

USB Power Supply 5V/1A with BJT in EmitterSwitchingTechnique.



Characteristics:

Designation: USB Power Supply with BJT

Application: Power Supply for Mobiles etc.

Power: 100-240v, 5V (USB)

Prize:

Special: Power Supply in Emitter-SwitchingTechnique. Very robust and reliable.

Fig. far left: Solution without optocoupler for regulation.

Fig. left: Solution with optocoupler.

Description:

For two examined commercial USB power supplies with a bipolar switching transistor and a control IC, where the transistor is operated in normal mode, the SOA diagram applies. The dielectric strength V_{CE} in this mode is 400V for the TS13003 transistor used, see Fig. 1a. For the EmitterSwitchingTechnique, the reverse bias SOA (SOAR) diagram applies for $V_{BE} -5V$, see Fig. 1b.

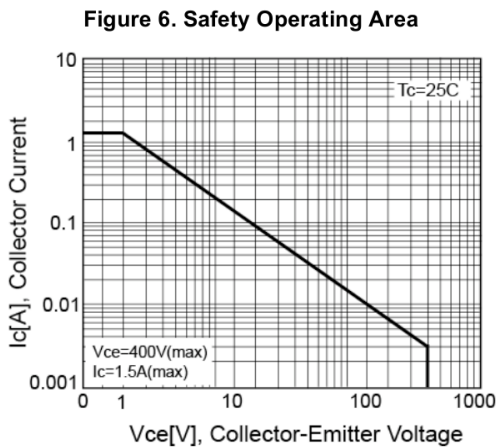


Fig. 1a: SOA of the TS13003

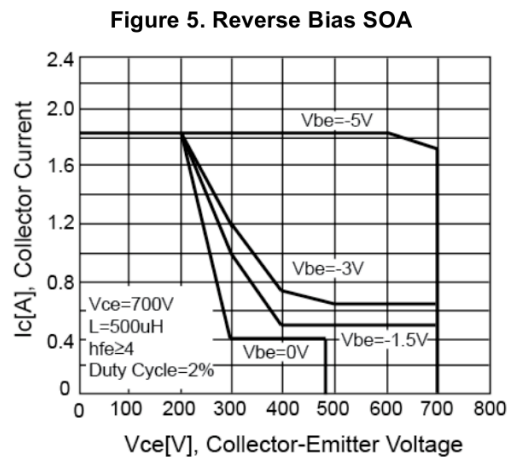


Fig. 1b: SOAR of the TS13003

It can be seen that the dielectric strength V_{CE} of the transistor is almost twice as high (700V SOAR instead of 400V SOA) as with standard control. Furthermore, all switching times are significantly shorter with EmitterSwitchingTechnology, especially the storage time t_s , which is particularly important for switching applications. This falls far below 1 μ s and is also independent of the control. Otherwise t_s is up to 5 μ s and depends strongly on the type of control. The control of the transistor in the original with a control IC allows the operation only in the SOA range, i.e. the collector-emitter voltage must not exceed 400V!

The present designs are based on commercially available power supplies with only the BJT switching transistor in EmitterSwitchingTechnique. This requires a few additional, very inexpensive components, which for this prototype are built on a small add-on board and could be integrated into the existing design. Figure 3 shows the basic circuit. In this case, the emitter-collector voltage, U_{CE} , may be 700V and poses no danger to the transistor.

Figure 2 shows the U_{CE} signals in blue and the I_{SEC} secondary current in yellow. The signals in EmitterSwitchingTechnique are the same as in the original. As can be seen, the maximum collector-emitter voltage U_{CE} is well above 500V, and thus well above the permissible 400V for SOA operation. This is not a problem for the emitter switching technology, since the voltage in this configuration may be 700V.

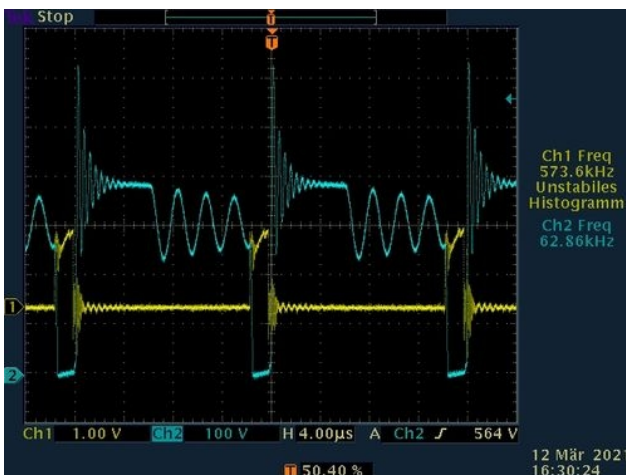


Fig. 2: Signals U_{CE} blue, U_B , yellow.

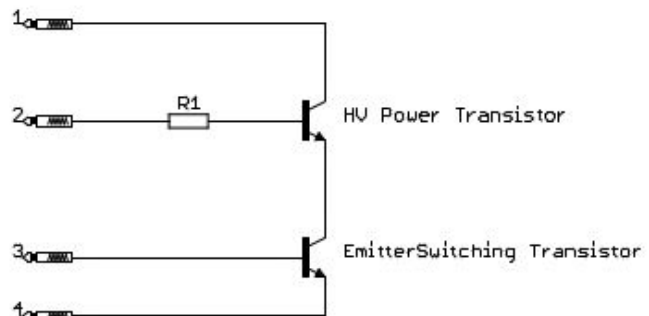


Fig. 3: EmitterSwitchingTechnique, Basic