

High Performance AC/DC Primary-Side Rapid Charge™ PWM Controller Supporting XM-Comm Technology

1 Description

The iW1796 is a high performance AC/DC power supply controller for Rapid Charge applications that uses transformer communication (XM-Comm) technology to minimize external component count and simplify system design. The iW1796 can support high power applications with power ratings of 45W or up and it can support voltage step requests up to 21V. The device operates in quasi-resonant mode to provide high efficiency and it also provides a number of key built-in protection features. The iW1796 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 iW1796 is optimized to work with Renesas' secondary-side controller supporting XM-Comm technology, such as iW662. for various rapid charge protocols, such as Qualcomm® Quick Charge™ 2.0 and 3.0 technologies and other proprietary rapid charge protocols to achieve fast and smooth voltage transitions upon request by mobile devices (MD). When paired with the iW662, the iW1796 completely eliminates the optocoupler between primary and secondary side. Using Renesas' proprietary transformer communication technology, XM-Comm, the iW662 can communicate with the iW1796 to send output voltage requests, output current limits, output voltage undershoot and over voltage information without any additional external components. The iW1796 paired with the iW662 can provide fast dynamic load response in typical AC/DC rapid charge adapter designs.

The iW1796 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 iW662 and iW1796 can provide various output voltage configurations for QC2.0/QC3.0 and other proprietary protocols, with various user-selected output current limit combinations.

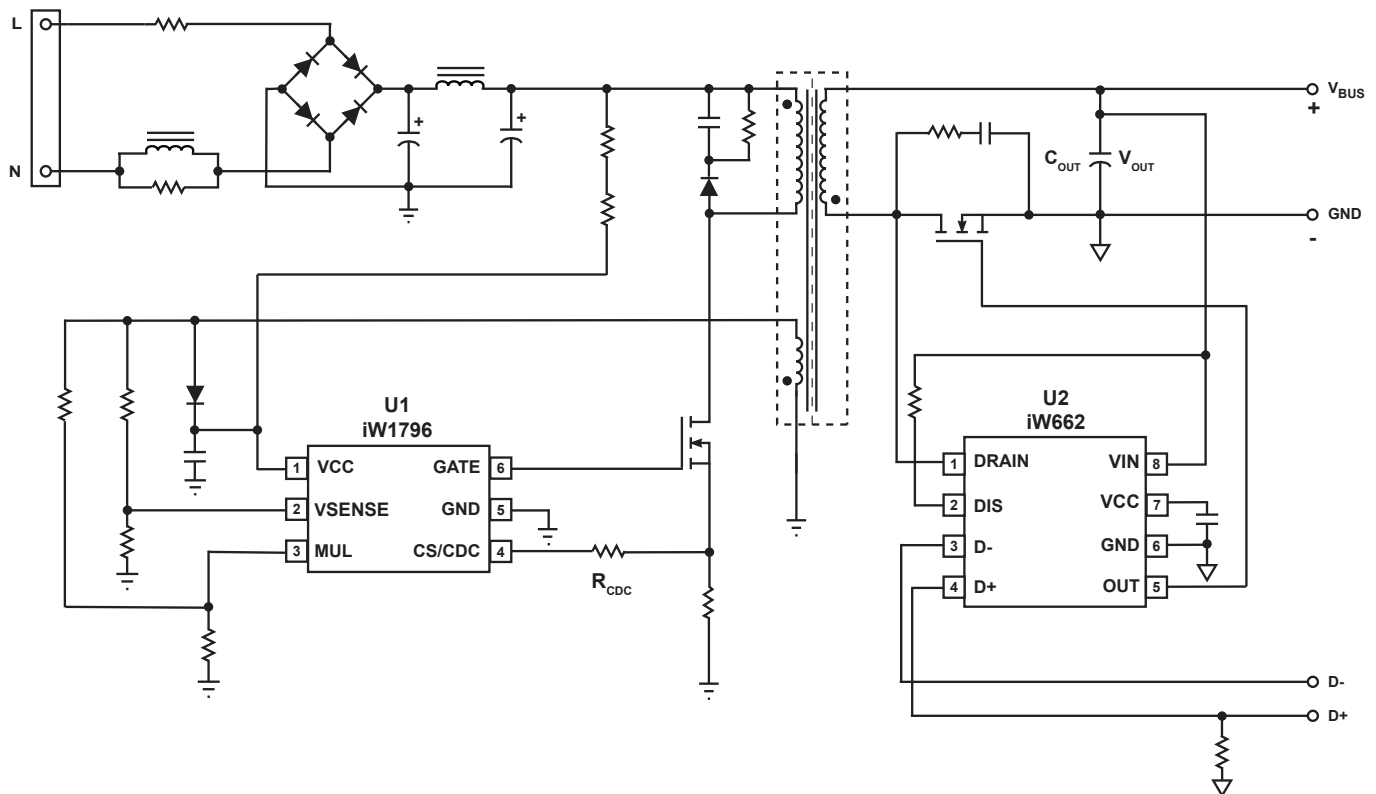
Qualcomm® Quick Charge™ 2.0 and 3.0 are products of Qualcomm Technologies, Inc.

2 Features

- Supports 45W or up application circuit designs
- Integrated XM-Comm technology eliminates secondary-to-primary optocoupler
 - Transformer communication for all the rapid charge information: output voltage request, output current limit, output voltage undershoot, and over-voltage protection
- RC charging VCC 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_{CC} LDO
- Tight multi-level constant-voltage and multi-level constant-current regulation with primary-side feedback and control
- Fast dynamic load response (DLR)
- Proprietary optimized load adaptive maximum constant frequency PWM switching with quasi-resonant operation achieves best size, efficiency, and common mode noise
- Multi-mode PWM/PFM control improves efficiency at various load conditions
- User-configurable 4-level cable drop compensation independent of output voltage
- **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
- Over-temperature protection with internal OTP control
- No audible noise over entire operating range
- Supports rapid charge technologies, such as QC 2.0 and 3.0 technologies, etc.

