

Off-Line Digital Green-Mode Quasi-Resonant PWM Controller

1.0 Features

- No-load power consumption < 30mW at 230V_{AC} in typical 5V/2A power supplies
- Fast dynamic response with secondary-side load transient detection without opto-coupler
- Direct drive of low-cost BJT power switch achieving high efficiency
- Tight constant-voltage and constant-current regulation across line and load range with primary-side feedback and control
- Intelligent low power management achieves ultra-low operating current at no-load
- Proprietary optimized line/load adaptive maximum constant frequency PWM switching with quasi-resonant operation achieves best size, efficiency, and common mode noise
- User-configurable 4-level cable drop compensation provides design flexibility
- **EZ-EMI**[®] design enhances manufacturability
- Adaptive multi-mode PWM/PFM control improves efficiency
- No external loop compensation components required
- Built-in single-point fault protections against output short-circuit, output over-voltage, and output over-current
- On-chip internal over-temperature protection
- No audible noise over entire operating range
- **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

2.0 Description

The iW1601 is a high performance AC/DC power supply controller that uses digital control technology to build peak current mode PWM flyback power supplies. The device directly drives a power BJT and operates in quasi-resonant mode to provide high efficiency along with a number of key built-in protection features while minimizing the external component count, simplifying EMI design, and lowering the total bill of material cost. The iW1601 removes the need for secondary feedback circuit while achieving excellent line and load regulation. It also eliminates the need for loop compensation components while maintaining stability over all operating conditions. Pulse-by-pulse waveform analysis allows for a loop response that is much faster than traditional solutions, resulting in improved dynamic load response. The built-in power limit function optimizes transformer design in universal off-line applications and allows for a wide input voltage range.



Dialog's innovative proprietary technology ensures that power supplies built with the iW1601 and the secondary-side voltage positioning controller iW600 can achieve both the highest average active efficiency and less than 30mW no-load power consumption, and have fast dynamic load response in a compact form factor in typical 5V2A 10W applications.

3.0 Applications

- Compact AC/DC adapters or chargers for media tablets and smart phone
- AC/DC adapters for consumer electronics

Off-Line Digital Green-Mode Quasi-Resonant PWM Controller

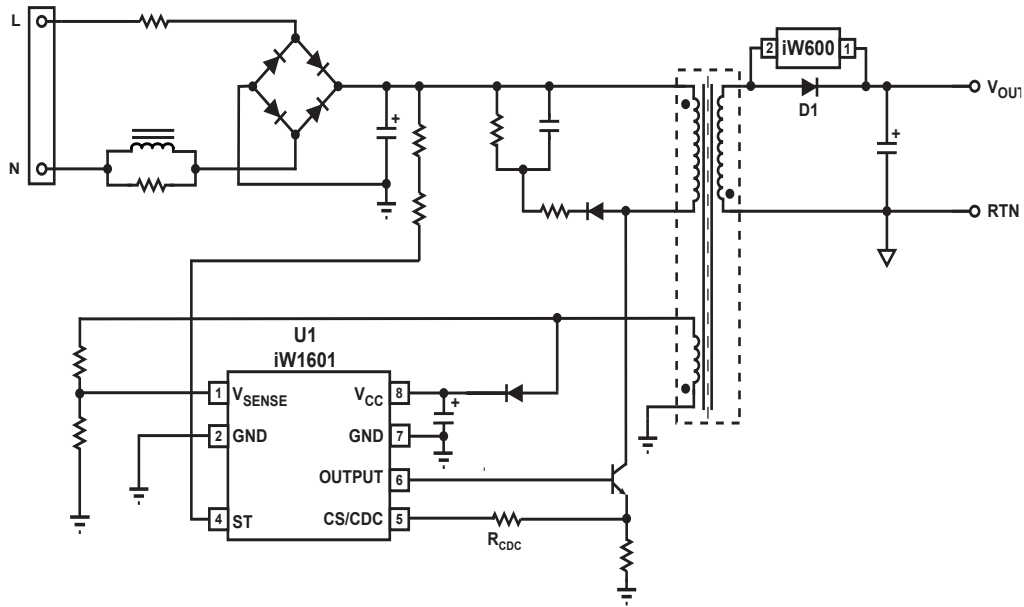


Figure 3.1: iW1601 Typical Application Circuit (Achieving < 30mW No-load Power Consumption in 5V2A 10W Adapter Designs with iW600 Secondary Voltage Position IC)

4.0 Pinout Description

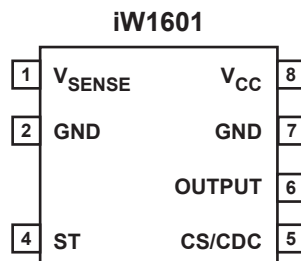


Figure 4.1: 7 Lead SOIC-7 Package

Pin #	Name	Type	Pin Description
1	V _{SENSE}	Analog Input	Auxiliary voltage sense. Used for primary side regulation and detection of secondary-side load transient signal.
2	GND	Ground	Ground.
4	ST	Power	Startup voltage input.
5	CS/CDC	Analog Input	Primary 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	Base drive for BJT.
7	GND	Ground	Ground.
8	V _{CC}	Power Input	IC power supply.

Off-Line Digital Green-Mode Quasi-Resonant PWM Controller

5.0 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 Electrical Characteristics in Section 6.0.

