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

1 Description

The iW1679 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 and key built-in protection features, while minimizing the external component count, simplifying EMI design, and lowering the total bill of material cost. The iW1679 removes the need for a 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. The pulse-by-pulse waveform analysis allows for fast dynamic load response for both one-time and repetitive load transients. The built-in power limit function enables optimized transformer design for a wide input voltage range.

Dialog's innovative proprietary technology ensures that power supplies built with the iW1679 can achieve both the highest average efficiency and less than 30mW no-load power consumption, and have fast dynamic load response in typical 5V/2A applications. The active start-up scheme enables the shortest possible start-up time without sacrificing no-load power loss.

2 Features

- No-load power consumption < 20mW at 230V_{AC} with typical application circuit (5-star rating)
- Optimized for 5V/2A AC/DC adapters/chargers with < 30mW no-load power consumption at 230V_{AC} and fast dynamic load response for both one-time and repetitive load transients
- Direct drive of low-cost BJT power switch
- Very tight constant voltage and constant current regulation over entire operating range
- ***PrimAccurate***™ primary-side feedback eliminates opto-isolators and simplifies design
- **EZ-EMI**® design enhances manufacturability
- Intrinsically low common mode noise
- Optimized 72kHz maximum PWM switching frequency achieves best size and efficiency
- Adaptive multi-mode PWM/PFM control improves efficiency
- Quasi-resonant operation for highest overall efficiency
- Dynamic base current control
- No external loop compensation components required
- Complies with EPA 2.0/CoC Ver5/DoE energy-efficiency specifications with ample margin
- Built-in protections for output short-circuit, output low impedance, and output overvoltage
- Built-in over-temperature protection (OTP)
- No audible noise over entire operating range

3 Applications

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

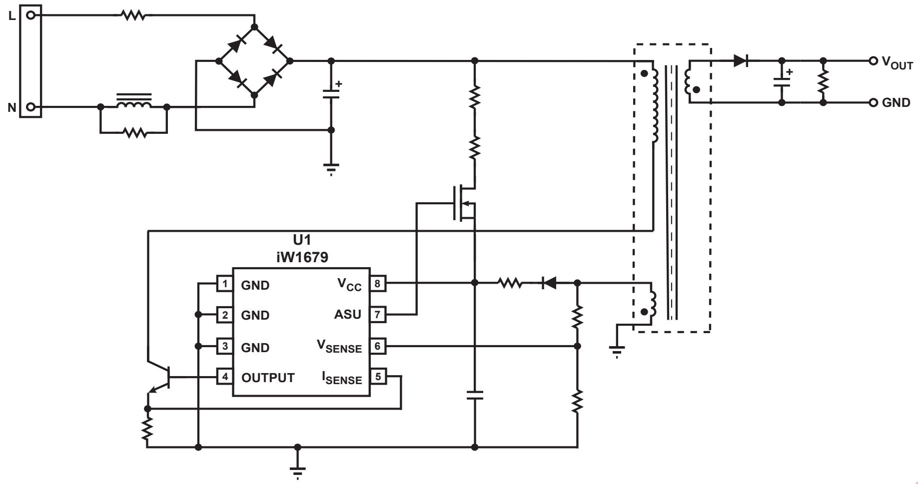


Figure 3.1 : iW1679 Typical Application Circuit
(Achieving < 30mW No-load Power Consumption. Using Depletion Mode NFET as Active Start-up Device)

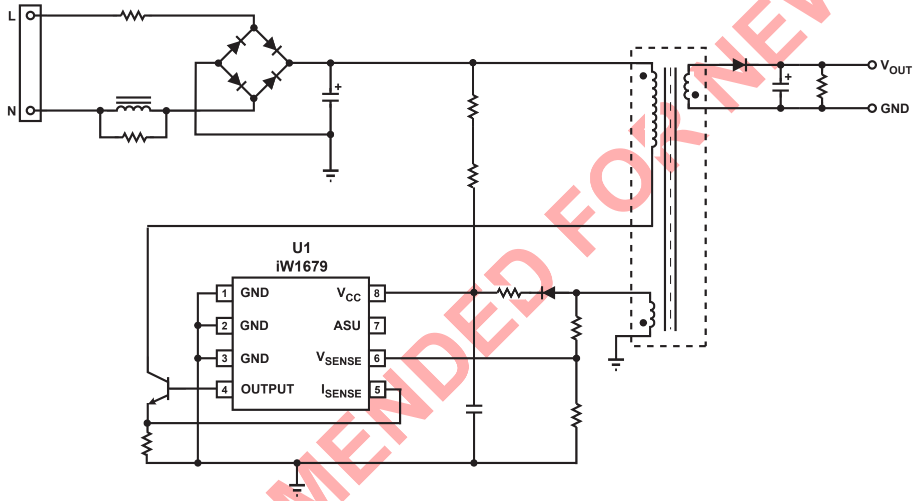


Figure 3.2: iW1679 Typical Application Circuit
(Achieving < 50mW No-load Power Consumption. Alternative Circuit without Using Active Start-up Device)

