USB Power Delivery 3.0 Controller with Integrated Current Sense Supports Qualcomm Quick Charge 4+

1 Description

The iW657P is a USB Power Delivery (USB PD) interface controller which handles the communication between a Power Adapter and Mobile Device (MD). The controller enables the mobile device to alter the V_{BUS} voltage from the default 5V and/or maximum current limitation (e.g. 3A) for higher power output or better efficiency. The iW657P supports USB PD 3.0, including Programmable Power Supply (PPS) support, while being backwards compatible with USB PD 2.0. The device also supports Qualcomm® Quick Charge™ 4+ technology. The iW657P enables the use of advanced USB Type-C™ connector technology with CC1/CC2 pins for MD attach/detach detection and V_{CONN} support for Electronically Marked Cable (EMC) rated current reading. The iW657P also integrates a high current charge-pump circuit to drive an external NFET V_{BUS} disconnect switch.

The iW657P resides on the secondary side of an AC/DC power supply and negotiates voltage and current settings with the primary-side controller, depending on the requests from the MD. The iW657P uses Dialog's proprietary secondary-to-primary digital communication technology and when paired with one of Dialog's primary-side ***RapidCharge***™ controllers, such as the iW1791 or iW1799, the iW657P eliminates the need for a discrete decoder on the primary side by using one optocoupler to transmit all necessary information for rapid charging to the primary side. This includes output voltage requests, output current limits, output voltage undershoot, output over-voltage, and fault and reset signals. The iW657P incorporates Dialog's proven and reliable DLNK technology to communicate from the secondary to the primary and also has a built-in optocoupler LED driver to minimize the bill of material cost.

The power supply designed with the iW657P is fully protected. Using over-voltage protection on the D+/D-/CC1/CC2 pins, the iW657P helps to address soft short issues in cables and connectors caused by poor or loose connections between the cable connector and the socket, contamination in the USB connector, or a worn out cable. Additionally, proprietary short circuit protection on the V_{BUS} NFET ensures safe operation in the event of a short on the output, while the SD pin can be used with an external NTC resistor for protection from over-temeperature faults. The iW657P also integrates a secondary-side current sensing circuit that provides additional over-current protection for the power adapter.

2 Features

- USB-IF PD certified: USB PD 3.0 + Programmable Power Supply (PPS)
  - » Maximum power limit in PPS to minimize power adapter size
  - » Integrated CC transmitter/receiver supports BMC communication
  - » Backwards-compatible with USB PD 2.0
- Supports Qualcomm Quick Charge 4+ Technology
- Supports up to 7 Power Data Objects (PDOs)
- Supports wide output voltage range from 3.3 to 21V
- Compatible with USB Type-C specification Rev 1.2 for MD attach/detach detection and V_{CONN} support for smart cables
- Integrated charge pump supports single NFET V_{BUS} switch
- 9-bit ADC provides accurate current (optional) and voltage sensing
- Proprietary V_{BUS} NFET protection to protect V_{BUS} switch from damage due to an output short circuit
- Proprietary secondary-to-primary digital communication eliminates discrete decoders on the primary side and simplifies system designs
- D+/D-/CC1/CC2 over-voltage protection (OVP) address soft short issues in the output cables and connectors
- Optional secondary-side current sensing circuit provides additional protection for over-load fault
- Uses external NTC for power adapter temperature sensing
- Programmable active fast discharge from a high voltage V_{BUS} level to 5V at MD unplug or upon request with built-in switch or external switch
- Intelligent circuits helps achieve < 20mW system no-load power at 5V steady-state operation.
- 14-pin 4x3mm TDFN package

3 Applications

- Rapid-charging AC/DC adapters for smart phones, tablets and other portable devices

Qualcomm® Quick Charge™ is a product of Qualcomm Technologies, Inc.