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}	25	mA
ST output (pin 4)		-0.3 to 25	V
OUTPUT (pin 6)		-0.3 to 4.0	V
V_{SENSE} input (pin 1, $I_{Vsense} \leq 10\text{mA}$)		-0.7 to 4.0	V
CS/CDC input (pin 5)		-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}	100	°C/W
ESD rating per JEDEC JESD22-A114 (except the HV pin) (Note 1)		$\pm 2,000$	V
Latch-up test per JESD78A		± 100	mA

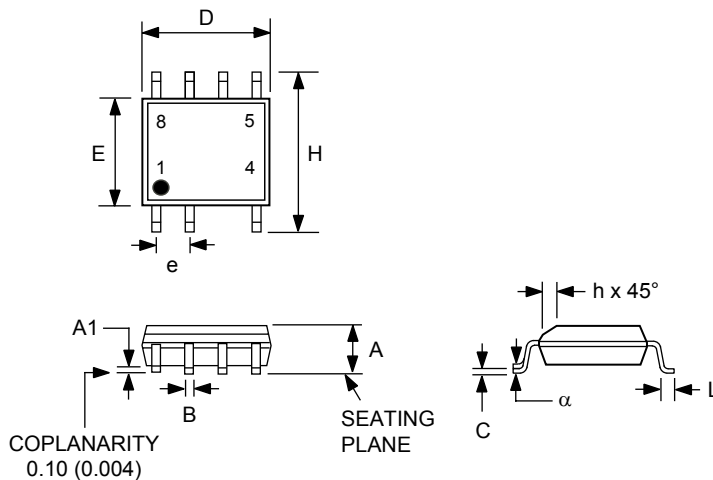
Notes:

Note 1. ESD rating including the HV pin: HBM= 400V.

Off-Line Digital Green-Mode Quasi-Resonant PWM Controller

6.0 Physical Dimensions

7-Lead Small Outline (SOIC) Package



Symbol	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	—	0.069	—	1.75
A1	0.004	0.0098	0.10	0.25
B	0.0123	0.0200	0.31	0.51
C	0.0075	0.0098	0.19	0.25
D	0.189	0.1970	4.80	5.00
E	0.1495	0.1575	3.80	4.00
e	0.05 BSC		1.27 BSC	
H	0.2284	0.244	5.80	6.20
h	0.0098 BSC		0.25 BSC	
L	0.0158	0.050	0.40	1.27
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 TBD

[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.

7.0 Ordering Information

Part Number	Options	Package	Description
iW1601-00	No latch, 2.8V CC shutdown voltage, smart hiccup with 2/8 duty cycle	SOIC-7	Tape & Reel ¹
iW1601-01	OVP latch, CC shutdown and latch, 3.5V CC shutdown voltage, no smart hiccup	SOIC-7	Tape & Reel ¹
iW1601-02	OVP latch, “no CC” operation and latch, no smart hiccup	SOIC-7	Tape & Reel ¹
iW1601-03	No latch, 3.0V CC shutdown voltage, no smart hiccup	SOIC-7	Tape & Reel ¹

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

Off-Line Digital Green-Mode Quasi-Resonant PWM Controller

Disclaimer

Information in this document is believed to be accurate and reliable. However, Dialog Semiconductor does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information. Dialog Semiconductor furthermore takes no responsibility whatsoever for the content in this document if provided by any information source outside of Dialog Semiconductor.

Dialog Semiconductor reserves the right to change without notice the information published in this document, including without limitation the specification and the design of the related semiconductor products, software and applications.

Applications, software, and semiconductor products described in this document are for illustrative purposes only. Dialog Semiconductor makes no representation or warranty that such applications, software and semiconductor products will be suitable for the specified use without further testing or modification. Unless otherwise agreed in writing, such testing or modification is the sole responsibility of the customer and Dialog Semiconductor excludes all liability in this respect.

Customer notes that nothing in this document may be construed as a license for customer to use the Dialog Semiconductor products, software and applications referred to in this document. Such license must be separately sought by customer with Dialog Semiconductor.

All use of Dialog Semiconductor products, software and applications referred to in this document are subject to Dialog Semiconductor's [Standard Terms and Conditions of Sale](#), unless otherwise stated.

© Dialog Semiconductor (UK) Ltd. All rights reserved.

RoHS compliance

Dialog Semiconductor complies to European Directive 2001/95/EC and from 2 January 2013 onwards to European Directive 2011/65/EU concerning Restriction of Hazardous Substances (RoHS/RoHS2).

Dialog Semiconductor's statement on RoHS can be found on the customer portal <https://support.diasemi.com/>. RoHS certificates from our suppliers are available on request.

Contacting Dialog Semiconductor

United Kingdom

Dialog Semiconductor (UK) Ltd
Phone: +44 1793 757700

Germany

Dialog Semiconductor GmbH
Phone: +49 7021 805-0

The Netherlands

Dialog Semiconductor B.V.
Phone: +31 73 640 88 22

Email

info_pcbg@diasemi.com

North America

Dialog Semiconductor Inc.
Phone: +1 408 845 8500

Japan

Dialog Semiconductor K. K.
Phone: +81 3 5425 4567

Taiwan

Dialog Semiconductor Taiwan
Phone: +886 281 786 222

Web site:

www.dialog-semiconductor.com

Singapore

Dialog Semiconductor Singapore
Phone: +65 648 499 29

Hong Kong

Dialog Semiconductor Hong Kong
Phone: +852 3769 5200

Korea

Dialog Semiconductor Korea
Phone: +82 2 3469 8200

China

*Dialog Semiconductor
(Shenzhen)*
Phone: +86 755 2981 3669

*Dialog Semiconductor
(Shanghai)*
Phone: +86 21 5424 9058