RENESAS

BIG IDEAS FOR EVERY SPACE

AC/DC POWER MANAGEMENT ICs

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

2022.05

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.

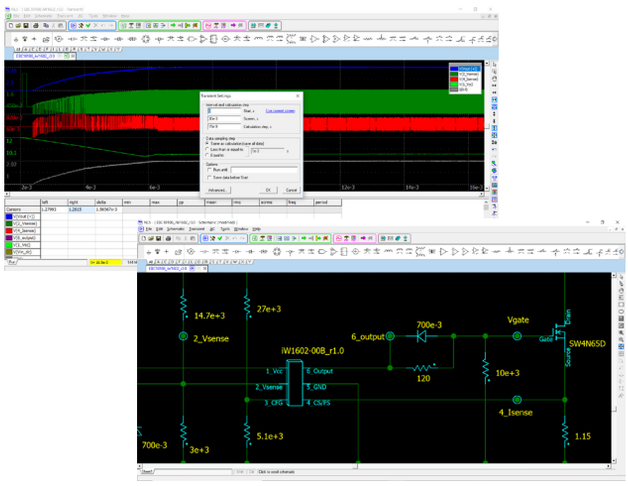
*All products with iWxxxx part numbers use Renesas' proprietary digital control technology.

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								
NEW 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
NEW iW9802	TL431	iW610	100W+		FET	Yes	▪ Compatible with TL431 ▪ SR controller optimized for ZVS (iW610)	SO-10/ SOT23-6
NEW iW9806	TL431	iW611	100W+		GaN	Yes	▪ Optimized for GaN power devices ▪ Compatible with TL431 ▪ SR controller optimized for ZVS (iW611)	SO-10/ SOT23-6
NEW 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
NEW 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
NEW 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
NEW iW9862	TL431	iW610	65W		FET		▪ Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design ▪ Compatible with TL431	SOT23-6/ SOT23-6
NEW 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
NEW 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
NEW 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

(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

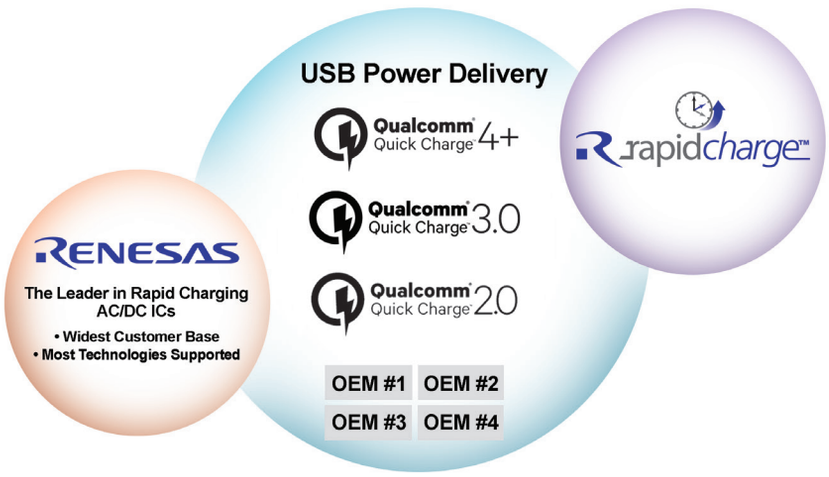
Qualcomm® Quick Charge™ is a product of Qualcomm Technologies, Inc.

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 3.0 + 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

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

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

	Primary Side	Secondary Side	Synchronous Rectifier (SR) (>90% Efficiency)	Primary-Side Driver Type	*RapidCharge*™ Protocol: Qualcomm® Quick Charge™	*RapidCharge*™ Protocol: Direct Charge	*RapidCharge*™ Protocol: USB Power Delivery[1]	Output Power[1]	No-Load Standby Power	Output Voltage	ZVS[2]	Features
NEW	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)
NEW	iW9802	TL431	iW610	FET	User Defined Interface			100W+		User Programmable	Yes	▪ Compatible with TL431 ▪ SR controller optimized for ZVS (iW610)
NEW	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)
NEW	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)
NEW	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)
NEW	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)
NEW	iW9862	TL431	iW610	FET	User Defined Interface			65W	--	User Programmable		▪ Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design ▪ Compatible with TL431
NEW	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
NEW	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
NEW	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

