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PRODUCTS LIST 2014

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* In the content the new devices are marked with color

1. STANDARD THYRISTOR-DIODE MODULES AND BRIDGES		
T _J = -40 ... +85 °C		
MODULE NAME	FUNCTIONAL APPLICATION	FEATURES
<u>to mount to panel</u>		
<i>Networks with frequency up to 1 kHz</i>		
BM	Compact rectifier module based on diodes and/or (depending on version) thyristors is intended to rectify 1- or 3-phase AC up to 400 Hz	15, 25, 45 A / 1200 V
M1, M1.1, M1.2	Thyristor module is intended to use as switch elements of controlled rectifiers, converters (inverters), power regulators, etc.	25, 40, 63, 80, 100, 125, 160, 200, 250 A / 1200, 1600 V
M2	Diode-thyristor module, is intended to use as switch elements of controlled rectifiers, converters (inverters), power regulators, etc.	25, 40, 63, 80, 100, 125, 160, 200, 250 A / 1200, 1600 V
M3	Thyristor-diode module, is intended to use as switch elements of controlled rectifiers, converters (inverters), power regulators, etc.	25, 40, 63, 80, 100, 125, 160, 200, 250 A / 1200, 1600 V
M4	Diode module, is intended to convert AC (as a part of single- and three-phase bridges)	25, 40, 63, 80, 100, 125, 160, 200, 250 A / 1200, 1600 V
M4.1, M4.2, M4.3	Module of single diode (two diodes with common cathode (anode)), is intended to use in converters	25, 40, 63, 80, 100, 125, 160, 200, 250 A / 1200, 1600 V
M5	Module of single-phase diode bridge, is intended to rectify AC	63, 100, 160, 200, 250 A / 1200, 1600 V
M5M	Module of single-phase diode bridge, is intended to rectify AC <i>in housings with reduced dimensions</i>	63, 100 A / 1200 V
M6	Module of three-phase diode bridge, is intended to rectify AC	63, 100, 160, 200, 250 A / 1200, 1600 V
M6M	Module of three-phase diode bridge, is intended to rectify AC <i>in housings with reduced dimensions</i>	63, 100 A / 1200 V
M20	Module of single-phase regulated thyristor-diode bridge with thyristors in cathode group, is intended to rectify AC	63, 100, 160, 200, 250 A / 1200, 1600 V
M21	Module of single-phase thyristor-diode bridge with thyristors in arm of AC, is intended to rectify AC	63, 100, 160 A / 1200, 1600 V
M22	Module of single-phase thyristor bridge, is intended to rectify AC	63, 100, 160 A / 1200, 1600 V
M23	Module of three-phase diode-thyristor bridge with thyristors in cathode group, is intended to rectify AC	63, 100, 160, 250 A / 1200, 1600 V
M23M	Module of three-phase diode-thyristor bridge with thyristors in cathode group, is intended to rectify AC <i>in housings with reduced dimensions</i>	63 A / 1200 V
M24	Module of three-phase thyristor bridge, is intended to rectify AC	63, 100, 160, 200, 250 A / 1200, 1600 V
M24M	Module of three-phase thyristor bridge, is intended to rectify AC <i>in housings with reduced dimensions</i>	63 A / 1200 V
M8	Thyristor module of two back-to-back connected thyristors with separate control, is intended to commutate power loads of AC	25, 40, 63, 80, 100, 125, 160, 200, 250 A / 1200, 1600 V
M26	Thyristor module of three back-to-back thyristors' pairs with separate control, is intended to commutate power loads of AC	25, 40, 63, 80, 100, 125 A / 1200, 1600 V
<u>to mount to PCB</u>		
<i>Networks with current frequency 50 Hz or 400 Hz</i>		
M5...PP3	Module of single-phase diode bridge, is intended to rectify AC	planar housing with in-built radiator
M6...PP3	Module of three-phase diode bridge, is intended to rectify AC	
M5...PP2.1	Module of single-phase diode bridge, is intended to rectify AC	housing to mount into PCB
M6...PP2.1	Module of three-phase diode bridge, is intended to rectify AC	

2. THYRISTORS CONTROL DRIVERS

$$T_j = -40 \dots +85 \text{ }^\circ\text{C}$$

Thyristors drivers

<u>TD1</u> <u>TD2</u>	Thyristor control driver is intended for current impulse signals forming with given values of amplitude and duration for one or two power thyristors with current from 320 to 5000A as a part of different converters. TD provides galvanically isolated control by thyristors having frequency from 10 to 20000 Hz, unlike TCC it forms negative locking voltage for increasing noise immunity and provides wide range of voltage supply and input signal. TD1- ME housing type TD2 – G housing	Control using fiber optic communication line (FOCL) or $U_{\text{cont.nom.}} = 5 \div 36 \text{ V}$, $U_{\text{sup}} = 15 \div 30 \text{ V}$, at $I_{\text{in}} = 10 \text{ mA}$, $U_{\text{isol}} = 5 \div 15 \text{ kV}$
<u>TD6</u>	Six-channel driver thyristor control is intended for current pulses forming with set amplitude values and duration for turn-on of six power thyristors as a part of different converters. The driver can form negative output locking voltage to increase noise immunity.	$U_{\text{sup}} = 24 \text{ V}$ Control using fiber optic communication line (FOCL) or $U_{\text{cont.nom.}} = 4 \div 32 \text{ V}$, at $I_{\text{in}} = 8 \div 12 \text{ mA}$ $U_{\text{isol}} = 2.5 \text{ kV (AC)}$
<u>OCTD</u>	Optical converter for thyristor driver is intended for transforming electrical control signal into optical control signal for control signal delivery to thyristor drivers inputs of TD type with CLFO control.	Control using fiber optic communication line (FOCL) or $U_{\text{cont.nom}} = 3 \div 27 \text{ V}$, at $I_{\text{in}} = 10 \text{ mA}$ $U_{\text{cont.nom}} = 5 \div 36 \text{ V}$, at $I_{\text{in}} = 10 \text{ mA}, 50 \text{ mA}$
<u>TTMD</u>	Three-channel driver for thyristors control	Control: $\approx 4 \div 32 \text{ V}$ $U_{\text{RRM}} = 1800 \text{ V}$ $I_{\text{out}} = 1 \text{ A}$ $U_{\text{isol}} = 4000 \text{ V}$
<u>TTMD-T3</u>	Compact three-channel thyristor driver, is intended for thyristor control ($I_y \leq 200 \text{ mA}$) as a part of half-bridges, single- and three-phase bridges	$U_{\text{peak}} = 13.5 \div 27 \text{ V}$ $U_{\text{cont}} = 5 \div 15 \text{ V}$ $I_{\text{out}} = 0.6 \text{ A}$ $U_{\text{isol}} = 4000 \text{ V}$
<u>3phPRD</u>	Three-phase power regulator driver with phase-pulse control, is used in AC circuits with frequency 50 Hz (400Hz).	$U_{\text{sup}} = 5 \text{ V}$ $U_{\text{net peak}} = 1200, 1600 \text{ V}$ $I_{\text{out}} = 1 \text{ A}$ $U_{\text{isol}} = 4000 \text{ V}$ Control: 1 - 0..5 V 4 - 0..5 mA 2 - 0..10 V 5 - 0..20 mA 3 - 4..20 mA
<u>PRD - FB</u>	Power regulator driver with feedback. It is intended for operation as a part of power regulator of active load and active-inductive one in AC circuits 220V and 380V with frequency 50Hz. There is feedback in the driver that provides parameter stabilization (voltage, square voltage, current, square current, power) on load.	$U_{\text{sup}} = \sim 220 \text{ V}$ $I_{\text{out}} = 0.6 \text{ A}$ $U_{\text{net peak}} = 1200, 1600 \text{ V}$ $U_{\text{RRM}} \leq 1200 \text{ V}$ Control: 1 - 0..5 V 4 - 0..5 mA 2 - 0..10 V 5 - 0..20 mA 3 - 4..20 mA

