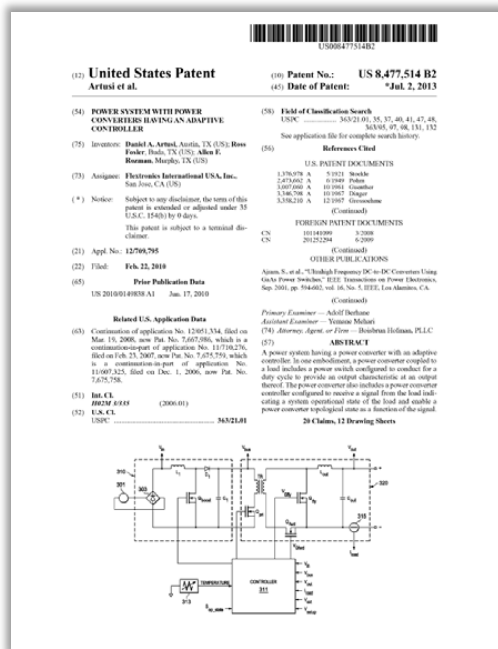


U.S. Patent No. 8,477,514 – Samsung S2MM101



Title: POWER SYSTEM WITH POWER CONVERTERS HAVING AN ADAPTIVE CONTROLLER

Priority Date: Dec. 01, 2006

Filed Date: Feb. 22, 2010

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Expiration Date: Dec. 01, 2026

Inventors: Daniel A. Artusi; Ross Fosler; Allen F. Rozman

Claims: 16, 17, 20



- All the claim elements identified herein are literally and equivalently present in the Accused Instrumentalities.
- For clarity, the portion of a cited reference that is relied upon for support may also be reproduced in the chart. Also, earlier, later, or otherwise different versions of the reference may be available but not specifically cited.
- This claim chart illustrates infringement contentions for the Samsung S2MM family, and would cover, for example, family members S2MM101 and S2MM102.
- The portion of the Accused Instrumentality covered by a claim element is typically identified by an arrow and/or outlined in the chart. Such identification is exemplary, not exclusive or exhaustive. The Asserted Claims are open ended, not close ended or improperly restricted. Additional portions of the Accused Instrumentality might also be covered by the claim element but might not be identified in the chart.
- All quantitative figures, qualitative figures and data cited in the chart are subject to measurement and/or computational variations.

Claim 16

A method of operating a **(SYS) power system**, comprising:
enabling operation of components of a **(PRO) processor system** to establish a **(DRN) state of power drain** thereof;
providing a **(S) signal** to identify **(OPN) operation** of said **(PRO) processor system** in said **(DRN) state of power drain**;
sensing a **(PL) power level** of said **(DRN) state of power drain** in response to said **(S) signal**; and
controlling an **(IOC) internal operating characteristic** of a **(PC) power converter** as a function of said **(PL) power level**.

Claim 17

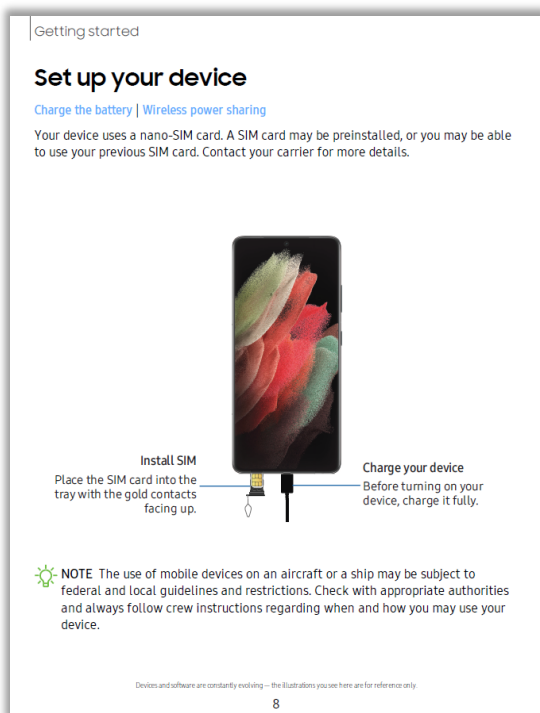
The method as recited in claim 16, further comprising:
inducing a **(PS) power switch** of said **(PC) power converter** to conduct for a **(DC) duty cycle** to provide an **output characteristic** at an **(OUT) output** thereof; and
controlling said **(DC) duty cycle** of said **(PS) power switch** dependent on said **(OC) output characteristic** in accordance with said **(PL) power level**.