4 Pinout Description

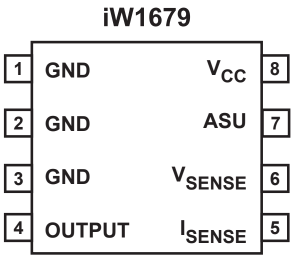


Figure 4.1 : 8-Lead SOIC Package

Pin #	Name	Type	Pin Description
1	GND	Ground	Ground.
2	GND	Ground	Ground.
3	GND	Ground	Ground.
4	OUTPUT	Output	Base drive for BJT.
5	I_{SENSE}	Analog Input	Primary current sense. It is used for cycle-by-cycle peak current control and limit.
6	V_{SENSE}	Analog Input	Auxiliary voltage sense. It is used for primary regulation.
7	ASU	Output	Control signal for active start-up device (BJT or Depletion NFET).
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 25.0	V
Continuous DC supply current at V_{CC} pin (V_{CC} = 15V)	I_{CC}	25	mA
ASU output (pin 7)		-0.3 to 19.0	V
Output (pin 4)		-0.3 to 4.0	V
V_{SENSE} input (pin 6, I_{Vsense} ≤ 10mA)		-0.7 to 4.0	V
I_{SENSE} 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}	135	°C/W
ESD rating per JEDEC JESD22-A114		±2,000	V
Latch-up test per JESD78D		±100	mA

6 Electrical Characteristics

V_{CC} = 12V, -40°C ≤ T_A ≤ 85°C, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
V_{SENSE} SECTION (Pin 6)						
Input leakage current	I_{BVS}	V_{SENSE} = 2V			1	µA
Nominal voltage threshold	$V_{SENSE(NOM)}$	T_A = 25°C, negative edge	1.521	1.536	1.551	V
Output OVP threshold (Note 1)	$V_{SENSE(MAX)}$	T_A = 25°C, negative edge Load = 100%	1.786	1.880	1.974	V
I_{SENSE} SECTION (Pin 5)						
Overcurrent threshold	V_{OCP}		1.11	1.15	1.19	V
I_{SENSE} regulation upper limit (Note 1)	$V_{IPK(HIGH)}$			1.0		V
I_{SENSE} regulation lower limit (Note 1)	$V_{IPK(LOW)}$			0.23		V
Input leakage current	I_{LK}	I_{SENSE} = 1.0V			1	µA
OUTPUT SECTION (Pin 4)						
Maximum BJT driving current	$I_{B(MAX)}$			50		mA
Output low level ON-resistance	$R_{DS(ON)LO}$	I_{SINK} = 5mA		1	3	Ω
Switching frequency (Note 2)	f_{SW}	> 50% load		72		kHz
V_{CC} SECTION (Pin 8)						
Operating voltage (Note 1)	V_{CC}				20	V
Start-up threshold	$V_{CC(ST)}$	V_{CC} rising	13.5	14.5	15.5	V
Undervoltage lockout threshold	$V_{CC(UVL)}$	V_{CC} falling	4.1	4.4	4.7	V
Start-up current	$I_{IN(ST)}$	V_{CC} = 13V		1.6		µA
Quiescent current	I_{CCQ}	V_{CC} = 14V, without driver switching		2.7	4.0	mA
No-load operating current (Note 1 & 3)	I_{CC_NL}	No-load operation in DDPWM mode		0.25		mA
ASU SECTION (Pin 7)						
Resistance between V_{CC} and ASU	R_{Vcc_ASU}		750	1000	1500	kΩ
THERMAL CHARACTERISTICS						
Thermal Shutdown Threshold (Note 1)	T_{SD}			150		°C
Thermal Shutdown Recovery (Note 1)	T_{SD-R}			100		°C

6 Electrical Characteristics (cont.)

Notes:

Note 1: These parameters are not 100% tested. They are guaranteed by design and characterization.

Note 2: Operating frequency varies based on the load conditions, see Section 9.6 for more details.

Note 3: See Sections 9.6 and 9.7 for details.