<u>3phCRD</u>	Three-phase regulated rectifier driver 3phCRD is used to control three-phase thyristor-diode bridge (thyristors in cathode group) and combined with it they can build three-phase regulated rectifier. The driver is intended to operate in network with peak voltage 1200 V.	$U_{sup} = 5 \text{ V}$ $U_{isol} = 4000 \text{ V}$ $U_{RRM} \leq 1200 \text{ V}$ $I_{out} = 1 \text{ A}$ Control: 1 - 0..5 V 4 - 0..5 mA 2 - 0..10 V 5 - 0..20 mA 3 - 4..20 mA
<u>3phCRD -6-DIN</u>	Driver of three-phase full bridge regulated rectifier, is intended to convert three-phase alternating voltage 50 Hz to direct voltage regulated by phase method, with pulsating frequency 300 Hz in all regulation range.	$U_{sup} = 5 \text{ V}$ $U_{RRM} \leq 1200 \text{ V}$ $I_{out} = 1 \text{ A}$ Control: 1 - 0..5 V 4 - 0..5 mA 2 - 0..10 V 5 - 0..20 mA 3 - 4..20 mA
<u>3phCRD -6.1-DIN</u>	Three-phase thyristor rectifier driver is intended for drivers TD control pulses forming as a part of power bridge thyristor rectifier powered from three-phase net with frequency 50 Hz. The driver provides thyristor protection at maximum current (CL1 and CL2 version). The driver can be also produced without maximum current protection (CL0 version).	$U_{sup} = 5 \text{ V}$ $I_{out} = 12 \text{ mA}$ Control: 1 - 0..5 V 4 - 0..5 mA 2 - 0..10 V 5 - 0..20 mA 3 - 4..20 mA
<u>3phCRD -6.2-DIN</u>	Three-phase thyristor rectifier driver is intended for drivers TD control pulses forming with fiber optical receivers as a part of power bridge three-phase thyristor rectifier powered from three-phase net with frequency 50 Hz. The driver provides thyristor protection at maximum current (CL1 and CL2 version). The driver can be also produced without maximum current protection (CL0 version).	$U_{sup} = 5 \text{ V}$ Optic output to connect fiber optic cable HFBR Control: 1 - 0..5 V 4 - 0..5 mA 2 - 0..10 V 5 - 0..20 mA 3 - 4..20 mA

**3. STANDARD THYRISTOR-DIODE MODULES AND BRIDGES WITH OPTODECOUPLERS
OF CONTROL CIRCUITS**

$$T_J = -40 \dots +85 \text{ }^\circ\text{C}$$

Networks with current frequency 50 Hz or 400 Hz

<u>MO1</u> <u>MO1A</u>	Thyristor module with opto decoupling, is used as switch elements of controlled rectifier, converters (inverters), power regulators, etc.	25, 40, 63, 80, 100, 125,160, 200, 250 A / 1200, 1600 V $U_{lin\ min(rms)} = 50 \text{ V}$, for MO1 $U_{lin\ min(rms)} = 10 \text{ V}$, for MO1A $U_{ISOL} = 4000 \text{ V}$
<u>MT1(A)</u>	Thyristor module with transformer decoupling is used as a switch element for power loads of AC and DC. The module is intended for module MO1 change that operates in devices with high level of impulse noises.	25, 40, 63, 80, 100, 125,160, 200, 250 A / 1200 V
<u>MO2</u> <u>MO2A</u>	Diode-thyristor module with opto decoupling, is used as switch elements of controlled rectifiers, converters (inverters), power regulators, etc.	25, 40, 63, 80, 100, 125,160, 200, 250 A / 1200, 1600 V $U_{lin\ min(rms)} = 50 \text{ V}$, for MO2 $U_{lin\ min(rms)} = 10 \text{ V}$, for MO2A $U_{ISOL} = 4000 \text{ V}$
<u>MO3</u> <u>MO3A</u>	Thyristor-thyristor module with opto decoupling, is used in AC circuits	25, 40, 63, 80, 100, 125,160, 200, 250 A / 1200, 1600 V $U_{lin\ min(rms)} = 50 \text{ V}$, for MO3 $U_{lin\ min(rms)} = 10 \text{ V}$, for MO3A $U_{ISOL} = 4000 \text{ V}$
<u>MO8D</u>	Thyristor module composed of two back-to-back thyristors with opto decoupling and separate control, is intended for load commutation in AC circuits	25, 40, 63, 80, 100,125, 160, 200, 250 A /1200,1600 V $U_{lin\ min(rms)} = 50 \text{ V}$ $U_{ISOL} = 4000 \text{ V}$
<u>MO26D</u>	Thyristor module composed of three pairs of back-to-back thyristors with opto decoupling and separate control, is intended for load commutation in AC circuits	25,40,63,80,100,125 A /1200, 1600 V $U_{lin\ min(rms)} = 50 \text{ V}$ $U_{ISOL} = 4000 \text{ V}$
<u>MO20</u> <u>MO20A</u>	Single-phase thyristor-diode bridge module with opto decoupling, with thyristors in cathode group, is intended for AC rectification	63, 100, 160, 200, 250 A / 1200, 1600 V $U_{lin\ min(rms)} = 50 \text{ V}$, for MO20 $U_{lin\ min(rms)} = 12 \text{ V}$, for MO20A $U_{ISOL} = 4000 \text{ V}$
<u>MO21</u> <u>MO21A</u>	Single-phase thyristor-diode bridge module with opto decoupling with thyristors control, in arm of AC, is intended for AC rectification.	63, 100, 160 A / 1200, 1600 V $U_{lin\ min(rms)} = 50 \text{ V}$, for MO21 $U_{lin\ min(rms)} = 12 \text{ V}$, for MO21A $U_{ISOL} = 4000 \text{ V}$
<u>MO22</u> <u>MO22A</u>	Single-phase thyristor bridge module with opto decoupling, is intended for AC rectification.	63, 100, 160 A / 1200, 1600 V $U_{lin\ min(rms)} = 50 \text{ V}$, for MO22 $U_{lin\ min(rms)} = 12 \text{ V}$, for MO22A $U_{ISOL} = 4000 \text{ V}$
<u>MO23</u> <u>MO23A</u>	Three-phase thyristor-diode bridge module with opto decoupling with thyristors in cathode group, is intended for AC rectification.	63, 100, 160, 200, 250 A / 1200, 1600 V $U_{lin\ min(rms)} = 50 \text{ V}$, for MO23 $U_{lin\ min(rms)} = 12 \text{ V}$, for MO23A $U_{ISOL} = 4000 \text{ V}$
<u>MO24</u> <u>MO24A</u>	Three-phase bridge module with opto decoupling, is intended for AC rectification	63, 100, 160, 200, 250 A / 1200, 1600 V $U_{lin\ min(rms)} = 50 \text{ V}$, for MO24 $U_{lin\ min(rms)} = 12 \text{ V}$, for MO24A $U_{ISOL} = 4000 \text{ V}$

**4. DIODE MODULES AND BRIDGES ON FAST RECOVERY DIODES (100 kHz) AND
ON SCHOTTKY DIODES (300 kHz)**

$$T_J = -40 \dots +85 \text{ } ^\circ\text{C}$$

to mount to panel

<u>M4SCH</u> <u>M4FRD</u>	Diode module on basis of Schottky diodes and fast-recovery diodes (FRD).	40, 80, 120, 160, 200, 240, 320 A / 60, 125, 150, 200 V – Schottky 50,100,150,200,250, 300A /1200V - FRD
<u>M4.1SCH</u> <u>M4.1FRD</u>	Module of single Schottky diode or FRD, is used as a part of converters.	40, 80, 120, 160, 200, 240, 320, 400 A / 60, 125, 150, 200 V – Schottky 50,100,150,200,250, 300, 400 A /1200 V – FRD
<u>M4.2SCH</u> <u>M4.2FRD</u>	Module consisting of two Schottky diodes or FRD with common cathode, is used as a part of converters.	40, 80, 120, 160, 200, 240, 320 A / 60, 125, 150, 200 V – Schottky 50,100,150,200,250, 300A/1200 V-FRD
<u>M4.3SCH</u> <u>M4.3FRD</u>	Module consisting of two Schottky diodes or FRD with common anode, is used as a part of converters.	40, 80, 120, 160, 200, 240, 320 A / 60, 125, 150, 200 V – Schottky 50,100,150,200,250, 300A/1200 V – FRD
<u>M5SCH</u> <u>M5FRD</u>	Single-phase rectifier bridge on basis of Schottky diodes or FRD, is intended for AC rectification.	40,80,120,160, 200 A / 60, 125, 150, 200 V – Schottky 50,100,150A / 1200 V – FRD
<u>M6SCH</u> <u>M6FRD</u>	Three-phase rectifier bridge on basis of Schottky diodes or FRD, is intended for AC rectification.	40,80,160, 240 A /60,125, 150 V 40,80,120,160,200, 240 A /200 V – Schottky 50,100,150,200A/1200 V – FRD
<u><i>high-voltage modules</i></u>		
<u>M4.1FRD</u>	Single FRD module, is used as a part of converters.	50, 100, 200 A / 3300, 6500 V
<u>M4.3FRD</u>	Module consisting of two FRD with common anode, is used as a part of converters.	100, 200 A / 3300 V 50, 100 A / 6500 V

