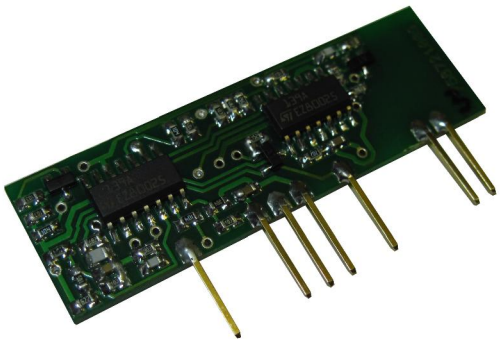
IGBT AND MOSFET TRANSISTOR DRIVER
DM150A
ANALOGUE OF M57962

USER'S MANUAL



5 Naugorskoe highway, Orel, 302020, Russia Tel. +7(4862) 44-03-44, Fax +7(4862) 47-02-12
E-mail: mail@electrum-av.com

CONTENTS

1 GENERAL INFORMATION

A single-channel MOSFET and IGBT transistors driver is intended for galvanic isolated controlling of the power field transistor with maximum current rates and voltages 600V/400 A, 1200V/200A, 1700V/200A. The driver is a former-amplifier of the transistor gate control signals with frequency up to 25 kHz. The driver is a driver's microchip M57962, an analogue of Mitsubishi.

2 FUNCTIONAL DRIVER FEATURES

2.1 The driver provides the following control, monitoring and protection functions:

1 Transistor control with voltage corresponding to agreed supply voltages;
2 Saturation voltage control on collector-emitter of controlled transistor, its protective disconnection when leaving saturation state;
3 Smooth driver junction from active state to inactive one when an "emergency" (output of controlled transistor from saturation mode);
4 Control block when an "emergency";
5 Emergency alarm;

3 OVERALL DRAWING AND FUNCTIONAL CIRCUIT

3.1 Overall drawing is shown at Figure 1, functional circuit is shown at Figure 2, as well as connection circuit is shown at Figure 3.

