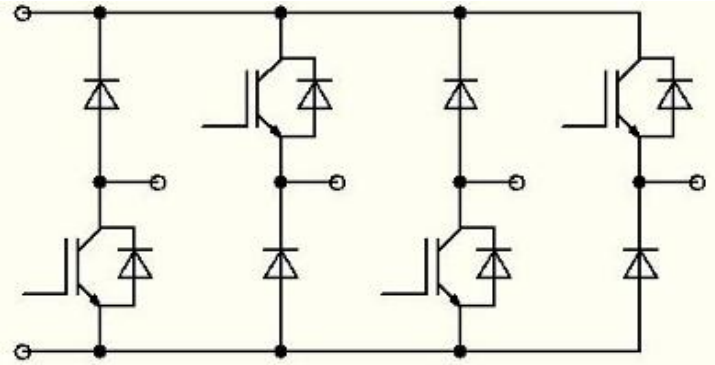


Figure 3

### Two skew bridges M13C

Module **M13C** – two skew bridges based on IGBT-transistors. The modules are produced maximum peak voltage 600 V or 1200 V with an amount of maximum average switch current 10,30,50 A.



Type	Class	Maximum average current, A		
		10	30	50
M13C	6	Fig. 1	Fig. 2	Fig. 2
	12	Fig. 1	Fig. 2	Fig. 2

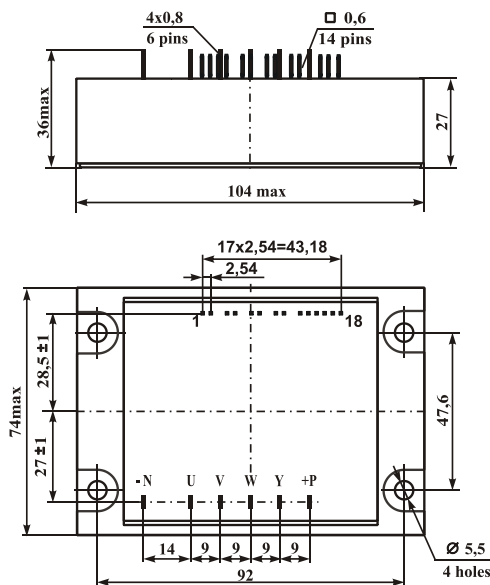


Figure 1

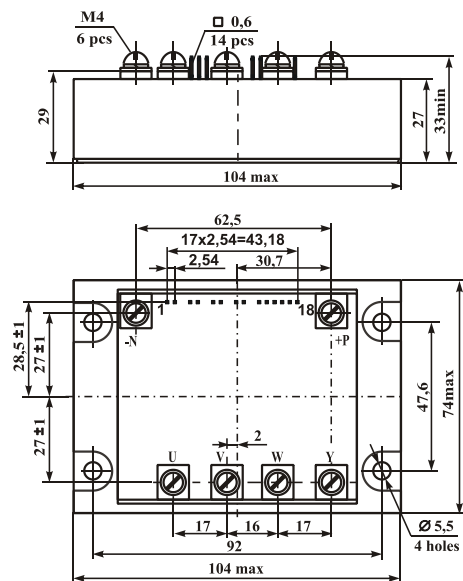


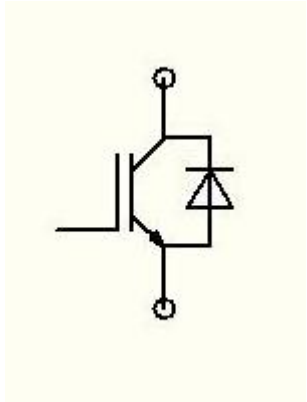
Figure 2

## Modules based on high-voltage IGBT-transistors

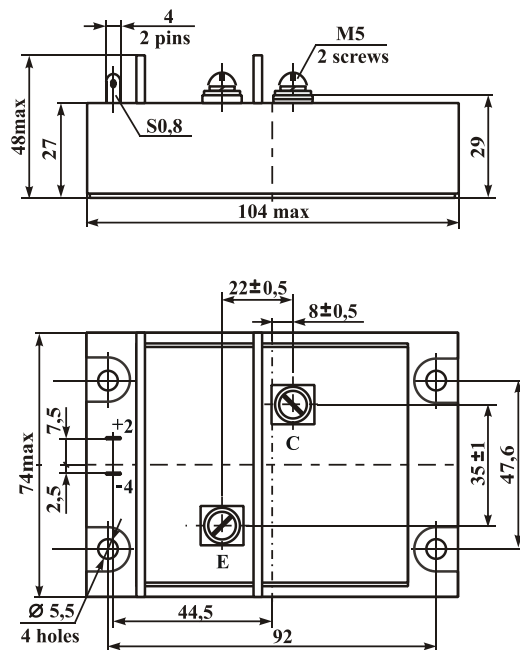


## High-voltage single switch M9

Modules **M9** – a single transistor shunted with a reverse fast-recovery diode. The module is produced with maximum voltage 3300 V (current 50,100 A) or 6500 V (current 25,50 A).



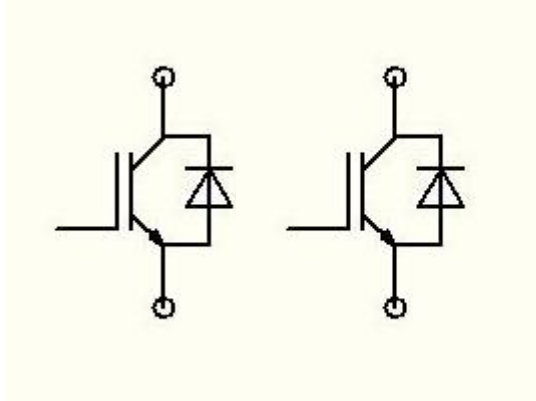
Module type	Current, A	Voltage class	
		33	65
M9	25		Fig. 1
	50	Fig. 1	Fig. 1
	100	Fig. 1	



**Figure 1**

### High-voltage dual switch 2M9

Modules **2M9** – two independent single transistor shunted reverse fast-recovery diodes. The module is produced with maximum voltage 3300 V (current 50,100 A).



Module type	Current, A	Voltage class	
		33	65
2M9	50	Fig. 1	
	100	Fig. 2	

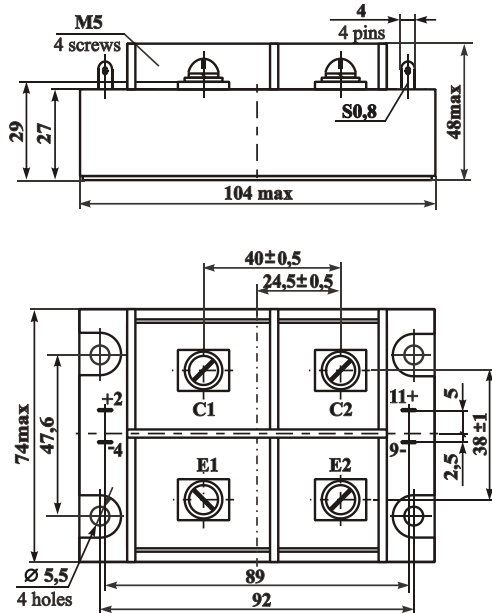


Figure 1

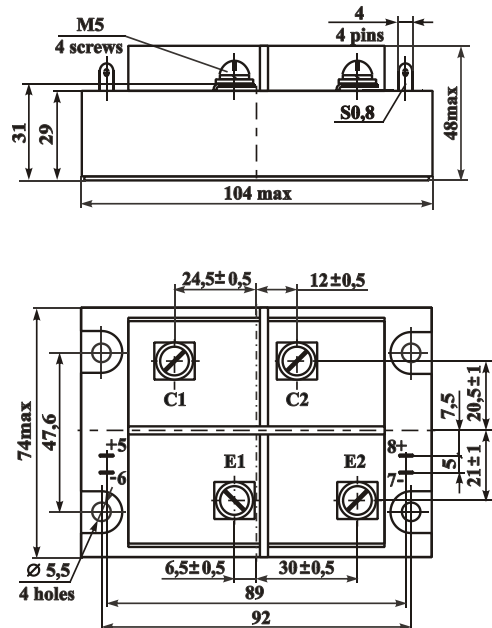
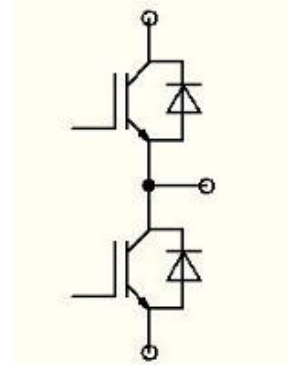


Figure 2

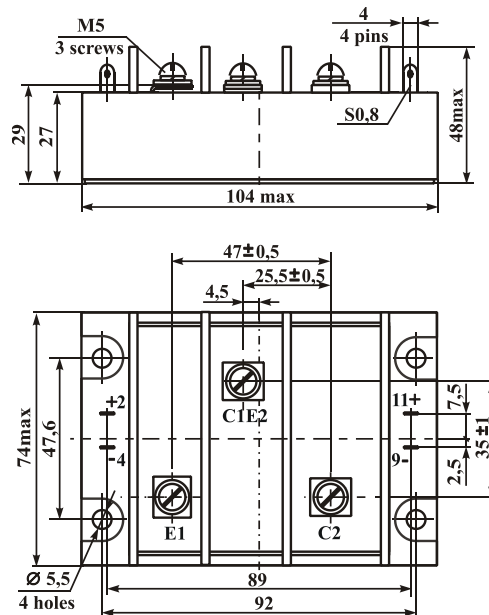


## High-voltage half-bridge M12

Modules **M12** – two series connected transistors (half-bridge) shunted with reverse fast-recovery diodes. The module is produced with maximum voltage 3300 V (current 50,100 A) or 6500 V (current 25,50 A).



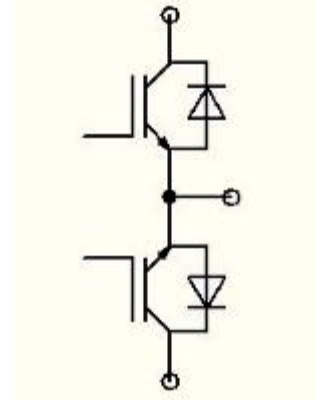
Module type	Current, A	Voltage class	
		33	65
M12	25		Fig. 1
	50	Fig. 1	Fig. 1
	100	Fig. 1	



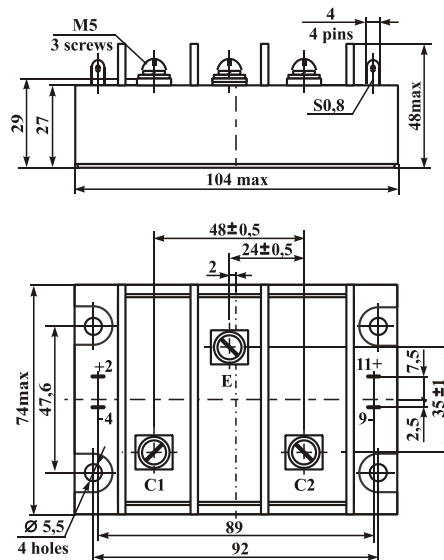
**Figure 1**

### High-voltage back-to-back transistors M12.1

Modules **M12.1** – two back-to-back transistors (common emitter) shunted with reverse fast-recovery diodes. The module is produced with maximum voltage 3300 V (current 50,100 A) or 6500 V (current 25,50 A).

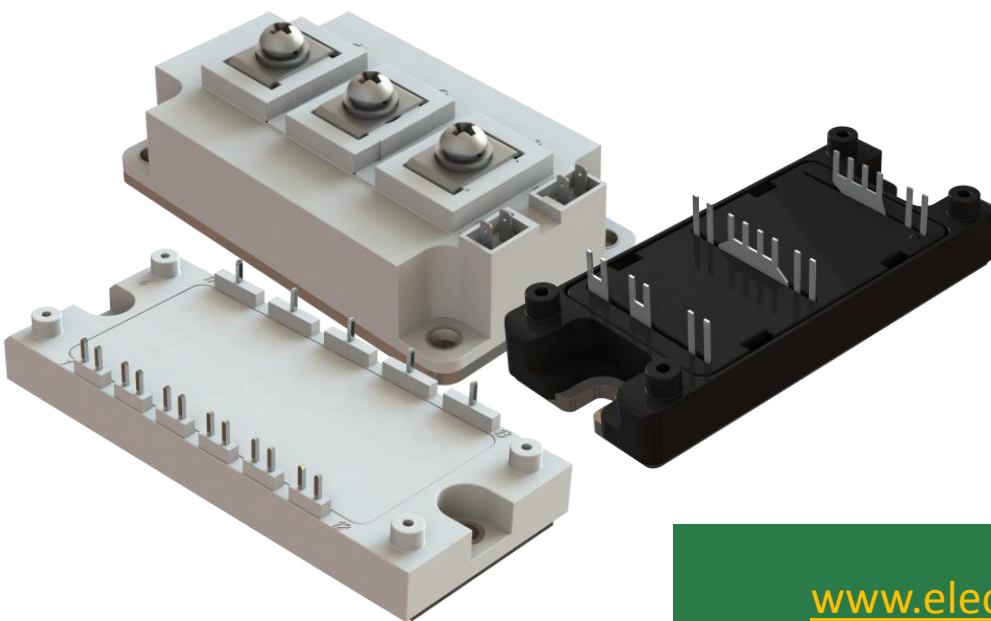


Module type	Current, A	Voltage class	
		33	65
M12	25		Fig. 1
	50	Fig. 1	Fig. 1
	100	Fig. 1	



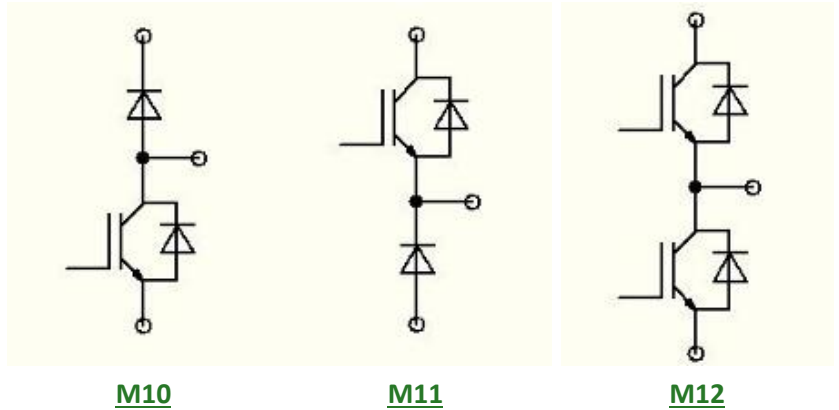
**Figure 1**

## Modules-analogues based on IGBT-transistors



### Assemblies in design version «E2»

IGBT-modules in design version «E2» are assemblies IGBT-transistors and FRDs intended to switch power loads as a part of converters with maximum peak voltage 600 V or 1200 V and DC up to 150 A. The modules are analogues of design «Semitrans2».

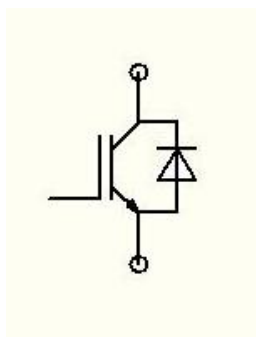


Module type	Voltage, V	Current, A			
		50	75	100	150
M10	600		+		
	1200	+	+	+	+
M11	600		+		
	1200				+
M12	600	+	+	+	+
	1200	+	+	+	+

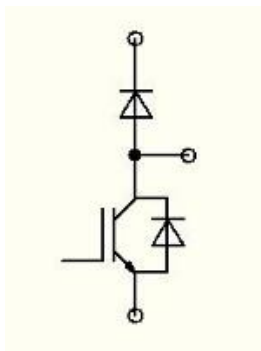


### Assemblies in design versions «E3-1», «E3-2»

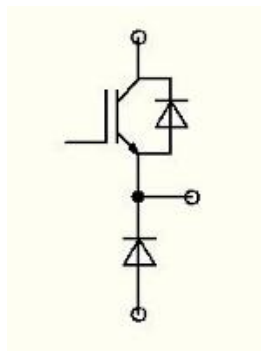
IGBT-modules in design versions «E3-1», «E3-2» are assemblies of IGBT-transistors and FRDs intended to switch power loads as a part of converters with maximum peak voltage 600 V or 1200 V and DC up to 600 A. The modules are analogues of design version «Semitrans3» and «Semitrans4».



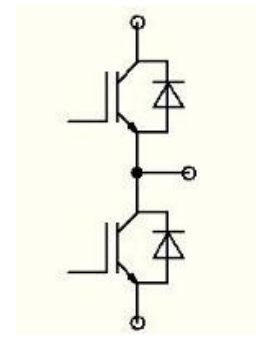
**M9**



**M10**



**M11**



**M12**

Module type	Voltage, V	Current, A				
		150	200	300	400	600
M9	1200		Fig. 1	Fig. 1	Fig. 1	Fig. 1
M10	600			Fig. 2		
	1200	Fig. 2	Fig. 2	Fig. 2	Fig. 2	
M11	600			Fig. 2		
	1200	Fig. 2	Fig. 2	Fig. 2	Fig. 2	
M12	600		Fig. 2	Fig. 2	Fig. 2	Fig. 2
	1200	Fig. 2	Fig. 2	Fig. 2	Fig. 2	



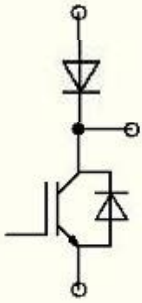
**Figure 1**



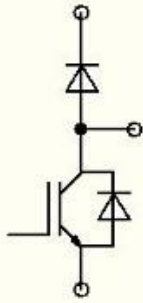
**Figure 2**

### Assemblies of switches in design version «M1»

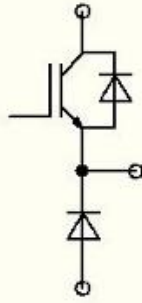
IGBT-modules in design versions «M1» are assemblies IGBT-transistors and FRDs intended to switch power loads as a part of converters with maximum peak voltage 600 V, 1200 V or 1700 V and DC up to 600 A. The modules are analogues of design version «SP6».



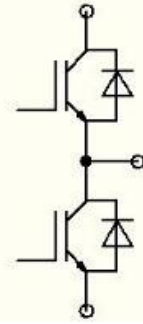
**M9.1**



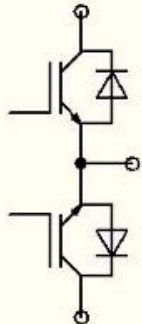
**M10**



**M11**



**M12**



**M12.1**

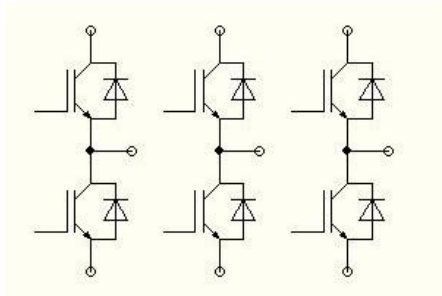
Type	Class	Current, A						
		150	200	300	350	400	450	600
M9.1	6							
	12	+	+	+				
	17	+	+	+				
M10	6				+		+	+
	12	+	+	+		+		
	17	+	+	+				
M11	6				+		+	+
	12	+	+	+		+		
	17	+	+	+				
M12	6				+		+	+
	12	+	+	+		+		
	17	+	+	+				
M12.1	6				+		+	+
	12	+	+	+		+		
	17	+	+	+				



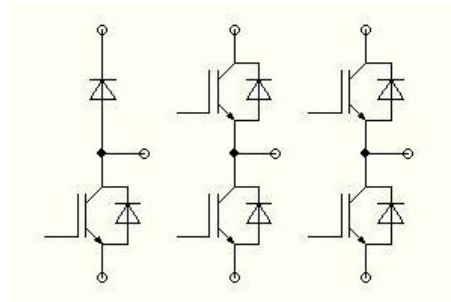
[see user's manual of product](#)

### Inverters in design version «M1»

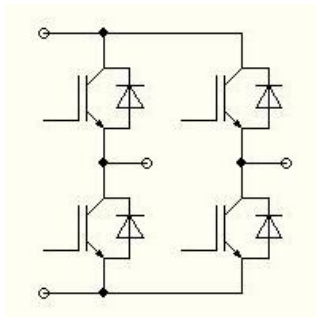
IGBT-modules in design versions «M1» are assemblies IGBT-transistors and FRDs intended to switch power loads as a part of converters with maximum peak voltage 600 V, 1200 V or 1700 V and DC up to 200 A. The modules are analogues of design version «SP6».



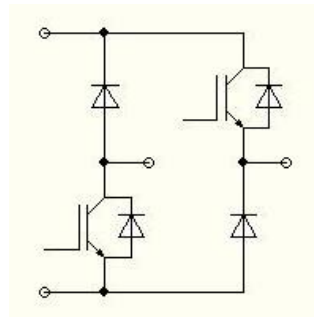
**M13A1**



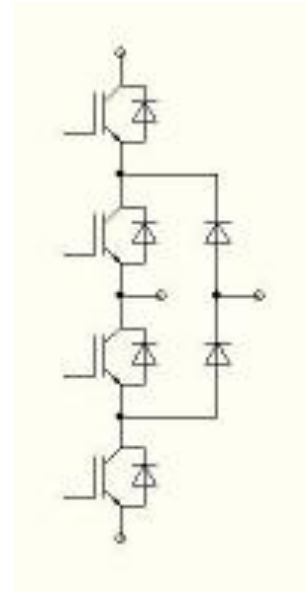
**M13A4**



**M13B**



**M13B1**

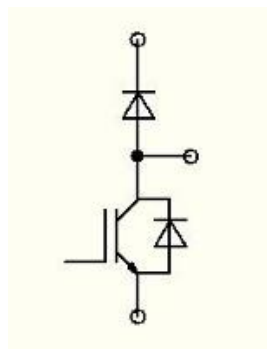


**M13A5**

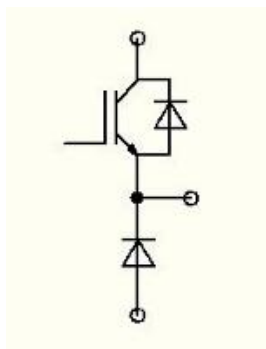
Type	Class	Current, A				
		50	75	100	150	200
M13A1	6	+	+	+	+	
	12	+	+	+		
	17	+				
M13A4	6			+		
	12	+				
M13A5	6				+	+
	12					+
	17			+		
M13B	12				+	+
	17			+	+	
M13B1	12				+	+
	17			+	+	

### Assemblies of switches in design version «M2»

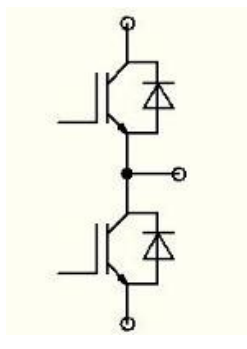
IGBT-modules in design versions «M2» are assemblies IGBT-transistors and FRDs intended to switch power loads as part of converters with maximum peak voltage 600 V, 1200 V or 1700 V and DC up to 300 A. The modules are analogues of design version «SP4».



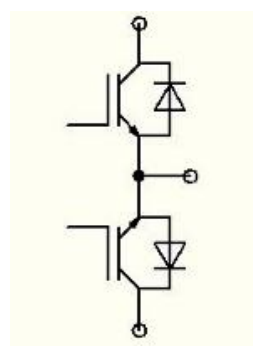
**M10**



**M11**

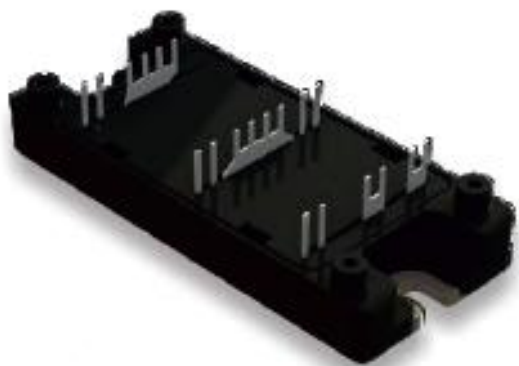


**M12**



**M12.1**

Type	Class	Current, A					
		50	75	100	150	200	300
M10	6					+	+
	12	+	+	+	+		
	17	+					
M11	6					+	+
	12	+	+	+	+		
	17	+					
M12	6					+	+
	12	+	+	+	+		
	17	+					
M12.1	6			+		+	
	12	+	+	+			
	17	+					

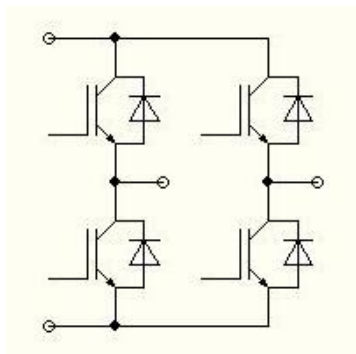


[see user's manual of product](#)

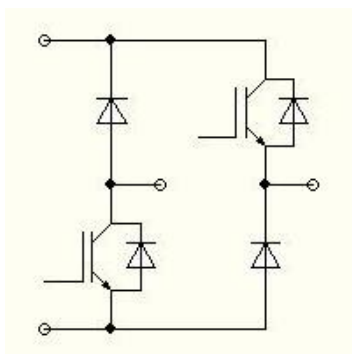


### Inverters in design version «M2»

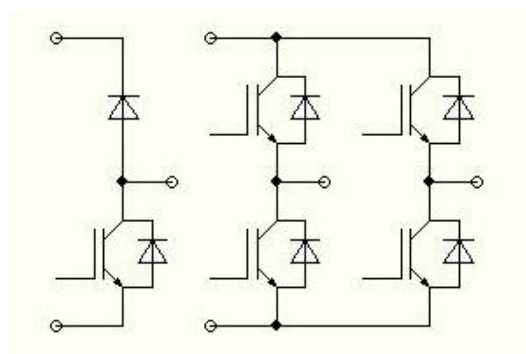
IGBT-modules in design versions «M2» are assemblies IGBT-transistors and FRDs intended to switch power loads as part of converters with maximum peak voltage 600 V, 1200 V or 1700 V and DC up to 150 A. The modules are analogues of design version «SP4».



**M13B**



**M13B1**

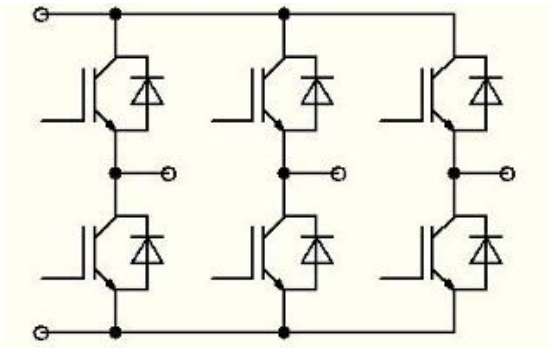


**M13E**

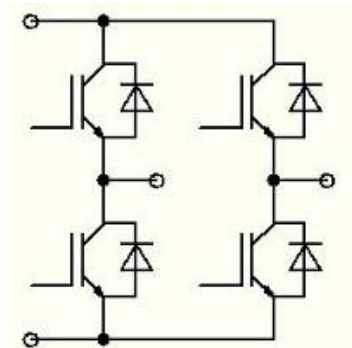
Type	Class	Current, A				
		25	50	75	100	150
M13B	6				+	+
	12		+	+	+	
	17		+			
M13B1	6				+	+
	12		+	+	+	
	17		+			
M13E	6		+			
	12	+				

### Inverters in design version «S1»

IGBT-modules in design versions «S1» are assemblies IGBT-transistors and FRDs intended to switch power loads as a part of converters with maximum peak voltage 1200 V and DC up to 50 A. The modules are analogues of design version «Econopack2».

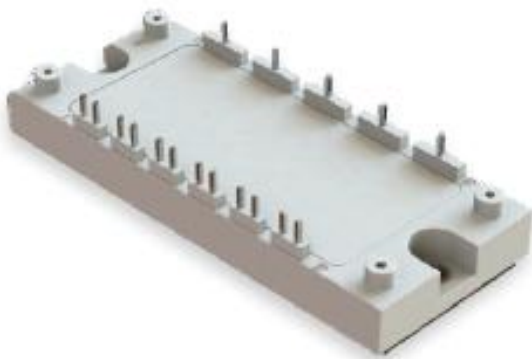


**M13A**



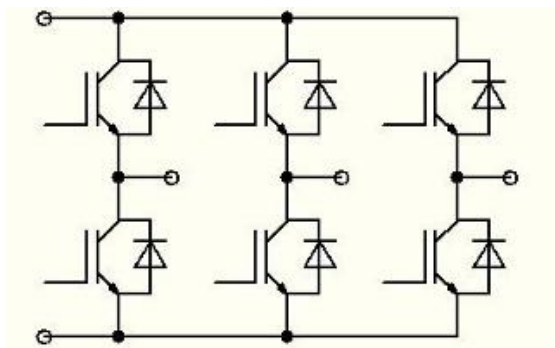
**M13B**

Type	Class	Current, A				
		25	50	75	100	150
<b>M13A</b>	<b>12</b>	+	+			
<b>M13B</b>	<b>12</b>	+	+			

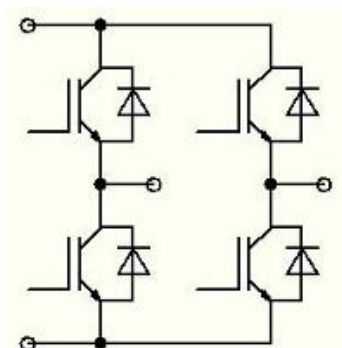


### Inverters in design version «S2»

IGBT-modules in design versions «S2» are assemblies IGBT-transistors and FRDs intended to switch power loads as a part of converters with maximum peak voltage 1200 V and DC up to 50 A. The modules are analogues of design version «Econopack2».



**M13A**



**M13B**

Type	Class	Current, A				
		25	50	75	100	150
<b>M13A</b>	<b>12</b>	+	+			
<b>M13B</b>	<b>12</b>	+	+			

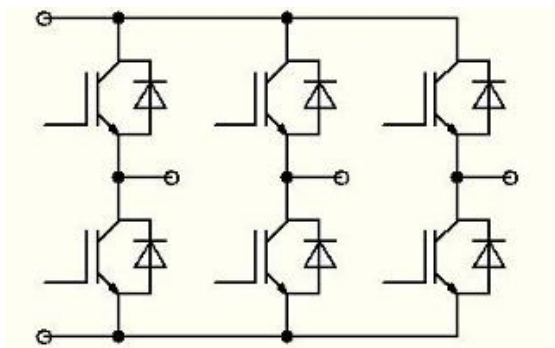


[see user's manual of product](#)

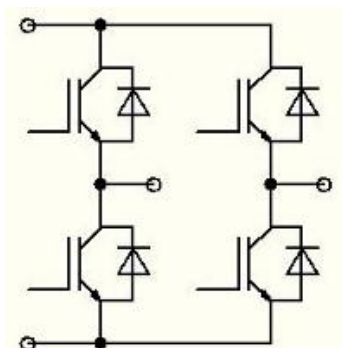
[www.electrum-av.com](http://www.electrum-av.com)

### Inverters in design version «S3»

IGBT-modules in design versions «S3» are assemblies IGBT-transistors of FRDs intended to switch power loads as a part of converters with maximum peak voltage 1200 V and DC up to 150 A. The modules are analogues of design version «Econopack3».



**M13A**



**M13B**

Type	Class	Current, A				
		25	50	75	100	150
M13A	12		+	+	+	
M13B	12				+	+



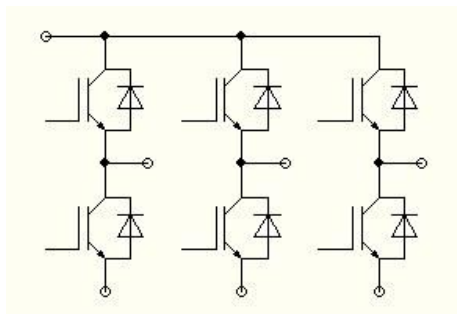
[see user's manual of product](#)

[www.electrum-av.com](http://www.electrum-av.com)

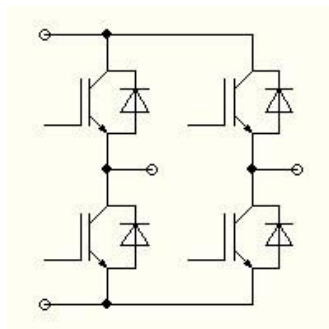
### Modules in design version «SK»

IGBT-modules in design versions «SK» are assemblies IGBT-transistors and FRDs intended for switch power loads as a part of converters with maximum peak voltage 1200 V and DC up to 100 A. The modules are analogues of design version «Semitop 3».

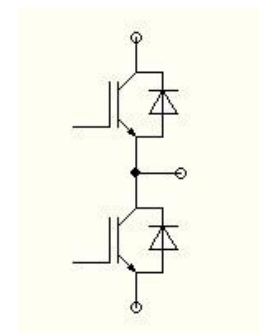
Module type	Voltage, V	Current, A		
		25	50	100
<b>M13A</b>	<b>1200</b>	+		
<b>M13B</b>	<b>1200</b>		+	+
<b>M12</b>	<b>1200</b>		+	+



**M13A**



**M13B**



**M12**



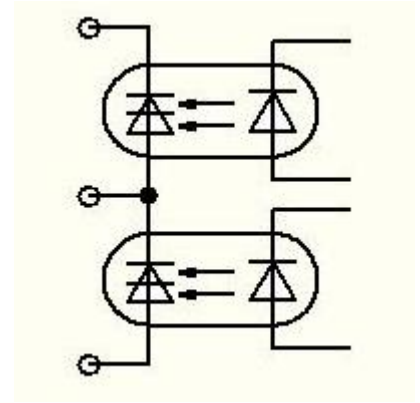
## Optothyristor modules



## Optothyristor assemblies MO1

Modules **MO1(A)** – optothyristor assembly (common cathode-anode). The modules are produced with an amount of maximum average current 25,40,63,80,100,125,160,200,250 A, with peak voltage 1200 V or 1600 V.

A Symbol «A» in the name of the module shows that the minimum voltage of main circuit is 10 V; the modules without a symbol «A» have the minimum voltage of main circuit 50 V.



Type	Maximum average current, A								
	25	40	63	80	100	125	160	200	250
MO1(A)	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 3	Fig. 3

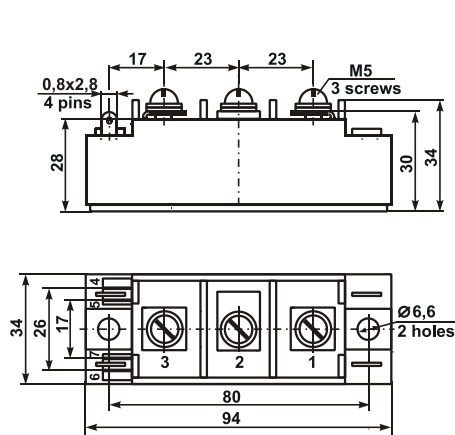


Figure 1

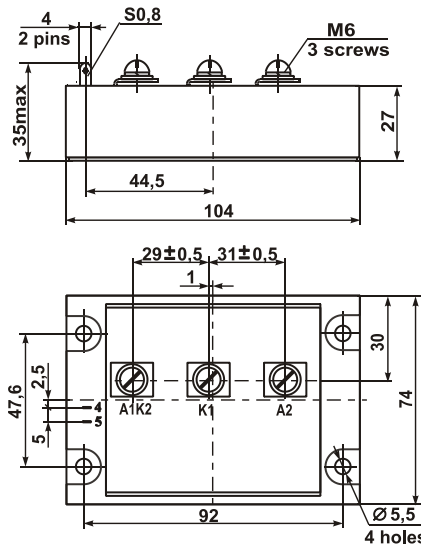


Figure 2

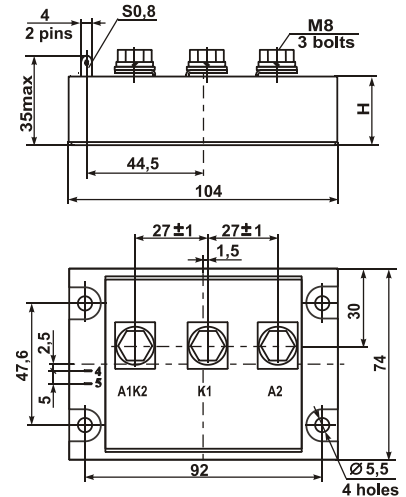
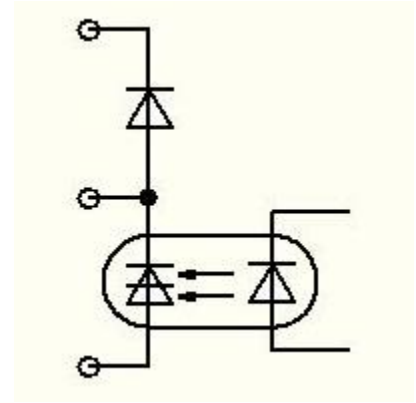


Figure 3

## Optothyristor assemblies MO2

Modules **MO2(A)** – diode-optothyristor module (common thyristor cathode and diode anode). The modules are produced with an amount of maximum average current 25,40,63,80,100,125,160,200,250 A, with peak voltage 1200 V or 1600 V.