7 Typical Performance Characteristics

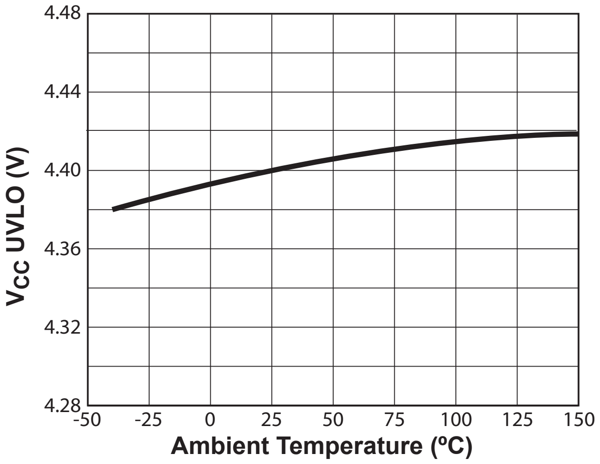


Figure 7.1 : V_{CC} UVLO vs. Temperature

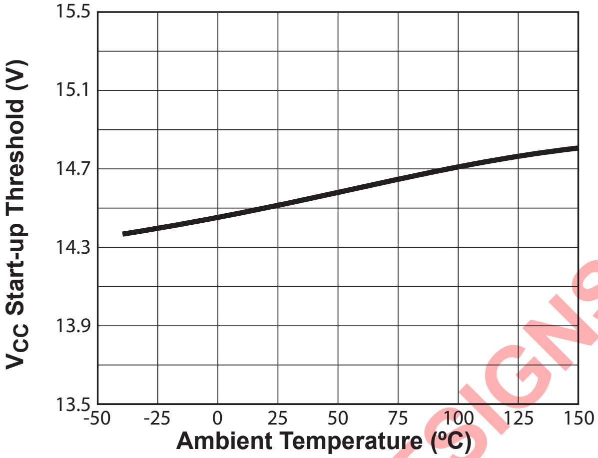


Figure 7.2 : Start-Up Threshold vs. Temperature

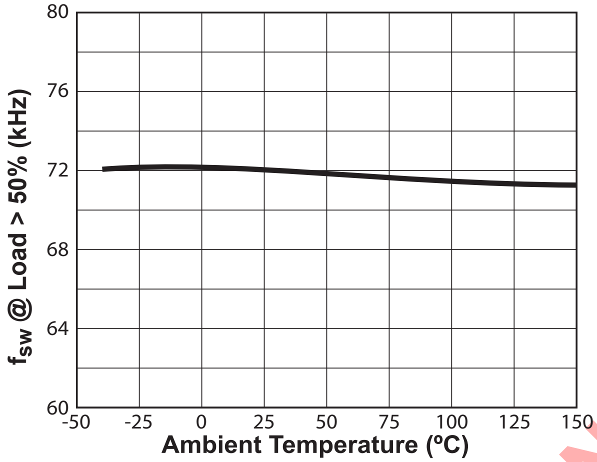


Figure 7.3 : Switching Frequency vs. Temperature[1]

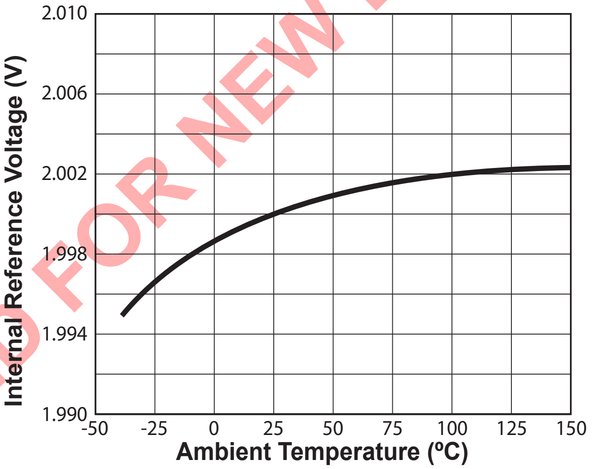


Figure 7.4 : Internal Reference vs. Temperature

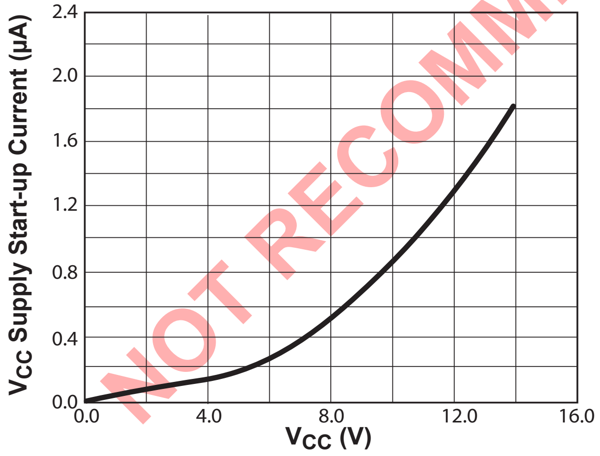


Figure 7.5 : V_{CC} vs. V_{CC} Supply Start-up Current

Notes:

Note 1: Operating frequency varies based on the load conditions, see Section 9.6 for more details.

