AC/DC POWER MANAGEMENT ICs

Digital & Analog AC/DC Converters
Digital AC/DC ***RapidCharge***™ Converters
Digital SSL LED Drivers

2024.11

INNOVATIVE, HIGH PERFORMANCE IC SOLUTIONS FOR

AC/DC POWER MANAGEMENT

Renesas' exclusive ***PrimAccurate*™ Digital Control Technology*** is at the heart of our AC/DC converters, ***RapidCharge*™** chipsets and solid state lighting LED driver solutions. This digital "engine" optimizes performance over a wide range of operating conditions, reduces external components, and lowers system cost, enabling more power in less space, with very low standby power and reduced system cost.

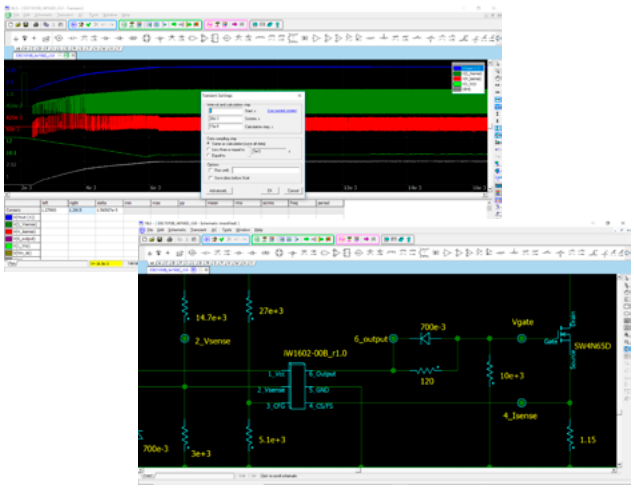
*All products with iWxxxx part numbers use Renesas' proprietary digital control technology.

CONTENT

DiaSIM™ Simulation Models

Simulate Before You Build!

- Quickly simulate, test and verify AC/DC power supplies before prototype build
- Test component variation and tolerances in existing designs
- Allows true simultaneous simulation of digital blocks and analog circuit elements
- Fast simulations – using "ideal" components
- Easy to use – no non-linear convergence
- Powered by Sideline Software NL5 simulation software (compatible with NL5 32-bit version only)



Simulation Models are Available for These Parts

Product	Feature
iW673	Synchronous rectifier controller
iW676	Synchronous rectifier controller with Active Voltage Position (AVP) control
iW873	Synchronous rectifier controller with integrated 60V MOSFET
iW1602	30W AC/DC PWM controller, cptimized for 5V output
iW1699B	30W AC/DC PWM controller
iW1702	45W AC/DC PWM controller, optimized for 9V+ output
iW1709	12W AC/DC PWM controller
iW1760B	45W AC/DC PWM controller
iW1770	40W AC/DC PWM controller with > 60W peak output power
iW1818	12W Primary-side switcher with integrated 800V BJT
iW1830	15W Primary-side switcher with integrated 700V MOSFET

DiaSIM™ Simulation Models Quick Start Guide
https://www.dialog-semiconductor.com/sites/default/files/2022-02/NL5_Quick_Start_Guide.pdf

AC/DC PWM Controller Solutions

Primary Side	Secondary Side	Synchronous Rectifier (SR) (>90% Efficiency)	Output Power[1]	No-Load Standby Power	Primary-Side Driver Type	DLNK[2] XM-Comm[3]	Features	Package
Output Power (max): ≤ 12W								
iW1700			5W	< 5mW	BJT		▪ Zero standby power controller	SOT23-6
iW1707			12W	< 100mW	BJT		▪ Active start-up scheme enables shortest turn-on delay ▪ Smooth output to drive large (up to 6,000µF) capacitive loads	SOT23-6
Output Power (max): ≤ 45W								
iW1602			30W	< 30mW	FET		▪ Optimized for 5V output ▪ Configurable light load operation mode	SOT23-6
iW1702			45W	< 75mW	FET		▪ Optimized for 9V+ output ▪ Option for input OVP ▪ Configurable light load operation mode	SOT23-6
iW1760B			45W	< 50mW	FET		▪ Active start-up scheme enables shortest turn-on delay ▪ Smooth output to drive large (up to 6,000µF) capacitive loads	SO-8
iW1790	iW662	Integrated iW662	27W	< 20mW	FET	XM-COMM	▪ Qualcomm® Quick Charge™ 3.0, 2.0 (iW662) ▪ D+/D- over-voltage protection ▪ Integrated SR for 90% efficiency, lower BOM (iW662)	SO-8/ SO-8
iW1791	iW657P	iW676	27W	< 20mW	FET	DLNK	▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW657P) ▪ D+/D- over-voltage protection	SO-8/ TDFN-14 SOT23-6
iW1796	iW662	Integrated iW662	27W	< 20mW	FET	XM-COMM	▪ Qualcomm® Quick Charge™ 3.0, 2.0 (iW662) ▪ D+/D- over-voltage protection ▪ Integrated SR for 90% efficiency, lower BOM (iW662)	SOT23-6/ SO-8
iW1797	iW657P	iW676	27W	< 75mW	FET	DLNK	▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW657P) ▪ < 20mW standby power with external startup circuit	SOT23-6/ TDFN-14/ SOT23-6
iW1799	iW657P	iW676	65W	< 75mW	FET	DLNK	▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW657P) ▪ < 20mW standby power with external startup circuit ▪ External shutdown. V_{IN} OVP or X-cap discharge	SO-8/ TDFN-14/ SOT23-6

(1) Maximum output power is application dependent
(2) DLNK is Renesas' digital communication from secondary to primary side via an optocoupler
(3) XM-Comm is Renesas' proprietary digital communication via the main power transformer that eliminates the need for an optocoupler

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

AC/DC PWM Controller Solutions (continued)

Primary Side	Secondary Side	Synchronous Rectifier (SR) (>90% Efficiency)	Output Power[1]	No-Load Standby Power	Primary-Side Driver Type	ZVS[2]	Features	Package
Output Power (max): ≥ 63W								
iW9801	iW709	Integrated iW709	100W	< 20mW	FET	Yes	▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW709) ▪ SSR[3] digital compensation eliminates loop components and ensures stability (iW709)	SO-10/ QFN-16
iW9802	TL431	iW610	100W+		FET	Yes	▪ Compatible with TL431 ▪ SR controller optimized for ZVS (iW610)	SO-10/ SOT23-6
iW9806	TL431	iW611	100W+		GaN	Yes	▪ Optimized for GaN power devices ▪ Compatible with TL431 ▪ SR controller optimized for ZVS (iW611)	SO-10/ SOT23-6
iW9809	iW709	Integrated iW709	65W	< 20mW	FET		▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW709) ▪ SSR[3] digital compensation eliminates loop components and ensures stability (iW709)	SO-8/ QFN-16
iW9860	iW760	Integrated iW760	63W	< 5mW	FET		▪ Zero standby power controller ▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW760) ▪ Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design ▪ SSR[3] digital compensation eliminates loop components and ensures stability (iW760)	SOT23-6/ TDFN-14
iW9861	iW760	Integrated iW760	63W	< 20mW	FET		▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW760) ▪ Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design ▪ SSR[3] digital compensation eliminates loop components and ensures stability (iW760)	SOT23-6/ TDFN-14
iW9862	TL431	iW610	65W		FET		▪ Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design ▪ Compatible with TL431	SOT23-6/ SOT23-6
iW9870	iW760	Integrated iW760	63W	< 5mW	GaN		▪ Optimized for GaN power devices ▪ Zero standby power controller ▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW760) ▪ Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design	SOT23-6/ TDFN-14
iW9871	iW760	Integrated iW760	63W	< 20mW	GaN		▪ Optimized for GaN Power Devices ▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW760) ▪ Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design	SOT23-6/ TDFN-14
iW9872	TL431	iW611	65W		GaN		▪ Optimized for GaN power devices ▪ Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design ▪ Compatible with TL431	SOT23-6/ SOT23-6

ZSP Product Family

Primary Side	Secondary Side	Output Power[1]	No-Load Standby Power	Output Voltage Range	Features	Package
iW9860/iW9870	iW765	45W+	< 5mW	3V - 21V	▪ USB PD 3.1 + PPS, output current up to 5A	SOT23-6/ TDFN-14
iW9860/iW9870	iW760	45W+	< 5mW	3V - 21V	▪ USB PD 3.1 + PPS, output current up to 3A	SOT23-6/ TDFN-14
iW9860/iW9870	iW690	45W+	< 5mW	3V - 21V	▪ Fixed V_{OUT}, output current up to 5A	SOT23-6/ TDFN-14
iW9860/iW9870	iW780	45W+	< 5mW	3V - 28V	▪ USB PD 3.1 EPR + PPS ▪ Fixed V_{OUT}	SOT23-6/ TDFN 5*4

(1) Maximum output power is application dependent
(2) Renesas' patented ZVS (Zero Voltage Switching) technology for highest power density and low EMI
(3) SSR: Secondary-Side Regulation

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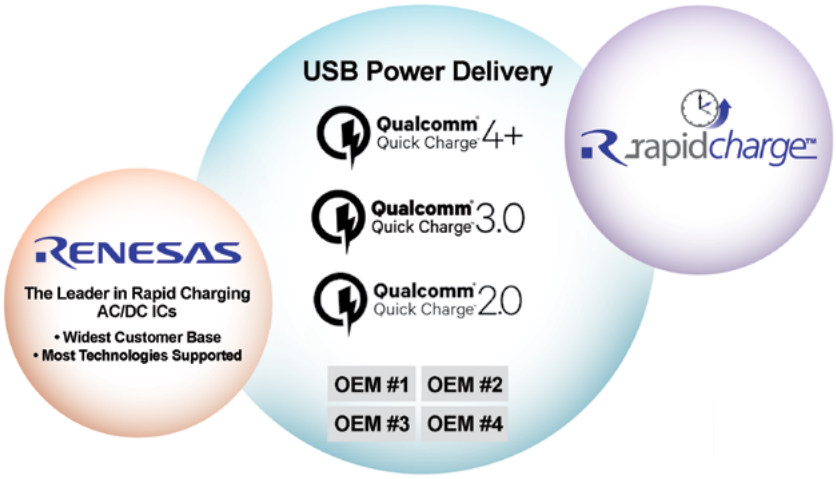
AC/DC *RapidCharge*™ Adapter Solutions

Renesas Supports Virtually All Fast Charging Protocols

As the leader in AC/DC *RapidCharge*™ solutions, Renesas supports more fast charging protocols than any other supplier.