5. OPTOELECTRONIC AC RELAY

 $T_J = -40 \dots +85 \text{ }^\circ\text{C}$ to mount to panel

Networks with current frequency 50 Hz or 400 Hz

MO8A MO8B MO8C	Solid state semiconductor optoelectronic single-phase AC relay with “normally open” contacts without zero transient phase control, is intended for loads commutation in AC circuits	25, 40, 63, 80, 100, 120,160, 200,250 A/1200, 1600 V Control: A - $\approx 4 \div 32 \text{ V}$ B - $\sim 6 \div 30 \text{ V}$ C - $\sim 110 \div 280 \text{ V}$
MO8MA MO8MB MO8MC	Solid state semiconductor optoelectronic single-phase relay with “normally open” contacts with zero transient phase control is intended for loads commutation in AC circuits.	25, 40, 63, 80, 100, 120,160, 200, 250 A/1200,1600 V Control: A- $\approx 4 \div 32 \text{ V}$ B- $\sim 6 \div 30 \text{ V}$ C- $\sim 110 \div 280 \text{ V}$
MO8MA – T	Solid state semiconductor optoelectronic single phase AC relay with “normally open” contacts with zero transient phase control, is intended for loads commutation in AC circuits with protection against overheating and overload.	25, 40 ,63, 80, 100, 120, 160, 200, 250, 320 A-1200 V Control: A- $4 \div 32 \text{ V}$
MO26A MO26B MO26C	Solid state semiconductor optoelectronic three-phase relays with “normally open” contacts without zero transient phase control, is intended for loads commutation in AC circuits.	25, 40, 63, 80, 100, 120A/ 1200, 1600 V Control: A- $\approx 4 \div 32 \text{ V}$ B - $\sim 6 \div 30 \text{ V}$ C - $\sim 110 \div 280 \text{ V}$
MO26MA MO26MB MO26MC	Solid state semiconductor optoelectronic single-phase relays with “normally open” contacts without zero transient phase control, is intended for loads commutation in AC circuits.	25, 40, 63, 80, 100, 120A/ 1200, 1600 V Control: A- $\approx 4 \div 32 \text{ V}$ B - $\sim 6 \div 30 \text{ V}$ C - $\sim 110 \div 280 \text{ V}$
MO26-MC	Microprocessor-based, solid state, semiconductor, optoelectronic, three-phase AC relays, are intended for loads commutation in AC circuits with frequency 50 Hz.	25, 40, 63, 80, 100, 120A/ 630 V Control: 80 mA / $\sim 10 \div 30 \text{ V}$ Interface RS485
MO26MA – T	Solid state semiconductor optoelectronic three-phase relays with “normally open” contacts with zero transient phase control, is intended for loads commutation in AC circuits by three circuits simultaneously with protection against overheat.	25, 40, 63, 80, 100, 120 A / 1200 V Control: A - $4 \div 32 \text{ V}$
CMP-200-MC	Microprocessor device of current protection is intended for elements protection of electrical circuits against overload. Remove current transformers are used as current sensors. CMP-200-MC controls the current value in each phase and compares it with the setting value. Dependency control of current value between phases is also carried out.	5 \div 200 A / 630 V Control: 40 mA / $\sim 10 \div 30 \text{ V}$ Interface RS485
MO27A	Reverse solid state semiconductor optoelectronic three-phase AC relay with zero transient phase control, is intended for three-phase asynchronous motors control. The relay provides reverse motor switch-on. The relay has opto decoupling of control signals from power circuits and also relay switch-on blocking signal input.	Rated motor current: 25, 40, 63 A Network 220, 380, 660 V
MO27A.1	Reverse solid state semiconductor optoelectronic three-phase AC relay (with commutation by two phases) with “zero” phase transient control, is intended for three-phase asynchronous motors control. The relay provides reverse motor switch-on. The relay has opto decoupling of control signals from power circuits and also relay switch-on blocking signal input.	Rated motor current: 100 A Network 220, 380, 660 V

<i>to mount to PCB</i>			
<u>MO8A...PCB1</u> <u>MO8MA...PCB1</u>	Solid state compact semiconductor optoelectronic single-phase AC relay with “normally open” contacts MO8A – without “zero” phase transient control and MO8MA – with “zero” phase transient control. They are intended for loads commutation in AC circuits with frequency from 50 to 400 Hz.	vertical housing	4 A / 800 V 4 A / 1200 V Control: A- \approx 4÷32 V
<u>MO8A...PCB2</u> <u>MO8MA...PCB2</u>		planar housing	4 A / 800 V 4 A / 1200 V Control: A- \approx 4÷32 V
<u>MO8A...PCB3</u> <u>MO8MA...PCB3</u>		planar housing with in-built radiator	10 A / 800 V 10 A / 1200 V Control: A- \approx 4÷32 V
<u>2MO8A...PCB4</u> <u>2MO8MA...PCB4</u>		two-channel one in planar housing	4 A / 800 V 4 A / 1200 V
<u>2MO8A...PCB5</u> <u>2MO8MA...PCB5</u>		two-channel one in planar housing with inbuilt radiator	10 A / 800 V 10 A / 1200 V Control: A- \approx 4÷32 V
<i>to mount to DIN-rail</i>			
MchCM(DIN)-nXPCB1 MchCM(DIN)-nXPCB2	Multichannel module of AC switching with several switched channels (from 1 to n), is used in automation systems as a switching element. It is produced as a carrier for mounting to DIN-rail with installed relay on it from 1 to n relays of type MO8A...PCB1, MO8MA...PCB1, MO8A...PCB2, MO8MA...PCB2 and other elements (signal LEDs, refuses, RC – circuits, voltage limiters.	3 A / 800 V 3 A / 1200 V	
2MO8A-DIN	Dual solid state compact semiconductor optoelectronic single-phase AC relay with “normally opened” contacts. The relays are intended for loads commutation in AC circuits with frequency from 50 to 400 Hz.	5 A / 1200 V	

6. POWER REGULATORS MODULES

$$T_J = -40 \dots +85 \text{ }^\circ\text{C}$$

Regulators modules

M25MA M25MB	Semiconductor optoelectronic modules – are thyristor power regulators with phase method of AC regulation, are intended for operation in AC circuits with frequency 50 Hz M25MB – direct regulation characteristics (100% of control signal correspond to full power) M25MA – reverse regulation characteristics (100% of control signal correspond to zero power).	25, 40, 63, 80, 100, 120,160, 200, 250 A / 1200 V Control: 1- 0..5 V; 2 – 0..10 V; 3 – 4..20 mA; 4 – 0..5 mA; 5 – 0..20 mA.
M25A-...-T M25B-...-T	Semiconductor optoelectronic modules – are thyristor power regulators with phase method of AC regulation. The module provides current protection. It is intended for operation in AC circuits with frequency 50 Hz M25B – direct regulation characteristics (100% of control signal correspond to full power) M25A – reverse regulation characteristics (100% of control signal correspond to zero power).	25, 40, 63, 80, 100, 120,160, 200, 250 A / 1200 V Control: 1- 0..5 V; 2 – 0..10 V; 3 – 4..20 mA; 4 – 0..5 mA; 5 – 0..20 mA.
<u>Regulators units</u>		
TPR1	Single-phase thyristor power regulator in unit version containing necessary control circuits, supply sources of control and fan, power actuating elements. The unit is intended to thyristor power regulation by phase method and for change regulators like 1phTR and similar devices.	25, 40, 63, 80, 100, 120,160, 200, 250 A / 1200 V Control: 1- 0..5 V; 4 – 0..5 mA; 2 – 0..10 V; 5 – 0...20 mA 3 – 4..20 mA;
TPR3	Three-phase thyristor power regulator in unit version containing necessary control circuits, supply sources of control and fan, power actuating elements. The unit is intended to thyristor power regulation by phase method and for change regulators like 3phTVR and similar devices.	Operating current 25, 40, 63, 80, 100, 120,160, 200, 250 A Operating voltage 100...400 V Net frequency 50 Hz Supply voltage ~ 110...240 V Control: 1- 0..5 V; 4 – 0..5 mA; 2 – 0..10 V; 5 – 0...20 mA. 3 – 4..20 mA;
TPR3-T	Thyristor power regulator in unit version containing necessary control circuits, supply sources of control and fan, power actuating elements, is intended to control active load or active-inductive one in three-phase AC circuits with voltage 220/380 V and frequency 50 Hz, with load current up to 1000 A.	Operating current 400, 500, 600, 800, 1000 A Operating voltage 100...400 V Net frequency 50 Hz Control: 1- 0..5 V; 4 – 0..5 mA; 2 – 0..10 V; 5 – 0...20 mA. 3 – 4..20 mA;

7. REVERSE AMPLIFIERS

$$T_J = -40 \dots +85 \text{ }^\circ\text{C}$$

Thyristor amplifiers

TRCB	Thyristor reverse control block – is a multifunctional thyristor starter with microprocessor control is used for smooth starting, braking and reversing three-phase asynchronous electric motors having power up to 15 kW. The TRCB is used in regulated and shutoff gate valves, overhead-track hoists, roller tables, working machines and other mechanisms with reverse control drive. Maintaining a given liquid level in reservoir upon signal from pressure sensor. Microcontroller of control module provides high operating accuracy and simplicity of operation. Quantity and settings range of TRCB enable you to adjust the used electric drive for necessary consumer's operating modes.	$I_{com} = 2.5 / 6.5 / 12 / 13 / 30 \text{ A}$ $U_{com} = 380 \text{ V}$
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8. IGBT AND MOSFET MODULES