(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

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

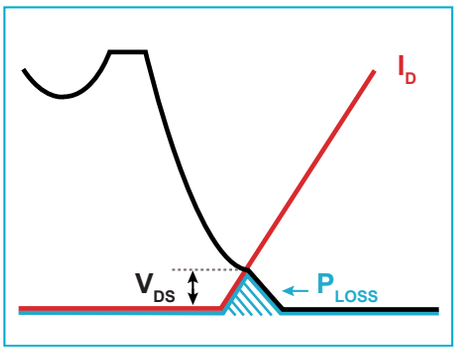
AC/DC *RapidCharge*™ Adapter Solutions (continued)

iW9801 + iW709

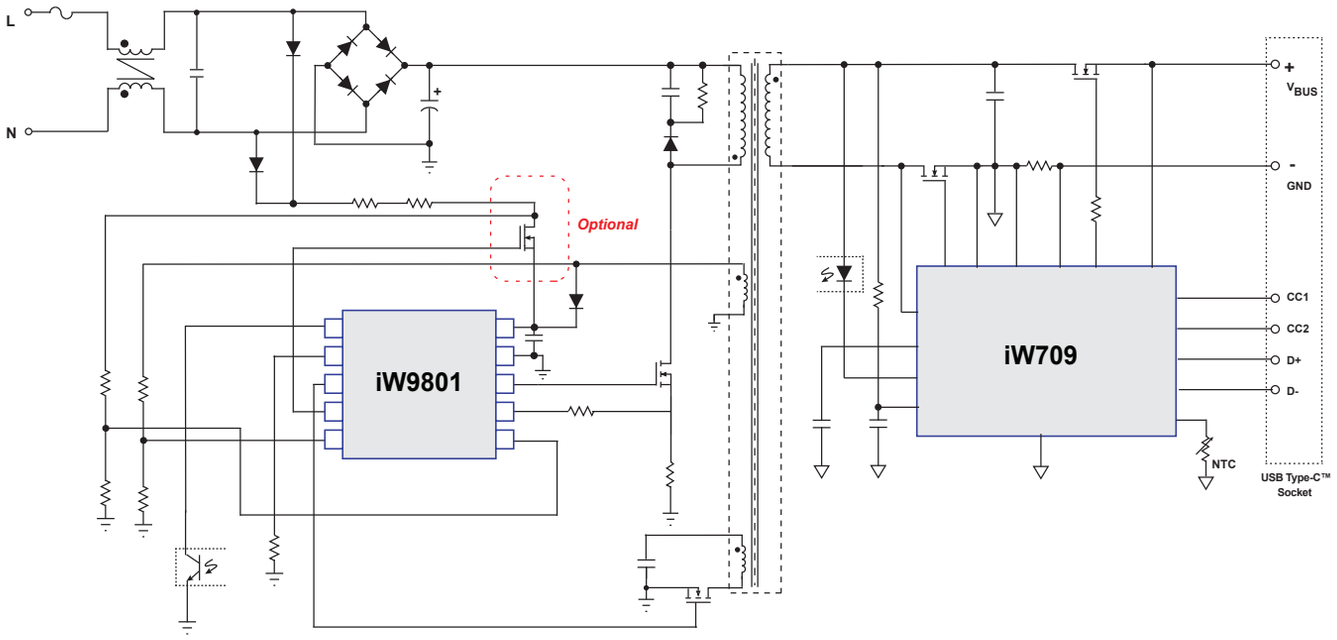
High-Power Density Solution Enables 65W USB PD Fast Chargers in Half the Size

- 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
- iW709 USB PD 3.0 controller
  - Integrated synchronous rectifier
  - Secondary-side digital compensation eliminates loop components, ensures stability
  - USB-IF PD certified (USB PD 3.0 + PPS)
- High switching frequency up to 200kHz enables
  - Smaller, lighter weight transformer
  - Lowest BOM cost
- < 20mW no-load standby power consumption
- iW9802 option for industry-standard interface (e.g. TL431)
- Hardwired state machine prevents fast chargers from hacking