8 Functional Block Diagram

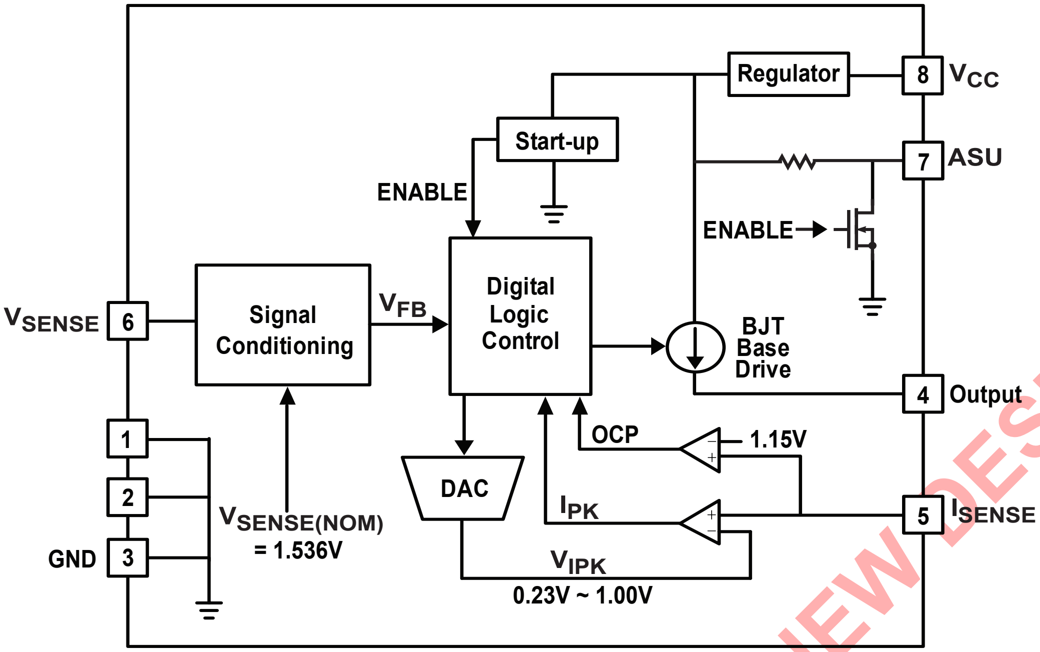


Figure 8.1 : iW1679 Functional Block Diagram

9 Theory of Operation

The iW1679 is a digital controller which uses a new, proprietary primary-side control technology to eliminate the opto-isolated feedback and secondary regulation circuits required in traditional designs. This results in a low-cost solution for low power AC/DC adapters. The core PWM processor uses fixed-frequency Discontinuous Conduction Mode (DCM) operation at higher power levels and switches to variable frequency operation at light loads to maximize efficiency. Furthermore, Dialog's digital control technology enables fast dynamic response, tight output regulation, and full-featured circuit protection with primary-side control.

Figure 8.1 shows that the iW1679 operates in peak current mode control. The digital logic control block generates the switching on-time and off-time information based on the output voltage and current feedback signal and provides commands to dynamically control the external BJT base current. The I_{SENSE} is an analog input configured to sense the primary current in a voltage form. In order to achieve the peak current mode control and cycle-by-cycle current limit, the V_{IPK} sets the threshold for the I_{SENSE} to compare with, and it varies in the range of 0.23V (typical) and 1.00V (typical) under different line and load conditions. The system loop is automatically compensated internally by a digital error amplifier. Adequate system phase margin and gain margin are guaranteed by design and no external analog components are required for loop compensation. The iW1679 uses an advanced digital control algorithm to reduce system design time and increase reliability.

Furthermore, accurate secondary constant-current operation is achieved without the need for any secondary-side sense and control circuits.

The iW1679 uses adaptive multi-mode PWM/PFM control to dynamically change the BJT switching frequency for efficiency, EMI, and power consumption optimization. It achieves unique BJT quasi-resonant switching to further improve efficiency and reduce EMI. Built-in single-point fault protection features include overvoltage protection (OVP), output short-circuit protection (SCP), over-current protection (OCP), I_{SENSE} fault detection, and over-temperature protection (OTP). In particular, it ensures that power supplies built with the iW1679 can meet 5-star energy saving requirement and achieve fast dynamic load response.

Dialog's digital control scheme is designed to address the challenges and trade-offs of power conversion design. This innovative technology is ideal for balancing new regulatory requirements for green-mode operation with more practical design considerations such as the lowest possible cost, smallest size and high performance output control.

9.1 Pin Detail

Pin 1, Pin 2, and Pin 3 – GND

Ground.

Pin 4 – OUTPUT

Base drive for the external power BJT switch.

Pin 5 – I_{SENSE}

Primary current sense. It is used for cycle-by-cycle peak current control and limit.

Pin 6 – V_{SENSE}

Sense signal input from auxiliary winding. This provides the secondary voltage feedback used for output regulation.

Pin 7 – ASU

Control signal for active startup device. This signal is pulled low after start-up is finished to cut off the active device.

Pin 8 – V_{CC}

Power supply for the controller during normal operation. The controller starts up when V_{CC} reaches $V_{CC(ST)}$ and shuts down when the V_{CC} voltage is 4.5V (typical). A decoupling capacitor of 0.1μF must be connected between the V_{CC} pin and GND.

