

Main components	
STCC2540	USB charging controller with integrated power switch

Specification

As the USB became probably the most popular data and charging interface, a number of USB charged devices is still increasing. Thus it is a good solution to manufacture dual-port chargers, capable of simultaneous charging of two devices.

The problem could be the management of charging current. Maximum charging current of “small” devices like smartphones is usually around 1 Amp, while for “big” devices such as tablets it is as much as 2.1 or 2.4 Amps. For two ports it would mean that the charger must be capable to deliver 4.2 – 4.8 Amps of current (21 – 24 Watts of power). On the other side, available space is usually limited and the same is valid for cooling, so it is not easy to develop a charger capable to simultaneously charge two tablets.

Most powerful currently available USB chargers are usually capable of delivering 2.1 to 2.4 Amps. This is already enough for charging of one tablet or two smartphones. If this kind of charger is equipped with two USB ports and intelligent control managing the charging current distribution (ensuring that the total charging current does not exceed the total current budget) and providing emulation of most popular charging profiles, we get a really universal and cost effective dual-port solution.

This design note is focused on the intelligent control and charging profiles emulation part of the charger, not on the power supply part.

The functionality is following:

- Initially, when no device is attached, both ports provide identical 2.2 Amps capability, so any smartphone or tablet can be plugged in any port.
- Once the 1st device is attached e.g. to Port 1 and the charging is established, the capability of the (free) Port 2 is reduced from 2.2 Amps to 1.1 Amps (and vice versa).
- If the 2nd device is attached to the Port 2 and the charging is established, the capability of the (already occupied) Port 1 is also reduced from 2.2 Amps to 1.1 Amps. If the device plugged in Port 1 was charging at higher current than 1.1 Amps (e.g. a tablet), fault flag is asserted (and vice versa).

This simple mechanism ensures that the total current budget of 2.2 Amps is never exceeded.

Possible charging combinations are following:

Port 1	Port 2	Total current (max.)
(nothing)	(nothing)	0 A
“Small” device e.g. smartphone	(nothing)	1.1 A
(nothing)	“Small” device e.g. smartphone	1.1 A
“Small” device e.g. smartphone	“Small” device e.g. smartphone	2.2 A
“Big” device e.g. tablet	(nothing)	2.2 A
(nothing)	“Big” device e.g. tablet	2.2 A

Other combinations assert fault flag because they would exceed the total budget.

Circuit description

This smart dual-port USB charger is based on the STCC2540 devices, relying on its features:

- Emulation of most popular charging standards (BC1.2, YD/T 1591-2009, Apple divider mode, BlackBerry mode, Korean tablets mode and legacy mode)
- Current limit programmable by external resistor
- /CHARGING output asserted when the charging current is above 20 mA
- /FAULT output asserted (besides other) when the current limit or thermal shutdown is reached.

Each port is controlled by one STCC2540 device. Both STCC2540 devices U1, U2 are set to the DCP Auto mode (CTLx=001) and permanently enabled.

The basic current limit of each device is set by the resistor R2, R4 to 1.1 A. If the MOSFET Q1 or Q2 is turned on, additional programming resistor R1 or R3 is connected in parallel, increasing the current limit to 2.2 A.

MOSFET Q1, controlling the charging current of U1, is controlled by the /CHARGING output of U2 and vice versa. This ensures the above specified functionality.

The /FAULT outputs of U1 and U2 are connected in parallel and can be used e.g. for controlling the power supply, for driving a red LED signaling fault etc.

