

AC/DC Primary-Side DLNK Rapid Charge™ Controller with High Performance Voltage/Current Control

1 Description

The iW1799 is a high performance AC/DC power supply controller for rapid charge applications that supports high resolution voltage/current control. The device can support high power applications with power ratings of 45W or up and it can support 10mV voltage step requests. It uses Renesas' **PrimAccurate™** technology to minimize external component count and simplify system design. The device operates in quasi-resonant mode to provide high efficiency and it also provides a number of key built-in protection features. The iW1799 can achieve tight multi-level constant voltage and multi-level constant current regulation without a traditional secondary feedback circuit. It also eliminates the need for loop compensation components while maintaining stability over all operating conditions.

The iW1799 is optimized to work with Renesas' secondary-side controllers that use the proprietary digital link (DLNK) technology. The iW1799 and DLNK-based secondary-side controller chipset together can implement various rapid charge protocols, such as USB Power Delivery (USB PD), Qualcomm® Quick Charge™ 2.0 and 3.0 (QC2.0 and QC3.0) technologies, etc. to achieve fast and smooth voltage transitions upon request by mobile devices (MD). The iW1799 and compatible secondary-side controller from Renesas use the DLNK communication protocol for output voltage requests, output current limits, output voltage undershoot and over voltage information from the secondary to the primary. The iW1799 can also provide the unique protection features, such as V_{VIN} OVP or X-cap discharge for different applications.

The iW1799 can provide no-load power consumption for a typical 5V output setting of less than 75mW with ample margin. The no-load power consumption can be reduced to less than 20mW with an optional, external active start-up DFET.

Renesas' innovative proprietary technology ensures that power supplies designed with the iW1799 and Renesas' secondary-side controllers can provide output voltage configurations of 3.3V to 21V for USB PD, 5V/9V/12V for QC2.0 and 3.6V to 12V in 200mV increments for QC3.0 and other proprietary protocols.

Qualcomm® Quick Charge™ 2.0 and 3.0 are products of QualcommTechnologies, Inc.

2 Features

- Supports 45W or up application circuit designs
- Supports 10mV DLNK voltage step requests required by USB PD programmable power supply (PPS) or other proprietary rapid charge protocols
- RC charging V_{CC} technology enables ultra-low no-load power of <75mW with ample margin at 230V_{AC} and 5V output voltage setting
 - <20mW achievable (at 230V_{AC}/5V_{OUT}) with an external active startup circuit
- High V_{CC} pin voltage rating eliminates external V_{VCC} LDO
- Tight multi-level constant-voltage and multi-level constant-current regulation with primary-side feedback and control
- Proprietary optimized load adaptive maximum constant frequency PWM switching with quasi-resonant operation achieves best size, efficiency, and common mode noise
- Backward compatible with QC2.0/3.0 and other proprietary rapid charge protocols with secondary-side interface circuits
- Multi-mode PWM/PFM control improves efficiency at various load conditions
- No audible noise over entire operating range
- User-configurable 4-level cable drop compensation independent of output voltage
- Proprietary secondary-to-primary digital communication with single optocoupler for all the rapid charge information:
 - Output voltage request
 - Output current limit
 - Output voltage undershoot detection for fast dynamic load response
 - Over-voltage protection
- **EZ-EMI™** design enhances manufacturability
- Built-in single-point fault protections against output short-circuit including soft short and half short, output over-voltage, and output over-current
- Advanced fault control technology addresses issues of soft shorts in cables and connectors by effectively reducing the average output power at fault conditions without latch
- Dual over-temperature protection with both internal OTP and external shutdown control
- DET pin provides V_{VIN} OVP or X-cap discharge protection

