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

1 Description

The iW1600-03 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 iW1600-03 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.

Renesas' innovative proprietary technology ensures that power supplies built with the iW1600-03 can achieve both the highest average active efficiency and less than 10mW no-load power consumption, and have fast dynamic load response in a compact form factor in typical 5V/2A 10W applications. The built-in active start-up scheme enables the shortest possible start-up time without sacrificing no-load power loss.

2 Features

- Ultra-low no-load power consumption with lowest system costs (< 10mW at $230V_{AC}$ in typical 5V/2A power supplies)
- Fast dynamic response with secondary-side load transient detection without optocoupler
- Built-in fast start-up
- 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

3 Applications

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

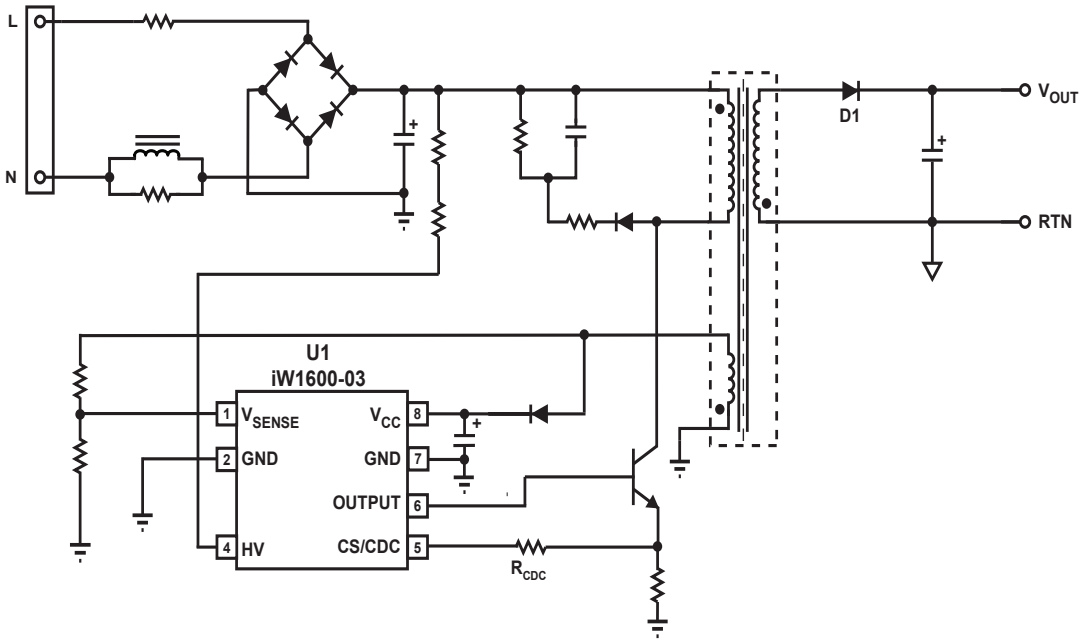


Figure 3.1: iW1600-03 Typical Application Circuit
(Achieving < 10mW No-load Power Consumption in 5V/2A 10W Adapter Designs)

4 Pinout Description

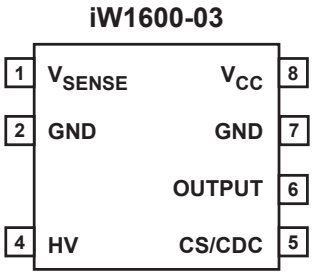


Figure 4.1 : 7 Lead SOIC-7 Package

Pin Number	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	HV	High Voltage Input	Startup voltage input. Used for active start-up.
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.