- USB Power Delivery 3.1 + PPS
- Qualcomm® Quick Charge™ 4+
- Qualcomm® Quick Charge™ 3.0
- Qualcomm® Quick Charge™ 2.0
- Samsung Adaptive Fast Charging
- Direct Charge
- Other Proprietary OEM Protocols



				RapidCharge™ Protocol							
Primary Side	Secondary Side	Synchronous Rectifier (SR) (>90% Efficiency)	Primary-Side Driver Type	Qualcomm® Quick Charge™	Direct Charge	USB Power Delivery(1)	Output Power(1)	No-Load Standby Power	Output Voltage	DLNK(2) XM-Comm(3)	Features
iW1790 iW1796	iW662	Integrated iW662	FET	QC 2.0 QC 3.0			27W	< 20mW	3V - 12V	XM-Comm	▪ D+/D- over-voltage protection ▪ Integrated SR for lower BOM and 90% efficiency (iW662)
iW1791 iW1797	iW657P	iW676	FET	QC 2.0 QC 3.0 QC 4+	✓	✓	27W	< 75mW	3.3V - 21V	DLNK	▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW657P) ▪ D+/D- over-voltage protection (iW657P) ▪ <20mW standby power with external startup circuit
iW1799	iW657P	iW676	FET	QC 2.0 QC 3.0 QC 4+	✓	✓	65W	< 75mW	3.3V - 21V	DLNK	▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW657P) ▪ <20mW standby power with external startup circuit ▪ External shutdown. V_{IN} OVP or X-cap discharge

(1) Maximum output power is application dependent
(2) DLNK is Renesas' digital communication from secondary to primary side via an optocoupler
(3) XM-Comm is Renesas' proprietary digital communication via the main power transformer that eliminates the need for an optocoupler

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AC/DC *RapidCharge*™ Adapter Solutions (continued)

				RapidCharge™ Protocol							
Primary Side	Secondary Side	Synchronous Rectifier (SR) (>90% Efficiency)	Primary-Side Driver Type	Qualcomm® Quick Charge™	Direct Charge	USB Power Delivery(1)	Output Power(1)	No-Load Standby Power	Output Voltage	ZVS(2)	Features
iW9801	iW709	Integrated iW709	FET	QC 2.0 QC 3.0 QC 4+	✓	✓	100W	< 20mW	3.3V - 21V	Yes	▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW709) ▪ SSR(3) digital compensation eliminates loop components and ensures stability (iW709)
iW9802	TL431	iW610	FET	User Defined Interface			100W+		User Programmable	Yes	▪ Compatible with TL431 ▪ SR controller optimized for ZVS (iW610)
iW9806	TL431	iW611	GaN	User Defined Interface			100W+		User Programmable	Yes	▪ Optimized for GaN power devices ▪ Compatible with TL431 ▪ SR controller optimized for ZVS (iW611)
iW9809	iW709	Integrated iW709	FET	QC 2.0 QC 3.0 QC 4+	✓	✓	65W	< 20mW	3.3V to 21V		▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW709) ▪ SSR(3) digital compensation eliminates loop components and ensures stability (iW709)
iW9860	iW760	Integrated iW760	FET	QC 2.0 QC 3.0 QC 4+	✓	✓	63W	< 5mW	3.4V to 21V		▪ Zero standby power controller ▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW760) ▪ Dual-polarity auxiliary winding sensor improves EMI, simpliies transformer design ▪ SSR(3) digital compensation eliminates loop components and ensures stability (iW760)
iW9861	iW760	Integrated iW760	FET	QC 2.0 QC 3.0 QC 4+	✓	✓	63W	< 20mW	3.4V to 21V		▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW760) ▪ Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design ▪ SSR(3) digital compensation eliminates loop components and ensures stability (iW760)
iW9862	TL431	iW610	FET	User Defined Interface			65W	--	User Programmable		▪ Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design ▪ Compatible with TL431
iW9870	iW760	Integrated iW760	GaN	QC 2.0 QC 3.0 QC 4+	✓	✓	63W	< 5mW	3.4V to 21V		▪ Optimized for GaN power devices ▪ Zero Standby Power Controller ▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW760) ▪ Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design
iW9871	iW760	Integrated iW760	GaN	QC 2.0 QC 3.0 QC 4+	✓	✓	63W	< 20mW	3.4V to 21V		▪ Optimized for GaN power devices ▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ (iW760) ▪ Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design
iW9872	TL431	iW611	GaN	User Defined Interface			65W		User Programmable		▪ Optimized for GaN power devices ▪ Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design ▪ Compatible with TL431
iW9801	iW780	iW610	FET	QC 2.0 QC 3.0 QC 4+		PD 3.1	65W+	< 50mW	3V to 28V		▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ ▪ ZVS Controller ▪ SR controller optimized for ZVS (iW610)
iW9807	iW780	iW610	GaN			PD 3.1	65W+	< 50mW	3V to 28V		▪ Optimized for GaN devices ▪ ZVS Controller ▪ SR controller optimized for ZVS (iW610)
iW9860	iW780	iW610	FET			PD 3.1	45W+	< 5mW	3V to 28V		▪ USB PD 3.0 + PPS + Qualcomm® Quick Charge™ 4+ ▪ Zero Standby Power Solution
iW9870	iW780	iW610	GaN			PD 3.1	45W+	< 5mW	3V to 28V		▪ Optimized for GaN devices ▪ Zero Standby Power Solution

(1) Maximum output power is application dependent
(2) Renesas' patented ZVS (Zero Voltage Switching) technology for highest power density and low EMI
(3) SSR: Secondary-Side Regulation

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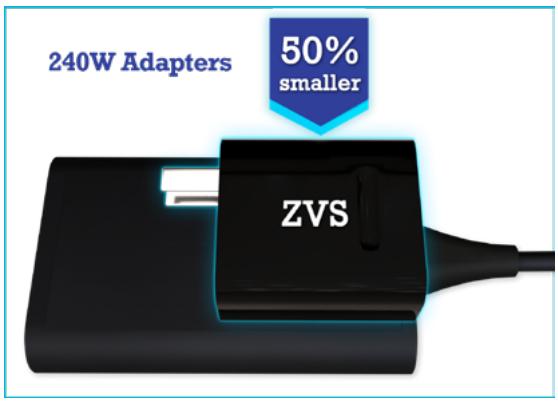
AC/DC *RapidCharge*™ Adapter Solutions (continued)