3 Applications

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

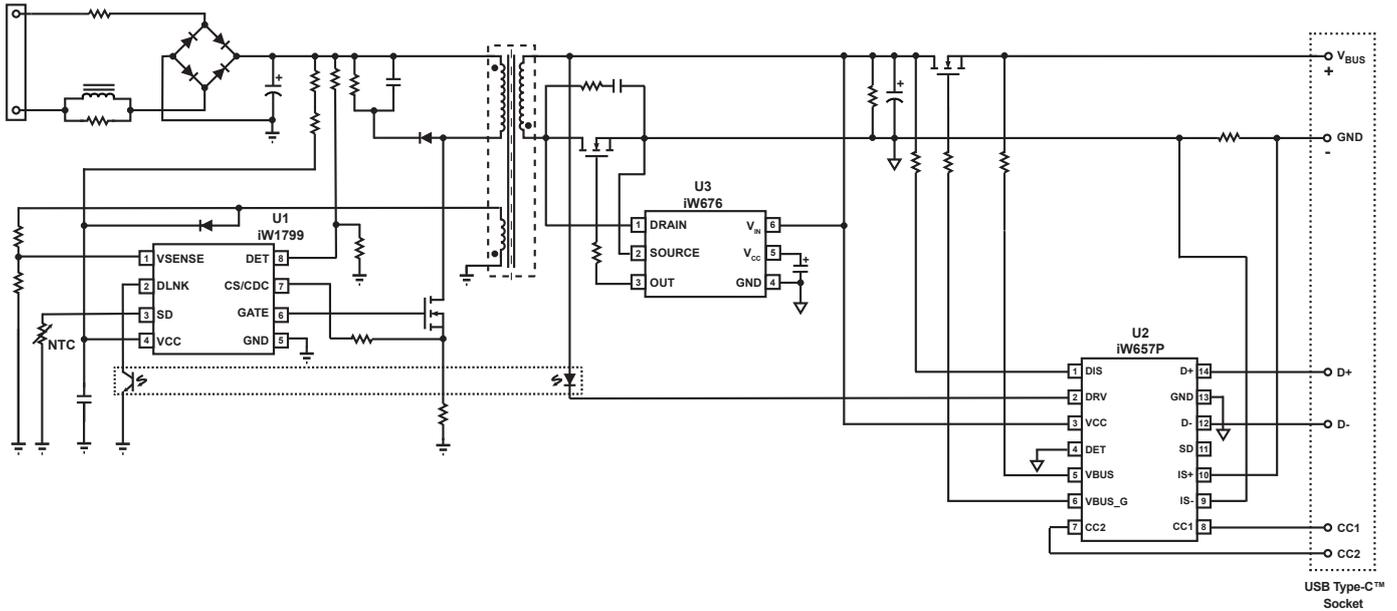


Figure 3.1 : iW1799 Typical Application Circuit for USB PD (DET Pin is Enabled for V_{IN} OVP Protection) (Using iW657P as Secondary-Side Controller for USB PD and iW676 as Synchronous Rectifier Controller.)

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4 Pinout Description

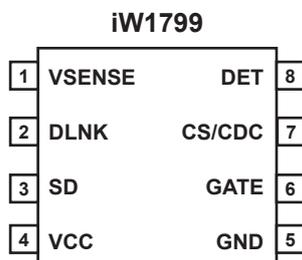


Figure 4.1 : 8-Lead SOIC Package

Pin Number	Pin Name	Type	Pin Description
1	VSENSE	Analog Input	Auxiliary voltage sense. Used for primary-side regulation.
2	DLNK	Analog Output	Digital communication link signal. Used for secondary-side to primary-side communication for all rapid charge information, which includes output voltage requests, output current limits, output voltage undershoot, and over-voltage protection.
3	SD	Analog Input	Used for external shutdown control. Can be configured for external over-temperature protection (OTP) by connecting an NTC resistor from this pin to ground.
4	VCC	Power Input	IC power supply.
5	GND	Ground	Ground.
6	GATE	Output	Gate drive for external MOSFET switch.
7	CS/CDC	Analog Input	Primary-side current sense. Used for cycle-by-cycle peak-current control and limit in primary-side CV/CC regulation. During configuration stage, used to configure the CDC compensation level.
8	DET	Analog Input	Used for external V_{VIN} OVP protection or X-Cap discharge function.

