iW780

Programmable AC/DC Multi-Protocol Controller with Integrated Secondary-Side Regulation

The iW780 is a programmable AC/DC multi-protocol controller with integrated secondary-side regulation for USB Power Delivery (PD) 3.1 and multiple D+/D- fast charging protocols. The device integrates a secondary-side regulation controller, interface protocol controller, and USB VBUS NFET driver into a single IC.

The iW780 has an internal MCU and hardware interface for multiple protocols. It allows rapid charge of PD or D+/D- protocol-enabled mobile devices (MDs) or notebook PC (NB) and automatically distinguishes between the different protocols. It resides on the secondary side of an AC/DC power supply and allows the adapter to be configured for multi-level output voltage and current.

The iW780 measures the output voltage and load current in real-time. The measurement results are sent to a digital compensator for closed-loop control of the flyback converter. The digital control signal generated by the compensator is converted to an analog signal and transferred to the primary-side controller via an optocoupler.

The iW780 are optimized to pair with Renesas' high-power-density ZVS Flyback primary-side controller to achieve high efficiency, low no-load power consumption, accurate voltage/current control, and fast dynamic load response. It can also pair with other PWM controllers and SR controllers. And, it also includes the necessary hardware for different multi-port design configurations with minimum BOM cost.

Features

- Internal MCU with OTP (One Time Programming)
- Supports USB PD3.0 with PPS
- Supports USB PD3.1 EPR
- Supports UFCS (Universal Fast Charging Specification)
- Supports various D+/D- protocols
  - HUAWEI SCP
  - VIVO Fast Charging
  - OPPO VOOC
  - Qualcomm® Quick Charge 3.0+, Etc.
- High-resolution accurate multi-level output voltage and current control
- Built-in digital loop compensation to minimize the external component count. Support up to 500kHz switching frequency, and GAN switch on the primary side
- Optimized to pair with all the Renesas primary-side controllers with secondary feedback
- Optimized to pair with Renesas SR controller iW610 in both high-side and low-side configurations
- Can pair with other PWM controllers and SR controllers
- NFET driver for VBUS switch
- Internal active fast discharge
- Intelligent standby mode: enables < 5mW standby power consumption for 45W Travel Adapter (TA) when V_{BUS} is off.
- Intelligent low power mode: < 3mA operation current in low power mode
- Optional constant power regulation
- Peak current configuration for Notebook TA
- High/low line sensing
- Wide V_{VIN} operating range from 2.7V to 30V
- Can provide up to six GPIOs
- Built-in hardware I^2C master can communicate with an external DC-DC converter to support multi-port chargers
- Comprehensive firmware-configurable protection features, including OVP, OTP, OCP, OSP, and LPS fault protection.
- Package: TDFN16 5x4mm

Applications

- Direct-charge AC/DC adapters for USB PD enabled smart phones, tablets and other mobile devices and notebook PC
- Multi-port chargers

