

Le-O2J20-09 GATE DRIVER



- Supply voltage Vcc between 10.0 and 13.5 V
- Input signal isolated by optocoupler
- Nominal input current 8 mA.
- Operation up to 400 KHz
- Suitable for controlling large Mosfets / IGBTs.
- Up to 9A peak
- Compatible with silicon carbide MOSFETs and GaN MOSFETs
- Output signal +20V/-5V
- Vertical mounting to reduce space
- Supports pulses with PWM modulation. Duty cycle between 0 and 100%
- Non-inverting amplifier
- Insulation voltage 4000V
- Propagation time 100 ns
- Rising and falling edges 25 ns
- Enable / Disable input, useful for protection
- 45mm x 36mm x 22mm.

The module has been designed using high quality components and high efficiency. Uses IXYS's IXDD609YI integrated circuit; These amplifiers have been implemented to

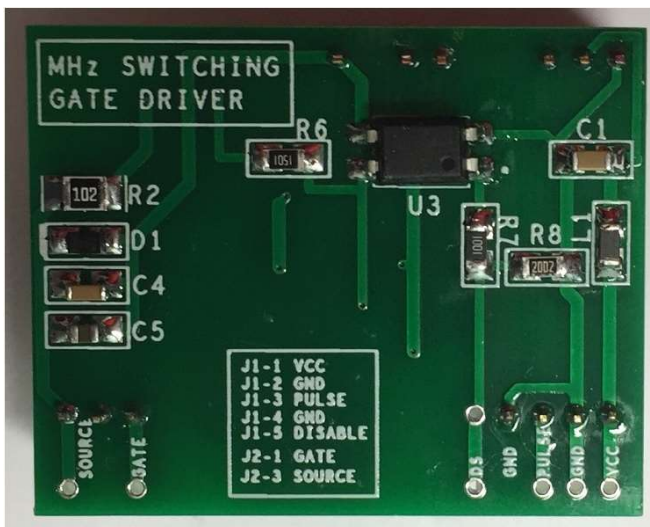
control large MOSFETs and IGBTs, and their output signal can reach peak currents of up to 9 A.

The turn-on and turn-off times of the controlled MOSFET or IGBT can be modified independently by selecting other values for resistors R3 and R4. The turn-off time depends mainly on the value of R3, the turn-on time depends on the sum of the values R3 and R4. R5 ensures a slow turn-off of the controlled device, to decrease di/dt when the Disable signal is enabled, and the IXDD609YI IC puts its output in a high-impedance state.

The control pulses reach the driver through the ACPL-M484 optocoupler, which guarantees the necessary isolation. To achieve total isolation of the driver, it is powered from Murata's MGJ2D122005 isolated DC-DC converter with a power of 2W and isolation voltage of 4000V.

The nominal input current of the optocoupler LED is 8 mA. The driver can be adapted to any type of logic, modifying the value of resistor R1.

The driver must be placed on the power board, as close as possible to the transistor to be controlled, to reduce parasitic inductance. The connectors present in the module are: S3B-XHA and S5B-XHA from the JST company, so in the power board where they are going to be used, the 03JQ-BT and 05JQ-BT connectors must be used, female connectors that are supplied with each module.



The module is also supplied with male pins, rather than JST connectors, for easy integration into any prototype.