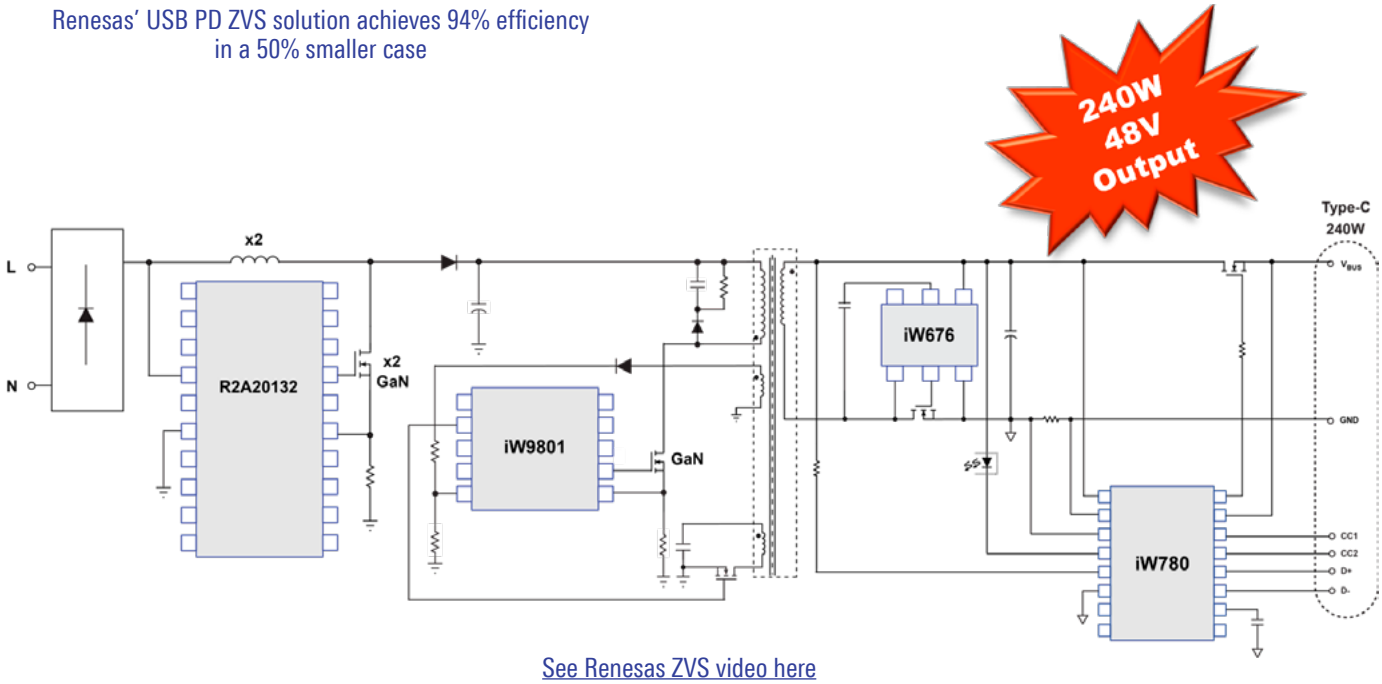
iW9801 + iW780+ iW676 + R2A20132

Zero Voltage Switching (ZVS) flyback & PFC chipset with GaN FET sources highest USB PD power at >21.1W/in³ for ubiquitous compact, slim USB PD3.1 240W applications.

- iW9801 AC/DC digital primary-side controller with Renesas' patented Zero Voltage Switching (ZVS) control
  - Excellent efficiency over the input/load range up to 94%
  - Low EMI and no audible noise
- iW780 USB PD3.1 protocol IC supporting 48V output
  - Integrated digital control loop compensation, disconnect FET control
  - Supports Renesas primary-side PWM controllers & SR controllers
- iW676 synchronous rectifier controller
  - Digital adaptive turn-off control technology delivers high efficiency to replace Schottky diodes
- R2A20132 Interleave PFC controller
  - Critical Conduction Mode (CrCM), high efficiency, low switching noise
  - Controls two boost converters, reduces input current ripple & thermal issues



Renesas' USB PD ZVS solution achieves 94% efficiency in a 50% smaller case



See Renesas ZVS video here

ZVS Product Table for Applications

Description	iW9801-32	iW9801-17	iW9802-21	iW9802-23	iW9802-52	iW9802-36
Max Fsw and mode	80kHz for low line; 75kHz for high line	140kHz for low line; 130kHz for high line	140kHz for low line; 130kHz for high line	75kHz for low line; 70kHz for high line	140kHz for low line; 130kHz for high line	70kHz for low line; 75kHz for high line
MMC Maximum Vipk	0.64V	0.64V	0.64V	0.64V	0.64V	0.64V
Vout to Vsense Ratio	5:0.7	5:0.7	5:0.7	5:0.7	5:0.7	5:0.7
PWM Maximum Fsw Corresponding Vout	20V	20V	20V	20V	20V	20V
ZVS Function	Low line and high line	Low line and high line	Low line and high line	Low line and high line	High line	High line
Lm/Rs (μH/Ω)	1750	1083	917	1833	1250	1833
CCM	No	No	No	No	No	Low line
Frequency dithering	Valley hopping	Valley hopping	Valley hopping	Valley hopping	In-valley dithering	Valley hopping
Startup Vout OVP	24V	24V	24V	24V	7V	24V
Kcc	0.367	0.313	0.391	0.489	0.313	0.419
X-cap discharge	Yes. 1 Sec.	Yes. 1 Sec.	Yes. 100ms	Yes. 1 Sec.	Yes. 1 Sec.	Yes. 1 Sec.
OTP configuration	135/130/105/100°C	135/130/105/100°C	125/120/115/110°C	135/130/105/100°C	125/120/115/110°C	Disable
Vctrl high protection / Vctrl low protection timer	200ms / 300ms	100ms / 200ms	100ms / 200ms	200ms / 300ms	200ms / 300ms	Disable / 300ms
Application Suggestion	PD3.1 PD EPR 28V5A	PD3.1 PD SPR 20V5A	PD3.1 PD EPR 28V5A	PD3.1 PD EPR 28V5A	PD3.1 PD SPR 20V5A w/o PFC	Power tool w/o PFC

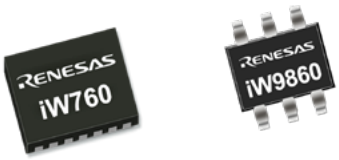
AC/DC *RapidCharge*™ Adapter Solutions (continued)

iW9860 + iW760

Zero Standby Power 63W USB PD Adapters

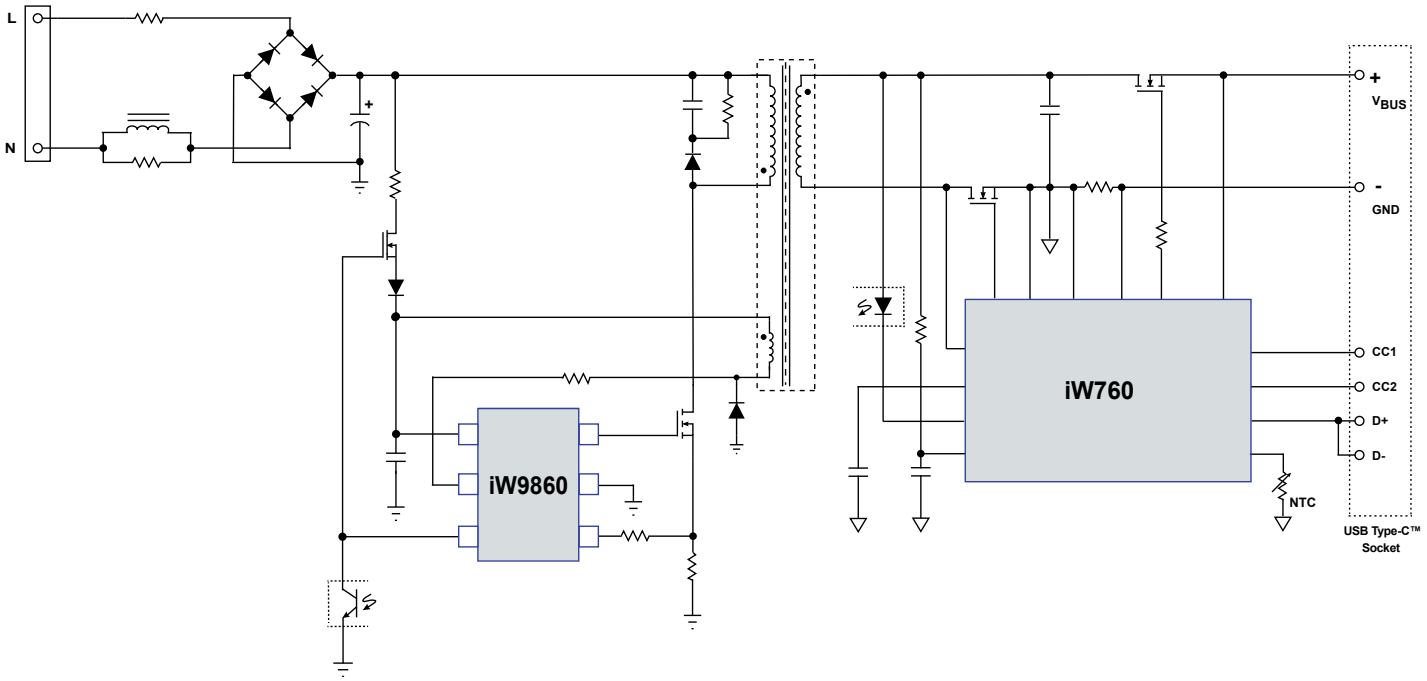
- < 5mW no-load standby power consumption
- Simple, easy-to-use, low BOM count solution
  - Single-layer PCB
- iW9860 AC/DC digital primary-side quasi-resonant (QR) flyback controller
  - Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design
- iW760 QR interface controller
  - Integrated synchronous rectifier
  - Secondary-side digital compensation eliminates loop components, ensures stability
  - USB-IF PD certified (USB PD 3.0 + PPS)
- Hardwired state machine prevents fast chargers from hacking

