

iW9880

AC/DC Primary-Side Digital Flyback Controller with High Frequency ZVS and Peak Power

Description

The iW9880 is a high-performance AC/DC primary-side digital flyback controller with advanced high-frequency zero-voltage-switching (ZVS) and peak power working with secondary-side regulation (SSR) for applications requiring high power density and high resolution in output voltage/current. The device can support USB power delivery (PD) or fixed output voltage applications up to 200W. It operates under multi-mode control (MMC) including PWM, PW-PFM and burst mode with main switch ZVS turn-on to achieve less switching loss and low EMI. It also provides a number of key built-in protection features.

The iW9880 is optimized to work with TL431 or other third party secondary-side IC with SSR loop control. The iW9880 paired with secondary side IC can achieve tight multi-level constant voltage (CV) regulation.

The iW9880 and TL431 can support fixed output voltage with tight CV regulation. It can also be paired with third party USB PD protocol IC to support USB PD 3.2 to achieve fast and smooth Vbus transitions upon request by the load side.

Renesas' innovative proprietary technology ensures that power supplies designed with the iW9880 can achieve high efficiency, high accuracy voltage control and fast dynamic load response.

Features

- Supports fixed output voltage or USB PD applications up to 200W
- Supports CV/CC regulation in fine steps by SSR.
- Renesas' patented high frequency adaptive ZVS control enables high efficiency, high power density and low EMI
- User configurable ZVS timing to optimize performance for different power devices
- Built-in switch for switching-mode VCC regulation
- Adaptive multi-mode control (MMC) using PWM/ PW-PFM/Burst modes based on input voltage and output voltage/current improves efficiency and eliminates audible noise
- Supports peak power mode without over-design
- Negative current sensing voltage option for easy PCB layout
- Built-in single-point fault protections against AC line voltage brown-out, output short-circuit, output over-voltage, and optocoupler failure
- Optimized for Renesas SuperGaN® GaN FET and power MOSFET
- AC unplug detection and X-capacitor discharge control
- 10-lead SOIC package

Applications

- AC/DC adapters for phones, tablets and laptops
- Power supplies up to 200W for industry, home appliances and various battery chargers

Contents

1. Overview.....	4
1.1 Block Diagram	4
1.2 Typical Application.....	4
2. Pin Information	5
2.1 Pin Assignments	5
2.2 Pin Descriptions.....	5
3. Specifications	6
3.1 Absolute Maximum Ratings	6
3.2 Recommended Operating Conditions.....	6
3.3 Thermal Specifications	6
3.4 Electrical Specifications	7
4. Functional Description	8
4.1 Pin Detail	8
4.1.1 Pin 1 – VCC	8
4.1.2 Pin 2 – FB/ASU.....	8
4.1.3 Pin 3 – MULTI	8
4.1.4 Pin 4 – VIN.....	8
4.1.5 Pin 5 – ZVS_DR	8
4.1.6 Pin 6 – VSENSE	8
4.1.7 Pin 7 – CS/CFG	8
4.1.8 Pin 8 – OUTPUT	8
4.1.9 Pin 9 – GND.....	8
4.1.10 Pin 10 – BSW	8
4.2 Active Start-up and Soft-Start	8
4.3 Secondary Side Regulation (SSR).....	9
4.4 Multi-Mode Control	9
4.5 Peak Power Operation.....	9
4.6 Zero Voltage Switching (ZVS).....	10
4.7 VSENSE Pin Voltage Sensing	11
4.8 Fast Dynamic Load Response.....	12
4.9 V _{VCC} Regulation	12
4.10 Voltage Protections.....	12
4.11 Over-Current and Short Circuit Protection	13
5. Package Outline Drawings.....	14
6. Ordering Information	14
7. Revision History	14

Figures

Figure 1. iW9880 Functional Block Diagram..... 4

Figure 2. iW9880 Typical Application Circuit with RRW43010 as SR Controller and TL431 for SSR..... 4