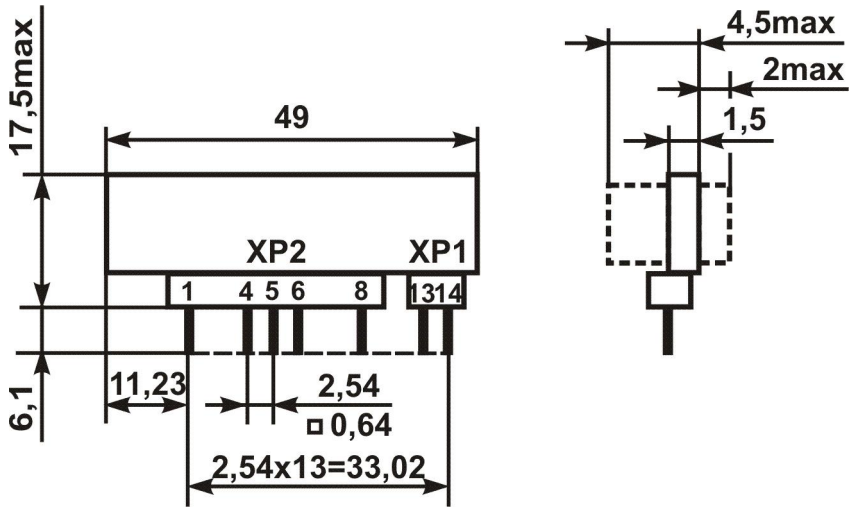


Figure 1 – Drawing

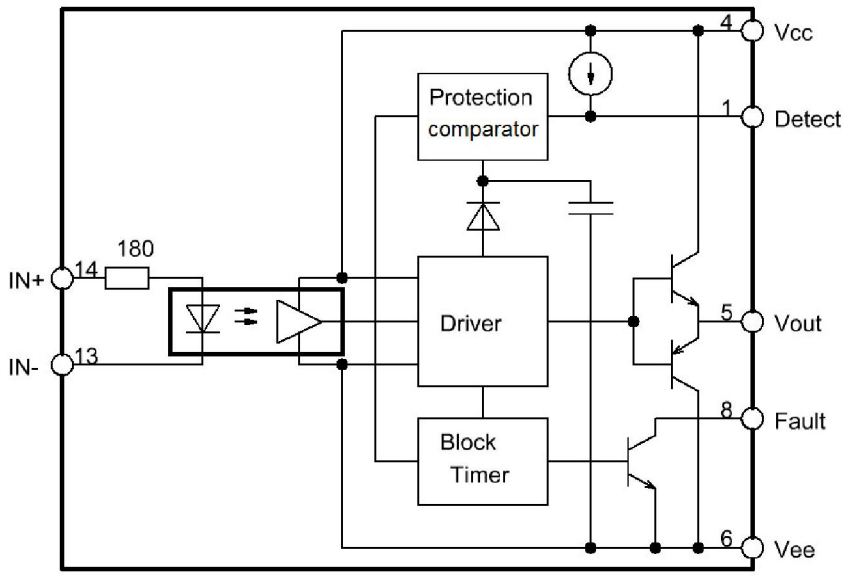


Figure 2 – Driver functional circuit

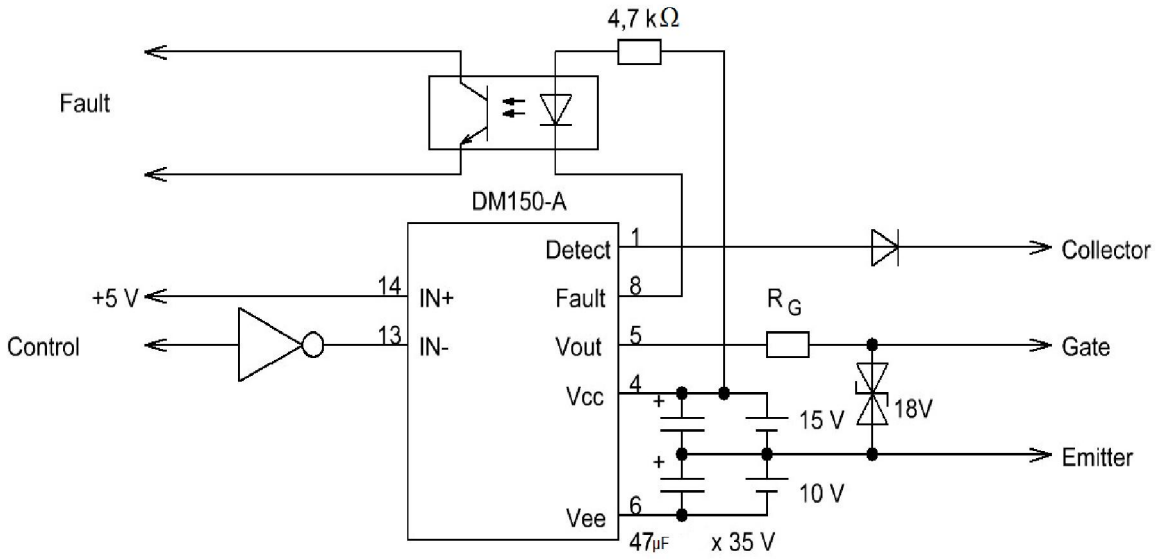


Figure 3 – Driver connection circuit

3.2 Outputs function is shown in Table 1.

Table 1 – Driver outputs function

Output	Symbol	Function
1	Detect	Measuring collector, saturation voltage control detector
2	-	Not involved
3	-	Not involved
4	Vcc	Positive output supply connection +10…20 V
5	Vout	Gate connection of controlled transistor
6	Vee	Negative output supply connection -20…0 V
7	-	Not involved
8	Fault	Fault output (open collector)
9	-	Not involved
10	-	Not involved
11	-	Not involved
12	-	Not involved
13	IN-	LED cathode of input optocoupler
14	IN+	LED anode of input optocoupler