 $T_j = -60 \dots +150 \text{ }^\circ\text{C}$ modules-analogues

M10 housing E2	Lower switch based on IGBT-transistors and FRD. It is an analogue of power modules «Semikron» and «Infineon» in a housing «Semitrans 2».	75 A/600 V* 50,100 A/1200 V
M11* housing E2	Upper switch based on IGBT-transistors and FRD. It is an analogue of power modules «Semikron» and «Infineon» in a housing «Semitrans 2».	75 A/600 V
M12 housing E2	Half-bridge based on IGBT-transistors and FRD. It is an analogue of power modules «Semikron» and «Infineon» in housing «Semitrans 2».	75 A/600 V* 50,100 A/1200 V
M9 housing E3-2	Lower switch based on IGBT-transistors and FRD. It is an analogue of power modules «Semikron» and «Infineon» in housing «Semitrans 4».	200,300,400 A/1200 V
M10 housing E3-3	Lower switch based on IGBT-transistors and FRD. It is an analogue of power modules «Semikron» and «Infineon» in housing «Semitrans 3».	300 A/600 V* 150,200 A/1200 V
M11 housing E3-3	Upper switch based on IGBT-transistors and FRD. It is an analogue of power modules «Semikron» and «Infineon» in housing «Semitrans 3».	300 A/600 V* 150,200 A/1200 V
M12* housing E3-3	Half-bridge based on IGBT-transistors and FRD. It is an analogue of power modules «Semikron» and «Infineon» in housing «Semitrans 3».	200, 300, 400, 600 A/600 V 150,200,300,400 A/1200 V
M9.1* housing M1	Two single switches based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP6.	150,200,300,400 A/1200 V
M10 housing M1	Lower switch based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP6.	350, 450, 600 A/600 V* 150,200,300 A/1200 V 400 A/1200 V* 150 A/1700 V
M11 housing M1	Upper switch based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP6.	350, 450, 600 A/600 V* 150,200,300 A/1200 V 400 A/1200 V* 150 A/1700 V
M12 housing M1	Half-bridge based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP6.	350, 450, 600 A/600 V* 150,200,300 A/1200 V 400 A/1200 V* 150 A/1700 V
M12.1 housing M1	Back-to-back transistors based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP6.	350, 450, 600 A/600 V* 150,200,300 A/1200 V 400 A/1200 V* 150 A/1700 V
M13A* housing M1	Three-phase inverter based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP6.	50,75,100,150 A/600 V
M13A4* housing M1	H-bridge and chopper based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP6.	100 A/600 V 50 A/1200 V
M13A5* housing M1	Three-level inverter based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP6.	150,200 A/600 V 200 A/1200 V 100 A/1700 V
M10 housing M2	Lower switch based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP4.	200, 300 A/600 V* 50,100,150 A/1200 V 50 A/1700 V
M11 housing M2	Upper switch based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP4.	200, 300 A/600 V* 50,100,150 A/1200 V 50 A/1700 V
M12 housing M2	Half-bridge based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP4.	200, 300 A/600 V* 50,100,150 A/1200 V 50 A/1700 V
M12.1 housing M2	Back-to-back transistors based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP4.	100, 200 A/600 V* 50,100 A/1200 V 50 A/1700 V
M13B housing M2	H-bridge based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP4.	100, 150 A/600 V* 50 A/1200 V

<u>M13B1</u> housing M2	Skew bridge based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP4.	100, 150 A/600 V* 50 A/1200 V
<u>M13E*</u> housing M2	H-bridge and chopper based on IGBT-transistors and FRD. It is an analogue of power modules «Microsemi» in housing SP4.	50 A/600 V
<u>M13A*</u> housing S2	Three-phase inverter based on IGBT-transistors and FRD. It is an analogue of power modules «Infineon» in housing «Econopack2».	25,50 A/1200 V
<u>M13B*</u> housing S2	H-bridge based on IGBT-transistors and FRD. It is an analogue of power modules «Infineon» in housing «Econopack2».	25,50 A/1200 V
<u>M13A</u> housing S3	Three-phase inverter based on IGBT-transistors and FRD. It is an analogue of power modules «Infineon» in housing «Econopack3».	50,100 A/1200 V
<u>M13B</u> housing S3	H-bridge based on IGBT-transistors and FRD. It is an analogue of power modules «Infineon» in housing «Econopack3».	100 A/1200 V
<u>M13A*</u> housing S4	Three-phase inverter based on IGBT-transistors and FRD. It is an analogue of power modules «Infineon» in housing «Easypack».	30 A/600 V 30 A/1200 V
<u>M13A1*</u> housing S4	Three-phase inverter and three-phase bridge based on IGBT-transistors and FRD. It is an analogue of power modules «Infineon» in housing «Easypack».	10,30 A/600 V
<u>M13A2*</u> housing S4	Three-phase inverter and single-phase bridge based on IGBT-transistors and FRD. It is an analogue of power modules «Infineon» in housing «Easypack».	10,30 A/600 V
<u>M13B*</u> housing S4	H-bridge based on IGBT-transistors and FRD. It is an analogue of power modules «Infineon» in housing «Easypack».	30 A/600 V
<u>M13D*</u> housing S4	Three-level inverter based on IGBT-transistors and FRD. It is an analogue of power modules «Infineon» in housing «Easypack».	30 A/600 V
<u>M13A*</u> housing S5	Three-phase inverter based on IGBT-transistors and FRD. It is an analogue of power modules «Infineon» in housing «Easypack».	50,75 A/1200 V
<u>M13A1*</u> housing S5	Three-phase inverter and three-phase bridge based on IGBT-transistors and FRD. It is an analogue of power modules «Infineon» in housing «Easypack».	30 A/1200 V
<u>M13D*</u> housing S5	Three-level inverter based on IGBT-transistors and FRD. It is an analogue of power modules «Infineon» in housing «Easypack».	30,50,75 A/1200 V
M12 housing SK	Half-bridge based on IGBT-transistors and FRD. It is an analogue of power modules «Semikron» in housing «SEMITOP 3».	50, 100 A/1200 V
M13A housing SK	Three-phase inverter based on IGBT-transistors and FRD. It is an analogue of power modules «Semikron» in housing «SEMITOP 3».	25 A/1200 V
M13B housing SK	H-bridge based on IGBT-transistors and FRD. It is an analogue of power modules «Semikron» in housing «SEMITOP 3».	50, 100 A/1200 V

* - the modules are in the process of developing

<i>to mount to panel</i>		
<i>MOSFET or IGBT</i>		
<u>M9 (MOSFET)</u>	Module of single MOSFET switch is intended to commutate power loads and to use it as a part of power converters with high switching frequency	100,200,300,400,500 A/40 V 150,220,300,360,450 A/60 V 120,160,200,250,300,400A/100 V 120,160,200,240,320,400A/200 V 120,150,200,240,300 A/ 250 V Switching frequency 300 kHz
<u>M9 (IGBT)</u>	Single IGBT module shunted by reverse FRD, is intended to commutate power loads and to use it as a part of power converters with high switching frequency	Version 1 50,100, 200, 300 A/1200 V Switching frequency 100 kHz
<u>M10 (IGBT)</u>	Series-connected IGBT shunted by reverse FRD, FRD is intended to use it as a part of commutating elements in power converters	50, 100, 150, 200 A/1200 V Frequency up to 100 kHz
<u>M11 (IGBT)</u>	Series-connected FRD and IGBT switches shunted by reverse FRD, are intended to use it as a part of commutating elements in power converters	50, 100, 150, 200A/1200 V Frequency up to 100 kHz
<u>M12 (MOSFET)</u> <u>M12 (IGBT)</u>	Two series-connected MOSFET or IGBT switches shunted by reverse FRD are intended to use them as a part of commutating elements in power converters	100,200,300,400,500A/ 40 V 75,150,220,300A/ 60 V 120,160,200,250 A/ 100 V 120,160,200 A/ 200 V 120 A/ 250 V Frequency up to 300 kHz 50,100,150, 200 A/ 1200 V Frequency up to 100 kHz
<u>M12.1 (MOSFET)</u> <u>M12.1 (IGBT)</u>	Two back-to-back MOSFET or IGBT switches shunted by reverse FRDs, are intended to use it as commutating elements in power converters (3 power outputs – common emitter/source)	100,200,300,400,500A/ 40 V 75,150,220,300A/ 60 V 120,160,200,250 A/ 100 V 120,160,200 A/ 200 V 120 A/ 250 V Frequency up to 300 kHz 50,100,150 A/ 1200 V Frequency up to 100 kHz
<u>M12Sic (MOSFET)</u>	Module of half-bridge based on high-voltage fast MOSFET-transistors. The module is intended to use it in high-voltage high-frequency pulse converters	100 A / 1200 V
<u>M13A (MOSFET)</u> <u>M13A (IGBT)</u>	M13A – Three-phase inverter	5,10,20,30,40,50 A/ 60 V; 10,30,50,90 A/ 100 V; 10,30,50,90 A/ 200 V; 5,10,20,30 A/ 250 V; Frequency up to 300 kHz 10,30,50,90 A/ 600 V; 10,30,50,90 A/ 1200 V. Frequency up to 100 kHz
<u>M13MA (MOSFET)</u> <u>M13MA (IGBT)</u>	M13MA – Three-phase inverter in compact housing	5,10,20 A/ 100 V; 5,10,20 A/ 200 V; Frequency up to 300 kHz 5,10,30 A/ 600 V; Frequency up to 100 kHz
<u>M13B (MOSFET)</u> <u>M13B (IGBT)</u>	M13B – Transistor bridge	5, 10, 20, 30, 40, 50 A/ 60 V; 5, 10, 20, 30, 40, 50 A/ 100 V; 5, 10, 20, 30 A/ 200 V; 5, 10, 20, 30 A/ 250 V; Frequency up to 300 kHz 5, 10, 20, 30, 40, 50 A/ 600 V; 5, 10, 20, 30, 40, 50 A/ 1200 V Frequency up to 100 kHz