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



Renesas' patented ZVS technology significantly reduces switching losses



See Renesas ZVS video here

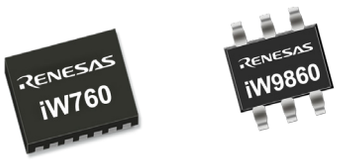
AC/DC *RapidCharge*™ Adapter Solutions (continued)

iW9860 + iW760

Zero Standby Power 63W USB PD Adapters

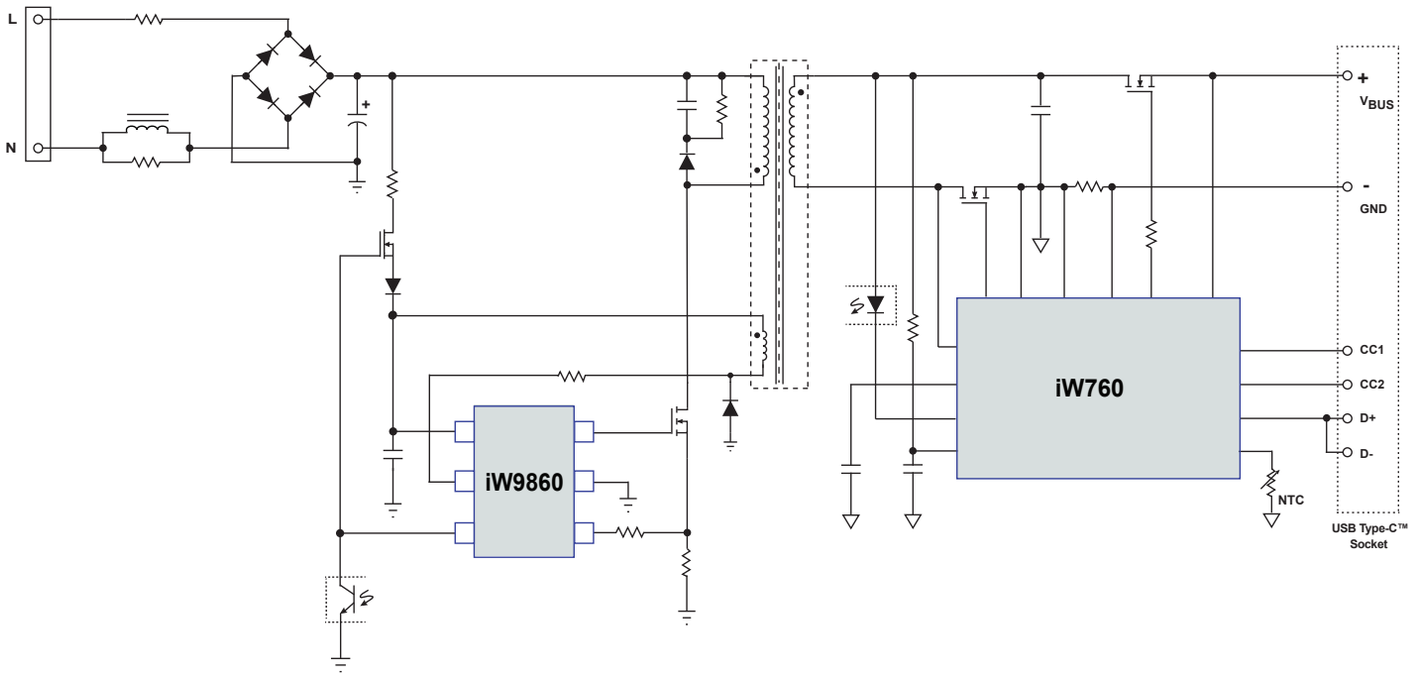
- < 5mW no-load standby power consumption
- Simple, easy-to-use, low BOM count solution
  - Single-layer PCB
- iW9860 AC/DC digital primary-side quasi-resonant (QR) flyback controller
  - Dual-polarity auxiliary winding sensor improves EMI, simplifies transformer design
- iW760 QR interface controller
  - 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