3 Applications

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



**Figure 3.1 : iW1796 Typical Application Circuit for Multi-Level Output Voltage and Current
(Using iW662 as Secondary-Side Controller for Rapid Charge Protocols. Achieving < 75mW No-Load Power
Consumption (with ample margin) in Typical 15W Design.)**

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4 Pinout Description

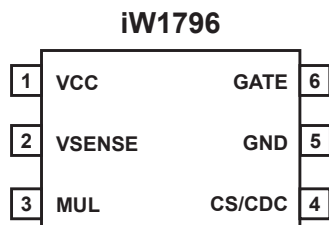


Figure 4.1 : 6-Lead SOT23-6 Package

| Pin Number | Pin Name | Type | Pin Description |
|------------|----------|---------------|--|
| 1 | VCC | Power Input | IC power supply. |
| 2 | VSENSE | Analog Input | Auxiliary voltage sense. Used for primary-side regulation and secondary-to-primary communication through main transformer. |
| 3 | MUL | Analog Output | Used for auxiliary winding open detection with or without external ASU control. |
| 4 | 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. |
| 5 | GND | Ground | Ground. |
| 6 | GATE | Output | Gate drive for external MOSFET switch. |

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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 |
| MUL (pin 3) | | -0.7 to 5.0 | V |
| CS/CDC (pin 4) | | -0.7 to 5.0 | V |
| GATE (pin 6) | | -0.3 to 30 | 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} | 208 | °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.

6 Physical Dimensions

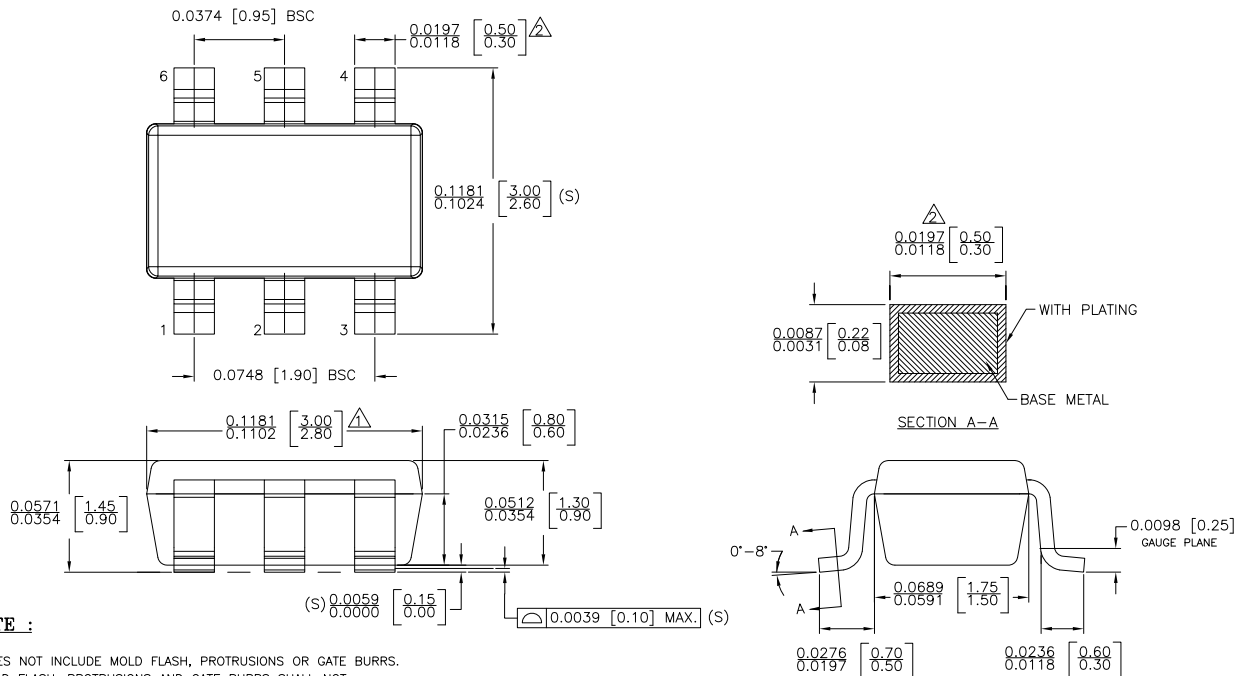


Figure 6.1 : SOT23-6 package outline drawing

7 Ordering Information

| Part Number | Secondary-Side Controller | Options | | | | Package | Description |
|-------------|---------------------------|--------------------|------------------------------|--|--|---------|--------------------------|
| | | Protocol Supported | Default k_{CC} at Start-up | CC Shutdown Voltage | k_{CC} Compensation for $V_{BUS} > 6V$ | | |
| iW1796-08 | iW662-05/08 | QC2.0/QC3.0 | 0.422 | 3.0V | No | SOT23-6 | Tape & Reel ¹ |
| iW1796-09 | iW662-01/02 | QC2.0/QC3.0 | 0.5 | 3.0V | No | SOT23-6 | Tape & Reel ¹ |
| iW1796-18B | iW662-18 | QC2.0/QC3.0/PE | 0.422 | 3.0V for $V_{BUS} < 9V$, 6.5V for $V_{BUS} = 9V$ | No | SOT23-6 | Tape & Reel ¹ |
| iW1796-39 | iW662-03 | QC2.0/QC3.0/PE | 0.5 | 3.0V | No | SOT23-6 | Tape & Reel ¹ |

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

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