

IGBT AND MOSFET TRANSISTORS WITH FIELD CONTROL M57962L and VLA500

IGBT and MOSFET transistors with field control M57962L and VLA500-01 by Mitsubishi those traditionally are very popular among developers of low and average power converters. Nowadays such devices are produced in Russia by “Electrum AV”, CJSC.

IGBT and MOSFET transistors power electronic nowadays is a very vast concept. It begins with converters of power in tens of Watt and finishes in tens of Megawatt. With it, less the power, the wider is assortment of converters, more variants of circuits, and then there are more developers and consumers. This is the reason why the widest assortment of different electronic component has to be kept to develop the converters from 1...100 kW. Manufacturers that produce average power devices don't brave their products and not as famous as manufacturers that targeted to high power production. If we speak about such well-known company as “CT Concept” then their powerful driver 1SC2060P is far-famed and to compare it with 2SC0108T - driver of the second generation – the last one is not so famous. And why must it be famous? Basic low powered driver and there is nothing else to add. However, in most tasks 1SC2060P driver type is abundant. Such driver can be used in power modules for current in thousands amperes when for current from tens of amperes up to several hundred is quite enough for 2SC0108. But this variant can usually not be convenient for developer. For example, if it is necessary to built frequency converter for motor in several kW or even tens of kW then overall dimensions for drivers of 2SC0108 type with all necessary additions can require too big space. In this case it is more convenient to use drivers' microchips by “Mitsubishi” (“Powerex”, “Isahaya”) of VLA or M57 series. But if price is the critical criteria, supply stability is required then these parts may not satisfy the developer. There we will start narration about DM150A and MD1120P-A (1) drivers chips by Electrum AV.

DM150A driver chip is functionally and constructively is the full analogue of M57962L. Present driver is intended for IGBT and MOSFET transistor power control up to 600V/ 400A or 1200V (1700V)/ 200A. Driver has inbuilt galvanic isolation for control circuits and protection circuit at controlled transistor non-saturation. There is no DC/DC-converter in driver. Driver block diagrams of DM150A and V57962L are equal to one that are presented on the Figure 1.

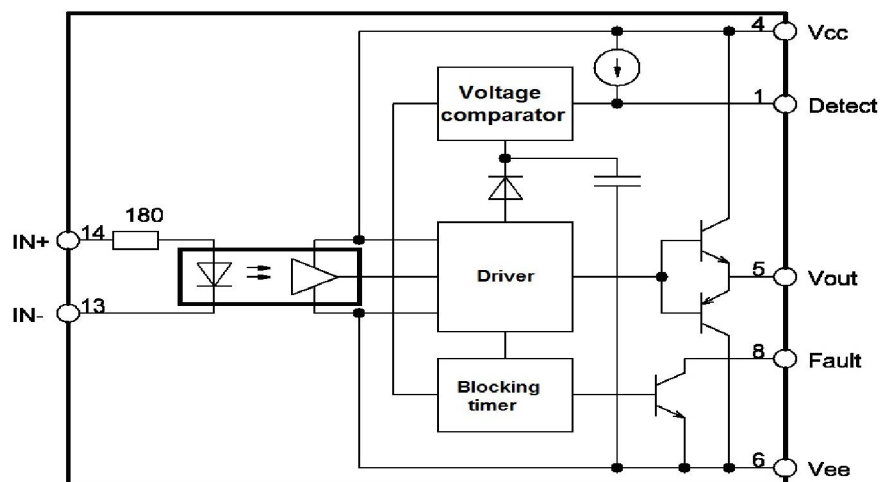


Figure 1 – DM150A and M57962L drivers block diagrams

In spite of block diagrams equality the driver schematic based theorem by Electrum AV is different from “Mitsubishi” because of national components base that is used first of all in aim of stability supply and secondary with aim of painless junction to requirements with note of “special purpose”. However, that didn't reflect on the driver; all functions and parameters of

DM150A completely match to M57962L. More then that at one microcircuit change to other it is impossible to find difference in existing circuit. Module driver MD1120P-A is completely relevant to VLA500-01 and that illustrates Table 1 and 2 (presented typical measured values).