Figure 3. 10 Lead SOIC Package..... 5

Figure 4. iW9880 ZVS Operation..... 10

Figure 5. Package Outline Drawings 14

Tables

Table 1. Pin Descriptions..... 5

Table 2. Absolute Maximum Ratings..... 6

Table 3. Recommended Operating Conditions..... 6

Table 4. Thermal Specifications 6

Table 5. Electrical Specifications 7

Table 6. ZVS Auxiliary Switching ON-Time Offset Configuration..... 11

Table 7. NPS Configuration..... 12

Table 8. Ordering Information..... 14

1. Overview

1.1 Block Diagram

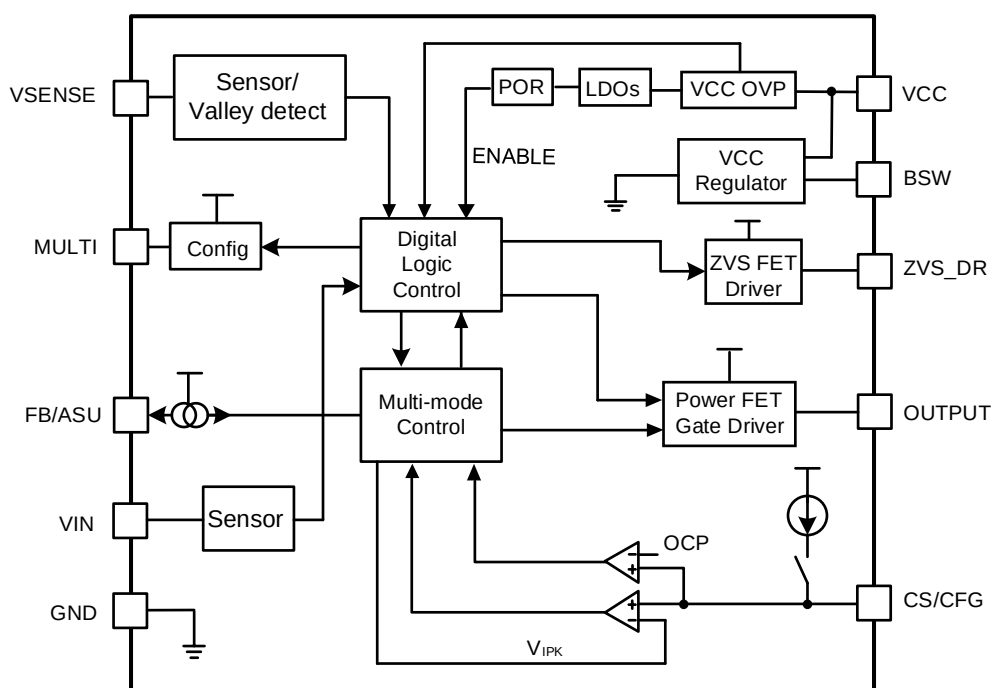


Figure 1. iW9880 Functional Block Diagram

1.2 Typical Application

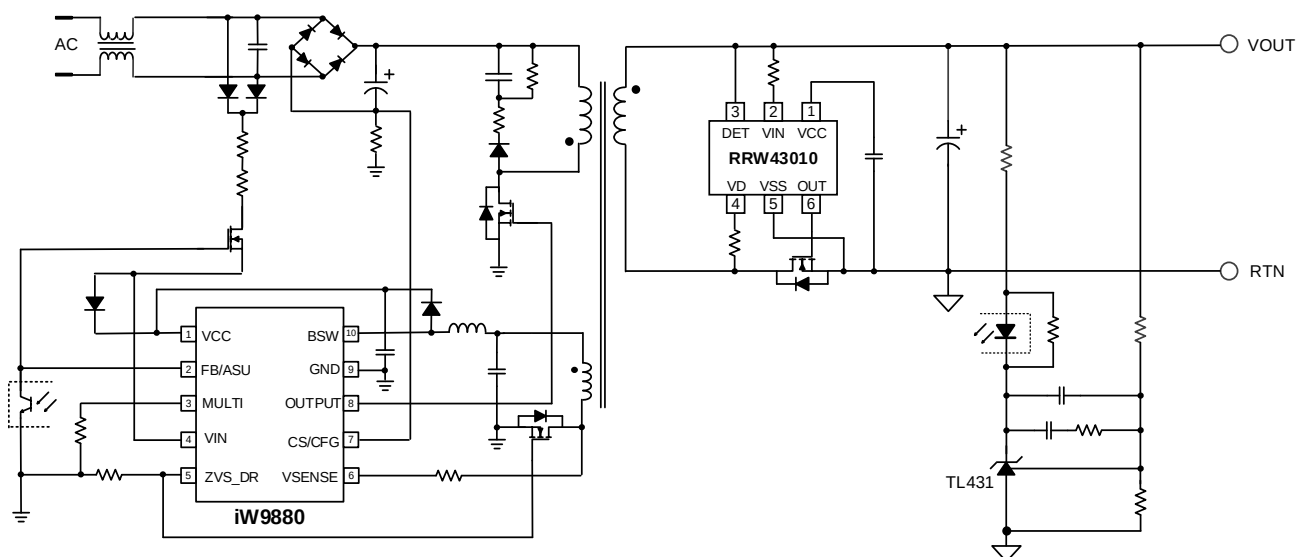


Figure 2. iW9880 Typical Application Circuit with RRW43010 as SR Controller and TL431 for SSR

