

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 Dialog's **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 Dialog's 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 Dialog 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.

Dialog's innovative proprietary technology ensures that power supplies designed with the iW1799 and Dialog's 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 Qualcomm Technologies, 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

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4 Pinout Description

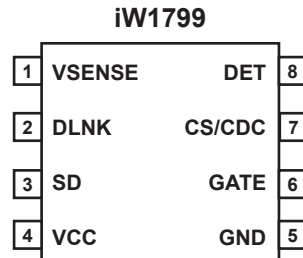


Figure 4.1 : 8-Lead SOIC Package

| 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 | | ±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.

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6 Physical Dimensions

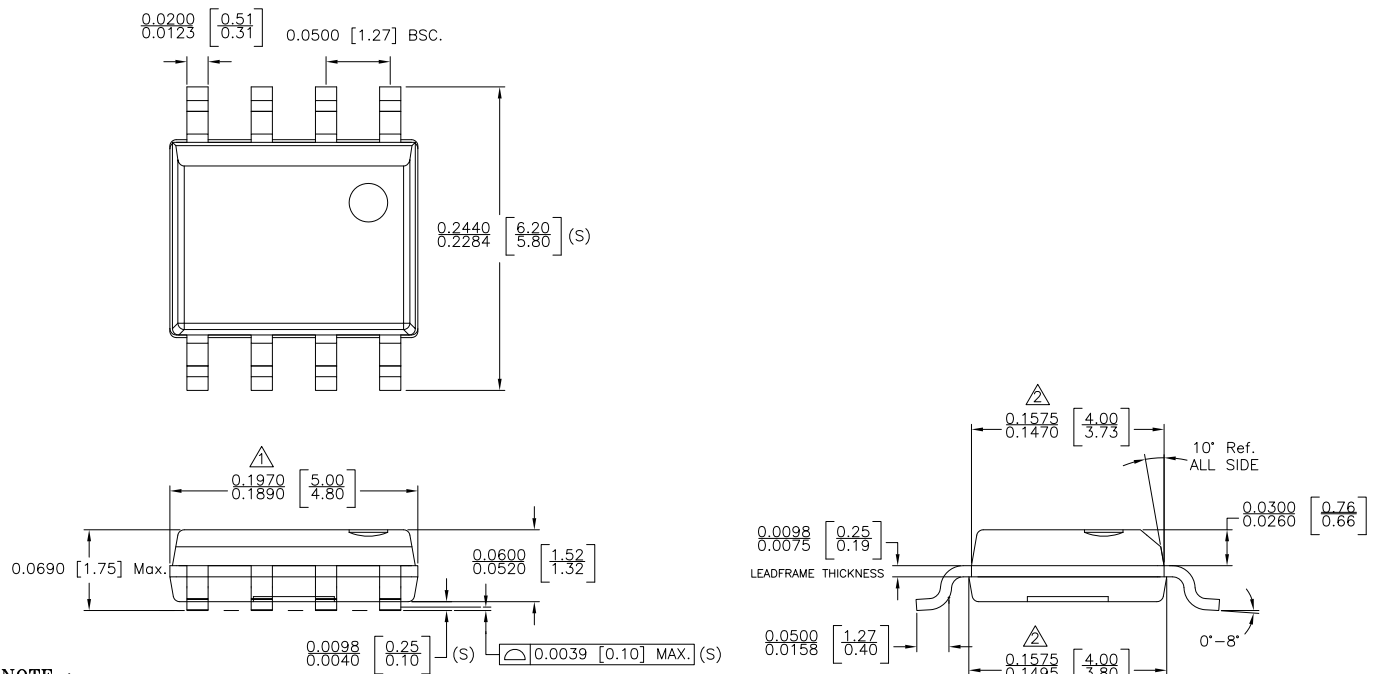


Figure 6.1 : 8-Lead SOIC package outline drawing

7 Ordering Information

| Part Number | Options | | | | | | Package | Description |
|-------------|--------------------|------------------------------|----------------------|---------------|--------------------|-----------------------------------------------------------------------------|---------------|--------------------------|
| | Protocol Supported | Default k_{CC} at Start-up | CC Shut-down Voltage | OVP/OTP Latch | CC Shut-down Latch | Supported DLNK Voltage Information Resolution | | |
| iW1799-02B | USB PD/QC | 0.422 | Disabled | No | No | 10mV/Step ($V_{BUS} \leq 12V$) 100mV/Step ($12V < V_{BUS} \leq 21V$) | V_{VIN} OVP | Tape & Reel ¹ |
| iW1799-32B | USB PD/QC | 0.422 | Disabled | No | No | 10mV/Step up to 21V V_{BUS} | V_{VIN} OVP | Tape & Reel ¹ |

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

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