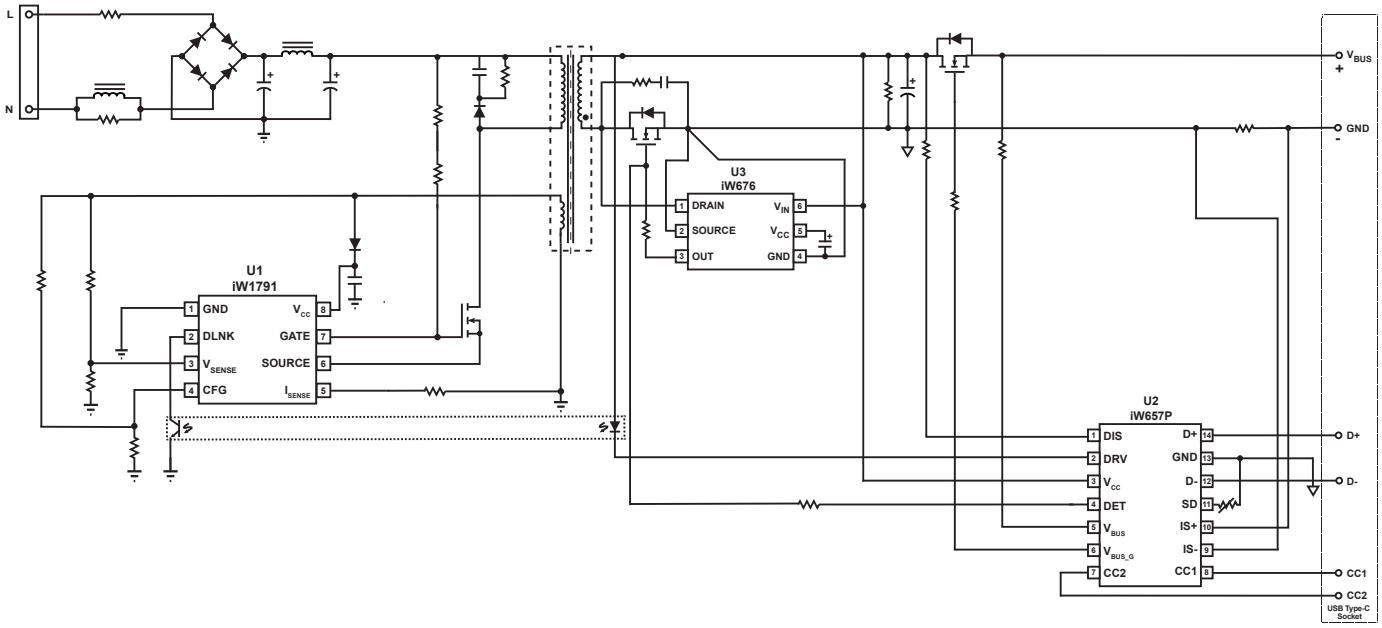


Figure 3.1 : iW657P Typical Application Circuit with Secondary-Side Current Sensing (with iW1791 as the Primary-Side Controller and the iW676 as the Synchronous Rectifier Controller)

