New IGBT and MOSFET drivers by «ELECTRUM AV» – analogues of «Mitsubishi» drivers.

Transistor drivers with field control M57962L and VLA500-01 by «Mitsubishi» manufacture are traditionally popular among the developers of converters of small and medium power. Analogue drivers are produced by Russian manufacturer «ELECTRUM AV».

Nowadays power electronics of IGBT and MOSFET transistors it is a very broad concept. IGBT and MOSFET power electronics starts with converters which capacity is tens of watt and ends on converters in tens of megawatt. What is more, than the power is less, so the range of converters is larger, the variants of schemes are more extensive, and the number of developers and consumers is higher. So the tasks for developing converters for powers 1…100 kW are the most common and broad range of different equipment is required in this area. At the same time manufacturer of equipment for the small power are not so popular at the global market as manufacturer who aimed on large powers. For example, «CT Concept» 1SC2060P driver is known practically everywhere, but «CT Concept» 2SC0108T driver of the second generation is not so popular. You will ask - why? Because it is a typical low-powered driver and there is nothing else to add. However, in most cases the 1SC2060P driver is redundant; such driver is useful in current of thousands ampere, when the 2SC0108 driver will be useful for current from tens to hundreds amperes. But this variant may not satisfy the developer. For example, if it is need to collect frequency converter for motor in several kilowatt or even in tens kilowatt, the dimensions of assembly on drivers like 2SC0108 can take invalid space. In this case it is much more useful to use driver chips as «Mitsubishi» («Powerex», «Isahaya») drivers of VLA range or M57 range. But if the price is critical, required stability of supplies or domestic equipment is necessary (or there is the prospect switching to the acceptance of 5), these chips may not satisfy the developer. So there we begin our narration about DM150A and DM 1120P-A drivers by «Electrum AV».

Chip (or module) of МД150А driver functionally and constructively is full analogue of M57962L driver. This driver is designed to control IGBT and MOSFET transistors with capacity to 600W/400A or to 1200W (1700W)/200A. Driver has got installed electrical isolation of control circuit and protection scheme for saturation of the controlled transistor. DC/DC converter is not part of the driver. Block diagrams of the DM150A and M57962L are the same and they are shown on the figure 1.