A Symbol «A» in the name of the module shows that the minimum voltage of main circuit is 10 V; the modules without a symbol «A» have the minimum voltage of main circuit 50 V.



Type	Maximum average current, A								
	25	40	63	80	100	125	160	200	250
MO2(A)	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 3	Fig. 3

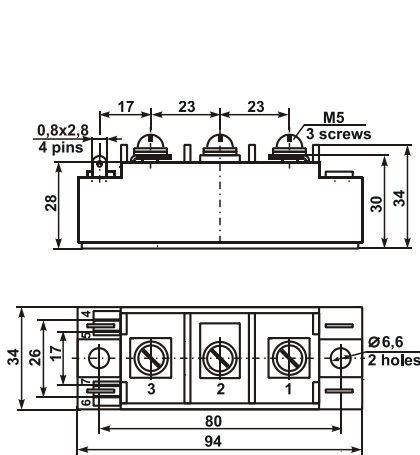


Figure 1

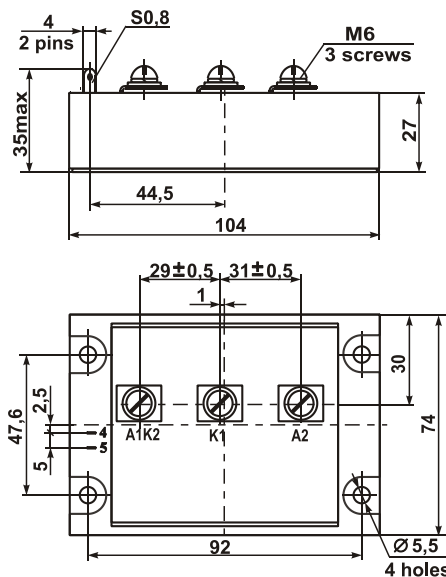


Figure 2

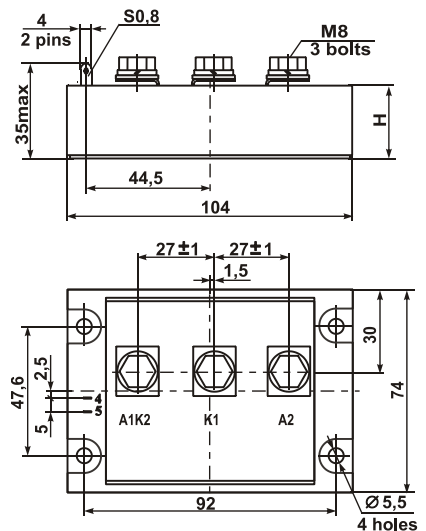


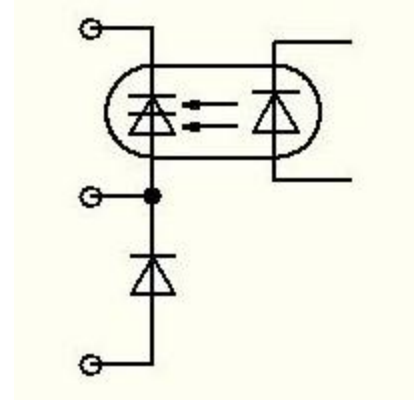
Figure 3



## Optothyristor assemblies MO3

Modules **MO3(A)** – diode-optothyristor module (common thyristor anode and diode cathode). The modules are produced with an amount of maximum average current 25,40,63,80,100,125,160,200,250 A, with peak voltage 1200 V or 1600 V.

A Symbol «A» in the name of the module shows that the minimum voltage of main circuit is 10 V; the modules without a symbol «A» have the minimum voltage of main circuit 50 V.



Type	Maximum average current, A								
	25	40	63	80	100	125	160	200	250
<b>MO3(A)</b>	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 3	Fig. 3

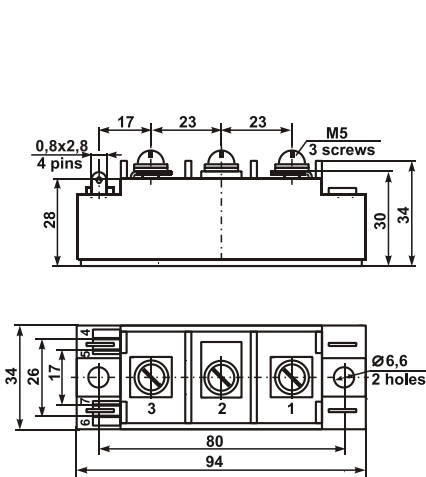


Figure 1

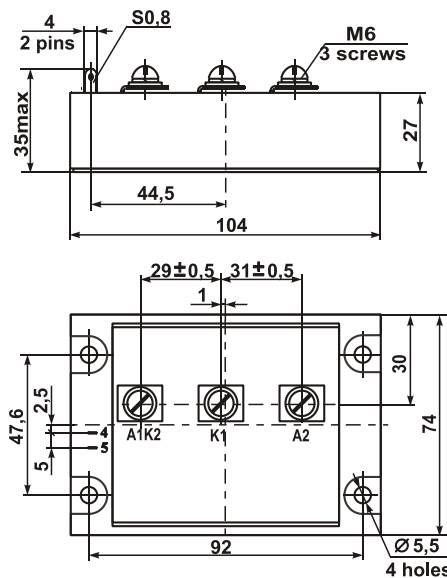


Figure 2

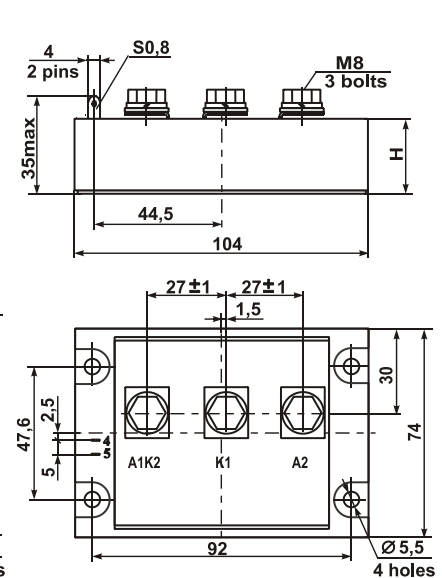
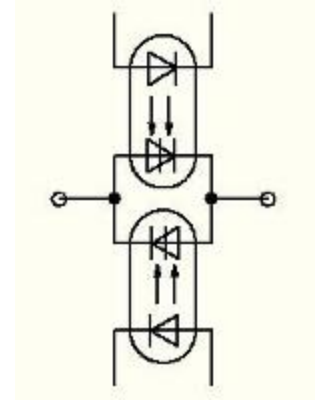


Figure 3

### Optothyristor assemblies MO8D

Module **MO8D** – single-phase optothyristor module. The modules are produced with an amount of maximum average current 25,40,63,80,100,125,160,200,250 A, with peak voltage 1200 V or 1600 V.



Type	Maximum average current, A								
	25	40	63	80	100	125	160	200	250
MO8D	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1

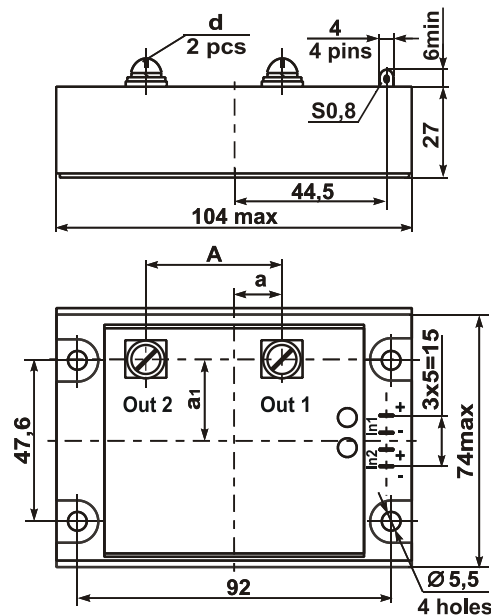
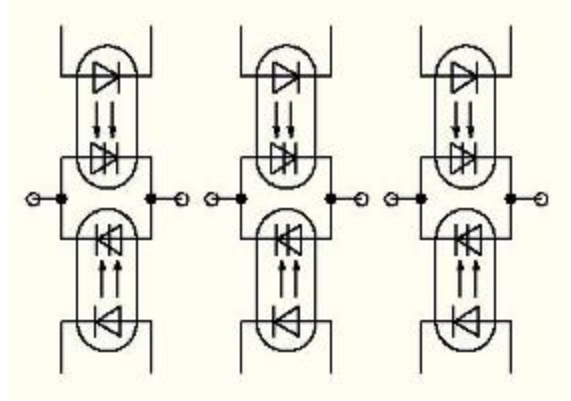


Figure 1

## Optothyristor assemblies MO26D

Module **MO26D** – three-phase optothyristor module. The modules are produced with an amount of maximum average current 25,40,63,100 A, with peak voltage 1200 V or 1600 V.



Type	Maximum average current, A					
	25	40	63	80	100	125
MO26D	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1

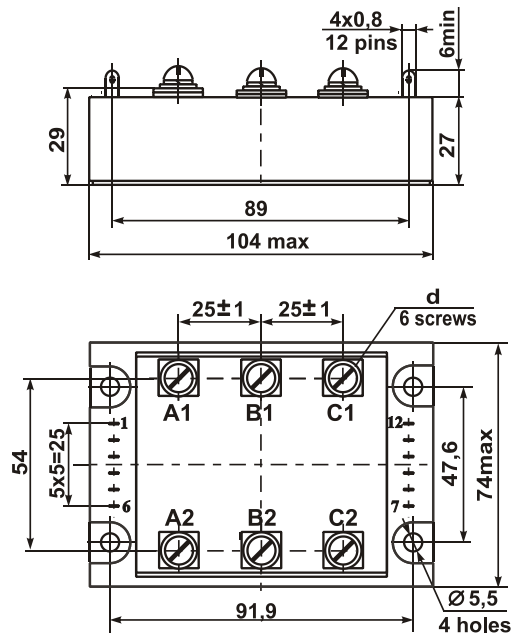
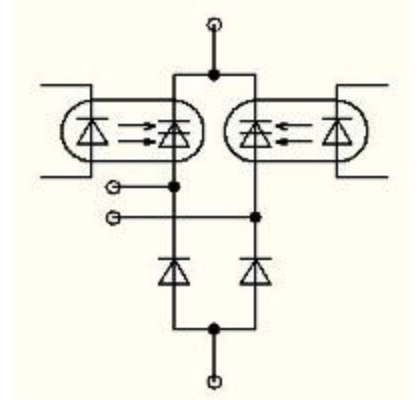


Figure 1

## Optothyristor bridges MO20

Module **MO20(A)** – diode-optothyristor single-phase rectifier bridge (thyristors in cathode group). The module are produced with an amount of maximum output average current 63,100,160,200,250 A, with peak voltage 1200 V or 1600 V.

A Symbol «A» in the name of the module shows that the minimum voltage of main circuit is 10 V; the modules without a symbol «A» have the minimum voltage of main circuit 50 V.



Type	Maximum average current, A				
	63	100	160	200	250
MO20(A)	Fig. 1	Fig. 2	Fig. 2	Fig. 3	Fig. 3

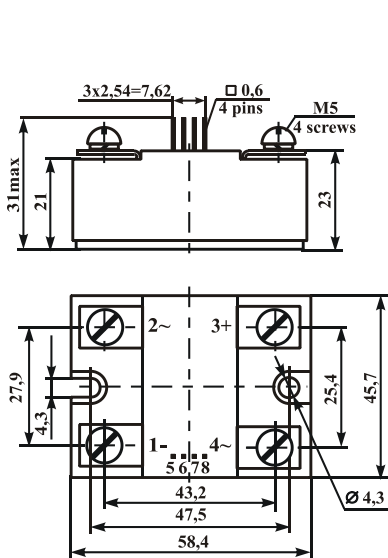


Figure 1

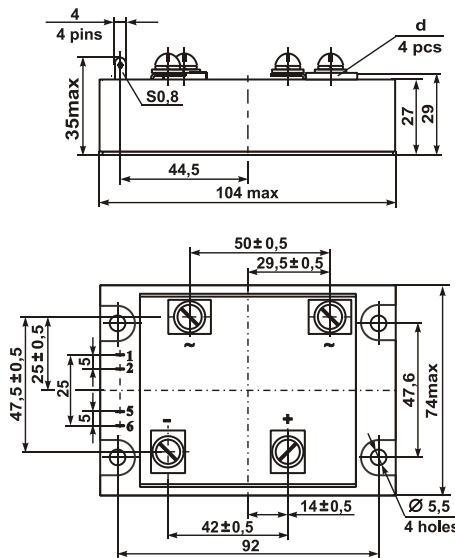


Figure 2

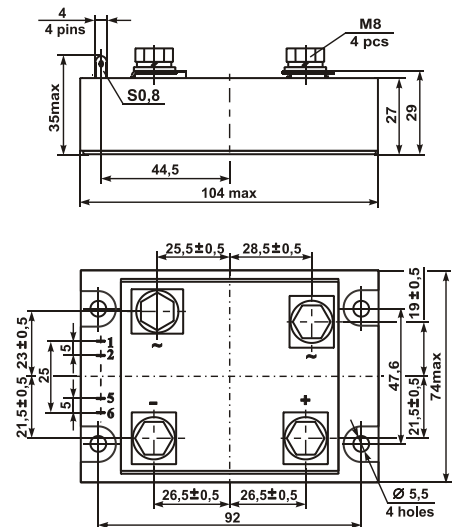
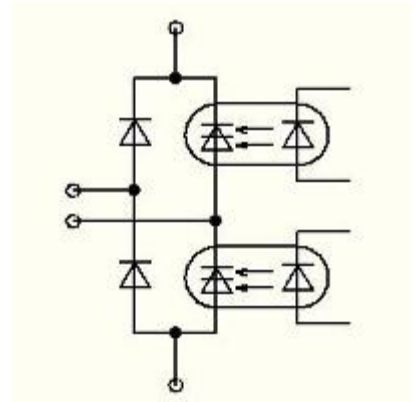


Figure 3

## Optothyristor bridges MO21

Module **MO21(A)** – diode-optothyristor single-phase rectifier bridge (thyristors in single arm). The modules are produced with an amount of maximum output average current 63,100,160 A, with peak voltage 1200 V or 1600 V.

A Symbol «A» in the name of the module shows that the minimum voltage of main circuit is 10 V; the modules without a symbol «A» have the minimum voltage of main circuit 50 V.



Type	Maximum average current, A		
	63	100	160
MO21(A)	Fig. 1	Fig. 2	Fig. 2

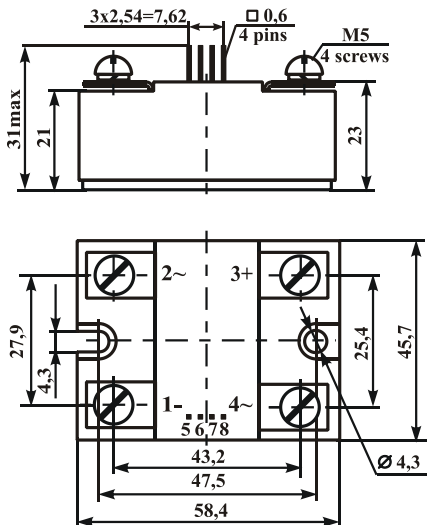


Figure 1

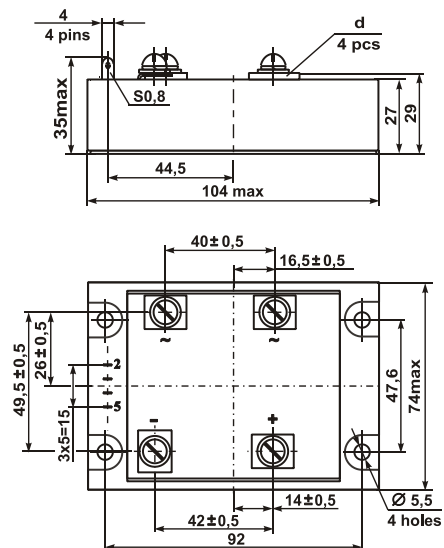
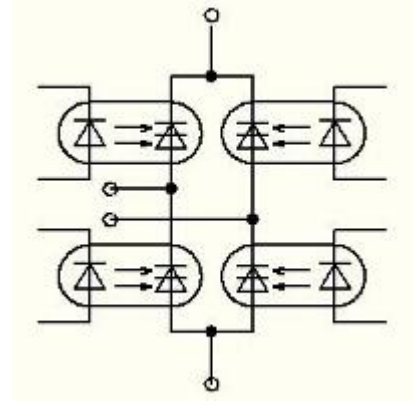


Figure 2

## Optothyristor bridges MO22

Module **MO22(A)** – optothyristor single-phase rectifier bridge. The modules are produced with an amount of maximum output average current 63,100,160 A, with peak voltage 1200 V or 1600 V.

A Symbol «A» in the name of the module shows that the minimum voltage of main circuit is 10 V; the modules without a symbol «A» have the minimum voltage of main circuit 50 V.



Type	Maximum average current, A		
	63	100	160
MO22(A)	Fig. 1	Fig. 1	Fig. 2

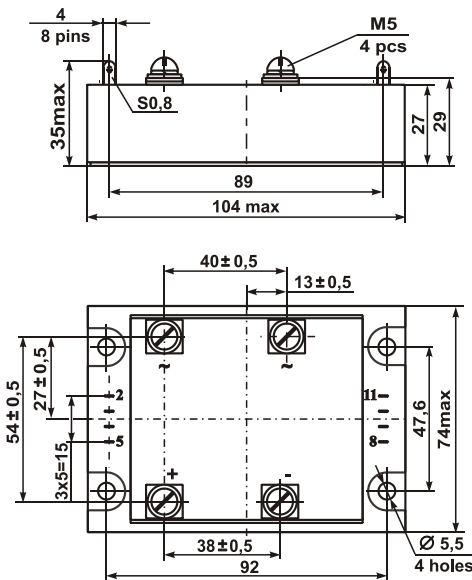


Figure 1

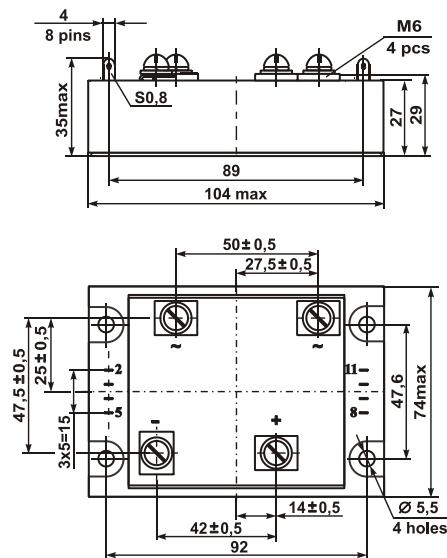
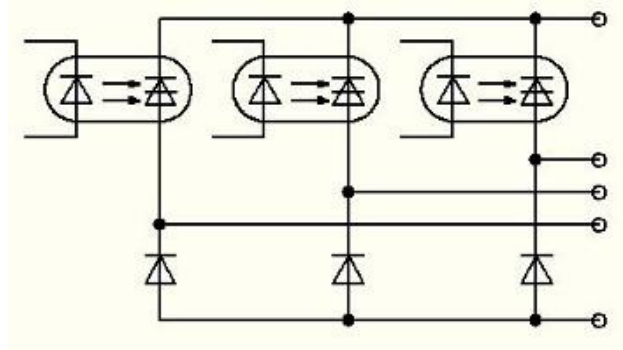


Figure 2

## Optothyristor bridges MO23

Module **MO23(A)** – diode-optothyristor three-phase rectifier bridge (thyristors in cathode group). The modules are produced with an amount of maximum output average current 63,100,160,200,250 A, with peak voltage 1200 V or 1600 V.

A Symbol «A» in the name of the module shows that the minimum voltage of main circuit is 10 V; the modules without a symbol «A» have the minimum voltage of main circuit 50 V.



Type	Maximum average current, A				
	63	100	160	200	250
<b>MO23(A)</b>	Fig. 1	Fig. 2	Fig. 2	Fig. 2	Fig. 2

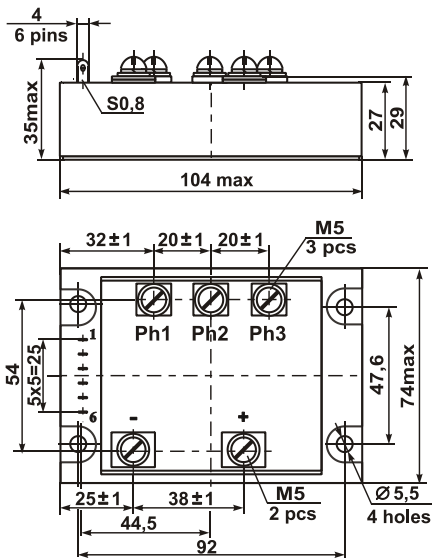


Figure 1

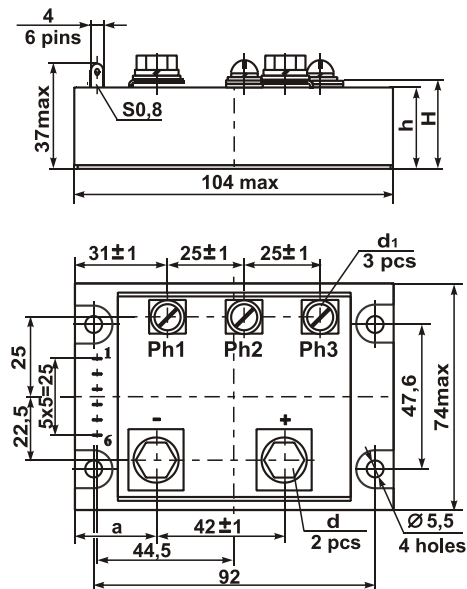
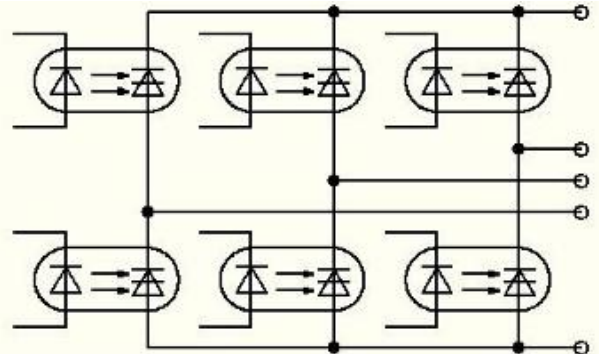


Figure 2

## Optothyristor bridges MO24

Module **MO24(A)** – optothyristor three-phase rectifier bridge. The modules are produced with an amount of maximum output average current 63,100,160,250 A, with peak voltage 1200 V or 1600 V.

A Symbol «A» in the name of the module shows that the minimum voltage of main circuit is 10 V; the modules without a symbol «A» have the minimum voltage of main circuit 50 V.



Type	Maximum average current, A			
	63	100	160	250
MO24(A)	Fig. 1	Fig. 1	Fig. 1	Fig. 2

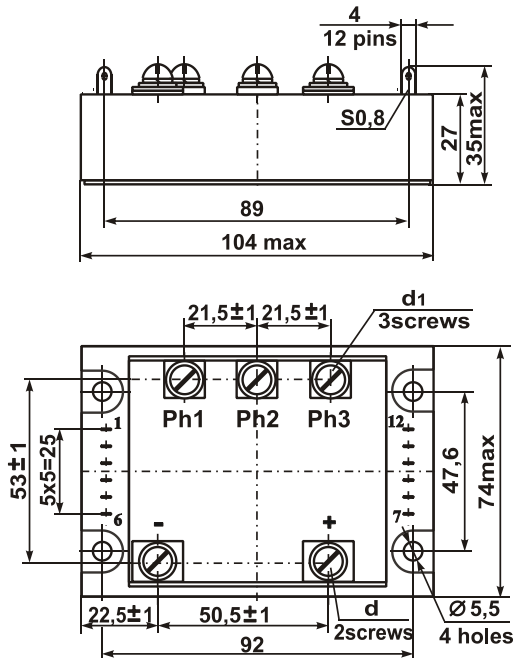


Figure 1

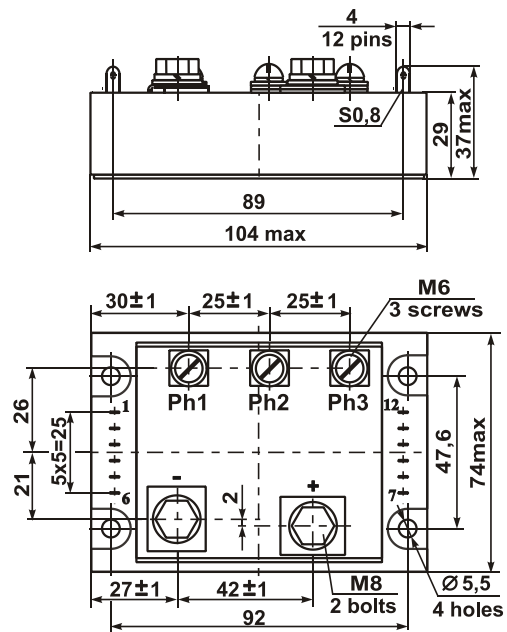


Figure 2



### Thyristor module with transformer control TM1

Modules **TM1** – thyristor module with transformer isolation intended to use them as a part of switch elements of control rectifiers, converters (inverters), power regulators for power loads with maximum peak voltage 1200 V or 1600 V and DC up to 250 A.

Type	Maximum average current, A					
	25	40	63	100	160	250
<b>TM1</b>	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 1	Fig. 1

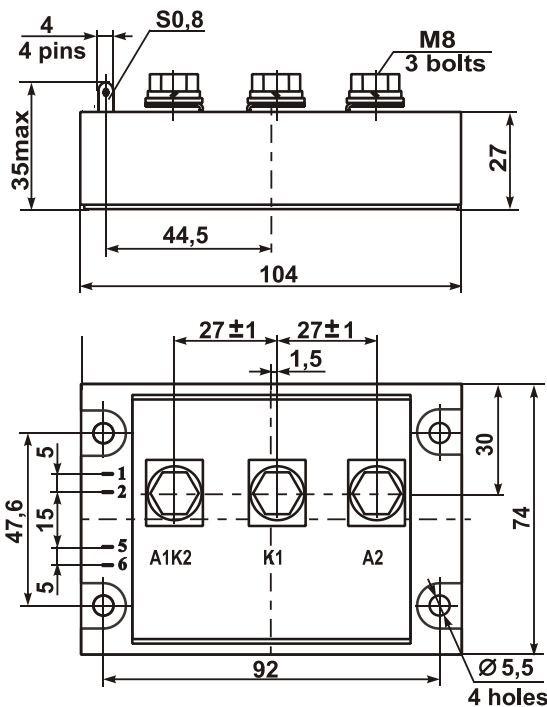


Figure 1

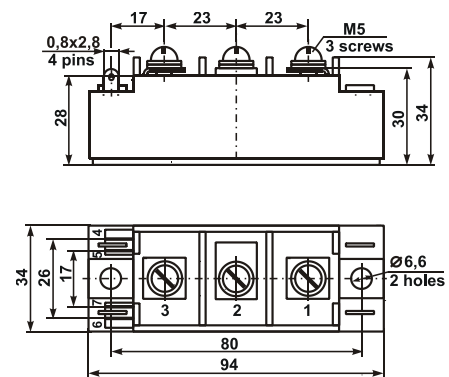
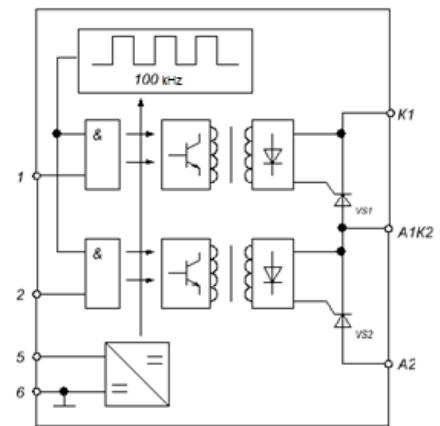
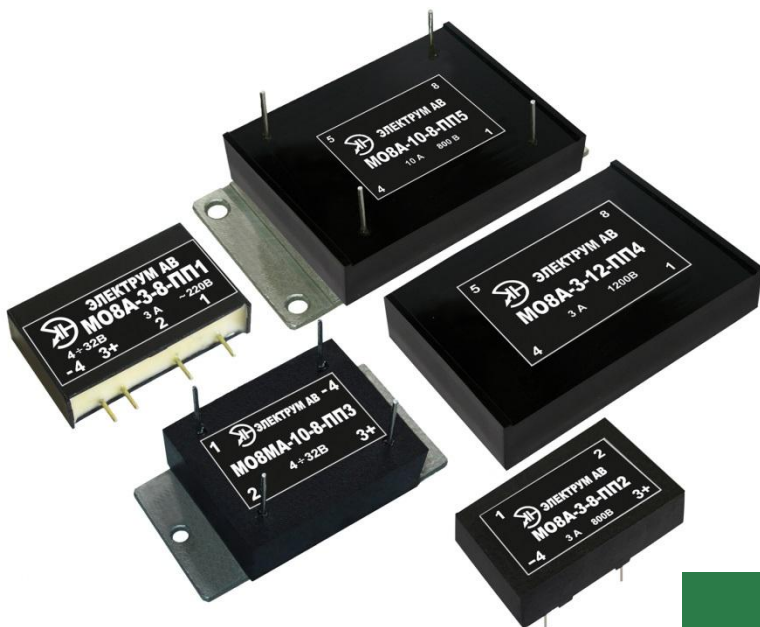


Figure 2

## Alternating current relays



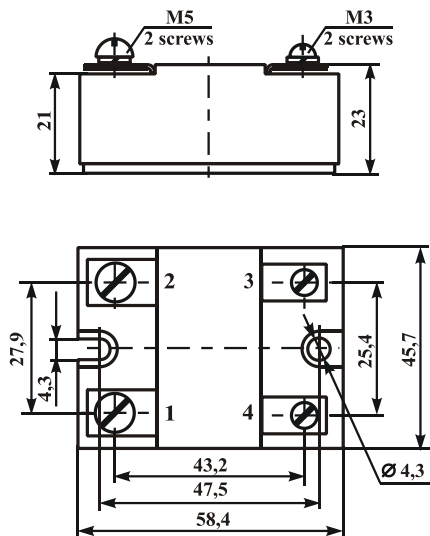
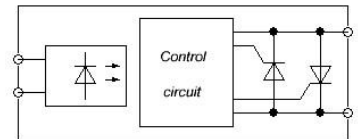
### Thyristor single-phase relay MO8

Modules **MO8** – a single-phase optothyristor relay. The modules are produced with an amount of maximum rated current 25,40,63,80,100,120,160,200,250 A, with peak voltage 1200 V or 1600 V.

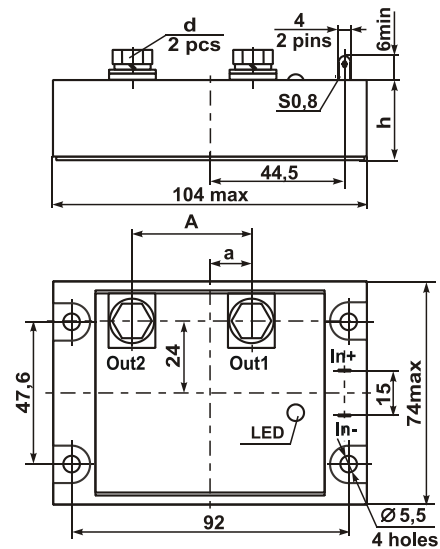
**By the control type:**

- MO8A – control voltage 4...32 V (DC) without control phase «zero».
- MO8B – control voltage 6...30 V (AC) without control phase «zero».
- MO8C – control voltage 110...280 V (AC) without control phase «zero».
- MO8MA – control voltage 4...32 V (DC) with control phase «zero».
- MO8MB – control voltage 6...30 V (AC) with control phase «zero».
- MO8MC – control voltage 110...280 V (AC) with control phase «zero».

Type	Maximum rated current, A								
	25	40	63	80	100	120	160	200	250
<b>MO8</b>	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 2	Fig. 2



**Figure 1**



**Figure 2**

### Compact single-phase relay MO8-PP

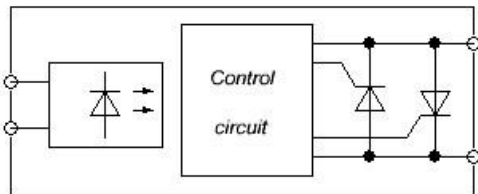
Modules of series **MO8-PP** – a single-phase optothyristor relay. The modules are produced with maximum rated current 4 A or 10 A, with peak voltage 800 V or 1200 V.

**By the control type:**

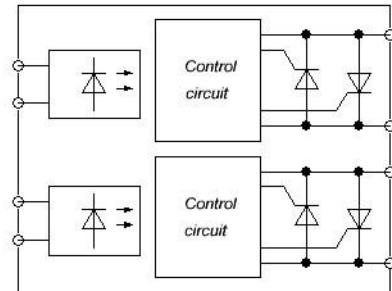
MO8A – control voltage 4...32 V (DC) without control phase «zero».

MO8MA – control voltage 4...32 V (DC) with control phase «zero».

Type	Maximum rated current, A	
	4	10
MO8-PP1	Fig. 1	
MO8-PP2	Fig. 2	
MO8-PP3		Fig. 3
2MO8-PP4	Fig. 4	
2MO8-PP5		Fig. 5



MO8



2MO8

## Compact single-phase relay MO8-PP

Overall drawings of modules **MO8-PP**

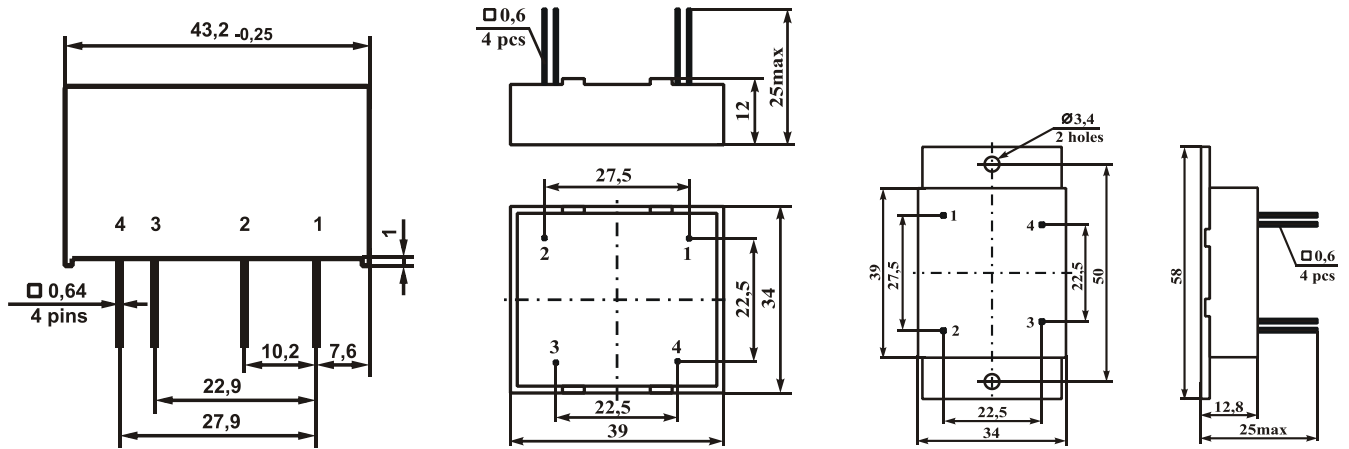


Figure 1

Figure 2

Figure 3

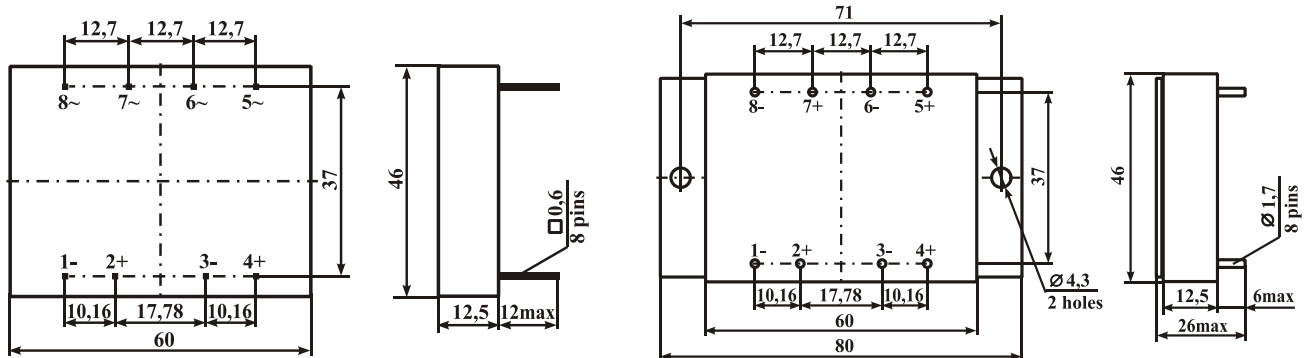


Figure 4

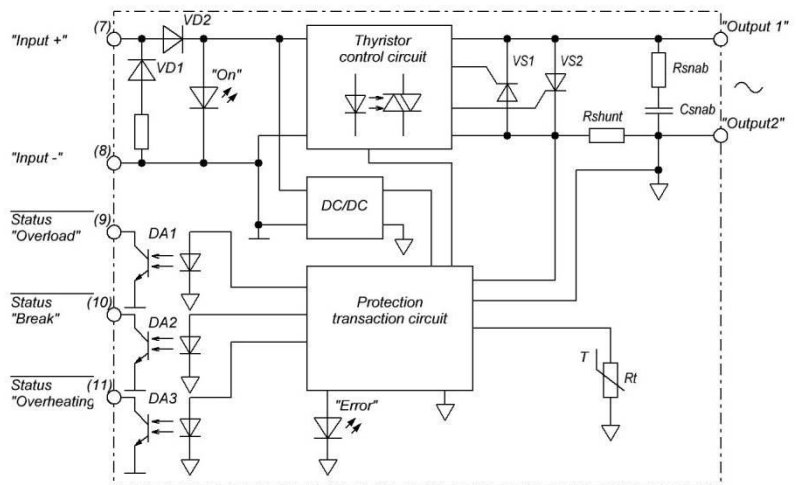
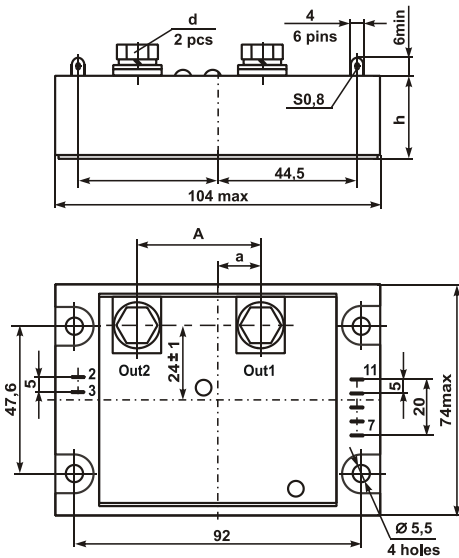
Figure 5

### Thyristor single-phase relay with protections MO8-T

Modules **MO8-T** – a solid state single-phase AC relay (optothyristor module) with protection against current overload, load open circuit and overheat. The modules are produced with an amount of maximum rated current 25,40,63,80,100,120,160,200,250,320 A, with peak voltage 1200 V or 1600 V.