Contents

1. Overview

1.1 Typical Application

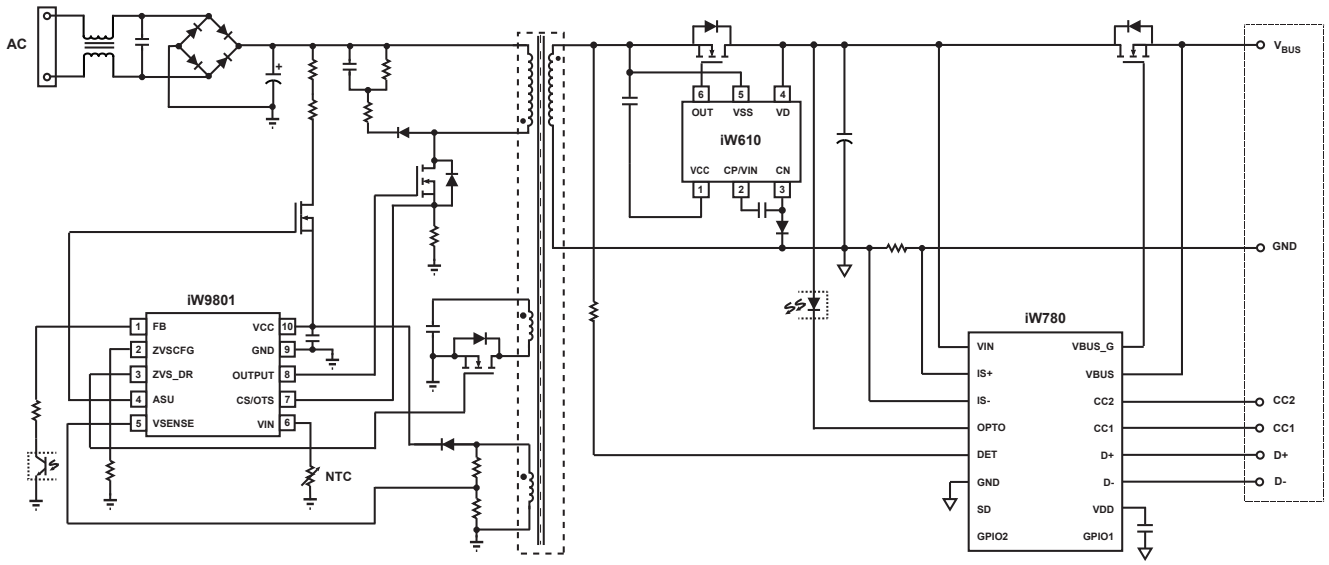

Figure 1. iW780 Typical Application Circuit with iW610/iW9801 for Single Port Charger

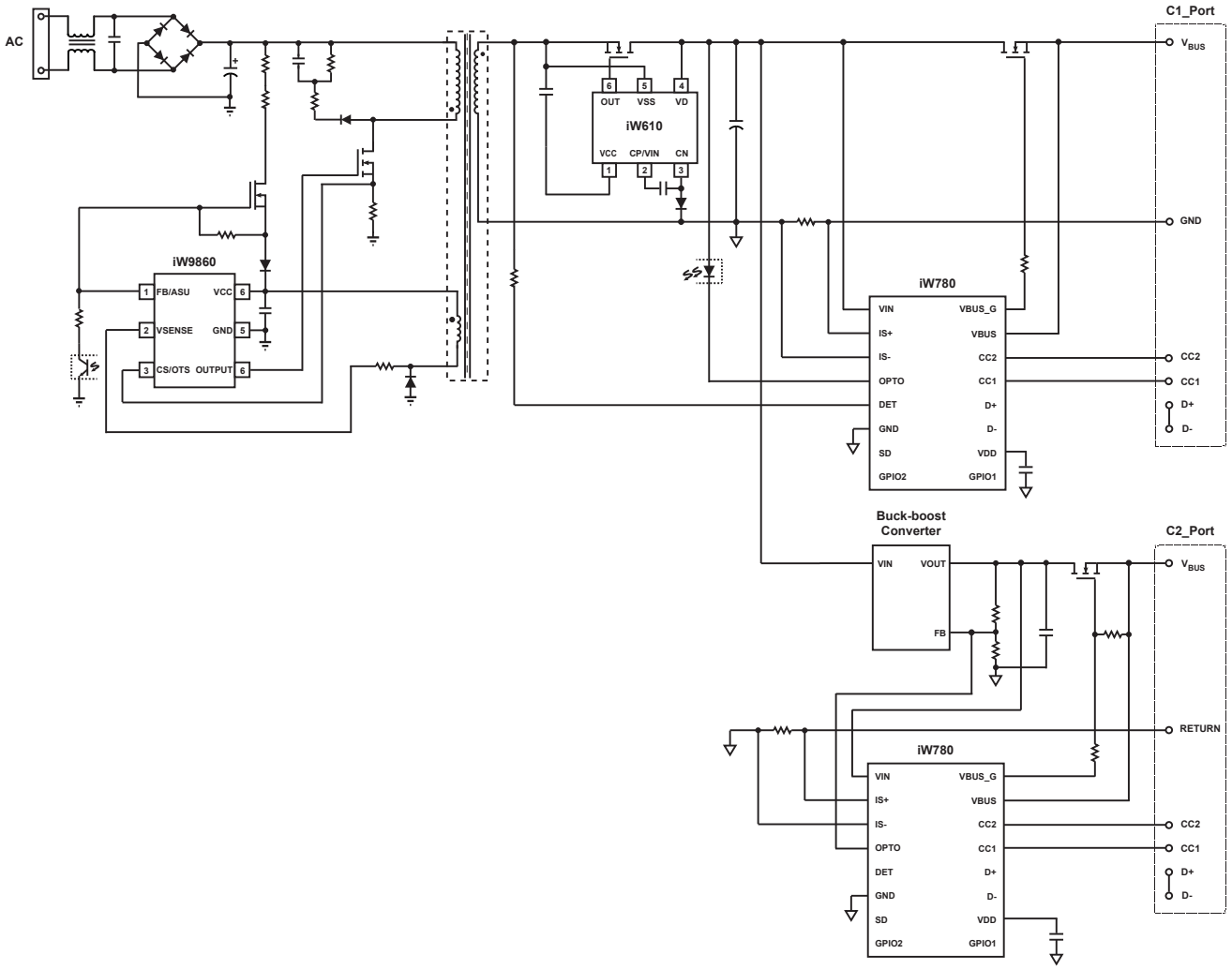

Figure 2. iW780 Typical Application Circuit with iW610/iW9860 for 2C Dual-Port Charger