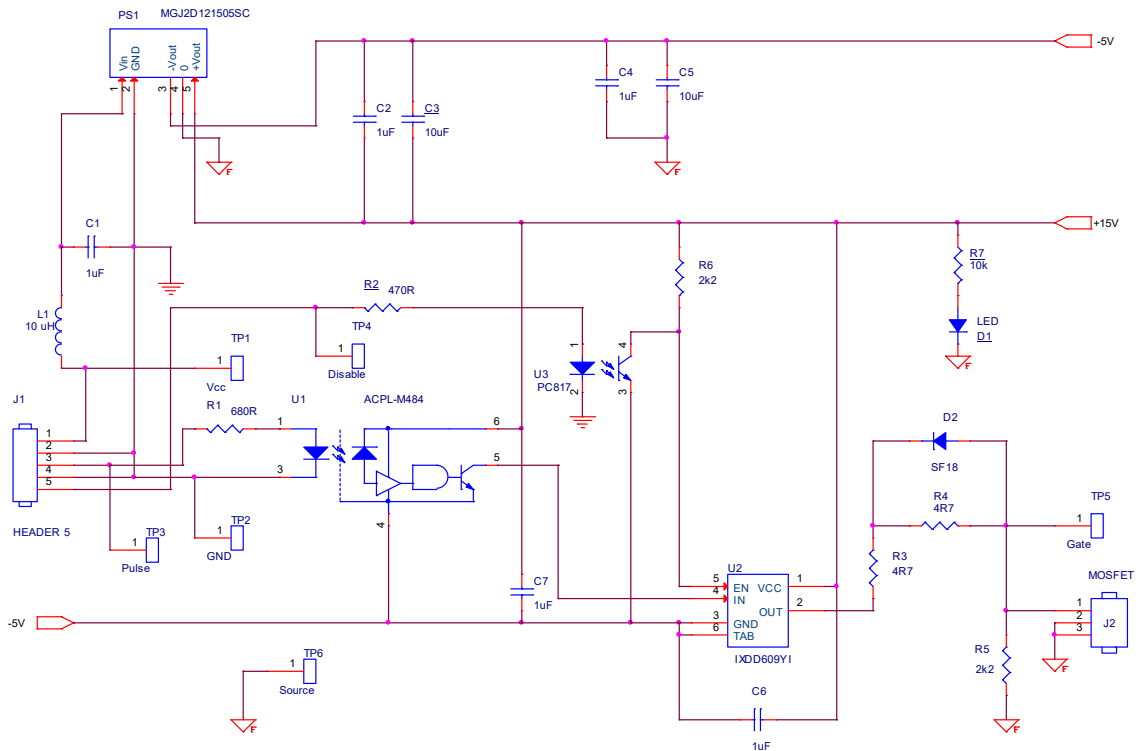


Fig.1 Electrical schematic of the Le-O2J20-09 gate amplifier.

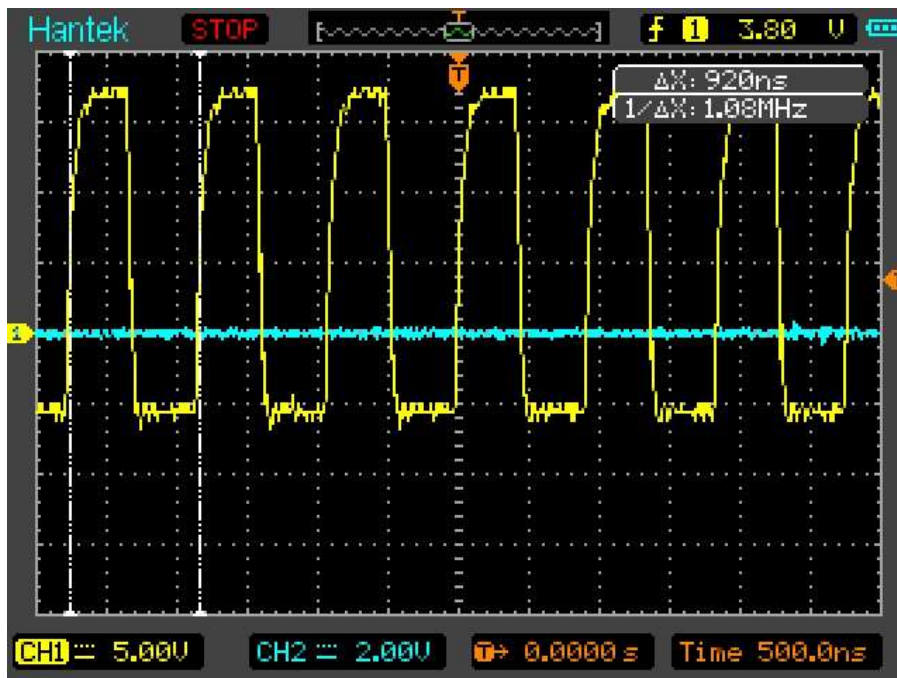
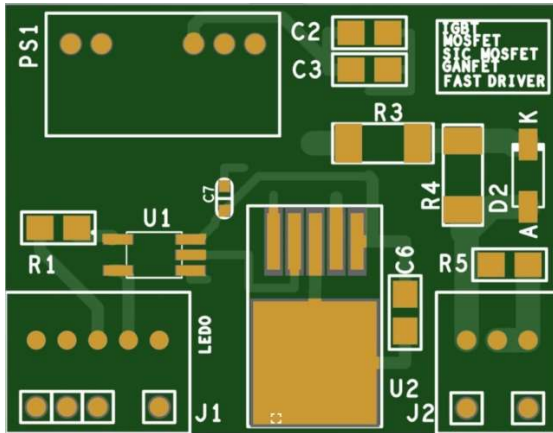


Fig.2. Signal at the Gate of CREE MOSFET C2M040120D at 1 MHz.