2. Pin Information

2.1 Pin Assignments

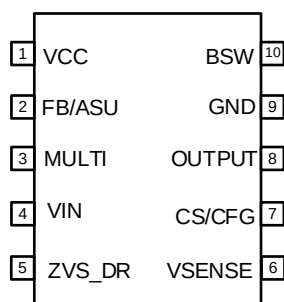


Figure 3. 10-Lead SOIC Package

2.2 Pin Descriptions

Table 1. Pin Descriptions

Pin Number	Pin Name	Type	Description
1	VCC	Power Input	IC power supply.
2	FB/ASU	Analog Input	Feedback and active startup. Used for determining multi-mode control, switching frequency and cycle-by-cycle peak current control. It is also used for control signal of active start-up device (depletion mode NFET).
3	MULTI	Analog Input	Multiple function. Used for primary winding to secondary winding turns ratio configuration.
4	VIN	Analog Input	Input AC line voltage detection. Used for AC line voltage detection and for X-capacitor discharge.
5	ZVS_DR	Analog Output	Gate drive for auxiliary switch for ZVS purpose.
6	VSENSE	Analog Input	Voltage sensing. Used for bulk capacitor voltage sensing and output voltage sensing.
7	CS/CFG	Analog Input	Current sensing and configuration. Used for cycle-by-cycle peak- current control and limit. It is also used for ZVS timing offset configuration.
8	OUTPUT	Analog Output	Gate drive for main switch.
9	GND	Ground	Ground.
10	BSW	Analog Output	Switching node for VCC switch-mode regulation.

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.

Table 2. Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Unit
FB/ASU Pin Voltage	V_{FB_ASU}	-0.3	20	V
OUTPUT Pin Voltage	V_{OUTPUT}	-0.3	20	V
MULTI Pin Voltage	V_{MULTI}	-0.3	20	V
ZVS_DR Pin Voltage	V_{ZVS_DR}	-0.3	20	V
VSENSE Pin Voltage	V_{VSENSE}	-0.7	45	V
CS Pin Voltage	V_{CS}	-1.5	5.5	V
VIN Pin Voltage	V_{IN}	-0.3	20	V
BSW Pin Voltage	V_{BSW}	-0.3	45	V
Maximum Junction Temperature	T_{JMAX}	-40	+150	°C
Storage Temperature Range	T_{STO}	-55	+150	°C
Human Body Model for BSW (tested per JS-001-2017)	$V_{ESD_HBM_BSW}$	-	±1000	V
Human Body Model for other Pins (tested per JS-001-2017)	$V_{ESD_HBM_OTHERS}$	-	±2000	V
Charged Device Model (tested per JS-002-2014)	V_{ESD_CDM}	-	±1000	V
Latch-up (tested per JESD78E; Class 2, Level A)	-	-	±100	mA

3.2 Recommended Operating Conditions

Table 3. Recommended Operating Conditions

Parameter	Symbol	Minimum	Maximum	Unit
Ambient Temperature	T_A	-40	85	°C
Junction Temperature	T_J	-40	150	°C

3.3 Thermal Specifications

Table 4. Thermal Specifications

Parameter	Package	Symbol	Condition	Typical Value	Unit
Thermal Resistance	SOIC-10 Package	θ_{JA}	Junction to ambient	160	°C/W

3.4 Electrical Specifications

Recommended operating conditions unless otherwise noted. $V_{VCC} = 12\text{ V}$, $T_A = 40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$. Typical values are at $T_A = +25\text{ }^{\circ}\text{C}$, unless otherwise specified.