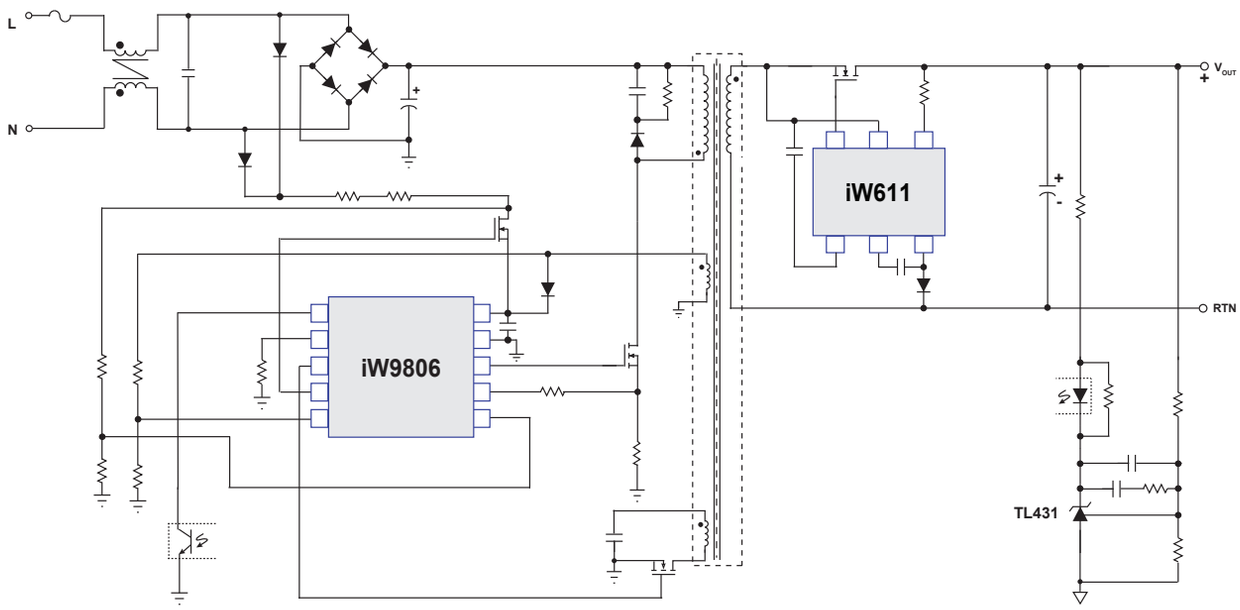


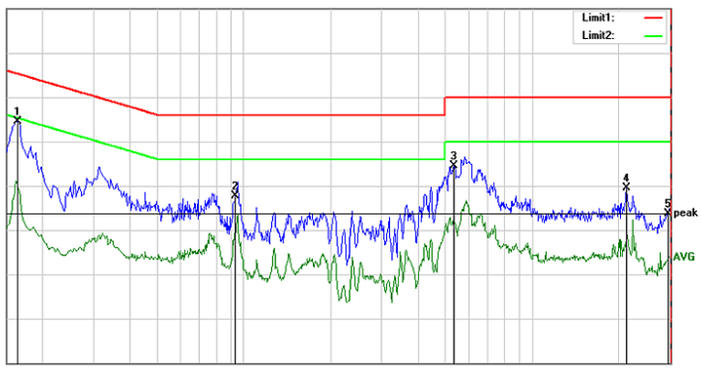
AC/DC *RapidCharge*™ Adapter Solutions (continued)

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

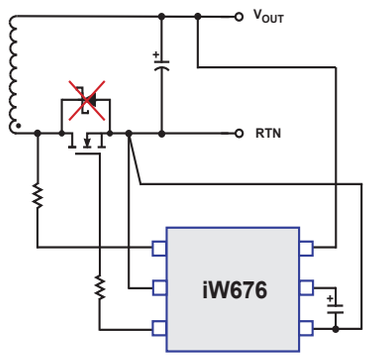
AC/DC Secondary-Side ICs

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
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

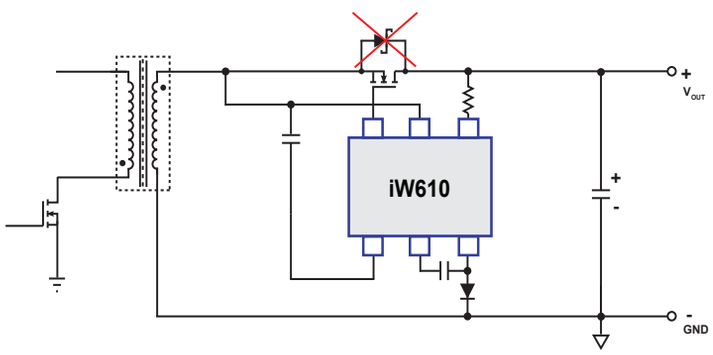
- Eliminates parallel Schottky diode for lower BOM cost
- Added benefits of iW676
  - 25V output, optimized for lowest BOM cost in applications up to 12V
  - Optimized for Direct Charging applications down to 3V
  - Incorporates AVP (Active Voltage Positioning) for fast dynamic load response
- ***DiaSIM***™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