**The module supports the following basic functions:**

- load switching in AC circuits with frequency from 50 to 400 Hz with power up to 250 kW;
- measuring of switching current using a inbuilt shunt (for devices up to 80 A) or using an external current-measuring transformer that comes fitted with the module (for devices up to 320 A);
- protection of power elements and commutated load against overcurrent and load open circuit;
- protection of power elements against overheat;
- presence of signaling LEDs about switching on the device (green) and failure (red);
- status signals about presence of failure: for T1 – one common status optically isolated signal; for T3 – three separated status optically isolated signals for overcurrent, load open circuit and overheat;
- protection against reverse of input control voltage.



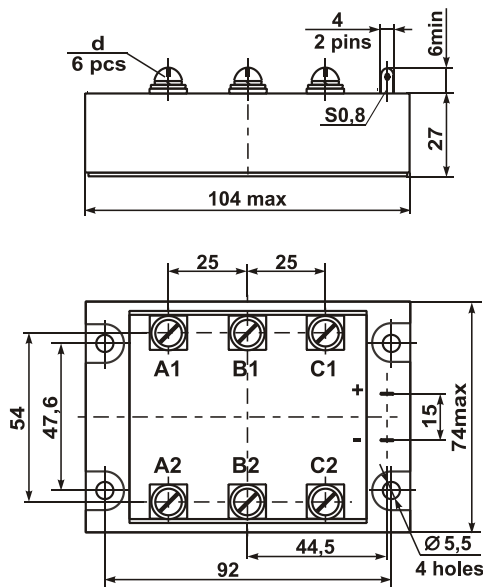
### Thyristor three-phase relay MO26

Modules **MO26** – a three-phase optothyristor relay. The modules are produced with an amount of maximum rated current 25,40,63,80,100,120 A, with peak voltage 1200 V or 1600 V.

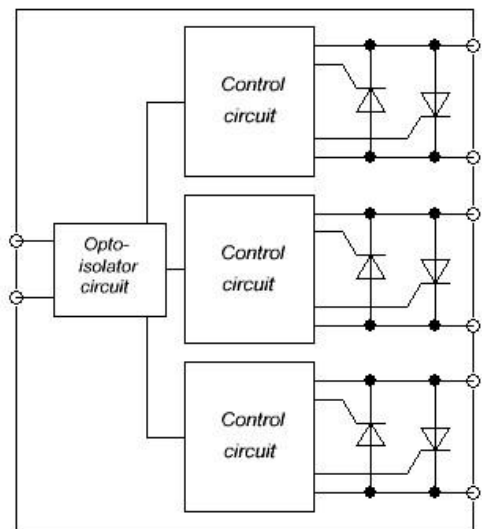
**By the control types:**

- MO26A – control voltage 4...32 V (DC) without control of phase «zero».
- MO26B – control voltage 6...30 V (AC) without control of phase «zero».
- MO26C – control voltage 110...280 V (AC) without control of phase «zero».
- MO26MA – control voltage 4...32 V (DC) with control of phase «zero».
- MO26MB – control voltage 6...30 V (AC) with control of phase «zero».
- MO26MC – control voltage 110...280 V (AC) with control of phase «zero».

Type	Maximum rated current, A					
	25	40	63	80	100	120
<b>MO26</b>	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1



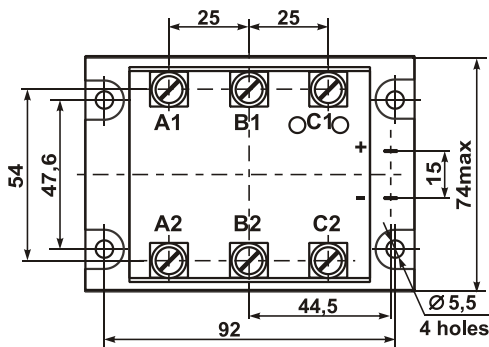
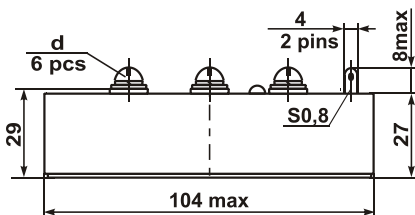
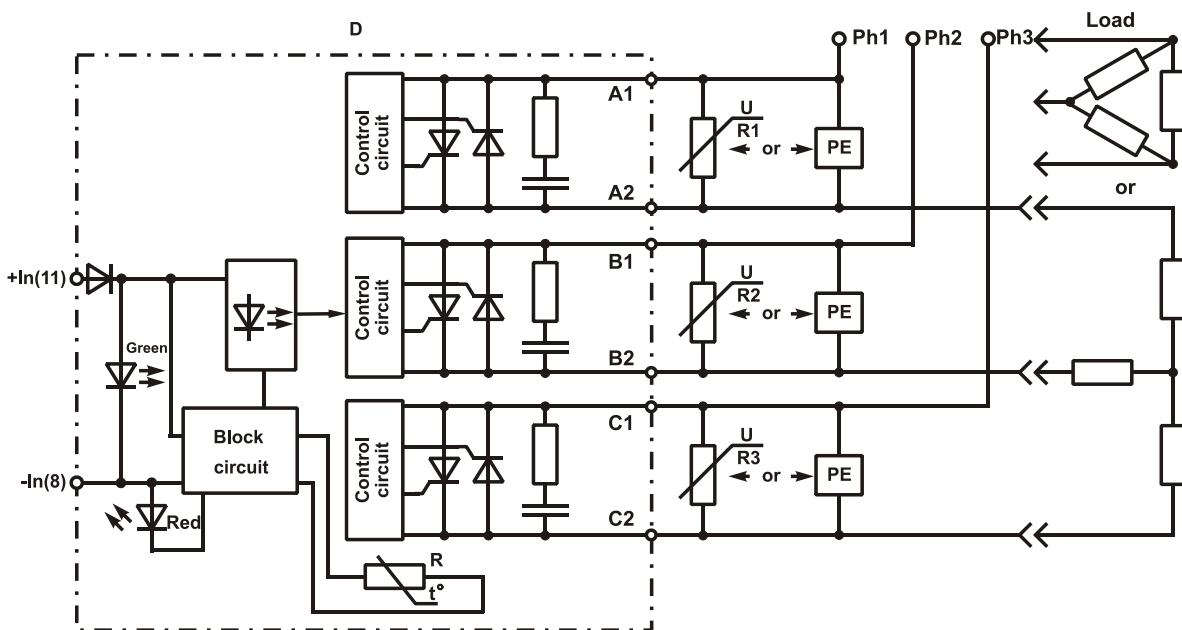
**Figure 1**



### Thyristor three-phase relay with protections MO26-T

Modules **MO26-T** – solid state thyristor optoelectronic three-phase AC relays with «normally open» contacts, with protection function of power thyristors against overheat. The modules are produced with an amount of maximum rated current 25,40,63,80,100,120 A, with peak voltage 1200 V or 1600 V.

Control voltage of module – 5...32 V with control of phase «zero».



[see user's manual of product](#)



### Thyristor three-phase relay MO26-MC

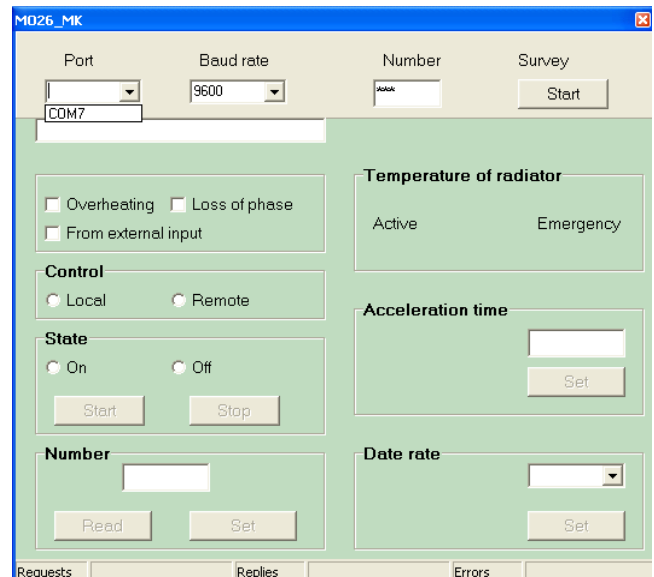
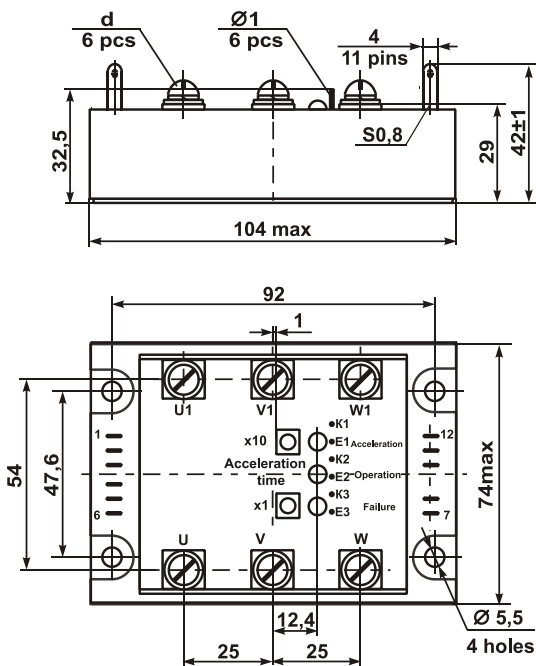
Modules **MO26-MC** – solid state thyristor three-phase AC relays with «normally open» terminals, with protection function against phase loss and overheat.

The module have the microprocessor control and intended to connect to PC via interface RS485.

The modules are produced with an amount of maximum rated current 25,40,63,80,100,120 A, with peak voltage 1200 V.

#### The modules perform the following basic functions:

- commutation of three-phase alternating voltage;
- control using PC via interface RS485;
- smooth supplying of alternating voltage;
- regulating of smooth switch-on duration;
- temperature control and emergency shutdown of the module when overheating;
- control of phases' presence and emergency shutdown of the module when phase loss;
- status display of the relay using status outputs and software-based to PC.



Control program window

### Microprocessor device of current protection MPT

**MPT** – microprocessor device of current protection (electronic starter) intended to protect elements of electric circuits against overload. Maximum limitation current 20 A for MPT 20MC and 200 A for MPT 200MC.

The MPT also researches ratio of current between phases and switches off load if the value exceeds by more than 2 times.

The MPT can be connected to PC via interface RS485

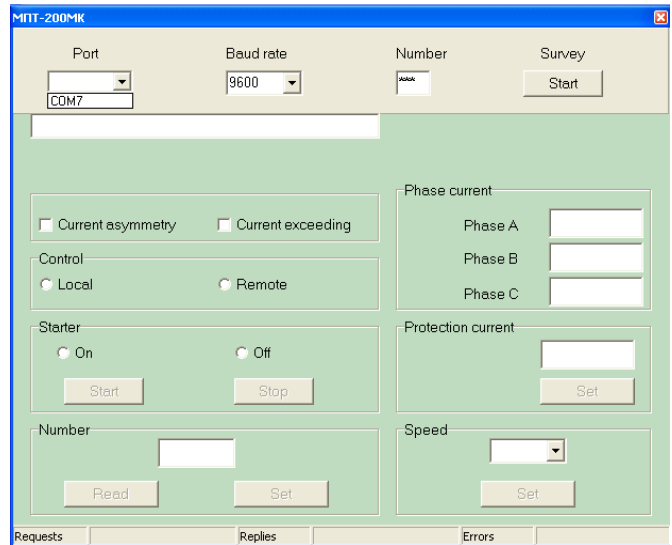
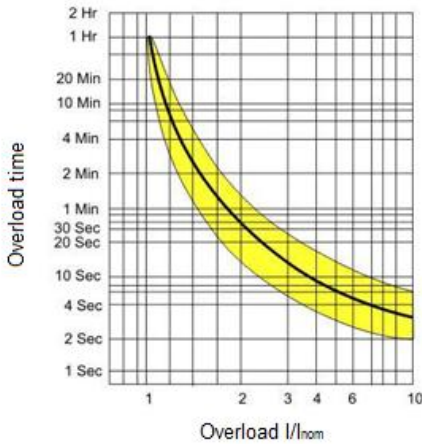
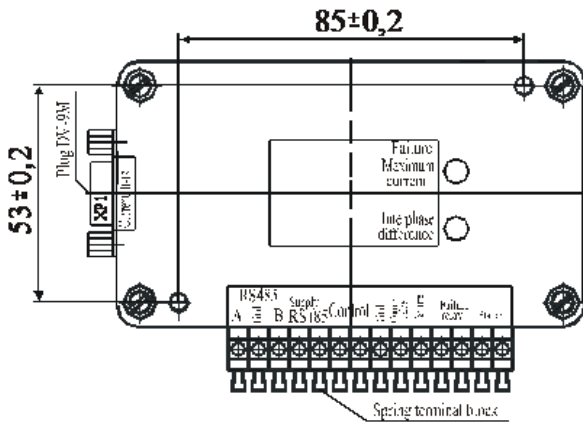


Diagram of current/time protection



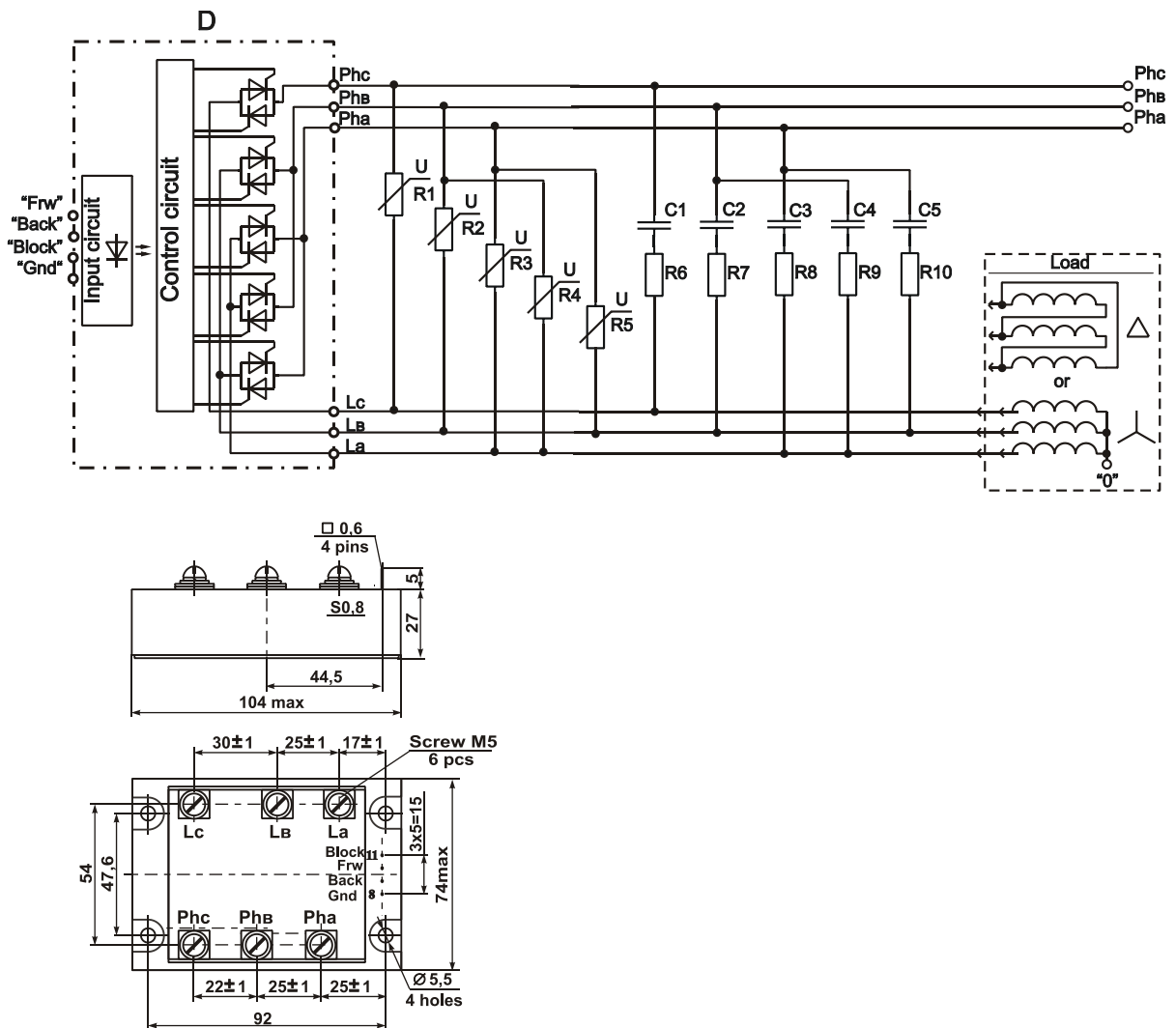
Control program window

[see user's manual of product](#)

### Thyristor reverse relay MO27

Modules **MO27A** – a three-phase optoelectronic thyristor relay for commutation of three motor phases. The modules are produced with an amount of maximum rated current 25,40,63 A, with peak voltage 1200 V.

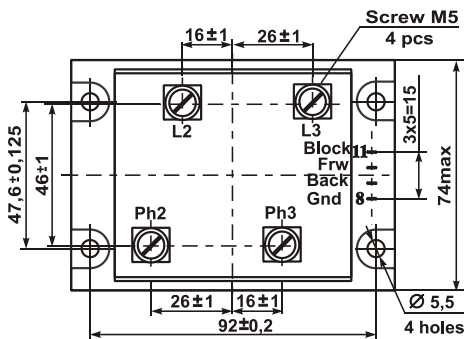
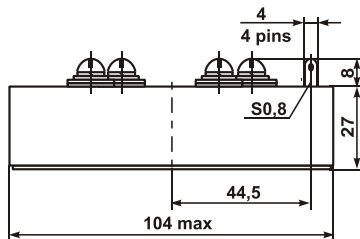
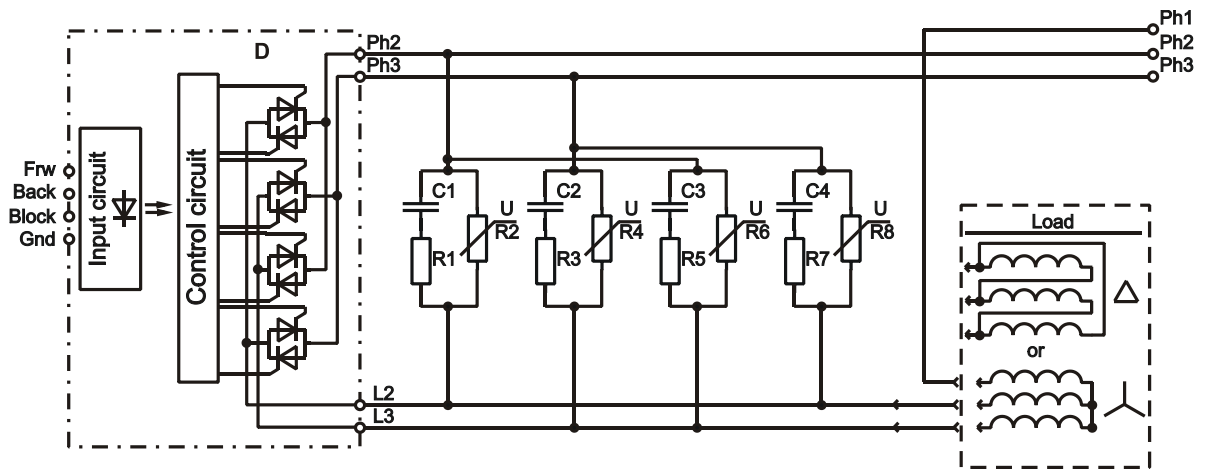
The modules are to control three-phase asynchronous motors. The relay performs on/off of motor and to change motor shaft spin direction and has optocoupler of controlling signals from power circuits, and also a blocking signal input of relay switch-on.



### Thyristor reverse relay MO27.1

Modules **MO27.1A** – a three-phase optothyristor relay for commutation of two motor phases. The modules are produced with maximum rated current 80 A or 120 A, with peak voltage 1200 V.

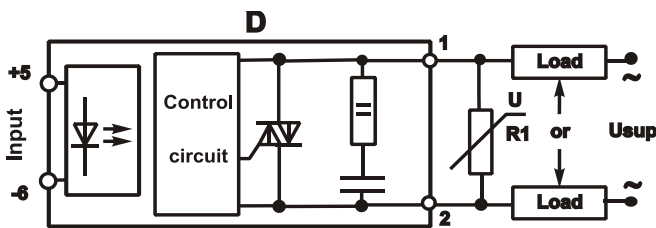
The modules intended to control three-phase asynchronous motors. The relay provides motor on/off and change of motor shaft spin direction and has optocoupler of controlling signals from power circuits, and also input of blocking signal of the relay switch-on.



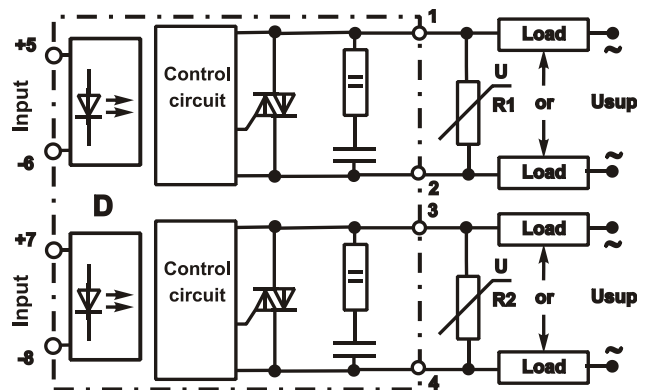
### Thyristor relay MO8-Din and 2MO8-Din

Modules **MO8-Din** and **2MO8-Din** – solid state semi-conductor optoelectronic relay with «normally open» terminals intended to switch loads in AC circuits with frequency from 50 to 400 Hz. The modules are intended to mount them to Din-rail.

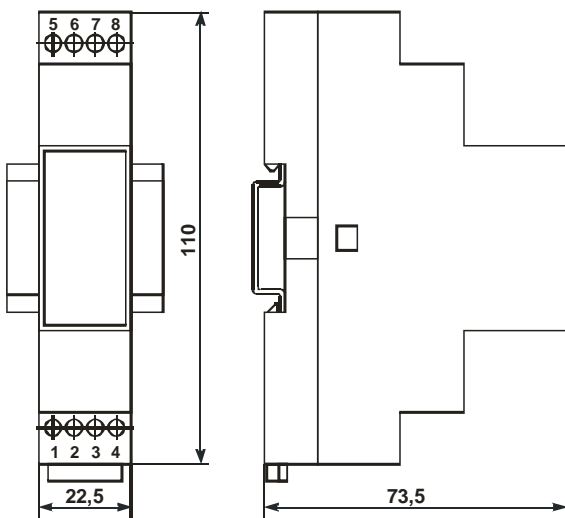
Maximum rated current of one channel is 5 A; peak voltage 1200 V.



**MO8**



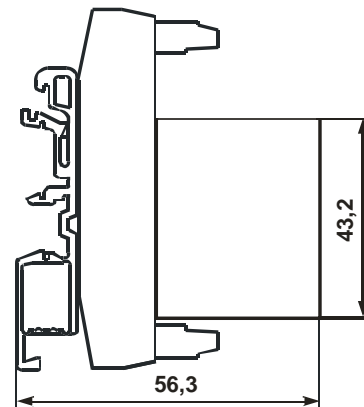
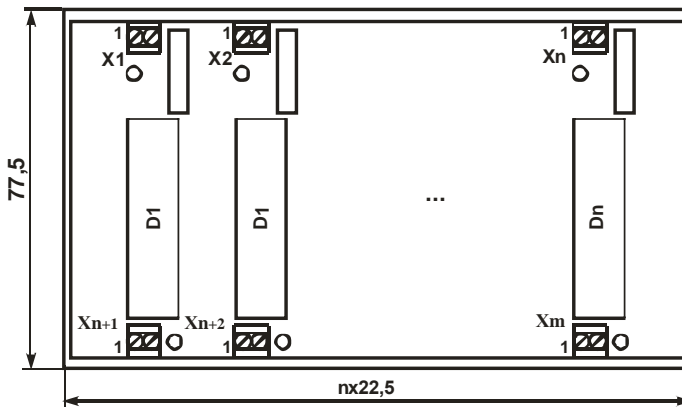
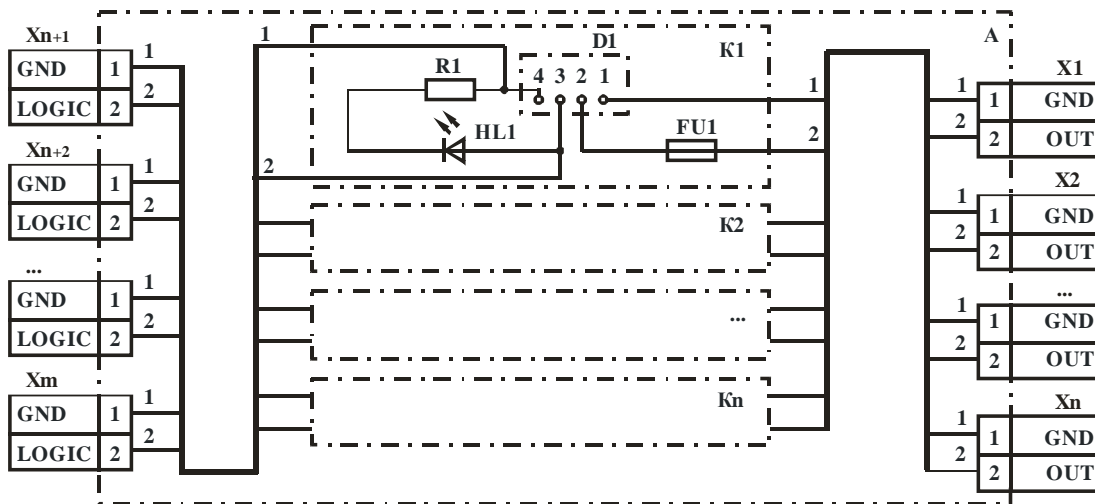
**2MO8**



## Thyristor multi-channel relay MMK(Din)n-PP1

Multi-channel module for AC commutation **MMK(Din)n-PP1** with some commutated channels (from 1 to n) is intended to use it in automation devices as a part of a commutating element. The module is intended to mount it on Din-rail.

Maximum rated current of one channel is 3 A; peak voltage 1200 V.



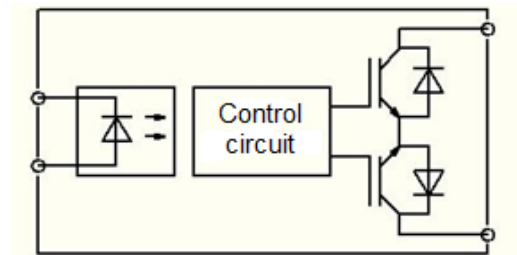
### Transistor relay MO16

Modules **MO16** – an optoelectronic relay for AC and DC commutation (a semi-conductor optoelectronic normally open bipolar relay with small switch-on current). The MO16 are intended to use them in automation devices as a part of commutating element with maximum peak voltage 60,100,200,250,600 V or 1200 V and DC up to 300 A.

**By the control types:**

**MO16A** – module with control voltage 4...10 V.

**MO16B** – module with control voltage 10...30 V.



Type	Class	Current, A											
		5	10	20	30	40	60	80	120	160	200	240	300
MO16	0,6		Fig. 1	Fig. 1		Fig. 1	Fig. 1	Fig. 2	Fig. 2		Fig. 2		Fig. 2
	1	Fig. 1	Fig. 1	Fig. 1		Fig. 1	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	
	2	Fig. 1	Fig. 1	Fig. 1		Fig. 1	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2		
	2,5	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2			
	6	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2		
	12	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2			

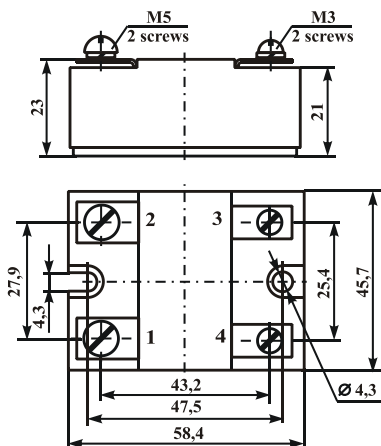


Figure 1

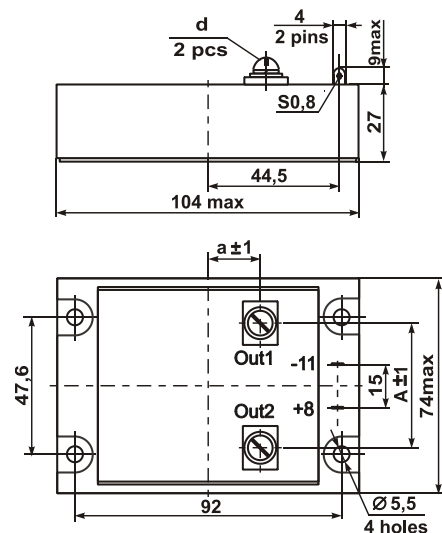


Figure 2

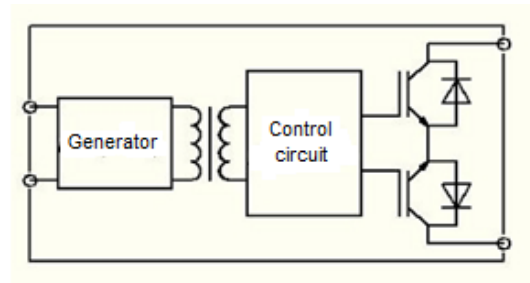
## Transistor relay MT16

Modules **MT16** – a relay with transformer isolation for AC and DC commutation (a semi-conductor optoelectronic normally open bipolar relay with small switch-on current). The MT16 are intended to use them in automation devices as a part of commutating element with maximum peak voltage 60,100,200,250,600 V or 1200 V and DC up to 300 A.

### By control types:

**MT16A** – module with control voltage 4...10 V.

**MT16B** – module with control voltage 10...30 V.



Type	Class	Current, A											
		5	10	20	30	40	60	80	120	160	200	240	300
MT16	0,6		Fig. 1	Fig. 1		Fig. 1	Fig. 1	Fig. 2	Fig. 2		Fig. 2		Fig. 2
	1	Fig. 1	Fig. 1	Fig. 1		Fig. 1	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	
	2	Fig. 1	Fig. 1	Fig. 1		Fig. 1	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2		
	2,5	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2			
	6	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2		
	12	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 2			

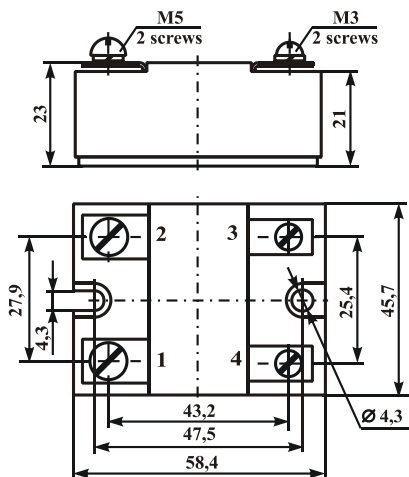


Figure 1

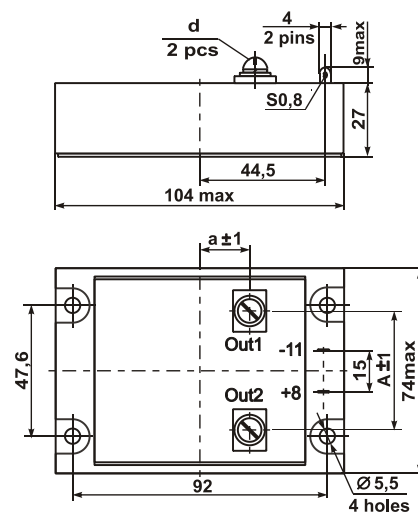


Figure 2



### Transistor relay with current protection MT16PT

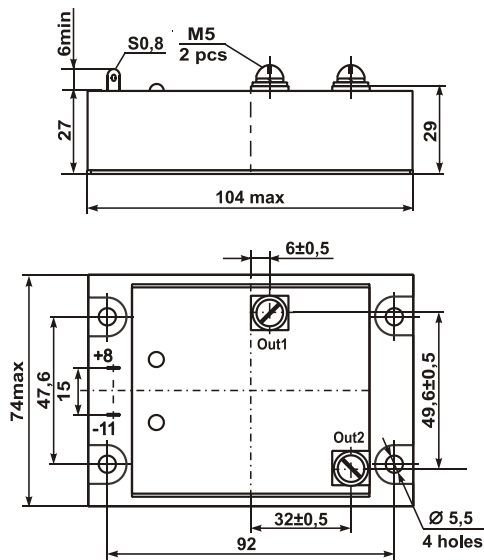
Modules **MT16PT** – a relay with transformer isolation for DC and AC commutation (a semi-conductor optoelectronic normally open bipolar relay with small switch-on current) with current protection. The MT16PT are intended to use them in automation devices as a part of commutating element with maximum peak voltage 60,100,200,250,600 V or 1200 V and DC up to 40 A.

**By control types:**

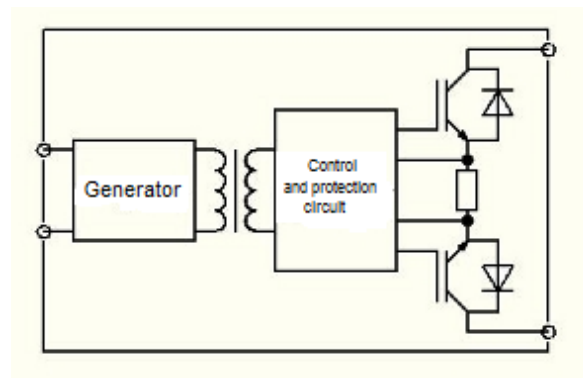
**MT16PTA** – module with control voltage 4...10 V.

**MT16PTB** – module with control voltage 10...30 V.

Type	Class	Current, A				
		5	10	20	30	40
MT16PT	0,6	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1
	1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	
	2	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1
	2,5	Fig. 1	Fig. 1	Fig. 1	Fig. 1	
	6	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1
	12	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1



**Figure 1**



## Direct current relays



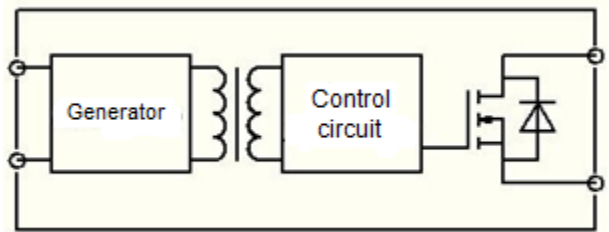
### Relay based on MOSFET-transistors MT14

Modules **MT14** – a relay with transformer isolation for DC commutation (a semi-conductor normally open bipolar relay with small switch-on current). The MT14 are intended to use them in automation devices as a part of a commutating element with maximum peak voltage 40,60,100,200,250 V and DC up to 400 A.

