Universal Serial Bus Hot Swap Power Controller

FEATURES

- Fully USB Compliant
- Support Four 5V Peripherals and One USB 3.3V Controller
- Separate Power Enables
- 500mA Current Limiting per Channel
- Separate Open Drain Fault Indicator for Each Channel
- 3.3V Output for USB Controller
- Available in 28 Pin Wide Surface Mount and DIP

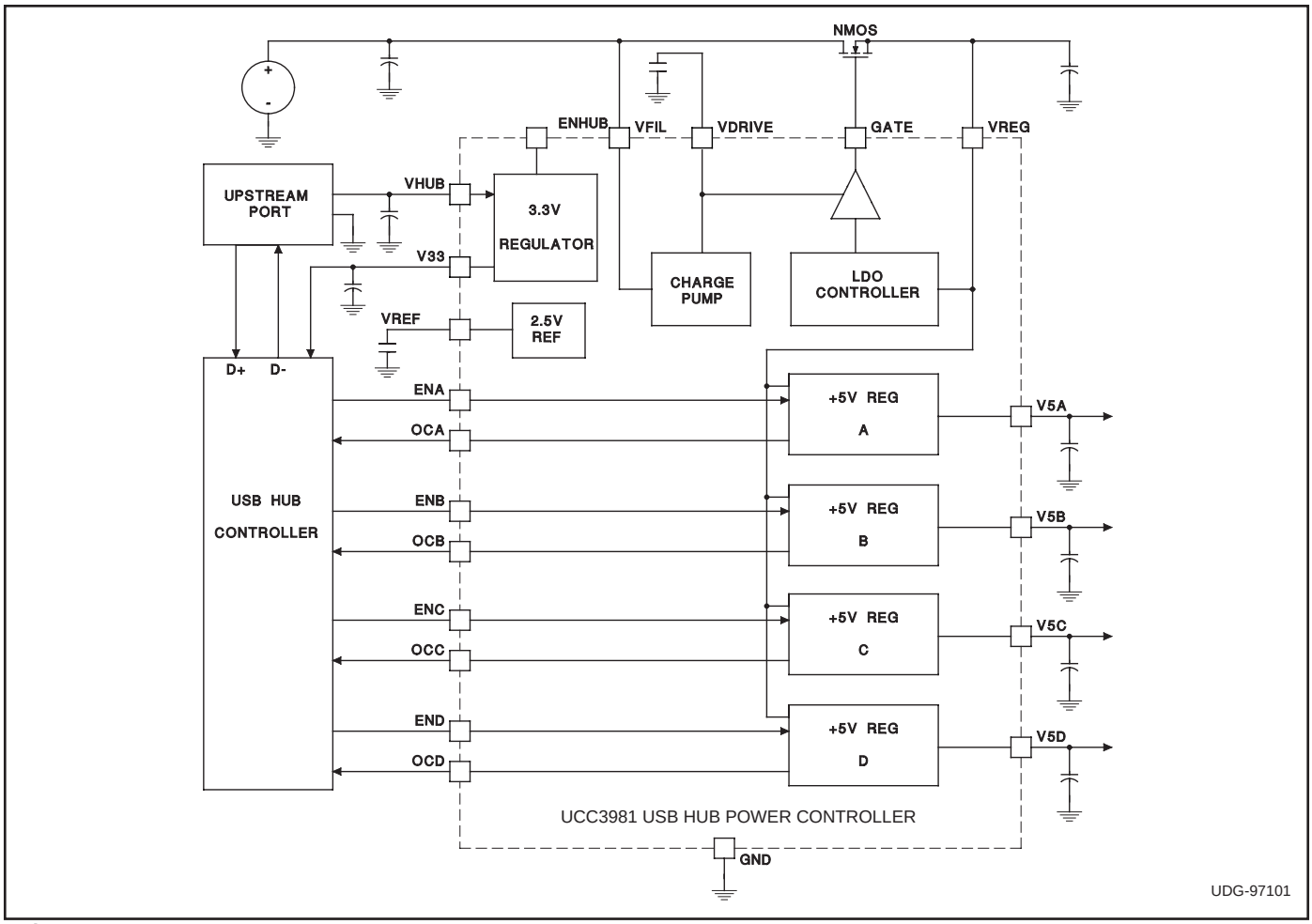
DESCRIPTION

The UCC3981 Hot Swap Power Controller is designed to provide a self powered USB hub with a local 3.3V regulated voltage and four 5V regulated voltages for USB ports. Each of the 5V output ports is individually enabled for optimal port control. Each port also provides an overcurrent fault signal indicating that the port has exceeded a 500mA current limit. The 3.3V linear regulator is used to power the local USB microcontroller. This regulator is protected with a 100mA current limit and has a logic level enable input.

The UCC3981 can be configured to provide USB port power from a loosely regulated voltage such as a Filament voltage internal to a monitor. Pre-regulation is provided by an internal linear regulator controller and one external logic level N-channel MOSFET. The UCC3981 can also be configured without using the pre-regulator stage by connecting the VREG pins to a regulated 5.5V 2A source.

The UCC3981 comes in a 28-pin wide SOIC power package optimized for power dissipation, and is protected by internal over-temperature shutdown mechanism, which disables the outputs should the internal junction temperature exceed 150°C.