M13MB (MOSFET) M13MB (IGBT)	M13MB – Transistor bridge in compact housing	5,10,20 A/ 100 V; 5,10,20 A/ 200 V; Frequency up to 300 kHz 5,10,20 A/ 600 V; Frequency up to 100 kHz
M13B (MOSFET) M13B (IGBT)	Two «skew» bridges	5,10,20 A/ 60 V; 5,10,20 A/ 100 V; 5,10,20 A/ 200 V; 5,10,20 A/ 250 V; Frequency up to 300 kHz 5,10,20,30,40,50 A/ 600 V; 5,10,20,30,40,50 A/ 1200 V. Frequency up to 100 kHz
M13D	Power assembly including six pairs of series-connected IGBT-transistors and FRDs	30 A / 600, 1200 V
<i>to mount to PCB</i>		
MOSFET or IGBT		
M13A-PCB4 (MOSFET) M13A-PCB4 (IGBT)	<i>Six-switch</i> modules on MOSFET and IGBT are intended to use them in low-power inverters and converters in planar housing	1, 2 A / 100, 200, 600 V
M13B-PCB4 (MOSFET) M13B-PCB4 (IGBT)	<i>Four-switch</i> modules on MOSFET and IGBT are intended to use them in low-power inverters and converters in planar housing	1, 2 A / 100, 200, 600 V
<i>high-voltage modulesu</i>		
IGBT modules		
M9	Transistor module is intended to commute power loads	10 A / 1300 V 50, 100 A / 3300 V 25, 50 A / 6500 V
M12	Transistor module is intended to commute power loads	50, 100 A / 3300 V 25, 50 A / 6500 V
M12.1	Two back-to-back IGBT switches shunted by reverse FRD, are intended to use them as commutating elements in power converters (3 power outputs – common emitter/source)	50,100 A/ 3300 V 25,50 A/ 6500 V

9. IGBT (MOSFET) DRIVERS

$T_J = -40 \dots +85 \text{ }^\circ\text{C}$

Drivers of power transistors with field control are shaping amplifiers of transistors' gates control signals and are intended to control power transistors with field control (MOSFET or IGBT). Types, parameters and functional features of the drivers are shown in the Table.

Device type	Channels qty	U_{sup} , V	U_{cont} , V	U_{isol} , V	I_{out} pul A	P_{out} , W	F_{com} kHz	U_{ce} max V	U_{ac} V	Notes
<u>Driver's modules</u>										
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	-	
2DM1180P-B	2 u	15	5	4000	18	2x3	100	1700	-	
DM2180P-B	2 h/b	15	5	4000	18	2x3	100	1700	-	
2DM180P-B(1)	2 i	15	5(15)	4000	8	2x4	50	1700	-	
DM2160P-B	2 u	15	5	4000	16	2x4	50	-	-	
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
<u>Drivers</u>										
DR180P-B(1)	1	15	5(15)	4000	8	4	50	1700	-	
DRA180P-B(1)	1	15	5(15)	7500	8	4	50	3300	≤ 3200	Analogue of SKHI 10
DR280P-B(1)	2 h/b	15	5(15)	4000	8	2x4	50	1700	-	Analogue of SKHI 23
2DR180P-B(1)	2 i	15	5(15)	4000	8	2x4	50	1700	-	
DRB280P-B(1)	2 u	15	5(15)	4000	8	2x4	200	1700	≤ 1200	
DR1300P-BF	1	15	FOCL	7500	30	10	50	1700	≤ 1200	
DR2160P-B1	2 h/b	15	15	4000	16	2x4	50	1700	-	Analogue of Skyper32
DR1480P-B1	1	15	15	4000	48	10	50	1700	≤ 1200	Analogue of 1SD1548AI
DR280P-B3	2 h/b	15	15	4000	8	2x4	50	1700	-	Analogue of SKHI 22A
DR280P-B4	2 u	15	15	4000	16	2x4	50	1700	-	Analogue of Skyper32 Pro
DR1280P-BF	1	15	FOCL	15000	28	6	50	6500	≤ 4400	Analogue of 1SP0635, 1SD536F2, 1SD418F2
DR2180P-B1	2 h/b	15	5	7500	18	2x3	100	3300	-	Analogue of 2SD315AI
DR2180P-B2	2 h/b	15	5	4000	18	2x3	100	1700	-	Analogue of 2SD300C
DR2180P-B3	2 h/b	15	5	4000	18	2x3	100	1700	≤ 1200	Analogue of 2SP0320T
DR2180P-B4	2 h/b	15	5	4000	18	2x3	100	1700	≤ 1200	Analogue of 2SP0115
DR2180P-B5	2 h/b	15	5	7500	18	2x3	100	3300	≤ 2400	Analogue of 2SB315A
DR2180P-BF	2 h/b	15	FOCL	7500	18	2x3	100	3300	≤ 2400	Analogue of 2SB315B
JDP2180P-BF1	2 h/b	15	FOCL	4000	18	2x3	100	1700	≤ 1200	Analogue of 2SP0320V(S)
DR6120P-A	6 (3 h/b)	15	5	4000	12	6x3	25	1700	-	
DR12120P-A	12 (6 h/b)	15	5	4000	12	12x3	25	1700	-	

h/b – half-bridge

i – independent control

u – universal control

10. COMMUTATION AND CURRENT CONTROL MODULES

$T_J = -40 \dots +85 \text{ }^\circ\text{C}$

Modules to control DC

SSPC1	Modules for commutation and current control in loads of BC circuits (SSPC1). The module provides the control of flowing the current through load, provides protection of load-bearing element against SC or increasing of current in load, protection of load-bearing element against overheat, also provides galvanic insulation of control circuit and state signals. It provides the control of I^2t characteristics of load circuit.	2, 5, 10, 20, 30, 40 A / 60, 100, 200, 400, 600, 1200 V 50, 60, 75, 90, 120, 150, 180, 240, 320 A / 60, 100, 200, 400, 600, 1200 V
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11. SEMICONDUCTOR RELAYS BASED ON FIELD TRANSISTORS OR IGBT WITH ELECTRICAL INSULATION OF OPTOCOUPLER OR TRANSFORMER TYPE