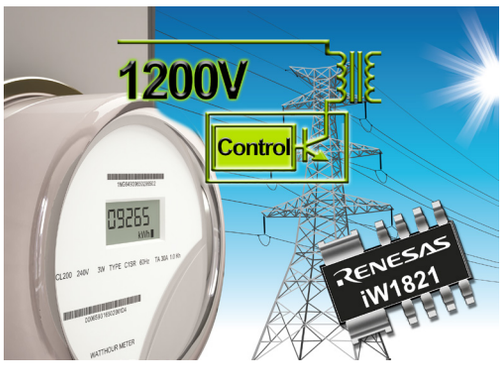
Product	Typical Output Power (max.)	Regulation	Power Supply Topology	No-Load Standby Power	Driver Type	Features	Package
iW1816	5W	Primary-side	Isolated Flyback	< 30mW	Integrated 800V BJT		SO-7
iW1818	12W	Primary-side	Isolated Flyback	< 50mW	Integrated 800V BJT		PDIP-7
iW1821	12W	Primary-side	Isolated Flyback	< 50mW	Integrated 1200V BJT	▪ Optimized for high-voltge 3-phase systems	SO-10 Batwing
NEW 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
SOON RAA223182	12W	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 12W 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
SOON 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	SOIC8-7
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
SOON 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	PDIP8-7
SOON RAA223883	40W	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	PDIP8-7

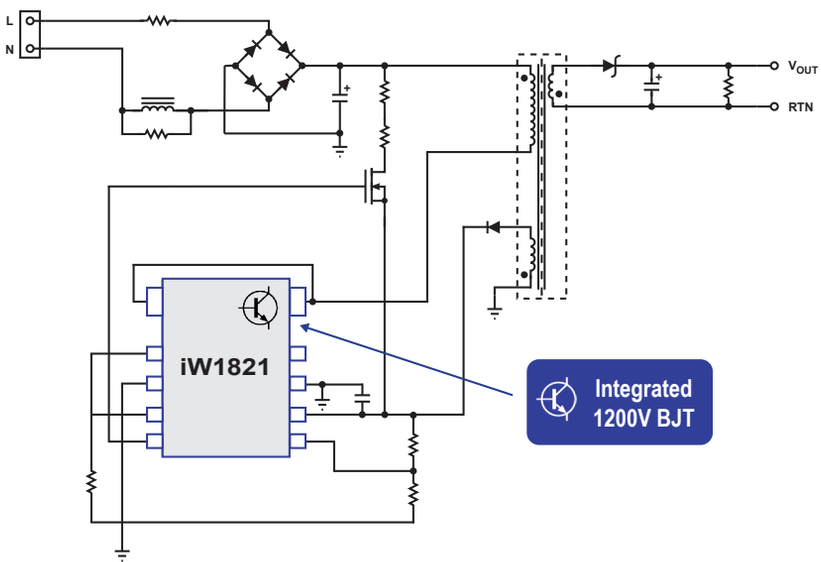
AC/DC PWM ICs with Integrated *AccuSwitch*™ High-Voltage Switch