2. Pin Information

2.1 Pin Assignments

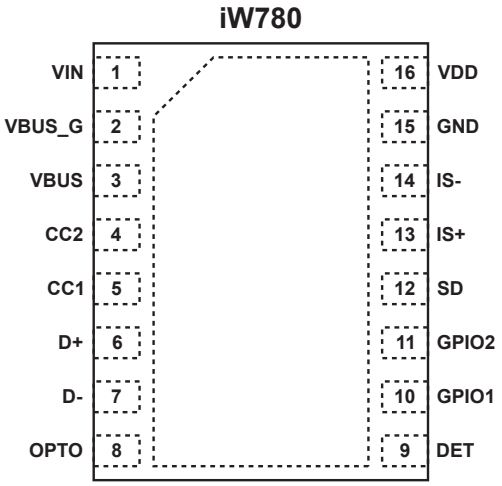

Figure 3. 16-Lead TDFN 5x4mm Pinout Diagram (Top View)

2.2 Pin Descriptions

Pin Number	Pin Name	Type	Description
1	VIN	Power	Voltage supply for the IC and output voltage sensing input
2	VBUS_G	Analog Output	Gate driver for the external VBUS switch
3	VBUS	Analog Input	Connect to VBUS switch source pin
4	CC2	Analog Input/Output	Communication channel 2
5	CC1	Analog Input/Output	Communication channel 1
6	D+	Analog Input/Output	USB D+ signal
7	D-	Analog Input/Output	USB D- signal
8	OPTO	Analog Output	Optocoupler driver
9	DET	Analog Input/Output	Primary side switching detection.
10	GPIO1	Analog Input/Output	GPIO pin. It can also be configured as line sensing input
11	GPIO2	Analog Input/Output	GPIO pin. It can also be configured as line sensing input or output voltage sensing pin
12	SD	Analog Input/Output	Connect to an NTC; It can also be configured as a GPIO
13	IS+	Analog Input	Connect to current sensing resistor "+ "end
14	IS-	Analog Input	Connect to current sensing resistor "-" end
15	GND	GND	IC ground
16	VDD	Power	Digital circuit power supply. Connect to an external 4.7μF capacitor

3. Specifications

3.1 Absolute Maximum Ratings

CAUTION: Do not operate at or near the maximum ratings listed for extended periods of time. Exposure to such conditions can adversely impact product reliability and result in failures not covered by warranty.

Parameter	Symbol	Minimum	Maximum	Unit
V_{VIN} DC Supply Voltage Range (I_{VIN} = 15mA max)	V_{VIN}	-0.3	32	V
Continuous DC Supply Current at VIN pin (V_{VIN} = 28V)	I_{VIN}		15	mA
Peak Current at VIN pin (V_{VDIS} = 28V; I_{DD} + Max Discharge Current)	I_{VIN_DIS}		175	mA
VDD Voltage	V_{DD}	-0.3	1.8	V
Continuous DC Supply Current at VDD pin (V_{VIN} = 4.5V)	I_{VDD}		10	mA
OPTO Voltage	V_{OPTO}	-0.3	32	V
D+ Voltage	V_{D+}	-0.3	28	V
D- Voltage	V_{D-}	-0.3	28	V
CC1 Voltage	V_{CC1}	-0.3	28	V
CC2 Voltage	V_{CC2}	-0.3	28	V
IS+ Voltage	V_{IS+}	-0.3	6	V
IS- Voltage	V_{IS-}	-0.3	6	V
GPIO Voltage	V_{GPIO}	-0.3	6	V
SD Voltage	V_{SD}	-0.3	6	V
VBUS Voltage (I_{BUS} < 10mA)	V_{VBUS}	-0.7	32	V
VBUS_G Voltage	V_{VBUS_G}	-0.7	38	V
DET Voltage	V_{DET}	-0.3	6	V
VSNS Voltage	V_{SNS}	-0.3	6	V

3.2 ESD Ratings

ESD Model/Test	Rating	Unit
JEDEC JS-001-2017 (HBM) (CC1/CC2/D+/D- pins)	±4,000	V
JEDEC JS-001-2017 (HBM) (all other pins)	±2,000	V