$T_J = -40 \dots +85 \text{ }^\circ\text{C}$

to mount to panel

<u>MT14A</u> <u>MT14B</u>	Modules for DC commutation (semiconductor normally opened unipolar relay with transformer insulation, with small switching duration), are intended to use them in devices of automation as a commutating element	10,20,40,60,80,120,160,200,240,300,400 A/60 V; 5,10,20,40,60,80,120,160,200,240,300,400 A/100 V; 5,10,20,30,40,60,80,120,160,200,240,320,400A/200V; 5,10,20,40,60,80,120,160,200,240 A/250 V. Control: A-(4÷10) V B-(10÷30) V On / Off duration: 20 µs / 20 µs, for MT14A, MT14B 50 µs / 50 µs, for MT14C, MT14D, MT14E
<u>MT14PTA</u> <u>MT14PTB</u>	Module for DC commutation with transformer insulation and protection against SC in load (semiconductor relay with small switching current) is intended to use it in automation devices as a power interface	10, 20, 60, 90, 120, 150, 240, 320, 400 A / 40 V; 10, 20, 60, 90, 120, 150, 240, 320, 400 A / 60 V; 5, 10, 20, 40, 60, 90, 120, 150, 180, 240, 320 A / 100 V; 5, 10, 20, 60, 90, 120, 150, 180, 240 A / 200 V; 5, 10, 20, 30, 40, 50, 60, 90, 120, 150, 180 A / 250 V. Control: A-(4÷10) V B-(10÷30) V On / Off duration: 50 µs / 50 µs
<u>MO14A</u> <u>MO14B</u>	Modules for DC commutation (semiconductor optoelectronic normally opened unipolar relay with small switching current), are intended to use them in automation devices as a commutating element	10,20,40,60,80,120,160,200,240,300,400 A /60 V; 5,10,20,40,60,80,120,160,200,240,300,400 A/100 V; 5,10,20,40,60,80,120,160,200,240,300,400 A/200 V; 5,10,20,40,60,80,120,160,200,240 A/250 V; Control: A-(4÷10) V B-(10÷30) V On / Off duration: 20 ms / 1 ms, for MO14A,MO14B 20 ms / 20 ms, for MO14C, MO14D, MO14E
<u>MT15DA</u> <u>MT15DB</u>	Modules for DC commutation (semiconductor normally opened unipolar relay with transformer insulation, with small switching duration and current), are intended to use them in automation devices as a commutating element	5,10,20,30,40,60,80,120,160,180, 240,300 A / 600 V; 5,10,20,30,40,60,80,120,160,180, 240,300 A / 1200 V; Control: A-(4÷10) V B-(10÷30) V On / Off duration: 20 µs / 20 µs, for MT14A, MT14B 50 µs / 50 µs, for MT14C, MT14D, MT14E
<u>MT15PTA</u> <u>MT15PTB</u>	Module for DC commutation with transformer insulation and protection against SC in load (semiconductor relay with small switching current) is intended to use it in automation devices as a power interface	5, 20, 30, 40,50, 60, 75, 90, 120,150,180,240 A / 600 V; 5, 20, 30, 40,50, 60, 75, 90, 120,150,180,240 A/1200 V Control: A-(4÷10) V B-(10÷30) V On / Off duration: 50/ 100 µs
<u>MO15DA</u> <u>MO15DB</u>	Modules for DC commutation (semiconductor optoelectronic normally opened unipolar relay with small switching current), are intended to use them in automation devices as a commutating element	5,10,20,30,40,60,80,120,160,200, 240,300 A / 600 V; 5,10,20,30,40,60,80,120,160,200, 240,300 A / 1200 V. Control: A-(4÷10) V B-(10÷30) V
<u>MT16A</u> <u>MT16B</u>	Modules for commutation (semiconductor normally opened unipolar relay with transformer insulation, with small switching current and duration), are intended to use them in automation and drive devices as a commutating element in DC and AC networks (with frequency up to 1 MHz)	10, 20, 40, 60, 80, 120, 160, 200, 240, 300 A / 60 V; 5, 10, 20, 40, 60, 80, 120, 160, 200, 240 A/100 V; 5, 10, 20, 40, 60, 80, 120, 160, 200 A/ 200 V 5, 10, 20, 30, 40, 60, 80, 120 A / 250 V 5, 10, 20, 30, 40, 60, 80, 120, 160 A / 600 V; 5, 10, 20, 30, 40, 60, 80, 120 A /1200 V Control: A-(4÷10) V B-(10÷30) V On / off duration: 20/ 20 µs

MT16PTA MT16PTB	Modules for commutation (semiconductor normally opened bipolar relay with transformer insulation, with small switching current and duration), with protection against SC in load, are intended to use them in automation devices and drive as a commutating element in DC and AC networks (with frequency up to 1 MHz)	5,10,20,30,40 A / 60 V; 5,10,20,30 A / 100 V; 5,10,20,30,40 A / 200 V; 5,10,20,30 A / 250 V; 5,10,20,30,40 A / 600 V; 5,10,20,30,40 A / 1200 V Control: A-(4÷10) V B-(10÷30) V On / off duration: 50/ 100 µs
MO16A MO16B	Modules for commutation (semiconductor, optoelectronic normally opened bipolar relays with small switching current), are intended to use them in automation and drive devices as a commutating element in DC and AC networks (with frequency up to 1 MHz)	10, 20, 40, 60, 80, 120, 200, 300 A / 60 V; 5, 10, 20, 40, 60, 80, 120, 160, 200, 250 A/100 V; 5, 10, 20, 40, 60, 80, 120, 160, 200 A/ 200 V 5, 10, 20, 30, 40, 60, 80, 120 A / 250 V 5, 10, 20, 30, 40, 60, 80, 120, 160 A / 600 V; 5, 10, 20, 30, 40, 60, 80, 120 A/1200 V Control: A-(4÷10) V B-(12÷30) V
MO17A	Optoelectronic module on bipolar transistors (normally opened) is intended to control loads in DC circuits and has a inbuilt protection against voltage surges	5, 12 A / 60 V
MO18A	Optoelectronic module on bipolar transistors (normally closed) is intended to control loads in DC circuits and has a inbuilt protection against voltage surges	5, 12 A / 60 V

<u>to mount to PCB</u>			
MT14PTA...PCB1, MT14PTB...PCB1	Module for DC commutation with transformer isolation and protection against SC in load (semiconductor relay with small switching current <i>on field transistors</i>) is intended to use them in automation devices as a power interface	vertical housing	Control: A-(4÷10) V B-(12÷30) V 5 A - 0,6 class 2.5 A, 5 A - 1 class 2.5 A, 5 A - 2 class 2.5 A - 4 class
MT14PTA...PCB2, MT14PTB...PCB2		vertical housing	Control: A-(4÷10) V B-(12÷30) V 5 A - 0,6 class 2.5 A, 5 A - 1 class 2.5 A, 5 A - 2 class 2.5 A - 4 class
MT14PTA...PCB3 MT14PTB...PCB3		planar housing with in-built radiator	Control: A-(4÷10) V B-(12÷30) V 10 A - 0,6 class 10 A - 1 class 8 A - 2 class 5 A - 4 class
2MT14PTA...PCB4, 2MT14PTB...PCB4		two-channel relay in planar housing	Control: A-(4÷10) V B-(12÷30) V 5 A - 0,6 class 2.5 A, 5 A - 1 class 2.5 A, 5 A - 2 class 2.5 A - 4 class
2MT14PTA...PCB5, 2MT14PTB...PCB5		two-channel relay in planar housing with inbuilt radiator	Control: A-(4÷10) V B-(12÷30) V 10 A - 0,6 class 10 A - 1 class 8 A - 2 class 5 A - 4 class

<u>MT14A(B) - ... - PCB6</u>	Modules for DC commutation (semiconductor normally opened unipolar relay with transformer isolation <i>on field transistors</i> , with small switching current and duration), are intended to use them in automation devices as a commutating element	metal-glass housing	Control: A-(4÷10) V B-(12÷30) V 2, 5 A - 100, 200 V
<u>MT15PTA...PCB1,</u> <u>MT15PTB...PCB1</u>	Module for DC commutation with transformer isolation and protection against SC in load (semiconductor relay with small switching current <i>on IGBT</i>) is intended to use it in automation devices as a power interface	vertical housing	Control: A-(4÷10) V B-(12÷30) V 2 A - 600, 1200 V
<u>MT15PTA...PCB2,</u> <u>MT15PTB...PCB2</u>		planar housing	Control: A-(4÷10) V B-(12÷30) V 2 A - 600, 1200 V
<u>MT15PTA...PCB3,</u> <u>MT15PTB...PCB3</u>		in planar housing with inbuilt radiator	Control: A-(4÷10) V B-(12÷30) V 4 A - 600, 1200 V
<u>MT15A(B) - ... - PCB6</u>	Modules for DC commutation (semiconductor normally opened unipolar relay with transformer isolation <i>on IGBT</i> , with small switching duration), are intended to use them in automation devices as a power element	metal-glass housing	Control: A-(4÷10) V B-(12÷30) V 2, 5 A - 600, 1200 V
<u>DCSSR A(1,2)</u> <u>DCSSR B(1,2)</u>	Solid state module for load commutation in compact housing is intended to change the mechanical normally opened or normally closed relays, the commutating element is made on field transistor	compact metal-ceramic housing DCSSR A – NC contact DCSSR B – NO contact	5, 10 A / 100 V 5, 10 A / 200 V U _{cc} = from 4 to 6 V I _{cont} = 500 μA

12. REGULATED RECTIFIERS AND VOLTAGE CONTROL MODULES

$T_J = -40 \dots +85 \text{ }^\circ\text{C}$

For alternating and direct voltage

MO30	Modules of regulated three-phase rectifier with galvanic isolation of control circuit, is intended to operate in AC circuit with frequency 50 Hz	63, 100, 160, 200, 250 A / 1200 V
MO30.1	Module of single-phase regulated rectifier is intended to form directed pulse voltage regulated by phase method from single-phase voltage with frequency 50 Hz	63, 100, 160, 200, 250 A / 1200 V
SSVCM	Module for control of commutated voltage, contains a three-phase rectifier, a control circuit of condenser charge current, voltage control circuit in «positive» bus and «brake» chopper, is intended to rectify the net voltage supplying to load, to limit and control buffer condenser charge current	5, 10, 20, 30, 50, 70, 100 A / 100 V 5, 10, 20, 30, 50, 70 A / 200 V 5, 10, 20, 30, 50 A / 600 V 5, 10, 20, 30, 50 A / 1200 V