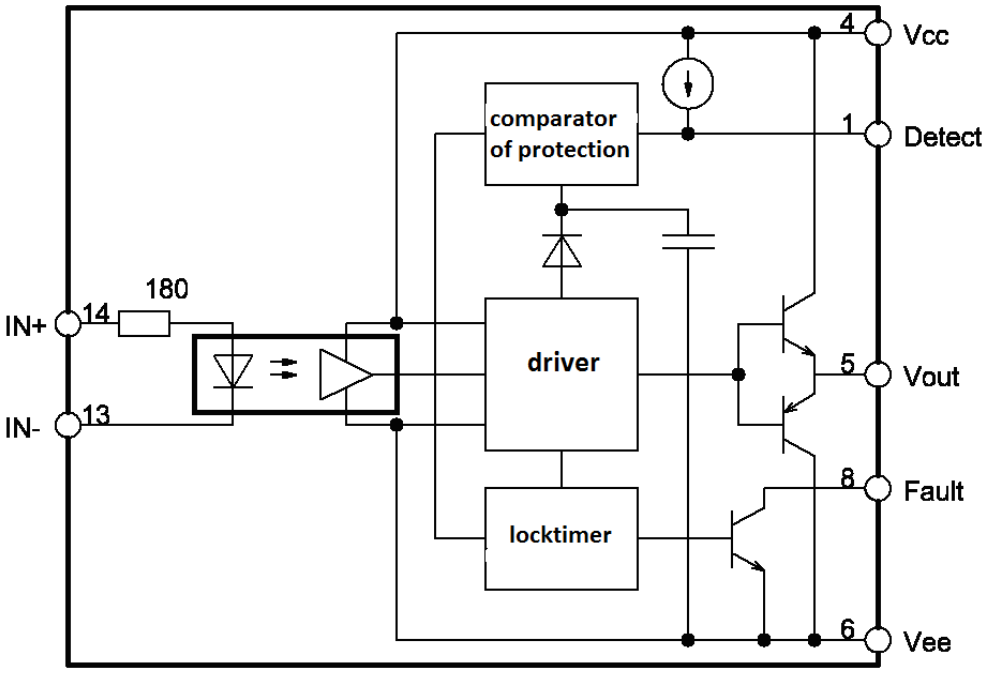

Figure 1– Block diagram of DM150A and M57962L driver

In spite of the block diagram similarity, circuit design of «Electrum AV» driver is different from circuit design «Mitsubishi» mostly because of using domestic equipment which is installed with the aim of permanent delivery and the second aim is painless transition to the requirements with a note of special purpose. However, there are no externally observable changes; all functions and options of DM150A driver are the same like in the M57962L driver. More than that during changing chip from one to another, it is very difficult to find difference in work among them. Looking ahead it is useful to say that DM1120П-А driver module is completely the same as VLA500-01 and there is an example of this fact in table (there are shown typically measured values).

Table 1 – compression of driver parameters DM150A («Electrum AV») and M57962L («Mitsubishi»)

option	measure	DM150A	M57962L
output current pulse	a	+15/-18	+16/-18
maximum operating frequency	kHz	25	20
current consumption+15 V (20 kHz)	mA	21	15
current consumption-10 V (20 kHz)	mA	-18	-13
total amplitude of the power	V	15…35	20…28
voltage protection operation in the saturation	V	9,0	9,2
on and off delay	μs	0,39/0,81	0,31/0,84
delay tripping on saturation	μs	2,7	2,7
duration smooth emergency shutdown	μs	10	10
duration of the lock in the accident mode	msec	1,5	1,5

Table 2 – compression of parameters DM1120П-А(1) («Electrum AV») and VLA500-01 («Mitsubishi»)

option	measure	МД1120П-А(1)	M57962L
output current pulse	a	+15/-18	+16/-18
maximum operating frequency	kHz	25	20
current consumption +15 V (20 kHz)	mA	73	75
current consumption -10 V (20 kHz)	V	15	15
total amplitude of the power	V	16,2/-9,8	16,3/-9,5
voltage protection operation in the saturation	V	9,0	9,2
on and off delay	μs	0,39/0,81	0,38/0,87
delay tripping on saturation	μs	2,7	2,7
duration smooth emergency shutdown	μs	10	10
duration of the lock in the accident mode	msec	1,5	1,5

It needless to say, that some parameters are differ from each other from one side to another more significantly. For example, working driver temperature by «Electrum AV» is -40…+85^{0}C, when «Mitsubishi» driver is -20…+60 ^{0}C. On the other hand the dU/dt stability at a rate not less than 15 kV/μs, «Electrum AV» has typically 22 kV/μs, and «Mitsubishi» has 30 kV /μs.

Features of DM150A driver in comparison with M57962L driver are an extended range of excitation voltage (that allows to use power +15/-0 V and +15/-15 V) and possibility of setting delay security for saturation, which is absent on «Mitsubishi» driver. On the connection diagram of DM150A (it is the same connection diagram for M57962L) capacitance setting of this delay is in bold (figure 2) .