Table 5. Electrical Specifications

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
VSENSE Section						
VSENSE Pin Current at 5V Output Voltage ^[1]	I_{VSENSE_5V}	VSENSE resistor setting at 5V V_{OUT} .	-	20	-	μA
VSENSE Pin Leakage Current	I_{VSENSE_LK}	$V_{VSENSE} = 5\text{ V}$	-	-	1	μA
CS/CFG Section ^[2]						
CS Regulation Lower Limit	V_{IPK_LOW}	-	-	0.10	-	V
CS Regulation Upper Limit	V_{IPK_HIGH}	-	-	0.64	-	V
Switching Cycle Over-Current Threshold	V_{OCP}	-	-	0.96	-	V
CS Pin Configuration Current	I_{CFG}	-	-	500	-	μA
VCC Section						
Maximum Operating Voltage ^[1]	V_{VCC_OP}	-	-	-	41	V
V_{VCC} Regulation Target Voltage ^[1]	V_{VCC_REG}	When rectified auxiliary winding voltage < 12V	-	12	-	V
V_{VCC} Startup Voltage	V_{VCC_ST}	-	-	18	-	V
VCC Pin Current During Startup	I_{VCC_ST}	$V_{VCC} = 12\text{ V}$	-	-	1	μA
V_{VCC} OVP	V_{VCC_OVP}	-	-	43.5	-	V
Under-Voltage Lockout Threshold	V_{VCC_UVL}	-	-	7.48	8.00	V
BSW Section						
BSW Pin Switching Frequency ^[1]	f_{SW_BSW}	-	-	1,000	-	kHz
FB/ASU Section						
ASU Power-Down Voltage after Startup ^[1]	V_{ASU_PD}	-	-	1.5	-	V
Equivalent FB Block Internal Resistance ^[1]	R_{FB}	-	-	20	-	k Ω
OUTPUT Section						
Main Switch Driver Pull-Up ON-Resistance	R_{ON_PU}	$I_{SOURCE} = 5\text{ mA}$	-	58	-	Ω
Main Switch Driver Pull-Down ON-Resistance	R_{ON_PD}	$I_{SINK} = 5\text{ mA}$	-	10	-	Ω
Voltage Source for Main Switch Driver	$V_{MAIN_DR_SRC}$	-	-	10.0	-	V
ZVS_DR Section						
ZVS Switch Driver Pull-Up ON-Resistance	R_{ON_PU}	$I_{SOURCE} = 5\text{ mA}$	-	280	-	Ω
ZVS Switch Driver Pull-Down ON-Resistance	R_{ON_PD}	$I_{SINK} = 5\text{ mA}$	-	28	-	Ω
Voltage Source for ZVS Switch Driver	$V_{MAIN_DR_SRC}$	-	-	10.0	-	V

1. These parameters are not 100% tested. They are confirmed by design.
2. CS pin signal has both positive and negative options as specified in ordering information. Absolute values are shown in the CS/CFG section.

4. Functional Description

4.1 Pin Detail

4.1.1 Pin 1 – VCC

IC power supply.

4.1.2 Pin 2 – FB/ASU

Feedback and active startup. Used for determining multi-mode control, switching frequency and cycle-by-cycle peak current control. It is also used for control signal of active start-up device (depletion mode NFET).

4.1.3 Pin 3 – MULTI

Multiple function. Used for primary winding to secondary winding turns ratio configuration.

4.1.4 Pin 4 – VIN

Input AC line voltage detection. Used for AC line voltage detection and for X-capacitor discharge.

4.1.5 Pin 5 – ZVS_DR

Gate drive for ZVS auxiliary switch.

4.1.6 Pin 6 – VSENSE

Voltage sensing. Used for bulk capacitor voltage sensing and output voltage sensing.

4.1.7 Pin 7 – CS/CFG

Current sensing and configuration. Used for cycle-by-cycle peak-current control and limit. It is also used for ZVS timing offset configuration.

4.1.8 Pin 8 – OUTPUT

Gate drive for main switch.

4.1.9 Pin 9 – GND

IC ground.

4.1.10 Pin 10 – BSW

Switching node for VCC regulation. It is typically used for boost converter to supply VCC when auxiliary winding voltage is low and needs boost.

4.2 Active Start-up and Soft-Start

The active start-up circuit uses an external depletion mode NFET. Prior to start-up, the ENABLE signal is low and the ASU pin voltage closely follows the VCC pin voltage. Consequently, the depletion mode NFET is switched on, allowing the start-up current to charge the VCC bypass capacitor. When the VCC bypass capacitor is charged to a voltage higher than the start-up threshold V_{VCC_ST} , the ENABLE signal becomes active to turn off depletion mode NFET. The iW9880 begins to perform internal OTP configuration and internal OTP check if the product option has internal OTP enabled. Afterwards, the iW9880 commences the soft-start function.