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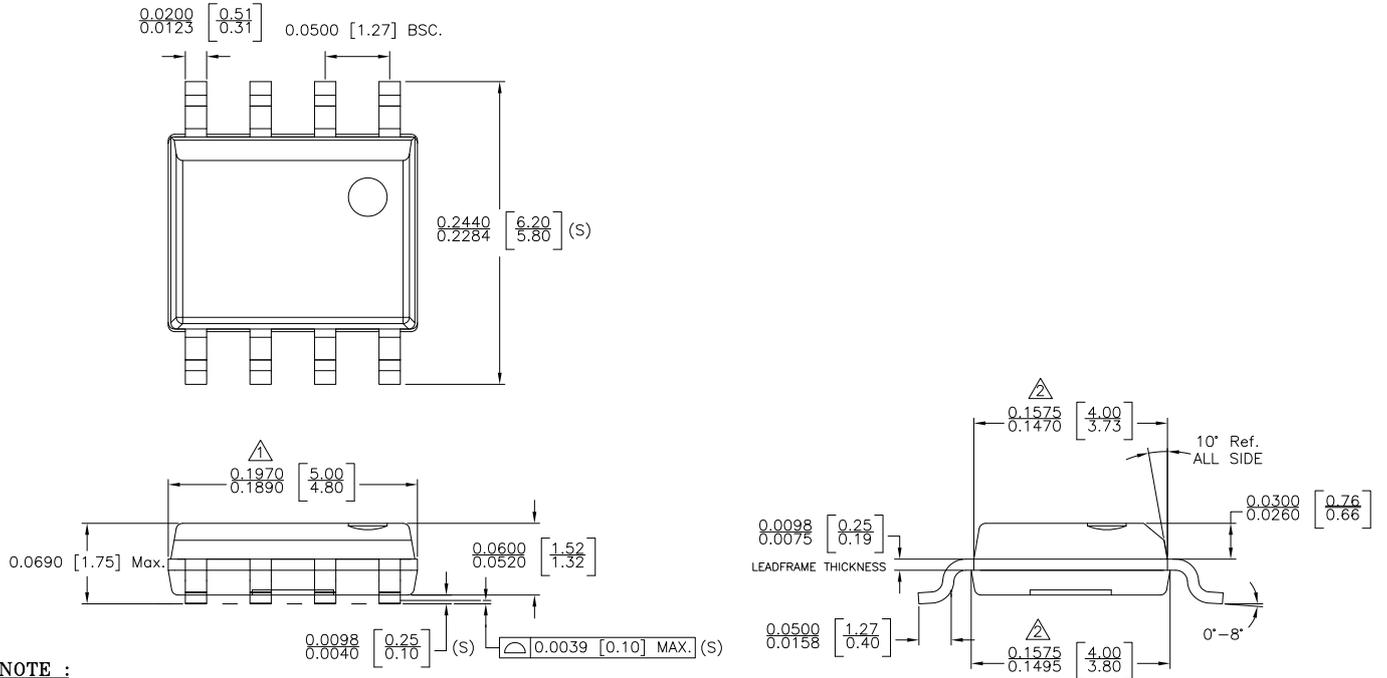
5 Absolute Maximum Ratings

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

Parameter	Symbol	Value	Units
DC supply voltage range (pin 1, $I_{VCC} = 20\text{mA max}$)	V_{VCC}	-0.3 to 45.0	V
Continuous DC supply current at VCC pin ($V_{VCC} = 15\text{V}$)	I_{VCC}	20	mA
VSENSE input (pin 2, $I_{VSENSE} \leq 10\text{mA}$)		-0.7 to 10.0	V
DLNK (pin 2)		-0.7 to 5.0	V
CS/CDC (pin 7)		-0.7 to 5.0	V
SD (pin 3)		-0.7 to 5.0	V
GATE (pin 6)		-0.3 to 30	V
DET (pin 8)		-0.7 to 5.0	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
Thermal resistance junction-to-ambient	θ_{JA}	160	°C/W
ESD rating per JEDEC JS-001-2017		$\pm 2,000$	V
Latch-up test per JESD78E		± 100	mA

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



NOTE :

- ▲ DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED .006 INCH PER SIDE.
- ▲ DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSIONS. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED .010 INCH PER SIDE.
- 3. THIS PART IS COMPLIANT WITH JEDEC SPECIFICATION MS-012.
- 4. LEAD SPAN/STAND OFF HEIGHT/COPLANARITY ARE CONSIDERED AS SPECIAL CHARACTERISTIC(S)
- 5. CONTROLLING DIMENSIONS IN INCHES. [mm]

STATUS: RELEASED		SCALE: DO NOT SCALE
TERMINAL FINISH: 100% Sn or NiPdAu (PPF)		
TITLE: 8 SOIC PACKAGE OUTLINE		
REV: A	REVISION NOTE: NEW DRAWING	DATE: 02-MAR-2015

Figure 6.1 : 8-Lead SOIC package outline drawing

7 Ordering Information

Part Number	Options						Supported DLNK Voltage Information Resolution	V _{VIN} OVP or X-cap discharge	Package	Description
	Protocol Supported	Default k _{CC} at Start-up	CC Shut-down Voltage	OVP/OTP Latch	CC Shut-down Latch					
iW1799-02B	USB PD/QC	0.422	Disabled	No	No	10mV/Step (V _{BUS} ≤ 12V) 100mV/Step (12V < V _{BUS} ≤ 21V)	V _{VIN} OVP	SOIC-8	Tape & Reel ¹	
iW1799-32B	USB PD/QC	0.422	Disabled	No	No	10mV/Step up to 21V V _{BUS}	V _{VIN} OVP	SOIC-8	Tape & Reel ¹	

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

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