9.2 Active Start-up and Soft-Start

Refer to Figure 3.1 and Figure 3.2 for active start-up circuits using external depletion NFET and BJT respectively. Prior to start-up, the depletion NFET or the BJT is turned on, allowing the start-up current to charge the V_{CC} bypass capacitor. When the V_{CC} bypass capacitor is charged to a voltage higher than the start-up threshold $V_{CC(ST)}$, the ENABLE signal becomes active and the iW1679 begins to perform initial OTP check (See Section 9.13). Afterwards, the iW1679 commences the soft start function. During this start-up process an adaptive soft-start control algorithm is applied, where the initial output pulses are small and gradually become larger until the full pulse width is achieved. The peak current is limited cycle by cycle by the I_{PEAK} comparator. If at any time the V_{CC} voltage drops below undervoltage lockout (UVLO) threshold $V_{CC(UVL)}$ then the iW1679 goes to shudown. At this time ENABLE signal becomes low and the V_{CC} capacitor begins to charge up again towards the start-up threshold to initiate a new soft-start process.

While the ENABLE signal initiates the soft-start process, it also pulls down the ASU pin voltage at the same time, which turns off the depletion NFET or the BJT, thus minimizing the no-load standby power consumption. For the active start-up scheme in Figure 3.2, the start-up resistors connected between the base of the BJT and DC input still conduct current after start-up is finished. Their resistance needs to be large enough to minimize no-load power consumption, meanwhile the BJT with ample gain should be selected in order to obtain a sufficient charge current for a fast start-up.

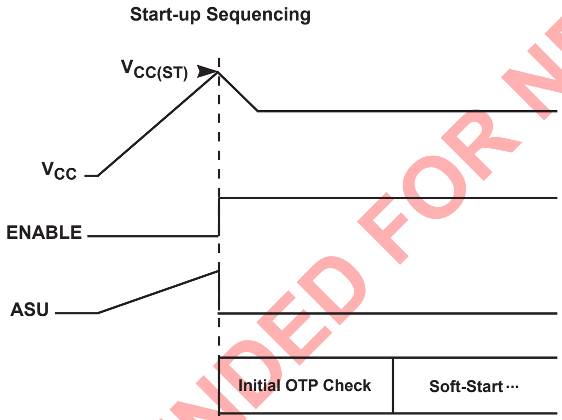


Figure 9.1 : Start-up Sequencing Diagram

9.3 Understanding Primary Feedback

Figure 9.2 illustrates a simplified flyback converter. When the switch Q_1 conducts during $t_{ON}(t)$, the current $i_g(t)$ is directly drawn from rectified sinusoid $v_g(t)$. The energy $E_g(t)$ is stored in the magnetizing inductance L_M. The rectifying diode D_1 is reverse biased and the load current I_O is supplied by the secondary capacitor C_O. When Q_1 turns off, D_1 conducts and the stored energy $E_g(t)$ is delivered to the output.

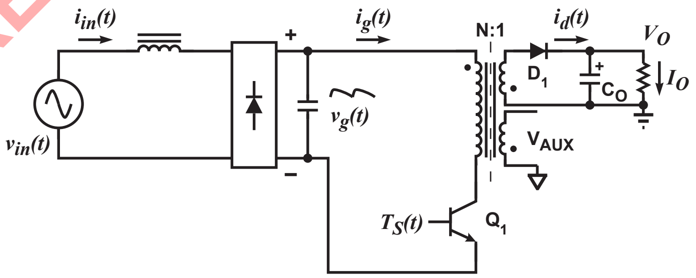


Figure 9.2 : Simplified Flyback Converter

In order to tightly regulate the output voltage, the information about the output voltage and load current need to be accurately sensed. In the DCM flyback converter, this information can be read via the auxiliary winding or the primary magnetizing inductance (L_M). During the Q_1 on-time, the load current is supplied from the output filter capacitor C_O. The voltage across L_M is $v_g(t)$, assuming the voltage dropped across Q_1 is zero. The current in Q_1 ramps up linearly at a rate of:

$$\frac{di_g(t)}{dt} = \frac{v_g(t)}{L_M} \qquad (9.1)$$

At the end of on-time, the current has ramped up to:

$$i_{g\_peak}(t) = \frac{v_g(t) \times t_{ON}}{L_M} \qquad (9.2)$$

This current represents a stored energy of:

$$E_g = \frac{L_M}{2} \times i_{g\_peak}(t)^2 \qquad (9.3)$$

When Q_1, turns off at t_O, $i_g(t)$ in L_M forces a reversal of polarities on all windings. Ignoring the communication-time caused by the leakage inductance L_K at the instant of turn-off t_O, the primary current transfers to the secondary at a peak amplitude of:

$$i_d(t) = \frac{N_P}{N_S} \times i_{g\_peak}(t) \qquad (9.4)$$

Assuming the secondary winding is master, and the auxiliary winding is slave,

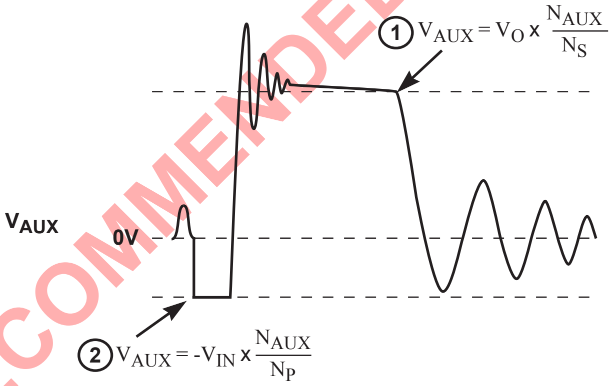


Figure 9.3 : Auxiliary Voltage Waveforms

the auxiliary voltage is given by:

$$V_{AUX} = \frac{N_{AUX}}{N_S}(V_O + \Delta V) \qquad (9.5)$$

and reflects the output voltage as shown in Figure 9.3.