Eco-friendly design enables zero standby power
< 5mW at $230V_{AC}$



TDFN-3x4 SOT23-6

Space-Saving Packages

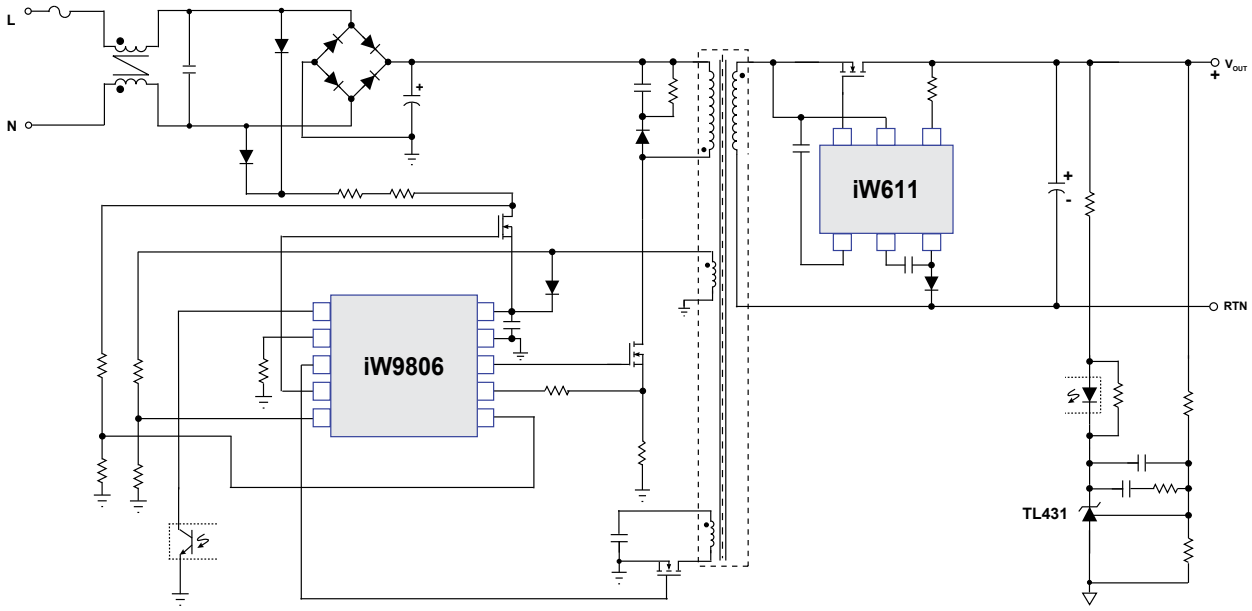


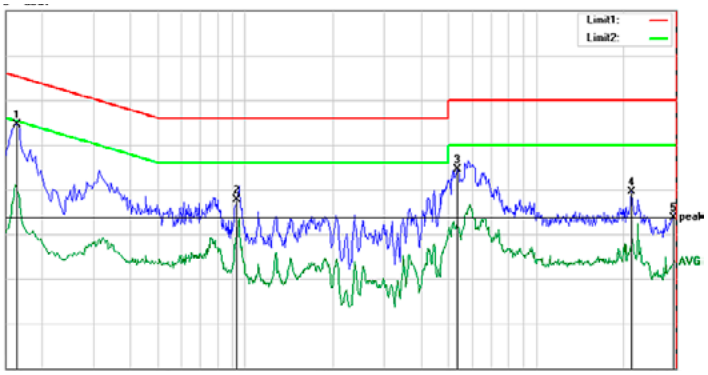
AC/DC *RapidCharge*™ Adapter Solutions (continued)

iW9806 + iW611

Digital ZVS Controller Optimized for GaN

- iW9806 AC/DC digital primary-side controller with Renesas' patented Zero Voltage Switching (ZVS) control
- Optimized for GaN power ICs
- Supports third-party USB PD secondary-side controllers
- Low EMI and no audible noise
- High switching frequency up to 200kHz enables
  - Smaller, lighter weight transformer
  - Lowest BOM cost
- Works with industry-standard interfaces (e.g. TL431)
- Works with iW611 synchronous rectifier optimized for ZVS to enable > 90% efficiency





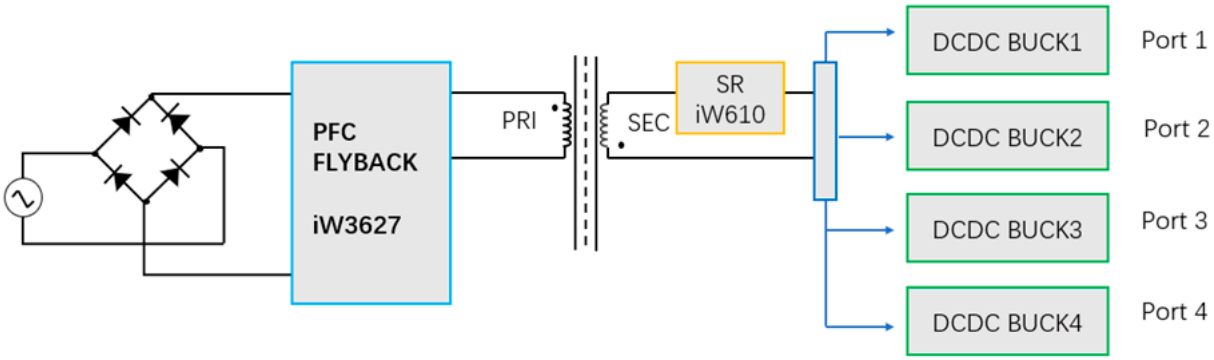
iW9806 Conducted EMI

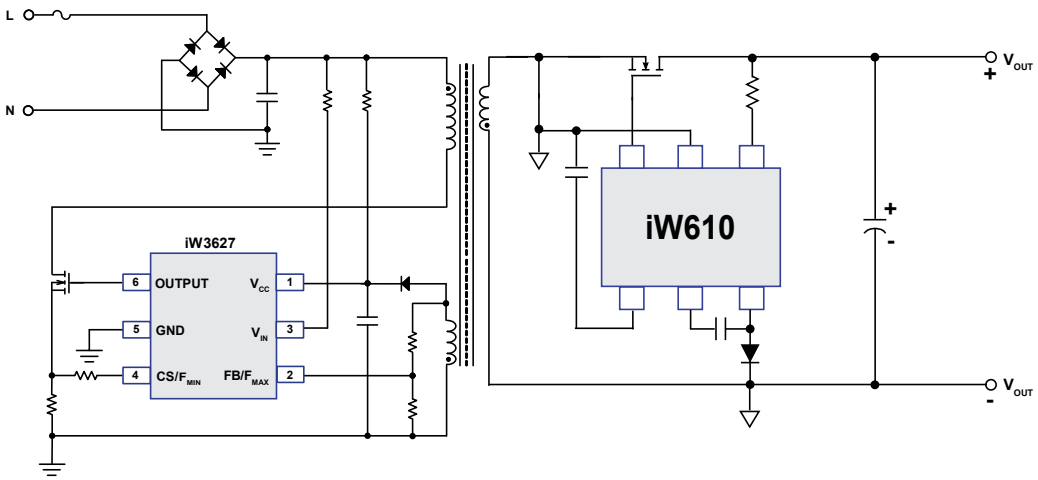
AC/DC *RapidCharge*™ Adapter Solutions (continued)

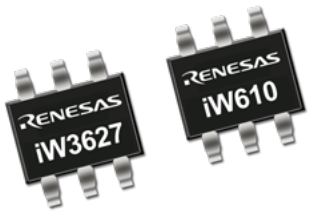
iW3627 + iW610-01C

Single Stage PFC for Multi-port TA Application

- iW3627 Single stage PFC with primary-side control
- iW610-01C Synchronous Rectifier for pair with PSR controller
- Low EMI and no audible noise
- Achieve >93% efficiency with 0.99 PF
- Support up to 200W multi-port TA application







SOT23-6

Space-Saving Packages

Low Cost 100W Multi-port Solution

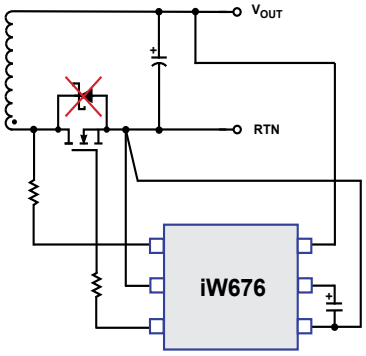
AC/DC Secondary-Side ICs

Product	Voltage Position Controller	Synchronous Rectifier Controller	Quiescent Current	Features	Package
iW610		✓	< 150µA at no load	▪ Low V_{CC} charging loss ▪ Optimized for high power density applications ▪ Optimized to support Quasi-Resonant, DCM, CCM Flyback, ZVS & Active Clamp Flyback topologies	SOT23-6
iW610-01C		✓	< 150µA at no load	▪ Pair with PSR controller ▪ Low V_{CC} charging loss ▪ Optimized for high power density applications ▪ Optimized to support Quasi-Resonant, DCM, CCM Flyback, ZVS & Active Clamp Flyback topologies	SOT23-6
iW611		✓	< 150µA at no load	▪ Low V_{CC} charging loss ▪ Optimized for high power density applications ▪ Optimized to support high frequency Quasi-Resonant, DCM, CCM Flyback, ZVS and Active Clamp Flyback topologies	SOT23-6
iW673		✓	< 450µA at no load	▪ Replaces Schottky diode with MOSFET	SOT23-6
iW676	✓	✓	< 650µA at no load	▪ 25V Output, optimized for lowest BOM cost in applications up to 12V ▪ Optimized for direct charging applications down to 3V	SOT23-6
iW873		✓	< 450µA at no load	▪ Integrated 60V power MOSFET	SO-8

iW673, iW676

Digital Synchronous Rectifiers Replace Schottky Diode for Higher Efficiency, Ultra-Compact Power Adapters