**By control types:**

**MT14A** – module with control voltage 4...10 V.

**MT14B** – module with control voltage 10...30 V.



Type	Class	Current, A													
		5	10	20	30	40	60	80	120	160	200	240	300	320	400
MT14	0,6		1	1		1	1	1	2		3	3	3		3
	1	1	1	1		1	1	1	2	2	3	3	3		3
	2	1	1	1	1	1	1	1	2	2	3	3		3	3
	2,5	1	1	1		1	2	2	2	2	3	3			

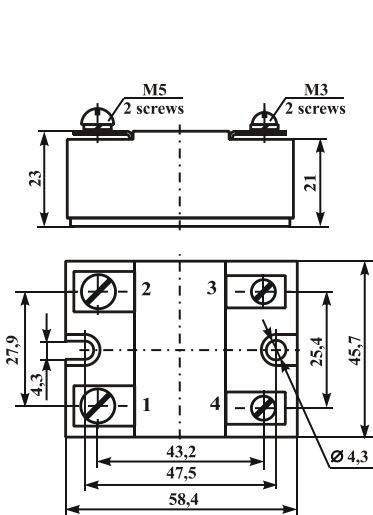


Figure 1

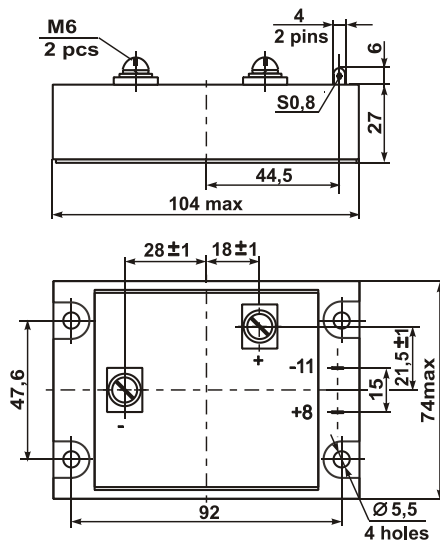


Figure 2

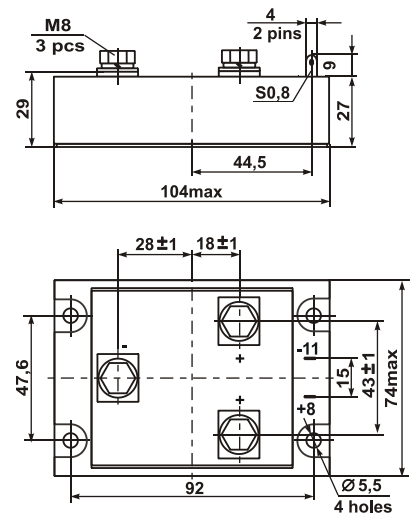


Figure 3

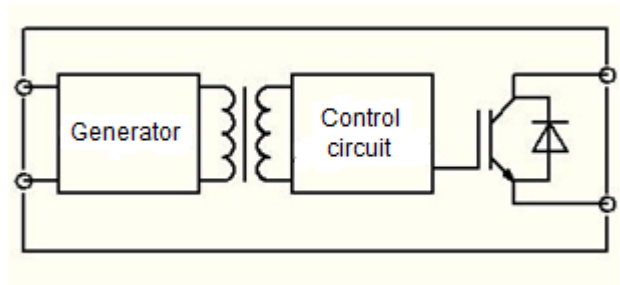
### Relay based on IGBT-transistors MT15D

Modules **MT15D** – a relay with transformer isolation for DC commutation (a semi-conductor normally open bipolar relay with small switch current). The MT15D are intended to use them in automation devices as a part of commutating element with maximum peak voltage 600 V or 1200 V and DC up to 300 A.

**By control types:**

**MT15DA** – module with control voltage 4...10 V.

**MT15DB** – module with control voltage 10...30 V.



Type	Class	Current, A											
		5	10	20	30	40	60	80	120	160	180	240	300
MT15D	6	1	1	1	1	1	1	2	2	3	3	3	3
	12	1	1	1		1	1	2	2	3	3	3	3

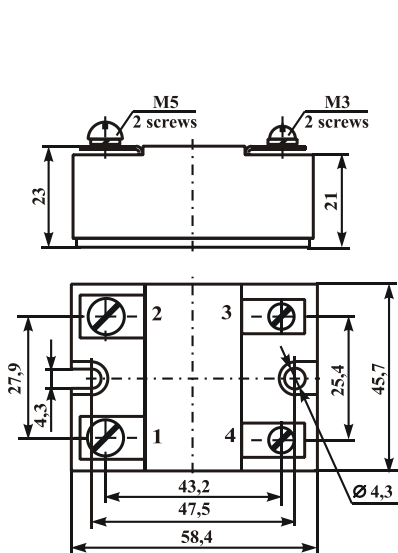


Figure 1

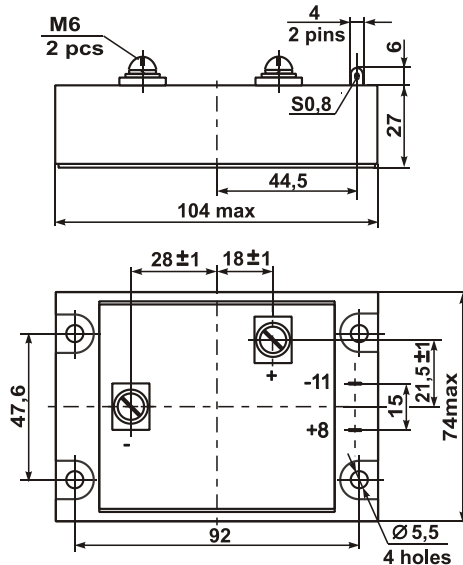


Figure 2

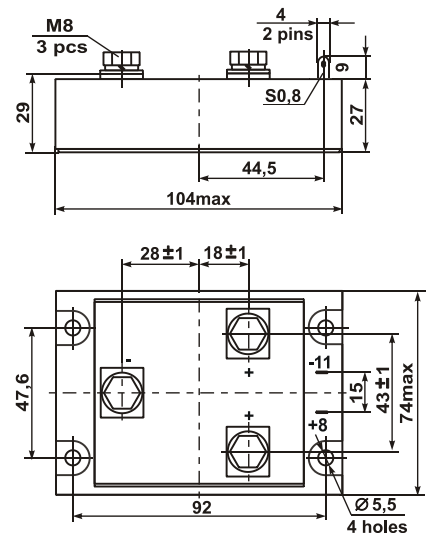


Figure 3

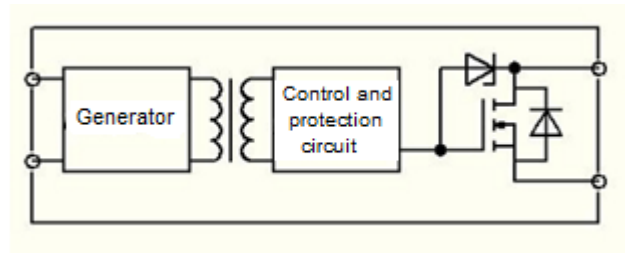
### Relay with protections based on MOSFET-transistors MT14PT

Modules **MT14PT** – a relay with transformer isolation for DC commutation (a semi-conductor normally open bipolar relay with small switch-on current) with current and voltage protection. The MT14PT are intended to use them in automation devices as a part of commutating element with maximum peak voltage 40,60,100,200,250 V and DC up to 400 A.

**By control types:**

**MT14PTA** – module with control voltage 4...10 V.

**MT14PTB** – module with control voltage 10...30 V.



Type	Class	Current, A													
		5	10	20	30	40	50	60	90	120	150	180	240	320	400
MT14PT	0,4		1	1				1	1	2	2		3	3	3
	0,6		1	1				1	1	2	2		3	3	3
	1	1	1	1		1		1	2	2	2	3	3	3	
	2	1	1	1				2	2	2	3	3	3		
	2,5	1	1	1	1	2	2	2	2	2	2	3			

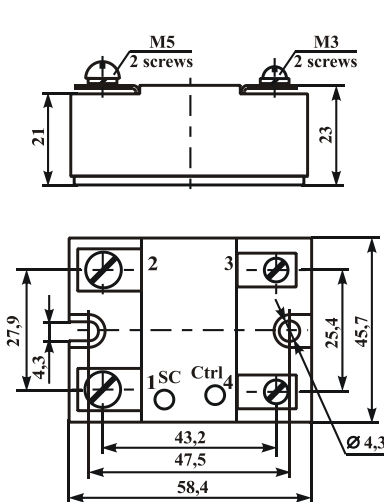


Figure 1

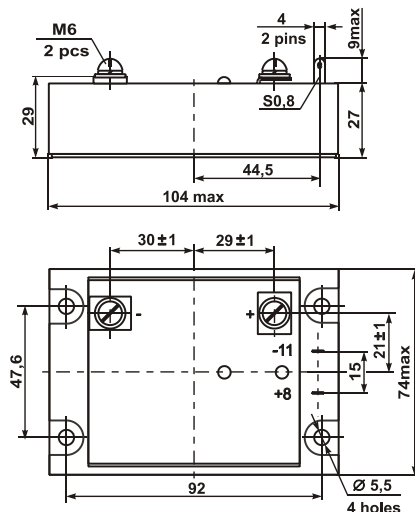


Figure 2

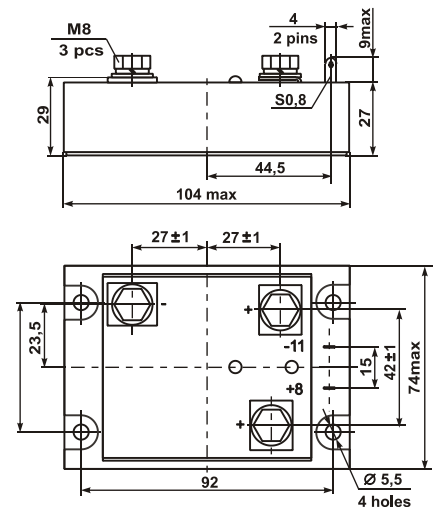


Figure 3

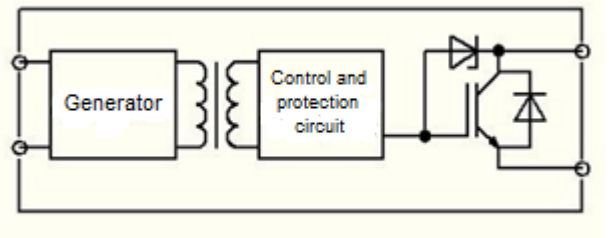
### Relay with protections based on IGBT-transistors MT15PT

Modules **MT15PT** – a relay with transformer isolation for DC commutation (a semi-conductor normally open bipolar relay with small switch-on current) with current and voltage protection. The MT15PT are intended to use them in automation devices as a part of a commutating element with maximum peak voltage 600 V or 1200 V and DC up to 240 A.

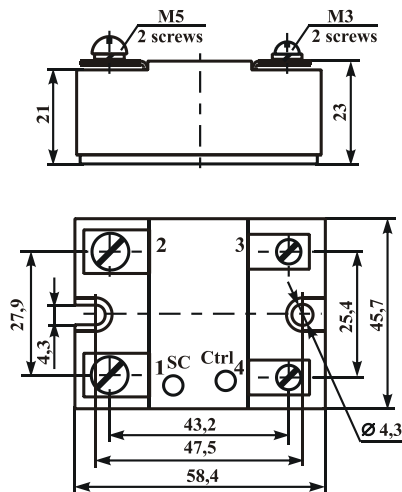
**By control type:**

**MT15PTA** – module with control voltage 4...10 V.

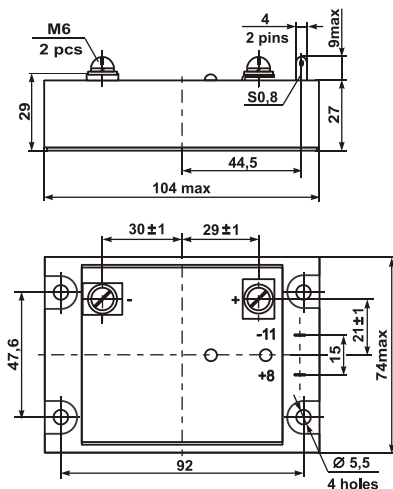
**MT15PTB** – module with control voltage 10...30 V.



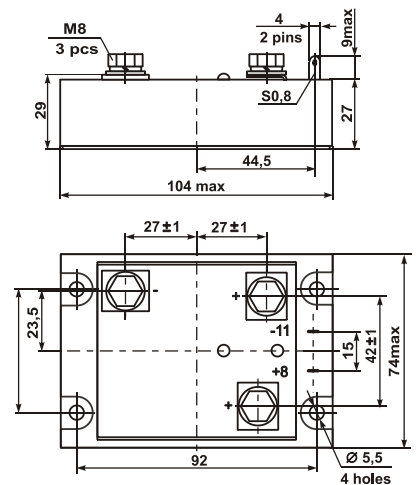
Type	Class	Current, A												
		5	10	20	30	40	50	60	75	90	120	150	180	240
MT15PT	6	1	1	1	1	1	1	2	2	2	2	2	3	3
	12	1	1	1	1	1	2	2	2	2	2	2	3	3



**Figure 1**



**Figure 2**



**Figure 3**

### Compact relays based on MOSFET-transistors MT14-PP

Modules of series **MT14-PP** – compact relays with transformer isolation for DC commutation (a semi-conductor normally open bipolar relay with small switch-on current). The MT14-PP are intended to use them in automation devices as a part of a commutating element with maximum peak voltage 100,200,400,800 V and DC up to 5 A.

**By control types:**

**MT14A** – module control voltage 4...10 V

**MT14B** – module with control voltage 10...30 V

Type	Class	Current, A	
		2.5	5
MT14A(B)-PP1	1		Fig. 1
	2		Fig. 1
	4	Fig. 1	Fig. 1
	8		Fig. 1
MT14A(B)-PP2	1		Fig. 2
	2		Fig. 2
	4	Fig. 2	Fig. 2
MT14A(B)-PP6	1	Fig. 3	
	2	Fig. 3	

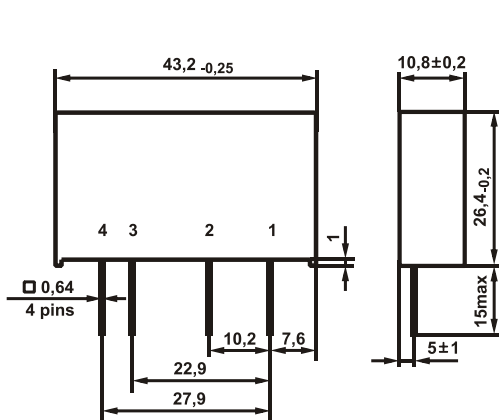
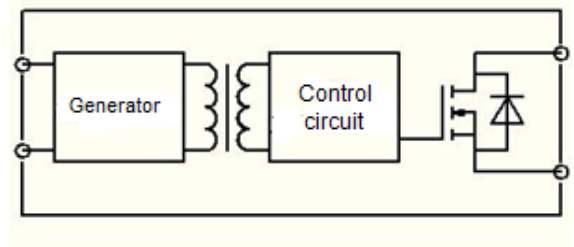


Figure 1

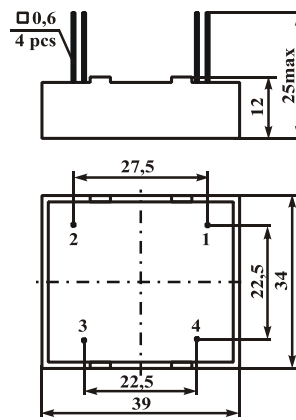


Figure 2

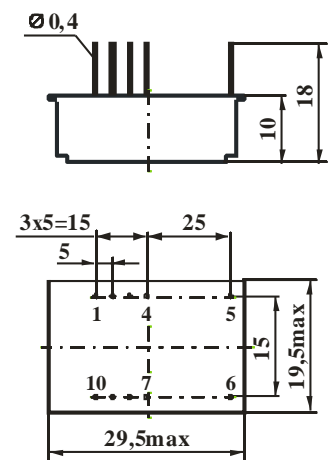


Figure 3

### Compact relays based on IGBT-transistors MT15D-PP

Modules of series **MT15D-PP** – compact relay with transformer isolation for DC commutation (a semiconductor normally open bipolar relay with small switching current). The MT15D-PP are intended to use them in automation devices as a part of a commutating element with maximum peak voltage 600 V or 1200 V or DC 2.5 A.

**By control types:**

**MT15DA** – module with control voltage 4...10 V

**MT15DB** – module with control voltage 10...30 V

Type	Class	Current, A
		2.5
MT15DA(B)-PP1	6	Fig. 1
	12	Fig. 1
MT15DA(B)-PP6	6	Fig. 2
	12	Fig. 2

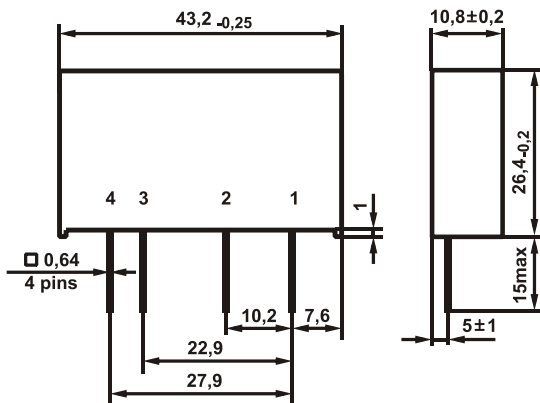
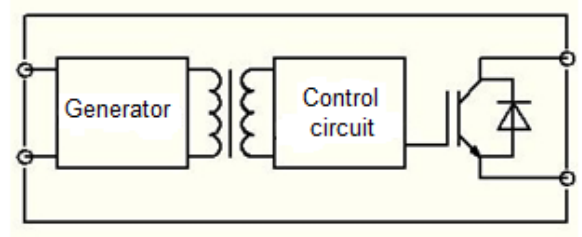


Figure 1

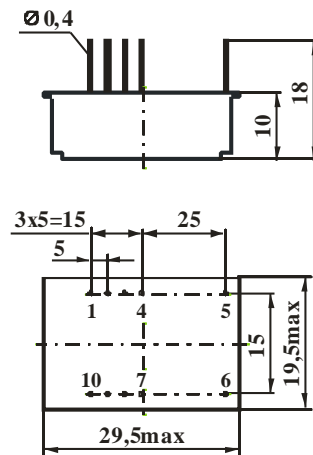


Figure 2



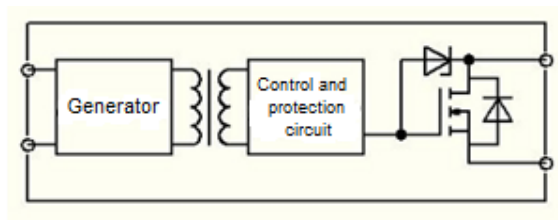
### Compact relays with current protection MT14PT-PP

Modules **MT14PT-PP** – compact relays with transformer isolation for DC commutation (a semi-conductor normally open bipolar relay with small switching current) with current protection. The MT14PT-PP are intended to use them in automation devices as a part of a commutating element with maximum peak voltage 60,100,200,400 V and DC up to 10 A.

**By control types:**

**MT14PTA** – module with control voltage 4...10 V

**MT14PTB** – module with control voltage 10...30 V



Type	Class	Current, A			
		2.5	5	8	10
MT14PTA(B)-PP1	0,6		Fig. 1		
	1	Fig. 1	Fig. 1		
	2	Fig. 1	Fig. 1		
	4	Fig. 1			
MT14PTA(B)-PP2	0,6		Fig. 2		
	1	Fig. 2	Fig. 2		
	2	Fig. 2	Fig. 2		
	4	Fig. 2			
MT14PTA(B)-PP3	0,6				Fig. 3
	1				Fig. 3
	2			Fig. 3	
	4		Fig. 3		

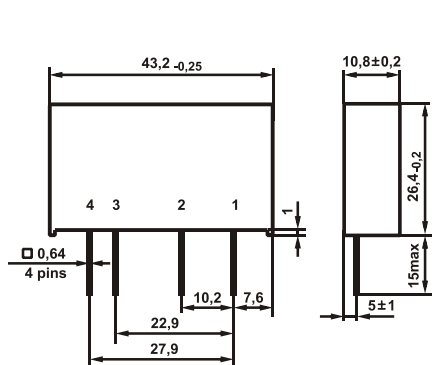


Figure 1

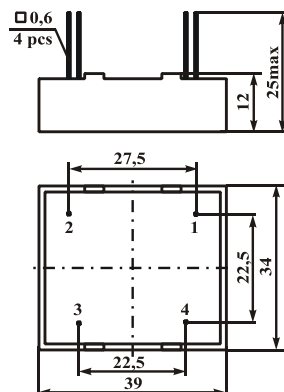


Figure 2

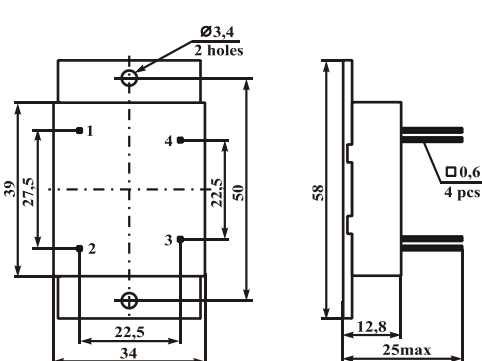


Figure 3

### Dual relay with current protection 2MT14PT-PP

Modules **2MT14PT-PP** – compact dual relays with transformer isolation for DC commutation (a semi-conductor normally open bipolar relay with small switching current) with current and voltage protection. The 2MT14PT-PP is intended to use them in automation devices as a part of a commutating elements with maximum peak voltage 60,100,200,400 V and DC up to 10 A.

**By control types:**

**2MT14PTA** – module with control voltage 4...10 V

**2MT14PTB** – module with control voltage 10...30 V

Type	Class	Current, A			
		2.5	5	8	10
<b>2MT14PTA(B)-PP4</b>	0,6		Fig. 1		
	1	Fig. 1	Fig. 1		
	2	Fig. 1	Fig. 1		
	4	Fig. 1			
<b>2MT14PTA(B)-PP5</b>	0,6				Fig. 2
	1				Fig. 2
	2			Fig. 2	
	4		Fig. 2		

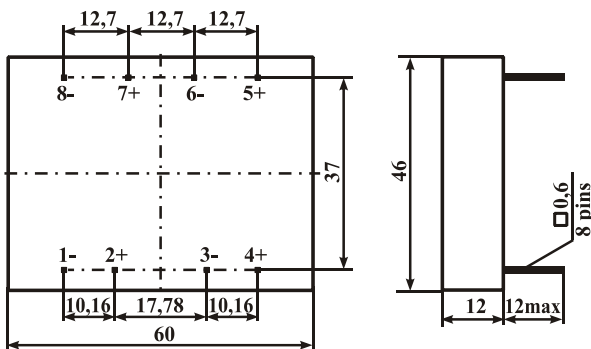
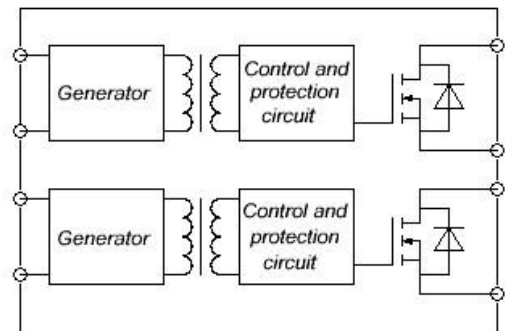


Figure 1

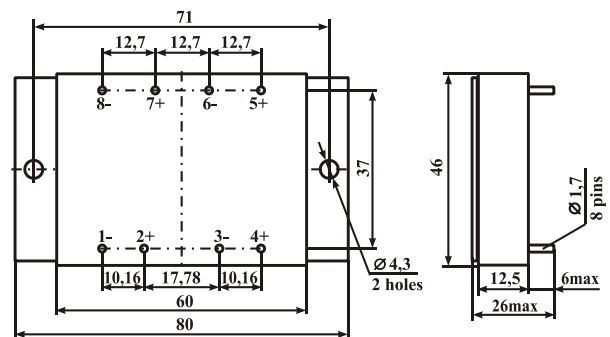


Figure 2

### Compact relays with current protection MT15PT-PP

Modules **MT15PT-PP** – compact relays with transformer isolation for DC commutation (a semi-conductor normally open bipolar relay with small switching current) with current protection. The MT15PT-PP are intended to use them in automation devices as a part of a commutating element with maximum peak voltage 600 V or 1200 V and DC up to 4 A.

**By control types:**

**MT15PTA** – module with control voltage 4...10 V

**MT15PTB** – module with control voltage 10...30 V

Type	Class	Current, A	
		2	4
MT15PTA(B)-PP1	6	Fig. 1	
	12	Fig. 1	
MT15PTA(B)-PP2	6	Fig. 2	
	12	Fig. 2	
MT15PTA(B)-PP3	6		Fig. 3
	12		Fig. 3

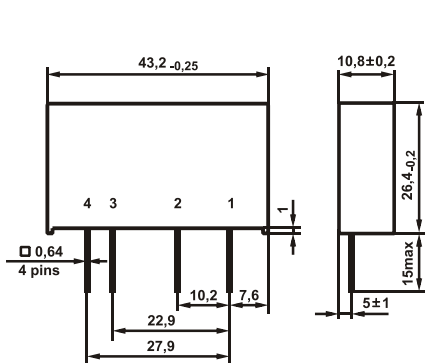
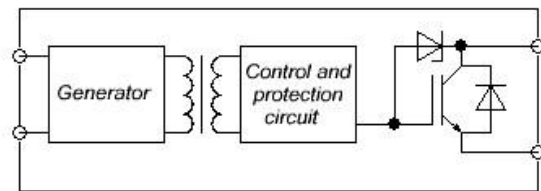


Figure 1

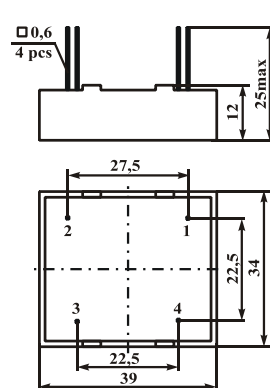


Figure 2

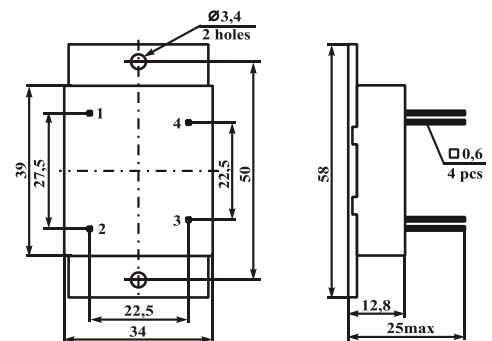


Figure 3

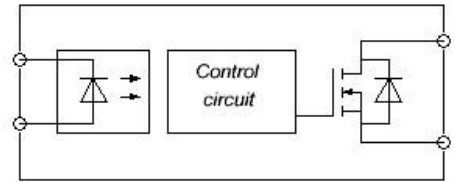
### Relay based on MOSFET-transistors MO14

Modules **MO14** – a relay with optocoupler for DC commutation (a semi-conductor optoelectronic normally open bipolar relay with small switching current). The MO14 are intended to use them in automation devices as a part of a commutating element with maximum peak voltage 60,100,200,250 V and DC up to 400 A.

**By control types:**

**MO14A** – module with control voltage 4...10 V

**MO14B** – module with control voltage 10...30 V



Type	Class	Current, A												
		5	10	20	40	60	80	120	160	200	240	300	400	
MO14	0,6		Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 2		Fig. 3	Fig. 3	Fig. 3	Fig. 3
	1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 3	Fig. 3	Fig. 3	Fig. 3
	2	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 3	Fig. 3	Fig. 3	Fig. 3
	2,5	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 1	Fig. 2	Fig. 2	Fig. 2	Fig. 2	Fig. 3	Fig. 3		

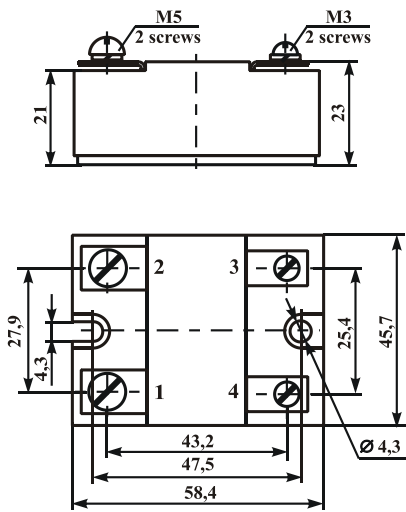


Figure 1

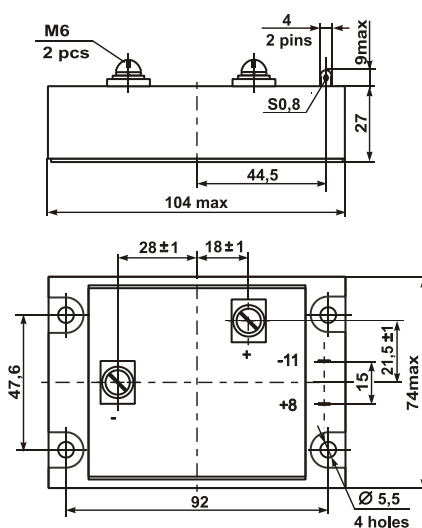


Figure 2

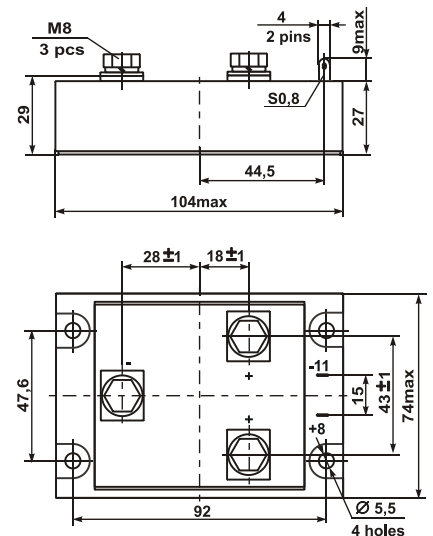


Figure 3

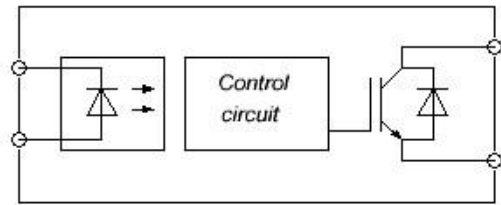
### Relays based on IGBT-transistors MO15D

Modules **MO15D** – a relay with optocoupler for DC commutation (a semi-conductor optoelectronic normally open relay with small switching current). The MO15D are intended to use them in automation devices as a part of a commutating element with maximum peak voltage 600 V or 1200 V and DC up to 300 A.

**By control types:**

**MO15DA** – module with control voltage 4...10 V

**MO15DB** – module with control voltage 10...30 V



Type	Class	Current, A											
		5	10	20	30	40	60	80	120	160	200	240	300
MO15D	6	Fig.1	Fig.1	Fig.1	Fig.1	Fig.1	Fig.1	Fig.2	Fig.2	Fig.2	Fig.3	Fig.3	Fig.3
	12	Fig.1	Fig.1	Fig.1	Fig.1	Fig.1	Fig.1	Fig.2	Fig.2	Fig.2	Fig.3	Fig.3	Fig.3

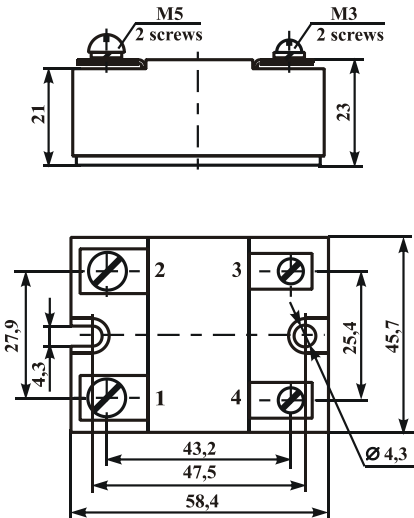


Figure 1

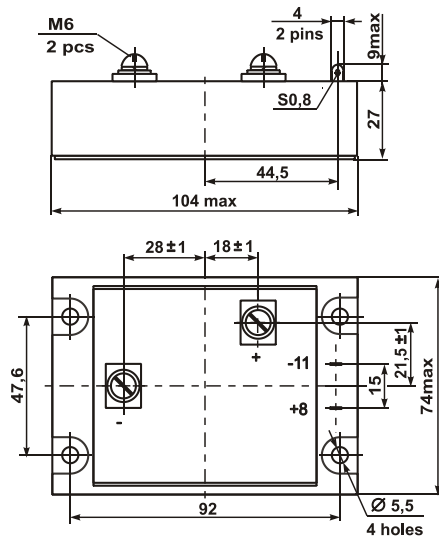


Figure 2

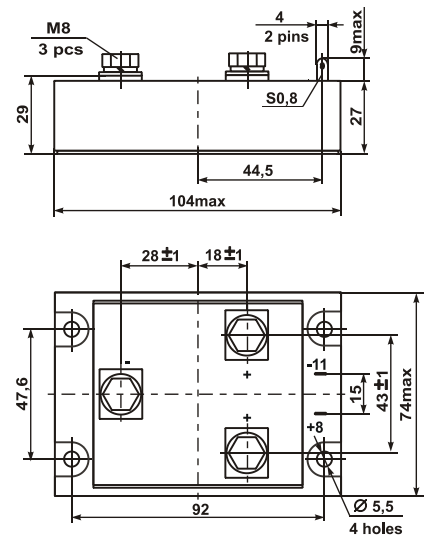
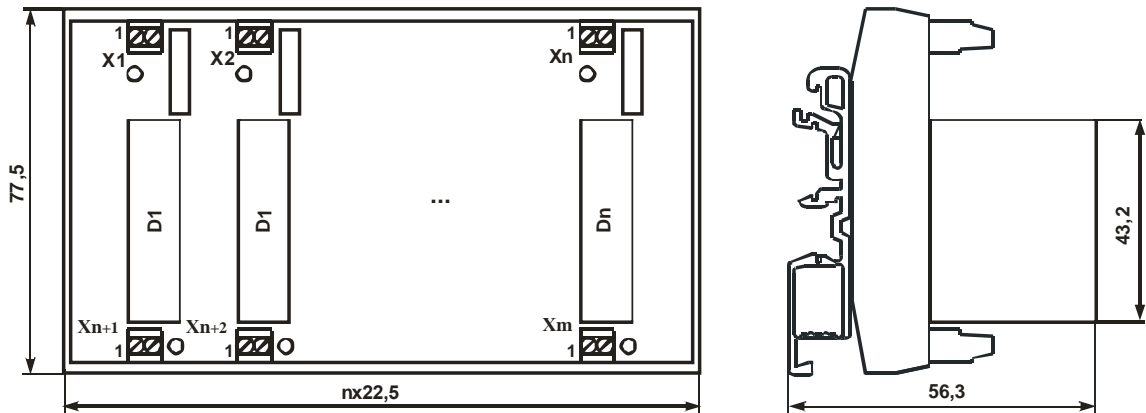
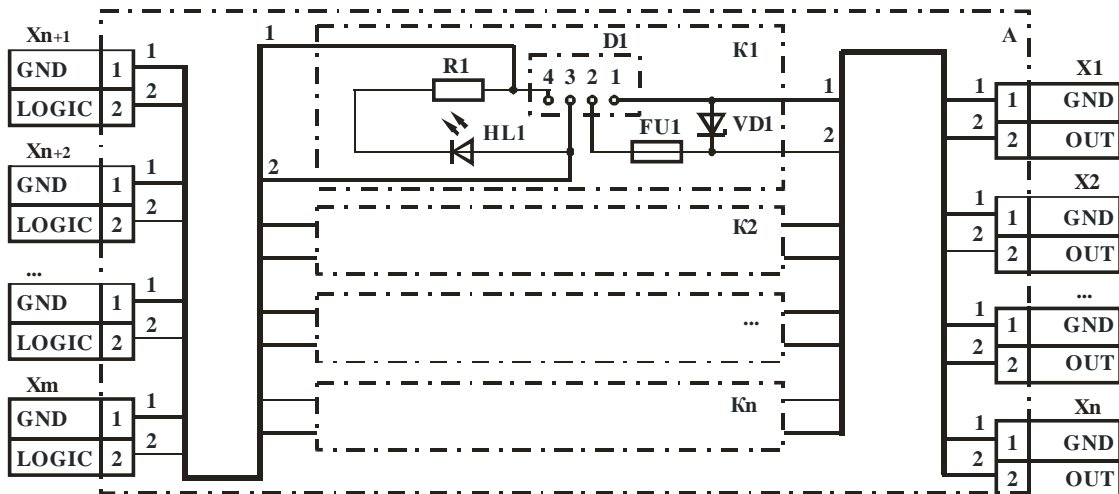


Figure 3

## Multi-channel DC relay MMK(Din)n-PP1

A multi-channel module for DC commutation **MMK(Din)n-PP1** with some commutating channels (from 1 to n) is intended to use them in automation devices as a part of a commutating element. In the module are used the modules **MT14PT-PP1** as relays. The module is intended to mount it on Din-rail.

