RapidCharge™ AC/DC Primary-Side Digital ZVS Flyback Controller

1 Description

The iW9801 is a high-performance AC/DC primary-side digital flyback controller with advanced zero-voltage-switching (ZVS) and adaptive multi-mode-control (MMC) working with secondary-side regulation (SSR) for applications requiring high power density and high resolution in output voltage/current setting. The device can support rapid charge applications such as travel adapters (TA) of 35W and above. It operates under multi-mode control (MMC) including PWM, PFM and burst mode with main switch ZVS turn-on at high line voltage to achieve less switching loss and low EMI. It also provides a number of key built-in protection features.

The iW9801 is optimized to work with Dialog's secondary-side controller, the iW70x, for SSR, synchronous rectifier (SR) control and USB PD 3.0 with PPS protocol support. The iW9801/iW70x chipset can achieve tight multi-level constant voltage (CV) and multi-level constant current (CC) regulation in very fine steps for rapid charge applications. With SSR digital compensation, the chipset eliminates the need for external loop compensation components while maintaining stability under all operating conditions.

The iW9801 and iW70x chipset can support USB PD 3.0 with PPS to achieve fast and smooth CV/CC transitions upon request by mobile devices (MD). The iW9801 and iW70x chipset can meet no-load power consumption of less than 20mW for a typical 45W design when the output USB cable is detached.

Dialog's innovative proprietary technology ensures that power supplies designed with the iW9801 and iW70x chipset can achieve high efficiency, high accuracy voltage/current control and fast dynamic load response.

2 Features

- Supports USB PD travel adapter (TA) applications of 35W and above

- Supports constant-voltage (CV) and constant-current (CC) regulation in fine steps by secondary-side regulation (SSR)

- Dialog's patented adaptive ZVS control enables high efficiency and low EMI

- User configurable ZVS timing to optimize performance for different power MOSFETs

- Adaptive multi-mode control (MMC) using PWM/ PFM/Burst modes based on input voltage and output voltage/current improves efficiency and eliminates audible noise

- Built-in single-point fault protections against AC line voltage brown-out, output short-circuit, output over-voltage, and optocoupler failure

- User programable internal over-temperature protection (OTP) threshold for various thermal requirement

- < 20mW no load standby power for typical 45W designs at $230V_{AC}$ when output USB cable is detached

- AC unplug detection and X-capacitor discharge control

- 10-lead SOIC package

3 Applications

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

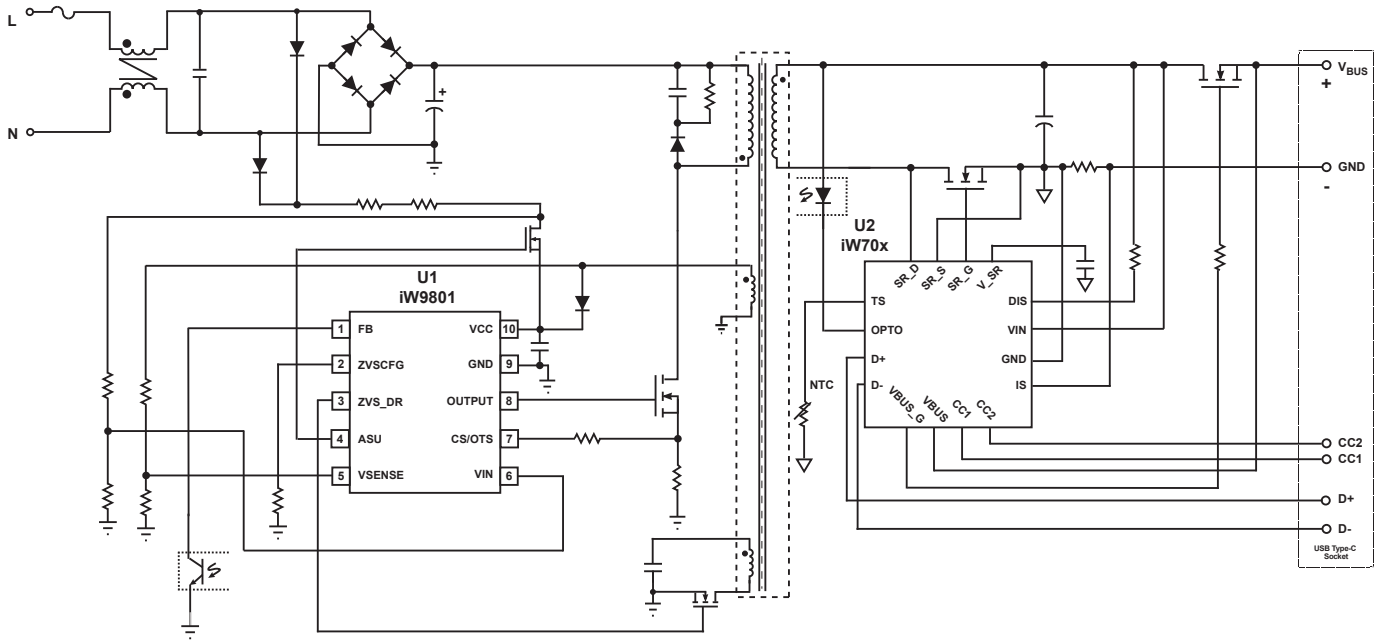## RapidCharge™ AC/DC Primary-Side Digital ZVS Flyback Controller