13. INVERTERS, CONTROLLERS AND MOTORS CONTROL MODULES

$T_J = -40 \dots +85 \text{ }^\circ\text{C}$

Inverters' modules

M31	Semiconductor module of inverter providing the current commutation, measuring and limiting current level consumed by load from an external source, setting off a signal «FAILURE» in critical modes. It contains power switches, protective circuits and drivers (IPM).	$U_{com} < 650 \text{ V}$ $I_{com} \leq 100 \text{ A}$ $P_{motor} \leq 15 \text{ kW}$
M31-10-6A4-Sip	Compact module of three-phase inverter based on IGBT-transistors (IPM). The module contains the power switches, protective circuits and drivers. The module is intended to control different types of electric motor and can be mounted both on a radiator and in a PCB.	$U_{peak} = 600 \text{ V}$ $I_{com} = 10 \text{ A}$
<i><u>Modules to control three-phase asynchronous motors</u></i>		
3phACCM	Module of inverter control M31 to realize a function to control asynchronous three-phase motors. The module forms PWM-signals for control of power transistors' gates commutating motor winds.	
3phACDMM	Semiconductor module is intended to control, adjust and stabilize rotation speed of three-phase asynchronous motors. The module provides the adjusting of motor rotation speed; motor braking; measuring and limiting current level consumed by motor from an external source, setting off a signal «FAILURE» in critical modes. It contains power switches, protective circuits, drivers, control interfaces, a pack of necessary supply sources.	$U_{com} < 650 \text{ V}$ $I_{com} \leq 100 \text{ A}$ $P_{motor} \leq 15 \text{ kW}$

<u>Modules to control single-phase asynchronous motors</u>		
<u>Modules to control brushless DC motors</u>		
3phBLDCCM	Module of inverter control M31 to realize a function to control three-phase brushless on direct magnets with position sensors. The module forms PWM-signals for control of power transistors' gates commutating motor winds.	
3phBLDCDM	Semiconductor module is intended to control, adjust and stabilize rotation speed of brushless motors. The module provides the adjusting of motor rotation speed; motor braking; measuring and limiting current level consumed by motor from an external source, setting off a signal «FAILURE» in critical modes. It contains power switches, protective circuits, drivers and control interfaces.	$U_{com}=11...30\text{ V}$ $I_{com} \leq 5\text{ A}$ $P_{motor} \leq 0.2\text{ kW}$
BDCMCM3110		$U_{com}=20...30\text{ V}$ $I_{com} \leq 10\text{ A}$ $P_{motor} \leq 0.4\text{ kW}$
3phBLDCDMM	Semiconductor module is intended to control, adjust and stabilize rotation speed of brushless motors. The module provides the adjusting of motor rotation speed; motor braking; measuring and limiting current level consumed by motor from an external source, setting off a signal «FAILURE» in critical modes. It contains power switches, protective circuits, drivers, control interfaces and a pack of necessary supply sources.	$U_{com}=20...650\text{ V}$ $I_{com} \leq 50\text{ A}$ $P_{motor} \leq 15\text{ kW}$
<u>Modules to control DC motors</u>		
BDCCM	Module of inverter control M31 to realize a function to control DC motors. The module forms PWM-signals for control of power transistors' gates commutating motor winds.	
BDCDM	Semiconductor module is intended to control, adjust and stabilize rotation speed of DC motors. The module provides the adjusting of motor rotation speed; motor braking; measuring and limiting current level consumed by motor from an external source, setting off a signal «FAILURE» in critical modes. It contains power switches, protective circuits, drivers and control interfaces.	$U_{com}=11...30\text{ V}$ $I_{com} \leq 5\text{ A}$ $P_{motor} \leq 0.2\text{ kW}$
BDCMCM1110		$U_{com}=20...30\text{ V}$ $I_{com} \leq 10\text{ A}$ $P_{motor} \leq 0.4\text{ kW}$
BDCDMM	Semiconductor module is intended to control, adjust and stabilize rotation speed of DC motors. The module provides the adjusting of motor rotation speed; motor braking; measuring and limiting current level consumed by motor from an external source, setting off a signal «FAILURE» in critical modes. It contains power switches, protective circuits, drivers, control interfaces and a pack of necessary supply sources.	$U_{com}=20...650\text{ V}$ $I_{com} \leq 50\text{ A}$ $P_{motor} \leq 15\text{ kW}$

14. POWER SUPPLIERS $T_J = -40 \dots +85 \text{ }^\circ\text{C}$		
<u>AC/DC-converters</u>		
PSM 100 E	Stabilized power supply 24 V	$U_{in} =$ from 175 V to 260 V, at $f = 50 \text{ Hz}$ $U_{out} = 24 \text{ V}$ $I_{max.out} = 4.2 \text{ A}$ $U_{isol}(rms) = 1500 \text{ V}$
PSM 15-220/5	Stabilized power supply 5 V	$U_{in} =$ from 160 V to 260 V, at $f = 50 \text{ Hz}$ $U_{out} = 5 \text{ V}$ $I_{max.out} = 3 \text{ A}$ $U_{isol}(rms) = 1500 \text{ V}$
PSM 380-15	Three-phase module of power supply AC/DC	$U_{in} =$ from 250 to 400 V, at $f = 50 \text{ Hz}$ $U_{out} = 2 \times 17 \text{ B}$ $I_{max.out} = 2 \times 300 \text{ mA}$ $U_{isol}(rma) = 1500 \text{ V}$
<u>LEDs' drivers</u>		
MPSLED-40AC220	LEDs' driver is to supply LED lamps stabilized by DC. The driver provides the galvanic isolation between electric network and LEDs' supply circuits	$U_{sup} = \sim 200 \div 240 \text{ V}$ $P_{max} = 40 \text{ W}$ $U_{out} = 24 \text{ V}$

15. PROTECTIVE ELEMENTS $T_J = -40 \dots +85 \text{ }^\circ\text{C}$		
<u>PE type</u>		
PE1 PE2 PE3 PE4 PE5 PE6 VM1 VM2	Protection element is to limit surges and/or voltages' rise speed that are dangerous for semiconductor devices in AC and DC nets. It can contain varistors, RC-circuits, voltage limiters and produced in different designs depending on housing type, supply voltage type (direct or alternating), supply voltage level and a value of the current flowing through a device.	PE – a PCB with a protection element for mounting it on the modules' power outputs VM1 – a protective element for use it with the power module in housing E1 (20 x 80) VM2 – a protective element for use it with the power module in housing E2 (34 x 96)

16. COOLERS		
<u>HS type</u>		
HS 153-110 HS 153-150 HS 153-150-DIN HS 153-250 HS 153-250-DIN HS 153-300 HS 153-400 HS 153-500 HS 271-110 HS 271-150 HS 271-150-DIN HS 271-250 HS 271-250-DIN HS 271-300 HS 271-500	Heat sinks are intended for heat dissipation released by power semiconductor devices: solid state relays and power modules in the housings VM and MD to refrigerating medium. The cooler's heat sinks are made of extruded aluminum profiles.	HS153-110 – l = 110 mm HS153-150 – l = 150 mm HS153-150-DIN – l = 150 mm HS153-250 – l = 250 mm HS153-150-DIN – l = 250 mm HS153-300 – l = 300 mm HS153-400 – l = 400 mm HS153-500 – l = 500 mm HS271-110 – l = 110 mm HS271-150 – l = 150 mm HS271-150-DIN – l = 150 mm HS271-250 – l = 250 mm HS271-250-DIN – l = 250 mm HS271-300 – l = 300 mm HS271-500 – l = 500 mm