iW1821, iW1822

AccuSwitch™ 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



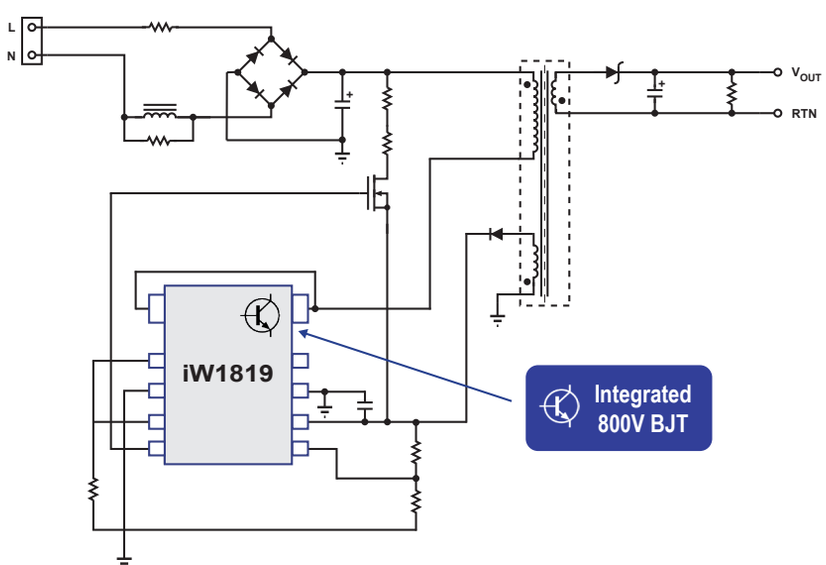


AC/DC PWM ICs with Integrated *AccuSwitch*™ High-Voltage Switch

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



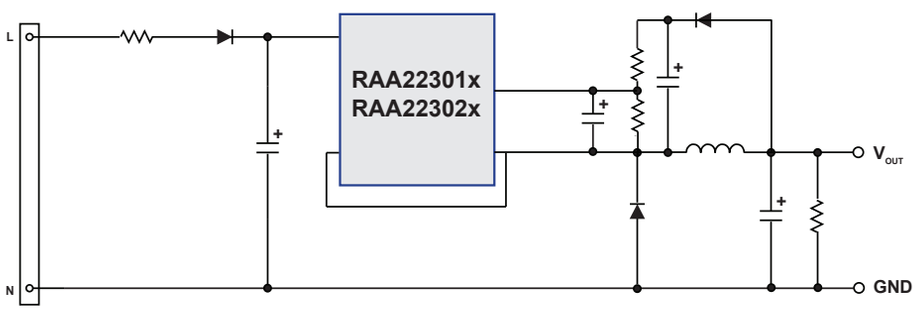
AC/DC Non-Isolated High-Voltage Buck Regulators

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	4W	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
NEW RAA223010	6W	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	8W	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

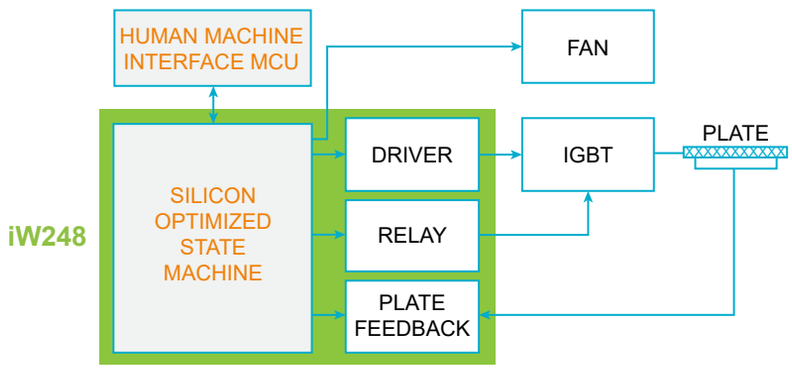
Controlled frequency eliminates sub-harmonic energy

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

Second-Stage SSL PWM Controllers

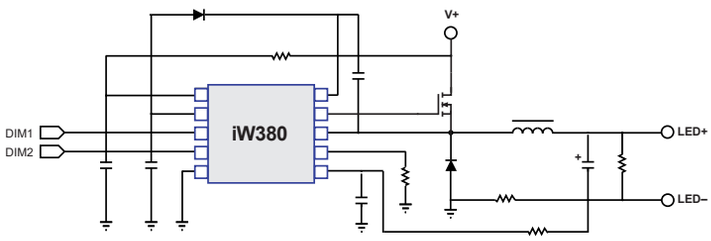
Product	Input Voltage	Output Power	Integrated FET	Dimming Range	Features	Package
iW3638	Low-voltage DC	90W	N/A	1% - 100%	▪ Buck Regulator with True DC dimming	SO-8
iW3637	High-voltage DC or AC	150W	N/A	1% - 100%	▪ Buck/Flyback Regulator with True DC dimming	SO-8
iW380	22V - 78V Input	150W	N/A	0.0625% ~ 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)

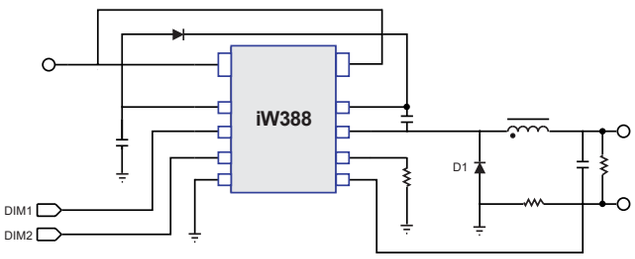
iW380, iW388

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

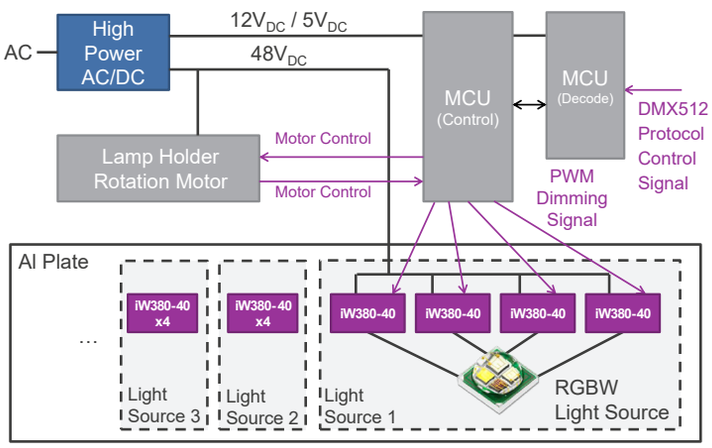
- Based on JEDEC-standard SOIC-14
- Provides high-voltage isolation
- Small footprint, enhanced thermal performance