Component description and general recommendation

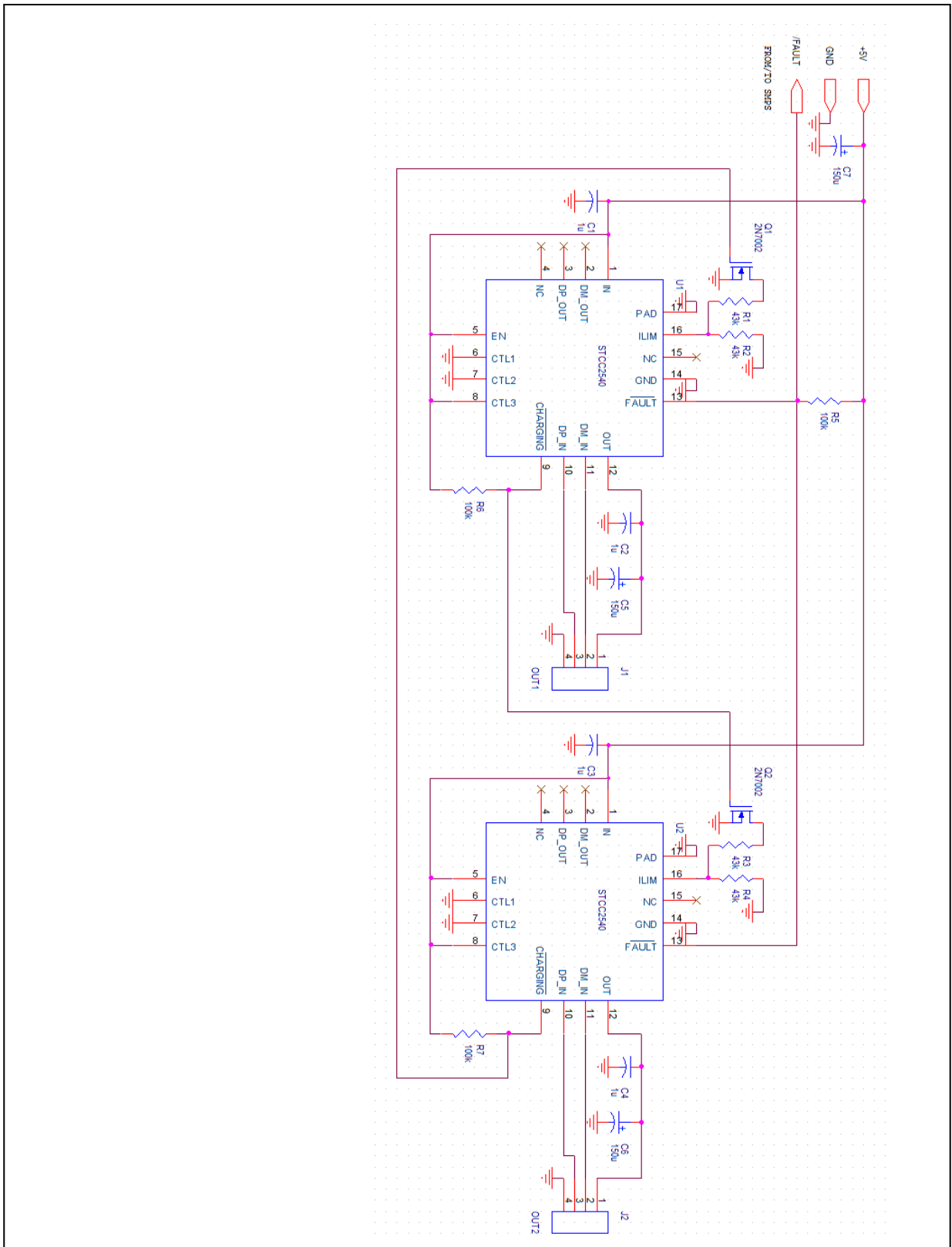
Any small N-channel MOSFET can be used as Q1, Q2.

Capacitors C1 – C4 are the decoupling capacitors required by STCC2540 and should be located as close as possible to U1, U2.

Capacitors C5, C6 are requested by the USB specification and may be located as close as possible to USB ports J1, J2.

If the power path between the 5 V power supply and U1, U2 IN pin is shorter than 15 cm and if there is a properly rated smoothing capacitor on the 5V power supply output (both is usually valid), the decoupling capacitor C7 is not necessary and can be omitted.

Figure 1. Circuit diagram



Support material

Documentation
Datasheet STCC2540, USB charging controller with integrated power switch
Design note DN0016, Dual current limit with STCC2540 / STCC5011 / STCC5021

Revision history

Date	Version	Changes
22-Aug-2013	1	Initial release

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