During this start-up process an adaptive soft-start control algorithm is applied, where the initial output pulses are small and gradually get larger until the full pulse width is achieved. The peak current is limited cycle-by-cycle by the V_{IPK} comparator. If at any time the V_{VCC} voltage drops below the under-voltage lockout (UVLO) threshold V_{VCC_UVL} then the iW9880 goes to shutdown. At this time the ENABLE signal becomes low and the VCC capacitor begins to charge up again towards the start-up threshold to initiate a new soft-start process.

4.3 Secondary Side Regulation (SSR)

The iW9880 works with TL431 or third party secondary-side ICs for SSR and USB PD. During the iW9880 soft-start process, the power-supply output voltage ramps up and reaches the voltage threshold such that the optocoupler current ramps up for control handover while iW9880 monitors the opto-coupler current signal through the FB pin. The optocoupler driver current is adjusted adaptively to achieve a smooth output voltage ramping until the output voltage reaches its regulation target, and the iW9880 works with TL431 for fixed output voltage regulation or third party USB PD controller for SSR-based multi-level CV/CC regulation. The SSR controller IC at the secondary side keeps sensing the output voltage and current, which are compared with CV/CC references determined by protocols such as USB PD. The control loop for SSR generates the control signal for optocoupler driver and optocoupler driver converts the control signal to a proper level of current to drive the diode side of the optocoupler.

The iW9880 receives the secondary side control signal in the format of the opto-transistor current through the FB pin. The internal control signal for iW9880's multi-mode control is determined by the opto-transistor current and internal equivalent resistance for the FB pin.

$$V_{CTRL} = V_{DRV_SRC} - I_{OPTO}R_{FB} \quad (4.1)$$

4.4 Multi-Mode Control

The iW9880 uses a patented adaptive multi-mode control (MMC) with PWM/PW-PFM/burst modes based on the input voltage and output voltage/current to optimize the efficiency and standby power consumption at various load conditions and eliminate audible noise.

During the CV operation and a part of CC operation, the iW9880 normally operates in a pulse-width-modulation (PWM) mode under heavy load conditions. In the PWM mode, the switching frequency stays constant while the on-time t_{ON} changes according to the load condition. The maximum switching frequency at PWM mode occurs at the highest output voltage setting. As the output voltage decreases, the switching frequency at PWM mode is scaled down accordingly.

As the output load decreases, the MMC control adaptively transitions to a hybrid pulse-width and pulse-frequency modulation (PW-PFM) mode. During PW-PFM mode, the power switch turn-on duration and its off time are modulated by the load current. With a decreasing load current, the on-time decreases, the off-time increases and thus both peak current and switching frequency decrease.

When the switching frequency approaches the human-ear-audible frequency band, the iW9880 transitions to a second level of PWM mode, namely the Deep PWM mode (DPWM). During the DPWM mode, the switching frequency keeps around 25kHz in order to avoid audible noise. As the load current is further reduced, the iW9880 transitions to a burst mode operation to eliminate audible noise. The burst mode keeps the DPWM switching frequency of 25kHz cycle-by-cycle, but the switching is enabled/disabled in groups adaptively based on the load condition. The switching group frequency is very low to avoid the audible noise frequency range.

The iW9880 also keeps a patented constant-frequency quasi-resonant (QR) switching scheme that has been used in previous generations of Renesas' AC/DC products. Unlike conventional QR modes, this unique QR scheme follows the basic switching-frequency profile determined by the MMC control in a deterministic constant-frequency manner and achieves valley mode turn-on for every PWM/PW-PFM/Burst switching cycle when not running in CCM, during all PWM/PW-PFM/burst modes, and in both CV and CC operation. This feature greatly reduces the switching loss and dv/dt across the entire operating range of the power supply.

4.5 Peak Power Operation

While the power supply is designed to operate near the maximum PWM frequency and peak-current control limit V_{IPK_HIGH} at full load, iW9880 supports peak-power operation in case of momentary heavy load exceeding full load specification. During peak-power mode, the switching frequency can increase up to twice the PWM switching frequency but is clamped at 360kHz. With the switching frequency increasing to deliver extra power, the peak current remains at its maximum and there is no transformer over-design. The peak-power mode can only last for short duration without causing thermal issues. If the peak-power mode lasts too long, the output current limit is applied by primary side OCP.