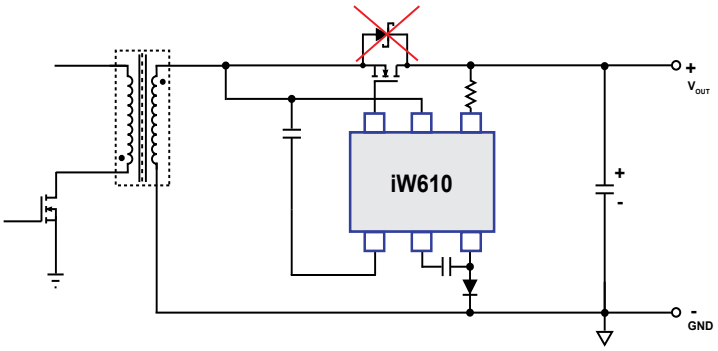
- Eliminates parallel Schottky diode for lower BOM cost
- Added benefits of iW676
  - 25V output, optimized for lowest BOM cost in applications up to 12V
  - Optimized for Direct Charging applications down to 3V
  - Incorporates AVP (Active Voltage Positioning) for fast dynamic load response
- ***DiaSIM***™ simulation models available



iW610, iW611

Synchronous Rectifier Controllers Optimized for ZVS

- Optimized for high power density ZVS applications
  - Supports multiple flyback topologies: QR, DCM/CCM mode, active clamp, ZVS
- Patented V_{CC} charging technology for higher system efficiency
- Support for high-side and low-side SR topologies
  - No auxiliary winding required
- Wide operating output voltage: 3V - 28V
- High frequency switching up to 500kHz (iW611)



High-side synchronous rectification using iW610 or iW611

AC/DC PWM ICs with Integrated *AccuSwitch*™ High-Voltage Switch

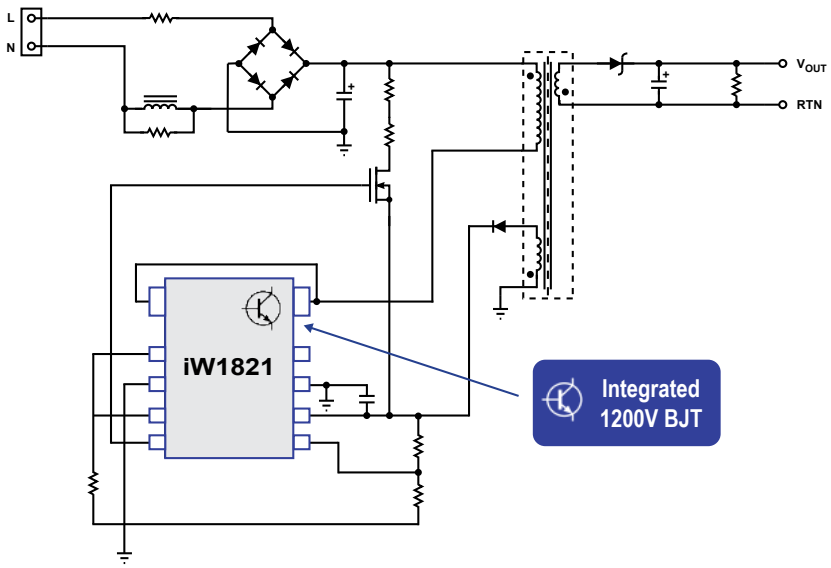
Product	Typical Output Power (max.)	Regulation	Power Supply Topology	No-Load Standby Power	Driver Type	Features	Package
iW1816	5W	Primary-side	Isolated Flyback	< 30mW	Integrated 800V BJT		SO-7
iW1818	12W	Primary-side	Isolated Flyback	< 50mW	Integrated 800V BJT		PDIP-7
iW1821	12W	Primary-side	Isolated Flyback	< 50mW	Integrated 1200V BJT	▪ Optimized for high-voltge 3-phase systems	SO-10 Batwing
RAA223181	12W	Secondary-side	Isolated Flyback	<150mW	Integrated 900V FET	▪ Single 400V input capacitor for input up to 450V_{AC} ▪ Frequency doubling for heavy load operation, up to 12W within 100ms ▪ Programmable fixed switching frequency, friendly with PLC communication ▪ Valley switching for best efficiency and EMI across full load range	SOIC16-13
RAA223182	11W	Secondary-side	Isolated Flyback	<150mW	Integrated 1000V FET	▪ Single 400V input capacitor for input up to 450V_{AC} Frequency doubling for heavy load operation, up to 21W within 100ms ▪ Programmable fixed switching frequency, friendly with PLC communication ▪ Valley switching for best efficiency and EMI across full load range	SOIC16-13
RAA223183	11W	Secondary-side	Isolated Flyback	<150mW	Integrated 1000V FET	▪ Single 400V input capacitor for input up to 450V_{AC} ▪ Frequency doubling for heavy load operation, up to 11W within 100ms ▪ Programmable fixed switching frequency, friendly with PLC communication ▪ Valley switching for best efficiency and EMI across full load range	SOIC16-13
iW1820	15W	Primary-side	Isolated Flyback	< 30mW	Integrated 800V BJT	▪ Optimized for 5V output	SO-10 Batwing
iW1830	15W	Primary-side	Isolated Flyback	< 50mW	Integrated 700V FET	▪ Optimized for 12V output	PDIP-7
NEW RAA223881	15W	Secondary-side	Isolated Flyback		Integrated 700V FET	▪ Quasi-resonant switching at full load and PFM at light load for best efficiency and EMI across full load range	PDIP-7
iW1819	18W	Primary-side	Isolated Flyback	< 30mW	Integrated 800V BJT		SO-10 Batwing
iW1822	18W	Primary-side	Isolated Flyback	< 30mW	Integrated 900V BJT	▪ 900V high breakdown voltage	SO-10 Batwing
iW1825	25W	Primary-side	Isolated Flyback	< 75mW	Integrated 700V FET	▪ Configurable light load mode	SO-10 Batwing
NEW RAA223882	30W	Secondary-side	Isolated Flyback		Integrated 700V FET	▪ Quasi-resonant switching at full load and PFM at light load for best efficiency and EMI across full load range	PDIP-7

AC/DC PWM ICs with Integrated *AccuSwitch*™ High-Voltage Switch

iW1821, iW1822

PWM Controllers Optimized for Smart Electricity Meters

- PWM controller and BJT in one package
  - iW1821: 12W output, integrated 1200V BJT, for high voltage three-phase meters
  - iW1822: 18W output, integrated 900V BJT, for single-phase and three-phase meters
- ***PrimAccurate***™ digital primary-side regulation eliminates optocoupler
- Isolated flyback power supply topology without adding components
- Optimized to start into large capacitive loads up to 6,000µF
- High light-load and active-mode efficiency
- Low standby power iW1821 < 50mW, iW1822 < 30mW
- ***EZ-EMI***™ - valley mode switching lowers EMI, reduces filtering components size/cost
- Innovative 10-lead SOIC Batwing package
  - Based on JEDEC-standard SOIC-14
  - Provides high-voltage isolation
  - Small footprint, enhanced thermal performance

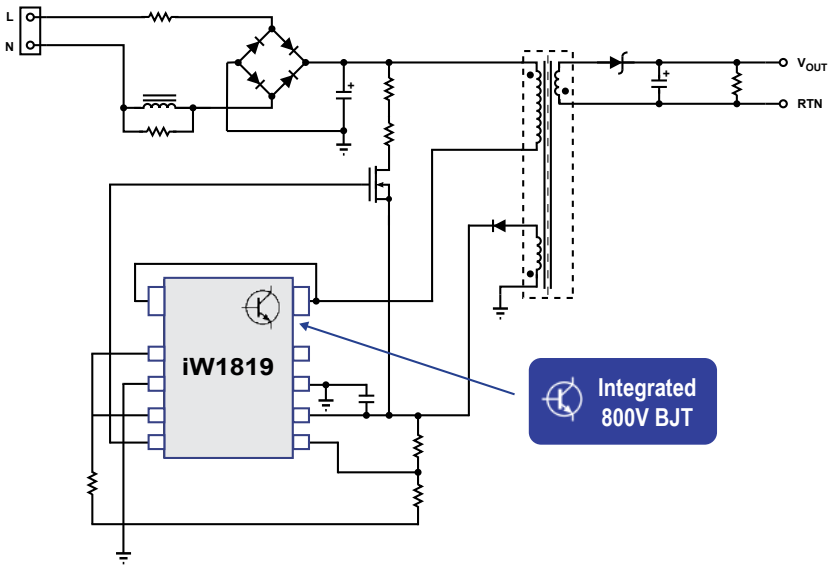


AC/DC PWM ICs with Integrated *AccuSwitch*™ High-Voltage Switch

iW1816, iW1819

AccuSwitch™ PWM Controllers Optimized for Appliances

- PWM controller and BJT in one package
  - iW1816: 5W output, integrated 800V BJT
  - iW1819: 18W output, integrated 800V BJT
- ***PrimAccurate***™ digital primary-side regulation eliminates optocoupler
- Isolated flyback power supply topology without adding components
- Optimized to start into large capacitive loads up to 6,000µF
- High light-load and active-mode efficiency
- Low standby power < 30mW
- ***EZ-EMI***™ - valley mode switching lowers EMI, reduces filtering components size/cost
- Innovative 10-lead SOIC batwing package (iW1819)
  - Based on JEDEC-standard SOIC-14
  - Provides high-voltage isolation
  - Small footprint, enhanced thermal performance

