



Title: Application Note 600
Using EM Supervisory ICs in Noisy Environment

Product Family: **Supervisory ICs**

Part Number: EM6151, EM6152 (A6130, A6150, A6155, A6250, A6300, V6130, V6150, V6155, V6175)

Keywords: Decoupling, PCB layout

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Basic Principles for using EM supervisory ICs in noisy environment

When designing systems using motors and relays besides electronic parts, the designer must take care of these specific sources of disturbances. Switching inductive loads ON and OFF creates transient voltages. Transient up to 35 or 40 volts may be generated when motors are switched off. This depends on diverse factors, such as PCB layouts, decoupling, load conditions, supply cable length, impedance etc.

happen during normal operation, but during sub-assembly testing, when some particular conditions differing from the normal usage are put together, e.g. stronger power supplies, faster step-up or -down of supply voltages, longer cables in the test system than in the real application. To guarantee a safe function of the system, it is important to pay attention to the design of the schematics and PCB in order to avoid or at least efficiently damp any over- and under- voltage spikes.

In seldom cases, such transients may disturb, damage or even destroy electronic parts. Such issues do not usually

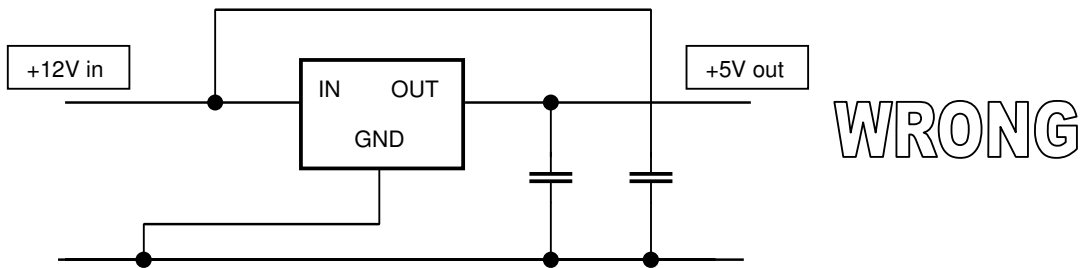


Fig. 1 Example of a non-suitable connection of decoupling capacitors. The exact implementation of this on the PCB may result in poor performances.

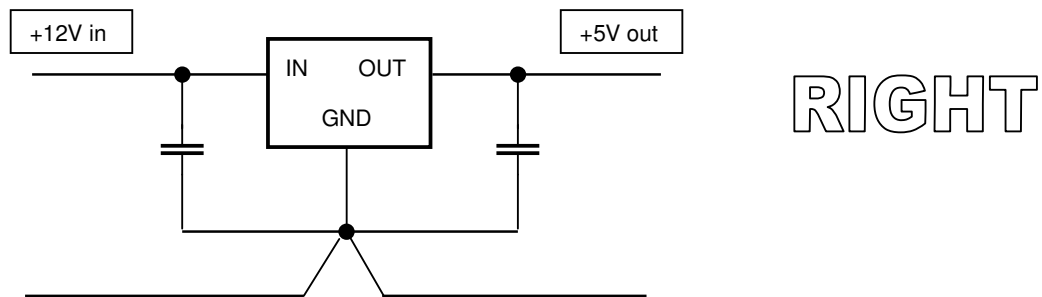


Fig. 2 Example of an improved connection of decoupling capacitors and power lines. The PCB layout should match this schematics as good as possible.

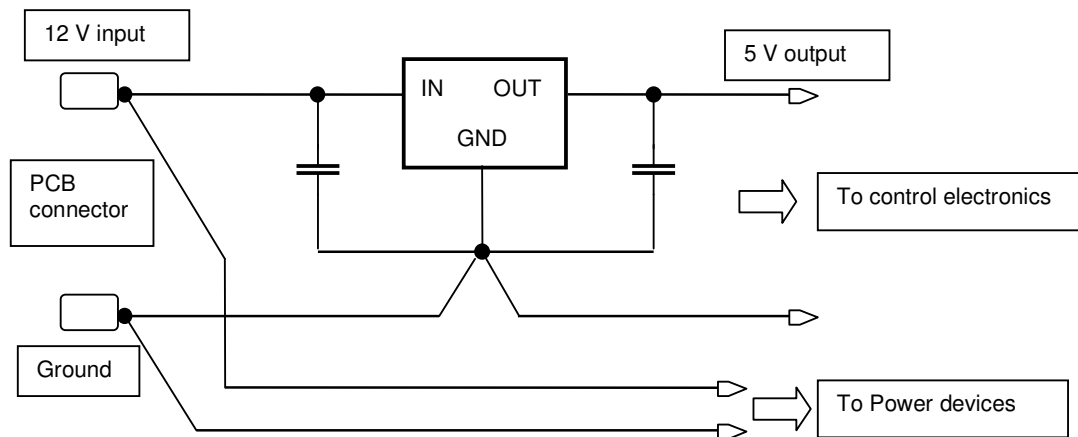


Fig. 3 In this example the supply to power devices is separated from the electronics directly at the PCB input connector.

In the case of the EM6151, EM6152, V61xx, A61xx, A6250 and A6300 watchdogs and reset ICs, we recommend the following considerations:

- Connect the components around the voltage regulator in a clean "Input to Output" way. This rule is valid for any linear regulators.
- To avoid the switching spikes coming backward to the electronics, special care must be given to the layout of the ground and supply lines. Separate as much as possible the supply lines to the power part from those to the control electronic part. The two power paths should be clearly defined from the PCB input connector immediately.
- The slew rate of any pulse at the voltage regulator INPUT terminal must be kept lower than 1V/us. This is related to the speed of the regulator's internal feedback loop. The pass transistor of the regulator acts essentially as a variable resistor, controlled as a function of the output voltage. Very fast pulses may have passed through the regulator faster than the reaction of the feedback loop. A fast transient will only be attenuated, depending on the equivalent resistors of the regulator and the load, as a resistive divider would do. The input and output capacitors will act as filters, improving the attenuation. This filter efficiency will depend on the capacitor quality and PCB layout.
- The input decoupling capacitors, as well as the way they are connected play an important role. Connecting several selected capacitors in parallel may help to attenuate the full spectrum of disturbing frequencies. Having separate paths for control and power subsystems is also helpful.
- Any spike must be suppressed as close as possible to its original place. Inductive components like relays, motors or other actuators must have an over-voltage protection device mounted as close as possible to attenuate the voltage spikes appearing when they are switched on or off. Varistors, capacitors, zener diodes or a combination of such devices may be used. Spikes that are not enough attenuated may propagate through the entire PCB due to capacitive and inductive coupling.
- At the output, a capacitor of at least 22 μ F is required, with an ESR value of less than 3 ohms. Tantalum capacitors are recommended. Several capacitors may be connected in parallel to attenuate the full spectrum of disturbing frequencies.

References

Datasheets EM6151, EM6152, A6130, A6150, A6155, A6250, A6300 which can be found on EM website www.emmicroelectronic.com.

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