The voltage at the load differs from the secondary voltage by a diode drop and IR losses. Thus, if the secondary voltage is always read at a constant secondary current, the difference between the output voltage and the secondary voltage will be a fixed ΔV. Furthermore, if the voltage can be read when the secondary current is small, ΔV will also be small. With the iW1679, ΔV can be ignored.

The real-time waveform analyzer in the iW1679 reads this information cycle by cycle. The part then generates a feedback voltage V_{FB}. The V_{FB} signal precisely represents the output voltage under most conditions and is used to regulate the output voltage.

9.4 Constant Voltage Operation

After soft-start has been completed, the digital control block measures the output conditions. It determines output power levels and adjusts the control system according to a light load or heavy load. If this is in the normal range, the device operates in the Constant Voltage (CV) mode, and changes the pulse width (T_{ON}) and off time (T_{OFF}) in order to meet the output voltage regulation requirements.

If no voltage is detected on V_{SENSE} it is assumed that the auxiliary winding of the transformer is either open or shorted and the iW1677K shuts down.

9.5 Constant Current Operation

The constant current (CC) mode is useful in battery charging applications. During this mode of operation the iW1679 regulates the output current at a constant level regardless of the output voltage, while avoiding continuous conduction mode.

To achieve this regulation the iW1679 senses the load current indirectly through the primary current. The primary current is detected by the I_{SENSE} pin through a resistor from the BJT emitter to ground.

When operating in the CC mode, with the decrease of equivalent load resistance or battery voltage, both the output voltage and VCC decrease. Once the VCC voltage is below UVLO threshold, the iW1679 shuts down (see Section 9.10). Meanwhile, the iW1679 monitors the output voltage, and shuts down the system when the detected output voltage is lower than certain level; this is known as the “CC shutdown voltage”. With this feature, the iW1679 can provide output low impedance protection when there is a low impedance fault at output, for example, short circuit at cable end. The actual shutdown can occur under either one of the above two conditions. The “CC shutdown voltage” here refers to the voltage at the cable end, and the actual output voltage at the PCB end is the sum of the “CC shutdown voltage” and the “Cable Comp” (specified in Section 9.13). Similar to the “Cable Comp”, the “CC shutdown voltage” is also specified based on the nominal output voltage of 5V. For different output voltage, the actual “CC shutdown voltage” needs to be scaled accordingly. As a result, the “CC shutdown voltage” option can adaptively match the cable voltage drop at CC mode.

For instance, for a 5V/2A charger design, if the cable resistance is around 75mΩ, the voltage drop cross the cable is around 150mV under both the CV mode full load and CC mode conditions. If CDC Comp is zero,at CV full load, the voltage at the PCB end is around 5V, and the voltage at the cable end is around 4.85V. Then the CC shutdown occurs when the voltage at the PCB end decreases to 2.5V if iW1679 provides 2.5V shutdown voltage, and the voltage at the cable end deceases to 2.35V. Normally a product option with CDC Comp is needed in this design in order to achieve a desirable voltage regulation at CV mode, e.g., the CDC Comp production option is selected as 150mV. Then at CV full load, the voltage at the PCB end is around 5.15V, and the voltage at the cable end is around 5V. Correspondingly the CC shutdown occurs when the voltage at the PCB end decreases to 2.65V, and the voltage at the cable end deceases to 2.5V.

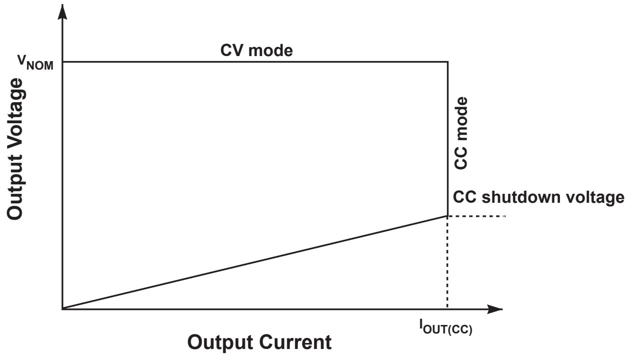


Figure 9.4 : Power Envelope

9.6 Multi-Mode PWM/PFM Control and Quasi-Resonant Switching

The iW1679 uses a proprietary adaptive multi-mode PWM /PFM control to dramatically improve the light-load efficiency and thus the overall average efficiency.