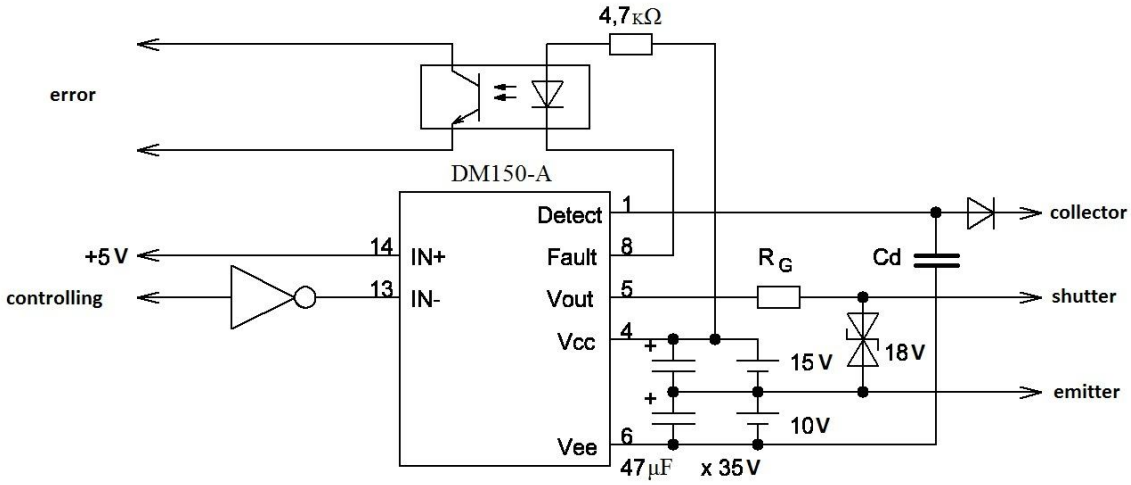

Figure 2 – Connection diagram of the DM150A and M57962L drivers

It is uncomfortable to use the driver described above. This inconvenience is connected mostly with absence of integrated DC/DC-converter. There is nothing terrible, if power supply voltage multi-converter in developers scheme. On the contrary there is gain in amount; however driver with DC/DC converter inside is also useful device. So, because of it the next generation of DM150A driver is DM1120П-А, which is full analogue of «Mitsubishi» VLA500-01 driver. Block diagram of these drivers is on the figure 3.