4 BASIC AND MAXIMUM PERMISSIBLE PARAMETERS

Table 2 – Basic and maximum permissible parameters (at T = 25 °C)

Parameter	Symbol	Unit	Value			Note
			min	type	max	
Supply parameters						
Max. supply voltages range	U_S	V			35	
Positive supply voltage	U_{CC}	V	10		20	
Negative supply voltage	U_{EE}	V	-20		0	
No-load current consumption	I_S	mA			35	f = 0 Hz
Max. current consumption	$I_{S\,max}$	mA			150	ref. to Figure 5
Control input parameters						
Optocoupler LED current respective to transistor connection	$I_{IN\,ON}$	mA	5		20	
Optocoupler LED current respective to transistor disconnection	$I_{IN\,OFF}$	mA	0		1.5	
Control current at U_{cont} = 5 V	$I_{IN\,5V}$	mA		17		
Input resistance	R_{IN}	Ω		180		
Time Parameters						
Turn-on/off delay time between input and output	$t_{d\,on/off\,(in\text{-}out)}$	µs			1	
Max working frequency	f_{max}	kHz			25	Ref. to Figure 5
Non-saturation protection operation delay	t_{trip}	µs	2	2.6	3	Ref. to Figure 4
Time of smooth fault transistor disconnection	ts	µs	5	8	15	Ref. to Figure 4
Block time of controlled transistor after «fault»	t_{block}	ms	1	1.6	2	Ref. to Figure 4
Delay time of fault signal connection	$td_{(on\text{-}err)}$	µs		0.1	1	
Output parameters						
Output pulse on current	I_{Omax+}	A	5			
Output pulse off current	I_{Omax-}	A			-5	
Output average current	I_O	mA			130	
Rise time of output signal	t_r	ns			100	No load
Fall time of output signal	t_f	ns			150	
Max. current of status output «Fault»	$I_{F\,max}$	mA			10	
Max. voltage of status output «Fault»	$U_{F\,max}$	V			30	
Residual voltage of «Fault» output	$U_{O\,F}$	V			1	at I_{ERR} = 10 mA
Threshold voltage at measuring input «Detect» that causes fault disconnection	U_{Mc}^{Th}	V	9	9.4	11	At Ucc=15 V and one protective diode
Insulation parameters						
Insulation voltage between input and output	$U_{ISO(IN\text{-}OUT)}$	V			4000	DC, 1 minute
Critical rate of output voltage change	dU/dt	kV/µs			20	
Service and storage parameter						
Working temperature range	T_A	°C	-40		+85	
Storing temperature	Ts	°C	-45		+100	

5 DRIVER OPERATION

Current supply more than 5 mA to the control inputs «IN» will lead to opening of controlled transistor. Open state voltage fall increasing by more than U_{mc}^{Th} per time, exceeding t_{trip}, will lead to protection operation of open state voltage fall increasing (when current overload). When “Fault” the transistor will open that connected in accordance with the circuit with open collector (output «Fault»). Within the time t_{block} “fault” reset

will be performed by internal circuit of fault reset and on rising edge of control signal «IN» the controlled transistor will be opened. In the event when the fault cause was not disposed then the protection cycle will be recurred.

Diagram explaining driver operation is shown at Figure 4.