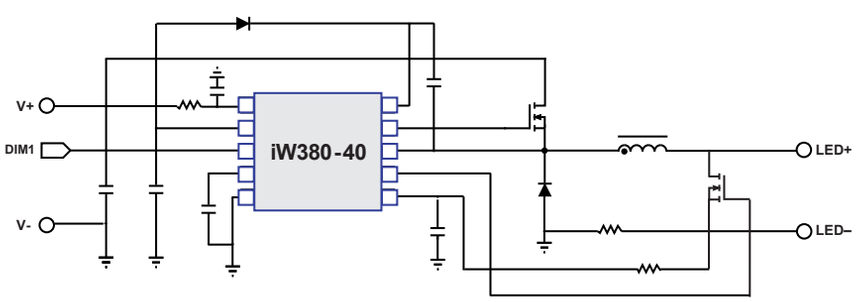
SSL LED Drivers Commercial (continued)

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)

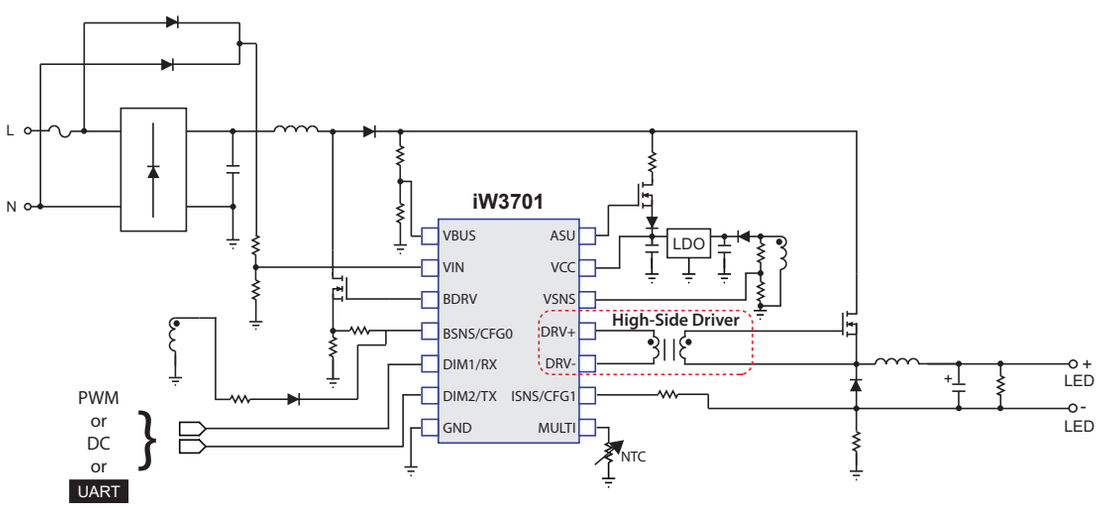
Combo SSL LED Drivers

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
NEW 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
NEW 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)