Fig.2 shows the work of the Driver on a C2M040120D transistor, which has an input capacitance around 2000 pF. The frequency exceeds MHz. The rising and falling edges of the signal in the Gate of the transistor can be modified by means of resistors R3, R4 and R5.



The maximum operating frequency of the amplifier is 500 kHz and depends on the total capacitance between the gate and the source of the transistor to be controlled, so that the total power consumed does not exceed 2 Watts (it is the power of the DC-DC converter that feeds the circuit). This means that the control power consumed by the transistor being controlled must not exceed 2 W.

The power needed to control a MOSFET or IGBT can be calculated by knowing the input capacitance of the transistor or the load of the input circuit, parameters that appear in the datasheet of each transistor. $P = C \cdot f \cdot V^2$

$$P = Q \cdot f \cdot V$$

Where P is the required power in Watts,

C is the input capacitance in Farads,

Q is the input circuit charge of the transistor in Coulombs,

f is the switching frequency in Hz

V is the amplitude of the signal at the output of the amplifier from peak to peak (V= 15V)

In practice, the input capacitance of the transistor is not constant or linear, and is strongly affected by the Miller effect, so its real value is greater than that shown in the datasheet. Therefore, the actual maximum frequency is much lower than that obtained by the formula above, especially when working with supply voltages greater than 500V.

The above formula only takes into account the power needed for control. There are other factors that limit the maximum working frequency, such as the heating of the different components, as the frequency increases.

The table shows the frequencies obtained in practical tests with different high voltage devices.

FREQUENCY, kHz	MOSFET	INPUT CAPACITANCE, pF
500	C3M0065090D (SiC)	660
400	C3M0065090D X 2 (SiC)	1320
380	C2M040120D (SiC)	1900
380	SCH2080KE (SiC)	1850
250	IXFH50N60P3 (Si)	6300
215	IXFK80N60P3 (Si)	13000
320	TPH3205WSBQA (GaN)	2200

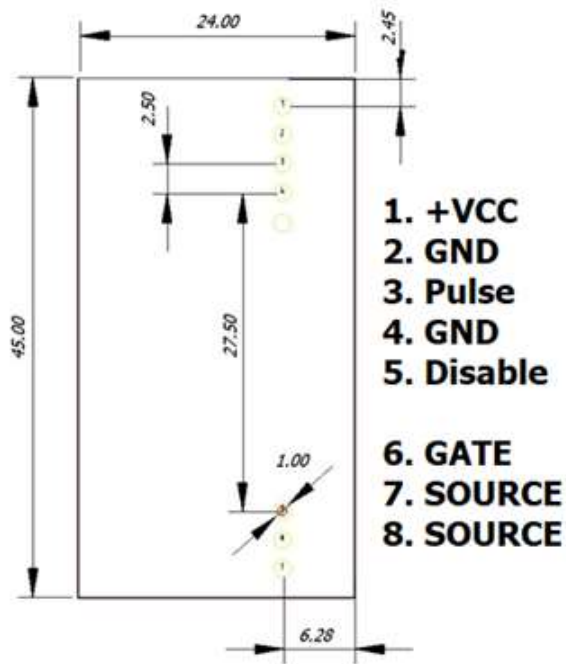


Fig.5. Pcb Footprint.

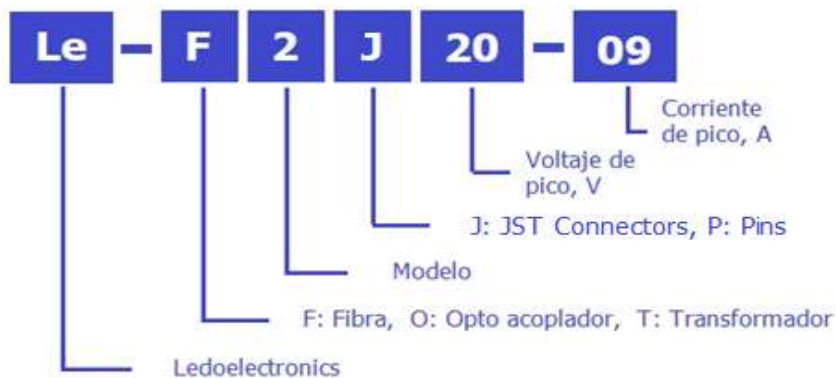


Fig.6. Structure of the name of the components of the series.