During the constant voltage (CV) operation, the iW1679 normally operates in a pulse-width-modulation (PWM) mode during heavy load conditions. In the PWM mode, the switching frequency keeps around constant. As the output load IOUT is reduced, the on-time tON is decreased, and the controller adaptively transitions to a pulse-frequency-modulation (PFM) mode. During the PFM mode, the BJT is turned on for a set duration under a given instantaneous rectified AC input voltage, but its off time is modulated by the load current. With a decreasing load current, the off time increases and thus the switching frequency decreases.

When the switching frequency approaches to human ear audio band, the iW1679 transitions to a second level of PWM mode, namely Deep PWM mode (DPWM). During the DPWM mode, the switching frequency keeps around 25kHz in order to avoid audible noise. As the load current is further reduced, the iW1679 transitions to a second level of PFM mode, namely Deep PFM mode (DPFM), which can reduce the switching frequency to a very low level. Although the switching frequency drops across the audible frequency range during the DPFM mode, the output current in the power converter has reduced to an insignificant level in the DPWM mode before transitioning to the DPFM mode. Therefore, the power converter practically produces no audible noise, while achieving high efficiency across varying load conditions.

As the load current reduces to very low or no-load condition, the iW1679 transitions from the DPFM to the third level of PWM mode, namely Deep-Deep PWM mode (DDPWM), where the switching frequency is fixed at around 2.1kHz.

The iW1679 also incorporates a unique proprietary quasi-resonant switching scheme that achieves valley-mode turn on for every PWM/PFM switching cycle, during all PFM and PWM modes and in both CV and CC operations. This unique feature greatly reduces the switching loss and dv/dt across the entire operating range of the power supply. Due to the nature of quasi-resonant switching, the actual switching frequency can vary slightly cycle by cycle, providing the additional benefit of reducing EMI. Together these innovative digital control architecture and algorithms enable the iW1679 to achieve highest overall efficiency and lowest EMI, without causing audible noise over entire operating range.

9.7 Less Than 30mW No-Load Power with Fast Load Transient Response

The iW1679 features the distinctive DDPWM control at no-load conditions to help achieve super-low no-load power consumption (< 30mW for typical applications) and meanwhile to ensure fast dynamic load response. The power supply system designs including the pre-load resistor selection should ensure the power supply can stably operate in the DDPWM mode at the steady-state no-load condition. If the pre-load resistor is too small, the no-load power consumption increases; on the other hand, if it is too large, the output voltage may increase and even cause overvoltage since the switching frequency is fixed at around 2.1kHz. For typical designs, the pre-load resistor is in the range of 5kΩ to 8kΩ.

Aside from the appropriate use of pre-load resistor, the iW1679 enjoys a few other features to bring down no-load power consumption as well. First, the iW1679 implements an intelligent low-power management technique that achieves ultra-low chip operating current at no-load (typically around 250μA). Second, the use of the power switch of BJT instead of MOSFET requires a lower driving voltage, enabling a low UVLO threshold (typically 4.5V). The power supply system design can fully utilize this low UVLO feature to have a low V_{CC} voltage at the no-load operation in order to minimize the no-load power. In addition, the active start-up scheme with depletion NFET eliminates the startup resistor power consumption after the ENABLE signal becomes active. All together these features ensure the lowest system cost power supplies built with the iW1679 can achieve less than 30mW no-load power consumption at $230V_{AC}$ input and very tight constant voltage and constant current regulation over the entire operating range including the no-load operation.

While achieving super-low no-load power consumption, the iW1679 implements innovative proprietary digital control technology to intelligently detect any load transient events, and achieve fast dynamic load response for both one-time and repetitive load transients. In particular, for load transients that are demanded in some applications as from absolutely no load to full load, the iW1679 can still guarantee a fast enough response to meet the most stringent requirements, with the no-load operating frequency designed at around 2.1kHz

9.8 Variable Frequency Operation Mode

At each of the switching cycles, the falling edge of V_{SENSE} is checked. If the falling edge of V_{SENSE} is not detected, the off-time is extended until the falling edge of V_{SENSE} is detected. The maximum allowed transformer reset time is 110μs. When the transformer reset time reaches 110μs, the iW1679 shuts off.

9.9 Internal Loop Compensation

The iW1679 incorporates an internal Digital Error Amplifier with no requirement for external loop compensation. For a typical power supply design, the loop stability is guaranteed to provide at least 45 degrees of phase margin and -20dB of gain margin.

9.10 Voltage Protection Features

The secondary maximum output DC voltage is limited by the iW1679. When the V_{SENSE} signal exceeds the output OVP threshold at point 1 indicated in Figure 9.3, the iW1679 shuts down.

Although there is no pin available to directly sense the input voltage, the iW1679 uses an innovative proprietary digital control method to detect and analyze the switch ON time, which provides real-time indirect sensing and monitoring of the magnitude and shape of the DC bulk capacitor voltage. This enables the iW1679 to determine and distinguish various conditions of the AC input voltage such as brown-out, brown-in and unplug, and to take appropriate actions. When the AC input voltage drops to below normal operation range and the power supply input is still connected to the AC source, the iW1679 initiates brown-out protection and shuts down the power supply adaptively according to the power supply load condition. Meanwhile, a brown-in input voltage threshold is set with hysteresis. In the case of the power supply input being unplugged or disconnected from the AC source, the iW1679 continues to control the switching actions to discharge the DC bulk capacitor voltage to a safe level before shutting down the power supply. Also, the iW1679 monitors the voltage on the V_{CC} pin and when the voltage on this pin is below UVLO threshold the IC shuts down immediately.