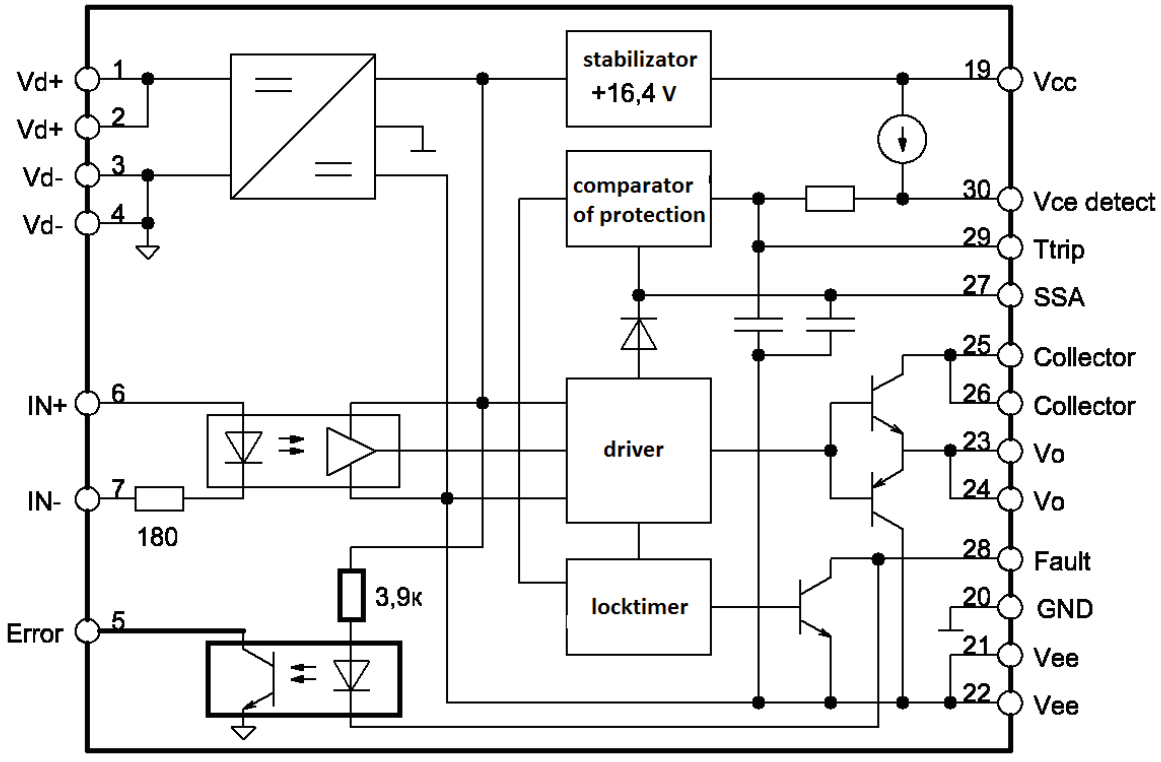

Figure 3 – Block diagram of DM1120П-А(1) and VLA500-01 drivers

Besides inbuilt DC/DC converter, DM1120P-A differs in functionality, as it helps to set not only the voltage operation to protect the saturation (in comparison with M57962L) but also delay of this protection and duration of the smooth emergency stop (condensers Ctrip and Cs are on the connection diagram – figure 4). Taking in the account the fact, that DM1120P-A driver helps to control IGBT and MOSFET transistors of power to 600V/400A or 1200V (1700V)/400A and having all settings for correct protection of controlled power transistor, that driver can be compared with «CT Concept» or «Semikron» single-channel drivers of the first generation. Differences of these drivers are confined to design and to inclusion characteristic. Only mines of DM1120P-A driver is that there is no status signal output on the control side of the driver; it is necessary to establish an external optocoupler to transmit a signal over current. This mines is absent in DM1120P-A1 driver.

Unlike mentioned drivers the DM1120P-A1 driver module is not full analogue of «Mitsubishi» drivers, however it has in construction DM1120P-A (VLA500-01) with the difference that this driver has in its construction optocoupler (figure 3 in bold) which transmit status signal onto galvanically isolated input part of the driver. This way, DM1120P-A1 can be called completely finished driver that is not need more chips and power supplies. Connection diagram of the DM1120P-A and DM1120P-A1 drivers are shown in figures 4 and 5.