3.3 Thermal Specifications

Thermal Resistance (Typical)	θ_{JA} (°C/W)
16-Led TDFN Package	25

3.4 Recommended Operating Conditions

Parameter	Symbol	Minimum	Maximum	Unit
Maximum Junction Temperature	T_{JMAX}	-40	+150	°C
Maximum Ambient Temperature	T_A	-40	+85	°C
Voltage on VIN pin	V_{VIN}		30	V

4. Package Outline Drawings

The package outline drawings are located at the end of this document and are accessible from the Renesas website. The package information is the most current data available and is subject to change without revision of this document.

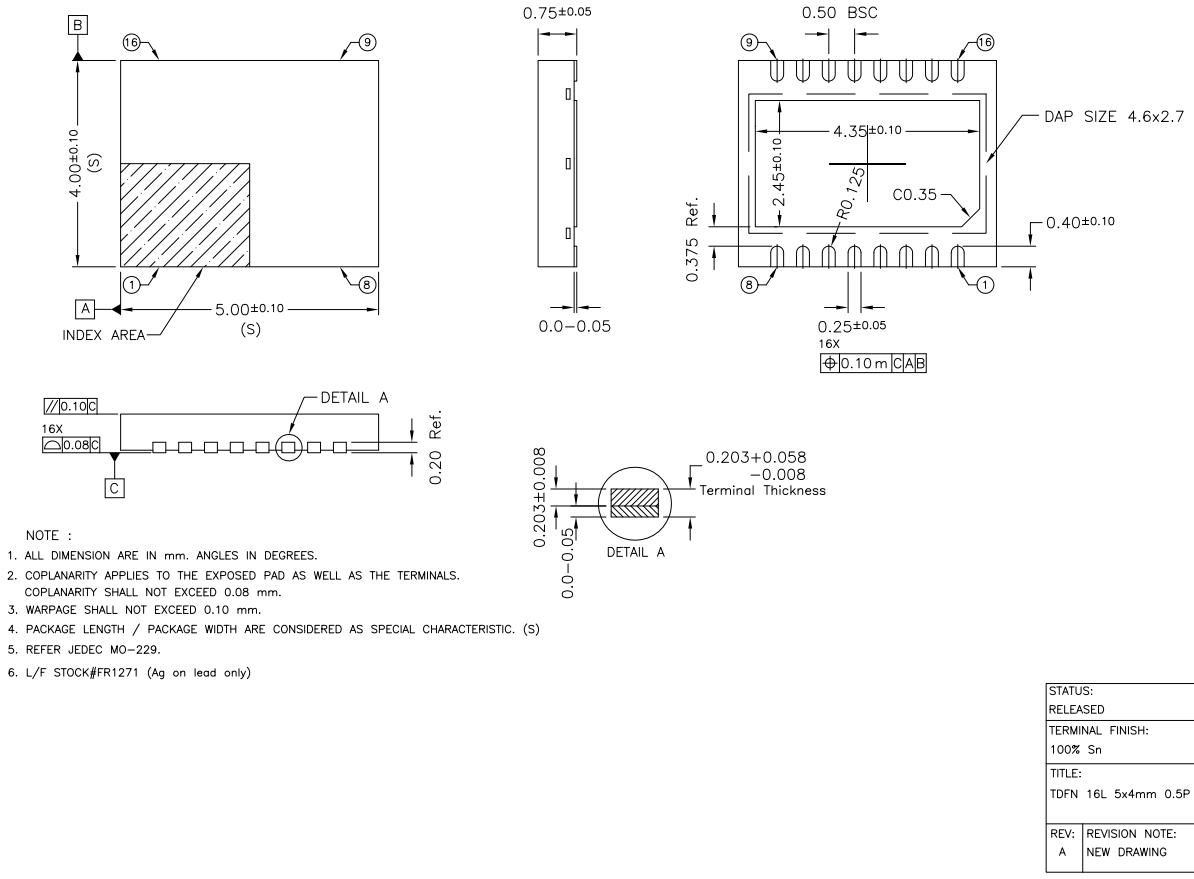

Figure 4. 16-Lead TDFN 5x4mm Package

5. Ordering Information

Part no.	Options		Package	Description
	Protocol and V/I Profile	Output Power		
iW780-XX-YY	TBD	TBD	TDFN-16	Tape & Reel[1]

Note 1: Tape & Reel packing quantity is 3,000/reel. Minimum packing quantity is 3,000.

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