

Rapid Charge™ AC/DC Digital Quasi-Resonant PWM Controller

1 Description

The iW1780H is a high performance AC/DC power supply controller for rapid charge that uses digital control technology to build peak-current mode PWM flyback power supplies. The device operates in quasi-resonant mode to provide high efficiency and a number of key built-in protection features. The iW1780H 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 iW1780H is optimized to work with Dialog's iW636 secondary-side controller for Qualcomm® Quick Charge™ 3.0 (QC3.0) technology, to achieve fast and smooth voltage transition upon request by mobile devices (MD). When paired with the iW636, the iW1780H eliminates the discrete decoders on the primary side, minimizes the external component count and simplifies system designs. The iW636 can communicate with the iW1780H through one opto-coupler for all the necessary rapid charge information including output voltage requests, output current limits, output voltage undershoot and output over-voltage.

Dialog's innovative proprietary technology ensures that power supplies designed with the iW636 and iW1780H can provide 5V/9V/12V output voltage configuration for QC2.0 and other proprietary protocols and 3.6V to 12V in 200mV increments for QC3.0, with user-selected various output current limit combinations. Furthermore, the chipset can achieve <10mW no-load power consumption at 5V2A output setting and fast dynamic load response in typical AC/DC rapid charge adapter designs.

2 Features

- Supports rapid charge technologies such as Qualcomm® Quick Charge™ 3.0 (QC3.0) technology to provide 3.6V to 12V in 200mV increments with user-selected various output current limit combinations
- Proprietary secondary-to-primary digital communication and built-in decoder eliminate discrete decoder and significantly simplify system design
- Single opto-coupler for all the rapid charge information: output voltage request, output current limit, output voltage undershoot, and over-voltage protection
- Tight multi-level constant-voltage and multi-level constant-current regulation with primary-side feedback and control
- Ultra-low no-load power consumption with lowest system cost (<10mW at 230V_{AC} with typical 5V2A setting using Schottky diode rectifier; <20mW at 230V_{AC} with typical 5V2A setting using synchronous rectifier)
- Fast dynamic load response (DLR) with secondary-side load transient detection
- 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
- **SmartDefender**™ smart hiccup technology helps address issues of soft shorts in cables and connectors by effectively reducing the average output power at fault conditions without latch
- User-configurable external shutdown control
- No audible noise over entire operating range

3 Applications

- Rapid-charging AC/DC adapters for smart phones, tablets and other portable devices (3.6V-12V, 1A-3A).



Qualcomm® Quick Charge™ 3.0 is a product of Qualcomm Technologies, Inc.

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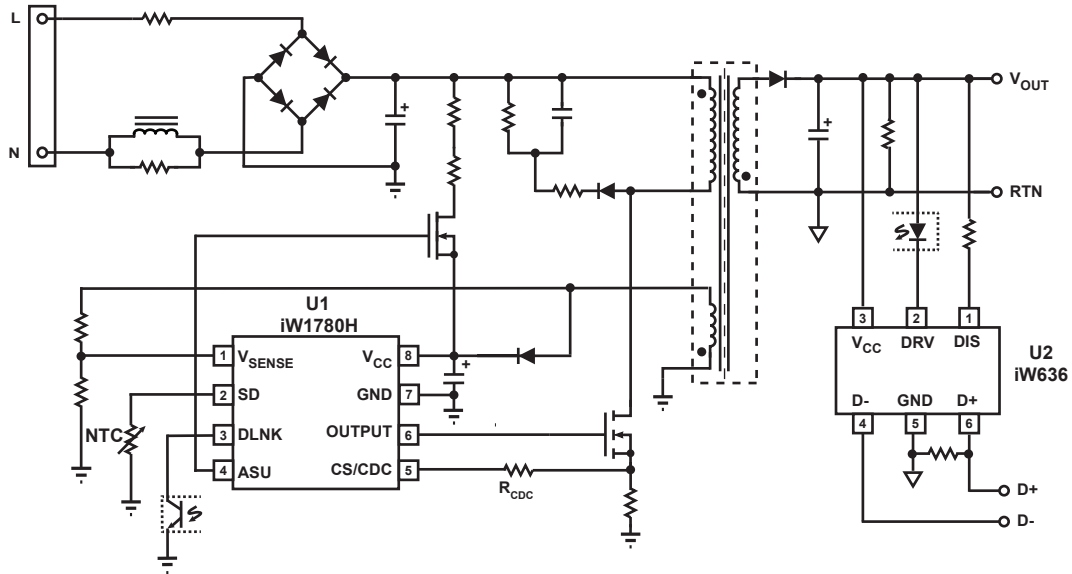