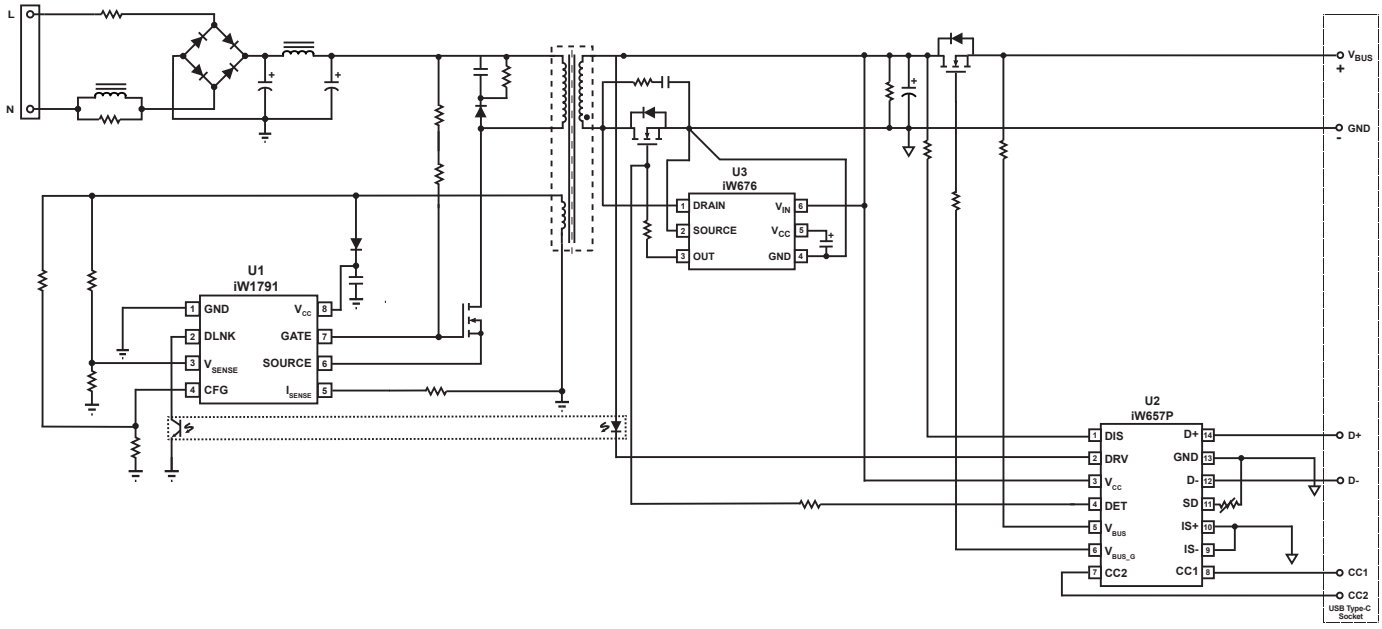


Figure 3.2 : iW657P Typical Application Circuit without Secondary-Side Current Sensing (with iW1791 as the Primary-Side Controller and the iW676 as the Synchronous Rectifier Controller)

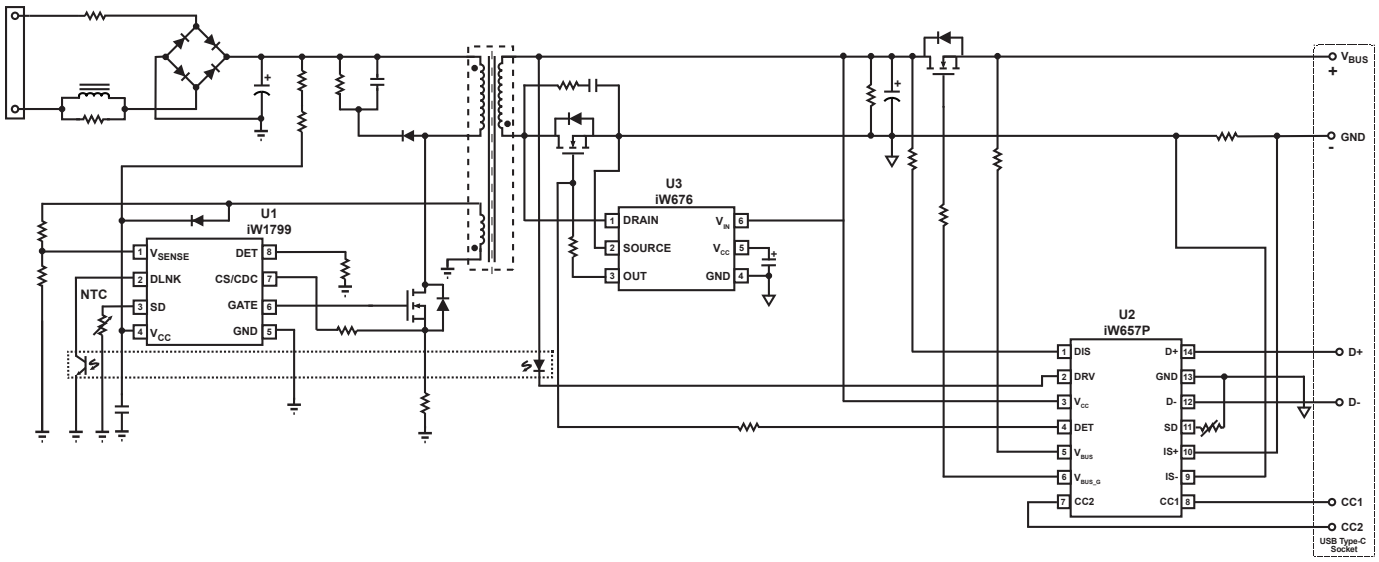


Figure 3.3 : iW657P Typical Application Circuit with Secondary-Side Current Sensing (with iW1799 as the Primary-Side Controller and the iW676 as the Synchronous Rectifier Controller)