4.6 Zero Voltage Switching (ZVS)

iW9880 features Renesas' patented adaptive ZVS technology to create ZVS conditions for the main switch turn-on at near zero voltage. This important feature significantly reduces the adaptor switching loss and EMI. iW9880 can achieve high frequency ZVS at around a 300kHz switching frequency which enables high-power density in adapter design. As shown in [Figure 4](#), the ZVS flyback converter controlled by iW9880 is formed based on a conventional flyback converter circuit with the addition of an auxiliary circuit, which consists of a ZVS auxiliary switch, an auxiliary winding and auxiliary capacitor. Depending on the commands generated by the Multi-Mode Control, when it is time to turn on the main switch, the ZVS auxiliary switch is turned on first for a short period of time before the main switch is turned on. During the ZVS auxiliary switch ON-time duration, the auxiliary capacitor charges the auxiliary winding, and the magnetizing inductance (L_M) current ramps up in the direction opposite to the L_M current in conventional flyback operation. There is a primary capacitance (C_P) in the circuit, mainly contributed from the main switch C_{OSS} and transformer interwinding capacitance. After sufficient energy has been built up in L_M , the ZVS auxiliary switch is turned off and a resonance between L_M and C_P starts. During the resonance the voltage across the main switch, V_{DS} , decreases to near zero and a ZVS condition for the main switch is created. The main switch can then be turned on at ZVS. The primary current is built up, and once it reaches the threshold determined by V_{IPK} , the main switch is turned off, following the peak current mode control.

iW9880 adaptively calculates the ZVS auxiliary switch ON-time duration and the time delay from the ZVS auxiliary turn-off instant to the main switch turn-on instant in every switching cycle in accordance with different input and output voltages to create favorable ZVS conditions. This adaptive ZVS timing control is specifically optimized for AC/DC rapid charging applications with wide range of input and output voltage.

Since switching loss is more dominant at high-line voltage and conduction loss is more dominant at low-line voltage, iW9880 normally enables ZVS when the adaptor operates at high-line voltage and enables quasi-resonant (QR) switching together with CCM at low-line voltage.

In order to provide flexibility to fine-tune the ZVS auxiliary switch ON-time duration during power supply design, the ZVS auxiliary switch ON-time can be configured by an external resistor between the CS/CFG pin and the current sensing resistor. [Table 6](#) shows ZVS auxiliary switch ON-time adjustment configuration via the CS/CFG pin external resistor.

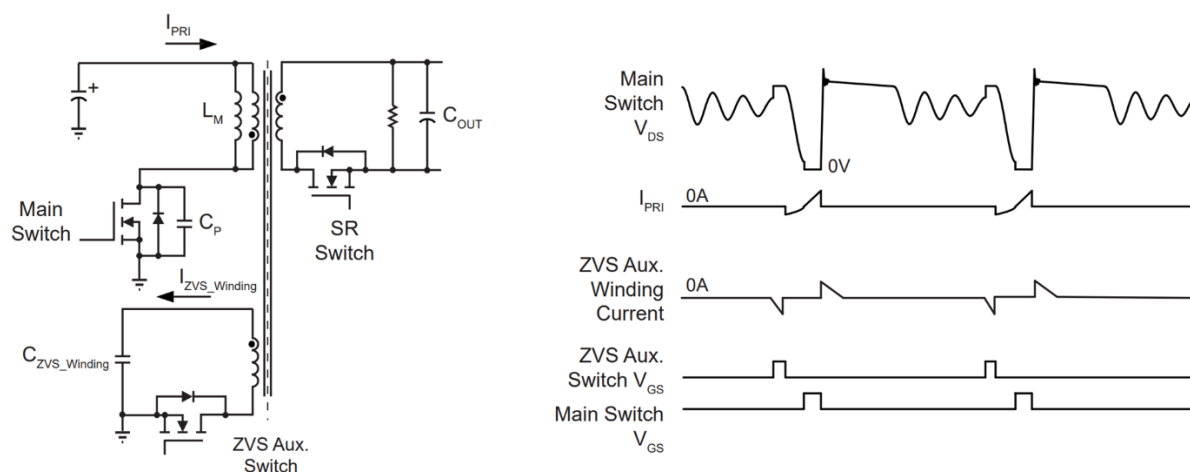


Figure 4. iW9880 ZVS Operation

Table 6. ZVS Auxiliary Switching ON-Time Offset Configuration

CS/CFG Pin Configuration Resistor (Ω)	ZVS Auxiliary Switching ON Time Adjustment (ns)
240	+100
400	0
560	-100
720	-200
880	+200
1040	+300
1200	+400
1360	-300
1520	-400
1680	-500
1840	-600
2000	-700
2160	+500
2320	+600
2480	+700
2640	+800

4.7 VSENSE Pin Voltage Sensing

Bulk capacitor voltage (V_{BULK}) and output voltage (V_{OUT}) are sensed by auxiliary winding through the VSENSE pin current. If the rectifier of the auxiliary winding is at high side, the average of auxiliary winding voltage (V_{AUX_AVG}) is near 0V. On the other hand, the V_{AUX_AVG} is V_{OUT} scaled by turns ratio if the auxiliary winding rectifier is at low side (ground side). During the main switch ON period, V_{BULK} is sensed by the difference between auxiliary winding voltage (V_{AUX}) and V_{AUX_AVG} . During the transformer reset time, V_{OUT} is sensed by the difference between V_{AUX} and V_{AUX_AVG} .