5 Absolute Maximum Ratings

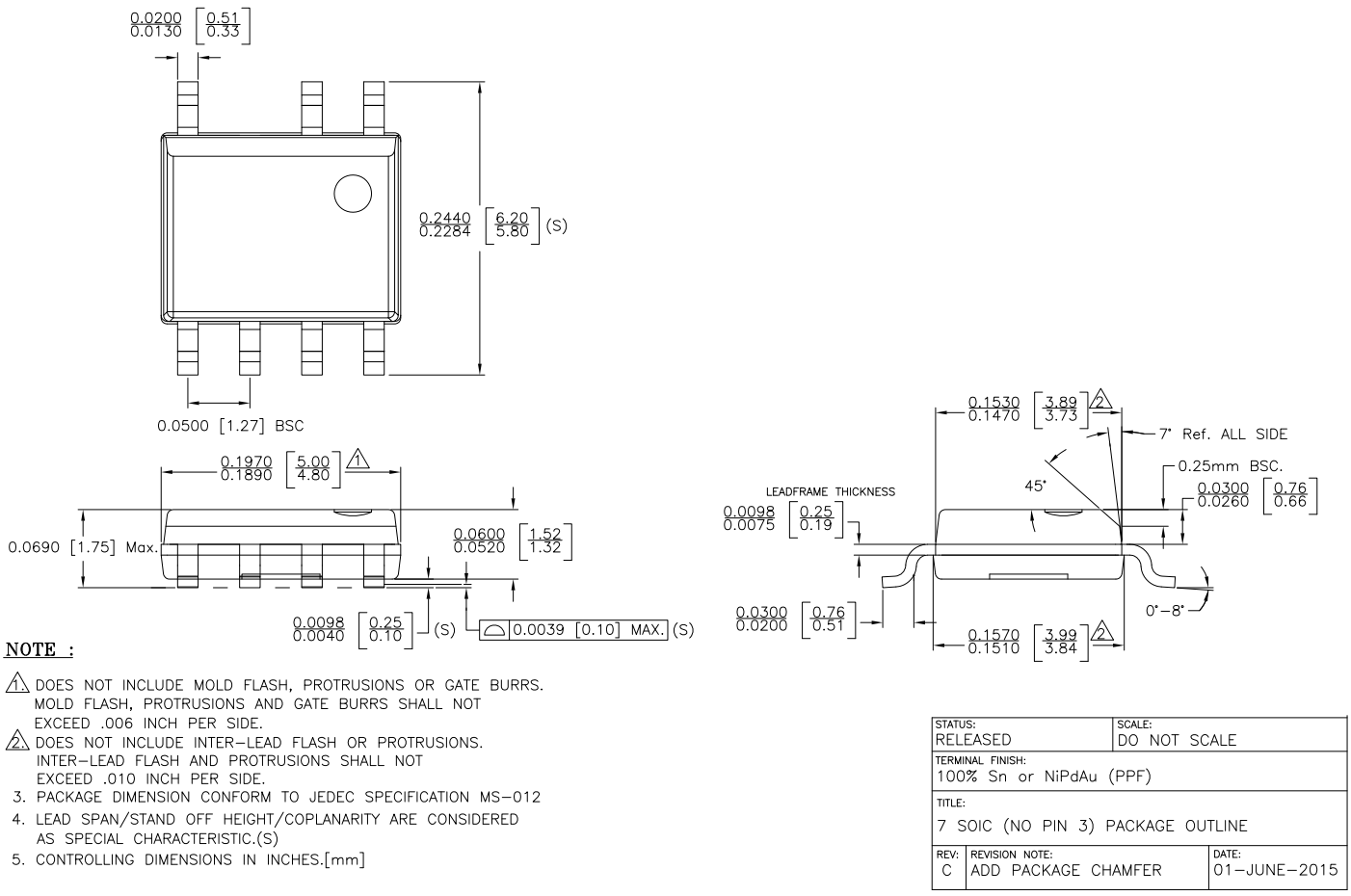
Absolute maximum ratings are the parameter values or ranges which can cause permanent damage if exceeded. For maximum safe operating conditions, refer to Electrical Characteristics in Section 6.

Parameter	Symbol	Value	Units
DC supply voltage range (pin 8, I_{CC} = 20mA max)	V_{CC}	-0.3 to 18.0	V
Continuous DC supply current at V_{CC} pin (V_{CC} = 15V)	I_{CC}	25	mA
HV output (pin 4)		-0.3 to 600	V
OUTPUT (pin 6)		-0.3 to 4.0	V
V_{SENSE} input (pin 1, I_{VSENSE} ≤ 10mA)		-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 JS-001-2017 (except the HV pin) (Note 1)		±2,000	V
Latch-up test per JESD78E		±100	mA

Notes:

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

6 Physical Dimensions



NOTE :

1. DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED .006 INCH PER SIDE.
2. DOES NOT INCLUDE INTER–LEAD FLASH OR PROTRUSIONS. INTER–LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED .010 INCH PER SIDE.
3. PACKAGE DIMENSION CONFORM TO JEDEC SPECIFICATION MS–012
4. LEAD SPAN/STAND OFF HEIGHT/COPLANARITY ARE CONSIDERED AS SPECIAL CHARACTERISTIC.(S)
5. CONTROLLING DIMENSIONS IN INCHES.[mm]

STATUS: RELEASED	SCALE: DO NOT SCALE
TERMINAL FINISH: 100% Sn or NiPdAu (PPF)	
TITLE: 7 SOIC (NO PIN 3) PACKAGE OUTLINE	
REV: C	REVISION NOTE: ADD PACKAGE CHAMFER / DATE: 01–JUNE–2015

Figure 6.1 : 7-Lead SOIC Package Outline Drawing

7 Ordering Information

Part Number	Options	Package	Description
iW1600-03	No latch, 3.0V CC shutdown voltage, no smart hiccup	SOIC-7	Tape & Reel[1]

Note 1: Tape and reel packing quantity is 2,500/reel. Minimum packing quantity is 2,500.

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