Figure 3.1 : iW1780H Typical Application Circuit for Multi-Level Output Voltage and Current (Using iW636 as Secondary-Side Controller for QC3.0. Achieving < 10mW No-Load Power Consumption in Typical 15W Design)

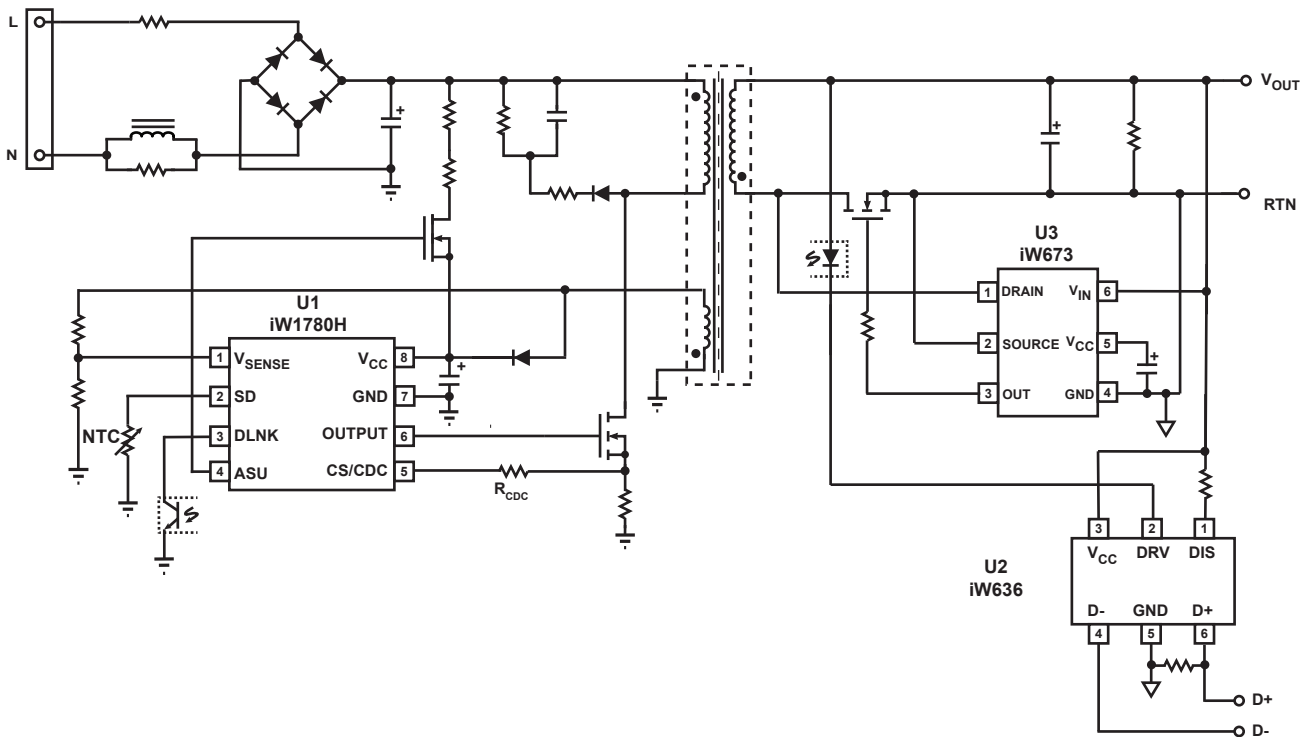


Figure 3.2 : iW1780H Typical Application Circuit for Multi-Level Output Voltage and Current (Using iW636 as Secondary-Side Controller for QC3.0 and iW673 as Synchronous Rectifier Controller Achieving < 20mW No-Load Power Consumption in Typical 15W Design)