Figure 3.1 : iW9801 Typical Application Circuit with Active Start-up Circuit
(Using iW70x as Secondary-Side Controller. Achieving Multi-Level CV/CC Regulation)

RapidCharge™ AC/DC Primary-Side Digital ZVS Flyback Controller
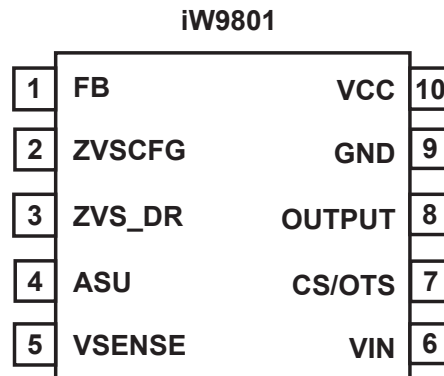
4 Pinout Description

iW9801

1	FB	VCC	10
2	ZVSCFG	GND	9
3	ZVS_DR	OUTPUT	8
4	ASU	CS/OTS	7
5	VSENSE	VIN	6

Figure 4.1 : 10-Lead SOIC Package

Pin Number	Pin Name	Type	Pin Description
1	FB	Analog Input	Feedback voltage. Used for determining multi-mode control and cycle-by-cycle peak current control.
2	ZVSCFG	Analog Input	ZVS timing configuraton. Used for fine-tuning of ZVS auxiliary switch turn-on time.
3	ZVS_DR	Analog Output	Gate drive for auxiliary MOSFET for ZVS purpose.
4	ASU	Analog Output	Control Signal. Used for active start-up device (BJT or depletion mode N-FET)
5	VSENSE	Analog Intput	Voltage sensing. Used for output voltage sensing and auxiliary winding ringing voltage sensing.
6	VIN	Analog Intput	Input AC line voltage detection. Used for AC line voltage detection and AC unplug detection for X-capacitor discharge.
7	CS/OTS	Analog Input	Current sensing. Used for cycle-by-cycle peak-current control and limit. During configuration stage, it can be used to configure certain parameters, such as internal over-temperature protection setting.
8	OUTPUT	Analog Output	Gate drive for power MOSFET.
9	GND	Ground	Ground.
10	VCC	Power Input	IC power supply.

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5 Absolute Maximum Ratings

Absolute maximum ratings are the parameter values or ranges which can cause permanent damage if exceeded. For maximum safe operating conditions, refer to Electrical Characteristics in Section 6.

Parameter	Symbol	Value	Units
DC supply voltage range	V_{VCC}	-0.3 to 45	V
Continuous DC supply current at VCC pin (V_{VCC} = 15V)	I_{VCC}	20	mA
VSENSE input (I_{VSENSE} ≤ 10mA)		-0.7 to 10	V
FB voltage		-0.3 to 5.0	V
ZVSCFG voltage		-0.3 to 5.5	V
ZVS_DR voltage		-0.3 to 20	V
VIN voltage		-0.3 to 5.0	V
ASU voltage		-0.3 to 45	V
CS/OTS voltage		-0.3 to 5.5	V
OUTPUT voltage		-0.3 to 20	V
Maximum junction temperature	T_{JMAX}	150	°C
Operating junction temperature	T_{JOPT}	-40 to 150	°C
Storage temperature	T_{STO}	-65 to 150	°C
Thermal Resistance Junction-to-Ambient	θ_{JA}	160	°C/W
ESD rating per JEDEC JS-001-2017		±2,000	V
Latch-up test per JESD78E		±100	mA

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.