4 Pinout Description

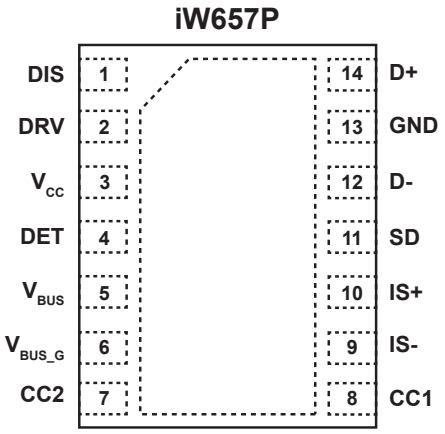


Figure 4.1 : 14-Lead TDFN 4x3mm Package
(Top View, Transparent)

Pin Number DFN-14	Pin Name	Type	Pin Description
1	DIS	Analog Output	Discharging circuit. Used for fast discharging of output capacitor.
2	DRV	Analog Output	External circuit drive. Can be used to drive optocoupler LED with automatic current limiting for transmitting signals to primary side.
3	V_{CC}	Power Supply	IC power supply.
4	DET	Analog Input	AC unplug detect.
5	V_{BUS}	Analog Input/ Output	Monitor V_{BUS} voltage after N-FET switch.
6	V_{BUS_G}	Analog Input/ Output	Connect to external N-FET gate pin for gate-source voltage control.
7	CC2	Analog Input/ Output	Configuration Channel 2.
8	CC1	Analog Input/ Output	Configuration Channel 1.
9	IS-	Analog Input	Output current sensing terminal - (for current sensing resistor).
10	IS+	Analog Input	Output current sensing terminal + (for current sensing resistor).
11	SD	Analog Input/ Output	Connect to an external NTC resistor to measure the power adapter temperature.
12	D-	Analog Input/ Output	USB D- signal.
13	GND	Ground	Ground.
14	D+	Analog Input/ Output	USB D+ signal.

5 Absolute Maximum Ratings

Absolute maximum ratings are the parameter values or ranges which can cause permanent damage if exceeded.

Parameter	Symbol	Value	Units
V_{CC} voltage	V_{CC}	-0.3 to 30	V
DIS voltage	V_{DIS}	-0.3 to 30	V
DRV voltage	V_{DRV}	-0.3 to 30	V
V_{SD} voltage	V_{SD}	-0.3 to 7	V
D- voltage	V_{D-}	-0.3 to 7	V
D+ voltage	V_{D+}	-0.3 to 7	V
CC1 voltage	V_{CC1}	-0.3 to 30	V
CC2 voltage	V_{CC2}	-0.3 to 30	V
V_{BUS} voltage (I_{VBUS} < 10mA)	V_{BUS}	-0.7 to 30	V
V_{BUS_G} voltage	V_{BUS_G}	-0.7 to 35	V
DET voltage	V_{DET}	-0.7 to 30	V
Peak current at DIS pin (V_{DIS}= 12V)	I_{DIS}	600	mA
IS+ voltage	V_{IS+}	-0.3 to 7	V
IS- voltage	V_{IS-}	-0.3 to 7	V
Maximum junction temperature	T_{JMAX}	150	°C
Operating junction temperature	T_{JOPT}	-40 to 150	°C
Storage temperature	T_{STG}	-65 to 150	°C
ESD rating per JEDEC JS-001-2017 (D+, D-, CC1, CC2)		±8,000	V
ESD rating per JEDEC JS-001-2017 (all other pins)		±2,000	V

Notes:

Note 1. Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, so functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