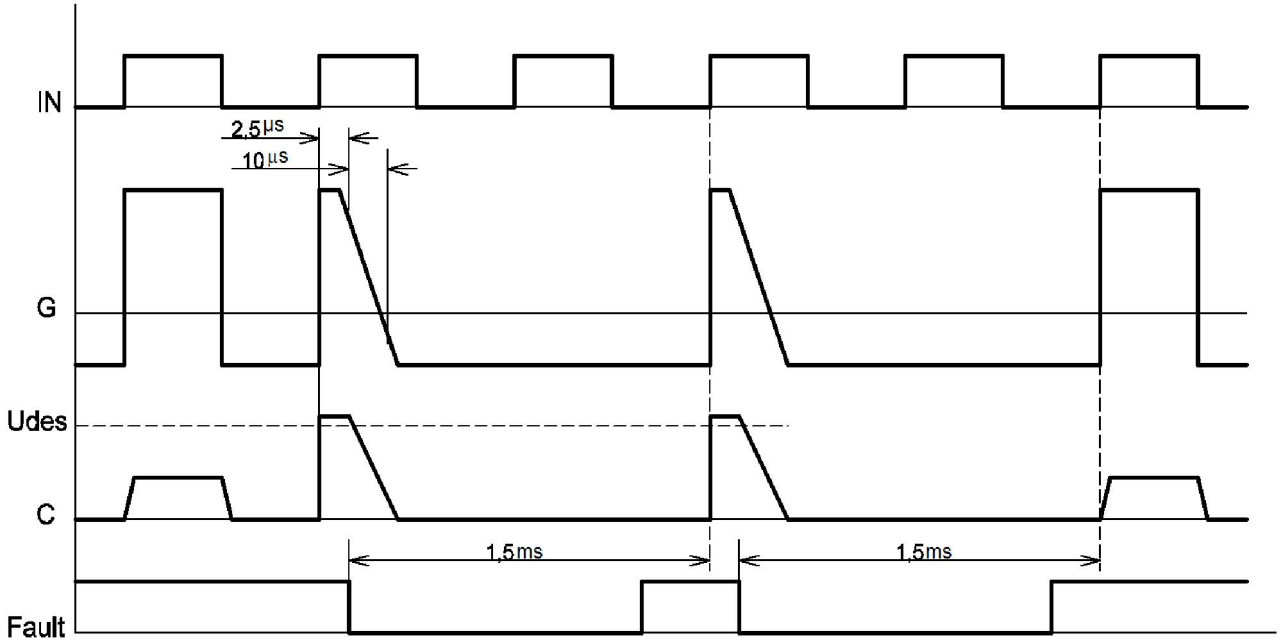


Figure 4 – Functional diagram of driver "fault" operation

6 CONNECTION RECOMENDATIONS

IN+, IN- – Controlling inputs. They are LED outputs of input optocoupler (anode and cathode). Driver control is described in section "Driver Operation"

Fault – output signaling about fault. The output is an open transistors collector of non-saturation protection circuit. The output has a galvanic isolation with output circuits; it is recommended to use optocoupler that connected according to scheme at Figure 3 to transfer status signal to galvanic isolated input driver circuit.

V_{CC}, V_{EE} – connection output of positive and negative supply according to output driver circuit therewith total range of supply voltages on these outputs should not exceed 35 V. You should install the capacitors 20…100 µF to supply connection outputs relative "ground" (ref to Figure 3). Current consumption of these outputs should not exceed 150 mA in any mode otherwise the driver can fail.

Vout – gate connection output. To decrease output pulse current (and on/off time of controlled transistor accordingly) you have to install the gate resistor to output and gate break; the driver may be connected without gate resistor. To protect controlled transistor against gate overvoltage you are recommended to install the bidirectional voltage limiter between gate and emitter (source) at rated breakdown voltage 18 V.

Detect – collector (drain) detector. The output is intended for voltage fall (non-saturation protection) on the transistor. The driver does not contain built-in protective reverse diode; you need to install the external reverse diodes at maximum reverse voltage more than the maximum permissible voltage at least by 20%.

Typical value of protection operate threshold is 9.4 V with one reverse diode. Protection operate threshold is regulated by the external elements (Zener diodes and diodes); voltage fall at Zener diodes and diodes at 4 mA is deducted from the maximum voltage (9.4 V). For instance, if you install the Zener diode (cathode to driver) serially to input "Detect" with nominal stabilization voltage 3.3 V and 2 diodes with voltage fall 0.7 V at 4 mA then protection operate threshold will be equal to 9.4-3.3-2*0.7=4.7 V.

If current overload protection is not required then this output should be short-circuited to emitter (source) of controlled transistor.