By aligning 20 μ A of V_{SENSE} pin current with 5V of V_{OUT} , V_{BULK} is calculated by iW9880 with turns ratio of primary and secondary winding (N_{PS}). [Table 7](#) shows the configuration of N_{PS} by MULTI pin resistor.

Table 7. N_{PS} Configuration

MULTI Pin Configuration Resistor (Ω)	N _{PS}
14.0	3.00
16.2	3.25
18.7	7.00
21.5	7.25
24.3	7.50
27.4	7.75
31.6	8.00
36.5	8.31
41.2	8.69
47.5	9.00
54.9	9.50
61.9	10.00
69.8	10.31
78.7	10.69
88.7	11.00
100.0	11.50

4.8 Fast Dynamic Load Response

While achieving low standby power, the iW9880 implements proprietary control technology to achieve fast dynamic load response. When a load transient event from light load to heavy load happens, the secondary-side controller quickly detects the event, and then responds immediately by increasing the optocoupler driving current and thus increasing the control signal, V_{CTRL} , in the iW9880. Once the iW9880 senses that V_{CTRL} increases, it responds promptly by immediately waking up from low-power mode to start switching events and delivers sufficient power to bring the output voltage back to regulation.

4.9 V_{VCC} Regulation

To support a wide output voltage range by USB PD and other protocols, iW9880 regulates VCC voltage with a boost converter configuration through built-in switch and the switching node BSW pin. The target VCC voltage is normally set to around 12V and the boost converter operates at 1MHz switching frequency to boost auxiliary winding voltage to target V_{VCC} voltage if auxiliary voltage is lower than target voltage. If the auxiliary winding voltage is higher than the target voltage, the V_{VCC} is directly supplied by rectified auxiliary winding voltage with boost converter bypassed.

4.10 Voltage Protections

While secondary-side controller monitors output VBUS for over-voltage protection (OVP) and CC shutdown voltage, the iW9880 also implements additional OVP and under-voltage protection. After startup, in most conditions, when the output voltage goes beyond the OVP threshold, the secondary-side IC enters fault state and informs the iW9880 to shut down by dramatically increasing optocoupler current. The iW9880 initiates auto-restart after shutdown. The iW9880 also has its additional layer of OVP through the VSENSE pin to provide further protection in some abnormal scenarios.

The iW9880 uses the VIN pin to directly sense the input voltage. This enables the iW9880 to determine and distinguish various conditions of the AC input voltage such as brown-out, brown-in, and AC unplug, and to take appropriate actions. When the AC input voltage drops below the normal operation range and the power supply input is still connected to the AC source, the iW9880 initiates a brown-out protection and shuts down the power supply. Meanwhile, a brown-in input voltage threshold is set with hysteresis. In the case of the power supply input being unplugged or disconnected from the AC source, the iW9880 continues to control the switching actions to discharge the DC bulk capacitor voltage to a safe level before shutting down the power supply.

Also, the iW9880 monitors the voltage on the VCC pin, and the IC shuts down immediately when the voltage on this pin is below the UVLO threshold. The iW9880 also has a V_{CC} over-voltage protection (V_{CC} OVP). During an abnormal event, if the V_{CC} voltage is higher than the protection threshold, the switching is stopped and the iW9880 shuts down.

When any of these faults are met, the IC remains biased to discharge the V_{CC} supply voltage. Once the V_{CC} voltage drops below the UVLO threshold, the iW9880 resets itself and then initiates a new soft-start cycle. The controller continues to attempt a start-up until the fault condition is removed.

4.11 Over-Current and Short Circuit Protection

Peak-current limit (PCL), over-current protection (OCP) and sense-resistor-short protection (SRSP) are features built into the iW9880. With the CS/CFG pin the iW9880 can monitor the peak primary current. This allows for cycle-by-cycle peak-current control and limit. When the peak primary current multiplied by the current sense resistor is greater than 0.96V, over-current is detected, and the IC immediately turns off the gate driver until the next cycle. If the OCP occurs for several consecutive switching cycles, the iW9880 shuts down.