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6 Physical Dimensions

Figure 6.1 : 10-Lead SOIC Package Outline Drawing
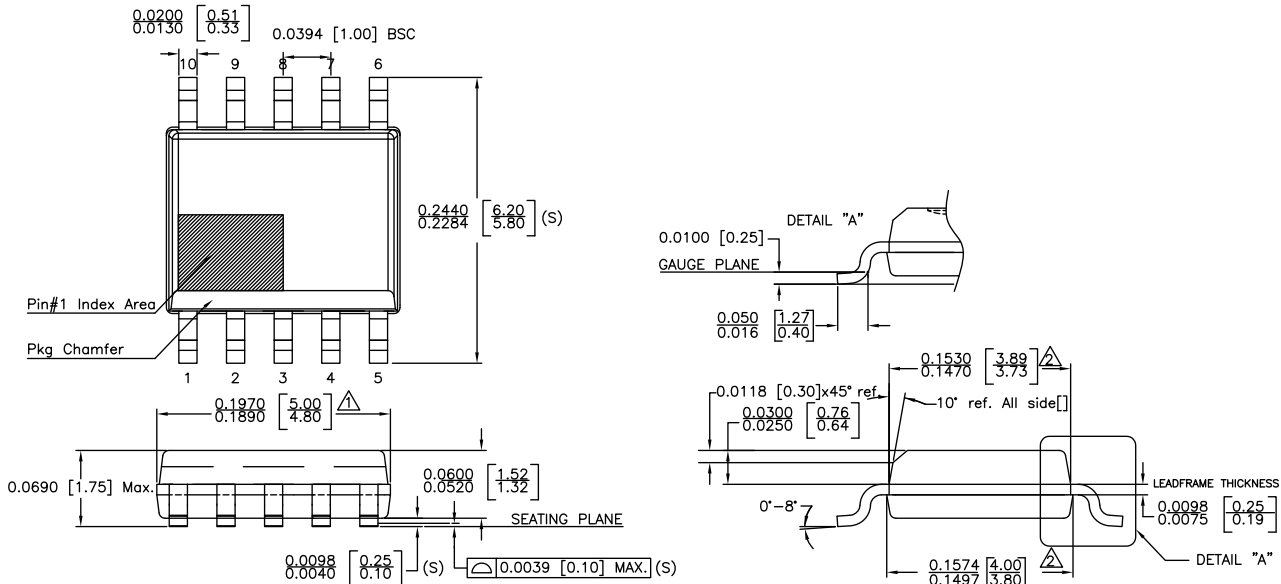
NOTE :

⚠1 DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT
EXCEED .006 INCH PER SIDE.

⚠2 DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSIONS.
INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT
EXCEED .010 INCH PER SIDE.

3. PACKAGE DIMENSION CONFORM TO JEDEC SPECIFICATION MS-012 EXCEPT
LEAD PITCH.

4. LEAD SPAN/STAND OFF HEIGHT/COPLANARITY ARE CONSIDERED
AS SPECIAL CHARACTERISTIC.(S)

5. CONTROLLING DIMENSIONS IN INCHES.[mm]

6. PHYSICAL APPEARANCE OF PACKAGE (E-PIN, DIMPLE, CHAMFER) MAY VARY DUE TO ASSEMBLY TOOLINGS

| STATUS: RELEASED |
| TERMINAL FINISH: PPF or 100% Sn |
| TITLE: SOP 10L 150MIL PACKAGE OUTLINE |
| REV: C | REVISION NOTE: STANDARDIZED POD |

7 Ordering Information

| Part no. | Options | | | | | | | Package | Description |
	V_{BUS} range	CCM	ZVS	$F_{SW(MAX)}$ at low line	$F_{SW(MAX)}$ at high line	$V_{BUS}/$ V_{SENSE}	X-cap discharge		
iW9801-00	3.3V to 21V	No	Yes at high line	100kHz	95kHz	1:0.7	Yes	SOIC-10	Tape & Reel[1]
iW9801-06	3.3V to 21V	Yes	Yes at high line	110kHz	95kHz	1:0.7	Yes	SOIC-10	Tape & Reel[1]

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

Product Summary   **Rev. 1.0**   **10-Nov-2020**

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8 Top Marking

9801:	iW9801
XX:	Product Option
LOTIDXXX:	Lot Number (can be up to 8 characters)
A:	Assembly Location Code
R:	Product Revision
YY:	Year
WW:	Work Week

Pin 1 marking may vary by assembly supplier, so line 3 left alignment may vary.

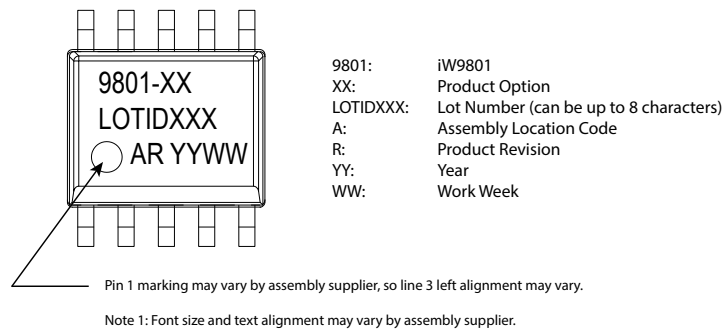Note 1: Font size and text alignment may vary by assembly supplier.

Figure 8.1 : Top Marking for the iW9801 (SOIC-10)

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