7 GRAPHICS EXPLAINING DRIVER OPERATION

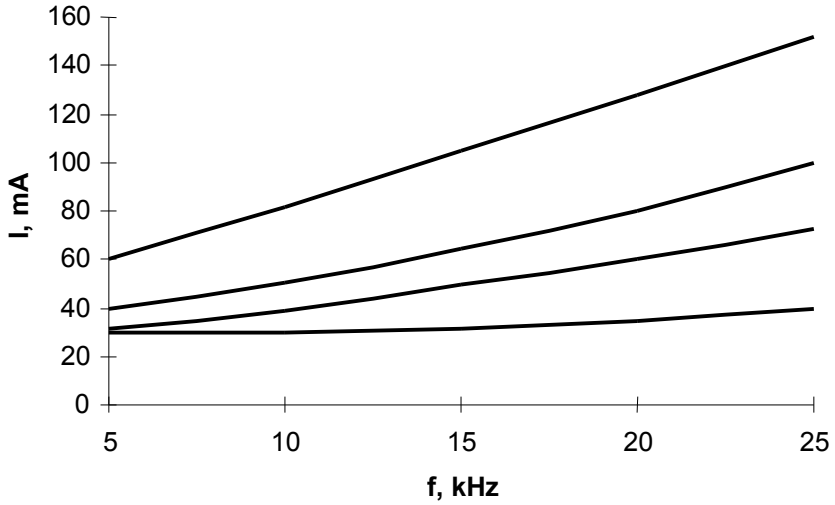


Figure 6 – Current consumption versus control signal frequency under load (with gate resistor 1 Ω) for gate capacitances 10 nF, 25 nF, 50 nF, 100 nF

8 INFORMATION ABOUT PRECIOUS METALS

Precious metals are not contained.

9 SERVICE RECOMMENDATIONS

9.1 Resistance requirements at mechanical impacts

Mechanical impacts for drivers in accordance with qualifying standards of controlled power transistors are shown in Table 3.

Table 3 – Drivers resistance requirements to mechanical impact factors

External exposure factor	External exposure factor value
Sinusoidal vibration:	
- frequency range, Hz;	0.5 - 100
- acceleration amplitude, m/s^2 (g)	150 (15)
Mechanical shock of single action:	
- peak shock acceleration, m/s^2 (g);	40 (4)
- pulse duration of shock acceleration, ms	50

9.2 Resistance requirements at climatic impacts

Climatic impacts in accordance with qualifying standards of controlled power transistors are shown in Table 4.

Table 4 -Resistance requirements to climatic impact factors

Climatic factor	Climatic factor value
Lower ambient temperature:	
- operating, °C;	minus 40
- maximum, °C	minus 45
Higher ambient temperature:	
- operating, °C;	+85
- maximum, °C	+100
Relative humidity with temperature 35 °C without moisture condensation, %, max	98
Ambient temperature change, °C	from minus 45 to +100
Lower atmospheric pressure, Pa (mm Hg)	86000 (650)
Higher atmospheric pressure, Pa (mm Hg)	106000 (800)

10 RELIABILITY SPECIFICATIONS

The manufacturer guarantees the quality of the module all the requirements of the user's manual if the consumer observes terms and conditions of storage, mounting and operation, as well as guidance on the application specified in the user's manual.

Operating warranty is 2 years from the acceptance date, in the case of requalification – from the date of the requalification.

Reliability probability of driver for 25000 hours must be at least 0.95.

Gamma-percent life must not be less than 50000 hours by $\gamma = 90$ %.

Gamma-percent service life of the modules, subject to cumulative operating time is not more than gamma-percent life, not less than 10 years, at $\gamma = 90$ %.

Gamma-percent storageability time of the modules, at $\gamma = 90$ % and storing – 10 years.

5 Naugorskoe highway, Orel, 302020, Russia Tel. +7(4862) 44-03-44, Fax +7(4862) 47-02-12
E-mail: mail@electrum-av.com