An amount of maximum commutating current of single channel: 2.5 or 5 A;  
 Peak voltage: 60, 100, 200 or 400 V.



### Compact relay based on MOSFET-transistor DCSSR

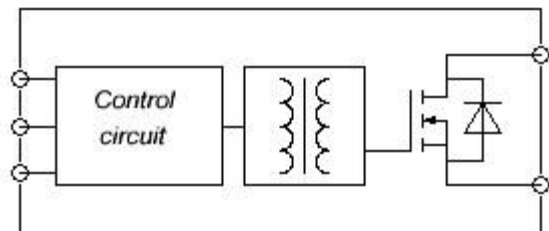
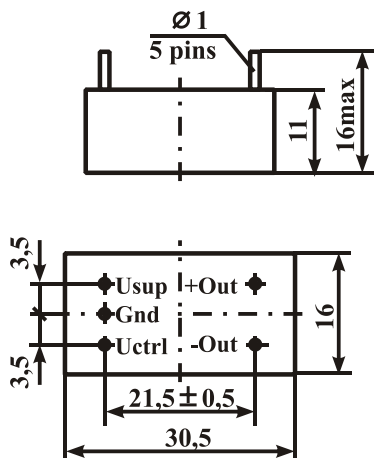
Modules **DCSSR** – a solid state relay for load commutation; it is an assembly of control circuit and MOSFET-transistor intended to switch loads accordance to a control signal with maximum peak voltage up to 200 V and DC up to 10 A.

**By types of control circuit the DCSSR is represented by the following version:**

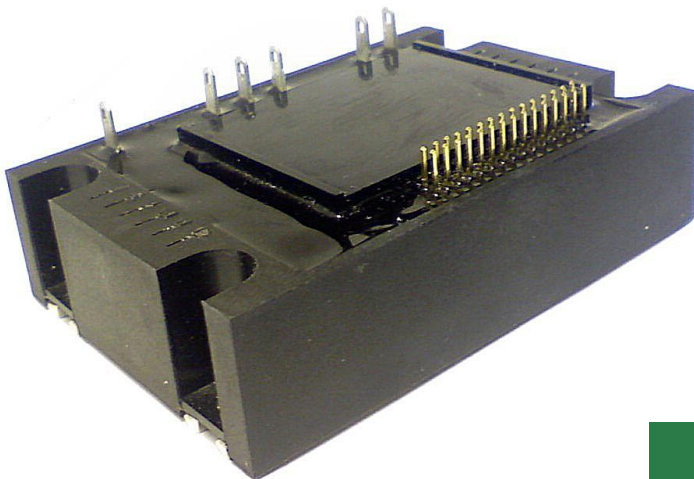
- DCSSR-A-x-x – a module with inverse control input (signal of level «log.1» conforming to blocking state of power transistor) with supply voltage 4...6 V and control voltage 2.4...5 V.
- DCSSR-A1-x-x – a module with inverse control input with supply voltage 14...16 V and control voltage 18...36 V.
- DCSSR-A2-x-x – a module with inverse control input with supply voltage 26...28 V and control voltage 18...36 V.
- DCSSR-B-x-x – a module with direct control input (signal of level «log.1» conforming to on-state of power transistor) with supply voltage 4...6 V and control voltage 2.4...5 V.
- DCSSR-B1-x-x – a module with direct control input with supply voltage 14...16 V and control voltage 18...36 V.
- DCSSR-B2-x-x – a module with direct control input with supply voltage 26...28 V and control voltage 18...36 V.

**By power circuit types the DCSSR is represented by the following versions:**

- DCSSR-x-5-1 – a module with maximum peak voltage of power circuit 100 V and maximum commutated DC 5 A.
- DCSSR-x-10-1 – a module with maximum peak voltage of power circuit 100 V and maximum commutated DC 10 A.
- DCSSR-x-5-2 – a module with maximum peak voltage of power circuit 200 V and maximum commutated DC 5 A.
- DCSSR-x-10-2 – a module with maximum peak voltage of power circuit 200 V and maximum commutated DC 10 A.



## Modules for motors control





## Intelligent inverter M31

Module **M31** is an assembly of power transistors with control circuits and protections circuits. The M31 is intended to control electric motors of different types.

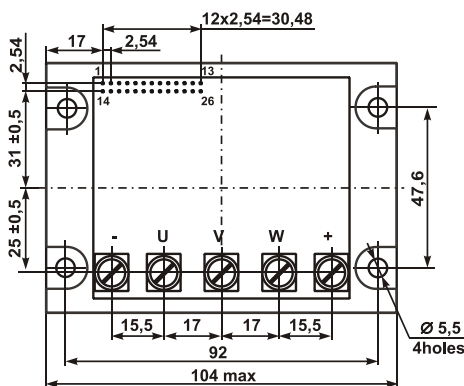
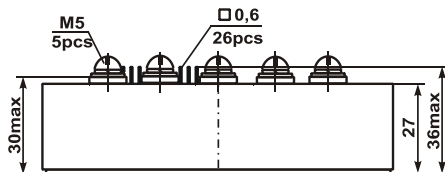
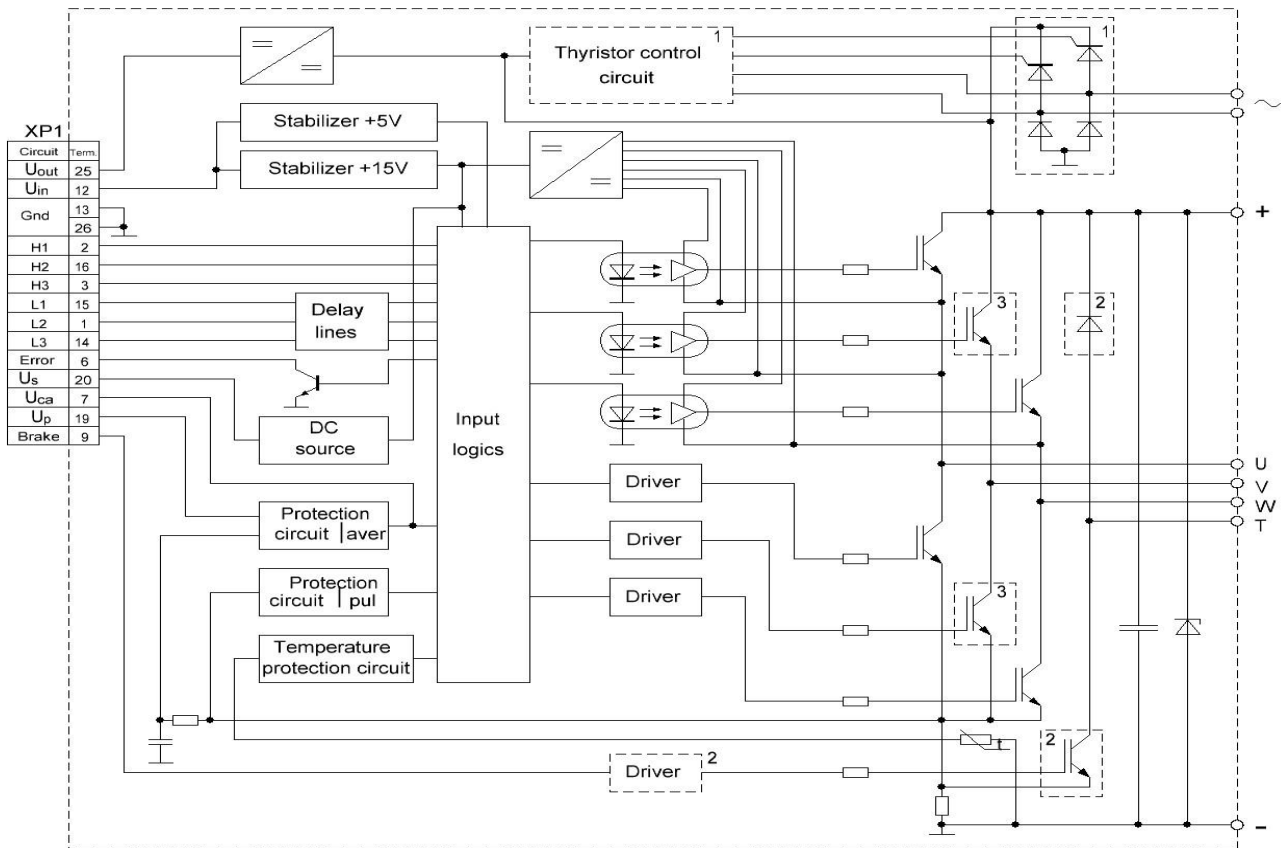
### The module maintains the following basic functions:

- control by any load type accordance to the control signals;
- protection against current overloads and SC;
- protection against pulse current surges;
- adjustment of current protection operation threshold;
- protection against overheat;
- protection against simultaneous switching of transistors of inverter upper and lower arm;
- external alarm about emergency;
- module supply directly from power circuit (for modules of 1, 2, 6 class);

Type of power assembly	Peak voltage, V	Max. inverter current, A	Modules
<b>A1</b>	100, 200, 600	5,10	Three-phase inverter + chopper + rectifier bridge
<b>A2</b>	100, 200, 600	5,10	Three-phase inverter + chopper
<b>A3</b>	100, 200, 600	5,10	Three-phase + rectifier bridge
<b>A4</b>	100	5,10,20,30,50,70,100	Three-phase inverter
	200	5,10,20,30,50,70	
	600	5,10,20,30,50	
	1200	5,10,20,30,50	
<b>B1</b>	100, 200, 600	5,10	Two-phase inverter + chopper + rectifier bridge
<b>B2</b>	100, 200, 600	5,10	Two-phase inverter + chopper
<b>B3</b>	100, 200, 600	5,10	Two-phase inverter + rectifier bridge
<b>B4</b>	100	5,10,20,30,50,70,100	Two-phase inverter
	200	5,10,20,30,50,70	
	600	5,10,20,30,50	
	1200	5,10,20,30,50	

For example, module **M31-10-6A2**: a module with maximum inverter current 10 A, with peak voltage 600 V, with three-phase inverter and break transistor.

### Intelligent inverter M31



**«1»** - rectifier bridge circuit providing smooth charge of filter capacitance and ability module operation from alternating voltage. The circuit is as a part of the M31 with the radiators' types «1» and «3».

**«2»** - break transistor circuit which is a part of the M31 with the power assembly types «1» and «2».

**«3»** - transistors which are absent for the radiator type «B» (two-phase inverter).

**DC-DC converter** of power supply in control circuit supply; it is installed on the modules of the 1, 2 and 6 classes.

### Modules for motors control based on M31 of series MC

Motor control modules based on M31 of series MC is an assembly of power transistors with control circuits and protections circuits. The modules are intended to control three-phase asynchronous (3phACDMM), DC (BDCDMM) and brushless DC (3phBLDCDMM) motors.

**The modules of series MC performs the following basic functions:**

- control electric motors accordance to the controlling signals;
- protection against current overloads and SC;
- external alarm about emergency;
- controlled motor start / stop;
- changing of motor shaft rotation direction;
- speed regulation by scalar algorithm;
- protection against wrong signals combination from the sensors of rotor position (for brushless DC motors)

Motor type	Power assembly type	Peak voltage, V	Max. inverter current, A	Modules
Control of DC motor (BDCDMM)	3	100, 200, 600	5,10	Inverter + rectifier bridge
	4	100	5,10,20,30,50,70,100	Inverter
		200	5,10,20,30,50,70	
		600	5,10,20,30,50	
		1200	5,10,20,30,50	
Control of brushless DC motor with sensors of rotor position (3phBLDCDMM)	3	100, 200, 600	5,10	Inverter + rectifier bridge
	4	100	5,10,20,30,50,70,100	Inverter
		200	5,10,20,30,50,70	
		600	5,10,20,30,50	
		1200	5,10,20,30,50	
Control of three-phase asynchronous motor (3phACDMM)	1	100, 200, 600	5,10	Inverter + chopper + rectifier bridge
	2	100, 200, 600	5,10	Inverter + chopper
	4	100	5,10,20,30,50,70,100	Inverter
		200	5,10,20,30,50,70	
		600	5,10,20,30,50	
1200		5,10,20,30,50		

For example, module **3phBLDCDMM-10-6A3**: a module to control a brushless DC motor with maximum inverter current 10 A, with peak voltage 600 V, with control type «A» and with an additional rectifier bridge.

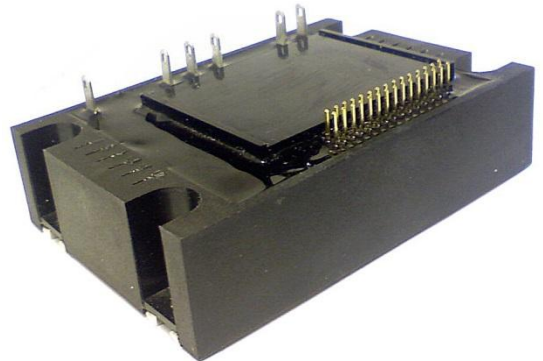
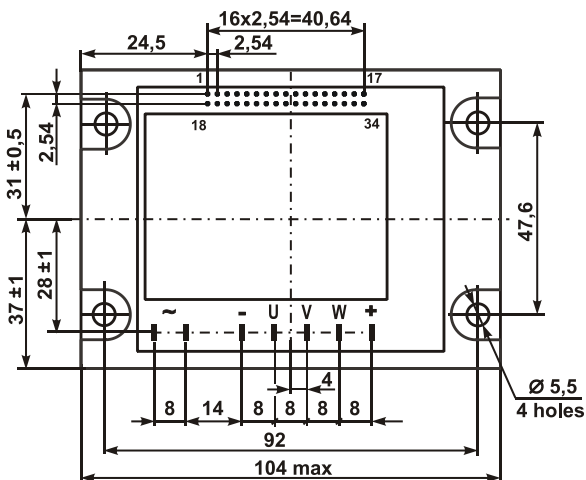
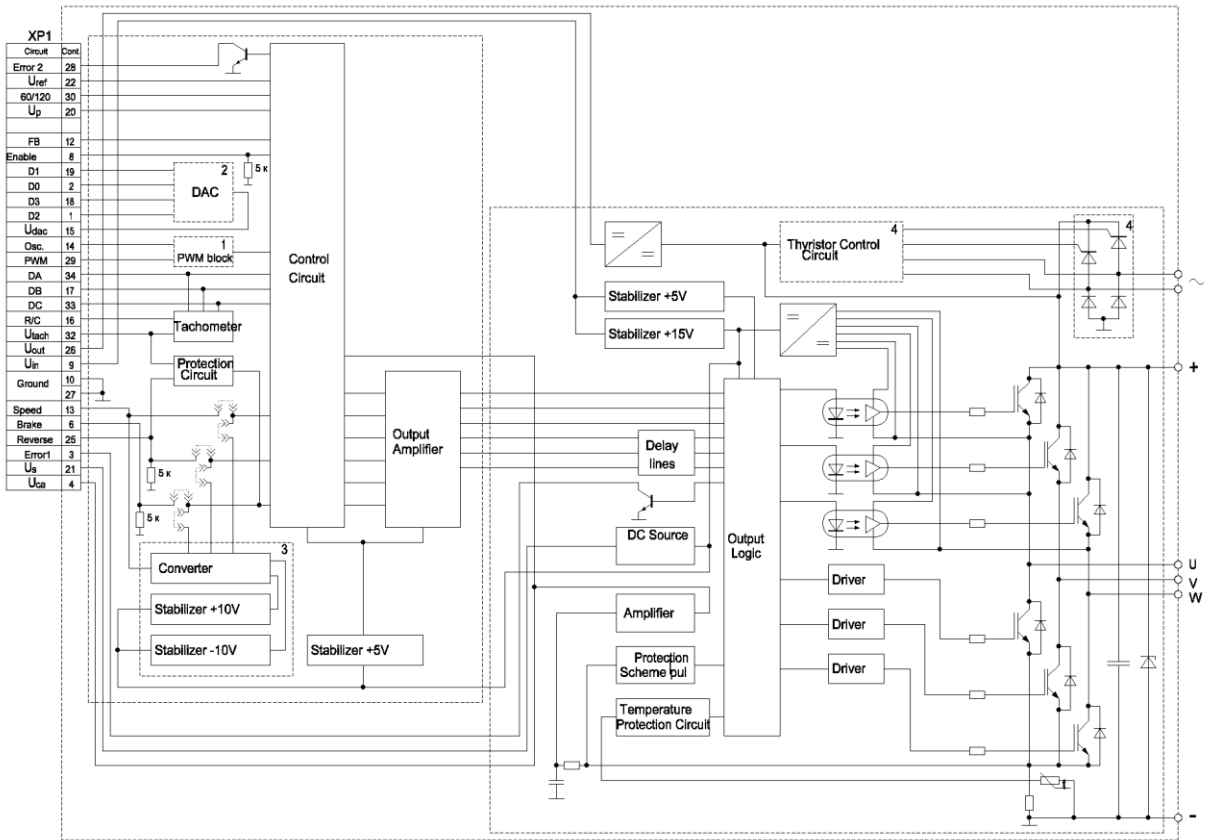
[see user's manual for BDCDMM](#)

[see user's manual for 3phBLDCDMM](#)

[see user's manual for 3phACDMM](#)

### Motors control modules based on M31 of series MC

Structure circuit and module overall dimension of series MC via example a module for control of brushless DC motor with assembly type «3» (inverter + rectifier bridge).



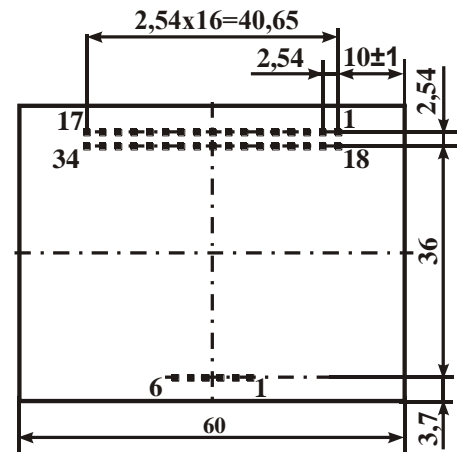
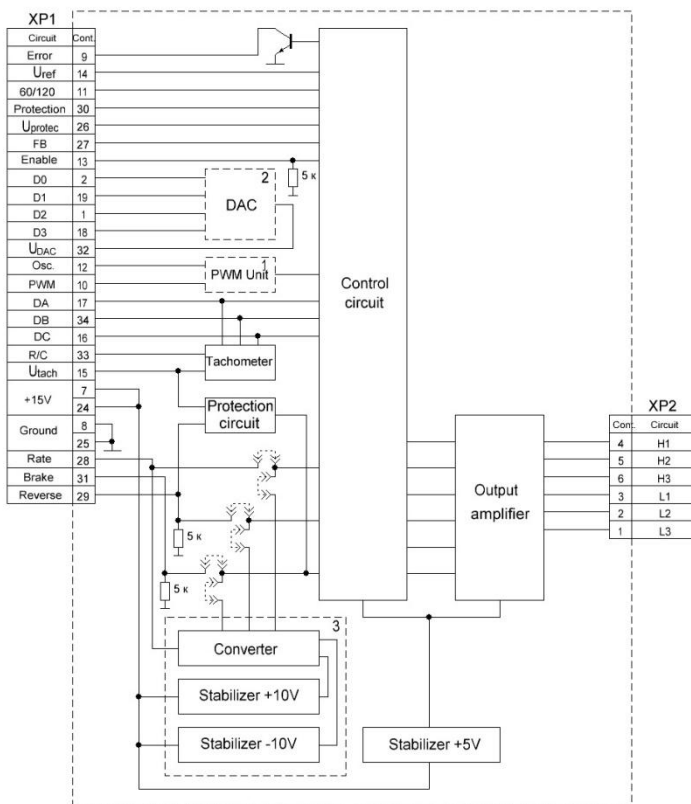
### Motors control controllers of series MCIC

Electric motors controllers of series MCICs (Motor Controller IC) are intended to form the logical signals to control drivers of inverter transistors accordance to the given analogue signals of speed, acceleration, rotation direction, etc. The controllers are intended to control three-phase asynchronous (3phACCM), DC motor (BDCCM) and brushless DC (3phBLDCCM) motors.

**The controller maintain the following functions and features:**

- forming of control signals by power inverter;
- controlled motor start / stop;
- changing of motor shaft rotation direction;
- speed regulation;
- external alarm about emergency.

Below you can see the structural circuit of the controller via example 3phBLDCCM.



[see user's manual for 3phACCM](#)

[see user's manual for 3phBLDCCM](#)

[see user's manual for BDCCM](#)

### Compact modules for motors control

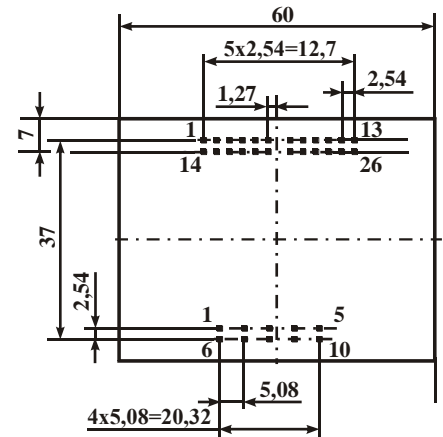
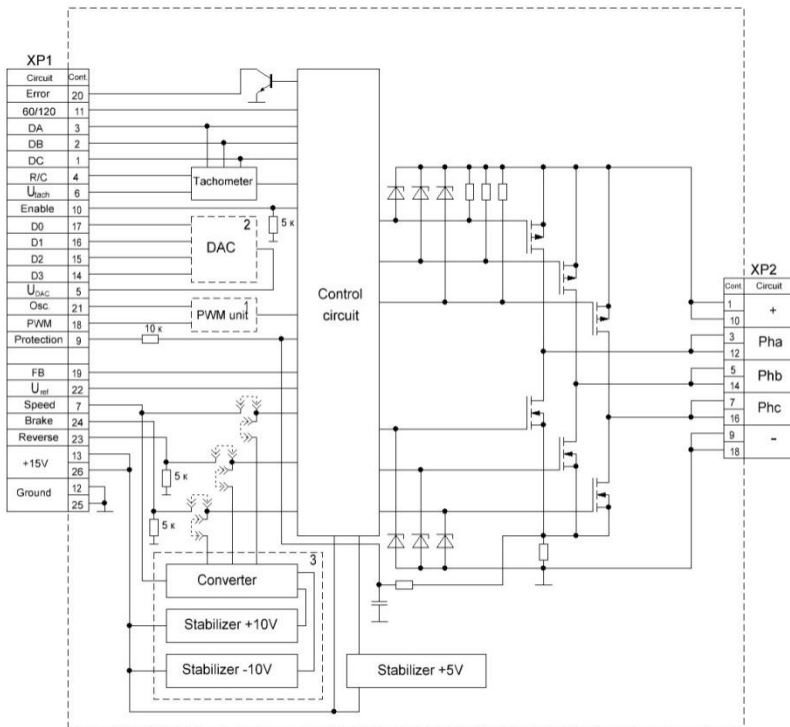
Module for brushless DC motor control with rotor position sensors (**MDB**) and module for control of DC motor (**MDK**) are intended to control electric motors in net with direct voltage 15...27 V with maximum inverter current up to 5 A.

The modules are intended to mount them to PCB.

The modules maintain the following functions and features:

- controlled motor start / stop;
- change of motor shaft rotation direction;
- regulation of speed by scalar algorithm;
- stabilization of speed at changing of motor supply voltage amplitude;
- protection of electric motor against current overload and SC;
- protection against wrong signals' combination from rotor position sensors (for brushless DC motors);
- external alarm about emergency;
- ability of module supply from net circuit;

Below you can see the structural circuit of the module via example MDV.



[see user's manual of MDV](#)

[see user's manual of MDK](#)

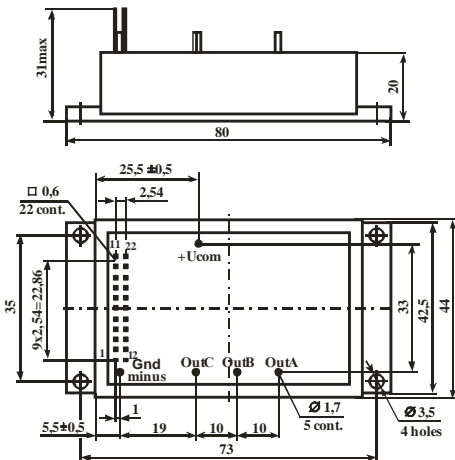
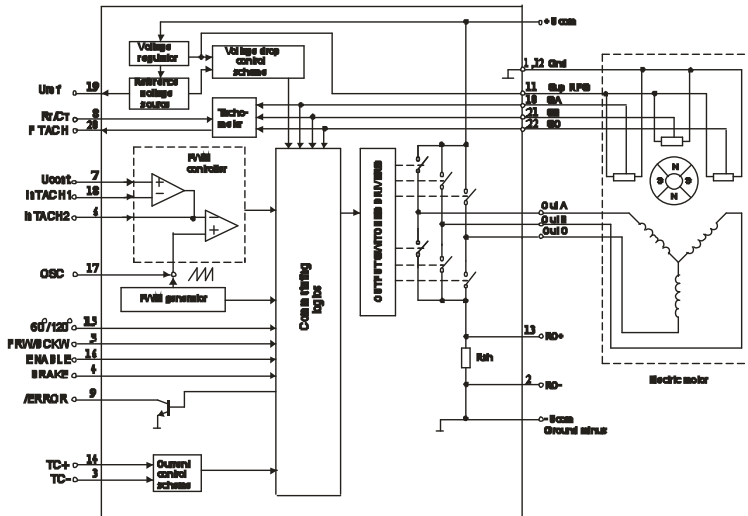
### Compact modules for motors control

Module for controlling of brushless motor with rotor position sensors (**BLDC-3**) and module to control DC motor (**DC-1**) are intended to control electric motors in net of direct voltage 24...27 V with maximum inverter current up to 10 A.

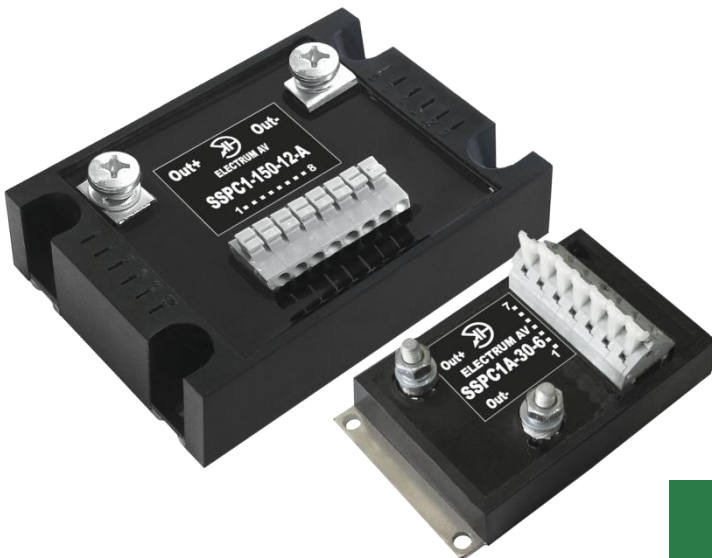
The modules are intended to mount them on a cooler; the size of module base – 80 x 44 mm.

The modules maintain the following functions and features:

- controlled motor start / stop;
- change of motor shaft rotation direction;
- regulation of speed by scalar algorithm;
- stabilization of speed at changing of motor supply voltage amplitude;
- protection of electric motor against current overload and SC;
- protection against wrong signals' combination from rotor position sensors (for brushless DC motors);
- external alarm about emergency;



Modules for voltage,  
current and power control



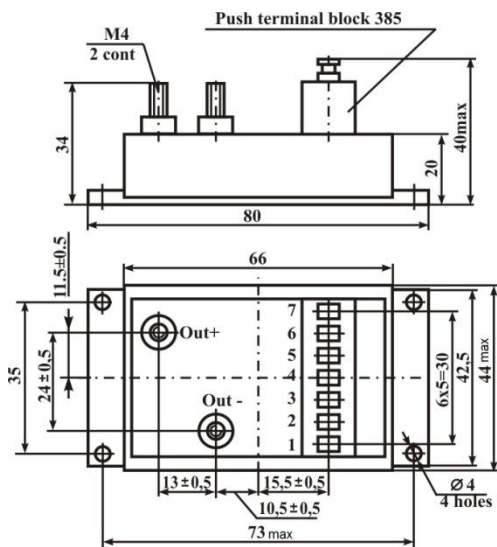


### Module to control commutated current SSPC1

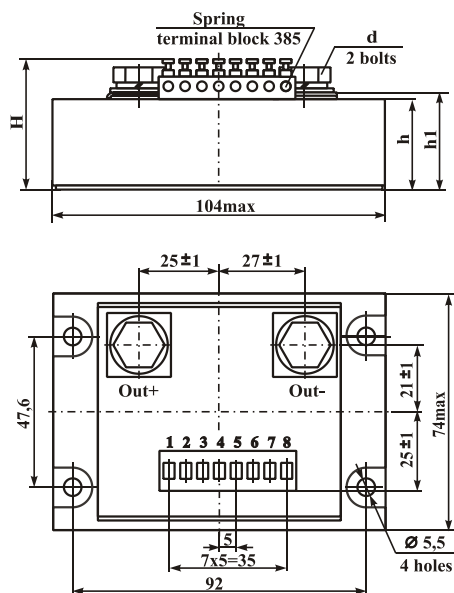
Module to control commutated current **SSPC1** is intended to commutate load DC, protection of load and commutating transistor against current overload (by value  $I^2t$ ), by temperature and against inductive surges in load circuit. The modules are produced with an amount of DC 2, 5, 10, 20, 30, 40 A (**Figure 1**) and with an amount 50, 60, 75, 90, 120, 150, 180, 240, 320 A (**Figure 2**) with peak voltage of power elements 60, 100, 200, 400, 600 V or 1200 V.

The modules maintain the following functions:

- commutation of load current;
- control of load current by value  $I^2t$  with protection against current overload;
- emitting status signals at exceeding load current of permitted value;
- protection of commutating transistor against overheat;
- emitting of an status signal at overheat of controlled transistor;
- protection of controlled transistor against collector-emitter (drain-source) overvoltage;
- emitting of an status signal by value  $I^3 \cdot 0.1I_{nom}$ .



**Figure 1**



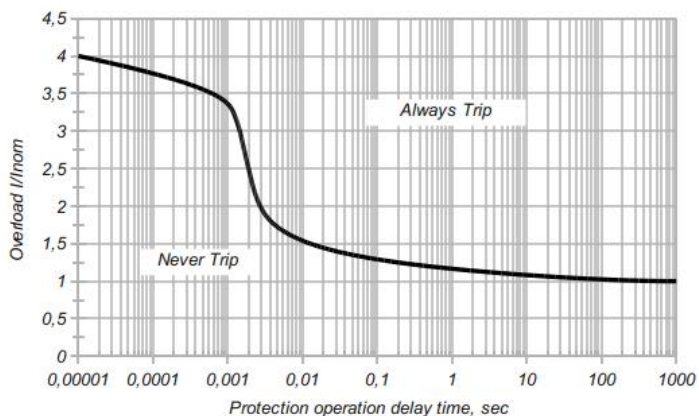
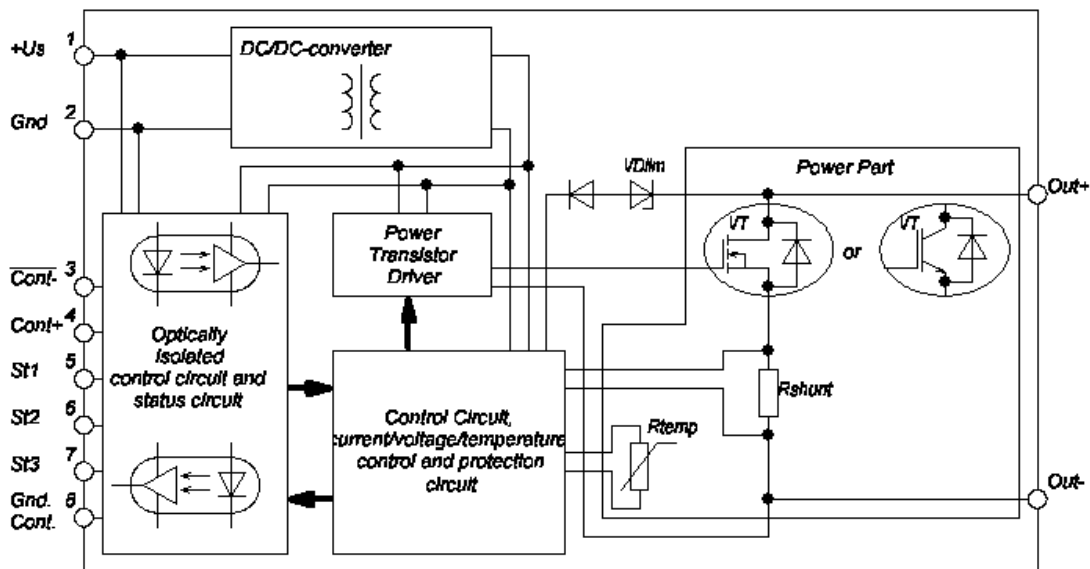
**Figure 2**

[see user's manual of product \(corr. to Fig.1\)](#)

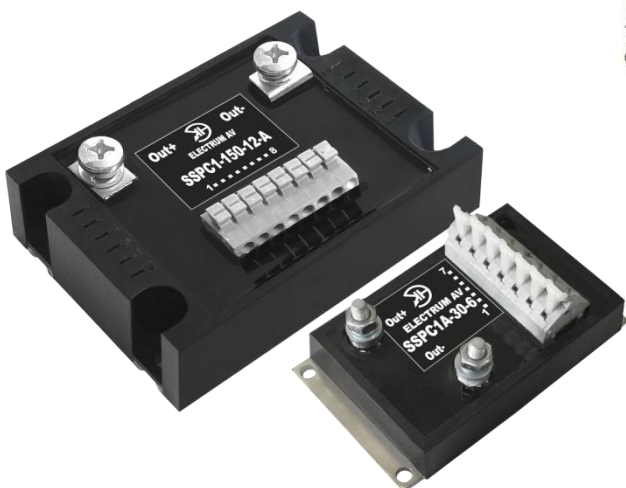
[see user's manual of product \(corr. to Fig.2\)](#)

### Module to control commutated current SSPC1

General structural circuit of SSPC1



Overload characteristics



### Modules to control commutated voltage SSVCM

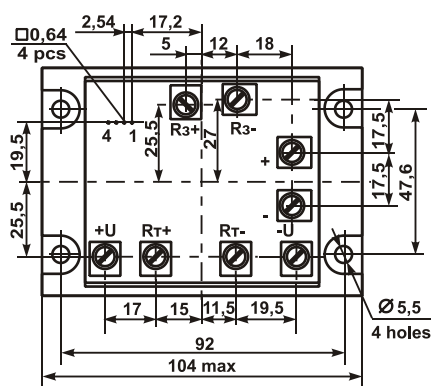
Module for commutated voltage control **SSVCM** is intended to commutate and control load voltage. The SSVCM is intended to use it in circuits where is necessary smooth charging of filter condensers, limitation of voltage surges created by the load and, in particular, in circuits of different types electric motors.

The modules maintain the following functions:

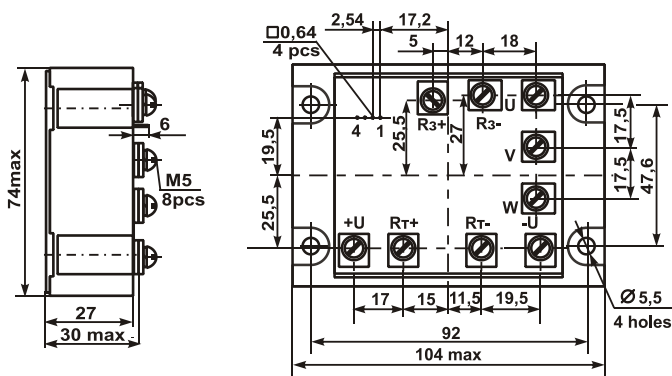
- commutation of power voltage;
- control of power voltage by brake and charge transistors switching on / off;
- adjustment of threshold for transistors switching on / off;
- adjustment of transistors operation delay duration;
- ability of supply directly from power circuit.