APPLICATION AND BLOCK DIAGRAM



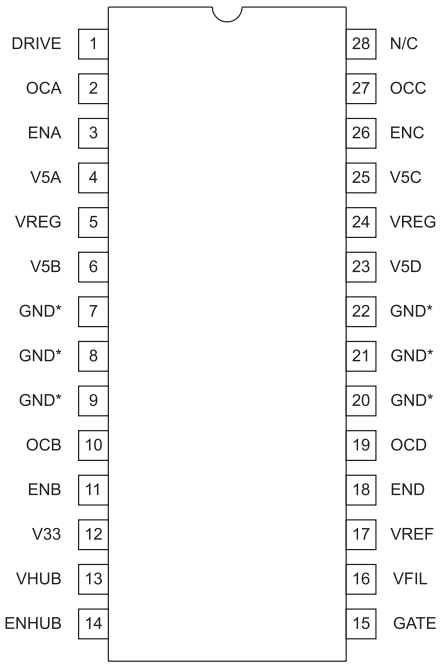
ABSOLUTE MAXIMUM RATINGS

VFIL 9V
VCON Supply Votage 9V
Logic Inputs (ENA-D, ENHUB)
  Maximum Forced Voltage . . . . . –0.3V to 7V
  Maximum Forced Current . . . . . ±1mA
V33
  Maximum Forced Voltage 5V
  Maximum Current 200mA
V5A-D
  Maximum Voltage 9V
  Maximum Current 750mA
Storage Temperature . . . . . –65°C to +150°C
Junction Temperature . . . . . –55°C to +150°C
Lead Temperature (Soldering, 10 sec.) . . . . . +300°C

Unless otherwise indicated, voltages are reference to ground. Pulsed is defined as a less than 10% duty cycle with a maximum duration of 500µS. Currents are positive into, negative out of the specified terminal. All voltages are with respect to ground. Consult Packaging Section of Databook for thermal limitations and considerations of packages.

CONNECTION DIAGRAM

SOIC-28 (Top View)
DWP Package



** DWP package pin 28 serves as signal ground; Pins 7, 8, 9, 20, 21, 22 serve as heatsink/ground.*

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, T_J = 0°C to 125°C for the UCC3981. VFIL = 6.5V, VHUB = 5V. $T_A = T_J$.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Input Supply Currents					
VHUB Supply Current	No External Load on V33		1	3	mA
VFIL Supply Current			1	3	mA
Reference					
VREF Voltage	Over Temperature	2.35	2.5	2.65	V
Line Regulation	VHUB = 4.5V to 9V		3	10	mV
3.3V Regulator					
V33 Voltage	T_J = 25°C, I_{LOAD} = 10mA	3.2	3.3	3.4	V
	0mA to 100mA, 0°C to 125°C, VHUB = 4.5V to 9V	3.165	3.3	3.435	V
Short Circuit Current Limit	VHUB = 6V, Output shorted to Ground	100	120	150	mA
Pre-Regulator					
VREG Voltage	0A to 2A, 0°C to 125°C, VFIL = 6V to 9V	5.25	5.5	5.7	V
5V Regulator					
V5A-D Voltage	T_J = 25°C, I_{LOAD} = 250mA, V_{REG} = 5.5V	4.85	5	5.15	V
	0mA to 500mA, 0°C to 125°C	4.8	5	5.2	V
Short Circuit Current Limit	VREG = 5.5V, Output Shorted to Ground	500	600	750	mA
Charge Pump					
Quiescent Output Voltage	T_J = 25°C, VFIL = 6V, ENA-D = 5V, ENHUB = 5V	11	11.45	12	V
	0°C to 125°C, VFIL = 6V	10.5	11.45	12	V
Output Impedance			9	15	kΩ

ELECTRICAL CHARACTERISTICS Unless otherwise specified, T_J = 0°C to 125°C for the UCC3981. VFIL = 6.5V, VHUB = 5V. $T_A = T_J$.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Enable Inputs					
ENA-D Inputs - Guaranteed Low				0.7	V
ENA-D Inputs - Guaranteed High		3			V
ENHUB Input - Guaranteed Low				0.7	V
ENHUB Input - Guaranteed High		3			V
Overcurrent Signals					
Active Sink Current	I_{OCX} =100µA		140	500	mV

PIN DESCRIPTIONS

ENA-D: Separate enables pins for each of the four 5V supplies.

ENHUB: Enables the 3.3V output V33. Pulling this pin low disables V33.

GATE: Gate drive for an external NMOS used to regulate the 5.5V VREG supply. Minimum available drive is 11V.

GND: All 6 GND pins must be tied to the system ground. In addition to serving as electrical conductors, these 6 pins are heat sinks. Refer to the Packaging Device Temperature Management guide in the Packaging section of the Unitrode Databook.

OCA-D: Open drain overcurrent indicator. OCA-D can be wire OR'ed by the user to create a single overcurrent indicator.

V5A-D: 5V regulated output with enable, 500mA (minimum) current limit, and overcurrent indicator.

V33: 3.3V regulator output. Enable when ENHUB is high. Current limit is 100mA minimum.

VDRIVE: Internal charge pump voltage is brought out for external decoupling. Nominal voltage is between 11V and 13V. No external loading permitting. Decouple with at least 0.001µF capacitor.

VFIL: Bias supply for all four of the 5V regulators. VFIL voltage must be between 6V and 9V.

VHUB: Supply for the 3.3V USB controller power supply and bandgap reference.

VREF: Internal 2.5V reference is brought out for external decoupling only. Decouple with 0.01µF capacitor.

VREG: Regulated to 5.5V by means of an external NMOS. Two pins supply up to a total of 2.5A to the four 5V bus voltages (V5A, V5B, V5C, V5D).

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PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
UCC3981DWP	OBSOLETE		UTR			TBD	Call TI	Call TI

[1] The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

[3] MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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