Table 1 – DM150A (“Electrum AV”) and M57962L (“Mitsubishi”) drivers parameters comparison

Parameter	Unit	DM150A	M57962L
Output pulse current	A	+15/ -18	+16/-18
Maximum operation frequency	kHz	25	20
Consumption current +15V (at 20 kHz)	mA	21	15
Consumption current - 10V (at 20 kHz)	mA	-18	-13
Supply voltage sum amplitude	V	15...35	20...28
Non-saturation protection voltage operation	V	9.0	9.2
Turn-on/ turn-off delay	μs	0,39/ 0.81	0.31/0.84
Non-saturation protection operation delay	μs	2.7	2.7
Smooth emergency turn-off duration	μs	10	10
Emergency mode blocking duraton	ms	1.5	1.5

Table 2 – DM1120P-A (1) (“Electrum AV”) and VLA500-01 (“Mitsubishi”) drivers parameters comparison.

Parameter	Unit	DM150A	M57962L
Output pulse current	A	+17/ -19	+18/-19
Maximum operation frequency	kHz	25	20
Consumption current	mA	78	81
Voltage supply	V	15	15
Supply voltage sum amplitude	V	17.6/-10.6	17.4/ -10.4
Non-saturation protection voltage operation	V	10.0	10.2
Turn-on/ turn-off delay	μs	0.49/ 0.81	0.52/0.87
Non-saturation protection operation delay	μs	2.7	2.6
Smooth emergency turn-off duration	μs	10	10
Emergency mode blocking duration	ms	1.5	1.5

Naturally, some characteristics of indicated drivers are differ one from another more substantially with advantage from one or other manufacturer. For example, Electrum AV driver’s operation frequency is -40...+85 °C when “Mitsubishi” is -20...+60 °C. But on the other side permanency is dU/dt at norm is minimum 15 kW/ μs. “Electrum AV” has typically 22 kW/ μs, “Mitsubishi” has 30 kW/ μs. However, usually these differences on the circuit operation will not influence essentially.

DM150A driver feature is in comparison with M57962L that are extended range of supply voltage (that allows to use supplies +15/-0 V and +15/-15 V) and possibility adjustment of protection operation delay at non-saturation that absence at “Mitsubishi” driver. At DM150A turn-on (it is the connection circuit of M57962L) adjustment capacity of present delay is marked bold (see Figure 2).

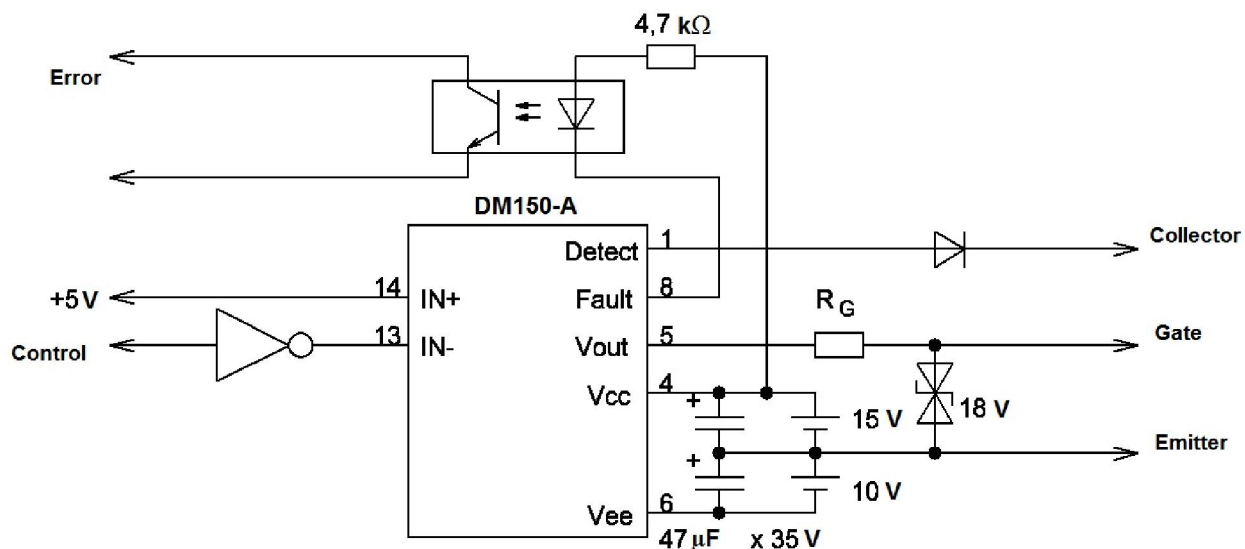


Figure 2 – Drivers turn-on circuit DM150A and M57962L

As aforesaid driver is not convenient to use and that inconvenience is connected first of all with absence of DC/DC-converter. If there is multichannel supply voltage converter then there is nothing terrible and more than that there is advantage in dimensions; however driver with inbuilt DC/DC-converter is also necessary. Thereby the further evolution of DM150A is DM1120P-A that is full analogue of VLA500-01 by “Mitsubishi”. The structure diagram is represented on Figure 3.