Type	Assembly	Peak voltage, V			
		100	200	600	1200
SSVCM-A	Without rectifier bridge	5,10,20,	5,10,20,	5,10,20,30,50	5,10,20,30,50
SSVCM-B	With three-phase rectifier bridge	30,50,70,100	30,50,70		

In the cells we placed an amount of the maximum average current



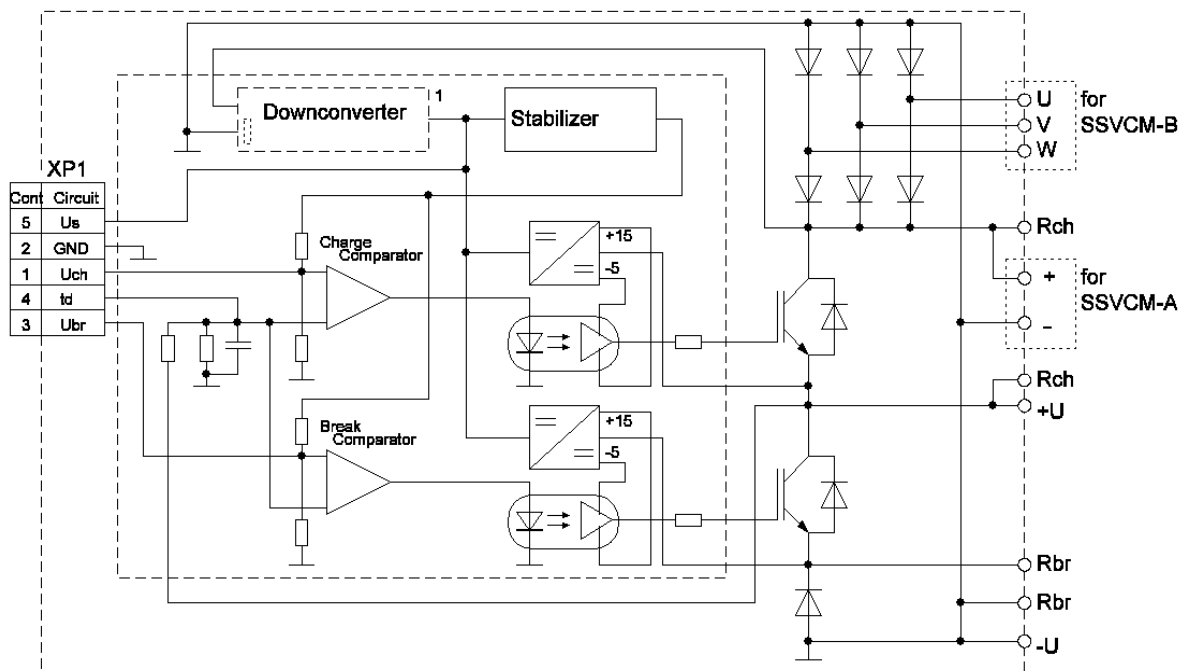
**SSVCM-A**



**SSVCM-B**

### Module for commutated voltage control SSVCM

Structural circuit of SSVCM



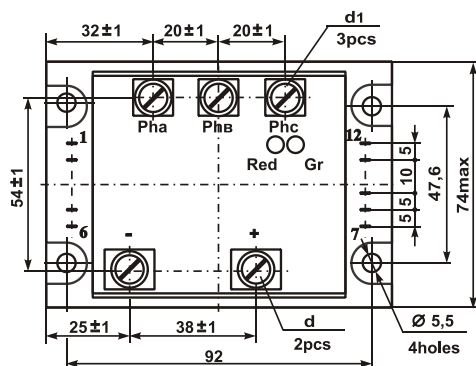
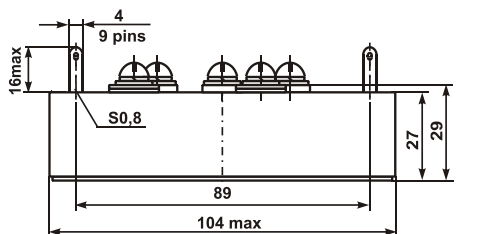
### Modules of regulated rectifier MO30, MO30.1

Module of a three-phase (**MO30**) and single-phase (**MO30.1**) regulated rectifier is intended to generate a rectified pulsing voltage that regulated by phase method. The voltage value is regulated by supplying of the control signal having the standard type (0...5 V, 0...10 V, 4...20 mA, 0...5 mA, 0...20 mA); the changing of the signal changes the value of rms rectified voltage in the range from 0 to 100%.

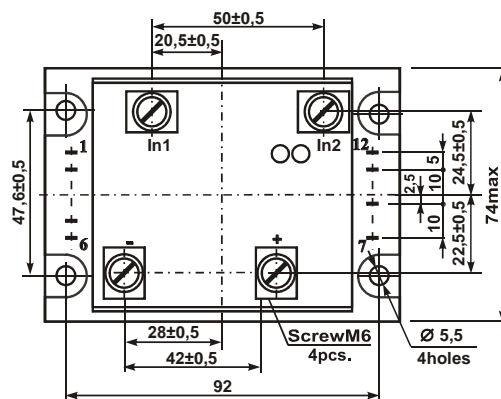
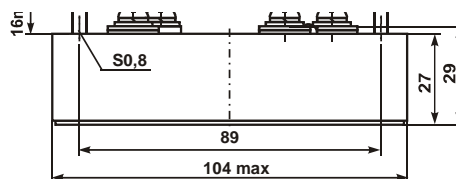
The modules are produced with an amount of maximum output rms current 63,100,160,200,250 A (for MO30) and 63,100,160 A (for MO30.1), with peak voltage 1200 V.

#### The modules maintain the following functions:

- rectification of alternating voltage;
- change of direct voltage amplitude on output by phase method;
- smooth start when supply starts;
- protection against overcurrent;
- indication of supply voltage presence and current protection operation.



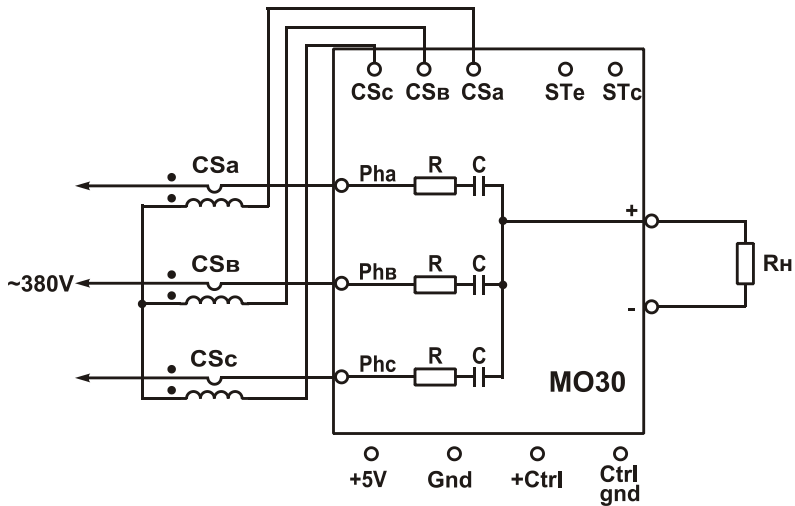
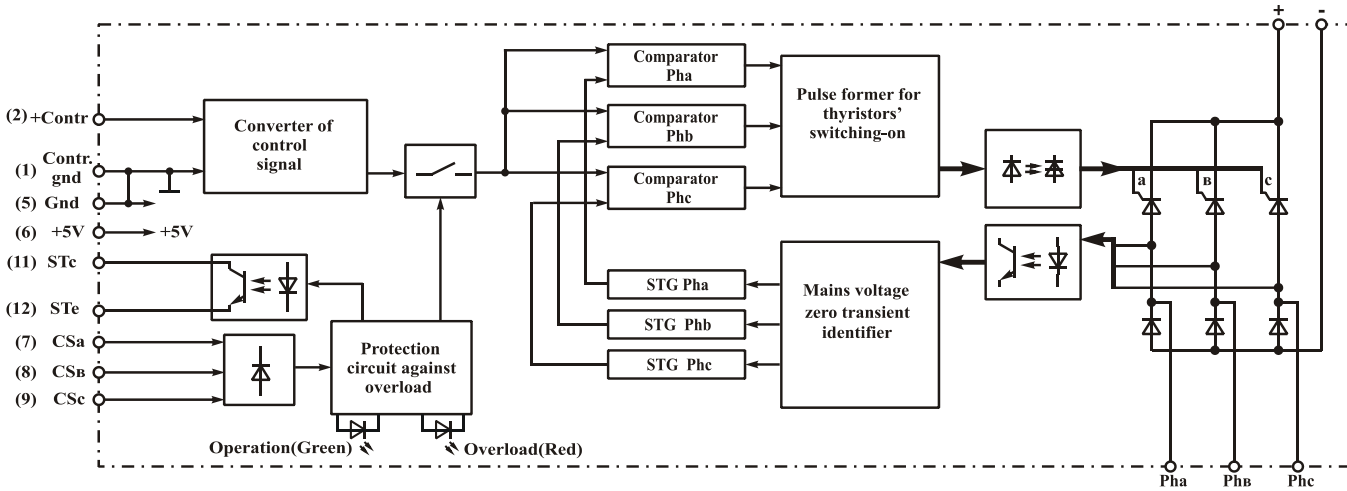
**MO30**



**MO30.1**

### Modules of regulated rectifier MO30, MO30.1

Structural circuit of MO30



Switching circuit of MO30 with external current sensors

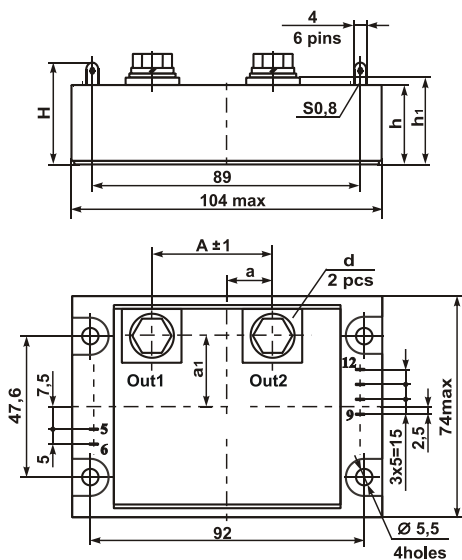
### Modules of power regulators M25M, M25T

Power regulator module with current protection (**M25T**) and without current protection (**M25M**) is intended to regulate power of active load and active-inductive one in AC nets with voltage 220/380V. In the modules M25 is used the phase method to adjust the power in the load; the power value is adjusted by supplying control signal having a standard type (0...5 V, 0...10 V, 4...20 mA, 0...5 mA, 0...20 mA); changing of the signal from the minimum to the maximum changes the value of output power from 0 to 100%.

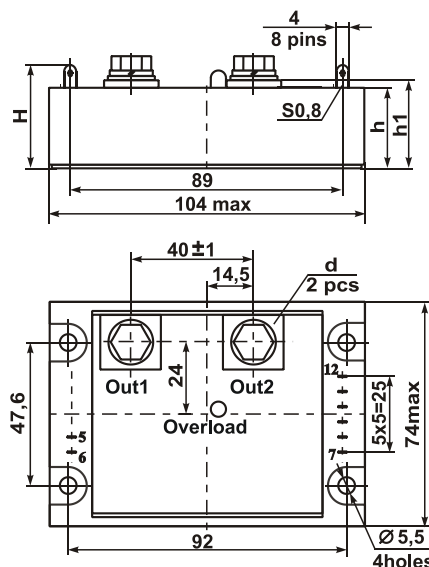
The modules are produced with an amount of maximum output rms current 25,40,63,80,100,120,160,200,250 A with peak voltage 1200 V.

#### The modules maintain the following functions:

- commutation of alternating voltage;
- change of output power by phase method;
- smooth start at supply switching on;
- protection against current overload (modules M25T);
- indication of current protection operation (modules M25T).



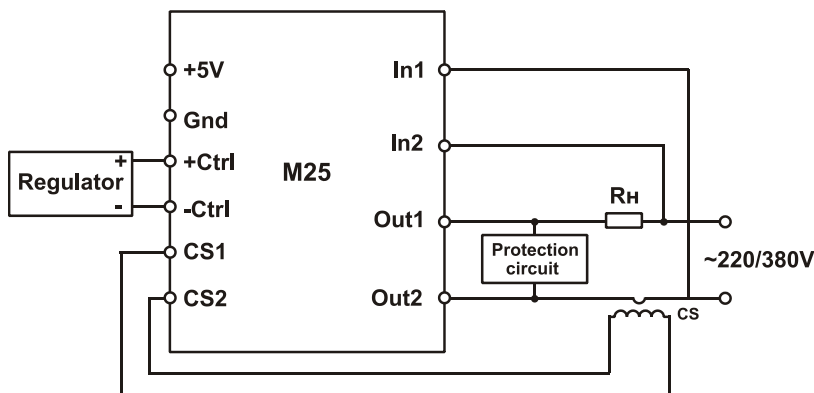
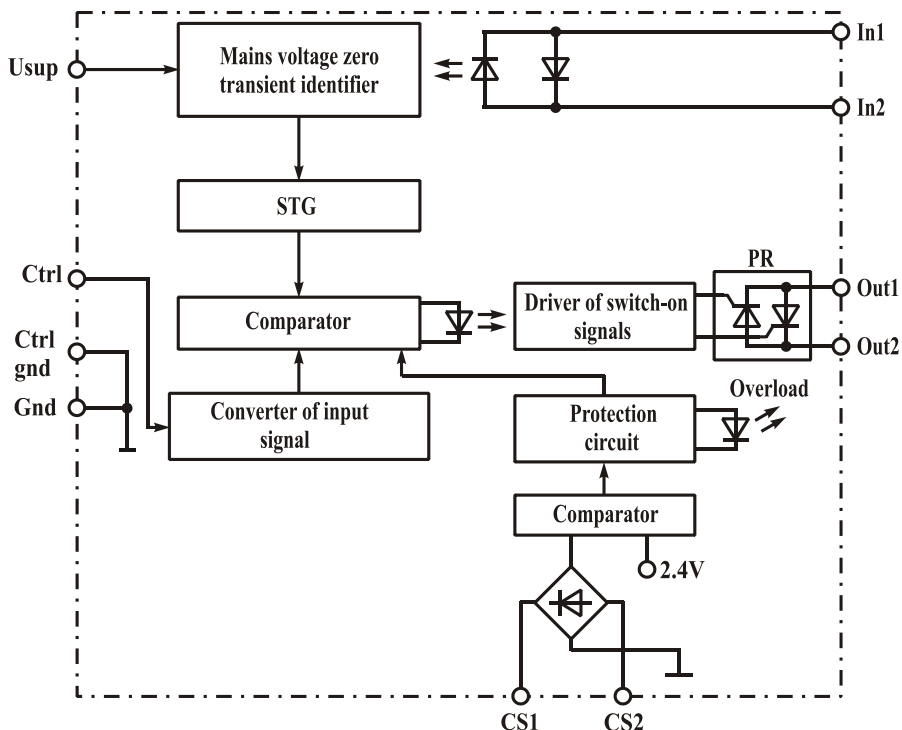
**M25M**



**M25T**

## Modules of power regulator M25M, M25T

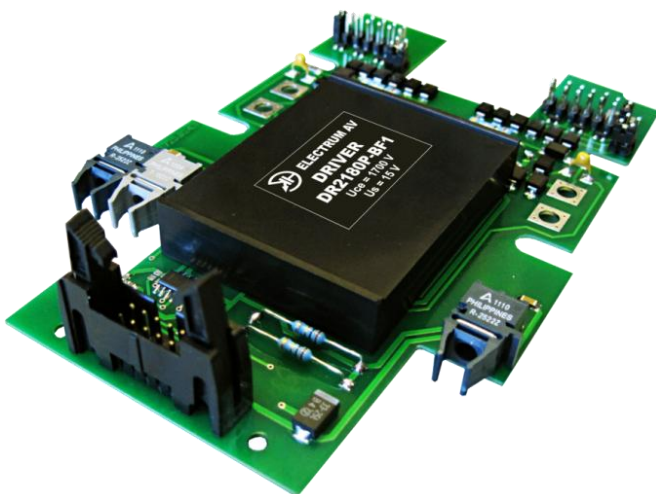
Structural circuit of M25T



Connection circuit of M25T with external current sensor



# Transistors drivers

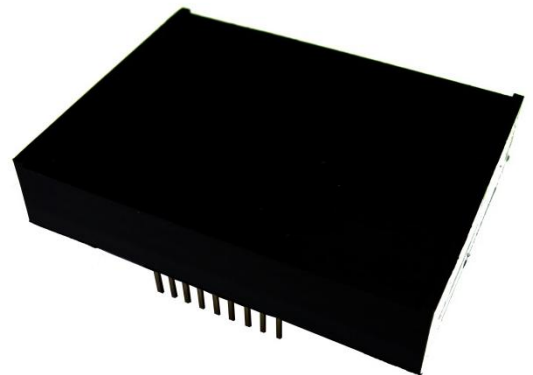
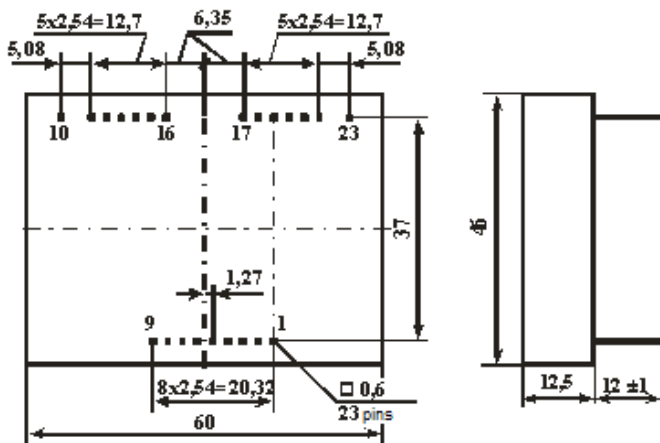


### Modules of transistors drivers

Drivers' modules IGBT- and MOSFET-transistors are intended to control and protect transistors with field control. The modules are intended to mount them to PCB.

Device type	Channels quantity	$U_{sup}$ V	$U_{ctrl}$ V	$U_{isol}$ V	$I_{out pul}$ A	$P_{out}$ W	$f_{com}$ kHz	$U_{ce max}$ V	$U_{ac}$ V	Notes
DM180P-B(1)	1	15	5(15)	4000	8	4	50	1700	-	
DM280P-B(1)	2 h/b	15	5(15)	4000	8	2x4	50	1700	-	
2DM180PB(1)	2 i	15	5(15)	4000	8	2x4	50	1700	-	
DM2180P-B	2 h/b	15	5	4000	18	2x3	100	1700	-	
2DM1180P-B	2 i	15	5	4000	18	2x3	100	1700	-	
DM2160P-B	2 u	15	5	4000	16	2x4	50	-	-	

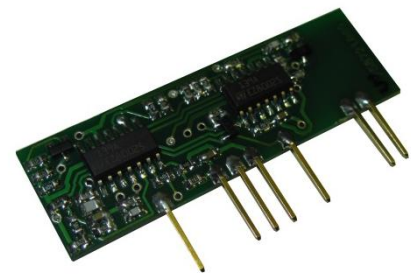
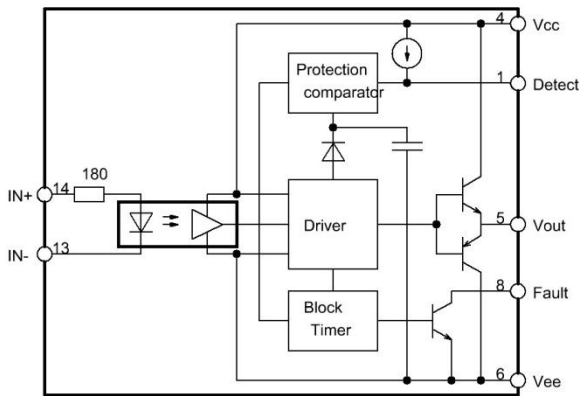
h/b – half-bridge (blocking of simultaneous transistors' switch-on);  
 i – independent channels (blocking is absent);  
 u – universal control (presence or absence of blocking is set by consumer)



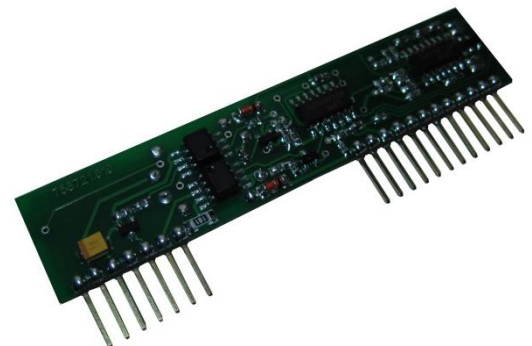
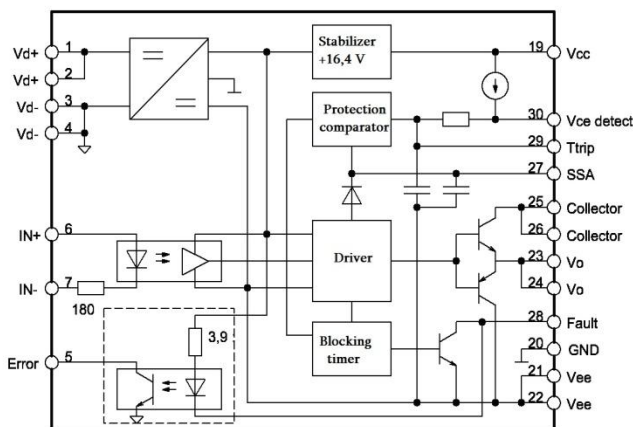
### Modules-analogues of transistors drivers

Modules-analogues of drivers IGBT- and MOSFET-transistors are intended to control and protect transistors with field control. The drivers are analogues of the drivers' microchips produced by Mitsubishi. The modules are intended to mount them to PCB.

Device type	Channels quantity	$U_{sup}$ V	$U_{ctrl}$ V	$U_{isol}$ V	$I_{out pul}$ A	$P_{out}$ W	$f_{com}$ kHz	$U_{ce max}$ V	$U_{ac}$ V	Notes
DM150A	1	15/-10	5 mA	4000	5	-	25	1700	-	Analogue of M57962
DM1120P-A(1)	1	15	5 mA	4000	12	3	25	1700	-	Analogue of VLA500-01



**DM150**



**DM1120**

### Transistors drivers

Drivers IGBT- and MOSFET-transistors are intended to control and protect transistors with field control with maximum collector current (drain) up to 1200 A and voltage up to 3300 V.

Device type	Channels quantity	$U_{sup}$ V	$U_{ctrl}$ V	$U_{isol}$ V	$I_{out pul}$ A	$P_{out}$ W	$f_{com}$ kHz	$U_{ce max}$ V	$U_{ac}$ V	Notes
<b>DR180P-B(1)</b>	1	15	5(15)	4000	8	4	50	1700	-	
<b>DRA180P-B(1)</b>	1	15	5(15)	7500	8	4	50	3300	≤3200	
<b>DR280P-B(1)</b>	2 h/b	15	5(15)	4000	8	2x4	50	1700	-	
<b>2DR180PB(1)</b>	2 i	15	5(15)	4000	8	2x4	50	1700	-	
<b>DRB280P-B(1)</b>	2 u	15	5(15)	4000	8	2x4	200	1700	≤1200	
<b>DR1300P-BF</b>	1	15	FOCL	7500	30	10	50	1700	≤1200	
<b>DR6120P-A</b>	6 (3h/b)	15	5	4000	12	6x3	25	1700	-	
<b>DR12120P-A</b>	12 (3h/b)	15	5	4000	12	6x3	25	1700	-	

h/b – half-bridge (blocking of simultaneous transistors' switch-on);

i – independent channels (blocking is absent);

u – universal control (presence or absence of blocking is set by consumer)



DR1300



DRA180



DR280  
2DR180  
DR180



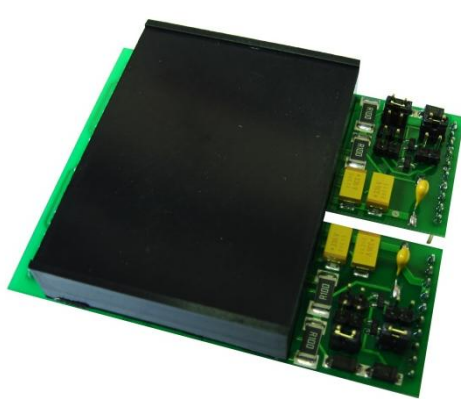
DRB280

### Drivers-analogues of CT Concept

Drivers IGBT- and MOSFET-transistors are intended to control and protect transistors with field control. The drivers are design and functional analogues of the drivers by CT Concept that are intended to mount them to PCB.

Device type	Channels quantity	$U_{sup}$ V	$U_{ctrl}$ V	$U_{isol}$ V	$I_{out pul}$ A	$P_{out}$ W	$f_{com}$ kHz	$U_{ce max}$ V	$U_{ac}$ V	Notes
<b>DR1480P-B1</b>	1	15	15	4000	48	10	50	1700	≤1200	analogue of 1SD1548AI
<b>DR2180P-B1</b>	2 h/b	15	5	7500	18	2x3	100	3300	-	analogue of 2SD315AI
<b>DR2180P-B2</b>	2 h/b	15	5	4000	18	2x3	100	1700	-	analogue of 2SD300C

h/b – half-bridge (blocking of simultaneous transistors' switch-on);



**DR2180P-B1**



**DR2180P-B2**



**DR1480P-B1**

### Drivers-analogues of CT Concept

Drivers IGBT- and MOSFET-transistors are intended to control and protect transistors with field control. The drivers are design and functional analogues of the drivers by CT Concept that are intended to mount them on controlled power module.

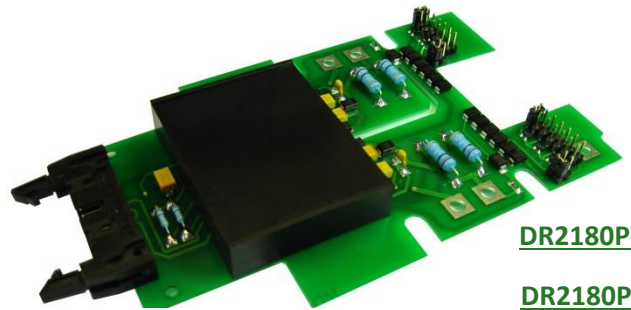
Device type	Channels quantity	$U_{sup}$ V	$U_{ctrl}$ V	$U_{isol}$ V	$I_{out pul}$ A	$P_{out}$ W	$f_{com}$ kHz	$U_{ce max}$ V	$U_{ac}$ V	Notes
<b>DR1280P-BF</b>	1	15	FOCL	15000	28	6	50	6500	≤4400	analogue of 1SP0635
<b>DR2180P-B3</b>	2 h/b	15	5	4000	18	2x3	100	1700	≤1200	analogue of 2SP0320T
<b>DR2180P-B4</b>	2 h/b	15	5	4000	18	2x3	100	1700	≤1200	analogue of 2SP0115
<b>DR2180P-B5</b>	2 h/b	15	5	7500	18	2x3	100	3300	≤2400	analogue of 2SB315A
<b>DR2180P-BF</b>	2 h/b	15	FOCL	7500	18	2x3	100	3300	≤2400	analogue of 2SB315B
<b>DR2180P-BF1</b>	2 h/b	15	FOCL	4000	18	2x3	100	1700	≤1200	analogue of 2SP0320V(S)

h/b – half-bridge (blocking of simultaneous transistors' switch-on);



DR2180P-B5

DR2180P-BF



DR2180P-B3

DR2180P-BF1



DR1280P-BF



DR2180P-B4



### Drivers-analogues of Semikron

Drivers IGBT- and MOSFET-transistors are intended to control and protect transistors with field control. The drivers are design and functional analogues of the drivers produced by Semikron.

Device type	Channels quantity	$U_{sup}$ V	$U_{ctrl}$ V	$U_{isol}$ V	$I_{out pul}$ A	$P_{out}$ W	$f_{com}$ kHz	$U_{ce max}$ V	$U_{ac}$ V	Notes
<b>DR2160P-B1</b>	2 h/b	15	15	4000	16	2x4	50	1700	-	analogue of Board 35 Skyper 32 pro
<b>DR280P-B3</b>	2 h/b	15	15	4000	16	2x4	50	1700	-	analogue of SKHI 22
<b>DR280P-B4</b>	2 u	15	15	4000	16	2x4	50	1700	-	analogue of Skyper32Pro

h/b – half-bridge (blocking of simultaneous transistors' switch-on);  
 u – universal control (presence or absence of blocking is set by consumer)



**DR2160P-B1**



**DR280P-B3**



**DR280P-B4**

## Thyristors drivers



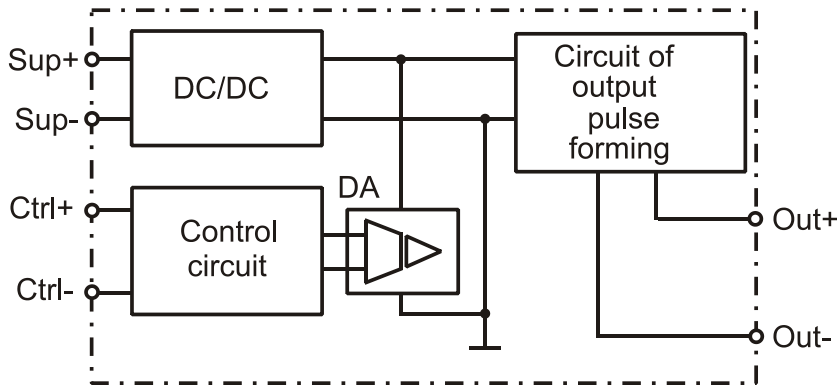


## Single-channel thyristors drivers TD

Single-channel thyristors' driver **TD** is intended to control power thyristors with currents 320÷5000 A with peak voltage up to 6500 V.

**The driver maintains the following functions:**

- forming of afterburning pulse with a curve of control current rise and time characteristics that meet the requirements of power thyristors switch-on for currents up to 5000 A;
- forming of continuous positive control current that follows the afterburning pulse;
- forming the continuous negative control current at closed thyristor;
- ability to control fast thyristors with switching speed up to 20 kHz;
- presence of status signal of current control in thyristor control circuit.

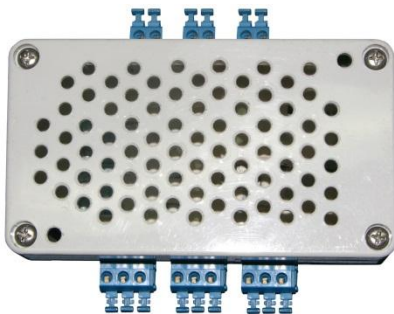


### Multi-channel thyristor drivers TTMD, TD6

Three-channel (**TTMD**, **TTMD-T3**) and six-channel (**TD6**) thyristor drivers are intended to control power thyristors with peak voltage up to 1700 B. The drivers form the control signals of thyristors according with the given logic signals.

Device type	Channels quantity	$U_{sup}$ V	$U_{ctrl}$ V	$U_{isol}$ V	$I_{out pul}$ A	$U_{thyr max}$ V	$I_{thyr max}$ A	Notes
<b>TTMD</b>	3	-	6...32	4000	1	1700	160	$U_{com min} = 50$ V
<b>TTMD-T3</b>	3	13.5...27	5...15	4000	0.2	1700	160	
<b>TD6</b>	6	24	4...32	4000	1	1700	1000	

The drivers TTMD-T3 and TD6 built based on transformer isolation; the driver TTMD – based on optocoupler.



TTMD



TTMD-T3



TD6

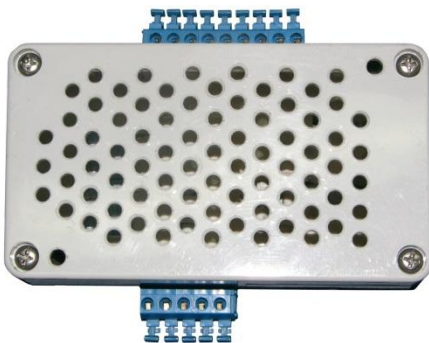
### Drivers of thyristor rectifiers 3phCRD

Drivers of three-phase thyristor rectifier **3phCRD** (thyristor in cathode group) and **3phCRD-6-DIN** (6 thyristors) are intended to control power thyristors and allows you to construct the three-phase regulated six-pulse rectifier. In the drivers has applied vertical-pulse method of regulating the average load voltage at which the change in the average values adjusted by changing duration of the open state of the thyristors during the corresponding half-cycle net voltage.

#### The drivers maintain the following function:

- control of power thyristors;
- change of output power by phase method;
- smooth start at supply switching on;
- protection against current overload (3phCRD-6-DIN);
- indication of current protection operation (3phCRD-6-DIN);
- external or automatic reset of current overload mode (3phCRD-6-DIN).

Issue	Driver	Application	Features	Current protection
<b>Controlled three-phase rectifier bridge</b>	3phCRD	Drivers are intended to control three-phase thyristor-diode bridge and together with it allows you to construct three-phase regulated rectifier	Control by three thyristors in thyristor-diode bridge	No
	3phCRD-6-Din		Direct control by thyristors	Yes
	3phCRD-6.1-Din		Forming of logic control signals by wire communication line	Yes
	3phCRD-6.2-Din		Forming of logic control signals via FOCL	Yes



**3phCRD**



**3phCRD-6-Din**

[see user's manual of 3phCRD](#)

[see user's manual of 3phCRD-6-Din](#)

### Drivers of thyristor power regulators 3phPRD, PRD-FB

Drivers of three-phase (**3phPRD**) and single-phase (**PRD-FB**) power regulators are intended to control by three pairs of inverse-parallel thyristors (**3phPRD**) or by one pair (**PRD-FB**) and together with them provide building of thyristor power regulator.

In the drivers has applied a phase method of regulating the load voltage at which the change of alternating voltage rms by changing duration of the open state of the thyristors during the corresponding half-cycle net voltage.

#### The drivers maintain the following functions:

- control of power thyristors;
- change of output power by phase method;
- smooth start at supply start;
- protection against overcurrent;
- indication of current protection operation;
- stabilization of the controlled values by feedback (PRD-FB).

Issue	Driver	Application	Features	Current protection
Single-phase power regulator	PRD-FB	The driver is intended to operate as a part of power regulator of active load and active-inductive one in AC circuits 220 V and 380 V with frequency 50 Hz.	Presence of feedback	Yes
Three-phase power regulator	3phPRD	Driver is intended to control three pairs of back-to-back thyristors with optocoupler and together with them provides building of three-phase power regulator		Yes

Depending on the version the driver PRD-FB allows you to carry the stabilization using feedback the following parameters:

- V** – load voltage;
- V<sup>2</sup>** – voltage squared on load;
- I** – load current;
- I<sup>2</sup>** – current squared of load;
- V × I** – load power.

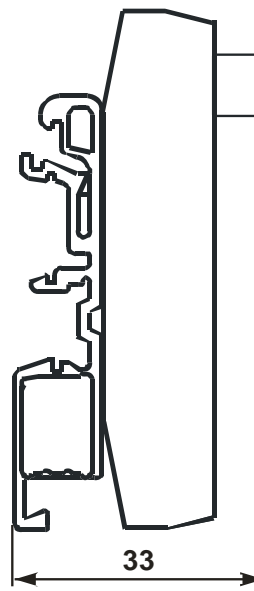
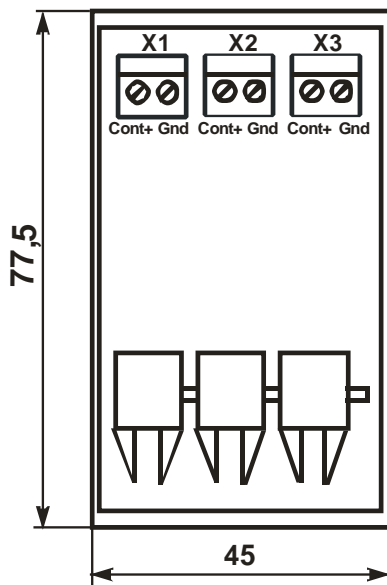
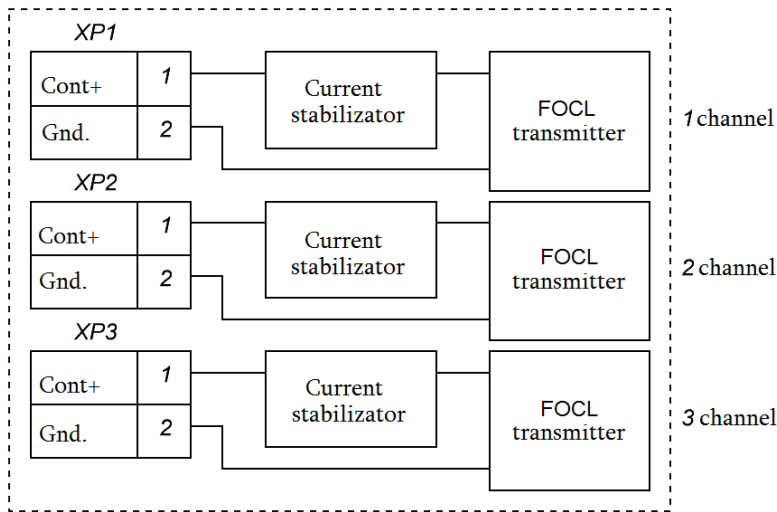


[see user's manual of 3phPRD](#)

[see user's manual of PRD-FB](#)

**Optical converter for thyristor driver OCTD**

An optical converter for thyristor driver **OCTD** is intended to convert an electric signal for amplitude control «log.1» corresponding to 3...27 V to an optical control signal to emit the control signal to thyristors' drivers input of kind TD with FOCL control.