18. ACCEPTANCE «5»

Products of special application without control, with control, drivers

<u>5M4SCH</u>	Diode-diode module based on Schottky diodes representing an assembly of 2 diodes with common anode-cathode, is intended for converting AC 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 special purpose on-board equipment.	40, 80, 120, 160, 200, 240, 320 A / 60, 125, 200 V
<u>5M4.1SCH</u>	Diode module based on Schottky diodes representing a power assembly of single diode, is intended for converting AC to pulsing DC as a part of single-phase and three-phase rectifier bridges, switch stabilizers, pulse supply source, in drive circuits, control and commutation of special purpose on-board equipment.	40, 80, 120, 160, 200, 240, 320 A / 60, 125, 200 V
<u>5M4.2SCH</u>	Diode modules based on Schottky diodes representing an assembly of two power diodes with common cathode, are intended for converting AC to pulsing DC as a part of single-phase and three-phase rectifier bridges, switch stabilizers, pulse supply source, in drive circuits, control and commutation of special purpose on-board equipment.	40, 80, 120, 160, 200, 240, 320 A / 60, 125, 200 V
<u>5M4.3SCH</u>	Diode-diode module based on Schottky diodes representing an assembly of 2 power diodes with common anode, is intended for converting AC 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 special purpose on-board equipment.	40, 80, 120, 160, 200, 240, 320 A / 60, 125, 200 V
<u>5M9 (MOSFET)</u>	Module of single MOSFET switch is intended for commutation of power loads and using it as a part of power converters with high switching frequency.	50,75,100,150,200,250,300,400 A/60 V 50,75,100,150,200,250,300,400A/100 V 50,75,100,150,200,250,300,400A/200 V T _J = -60 ... +85 °C
<u>5M9(IGBT)</u>	Single IGBT module shunted by reverse FRD is intended for power loads commutation and using as a part of power converters with high switching frequency.	50,75,100,150,200,250,300 A / 600 V 50,75,100,150,200,250,300 A / 1200 V T _J = -60 ... +85 °C
<u>5M10</u>	Transistor module - back-to-back connected IGBT-module shunted by reverse fast recovery diode and fast recovery diode in collector circuit, that is intended for power loads and using it as a part of power converters with high switching frequency.	25,50,75,100,150,200 A / 600 V 25,50,75,100,150,200 A / 1200 V T _J = -60 ... +85 °C
<u>5M11</u>	Transistor module – series-connected IGBT modules shunted by reverse fast recovery diode and FRD in emitter circuit, is intended for power loads commutation and using it as a part of power converters with high switching frequency.	25,50,75,100,150,200 A / 600 V 25,50,75,100,150,200 A / 1200 V T _J = -60 ... +85 °C
<u>5M12</u>	Two series-connected MOSFET or IGBT switches that shunted by reverse FRDs, are intended for using them as commutated elements in power converters.	25,50,75,100,150,200,250 A / 60 V 25,50,75,100,150,200,250 A / 100 V 25,50,75,100,150,200,250 A / 200 V 25,50,75,100,150,200 A / 600 V 25,50,75,100,150,200 A / 1200 V T _J = -60 ... +85 °C
<u>5M12.1 (MOSFET)</u>	Module of two multiple connected power switches based on MOSFET-transistors is intended for operation in switch stabilizers, pulse supply source, in drive circuits, control and commutation of special purpose on-board equipment.	25, 50, 75, 100, 150, 200 A / 60, 100, 200 V
<u>5M12.1 (IGBT)</u>	Module of two multiple connected power switches based on IGBT-transistors is intended for operation in switch stabilizers, pulse supply source, in drive circuits, control and commutation of special purpose on-board equipment.	50, 75, 100, 150 A / 600, 1200 V
<u>5M13B</u>	Transistor bridge based on IGBT-transistors is intended to design converting devices.	25, 50 A / 1200 V

5MO26	Semiconductor solid state optoelectronic three-phase AC relay with “normally opened” contacts: 5MO26A – without control of phase transient through “zero” and 5MO26MA - with control of phase transient through “zero” are intended for commutation of loads in AC circuits with frequency from 50 to 400 Hz.	25,40,63,80,100,120,200,250A/1200 V $T_J = -60 \dots +85 \text{ }^\circ\text{C}$
BDCMCM1C	Module for brushless DC motor control as a part of: - module of brushless DC motor control with permanent magnets, Hall sensors and braking electromagnetic clutch - noise filter module operating together with control module for decreasing noise level. Protection and control circuit power switches containing in the module provide stabilization of rotation speed of brushless DC motor and limitation of the current level consumed by motor from an external source.	$I_{\text{start}} = 10 \text{ A}$ $U_{\text{sup}} = 27 \text{ V}$ $T_J = -60 \dots +85 \text{ }^\circ\text{C}$
2005XX1	Driver of power transistors with field control is intended for galvanic isolated control of power transistor with field control (MOSFET or IGBT) with maximum permissible voltage up to 1700V. The driver is a former-amplifier of transistors gates control signals with frequency up to 100 kHz and provides the protection of controlled transistor against emergency modes.	$U_{\text{sup}} = 5 \text{ V}$ $U_{\text{out}} = +18/-7 \text{ V}$ $I_{\text{out}} = 10 \text{ A}$ $f = 100 \text{ kHz}$ $T_J = -60 \dots +85 \text{ }^\circ\text{C}$
2005EU1	Integral module of voltage converting is intended for converting of direct voltage 24 V to voltages +18V/-7V to supply the control circuit MOS- and bipolar transistors with isolated gates, provides galvanic isolation of input voltage from output ones with minimum strength 4000V at DC, provide stabilization of output voltage at changing of supply voltage and load.	$U_{\text{sup}} = 24 \text{ V}$ $U_{\text{out}} = +18/-7 \text{ V}$ $P_{\text{out}} = 5 \text{ W}$ $T_J = -60 \dots +85 \text{ }^\circ\text{C}$
5IPM14B	Semiconductor module of inverter that provides current commutation measuring and current level limitation consumed by the load from an external source, setting off a signal «ERROR» in critical modes (IPM). It contains the power switches, protection circuits and drivers.	200 V / 45 A $T_J = -55 \dots +85 \text{ }^\circ\text{C}$
5MTI-50-6A	Semiconductor module of inverter that provides current commutation, measuring and limitation of current level consumed by the load from an external source, emergency signaling in critical modes (IPM). It contains power switches, protection circuits and drivers.	$U_{\text{sup,cont}} = 11 \dots 31 \text{ V}$ $U_{\text{sup,inv}} < 360 \text{ V}$ $I_{\text{inv,max}} = 50 \text{ A}$ $T_J = -60 \dots +85 \text{ }^\circ\text{C}$
5SSVC-50-6A	Modules for controlling of commutated voltage providing rectifying of alternating voltage, load current commutation, protection against load SC, setting off alarms in critical modes. It contains power switches, protection circuits and drivers.	$U_{\text{sup,cont}} = 11 \dots 31 \text{ V}$ $U_{\text{sup,inv}} < 360 \text{ V}$ $I_{\text{inv,max}} = 50 \text{ A}$ $T_J = -60 \dots +85 \text{ }^\circ\text{C}$
5SSPC-5-1-C 5SSPC-10-1-C	Modules for commutation and current control with nominal currents are intended for use at radio electronic devices to commutate loads. The SSPCs provide control of current flow through load, provide protection of power element against SC or current exceeding on the load, provide protection the power element against overheating.	5, 10 A / 100 V $U_{\text{net nom}} = 48 \text{ V}$
5MT14B	DC commutation relay based on MOSFET-transistors are intended for operation in devices of special purpose as a commutator in DC nets.	5,10,20,40,60,80 A / 100 V $U_{\text{sup}} = 15 \dots 20 \text{ V}$
5DR1160P-B1	Single-channel driver of power transistors with filed control for single MOSFET or IGBT transistor control. The driver is an amplifier-shaper of transistor gates control signals with frequency up to 200 kHz with an inbuilt DC-DC converter.	$U_{\text{sup}} = 15 \text{ V}$ $U_{\text{out}} = +18/-7 \text{ V}$ $I_{\text{out}} = 16 \dots 34 \text{ A}$ $C_{\text{load}} = 10 \dots 100 \text{ nF}$ $f_{\text{max}} = 1.2 \text{ MHz}$ $T_J = -40 \dots +85 \text{ }^\circ\text{C}$
5DR1120P-A	Single-channel driver of power transistors with filed control for single MOSFET or IGBT transistor control. The driver is an amplifier-shaper of transistor gates control signals with frequency up to 100 kHz with an inbuilt DC-DC converter.	$U_{\text{sup}} = 15 \text{ V}$ $U_{\text{out}} = +15/-10 \text{ V}$ $I_{\text{out}} = 12 \text{ A}$ $T_J = -60 \dots +85 \text{ }^\circ\text{C}$

5DR2120P-A	Two-channel driver of power transistors with field control are intended for half- bridge control on MOSFET or IGBT transistor. The driver is an amplifier-shaper of transistor gates control signals with frequency up to 100 kHz with an inbuilt DC-DC converter.	$U_{sup} = 15 \text{ V}$ $U_{out} = +15/-10 \text{ V}$ $I_{out} = 12 \text{ A}$ $T_J = -60 \dots +85 \text{ }^\circ\text{C}$
5DM1110A	Driver of power transistors with field control is intended for galvanic isolated controlling by power transistor with field control (MOSFET and IGBT) with maximum permissible voltage up to 1700 V. The driver is an amplifier-shaper of transistors gates control signals with frequency up to 100 kHz and provides protection of controlled transistor against emergency modes.	$U_{sup} = 5 \text{ V}$ $U_{out} = 15 \dots 35 \text{ V}$ $I_{out} = 11 \text{ A}$ $f = 100 \text{ kHz}$ $T_J = -60 \dots +85 \text{ }^\circ\text{C}$

19. POWER MODULES WITH SPECIFIC REQUIREMENTS

- wide temperature range (from - 60 to +125 °C)
- resistance to difficult operating conditions (humidity, dust, sea fog, radiation, vibration, impacts)
- hermetic modules
- different variants of power assembly schemes and control circuit
- high-voltage isolation up to 15 kV
- "light" modules
- different protective circuits (voltage limiters, current limiter, protection against pulse noise, etc); different variants of operation currents and voltages, including high power modules, different housings
- in-built air cooler
- protection against current overloads
- temperature and current sensors
- different variants of glue and connectors
- different variants of operation currents and voltages including high-power modules

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