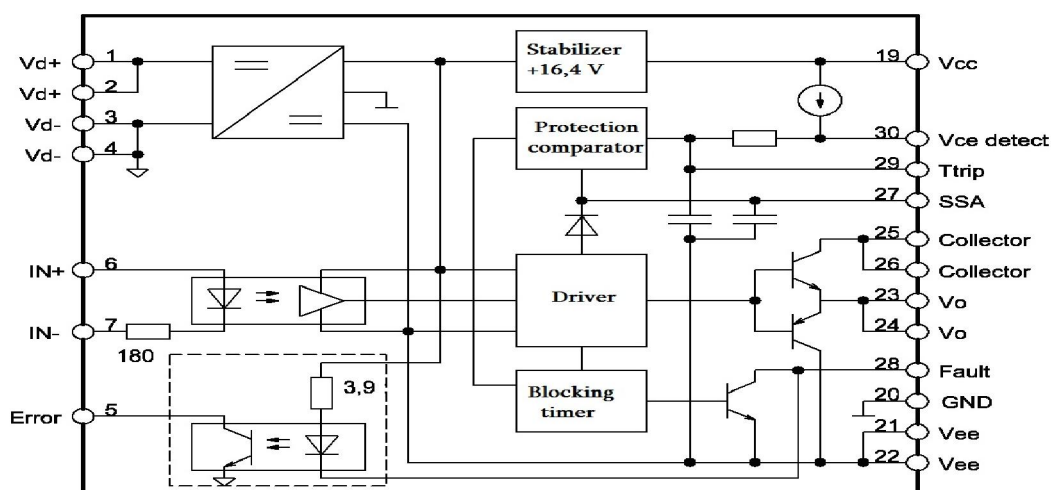


Figure 3 – Structure driver circuit of DM1120P-A(1) and VLA500-01

Moreover inbuilt DC/DC-converter the DM1120P-A driver differs by functionality as allows to adjust not only protection operation voltage at non-saturation (in difference with M57962L), but also delay protection operation and also smooth emergency turn-off duration C_{trip} and C_s capacitors relevant to turn-on circuit – Figure 4). Entertaining the notion for driver DM1120P-A allows control IGBT and MOSFET transistors with help up to 600V/ 400A or 1200V (1700V)/ 400A and has all necessary adjustments for proper protection of controlled power transistor then this driver can be matched with “adult” single channel drivers by “CT Concept” or “Semikron” of the first generation. Difference of these drivers can be summarized to construction and to not so substantial turn-on functions. One broadly mines of DM120P-A is lack of signal state output at output driver side; to transmit overload signal at current is necessary to set external optron. DM1120P-A1 is divested of that mines.

In difference from above mentioned drivers the DM1120P-A is not complete analogue of “Mitsubishi” driver. Notwithstanding on its base DM1120P-A (VLA500-01) with difference that present driver has optron isolation inside (marked bold on Figure 3) that transmit state signal to galvanically isolated driver input part. Hence, DM1120P-A1 can be named full completed driver that doesn’t require additional circuits or supply sources. Driver’s connection circuits of DM1120P-A and DM1120P-A1 are represented at Figures 4 and 5 appropriately.