## Power supplies



### AC/DC - converters

AC/DC-converters of voltage are intended to convert single-phase alternating voltage 220 V to direct voltage 24 V (**PSB**), voltage 4 V and 5 V (**PS 220**), voltage 5 V (**PSM**), and also for converting of three-phase alternating voltage 380 V to direct voltage 15 V (**PSM\_380**).

The converters provide galvanic isolation of input and output circuits.

Parameter	Unit	Converter			
		PSB 100E	PS 220-5-24	PSM 15-220/5	PSM 380_15
Input voltage range, (f=50 Hz)	V	175...260	160...260	160...260	250...400
Phase quantity of input circuit		1	1	1	2/3
Output voltage of channel 1, typ.	V	24	5	5	15...21
Maximum output current of channel 1, max	A	4.2	0.2	3	0.3
Output voltage of channel 2, typ.	V	-	24	-	15...21
Maximum output current of channel 2, max	A	-	0.2	-	0.3
Deviation of output voltage, max	%	±2			see user's manual
Change of output voltage when changing input voltage, max	%	±0.5			
Change of output voltage when changing load from 10 to 100%, max	%	±0.5			-10
Pulsing of output voltage, max	mV	150			100
Isolation voltage (AC, 1 minute), min	V	1500			

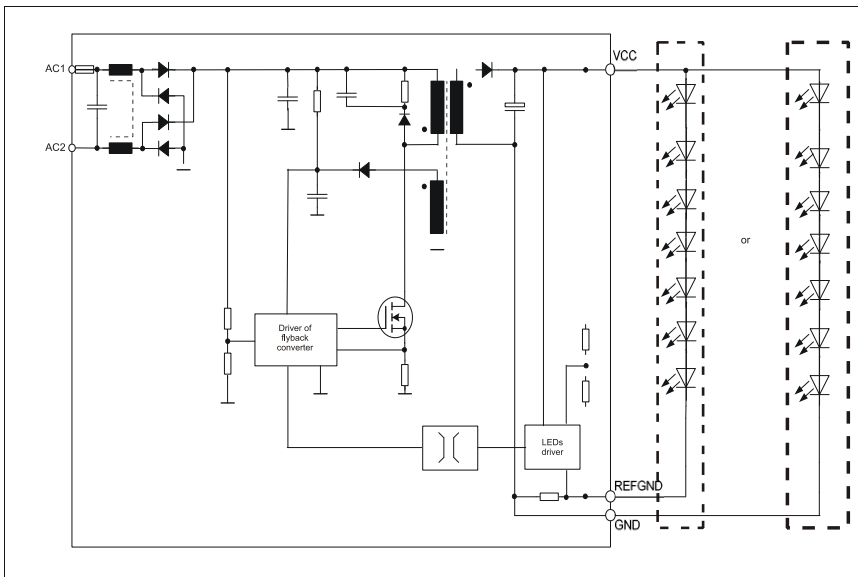


PSM 380-15

### LEDs Driver

LEDs driver **MPSLED-40AC220** is intended to supply LED lights with stabilized direct current. The driver maintains the galvanic isolation between electric net and LED supply circuits. The driver maintains the operation of LED lights from net alternating voltage 200...240 V with supplied power up to 40 W.

Parameter name	Unit	Value	Note
<b>1 Supply voltage</b>	V	200...240	AC
<b>2 Efficiency</b>	%	90	at $I_{out} = 1.5 A$
<b>3 Power coefficient</b>	%	95	at $I_{out} = 1.5 A$
<b>4 Maximum load power</b>	W	40	
<b>5 Maximum output voltage</b>	V	24	
<b>6 Maximum output current</b>	A	1.5	
<b>7 Control stability of output current</b>	%	2	
<b>8 Electric insulation voltage</b>	kV	2.5	AC, 1 minute, «input-output»





## Power units



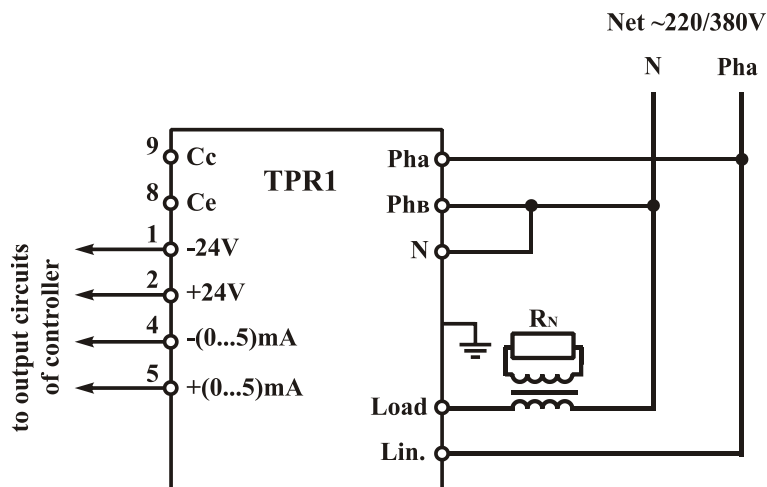
### Unit of single-phase power regulator TPR1

Thyristor single-phase power regulator **TPR1** is intended to adjust power of active load and active-inductive one in AC nets with voltage 220/380V. In the TPR has applied a phase method of regulating the load power at which the change of power by changing duration of the open state of the inverse-parallel thyristors during the corresponding half-cycle net voltage.

#### TPR1 maintains the following functions:

- commutation of alternating voltage;
- change of output power by phase method;
- smooth start when supplying power supply voltage;
- protection against overload in load circuit;
- forming of status signal «Overload» (output – open collector);
- forming of voltage 24 V of DC (for supplying of controlling device).

TPR1 are produced with an amount of maximum output rms current 25,40,63,80,100,120,160,200,250 A, with peak voltage 1200 V.



## Unit of three-phase power regulator TPR3

Thyristor three-phase power regulator **TPR3** is intended to adjust power of active load and active-inductive one in AC nets with voltage 220/380V. In the TPR has applied a phase method of regulating the load power at which the change of power by changing duration of the open state of the inverse-parallel thyristors during the corresponding half-cycle net voltage.

### The TPR3 maintains the following functions:

- commutation of alternating voltage;
- change of output power by phase method;
- smooth start when supplying power supply voltage;
- protection against overload in load circuit;
- forming of status signal «Overload» (output – open collector);
- control of phase loss;
- forming of status signal «Loss» (output – open collector);
- forming of voltage 24 V of DC (for supplying of controlling device).

The TPR3 are produced with an amount of maximum output rms current 25,40,63,80,100,120,160,200,250 A (current of each phase), with peak voltage 1200 V.

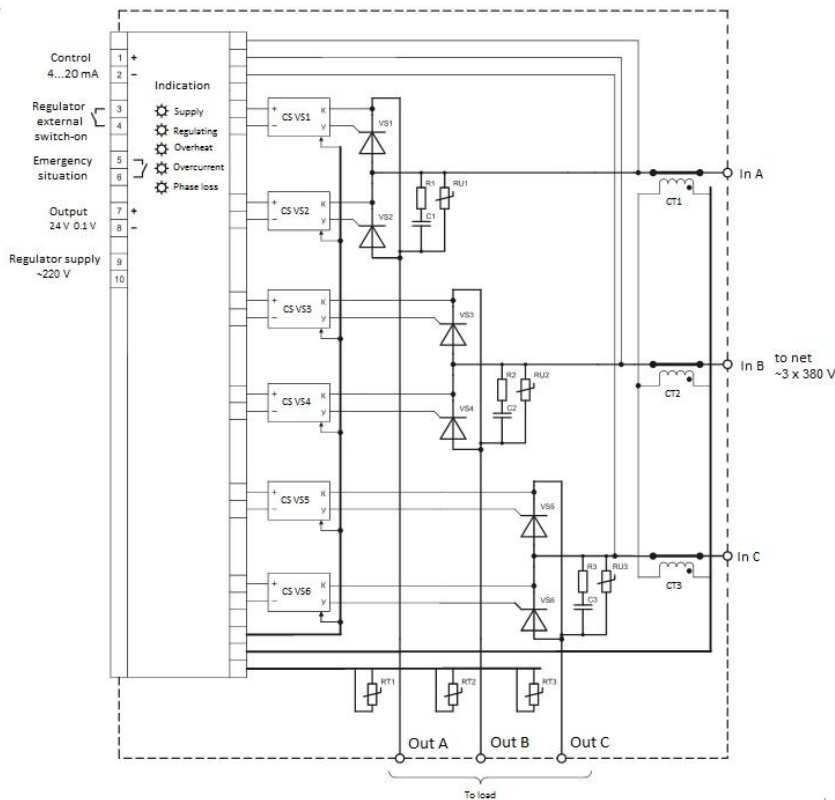


### Unit of three-phase power regulator TPR3-T

**TPR3-T** is intended to adjust power of active load and active-inductive one in AC nets with voltage 220/380V. In the TPR has applied a phase method of regulating the load power at which the change of power by changing duration of the open state of the inverse-parallel thyristors during the corresponding half-cycle net voltage.

**The TPR3-T maintains the following functions:**

- change of output power by phase method;
- protection and indication of overcurrent;
- control and indication of phase loss;
- control and indication of power thyristors overheat;
- indication of supply voltage;
- forming of overcurrent status signal, phase loss and overheat;
- smooth start when supplying power supply voltage;
- forming of voltage 24 V of DC (for supplying external device).



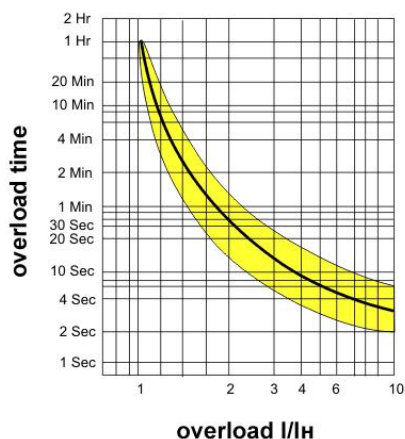
The TPR3-T are produced with an amount of maximum output rms current of each phase **400,500,600,800,1000 A**, with peak voltage 1200 V.

## Thyristor unit of reverse control TRCB

Thyristor unit of reverse control **TRCB** – a multi-functional starter with microchip control intended for smooth start, stop and reversing of three-phase asynchronous electric motors having power up to 15 kW. The unit is produced with an amount of maximum output current 2.5, 6.5, 12, 16, 30 A, with peak voltage 1200 V.

### Functional capabilities of the unit:

- Setting up accelerating time 0 – 99 sec.
- Setting up stop time 1 – 99 sec.
- Setting up maximum motor current 1 – 30 A
- Setting up starting moment when starting 0 – 100%
- Switching on inching when starting
- Setting up value for protection operation against external temperature sensor 1 – 99 °C
- Ability of operation in three control kinds: handle, analogue, discrete
- Choice of start condition: by time or with current limitation
- Choice of stop condition: by time or running-out stop
- Setting up blocking of repetitive switch-on «restart time» 0 – 99 sec (at running-out stop)
- Choice of analogue sensor type (at analogue controlling): 0 - 10 V, 0 - 5 mA, 0 - 20 mA, 4 - 20 mA
- Setting up analogue sensor threshold and its hysteresis for switching
- Emergency electric motor shutdown:
  1. When exceeding maximum motor current
  2. When exceeding interphase current by more than 50%
  3. When one of phase missing
  4. When overheating of power module radiator (programmed value)
  5. When exceeding threshold of remote temperature sensor
- The information about electric motor condition, chosen the operation modes, the emergency shutdowns and about the entered set points are displayed on two-lines LCD indicator.

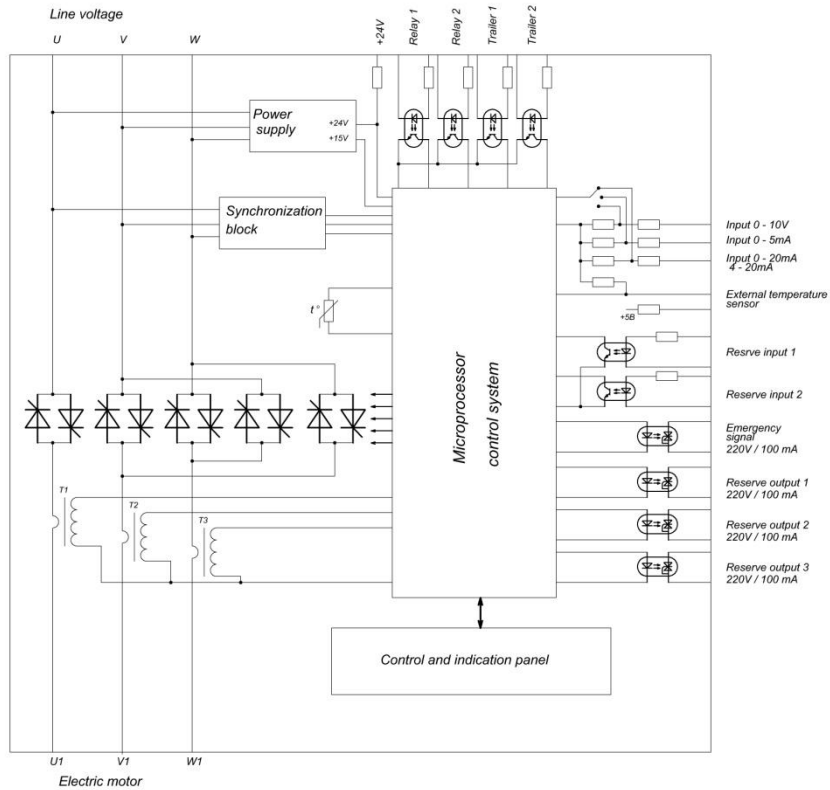


### Time diagram of emergency electric motor shutdown

[see user's manual of product](#)

### Thyristor unit of reverse control TRCB

Functional circuit



Structural circuit of TRCB



[see user's manual of product](#)

## Accessories

### Coolers

Aluminum coolers by type of profile are produced in versions **153** and **271**.

By type of fastening – without any additional tacking and with additional tacking for mounting on Din-rail (in the name specified «Din»).

By length the coolers HS153 are represented by the following sizes: 110, 150, 250, 300, 400, 500 mm.

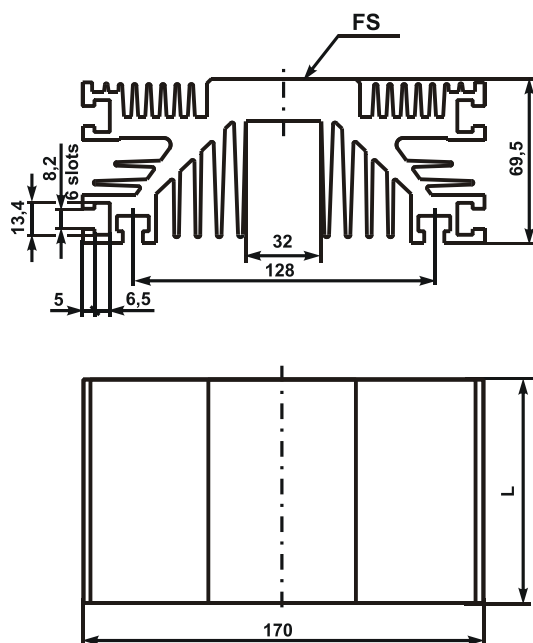
By length the coolers HS153-Din are represented by the following sizes: 110, 150, 250 mm.

By length the cooler HS271 are represented by the following sizes: 50, 110, 150, 250, 300, 500 mm.

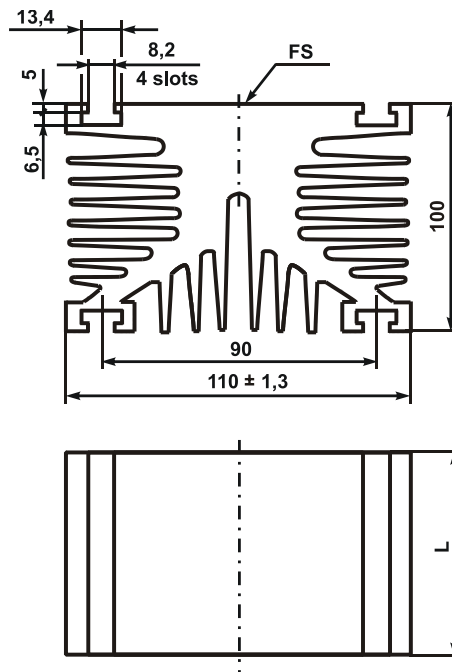
By length the coolers HS271-Din are represented by the following sizes: 110, 150, 250, 300, 500 mm.

#### The coolers allow operating at:

- ambient temperature from minus 60 to 85°C with air cooling;
- relative humidity up to 98% at 35°C and with humidity condensation;
- atmosphere pressure  $(8.66 - 10.66) \cdot 10^4$  Pa;
- temperature change from minus 60 to +125 °C



**HS 153**



**HS 271**



### Protection elements

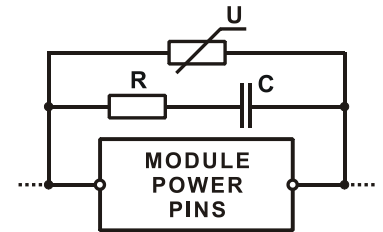
Protection elements **PE** are intended to protect the power semiconductor switches of power modules against overvoltage in the power circuit, that are able to lead to failure a device because of breakdown of a power element, and also it increases devices' stability based on thyristors to  $dU/dt$ .

The PEs are intended to operate as a part of the power modules produced by «Electrum AV», CJSC.

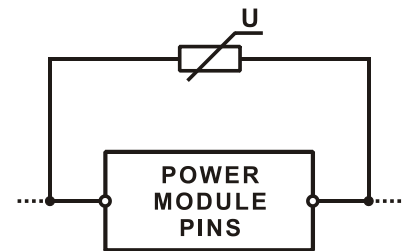
#### Limiters' parameters

Symbol	Classified limiter voltage, U, V			Maximum power, Pmax, W		
	min	max	typ.			
PE1-V3	38	47	43	400	600	1500*
PE1-V4	56	68	63			
PE1-V5	82	100	91			
PE1-V6	144	176	160			
PE1-V7	225	275	250			
PE1-V8	315	385	350			
PE1-V9	630	770	700			
PE4-V3	38	47	43			
PE4-V4	56	68	63			
PE4-V5	82	100	91			
PE4-V6	144	176	160			
PE4-V7	225	275	250			
PE4-V8	315	385	350			
PE4-V9	630	770	700			

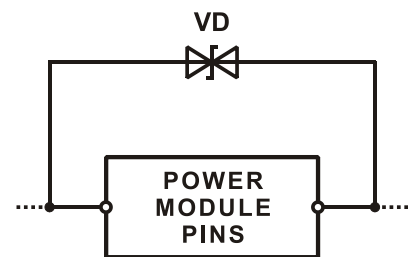
\* Standard version



Version «A»



Version «B»



Version «C»

#### Parameters of protective RC-circuit

Load current, $I_{load}$ , A	25	40	63	100	160	250
Protective condenser, $\mu F / V$	0.12 / 1000			0.22 / 1000	0.39 / 1000	
	0.015 / 1600			0.08 / 1600	0.22 / 1600	
Protective resistance, R, $\Omega$	min	18		8.2	3.6	
	max	22		10	3.9	

**Products for hard condition use (HC):**  
**modules without control**

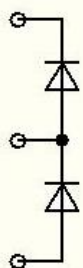


## Power modules based on Schottky diodes

Diode modules based on Schottky diodes of series **5M4** are assemblies of one or two diodes intended to convert AC current to pulsing DC as a part of single-phase and three-phase rectifier bridges, switch stabilizers, pulse supply sources, in electric drive circuits, control and commutation of on-board and other equipments for special purposes.

An amount of maximum module DC: **40,80,120,160,200,240,280,320 A**

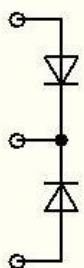
An amount of module diodes reverse voltage: **60,125,200 V**



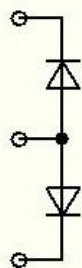
**5M4Sch**



**5M4.1Sch**

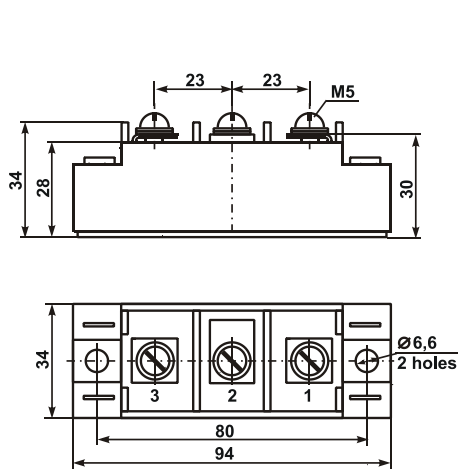


**5M4.2Sch**

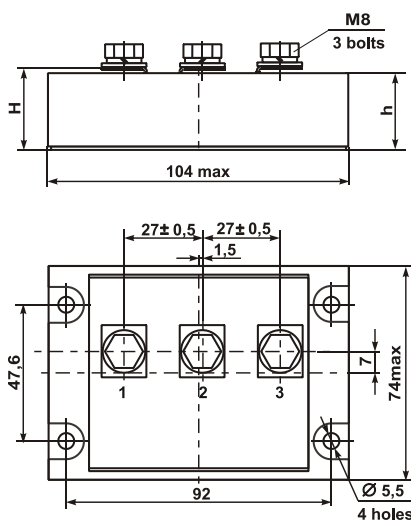


**5M4.3Sch**

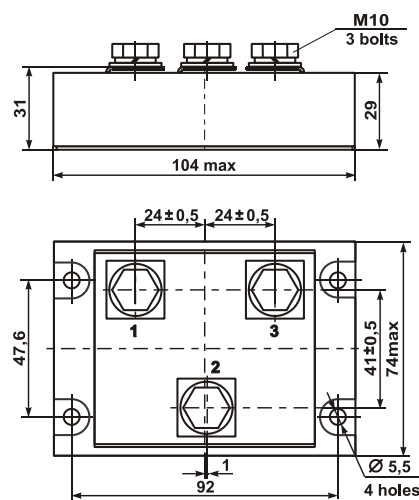
Current, A	Figure
40	1
80	1
120	1
160	1
200	2
240	2
280	3
320	3



**Fig. 1**



**Fig. 2**

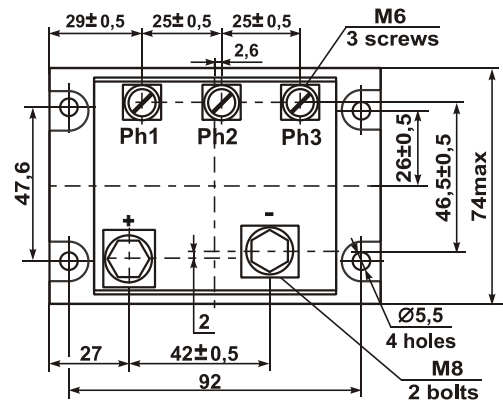
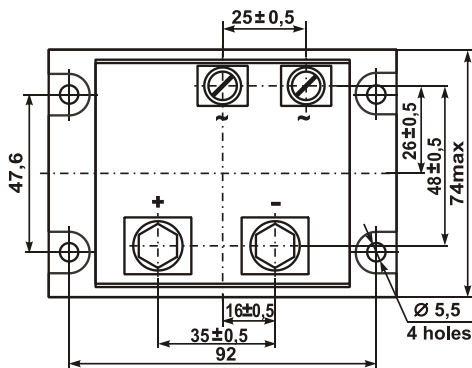
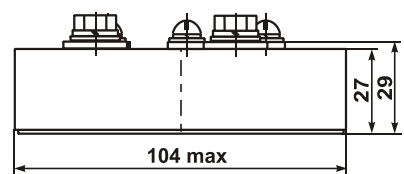
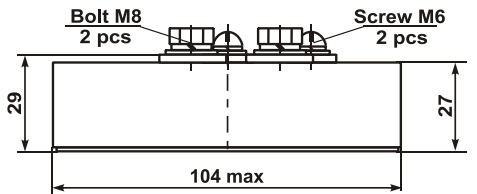
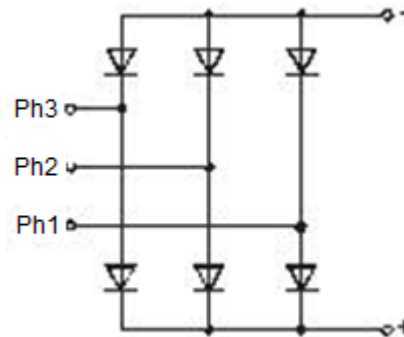
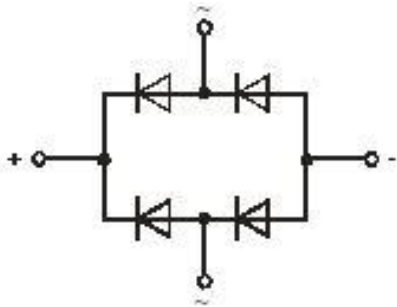


**Fig. 3**

### Power modules based on fast-recovery diodes

Module of single-phase (5M5) or three-phase (5M6) diode bridge based on fast-recovery diodes intended to convert AC to pulsing DC in electric drive circuits, control and commutation of on-board and other equipment for special purposes.

The modules include the fast-recovery diodes with reverse voltage 1200 V;  
 Maximum average rectifier module current: 100,200 A (for 5M6) and 100,150,300 A (for 5M5).

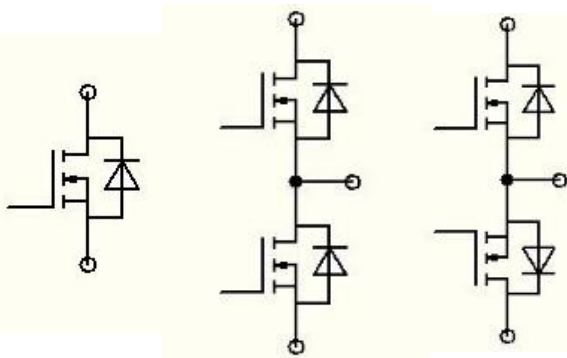


**5M5FRD**

**5M6FRD**

### Power modules based on MOSFET-transistors

Modules MOSFET-transistors **5M9**, **5M12**, **5M12.1** are assemblies based on MOSFET-transistors with reverse diodes. The modules are intended to commutate the power loads and to use them as a part of the converters.



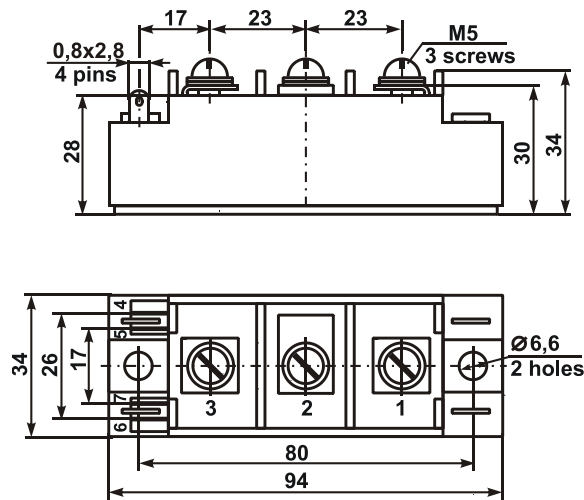
Type	Breakdown voltage, V		
	60	100	200
5M9	50,75,100,200,250,300,400	50,75,100,200,250,300,400	50,75,100,200,300
5M12	50,75,100,150,200	25,50,75,100,150,200	25,50,75,100,150,200
5M12.1	50,75,100,150,200	25,50,75,100,150,200	25,50,75,100,150,200

**5M9**

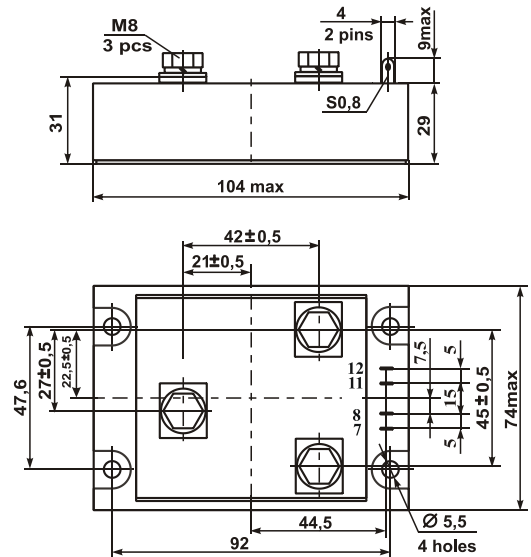
**5M12**

**5M12.1**

In the cells is specified an amount of the module DC



**Module current 25,50 A**

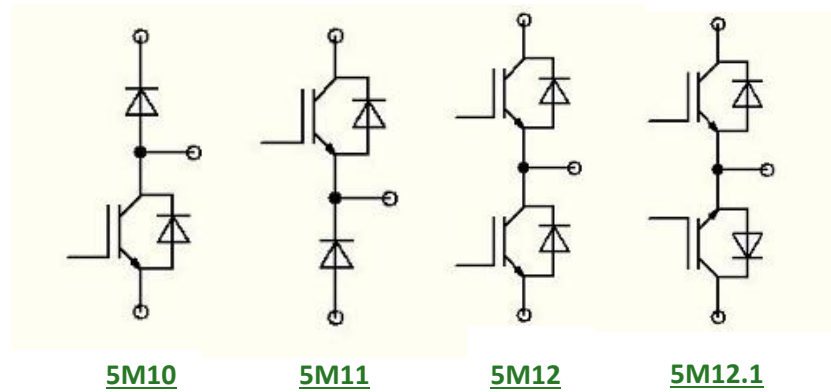


**Module current from 75 A**

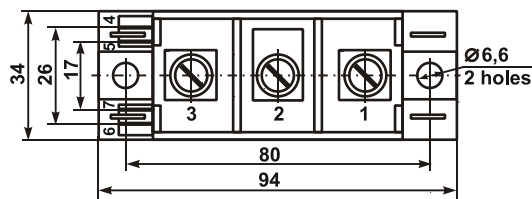
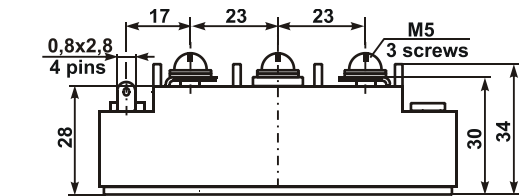
## Power modules based on IGBT-transistors

Modules IGBT-transistors 5M9, 5M12, 5M12.1 are assemblies based on IGBT-transistors with reverse fast-recovery diodes. The modules are intended to commutate the power loads and to use them as a part of the converters.

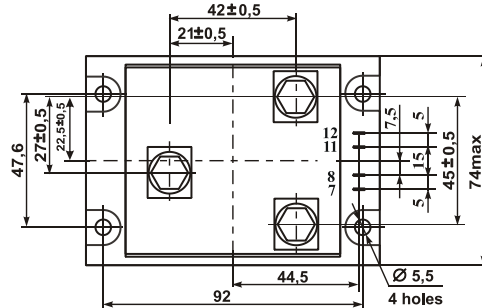
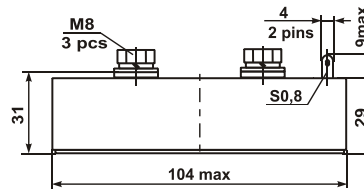
Type	Breakdown voltage, V	
	600	1200
5M9	75,100, 200,300	75,150, 200,300
5M10	75,100,200	75,150,200
5M11	75,100,200	75,150,200
5M12	75,100,200	75,150,200
5M12.1	75,100	75,150



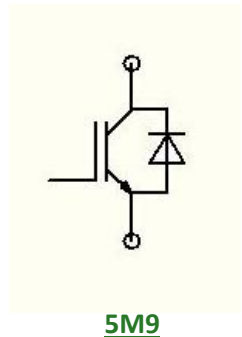
In the cells is specified an amount of the modules DC



Module current 75 A

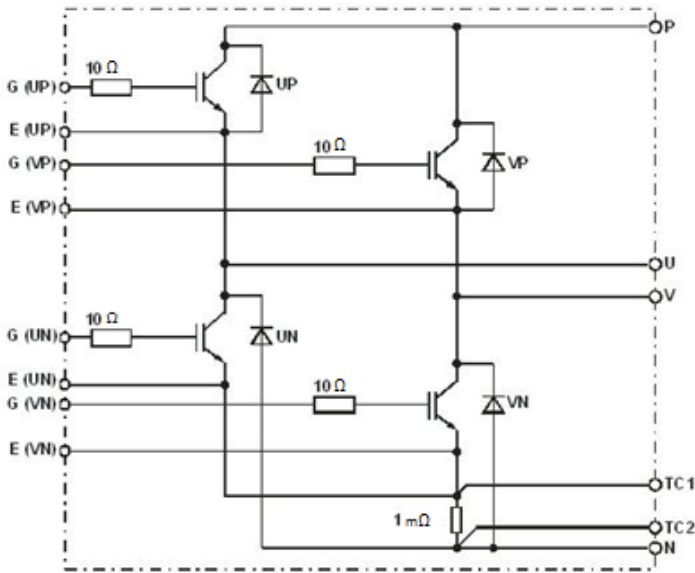


Module current from 100 A

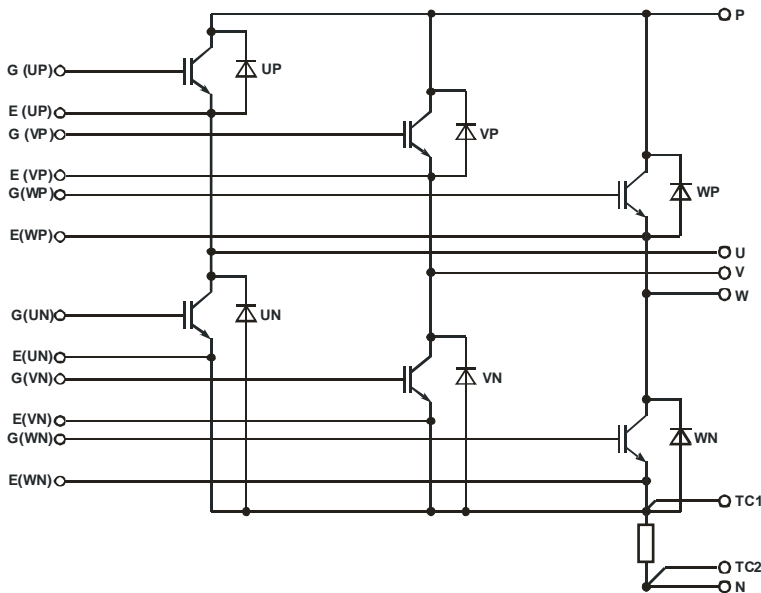


## Power IGBT-module of inverters 5M13

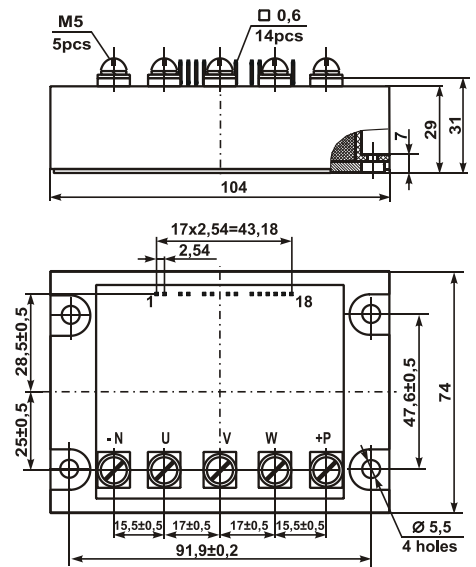
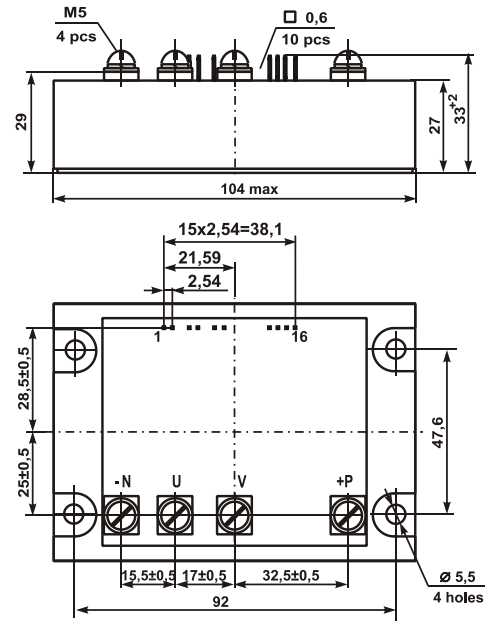
Transistor bridges **5M13A** and **5M13B** produced based on IGBT-transistors intended to build the converter devices with peak voltage 1200 V and maximum load DC 25 A or 50 A



**5M13B**



**5M13A**



## Products for hard condition use (HC): modules with control

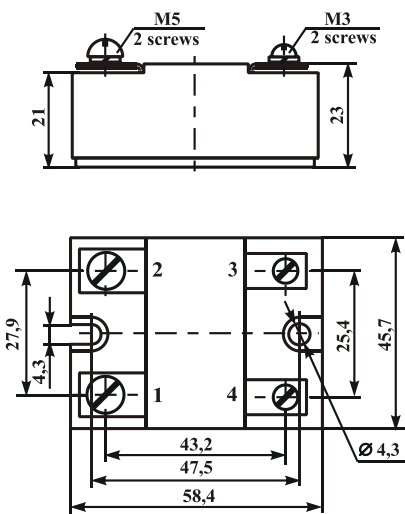




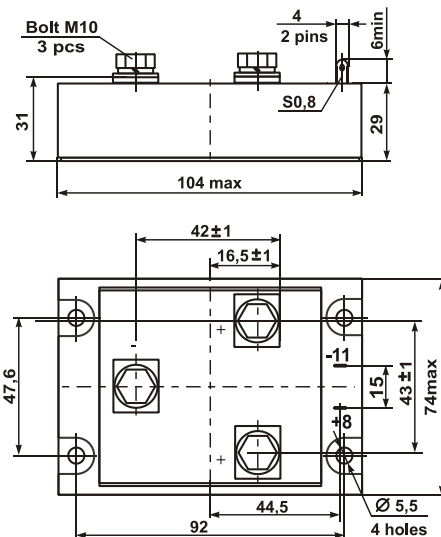
## DC relays MT14, MT15

Relay of DC commutation based on MOSFET- (**5MT14**) or IGBT-transistors (**5MT15**) with current protection (symbol **PT** in the name) or without protection are intended to operate in devices of special purposes as a commutator. The relays provide the galvanic insulation of control circuits from power circuits and provide the current and voltage protection.