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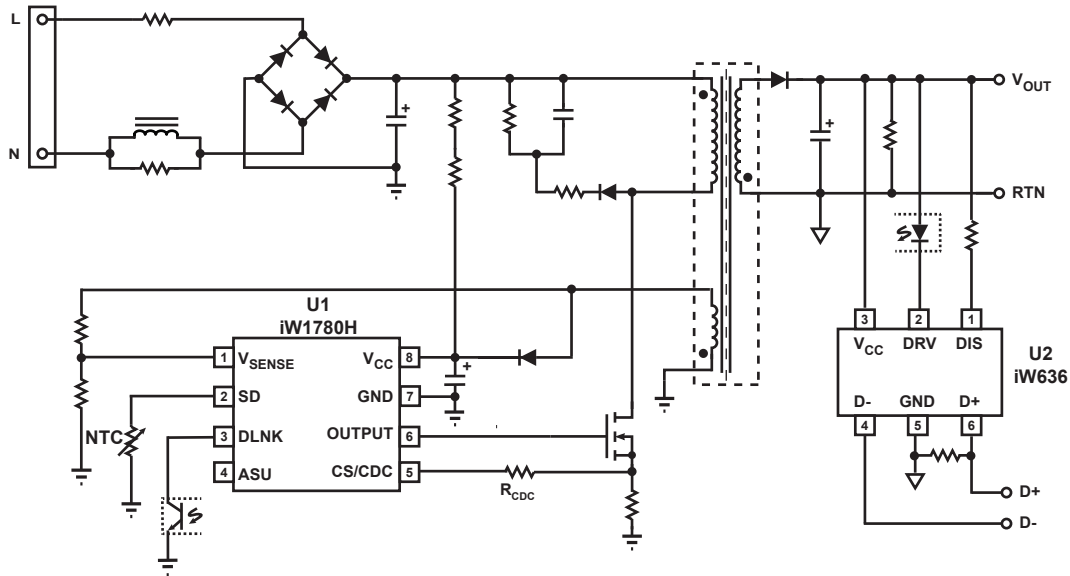


Figure 3.3 : iW1780H Typical Low Cost Application Circuit for Multi-Level Output Voltage and Current (Using iW636 as Secondary-Side Controller for QC3.0. Achieving < 50mW No-Load Power Consumption Without Using Active Start-up Device)

4 Pinout Description

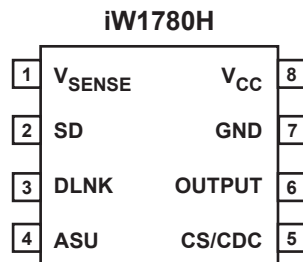


Figure 4.1 : 8-Lead SOIC-8 Package

Pin Number	Pin Name	Type	Pin Description
1	V _{SENSE}	Analog Input	Auxiliary voltage sense. Used for primary-side regulation.
2	SD	Analog Input	External shutdown control. Can be configured for external over-temperature protection (OTP) by connecting an NTC resistor from this pin to Ground.
3	DLNK	Analog Input	Digital communication link signal. Used for secondary-side to primary-side communication for all rapid change information, which includes output voltage requests, output current limits, output voltage undershoot, and over-voltage protection.
4	ASU	Output	Control signal. Used for active start-up device (BJT or depletion mode N-FET).
5	CS/CDC	Analog Input	Primary-side current sense and external cable drop compensation (CDC). Used for cycle-by-cycle peak-current control and limit in primary-side CV/CC regulation. Also used for CDC configuration.
6	OUTPUT	Output	Gate drive for external MOSFET switch.
7	GND	Ground	Ground
8	V _{CC}	Power Input	IC power supply.