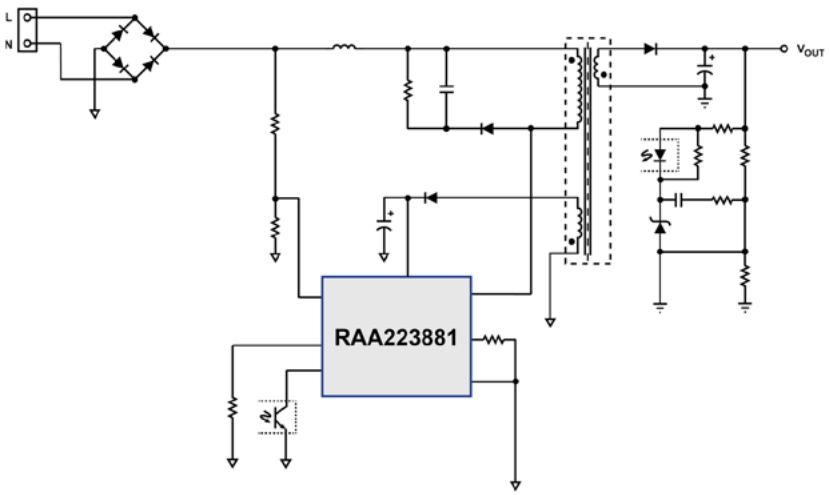


AC/DC PWM ICs
RAA22388X 700V Flyback Regulators from 15W to 30W+

RAA223881, RAA223882

RAA22388X 700V Flyback Regulators from 15W to 30W+

- Built-in avalanche-rated 700V MOSFET:
  - RAA223881: up to 15W, integrated 700V 5W MOSFET, PDIP-7
  - RAA223882: up to 30W, integrated 700V 1.4W MOSFET, PDIP-7
- Built-in 700 V startup JFET for low standby power
- 65kHz switching frequency
- Best efficiency and EMI across full load range
  - PWM@ full load
  - PFM @ light load
- Current-Mode operation, Burst Mode for Low Standby Power
- Full Protection Features, including ULVO, OVP, OLP, OTP, SCP, Latch-Off Protection



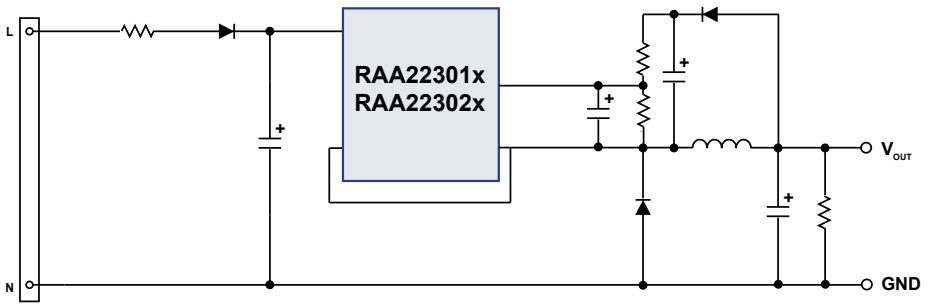
AC/DC Non-Isolated High-Voltage Buck Regulators

Product	Typical Output Power (max.)	Power Supply Topology	No-Load Standby Power	Driver Type	Key Features	Package
RAA223012	2.5W	Non-Isolated Buck	<10mW	Integrated 700V MOSFET	▪ Low EMI, no audible noise, supports 3.3V or 5V output directly - no second-stage LDO needed	TSOT23-5, SOIC-8
RAA223011	5W	Non-Isolated Buck	<10mW	Integrated 700V MOSFET	▪ Low EMI, no audible noise, supports 3.3V or 5V output directly - no second-stage LDO needed	TSOT23-5, SOIC-8-7, SOIC-8
RAA223010	10W	Non-Isolated Buck	~ 5-30mW	Integrated 700V MOSFET	▪ Low EMI, no audible noise, supports 3.3V or 5V output directly - no second-stage LDO needed	SOIC8-7
RAA223021	12W	Non-Isolated Buck	< 20mW	Integrated 700V MOSFET	▪ Low EMI, no audible noise, supports 3.3V or 5V output directly - no second-stage LDO needed	SOIC8-7

RAA223010

Key Features

- Non-isolated buck makes AC/DC design easy
  - Eliminates power transformer
- Also supports flyback topologies
- No audible noise, even at light load
- Low standby power: 5 to 30mW
- Low EMI (conducted and radiated)
- Supports 3.3V or 5V output directly
  - No second-stage LDO needed



Renesas' Quiet light-load PFM Mode

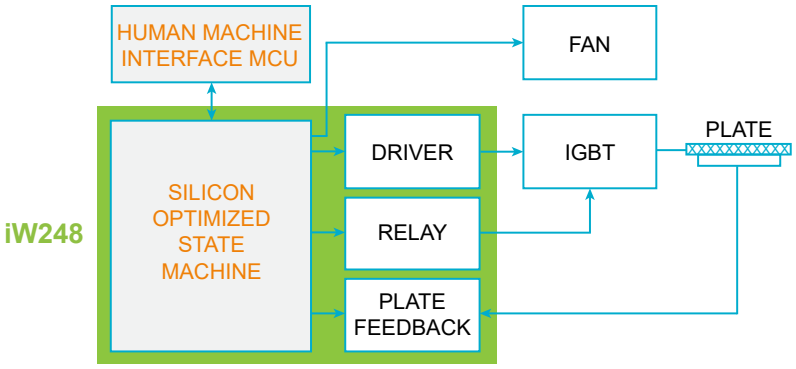
Controlled frequency eliminates sub-harmonic energy

Induction Cooker Controller

iW248

Smart IGBT Controller Simplifies Induction Heat Cooker Design

- Digital controller and analog driver blocks in one IC
  - Digital state machine replaces traditional MCU
  - Integrated IGBT controller
  - No programming needed
  - Full functions built in
- Built-in advanced protection circuitry, including:
  - Input voltage and current sense circuit
  - System component temperature sense circuit
  - Pan detection circuit to protect IGBT
  - Over-voltage protection for IGBT collector
  - Three dedicated over-temperature protection pins
  - Input surge protection
  - Output power compensation
  - EMI enhancement
- Eliminates up to 35 components
- Low-power continuous mode operation option
- 10W resolution power control, starts from 0W
- Supports $110V_{AC}$ and $220V_{AC}$



See Renesas iW248 video

SSL LED Drivers Commercial

Two-Stage SSL Phase-Cut Drivers

Product	Typical Output Power	Power Factor	Topology	Maximum Switching Frequency	Boost Driver Type	Flyback Driver Type	Dimming Range	Features	Package
iW3614	3W - 15W	PF > 0.9	2 Stages	200kHz	FET	FET	1% - 100%	▪ Phase-cut dimming	SO-8
iW3616	3W - 12W	PF > 0.95	2 Stages	200kHz	BJT	FET	1% - 100%	▪ Phase-cut dimming	SO-14
iW3617	12W - 25W	PF > 0.95	2 Stages	200kHz	BJT	FET	1% - 100%	▪ Phase-cut dimming	SO-14

Single-Stage PFC and PFC Flyback SSL Controllers

Product	Typical Output Power	Power Factor	Topology	Maximum Switching Frequency	Boost Driver Type	CC Tolerance	Flyback Driver Type	Features	Package
iW2206	3W - 250W	PF > 0.9	1 Stage (Boost PFC)	300kHz	FET	N/A	N/A	▪ High-power boost PFC front-end controller ▪ Configurable DC bus voltage	SOT23-6
iW3627	3W - 90W	PF > 0.9	1 Stage Constant Voltage	Configurable 90kHz or 120kHz	N/A	N/A	FET	▪ PFC front-end controller ▪ Output OVP, OCP ▪ Over-temperature protection	SOT23-6
iW3636	3W - 90W	PF > 0.9	1 Stage	Configurable 72kHz or 90kHz	N/A	± 5%	1% - 100%	▪ 0-10V & PWM dimming	SO-8
iW3671	3W - 90W	PF > 0.9	1 Stage	300kHz	N/A	± 5%	FET	▪ PFC front-end controller ▪ CV/CC flyback	SOT23-6
iW3677	3W - 90W	PF > 0.9	1 Stage	300kHz	N/A	± 5%	FET	▪ PFC front-end controller ▪ CV/CC flyback ▪ Integrated high-voltage startup	SO-7
iW3827	3W - 8W	PF > 0.9	1 Stage Constant Voltage	Configurable 90kHz or 120kHz	N/A	N/A	Internal 650V FET	▪ Output OVP, OCP ▪ Over-temperature protection	SO-7

SSL LED Drivers Commercial (continued)