When any of these faults are met the IC remains biased to discharge the V_{CC} supply. Once V_{CC} drops below UVLO threshold, the controller resets itself and then initiates a new soft-start cycle. The controller continues attempting start-up until the fault condition is removed.

9.11 PCL, OCP and SRS Protection

Peak-current limit (PCL), over-current protection (OCP) and sense-resistor short protection (SRSP) are features built-in to the iW1679. With the I_{SENSE} pin the iW1679 is able to monitor the peak primary current. This allows for cycle by cycle peak current control and limit. When the primary peak current multiplied by the I_{SENSE} resistor is greater than 1.15V, over current (OCP) is detected and the IC immediately turns off the base driver until the next cycle. The output driver sends out a switching pulse in the next cycle, and the switching pulse continues if the OCP threshold is not reached; or, the switching pulse turns off again if the OCP threshold is reached. If the OCP occurs for several consecutive switching cycles, the iW1679 shuts down.

If the I_{SENSE} resistor is shorted there is a potential danger of the over current condition not being detected. Thus, the IC is designed to detect this sense-resistor-short fault during startup and shut down immediately. The V_{CC} is discharged since the IC remains biased. Once V_{CC} drops below the UVLO threshold, the controller resets itself and then initiates a new soft-start cycle. The controller continues attempting to startup, but does not fully startup until the fault condition is removed

9.12 Dynamic Base Current Control

One important feature of the iW1679 is that it directly drives a BJT switching device with dynamic base current control to optimize performance. The iW1679 is optimized for 5V/2A AC/DC adapters/chargers. The BJT base current ranges from 16mA to 50mA, and is dynamically controlled according to the power supply load change. The higher the output power, the higher the base current. Specifically, the base current is related to V_{IPK}.

9.13 Cable Drop Compensation

The iW1679 incorporates an innovative method to compensate for any IR drop in the secondary circuitry including cable and cable connector. A 10W adapter with 5V DC output has 6% deviation at 0.2A load current due to the drop across a 21 AWG, 1.8 meter DC cable without cable compensation. The iW1679 compensates for this voltage drop by providing a voltage offset to the feedback signal based on the amount of load current detected.

The “Cable Comp” specified in the table in Section 11.0 refers to the voltage increment at PCB end from no-load to full-load conditions in the CV mode, with the assumption that the secondary diode voltage drop can be ignored at the point when the secondary voltage is sensed. Also, the “Cable Comp” is specified based on the nominal output voltage of 5V. For different output voltage, the actual voltage increment needs to be scaled accordingly.

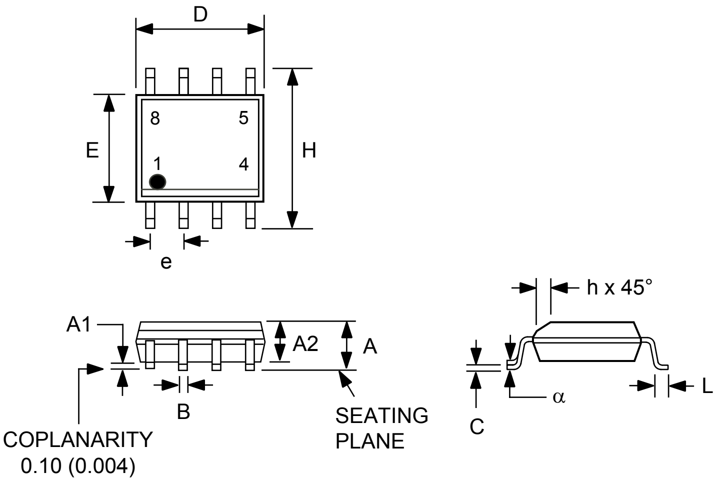
To calculate the amount of cable compensation needed, take the resistance of the cable and connector and multiply by the maximum output current.

9.14 Internal OTP

The iW1679 features an internal OTP which shuts down the device if the internal die junction temperature reaches above 150°C (typical). The device is kept off until the junction temperature drops below 100°C (typical), when the device initiates a new soft-start process to build up the output voltage.

10 Physical Dimensions

8-Lead Small Outline (SOIC) Package



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

Compliant to JEDEC Standard MS12F

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

This product is RoHS compliant and Halide free.

Soldering Temperature Resistance:
[a] Package is IPC/JEDEC Std 020D moisture sensitivity level 1
[b] Package exceeds JEDEC Std No. 22-A111 for solder immersion resistance; package can withstand 10 s immersion < 260˚C

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

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

11 Ordering Information

Part Number	Options	Package	Description
iW1679-35	Cable Comp = 150mV, CC shutdown voltage = 3V	SOIC-8	Tape & Reel[1]

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

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