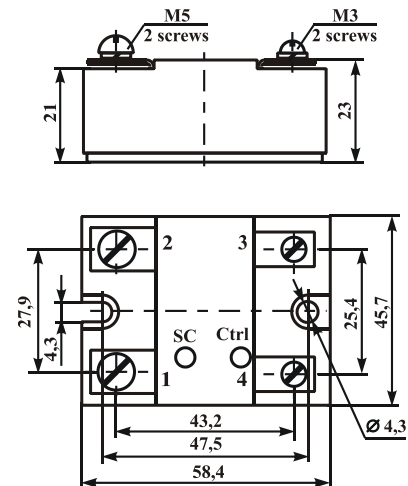
5MT	U <sub>max</sub> , V	Maximum DC, A											
		5	10	20	30	40	50	80	120	160	180	240	300
14B	100	+	+	+		+							
15PTB	600	+		+	+	+	+						
15DB	1200							+	+	+	+	+	+



**5MT14B**



**5MT15DB**



**5MT15PTB**

[see user's manual of 5MT14B](#)

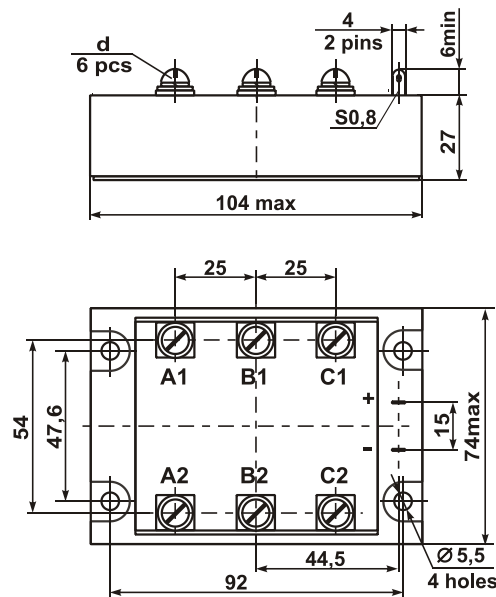
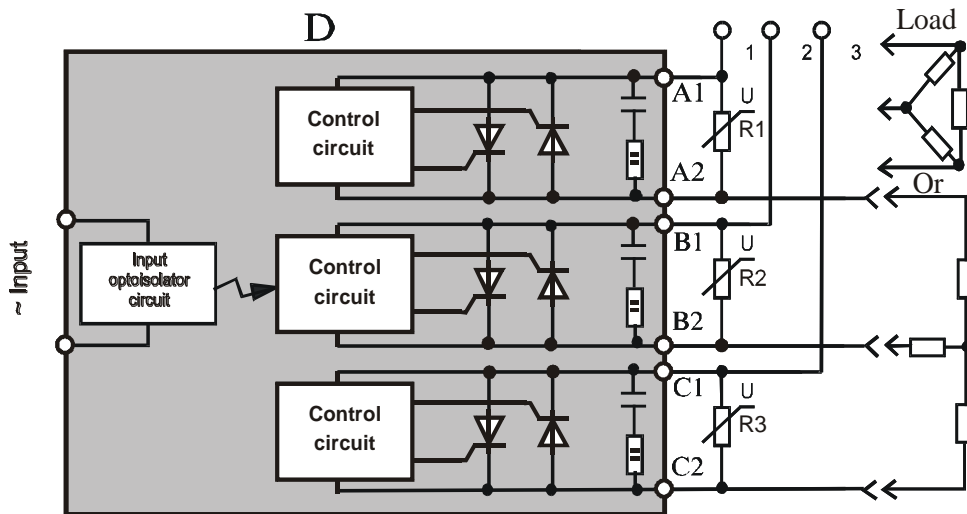
[see user's manual of 5MT15DB](#)

[see user's manual of 5MT15PTB](#)

## AC relay 5MO26

Solid state semi-conductor optocoupler three-phase AC relays **5MO26** with «normally open» terminals with controller of through «zero» phase transient are intended to commutate loads in AC circuits with frequency from 50 to 400 Hz.

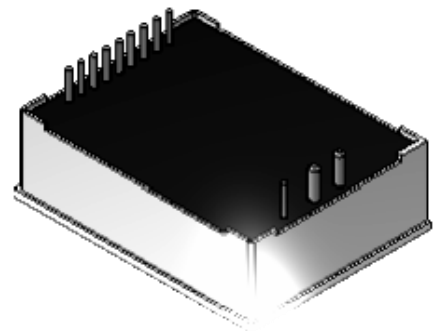
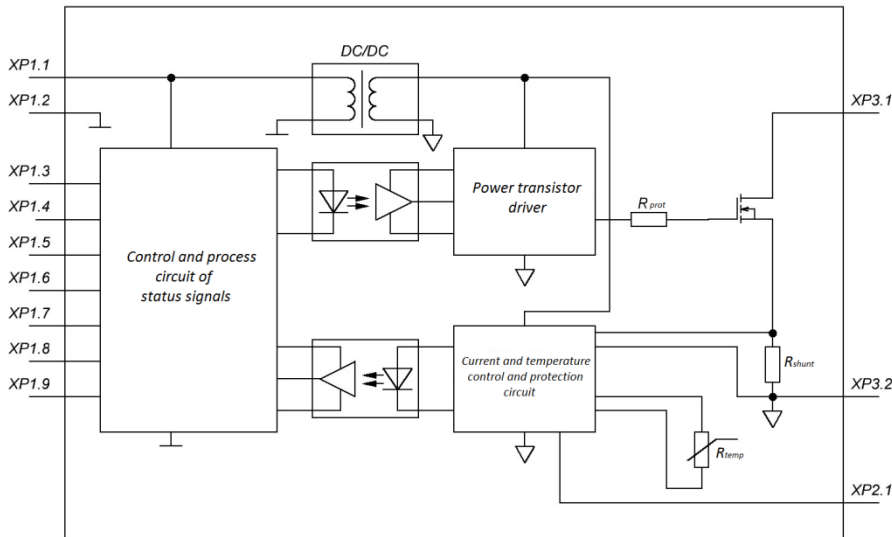
The modules are produced with an amount of maximum rms current 25,40,63,80,100,120 A with maximum reverse thyristors' voltage 1200 V.



## Solid state power controller 5SSPC

Modules of DC commutation and control **5SSPC** are intended to use them in CEE to commutate the loads. The SSPCs provide the control of current flow through load (with giving a status signal CT1 by value  $I < 0.3I_{nom}$ , status CT2 by value  $0.3 I_{nom} < I < 1.1 I_{nom}$ ); they provide the protection of power element against SC or exceeding the current in load (with giving a status signal CT3 by value  $I > 1.1 I_{nom}$ ), they provide the protection of power element against overheat (with giving a status signal CT4 at  $T = 90...100\text{ }^{\circ}\text{C}$ ).

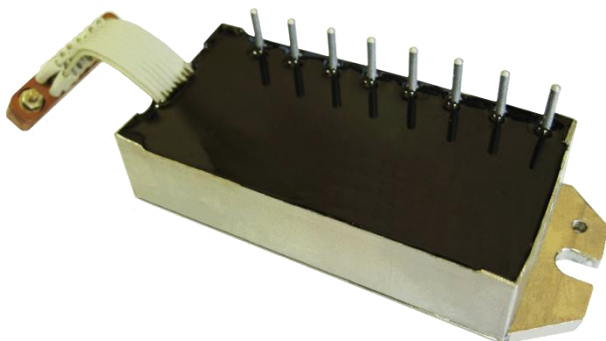
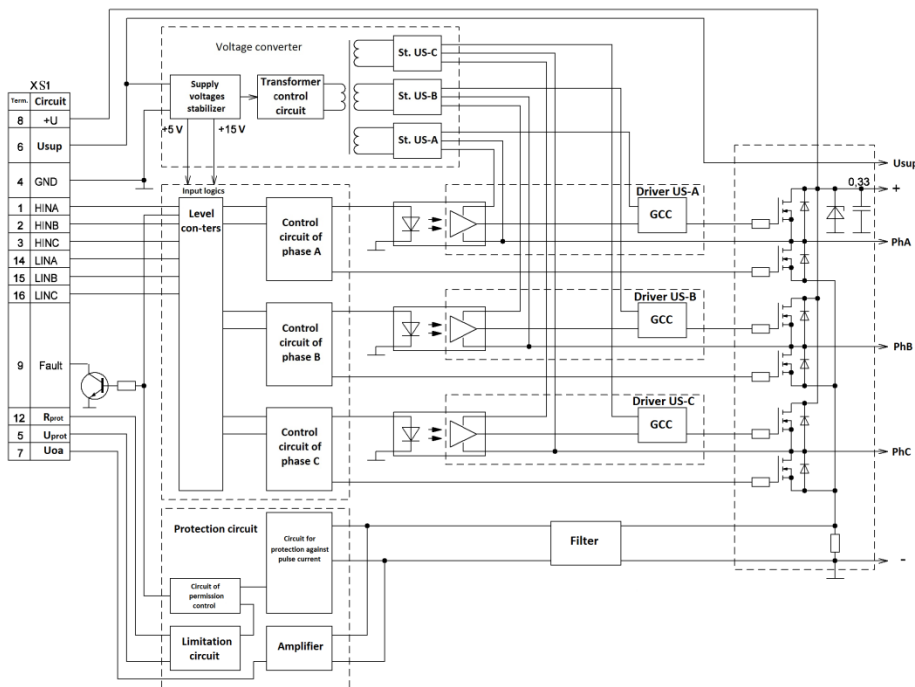
Maximum DC for module commutation 5 A or 10 A; peak voltage 100 V.



## Module of intelligent inverter 5UM14

Module of intelligent inverter **5UM14** is intended to control an electric motor and provides current commutation, measuring and limiting of current level consumed by the load from an external source, generating a signal «Error» in critical modes. The module includes the power switches, protection circuits and drivers.

The module inverter built on MOSFET-transistors with drain-source breakdown voltage 200 V and maximum drain current 45 A.



[see user's manual of product](#)

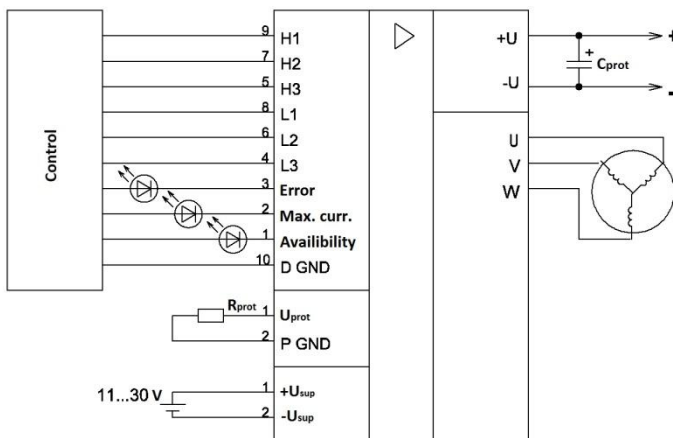
## Module of intelligent inverter 5M31

Module of intelligent inverter **5M31** is intended to control electric motor and provides the current commutation, measurement and limitation of current level consumed by the motor from an external source, generating signals «Error» in critical modes. The module includes the power switches, protection circuits and drivers.

**The 5M31 maintains the following functions:**

- control the motor according to the control signals;
- protection against current overloads and SC;
- limitation of load current on the given level;
- adjustment of current protection operation threshold;
- protection against overheat;
- protection against simultaneous transistors switch-on of upper and lower inverter arm;
- protection against supply undervoltage;
- shows an indication of operation mode and emergency situations.

Current of module protection operation – 50 A; peak inverter voltage – 600 V.



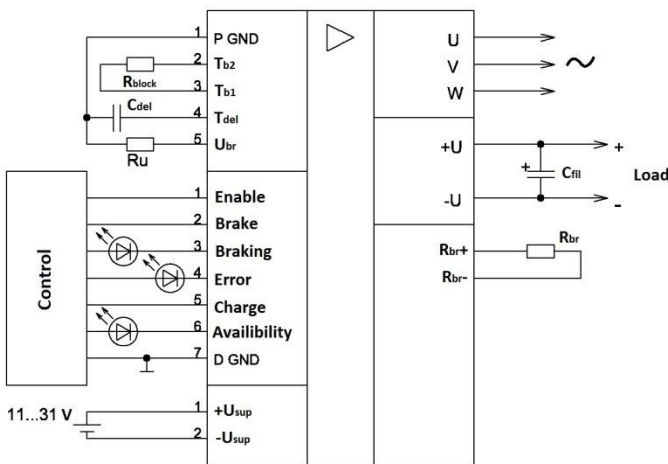
## Module for commutated voltage control 5RM

Module for commutated control voltage **5RM** is intended to control electric motor power supply and provides rectifying of alternating voltage, commutating load current, protecting against load SC, giving the emergency signals in critical modes. The module includes the power switches, protection circuits and drivers.

### The 5RM maintains the following functions:

- commutation of power voltage;
- disconnection/connection of load through an external control signal;
- control of commutated voltage by brake and charge transistors switching on/off;
- smooth load capacitance charge by pumping pulses;
- adjustment of equivalent charge current;
- adjustment of brake transistor on/off threshold;
- adjustment of transistors' operation delay duration;
- protection of built-in transistors and load against SC;
- provides temperature protection;
- protection against supply undervoltage;
- shows an indication of operation mode and emergency situations.

Maximum module DC – 50 A; peak voltage – 600 V.



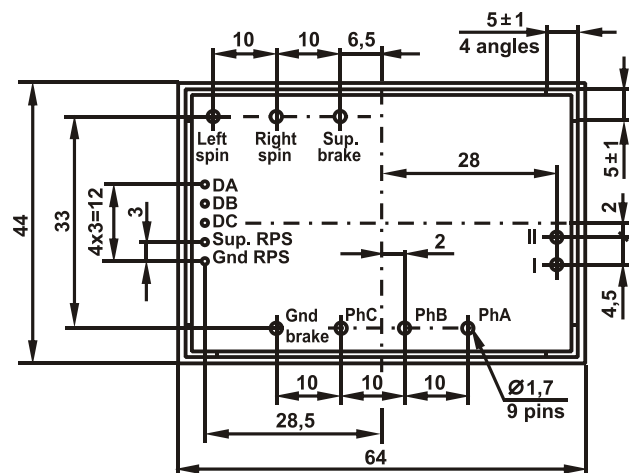
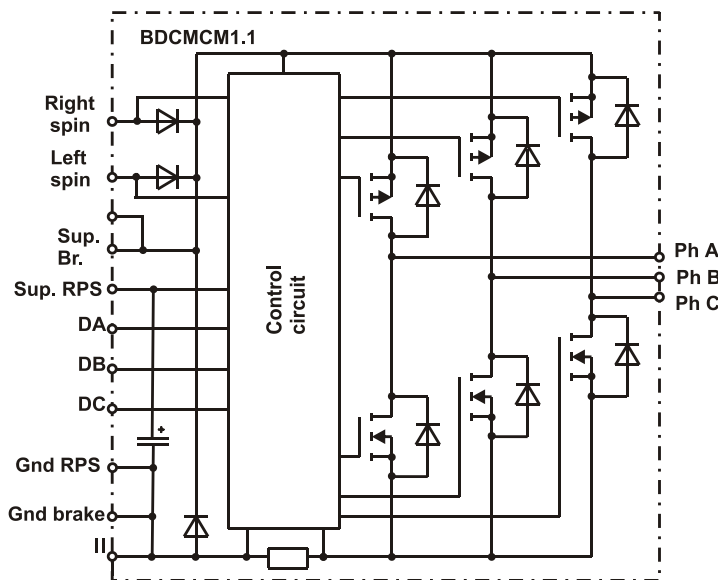
## Module for brushless DC motor control BDCMCM-1C

Module for brushless DC motor control **BDCMCM-1C** is intended to operate in board equipment with nominal supply voltage 27 V in the systems for brushless DC motor control with rotor position sensors.

**The module maintains the following functions:**

- forming of supplying voltages;
- forming of current commands for drive control: «frwd/bckwd», «braking», «stop»;
- current control through motor windings and forming of motor phasing algorithm;
- supplying and reference voltages control.

Maximum module DC – 10 A; peak voltage – 60 V.



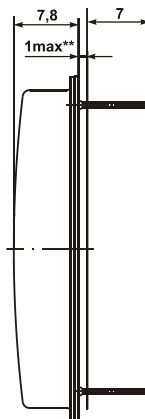
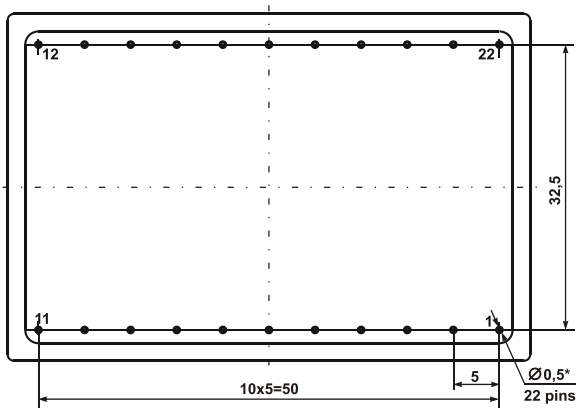
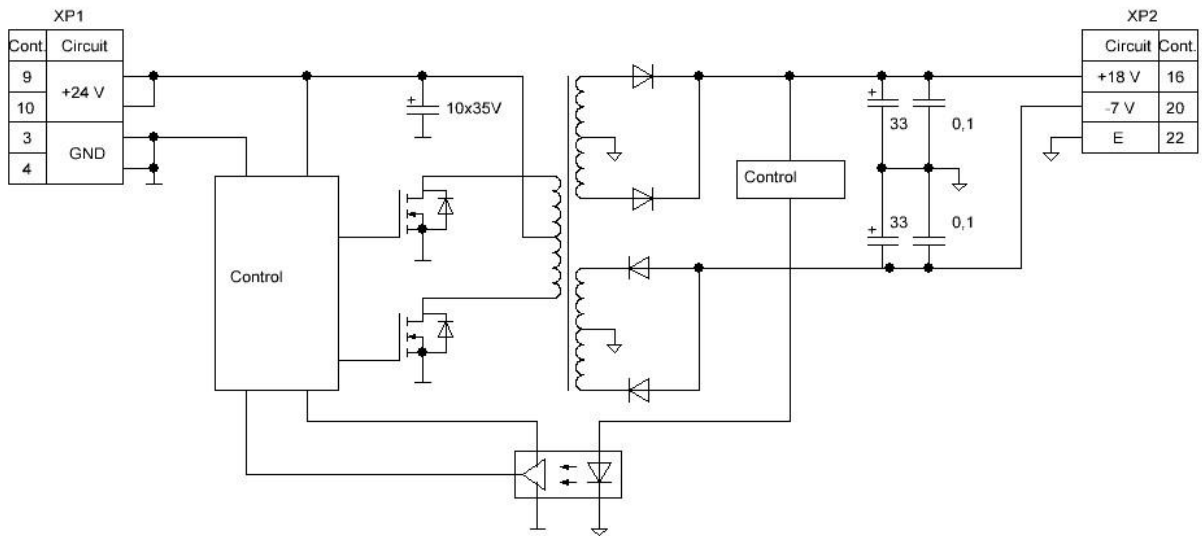
## Products for hard condition use (HC): transistors drivers





## DC/DC-converter of driver 2005EU1

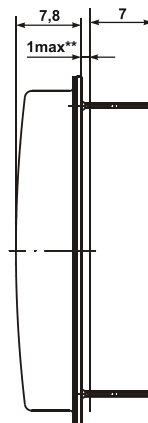
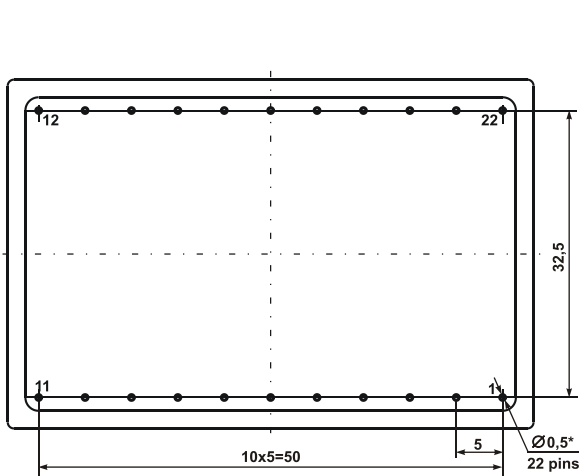
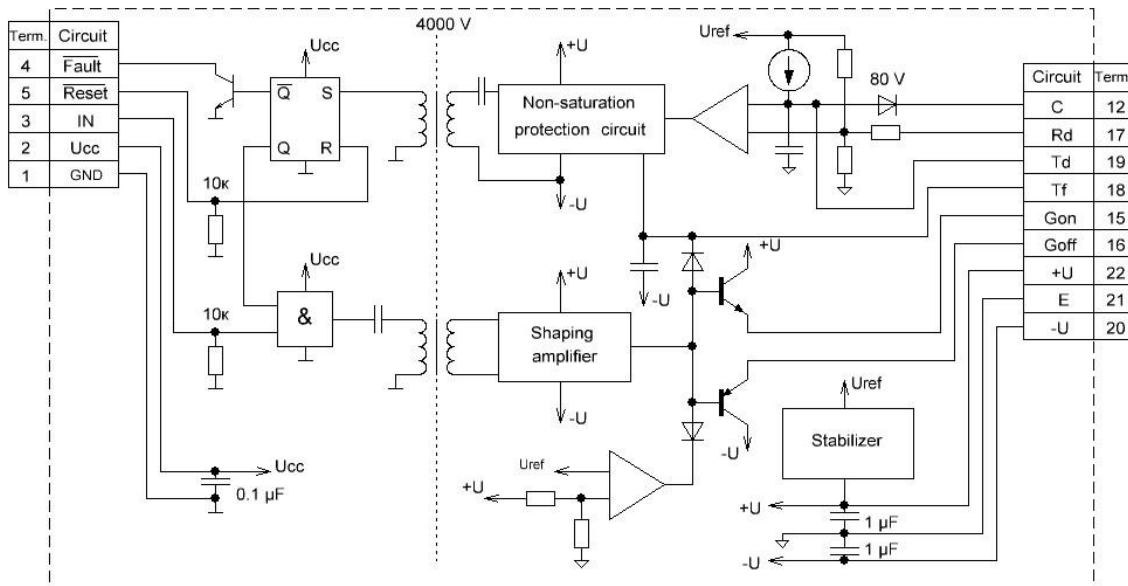
Module of voltage converter **2005EU1** is intended to convert direct voltage 24 V to voltages +18V/-7V to supply control circuit MOS- and bipolar transistors with isolated gates. The module provides the galvanic insulation of input voltage from output ones with DC strength not less than 4000 V, provides the stabilization of output voltage when temperature, supply voltage and load changing.



**U sup = 24 V**  
**U out = +18/-7 V**  
**P out = 5 W**  
**T<sub>j</sub> = -60 ... +85 °C**

## Driver module MOSFET- and IGBT-transistors 5DM110

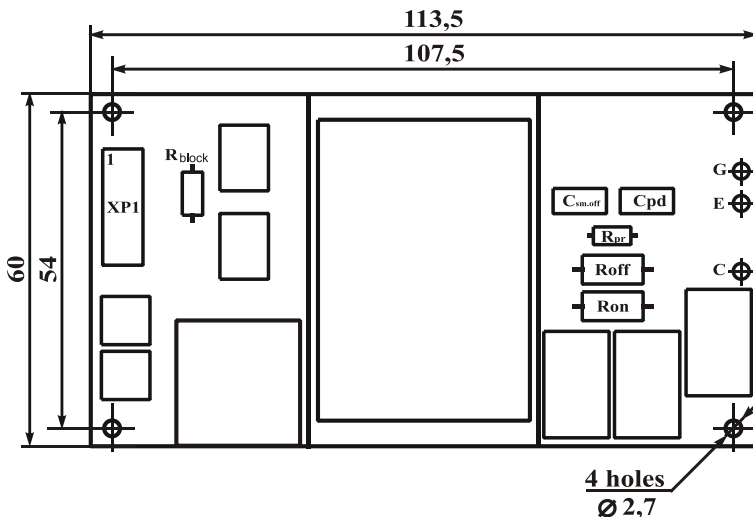
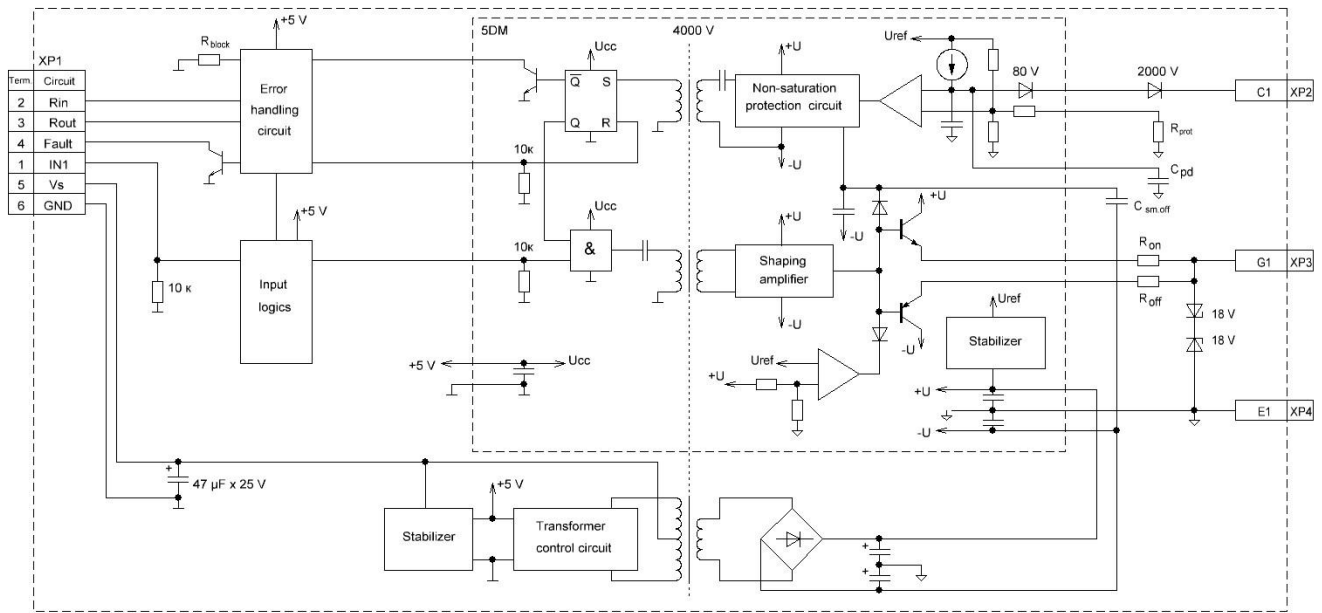
Driver of power transistors with field control **5DM110** is intended for galvanically isolated control a power transistor with field control (MOSFET или IGBT) with maximum permissible voltage up to 1700 V. The driver is a shaping amplifier of transistor gates control signals with frequency up to 100 kHz and provides the protection of the controlled transistor against emergency operation modes.



**U sup = 5 V**  
**U out = 15...35 V**  
**I out = ±11 A**  
**f = 100 kHz**  
**T<sub>J</sub> = -60 ... +85 °C**

### Single-channel driver MOSFET- and IGBT-transistors 5DR1120

Single-channel driver of power transistors with field control **5DR1120** are intended to control a single MOSFET or IGBT transistor. The driver is a shaping amplifier of transistor gates control signals with frequency up to 100 kHz with a built-in DC-DC converter. The driver provides protection functions against overcurrent of the controlled transistor and provides protection of the gate against undervoltage/overvoltage.



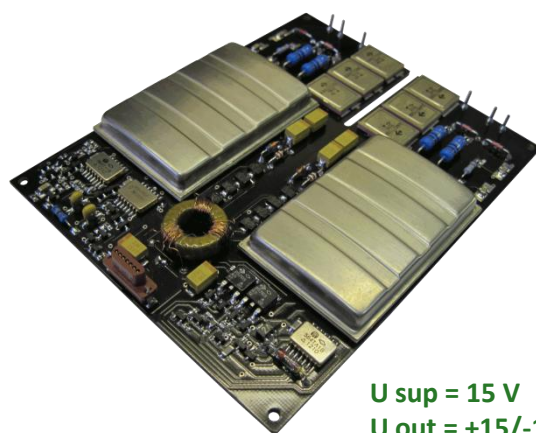
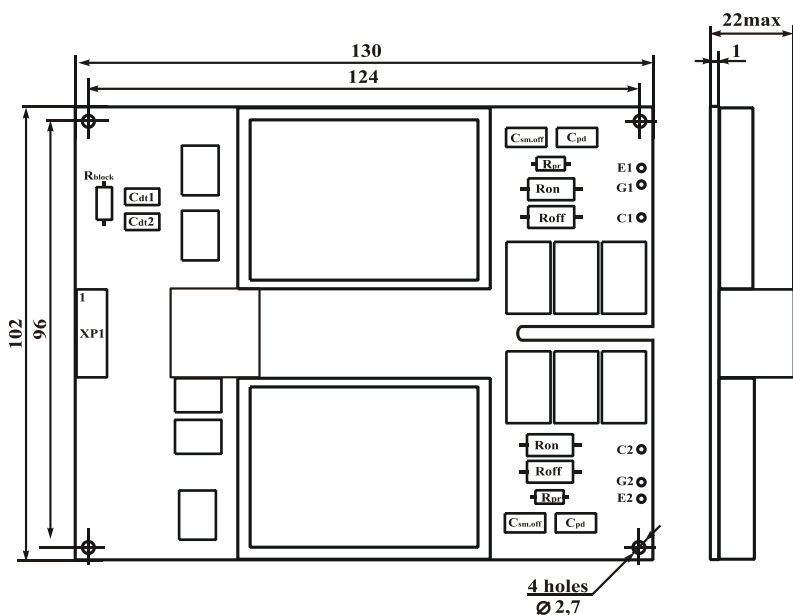
$U_{sup} = 15\text{ V}$   
 $U_{out} = +15/-10\text{ V}$   
 $I_{out} = \pm 12\text{ A}$   
 $T_j = -60 \dots +85\text{ }^\circ\text{C}$

## Two-channel driver of MOSFET- and IGBT-transistors 5DR2120

Two-channel driver of power transistors with field control **5DR2120** is intended to control by half-bridge on MOSFET- or IGBT-transistors. The driver is a shaping amplifier of transistors' gates control signals with frequency up to 100 kHz with a built-in DC-DC converter.

### The driver maintains the following functions:

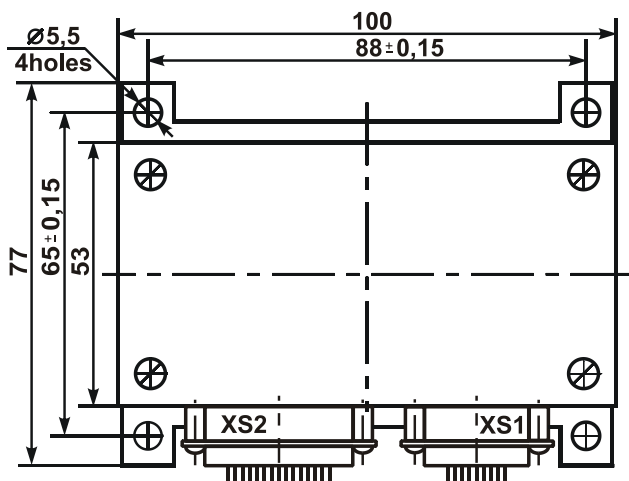
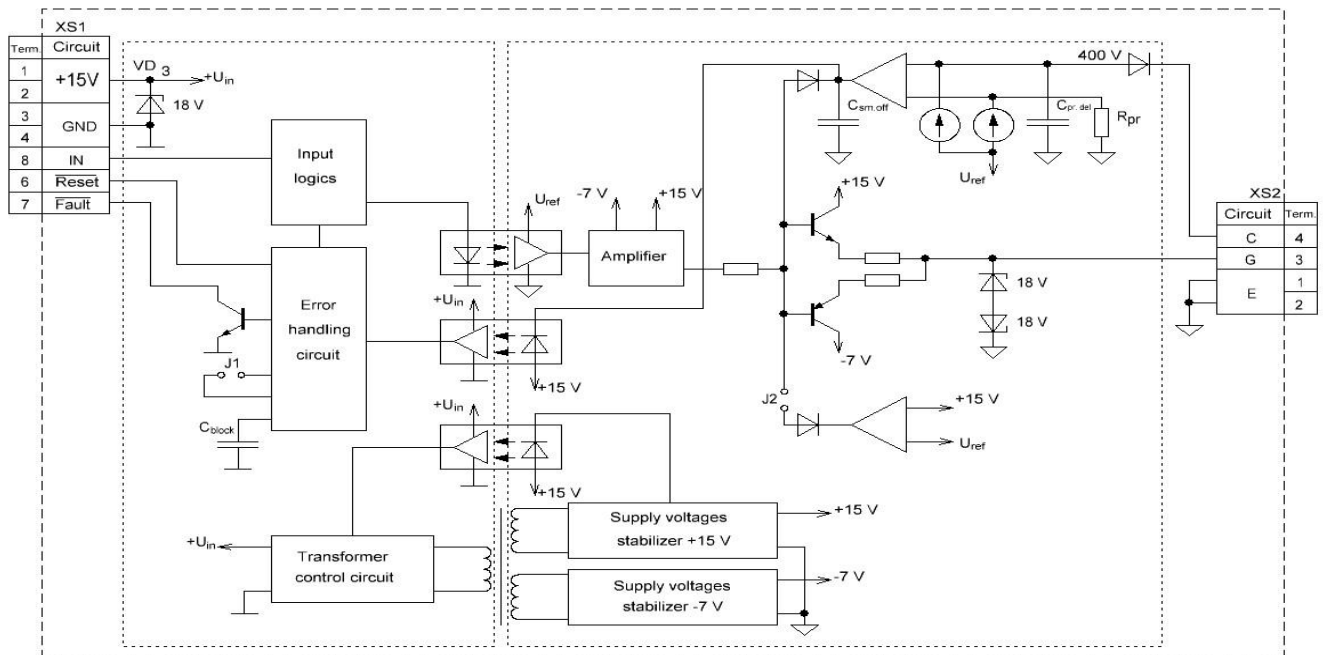
- Saturation voltage control on controlled transistors collectors, protective switch-off when leaving saturation condition;
- Adjustment of saturation voltage protective shutdown threshold;
- Driver smooth junction from active state from non-active one at an emergency;
- Adjustment of non-saturation protection operation delay;
- Adjustment of smooth emergency shutdown duration;
- Blocking of control in an emergency mode;
- External reset of emergency mode or automatic one;
- Adjustment of automatic reset duration in an emergency mode;
- Alarm about failure;
- Forming of «dead time» for transistors' switching;
- Adjustment of «dead time» duration;
- Blocking of simultaneous transistors' switching;
- Control of supply voltages on driver inputs;
- Limitation of voltage on controlled transistors' gates.



$U_{sup} = 15\text{ V}$   
 $U_{out} = +15/-10\text{ V}$   
 $I_{out} = \pm 12\text{ A}$   
 $T_j = -60 \dots +85\text{ }^\circ\text{C}$

## Single-channel driver MOSFET-transistors 5DR1160

Single-channel drivers of power transistors with field control **5DR1160** are intended to control single MOSFET-transistor with peak voltage up to 250 V. The driver is a shaping amplifier of transistors' gates control signals with frequency up to 200 kHz with a built-in DC-DC converter.



**U sup = 15 V**  
**U out = +18/-7 V**  
**I out = 16...34 A**  
**f = 200 kHz**

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