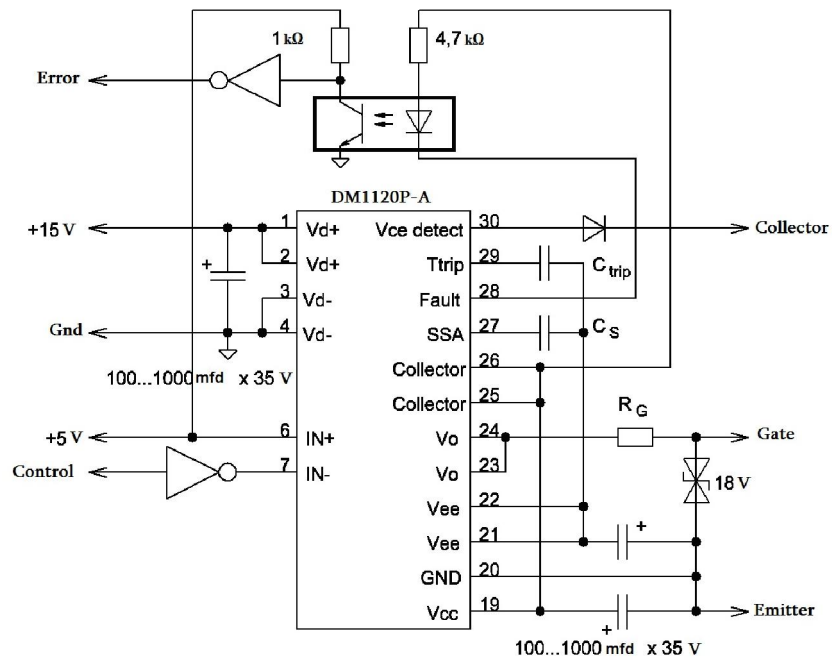


Figure 4 – DM1120P-A and VLA500-01 driver connection circuit

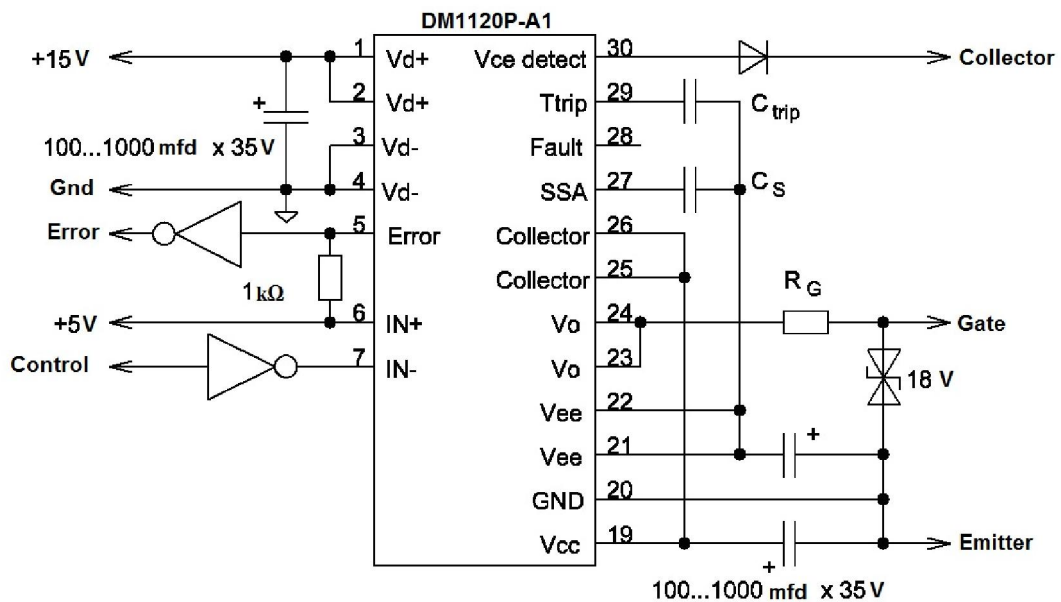


Figure 5 – DM1120P-A1 driver turn-on circuit

Drivers of M57 and VLA were devised by “Mitsubishi” more then 10 years ago and regarding nowadays progress of power electronics they became old. However, they are popular even today. Reason of their popularity is not in incredible output current, marvelous speed or unordinary beauty but in simplicity, reliability and convenience; they are work horses in converters of low and average power. Concerning these characteristics described drivers are relevant to solve

majority of tasks that are set for developers of power converters, concerning construction – microchips of DM150A and DM1120P-A (1) drivers are more convenient than drivers modules with “CT Concept” design and so on.

In the end it is necessary to say that possibilities of “Electrum AV” are not limited by these three drivers. Generally, without much time and money spending it is possible to realize manufacturing of all drivers-analogues by “Mitsubishi”, the more especially that circuit design are very close. Driver can be adjusted for customer requirements or for concrete power module. Drivers also can be supplied under customer requirements.