Claim 20

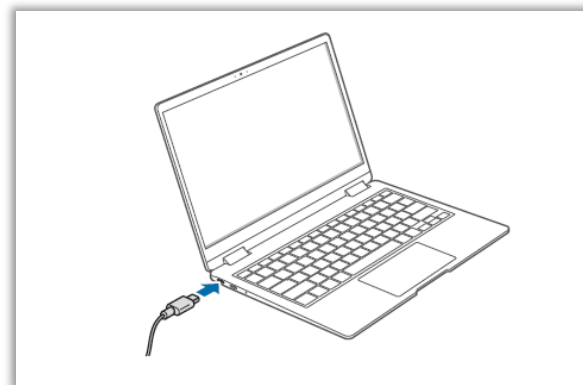
The method as recited in claim 16 wherein said **(IOC) internal operating characteristic** is selected from the group consisting of:
a gate drive voltage level of a **(PS) power switch** of said **(PC) power converter**,
a switching frequency of said **(PC) power converter**, and
an **(DCBV) internal direct current bus voltage** of said **(PC) power converter**.

Claim 16

A method of operating a (SYS) power system, comprising:



Samsung Electronics America, Inc., User Manual for Samsung Galaxy S21 5G, S21+ 5G, and S21 Ultra 5G at p. 8 (2021).



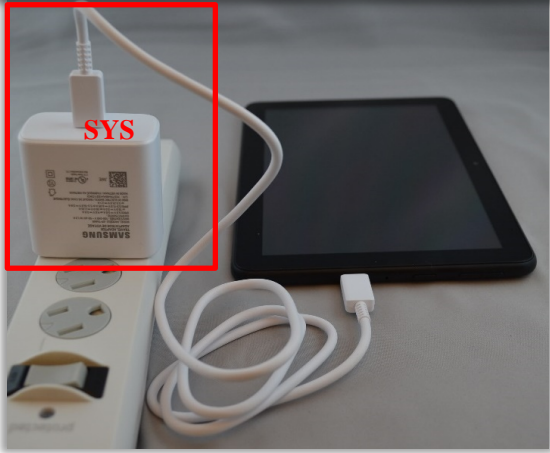
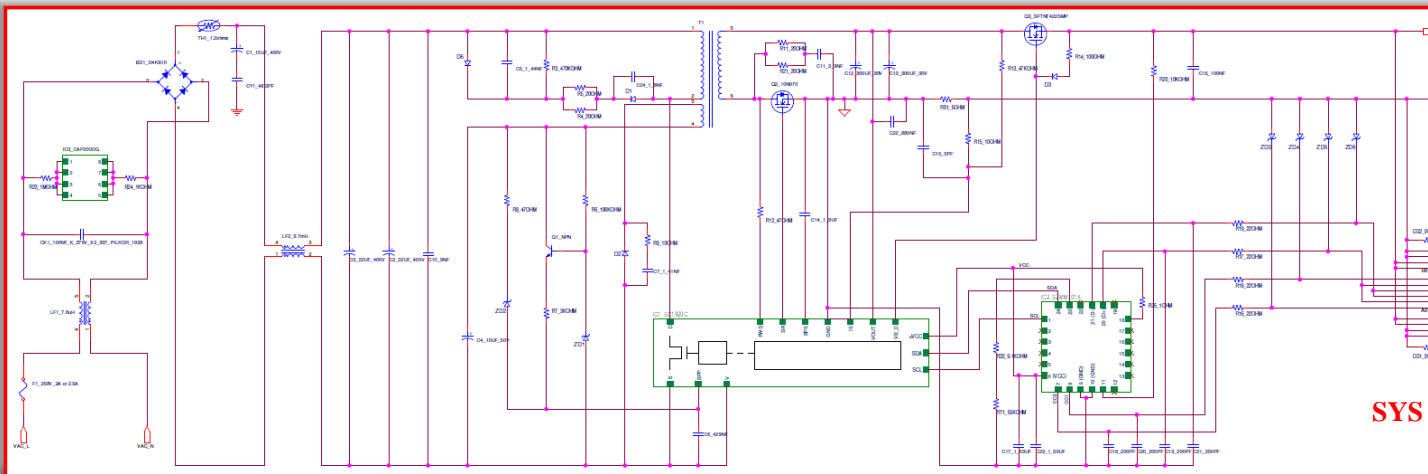
Samsung Electronics Co., Ltd., Users Guide for Samsung EP-TA865 at p. 71.