If the current sense resistor is shorted prior to the power supply startup, there is a potential danger that an over-current condition may not be detected. Thus, the IC is designed to detect this sense-resistor-short fault before start-up and the start-up process will not be pursued if the fault exists. The V_{CC} voltage is discharged since the IC remains biased. Once V_{CC} drops below the UVLO threshold, the controller resets itself and then initiates a new soft-start cycle. The controller continues attempting to start up until the fault condition is removed.

5. Package Outline Drawings

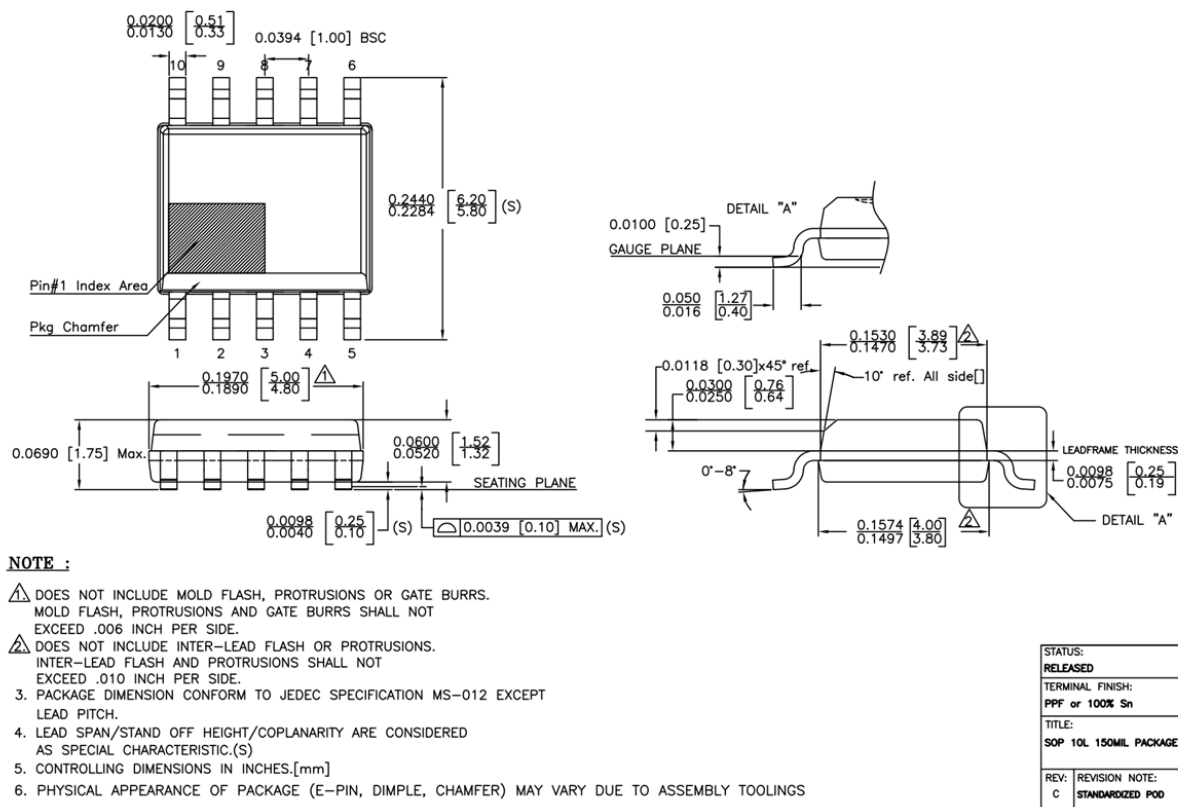


Figure 5. Package Outline Drawings

6. Ordering Information

Table 8. Ordering Information

Part Number	CCM	ZVS	$f_{SW(MAX)}$ at High Line (kHz)	$f_{SW(MAX)}$ at Low Line (kHz)	Peak Power	CS Signal	Package Description	Carrier Type
iW9880-01	Yes, at low line	Yes, at high line	100	100	Yes	Negative	SOIC-10	Tape & Reel ^[1]

1. Tape & Reel packing quantity is 2,500/reel. Minimum packing quantity is 2,500.

7. Revision History

Revision	Date	Description
1.00	Aug 11, 2026	Initial release.