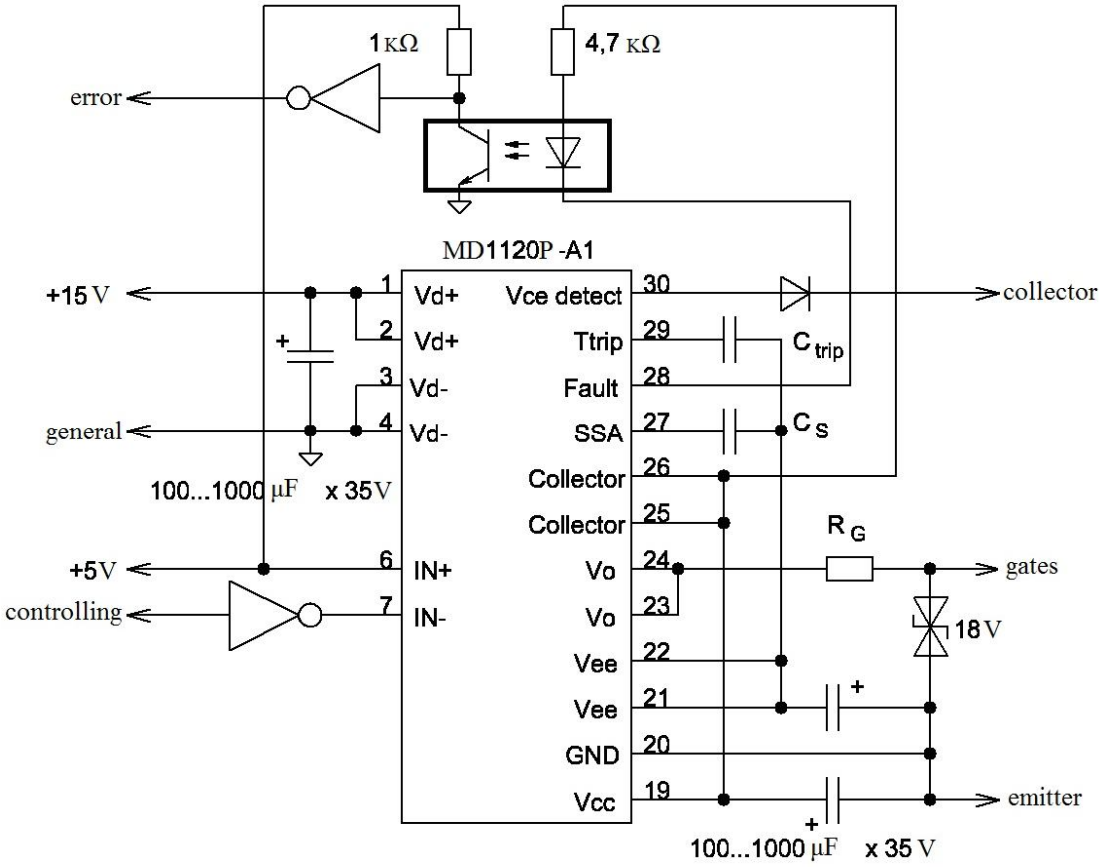

Figure 4 – Connection diagram of DM 1120P-A and VLA500-01 drivers

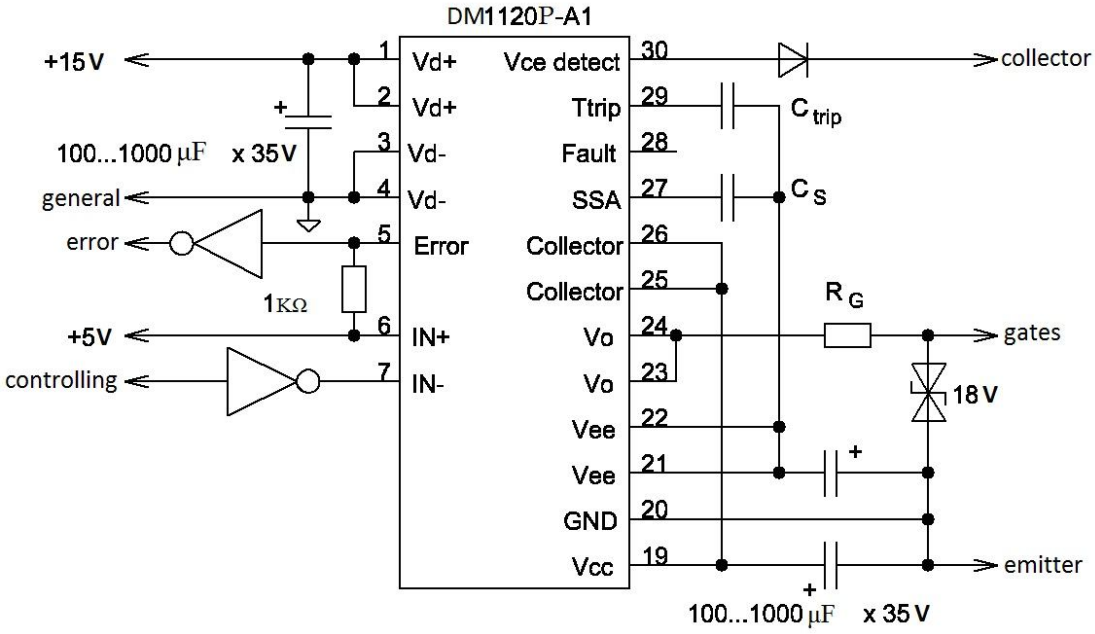

Figure 5 –Connection diagram of DM 1120P-A1 driver

«Mitsubishi» drivers of M57 and VLA range developed more than 10 years ago and nowadays they are outdated. However, they are popular. And its popularity does not depend from its current output, wonderful high-speed performance or in its beauty, but in simplicity, reliability and convenience. These modules characteristics are useful for most solutions practically, which assigns to the developers of any power converters, and for construction chips of DM150A and DM1120P-A (1) drivers are much easier than «CT Concept» module drivers, for example.

In detention, «Electrum AV» possibility does not limit oneself in drivers given above. As a matter of principle, without substantial time and cost can be mastered production of all «Mitsubishi» analogues. More than that, they are schematically similar. Driver can be debugged to the requirements of customer or to specific power module. Drivers delivery can be done with customer acceptance. The possibilities are limitless.