These are typical examples of Samsung generally instructing users of its power converters to couple them to loads.

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Claim 16

A method of operating a (SYS) power system, comprising:



Claim 16

enabling operation of components of a (PRO) processor system to establish a (DRN) state of power drain thereof;

4.5.2.2 Connection State Machine Requirements PRO

Entry into any unattached state when "directed from any state" shall not be used to override tDRP toggle.

A DRP or a Sink may consume default power from VBUS in any state where it is not required to provide VBUS. DRN

The following two tables define the electrical states for a CC pin in both a Source and a Sink. Every port has CC1 and CC2 pins, each with its own individual CC pin state. The combination of a port's CC1 and CC2 pin states are used to define the conditions under which a port transitions from one state to another.

Table 4-14 Source Port CC Pin State

CC Pin State	Port partner CC Termination	Voltage Detected on CC when port asserts Rp
SRC.Open	Open, Rp	Above v_{OPEN}
SRC.Rd	Rd	Within the v_{Rd} range (i.e., between minimum v_{Rd} and maximum v_{Rd})
SRC.Ra	Ra	Below maximum v_{Ra}

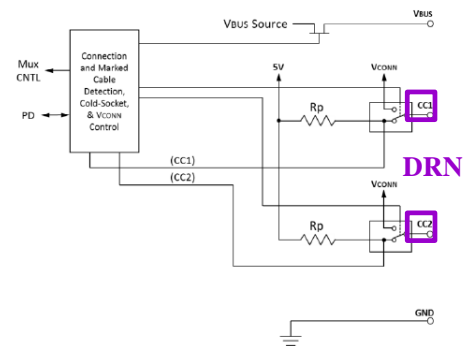
Table 4-15 Sink Port CC Pin State

CC Pin State	Port partner CC Termination	Voltage Detected on CC when port asserts Rd
SNK.Rp	Rp	Above minimum $v_{Rd-Connect}$
SNK.Open	Open, Ra, Rd	Below maximum v_{Ra}

Sink	Port asserting Rd on CC and when attached is consuming power from VBUS; most commonly a Device. DRN
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Figure 4-7 Source Functional Model for CC1 and CC2



Referring to Figure 4-7, a port that behaves as a Source has the following functional characteristics:

1. The Source uses a FET to enable/disable power delivery across VBUS and initially Source has VBUS disabled.
2. The Source supplies pull-up resistors (R_p) on CC1 and CC2 and monitors both to detect a Sink. The presence of an R_d pull-down resistor on either pin indicates a Sink is being attached. The value of R_p indicates the initial USB Type-C Current supported by the host.
3. The Source uses the CC pin pull-down characteristic to detect and establish the correct routing for the SuperSpeed USB data path and determine which CC pin is intended for supplying VCONN.
4. Once a Sink is detected, the Source enables VBUS and VCONN.
5. The Source can dynamically adjust the value of R_p to indicate a change in available USB Type-C Current to a Sink.

The source functional model detects CC1/CC2 and dynamically adjusts the current, voltage x current is the state of power drain

Source(s): [1]

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