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5 Absolute Maximum Ratings

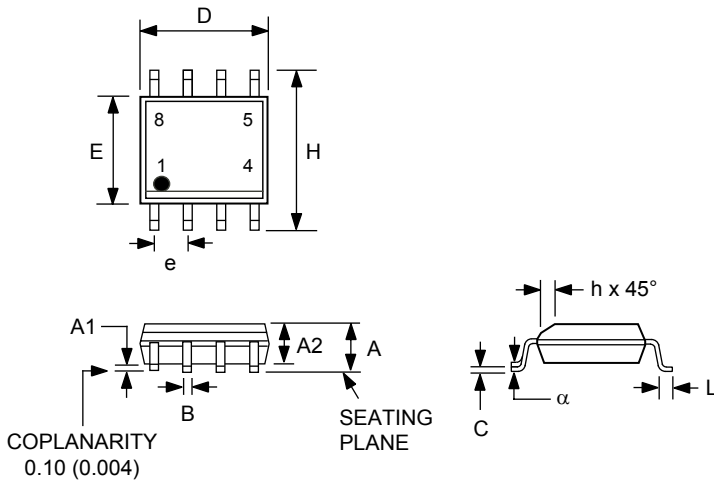
Absolute maximum ratings are the parameter values or ranges which can cause permanent damage if exceeded. For maximum safe operating conditions, refer to the Electrical Characteristics section.

Parameter	Symbol	Value	Units
DC supply voltage range (pin 8, $I_{CC} = 20\text{mA max}$)	V_{CC}	-0.3 to 25.0	V
Continuous DC supply current at V_{CC} pin ($V_{CC} = 15\text{V}$)	I_{CC}	20	mA
ASU output (pin 4)		-0.3 to 19.0	V
OUTPUT (pin 6)		-0.3 to 20.0	V
V_{SENSE} input (pin 1, $I_{Vsense} \leq 10\text{mA}$)		-0.7 to 10.0	V
CS/CDC input (pin 5)		-0.3 to 4.0	V
SD (pin 2)		-0.3 to 4.0	V
DLNK (pin 3)		-0.3 to 4.0	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 JESD22-A114		±2,000	V
Latch-up test per JESD78A		±100	mA

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6 Physical Dimensions

8-Lead Small Outline (SOIC) Package



Symbol	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.0040	0.010	0.10	0.25
A2	0.049	0.059	1.25	1.50
B	0.014	0.019	0.35	0.49
C	0.007	0.010	0.19	0.25
D	0.189	0.197	4.80	5.00
E	0.150	0.157	3.80	4.00
e	0.050 BSC		1.27 BSC	
H	0.228	0.244	5.80	6.20
h	0.10	0.020	0.25	0.50
L	0.016	0.049	0.4	1.25
α	0°	8°		

Compliant to JEDEC Standard MS12F

Controlling dimensions are in inches; millimeter dimensions are for reference only

This product is RoHS compliant and Halide free.

Soldering Temperature Resistance:

[a] Package is IPC/JEDEC Std 020D moisture sensitivity level 1

[b] Package exceeds JEDEC Std No. 22-A111 for solder immersion resistance; package can withstand 10 s immersion < 260°C

Dimension D does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.15 mm per end. Dimension E1 does not include interlead flash or protrusion. Interlead flash or protrusion shall not exceed 0.25 mm per side.

The package top may be smaller than the package bottom. Dimensions D and E1 are determined at the outermost extremes of the plastic body exclusive of mold flash, tie bar burrs, gate burrs and interlead flash, but including any mismatch between the top and bottom of the plastic body.

7 Ordering Information

Part Number	Options						Package	Description
	Protocol Supported	Default k_{CC} at Start-up	CC Shutdown Voltage at 5V Output ¹	Latch Conditions	Rated Max Current at PE+ Mode	Rated Max Power at PE+ Mode		
iW1780H-21	QC2.0/QC3.0	0.422	No CC Operation	OVP/OTP	N/A	N/A	SOIC-8	Tape & Reel ²
iW1780H-27	QC2.0/QC3.0 PE+ 1.1/PE+ 2.0	0.422	3V	N/A	1.67A	15W	SOIC-8	Tape & Reel ²
iW1780H-28	QC2.0/QC3.0 PE+ 1.1/PE+ 2.0	0.422	3.6V	N/A	3A	27W	SOIC-8	Tape & Reel ²

Note 1: Unless specified, the default CC shutdown voltages are 6.5V for 9V V_{OUT} and 10V for 12V V_{OUT} . The iW1780H-28 has CC shutdown voltage at 66% of V_{BUS} with the minimum CC shutdown voltage clamped at 3.6V.

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

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