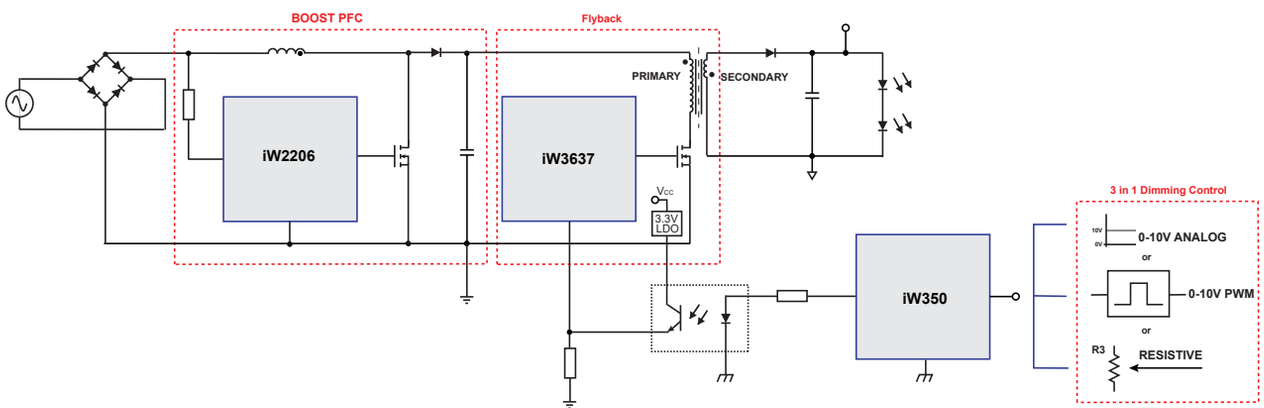


PFC Front-End Controllers

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

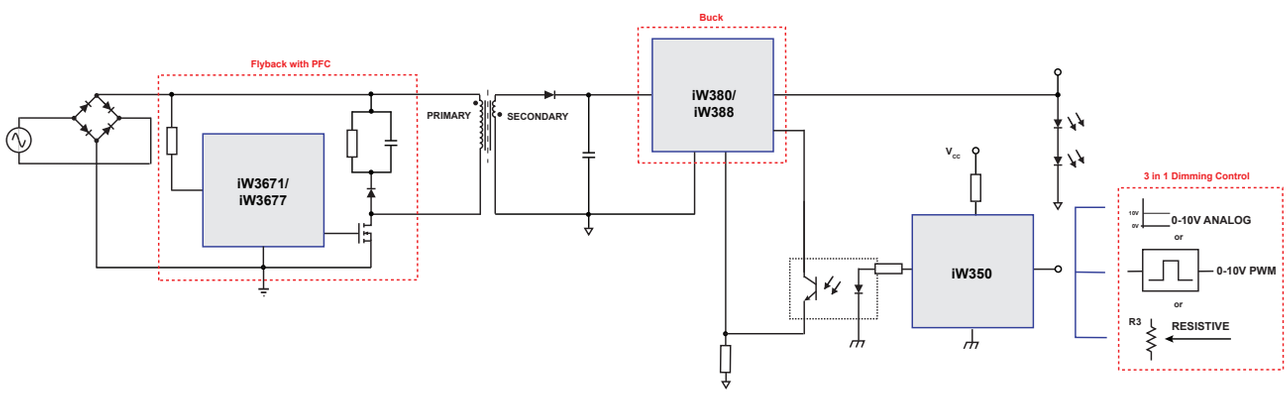


Boost PFC + Flyback/LLC/Forward LED Driver Application

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

RENESAS

BIG IDEAS FOR EVERY SPACE

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
6. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.
   Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS DOES NOT WARRANT OR GUARANTEE THAT RENESAS ELECTRONICS PRODUCTS, OR ANY SYSTEMS CREATED USING RENESAS ELECTRONICS PRODUCTS WILL BE INVULNERABLE OR FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION ("Vulnerability Issues"). RENESAS ELECTRONICS DISCLAIMS ANY AND ALL RESPONSIBILITY OR LIABILITY ARISING FROM OR RELATED TO ANY VULNERABILITY ISSUES. FURTHERMORE, TO THE EXTENT PERMITTED BY APPLICABLE LAW, RENESAS ELECTRONICS DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THIS DOCUMENT AND ANY RELATED OR ACCOMPANYING SOFTWARE OR HARDWARE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.
8. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
12. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
13. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
14. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.
(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev. 5.0-1 October 2020)

SALES OFFICES

Refer to "http://www.renesas.com/" for the latest and detailed information.

Renesas Electronics Corporation
TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0061, Japan

Renesas Electronics America Inc. Milpitas Campus
1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.
Tel: +1-408-432-8888, Fax: +1-408-434-5351

Renesas Electronics America Inc. San Jose Campus
6024 Silver Creek Valley Road, San Jose, CA 95138, USA
Tel: +1-408-284-8200, Fax: +1-408-284-2775

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 101-T01, Floor 1, Building 7, Yard No. 7, 8th Street, Shangdi, Haidian District, Beijing 100085, China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai 200333, China
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, #06-02 Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit No 3A-1 Level 3A Tower 8 UOA Business Park, No 1 Jalan Pengaturcara U1/51A, Seksyen U1, 40150 Shah Alam, Selangor, Malaysia Tel: +60-3-5022-1288, Fax: +60-3-5022-1290

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India
Tel: +91-80-67208700

Renesas Electronics Korea Co., Ltd.
17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5338

Renesas Electronics America, Inc.

www.renesas.com

Document No. R16CP0002EU0102