SSL Interface ICs

Product	Voltage	Optocoupler Delay Elimination	Dimming			Features	Package
			Analog	PWM	Resistive		
iW330	5V - 60V Operating	Yes	0-10V, 0-5V ✓	0-10V, 0-5V ✓	✓	▪ Serial Interface Controller	SO-8
iW337	15V - 60V Operating	Yes	✓	✓	✓	▪ Serial Interface Controller	SO-8
iW338	8V - 60V Operating	No	✓			▪ 0 - 0.6V Analog Interface Controller	SO-8
iW339	15V - 60V Operating	Yes	✓	✓	✓	▪ Serial Interface Controller	SO-8
iW350	15V - 60V Operating	Yes	✓	✓	✓	▪ Serial Interface Controller with programmable: - Minimum duty - Maximim voltage - PWM frequency range - Turn-off voltage	SO-8
NEW RRW60360	14V - 55V Operating	Yes	✓	✓	✓	▪ Dual-channel Interface Controller with programmable: - Minimum duty - Maximim voltage - PWM frequency range - Turn-off voltage	SO-8

Second-Stage SSL PWM Controllers

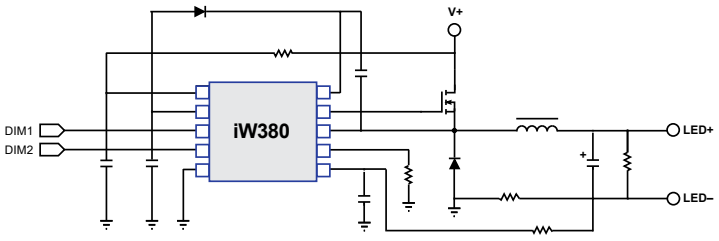
Product	Input Voltage	Output Power	Integrated FET	Dimming Range	Features	Package
iW3638	Low-voltage DC	90W	N/A	1% - 100%	▪ Buck Regulator with True DC dimming	SO-8
iW3637	High-voltage DC or AC	150W	N/A	1% - 100%	▪ Buck/Flyback Regulator with True DC dimming	SO-8
iW380	22V - 78V Input	150W	N/A	0.0625% ~ 100%	▪ Buck Regulator with high-resolution True DC dimming ▪ IEC62386-2014 DALI-2 compliant ▪ iW380-40 for stage lighting applications	SO-10
iW388	22V - 78V Input	40W	Yes	0.0625% ~ 100%	▪ Buck Regulator with high-resolution True DC dimming ▪ IEC62386-2014 DALI-2 compliant ▪ Integrated MOSFET	SO-10 Batwing

SSL LED Drivers Commercial (continued)

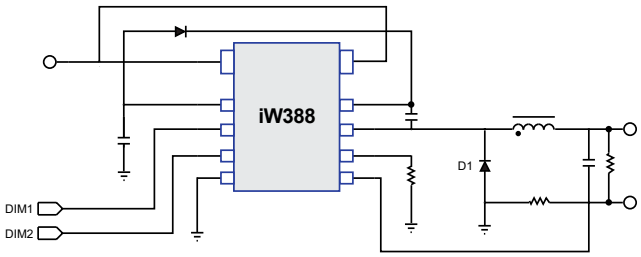
iW380, iW388

High-Resolution, True DC Dimming Solutions for DALI, Stage Lighting

- High-resolution, second-stage PWM buck controllers
- True DC dimming – low-end dimming without flicker
  - Deep dimming range: 0.0625% to 100%
  - Flicker-free dimming resolution: 0.0625% steps
- IEC62386-2014 DALI-2 compliant
- 3-in-1 dimming: RSET, PWM, analog
- Wide input voltage range: 22V – 78V



iW380: 150W Low-Voltage Buck Controller



iW388: 40W Low-Voltage Buck Controller with Integrated MOSFET

SOIC-10 Package

Innovative SO-10 Batwing Package

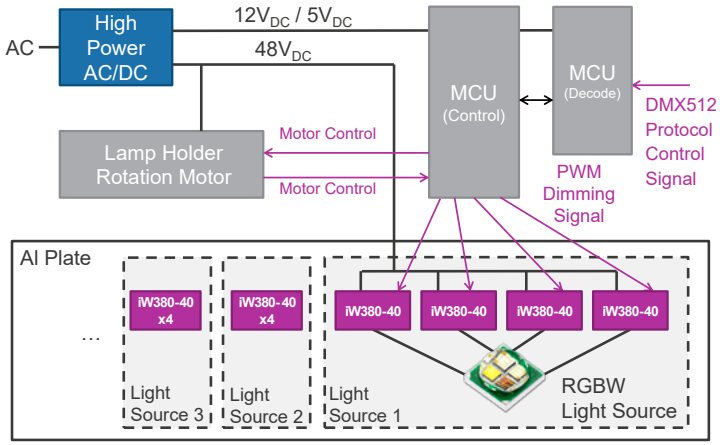
- Based on JEDEC-standard SOIC-14
- Provides high-voltage isolation
- Small footprint, enhanced thermal performance

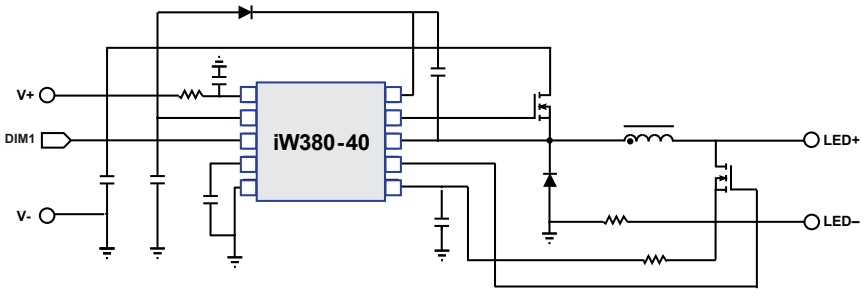
SSL LED Drivers Commercial (continued)

iW380-40

High-Resolution, High-Frequency PWM Controller Optimized for Stage Lighting

- High-resolution, second-stage PWM buck controller
- DC dimming combined with PWM dimming
  - Deep dimming range: 0.01% to 100%
  - Flicker-free dimming resolution: 0.0625% steps
- PWM control for accurate color mixing
- Fast PWM dimming: 20kHz to 35kHz input frequency range
- Uses power NMOS as buck main switch
- Highly integrated to reduce BOM size/cost
  - Built-in LED short-circuit MOS driver (Shunt pin)
  - Internal reverse MCU PWM signal
- Digital control
  - Simplifies design, eliminates many resistors and capacitors
  - Enables stable, flickerless low-end dimming



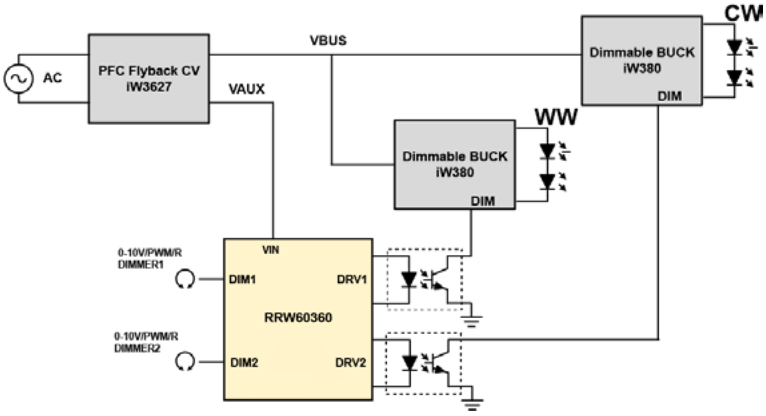


SSL LED Drivers Commercial (continued)

RRW60360

Dual Channel SSL Interface Controller

- 14V to 55V V_{IN}
- Dual input / dual output
  - 3 in 1 dimmer input (0-10V, PWM and Rset)
  - Independent or related two outputs
    - ✓ **Similar performance as MCU, but less cost!**
- High dimming resolution
  - 0.1% resolution for 0-10V and R dimming
  - 0.025% resolution for PWM dimming
- Rich configurations for min output duty, turn-off threshold, and max dimming voltage
- Flexible PWM output frequency options: configurable 0.1 - 1.3kHz, 0.4 - 5kHz, and 20kHz
- Low power mode



SOIC-8 Package

SSL LED Drivers Commercial (continued)