6 Physical Dimensions

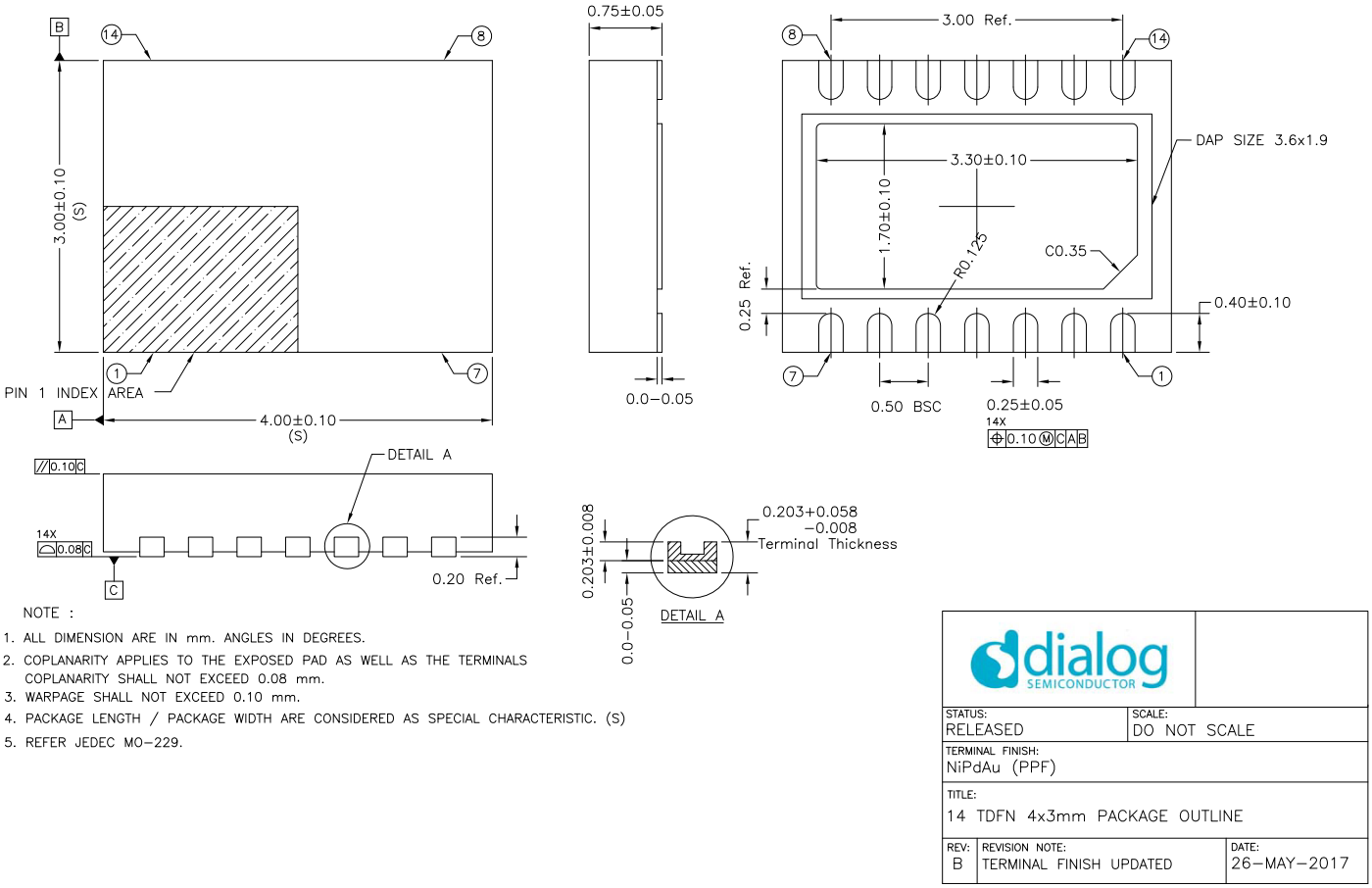
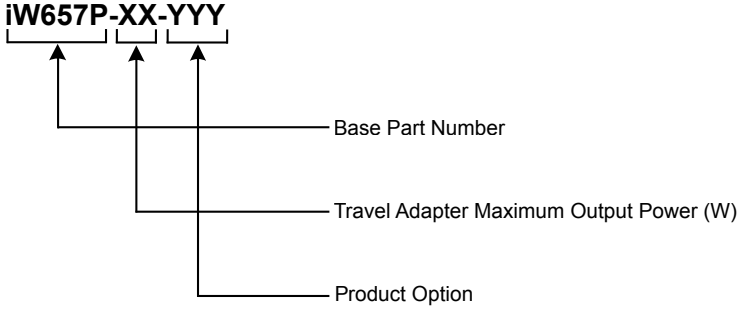


Figure 6.1 : 14-Lead TDFN 4x3mm Package

7 Part Number Code Description



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