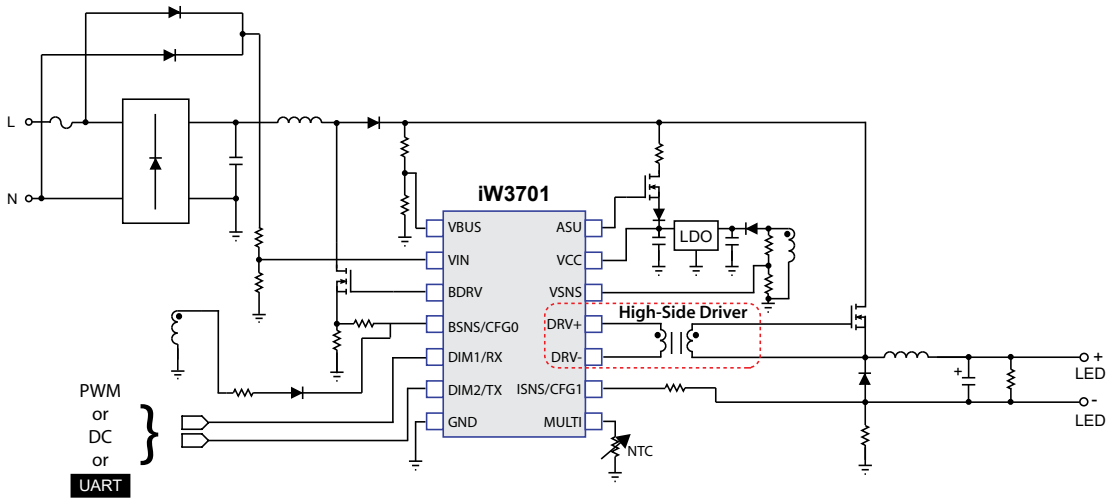
Combo SSL LED Drivers

Product	Typical Output Power	Power Factor	Topology	Maximum Switching Frequency	Dimming Resolution	CC Tolerance	Flyback Driver Type	Features	Package
iW3629	5W - 120W	PF > 0.95	2 Stages (Boost+Flyback)	200kHz	N/A	± 5%	FET	▪ Non-dimmable ▪ Flickerless high PF and low THD combo chip ▪ Over-temperature protection and derating, optional external NTC	SO-14
iW3631	5W - 120W	PF > 0.95	2 Stages (Boost+Flyback)	200kHz	N/A	± 5%	FET	▪ 0-10V Dimming ▪ Flickerless high PF and low THD combo chip ▪ Over-temperature protection and derating, optional external NTC	SO-14
iW3700	5W - 120W	PF > 0.95	2 Stages (Boost+Flyback)	200kHz	0.0625%	± 3%	FET	▪ UART or 3-in-1 dimming option ▪ Flickerless high PF and low THD combo chip ▪ 0.0625% dimming resolution	SO-14
iW3701	5W - 200W	PF > 0.95	2 Stages (Boost+HV Buck)	200kHz	0.0625%	± 3%	FET	▪ UART or 3-in-1 dimming option ▪ Flickerless high PF and low THD combo chip ▪ 0.0625% dimming resolution	SO-14

iW3700, iW3701

Digital Combo SSL Controllers Optimized for Industrial Lighting

- Digital PFC + flyback and PFC + buck topologies
- True DC dimming – low-end dimming without flicker
  - Maximum dimming range: 0.0625% to 100%
  - Flicker-free dimming resolution: 0.0625% steps
- High PF > 0.95 with low THD < 20% at 277V/50Hz, 50% load
- Digital PFC stage optimizes for high PF, low THD at light loads with fast dynamic load response
  - Enables use of small input capacitors with low voltage rating for higher power density, lower cost
- Meets IEC61000-3-2 harmonic current requirements
- Dual dimming ports for application flexibility
  - One port: field program maximum LED current
  - Second port: 3-in-1 dimming (0-10V analog, PWM, resistive)
- UART communication simplifies design for smart applications (e.g. IEC62386-2014 DALI-2)

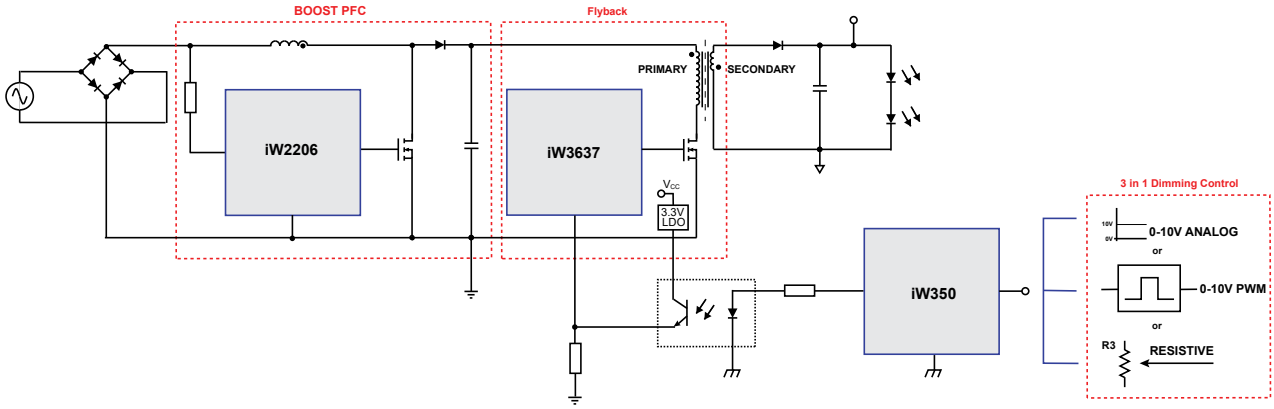


PFC Front-End Controllers

iW2206

High-Power Boost Front-End Controller with PFC

- Universal AC input ($90V_{AC}$ - $305V_{AC}$)
- Output power up to 250W
- Low standby power < 150mW at $230V_{AC}$ with 100W input power
- No audible noise at steady and dynamic load
- Configurable DC bus voltage
- High PF > 0.9, with low THD < 10% at $120V_{AC}$ and $230V_{AC}$ with full load
- Meets IEC61000-3-2 harmonic current requirements

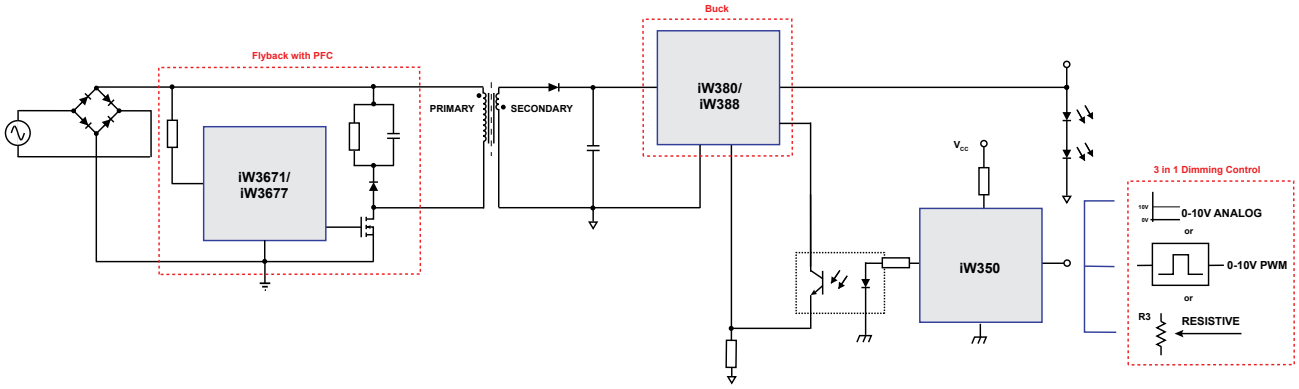


Boost PFC + Flyback/LLC/Forward LED Driver Application

iW3671, iW3677

Flyback Front-End Controllers with PFC

- Universal AC input ($90V_{AC}$ - $305V_{AC}$)
- Output power up to 90W
- Low standby power < 150mW at $230V_{AC}$ with 90W input power
- No audible noise at steady and dynamic load
- High PF > 0.9, with low THD < 10% at $120V_{AC}$ and $230V_{AC}$ with full load
- Meets IEC61000-3-2 harmonic current requirements
- Integrated high-voltage startup (iW3677)



Flyback PFC + Buck LED Driver Application

SSL LED Drivers Residential

Phase-Cut Dimmable LED Drivers

Product	Typical Output Power	Power Factor	Topology	Maximum Switching Frequency	Boost Driver Type	Flyback Driver Type	Dimming Range	Features	Package
iW3602	3W - 10W	PF > 0.9	2 Stages	200kHz	FET	FET	1% - 100%	▪ Phase-cut dimming	SO-8
iW3605	5W - 25W	PF > 0.92	1 Stage	90kHz	N/A	FET	10% - 100%	▪ Phase-cut dimming ▪ Bleederless	SO-8
iW3658	3W - 15W	Configurable PF > 0.7 to > 0.9	1 Stage	200kHz	N/A	FET (Integrated)	1% - 100%	▪ Phase-cut dimming ▪ Integrated FET	SO-7
iW3662	4W - 8W	PF > 0.7	2 Stages	1MHz	FET	FET	5% - 100%	▪ Phase-cut dimming ▪ Magnetic or electronic transformer capable	QFN-16
iW3688	3W - 20W	PF > 0.92	1 Stage	90kHz	N/A	FET	1% - 100%	▪ Phase-cut dimming ▪ Configurable temperature derating point	SO-14
iW3689	3W - 25W	PF > 0.92	1 Stage	200kHz	N/A	FET	1% - 100%	▪ Phase-cut dimming ▪ Configurable temperature derating point	SO-8
iW3989	3W - 15W	Configurable PF > 0.7 to > 0.9	Linear	N/A	N/A	FET	1% - 100%	▪ AC direct phase-cut dimming	QFN-12

Non-Dimmable LED Drivers

Product	Typical Output Power	Power Factor	Topology	Maximum Switching Frequency	Boost Driver Type	CC Tolerance	Flyback Driver Type	Features	Package
iW3626	3W - 10W	Configurable PF > 0.7 to > 0.9	1 Stage	72kHz	N/A	± 5%	BJT	▪ LED Open/Short ▪ Over-temperature protection and derating	SOT23-6
iW3625	10W-45W	Configurable PF > 0.7 to > 0.9	1 Stage	72kHz	N/A	± 5%	FET	▪ LED Open/Short ▪ Over-temperature protection and derating	SOT23-6

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